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PROPRIETARY NOTICE

The information contained in this publication is derived in part from proprietary and patented data. This information has been prepared for the express purpose of assisting in installation, operation, and maintenance of the instruments described herein. Publication of this information does not convey any rights of use or reproduction other than in connection with the installation, operation and maintenance of the equipment described herein. Universal Flow Monitors, Inc. reserves the right to change the information contained in this publication at any time and without prior notice.
**NAMEPLATE EXAMPLE**

<table>
<thead>
<tr>
<th>MIN:</th>
<th>S/N:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD-EF-2N-360SCFH-A-USB</td>
<td>TYPE:</td>
</tr>
<tr>
<td>MIN:</td>
<td>S/N:</td>
</tr>
<tr>
<td>FD-EF-2N-360SCFH-A-USB</td>
<td>TYPE:</td>
</tr>
</tbody>
</table>

Serial numbers are formatted as YY MM ID 000
YY = year, MM = month, ID = product identifier, 000 through 999 = three-digit sequential number.
GENERAL SPECIFICATIONS

Flow Ranges: 2 SLPM/5 SCFH F.S. to 1300 SLPM/2600 SCFH F.S.
Turndown Ratio: 400:1
Accuracy: ± 1% of reading
Repeatability: ± 0.2% of full-scale
Maximum Measurable Flow: Up to 125% of full-scale, gas dependent
Pressure Effect on Accuracy: Less than ±0.04% of reading/ PSI
Temperature Effect on Accuracy: Less than ±0.04% of reading/ °F
Response Time: 100 msec
Pressure Drop: 2.5 PSI at maximum flow (port to port)
Gases: Air, Argon, Nitrogen, CO2, Oxygen, Helium, Hydrogen, Methane, and user selectable
Gas compatibility: Non-corrosive, non-condensing
Maximum Operating Pressure: 150 PSIG
Sensor Burst Pressure: 200 PSIG
Operating Temperature: 0-40 °C (32-104 °F)
Process Connections: 1/8”-1/4”-3/8”-1/2”-3/4” NPT. SAE, BSPT, BSPP also available
Display: Rate, total, pressure, temperature, multi-gas, alarms, engineering units, battery status
Wetted Parts: Sensors: Ceramic, silicon, gold, epoxy, RTV
Flow body: Stainless steel, anodized aluminum, Viton®
Enclosure Rating: Type 1

ELECTRICAL SPECIFICATIONS

Power: Direct USB powered, and Internal Lithium-Polymer rechargeable battery
Output: Direct USB serial data to PC, or log data on USB memory
USB Port: Type A female
USB Charger Rating: 5VDC/1A
Charge Time: 2 hours to full charge
Battery Usage: 40 hours of operation on full battery charge, 10 hours of operation when logging data to USB memory

ENVIRONMENTAL CONDITIONS

Operation of battery-powered devices are limited to the following conditions:

- Limit the storage and operating temperatures to 0-40 °C (32-104 °F)
- Do not throw in trash
- Limit ambient operating pressure to 80-120 kPa
- Limit ambient relative humidity to 0-95%
- Do not expose to water
OPERATION

**FlowStream** flowmeters accurately measure the mass flow rate of most gases. The flow rate is determined by measuring the pressure drop across a unique internal restriction, known as Laminar Flow Element (LFE). The restriction is designed such that the gas molecules are forced into moving in parallel paths along the entire length of the passage for the entire range of operation of the device. Unlike other pressure-flow measuring devices, the relationship between pressure drop and flow is *linear* in laminar flowmeters.

**FlowStream** mass flowmeters utilize an absolute pressure sensor along with a temperature sensor to compensate for density variations of the gas. When combined with the differential pressure (volumetric flow) output, the mass flow rate of the gas can be determined.

![Laminar Flow Illustration](image)

APPLICATIONS

**FlowStream** flowmeters are designed to work with non-corrosive, non-ionic, clean, dry gases only. Introduction of liquids to the internal sensors will damage the unit, and the repair is not covered under warranty. Relative humidity of the gas can be as high as 100%, as long as proper installation guarantees that no internal condensation will occur. A 50-micron filter and/or dryer may be required for some applications.

Using **FlowStream** at Varying Temperatures

Even though **FlowStream** flowmeters measure true mass flow, rapid variations in ambient and/or gas temperature may affect performance. This is due to the time lag of the internal temperature sensor and the slow heating and cooling of the flowmeter body. It is highly recommended that through *proper installation* the following two objectives be met:

- There be minimal difference between gas temperature and ambient temperature;
- Rapid temperature variations be avoided.
Since the temperature sensor is embedded inside the sensor block, if ambient temperature is different from gas temperature, there would be a discrepancy between what the sensor reads and the true gas temperature. The flowmeter body would track ambient temperature while gas temperature would heat/cool the body at a different rate.

Likewise, if temperature variation is rapid, the flowmeter body may not follow it quickly enough due to the mass of the metal flow chamber, which in turn would result in inaccurate measurement of gas temperature.

For optimal performance, always allow two to four hours from the time the ambient and gas temperatures are stabilized to when the first flowmeter reading is taken.

**Reference Conditions for Mass Flow Measurement**

Although the correct units for mass are expressed in grams, kilograms, etc., it has become somewhat standard that mass flow rate is specified in SLPM (standard liters per minute), SCFH (standard cubic feet per hour) or other similar units.

This means that the mass flow rate is calculated by normalizing the volumetric flow rate to some standard temperature and pressure (STP). By knowing the gas density at that STP, one can determine the mass flow rate in grams per minute, kilograms per hour, etc. STP is usually specified at sea level conditions; however, no single standard exists for this convention. UFM uses STP of 70° F and 14.7 PSIA.

Note: If used outside the parameters specified in this manual, the proper operation of the flowmeter cannot be guaranteed.
BATTERY OPERATION

The flowmeter includes an internal 800 mAh Lithium-Polymer battery that allows for 40 hours of continuous operation. The battery can be charged from any USB charger, and it typically takes 2 hours for a full charge when using a 1-Amp charger. When the meter is plugged into a PC for data logging, the battery will continue to charge through the USB port. A full charge through the computer USB port will take longer than 2 hours, as PC USB ports are limited to 500 mA of output current.

The charge LED on the unit (CHG) indicates the battery status while plugged into a charger.

Yellow means battery is charging.
Green means battery is fully charged.

Note: If the meter is plugged into an external charger or a PC, the battery continues to charge while the meter is operating.
FEATURES

USB Port

Power Switch

Flow Inlet

USB Memory Stick

USB Connection to a PC
KEYPAD OPTIONS

**UP:** Pressing and holding the UP button for 5 seconds will take you into the data Upload mode (refer to USB data upload mode).

**UP:** Consecutive (short) button press cycles between the following information on top of the display.

   a. **Gas:** Current selected Gas
   b. **Pressure:** Gas pressure in PSI
   c. **Pressure:** Gas pressure in PSIA
   d. **Totalizer:** Total volume of gas according to the selected units.
   e. **Temperature:** Temperature in degree Celsius
   f. **Temperature:** Temperature in degree Fahrenheit
   g. **Battery:** Battery charge level percentage

   Options (a) through (f) are saved in the memory so that next time you turn the power on it will remember the display settings.

**DOWN:** Consecutive button press cycles between the different flow units. SCFH, SLPM and SCCM. Once selected, the setting is saved into the memory of the device. Long pressing this button will take it into data Download mode (refer to USB data download mode).

To reset the totalizer, press **SET** until the LCD shows “TARING”. Release the SET button immediately, and the totalizer will be reset.
To tare the meter (at zero flow) press **SET** until the LCD shows “TARING”. Keep holding the SET button (for 5 seconds) until the LCD shows “TARED” and the flow output will be set to zero.
CHG: Pressing CHG once shows the user menu. Once the desired menu item is selected, you can do one of the following:

- **To change the set points**
  - Press SET to choose the particular menu item.
  - Consecutive pressing of SET will cycle through the different digits of the set point.
  - Press UP or DOWN to increase or decrease the particular digit. Pressing SET will set the digit.
  - Long press SET until “SAVED” is displayed on the upper row of the LCD.
  - Press CHG to exit out of current menu item and change the next item.

- **To change Gas Setting**
  - Consecutive pressing of SET will cycle through the different Gas options.
  - Once the desired gas is selected, keep holding the SET button down until “SAVED” is displayed on the upper row of the LCD.

- **To exit out of the menu**
  Navigate to “EXIT” menu item with consecutive CHG presses. Press SET to exit out. An alternative option is to not touch any buttons for 5 seconds, as the program will exit the user menu after 5 seconds of inactivity. *Note: this option does not save the recent settings.*

**USER MENU**

**FLOW HI**: High set point for flow alarm. (This example shows the detailed steps for changing a set point. All other menu items use the same method.)

Press the SET button to change. Range is 0-100% FS. If set to 0, alarm is disabled. Alarm hysteresis is 1% FS.

When first digit starts blinking, use the UP and DOWN buttons to adjust the digit, then press SET to move to the next digit.

When finished, keep holding the SET button down until “SAVED” is displayed, then release the SET button.
**FLOW LO**: Low set point for flow alarm.

![Image of Flow LO](image)

Range is 0 to FLOW HI – 2% FS. If set to 0, alarm is disabled. Alarm hysteresis is 1% FS.

Use **SET**, **UP**, **DOWN** buttons as explained above to change the set point.

**LOG I**: Time interval between data samples logged to USB memory stick.

![Image of LOG I](image)

Range is 0.1 to 999.9 seconds.

Use **SET**, **UP**, **DOWN** buttons as explained above to change the set point.

**LOG T**: Total datalogging time in minutes.

![Image of LOG T](image)

Range is 1 to 9999 minutes. If set to 0, it records data without any time limits (until memory is full).

Use **SET**, **UP**, **DOWN** buttons as explained above to change the set point.

**THRESH**: Threshold percentage for filtering noisy flow readings.

![Image of THRESH](image)

Use **SET**, **UP**, **DOWN** buttons as explained above to change the set point.

The filtering algorithm can detect outliers and exclude them from signal averaging. The Threshold value (in percent) determines which samples will be left out. Percentage is with respect to the internal moving average. Range is 3-50%. For example, when Threshold is set to 20%, if the moving average is 100 SCFH and a single flow sample is either above 120 SCFH or below 80 SCFH (i.e. 20% of the average), it will be ignored and not added to the moving average. However, if subsequent samples are all outside the threshold band, then they will be counted in and the moving average is updated with the new values (more than one sample signifies a real change in flow, not noise).
**AVG:** Moving average array size.

Use **SET, UP, DOWN** buttons as explained above to change the set point.

This is the number of samples that are averaged when calculating the flow. Range is 1-100. Samples are added to the internal moving average array and a new output is displayed once every 100 msec.

**GAS:** Current Gas.

Use the **SET** button to change the gas.

Pre-programmed gases are: Air, Argon, CO₂, Helium, Nitrogen, Methane, Hydrogen, Oxygen.

**USER FACTOR:**

Range is 0.200 to 2.000. The LCD will show this factor x1000 (i.e. without the decimal point). It is implied that there are 3 decimal places (e.g. 1000 means 1.000).

You can use as many gases with the flowmeter as you wish. If the gas is not on the pre-programmed list, you can enter the gas factor in this menu. Please note that the flowmeter accuracy may be degraded as much as 5% of full-scale when using this option (depending on the accuracy of the gas factor and the nature of the gas itself). There are other factors involved in accurately measuring different gases as well.

**Note:** If you change this factor to any values other than 1.000, you must use Air in your gas selection; otherwise, there will be a “double-correction” applied to the output.
**RESET:** Reset the parameters back to the original factory settings.

Hold the SET button until the letters RESET will be displayed on the LCD one by one. This will provide a 5 second delay that is intended to prevent and accidental reset.

The following variables will be reset to their original values:
- High flow alarm = 80% of FS
- Low flow alarm = 20% of FS
- Log interval = 0.5 sec
- Log time = 0 sec (no end time)
- Threshold = 20%
- Moving average = 25
- GAS = Factory-calibrated gas, specified in the Model Code
- USRFCT = 1.000

**EXIT:** Exit the user menu.

### USB DATA STREAM

**Data Upload Mode**
The device has a USB port to output the data to a USB host in real-time.

- **Entering the Data Upload Mode:** Long press UP button until “PC” appears on the LCD.
- **Protocol:** The device sends the data as a response to a custom command (“D!”). Any serial terminal software can be used to observe the data.

Command: “D!” (ASCII) or hexadecimal 0x44 followed by 0x21
Response is always 21 bytes arranged as follows:

<table>
<thead>
<tr>
<th>0x3E</th>
<th>Gas</th>
<th>Flow</th>
<th>Status</th>
<th>Temperature</th>
<th>Pressure</th>
<th>Alarm</th>
<th>Total</th>
<th>Reserved</th>
<th>Checksum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 byte</td>
<td>1 byte</td>
<td>2 bytes</td>
<td>1 byte</td>
<td>2 bytes</td>
<td>2 bytes</td>
<td>1 byte</td>
<td>4 bytes</td>
<td>6 bytes</td>
<td>1 byte</td>
</tr>
</tbody>
</table>

- Start Delimiter 0x3E (hex) or 62 (decimal): 1 Byte
  Indicates the beginning of the packet.
• Gas number: 1 Byte

<table>
<thead>
<tr>
<th>Gas Name</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>0</td>
</tr>
<tr>
<td>Argon</td>
<td>1</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>2</td>
</tr>
<tr>
<td>Helium</td>
<td>3</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>4</td>
</tr>
<tr>
<td>Methane</td>
<td>5</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>6</td>
</tr>
<tr>
<td>Oxygen</td>
<td>7</td>
</tr>
<tr>
<td>User Factor</td>
<td>255</td>
</tr>
</tbody>
</table>

• Flow: 2 Bytes
Flow in SCFH or SLPM transmitted as Flow x 10 (depends on the units selected on the LCD)

• Status: 1 Byte
- Engineering units – Bits 7, 6: (depends on the units selected on the LCD)
  - 00 = SCFH
  - 01 = SLPM
  - 10 = SCCM
- Bits 5, 4, 3 are zeros (reserved)
- Sensor status – Bits 2, 1, 0:
  - Bit 0: AP sensor (0=okay, 1=failed)
  - Bit 1: DP sensor (0=okay, 1=failed)
  - Bit 2: Temperature (0=okay, 1=failed)

• Temperature: 2 Bytes
Gas temperature in °C or °F transmitted as Temperature x 10 (depends on the units selected on the LCD)

• Pressure: 2 Bytes
Pressure value in PSIA transmitted as Pressure x 10

• Flow alarm – 1 Byte
  - 0 = No alarm
  - 1 = High alarm
  - 2 = Low alarm

• Totalizer – 4 Bytes
It is transmitted as Total x 100. Maximum value is 999999, transmitted as 99999900 (units depends on what is selected on the LCD).

• Gas Factor Value – 2 Bytes

• Padding Bytes – 4 Bytes
Default all zeroes. Reserved for future implementation.
• Checksum – 1 Byte
  2’s complement of the sum of the data sent (excluding Start Delimiter)

Example:
  Gas = Air
  Flow = 72.8 SCFH
  Sensor status = Okay
  No alarms
  Temperature = 22.2 Degree Celsius
  Pressure = 14.4 PSIA
  Totalizer = 000000.01 (SCFH)

Sending the command “D!” will result in a 21-byte response shown below. The response string is listed as 3 decimal digits per byte to show the spacing between each byte (terminal programs may display 000 as 0 and 062 as 62):

062 000 002 216 000 000 000 222 000 144 000 000 000 001 000 000 000 000 000 000 181

<table>
<thead>
<tr>
<th>Value</th>
<th>Breakdown</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>062</td>
<td></td>
<td>Start Delimiter (3E hex)</td>
</tr>
<tr>
<td>000</td>
<td>Air</td>
<td>Gas number 0</td>
</tr>
<tr>
<td>002 216</td>
<td>728 = 0x2D8: 2 = 2, D8 = 216</td>
<td>Flow transmitted as x10</td>
</tr>
<tr>
<td>000</td>
<td>0 = SCFH</td>
<td>Engineering units – Bits 7, 6:</td>
</tr>
<tr>
<td></td>
<td>0 = Both sensors Okay</td>
<td>00 = SCFH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 = SLPM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 = SCCM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bits 5, 4, 3 are zeros (reserved)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sensor status – Bits 2, 1, 0:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit 0: AP sensor (0=okay, 1=failed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit 1: DP sensor (0=okay, 1=failed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit 2: Temperature (0=okay, 1=failed)</td>
</tr>
<tr>
<td>000</td>
<td></td>
<td>Alarm status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 = No alarm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = High alarm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 = Low alarm</td>
</tr>
<tr>
<td>000 222</td>
<td>222 = 0x0DE: 0 = 0, 0xDE = 222</td>
<td>Temperature transmitted as x10</td>
</tr>
<tr>
<td>000 144</td>
<td>144 = 0x090: 0 = 0, 0x90 = 144</td>
<td>Pressure transmitted as x10</td>
</tr>
<tr>
<td>000 000 000 001</td>
<td></td>
<td>Totalizer transmitted as x100</td>
</tr>
<tr>
<td>003 232</td>
<td>1000 (1.000) = 0x3E8 = 3, 232</td>
<td>Gas Factor x1000</td>
</tr>
<tr>
<td>000 000 000 000</td>
<td></td>
<td>Padding Bytes, 4 zeros</td>
</tr>
<tr>
<td>181</td>
<td></td>
<td>Checksum</td>
</tr>
</tbody>
</table>

→ To exit Data Upload mode, turn the power switch off and back on.
Data Download Mode
A USB thumb drive can be plugged in into the USB port of the device to log the data. It only supports FAT file system. File is saved in a standard .CSV format to be easily opened into programs such as Microsoft Excel.

- **Initiating Data Download Mode**
  Long press the DOWN button until “USB” is displayed on the LCD. It looks for a USB thumb drive with FAT file system. If found, it displays “DETECT” and immediately displays the name of the next available file as LOGx on the upper display. File names are automatically generated as LOGx or LOGxx or LOGxxx where x ranges from 0 to 999. The LOG file number can be incremented manually with the UP and DOWN buttons. File numbers that already exist on the memory stick will be skipped (you cannot overwrite them, unless they are deleted on a PC).

![FlowStream LCD Display](image)

- **Logging the Data**
  Once the LOG file is selected, press CHG to start recording the data on the memory stick. The sample interval and duration to log the data can be set from the User Menu (LOG I and LOG T settings). To confirm that the USB communication is up and running, LED A2 will start flashing at 5 Hz. The LED A1 will flash at log time intervals (LOG I) and will continue recording for selected minutes (LOG T), then stops.

  Note 1: If you remove the memory stick in the middle of recording, “ERROR” will be displayed on the LCD (followed by an internal error code).

  Note 2: When the memory becomes full, the log file is saved and the LCD will display “FULL.”

An example of a single line of data when viewed as a raw text file is as follows:

**Oxygen,Flow:48.56,Temp:,19.78,Pressure:,15.52 ,Total:,488.58,**

Engineering units for flow, temperature and pressure are the same as selected on the LCD.
Saving the data and exiting out of the Data Download Mode
Pressing the SET button will save the current log and displays “DONE” on the LCD, then returns to normal mode.

Changing the firmware using USB drive
The flowmeter firmware can be updated when a new version becomes available. You can obtain a USB drive with the new firmware from UFM. To upgrade the firmware:

a. Turn off the meter.
b. Press and hold UP and SET buttons
c. Turn on the meter
d. LED A1 flashes while LED A2 remains ON
e. Insert the USB drive with firmware
f. LCD will display FAILED or DONE when operation is complete according to failure or success respectively.
AVAILABLE FLOW SIZES

Each flow meter is offered with the full scale value specified which corresponds to the max flow rate of the gas. The available ranges for each port size and gas are shown in the below table. Please refer to the model code in the Ordering Information section to select the desired flow rate.

<table>
<thead>
<tr>
<th>Port size</th>
<th>Air, N, O2, CO2, He, Methane (Max SCFH)</th>
<th>Air, N, O2, CO2, He, Methane (Max SLPM)</th>
<th>Argon (Max SCFH)</th>
<th>Argon (Max SLPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8” Min. F.S.</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>1/8” Max F.S.</td>
<td>60</td>
<td>30</td>
<td>45</td>
<td>20</td>
</tr>
<tr>
<td>1/4” Min. F.S.</td>
<td>10</td>
<td>5</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>1/4” Max F.S.</td>
<td>360</td>
<td>180</td>
<td>270</td>
<td>135</td>
</tr>
<tr>
<td>3/8” Min. F.S.</td>
<td>360</td>
<td>180</td>
<td>270</td>
<td>135</td>
</tr>
<tr>
<td>3/8” Max F.S.</td>
<td>600</td>
<td>300</td>
<td>450</td>
<td>225</td>
</tr>
<tr>
<td>1/2” Min. F.S.</td>
<td>600</td>
<td>300</td>
<td>450</td>
<td>225</td>
</tr>
<tr>
<td>1/2” Max. F.S.</td>
<td>1400</td>
<td>700</td>
<td>1050</td>
<td>525</td>
</tr>
<tr>
<td>3/4” Min. F.S.</td>
<td>1400</td>
<td>700</td>
<td>1050</td>
<td>525</td>
</tr>
<tr>
<td>3/4” Max. F.S.</td>
<td>2600</td>
<td>1300</td>
<td>1980</td>
<td>990</td>
</tr>
</tbody>
</table>

Gas Factors

<table>
<thead>
<tr>
<th>Gas</th>
<th>Symbol</th>
<th>Absolute Viscosity* 25°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Air</td>
<td>184.8989</td>
</tr>
<tr>
<td>Argon</td>
<td>Ar</td>
<td>226.2399</td>
</tr>
<tr>
<td>Methane</td>
<td>CH4</td>
<td>110.7595</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>CO</td>
<td>176.4933</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>CO2</td>
<td>149.3184</td>
</tr>
<tr>
<td>Ethane</td>
<td>C2H6</td>
<td>93.5412</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>H2</td>
<td>89.1535</td>
</tr>
<tr>
<td>Helium</td>
<td>He</td>
<td>198.4561</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>N2</td>
<td>178.0474</td>
</tr>
<tr>
<td>Nitrous Oxide</td>
<td>N2O</td>
<td>148.4124</td>
</tr>
<tr>
<td>Neon</td>
<td>Ne</td>
<td>311.1264</td>
</tr>
<tr>
<td>Oxygen</td>
<td>O2</td>
<td>205.5021</td>
</tr>
<tr>
<td>Propane</td>
<td>C3H8</td>
<td>81.4631</td>
</tr>
<tr>
<td>normal-Butane</td>
<td>n-C4H10</td>
<td>74.0536</td>
</tr>
<tr>
<td>Acetylene</td>
<td>C2H2</td>
<td>104.4480</td>
</tr>
<tr>
<td>Ethylene</td>
<td>C2H4</td>
<td>103.1839</td>
</tr>
<tr>
<td>iso-Butane</td>
<td>i-C4H10</td>
<td>74.7846</td>
</tr>
<tr>
<td>Krypton</td>
<td>Kr</td>
<td>251.3249</td>
</tr>
<tr>
<td>Xenon</td>
<td>Xe</td>
<td>229.8483</td>
</tr>
</tbody>
</table>

To use a gas from this list, first calculate the viscosity ratio with respect to Air. For example, for N2O the factor is: 148.4124/184.8989 = 0.803

Scroll down the User Menu until you see USRFCT and enter the User Factor of 0.803.

Note: When applying (user) gas factors other than those pre-programmed in the unit, the accuracy will be further degraded by an additional 1% of full-scale.
How To Order Flowstream for a Single Gas

Select the appropriate symbols to build a model code:

Example: FD- E F  2 N- 360 SCFH- CO2- USB

---

**SERIES**
- FD
- E
- F
- 2
- N
- 360 SCFH
- CO2
- USB

**MATERIAL FOR METER BODY**
- Anodized Aluminum = [E]
- 316 Stainless Steel = [ ]

**SEALS**
- Viton* = [F]

**PIPE SIZE**
- in inches
  - 1/8 = 1
  - 1/4 = 2
  - 3/8 = 3
  - 1/2 = 4
  - 3/4 = 6

**FLOW RANGE IN SLPM**

<table>
<thead>
<tr>
<th>FLOW RANGE IN SCFH</th>
<th>MIN FLOW</th>
<th>MIN MAX F.S.</th>
<th>MIN FLOW</th>
<th>MIN MAX F.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.005</td>
<td>2.0</td>
<td>0.0125</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>0.05</td>
<td>5</td>
<td>0.1</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>0.45</td>
<td>180</td>
<td>0.9</td>
<td>360</td>
</tr>
<tr>
<td></td>
<td>0.75</td>
<td>300</td>
<td>1.5</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>0.75</td>
<td>300</td>
<td>1.5</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>1.75</td>
<td>700</td>
<td>3.5</td>
<td>1400</td>
</tr>
<tr>
<td></td>
<td>3.25</td>
<td>1300</td>
<td>6.5</td>
<td>2600</td>
</tr>
</tbody>
</table>

* Argon flow rates are 75% of the above values (multiply by 0.75) due to higher viscosity

**GAS TYPE**
- Air = A
- Argon* = R
- Carbon Dioxide = [CO2]
- Helium = HE
- Nitrogen = N
- Oxygen = O
- Hydrogen = H
- Methane = M

**OUTPUT**
- USB Serial Data Link = [USB]

**SPECIAL OPTIONS**
- CLEAN FOR OXYGEN SERVICE = [C1]
- VACUUM USE = [ZVAC]
- SPECIFIC PRESSURE (I.E. P10) = [P]
- ACTUAL GAS CALIBRATION = [GAS]
INSTALLATION DIMENSIONS

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DIM &quot;A&quot;</th>
<th>DIM &quot;B&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8 Inch</td>
<td>3.00 Inches</td>
<td>0.38 Inches</td>
</tr>
<tr>
<td>1/4 Inch</td>
<td>3.00 Inches</td>
<td>0.38 Inches</td>
</tr>
<tr>
<td>3/8 Inch</td>
<td>3.25 Inches</td>
<td>0.50 Inches</td>
</tr>
<tr>
<td>1/2 Inch</td>
<td>3.50 Inches</td>
<td>0.63 Inches</td>
</tr>
<tr>
<td>3/4 Inch</td>
<td>4.00 Inches</td>
<td>0.68 Inches</td>
</tr>
</tbody>
</table>
NOTICE

RETURN MATERIAL AUTHORIZATION

Please read the following UFM policy information carefully. By following the guidelines outlined below you will assist in providing a timely evaluation and response regarding the status of your flowmeter. UFM evaluates all AUTHORIZED RETURNED MATERIALS in a timely manner and will promptly provide notification regarding the status of the related materials and/or a written quotation indicating the total charges and description of the necessary repairs.

1. All returns must have a RMA form completed by the customer.
2. Any meter returned that was previously in service must have the OSHA requirements completed and a MSDS included where applicable.
3. An RMA number will only be issued when UFM has received a copy of the completed RMA form and any applicable MSDS.
4. A “Return Goods” shipping label (located in the back of the Instruction Manual) must be used for returning materials to UFM.
5. Returned goods must be shipped prepaid or they will be rejected.

REPAIRABLE MATERIAL
Written or verbal authorization to proceed with the repair under an assigned Purchase Order must be received within 30 days of repair quotation. If the unit(s) is repaired, the $90.00 evaluation charge will be applied to the quoted repair costs. If no repairs are authorized within this 30-day period, the customer will be billed $90.00 plus shipping charges and the materials will be returned to the customer.

NON-REPAIRABLE MATERIAL
If materials are found non-repairable, a written notice that the material is non-repairable will be provided to the customer by UFM. If no disposition to scrap or return the material is received from the customer within 30 days, non-repairable material will be scrapped and the customer will be billed the $90.00 evaluation charge. If a UFM replacement unit is purchased within 30 days of non-repairable condition notice, the $90.00 evaluation fee will be waived. The return of non-repairable materials may be ordered by a customer Purchase Order; shipping and handling charges will be assumed by customer.

RETURN FOR RESTOCK
All goods returned for restock adjustment must be:
A. New and unused.
B. Returned to the factory within ONE YEAR of date of original shipment.
C. Returned through the distributor where the goods were originally purchased.
D. Returned material will be subject to an evaluation charge of $90.00.

The customer will be advised of the restocking adjustment for all restockable goods. Upon customer’s acceptance of the restocking adjustment, the $90.00 evaluation fee will be waived and UFM will issue a credit to the customer. The customer will be advised of any non-restockable goods and will be charged the $90.00 evaluation fee plus any shipping charges if goods are returned to the customer.
If no disposition is received by UFM within 30 days, the goods will be scrapped and the $90.00 evaluation fee will be billed.

**WARRANTY RETURNS**

Warranty returns must be shipped prepaid to UFM. UFM will review the goods and advise the customer of the evaluation and validity of the warranty claim. Valid warranty claims will be repaired or replaced at no charge. No evaluation fee will be charged for repairs made under warranty. Return shipping costs will be prepaid by UFM. Should UFM determine returned material not to be defective under the provisions of UFM’s standard warranty, the customer will be advised of needed repairs and associated costs. All materials returned for warranty repair that are determined not to have a valid warranty claim will be subject to the “Repairable Material” policy outlined above.
WARRANTY INFORMATION

1) ACCEPTANCE AND INTEGRATION CLAUSE: This Sales Order Acknowledgment and the sales order information that Universal Flow Monitors, Inc. ("Universal") attaches to or associates with it (herein "Acknowledgment"), constitutes an acceptance by Universal of an offer by the buyer upon the conditions and terms and at the prices stated in this Acknowledgment. The Acknowledgment contains the entire understanding of Universal and the buyer regarding the subject matter of said Acknowledgment. This Acknowledgment may only be modified by a written agreement signed by the party against whom enforcement is sought.

2) WAIVER: Waiver by Universal of any default(s) by the buyer shall not constitute waiver by Universal of any of the conditions of the agreement between Universal and the buyer as set forth hereunder with respect to any further or subsequent default by the buyer.

3) FORCE MAJEURE: Universal shall not be responsible for failure or delays in deliveries due to fire, strikes, breakdowns, acts of God, failure of carriers, inability to secure required materials, or other causes beyond Universal's control. Buyer waives any claims for damage arising by virtue of delay in delivery of material by Universal.

4) LIMITED WARRANTY:
   (a) Warranty. For a period of one year from the date of manufacture, Universal warrants that each product covered by this Acknowledgment will be free from defects in material and workmanship. In order to qualify for any remedy provided in this Acknowledgment, buyer must give notice to Universal within the one-year period, return the product to Universal freight paid and intact with Material Safety Data Sheets covering all substances passing through the product or that form a residue on the product.
   (b) Exclusive Remedy. The buyer's EXCLUSIVE REMEDY for failure of any product to conform to any warranty or otherwise for any defect is, at Universal's sole option: (i) repair; (ii) replacement; or (iii) refund of the entire purchase price for the specific product. Without limiting the foregoing, in no case will Universal be liable for de-installation of any defective product or installation of any repaired or replaced product. THIS REMEDY IS THE EXCLUSIVE REMEDY AVAILABLE TO THE BUYER OR ANY OTHER PERSON. UNIVERSAL SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, CONSEQUENTIAL, SPECIAL, PUNITIVE, OR OTHER DAMAGES IN CONNECTION WITH ANY CAUSE OF ACTION, WHETHER IN CONTRACT, TORT, OR OTHERWISE.
   (c) Disclaimer of Other Warranties. The express warranty in this Acknowledgment is in lieu of any other warranty, express or implied. Without limiting the foregoing, UNIVERSAL DISCLAIMS THE IMPLIED WARRANTY OF MERCHANTABILITY AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.
   (d) Special Note About Fitness for a Particular Purpose. This website and other materials of Universal may place products into, or display products in, categories according to function, size, construction, materials, or other property. This is for organizational purposes only and NO PLACEMENT OF ANY PRODUCT IN ANY CATEGORY OR ANY PRESENTATION OF A PRODUCT IN RELATION TO OTHER PRODUCTS WILL CONSTITUTE A WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

5) PROHIBITED USES: As a condition of the sale of goods or services, buyer will not use, sell, distribute, or otherwise transfer for use, or permit to be used, sold, distributed, or otherwise transferred any product purchased from Universal for any of the following uses:
   (a) Nuclear Energy Applications. Any application involving, directly or indirectly: (i) exposure of any product to any hazardous properties of nuclear material; (ii) dependence on the proper functioning of the product for the operation of a nuclear facility by any person or organization; (iii) use in or for any equipment or device used for the processing, fabricating or alloying of special nuclear material if, at any time, the total amount of such material on the premises where such equipment or device is located consists of or contains more than 25 grams of (A) Plutonium (any isotope) or Uranium 233 or any combination thereof; (B) more than 250 grams of Uranium 235; (iv) use in, or for the control of any aspect of, any structure, basin, excavation, premises or place prepared or used for the storage or disposal of waste. The foregoing include, without limitation, any application involving nuclear material contained in spent fuel or waste that is possessed, handled, used, processed, stored, transported or disposed of, any application related to the furnishing of services, materials, parts or equipment in connection with the planning, construction, maintenance, operation or use of any nuclear facility.
(b) Aircraft Applications. Any application involving direct or indirect installation in or on, or use in connection with, any aircraft or aircraft product.

(c) Definitions. As used in this section, the following definitions apply, whether the terms use initial capitals or not.

"Aircraft" includes powered and non-powered winged aircraft, missiles, spacecraft, and other aeronautical craft or mechanisms.

"Aircraft product" includes:

1. Any ground support or control equipment used with any aircraft;
2. Any article designed for installation in or on aircraft;
3. Any ground handling tools or equipment used with aircraft;
4. Any aircraft training aids, instructions, manuals, or blueprints; and
5. Any engineering, labor or other services involving aircraft. "Hazardous properties" include radioactive, toxic or explosive properties; "Nuclear facility" means

a. Any nuclear reactor; or
b. Any equipment or device designed or used for: (1) Separating the isotopes of uranium or plutonium; (2) Processing or utilizing spent fuel; or
   (3) Handling, processing or packaging waste.
"Nuclear material" means source material, special material or by-product material;

"Nuclear reactor" means any apparatus designed or used to sustain nuclear fission in a self-supporting chain reaction or to contain a critical mass of fissionable material. "Property damage" includes all forms of radioactive contamination of property.

"Source material," "special nuclear material," and "by-product material" have the meanings given them in the Atomic Energy Act of 1954 and any regulation promulgated thereunder, as the same may be amended from time to time.

"Spent Fuel" means any fuel element or fuel component, solid or liquid that has been used or exposed to radiation in a nuclear reactor.

"Waste" means any waste material (1) containing by-product material and (2) resulting from the operation by any person or organization of any nuclear facility.