

SONDAR 5000

Ultrasonic Open Channel Flow Meter

(USER'S MANUAL/FEET)



IS Technologies Co., Ltd.

SONDAR 5000

May.2005 Edition

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TECHNICAL ENQUIRIES

Please contact IS Technologies Co., Ltd. for technical support.

IS Technologies Co., Ltd.

203/504 Buchon Techno Park, 192, Yakdae Dong, Wonmi Gu, Buchon City, Kyungki, Korea

Tel: 82-32-621 2606 Fax: 82-32-621 2612

Web Site: <http://www.sondar.com>

e-mail: sales@sondar.com

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About SONDAR 5000

Sondar 5000 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 rate 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 6 months.

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

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

Features of SONDAR 5000

- 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 (0.01 gal/min)
- Current output in proportion to flow measurement (4mA ~ 20mA)
- Flow rate setting at 4mA ~20mA
- Flow-based pulse output (able to set unit flow rate) - applicable to mechanical flow meter
- 2 programmable SPDT relays
- 5 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 6 months.
- Flow Switch input function able to measure the flow rate at Zero flow [Option]
- Operation with free voltage power, low power consumption

Product Specification

Physical

Controller	240(width). X 185(height) mm
Sensor	Ø 67(dia) X 160(height) mm
Mounting	3/4" NPT
Weight	around 3.0kg (sensor, controller)
Sensor Material	Polypropylene

Environmental

IP Rating (electronics housing)	IP65(Controller)
Max. & Min. temperature (electronics)	-20 °C to +60 °C(Controller), -20 to +70°C(Sensor)
RTX cable length	10m (Standard)

Performance

Resolution	1mm
Range(Flow rate)	0.00m ³ /h ~ 200,000.00 m ³ /h
Range(Total flow)	999999999.99 m ³ /h
Range(level)	250 ~ 2000mm
Beam Angle	8° 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

Analogue Output	4-20mA into Max 600Ω (user adjustable) Fault condition Alarm 3.8mA /Hold/21mA,
Setpoint Relay	3 SPDT Relays
Relay capacity	5A, AC250V
Communication Port	1 point RS-232C/RS485
Pulse output	1 point, open collector or line drive

Programming

On-board programming	via 5 tactile push button buttons
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Supply

Power supply	AC90 ~ 260V, Less than 15VA(50Hz ~ 60Hz),
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Applicable Channel

15 kinds of Parshall Flumes
Suppressed Rectangular Weirs
Contracted Rectangular Weirs
V-Notch[Triangular] Weirs.[22.5°, 30°, 45°, 60°, 90°, 120°]
10 kinds of Cippolletti Weirs
10 kinds of Leopold Lagco Flumes
10 kinds of Palmer Bowls Flumes

Special function

10 Point DIY CURVE
Flow equation($Q=K \cdot H(PWR)$)

Chapter 2 Installation

Sondar 5000 is composed of a controller unit and one sensor

Power Supply Requirements

The **Sondar 5000** operates from a AC supply of 90 ~260V.

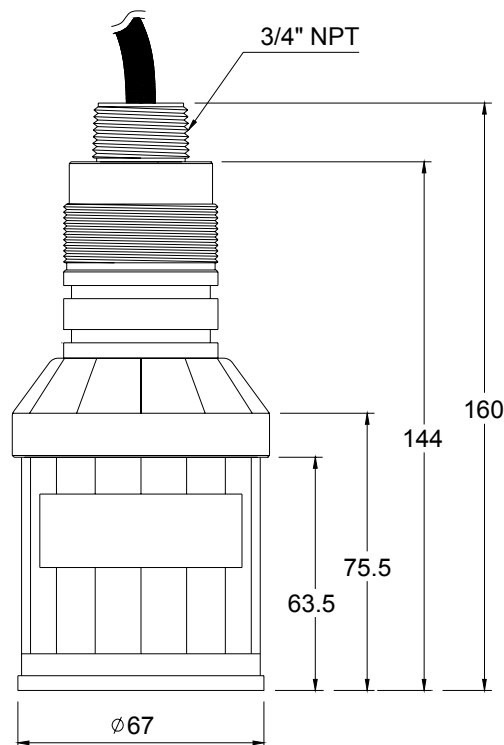
All electronic products are susceptible to electrostatic shock, so follow proper grounding procedures during installation.

When choosing a location to mount the sensor, bear in mind the following:

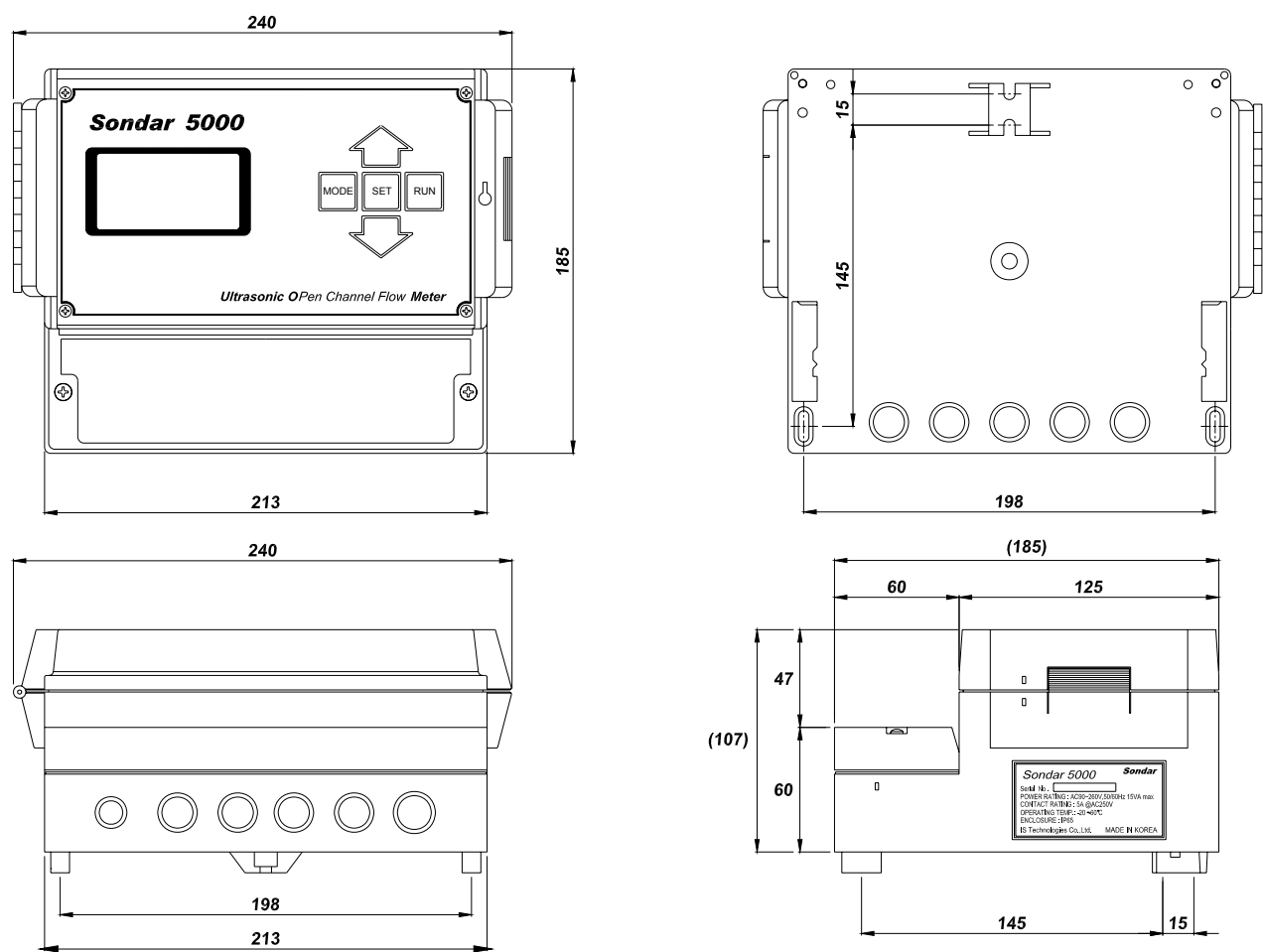
- For easy access to the LCD display and programming buttons mount it where it is easily accessible.
- The ultrasonic signal path should be free of falling material and obstructions such as pipes, beams etc.
- The sensor should be mounted at least 30cm above the maximum level of the material and be perpendicular to the surface.
- The mounting surface should be vibration-free.
- The ambient temperature of the sensor is between -20°C and 70°C.
- There should be no high voltage cables or electrical inverters close by.

Dimensions

Sensor



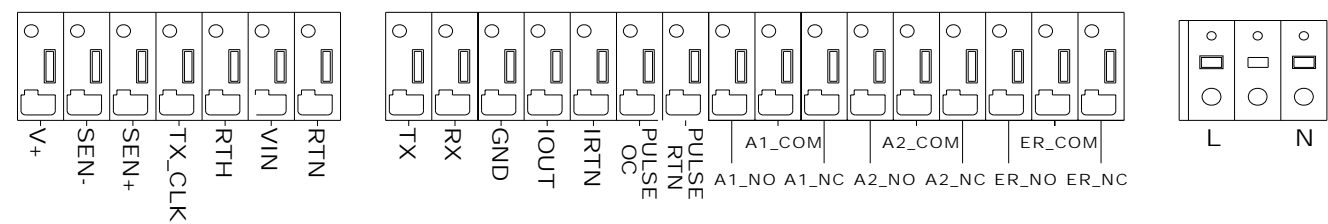
Controller



Cable Entry

There are 23 terminals for controller and 3 terminals for power board as follows:

Input & Output Terminal



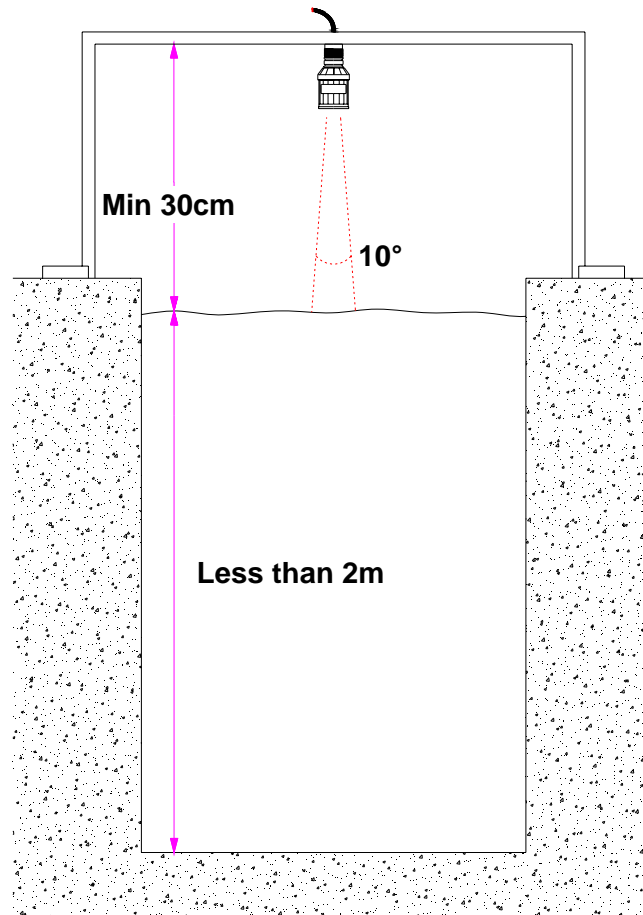
Function

Terminal	Function	Note
V+	DC +12V output	
SEN-	Connect to shield cable of sensor of RTX	Black
SEN+	Connect to +cable of sensor of RTX	Red
TX CLK	Output of sensor's transmitting signals in pulse form	Option
RTH	Connect to outer temperature sensor	
VIN	External Input[FOLW SWITCH]	
RTN	External input GND	
TX	When using RS232C interface, connection to RS232C's transmitter. When using RS485, connection to Y.	
RX	When using RS232C interface, connection to RS232C's receiver. When using RS485, connection to Z.	
GND	Digital communication GND	
IOUT	Current output (+): Output of 4 mA ~ 20 mA in proportion to flow rate	Max. 600Ω
IRTN	Current output (-)	
PULSE OC	Pulse output (+): at the set intervals	
PULSE RTN	Pulse output (-)	
A1_NO	ALARM_1 NO contact point. On operation of ALARM_1, disconnection from A1_COM	
A1_COM	ALARM_1 COM contact point. On operation of ALARM_1, disconnection from A1_NO & on its stop, disconnection from A1_NC	
A1_NC	ALARM_1 NC contact point. When ALARM_1 is not in operation, disconnection from A1_COM	
A2_NO	ALARM_2 NO contact point. On operation of ALARM_2, disconnection from A2_COM	
A2_COM	ALARM_2 COM contact point. On operation of ALARM_2, disconnection from A2_COM & on its stop, disconnection from A2_NC	
A2_NC	ALARM_2 NC contact point. When ALARM_2 is not in operation, disconnection from A2_COM	
ER_NO	ERROR_NO contact point. On operation in ERROR situation, disconnection from ER_COM	
ER_COM	ERROR_COM contact point. On operation in ERROR situation, disconnection from ER_NO & on its stop, disconnection from ER_NC	
ER_NC	ERROR_NC contact point. When not operated even in ERROR situation, disconnection from ER_COM	
L	AC power connection	
N	AC power connection	

* The below points are useful when test the Sondar5000 in field.

THR	Output of standard voltage that determines the volume of the ultrasonic signal. Users can check the most suitable installation location.	Test Point
DET	Output voltage of the detected ultrasonic signal	Test Point
TVG	Output of amplified voltage of the ultrasonic signal. Trigger source of DET signal	Test Point

Sensor Installation

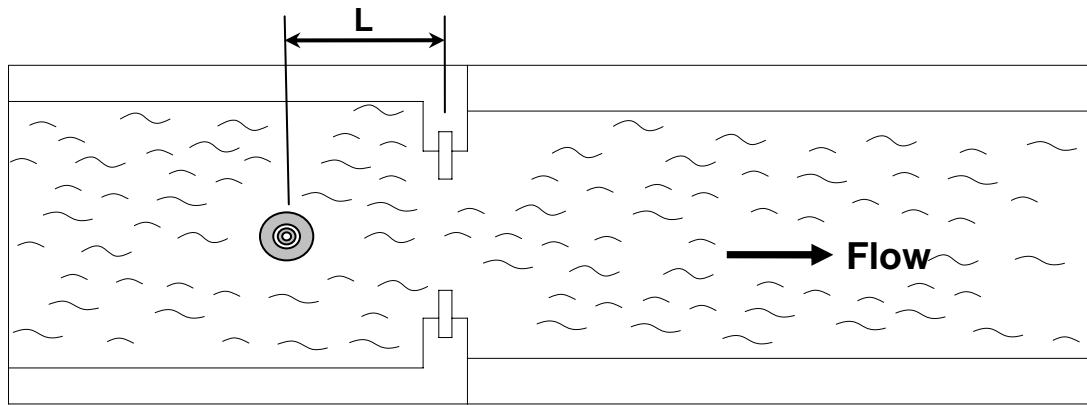


In order to prevent malfunctions and assure accurate measurement, installation should be conducted under consideration of the following points.

- 1) There should be no disturbing objects within the range of 10° beam angle where the ultrasonic pulse moves.
- 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).

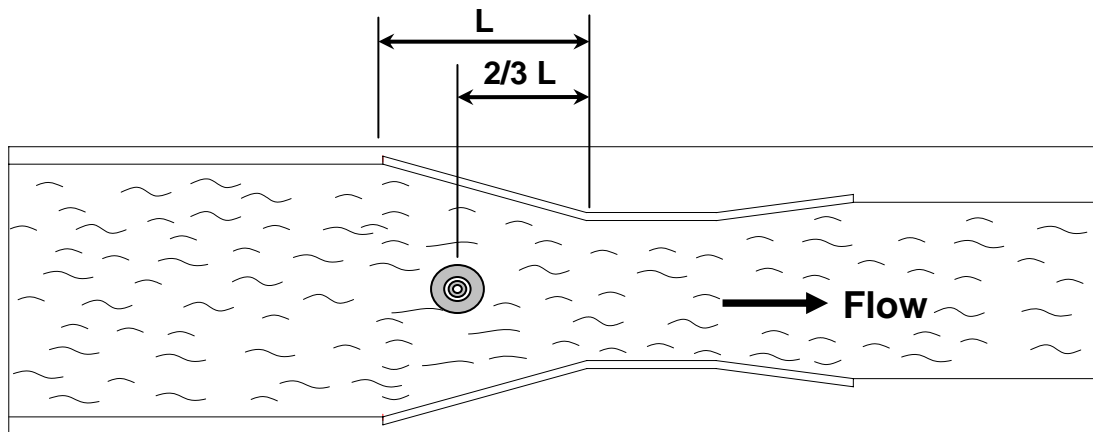
The sensor should be installed at a position of above maximum water level of the channel to be measured (more than 30 cm).

Weir



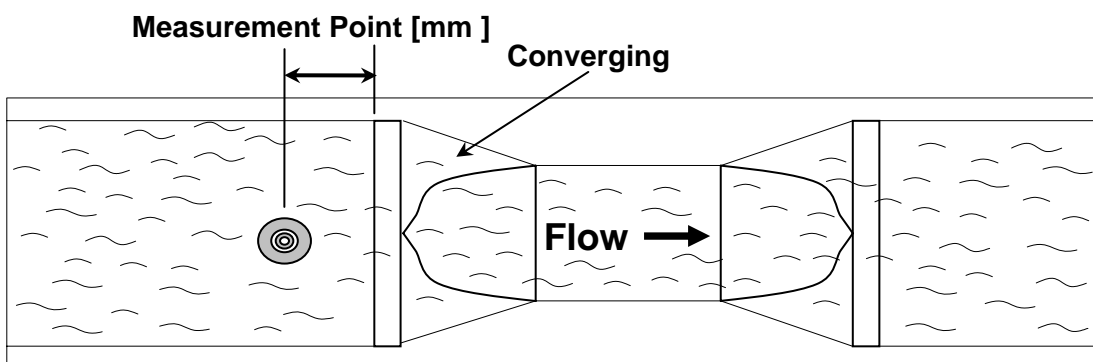
- In the rectangular, triangular, and Cipolletti channels, the sensor should be installed at the top of the channel (Max. height $\times 4 \sim 5$ times recommended).

Parshall Flume



- In the Parshall Flume, the sensor should be installed at a $\frac{2}{3}$ position of the whole converging section length.

Leopold Lagco Flume



- 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)

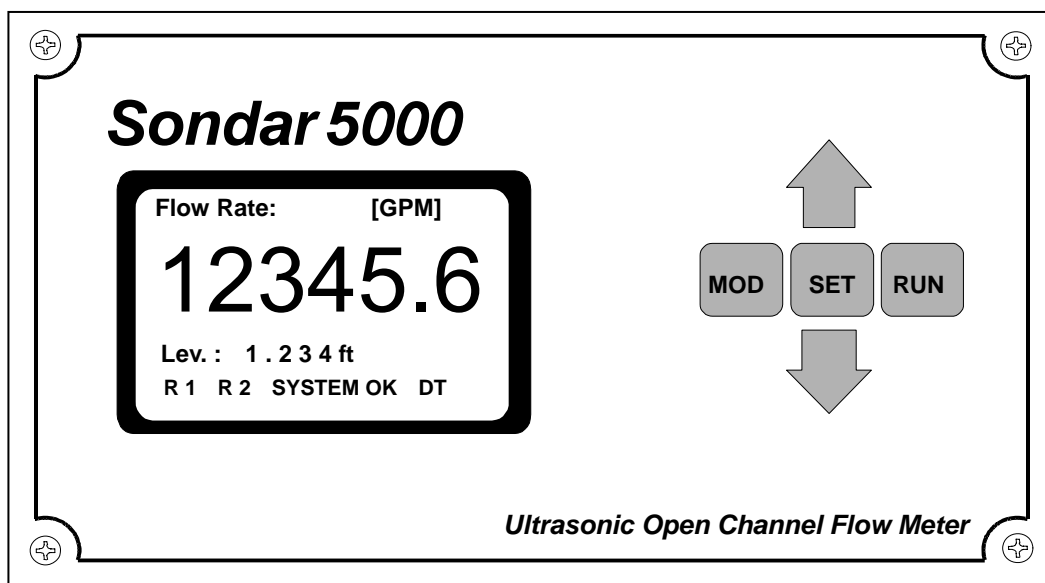
Flume Size		Measurement Point	
mm	inches	mm	inches
100 ~	4~12	25	1.0
380	15	32	1.3
455	18	38	1.5
530	21	44	1.8
610	24	51	2.1
760	30	64	2.5

- 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.**

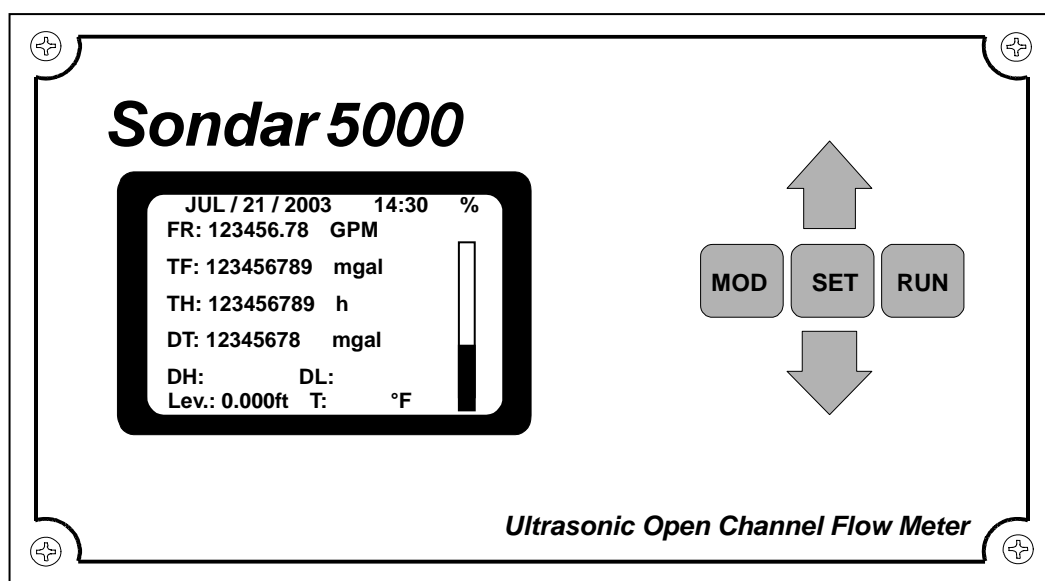
Chapter 3 How To Use SONDAR 5000

Operating the controller



Operation Mode I

- Push **SET** button at Operation Mode I and Operation Mode II will be displayed. Operation Mode II can be toggled to Operation Mode I by **SET** button.
- To see **MGD**(millions gallons per day)unit information, you can simply press **UP** button at Operation Mode I
- You can choose Operation Mode I or II as you want.



Operation Mode II

- Description of abbreviations displayed
 - 1) FR : Flow rate measured in m³/h.
 - 2) TF : Total flow from the set time.
 - 3) TH : Total hours from the set time.
 - 3) LE : Measured level from the bottom to the surface in mm.
 - 4) T : Ambient temperature.
 - 5) Bar graph: Ratio of measured flow rate to max. flow rate.

- Description of characters displayed

SONDAR 5000 shows its operational conditions on its LCD.

 - 1) A1 : RELAY1 is ON.
 - 2) A2 : RELAY2 is ON.
 - 3) SYSTEM OK : System is normal.
 - 4) FAIL: Failure to measure the flow rate.
 - 5) DT: Flickered on normal measurement of water level.
(meaning normal detection of reflected waves)
 - 6) D: Echo detection is okay
 - 7) S: Searching Echo
 - 8) LE: On failure to detect the reflected waves.

Button Functions

1) MODE Button

- To convert Operation Mode to Program Mode.
- Push MODE button at Operation Mode and PASSWORD CHECK, the first menu of Program Mode, will be displayed.
- Push SET button and Program Mode will be immediately shown.
- At Program Mode, push Up or Down button to move to other menu option.
- Use MODE button to return to menu option after device selection (02. DEVICE SELECTION)

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

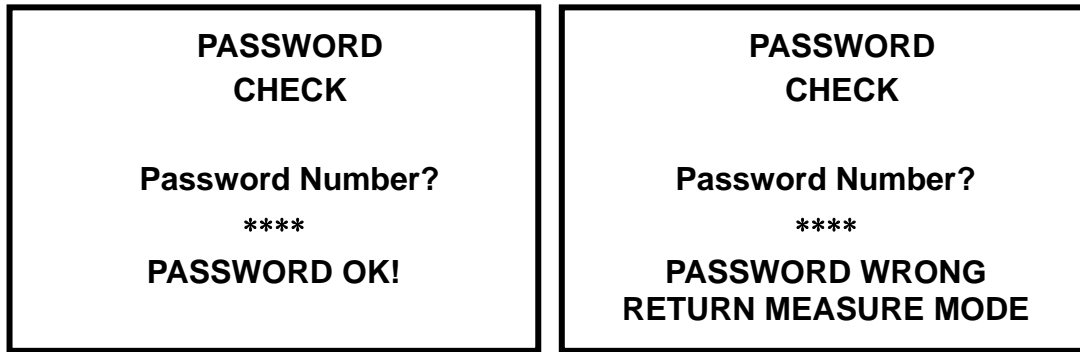
- Use this button to save the values of an option and then, go to the next option selection.

4) RUN Button

- Use this button to return to Operation Mode from Program Mode.

Application Menu Option

Password Check



< When password is confirmed >

< When password is not confirmed >

- Push MODE button at Operation Mode and PASSWORD CHECK, the initial menu of Program Mode, will be displayed. This is a function to prevent change of set values by unauthorized persons.
- 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.
- The password can be changed at PASSWORD CHANGE. The password numbers can be selected within the range of 0~1000.
- Use ↑ or ↓ to move to a specific menu. Place the cursor (*) at a specific menu and push SET button. Then, you can change the value of the menu.
- If you don't want to change the value, push SET button and then, select another menu option.
- If you want to change the value, push ↑ or ↓ to change it. After change, push SET button to save the set value and then, select another menu.
- If you push RUN in the course of selecting an option, Program Mode is converted into Operation Mode.

Password Change

Factory Set= 0

***01. PASSWORD CHANGE**

□ □ □ □

02. DEVICE SELECTION

03. AUTO ZERO

04. BOTTOM DISTANCE

- 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. (Setting range: 0~1000, Unit: 1)

※Note: If the password is wrong, you cannot go to Program Mode from Operation Mode. Therefore, careful attention should be paid to password change. When you forget the password, please contact the local distributor.

Device Selection

Factory Set = 1

01. PASSWORD CHANGE

***02. DEVICE SELECTION**

03. AUTO ZERO

04. BOTTOM

- This is an option for channel selection and detailed parameter setting. Select the channel first and then, set parameters for the channel.
- Place the cursor at this menu. Push SET button and the following screen I will be displayed. The initial value is 1. (Setting range: 1~8, Unit: 1)

***** DEVICE : 1) - 6**

***1. Parshall Flumes**

2. Rect. Suppressed

3. Rect. Contracted

4. V-Notch Weirs

< 2. DEVICE SELECTION Screen I >

***** DEVICE : 1) - 6**

5. Cipoletti Weirs

6. Leopold Lagco Flume

7. Palmer Bowlus Flume

8. DIY Curve/Special

< 2. DEVICE SELECTION Screen II >

- At Program Mode, push ↑ or ↓ to place the cursor (*) at a specific menu and push SET button to go to the mode for change of the relevant device.
- Push ↓ at No. 4 and Screen II showing No. 5 to 8 will be displayed. Also, push ↑ at No. 1 and the cursor will go to No. 8.
- Push MODE button to return to upper-level menu option.
- On selection of 2. DEVICE SELECTION menu, the channel and max. flow rate value able to measure in the channel with the relevant device will be automatically set.
- When the type of channel is changed during measurement, the previously set values will be lost and values for menus (No. 7, 8, 9, 11, 14) will be initialized as those for the changed channel.

Pharshall flumes

Factory Set = 1

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.

- Select Parshall Flumes and push SET button. Then, the menu for flume selection will 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. (Setting range: 1~15, Unit: 1)
- Measurable maximum height is automatically set.

Parshall Flume	Max. Height [mm]	Parshall Flume	Max. Height [mm]
1"	180	9"	600
2"	180	1~8 ft	760
3"	450	10 ft	1060
6"	450	12 ft	1370

Rect. Suppressed

Factory Set B = 1

Factory Set D = 1

Factory Set H = 1m

2. Rect. Suppressed

**** Crest Length: 1**

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

- 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 relevant Rect. Suppressed and push SET button to save the set values and return to main menu option. (Setting range: 1~10, Unit: 1)
- Measurable maximum height is automatically set.

Rect. Suppressed	Max. Height [mm]	Rect. Suppressed	Max. Height [mm]
1 ft	150	4 ft	600
1.5ft	220	5 ft	750
2 ft	300	6 ft	900
2.5 ft	370	8 ft	1200
3 ft	450	10 ft	1500

Rect. Contracted

Factory Set B = 1
 Factory Set D = 1
 Factory Set b = 1
 Factory Set H = 1m

3. Rect. Contracted

**** Crest Length: 1**

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

- 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 relevant Rect. Contracted and push SET button to save the set values and return to main menu. (Setting range: 1~10, Unit: 1)
- Measurable maximum height is automatically set.

Rect. Suppressed	Max. Height [mm]	Rect. Suppressed	Max. Height [mm]
1 ft	150	4 ft	600
1.5ft	220	5 ft	750
2 ft	300	6 ft	900
2.5 ft	370	8 ft	1200
3 ft	450	10 ft	1500

V-Notch Weirs[Triangular]

Factory Set = 0.600m

4. V-Notch Weirs

**** Weir Selection: 1**

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

- Select V-Notch Weirs and push SET button. Then, the menu for selection of the triangular weir will be displayed as shown in the above figure.
- Use ↑ or ↓ to select the relevant V-Notch Weir and push SET button to save the set values and return to menu option. (Setting range: 1~6, Unit: 1)
- Measurable maximum height is automatically set at 600 mm.

Cipolletti Weirs [Trapezodial Weirs]

Factory Set = 0.600m

5. Cipolletti Weirs

**** Weir Selection: 1**

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

- 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. (Setting range: 1~10, Unit: 1)
- Measurable maximum height is automatically set.

Cipolletti Weirs	Max. Height [mm]	Cipolletti Weirs	Max. Height [mm]
1 ft	150	4 ft	600
1.5ft	220	5 ft	750
2 ft	300	6 ft	900
2.5 ft	370	8 ft	1200
3 ft	450	10 ft	1500

Leopold Lagco Flumes

Factory Set = 1

6. Leopold Lagco Flumes

**** Flume Selection: 1**

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

- 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. (Setting range: 1~10, Unit: 1)
- Measurable maximum height is automatically set.

Leopold Lagco Flumes	Max. Height [mm]	Leopold Lagco Flumes	Max. Height [mm]
4 inch	70	15 inch	270
6 inch	100	18 inch	320
8 inch	130	21 inch	380
10 inch	180	24 inch	420
12 inch	210	30 inch	530

Palmer Bowlus Flumes

Factory Set = 1

7. Palmer Bowlus Flumes

**** Flume Selection: 1**

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

Leopold Lagco Flumes	Max. Height [mm]	Leopold Lagco Flumes	Max. Height [mm]
4 inch	76	15 inch	274
6 inch	107	18 inch	320
8 inch	152	21 inch	381
10 inch	183	24 inch	427
12 inch	213	27 inch	488

DIY Curve / Special

Factory Set = 1

8. DIY Curve/Special

**** Selection: 1**

1 : DIY CURVE

2 : $Q=K \cdot H(PWR)$

3 : Rectangular Weir

- Select DIY Curve / Special and push SET button. Then, an option for selection of 1. DIY Curve, 2. $Q=K \cdot H(PWR)$, 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.
 1. 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.
 2. $Q=K \cdot H(PWR)$: This option inputs constant values, K and PWR, to a exponentially changing device and measures the flow rate.
 3. Rectangular Weir: This option selects Crest Length of all Rectangular Weirs in mm unit and measures the flow rate.
- Use \uparrow or \downarrow to select the relevant special option and push SET button to save the set values and return to menu option. (Setting range: 1~3, Unit: 1)

DIY Curve / Special

Factory Set = 1.234

1. 10 POINT DIY CURVE

MAX. HEIGHT: 1.234m

1) 0.1H:	00100.0	m3/h
2) 0.2H:	00200.0	m3/h
3) 0.3H:	00300.0	m3/h
4) 0.4H:	00400.0	m3/h

1. 10 POINT DIY CURVE

5) 0.1H:	00500.0	m3/h
6) 0.2H:	00600.0	m3/h
7) 0.3H:	00700.0	m3/h
8) 0.4H:	00800.0	m3/h
9) 0.4H:	00900.0	m3/h
10) 0.4H:	01000.0	m3/h

- 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 \uparrow or \downarrow 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. (Setting range: 0.1 ~ 99999.9 [m3/h])
- Use \uparrow or \downarrow 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. (Setting range: 0.1 ~ 99999.9 [m3/h])
- 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 \uparrow or \downarrow button, push SET button to go to 2. DEVICE SELECTION. Push MODE button again to go to menu option.

$$Q=K \cdot H(PWR)$$

Factory Set = 1.234

2. $Q=K \cdot H(PWR)$

K Constant : 1.234

KWR Constant : 1.234

H: Height [mm]

- Select 2. $Q=K \cdot H(PWR)$ 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. (Setting range: 0.001 ~ 9.999)
- 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. (Setting range: 0.001 ~ 9.999)
- Push MODE button to return to main menu.

Rectangular Weir

Factory Set = 1

3. Rectangular Weirs

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

***Crest Length[m]:**
1.234

- Select 3. Rectangular Weirs and push SET button. Then, two options to select the type of rectangular weir, *Selection and *Crest Length [m], 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 [m]. (Setting range: 1 ~ 2)
- 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. (Setting range: 1 ~ 2)
- Push MODE button to return to menu option.

Auto Zero

Factory Set = N/A

01. PASSWORD CHANGE

02. DEVICE SELECTION

***03. AUTO ZERO**

04. BOTTOM DISTANCE

- This is an option for automatic detection of bottom distance from the sensor to the bottom. 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.

AUTO ZERO

1.234 m
Auto SET? SET, No? DOWN

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.

※ 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.

Bottom

Factory Set = 1.200m

01. PASSWORD CHANGE

02. DEVICE SELECTION

03. AUTO ZERO

***04. BOTTOM DISTANCE**
1.234m

- This is an option to manually set the distance from the ultrasonic sensor to the bottom of the channel. For automatic setting, please refer to 3. AUTO ZERO.
- Since the flow meter installed in open channel is a device to measure the water level and the flow rate, it requires input of accurate distance. Otherwise error will occur.
- The unit for the distance is meter (m). 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 1.200 m.

Max Flow

Factory Set = Allowable Max. flow of selected device

***05. MAX FLOW**

06. 4mA POINT SET

07. 21mA POINT SET

08. RELAY1 ON POINT

- Maximum or minimum flow rate based on the height of the channel can be searched in m³/h or gal/h unit.
- Place the cursor at this menu and push SET button. Then, the following screen will be displayed.

5. MAX FLOW

1. 2 3 4m [1 2 3 4ft]

1 2 3 4 5 6 7.8 9 m³/h

1 2 3 4 5 6 7.8 9 gal/min

- Use ↑ or ↓ to change maximum acceptable height and the flow rate at the height will be displayed. The initial value is the channel-based maximum measurable height (Max Head).

Process Menu Options

4mA Point Set

Factory Set = 0.00m³/h

05. MAX FLOW

***06. 4mA POINT**

□□□□□□□.□□ m³/h

07. 21mA POINT

08. RELAY 1 ON POINT

- This is an option for setting the flow rate value corresponding to 4 mA output. The set value determines Zero current output. In general, 0 is set. The initial value is 0.00 m³/h. (Setting range: 0.00 ~ Max. Flow Rate, Unit: 0.01 m³/h)
- 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.

20mA Point Set

Factory Set= Max. flow rate

05. MAX FLOW

06. 4mA POINT

***07. 20mA POINT**

□□□□□□□.□□ m³/h

08. RELAY 1 ON POINT

- This is an option for setting the flow rate value corresponding to 20 mA output. The set value determines Span current output. In general, maximum flow rate is set. The initial value is the maximum measurable flow rate (m³/h) of the device set in 02. (Setting range: 0.00 ~ Max. Flow Rate, Unit: 0.01 m³/h)

Relay1 On Point

Factory Set= 10% of Max. flow value set at option 02 "Device Selection"

05. MAX FLOW

06. 4mA POINT

07. 20mA POINT

***08. RELAY 1 ON POINT**

□□□□□□.□□ m³/h

- 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 (m³/h) of the device set in 02. (Setting range: 0.00 ~ Max. Flow Rate, Unit: 0.01 m³/h)

Relay1 Off Point

Factory Set= 20% of Max. flow value set at option 02 "Device Selection"

***09. RELAY 1 OFF POINT**

□□□□□□.□□ m³/h

10. RELAY 2 ON POINT

11. RELAY 2 OFF POINT

12. RELAY SIMULATION

- 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 (m³/h) of the device set in 02. (Setting range: 0.00 ~ Max. Flow Rate, Unit: 0.01 m³/h)

Relay2 On Point

Factory Set= 90% of Max. flow value set at option 02 "Device Selection"

09. RELAY 1 OFF POINT

***10. RELAY 2 ON POINT**

□□□□□□.□□ m³/h

11. RELAY 2 OFF POINT

12. RELAY SIMULATION

- 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 (m³/h) of the device set in 02. (Setting range: 0.00 ~ Max. Flow Rate, Unit: 0.01 m³/h)

Relay2 Off Point

Factory Set= 80% of the Max. flow value set at option 02 "Device Selection"

09. RELAY 1 OFF POINT

10. RELAY 2 ON POINT

***11. RELAY 2 OFF POINT**

□□□□□□.□□ m³/h

12. RELAY SIMULATION

- 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 (m³/h) of the device set in 02. (Setting range: 0.00 ~ Max. Flow Rate, Unit: 0.01 m³/h)

<Examples of RELAY ON/OFF POINT Setting>

- 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 1.00 m³/h and OFF POINT is set at 2.00 m³/h, RELAY 1 is turned on when the flow rate is below 1.00 m³/h. If the water supply pump is turned on in this case, the water level is increased. When the level reaches OFF POINT (2.00 m³/h), 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 1.00 m³/h and ON POINT is set at 2.00 m³/h, RELAY 2 is turned on when the flow rate is above 2.00 m³/h. If the water drain pump is turned on in this case, the water level is decreased. When the level reaches OFF POINT (1.00 m³/h), RELAY 2 becomes off and the pump stops.

Relay Simulation

Factory Set =0.00 m³ /h

09. RELAY 1 OFF POINT

10. RELAY 2 ON POINT

11. RELAY 2 OFF POINT

***12. RELAY SIMULATION**

□□□□□□.□□ m³/h

- This is an option to check if RELAY is in normal operation after setting 08, 09, 10, and 11 items.
- Place the cursor at this menu and push SET button. Then, the following screen will be displayed.

RELAY SIMULATION	
R1 ON :	□□□□□□.□□ m ³ /h
R1 OFF :	□□□□□□.□□ m ³ /h
R2 ON :	□□□□□□.□□ m ³ /h
R2 OFF :	□□□□□□.□□ m ³ /h
FR :	□□□□□□.□□ m ³ /h
A1	A2

- 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 way, 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.

Low Cut Value

Factory Set = 0.00 m³ /h

<p>*13. LOW CUT VALUE □□□□□□.□□ m³/h</p> <p>14. HIGH CUT VALUE</p> <p>15. TIME</p> <p>16. TOTALIZER</p>

- This is an option to set minimum measurable flow rate. Those below this value will be treated as "0". The initial value is 0.00 m3/h. (Setting range: 0.00 ~ Max. Flow Rate, Unit: 0.01 m3/h)

High Cut Value

Factory Set = Max. flow rate

<p>13. LOW CUT VALUE</p> <p>*14. HIGH CUT VALUE □□□□□□.□□ m³/h</p> <p>15. TIME</p> <p>16. TOTALIZER</p>

- This is an option to set maximum measurable flow rate. Those above this value will be treated as the maximum flow rate. The initial value is maximum flow rate of the device (m3/h). (Setting range: 0.00 ~ Max. Flow Rate, Unit: 0.01 m3/h)

Time

Factory Set = N/A

13. LOW CUT VALUE

14. HIGH CUT VALUE

*15. TIME

SEP/02/2003/ Tue 16:30

16. TOTALIZER

- Push SET button and the month/date/year/day 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 ↓. In this way, the day, hour, and minute can be changed.

Totalizer

Factory Set = N/A

13. LOW CUT VALUE

14. HIGH CUT VALUE

15. TIME

*16. TOTALIZER

- This is an option to set 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.

TOTALIZER

1. Total Flow Set

□□□□□□.□□ m³

2. Total Time Set

□□□□□□.□□ 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 (Setting range: 0.00 ~ 999999999.99, Unit: 0.01 m3).

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.
(Setting range: 0 ~ 999999999, Unit: 1 h)

※ Delete all data previously saved.

Data Save Period

FactorySet = 10 mins

<p>*17. DATA SAVE PERIOD</p> <p>□ min</p> <p>18. PULSE VALUE</p> <p>19. PULSE PERIOD</p> <p>20. DATA TRANSFER</p>

- Period for storage of total flow data can be set.
- The period for storage of data can be calculated as follows:
- Min x 3 = (day) In other words, if 10 minutes are set, data for about 30 days can be saved. When 30 days have passed, total flow data before 30 days are eliminated. Only the current total flow data for 30 days are saved.
- The initial value is 10 min. (Setting range: 1 ~ 60, Unit: 1 min)

Pulse Value

FactorySet = 30.00m³

<p>17. DATA SAVE PERIOD</p> <p>*18. PULSE VALUE</p> <p>□□□.□□ m³</p> <p>19. PULSE PERIOD</p> <p>20. DATA TRANSFER</p>
--

- This is an option for setting the flow rate value for output of one pulse.
- Pulse output is applicable to total flow meter in pulse count type and this menu determines the flow rate for one pulse. The initial value is 30.00 m³. (Setting range: Max. flow rate per second ~ 100.00, Unit: 0.01 m³)

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

Pulse period

FactorySet = 0.10 sec

17. DATA SAVE PERIOD

18. PULSE VALUE

***19. PULSE PERIOD**

□ . □ □ **sec**

20. DATA TRANSFER

- This is an option for setting the width for one pulse output according to the flow rate set in No. 18. The initial value is 0.10 sec. (Setting range: 0.01 ~ 1.00, Unit: 0.01 sec)

Data Transfer

Factory Set = N/A

17. DATA SAVE PERIOD

18. PULSE VALUE

19. PULSE PERIOD

***20. DATA TRANSFER**

- Place the cursor at this menu and push SET button. Then, data saved from the initial time to the present will be transferred according to RS-232 communication protocol (BPS: 9600, Parity Bit: None, Data Bit: 8, Stop Bit: 1).
- In the course of data transfer, "RS-232C Transfer!" and "STOP? DOWN" are repeated. If you want to stop data transfer, push DOWN for 2 seconds.
- On completion of data transfer, "RS-232C Transfer END!" will be displayed if there are no previous data. Push DOWN to go to other menu. If there is any previous data, "Want Before Data?" and "Yes? SET, No? DOWN" will be repeated.
- Push SET button for 2 seconds and the remaining data will be dumped. Push DOWN button to go to other menu. In the course of DUMP, "RS-232C Transfer!" and "STOP? DOWN" will be repeated. If you want to stop it in the course of DUMP, push DOWN button.

17. DATA SAVE PERIOD

18. PULSE VALUE

19. PULSE PERIOD

***20. DATA TRANSFER**
Want Before Data ?

```

2001/01/10 14/01 Memory restart! Save time:01min
2001/01/10 14/02 LE:0.194m FR: 17.14m3/h TF: 4066.90m3
2001/01/10 14/03 LE:0.195m FR: 17.28m3/h TF: 4067.19m3
2001/01/10 14/04 LE:0.194m FR: 17.14m3/h TF: 4067.47m3
2001/01/10 14/05 LE:0.194m FR: 17.14m3/h TF: 4067.75m3
2001/01/10 14/06 LE:0.194m FR: 17.14m3/h TF: 4068.04m3
2001/01/10 14/07 LE:0.194m FR: 17.14m3/h TF: 4068.33m3
2001/01/10 14/08 LE:0.194m FR: 17.14m3/h TF: 4068.62m3
2001/01/10 14/09 LE:0.194m FR: 17.14m3/h TF: 4068.90m3
2001/01/10 14/10 LE:0.194m FR: 17.14m3/h TF: 4069.19m3
2001/01/10 14/11 Power on time! Save time:01min
2001/01/10 14/12 LE:0.194m FR: 17.14m3/h TF: 4069.39m3
RS-232C Dump END!
Want Before Data? YES?SET,No?DOWN
2001/01/10 13/44 Power on time! Save time:01min
2001/01/10 13/45 LE:0.196m FR: 17.41m3/h TF: 4063.44m3
2001/01/10 13/46 LE:0.195m FR: 17.28m3/h TF: 4063.73m3
2001/01/10 13/47 LE:0.197m FR: 17.55m3/h TF: 4064.01m3
2001/01/10 13/47 Power off time! Save time:01min
2001/01/10 13/50 Power on time! Save time:01min
2001/01/10 13/51 LE:0.197m FR: 17.55m3/h TF: 4064.26m3
2001/01/10 13/52 LE:0.197m FR: 17.55m3/h TF: 4064.55m3
2001/01/10 13/53 LE:0.194m FR: 17.14m3/h TF: 4064.84m3
2001/01/10 13/54 Mode setup time! Save time:01min
2001/01/10 13/55 LE:0.194m FR: 17.14m3/h TF: 4065.10m3
2001/01/10 13/56 LE:0.194m FR: 17.14m3/h TF: 4065.39m3
2001/01/10 13/56 Mode setup time! Save time:01min
2001/01/10 13/57 LE:0.194m FR: 17.14m3/h TF: 4065.47m3
2001/01/10 13/58 LE:0.194m FR: 17.14m3/h TF: 4065.76m3
2001/01/10 13/59 LE:0.194m FR: 17.14m3/h TF: 4066.04m3
2001/01/10 14/00 LE:0.194m FR: 17.14m3/h TF: 4066.33m3
2001/01/10 14/01 LE:0.194m FR: 17.14m3/h TF: 4066.61m3
RS-232C Dump END!

```

<Example of Data Transfer displayed on PC>

Blanking

Factory Set = 0.35m

*21. BLANKING

□ . □ □ □ m

22. TRANSMIT POWER

23. OUTPUT DAMPING

24. FAIL SAFE CURRENT

- In general, the ultrasonic sensor cannot detect any object within a specific distance from the sensor. The distance is about 0.250 ~ 0.350 m 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 0.350 m. (Setting range: 0.250 ~ 3.000, Unit: 0.001 m)

Compensation Menu Options

Transmit Power

Factory Set = 3

21. BLANKING

*22. TRANSMIT POWER

□

23. OUTPUT DAMPING

24. FAIL SAFE CURRENT

- 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 remote measurement.
- At the time of release from the manufacturer, the value is set at 3, which is optimal one for normal operating environments. The initial value is 3. (Setting range: 1 ~ 5, Unit: 1)

Output Damping

Factory Set = 2

21. BLANKING

22. TRANSMIT POWER

*23. OUTPUT DAMPING

□ □ □

sec

24. FAIL SAFE CURRENT

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

- Setting Range : 1 = 0.1m/min
2 = 0.5m/min
3 = 1m/min
4 = 10m/min

Fail Safe Current

Factory Set = 3.8mA

- 21. BLANKING**
- 22. TRANSMIT POWER**
- 23. OUTPUT DAMPING**
- *24. FAIL SAFE CURRENT**
3.8mA

- 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 21mA is used for this purpose.
- If measurement is not normally conducted, FAIL SAFE CURRENT is generated after FAIL SAFE TIME.
- If HOLD is set, the flow under HOLD is totalized. In the case of other settings, totalization is not conducted. The initial value is 3.8 mA. (Setting range: 3.8 mA, HOLD, 21 mA).

Fail Safe Time

Factory Set = 120 sec

- *25. FAIL SAFE TIME**
 sec
- 26. DETECT THRESHOLD**
- 27. 12mA OUTPUT**
- 28. FLOW SWITCH**

- 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 some time.
- The initial value is 120 sec. (Setting range: 20 ~ 999, Unit: 1 sec)

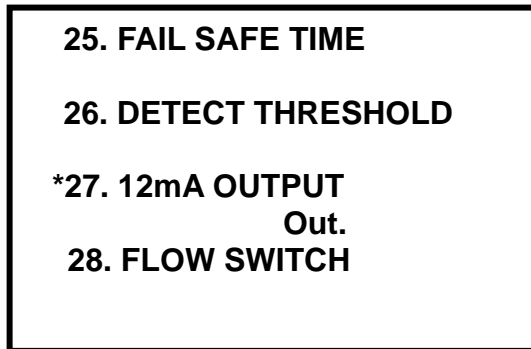
Detect Threshold

Factory Set = 4

- 25. FAIL SAFE TIME**
- *26. DETECT THRESHOLD**
- 27. 12mA OUTPUT**
- 28. FLOW SWITCH**

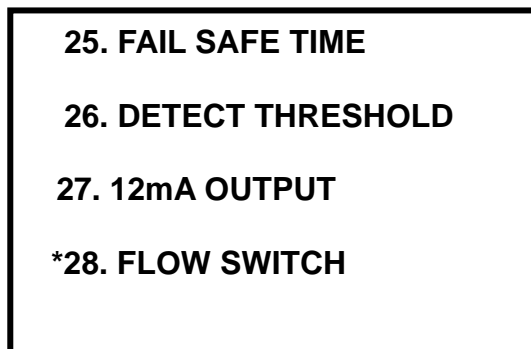
- This is an option for setting threshold for detection of the reflected wave. This menu adjusts the threshold for detection of the reflected wave and maintains optimal conditions under operating environments.
- To reduce the probability of false detection or at an environment generating lots of noise, increase the threshold value. For detection of weak signals, decrease the value. In this way, set the threshold value according to the environmental conditions. The initial value is 4. (Setting range: 3 ~ 15, Unit: 1)

12mA Output



- This is an option for 12 mA 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.

Flow Switch



- This function is used when an external flow switch is installed. If the measured flow rate is 0, the flow rate is displayed as 0, regardless of the measurement level.
- Place the cursor at this menu and push SET button. Then, the following screen will be displayed.

28. FLOW SWITCH

****Selection. 2**

- 1. Installation**
- 2. Uninstallation**

- If a flow switch is installed and used, select "1". If not, select "2".
- 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.

Chapter 5 Digital Communication

The Sondar5000 provides RS232/385 digital communication interface function as an option.

The kinds of data and its 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	:		1.234			f	t		F	R	:		1234567.89		g	a	l	/	m
		T	F	:		123456789			g	a	l												

1. Baud Rate is 9600BPS.
2. 1 Data Frame is composed of 59 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 → 123456789 gal

Chapter 6 Maintenance

Sondar 5000 does not require any special maintenance work. However, in areas where there are lots of floating matters or viscous sludge, the sensor's surface may be contaminated by them. Therefore, for accurate measurement, it is necessary to install a device to clean the sensor at appropriate interval.

Chapter 7 Menu Option Record

SONDAR 5000

APPLICATION

Option Details		Entered Value					
No.	Description	Factory Set	Value Range	1	2	3	4
01	Password Change	0	0~1000				
02	Device Selection	1(Parshall Flume)	Refer to manual				
03	Auto Zero	-	-				
04	Bottom	1.200m	0.400~4.000m				
05	Max Flow	Refer to manual	Refer to manual				

PROCESS

06	4mA Set Point	0.00m ³ /h	0.00~Max flow				
07	20mA Set Point	Max flow rate	0.00~Max flow				
08	Relay 1 on Point	Refer to manual	0.00~Max flow				
09	Relay 1 off Point	Refer to manual	0.00~Max flow				
10	Relay 2 on Point	Refer to manual	0.00~Max flow				
11	Relay 2 off Point	Refer to manual	0.00~Max flow				
12	Relay simulation	-	-				

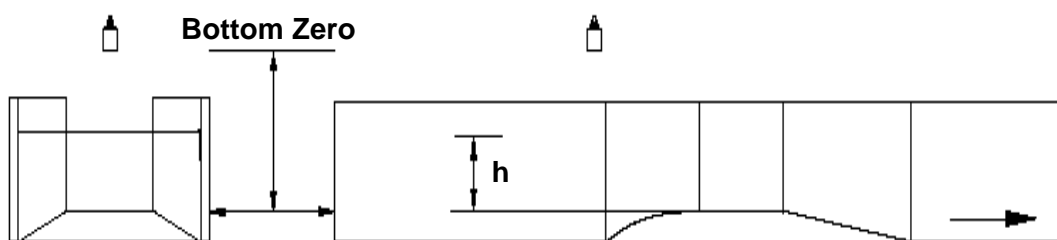
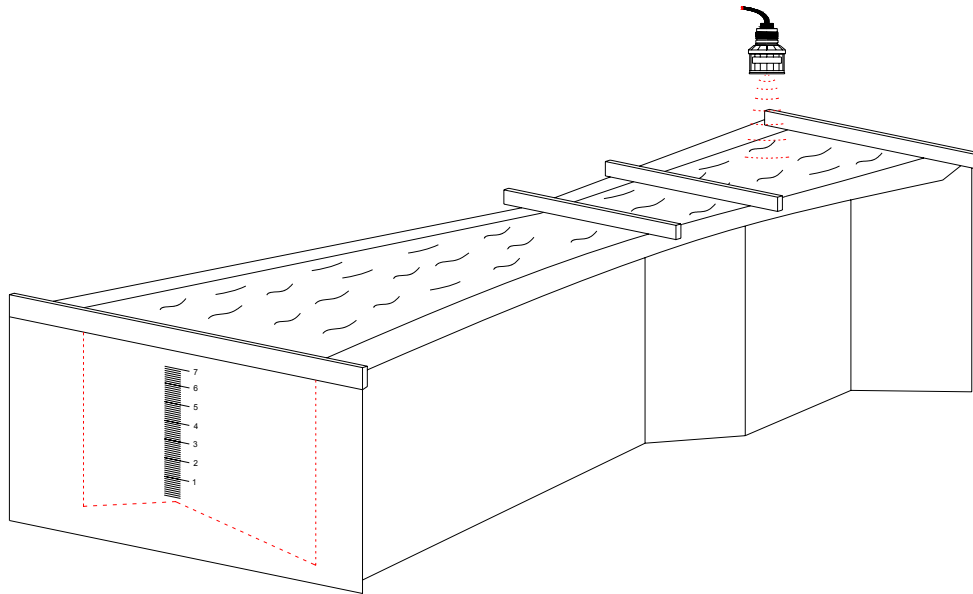
COMPENSATION

13	Low cut value	0.00	0.00~Max flow				
14	High cut value	Refer to manual	0.00~Max flow				
15	Time	-	-				
16	Totalizer	-	-				
17	Data save time	10 min.	1~60min				
18	Pulse value	30.00m ³	Refer to manual				
19	Pulse period	0.10sec	0.01~1.00sec				
20	Data transfer	-	-				
21	Blanking	0.350m	0.250~3.00m				
22	Transmit power	3	1,2,3,4,5				
23	Output damping	10 sec	0,1,2,5,10,20 50,100 sec				
24	Fail safe current	3.8mA	3,8mA/HOLD 21.0mA				
25	Fail safe time	120 sec	20~999sec				
26	Detect threshold	4	3~15				
27	12mA output	-	-				

< Appendix > Schematic Diagrams of Channels

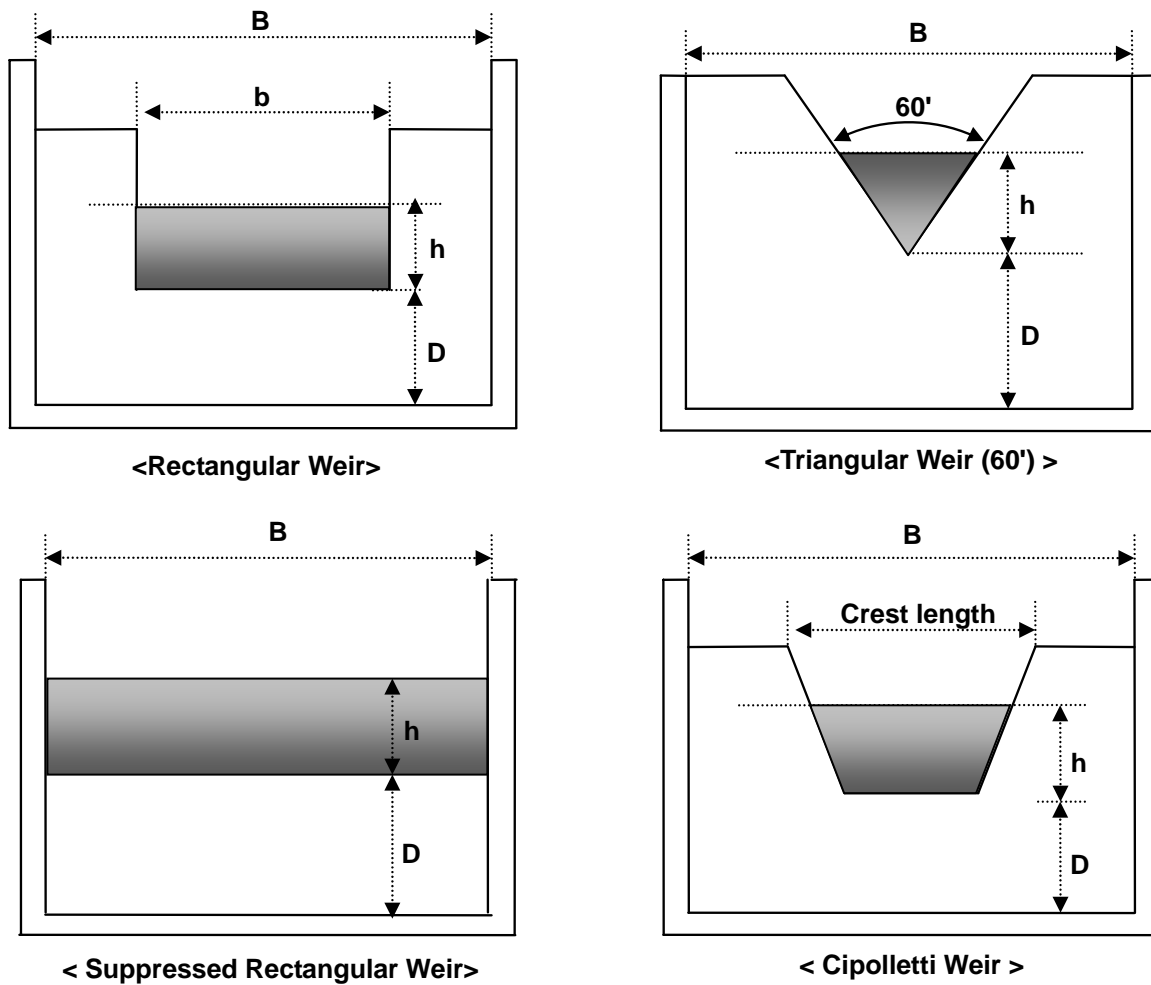
A. Parshall Flume

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

Weir



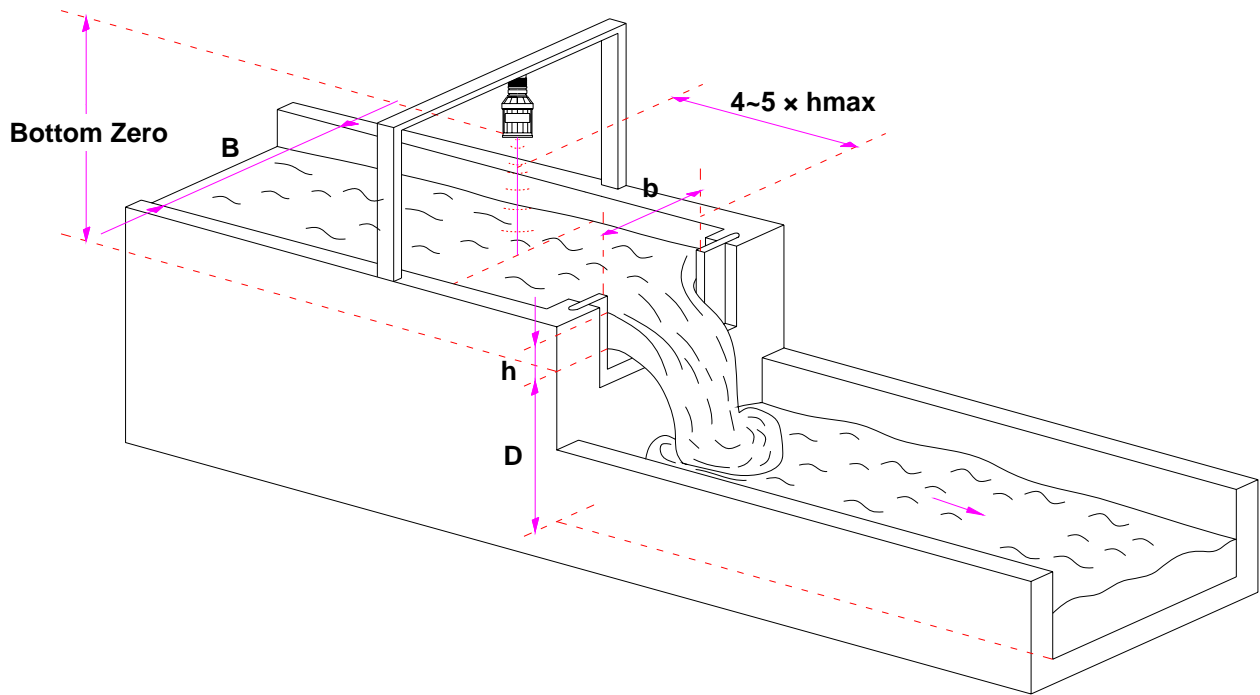
<Fig. B-1 > Front Views of Weirs

h : Water level

B : Suppressed Rectangular Weir's Width (m)

b : Rectangular Weir's Width (m)

D : Thickness from Weir's Bottom (m)



<Fig. B-2 > Aerial View of Rectangular Weir