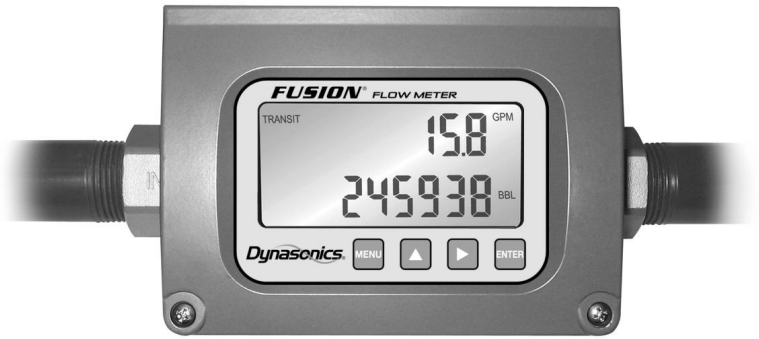
Dynasonics®

FUSION®

Water Flow Meter

Installation and Operating Instructions



RACINE FEDERATED INC.
UL REGISTERED FIRM
ISO 9001:2008
10001652 QM08

TABLE OF CONTENTS

QUICK-START INSTRUCTIONS

This manual contains detailed operating instructions for the FUSION flow meter. The following condensed instructions are provided to assist an experienced operator in basic operation of the instrument. If the operator is unfamiliar with this type of instrument, refer to the detailed explanations located on pages 9-32.

1. **MOUNTING LOCATION** Determine the proper mounting location for the flow meter by referring to **Figure 1** below. The pipe must be completely filled with liquid while measurements are being made—avoid installations where pipes can become partially filled. (It is acceptable to have the pipe drain out when the pump or valve is turned off, so long as the pipe refills completely when the pump turns on or the valve opens.)

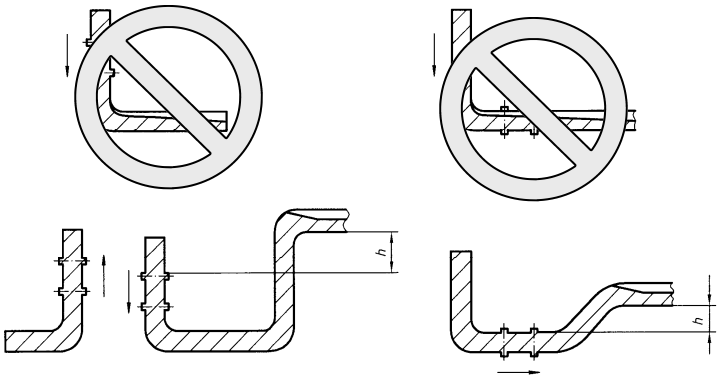


Figure 1 - Flow Meter Location

2. **PLUMBING** FUSION is equipped with an **IN▶** directional arrow pointing in the flow direction that will produce positive readings with the **FLO DIR** set to **POS**. Mount the meter for best viewing of the display regardless of the flow direction; the direction can be changed in CONFIGURATION. The flow meter is equipped with NPT female threads. Apply pipe sealant or tape to mating components and tighten securely. For best accuracy, install a straight pipe nipple that is a minimum of 10 times the pipe ID immediately before the FUSION flow meter. It is recommended that a pipe union be utilized near the flow meter to facilitate easy removal of the meter for service.

3. **ELECTRICAL CONNECTIONS** Route 12-30 volt DC power and earth ground through one of the FUSION conduit connections and secure at the 12-30 VDC In, Power Gnd and Earth Gnd terminals. Ensure that electrical codes applicable to the installation area are followed. An installation drawing covering Hazardous Area installations is located in the back of this manual. (The FUSION meter contains several output options that will be covered in detail in subsequent sections of this manual.)

4. **APPLY POWER** After power is applied to the FUSION flow meter, the display will illuminate and show the software version that is running inside of the flow meter as Ux.xx. The flow meter will then conduct self-diagnostic, measurement and buffering operations during an Auto Adjust countdown that is shown on the display. These operations are also conducted each time a user exits from the keypad configuration menu.

5. **OPERATION** If the flow meter is started empty, the display will indicate "EMPTY PIPE" until the flow meter fills with liquid. If the flow meter is filled with liquid, the flow meter will display either DOPPLER or TRANSIT (indicating the mode of operation that is supplying the flow readings to the display and outputs).

6. **CONFIGURATION** There are seven parameters that are configured in the field on a typical installation.

    A. RATE UNIT <GPM, BPD, LPM, M3/H>
    B. TOTAL UNIT <GAL, BBL, LIT, M3>
    C. FLOW DIRECTION <POS, NEG>
    D. OUTPUT <4-20 mA, PULSE>
    E. FULL FLOW <Maximum flow rate for span>
    F. FLOW CUTOFF <Meter indicates zero below setting>
    G. RESPONSE <SLOW, MEDIUM, FAST>

7. **TOTALIZER RESET** The flow totalizer can be reset to zero by simultaneously pressing the MENU and ENTER keys or by momentarily connecting the Reset Total In terminal to Power Gnd terminal.

OPERATING THEORY

The FUSION ultrasonic flow meter is designed to measure volumetric flow of clean, solids-bearing or aerated liquid on full pipes. There are no moving parts to jam or wear and the product cannot be damaged by gas pockets, particulate or high flowing conditions. The unit contains several input/output options for integration with monitoring and control systems.

The flow meter's patent pending operation consists of continuously measuring flow using both transit time and Doppler ultrasonic sound techniques, and using the better of the two signals to calculate the flow rate.

When in transit time mode, the flow meter transmits an ultrasonic sound from the upstream transducer into the flowing liquid. The travel time to the downstream transducer is measured. The flow meter then transmits an ultrasonic sound from the downstream transducer into the flowing liquid. The travel time to the upstream transducer is measured. The difference between the two travel times is then used to calculate the measured flow rate.

When in Doppler mode, the flow meter transmits an ultrasonic sound from its transmitting transducer into the flowing liquid. The sound will be reflected by sonic reflectors (gas bubbles or particulate) suspended within the liquid and recorded by the receiving transducer. If the sonic reflectors are moving within the sound transmission path, sound waves will be reflected at a frequency shifted (Doppler frequency) from the transmitted frequency. The shift in frequency will be directly related to the speed of the moving particle or bubble. This shift in frequency is interpreted by the instrument and converted to various user defined measuring units.

FUSION retains all user configured data and accumulated flows (totalizers) in non-volatile Flash memory indefinitely.

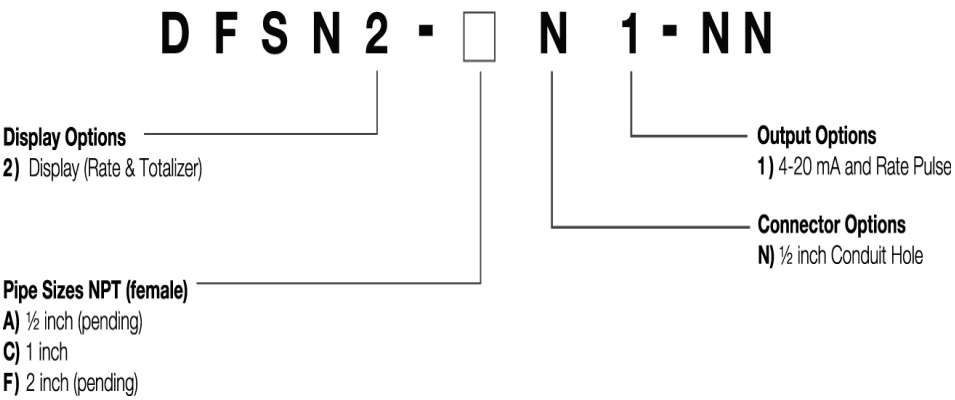
PRODUCT SPECIFICATIONS

See **Appendix A**.

SYMBOL EXPLANATIONS

See **Appendix A**.

PRODUCT MATRIX



1. MOUNTING LOCATION

The first step in the installation process is the selection of an optimum location for the flow measurement to be made. For this to be done effectively, a basic knowledge of the piping system and its plumbing is required.

The pipe must be completely filled with liquid while measurements are being made—avoid installations where pipes can become partially filled for long periods of time. It is acceptable to have the pipe drain out when the pump turns off or a valve closes, so long as the pipe refills completely when the pump turns on or the valve opens. Refer to **Figure 2** for unacceptable and acceptable piping configurations.

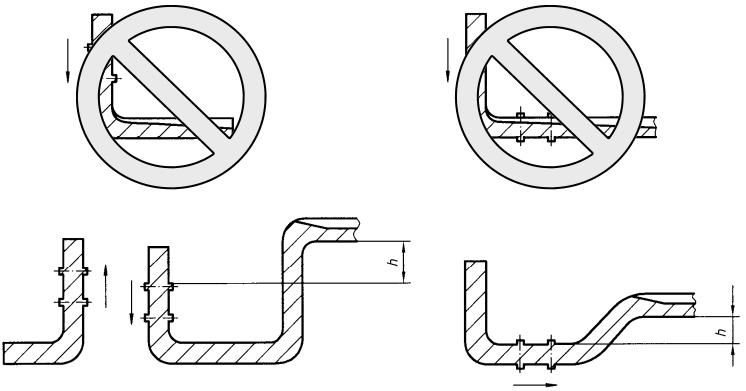


Figure 2 - Proper Mounting Locations

2. PLUMBING

FUSION is equipped with an **IN▶** directional arrow pointing in the flow direction that will produce positive readings with the **FLO DIR** set to **POS**. Mount the meter for best viewing of the display regardless of the flow direction; the direction can be changed in CONFIGURATION (see page 22).

If flow through the system is in the direction of the **IN▶** arrow, the **FLO DIR** should be set to **POS.**

If flow through the system is opposing the **IN▶** arrow, the **FLO DIR** should be set to **NEG.**

Selection of **POS** and **NEG** flow direction is covered in detail in the CONFIGURATION section of this manual.

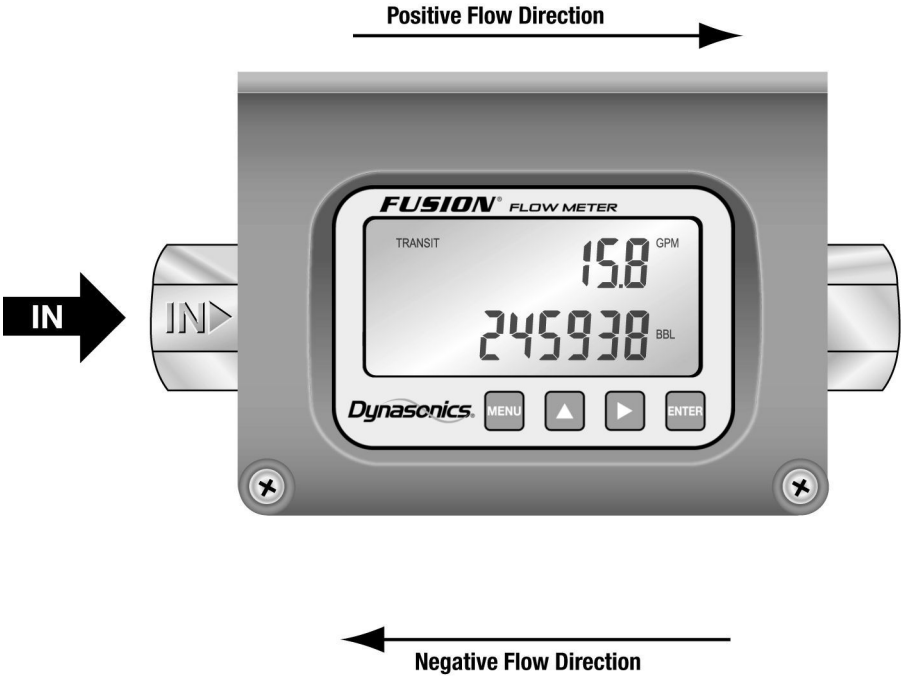


Figure 3 - Flow Meter Direction

For best measurement accuracy and reading stability, mount the meter with the minimum lengths of straight pipe described in **Figure 4**. The optimum straight pipe diameter recommendations apply to pipes in both horizontal and vertical orientation.

Note: If adequate straight plumbing cannot be provided, the FUSION will operate repeatably and reliably, but will not achieve optimum accuracy.

Pipe Size	A	B
1/2"	6"	3"
1"	12"	6"
2"	24"	12"

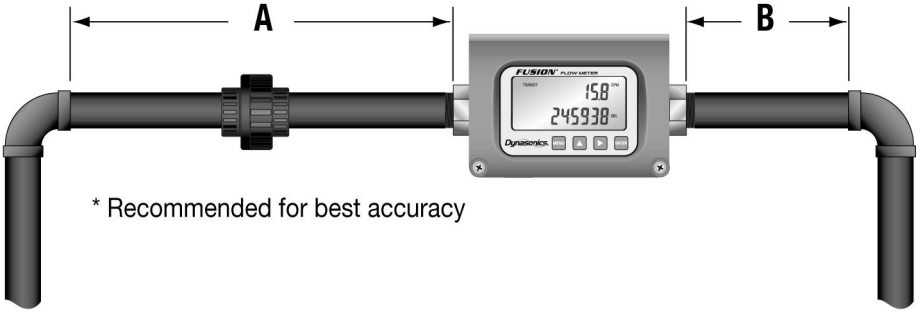


Figure 4 - Straight Pipe Recommendations

Outdoor Installations

In outdoor installations, mount the flow meter with the display/ keypad facing 9-10 o'clock to prevent water from collecting in the keypad recess and water running down the cables to the conduit connections. Refer to **FIGURE 5**.

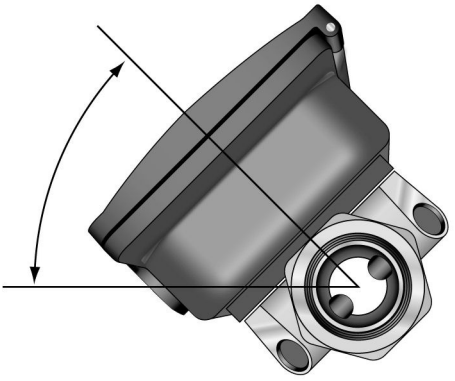


Figure 5 - Display/Wiring Orientation

3. ELECTRICAL CONNECTIONS

The FUSION flow meter is equipped with three threaded conduit holes located on the bottom of the flow meter enclosure that are suitable for routing of field wiring. A sealed cord grip or sealed threaded conduit connection should be utilized to retain the NEMA 4 integrity of the flow meter enclosure. Failure to do so will void the manufacturer's warranty and can lead to product failure.

For hazardous area installation, see drawing number D091-1054-002 located in the back of this manual. For non-hazardous location installations, flow meter power and output signals can be carried by a single cable with multiple conductors. Select a 20-24 AWG shielded cable with an external jacket suitable for the installation environment and appropriate number of conductors. The number of conductors can range from 3-11 depending on the number of input/output connections that will be utilized.

Wiring methods and practices are to be made in accordance with the NEC—National Electrical Code®—and/or other local ordinances that may be in effect. Consult the local electrical inspector for information regarding wiring regulations.

When making connections to the field wiring terminals inside of the flow meter, strip back the wire insulation approximately 0.25 inch (6 mm). Stripping back too little may cause the terminals to clamp on the insulation and not make good contact. Stripping back too much insulation may lead to a situation where the wires could short together between adjacent terminals. Wires should be secured in the Field Wiring Terminals using a screw torque of between 0.5 and 0.6 Nm.

IMPORTANT NOTE:
Must be operated by a Class 2 supply suitable for the location.

IMPORTANT NOTE:
Do not connect or disconnect either power or outputs unless the area is known to be non-hazardous.

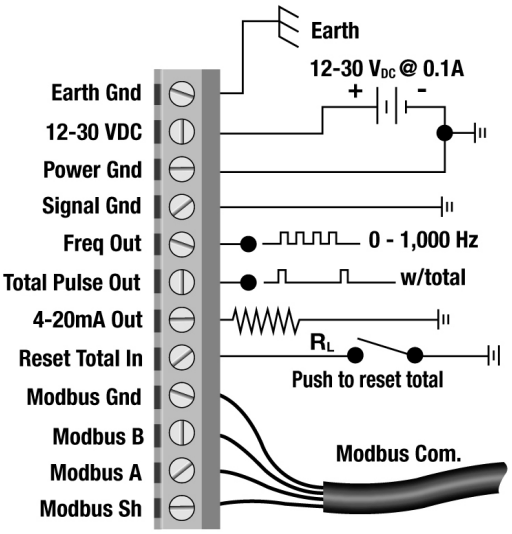


Figure 6 - FUSION Wiring Diagram

POWER CONNECTIONS

Power for the FUSION flow meter is obtained from a DC (direct current) power source. The power source should be capable of supplying between 12 and 30 Vdc at a minimum of 0.1 Amps or 100 milliamps. With the power from the DC power source disabled or disconnected, connect the positive supply wire and ground to the appropriate field wiring terminals in the flow meter. See **Figure 7**. A wiring diagram decal is located adjacent to the field wiring terminals within the FUSION enclosure.

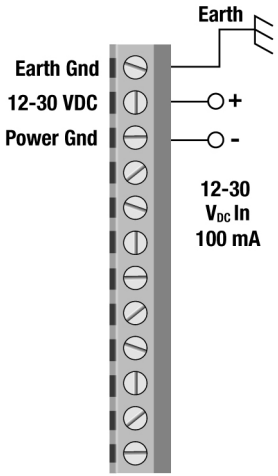


Figure 7 - DC Power Connections

If the flow meter is only to be utilized as a flow rate indicator or totalizer, no further wiring will be required. Skip to the Flow Meter Configuration section of this manual (see page 19).

4-20mA CONNECTION

The FUSION is equipped with a ground-referenced 4-20 mA output—the output shares a common ground with the power supply. The output transmits a continuous current output that is proportional to liquid flow rate. The output was scaled at the Dynasonics factory and the scaling information is recorded on the label located outside of the FUSION enclosure. To ensure that the instrument or data acquisition system that is receiving the 4-20 mA signal responds properly, the receiving device must be spanned identically to the FUSION.

IMPORTANT: The RATE PULSE and 4-20mA outputs cannot be operated simultaneously. Select the desired output type from the **OUTPUT** menu. Details of this selection are covered in the Flow Meter Configuration section of this manual.

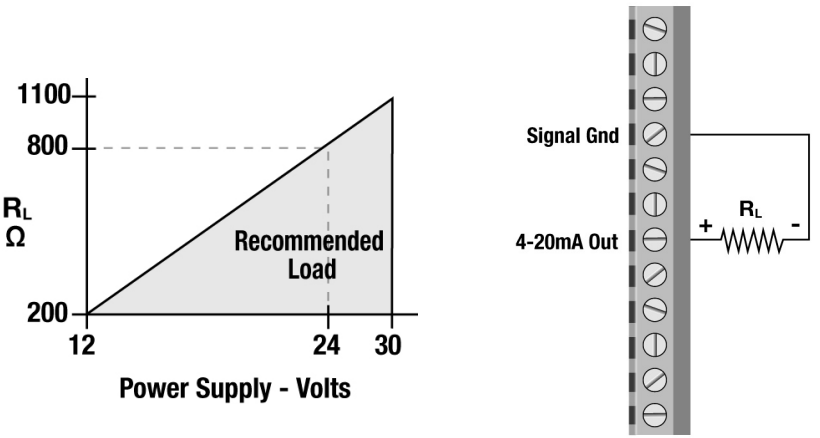


Figure 8 - 4-20mA Connections and Loop Resistance

The 4-20 mA output is designed to source current across a loop resistance that is typically located within a data acquisition system or other receiving instrument. The maximum resistance that the FUSION can accommodate is directly related to the DC power source that is powering the flow meter and the 4-20 mA loop. **Figure 8** illustrates the range of load resistance that can be used with a given power supply voltage. Ensure that the loop load resistance is within the shaded region of the graph, or non-linearity and transmitting errors will occur.

The 4-20 mA output is polarized and since the output shares the DC common with the power supply, reversing the connections can cause a short circuit in the DC power circuit. **Figure 9** shows a block diagram of how the 4-20 mA interfaces with the receiving device.

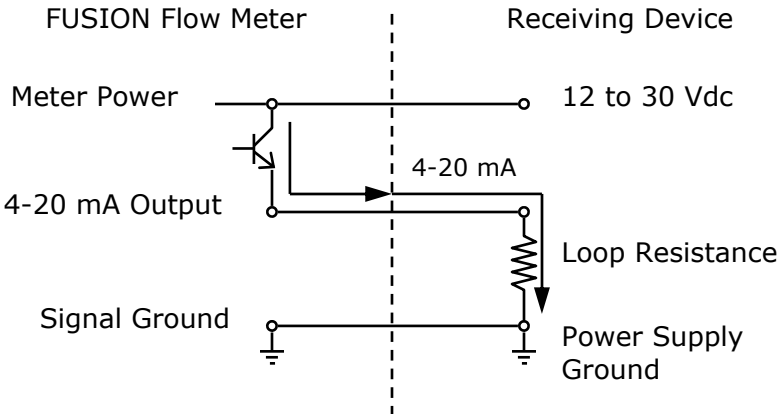


Figure 9
4-20 mA Block Diagram

RATE PULSE OUTPUT

The FUSION is equipped with an open-collector transistor circuit that outputs a pulse waveform that varies proportionally with flow rate—from 0 Hz at zero flow rate to 1,000 Hz at full flow rate (configuration entry **FULL FLOW** described in detail in the flow meter configuration section of this manual). To ensure that accurate readings are being recorded by the receiving instrument, the FUSION and the receiving instrument must have identical K-factor values programmed into them. Unlike standard mechanical flow meters such as turbines, gear or nutating disk meters, the K-factor of the FUSION meter can be changed by modifying the **FULL FLOW** flow rate value. Please refer to the equations on the following page for the Full Flow / K-factor Calculation.

IMPORTANT: The RATE PULSE and 4-20mA outputs cannot be operated simultaneously. Select the desired output type from the **OUTPUT** menu. Details of this selection are covered in the Flow Meter Configuration section of this manual.

Two pulse output options are available with the FUSION:

- *Turbine meter simulation*—This option is utilized when a receiving instrument is capable of interfacing directly with a turbine flow meter's magnetic pickup. The output is a relatively low voltage AC signal whose amplitude swings above and below the signal ground reference. The minimum AC amplitude is approximately 500 mV peak-to-peak. To activate the turbine output circuit, turn on SW1-2 and turn off SW1-3.
- *Square-wave (TTL) frequency*—This option is utilized when a receiving instrument requires that the pulse voltage level be either of a higher potential and/or referenced to DC ground. The output is a square-wave with a peak-to-peak voltage that swings to the DC supply rail when the SW1-2 is ON or to an alternate voltage level if SW1-2 is turned OFF and an external pull-up resistor and power source are utilized.

Rate Pulse Output Connection

Figure 10 illustrates the field wiring terminals and switch settings utilized for the rate pulse output.

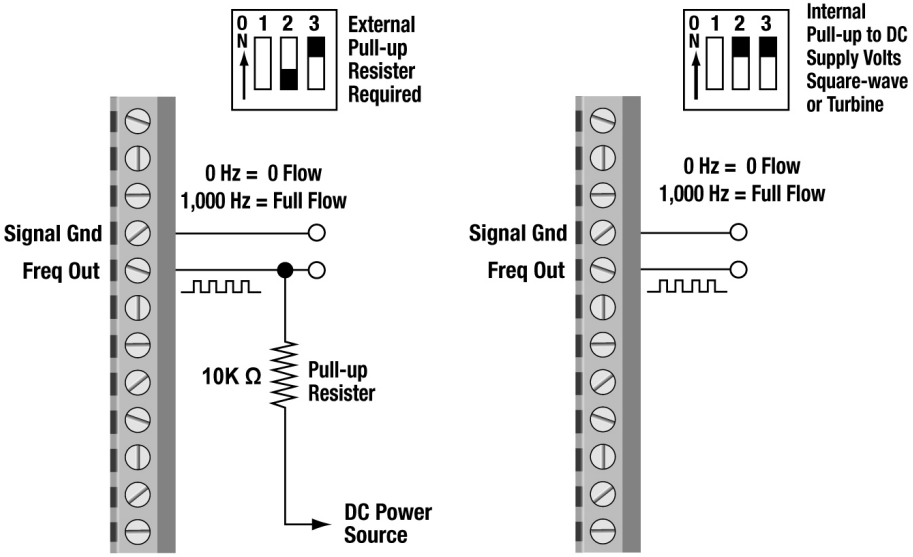


Figure 10- Rate Pulse Output Connections

Full Flow / K-factor Calculation

The Rate Pulse output generates 1,000 Hz (pulses per second) at **full flow**. To adjust the K-factor of the meter, adjust the **full flow** entry. Two examples of this conversion are listed below.

Example 1

K-factor (pulses/gallon) = 1,000 ÷ (**Full Flow** GPM ÷ 60)

K-factor (pulses/gallon) = 60,000 ÷ **Full Flow** GPM

Example, K-factor = 1,200 if **full flow** = 50 GPM

Example 2

K-factor (pulses/gallon) = 1,000 ÷ (**Full Flow** BPD ÷ 2057)

K-factor (pulses/gallon) = 2,057,000 ÷ **Full Flow** BPD

Example, K-factor = 1,143 if **full flow** = 1,800 BPD

TOTAL PULSE OUTPUT

The FUSION is equipped with an open-collector transistor circuit that outputs a 33 millisecond pulse each time the flow meter totalizer display increments—i.e., one pulse for every gallon or barrel. Adjustment of the Total Unit and Total Exponent parameters influences the frequency of the total pulse output.

Total Pulse output examples,

Example 1: If the Total Unit is set to Gallons and the Total Multiplier is set to E0 ($\times 1$), the FUSION will output one pulse for every gallon of liquid that passes through the meter.

Example 2: If the Total Unit is set to Gallons and the Total Multiplier is set to E1 ($\times 10$), the FUSION will output one pulse for every ten gallons of liquid that passes through the meter.

Example 3: If the Total Unit is set to Barrels and the Total Multiplier is set to E-1 ($\times 0.1$), the FUSION will output one pulse for every 0.1 barrels of liquid that passes through the meter.

Figure 11 illustrates common wiring configurations of the Total Pulse output feature. The output is a square-wave with a peak-to-peak voltage that swings to the DC supply rail when the SW1-1 is ON or to an alternate voltage level if SW1-1 is turned OFF and an external pull-up resistor and power source are utilized. The output will remain in a "high" state and pulse low for 33 mSec when the totalizer increments.

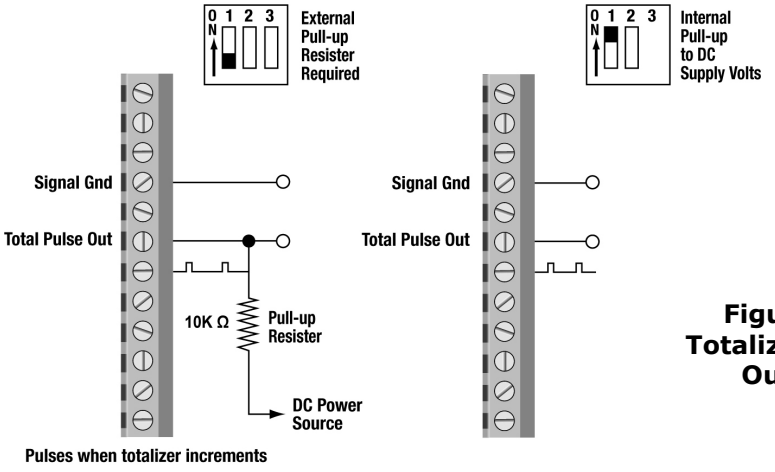


Figure 11 Totalizer Pulse Output

4. FUSION POWER-UP

FUSION Firmware Version
After power is applied to the FUSION flow meter, the display will illuminate and show the software version that is running inside of the flow meter as **Ux.xx**. Have the firmware version available when contacting factory technical support personnel so that more effective service can be provided.

Initialization
After power-up or after exiting Keypad Configuration, the flow meter will conduct self-diagnostic, measurement and buffering operations. During this time, the flow meter display will show **AUTO ADJ** and will count down from **10**.

Total Flow Backup
The accumulated flow, indicated on the bottom line of the LCD, is backed up into FLASH memory once every 10 minutes. On power -up, the last value written to memory is restored on the LCD and new accumulations are added as they are recorded.

5. FUSION OPERATION

Normal Operation
If the flow meter is filled with liquid, the flow meter will display either DOPPLER or TRANSIT on the upper right side of the LCD—indicating the mode of operation that is supplying the flow readings to the display and outputs. When operated in AUTO mode, the FUSION continuously dwells between transit time and Doppler flow measurement circuits and determines the better measurement based on the present liquid conditions.

Positive and Negative Flow
FUSION, when operated in AUTO mode, will measure positive and negative flow rate—so long as the liquid is relatively clean and the unit is operating in Transit mode. Negative flow will not influence the 4-20mA or pulse outputs, but will show on the LCD as a negative flow rate. (Faulty check valves are the primary reason for negative flow indication.) FUSION will also indicate negative flow if the flow direction through the meter does not match the **FLO DIR** selection parameter that has been entered—see page 22 for details.

6. CONFIGURATION

The FUSION meter has two basic sets of programming procedures: List Item Selection and Numeric Value Entry. It also has two configuration menus—Basic and Advanced.

IMPORTANT: The FUSION software is structured using two menus—a *Basic* menu and an *Advanced* menu. Pressing the MENU key for less than three seconds places the user into the Basic menu. Pressing and holding the MENU key for more than three seconds will place the user into the Advanced menu. A Map of the user interface is included in the Appendix of this manual. The Map provides a visual path to the configuration parameters that users can access. This tool should be employed each time configuration parameters are accessed or revised.

List Item Selection Procedure

Note: *If you are already in PROGRAM mode and the selection to be viewed or changed is already displayed, proceed to step 3 below. If you are in PROGRAM mode and the selection to be viewed or changed is not displayed, press the ▲ or ► arrow keys and repeat pressing until the desired selection appears. Proceed to step 3.*

1. To access the Basic menu, press the MENU key for less than three seconds and release the key. The unit will enter the Basic menu. To access the Advanced menu, press and hold the MENU key for more than three seconds and release the key.
2. Press the ► key to move to the desired selection.
3. Press ENTER to view the current selection.
4. If the current selection is desired, press ENTER to confirm. The unit will automatically advance to the next selection.
5. If the current selection must change, press the ► key and repeat pressing to scroll through the available choices. Press ENTER to confirm your selection. The unit will automatically advance to the next selection.
6. To exit PROGRAM mode, press the MENU key. Depending on your position in the PROGRAM mode, up to three MENU key presses may be required to exit. The display will change to RUN mode.

Numeric Value Entry Procedure

Note: *If you are already in PROGRAM mode and the selection to be viewed or changed is already displayed, proceed to step 3 below. If you are in PROGRAM mode and the selection to be viewed or changed is not displayed, press the ▲ or ► arrow keys and repeat pressing until the desired selection appears. Proceed to step 3.*

1. Press MENU key.
2. Press the ► arrow key to move to the desired selection. The current numeric value for this selection appears on the upper line of the display.
3. If the current value is desired, press ENTER. The left most programmable number begins to flash. Press ENTER again to confirm and keep the current numeric value. The unit will automatically advance to the next menu selection.
4. If the current selection must be changed, press ENTER. The left most programmable number begins to flash. Use the ▲ arrow key to scroll through the digits 0-9 and change the flashing digit to the desired value. Use the ► arrow key to move the active digit to the right. Continue using the ▲ and ► arrow keys until all digits are selected.
5. Press ENTER to confirm your selection. The unit will automatically advance to the next selection.
6. To exit PROGRAM mode, press the MENU key. Depending on your position in the PROGRAM mode, up to three MENU key presses may be required to exit. The display will change to RUN mode.

Resetting the Flow Totalizer

Press both the ENTER and the MENU keys when in the RUN mode to reset the totalizer. The message **TOTAL RST** will be displayed for a few seconds to indicate that the totalizer had been cleared. If a password has been set, the user must enter the correct password for the totalizer to be cleared.

Basic Menu Items

The Basic Menu contains standard configuration items that are utilized to setup a FUSION flow meter in common applications. The following items are available for viewing and modification in the Basic Menu:

MENU key, press ▸ key to step through setup. Press ENTER to edit a value. Press ENTER to save a value.

RATE UNIT	GPM ▸ M3/H ▸ BPD ▸ LPM
TOTAL UNIT	GAL ▸ M3 ▸ BBL ▸ LIT
FLOW DIR	POS ▸ NEG
FULL FLOW	**0-9999** Rate Unit
FLOW C-OFF	**0-999.9** Rate Unit
OUTPUT	NONE ▸ 4-20MA ▸ PULSE
RESPONSE	FAST ▸ MED ▸ SLO

Press MENU to exit.

RATE UNT -- Engineering Units for Flow Rate

GPM—Gallons per minute
LPM—Liters per minute
BPD—Barrels per days (42 U.S. gallons)
M3/H—Cubic meters per hour

1. To change flow rate units, press the MENU key.
2. Press the ► key to display **RATE UNT** on bottom display. Press ENTER key.
3. Press the ► key to select new rate unit (four selections located in the upper right-hand corner of the display.
4. Press the ENTER key.
5. Press the MENU key to exit.

TOTL UNT -- Engineering Units for Flow Totalizer

GAL - U.S. Gallons
LIT - Metric Liters
BBL - Oil Barrels (42 U.S. Gallons)
M3 - Cubic Meters

1. To change flow totalizer units, press the MENU key.
2. Press the ► key to display **TOTL UNT** on bottom display. Press ENTER key.
3. Press the ► key to select new totalizer unit.
4. Press the ENTER key.
5. Press the MENU key to exit.

FLO DIR -- Flow Direction

POS - Normal Flow Direction
NEG - Reverse Flow Direction

Corrects (shows positive flow) display and outputs if flow is running backwards through the FUSION meter.

If flow through the system is in the direction of the **IN▸** arrow, the **FLO DIR** should be set to **POS.**

If flow through the system is opposing the **IN▸** arrow, the **FLO DIR** should be set to **NEG.**

1. To change flow direction, press the MENU key.
2. Press the ► key to display **FLO DIR** on bottom display. Press the ENTER key.
3. Press the ► key to select **POS** (if flow matches IN▸ symbol on the hex of the flow meter body) or **NEG** if it flows opposite.
4. Press the ENTER key.
5. Press the MENU key to exit.

FULL FLO -- Full Scale Flow Rate

Enter the value in user selected rate units that represents the maximum flow rate. This value will be used to set the Modbus, rate pulse and 4-20mA full scale output.

1. To change the flow span value, press the MENU key.
2. Press the ► key to display **FULL FLO** on bottom display. Press ENTER key.
3. Press the ► key to move one digit right and the ▲ key to increment a flashing digit. Values are entered in flow rate units.
4. Press the ENTER key.
5. Press the MENU key to exit.

FL C-OFF -- Low Flow Cutoff

A Low Flow Cutoff entry is provided to allow very low flow rates (that can be present when pumps are off and valves are closed) to be displayed as Zero flow. The value entered is in actual rate units.

1. To change flow cutoff, press the MENU key.

2. Press the ► key to display **FL C-OFF** on bottom display. Press the ENTER key.
3. Press the ► key to move one digit right and the ▲ key to increment a flashing digit. Values are entered in flow rate units.
4. Press the ENTER key.
5. Press the MENU key to exit.

OUTPUT -- Output Type

NONE - 4-20mA and Rate Pulse Outputs disabled
4-20MA - 4-20mA Analog Output
RATE - Rate Pulse Output (0-1,000 Hz)

Utilized to select either the 4-20mA or 1,000 Hz rate pulse output.

1. To select either the mA or pulse output, press the MENU key.
2. Press the ► key to display **output** on bottom display. Press ENTER key.
3. Press the ► key to select **4-20mA**, **pulse** or **none**.
4. Press the ENTER key.
5. Press the MENU key to exit.

IMPORTANT: The RATE PULSE and 4-20 mA outputs cannot be operated simultaneously. Select the desired output type from the **OUTPUT** menu.

4-20TEST -- 4-20 mA Output Test

Allows a fixed current to be output from the 4-20 mA output. By incrementing this value, the 4-20 mA output will transmit the indicated current value.

The 4-20TEST prompt only appears if the output is configured for 4-20mA output. The output will be spanned between 0 flow and the value entered for Full Flow Rate.

Select the **4-20TEST** feature. Use the ▲ and ► keys to increment/ decrement mA output current. Verify that at mid-scale, 12 mA, that the receiving unit is showing 50% of **full flow**.

RATE TST -- Rate Pulse Output Test

Allows a fixed frequency to be output from the rate pulse output. By incrementing this value, the rate pulse output will transmit the indicated frequency.

The RATE TEST prompt only appears if the output is configured for Pulse output. The output will be spanned between 0 flow and the value entered for Full Flow Rate.

Select the **rate tst** feature. Use the ▲ and ► keys to increment/ decrement output frequency. Verify that at mid-scale, 500 Hz, that the receiving unit is showing 50% of **full flow**.

RESPONSE -- Flow Meter Response Time

SLO - Maximum filtering applied
MED - Medium filter applied
FAST- Minimum filtering applied

Utilized to speed up (low dampening) or slow down (high dampening) the display and output reactions to changes in flow.

1. To select the response of the meter, press the MENU key.
2. Press the ► key to display **response** on bottom display. Press ENTER key.
3. Press the ► key to select **FAST**, **MED** or **SLO**.
4. Press the ENTER key.
5. Press the MENU key to exit.

Advanced Menu Items

Press and hold the MENU key until the meter switches to the setup mode to access the Advanced menu items. The Advanced Menu contains all of the items from the *Basic* menu plus the following additional parameters:

OP MODE

Auto
TT
Doppler

Selects the operating mode. Auto measures using both transit time and Doppler. TT locks the unit in transit time mode only. Doppler locks the unit in Doppler mode only.

ID INCH -- Pipe Inside Diameter Entry

0.5 (Inches)
1.0 (Inches)
2.0 (Inches)

Select the appropriate transducer size.

DISPLAY -- Display Mode Selection

RATE
TT Diag *(transit time diagnostics)*
DOP DIAG *(Doppler Diagnostics)*

To display only the Flow Rate and Total, select RATE. Diagnostic display modes are explained in the troubleshooting section.

The TT diagnostics selection places the display in the transit time diagnostics mode. When selected, the display will show the measured velocity on the top display and the difference time in picoseconds on the bottom display.

The Doppler diagnostics selection places the display in the Doppler diagnostics mode. When selected, the display will show the measured frequency on the top display, and the gain setting and the signal strength on the bottom display.

TOTL MUL -- Flow Totalizer Multiplier

E-2 to E3—*0.01 to 1,000*

Utilized for setting the flow totalizer exponent. This feature is useful for accommodating a very large accumulated flow or to increase totalizer resolution when flows are small (displaying fractions of whole barrels, gallons, etc.) The exponent is a $\times 10^n$ multiplier, where "n" can be from –2 ($\times$0.01) to +3 ($\times$1,000). **Table 3.1** should be referenced for valid entries and their influence on the FUSION display. Selection of E-2, E-1 and E0 adjust the decimal point on the display. Selection of E1, E2 and E3 cause an icon of $\times$10, $\times$100 or $\times$1000 respectively to appear to the right of the total flow display value.

TABLE 3.1 - Totalizer Exponent Values

Entry	Display Multiplier
E-2	$\times$0.01
E-1	$\times$0.1
E0	$\times$1
E1	$\times$10
E2	$\times$100
E3	$\times$1,000

TOTAL OP -- Total Operation

POS - Accumulates when flow direction is positive only.

NET - Adds or Subtracts from Total depending upon flow direction. Applies to transit time mode only.

SET TOTAL -- Preset Totalizer

Enter the value in user selected total units that the flow meter is to begin totalizing.

PASSWORD -- Change the Security Password

0-9999

By changing the Security Password from 0 to some other value (any value between 1-9999), configuration parameters will not be accessible without first entering that value when prompted. If the value is left at 0, no security is invoked and unauthorized changes could be made. Access to resetting of the Totalizer is also protected by this password.

If the FUSION password is lost or forgotten, contact the Dynasonics factory for a universal password to unlock the meter.

4-20CAL -- Calibration of the 4-20 mA Output

IMPORTANT: The 4-20 mA output is factory calibrated and typically does not require field adjustment.

The **4-20CAL?** entry allows fine adjustments to be made to the "zero" and span of the 4-20 mA output. Select YES to access adjustment. To adjust the 4 mA output, a milliammeter or reliable reference must be connected to the 4-20 mA output.

Procedure:

1. Disconnect the current loop output and connect the milliammeter in series between the 4-20 mA output and the recording device.
2. Using the arrow keys, increase the numerical value to increase the current in the loop to 4 mA. Decrease the value to decrease the current in the loop to 4 mA. Typical values range between 40-80 counts.
3. Re-connect the 4-20 mA output circuitry as required.

Calibration of the 20 mA setting is conducted much the same way as the 4 mA adjustments.

Procedure:

1. Disconnect the current loop output and connect the milliammeter in series between the 4-20mA output and the recording device.
2. Using the arrow keys, increase the numerical value to increase the current in the loop to 20 mA. Decrease the value to decrease the current in the loop to 20 mA. Typical values range between 3700-3900 counts.
3. Re-connect the 4-20 mA output connections as required.

ADV DOP -- Advance Doppler Setup Mode

Advance setup mode allows access to the following parameters. Select YES to access these parameters.

DOP SPAN - *Doppler Span Factor*
AGC MODE - *Automatic Gain Control*
****GAIN POT** - *Digital Gain Control*
****FILTER** - *Hardware Filter Control*
****DRIVE** - *Transducer Drive Signal Level*

Note: Only available with **AGC MODE selected.

DOP SPAN—Doppler Scale Factor

This function can be used to make the FUSION Doppler flow reading agree with a different or reference flow meter, or to compensate for installation where there is inadequate straight pipe to obtain a steady flow profile, by applying a correction factor/multiplier to the readings and outputs. A factory calibrated system should be set to 1.000. The range of settings for this entry is 0.001 to 9.999. The following example describes using the **DOP SPAN** entry.

- The FUSION meter is indicating a flow rate that is 4% higher than another flow meter located in the same pipe line. To make the FUSION indicate the same flow rate as the other meter, enter a DOP SPAN of 0.960, to lower the readings by 4%.

AGC MODE—Automatic Gain Control Mode of Operation

NORMAL - Standard Configuration
MANUAL - AGC disabled

Select the desired mode of operation. A basic understanding of the AGC logic is required in order to know when to use any selection other than **NORMAL**.

When the unit is powered up, there is a delay before the unit begins transmitting sound into the pipe. During this time, the signal strength is measured, and a base signal level is obtained. Typically this is a value of about 20. The unit measures flow by measuring the Doppler frequency shift. The frequency shift is approximately 120Hz per foot per second. For every foot per second increase in velocity, the signal strength should increase by 1. The unit automatically adjusts the gain and selects the proper hardware filter for the measured velocity. The control can be observed when the **DISPLAY** mode is set to **DOP DIAG**.

When **NORMAL** is selected, the unit will automatically control the gain and front end hardware filter for optimum measurement of the Doppler signal.

For applications where the flow is constant, but you may need to tune the unit to filter out extraneous noise, select the **MANUAL** mode. Typically, this would only be required at very low flow rates. When **MANUAL** mode is selected, the **GAIN POT** and **FILTER** settings are manually set. Automatic control is disabled.

GAIN POT—Digital Gain Pot

0-64

Using the arrow keys, increase or decrease the numerical value to set the signal gain level. Typically, optimum flow measurement is made when this value is between 10 and 50. Use the lowest value that provides an accurate and stable flow reading. This adjustment must be made in conjunction with the **FILTER** setting, and may be an iterative process.

FILTER—Hardware Filter Selection

NONE - No Filter
LOW - (1600Hz Cutoff)

MEDIUM - (350Hz Cutoff)
HIGH - (250Hz Cutoff)

Select the hardware filter with a cutoff frequency that is above the Doppler shift frequency to be measured.

DRIVE—Transducer Drive Signal Level

If the signal strength is higher than normal, or the meter is reading noise at no flow, the drive level may be reduced to obtain a more accurate reading.

0 = *Lowest Drive Level*
4 = *Highest Drive Level*

ADV TT -- Advance Transit Time Setup Mode

Advance setup mode allows access to the following parameters. Select YES to access these parameters.

CAPTURE 0 - *Capture Zero Flow* Reference
TT SPAN - *Transit Time Span Factor*

CAPTURE 0—Capture 0 Flow Reference

Important: The zero flow calibration is conducted at the factory and typically does not need field adjustment.

This function is used to capture the zero reference reading for the transit time flow measurement. Make sure that the pipe is full and that the flow is stopped, then select **YES**. The display will flash **CAPTURE** during the process, then display **GOOD** if a valid signal was measured. If a valid signal was not measured due to an empty pipe or a faulty transducer, **ERROR** will be displayed. Press the Enter key to continue.

1. Block a full pipe of liquid within the FUSION flow meter using ball valves. If the unit indicates EMPTY PIPE, not enough liquid was caught and the blocking procedure will need to be completed again.
2. Ensure that the FUSION display is displaying TRANSIT. If the display is indicating DOPPLER, wait a few moments to allow gas to rise and the unit to automatically switch to TRANSIT.
3. Press and hold the MENU key for a minimum of 3 seconds to access the Advanced Menu.

4. Press the ▸ key to display **adv tt** on bottom display. Press ENTER key. Press the ▸ key to display **yes** on bottom display. Press ENTER key.
5. At **capture 0** display, press ENTER key. Press the ▸ key to display **yes** on bottom display. Press ENTER key.
6. If **ERROR** is displayed on bottom display, repeat step 5 until successful.
7. Press the MENU key to exit.

TT SPAN—Transit Time Scale Factor

This function can be used to make the FUSION transit time flow reading agree with a different or reference flow meter, or to compensate for installation where there is inadequate straight pipe to obtain a steady flow profile, by applying a correction factor/multiplier to the readings and outputs. A factory calibrated system should be set to 1.000. The range of settings for this entry is 0.001 to 9.999. The following example describes using the TT SPAN entry.

- The FUSION meter is indicating a flow rate that is 4% higher than another meter located in the same pipe line. To make the FUSION indicate the same flow rate as the other meter, enter a TT SPAN of 0.960, to lower the readings by 4%.

MODBUS -- Modbus interface configuration

Modbus setup mode allows access to the following parameters. Select YES to access these parameters.

BUS ADDR - Modbus Address
*BAUD RAT*E - Communications Baud Rate

BUS ADDR—Modbus Bus Address

This function is used to set the communication bus address for the unit. An address of 0 will place the unit in a listen only mode as this is reserved as a broadcast address for the host to use. An address of 127 is a universal address. The unit will respond to any address received except for address 0. Any other address value will cause the unit to only respond to that address from the host.

BAUD RATE—Modbus communications baud rate

9600 - 9600 Baud
19200 - 19.2K Baud

Select the required baud rate from the list.

Standard Modbus Implementation

A subset of the standard Modbus commands is implemented to provide access into the data and status of the FUSION Meter.

The following Modbus commands are implemented:

Command	Description
04	Read Input Registers
05	Force Single Coil

Opcode 04 – Read Input Registers

This opcode returns the input registers, such as flow rate or totalizer. All data is returned as 16 bit values with the MSB first as required by Modbus

The following Input Registers are defined:

Modbus Register	Starting Address	Description
30001	<00><00>	Normalized flow rate
30002	<00><01>	Spares
30003	<00><02>	MS Word of Totalizer
30004	<00><03>	LS Word of Totalizer
30005	<00><04>	TT Velocity (in .1 ft/sec)
30006	<00><05>	Doppler Velocity (in .1 ft/sec)
30007	<00><06>	TT Success Rate (0-100)
30008	<00><07>	Doppler Signal Strength (0-100)
30009	<00><08>	Doppler Gain (0-64)
30010-30016	<00><09>	Doppler Filter (0-3)
30011-30016	<00><0A> to <007><0F>	Spares

The flow rate is normalized to return 0 for min flow and 65535 for the maximum flow as specified in the system configuration for Full Flow rate. (See page 23.)

Command: <addr><04><00><00><00><01><crc-16>
Reply: <addr><04><02><data HI><data LO><crc-16>

The totalizer returns the displayed value in four 8 bit words.

Command: <addr><04><00><02><00><02><crc-16>
Reply: <addr><04><04><MSW HI><MSW LO><LSW HI><MSW LO><crc-16>

Opcode 05 – Force Single Coil

This opcode sets the state of a single coil (digital output).

The following Coil Registers are defined:

Coil #	Description
1..8	Spare
9	Reset Totalizer
10.16	Spare

The transition of coil 9 from 0 to 1 will initiate function. This bit is auto reset to 0, so there is no need to set it to 0 after a totalizer reset command.

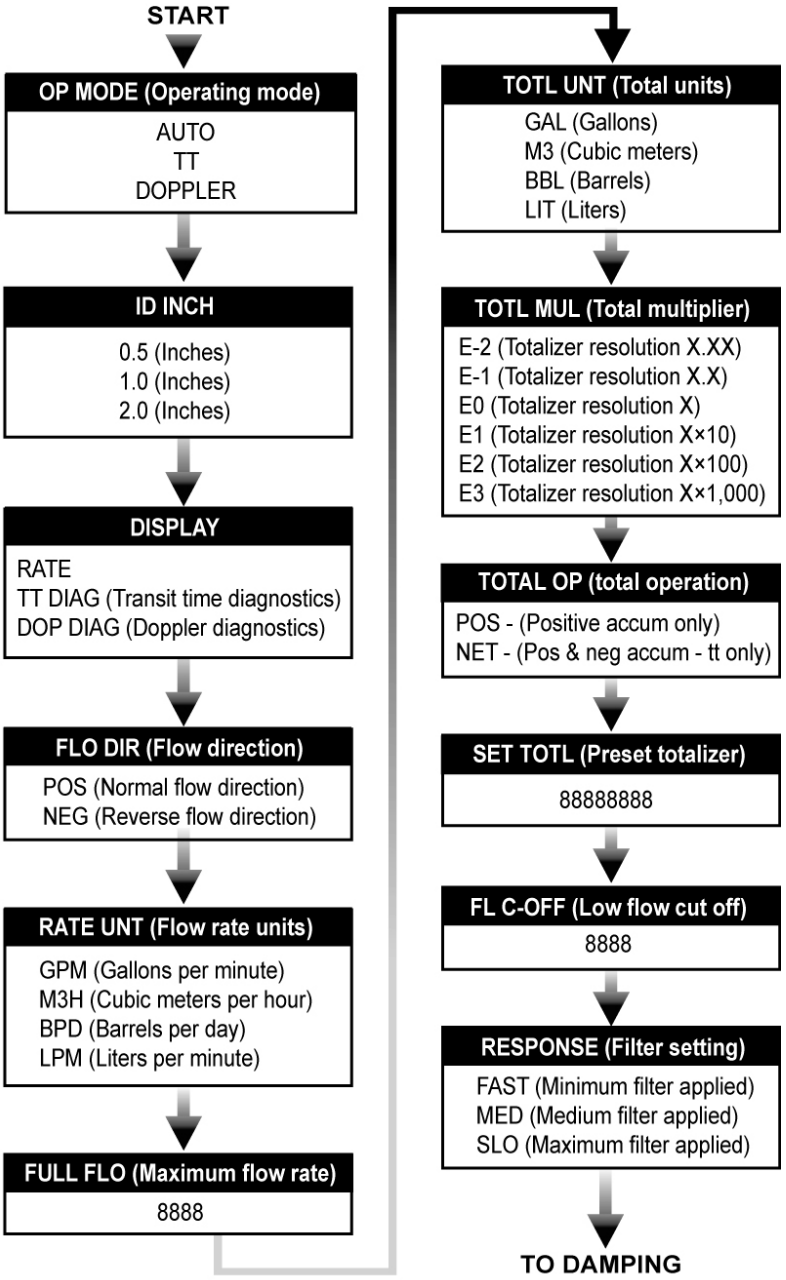
Command: <addr><05><00><08><FF><00><crc-16>
Reply: <addr><05><00><08><FF><00><crc-16>

C Source Code

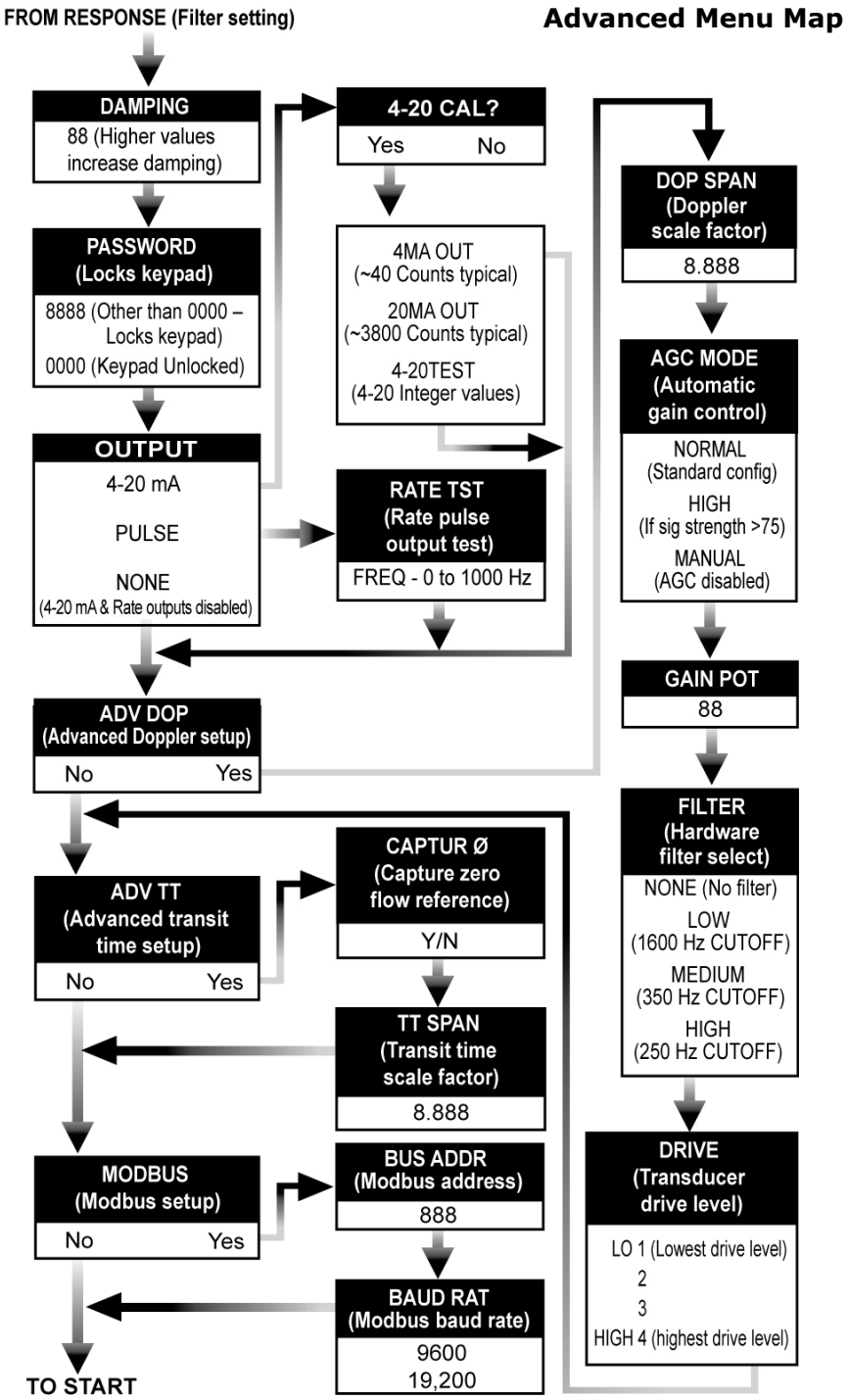
A.1.1 CRC-16 Calculations

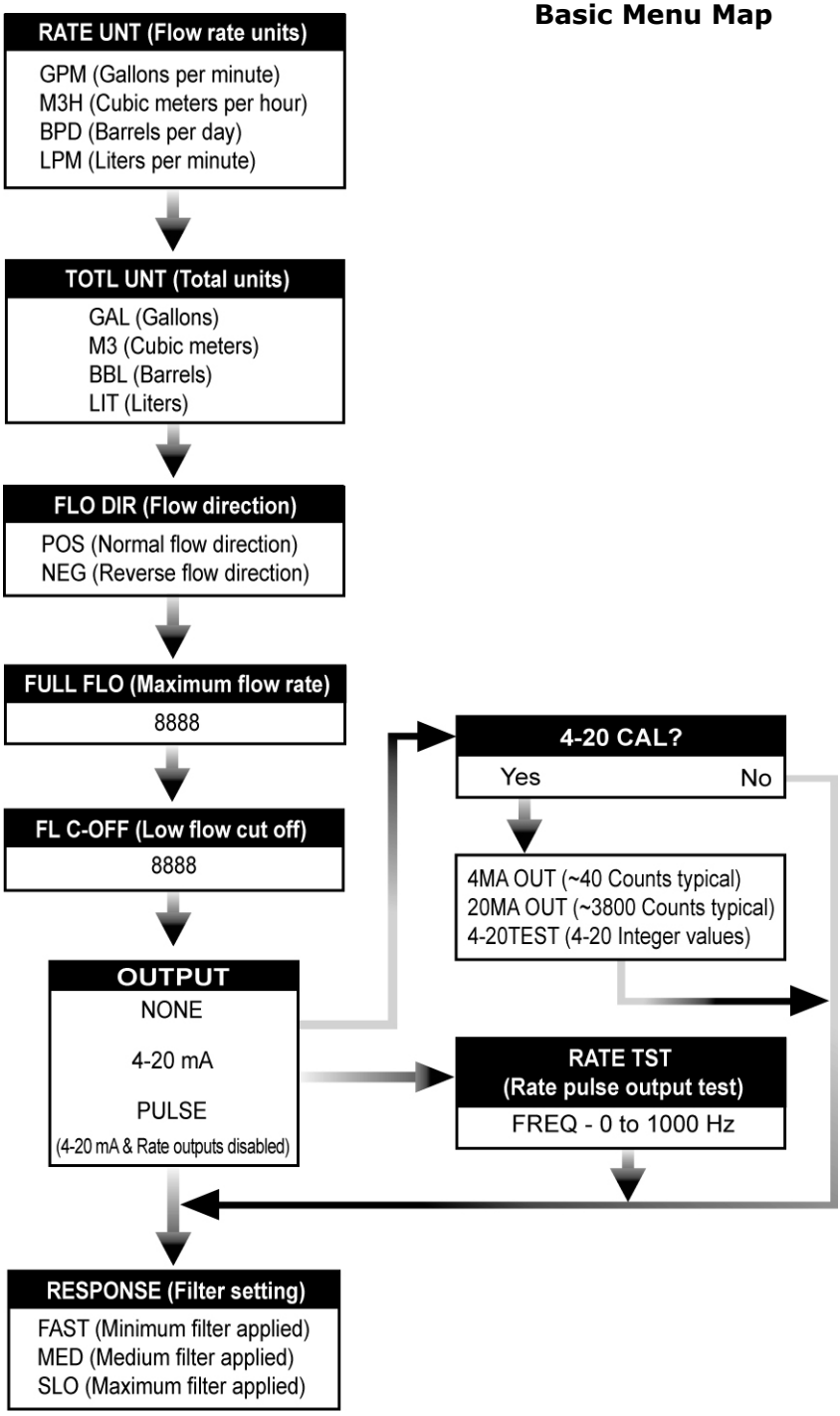
```
unsigned short crc_table[256] = {
   0x0000, 0xC0C1, 0xC181, 0x0140, 0xC301, 0x03C0, 0x0280, 0xC241,
   0xC601, 0x06C0, 0x0780, 0xC741, 0x0500, 0xC5C1, 0xC481, 0x0440,
   0xCC01, 0x0CC0, 0x0D80, 0xCD41, 0x0F00, 0xCFC1, 0xCE81, 0x0E40,
   0x0A00, 0xCAC1, 0xCB81, 0x0B40, 0xC901, 0x09C0, 0x0880, 0xC841,
   0xD801, 0x18C0, 0x1980, 0xD941, 0x1B00, 0xDBC1, 0xDA81, 0x1A40,
   0x1E00, 0xDEC1, 0xDF81, 0x1F40, 0xDD01, 0x1DC0, 0x1C80, 0xDC41,
   0x1400, 0xD4C1, 0xD581, 0x1540, 0xD701, 0x17C0, 0x1680, 0xD641,
   0xD201, 0x12C0, 0x1380, 0xD341, 0x1100, 0xD1C1, 0xD081, 0x1040,
   0xF001, 0x30C0, 0x3180, 0xF141, 0x3300, 0xF3C1, 0xF281, 0x3240,
   0x3600, 0xF6C1, 0xF781, 0x3740, 0xF501, 0x35C0, 0x3480, 0xF441,
   0x3C00, 0xFCC1, 0xFD81, 0x3D40, 0xFF01, 0x3FC0, 0x3E80, 0xFE41,
   0xFA01, 0x3AC0, 0x3B80, 0xFB41, 0x3900, 0xF9C1, 0xF881, 0x3840,
   0x2800, 0xE8C1, 0xE981, 0x2940, 0xEB01, 0x2BC0, 0x2A80, 0xEA41,
   0xEE01, 0x2EC0, 0x2F80, 0xEF41, 0x2D00, 0xEDC1, 0xEC81, 0x2C40,
   0xE401, 0x24C0, 0x2580, 0xE541, 0x2700, 0xE7C1, 0xE681, 0x2640,
   0x2200, 0xE2C1, 0xE381, 0x2340, 0xE101, 0x21C0, 0x2080, 0xE041,
   0xA001, 0x60C0, 0x6180, 0xA141, 0x6300, 0xA3C1, 0xA281, 0x6240,
   0x6600, 0xA6C1, 0xA781, 0x6740, 0xA501, 0x65C0, 0x6480, 0xA441,
   0x6C00, 0xACC1, 0xAD81, 0x6D40, 0xAF01, 0x6FC0, 0x6E80, 0xAE41,
   0xAA01, 0x6AC0, 0x6B80, 0xAB41, 0x6900, 0xA9C1, 0xA881, 0x6840,
   0x7800, 0xB8C1, 0xB981, 0x7940, 0xBB01, 0x7BC0, 0x7A80, 0xBA41,
   0xBE01, 0x7EC0, 0x7F80, 0xBF41, 0x7D00, 0xBDC1, 0xBC81, 0x7C40,
   0xB401, 0x74C0, 0x7580, 0xB541, 0x7700, 0xB7C1, 0xB681, 0x7640,
   0x7200, 0xB2C1, 0xB381, 0x7340, 0xB101, 0x71C0, 0x7080, 0xB041,
   0x5000, 0x90C1, 0x9181, 0x5140, 0x9301, 0x53C0, 0x5280, 0x9241,
   0x9601, 0x56C0, 0x5780, 0x9741, 0x5500, 0x95C1, 0x9481, 0x5440,
   0x9C01, 0x5CC0, 0x5D80, 0x9D41, 0x5F00, 0x9FC1, 0x9E81, 0x5E40,
   0x5A00, 0x9AC1, 0x9B81, 0x5B40, 0x9901, 0x59C0, 0x5880, 0x9841,
   0x8801, 0x48C0, 0x4980, 0x8941, 0x4B00, 0x8BC1, 0x8A81, 0x4A40,
   0x4E00, 0x8EC1, 0x8F81, 0x4F40, 0x8D01, 0x4DC0, 0x4C80, 0x8C41,
   0x4400, 0x84C1, 0x8581, 0x4540, 0x8701, 0x47C0, 0x4680, 0x8641,
   0x8201, 0x42C0, 0x4380, 0x8341, 0x4100, 0x81C1, 0x8081, 0x4040,
};

unsigned short calculate_crc(const unsigned char *pv, int size)
{
        unsigned short crc = 0xFFFF;
        for ( ;size-- ; pv++)
        {
                crc = (crc >> 8) ^ crc_table[(crc ^ *pv) & 0xFF];
        }
        return crc;
}
```

Advanced Menu Map



Note:
Flow Total/Accumulators are reset to zero by simultaneously pressing the ENTER and MENU keys.


FROM RESPONSE (Filter setting)
Advanced Menu Map
DAMPING
88 (Higher values increase damping)
PASSWORD (Locks keypad)
8888 (Other than 0000 – Locks keypad)
0000 (Keypad Unlocked)
OUTPUT
4-20 mA
PULSE
NONE
(4-20 mA & Rate outputs disabled)
4-20 CAL?
Yes No
4MA OUT
(~40 Counts typical)
20MA OUT
(~3800 Counts typical)
4-20TEST
(4-20 Integer values)
RATE TST (Rate pulse output test)
FREQ - 0 to 1000 Hz
ADV DOP (Advanced Doppler setup)
No Yes
ADV TT (Advanced transit time setup)
No Yes
CAPTUR Ø (Capture zero flow reference)
Y/N
TT SPAN (Transit time scale factor)
8.888
MODBUS (Modbus setup)
No Yes
BUS ADDR (Modbus address)
888
BAUD RAT (Modbus baud rate)
9600
19,200
TO START
DOP SPAN (Doppler scale factor)
8.888
AGC MODE (Automatic gain control)
NORMAL
(Standard config)
HIGH
(If sig strength >75)
MANUAL
(AGC disabled)
GAIN POT
88
FILTER (Hardware filter select)
NONE (No filter)
LOW
(1600 Hz CUTOFF)
MEDIUM
(350 Hz CUTOFF)
HIGH
(250 Hz CUTOFF)
DRIVE (Transducer drive level)
LO 1 (Lowest drive level)
2
3
HIGH 4 (highest drive level)


RATE UNT (Flow rate units)
GPM (Gallons per minute)
M3H (Cubic meters per hour)
BPD (Barrels per day)
LPM (Liters per minute)
TOTL UNT (Total units)
GAL (Gallons)
M3 (Cubic meters)
BBL (Barrels)
LIT (Liters)
FLO DIR (Flow direction)
POS (Normal flow direction)
NEG (Reverse flow direction)
FULL FLO (Maximum flow rate)
8888
FL C-OFF (Low flow cut off)
8888
OUTPUT
NONE
4-20 mA
PULSE
(4-20 mA & Rate outputs disabled)
4-20 CAL?
Yes
No
4MA OUT (~40 Counts typical)
20MA OUT (~3800 Counts typical)
4-20TEST (4-20 Integer values)
RATE TST
(Rate pulse output test)
FREQ - 0 to 1000 Hz
RESPONSE (Filter setting)
FAST (Minimum filter applied)
MED (Medium filter applied)
SLO (Maximum filter applied)

Troubleshooting

Display does not illuminate	1. Check DC voltage at terminal strip. 2. Check display ribbon cable. 3. FUSION meters are equipped with automatic reset fuses.
Output does not match displayed flow value	1. Verify that 4-20mA or Rate PULSE is properly selected in the OUTPUT selection. 2. Check **full flo** span value entry—ensure it matches receiving device. 3. PULSE outputs—verify proper pull-up jumpers are in place. 4. Utilize 4-20mA Test and PULSE test to simulate outputs to receiving devices.
Unstable flow readings	1. Increase straight plumbing at meter inlet. 2. Change **response** to medium or slow. 3. Increase **damping** value.
Fusion indicates flow when none is present	1. Verify earth ground connection. 2. Verify that check valves are operating properly—shut manual valve. 3. Perform **zero capture**—see software functions.
EMPTY PIPE indication	1. Pipe is not filled with liquid. 2. Flow is off, but the liquid within the sensor is degassing—the error will clear when gas clears.

SERVICE AND REPAIR

When returning equipment, it is necessary to contact our service department at (800) 535-3569 or (262) 639-6770 to obtain an RGA number for the authority and tracking of your material and its proper inspection and return. All returns of equipment must go to the following address:

Dynasonics
Attn: RGA#xxxx
8635 Washington Avenue
Racine, WI 53406

WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE) DIRECTIVE

In the European Union, this label indicates that this product should not be disposed of with household waste. It should be deposited at an appropriate facility to enable recovery and recycling.

For information on how to recycle this product responsibly in your country, please visit:

www.racinefed.com/recycle/

STATEMENT OF WARRANTY

Dynasonics, a division of Racine Federated Inc. warrants to the end purchaser, for a period of one year from the date of shipment from the factory, that all flow meters manufactured by it are free from defects in materials and workmanship. This warranty does not cover products that have been damaged due to misapplication, abuse, lack of maintenance, modified or improper installation. Dynasonics' obligation under this warranty is limited to the repair or replacement of a defective product, at no charge to the end purchaser, if the product is inspected by Dynasonics and found to be defective. Repair or replacement is at Dynasonics' discretion. A return goods authorization (RGA) number must be obtained from Dynasonics before any product may be returned for warranty repair or replacement. The product must be thoroughly cleaned and any process chemicals removed before it will be accepted for return.

The purchaser must determine the applicability of the product for its desired use and assumes all risks in connection therewith. Dynasonics assumes no responsibility or liability for any omissions or errors in connection with the use of its products. Dynasonics will under no circumstances be liable for any incidental, consequential, contingent or special damages or loss to any person or property arising out of the failure of any product, component or accessory.

All expressed or implied warranties, including **the implied warranty of merchantability and the implied warranty of fitness for a particular purpose or application are expressly disclaimed** and shall not apply to any products sold or services rendered by Dynasonics.

The above warranty supersedes and is in lieu of all other warranties, either expressed or implied and all other obligations or liabilities. No agent or representative has any authority to alter the terms of this warranty in any way.

APPENDIX A

PRODUCT SPECIFICATIONS

Description	Specification
Input Voltage	12-30 VDC @ 100 mA Max; Class 2 Supply
Protection	Reverse polarity; auto-reset polyfuse; transient voltage suppression
Flow Range **1-Inch**	0.7—60 GPM [24-2057 BPD] 3-230 LPM [0.18-13.8 M3/H]
Accuracy	1% of Rate over the top 10:1 measuring range; 0.1% of full scale at rates less than this range
Pressure **Temperature**	300 PSI [2,070 kPa] -30 to +160 °F [-34 to +70 °C]
Outputs	(FUSION cannot output 4-20mA and Rate Pulse simultaneously. Only one can be selected.)
4-20mA	12-bit; source from DC supply voltage
Rate Pulse	0-1,000 Hz; open collector; internal/ external pull-up; TTL square-wave or turbine simulation; 50% duty cycle, sink 100mA max
Total Pulse	Open collector, internal/external pull-up; 33 mSec duration, sink 100mA max
RS485	1/4-node; 128 drop, Modbus command set
Rate Units **Total Units**	GPM, BPD, LPM, M3/H GAL, BBL, LIT, M3
Wetted Materials	316 SS, polyetherimide, Buna-N
Enclosure	TYPE 4; powder coated aluminum, SS, polycarbonate, urethane, PVC
Ports	(2) 1/2” NPSM and (1) 3/4” NPSM
Display	Flow Rate: auto ranging 4-digit LCD Flow Total: 8-digit, E-2 to E+3
Approvals	Class I Division 2 Groups C, D; CSA 22.2 No. 142 & 213; UL 508, ISA 12.12.01; File 215035

SYMBOL EXPLANATIONS

Caution—Refer to accompanying documents

FLOW METER INSTALLATION

WARNING:

EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2

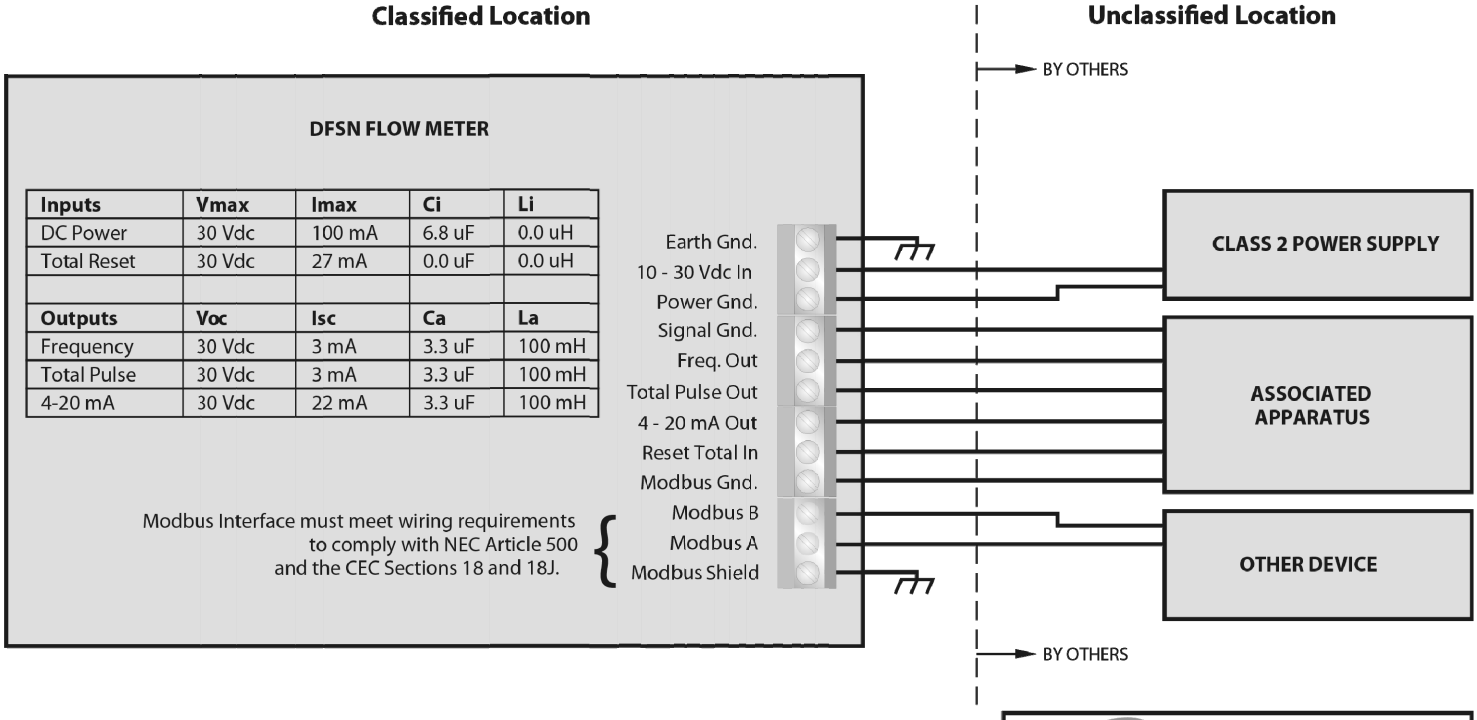
IMPORTANT NOTE:
Not following instructions properly may impair safety of equipment and/or personnel.

IMPORTANT NOTE:
Must be operated by a Class 2 supply suitable for the location.

IMPORTANT NOTE:
Do not connect or disconnect either power or outputs unless the area is known to be non-hazardous.

IMPORTANT NOTE:
Do not connect the interface cable between a FUSION flow meter and a personal computer unless the area is known to be non-hazardous.

DYNASONICS
8635 Washington Avenue
Racine, WI 53406
Toll-Free in U.S. and Canada:
Tel: (800) 535-3569 Fax: (800) 732-8354
Tel: (262) 639-6770 Fax: (262) 639-2267
www.dynasonics.com



Information shown on this drawing is provided to indicate wiring requirements to comply with the National Electrical Code® (NEC) Article 500, and the Canadian Electrical Code (CEC) Part I and Part II.

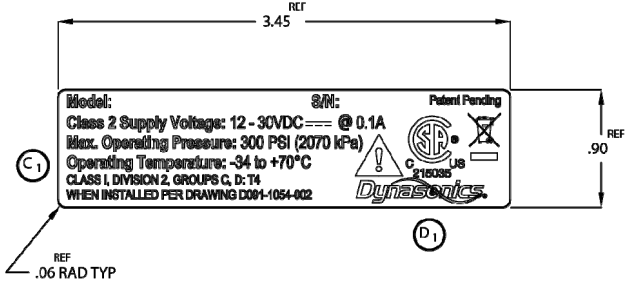
Dynasonics®
DIVISION OF RACINE FEDERATED INC.

NAME: **CONTROL DRAWING, DFSN; CLASS I DIV 2 INSTALLATION**

PART NUMBER: **D091-1054-002**

REVISIONS

ZONE	REV	DESCRIPTION	E.C.N.	DATE	APPROVAL
B8	A	1) NOTE 2 DYNASONICS PART NO. WAS D003-0905-075	R0293	5/21/08	
ALL	B	UPDATED ARTWORK PER CSA	R0401	8/14/08	
C6	C	1) OPERATING TEMPERATURE WAS -30 TO +70 C	R0404	8/19/08	
C4	D	1.) UPDATED LOGO	R1016	12/1/10	



NOTE:

1) TO BE PRINTED BY DYNASONICS
A1 2) LABEL STOCK MATERIAL: WHITE GLOSSY POLYESTER W/ SYNTHETIC RUBBER ADHESIVE (DYNASONICS PART NO. D003-0905-083)
3) RIBBON MATERIAL: BRADY BLACK 6000 SERIES THERMAL TRANSFER PRINTER RIBBON (DYNASONICS PART NO. D003-0905-076)

3. RADII TO BE .005/.010
2. FINISH TO BE 63✓
1. REMOVE ALL BURRS AND BREAK SHARP EDGES .005/.010

NOTES: UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCE ON DECIMALS .00±.010, .000±.005
ANGLES ±1/2°

MATERIAL: SEE ABOVE

DRAWN BY:	KOUN	3/17/08
CHECKED BY:		
ENGINEER:		
REVISED BY:	T. PAUL	12/1/10
SUPERSEDES:	D003-0905-081	
DATE:	8/14/08	

THIS DRAWING WAS DONE ON AUTOCAD AND CAN ONLY BE REVISED ON AUTOCAD SYSTEM. ANY MANUAL CHANGES DONE TO THIS DRAWING WILL BE IGNORED UNLESS AUTHORIZED.

Dynasonics® DIVISION OF RACINE FECERATED, INC.
RACINE, WISCONSIN U.S.A.
TEL: 262-638-8770 FAX: 262-638-9857

NAME: LABEL, MODEL/SN; FUSION METER; CSA

SIZE:	CODE I.D. NO.	PART NUMBER:
B	59380	D003-0905-081

SCALE: 1.5=1 | CURRENT REV: D | SHEET: 1 OF 1

NOTES

8635 Washington Avenue
Racine, WI 53406
Toll-Free in U.S. and Canada:
Tel: (800) 535-3569 Fax: (800) 732-8354
Tel: (262) 639-6770 Fax: (262) 639-2267
www.dynasonics.com

Racine Flow Meter Group · Blancett · Dynasonics · Flo-tech · HEDLAND · PRESO · racine

Printed in USA
FUSION O&M REV 01/11