# V-Cone Flow Calculation Program
## (For the FloBoss 107)

## User Manual
### (QER 07Q032)

**Form A6226**
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**EMERSON**
Process Management

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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):

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# Contents

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# 1  INTRODUCTION

## 1.1 Scope and Organization

This document serves as the user manual for the V-Cone® Flow Calculation User Program (QER 07Q032), which is intended for use in a FloBoss™ 107. This manual describes how to download and configure this program (referred to as the "V-Cone program" or "the program" throughout the rest of this manual). You access and configure this program using ROCLINK™ 800 Configuration Software (version 1.83 or greater) loaded on an IBM-compatible personal computer running Windows® 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 running in a FloBoss 107, 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 FloBoss unit and its configuration. For more information, refer to the following manuals

- *FloBoss 107 Flow Manager Instruction Manual (Form A6206)*
- *ROCLINK 800 Configuration Software User Manual (for FB107) (Form A6217).*

## 1.2 Product Overview

This program allows a FloBoss 107 Flow Manager to calculate a volumeteric flow rate (at a specified base pressure and temperature) and a mass flow rate for a McCrometer V-Cone flowmeter. The V-Cone calculations are very similar to orifice plate calculations, use many of the same configuration parameters, and produce many of the same calculated values. The program uses the corresponding meter run point in the FB107's firmware to store the calculated values and accumulations. Additional parameters are located in the program's user-defined point types, including actual volumetric flow rate, fluid velocity, thermal expansion factor, and percent pressure loss. Details of the V-Cone flow calculations are found in the McCrometer publication *Flow Calculations for the V-Cone® and Wafer-Cone® Flowmeters, Lit. #24509-54 Rev. 3.2/02-08*.

The V-Cone point configuration requires you enable the V-Cone calculation for the meter runs with V-Cone hardware installed. With the calculation enabled, the FB107 bypasses the standard orifice calculation and performs the McCrometer V-Cone calculations instead. All standard orifice parameters, as well as the additional V-Cone parameters, are available for assignment to Modbus registers, PID control loops, historical archiving, and FST functions.

The program is designed to calculate flows of natural gas and other related hydrocarbons, as defined in *AGA Report #8, 1992* and included in the FB107 firmware, or fluids whose properties are provided by a

separate user program installed in the FB107. The only fluid properties used by the V-Cone program are the flowing density, base density, viscosity, specific heat ratio, and heating value.

## 1.3 Program Requirements

You download the V-Cone program to—and then run it from—the Flash and RAM memory on the FloBoss 107. Download and configure the program using the ROCLINK 800 Configuration software (version 1.83 or greater).

The downloadable program is:

| File Name | Target Unit/ Version | User Defined Point (UDP) | Flash Used (in bytes) | DRAM Used (in bytes) | ROCKLINK 800 Version | Display Number |
|---|---|---|---|---|---|---|
| V-Cone_5.bin | 1.10 | 31, 32 | 11347 | 16384 | 1.83 | 32, 33 |

Note: You must connect a PC to the FloBoss'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 (for FB107)* (Form A6217).

## 2 INSTALLATION

This section provides instructions for installing the V-Cone program into the FB107. Read *Section 1.3* of this manual for program requirements.

### 2.1 Downloading the Program

This section provides instructions for installing the user program into FloBoss memory.

**Note:** Connect a PC to the FloBoss's LOI port **before** starting the download.

To download the user program:

1. Start and logon to ROCLINK 800.
2. Select **ROC** > **Direct Connect** to connect to the FloBoss unit.
3. Select **Utilities** > **User Program Administrator** from the ROCLINK menu bar. The User Program Administrator screen displays (see *Figure 1*):
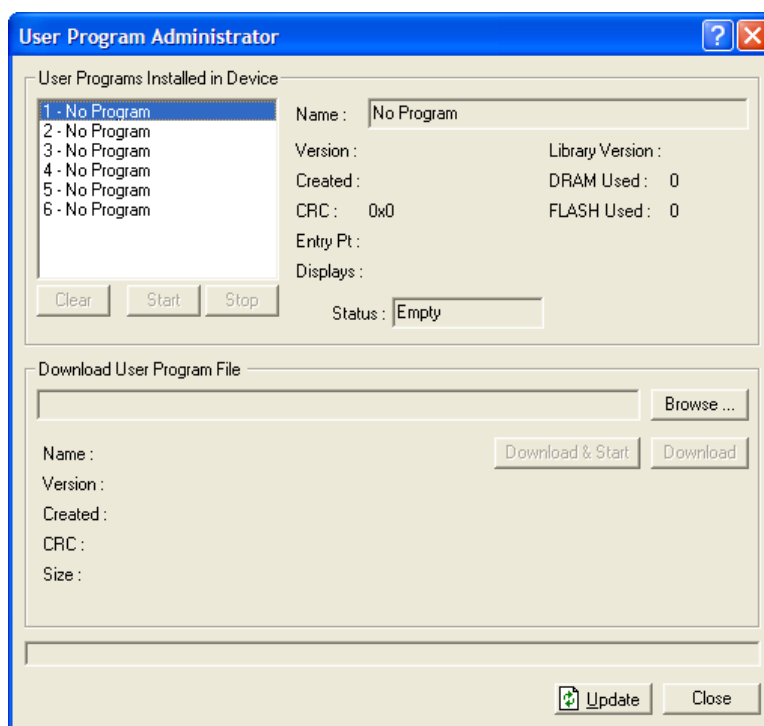


*Figure 1. User Program Administrator*

4. Click **Browse** in the Download User Program File frame. The Select User Program File screen displays (see *Figure 2*).
5. 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 2* shows, the screen lists all valid user program files with the .BIN extension:
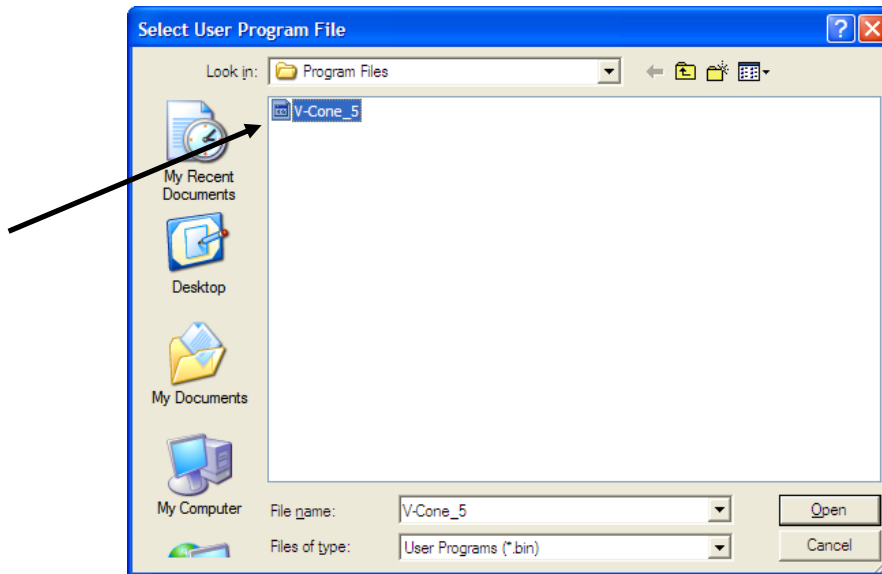
*Figure 2. Select User Program File*

6. Click **Open** to select the program file. The User Program Administrator screen displays. As shown in *Figure 3*, note that the Download User Program File frame identifies the selected program and that the **Download & Start** button is active:
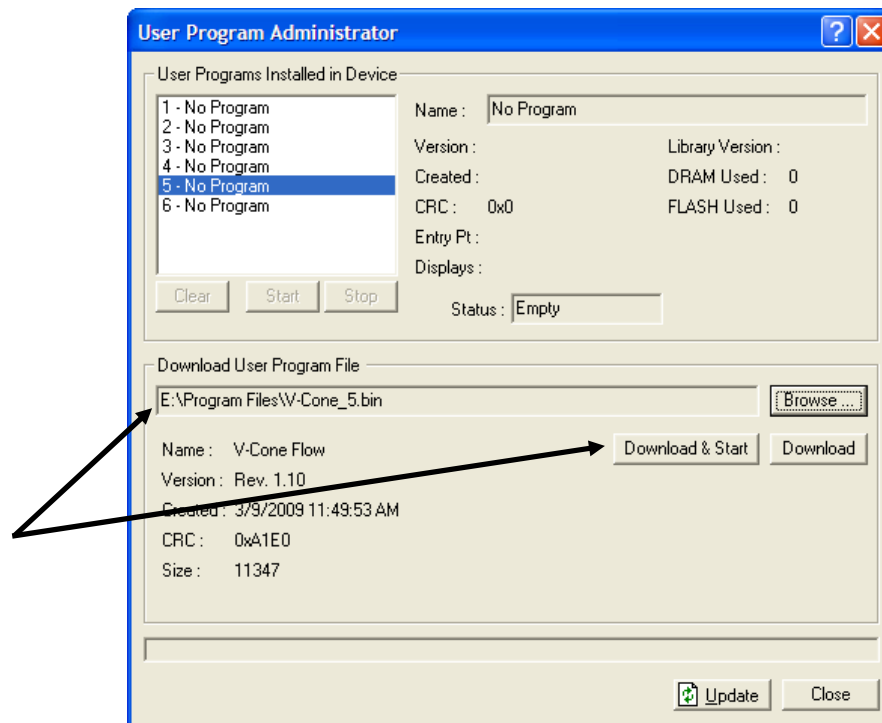


*Figure 3. User Program Administrator*

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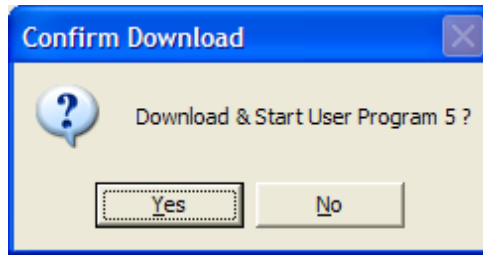


*Figure 4. Confirm Download*

**Note:** For the FB107, ROCLINK800 assigns program positions based on memory allocations. For this reason, the V-Cone program automatically installs as program 5.

8. Click **Yes** to begin the download. During the download, the program performs a warm start, creates an event in the event log, and—when the download completes—displays the following message:
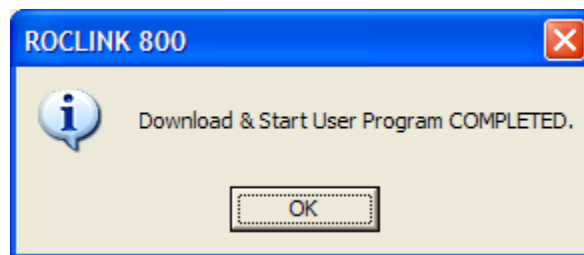


*Figure 5. ROCLINK 800 Download Confirmation*

9. Click **OK**. The User Program Administrator screen displays (see *Figure 6*). Note that:
   ▪ The User Programs Installed in Device frame identifies the loaded program.
   ▪ The Status field indicates that the program is running.
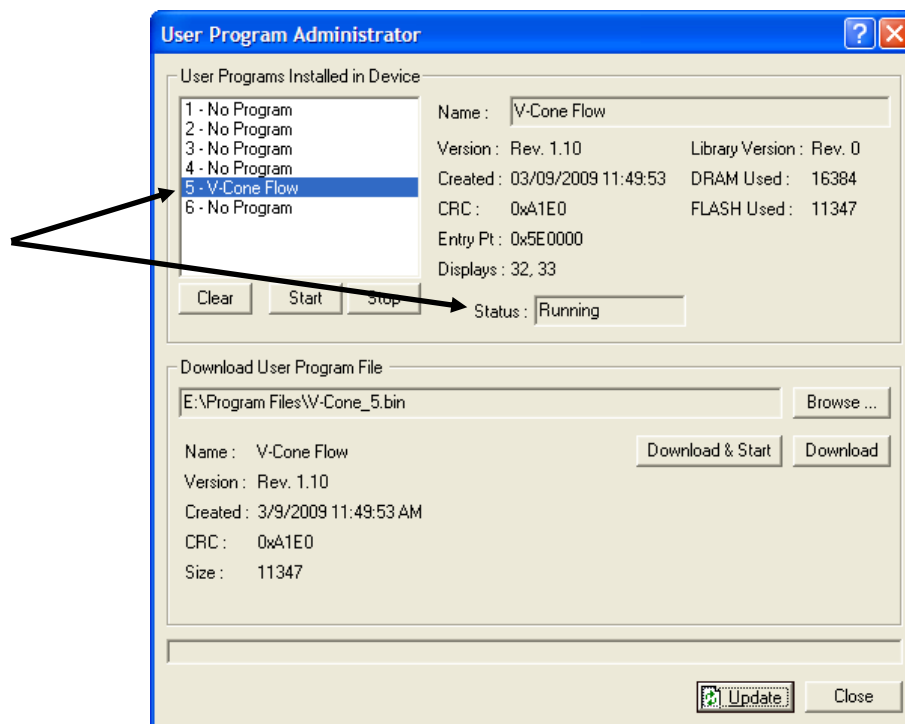
*Figure 6. User Program Administrator*

**10.** Click **Close** and proceed to *Section 3* to configure the program.

## 3  CONFIGURATION

After you have downloaded and started the V-Cone program, you configure the program and view calculation results using the ROCLINK 800 software. To do this, you use two program-specific screens (V-Cone Setup and V-Cone Values):

▪ Use the V-Cone Setup screen to set the parameters for the selected meter run.

▪ Use the V-Cone Values screen to view results from the V-Cone flow calculations.

**Note:** Configure history points after you configure the V-Cone program. To configure history points, refer to *Table 7-1. EFM History Points (AGA 3)* in *Section 7.10.2* of the *ROCLINK 800 Configuration Software User Manual (for FloBoss 107), Form A6217*.
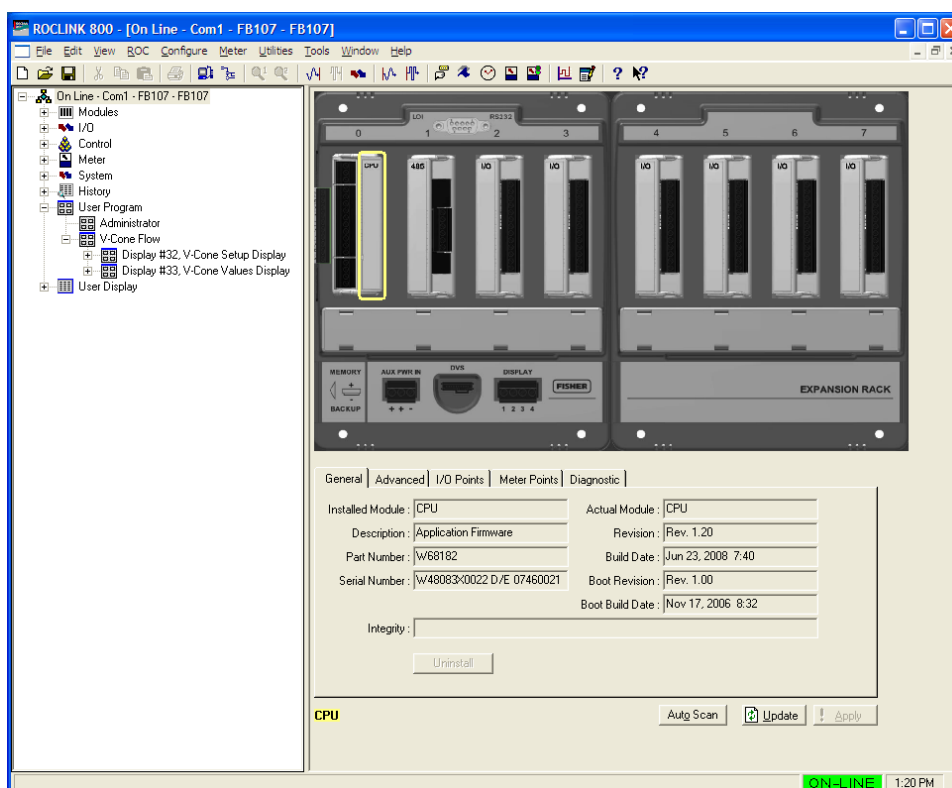


*Figure 7. ROCLINK 800*

## 3.1 V-Cone Setup Screen

Once you have successfully loaded the V-Cone program into the FloBoss, you can access the V-Cone Setup screen and configure the meter runs.

To access this screen:

1. Click **User Program** > **V-Cone Flow > Display #32, V-Cone Setup Display** from the ROCLINK configuration tree:

2. Double-click **#1, Meter #1**. The V-Cone Setup screen displays:
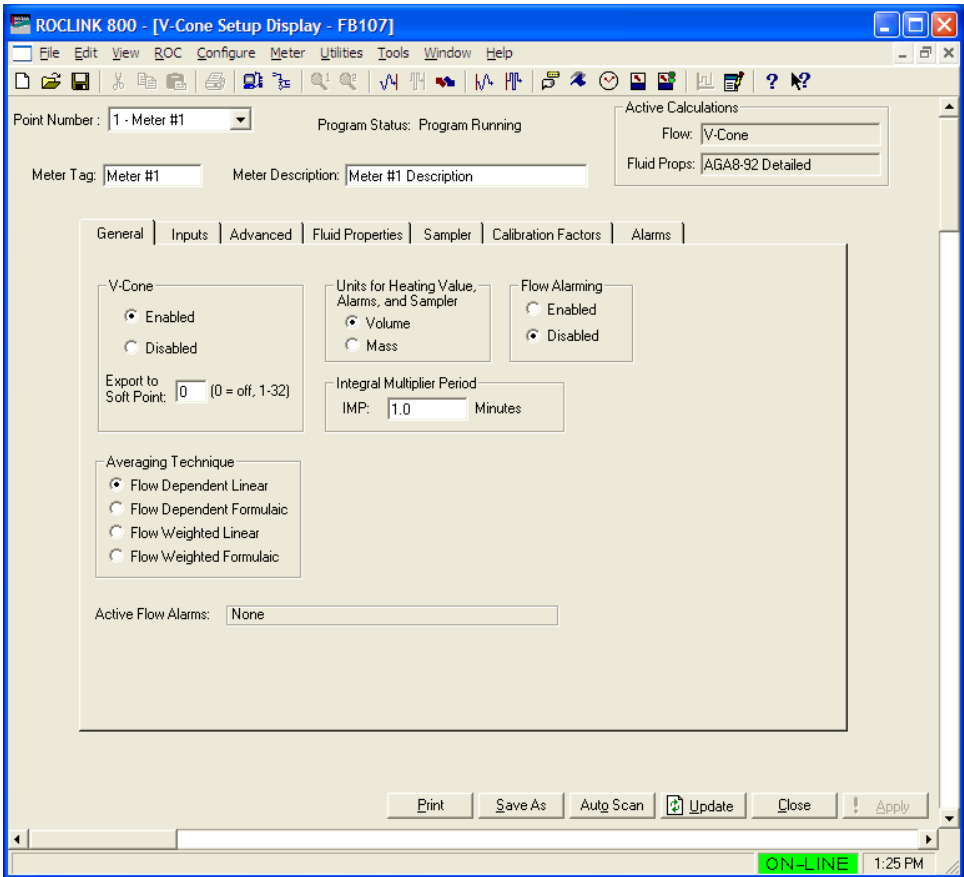


*Figure 8. V-Cone Setup*

| | |
|---|---|
| **Note:** | Six fields at the top of the screen (Point number, Program Status, Meter Tag, Meter Description, Active Calculations – Flow, and Active Calculations – Fluid Props) appear on all tabs. |

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

| Field | Description |
|---|---|
| **Point Number** | Selects the meter run to configure. Click ▼ to display all defined instances. Clicking a different meter run causes the screen to display the values for that meter run. |

| Field | Description |
|---|---|
| **Program Status** | This **read-only** field shows the current state of the user program. Valid values are: **Program Not Loaded**, **Program Loaded – Not Started**, **Program Running**, **Program Shutting Down**, **License Not Found**, and **Not Running – Library Version Error.** |
| **Meter Tag** | Sets the unique identifier for the selected meter. |
| **Meter Description** | Sets the description of the selected meter. |
| **Active Calculations Flow** | This **read-only** field shows the flow calculation standard currently performing flow calculations for the selected meter run. |
| **Active Calculations Fluid Props** | This **read-only** field shows the properties calculation standard currently performing properties calculations for the selected meter run. |

**4.** Click **Apply** to save your changes, and proceed to *Section 3.1.1* to configure the General tab.

### 3.1.1 V-Cone Setup – General Tab

Use the General tab (which displays when you access the V-Cone Setup screen) to enable the V-Cone flow calculation for a meter run, specify the averaging technique used by the program, and define program-specific options.
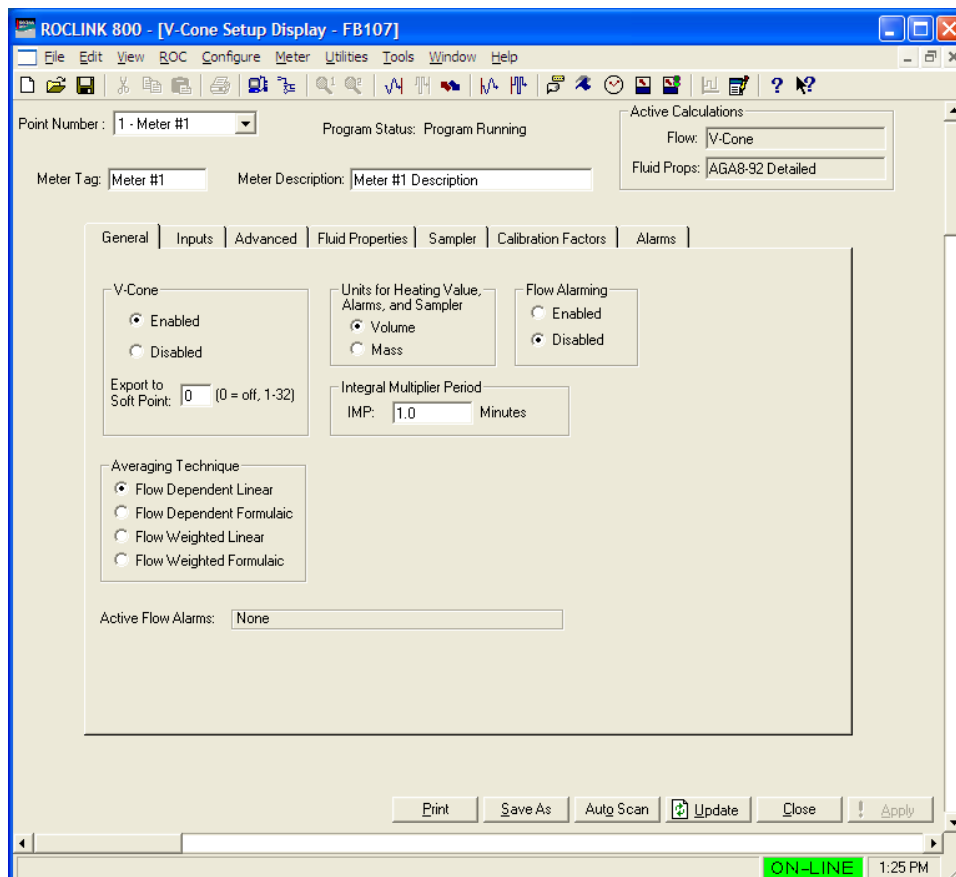


*Figure 9. V-Cone Setup, General Tab*

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

| Field | Description |
|-------|-------------|
| **V-Cone** | Enables or disables the V-Cone Flow program to perform the flow calculations for the selected meter run. Valid selections are Enabled or Disabled. |
| **Export to Soft Point** | Allows a host to access data from a softpoint if it cannot access the data through other means. Valid values are **0** (disable the access) or **1** through **32** (enable the access **and** save the following values to the designated softpoint parameter starting at Data #1 (parameter 2)): |
| **1** | Calculation Period (Sec) |
| **2** | V-Cone Beta Ratio |
| **3** | Velocity of Approach |
| **4** | Pressure Loss (% of differential pressure) |
| **5** | Expansion Factor |
| **6** | Linear Gas Velocity (Ft/Sec or M/Sec) |

| Field | Description | |
|---|---|---|
| **Export to Soft Points** (continued) | **7** | Correction to Contract Conditions |
| | **8** | Thermal Correction Factor |
| | **9** | Actual Volume Flow Rate (Cf/Sec or M$^3$/Sec) |
| **Units for Heating Value, Alarms, and Sampler** | Sets the type of units used for the heating value, alarms, and sampler of the meter run. Valid selections are Volume, (units are BTU/CF or MJ/M3, Ft$^3$ or M3) and Mass (units are BTU/Lb or MJ/Kg, Lb or Kg). | |
| **Flow Alarming** | Enables or disables flow alarming for the meter. If enabled, alarm status changes are added to the Alarm Log. Use the Alarms tab to configure the alarms. If disabled, no alarm generates for this meter, regardless of the alarm configuration. | |
| **Integral Multiplier Period (IMP)** | Sets, in minutes, how frequently the system recalculates the fluid properties and resulting Integral Multiplier Value (IMV) (per the API measurement standard *Chapter 21, Section 1*). | |
| **Averaging Technique** | Sets the averaging technique for determining the average differential pressure, static pressure, and flowing temperature during each IMP for the meter run. For further details, see API measurement standard *Chapter 21, Section 1, Appendix B*. Valid selections are: | |
| | **Flow Dependant Linear** | Calculates the averages for the differential pressure, static pressure, and flowing temperature with equal weighting given to each sample when there is flow through the meter. For samples in which there is no flow, the value is not included in the average. However, if there is no flow during the IMP, averages are determined using all of the samples. |
| | **Flow Dependant Formulaic** | Calculates averages for the differential pressure, static pressure, and flowing temperature where each sample is raised to the power to which the parameter is raised in the flow equation, with equal weighting given to each sample when there is flow through meter. For samples where there is no flow, the value is not included in the averaging. However, if there is no flow during the IMP, averages are determined using all of the samples. At the end of the IMP, the resulting average is raised to the reciprocal of the power to which the value is raised in the flow equation. |
| | **Flow Weighted Linear** | Calculates averages for the differential pressure, static pressure, and flowing temperature with weighting for a sample being the ratio of the flow through the meter at the time of the sample to the total flow during the IMP. For samples where there is no flow, the value is not included in the average. However, if there is no flow during the IMP, averages are determined using all of the samples. |
| | **Flow Weighted Formulaic** | Calculates averages for the differential pressure, static pressure, and flowing temperature where each sample is raised to the power to which the parameter is raised in the flow equation, with weighting for a sample being the ratio of the flow at the time of the sample to the total flow during the IMP. For samples where there is no flow, the value is not included in the average. However, if there is no flow during the IMP, averages are determined using all of the samples. At the end of the IMP, the resulting average is raised to the reciprocal of the power to which the value is raised in the flow equation. |

| Field | Description |
|---|---|
| **Active Flow Alarms** | This **read-only** field shows any alarm currently active. For example, Low indicates that the calculated flow is below the Low Alarm limit. Other alarms can include High, No Flow, and Manual Mode. |

**2.** Click **Apply** to save any changes, and proceed to *Section 3.1.2* to configure the Inputs tab.

### 3.1.2 V-Cone Setup – Inputs Tab

Use the Inputs tab to define the inputs used by the V-Cone Flow calculation.

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**Note:** The V-Cone selection on the General tab must be set to **Enabled** to view this tab.

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To access this screen:

1. Select the **Inputs** tab on the V-Cone Setup screen. The following screen displays:
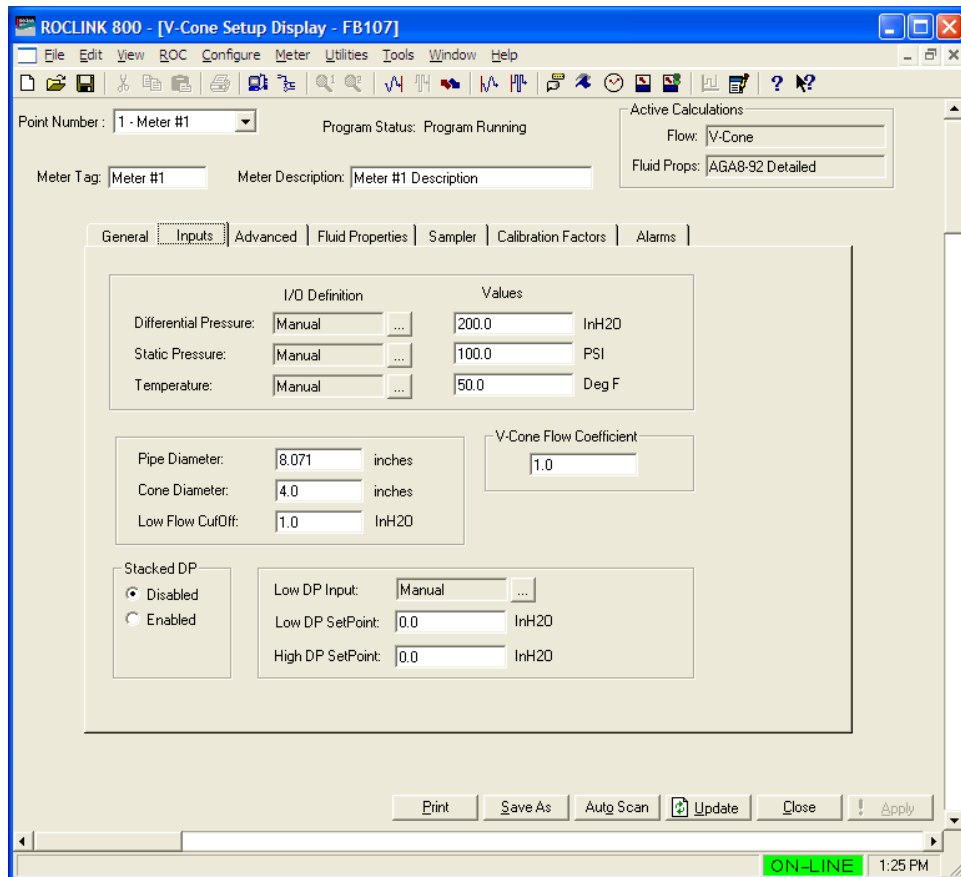


*Figure 10. V-Cone Setup, Inputs tab*

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

| Field | Description |
|---|---|
| **Differential Pressure** | Sets the paramater for the differential pressure (or high differential pressure, if you enabled Stacked DP). Click ... to display the Select TLP dialog box you use to assign the parameter. If Manual appears, use the Values field to enter an engineering units value for the differential pressure. Otherwise, the Values field indicates the current value. The units for the differential pressure are InH2O or kPa. |
| **Static Pressure** | Sets the parameter for the static pressure. Click ... to display the Select TLP dialog box you use to assign the parameter. If Manual appears, use the Values field to enter an engineering units value for the static pressure. Otherwise, the Values field indicates the current value. The units for the static pressure are PSIG/PSIA or kPa(g)/kPa(a). |

| Field | Description |
|-------|-------------|
| **Temperature** | Sets the parameter for the flowing temperature of the fluid. Click ▢ to display the Select TLP dialog box you use to assign the parameter. If Manual appears, use the Values field to enter an engineering units value for the temperature. Otherwise, the Values field indicates the current value. The units for the flowing temperature are Deg F or Deg C. |
| **Pipe Diameter** | Sets the inside diameter of the pipe near the nozzle. The units are inches or millimeters. |
| **Cone Diameter** | Sets the diameter of the V-Cone. The units are inches or millimeters. |
| **Low Flow Cutoff** | Sets the low flow cutoff point. When the value of the differential pressure parameter is less than or equal to this value, the calculated flow rate is set to zero and, if alarming is enabled, the No Flow alarm status is set and an entry is made in the Alarm Log. The units of the low flow cutoff are InH2O or kPa. |
| **V-Cone Flow Coefficient** | Sets the coefficient of discharge (Cd) for the V-Cone as shown on the information tag fixed to the body of the V-Cone tube. |
| **Stacked DP** | Enables the use of standard differential pressure transmitters for low and high pressure ranges. Valid values are Enabled (use stacked DP transmitters) or Disabled (do not allow use of stacked DP transmitters). |
| **Low DP Input** | Sets the parameter for monitoring low differential pressure. Click ▢ to display a Set TLP dialog box you use to assign the parameter. You must Enable the Stacked DP parameter to use this input or you can leave this input in Manual Mode when you Disable Stacked DP. |
| **Low DP SetPoint** | Sets the differential pressure point at which the system switches over to the low differential pressure input. When the High DP input is active and the High DP reading drops below this value, the Low DP input becomes the active input. The units are InH2O or kPa. |
| **High DP SetPoint** | Sets the differential pressure point at which the system switches over to the high differential pressure input. When the Low DP input is active and the Low DP reading rises above this setpoint, the High DP input becomes the active input. The units are InH2O or kPa. |

3. Click **Apply** to save any changes, and proceed to *Section 3.1.3* to configure the Advanced tab.

### 3.1.3  V-Cone Setup – Advanced Tab

Use the Advanced tab to define additional meter run information for the V-Cone flow calculation.

**Note:**  The V-Cone selection on the General tab must be set to **Enabled** to view this tab.

To access this screen:

1.  Select the **Advanced** tab on the V-Cone Setup screen. The following screen displays:



*Figure 11. V-Cone Setup, Advanced tab*

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

| Field | Description |
| --- | --- |
| **Atmospheric Pressure** | Sets how the program determines atmospheric pressure (absolute) at the metering location. Valid selections are Calculate (calculate atmospheric pressure from other parameters defined on this screen) or Enter (use the value entered in the field in this frame). The units of the atmospheric pressure are PSIA or kPa(a). |
| **Gravitational Acceleration** | Sets how the program determines gravitational acceleration at the metering location. Valid selections are Calculate (calculate gravitational acceleration from other parameters defined on this screen) or Enter (use the value entered in the field in this frame). The units of the gravitational acceleration are Ft/Sec$^2$ or M/Sec$^2$. |
| **Base Pressure** | Sets, in PSIA or kPa(a), the flow measurement base pressure specified for the base conditions. |

| Field | Description |
|---|---|
| **Base Temperature** | Sets, in degrees Fahrenheit or degrees Celsius, the flow measurement base temperature specified for the base conditions. |
| **Elevation** | Sets, in feet or meters above sea level, the elevation of the metering location. |
| **Latitude** | Sets, in degrees, the latitude of the metering location. |
| **V-Cone Material** | Indicates the material from which the V-Cone is made. You must also complete the Ref Temperature field. This indicates the reference temperature at which the V-Cone diameter was measured, in units of degrees Fahrenheit or degrees Celsius. |
| **Pipe Material** | Indicates the material from which the pipe is made. You must also complete the Ref Temperature field. This indicates the reference temperature at which the pipe diameter was measured, in units of degrees Fahrenheit or degrees Celsius. |
| **Force Recalculation** | Forces the program to immediately recalculate the flow without waiting for the next normal recalculation period. Select **Set** and click **Apply** to force the recalculation.<br><br>**Note:** You define normal recalculation periods using the Integral Multiplier Period field (located on the V-Cone Setup screen's General tab). |
| **Limit Meter Events** | Sets whether the FB107 logs all flow-related events. Valid selections are Enabled (log all events) or Disabled (do not log events). |
| **Pressure Tap** | Sets the reference of the static pressure and location of the pressure tap. This field must match how the sensor or transmitter actually measures the static pressure. Valid selections for pressure tap type are Gauge or Absolute. Valid selections for the pressure tap location are Upstream or Downstream. |

**3.** Click **Apply** to save any changes, and proceed to *Section 3.1.4* to configure the Fluid Properties tab.

### 3.1.4 V-Cone Setup – Fluid Properties Tab

Use the Fluid Properties tab to define the fluid composition and other properties.

**Note:** To view this tab, the V-Cone selection on the General tab must be set to **Enabled** and the active fluid properties calculation must be **AGA8**.

To access this screen:

1. Select the **Fluid Properties** tab on the V-Cone Setup screen.



*Figure 12. V-Cone Setup, Fluid Properties tab*

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

| Field | Description |
|---|---|
| **Compositions** | Sets the mole percent for each gas component. If the FPV Method is Detailed, the value in the Total Mole % field must equal 100%. If the FPV Method is Gross1, only the mole % of $CO_2$ must be entered. If the FPV Method is Gross2, the mole % of $CO_2$ and the mole % of $N_2$ must be entered. |
| **FPV Method** | Sets the method of determining the compressibility factors for AGA8 calculations. Valid selections are: |
| | **Detailed**  Requires the natural gas composition in mole percent to be entered for all components. |
| | **Gross1**  Requires the specific gravity of the natural gas, the real gas gross heating value per unit volume, and the mole % of $CO_2$ to be entered. |

| Field | Description | |
|---|---|---|
| **FPV Method** (continued) | **Gross2** | Requires the specific gravity of the natural gas, the mole % of $CO_2$, and the mole % of $N_2$ to be entered. |
| | **Note**: If you choose either Gross1 or Gross2, you must manually enter values for Specific Gravity and Heating Value on this screen | |
| | While the Detailed method provides the highest accuracy in a broad range of measurement conditions, you can use either of the Gross methods when: | |
| | ▪ Temperature is between 32°F and 130°F (0°C and 54°C). | |
| | ▪ Pressure is between 0 and 1200 PSIA (0 and 8274 kPa(a)). | |
| | ▪ Gas composition is within the Normal range, as defined in the 1992 AGA8 report. | |
| **Heating Value** | Sets how the system determines the heating value of the gas. Valid selections are Calculate (allow the system to calculate the heating value from the gas composition data) or Enter (manually specify a value). | |
| | **Note**: Set the *Units for Heating Value, Alarms, and Sampler* parameter on the General tab to select volume or mass measurement in English units (BTU/CF or BTU/Lb) or metric units (MJ/M$^3$ or MJ/Kg). | |
| **Heating Value Basis** | Identifies the basis the system uses to determine the heating value for flow or energy calculations. Valid selections are: | |
| | **Dry** | No water vapor present in gas. |
| | **Wet** | Saturated water vapor present in gas. |
| | | **Note**: When you select this option, the FB107 calculates the mole percentage of water based on the algorithm from IAPWS—IF97 standards and adjusts the other mole percentages accordingly. |
| | **As Delivered** | Gas may contain some water vapor. |
| **Specific Gravity** | Sets the ratio of the molar mass of the gas to the molar mass of the air. Valid selections are Calculate (the system calculates the value) and Enter (manually specify a value). | |
| | **Note**: If you select Enter, the value should represent the gas at standard conditions and cannot be less that 0.07. | |
| **Viscosity** | Sets the dynamic viscosity of the flowing gas. Units are Lbm/Ft-Sec or cP. | |
| **Sp Heat Ratio** | Sets the specific heat ratio of the gas (defined as the specific heat of the gas at constant pressure divided by the specific heat of the gas at constant volume). Accepted practice for natural gas applications is to use a value of 1.3, which was used to develop the expansion factor tables in the AGA 3 Report – Part 3. | |
| **Gas Quality** | Sets the source for the gas compositions and other properties. Valid selections are Constant (readings are manually entered and changes are added to the event log) or Live (readings come from a gas chromatograph or are periodically downloaded from a host and changes are not added to the event log). | |
| **Log Methane Adjust** | Sets if system adjustments to the methane composition are added to the event log. Valid selections are Enabled (adjustments are added to the event log) or Disabled (adjustments are not added to the event log). | |

3. Click **Apply** to save any changes, and proceed to *Section 3.1.5* to configure the Sampler tab.

### 3.1.5  V-Cone Setup – Sampler Tab

Use the Sampler tab to set up the discrete output (DO) to send a pulse output to another device, such as an odorizer, or to control a sampler for a meter run.

**Note:**  The V-Cone selection on the General tab must be set to **Enabled** to view this tab.

To access this screen:

1.  Select the **Sampler** tab on the V-Cone Setup screen. The following screen displays:
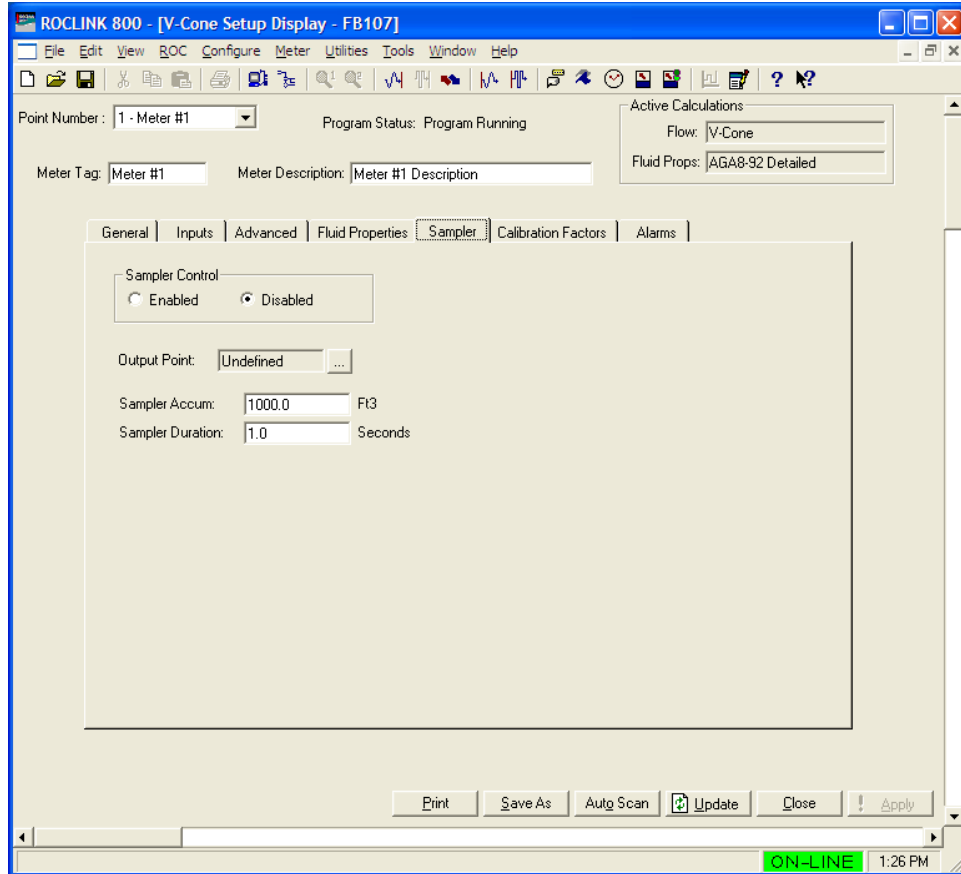


*Figure 13. V-Cone Setup, Sampler tab*

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

| Field | Description |
|---|---|
| **Sampler Control** | Enables sampling for the meter run. When enabled, the Output Point is set when the previous flow matches or exceeds the value in the Sampler Accum field. |
| **Output Point** | Sets the parameter for the output to drive the sampler. Click ⬚ to display the Select TLP dialog box you use to define the parameter. It must be parameter 3 of a DO point. |
| **Sampler Accum** | Sets the quantity of fluid that must pass before the status of the Output Point is set. Units are Cf, M$^3$, Lb, or Kg based on the Units Type for Heating Value, Alarms, and Sampler on the General tab. |

| Field | Description |
|---|---|
| **Sampler Duration** | Sets the duration, in seconds, for holding the status of the Output Point to ON when the quantity of fluid passed matches or exceeds the Sampler Accum. |

**3.** Click **Apply** to save any changes, and proceed to *Section 3.1.6* to configure the Calibration Factors tab.

### 3.1.6 V-Cone Setup – Calibration Factors Tab

Use the Calibration Factors tab to define information related to pressure calibration.

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**Note:** The V-Cone selection on the General tab must be set to **Enabled** to view this tab.

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To access this screen:

1. Select the **Calibration Factors** tab on the V-Cone Setup screen. The following screen appears:
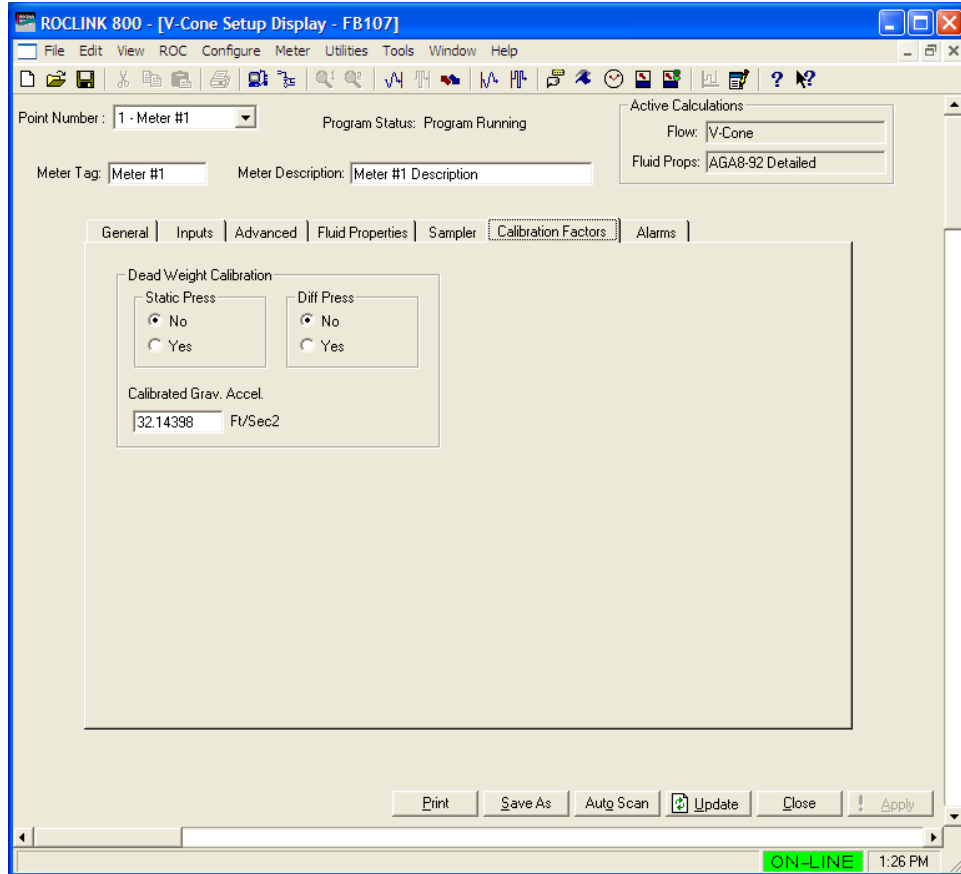


*Figure 14. V-Cone Setup, Calibration Factors tab*

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

| Field | Description |
|---|---|
| **Dead Weight Calibration: Static Pressure** | Sets if the program compensates the static pressure value for the difference between the gravitational acceleration at the location where the static pressure was calibrated and the gravitational acceleration associated with the dead weight calibrator. |
| **Dead Weight Calibration: Diff Pressure** | Sets if the program compensates the differential pressure value for the difference between the gravitational acceleration at the location where the differential pressure was calibrated and the gravitational acceleration associated with the dead weight calibrator. |
| **Calibrated Gravitational Acceleration** | Sets the gravitational acceleration associated with the dead weight calibrator. The units are Ft/Sec$^2$ or M/Sec$^2$. |

**3.** Click **Apply** to save any changes, and proceed to *Section 3.1.7* to configure the Alarms tab.

### 3.1.7  V-Cone Setup – Alarms Tab

Use the Alarms tab to define information related to flow alarming.

**Note:**   The V-Cone selection on the General tab must be set to **Enabled** to view this tab.

To access this screen:

1.  Select the **Alarms** tab on the V-Cone Setup screen. The following screen appears:
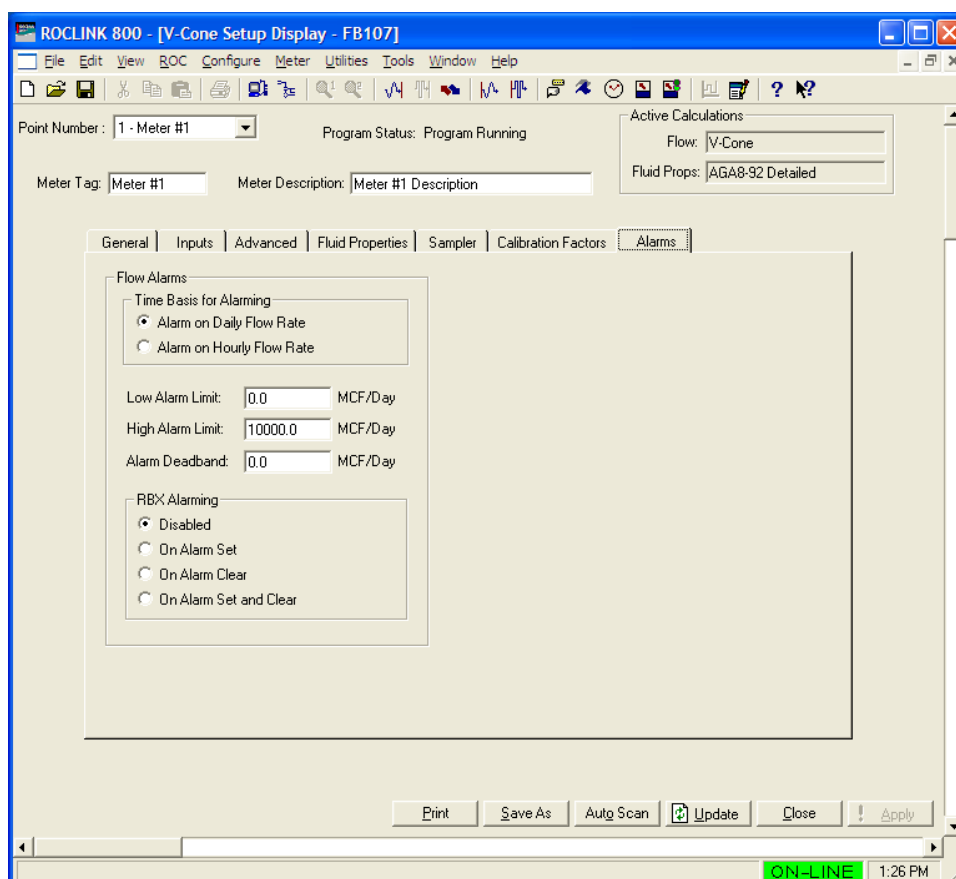


*Figure 15. V-Cone Setup, Alarms tab*

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

| Field | Description |
|---|---|
| **Time Basis for Alarming** | Sets the parameter whose value is to be used for alarming. If Alarm on Daily Flow Rate is selected, the daily volume or mass flow rate is used for alarming. If Alarm on Hourly Flow Rate is selected, the hourly volume or mass flow rate is used for alarming. The use of the volume or mass flow rate is dependent on the Units Type for Heating Value, Alarms, and Sampler on the General tab. |
| **Low Alarm Limit** | Sets the value at or below which the calculated flowrate must fall to generate a low alarm. The units are MCF/Day, CF/Hour, Mlb/Day, Lb/Hour, kM$^3$/Day, M$^3$/Hour, Tonnes/Day, or Kg/Hour. |
| **High Alarm Limit** | Sets the value at or above which the calculated flowrate must rise to generate a high alarm. The units are MCF/Day, CF/Hour, Mlb/Day, Lb/Hour, kM$^3$/Day, M$^3$/Hour, Tonnes/Day, or Kg/Hour. |

| Field | Description | | |
|---|---|---|---|
| **Alarm Deadband** | Sets a value that defines a zone above the Low Alarm limit and below the High Alarm limit. When an alarm condition is set, the flowrate must clear the alarm limit plus the zone defined by the deadband, before the alarm condition clears. This deadband prevents the system from setting and clearing the alarm continuously when the input value is oscillating around the alarm limit. The units are MCF/Day, CF/Hour, Mlb/Day, Lb/Hour, $kM^3$/Day, $M^3$/Hour, Tonnes/Day, or Kg/Hour. | | |
| **RBX Alarming** | Sets the action taken for Report-by-Exception (RBX) alarm messages. These messages are sent via communication ports that have RBX mode enabled. | | |
| | **Disabled** | RBX Alarming is turned off. | |
| | **On Alarm Set** | When the value of the parameter for alarming enters the alarm condition, the FB107 generates an RBX message(s). | |
| | **On Alarm Clear** | When the value of the parameter for alarming clears the alarm condition, the FB107 generates an RBX message(s). | |
| | **On Alarm Set and Clear** | When the value of the parameter for alarming enters or clears the alarm condition, the FB107 generates an RBX message(s). | |

3. Click **Apply** to save any changes.

4. Click **Close** to close this screen, and proceed to *Section 3.2* to configure the V-Cone Values screen.

## 3.2 V-Cone Values Screen

Use this screen to view the results and calculation factors used in V-Cone flow calculations.

To access this screen:

1. Click **User Program** > **V-Cone Flow > Display #33, V-Cone Values** from the ROCLINK configuration tree:
2. Double-click **#1, Meter #1**. The V-Cone Values screen displays:



*Figure 16. V-Cone Values*

**Note:** Six fields at the top of the screen (Point number, Program Status, Meter Tag, Meter Description, Active Calculations – Flow, and Active Calculations – Fluid Props) appear on all tabs.

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

| Field | Description |
|---|---|
| **Point Number** | Selects the meter run to view. Click ▼ to display all defined instances. Clicking a different meter run causes the screen to display the values for that meter run. |
| **Program Status** | This **read-only** field shows the current state of the user program. Valid values are: Program Not Loaded, Program Loaded – Not Started, Program Running, Program Shutting Down, and Not Running – Library Version Error. |
| **Meter Tag** | This **read-only** field shows the unique identifier for the selected meter. |

| Field | Description |
|---|---|
| **Meter Description** | This **read-only** field shows the description of the selected meter. |
| **Active Calculations: Flow** | This **read-only** field shows the flow calculation standard currently performing flow calculations for the selected meter run. |
| **Active Calculations: Fluid Props** | This **read-only** field shows the properties calculation standard currently performing properties calculations for the selected meter run. |

4. Click **Apply** to save any changes, and proceed to *Section 3.2.1* to configure the Values tab.

### 3.2.1  V-Cone Values –Values Tab

Use the Values tab to view results of the V-Cone flow calculations.

1.  Select the **Values** tab on the V-Cone Values screen. The following two screens displays:



*Figure 17. V-Cone Values, Values tab*

2.  Review the values in the following fields:

| Field | Description |
|---|---|
| **Differential Pressure** | This **read-only** field displays the current differential pressure. The units are InH2O or kPa.<br><br>**Note:** This field displays only if the meter's input type is differential. |
| **Uncorrected Volume** | This **read-only** field displays the uncorrected volume flow rate, which is the volumetric flow input before any density correction is applied. The units are MCF/Day or kM3/Day.<br><br>**Note:** This field displays only if the meter's input type is linear. |
| **Static Pressure** | This **read-only** field displays the current static pressure in PSIG, PSIA, kPa(g) or kPa(a). |
| **Temperature** | This **read-only** field displays the current flowing temperature in Deg F or Deg C. |
| **Current Flow Rate – Volume** | This **read-only** field displays the current hourly and daily volumetric flow rates in CF/Hour and MCF/Day or M3/hr and kM3/Day. |

| Field | Description |
|---|---|
| **Current Flow Rate – Energy** | This **read-only** field displays the current hourly and daily energy rates in BTU/Hour and MMBTU/Day or MJ/Hour and GJ/Day. |
| **Current Flow Rate – Mass** | This **read-only** field displays the current hourly and daily mass flow rates in Lb/Hour and Mlb/Day or Kg/Hour and Tonnes/Day. |
| **Accumulation – Uncorrected** | This **read-only** field displays the uncorrected volume total flow in MCF or Km3 for the current day, the previous day, the current month, the previous month, and the accumulated total since the accumulator last reset.<br><br>**Note:** This field displays only if the meter's input type is linear. |
| **Accumulation – MCF** | This **read-only** field displays the total volumetric flow in MCF or kM3 for the current day, the previous day, the current month, the previous month, and the accumulated total since the accumulator last reset. |
| **Accumulation – MMBTU** | This **read-only** field displays the total energy in MMBTU or GJoules for the current day, the previous day, the current month, the previous month, and the accumulated total since the accumulator last reset. |
| **Accumulation – Mlb** | This **read-only** field displays the total mass flow in Mlb or Tonnes for the current day, the previous day, the current month, the previous month, and the accumulated total since the accumulator last reset. |
| **Accumulation – Minutes** | This **read-only** field displays the flowing time in Minutes for the current day, the previous day, the current month, the previous month, and the accumulated total since the accumulator last reset. |

3.  Click **Apply** to save any changes and proceed to *Section 3.2.2* to configure the Calculated Factors tab.

### 3.2.2 V-Cone Values Screen –Factors Tab

Use this tab to view the calculation factors used in V-Cone flow calculations.

**Note:** The V-Cone selection on the General tab must be set to **Enabled** to view this tab.

To access this screen:

1. Select the **Factors** tab on the V-Cone Values screen. The following screen displays:
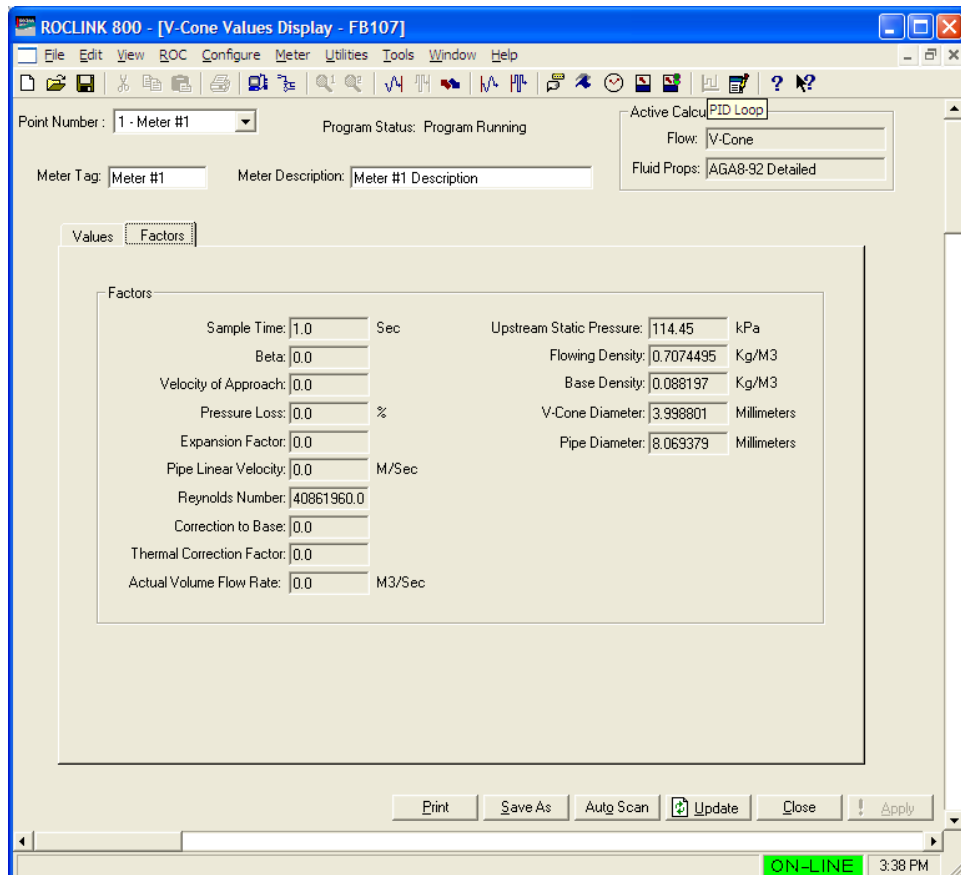


*Figure 18. V-Cone Values, Factors tab*

2. Review the values in the following fields:

| Field | Description |
| --- | --- |
| **Sample Time** | This **read-only** field shows, in seconds, the period between flow rate and accumulation calculations.<br><br>**Note**: This value is always **1.0 Sec**. |
| **Beta** | This **read-only** field shows the diameter ratio (β) as calculated for the V-Cone. |
| **Velocity of Approach Factor** | This **read-only** field shows the velocity of approach factor ($E_v$). |
| **Pressure Loss** | This **read-only** field shows the pressure loss ($\%P_{loss}$) as a percentage of differential pressure. |
| **Expansion Factor** | This **read-only** field shows the expansion factor (Y). |

| | |
|---|---|
| **Pipe Linear Velocity** | This **read-only** field shows, in Ft/Sec or M/Sec, the linear velocity (v) of the fluid. |
| **Reynolds Number** | This **read-only** field displays the Reynolds number (ReD), calculated based on the average flowing conditions during the previous IMP. |
| **Correction to Base** | This **read-only** field shows the correction from the flowing to the base conditions. |
| **Thermal Correction Factor** | This **read-only** field shows the thermal correction factor ($F_a$). |
| **Actual Volume Flow Rate** | This **read-only** field shows the actual volumetric flow rate ($Q_{acfs}$ or $Q_{m3/s}$) in Cf/Sec or $M^3$/Sec. |
| **Upstream Static Pressure** | This **read-only** field displays the upstream static pressure in PSIA or kPa(a). |
| **Flowing Density** | This **read-only** field displays the density at flowing conditions, calculated based on the average flowing conditions during the previous IMP. The units are Lb/CF or Kg/M3. |
| **Base Density** | This **read-only** field displays the density at base conditions. The units are Lb/CF or Kg/M3. |
| **V-Cone Diameter** | This **read-only** field displays the actual diameter of the V-Cone, calculated based on the specified V-Cone diameter and the averaging flowing temperature during the previous IMP. The units are inches or millimeters. |
| **Pipe Diameter** | This **read-only** field displays the actual inside diameter of the pipe, calculate based on the specified pipe diameter and the averaging flowing temperature during the previous IMP. The units are inches or millimeters. |
| **Beta** | This **read-only** field displays the ratio of the V-Cone to pipe diameters ratio at the average flowing temperature during the previous IMP. |

3.  Click **Apply** to save any changes.
4.  Click **Close** to close this screen. Proceed to *Section 3.3* to save your configuration.

## 3.3 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:

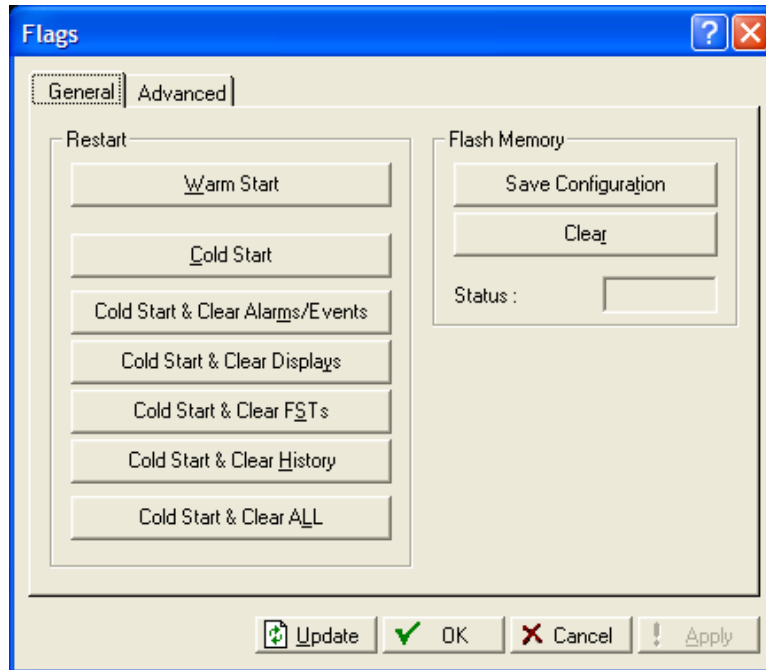1. Select **ROC** > **Flags**. The Flags screen displays:



*Figure 19. Flags*

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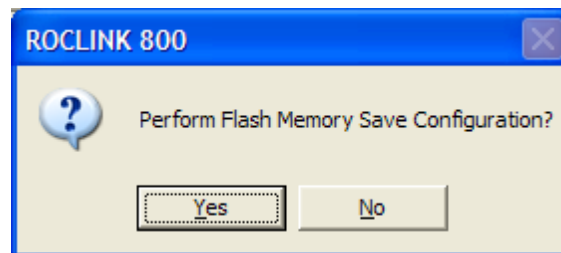


*Figure 20. Save Verification*

**3.** Click **Yes.** When the save process completes, a confirmation message displays:
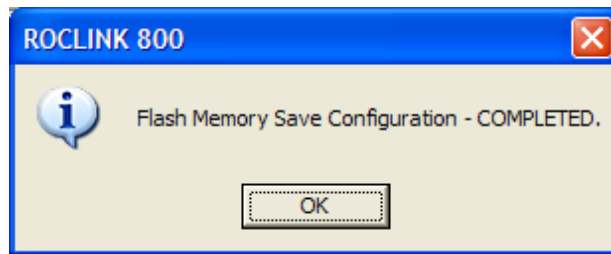


*Figure 21. Confirmation*

**Note:** Depending on the size and complexity of the user program, this process may take several seconds. When the process ends, the Status field on the Flags screen displays *Completed*.

**4.** 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 a removable media (such as a diskette or a flash drive) using the **File** > **Save Configuration** option on the ROCLINK 800 menu bar.

## 4  REFERENCE

This section provides the reference for the calculations and tables of parameters for the user defined points used by the V-Cone Flow Calculation program.

- Calculations Reference
- Point Type 31: V-Cone Setup
- Point Type 32: V-Cone Values

### 4.1  Calculations Reference

The calculations implemented for the V-Cone flow rates and factors are presented in the McCrometer publication *Flow Calculations for the V-Cone® and Wafer-Cone® Flowmeters, Lit. #24509-54 Rev. 3.2/02-08*.

## 4.1 Point Type 31: V-Cone Setup

Point type 31 contains the parameters for configuring and viewing the V-Cone flow calculations. There are four logicals of this point type (one logical for each meter run).

**Point Type 31: V-Cone Setup**

| Parm # | Name | Access | Data Type | Length | Range | Default | Description of functionality and meaning of values |
|---|---|---|---|---|---|---|---|
| 0 | Point Tag ID | R/O | AC | 10 | 0x20 -> 0x7E for Each ASCII character | " " | Point tag identification. This value is copied from point type 46, parameter 0. |
| 1 | Sample Time | R/O | FLP | 4 | 1.0 | 1.0 | Period of time, in seconds, between flow rate and accumulation calculations. |
| 2 | Beta | R/O | FLP | 4 | Any positive floating point number. | 0.0 | The diameter ratio ($\beta$) as calculated for the V-Cone. |
| 3 | Velocity of Approach | R/O | FLP | 4 | Any positive floating point number. | 0.0 | The velocity of approach factor ($E_v$). |
| 4 | Pressure Loss | R/O | FLP | 4 | Any positive floating point number. | 0.0 | The pressure loss ($\%P_{loss}$) as a percentage of differential pressure. |
| 5 | Expansion Factor | R/O | FLP | 4 | Any positive floating point number. | 0.0 | The expansion factor ($Y$). |
| 6 | Fluid Velocity | R/O | FLP | 4 | Any positive floating point number. | 0.0 | The linear velocity ($v$) of the fluid. |
| 7 | Correction to Base | R/O | FLP | 4 | Any positive floating point number. | 0.0 | The correction from the flowing to the base conditions. This value is the ratio of the flowing density to the base density. |
| 8 | Thermal Expansion Factor | R/O | FLP | 4 | Any positive floating point number. | 0.0 | The thermal correction factor ($F_a$). |
| 9 | Actual Volumetric Flow Rate | R/O | FLP | 4 | Any positive floating point number. | 0.0 | The actual volumetric flow rate ($Q_{acfs}$ or $Q_{m3/s}$) in Cf/Sec or $M^3$/Sec. |

**Point Type 31: V-Cone Setup**

| Parm # | Name | Access | Data Type | Length | Range | Default | Description of functionality and meaning of values |
|---|---|---|---|---|---|---|---|
| 10 | Export to Soft Point. | R?W | UINT8 | 1 | 0 → 32 | 0 | Allows a host to access data from a soft point if it cannot access the data through other means. Valid values are **0** (disable the access) or **1** through **32** (enable the access **and** save the following values to the designated soft point starting with parameter 2):<br><br>0 = Disabled<br>1 = Calculation Period (Sec)<br>2 = V-Cone Beta Ratio<br>3 = Velocity of Approach<br>4 = Pressure Loss (% of differential pressure)<br>5 = Expansion Factor<br>6 = Linear Gas Velocity (Ft/Sec or M/Sec)<br>7 = Correction to Contract Conditions<br>8 = Thermal Correction Factor<br>9 = Actual Volume Flow Rate (Cf/Sec or $M^3$/Sec) |
| 11 | Enable V-Cone | R/W | UINT8 | 1 | 0 → 1 | 0 | Enabled/disabled status of the V-Cone flow calculation for the meter run. Valid values are:<br><br>0 = Disabled<br><br>1 = Enabled |
| 12 | V-Cone Flow Coefficient | R/O | FLP | 4 | Any positive floating point number. | 1 | Coefficient of discharge (Cd) for the V-Cone as shown on the information tag fixed to the body of the V-Cone tube. This value is copied from TLP 45,x,6. |

## 4.2   Point Type 32: V-Cone Values

Point type 32 contains only the meter point tag of the logicals of the V-Cone program. All of the calculated values are stored to the meter run values point, point type 47 or to the V-Cone Setup user-defined point type. There are four logicals of this point type (one logical for each meter run).

**Point Type 32: V-Cone Values**

| Parm # | Name | Access | Data Type | Length | Range | Default | Description of functionality and meaning of values |
|---|---|---|---|---|---|---|---|
| 0 | Point Tag ID | R/O | AC | 10 | 0x20 -> 0x7E for Each ASCII character | " " | Point tag identification. This value is copied from point type 46, parameter 0. |

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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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