**FLOMOTION** SYSTEMS

**FLOMOTION FM900**
Ultrasonic Open Channel Flow Meter
USER'S MANUAL

JULY 24, 2013

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# Chapter 1 Introduction

## About the FLOMOTION FM900

The FLOMOTION FM900 is an instrument that can be used both as ultrasonic open channel flow meter and level gauge. The ultrasonic open channel flow meter measures the water level and calculates and displays accurate flow rate and total flow in a manner to measure the flow rate according to a flow/level calculation method, based on the principle that water level is specifically related to flow rate in the standardized open channel.

The ultrasonic flow meter employing non-contact measurement method can be applicable to various fluids, including corrosive fluid, and has semi-permanent life.
Data Logger function is built in this product, enabling long-term storage of various data, such as level, flow rate, and total flow rate. These data can be saved for up to 420 days

This product can be applicable to the following open channels.

1. Parshall Flumes
2. Suppressed Rectangular Weirs
3. Contracted Rectangular Weirs
4. V-Notch [Triangular] Weirs. [22.5°, 30°, 45°, 60°, 90°, 120°]
5. Cipolletti Weirs
6. Leopold Lagco Flumes
7. Palmer Bowlus Flumes
8. H Flumes

In addition, 10 point DIY CURVE and flow equation (Q=K*H(PWR)) are used to measure the flow rate in various open channels.

## Features of the FLOMOTION FM900

- Non-contact flow measurement - applicable to various fluids, semi-permanent life
- Applicable to various kinds of channels
- 10 point DIY CURVE function able to conduct flow measurement, regardless of the types of channels
- Digital measurement and display
- Current output in proportion to flow measurement (4mA ~ 20mA)
- Current output in proportion to level measurement (4mA ~ 20mA)
- Flow-based pulse output
- Programmable SPDT relays
- Buttons for convenient and easy operation
- LCD to display operational conditions - convenient setting
- Built-in temperature sensor and temperature compensation function
- Ultrasonic output adjustment and algorithm selection assuring consistent flow measurement
- Automatic detection of bottom distance
- Storage of various data, including water level, flow rate, and total flow rate, for up to 420 days.
- Operation with free voltage power, low power consumption

# Product Specification

**Physical**

| | |
|---|---|
| Controller | 9.45" (width). X 7.3" (height) |
| Sensor | Ø 2.6"(dia) X 4.8"(height) |
| Mounting | 1" NPT |
| Weight | Approx. 8.8 lbs (4.0kg) (sensor, controller) |
| Sensor Material | Polypropylene |
| Sensor Cable Length | 33ft (10m) Standard, Up to 650ft max. |
| | |
| IP Rating (electronics housing) | NEMA 4x (Controller) |
| Max. & Min. temperature (electronics) | -4 ºF to 140 ºF (-20 ºC to +60 ºC) Controller |
| | -4 ºF to 160 ºF (-20 ºC to +70 ºC) Sensor |

**Performance**

| | |
|---|---|
| Resolution | .04" (1mm) |
| Range(Flow rate) | 0.00gal/min ~ 999999.0 gal/min |
| Range(Total flow) | 999999999 gal |
| Range(level) | 10 ft. (S100, 75kHz Transducer Assy) |
| Beam Angle | 8º at -3dB |
| Response Time | 500ms |
| Displayed Value | Flow rate, Total flow, Level, graphic LCD (128X68 dot) |
| Temperature Compensation | Fully compensated via integral temperature sensor over entire operational span |

**Outputs**

| | |
|---|---|
| Analog Outputs | 2 points 4-20mA into Max 750Ω (user adjustable for Level and Flow) |
| | Fault condition Alarm 3.8mA /Hold/21mA, |
| Setpoint Relay | 2 SPDT Relays - 5A, AC250V |
| Communication Port | RS-232C/RS485 |
| Pulse output | Open collector (see appendix for details) |

**Programming**

| | |
|---|---|
| On-board programming | 5 tactile push buttons |

**Supply**

| | |
|---|---|
| Power supply | AC110 ~ 230V, Less than 15VA (50Hz ~ 60Hz), |

**Primary Devices**

Parshall Flumes
Suppressed Rectangular Weirs
Contracted Rectangular Weirs
V-Notch[Triangular] Weirs.[22.5°, 30°, 45°, 60°, 90°, 120°]
Cipolletti Weirs
Leopold Lagco Flumes
Palmer Bowlus Flumes
H Flumes
10 Point DIY CURVE
Flow equation($Q=K*H(PWR)$)

## Chapter 2 Installation

The FLOMOTION FM900 is composed of one controller unit and one sensor.

## Power Supply Requirements

The FLOMOTION FM900 operates with AC supply of 110V to 230V (20 to 30VDC opt.)
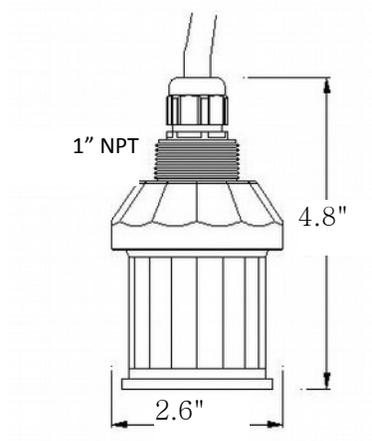
> *All electronic products are susceptible to electrostatic shock, so follow proper grounding procedures during installation.*

When choosing a location to mount the sensor, bear in mind the following:
- For easy access to the LCD display and programming buttons mount it where it is easily accessible.
- The ultrasonic signal path should be free of falling material and obstructions such as pipes, beams etc.
- The sensor should be mounted at least 14" above the maximum level of the material and be perpendicular to the surface.
- The mounting surface should be vibration-free.
- The ambient temperature of the sensor is between -4 ºF to 140 ºF (-20ºC and 70ºC.)
- There should be no high voltage cables or electrical inverters close by.

# Dimensions

## Sensor



1″ NPT

4.8"

2.6"

## Controller



9.45"

8.38"

7.28"

0.6"

5.71"

7.81"

9.45"

7.80"

8.38"

7.28"

2.36"
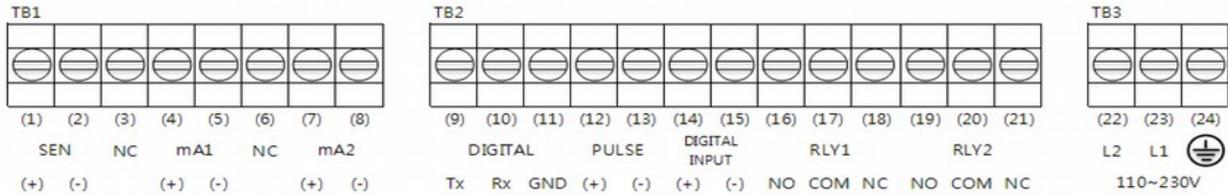
5.04"

1.85"

4.21"

2.36"

5.71"

0.6"
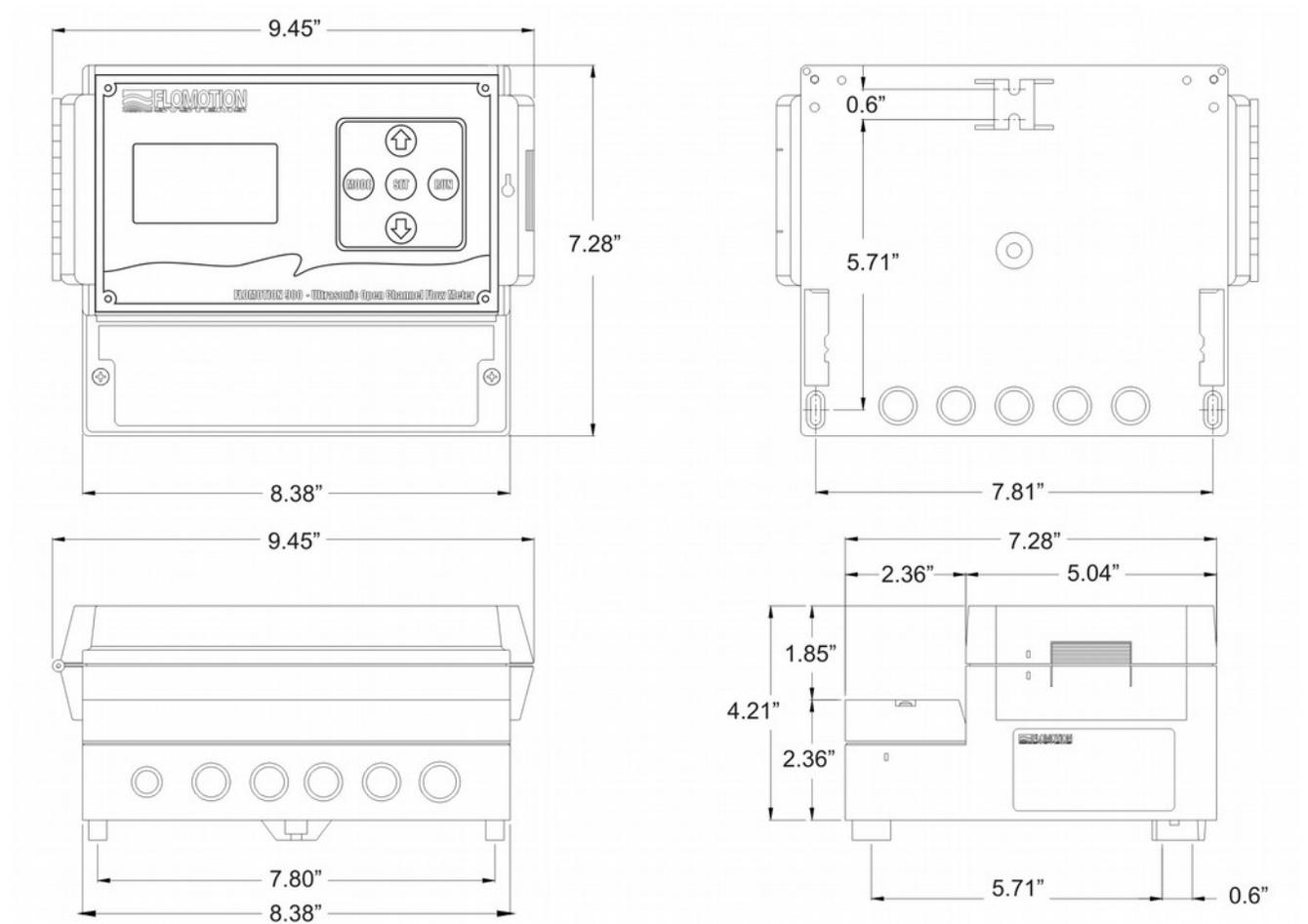
# Terminal Block Wiring

There are 21 terminals for the controller and 3 terminals for power as follows:

## Input & Output Terminal

| TB1 | | | | | | | | TB2 | | | | | | | | | | | | | | TB3 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) | (21) | | (22) | (23) | (24) |
| SEN | | NC | mA1 | | NC | | mA2 | DIGITAL | | | PULSE | | DIGITAL INPUT | | | RLY1 | | | RLY2 | | | L2 | L1 | ⏚ |
| (+) | (-) | | (+) | (-) | | (+) | (-) | Tx | Rx | GND | (+) | (-) | (+) | (-) | NO | COM | NC | NO | COM | NC | | 110~230V | | |

## Function

| Terminal | | Function | Note |
|---|---|---|---|
| SENSOR (+) | | Connect to +cable of sensor of RTX | Red |
| SENSOR (-) | | Connect to shield cable of sensor of RTX | Blue |
| NC | | Not Used | |
| mA1 (+) | | FLOW 4-20mA current output (+) | Output1 |
| mA1 (-) | | FLOW 4-20mA current output (-) | |
| NC | | Not Used | |
| mA2 (+) | | LEVEL 4-20mA current output (+) | Output2 |
| mA2 (-) | | LEVEL 4-20mA current output (-) | |

| Terminal | | Function | |
|---|---|---|---|
| DIGITAL TX | 9 | When using RS232C interface, connection to RS232C's transmitter. When using RS485, connection to Y. | |
| DIGITAL RX | 10 | When using RS232C interface, connection to RS232C's receiver. When using RS485, connection to Z. | |
| DIGITAL GND | | Digital communication GND | |
| PULSE(+) | | Pulse output (+): at set intervals | |
| PULSE(-) | | Pulse output (-) | |
| DIGITAL NPUT(+) | | Not Used | |
| DIGITAL INPUT(-) | | Not Used | |
| RLY1  NO | | Relay_1 Normally Open contact point. | |
| RLY1  COM | | Relay _1 Common contact point. | |
| RLY1  NC | | Relay _1  Normally Closed contact point. | |
| RLY2  NO | | Relay _2 Normally Open contact point. | |
| RLY2  COM | | Relay _2  Common contact point. | |
| RLY2  NC | | Relay _2 Normally Closed contact point. | |

| Terminal | | Function | |
|---|---|---|---|
| L2 | 22 | AC power connection | 110-230V |
| L1 | 23 | AC power connection | |
| ⏚ | 24 | Ground | |

# Sensor Installation

In order to prevent malfunctions and assure accurate measurement, installation should be conducted under consideration of the following points.

1. **There should be no disturbing objects within the range of 8° beam angle where the ultrasonic pulse travels.**



Min 14 in.

8°

Less than 10ft
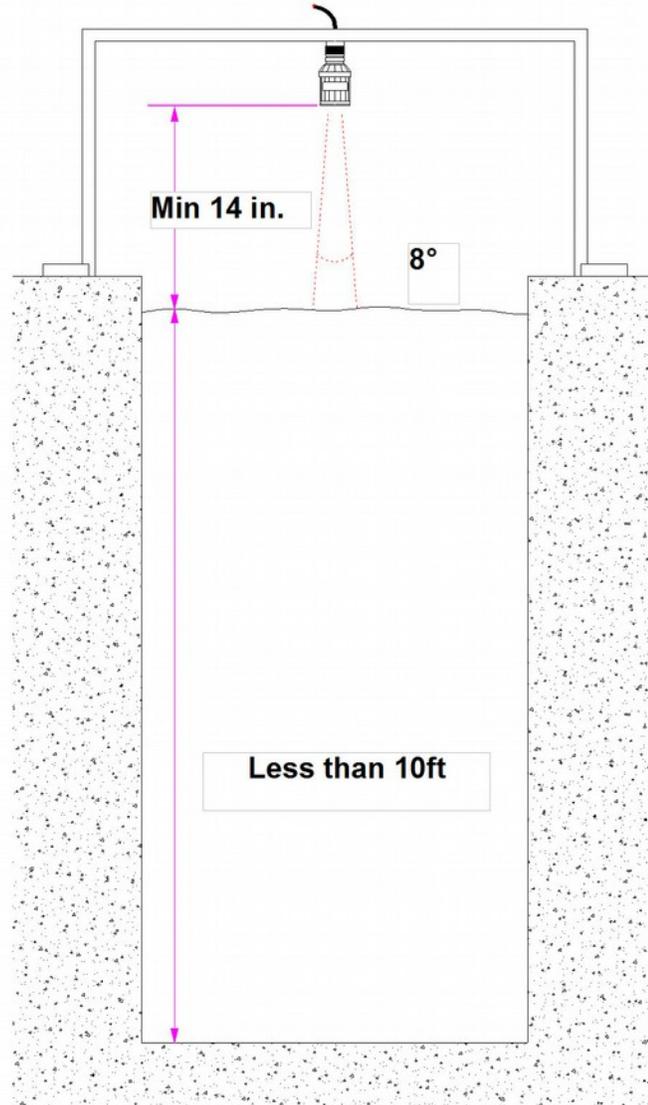
2. **It should be installed at right angles to the water surface. (The sensor should be vertical to the floor.)**
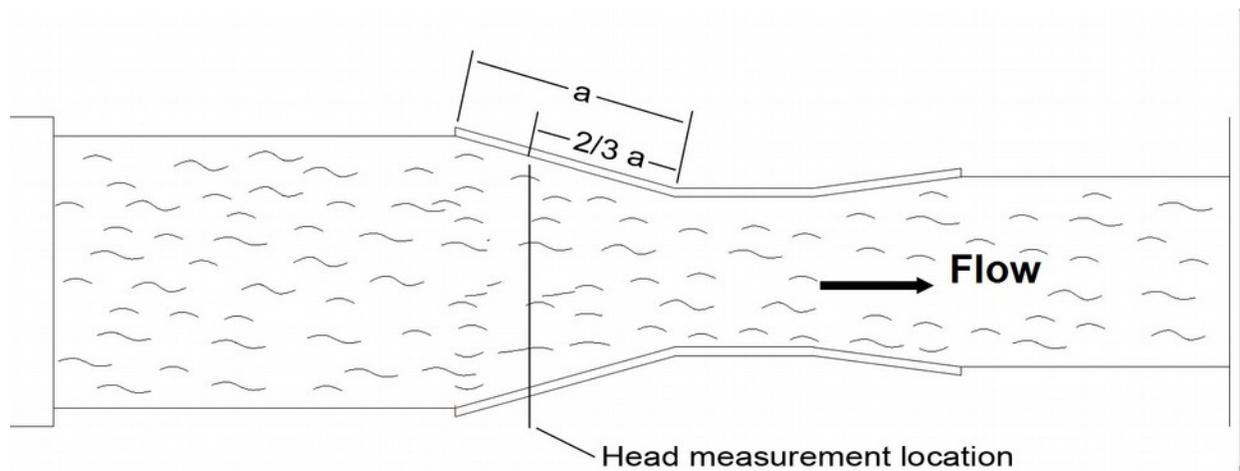3. **Input accurate bottom distance (04. BOTTOM DISTANCE).**

The sensor should be installed at a position of above maximum water level of the channel to be measured (more than 14 in.)
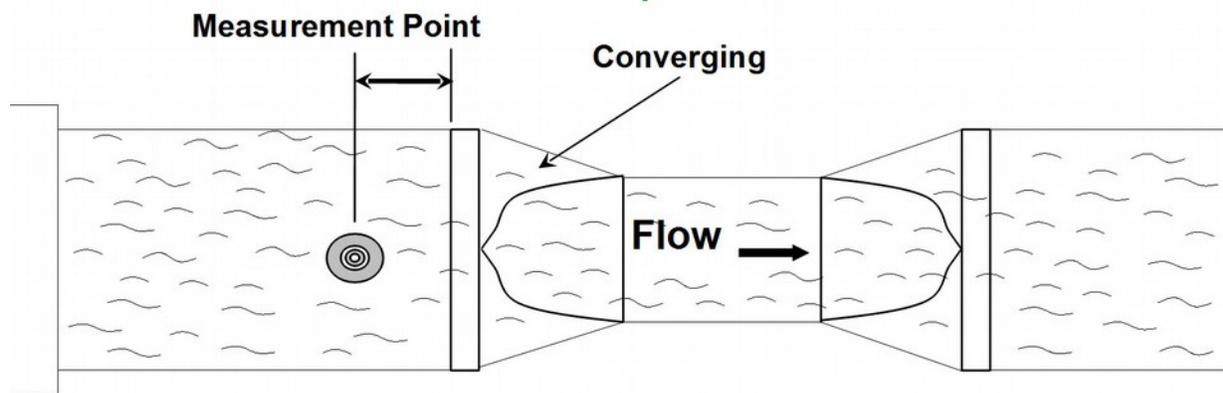
**Weir**
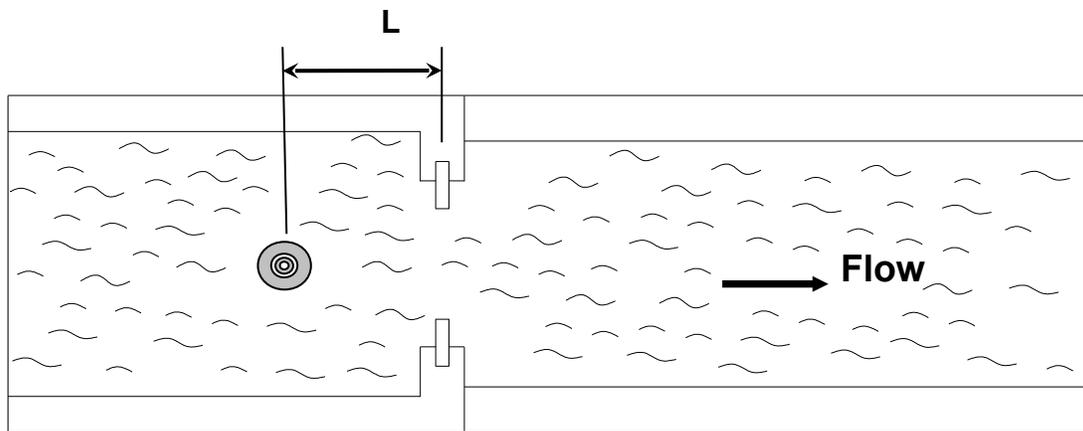


- In the rectangular, triangular, and Cipolletti channels, the sensor should be installed at the top of the channel (Max. height x 4 ~ 5 times recommended).

**Parshall Flume**



- In the Parshall Flume, the sensor should be installed at a 2/3 position of the whole converging section length.

**Leopold Lagco**



- In the Leopold-Largco Flume, the sensor should be installed at a position distant from Converging Section (corresponding to the distance of measurement point according to Flumes size)

| Flume Size | | Measurement Point | |
|---|---|---|---|
| mm | inches | mm | inches |
| 100 ~ | 4~12 | 25 | 1.0 |
| 380 | 15 | 32 | 1.3 |
| 455 | 18 | 38 | 1.5 |
| 530 | 21 | 44 | 1.8 |
| 610 | 24 | 51 | 2.1 |
| 760 | 30 | 64 | 2.5 |

- Flickering of "DT" at the bottom of the screen at Operation Mode means detection of water level. Therefore, such flickering should be confirmed in the course of installation.

- Installation should not be done at places exposed to direct sunlight or strong wind.

- After installation, operational conditions should be checked again (Power On/Off and display of measurement level).

※ **Note: If not correctly installed, this product may not desirably work in the winter when temperature difference between the sensor and the water surface is high.**

# Chapter 3    How To Use The FLOMOTION FM900

## Button Functions

**1) MODE Button**
- To convert Operation Mode to Program Mode.

**2) UP [↑] and DOWN [↑] Button**
- Use this button to change the value of an option selected.
- One push of these buttons leads to increase by one. Continuous push of these buttons results in continuous increase one by one. Further push of this button results in change of the number at tenth or hundredth figures.
- If a specific menu is not selected, this button can be used to change menu options. One push of this button results in return to the previous menu.

**3) SET Button**
- Use this button to save the values of an option and then, go to the next option selection.
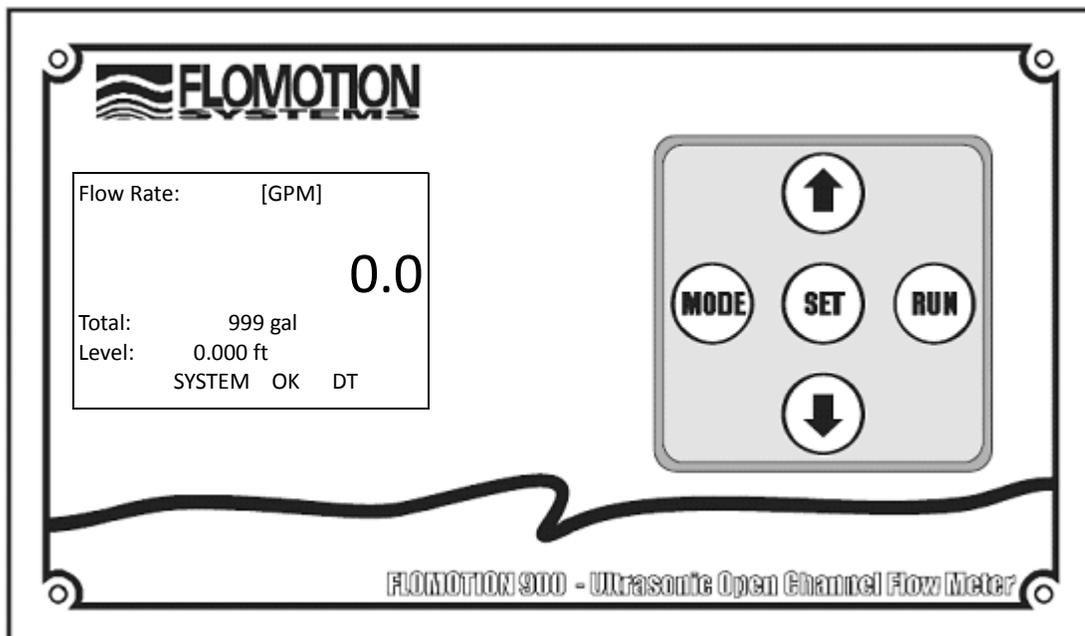
**4) RUN Button**
- Use this button to return to Operation Mode from Program Mode.

## Operating the Controller

- When powered on, Operation Mode I shows on the display screen.
- Push UP [↑] button to toggle around to Operation Module II and Echo Test.
- Return to Operation Mode I, push UP [↑] button.

**Operation Mode I – Flow Rate displayed in [GPM]**

## Operation Mode II – Flow Rate displayed in [MGD]



```
Flow Rate:          [MGD]

              0.000
Total:          999.99 gal
Level:      0.000 ft
          SYSTEM   OK    DT
```

## Echo Test
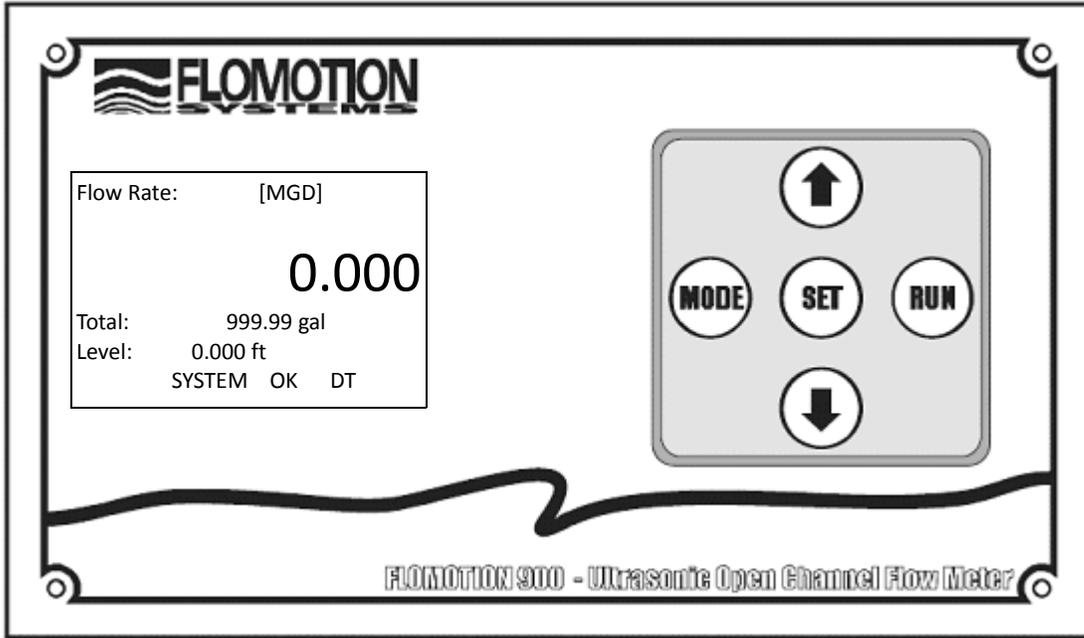


```
ECHO TEST




    0.000ft     20ft
```
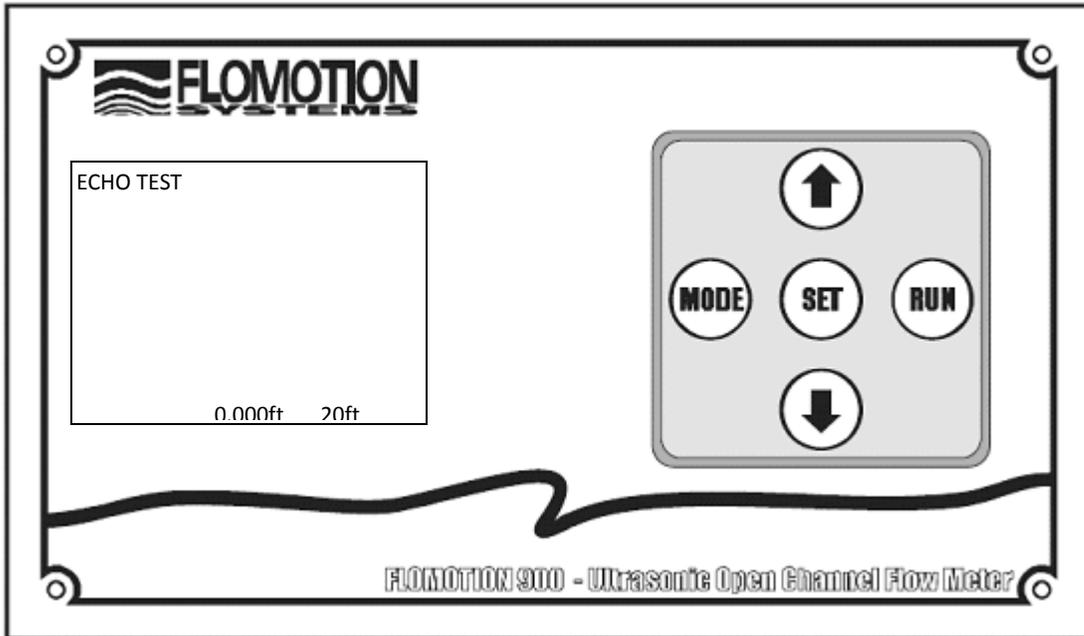
**Operation Mode III**



- Push SET button at Operation Mode I or Operation Mode II and Operation Mode III will be displayed.
- Operation Mode III shows the flow rate, total flow, total hour, water level, ambient temp, relay condition, and sensor status.
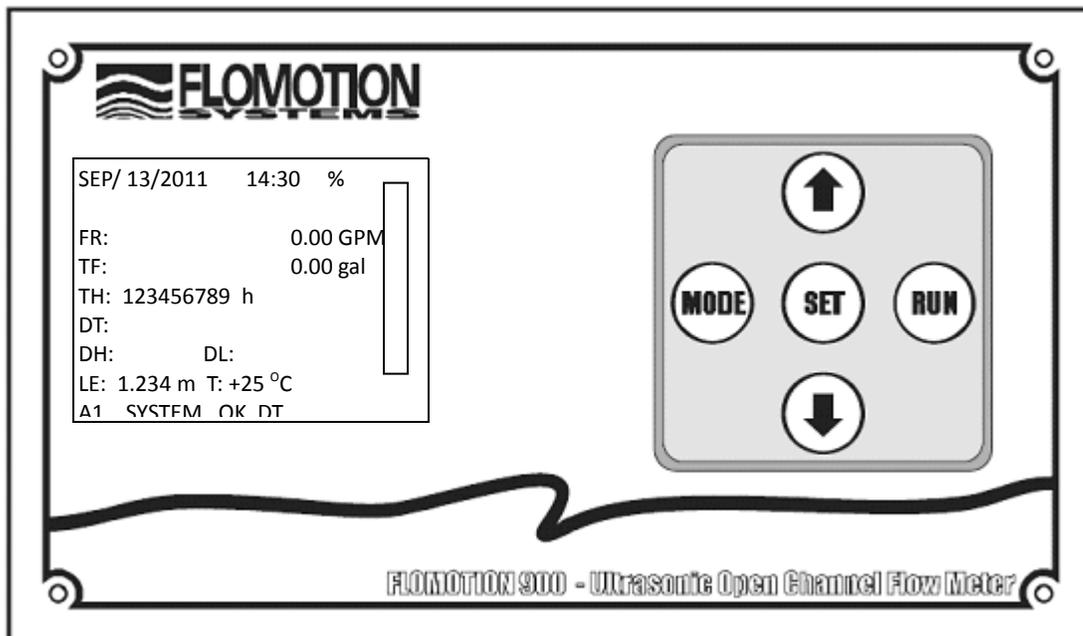- Returned to Operation Mode I by pressing the SET button.

### Description of abbreviations displayed
**FR:**      Flow rate measured in GPM, MGD or m3/h
**TF:**      Total flow from the set time, GAL or m3
**TH:**      Total hours from the set time
**DT:**      Total flow in a day
**DH:**      Highest flow in a day
**DL:**      Lowest flow in a day
**LE:**      Measured level from the bottom to the surface in mm
**T:**      Ambient temperature.
**Bar graph:**  Ratio of measured flow rate to max. flow rate

### Description of characters displayed
**A1:**      RELAY1 is ON
**A2:**      RELAY2 is ON
**SYSTEM OK:**  System is normal.
**FAIL:**      Failure to measure the flow rate
**DT:**      Flickered on normal measurement of water level (meaning normal detection of reflected waves)
**D:**      Echo detection is okay
**S:**      Searching Echo
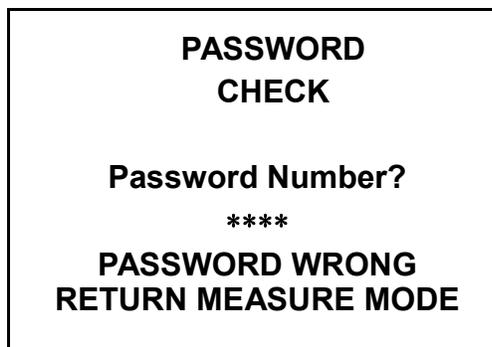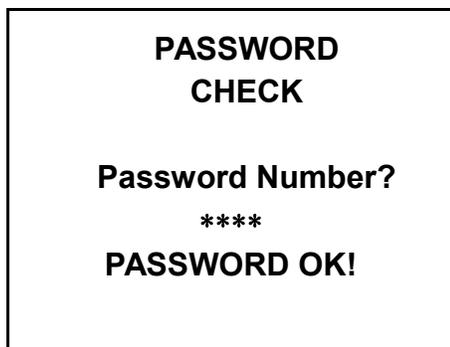**LE:**      Failure to detect the reflected waves

# Chapter 4 Menu Guide

| | |
|---|---|
| 01. SW VERSION | 18. PULSE VALUE |
| 02. DEVICE SELECTION | 19. LOG PERIOD |
| 03. AUTO BOTTOM ZERO | 20. LOG ERASE |
| 04. BOTTOM DISTANCE | |
| | 21. BLANKING |
| 05. FLOW INDEX | 22. TRANSMIT POWER |
| 06. FLOW 4/20mA SET | 23. OUTPUT DAMPING |
| 07. LEVEL 4/20mA SET | 24. FAIL SAFE CURRENT |
| 08. RELAY1 ON POINT | |
| | 25. FAIL SAFE TIME |
| 09. RELAY1 OFF POINT | 26. DETECT THRESHOLD |
| 10. RELAY2 ON POINT | 27. FLOW mA TEST |
| 11. RELAY2 OFF POINT | 28. LEVEL mA TEST |
| 12. RELAY SIMULATION | |
| | 29. FLOW RATE FACTOR |
| 13. LOW CUT VALUE | 30. SYSTEM ID |
| 14. HIGH CUT VALUE | 31. UNIT SELECTION |
| 15. TIME SET | 32. PASSWORD CHANGE |
| 16. TOTALIZER SET | |
| | 33. MASTER RESET |
| 17. PULSE WIDTH | |

## Program Mode

- To convert Operation Mode to Program Mode, push Mode button.
- PASSWORD CHECK, the initial menu of Program Mode, will be displayed.
- **Factory Set = 0**
- Press the SET button. Menu Guide will be displayed.

**Password Check Option** - This is a function to prevent change of set values by unauthorized persons.  Use UP [↑] and DOWN [↑] to place the cursor [*] at PASSWORD CHANGE on the menu guide and push SET button. Then, you can change the value of the password.

| | |
|---|---|
| **PASSWORD**<br>**CHECK**<br><br>**Password Number?**<br>****<br>**PASSWORD OK!** | **PASSWORD**<br>**CHECK**<br><br>**Password Number?**<br>****<br>**PASSWORD WRONG**<br>**RETURN MEASURE MODE** |

- If the password is wrong, "PASSWORD ERROR!" and "RETURN MEASURE MODE" will be displayed at the same time and it will return to Operation Mode.
- If the password is confirmed, "PASSWORD OK!" will be displayed and it will go to Program Mode.
- If you push RUN in the course of selecting an option, Program Mode is converted into Operation Mode.

## 1.   SW VERSION

- This menu shows the S/W version of the unit.

Factory Set:

```
*01. SW VERSION
       VER. 5. 0. 1
```

## 2.      DEVICE SELECTION

- This is an option for primary device selection and detailed parameter setting. Select the primary device first and then, set the appropriate size.
- Place the cursor at this menu. Push SET button and the following screen I will be displayed.

Factory Set:

```
*** DEVICE:  1) – 1
  1. Parshall Flumes

  2. Rect. Suppressed

  3. Rect. Contracted

  4. V-Notch Weirs
          --- (Next Screen) ---
  5. Cipoletti Weirs

  6. Leoplod Lagco Flume

  7. Palmer Bowlus Flume

  8. H Flumes
          --- (Next Screen) ---
  9. DIY Curve/Special
```

(Setting range: 1-9)

- At Program Mode, push ↑ or ↓ to place the cursor (*) at a specific menu and push SET button to go into the primary device desired.
- Push ↑ or ↓ showing No. 1 to 9 will be displayed.
- Push MODE button to return to main Menu Guide.
- On selection 2. DEVICE SELECTION menu, the primary device and max. flow rate value able to be measured will be automatically set.
- When the primary device is changed during measurement, the previously set values will be lost and values for menus (No. 7, 8, 9, 11, 14) will change to the corresponding primary device.

## 2.  DEVICE SELECTION > 1. PARSHALL FLUMES

Factory set:

**1. Parshall Flumes**

** Flume Selection:      1

| | | |
|---|---|---|
| 1: 1in. | 6: 1ft. | 11: 5ft. |
| 2: 2in. | 7: 1.5ft. | 12: 6ft. |
| 3: 3in. | 8: 2ft. | 13: 8ft. |
| 4: 6in. | 9: 3ft. | 14: 10ft. |
| 5: 9in. | 10: 4ft. | 15: 12ft |

**Measurable Maximum Height**

| Parshall Flume | mm | ft |
|---|---|---|
| 1" | 180 | .6 |
| 2" | 180 | .6 |
| 3" | 450 | 1.5 |
| 6" | 450 | 1.5 |
| 9" | 600 | 2.0 |
| 1-8 ft | 760 | 2.5 |
| 10 ft | 1060 | 3.5 |
| 12 ft | 1370 | 4.5 |

(Setting range: 1-15)

- Select Parshall Flumes and push SET button. Then, the menu for flume selection ill be displayed as shown in the above figure.
- Use ↑ or ↓ to select the relevant Parshall Flume and push SET button to save the set value and return to main menu.
- Measurable maximum height is automatically set.

## 2. DEVICE SELECTION > 2.RECT. SUPPRESSED

Factory Set:

**2. Rect. Suppressed**

| ** Crest Length: | 1 |
|---|---|

| | |
|---|---|
| 1: 1ft. | 6: 4ft. |
| 2: 1.5ft. | 7: 5ft. |
| 3: 2ft. | 8: 6ft. |
| 4: 2.5ft. | 9: 8ft. |
| 5: 3ft. | 10: 10ft. |

**Measurable Maximum Height**

| Rect. Suppressed | mm | ft |
|---|---|---|
| 1 ft | 150 | .5 |
| 1.5ft | 220 | .75 |
| 2 ft | 300 | 1.0 |
| 2.5 ft | 370 | 1.25 |
| 3 ft | 450 | 1.5 |
| 4 ft | 600 | 2.0 |
| 5 ft | 750 | 2.5 |
| 6 ft | 900 | 3.0 |
| 8 ft | 1200 | 4.0 |
| 10 ft | 1500 | 5.0 |

(Setting range: 1-10)

- Select Rect. Suppressed and push SET button. Then, the menu for selection of the rectangular weir will be displayed as shown in the above figure.
- Use ↑ or ↓ to select the appropriate size and push SET button to save the set values and return to main menu option.
- Measurable maximum height is automatically set.

## 2. DEVICE SELECTION > 3. RECT. CONTRACTED

Factory Set:

### 1. Rect. Contracted

**\*\* Crest Length:**         **1**

| | |
|---|---|
| **1: 1ft.** | **6: 4ft.** |
| **2: 1.5ft.** | **7: 5ft.** |
| **3: 2ft.** | **8: 6ft.** |
| **4: 2.5ft.** | **9: 8ft.** |
| **5: 3ft.** | **10: 10ft.** |

### Measurable Maximum Height

| Rect. Contracted | mm | ft |
|---|---|---|
| 1 ft | 150 | .5 |
| 1.5ft | 220 | .75 |
| 2 ft | 300 | 1.0 |
| 2.5 ft | 370 | 1.25 |
| 3 ft | 450 | 1.5 |
| 4 ft | 600 | 2.0 |
| 5 ft | 750 | 2.5 |
| 6 ft | 900 | 3.0 |
| 8 ft | 1200 | 4.0 |
| 10 ft | 1500 | 5.0 |

(Setting range: 1-10)

- Select Rect. Contracted and push SET button. Then, the menu for selection of the rectangular weir will be displayed as shown in the above figure.
- Use ↑ or ↓ to select the appropriate size and push SET button to save the set values and return to main menu.
- Measurable maximum height is automatically set.

## 2. DEVICE SELECTION > 4. V-NOTCH WEIRS

## [TRIANGULAR]

Factory Set:

```
    4.  V-Notch Weirs

** Weir Selection:        6

  1: 22.5°        4: 60°
  2: 30°          5: 90°
  3: 45°          6: 120°
```

(Setting range: 1-6)

- Select V-Notch Weirs and push SET button. Then, the menu for selection of the v-notch weir will be displayed as shown in the above figure.
- Use ↑ or ↓ to select the appropriate size V-Notch Weir and push SET button to save the set values and return to menu option.
- Measurable maximum height is automatically set at 2 ft.

## 2. DEVICE SELECTION > 5. CIPOLLETTI WEIRS

## [TRAPEZODIAL WEIRS]

Factory Set:

```
   5.  Cipolletti Weirs

** Weir Selection:  1

  1: 1ft          6: 4ft.
  2: 1.5ft        7: 5ft
  3: 2ft          8: 6ft
  4: 2.5ft        9: 8ft
  5: 3ft          10: 10ft
```

| Measurable Maximum Height | | |
|---|---|---|
| **Cipolletti Weirs** | **mm** | **ft** |
| 1 ft | 150 | 0.5 |
| 1.5ft | 220 | 0.75 |
| 2 ft | 300 | 1.0 |
| 2.5 ft | 370 | 1.25 |
| 3 ft | 450 | 1.5 |
| 4 ft | 600 | 2.0 |
| 5 ft | 750 | 2.5 |
| 6 ft | 900 | 3.0 |
| 8 ft | 1200 | 4.0 |
| 10 ft | 1500 | 5.0 |

(Setting range: 1-10)

- Select Cipolletti Weirs and push SET button. Then, the menu for selection of the weir will be displayed as shown in the above figure.
- Use ↑ or ↓ to select the relevant Cipolletti Weir and push SET button to save the set values and return to menu option.
- Measurable maximum height is automatically set.

## 2. DEVICE SELECTION > 6. LEOPOLD LAGCO FLUMES

Factory Set:

### 6. Leopold Lagco Flumes

**\*\* Flume Selection:       1**

| | |
|---|---|
| 1: 4in. | 6: 15in. |
| 2: 6in. | 7: 18in. |
| 3: 8in. | 8: 21in. |
| 4: 10in. | 9: 24in. |
| 5: 12in. | 10: 30in. |

| Measurable Maximum Height | | |
|---|---|---|
| Leopold Lagco Flumes | mm | ft |
| 4 inch | 70 | .25 |
| 6 inch | 100 | .3 |
| 8 inch | 130 | .4 |
| 10 inch | 180 | .6 |
| 12 inch | 210 | .7 |
| 15 inch | 270 | .9 |
| 18 inch | 320 | 1.05 |
| 21 inch | 380 | 1.25 |
| 24 inch | 420 | 1.4 |
| 30 inch | 530 | 1.7 |

(Setting range: 1-10)

- Select Leopold Lagco Flumes and push SET button. Then, the menu for selection of the flume will be displayed as shown in the above figure.
- Use ↑ or ↓ to select the relevant Leopold Lagco Flume and push SET button to save the setting values and return to menu option.
- Measurable maximum height is set automatically.

## 2. DEVICE SELECTION > 7. PALMER BOWLUS FLUMES

Factory Set:

### 7. Palmer Bowlus Flumes

**\*\* Flume Selection:** 1

| | |
|---|---|
| 1: 4in. | 6: 15in. |
| 2: 6in. | 7: 18in. |
| 3: 8in. | 8: 21in. |
| 4: 10in. | 9: 24in. |
| 5: 12in. | 10: 27in. |

### Measurable Maximum Height

| Palmer Bowlus Flumes | mm | ft |
|---|---|---|
| 4 inch | 76 | .25 |
| 6 inch | 107 | .35 |
| 8 inch | 152 | .5 |
| 10 inch | 183 | .6 |
| 12 inch | 213 | .7 |
| 15 inch | 274 | .9 |
| 18 inch | 320 | 1.05 |
| 21 inch | 381 | 1.25 |
| 24 inch | 427 | 1.4 |
| 27 inch | 488 | 1.6 |

(Setting range: 1-10, Unit: 1)

## 2. DEVICE SELECTION > 8. H FLUMES

Factory Set:

```
8. H Flumes

** Flume Selection: 14

   1:  0.50 H          5:  2.0 H
   2:  0.75 H          6:  2.5 H
   3:  1.00 H          7:  3.0 H
   4:  1.50 H          8:  4.5 H
   --- (Next Screen) ---
   9:  0.40 HS        12:  1.0 HS
  10:  0.6 HS         13:  3.0 HL
  11:  0.8 HS         14:  4.0 HL
```

(Setting range: 1-14)

- Select H Flumes and push SET button. Then, the menu for selection of the flume will be displayed as shown in the above figure.
- Use ↑ or ↓ to select the appropriate H Flume selection and push SET button to save the setting values and return to menu option.

## 2. DEVICE SELECTION > 9. DIY CURVE / SPECIAL

Factory Set:

```
┌──────────────────────────────────────┐
│                                      │
│      9. DIY Curve/Special            │
│                                      │
│  ** Selection:    3                  │
│                                      │
│    1: 10point DIY CURVE              │
│    2: Q=K*H(PWR)                     │
│    3: Rectangular Weir               │
│                                      │
│                                      │
│                                      │
└──────────────────────────────────────┘
```
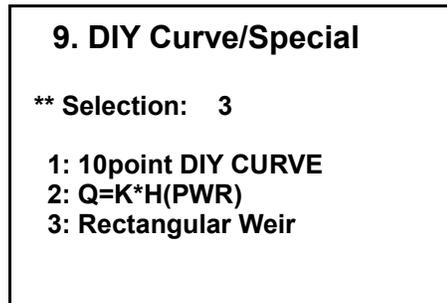
(Setting range: 1-3)

- Select DIY Curve / Special and push SET button. Then, an option for selection of 1. DIY Curve, 2. Q=K*H*PWR), or 3. Rectangular Weir will be displayed as shown in the above figure.
- This menu is used for measurement of flow rate, regardless of the type of device.
- DIY Curve: This option equally divides the known level-based flow rate into 10 parts and measures the flow rate according to change of level.
- Q=K*H(PWR): This option inputs constant values, K and PWR, to a exponentially changing device and measures the flow rate.
- Rectangular Weir: This option selects Crest Length of all Rectangular Weirs in ft and measures the flow rate.
- Use ↑ or ↓ to select the relevant special option and push SET button to save the set values and return to menu option.

## 2. DEVICE SELECTION > 9. DIY CURVE/SPECIAL > 1.

## 10 POINT DIY CURVE

Factory Set:

```
    1.       10 POINT DIY CURVE

  MAX. HEIGHT: 1.00 ft
  1) 0.1H:          100.0      gal/m
  2) 0.2H:          200.0      gal/m
  3) 0.3H:          300.0      gal/m
  4) 0.4H:          400.0      gal/m
  --- (Next Screen) ---
  5) 0.5H:          500.0      gal/m
  6) 0.6H:          600.0      gal/m
  7) 0.7H:          700.0      gal/m
  8) 0.8H:          800.0      gal/m
  9) 0.9H:          900.0      gal/m
  10 MAX:          1000.0      gal/m
```

(Setting range: 1-10 (0.1 - 99999.9 [gal/m]))

- Select 1. DIY Curve and push SET button. Then, an option to input max. height of 1. 10 Point DIY Curve will be displayed as shown in the above figure.
- Use ↑ or ↓ to input measurable maximum height of the installed device and push SET button to save the value and go to an option for input of flow rate at 10% height.
- Use ↑ or ↓ to increase or decrease the value and input the relevant flow rate value and then, push SET button to save the flow rate value and go to an option for input of flow rate at 20% height.
- In this way, input the flow rate values corresponding to 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100%.
- After input of value for 100% with use of ↑ or ↓ button, push SET button to go to 2. DEVICE SELECTION. Push MODE button again to go to menu option.

## 2. DEVICE SELECTION > 9. DIY CURVE/SPECIAL > 2.

## Q=K*H(PWR)

Factory Set:

```
2.  Q=K*H(PWR)

  K Const:              0.9999

  PWR Constant:         1.500

  H: ft          Q: m3/h
```

(K constant setting range: 0.0001 - 9999.9999)
(PWR setting range: 0.001 - 9.999)
(Height setting range: m, cm, mm, ft, in.)
(Q setting range: meter= m3/h, feet= GPM)

- Select 2. Q=K*H(PWR) and push SET button. Then, an option to input constants, K and PWR, will be displayed as shown in the above figure.
- Use ↑ or ↓ to input K constant, known or calculated, and push SET button to save the value and go to an option for input of PWR Constant.
- In this way, input PWR Constant with use of ↑ or ↓ button and push SET button to save the value and return to 2. DEVICE SELECTION.
- Select Height unit among m, cm, mm, ft, in.
- Q is the unit for the flow. Select Q unit among m3/h, GPM
- The Q value is displayed by the selected unit on Menu 31. Unit Selection. (if the "Meter" is selected, Q value is calculated into m3/h, if the "feet" is selected, Q value is calculated into GPM.
- Push MODE button to return to main menu.

## 2. DEVICE SELECTION > 9. DIY CURV/SPECIAL > 3.

## RECTANGULAR WEIR

Factory Set:

```
3.  Rectangular Weirs

  * Selection:    1
     1: Suppressed Weir
     2: Contracted Weir

  * Crest Length:  ft
        1.00
```

(Setting range: 1-2)

- Select 3. Rectangular Weirs and push SET button. Then, two options to select the type of rectangular weir, *Selection and *Crest Length [ft], will be displayed as shown in the above figure.
- If the weir is the suppressed weir, select 1. Suppressed Weir and push SET button. Then, move to the option for input of Crest Length [ft].
- In this way, select 2. Contracted Weir and set the relevant Crest Length. And push SET button to save the value and return to 2. DEVICE SELECTION.
- Push MODE button to return to menu option.

## 3. AUTO BOTTOM ZERO

- This is an option for automatic detection of bottom distance from the sensor to the bottom or zero level/flow point. 04. BOTTOM DISTANCE is used for manual input of the distance from the sensor to the bottom.
- Place the cursor at this option and push SET button. Then, the following screen will be displayed.

Factory Set:

```
3. AUTO BOTTOM ZERO ADJUSTING

            3.936 ft
 SET :    SET  KEY
 ESC :     DOWN KEY
                      DT
```
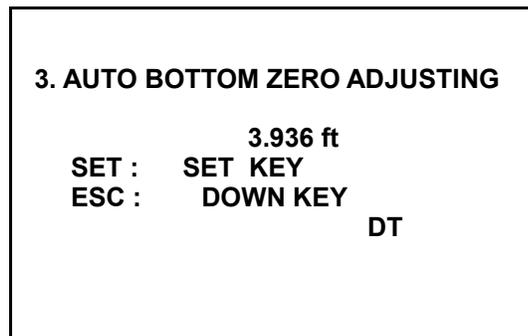
- DT will flicker and the distance will appear. When the distance is stabilized after damping time (measurement response rate), "Auto SET? SET, No? DOWN" will be displayed.
- If you want automatic setting of the measured value, push SET button. If not, push DOWN button and select other menu.

NOTE: It is important to conduct measurement when the inflow water level is the same as the bottom of the channel and there should be no water overflow in the channel. **If you select Auto, omit 04. BOTTOM DISTANCE**.

## 4. BOTTOM DISTANCE

Factory Set:

```
*04. BOTTOM DISTANCE
                3.936 ft
```

- This is an option to manually set the distance from the sensor to the bottom of the channel or zero level/flow point. For automatic setting, please refer to 3. AUTO ZERO.
- Since the flow meter is a device to measure the water level and convert it to a flow rate, it requires input of accurate distance. Otherwise error will occur.
- The unit for the distance is displayed in feet (ft). Push SET button and the saved value will be displayed. In this condition, the value can be changed. Use ↑ or ↓ to input the desirable value. And push SET button again to save the value and return to main menu.
- Distance detection will not be done beyond the set value. The initial value is 3.936ft.

## 5. FLOW INDEX

- Maximum flow rate based on the height of the channel can be displayed in gal/m.
- Place the cursor at this menu and push SET button. Then, the following screen will be displayed.

Factory Set:

```
5. FLOW CHANGE VIEW

    0.997 ft   [ 0.304 m]

    1488.77  gal/min
     338.12   m3/h
```

Factory Set = Allowable Max. flow of selected device

- Use ↑ or ↓ to change maximum acceptable height and the flow rate. The initial value is primary device maximum measurable height (Max Head) and flow rate.

## 6. FLOW 4-20mA SET

Factory Set:

```
06. FLOW mA SET POINT

  (1)  4mA SET POINT
                        0.00 gal/m

  (2)  20mA SET POINT
                     2500.00 gal/m
```

4mA (Setting range: 0.00 - Max. Flow Rate, Unit: 0.01 gal/m)
20mA (Setting range: 0.00 - Max. Flow Rate, Unit: 0.01 gal/m)

- This is an option for setting the flow rate value corresponding to 4mA output and 20mA output. The set value determines the current output. The initial value of 4mA output is 0.00 gal/m. The initial value of 20mA output is 25122.50 gal/m.
- Push SET button to display the saved value and change it. Use ↑ or ↓ to input the desirable value. Push SET button again to save the value and return to main menu.


## 7. LEVEL 4-20mA SET

Factory Set:

```
07. LEVEL mA SET POINT

  (1) 4mA SET POINT
             0.000 ft

  (2) 20mA SET POINT
             3.943 ft
```

4mA   (Setting range: 0.00 – 13.123ft)
20mA (Setting range: 0.00 – 13.123ft)

- This is an option for setting the level value corresponding to 4mA output and 20mA output. The set value determines the current output. The initial value of 4mA output is 0.000 ft. The initial value of 20mA output is 3.943 ft.
- Push SET button to display the saved value and change it. Use ↑ or ↓ to input the desirable value. Push SET button again to save the value and return to main menu.

## 8.   RELAY1 ON POINT

Factory Set:

```
*08. RELAY 1 ON POINT
             0.03 gal/m
```

(Setting range: 0.00 - Max. Flow Rate, Unit: 0.01 gal/m)
Factory Set = 10% of the max. flow value set at option 02 "Device Selection"

- When the measured flow rate is below RELAY 1 On Point, the device's RELAY 1 is turned on. The initial value is the flow rate corresponding to 10% of the maximum measurable flow  rate (gal/m) of the primary device set in parameter 02.


## 9.   RELAY1 OFF POINT

Factory Set:

```
*09. RELAY 1 OFF POINT
             0.00 gal/m
```

(Setting range: 0.00 - Max. Flow Rate, Unit: 0.01 gal/m)
Factory Set = 20% of max. flow value set at option 02 "Device Selection"

- When the measured flow rate is above RELAY 1 Off Point, the device's RELAY 1 is turned off.
- The initial value is the flow rate corresponding to 20% of the maximum measurable flow rate (gal/m) of the device set in 02.


## 10.  RELAY2 ON POINT

Factory Set:

```
*10. RELAY 2 ON POINT
             0.00 gal/m
```

(Setting range: 0.00 - Max. Flow Rate, Unit: 0.01 gal/m)
Factory Set = 90% of Max. flow value set at option 02 "Device Selection"

- When the measured flow rate is above RELAY 2 On Point, the device's RELAY 2 is turned on.
- The initial value is the flow rate corresponding to 90% of the maximum measurable flow rate (gal/m) of the device set in 02.


## 11.  RELAY2 OFF POINT

Factory Set:

```
┌─────────────────────────────────────┐
│ *11. RELAY 2 OFF POINT              │
│                   0.00 gal/m        │
│                                     │
│                                     │
└─────────────────────────────────────┘
```

(Setting range: 0.00 - Max. Flow Rate, Unit: 0.01 gal/m)
Factory Set = 80% of the Max. flow value set at option 02 "Device Selection"

- When the measured flow rate is below RELAY 2 Off Point, the device's RELAY 2 is turned off.
- The initial value is the flow rate corresponding to 80% of the maximum measurable flow rate (gal/m) of the device set in 02.

### &lt;Examples of RELAY ON/OFF POINT Setting&gt;

- RELAY1 & 2 can be used for generation of alarms (low or high flow) and control of water supply pump or drain pump.
- Example 1: Use of RELAY 1 for control of water supply pump (low flow alarm). If RELAY 1 ON POINT is set at 100.00 gal/m and OFF POINT is set at 200.00 gal/m, RELAY 1 is turned on when the flow rate is below 100.00 gal/m. If the water supply pump is turned on in this case, the water level is increased. When the level reaches OFF POINT (200.00 gal/m), RELAY 1 becomes off and the pump stops.
- Example 2: Use of RELAY 2 for control of water drain pump (high flow alarm). If RELAY 2 OFF POINT is set at 100.00 gal/m and ON POINT is set at 200.00 gal/m, RELAY 2 is turned on when the flow rate is above 200.00 gal/m. If the water drain pump is turned on in this case, the water level is decreased. When the level reaches OFF POINT (100.00 gal/m), RELAY 2 becomes off and the pump stops.

## 12. RELAY SIMULATION

Factory Set:

```
┌─────────────────────────────────────┐
│          RELAY SIMULATION           │
│                                     │
│ R1  ON   :            0.00 gal/m    │
│ R1    OFF :           0.00 gal/m    │
│ R2   ON   :           0.00 gal/m    │
│ R2    OFF :           0.00 gal/m    │
│ FR  SIM  :            1.00 gal/m    │
│                                     │
└─────────────────────────────────────┘
```

- This is an option to check if RELAY is in normal operation after setting Menu 08, 09, 10, and 11 items.
- Place the cursor at this menu and push SET button. Then, the following screen will be displayed.
- This shows flow rate values set in 08, 09, 10, and 11. Further, virtual flow rates will flicker.
- Use ↑ or ↓ to adjust those virtual values. In this mode, operational

conditions of R1 and R2 can be checked.

- When it is below R1 ON POINT, RELAY 1 will be turned on and A1 will be displayed.
- When it is above R1 OFF POINT, RELAY 1 will be turned off and A1 will disappear.
- When it is above R1 ON POINT, RELAY 2 will be turned on and A2 will be displayed.
- When it is below R1 OFF POINT, RELAY 2 will be turned off and A2 will disappear.

## 13. LOW CUT VALUE

Factory Set:

```
*13. LOW CUT VALUE
            0.00 gal/m
```

(Setting range: 0.00 - Max. Flow Rate, Unit: 0.01 gal/m)

- This is an option to set minimum measurable flow rate. Flow rates below this value will be treated as "0". The initial value is 0.00 gal/m.

## 14. HIGH CUT VALUE

Factory Set:

```
*14. HIGH CUT VALUE
            25155.50 gal/m
```

(Setting range: 0.00 - Max. Flow Rate, Unit: 0.01 gal/m)

- This is an option to set maximum measurable flow rate. Flow rates above this value will be treated as the maximum flow rate or enter value. The initial value is maximum flow rate of the device (gal/m).

## 15. TIME SET

```
*15. TIME
   Sep/26/2011    11:05
```

- Push SET button and the month/day/year and hour:minute will be displayed. If you don't want to change the value, push SET button again. If you want to change the value, push ↑ or ↓ to change the month. Push SET button again to change the date with use of ↑ or ↓. Continue to change the day, year, hour, and minute.

## 16. TOTALIZER SET

- This is an option to set or reset the initial values of total flow and total time.
- Place the cursor at this menu and push SET button. Then, the following screen will be displayed.

Factory Set:

```
16. TOTALIZER

1. Total Flow Set
        0.00            gal
2. Total Time Set
        2               h


```

(Flow Setting range: 0.00 - 999999999.99, gal)
(Time Setting range: 0 - 999999999, h)

### Total Flow Set

- Use ↑ or ↓ to set the integral number of the initial value and push SET button to save value. The decimal number flickers automatically. Use ↑ or ↓ to set the value and push SET button to save the value.

### Total Time Set

- After completion of setting in 16-1), push SET button and values in Total Time Set will flicker. Use ↑ or ↓ to set total time and then, push SET button to save the value and go to other menu.

**Note: Resetting the totalizer will delete all data previously saved.**

## 17. PULSE WIDTH

Factory Set:

```
*17. PULSE PERIOD
        0.10 sec

```

(Setting range: .01 – 1.00, Unit: sec)

- This is an option for setting the width for one pulse output according to the flow value set in No. 18. The initial value is .10 sec

## 18. PULSE VALUE

Factory Set:

```
*18. PULSE VALUE
            418.00     gal
```

(Setting range: Max. flow rate per second – 100.00 gal)

- This is an option for setting the flow rate value for output of one pulse.
- Pulse output is applicable to total flow. The pulse value determines the flow rate for one pulse. The initial value is 30.00 gal.

    Note: Minimum value of setting range is automatically limited against maximum measurable flow rate of the device.


## 19. LOG PERIOD

Factory Set:

```
*19. LOG PERIOD
                1     min
```

(Setting range: 1 - 60, Unit: 1 min.)

- This is an option for setting the interval for saving totalized flow . The initial value is 60min.
- Data logging Period & Point Information:
    - Memory Size: 262,144 Bytes
    - Unit Log Size: 26 Bytes
    - Total Log Point: 262,144/26 = 10,082 points

    [Example]
    1. When the data is logged once a minute, it can be stored for 7 days.  10,082/(24*60)=7days
    2. When the data is logged once an hour, it can be stored for 420 days.
       10,082/24= 420days


## 20. LOG ERASE

Factory Set:

```
*20. LOG ERASE
                EXIT
```

- This is an option for deleting the logged data.

## 21. BLANKING

Factory Set:

```
*21. BLANKING
            1.148      ft
```

(Setting range: 0.85 – 1.148, ft)

- In general, the ultrasonic sensor cannot detect any object within a specific distance from the sensor. The distance is about 0.85 – 1.148 ft for this product.
- If a user increases this value, false detection arising from an obstacle close to the sensor can be prevented.
- The initial value is 1.148 ft.

## 22. TRANSMIT POWER

Factory Set:

```
*22. TRANSMIT POWER
            3   (NORMAL)
```

(Setting range: 1 - 5)

- This is an option for setting the ultrasonic sensor's output. This menu adjusts the output and maintains optimal conditions under operating environments.
- Set low TRANSMIT POWER if there are many obstacles around it. Increase TRANSMIT POWER value for extended lengths or minimal foam/bubbles that arise on the water surface.
- The initial value is 3, which is optimal setting under normal operating environments.

## 23. OUTPUT DAMPING

Factory Set:

```
*23. OUTPUT DAMPING
            2   (NORMAL)
```

(Setting Range: 1=0.1m/min, 2=0.5m/min, 3=1m/min, 4=10m/min)

- This option determines the maximum rate at which the unit will respond to an increase/decrease in level.

Setting Range:
1 = .033 ft/min (Slow)
2 = 1.64 ft/min (Normal)
3 = 3.28 ft/min (Fast)
4 = 32.8 ft/min (Very Fast)

## 24. FAIL SAFE CURRENT

Factory Set:

```
*24. FAIL SAFE CURRENT
              3.8mA
```

(Setting range: 3.8 mA, HOLD, 21.0 mA).

- This is an option for setting FAIL SAFE CURRENT. If the reflected wave is not sufficiently received, a specific current different from normal output current is generated to indicate the error. 3.8 mA, HOLD, or 21.0mA is used for this purpose.
- If measurement is not detected, FAIL SAFE CURRENT is generated after FAIL SAFE TIME.
- If HOLD is set, the current flow under HOLD is totalized. In the case of other settings, totalization is not conducted. The initial value is 3.8 mA.

## 25. FAIL SAFE TIME

Factory Set:

```
*25. FAIL SAFE TIME
           300   sec
```

(Setting range: 20 - 999)

- This is an option for setting FAIL SAFE TIME. If the reflected wave is not sufficiently received, FAIL SAFE CURRENT output and ERROR relay operation are held for the set time.
- The initial value is 300 sec.

## 26. DETECT THRESHOLD

Factory Set:

```
*26. DETECT THRESHOLD
            6  (  0.6v)
```

(Setting range: 4 - 15)

- This is an option for setting threshold for detection of the reflected wave. This menu adjusts the threshold for detection of the reflected wave and maintains optimal performance.
- To reduce the probability of false detection or at an environment generating a lot of noise, increase the threshold value. For detection of weak signals, decrease the value. Set the threshold value according to the environmental conditions. The initial value is 6.
-

## 27. FLOW mA TEST

Factory Set:

```
*27. FLOW mA TEST
          HOLD
```

(Setting Range: 4mA, 12mA, 20mA, 3.8mA, 21.0mA, HOLD)

- This is an option to test the flow output, regardless of measurement result. Such output is used to check operation conditions of current output circuits and interface with other equipment. On returning to Operation Mode, this function is automatically cancelled.

## 28. LEVEL mA TEST

Factory Set:

```
*28. LEVEL mA TEST
          HOLD
```

(Setting Range: 4mA, 12mA, 20mA, 3.8mA, 21.0mA, HOLD)

- This is an option to test the level output, regardless of measurement result. Such output is used to check operation conditions of current output circuits and interface with other equipment. On returning to Operation Mode, this function is automatically cancelled.

## 29. FLOW RATE FACTOR

- This is an option to change the flow rate by entering a flow rate scale factor.
- Place the cursor at this menu and push SET button. Then, the following screen will be displayed.

Factory Set:

```
28. FLOW RATE FACTOR

  FR:        0.00   gal/m
  LE:        0.000 ft

             1.000
```

- Push SET button to display the saved value and change it. Use ↑ or ↓ to select the one you want. Push SET button again to save the value and return to main menu.

# 30. SYSTEM ID

Factory Set:

```
*30. SYSTEM ID
       0
```

(setting range: (0 – 9)

- Menu for factory use only

# 31. UNIT SELECTION

Factory Set:

```
*31. UNIT SELECTION
     FEET MODE  [gal/min]
```

(setting range: FEET MODE: [gal/min], METER MODE: [m3/h])

- This option is for the selecting the measuring unit. It provides two different units. One is Meter and the other is Feet.

# 32. PASSWORD CHANGE

Factory Set:

```
*32. PASSWORD CHANGE
             0
```

(Setting range: 0 -1000)

- This is an option for change of password. Push ↑ or ↓ to change the password.
- Push SET button and the changed password will be saved.
- The initial value is 0.
- If the password is forgotten the factory override password is either 413 or 419.

**Note: If the password is wrong, you cannot go to Program Mode from Operation Mode. Therefore, careful attention should be paid to password change.**

## 33. MASTER RESET

Factory Set:

```
*33. MASTER RESET
                EXIT
```

- This is an option for factory default reset.
- Push SET button, "EXIT" is displayed
- Push SET button and the parameter can be reset as the factory default by up and down key.
- When the reset is done, "RESET END" is displayed, Press Set button.
- Before using this option, take a note for current setting value. The note form is in the end of this manual.

# Chapter 5 Digital Communication

FLOMOTION 900 provides RS232/485 digital communication interface function as an option.

The data and format are as follows

### *Output Format*

1.  Level Data
    Output level data in ft.

2.  Flow Rate Data
    Output flow rate data in gal/m

3.  Total Flow Data
    Output total flow data in gal

### *Output Data Format*

ASCII edits data and the following is its sequence

| LF | CR | L | E | : | 9.999 | f | t | | F | R | : | 1234567.89 | g | a | l | / | m | |
|----|----|---|---|---|-------|---|---|---|---|---|---|------------|---|---|---|---|---|---|
| T | F | : | 123456789.12 | g | a | l | | | | | | | | | | | | |

1.  Baud Rate is 9600BPS.

2.  1 Data Frame is composed of 47 byte

3.  Data Frame outputs on a second basis.

4.  LE: Level data, composed of 5byte, The unit is ft.
    ex) 1.234 → 1.234 ft
    FR: Flow Rate data, composed of 10 byte, the unit is gal/m.
    ex) 1234567.89 → 1234567.89 gal/m
    TF: Total Flow Rate, composed of 12 byte, the unit is gal.
    ex) 123456789.12 → 123456789.12 gal

# Chapter 6 Maintenance

The FLOMOTION FM900 does not require any special maintenance. However, in areas where there is a lot of floating matter or viscous sludge, the sensor's surface may be contaminated.  Therefore, for accurate measurement, it may be necessary to clean the sensor face if these conditions occur.

# Chapter 7  Menu Option Record

## FLOMOTION FM900

| | MENU | RANGE | FACTORY SET | 1 | 2 |
|---|---|---|---|---|---|
| 01. | SW VERSION | | | | |
| 02. | DEVICE SELECTION | | Parshall 2" | | |
| 03. | AUTO BOTTOM ZERO | | - | | |
| 04. | BOTTOM DISTANCE | 0.30-4.00 | 3.936ft | | |
| 05. | FLOW INDEX | 0.00-2.00 | .597 ft [0.182m] | | |
| 06. | FLOW  4/20mA SET | 0.00 - max | 0.00 gal/m | | |
| 07. | LEVEL  4/20mA SET | 0.00 - max | 0.000 ft | | |
| 08. | RELAY1 ON POINT | 0.00 - max | 0.00 gal | | |
| 09. | RELAY1 OFF POINT | 0.00 - max | 0.00 gal | | |
| 10. | RELAY2 ON POINT | 0.00 - max | 0.00 gal | | |
| 11. | RELAY2 OFF POINT | 0.00 - max | 0.00 gal | | |
| 12. | RELAY SIMULATION | 0.00 - max | 1.00 gal | | |
| 13. | LOW CUT VALUE | 0.00 - max | 0.00 gal/m | | |
| 14. | HIGH CUT VALUE | 0.00 - max | 5,602.94gal/m | | |
| 15. | TIME SET | - | - | | |
| 16. | TOTALIZER SET | 0-999999999.99 | 0.00 | | |
| 17. | PULSE WIDTH | 0.01-1.00 | 0.10 sec | | |
| 18. | PULSE VALUE | 0.1-100.0 | 93.00 gal | | |
| 19. | LOG PERIOD | 1-60 min. | 1 min | | |
| 20. | LOG ERASE | - | - | | |
| 21. | BLANKING | 0.25-3.00 | 1.148 ft | | |
| 22. | TRANSMIT POWER | 1,2,3,4,5 | 3 (NORMAL) | | |
| 23. | OUTPUT DAMPING | 1 - 4 | 2 (NORMAL) | | |
| 24. | FAIL SAFE CURRENT | 3.8/HOLD/21.0 | 3.8mA | | |
| 25. | FAIL SAFE TIME | 20-999 | 300 Sec | | |
| 26. | DETECT THRESHOLD | 4-15 | 6 (0.6v) | | |
| 27. | FLOW  mA TEST | | HOLD | | |
| 28. | LEVEL  mA TEST | | HOLD | | |
| 29. | FLOW RATE FACTOR | .001-1.999 | | | |
| 30. | SYSTEM  ID | Factory Use Only | 0 | | |
| 31. | UNIT SELECTION | FEET MODE [gal/min] – METER MODE [m3h] | FEET MODE [gal/min] | | |
| 32. | PASSWORD CHANGE | 0-1000 | 0 | | |
| 33. | MASTER RESET | RESET/EXIT | | | |

# Appendix 1 - Schematic Diagrams of Channels

## A.    Parshall Flume

Parshall Flumes are standardized. Depending on the channel width, there are 15 kinds of Parshall Flumes.
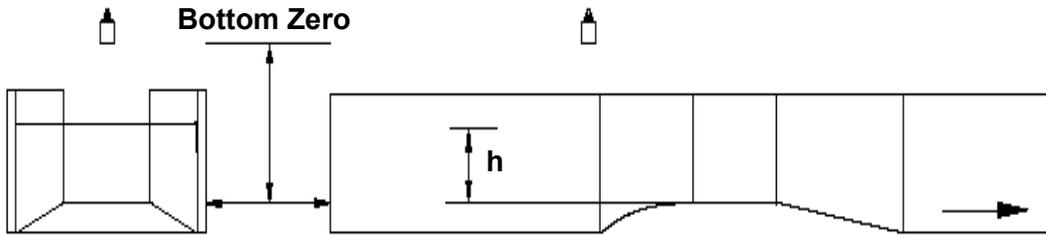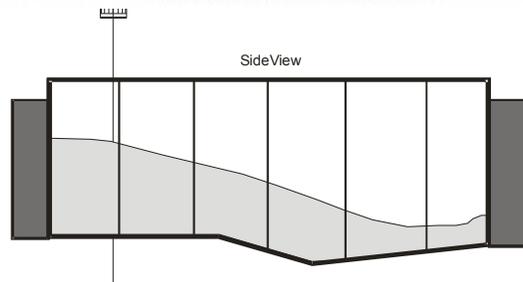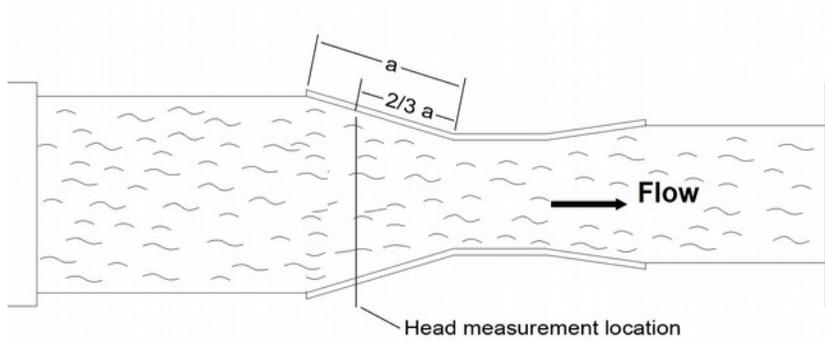
## B. Rectangular Weir, Triangular Weir, Suppressed Rectangular Weir, and Cipolletti Weir
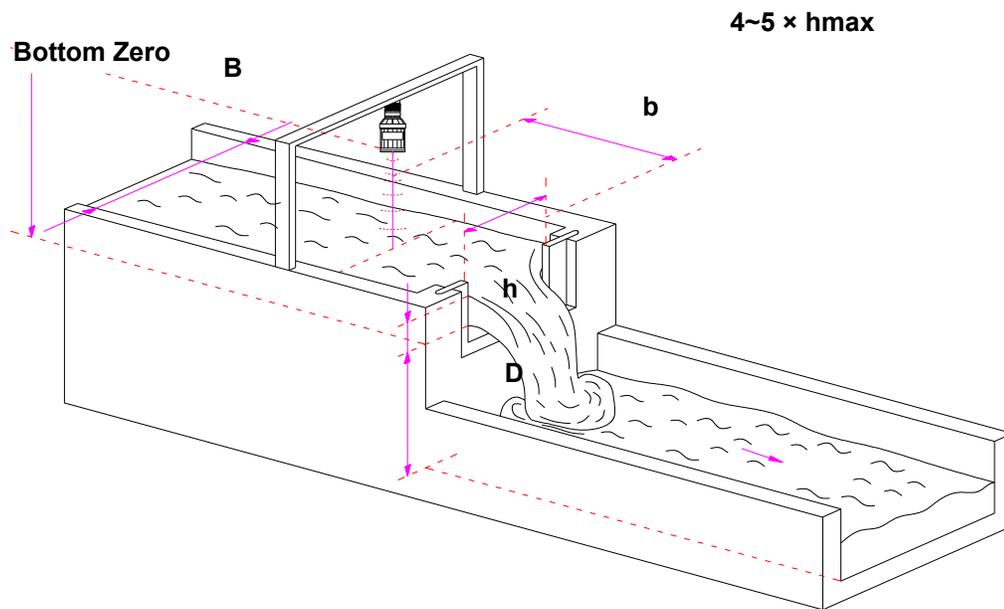


**<Rectangular Weir>**          **<Triangular Weir (60') >**

**< Suppressed Rectangular Weir>**          **< Cipolletti Weir >**
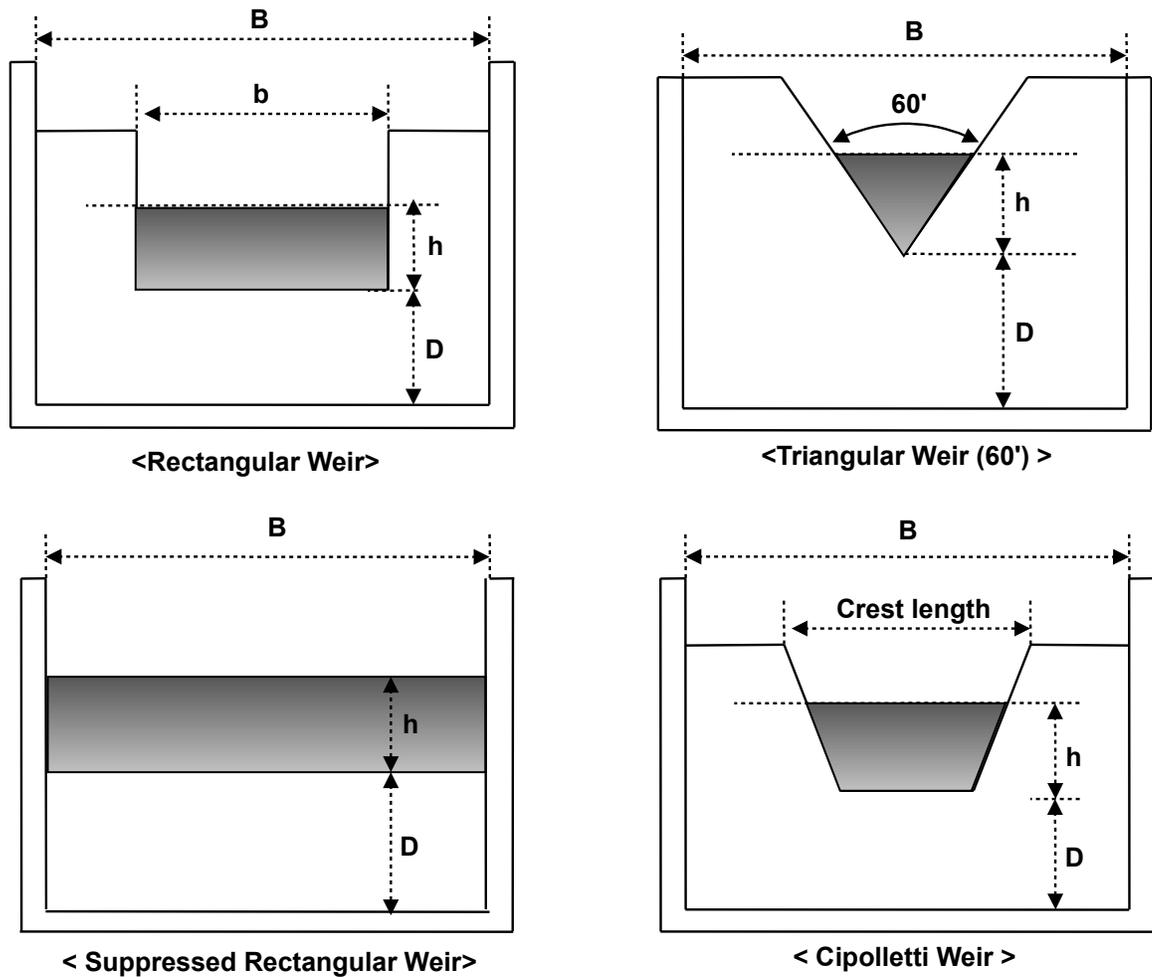
**<Fig. B-1 > Front Views of Weirs**

**h : Water level**

**B : Suppressed Rectangular Weir's Width (ft)**

**b : Rectangular Weir's Width (ft)**
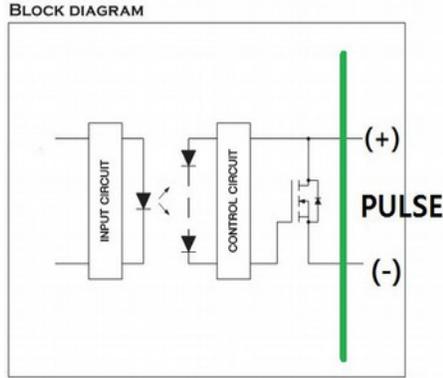
**D : Thickness from Weir's Bottom (ft)**

47

**4~5 × hmax**

**Bottom Zero**

**B**

**b**

**h**

**D**

**<Fig. B-2 >  Iso View of Rectangular Weir**

# Appendix 2 – Pulse Output Schematic

## 1. Pulse Output

BLOCK DIAGRAM



| | | | |
|---|---|---|---|
| **OUTPUT** | DC ON-STATE LOAD CURRENT | **2** | Adc |
| | LOAD VOLTAGE RANGE | 5 ~ 120 | Vdc |
| | BLOCKING VOLTAGE | 200 | Vdc |
| | ON-STATE VOLTAGE DROP | 2 Max | Vdc |
| | OFF-STATE LEAKAGE CURRENT | 1 Max | mAdc |
| **GENERAL** | ISOLATION VOLTAGE | 2,500Vrms between I/O terminals and case for 1 minute | / |
| | ISOLATION RESISTANCE | 500Vdc 100Mohm between I/O terminals and case | / |
| | OPERATING TEMPERATURE | -30 ~ +80 | ℃ |
| | STORAGE TEMPERATURE | -30 ~ +100 | ℃ |
| | TURN-ON TIME | 1 Max | msec |
| | TURN-OFF TIME | 1 Max | msec |