Expanded Calculation Set Program
(For ROC800-Series Remote Operations Controllers)

User Manual
(QER 06Q018)

Form A6203
January 2009

EMERSON
Process Management

Revision Tracking Sheet

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This manual may be revised periodically to incorporate new or updated information. The revision date of each page appears at the bottom of the page opposite the page number. A change in revision date to any page also changes the date of the manual that appears on the front cover. Listed below is the revision date of each page (if applicable):

Page	Revision
All pages	Jan-09
Initial release	Sep-06

Contents

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1 INTRODUCTION

1.1 Scope and Organization

This document serves as the user manual for the Expanded Calculation Set program (QER 06Q018), which is intended for use in the ROC800-Series Remote Operations Controllers ("ROC800s"). This manual describes how to download, install, and configure the Expanded Calculation Set user program (referred to as the "Expanded Calcs program" or "the program" throughout the rest of this manual). You access and configure this program using ROCLINK™ 800 Configuration Software loaded on an IBM-compatible personal computer running 2000 (with Service Pack 2), XP, or Vista.

The sections in this manual provide information in a sequence appropriate for first-time users. Once you become familiar with the procedures and the software, the manual becomes a reference tool.

This manual has the following major sections:

- *Section 1 – Introduction*
- *Section 2 – Installation*
- *Section 3 – Configuration*
- *Section 4 – Reference*

This manual assumes that you are familiar with the ROC800s and their configuration. For more information, refer to the following manuals:

- *ROC809 Remote Operations Controller Instruction Manual* (Form A6116).
- *ROC827 Remote Operations Controller Instruction Manual* (Form A6175).
- *ROCLINK 800 Configuration Software User Manual* (Form A6121).

1.2 Product Overview

The Expanded Calculation Set program enables a ROC800 to calculate the density, viscosity, and specific heat ratio of various pure fluids based on the National Institute of Standards and Technology Standard Reference Database 23 (NIST 23). The program then copies these physical property values to the associated meter and station parameters, which enables the calculation of mass, standard volume, and energy flow rates and accumulations.

The program supports the following fluids: oxygen, nitrogen, hydrogen, carbon dioxide (liquid), carbon dioxide (vapor), carbon monoxide, helium, argon, steam, and water. Additionally, the program supports the configuration of air and natural gas, which permits the use of a single interface, regardless of the fluid type. The standard firmware calculates air and natural gas properties using the American Gas Association Report No. 8 (AGA8).

This program also supplements the flow calculation capabilities of the ROC800 to support calculation of flow through various types of differential and linear meters. Differential meter types supported include flange-tapped orifice, Venturi, Annubar, and V-Cone. Any linear meter that provides either an actual (gross) volume or a mass flow (represented as either a pulse or analog input or retrieved through serial communications) is supported.

Additionally, the Expanded Calcs program allow calculation of flow rates using the Russian MI-2667 (GOST) standard, permitting flow calculations for gas, steam/water, and fluid applications in metric units. It supports installations implementing either an Annubar Diamond II or an Annubar 485 T-shaped element.

1.3 Program Requirements

The Expanded Calcs (version 1.1) program is compatible with version 2.13 (or greater) of the ROC800-Series firmware and with version 1.83 (or greater) of the ROCLINK 800 software.

Program specifics include:

File Name	Target Unit/ Version	User Defined Point (UDP)	Flash Used (in bytes)	SRAM Used (in bytes)	DRAM Used (in bytes)	ROCLINK 800 Version	Display Number
ExpandedCalc.tar	ROC800 2.13	60, 61, 62	84,621	924	290,816	1.83	1, 2, 3

Note: You must connect a PC to the ROC800's LOI port **before** starting the download.

For information on viewing the memory allocation of user programs, refer to the *ROCLINK 800 Configuration Software User Manual* (Form A6121).

1.3.1 License Keys

License keys, when matched with valid license codes, grant access to applications such as the Expanded Calcs program.

The term "license key" refers to the physical piece of hardware that can contain up to seven different licenses (refer to *Figure 1*). Each ROC800 can have none, one, or two license keys installed. If you remove a license key after enabling an application, the firmware disables the task from running. This prevents unauthorized execution of protected applications in a ROC800.

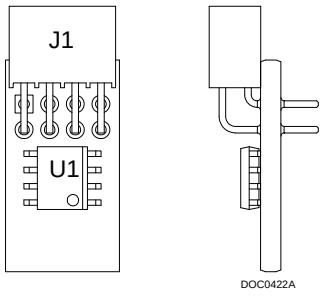

Figure 1. License Key

You must install the following license keys to use the Expanded Calculation Set program.

- Expanded Calculation Set License Key.
- AGA_3/7/8 License Key (**not included in this program**).

2 INSTALLATION

This section provides instructions for installing the Expanded Calcs program. Read *Section 1.3* of this manual for program requirements.

2.1 Installing the License Key

If you order the Expanded Calcs program for a new ROC800, your ROC800 is delivered with the license key installed. Go to *Section 2.2*.

If you order the program for an existing ROC800, you must install the license key yourself.

Caution

Failure to exercise proper electrostatic discharge precautions, such as wearing a grounded wrist strap may reset the processor or damage electronic components, resulting in interrupted operations.

When working on units located in a hazardous area (where explosive gases may be present), make sure the area is in a non-hazardous state before performing these procedures. Performing these procedures in a hazardous area could result in personal injury or property damage.

To install a license key:

1. Remove power from the ROC800.
2. Remove the wire channel cover.
3. Unscrew the screws from the Central Processing Unit (CPU) faceplate.
4. Remove the CPU faceplate.
5. Place the license key in the appropriate terminal slot **(P4** or **P6)** in the CPU.

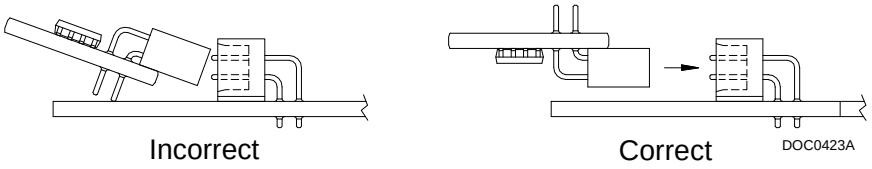

Figure 2. License Key Installation

Note: When using a single license key, install it in **slot P4**.

6. Press the license key into the terminal until it is firmly seated (refer to *Figure 2*).
7. Replace the CPU faceplate.
8. Replace the screws on the CPU faceplate.
9. Replace the wire channel cover.
10. Restore power to the ROC800.

2.1.1 Verifying the License Key Installation

After you install the license key, you can verify whether the ROC800 recognizes the key. From the ROCLINK 800 screen, select **Utilities** > **License Key Administrator**. The License Key Administrator screen displays:

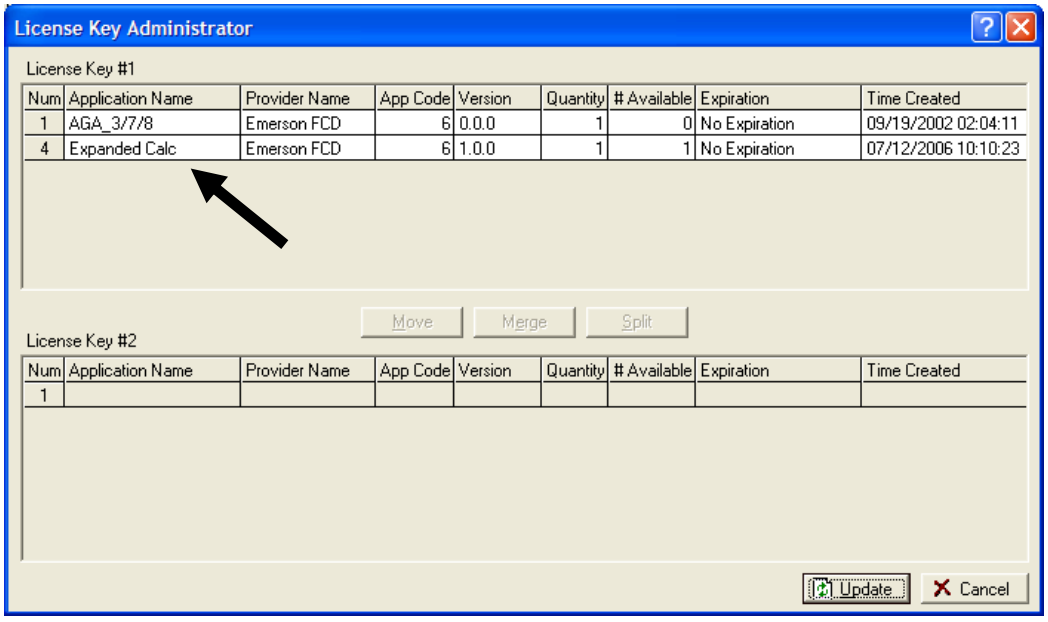

Figure 3. License Key Administrator

The Expanded Calc program appears in the Application Name column. (For further information on the License Key Administrator screen, refer to the *ROCLINK 800 Configuration Software User Manual*, Form A6121).

Note: The value in the App Code field on this screen indicates the total number of stream licenses available on this ROC800.

After you verify that the license key is correctly installed and recognized, proceed to *Section 2.2*.

2.2 Downloading the ExpandedCalc.tar Program

This section provides instructions for installing the ExpandedCalcs.tar program file into the Flash memory on the ROC800.

To download the program using ROCLINK 800 software:

1. Select any empty program number into which to download the program:

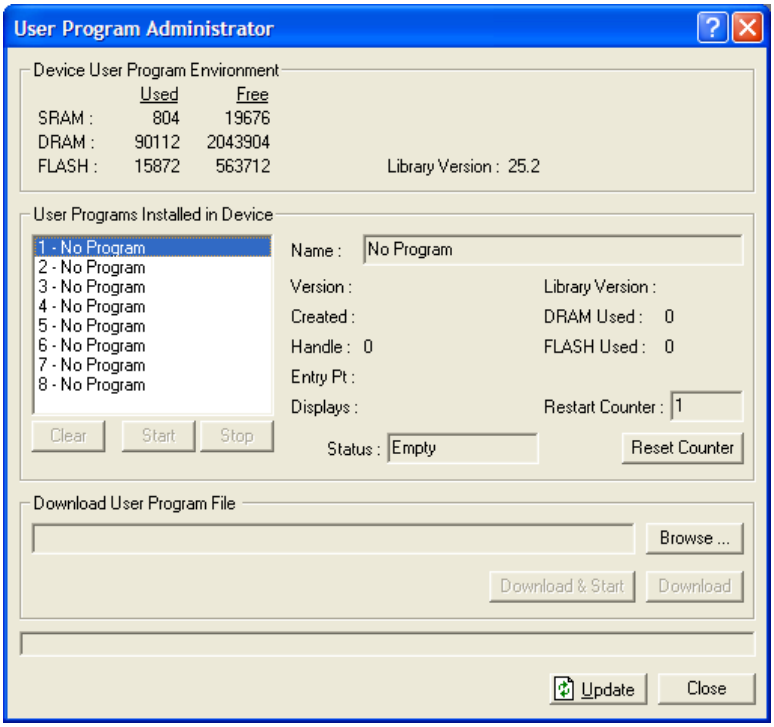

Figure 4. User Program Administrator

2. Click **Browse** in the Download User Program File frame. The Select User Program File screen displays (see *Figure 5*).
3. Select the path and user program file to download from the CD-ROM. (Program files are typically located in the Program Files folder on the CD-ROM.) As *Figure 5* shows, the screen lists all valid user program files with the .TAR extension:

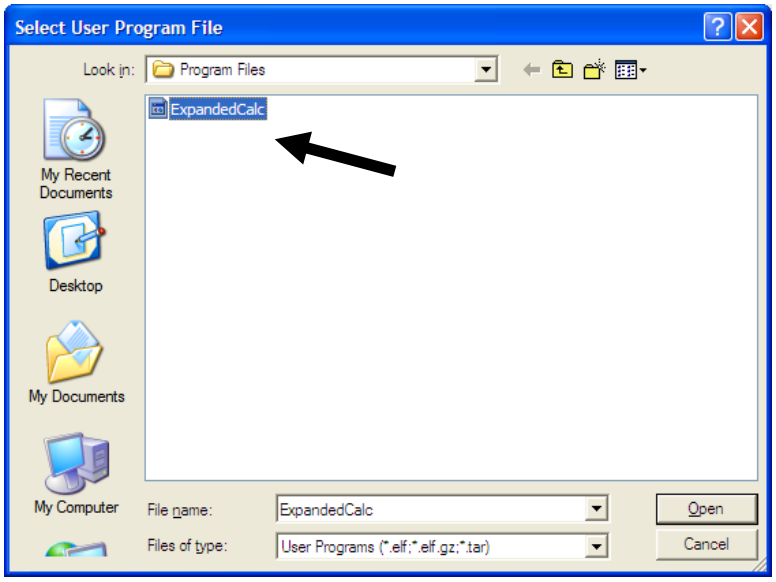

Figure 5. Select User Program File

4. Click **Open** to select the program file. The User Program Administrator screen displays. As shown in *Figure 6*, note that the Download User Program File frame identifies the selected program and that the **Download & Start** button is active:

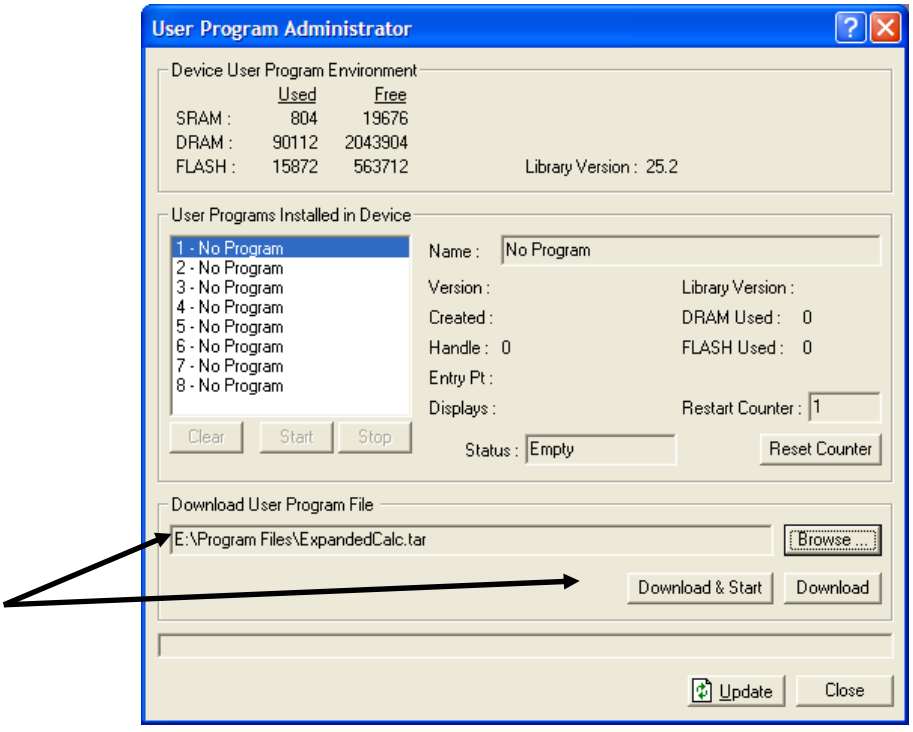

Figure 6. User Program Administrator

5. Click **Download & Start** to begin loading the selected programs. The following message displays:

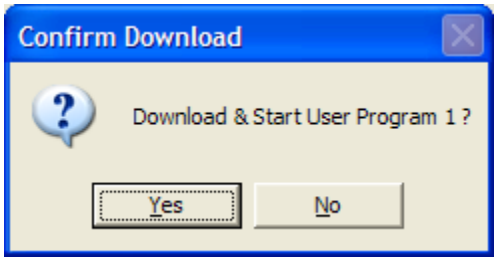

Figure 7. Confirm Download

6. Click **Yes** to begin the download. When the download completes the following message displays:

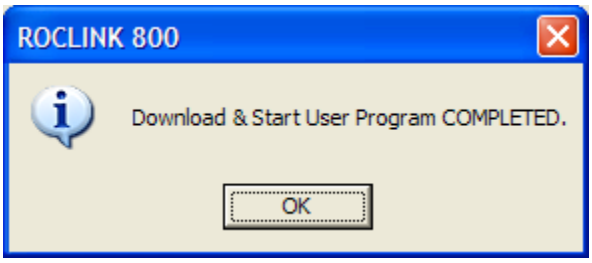

Figure 8. ROCLINK 800 Download Confirmation

7. Click **OK**. The User Program Administrator screen displays (see *Figure 9*). Note that:

   - The Device User Program Environment frame reflects the use of system memory.
   - The User Programs Installed in Device frame identifies the installed program(s).

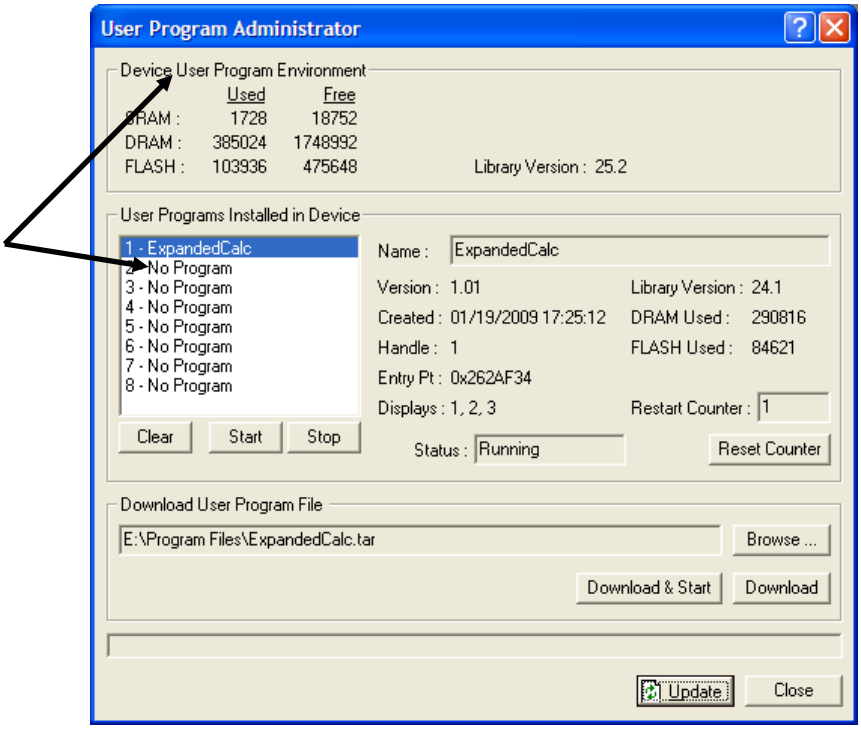

Figure 9. User Program Administrator

8. Click **Close**. The ROCLINK 800 screen displays and the download is complete.

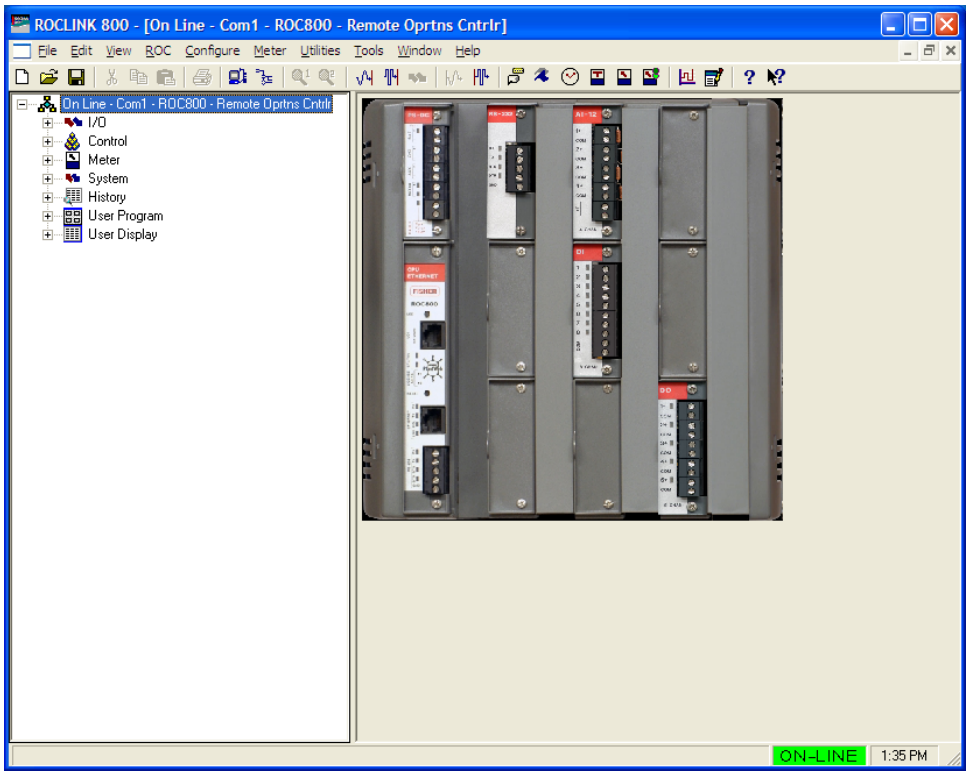

Figure 10. ROCLINK 800

3 CONFIGURATION

After you have loaded the Expanded Calcs program on the ROC800, you configure the program using one ROCLINK 800 screen (Device Information) and three program-specific screens (Station, Differential Meters, and Linear Meters):

- Use the Points tab on the ROCLINK 800 Device Information screen (**ROC** > **Information**) to configure the number of active orifice (differential) meters and the number of active linear (turbine, including the Coriolis mass) meters.
- Use the Station screen to select the calculation standard and specify the fluid being measured or the percentage of various components in the fluid.
- Use the Differential Meters screen to select the type of meter and to specify meter-specific parameters for supported differential meters (orifice, Venturi, Annubar, or V-Cone).
- Use the Linear Meters screen to select either a volume or mass input and to specify meter-specific parameters for supported linear meter runs (turbine, PD meter, ultrasonic, or Coriolis).

To configure the program (after logging onto ROCLINK 800 and successfully installing the program and license key), proceed through the program screens as shown in this section.

You can access all the program-specific screens from the main ROCLINK 800 screen:

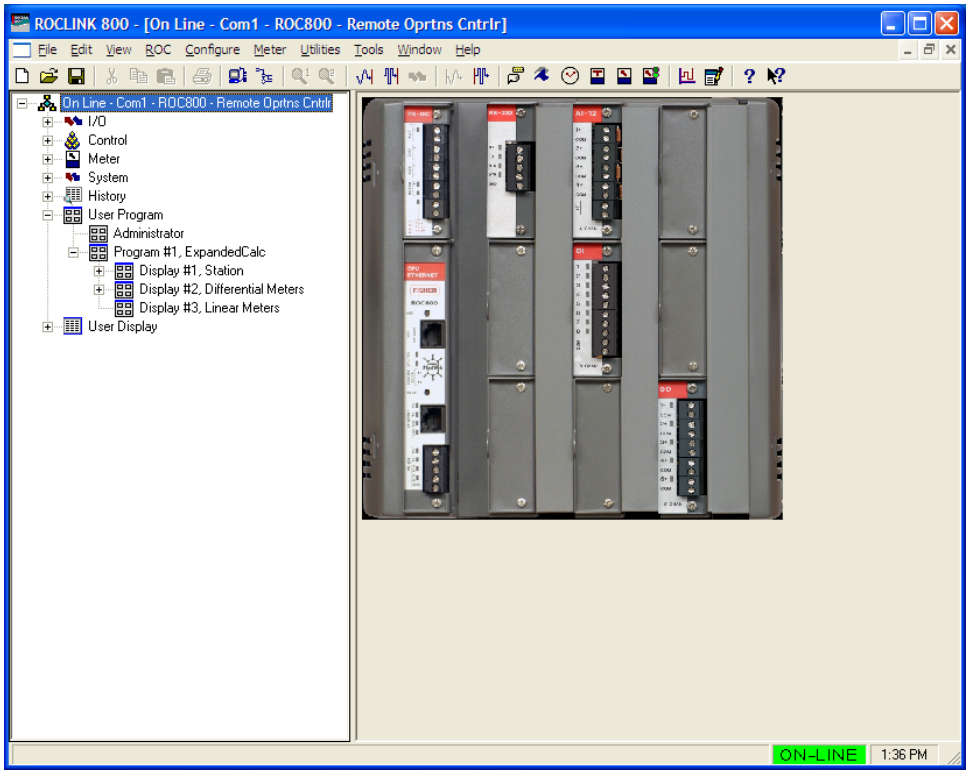

Figure 11. ROCLINK 800

3.1 Device Information Screen

Use this screen to set the active number of meters. To access this screen:

1. Select **ROC** > **Information** from the ROCLINK menu bar. The Device Information screen displays.
2. Select the **Points** tab.

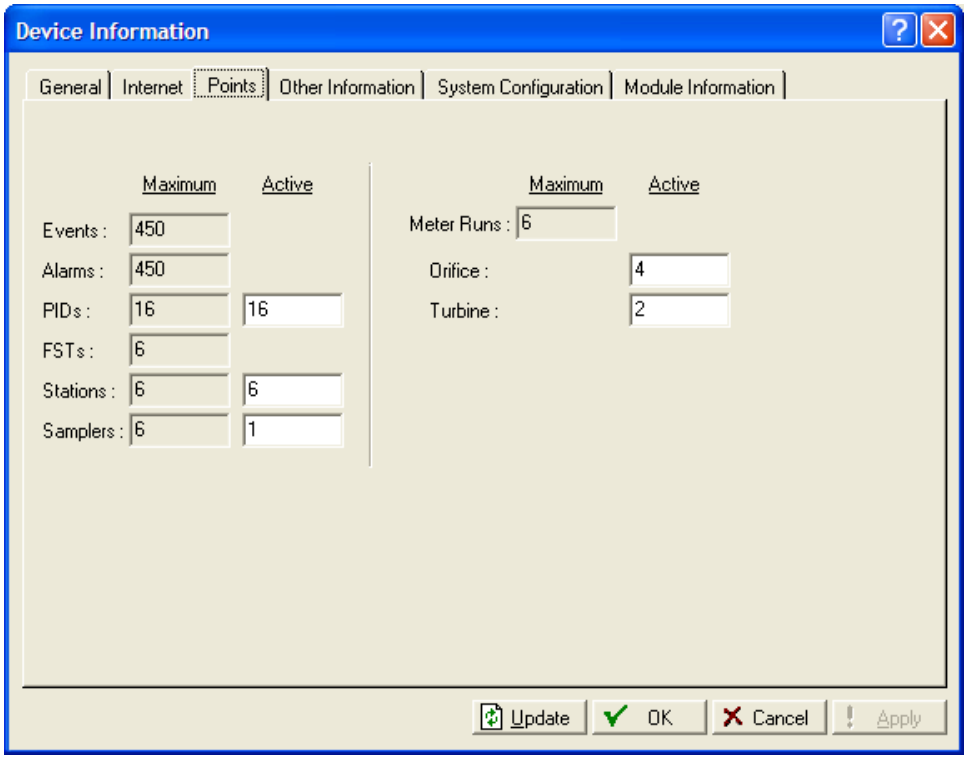

Figure 12. Device Information, Points tab

3. Review—and change as necessary—the values in the following fields:

Note: Each AGA 3/7/8 license key accommodates a maximum of six meter runs. You can define any combination of active orifice meter runs and active turbine meter runs, as long as the sum of the two does not exceed the maximum of 6 runs. Provided you have a maximum of two AGA 3.7.8 license keys installed, the system can support a total of 12 runs.

Field	Description
Orifice	Indicates the number of active orifice (differential) meters.
Turbine	Indicates the number of active turbine (linear) meters.

4. Click **Apply** to save your changes.
5. Click **OK** to close the screen.
6. Proceed to *Section 3.2* to configure station values.

3.2 Station Screen

Use this screen and its tabs to specify a broad range of station-specific parameters. To access this screen:

1. From the Directory Tree, select **User Program** > **Program #1, ExpandedCalc** > **Display #1, Station**.
2. Double-click **#1, Station 1**. The Station screen displays, showing the General tab:

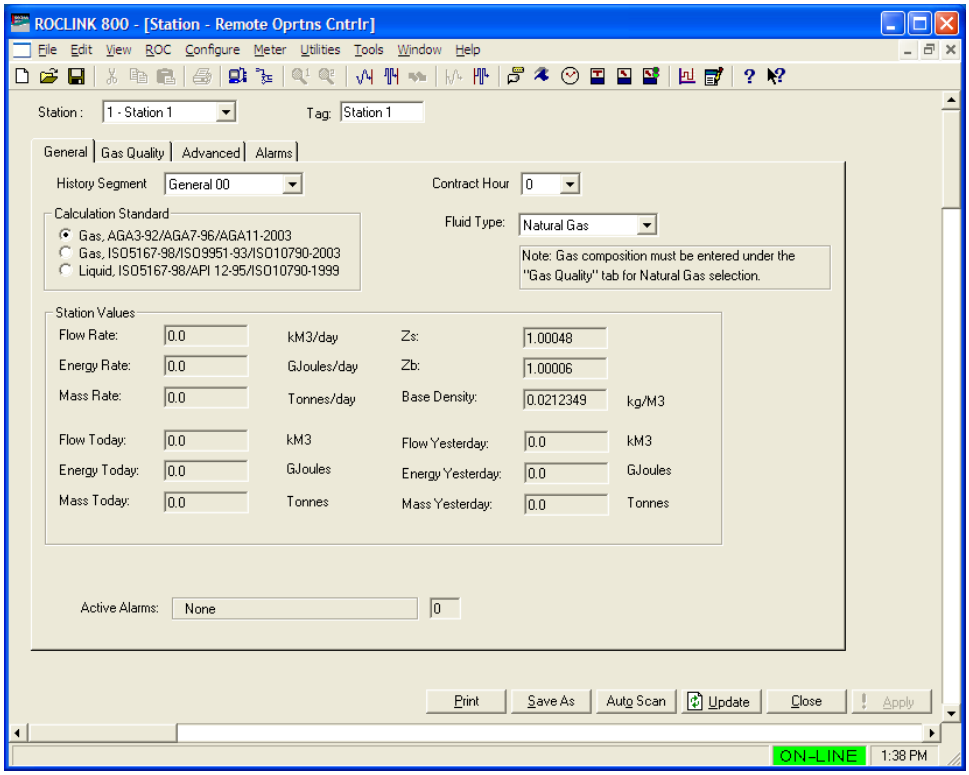

Figure 13. Station, General tab

Note: The Station screen—like the Differential Meters and Linear Meters screens—has a tab format. *Sections 3.2.1* through *3.2.4* discuss the requirements for each tab on the Station screen.

3.2.1 Station – General Tab

Use this tab (which displays when you access the Station screen) to provide general information about the station.

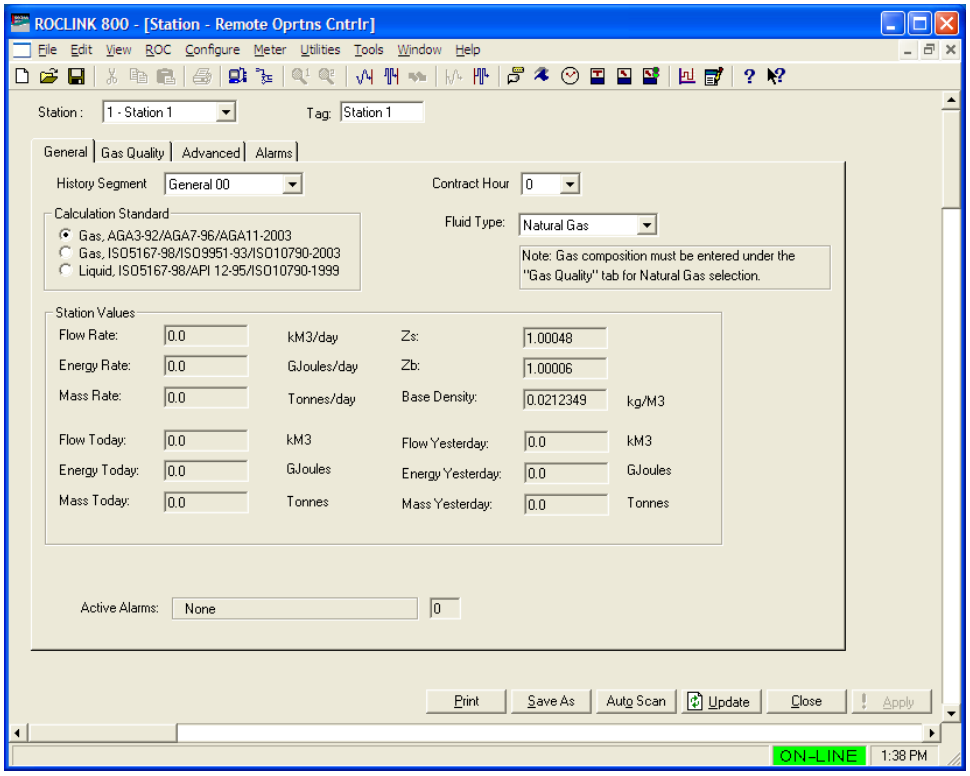

Figure 14. Station, General tab

1. Review the values in the following fields:

Field	Description
Station	Indicates the current station. Click ▼ to display additional stations for this screen.
Tag	Provides a short description (up to 10 alphanumeric characters) for the selected station.
History Segment	Indicates the segment in the historical database in which the program stores history points for meters in this station.
Contract Hour	Indicates the hour at which the system totals values for a single day of production, clears today's accumulators, and logs data to the Daily History database. **0** represents midnight on a 24-hour clock. **Note**: Ensure that this value is correct for your organization. Changing this value directly affects the "contract hour" in the history segment configuration.
Calculation Standard	Indicates the standard the program uses for calculations. The default value is **Gas, AGA3-92/AGA7-96/AGA11-2003**.
Fluid Type	Sets the fluid the station handles. Click ▼ to display all valid selections. The default value is **Natural Gas**.
Station Values	These **display-only** fields show the current values defined for various station parameters.

Field	Description
Active Alarms	This **display-only** field shows any flow alarms currently active.

2. Click **Apply** to save any changes you have made to this screen.
3. Proceed to *Section 3.2.2* to define gas quality parameters for the station.

3.2.2 Station – Gas Quality Tab

Use this tab to set up specifics of gas quality for a station.

1. Select the **Gas Quality** tab on the Station screen:

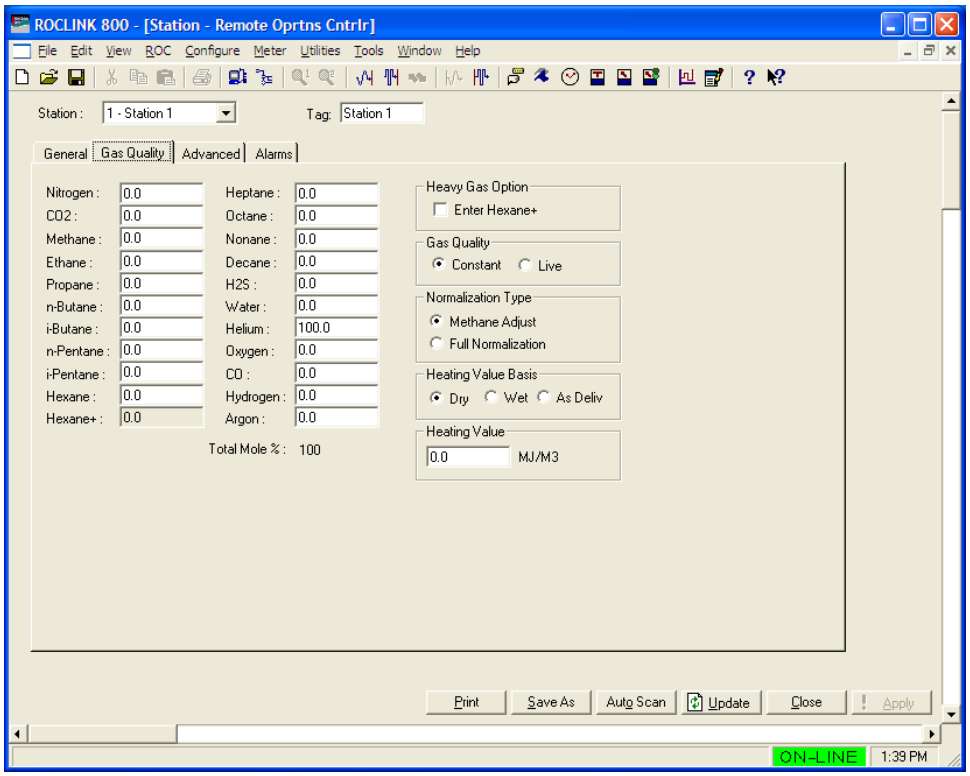

Figure 15. Station, Gas Quality tab

2. Review the values in the following fields:

Field	Description
Gas Component	Sets (for each indicated gas) the mole % components present in the natural gas this station is measuring. **Note**: These selections are valid only if the selected fluid type is natural gas or air. For all other fluids, the program sets the appropriate gas components.
Heavy Gas Option	Indicates whether the program splits the mole percentage of hexane and heavier hydrocarbons into mole percents of hexane, heptane, octane, nonane, and decane, based on a pre-determined split (displayed on the Advanced tab).
Gas Quality	Sets the source of the gas quality values. Valid values are **Constant** (values are manually entered) or **Live** (values are updated by an online gas chromatograph). **Note**: If you select **Live**, the program **does not** generate either events or periodic and daily history records when the gas quality values change. If you select **Constant**, the program **does** generate both events and period and daily history records when the gas quality values change.

Field	Description
Normalization Type	Sets how the program adjusts the gas composition if the entered values do not add up to 100 percent. Valid values are **Methane Adjust** (the program adjusts the mole percentage of methane up or down to force the total mole percentage to 100) or **Full Normalization** (the program adjusts all components proportionally to their original values to force the total mole percentage to 100).
Heating Value Basis	Indicates the conditions assumed for the entered heating value. Valid values are **Dry** (heating value represents the gas without a water component), **Wet** (heating value represents the gas saturated with water at the flowing pressure and temperature), or **As Deliv** (heating value represents the gas in the state as delivered to the customer).
Heating Value	Indicates the heat of combustion of the fluid.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.2.3* to define advanced parameters for stations.

3.2.3 Station – Advanced Tab

Use this tab to set up parameters for stations.

1. Select the **Advanced** tab on the Station screen:

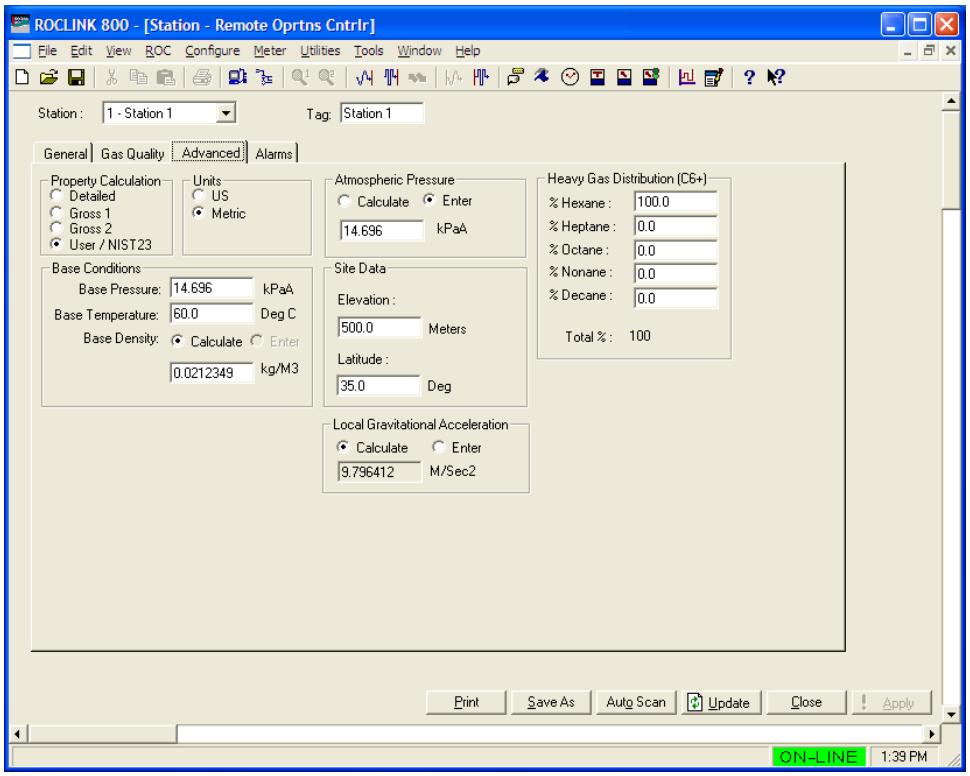

Figure 16. Station, Advanced tab

2. Review the values in the following fields:

Field	Description
Property Calculation	Indicates the supercompressibility property calculation associated with this station. **Note**: Generally the fluid type automatically determines the property calculation as NIST 23. For air, the only valid property calculation is Detailed (AGA8). For natural gas, however, you can select Detailed (AGA8), Gross 1 (AGA8) or Gross 2 (AGA8).
Units	Sets the engineering units the program uses. **US** is the default value.
Base Conditions	Sets values for the pressure, temperature, and density the program uses to calculate the net or corrected volume. For Base Density, if you select **Enter**, provide a value in lb/ft^3 at the specified base pressure and temperature in the associated field. If you select **Calculate**, the program displays the calculated base density value in the associated field.
Atmospheric Pressure	Indicates how the program calculates atmospheric pressure. Valid values are **Calculate** (calculate value from elevation) or **Enter** (use the value provided). **Note**: If you select **Enter**, you must also provide a value in the associated field.
Site Data	Sets values for the meter site's elevation (above sea level) and latitude (in degrees of latitude).

Field	Description
Local Gravitational Acceleration	Sets whether the program uses an entered value or calculates the local gravitational acceleration. If you select **Enter**, provide the value in the associated field. If you select **Calculate**, the program calculates the local gravitational acceleration from the site elevation and latitude (entered on the Advanced tab).
Heavy Gas Distribution (C6+)	Assigns the mole percentages of the composite heavy gas mole percentage (usually referred to as "hexane+" or "C6+") the program assigns to hexane, heptane, octane, nonane, and decane. The percentages must add to 100. If the Total % of the distribution among the five heavier components is **less** than 100, the program increases the values for decane first, then nonane, octane, heptane, and hexane, until the total equals 100%. Similarly, if the Total % is **more** than 100, the program reduces the values for decane, nonane, octane, heptane, and hexane until the total equals 100%. **Note**: These adjustments do not display on the screen.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.2.4* to define alarms for stations.

3.2.4 Station – Alarms Tab

Use this tab to set up alarms and spontaneous report-by-exception (SRBX) messages.

1. Select the **Alarms** tab on the Station screen:

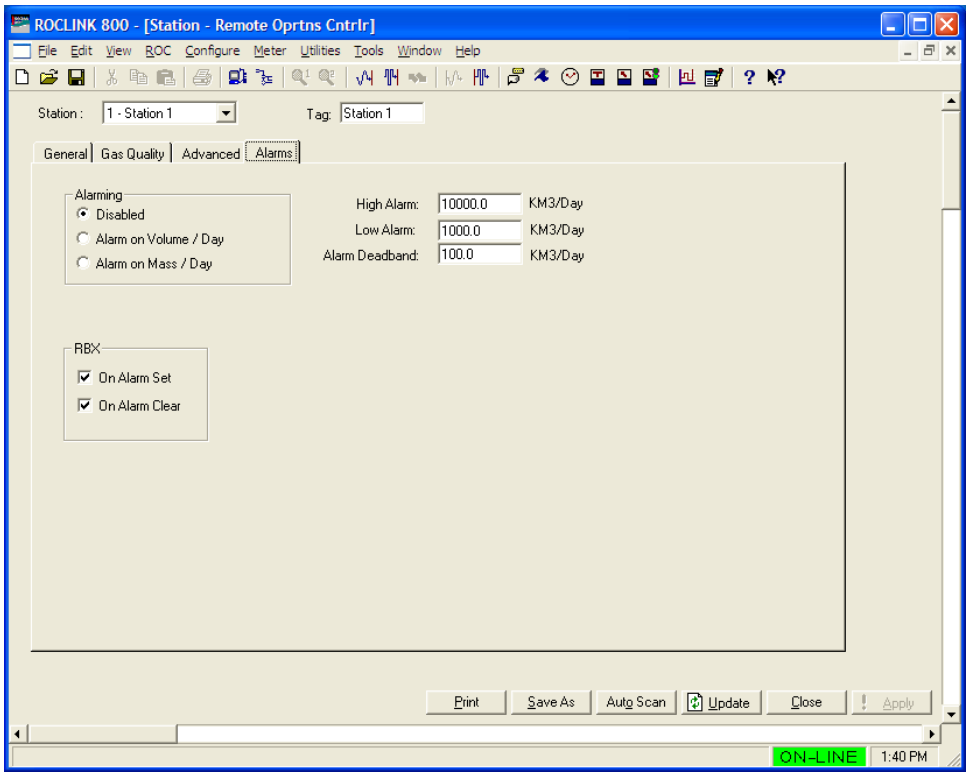

Figure 17. Station, Alarms tab

2. Review the values in the following fields:

Field	Description
Alarming	Activates or disables the alarm function based on flow value. You can set alarms to trigger on either volume/day or mass/day.
High Alarm	Sets the value that flow must **exceed** before the program generates a high alarm. Define units using the Alarming field: MSCF/Day or kM^3/Day for Volume/Day or MLb/Day or Tonnes/Day for Mass/Day.
Low Alarm	Sets the value that flow must fall **below** before the program generates a low alarm. Define units using the Alarming field: MSCF/Day or kM^3/Day for Volume/Day or MLb/Day or Tonnes/Day for Mass/Day
Alarm Deadband	Sets alarm limits in which the flow must fall within before the program clears an existing alarm. Define units using the Alarming field: MSCF/Day or kM^3/Day for Volume/Day or MLb/Day or Tonnes/Day for Mass/Day
RBX	Sets whether the program generates a spontaneous report-by-exception (SRBX) message when a flow alarm for this meter is set and/or cleared.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.3* to define parameters for differential meters.

3.3 Differential Meters Screen

Use this screen and its tabs to specify a broad range of meter-specific parameters for supported differential meters (orifice, Venturi, Annubar, or V-Cone). To access this screen:

1. From the Directory Tree, select **User Program** > **Program #1, ExpandedCalc** > **Display #2, Differential Meters**.
2. Double-click **#1, Orifice 1**. The Differential Meters screen displays, showing the General tab:

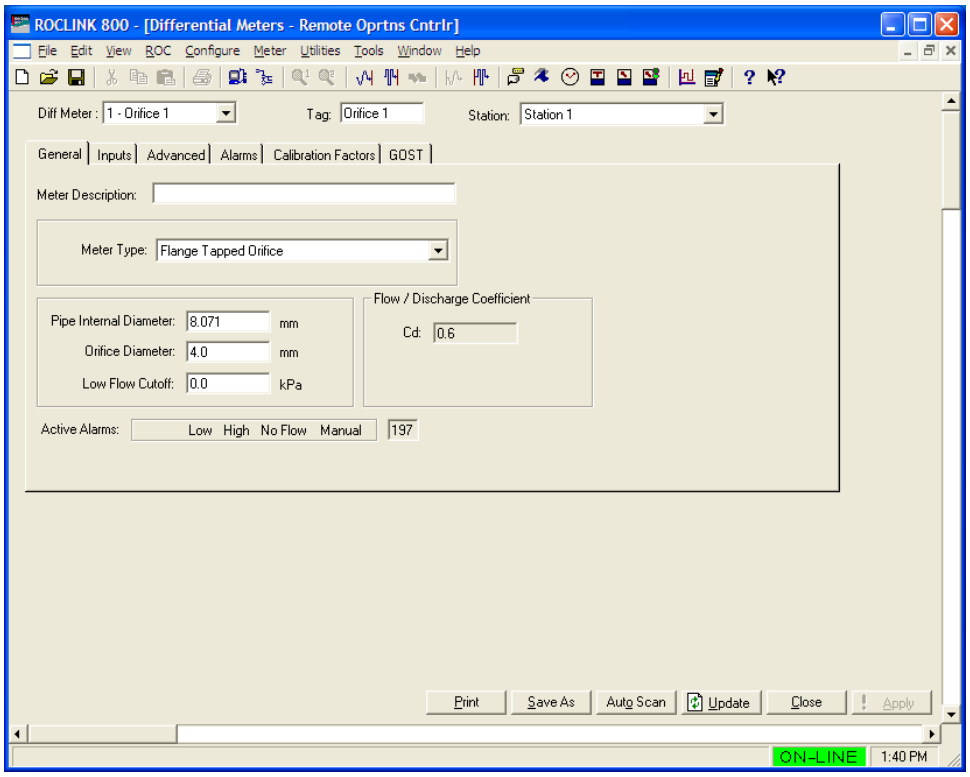

Figure 18. Differential Meters, General tab

Note: The Differential Meters screen—like the Station and Linear Meters screens—has a tab format. *Sections 3.3.1* through *3.3.6* discuss the requirements for each tab on the Differential Meters screen.

3.3.1 Differential Meters – General Tab

Use this tab (which displays when you access the Differential Meters screen) to provide general information about the differential meters.

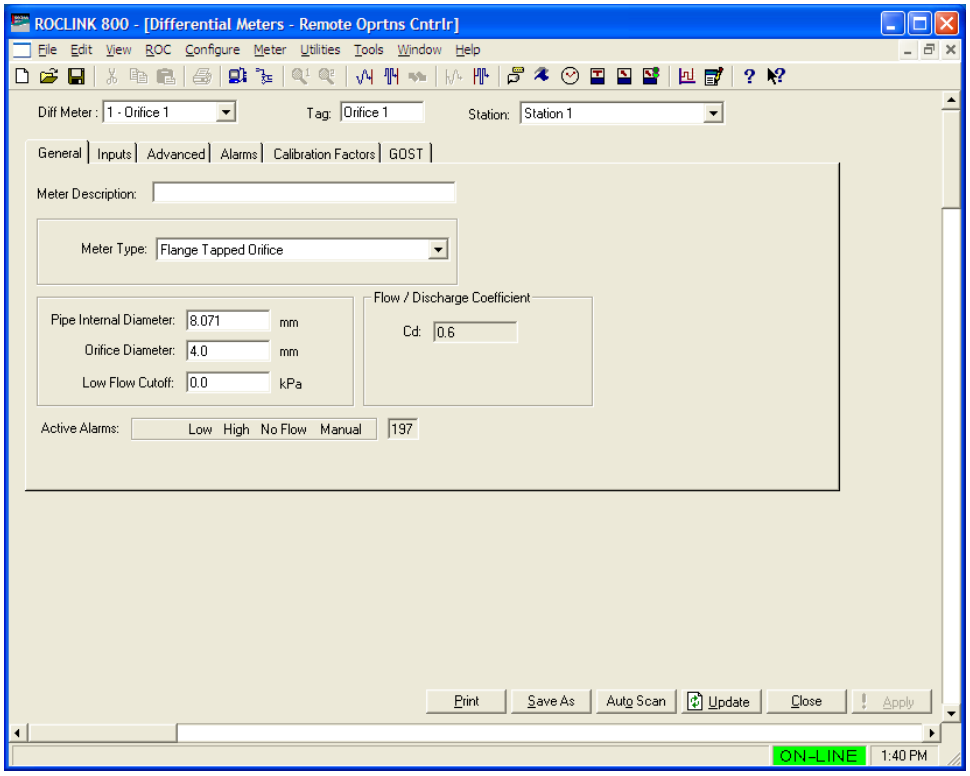

Figure 19. Differential Meters, General tab

1. Review the values in the following fields:

Field	Description
Diff Meter	Indicates the current differential meter. Click ▼ to display additional differential meters for this screen.
Tag	Provides a short description (up to 10 alphanumeric characters) for the selected differential meter.
Station	Indicates the station associated with this differential meter. Click ▼ to display all valid selections.
Meter Description	Provides a user-defined description of up to 30 alphanumeric characters to further identify the selected differential meter.
Meter Type	Sets the physical type of differential meter installed. Click ▼ to display all valid selections. The default value is **Flange Tapped Orifice**. **Note**: For Venturi (ASME MFC-3m- 1989) meters, you must define a coefficient of discharge. For generic Annubar meters, you must define the probe width and the flow coefficient. For V-Cone meters, you must define a flow coefficient.
Pipe Internal Diameter	Defines the internal diameter of the meter pipe.

Field	Description
Diameter	Defines the measured diameter of the meter selected in the Meter Type field. ▪ If the Meter Type is Flange Tapped Orifice, this value indicates the measured diameter of the orifice. ▪ If the Meter Type is Venturi, this value indicates the internal diameter of the throat section of the meter. ▪ If the Meter Type is Annubar, this value indicates the width of the Annubar probe. (The program sets probe width for all other types of Annubar meters.) ▪ If the Meter Type is V-Cone, this value indicates the internal diameter of the V-Cone meter. **Note**: This field's label changes based on the meter type selected.
Low Flow Cutoff	Sets the minimum value of differential pressure (DP) the program considers as a valid flow. If the DP falls below this value, the program sets all flow values to zero.
Flow/Discharge Coefficient	Displays the calculated flow or discharge coefficient for flange-tapped orifice meters and defined Annubar meter types. For Venturi, Annubar other, and V-Cone meters, enter the value of the flow or discharge coefficient provided with the meter calibration sheet supplied with the meter.
Active Alarms	This **display-only** field shows any flow alarms currently active.

2. Click **Apply** to save any changes you have made to this screen.
3. Proceed to *Section 3.3.2* to define inputs for differential meters.

3.3.2 Differential Meters – Inputs Tab

Use this tab to set up values for differential pressure, static pressure, and temperature.

1. Select the **Inputs** tab on the Differential Meters screen:

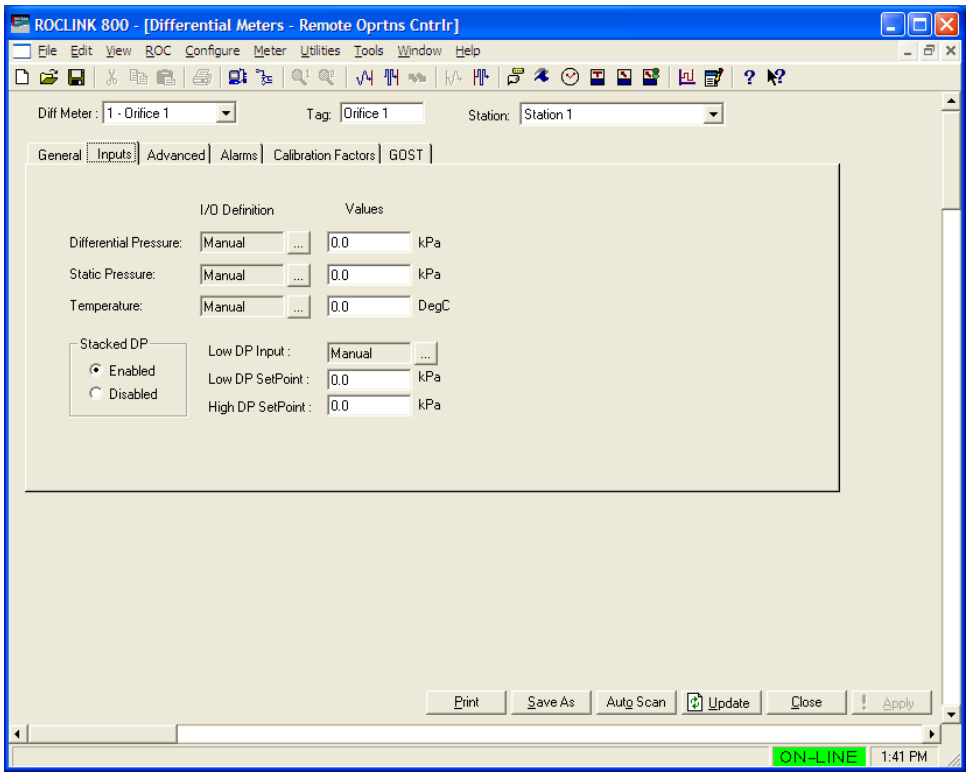

Figure 20. Differential Meters, Inputs tab

2. Review the values in the following fields:

Field	Description
Differential Pressure	Assigns the point type, logical, and parameter (TLP) of the differential pressure value across the meter (or high differential pressure, if you **enabled** Stacked DP). Click **...** to display the Select TLP screen and define your TLP selection. **Note**: If you select **Undefined** for the I/O Definition, you can enter a value for the differential pressure. Otherwise, the program displays the value for the currently selected input.
Static Pressure	Assigns the point type, logical, and parameter (TLP) of the pressure of the fluid in the line, either upstream or downstream. (See the descriptions for Pressure Tap selections on the Advanced tab.) Click **...** to display the Select TLP screen and define your TLP selection. **Note**: If you select **Undefined** for the I/O Definition, you can enter a value for the static pressure. Otherwise, the program displays the value for the currently selected input.

Field	Description
Temperature	Assigns the point type, logical, and parameter (TLP) for the temperature of the fluid in the line. Click **…** to display the Select TLP screen and define your TLP selection. **Note**: If you select **Undefined** for the I/O Definition, you can enter a value for the temperature. Otherwise, the program displays the value for the currently selected input.
Stacked DP	Provides an option to allow two differential pressure transmitters for low and high differential pressure ranges. Valid values are **Enabled** (allow two transmitters) or **Disabled** (allow only one transmitter).
Low DP Input	Assigns the point type, logical, and parameter (TLP) of the differential pressure input the program uses in low flow conditions. Click **…** to display the Select TLP screen and define your TLP selection. **Note**: This option is valid **only** if Stacked DP is enabled.
Low DP SetPoint	Sets the switchover value at which the meter switches from using the high DP input to the low DP input. **Note**: This option is valid **only** if Stacked DP is enabled.
High DP SetPoint	Sets the switchover value at which the meter switches from using the low DP input to the high DP input. **Note**: This option is valid **only** if Stacked DP is enabled.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.3.3* to define advanced parameters for differential meters.

3.3.3 Differential Meters – Advanced Tab

Use this tab to set up parameters for differential meters.

1. Select the **Advanced** tab on the Differential Meters screen:

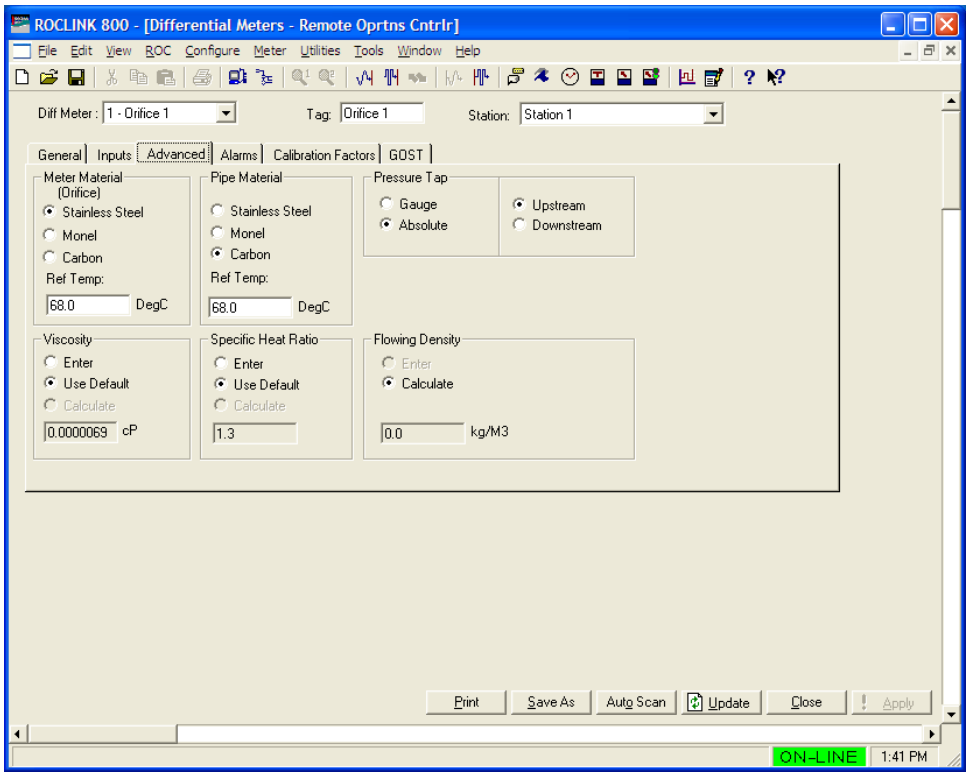

Figure 21. Differential Meters, Advanced tab

2. Review the values in the following fields:

Field	Description
Meter Material	Indicates the meter's construction material.
Meter Ref Temp	Sets the temperature at which the meter's dimension (orifice diameter, throat diameter, probe width, or V-Cone diameter) was measured.
Pipe Material	Indicates the meter tube's construction material.
Pipe Ref Temp	Sets the temperature at which the pipe's internal diameter was measured.
Pressure Tap	Identifies the location of the static pressure tap and the type of static input. Select **Upstream** or **Downstream** to indicate the physical location of the pressure tap relative to the meter. Select **Gauge** if the static pressure transmitter produces a pressure relative to atmospheric pressure, or select **Absolute** if the transmitter produces a pressure relative to a vacuum.

Field	Description
Viscosity	Sets whether the program uses an entered value for the fluid's viscosity, uses a default viscosity for the selected fluid, or calculates (at flowing temperature and pressure) a viscosity value for the selected fluid. If you select **Enter**, provide a value in centipoise in the associated field. **Note**: **Calculate** is an option only if you have selected either **Natural Gas** or **Air** as a Fluid Type on the Station screen's General tab. Also, a program default is to display viscosity in cP, unless you have selected **Natural Gas** as the Fluid Type and **US** as the Units.
Specific Heat Ratio	Sets whether the program uses an entered value for the fluid's specific heat ratio, uses a default specific heat ratio for the selected fluid, or calculates (at flowing temperature and pressure) a specific heat ratio value for the selected fluid. If you select **Enter**, provide a value in the associated field. **Note**: If you select either **Calculate** or **Use Default**, the program displays the specific heat ratio value in the associated field. **Calculate** is an option only if you have selected either **Natural Gas** or **Air** as a Fluid Type on the Station screen's General tab.
Flowing Density	Sets values for density at the flowing pressure and temperature. If you select **Enter**, provide a value in the associated field. If you select **Calculate**, the program displays the flowing density value in the associated field. **Note**: **Enter** is an option only if you have selected either **Natural Gas** or **Air** as a Fluid Type on the Station screen's General tab.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.3.4* to define alarms for differential meters.

3.3.4 Differential Meters – Alarms Tab

Use this tab to set up alarms and spontaneous report-by-exception (SRBX) messages.

1. Select the **Alarms** tab on the Differential Meters screen:

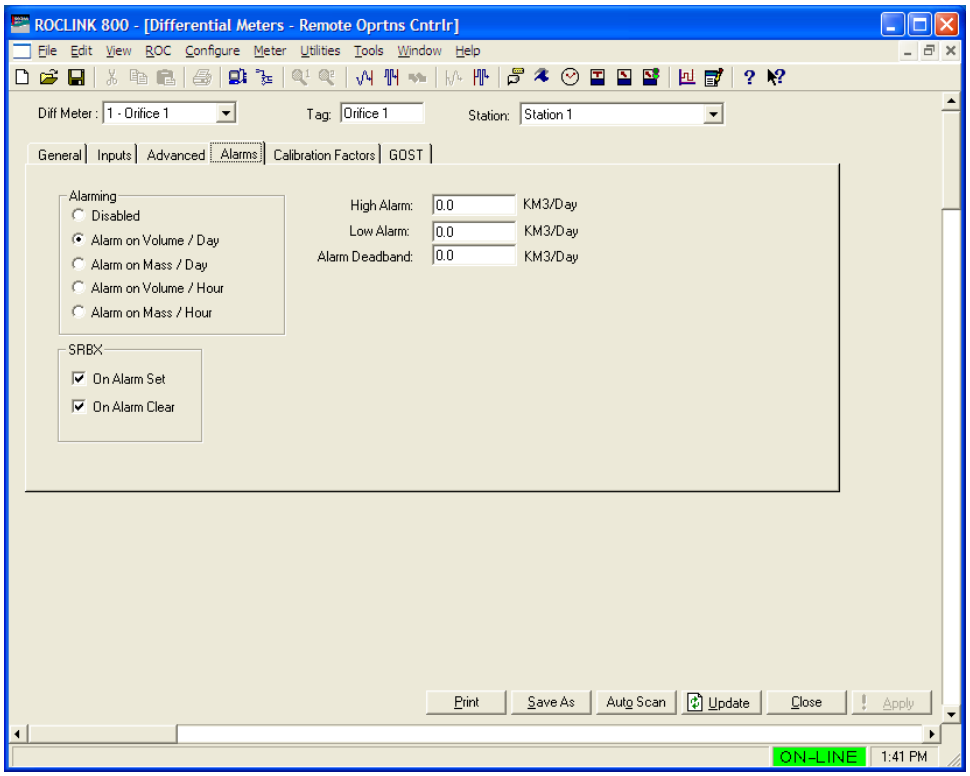

Figure 22. Differential Meters, Alarms tab

2. Review the values in the following fields:

Field	Description
Alarming	Activates or disables the alarm function based on flow value. You can set alarms to trigger on volume/day, mass/day, volume/hour, or mass/hour.
High Alarm	Sets the value that flow must **exceed** before the program generates a high alarm. Define units using the Alarming field: MSCF/Day or kM^3/Day for Volume/Day; MLb/Day or Tonnes/Day for Mass/Day; SCF/Hr or m^3/Hr for Volume/Hour, or Lb/Hr or Kg/Hr for Mass/Hour.
Low Alarm	Sets the value that flow must fall **below** before the program generates a low alarm. Define units using the Alarming field: MSCF/Day or kM^3/Day for Volume/Day; MLb/Day or Tonnes/Day for Mass/Day; SCF/Hr or m^3/Hr for Volume/Hour, or Lb/Hr or Kg/Hr for Mass/Hour.
Alarm Deadband	Sets alarm limits in which the flow must fall within before the program clears an existing alarm. Define units using the Alarming field: MSCF/Day or kM^3/Day for Volume/Day; MLb/Day or Tonnes/Day for Mass/Day; SCF/Hr or m^3/Hr for Volume/Hour, or Lb/Hr or Kg/Hr for Mass/Hour.
SRBX	Sets whether the program generates a spontaneous report-by-exception (SRBX) message when a flow alarm for this meter is set and/or cleared.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.3.5* to define calibration factors for differential meters.

3.3.5 Differential Meters – Calibration Factors Tab

Use this tab to set up calibration parameters.

1. Select the **Calibration Factors** tab on the Differential Meters screen.

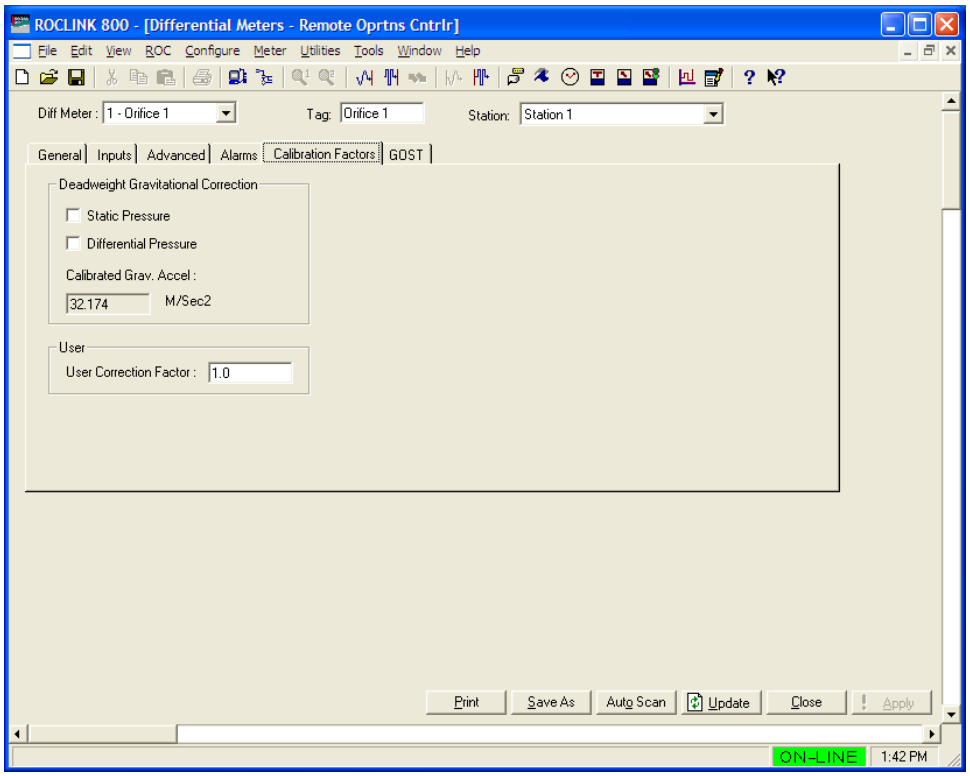

Figure 23. Differential Meters, Calibration Factors tab

2. Review the values in the following fields:

Field	Description
Deadweight Gravitational Correction	Sets the option the program uses to correct the flow rate for calibration errors resulting from a deadweight test performed at a location with a gravitational acceleration that differs from that during calibration of the deadweight set. Select a correction independently for each type of input, since the program applies the correction twice if the deadweight test set is used to calibrate both the differential pressure and static pressure. Enter a value for the gravitational acceleration at the location where the deadweight set was calibrated.
User Correction Factor	Sets a flow factor value the system multiplies by the flow equation to correct for calibration errors from other calibration equipment. You can also use this factor for special user applications.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.3.6* to define GOST-related parameters for differential meters.

3.3.6 Differential Meters – GOST Tab

Use this tab to set up GOST-related flow calculations for differential meters.

1. Select the **GOST** tab on the Differential Meters screen.

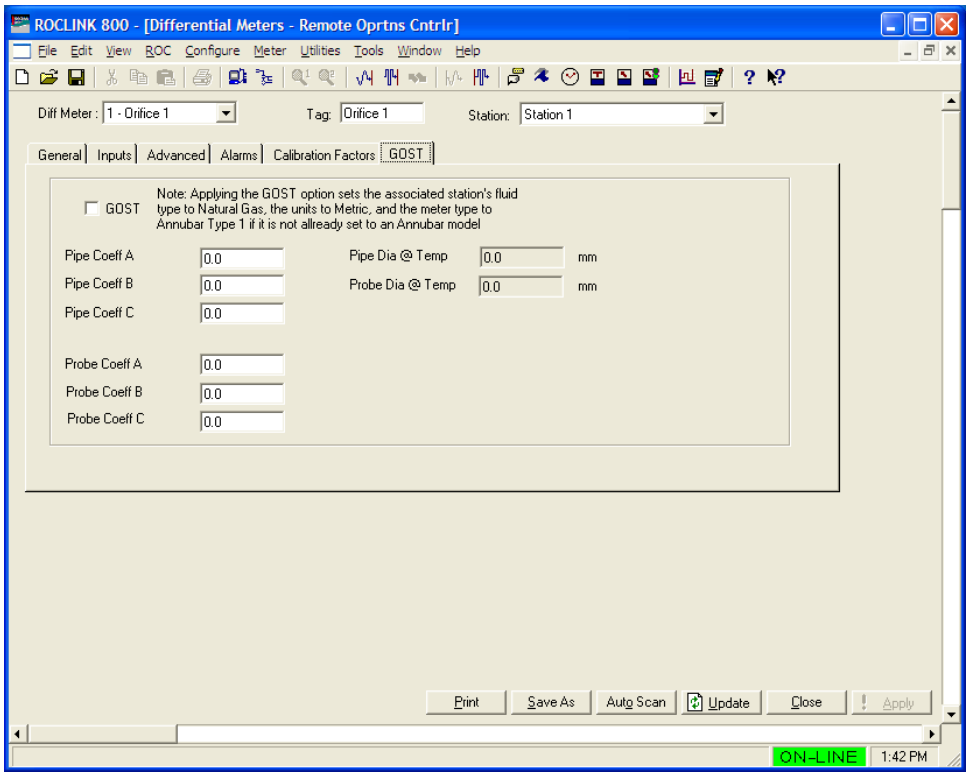

Figure 24. Differential Meters, GOST tab

2. Review the values in the following fields:

Field	Description
GOST	Selects the GOST flow calculation for the meter run. **Note**: If you select this check box, the program automatically resets the Units to Metric, Fluid Type to Natural Gas, and Meter Type to Annubar Type 1 (if you have not already selected a valid Annubar option as a Meter Type).
Pipe Coefficient A, B, C	Sets (for each pipe choice) the coefficient value required for corrections to pipe diameter, in accordance with the GOST 8.563.1 standard.
Probe Coefficient A, B, C	Sets (for each probe choice) the coefficient value required for corrections to probe diameter, in accordance with the GOST 8.563.1 standard.
Pipe Diameter @ Temp	This **read-only** field shows the corrected pipe diameter for temperature at flowing conditions, calculated according to the GOST 8.563.1 standard.
Probe Diameter @ Temp	This **read-only** field shows the corrected Annubar probe (orifice) diameter for temperature at flowing conditions, calculated according to the GOST 8.563.1 standard.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.4* to define parameters for linear meters.

3.4 Linear Meters Screen

Use this screen and its tabs to specify a broad range of meter-specific parameters for supported linear meters (turbine, positive displacement, ultrasonic, and Coriolis). To access this screen:

1. From the Directory Tree, select **User Program** > **Program #1, ExpandedCalc** > **Display #3, Linear Meters**.
2. Double-click **#1, Turbine 1**. The Linear Meters screen displays, showing the General tab:

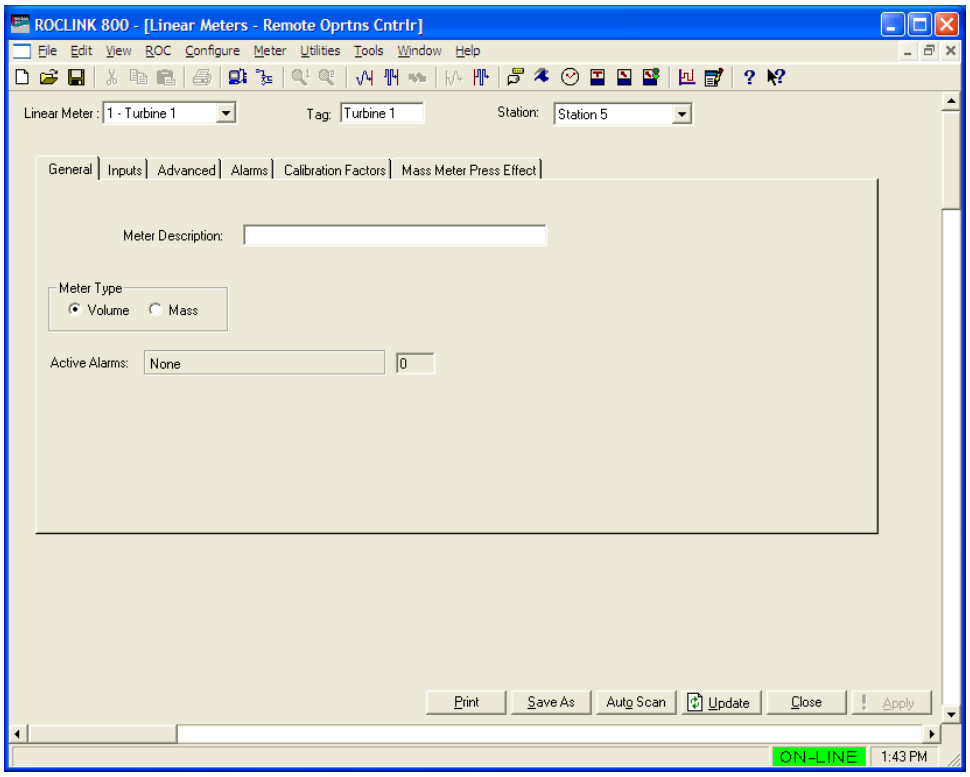

Figure 25. Linear Meters, General tab

Note: The Linear Meters screen—like the Station and Differential Meters screens—has a tab format. *Sections 3.4.1* through *3.4.6* discuss the requirements for each tab on the Linear Meters screen.

3.4.1 Linear Meters – General Tab

Use this tab (which displays when you access the Linear Meters screen) to provide general information about linear meters.

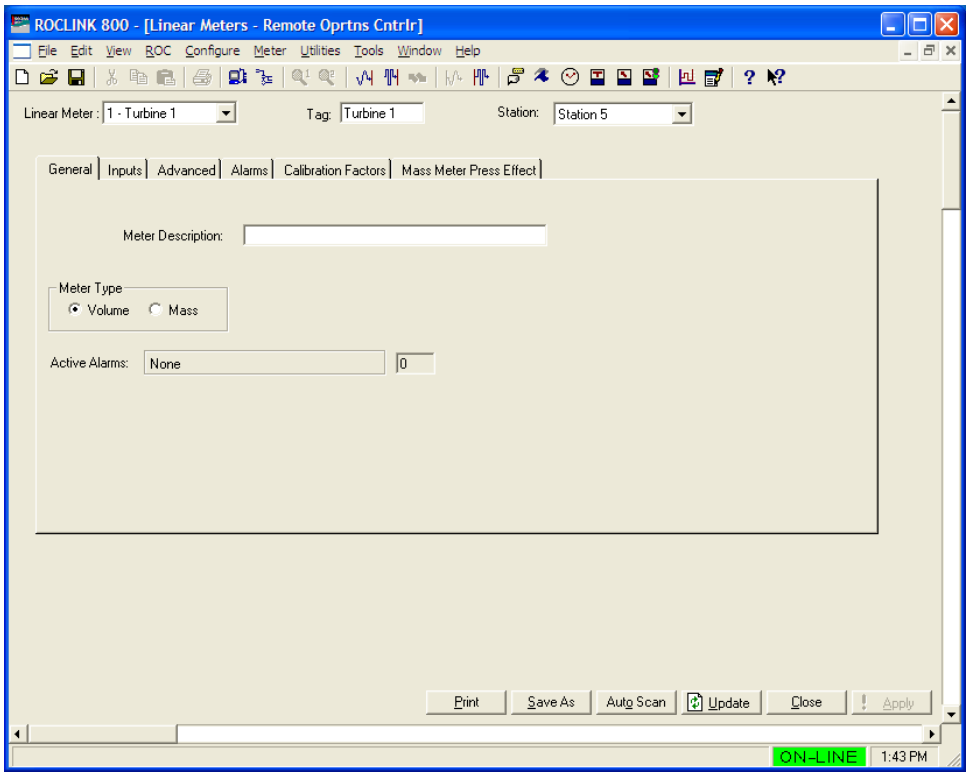

Figure 26. Linear Meters, General tab

1. Review the values in the following fields:

Field	Description
Linear Meter	Indicates the currently displayed linear meter**.** Click ▼ to display additional linear meters for this screen.
Tag	Provides a short description (up to 10 alphanumeric characters) for the selected linear meter.
Station	Indicates the station associated with this linear meter. Click ▼ to display all valid selections.
Meter Description	Provides a user-defined description of up to 30 alphanumeric characters to further identify the selected linear meter.
Meter Type	Sets the physical type of linear meter installed. Valid values are **Volume** or **Mass**. The default value is **Volume**. **Note**: This selection changes the field labels on the Inputs tab. If you select **Volume**, the first field on the Inputs tab is Uncorrected Value. If you select **Mass**, the first field on the Inputs tab is Mass.
Active Alarms	This **display-only** field shows any flow alarms currently active.

2. Click **Apply** to save any changes you have made to this screen.
3. Proceed to *Section 3.4.2* to define inputs for the linear meters.

3.4.2 Linear Meters – Inputs Tab

Use this tab to set up uncorrected volume, static pressure, and temperature information for the linear meters.

1. Select the **Inputs** tab on the Linear Meters screen:

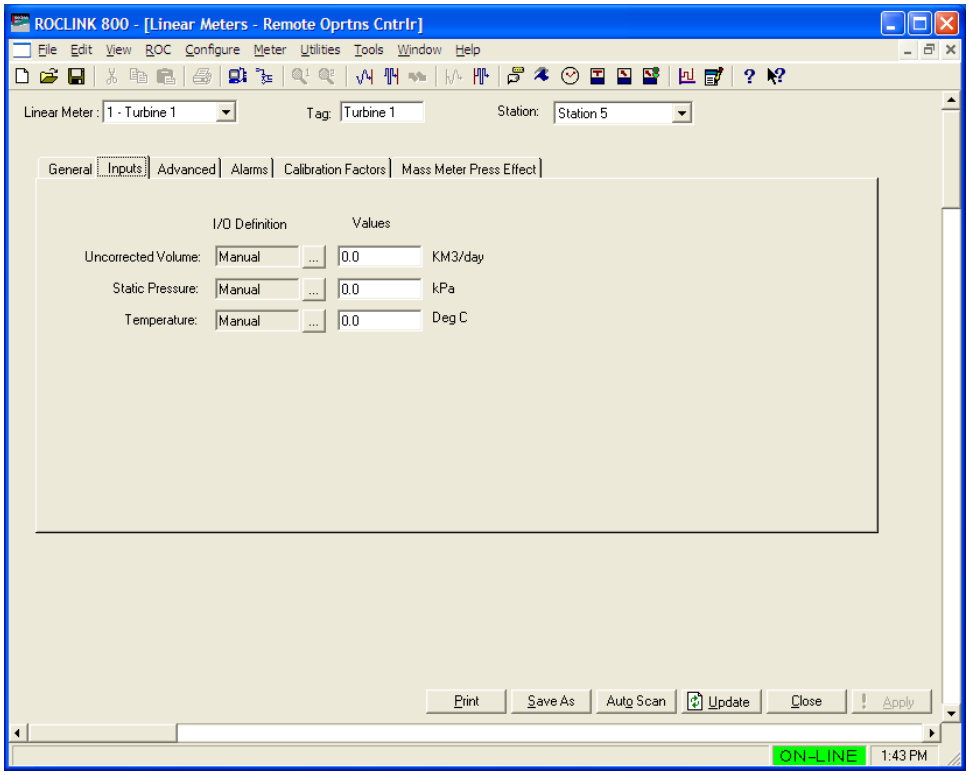

Figure 27. Linear Meters, Inputs Tab

2. Review the values in the following fields:

Field	Description
Uncorrected Volume	Assigns the point type, logical, and parameter (TLP) of the uncorrected or gross volume (volume at flowing pressure and temperature) through the meter. Click **…** to display the Select TLP screen and define your TLP selection. If you select **Undefined** for the uncorrected volume input, you can enter a value for the uncorrected volume flow rate. Otherwise, the program displays the value for the currently selected input. **Note**: This field displays **only** if you selected **Volume** as the Meter Type on the General Tab.
Mass	Assigns the point type, logical, and parameter (TLP) of the value of the mass flow through the meter. Click **…** to display the Select TLP screen and define your TLP selection. If you select **Undefined** for the mass input, you can enter a value for the mass flow rate. Otherwise, the program displays the value for the currently selected input. **Note**: This field displays **only** if you selected **Mass** as the Meter Type on the General Tab.

Field	Description
Static Pressure	Assigns the point type, logical, and parameter (TLP) of the value of the pressure of the fluid in the line. Click **…** to display the Select TLP screen and define your TLP selection. **Note**: If you select **Undefined** for the static pressure input, you can enter a value for the static pressure. Otherwise, the program displays the value for the currently selected input.
Temperature	Assigns the point type, logical, and parameter (TLP) for the temperature of the fluid in the line. Click **…** to display the Select TLP screen and define your TLP selection. **Note**: If you select **Undefined** for the temperature input, you can enter a value for the temperature. Otherwise, the program displays the value for the currently selected input.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.4.3* to define advanced parameters for the linear meters.

3.4.3 Linear Meters – Advanced Tab

Use this tab to set up advanced parameters for linear meters.

1. Select the **Advanced** tab on the Linear Meters screen.

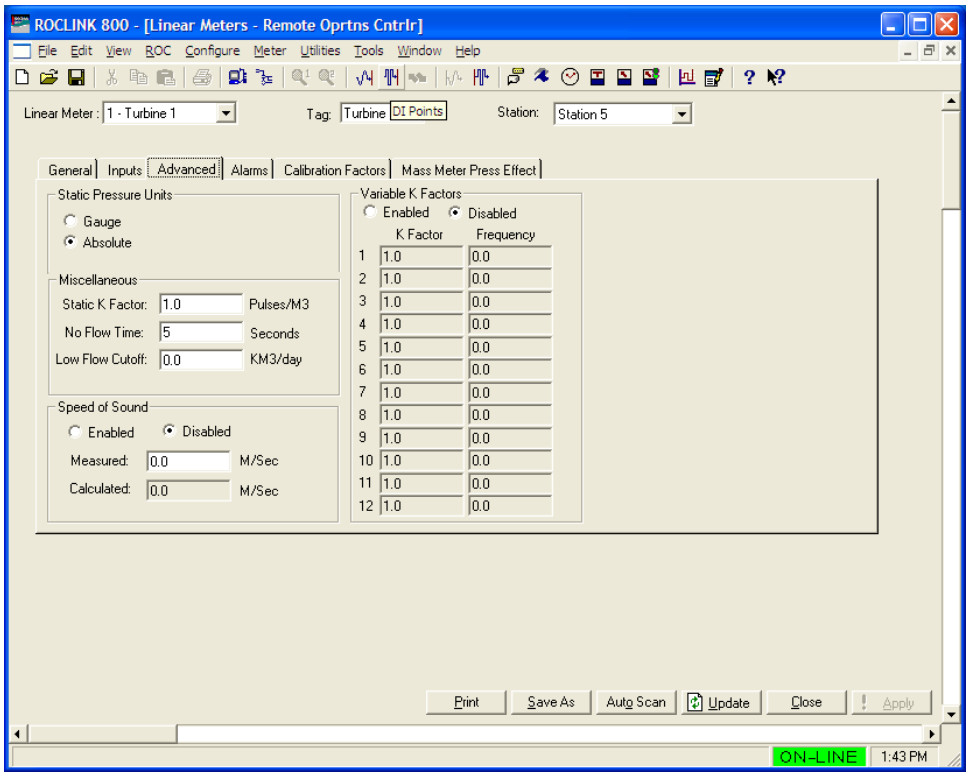

Figure 28. Linear Meters, Advanced tab

2. Review the values in the following fields:

Field	Description
Static Pressure Units	Indicates the type of static pressure unit. Valid values are **Gauge** (the static pressure transmitter produces a pressure relative to atmospheric pressure) or **Absolute** (transmitter produces a pressure relative to a vacuum).
Static K Factor	Sets the number of pulses represented either as pulses/ft^3 or pulses/m^3 (for volume) or pulses/Lb or pulses/Kg (for mass).
No Flow Time	Indicates, in seconds, the amount of time the program waits without receiving a pulse to be considered in a "no flow" condition.
Low Flow Cutoff	Sets the minimum value of the uncorrected volume or mass input the program considers to be a valid flow. **Note**: The program applies this value only when the uncorrected volume or mass input **is not** a pulse input point type. The program counts all pulses and considered them as valid flow.

Field	Description
Calculated Speed of Sound	Sets whether the program calculates the speed of sound through the fluid. The speed of sound does not affect the flow calculation, but you may compare that value against the measured speed of sound from an ultrasonic meter for diagnostic purposes. Valid values are **Disabled** (no calculation occurs) or **Enabled** (calculate speed of sound in accordance with AGA 10). **Note**: If a serial connection to an ultrasonic meter is available and you select **Enabled**, the program updates the Calculated field automatically.
Measured Speed of Sound	Sets the speed of sound as measured by the ultrasonic meter. **Note**: If a serial connection to an ultrasonic meter is available, you can map this parameter to a Modbus register for automatic updates.
Variable K Factors	Sets whether the program accepts multiple frequency and K factor pairs and then calculates a K factor by interpolating between the entered points. Valid values are **Disabled** (no calculation occurs) or **Enabled** (enter up to 12 Frequency/K Factor pairs).

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.4.4* to define alarms for the linear meters.

3.4.4 Linear Meters – Alarms Tab

Use this tab to set up alarms and spontaneous report-by-exception (SRBX) messages.

1. Select the **Alarms** tab on the Linear Meters screen.

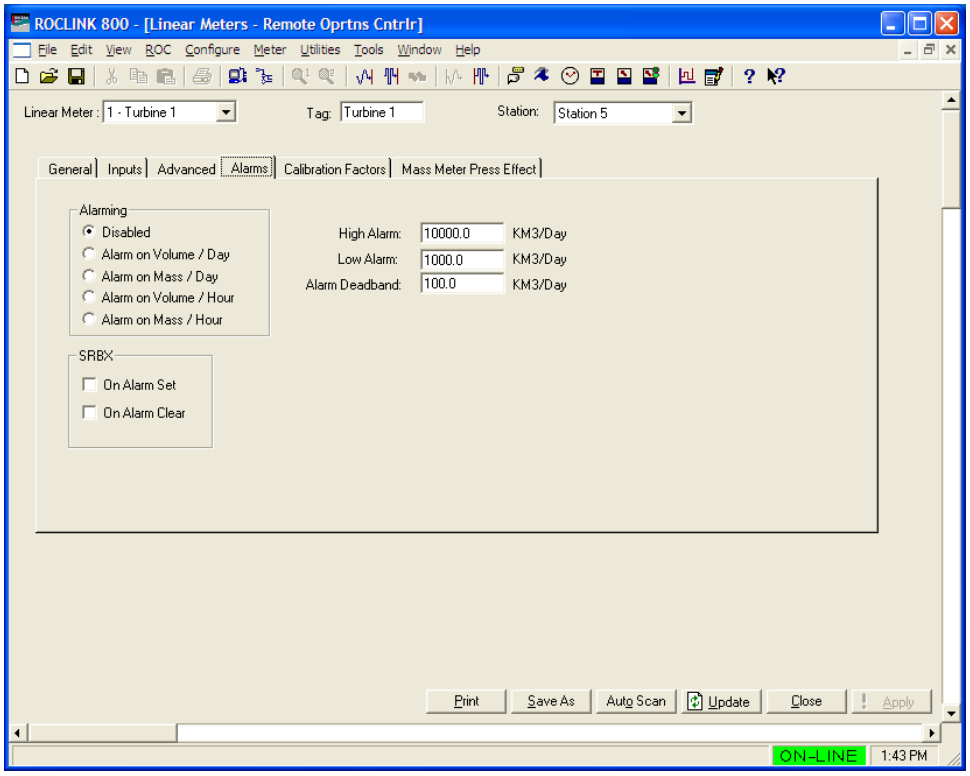

Figure 29. Linear Meters, Alarms tab

2. Review the values in the following fields:

Field	Description
Alarming	Activates or disables the alarm function based on flow value. You can set alarms to trigger on volume/day, mass/day, volume/hour, or mass/hour.
High Alarm	Sets the value that flow must **exceed** before the program generates a high alarm. Define units using the Alarming field: MSCF/Day or kM^3/Day for Volume/Day; MLb/Day or Tonnes/Day for Mass/Day; SCF/Hr or m^3/Hr for Volume/Hour, or Lb/Hr or Kg/Hr for Mass/Hour.
Low Alarm	Sets the value that flow must fall **below** before the program generates a low alarm. Define units using the Alarming field: MSCF/Day or kM^3/Day for Volume/Day; MLb/Day or Tonnes/Day for Mass/Day; SCF/Hr or m^3/Hr for Volume/Hour, or Lb/Hr or Kg/Hr for Mass/Hour.
Alarm Deadband	Sets alarm limits in which the flow must fall within before the program clears an existing alarm. Define units using the Alarming field: MSCF/Day or kM^3/Day for Volume/Day; MLb/Day or Tonnes/Day for Mass/Day; SCF/Hr or m^3/Hr for Volume/Hour, or Lb/Hr or Kg/Hr for Mass/Hour.
SRBX	Sets whether the program generates a spontaneous report-by-exception (SRBX) message when a flow alarm for this meter is set and/or cleared.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.4.5* to define calibration factors for the linear meters.

3.4.5 Linear Meters – Calibration Factors Tab

Use this tab to set up calibration factors for linear meters.

1. Select the **Calibration Factors** tab on the Linear Meters screen.

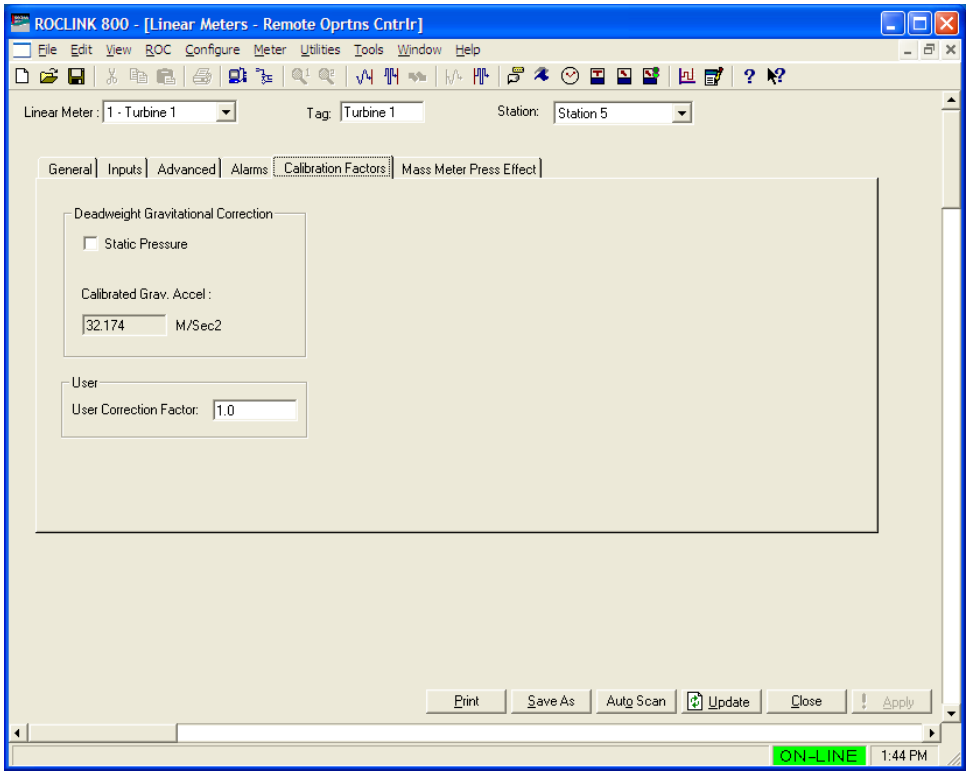

Figure 30. Linear Meters, Calibration Factors tab

2. Review the values in the following fields:

Field	Description
Deadweight Gravitational Correction	Sets the option the program uses to correct the flow rate for calibration errors resulting from a deadweight test to calibrate static pressure performed at a location with a gravitational acceleration that differs from that during calibration of the deadweight set. Enter a value for the gravitational acceleration at the location where the deadweight set was calibrated.
User Correction Factor	Sets a flow factor value the system multiplies by the flow equation to correct for calibration errors from other calibration equipment. You can also use this factor for special user applications.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.4.6* to define mass meter pressure effect parameters for the linear meters.

3.4.6 Linear Meters – Mass Meter Press Effect Tab

Use this tab to set up options for mass meter pressure effects for linear meters.

Note: If you select **Volume** as the Meter Type on the Linear Meters screen's General tab, this tab is unavailable for entry.

1. Select the **Mass Meter Press Effect** tab on the Linear Meters screen.

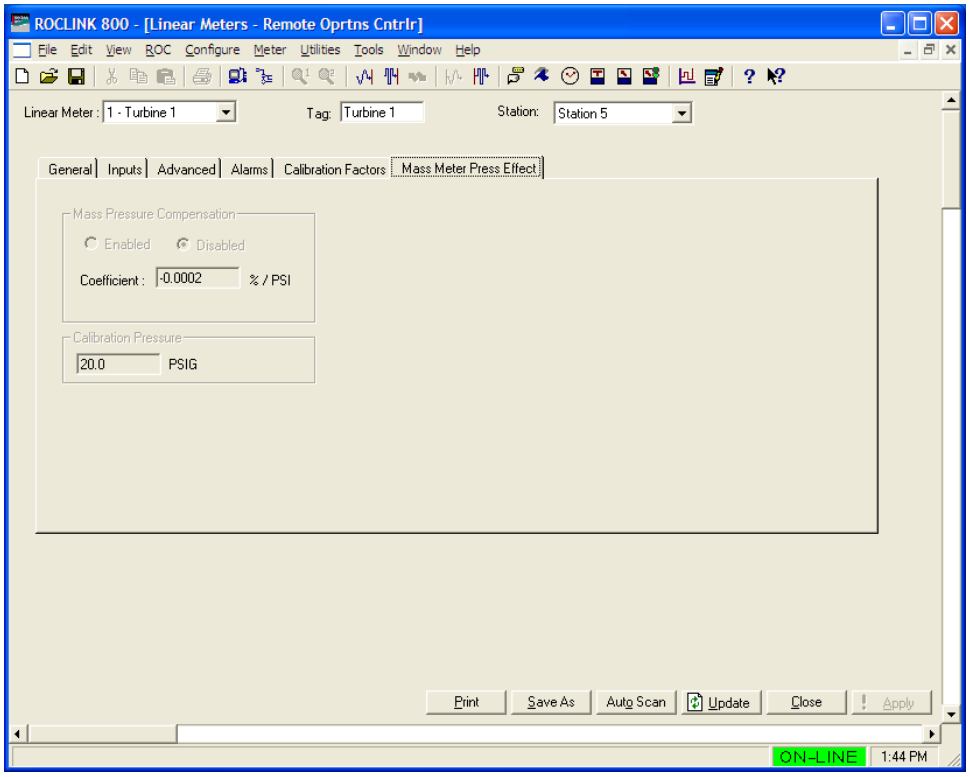

Figure 31. Linear Meters, Mass Meter Press Effect tab

2. Review the values in the following fields:

Field	Description
Mass Pressure Compensation	Activates the option the program uses to compensate the raw mass flow reading from a Coriolis meter for pressure effect on the meter. The meter was initially calibrated at a specific line pressure. Changes in pressure affect the stiffness of the metering tube. Valid values are **Enabled** (you provide a pressure effect coefficient in %/PSI for the program to use) or **Disabled** (no compensation calculation occurs. **Note**: This value comes from the meter calibration sheet provided with your Coriolis mass meter.
Calibration Pressure	Indicates the calibration pressure of the meter in PSIG. This field is required if you enable pressure compensation. **Note**: This value comes from the meter calibration sheet provided with your Coriolis mass meter.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.5* to save the configuration.

3.5 Saving the Configuration

Whenever you modify or change the configuration, it is a good practice to save the final configuration to memory. To save the configuration:

1. Select **ROC** > **Flags**. The Flags screen displays:

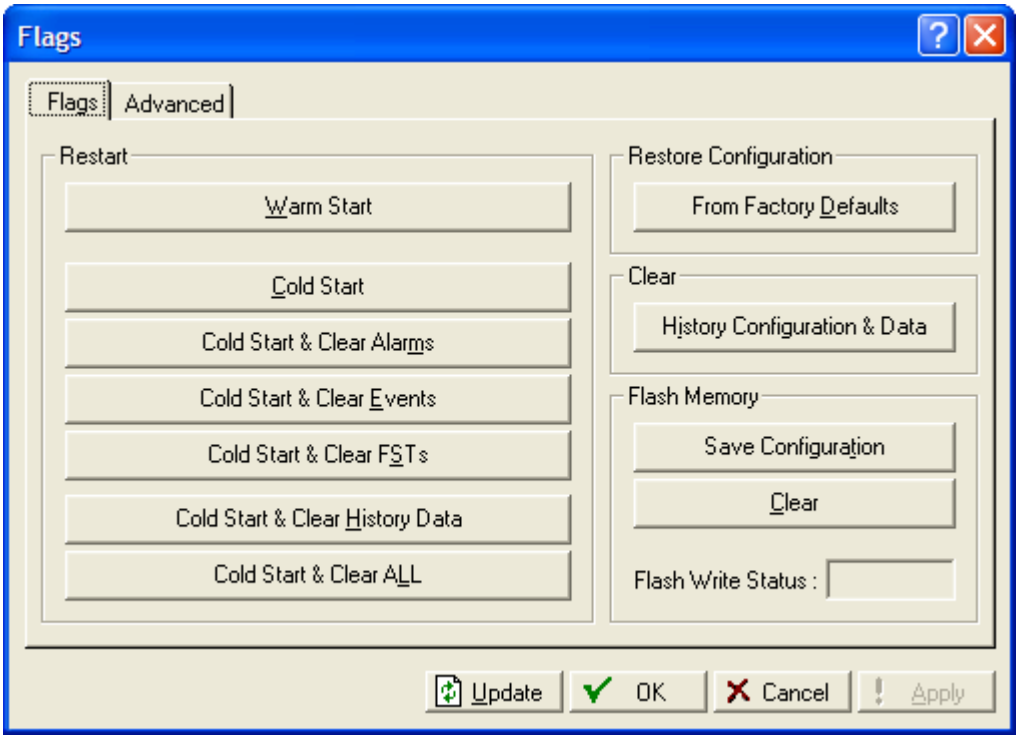

Figure 32. Flags screen

2. Click **Save Configuration**. A verification message displays:

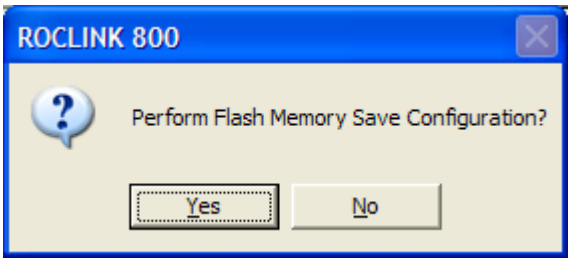

Figure 33. Perform screen

3. Click **Yes.** A confirmation message displays:

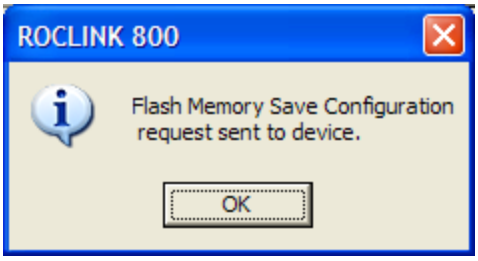

Figure 34. Flags screen

4. Click **OK** to begin the save process. The Status field on the Flags screen displays *In Progress*. When the process ends, the Status field on the Flags screen displays *Completed*.
5. Click **Update** on the Flags screen. This completes the process of saving your new configuration.

Note: For archive purposes, you should also save this configuration to your PC's hard drive or removable media (such as a diskette or a flash drive) using the **File** > **Save Configuration** option on the ROCLINK 800 menu bar.

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4 REFERENCE MATERIALS

This section provides tables of information on the user-defined point types the Expanded Calculation program uses:

- 60 Differential Meter Configuration.
- 61 Station Configuration.
- 62 Linear Meter Configuration.

4.1 Point Type 60: Differential Meter Configuration

Point type 60 is associated with differential (orifice) meter types. The program maintains one logical point for each active differential meter, and saves point type 60 information to internal configuration memory.

Parm #	Name	Access	Program or User Update	Data Type	Length	Range	Default	Version	Description of functionality and meaning of values
0	Tag ID	R/O	System	STRING	10	0x20 -> 0x7E for each ASCII Character	"Orifice X" where X is the meter number	1.00	Identifies the specific differential meter run. This parameter is copied to the associated orifice meter point (113, x, 0).
1	Viscosity Option	R/W	User	UINT8	1	0 → 2	1	1.00	Selection to determine the viscosity of the fluid. 0 = User Entered, 1 = Use default value for fluid selected, 2 = Calculate from fluid type, pressure, and temperature.
2	Specific Heat Option	R/W	User	UINT8	1	0 → 2	1	1.00	Selection to determine the specific heat ratio. 0 = User Entered, 1 = Use default value for the fluid selected, 2 = Calculate from fluid type, pressure, and temperature.
3	Flowing Density Option	R/W	User	UINT8	1	0 → 1	1	1.00	Selection to determine the density of the fluid at flowing conditions. 0 = User Entered, 1 = Calculated.

Parm #	Name	Access	Program or User Update	Data Type	Length	Range	Default	Version	Description of functionality and meaning of values
4	Differential Meter Type	R/W	User	UINT8	1	0, 6, 10 → 25	0	1.00	Selection for the type of differential meter. 0 = Flange Orifice; 6 = Venturi, 10 = Annubar 485 Type 1, 11 = Annubar 485 Type 2; 12 = Annubar 485 Type 3; 13 = Annubar Diamond Type 10+; 14 = Annubar Diamond Type 15/16+; 15 = Annubar Diamond Type 25/26+; 16 = Annubar Diamond Type 35/36+; 17 = Annubar Diamond Type 45/46+; 18 = Annubar Diamond Type 10-; 19 = Annubar Diamond Type 15/16-; 20 = Annubar Diamond Type 25/26-; 21 = Annubar Diamond Type 35/36-; 22 = Annubar Diamond Type 45/46-; 23 = Annubar Streamline Type 43/44; 24 = Annubar Other (Enter d and K); 25 = V-cone
5	GOST option	R/W	User	UINT8	1	0 → 1	0	1.00	Indicates the GOST calculations to be used with this meter (as opposed to AGA): 0 = Inactive 1 = Active
6	Pipe Coeff A	R/W	User	Float	4	Any valid IEEE 754 float	0	1.00	Provides GOST Pipe Coefficient A
7	Pipe Coeff B	R/W	User	Float	4	Any valid IEEE 754 float	0	1.00	Provides GOST Pipe Coefficient B
8	Pipe Coeff C	R/W	User	Float	4	Any valid IEEE 754 float	0	1.00	Provides GOST Pipe Coefficient C

Parm #	Name	Access	Program or User Update	Data Type	Length	Range	Default	Version	Description of functionality and meaning of values
9	Probe Coeff A	R/W	User	Float	4	Any valid IEEE 754 float	0	1.00	Provides GOST Probe Coefficient A
10	Probe Coeff B	R/W	User	Float	4	Any valid IEEE 754 float	0	1.00	Provides GOST Probe Coefficient A
11	Probe Coeff C	R/W	User	Float	4	Any valid IEEE 754 float	0	1.00	Provides GOST Probe Coefficient A
12	Pipe @ Temp	R/O	Program	Float	4	Any valid IEEE 754 float	0	1.00	Indicates GOST-calculated pipe diameter in millimeters.
13	Probe @ Temp	R/O	Program	Float	4	Any valid IEEE 754 float	0	1.00	Indicates GOST-calculated probe diameter in millimeters.
14	Units	R/W	User	UINT8	1	$0 \rightarrow 1$	0	1.00	Indicates what engineering units the process variables, inputs, and calculation should be. This parameter is copied to the associated station point (112, x, 4). 0 = English Units; 1 = Metric Units.
15	Station Number	R/W	User	UINT8	1	$0 \rightarrow 11$	0	1.00	Associates this meter with a particular station.
16	Viscosity	R/W	Both	Float	4	>0	6.9×10^{-6}	1.00	Indicates the viscosity of the fluid.

4.2 Point Type 61: Station Configuration

Point type 61 is the point associated with station configuration information. The program maintains one logical point for each active station and saves point type 61 information to internal configuration memory.

Parm #	Name	Access	Program or User Update	Data Type	Length	Range	Default	Version	Description of functionality and meaning of values
0	Tag ID	R/O	System	STRING	10	0x20 -> 0x7E for each ASCII Character	"Station X" where X is the meter number	1.00	Identifies a specific station. The program copies this tag to the associated station (112, x, 0).
1	Fluid Type	R/W	User	UINT8	1	0 → 11	0	1.00	Selection for the type of fluid being measured with this station. 0 = Natural Gas, 1 = Oxygen, 2 = Nitrogen, 3 = Hydrogen, 4 = Helium, 5 = Carbon Monoxide, 6 = Carbon Dioxide Liquid, 7 = Carbon Dioxide Gas, 8 = Steam, 9 = Water, 10 = Argon, 11 = Air.
2	Base Density Option	R/W	User	UINT8	1	0 → 1	1	1.00	Selection to determine the density of fluid at base conditions. 0 = User entered 1 = System calculated
3	Number of GOST Meters	R/W	Program	UINT8	1	0 → 12	0	1.00	Indicates the number of GOST differential meters associated with this station.

4.3 Point Type 62: Linear Meter Configuration

Point type 62 contains configuration information for linear (turbine) meter types. The program maintains one logical point for each active linear meter and saves point type 62 information to internal configuration memory.

Parm #	Name	Access	Program or User Update	Data Type	Length	Range	Default	Version	Description of functionality and meaning of values
0	Tag ID	R/O	System	STRING	10	0x20 -> 0x7E for each ASCII Character	"Orifice X" where X is the meter number	1.00	Identification name for specific Linear Meter Run. The program copies the tag from the associated linear meter run to the linear tag.
1	Units	R/W	User	UINT8	1	0 → 1	0	1.00	Indicates the engineering units the process variables, inputs, and calculations use. The program copies this parameter to the associated station point. (112, x, 4) 0 = English (Imperial) units 1 = Metric units.

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If you have comments or questions regarding this manual, please direct them to your local sales representative or contact:

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