Using ProLink® Software with Micro Motion® Transmitters

Instruction Manual

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Micro Motion

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Using ProLink® Software with Micro Motion® Transmitters

Instruction Manual

For technical assistance, phone the Micro Motion Customer Service Department:

- In the U.S.A., phone 1-800-522-6277, 24 hours
- Outside the U.S.A., phone 303-530-8400, 24 hours
- In Europe, phone +31 (0) 318 549 443
- In Asia, phone 65-770-8155

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1 Before You Begin

1.1 About the ProLink® program

This manual explains how to use the Micro Motion® ProLink™ software program under the Microsoft® Windows® graphical environment for IBM-compatible personal computers. Before using this instruction manual, the reader should be familiar with Microsoft Windows.

The ProLink program provides communication between a personal computer and Micro Motion RFT9739, IFT9701, IFT9703, RFT9712, and RFT9729 transmitters.

The Micro Motion PC Interface adaptor, included with the ProLink kit, converts Bell 202 or RS-485 signals to and from the RS-232-C standard used by personal computers.

The ProLink program presents menus, windows, and dialog boxes familiar to Microsoft Windows users.

The ProLink program enables off-line editing of transmitter configurations, and enables transfer of configurations to or from the ProLink transmitter database or data storage media, or from the database to a Rosemount Model 268 SMART FAMILY® hand-held communicator. **The ProLink program cannot be used with a Model 275 HART® Communicator.**

Uses of the ProLink® program

While using the ProLink program, press F1 at any time for on-line help.

Use the ProLink program to:
- Transfer transmitter configurations to and from the ProLink transmitter database, the hard drive, diskettes, or the connected transmitter
- Upload a configuration to a Model 268 hand-held communicator
- Poll for data from devices on a multidrop network
- Set up an error log and change log
- Send data to a printer or an ASCII file
- Configure measurement units and range limits
- Read process variables and output variables
- Configure, read, trim, and test transmitter outputs
- Store messages and information such as sensor serial number and model, flow tube and liner materials, and flange type
- Calibrate the flowmeter
- Assign events to RFT9739 outputs
- Reset the transmitter internal totalizers
- Troubleshoot the sensor, transmitter, and cable connections

File location

ProLink files are saved to the default ProLink directory on the personal computer, unless otherwise specified by the user. Such files include:
- Change log files
- Error log files
- Ticket definition files
- Ticket destination files

If a previous release of the ProLink program is installed:
- The new software may be installed in the same directory as the earlier version, or in a new directory. The new program files will not overwrite any configuration or default files that were created previously.
- The new software will use any configuration and default files that were created using earlier ProLink versions. However, if the new software is installed in a directory other than the default ProLink directory, it might be necessary to locate configuration and default files manually when using the new program.

1.2 The ProLink® kit and system requirements

The ProLink® kit includes the items illustrated in **Figure 1-1**. To order replacement parts, see **Appendix A**, page 169.

To use the ProLink program, the personal computer must have:
- Intel® 80386 or higher version microprocessor
- Microsoft Windows version 3.1 or higher
- Hard drive with at least 2.5 MB available for storage
- 4 MB random-access memory (RAM)
- An available 9-pin or 25-pin serial port for RS-232-C communication

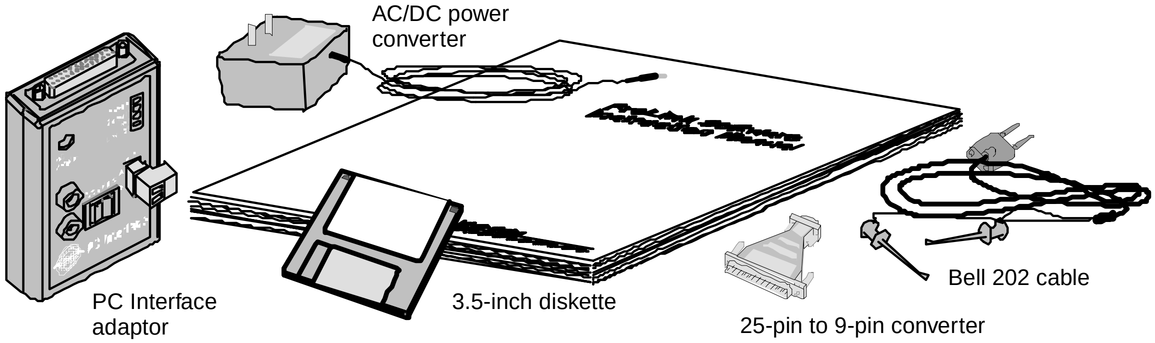
ProLink software compatibility with Micro Motion transmitters and Rosemount hand-held communicators is listed in **Table 1-1**.

Table 1-1. ProLink® compatibility

Transmitter/communicator	ProLink® software requirement
RFT9739 Version 3.6	ProLink version 2.4
RFT9739 Version 3, 3.5	ProLink version 2.3
RFT9739 Version 2	ProLink version 2.1
RFT9739 earlier than version 2	Any ProLink version
IFT9701, IFT9703	ProLink version 2.2 or higher
RFT9712, RFT9729	Any ProLink version*
HART® Communicator Model 275	Not compatible with ProLink program
SMART FAMILY® Interface Model 268	Any ProLink version

*RFT9712 and RFT9729 require transmitter software version 5.0 or higher.

Figure 1-1. ProLink® kit



1.3 Customer service

For technical assistance with the ProLink software program or any Micro Motion product, contact the Micro Motion Customer Service Department:

- In the U.S.A., phone **1-800-522-MASS** (1-800-522-6277), 24 hours
- Outside the U.S.A., phone 303-530-8400, 24 hours
- In Europe, phone +31 (0) 318 549 443
- In Asia, phone (65) 770-8003

2 Getting Started

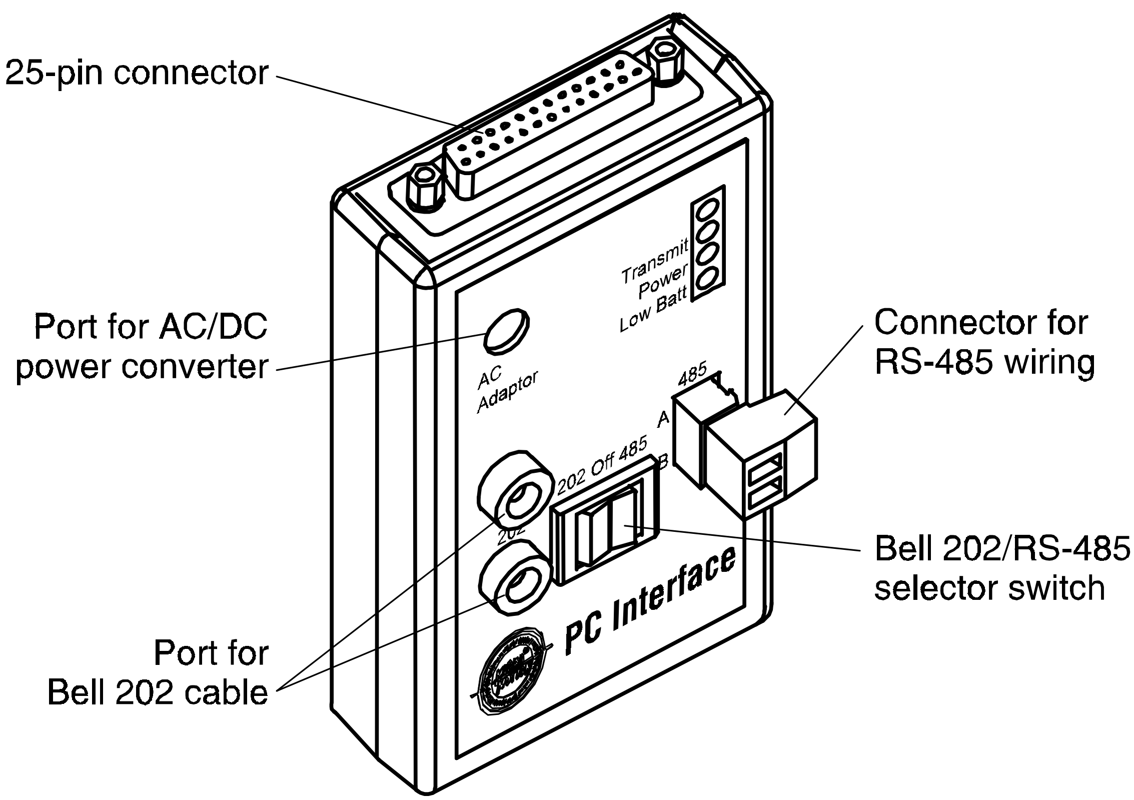
2.1 Overview

Depending on the transmitter model, communication with the flowmeter uses the Bell 202 and/or RS-485 communication standards. The PC Interface adaptor, shown in **Figure 2-1**, converts Bell 202 or RS-485 signals from the flowmeter to and from the RS-232-C standard used by personal computers.

Installing the ProLink program requires the following four steps:

1. Choose a communication standard, as described in **Section 2.2**.
2. Connect the PC Interface adaptor to the transmitter, as described in **Section 2.3**.
3. Install the PC Interface adaptor to the personal computer and a power supply, as described in **Section 2.4**.
4. Install the ProLink software program, as described in **Section 2.5**.

Figure 2-1. PC Interface adaptor



2.2 Communication standards

Switches and jumpers on the transmitter determine the communication standard used by the transmitter. Micro Motion configures each transmitter's default communication settings at the factory.

Depending on the transmitter model, transmitters can communicate using HART and/or Modbus® protocol, using the Bell 202 or RS-485 standard. Communication configuration for the ProLink program and transmitter must be the same.

Factory-default settings

The factory default settings for Version 3 RFT9739 transmitters are:

- HART protocol over the Bell 202 standard at 1200 baud, 1 stop bit, odd parity
- Modbus protocol over the RS-485 standard at 9600 baud, 1 stop bit, odd parity

The factory default settings for the IFT9701, IFT9703, RFT9712, and RFT9729 are: HART protocol over the Bell 202 standard at 1200 baud, 1 stop bit, odd parity.

User configuration

Transmitter models RFT9739, RFT9712, and RFT9729 can be reconfigured for user-defined communication settings using switches and jumpers on the transmitter. To establish a user-defined communication configuration, see the transmitter instruction manual.

HART® and Modbus® communication

The primary variable milliamp output on the RFT9739, and the 4-20 mA output on the IFT9701, IFT9703, RFT9712, and RFT9729 can produce HART-compatible signals for Bell 202 communication.

Micro Motion transmitters can function as part of a Bell 202 or RS-485 multidrop network.

- The RFT9739 can use the Bell 202 or RS-485 standard under HART protocol, or the RS-485 standard under Modbus protocol.
- The IFT9701 and IFT9703 can use the Bell 202 standard under HART protocol only.
- The RFT9712 and RFT9729 can use the Bell 202 or RS-485 standard under HART protocol only.

Up to 15 transmitters can participate with other devices in a Bell 202 multidrop network. Each transmitter must have a unique polling address of 1 to 15, or a unique tag name.

Up to 32 transmitters can participate in an RS-485 multidrop network. Each transmitter must have a unique tag name; up to 15 transmitters may have unique polling addresses from 1 to 15. The IFT9701 and IFT9703 cannot communicate in an RS-485 network.

2.3 Wiring to the transmitter

Wiring connections to RFT9739, IFT9701, IFT9703, RFT9712, and RFT9729 transmitters are shown on the following pages. The configured communication standard (Bell 202 or RS-485) determines how the transmitter and PC Interface adaptor are wired together.

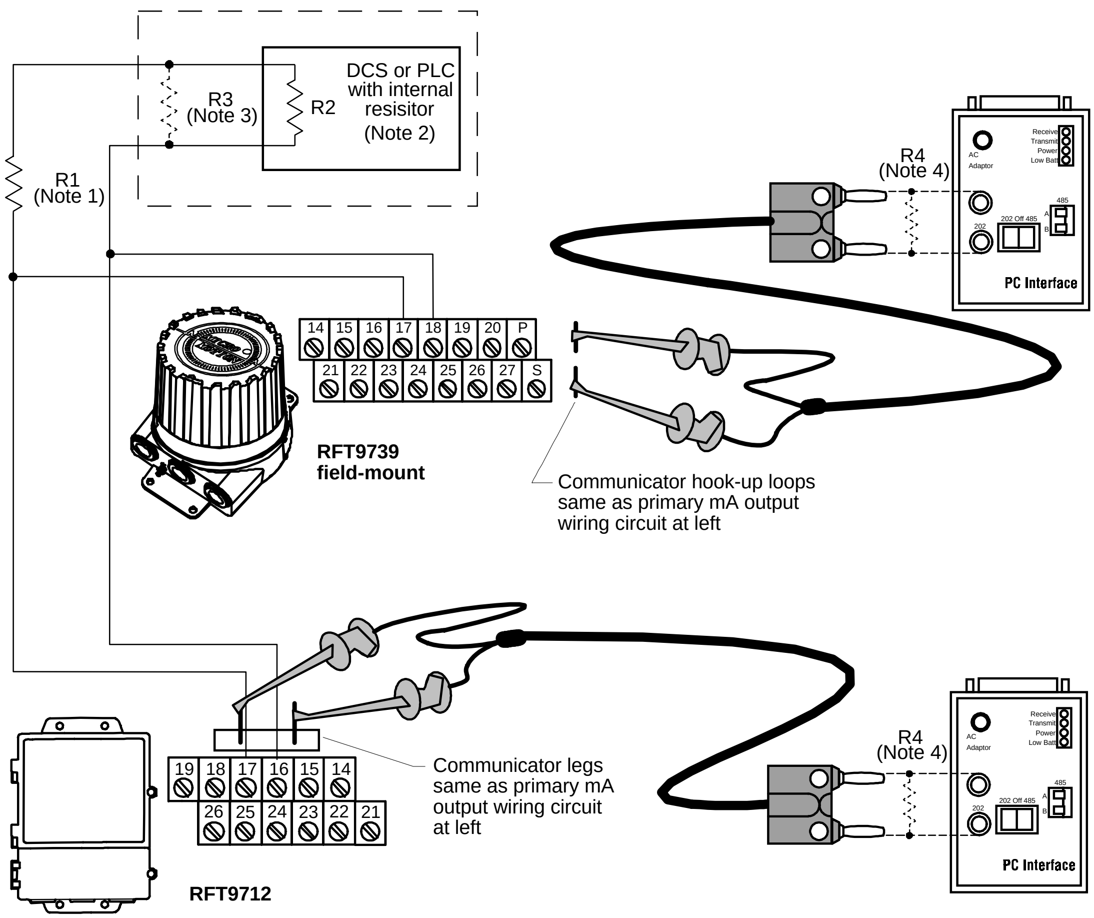
Table 2-1 lists the appropriate wiring diagrams for temporary connections to transmitters using the Bell 202 standard, and for hard-wiring to individual transmitters and multidrop networks using the Bell 202 and RS-485 standards.

Table 2-1. Wiring diagrams for PC interface and transmitters

Communication standard	Type of Connection	Transmitters	Wiring diagram
Bell 202	Temporary connection to field-mount transmitters[1]	RFT9739 RFT9712	**Figure 2-2**
	Temporary connection to rack-mount transmitters	RFT9739 RFT9729	**Figure 2-3**
	Hard-wiring to individual transmitters or multidrop networks	RFT9739 IFT9701 IFT9703 RFT9712 RFT9729	**Figure 2-4**
RS-485[2]	Hard-wiring to individual transmitters or multidrop networks	RFT9739 RFT9712 RFT9729	**Figure 2-5**

[1] There are no temporary field connections on the IFT9701 or IFT9703.
[2] RS-485 not supported by the IFT9701 or IFT9703.

Figure 2-2. Bell 202 temporary connection to field-mount transmitters



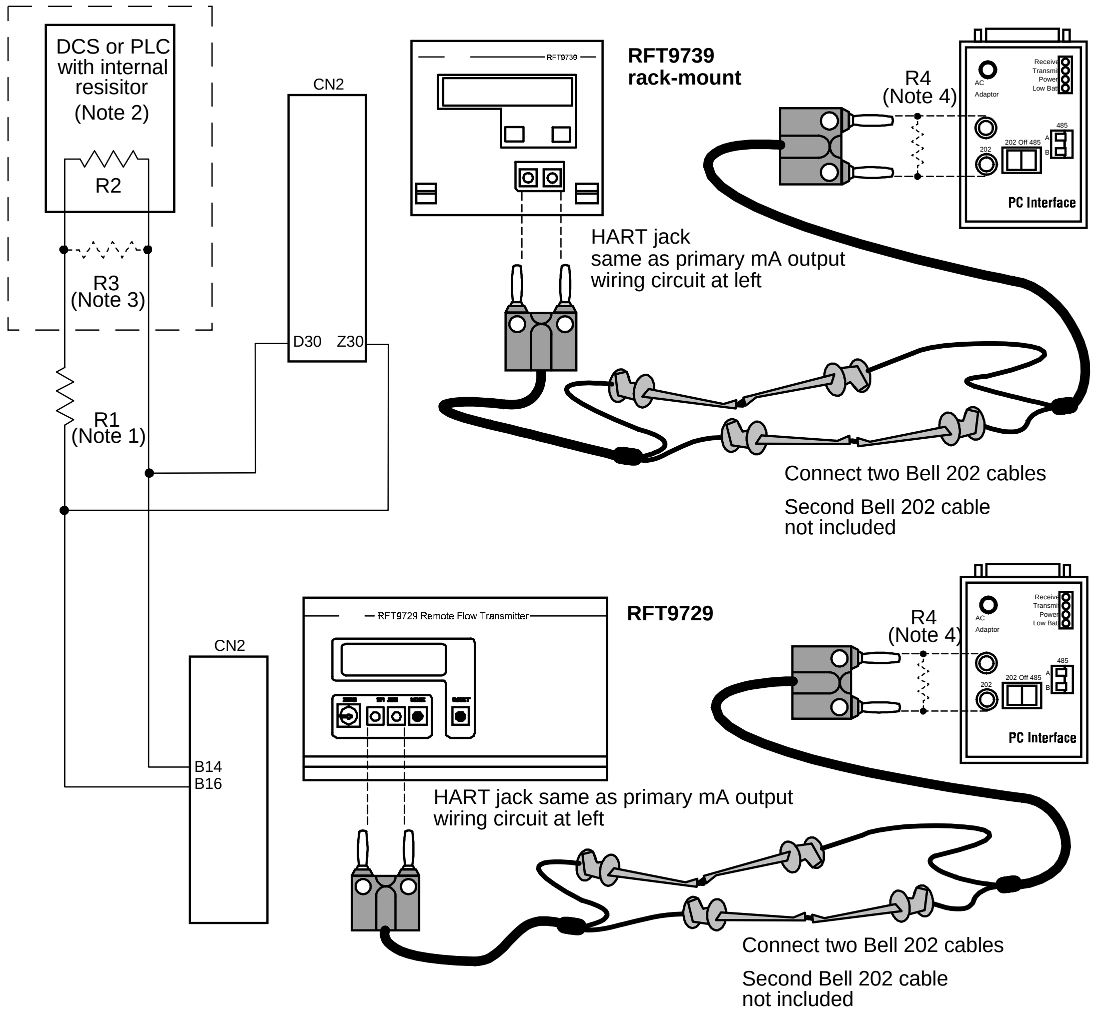
Notes for Figure 2-2

1. If necessary, add resistance in the loop by installing resistor R1. SMART FAMILY devices require a minimum loop resistance of 250 ohms. Loop resistance must not exceed 1000 ohms, regardless of the communication setup.

> **⚠ CAUTION**
>
> **Connecting a HART device to the transmitter's primary analog output could cause transmitter output error.**
>
> If the primary variable analog output is being used for flow control, connecting a PC interface adaptor to the primary analog output loops or legs could cause the transmitter 4-20 mA output to change, which would affect flow control devices.
>
> Set control devices for manual operation before connecting a PC interface adaptor to the transmitter's primary analog output loops or legs.

2. The DCS or PLC must be configured for an active milliamp signal.
3. Resistor R3 is required if the DCS or PLC does not have an internal resistor.
4. Resistor R4 is required if the illustrated transmitter output wiring is not connected to an input device. Required loop resistance: minimum 250 ohms, maximum 1000 ohms. Wrap ends of resistor around prongs of plug before inserting into jack.

Figure 2-3. Bell 202 temporary connection to rack-mount transmitters



Notes for Figure 2-3

1. If necessary, add resistance in the loop by installing resistor R1. SMART FAMILY devices require a minimum loop resistance of 250 ohms. Loop resistance must not exceed 1000 ohms, regardless of the communication setup.

⚠ CAUTION

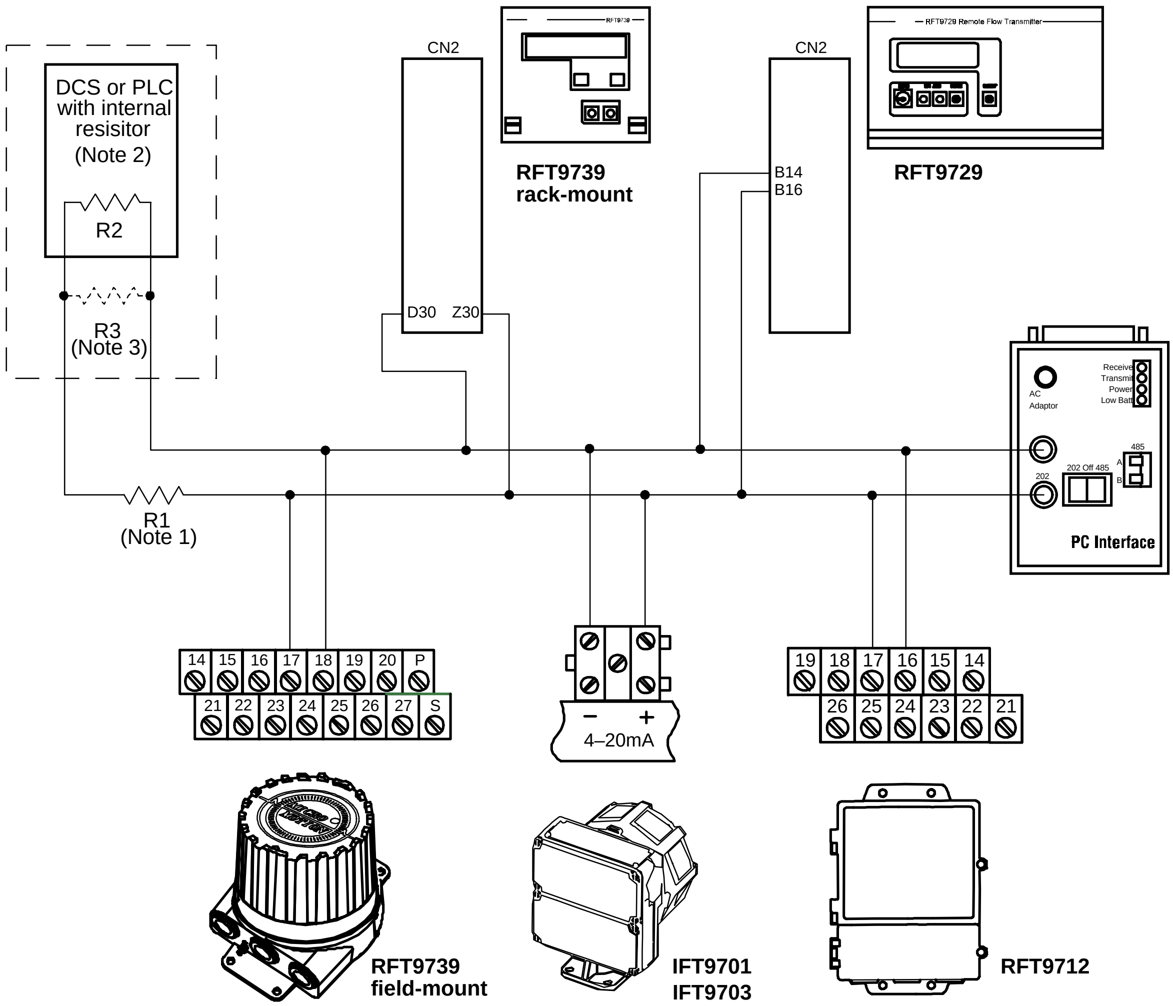
Connecting a HART device to the transmitter's HART jack could cause transmitter output error.

If the primary variable analog output is being used for flow control, connecting a PC interface adaptor to the HART jack could cause the transmitter 4-20 mA output to change, which would affect flow control devices.

Set control devices for manual operation before connecting a PC interface adaptor to the transmitter's HART jack.

2. The DCS or PLC must be configured for an active milliamp signal.
3. Resistor R3 is required if the DCS or PLC does not have an internal resistor.
4. Resistor R4 is required if the illustrated transmitter output wiring is not connected to an input device. Required loop resistance: minimum 250 ohms, maximum 1000 ohms. Wrap ends of resistor around prongs of plug before inserting into jack.

Figure 2-4. Bell 202 hard-wiring to transmitters or multidrop networks



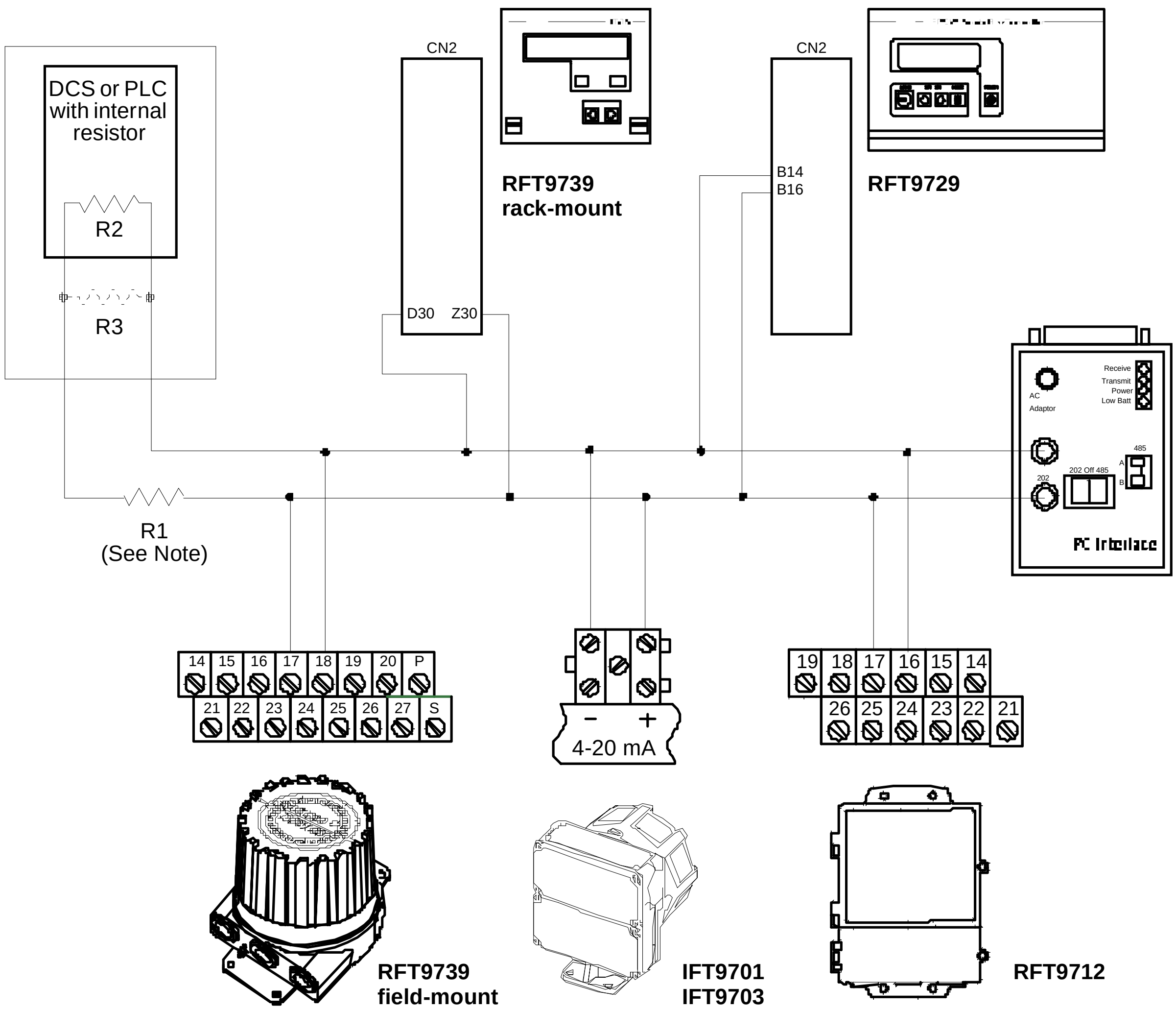
Notes for Figure 2-4

1. If necessary, add resistance in the loop by installing resistor R1. SMART FAMILY devices require a minimum loop resistance of 250 ohms. Loop resistance must not exceed 1000 ohms (600 ohms for an IFT9701), regardless of the communication setup.

> **⚠ CAUTION**
>
> **Connecting a HART device to the transmitter's primary milliamp output loop could cause transmitter output error.**
>
> If the primary variable analog output is being used for flow control, connecting a PC interface adaptor to the output loop could cause the transmitter 4-20 mA output to change, which would affect flow control devices.
>
> Set control devices for manual operation before connecting a PC interface adaptor to the transmitter's primary variable milliamp output loop.

2. The DCS or PLC must be configured for an active milliamp signal.
3. Resistor R3 is required if the DCS or PLC does not have an internal resistor.

Figure 2-5. RS-485 hard-wiring to transmitters or multidrop networks



Note for Figure 2-5

For long-distance communication, or if noise from an external source interferes with the signal, install 120-ohm, ½-watt resistors across terminals of both end devices.

2.4 Connecting to the PC and power source

Follow these instructions to install the PC Interface adaptor:

1. Plug the AC/DC power converter into the adaptor. Or, if desired, install a 9-volt battery (not included) in the battery compartment on the back of the adaptor (see **Figure 2-1**, page 5).
   - Battery life is approximately 11 hours when the transmitter operates at 38.4 kilobaud.
   - To remove the battery compartment cover, push down on the cover and slide it in the direction indicated by the arrow. After installing the battery, put the battery compartment cover securely in place on the back of the adaptor.

   For use in the European community, the Micro Motion PC Interface is CE compliant only when used with a power supply that is filtered against electromagnetic interference. Use of a battery or the power converter in the ProLink kit meets this requirement. To order a replacement power converter, see **Appendix A**.

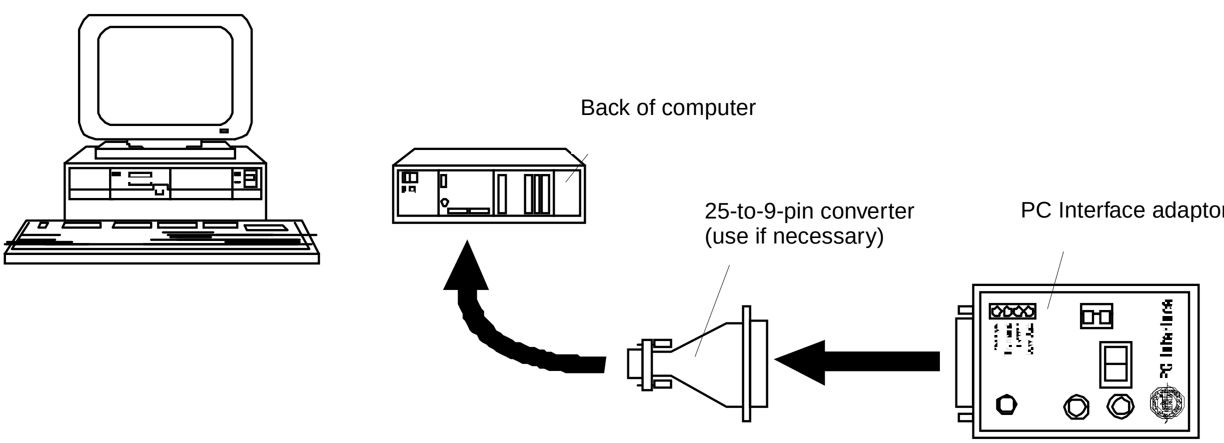
2. Set the selector switch on the adaptor to the center position, which shuts off power to the adaptor.

3. Plug the adaptor into a serial port on the personal computer, as illustrated in **Figure 2-6**. If necessary, install the supplied 25-pin to 9-pin converter between the serial port and the PC Interface adaptor.

4. Set the selector switch on the adaptor to the appropriate position:
   - To use the Bell 202 standard, set the switch to 202.
   - To use the RS-485 standard, set the switch to 485.

5. With a battery installed or the AC/DC adaptor plugged into the adaptor and a power supply, and with the selector switch set to the 202 or 485 the adaptor is ready for use. The red light labeled "Power" on the adaptor should be lit.

Figure 2-6. Installing the PC Interface adaptor



2.5 Installing the software

The ProLink kit comes with one 3½-inch diskette, which contains the operating files for the software. Because the ProLink installation/setup program decompresses files during installation, ProLink software cannot be installed by copying files from the diskette to the hard drive. Run the ProLink installation/setup program to install the ProLink software on the personal computer hard drive.

Before installing the program, make a back-up copy of the ProLink disk.

To install the ProLink program:

1. Insert the ProLink diskette into a disk drive.

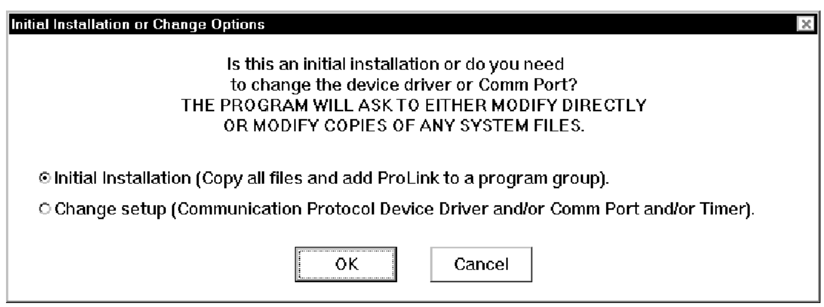
2. Open the Windows program manager, open the File menu, then choose Run. Windows 95 users, choose Start, then choose Run.

3. At the Run dialog box, depending on the drive where the ProLink diskette has been inserted, enter one of the following commands into the File Name text box:

   `A:\SETUP.EXE`
   or
   `B:\SETUP.EXE`

4. Follow the on-screen instructions to complete the installation process. Consult the sections below and on the following pages, if necessary, or contact the Micro Motion Customer Service Department for technical assistance.

Initial Installation dialog box



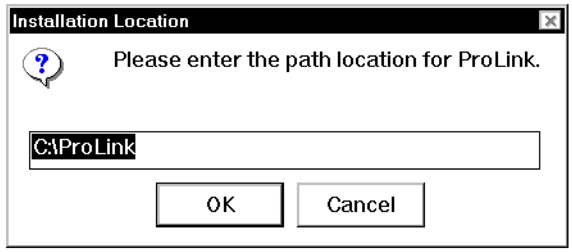
The Initial Installation or Change Options dialog box appears as shown above.

The installation/setup program offers two options:

- Initial Installation, which installs the ProLink software and places ProLink icons in a Windows program group.
- Change setup, which allows changes to device drivers for HART or Modbus protocol and the communication port.

To install the ProLink software, select Initial Installation, then click OK.

Installation Location dialog box



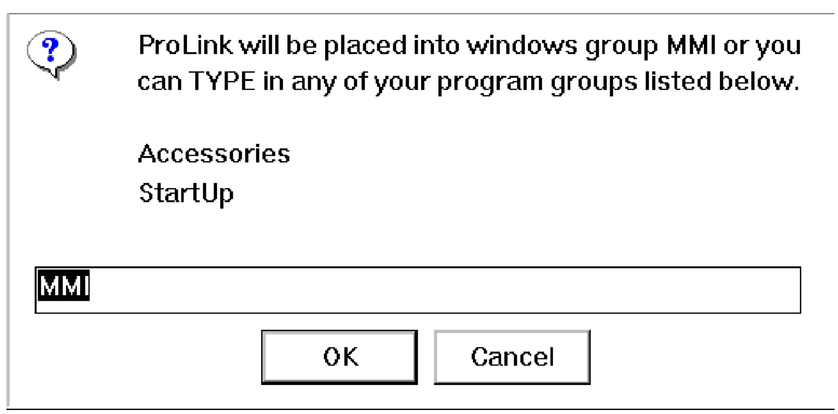
When the Installation Location dialog box appears as shown above, enter the desired directory pathname, then click OK.

The installation/setup program creates the directory. As ProLink program files are copied into the chosen directory, a "thermometer" indicates the percentage of the installation that has been completed.

If a previous release of the ProLink program is installed on the computer:

- The new program may be installed in the same directory as the earlier version, or in a new directory. The new program files will overwrite any default files that were created previously.
- The new program will use any configuration and default files that were created using an earlier ProLink version. However, if the new program is installed in a directory other than the default ProLink directory, it will be necessary to locate configuration and default files manually when using the new program.

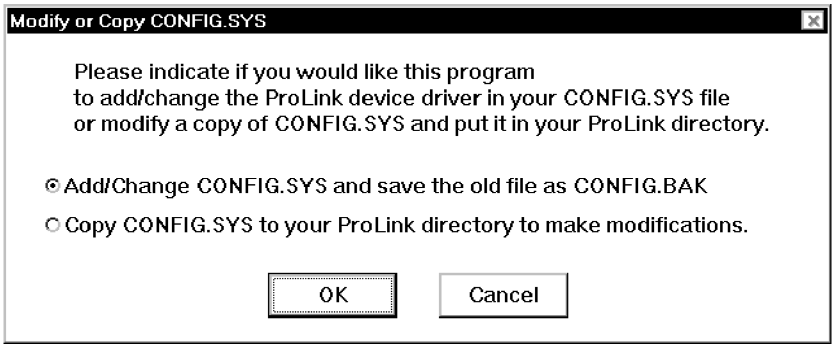
Program Group dialog box



During software installation, the Select Program Group dialog box, shown above, prompts the user to place the icons in a group window or submenu named MMI, or in another group window or submenu.

Enter the name of the desired group window or submenu from the Start menu in the text box, then click OK.

Modify/Copy CONFIG.SYS dialog box

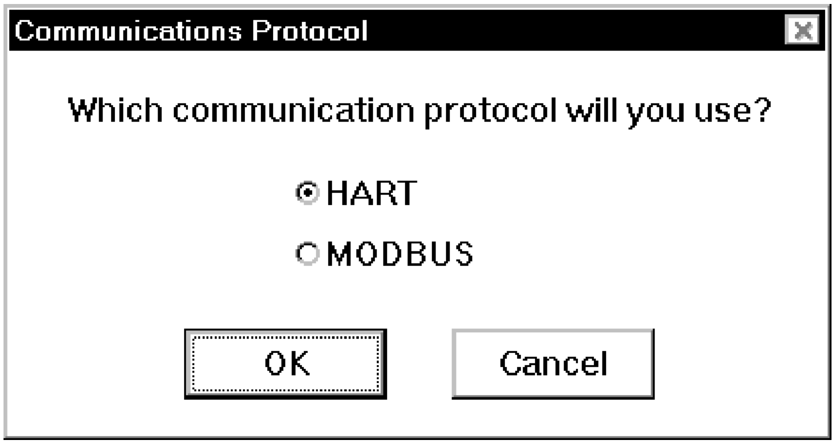


After the user specifies a Windows program group, the Modify or Copy CONFIG.SYS dialog box appears as shown above. The choice determines how device drivers are added to the personal computer CONFIG.SYS file.

Select an option, then click OK.

- Select Add/Change to add the HART or Modbus device driver to the CONFIG.SYS file in the root directory on the hard drive.
- Select Copy to copy the CONFIG.SYS file to the ProLink directory before adding the appropriate device driver.

Communications Protocol dialog box



After the user chooses how the installation/setup program modifies the CONFIG.SYS file, the Communications Protocol dialog box appears as shown above. The choice determines the protocol used by the software, without affecting the protocol used by the PC Interface adaptor or the connected transmitter.

Select either option, then click OK:

- Select HART or Modbus protocol if the PC Interface adaptor is connected to an RFT9739.
- Select HART protocol if the PC Interface adaptor is connected to an IFT9701, IFT9703, RFT9712, or an RFT9729.

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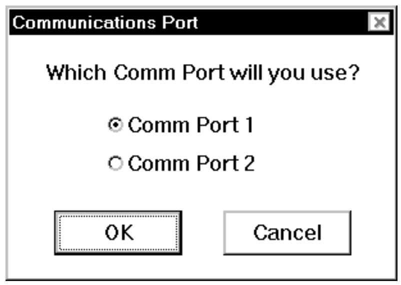
File Menu: Database
File Menu: Print
File Menu: Log Files
View Menu: Variables

After ProLink software installation is completed, the ProLink Setup icon enables switching of protocols used by the ProLink program. To change the protocol used by:

- The ProLink program, see **Section 2.8**, page 22
- An RFT9739 transmitter, see the RFT9739 instruction manual

Communications Port dialog box



After the installation/setup program establishes the protocol that the ProLink program will use, the Communications Port dialog box appears as shown above. The dialog box prompts the user to choose COM1 or COM2 as the communication port.

Select the desired option, then click OK, or, if the personal computer has more than two serial ports, and a port other than COM1 or COM2 is desired:

1. At the Communications Port dialog box, choose COM2.

2. After installation is completed, use the Windows Notepad program to open and read the 3COM.TXT file (located in the INST subdirectory of the ProLink directory). The 3COM.TXT file is an ASCII file that explains how to modify the CONFIG.SYS file to designate COM3 or COM4 as the communication port.

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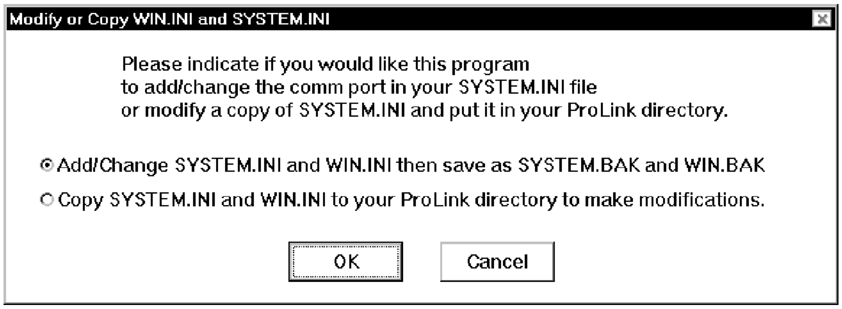
Installing the software

Modify/Copy .INI files dialog box

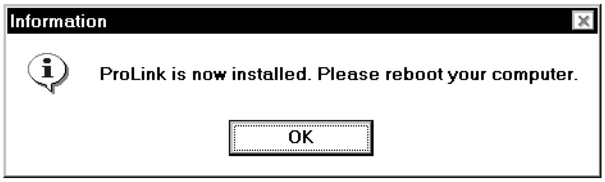


After the user selects a communication port, the Modify or Copy WIN.INI and SYSTEM.INI dialog box appears as shown above. The choice determines how the installation/setup program modifies the personal computer SYSTEM.INI and WIN.INI files to include the user-selected communication port and display parameters specified in the installation process.

Select an option, then click OK:

- Select Add/Change to add the communication port and display parameters to the SYSTEM.INI and WIN.INI files in their default directories on the hard drive.
- Select Copy to copy the SYSTEM.INI and WIN.INI files to the ProLink directory before adding the communication port and display parameters.

Setup Complete/Reboot dialog box



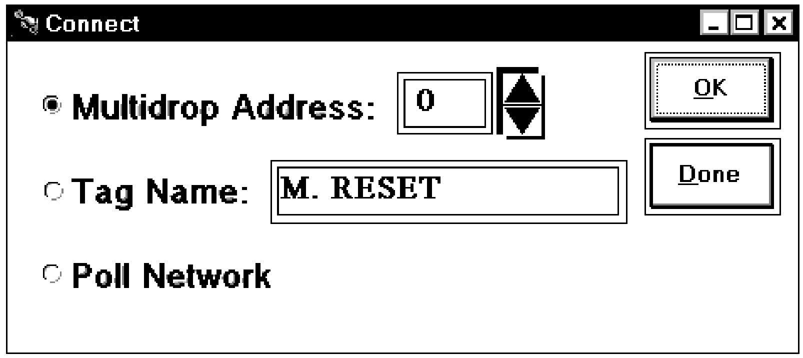
After the user chooses how the installation/setup program modifies the SYSTEM.INI and WIN.INI files, the Setup Complete dialog box appears as shown above.

If CONFIG.SYS, SYSTEM.INI and WIN.INI files were copied during the installation, copy them back to their default directories (e.g., using File Manager or Windows Explorer), then reboot the computer.

- Copy the CONFIG.SYS file to the root directory.
- Copy the SYSTEM.INI and WIN.INI files to the Windows directory.
- It is necessary to reboot the computer to initialize changes made to the CONFIG.SYS file.

2.6 Start-up

To run the ProLink program, select the MMI program group, then click on the ProLink icon. In Windows 95, click the Start button, select Programs, then select the MMI program group and click the ProLink icon. The ProLink application window and Connect dialog box will be displayed, as shown below.



In the ProLink application window:

- Labels for the File, Applications, Window, and Help menus appear highlighted to indicate they can be accessed without a transmitter connection, as shown below.
- Labels for the View, Configure, Calibrate, and Test menus appear dimmed to indicate they are temporarily inaccessible, as shown below.
- Press F1 for help at any time.

2.7 Connecting to the transmitter

Use the option buttons and text boxes in the Connect dialog box to identify the transmitter by polling address or HART tag name, then click OK.

- Under HART protocol, the connected RFT9739, RFT9712, RFT9729, or IFT9701 can use the polling address or the (HART) tag name.
- Under Modbus protocol, the connected RFT9739 must use a polling address from 1 to 15.

To connect to the transmitter using its polling address:

1. Select Multidrop Address.
2. Enter the multidrop address, from 0 to 15 (1 to 15 for Modbus protocol).
3. Click OK.

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Connecting to the transmitter

To connect to the transmitter using its HART tag name (HART protocol only):

1. Select Tag Name.
2. Enter the transmitter tag name.
3. Click OK.

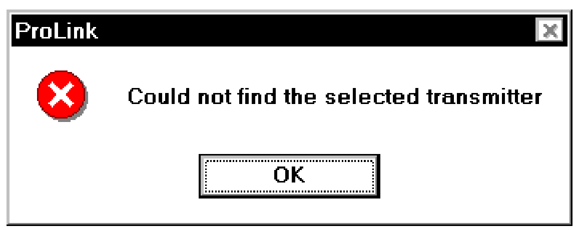
To view a list of available transmitters:

1. Select Poll Network.
2. Click Poll.
3. The network will be polled, and a drop-down list of available transmitters is displayed, including addresses and HART tag names. Select a transmitter, then click OK.

Menu bar

When a transmitter connection is established, all labels in the ProLink menu bar are highlighted, as shown below, indicating the user can open any menu.

Cannot Find message



If a connection with the transmitter cannot be made, the Cannot Find dialog box appears, as shown above. Typical causes and appropriate corrective actions are listed in **Table 2-2**.

Table 2-2. Troubleshooting the "cannot find" message

Status	Cause	Corrective Action
Transmitter not receiving power	Power OFF to transmitter	Verify the transmitter is receiving supply power (see the transmitter instruction manual for troubleshooting instructions)
Power light on PC Interface adaptor is OFF	Power OFF on PC Interface adaptor	• Ensure selector switch on PC Interface adaptor is set to either 202 or 485 • Ensure power cord is plugged into power socket and firmly in place on PC Interface adaptor, or install new 9-volt battery

Table 2-2. Troubleshooting the "cannot find" message

Status	Cause	Corrective Action
Transmit light on PC Interface adaptor does not flash when trying to connect to the transmitter	Incorrect computer communication port	• Change comm ports with the ProLink® setup program • Check cable connections between the computer and the PC Interface adaptor
	Computer communication port (COMM1 or COMM2) is being used by another program or device, such as a mouse, fax, or modem	• Change comm ports with the ProLink setup program • Disable device and remove other conflicting comm drivers
	IRQ is being shared by ProLink and another program or device, such as a mouse, fax, or modem, which is using communication port 3 (COMM3) or 4 (COMM4)	Disable device and remove other conflicting comm drivers
	Windows 3.1 and ProLink time source in conflict	Change the time source from Real Time clock to Interval Timer with the ProLink setup program
Transmit light on PC Interface adaptor remains OFF, and the receive light flashes while trying to connect to transmitter	Using wrong type of cable between the computer and the PC Interface adaptor	Use a straight through RS-232 cable from the computer to the PC Interface adaptor
Transmit light on PC Interface adaptor flashes while trying to connect to transmitter using the Bell 202 physical layer	Conflict between physical layer settings	Ensure that transmitter and position of selector switch on PC Interface adaptor, are all set to Bell 202
	Improper wiring between PC Interface adaptor and transmitter	Ensure proper Bell 202 wiring (see “Wiring to the transmitter” on page 7)
	Incorrect load resistance in wiring loop	Ensure proper load in Bell 202 wiring loop (see “Wiring to the transmitter” on page 7)
	Incorrect communication parameters	Bell 202 requires HART® protocol at 1200 baud, 1 stop bit, and odd parity (see “Communication options” on page 22, to change settings)
	Noise on mA loop from an external source	Ensure proper resistance in the Bell 202 wiring loop (see “Wiring to the transmitter” on page 7)
	RFT9739 not properly configured for Bell 202	Change RFT9739 settings (see the instruction manual that was shipped with the transmitter)
	RFT9712 or RFT9729 not properly configured for Bell 202	See the RFT9712 or RFT9729 instruction manual to verify: • The communications jumper located on the processor board in the RFT9712 or RFT9729 is set to 268 • The RFT9712 or RFT9729 has transmitter software version 5.0 or higher
	Incompatible communication settings between IFT9701/IFT9703 and ProLink program	Ensure ProLink settings are configured for HART protocol, 1200 baud, 1 stop bit, 250-600 ohm resistance and odd parity (see “Communication options” on page 22)

Table 2-2. Troubleshooting the "cannot find" message

Status	Cause	Corrective Action
Transmit light on PC Interface adaptor flashes while trying to connect to transmitter using the RS-485 physical layer	Conflict between physical layer settings	Ensure that transmitter and ProLink setup, and position of selector switch on PC Interface adaptor, are all set to RS-485
	Improper wiring between PC Interface adaptor and transmitter	• Ensure proper RS-485 wiring (see "Wiring to the transmitter" on page 7) • Verify terminal blocks are firmly seated at transmitter and PC Interface adaptor
	Incorrect communication parameters	Verify that settings for protocol (HART or Modbus®), baud rate, parity, and stop bits are the same for the transmitter and ProLink program
	Incorrect polling address	Open the File menu, then choose Connect. Click the Poll Network button in the Connect dialog box, then choose Poll for a list of available transmitters
	Baud rate too high for computer	Change ProLink baud rate to 1200 baud, then reset to higher rate is desired: Open the File menu, then choose Comm Options
	RFT9739 not properly configured for RS-485	Change RFT9739 settings (see the instruction manual that was shipped with the transmitter)
	RFT9712 or RFT9729 not properly configured for RS-485	See the RFT9712 or RFT9729 instruction manual to verify: • The communications jumper located on the processor board in the RFT9712 or RFT9729 is set to 485 • The RFT9712 or RFT9729 is using 1200 baud for HART communication, and has transmitter software version 5.0 or higher
	Noise interference	Ensure proper RS-485 wiring (see "Wiring to the transmitter" on page 7)

Windows® hour glass

When the Windows hour-glass symbol does not disappear, the ProLink program has experienced a fatal error. Reboot the computer, then refer to **Table 2-3** for typical causes and appropriate corrective actions.

Table 2-3. Additional ProLink troubleshooting information

Symptom	Cause	Corrective Action
Windows® hourglass symbol does not disappear	Windows 3.1 and ProLink time source are in conflict	Change the time source from Real time clock to Interval timer with the ProLink setup program
	Computer communication port (COMM1 or COMM2) is being used by another program or device, such as a mouse, fax, or modem	• Change comm ports with the ProLink setup program • Disable device and remove any other comm drivers
	IRQ is being shared by ProLink and another program or device, such as a mouse, fax, or modem, which is using communication port 3 (COMM3) or 4 (COMM4)	Disable device and remove any other comm drivers

Switch to another transmitter

To switch to another transmitter, disconnect the transmitter connection. Open the File menu, then choose Disconnect. The labels for the File, Applications, and Help menus remain highlighted to indicate that they are accessible without a connection.

During a work session, the user can repeatedly make or break transmitter connections without closing the ProLink program.

2.8 Communication options

The ProLink installation/setup program makes changes to the CONFIG.SYS file in the personal computer root directory and to the SYSTEM.INI file in the Windows directory. These changes enable communication between the personal computer and the connected transmitter, and enable the user to poll devices on a multidrop network.

If the Cannot Find dialog box appears (see page 19), the communication options for the transmitter might be incompatible with communication options for the ProLink software. In such situations, the user can enable a software connection by changing the communication options for either the transmitter or the ProLink software.

Transmitter communication options

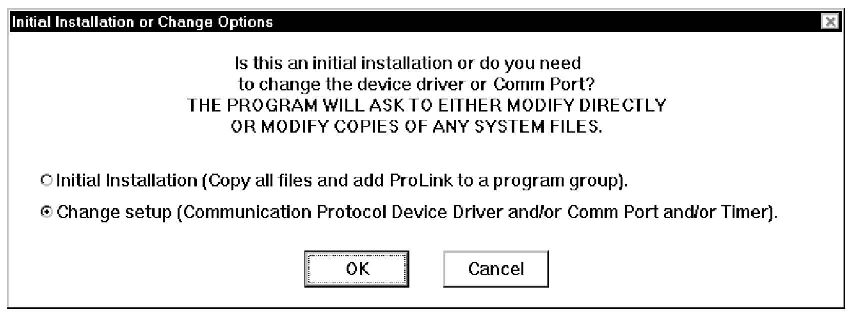
The transmitter has switches and jumpers that control the transmitter baud rate, protocol, stop bits and parity. To set transmitter switches and jumpers, see the transmitter instruction manual. Instructions for setting communication options are unique for each RFT9739 version. Be sure to use the instruction manual that was shipped with the transmitter.

Software communication options

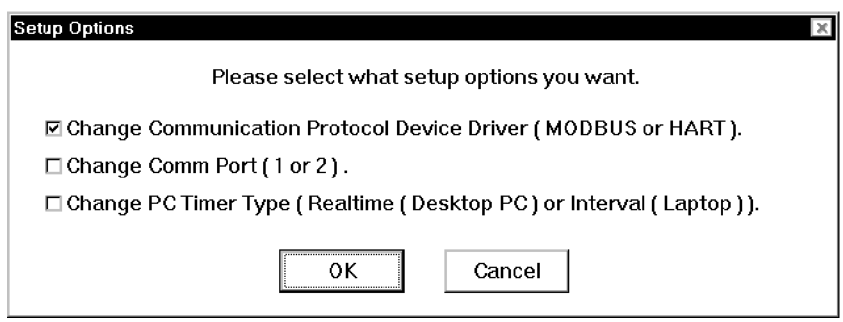
After software installation is completed, communication protocols, communication ports, and time source may be changed with the ProLink installation/setup program. Communication options may then be changed using the Configure Communications dialog box.

To change the configured ProLink communication setup:

1. Open the Windows Program Manager, open the MMI program group, then double-click the ProLink Setup icon to run the ProLink setup program. Windows 95 users select Programs from the Start menu, then MMI (or the program group containing ProLink), then ProLink Setup from the cascading menus.
2. When the Initial Installation or Change Options dialog box appears as shown below, select Change setup.



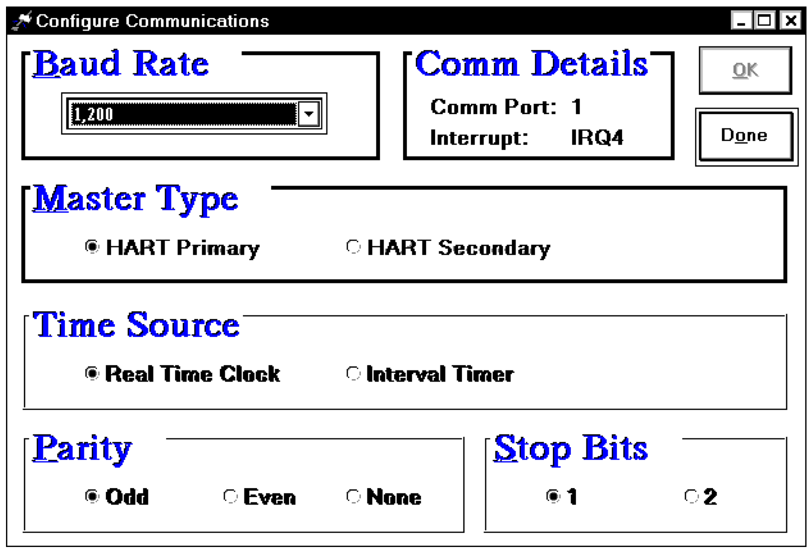
3. When the Setup Options dialog box appears as shown below, select one or more parameters to change. Click OK, then follow the on-screen instructions to switch protocol, port, and/or PC timer options.



4. After using the setup program:
   a. If CONFIG.SYS, SYSTEM.INI and WIN.INI files were copied during setup, use File Manager or Windows Explorer to copy them back to their default directories.
      - Copy the CONFIG.SYS file into the root directory.
      - Copy the SYSTEM.INI and WIN.INI files into the Windows directory.
5. Reboot the computer.

6. Open the Windows Program Manager, open the MMI program group, then double-click the ProLink icon to run the ProLink program. Windows 95 users select Programs from the Start menu, then select MMI (or the program group containing ProLink), then select ProLink from the cascading menus.
7. Open the File menu, then choose Comm Options. The Communication Options dialog box appears as shown in **Figure 2-7**.

Figure 2-7. Configure Communications dialog box



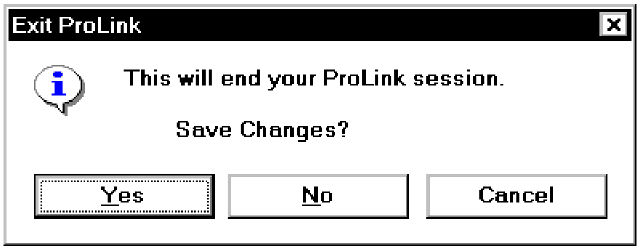
8. Open the Baud Rate list box to select a baud rate.
   - Select 1200 baud for IFT9701, IFT9703, RFT9712, and RFT9729 transmitters.
   - Select 1200 baud for RFT9739 transmitters configured for HART Bell 202 communication.
   - Select any baud rate for RFT9739 transmitters using HART or Modbus RS-485 communication.
9. Comm Details shows the configured communications port and communication hardware interrupt request line (IRQ). The port and IRQ cannot be changed from the Configure Communications dialog box, but must be configured in the ProLink setup routine. Follow steps 1 through 3 to change the communications port and IRQ.
10. Select a Master Type option button. The available master types depend on the protocol established when the software was installed:
    - With the ProLink program configured for HART protocol (default), select HART Primary or HART Secondary as the master type.
      - Select HART Primary to designate the ProLink program as the primary master for the network. Choosing HART Primary enables the ProLink program and a secondary master, such as a Model 268 or 275, to communicate at the same time.
      - Select HART Secondary to designate the ProLink program as the secondary master for the network. Choosing HART Secondary enables a control system to serve as the primary master.

- With the ProLink software configured for Modbus protocol, choose Modbus ASCII or Modbus RTU.
  - If Modbus RTU (default) is chosen, the ProLink program will use the RTU data transmission mode (8 data bits).
  - If Modbus ASCII is chosen, the ProLink program will use the ASCII data transmission mode (7 data bits). Choose this option if the communication network cannot support binary data.

11. For Windows 3.1 users only, Time Source shows whether the ProLink software will use a real time clock or interval timer. The time source cannot be changed from the Configure Communications dialog box, but must be configured in the ProLink setup routine. Follow steps 1 through 3 to change the time source configuration.
12. Use the Parity and Stop Bits option buttons to select the appropriate parity and stop bits.
    - Under HART protocol, the transmitter must use odd parity and one stop bit.
    - Under Modbus protocol, the transmitter can use odd parity, even parity, or no parity, and either one or two stop bits.
13. Click OK when ready to accept the software communications configuration.

2.9 Exit

To exit the ProLink program, open the File menu, then choose Exit. The Exit ProLink dialog box appears, as shown below.



- Select Yes to save the ProLink setup and communication options to the PROLINK.INI file in the ProLink directory.
- Select No to exit without saving the ProLink setup and communication options.
- Select Cancel to return to the ProLink program.

3 File Menu: Database

3.1 Overview

The Transmitter Database dialog box, shown in **Figure 3-1**, page 28, enables storage, retrieval, transfer, and editing of transmitter configurations. To open the Transmitter Database dialog box, open the File menu, then choose Database.

The database contains transmitter configuration files in ASCII code. A transmitter configuration file has an 8-character filename and a .CFG extension. The default database includes one sample transmitter configuration file for:

- the RFT9739 (samp9739.cfg)
- the IFT9701 (samp9701.cfg)
- the IFT9703 (samp9703.cfg)
- the RFT9712 and RFT9729 (samp9712.cfg)

The Transmitter Database dialog box operates in the connect mode and the offline mode. The mode determines the tasks that the user can perform.

To connect to the transmitter, open the File menu, then choose Connect. When connected, the user can:

- Load a configuration file from the connected transmitter to the hard drive or to a diskette.
- Send a configuration file from the hard drive or from a diskette to the connected transmitter.

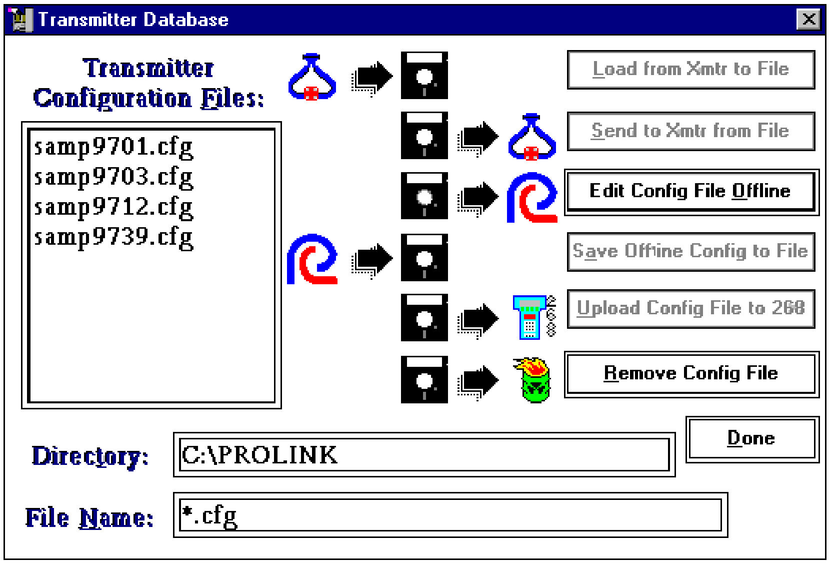
To disconnect from the transmitter, open the File menu, then choose Disconnect. When disconnected, the user can:

- Edit an existing configuration file.
- Save a configuration file to the hard drive or to a floppy diskette.
- Upload a Model 268 with an RFT9739, RFT9712, or RFT9729 configuration file (the ProLink program cannot be used with a Model 275 HART Communicator).

The user can remove a configuration file from the database at any time.

In the Transmitter Database dialog box, arrows and icons indicate the direction of the transfer the ProLink program performs when a command button is selected.

Figure 3-1. Transmitter Database dialog box



3.2 File selection

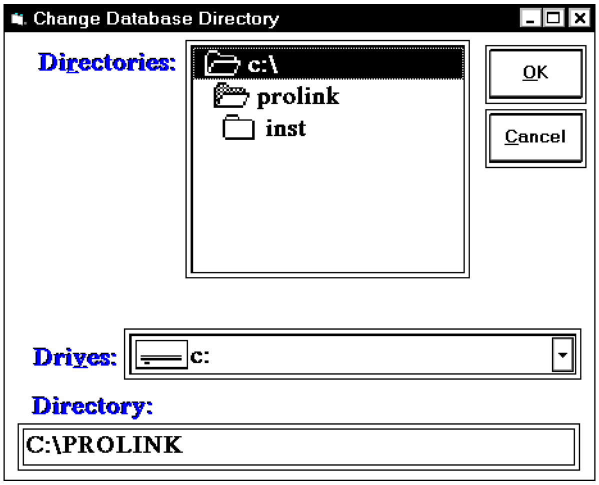
Use the Directory list box, Transmitter Configuration Files list box, and File Name text box to select a file, then choose Load, Send, Offline, Save, Upload, or Remove to transfer, edit, or erase the selected file.

Directory list box

The Directory list box lists directories on a specified hard drive or floppy diskette. To change directories, click the Directory list box. The Change Database Directory dialog box appears as shown in **Figure 3-2**.

1. Use the Drives list box in the Change Database Directory dialog box to change drives. Open the drives list, then choose the desired drive.
2. Changing drives updates the Directories list box, which shows the directories on the specified drive. Open folder icons appear beside the active directory and its subdirectories. Select a directory, then click OK.
3. Choosing OK returns the user to the Transmitter Database dialog box and updates the list of configuration files displayed in the Transmitter Configuration Files list box.

Figure 3-2. Change Database Directory dialog box



Transmitter configuration files list box

The Transmitter Configuration Files list box displays transmitter configuration files in the active directory. Each file contains a partial or complete configuration for an RFT9739, IFT9701, IFT9703, RFT9712, or RFT9729.

Select a filename from the Transmitter Configuration Files list box. The selected filename appears in the File Name list box.

File name text box

Enter the name of a transmitter configuration file in the File Name text box. The filename can include a DOS pathname, which overrides the currently displayed drive and directory.

Create new configuration files by using Windows Explorer or File Manager to copy an existing configuration file, which then can be transferred or edited.

3.3 Database command buttons

After selecting a configuration file, as described in **Section 3.2**, choose any active command button. Arrows and icons beside the command buttons indicate the direction of the file transfer.

- From the transmitter, load the file to the hard drive or to a diskette.
- From the hard drive or from a diskette, send the file to the transmitter.
- From the hard drive or from a diskette, retrieve the file into the ProLink database for offline editing.
- From the ProLink database, save the file to the hard drive or to a diskette.
- From the hard drive or from a diskette, upload the file to a Model 268 (the ProLink program cannot be used with a Model 275 HART Communicator).
- Erase (remove) the file from the ProLink database.

3.4 Offline, save, and upload commands

Before choosing Offline, Save or Upload, open the File menu, then choose Disconnect.

- Choose Offline to edit an existing configuration file.
- Choose Save to save a configuration to the hard drive or to a diskette.
- With software communication options set for HART primary at 1200 baud, choose Upload to upload a Model 268 with an RFT9739 version 2, RFT9712, or RFT9729 configuration file from the hard drive or from a diskette. (The IFT9701 and IFT9703 transmitters are not supported by the Model 268.)

Several RFT9739 configuration items are not saved or restored using the Save and Upload commands. These items are listed in **Table 3-1**.

Table 3-1. Items not saved or restored with the transmitter database

Configuration items not saved with HART® or Modbus® protocols	
Baud rate	Milliamp output trim factors
Burst mode (ON or OFF)	Modbus maximum integer
Communication protocol	Modbus integer offsets
Convergence limit	Modbus integer scale factors
External pressure transmitter polling*	Multidrop/polling address
External pressure transmitter tag	Number of data bits
HART unique ID (Long frame address)	Number of HART response preambles
Maximum zeroing time	Number of stop bits
Mechanical zero offset	Parity
Mechanical zero standard deviation	Sensor type*

*Saved with HART protocol; not saved with Modbus protocol

Offline and save

To perform an offline configuration:

1. Select an existing configuration file for editing, then choose Offline to highlight the Configure menu.
2. Open the Configure menu, then use its commands to access the configuration dialog boxes. Follow the instructions in **Chapter 8** (page 71) through **Chapter 13** (page 131) to edit the configuration file.
3. After changing the configuration, choose Save to save the edited file.

Upload

Uploading involves four separate procedures:

1. Connecting the PC Interface adaptor to a Model 268
2. Running the ProLink setup program to choose HART protocol (if not already chosen)
3. Opening the Communication Options dialog box to choose 1200 baud and the HART primary master type (if not already chosen)
4. Choosing Upload in the Transmitter Database, then following the on-screen instructions

After the Model 268 has been uploaded with the configuration file, the configuration can be downloaded to a compatible transmitter. For complete instructions for uploading and downloading with a Model 268, and for transmitter compatibility, see **Appendix B**, page 171.

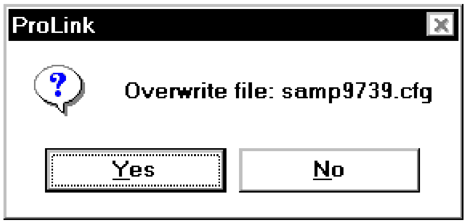
3.5 Load command

Before choosing the Load command:
1. Open the File menu, then choose Connect.
2. Set the flow loop for manual operation.

To load a transmitter configuration into the ProLink database:
1. Open the File menu, then choose Database.
2. Select a file from the Transmitter Configuration Files list box, or type a new configuration file name in the File Name text box. If desired, click in the Directory box to change directories.
3. Choose Load to load the transmitter configuration into the configuration file.
4. If the filename already exists, the Overwrite File dialog box appears, as shown in **Figure 3-3**, before the configuration begins loading. Choose Yes to proceed. The transmitter memory then overwrites the selected configuration file.

After loading is completed, the user can access the configuration with the ProLink program.

Figure 3-3. File Overwrite dialog box



3.6 Send command

Before choosing the Send command:
1. Open the File menu, then choose Connect.
2. Set the flow loop for manual operation.
3. Make sure the transmitter memory and the source configuration file have the same measurement units. Otherwise, the transmitter will refuse the configuration.

If the source configuration file includes measurement units, follow these steps to ensure they match the measurement units already stored in the transmitter memory.
1. Set the control loop for manual operation.
2. Load the transmitter memory into the ProLink database as instructed in **Section 3.5**.
3. Open the Configure menu, then choose Transmitter Variables.
4. In the Configure Transmitter Variables dialog box, use the Units list boxes to change the measurement units so they match the units in the source configuration, then click OK.

To send a configuration file to the transmitter:

1. Open the File menu, then choose Connect.
2. Select the desired transmitter, then click OK.
3. Reopen the File menu, then choose Database.
4. Use the Transmitter Database dialog box to select the configuration file to be sent to the transmitter, then choose Send.

3.7 Remove command

The user can erase (remove) configuration files with the ProLink program in the connect or offline mode.

To remove a configuration file from the transmitter database:

1. Open File menu, the choose Database.
2. Select the configuration file to be erased, then choose Remove.

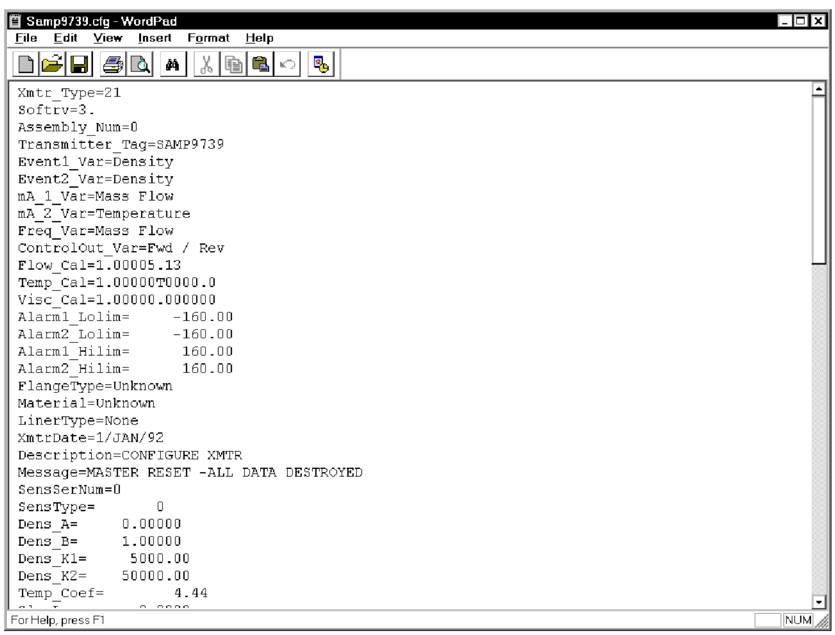
3.8 On-screen viewing of transmitter configuration files

Use a text editor program, such as WordPad or Notepad, for on-screen viewing of transmitter configuration files.

To view a transmitter configuration file:

1. Open a transmitter configuration file in WordPad or Notepad. Transmitter configuration files are located in the default ProLink directory, and are saved with a .CFG extension.
2. The chosen transmitter configuration file appears on screen as depicted in **Figure 3-4**.

Figure 3-4. Typical transmitter configuration file



3.9 Exporting transmitter configuration files

Because transmitter configurations are stored as text files, they can readily be imported into spreadsheets, word processors, and other software applications. For more information about importing files, see the documentation for the application that will receive the configuration.

4 File Menu: Print

4.1 Overview

The File menu includes several commands used for retrieving process information from one or more devices on a multidrop network and sending the information to a printer or to an ASCII file. If the information goes to a file, the data in the file can be imported into spreadsheets, databases, word processors, and other software applications.

The File menu includes the following print commands:

- Choose Print Setup to define any number of tickets, which can include data from transmitters and other HART 5.0 or higher revision devices on a multidrop network. The ticket can go to a printer or to an ASCII file.
- Choose Print to send one copy of a ticket to a printer or an ASCII file.
- Toggle the Interval Print command ON to send a ticket to the printer or to the file at regular intervals controlled by the refresh rate.
- Choose Update Rate to set the print interval for tickets and the update rate for all ProLink windows.
- Choose Print File to send a selected file to the connected printer.

4.2 Print setup

Use the Print Setup/Ticket Builder dialog box to create a ticket definition file. The ticket definition file specifies which transmitters the ProLink program will poll, which data will be sent to the print ticket, and the format of the print ticket.

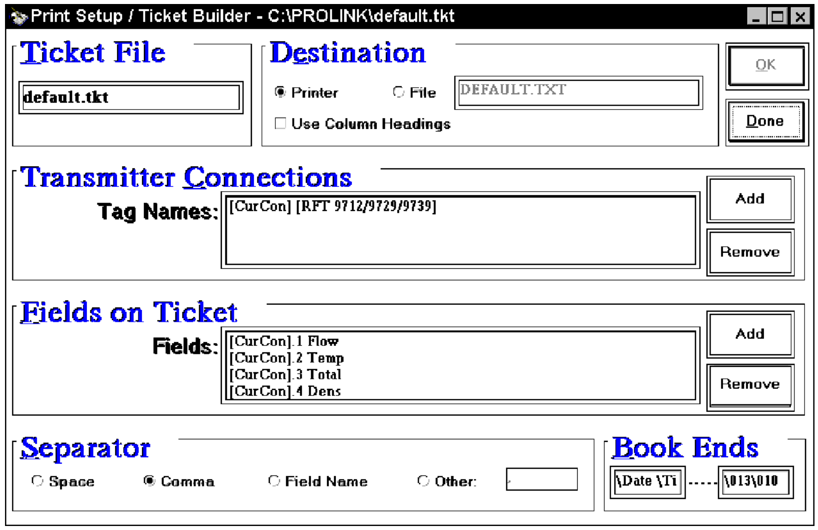
Open the File menu, then choose Print Setup. The Print Setup/Ticket Builder dialog box appears, as shown in **Figure 4-1**, page 34.

The Print Setup/Ticket Builder dialog box allows the user to create a ticket definition file with the following information:

- **Destination** determines where the polled data will be stored. Data may be sent to a printer or written to an ASCII file.
- **Transmitter Connections** specify which transmitters are to be polled. Up to 15 transmitters per ticket definition file can be specified.
- **Fields on Ticket** specifies fields, for each transmitter, that are to be sent to the defined destination. A single ticket can include up to 100 data fields.
- **Separator** defines the delimiter for fields on the ticket. The delimiter is used to separate fields in a file for importation into other software applications (such as spreadsheets and databases).
- **Book Ends** define the text that will print at the beginning and end of each print cycle.

The user can define and store any number of ticket definition files. The ProLink software saves ticket definition file names with a .TKT extension.

Figure 4-1. Print Setup/Ticket Builder dialog box

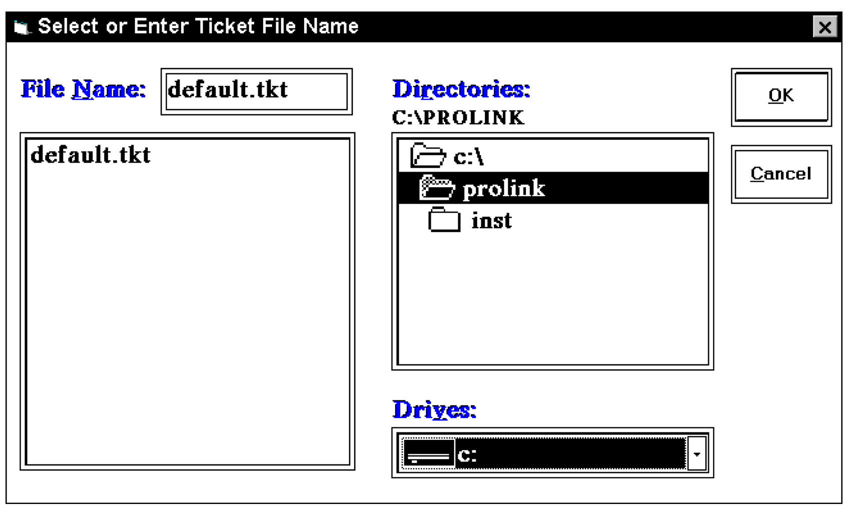


Select, edit, or create a ticket definition file

The Ticket File text box shows the ticket definition file name.To select, edit, or create a ticket definition file, other than the displayed definition:

1. Click the Ticket File text box. The ticket File Name dialog box appears as depicted in **Figure 4-2**.
2. When the Ticket File Name dialog box appears:
   - To select or edit an existing ticket definition file, select the desired drive and directory, then double-click the desired filename.
   - To create a new ticket definition file, select a drive and directory, enter a new filename in the File Name text box, then click OK.

Figure 4-2. Ticket File Name dialog box



Destination

Destination options enable the ticket to go to a printer or to an ASCII text file. If the ticket will go to a file, the user may name the ASCII text file that will receive the data specified by the ticket definition.

Click an option button to choose a destination.
- If the ticket will go to an ASCII text file, enter the desired filename in the text box. Do not enter a DOS pathname. Ticket text files are saved to the default ProLink directory with a .TXT extension.
- If desired, column headings can be added to the ticket by selecting the Use Column Headings checkbox. This option is overridden if Field Name is chosen as a separator (see “Separator and book ends” on page 37).

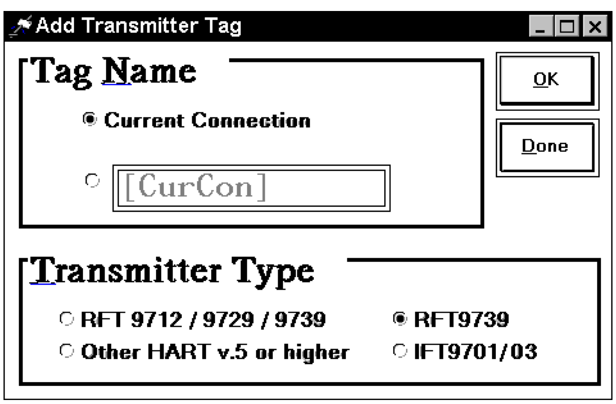
Transmitter connections

The Transmitter Connections list box displays all transmitter devices that will be polled for the data to be printed on the ticket. The ticket definition file may include up to 15 devices on a multidrop network, including the currently connected transmitter.
- Under HART protocol, the currently connected transmitter can be referred to as the special tag name "[CurCon]", as well as by its established HART tag name or polling address.
- Under Modbus protocol, the currently connected transmitter can be referred to by the special tag name "[CurCon]" or the polling address.

The first time a ticket is printed, the ProLink program checks for all transmitter connections that are listed in the ticket definition file. If any connection fails, the ticket will not print, and an error message will appear. If the ticket definition file includes [CurCon], the ProLink program must be in the connect mode.

To add a device to the ticket definition file:
1. Choose Add in the Transmitter Connections frame. The Add Transmitter Tag dialog box appears as shown in **Figure 4-3**.

Figure 4-3. Add Transmitter Tag dialog box



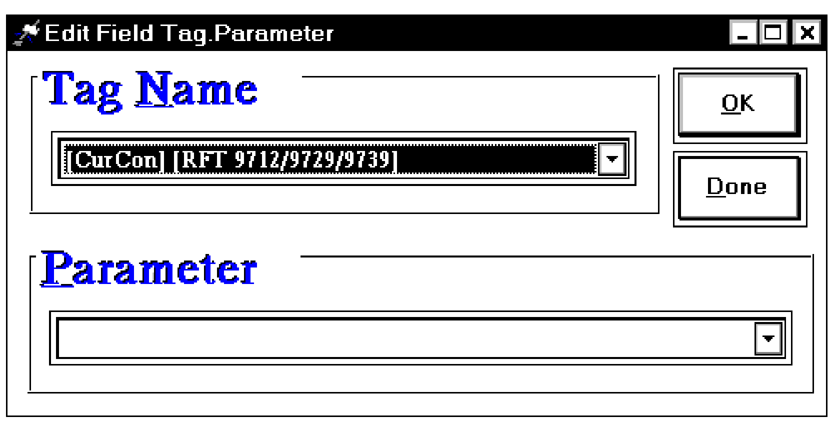
2. At the Add Transmitter Tag dialog box, use the Tag Name option buttons to select a device. If a device other than the connected transmitter [CurCon] is selected, enter the polling address or HART tag name in the text box. A device cannot be added to the ticket definition file if a device with the same tag name already exists in the file.
3. Use the Transmitter Type option buttons to specify one of three available transmitter types:
   - Select RFT9739 to poll for parameters available from an RFT9739. When using Modbus protocol, select this option for all devices on the ticket.
   - Select RFT9712/9729/9739 to poll under HART protocol for parameters common to all three transmitter models.
   - Select IFT9701 to poll for parameters available from an IFT9701 or IFT9703.
   - Select Other HART v.5 or higher to poll for parameters available from transmitters or other devices that have HART 5.0 or higher revision software.
4. Click OK to add the device to the ticket.

To remove a device from the ticket: in the Transmitter Connections frame, select the device from the Tag Names list, then choose Remove. When a device is removed from a ticket, the fields associated with the device are also removed.

Fields on ticket

To add a parameter to a device on the ticket:
1. Choose Add in the Fields on Ticket frame. The Edit Field Tag Parameter dialog box appears as shown in **Figure 4-4**.
2. Select a device from the Tag Name text box. Each device includes the polling address or HART tag name, followed by the transmitter type in brackets.
3. All the parameters available from the chosen device appear in the Parameter list box. To add a parameter, select it, then click OK.

Figure 4-4. Edit Field Tag Parameter dialog box



In the Print Setup/Ticket Builder dialog box, the Fields on Ticket list box shows parameters listed with alphanumeric codes.

- The polling address or tag name to the left of the decimal point identifies the device that returns the parameter.
- The label to the right of the decimal point identifies the parameter.

Example:

Identify a parameter returned from an RFT9739 that has the HART tag name ELITEFLO.

The Fields list box includes the following parameter:

```
ELITEFLO.216 MA_1_Var
```

The characters to the left of the decimal point indicate the HART tag name (ELITEFLO). The digits to the right of the decimal point indicate that the parameter is the primary milliamp output variable.

Example:

Identify a parameter returned from an RFT9712 that has 10 as its polling address.

The Fields list box includes the following parameter:

```
10.171    Flow_Cal
```

The digits to the left of the decimal point indicate the polling address (10). The digits to the right of the decimal point indicate that the parameter is the flow calibration factor.

To remove a parameter from a device on the ticket: In the Fields on Ticket frame, select a parameter from the Fields list, then choose Remove.

Separator and book ends

The Separator separates the various fields on the ticket. The user can place any of the following separators between fields:

- A space
- A comma
- The field name (such as, "Mass_Flow =")
- A custom separator (such as ASCII characters, date, fieldname, etc.)

The separator should be selected based on the ticket destination.

- Select Field Name to print each field on a separate line (typically used if the ticket destination is defined as Printer). **Figure 4-5**, page 39 shows a typical ticket printed with the fieldname as the separator.
- For ASCII text files that will be imported into other software applications, determine the appropriate separator by referring to the instruction manual for the application into which the data will be imported.

Click an option button to choose a separator. If Other is chosen, the user can enter text as ASCII printable characters, and can also enter ASCII decimal codes for nonprintable characters such as a carriage return (013) or line feed (010). The ASCII character set is listed in **Appendix D**, page 181.

Book Ends indicate the beginning and end of each print interval. Enter characters for each book end as ASCII printable characters and/or ASCII decimal codes.

To include the date, time, or fieldname as a separator or book end, enter the following character strings:

```
\DATE
\TIME
\FIELDNAME
```

To enter the time, date, and fieldname on the same line with spaces between them, enter a space before entering the next character string. For example:

```
\DATE \TIME \FIELDNAME
```

To enter ASCII decimal codes for nonprintable characters:

- Enter the 3-digit decimal code for each character. The ASCII character set is shown in **Appendix D**.
- Enter a backslash character (\) before each 3-digit code.
- The ASCII codes for carriage return (013) and line feed (010) separate lines of text in most software applications. To make a new line, enter \013\010.
- To enter a backslash as a printable character, enter two backslash characters (\\).

Figure 4-5, page 39 shows a typical ticket printed with the leading book end:

```
START TICKET \DATE \TIME
```

and the trailing book end:

```
END TICKET \013\010
```

4.3 Print

The Print command sends one complete ticket to a printer or ASCII text file. **Figure 4-5** depicts a simple ticket as it appears when the user chooses the Print command.

- The ticket will print in accordance with the current ticket definition, displayed in the Print Setup/Ticket Builder dialog box.
- To choose, edit, or create a ticket definition file, see **Section 4.2**, page 33.
- To print a ticket, open the File menu, then choose Print.

Figure 4-5. Typical ticket printed using print command

```
Start ticket 7/10/96 3:25:15 PM
Mass_Flow = 21.9
Temp = 25.9
Dens = 0.04561
End ticket
```

4.4 Interval print

With Interval Print command toggled ON, the ProLink program sends the ticket to the printer or ASCII text file at regular intervals. At each interval, if the ticket goes to an ASCII text file, the new ticket appends to the end of the existing file.

- The printer receives the ticket that is named in the Ticket File text box of the Print Setup/Ticket Builder dialog box.
- To choose, edit, or create a ticket definition file, see **Section 4.2**, page 33.

To toggle the Interval Print command ON or OFF, open the File menu, then choose Interval Print.

- If a checkmark appears beside the command line when the File menu opens, choosing Interval Print toggles interval printing OFF.
- If the command line appears without a checkmark when the File menu opens, choosing Interval Print toggles interval printing ON.
- Interval print is suspended while menus are open.

Figure 4-6 depicts a sample ticket as it appears when the user toggles interval printing ON.

Figure 4-6. Typical ticket printed using interval print command

```
Start ticket 7/10/96 3:25:15 PM
Mass_Flow = 21.9
Temp = 25.9
Dens = 0.04561
End ticket

Start ticket 7/10/96 3:26:15 PM
Mass_Flow = 21.6
Temp = 25.9
Dens = 0.04561
End ticket

Start ticket 7/10/96 3:27:15 PM
Mass_Flow = 21.0
Temp = 25.9
Dens = 0.04561
End ticket
```

4.5 Update rate

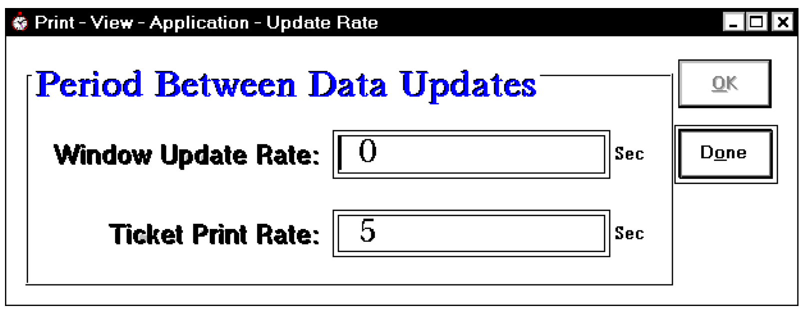
Update Rate controls how often the ProLink program prints tickets and updates on-line values of variables displayed in the View windows. See **Chapter 6** (page 47).

- The Window Update Rate is the number of seconds the program waits before updating values displayed in the View windows.
- The Ticket Print Rate is the number of seconds the program waits between each interval print.

The update rate is dependent on selected communication options such as baud rate, computer performance, and number of parameters polled. Therefore, the rate entered is a "minimum" value. The maximum value that can be entered is 86,400 (equal to 24 hours).

Open the File menu, then choose Update Rate. The Update Rate dialog box appears as shown in **Figure 4-7**. Enter the desired rates in seconds, then click OK. To update the displayed value as quickly as possible, enter a value of zero in the Window Update Rate text box.

Figure 4-7. Print - View - Application - Update Rate dialog box



4.6 Print file

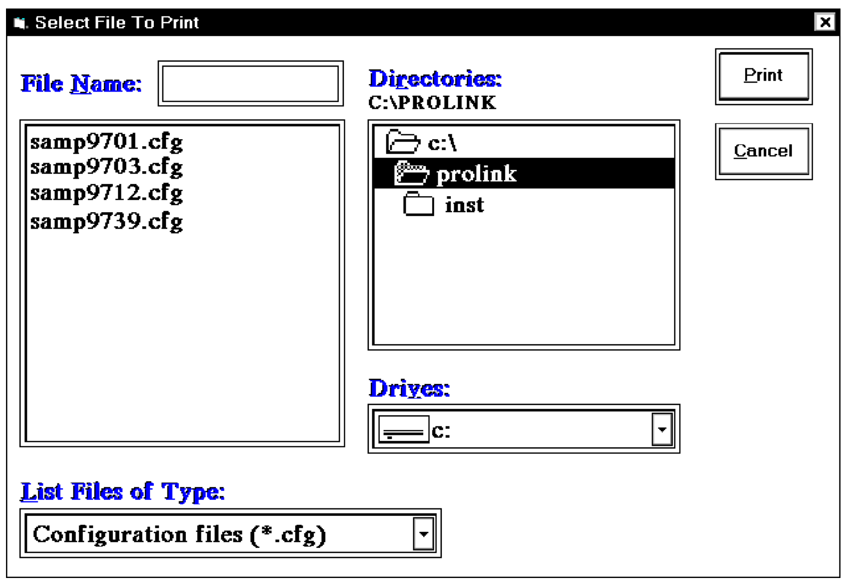
Use the Print File command to send a selected file to the configured printer. File types include:

- Configuration files
- Ticket definition files
- Text files
- Log files
- Initialization files
- Data files

To print a file:

1. Open the File menu, then choose Print File. The Print File dialog box appears as shown in **Figure 4-8**.
2. Select a file type from the drop-down list.
3. Select a drive and directory, then select a file to be printed.
4. When the desired file is listed in the File Name text box, choose Print to send the file to the connected printer.

Figure 4-8. Select File To Print dialog box



4.7 Exporting print ticket files to other software applications

Because a print ticket text file contains data in ASCII code, the ticket or individual fields from a ticket ASCII text file can be imported into spreadsheets, databases, word processors, and other software applications.

For more information about exporting data to other software applications, see the documentation for the application that will receive the data.

5 File Menu: Error and Change Log Files

5.1 Error logging

An error log is a record of transmitter configuration changes, data entry errors, faults, and changes in the operating condition of the flowmeter. With error logging toggled ON, the ProLink program reports the selected errors whenever they occur.

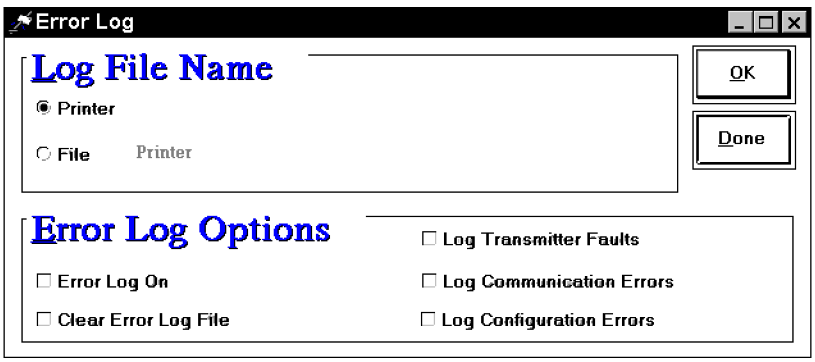
Figure 5-1 depicts a typical error log file.

Figure 5-1. Typical error log file

```
7/15/96 2:53:55 PM Transmitter Status Changed: POWER RESET Set
7/21/96 8:32:06 AM UPDATE: Error Sending Visc_Cal
7/30/96 0:58:30 PM UPDATE: Error Sending Slug_Duration
```

To set up an error log, open the File menu, then choose Error Log File. The Error Log dialog box appears as shown in **Figure 5-2**.

Figure 5-2. Error Log dialog box



Log file name

In the Error Log dialog box, the Log File Name frame contains option buttons and a text box, which enable the error log to go to a printer or to an ASCII file. If the error log will go to a file, the text box indicates the name the ASCII file that will receive the data in the log.

Click an option button to choose a destination. If the error log will go to an ASCII file, enter a filename in the text box. A pathname may also be entered. Log files are saved with a .LOG default extension.

Error log options

Use the Error Log Option check boxes to set the options for the error log file. A check box indicating an active option contains an "X".

Click check boxes to toggle options ON or OFF.

Error log on

ON: The ProLink program reports errors whenever they occur. If the user opens the File menu with error logging toggled ON, a checkmark appears beside the Error Log File command line.

If Error Log is turned ON, the Transmitter Status window must be active for faults to be properly logged. The window may be minimized if desired, but no transmitter faults will be logged with the window closed. To view the Status window, open the View menu, then choose Transmitter Status.

OFF: The program does not report errors. With error logging toggled OFF, the Error Log File command appears without a checkmark.

Clear error log file

ON: Each report erases the existing error log file and starts appending the error log file.

OFF: Each report appends the error log file.

Log transmitter faults

ON: The ProLink program reports all changes that the user can observe in the Status window.

OFF: The program does not report changes that the user can observe in the Status window.

Log communication errors

ON: The ProLink program reports communication errors between ProLink and the slave device.

OFF: The program does not report data entry errors.

Log configuration errors

ON: The ProLink program reports all errors made during entry of data into dialog boxes in the Configure menu.

OFF: The program does not report configuration errors.

5.2 Change logging

A change log is a record of changes and data entry errors made in dialog boxes in the Configuration menu. With change logging toggled ON, if the user makes any changes or data entry errors while working in the Configuration menu, the ProLink program updates the change log.

Figure 5-3 depicts a typical change log file.

File Menu: Error and Change Log Files *continued*

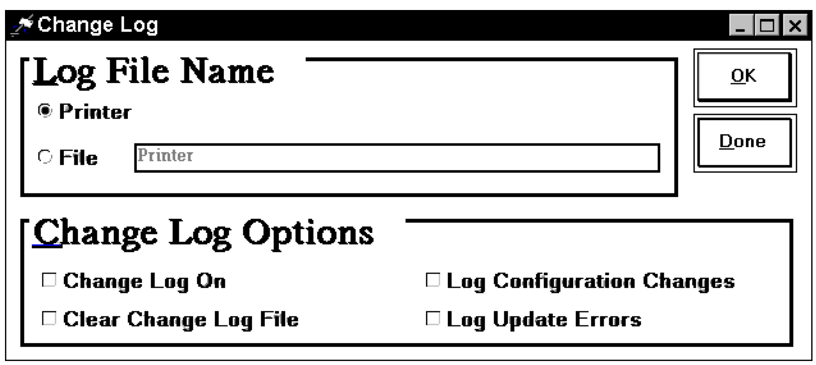
Change logging

Figure 5-3. Typical change log file

```
7/15/96 5:47:06 PM XMTR_1 .Dens_A= 0.00110
7/15/96 5:47:06 PM XMTR_1 .Dens_B= 0.09980
7/15/96 5:47:06 PM XMTR_1 .Flow_Cal=0000.75.13
7/15/96 5:47:06 PM XMTR_1 .SlugLow= 0.0050
7/15/96 5:47:06 PM XMTR_1 .SlugHigh= 0.1000
7/15/96 5:47:09 PM UPDATE: Completed Successfully
7/15/96 5:48:21 PM XMTR_1 .Vol_Flow_Unit=USgpm
7/15/96 5:48:21 PM XMTR_1 .Visc_Unit=cP
7/15/96 5:48:21 PM XMTR_1 .DP_Unit=psi
7/15/96 5:48:21 PM XMTR_1 .Mass_Flow_Unit=kg/hr
7/15/96 5:48:21 PM XMTR_1 .Meter_Direction=Bi-Directional
7/15/96 5:48:26 PM UPDATE: Completed Successfully
7/15/96 5:49:51 PM XMTR_1 .Freq_Var=Volume Flow
7/15/96 5:49:51 PM XMTR_1 .Fault_Ind=Upscale
7/15/96 5:49:51 PM XMTR_1 .Slug_Duration=100.00
7/15/96 5:49:52 PM UPDATE: Error Sending Slug_Duration
7/15/96 5:50:54 PM XMTR_1 .mA_2_Zero= 0.00250
7/15/96 5:50:54 PM XMTR_1 .mA_2_Gain= 0.2500
7/15/96 5:50:54 PM XMTR_1 .mA_2_Damp= 8.00
7/15/96 5:50:54 PM XMTR_1 .mA_1_Damp= 2.00
7/15/96 5:50:55 UPDATE: Completed Successfully
```

To set up a change log, open the File menu, then choose Change Log File. The Change Log dialog box appears as shown in **Figure 5-4**.

Figure 5-4. Change Log dialog box



Log file name

In the Change Log dialog box, the Log File Name frame contains option buttons and a text box, which enable the change log to go to a printer or to an ASCII file. If the change log will go to a file, the text box indicates the name the ASCII file that will receive the data in the log.

Click an option button to choose a destination. If the change log will go to an ASCII file, enter a filename in the text box. A pathname may also be entered. If no pathname is specified, the file will be saved in the ProLink default directory.

Change log options

Use the Change Log check boxes to set the options for the change log file. A check box indicating an active option contains an "X".

Click check boxes to toggle options ON or OFF.

Change log on

ON: The ProLink program reports configuration changes and data entry errors whenever they occur. If the user opens the File menu with change logging toggled ON, a checkmark appears beside the Change Log File command line.

OFF: The program does not report configuration changes or data entry errors. With change logging toggled OFF, the Change Log File command appears without the checkmark.

Clear change log file

ON: Each report erases the existing change log file and starts appending the change log file.

OFF: Each report appends the change log file.

Log configuration changes

ON: The ProLink program reports changes that the user enters into the dialog boxes in the Configure menu.

OFF: The program does not report configuration changes.

Log update errors

ON: The ProLink program reports configuration errors that the user enters into the dialog boxes in the Configure menu.

OFF: The program reports configuration changes, but does not report configuration errors.

6 View Menu: Variables

6.1 Overview

The View menu opens windows rather than dialog boxes. Open the View menu to read process variables, outputs, and flowmeter status indicators.

- Choose Process Variables to read values of process variables.
- Choose Output Levels to read output levels and corresponding output variables.

The flowmeter configuration determines the values of outputs displayed in the Output Levels window. The update rate determines how often the displayed values are updated.

6.2 Process variables window

RFT9739
With the ProLink program connected to an RFT9739, the process variables window can indicate:

- Mass flow rate
- Mass total
- Mass inventory
- Volume flow rate
- Volume total
- Volume inventory
- Density
- Temperature
- Viscosity
- Differential pressure (DP)

Indication of viscosity and differential pressure requires a DP cell that measures pressure drop across the sensor.

Figure 6-1 depicts the Process Variables window for an RFT9739.

IFT9701, IFT9703, RFT9712, and RFT9729
With the ProLink program connected to an IFT9701, IFT9703, RFT9712, or RFT9729, the process variables window can indicate:

- Mass flow rate or volume flow rate
- Mass total (inventory) or volume total (inventory)
- Density
- Temperature

Figure 6-2 depicts the Process Variables window for an IFT9701 or IFT9703. **Figure 6-3** depicts the Process Variables window for an RFT9712 or RFT9729.

Figure 6-1. Process variables window for RFT9739

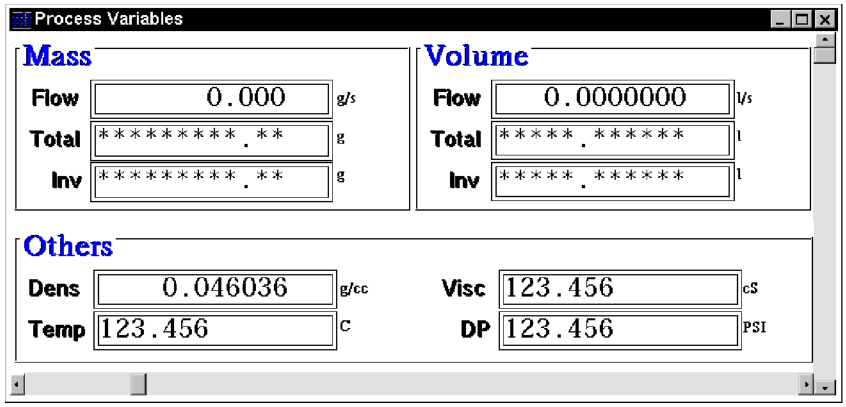


Figure 6-2. Process variables window for IFT9701/IFT9703

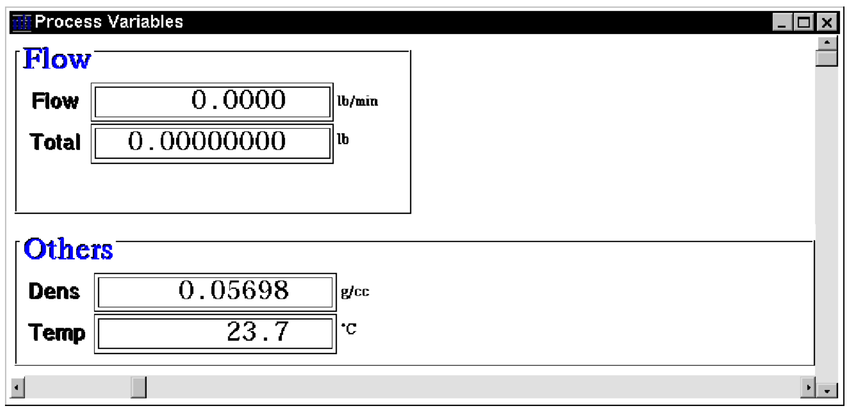
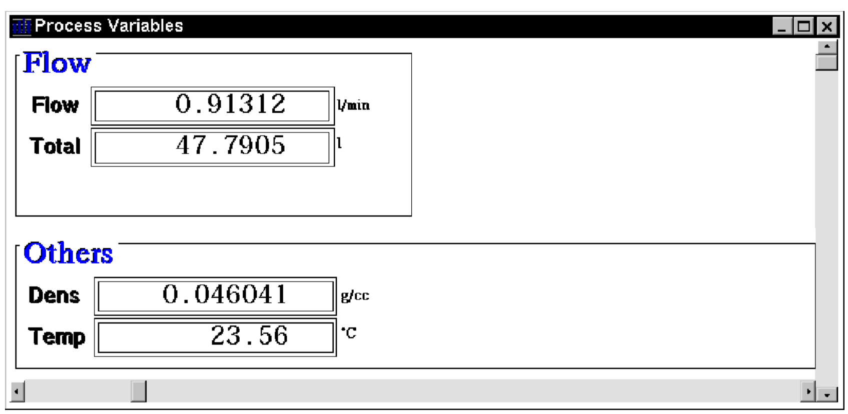


Figure 6-3. Process variables window for RFT9712/RFT9729



6.3 Output levels window

RFT9739
With the ProLink program connected to an RFT9739, the Output Levels window displays the following values:

- The 0-20 mA or 4-20 mA current level and corresponding flow rate, density, temperature, differential pressure, or viscosity indicated by milliamp output 1
- The 0-20 mA or 4-20 mA current level and corresponding flow rate, density, temperature, differential pressure, or viscosity indicated by milliamp output 2
- The frequency and corresponding flow rate indicated by the frequency/pulse output
- The ON/OFF status of events, which can be tied to milliamp outputs or to the 0/15 V control output

Figure 6-4 depicts the Output Levels window for an RFT9739.

IFT9701 or IFT9703
With the ProLink program connected to an IFT9701 or an IFT9703, the Output Levels window displays the following values:

- The 4-20 mA current level and corresponding flow rate as indicated by the milliamp output
- The frequency and corresponding totalizer value indicated by the frequency/pulse output

Figure 6-5 (page 50) depicts the Output Levels window for an IFT9701 or IFT9703.

RFT9712 and RFT9729
With the ProLink program connected to an RFT9712 or RFT9729, the Output Levels window displays the following values:

- The 4-20 mA current level and corresponding flow rate, density, or temperature indicated by the milliamp output
- The totalizer value indicated by the frequency/pulse output

Figure 6-6 (page 50) depicts the Output Levels window for an RFT9712 or RFT9729.

Figure 6-4. Output Levels window for RFT9739

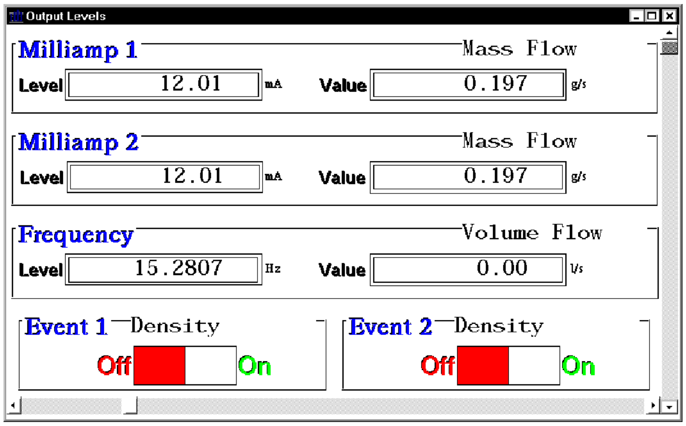


Figure 6-5. Output Levels window for IFT9701 or IFT9703

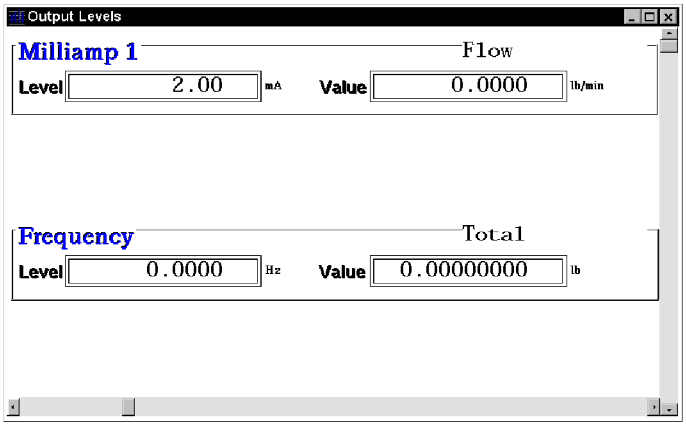
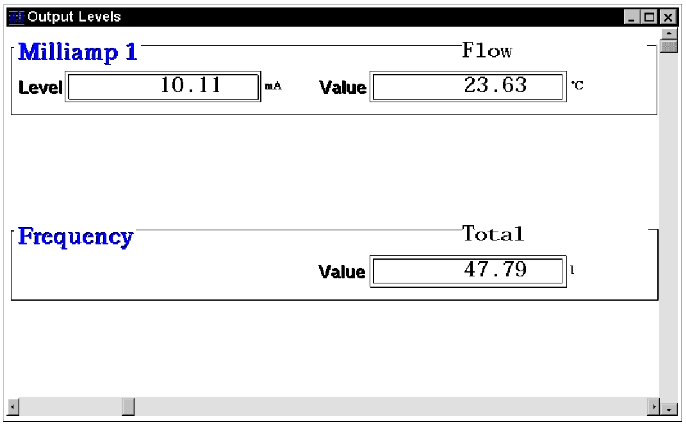


Figure 6-6. Output Levels window for RFT9712/9729



6.4 Copying displayed values to other software applications

Values from display boxes in the Process Variables and Output Levels windows can be copied or linked to spreadsheets, databases, word processors, and other software applications.

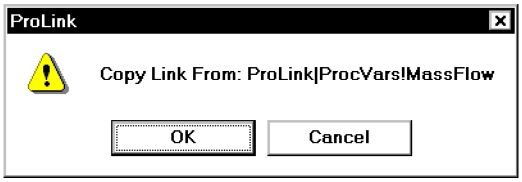
In the other application, the copied value can be pasted as ASCII text, or linked to the ProLink window using a dynamic data exchange (DDE) link. Links may be established from as many of the fields in the Process Variables and Output Levels windows as desired.

After a DDE link is established, linked values are continuously updated in the other application as long as the linked ProLink windows remain open. The linked windows may be minimized, but when one is closed, all DDE links from the closed window are broken. For information on reestablishing DDE links, see the documentation for the other software application.

Copying displayed values to other software applications

To copy or link text from the ProLink window: move the mouse pointer to the desired value. When the pointer changes to a cross hair (+), click the mouse to copy the value. A Copy/Link dialog box appears as depicted in **Figure 6-7**. Choose OK to copy the value.

Figure 6-7. Copy or Link dialog box



To paste ASCII text in another application: place the insertion point where the text should be pasted in the document, then open the Edit menu and choose Paste.

To establish a DDE link: place the insertion point where the linked text should be pasted in the document, then open the Edit menu and choose Paste Special or Paste Link.

- After choosing Paste Special, choose Link as an option.
- Choosing Paste Link, if the option is available, automatically establishes the DDE link.

Some software applications do not support DDE links. For more information on linking data, see the documentation for the other software application.

7 View Menu: Status

7.1 Overview

The Status window indicates operating conditions. When used with tools such as a digital multimeter (DMM), the transmitter diagnostic LED, and fault output levels, the Status window facilitates flowmeter characterization, calibration, testing, and troubleshooting.

To open the Status window, open the View menu, then choose Transmitter Status. The Status window appears as depicted in:

- **Figure 7-1** for an RFT9739
- **Figure 7-2** for an IFT9701 or IFT9703
- **Figure 7-3** for an RFT9712 or RFT9729

The Status window has separate frames for critical, operational, and informational indicators.

- Critical indicators are described in **Section 7.3**, page 56.
- Operational indicators are described in **Section 7.4**, page 62.
- Informational indicators are described in **Section 7.5**, page 66.

Status indicators aid in troubleshooting the flowmeter. When troubleshooting, investigate critical indicators first, then check operational and informational indicators.

- When an indicator switch is OFF, the accompanying message appears dimmed.
- When an indicator switch is ON, the accompanying message appears highlighted to indicate a particular condition.

When a status indicator switches ON, refer to **Table 7-1**, page 54, which lists status indicators alphabetically and lists the pages where troubleshooting procedures for each indicator are described. Use the Status window, transmitter fault output levels, and a digital multimeter (DMM) to troubleshoot the flowmeter.

⚠ CAUTION

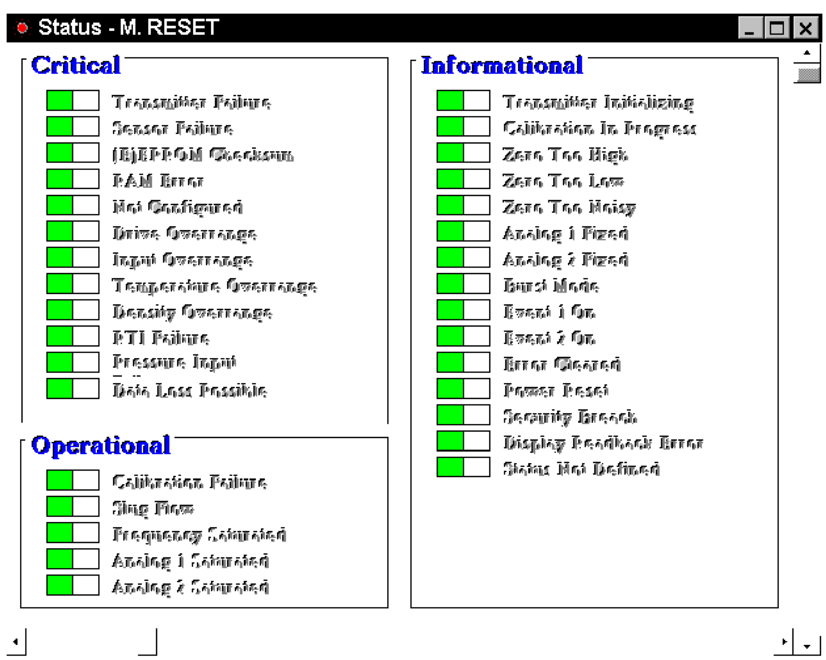
During troubleshooting, the transmitter could produce inaccurate flow signals.

- Set control devices for manual operation before troubleshooting the flowmetering system.
- If terminal blocks or wiring are disconnected from the transmitter during troubleshooting, cycle power to the transmitter after reconnecting terminal blocks or wiring.

Table 7-1. Status indicators

Status indicator	pages	Status indicator	pages
0 deg cal failed	57	Frequency saturated	65
200 deg cal failed	57	Input overrange	57
Analog 1 fixed	64, 69	Mass flow overrange	57
Analog 1 saturated	64	Not configured	57
Analog 2 fixed	64, 69	Power reset	70
Analog 2 saturated	64	Pressure input failure	62
Analog input error	62	RAM error	57
Analog output fixed	64, 69	Raw elec. zero overflow	66
Analog output saturated	64	Raw flow overflow	66
Burst Mode	69	RTD failure	57
Calibration failure	57, 62	RTI failure	57
Calibration in progress	67	Security breach	70
Data loss possible	62	Sensor failure	57
Density overrange	57	Slug flow	63
Display readback error	70	Temperature overrange	57
Drive overrange	57	Transmitter failiure	56
(E)EPROM checksum	57	Transmitter initializing	67
Error cleared	70	Volume flow overrange	57
Event 1 on	70	Zero too high	67
Event 2 on	70	Zero too low	67
Frequency output fixed	69	Zero too noisy	67
Frequency output saturated	65		

Figure 7-1. Status window for RFT9739



View Menu: Status *continued*

Overview

Figure 7-2. Status window for IFT9701/IFT9703

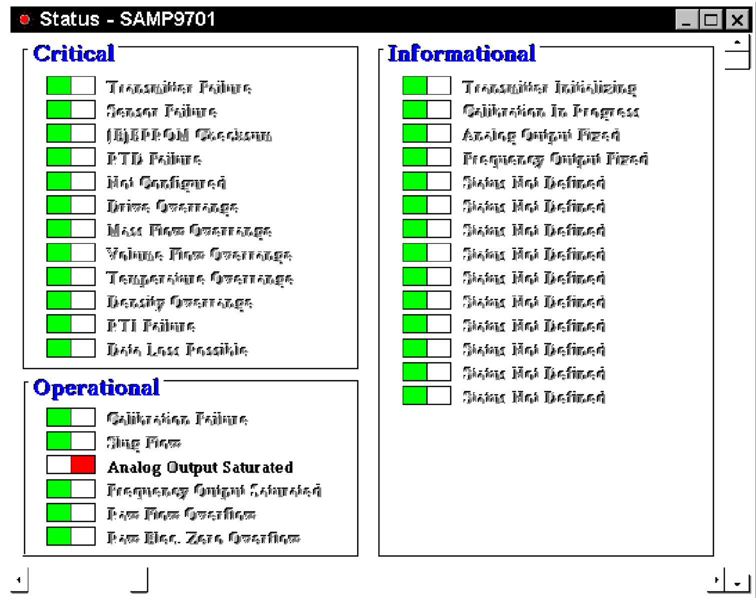
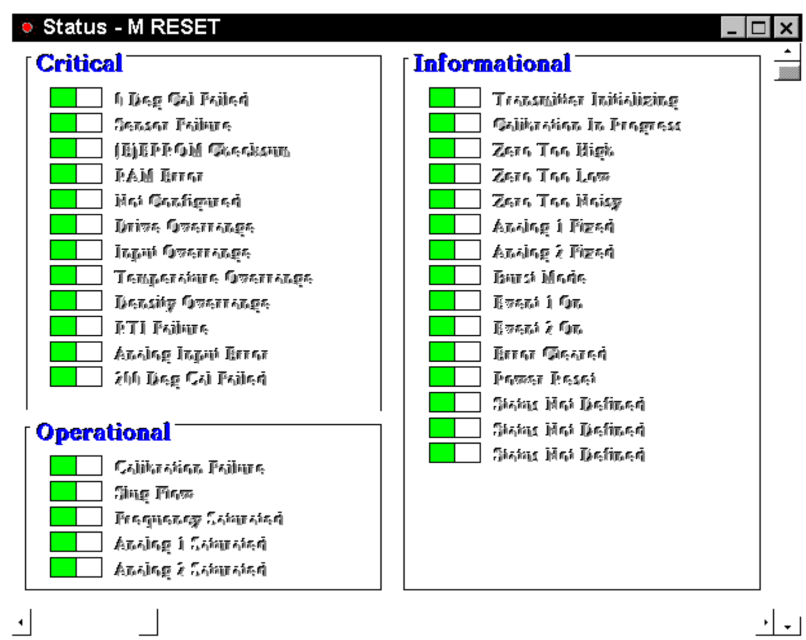


Figure 7-3. Status window for RFT9712/RFT9729



7.2 Fault outputs

If a flowmeter failure occurs, transmitters produce fault outputs. Model RFT9739, IFT9701, IFT9703, RFT9712, and RFT9729, produce downscale or upscale outputs to indicate a fault. In addition, a Version 2 or earlier RFT9739 also has last measured value and internal zero fault levels.

- To set downscale or upscale fault output levels for a Version 3 RFT9739, an IFT9701, an IFT9703, an RFT9712, or an RFT9729, refer to the transmitter instruction manual.
- To set fault levels for a Version 2 or earlier RFT9739, open the Configure menu, then choose Transmitter Outputs.

RFT9739

- Downscale: milliamp outputs go to 0 mA if they produce a 0-20 mA current, or to 0-2 mA if they produce a 4-20 mA current; frequency/pulse output goes to 0 Hz.
- Upscale: milliamp outputs go to 22-24 mA; frequency/pulse output goes to 15-19 kHz.
- Last measured value (not available with Version 3 transmitters): Outputs hold the values measured immediately before the fault condition occurred.
- Internal zero (not available with Version 3 transmitters): Outputs indicate a value of zero for the represented process variable.

IFT9701/IFT9703

- Downscale: The milliamp output goes to 2 mA; the pulse output goes to 0 Hz.
- Upscale: The milliamp output goes to 22 mA; the pulse output goes to 7200 Hz for version 1.2 and higher or 1200 Hz for lower versions.

RFT9712/RFT9729

- Downscale: The milliamp output goes to 2 mA; the frequency/pulse output goes to 0 Hz.
- Upscale: The milliamp output goes to 22 mA; the frequency/pulse output goes to 11,520 Hz.

7.3 Critical indicators

Critical indicators switch ON under the following conditions:

- Master reset defaults in transmitter software
- Transmitter failure
- Flow, temperature, or density outside sensor limits
- Faulty flowmeter wiring, cable, or connections
- Inappropriate density calibration factors
- Plugged or partially plugged flow tubes
- Loss of input signal (when pressure is enabled)
- Temperature calibration failed (RFT9712 and RFT9729 only)
- Data loss during configuration

"Not Configured"

If a master reset is performed on the transmitter, Not Configured switches ON to indicate the flowmeter requires complete characterization and reconfiguration. A master reset returns all transmitter options to their default factory values.

- To perform a master reset, refer to the transmitter instruction manual.
- To characterize the flowmeter, open the Configure menu, then choose Characterize. For more information about characterization, see **Chapter 8** (page 71).

Transmitter failure indicators

If one or more of the following indicators switches ON, a transmitter failure has occurred:

- "Transmitter Failure"
- "(E)EPROM Checksum"
- "RAM Error"
- "RTI Failure"
- "0 Deg Cal Failure"
- "200 Deg Cal Failure"

If any of these errors occur, contact the Micro Motion Customer Service department.

⚠ CAUTION

During troubleshooting, the transmitter could produce inaccurate flow signals.

- Set control devices for manual operation before troubleshooting the flowmetering system.
- If terminal blocks or wiring are disconnected from the transmitter during troubleshooting, cycle power to the transmitter after reconnecting terminal blocks or wiring.

Sensor failure and overrange indicators

If a sensor failure occurs, if the sensor cable is faulty, or if measured flow, measured temperature, or measured density goes outside the sensor limits, one or more of the following indicators switches ON:

- "Sensor Failure"
- "RTD Failure"
- "Drive Overrange"
- "Input Overrange"
- "Temperature Overrange"
- "Mass Flow Overrange"
- "Volume Flow Overrange"
- "Density Overrange"

To troubleshoot these status indicators, follow these steps:

1. Wiring problems are often incorrectly diagnosed as a faulty sensor. At initial startup of the transmitter, always check the following:
   a. Proper cable, and use of shielded pairs
   b. Proper wire termination
      - Wires on correct terminals
      - Wires making good connections at transmitter terminals (**Table 7-2** lists terminal designations for Micro Motion sensors)
      - Wires properly connected at any intermediate terminal junction, such as the junction box between a Model DT sensor and transmitter
2. For a Version 3 RFT9739, follow steps 2a through 2b. For earlier versions, and for other transmitter models, go to step 3.
   a. Open the Test menu, then choose Test Points. The Test Point Diagnostics dialog box appears, as depicted in **Figure 7-4**, page 59.
   b. Compare the displayed values with the values listed below and proceed as follows:
      - If the displayed drive gain exceeds 8 V, see **Table 7-3**, page 59 to troubleshoot the problem.
      - If the displayed value for the left or right pickoff does not equal approximately 0.0034 V per Hz, based on the displayed tube frequency, go to step 3.

Table 7-2. Sensor and transmitter terminal designations

	Transmitter terminals					
Sensor terminal	**RFT9739 field-mount, RFT9712**	**RFT9739 rack-mount**	**RFT9729**	**IFT9701 or IFT9703**	**Wire color**	**Function**
No connection	0	CN1-Z4	CN1-26d	GD	Black	Shields
1	1	CN1-Z2	CN1-10d	1	Brown	Drive +
2	2	CN1-B2	CN1-8d	2	Red	Drive -
3	3	CN1-B6	CN1-14d	3	Orange	Temperature -
4	4	CN1-B4	CN1-12d	4	Yellow	Temperature lead length compensator
5	5	CN1-Z8	CN1-20d	5	Green	Left pickoff +
6	6	CN1-Z10	CN1-24d	6	Blue	Right pickoff +
7	7	CN-Z6	CN1-16d	7	Violet	Temperature +
8	8	CN1-B10	CN1-22d	8	Gray	Right pickoff -
9	9	CN1-B8	CN1-18d	9	White	Left pickoff -

Figure 7-4. Test Point Diagnostics dialog box

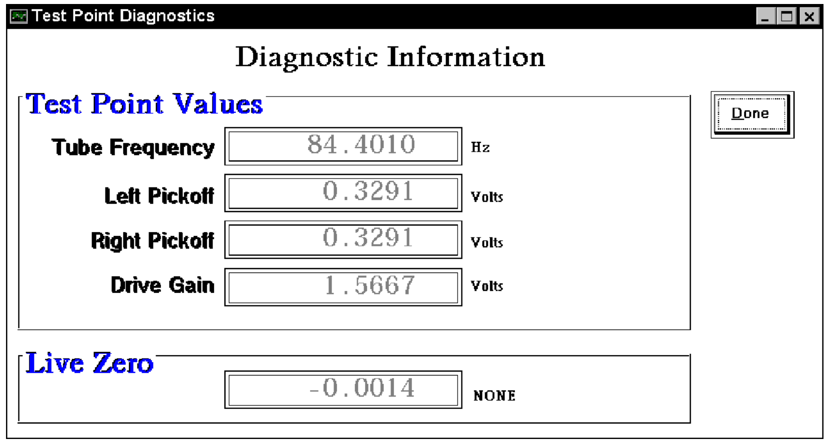


Table 7-3. Troubleshooting excessive drive gain

Symptom	Cause	Corrective action(s)
Drive gain exceeds 8 V	Erratic process density (slug flow) has caused flow tubes to vibrate erratically or stop vibrating	• Monitor density • Change sensor orientation
	Plugged flow tube	Purge flow tubes
	Cavitation or flashing of process fluid	• If possible, increase inlet pressure and/or back pressure • If pump is mounted upstream from sensor, increase distance between pump and sensor
	• Drive board or module failure • Cracked flow tube • Sensor imbalance	Phone the Micro Motion Customer Service Department

3. Disconnect sensor wiring from the intrinsically safe transmitter terminals (listed in **Table 7-2**, page 58), then use a DMM to measure resistance between wire pairs.
   - If open or short circuits are found, or if measured resistance values are outside the ranges listed in **Table 7-4**, page 60, the sensor cable could be faulty. See **Table 7-5**, page 60, to troubleshoot the problem.
   - If faulty sensor cable is not indicated, go to step 4.
4. Before reconnecting wiring at the transmitter terminals, measure resistance between wire pairs at the sensor junction box.
   - If all measured resistance values are within the ranges listed in **Table 7-4**, page 60, either the process is outside acceptable limits, or the flowmeter calibration needs to be changed. See **Table 7-5**, page 60, to troubleshoot the problem.
   - If open or short circuits are found, either the sensor junction box contains moisture, or the sensor is damaged. See **Table 7-6**, page 61, for corrective actions.
5. If troubleshooting fails to reveal why status indicators have switched ON, phone the Micro Motion Customer Service Department for technical assistance.

Table 7-4. Nominal resistance and voltage ranges for flowmeter circuits

Notes

- Temperature sensor value increases 0.38675 ohms per °C increase in temperature.
- Nominal resistance values will vary 40% per 100°C. However, confirming an open coil or shorted coil is more important than any slight deviation from the resistance values presented below.
- Resistance across terminals 6 and 8 (right pickoff) should be within 10% of resistance across terminals 5 and 9 (left pickoff).
- Resistance values depend on the sensor model and date of manufacture.

Circuit	Wire colors	Sensor terminals	Normal resistance range	Normal voltage
Drive coil	Brown to red	1 to 2	8 to 2650	~8.0 V
Left pickoff	Green to white	5 to 9	15.9 to 300	3.4 mV/Hz
Right pickoff	Blue to gray	6 to 8	15.9 to 300	3.4 mV/Hz
Temperature sensor	Orange to violet	4 to 7	100 Ω at 0°C + 0.38675 Ω / °C	not applicable
Lead length compensator	Yellow to violet	4 to 7	100 Ω at 0°C + 0.38675 Ω / °C	not applicable

Table 7-5. Troubleshooting faulty sensor cable

Status indicators	Resistance at transmitter terminals	Cause	Corrective action(s)
Sensor Failure Input Overrange	• Open or short from green to white • Open or short from blue to gray	Faulty cable	Repair or replace sensor cable
Sensor Failure Drive Overrange	Open or short from red to brown		
Sensor Failure Temperature Overrange	• Open or short from violet to yellow • Open or short from violet to orange		
Sensor Failure Input Overrange Temperature Overrange Drive Overrange	Resistance of any wire pair is outside range listed in **Table 7-4**	• Incorrect or faulty cable connection • Sensor failure	Reconnect sensor cable according to installation instructions

View Menu: Status *continued*
Critical indicators

Table 7-6. Troubleshooting overrange conditions

<table>
<tr><th>Status indicators</th><th>Resistance at sensor terminals</th><th>Cause</th><th>Corrective action(s)</th></tr>
<tr><td rowspan="2">Sensor Failure
Input Overrange</td><td>Open or short from green to white</td><td>• Moisture in sensor case or junction box
• Open or short left pickoff</td><td rowspan="2">• If sensor junction box contains moisture, check for leaking junction box, conduit, or conduit seals
• If sensor junction box does not contain moisture, return sensor to factory</td></tr>
<tr><td>Open or short from blue to gray</td><td>• Moisture in sensor case or junction box
• Open or short right pickoff</td></tr>
<tr><td>Sensor Failure
Input Overrange
Zero Too Noisy</td><td>Values within ranges listed in Table 7-4, page 60</td><td>Transmitter cannot calculate offset of flow signal</td><td>• Eliminate pipe stress, vibration, or mechanical noise
• If using volume flow units, verify density measurement
• Verify flow calibration
• Eliminate noise, then re-zero
• Shut off flow, then re-zero</td></tr>
<tr><td>Sensor Failure
Drive Overrange</td><td>Open or short from red to brown</td><td>• Moisture in sensor case or junction box
• Open or short drive coil</td><td>• If sensor junction box contains moisture, check for leaking junction box, conduit, or conduit seals
• If sensor junction box does not contain moisture, return sensor to factory</td></tr>
<tr><td>Sensor Failure
Drive Overrange
Input Overrange</td><td>Values within ranges listed in Table 7-4, page 60</td><td>Flow rate outside sensor limit</td><td rowspan="2">• Bring flow rate within sensor limit
• Monitor flow rate
• If using volume flow units, verify density measurement
• Verify flow calibration</td></tr>
<tr><td>Sensor Failure
Mass Flow Overrange
Volume Flow Overrange</td><td>Values within ranges listed in Table 7-4, page 60</td><td>Mass or volume flow rate outside sensor limit</td></tr>
<tr><td>Sensor Failure
Drive Overrange
Density Overrange</td><td>Values within ranges listed in Table 7-4, page 60</td><td>• Inappropriate density factors
• Process density above 5 g/cc for an RFT9739
• Process density above 10 g/cc for an RFT9712 or RFT9729
• Process density above 2 g/cc for an IFT9701 or IFT9703
• Erratic process density has caused flow tubes to stop vibrating
• Plugged flow tube</td><td>• Perform density calibration or density characterization
• Bring density within sensor limit
• Monitor density
• Eliminate pipe stress, vibration, or mechanical noise
• Purge flow tubes</td></tr>
<tr><td rowspan="3">Sensor Failure
Temperature Overrange</td><td>Values within ranges listed in Table 7-4, page 60</td><td>Temperature outside sensor limit</td><td>• Bring temperature within sensor limit
• Monitor temperature</td></tr>
<tr><td>Open or short from violet to yellow</td><td>• Moisture in sensor case or junction box
• Open or short lead length compensator</td><td rowspan="2">• If sensor junction box contains moisture, check for leaking junction box, conduit, or conduit seals
• If sensor junction box does not contain moisture, return sensor to factory</td></tr>
<tr><td>Open or short from violet to orange</td><td>• Moisture in sensor case or junction box
• Open or short RTD</td></tr>
</table>

"Analog Input Error" and "Pressure Input Failure"

Analog Input Error applies only to versions 2.0 and higher RFT9739 transmitters. Analog Input Error switches ON when the pressure input to the RFT9739 is less than 4 mA or greater than 20 mA, and indicates one of the following conditions:

- Faulty wiring between a pressure transmitter and the RFT9739
- Pressure input requires characterization

Pressure Input Failure applies only to RFT9739 transmitters with software versions 2.3 and higher. Pressure Input Failure switches ON to indicate a loss of either the analog input signal, as above, or the HART signal.

If Analog Input Error or the Pressure Input Failure switches ON:

- Characterize range limits for milliamp input
- Check for faulty wiring to or from pressure transmitter
- Alter fluid process

"Data Loss Possible"

Data Loss Possible switches ON when a power fluctuation occurs during transmitter configuration, to indicate the last configuration parameters might not have been saved.

If Data Loss Possible switches ON, open the appropriate configuration window and check the last parameters that were entered. Re-enter any parameters that are not correct.

7.4 Operational indicators

Operational indicators switch ON to indicate the following conditions:

- The process is operating outside control limits.
- The transmitter cannot properly calculate settings during a calibration procedure.
- Inappropriate measurement units or inappropriate limits on output variables are driving outputs to their limits.
- The transmitter cannot calculate the flow rate.

Table 7-7 summarizes conditions indicated by operational indicators, and lists appropriate corrective actions.

"Calibration Failure"

Calibration Failure switches ON if the transmitter cannot properly calculate settings during a calibration procedure. The cause of the failure depends on the type of calibration that is being performed:

- During auto zero, failure can occur due to mechanical noise from an external source or due to flow of fluid through the sensor.
- During a two-point density calibration, failure can occur due to use of a low-density fluid that is too dense, a high-density fluid that is not sufficiently dense, or mechanical noise from an external source.

For more information about flowmeter calibration, see **Chapter 14** (page 133).

View Menu: Status *continued*

Operational indicators

Table 7-7. Troubleshooting operational failures

Operational indicator	Cause	Corrective actions
Slug Flow	• Gas slugs causing process density to go below low slug flow limit • Solids causing process density to go above high slug flow limit	• Open View menu, choose Process Variables to monitor density • Open Configure menu, choose Characterize, enter new slug flow limits • Open Configure menu, choose Transmitter Outputs, enter new slug duration for Model RFT9739
Frequency Saturated	• Flow rate driving RFT9739 output from FREQ+ and RETURN terminals to 0 or 15 kHz • Flow rate driving RFT9712 or RFT9729 frequency/pulse output to 0 or 11,520 Hz	• Open Configure menu, choose Transmitter Variables, change flow measurement units • Open Configure menu, choose Transmitter Outputs, rescale frequency/pulse output • Reduce flow rate
Frequency Output Saturated	Flow rate driving IFT9701 or IFT9703 pulse output to 0 or 7200 Hz for versions 1.2 and higher, or 0 to 1200 Hz for lower versions	
Analog 1 Saturated	• RFT9739 output from PV+ and PV– terminals is 0, 2, or 22 mA • RFT9712 or RFT9729 milliamp output is 2 or 22 mA	• Open Configure menu, choose Transmitter Outputs, change value of variable at 20 mA • Alter fluid process
Analog 2 Saturated	RFT9739 output from SV+ and SV– terminals is 0, 2, or 22 mA	
Analog Output Saturated	IFT9701 or IFT9703 milliamp output is 0 or 22 mA	
Raw Flow Overflow Raw Elec. Zero Overflow	Transmitter cannot calculate flow rate	Eliminate pipe stress, vibration, or mechanical noise

"Slug Flow"

Programmed slug flow limits enable transmitter outputs and the ProLink Status window to indicate conditions such as slug flow (gas slugs in a liquid flow stream or liquid in a gas stream). Such conditions adversely affect sensor performance by causing erratic vibration of the flow tubes, which in turn causes the transmitter to produce inaccurate flow signals.

If the fluid density goes outside the user-defined slug flow limits, all of the following occur:

- The Slug Flow indicator in the ProLink Status window switches ON.
- Milliamp outputs go to 0 mA if they produce a 0-20 mA current, or to 4 mA if they produce a 4-20 mA current.
- Frequency/pulse output goes to 0 Hz.
- Flow totalization stops while the density reading is outside density limits.
- The diagnostic LED on RFT9739 field-mount, IFT9701, IFT9703, and RFT9712 transmitters blink OFF once per second (75% ON, 25% OFF).
- The flowmeter resumes normal operation when liquid fills the flow tubes (when density stabilizes within the programmed slug flow limits).

To program slug flow limits, follow these steps. For more information, see **Section 8.5**, page 81.

1. Open the Configure menu, then choose Characterize.
2. In the Characterize Sensor dialog box, at the Low and High text boxes in the Slug Flow Limits frame, enter the desired slug flow limits in grams per cubic centimeter (g/cc).
3. Click OK.

In some applications, slug flow typically occurs for short periods of time. If slug flow ceases in less than one minute, an RFT9739 can continue holding the last accurately measured flow value until process density stabilizes within the programmed slug flow limits. A user-defined slug duration specifies the amount of time the RFT9739 indicates the last measured flow value before indicating zero flow. (Some RFT9739 software versions cannot indicate last measured value.)

To program a slug duration for an RFT9739, follow these steps. For more information, **Section 10.5**, page 116.

1. Open the Configure menu, then choose Transmitter Outputs.
2. Enter the desired time, from 0.00 to 60.00 seconds, into the Slug Duration text box.
3. Click OK.

Analog and frequency saturated indicators

If an output variable exceeds its upper range limit, a frequency saturated or analog saturated indicator switches ON. The indicator can mean the output variable has exceeded appropriate limits for the process, or the user needs to change measurement units.

Analog output saturated
If Analog 1 Saturated, Analog 2 Saturated, or Analog Output Saturated switches ON, open the View menu, then choose Output Levels to open the Output Levels window.

If the output variable is outside control limits: use a control device to decrease the flow rate, density, temperature, or pressure of the fluid.

If the output variable is within control limits: set the flow loop for manual operation, then follow one of the procedures described below to change the span of the milliamp output.

- Rescale the milliamp output by adjusting the 4 mA and/or 20 mA range limit: Open the Configure menu, then choose Transmitter Outputs. Low Limit, High Limit, and Minimum Span, displayed at the bottom of the dialog box, indicate sensor limits in the measurement units established for milliamp output variables.
  - The value entered into the 4 mA text box must be lower than the value entered into the 20 mA text box.
  - The value entered into the 20 mA text box must be higher than the displayed low limit and lower than the displayed high limit.
  - The difference between the values entered into the text boxes must be greater than the displayed minimum span.

For more information about configuring transmitter outputs, see **Section 10**, page 107.

- If the milliamp output represents a flow rate, change the measurement units for the flow rate: Open the Configure menu, then choose Transmitter Variables. Choose a new unit of measure from the units list box under Mass Flow or Volume Flow. For more information about configuring measurement units and other transmitter variables, see **Chapter 9**.

Example:	*Given:* An RFT9739 is configured to measure temperature in degrees Celsius (°C). The milliamp output is configured so that 20 mA represents 80°C. The milliamp output goes out of range (high) at 20 mA. *Problem:* When the process fluid temperature exceeds 80˚C, the milliamp (analog) output is saturated. *Solution:* Change the span of the milliamp output. Increase the temperature indicated by the output at 20 mA to 100˚C.

Frequency output saturated
If Frequency Output Saturated switches ON, open the View menu, then choose Output Levels to open the Output Levels window.

If the flow rate is outside control limits: use a control device to decrease the flow rate.

If the flow rate is within control limits: set the flow loop for manual operation, then follow one of these procedures to change the span of the frequency/pulse output:

- Rescale the frequency/pulse output: Open the Configure menu, then choose Transmitter Outputs. Enter new values into the Frequency and Rate text boxes. For more information about configuring transmitter outputs, see **Chapter 10**.
- Change the measurement units for the flow rate: Open the Configure menu, then choose Transmitter Variables. Choose a new unit of measure from the units list box under Mass Flow or Volume Flow. For more information about configuring measurement units and other transmitter variables, see **Chapter 9**.

Example:	*Given:* An RFT9739 is configured to indicate flow rate in pounds per minute (lb/min). The frequency/pulse output has been scaled so that 100 Hz = 1 lb/min. The frequency/pulse output goes out of range at 15 kHz. *Problem:* When the process flow rate exceeds 150 lb/min, the frequency/pulse output is saturated. *Solution:* Increase the flow rate represented by the output at 15 kHz by rescaling the frequency/pulse output so that 100 Hz = 2 lb/min (the output will be saturated at 300 lb/min).

"Raw Flow Overflow" and "Raw Elec. Zero Overflow"

Raw Flow Overflow and Raw Elec Zero Overflow switch ON to indicate the transmitter cannot calculate flow. If there are no open circuits in the sensor wiring, the sensor is being subjected to mounting stress or external noise.

If Raw Flow Overflow or Raw Elec Zero Overflow switches ON, eliminate mounting stress on the sensor, and isolate the sensor from vibration and mechanical noise.

7.5 Informational indicators

Informational indicators switch on to indicate the following changes in operating states:

- Transmitter start-up, calibration, zeroing, and testing
- Polling address other than 0 assigned to the transmitter for HART communication in a Bell 202 multidrop network
- Cancel chosen during an output calibration or test
- Transmitter configured to send data in burst mode under HART protocol
- An event assigned to an RFT9739 output achieves the setpoint
- An interruption or error occurs in analog input

Table 7-8, page 68 summarizes conditions indicated by informational indicators.

"Transmitter Initializing"

Transmitter Initializing switches ON to indicate transmitter self-calibration in progress at start-up or after power cycling.

"Calibration In Progress"

Calibration in Progress switches ON if the user performs a density calibration or auto zero.

- For information about density calibration, see **Section 14.4**, page 138.
- For information about auto zero, see **Section 14.2**, page 133 and **Section 14.3**, page 136.

Zero indicators

Zero Too Noisy switches ON if mechanical noise prevents the transmitter from setting an accurate zero flow offset during transmitter zeroing. If auto zeroing fails, Calibration Failure switches ON in the Operational frame of the Status window.

Zero Too High or Zero Too Low switches ON if flow is not completely shut off during sensor zeroing, thereby causing the transmitter to calculate a zero flow offset that is too high or too low to allow accurate flow measurement.

For more information about transmitter zeroing, see **Section 14.2**, page 133 and **Section 14.3**, page 136.

Table 7-8. Troubleshooting informational failures

Informational indicator	Cause(s)	Corrective action(s)
Pressure Input Failure	No pressure input signal	• Verify wiring to pressure transmitter • Disable pressure compensation
Transmitter Initializing	Transmitter start-up/self-calibration in progress	• If indicator switches OFF, no action • If indicator remains ON, check flowmeter cable
Calibration in progress	• Auto zero in progress • Density calibration in progress	• If indicator switches OFF, no action • If indicator remains ON: - Check flowmeter cable - Eliminate noise, then re-calibrate or re-zero
Zero Too High Zero Too Low	Flow not completely shut off during auto zero	Completely shut off flow, then re-zero
	Moisture in sensor junction box caused zero drift	Ensure interior of junction box is completely dry, then rezero
Zero Too Noisy	Mechanical noise prevented accurate zero flow setting during auto zero	Eliminate mechanical noise if possible, then rezero
Analog 1 Fixed Analog Output Fixed	• Communication failed during test or trim of milliamp output from RFT9739 PV+ and PV– terminals • Communication failed during test or trim of milliamp output from RFT9712, RFT9729, or IFT9701 or IFT9703	Reconnect to transmitter, then reopen Milliamp Test or Milliamp Trim dialog box and complete test or trim
	Polling address of 1 to 15 assigned to transmitter for HART Bell 202 communication	• Open Configure menu, choose Transmitter Information, change polling address to 0 • For an RFT9739, RFT9712, or RFT9729, use RS-485 communication standard
Analog 2 Fixed	Communication failed during test or trim of milliamp output from RFT9739 SV+ and SV– terminals	Reconnect to transmitter, then reopen Milliamp Test or Milliamp Trim dialog box and complete test or trim
Frequency Output Fixed	Communication failed during test of IFT9701 or IFT9703 frequency output	Reconnect to transmitter, then reopen Frequency Test dialog box and complete test
Burst mode	Transmitter configured to send data in burst mode under HART protocol	Open Configure menu, choose Transmitter Information, switch burst mode OFF
Event 1 On	Event 1 is ON	• If totalizer assigned: - Low alarm switches event ON at totalizer reset - High alarm switches event OFF at totalizer reset • If other variable assigned, event switches ON/OFF when variable crosses setpoint
Event 2 On	Event 2 is ON	
Error Cleared	Causes of errors have been corrected.	Wait ten seconds
Power Reset	• Power failure • Brownout • Power cycling	Check accuracy of totalizers
Security Breach	Security mode changed from mode 8	Re-enter security mode 8 (see RFT9739 instruction manual for instructions)
Display Readback Error	Value written to display was not received	If error does not clear itself in 60 seconds, cycle power to the transmitter (turn power OFF, then ON) to disable the display

Analog Fixed indicators

Analog 1 Fixed, Analog 2 Fixed, or Analog Output Fixed switches ON if communication between the ProLink program and the transmitter is interrupted during a milliamp output test or trim. The output remains fixed at the assigned level until the trim or test procedure is completed.

- For more information about trimming milliamp outputs, see **Section 14.6**, page 151.
- For more information about testing milliamp outputs, see **Section 15.2**, page 156.

Analog 1 Fixed or Analog Output Fixed switches ON if the user assigns a polling address other than 0 to the transmitter for HART communication in a Bell 202 multidrop network. The output remains fixed at 4 mA until the user assigns a polling address of 0 to the transmitter. For RFT9739 transmitters using the RS-485 standard, the primary milliamp output remains active.

To assign a polling address to the transmitter:
1. Open the Configure menu, then choose Transmitter Information.
2. Enter the desired polling address of 0 to 15 into the Comm Addr text box in the Transmitter Database frame.
3. Click OK.

For more information about polling addresses, see **Section 11.2**, page 121.

"Frequency Output Fixed"

Frequency Output Fixed switches ON if communication between the ProLink program and the transmitter is interrupted during a frequency/pulse output test. The output remains fixed at the assigned level until the test procedure is completed.

For more information about testing the frequency/pulse output, see **Section 15.3**, page 157.

"Burst Mode"

Burst Mode switches ON if the user configures the transmitter to send data in burst mode while operating under HART protocol. In burst mode, the transmitter bursts data at regular intervals.

To toggle burst mode ON or OFF:
1. Open the Configure menu, then choose Transmitter Information.
2. Select ON or OFF at the Burst Control option buttons.
3. Click OK.

For more information about burst mode, see **Section 11.4**, page 124.

Event indicators

With flow, density, temperature, pressure, or assigned to an RFT9739, RFT9712, or RFT9729 event, Event 1 or Event 2 switches OFF or ON whenever the process variable crosses the setpoint.

With mass total or volume total assigned to an event, Event 1 or Event 2 switches ON and OFF according to the low or high configuration of the alarm.

- With a low alarm, Event 1 or Event 2 switches ON when the user resets the totalizer.
- With a high alarm, Event 1 or Event 2 switches OFF when the user resets the totalizer.

For more information about configuring events, see **Chapter 12**.

"Error Cleared"

Error Cleared switches ON for 1 second after other indicators in the Status window have switched OFF. Error Cleared switches OFF when the user closes the Status window.

"Power Reset"

Power Reset switches ON after a power failure, brownout, or power cycle has interrupted operation of the transmitter. The transmitter has a nonvolatile memory, which remains intact despite power interruptions.

"Security Breach"

Security Breach applies only to Version 3.0, 3.5, and 3.6 RFT9739 transmitters. Security Breach switches ON to indicate the transmitter security mode has been changed from security mode 8. Clear the message by re-entering security mode 8 or by performing a master reset.

For more information about RFT9739 security modes, or to perform a master reset, refer to the transmitter instruction manual.

"Display Readback Error"

Display Readback Error applies only to Version 3.0, 3.5, and 3.6 RFT9739 transmitters with a local display. Display Readback Error switches ON to indicate the value written to the transmitter display was not properly received by the transmitter display.

If the error does not clear itself within 60 seconds, cycle power to the transmitter (turn power OFF, then ON) to disable the display. Contact the factory to replace a faulty display.

8 Configure Menu: Characterize

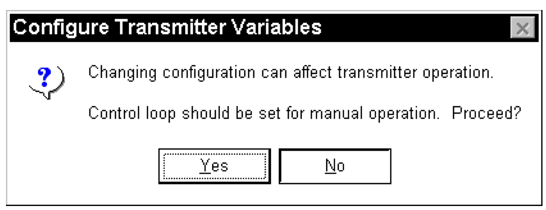
8.1 Overview

⚠ CAUTION

Failure to set control devices for manual operation before characterization could cause transmitter output error.

Before opening the File, Configure, Calibrate, or Applications menus, set process control devices for manual operation.

Whenever a dialog box such as the one depicted below appears, isolate the transmitter from devices that used transmitter outputs for process control, then choose Yes.



The Characterize Sensor dialog box contains text boxes for entry of factors that describe sensor sensitivity to flow and density.

- The flow calibration factor describes a particular sensor's sensitivity to flow.
- Density factors describe a particular sensor's sensitivity to density.
- Slug flow limits set the density at which flow outputs indicate zero flow due to slug flow (slugs of gas in a liquid flow stream).

For RFT9739 transmitters, the ProLink program also supports entry of factors used for calculating temperature and pressure.

- The temperature calibration factor describes the slope and offset of the equation used for calculating temperature.
- The viscosity calibration factor describes the slope or the slope and offset of the equation used for calculating viscosity.
- For a Version 2 or later model RFT9739, the pressure compensation parameters compensate for the pressure effect on sensor flow tubes.

To open the Characterize Sensor dialog box, open the Configure menu, then choose Characterize. The Characterize Sensor dialog box appears as depicted in:

- **Figure 8-1** for an RFT9739
- **Figure 8-2** for an IFT9701, IFT9703, RFT9712, or RFT9729

Values entered during sensor characterization override existing flow, density, temperature, and viscosity factors, and change the flowmeter calibration.

While characterizing the sensor, record factors in the appropriate Transmitter Configuration Worksheet, shown in **Appendix E**.

Figure 8-1. Characterize Sensor dialog box for RFT9739

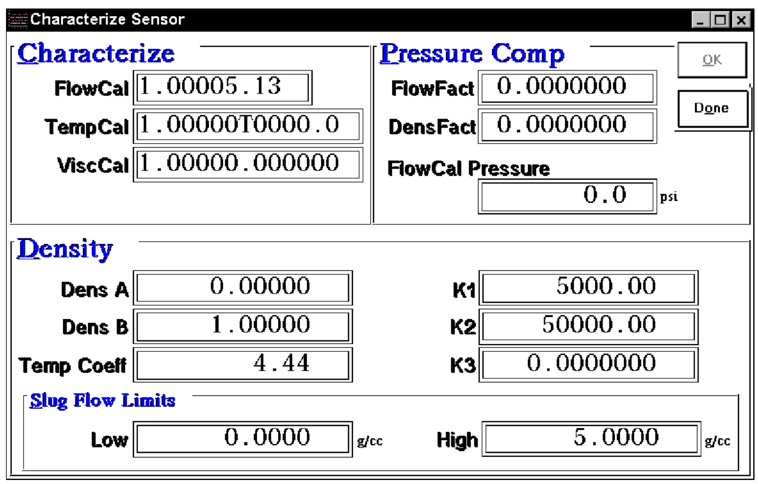
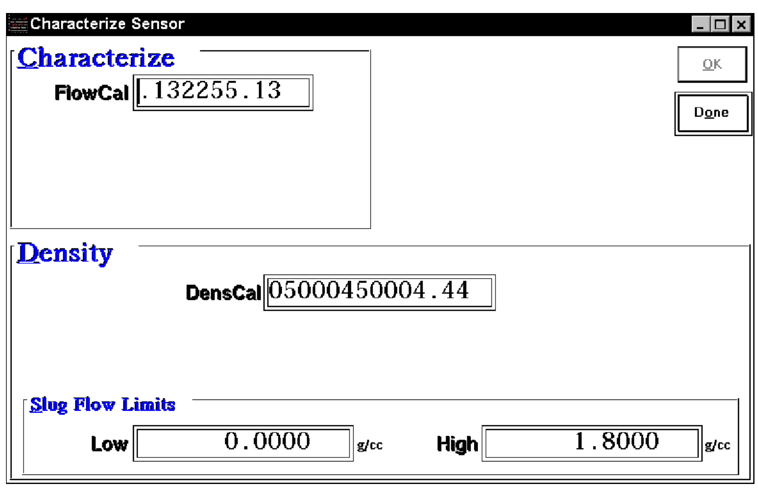


Figure 8-2. Characterize Sensor dialog box for IFT9701/IFT9703 or RFT9712/RFT9729



8.2 Flow calibration factor

The flow calibration factor describes a particular sensor's sensitivity to mass flow. Testing conducted in the Micro Motion flow calibration laboratory determines the precise value of the flow calibration factor for each sensor. (For an RFT9739, IFT9701, IFT9703, RFT9712, or RFT9729 that is shipped without a sensor, the default value — which must be changed — is 1.00005.13).

The first five digits and first decimal point are the flow rate, in grams per second, required to produce one microsecond of time shift between velocity signals transmitted by sensor pickoff coils. In the default calibration factor above, the first five digits and first decimal point indicate that, for every detected microsecond of time shift, 1.0000 grams of fluid per second flow through the sensor.

The last three digits and second decimal point represent the temperature coefficient for the sensor. The temperature coefficient represents the percent change in the rigidity of the flow tubes around the twisting axis per 100˚C.

Sensor and transmitter shipped together

If the sensor and transmitter were ordered together as a Coriolis flowmeter, the correct flow calibration factor was programmed into the transmitter at the factory and does not need to be changed.

After calibration at the factory, the value displayed in the FlowCal text box is the same as the flow cal factor on the sensor serial number tag and the flowmeter calibration certificate, which is shipped with the sensor.

With a Version 3.0, 3.5, or 3.6 RFT9739, a meter factor is available, which adjusts the flowmeter measurement without modifying the flow calibration factor. For information on meter factors, see **Chapter 13**.

Model RE-01 Remote Electronics Unit replaced in the field

Model RFT9739, IFT9701, IFT9703, RFT9712, and RFT9729 transmitters use the flow calibration factor in calculating mass flow rate. The Model RE-01 Remote Electronics Unit uses a sensor sensitivity factor.

If an RE-01 is being replaced by another transmitter:

1. Use the following equation to derive the first five digits of the flow calibration factor from the RE-01 flow sensitivity factor:

$$1.507 \times \text{Flow Sensitivity Factor}$$

2. Use the appropriate value from **Table 8-1** for the last three digits of the flow calibration factor.

Table 8-1. Temperature coefficients for flow

Sensor model	Coefficient	Sensor model	Coefficient
CMF010HP, high pressure	2.88	D sensor, stainless, serial number equal to or below 214724	5.13
CMF010M, stainless	4.26	D sensor, stainless, serial number above 214724	4.26
CMF010N, Inconel®	2.79	D sensor, Hastelloy, serial number equal to or below 214724	3.15
CMF025M, stainless	4.75	D sensor, Hastelloy, serial number above 214724	2.79
CMF025H, Hastelloy®	2.90	D600, serial number equal to or below 214724	4.70
CMF050M, stainless	4.75	D600, serial number above 214724	4.50
CMF050H, Hastelloy	2.90	F025, stainless	4.65
CMF100M, stainless, serial number below 357341	4.75	F050, stainless	4.77
CMF100M, stainless, serial number equal to or above 357341	4.26	F100, stainless	4.32
CMF100H, Hastelloy, serial number below 357341	2.90	F200, stainless	4.29
CMF100H, Hastelloy, serial number equal to or above 357341	2.79	R025, stainless	4.65
CMF200M, stainless, serial number below 332683	4.75	R050, stainless	4.50
CMF200M, stainless, serial number equal to or above 332683	4.26	R100, stainless	4.67
CMF200H, Hastelloy, serial number below 332683	2.90	DL025, Tantalum®	2.18
CMF200H, stainless, serial number equal to or above 332683	2.79	DS012, Tantalum	2.18
CMF300M, stainless, serial number below 332692	4.75	DL050, Tantalum	2.18
CMF300M, stainless, serial number equal to or above 332692	4.26	DX025, stainless	4.26
CMF300H, Hastelloy, serial number below 332692	2.90		
CMF300H, Hastelloy, serial number equal to or above 332692	2.79		
CMF300A	4.26		
CMF400	3.89		

Example:	*Given:* A D100 sensor with 316L stainless steel flow tubes, originally calibrated with an RE-01, has a sensitivity factor of 44.5. *Problem:* The RE-01 has been replaced by an RFT9739. A flow calibration factor must be programmed into the new transmitter. *Solution:* The first five digits of the flow calibration factor are calculated from the RE-01 flow sensitivity factor, as follows: $44.5 \cdot 1.507 = 67.062$ The appropriate value for a D100 sensor with 316L stainless steel flow tubes is: 5.13 The complete flow calibration factor is 67.0625.13

3. Perform this step only if the following conditions are true:
   - The transmitter is an RFT9739 with software version 2.4 or higher (all RFT9739 transmitters shipped after April 1995 have software version 2.4 or higher); and
   - The sensor is an older Model D or DL sensor, with a serial number of 87263 or lower (shipped before November 1986)

⚠ CAUTION

Failure to properly characterize a Model D or DL sensor with a copper RTD will cause measurement error.

If the sensor has a copper RTD, the flow calibration factor programmed into the transmitter must be modified as described below, to ensure accurate flow measurement.

   a. Contact the factory to identify the sensor's RTD type.

   b. If the sensor has a copper RTD, modify the temperature coefficient from step 2, by replacing the decimal point with the letter "c". For example, change "5.13" to "5c13".

Sensor or transmitter replaced in the field

If the sensor or transmitter is replaced in the field, the user must re-characterize the transmitter by programming the new sensor flow calibration factor into the transmitter. (For an RFT9739, IFT9701, IFT9703, RFT9712, or RFT9729 that is shipped without a sensor, the default value — which **must** be changed — is 1.00005.13).

To characterize the transmitter for flow measurement:

- Enter the flow calibration factor (eight digits and two decimal points) from the sensor serial number tag — this is the preferred method; or
- Enter the flow calibration factor (eight digits and two decimal points) from the calibration certificate that was shipped with the sensor.

Field flow-calibration

Flow calibration is performed at the factory to NIST (National Institute of Standards and Technology) standards. If, after characterizing the transmitter for flow as described above, the meter fails to perform within the accuracy specifications provided by Micro Motion, it might be necessary to perform a field flow-calibration or, for a Version 3.0, 3.5, or 3.6 RFT9739, to adjust the meter factor (see **Chapter 13**).

If a field flow-calibration is performed, and the transmitter is an RFT9739 using a pressure input for pressure compensation, the user should enter the calibration pressure in the FlowCal Pressure text box. Enter the value in psi. For more information on pressure compensation, see **Section 8.7**, page 86.

In the flow calibration procedure, a batch of fluid is run through the sensor, then the weighed amount of fluid in the batch is compared with the measured amount of fluid indicated in the Totalizer Control dialog box. To perform a flow calibration, follow these steps:

1. Set process control devices for manual operation.

2. For an IFT9701, IFT9703, RFT9712, or RFT9729, if the application requires volume flow measurement, choose a mass flow unit for the flow calibration, then choose a volume flow unit for the application after the calibration is complete. The flow calibration factor will be the same regardless of the mass flow unit that is chosen.

   To select a mass flow unit:
   a. Open the Configure menu, then choose Transmitter Variables.
   b. When the Configure Transmitter Variables dialog box appears, open the Units list box under Mass/Volume Flow (for an IFT9701 or IFT9703) or Mass Flow (for an RFT9712 or RFT9729) to select a standard engineering mass flow unit.

   For more information about configuring flow units, see **Section 9.2**, page 93.

3. For a Version 3.0, 3.5, and 3.6 RFT9739, ensure the mass-flow meter factor is *1.0000*. To check the meter factor, open the Configure menu, then choose Meter Factors to open the Meter Factors dialog box. Change the mass-flow meter to 1.0000 if any other value is displayed.

4. Enter the flow calibration factor (eight digits and two decimal points) into the FlowCal text box.
   - Enter the flow calibration factor from the sensor serial number tag — this is the preferred method;
   or
   - Enter the flow calibration factor from the calibration certificate that was shipped with the sensor.

5. Zero the flowmeter. The zeroing procedure is described in **Section 14.2**, page 133.

6. Open the Applications menu, then choose Totalizer Control or IFT9701/IFT9703 Totalizer Control (for an IFT9701 or IFT9703). Choose Reset to reset the internal totalizer to zero.

7. Run three batches of fluid, resetting the scale and totalizer between batches. For each batch, record the weights indicated by the scale and the totalizer.

	Weight$_{scale}$	**Weight$_{flowmeter}$**
First batch	______________	______________
Second batch	______________	______________
Third batch	______________	______________
Total	______________	______________

8. Divide *Total Weight$_{scale}$* by *Total Weight$_{flowmeter}$*. This is the mass-flow meter factor. Record the meter factor.

   Mass-flow meter factor ______________

9. For a Version 3.0, 3.5, or 3.6 RFT9739, the mass-flow meter factor may be entered into the transmitter as an alternative to completing this procedure. The meter factor adjusts the flowmeter measurement without modifying the flow calibration factor.
   - To enter the meter factor, open the Configure menu, then choose Meter Factors to open the Meter Factors dialog box. After entering the meter factor, it is not necessary to perform steps 10 through 12 of this procedure.
   - For information on meter factors, see **Chapter 13.**

10. Multiply the meter factor from step 8. This is the mass-flow meter factor. Record the meter factor. by the first five digits of the current flow calibration factor. This is the first five digits of the new flow calibration factor.

    Mass-flow meter factor ________________________

11. Open the Configure menu, then choose Characterize to open the Characterize Sensor dialog box. Enter the new flow calibration factor in the FlowCal text box. The complete flow calibration factor should have eight digits and two decimal points.
    - Enter the value from step 10 as the first five digits and first decimal point.
    - For the last three digits and second decimal point, enter the last three digits and decimal point from the flow calibration factor entered in step 4.

12. To verify the accuracy of the new flow calibration factor, repeat step 7. The amount of fluid indicated in the Totalizer Control dialog box should equal the weighed amount of fluid in the batch, within accuracy specifications provided by Micro Motion for the flowmeter.

8.3 Density factors for RFT9739

Density factors describe a particular sensor's density measurement sensitivity. Testing conducted in the Micro Motion Flow Calibration Laboratory determines the precise values of the density factors for each sensor.

The RFT9739 uses six separate factors to calculate density:

- **Dens A** is the density, in grams per cubic centimeter, at line conditions, of the low-density material used during a two-point density calibration.
- **Dens B** is the density, in grams per cubic centimeter, at line conditions, of the high-density fluid used during a two-point density calibration.
- **K1** is the tube period, in microseconds, adjusted to 0˚C, when the flow tubes contain the Dens A calibration fluid at line conditions.
- **K2** is the tube period, in microseconds, adjusted to 0˚C, when the flow tubes contain the Dens B calibration fluid at line conditions.
- **FD** (or **K3)** accounts for the effect of high flow rate on the density measurement, and usually is not required. The FD and K3 factors can be stored in, and viewed from, the ProLink transmitter configuration file. The FD or K3 density calibration procedure is described in **Section 14.4**, page 138.
- **Temp Coeff**, the temperature coefficient for density, represents the percent change in the elasticity of the flow tubes around the bending axis, and the corresponding change in tube period, per 100˚C.

Density characterization for RFT9739

If the sensor and transmitter were ordered together as a Coriolis flowmeter, they are factory calibrated. No additional characterization or calibration is necessary. Characterization is required if either the sensor or RFT9739 is replaced.

If the sensor or RFT9739 is replaced in the field, the user must re-characterize the sensor by programming new density factors into the transmitter.

> **⚠ CAUTION**
>
> **Improper density characterization could cause density and volume measurement error.**
>
> Density characterization resets the third density calibration factor (K3) for the RFT9739. For sensors manufactured after October 1997, a new FD calibration factor is provided on serial number tags and calibration certificates.
>
> For RFT9739 transmitters only, perform a third-point density calibration, as instructed in **Section 14.4**, page 138, after characterizing the sensor for density.

In density characterization, density factors are entered using one of the methods described in **Table 8-2**. During density characterization, record each density factor in the appropriate Transmitter Configuration Worksheet, shown in **Appendix E**, page 183.

Table 8-2. Methods for determining RFT9739 density factors

	Use the same method for all six density factors		
	Method 1	**Method 2**	**Method 3**
Density factor	This method is preferred. If possible, use this method.	This method is acceptable if D1 and D2, or K1 and K2 are not listed on the sensor tag.	This method is acceptable if Method 2 is not possible.
Dens A	Enter the *D1* value from the sensor serial number tag		Enter the *D1* value from the sensor tag, or enter 0.0012 if no *D1* value is listed
Dens B	Enter the *D2* value from the sensor serial number tag		Enter the *D2* value from the sensor tag, or enter 0.998 if no *D2* value is listed
K1	Enter the *K1* value from the sensor serial number tag		Enter the first five digits of the 13-digit density calibration factor from the sensor serial number tag
K2	Enter the *K2* value from the sensor serial number tag		Enter the second five digits of the 13-digit density calibration factor from the sensor serial number tag
K3	Enter 0 (the factory-default value for K3)		Enter 0 (the factory-default value for K3)
FD	Enter the *FD* from the sensor tag or calibration certificate	Perform the density calibration procedure, described in **Section 14.4**, page 138.	Contact Micro Motion for an appropriate value for FD
Temp Coeff	Enter the *TC* value from the sensor serial number tag	Enter the Temp Coeff value from Methods 1 or 3. If it is not possible to read the sensor tag, enter the appropriate density temperature coefficient from **Appendix C**.	Enter the last three digits and decimal point from the 13-digit density calibration factor from the sensor serial number tag

8.4 Density factor for IFT9701/IFT9703 and RFT9712/RFT9729

Density factors describe a particular sensor's density measurement sensitivity. Testing conducted in the Micro Motion Flow Calibration Laboratory determines the precise values of the density factors for each sensor.

The IFT9701, IFT9703, RFT9712, and RFT9729 use a 13-digit density calibration factor to calculate density (For an IFT9701, IFT9703, RFT9712, or RFT9729 that is shipped without a sensor, the default value — which **must** be changed — is 05000500004.44).

The first five digits represent the natural tube period, in microseconds, when the flow tubes contain a fluid (factory-calibrated with air) with a density of 0.0000 g/cc. This value is also referred to as K1.

The second five digits represent the natural tube period, in microseconds, when the flow tubes contain a fluid (factory-calibrated with water) with a density of 1.0000 g/cc. This value is also referred to as K2.

The last three digits and decimal point are the density temperature coefficient, which represents the percent change in the elasticity of the flow tubes around the bending axis, and the corresponding change in tube period, per 100˚C.

Density characterization for IFT9701/IFT9703 and RFT9712/RFT9729

If the sensor and transmitter were ordered together as a Coriolis flowmeter, the density calibration factor was programmed into the transmitter at the factory and does not need to be changed.

If the sensor or transmitter is replaced in the field, the user must re-characterize the sensor by programming the correct density calibration factor into the transmitter.

In density characterization, density factors are entered using one of the methods described in **Table 8-3**. During density characterization, record each density factor in the appropriate Transmitter Configuration Worksheet, shown in **Appendix E**, page 183.

Table 8-3. Methods for determining IFT9701/IFT9703 or RFT9712/9729 density factors

Method 1 (preferred)	Method 2* (acceptable)
Enter the 13-digit density calibration factor from the sensor tag or calibration certificate that was shipped with the sensor.	Perform the density calibration procedure described in **Section 14.4**, page 138.*

** Not acceptable for IFT9701 or IFT9703. If no tag or no 13-digit number on tag, contact factory.*

8.5 Slug flow limits

Slug flow limits enable detection of conditions such as slug flow (such as gas slugs in a liquid flow stream, or liquid in a gas/air flow stream).
- If fluid density goes outside a slug flow limit, all of the following occur:
- The Slug Flow indicator in the ProLink Status window switches ON
- The frequency/pulse output goes to 0 Hz
- Milliamp outputs indicating flow go to a level that corresponds to a zero flow condition
- Flow totalization stops while density reading is outside slug flow limits
- On field-mount transmitters, the diagnostic LED blinks once per second (75% ON, 25% OFF)

To establish slug flow limits, enter values in grams per cubic centimeter (g/cc), regardless of the density units established for density as a transmitter variable.

The RFT9739 offers an additional slug flow parameter, slug duration, which is described in **Section 10.5**, page 116.

Example:	Vaporization of the process liquid sometimes causes slug flow in a liquid flow stream in which the density of the liquid should remain above 0.9000 grams per cubic centimeter (g/cc). To detect density below the specified density of the process liquid due to vaporization, set the low slug flow limit at a density above 0.9000 g/cc. Such a setting will cause the transmitter to indicate slug flow when the process density goes below the specified limit for the liquid.

8.6 Temperature factor for RFT9739

Temperature characterization (calibrating the flowmeter for temperature) is not recommended.

⚠ CAUTION

Temperature characterization will cause measurement error.

Temperature characterization affects the RFT9739 flow and density and will require completely recalibrating the flowmeter for flow, density, and viscosity measurement.

Temperature characterization of the RFT9739 is not recommended.

For an RFT9739, the temperature calibration factor describes the slope and offset of the equation used for calculating the output level that represents the temperature of the sensor flow tubes. In a Micro Motion flow sensor, a platinum resistance temperature detector (RTD) with a resistance of 100 ohms at 0˚C measures the flow tube temperature. The specified temperature accuracy is ±1˚C ± 0.5% of the reading in ˚C.

The temperature calibration factor represents A and B in the following equation, which expresses a straight-line correction of the linear output indicating flow tube temperature:

$$T_{corrected} = A \cdot T_{measured} + B$$

Where:

A = Slope
B = Offset

Since the transmitter ordinarily does not correct the measured temperature, $T_{corrected} = T_{measured}$. The linear output therefore has a slope of one and an offset of zero. The default temperature calibration factor is:

1.00000T0000.0

- The digits before the placeholder "T" represent the slope of the linear output.
- The digits after the placeholder "T" represent the temperature offset, or the difference between the actual flow tube temperature and the temperature indicated by the output when $T_{measured}$ indicates a temperature of 0°C.

The procedure for characterizing the flowmeter for temperature involves calculating the slope and offset of the corrected linear output representing flow tube temperature, and completely recalibrating the flowmeter for flow and density measurement. During temperature characterization, write values in the appropriate Transmitter Configuration Worksheet, shown in **Appendix E**, page 183.

Temperature characterization is not recommended, and will require ***complete recalibrating of the flowmeter for flow, density, and viscosity measurement.*** Refer to **Section 14.5**, page 148. To characterize the flowmeter for temperature manually:

1. Ensure the value shown in the TempCal text box reads "1.00000T0000.0".

2. Pump a process fluid through the sensor at the lowest temperature measured during the application. Wait approximately five minutes for the flow tube temperature to stabilize.

3. Use a thermometer, temperature sensor, or another device to establish the reference temperature of the process fluid. Write the reference temperature as T_1 in the appropriate Calibration Record in **Appendix F**, page 189.

4. Open the View menu, choose Process Variables to read the flow tube temperature. Write the indicated temperature as T_2.

5. Pump a process fluid through the sensor at the highest temperature measured during the application. Wait approximately five minutes for the flow tube temperature to stabilize.

6. Using the same temperature measurement device used in step 3, establish the reference temperature of the process fluid. Write the reference temperature as T_3.

7. Use the Process Variables window to read the flow tube temperature. Write the indicated temperature as T_4.

8. Using the values determined above, calculate slope and offset from both temperature measurement points according to the following formulas:

$$A = (T_3 - T_1)/(T_4 - T_2)$$

$$B = T_1 - (A \cdot T_2) = T_3 - (A \cdot T_4)$$

W*here:*

A = Slope of linear output indicating temperature
B = Offset of linear output indicating temperature
T_1 = Reference temperature of low-temperature process fluid
T_2 = Temperature indicated in the ProLink window when flow tubes contain the low-temperature process fluid
T_3 = Reference temperature of high-temperature process fluid
T_4 = Temperature indicated in the ProLink window when flow tubes contain the high-temperature process fluid

9. Enter the temperature calibration factor into the TempCal text box. The first six digits and decimal point are the value A, determined in step 8, above. The next character is "T", the placeholder. The last five digits and decimal point are the value B, determined in step 8, above. An example is shown below.

Example:

Given:

- The measured temperature of the low-temperature process fluid is 20.0°C ($T_1 = 20$).
- The Process Variables window indicates a temperature of 20.1°C when the flow tubes contain the low-temperature process fluid ($T_2 = 20.1$).
- The measured temperature of the high-temperature process fluid is 80.0°C ($T_3 = 80$).
- The Process Variables window indicates a temperature of 80.3°C when the flow tubes contain the high-temperature process fluid ($T_4 = 80.3$).

Problem: Determine the temperature calibration factor. Follow these steps:

Solve for A:

$$A = (T_3 - T_1) / (T_4 - T_2)$$

$$= (80 - 20) / (80.3 - 20.1)$$

$$= 0.99668$$

Solve for B:

$$B = T_1 - A(T_2) = T_3 - A(T_4)$$

$$= 20 - 0.99668(20.1) \cong 80 - 0.99668(80.3)$$

$$= -0.0333$$

The temperature calibration factor is:

$$K = 0.99668T - 0.0333$$

10. To verify the accuracy of the temperature calibration factor, repeat steps 5 through 8. The measured temperature of the process fluid should equal the temperature indicated in the Process Variables window.

11. Recalibrate the flowmeter:
    a. Perform the flow calibration procedure described in **Section 8.2**, page 73.
    b. Perform the density calibration procedure described in **Section 14.4**, page 138.
    c. Perform the viscosity calibration procedure described in **Section 14.5**, page 148.

8.7 Pressure compensation with RFT9739

A Version 2 or Version 3 RFT9739 can compensate for the effect of pressure on sensor flow tubes. Pressure effect is defined as the change in sensor flow sensitivity due to process pressure change away from calibration pressure. Sensors that are affected by pressure are listed in **Table 8-4**, page 87.

In applications where the operating pressure varies significantly from the pressure at which the flowmeter was calibrated, the user can establish pressure compensation. Pressure effect can be corrected in one of two ways:

- For real-time compensation, by entering pressure correction factors and connecting an external pressure transmitter
- For relatively stable operating pressures, by adjusting the calibration factors for flow and density

Real-time compensation

For real-time pressure compensation, two pressure compensation factors must be entered, one for flow and one for density. In the FlowFact and/or DensFact text boxes, enter the appropriate values from **Table 8-4**, then click OK.

- The pressure correction factor for flow is the percent change in the flow rate per psi.
- The pressure correction factor for density is the grams per cubic centimeter change in density per psi.

The user should also enter the calibration pressure for real-time pressure compensation. In the FlowCal Pressure text box, enter the appropriate value in psi, then click OK. (At the factory, Micro Motion sensors are calibrated for flow at 20 psig.)

In addition, real-time pressure compensation requires either gauge pressure or analog pressure input. (To select an input for pressure compensation, see **Section 11.3**, page 122.)

Gauge pressure input

If a pressure transmitter connected to a host controller measures gauge pressure at the sensor input, the RFT9739 can use flow and density signals from the sensor, and pressure signals from the host controller, to compensate for the pressure effect on the sensor.

- In a HART-compatible network, the RFT9739 functions as a primary or secondary master while polling the host controller.
- In a Modbus-compatible network, the host controller downloads pressure values to register 40007 or register pair 20257-20258.

Analog pressure input

The RFT9739 can be connected to an analog pressure transmitter that produces a 4-20 mA input signal representing pressure. The RFT9739 or an external source can power the pressure transmitter.

- To connect a pressure transmitter to the RFT9739, see the RFT9739 instruction manual.
- If a sensor is ordered for an application requiring pressure compensation, the pressure input is configured at the factory.

Table 8-4. Pressure correction factors

Sensor model	Correction factor for flow (FlowFact)	Correction factor for density (DensFact)
D300	0.009	0.00001
D600	0.005	0.0000031
DL100	0.005	0.000001
DL200	0.009	0.00001
CMF100	0.0002	0.000006
CMF200	0.0008	–0.000001
CMF300	0.0006	–0.0000002
F050	0.0007	—
F100	0.001	—
F200	0.0005	—

Compensation for stable operating pressures

If the process pressure is relatively stable, the user can establish pressure compensation by adjusting flow and density calibration factors. In most applications, these calibration factors do not require adjustment for pressure correction.

Flow measurement
If the sensor is one of the models listed in **Table 8-4**, and it operates at a relatively constant pressure, the user can apply the following equation to the first five digits of the flow calibration factor:

$$\text{Flow cal factor}_{new} = \text{Flow cal factor}_{old} \cdot [1 + K_{Pflow}(0.01)(P_{meas} - P_{cal})]$$

Where:

K_{Pflow} = Pressure correction factor for flow
P_{meas} = Measured pressure, in psig, at sensor inlet
P_{cal} = Pressure at which the flowmeter was calibrated for flow (20 psig for a factory-calibrated meter)

Example:	*Given:* A CMF300 sensor will operate at 100 psig. After being calibrated for flow at 20 psig, the sensor has a flow calibration factor of 697.624.75. *Problem:* Apply pressure compensation by calculating a new flow calibration factor using the CMF300 pressure correction factor. *Solution:* Flow cal $factor_{new}$ = 697.62 ∗ [1 + (0.0006)(0.01)(100 -20)] = 697.62 ∗ (1.00048) = 697.95 The new flow calibration factor is: ***697.95 4.75***

Enter the new flow calibration factor into the FlowCal text box in the Characterize Sensor dialog box.

Density measurement
If the sensor is one of the models listed below, and it operates at a relatively constant pressure, the user can adjust the density calibration settings:
- For an ELITE CMF100, CMF200, CMF300, or CMF400 sensor, adjust the K2 density constant.
- For a Model D300, D600, DL100, or DL200 sensor, adjust the second five digits of the density calibration factor.

Follow these steps to adjust the density calibration settings:

1. Use the following equation to find the density offset (convert pressure to psig for use in this equation):

$$\text{Density offset} = K_{Pden} * P_{meas}$$

Where:

K_{Pden} = Pressure correction factor for density (listed in **Table 8-4**)
P_{meas} = Measured pressure, in psig, at sensor inlet

After finding the density offset, use the following equation to calculate the correct density:

$$Density_{corrected} = Density_{measured} + \text{Density offset}$$

Example:	*Given:* After being calibrated at the factory at 20 psi, a D300 sensor operating at 220 psig indicates a process density of 0.9958 grams per cubic centimeter (g/cc). *Problem:* Determine the density offset and the corrected density. *Solution:* Density offset= 0.00001 * 220 = 0.0022 $\text{Density}_{\text{corrected}}$ = 0.9958 + 0.0022 = 0.9980 g/cc

2. After calculating the corrected density, use the following equation to adjust the K2 density constant or the second five digits of the density calibration factor:

$$K2_{new} = \sqrt{[(K2_{old})^2 - (K1)^2] \cdot \frac{Density_{measured}}{Density_{corrected}} + (K1)^2}$$

Example:

Given: An RFT9739 is connected to a D300 sensor with 316L stainless steel flow tubes. The flowmeter indicates a density of 0.9958 grams per cubic centimeter (g/cc), which has been corrected to 0.9980 g/cc. The first five digits of the density calibration factor are 09615, and the second five digits are 13333.

Problem: Adjust the second five digits of the density calibration factor to compensate for pressure.

Solution:

$$K2_{new} = \sqrt{[(13333)^2 - (9615)^2] \cdot \frac{0.9958}{0.9980} + (9615)^2}$$

$$= \sqrt{85{,}320{,}664 \cdot 0.9978 + 92{,}448{,}225}$$

$$= 13325.9590$$

The new K2 value is:

13325

Enter the new density calibration factor into the K2 text box in the Characterize Sensor dialog box for an RFT9739

For an IFT9701, IFT9703, RFT9712, RFT9729, update the density calibration factor.

9 Configure Menu: Transmitter Variables

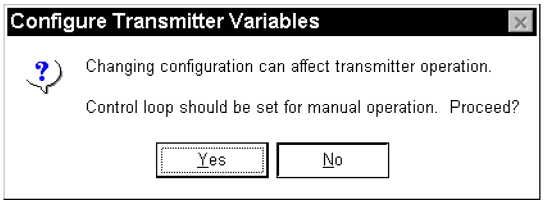
9.1 Overview

⚠ CAUTION

Failure to set control devices for manual operation during configuration could cause transmitter output error.

Before opening the File, Configure, Calibrate, or Applications menus, set process control devices for manual operation.

Whenever a dialog box such as the one depicted below appears, isolate the transmitter from devices that used transmitter outputs for process control, then choose Yes.



The Configure Transmitter Variables dialog box allows the user to configure units of measure, cutoffs, damping, and flow direction for these process variables:

- Mass flow
- Volume flow
- Density
- Temperature
- Pressure

If a process variable or unit of measure is not shown in the dialog box, then it is not available for the connected transmitter.

Figure 9-1. Configure Transmitter Variables dialog box for RFT9739

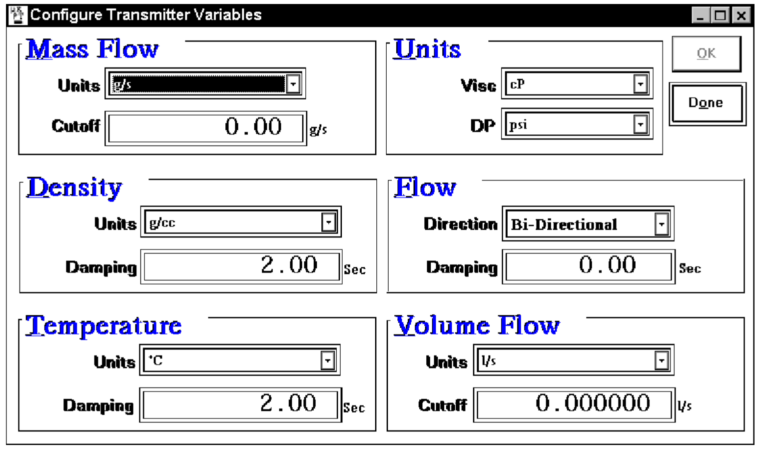


Figure 9-2. Configure Transmitter Variables dialog box for IFT9701/IFT9703

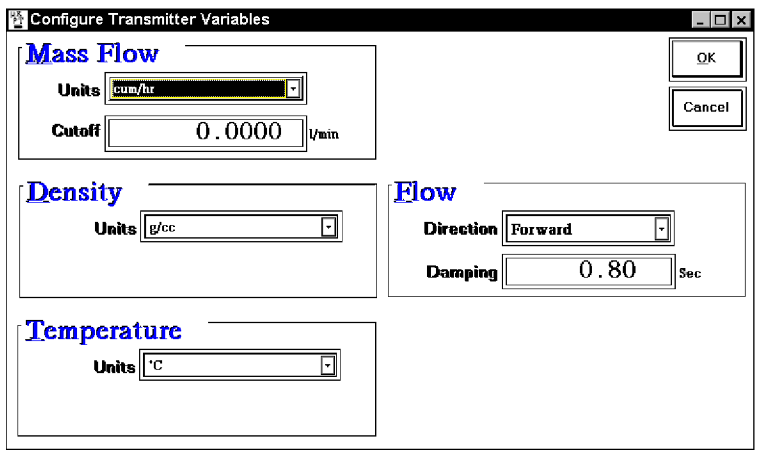
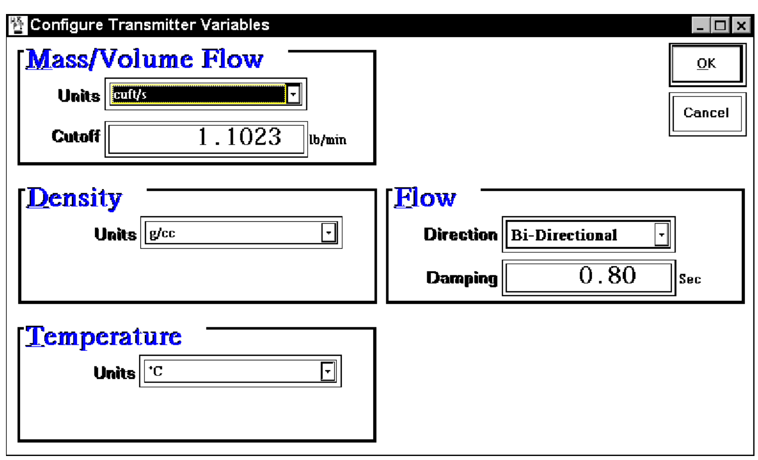


Figure 9-3. Configure Transmitter Variables dialog box for RFT9712/RFT9729



To open the Configure Transmitter Variables dialog box, open the Configure menu, then choose Transmitter Variables. The Configure Transmitter Variables dialog box appears, as depicted in:

- **Figure 9-1** for an RFT9739
- **Figure 9-2** for an IFT9701 or IFT9703
- **Figure 9-3** for an RFT9712 or RFT9729

While configuring transmitter variables, write values in the appropriate Transmitter Configuration Worksheet, shown in **Appendix E**, page 183.

The ProLink program supports complete configuration of measurement units for all process variables measured by the transmitter. Transmitters can use standard engineering units for all variables. Special mass flow and volume flow units can be assigned with an RFT9739, RFT9712, or RFT9729. Special units cannot be assigned with an IFT9701 or an IFT9703.

- Open the Units list boxes to select any of the standard engineering units listed in **Table 9-1**, page 94, through **Table 9-8**, page 96.
- To assign special units, see **Section 9.2**.

9.2 Flow units

Units of mass and volume can be standard engineering units listed in **Table 9-1** through **Table 9-7** or special units.

- The RFT9739 can use one mass flow unit and one volume flow unit simultaneously.
- The IFT9701, IFT9703, RFT9712, and RFT9729 can use one mass flow unit or one volume flow unit.
- The transmitter automatically totalizes in the base unit of mass or volume chosen for the flow rate.

Use of a special unit of mass or volume requires converting the base unit of mass or volume to another unit (such as converting pounds to ounces or converting gallons to pints).

The meter measures mass flow of gas or standard volumetric flow of a gas. Mass flow rate and volumetric flow rate are related by the density of the gas at a reference condition. The meter should not be used to measure actual volumetric flow of a gas.

After establishing flow units, continue using them to configure outputs and process limits.

Table 9-1. Mass flow measurement units for process variables

Units	RFT9739	IFT9701	IFT9703	RFT9712	RFT9729
grams/second	X	X	X	X	X
grams/minute	X	X	X	X	X
grams/hour	X	X	X	X	X
kilograms/second	X	X	X	X	X
kilograms/minute	X	X	X	X	X
kilograms/hour	X	X	X	X	X
kilograms/day	X	X	X	X	X
metric tonnes/minute	X	X	X	X	X
metric tonnes/hour	X	X	X	X	X
metric tonnes/day	X	X	X	X	X
pounds/second	X	X	X	X	X
pounds/minute	X	X	X	X	X
pounds/hour	X	X	X	X	X
pounds/day	X	X	X	X	X
tons/minute	X	X	X	X	X
tons/hour	X	X	X	X	X
tons/day	X	X	X	X	X
SPECIAL	X			X	X

X Indicates units are available

Table 9-2. Mass total and mass inventory measurement units for process variables

Units	RFT9739	IFT9701	IFT9703	RFT9712	RFT9729
grams	X	X	X	X	X
kilograms	X	X	X	X	X
metric tonnes	X	X	X	X	X
pounds	X	X	X	X	X
tons	X	X	X	X	X
SPECIAL	X			X	X

X Indicates units are available

Table 9-3. Viscosity measurement units for process variables

Units	RFT9739	IFT9701	IFT9703	RFT9712	RFT9729
centistokes	X				
centipoise	X				

X Indicates units are available

Configure Menu: Transmitter Variables *continued*

Flow units

Table 9-4. Density measurement units for process variables

Units	RFT9739	IFT9701	IFT9703	RFT9712	RFT9729
grams/cubic centimeter	X	X	X	X	X
kilograms/cubic meter	X			X	X
pounds/gallon	X			X	X
pounds/cubic foot	X			X	X
specific gravity units	X			X	X

X Indicates units are available

Table 9-5. Temperature measurement units for process variables

Units	RFT9739	IFT9701	IFT9703	RFT9712	RFT9729
degrees API	X[1]				
degrees Celsius	X	X	X	X	X
degrees Fahrenheit	X			X	X
degrees Kelvin	X			X	X
degrees Rankine	X				

X Indicates units are available

[1] RFT9739 with software version 2.1 and higher

Table 9-6. Volume flow rate measurement units for process variables (liquids only)

Units	RFT9739	IFT9701	IFT9703	RFT9712	RFT9729
gallons/second	X	X	X		
gallons/minute	X	X	X	X	X
gallons/hour	X[2]	X	X		
liters/second	X	X	X		
liters/minute	X	X	X	X	X
liters/hour	X[2]	X	X		
imperial gallons/second	X[2]	X	X		
imperial gallons/minute	X	X	X	X	X
imperial gallons/hour	X	X	X		
imperial gallons/day	X	X	X		
cubic feet/second	X	X	X		
cubic feet/minute	X	X	X		
cubic feet/hour	X	X	X		
cubic feet/day	X	X	X		
cubic meters/second	X	X	X		
cubic meters/minute	X	X	X		
cubic meters/hour	X	X	X	X	X
cubic meters/day	X	X	X		
oil barrels/second	X	X	X		
oil barrels/minute	X	X	X		
oil barrels/hour	X	X	X		
oil barrels/day	X	X	X		
SPECIAL	X			X	X

X Indicates units are available

[2] RFT9739 with software 2.4 and higher

Table 9-7. Volume total and volume inventory measurement units for process variables

Units	RFT9739	IFT9701	IFT9703	RFT9712	RFT9729
gallons	X	X	X	X	X
liters	X	X	X	X	X
imperial gallons	X	X	X	X	X
cubic feet	X	X	X		
cubic meters	X	X	X	X	X
oil barrels	X	X	X		
SPECIAL	X			X	X

X Indicates units are available

Table 9-8. Differential pressure measurement units for process variables

Units	RFT9739	IFT9701	IFT9703	RFT9712	RFT9729
inches of water at 68°F	X				
inches of mercury at 0°C	X				
feet of water at 68°F	X				
millimeters of water at 68°F	X				
millimeters of mercury at 0°C	X				
pounds/square inch	X				
bar	X				
millibar	X				
grams/square centimeter	X				
kilograms/square centimeter	X				
pascals	X				
kilopascals	X				
torr at 0°C	X				
atmospheres	X				

X Indicates units are available

Special flow units

Special flow units require a base unit of mass or volume, a conversion factor, and a time base. The conversion factor determines the value of the special unit in terms of the base mass or volume unit. Find the conversion factor by performing the following calculation:

$$\text{Special flow unit} = (\text{Conversion factor} \cdot \text{Base flow unit}) \div \text{Time}$$

Since the flow rate is mass or volume per unit time, the special unit must have a time base.

- The RFT9739 can use one special unit of mass and one special unit of volume to calculate mass and volume flow rates and totals.
- The RFT9712 and RFT9729 can use one special unit of mass or volume to calculate a flow rate and a total.
- The IFT9701 and IFT9703 do not support special measurement units.

To establish a special unit of mass or volume for a process fluid other than gas:

1. In the Configure Transmitter Variables dialog box, select SPECIAL as the mass flow or volume flow unit, then click OK.

2. Open the Configure menu, then choose Special Units to open the Configure Special Units dialog box, depicted in:
   - **Figure 9-4** for an RFT9739
   - **Figure 9-5** for an RFT9712 or RFT9729

Figure 9-4. Configure Special Units dialog box for RFT9739

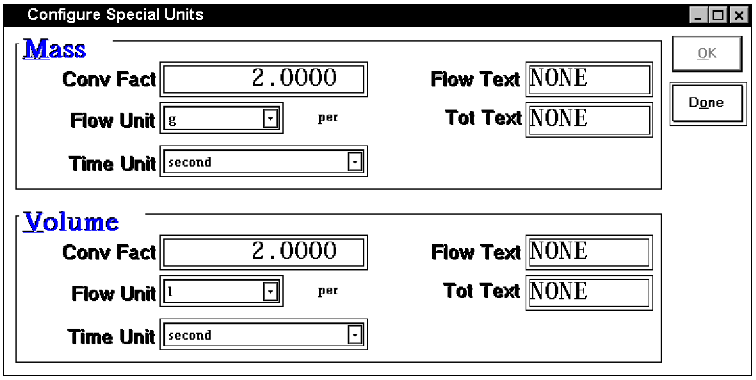
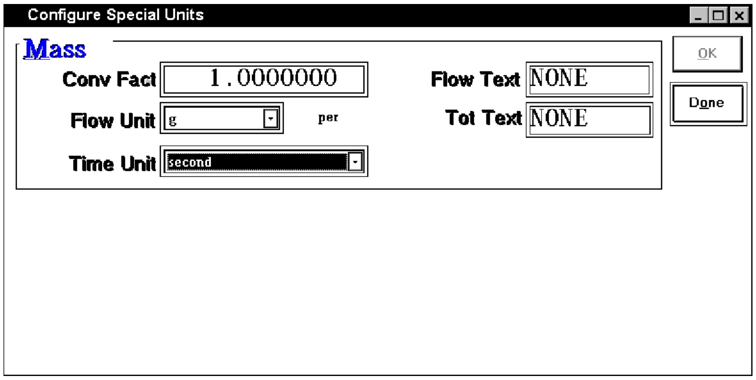


Figure 9-5. Configure Special Units dialog box for RFT9712/RFT9729



3. Determine a conversion factor as follows.

   The example below each step will convert the standard unit of **measure** *gallons per fortnight* into the special unit of measure *pints **per hour***:

   a. Choose a special unit of measure.
   For example, ***pints per hour***.

   b. Select an appropriate standard mass or volume flow unit of measure for conversion.
   For example, *pints* easily convert to ***gallons***.

   c. Determine how many special flow units are in the selected standard unit.
   For example, there are ***8*** *pints* in a *gallon.*

d. Select an appropriate time unit for conversion.
For example, *fortnights* easily convert to ***minutes***.

e. Determine how many special time units are in the selected standard time unit.
For example, there are ***336*** hours in 1 *fortnight.*

f. Divide the value from step 3c by the value in step 3e to determine the units conversion.
For example, ***8/336***.

g. Take the inverse of the value from step 3f to determine the conversion factor.
For example, the inverse of *8/336* is *336/8* or ***42***.

4. Select standard mass or standard volume unit.

5. Enter the conversion data into the ProLink Configure Special Units dialog box as follows:
   a. Enter the value from step 3g into the ProLink Conv Fact text box.
   For example, enter ***42***.

   b. From the Flow Unit drop-down list, choose the standard mass or volume flow unit of measure that was selected in step 3b.
   For example, choose ***gallons***.

   c. From the Time Unit drop-down list, choose the standard time unit that was selected in step 3d.
   For example, choose ***hour***.

   d. If desired, enter an abbreviation (one to four characters in length) for the special unit of measure in the Flow Text text box. If the transmitter has a display, this text appears in the flow rate screen.
   For example, enter ***PPH*** for *pints per hour*

   e. If desired, enter text for the flow total unit of measure in the Tot Text text box. If the transmitter has a display, this text appears in the flow total screen.
   For example, enter ***PINT***

6. Choose OK.

Special units of mass for gases

The meter measures mass flow of gas or standard volumetric flow of a gas. Mass flow rate and volumetric flow rate are related by the density of the gas at a reference condition. To establish a special unit of mass for a gas, determine the density of the gas at a reference temperature, pressure, and composition. The meter should not be used to measure actual volumetric flow of a gas.

To establish a special unit of mass for measuring a gas:

1. In the Configure Transmitter Variables dialog box, select SPECIAL as the mass flow unit, then click OK.

> **⚠ CAUTION**
>
> **The meter should not be used to measure the actual volume of gases.**
>
> While a special unit for volume of gas may be established from the Configure Transmitter Variables dialog box or the Configure Special Units dialog box, it is not recommended.

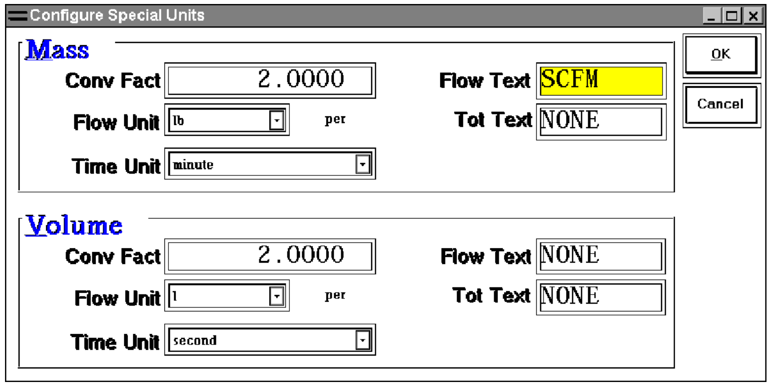
2. Open the Configure menu, then choose Special Units to open the Configure Special Units dialog box, depicted in:
   - **Figure 9-4**, page 97 for an RFT9739
   - **Figure 9-5**, page 97 for an RFT9712 or RFT9729
3. Enter the standard (or normal) density of the gas into the ProLink Conv Fact text box.

   The standard or normal density of the gas depends on a reference temperature, pressure, and composition.
   For example, one cubic foot of air has a normal density of 0.075 lb, so enter ***0.075***.

4. From the Time Unit drop-down list, choose the standard time unit for this measurement.
   For example, choose ***minute***.

5. Enter an abbreviation (one to four characters in length) for the special unit of measure in the Flow Text text box. If the transmitter has a display, this text appears in the flow rate screen. Common units are ***SCF*** (standard cubic feet) or ***Nm***^{3} (normal cubic meters), followed by a letter indicating the time unit being used.
   For example, enter ***SCFM*** for *standard cubic feet per minute* as shown in **Figure 9-6**.

Figure 9-6. RFT9739 for Gas



6. If desired, enter text for the flow total unit of measure in the Tot Text text box. If the transmitter has a display, this text appears in the flow total screen.
   For example, enter ***SCF***.

7. Choose OK.

9.3 Density units

The transmitter can measure and indicate density in any of the standard density units listed in **Table 9-4**, page 95.

After establishing the standard density unit, continue using it to configure density outputs, but use grams per cubic centimeter (g/cc) to configure slug flow limits and density calibration factors.

- To configure slug flow limits, see **Section 8.5** (page 81).
- To perform a density calibration, see **Section 14.4** (page 138).

API gravity

For an RFT9739 with software version 2.1 or higher, API gravity may be selected as the density unit. If degrees API is selected, scale the density output(s) to represent the range of densities for the Generalized Petroleum Products measured during the application.

If degrees API is selected as the density unit, the RFT9739 calculates standard volume at 1 atmosphere pressure (1 bar) for Generalized Petroleum Products according to API-2540. The RFT9739 calculates volume flow and volume total at 60˚F or 15˚C, depending on the temperature unit:

- If degrees Fahrenheit or degrees Rankine is selected as the temperature unit, the RFT9739 calculates volume at 60˚F.
- If degrees Celsius or degrees Kelvin is selected as the temperature unit, the RFT9739 calculates volume at 15˚C.

Configure Menu: Transmitter Variables *continued*

Density units

From the operating density (fluid density at line conditions) and operating temperature of a given petroleum fluid, the standard density (density at 60˚F or 15˚C) can be determined directly from API thermal expansion tables or by using API equation API-2540:

$$\rho_o = \rho_s \times [(-\alpha)\Delta T(1 + 0.8\alpha\Delta T)]$$

Where:

ρ_O	=	operating density
ρ_S	=	standard density
ΔT	=	temperature difference from base (standard) temperature (60˚F or 15˚C)
α	=	$\frac{K_0}{\rho_s^2} + \frac{K_1}{\rho_s}$ where K_0 and K_1 are constants

The equation requires significant calculation time to generate one reading. The RFT9739 software uses a simplification of this correlation to maximize sampling frequency of the measurement. Accuracy of the Micro Motion correlation is ±0.0005 g/cc relative to the API-2540 equation. After temperature correction to 60˚F or 15˚C, the density is converted to degrees API by the following expression:

$$\text{Degrees API} = \left(\frac{141.5}{\text{Standard specific gravity}}\right) - 131.5$$

The K_0 and K_1 in the API-2540 equation are constants characteristic of different types of Generalized Petroleum Products. Separate API tables exist for crude oils, distillates, gasolines, lube oils, and other products. The correlation in the RFT9739 software is based on the API constants for Generalized Petroleum Products.

The API equation used by the RFT9739 is valid for Generalized Petroleum Products from 2 to 95˚ API over an operating temperature range of 0 to 300˚F. As fluid density or operating temperature extends beyond these values, the RFT9739 correlation error will increase. Density calibration must be performed in units of g/cc for the API correlation to be correct.

API standard volume

If degrees API is selected as the density unit, the RFT9739 automatically calculates standard volume at 60˚F or at 15˚C based on the following expression:

$$\text{Standard volume} = \frac{\text{Mass flow}}{\text{Standard density}}$$

If a density unit other than degrees API is selected, the RFT9739 calculates gross volume at line conditions. Any standard engineering units for gross volume can be selected for standard volume.
Accuracy of standard volume measurement is dependent on the accuracy of the following factors:

- Mass flow rate measurement
- Operating density measurement
- Temperature measurement
- Transmitter correlation to API tables

The accuracy of each factor varies based on process operating conditions and the fluid being measured. For most Generalized Petroleum Products, standard volume will be accurate within ±0.5% of the flow rate. Because the temperature correction correlations for density are based on API equations, the standard volume output applies only to Generalized Petroleum Products or materials that exhibit the same thermal expansion characteristics as Generalized Petroleum Products.

9.4 Temperature and pressure units

The transmitter can measure and indicate temperature in any of the standard units listed in **Table 9-5**, page 95. After selecting the temperature unit of measure, continue using the same units to configure outputs, process limits, calibration factors, and characterization factors.

A Version 2 or 3.0 RFT9739 can measure and indicate pressure and viscosity in any of the standard units listed in **Table 9-3**, page 94, and **Table 9-8**, page 96. After selecting the pressure and/or viscosity units of measure, continue using the same units to configure outputs, process limits, calibration factors, and characterization factors.

9.5 Flow cutoffs

Enter mass or volume flow cutoffs into the Cutoff text boxes under Mass Flow or Volume Flow.

In some sensor installations, process conditions may cause the transmitter to read slightly nonzero values when the process is at a no-flow state. Flow cutoffs allow the user to filter out noise by defining the measured value below which the transmitter frequency/pulse and digital outputs indicate zero flow.

A flow cutoff is the lowest flow rate at which the transmitter produces a nonzero digital flow reading and frequency/pulse output. If the flow signal drops below the flow cutoff:

- The transmitter frequency/pulse output goes to 0 Hz
- The transmitter internal totalizers stop counting
- The transmitter indicates zero flow during polling from a host controller

A default flow cutoff is entered into the transmitter at the factory. This number can be adjusted by the customer, using the ProLink program, to achieve the filter effect described above.

If the transmitter is an RFT9739 measuring viscosity, the flow cutoff should be greater than the flow rate at which the process achieves the maximum turndown pressure drop specified for the DP cell (the minimum pressure drop that the DP cell can accurately measure). For maximum turndown ratings of individual DP cells, refer to manufacturer's specifications.

Example:

Given: The RFT9739 is configured to calculate viscosity in centistokes. The maximum pressure drop measurable by the DP cell is 33 psid, at a mass flow rate of 160 grams per second (g/sec). The maximum turndown specified for the DP cell is 40:1. To minimize measurement error, the flow cutoff is set to the flow rate that corresponds to a DP turndown of 20:1.

Problem: The frequency/pulse output should indicate zero flow when the mass flow rate drops below 5% of 160 g/sec.

Solution:

Mass flow cutoff = 0.05 * 160 g/sec = 8 g/sec

Enter 8 into the Mass Flow Cutoff text box in the Configure Transmitter Variables dialog box.

Milliamp outputs have their own flow cutoffs, which remain unaffected by the flow cutoffs established for the frequency/pulse output and internal totalizers. **Section 10.3** (page 112) explains how to set flow cutoffs for milliamp outputs.

If the transmitter is a Version 3 RFT9739, the ProLink program provides a "live zero" display, which enables the user to read the mass flow rate when it drops below the cutoff that is set for mass flow. **Section 15.4** (page 158) describes how live zero can be used in the diagnostic process.

9.6 Flow direction

Open the Direction list box under Flow to configure milliamp outputs, the frequency/pulse output, and internal totalizers for flow direction. The option that is chosen (forward, reverse, or bi-directional), determines how the outputs and totalizers will react when fluid flows through the sensor.

- The flow direction arrow on the sensor is considered the "forward" flow direction (when the sensor is installed and properly wired). However, the flowmeter will measure fluid flow accurately in either direction.
- **Table 9-9** lists how outputs and totalizers are affected by the option chosen from the Direction list box. Note that NAMUR-compliant transmitters are affected differently than transmitters that are not NAMUR-compliant.
- **Table 9-10**, page 105, lists software versions and dates for NAMUR-compliant transmitters.

Table 9-9. Effect of flow direction on outputs

Fluid flow direction	Output or totalizer	Option chosen from Direction list box		
		Forward	**Reverse**	**Bi-directional**
Fluid flowing in *same direction* as flow arrow on sensor	Milliamp outputs, transmitters that are not NAMUR-compliant	Output increases as flow rate increases	• 4-20 mA output goes to 2 mA • 0-20 mA output goes to 0 mA	• Output increases as flow rate increases • 4-20 mA output remains at or above 4 mA
	Milliamp outputs, NAMUR-compliant transmitters	Output increases as flow rate increases	• 4-20 mA output goes to 3.8 mA • 0-20 mA output goes to 0 mA	• Output increases as flow rate increases • 4-20 mA output remains at or above 4 mA
	Frequency/pulse output	Output increases as flow rate increases	Output remains at 0 Hz	Output increases as flow rate increases
	Control output[1] Flow direction output[2]	Output is 15 VDC	Output is 15 VDC	Output is 15 VDC
	Internal totalizers	Flow totals increase	Flow totals remain constant	Flow totals increase
Fluid flowing in *opposite direction* from flow arrow on sensor	Milliamp outputs, transmitters that are not NAMUR-compliant	• 4-20 mA output goes to 2 mA • 0-20 mA output goes to 0 mA	Output increases as flow rate increases	• Output increases as flow rate increases • 4-20 mA output remains at or above 4 mA
	Milliamp outputs, NAMUR-compliant transmitters	• 4-20 mA output goes to 3.8 mA • 0-20 mA output goes to 0 mA	Output increases as flow rate increases	• Output increases as flow rate increases • 4-20 mA output remains at or above 4 mA
	Frequency/pulse output	Output remains at 0 Hz	Output increases as flow rate increases	Output increases as flow rate increases
	Control output[1] Flow direction output[2]	Output is 0 VDC	Output is 0 VDC	Output is 0 VDC
	Internal totalizers	Flow totals remain constant	Flow totals increase	Flow totals decrease

[1]RFT9739 control output configured for flow direction
[2]RFT9712 and RFT9729 only

Table 9-10. Software versions and dates for NAMUR compliance

Model	Milliamp outputs	Software version	Effective date for NAMUR
Series 3000	NAMUR (configurable)	All	Not applicable
RFT9739	NAMUR	3.8 and higher	November 29, 1999
IFT9701	NAMUR	1.3 and higher	October 29, 1999
IFT9703	NAMUR	1.3 and higher	October 29, 1999
5300	Fieldbus	Not applicable	Not applicable
RFT9709	Old MMI standard	Not applicable	Not applicable
Japan transmitter	NAMUR	3.8 and higher	November 29, 1999
RFT9712	Old MMI standard	Not applicable	Not applicable

9.7 Internal damping

Enter internal damping values into the Damping text boxes under Flow, Density, and Temperature.

Internal damping filters out noise or the effects of rapid changes in the variable without affecting measurement accuracy. All transmitters use a digital emulation of a Resistance Capacitance low-pass filter.

- The RFT9739 implements a selective digital filter on the flow, density, and temperature outputs.
- The IFT9701 and IFT9703 implement damping by emulating the effect of a low-pass resistance-capacitance (RC) filter on the flow output.
- The RFT9712 and RFT9729 implement damping by emulating the effect of a low-pass resistance-capacitance (RC) filter on the flow and density outputs.

Internal damping

The damping value is the filter coefficient that approximates the time required for the output to achieve 63% of its new value in response to a step change at the input. The actual time depends on many factors, including sensor type and density of the process fluid. The transmitter rounds down the chosen damping value to the nearest available programmed filter coefficient.

Table 9-11 lists programmed filter coefficients for internal damping on process variables indicated by RFT9739, IFT9701, IFT9703, RFT9712, and RFT9729 transmitters.

For an RFT9739, added damping can be placed on milliamp outputs configured to indicate flow, temperature, or density. For more information on milliamp outputs, see **Section 10.3** (page 112).

Table 9-11. Filter coefficients for internal damping on process variables

RFT9739			IFT9701 IFT9703	RFT9712/ RFT9729
Flow	**Density**	**Temperature**	**Flow**	**Flow and density**
0	-	0	0.1	0.05
0.1	0.5	2	0.2	0.1
0.2	1	4	0.4	0.2
0.4	2	8	0.8	0.4
0.8	4	16	1.6	0.8
1.6	8	32	3.2	1.6
3.2	16	64	6.4	3.2
6.4	32	128	12.8	6.4
12.8	64	256		12.8
25.6	128	512		
51.2	256	1024		
102.4	512	2048		
204.8	1024	4096		
409.6	2048	8192		
819.2	4096	16384		
1638.4	8192	32768		

10 Configure Menu: Transmitter Outputs

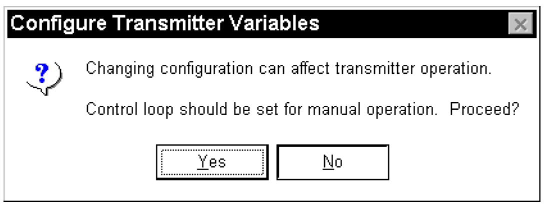
10.1 Overview

⚠ CAUTION

Failure to set control devices for manual operation before characterization could cause transmitter output error.

Before opening the File, Configure, Calibrate, or Applications menus, set process control devices for manual operation.

Whenever a dialog box such as the one depicted below appears, isolate the transmitter from devices that used transmitter outputs for process control, then choose Yes.



To configure transmitter outputs, open the Configure menu, then choose Transmitter Outputs to open the Configure Outputs dialog box. The Configure Outputs dialog box appears, as depicted in:

- **Figure 10-1** for an RFT9739
- **Figure 10-2** for an IFT9701 or IFT9703
- **Figure 10-3** for an RFT9712 or RFT9729

While configuring transmitter outputs, write values in the appropriate Transmitter Configuration Worksheet, shown in **Appendix E**, page 183.

Figure 10-1. Configure Outputs dialog box for RFT9739

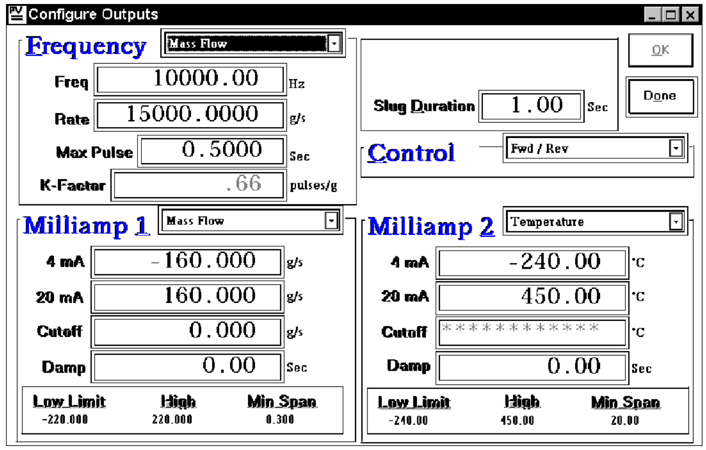


Figure 10-2. Configure Outputs dialog box for IFT9701/IFT9703

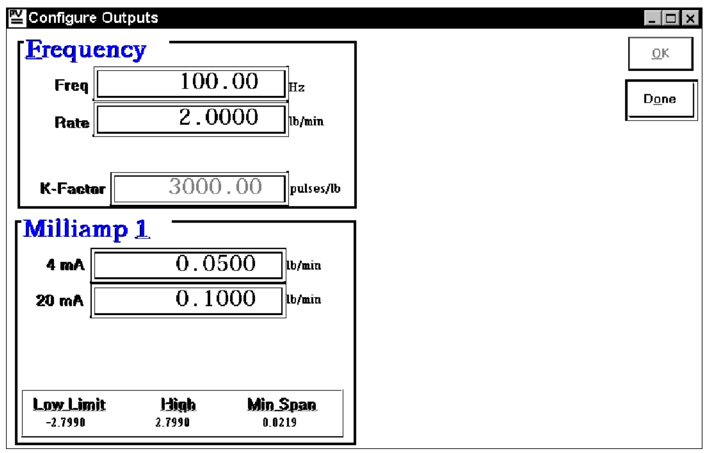
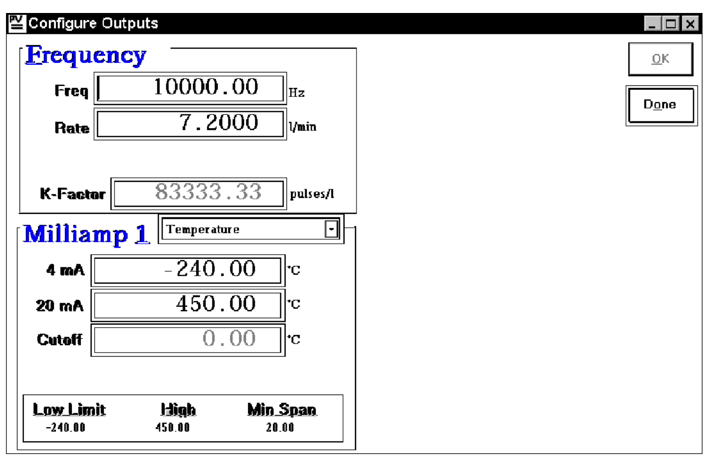


Figure 10-3. Configure Outputs dialog box for RFT9712/RFT9729



RFT9739 outputs

The RFT9739 has two milliamp outputs, a frequency/pulse output, a control output, fault indicators, and a slug duration.

- Primary and secondary milliamp outputs can produce a 0-20 or 4-20 mA current. Milliamp outputs can independently indicate mass flow, volume flow, density, temperature, differential pressure, viscosity, event 1 status or event 2 status.
- The frequency/pulse output can indicate mass flow rate, mass flow total, volume flow rate, or volume flow total.
- The 0/15 V control output can indicate forward or reverse flow; transmitter zeroing in progress; any fault indication; event 1 status or event 2 status.
- Outputs can produce upscale or downscale fault indicators. Most RFT9739 can also produce internal zero or last measured value fault indicators.
- The slug duration is a set period of time during which flow outputs hold their last measured value after density goes outside a slug flow limit.

Assigning a process event to an RFT9739 output changes the function of the output, and changes the procedure for configuring the output. To assign an event to an output, see **Chapter 12**.

IFT9701/IFT9703 outputs

The IFT9701 and the IFT9703 have a 4-20 mA output and a pulse output:

- The milliamp output can indicate mass or volume flow rate.
- The pulse output can indicate mass or volume flow rate.

RFT9712/RFT9729 outputs

The RFT9712 and RFT9729 have a 4-20 mA output, a frequency/pulse output, and a flow direction output:

- The milliamp output can indicate flow, density, or temperature.
- The frequency/pulse output can indicate mass flow rate or volume flow rate.
- The 0/15 V flow direction output can indicate forward or reverse flow.

10.2 Frequency/pulse output

The frequency/pulse output goes to any frequency-based totalizer or flow computer.

The output requires frequency/flow rate scaling when indicating flow rate, or number of pulses per flow total when indicating the flow total. The K-factor indicates the number of pulses per unit of flow. Regardless of the scaling, the frequency is always proportional to the flow rate.

For the RFT9739:

- The pulse width is programmable for low frequencies.
- A process variable (mass or volume) can be assigned to the frequency/pulse output. The frequency or number of pulses is always proportional to a flow rate, regardless of the assigned process variable. The output for each variable is described in **Table 10-1**.

Table 10-1. RFT9739 Frequency/pulse variables and output

Variable	Frequency/pulse output
Mass Flow	A frequency proportional to the mass flow rate
Mass Total*	A given number of pulses per mass flow unit
Volume Flow	A frequency proportional to the volume flow rate
Volume Total*	A given number of pulses per volume flow unit

*Not available with RFT9739 software versions 3.0-3.5.

Frequency/pulse output scaling

Use the Frequency and Rate text boxes to scale the frequency/pulse output:

- If the output indicates flow rate, enter a frequency and a flow rate. See Example 1, below. Use the units of measure that were configured in **Chapter 9**, indicated by the labels next to the text boxes. (To change the units of measure, see **Section 9.2**, page 93.)
- If the output indicates flow total, enter the number of pulses you wish to indicate a certain mass or flow. See Example 2, below. (RFT9739 software versions 3.0 through 3.5 do not support flow total over the frequency/pulse output.)

Example 1:

Scaling the frequency output to indicate mass flow rate:

Given: The RFT9739 frequency/pulse output represents mass flow. The RFT9739 maximum frequency output is 10 kHz.

Problem: Scale the frequency output so that 4000 Hz represents a mass flow rate of 400 grams per minute (g/min).

Solution:

- Enter a value of 4000 into the Frequency text box.
- Enter a value of 400 into the Rate text box.

Since 4000/400 = 10, the frequency is 10 times as large as the proportional flow rate. Therefore, 1 Hz represents a mass flow rate of 0.10 g/min. The maximum output of 10,000 Hz represents a flow rate of 1000 g/min or 1 kg/min.

Example 2:	Scaling the pulse output to represent volume flow total: *Given:* The RFT9739 frequency/pulse output represents volume total. *Problem:* Scale the pulse output so that 3000 pulses represents an accumulated volume (a volume flow total) of 150 cubic meters. *Solution:* • Enter a value of 3000 into the Frequency text box. • Enter a value of 150 into the Rate text box. Since 3000/150 = 20, the frequency, or number of pulses, is 20 times as large as the proportional flow total. Therefore, each pulse represents a volume flow total of 0.05 cubic meters.

Maximum pulse width for RFT9739

If the configuration applies to an RFT9739, enter the frequency pulse width into the Max Pulse text box.

The RFT9739 frequency/pulse output operates in different modes at high and low frequencies. At high frequencies, the output produces a square wave with an approximate 50% duty cycle (the ON and OFF states are of approximately equal duration). High-frequency counters such as frequency-to-voltage converters, frequency-to-current converters, and Micro Motion peripherals usually require such an input.

At low frequencies, the output can revert to a constant pulse width in the ON state, with an OFF state that varies in relationship to the actual frequency. Electromechanical counters and PLCs that have low-scan cycle rates generally use an input with a constant ON state and a varying OFF state. Most low frequency counters have a specified requirement for the maximum pulse width.

The user can program the frequency/pulse output by setting the ON state at a specified pulse width from 0.012 to 0.500 seconds to accommodate the requirements of a particular counting device. The programmed pulse width defines a crossover frequency:

$$\text{Crossover frequency} = \frac{1}{2 \times \text{pulse width}}$$

Above the crossover frequency, the output has a 50% duty cycle. Below the crossover frequency, the output has a constant ON state (0 V) duration.

- The lowest available crossover frequency is 1 Hz, when the pulse width is 0.500 seconds.
- The highest available crossover frequency is 41.67 Hz, when the pulse width is 0.012 seconds.

Example:	*Given:* The RFT9739 frequency/pulse output goes to a totalizer with a specified pulse width requirement of 50 milliseconds. The maximum frequency input to the totalizer is 10 pulses per second. *Problem:* The RFT9739 maximum frequency output exceeds the totalizer specifications. *Solution:* Since 50 milliseconds equals 0.05 seconds (50 * 0.001 = 0.05), the totalizer pulse width requirement is 0.05. Enter a value of 0.050 into the Max Pulse text box in the Configure Outputs dialog box. For frequency less than 10 Hz, the frequency output will have a 50 millisecond ON state. For frequency higher than 10 Hz, the frequency output will be a square wave with a 50% duty cycle.

K-factor

The K-factor enables the user to read the frequency or number of pulses that is proportional to a unit of flow.

As described above, scaling the frequency/pulse output requires entry of frequency and rate. The output is scaled so the frequency or number of pulses per unit of time is always proportional to the flow rate, regardless of the process variable assigned to the output.

10.3 Milliamp outputs

The RFT9739 has primary and secondary milliamp outputs that independently produce a 0-20 or 4-20 mA current. The IFT9701, IFT9703, RFT9712, and RFT9729 have a single 4-20 mA output. Milliamp outputs can go to controllers, PLCs, or recording devices.

- Milliamp output variables require a lower range value and an upper range value.
- Each milliamp output can have a flow cutoff if mass flow or volume flow is the output variable.
- Milliamp outputs from the RFT9739 can have added damping if the output variable is mass flow, volume flow, density, or temperature.

Milliamp output variables

For an RFT9739, RFT9712, or RFT9729, use the drop-down list boxes under Milliamp, Milliamp 1, and Milliamp 2 to select variables indicated by milliamp outputs.

The RFT9739 0-20 or 4-20 mA outputs can independently indicate mass flow, volume flow, density, temperature, differential pressure, viscosity, event 1 status or event 2 status.

- To select variables indicated by RFT9739 mA outputs, use the drop-down list boxes under Milliamp 1 and Milliamp 2
- To configure the RFT9739 milliamp outputs spans, see the transmitter instruction manual.

Milliamp outputs

The IFT9701 4-20 mA output can indicate mass flow or volume flow.

- To select variables indicated by the IFT9701 or RFT9703 mA output, choose a mass or volume flow unit from the Configure Transmitter Variables dialog box.
- The flow unit that is chosen determines whether the IFT9701 4-20 mA output will represent mass flow or volume flow.
- To choose a mass or volume flow unit, see **Section 9.2** (page 93).

The RFT9712 and RFT9729 4-20 mA output can indicate mass flow, volume flow, density, or temperature.

- To select variables indicated by the RFT9712 or RFT9729 mA output, use the drop-down list box under Milliamp 1.
- If Mass Flow is chosen, the type of flow (mass or volume) indicated by the output is dependent on the flow unit of measure that was selected in the Configure Transmitter Variables dialog box.
- To choose a mass or volume flow unit of measure, see **Section 9.2** (page 93).

Range limits

Use the 4 mA and 20 mA text boxes to program the range of process variables assigned to milliamp outputs. The range represents values of the variable at 4 mA and 20 mA if the output produces a 4-20 mA current, or at 0 mA and 20 mA if the output produces a 0-20 mA current.

Low Limit, High Limit, and Minimum Span, displayed at the bottom of the dialog box, indicate sensor limits in the measurement units established for milliamp output variables.

- The value entered into the 4 mA text box must be lower than the value entered into the 20 mA text box.
- The value entered into the 20 mA text box must be higher than the displayed low limit and lower than the displayed high limit.
- The difference between the values entered into the text boxes must be greater than the displayed minimum span.

Milliamp output flow cutoffs for RFT9739 and RFT9712/RFT9729

If the configuration applies to an RFT9739, RFT9712, or RFT9729, enter flow cutoffs for milliamp outputs into the Cutoff text boxes. Flow cutoffs enable the user to filter out noise by defining the level below which milliamp outputs will indicate zero flow.

If a milliamp output indicates mass flow or volume flow, the user can define a flow cutoff for the output. A flow cutoff is the lowest flow rate at which the milliamp output indicates nonzero flow. If the flow signal drops below the flow cutoff, the output goes to the current level that indicates zero flow.

Flow cutoffs for milliamp outputs remain unaffected by the flow cutoff for the transmitter frequency/pulse output and internal totalizers. To assign a flow cutoff to the frequency/pulse output and internal totalizers, use the Configure Transmitter Variables dialog box.

Example:	*Given:* The primary milliamp output from an RFT9739 indicates mass flow, and has programmed limits of zero flow at 4 mA, and 100 grams per minute (g/min) at 20 mA. *Problem:* Configure the output to go to 4 mA when the mass flow rate goes below 2.00 g/min. *Solution:* Enter a value of 2.00 into the Cutoff text box under Milliamp 1. An output of 4.32 mA indicates a mass flow rate of 2.00 g/min. The primary milliamp output goes to 4 mA if the flow rate drops below 2.00 g/min.

Added damping on RFT9739 outputs

Use the Damp text boxes to put a secondary digital filter on milliamp outputs from the RFT9739. The secondary filter adds damping to internal damping on flow, temperature, and density. If two or three outputs indicate the same variable, added damping enables more than one damping value on the variable. Damping filters the effects of rapid changes in the variable.

The added damping value is the coefficient of the secondary filter. The actual time depends on many factors, including sensor type, density of the process fluid, and the duration of the digital time constant. The transmitter rounds down the entered value to the nearest available programmed filter coefficient.

Table 10-2 lists programmed filter coefficients for added damping on flow, density, and temperature as indicated by the milliamp outputs.

Table 10-2. Filter coefficients for added damping on RFT9739 milliamp outputs

Mass or volume flow	Temperature	Density
0	0	0.5
0.1	2	1
0.2	4	2
0.4	8	4
0.8	16	8
1.6	32	16
3.2	64	32
6.4	128	64
12.8	256	128
25.6	512	256
51.2	1024	512
102.4	2048	1024
204.8	4096	2048
409.6	8192	4096
819.2	16384	8192
1638.4	32768	

Example:	*Given*: Primary milliamp and frequency/pulse outputs indicate the mass flow rate. *Problem*: To compensate for noise from a slow-acting valve, approximately two seconds of damping need to be added to the existing 0.8 second of internal damping on mass flow as indicated by an RFT9739. *Solution*: Enter a value of 2.00 into the Damp text box under Milliamp 1. The RFT9739 damps the frequency/pulse output at a filter coefficient of 0.8 second. After rounding down to the nearest programmed coefficient of the secondary filter, the RFT9739 damps the primary milliamp output at approximately 0.8 + 1.6 seconds, or 2.4 seconds.

10.4 Fault indicators for RFT9739

Fault indicators control milliamp outputs and the frequency/pulse output when the RFT9739 cannot accurately measure process variables.

For Version 2 and earlier RFT9739 transmitters, fault indicators can be configured using the ProLink program (see below). Later versions of the RFT9739 require setting of hardware switches inside the transmitter. See the instruction manual that was shipped with the transmitter.

To use fault indicators to troubleshoot the flowmeter, see **Section 7.2** (page 56).

Configuring fault indicators for a Version 2 or earlier RFT9739

If the RFT9739 is a Version 2 or earlier model, open the Fault Indicator list box to select from four fault indicators for milliamp outputs and the frequency/pulse output from the RFT9739. On field-mount transmitters, regardless of the fault indicator that is chosen, the transmitter diagnostic LED blinks 4 times per second to indicate a fault condition.

Downscale
Milliamp outputs go to 0 mA if they produce a 0-20 mA current, or to 2 mA if they produce a 4-20 mA current; the frequency/pulse output goes to 0 Hz.

Upscale
Milliamp outputs go to 22 mA; the frequency/pulse output goes to 15 kHz.

Last measured value
Outputs hold the values measured immediately before the fault condition occurred.

Internal zero
If the user has scaled a milliamp output so it represents zero flow at some setting above the minimum 0 mA or 4 mA current level, the output goes to the scale setting that represents zero flow. The frequency/pulse output goes to 0 Hz.

10.5 Slug duration for RFT9739

After using the Characterize dialog box to program slug flow limits (see **Section 8.5**, page 81), open the Transmitter Outputs dialog box to set a slug duration for the RFT9739. At the Slug Duration text box, enter the desired slug duration in seconds.

In some applications, slug flow typically occurs for short periods of time. If the slug flow condition ceases in less than one minute, the RFT9739 can continue holding the last accurately measured flow value until process density stabilizes within the programmed slug flow limits. The slug duration specifies the amount of time the transmitter indicates the last measured flow value before indicating zero flow.

10.6 Control output from RFT9739

The RFT9739 control output produces a digital signal level, which has a 15 V OFF state and a 0 V ON state. The control output can indicate flow direction, transmitter zeroing in progress, faults, event 1 or event 2.

Open the Control list box to select a control output variable.

Flow direction
If the control output indicates flow direction, the output is low (0 V) when indicating reverse flow, and high (+15 V) when indicating forward flow. At zero flow, the output remains low or high, depending on the flow direction before the flow rate reached zero.

- When configured to indicate flow direction, the control output is affected by the flow cutoff. If the flow signal drops below the flow cutoff, the output remains low or high, depending on the flow direction before the flow rate reached the cutoff.
- Configure the control output to indicate flow direction if the transmitter connects to a Micro Motion peripheral device.

Zero in progress
If the control output indicates zero in progress, the output is low (0 V) when zeroing is in progress, and high (+15 V) at all other times. On field-mount transmitters, whether or not the control output is configured to indicate transmitter zeroing in progress, the transmitter diagnostic LED remains on during transmitter zeroing.

Faults
If the control output indicates faults, the output is low (0 V) when indicating a fault condition, and high (+15 V) when indicating normal operation. Whether or not the control output is set to indicate faults, the transmitter diagnostic LED blinks 4 times per second to indicate a fault condition. For a rack-mount transmitter, “ERR” flashes on display.

Event 1 and event 2
Assigning event 1 or event 2 to the control output requires output configuration and event parameters configuration. To assign an event to the control output:

1. Open the Configure menu, then choose Events.
2. Configure event parameters as described in **Section 12.2**, page 127.

11 Configure Menu: Transmitter Information

11.1 Overview

The Transmitter Information dialog box provides information about the transmitter and sensor. Some information is entered by the user and can be changed; some fields are read-only.

The Transmitter Information dialog box is divided into distinct "frames": Transmitter Database, Pressure Input, Burst, and Sensor Database.

- The Transmitter Database frame contains text boxes for the transmitter HART tag, serial number, configuration date, polling address, a description, and a message. Display boxes indicate the Micro Motion device identifier and transmitter software revision. If the transmitter is a Version 3 RFT9739 in security mode 8, display boxes also indicate security event register values.
- For an RFT9739, the Pressure Input frame contains a drop-down list box that allows the user to configure the transmitter for pressure compensation or viscosity measurement.
- For an RFT9739, RFT9712, or RFT9729, the Burst frame contains option buttons that enable the transmitter to communicate in burst mode under HART protocol at 1200 baud.
- For an RFT9739, RFT9712, or RFT9729, the Sensor Database frame contains text boxes for entering the sensor serial number and sensor type, and list boxes for choosing options that describe the sensor lange, flow tube construction material, and liner material.

The user can change most transmitter information without affecting flowmeter operation. However, the transmitter does use the data in the Tag, Comm Addr, and Pressure Input fields. More information is provided throughout this chapter.

To open the Transmitter Information dialog box, open the Configure menu, then choose Transmitter Information. The Transmitter Information dialog box appears, as depicted in:

- **Figure 11-1** for an RFT9739
- **Figure 11-2** for an IFT9701 or IFT9703
- **Figure 11-3** for an RFT9712 or RFT9729

Record transmitter information in the appropriate Transmitter Configuration Worksheet, shown in **Appendix E**, page 183.

Figure 11-1. Transmitter Information dialog box for RFT9739

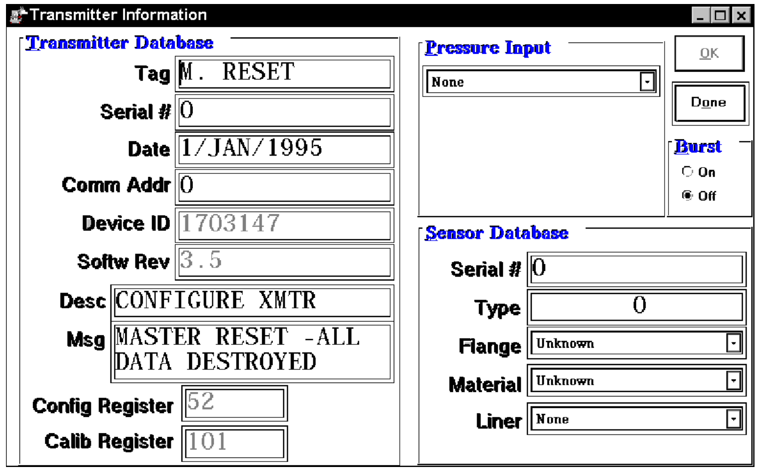


Figure 11-2. Transmitter Information dialog box for IFT9701 or IFT9703

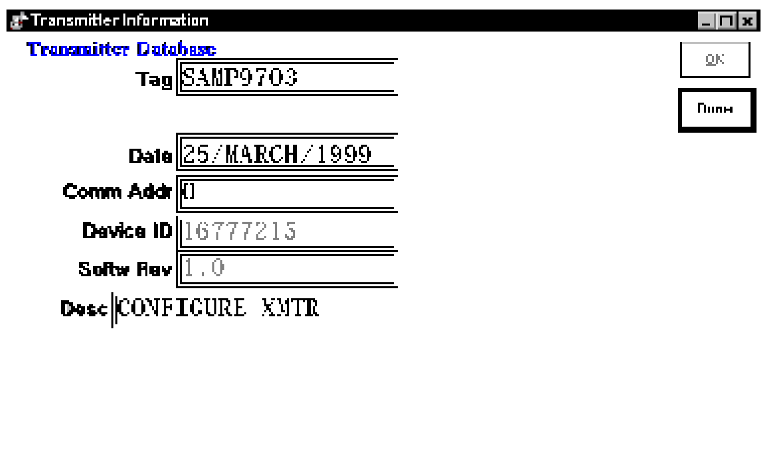
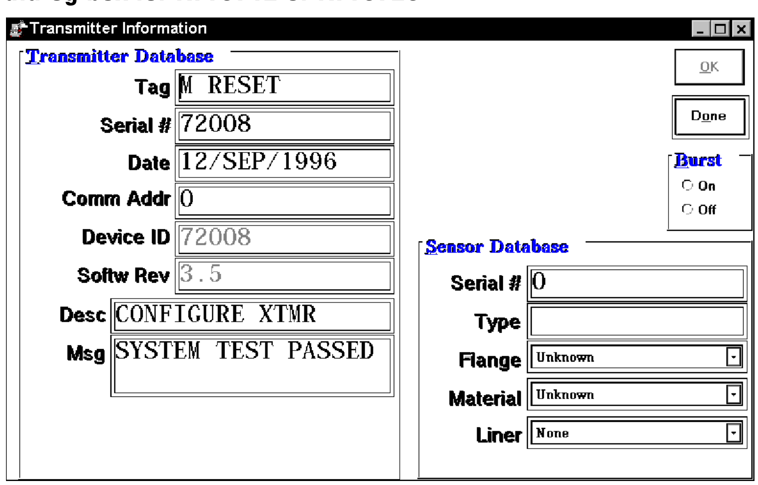


Figure 11-3. Transmitter Information dialog box for RFT9712 or RFT9729



11.2 Transmitter database

The transmitter database area of the Transmitter Information dialog box contains text boxes for entering the HART tag, transmitter serial number, polling address, configuration date, a description and message, and display boxes that show the transmitter serial number and the software revision level.

Tag
Enter up to eight characters that identify the transmitter when it communicates with other devices in a HART-compatible network. Up to 32 transmitters can participate in an RS-485 multidrop network using HART protocol and unique tag names.

Serial #
Enter the serial number from the serial number tag attached to the transmitter housing. The number should match the serial number that appears dimmed in the Device ID display box.

Date
Enter a 1-digit or 2-digit code for the day, a 3-letter code for the month, and a 4-digit code for the year, separated by slashes (/). ProLink is year 2000 compliant. When shipped from the factory, the date is the day on which the flowmeter was calibrated in the Micro Motion Flow Calibration Lab.

Comm Addr
Enter an integer from 0 to 15. The communication address (polling address) identifies the transmitter when it communicates with the ProLink program or with network devices. The polling address is required for the transmitter to communicate with other devices via the Bell 202 (milliamp) or RS-485 wiring loop.

- For HART protocol, enter a polling address from 0 to 15. For Bell 202 communication, a polling address of 1 to 15 fixes the primary milliamp output at 4 mA. A polling address of 0 enables the primary milliamp output to represent a process variable.
- For Modbus protocol, enter a polling address from 1 to 15.

Device ID
The Device ID display box shows the serial number programmed into the transmitter. The number shown should match the transmitter serial number entered into the Serial # text box.

Softw Rev
The Softw Rev display box shows the transmitter software version.

Desc
Enter any description or message from 1 to 16 characters. This field is for user information only, and is not used by the transmitter.

Msg
Enter any description or message from 1 to 32 characters. This field is for user information only, and is not used by the transmitter.

Config and Calib Registers

For custody transfer applications, security event registers enable the user to determine whether the configuration or calibration of the RFT9739 has been changed.

- Security event register display boxes will only be displayed if the transmitter is a Version 3 RFT9739.
- Regardless of the transmitter security mode, the security event registers count changes to the parameters listed in **Table 11-1**.
- Each security event register will count to 999, then roll over to zero (0).

Table 11-1. Parameters that increment event registers

Configuration register	see page:
Range values for milliamp outputs	113
Variables assigned to milliamp outputs	112
Variable assigned to control output	117
Mass and volume flow cutoffs	102
Internal damping	105
Flow direction	104
Milliamp output trim	151
Master reset (see transmitter instruction manual)	

Calibration register	see page:
Mass and volume measurement units	96
Frequency/pulse output scaling factors	110
Flow calibration factor	73
Flowmeter zeroing	133
Density calibration factors	78, 80
Density calibration	138
Pressure compensation factors	86
Meter factors for flow and density	131

11.3 Pressure input for RFT9739

The pressure input option allows the user to select the appropriate input for either pressure compensation or viscosity measurement. Open the Pressure Input drop-down list:

- Options in the drop-down list are described below.
- Based on the user's selection, a HART tag name or a 4-20 mA range may need to be entered for the pressure device.

The RFT9739 accepts pressure input signals from a pressure transmitter for viscosity measurement or pressure compensation. If the signal from the pressure transmitter fails, both of the following occur:

- The RFT9739 continues to operate in a non-fault mode.
- A "Pressure Input Failure" message is shown on the transmitter display (if it has one).

Primary viscosity

The RFT9739 polls for differential pressure values from a HART-compatible DP cell as a primary master.

- The user must enter the HART tag name for the desired transmitter.
- The user must perform a viscosity calibration, as described in **Section 14.5**, page 148.

Secondary viscosity

The RFT9739 polls for differential pressure values from a HART-compatible DP cell as a secondary master.

- The user must enter the HART tag name for the desired transmitter.
- The user must perform a viscosity calibration, as described in **Section 14.5**, page 148.

Pressure input for RFT9739

Pressure compensation
If the RFT9739 is configured for pressure compensation, flowmeter measurement will not be compensated for pressure during a pressure input failure.

Primary pressure compensation
The RFT9739 polls for gauge pressure values from the HART-compatible pressure cell as a primary master.

- The user must enter the HART tag name for the desired pressure transmitter.
- The user must configure the RFT9739 for pressure compensation, as described in **Section 8.7**, page 86.

Secondary pressure compensation
The RFT9739 polls for gauge pressure values from the HART-compatible pressure cell as a secondary master.

- The user must enter the HART tag name for the desired pressure transmitter.
- The user must configure the RFT9739 for pressure compensation, as described in **Section 8.7**, page 86.

Analog input viscosity
The RFT9739 accepts the 4-20 mA signal for differential pressure values from a DP cell. See the RFT9739 instruction manual for pressure input wiring instructions.

- The user must set values represented by the input at 4 mA and 20 mA, as described in **Section 10.3**, page 112.
- The user must perform a viscosity calibration, as described in **Section 8.7**, page 86.

Analog input pressure compensation
The RFT9739 accepts the 4-20 mA signal for gauge pressure values from a pressure cell. See the RFT9739 instruction manual for pressure input wiring instructions.

- The user must set values represented by the input at 4 mA and 20 mA, as described in **Section 10.3**, page 112.
- The user must configure the RFT9739 for pressure compensation, as described in **Section 8.7**, page 86.

Modbus viscosity
The Modbus-compatible host controller downloads differential pressure values to the RFT9739 by writing an integer that represents differential pressure to input register 40007, or by writing an IEEE 754 floating point value that represents differential pressure to register pair 20257-20258.

The user must perform a viscosity calibration, as described in **Section 14.5**, page 148.

Modbus pressure compensation
The Modbus-compatible host controller downloads pressure values to the RFT9739 by writing an integer that represents gauge pressure to input register 40007, or by writing an IEEE 754 floating point value that represents pressure to register pair 20257-20258.

The user must configure the RFT9739 for pressure compensation, as described in **Section 8.7**, page 86.

Control output
The RFT9739 control output can be configured to indicate pressure input failure. In this configuration, if an input failure is indicated, one of the following has occurred:
- The mA or digital input from the pressure transmitter is out of range (less than 2 mA or greater than 22 mA).
- The pressure device failed to respond to a HART command.

11.4 Burst control for RFT9739 and RFT9712/RFT9729

Use the Burst option buttons to determine whether the RFT9739, RFT9712, or RFT9729 will communicate in burst mode under HART protocol. The IFT9701 and IFT9703 do not support burst mode data transmission.

Before switching burst mode ON, configure the transmitter to use HART protocol (see the transmitter instruction manual), then use a Model 275 HART Communicator or AMS with the transmitter to configure the burst mode.

If ON is chosen, the transmitter bursts data at regular intervals via the fixed 4 mA or RS-485 wiring loop. The interval varies according to the baud rate. At 1200 baud, the host receives two updates every 3.7 seconds.
- The RFT9739 can burst HART commands 1, 2, 3, 33, and 110. The default command after a master reset is 2.
- The RFT9712 and RFT9729 can burst HART commands 1, 2, 3, and 110. The default command after a master reset is 1.
- HART commands are listed in **Table 11-2**.

- On a multidrop network, only one transmitter at a time may be in burst mode. Burst mode can be enabled regardless of the transmitter address.
- When using the Bell 202 standard, the transmitter primary variable milliamp output will become fixed if the transmitter has an address other than zero (0).

For RFT9712 and RFT9729 transmitters, when the display is opened, neither button will be selected, as shown in **Figure 11-3**, because the ProLink software cannot predetermine the RFT9712 or RFT9729 burst state.

The burst mode can be enabled or disabled by the user with the appropriate button in the ProLink Transmitter Information dialog box. The burst option (Burst On/Off) cannot be changed during off-line configuration.

Table 11-2. HART commands for burst mode

HART command	Description
1	Read primary variable
2	Read mA1 current and percent of range
3	Read dynamic variables and mA1 current
33	Read transmitter variables
110	Read all dynamic variables

11.5 Sensor database for RFT9739 and RFT9712/RFT9729

The Sensor Database describes the sensor that operates with the RFT9739, RFT9712, or RFT9729. The user can change the sensor database without affecting transmitter outputs or the flowmeter configuration.

Serial #
Enter the serial number from the serial number tag attached to the sensor housing.

Type
Enter a description of the sensor type (such as CMF200M for an ELITE CMF200 sensor with 316L stainless steel flow tubes).

Flange, material, and liner
Open the list boxes in the Sensor Database frame to select from options that describe the sensor flange type, flow tube construction material, and flow tube liner material (see **Table 11-3**). Default options are shown if the transmitter has not been configured. The last-chosen option is shown if the transmitter has been configured.

Table 11-3. Flange types, tube and liner material options

Flange		Material	Liner
Sanitary	ANSI 600	316L	None
PN40	ANSI 900	Hastelloy-C	PTFE
JIS 10K	Union	Monel	Halar
ANSI150	SPECIAL	Tantalum	SPECIAL
ANSI 300	Unknown	SPECIAL	Unknown
		Inconel*	
		Unknown	

*The RFT9712 will not accept this setting

12 Configure Menu: Events

12.1 Overview

Assigning Event 1 or Event 2 to an RFT9739 output changes the function of the output. If associated with an event, a milliamp output or the control output functions as an event indicator. An event indicator operates in ON/OFF states. It switches from one state to the other when the process reaches a programmed setpoint.

- As an event indicator, a milliamp output switches from one programmed current level to another programmed current level when the process reaches the setpoint.
- As an event indicator, the control output switches from 0 V to +15 V or vice versa when the process reaches the setpoint.

IFT9701, IFT9703, RFT9712, and RFT9729 outputs cannot be configured for events.

To assign an event to an output:

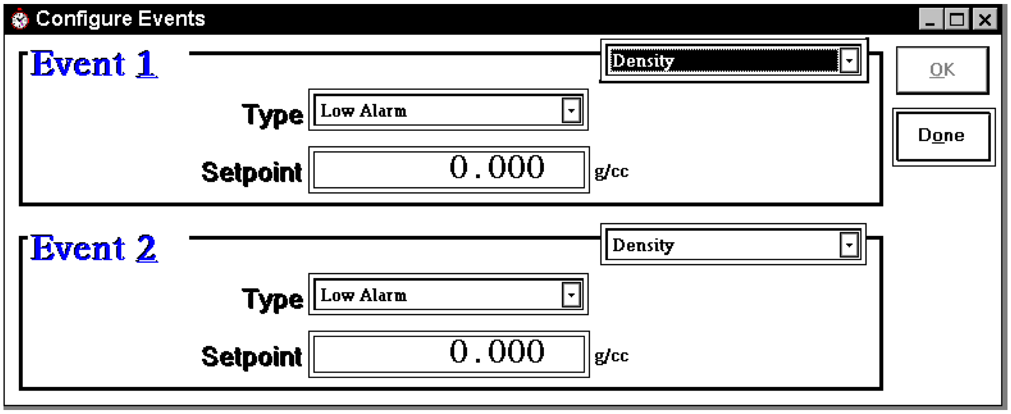
1. Open the Configure menu, then choose Transmitter Outputs to open the Configure Outputs dialog box.
2. Open the list box beside Milliamp 1, Milliamp 2, or Control, then select Event 1 or Event 2 as the output variable.
3. Configure event parameters as described in **Section 12.2**.
4. If Milliamp 1 or Milliamp 2 was configured as an event indicator, configure milliamp current levels as described in **Section 12.3**.

12.2 Configuring event parameters

After assigning Event 1 or Event 2 to a milliamp output or the control output, use the Configure Events dialog box to configure event parameters.

Open the Configure menu, then choose Events. The Configure Events dialog box appears as shown in **Figure 12-1**. Assign variables, alarms, and setpoints to events as described on pages 128 and 130.

Figure 12-1. Configure Events dialog box



Process variables

Any process variable, including a mass or volume total or inventory, can control the state of an event indicator. To select a process variable for an event, open the Event 1 or Event 2 variables list box.

When outputs function as event indicators, the transmitter periodically compares the measured value of the assigned process variable against the setpoint. The process variable determines the rate of the comparison. **Table 12-1** summarizes rates of comparison between the measured value and the setpoint, based on the process variable assigned to the event.

Table 12-1. Event setpoint and process variable comparison

Process variable assigned to event	Frequency of comparison between setpoint and measured value of variable
Mass total (mass inventory) Volume total (volume inventory)	1000 comparisons per second
Mass flow Volume flow	1 comparison every 2 tube cycles, or approximately 20 to 80 comparisons per second, depending on sensor size, flow tube construction material, and process fluid density
Density	10 comparisons per second
Temperature	1 comparison every 0.8 seconds, or 1.25 comparisons per second
Differential pressure Viscosity	1 comparison per second

Low and high alarms

Event 1 or Event 2 can serve as a low or high process alarm. Use the Type list boxes to configure alarms.

With any process variable except a total or inventory assigned to an event, the following conditions determine the alarm state:

- A high alarm is ON if the measured value is equal to or greater than the setpoint. Otherwise, the alarm is OFF.
- A low alarm is ON if the measured value is equal to or less than the setpoint. Otherwise, the alarm is OFF.

Example:	*Given:* Event 1 has been assigned to the control output, and temperature has been assigned to the event. The output controls a normally-closed electronic valve (the valve is closed when no power is supplied from the control output). *Problem:* Configure the control output to close the valve if the process temperature exceeds the setpoint. *Solution:* With temperature assigned to the Event 1, a high alarm switches ON when temperature goes above the setpoint. Open the Type list box under Event 1, then select High Alarm. The alarm will switch ON and produce 0 V output to close the valve when temperature exceeds the setpoint.

With a total or inventory assigned to the event, the value of the setpoint determines when the alarm switches states.

- If the setpoint is positive, and forward flow causes the total or inventory level to increase, the alarm switches states when the total reaches the setpoint.
- If the setpoint is negative, and reverse flow causes the total or inventory level to decrease, the alarm switches states when the total reaches the setpoint.
- Once the totalizer alarm has been activated, the totalizer must be reset. Resetting the totalizer switches a high totalizer alarm OFF or switches a low totalizer alarm ON. To stop, start, or reset mass or volume totalizers, open the Applications menu, then choose Totalizer Control.

Example:	*Given:* Mass total has been assigned to Event 1. *Problem:* Configure the totalizer alarm to switch OFF when 500 kg of fluid has been loaded. *Solution:* With mass total assigned to the event, the low alarm will switch OFF when the mass total equals the setpoint, then will switch ON when the totalizer is reset. Open the Type list box under Event 1, then select Low Alarm. Since the setpoint is positive (500 kg), the low alarm will switch OFF when forward flow causes the mass total to exceed 500 kg. The totalizer alarm then will remain OFF until the user resets the mass totalizer.

Event setpoints
Any value of the assigned process variable can serve as the setpoint at which the event switches states. Enter the setpoint into the Setpoint text box under Event 1 or Event 2.

- Before establishing the setpoint for any process variable, assign a process variable to the event as instructed on page 128.
- Before establishing the setpoint for a total or inventory, configure outputs to indicate forward, reverse, or bi-directional flow, as instructed in **Section 9.6**, page 104.

12.3 Current levels for milliamp events

Use the Configure Outputs dialog box to set low and high current levels for a milliamp event indicator. Open the Configure menu, then choose Transmitter Outputs.

- Enter the desired low current level into the 4 mA text box under Milliamp 1 or Milliamp 2.
- Enter the desired high current level into the 20 mA text box under Milliamp 1 or Milliamp 2.

If a milliamp output functions as an event indicator, the output produces the programmed high current level in an ON state, and the low current level in an OFF state. The programmed low current level must be lower than the high current level.

The low or high configuration of the alarm determines when the output is ON or OFF, as shown in the following example.

Example:

Given: The primary milliamp output indicates Event 1. Density is the process variable.

Problem: With Event 1 configured as a low alarm, set the output to produce an 18 mA current while density remains below the setpoint, and a 10 mA current if density exceeds the setpoint.

Solution: Open the Configure menu, then choose Transmitter Outputs to open the Configure Outputs dialog box.

- Enter a value of 10.00 into the 4 mA text box under Milliamp 1.
- Enter a value of 18.00 into the 20 mA text box under Milliamp 1.

The primary milliamp output will remain ON and produce an 18 mA current unless density exceeds the setpoint.

12.4 Reading event states

The View menu enables the user to read the ON or OFF states of events in two different windows:

- Event 1 On and Event 2 On indicators in the Informational frame of the Status window indicate event states. To view the Status window, open the View menu, then choose Transmitter Status.
- Indicators in the Output Levels window also show the ON or OFF state of Event 1 and Event 2. To view the Output Levels window, open the View menu, then choose Transmitter Outputs.

13 Configure Menu: Meter Factors

13.1 Overview

Meter factors adjust the flowmeter measurement without modifying calibration factors. Meter factors perform the following operation on flowmeter measurements:

$$\text{Corrected measurement} = \text{Meter factor} \cdot \text{Uncorrected measurement}$$

Meter factors can be entered for mass flow, density, or volume flow, only when connected to a Version 3.0 RFT9739 transmitter. Meter factors cannot be entered for earlier RFT9739 versions, or for IFT9701, IFT9703, RFT9712, or RFT9729 transmitters.

13.2 Meter factors for mass, volume, and density

Meter factors apply primarily to proving applications, in which the flowmeter measurement is checked against a calibrated reference. The reference measurement is assumed to be correct. The meter factor is determined from the following calculation:

$$\text{Meter factor} = \frac{\text{Reference device measurement}}{\text{Flowmeter measurement}}$$

- For a mass-flow meter factor, check the flowmeter mass flow measurement against a reference.
- For a density meter factor, check the flowmeter density measurement against a reference.
- For a volume-flow meter factor, check the flowmeter volume flow measurement against a reference.

Coriolis mass and density measurements are independent from one another. The volume measurement is derived from the mass and density measurements:

$$\text{Volume} = \frac{\text{Mass}}{\text{Density}}$$

Because the volume measurement is derived from the mass and density measurements, the volume measurement is corrected when meter factors for mass flow and density are entered. The volume-flow meter factor has no effect on the flowmeter mass or density measurements.

- If a mass-flow or density meter factor is entered, the volume meter factor defaults to 1.0000.
- If a volume-flow meter factor is entered, the mass and density meter factors each default to 1.0000.
- Only values from 0.8 to 1.2 may be entered.

Some applications, such as custody transfer, require that the flowmeter measurement be checked against a reference (proved) on a periodic basis. Meter factors are useful for validating the stability of a flowmeter's measurements over time.

After meter factors have been determined and entered, flowmeter measurements are corrected. When the flowmeter is proved again, new meter factors are determined from the following equation:

$$\text{New meter factor} = \text{Current meter factor} \times \text{Meter factor from proving}$$

Example:

The flowmeter is installed and proved: The flowmeter mass measurement is 250.27 lb, the reference device measurement is 250 lb. A mass-flow meter factor is determined as follows:

$$\text{Meter factor} = \frac{250}{250.27} = 0.9989$$

A mass-flow meter factor of 0.9989 is entered.

One month later, the flowmeter is proved again. The flowmeter mass measurement is 250.07 lb, the reference device measurement is 250.25 lb. A new mass-flow meter factor is determined as follows:

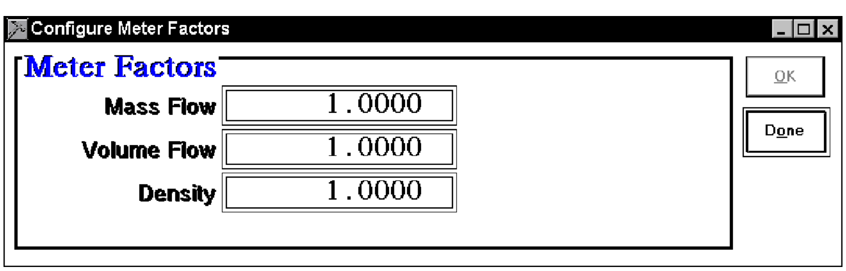
$$\text{Meter factor} = \frac{0.9989 \times 250}{250.27} = 0.9986$$

13.3 Entering meter factors

To enter meter factors, open the Configure menu, then choose Meter Factors. The Configure Meter Factors dialog box appears, as depicted in **Figure 13-1**. Enter mass flow, volume flow, or density meter factors.

- If a mass-flow or density meter factor is entered, the volume meter factor defaults to 1.0000.
- If a volume-flow meter factor is entered, the mass and density meter factors each default to 1.0000.
- Only values from 0.8 to 1.2 may be entered.

Figure 13-1. Configure Meter Factors dialog box



14 Calibrate Menu

14.1 Overview

Calibration and trim account for performance variations in individual sensors, transmitters, and peripheral devices. When a transmitter and sensor are ordered together as a Coriolis flowmeter, they are factory calibrated to produce highly accurate measurements of mass flow, fluid density, and flow tube temperature. However, the ProLink program supports field calibration, thereby enabling sensors and transmitters to be interchanged.

While performing calibration procedures, write values in the appropriate Flowmeter Calibration Record, shown in **Appendix F**, page 189.

14.2 Auto zero

Flowmeter zeroing establishes flowmeter response to zero flow and sets a baseline for flow measurement.

To zero the transmitter, follow these steps:

1. Prepare the flowmeter for zeroing:
   a. Install the sensor according to the appropriate sensor instruction manual.
   b. Apply power to the transmitter, then allow it to warm up for at least 30 minutes.
   c. Ensure the transmitter is in a security mode that allows flowmeter zeroing.
   d. Run the process fluid to be measured through the sensor until the sensor temperature reading approximates the normal process operating temperature.

2. Close the shutoff valve downstream from the sensor.

3. Fill the sensor **completely** with fluid under normal process conditions of temperature, density, pressure, etc., and ensure zero flow through the sensor.

⚠ CAUTION

Flow through the sensor during flowmeter zeroing will result in an inaccurate zero setting.

Make sure fluid flow through the sensor is **completely** stopped during flowmeter zeroing.

4. Open the Calibrate menu, then choose Auto Zero. The Flow Calibration dialog box will be displayed, as depicted in:
   - **Figure 14-1** for an RFT9739
   - **Figure 14-2** for an IFT9701 or IFT9703
   - **Figure 14-3** for an RFT9712 or RFT9729

5. **Make sure flow through the sensor is completely stopped,** then choose Zero. The transmitter begins zeroing.
   - The indicator in the lower right corner of the Flow Calibration dialog box blinks to indicate transmitter zeroing is in progress.
   - Transmitters with a display: the message screen reads CAL IN PROGRESS or ZERO during transmitter zeroing.
   - Field-mount transmitters: the diagnostic LED remains ON during transmitter zeroing.

   To end the zero operation before its completion, choose Stop.

6. When transmitter zeroing is completed, the Zero In Progress indicator stops blinking. Choose Done to exit the Flow Calibration dialog box.
   - Transmitters with a display: the message screen reads ERROR CLEARED.
   - Field-mount transmitters: the diagnostic LED blinks ON once per second to indicate normal operation.

Calibrate Menu *continued*

Auto zero

Figure 14-1. Flow Calibration dialog box for RFT9739

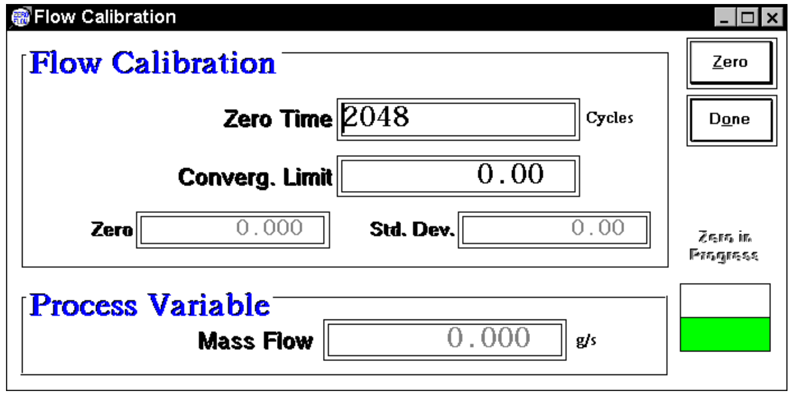


Figure 14-2. Flow Calibration dialog box for IFT9701/IFT9703

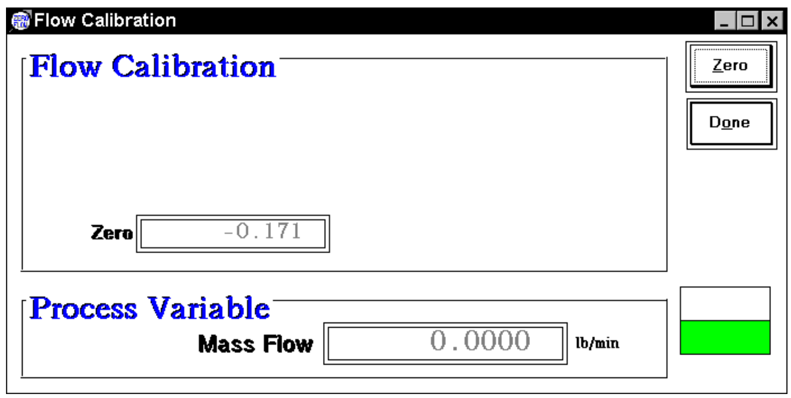
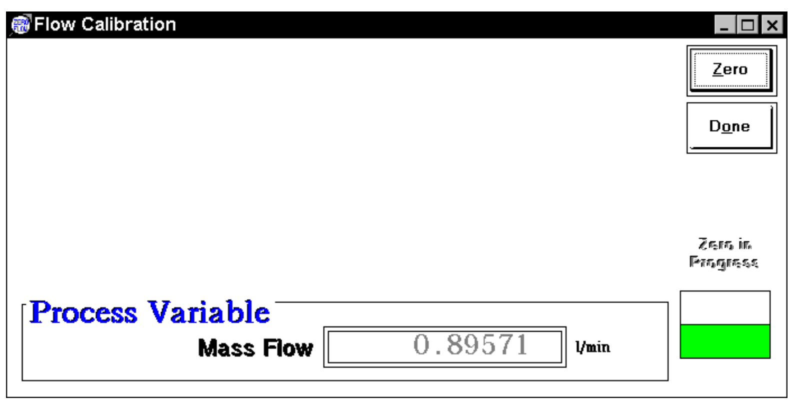


Figure 14-3. Flow Calibration dialog box for RFT9712/RFT9729



Diagnosing zeroing failure

If zeroing fails, indicators in the Status window switch ON. To view the Status window, open the View menu, then choose Transmitter Status.

- The Calibration Failure indicator switches ON
- If the transmitter is an RFT9739, RFT9712, or RFT9729, the Zero Too Noisy, Zero Too High, or Zero Too Low might also switch ON.

The most common sources of zeroing failure are:

- Flow of fluid through sensor during zeroing
- Partially empty sensor flow tubes
- An improperly mounted sensor

To clear a zeroing error, re-zero the transmitter after correcting the problem, or cycle power to the transmitter to abort the procedure and return to the previously established zero. For an RFT9739, adjust the programmable auto zero parameters before re-zeroing. See **Section 14.3**.

14.3 Programming auto zero for RFT9739

If Calibration Failure switches ON in the Status window, auto zero has failed. If the Zero Too Noisy, Zero Too Low, or Zero Too High indicator is also ON, and the zeroing procedure was performed on an RFT9739, the auto zero parameters can be reprogrammed.

During the zeroing process, the RFT9739 measures the time shift (the time between signals from the left and right sensor pickoff coils) for each measurement cycle, computes the average time shift per cycle, then derives the standard deviation of the average time shift over the zero time.

- If zeroing is too noisy, the user can program a standard deviation limit to account for mechanical noise from vibrating pumps or other equipment. Mechanical noise can cause zero failure by interfering with signals from the sensor.
- Zero time is the number of measurement cycles required for transmitter zeroing, where one measurement cycle equals two tube periods. The default zero time is 2048 cycles (approximately 40 seconds at a tube frequency of 100 Hz). A longer zero time might improve the accuracy of the zeroing procedure by increasing the number of measurement cycles.

Convergence limit

To reprogram the convergence (standard deviation) limit, enter the desired value into the Convergence Limit text box (see **Figure 14-1**, page 135). Record the convergence limit in the appropriate Flowmeter Calibration Record in **Appendix F**, page 189.

Calibrate Menu *continued*

Programming auto zero for RFT9739

Programming the limit of the standard deviation causes the RFT9739 to zero in one of the following ways:

- When the standard deviation measured by the transmitter converges to a value that is less than the programmed standard deviation limit, the RFT9739 will successfully zero. The time required for zeroing to be completed will be equal to or less than the configured zero time.
- If the standard deviation measured by the transmitter exceeds, but is not more than 10 times the programmed standard deviation limit, the RFT9739 will successfully zero, but will continue sampling throughout the entire zero time.
- If the standard deviation measured by the transmitter is more than 10 times the programmed standard deviation limit, the RFT9739 indicates zero failure and retains the previous zero calibration. This condition indicates a fault.

Zero time

The user can program a zero time of 100 to 65,535 cycles. The default zero time is 2048 cycles (approximately 40 seconds at a tube frequency of 100 Hz). A longer zero time might improve the accuracy of the zeroing procedure by increasing the number of measurement cycles.

To program the zero time for the RFT9739, enter the desired number of measurement cycles into the Zero Time text box (see **Figure 14-1**, page 135). Record the zero time in the appropriate Flowmeter Calibration Record in **Appendix F**, page 189.

Example:

Given: The default zero time is 2048 measurement cycles, approximately 40 seconds at a tube frequency of 100 Hz. Under zero flow conditions, the sensor flow tubes vibrate at a rate of 100 Hz, or 50 cycles per second.

Problem: Because the process does not allow flow to be stopped for the amount of time usually required for auto zeroing, the RFT9739 needs to zero in 10 or fewer seconds.

Solution: Since 10 seconds · 50 measurement cycles/second = 500 cycles, the zero time is 500.

Enter a value of 500 into the Zero Time text box. The transmitter will zero in 10 or fewer seconds, unless the measured standard deviation is 10 times the programmed convergence limit during the auto zero (in which case, the RFT9739 will indicate zero failure).

If the RFT9739 cannot zero because the programmed limit of the standard deviation is too small, enter a larger value into the Convergence Limit text box.

14.4 Density calibration

Density calibration adjusts the factors that are used by the transmitter to calculate density. Fluid density, calculated by the transmitter, is inversely proportional to the square of the sensor tube frequency. The ProLink program supports three types of density calibration: one-point, two-point (or dual-point), and third-point.

During two-point density calibration, the user commands the transmitter to measure the tube period when the flow tubes contain a fluid with a reference low density (usually air) and when the flow tubes contain a fluid with a reference high density (usually water). The transmitter then calculates the density of the process fluid from the following equation:

$$D = (D_2 - D_1) \times \frac{\tau^2 - \tau_1^2}{\tau_2^2 - \tau_1^2} + D_1$$

Where:

- D = Calculated density at measured temperature t
- D_1 = Reference density of low-density calibration fluid at calibration temperature t_1
- D_2 = Reference density of high-density calibration fluid at calibration temperature t_2
- τ^2 = Measured tube period squared at measured temperature t, corrected to 0°C
- τ_1^2 = Tube period squared at D1, corrected to 0°C
- τ_2^2 = Tube period squared at D2, corrected to 0°C

Two-point density calibration is preferably performed under zero flow conditions.

One-point density calibration is an option when two-point calibration is not possible. However, because one-point calibration is performed with only one reference density, two-point calibration is recommended for increased accuracy.

Third-point density calibration is available only for the RFT9739. As the flow rate approaches the maximum flow rate of the sensor, the angular momentum of the fluid can alter the tube period, which causes an increase in the density value measured by the sensor. An increase in the flow rate causes a proportional increase in the angular momentum of the fluid. A third-point density calibration accounts for the effect of flow on the tube period at high flow rates.

Third-point density calibration is desirable if the process exceeds or often approaches the flow rate listed in **Table 14-1**.If the process remains below this rate, calibrating a third density point is unnecessary, since angular momentum of the fluid will have a minimal effect on the flow tube frequency. Use the data listed in **Table 14-1** to determine whether third-point density calibration is desirable.

Table 14-1. Minimum flow rate for third-point calibration

Sensor model		Minimum flow rate lb/min	Minimum flow rate kg/h
ELITE®	CMF010	2.5	69
	CMF025	27	720
	CMF050	86	2350
	CMF100	280	7575
	CMF200	1270	34,540
	CMF300	4390	119,600
	CMF400	15,000	409,000
T-Series	T075	500	13,630
	T100	1100	29,990
	T150	3500	95,430
BASIS®	F200	2315	63,045
	All other F sensors	K3 density calibration not necessary	
Model D	D6	0.8	25
	D12	4.5	125
	D25	18	485
	D40 stainless steel	33	900
	D40 Hastelloy® C-22	52	1395
	D65	115	3060
	D100	405	11,010
	D150	1140	31,050
	D300	2705	73,660
	D600	9005	245,520
Model DH	All DH sensors	K3 density calibration not necessary	
Model DL	DL65	115	3075
	DL100	325	8,780
	DL200	1210	32,950
Model DT	DT65	150	4040
	DT100	315	8460
	DT150	580	15,780

Density calibration for RFT9739

During density calibration, write values in the appropriate Flowmeter Calibration Record, shown in **Appendix F**, page 189. Follow these steps to perform a density calibration for an RFT9739:

1. Density calibration requires reading and entering density values in grams per cubic centimeter. To change the density unit of measure:

   a. Open the Configure menu, then choose Transmitter Variables.

   b. In the Configure Transmitter Variables dialog box, open the density units list box, then select g/cc as the density unit.

   c. Click OK.

2. Perform a two-point, one-point, or three-point density calibration:
   - To perform a two-point density calibration for an RFT9739, follow the procedures in steps 3 and 4.
   - If performing a one-point density calibration, follow either step 3 or step 4.
   - The third-point density calibration procedure is described in step 5.

3. To perform the low-density calibration:

   a. Fill the sensor with a low-density fluid, such as air.

   b. If possible, shut off the flow. Otherwise, pump the fluid through the sensor at the lowest flow rate allowed by the process.

   c. Use any established method to derive an accurate density, in grams per cubic centimeter, for the fluid at line conditions. If air is the low-density calibration fluid, a value from **Table 14-2** can be used for the density.

   d. Open the Calibrate menu, then choose Density. At the cascading menu, choose First Point (Air) to open the Density Point 1 dialog box, shown in **Figure 14-4**.

   e. Enter the line-condition density, **in grams per cubic centimeter**, into the Enter Density text box, then choose Do Cal. The transmitter measures the tube period, corrects it to 0°C, and stores the value. The indicator in the dialog box blinks ON and OFF while density calibration is in progress. When the indicator stops blinking, the low-density calibration is complete.

Figure 14-4. Density Point 1 Calibration dialog box for RFT9739

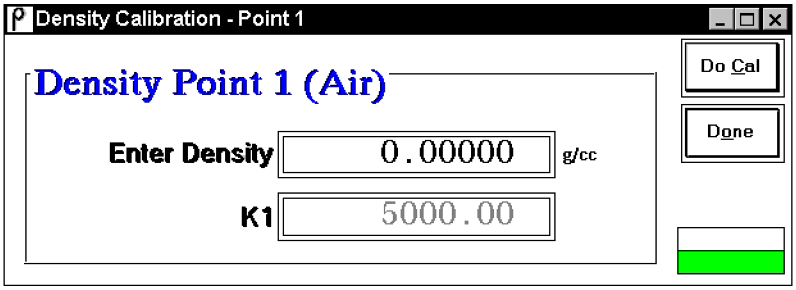


Table 14-2. Density of air

Pressure in-Hg (millibar)	Density in g/cc at: 10°C 50°F	15°C 59°F	20°C 68°F	25°C 77°F	30°C 86°F	35°C 95°F	40°C 104°F	45°C 113°F	50°C 122°F
25.14 (850)	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0009	0.0009	0.0009
26.62 (900)	0.0011	0.0011	0.0011	0.0010	0.0010	0.0010	0.0010	0.0010	0.0009
28.10 (950)	0.0012	0.0011	0.0011	0.0011	0.0011	0.0011	0.0010	0.0010	0.0010
29.57 (1000)	0.0012	0.0012	0.0012	0.0012	0.0011	0.0011	0.0011	0.0011	0.0011
31.06 (1050)	0.0013	0.0013	0.0012	0.0012	0.0012	0.0012	0.0012	0.0011	0.0011

4. To perform the high-density calibration:

   a. Fill the sensor with a high-density fluid, such as water.

   b. If possible, shut off the flow. Otherwise, pump the fluid through the sensor at the lowest flow rate allowed by the process. The rate must be less than the flow rate listed in **Table 14-3**, or the calibration will be in error. To ensure stable density, make sure the fluid in the flow tubes remains completely free of gas bubbles during the calibration.

Table 14-3. Maximum flow rates for Micro Motion sensors

Sensor model		Maximum flow rate lb/min	kg/h
ELITE®	CMF010	0.25	6.75
	CMF025	5	135
	CMF050	15	425
	CMF100	62	1700
	CMF200	200	5440
	CMF300	625	17,010
	CMF400	1250	34,090
BASIS®	F025	5	135
	F050	15	425
	F100	62	1700
	F200	200	5440
Model D	D6	0.125	3.25
	D12	0.25	8.25
	D25	1.5	42
	D40	2.75	76
	D65	18	510
	D100	50	1360
	D150	175	4760
	D300	435	11,905
	D600	1560	42,525
Model DH	DH6	0.125	3.25
	DH12	0.25	8.25
	DH25	1.5	42
	DH38	3	85
	DH100	50	1360
	DH150	175	4760
	DH300	435	11,905
Model DL	DL65	15	420
	DL100	50	1360
	DL200	215	5950
Model DT	DT65	18	510
	DT100	50	1360
	DT150	87	2380

c. Use any established method to derive an accurate density, in grams per cubic centimeter, for the fluid at line conditions. If water is the high-density calibration fluid, a value from **Table 14-4** can be used for the density.

d. Open the Calibrate menu, then choose Density. At the cascading menu, choose Second Point (Water) to open the Density Point 2 dialog box, shown in **Figure 14-5**.

e. Enter the line-condition density, in grams per cubic centimeter, into the Enter Density text box, then choose Do Cal. The transmitter measures the tube period, corrects it to 0°C, and stores the value. The indicator in the Density Point 2 dialog box blinks ON and OFF while calibration is in progress. When the indicator stops blinking, the high-density calibration is complete.

Figure 14-5. Density Point 2 Calibration dialog box for RFT9739

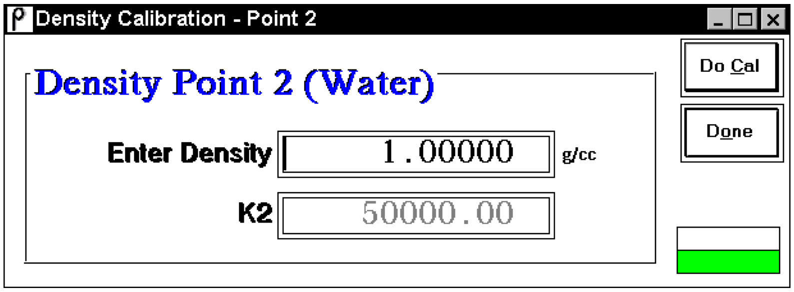


Table 14-4. Density of water

Temperature		Density	Temperature		Density	Temperature		Density
°F	°C	g/cc	°F	°C	g/cc	°F	°C	g/cc
32	0.0	0.9998	56	13.3	0.9994	80	26.7	0.9966
33	0.6	0.9998	57	13.9	0.9992	81	27.2	0.9964
34	1.1	0.9999	58	14.4	0.9992	82	27.8	0.9963
35	1.7	0.9999	59	15.0	0.9991	83	28.3	0.9961
36	2.2	0.9999	60	15.6	0.9991	84	28.9	0.9960
37	2.8	0.9999	61	16.1	0.9989	85	29.4	0.9958
38	3.3	0.9999	62	16.7	0.9989	86	30	0.9956
39	3.9	1.0000	63	17.2	0.9988	95	35	0.9941
40	4.4	1.0000	64	17.8	0.9987	100	38	0.9930
41	5.0	0.9999	65	18.3	0.9986	104	40	0.9922
42	5.6	0.9999	66	18.9	0.9984	113	45	0.9902
43	6.1	0.9999	67	19.4	0.9983	122	50	0.9881
44	6.7	0.9999	68	20.0	0.9982	131	55	0.9857
45	7.2	0.9999	69	20.6	0.9981	140	60	0.9832
46	7.8	0.9999	70	21.1	0.9980	149	65	0.9806
47	8.3	0.9998	71	21.7	0.9980	158	70	0.9778
48	8.9	0.9998	72	22.2	0.9979	167	75	0.9749
49	9.4	0.9998	73	22.8	0.9977	176	80	0.9718
50	10.0	0.9997	74	23.3	0.9975	185	85	0.9686
51	10.6	0.9996	75	23.9	0.9973	194	90	0.9653
52	11.1	0.9996	76	24.4	0.9972	203	95	0.9619
53	11.7	0.9995	77	25.0	0.9970	212	100	0.9584
54	12.2	0.9995	78	25.6	0.9969			
55	12.8	0.9994	79	26.1	0.9968			

5. To perform the third-point density calibration, follow these steps:

   a. Compare the maximum flow rate allowed by the process against the appropriate value from **Table 14-1**. If the maximum flow rate allowed by the process is less than the value listed in **Table 14-1**, it is not necessary to perform the third-point (K3) calibration.

   b. Fill the sensor with a process fluid that has a stable density.

c. If possible, shut off the flow. Otherwise, pump the fluid through the sensor at the lowest flow rate allowed by the process. To ensure stable density, make sure the fluid in the flow tubes remains completely free of gas bubbles during the calibration.

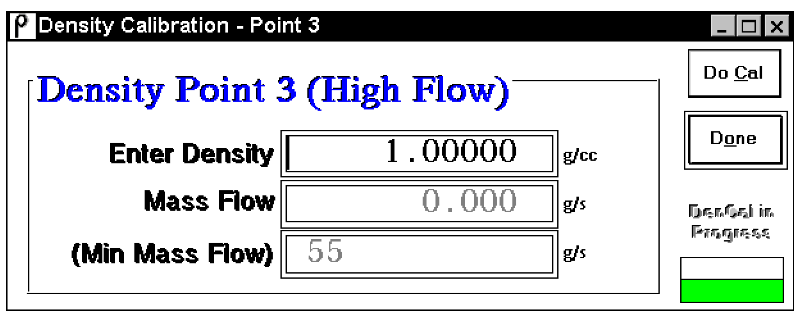
d. With the process under no-flow or low-flow conditions, open the View menu, then choose Process Variables. Read the density of the process fluid, taking note of the value for use in step 5g.

e. Pump the fluid through the sensor at the highest flow rate allowed by the process. The rate must be greater than the appropriate value from **Table 14-1**, or the calibration will be in error. To ensure stable density, make sure the fluid in the flow tubes remains **completely** free of gas bubbles during the calibration.

f. Open the Calibrate menu, then choose Density. Then select Density Point 3 from the cascading menu to display the Density Point 3 Calibration dialog box, shown in **Figure 14-6**.

g. Enter the density, in grams per cubic centimeter, that was read from the Process Variables window in step 5d. The indicator in the dialog box blinks ON and OFF while density calibration is in progress. When the indicator stops blinking, the third-point density calibration is complete.

Figure 14-6. Density Point 3 Calibration dialog box for RFT9739



Density calibration for IFT9701/IFT9703

⚠ CAUTION

Density calibration will cause measurement error.

Density calibration affects the IFT9701 and IFT9703 flow, temperature, and viscosity calculations, and will require completely recalibrating the flowmeter for temperature, density, and viscosity measurement.

Density calibration of the IFT9701 and IFT9703 is not recommended.

During density calibration, write values in the appropriate Flowmeter

Calibration Record, shown in **Appendix F**, page 189. Follow these steps to perform a density calibration for an IFT9701 or IFT9703:

1. Density calibration requires reading and entering density values in **grams per cubic centimeter**. To change the density unit of measure:
   a. Open the Configure menu, then choose Transmitter Variables.
   b. In the Configure Transmitter Variables dialog box, open the density units list box, then select g/cc as the density unit.
   c. Click OK.

2. Perform a two-point or one-point density calibration:
   - To perform a two-point density calibration for an IFT9701 or IFT9703, follow the procedures in steps 3 and 4.
   - If performing a one-point density calibration, follow either step 3 or step 4.

3. To perform the low-density calibration:
   a. Fill the sensor with a low-density fluid, such as air.

   b. If possible, shut off the flow. Otherwise, pump the fluid through the sensor at the lowest flow rate allowed by the process.

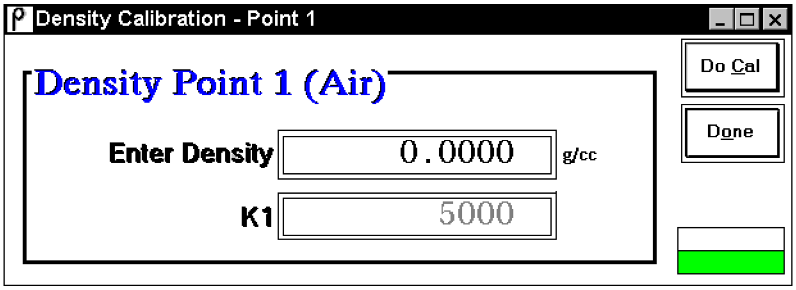
   c. Use any established method to derive an accurate density, in grams per cubic centimeter, for the fluid at line conditions. If air is the low-density calibration fluid, a value from **Table 14-2** can be used for the density.

   d. Open the Calibrate menu, then choose Density. At the cascading menu, choose First Point (Air) or Dual Point (Air & Water) to open the Density Point 1 dialog box, shown in **Figure 14-7**.

> **⚠ CAUTION**
>
> **If dual-point density calibration is initiated, failure to perform the entire procedure will result in inaccurate density measurement.**
>
> To avoid inaccurate density measurement, initiate dual-point density calibration only when the entire procedure can be completed. Otherwise, perform only the first point (air) or second point (water) procedure.

   e. Enter the line-condition density, **in grams per cubic centimeter**, into the Enter Density text box, then choose Do Cal. ProLink reads density, determines tube period, corrects it to 0°C, and updates the density calibration factor, indicating per cent complete. The indicator in the dialog box blinks ON and OFF while density calibration is in progress. When the indicator stops blinking, the low-density calibration is complete.

Figure 14-7. Density Point 1 Calibration dialog box for IFT9701/IFT9703



4. To perform the high-density calibration:

   a. Fill the sensor with a high-density fluid, such as water.

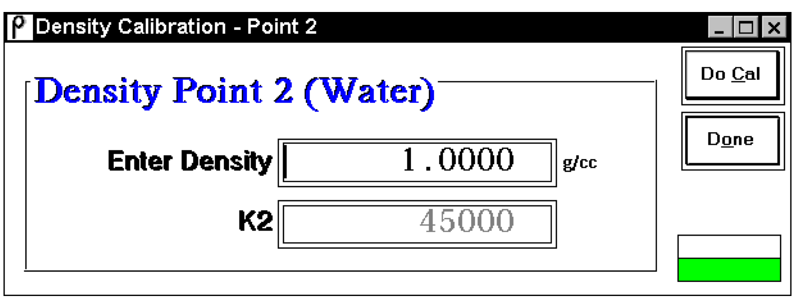
   b. If possible, shut off the flow. Otherwise, pump the fluid through the sensor at the lowest flow rate allowed by the process. To ensure stable density, make sure the fluid in the flow tubes remains completely free of gas bubbles during the calibration.

   c. Use any established method to derive an accurate density, in grams per cubic centimeter, for the fluid at line conditions. If water is the high-density calibration fluid, a value from **Table 14-4**, page 143 can be used for the density.

   d. If First Point (Air) was chosen in step 3, above, or if a one-point high-density calibration is being performed, open the Calibrate menu, then choose Density. At the cascading menu, choose Second Point (Water) to open the Density Point 2 dialog box, shown in **Figure 14-8**. If Dual Point (Air and Water) was chosen in step 3, the Density Point 2 dialog box is already displayed.

   e. Enter the line-condition density, in grams per cubic centimeter, into the Enter Density text box, then choose Do Cal. ProLink reads density, determines tube period, corrects it to 0°C, and updates the density calibration factor, indicating per cent complete. The indicator in the Density Point 2 dialog box blinks ON and OFF while density calibration is in progress. When the indicator stops blinking, the high-density calibration is complete.

Figure 14-8. Density Point 2 Calibration dialog box for IFT9701



Calibrate Menu *continued*
Density calibration

Density calibration for RFT9712/RFT9729

During density calibration, write values in the appropriate Flowmeter Calibration Record, shown in **Appendix F**. Follow these steps to perform a density calibration for an RFT9712 or RFT9729:

1. Density calibration requires reading and entering density values in **grams per cubic centimeter**. To change the density unit of measure:

   a. Open the Configure menu, then choose Transmitter Variables.

   b. In the Configure Transmitter Variables dialog box, open the density units list box, then select g/cc as the density unit.

   c. Click OK.

2. Perform a two-point or one-point density calibration:
   - To perform a two-point density calibration for an RFT9712 or RFT9729, follow the procedures in steps 3 and 4.
   - If performing a one-point density calibration, follow either step 3 or step 4.

3. To perform the low-density calibration:

   a. Fill the sensor with air.

   b. If possible, shut off the flow. Otherwise, pump the air through the sensor at the lowest flow rate allowed by the process.

   c. Open the Calibrate menu, then choose Density. At the cascading menu, choose First Point (Air) to open the Density Point 1 dialog box, shown in **Figure 14-9**.

   d. Choose Do Cal. The transmitter measures the tube period, corrects it to 0°C, and stores the value. The indicator in the dialog box blinks ON and OFF while density calibration is in progress. When the indicator stops blinking, the low-density calibration is complete.

Figure 14-9. Density Point 1 Calibration dialog box for RFT9712/RFT9729

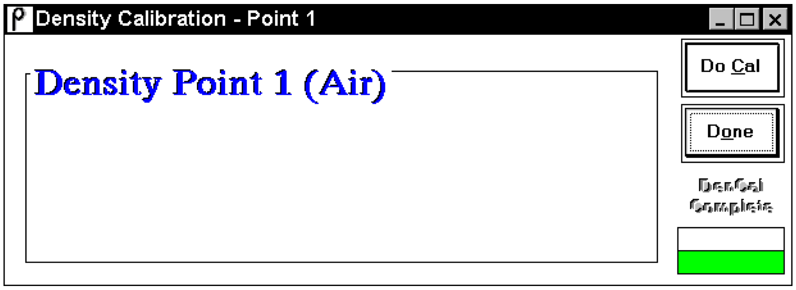
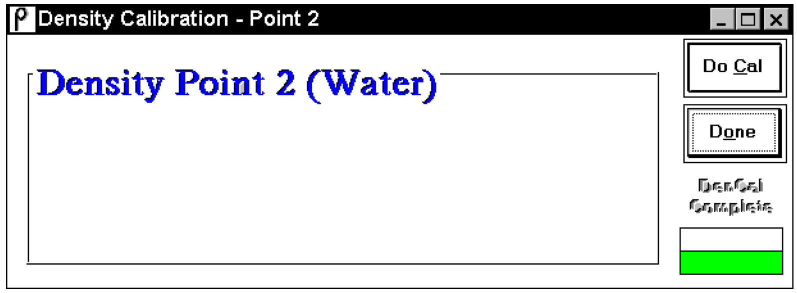


Figure 14-10. Density Point 2 Calibration dialog box for RFT9712/RFT9729



4. To perform the high-density calibration:

   a. Fill the sensor with water.

   b. If possible, shut off the flow. Otherwise, pump the water through the sensor at the lowest flow rate allowed by the process. To ensure stable density, make sure the fluid in the flow tubes remains completely free of gas bubbles during the calibration.

   c. Open the Calibrate menu, then choose Density. At the cascading menu, choose Second Point (Water) to open the Density Point 2 dialog box, shown in **Figure 14-10**.

5. Choose Do Cal. The transmitter measures the tube period, corrects it to 0°C, and stores the value. The indicator in the dialog box blinks ON and OFF while density calibration is in progress. When the indicator stops blinking, the high-density calibration is complete.

14.5 Temperature calibration for RFT9739

Temperature calibration of the RFT9739 is not recommended.

CAUTION

Temperature calibration will cause measurement error.

Temperature calibration affects the RFT9739 flow, density, and viscosity calculations, and will require completely recalibrating the flowmeter for flow, density, and viscosity measurement.

Temperature calibration of the RFT9739 is not recommended.

Calibrate Menu *continued*

Temperature calibration for RFT9739

Temperature calibration, performed while process fluid flows through the sensor at line conditions, adjusts the slope and offset of the equation used for calculating flow tube temperature. Performing a temperature calibration on an RFT9739 involves using a low-temperature calibration fluid to establish the offset and a high-temperature calibration fluid to establish the slope, then recalibrating the flowmeter for flow, density, and viscosity.

During temperature calibration, write values in the appropriate Flowmeter Calibration Record, shown in **Appendix F**.

Temperature calibration is not recommended, and will require ***complete recalibration of the flowmeter for flow, density, and viscosity measurement.*** To calibrate the flowmeter for temperature:

1. Choose degrees Celsius (°C) as the temperature unit:

   a. Open the Configure menu, then choose Transmitter Variables.

   b. In the Configure Transmitter Variables dialog box, open the Units list box in the Temperature frame, then select °C.

   c. Click OK.

2. To perform the temperature offset calibration:

   a. Pump a process fluid through the sensor at the lowest temperature measured during the application.

   b. Wait approximately five minutes for the flow tube temperature to stabilize.

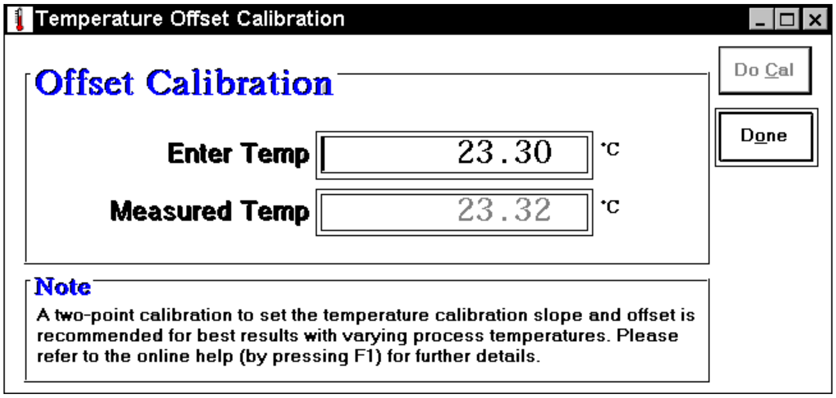
   c. Use a highly accurate thermometer, temperature sensor, or another device to measure the temperature of the process fluid.

   d. Open the Calibrate menu, then choose Temperature. At the cascading menu, choose Offset Calibration to open the Temperature Offset Calibration dialog box, shown in **Figure 14-11**.

   e. Enter the temperature that was measured in step 2c into the Enter Temp text box, then choose Do Cal. The transmitter calculates the offset of the linear representation of temperature and stores the value internally for use in the slope calibration.

   The temperature calibration factor will not change until slope calibration is complete. Power must not be interrupted between offset and slope calibration.

Figure 14-11. Temperature Offset Calibration dialog box



3. To perform the temperature slope calibration:

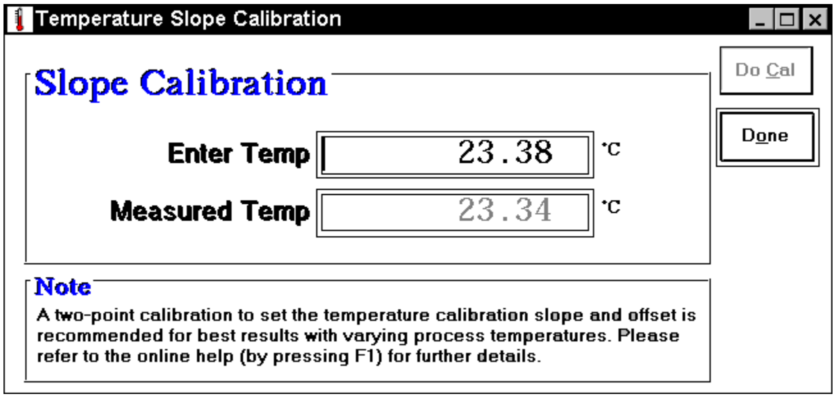
   a. Pump a process fluid through the sensor at the highest temperature measured during the application.

   b. Wait approximately five minutes for the flow tube temperature to stabilize.

   c. Use a highly accurate thermometer, temperature sensor, or another device to measure the temperature of the process fluid.

   d. Open the Calibrate menu, then choose Temperature. At the cascading menu, choose Slope Calibration to open the Temperature Slope Calibration dialog box, shown in **Figure 14-12**.

Figure 14-12. Temperature Slope Calibration dialog box



   e. Enter the temperature that was measured in step 3c into the Enter Temp text box, then choose Do Cal. The transmitter calculates the slope and offset of the linear representation of temperature and enters these factors into the microprocessor.

4. Recalibrate the flowmeter:

   a. Perform the flow calibration procedure described in **Section 8.2**, page 73.

   b. Perform the density calibration procedure described in **Section 14.4**, page 138.

   c. Perform the viscosity calibration procedure described in **Section 14.5**, page 148.

14.6 Milliamp output trim

Milliamp output trim adjusts the transmitter digital-to-analog converter to match milliamp outputs with a specific reference standard, receiver, or readout device.

Preparing for milliamp output trim

For trimming, milliamp outputs require a reference device such as a digital multimeter (DMM). To trim the milliamp output, connect the reference device to the transmitter terminals listed in **Table 14-5**, then perform the milliamp output trim procedure as described below.

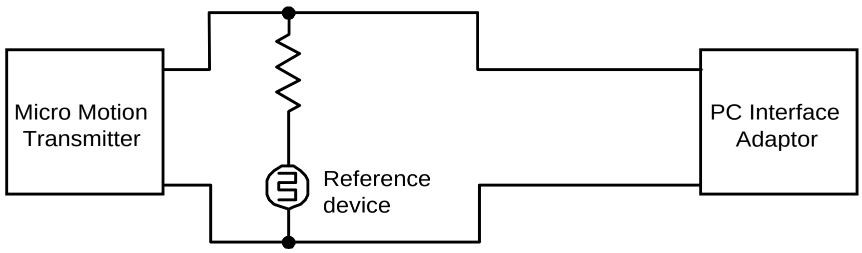
If HART over Bell 202 is being used, and the output being trimmed is the primary milliamp (mA) output, connect the reference device to the transmitter as shown in **Figure 14-13**.

Table 14-5. Milliamp output terminals

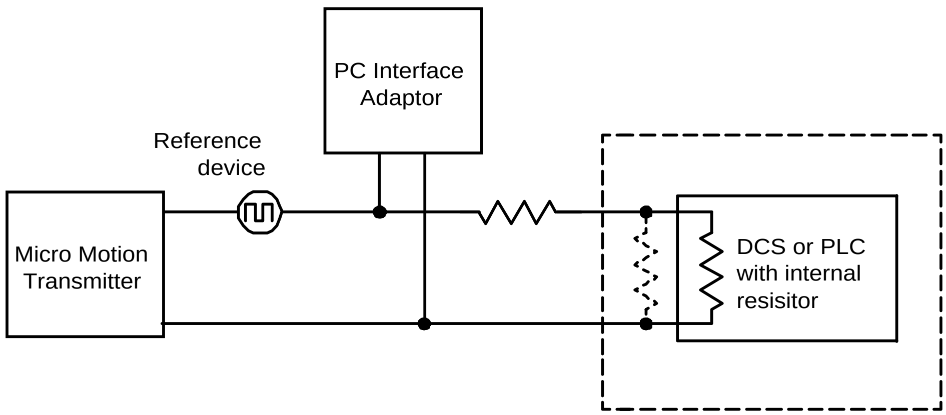
Transmitter	Primary mA output terminals		Secondary mA output terminals	
RFT9739 field-mount	17	PV+	19	SV+
	18	PV–	20	SV–
RFT9739 rack-mount	CN2-Z30	PV+	CN2-Z28	SV+
	CN2-D30	PV–	CN2-D28	SV–
IFT9701		4-20 mA +		—
		4-20 mA –		
RFT9712	17	4-20 mA +		—
	16	4-20 mA –		
RFT9729	B16	mA +		—
	B14	mA –		

Figure 14-13. Connecting a reference device to a transmitter

Connecting to an individual Bell 202 transmitter



Connecting to a Bell 202 multidrop network



Note for Figure 14-13.

Do not use these diagrams to wire the transmitter, PC Interface adaptor, DCS or PLC. For transmitter wiring, see the transmitter instruction manual. To wire the PC Interface adaptor, see **Chapter 2**.

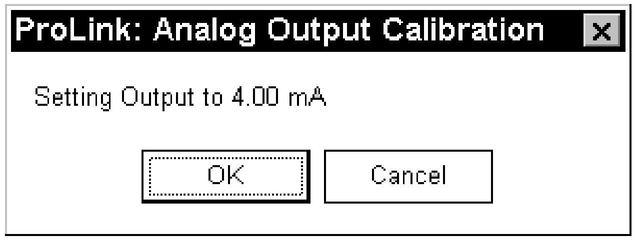
Performing milliamp output trim

To trim a milliamp output:

1. Open the Calibrate menu, then choose Milliamp Output Trim. When connected to an RFT9739, the ProLink menu bar displays a cascading menu, allowing the user to choose the primary output (milliamp output 1) or secondary output (milliamp output 2) for trimming.
   - For HART protocol only, when the output produces either a 0-20 mA or a 4-20 mA current, the dialog box indicates the output will be set at 4 mA, as shown in **Figure 14-14**.
   - For Modbus protocol, regardless of output current, the ProLink program will indicate the output will be set at 4 mA for the milliamp trim, as shown in **Figure 14-14**.

Calibrate Menu *continued*
Milliamp output trim

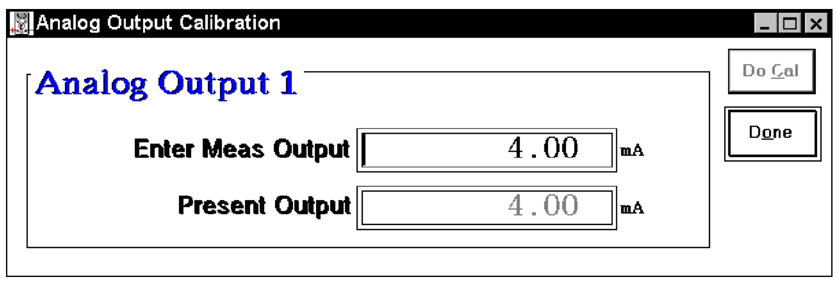
Figure 14-14. Milliamp output trim: setting output to 4 mA



2. Choose OK to set the output at the 0 mA or 4 mA level.

3. When the dialog box shown in **Figure 14-14** appears, read the amount of current indicated by the reference device. The current level should be approximately 4 mA, regardless of the 0-20 or 4-20 mA span of the output. Enter the measured amount of current into the Enter Meas Output text box, shown in **Figure 14-15**, then choose Do Cal.

Figure 14-15. Milliamp output trim: enter measured low output

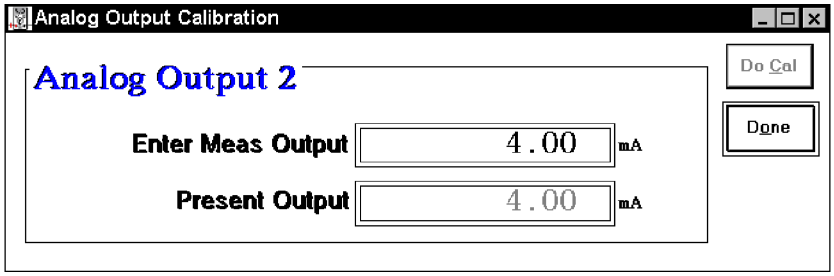


4. When the Compare Output Trim dialog box appears, choose Yes if the reference device indicates approximately 4 mA. If the reference device indicates an output level that is not acceptably close to 4 mA, choose No, then repeat step 3.

5. When Yes is chosen in step 4, choose OK to set the output at 20 mA.

6. When the dialog box shown in **Figure 14-16** appears, read the amount of current indicated by the reference device. The current level should be approximately 20 mA. Enter the measured amount of current into the Enter Meas Output text box, then choose Do Cal.

Figure 14-16. Milliamp output trim: enter measured high output



7. When the dialog box appears, choose Yes if the reference device indicates approximately 20 mA. If the reference device indicates an output level that is not acceptably close to 20 mA, choose No, then repeat step 6.

8. After completing the milliamp output trim, choose Yes to enable the output to produce a varying current.

If communication between the ProLink program and the transmitter is interrupted before the trim procedure is complete, one of the following indicators in the Status window switches ON:

- Analog 1 Fixed
- Analog 2 Fixed
- Analog Output Fixed

To view the Status window, open the View menu, then choose Transmitter Status.

After checking indicators in the Status window, reopen the Calibrate menu, then complete the milliamp output trim.

15 Test Menu

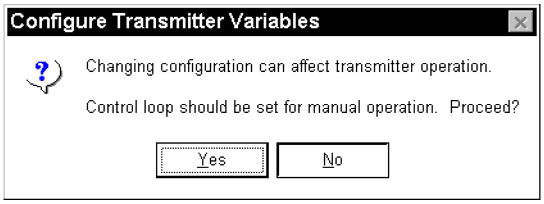
15.1 Overview

⚠ CAUTION

Failure to set control devices for manual operation before characterization could cause transmitter output error.

Before opening the File, Configure, Calibrate, or Applications menus, set process control devices for manual operation.

Whenever a dialog box such as the one depicted below appears, isolate the transmitter from devices that used transmitter outputs for process control, then choose Yes.



The Test menu enables testing of milliamp outputs at the low output level (0 or 4 mA), at the high output level (20 mA), or at a specified level from 0 to 22 mA for an RFT9739, or from 2 to 22 mA for an IFT9701, IFT9703, RFT9712, or RFT9729. A milliamp output test requires a reference device such as a digital multimeter (DMM).

The Test menu also enables testing of the frequency/pulse output at any level from 0.1 Hz to 15 kHz for an RFT9739, from 0.01 to 7.2 kHz for an IFT9701 or IFT9703 version 1.2 or higher, from 0.01 to 1.2 kHz for an IFT9701 or IFT9703 version lower than 1.2, or from 1 to 10 kHz for an RFT9712 or RFT9729. A frequency/pulse output test requires a frequency counter.

The loop test will work only if the transmitter is connected to a sensor. The loop test will not work if either the transmitter or sensor is in a critical failure mode.

15.2 Milliamp output testing

Connect a reference device such as a digital multimeter (DMM) to the transmitter terminals listed in **Table 15-1**, then perform the milliamp output test procedure as described below.

If HART over Bell 202 is being used, and the output being trimmed is the primary milliamp (mA) output, before performing the milliamp output test procedure:

- Connect a 600 ohm resistor in series to the mA output terminals of an IFT9701 or IFT9703.
- Connect a 250-1000 ohm resistor in series to the primary mA output terminals of an RFT9739, RFT9712, or RFT9729.

Table 15-1. Milliamp output terminals

Transmitter	Primary mA output terminals		Secondary mA output terminals	
RFT9739 field-mount	17	PV+	19	SV+
	18	PV–	20	SV–
RFT9739 rack-mount	CN2-Z30	PV+	CN2-Z28	SV+
	CN2-D30	PV–	CN2-D28	SV–
IFT9701/IFT9703		4-20 mA +		—
		4-20 mA –		
RFT9712	17	4-20 mA +		—
	16	4-20 mA –		
RFT9729	B16	mA +		—
	B14	mA –		

Performing milliamp output test

To perform a milliamp output test:

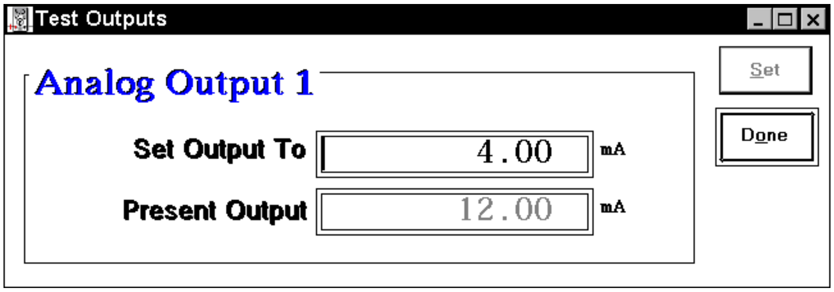
1. Open the Test menu, then choose Milliamp Output Test. When connected to an RFT9739, the ProLink menu bar displays a cascading menu, allowing the user to choose the primary output (milliamp output 1) or secondary output (milliamp output 2) for testing. The dialog box shown in **Figure 15-1** then appears.

2. Enter the desired output level, in milliamps, into the Set Output To text box.
   - For an RFT9739, enter any current level from 0 to 22 mA if the output produces a 0-20 mA current, or 2 to 22 mA if the output produces a 4-20 mA current
   - For an IFT9701, IFT9703, RFT9712, or RFT9729, enter any current level from 2 to 22 mA

3. Choose Set, then check the readout from the reference device. It should indicate the same amount of current as the amount entered into the Set Output To text box in step 2.

If you choose Cancel before selecting Done, or if communication between the ProLink program and the transmitter is interrupted before the procedure is completed, Analog 1 Fixed or Analog 2 Fixed remains ON in the Status window. To read the Status window, open the View menu, then select Transmitter Status. To clear the alarm, reopen the Test Dialog box and select Done.

Figure 15-1. Test Milliamp Outputs dialog box



If the Bell 202 standard is being used over the primary mA output, communication failure will occur if output drops below 2 mA. If communication between the ProLink program and the transmitter is interrupted before completing the test, one of the following indicators in the Status window switches ON:

- Analog 1 Fixed
- Analog 2 Fixed
- Analog Output Fixed

To view the Status window, open the View menu, then choose Transmitter Status. After checking indicators in the Status window, reopen the Test menu and complete the milliamp output test.

15.3 Frequency/pulse output testing

Frequency/pulse output testing requires a frequency counter. To test the output, connect the frequency counter to the transmitter frequency/pulse output terminals listed in **Table 15-2**, then perform the frequency/pulse output test procedure.

Table 15-2. Frequency/pulse output terminals

Transmitter	Terminals	
RFT9739 field-mount	15	Freq +
	16	Return
RFT9739 rack-mount	CN2-D24	Freq
	CN2-D26	Return
IFT9701/IFT9703	+	
	–	
RFT9712	19	Freq +
	18	Freq F/R –
RFT9729	CN2-28b	Freq +
	CN2-24b	Freq F/R –

If communication is lost while in fixed frequency mode, the transmitter remains in fixed frequency mode. No status indicates this state.

Performing the frequency/pulse output test

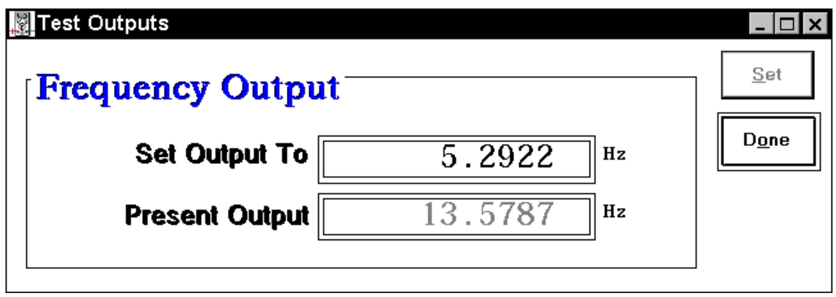
To perform a frequency/pulse output test:

1. Open the Test menu, then choose Frequency/Pulse Output Test. The dialog box shown in Test Frequency Outputs dialog box then appears.

2. Enter the desired output level, in Hz, into the Set Output To text box.
   - For an RFT9739, enter any frequency from 0.1 to 15,000 Hz
   - For an IFT9701 or IFT9703 with software version 1.2 or higher, enter any frequency from 0.01 to 7200 Hz
   - For an IFT9701 or IFT9703 with a software version lower than 1.2, enter any frequency from 0.01 to 1200 Hz
   - For an RFT9712 or RFT9729, enter any frequency from 1 to 10,000 Hz

3. Choose Set, then check the readout from the frequency counter. It should indicate the same frequency as the frequency entered in the Set Output To text box in step 2.

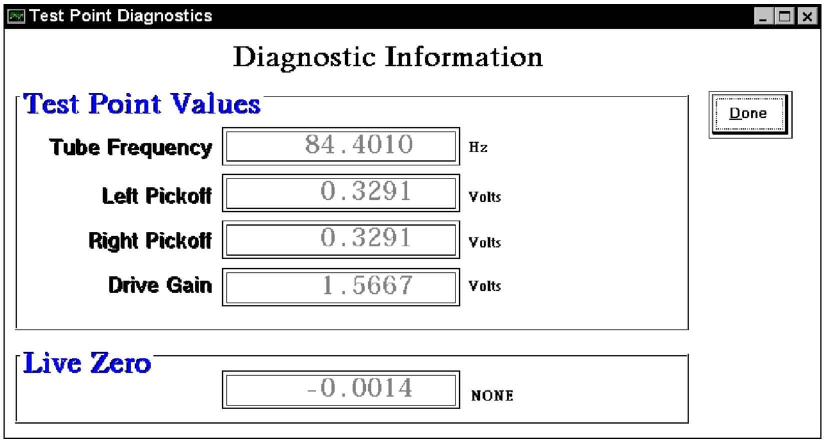
Figure 15-2. Test Frequency Outputs dialog box



15.4 Test point diagnostics for Version 3 RFT9739

The ProLink program provides on-line test point information for Version 3 RFT9739 transmitters. Use the Test Points dialog box to view sensor tube frequency, pickoff voltages, drive gain voltage, and live zero. Open the Test menu, then choose Test Points. The Test Points dialog box appears, as depicted in **Figure 15-3**, page 159.

Figure 15-3. Test points dialog box



Test point values

To use the displayed tube frequency, pickoff and drive gain voltages in **Section 7.3**.

When the sensor is disconnected from an RFT9739, the following values go to zero:

- Drive gain
- Left and right pickoff signals
- Live zero

Live zero

Live zero flow enables the user to read the mass flow rate when it drops below the cutoff that is set for mass flow. (To set a mass flow cutoff, see **Section 9.5**, page 102.)

The live zero flow value is for diagnostic purposes only. If the mass flow rate drops below the flow cutoff, internal totalizers will stop counting, whether or not the user is reading live zero flow.

When flow through the sensor is completely stopped, live zero flow can be used for calculating the zero stability portion of the flow measurement error.

16 Applications Menu

16.1 Overview

The Applications menu enables the user to control the transmitter internal totalizers. The Application Builder command is designed as an enhancement to the ProLink software program.

16.2 Totalizer control

For an RFT9739, RFT9712 or RFT9729, the Totalizer Control command enables the user to reset, start, or stop the internal totalizers. For an IFT9701 or IFT9703, the IFT9701/9703 Totalizer Control command allows the user to reset the totalizer.

⚠ CAUTION

When the totalizer is stopped, the frequency/pulse output is disabled.

If the frequency/pulse output is used for process control, failure to set control devices for manual operation could affect process control.

- Before stopping the totalizer, set process control devices for manual operation.
- To enable the frequency/pulse output, restart the totalizer.

For RFT9712 and RFT9729 transmitters only, the totalizer will start immediately after it is reset to zero.

To control totalizers, open the Applications menu, then choose Totalizer Control or IFT9701 Totalizer Control. The Totalizer Control dialog box appears as depicted in:

- **Figure 16-1** for an RFT9739, RFT9712, or RFT9729
- **Figure 16-2** for an IFT9701 or IFT9703

Figure 16-1. Totalizer Control dialog box for RFT9739 and RFT9712/RFT9729

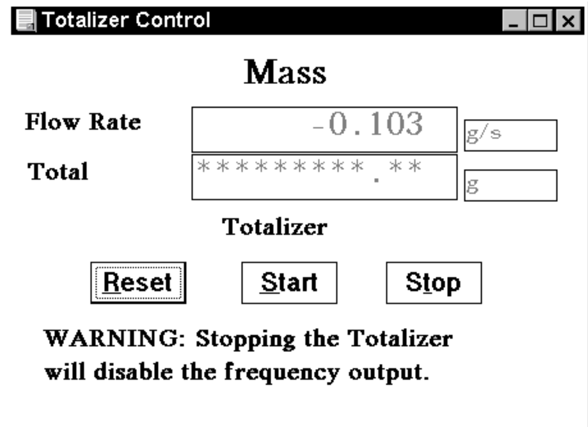
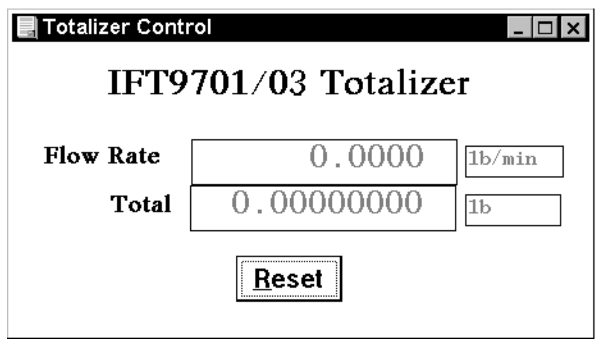


Figure 16-2. Totalizer Control dialog box for IFT9701/IFT9703



Display boxes indicate the flow rate and accumulated total.

- For an RFT9739, the displayed flow rate and total are in the *mass* flow units selected by the user in **Section 9.2**, page 93.
- For an IFT9701, IFT9703, RFT9712, or RFT9729, the displayed flow rate and total are in the *mass or volume* flow unit of measure selected by the user in **Section 9.2**, page 93.
- To change the flow unit of measure, see **Section 9.2**, page 93.
- With an RFT9739, flow rates and flow totals for mass and volume can be viewed simultaneously in the Process Variables window. Open the View menu, then choose Process Variables. (For more information about viewing process variables, see **Section 6.2**, page 47.)

RFT9739

- Choose Start to start the internal totalizers.
- Choose Stop to stop the internal totalizers.
- Choose Reset to reset the mass and volume total to 0.00.

To exit the Totalizer Control, double-click the control-menu box in the upper left corner of the dialog box.

Totalizer functions can be disabled, depending on the RFT9739 security mode. See **Table 16-1**. For more information about security modes, refer to the RFT9739 instruction manual.

Table 16-1. Totalizer Control for the RFT9739

Function	Performed with	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6	Mode 7	Mode 8
Totalizer reset*, no flow	Scroll and Reset buttons/knobs		Disabled		Disabled	Disabled		Disabled	
	HART or Modbus device			Disabled		Disabled	Disabled		
Totalizer reset*/start/ stop, with flow	Scroll and Reset buttons/knobs		Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled
	HART or Modbus device			Disabled	Disabled	Disabled	Disabled	Disabled	Disabled

**Resetting the totalizer has no affect on the mass or volume inventory. For more information, refer to “Outputs” in the RFT9739 manual.*

IFT9701/IFT9703
Choose Reset to reset the mass or volume total to 0.00.

RFT9712/RFT9729

- Choose Start to start the internal totalizers.
- Choose Stop to stop the internal totalizers.
- Choose Reset to reset the mass or volume total to 0.00.

16.3 Application builder

The Application Builder is a future enhancement to the ProLink software program.

17 Help Menu

17.1 Overview

Open the Help menu to get help using the ProLink program. The commands in the Help menu provide access to hundreds of topic files, which help explain how to use the program.

Help topics can be accessed from the index or by using search, browse, and jump functions.

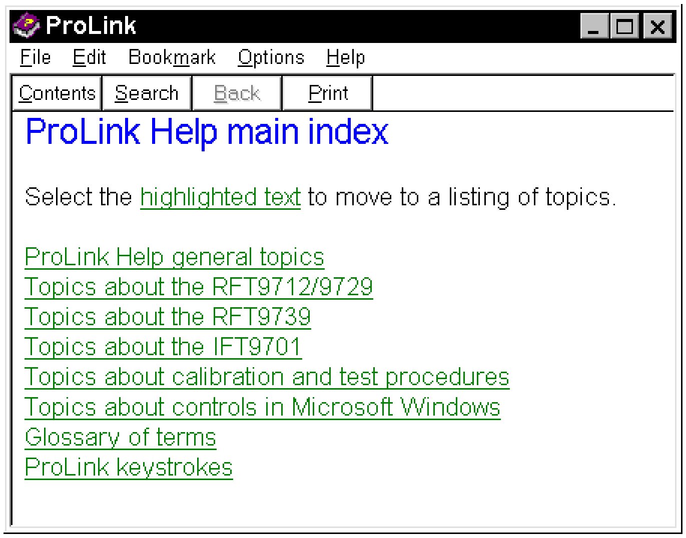
- Choose Index to access a complete list of ProLink help topics.
- Choose Keyboard to see a complete list of keystrokes used in ProLink menus, dialog boxes, and windows.
- Choose Using Help to access the Microsoft Windows Help program.
- Choose About to check the ProLink software version and copyright.

ProLink software also features context-sensitive help, which provides immediate information about the task the user is performing. To get help at any time, press F1.

17.2 Index

To access a complete list of ProLink help topics, open the Help menu, then choose Index. The ProLink help main index appears as depicted in **Figure 17-1**.

Figure 17-1. ProLink Help main index

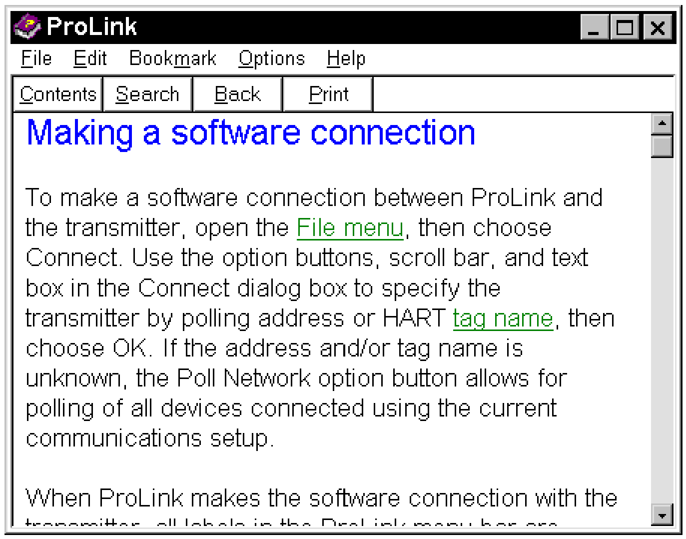


The ProLink Help main index consists of index headings. Each heading provides access to another index, which lists specific topics. To choose a heading from the main index, click the desired index heading.

Choosing a heading leads to an index that lists specific topics. To choose a topic, click the desired topic.

Figure 17-2 depicts an on-screen display of a ProLink help topic.

Figure 17-2. Typical ProLink Help display



17.3 Keyboard

To view a complete list of ProLink keystrokes, open the Help menu, then choose Keyboard.

The Keyboard command provides help for users who prefer working with the keyboard rather than the mouse, or for users of a personal computer that is not equipped with a mouse.

17.4 Using Help

To access the Microsoft Windows Help program, open the Help menu, then choose Using Help.

The Windows help program includes topics that explain how to use Help in all Windows applications.

17.5 Context-sensitive Help

ProLink software features context-sensitive help, which provides immediate information about the task the user is performing. To get help at any time, press F1.

17.6 Getting around in Help

Use the menu bar and buttons at the top of the Help window to return to the main index, choose new Help topics, and exit Help.

- Open the File menu to print topics or exit the Help program.
- Choose Contents to return to the ProLink Help main index.
- Choose Search to find a topic in a list of related topics.
- Choose Back to trace through the path that led to the current topic.
- Choose History to view a list of topics viewed during the present Help session.
- Choose the arrow buttons (<< or >>) to browse through topics related to the current topic.

Contents

Choose the Contents button to return to the ProLink Help main index. From there, choose any heading to access an index of specific topics, then choose a topic.

Search

Choose Search to display an alphabetical listing of words and subjects that have related Help topics.

Choosing Search produces a Help directory list box such as the one shown in Directory list box for search function in Help. Type a word, or select an entry from the list in the top of the Search dialog box, then choose Show Topics to display a list of related topics. Select a topic from the list in the bottom of the dialog box, then choose Go To to view the Help entry.

Back

Choose Back to move backward through the path that lead to the current topic.

- If a topic is displayed, choosing Back restores the index from which the topic was chosen.
- If an index is displayed, choosing Back restores the ProLink Help main index.

History

Choose History to view a list of Help topics previously chosen during the present Help session. Double-click any topic on the list to display the Help screen for that topic.

Browse

Each ProLink help topic is part of an ordered sequence of related topics. The arrow buttons at the top of the Help window let the user browse through the entire sequence of related topics without returning to the ProLink Help main index.

Choose the arrow buttons (>> or <<) to browse through the ordered sequence of topics.

- Choose >> to see the topics that follow the displayed topic.
- Choose << to see the topics that precede the displayed topic.

Jumping from one Help topic to another

In ProLink Help, highlighted text lets the user jump from one topic to another. To choose a jump, click the desired highlighted text.

Most highlighted text is listed in the glossary of terms at the ProLink Help main index (see **Section 17.7**).

17.7 Glossary of terms

The glossary of terms is a special help topic file, which defines terminology used in the ProLink program. Choose Glossary of Terms from the ProLink Help main index.

Appendix A How to Specify the ProLink® Product

ProLink kit	Product number
ProLink kit with 110V AC/DC power converter	
English software	PCI1EW
French software	PCI1FW
German software	PCI1GW

Individual components	
Personal Computer Interface adaptor	PCINTERFACE
110V AC/DC power converter	PCIADAPTER115
220V AC/DC power converter	PCIADAPTER220
Bell 202 cable with Minigrabber® connectors	PCICOMMCORD
25-pin/9-pin RS-232 converter	PCIPINCONN

ProLink kit with 220V AC/DC power converter	
English software	PCI2EW
French software	PCI2FW
German software	PCI2GW

Software upgrade, 3.5-inch diskette	
English software	PCIDISK350E
French software	PCIDISK350F
German software	PCIDISK350G

Instruction manuals	
English manual	MPROLINKE
French manual	MPROLINKF
German manual	MPROLINKG

Appendix B Uploading and Downloading Configuration Files with a Model 268

B.1 Uploading files

If for any reason the transmitter cannot be connected to a personal computer, a configuration file can be created using the ProLink program, then transferred to the transmitter using a Model 268.

This procedure is for an RFT9739 or RFT9729. The **IFT9701, IFT9703, Version 3.x 9739, and 9712 transmitters are not supported by the Model 268. ProLink does not support upload and download of configuration files or the Model 275 HART Communicator.**

Uploading involves four separate procedures:
1. Connecting the PC Interface adaptor to a Model 268
2. Running the ProLink setup program to choose HART protocol (if not already chosen)
3. Opening the Communication Options dialog box to choose 1200 baud and the HART primary master type (if not already chosen)
4. Choosing Upload in the Transmitter Database, then following the on-screen instructions

After the Model 268 has been uploaded with the configuration file, the configuration can be downloaded to a compatible transmitter. **Table B-1** lists Model 268 software compatibility with Micro Motion transmitters.

Table B-1. Model 268 software compatibility

Transmitter model	Required Model 268 software
RFT9739 Version 3 or later	Cannot be uploaded to a 268
RFT9739 Version 2 or earlier	HART 6.2 or higher
IFT9701, IFT9703	Cannot be uploaded to a 268
RFT9712, RFT9729	HART 5.0 or higher

To connect the PC Interface adaptor to a Model 268:

1. Using the Bell 202-compatible cables supplied with the ProLink kit and with the Model 268 (each cable has a plug and two Minigrabber connectors), plug one cable into the PC Interface adaptor ports labeled Bell 202, or into another Bell 202 signal converter. Plug the other cable into the ports on the Model 268.

2. Hook the Minigrabber connectors on one cable to the Minigrabber connectors on the other cable.

To switch to HART protocol (required by the Model 268):

1. Run the ProLink setup program as instructed in **Chapter 2** (page 5).

2. Follow the on-screen instructions to switch from Modbus to HART protocol.

3. After switching to HART protocol:
   a. If the CONFIG.SYS file was copied into the ProLink directory, copy it back into the root directory.
   b. Reboot the computer to activate changes made to the CONFIG.SYS file.

To choose 1200 baud and the HART primary master type (required by the Model 268):

1. Open the File menu, then choose Communication Options.

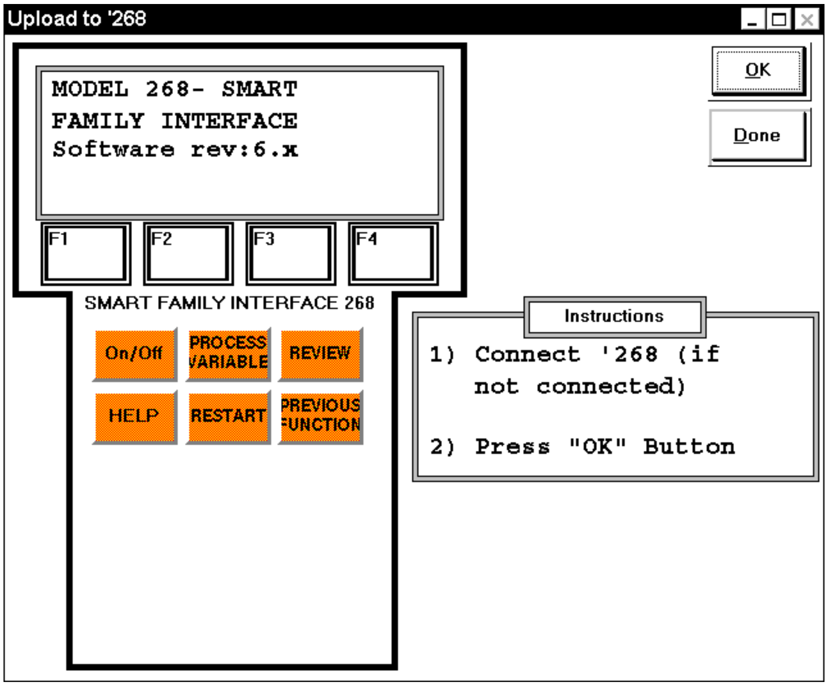
2. At the Configure Communications dialog box:
   a. Open the Baud Rate list box and select 1200 baud.
   b. Select HART Primary.
   c. Click OK.

To upload the Model 268 with a configuration file:

1. Use the Transmitter Database dialog box to select the desired transmitter configuration file.

2. To avoid "locking up" the personal computer, make sure to connect the Model 268 to the PC Interface adaptor, then choose Upload. The Upload to 268 dialog box appears as shown in **Figure B-1**.

Figure B-1. Upload to 268 dialog box



3. Follow the step-by-step instructions in the dialog box.
   - At each step, the Model 268 key that the user should press appears highlighted in the illustration.
   - After reading the on-screen instructions at each step, advance to the next step by clicking the highlighted key in the illustration.

4. As the configuration uploads, the message "UPLOADING" appears.
   - The message blinks until uploading is completed.
   - If the "UPLOADING" message fails to blink, press the tan RESTART key on the Model 268.

5. After uploading is completed, continue using the on-screen instructions to save the uploaded configuration to the offline memory (OFLN Mem) of the Model 268.

B.2 Downloading a configuration to a transmitter

After the Model 268 has been uploaded, the configuration file can be downloaded to a target transmitter. **Table B-1**, page 171 lists Model 268 software compatibility with Micro Motion transmitters.

⚠ CAUTION

Failure to enter calibration factors could cause measurement error.

To avoid measurement error after downloading a configuration file to a transmitter, use the Model 268 to enter flow and density calibration factors into the transmitter memory, or open the Configure menu and characterize the sensor as described in **Chapter 8**.

To download the configuration file from the Model 268:

1. After uploading the Model 268, connect the Model 268 to the target transmitter, then press RESTART.

2. Compare the measurement units in the target transmitter memory with those in the source configuration file. The source configuration must have the same measurement units as those in the target transmitter memory. Otherwise, the target transmitter will refuse the source configuration when it is downloaded.
   a. After saving the work registers in the safe memory or proceeding without saving the work registers, press REVIEW.
      - To review the measurement units from the source configuration, press F2 (OFLN Mem).
      - To review the measurement units from the target transmitter, press F3 (WORK Regs).
   b. If necessary, enter the change input/output (Chng I/O) branch of the Model 268 software, reconfigure measurement units so they match the measurement units in the source configuration, then send the units to the target transmitter.
3. After sending measurement units to the target transmitter, the user can download the source configuration.

   With the Model 268 still connected to the target transmitter, press RESTART.

   The Model 268 again uploads the work registers from the transmitter memory.

4. After saving the work registers in the safe memory or proceeding without saving the work registers, press F3 (Config) to access the configuration branch.

5. Press F1 (OFLN Data).

6. Press F3 (Recall) to recall the source configuration from the offline memory (OFLN Mem).

7. When the display warns that recalling the offline memory will erase the work registers, press F4 (Proceed).

8. Press F4 (Send Data) to send the source configuration to the target transmitter.

Appendix C Temperature Coefficients for Flow and Density

⚠ CAUTION

Entering incorrect flow and density temperature coefficients can cause measurement error.

Do not enter flow and density temperature coefficient values that are listed in the instruction manual.

Make sure flow and density temperature coefficients entered into the transmitter and peripheral device are equivalent to the coefficients on the sensor serial number tag.

C.1 Flow temperature coefficient

The flow temperature coefficient represents the percent change in the rigidity of the flow tubes around the twist axis per 100°C.

The flow temperature coefficient is derived from the last three digits and second decimal point in the flow calibration factor that appears on the sensor serial number tag.

- Sensor serial number tags vary in appearance, depending on the manufacturing date.
- Use a HART Communicator, Modbus protocol, or ProLink software to enter the flow temperature coefficient into the transmitter memory.

C.2 Density temperature coefficient

The density temperature coefficient represents the percent change in the elasticity of the flow tubes around the bend axis per 100°C.

The density temperature coefficient is derived from values that appear on the sensor serial number tag.

- If the tag shows a 13-digit density calibration factor, derive the density temperature coefficient from the last three digits of the density calibration factor.
- If the tag shows K1, K2, and TC values, derive the density temperature coefficient from the TC value.
- Sensor serial number tags vary in appearance, depending on the manufacturing date.

Use a HART Communicator, Modbus protocol, or ProLink software to enter the flow temperature coefficient into the transmitter memory.

Table C-1. Temperature coefficients for flow

Stainless steel sensor model	Coefficient
D (except D600)	5.13
D600	4.70
DL	5.13
CMF	4.75
F025	4.65
F050	4.77
F100	4.32
F200	4.29
Hastelloy® sensor model	
D	3.15
DT	3.15
CMF	2.90

Temperature Coefficients for Flow and Density *continued*

Density temperature coefficient

Table C-2. Temperature coefficients for density

Stainless steel sensor model	Coefficient
D (except D600)	4.44
D600	4.70
DL	4.44
CMF	4.44
F025	4.39
F050	4.36
F100 and F200	4.25
Hastelloy® sensor model	
D	2.75
DT	2.75
CMF010	
CMF025	3.10
CMF050 and CMF100	3.00
CMF200	2.95
CMF300	2.90
CMF400	2.75

Appendix D ASCII Character Set

Decimal code		Decimal code		Decimal code	
000	NUL	043	+	086	V
001	SOH	044	,	087	W
002	STX	045	-	088	X
003	ETX	046	.	089	Y
004	EOT	047	/	090	Z
005	ENQ	048	0	091	[
006	ACK	049	1	092	\
007	BEL	050	2	093	]
008	Back Space	051	3	094	^
009	Horizontal Tab	052	4	095	_
010	Line Feed	053	5	096	`
011	VT	054	6	097	a
012	Form Feed	055	7	098	b
013	Carriage Return	056	8	099	c
014	SO	057	9	100	d
015	SI	058	:	101	e
016	DLE	059	;	102	f
017	DC1	060	<	103	g
018	DC2	061	=	104	h
019	DC3	062	>	105	i
020	DC4	063	?	106	j
021	NAK	064	@	107	k
022	SYN	065	A	108	l
023	ETB	066	B	109	m
024	CAN	067	C	110	n
025	EM	068	D	111	o
026	SUB	069	E	112	p
027	ESC	070	F	113	q
028	FS	071	G	114	r
029	GS	072	H	115	s
030	RS	073	I	116	t
031	US	074	J	117	u
032	Space	075	K	118	v
033	!	076	L	119	w
034	"	077	M	120	x
035	#	078	N	121	y
036	$	079	O	122	z
037	%	080	P	123	{
038	&	081	Q	124	|
039	'	082	R	125	}
040	(	083	S	126	~
041	)	084	T	127	_
042	*	085	U		

Appendix E Transmitter Configuration Worksheets

The following worksheets, shown in this appendix, should be used for recording transmitter data during configuration.

- RFT9379 Configuration Worksheet
- IFT9701/IFT9703 Configuration Worksheet
- RFT9712/9729 Configuration Worksheet

Model RFT9739 Configuration Worksheet

Date ____________________

Characterize (Chapter 8)

FlowCal________________	FlowFact*________________
TempCal________________	DensFact*________________
ViscCal________________	FlowCal Pressure*________________
Dens A________________	K1________________
Dens B________________	K2________________
Temp Coeff________________	K3*________________
Slug Flow Low________________	Slug Flow High________________

*Only for RFT9739 with software versions 2.1 through 3.5.

Transmitter Variables (Chapter 9)

Mass Flow Unit________________	Visc Unit________________
Mass Flow Cutoff________________	DP Unit________________
Density Unit________________	Flow Direction________________
Density Damping________________	Flow Damping________________
Temperature Unit________________	Volume Flow Unit________________
Temperature Damping________________	Volume Flow Cutoff________________

Special Units (Chapter 10)

Mass	Volume
Conv Fact________________	Conv Fact________________
Flow Unit________________	Flow Unit________________
Time Unit________________	Time Unit________________
Flow Text________________	Flow Text________________
Total Text________________	Total Text________________

Model RFT9739 Configuration Worksheet
(continued)

Transmitter Outputs (Chapter 10)

Frequency variable	________________	Fault Indicator	________________
Freq	________________	Slug Duration	________________
Rate	________________		
Max Pulse	________________	Control	________________
Milliamp 1 variable	________________	Milliamp 2 variable	________________
4 mA (0 mA)	________________	4 mA (0 mA)	________________
20 mA	________________	20 mA	________________
Cutoff	________________	Cutoff	________________
Damp	________________	Damp	________________

Transmitter Information (Chapter 11)

Transmitter Database		Pressure Input*	________________
Tag	________________	DP Tag	________________
Serial #	________________	Analog Input Pressures	
Date	________________	4 mA	________________
Comm Addr	________________	20 mA	________________
Desc	___________________________	Sensor Database	
Msg	___________________________	Serial #	________________
	___________________________	Type	________________
		Flange	________________
Burst Control	_ On _ Off	Material	________________
		Liner	________________

*Only for RFT9739 with software version 2.1 or higher.

Events (Chapter 12)

Event 1		Event 2	
Process Variable	________________	Process Variable	________________
Type	_ High Alarm _ Low Alarm	Type	_ High Alarm _ Low Alarm
Setpoint	________________	Setpoint	________________

Model IFT9701 / IFT9703 Configuration Worksheet

Date ____________________________

Transmitter Information (Chapter 11)

Transmitter Database	Burst Control _ On _ Off
Tag________________	Sensor Database
Serial #________________	Serial #________________
Date________________	Type________________
Comm Addr________________	Flange________________
Desc____________________________	Material________________
Msg____________________________	Liner________________
____________________________	

Characterize (Chapter 8)

FlowCal________________	Slug Flow Low________________
DensCal________________	Slug Flow High________________

Transmitter Variables (Chapter 9)

Mass/Volume Flow Unit________________	Flow Direction________________
Mass/Volume Flow Cutoff________________	Flow Damping________________
Density Unit g/cc ________________	Temperature Unit ˚C ________________

Transmitter Outputs (Chapter 10)

Frequency	Milliamp 1
Freq________________	4 mA________________
Rate________________	20 mA________________

Transmitter Information (Chapter 11)

Tag________________	Comm Addr________________
Date________________	Desc____________________________

Model RFT9712 / RFT9729 Configuration Worksheet

Date ____________________________

Meter Factors (Chapter 13)

Mass Flow	________________
Volume Flow	________________
Density	________________

Characterize (Chapter 8)

FlowCal________________	Slug Flow Low________________
DensCal________________	Slug Flow High________________

Transmitter Variables (Chapter 9)

Mass Flow Unit________________	Flow Direction________________
Mass Flow Cutoff________________	Flow Damping________________
Density Unit________________	Temperature Unit________________

Special Units (Chapter 9)

Mass	
Conv Fact________________	Flow Text________________
Flow Unit________________	Total Text________________
Time Unit________________	

Transmitter Outputs (Chapter 10)

Frequency	Milliamp 1 variable________________
Freq________________	4 mA________________
Rate________________	20 mA________________
	Cutoff________________

Appendix F Flowmeter Calibration Records

The worksheets shown in this appendix should be used for recording transmitter data during calibration.

- RFT9379 Calibration Record
- IFT9701/IFT9703 Calibration Record
- RFT9712/RFT9729 Calibration Record

Model RFT9739 Calibration Record

Date ________________________

Auto Zero (Chapter 14)

Convergence limit________________	Zero time________________

Density Calibration (Chapter 14)

First Point (Air) Line-condition density___________ g/cc Second Point (Water) Line-condition density___________ g/cc	Third Point Line-condition density___________ g/cc

Viscosity Calibration (Chapter 14)

Slope calibration Line-condition viscosity________________	Offset calibration Line-condition viscosity________________

Temperature Calibration (Chapter 14)

Slope Calibration Measured temperature____________ °C	Offset Calibration Measured temperature____________ °C

Milliamp Output Trim (Chapter 14)

Milliamp Output 1 Reference current at ±4 mA_________ mA Reference current at ±20 mA_________ mA	Milliamp Output 2 Reference current at ±4 mA_________ mA Reference current at ±20 mA_________ mA

Model IFT9701 / IFT9703 and RFT9712 / RFT9729 Calibration Record

Date ___________________________

Milliamp Output Trim (Chapter 14)

Reference current at ±4 mA	_________ mA
Reference current at ±20 mA	_________ mA

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Page numbers in **bold** indicate illustrations.

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