Brooks® Service Suite™
for Smart *II* Digital Products with
Analog or RS-485 I/O

BROOKS®
INSTRUMENT

Essential Instructions

Read this page before proceeding!

Brooks Instrument designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using and maintaining Brooks Products.

- Read all instructions prior to installing, operating and servicing the product. If this instruction manual is not the correct manual, please see back cover for local sales office contact information. Save this instruction manual for future reference.
- If you do not understand any of the instructions, contact your Brooks Instrument representative for clarification.
- Follow all warnings, cautions and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation and maintenance of the product.
- Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Brooks Instrument. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result in fire, electrical hazards or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

ESD (Electrostatic Discharge)

⚠ CAUTION

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during the removal, installation or other handling of circuit boards or devices.

Handling Procedure:
1. Power to unit must be removed.
2. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.
3. Printed circuit cards must be transported in a conductive container. Boards must not be removed from protective enclosure until immediately before installation. Removed boards must immediately be placed in protective container for transport, storage or return to factory.

Comments

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (e.g. CMOS). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

Dear Customer,

The Brooks Service Suite is a Windows-based application that provides expanded control of Brooks Smart *II* Digital Mass Flow Control (MFC) and Mass Flow Meter (MFM) devices for servicing tasks that include setup and configuration, troubleshooting, and tuning and calibration.

We recommend that you read this manual in its entirety as this will enable efficient and proper use of the Brooks Service Suite. Should you require any additional information concerning the Brooks Service Suite, please feel free to contact your local Brooks Sales and Service Office or visit us on the web at www.brooksinstrument.com. We appreciate this opportunity to service your fluid measurement and control requirements,and trust that we will be able to provide you with further assistance in future.

Yours sincerely,

Brooks Instrument

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X-SW-BSS-eng
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May, 2010

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Section 1 Introduction

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1.1 Description

The Brooks Service Suite is a Windows-based application that provides expanded control of the Brooks Smart II Digital Mass Flow Control (MFC) and Mass Flow Meter (MFM) devices with analog or RS-485 I/O for servicing tasks that include setup and configuration, troubleshooting, tuning, and calibration.
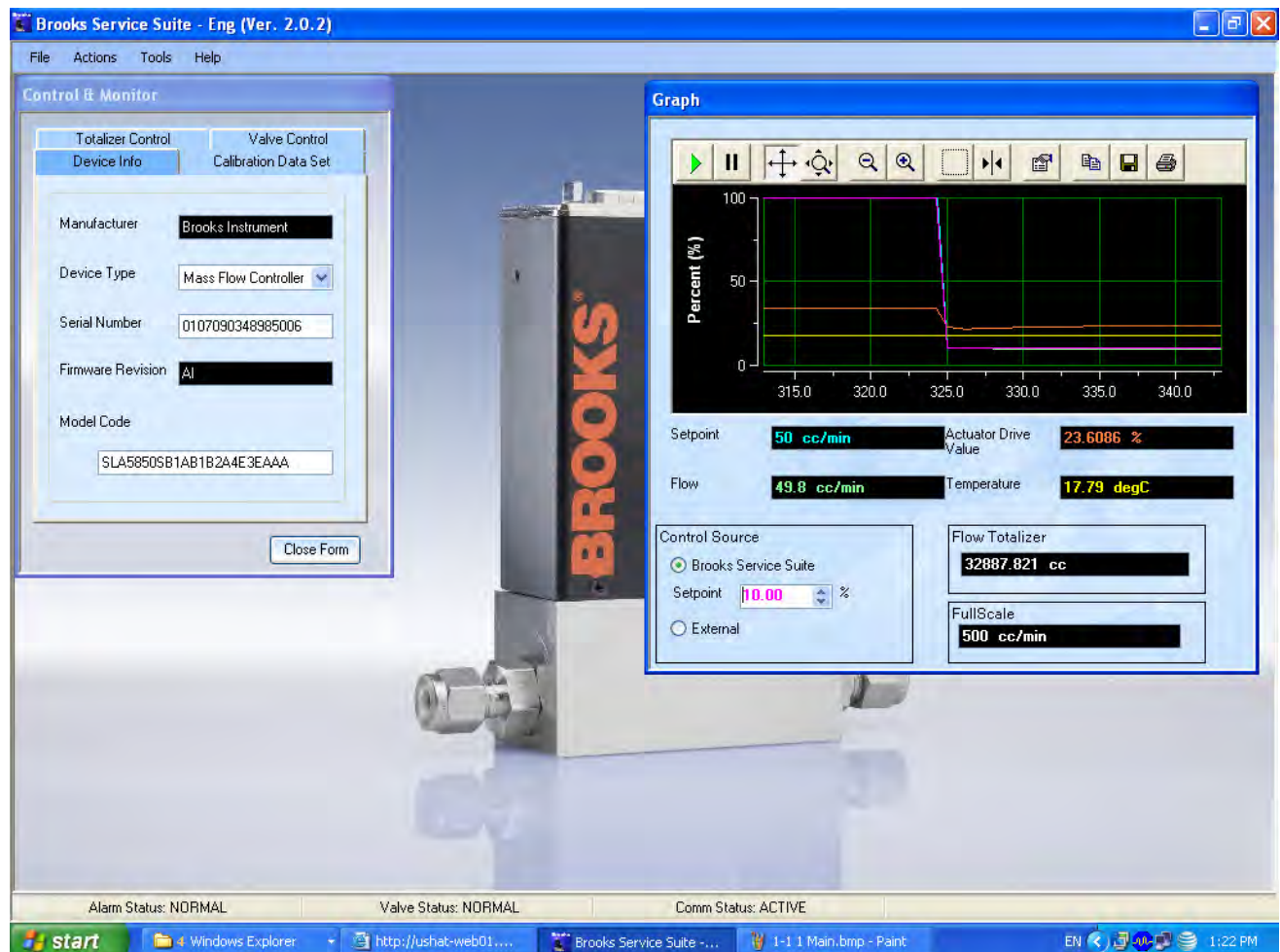
Shown above Brooks Service Suite Main Window

Using an RS-232 connection between a personal computer (PC) and the device's service port, you can use the Service Suite to view, control, and modify data such as:

• Flow
• Setpoint
• Analog input/output (I/O) configuration
• Valve tuning
• Device I/O calibrations
• Diagnostics
• Alarm and Warning Configuration

1.2 Standard vs. Pro Version

There are two versions of the Brooks Service Suite application: Standard and Pro. The Pro version includes all of the functions in the Standard version, but also includes the ability to perform flow calibration as described in Chapter 8.

Note that the screen examples used throughout the manual are of the Standard version, except for Chapter 8.

1.3 How to Use This Manual

It is recommended that you read this manual before installing or using the Service Suite.

The manual is organized into eight sections:

Section 1 Introduction

Section 2 Theory of Operation

Section 3 Installation

Section 4 Basic Operations

Section 5 Control and Monitor

Section 6 Diagnostics

Section 7 Tuning

Section 8 Gas Calibration and Reporting (Pro Version Only)

NOTE:

For device troubleshooting information, refer to the device's Installation and Operations Manual.

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Section 1 Introduction

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1.4 Integrated Help

The Brooks Service Suite features a searchable Help Database. This database contains much of the information provided within this manual. To access the Integrated Help feature, open the 'Help Menu' at the top of the application and select 'Help' or press 'F1' from anywhere within the program.

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Section 2 Theory of Operation

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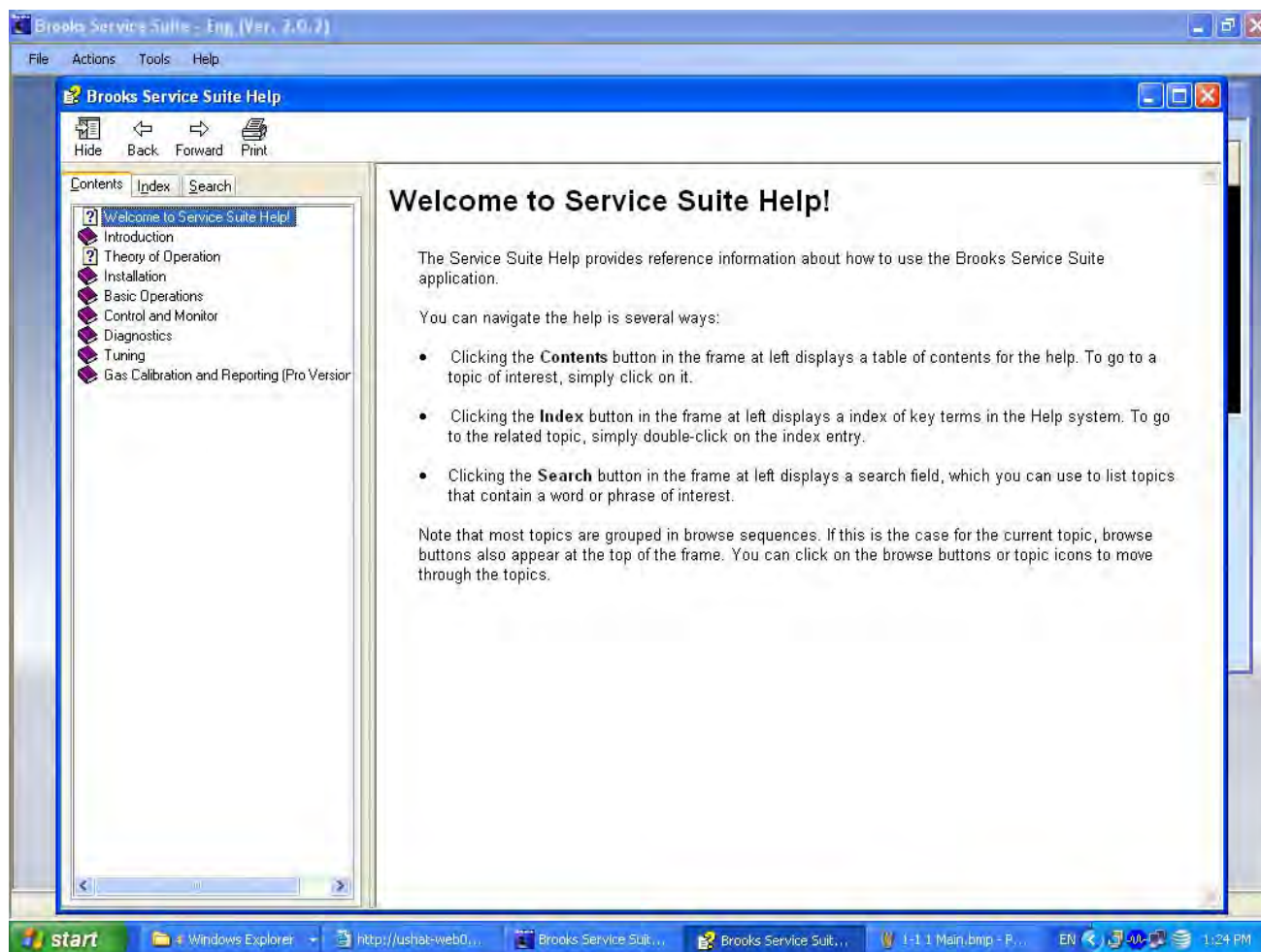
2.1 Theory of Operation

A typical mass flow measurement and control system consists of two components:

• **Mass flow meter.** A mass flow meter incorporates a sensor that measures the amount of mass flow and generates an electrical output signal directly proportional to the mass flow rate.

• **Control valve.**

   Mating a control valve with a mass flow meter provides a mass flow controller (MFC).

Implementing a mass flow controller requires using the mass flow output signal as one input and a user-supplied setpoint signal as another input into a comparator circuit. These two signals are then compared and a control signal is generated to operate the opening or closing of the valve. The setpoint signal is, in effect, a request that the mass flow controller maintain a fixed mass flow rate.

A setpoint signal can come in many forms. The Brooks Smart *II* MFC devices can be digital or analog. The analog input/output (I/O) signals between the mass flow device and the user's control side are represented as a voltage (0-5 Vdc or 1-5 Vdc) or current (0-20 mA or 4-20 mA). Alternately, a service tool can be used to drive the setpoint digitally.

The Brooks Service Suite, which communicates with the device through an RS-232 connection between the PC and the device's service port connector, uses a digital signal based on a proprietary protocol. The Service Suite has two modes of setpoint control:

• **External**, in which the Service Suite is allowing an external setpoint source to command flow.

• **Brooks Service Suite**, in which the Service Suite overrides the external setpoint source with a value specified by the user.

In either arrangement, the device will attempt to manage the opening and closing of the control valve to maintain the amount of mass flow as requested by the setpoint source.

Note that the Brooks Service Suite is meant to be used as a startup and troubleshooting tool. It is not intended to be permanently connected to the device in your application.

Section 2 Theory of Operation

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Section 3 Installation

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3.1 System Requirements

This section describes how to install the Service Suite application onto a personal computer (PC), and how to connect the PC to the device.

The Brooks Service Suite application can be installed on a Windows PC with the following requirements:

Component	Minimum Requirements
Operating System	Microsoft Windows 2000 (With SP4) Microsoft Windows XP (With SP2) Microsoft Windows Vista
COM Port	One Serial or USB-to-Serial port adaptor For the Pro version two serial or USB-to-serial port adaptors are needed.
Security	One spare USB port for security dongle.

3.2 Installing the Service Suite Application

To install the Service Suite application, load the Service Suite CD-ROM into the drive. If the program installation shell does not appear automatically, find the installation file in the root of the CD-ROM folder and double click it to launch the installation wizard. Follow the installation instructions in the wizard. In case no CD-ROM has been purchased, download the BSS setup from the http://www.BrooksInstrument.com/bss website and follow the instructions which are also available on this website.

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3.3 Connecting the Service Suite Dongle

The Service Suite requires that a dongle is connected to a USB port on the PC, the picture below shows you how. You may install the application on as many PCs are desired. However, the Service Suite will only operate on a PC which has the dongle connected. The dongle comes in two versions, i.e. Standard and Pro.

USB Dongle

3.4 Connecting the PC to the Device

The following topics list the hardware requirements and describe the procedure for connecting the PC running the Service Suite to the device's service port.

3.4.1 Hardware Requirements

The following tools and cables are required to connect the PC serial port to the device's service port:

• RS-232 to TTL communications interface adapter.
• Standard RS-232 serial cable (between your PC's serial connector and the communications interface adapter).
• Service Suite 3-wire communications cable (between the interface connector and the device's service port connector).

This equipment may be purchased either with the Brooks Service Suite or separately from Brooks Instrument. Contact the Factory or your local representative for details.

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NOTE:

If the distance between the PC and the device is short enough, the RS-232 cable is not necessary. Plug the communications interface adapter directly into the PC serial port.

- 3-wire communications cable (between the interface connector and the device's service port connector)
- Straight (flat blade) screwdriver
- 3/16-in. nut driver

Communications interface adapter

3-wire communications cable

The cable kit part number is: S778D023ZZZ

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3.4.2 Connection Procedure (SL58xxS Series)

> ⚠ **CAUTION**
>
> The electronics within this device are Electrostatic Discharge (ESD) sensitive. Be sure to follow proper ESD precautions at all times while the service port connector is exposed. The unit chassis should be adequately grounded. The operator should also be grounded (via wrist/ankle strap) when contacting the device while the service port connector is exposed. Failure to follow these precautions may void your device warranty.

connect the PC to the device's service port:

1. Turn off power to the device.
2. Remove the standard cable from the device's 15-pin D-connector.
3. Remove the screw at the center of the top cover.
4. Remove the cover.

Black service port connector

15-pin D-Connector

Center cover screw
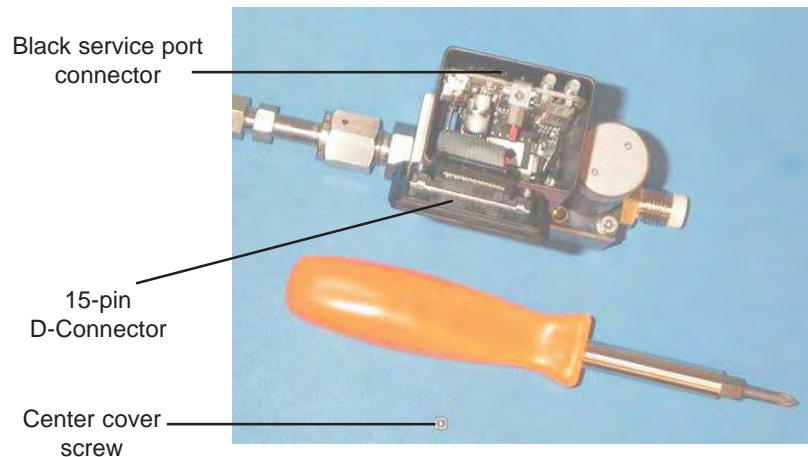
5. Assemble the RS-232 serial cable, communications interface adapter, and Service Suite 3-wire communications cable.

6. Connect the RS-232 serial cable to a serial port on your computer.

   If the distance is short enough, you can connect the communications interface adapter directly to the PC's serial port, as shown below, and do not need the RS-232 serial cable.

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7. Connect the 3-wire communications cable to the device's service port, which is the black connector located behind the D-connector. Align the communications cable's 5-pin connector with the **black wire** towards the **center** of the device (towards the LEDs), as shown in the following illustration.

Service port
connector attached

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8. Reconnect the standard cable to the device's D-connector.

   This connection is used to apply power and the analog setpoint to the device while using the Service Suite.

9. Turn on power to the device.

10. Verify that the device initializes properly, as indicated by the Status LED being solid green.

    You are now ready to use the Service Suite.

3.4.3 Connection Procedure (SLMfxxS Series)

> ⚠ **CAUTION**
>
> The electronics within this device are Electrostatic Discharge (ESD) sensitive. Be sure to follow proper ESD precautions at all times while the service port connector is exposed. The unit chassis should be adequately grounded. The operator should also be grounded (via wrist/ankle strap) when contacting the device while the service port connector is exposed. Failure to follow these precautions may void your device warranty.

To connect the PC to the device's service port:

1. Turn off power to the device.

2. Loosen the four (4) top cover screws using a ¼" allen wrench.

3. Remove the top cover.

Service port connector

Top cover

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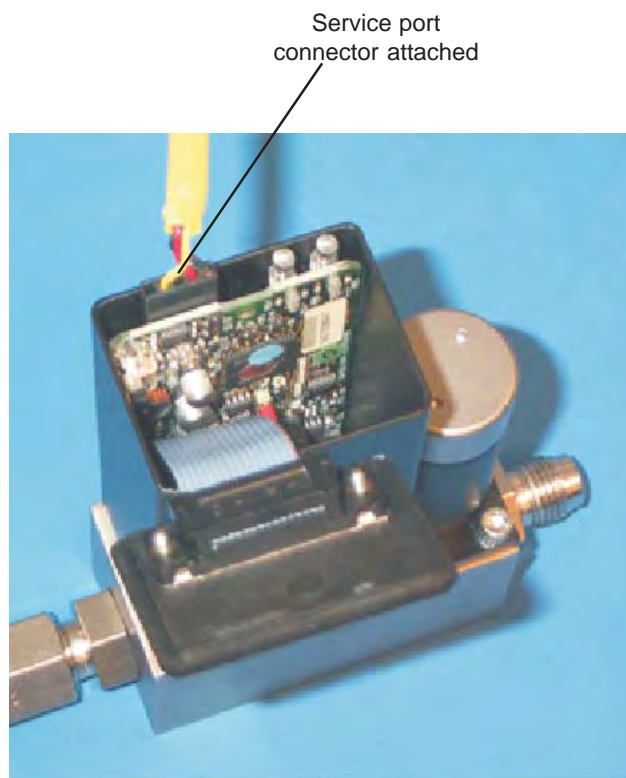
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4. Assemble the RS-232 serial cable, communications interface adapter, and Service Suite 3-wire communications cable.

5. Connect the RS-232 serial cable to a serial port on your computer.

If the distance is short enough, you can connect the communications interface adapter directly to the PC's serial port, as shown below, and do not need the RS-232 serial cable.

6. Connect the 3-wire communications cable to the device's service port, which is the 5-pin connector (labeled SERVICE PORT) located to the rear of the device next to the ALARM and STATUS LEDs. The **black** wire should be located next to the SERVICE PORT pin 1 identifier (towards the ALARM LED) as shown in the following illustration.

Service port
connector attached —

7. Turn on power to the device.

8. Verify that the device initializes properly, as indicated by the STATUS LED being solid green.
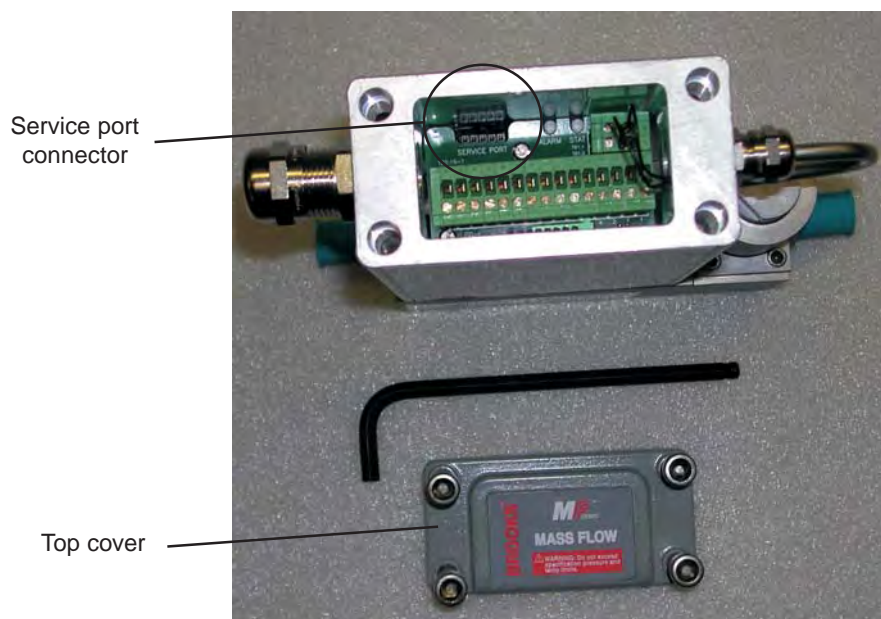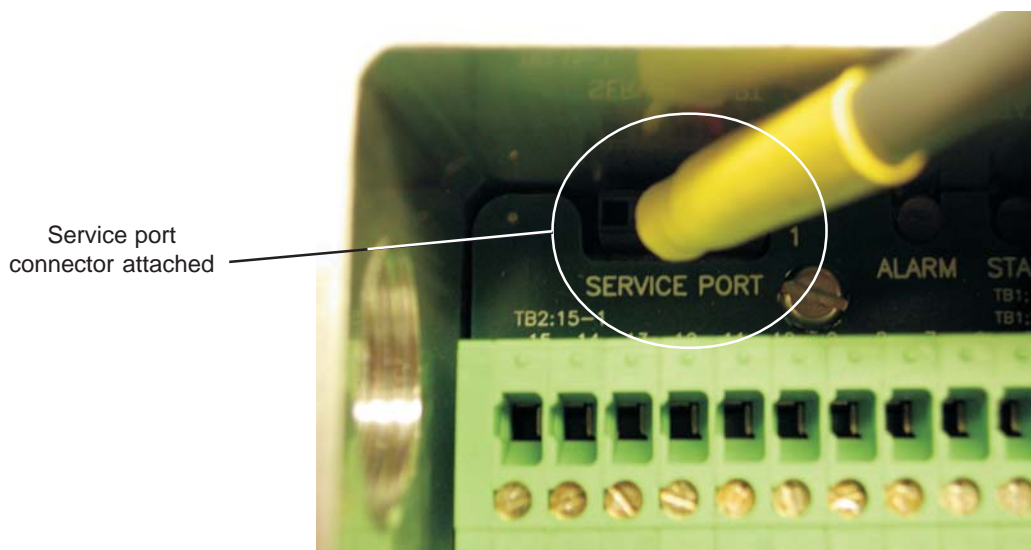
You are now ready to use the Service Suite.

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3.4.4 Connection Procedure (SL79xxS Series)

> ⚠ **CAUTION**
>
> The electronics within this device are Electrostatic Discharge (ESD) sensitive. Be sure to follow proper ESD precautions at all times while the service port connector is exposed. The unit chassis should be adequately grounded. The operator should also be grounded (via wrist/ankle strap) when contacting the device while the service port connector is exposed. Failure to follow these precautions may void your device warranty.

To connect the PC to the device's service port:

1. Turn off power to the device.

2. Remove the screw at the center of the top cover.

3. Remove the detachable portion of the top cover.
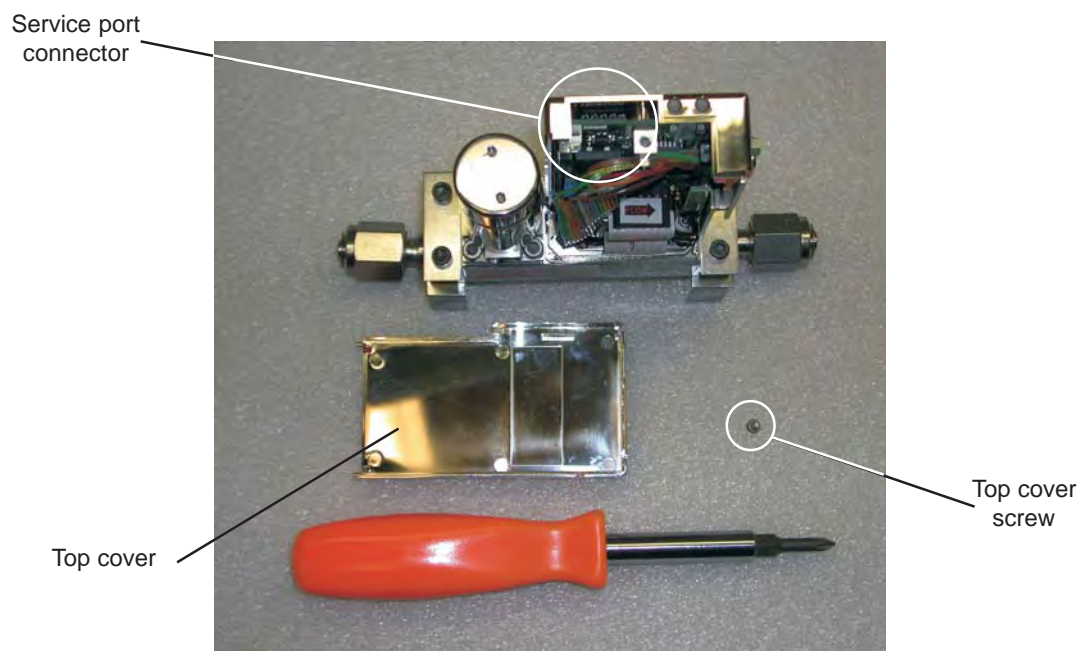
4. Assemble the RS-232 serial cable, communications interface adapter, and Service Suite 3-wire communications cable.

5. Connect the RS-232 serial cable to a serial port on your computer.

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If the distance is short enough, you can connect the communications interface adapter directly to the PC's serial port, as shown below, and do not need the RS-232 serial cable.

6. Connect the 3-wire communications cable to the device's service port, which is the 5-pin connector (labeled SERVICE PORT) located to the rear of the device next to the ALARM and STATUS LEDs. The **black** wire should be located towards the **center** of the device (towards the LEDs), as shown in the following illustration.
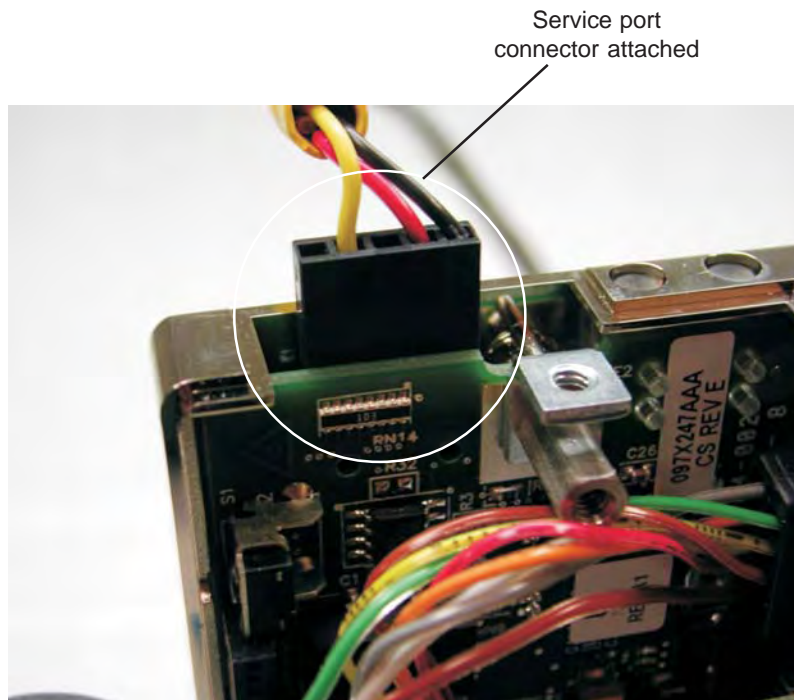
Service port
connector attached

7. Turn on power to the device.

8. Verify that the device initializes properly, as indicated by the STATUS LED being solid green.

You are now ready to use the Service Suite.

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3.4.5 Disconnecting the PC from the Device (SL58xxS Series)

> ⚠ **CAUTION**
>
> The electronics within this device are Electrostatic Discharge (ESD) sensitive. Be sure to follow proper ESD precautions at all times while the service port connector is exposed. The unit chassis should be adequately grounded. The operator should also be grounded (via wrist/ankle strap) when contacting the device while the service port connector is exposed. Failure to follow these precautions may void your device warranty.

When you are done using the Service Suite, you should disconnect the PC from the device and reinstall the device's cover.

To disconnect the PC from the device's service port:

1. Exit from the Service Suite.

2. Turn off power to the device.

3. Disconnect the standard cable and the 3-wire communications cable from the device.

4. Disconnect the RS-232 serial cable (or interface adapter) from your PC.

5. Place the cover onto the device, and reattach it using the screw at the center of the top cover.

6. Reconnect the standard cable to the device's 15-pin D-connector.

You can now reapply power to the device and begin using it in a process application.

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3.4.6 Disconnecting the PC from the Device (SLMfxxS Series)

> ⚠ **CAUTION**
>
> **The electronics within this device are Electrostatic Discharge (ESD) sensitive. Be sure to follow proper ESD precautions at all times while the service port connector is exposed. The unit chassis should be adequately grounded. The operator should also be grounded (via wrist/ankle strap) when contacting the device while the service port connector is exposed. Failure to follow these precautions may void your device warranty.**

When you are done using the Service Suite, you should disconnect the PC from the device and reinstall the device's cover.

To disconnect the PC from the device's service port:

1. Exit from the Service Suite.

2. Turn off power to the device.

3. Disconnect the 3-wire communications cable from the device.

4. Disconnect the RS-232 serial cable (or interface adapter) from your PC.

5. Place the top cover onto the device and reattach it by tightening the four (4) allen head socket screws.

You can now reapply power to the device and begin using it in a process application.

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3.4.7 Disconnecting the PC from the Device (SL79xxS Series)

> ⚠ **CAUTION**
>
> **The electronics within this device are Electrostatic Discharge (ESD) sensitive. Be sure to follow proper ESD precautions at all times while the service port connector is exposed. The unit chassis should be adequately grounded. The operator should also be grounded (via wrist/ankle strap) when contacting the device while the service port connector is exposed. Failure to follow these precautions may void your device warranty.**

When you are done using the Service Suite, you should disconnect the PC from the device and reinstall the device's cover.
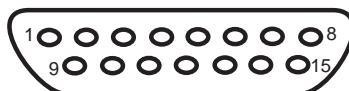
To disconnect the PC from the device's service port:

1. Exit from the Service Suite.

2. Turn off power to the device.

3. Disconnect the 3-wire communications cable from the device.

4. Disconnect the RS-232 serial cable (or interface adapter) from your PC.

5. Place the detachable top cover back onto the device by inserting the alignment pegs located at the bottom of the detachable cover into their respective mating holes on the stationary portion of the top cover.

6. Insert and tighten the top cover screw.

You can now reapply power to the device and begin using it in a process application.
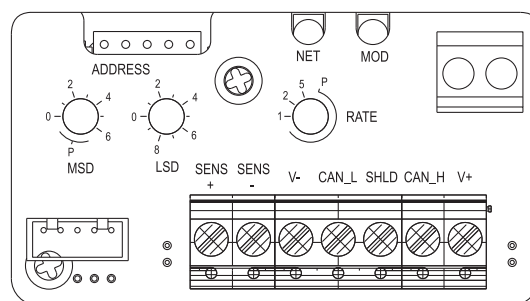
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3.4.8 Device D-Connector Pin-Outs

The Smart **II** pin-outs are listed below.

Pin No.	Function
1	**Setpoint Return**, Common Input (-)
2	**Flow Signal**, 0(1) -5 volt, Output (+)
3	**TTL Alarm** open collector, Output (+)
4	**Flow Signal**,0(4) -20 mA, Output (+)
5	**Power Supply**, +13.5 to +27 Vdc (+)
6	**Not Connected**
7	**Setpoint**,0(4) -20 mA, Input (+)
8	**Setpoint**, 0(1) -5 volt, Input (+)
9	**Power Supply**, Common (-)
10	**Flow Signal**,Common, Output, (-)
11	**Reference**, +5 Vdc, Output (+)
12	**Valve Override**, Input
13	**Calibration Select**, Input
14	**RS-485** Comm B (-)
15	**RS-485** Comm A (+)

Terminal diagrams for the Mf models

DeviceNet
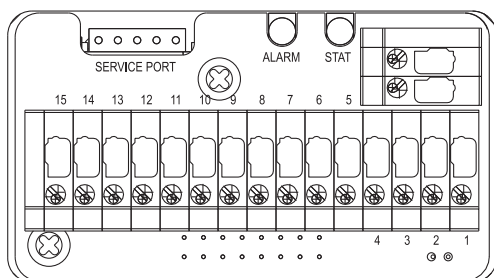
Analog

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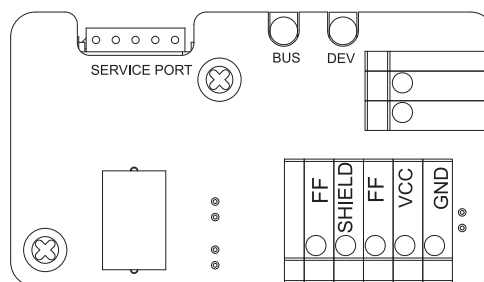
Section 4 Basic Operations

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4.1 Basic Operations

This section describes the Service Suite's basic operations, including:

- Service Suite conventions

- Starting the tool and opening a new session

- Setting the options to determine what variables will be displayed in the Graph window and how they will be displayed

- Specify whether the setpoint will be controlled from the Service Suite or by an external source

- Controlling different aspects of how the trend graph is displayed in the Graph window

- Capturing the current state of the trend graph to the clipboard or a file, and/or by printing it to a hard copy

- Changing Report Template Preferences allowing the user to customize the logo and address information on the Calibration Report

- Saving and restoring a device configuration file

- Closing the session and exiting the tool

- Import Database functionality which allows the user to retain device and calibration related data used on the Calibration Report, when performing an upgrade of the Service Suite application

4.1.1 Service Suite Conventions

The Service Suite was designed to remain consistent with regard to how the user interacts with the application across all functions and features.

The following text field conventions apply throughout the application:

- Text fields with a black background display a read-only parameter.

- Text fields with a white background are editable.

- Text fields will be stored when the focus changes to another field by means of a mouse click or the TAB. The text field will change color to indicate that the new value has been stored.

- Text fields which are indicated with a red asterisk need to be filled with a valid value.

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4.2 Starting the Service Suite and Opening a New Session

To start the Service Suite and open a new session:

1. Select the Brooks Service Suite from your **Start** menu, or double-click its application file. The main window displays, with no session open.


2. To open a new session, open the **File** menu and select **New Session**.

The Open Session dialog box displays.

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3. From the drop-down lists, select the device type and the Comm port to which the Service Suite cable is connected, then click **OK**.

    The Control & Monitor and Graph windows open, and the Graph window begins showing the trend data that is being read from the device.
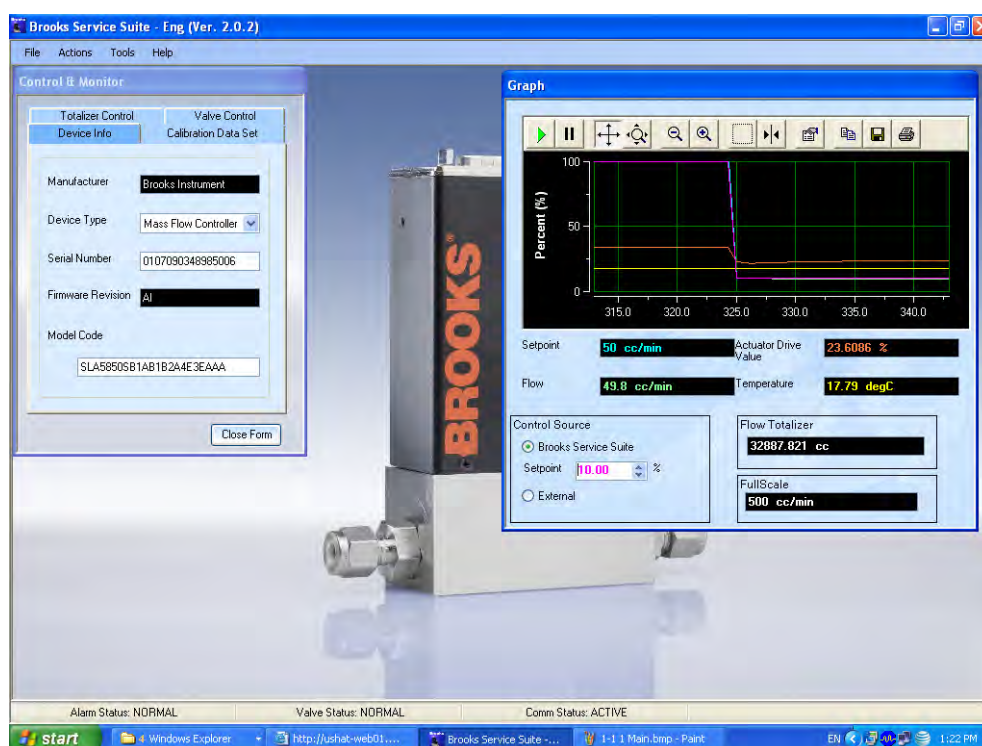
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4.3 Graph Window Elements

Figure 4-1 indicates the major elements of the Graph window.
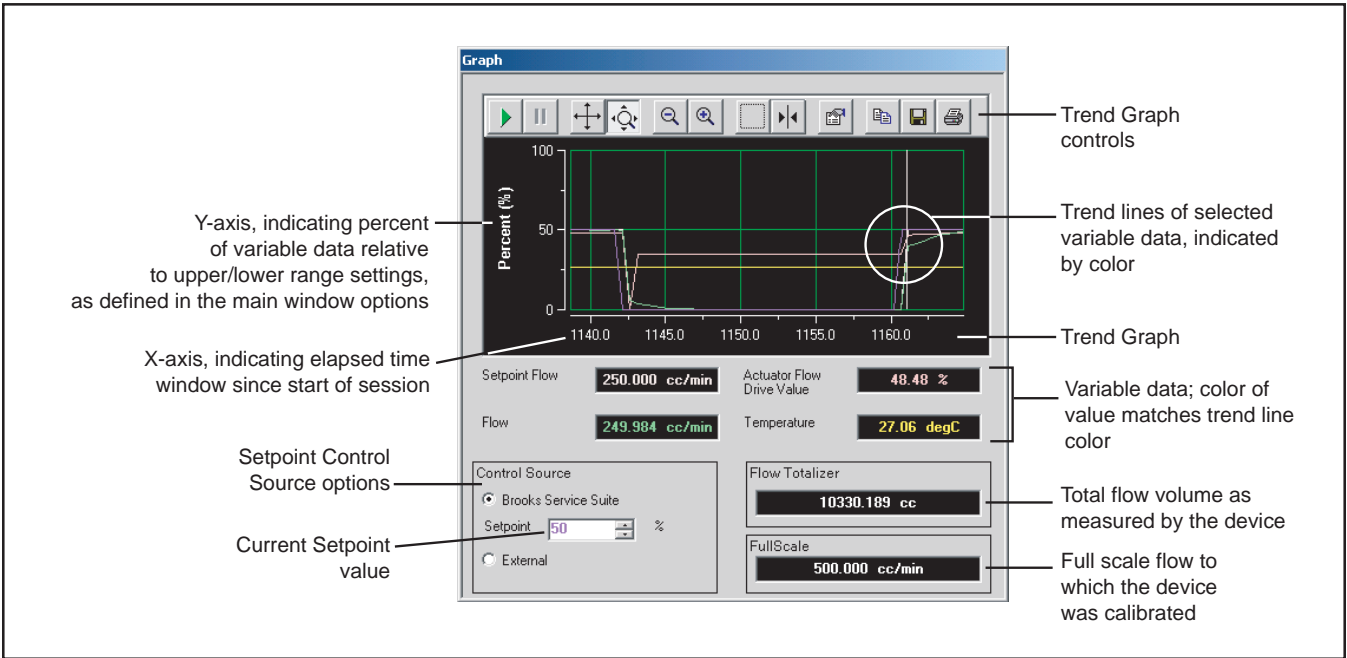
Figure 4-1 Graph Window Elements

4.4 Setting the Graph Window Options

To set the Graph window options, open the **Tools** menu and select **Trend Graph Options**. The Options window displays. From this window, you can perform the functions described in Table 4-1.

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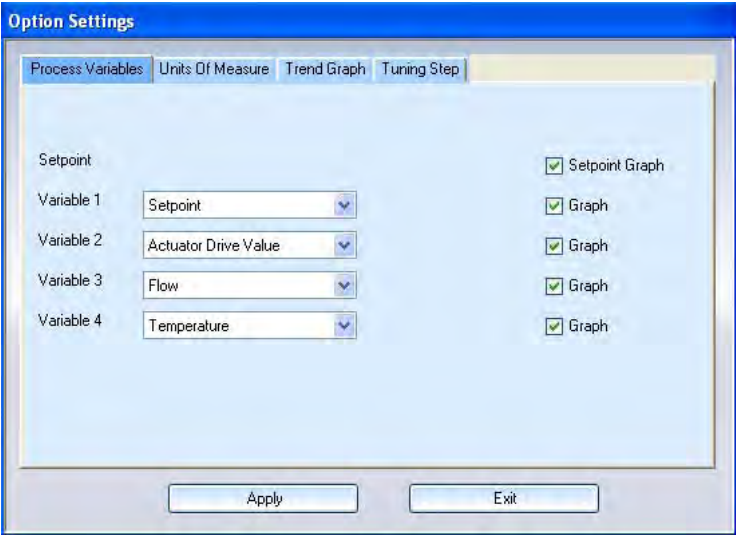
Table 4-1 Options Window Functions

Function	Description
Modify the current settings	You can modify the options settings on any of the three tabs. The options on the three tabs, and which elements on the Trend Graph window they control, are illustrated in Figures 4-2 through 4-4.
Cancel your setting changes	Click the **Cancel** button.
Save your setting changes	Click the **Apply** button.

NOTE:

Changes that you make to the option settings become the default values the next time a session is opened.
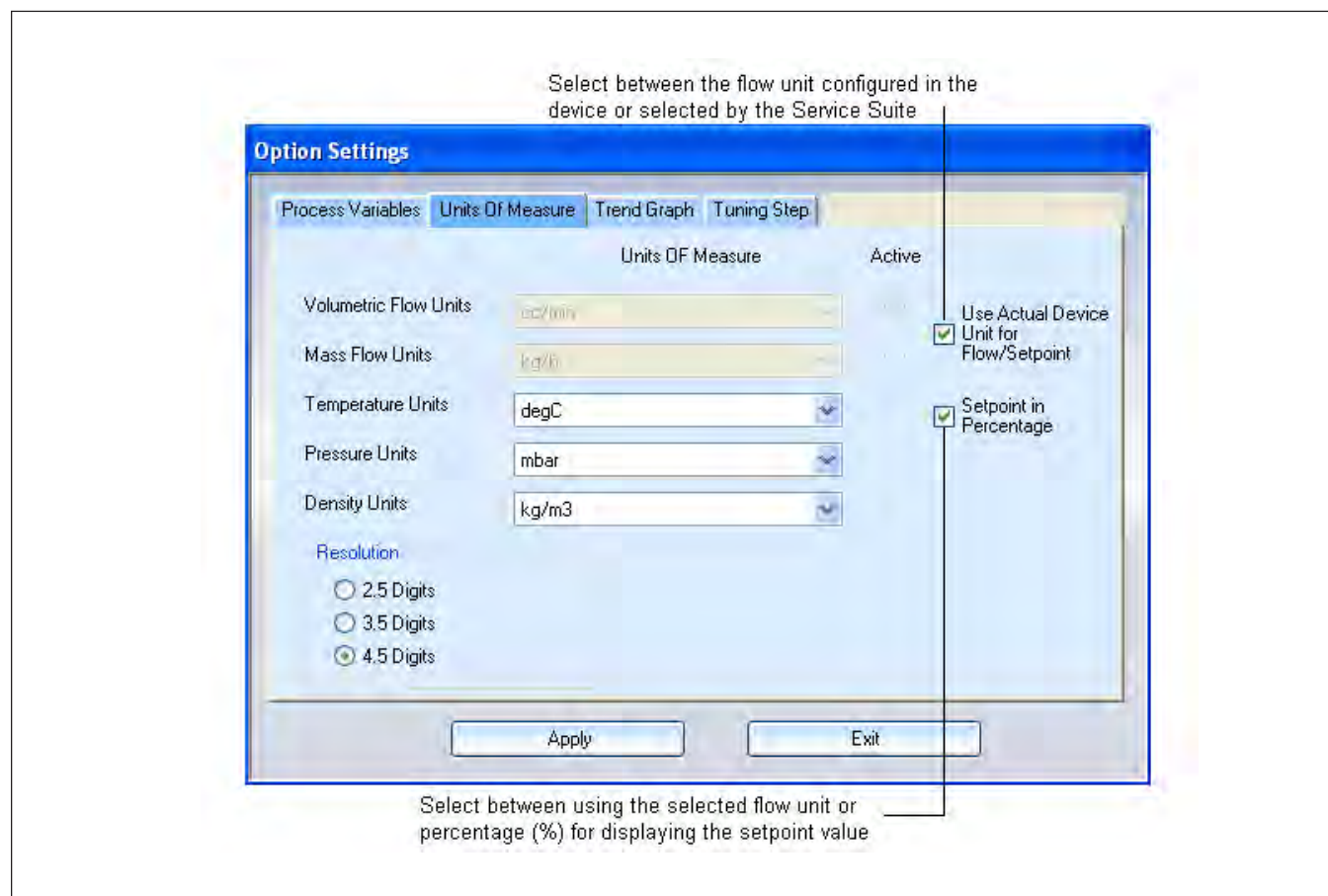
Figure 4-2 Process Variable Options

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Figure 4-3 Units of Measure Options

Resolution
The amount of decimal digits shown for volumetric and mass flow process variable values in the graph window depend on the selected resolution and the full scale value. The resolution can be 2.5, 3.5 and 4.5 Digits. Dependent on the full scale value the .5 digit means that you'll get 1 digit more to display the value if the full scale value starts with 1, e.g. full scale value is 100 you'll get 3, 4 or 5 digits for displaying the process variable. This will lead to 0, 1 or 2 decimal digits for resolution set to 2.5, 3.5 or 4.5 digits respectively. If the full scale value starts with e.g. a 2, you'll get 2, 3 and 4 digits to display the process variable value in case the resolution is set to 2.5, 3.5 or 4.5 digits respectively. This will lead to 0, 0 and 1 decimal digits to display. In case e.g. a 2.5 digit resolution is selected and the full scale value is 200, the volumetric and mass flow process variables will only have 2 digits available for displaying a value. This means that value higher than 99 can not be shown, the field will indicate '#RES', see picture ('graph window RES.bmp') below.

To solve this issue the resolution needs to be increased or another unit needs to be chosen.

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X-Axis Scroll Method determines how trend graph
will advance over time:
-Smooth (continuously), or
-Page (in time window increments; for example, every 30 seconds)
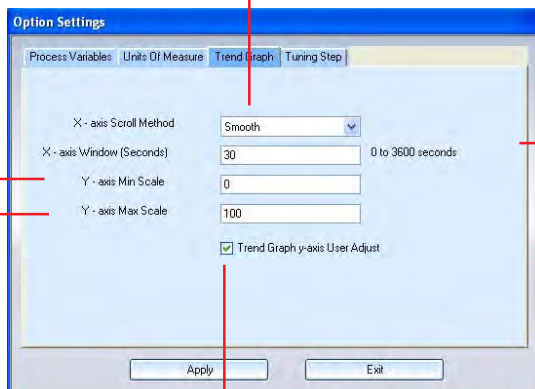
Y-Axis Scale values
determine upper and lower
percentage values
of full scale flow
along the Y-axis

Select the option to assume manual control
of the Y-axis by entering values in the
Y-axis Min Scale and **Max Scale** fields.
When deselected, the Y-axis scaling
changes dynamically with changes
in signal magnitude.*

X-Axis Window
determines the time
window displayed
along the X-axis
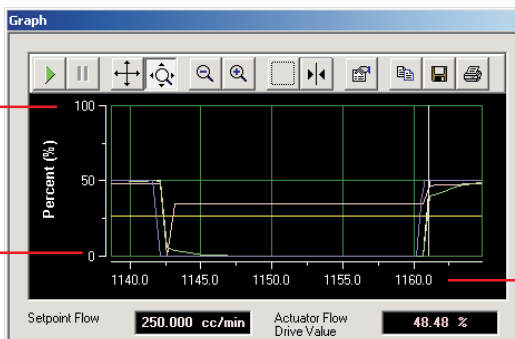
** With the **User Adjust** option selected, trend graphs whose values exceed the value
in the **Y-axis Max Scale** field will not be viewable in the trend graph. You could use
the scroll tool to scroll up the Y-axis to view the graph, but scrolled views will snap
back to standard view once you release the mouse button.*

Figure 4-4 Trend Graph Options

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Tuning Step

The following window will allow the user to select the step which is used for increasing or decreasing the following data fields using the up and down buttons:

- Valve Tuning, position of the valve in case manual mode is selected.
- PID Control in response tuning window.
- Flow Sensor in response tuning window.

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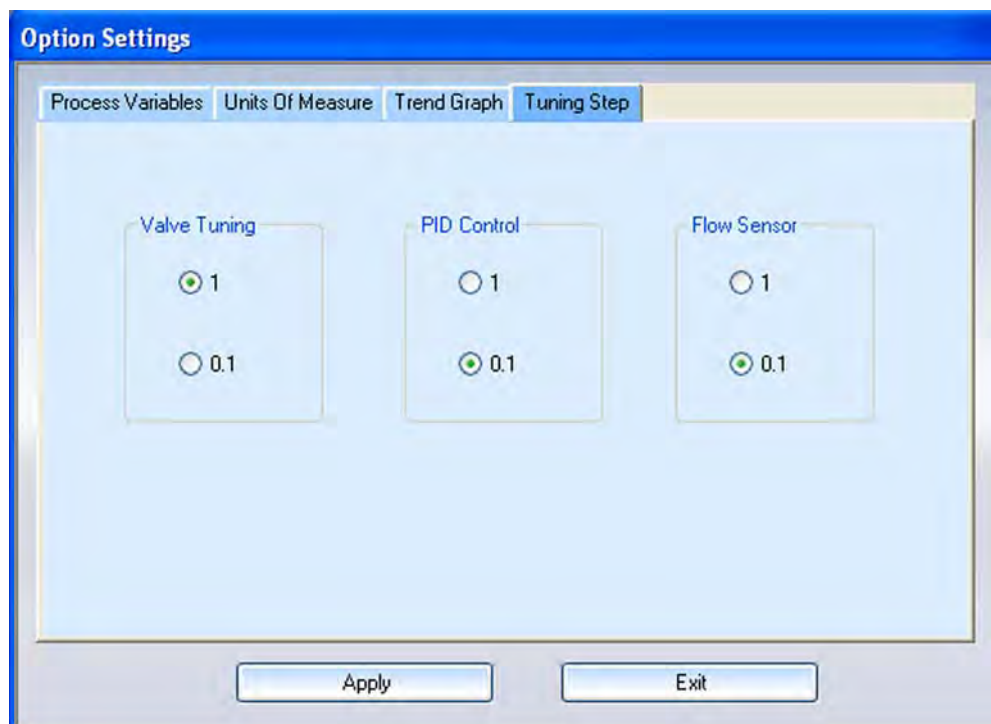
4.5 Choosing the Input Source for the Device - Service Suite or External

By default, a session opens with the external source providing the setpoint input to the device. In this mode, data in the Service Suite's Graph window indicates what the device is currently reporting as its setpoint.

However, you can control the setpoint directly from the Service Suite by selecting the **Brooks Service Suite** option in the Source Control panel, then entering a value in the **Setpoint** field. Figure 4-1 on p. 4-4 calls out these controls.

Upon exiting the application, setpoint source control is automatically set to **External**.

4.6 Trend Graph Functions

The following topics cover the functions that you can perform on the trend graph.

4.6.1 Trend Graph Toolbar Functions

Table 4-2 summarizes the Trend Graph's toolbar functions.

The following topics provide more detail about each of the Trend Graph toolbar functions.

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Table 4-2 Summary of Trend Graph Toolbar Functions

Function	Description
▶	Starts variable data trending, if it has been stopped.
‖	Stops variable data trending.
✛	Scroll up and down the Y-axis, or back and forth across the X-axis. (Y-axis User Adjust option must be selected; refer to Figure 4-4 on p. 4-7.)
🔍	Zoom in and out of a selected axis. (Y-axis User Adjust option must be selected; refer to Figure 4-4 on p. 4-7.)
🔍 🔍	Zoom in and out of both axes simultaneously.
▢	Zoom in on a region of the trend graph.
▮◀	View the X- and Y-axes values at a given point in time the trend graph.
🖳	Change the graph's display properties. It is recommended that you use the default settings.
🗎	Copy the trend graph to the clipboard.
💾	Save the trend graph as a file.
🖨	Print the trend graph.

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4.6.2 Pausing and Starting Trending

You can pause the real-time updating of trending data at any time. For example, you may want to analyze the current window of data for troubleshooting. Pausing the trend graph freezes the data as it is currently displayed.

To pause trending, click the ⏸ button in the Trend Graph toolbar. With trending paused, you can continue to use the other toolbar functions on the portion of the graph that is displayed.

By default, when trending is paused, the data from the device is not tracked until trending is restarted. However, you can enable data tracking with trending paused, and thus pick up the trending graph where it left off when paused when you decide to restart trending.

To enable data tracking with trending paused, move the pointer over the X or Y axis area and right-click. From the pop-up menu that displays, select the **Tracking Enabled** option.

Tracking Enabled
Update Resume Values
Zoom to Fit
Edit...
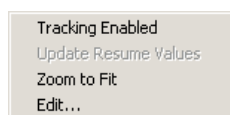
To restart trending, click the ▶ button. When you restart trending, the trend graph will jump to display the most recently collected data. To see data collected while the trend graph was stopped, use the X-axis Scroll Tool, covered in the next topic.
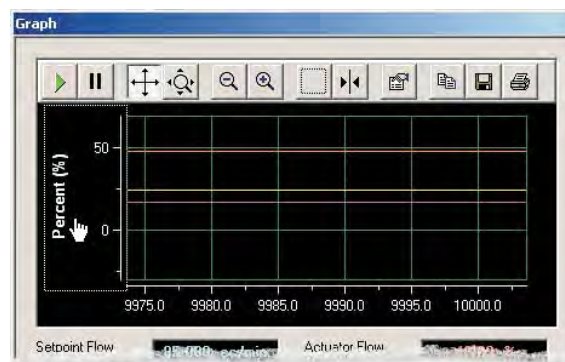
4.6.3 Scrolling a Graph Axis

The Scrolling tool allows you to scroll up and down the Y-axis, or back and forth across the X-axis. This can be helpful in seeing other areas of the trend graph (for example, if you have zoomed in on it, or if you want to see previous portions of the trend graph).

To scroll on an axis, click the ✛ button in the Trend Graph toolbar and move the pointer over the axis on which you want to scroll. The pointer turns into a pointing hand. Click and drag in the direction you want to scroll.

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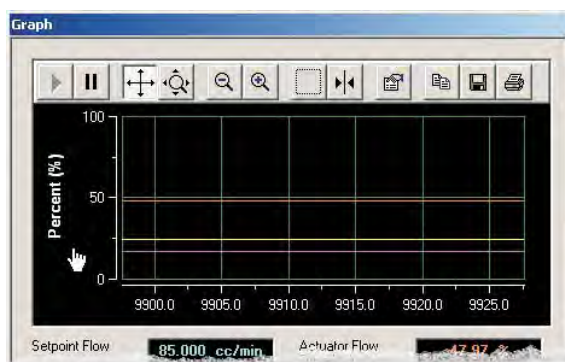
Before Y-axis scrolling
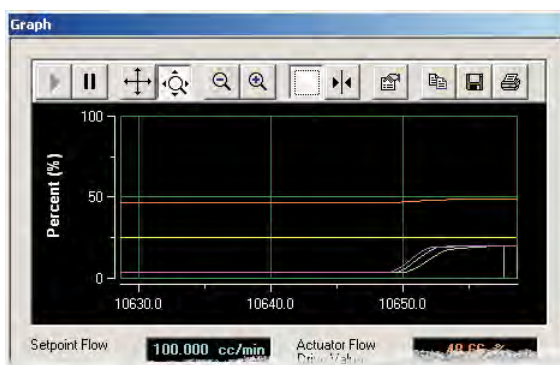

After Y-axis scrolling

NOTE:

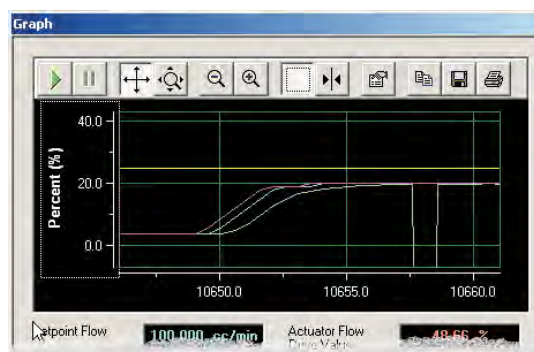The Y-axis User Adjust option must be selected for this feature to work; refer to Figure 4-4 on p. 4-7.

4.6.4 Zooming on a Single Graph Axis

The Zooming on a Single Axis tool allows you to zoom on the X- or Y-axis.

To zoom on an axis, click the [⊕] button in the Trend Graph toolbar and move the pointer over the axis on which you want to scroll. The pointer turns into a double-headed arrow, pointing in the directions relative to the axis it is over. Click and drag in the direction you want to zoom.
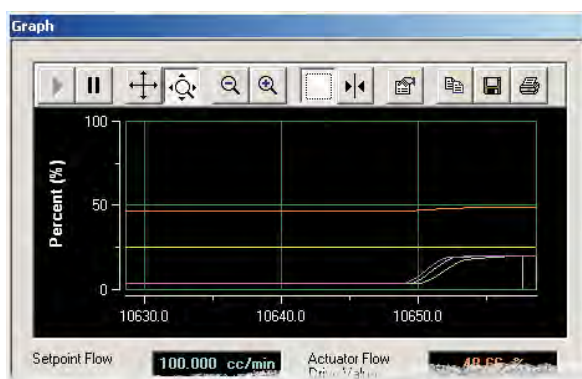

Before X-axis zooming

After X-axis zooming

NOTE:

The Y-axis User Adjust option must be selected for this feature to work; refer to Figure 4-4 on p. 4-7.

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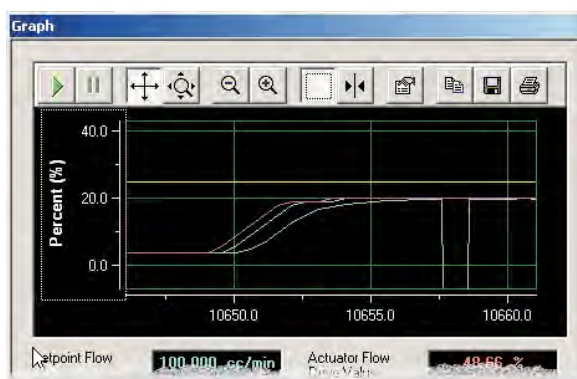
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4.6.5 Zooming on Both Graph Axes

The Zooming on Both Axes tool allows you to zoom on the X- and Y-axes at the same time.

To zoom on both axes simultaneously, click one of the [buttons] buttons in the Trend Graph toolbar. The trend graph scrolling is paused. Click and drag on the axes to scroll them to view the portion of the graph you

zoomed in on (if you zoomed in). Click the [▶] button to restart graphing. After clicking play, axes return to default zoom factor.

Before zooming in on both axes

After zooming in on both axes

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4.6.6 Zooming on a Region of the Graph

The Zooming on a Region tool allows you to zoom on a region on the trending graph, adjusting the X- and Y-axes scales accordingly.

To zoom on a region of the trend graph, click the ▢ button in the Trend Graph toolbar and move the pointer over the trend graph. The pointer turns into an arrow with a box. Click and drag to draw a box around the region on which you want to zoom, then release the mouse button. Graphing pauses like before to allow you to examine the zoomed area. You can click and drag to scroll through the axes.

With region to zoom selected in box
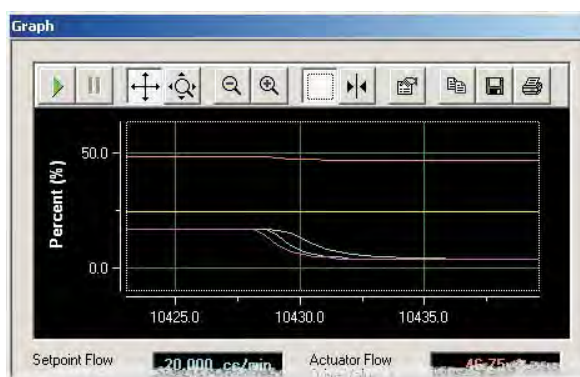

After region was zoomed on

NOTE:

When you release the mouse button, the trend graph freezes on the bounded region. You have to click the ▶ button to resume trending.

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4.6.7 Displaying the Entire Trend Graph

You can display the entire trend graph in the graph area.

To display the entire trend graph, move the pointer over the X or Y axis area and right-click. From the pop-up menu that displays, select the **Zoom to Fit** option.
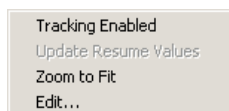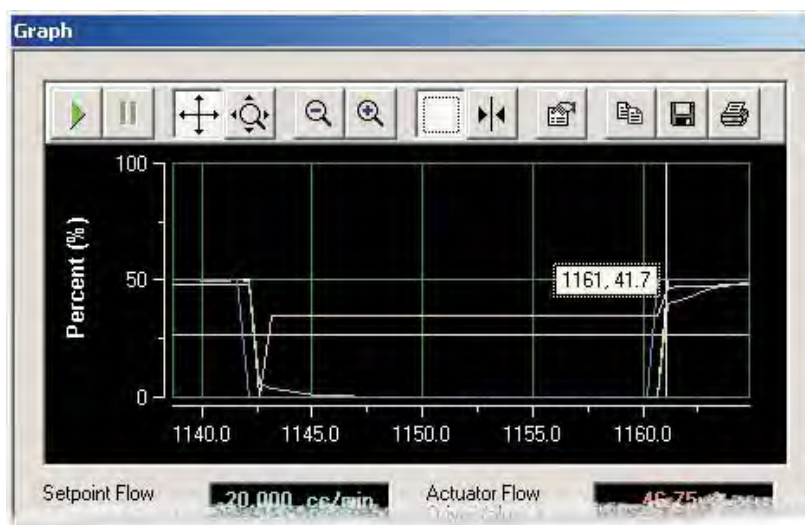

To return to the standard view of the trend graph, deselect the **Zoom to Fit** option.

4.6.8 Displaying X and Y Values at a Particular Point

The Values tool allows you to select a point along the Mass Flow trending graph and display the corresponding X- and Y-axis values at that point.

To display the exact X and Y values of the trend graph, click the [button icon] button in the Trend Graph toolbar and move the pointer over the trend graph. The pointer turns into pointing finger over a colored vertical line—the *cursor*. The X,Y values for the current cursor position are displayed. As you click and drag the cursor across the trend graph, the X,Y values dynamically update.

X,Y values at current cursor position

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If you right-click on the cursor, a pop-up menu displays, allowing you to select from several options that control the cursor's attributes. These options are described in Table 4-3.
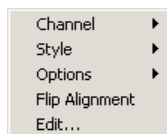
```
Channel          ▶
Style            ▶
Options          ▶
Flip Alignment
Edit...
```

Table 4-3 Trend Graph Cursor Options

Option	Description
Channel	Allows you choose the channel to which the cursor is attached. The channels correspond to the variables (Mass Flow, Setpoint, and so on).
Style	Allows you to choose the measurement being made: • **Value X-Y.** Cursor is a single line. • **Value X.** Cursor is a single line. • **Value Y.** Cursor is a single line. • **Period.** Cursor is two vertical lines connected with a dotted line, showing the time/frequency between the lines. • **Peak-Peak.** Cursor is two horizontal lines connected by a dotted line showing the percentage difference between the lines (because Y-axis is in percent). • **Frequency.** Cursor is two vertical lines connected with a dotted line, showing the time/frequency between the lines. For Styles whose cursor is two lines, you can drag each line separately to make measurements.
Options>Use Channel Color	If selected (the default), the cursor is the color related to the variable. If not selected, the cursor is yellow.
Options>Hide Hint on Release	If selected, the values associated with the cursor are shown only while the left mouse button is held down.
Flip Alignment	Enabled only with single-line cursor styles. If selected, moves the values displayed to the opposite side of the vertical line.
Edit	For Brooks internal use only.

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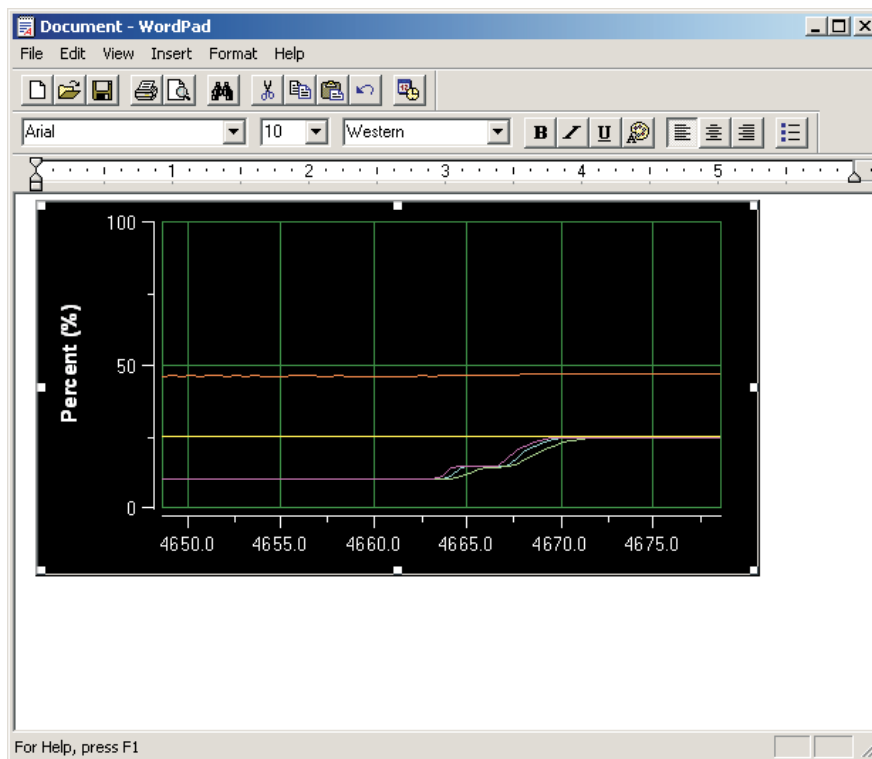**Section 4 Basic Operations**

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4.6.9 Copying the Graph to the Clipboard

You can copy the current state of the trend graph to the clipboard, for pasting into another Windows application.

To copy the current state of the trend graph to the clipboard, click the

[icon] button in the Trend Graph toolbar. The trend graph is copied to the clipboard. A sample of the trend graph pasted into a document is shown below.

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4.6.10 Saving the Graph to a File

You can save the current state of the trend graph to a graphic file.

To save the current state of the trend graph to a graphic file, click the

🖫 button in the Trend Graph toolbar. The Save As dialog box displays.
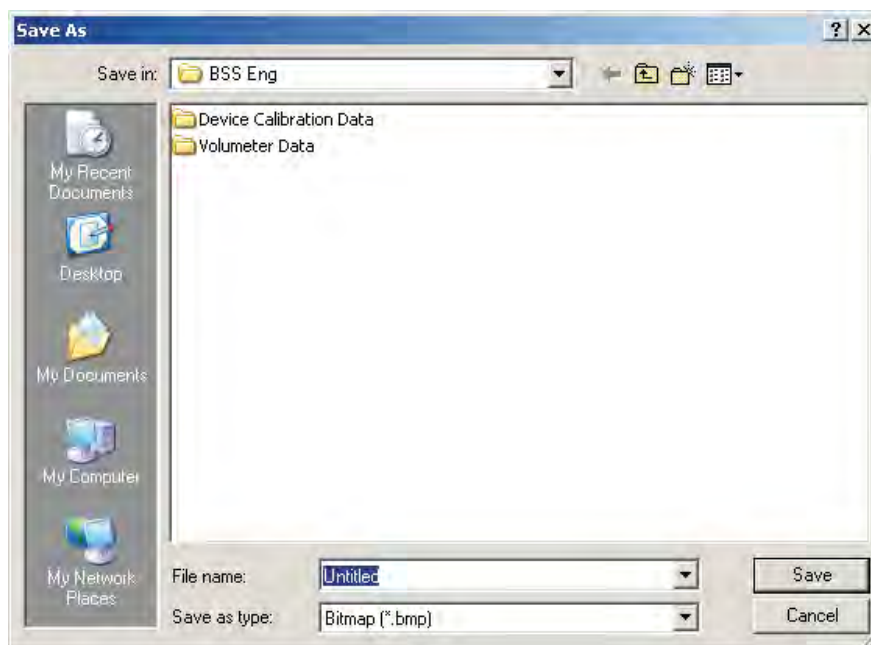
Navigate to the desired directory and enter a name for the file. You can also specify the graphic format—Bitmap (.bmp), Enhanced Metafile (.emf), or JPEG (.jpg)—from the **Save as type** drop-down list. Click the **Save** button to save the file.

4.6.11 Printing the Graph

You can print the current state of the trend graph to a printer.

To print the current state of the trend graph, click the 🖨 button in the Trend Graph toolbar. The standard Windows Print dialog box displays.

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4.7 Status Bar

The Status Bar, at the bottom of the Service Suite main window, indicates the status of alarms and warnings, the valve, and the communications interface between the application and the device.

Alarm Status: NORMAL	Valve Status: NORMAL	Comm Status: ACTIVE
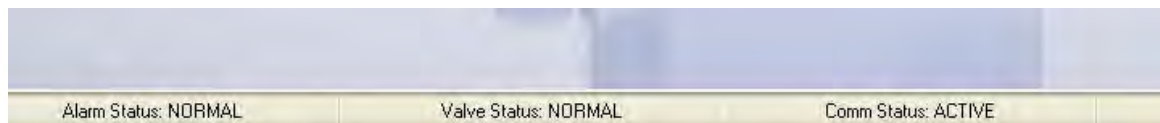
4.8 Preferences, Report Template

It's possible to change the default Brooks addresses and logo on the calibration report by selecting the 'Custom' radio button.

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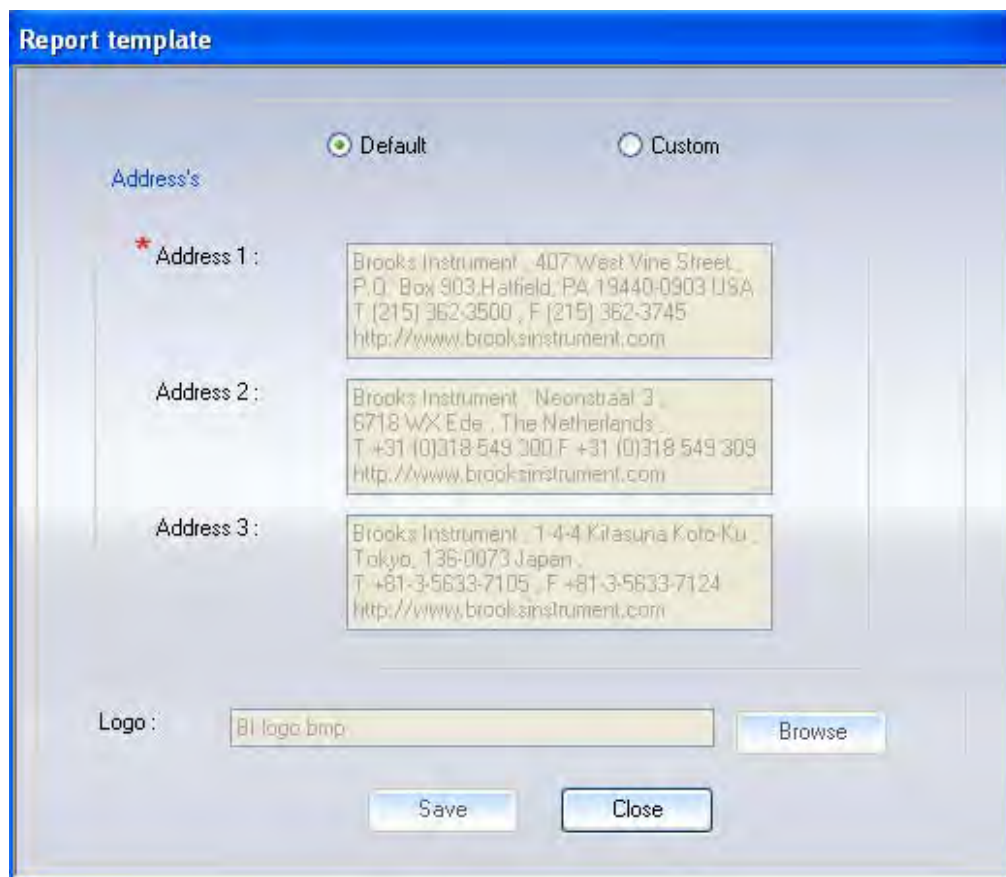
4.9 Saving the Current Device Configuration

To save the current device configuration settings and calibration data, open the **File** menu and choose **Save Device Configuration**. The Save Device Configuration File window displays.
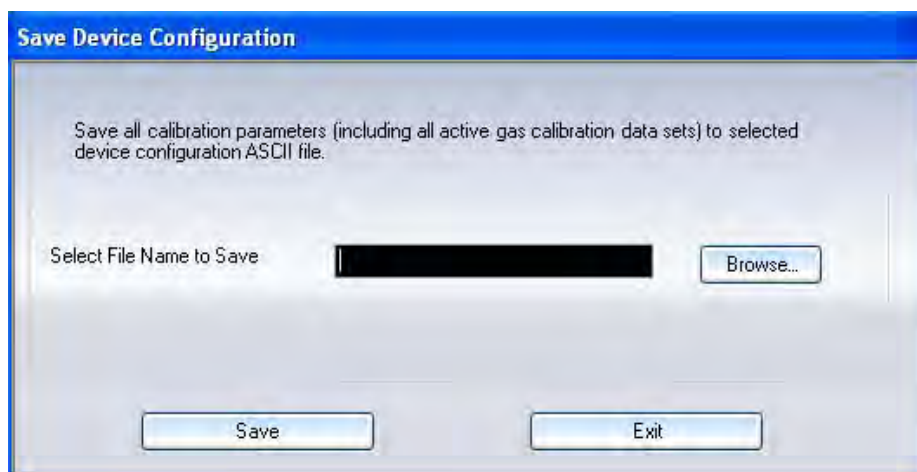
To accept the default file name and directory, click the **Save** button. You can also change the file path and name by editing the file name field entry, or by clicking the **Browse** button to display a Save As dialog box.

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4.10 Import Database

This version of the Brooks Service Suite supports the Import Database functionality in order not to loose any product and calibration related data used on the Calibration Report when performing an upgrade of the Brooks Service Suite application. In case the version of the Brooks Service Suite application you're going to uninstall is 2.0.1 or older, you'll have to perform some manual copy actions. If the version of the Brooks Service Suite application you're going to uninstall is 2.0.2 or newer the database will be stored in a backup folder called 'BSS Backup' ($programfiles-> Brooks Instrument->BSS Backup). In the newer version of the Brooks Service Suite you'll have to execute the 'Import Database' functionality and select this backup copy to restore the database. Note that the Import Database functionality is only available in case the session is closed.

Manually backup database:

- Create a backup folder called 'BSS Backup' in the Brooks Instrument Program Files folder ($programfiles->Brooks Instrument->BSS Backup).

- Copy the 'UserEntry.mdb' file available in the 'Brooks Service Suite' folder ($programfiles->Brooks Instrument->BSS Backup->Brooks Service Suite) to this newly created 'BSS Backup' folder, make sure hidden files and operating files are visible.

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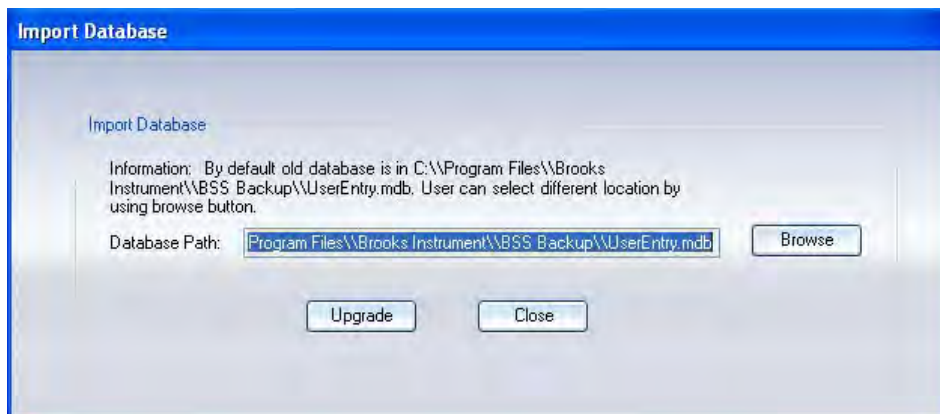
4.11 Restoring a Saved Device Configuration

You can restore any previously saved device configuration and calibration data set.

To restore a saved current device configuration, open the **File** menu and choose **Restore Device Configuration**. The Restore Device Configuration File window displays.
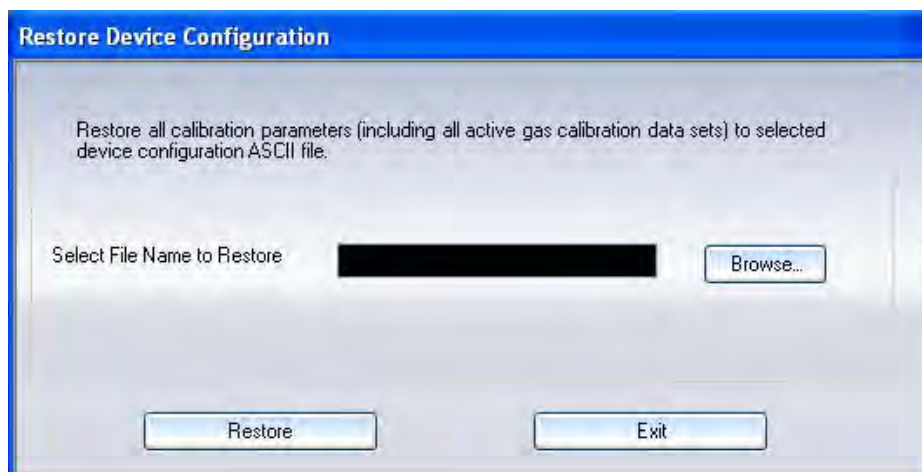
You can enter the file path and name in the file name field or, to select the desired file, click the **Browse** button to display an Open dialog box. Once you have specified the file path and name, click the **Restore** button to restore the configuration from that file.

4.12 Closing the Session and Exiting the Service Suite

To close the current session and exit the Service Suite, open the **File** menu and choose **Exit**, or click the window's close button (at the upper right corner).

Alternately, if you just want to close the session but not the application, open the **File** menu and choose **Close Session**. This feature is useful when switching the application from one device to another.

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Section 5 Control and Monitor

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5.1 Control and Monitor

This section describes how to:

- View device information

- Select a calibration data set

- Set the Totalizer function, which keeps a running total of the amount of gas or fluid that has flowed through the device

- Override the normal operation of the device's valve

5.1.1 Viewing Device Information

To view device information, open the **Actions** menu and choose **Control and Monitor**. The Control & Monitor dialog box opens. Click the Device Info tab.

The device information parameters are read-only.

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5.2 Selecting a Calibration Data Set

You can switch between up to 10 calibration data sets, according to the current application of the device. These data sets are created as part of the Service Suite's Calibration function (available in the Pro version). Each calibration data set includes a unique set of calibration and tuning parameters, to be used with a specific application of the device.

The service person at the site who is performing calibrations should keep a record listing to which application each calibration data set number applies.

To select a calibration data set, open the **Actions** menu and choose **Control and Monitor**. The Control & Monitor dialog box opens. Click the Calibration Data Set tab.

Select a data set from the **Selected Flow Calibration Record** drop-down list. Key descriptive parameters for each data set are displayed in the other, read-only fields.

NOTE:
Setting pin 13 (Calibration Select Input) will override the selected flow calibration record as set by the Service Suite.

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5.3 Setting the Totalizer Control

The Totalizer function keeps a running total of the amount of gas or fluid that has flowed through the device since the Totalizer function was turned on or reset.

To set the Totalizer Control, open the **Actions** menu and choose **Control and Monitor**. The Control & Monitor dialog box opens. Click the Totalizer Control tab.

Use the Flow Totalizer Control options to turn the Totalizer function on or off, or to reset it.

The dialog box also shows you the following read-only information:

• How frequently the nonvolatile flow totalizer is updated

• The current total flow

• The total flow as stored in non-volatile memory. This value is updated by the rate in the Flow Totalizer Update Time field.

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5.4 Using the Valve Control Function

The Service Suite's Valve Control function allows you to have the valve track setpoint (normal mode), completely open or close the valve, or manually open the valve at a percentage between 0 and 100%.

To control the valve, open the **Actions** menu and choose **Control and Monitor**. The Control & Monitor dialog box opens. Click the Valve Control tab.
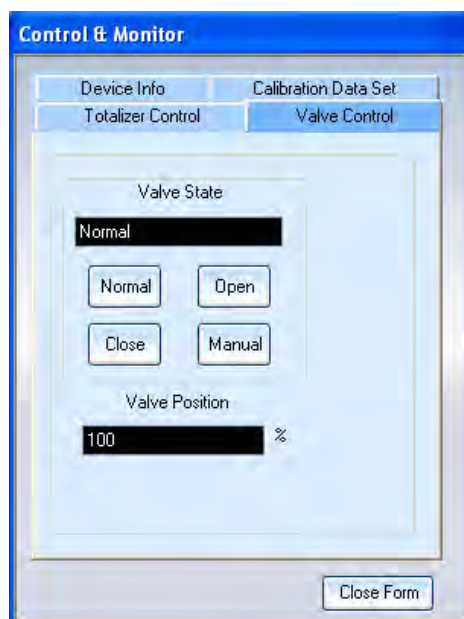
Set the valve position by:

- Clicking one of the preset value buttons—**Normal** (tracks setpoint), **Close**, or **Open**.

or

- Clicking the **Manual** button and entering the value in the **Valve Position** field, then pressing the Enter key.

The Manual mode of operation is sometimes useful for diagnostic purposes. The valve must be set to Normal mode for the device to function properly.

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5.4.1 Using Pin 12 to Control the Valve Override

You can also use pin 12 of the device's 15-pin D-connector to override normal valve operation:

- Grounding pin 12 causes the device to close the valve.

- Applying a voltage from 5–24 V nominal causes the device to open the valve. Do not exceed 25 V.

- Leaving pin 12 open (unconnected) causes the valve to operate normally (device tracks setpoint).

Note that an input signal to pin 12 takes precedence over the Service Suite's Valve Override function. If the device is in VOR Open or VOR Closed due to the signal at pin 12, then in the Service Suite:

- The status message "Analog Override Active" will appear at the top of the Valve Override Control window.

- The Valve Override Control buttons will not change.

- The Valve Status in the Status Bar indicates the actual state of the device.

- The Valve State field in the Valve Control tab also indicates the actual state of the device.

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Section 6 Diagnostics

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6.1 Diagnostics

This section describes how to:

- Test that the device is correctly reading its input (setpoint), and correctly setting its output

- View and set S-Protocol configuration parameters

- Reset the device

- View the current state of the device's warning/alarm conditions and diagnostic results

6.1.1 Testing the Analog Output

You can use the diagnostic Test Analog Output function to verify that the device is correctly setting its analog output.

Prior to using the Service Suite to test the output, you must connect a digital multimeter (DMM) to the output signal to measure the true output reading. Figures 6-1 and 6-2 show how to set up the DMM for the available output type configurations.

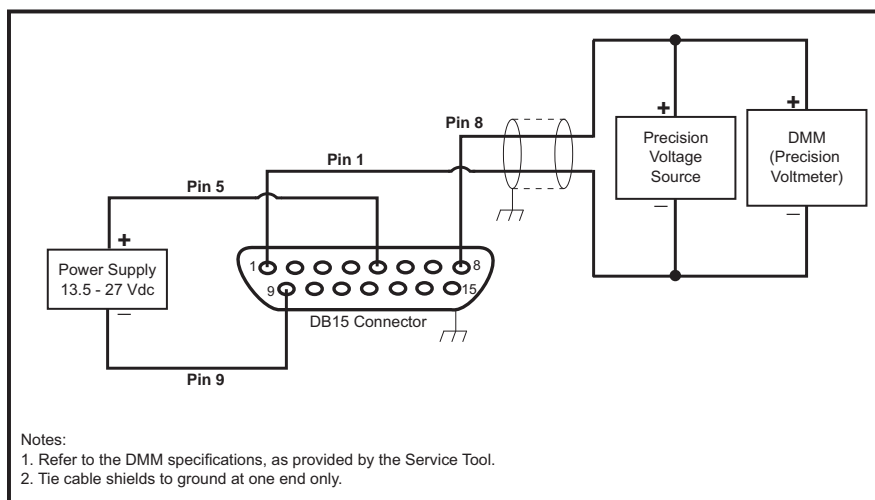Note that all of the D-connector pin-outs are listed in "3.5 Device D-Connector Pin-Outs" on p. 3-8.
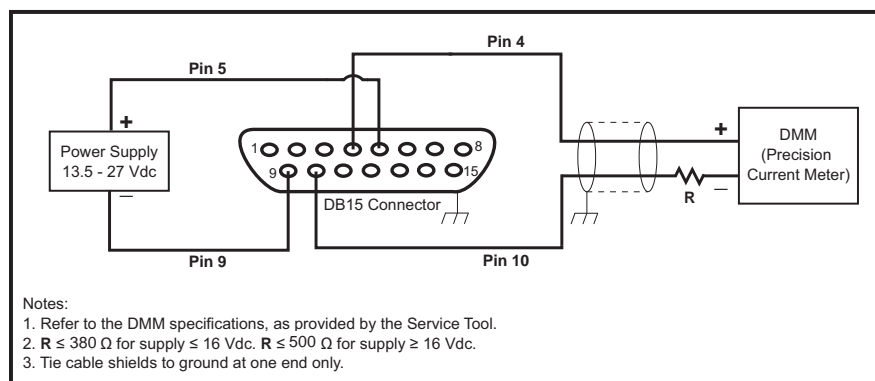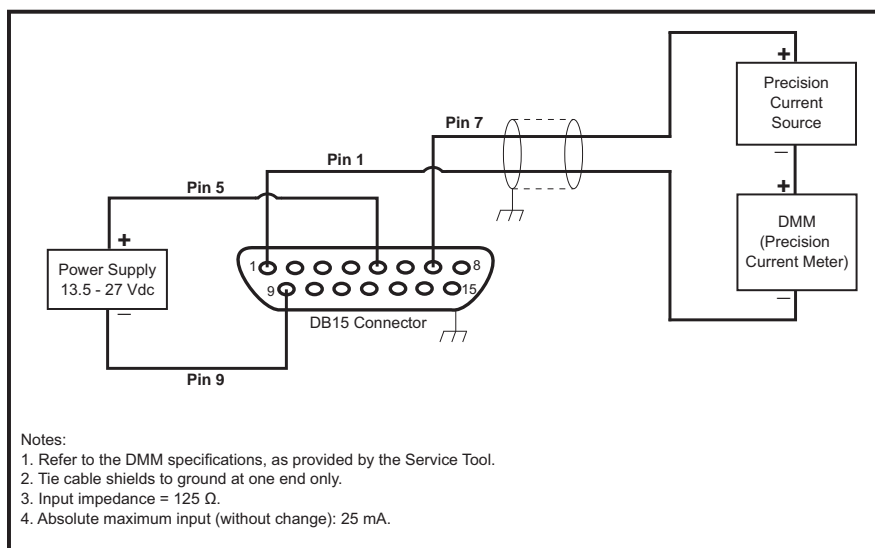

Figure 6-1 Setup for Testing Output Voltage

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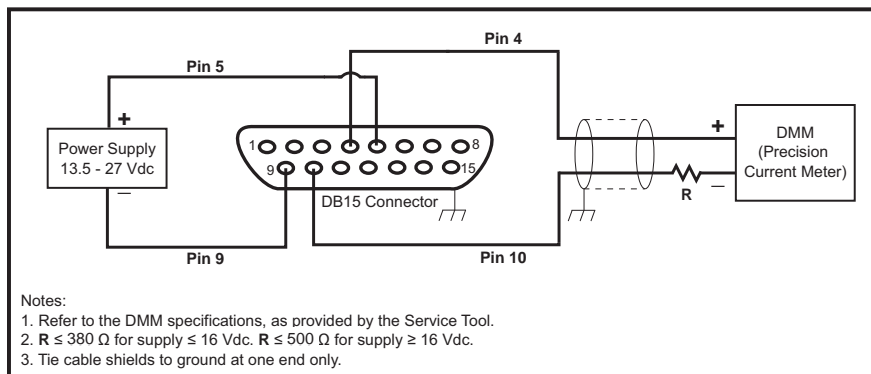
Figure 6-2 Setup for Testing Output Current

To test an output:

1. Open the **Actions** menu and choose **Service Actions>Diagnose**.

   The Diagnose dialog box opens. Go to the Test Analog Output tab. The device's output signal type is automatically chosen and cannot be changed from this dialog box.

NOTE:

For an explanation of the Output Configuration parameters, refer to Table 7-1 on p. 7-17. To change the output configuration type or adjust the output behavior options, refer to "7.4.1 Viewing the Output Signal Setting and Parameters" on p. 7-17.

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2. Change the device's output value by:

- Clicking one of the preset value buttons in the Test panel, or

- Clicking the **User** button, which makes the **Current Value** field editable, and entering a value in the field, then pressing the Enter key.

Regardless of which method you choose, the selected value is shown in the **Current Value** field at the bottom of the window. This is the value at which the Service Suite is telling the device to set its output.

3. Verify whether the DMM shows the same value as set using the Service Suite.

4. Try a few additional values to check that the output is correct.

   If the DMM reading does not match the value being set in the Test Analog Output tab, the device's output may need to be calibrated. Refer to "7.4.2 Calibrating the Output Signal" on p. 7-18.

6.2 Testing the Setpoint Input

You can use the diagnostic Test Setpoint Input function to verify that the device is correctly reading its input (setpoint) value.

Prior to using the Service Suite to test the setpoint, you must connect a DMM to the device's setpoint signal to measure the true reading. Figures 6-3 and 6-4 show how to set up the DMM for the available input types.

Note that all of the D-connector pin-outs are listed in "3.5 Device D-Connector Pin-Outs" on p. 3-8.

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Notes:
1. Refer to the DMM specifications, as provided by the Service Tool.
2. Tie cable shields to ground at one end only.

Figure 6-3 Setup for Testing Voltage Setpoint

Notes:
1. Refer to the DMM specifications, as provided by the Service Tool.
2. Tie cable shields to ground at one end only.
3. Input impedance = 125 Ω.
4. Absolute maximum input (without change): 25 mA.

Figure 6-4 Setup for Testing Current Setpoint

NOTE:

When the analog input is configured for digital mode, the setpoint is controlled via digital communications and the signal on the analog input is ignored. To test the analog input, the analog input configuration must be set to a mode other than digital. The analog input configuration can be changed from the Trend Graph window using the Control Source function.

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To test the device's setpoint reading:

1. Open the **Actions** menu and choose **Service Actions>Diagnose**.

   The Diagnose dialog box opens. Go to the Test Setpoint Input tab. The device's input signal type is automatically chosen.

The device's current reading of the setpoint is displayed in the **Measured Input** field.

NOTE:

For an explanation of the Current Configuration parameters, refer to Table 7-2 on p. 7-22. To change the current configuration type or adjust the output behavior options, refer to "7.5.1 Changing the Input Signal Setting and Parameters" on p. 7-21.

2. Verify whether the DMM shows the same value as that shown for the device value in the **Measured Input** field.

NOTE:

Input signals below the level shown in the Low Input Cutoff field will be shown as 0 V or 4 mA.

3. Try a few additional setpoint values by changing the setpoint from the input source, and verify that the value in the **Measured Input** field reflects those changes.

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If the DMM reading does not match the value in the **Measured Input** field, the device's setpoint may need to be calibrated. Refer to "7.5.2 Calibrating the Device Input (Setpoint)" on p. 7-22.

6.3 Viewing and Setting S-Protocol Parameters

The S-Protocol is an RS-485 based form of digital communication used by an external source to control the device. The protocol may be used in a standalone or multi-drop configuration to perform basic operations, such as setting the setpoint, reading flow, setting valve override, setting units of measure, and managing alarms.

The S-Protocol function in the Service Suite allows you to set the device's S-Protocol configuration parameters.

To set S-Protocol configuration parameters, open the **Actions** menu and choose **Service Actions>Diagnose**. The Diagnose dialog box opens. Go to the S-Protocol tab.

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Table 6-1 describes the S-Protocol configuration parameters.

NOTE:

The Service Suite does **not** use the S-protocol to communicate with the device. Access to the S-protocol parameters provided by the Service Suite may be used only to determine or configure this protocol's communication settings.

Table 6-1 S-Protocol Configuration Parameters

Parameter	Description
Date	32-bit integer value that represents the date value that is written and read via the S-Protocol Communication port. The Date value can be utilized by the user for any purpose and has no affect on the device.
Descriptor	A 16-character string that the user can use to describe the device. This parameter can be written and read via the S-Protocol Communication port.
Device Type	Read Only. Will always be **5** for Smart II devices.
Data Rate	Sets the data rate for serial communications of the S-Protocol port. Must be 1200, 2400, 4800, 9600, 19200, or 38400.
User Ref. Temp.	Reference Temperature (in degrees K) for which flow is to be reported if the user-specified Standard Reference Conditions. (See S-protocol manual for more details.)
Manuf. ID	Read Only. Always **10** for Brooks Instrument devices.
Message	A 32-character string that the user can use for any desired purpose. This parameter can be written and read via the S-Protocol Communication port.
Tag Name	8-character string used to identify the device on the network to obtain the device's long address.
Unique ID No.	A 32-bit integer in the range of 0 to 16777216. This value is assigned by Brooks and must be unique for all Smart II devices.
User Ref. Pressure	Reference Pressure (mbar) for which flow is to be reported if the user-specified Standard Reference Conditions. (See S-protocol manual for more details.)
Number of Preambles	The number of Preamble characters that the device will transmit as part of every response message on the S-Protocol communications port.

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Table 6-1 S-Protocol Configuration Parameters (cont.)

Parameter	Description
Polling Address	Short address of the device, must be in the range 0 to 15. This address can be used to access the long address from the device.
Primary Alarm Behavior	Read Only. Specifies how the Flow Output will behave if an alarm is active. Settings are: Track, Hold Last, Upscale, Downscale.
Flow Units	Defines the UOM that flow is to be reported in on the S-Protocol Communications Port. (The meaning of this 8-bit code is defined in the S-Protocol manual).
Temp. Units	Defines the UOM that temperature is to be reported in on the S-Protocol Communications Port. (The meaning of this 8-bit code is defined in the S-Protocol manual.)

NOTE:

Brooks Instrument provides an S-Protocol manual that describes the operation of the S-Protocol for Smart II devices. Contact the Factory or your local sales representative for more information.

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6.4 Rebooting the Device

The Software Suite's Device Reboot function allows you to Reboot the device, which is similar to powering the device off and on.

To reboot the device, open the **Actions** menu and choose **Service Actions>Diagnose**. The Diagnose dialog box opens. Go to the Device Reboot tab and click the **Reboot** button.

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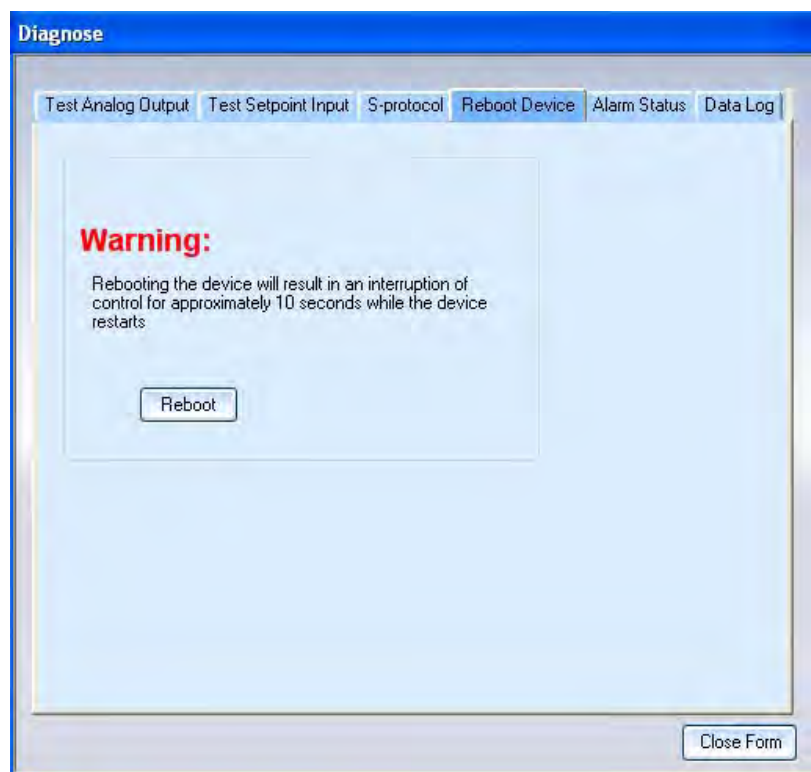
6.5 Checking the Warning, Alarm and Diagnostic Status

The Service Tool monitors the warning or alarm status for all of the alarms and warnings that the device may potentially indicate. The Service Tool also reports on the status of the device diagnostics, which run continuously.

To view the current state of alarm/warning conditions and diagnostic results, open the **Actions** menu and choose **Service Actions>Diagnose**. The Diagnose dialog box opens. Go to the Alarm Status tab.

The Alarm Status tab includes three subtabs, explained in the following topics.

6.5.1 Checking the Alarm/Warning Status in the Alarms/Warnings Tab

The Alarm/Warning Status subtab lists each of the alarm/warning conditions that the device may indicate and its respective flash codes (the code that is flashed on the device's Alarm LED).

NOTE:

For information on configuring the alarm/warning settings, refer to "7.6 Configuring Alarm Settings" on p. 7-25. For a description of the various conditions for which alarms/warnings that are available, refer to Table 7-3 on p. 7-26.

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• If an alarm condition is detected, its code field will flash red and the Alarm Status indicator in the Status Bar of the main window will flash.

• If a warning condition is detected, its code field will be yellow and the Alarm Status indicator in the Status Bar of the main window will flash.

NOTE:

Alarms, warnings, and diagnostics results can also be reported via pin 3 of the device's D-connector. This pin is configured as an open collector output. The maximum source current is 25 mA when grounded. To enable this feature, refer to "7.6 Configuring Alarm Settings" on p. 7-25.

6.5.1.1 Clear Latched Alarm and Warning Conditions

A Latching option can be set for each alarm/warning condition. If latching is enabled for a specific alarm/warning condition and that condition occurs, the latched state will persist even if the alarm/warning condition goes away. However, if you know that it is safe to operate the device, you may want to clear the latched alarm/warning condition.

To clear all latched warning and alarm conditions, click the **Clear Alarm/Warnings** button in the Alarms/Warnings subtab of the Alarm Status tab in the Diagnose window. If an alarm or a warning condition is cleared, the alarm or warning will latch again if the condition reoccurs.

6.5.2 Checking Device Diagnostic Status

The device continuously runs diagnostics. If the diagnostics detect a fatal error, the device will briefly flash the Status LED red and then reset itself after approximately 5 seconds. The tests are listed in Table 6-3 on p. 6-14.

NOTE:

The periodic device resetting that occurs during a diagnostic fault condition will make communication with the Service Suite impossible. If a diagnostic failure occurs, please make arrangements to return the device to your nearest service center.

The results of the most recent diagnostic fault(s) are displayed in the Diagnostics subtab of the Alarm Status tab in the Diagnose window.

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Table 6-2 Diagnostic Tests

Diagnostic	Failure Description
Flash Memory	8-bit checksum of the Flash memory device.
RAM Memory	Byte-by-byte test of RAM; detects bad memory location.
Non-Volatile Memory	Byte-by-byte test of non-volatile memory; detects bad memory location.
Temperature Sensor	Temperature sensor reports a value outside the nominal range of 32 to 212°F (0 to 100°C).
Internal (Device) Power Supply	Any internally generated power supply voltage outside operational limits. Internal supply voltages must be within their nominal limits.

Diagnose

Test Analog Output | Test Setpoint Input | S-protocol | Reboot Device | Alarm Status | Data Log

Alarms/Warnings | Diagnostics | Alarm Behaviour | Zero Drift Diag

Diagnostic Status Selection

Diagnostic Status
Flash Memory
RAM Memory
Non-volatile Memory (EEPROM)
Temperature Sensor
Internal (Device) Power Supply

Close Form

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6.5.3 Modifying Flow Alarms Behavior

You can modify the behavior of all flow-related alarms to become automatically disabled when one or both of the following conditions exist: setpoint is zero and valve override is active.

These options are available from the Alarm Behaviour subtab of the Alarm Status tab in the Diagnose window.

NOTE:

Flow-related alarms/warnings are considered to be:

• Flow 1

• Flow 2

• *No Flow Indication*

NOTE:

More comprehensive configuration tools for alarms and warnings are available using the Tune function. For more information, refer to "7.6 Configuring Alarm Settings" on p. 7-25.

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- **Output Alarm Behavior.** The setting selected for this option determines what will happen to the output flow signal if there is an alarm condition. The available settings are:

- **Track Flow.** Output will continue to report the value of the measured process variable.

- **Hold Last.** Output will remain at the value in effect when the alarm condition was detected.

- **Upscale.** Output will go to the maximum output signal.

- **Downscale.** Output will go to the minimum output signal.

NOTE:

The Output Alarm Behavior parameter affects both the analog output and flow output as reported by the S-Protocol (for devices so equipped).

- **Disable all 'flow' alarms when the setpoint is zero.** When this option is selected, any flow-related alarm/warning will not occur if the setpoint is zero. For example, if the Flow 1 parameter alarm is enabled and you do not want the alarm to occur while the setpoint is zero (flow is commanded to be zero), causing flow to be less than the lower limit, select this option.

- **Disable all 'flow' alarms during the valve override condition.** When this option is enabled, any flow-related alarm/warning will not occur if the valve override is in the open or closed state. For example, if the Flow 1 parameter alarm is enabled and you do not want the alarm to occur while the valve override is set to open, causing flow to exceed the upper alarm limit, select this option.

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6.5.4 Modifying Zero Drift Diagnostics

If the mass flow controller device supports the Zero Drift Diagnostics feature the Zero Drift Alarm can be enabled in the 'Alarm Settings' window, see section 7.6 Configuring Alarm Settings. If this feature is not supported by the mass flow controller device the 'Warning' and 'Alarm' options in the 'Alarm Settings' window will be disabled. The table below lists the Zero Drift Diagnostic related parameters which can be configured.

Table 6-3 Zero Drift Diagnostics Parameters

Name	Description
Adjust Error Limit For Temperature	If this option is disabled, then the limit is defined by the user configurable Error Limit parameter. If this option is enabled, then the limit is computed to be the greater of the user configurable Error Limit parameter and the maximum allowable drift per the device's Zero Drift specification
Alarm Delay	The time that the flow signal must exceed the Error Limit before the alarm is activated. The range for delay values is 0 – 99.9 seconds with 0.1 sec. resolution.
InterLock Delay	The time period between setpoint becoming zero and alarm monitoring starts. The range for Interlock delay parameter is 0 – 99 minutes with 0.1 min. resolution.
Safe State Enable	If the Safe State Enable is set to ENABLED, then the device will transition to a state such that the valve will go to the Valve Override Closed state, the device will not respond to setpoint, and flow output signal will be reported as 0.0. The Module Status LED will flash Red to indicate that the device is in this state. This state will be referred to as the Recoverable Fault State. To recover from this state, a Zero operation or a power cycle of the device must be performed.

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6.6 Data Logging

This Data Log window allows the user to periodically log the data of the selected variables in the graph window. The target file needs to be selected or created using the Browse button. The Log Rate must be specified from 1ms and up.

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7.1 Tuning

This section provides procedures for using the Service Suite to adjust the device to ensure optimum performance.

The Service Suite includes several functions that allow you to tune and calibrate the device:

- Zeroing the sensor, to properly set the device to the no-flow state.

- Adjusting the valve offset and span, to optimize the valve behavior during process conditions.

- Calibrating the device's input and output signals, to ensure that the device is accurately reading setpoint and setting its output signal.

- Configuring Alarm settings, to set and modify the conditions under which an alarm or warning event may occur.

These functions can be accessed via the Tuning function, available from the **Service Actions** menu.

⚠ CAUTION

Some of the features contained within the tuning window can be used to alter the performance of the device. It is *HIGHLY* recommended that you save the device configuration before proceeding with any tuning function. For instructions on how to save the device configuration, refer to Section 4.8 " Saving the Curent Device Configuration" on page 4-18.

7.1.1 Zeroing the Device's Sensor

The Service Suite's Sensor Adjust function allows you to zero the device's sensor when there is a no-flow condition. The device also includes a Zero pushbutton (located at the side of the device) that performs this same function.

To zero the device's sensor:

1. Allow the device to be powered on for 45 minutes so that it achieves its operating temperature.

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2. Close the downstream shutoff valve.

   The device should be full of process gas with no pressure differential.

3. Wait at least 30 seconds for the flow signal to drop to zero.

4. Using the device's Zero pushbutton or the Service Suite's Sensor Adjust function, zero the device:

   If using the pushbutton, press the pushbutton until the device's Status LED flashes red, then release the pushbutton. A successful zeroing operation is indicated by the Status LED being a steady green.

   If using the Zero Sensor function, open the **Actions** menu and choose **Service Actions>Tune** to display the Tuning dialog box.

On the Sensor Adjust tab, click the **Zero** button. A message box displays when the zeroing operation is complete.

In either case, the zeroing operation can take up to 10 seconds to complete.

If you attempt to zero the device using the Sensor Adjust function while gas is flowing at ³5% of full scale, a dialog box displays prompting you to confirm whether you want to continue with the operation. This allows you to zero the device if there is some reason for which you want to zero the device with low flow.

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If the unit cannot zero the device (for example, the device is malfunctioning, flow is too high, or the flow oscillates), a dialog box displays indicating that the device cannot be zeroed.

7.2 Valve Tuning

The Service Suite includes a Valve Tuning function that allows you to tune two valve parameters to optimize its performance:

- Valve offset (flow off, 0%)

- Valve span (at flow + span, flow is just at fullscale, 100%).

Device performance can be affected by contaminants or pressure changes. Tuning the valve offset and span can help to optimize the valve response.

At process conditions with process flow:

- The valve **offset** value corresponds to the valve position (measured as a percentage from fully closed to fully open) at which flow is off.

- The valve **span** value is used to determine the valve position—offset + span—at which flow is just at fullscale.

All valve offset values are calibrated at the factory at the conditions specified on the device's production order.

> ⚠️**CAUTION**
>
> It is highly recommended that you use the Service Suite's Save Device Configuration function to save the device's current configuration before making any changes to the valve offset and span. This will allow you to restore a working configuration if the valve tuning results in incorrect settings or faulty operation. For more information, refer to Section 4.8 "Saving Current Device Configuration" on page 4-18.

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7.2.1 Checking the Offset and Span Values

To check the offset and span values:

1. Open the **Actions** menu and choose **Service Actions>Tune** to display the Tuning dialog box, then go to the Valve Tuning tab.

2. Set inlet and outlet pressure conditions to match those specified on the device's order or on its Calibration Report.

3. Click the Adaptive Control **Disable** button to make sure that Adaptive Control is not on.

4. In the Manual Tuning panel, click the **Manual** button to enable the **Valve Position (Current)** field.

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5. Starting with 0, enter percentage values in the **Valve Position (Current)** field (press the Enter key after entering a value) until the flow rate just begins (1%).

   At this point, the value in the **Valve Position (Current)** field should be very close to the value shown in the **Valve Offset (Stored)** field. Some small difference between **Valve Position (Current)** and **Valve Offset (Stored)** is acceptable.

6. Continue to enter higher values in the **Valve Position (Current)** field until 100% flow is reached.

   At this time, the value in the **Valve Position (Current)** field should be very close to the sum of the values in the **Valve Offset (Stored)** and **Valve Span (Stored)** fields. Some difference in these values is acceptable.

You should adjust the offset and span values if one of the following are true:

• The process conditions are now different from that specified on the device's order.

• The valve position that produces a flow rate of 1% does not closely match the offset value in the **Valve Offset (Stored)** field.

• The valve position that produces a flow rate of 100% does not closely match the current offset + span values in the **Valve Offset (Stored)** and **Valve Span (Stored)** fields.

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7.2.2 Adjusting the Offset and Span Values - Manual Tuning

To adjust the offset and span values manually:

1. Set inlet and outlet pressure conditions to your process or application specs.

2. Open the **Actions** menu and choose **Service Actions>Tune** to display the Tuning dialog box, then go to the Valve Tuning tab.

3. Click the Adaptive Control **Disable** button to make sure that Adaptive Control is not on.

4. In the Manual Tuning panel, click the **Manual** button to enable the **Valve Position (Current)** field.

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5. Starting with 0, enter incremental values in the **Valve Position (Current)** field until flow just begins (press the Enter key after entering a value). Make sure you have stopped at £1% flow.

NOTE:

Do not overshoot and then decrease the valve value to locate the offset position. Because of valve hysteresis, you must start at zero and find the offset value only by increasing up from zero.

6. Press the **Save Offset** button to save the new offset value.

7. Once the offset value is determined and set, continue to slowly increment the current valve value. As flow rate approaches 100%, enter values in smaller increments until 100% flow is achieved.

8. Allow the flow rate to stabilize. When the flow rate has stabilized, press the **Save Span** button to save the new span value.

9. Enter different values in the **Value Position (Current)** field to determine whether or not the newly saved offset and span values produce the desired flow rates, that is, 1–2% with the valve drive at offset, and 100% with the valve drive at offset + span.

10. Click the **Normal** button to return the valve to its normal operating state.

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7.2.3 Adjusting the Offset and Span Values - Auto Tuning

The Auto Tune function determines the valve offset and span values automatically.
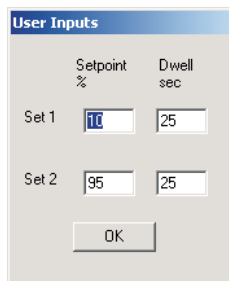
To adjust the offset and span values using the Auto Tune function:

1. Set inlet and outlet pressure conditions to your process or application specs. Select the Service Suite as the setpoint source in the graph window and configure 0% setpoint.

2. Open the **Actions** menu and choose **Service Actions>Tune** to display the Tuning dialog box, then go to the Valve Tuning tab.

3. Click the **Auto Tune** button to start the operation.

You are prompted to enter step values. These values define the low (Set 1) and high (Set 2) valve step values that will be used to adjust the valve during the second phase of the Auto Tune operation. The Dwell values determine how long to maintain the step value before switching to the next value.

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NOTE:

It is recommended to keep the User Inputs parameters at their default settings.

4. Enter the step values and dwell time in the User Inputs dialog box, then click **OK**.

The Auto Tune operation starts.

In the first adjustment phase, the device valve is opened in gradual steps to determine an approximated rough valve offset.
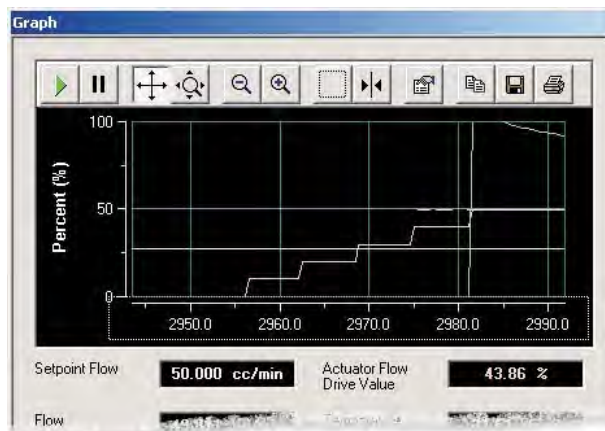
In the second adjustment phase, the setpoint is repeatedly cycled (according to the setpoint cycling values that you specified) until offset and span differences are below an acceptable threshold, or for a maximum of six cycling periods. This adjustment process can take several minutes.

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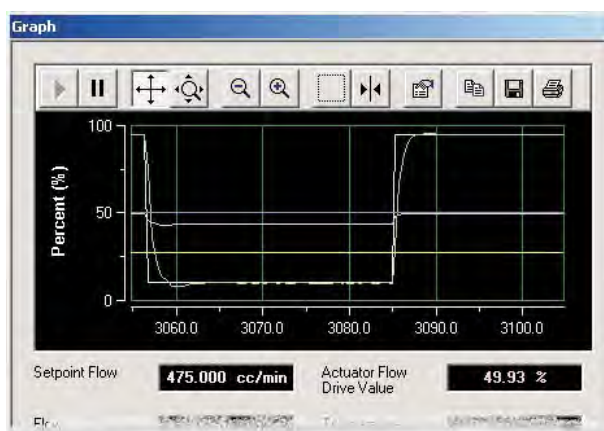
When the Auto Tune operation is complete, a message box displays.

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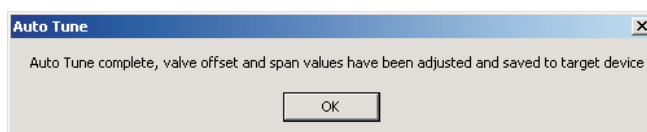
7.2.4 Dynamically Adjusting the Offset and Span Values During Device Operation

The Valve Tuning Adaptive Control function, when enabled, causes the device to dynamically adjust valve offset and span, or just offset, while the device is operating.

If process conditions change significantly (such as moderate shifts in inlet or outlet pressure) while Adaptive Control is enabled, valve offset and span will dynamically self-adjust for optimum valve performance under the new process condition without requiring operator intervention.

To enable Adaptive Control, open the **Actions** menu and choose **Service Actions>Tune** to display the Tuning dialog box, then go to the Valve Tuning tab. In the Adaptive Control panel:

- Select the **Offset and Span** or **Offset Only** option from the **Mode Select** drop-down list.

- Click the **Enable** button.

Adaptive Control

| Enable | Disable |

Mode Select

| Offset Only ▼ |

Adaptive Control is
Disabled for Offset only
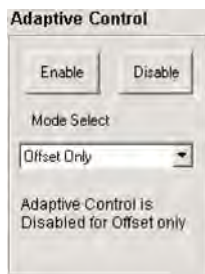
NOTE:

When adaptive control is enabled, offset and/or span may change dynamically. However, these changes are not permanent, and the device returns to the stored offset and span after a power cycle or system reset.

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7.3 Response Tuning

Response tuning optimizes the dynamic performance of the mass flow controller device to changes in setpoint. You can use this feature to eliminate undesired flow under- and overshoot.

If the mass flow controller device supports the Improved Response and Control feature also PID Kd (derivative gain) value can be changed. If this feature is not supported by the mass flow controller device the PID Kd value can not be changed.

NOTE:

For devices calibrated at the factory, response tuning adjustments should not be necessary, as calibrations are performed to the device's specified process conditions. If you do want to adjust the response tuning, it is strongly recommended that you adjust only the PID **Kp** and **Ki** (proportional and integral gain) values. Do not adjust the Flow Control **K-up** and **K-down** values. For Service Suite training, which includes training for response tuning, contact your local Brooks service representative.

To tune the device's response, you will set up a square wave for the setpoint. You will then make adjustments to tuning parameters to make the actual flow graph match the setpoint's square wave.

To tune the device's response:

1. Open the **Actions** menu and choose **Service Actions>Tune** to display the Tuning dialog box, then go to the Response Tuning tab.

   The sample screen below shows the default tuning values.

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2. Position the Graph window so that you can see the Tuning and Graph windows at same time.

3. Set up the setpoint square wave, as shown in Figure 7-1. You should pick high and low setpoints that are at the expected range of your process application.
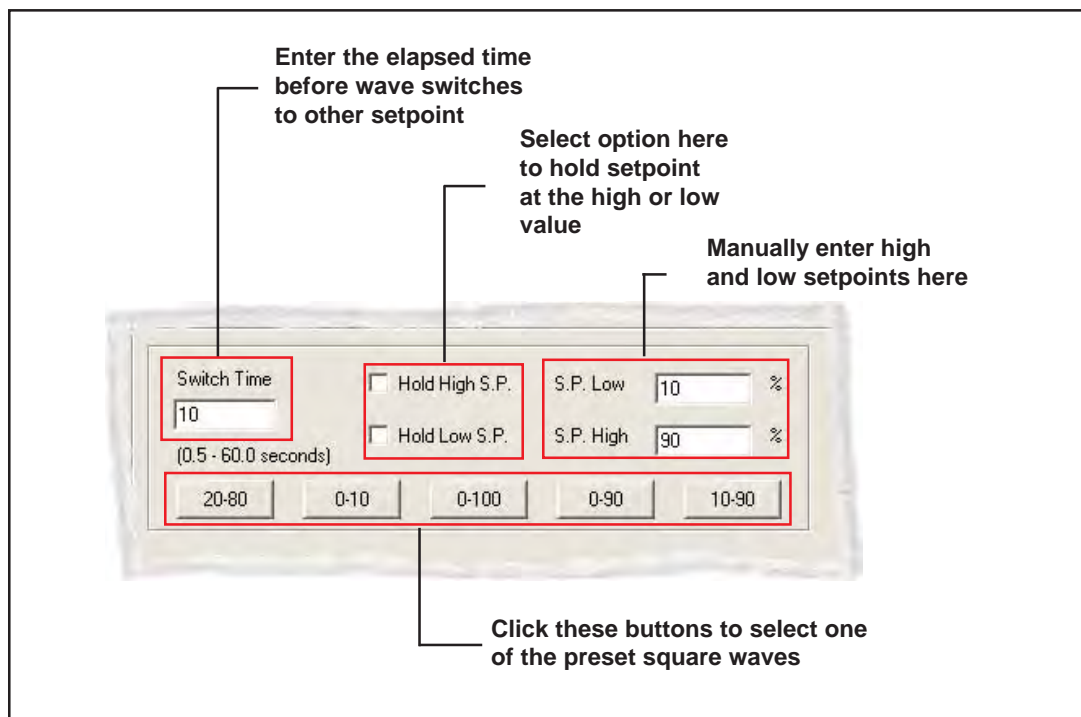
Figure 7-1 Setting Up the Setpoint Square Wave

NOTE:

The Brooks Service Suite is intended to be used for mass flow controls and mass flow meters. If you are adjusting a meter model, use a separate flow controller to regulate the setpoint cycling.

4. Make sure that the **Adaptive Control Enable** option is **not** selected.

5. Click the **Start** button to begin flow.

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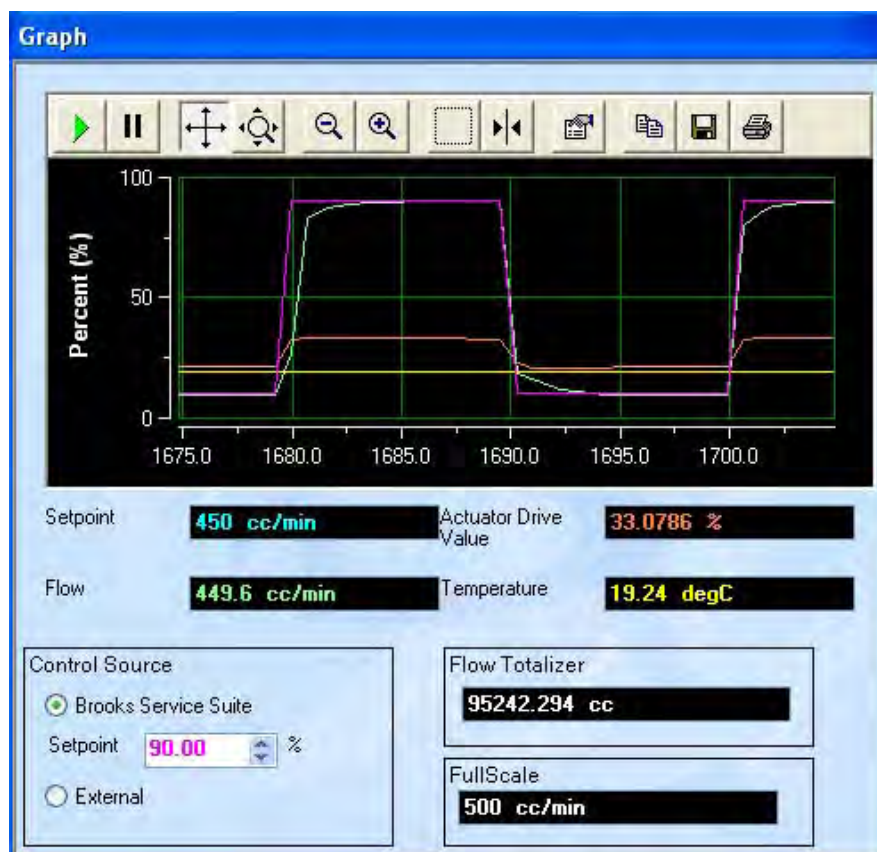
6. Observe how closely the actual flow matches the setpoint square wave.

7. Start making adjustments using the PID **Kp** and **Ki** (proportional and integral gain) values. (Do not adjust the Flow Control **K-up** and **K-down** values.)

     Figures 7-2 and 7-3 shows some examples of what the flow graph looks like when Kp and Ki values are too high or too low.

NOTE:

If you are having difficulty getting the actual flow graph to look like the setpoint square wave, you can restore the initial settings that were in effect when the window was opened by clicking the **Restore Settings** button.

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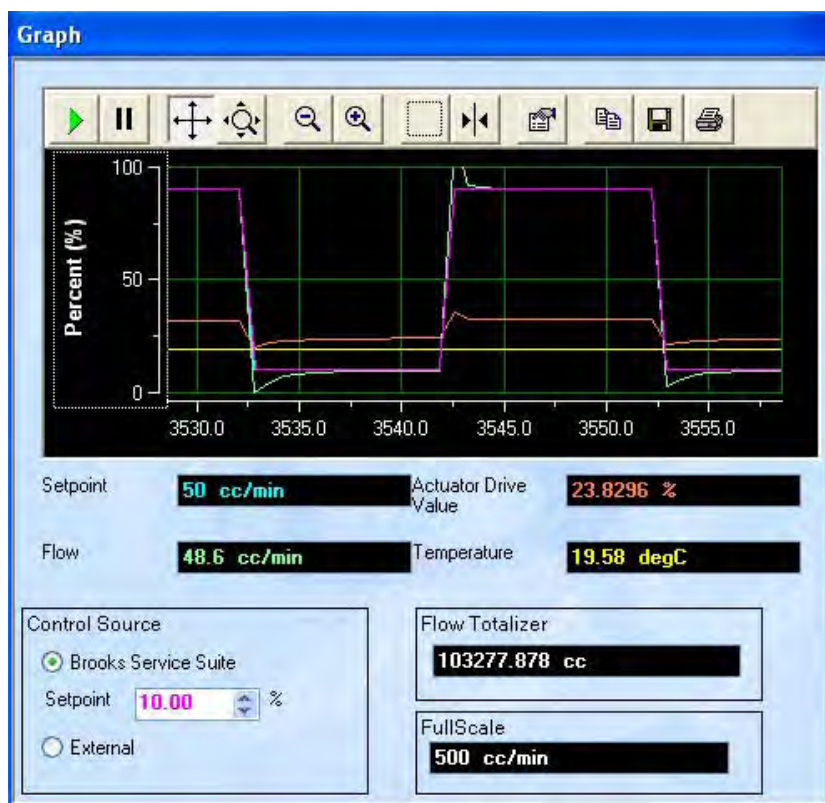
Figure 7-2 Kp Value Is Too High, or Ki Value Is Too Low
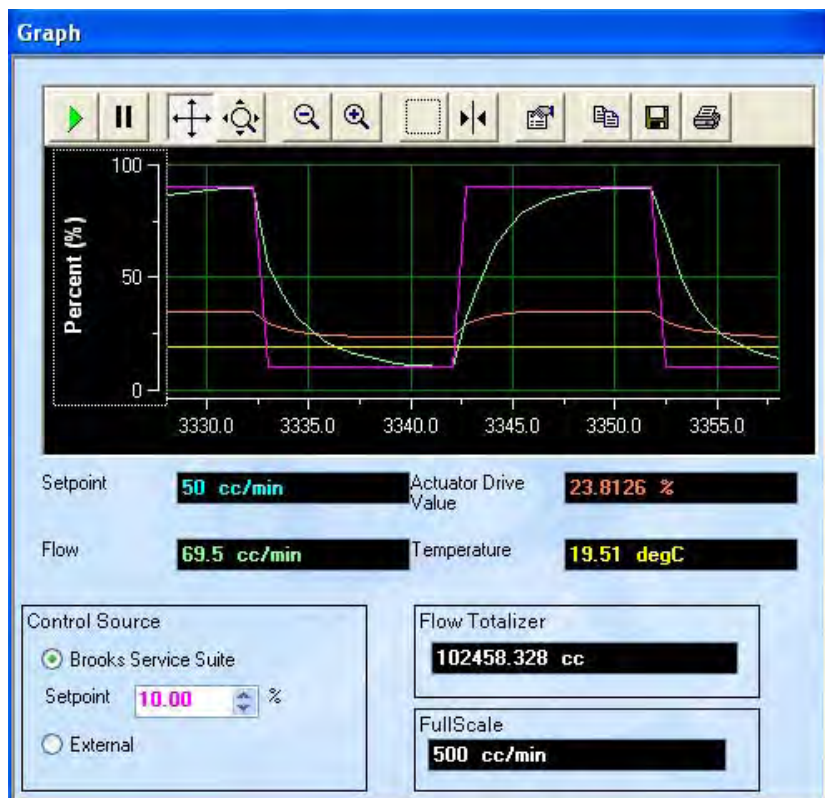
Figure 7-3 Kp Value Is Too Low, or Ki Value Is Too High

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7.4 Setting and Calibrating the Output Signal

The Output Adjust function allows you to change the output signal setting and its operating parameters. After making changes to the output signal setting, you must calibrate the device to the new signal setting.

To access the Output Adjust function, open the **Actions** menu and choose **Service Actions>Tune** to display the Tuning dialog box, then go to the Output Adjust tab.

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7.4.1 Viewing and Changing the Output Signal Setting and Parameters

In the Output Configuration panel of the Output Adjust tab, you can:

• Change the type of signal (for example, from 0–5 Vdc to 0–20 mA).

• View the current output signal parameter values. These parameters are explained in Table 7-1.

NOTE:

If you change the output signal type, you will be prompted that you must calibrate the signal, and that all old output signal calibration settings will be lost. However, you could click the **Restore** button in the Output Calibration panel to return to the previous calibration settings.

Table 7-1 Output Signal Parameters (Read Only)

Parameter	Description
Damping	Used as a low-pass filter in the analog output only (actual flow is not affected). Higher values slow down the output response. The default is 1.5 seconds. The range is 0 to 10 seconds.
Low Output Cutoff	When the measured flow is below this value, the analog flow output will be set to its zero (no flow) value.
Output Lock-in Error Limit	The analog flow output value will "lock in" to the setpoint whenever the error between measured flow and setpoint is less than this value.
Transient Lock-in Time	When this feature is enabled (non-zero) and a change in setpoint is detected, the analog flow output signal will equal setpoint for the time period that is set for this location. At the end of the time period, the analog flow output signal will indicate actual flow. Setpoint change must be greater than ±1% of full scale.

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7.4.2 Calibrating the Output Signal

You can calibrate the device's output signal to ensure that the device is accurately setting the output signal and, thus, maintaining the correct flow relative to the setpoint.

Prior to using the Service Suite to calibrate the device output, you must connect a DMM to the device's output signal, which you will use to verify the actual signal level. Figures 7-4 and 7-5 show how to set up the DMM for voltage and current output types.

Note that all D-connector pin-outs are listed in "3.5 Device D-Connector Pin-Outs" on p. 3-8.

Notes:
1. Refer to the DMM specifications, as provided by the Service Tool.
2. Tie cable shields to ground at one end only.
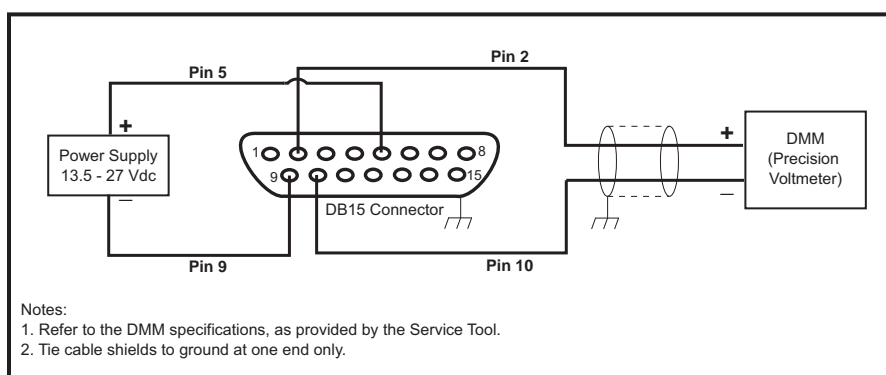
Figure 7-4 Setup for Calibrating to an Output Voltage

Notes:
1. Refer to the DMM specifications, as provided by the Service Tool.
2. **R** ≤ 380 Ω for supply ≤ 16 Vdc. **R** ≤500 Ω for supply ≥ 16 Vdc.
3. Tie cable shields to ground at one end only.
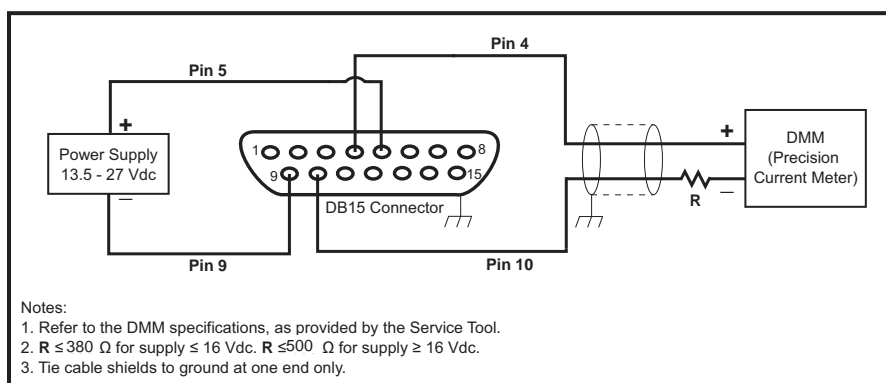
Figure 7-5 Setup for Calibrating to an Output Current

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To calibrate the device's output:

1. Open the **Actions** menu and choose **Service Actions>Tune** to display the Tuning dialog box, then go to the Output Adjust tab.

2. In the Output Calibration panel, click the **2a. Offset** button, and note the measured output signal level on the DMM.

The Service Suite forces the device to output the minimum signal level.

3. Enter the value displayed on the DMM in the offset's **Measured Output** field, then press the Enter key. Continue entering the DMM value until it is within ±0.1% of full scale.

4. When the DMM value is within ±0.1% of full scale, click the **2b. Span** button.

    The Service Suite forces the device to output the maximum signal level.

5. Enter the value displayed on the DMM in the span's **Measured Output** field, then press the Enter key. Continue entering the DMM value until it is within ±0.1% of full scale.

6. When the DMM value is within ±0.1% of full scale, click the **Check** button to verify the output is properly calibrated.

7. When you have completed verifying the adjustment, click the **OK** button to save the calibration settings.

At any point, you can:

*   Cancel the changes to all parameter values by clicking the **Cancel** button to cancel the calibration. You will be prompted to confirm the cancellation. If the calibration is cancelled, the most recently saved calibration data is restored.

*   Restore the previous offset and span values by clicking the **Restore** button.

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7.4.2.1 Checking the Output signal from the Output Adjust Tab

To check the output signal from the Output Adjust tab, click the **Check** button. The 3. Check Output panel displays on the right side of the tab.

You can use the buttons on this panel to check the output signal as set by the device against the actual signal level measured on a DVM. This function is the same as that described in "6.1 Testing the Analog Output" on p. 6-1.

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7.5 Setting and Calibrating the Input signal

The Input Adjust function allows you to change the input signal setting and its operating parameters. After making changes to the input signal setting, you must calibrate the device to the new signal setting.

To access the Input Adjust function, open the **Actions** menu and choose **Service Actions>Tune** to display the Tuning dialog box, then go to the Input Adjust tab.

7.5.1 Changing the Input Signal Setting and Parameters

In the Configure panel of the Input Adjust tab, you can:

- Change the type of signal (for example, from 0–5 Vdc to 0–20 mA).

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- View values of the input signal behavior parameter values. These parameters are explained in Table 7-2.

NOTE:

If you change the input signal type, you will be prompted that you must calibrate the signal, and that all old input signal calibration settings will be lost. However, you could click the **Restore** button in the Configure panel to return to the previous calibration settings.

Table 7-2 Configurable Input Signal Behavior Parameters (Read Only)

Parameter	Description
Softstart Mode	Normally, the setpoint responds immediately to changes in value. Alternately, the response of the unit to changes in setpoint can be affected in either of the following ways: • **Slope.** The device will ramp flow from the old setpoint to the new setpoint with a fixed ramp rate specified by the user in %/sec. • **Time.** The device will ramp flow from the old setpoint to the new setpoint in the time specified by the user in seconds.
Low Input Cutoff	When the setpoint is derived from an external source, this parameter sets the minimum valid value of the setpoint. If the setpoint value reported by the analog input is below the cutoff value, then the setpoint is effectively interpreted as zero.
Zero Drift Alarm	An alarm or warning will occur when the flow signal starts to drift during non-flow conditions.
Temperature Alarm	Each allows you to set an inclusive minimum and maximum sensor temperature limit range. Whenever the sensor temperature is not within the stated range, the alarm or warning will occur.

7.5.2 Calibrating the Device Input (Setpoint)

You can calibrate the device's input to ensure that the device is accurately reading the setpoint from its external analog source.

Prior to using the Service Suite to calibrate the device input, you must connect a digital multimeter (DMM) to the device's setpoint signal, which you will use to verify the actual signal level. Figures 7-6 and 7-7 show how to set up the DMM for the available input types.

Note that all D-connector pin-outs are listed in "3.5 Device D-Connector Pin-Outs" on p. 3-8.

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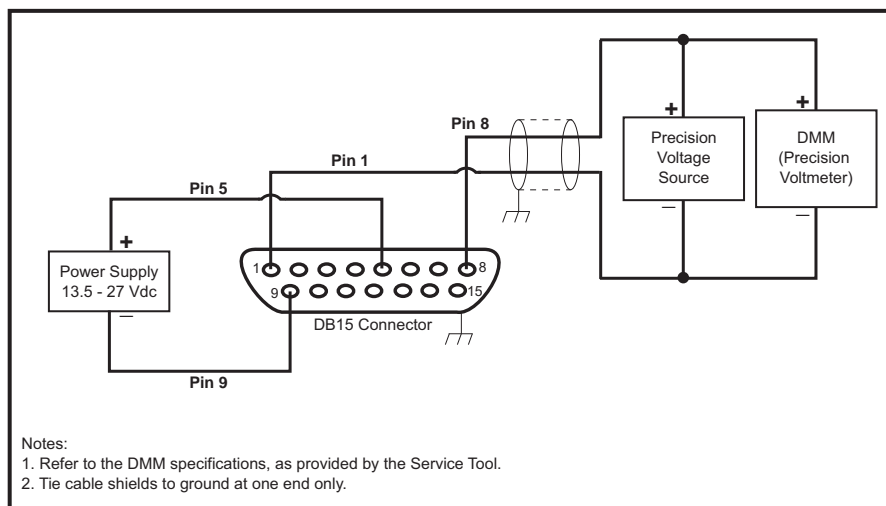
Figure 7-6 Setup for Calibrating to a Voltage Setpoint
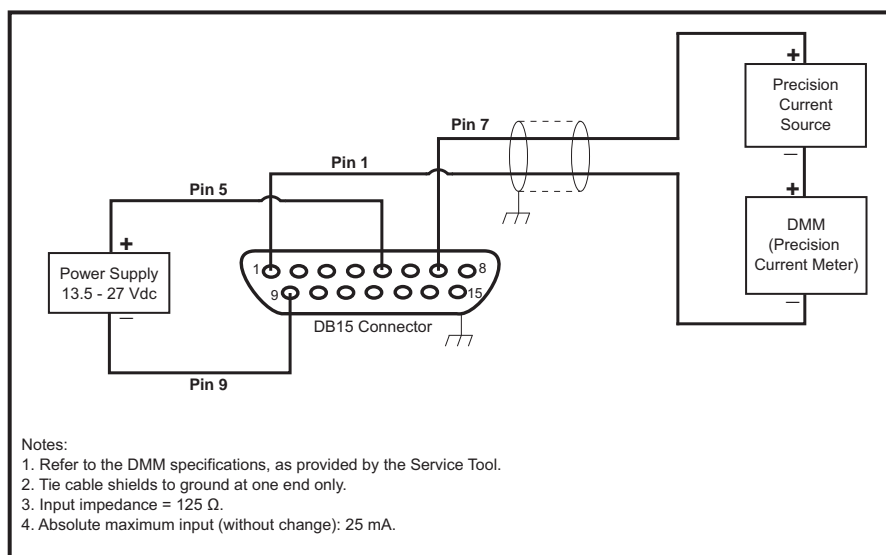
Figure 7-7 Setup for Calibrating to a Current Setpoint

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To calibrate the device's input:

1. Open the **Actions** menu and choose **Service Actions>Tune** to display the Tuning dialog box, then go to the Input Adjust tab.

2. Set the external analog setpoint to its appropriate zero value, and confirm this value with the DMM:

    - 1.000 for 1–5 Vdc
    - 0.000 for 0–5 Vdc
    - 4.000 for 4–20 mA
    - 20.000 for 0–20 mA

3. In the Input Calibration panel, click the **Offset** button.

    The external analog setpoint offset is now set. This is the minimum signal level for the setpoint.
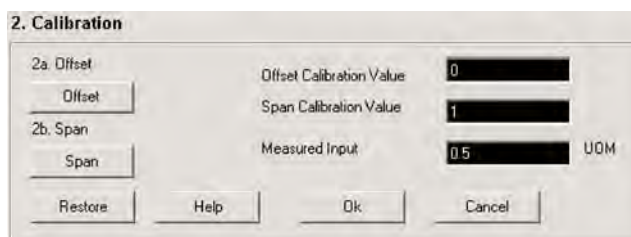
NOTE:
Sometimes the valve may oscillate during the time between adjusting setpoint input offset and span. This is a normal event that will resolve itself immediately after setpoint input span is adjusted.

4. Set the external analog setpoint to its appropriate full scale value:

    - 5.000 for 1–5 Vdc
    - 5.000 for 0–5 Vdc
    - 20.000 for 4–20 mA
    - 20.000 for 0–20 mA

5. In the Input Calibration panel, click the **Span** button.
    The external analog setpoint span is now set. This is the maximum signal level for the setpoint.

6. Click the **OK** button to save the calibration data.

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7.6 Configuring Alarm Settings

The Alarm Settings function allows you to set alarm behavior for several device event conditions.

To access the alarm settings, open the **Actions** menu and choose **Service Actions>Tune** to display the Tuning dialog box, then go to the Alarm Settings tab.

After changing settings, click the **Apply Settings** button to save them.

In addition to the Diagnostic alarm, you can enable the device to indicate warning and alarm conditions related to the event conditions listed in Table 7-3. The alarm settings are described in Table 7-4.

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Table 7-3 Event Conditions for Which Alarms/Warnings Can Be Set

Event Condition	Description
Flow 1 and 2	Each allows you to set an inclusive minimum and maximum flow limit range. Whenever flow is not within the stated range, the alarm or warning will occur. These two general flow alarms provide more flexibility than having specific low and high flow alarms. These alarms can be used to create separate low and high flow alarms. They can also be used together to monitor deviation about a flow rate. If the device is a controller, then this alarm/warning is disabled if the setpoint is not within the specified flow limits or if the valve override is active.
No Flow Indication	This condition occurs if the measurement of flow indicates flow less the specified Low Limit value. The Low Limit value can be from 0–2%. If the device is a controller, this condition will not set an alarm/warning unless the setpoint exceeds the configured limit and valve override is inactive.
Setpoint Deviation	An alarm/warning condition occurs if the difference between the setpoint and flow exceeds the specified limits for more than the specified delay period. This alarm/warning is disabled if the valve override is active.
Totalizer Overflow	This condition occurs if the Flow Totalizer value exceeds its maximum value and resets to zero. This parameter is permanently configured as a latch-type alarm/warning, which requires you to use the **Clear Alarms/Warnings** button on the Alarm Status tab or the S-Protocol interface to reset the alarm/warning.
User Power Supply	An alarm/warning condition occurs if the power input to the device is outside the specified range. You can make the voltage limits smaller than the default range if you want to monitor your supply voltage to a tighter specification than the device requires.

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Table 7-3 Event Conditions for Which Alarms/Warnings Can Be Set (cont.)

Event Condition	Description
Setpoint Out of Range	An alarm/warning condition occurs if the difference between the setpoint and flow exceeds the specified limits for more than the specified delay period. This alarm/warning is disabled if the valve override is active.
Flow Output Out of Range	An alarm/warning condition occurs if the measured flow results in an analog output that exceeds the specified range for either the voltage or current output.
Flow Output Loop Open	An alarm/warning condition occurs if the device detects that there is no current flowing on the current loop. The alarm/warning condition could be the result of an open connection on the analog output current loop.
Flow Sensor Out of Range	An alarm/warning condition occurs if the device detects that the signal received from the sensor is not within the allowable tolerance band. This alarm/warning condition could be the result of a flow sensor failure.
Zero Drift Alarm	An alarm or warning will occur when the flow signal starts to drift during non-flow conditions.
Temperature Alarm	Each allows you to set an inclusive minimum and maximum sensor temperature limit range. Whenever the sensor temperature is not within the stated range, the alarm or warning will occur.

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Table 7-4 Alarm Settings
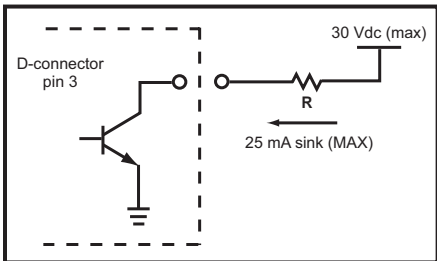
Field/Option	Description
Alarm choice	Options are: • **Off.** No warning/alarm will be set if the alarm/warning condition occurs. • **Warning.** A warning will be set if the alarm/warning condition occurs. Alarm LED flashes green, but the device will continue normal operation. • **Alarm.** An alarm will be set if the alarm/warning condition occurs. Alarm LED flashes red. Device will enter its safe state. If the alarm was set by the device diagnostics, a diagnostic alarm is set and the device will reset after 5 seconds. The *safe state* is defined as: • The valve is unpowered (the valve will close for a normally closed valve, or will open for a normally open valve). • The analog output will reflect the flow under the valve's safe state condition.
Latching Enable	If selected, the warning/alarm condition will persist, even if the condition goes away. You must use the **Clear Alarms/Warnings** button on the Alarm Status tab to reset the alarm/warning.
Contact Enable	If selected, a warning/alarm condition for this variable will cause the open-collector output at pin 3 of the device's D-connector to be active. **R** can be any device that the user chooses to indicate an alarm/warning/diagnostic failure condition. No matter what is chosen, input current to pin 3 must be limited to 25 mA (closed) and applied voltage must be less than 30 Vdc (open).
Flash Code	The code flashed by the Alarm LED to indicate a warning/alarm condition for this parameter.
Low Limit	Lower limit for this parameter. If the **Alarm** option is set to Warning or Alarm, and the parameter's data value drops below the low limit value, the parameter's warning/alarm condition will be active.

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Table 7-4 Alarm Settings (cont.)

Field/Option	Description
High Limit	Upper limit for this parameter. If the **Alarm** option is set to Warning or Alarm, and the parameter's data value exceeds the high limit value, the parameter's warning/alarm condition will be active.
Delay	Number of seconds that the warning/alarm condition must be active before the warning/alarm is indicated on the Alarm LED and Alarm contact (and reported to the Service Suite application, if a session is open).

7.7 Alarm Status

The Alarm Status tab in the Tuning dialog box is the same as that in the Alarm/Warning Status subtab of the Diagnose dialog box. For more information, refer to "6.5 Checking the Warning, Alarm, and Diagnostic Status" on p. 6-12.

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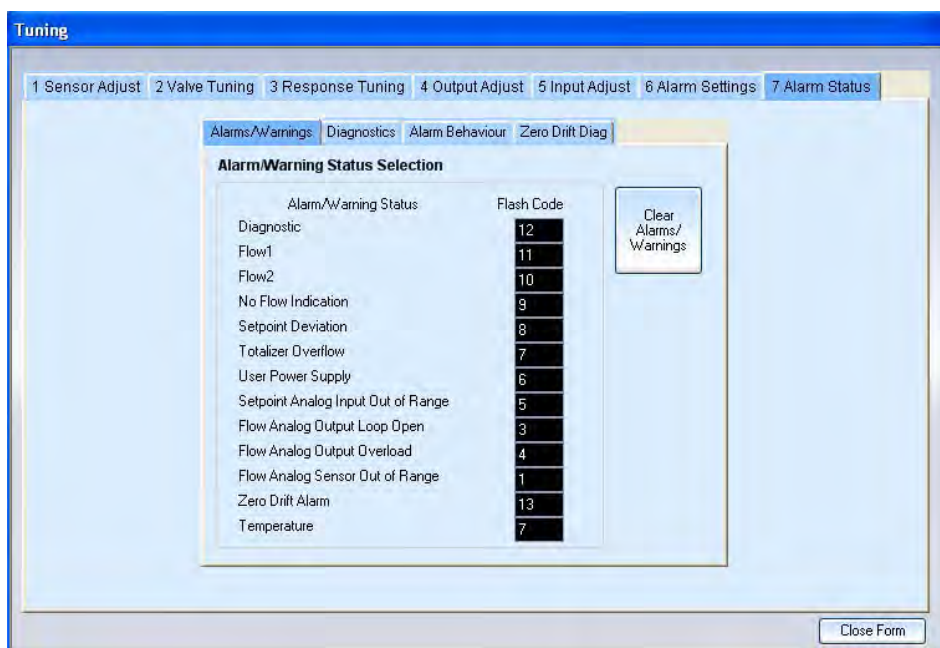
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8.1 Gas calibration and reporting (Pro version Only)

This section explains how to use the advanced calibration and reporting functions available in the Brooks Service Suite Pro version.

The device must be calibrated so that it can accurately read flow rates.

8.1.1 Required Conditioning During Calibration

To perform calibration, the following conditions are required:

- The device has been powered on for at least 45 minutes.

- The sensor has been zeroed.

- There is a supply of gas.

- During the calibration process, the device must be in a thermally stable environment. Rapid or significant temperature changes during the calibration process will affect the device's accuracy.

- When clicking the 'Linearize Sensor' or 'Check Linearization' button in the main calibration window, the option is given to start with a cleared 'Linearize Sensor' or 'Check Linearization' screen or show the previous values, it is possible to perform a rerun of one or more rows in the 'Linearize Sensor' screen and recalculate the polynomials. Note that this is not recommended and that it might affect the accuracy, for the second run might be performed in different ambient conditions. In order get the best accuracy it's recommended to perform all runs in one go.

- When performing a linearization in 'Reference Meter' or 'Manual Vol-U-Meter' mode, a window will pop-up, showing a decrementing counter, when a button in the 'Start' column is clicked. This window will automatically close when the timer has reached 0, do not close this window because it might affect the accuracy.

8.1.2 Device Accuracy

The accuracy which is used during the check calibration phase, is automatically derived from the model code and depends on the device specification.

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8.2 Available Calibration methods

You can use one of the following calibration methods:

- **Reference Meter Mode.** The reference meter must be connected in series with the device being calibrated. Make sure the reference meter can measure flow at least 1.5 to 4 times the desired full scale calibration flow amount. For a truly accurate gas calibration, the reference meter must be substantially more accurate than the device being calibrated.

- **Manual Vol-U-Meter Mode.** This method requires a Brooks Vol-U-Meter, which can be obtained by contacting your local Brooks representative. The Vol-U-Meter provides a precise means of measuring flow rate. This method also requires a Brooks 1060 Vol-U-Meter Read-Out Device, for reading the flow data from the Vol-U-Meter. With regard to flow, the Vol-U-Meter is connected in series with the device being calibrated.

- **Automatic Vol-U-Meter Mode.** This method requires a Vol-U-Meter and 1060 Read-Out Device. However, instead of you reading data from the 1060 display and entering them manually in the Service Suite application, the 1060 is connected to the PC via a serial cable and the data are read into the application automatically.

8.3 Meter Calibration

There are two ways of calibrating a meter using Service Suite.

- **Using the valve output of the meter.** Since the meter version of Brooks SLA products contains the same electronics circuitry as the controller version, it's possible to connect a standalone valve or a compatible valve from a Brooks SLA controller to the valve output of the electronics circuitry. If the device type in the Product Data tab of the Calibration window is changed to MFC (controller) during the calibration phase, the device will act as a controller. After calibration the device type needs to be configured back to MFM. Note that this valve connected to the meter needs to be in the flow path during calibration. Using this setup all calibration methods are supported.

- **Using an external valve.** In case it's not possible to connect a standalone valve or a compatible valve from a Brooks SLA controller to the valve output of the electronics circuitry, it's possible to put an external valve in the flow path and regulate flow using this external valve. Note that the device type needs to be configured to MFM, this will adjust the behavior of the Optimize Sensor, Linearization and Check Linearization functionality in the Service Suite. In the Optimize Sensor functionality the user will be asked to adjust the flow indicated in the pop-up window, to a certain percentage by using the external valve. In the Linearization and Check Linearization process the user needs to adjust the flow using the external valve to the desired flow value before clicking the start button. Using this setup the auto vol-u-meter calibration method is not supported.

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8.4 Preliminary Setup Tasks

The following topics describe the preliminary setup tasks that are required prior to performing the calibration.

8.4.1 Entering the Vol-U-Meter Tube Characteristics

If you are going to use either of the Vol-U-Meter modes, you must enter the Vol-U-Meter's tube characteristics in the Service Suite.

The Vol-U-Meter can have up to three tubes. Each tube has pick-offs, from which it reads when the rising piston passes. The 1060 calibrator then uses this data to calculate the flow rate. The Service Suite needs to know how many pick-offs each tube has and what measurement each pick-off represents.

Each Vol-U-Meter comes with a sheet that lists the pick-offs and their measurement values. You will need this form when entering the pick-off values in the Service Suite.

To enter the Vol-U-Meter's tube characteristics:

1. Open the **Tools** menu and choose **Tube Characteristics**.

   The Tube Characterization dialog box displays.

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2. Referring to the Vol-U-Meter's tube data sheet, enter the values for the pick-offs. There is a tab available for each tube.

3. In the **Piston Pressure** field, enter the piston pressure in mm-H$_2$O or mbar. Select the related radio button for the UOM of the piston pressure. The pressure will be the same for all three tubes. The standard pressure value is 50.8 mm-H$_2$0.

4. Enter the tool number of the Vol-U-Meter to uniquely identify it.

    The tool number that you enter is used as the file name for the tube characterization file that is created as a result of entering the data in this dialog box.

5. When entering data in the dialog box, click the **Apply** button at any time to save what you have entered.

6. When you have completed the fields, click the **New File** button.
    The Tube Characterization Save File dialog box displays.
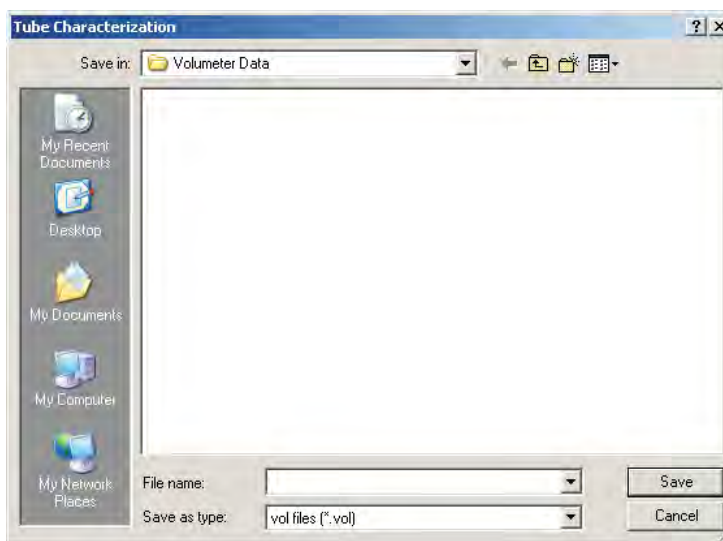
7. Enter a name for the tube characterization, then click the **Save** button.

8. When you are done entering the characterization data, click the **Exit** button.

    If you want to change the tube characterization data at a later time, you can click the **Open File** button in the Tube Characterization dialog box. From the Open File dialog box that displays, you can select the tube characterization file to load in the Tube Characterization dialog box.

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8.4.2 Accessing the Calibration Functions

All calibration-related functions are executed from the Calibration window.

To display the Calibration window, open the **Actions** menu and choose **Calibration Actions>Calibration**.

To perform the calibration, you will go sequentially through tabs 1 through 5. The following topics discuss the preliminary tasks associated with tabs 1 through 4. You will then perform the linearization calibration from tab 5.

The functions on tabs 6 through 11 allow you to perform tuning operations, exactly as those described in Section 7.

The function on tab 12 allows you to save the device calibration data to a file. This file can be used to restore the device configuration, if necessary.

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8.4.3 Entering the Device's Product Data

Go to the Product Data tab in the Calibration window. Using the information on the device's product order or data sheet, complete the fields on this tab. Only the Model Number and Serial Number fields are required; however, the data entered here does appear on the Calibration Report to provide identifying information about the device that has been calibrated.

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8.4.4 Entering the Device's Process Application Data

In the Gas Cal. Data tab, you enter information about the process application in which the device is to be used

To support calibrations for using the device under multiple process application conditions, you can enter and save up to 10 Gas Calibration Data sets. Each calibration set is saved in the device. When the tab is displayed, the Service Suite loads the most recently used set. In case no set has ever been created the fields are disabled and a new set needs to be created. The "Gas. Cal #" field will indicate 0 in this case.

To enter gas calibration data for the process conditions to which you are currently calibrating the device:

1. Click the **Select Gas Calibration** button.

   A pop-up window displays.

2. *To load an existing set,* select the set's number from the **Select Gas Cal Record** drop-down list.

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To create a new set, select a set number that has not been used yet from the **Select Gas Cal Record** drop-down list.

3. Complete the **Full Scale Value** and **Gas Name** fields for the target process conditions, then click the **Close** button. Note that both fields refer to the process gas.

    The Gas Cal. Data tab is loaded with the data from the selected set, or with default data if you are creating a new set.

4. Enter the process application data for the current calibration in the Gas Cal. Data tab fields (press the Enter key after each text entry).

    Table 8-1 describes some of the parameters.

Table 8-1 Descriptions of Selected Gas Calibration Data Parameters

Parameter	Description
Gas Cal #	Number assigned to the currently loaded Gas Calibration Data set.
Cal Type	For Brooks internal use only.
Ref. Temp	Indicates the temperature of the process gas, from which volumetric flow will be inferred.
Ref. Press.	Indicates the pressure of the process gas, from which volumetric flow will be inferred.

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Table 8-1 Descriptions of Selected Gas Calibration Data Parameters (Cont.)

Process Gas Density	Density of the process gas at reference conditions (see Ref. Temp and Ref. Press. descriptions above). Used to determine mass flow when requested by the user (refer to the units of measure description in Figure 4-3 on p. 4-6).
Process Gas Full Scale	The volumetric flow value of the process gas at reference conditions when setpoint = 100%.
Cal. Gas Correction Factor	When a gas other than the process gas is used to calibrate the device, this factor is multiplied with the Process Gas Full Scale parameter to compensate for differences in gas properties.

8.4.5 Zeroing the Device

Before starting the calibration, you must zero the device using the controls on the Sensor Adjust tab. This ensures that, in the absence of flow, the device measures no flow.

For the zeroing procedure, refer to "7.1 Zeroing the Device's Sensor" on p. 7-1. That procedure refers to using the Sensor Adjust tab in the Tuning window, accessed through the **Service Actions** option in the **Actions** menus. However, the functionality on both Sensor Adjust tabs is exactly the same.

8.4.6 Valve Pre-Adjust

Before starting the calibration, you must tune the device's valve using the controls on the Valve Pre-Adjust tab. This ensures that the valve is performing properly.

For the valve tuning procedure, refer to "7.2.1 Tuning the Valve Offset and Span" on p. 7-3. That procedure refers to using the Valve Tuning tab in the Tuning window, accessed through the **Service Actions** option in the **Actions** menus. However, the functionality on the Valve Pre-Adjust and the Valve Tuning tabs is exactly the same.

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8.5 Automatic Vol-U-Meter® Mode Calibration

8.5.1 Equipment Setup for Automatic Vol-U-Meter Mode Calibration

For Automatic Vol-U-Meter mode, set up the equipment as shown in Figure 8-1.
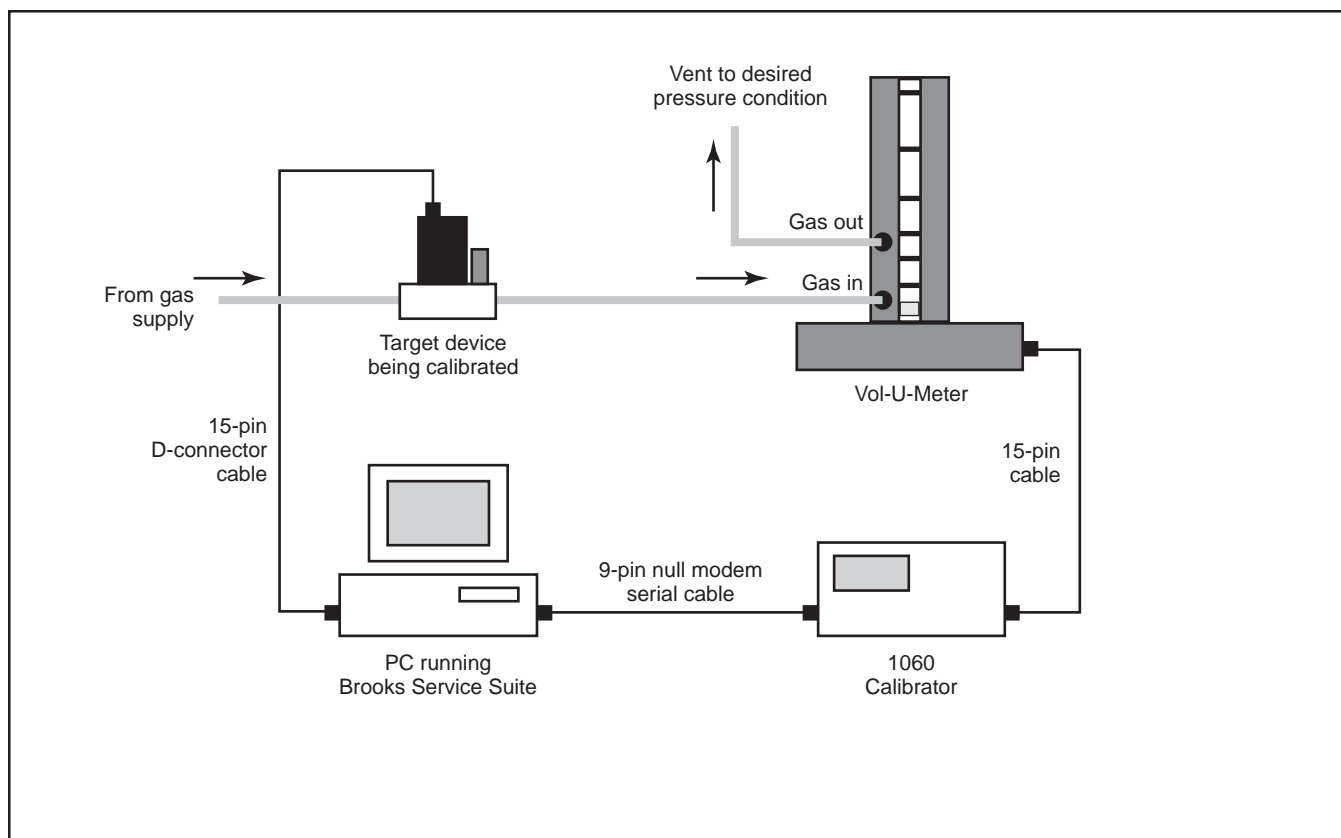
Figure 8-1 Equipment Setup for Automatic Vol-U-Meter Mode Calibration

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8.5.2 Having the Service Suite Recognize the 1060 Device
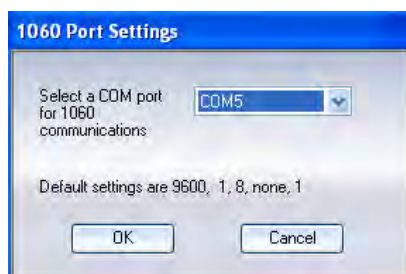
Select the Comm port on the PC to which you connected the serial cable from the 1060, then click **OK**.

8.5.3 Performing the Automatic Vol-U-Meter Mode Calibration

You access the calibration functions from the Linearization tab.
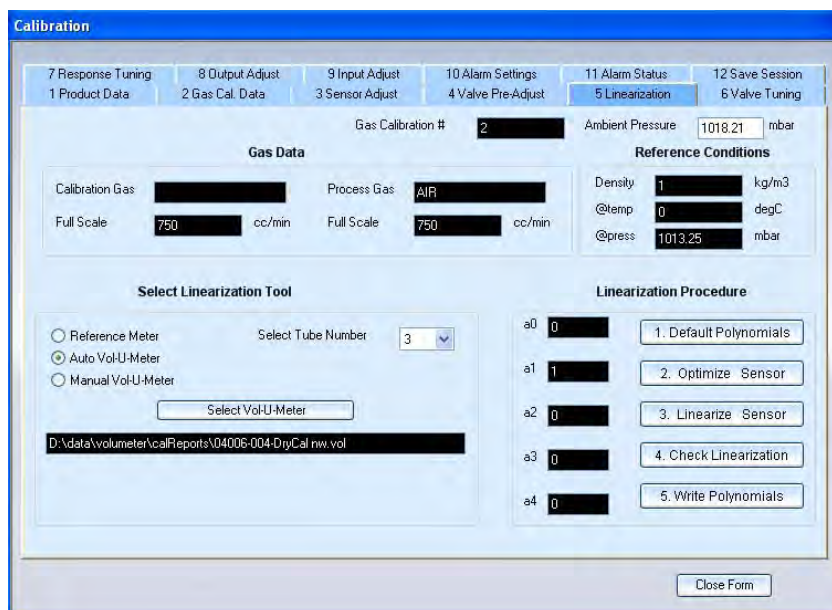
To perform device calibration in Automatic Vol-U-Meter mode:

1. In the Select Linearization tool panel, select the **Auto Vol-U-Meter** option.
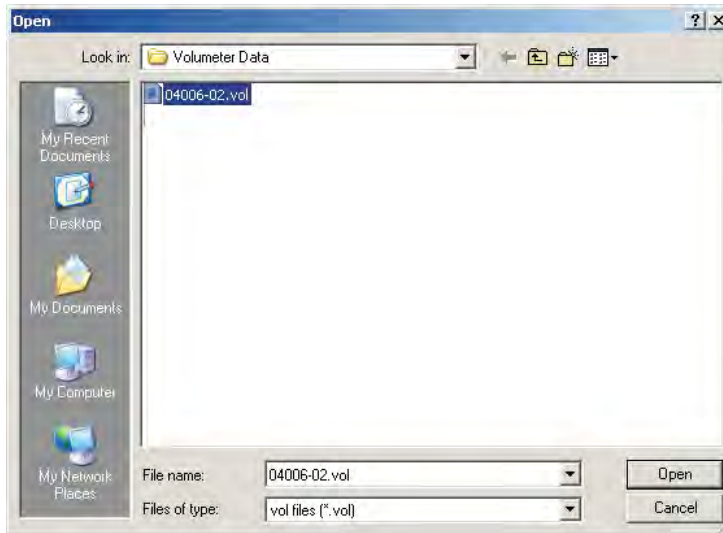
2. Click the **Select Vol-U-Meter** button.
   An Open dialog box displays.

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3. Select the Tube Characterization set that you want to use for this calibration, then click the **Open** button to load it.

4. Select the Vol-U-Meter tube you are going to use from the **Select Tube Number** drop-down list.

In the Linearization tab, there are four buttons; you are going to go through these in sequence to perform and check the calibration. The first step is to clear the coefficients a0 through a4 of the polynomial. This is the polynomial of the curve that is used to linearize the mass flow sensor.

⚠ CAUTION

Once you perform the next step (clicking the *Default Polynomials* button), you have to finish the calibration procedure; otherwise, the device will not be calibrated.

---

5. Click the **Default Polynomials** button to clear the coefficients.

   A dialog box displays when the clearing process is complete.

6. Click **OK** to dismiss the dialog box.

   The polynomial coefficients are cleared.

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7. Click the **Optimize Sensor** button.

A dialog box explains what the Optimize Sensor process will do.

8. Click **OK** to start the Optimize Sensor process. Click **Default** to configure a default value of 0.81 for the Sensor Drive Setting (proceed with numbered item 10)."

9. Click **OK** to dismiss the dialog box.

10. Click the **Linearize Sensor** button.

In case of Auto or Manual Vol-U-Meter mode you are prompted to enter the ambient pressure.

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11. Enter the ambient pressure, then click **OK**.

The Linearization Calibration window displays.

By default, there are six Linearization Data Points with setpoint settings (as percentages of full scale flow) entered. It is recommended to use the default settings. But the desired flow can be changed to the required values. There are 2 option buttons **Default** and **Custom**. If the values are changed in any of the fields the **Save Custom Values** button will get enabled. By clicking on this button the custom flow values can be saved. For the next time we can use the default values or the stored custom values by choosing the required option.

Each setpoint setting has a corresponding Vol-U-Meter pick-off selected. This is the pick-off that will be used when determining the actual flow rate for that setpoint.

You can change the setpoint values and pick-offs used. However, make sure you pick a flow rate and pick-off that will allow flow to continue for at least 30 to 60 seconds before the piston rises past the selected pick-off. The higher the flow rate, the faster the piston will move, and so the higher the pick-off that should be used. The pick-off volumes are included on the Vol-U-Meter's data sheet, and are much more accurate than a visual determination.

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Normally, just use defaults for Automatic Vol-U-Meter mode. However, if you are certain that your system and Vol-U-Meter have no leaks, then you could use a higher pick-off for a lower flow rate, to compensate for any initial flow spike that may occur as a result of triggering the Vol-U-Meter to begin a flow run.

12. To start the linearization process, click the **Execute Linearization** button.

A message flashes, indicating the execution of an initial check operation.

When the check operation is complete, the Linearization process sets the setpoint to the percentage of the first Data Point row and waits 30 seconds to allow the mass flow sensor to stabilize. After the stabilization delay, the piston in the Vol-U-Meter starts rising. When it reaches the assigned pick-off, the Linearization process updates that Data Point's Pick-off Volume, Time, and Flow values.

When one Data Point flow run completes, the Linearization process starts the next one. Between each flow run, the application sets the setpoint to the next value and allows 30 seconds for the sensor to completely stabilize. The following screen shows what the window looks like after the second Data Point flow run was complete.

NOTE: During the Data Point flow runs, the **Execute Linearization** button changes to a **Pause** button, allowing you to pause the process.

When all Data Point flow runs are complete, the **Calculate Polynomial** button enables.

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13. Click the **Calculate Polynomial** button.

A dialog box indicates that the polynomial coefficients have been stored.

14. Click OK to dismiss the dialog box, then click the **Exit** button to close the Linearization Calibration window.

The updated coefficients are displayed in the Linearization tab.

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In the next series of steps, you are going to check the flow for different Data Points, but using the updated linearization polynomial. The Check Linearization process will check the results against the expected flow rates, and display deviation error values for each Data Point flow run.

15. Click the **Check Linearization** button.

   In case of Auto or Manual Vol-U-Meter mode you are prompted to enter the ambient pressure.

16. Enter the ambient pressure, then click **OK**.

   The Linearization Calibration window displays, but with two additional columns of data: **Measured Error** and **Spec. Error Limit**.

17. You can change the setpoint setting and pick-off for each Data Point; however, it is recommended that you use the default values for the six Data Points.

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17. You can change the setpoint setting and pick-off for each Data Point; however, it is recommended that you use the default values for the six Data Points.

18. To start the Check Linearization process, click the **Start Check** button.

The Data Point flow runs are performed, as in the Linearization process, but using the new linearization polynomial. After each run, deviations from expected flow rates are entered in the **Measured Error** and **Spec. Error Limit** fields.

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Calibration Check

Measuring Tool

Tool # `04006-04`   Piston Pressure `48`   mmH2O   Setpoint % `50.0894`   Flow % `50.09`

Accuracy: 1% of rate (setpoint 20%-100%), 0.2 % of Full Scale (setpoint <20%)

• Default   Custom

Linearization Data Points

Desired Flow (%)	Start	Tgas degC	Pamb mbar	Pickoff	Pickoff Volume ml	Time (sec)	Process Flow cc/min	Measured Error (%)		Spec. Error Limit (%)
10	# 1	20.1	1018.21	1	51.51	39.17	74.195	-1.073	+/-	2
25	# 2	20.1	1018.21	1	51.51	15.57	186.656	-0.45	+/-	1
50	# 3	20.1	1018.21	2	101.02	15.23	374.236	-0.204	+/-	1
75	# 4	20.1	1018.21	3	200.97	20.18	561.886	-0.109	+/-	1
90	# 5	20.1	1018.21	3	200.97	16.81	674.531	-0.069	+/-	1
100	# 6	20.1	1018.21	4	251.43	18.94	748.989	-0.135	+/-	1
	# 7		1018.21	1	51.51				+/-	
	# 8		1018.21	1	51.51				+/-	

PAUSE Check   Clear Fields   Exit

                               Save Custom Values

19. **If deviations are not within acceptable limits,** you can click the **Clear Fields** button. If the error is greatest at the lowest setpoint(s), re-zero the sensor. Then rerun the Check Linearization process, using one or more checkpoints. If the deviation are still not acceptable, make sure that the calibration conditions and equpiment are accurate.

20. Click the **Exit** button to close the Linearization Calibration window. The Linearization tab displays again, and the calibration process is complete.

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8.6 Manual Vol-U-Meter Mode Calibration

8.6.1 Equipment Setup for Manual Vol-U-Meter Mode Calibration

For Manual Vol-U-Meter mode, set up the equipment as shown in Figure 8-2.
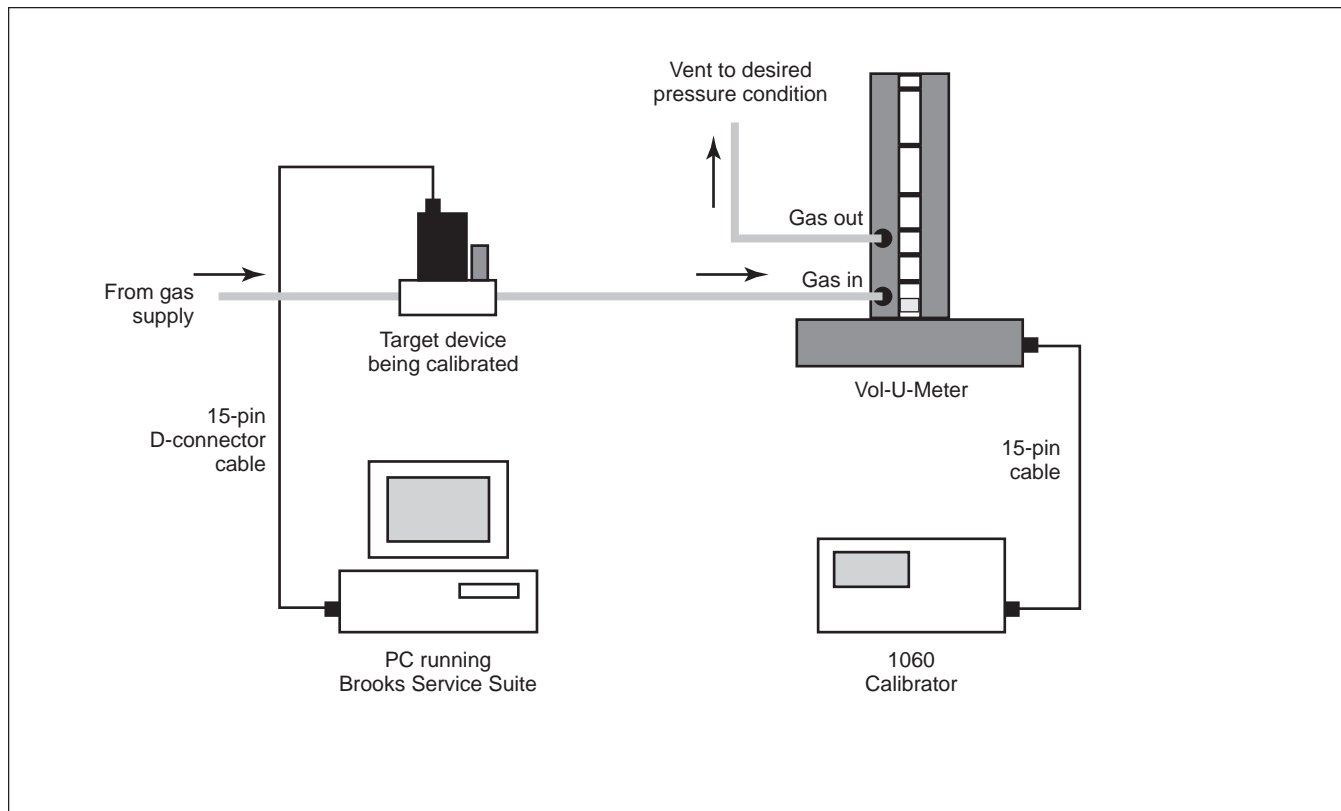
Figure 8-2 Equipment Setup for Manual Vol-U-Meter Mode Calibration

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8.6.2 Performing the Manual Vol-U-Meter Mode Calibration

You access the calibration functions from the Linearization tab.

To perform device calibration in Manual Vol-U-Meter mode:

1. In the Select Linearization tool panel, select the **Manual Vol-U-Meter**
   option.
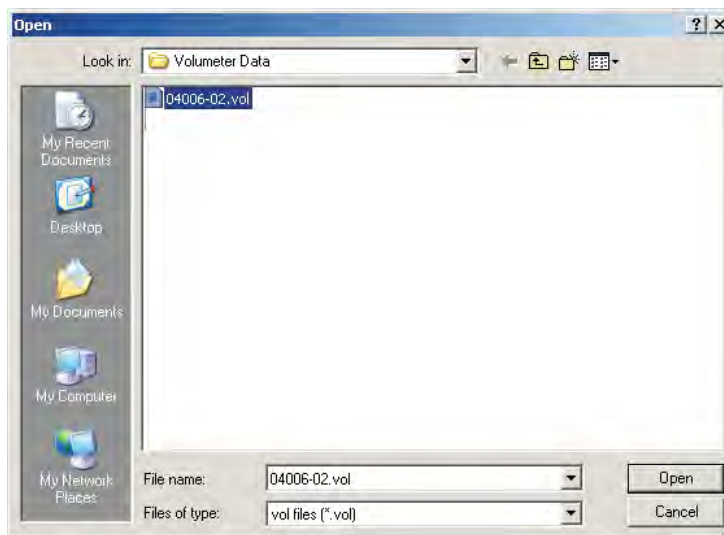
2. Click the **Select Vol-U-Meter** button.
   An Open dialog box displays.

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3. Select the Tube Characterization set that you want to use for this calibration, then click the **Open** button to load it.

4. Select the Vol-U-Meter tube you are going to use from the **Select Tube Number** drop-down list.

In Linearization Procedure panel, there are four buttons; you are going to go through these in sequence to perform and check the calibration. The first step is to clear the coefficients a0 through a4 of the polynomial. This is the polynomial of the curve that is used to linearize the mass flow sensor.

> **⚠ CAUTION**
>
> **Once you perform the next step (clicking the *Default Polynomials* button), you have to finish the calibration procedure; otherwise, the device will not be calibrated.**

5. Click the **Default Polynomials** button to clear the coefficients.

A dialog box displays when clearing process is complete.

6. Click **OK** to dismiss the dialog box.
    The polynomial coefficients are cleared.

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7. Click the **Optimize Sensor** button.

A dialog box explains what the Optimize Sensor process will do.

8. In case the device type is set to Mass Flow Meter (MFM) the flow needs to be adjusted by using an external valve. Two additional pop-ups will appear to indicate this, adjust the flow by using the external valve such that the 'Flow(%)' indicates the suggested value. A difference between the actual and suggested flow of 1% is allowed.
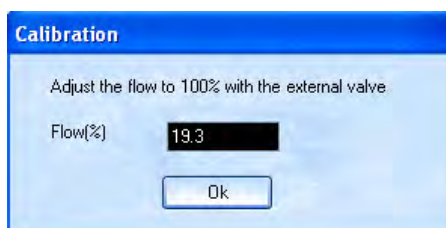
9. Click **OK** to start the Optimize Sensor process. Click **Default** to configure a default value of 0.81 for the Sensor Drive Setting (proceed with numbered item 15).

A dialog box prompts you to determine the true flow of the target device. Do not enter any information yet.
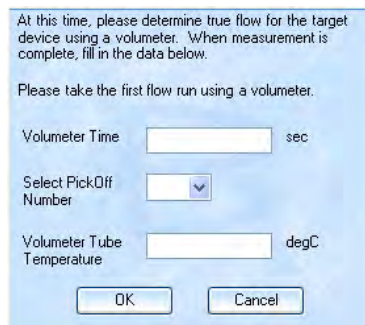
To execute the Optimize Sensor process, you will use the Vol-U-Meter and 1060 device to perform three flow runs at different flow rates. For each run, you will read the time it takes for the Vol-U-Meter piston to reach a pick-off, as shown on the 1060 display, and enter the time in the dialog box.
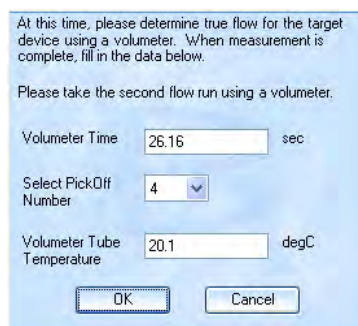
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The three readings will be used to: (1) make sure that the tube flows at least to its full scale value; and (2) optimize the gain of the thermal mass flow output.

Select a pick-off on the Vol-U-Meter that, under normal full scale flow conditions, would require 30 seconds for the piston to reach the pick-off.

10. To start the first run, press the **Start** button on the Vol-U-Meter, then press the **Start** button on the 1060.

    Full scale flow to the Vol-U-Meter begins, and the piston starts to rise.

11. When the piston passes the pick-off, note the elapsed time for that pick-off and the temperature on the 1060 display. In the dialog box prompt, enter those values and select the appropriate pick-off.
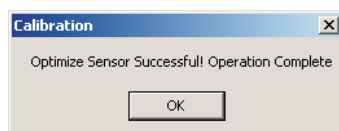
12. Click **OK**.

    The values you entered are saved, the dialog box clears, and you are ready to start the second run.

13. Perform the second and third runs. Note that the Vol-U-Meter time is different for each run.

    After entering the results of the third run and clicking **OK**, a dialog box displays indicating the optimization has successfully completed.

14. Click **OK** to dismiss the dialog box.

15. Click the **Linearize Sensor** button.
    In case of Auto or Manual Vol-U-Meter mode you are prompted to enter the ambient pressure.

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16. Enter the ambient pressure, then click **OK**.

The Linearization Calibration window displays.

By default, there are six Linearization Data Points with setpoint settings (as percentages of full scale flow) entered. It is recommended to use the default settings. But the desired flow can be changed to the required values. There are 2 option buttons **Default** and **Custom**. If the values are changed in any of the fields the **Save Custom Values** button will get enabled. By clicking on this button the custom flow values can be saved. For the next time we can use the default values or the stored custom values by choosing the required option.

You can change the setpoint values and pick-offs used. However, make sure you pick a flow rate and pick-off that will allow flow to continue for at least 30 to 60 seconds before the piston rises past the pick-off. The higher the flow rate, the faster the piston will move, and so the higher the pick-off that should be used. The pick-off volumes are included on the Vol-U-Meter's data sheet, and are much more accurate than a visual determination.

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Normally, just use defaults for Manual Vol-U-Meter mode. However, if you are certain that your system and Vol-U-Meter have no leaks, then you could use a higher pick-off for a lower flow rate, to compensate for any initial flow spike.

17. To start the linearization process, click the **#0** button (in the first Data Point row) to start the first flow run. Whenever a button in the 'Start' column is clicked, a window will pop up showing a decrementing 30-seconds stabilization timer. This window will automatically close when the timer has reached 0, do not close this window because it might affect the accuracy.

18. Click the **#1** button (in the second Data Point row) to start the second flow run. After expiry of the 30-second stabilization timer, press the Start button on the 1060.

19. When the piston reaches the assigned pick-off, enter the temperature and elapsed time shown on the 1060 display for the specified pick-off.

NOTE:

You must press the Enter key after entering values in the **degC** and **Time** fields to have the entries saved.

20. Click the **#2** button to start the second flow run.

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Continue the flow runs, entering the temperature and elapsed time for each run. The following screen shows an example of what the window looks like after the final Data Point values have been entered.

When all flow runs have been completed the **Calculate Polynomial** button enables.

21. Click the **Calculate Polynomial** button.

A dialog box indicates that the polynomial coefficients have been stored.

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22. Click OK to dismiss the dialog box, then click the **Exit** button to close the Linearization Calibration window.

The updated coefficients are displayed in Linearization tab.

In the next series of steps, you are going to check the flow for different Data Points, but using the updated linearization polynomial. The Check Linearization process will check the results against the expected flow rates, and display deviation error values for each Data Point flow run.

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23. Click the **Check Linearization** button.

    In case of Auto or Manual Vol-U-Meter mode you are prompted to enter the ambient pressure.

    | Ambient Pressure | 1017 | mbar |

24. Enter the ambient pressure, then click **OK**.

    The Linearization Calibration window displays, but with two additional columns of data: **Measured Error** and **Spec. Error Limit**.

25. You can change the setpoint setting and pick-off for each Data Point; however, it is recommended that you use the default values for the six Data Points.

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26. Click the **#1** button (in the first Data Point row) to start the first flow run. Continue the flow runs and entering the data, just as you did during the Linearization procedure.

NOTE:

When entering the flow rate, you must press the Enter key to compute the error deviations. After pressing the Enter key but before pressing the **#N** button for the next Data Point, the entry can be changed (for example, if you accidentally entered the wrong value). However, once you press the **#N** button for the next Data Point, the entries cannot be changed (unless you press the **Clear Fields** button, which will clear all Data Point fields).

As you save the entered values for a Data Point, the deviations from expected flow rates are entered in the **Measured Error** and **Spec. Error Limit** fields.

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27. ***If deviations are not within acceptable limits,*** you can click the **Clear Fields** button. Re-zero the sensor, then rerun the Check Linearization process, using one or more checkpoints. If the deviations are still not acceptable, make sure that the calibration conditions and equipment are accurate.

28. Click the **Exit** button to close the Linearization Calibration window.

    The Linearization tab displays again, and the calibration process is complete.

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8.7 Reference Meter Mode calibration

8.7.1 Equipment Setup for Reference Meter Mode calibration

For Reference Meter mode, set up the equipment as shown in Figure 8-3.
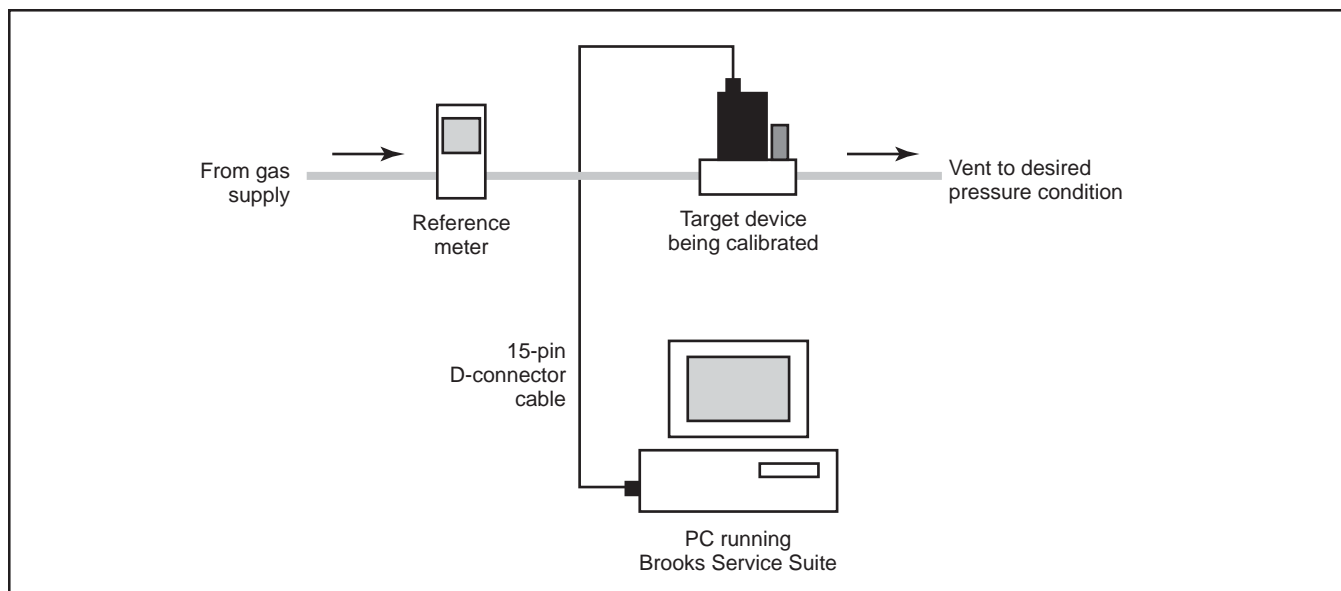
Figure 8-3 Equipment Setup for Reference Meter Mode Calibration

NOTE:

A Molbloc® or a BI05 may be used in place of the reference meter illustrated above. If using a BI05, this device should be installed downstream of the target device.

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8.7.2 Performing the Reference Meter Mode calibration

You access the calibration functions from the Linearization tab.

NOTE:

When calibrating with a reference meter and the calibration gas is different than the process gas, it is assumed that the reference meter itself was calibrated with the calibration gas.

To perform device calibration in Reference Meter mode:

1. In the Select Linearization tool panel, select the **Reference Meter** option.

In Linearization Procedure panel, there are four buttons; you are going to go through these in sequence to perform and check the calibration. The first step is to clear the coefficients a0 through a4 of the polynomial. This is the polynomial of the curve that is used to linearize the mass flow sensor.

⚠ **CAUTION**

Once you perform the next step (clicking the *Default Polynomials* button), you have to finish the calibration procedure; otherwise, the device will not be calibrated.

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2. Click the **Default Polynomials** button to clear the coefficients.

    A dialog box displays when clearing process is complete.
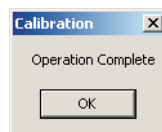
3. Click **OK** to dismiss the dialog box.
    The polynomial coefficients are cleared.
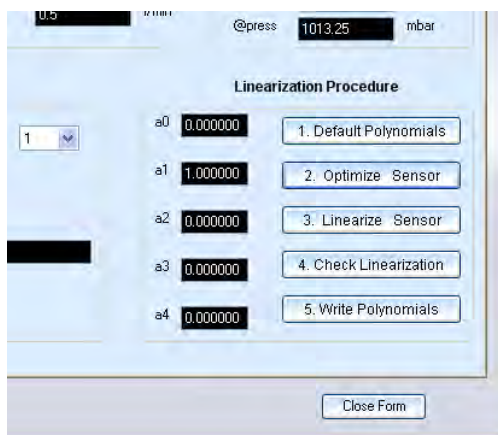
4. Click the **Optimize Sensor** button.

    A dialog box explains what the Optimize Sensor process will do.
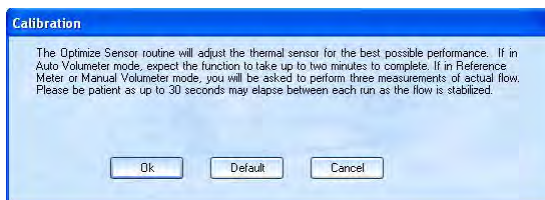
To execute the Optimize Sensor process, you will use the reference meter to determine the actual flow rates for three setpoints set by the Service Suite application.

The three readings will be used to: (1) make sure that the tube flows at least to its full scale value; and (2) optimize the gain of the thermal mass flow output.

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5. Click **OK** to start the Optimize Sensor process. Click **Default** to configure a default value of 0.81 for the Sensor Drive Setting (proceed with numbered item 9)

In case the device type is set to Mass Flow Meter (MFM) the flow needs to be adjusted by using an external valve. Two additional pop-ups will appear to indicate this, adjust the flow by using the external valve such that the 'Flow(%)' indicates the suggested value. A difference between the actual and suggested flow of 1% is allowed.
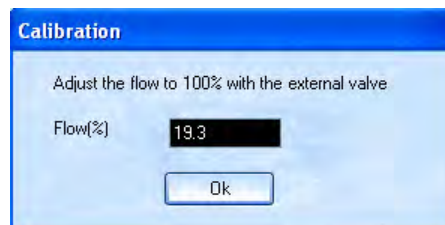
After the flow stabilizes, a dialog box prompts you to enter the true flow of the target device.

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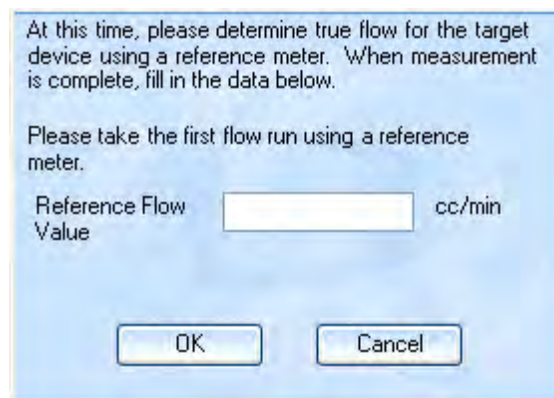
6. Enter the flow rate detected by the reference meter, then click **OK**.

   The entry is saved, and the flow at the second setpoint is started. When the flow stabilizes, the dialog box prompt is displayed again.

7. Perform the second and third runs.

   After entering the results of the third run and clicking **OK**, a dialog box displays indicating the optimization has successfully completed.
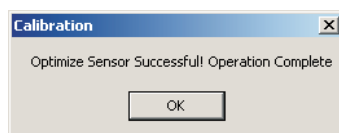
8. Click **OK** to dismiss the dialog box.

9. Click the Linearize Sensor button.

   The Linearization Calibration window displays.

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By default, there are six Linearization Data Points with setpoint settings (as percentages of full scale flow) entered. It is recommended to use the default settings. But the desired flow can be changed to the required values. There are 2 option buttons **Default** and **Custom**. If the values are changed in any of the fields the **Save Custom Values** button will get enabled. By clicking on this button the custom flow values can be saved. For the next time we can use the default values or the stored custom values by choosing the required option.

10. To start the linearization process, click the **#0** button (in the first Data Point row) to start the first flow run. Whenever a button in the 'Start' column is clicked, a window will pop up showing a decrementing 30-seconds stabilization timer. This window will automatically close when the timer has reached 0, do not close this window because it might affect the accuracy." After the stabilization timer has expired, click the #1 button in the 'Start' column and wait for the stabilization timer expiry.

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11. Enter the flow rate displayed on the reference meter in the **Flow** field.

NOTE:

You must press the Enter key after entering values in the **Flow** fields to have the entries saved..

12. Click the **#2** button to start the second flow run.

Continue the flow runs, entering the flow rate for each run. The following screen shows an example of what the window looks like after the final Data Point flow rate has been entered.

After having completed all flow runs, the **Calculate Polynomial** button enables.

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13. Click the **Calculate Polynomial** button.

    A dialog box indicates that the polynomial coefficients have been stored.

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14. Click OK to dismiss the dialog box, then click the **Exit** button to close the Linearization Calibration window.

The updated coefficients are displayed in Linearization tab.

In the next series of steps, you are going to check the flow for different Data Points, but using the updated linearization polynomial. The Check Linearization process will check the results against the expected flow rates, and display deviation error values for each Data Point flow run.

15. Click the **Check Linearization** button.

The Linearization Calibration window displays, but with two additional columns of data: **Measured Error** and **Spec. Error Limit**.

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16. You can change the setpoint setting and pick-off for each Data Point; however, it is recommended that you use the default values for the six Data Points.

17. Click the **#1** button (in the first Data Point row) to start the first flow run. Continue the flow runs and entering the flow rate data, just as you did during the Linearization procedure.

NOTE:

When entering the flow rate, you must press the Enter key to compute the error deviations. After pressing the Enter key but before pressing the **#N** button for the next Data Point, the entry can be changed (for example, if you accidentally entered the wrong value). However, once you press the **#N** button for the next Data Point, the entries cannot be changed (unless you press the **Clear Fields** button, which will clear all Data Point fields).

As you save the entered values for a Data Point, the deviations from expected flow rates are entered in the **Measured Error** and **Spec. Error Limit** fields.

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18. *If deviations are not within acceptable limits,* you can click the **Clear Fields** button. Re-zero the sensor, then rerun the Check Linearization process, using one or more checkpoints. If the deviations are still not acceptable, make sure that the calibration conditions and equipment are accurate.

19. Click the **Exit** button to close the Linearization Calibration window.

   The Linearization tab displays again, and the calibration process is complete.

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8.8 Saving the Calibration Data to a File

To save the gas calibration data to a device configuration text file:

1. Open the **Actions** menu and choose **Calibration Actions>Calibration**.
   The Calibration dialog box displays.

2. Go to the Save Session tab.

3. Click the **Browse** button.

   The Save Device Configuration dialog box displays.

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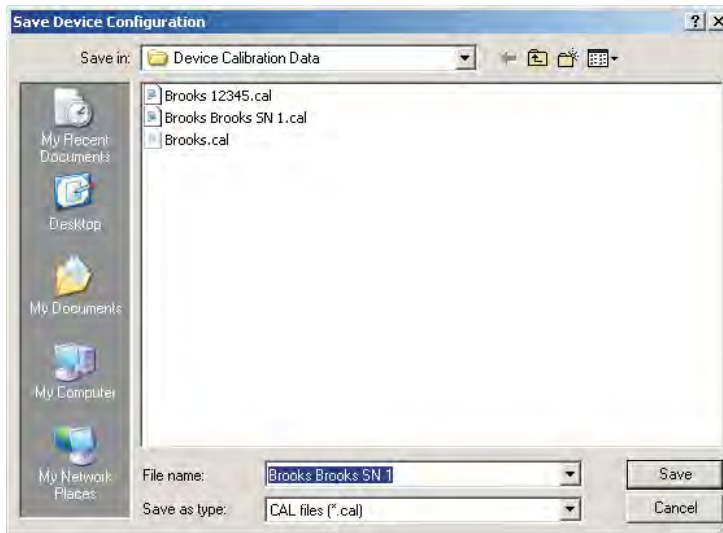
4. Enter the name for the device configuration file, then click the **Save** button.

   You are prompted to confirm creating the file or, if you entered the name of an existing file, to replace it.

5. To continue, click **Yes**.

   The path and name of the device configuration file is displayed in the Select File Name to Save field.

6. To initiate the save operation, click the **Save** button.

   A message flashes, indicating the progress of the save operation. When the operation is complete, the message stops flashing.

8.9 Calibration Report

The calibration report can only be shown in case the device is connected and a session opened. In case you want to view calibration reports offline you need to export the report to a file.

The Calibration Report summarizes product and calibration information about the device.

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Product/Calibration Data Sheet

Product Data

Model Number SLA5850SB1AB1B2A1	**Firmware Revision** AF	**Valve Type** Normally Closed
Serial Number 107090348985001	**Hardware Revision** INIT	**Valve Seat Material** Viton
Customer Brooks	**Power Supply Type** +/-15 VDC	**O-Ring / Seal Material** Viton
Customer Part Number 1	**Input Type** 0 to 5 VDC	**Mounting Attitude** Horizontal side down
Reference Number 1	**Output Type** 0 to 5 VDC	

Calibration Data

	Cal. Date 3-4-2008 **Cal. Time** 15:36	**Gas Cal. #** 1 **Cal. Type** 0	
Calibration System ID 1	**Calibration Gas** AIR	**Ref. Temp.** 0 degC **Ref. Pres.** 1013.25 mbar	
Calibration Software Revision 1	**Calibration Inlet Pressure** 44.7 PSIA	**Process Gas** AIR	
Calibrator Name Mr	**Calibration Outlet Pressure** 14.7 PSIA	**Process Gas Inlet Pressure** 44.7 PSIA	
Calibration Location Ede	**Process Gas Full Scale Flow** 500 cc/min	**Process Gas Outlet Pressure** 14.7 PSIA	
Calibration Procedure Ref Meter	**Calibration Gas Conversion Factor** 1	**Process Gas Density** 1 kg/m3	

Remarks

S-protocol Data Rate = 19200   S-protocol Tag Name =   S-protocol Unique ID = 0

Calibration Check Data

Set Point (%)	Out put (%)	Flow (UOM)	Error (% Rate)
10.00	10.108	50.54	1.08
25.00	24.98	124.9	-0.08
50.00	49.94	249.7	-0.12
75.00	75.04	375.2	0.05
90.00	90.08	450.4	0.09
100.00	100.18	500.9	0.18

Setpoint vs. Error (% Rate)

UOM -   cc/min
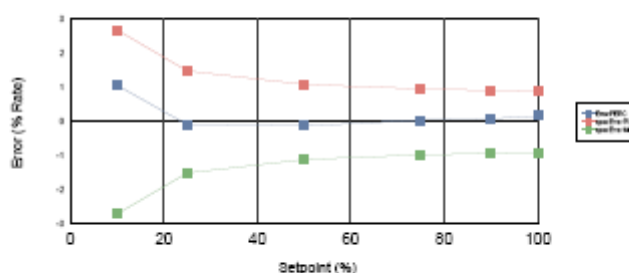
The report content includes:

- The product data, as entered on the Product Data tab on the Calibration window.

- The calibration data, as entered on the Gas Cal. Data tab on the Calibration window.

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- The results of the calibration linearization check procedure.

- In the Remarks section, important S-protocol data configuration parameters.

To view the Calibration Report, select open the **Actions** menu and choose **Calibration Actions>Report**. The Report Viewer window displays.

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From the Report Viewer, you can:

• Zoom in and out.

• Print the report.

• Save the report to one of the following file formats: PDF, Word, RTF, Excel spreadsheet, Excel data only, or Crystal Reports (.rpt).
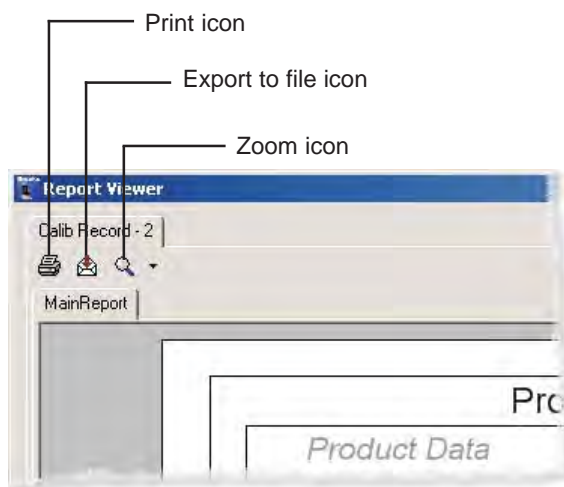
Print icon

Export to file icon

Zoom icon

The calibration report can only be shown in case the device is connected and a session opened. In case you want to view calibration reports offline you need to export the report to a file.

To close the Report Viewer window, click the **X** button at the top right of the window.

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LIMITED WARRANTY

Seller warrants that the Goods manufactured by Seller will be free from defects in materials or workmanship under normal use and service and that the Software will execute the programming instructions provided by Seller until the expiration of the earlier of twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller. Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer.

All replacements or repairs necessitated by inadequate preventive maintenance, or by normal wear and usage, or by fault of Buyer, or by unsuitable power sources or by attack or deterioration under unsuitable environmental conditions, or by abuse, accident, alteration, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense.

Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller.

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Visit www.BrooksInstrument.com to locate the service location nearest to you.

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For some process applications, where ISO-9001 Quality Certification is important, it is mandatory to verify and/or (re)calibrate the products periodically. In many cases this service can be provided under in-situ conditions, and the results will be traceable to the relevant international quality standards.

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