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Annubar Flow Calculation Software (for FloBoss™ 107 Flow Managers) User Manual

Revision Tracking Sheet

March 2008

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Chapter 1 – Introduction

This chapter describes the structure of this manual and presents an overview of the Annubar Flow Calculation Software for the FloBoss™ 107.

1.1 Scope and Organization

This document serves as the user manual for the Annubar Flow Calculation Software, which is intended for use in a FloBoss 107 (FB107). This manual describes how to download, install, and configure the Annubar Flow Calculation user program (referred to as the “Annubar 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 Windows® 98, NT 4.0 (with Service Pack 6), 2000 (with Service Pack 2), or XP.

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:

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

This manual assumes that you are familiar with the FB107 and its configuration. For more information, refer to the *FloBoss 107 Flow Manager Instruction Manual* (Form A6206) or the *ROCLINK 800 Configuration Software User Manual (for FloBoss 107)* (Form A6217).

1.2 Product Overview

The Annubar program allows a FB107 to calculate flow rates, integrate volumes, and archive historical values for installations implementing an Annubar end element. The program supports both the Annubar Diamond II and Annubar 485 “T-shaped” element types. The program provides flow calculations for gas, steam/water and fluid applications in either Metric or Imperial units.

The Annubar Flow Calculation Program is compatible with FB107, firmware version 1.10 and greater. The user program is downloaded and configured in the FB107 with ROCLINK™ 800 Configuration Software (version 1.75 or greater).

The components of the Annubar Flow Calculation Software are:

- The Annubar Flow Calculation user program that loads into FloBoss memory to provide support for Annubar applications.
- License Key, containing license(s) enabling the Annubar user program.
- This manual, Form A6255.

1.3 Program Operation

The FB107 reads flow inputs (differential pressure, temperature, and static pressure) once every second. The Annubar instantaneous flow rate calculation is performed once a second by the user program. Configuration is accomplished through a custom Annubar Setup user display.

The program itself does not perform gas or fluid property calculations. Gas properties can be obtained from FloBoss firmware, using AGA8 1992 standards or from a separate user program installed in the FloBoss. The program requires density at base conditions, density at flowing conditions, and heating value be provided.

The user program calculates instantaneous volume, mass and energy and provides the rates to the FB107 for archival into the periodic and daily databases. Values saved to the historical database are in the units shown below.

Volume Units	Mass Units	Energy Units
MCF or km ³	Mlb or Tonnes	MMBTU or GJoules

1.3.1 Annubar Flow Calculation

The purpose of the Annubar Flow Calculation program is to provide an instantaneous flow rate for Annubar installations. Following is the base equation implemented by the Annubar program:

Annubar Flow Equation	$Q_m = F_{na} * K * D^2 * Y_a * \text{sqrt}(h_w * \rho_f)$.
Q_m	Mass flow rate in lbm/hour or kg/hour.
F_{na}	Units conversion factor.
K	Annubar flow coefficient (calculated by Annubar user program or entered by user).
D	Pipe diameter (ID) at flowing temperature in inches or millimeters.
Y_a	Gas expansion factor (calculated by Annubar user program, always 1.0 for liquids).
h_w	Differential pressure in Inches H2O or kPa.
ρ_f	Flowing density in lb/ft ³ or kg/m ³ (provided by FB107 AGA8 calc or other user program).

1.4 Program Requirements

The Annubar program is compatible with version 1.10 (or greater) of the FB107 firmware and with version 1.75 (or greater) of the ROCLINK 800 software.

Program specifics include:

File Name	Target Unit/ Version	User Defined Point (UDP)	Flash Used (in bytes)	DRAM Used (in bytes)	ROCKLINK 800 Version	Display Number
Annubar_5.bin	FB107 1.10	31, 32	9,999	16,384	1.75	32, 33

Note: You must connect a PC to the FB107's LOI port before starting the download.

For information on viewing the memory allocation of user programs, refer to *ROCLINK 800 Configuration Software User Manual (for FloBoss 107)* (Form A6217).

1.4.1 License Keys

Some applications require that you install a license in the CPU to run the application. This license software is specific to these applications and is the property of the individual vendor (shown in the Vendor Name field on the License Key Administrator screens).

RAS (and other authorized vendors) distributes software licenses on security-enhanced universal serial bus (USB) drives.

You must install the following license keys to use the Annubar Flow Calculation Program.

- Annubar Calc License Key.

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Chapter 2 – Installation

This section provides instructions for installing the Annubar program. Read *Section 1.4* of this manual for program requirements.

Note: The program and license key can be installed in any order. The manual shows the installation of the license key first.

2.1 Installing the License Key

A license key is required to use the Annubar program. The license is a USB key-based license. *Section 2.1.1* describes the installation process.

2.1.1 Installing a License

To install a USB key-based license on the FB107:

1. Insert the USB license key in a USB port on your PC.
2. Select **Utilities > License Key Administrator > Transfer Between Device and Key** from the ROCLINK 800 menu bar. The Transfer Licenses Between a Device and a Key screen displays.

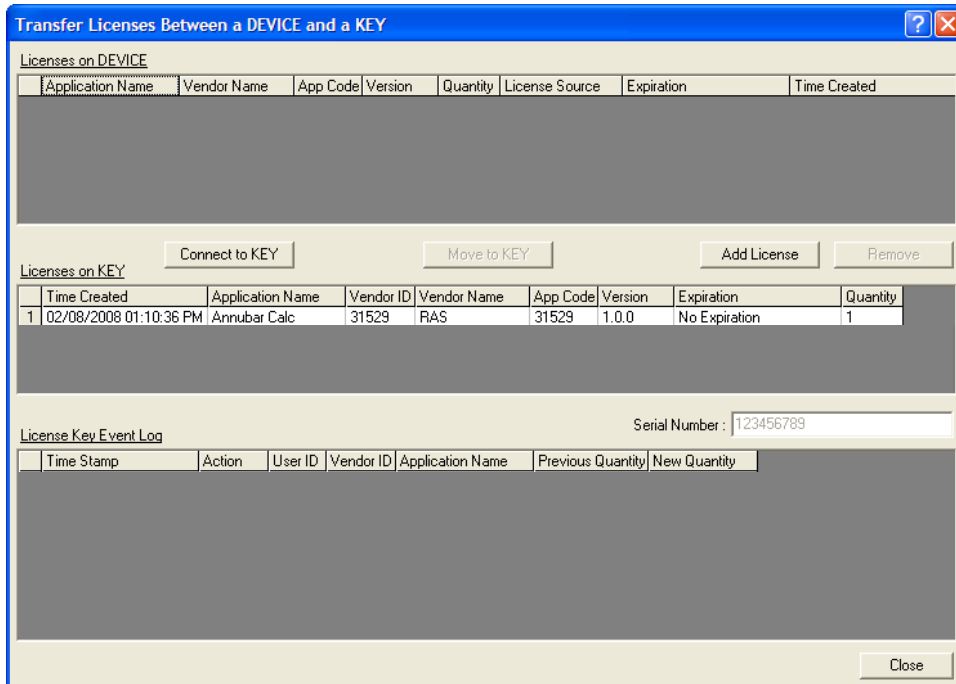


Figure 1. Transfer Licenses Between a Device and a Key

Note: This screen has three sections. The upper portion (Licenses on Device) shows any software licenses installed on the FB107. The middle portion (Licenses on Key) shows software licenses on the license key. The lower portion of the screen (License Key Event Log) provides a rolling log of the last eight events related to this license key.

3. Select the key-based license you want to transfer to the FB107 (Annubar Calc, as shown in *Figure 1*).
4. Click **Move to Device**. ROCLINK moves one instance of the license from the key to the FB107 and updates the screen.

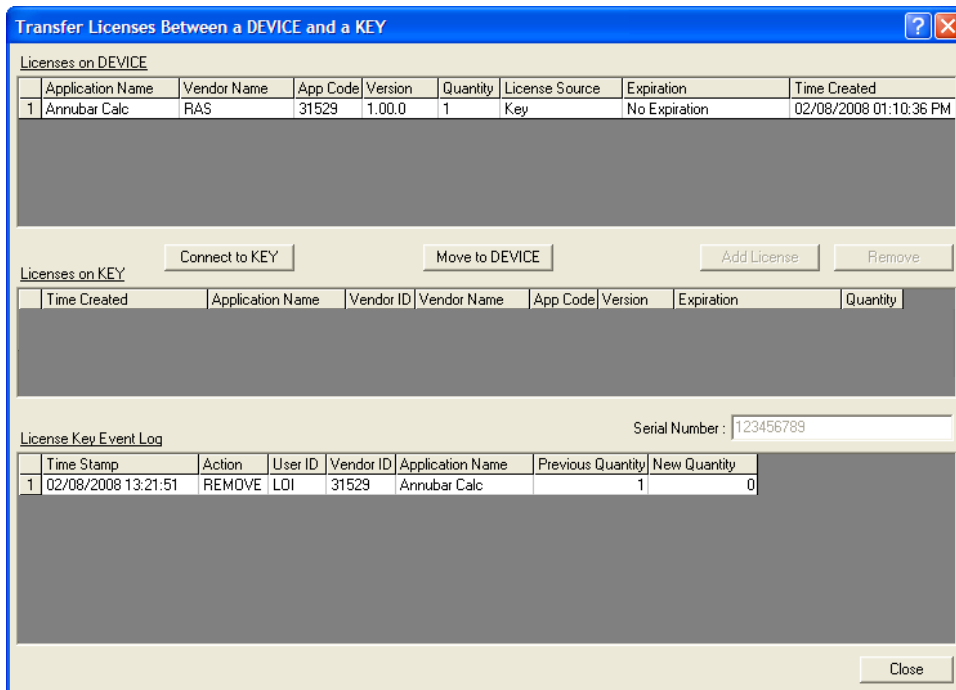


Figure 2. License Installed

Note: An FB107 can hold up to six different licenses, although you can install only one instance of each license on the FB107. When you click Move to Device, ROCLINK 800 moves only one instance of the license onto the FB107 and automatically decreases the license quantity on the USB key by one.

5. Verify the license name displays in the Licenses on Device section of the screen. Proceed to *Section 2.2* to download the user program.

2.2 Downloading the Program

This section provides instructions for installing the program into the Flash memory on the FB107.

To download the program using ROCLINK 800 software:

1. Connect the FB107 to your computer using the LOI port.
2. Start and logon to ROCLINK 800.
3. Select **Utilities > User Program Administrator** from the ROCLINK menu bar. The User Program Administrator screen displays (see *Figure 3*):

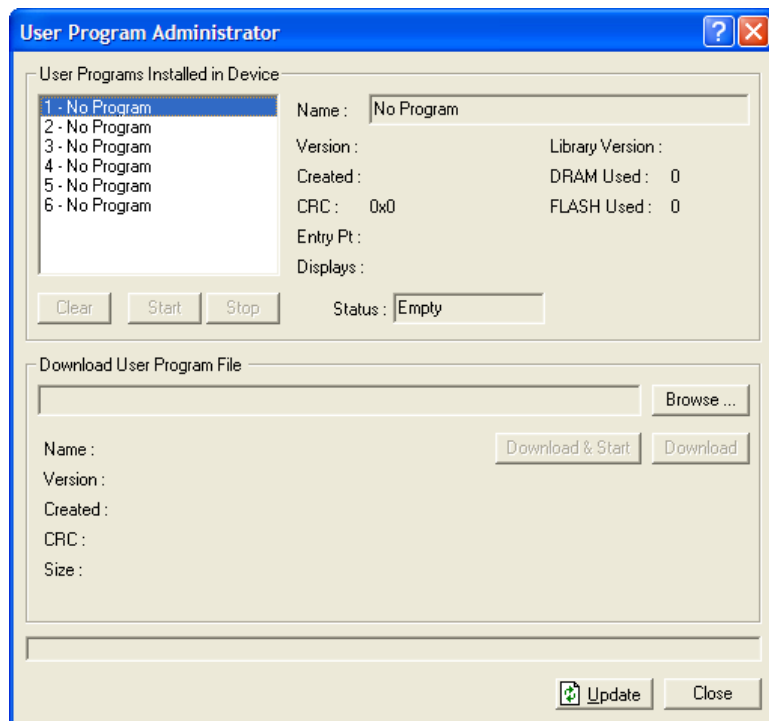


Figure 3. User Program Administrator

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

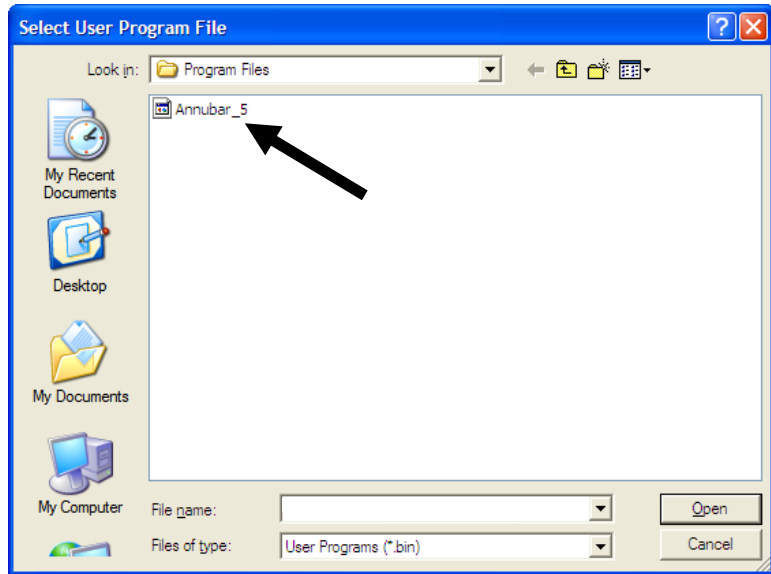


Figure 4. Select User Program File

6. Click **Open** to select the program file. The User Program Administrator screen displays. As shown in Figure 5, note that the Download User Program File frame identifies the selected program and that the **Download & Start** button is active:

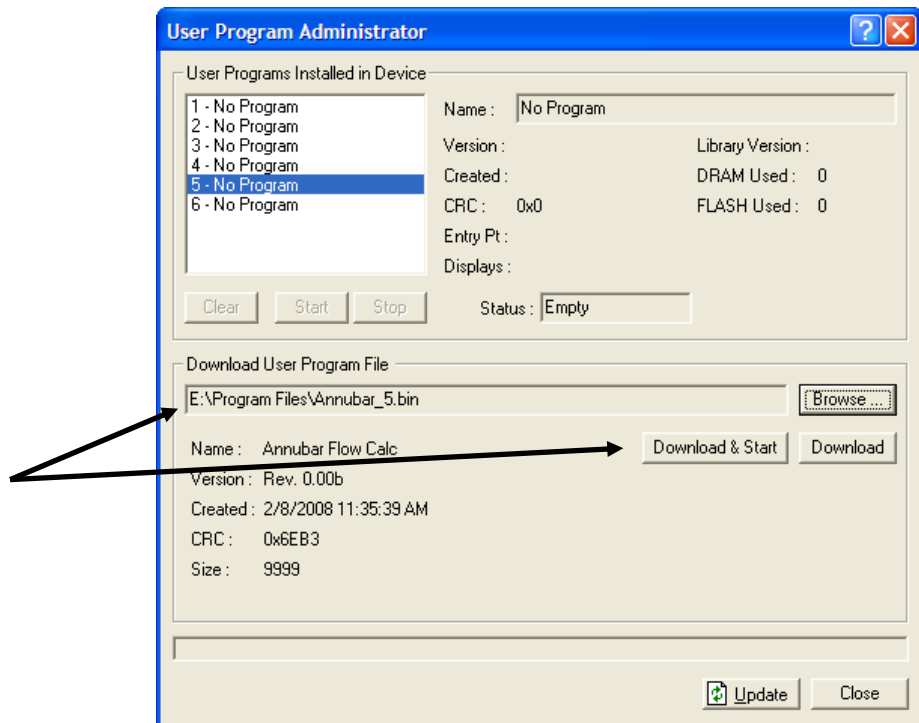


Figure 5. User Program Administrator

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

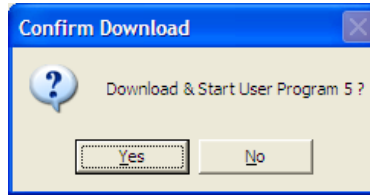


Figure 6. Confirm Download

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

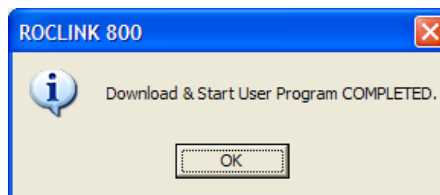


Figure 7. ROCLINK 800 Download Confirmation

9. Click **OK**. The User Program Administrator screen displays (see Figure 8). Note that:
 - The User Programs Installed in Device frame identifies the installed program(s).
 - The Status field indicates that the program is running.

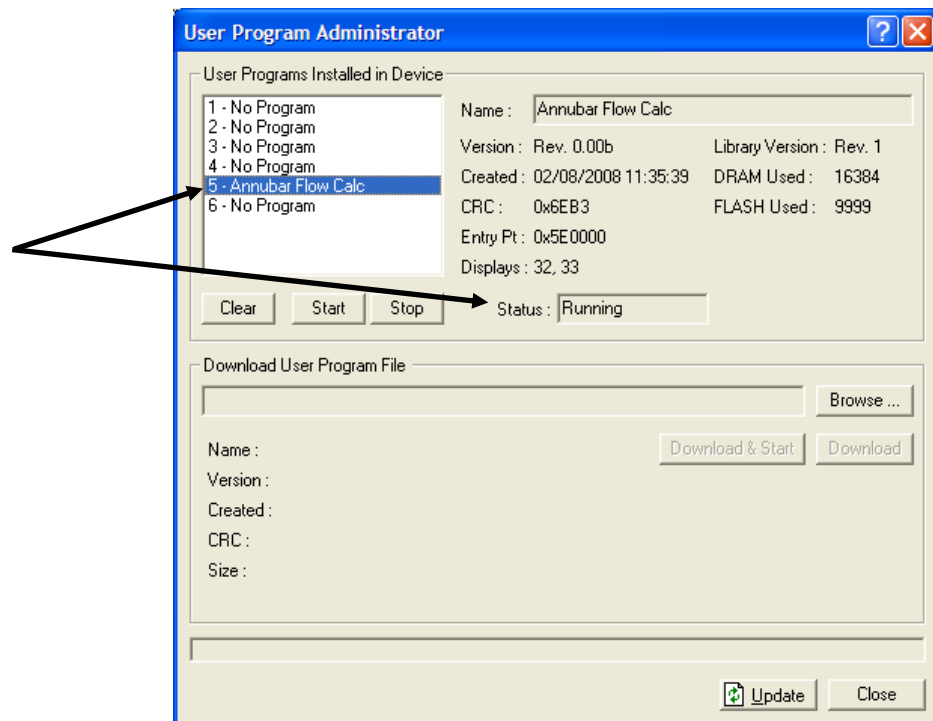


Figure 8. User Program Administrator

Note: If you install the program **before** you install the license key, the Status field reads “License Key Not Found.”

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

Chapter 3 – Configuration

After you have loaded the Annubar program on the FB107 and installed the required license, you configure and monitor the program using two program-specific displays (Annubar Setup and Annubar Values):

- Use the Annubar Setup display to configure all parameters associated with the Annubar meter run.
- Use the Annubar Values screen to view all instantaneous rates, accumulations, and calculated Annubar factors for each meter run.

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

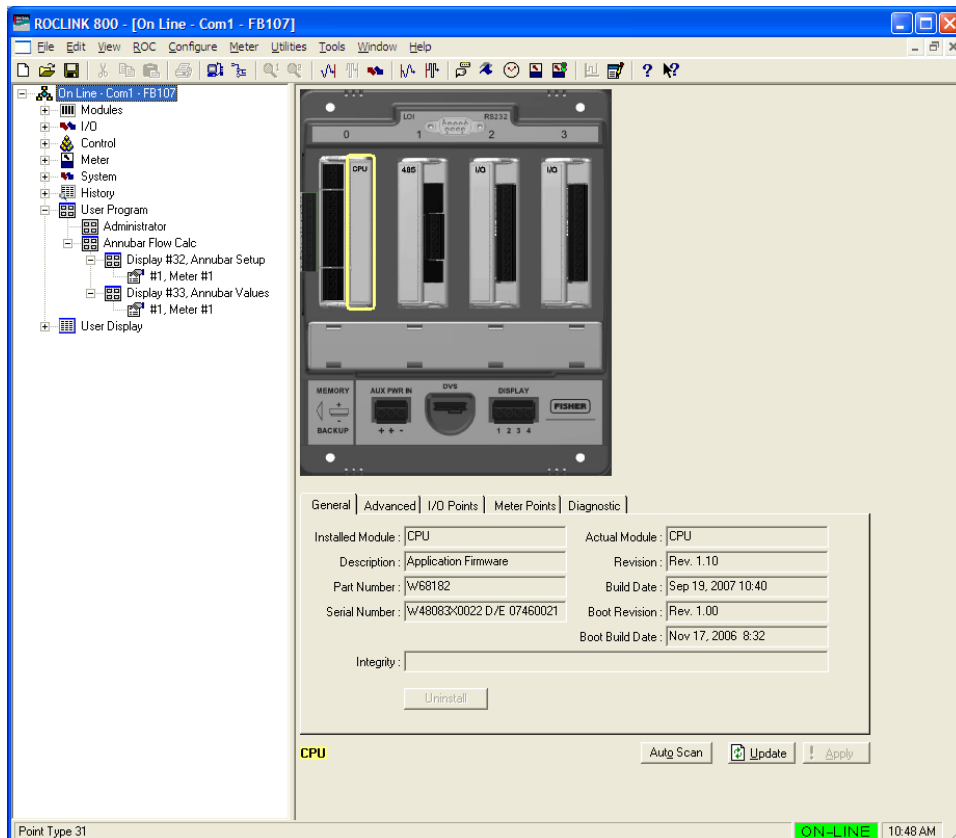


Figure 9. ROCLINK 800

3.1 Annubar Setup Screen

Use this display to configure parameters required for Annubar flow calculation.

1. From the Directory Tree, select **User Program > Annubar Flow Calc > Display #32 Annubar Setup**.
2. Double-click **#1, Meter #1**. The Annubar Setup screen displays:

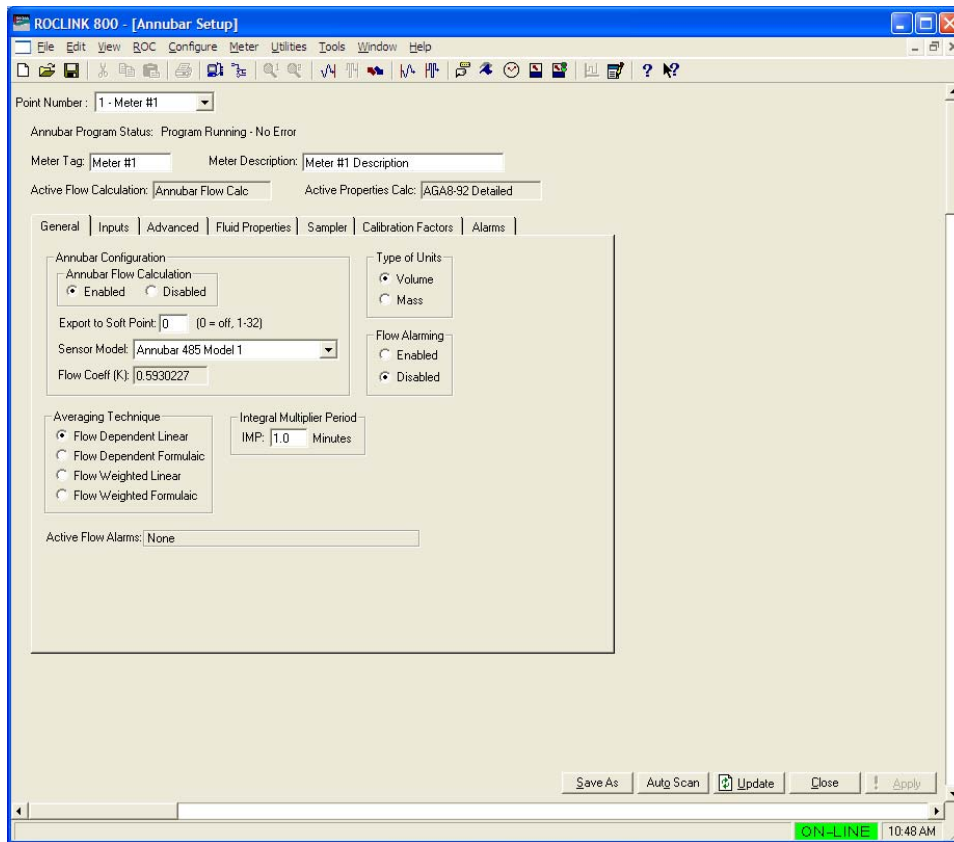


Figure 10. Annubar Setup Display

3. The following fields appear on all tabs of the setup display:

Field	Description
Point Number	Selects the logical number of the meter run to configure.
Meter Tag	Provides a user-defined 10-character description that uniquely identifies the meter run.
Meter Description	Provides a user-defined 30-character description to further identify this meter run, or to provide information about the meter.

Field	Description
Active Flow Calculation	This read-only field shows the calculation standard in use for calculating flow rate. For meter runs with the Annubar calculation enabled, this field always shows Annubar Flow Calc . When the Annubar calculation is not enabled and the FloBoss 107 internal flow calculations are active, this field shows either AGA3-92 , AGA7-96 , or ISO5167-2003 .
Active Properties Calc	This read-only field shows the gas or fluid properties calculation the program uses to calculate and provide gas compressibility, density, and heating value. Note: For gas volume calculations, this field may show AGA8 1992 Detailed if the FloBoss 107 internal AGA8 properties calculation is active. If a separate gas properties user program is active in the unit, the field displays the name of the standards calculation implemented in that program.

4. Click **Apply** to save any changes you have made to this screen.
5. Proceed to *Section 3.1.1* to define the General tab.

3.1.1 Annubar Setup – General Tab

Use the General tab (which displays when you access the Annubar Setup screen) to define Annubar-specific configuration information.

Note: You must select **Enabled** in the Annubar Flow Calculation section to view all available fields on this tab.

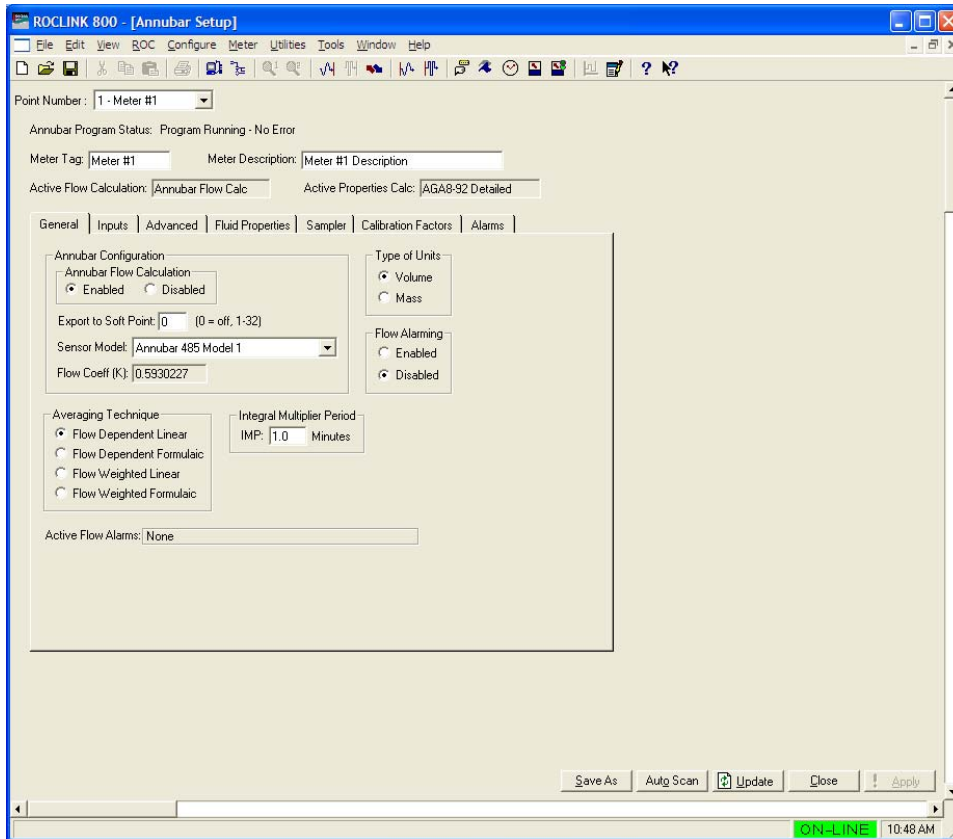


Figure 11. Annubar Setup, General tab

1. Complete the screen fields based on your organization’s requirements.

Field	Description
Annubar Flow Calc	Sets the flow calculation for the meter run. Valid values are Enabled (use the Annubar flow calculation) or Disabled (use the AGA3 or ISO5167 flow calculations). The default is Disabled . Note: The Active Flow Calculation field shows the current flow calculation.
Export to Soft Point:	Specifies the logical of the target softpoint. This 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 value to the designated softpoint parameter):

Field	Description
Export to Soft Point: (continued)	1 Live Differential Pressure Value (in Inches H2O or kPa).
	2 Live Static Pressure Value (in PSI or kPa).
	3 Live Flowing Temperature Value (in Deg F or Deg C).
	4 Current Volume Rate (in MCF/Day or km3/Day).
	5 Current Energy Rate (in MMBTU/Day or GJoules/Day).
	6 Current Mass Rate (in Mlb/Day or Tonnes/Day).
	7 Current Pressure Extension Value (IV) – (sqrt (hw)).
	8 Current Integral Multiplier Value (IMV).
	9 Upstream/Absolute Static Pressure (in PSIA or kPaA).
	10 Density at Flowing Conditions (in lb/ft3 or kg/m3).
	11 Density at Base Conditions (in lb/ft3 or kg/m3).
	12 Calculated Gas Expansion Factor.
	13 Annubar Flow Coefficient (K).
	14 Pipe Diameter at Flowing Temperature (in inches or millimeters).
	15 Probe Diameter at Flowing Temperature (in inches or millimeters).
Sensor Model:	<p>Sets the model and size of the Annubar sensor. Both Annubar Diamond II and Annubar 485 “T-shape” models are supported.</p> <p>The selection automatically sets the probe diameter on the Inputs tab. Valid selections include:</p> <p>Annubar 485 Model 1</p> <p>Annubar 485 Model 2</p> <p>Annubar 485 Model 3</p> <p>Annubar Diamond II Model 10</p> <p>Annubar Diamond II Model 15</p> <p>Annubar Diamond II Model 16</p> <p>Annubar Diamond II Model 25</p> <p>Annubar Diamond II Model 26</p> <p>Annubar Diamond II Model 35</p> <p>Annubar Diamond II Model 36</p> <p>Annubar Diamond II Model 45</p> <p>Annubar Diamond II Model 46</p> <p>Other – Enter Flow Coefficient (K)</p>

Field	Description								
Flow Coeff (K):	Displays the Annubar Flow Coefficient (K) used in the rate calculation. This value is typically calculated by the user program, but can be entered when the Sensor Model field is set to Other.								
Type of Units	Sets the type of units used by the sampler and alarming functions. Valid values are Volume or Mass . The default value is Volume .								
Flow Alarming	Sets Flow Alarming as Enabled or Disabled . Alarms are configured on the Alarms tab of the Annubar Setup screen. If Enabled, alarms are displayed in the Active Alarms field and logged to the Alarm Log. If disabled, no alarm generates for this point, regardless of the alarm configuration. The default value is Disabled .								
Averaging Technique	Select an Averaging Technique for the Meter Run. The default value is Flow Dependent Linear.								
	<table border="1"> <tbody> <tr> <td>Flow Dependant Linear</td> <td>This is the simplest and most commonly used method. This method discards samples for periods when there is no measurable flow, and performs a straightforward (linear) average of the remaining samples to compute the minute and hour values. The value specified in the Low Flow Cutoff section of the Inputs tab determines the values. When no flow occurs, all values are sampled.</td> </tr> <tr> <td>Flow Dependant Formulaic</td> <td>This method discards samples for periods when there is no flow. However, in calculating the average, this method typically takes the square root of each sample before averaging the samples together, and then squares the result. This formulaic method produces a slightly lower value than the linear method.</td> </tr> <tr> <td>Flow Weighted Linear</td> <td>This method does not discard any samples; instead, it "weights" each sample by multiplying it by a flow value (square root of the differential pressure measured during the sample period). Next, a linear average is calculated by dividing the sum of the flow-weighted sample by the sum of the flow values. This result includes minute and hourly values that are more reflective of short periods of high flow.</td> </tr> <tr> <td>Flow Weighted Formulaic</td> <td>This method combines the flow-weighting action with the formulaic averaging technique, both of which were described previously.</td> </tr> </tbody> </table>	Flow Dependant Linear	This is the simplest and most commonly used method. This method discards samples for periods when there is no measurable flow, and performs a straightforward (linear) average of the remaining samples to compute the minute and hour values. The value specified in the Low Flow Cutoff section of the Inputs tab determines the values. When no flow occurs, all values are sampled.	Flow Dependant Formulaic	This method discards samples for periods when there is no flow. However, in calculating the average, this method typically takes the square root of each sample before averaging the samples together, and then squares the result. This formulaic method produces a slightly lower value than the linear method.	Flow Weighted Linear	This method does not discard any samples; instead, it "weights" each sample by multiplying it by a flow value (square root of the differential pressure measured during the sample period). Next, a linear average is calculated by dividing the sum of the flow-weighted sample by the sum of the flow values. This result includes minute and hourly values that are more reflective of short periods of high flow.	Flow Weighted Formulaic	This method combines the flow-weighting action with the formulaic averaging technique, both of which were described previously.
Flow Dependant Linear	This is the simplest and most commonly used method. This method discards samples for periods when there is no measurable flow, and performs a straightforward (linear) average of the remaining samples to compute the minute and hour values. The value specified in the Low Flow Cutoff section of the Inputs tab determines the values. When no flow occurs, all values are sampled.								
Flow Dependant Formulaic	This method discards samples for periods when there is no flow. However, in calculating the average, this method typically takes the square root of each sample before averaging the samples together, and then squares the result. This formulaic method produces a slightly lower value than the linear method.								
Flow Weighted Linear	This method does not discard any samples; instead, it "weights" each sample by multiplying it by a flow value (square root of the differential pressure measured during the sample period). Next, a linear average is calculated by dividing the sum of the flow-weighted sample by the sum of the flow values. This result includes minute and hourly values that are more reflective of short periods of high flow.								
Flow Weighted Formulaic	This method combines the flow-weighting action with the formulaic averaging technique, both of which were described previously.								

Field	Description
Integral Multiplier Period	<p>Sets, in minutes, the Integral Multiplier Period (IMP). The IMP is the amount of time between calculations of the combined correctional factors, called the Integral Multiplier Value (IMV) in the API measurement standard <i>Section 21, Section 1</i>.</p> <p>This value cannot be more than 60 minutes and cannot be less than 1 minute in length. The default value is 1 minute.</p>
Active Flow Alarms	<p>Displays any currently activated flow related alarms. For example, Low indicates that the calculated flow is below the Low Alarm limit. Other alarms can include High, No Flow, and Manual Mode.</p>

2. Click **Apply** to save any changes you have made to this screen.
3. Proceed to *Section 3.1.2* to define Annubar inputs.

3.1.2 Annubar Setup Display – Inputs Tab

The Inputs tab allows you to define pressure sources, temperature source, diameters, and low flow cutoff value.

Note: You must select **Enabled** in the Annubar Flow Calculation section of the General tab to view the fields on this tab.

1. Select the **Inputs** tab on the Annubar Setup screen.

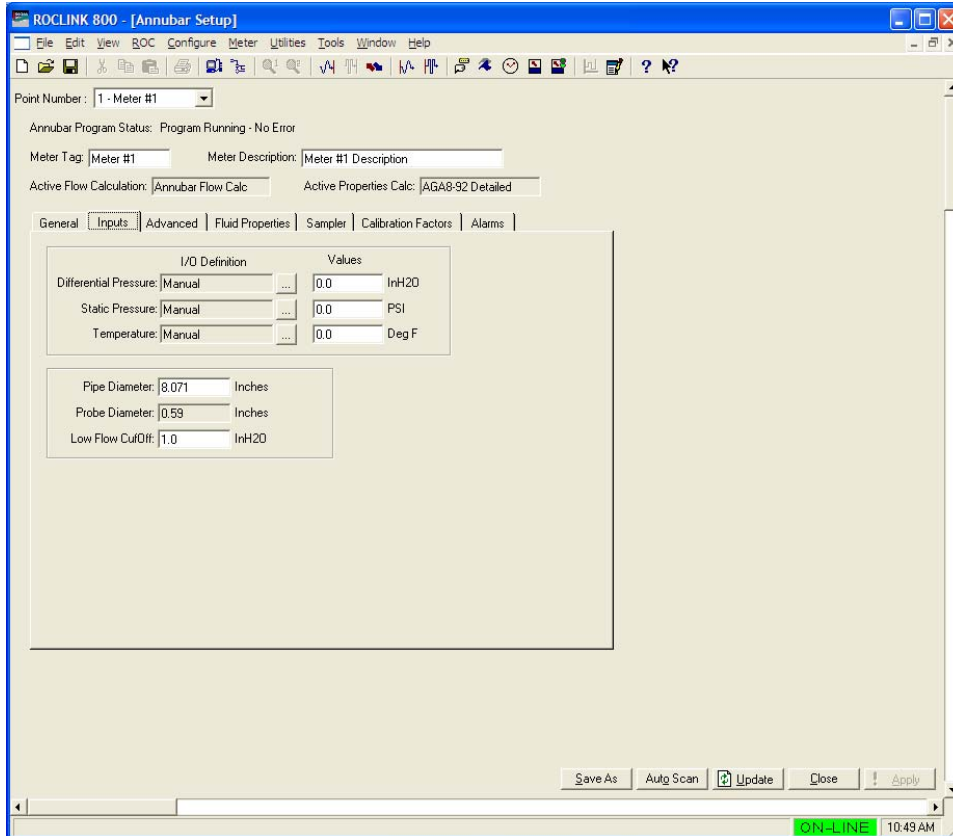


Figure 12. Annubar Setup, Inputs tab

2. Complete the screen fields based on your organization’s requirements.

Field	Description
Differential Pressure	Click “...” to define an input to provide the differential pressure reading. Values are displayed in H2O or kPa.
Static Pressure	Click “...” to define an input to provide the static pressure reading. Values are displayed in PSI or kPa.
Temperature	Click “...” to define an input to provide the temperature reading. Values are displayed in Deg F or Deg C.
Pipe Diameter:	Sets the inside Pipe Diameter of the pipe near the Annubar probe at reference conditions in this Meter Run. Values are displayed in inches or millimeters.

Field	Description
Probe Diameter:	Sets the Annubar probe diameter at reference conditions. Note: This field is read-only and the value is set by the program unless you select Other – Enter Flow Coefficient (K) in the Sensor Model field on the General tab.
Low Flow CutOff:	Enter a value for the Low Flow CutOff. When the differential pressure value of the metering device falls below this value, the calculated flow rate is set to zero and a No Flow alarm is recorded in the Alarm Log if Alarming is Enabled. For the Annubar calculation method, this value is in terms of inches of water column or kPa.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.1.3* to define Annubar advanced configuration.

3.1.3 Annubar Setup Display – Advanced Tab

The Advanced tab allows you to define advanced configuration parameters.

Note: You must select **Enabled** in the Annubar Flow Calculation section of the General tab to view the fields on this tab.

1. Select the **Advanced** tab on the Annubar Setup screen.

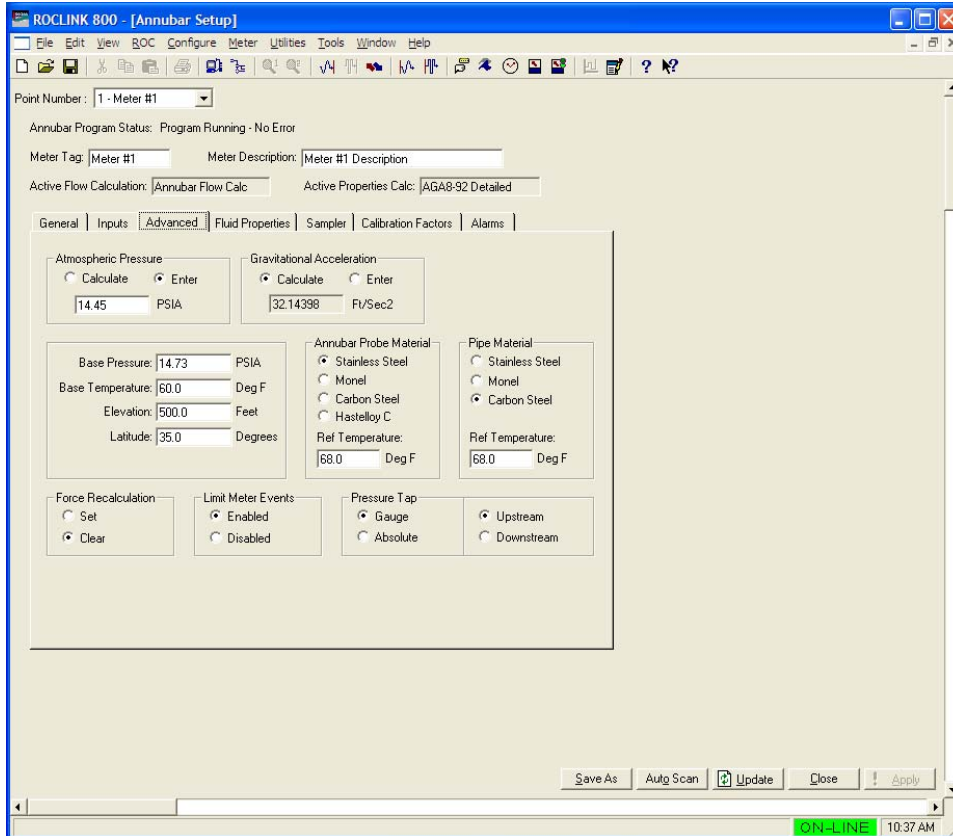


Figure 13. Annubar Setup, Advanced tab

2. Complete the screen fields based on your organization’s requirements.

Field	Description
Atmospheric Pressure	Select either Calculate or Enter Atmospheric Pressure for the value of the atmospheric pressure (absolute) at the metering location. If Calculate is selected, the value is calculated from Elevation. If Enter is selected, type a value for the pressure. The units of measurement are in PSIA or kPaA. If entered, the value must be greater than zero.

Field	Description
Gravitational Acceleration	Select Calculate or Enter Gravitational Acceleration for the value at the metering location. If Calculate is selected, the value is calculated from elevation and latitude. If Enter is selected, type a value for the acceleration. The units of measurement are in ft/sec ² or M/sec ² . If entered, the value must be greater than zero.
Base Pressure	Enter the flow measurement Base Pressure specified in the gas contract. The pressure units are in PSIA or kPaA.
Base Temperature	Enter the flow measurement Base Temperature specified in the gas contract. The temperature units are in degrees Fahrenheit or degrees Celsius.
Elevation	Enter the elevation of the metering location. The units are in feet or meters. Elevation is required for the calculation of atmospheric pressure and gravitational acceleration.
Latitude	Enter the geographic Latitude of the metering location. Latitude is required for calculation of gravitational acceleration. The units are in degrees and minutes, separated by a decimal point. For example: 46.15.
Annubar Probe Material	Select the material the Annubar probe is constructed of. Valid Values are Stainless Steel, Monel, Carbon Steel, or Hastelloy C.
Ref Temperature (Annubar Probe)	Sets the temperature at which the bore diameter of the probe was measured. Values are displayed in Deg F or Deg C.
Pipe Material	Select the meter tube material (Pipe Material): Stainless Steel, Monel, or Carbon Steel. Nearly all natural gas applications use carbon steel meter tubes.
Ref Temperature (Pipe)	Sets the temperature at which the inside diameter of the pipe was measured. Values are displayed in Deg F or Deg C.
Force Recalculation	Select Force Recalculation and click Apply to cause a full recalculation of the flow without waiting for the next Normal recalculation. Normal recalculation periods are established in Annubar Setup screen using the Integral Multiplier Period. The Force Recalculation parameter is automatically set to Clear after the recalculation completes.
Limit Meter Events	Enable Limit Meter Events if the FloBoss is to log AGA events. An AGA limit event is logged when an input to the AGA calculation is outside the specified limits or the calculation fails. Disable this parameter if the FloBoss should ignore AGA calculation related events. Disabling this parameter prevents the Event Log from filling with AGA limit type events.

Field	Description
Pressure Tap	Select the Pressure Tap type and location used in this Meter Run.
Gauge or Absolute	Select either Gauge or Absolute as the pressure tap type. This choice must match the static pressure type actually measured by the sensor. The MVS sensor, DVS sensor, or other pressure transmitter can be ordered to provide either absolute or gauge measurements. The default value is Gauge .
Upstream or Downstream	Select either Upstream or Downstream to indicate the location of the static pressure tap in relation to the Annubar element during normal flow. The default value is Upstream .

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.1.4* to define fluid properties.

3.1.4 Annubar Setup Display – Fluid Properties Tab

The Fluid Properties tab allows you to define properties of the gas following through the meter.

Notes:

- You must select **Enabled** in the Annubar Flow Calculation section of the General tab to view the fields on this tab.
- If fluid properties are being calculated a separate user program (and not the embedded FB107 AGA8 calculation), the fields on this tab are replaced by the following message: Fluid properties for the meter run are not being calculated using AGA8.

1. Select the **Fluid Properties** tab on the Annubar Setup screen.

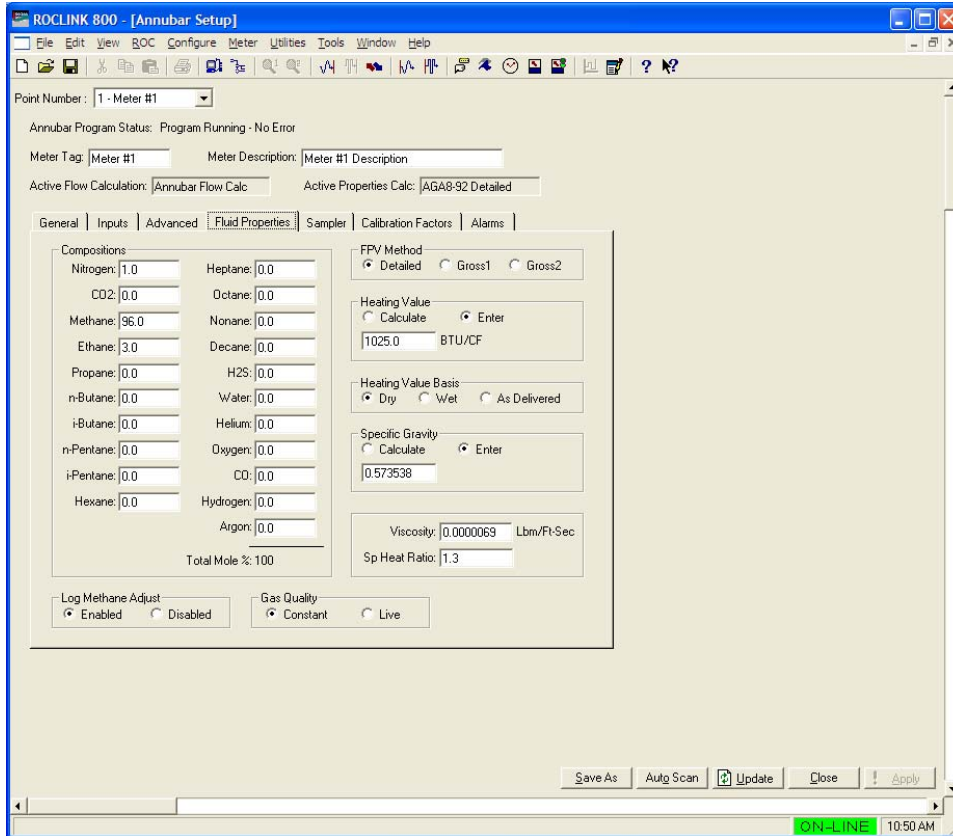


Figure 14. Annubar Setup, Fluid Properties tab

2. Complete the screen fields based on your organization’s requirements.

Field	Description
Compositions	Enter the mole percent of each Gas Component. This value is required to calculate the compressibility of gas using the AGA 8 detailed method. If the AGA 8 detailed method is selected, the Total Mole % should equal 100% after all the component mole percentages have been entered. The default value is 96% Methane, 3% Ethane, and 1% Nitrogen.

Field	Description
FPV Method	Sets the method of calculating the compressibility factor. Valid values are:
Detailed	Requires the natural gas composition in mole percent to be entered for all components. Refer to the information on the Gas Quality.
Gross I	<p>Uses the Specific Gravity of the natural gas, its heating value, and the quantity of non-hydrocarbon components as follows:</p> <ul style="list-style-type: none"> ▪ Specific Gravity ▪ Real gas gross heating value per unit volume ▪ The mole % of CO₂
Gross II	<p>Uses the Specific Gravity of the natural gas, as well as the quantity of non-hydrocarbon components as follows:</p> <ul style="list-style-type: none"> ▪ Specific Gravity ▪ The mole % of CO₂ ▪ The mole % of N₂ <p>Note: If either Gross Method is chosen, manually enter the Specific Gravity and Heating Value in the Gas Quality screen. For Gross Method II, the Heating Value is required only for calculating the gas energy flow.</p>
<p>For AGA calculations, select FPV Method Detailed, Gross I, and Gross II (methods of calculating the compressibility factor). The Detailed method provides the highest accuracy in a broader range of measurement conditions; however, one of the Gross methods can be used when:</p> <ul style="list-style-type: none"> ▪ Temperature is between 0 and 54°C (32 and 130°F). ▪ Pressure is between 0 and 8274 kPa (0 and 1200 PSIA). ▪ Gas composition is within the Normal range as defined in the 1992 AGA8 report 	
Heating Value	Select Enter to manually set the Heating Value or Calculate to have the program automatically calculate the Heating Value of a specified gas.

Field	Description
Heating Value Basis	<p>Select between Dry (no water vapor present in the gas), Wet (saturated water vapor present in the gas), or As Delivered (may contain some water vapor) for the Heating Value Basis. This selection indicates on what basis the entered Heating Value was determined and affects the flow or energy calculations.</p> <p>If Wet Gas selected, the FB107 calculates the mole percentage of water based on the algorithm from IAPWS – IF97 standards and adjusts the other mole percentages accordingly.</p>
Specific Gravity	<p>Select either Calculate or Enter for the Spec Gravity ratio of the molar mass of the gas to the molar mass of air. The value entered for standard conditions is used in the flow calculation. The Specific Gravity value cannot be less than 0.07.</p> <p>If Calculate, the FloBoss calculates the Specific Gravity value to be used in the flow calculations.</p> <p>If Enter, the value entered is used in the flow calculation. The Specific Gravity should be entered for the gas at standard conditions and cannot be less than 0.07.</p>
Viscosity:	<p>Enter the dynamic Viscosity of the flowing gas. The units of measure will be either Lbm/Ft-Sec for US Units or cP for Metric Units.</p>
Sp Heat Ratio:	<p>Enter the Specific Heat Ratio (Sp 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. If entered, the value must be greater than zero.</p>
Log Methane Adjust	<p>If the percentages are automatically adjusted to total 100 and you would like to log this adjustment, select Enabled in the Log Methane Adjust field. If you select Disable, this does not prevent the FloBoss from automatically adjusting the Methane, but does prevent an Event Log entry.</p>
Gas Quality	<p>The Gas Quality field determines where to get Gas Quality readings. Live indicates readings come from a gas chromatograph or periodically downloaded from a host and changes are not entered in the Event Log. Constant indicates that the changes are entered in the Event Log.</p>

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.1.5* to define sampler setup.

3.1.5 Annubar Setup Display – Sampler Tab

The Sampler tab allows you to define the sampler functionality.

Note: You must select **Enabled** in the Annubar Flow Calculation section of the General tab to view the fields on this tab.

1. Select the **Sampler** tab on the Annubar Setup screen.

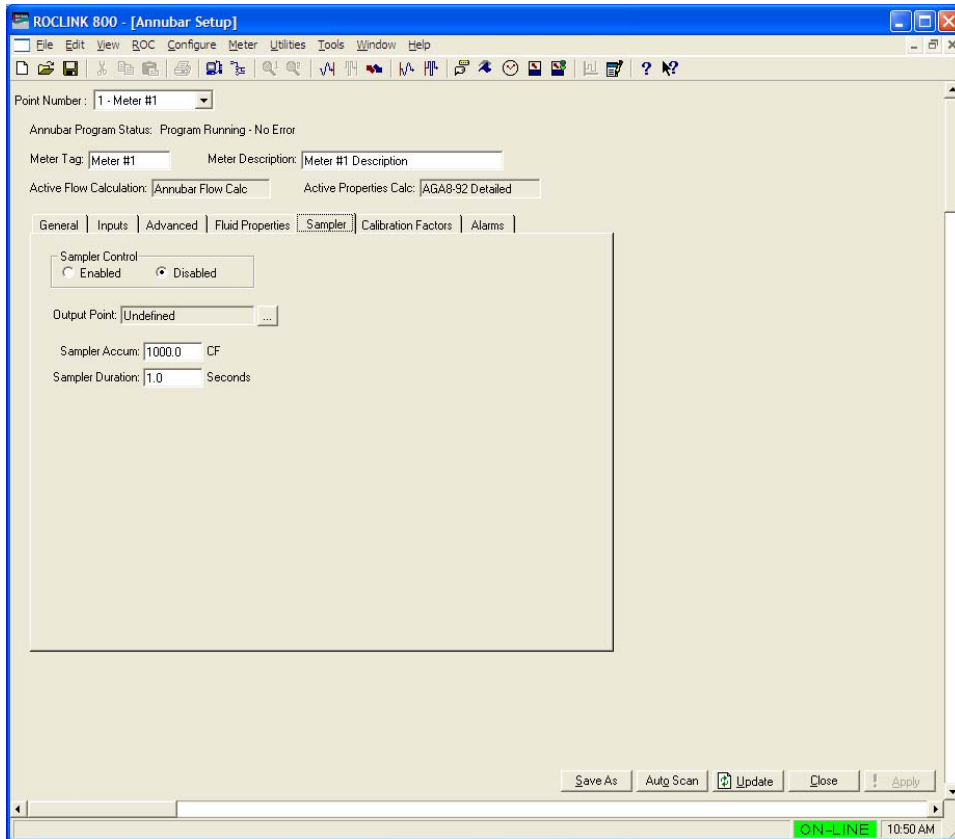


Figure 15. Annubar Setup, Sampler tab

2. Complete the screen fields based on your organization’s requirements.

Field	Description
Sampler Control	Select Enabled in the Sampler Control field for the Sampler to override the DO located on the CPU I/O assembly or on an I/O module
Output Point:	Use the Output Point TLP box to select the DO point is to be used.
Sampler Accum:	The Unit Accumulation field determines when an output pulse generates. The Input Rate Value is integrated over time. When the total matches the Unit Accumulation value, a pulse is generated for the duration specified in the duration field.

Field	Description
Sampler Duration:	The Duration is how long (in seconds) the output pulse will be on. This is how long the DO stays ON. The DO is turned on for the amount of time set in the Duration field every time the Unit Accumulation value is exceeded.

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.1.6* to define calibration factors.

3.1.6 Annubar Setup Display – Calibration Factors Tab

The Calibration Factors tab allows you to define deadweight calibration factors applied to differential and static pressure inputs.

Note: You must select **Enabled** in the Annubar Flow Calculation section of the General tab to view the fields on this tab.

1. Select the **Calibration Factors** tab on the Annubar Setup screen.

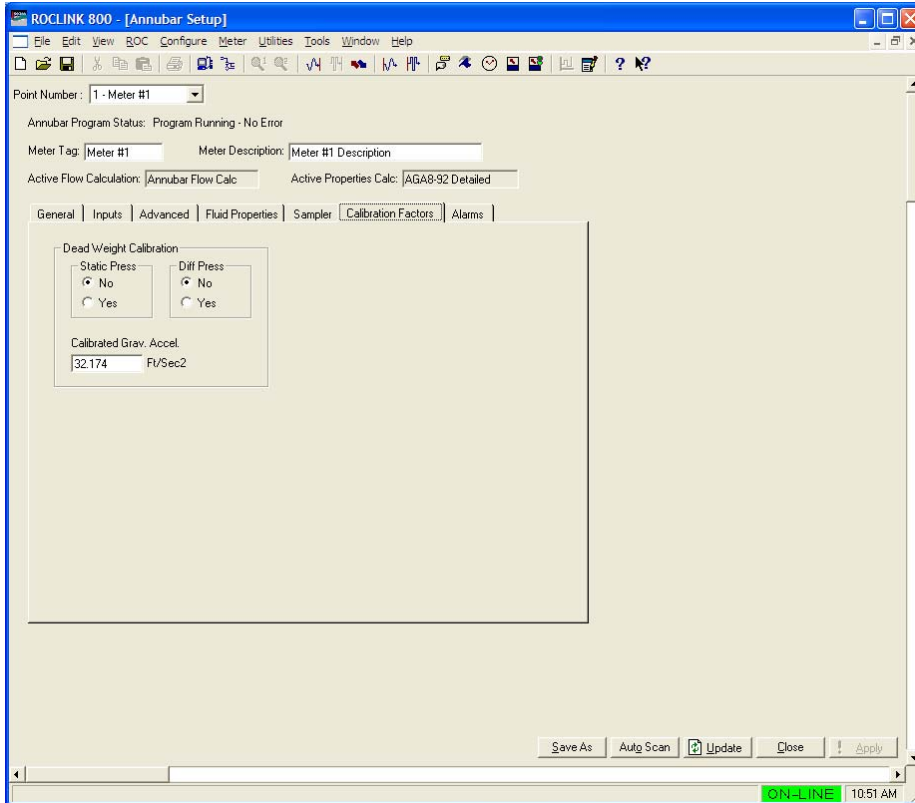


Figure 16. Annubar Setup, Calibration Factors Tab

2. Complete the screen fields based on your organization’s requirements.

Field	Description
Static Press	Select Yes or No to have the program correct the static pressure for local gravity effect on deadweight calibration.
Dif Press	Select Yes or No to have the program correct the differential pressure for local gravity effect on deadweight calibration.
Calibrated Grav. Accel.	Enter a value in this field if the gravitational acceleration at the site where the deadweights were calibrated is different from the value indicated. The units assumed for the input are Ft/Sec ² or m/Sec ² .

3. Click **Apply** to save any changes you have made to this screen.
4. Proceed to *Section 3.1.7* to define alarm parameters.

3.1.7 Annubar Setup Display – Alarms Tab

The Alarms tab allows you to define limits for flow alarming.

Note: You must select **Enabled** in the Annubar Flow Calculation section of the General tab to the available fields on this tab.

1. Select the **Alarms** tab on the Annubar Setup screen.

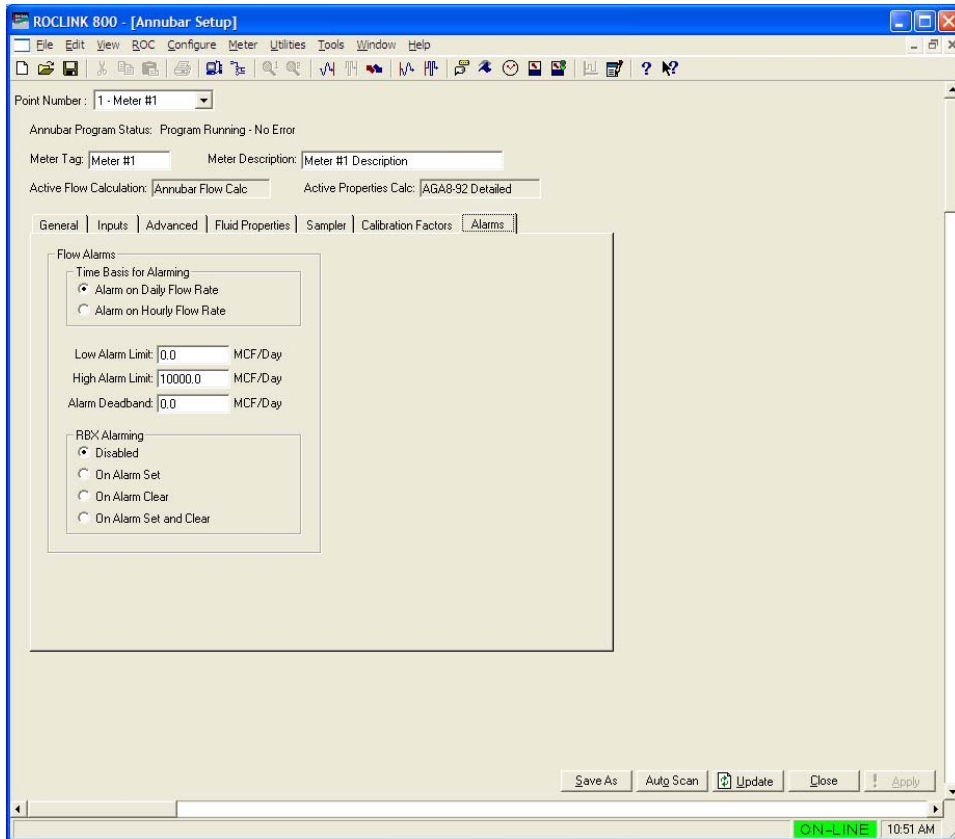


Figure 17. Annubar Setup, Alarms Tab

2. Complete the screen fields based on your organization’s requirements.

Field	Description
Time Basis For Alarming	Determines the time base for which the flow alarms are calculated. Valid values are Alarm on Daily Flow Rate and Alarm on Hourly Flow Rate. The default value is Alarm on Daily Flow Rate.
Low Alarm Limit:	Enter the Low Alarm limit value to which the Volumetric or Mass Flow Rate value must fall to generate a Low Alarm.
High Alarm Limit:	Enter the High Alarm limit value to which the Volumetric or Mass Flow Rate value must rise to generate a High Alarm.

Field	Description
Alarm Deadband:	Enter the amount of time, in seconds, that is an inactive zone before and after the flow alarm is triggered. The purpose of the Alarm Deadband Time is to prevent the alarm from being set and cleared continuously when the input value is oscillating around the alarm limit.
RBX Alarming	<p>Select the RBX Alarming option to configure Spontaneous-Report-by-Exception (SRBX or RBX) alarming for this point.</p> <p>Disabled – The RBX Alarming is turned off.</p> <p>On Alarm Set – When the point enters an alarm condition, the FloBoss generates a Spontaneous-Report-by-Exception message to the host.</p> <p>On Alarm Clear – When the point leaves an alarm condition, the FloBoss generates a Spontaneous-Report-by-Exception message to the host.</p> <p>On Alarm Set and Clear – In either condition, an RBX message generates to the host.</p> <p>Note: RBX Alarming requires the communications port to be properly configured for RBX Alarming.</p>

-
3. Click **Apply** to save any changes you have made to this screen.
 4. Proceed to *Section 3.2* to view flow rates, accumulations and calculated factors associated with the Annubar flow calculation.

3.2 Annubar Values Screen

Use this display to view flow rates, accumulations and calculated factors associated with the Annubar flow calculation.

1. From the Directory Tree, select **User Program > Annubar Flow Calc > Display #33 Annubar Values**.
2. Double-click **#1, Meter Tag**. The Annubar Values screen displays:

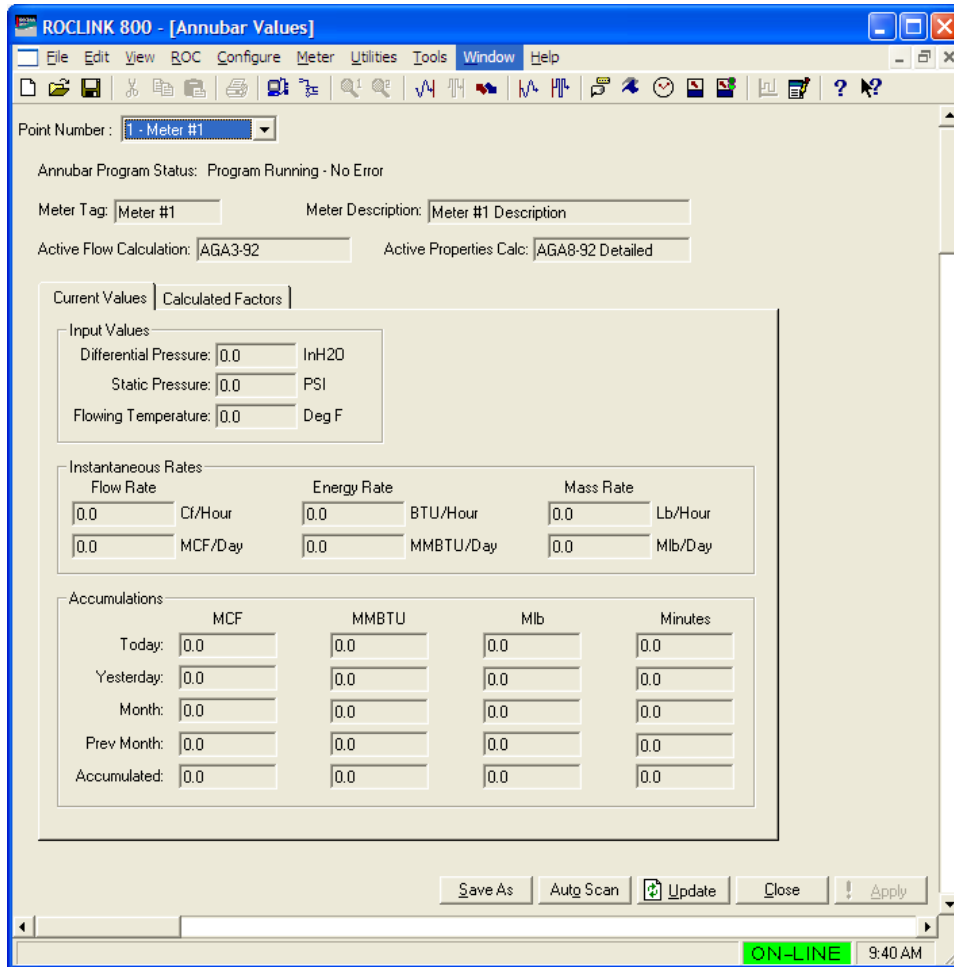


Figure 18. Annubar Values Screen

3. The following fields appear on all tabs of the setup display:

Field	Description
Point Number	Selects the logical number of the meter run to view.
Meter Tag	This read-only field shows a 10-character description that uniquely identifies the meter run.
Meter Description	This read-only field shows a 30-character description to further identify this meter run, or to provide information about the meter.

Field	Description
Active Flow Calculation	This read-only field shows the calculation standard in use for calculating flow rate. For meter runs with the Annubar calculation enabled, this field always shows Annubar Flow Calc . When the Annubar calculation is not enabled and the FloBoss 107 internal flow calculations are active, this field shows either AGA3-92 , AGA7-96 , or ISO5167-2003 .
Active Properties Calc	This read-only field shows the gas or fluid properties calculation the program uses to calculate and provide gas compressibility, density, and heating value. Note: For gas volume calculations, this field may show AGA8 1992 Detailed if the FloBoss 107 internal AGA8 properties calculation is active. If a separate gas properties user program is active in the unit, the field displays the name of the standards calculation implemented in that program.

4. Proceed to *Section 3.2.1* to view totals on the Current Values tab.

3.2.1 Annubar Values – Current Values Tab

Use the Current Values tab (which displays when you access the Annubar Values screen) to view current input values, flow rates, and accumulations. All fields on this screen are **read-only**.

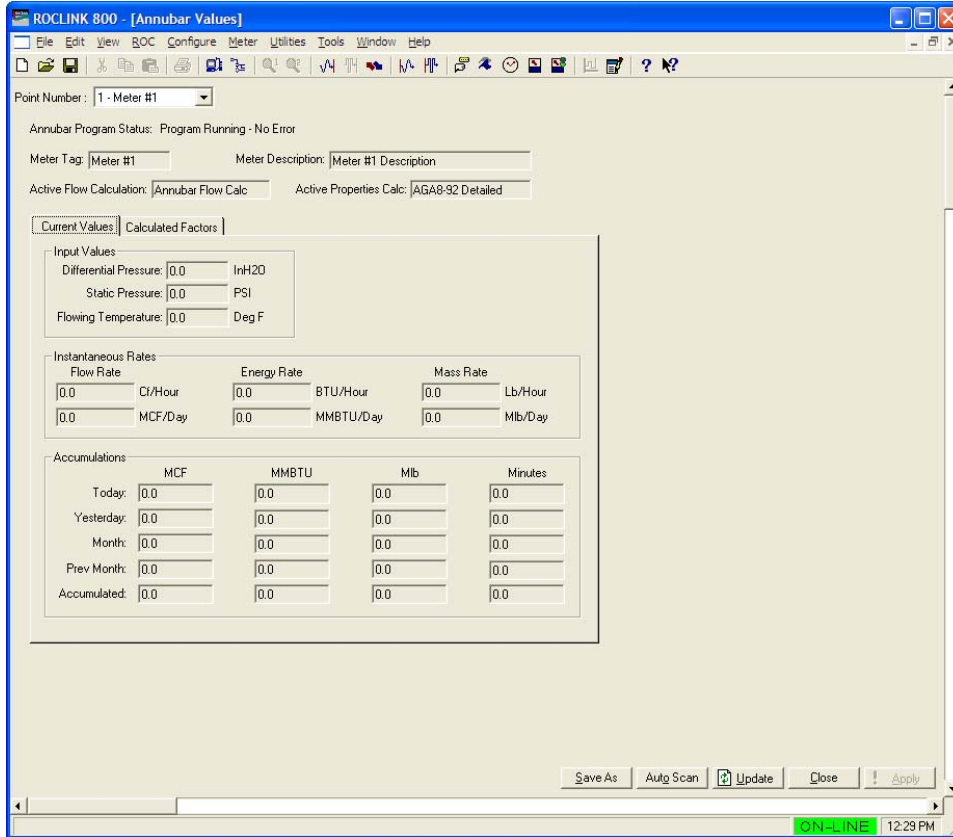


Figure 19. Annubar Values, Current Values Tab

1. Review the values in the following fields.

Field	Description
Differential Pressure	This read-only field displays the current differential pressure in H2O or kPa.
Static Pressure	This read-only field displays the current static pressure in PSI or kPa.
Flowing Temperature	This read-only field displays the current flowing temperature in Deg F or Deg C.
Flow Rate	This read-only field displays the current hourly and daily flow rates in Cf/Hour and MCF/Day or m3/hr and Km3/Day.
Energy Rate	This read-only field displays the current hourly and daily energy rates in BTU/Hour and MMBTU/Day or MJ/Hour and GJ/Day.
Mass Rate	This read-only field displays the current hourly and daily mass rates in Lb/Hour and Mlb/Day or Kg/Hour and Tonnes/Day.

Field	Description
MCF/Km3	Displays the 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 program began running.
MMBTU/GJoules	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 program began running.
Mlb/Tonnes	Displays the total mass in Mlb or Tonnes for the current day, the previous day, the current month, the previous month and the accumulated total since the program began running.
Minutes	Displays flow time in Minutes for the current day, the previous day, the current month, the previous month and the accumulated total since the program began running.

2. Proceed to *Section 3.2.2* to view factors used in the Annubar flow rate calculation.

3.2.2 Annubar Values – Calculated Factors Tab

The Calculated Factors tab shows the factors used in the Annubar flow rate calculation. Use this screen to view the individual factors used in the Annubar flow equation described in *Section 1.3.1*. All fields on this screen are **read-only**.

Note: You must select **Enabled** in the Annubar Flow Calculation section of the Annubar Setup screen to view all available fields on this tab.

1. Select the **Calculated Factors** tab on the Annubar Values screen.

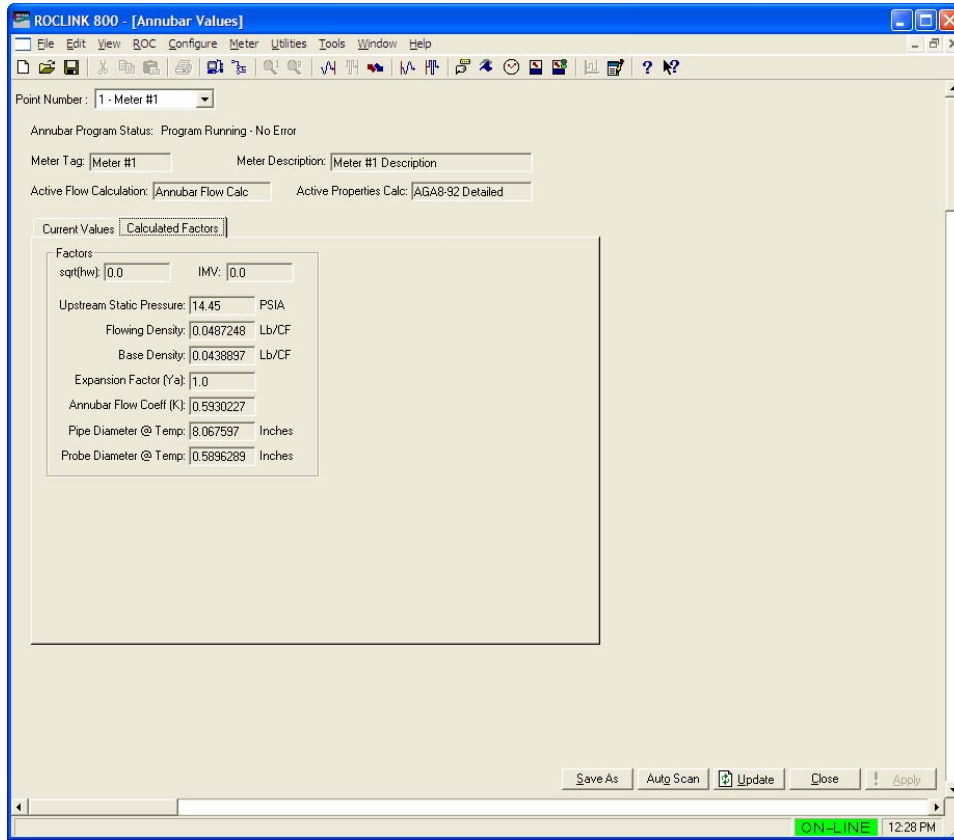


Figure 20. Annubar Values, Calculated Factors Tab

2. Review the values in the following fields.

Field	Description
Sqrt(hw):	This read-only field shows the instantaneous Integral Value (IV) which for the Annubar calculation is square root of current differential pressure.
IMV:	This read-only field shows the Integral Multiplier Value (IMV) calculated at period defined in the Integral Multiplier Period (IMP) defined on the Annubar Setup, General tab. This value is based on the average pressure and temperature over the last IMP.

Field	Description
Upstream Static Pressure:	This read-only field shows the static pressure corrected to absolute upstream conditions in psia or KpaA.
Flowing Density:	This read-only field shows the calculated density at flowing conditions in lb/cf or Kg/m3.
Base Density:	This read-only field shows the calculated density at base conditions in lb/cf or Kg/m3.
Expansion Factor (Ya):	This read-only field shows the gas expansion factor used in the flow rate calculation. The expansion factor adjusts for density and internal energy effects of a gas as it flows around the Annubar primary element. The expansion factor is set to 1.0 for liquid applications.
Annubar Flow Coeff (K):	This read-only field shows the Annubar Flow Coefficient (K) used in the flow calculation. This value may be calculated by the user program or manually entered.
Pipe Diameter @ Temp:	This read-only field shows the adjusted pipe diameter at flowing temperature in inches or millimeters.
Probe Diameter @ Temp:	This read-only field shows the adjusted probe diameter at flowing temperature in inches or millimeters.

3. Proceed to *Section 3.3* to save the configuration to non-volatile memory and/or to file.

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:

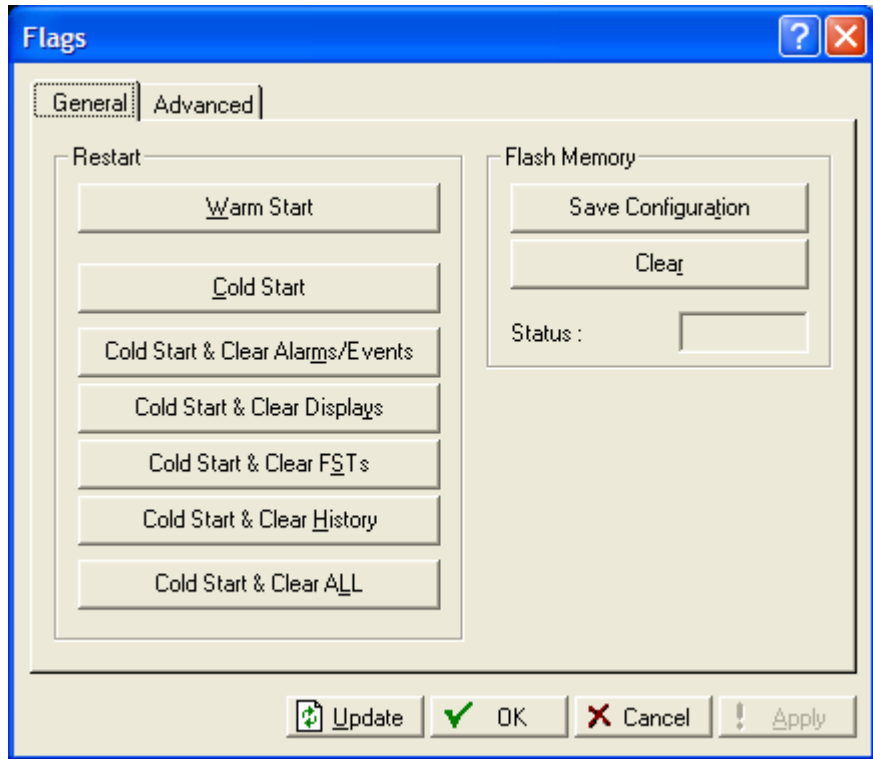


Figure 21. Flags

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

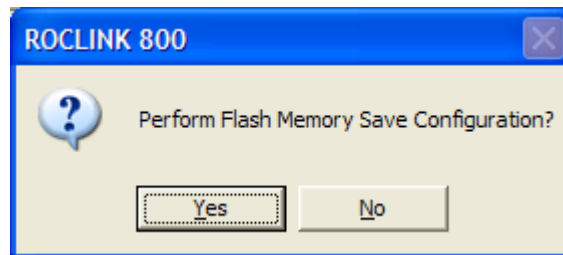


Figure 22. Save Verification

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

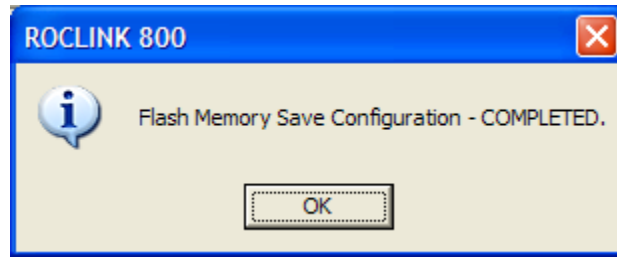


Figure 23. Confirmation

Note: Depending on the size and complexity of the user program, this process may take several minutes. 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.

Chapter 4 – Reference Materials

This section provides tables of information on the user-defined point types used by the Annubar Flow Calculation program.

- Point Type 31: Annubar Configuration
- Point Type 32: Annubar Flow Calculation Values

4.1 Point Type 31: Annubar Configuration

Point type 31 contains the parameters for configuring the Annubar Flow calculation program. The program maintains up to four logicals of this point.

Parm #	Name	Access	Data Type	Length	Range	Default	Description of functionality and meaning of values
0	Point Tag ID	R/W	AC	10	0x20 → 0x7E for each ASCII character	""	Point Type Description
1	Calc Enable Flag	R/W	UINT8	1	0, 1	0	0 = FB107 AGA3 or ISO5167 Flow Calculation active 1 = User Program Annubar Flow Calculation active
2	Softpoint Enable Flag	R/W	UINT8	1	0 → 31	0	0 = Transfer to softpoint is disabled 1-31 = Transfer of Annubar data to softpoint active (value specifies logical of destination softpoint). See <i>Section 3.1.1</i> for description of data transferred.
3	Sensor Model	R/W	UINT8	1	0, 1, 2, 3, 10, 15, 16, 25, 26, 35, 36, 45, 46	1	Valid values include: 0 = Other model, enter Flow Coeff (K) 1 = Annubar 485 Model 1 2 = Annubar 485 Model 2 3 = Annubar 485 Model 3 10 = Annubar Diamond II Model 10 15 = Annubar Diamond II Model 15 16 = Annubar Diamond II Model 16 25 = Annubar Diamond II Model 25 26 = Annubar Diamond II Model 26 35 = Annubar Diamond II Model 35 36 = Annubar Diamond II Model 36 45 = Annubar Diamond II Model 45 46 = Annubar Diamond II Model 46
4	Annubar Flow Coefficient (K)	R/W	FL	4	Any Positive Floating Point Number		Annubar Flow Coefficient value used in flow equation. This value is calculated by the program when Sensor model is set to valid model number. You must enter this value when Sensor Model is set to "Other".
5	Pipe Diameter at Flowing Temperature	R/O	FL	4	Any Positive Floating Point Number		Pipe diameter adjusted to flowing temperature conditions (in inches or millimeters)
6	Annubar Probe Diameter Flowing at Temperature	R/O	FL	4	Any Positive Floating Point Number		Annubar probe diameter adjusted to flowing temperature conditions (in inches or millimeters)
7	Gas Expansion Factor	R/O	FL	4	Any Positive Floating Point Number		Calculated gas expansion factor used in the Annubar flow rate calculation.

4.2 Point Type 32: Annubar Flow Calculation Values

Point type 32 is required for ROCLINK to properly display the meter tag for each meter run when accessing the Annubar Values display.

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 Type Description

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

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