Cox Turbine Flow Meters

# Integrated Flow Computer

## IFC15 Graphical User Interface (GUI)

Badger Meter

CXX-UM-02154-EN-01 (September 2017)

# User Manual

# CONTENTS


About this Manual . . . . . 5

Typographic Conventions . . . . . 5

Installation . . . . . 5

Running IFC Software for the First Time . . . . . 6

Flow Meter Hardware Configuration . . . . . 8

Model Information . . . . . 8

Meter Selection (BUS ID) . . . . . 10

Profile Creation . . . . . 10

Linearization . . . . . 11

Rotor Ratio . . . . . 13

Pressure Calibration . . . . . 14

Temperature Compensation . . . . . 14

Configuring Flow Computer Outputs . . . . . 15

Frequency Outputs (1 & 2) . . . . . 15

Analog Output (Channels 1, 2, 3 and 4) . . . . . 16

Configuring Analog Input . . . . . 17

Liquid Properties . . . . . 18

Temperature vs Viscosity Table . . . . . 18

Temperature vs Density Table . . . . . 19

Fluid Pressure Compensation . . . . . 19

Real-time Monitoring . . . . . 20

Real-Time Report Display . . . . . 20

Flow Computer Programming . . . . . 22

Uploading Profiles . . . . . 22

Downloading Profiles . . . . . 22

Locating Multiple IFC15 Flow Computers . . . . . 23

Commands . . . . . 23

Configuration Options . . . . . 24

Options – General . . . . . 24

Options – Report Display . . . . . 24

Options – Communication (Comm.) . . . . . 25

Options – Database . . . . . 25

Options – Gator Display . . . . . 25

Options – Gator Report . . . . . 26
Options – Real Time Clock (RTC) . . . . . 26
Version Information . . . . . 26
Model IFC15BB . . . . . 28
IFC15BB Wiring Instructions . . . . . 28
IFC15BB Specifications . . . . . 29
Model IFC15BBA . . . . . 30
IFC15BBA Wiring Instructions . . . . . 30
IFC15BBA Specifications . . . . . 31
Model IFC15BBAP . . . . . 32
IFC15BBAP Wiring Instructions . . . . . 32
IFC15BBAP Specifications . . . . . 33
Model IFC15L . . . . . 34
IFC15L Wiring Instructions . . . . . 34
IFC15L Specifications . . . . . 35

# ABOUT THIS MANUAL

This manual describes the Exact Flow Graphical User Interface (GUI) for the following flow computers: IFC15L, IC15BB IFC15BBAP and IFC15BBA

Your specific application may be configured differently from this manual, based on individual requirements for your application. This manual addresses each screen section in an easy-to-understand presentation.

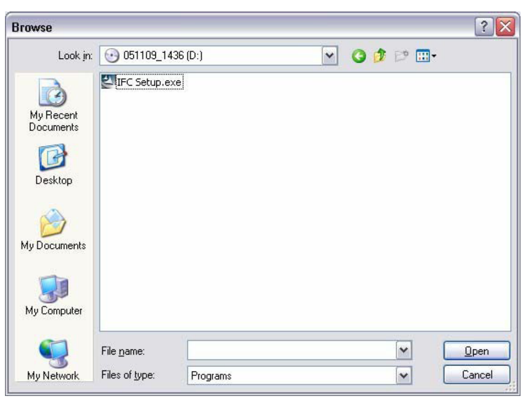
## Typographic Conventions

- Items on the software screens that you need to select or choose by clicking a button, highlighting, checking a box or another similar means are in bold text and capitalized in the manual.
  Example: Click the **View Report** button.
- Names of options, boxes, columns and fields are italicized. In most cases, first letters are capitalized.
  Example: The value displays in the *Status Information* field.
- Messages and special markings are shown in quotation marks.
  Example: "Service Stopped" displays in the title bar.

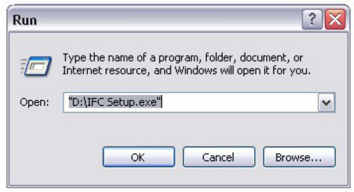
**NOTE:** Names, addresses and other customer-related information displayed in screen examples were created for demonstration purposes in this manual. No actual customer information is included.

# INSTALLATION

1. Place the *Exact Flow Graphical User Interface (GUI)* CD into your CD-ROM Drive.
   Windows® applications may or may not automatically begin the installation. If your PC does not automatically start the installation, browse the CD for the executable file (*.exe):
   a. Click the **Start** menu.
   b. Click **Run**.
   c. Click **Browse**.
   d. Click **My Computer**.
   e. Click your CD-ROM Drive letter (for example, **D:**) from the left column.
   f. Click **Open**.
   The *IFC Setup.exe* file displays.




2. Click **IFC Setup.exe**.
3. Click **Open**.
4. Click **OK**.
   Windows Install Shield Wizard begins installing the *IFC (GUI)* software.




5. Follow the directions given in the installer.
    a. Accept the *End-User Agreement*.
    b. Select the *Typical* install.
       All necessary files are installed in your designated location.
6. Click **Finish** to finalize the installation.

## Running IFC Software for the First Time

1. Click the **IFC Software** icon on your desktop.
   A "User login/password not found" message displays.


2. Click **OK** to close the error message.
   The software requires a *User Name* and *Password* before allowing any configuration changes.

**NOTE:** If any other errors messages display, close them out. The *IFC configuration* has not been initialized yet.

### Password Initialization

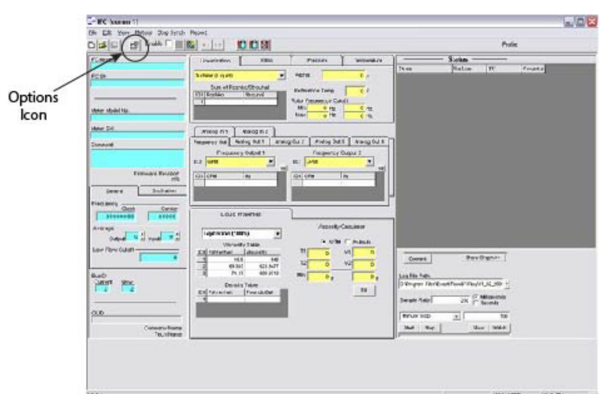
The *Password* feature allows only users with permission to access or manipulate the data in the configuration profile and flow computer.

If multiple users are interfacing with the software, set a default *User Name* and *Password* that is easily remembered. For example: *User Name*=**admin**; *Password*=**admin**

Un-installing or re-installing does not erase any set users.

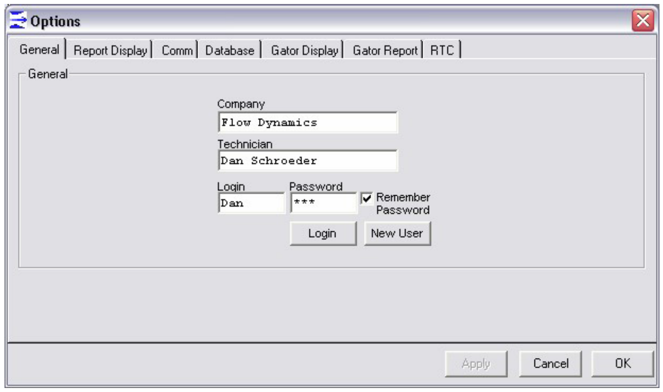
To set the password for the first time, or to add a user name later:

1. Click the **IFC Software** icon on your desktop.
   The initial screen displays.




2. Click the **Options** icon in the upper left portion of the toolbar of the main GUI screen.
3. Select the **General** tab to view the password options.

**NOTE:** The *General* options are also available from *File* > *Options* > *General*.




4. Enter a *Company* name and *Technician* name. These two fields remain the same when opening the *Options* window, and are not protected.
5. Enter a *Login* name to be associated with a specific password.

## IMPORTANT

*Be sure to write down the password or click the Remember Password checkbox. Entering an incorrect password locks the software.*

6. Click **Login**. The currently logged-in person can then access the *Graphical User Interface (GUI)*, and make changes to IFC profiles.

**NOTE:** The first user to initialize the software can also choose to add new users.

7. Re-enter the password and click **OK**:


### Communication Ports

Communication needs to be established between the PC and the flow computer hardware. See the proper IFC Integrated Flow Computer User Manual, available though the factory, to connect the flow computer hardware.

To see the communications port you're currently connected to:

1. Click the **Start** menu on your desktop.
2. Right-click **My Computer**.
3. Click **Properties**.
4. Click the **Hardware** tab.
5. Click **Device Manager**.
6. Click the plus sign (+) next to the *Ports (Com & LPT)* category to see the com port that the IFC15 or IFC15 serial converter is connected to.

To establish communication between the PC and IFC software:

1. Click the **Options** icon in the upper left portion of the toolbar of the main GUI screen.
2. Select the Comm. tab to view the communications configuration options.

**NOTE:** The *Comm* options are also available from *File* > *Options* > *Comm*.

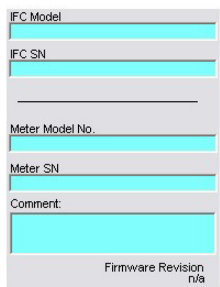
3. From the drop-down menu, select the communication port.
4. Set the *Baud Rate* to **115200**.


5. If the flow computer in use is capable of Ethernet communication, check the **Use TCP/IP** box and type the *IP Address* for the connected flow computer.

# FLOW METER HARDWARE CONFIGURATION

## Model Information

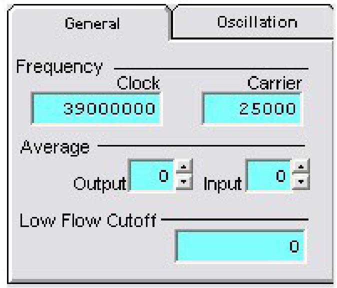
The model information is on the left side of the interface. It shows information pertaining to the profile currently loaded. The model information is input at the factory and offers our technicians the base information needed for troubleshooting or profile tracking. ***Do not change these factory settings.***




| **Field** | **Function** |
|---|---|
| IFC Model | Identifies the configuration of IFC15 flow computer for which the profile was designed |
| IFC SN | Provides traceability of an individual IFC15 flow computer and associated documentation. |
| Meter Model No | Identifies the configuration and features of the flow meter |
| Meter SN | Provides traceability and calibration information pertaining to the flow meter |
| Firmware Revision | States the flow computers firmware configuration and provides historical revision control |

## General Hardware Information

The general hardware information is on the left side side of the interface. It contains factory configuration information, regarding the *Clock Frequency*, *Carrier Frequency*, *Input & Output Average* and *Low Flow Cutoff* (in gpm).

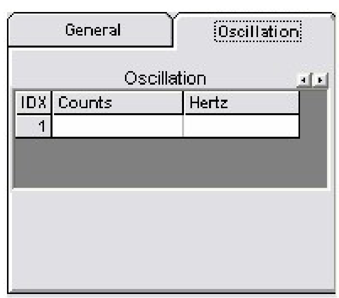



**NOTE:** The clock frequency and carrier frequency match the particular model of flow computer in use. ***Do not change these factory settings.***

| Field | Sub-Field | Function |
|---|---|---|
| Frequency | Clock (Hz) | Configured at the factory to match individual IFC15 flow computer |
| | Carrier (Hz) | Configured at the factory to optimize resonance curve when using RF carrier pickoffs |
| Average | Output (Cycles) | The number of output samples necessary before the flow computer yields a single value at the output. If data obtained from the flow computer is updating too fast, use this feature to smooth the data so more samples are taken prior to outputting a value. Use the **Up** and **Down** arrow keys |
| | Input (Cycles) | The number of input samples necessary before the flow computer yields a single value at the processor. If data obtained from the flow computer is updating too fast, use this feature to smooth the data so more samples are taken prior to inputting a value to the processor. Use the **Up** and **Down** arrow keys |
| Low Flow Cutoff | Numeric Entry (GPM) | The low flow cutoff omits erroneous data in the low flow region of a turbine meter. Near zero state conditions, or pulsating flow, may cause erratic readings near zero flow. In this case, the flow computer can be told to not output a flow rate below the set flow rate. Low Flow Cutoff is typically set to zero, and not used |

## Oscillation Calibration

The *Oscillation* tab is only used at the factory to calibrate the processor's internal clock. ***Do not change these factory settings.***



### Meter Selection (BUS ID)

The software has provisions for multi-drop applications, where multiple flow computers need to communicate to one central location. In order to address multiple meters, you must designate a different Bus ID# to each flow computer. There are 256 available Bus IDs (0…FF). Each ID consists of a one- or two-digit hexadecimal value, where 0 = 0, and 255 = FF. In order for the software to search and display a particular flow computer, you must upload the Bus ID (see instructions below). This tells the interface to attempt communication with that particular Bus ID.

The Bus ID information displays in the lower left corner of the main screen.


To address an individual flow computer:

1. Click on the **Current Bus ID #** field.
2. Change the value to correspond with the meter to be addressed.
3. Click the **Upload** icon on the toolbar of the main GUI screen.
   The profile from the flow computer you addressed then populates the software interface with the information stored in that particular flow computer. The Bus ID# simply selects which flow computer to address.
4. (Optional) Click the **Download** icon to place another meter's profile into the currently selected flow computer.

**IMPORTANT**
*Always keep an OEM copy (original) of the profile, in case you want to restore the factory configuration. See* *“Uploading Profiles” on page 22* *to create a profile from the IFC15 flow computer.*

## PROFILE CREATION

You can create or modify profiles in two ways:

- Manually change each cell value to correspond with calibration data, or
- Import multiple values into the interface using Microsoft Excel®.

Although the *Linearization* table is the table most often modified, any of the data entry look-up tables can be modified. Make sure to follow these guidelines when importing or exporting the data.

- Always erase the cell(s) entirely before entering data so the new data does not combine with prior profile data. To erase all cells of a grid, right-click the **IDX** button in the upper left corner of the grid and select **Clear Grid**.
- The number of XY pairs imported from Excel have to be less than, or equal to, the available number of index numbers (IDX) for each respective look-up table.
- To avoid truncation, or excessive interpolation of profile data, make sure the Excel data tables match the maximum number of columns for each respective look-up table. For example, if the table holds 100 XY pairs, then maximize the resolution of the table by placing points at all 100 index points.
- Data obtained through independent testing needs to be manually entered, cell by cell, or entered into Excel first and then copied into the profile.
- If the data collected is not formatted to use the maximum number of IDX entries in the GUI, accuracy is jeopardized. For example, if independent testing yields only 50 Roshko/Strouhal points (IDX linearization entries), the data will not be as accurate as it would be by using all 100 points in the *Linearization* table.
- Data tables interpolate between points.
- Data tables do not extrapolate beyond the minimum and maximum values. The flow computer holds the last value in the table, if the threshold is exceeded.

Flow computers with factory-created profiles have pre-formatted data in the cells of each lookup table. Powerful software, in conjunction with highly repeatable and accurate calibration systems, provides Flow Dynamics the ability to fit accurate curves to calibration profiles. Using linear, exponential, or logarithmic interpolation, the maximum number of IDX entries can be used and optimized.

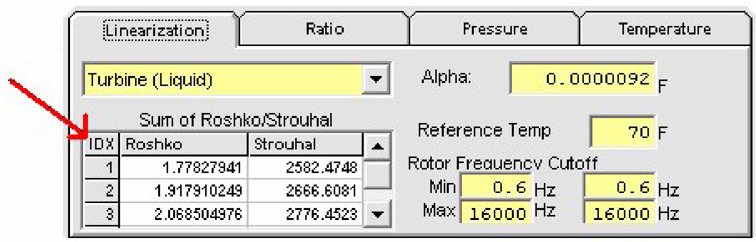
The minimum number of IDX (X,Y) entries for the linearization table is 2. The maximum number of IDX (X,Y) entries for the linearization table is 200.

## Linearization

The *Linearization* process takes a raw, non-linear output from a turbine meter and performs mathematical calculations to provide a linearized output. The IFC15 computer uses the Roshko/Strouhal method for correlating the meter's volumetric flow rate, and reflects the sum of all rotors. In a single rotor application, the sum Roshko and sum Strouhal equate to the correlation of a single rotor. In a dual rotor application, the sum Roshko and sum Strouhal equate to the correlation of both rotors, summed together.

To ***manually*** modify or update the linearization table with fresh calibration data:

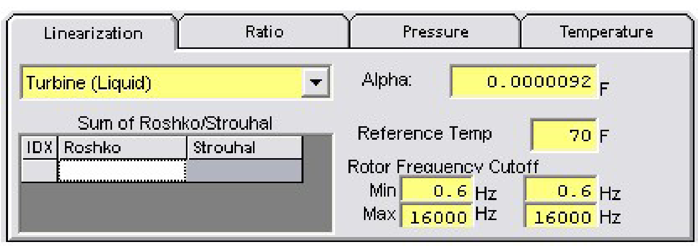
1. Click the **Linearization** tab.
2. Right-click the **IDX** button in the upper left corner of the grid and select **Clear Grid**. The table may change appearance slightly.




3. Click in each cell and type the new value.

## IMPORTANT

*Be careful when typing the values, as keystroke errors can occur. Verify all data entries prior to downloading the profile into the IFC15 flow computer.*




A more convenient method is to copy and paste multiple data entries from Microsoft Excel. This procedure saves time and provides data accuracy.

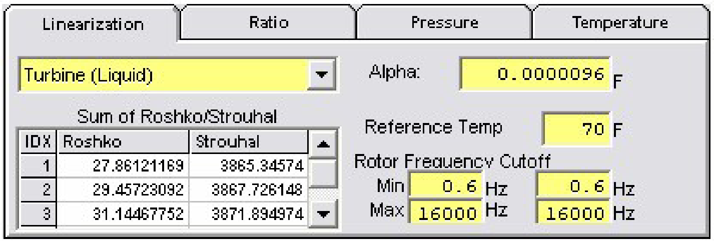
To ***import*** multiple values into the interface using Microsoft Excel:

1. In Excel, highlight a minimum of 2 (X,Y) pairs and a maximum of up to 200 (X,Y) pairs, and copy them to the clipboard. For example, if we had a total of three Roshko/Strouhal (X,Y) pairs, the Excel spreadsheet would be set up as below, with Roshko as the x-axis variable and Strouhal as the y-axis variable:

| Roshko (X) | Strouhal (Y) |
|---|---|
| 1.7782794 | 1.77827941 |
| 1.9179102 | 2666.6081 |
| 2.068505 | 2776.4523 |

2. Click and drag over the data to be copied, but not the column or row labels. Only grab the raw data from the Excel spreadsheet. Make sure that the Roshko values are located on the left side as the X-axis variable, and the Strouhal values are on the right side as the Y-axis variable.

3. With the Roshko/Strouhal values highlighted, right-click in the shaded area and click **Copy** to place data onto the clipboard. Alternatively, with the data highlighted, press **Ctrl+C** to copy the data to the clipboard.
4. Switch to, or re-open, the IFC15 GUI and right-click **IDX** in the upper left corner of the table. S
5. Select **Paste Grid** to copy the raw data from the clipboard to the Roshko/Strouhal table.




6. Click the **Download** icon to download the IFC15 profile. See *"Downloading Profiles" on page 22*.

In addition to the Linearization table itself, a number of additional fields on the can be changed. Although not typically modified from factory settings, they perform additional advanced operations in the IFC15 flow computer.

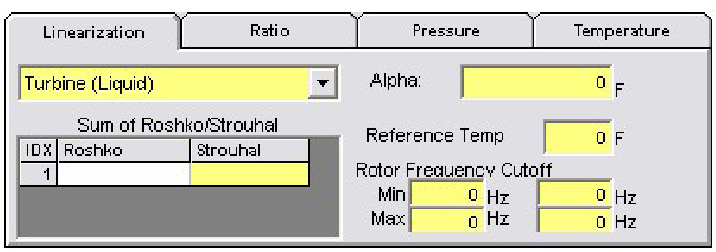
| **Field** | **Function** |
|---|---|
| Alpha | Corresponds to the coefficient of thermal expansion of the flow meter housing. This field is factory configured for the thermal expansion of stainless steel. The thermal expansion coefficient for stainless steel is $9.6 \times 10^{-4}$ or 0.0000096. Other expansion coefficients are available from the factory |
| Reference Temp | The reference temperature, in degrees Fahrenheit, in which the calibration data was obtained. Typical calibration reports state the reference temperature in which the data was obtained, and should be the same as the temperature in which the Roshko/Strouhal calibration data was obtained |
| Rotor Frequency Cutoff | These fields limit the output of the flow computer to a minimum and maximum threshold. The minimum frequency (Hz) is set so that if rotor frequency decreases below this value, the flow computer stops outputting a flow rate. The opposite is true for the maximum flow rate. If the rotor frequency exceeds the set frequency, the flow computer stops outputting a flow rate. The left column corresponds to the rotor frequency of the A rotor (Upstream), and the right column is for the B rotor (Downstream). In single rotor applications, only the left field is used. |

**Standard vs. Auto-Viscosity**

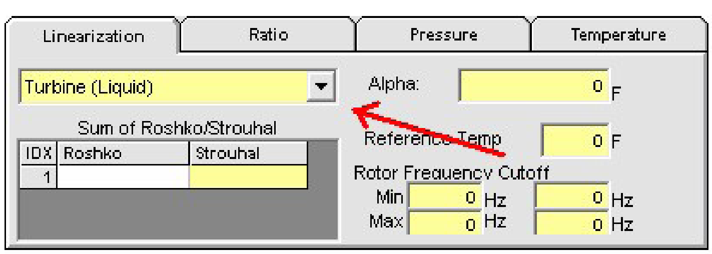
The FC15 flow computer, when used with a dual rotor turbine meter, incorporates the ability to determine fluid viscosity directly from the turbine meter. The *Auto-Viscosity* feature is applicable only to fluid viscosities at or below 40 cStk. If you are unsure as to what range of viscosity you are operating over, please contact Flow Dynamics, as a large database of fluid properties has been generated.

To select the *Auto-Viscosity* feature:

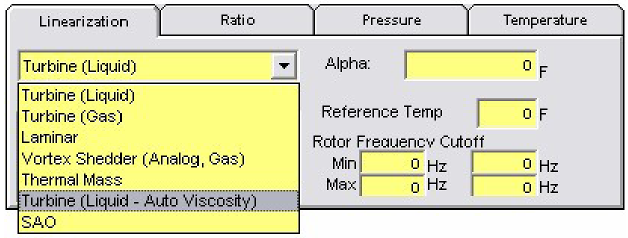
1. Click the **Linearization** tab on the GUI interface main screen. The *Linearization* screen shows the various types of flow measurement devices associated with the *Linearization* table.




2. Click on the pull-down menu.

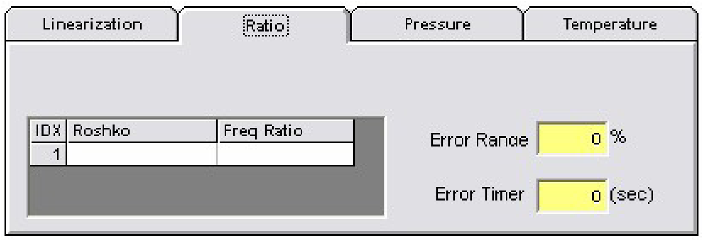


3. Highlight **Turbine (Liquid - Auto Viscosity)** and click to select:




The *Linearization* table displays, showing the *Auto-Viscosity* feature enabled. Remember, the liquid being metered must be below 40 cStks to use this feature. If your unsure of the liquid's viscosity, call Flow Dynamics at (480) 948-3789.

## Rotor Ratio




The *Rotor Ratio* table, as seen above, provides for a number of powerful diagnostic and analytical features. In dual-rotor applications, the ratio of the upstream and downstream rotors can be compared to provide self checks, diagnostic provision, or automatically determine the fluid viscosity.

Rotor ratio is a feature that is typically configured at the factory; however it can be implemented by the end-user as well. Frequency data is obtained from each rotor and the frequency ratio is calculated. Once the ratio has been calculated, a high order polynomial is fit to the data and a Roshko number is then associated to it. The frequency ratio is calculated as follows:

$$RotorRatio = \frac{Fb}{Fa}$$

Where, $Fa$ = Frequency of Rotor A, and $Fb$ = Frequency of rotor B.

This ratio function can be used to address any potential failures in the meter. Because we are comparing the frequency output of one rotor to the other, we can determine if bearing failure, pickoff failure, or even if fluid particulates are hindering meter performance. This same method is also used to determine viscosity.

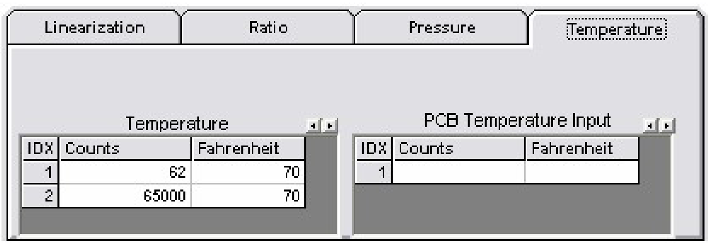
Upon editing any fields contained in the *Rotor Ratio* table, a new button will appear in the menu bar as seen above. This provides the ability to write updated *Rotor Ratio* information to the IFC15 flow computer. Please note, this does not write the entire profile down to the IFC15, it only writes the information contained in the Rotor Ratio table.

| **Field** | **Function** |
|---|---|
| Error Range | If the ratio is exceeded by the set percentage, the flow computer will output zero flow, therefore stating a malfunction has occurred. Further prognosis could lead to pickoff failure, bearing failure, or possibly flow computer failure |
| Error Timer | Once the ratio is exceeded, therefore indicating a failure of some kind, the error timer dictates how long the meter will have to stay in excess of the current set ratio percentage, before an error condition occurs and zero flow results |

## Pressure Calibration


The *Pressure* table is used for calibrating pressure transducers. Although not typically used in turbine meter applications, are detrimental to sonic nozzle and other technologies requiring absolute and differential pressure. Please consult the factory regarding these types of instruments, as IFC15 flow computers were not designed to address these technologies. In addition, the engineering unit may be selected from the drop down box by left-clicking on the down arrow.

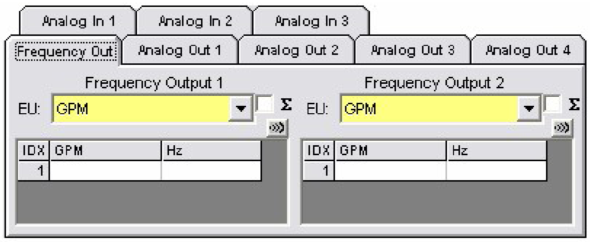
## Temperature Compensation




The *Temperature* table provides the necessary calibration of the flow computer's temperature input device. A temperature profile is obtained through testing for the particular temperature sensor being used, and is proprietary to the individual sensor. The temperature sensor of choice is placed in a temperature bath and temperature vs. counts data is entered. Typical applications will use either a 10k Ohm Thermistor or 100 Ohm Platinum RTD. This provides the flow computer the look-up table necessary for temperature acquisition.

# CONFIGURING FLOW COMPUTER OUTPUTS

## Frequency Outputs (1 & 2)




The *Frequency Out* table is used for configuring both of the IFC15 flow computer's frequency outputs. All IFC15 flow computers come with 2 frequency channels, and the channels can be configured independently. This table will completely configure the desired channels type of information to be output, as well as adjust the output scaling. A few possible types are volumetric flow rates, mass flow rates, temperature (both °F and °C), and the sum of rotor frequencies (Rotor A + Rotor B), pressure, and finally differential pressure.

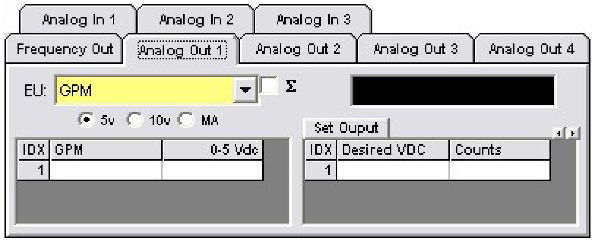
1. Click the down arrow to select the engineering unit. The engineering units for Frequency 1 and frequency 2 do not need to be the same.
2. Right click the **IDX** button and select **Clear Grid**.
3. Enter values for the Engineering Unit (EU) and the frequency. The first entry typically corresponds to zero flow, and is set to zero Hertz. Once the zero flow/zero frequency value have been entered, the max output frequency needs to be set.
4. Press **Enter** to enter the first data point in the table.
5. Enter the maximum flow rate ( or other variable) and the corresponding frequency in which you would like the flow computer to output.

**NOTE:** The IFC15 flow computer's maximum output frequency is 16 kHz. Setting the maximum flow rate to a frequency greater than 16 kHz causes the flow computer to operate improperly.

Σ Use the summation check box for totalizing (accumulation) of the frequency output. This feature is only applicable to special firmware editions. The feature needs to be configured at the factory and is not available in standard applications. The feature works by summing flow rates and outputting a frequency proportional to total flow, not flow rate.

The test frequency button takes the value input as the scaling frequency and outputs that frequency from the flow computer. Use this feature to verify that the flow computer is outputting the appropriate frequency and to verify the calibration of the flow computer.

## Analog Output (Channels 1, 2, 3 and 4)




The *Analog Out 1* table configures the IFC15 flow computer's analog channels. Consult individual flow computer manuals to determine if your flow computer incorporates this feature. This table completely configures the type of information as well as scaling. Not all IFC15 flow computer boards have an analog output. If yours does, proceed with this procedure. You can select the engineering unit for things such as volumetric flow rate, mass flow rate and temperature.

**NOTE:** The IFC15 flow computer needs to be jumper-configured per applicable flow computer manual prior to selecting the corresponding electrical type. Consult the factory for a copy of the proper IFC15 flow computer manual.

The electrical waveform needs to match your board's particular jumper configuration. Consult your particular flow computer manual for information regarding jumper configuration.

1. Select the bullet next to the waveform for which the flow computer's analog channel is jumper-configured (0…5V DC, 0…10V DC or 4…20 mA).
2. Click the down arrow to select the engineering unit.
3. Right-click the **IDX** button and select **Clear Grid**.
4. Press **Enter** to enter values for the Engineering Unit (EU) and the corresponding frequency for the flow computer to output. The first entry typically corresponds to zero flow, and is set to zero V DC or mA.
5. Press **Enter** to enter the maximum output V DC or mA.
6. Press **Enter** to enter the maximum flow rate (or other variable) and the corresponding analog value for the flow computer to output.

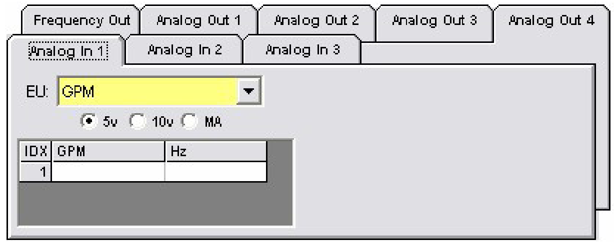
In addition to adjusting the scaling and determining the unit of measurement, you need to calibrate the analog channels. Typically, 10 points are performed in calibration, evenly spaced throughout the range of the channel. For instance, on a 0…10V channel, the output would be calibrated at 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10V DC.

7. Use a multimeter to monitor the output.
8. Press the left or right arrows to adjust the Digital-to-Analog Converter (DAC) counts until the multimeter reads the correct value.
9. Click **Set Output** to store the number of DAC counts and move on to the next index point.

Use the **IDX** button to can copy and paste data to and from the table via the IDX button.

Use the summation check box for totalizing (accumulation) of the frequency output. This feature is only applicable to special firmware editions. The feature needs to be configured at the factory and is not available in standard applications. The feature works by summing flow rates and outputting a frequency proportional to total flow, not flow rate.

# CONFIGURING ANALOG INPUT



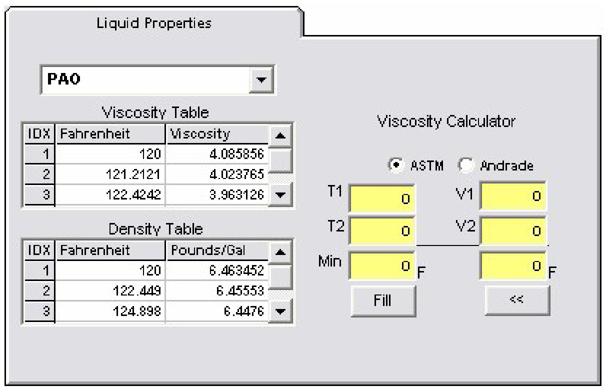

You can configure the analog inputs (*Analog In 1*, *Analog in 2* and *Analog In 3*) to except external analog devices.

Typically, this applies to flow computers that use pressure compensation, where an external pressure transducer is used. In special instances, this channel may be used for other functions. Consult the factory if your application includes an analog input.

The electrical waveform needs to match your board's particular jumper configuration. Consult your particular flow computer manual for information regarding jumper configuration.

1. Select the bullet next to the waveform for which the flow computer's analog channel is jumper-configured (0…5V DC, 0…10V DC or 4…20 mA).
2. Click the down arrow to select the engineering unit.
3. Right-click the **IDX** button and select **Clear Grid**.
4. Press **Enter** to enter values for the Engineering Unit (EU) and the corresponding frequency for the flow computer to input. The first entry typically corresponds to zero flow, and is set to zero V DC or mA.

# LIQUID PROPERTIES




The *Liquid Properties* table lets the flow computer correct for changes in fluid viscosity, compute mass flow rate via density tables and provide pressure versus viscosity compensation.

Left-click the down arrow to select a fluid and display the fluid properties that were factory configured.

If the fluid you want is not listed in the drop-down box, you can create a new fluid by following the instructions below.

To add a new fluid to the drop-down box:

1. Highlight the **Fluid Properties** field.
2. Type a new fluid name.
3. Fill the viscosity table through use of the viscosity calculator or import a table.

When you change the data in the table or re-name an existing fluid, the software shows additional options in the menu bar:


The teal cylinders buttons appear for modification of the fluid registry. The choice is:

| Field | Function |
|---|---|
| Load Fluid Tables | Loads the currently stored fluid tables. The fluid tables are stored on the PC |
| Save Fluid Tables | Overwrites any existing fluids stored on the PC and creates a group of fluids based on what is saved |
| Delete Selected Fluid | Deletes the currently selected fluid from the fluid registry. Fluids are selected via the drop-down box or placing your cursor in the corresponding fluids table, which activates the fluid and provides the ability to delete from the fluid registry |

## Temperature vs Viscosity Table

The entire viscosity table, all 100 index points, is easily populated. You need to know two fluid viscosities and the corresponding fluid temperature and enter them in the yellow cells, as seen above.

**NOTE:** Please pay close attention to appropriate units when entering data into the fields above. The temperature units are in Fahrenheit (°F), the Density units are in Pounds per Gallon (Pounds/Gal), and Viscosity in Centi-Stokes (cStk)

The temperature engineering unit (T1 and T2) is degrees Fahrenheit (°F) and kinematic viscosity (V1 and V2) is in centistokes (cStk).

1. Type a fluid name in the white field near the top of the table.
2. Click the bullet next to the **ASTM** or **Andrade** method for computation of viscosity. The ASTM equation is typically more accurate.
3. Input the lesser temperature value and the corresponding viscosity value in the top-most yellow data fields of the viscosity calculator.
4. Input the greater temperature value and the corresponding viscosity value in the middle row of yellow data fields of the viscosity calculator.

**NOTE:** Place the *lesser* value for temperature at the *top* of the yellow user-defined fields. Placing the lesser temperature on the middle row of yellow cells causes the viscosity calculator to fail and possibly corrupt profile data.

5. Specify a minimum and maximum temperature values. This tells the viscosity calculator over which range in temperature to populate the temperature vs viscosity table.

**NOTE:** Exceed your intended operating temperature by 5…10 degrees or more so that temperature range is not exceeded and proper viscosity correction is taking place in the flow computer.

6. In the *lower* yellow data fields, click the button to populate the temperature vs viscosity lookup table.

The software calculates the viscosity across the entire specified temperature range. The most commonly used and most accurate method for calculating viscosity is the *ASTM* method. However, the *Andrade* method may be used.

**NOTE:** All calculations are done per ASTM D341 when *ASTM* is selected.

## Temperature vs Density Table

The density table is only applicable when a mass flow rate is desired. Using the flow meters temperature sensor, density is calculated from the *Temperature vs Density* table and then multiplied by the volumetric flow rate to obtain the mass flow rate.

$MassFlowRate = VolumetricFlowRate \times Density$

Leave these fields blank or clear the table using the IDX button (right-click the **IDX** button and select **Clear Grid)**, if a mass flow rate is not desired.

You will need to get the density properties from our factory or independently in order to calculate mass flow rate. If difficulty arises in obtaining density information regarding your fluid, have Flow Dynamics test the fluid properties in our laboratory, and supply you with the temperature vs density information.

## Fluid Pressure Compensation

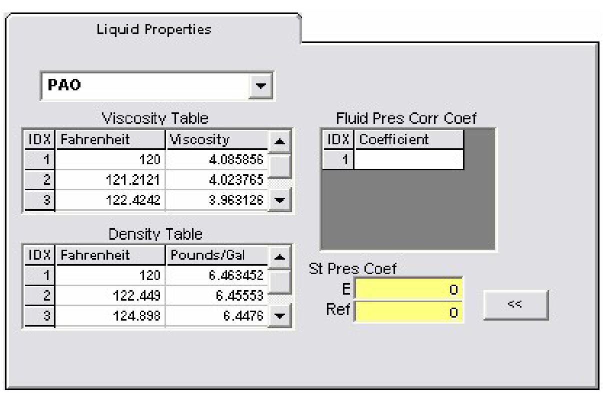
Elevated pressure has an effect on the viscosity, and therefore on the flow measurement of the flow meter. In order to account for this dynamic fluid property, pressure compensation is necessary via use of an integrated pressure transducer.

Some IFC15 flow computers can correct for changes in fluid pressure by providing for a pressure sensing input.

The *Fluid Pressure Correction Coefficient* table and *Static Pressure Coefficient* table provide the flow rate pressure compensation. The fluid properties are addressed per individual fluid and a polynomial is generated to model the pressure vs viscosity relationship. The coefficients for the modeled data are placed into the flow computer and a correction is applied based upon real-time pressure.

Click the **Change Pane** << button in the lower right corner of the *Liquid Properties* tab to access the data fields for pressure compensation.

This hides the viscosity calculator and exposes the pressure compensation variables.




If the flow computer in use is capable of pressure compensation, and pressure compensation is desired, the analog input channel of the IFC15 flow computer has to be calibrated. This is typically performed at the factory by simulating a known pressure, and adjusting the flow computer's DAC to correspond to the same pressure. The procedure for calibrating the analog input channel is the same as calibrating the analog output channels, however known pressure needs to be applied.

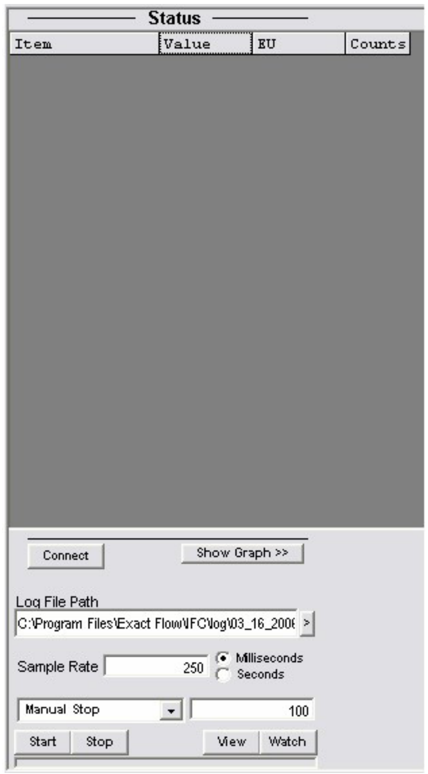
Only some flow computer models are capable of accepting a pressure input. Contact a sales representative for information regarding pressure compensation. This feature is typically configured at the factory. Consult the factory for more information on pressure correction.

# REAL-TIME MONITORING

The IFC15 flow computer outputs real-time values via the established RS485 communication. Parameters and variables can be viewed in the *Status* region of the IFC15 GUI. The *Status* screen displays the item (variable), the numerical value, the engineering unit, and, if applicable, the number of counts associated with that particular variable.

It is necessary to select which parameters you would like to view in the options menu under the *Report Display* tab. Please see subsequent documentation pertaining to the options menus. The *Report Display* is preloaded from the factory to display a core group of variables, however many more can be applied to the report format.

The status display can be seen below; however it will be necessary to follow the subsequent procedure to establish real-time update of the selected variables.




## Real-Time Report Display

The selected parameters can be viewed in real-time via the IFC15 GUI. In order to view the parameters, a flow computer must have established communication with the PC, and be communicating properly.

Since the flow computer is the device responsible for all calculations and transmitting the real-time variables, the flow computer will have to be connected.

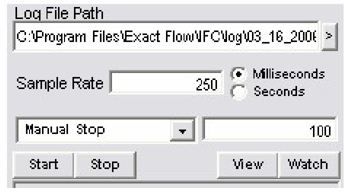
To connect the flow computer to the IFC GUI and start viewing real-time data, simply press the connect button .

**NOTE:** See *"Options – Report Display" on page 24* for all the variables for monitoring.

In addition to viewing all real time variables, the following features can also be accessed:

The *Show Graph* button switches the logging information section to a small graph of the currently selected table. If another data table is desired, simply click somewhere in the corresponding tables data.

The IFC GUI provides for data logging so that trends may be observed over set intervals, or manually stopping recordings. The GUI sends information to a tab-delimited file based on the time interval set inside of the software.




To configure the IFC GUI to provide log reports:

1. Type or browse to a location on your computer to output data logging. This designates the file name and location in which you wish to store the information.
2. Type a numeric value in the *Sample Rate* field to specify how often a new entry should be placed in the data log.
3. Select either seconds (**S**) or milliseconds (**mS**).
4. Select the interval stop from the drop down box, by
5. Click the down arrow button to select the interval stop from the drop-down menu.

| **Field** | **Function** |
|---|---|
| Manual Stop | Manual stop begins data logging when you click *Start* and ends data logging when you click *Stop* |
| Timed Stop (Seconds) | Timed stop (Seconds) begins data logging when you click *Start* and ends data logging when it reaches the numerical value adjacent to the drop-down box. For Example, if 100 were placed in the time field adjacent to the drop-down box, 100 seconds would elapse before the data would cease to log |
| Timed Stop (Minutes) | Timed stop (Minutes) begins data logging when you click *Start* and ends data logging when upon reaching the numerical value adjacent to the drop-down box. For Example, if 100 were placed in the time field adjacent to the drop-down box, 100 minutes would elapse before the data would cease to log |
| Timed Stop (Date) | Timed stop (Date) begins data logging when you click *Start* and ends data logging when upon reaching the numerical value adjacent to the drop-down box. For Example, if 1/1/20 were placed in the time field adjacent to the drop-down box, the GUI would continue to log data until January 1st 2020 |
| Sample Stop | Sample stop logs one sample's worth of data and stops at the set interval in the sample rate field |

### Viewing Log

To view the log being populated, click **View**. You will be transferred to the logging file you have designated. Values update at the intervals set.

### Watching Log

To watch the log being populated in real-time, click **Watch**. You will be transferred to the logging file you have designated.

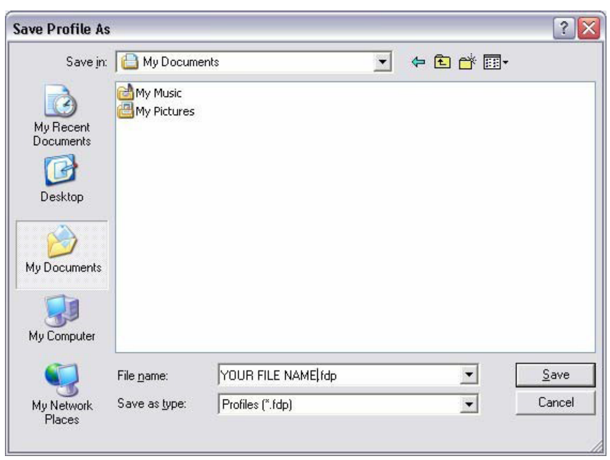
# FLOW COMPUTER PROGRAMMING

Connect all sensors, transducers, pick-offs and com. link cables to the IFC15 flow computer before powering up the computer. Communication needs to be established with the IFC flow computer prior to uploading or downloading a profile. All flow computers, unless specially configured, communicate via an RS485 connection to the PC. The PC, in conjunction with an RS485 converter shown below are required for communicating with the flow computer. Ask your sales representative regarding purchase of USB-to-RS485 converters (PN EF I-7561).

## Uploading Profiles

You can upload an existing profile from the IFC15 flow computer and save it under a different filename, then manipulate the data, yet still retrieve the old data, if necessary.

1. Click the **Upload** button in the toolbar of the main GUI screen. This retrieves the profile currently stored in the IFC15 (if previously downloaded) and places all profile data from the flow computer to the GUI.
2. Click the **File** menu.
3. Click **Save As**.
4. Click the **Down Arrow** the *Save In:* field and browse to the directory in which you want to save the file.
5. In the *File name:* field, type a name for your file (for example, YOUR FILE NAME.fdp)
6. Make sure the *Save as Type:* field indicates *Profiles (*.fdp)* and click **Save**.




All tables and configuration information are now in the profile for ready access.

## Downloading Profiles

Downloading a profile requires two steps.

The first step involves enabling the GUI to download. To download a profile to the IFC15 Flow Computer, please follow the subsequent procedure:

1. Click the white box next to **Enable** on the tool bar.
2. Click the **Download** icon. This downloads the profile currently in the GUI and places all profile data on board the IFC15 flow computer. Any information in the data tables, either blank or populated, is written to the IFC15 flow computer. An exact image of what you see on the screen is programmed into the IFC15 flow computer.

## Locating Multiple IFC15 Flow Computers

The *Locate IFC* function is for users who use many flow computers that all communicate with a central PC. Daisy-chained flow computers, all communicating via RS485, can be addressed individually via their corresponding Bus ID. You can search to see which flow computers are currently connected in the loop. Since each flow computer has its own Bus ID, each flow computer appears on this display. Information such as the Bus ID, Firmware Revision, and GUID hexadecimal string can all be displayed in this screen.

To locate an IFC15 flow computer:

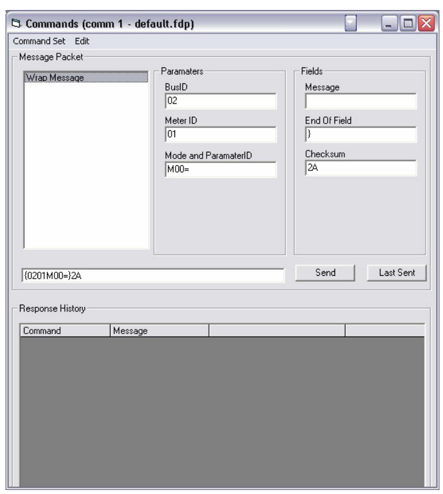
1. Click the **View** menu.
2. Click **Find IFC**.


The *Refresh* button clears the display and begins searching again for IFC15 flow computers.

The *Get Profile* button loads the currently selected flow meter's profile into the GUI tables so you can modify the tables.

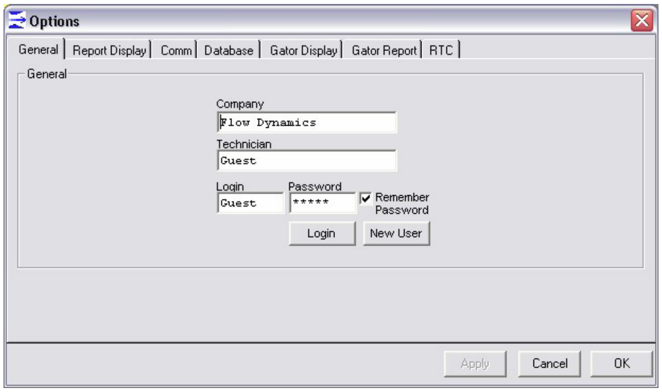
## Commands

The *Commands* feature is for specific applications where polling or Ethernet configurations are being used. Do not use this feature unless the application requires it. Consult your sales representative if this feature interests you.



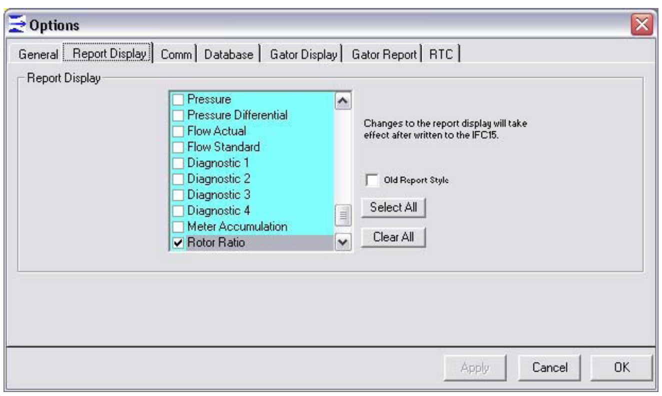
# CONFIGURATION OPTIONS

## Options – General



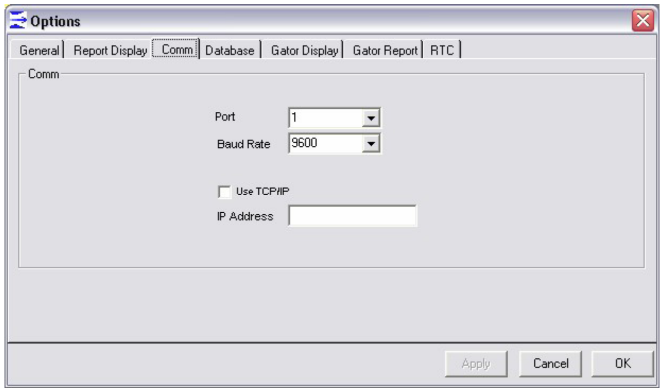

The *General* tab provides for user sign in. A company name, technician name, login ID and password can be set here. If you are a new user, click the **New User** button so the software adds you to its registry.

## Options – Report Display



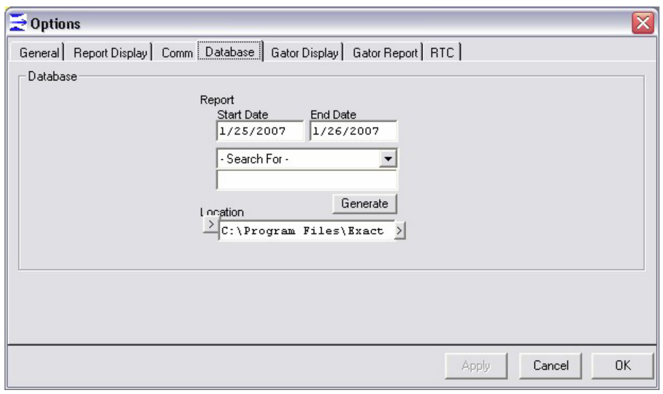

The *Report Display* tab is where you select all of the flow computer variables that you would like to see in the status window. After connecting to the IFC15 flow computer, select the variables or parameters to update in real-time. Every variable the flow computer uses for computation of flow is listed here. If you want to display all the variables, click **Select All**. If you want to display none of the variables, click **Clear All**. If you are used to viewing the old report style, click the box next to *Old Report Style*.

## Options – Communication (Comm.)



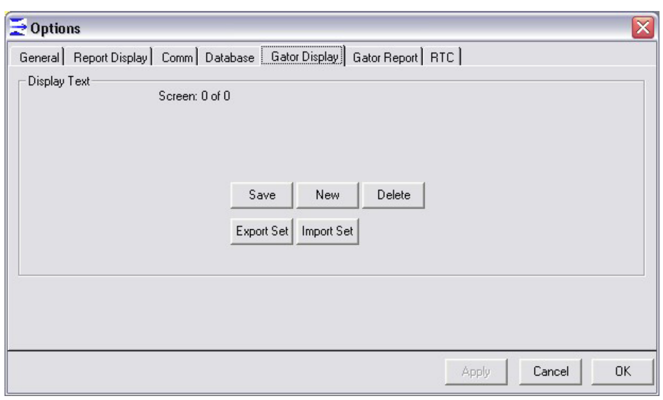

The *Communications* tab is described in detail in *"Communication Ports" on page 7*, and offers a variety of connectivity options.

## Options – Database



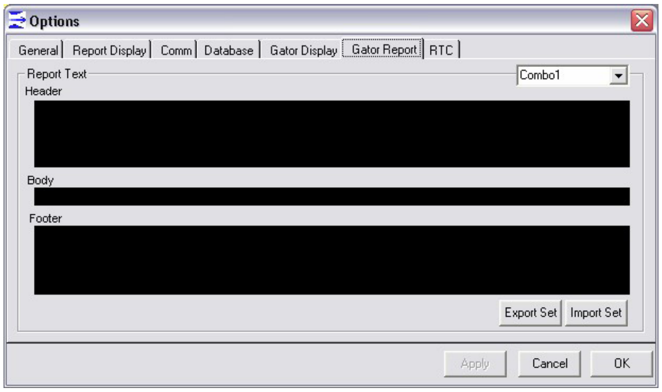

The *Database* tab is currently used only on Flow Gator products and is not applicable to IFC15 or earlier Flow Computers.

## Options – Gator Display



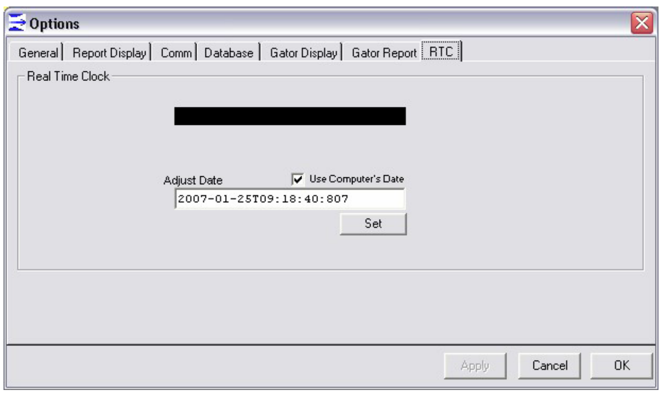

The *Gator Display* tab is currently used only on Flow Gator products and is not applicable to IFC15 or earlier Flow Computers.

## Options – Gator Report



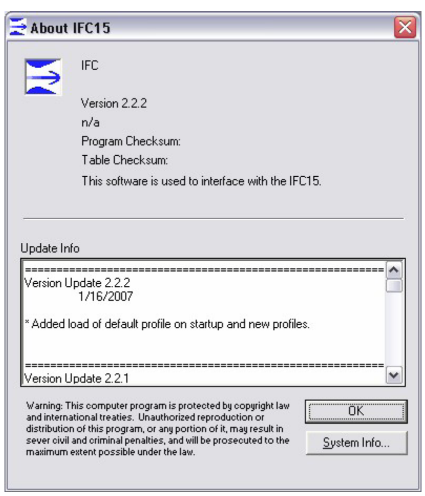

The *Gator Report* tab is currently used only on Flow Gator products and is not applicable to IFC15 or earlier Flow Computers.

## Options – Real Time Clock (RTC)




The *RTC* tab is currently used only on Flow Gator products and is not applicable to IFC15 or earlier Flow Computers.

# VERSION INFORMATION




Click the **View** menu bar and select **About** to display important information regarding the software. The factory may ask for the version of software you are using.

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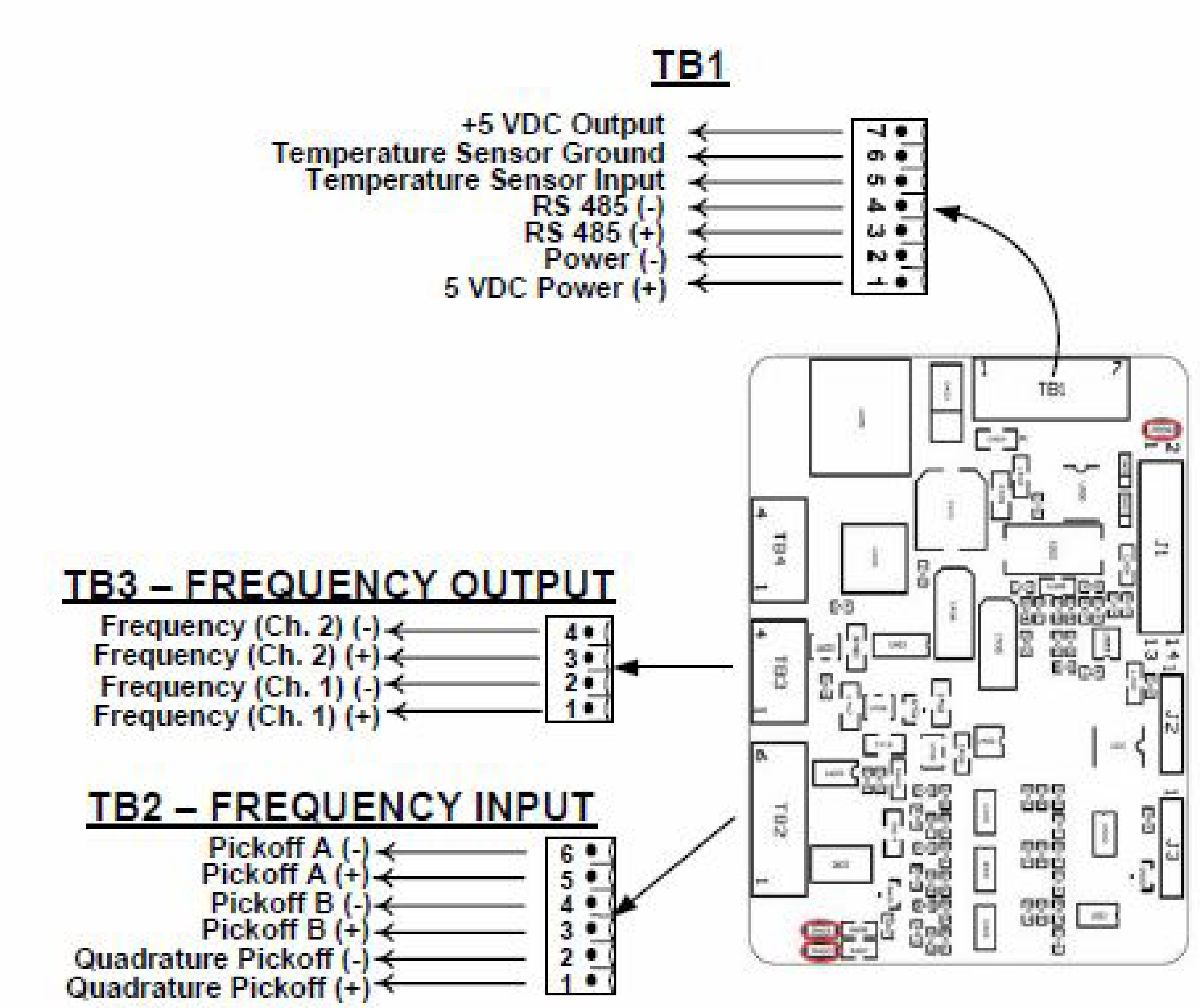
# MODEL IFC15BB

## IFC15BB Wiring Instructions

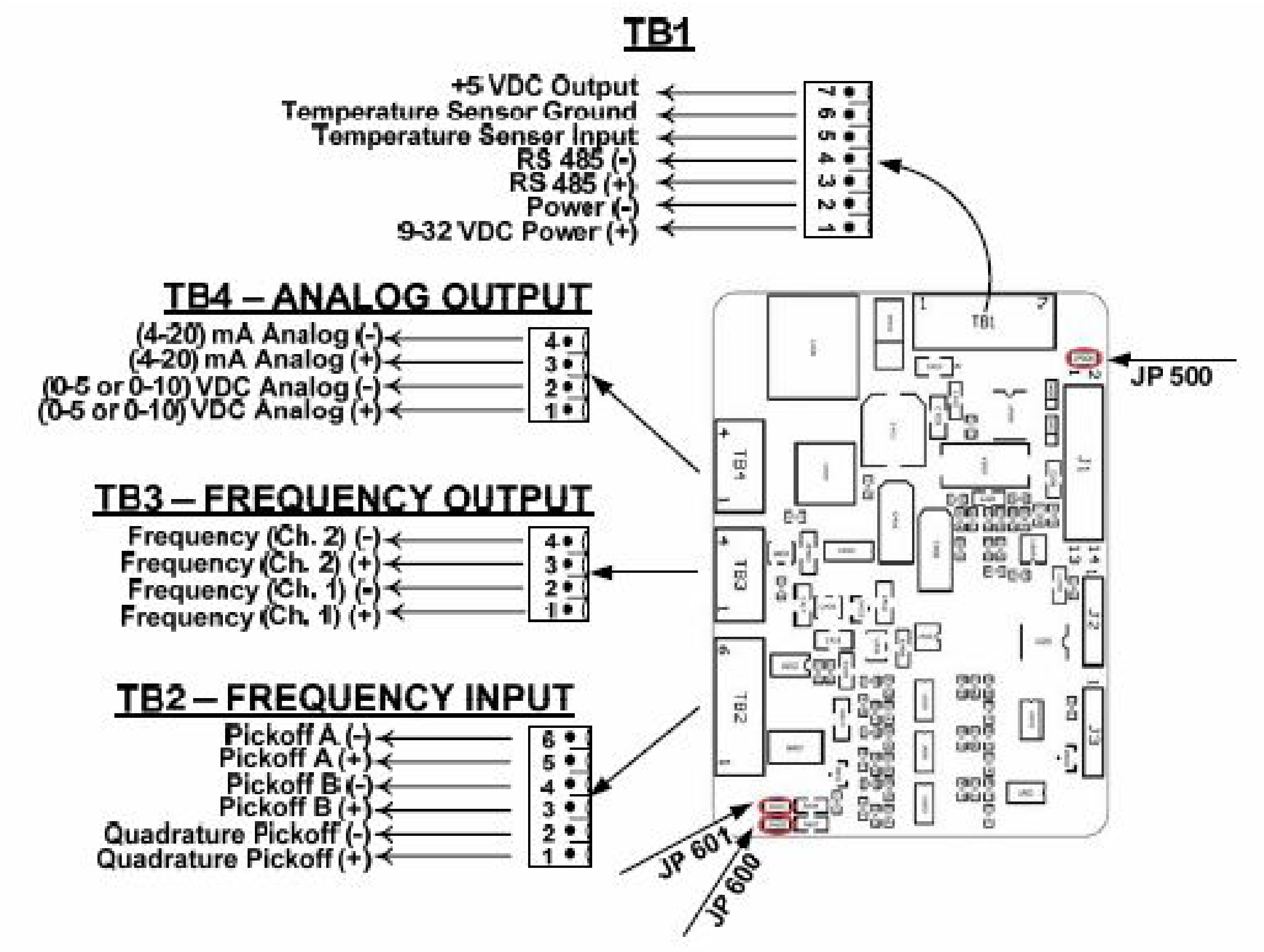


## IFC15BB Specifications

| | | | |
|---|---|---|---|
| **Input Power** | 5V DC nominal | 9…32V DC, 1.2W maximum, (excluding 4…20 mA) | |
| | **Note:** 15…32V DC power required for analog output | | |
| **Flow Meter Input Type** | Pulse TTL | Frequency range | 1 Hz…16 kHz |
| | | Impedance | 5.8 kΩ…5V DC |
| | RF carrier | Frequency range | 5 Hz…3 kHz |
| | | Inductance | 1 mH |
| | | Oscillator frequency | 55…65 kHz |
| **Temperature Input Type** | Thermistor 10 kΩ | | |
| **Linearization** | Flow meter K-factor | Number of points | 2…200 |
| | | Interpolation method | Linear |
| | | Correlation | Strouhal-Roshko (per ARP4990 publication) |
| | Temperature | Number of points | 2…50 |
| | | Interpolation method | Linear |
| | Viscosity | Number of points | 2…100 |
| | | Interpolation method | Linear |
| | | Correlation | ASTM D341-93, Andrades equation or user-defined |
| | Density | Number of points | 2…50 |
| | | Interpolation method | Linear |
| **Outputs** | Variables available for output | Linearized volume flow rate | |
| | | Linearized mass flow rate | |
| | | Flow total | |
| | | Temperature | |
| | | Pressure | |
| | Frequency (2 frequency output channels) | 0…5 V TTL, 0.6…16,000 Hz | |
| | | Transmission distance | 250 ft maximum |
| | Analog (1 analog output channels) | 0…5V DC, 0…10V DC or 4…20 mA | |
| | | Voltage | Linearized, scaled |
| | | Zero offset | < 5 mV |
| | | Current | Linearized, scaled |
| | | Maximum load | 500 Ω max. load resistance (4…20 mA) |
| | RS485 (volume/mass flow, temperature, other) | Baud rate, 115K | |
| | | Update rate | Selectable, 0.1 sec minimum |
| | | Data bits | 8 |
| | | Stop bit | 1 |
| | | Parity | None |
| **Performance** | Accuracy | Linearized frequency | 0.1% of reading |
| | | Linearized analog | 0.1% of full scale |
| | | Thermistor | ±0.5 °C (does not include sensor uncertainty |
| | | Analog input (temperature) | 16 bit A/D resolution |
| | Linearization latency | 0.8…2.0 ms + period of input | |
| **Batching** | 2 I/O ports for control, batching, manifolding | 1 input port | |
| | | 1 output port | |
| **Environment** | Temperature | Operating | –40…185° F (–40…85° C) |
| | | Storage | –67…257° F (–55…125° C) |
| | Humidity | 0…85% RH non-condensing | |
| | Enclosure | NEMA 4 or NEMA 4 CLI GR.CD CL II GR.EFG CL.III WET LOC. Aluminum | |
| **Communication** | Interface RS485, serial USART connection to personal computer (with serial cable) | | |
| | Baud | Output | 115K |
| | | Programming | 115K |
| | | Data bits | 8 |
| | | Stop bit | 1 |
| | | Parity, | none |

# MODEL IFC15BBA

## IFC15BBA Wiring Instructions

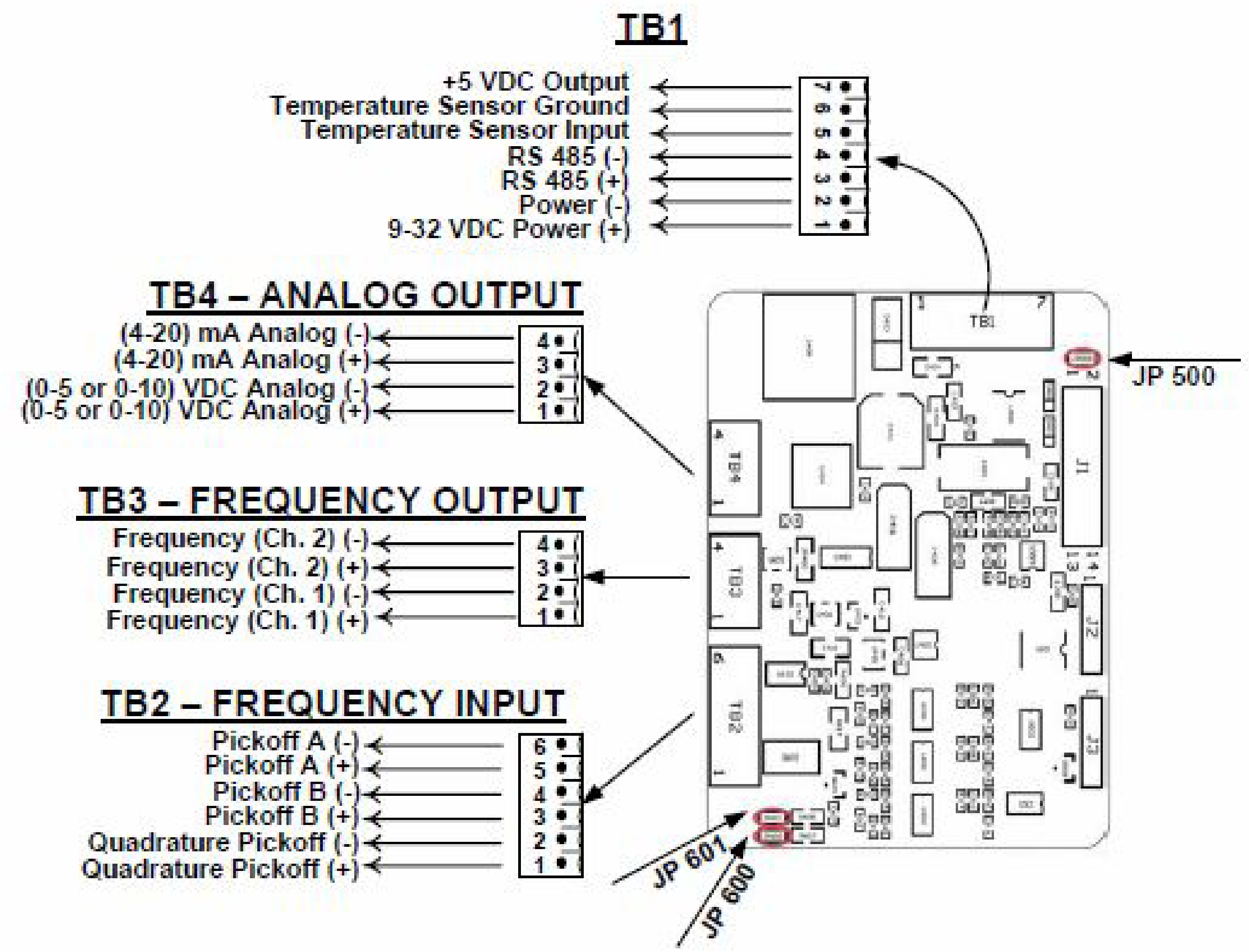


## IFC15BBA Specifications

| | | | |
|---|---|---|---|
| **Input Power** | 24V DC nominal | 9…32V DC, 1.2W max, (excluding 4…20 mA) | |
| | **Note:** 15…32V DC power required for analog output | | |
| **Flow Meter Input Type** | Pulse TTL | Frequency range | 1 Hz…16 kHz |
| | | Impedance | 5.8 kΩ…5V DC |
| | RF Carrier | Frequency range | 5 Hz…3 kHz |
| | | Inductance | 1 mH |
| | | Oscillator frequency | 55…65 kHz |
| **Temperature Input Type** | Thermistor 10 kΩ | | |
| **Linearization** | Flow meter K-factor | Number of points | 2…200 |
| | | Interpolation method | Linear |
| | | Correlation | Strouhal-Roshko (per ARP4990 publication) |
| | Temperature | Number of points | 2…50 |
| | | Interpolation method | Linear |
| | Viscosity | Number of points | 2…100 |
| | | Interpolation method | Linear |
| | | Correlation | ASTM D341-93, Andrades equation or user-defined |
| | Density | Number of points | 2…50 |
| | | Interpolation method | Linear |
| **Outputs** | Variables available for output | Linearized volume flow rate | |
| | | Linearized mass flow rate | |
| | | Flow total | |
| | | Temperature | |
| | | Pressure | |
| | Frequency (2 frequency output channels) | 0…5 V TTL, 0.6…16,000 Hz | |
| | | Transmission distance | 250 ft maximum |
| | Analog (1 analog output channel) | 0…5V DC, 0…10V DC, or 4…20 mA | |
| | | Voltage | Linearized, scaled |
| | | Zero offset | < 5 mV |
| | | Current | Linearized, scaled |
| | | Maximum load | 500 Ω; max. load resistance (4…20 mA) |
| | RS485 (volume/mass flow, temperature, other) | Baud rate | 115K |
| | | Update rate | Selectable, 0.1 sec minimum |
| | | Data bits | 8 |
| | | Stop bit | 1 |
| | | Parity | None |
| **Performance** | Accuracy | Linearized frequency | 0.1% of reading |
| | | Linearized analog | 0.1% of full scale |
| | | Thermistor | ±0.5 °C (does not include sensor uncertainty) |
| | | Analog input (temperature) | 16 bit A/D resolution |
| | Linearization latency | 0.8…2.0 ms + period of input | |
| **Batching** | Two I/O ports for control, batching, manifolding | 1 input port | |
| | | 1 output port | |
| **Environment** | Temperature | Operating | –40…185° F (–40…85° C) |
| | | Storage | –67…257° F (–55…125° C) |
| | Humidity | 0…85% RH non-condensing | |
| | Enclosure | NEMA 4 or NEMA 4 CLI GR.CD CL II GR.EFG CL.III WET LOC. Aluminum | |
| **Communication** | Interface | RS485, serial USART connection to personal computer (with serial cable) | |
| | Baud | Output | 115K |
| | | Programming | 115K |
| | | Data bits | 8 |
| | | Stop bit | 1 |
| | | Parity | None |

# MODEL IFC15BBAP

## IFC15BBAP Wiring Instructions

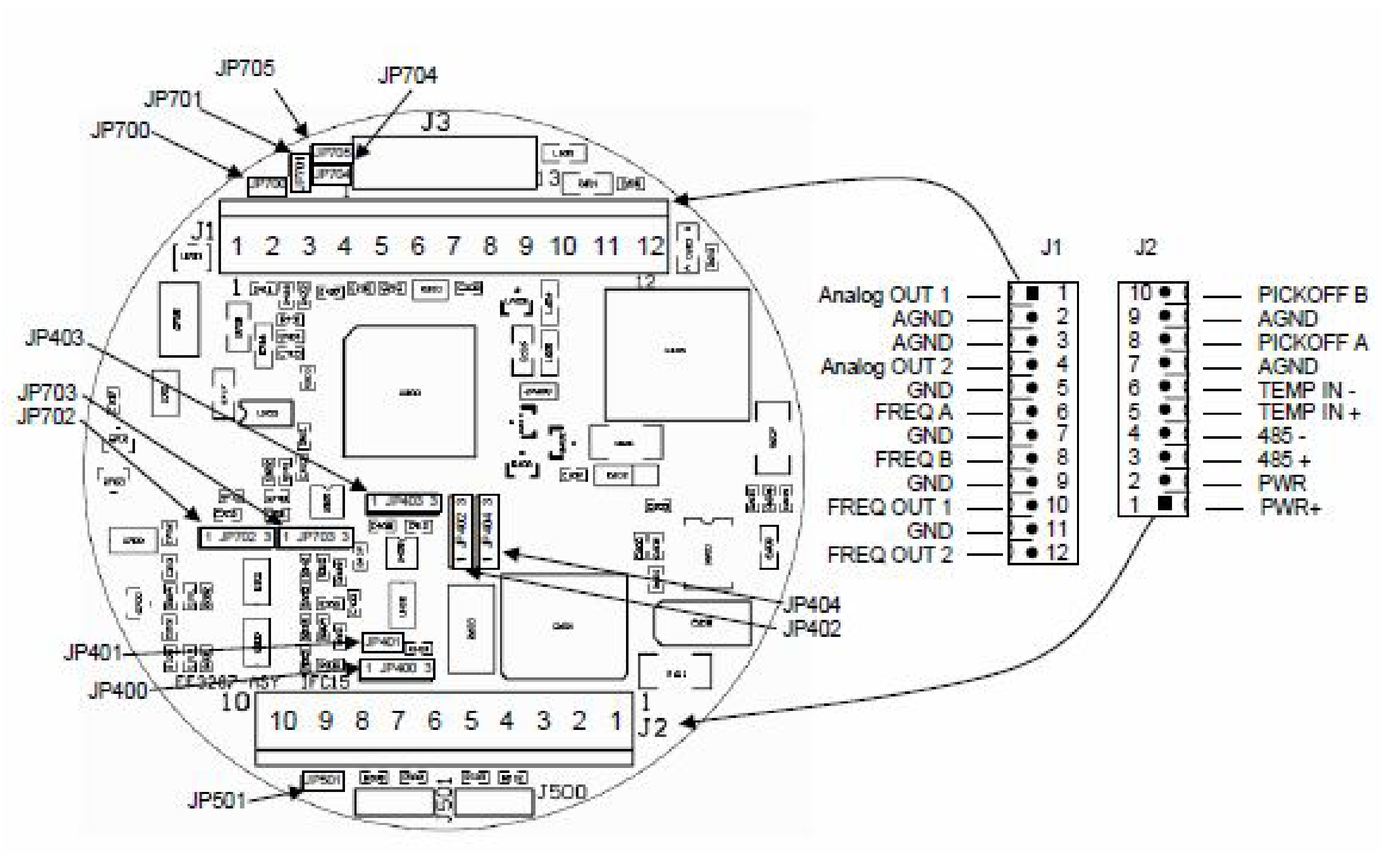


## IFC15BBAP Specifications

| | | | |
|---|---|---|---|
| **Input Power** | 24V DC nominal | 9…32V DC, 1.2W max. (excluding 4…20 mA) | |
| | **Note:** 15…32V DC power required for analog output | | |
| **Flow Meter Input Type** | Pulse TTL | Frequency range | 1 Hz…16 kHz |
| | | Impedance | 5.8 kΩ…+5V DC |
| | RF carrier | Frequency range | 5 Hz…3 kHz |
| | | Inductance | 1 mH |
| | | Oscillator frequency | 55…65 kHz |
| **Temperature Input Type** | Thermistor 10 kΩ | | |
| **Linearization** | Flow meter K-factor | Number of points | 2…200 |
| | | Interpolation method | Linear |
| | | Correlation | Strouhal-Roshko (per ARP4990 publication) |
| | Temperature | Number of points | 2…50 |
| | | Interpolation method | Linear |
| | Viscosity | Number of points | 2…100 |
| | | Interpolation method | Linear |
| | | Correlation | ASTM D341-93, Andrades equation or user-defined |
| | Density | Number of points | 2…50 |
| | | Interpolation method | Linear |
| **Outputs** | Variables available for output | Linearized volume flow rate | |
| | | Linearized mass flow rate | |
| | | Flow total | |
| | | Temperature | |
| | | Pressure | |
| | Frequency (2 frequency output channels) | 0…5 V TTL, 0.6…16,000 Hz | |
| | | Transmission distance | 250 ft. maximum |
| | Analog (1 analog output channel) | 0…5V DC, 0…10V DC or 4…20 mA | |
| | | Voltage | Linearized, scaled |
| | | Zero offset | Less than 5 mV |
| | | Current | Linearized, scaled |
| | | Maximum load | 500 Ω max. load resistance (4…20 mA) |
| | RS485 (volume/mass flow, temperature, other) | Baud rate | 115K |
| | | Update rate minimum | Selectable, 0.1 sec |
| | | Data bit | 8 |
| | | Stop bit | 1 |
| | | Parity | None |
| **Performance** | Accuracy | Linearized frequency | 0.1% of reading |
| | | Linearized analog | 0.1% of full scale |
| | | Thermistor | ±0.5° C (does not include sensor uncertainty) |
| | | Analog input (temperature) | 16 Bit A/D resolution |
| | Linearization latency | 0.8…2.0 ms + period of input | |
| **Batching** | 2 I/O ports for control, batching, manifolding | 1 input port | |
| | | 1 output port | |
| **Environment** | Temperature | Operating | –40…185° F (–40…85° C) |
| | | Storage | –67…257° F (–55…125° C) |
| | Humidity | 0…85% RH non-condensing | |
| | Enclosure | NEMA 4 or NEMA 4 CLI GR.CD CL II GR.EFG CL.III WET LOC. Aluminum | |
| **Communication** | Interface | RS485, serial USART connection to personal computer (with serial cable) | |
| | Baud | Output | 115K |
| | | Programming | 115K |
| | | Data bits | 8 |
| | | Stop bit | 1 |
| | | Parity | none |

# MODEL IFC15L

## IFC15L Wiring Instructions



## IFC15L Specifications

| | | | |
|---|---|---|---|
| **Input Power** | 24V DC nominal | 15…32V DC, 0.120 amps maximum, (excluding 4…20 mA) | |
| | **Note:** 18…32V DC power required for analog output | | |
| **Flow Meter Input Type** | Pulse TTL | Frequency range | 1 Hz…16 kHz |
| | | Impedance | 5.8 kΩ…5V DC |
| | RF Carrier | Frequency range | 5 Hz…3 kHz |
| | | Inductance | 1 mH |
| | | Oscillator frequency | 55…65 kHz |
| **Temperature Input Type** | Thermistor | 10 kΩ | |
| | Current | 4…20 mA | |
| | Voltage | 0…10V DC or 0…5V DC | |
| **Linearization** | Flow meter K-factor | Number of points | 2…200 |
| | | Interpolation method | Linear |
| | | Correlation | Strouhal-Roshko (per ARP4990 publication) |
| | Temperature | Number of points | 2…50 |
| | | Interpolation method | Linear |
| | Viscosity | Number of points | 2…100 |
| | | Interpolation method | Linear |
| | | Correlation | ASTM D341-93, Andrades Equation or user-defined |
| | Density | Number of points | 2…50 |
| | | Interpolation method | Linear |
| **Outputs** | Variables available for output | Linearized volume flow rate | |
| | | Linearized mass flow rate | |
| | | Flow total | |
| | | Temperature | |
| | | Pressure | |
| | Frequency (2 frequency output channels) | 0…5 V TTL, 0.6…16,000 Hz | |
| | | Transmission distance | 250 ft maximum |
| | Analog (2 analog output channels) | 0…5V DC, 0…10V DC or 4…20 mA | |
| | | Voltage | Linearized, scaled |
| | | Zero offset | Less than 5 m |
| | | Current | Linearized, scaled |
| | | Maximum load | 500 Ω max. load resistance (4…20 mA) |
| | RS485 (volume/mass flow, temperature, other) | Baud rate | 115K |
| | | Update Rate | Selectable, 0.1 sec minimum |
| | | Data Bits | 8 |
| | | Stop Bit | 8 |
| | | Parity | None |
| **Performance** | Accuracy | Linearized frequency | 0.1% of reading |
| | | Linearized analog | 0.1% of full scale |
| | | Thermistor | ±0.5° C (does not include sensor uncertainty) |
| | | Analog input (temperature) | 16 bit A/D resolution |
| | Linearization latency | 0.8…2.0 ms + period of input | |
| **Batching** | 2 I/O ports for control, batching, manifolding | 1 input port | |
| | | 1 output port | |
| **Environment** | Temperature | Operating | –40…185° F (–40…85° C) |
| | | Storage | –67…257° F (–55…125° C) |
| | Humidity | 0…85% RH non-condensing | |
| | Enclosure | NEMA 4 or NEMA 4 CLI GR.CD CL II GR.EFG CL.III WET LOC. Aluminum | |
| **Communication** | Interface | RS485, serial USART connection to personal computer (with serial cable) | |
| | Baud | Output | 115K |
| | | Programming | 115K |
| | | Data Bits | 8 |
| | | Stop Bit | 1 |
| | | Parity | None |

**Control. Manage. Optimize.**



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