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Liquid Allocation Program for Continuous Flow (for FloBoss™ 107 Flow Managers) User Manual

Remote Automation Solutions

EMERSON
Process Management

Revision Tracking Sheet

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

Page	Revision
All pages	July-15
All pages	May-11
Initial release	Sep-09

Contents

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Chapter 1 – Introduction

This chapter describes the structure of this manual and presents an overview of the Liquid Allocation Program for Continuous Flow for the FloBoss™ 107 (FB107).

1.1 Scope and Organization

This document is the user manual for the Liquid Allocation Program for Continuous Flow (1LK-7) for use in the FB107, and the user manual for the Liquid Allocation Program for Continuous Flow (QER 10Q006) for use in the FB107 with Measurement Canada firmware.

Notes:

- The standard version of this program (1LK-7) **only** works with the standard version of FB107 firmware**.**
- The Measurement Canada version of this program (QER 10Q006) **only** works with the Measurement Canada version of FB107 firmware.

This manual describes how to download and configure this program (referred to as the "Liquid Allocation program" or "the program" throughout the rest of this manual).

You access and configure this program using ROCLINK™ 800 Configuration Software (version 1.80 or greater) loaded on a personal computer (PC) running Windows® 8 or Windows 7 (32 or 64-bit).

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 FB107, 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 following manuals:

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

1.2 Product Overview

The Liquid Allocation program allows a FB107 to interface with up to two meter runs passing liquid hydrocarbon fluids or water. These meter runs are in addition to the meter runs provided by the FB107 Application Firmware. The flowing densities (and optionally, base densities) of the liquid hydrocarbon or water are calculated based on temperatures and pressures using one or more of the following standards:

- API Standard 2540 [Chapter 11.1] (1980) Volume X, Reaffirmed, October 1993.
- The Institute of Petroleum, Petroleum Measurement Paper No. 3, October, 1988.
- API Chapter 11.2.1 – Compressibility Factors for Hydrocarbons: 0 – 90 Degrees API Gravity Range (1st Edition, August 1984), Reaffirmed, May 1996.
- API Chapter 11.2.2 – Compressibility Factors for Hydrocarbons: 0.350 – 0.637 Relative Density (60°F/60°F) and -50°F to 140°F Metering Temperature (2nd Edition, October 1986).
- API Chapter 11.2.1M – Compressibility Factors for Hydrocarbons: 638 – 1074 Kilograms per Cubic Metre Range (1st Edition, June, 1984), Reaffirmed, May 1996.
- API Chapter 11.2.2M – Compressibility Factors for Hydrocarbons: 350 – 637 Kilograms per Cubic Metre Density (15°C) and -46°C to 60°C Metering Temperature (1st Edition, October 1986), Reaffirmed, March, 1997.
- API MPS (Manual of Petroleum Measurement Standards) Chapter 11 – Physical Properties Data Section 1, Temperature and Pressure Volume Correction Factors for Generalized Crude Oil, Refined Products, and Lubricating Oils, May 2004.
- Gas Processors Association (GPA) TP-27, Temperature Correction for the Volume of NGL and LPG, Section 5, January, 2005.
- API MPS (Manual of Petroleum Measurement Standards) Chapter 11 – Physical Properties Data, Section 4 – Properties of Reference Materials, Part 1 – Density of Water and Water Volumetric Correction Factors for Water Calibration of Volumetric Provers, First Edition, December 2003.

Meter types can be either differential or linear. The calculation standard used for differential meters is ISO5167. The calculation used for linear meters is based on AGA Report No. 11. Volume and mass flow rates and totals are calculated and stored for both meter types. The program uses user-defined point types for storing the calculated flow rates and accumulations. The program's user-defined point types are also the location where the configuration parameters reside.

The Liquid Allocation program also supports up to two liquid density interface points. The liquid density interface points allow for manual density inputs; density inputs from densitometers; frequency inputs from a

Micro Motion (or Solartron) 7830/40 or 7835/45/46/47; and UGC densitometers. The density value determined from the density input is referred to as the observed density. The base density of the liquid hydrocarbon passing through a meter can be specified to be calculated from the observed density.

1.3 Program Requirements

You download the Liquid Allocation program to—and then run it from—the Flash and RAM memory on the FB107 with firmware version 1.30 (or greater). Because the program is larger than 64K, it occupies two user C program numbers (1 & 2). Download and configure the program using ROCLINK 800 Configuration software version 1.84 (or greater).

The downloadable program is:

File Name	Target Unit/ Version	User Defined Points (UDP)	Flash Used (in bytes)	DRAM Used (in bytes)	ROCLINK 800 Version	Display Number
LiquidAlloc_1.bin (1LK-7)	FB107 1.30	22, 23, 25, 26	94,560	32,768	1.84	23, 24, 26, 27
LiquidAlloc_1.bin (QER 10Q006)	FB107 with MC Firmware 1.00	22, 23, 25, 26	94,560	32,768	1.84	23, 24, 26, 27

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).

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Chapter 2 – Installation

This section provides instructions for installing the Liquid Allocation program into the FB107. Read *Section 1.3* 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 (1LK-7) is required to use the Liquid Allocation program. 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.

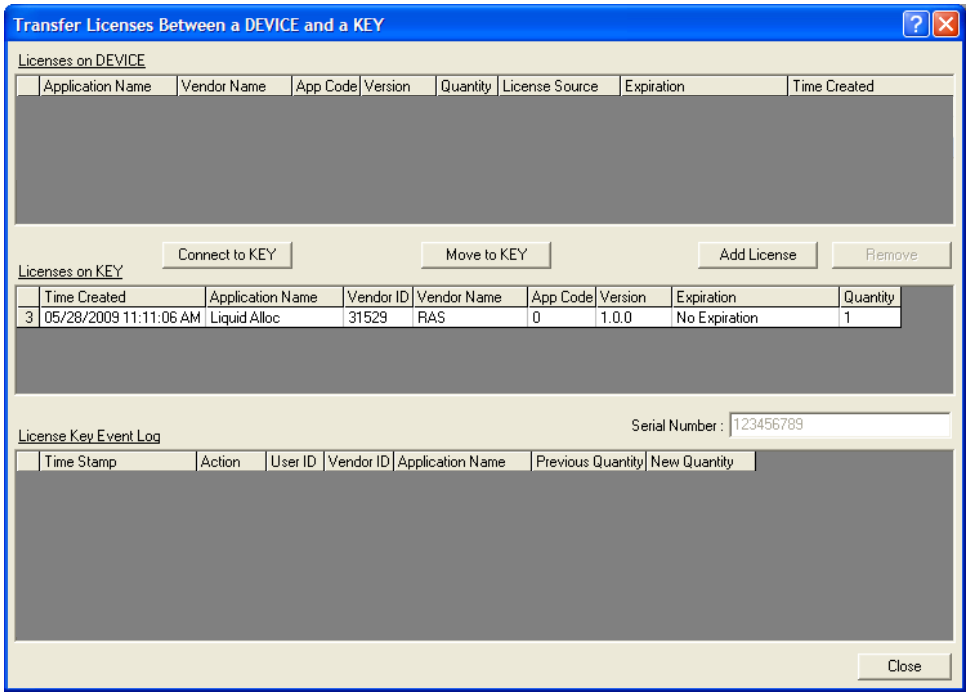

Figure 1. Transfer Licenses Between a Device and a Key

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 (Liquid Alloc, 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.

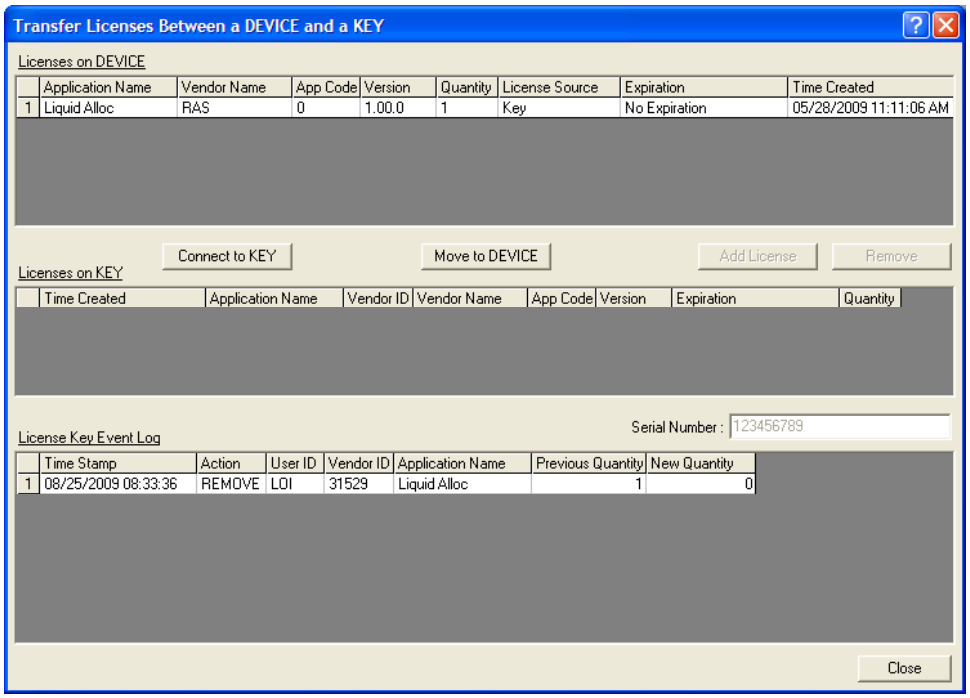

Figure 2. License Installed

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 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 3*):

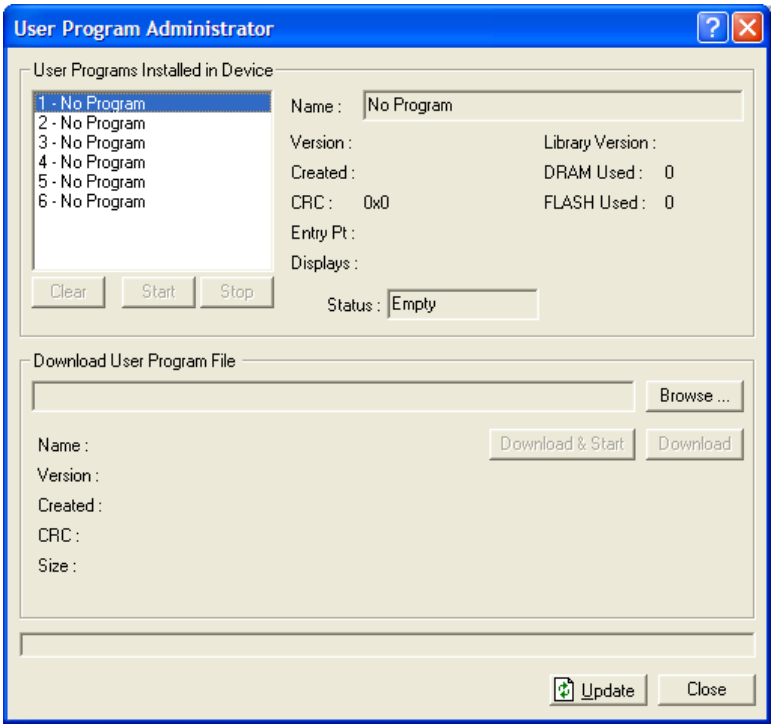

Figure 3. User Program Administrator

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:

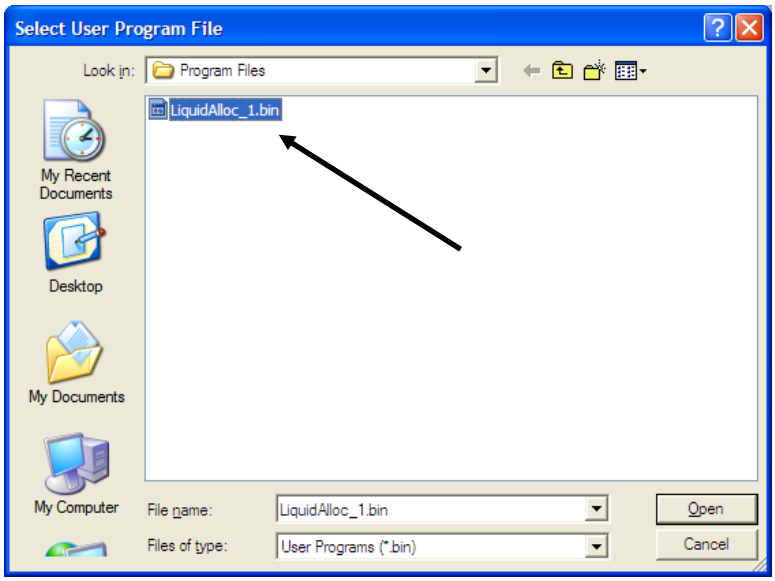

Figure 4. Select User Program File

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:

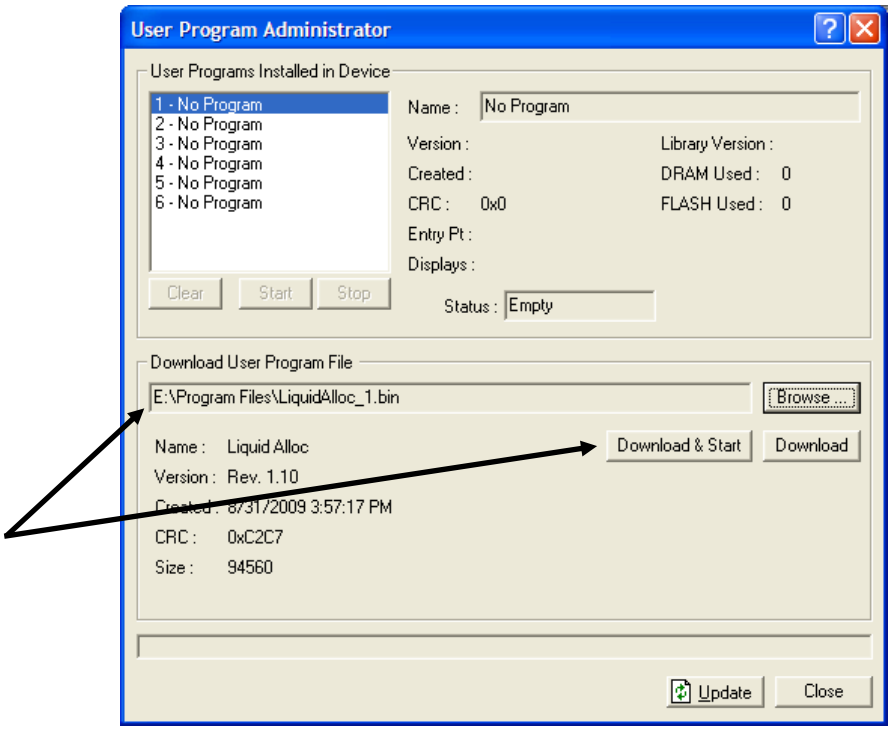

Figure 5. User Program Administrator

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

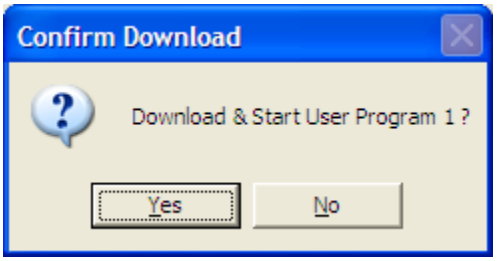

Figure 6. Confirm Download

Note: For the FB107, ROCLINK 800 assigns program positions based on memory allocations. For this reason, the Liquid Alloc program automatically installs as program 1. Because the program is larger than 64K, it occupies two user C program numbers (1 & 2).

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:

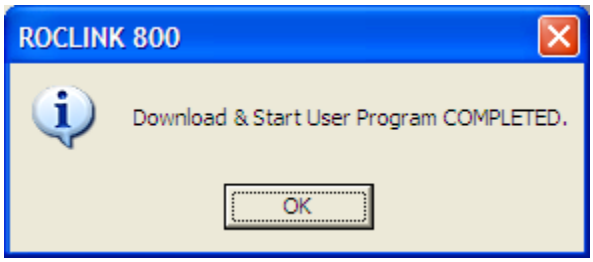

Figure 7. ROCLINK 800 Download Confirmation

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

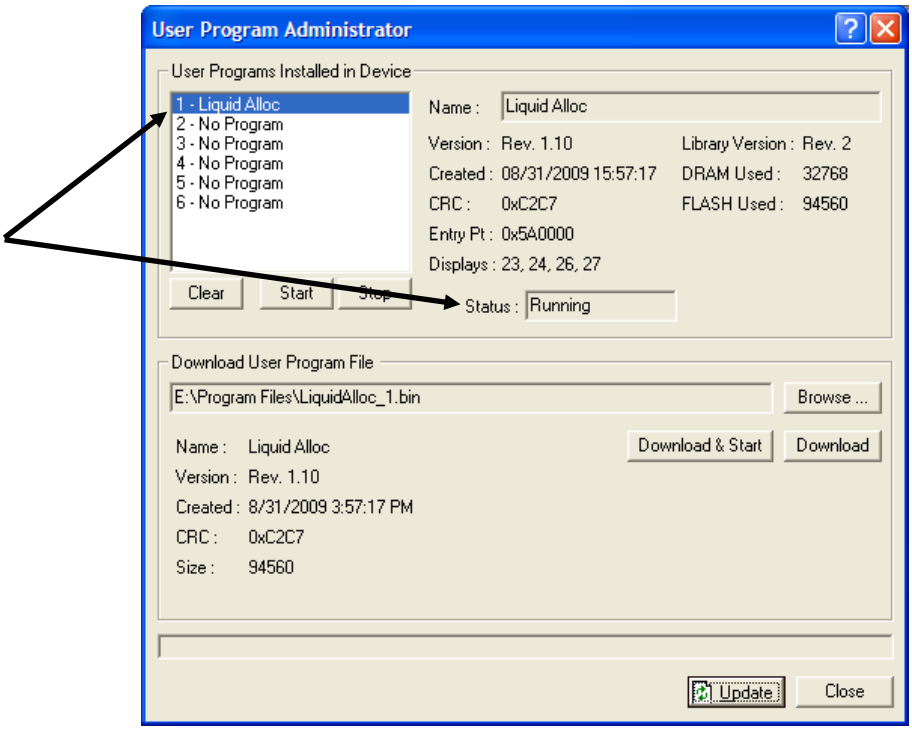

Figure 8. User Program Administrator

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

Chapter 3 – Configuration

After you download and start the Liquid Allocation program, you configure the program and view calculation results using ROCLINK 800 software. To do this you use four program-specific screens (Liquid Preferences, Liquid Products, Liquid Meters, and Liquid Density Interfaces):

- Use the Liquid Preferences screen to set the units of the inputs and calculated results values.
- Use the Liquid Products screen to configure up to two liquid hydrocarbon or water products which can be selected as the fluid passing through a liquid meter run.
- Use the Liquid Meters screen to configure and view the results for up to two liquid meter runs through which one of the liquid products defined by the Liquid Products screen flows. One of the configuration items is to specify if the base density for the product passing through the meter is to be calculated from a Liquid Density Interface point, or to use the user-specified base density for the liquid product.
- Use the Liquid Density Interface screen to configure and view the observed densities for up to two liquid density interface points.

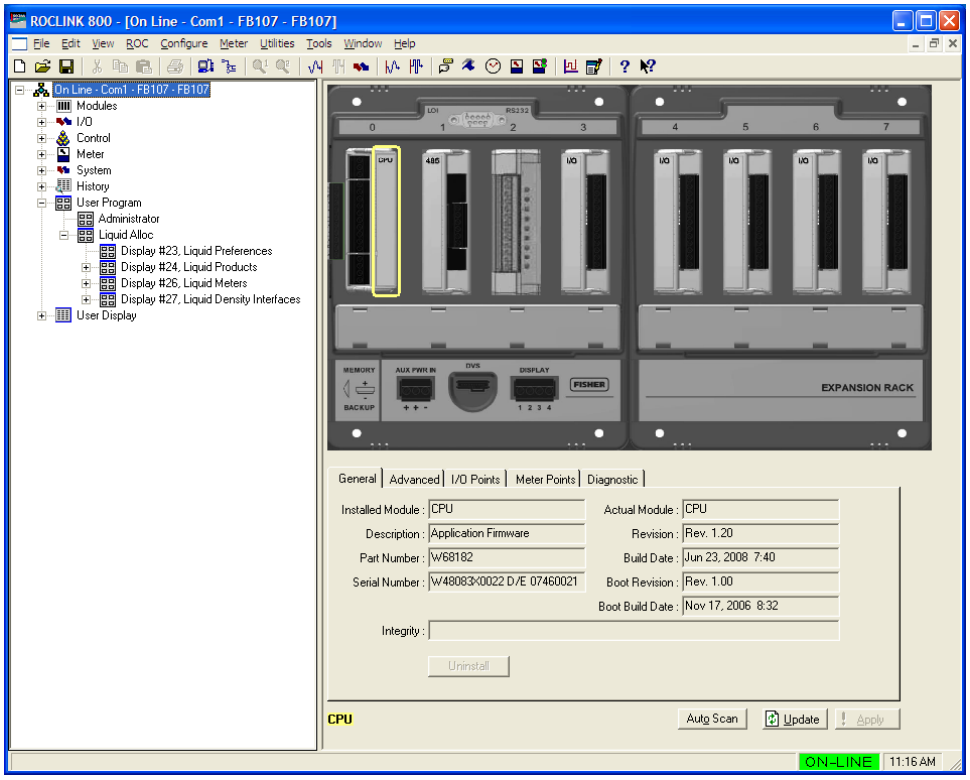

Figure 9. ROCLINK 800

3.1 Liquid Preferences Screen

Once you have successfully loaded the Liquid Allocation program into the FloBoss, you can access the Liquid Preferences screen and configure the units for the inputs and calculated results for the program.

To access this screen:

1. Click **User Program** > **Liquid Alloc** from the ROCLINK configuration tree.
2. Double-click **Display #23, Liquid Preferences**. The Liquid Preferences screen displays:

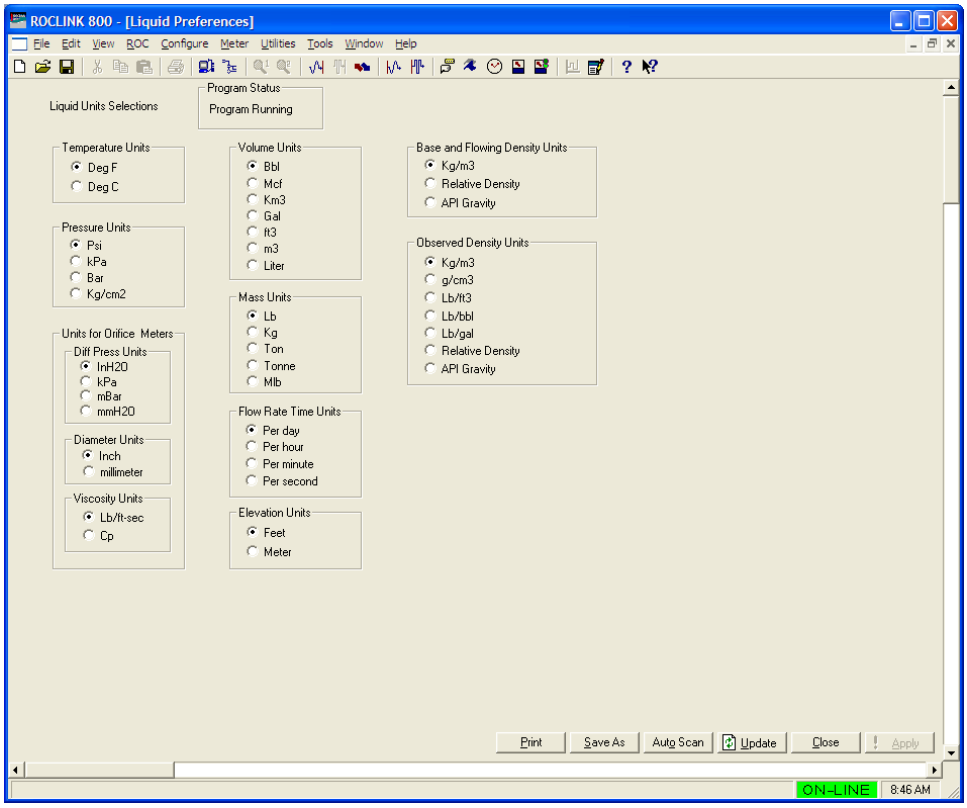

Figure 10. Liquid Preferences Screen

3. Review the values in the following fields:

Field	Description
Program Status	This **read-only** field shows the current status for the Liquid Allocation program. Possible statuses are Program Running and License Not Found (you must install a Liquid Alloc license key to use the program).
Temperature Units	Sets the units of all temperature inputs. Valid selections are Deg F and Deg C.
Pressure Units	Sets the units of all pressure inputs. Valid selections are Psi, kPa, Bar, and Kg/cm2.

Field	Description	
Units for Orifice Meters	The following units are applicable if the meter type of a liquid meter is specified as orifice, in which case ISO-5167-2003 is used as the flow calculation standard.	
	Diff Press Units	Sets the units of the differential flow input. Valid selections are InH2O, kPa, mBar, and mmH2O. (Units of InH2O and mmH2O are based on a water temperature of 60 Deg F).
	Diameter Units	Sets the units for the meter and pipe orifice diameters. Valid selections are Inch and millimeter.
	Viscosity Units	Sets the units for the viscosity of the fluid. Valid selections are Lb/ft-sec and Cp.
Volume Units	Sets the units for all volume flow rates and total values. Valid selections are Bbl, Mcf, Km3, Gal, ft3, m3, and Liter.	
Mass Units	Sets the units for all mass flow rates and totals. Valid selections are Lb, Kg, Ton, Tonne, and Mlb.	
Flow Rate Time Units	Sets the time units for all volume and mass flow rates. Valid selections are Per day, Per hour, Per minute, Per second.	
Elevation Units	Sets the units for the elevation used to determine the atmospheric pressure when the latter is specified to be calculated. Valid selections are Feet and Meters.	
Base and Flowing Density Units	Sets the units for the base and flowing densities. Valid selections are Kg/m3, Relative Density, and API Gravity.	
Observed Density Units	Sets the units for the density determined by the density interface point (observed density). Valid selections are Kg/m3, g/cm3, Lb/ft3, Lb/bbl, Lb/gal, Relative Density, and API Gravity.	

4. Click **Apply** to save your changes, and proceed to *Section 3.2* to configure the Liquid Products.

3.2 Liquid Products Screen

Use this screen to specify up to two liquid products that could flow through the liquid meters.

To access this screen:

1. Click **User Program** > **Liquid Products** from the ROCLINK configuration tree.
2. Double-click **Display #24, Liquid Products**.
3. Double-click **#1, Product #1**. The following screen displays:

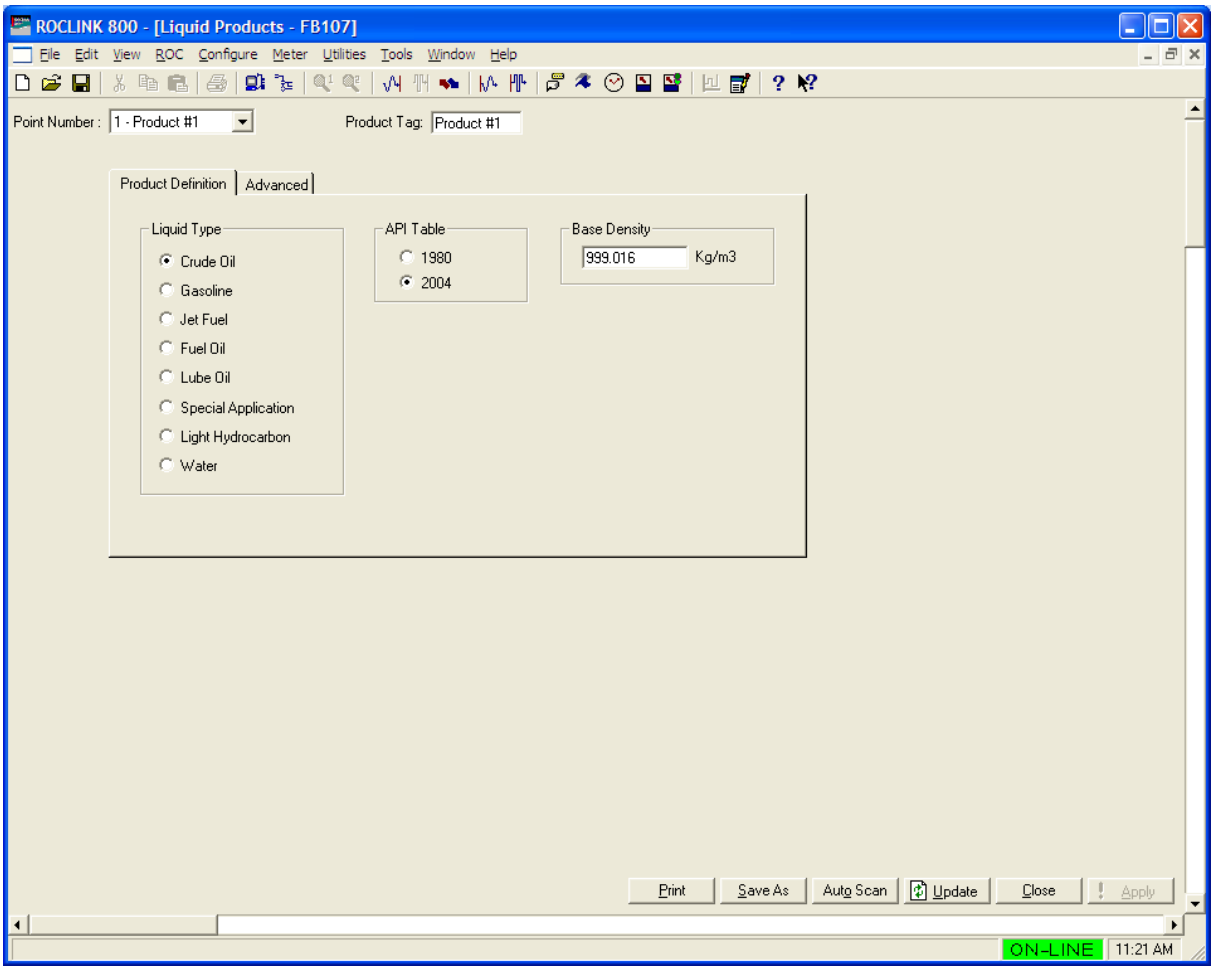

Figure 11. Liquid Products Screen

Note: Two fields at the top of the screen (Point Number and Product Tag) appear on both tabs.

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

Field	Description
Point Number	Selects the liquid product to configure. Click ▼ to display all of the products. Clicking a different liquid product causes the screen to display the values for that product.
Product Tag	Sets a unique identifier for the selected liquid product.

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

3.2.1 Liquid Products – Product Definition Tab

Use this tab (which displays when you access the Liquid Products screen) to specify the liquid type, API table, and the base density of a liquid product.

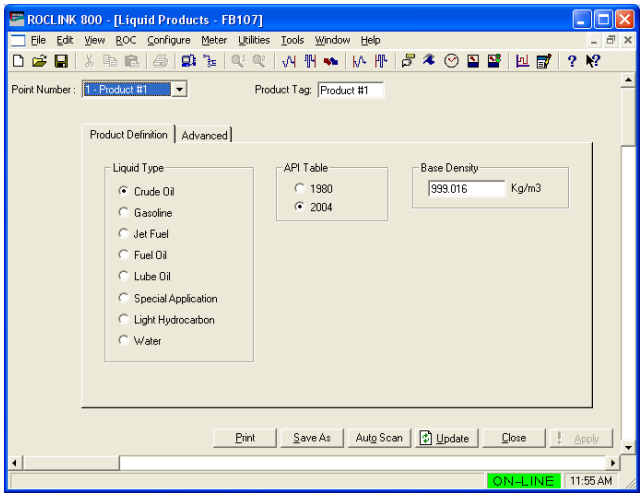

Figure 12(a). Liquid Products, Product Definition tab (Liquid Type is Not Light Hydrocarbon or Water)

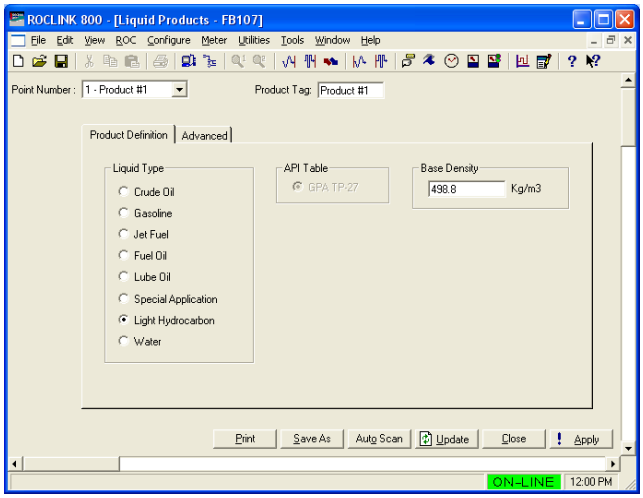

Figure 12(b). Liquid Products, Product Definition tab (Liquid Type is Light Hydrocarbon)

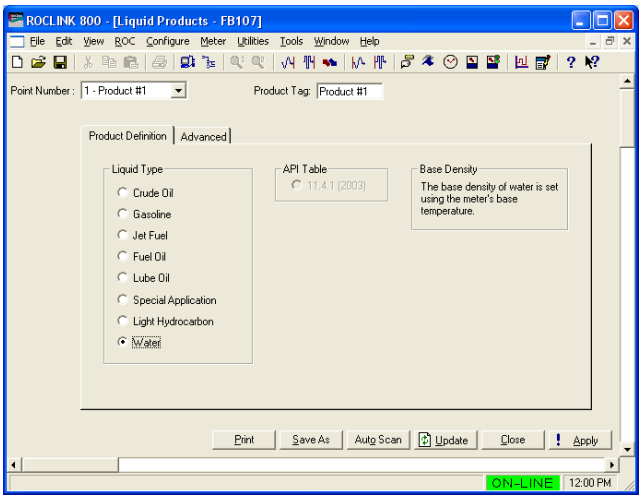

Figure 12(c). Liquid Products, Product Definition tab (Liquid Type is Water)

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

Field	Description
Liquid Type	Sets the type of fluid associated with this product number. Valid selections are Crude Oil, Gasoline, Jet Fuel, Fuel Oil, Lube Oil, Special Application, Light Hydrocarbon, and Water. **Note:** See *Section 4.1* for density ranges and additional information about the liquid types.
API Table	If the Liquid Type is **anything other than light hydrocarbon or water** (Crude Oil, Gasoline, Jet Fuel, Fuel Oil, Lube Oil, or Special Application), select the appropriate the API table to use for calculations. Valid selections are 1980 and 2004. If the Liquid Type is **light hydrocarbon**, this field shows that the GPA TP-27 table is being used for calculations. If the Liquid Type is **water**, this field shows that the API Table 11.4.1 (2003) is being used for calculations.
Base Density	Sets the density of the liquid product at the base temperature and base (or equilibrium) pressure. The units are as specified by the base and flowing density units selected on the Liquid Preferences screen. **Note:** This value is **only** used if the base density option on the Inputs tab of the Liquid Meters screen is set to use the base density of the product.

2. Click **Apply** to save any changes and proceed to *Section 3.2.2* to configure the Advanced tab.

3.2.2 Liquid Products – Advanced Tab

Use this tab to specify additional information, as appropriate for the liquid products.

To access this screen:

1. Select the **Advanced** tab on the Liquid Products screen. One of the following four screens displays:

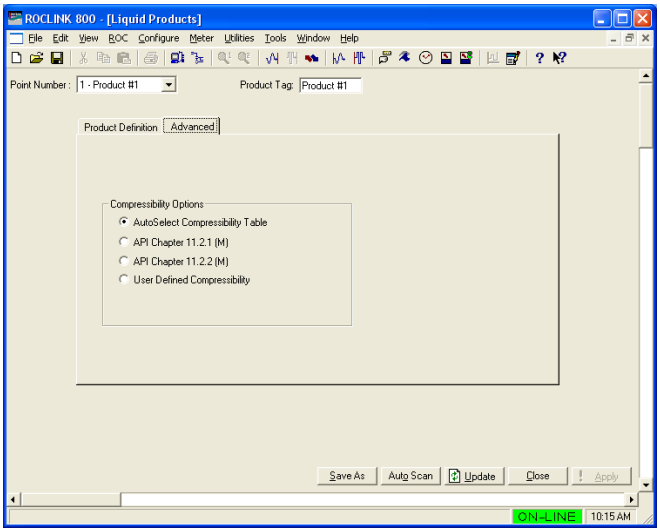

Figure 13(a). Liquid Products, Advanced tab (All Liquid Types and API Table 1980 or GPA TP-27, except Special Application and Water)

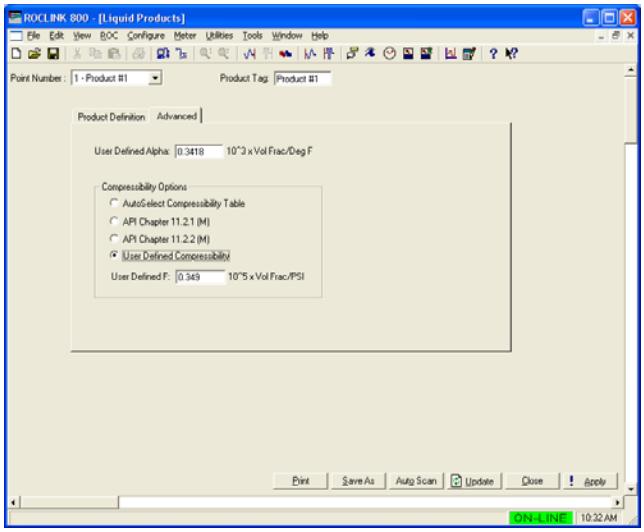

Figure 13(b). Liquid Products, Advanced tab (Liquid Type of Special Application and API Table 1980)

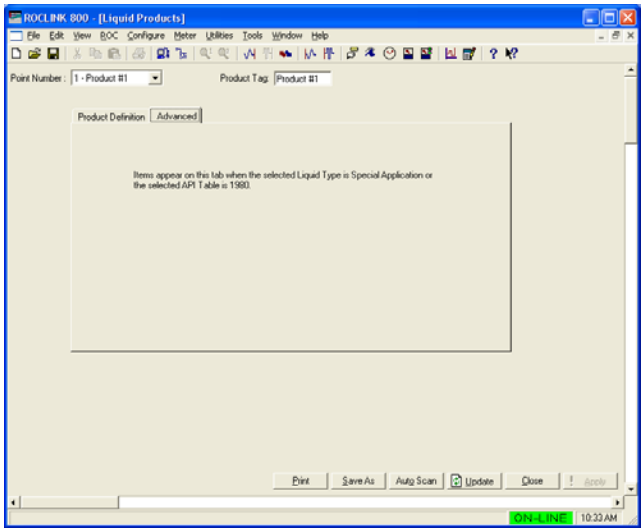

Figure 13(c). Liquid Products, Advanced tab (All Liquid Types and API Table 2004 and water, except Special Application)

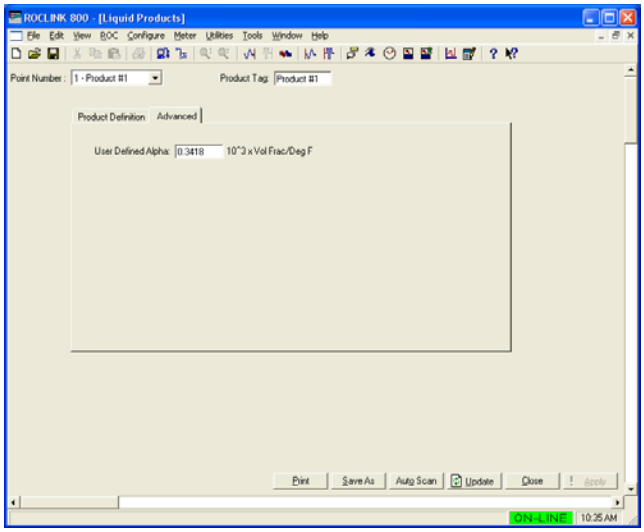

Figure13(d) Liquid Products, Advanced tab (Liquid Type of Special Application and API Table 2004)

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

Field	Description
User Defined Alpha	Sets the coefficient of thermal expansion (alpha) to use when determining the flowing density from the base density. The units are 10^3 times the volume fraction per temperature unit; the temperature units being specified on the Liquid Preferences screen. **Note:** This field **only** displays if the liquid type is special application.
Compressibility Options	Sets the option for correcting for the pressure effect when determining the flowing density from the base density. Valid selections are Auto Select Compressibility Table, API Chapter 11.2.1, API Chapter 11.2.2, and User Defined Compressibility. **Note:** This field **only** displays when the API Table is 1980 or the liquid product is light hydrocarbon.
User Defined F	Sets the compressibility (F) for the liquid product. If the base temperature is 60 Deg F, the units are 10^5 times the volume fraction per pressure unit. If the base temperature is 15, 20, or 30 Deg C, the units are 10^6 times the volume fraction per pressure unit. The pressure units are specified on the Liquid Preferences screen. **Note**: This field **only** displays when the compressibility option is specified as user defined compressibility.

3. Click **Apply** to save any changes.
4. Click **Close** to close this screen. Proceed to *Section 3.3* to configure the liquid meters and view the calculated values.

3.3 Liquid Meters Screen

Use this screen to configure up to two liquid meter runs and observe the calculated values.

To access this screen:

1. Click **User Program** > **Liquid Alloc** from the ROCLINK configuration tree.
2. Double-click **Display #26, Liquid Meters**. The Liquid Meters screen displays:

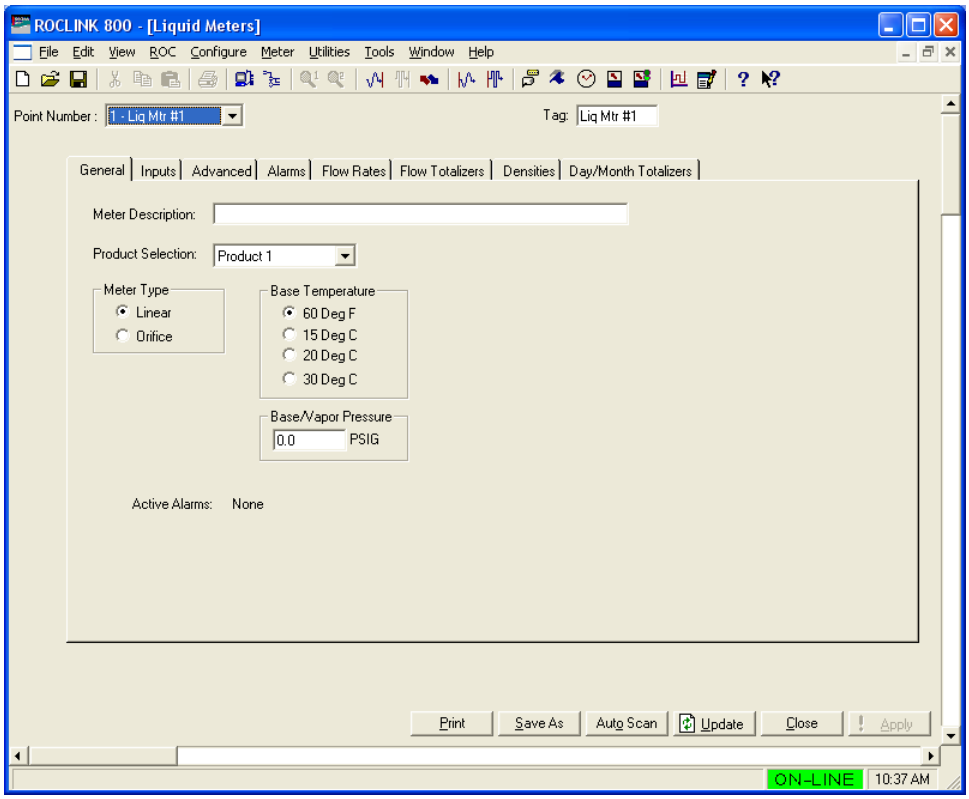

Figure 14. Liquid Meters Screen

Note: Two fields at the top of the screen (Point Number and Tag) appear on all tabs.

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

Field	Description
Point Number	Selects the liquid meter run to configure. Click ▼ to display all of the liquid meters runs. Clicking a different meter run causes the screen to display the values for that meter run.
Tag	Sets a unique identifier for the selected liquid meter.

4. Click **Apply** to save any changes, and proceed to *Section 3.3.1* to configure the General tab.

3.3.1 Liquid Meters – General Tab

Use this tab (which appears when you access the Liquid Meters screen) to specify a liquid meter's description, liquid product passing through it, meter type, base temperature, and base (or vapor) pressure. Any active alarms are also shown on this tab.

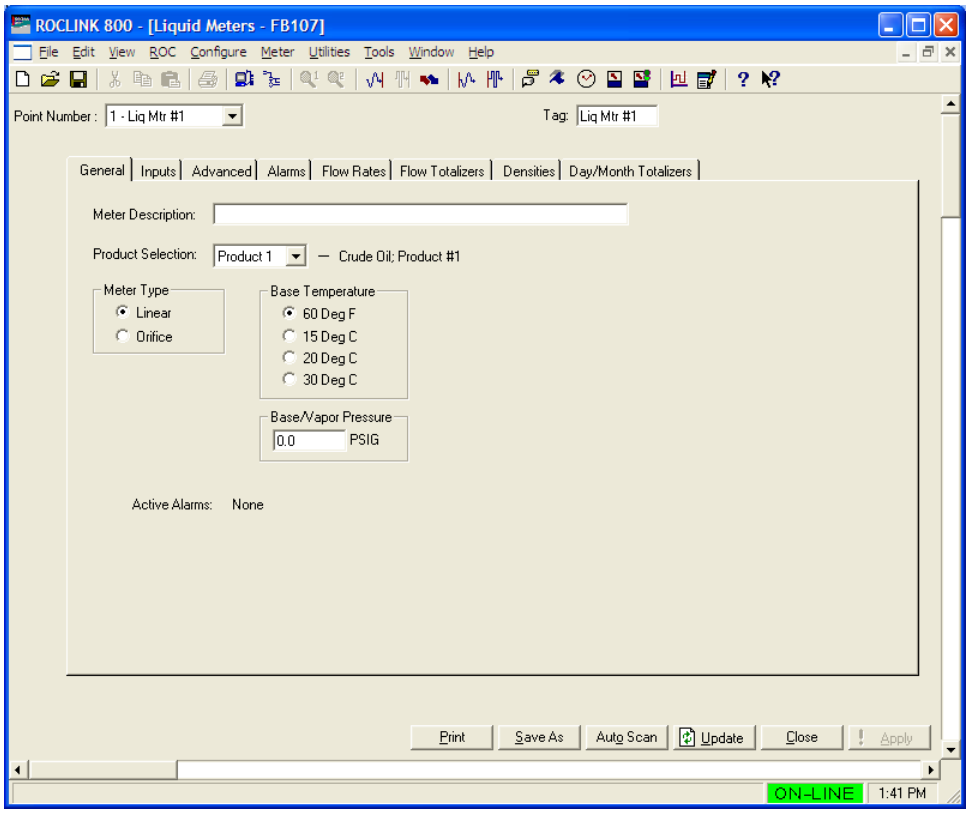

Figure 15. Liquid Meters, General tab

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

Field	Description
Meter Description	Sets a description for the liquid meter, up to 30 alphanumeric characters.
Product Selection	Sets the product, as defined on the Liquid Products screen, associated with the liquid meter. Click ▼ to display additional products. The liquid type and its tag display to the right of the selected product.
Meter Type	Sets the type of meter for the liquid meter run. Valid selections are Linear and Orifice. **Notes:** ▪ Linear meter calculations are based on AGA Report No. 11. ▪ Orifice meter calculations are based on ISO5167-2003.

Field	Description
Base Temperature	Sets the base temperature to which volume flows are adjusted for the liquid meter. Valid selections are 60 Deg F, 15 Deg C, 20 Deg C, and 30 Deg C.
Base/Vapor Pressure	Sets the base pressure to which volume flows are adjusted for the liquid meter. The pressure units are specified on the Liquid Preferences screen.
Active Alarms	This **read-only** field shows the status of any active alarms associated with this meter. Possible alarms are Low, High, No Flow, and Manual. **Notes:** ▪ A Manual alarm means one or more of the density, temperature, or pressure I/O definitions on the Inputs tab is Undefined. ▪ You define these alarms on the Alarms tab.

2. Click **Apply** to save any changes, and proceed to *Section 3.3.2* to configure the Inputs tab.

3.3.2 Liquid Meters – Inputs Tab

Use this tab to configure the inputs for a liquid meter and the source for the base density of the fluid passing through the meter.

To access this screen:

1. Select the **Inputs** tab on the Liquid Meters screen. One of the following two screens displays.

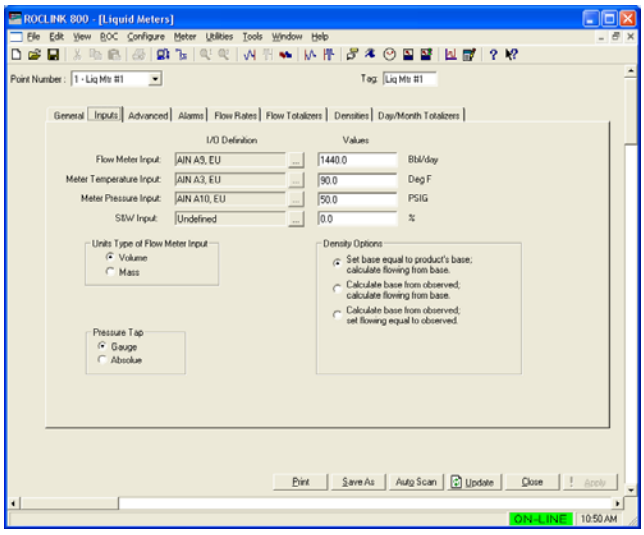

Figure 16(a). Liquid Meters, Inputs tab (Meter Type is Linear)

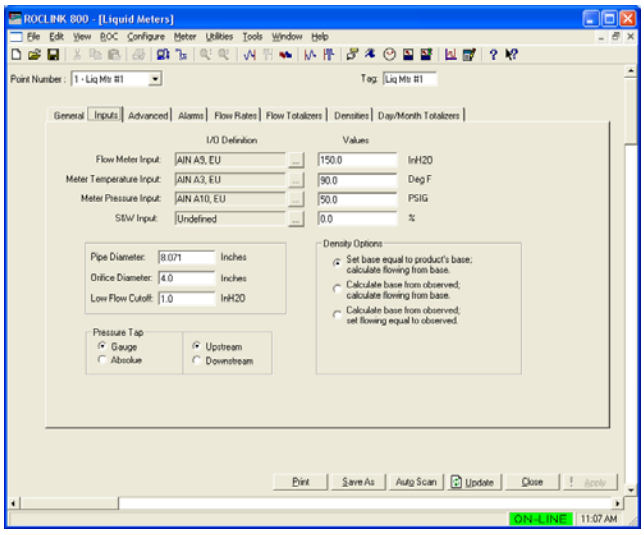

Figure 16(b). Liquid Meters, Inputs tab (Meter Type is Orifice)

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

Field	Description
Flow Meter Input	Sets the source for the flow input for the liquid meter. Click ... to display the Select TLP screen and specify the TLP selection. If the meter type is **linear**, the units are volume/time or mass/time, where the units for volume, mass, and time are specified on the Liquid Preferences screen. If the meter type is **orifice**, the units are the units for differential pressure specified on the Liquid Preferences screen. **Note:** If you select **Undefined (0, 0, 0)** for the I/O definition, you can manually enter a value in the Value field. Otherwise, the program displays the value for the currently selected input.

Field	Description
Meter Temperature Input	Sets the source for the flowing temperature of the liquid meter. Click ... to display the Select TLP screen and specify the TLP selection. The units are the temperature units selected on the Liquid Preferences screen. **Note:** If you select **Undefined (0, 0, 0)** for the I/O definition, you can manually enter a value in the Value field. Otherwise, the program displays the value for the currently selected input.
Meter Pressure Input	Sets the source for the flowing pressure of the liquid meter. Click ... to display the Select TLP screen and specify the TLP selection. The units are the pressure units selected on the Liquid Preferences screen. **Note:** If you select **Undefined (0, 0, 0)** for the I/O definition, you can manually enter a value in the Value field. Otherwise, the program displays the value for the currently selected input.
S&W Input	Sets the source for the percent of sediment and water for the liquid meter. Click ... to display the Select TLP screen and specify the TLP selection **Note:** If you select **Undefined (0, 0, 0)** for the I/O definition, you can manually enter a value in the Value field. Otherwise, the program displays the value for the currently selected input.
Units Type of Flow Meter Input	Sets the type of units for the meter flow input. Valid selections are Volume and Mass. **Note:** This field **only** displays when the meter type is linear.
Pipe Diameter	Sets the inside diameter for the pipe near the liquid meter. The units are the diameter units selected on the Liquid Preferences screen. **Note**: This field **only** displays when the meter type is orifice.
Orifice Diameter	Sets the diameter of the orifice plate of the liquid meter. The units are the diameter units selected on the Liquid Preferences screen. **Note:** This field **only** displays when the meter type is orifice.
Low Flow Cutoff	Sets the low flow cutoff point. When the valve of the flow input of the liquid meter is less than this value, the calculated flow rate is set to 0.0, and the system records a No Flow alarm in the Alarm Log if alarming is enabled. The units are the same as the Flow Meter Input.

Field	Description	
Density Options	Sets the source for the base and flowing density of the liquid meter. Valid selections are: **Note:** This field **does not** display if the liquid type is water.	
	Set base equal to product base; calculate flowing from base	Liquid meter calculations use the base density of the product assigned to the meter, and calculate the flowing density from the base density.
	Calculate base from observed; calculate flowing from base	Liquid meter calculations determine the base density from the specified Density Interface Point field, and calculate the flowing density from the base density.
	Calculate base from observed; set flowing equal to observed	Liquid meter calculations determine the base density from the specified Density Interface Point field, and set the flowing density to the value of the observed density.
Density Interface Point	Sets the source for the observed density of the liquid meter. **Note:** This field **only** displays if you select either "Calculate base from observed" options in the Density Options field.	
Pressure Tap	Sets the reference for the meter's flowing pressure (valid selections are Gauge and Absolute), and sets the tap location of the meter's flowing pressure sensor (valid selections are Upstream and Downstream). **Note:** The Upstream and Downstream fields **only** display when the meter type is orifice.	

3. Click **Apply** to save any changes and proceed to *Section 3.3.3* to configure the Advanced tab.

3.3.3 Liquid Meters – Advanced Tab

Use this tab to configure additional information for a liquid meter.

To access this screen:

1. Select the **Advanced** tab on the Liquid Meters screen. One of the following two screens displays:

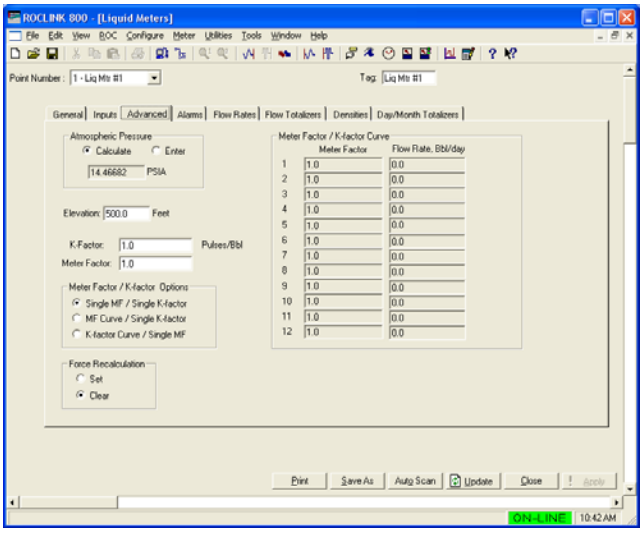

Figure 17(a). Liquid Meters, Advanced tab (Meter Type is Linear)

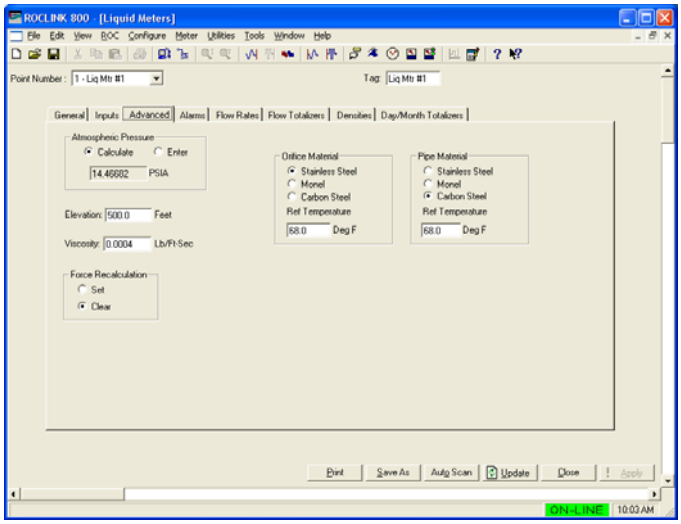

Figure 17(b). Liquid Meters, Advanced tab (Meter Type is Orifice)

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

Field	Description
Atmospheric Pressure	Sets how the atmospheric pressure at the site of the liquid meter is determined. Valid selections are Calculate and Enter. Select **Calculate** to calculate the atmospheric pressure based on the specified elevation. Select **Enter** to manually enter the value for the atmospheric pressure. The units are the pressure (absolute) units selected on the Liquid Preferences screen.
Elevation	Sets the elevation at the site of the liquid meter. The units are the elevation units selected on the Preferences screen.
Viscosity	Sets the flowing viscosity for the meter. The units are the viscosity units selected on the Liquid Preferences screen. **Note:** This field **only** displays when the meter type is orifice.

Field	Description	
K-Factor	Sets the linear meter constant (K-factor) value used for this meter. The units are in Pulse / Unit Volume or Pulse / Unit Mass and must match the units selected for the volume or mass on the Liquid Preferences screen **Notes:** ▪ This field can **only** be set if you select **Single MF / Single K-factor** or **MF Curve / Single K-factor** in the Meter Factor / K-factor Options field. ▪ This field **only** displays when the meter type is linear.	
Meter Factor	Sets the meter factor (obtained by dividing the quantity of fluid the proving system measured by the quantity the meter indicates during proving) for the liquid meter. **Notes:** ▪ This field can only be set if you select **Single MF / Single K-factor** or **K-factor Curve / Single MF** from the Meter Factor / K-factor Options field. ▪ This field **only** displays when the meter type is linear.	
Meter Factor / K-Factor Options	Sets the option to use when calculating K-factors or meter factors. Valid selections are: **Note:** This field **only** displays when the meter type is linear.	
	Single MF / Single K-factor	Uses a single meter factor and a single K-factor for the liquid meter. These values are set in the K-factor and Meter Factor fields.
	MF Curve / Single K-factor	Uses a series of meter factor curve values and a single K-factor. Specify up to 12 meter factors corresponding to flow rates in the Meter Factor / K-factor Curve frame, and a value for the K-factor field.
	K-factor Curve / Single MF	Uses a series of K-factor curve values and a single meter factor. Specify up to 12 K-factors corresponding to pulse frequencies in the Meter Factor / K-factor Curve frame, and a value for the Meter Factor field.
Force Recalculation	Forces an immediate recalculation of the flow for the current main calculation period (mcp). A new main calculation period begins at this time. Select **Set** to force the recalculation. When the recalculation is complete, the selection is automatically reset to Clear.	

Field	Description	
Meter Factor / K-factor Curve	Sets up to 12 entries for the Meter Factor / K-factor curve. **Notes:** ▪ The fields in this frame can **only** be set if you select **MF Curve / Single K-factor** or **K-factor Curve / Single MF** in the Meter Factor / K-factor Options field. ▪ This field **only** displays when the meter type is linear.	
Orifice Material	Sets the material of construction of the orifice. Valid selections are **Stainless Steel**, **Monel**, and **Carbon Steel**. **Note:** This field **only** displays when the meter type is orifice.	
	Ref Temperature	Sets the reference temperature for the measurement of the orifice diameter. The units are the temperature units selected on the Liquid Preferences screen.
Pipe Material	Sets the material of construction of the pipe in which the orifice is installed. Valid selections are Stainless Steel, Monel, and Carbon Steel. **Note:** This field **only** displays when the meter type is orifice.	
	Ref Temperature	Sets the reference temperature for the measurement of the pipe diameter. The units are the temperature units selected on the Liquid Preferences screen.

3. Click **Apply** to save any changes and proceed to *Section 3.3.4* to configure the Alarms tab.

3.3.4 Liquid Meters – Alarms Tab

Use this tab to configure the alarms for a liquid meter.

To access this screen:

1. Select the **Alarms** tab on the Liquid Meters screen. The following screen displays:

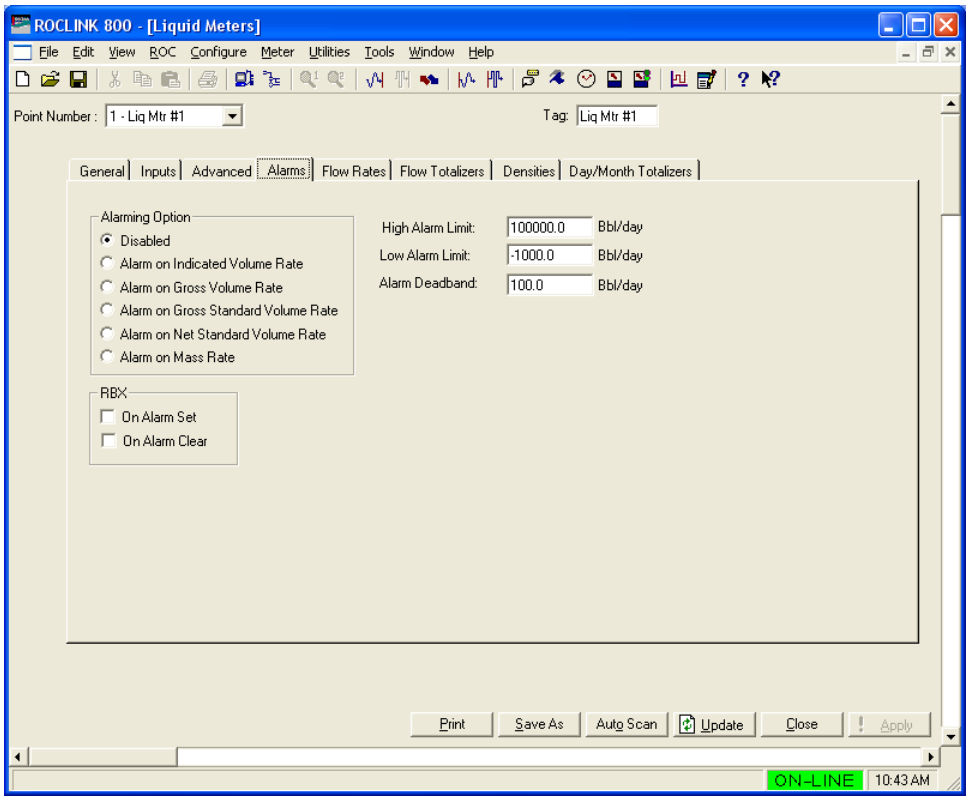

Figure 18. Liquid Meters, Alarms tab

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

Field	Description	
Alarming Option	Sets the parameter whose value is to be used for alarming. Valid selections include Disabled, Alarm on Indicated Volume Rate, Alarm on Gross Volume Rate, Alarm on Gross Standard Volume Rate, Alarm on Net Standard Volume Rate, and Alarm on Mass Rate.	
RBX	Enables Report-by-Exception (RBX) alarm messages. These messages are sent via communication ports that have RBX mode enabled.	
	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

Field	Description
	for alarming clears the alarm condition, the FB107 generates an RBX message(s).
High Alarm Limit	Sets the value at or above which the value of the parameter for alarming must rise to generate a high alarm. The units are based on the selected Alarming Option.
Low Alarm Limit	Sets the value at or below which the value of the parameter for alarming must fall to generate a low alarm. The units are based on the selected Alarming Option.
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 value of the alarming parameter 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 value of the alarming parameter oscillates around the alarm limit. The units are based on the selected Alarming Option.

3. Click **Apply** to save any changes and proceed to *Section 3.3.5* to view the values on the Flow Rates tab.

3.3.5 Liquid Meters – Flow Rates Tab

Use this tab to view the current values of a liquid meter's flow rates.

To access this screen:

1. Select the **Flow Rates** tab on the Liquid Meters screen. One of the following three screens displays:

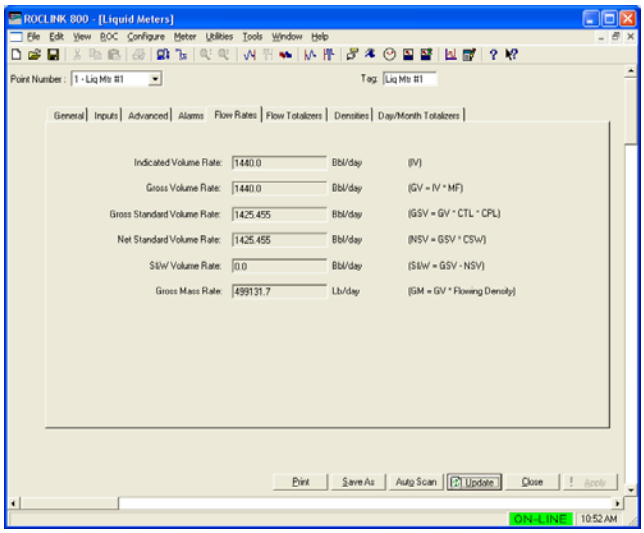

Figure 19(a). Liquid Meters, Flow Rates tab (Meter Type is Linear and Units Type of Flow Meter Input is Volume)

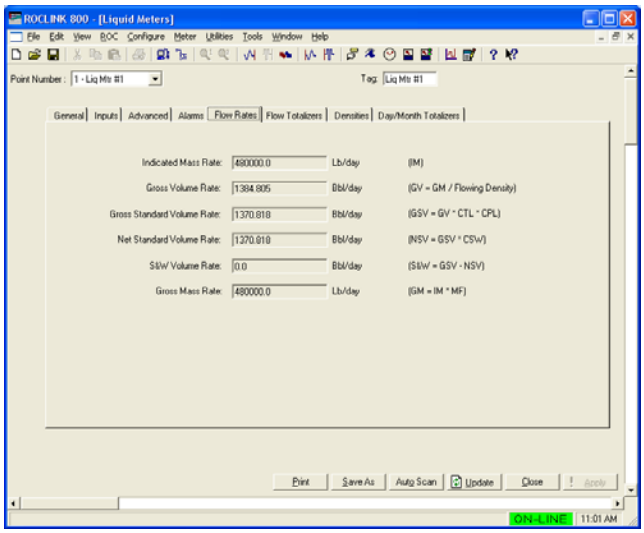

Figure 19(b). Liquid Meters, Flow Rates tab (Meter Type is Linear and Units Type of Flow Meter Input is Mass)

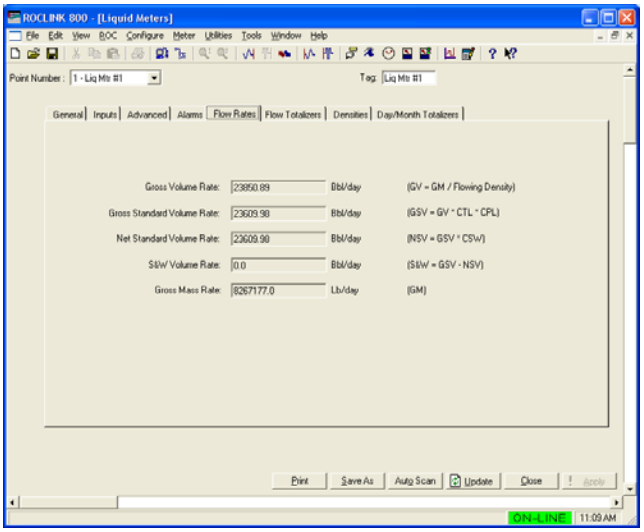

Figure 19(c). Liquid Meters, Flow Rates tab (Meter Type is Orifice)

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

Field	Description
Indicated Volume Rate	This **read-only** field shows the current indicated volume (IV) flow rate. The units are as specified for the volume and flow rate time units selected on the Liquid Preferences screen. **Note:** This field **only** displays when the Meter Type field on the General tab is set to Linear and the Units Type of Flow Meter Input field on the Inputs tab is set to Volume.
Indicated Mass Rate	This **read-only** field shows the current indicated mass (IM) flow rate. The units are as specified for the mass and flow rate time units selected on the Liquid Preferences screen. **Note:** This field **only** displays when the Meter Type field on the General tab is set to Linear and the Units Type of Flow Meter Input field on the Inputs tab is set to Mass.
Gross Volume Rate	This **read-only** field shows the current gross volume (GV) flow rate. If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Volume**, the program calculates this value by multiplying the indicated volume (IV) rate by the meter factor (MF). If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Mass** or if the Meter Type field is set to **Orifice**, he program calculates this value by dividing the gross mass (GM) flow rate by the flowing density. The units are the volume and flow rate time units selected on the Liquid Preferences screen.
Gross Standard Volume Rate	This **read-only** field shows the current gross standard volume (GSV) flow rate. The program calculates this value by multiplying the gross volume (GV) rate by the correction factor for the temperature of the liquid (CTL) and the correction factor for the pressure of the liquid (CPL). The units are the volume and flow rate time units selected on the Liquid Preferences screen.
Net Standard Volume Rate	This **read-only** field shows the current net standard volume (NSV) flow rate. The program calculates this value by multiplying the gross standard volume (GSV) rate by the base sediment and water (S&W) correction factor. The units are as specified for the volume and flow rate time units selected on the Liquid Preferences screen.

Field	Description
S&W Volume Rate	This **read-only** field shows the current sediment and water (S&W) volume flow rate. The program calculates this value by subtracting the net standard volume (NSV) flow rate from the gross standard volume (GSV) flow rate. The units are as specified for the volume and flow rate time units selected on the Liquid Preferences screen.
Gross Mass Rate	This **read-only** field shows the current gross mass (GM) flow rate. The units are as specified for the mass and flow rate time units selected on the Liquid Preferences screen. If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Volume**, the program calculates this value by multiplying the gross volume (GV) flow rate by the flowing density. If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Mass**, the program calculates this value by multiplying the indicated mass (IM) flow rate by the meter factor (MF). If the Meter Type field on the General tab is set to **Orifice**, this value is the result of the ISO5167-2003 orifice flow rate calculation.

3. Click **Apply** to save any changes and proceed to *Section 3.3.6* to view the values on the Flow Totals tab.

3.3.6 Liquid Meters – Flow Totalizers Tab

Use this tab to view the values of a liquid meter's continuous flow totalizers.

Note: Each totalizer value rolls over when its value exceeds 1,000,000.

To access this screen:

1. Select the **Flow Totalizers** tab on the Liquid Meter screen. One of the following three screens displays:

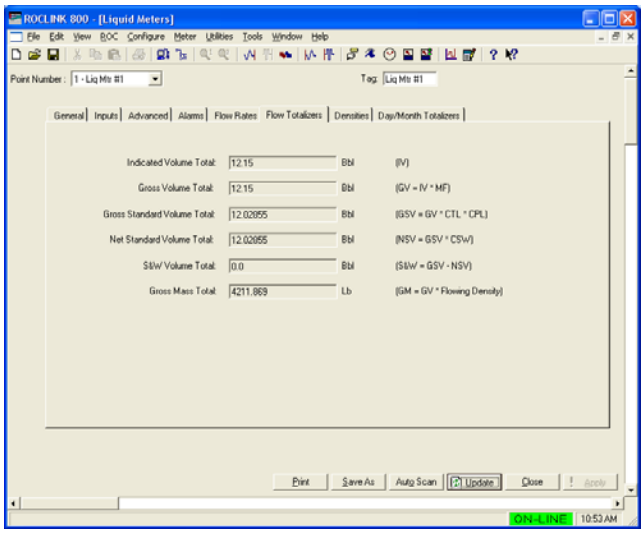

Figure 20(a). Liquid Meters, Flow Totalizers tab (Meter Type is Linear and Units Type of Flow Meter Input is Volume)

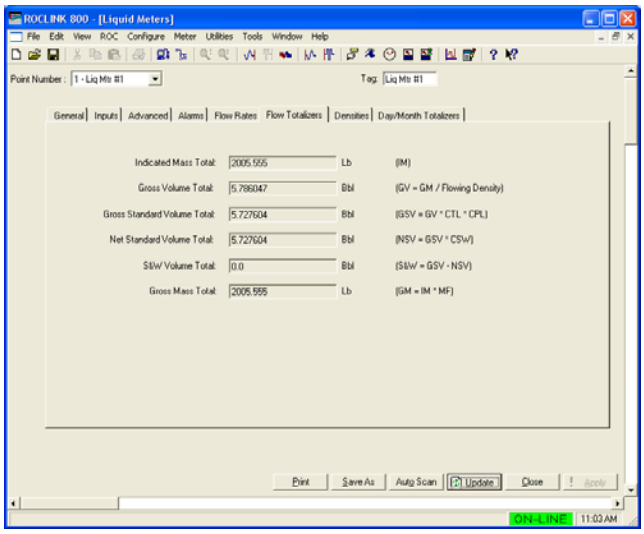

Figure 20(b). Liquid Meters, Flow Totalizers tab (Meter Type is Linear and Units Type of Flow Meter Input is Mass)

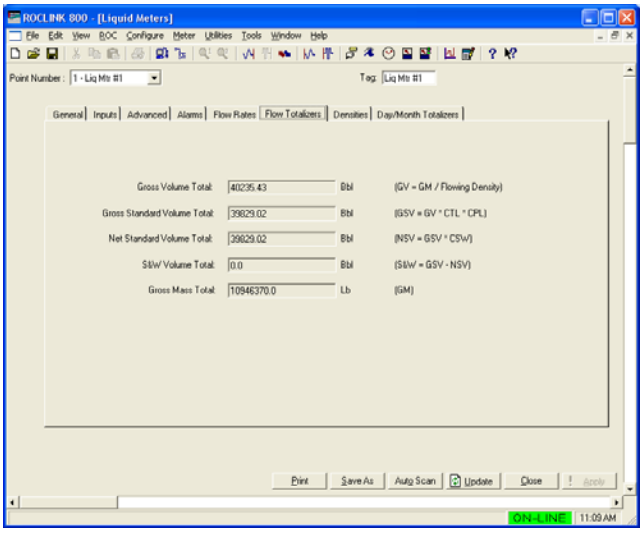

Figure 20(c). Liquid Meters, Flow Totalizers tab (Meter Type is Orifice)

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

Field	Description
Indicated Volume Total	This **read-only** field shows the indicated volume (IV) flow totalizer. The units are the volume units selected on the Liquid Preferences screen. **Note:** This field **only** displays when the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Volume**.
Indicated Mass Total	This **read-only** field shows the indicated mass (IM) flow totalizer. The units are the mass units selected on the Liquid Preferences screen. **Note:** This field **only** displays when the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Mass**.
Gross Volume Total	This **read-only** field shows the current gross volume (GV) flow totalizer. If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Volume**, the program calculates this value by multiplying the indicated volume (IV) flow by the meter factor (MF). The result is added to the totalizer once a second. If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Mass**, or if the Meter Type is Orifice, the program calculates this value by dividing the gross mass (GM) flow by the flowing density. The result is added to the totalizer once a second. The units are the volume units selected on the Liquid Preferences screen.
Gross Standard Volume Total	This **read-only** field shows the gross standard volume (GSV) flow totalizer. The program calculates this value by multiplying the gross volume (GV) flow by the correction factor for the temperature of the liquid (CTL) and the correction factor for the pressure of the liquid (CPL). The result is added to the totalizer once a second. Units are the volume units selected on the Liquid Preferences screen.
Net Standard Volume Total	This **read-only** field shows the current net standard volume (NSV) flow totalizer. The program calculates this value by multiplying the gross standard volume (GSV) flow by the base sediment and water (CSW) correction factor. The result is added to the totalizer once a second. Units are the volume units selected on the Liquid Preferences screen.

Field	Description
S&W Volume Total	This **read-only** field shows the sediment and water (S&W) volume flow totalizer. The program calculates this value by adding, the net standard volume (NSV) flow minus the gross standard volume (GSV) flow, to the totalizer once a second. The units are the volume units selected on the Liquid Preferences screen.
Gross Mass Total	This **read-only** field shows the gross mass (GM) flow totalizer. If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Volume**, the program calculates this value by multiplying the gross volume (GV) flow by the flowing density. The result is added to the totalizer once a second. If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Mass**, the program calculates this value by multiplying the indicated mass (IM) flow by the meter factor (MF). The result is added to the totalizer once a second. If the Meter Type field on the General tab is set to **Orifice**, the program calculates this value by integrating the result of the ISO5167-2003 orifice flow rate calculation, once a second. The units are the mass units selected on the Liquid Preferences screen.

3. Click **Apply** to save any changes.
4. Click **Close** to close this screen. Proceed to *Section 3.3.7* to view the values on the Densities tab.

3.3.7 Liquid Meters – Densities Tab

Use this tab to view a meter's correction factors, densities, and information showing how these values are calculated.

To access this screen:

1. Select the **Densities** tab on the Liquid Meters screen. One of the following two screens displays:

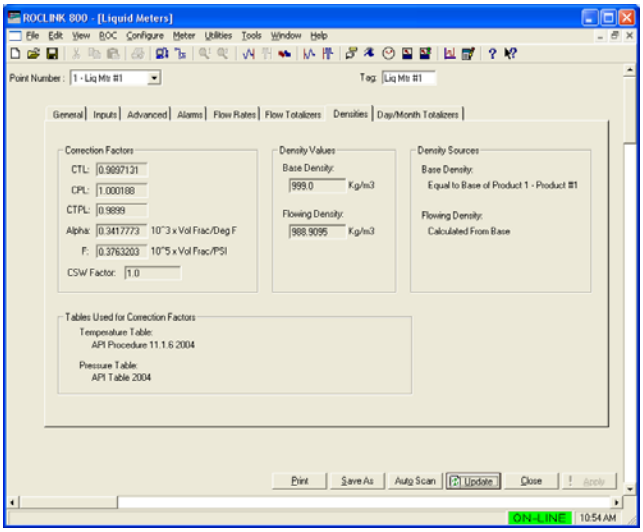

Figure 21(a). Liquid Meters, Densities tab (Base Density Source is Product)

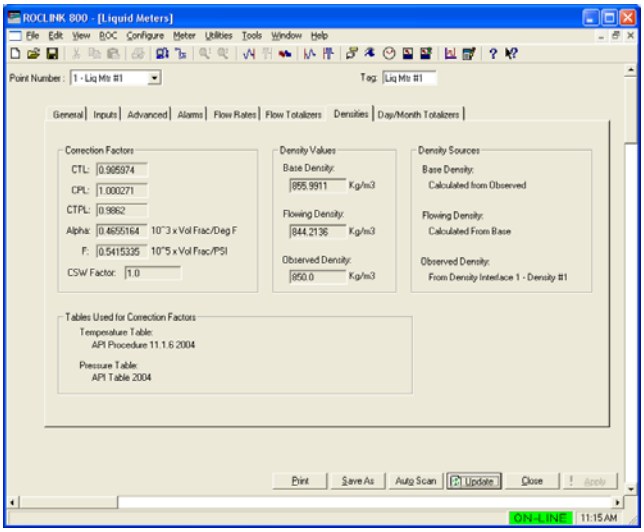

Figure 21(b). Liquid Meters, Densities tab (Base Density Source is Density Interface)

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

Field	Description
CTL	This **read-only** field shows the correction factor for the temperature of the liquid when calculating the flowing density from the base density. The value is updated each main calculation period (mcp), which is one minute, using the average temperature during the mcp.
CPL	This **read-only** field shows the correction factor for the pressure of the liquid when calculating the flowing density from the base density. The value is updated each main calculation period (mcp), which is one minute, using the average pressure during the mcp.
CTPL	This **read-only** field shows the correction factor for the temperature and pressure of the liquid when calculating the flowing density from the base density. It is calculated as CTL * CPL.

Field	Description
Alpha	This **read-only** field shows the coefficient of thermal expansion of the liquid when adjusting the volume from the base to the flowing temperature. The units are 10^3 times the volume fraction per temperature unit. The temperature units are as specified on the Liquid Preferences screen.
F	This **read-only** field shows the compressibility of the liquid when adjusting the volume from the base to the flowing pressure. If the meter's base pressure is 60 Deg F, the units are 10^5 times the volume fraction per pressure unit. If the meter's base pressure is 15, 20, or 30 Deg C, the units are 10^6 times the volume fraction per pressure unit. The pressure units are as specified on the Liquid Preferences screen.
CSW Factor	This **read-only** field shows the correction factor for the sediment and water in the liquid. It is calculated as (100 – S&W) / 100. Its value is 1.0 when the % of sediment and water (S&W) is 0.0 %.
Base Density (Density Values)	This **read-only** field shows the density of the liquid at the base temperature and pressure. The units are specified by the Base and Flowing Density Units field on the Liquid Preferences screen.
Flowing Density (Density Values)	This **read-only** field shows the density of the liquid at the flowing temperature and pressure. The units are specified by the Base and Flowing Density Units field on the Liquid Preferences screen.
Observed Density (Density Values)	This **read-only** field shows the density of the liquid at the observed temperature and pressure. The units are specified by the Base and Flowing Density Units field on the Liquid Preferences screen. **Note:** This field **only** displays when the Density Option on the Inputs tab is set to one of the selections for calculating the base from the observed density.
Base Density (Density Sources)	This **read-only** field shows the source of the base density value. Valid values are Equal to Base of Product or Calculated from Observed.
Flowing Density (Density Sources)	This **read-only** field shows the source of the flowing density value. Valid values are Calculated from Base or Equal to Observed.
Observed Density (Density Sources)	This **read-only** field shows the density interface point for the observed density. **Note:** This field **only** displays when the Density Option on the Inputs tab is set to one of the selections for calculating the base from the observed density.

Field	Description
Tables Used for Correction Factor	This **read-only** field shows the correction standards (also referred to as "table") used in calculating the flowing density and, if specified, base density of the liquid.
Tables Used for Correction Factor (continued)	**Temperature Table** — This **read-only** field shows the temperature correction standard (also referred to as "table") used in calculating the flowing density and, if specified, base density of the liquid. The following are the possible entries for the field. Entries followed by "*" indicate the base density value for the table is converted to the density units required by the table.

- API Table 5A/6A
- API Table 5B/6B
- API Table 5D/6D
- API Table 6C
- API Table 23A/24A
- API Table 23B/24B
- API Table 23D/24D
- GPA TP-27 23E/24E
- API Table 24C
- API Table 53A/54A
- API Table 53B/54B
- API Table 53D/54D
- GPA TP-27 Table 53E/54E
- API 2540 Table 54C
- IP-3 Table 59A/60A
- IP-3 Table 59B/60B
- IP-3 Table 59D/60D
- GPA TP-27 Table 59E/60E
- API Procedure 11.1.6 2004
- API Procedure 11.1.7 2004
- API Table 23A/24A*
- API Table 23B/24B*
- API Table 23D/24D*
- GPA TP-27 23E/24E*
- API Table 24C*
- API Table 53A/54A*
- API Table 53B/54B*
- API Table 53D/54D*
- GPA TP-27 Table 53E/54E*
- API 2540 Table 54C*
- IP-3 Table 59A/60A*
- IP-3 Table 59B/60B*
- IP-3 Table 59D/60D*
- GPA TP-27 Table 59E/60E*
- API 11.4.1 (2003) Invalid Table

Note: "Invalid Table" appears when the liquid type is a refined product (gasoline, jet fuel, or fuel oil) and the base density is out of range. The valid base density range for refined products are as follows:

1980 Tables: 350.0 – 1075.0 kg/m3
2004 Tables: 350.0 – 1163.5 kg/m3.

Field	Description	
Tables Used for Correction Factor (continued)	**Pressure Table**	This **read-only** field shows the pressure correction standard (also referred to as "table") used in calculating the flowing density and, if specified, base density of the liquid. The following are the possible entries for the field. User Entered F API Table 11.2.1 API Table 11.2.1M API Table 11.2.2 API Table 11.2.2M API Prodedure 11.1.6 2004 API Prodedure 11.1.7 2004 API 11.4.1 2003 Invalid Table **Note:** "Invalid Table" appears when the liquid type is a refined product (gasoline, jet fuel, or fuel oil) and the base density is out of range. The valid base density range for refined products are as follows: 1980 Tables: 350.0 – 1075.0 kg/m3 2004 Tables: 350.0 – 1163.5 kg/m3

3. Click **Apply** to save any changes and proceed to *Section 3.3.8* to view the values on the Day/Month Totalizers tab.

3.3.8 Liquid Meters – Day/Month Totalizers Tab

Use this tab to view a liquid meter's totalizers for the current and previous day and month.

To access this screen:

1. Select the **Day/Month Totalizers** tab on the Liquid Meters screen. One of the following three screens displays:

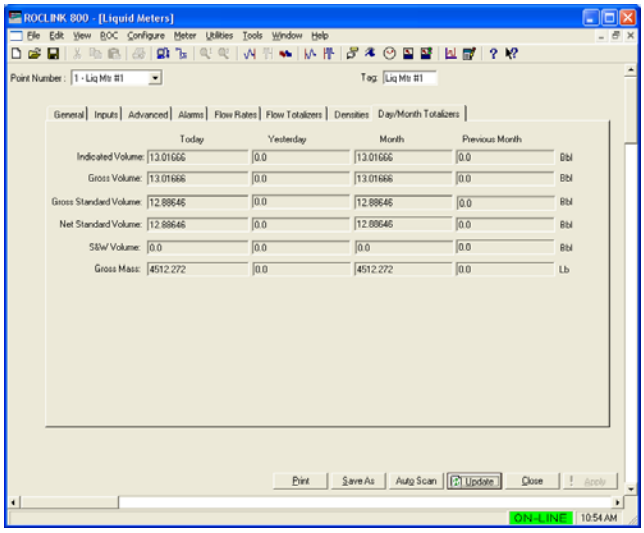

Figure 22(a). Liquid Meters, Day/Month Totalizer tab (Meter Type is Linear and Units Type of Flow Meter Input is Volume)

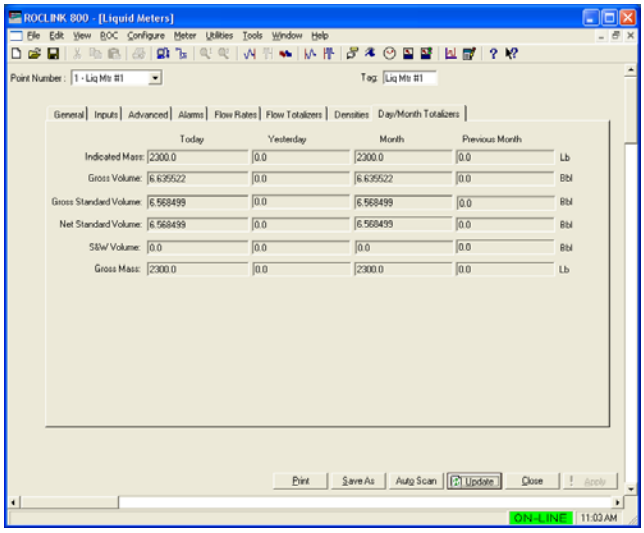

Figure 22(b). Liquid Meters, Day/Month Totalizer tab (Meter Type is Linear and Units Type of Flow Meter Input is Mass)

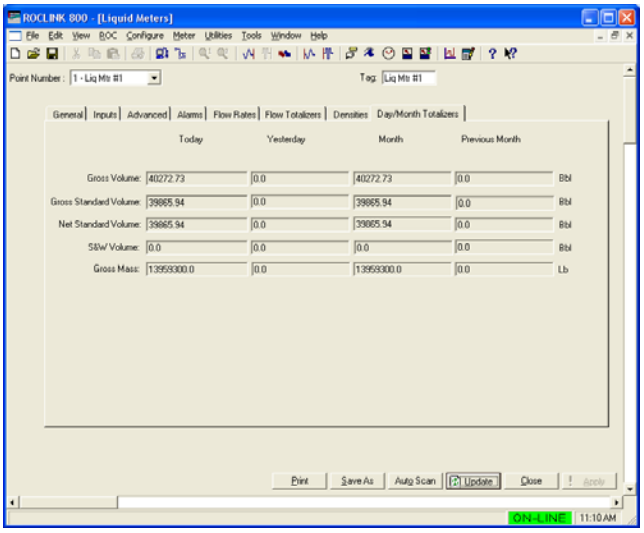

Figure 22(c). Liquid Meters, Day/Month Totalizer tab (Meter Type is Orifice)

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

Field	Description
Indicated Volume	This **read-only** field shows the indicated volume (IV) flow totals for the current and previous days and months. The units are the volume units selected on the Liquid Preferences screen. **Note:** This field **only** displays when the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Volume**.
Indicated Mass	This **read-only** field shows the indicated mass (IM) flow totals for the current and previous days and months. The units are the mass units selected on the Liquid Preferences screen. **Note:** This field **only** displays when the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Mass**.
Gross Volume	This **read-only** field shows the gross volume (GV) flow totals for the current and previous days and months. If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Volume**, the program calculates this value by multiplying the indicated volume (IV) by the meter factor (MF) and adding the result to the totalizers. This calculation occurs once a second. If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Mass**, or if the Meter Type field on the General tab is set to is **Orifice**, the program calculates this value by dividing the gross mass (GM) flow by the flowing density and adding the result to the totalizers. This calculation occurs once a second. The units are the volume units selected on the Liquid Preferences screen.
Gross Standard Volume	This **read-only** field shows the gross standard volume (GSV) flow totals for the current and previous days and months. The program calculates these values by adding the gross volume (GV) multiplied by the correction factors for the temperature of the liquid (CTL) and pressure of the liquid (CPL) to the totalizers once a second. The units are the volume units selected on the Liquid Preferences screen.

Field	Description
Net Standard Volume	This **read-only** field shows the net standard volume (NSV) flow totals for the current and previous days and months. The program calculates these values by adding the gross standard volume (GSV) multiplied by the sediment and water (CSW) correction factor to the totalizers once a second. The units are the volume units selected on the Liquid Preferences screen.
S&W Volume	This **read-only** field shows the sediment and water (S&W) flow totals for the current and previous days and months. The program calculates these values by adding the net standard volume (NSV) flow minus the gross standard volume (GSV) flow to the totalizers once a second. The units are the volume units selected on the Liquid Preferences screen.
Gross Mass	This **read-only** field shows the gross mass (GM) flow totals for the current and previous days and months. If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Volume**, the values are calculated by adding the gross volume (GV) flow multiplied by the flowing density to the totalizers once a second. If the Meter Type field on the General tab is set to **Linear** and the Units Type of Flow Meter Input field on the Inputs tab is set to **Mass**, the values are calculated by adding the indicated mass (IM) flow multiplied by the meter factor (MF) to the totalizers once a second. If the Meter Type field on the General tab is set to **Orifice**, the values are calculated by integrating the result of the ISO5167-2003 orifice flow rate calculation once a second. The units are the mass units selected on the Liquid Preferences screen.

3. Click **Apply** to save any changes.
4. Click **Close** to close this screen. Proceed to *Section 3.4* to configure the liquid density interfaces and view the calculated values.

3.4 Liquid Density Interfaces Screen

Use this screen to configure up to two liquid density interfaces, and view the resulting calculated (also called "observed") density values.

To access this screen:

1. Click **User Program** > **Liquid Alloc** from the ROCLINK configuration tree.
2. Double-click **Display #27, Liquid Density Interfaces**. The Liquid Density Interfaces screen displays:

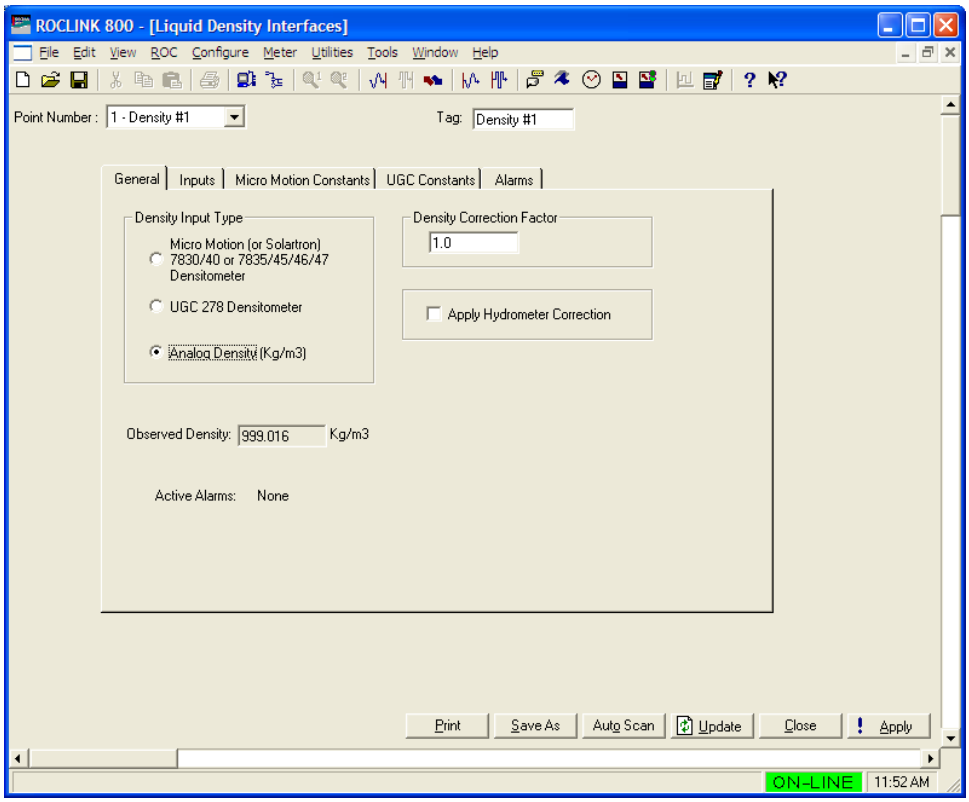

Figure 23. Liquid Density Interfaces Screen

Note: Two fields at the top of the screen (Point Number and Tag) appear on all tabs.

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

Field	Description
Point Number	Selects the liquid density interface to configure. Click ▼ to display all of the liquid density interfaces. Clicking a different liquid density interface causes the screen to display the values for that density interface.
Tag	Sets a unique identifier for the selected liquid density interface.

4. Click **Apply** to save any changes, and proceed to *Section 3.4.1* to configure the General tab.

3.4.1 Liquid Density Interfaces – General Tab

Use this tab (which displays when you access the Liquid Density Interfaces screen) to configure a density interface point's type of density input and correction factor, and view its observed density and alarm statuses.

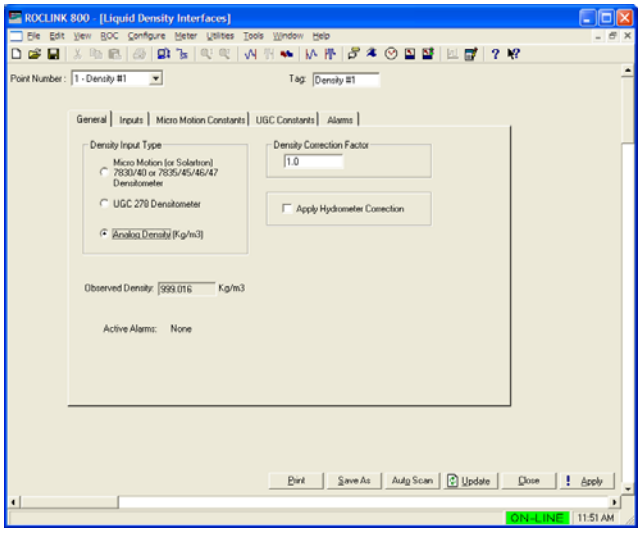

Figure 24(a). Liquid Density Interfaces, General tab (Density Input Type is an Analog Density)

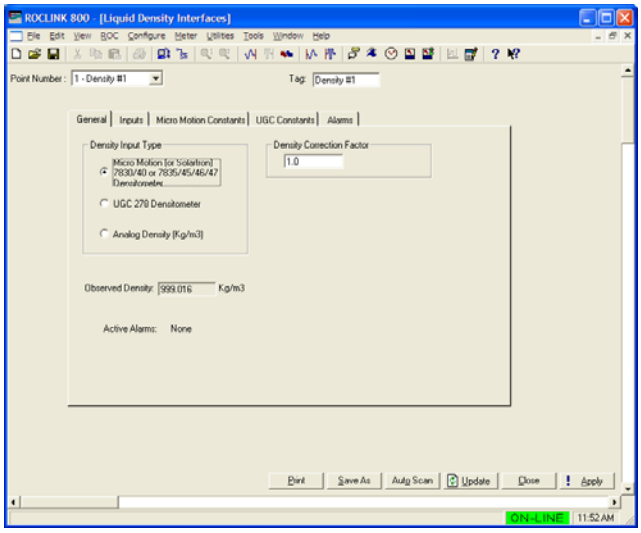

Figure 24(b). Liquid Density Interfaces, General tab (Density Input Type is a Frequency Densitometer)

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

Field	Description
Density Input Type	Sets the type of density input. The density value can be from a frequency densitometer or an analog value. Valid selections include Micro Motion (or Solartron) 7830/40 or 7835/45/46/47, UGC 278 Densitometer, and Analog Density. **Note:** The input units of a frequency densitometer are Hz. The resulting density is in the units of the Observed Density specified on the Liquid Preference screen. The units of an Analog Density Input value must be the units of the Observed Density specified on the Liquid Preferences screen.
Observed Density	This **read-only** field shows the calculated observed density of the selected density interface point. The units are those for the Observed Density specified on the Liquid Preferences screen.

Field	Description
Active Alarms	This **read-only** field shows the status of any active alarms of the density interface point. Possible alarms are Low, High, and Manual. **Notes:** ▪ A Manual alarm means one or more of the density, temperature, or pressure I/O definitions on the Inputs tab is Undefined. ▪ You define these alarms on the Alarms tab.
Density Correction Factor	Sets a density correction factor, which is a multiplier to correct the densitometer's calculated density. This value is typically obtained after performing a densitometer calibration using a pycnometer or similar device.
Apply Hydrometer Correction	Select to apply a correction for the temperature effects on a glass hydrometer. For more information, refer to the *Manual of Petroleum Measurement Standards, Chapter 9*. **Note:** This field **only** displays when **Analog Density** is selected as the Density Input Type.

2. Click **Apply** to save any changes and proceed to *Section 3.4.2* to configure the Inputs tab.

3.4.2 Liquid Density Interfaces – Inputs Tab

Use this tab to configure a density interface point's inputs for density, temperature, and pressure.

To access this tab:

1. Select the **Inputs** tab on the Liquid Density Interfaces screen. One of the following two screens display:

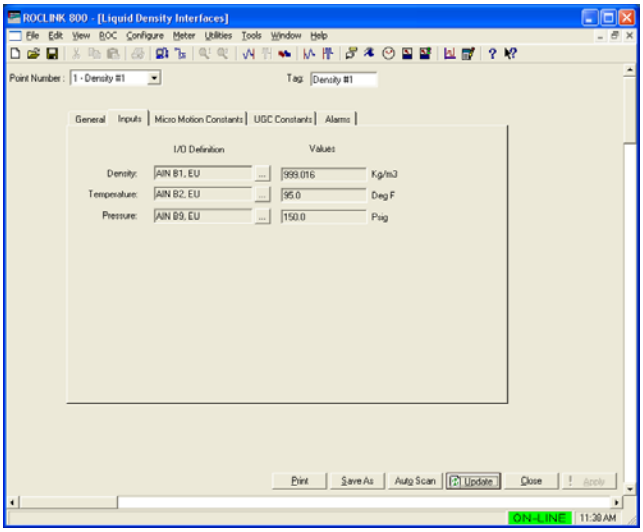

Figure 25(a). Liquid Density Interfaces, Inputs tab (Density Input Type is an Analog Density)

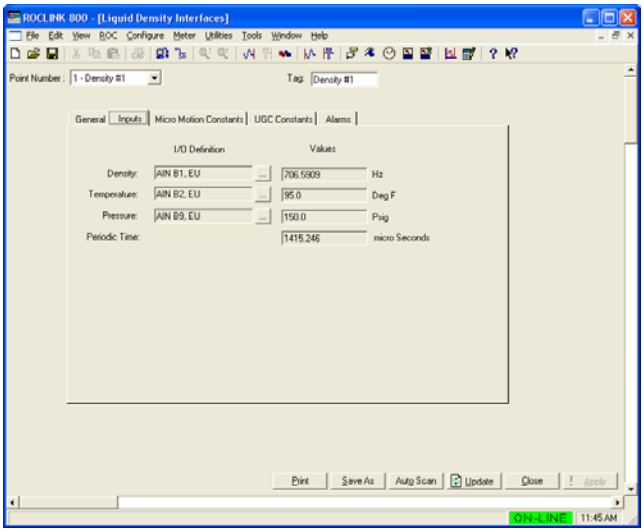

Figure 25(b). Liquid Density Interfaces, Inputs tab (Density Input Type is a Frequency Densitometer)

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

Field	Description
Density	Assigns the point type, logical, and parameter (TLP) of the density I/O value of the selected density interface point. Click ... to display the Select TLP screen and define your TLP selection. **Note:** If you select **Undefined (0, 0, 0)** for the density input, you can manually enter a value for the density input. Otherwise, the value of the selected input is displayed.
Temperature	Assigns the point type, logical, and parameter (TLP) of the temperature I/O value for the selected density interface point. Click ... to display the Select TLP screen and define your TLP selection. **Note:** If you select **Undefined (0, 0, 0)** for the temperature input, you can manually enter a value for the temperature. Otherwise, the value of the selected input is displayed.

Field	Description
Pressure	Assigns the point type, logical, and parameter (TLP) of the pressure I/O value for the selected density interface point. Click ... to display the Select TLP screen and define your TLP selection. **Note:** If you select **Undefined (0, 0, 0)** for the pressure input, you can manually enter a value for the static pressure. Otherwise, the value of the selected input is displayed.
Periodic Time	This **read-only** field shows the time between pulses in microseconds. **Note:** This field displays **only** if a **Frequency Densitometer** is selected as the Density Input Type.

3. Click **Apply** to save any changes.
4. Click **Close** to close this screen. Proceed to *Section 3.4.3* to configure the Micro Motion Constants tab.

3.4.3 Liquid Density Interfaces – Micro Motion Constants Tab

Use this tab to configure a density interface point's constants for calculating the density of a Micro Motion densitometer.

Notes:

- Micro Motion densitometers were formerly labeled as Solartron densitometers.
- These fields **only** display when the Density Input Type field on the General tab is set to **Micro Motion (or Solartron) 7830/40 or 7835/45/46/47**. For further details, refer to the Micro Motion Technical Manual for 7835/45/46/47 Liquid Density Meter (78355080_US Rev. C, October 2007)
- The constants entered must be from a calibration certificate using density units of Kg/m3, temperature units of Deg C, and pressure units of BarA.

To access this screen:

1. Select the **Micro Motion Constants** tab on the Liquid Density Interfaces screen. One of the following two display:

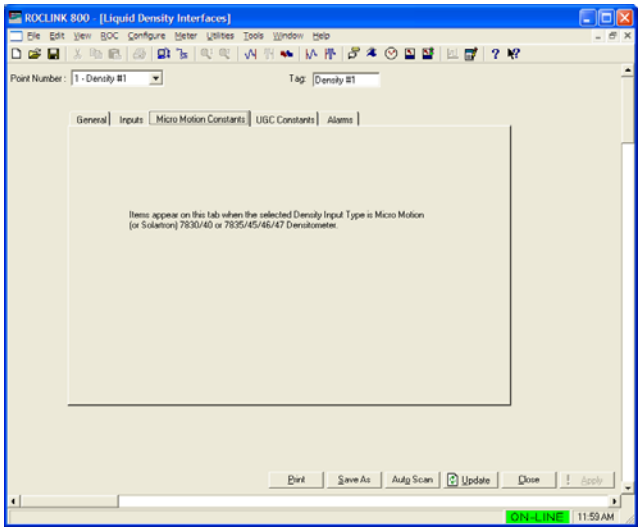

Figure 26(a). Liquid Density Interfaces, Micro Motion Constants tab [Density Input Type is not a Micro Motion (or Solartron) Densitometer]

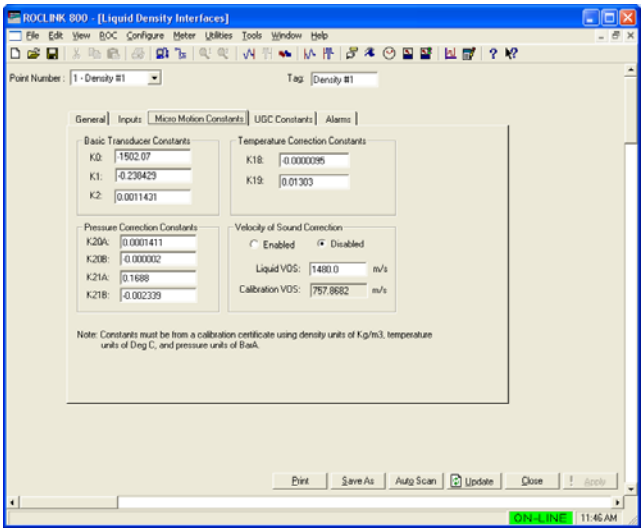

Figure 26(b). Liquid Density Interfaces, Micro Motion Constants tab [Density Input Type is a Micro Motion (or Solartron) Densitometer]

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

Field	Description
Basic Transducer Constants	Sets three transducer constant values KO, K1 & K2 used to calculate the uncorrected density for the Micro Motion (or Solartron) densitometer.

Field	Description	
Pressure Correction Constants	Sets four pressure correction constant values (K20A, K20B, K21A, and K21B) for the Micro Motion (or Solartron) densitometer.	
Temperature Correction Constants	Sets two temperature correction constant values (K18 & K19) for the Micro Motion (or Solartron) densitometer.	
Velocity of Sound Correction	Enables or disables correction of the density for the velocity of sound in the liquid. Valid values are Enabled or Disabled.	
	Liquid VOS	Sets a value for the velocity of sound in the liquid for the Micro Motion (or Solartron) densitometer.
	Calibration VOS	This **read-only** field shows the calculated calibration value for the velocity of sound in the liquid based on the temperature and pressure corrected density.

3. Click **Apply** to save any changes and proceed to *Section 3.4.4* to configure the UGC Constants tab.

3.4.4 Liquid Density Interfaces – UGC Constants Tab

Use this tab to configure a density interface point's constants for calculating the density for a UGC 278 densitometer.

Notes:

- These fields **only** display when the Density Input Type field on the General tab is set to **UGC 278 Densitometer**. For further details, refer to the (UGC) Model 278 Vibrating Densitometer User Manual (UA27800 Rev B).
- The constants entered must be from a calibration certificate using density units of g/cm3, temperature units of Deg F, and pressure units of Psig.

To access this screen:

1. Select the **UGC Constants** tab on the Liquid Density Interfaces screen. One of the following two screens display:

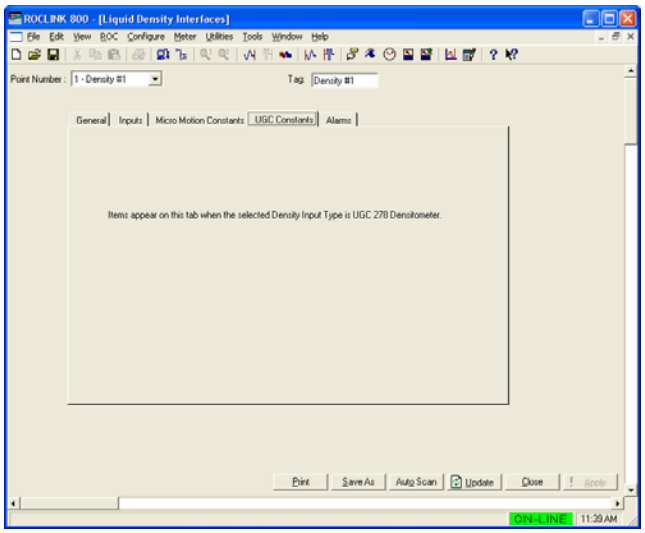

Figure 27(a). Liquid Density Interfaces, UGC Constants tab (Density Input Type is not a UGC 278 Densitometer)

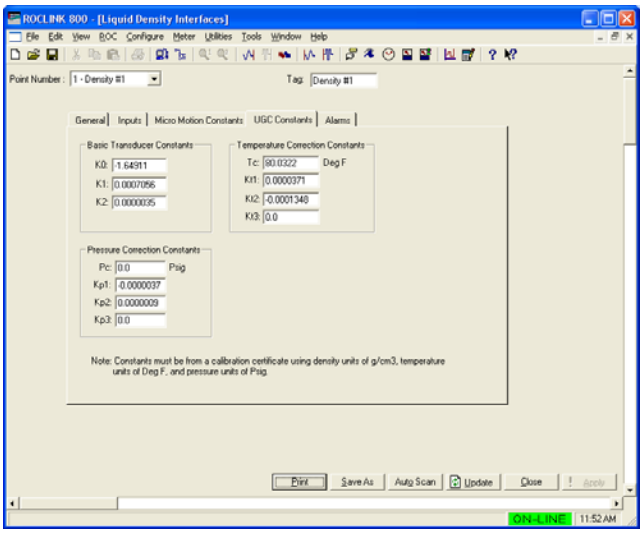

Figure 27(b). Liquid Density Interfaces, UGC Constants tab (Density Input Type is a UGC 278 Densitometer)

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

Field	Description
Basic Transducer Constants	Sets three transducer constant values KO, K1 & K2 used to calculate the uncorrected density for the UGC densitometer.
Pressure Correction Constants	Sets the calibration pressure (Pc) and three pressure correction constant values (Kp1, Kp2, and Kp3) for the UGC densitometer.

Field	Description
Temperature Correction Constants	Sets the calibration temperature (Tc) and three temperature correction constant values (Kt1, Kt2, and Kt3) for the UGC densitometer.

3. Click **Apply** to save any changes.
4. Click **Close** to close this screen. Proceed to *Section 3.4.5* to configure the Alarms tab.

3.4.5 Liquid Density Interfaces – Alarms Tab

Use this tab to configure the observed density alarming parameters for a density interface point.

To access this screen:

1. Select the **Alarms** tab on the Liquid Density Interfaces screen. The following screen displays:

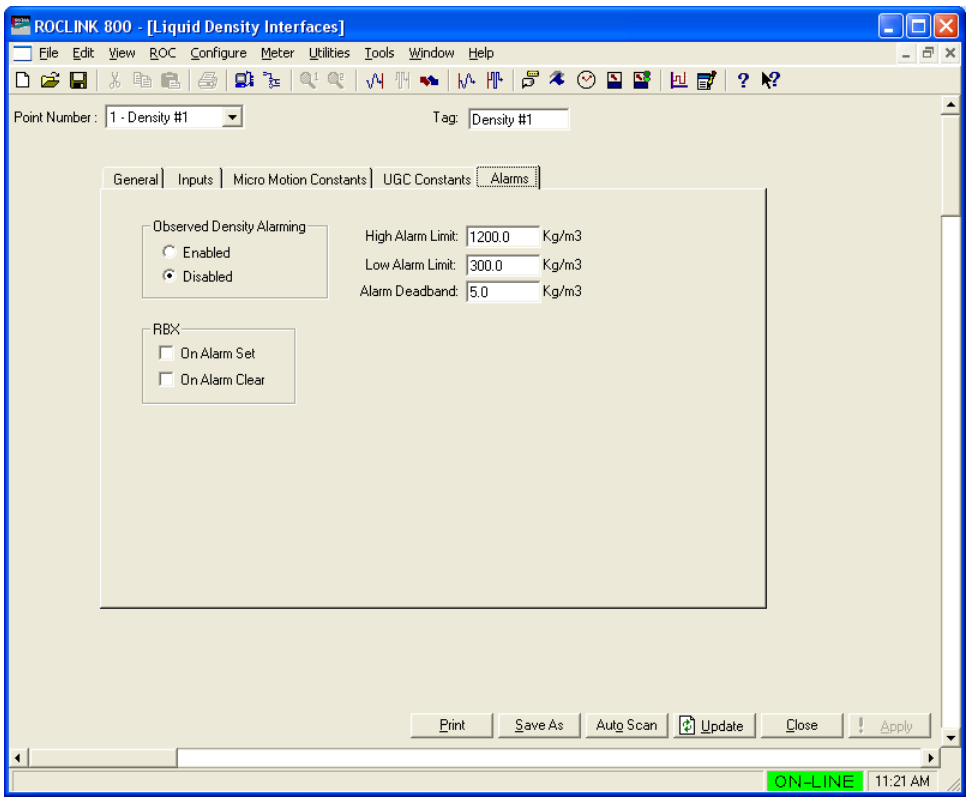

Figure 28. Liquid Density Interfaces, Alarms tab

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

Field	Description	
Observed Density Alarming	Enables or disables alarming of the observed density. If **enabled**, alarm status changes are added to the Alarm Log. If **disabled**, no alarm generates for this density interface point, regardless of the alarm configuration.	
RBX	Enables Report-by-Exception alarm messages. These messages are sent via communication ports that have RBX mode enabled.	
	On Alarm Set	When the observed density value enters the alarm condition, the FB107 generates an RBX message(s).

Field	Description	
	On Alarm Clear	When the observed density value clears the alarm condition, the FB107 generates an RBX message(s).
High Alarm Limit	Sets the value at or above which the value of the observed density must rise to generate a high alarm. The units are those of the Observed Density on the Liquid Preferences screen.	
Low Alarm Limit	Sets the value at or below which the value of the observed density must fall to generate a low alarm. The units are those of the Observed Density on the Liquid Preferences screen.	
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 value of the observed density 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 value of the observed density oscillates around the alarm limit. The units are those of the Observed Density on the Liquid Preferences screen.	

3. Click **Apply** to save any changes.
4. Click **Close** to close this screen. Proceed to *Section 3.5* to save the configuration.

3.5 Saving the Configuration

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

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

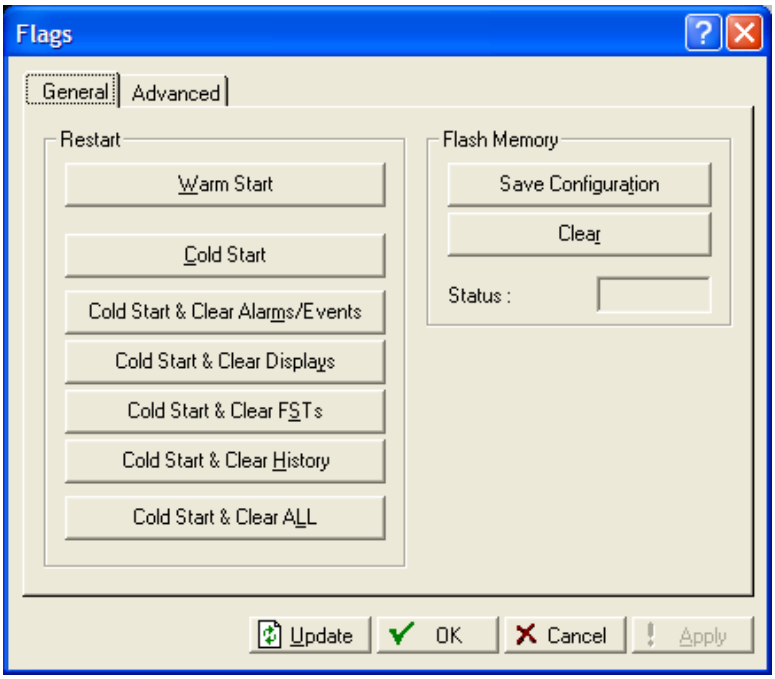

Figure 29. Flags

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

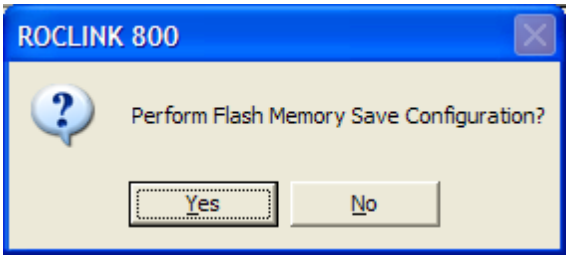

Figure 30. Save Verification

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

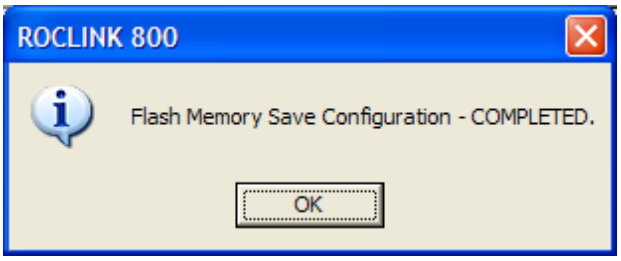

Figure 31. Confirmation

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.

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Chapter 4 – Reference

This section presents tables of ranges of base densities for each of the Liquid Types shown on the Liquid Products screen, discusses how history is handled by the program, and lists the parameters of the user defined points used by the Liquid Allocation program, including the following.

- Point Type 22: Liquid Preferences Point Type
- Point Type 23: Liquid Products Point Type
- Point Type 25: Liquid Meters Point Type
- Point Type 26: Liquid Density Interfaces Point Type

4.1 Density Ranges for Liquid Product Types

The following tables show the ranges of base densities for the types of liquid that can be selected on the Liquid Products screen. Be sure to review the notes for each liquid type when determining which liquid applies to your application.

Crude Oil (Includes Gas Well Condensate)		
Table Version	**Base Density Range (Kg/m3)**	**Base Density Range (API Gravity)**
1980	610 – 1075	0 – 100
2004	610 – 1165	-10 – 100
Note: Paraffinic condensate (drip gasoline) from a gas well comprised of butanes, pentanes, hexanes, and heptanes should be considered Crude Oil, provided its base density lies within the range for Crude Oil. Otherwise, it should be considered a Light Hydrocarbon.		

Gasoline, Jet Fuel, and Fuel Oil (Refined Products)		
Table Version	**Base Density Range (Kg/m3)**	**Base Density Range (API Gravity)**
1980	650 – 1075	0 – 85
2004	610 – 1165	-10 – 100

Notes:

- Aromatic natural gasoline should be considered Gasoline.
- With the 1980 Table, even though one of the refined products is specified as the liquid product type, the program compares the meter run's base density against the ranges listed below and calculates the flowing density based on the product that falls within the range.

  > 1075 Kg/m3 – Invalid Table

  >= 838.9 Kg/m3 – Fuel Oil

  >= 787.5 Kg/m3 – Jet Fuel

  >= 770.5 Kg/m3 – Transition Product

  >= 350 Kg/m3 – Gasoline (even though the low range is 650 Kg/m3, the program calculates a flowing density if the base density is greater than or equal to 350 Kg/m3).

  < 350 Kg/m3 – Invalid Table

- With the 2004 Table, even though one of the refined products is specified as the liquid product type, the program compares the meter run's base density against the ranges listed below and calculates the flowing density based on the product that falls within the range.

  > 1163.5 Kg/m3 – Invalid Table

  >= 838.3 Kg/m3 – Fuel Oil

  >= 787.5 Kg/m3 – Jet Fuel

  >= 770.4 Kg/m3 – Transition Product

  >= 350 Kg/m3 – Gasoline (even though the low range is 650 Kg/m3, the program calculates a flowing density if the base density is greater than or equal to 350 Kg/m3).

  < 350 Kg/m3 – Invalid Table

Lube Oil		
Table Version	**Base Density Range (Kg/m3)**	**Base Density Range (API Gravity)**
1980	800 – 1165	-10 – 45
2004	800 – 1165	-10 – 45
Note: A Lube Oil is derived from a crude oil fraction by distillation or asphalt precipitation.		

Special Application (User Specified Alpha)		
Table Version	**Base Density Range (Kg/m3)**	**Base Density Range (API Gravity)**
1980	610 – 1165	-10 – 100
2004	610 – 1165	-10 – 100
Note: The valid range of the coefficient of thermal expansion (Alpha) is: 230.0 x 10^{-6} to 930.0 x 10^{-6} volume fraction per Deg F 414.0 x 10^{-6} to 1674.0 x 10^{-6} volume fraction per Deg C		

Light Hydrocarbon (Includes LPG and NGL)		
Table Version	**Base Density Range (Kg/m3)**	**Base Density Range (API Gravity)**
TP-27	350 – 690	70 – 275
Note: A LPG (Liquified Petroleum Gas) or NGL (Natural Gas Liquid) comprised of predominately propane and butane should be considered a Light Hydrocarbon, provided its base density lies within the range for Light Hydrocarbon. Otherwise, it should be considered a Crude Oil.		

Water		
Table Version	**Temperature Range (deg F)**	**Density at 60 deg C**
API 11.4.1 2003	33 – 104	999.016 kg/m3

4.2 Liquid Allocation History

For many liquid measurement use cases, it is desirable to calculate hourly and daily flow weighted averages for the process variables (such as temperature, pressure, and density). The Liquid Allocation Program can be used to archive weighted averages in history for a limited set of liquid meter values. When these parameters are configured in the FB107 standard history, the program overrides the typical firmware history mechanism. The program calculates the flow weighted average using the indicated volume. The program performs weighted averages regardless of the archive type you select on the History Setup screen. The following parameters are supported for this feature:

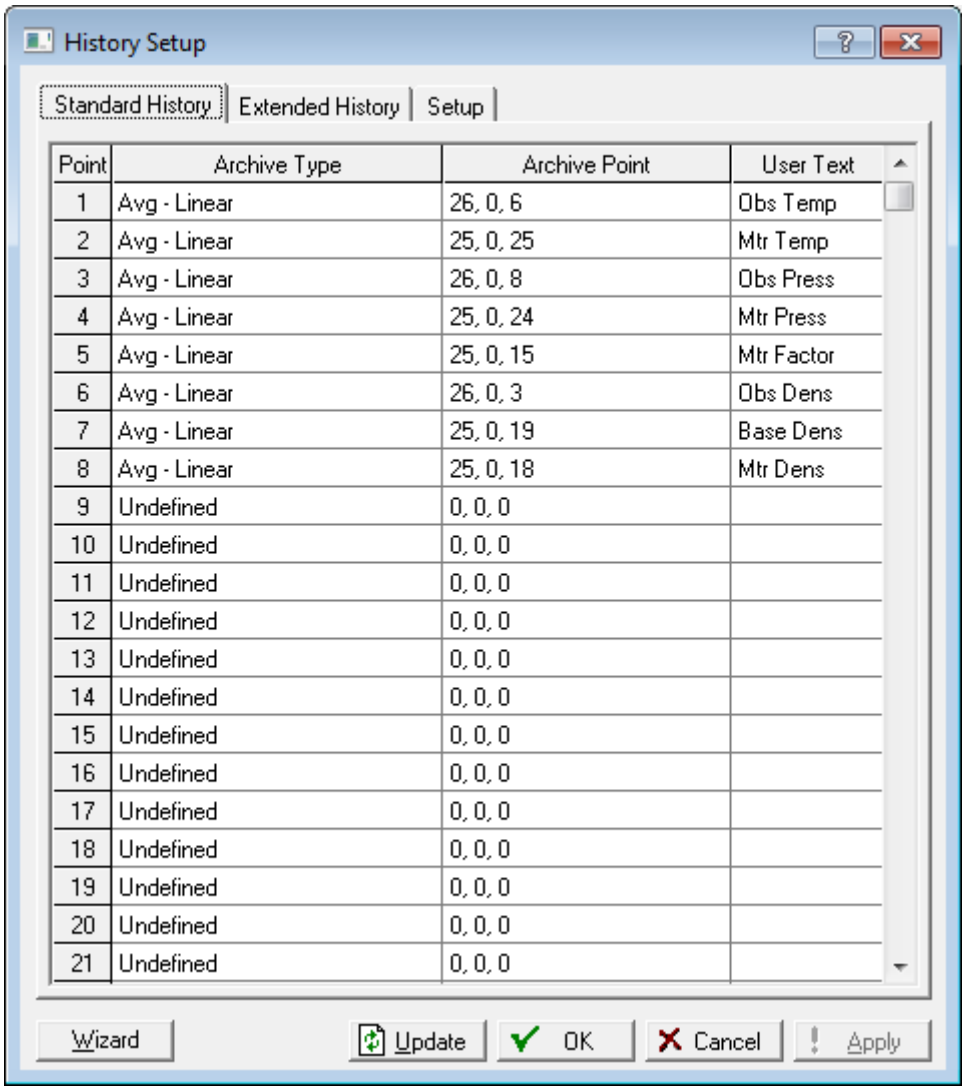
Note: If additional parameters for the Liquid Allocation Program point types are added, they will not be correctly calculated as a flow weighted average.

Parameter Name	Archive Point
Observed Temperature (density)	Liquid Density Interface (26,X,6)
Flowing Temperature (meter)	Liquid Meter (25,X,25)
Observed Pressure (density)	Liquid Density Interface (26,X,8)
Flowing Pressure (meter)	Liquid Meter (25,X,24)
Meter Factor	Liquid Meters (25,0,15)
Observed Density	Liquid Density Interface (26,X,3)
Base Density	Liquid Meters (25,0,19)
Flowing Density (Meter)	Flowing Density (25,0,18)

4.2.1 Typical History Setup

A typical configuration for the history setup for the first Liquid Allocation Program meter is shown below:

Note: The Archive Type implies that a linear average is being recorded; however, the program overrides this selection and stores a flow weighted average which is displayed when the daily or hourly history is retrieved.



Point	Archive Type	Archive Point	User Text
1	Avg - Linear	26, 0, 6	Obs Temp
2	Avg - Linear	25, 0, 25	Mtr Temp
3	Avg - Linear	26, 0, 8	Obs Press
4	Avg - Linear	25, 0, 24	Mtr Press
5	Avg - Linear	25, 0, 15	Mtr Factor
6	Avg - Linear	26, 0, 3	Obs Dens
7	Avg - Linear	25, 0, 19	Base Dens
8	Avg - Linear	25, 0, 18	Mtr Dens
9	Undefined	0, 0, 0	
10	Undefined	0, 0, 0	
11	Undefined	0, 0, 0	
12	Undefined	0, 0, 0	
13	Undefined	0, 0, 0	
14	Undefined	0, 0, 0	
15	Undefined	0, 0, 0	
16	Undefined	0, 0, 0	
17	Undefined	0, 0, 0	
18	Undefined	0, 0, 0	
19	Undefined	0, 0, 0	
20	Undefined	0, 0, 0	
21	Undefined	0, 0, 0	

Figure 32. Typical History Setup

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4.3 Point Type 22: Liquid Preference Parameters

Point type 22 contains the parameters for configuring the units and viewing the program status. There is one logical for this point type.

Point Type 22: Liquid Preferences Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
0	Differential Pressure Units	R/W	UINT8	1	$0 \rightarrow 3$	0	Engineering units for differential pressure values: 0 = InH2O 1 = kPa 2 = mBar 3 = mmH2O
1	Pressure Units	R/W	UINT8	1	$0 \rightarrow 3$	0	Engineering units for pressure values. Flowing pressure units are in gauge or absolute depending on the selection for the meter (TLP=25,meter logical,120, Bit 1). The atmospheric pressure units are always absolute. 0 = Psi 1 = kPa 2 = Bar 3 = Kg/cm2
2	Temperature Units	R/W	UINT8	1	$0 \rightarrow 1$	0	Engineering units for temperature values: 0 = Deg F 1 = Deg C
3	Observed Density Units	R/W	UINT8	1	$0 \rightarrow 6$	0	Engineering units for the observed density determined by a density interface point. 0 = Kg/m3 1 = g/cc 2 = Lb/ft3 3 = Lb/bbl 4 = Lb/gal 5 = Relative Density 6 = API Gravity

Point Type 22: Liquid Preferences Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
4	Length Units	R/W	UINT8	1	0 → 1	0	Engineering units for length (orifice and plate diameters): 0 = Inch 1 = millimeter
5	Viscosity Units	R/W	UINT8	1	0 → 1	0	Engineering units for viscosity of the liquids: 0 = Lb/ft-sec 1 = Cp (centipoise)
6	Volume Units	R/W	UINT8	1	0 → 6	0	Engineering units for volume values: 0 = Bbl 1 = Mcf 2 = Km3 3 = Gal (US) 4 = ft3 5 = m3 6 = Liter
7	Mass Units	R/W	UINT8	1	0 → 4	0	Engineering units for mass values: 0 = Lb 1 = Kg 2 = Ton (short) 3 = Tonne (1000 kg) 4 = Mlb
8	Flowrate Time Units	R/W	UINT8	1	0 → 3	0	Time units for flow rates: 0 = Per day 1 = Per hour 2 = Per minute 3 = Per second
9	Program Status	R/O	UINT8	1	0 → 2	0	Current status of the Liquid Allocation program: 1 = Program running 2 = License key not available

Point Type 22: Liquid Preferences Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
10	Product and Meter Density Units	R/W	UINT8	1	$0 \rightarrow 2$	0	Engineering units for densities of the product and meter point types: 0 = Kg/m3 1 = Relative Density 2 = API Gravity
11	Accumulation Rollover Value	RO	FL	4	> 0.0	1000000	Rollover value for all of the continuous totalizers.
12	Elevation Units	R/W	UINT8	1	$0 \rightarrow 1$	0	Engineering units for elevation: 0 = Feet 1 = Meter

4.4 Point Type 23: Liquid Product Parameters

Point type 23 contains the parameters for configuring the liquid products. There are two logicals for this point type.

Point Type 23: Liquid Product Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
0	Point Tag Id	R/W	AC	10	10 ASCII characters	Logical 0: "Product #1" Logical 1: "Product #2"	Point tag identification for the product.
1	Liquid Type	R/W	UINT8	1	0 → 9	0	Indicates the type of liquid for this product: 0 = Crude Oil 1 = Gasoline 2 = Jet Fuel 3 = Fuel Oil 4 = Lube Oil 5 = Special Application (User Entered Alpha) 6 = Light Hydrocarbon 7 = Water 8 = Used Internally for Transition 9 = Invalid Product
2	API Standard Version	R/W	UINT8	1	1 → 2	2	Indicates the version of the API MPMS Chapter 11.1 standard to use: 1 = 1980 2 = 2004
3	Light Hydrocarbon Standard Version	R/W	UINT8	1	3	3	Indicates the standard to use to calculate the temperature correction factor for light hydrocarbons: 3 = GPA TP-27

Point Type 23: Liquid Product Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
4	Compressibility Option	R/W	UINT8	1	$0 \rightarrow 3$	0	Indicates the method to use for calculating the product's compressibility: 0 = Program determines the method based on the density of the product and units of the base temperature. 1 = API 11.2.1 or API 11.2.1(M) calculation 2 = API 11.2.2 or API 11.2.2(M) calculation 3 = User entered compressibility. This selection is only valid if the 1980 version of the API MPMS Chapter 11.1 standard is selected (parameter #2 is set to 1).
5	Compressibility Factor	R/W	FL	4	>= 0.0	0.349	User specified value of the compressibility (F) for adjusting the volume from the base to the flowing pressure. This value is used only if the user entered compressibility is selected (parameter #4 is set to 3). If the base temperature is 60 Deg F: Units are 10^5 times the volume fraction pressure unit. If the base temperature is 15, 20, or 30 Deg C: Units are 10^6 times the volume fraction per pressure unit.
6	Alpha Coefficient	R/W	FL	4	>= 0.0	0.3418	User entered alpha coefficient. This value is used only if the fluid type selected (parameter #2) is Special Applications (2). The units are volume fraction per temperature increment. The units of the temperature increment are specified by TLP=22,0,2.
7	Base Density	R/W	FL	4	>= 0.0	999.016	Density of the product at base temperature and pressure. Density units are specified by TLP=22,0,10.

4.5 Point Type 25: Liquid Meter Parameters

Point type 25 contains the parameters for configuring the liquid meters and viewing the results of the calculations. There are two logicals for this point type.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
0	Point Tag Id	R/W	AC	10	10 ASCII characters	Logical 0: "Liq Mtr #1" Logical 1: "Liq Mtr #2	Point tag identification.
1	Point Description	R/W	AC	30	30 ASCII characters	" "	Description of the liquid meter.
2	Liquid Product Point	R/W	UINT8	1	0 → 1	0	The liquid product point (0-based,point type 23) assigned to the liquid meter.
3	Meter Units Type	R/W	UINT8	1	0 → 1	0	Indicates the type of units for the flow meter input. This is only used with linear meters. 0 = Volume 1 = Mass
4	Reserved	R/W	UINT8	1	0	0	Reserved
5	Reserved	R/W	UINT8	1	0	0	Reserved
6	Reserved	R/W	FL	1	0	0	Reserved
7	Alarming Option	R/W	UINT8	1	0 → 5	0	If enabled, the indicated parameter for the liquid meter is compared to the alarm limits, and the alarm statuses set and cleared accordingly. 0 = Disabled 1 = Enabled for Indicated Volume Flowrate (parameter #27) 2 = Enabled for Gross Volume Flowrate (parameter #29) 3 = Enabled for Gross Standard Volume Flowrate (parameter #31) 4 = Enabled for Net Standard Volume Flowrate (parameter #33) 5 = Enabled for Mass Flowrate (parameter #35)

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
8	RBX on Clear	R/W	UINT8	1	0 → 1	0	Enable/disable status for an RBX alarm when an alarm condition clears: 0 = RBX on Clear Disabled 1 = RBX on Clear Enabled
9	RBX on Set	R/W	UINT8	1	0 → 1	0	Enable/disable status for an RBX alarm when an alarm condition gets set: 0 = RBX on Set Disabled 1 = RBX on Set Enabled
10	Alarm Code	R/O	BIN	1	–	0x00	Alarm statuses: Bit 7 – Manual mode status. 0 = No flow inputs for the flow calculation is a manual entry. 1 = At least one input for the flow calculation is a manual entry. Bit 6 – No flow alarm status. No flow occurs when the flowrate specified by parameter #7 is 0.0. 0 = No flow alarm status is clear. 1 = No flow alarm status is set. Bit 5 – Reserved Bit 4 – Reserved. Bit 3 – Reserved Bit 2 – High flowrate alarm status. The value of the flowrate is that specified by parameter #7. 0 = High flow rate alarm status is clear. 1 = High flow rate alarm status is set. Bit 1 – Reserved. Bit 0 – Low flowrate alarm status. The value of the flowrate is that specified by parameter #7. 0 = Low flow rate alarm status is clear. 1 = High flow rate alarm status is set.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
11	Low Alarm Flow	R/W	FL	4	Any floating point number	–1000.0	Value of the low flow alarm limit in the units of the selected flowrate for alarming (see parameter #7).
12	High Alarm Flow	R/W	FL	4	Any floating point number	100000.0	Value of the high flow alarm limit in the units of the selected flowrate for alarming (see parameter #7).
13	Alarm Deadband	R/W	FL	4	Any floating point number	100.0	Value that the selected flowrate for alarming (see parameter #7) must be above the low alarm limit (parameter #11) or below the high alarm limit (parameter #12) before the associated alarm clears.
14	K-Factor	R/W	FL	4	>= 0.0	1.0	If the meter input is a PI point, this is the meter constant (K-Factor) in pulses/unit volume or pulses/unit mass. If a K-Factor curve is being used (parameter #42), this is equal to the current value of the K-Factor. If the meter is not a PI point : Not used.
15	Meter Factor	R/W	FL	4	>= 0.0	1.0	Value obtained by dividing the quantity of fluid measured by the proving system by the quantity indicated by the meter during proving.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
16	Density Interface Option	R/W	UINT8	1	0 → 2	0	Specifies if a density interface point is assigned to the liquid meter. If a density interface point is assigned, the base density for the liquid meter is determined from the observed density. Otherwise, the base density of the product assigned to the liquid meter is used. 0 = No density interface point is assigned to the liquid meter so use the base density specified by parameter #7 of the liquid product assigned to the meter (parameter #2). Then, the flowing density is calculated using the base density and flowing temperature and pressure. 1 = A density interface point is assigned to the liquid meter (parameter #17), but the observed density is not the density at the liquid meter. So, the liquid meter's base density is to be calculated using the observed density and the liquid meter's base temperature and equilibrium or base pressure. Then, the flowing density is calculated using the base density and flowing temperature and pressure. 2 = A density interface point is assigned to the liquid meter (parameter #17), and the observed density is the density at the liquid meter. So, the liquid meter's base density is to be calculated using the observed density and the liquid meter's base temperature and equilibrium or base pressure. The flowing density is set to the value of the observed density.
17	Density Interface Point	R/W	UINT8	1	0 → 1	0	Specifies the density interface point assigned to the liquid meter. It is used if the density interface option (parameter #16) is not equal to 0.
18	Flowing Density	R/O	FL	4	>= 0.0	999.016	Flowing density for the meter, in the density units specified by TLP=22,0,10.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
19	Base Density	R/O	FL	4	>= 0.0	999.016	Density of the liquid at the base temperature and base or equilibrium pressure, in the density units specified by TLP=22,0,10.
20	Flow Input TLP	R/W	TLP	3	TLP	0,0,0	TLP for the uncorrected flowrate from the meter.
21	Static Pressure TLP	R/W	TLP	3	TLP	0,0,0	TLP for the static pressure.
22	Temperature TLP	R/W	TLP	3	TLP	0,0,0	TLP for the flowing temperature.
23	S&W TLP	R/W	TLP	3	TLP	0,0,0	TLP for the percent of sediment and water (S&W).
24	Static Pressure Value	R/W	FL	4	–	0.0	Value of the flowing pressure, in units specified by TLP=22,0,1.
25	Temperature Value	R/W	FL	4	–	0.0	Value of the flowing temperature, in units specified by TLP=22,0,2.
26	S&W Value	R/W	FL	4	>= 0.0	0.0	Percentage by volume of the sediment and water (S&W) in the liquid.
27	Indicated Flowrate (Volume or Mass)	R/W	FL	4	>= 0.0	0.0	If the meter type (parameter #104) is linear and the type of units of the liquid meter flow input (parameter #3) is volume: Indicated volume flowrate through the meter. The volume units are specified by TLP=22,0,6, and the time units are specified by TLP=22,0,8. If the meter type (parameter #104) is linear and the type of units of the liquid meter flow input (parameter #3) is mass: Indicated mass flowrate through the meter. The mass units are specified by TLP=22,0,7, and the time units are specified by TLP=22,0,8. If the liquid meter type (parameter #104) is orifice: sqrt(hw). If the flow input is less than or equal to the differential pressure for low flow cutoff (parameter #112), hw is set to 0.0. The units are sqrt of the units specified by TLP=22,0,0.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
28	Indicated Flow Totalizer (Volume or Mass)	R/O	FL	4	>= 0.0	0.0	Continuous totalizer of the indicated flow. The value rolls over when it exceeds 1000000.0. If the type of units of the liquid meter flow input (parameter #3) is volume: Total indicated volume through the meter. The volume units are specified by TLP=22,0,6. If the type of units of the liquid meter flow input (parameter #3) is mass: Total indicated mass through the meter. The mass units are specified by TLP=22,0,7. If the meter type (parameter #104) is orifice: Total of sqrt(hw). Units are sqrt of the units specified by TLP=22,0,0.
29	Gross Volume Flowrate	R/O	FL	4	>= 0.0	0.0	Gross volume flowrate as indicated by the meter. The volume units are specified by TLP=22,0,6, and the time units are specified by TLP=22,0,8.
30	Gross Volume Totalizer	R/O	FL	4	>= 0.0	0.0	Continuous totalizer of the gross volume flow. The value rolls over when it exceeds 1000000.0. The volume units are specified by TLP=22,0,6.
31	Gross Standard Volume Flowrate	R/O	FL	4	>= 0.0	0.0	Volume flowrate at base conditions. The volume units are specified by TLP=22,0,6, and the time units are specified by TLP=22,0,8.
32	Gross Standard Volume Totalizer	R/O	FL	4	>= 0.0	0.0	Continuous totalizer of the volume flow at base conditions. The volume units are specified by TLP=22,0,6.
33	Net Standard Volume Flowrate	R/O	FL	4	>= 0.0	0.0	Volume flowrate at base conditions corrected for non-merchantable quantities such as sediment and water. Applies to crude oil only. For other liquid products, it is identical to gross standard volume flowrate. The volume units are specified by TLP=22,0,6, and the time units are specified by TLP=22,0,8.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
34	Net Standard Volume Totalizer	R/O	FL	4	>= 0.0	0.0	Continuous totalizer of the volume flow at base conditions corrected for non-merchantable quantities such as sediment and water. Applies to crude oil only. For other liquid products, it is identical to the gross standard volume total. The value rolls over when it exceeds 1000000.0. The volume units are specified by TLP=22,0,6.
35	Mass Flowrate	R/W	FL	4	>= 0.0	0.0	Mass flowrate. The mass units are specified by TLP=22,0,7, and the time units are specified by TLP=22,0,8.
36	Mass Totalizer	R/O	FL	4	>= 0.0	0.0	Continuous totalizer of the mass flow. The value rolls over when it exceeds 1000000.0. The mass units are specified by TLP=22,0,7.
37	Correction for Temperature of the Liquid (CTL)	R/O	FL	4	>= 0.0	1.0	Factor for adjusting the base density to the flowing density due to difference between the base and flowing temperatures.
38	Correction for Pressure of the Liquid (CPL)	R/O	FL	4	>= 0.0	1.0	Factor for adjusting the base density to the flowing density due to the difference between the base or equilibrium pressure and the flowing pressure.
39	Combined Correction Factor (CCF)	R/O	FL	4	>= 0.0	1.0	CTL x CPL x Meter Factor.
40	Compressibility Factor (F)	R/O	FL	4	>= 0.0	0.3494896	Compressibility factor of the liquid when adjusting the volume at the base or equilibrium pressure to the flowing pressure. If the base temperature is 60 Deg F, the units are 10^5 times the volume fraction per pressure unit. If the base temperature is 15, 20, or 30 Deg C, the units are 10^6 times the volume fraction per pressure unit. The pressure units are specified by TLP=22,0,1.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
41	Alpha for Base to Flowing Temperature	R/O	FL	4	>= 0.0	0.3417773	Coefficient of thermal expansion used when adjusting the volume at the base temperature to the flowing temperature. The units are 10^3 times the volume fraction per Deg F or Deg C, depending on the selected temperature units. The units of the temperature increment are specified by TLP=22,0,2.
42	Meter Factor / K-Factor Option	R/W	UINT8	1	0 → 2	0	Option indicating the use of either a single K-Factor or the K-Factor table with interpolation between points: 0 = Single K-Factor, Single Meter Factor 1 = Meter Factor Curve, Single K-Factor 2 = K-Factor Curve, Single Meter Factor
43	Meter Factor 1 / K-Factor 1	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1) this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.
44	Meter Factor 1 Flowrate / K-Factor 1 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1) this parameter is the indicated flowrate that corresponds to the associated meter factor.
45	Meter Factor 2 / K-Factor 2	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1) this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
46	Meter Factor 2 Flowrate / K-Factor 2 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the indicated flowrate that corresponds to the associated meter factor.
47	Meter Factor 3 / K-Factor 3	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1) this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.
48	Meter Factor 3 Flowrate / K-Factor 3 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the indicated flowrate that corresponds to the associated meter factor.
49	Meter Factor 4 / K-Factor 4	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1) this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
50	Meter Factor 4 Flowrate / K-Factor 4 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the indicated flowrate that corresponds to the associated meter factor.
51	Meter Factor 5 / K-Factor 5	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1) this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.
52	Meter Factor 5 Flowrate / K-Factor 5 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the indicated flowrate that corresponds to the associated meter factor.
53	Meter Factor 6 / K-Factor 6	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1) this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
54	Meter Factor 6 Flowrate / K-Factor 6 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the indicated flowrate that corresponds to the associated meter factor.
55	Meter Factor 7 / K-Factor 7	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.
56	Meter Factor 7 Flowrate / K-Factor 7 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the indicated flowrate that corresponds to the associated meter factor.
57	Meter Factor 8 / K-Factor 8	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
58	Meter Factor 8 Flowrate / K-Factor 8 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the indicated flowrate that corresponds to the associated meter factor.
59	Meter Factor 9 / K-Factor 9	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.
60	Meter Factor 9 Flowrate / K-Factor 9 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the indicated flowrate that corresponds to the associated meter factor.
61	Meter Factor 10 / K-Factor 10	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
62	Meter Factor 10 Flowrate / K-Factor 10 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the indicated flowrate that corresponds to the associated meter factor.
63	Meter Factor 11 / K-Factor 11	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.
64	Meter Factor 11 Flowrate / K-Factor 11 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the indicated flowrate that corresponds to the associated meter factor.
65	Meter Factor 12 / K-Factor 12	R/W	FL	4	>= 0.0	1.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the meter constant (K-Factor) in pulses / unit of flow input for the associated frequency in Hz. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the dimensionless meter factor (MF) for the associated indicated flowrate.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
66	Meter Factor 12 Flowrate / K-Factor 12 Frequency	R/W	FL	4	>= 0.0	0.0	If a K-Factor Curve, Single Meter Factor has been selected (parameter #42 = 2), this parameter is the frequency in Hz that corresponds with the associated K-Factor. If a Meter Factor Curve, Single K-Factor has been selected (parameter #42 = 1), this parameter is the indicated flowrate that corresponds to the associated meter factor.
67	S&W Flowrate	R/O	FL	4	>= 0.0	0.0	Volume flowrate of non-merchantable quantities such as sediment and water. The volume units are specified by TLP=22,0,6, and the time units are specified by TLP=22,0,8.
68	S&W Volume Total	R/O	FL	4	>= 0.0	0.0	Continuous totalizer of the volume flow of non-merchantable quantities such as sediment and water. The value rolls over when it exceeds 1000000.0. The volume units are specified by TLP=22,0,6.
69	Indicated Flow Today	R/O	FL	4	>= 0.0	0.0	Total so far today of the indicated flow. If the type of units of the liquid meter flow input (parameter #3) is volume: Total so far today of the indicated volume. The volume units are specified by TLP=22,0,6. If the type of units of the liquid meter flow input (parameter #3) is mass: Total so far today of the indicated mass. The mass units are specified by TLP=22,0,7. If the meter type (parameter #104) is orifice: Total so far today of sqrt(hw). Units are sqrt of the units specified by TLP=22,0,0.
70	Gross Volume Today	R/O	FL	4	>= 0.0	0.0	Total so far today of the gross volume flow. The volume units are specified by TLP=22,0,6.
71	Gross Standard Volume Today	R/O	FL	4	>= 0.0	0.0	Total so far today of the volume flow at base conditions. The volume units are specified by TLP=22,0,6.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
72	Net Standard Volume Today	R/O	FL	4	>= 0.0	0.0	Total so far today of the volume flow at base conditions minus the non-merchantable quantities. The volume units are specified by TLP=22,0,6.
73	S&W Volume Today	R/O	FL	4	>= 0.0	0.0	Total so far today of the volume flow of non-merchantable quantities. The volume units are specified by TLP=22,0,6.
74	Mass Today	R/O	FL	4	>= 0.0	0.0	Total so far today of the mass flow. The mass units are specified by TLP=22,0,7.
75	Indicated Volume Yesterday	R/O	FL	4	>= 0.0	0.0	Yesterday's total indicated flow. If the type of units of the liquid meter flow input (parameter #3) is volume: Yesterday's total indicated volume. The volume units are specified by TLP=22,0,6. If the type of units of the liquid meter flow input (parameter #3) is mass: Yesterday's total indicated mass. The mass units are specified by TLP=22,0,7. If the meter type (parameter #104) is orifice: Yesterday's total of sqrt(hw). Units are sqrt of the units specified by TLP=22,0,0.
76	Gross Volume Yesterday	R/O	FL	4	>= 0.0	0.0	Yesterday's total gross volume flow. The volume units are specified by TLP=22,0,6.
77	Gross Standard Volume Yesterday	R/O	FL	4	>= 0.0	0.0	Yesterday's total volume flow at base conditions. The volume units are specified by TLP=22,0,6.
78	Net Standard Volume Yesterday	R/O	FL	4	>= 0.0	0.0	Yesterday's total volume flow at base conditions minus the non-merchantable quantities. The volume units are specified by TLP=22,0,6.
79	S&W Volume Yesterday	R/O	FL	4	>= 0.0	0.0	Yesterday's total volume flow of non-merchantable quantities. The volume units are specified by TLP=22,0,6.
80	Mass Yesterday	R/O	FL	4	>= 0.0	0.0	Yesterday's total mass flow. The mass units are specified by TLP=22,0,7.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
81	Indicated Flow This Month	R/O	FL	4	>= 0.0	0.0	Total so far this month of the indicated flow. If the meter type (parameter #104) is linear and the type of units of the liquid meter flow input (parameter #3) is volume: This month's total of the indicated volume flow. The volume units are specified by TLP=22,0,6. If the meter type (parameter #104) is linear and the type of units of the liquid meter flow input (parameter #3) is mass: This month's total of the indicated mass flow. The mass units are specified by TLP=22,0,7. If the meter type (parameter #104) is orifice: This month's total of sqrt(hw). Units are sqrt of the units specified by TLP=22,0,0.
82	Gross Volume This Month	R/O	FL	4	>= 0.0	0.0	Total so far this month of the gross volume flow. The volume units are specified by TLP=22,0,6.
83	Gross Standard Volume This Month	R/O	FL	4	>= 0.0	0.0	Total so far this month of the volume flow at base conditions. The volume units are specified by TLP=22,0,6.
84	Net Standard Volume This Month	R/O	FL	4	>= 0.0	0.0	Total so far this month of the volume flow at base conditions minus the non-merchantable quantities. The volume units are specified by TLP=22,0,6.
85	S&W Volume This Month	R/O	FL	4	>= 0.0	0.0	Total so far this month of the volume flow of non-merchantable quantities. The volume units are specified by TLP=22,0,6.
86	Mass This Month	R/O	FL	4	>= 0.0	0.0	Total so far this month of the mas flow. The mass units are specified by TLP=22,0,7.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
87	Indicated Flow Previous Month	R/O	FL	4	>= 0.0	0.0	Previous month's total indicated flow. If the meter type (parameter #104) is linear and the type of units of the liquid meter flow input (parameter #3) is volume: Previous month's total indicated volume flow. The volume units are specified by TLP=22,0,6. If the meter type (parameter #104) is linear and the type of units of the liquid meter flow input (parameter #3) is mass: Previous month's total indicated mass flow. The mass units are specified by TLP=22,0,7. If the meter type (parameter #104) is orifice: Previous month's total of sqrt(hw). Units are sqrt of the units specified by TLP=22,0,0.
88	Gross Volume Previous Month	R/O	FL	4	>= 0.0	0.0	Previous month's total gross volume. The volume units are specified by TLP=22,0,6.
89	Gross Standard Volume Previous Month	R/O	FL	4	>= 0.0	0.0	Previous month's total volume at base conditions. The volume units are specified by TLP=22,0,6.
90	Net Standard Volume Previous Month	R/O	FL	4	>= 0.0	0.0	Previous month's total volume at base conditions minus the non-merchantable quantities. The volume units are specified by TLP=22,0,6.
91	S&W Volume Previous Month	R/O	FL	8	>= 0.0	0.0	Previous month's total volume of non-merchantable quantities. The volume units are specified by TLP=22,0,6.
92	Mass Previous Month	R/O	FL	4	>= 0.0	0.0	Previous month's total mass. The mass units are specified by TLP=22,0,7.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
93	Meter uncorrected flowrate	R/W	FL	4	>= 0.0	0.0	Flow input of the liquid meter. If the meter type (parameter #104) is linear and the type of units of the liquid meter flow input (parameter #3) is volume: Indicated volume flowrate through the meter. This value matches that of the indicated flowrate (parameter #27). The volume units are specified by TLP=22,0,6, and the time units are specified by TLP=22,0,8. If the meter type (parameter #104) is linear and the type of units of the liquid meter flow input (parameter #3) is mass: Indicated mass flowrate through the meter. This value matches that of the indicated flowrate (parameter #27). The mass units are specified by TLP=22,0,7, and the time units are specified by TLP=22,0,8. If the liquid meter type (parameter #104) is orifice this value is before the low differential flow cutoff is applied: sqrt(hw). The units are sqrt of the units specified by TLP=22,0,0.
94	CSW	R/O	FL	4	>= 0.0	1.0	The correction factor due to non-merchantable quantities, such as sediment and water. It is one (1) minus the volumetric fraction of merchantable quantities in the liquid.
95	Combined Correction Factor (CTPL) When Determining the Flowing Density	R/O	FL	4	>= 0.0	1.0	The combined correction factor for adjusting the volumetric flow from the base temperature and pressure to the flowing temperature and pressure: CTPL = CTL * CPL

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
96	Correction for Temperature of the Liquid (CTL) When Determining the Base Density	R/O	FL	4	>= 0.0	1.0346	Factor for adjusting the volume of the liquid from the observed temperature to the base temperature. This value gets set whenever the base density for the meter is to be determined from the observed density of a density interface point.
97	Correction for Pressure of the Liquid (CPL) When Determining the Base Density	R/O	FL	4	>= 0.0	1.0	Factor for adjusting the volume of the liquid from the observed pressure to the base or equilibrium pressure. This value gets set whenever the base density for a meter is to be determined from from the observed density of a density interface point.
98	Compressibility Factor (F) When Determining the Base Density	R/O	FL	4	>= 0.0	0.0	Compressibility factor used to determine the base density from the observed density. This value gets set whenever the base density for the meter is to be determined from the observed density of a density interface point, and the temperature correction table includes adjustment for the difference between the observed and base pressure when determining the base density from the observed density. This only applies in the case of the API 11.1.6 (2004) and API 11.1.7 (2004) tables. If the base temperature is 60 Deg F, the units are 10^5 times the volume fraction per pressure unit. If the base temperature is 15, 20, or 30 Deg C, the units are 10^6 times the volume fraction per pressure unit. The pressure units are specified by TLP=22,0,1.
99	Base Temperature Option	R/W	UINT8	1	$0 \rightarrow 4$	0	Reference temperature for the base volume. 0 = 60 Deg F 1 = Reserved 2 = 15 Deg C 3 = 20 Deg C 4 = 30 Deg C
100	Base Temperature Value	R/O	FL	4	60.0, 15.0, 20.0, or 30.0	60.0	This parameter displays the numeric value of the base temperature selected by the base temperature option (parameter #99). Units are Deg F or Deg C depending on the value of parameter #99.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
101	Base/Equilibrium Pressure	R/W	FL	4	>= 0.0	0.0	Base or equilibrium (bubble point) pressure for the current product in gauge pressure units specified by TLP=22,0,1. The equilibrium pressure is the minimum pressure at which bubbles of gas appear in a liquid.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
102	Temperature Correction Table	R/O	UINT8	1	0 → 34, 99	4	Temperature correction table used to calculate the flowing density, which is calculated using the even numbered table, where applicable. If the base density is calculated from the observed density, the odd numbered table is utilized, where applicable. (* Denotes the base density had to be converted to units that match that of the table). 0 = API 2540 Table 5/6A (1980) 1 = API 2540 Table 5/6B (1980) 2 = API 2540 Table 5/6D (1982) 3 = API 2540 Table 6C (1980) 4 = API 2540 Table 23/24A (1980) 5 = API 2540 Table 23/24B (1980) 6 = API 2540 Table 23/24D (1982) 7 = GPA TP-27 23/24E (2007) 8 = API 2540 Table 24C (1980) 9 = API 2540 Table 53/54A (1980) 10 = API 2540 Table 53/54B (1980) 11 = API 2540 Table 53/54D (1982) 12 = GPA TP-27 Table 53/54E (2007) 13 = API 2540 Table 54C (1980) 14 = IP-3 Table 59/60A (1988) 15 = IP-3 Table 59/60B (1988) 16 = IP-3 Table 59/60D (1988) 17 = GPA TP-27 Table 59/60E (2007) 18 = API 11.1.6 (2004) 19 = API 11.1.7 (2004) 20 = API 2540 Table 23/24A* (1980) 21 = API 2540 Table 23/24B* (1980) 22 = API 2540 Table 23/24D* (1982) 23 = GPA TP-27 Table 23/24E* (2007) 24 = API 2540 Table 24C* (1980) 25 = API 2540 Table 53/54A* (1980) 26 = API 2540 Table 53/54B* (1980) 27 = API 2540 Table 53/25D* (1982) 28 = GPA TP-27 Table 53/54E* (2007) 29 = API 2540 Table 54C* (1980 30 = API 2540 Table 59/60A* (1980) 31 = API 2540 Table 59/60B* (1980) 32 = API 2540 Table 59/60D* (1982) 33 = GPA TP-27 Table 59/60E* (2007) 34 = API 11.4.1 (2003) 99 = Invalid Table

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
103	Pressure Correction Table	R/O	UINT8	1	0 → 7, 99	1	Pressure correction table used to calculate the flowing density. 0 = User compressibility 1 = API Table 11.2.1 2 = API Table 11.2.1M 3 = API Table 11.2.2 4 = API Table 11.2.2M 5 = API Procedure 11.1.6 (2004) 6 = API Procedure 11.1.7 (2004) 7 = API 11.4.1 (2003) 99 = Invalid Table
104	Meter Type	R/W	UINT8	1	0 → 1	0	Type of meter: 0 = Linear 1 = Orifice with flange taps – uses ISO5167
105	Nominal Pipe Diameter	R/W	FL	4	> 0.0	8.071	If the meter type (parameter #104) is orifice: Pipe internal diameter at the pipe reference temperature. The units are specified by TLP=22,0,4. If the meter type (parameter #104) is linear: Not used.
106	Pipe Reference Temperature	R/W	FL	4	Any floating point number	68.0	If the meter type (parameter #104) is orifice: Reference temperature for the orifice diameter measurement. The units are specified by TLP=22,0,2. If the meter type (parameter #104) is linear: Not used.
107	Pipe Material	R/W	UINT8	1	0 → 2	2	If the meter type (parameter #104) is orifice: Pipe material: 0 = Stainless Steel (304 or 316) 1 = Monel 2 = Carbon Steel If the meter type (parameter #104) is linear: Not used.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
108	Nominal Orifice Diameter	R/W	FL	4	> 0.0	4.000	If the meter type (parameter #104) is orifice: Orifice diameter at the orifice reference temperature. The units are specified by TLP=22,0,4. If the meter type (parameter #104) is linear: Not used.
109	Orifice Reference Temperature	R/W	FL	4	Any floating point number	68.0	If the meter type (parameter #104) is orifice: Reference temperature for the orifice diameter measurement. The units are specified by TLP=22,0,2. If the meter type (parameter #104) is linear: Not used.
110	Orifice Material	R/W	UINT8	1	$0 \rightarrow 2$	0	If the meter type (parameter #104) is orifice: Orifice material: 0 = Stainless Steel (304 or 316) 1 = Monel 2 = Carbon Steel If the meter type (parameter #104) is linear: Not used.
111	Viscosity	R/W	FL	4	> 0.0	4.0E-04	If the meter type (parameter #104) is orifice: Absolute flowing viscosity. The units are specified by TLP=22,0,5. If the meter type (parameter #104) is linear: Not used.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
112	Low Differential Pressure Cutoff	R/W	FL	4	>= 0.0	1.0	If the meter type (parameter #104) is orifice: Differential pressure at or below which the flowrate is set to 0.0. The units are specified by TLP=22,0,0. If the meter type (parameter #104) is linear and the flow input is not a pulse input: Flow input value below which the flowrate is set to 0.0. The units are the specified volume or mass units depending on the type of units of the flow meter (TLP=25,x,3). If the meter type (parameter #104) is linear and the flow input is a pulse input: Not used.
113	Expansion Factor	R/O	FL	4	>= 0.0	1.0	If the meter type (parameter #104) is orifice: Meter expansion factor (Y1). If the meter type (parameter #104) is linear: Not used.
114	Coefficient of Discharge	R/O	FL	4	>= 0.0	1.0	If the meter type (parameter #104) is orifice: Coefficient of discharge (CdFT). If the meter type (parameter #104) is linear: Not used.
115	Actual Orifice Diameter	R/O	FL	4	> 0.0	4.000	If the meter type (parameter #104) is orifice: Orifice diameter at the flowing temperature. The units are specified by TLP=22,0,4. If the meter type (parameter #104) is linear: Not used.
116	Actual Pipe Diameter	R/O	FL	4	> 0.0	8.071	If the meter type (parameter #104) is orifice: Pipe diameter at the flowing temperature. The units are specified by TLP=22,0,4. If the meter type (parameter #104) is linear: Not used.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
117	Actual Beta	R/O	FL	4	> 0.0	0.4956	If the meter type (parameter #104) is orifice: Beta at the flowing temperature. If the meter type (parameter #104) is linear: Not used.
118	Velocity of Approach	R/O	FL	4	> 0.0	1.03	If the meter type (parameter #104) is orifice: Velocity of approach (Ev) at the flowing temperature. If the meter type (parameter #104) is linear: Not used.
119	Reynolds Number	R/O	FL	4	>= 0.0	0.00	If the meter type (parameter #104) is orifice: Pipe Reynolds number (ReD) at flowing conditions. If the meter type (parameter #104) is linear: Not used.
120	Configuration Statuses	R/W	BIN	1	–	0x00	Configuration statuses: Bit 7 – Not used. Bit 6 – Not used Bit 5 – Not used. Bit 4 – Not used. Bit 3 – Not used. Bit 2 – Atmospheric pressure source: 0: Calculate based on the elevation 1: Manual entry Bit 1 – Pressure reference: 0: Gauge 1: Absolute Bit 0 – Pressure tap location (orifice meters only): 0: Downstream 1: Upstream

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
121	Atmospheric Pressure	R/W	FL	4	>= 0.0	14.73	Atmospheric pressure at the meter location. The units are specified by TLP=22,0,1.
122	Elevation	R/W	FL	4	Any floating point number	500	Elevation of the meter. The units are specified by TLP=22,0,13.
123	Request Recalculation Status	R/W	UINT8	1	0 → 1	0	Request recalculation status. When the recalculation for a meter run is requested, recalculation of all meter runs is performed : 0 = Recaculation is not requested. 1 = Recalculation is requested.
124	Observed Density in Observed Density Units	R/O	FL	1	> 0.0	999.016	Average observed density during the previous mcp. The units are those specified for the observed density (TLP=22,0,3).
125	Observed Density in Base and Flowing Density Units	R/O	FL	1	> 0.0	999.016	Average observed density during the previous mcp. The units are those specified for the base and flowing densities (TLP=22,0,11).
126	Alpha for Observed to Base Temperature	R/O	FL	1	> 0.0	0.3417773	Coefficient of thermal expansion used when adjusting the volume at the observed temperature to the base temperature. The units are 10^3 times the volume fraction per Deg F or Deg C, depending on the selected temperature units. The units of the temperature increment are specified by TLP=22,0,2.
127	Average Observed Temperature	R/O	FL	4	Any floating point number	60	Average observed temperature during the previous mcp. The units of the temperature are specified by TLP=22,0,2.
128	Average Observed Pressure	R/O	FL	4	Any floating point number	0.0	Average observed pressure during the previous mcp. The units of the pressure are specified by TLP=22,0,1.

Point Type 25: Liquid Meter Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
129	No Flow Time	R/W	UINT8	1	0 → 255	10	If the meter type (parameter #104) is orifice: Not used. If the meter type (parameter #104) is linear and the flow input is not a pulse input: Not used. If the meter type (parameter #104) is linear and the flow input is a pulse input: Time, in seconds, without a pulse before setting the flow rate to 0.0.
130	Flowing Status	R/O	UINT8	1	0 → 1	0	Current flowing status: 0 = Currently there is no flow through the meter. 1 = Currently there is flow through the meter.

4.6 Point Type 26: Density Interface Parameters

Point type 26 contains the parameters for configuring the density interface points and viewing the results of the calculations. There are two logicals for this point type.

Point Type 26: Densitometer Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
0	Point Tag Id	R/W	AC	10	10 ASCII characters	Logical 0: "Density #1" Logical 1: "Density #2	Point tag identification for the density interface point.
1	Density Type	R/W	UINT8	1	0 → 3	3	Indicates the type of density input interface: 0 = Micro Motion (or Solartron) Model 7830/40 or Model 7835/45/46/47 1 = Reserved 2 = UGC 278 3 = Analog input – The units of the density input are assumed to be that specified for the observed density units (TLP=22,0,3).
2	Density Input TLP	R/W	TLP	3	TLP	0, 0, 0	TLP from which to retrieve the density input. The input may either be a frequency from a densitometer or an analog density value from any source.
3	Density Input Value	R/W	FL	4	>= 0.0	999.012	Value of the density input. If the density input is a frequency from a densitometer, this value contains the frequency in Hz. Otherwise; it contains the density input value in the units specified for the observed density (TLP=22,0,3).

Point Type 26: Densitometer Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
4	Alarm Config Statuses	R/W	UINT8	1	–	0	Alarm configuration statuses: Bit 7 – Reserved Bit 6 – RBX on alarm set: 0 = Disabled, 1 = Enabled Bit 5 – RBX on alarm clear: 0 = Disabled, 1 = Enabled Bit 4 – Alarming: 0 = Disabled, 1 = Enabled Bit 3 – Reserved Bit 2 – Reserved Bit 1 – Reserved Bit 0 – Reserved
5	Observed Temperature TLP	R/W	TLP	3	TLP	0, 0, 0	TLP of the temperature at the density measurement location (observed temperature).
6	Observed Temperature	R/W	FL	4	Any floating point number	60.0	Value of the temperature at the density measurement location (observed temperature), in the temperature units specified by TLP=22,0,2.
7	Observed Pressure TLP	R/W	TLP	3	TLP	0, 0, 0	TLP for the pressure at the density measurement location (observed pressure).
8	Observed Pressure	R/W	FL	4	Any floating point number	0.0	Value of pressure at the density measurement location measurement site (observed pressure), in the pressure units specified by TLP=22,0,1.
9	Basic Transducer Constant K0	R/W	FL	4	Any floating point number	0.0	Constant K0 from the calibration certificate of the Micro Motion (or Solartron) or UGC densitometer. The program uses this constant in the general density calculation.

Point Type 26: Densitometer Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
10	Basic Transducer Constant K1	R/W	FL	4	Any floating point number	0.0	Constant K1 from the calibration certificate of the Micro Motion (or Solartron) or UGC densitometer. This program uses this constant in the general density calculation.
11	Basic Transducer Constant K2	R/W	FL	4	Any floating point number	0.0	Constant K2 from the calibration certificate of the Micro Motion (or Solartron) or UGC densitometer. The program uses this constant in the general density calculation.
12	Micro Motion Temperature Correction Constant K18	R/W	FL	4	Any floating point number	0.0	If the densitometer type is Micro Motion (or Solartron) (parameter #1 is set to 0): Constant K18 from the calibration certificate of the Micro Motion (or Solartron) densitometer. The program uses this constant in the temperature compensation calculation. Otherwise: Not used
13	Micro Motion Temperature Correction Constant K19	R/W	FL	4	Any floating point number	0.0	If the densitometer type is Micro Motion (or Solartron) (parameter #1 is set to 0): Constant K19 from the calibration certificate of the Micro Motion (or Solartron) densitometer. The program uses this constant in the temperature compensation calculation. Otherwise: Not used
14	Micro Motion Pressure Correction Constant K20A	R/W	FL	4	Any floating point number	0.0	If the densitometer type is Micro Motion (or Solartron) (parameter #1 is set to 0): Constant K20A from the calibration certificate of the Micro Motion (or Solartron) densitometer. The program uses this constant in the pressure compensation calculation. Otherwise: Not used

Point Type 26: Densitometer Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
15	Micro Motion Pressure Correction Constant K20B	R/W	FL	4	Any floating point number	0.0	If the densitometer type is Micro Motion (or Solartron) (parameter #1 is set to 0): Constant K20B from the calibration certificate of the Micro Motion (or Solartron) densitometer. The program uses this constant in the pressure compensation calculation. Otherwise: Not used
16	Micro Motion Pressure Correction Constant K21A	R/W	FL	4	Any floating point number	0.0	If the densitometer type is Micro Motion (or Solartron) (parameter #1 is set to 0): Constant K21A from the calibration certificate of the Micro Motion (or Solartron) densitometer. The program uses this constant in the pressure compensation calculation. Otherwise: Not used
17	Micro Motion Pressure Correction Constant K21B	R/W	FL	4	Any floating point number	0.0	If the densitometer type is Micro Motion (or Solartron) (parameter #1 is set to 0): Constant K21B from the calibration certificate of the Micro Motion (or Solartron) densitometer. The program uses this constant in the pressure compensation calculation. Otherwise: Not used

Point Type 26: Densitometer Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
18	Velocity of Sound Compensation Option	R/W	UINT8	1	0 → 1	0.0	If the densitometer type is Micro Motion (or Solartron) (parameter #1 is set to 0): Velocity of sound compensation enable status: 0: Disabled 1: Enabled Otherwise: Not used
19	Liquid Velocity of Sound	R/W	FL	4	>= 0.0	0.0	If the densitometer type is Micro Motion (or Solartron) (parameter #1 is set to 0): Actual velocity of sound in the liquid at flowing conditions in meters per second. Otherwise: Not used
20	Calibration Velocity of Sound	R/O	FL	4	>= 0.0	0.0	If the densitometer type is Micro Motion (or Solartron) (parameter 1 is set to 0): Velocity of sound in the liquid at the calibration conditions, in meter per seconds. Otherwise: Not used
21	UGC Pressure Correction Constant Pc	R/W	FL	4	Any floating point number	0.0	If the densitometer type is UGC (parameter #1 is set to 2): Constant Pc from the calibration certificate of the UGC densitometer. The program uses this constant in the pressure compensation calculation. Otherwise: Not used

Point Type 26: Densitometer Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
22	UGC Pressure Correction Constant Kp1	R/W	FL	4	Any floating point number	0.0	If the densitometer type is UGC (parameter #1 is set to 2): Constant Kp1 from the calibration certificate of the UGC densitometer. The program uses this constant in the pressure compensation calculation. Otherwise: Not used
23	UGC Pressure Correction Constant Kp2	R/W	FL	4	Any floating point number	0.0	If the densitometer type is UGC (parameter #1 is set to 2): Constant Kp2 from the calibration certificate of the UGC densitometer. The program uses this constant in the pressure compensation calculation. Otherwise: Not used
24	UGC Pressure Correction Constant Kp3	R/W	FL	4	Any floating point number	0.0	If the densitometer type is UGC (parameter #1 is set to 2): Constant Kp3 from the calibration certificate of the UGC densitometer. The program uses this constant in the pressure compensation calculation. Otherwise: Not used
25	UGC Temperature Correction Constant Tc	R/W	FL	4	Any floating point number	0.0	If the densitometer type is UGC (parameter #1 is set to 2): Constant Tc from the calibration certificate of the UGC densitometer. The program uses this constant in the temperature compensation calculation. Otherwise: Not used

Point Type 26: Densitometer Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
26	UGC Temperature Correction Constant Kt1	R/W	FL	4	Any floating point number	0.0	If the densitometer type is UGC (parameter #1 is set to 2): Constant Kt1 from the calibration certificate of the UGC densitometer. The program uses this constant in the temperature compensation calculation. Otherwise: Not used
27	UGC Temperature Correction Constant Kt2	R/W	FL	4	Any floating point number	0.0	If the densitometer type is UGC (parameter #1 is set to 2): Constant Kt2 from the calibration certificate of the UGC densitometer. The program uses this constant in the temperature compensation calculation. Otherwise: Not used
28	UGC Temperature Correction Constant Kt3	R/W	FL	4	Any floating point number	0.0	If the densitometer type is UGC (parameter #1 is set to 2): Constant Kt3 from the calibration certificate of the UGC densitometer. The program uses this constant in the temperature compensation calculation. Otherwise: Not used
29	Density Correction Factor	R/W	FL	4	>= 0.0	1.0	Multiplier value to correct the observed density before it is stored to parameters #30, 31, and 32.
30	Observed Density	R/O	FL	4	>= 0.0	999.012	Observed density, in the units selected for the observed density (TLP=22,0,3)
31	Observed Relative Density	R/O	FL	4	>= 0.0	1.0	Observed density, in units of relative density.
32	Observed API Gravity	R/O	FL	4	0.0 to 100.0	10.0	Observed density, in units of API gravity.

Point Type 26: Densitometer Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
33	Hydrometer Correction Option	R/W	UINT8	1	0 → 1	0	Enable status for correction for a hydrometer when calculating the base density. 0 = Disabled 1 = Enabled
34	Periodic Time	RO	FL	4	0.0	0.0	If the density interface type is a Micro Motion (or Solartron) or UGC densitometer (TLP=27,Logical,1 is 0 or 2): Period between cycles of the densitometer input, in microseconds. If the density interface type is an analog value (TLP=27,Logical,1 is 3): Not used.
35	Alarm Code	R/O	BIN	1	–	0x00	Alarm statuses: Bit 7 – Manual mode status 0 = No inputs for the observed density calculation is a manual entry. 1 = At least one input for the observed density calculation is a manual entry. Bit 6 – Reserved Bit 5 – Reserved Bit 4 – Reserved Bit 2 – High observed density alarm status: 0 = High observed density alarm status is clear. 1 = High observed density alarm status is set. Bit 1 – Reserved Bit 0 – Low observed density alarm status: 0 = Low observed density alarm status is clear. 1 = Low observed density alarm status is set.

Point Type 26: Densitometer Parameters

Parm #	Name	Access	Data Type	Length	Range	Default	Description
36	Low Density Alarm Limit	R/W	FL	4	>= 0.0	300.0	Low observed density alarm limit, in the units specified for the observed density (TLP=22,0,3).
37	High Density Alarm Limit	R/W	FL	4	>= 0.0	1200.0	High observed density alarm limit, in the units specified for the observed density (TLP=22,0,3).
38	Alarm Deadband	R/W	FL	4	>= 0.0	5.0	The alarm deadband is the amount the observed density must be above the low alarm limit (parameter #36) or below the high alarm limit (parameter #37) before the associated alarm clears. The units are those specified for the observed density (TLP=22,0,3).

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