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# Installation and Operating Instructions

**USonic-R™ Series**  
2-Channel Continuous Remote  
Ultrasonic Level Transmitter  
using USR-XXXX Series  
Electronics  
and USS-XX Remote Sensors

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**USonic-R™ Series**  
2-Channel Continuous Remote  
Ultrasonic Level Transmitter  
using USR-XXXX Series Electronics  
and USS-XX Remote Sensors



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# **Section 1**

## **Section 1: Introduction**

### **1.1 Product Description**

The AMETEK Drexelbrook® USonic-R™ Series Level Measurement System is a 2-Channel, Line Powered, assembly. Using ultrasonic technology, the USonic-R™ continuously and accurately measures **Level & Distance** up to a range of 30 feet, or **Open Channel Flow**. The measurement output is a 4-20 mA current signal or **Digital Communications**. Internal Strapping tables can convert the USonic-R output signal to be proportional to volume.

The USonic-R sensor is made of CPVC for compatibility with a wide range of process materials.

### **1.2 Types of Output**

#### **Level Mode:**

Output increases as the internal level of the vessel increases.  
Level output is the most common type of output measurement.  
Configuration is referenced from the bottom of the vessel.

#### **Distance Mode:**

Output increases as the distance increases away from the transducer.  
Configuration is referenced from the Transducer Face.

#### **Flow Mode:**

Output increases as head height level increases (increasing flow rate). Output is non-linear with level changes and is based on the flow characteristic of a selected Flume, Weir, or strapping table for a custom primary flow device.

#### **Fault Indication:**

Output goes to 3.7 or 22 mA (user selectable) during a fault condition such as Lost Echo or Near Zone violations.

### 1.3 System Specifications

- **Power:** 24 VDC, 120 VAC **or** 240 VAC - Jumper Selectable
- **Output:** 4-20 mA, Analog or selected Digital
- **Sensor:** 6.5” CPVC sensor rated: -40°F to +158°F (-40°C to +70°C)
- **Sensor Mounting:** ¾” / 2” NPT or ¾” / 2” BSP (G)
- **Display Option:** 2-Line, LCD  
(7 digit-Numeric / 10 digit-Alpha-Numeric)
- **Software:** Level, Distance, Volume, Flow rate via user selectable Flume and Weir characterizations or 21-Point strapping table, Totalization via 1 resettable and 1 non-resettable totalizer. Differential Level (Channel #1 vs. Channel #2) for Submerged Flow, Sum, Difference, and Traveling Bar Screen Control, Pump Alternation, Batch Sample Activation.

### 1.4 Definition of Terms

**Zero:**

The point at which the output signal is equal to 4 mA (0%)

**Span:**

The point at which the output signal is equal to 20 mA (100%)

**Range:**

The Maximum distance measurable from the transducer face.

**Near Zone:**

The distance just below the transducer face where the transmitter cannot make a level measurement (12 inches / 305 mm).

**Lost Echo:**

A condition that occurs when the ultrasonic energy is not being returned to the transducer. For example, a loss of echo may occur when large amounts of foam are present.

**Strapping Table:**

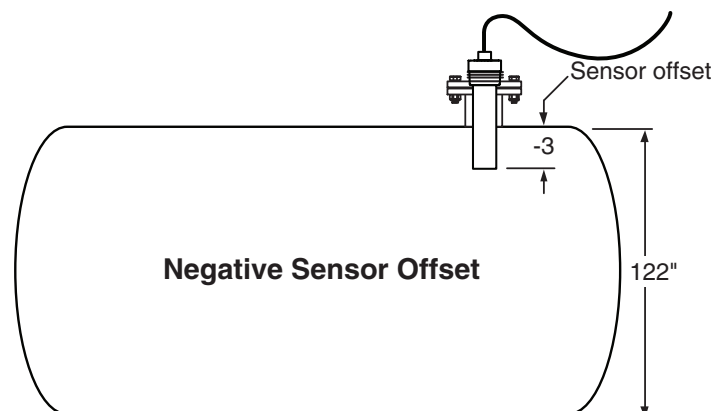
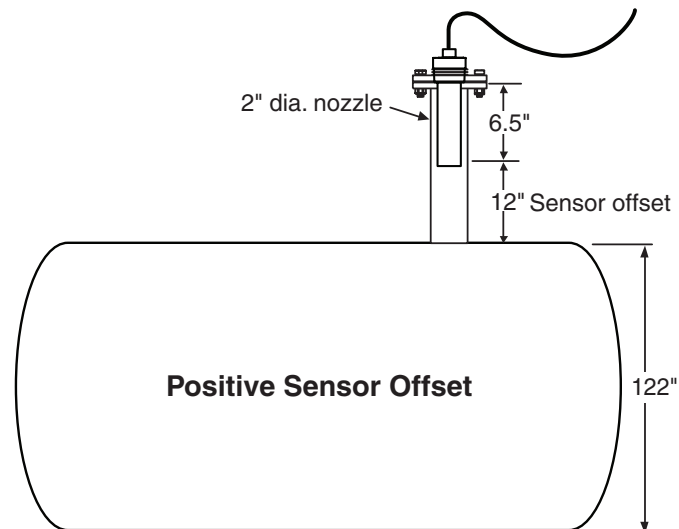
Displays the value of the input to level and output to volume in percent in a 21-Point table. This also allows points to be changed to accommodate irregular shaped vessels and custom flume or weir characterizations.

## 1.4 Definition of Terms (Continued)

### Sensor Offset:

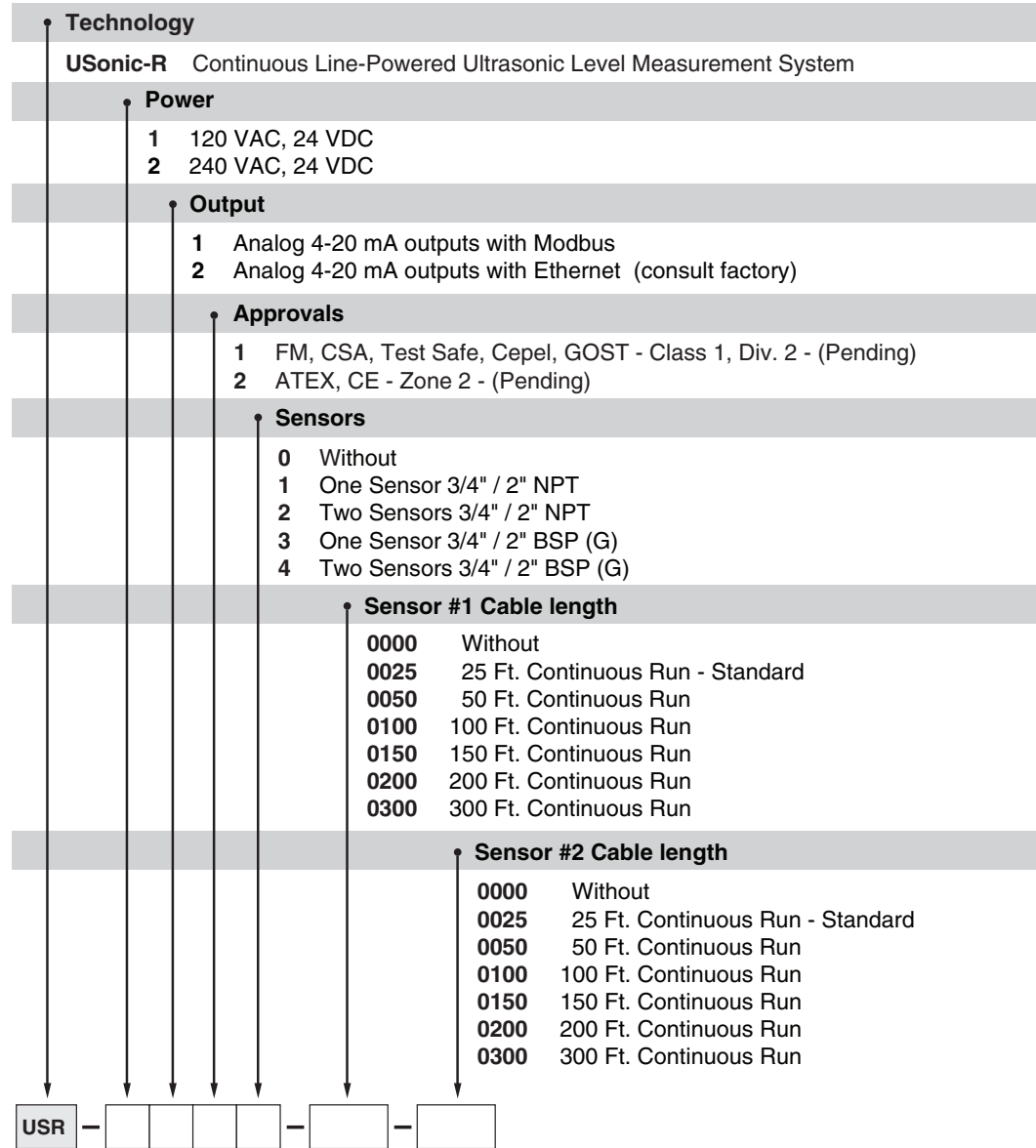
Sensor Offset is used to tell the transmitter the amount of distance above or below the top of the tank that the transducer face is located in order to calculate the tank volume. Sensor Offset can be applied in cases where:

- The transducer protrudes below the top of the tank, or
- The transducer is mounted above the top of the tank, or
- A pipe extension is installed to raise the transducer face 12 inches above the tank height to compensate for the 12-Inch Near Zone.
  - If the transducer is mounted above the top of the vessel, a **Positive** value is entered in **Sensor Offset**.
  - If the transducer is mounted below the top of the tank, a **Negative** value is entered in **Sensor Offset**.

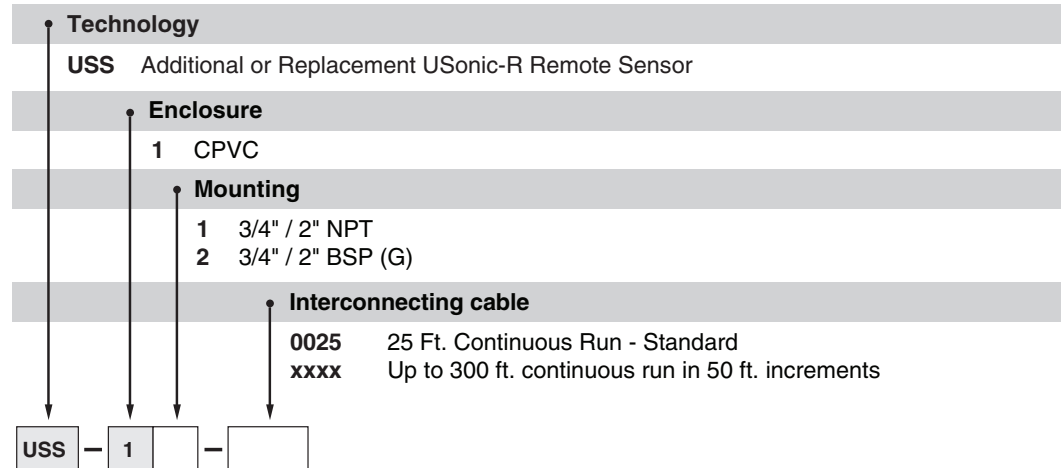


## 1.5 Models Available

### USonic-R™



### Additional or Replacement USonic-R Remote Sensor



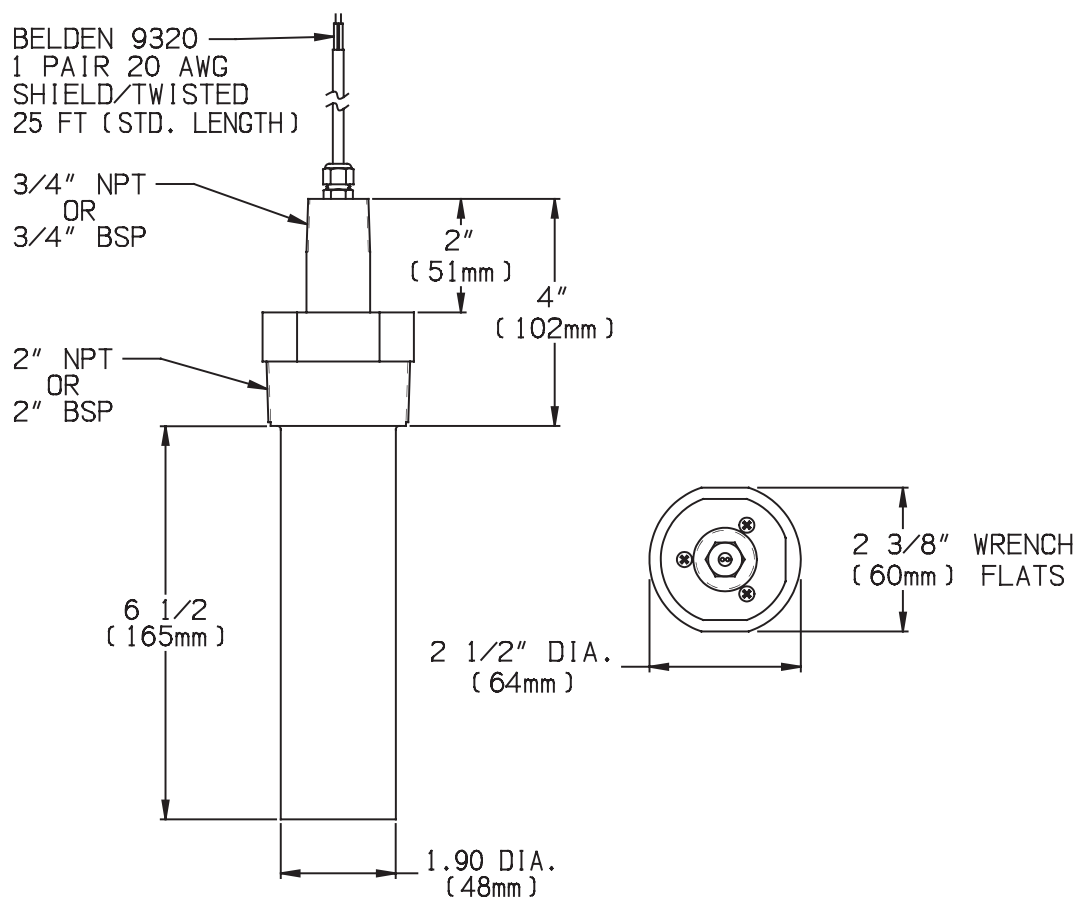
## Section 2: Installation

### 2.1 Unpacking

Carefully remove the contents of the shipping carton and check each item against the packing list before destroying any packing material. If there is any shortage or damage, report it to the factory immediately.

### 2.2 Mounting the Transmitter

The USonic-R electronic transmitter is located within the tube assembly of the sensor and is not serviceable by the user. Tampering with this construction will void any existing warranties.



**Transducer Mounting Dimensions**

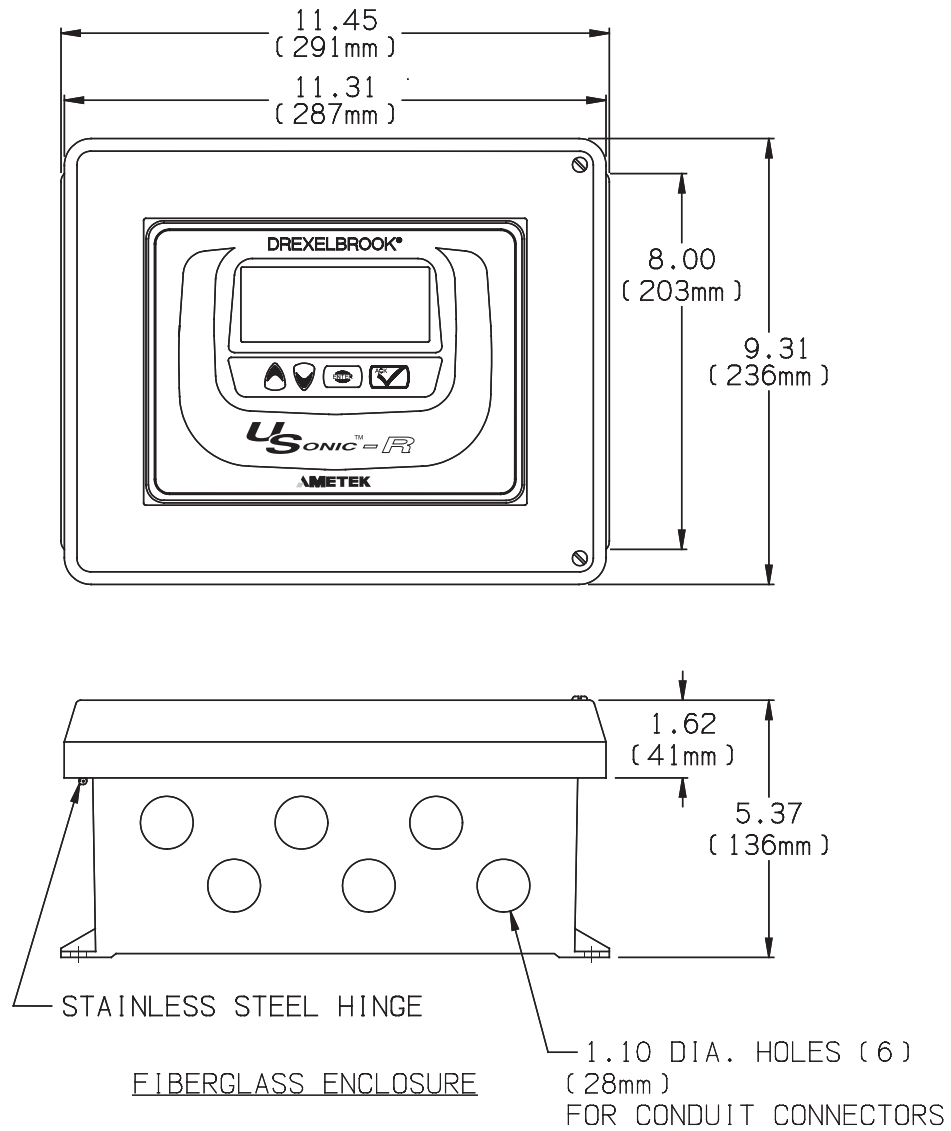


#### **Warning - Potential Electrostatic Charge Hazard**

Special Condition for Use:

For Zone 0 Installations care should be taken that the plastic sensor be installed and used in such a way that the danger of Electrostatic charge is excluded. For use only on liquid process mediums. Avoid rapid contact between the process medium and the plastic sensor.

### 2.3 Mounting the Transmitter (Continued)



**Electronics Enclosure Mounting Dimensions**

## 2.3 Mounting the Transmitter (Continued)

The USonic-R Series transmitter is designed for field mounting, but it should be mounted in a location as free as possible from vibration, corrosive atmospheres, and any possibility of mechanical damage.

For convenience when adjusting and configuring, place the USonic-R Series in a reasonably accessible location. Ambient temperature should be between -40°F to 158°F (-40°C to 70°C).

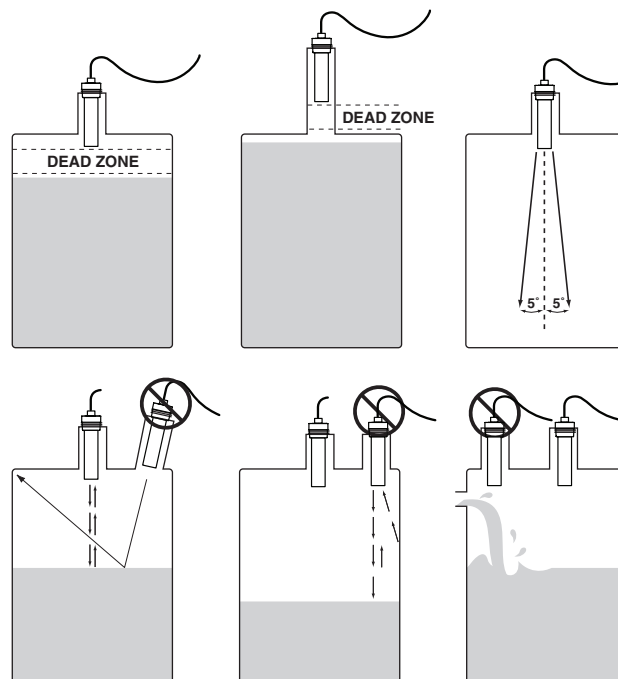
The transmitter must be mounted vertically with the transducer perpendicular to the liquid surface. When mounting the USonic-R Series transmitter, consideration must be given to the 12-Inch (305 mm) Near Zone. If the level rises to within 12 inches (305 mm) of the sensor face, a user selectable 3.7 mA or 22 mA error signal is generated; Error message (*NEAR ZONE*) is indicated.

The conical beam of the USonic-R Series is approximately 10 degrees. Therefore it is necessary to ensure that there are no unnecessary obstructions within this beam path. Erroneous reflections can adversely affect system operation.

**For Open Channel Flow** use, an optional mounting kit is available for mounting above a flume or weir to position the system above the flow stream. The mounting kit allows movement vertically and horizontally for maximum placement.

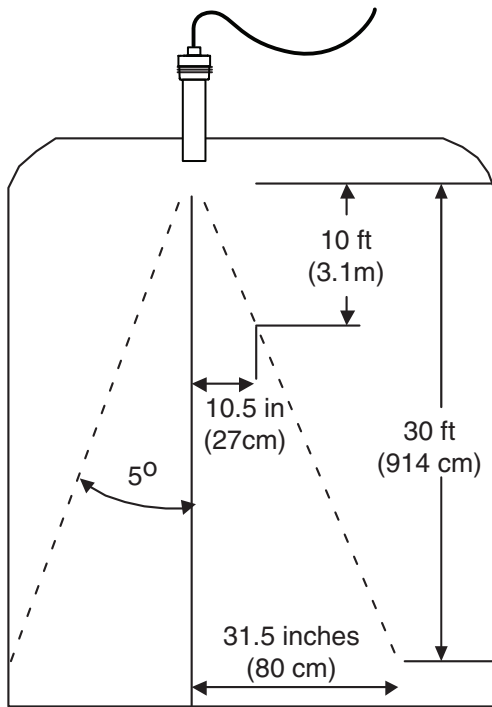
- Part # 285-0001-187 (Corrosion Resistant Aluminum)
- Part # 285-0001-188 (316 SS)

Refer to drawings 285-0001-187-CD and 285-0001-188-CD for Mounting Details.

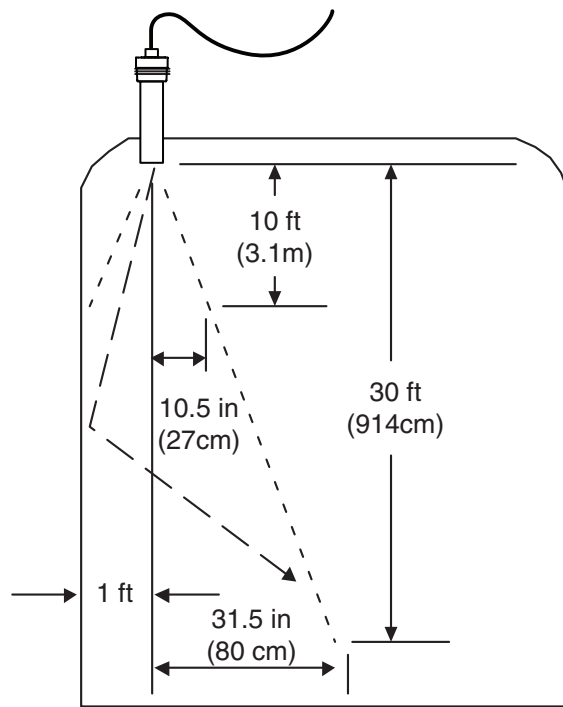


Mounting Recommendations

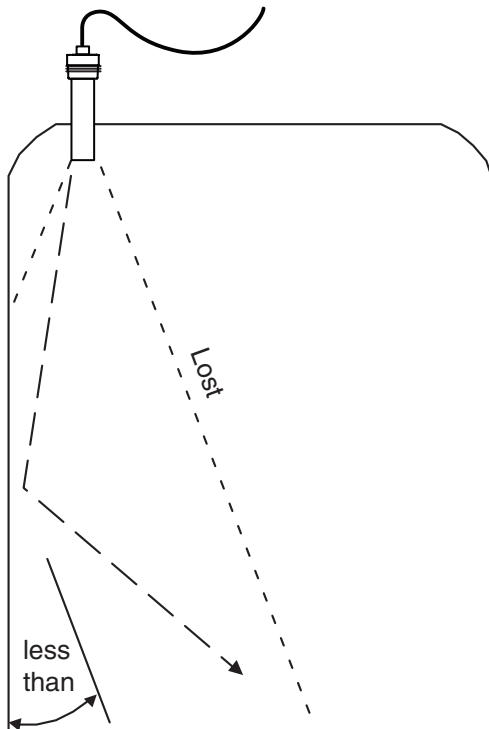
### 2.3 Installation Examples



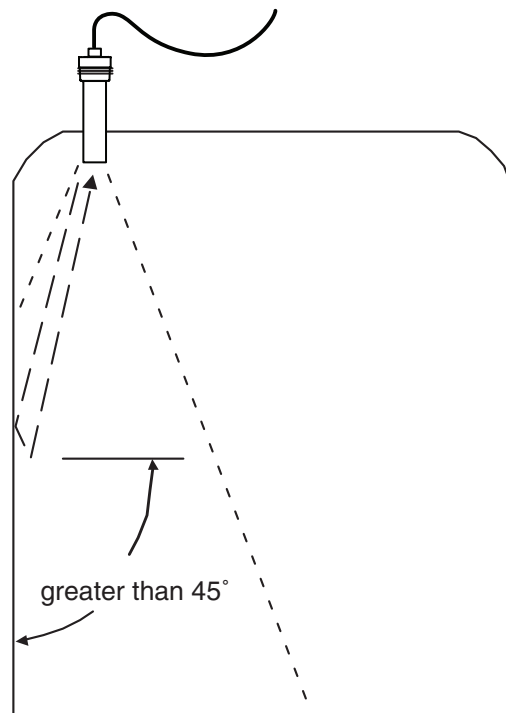
When there are no obstructions within the beam area, there is no chance of false echoes or readings.



Smooth wall in beam with no other obstructions will not cause false echoes.

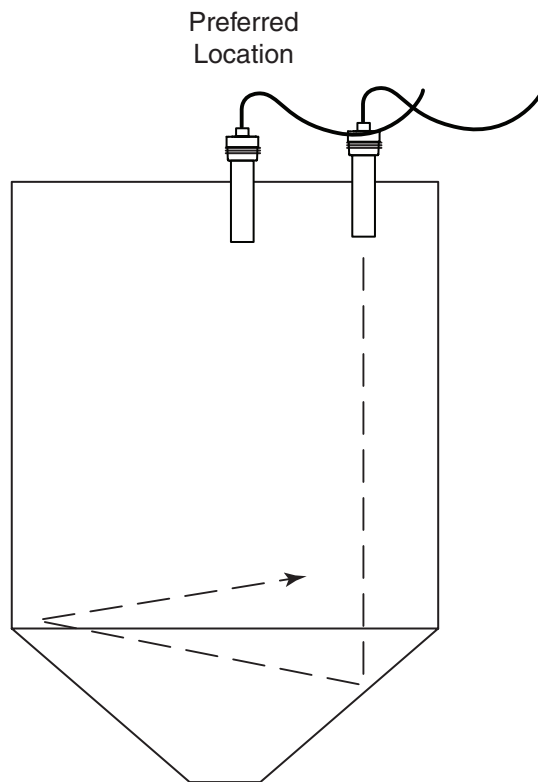


Protrusions from the wall at an angle less than 45 degrees does not cause false echoes.

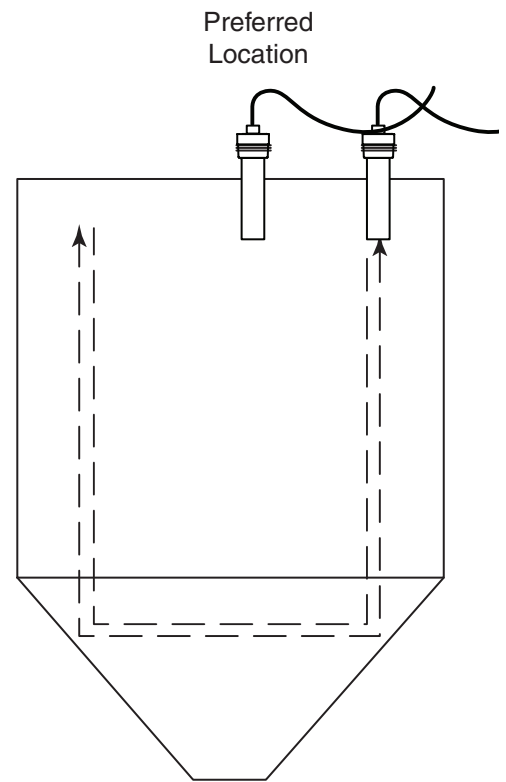


Protrusion from the wall at an angle greater than 45 degrees may cause false echoes.

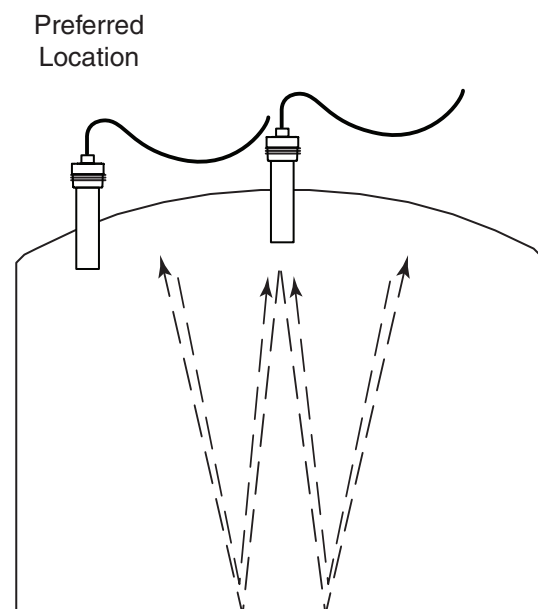
## 2.3 Installation Examples (Continued)



When mounted off center in conical bottom tanks, reflected echoes can reflect away from the transducer in the conical bottom resulting in a lost echo. Move the transducer to the center of the bin for best results.

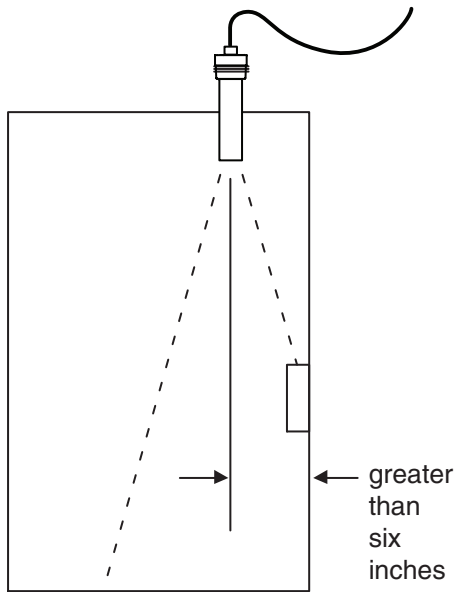


When mounted off center in conical bottom tanks, reflected echoes can be redirected back to the transducer. Use 400 mS repetition rate to allow these echoes to subside before transmitting the next pulse and/or move the transducer to another location.



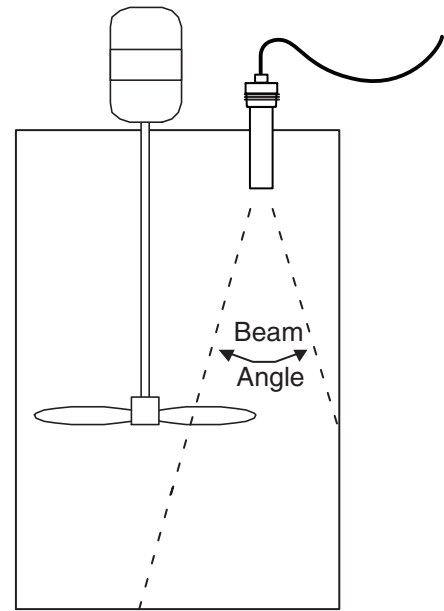
When mounted in the center of domed-roof tanks, reflected echoes can be redirected back to the transducer. Use 400 mS repetition rate to allow these echoes to subside before transmitting the next pulse and/or move the transducer to another location.

### 2.3 Installation Examples (Continued)

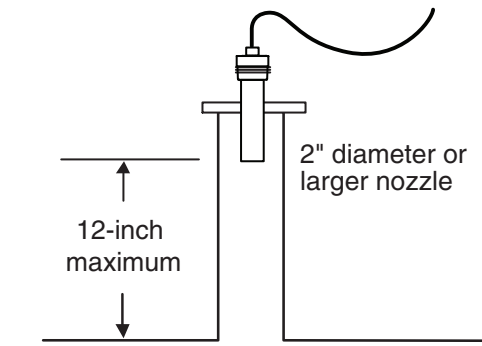
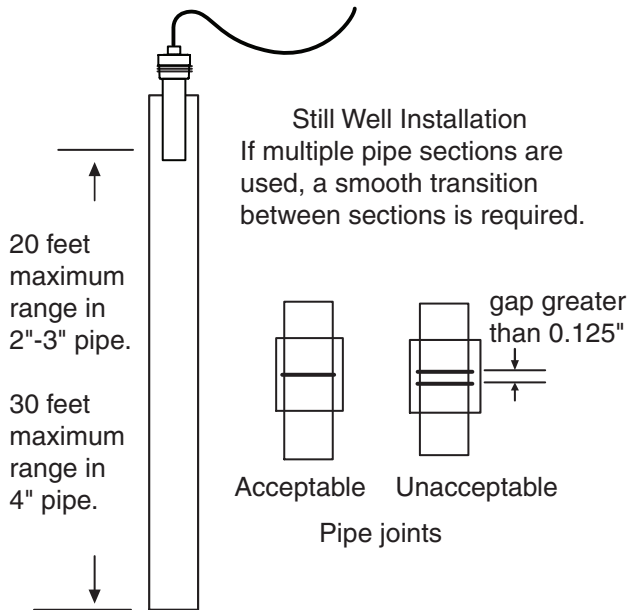


Mounted close to a wall or obstructions are present. Ability to ignore obstructions will depend on the exact size and location of the obstructions.

Use standard electronics with Smart Gain™ "SG" setting.



Agitators within the beam path



Recommended mounting when recessed in a nozzle.

## 2.4 Wiring the Transmitter



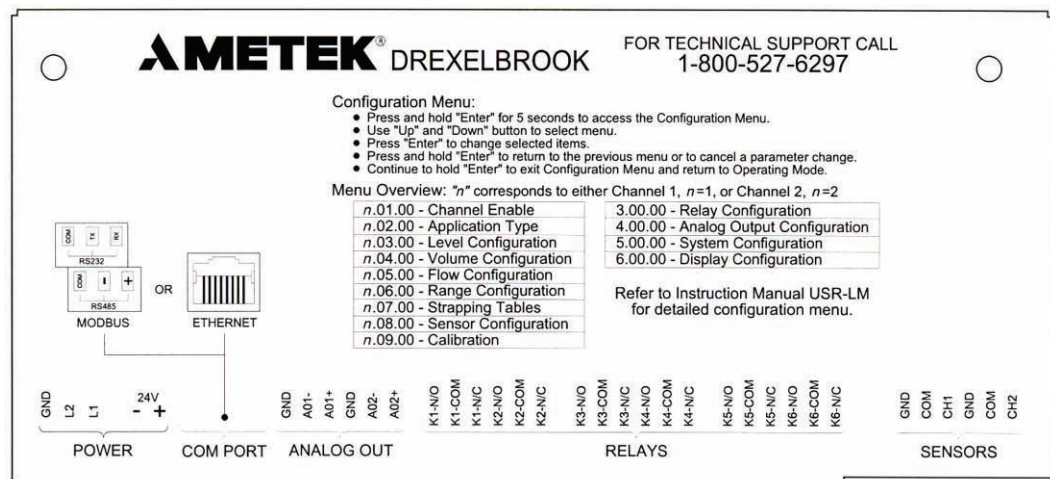
**WARNING!** If the USonic-R Series transmitter is located in a hazardous environment, do not open the enclosure cover or make/break any electrical connections without first disconnecting electrical power at the source.



Ensure that wiring, electrical fittings and conduit connections conform to electrical codes and Approval Agency Control Drawings for specific location and environment.

Refer to the Wiring Diagram of the USonic-R Series transmitter.

Connect input power, sensor relays, and signal leads to the terminal block as shown. It is recommended to use twisted, shielded pair to eliminate noise for both signal and sensor lead extensions. The shield (or drain) wire should be grounded at the power source and left floating at the USonic-R Series Transmitter end.



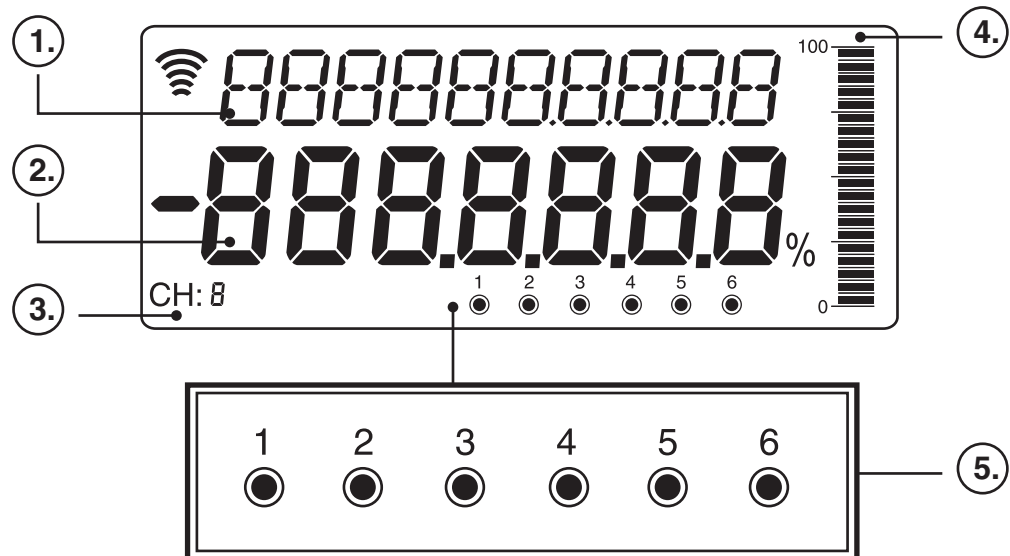
**Wiring Diagram**  
Wiring (14 - 22 AWG)

## 2.5 Installation Notes

1. Changes or modifications not expressly approved by AMETEK Drexelbrook could void the hazardous certification rating of the equipment.
2. USonic R series and USS series are to be used only in the manner outlined in this manual; otherwise protection provided by the equipment may be impaired.
3. Use Copper wiring only. Use wiring rated for 900 C or higher when ambient is above 500 C.
4. Use wire gauge AWG 18 to AWG 12
5. All unused openings must be closed / plugged with suitable components to maintain protective rating of the enclosure (Type 4, 4X IP 65).
6. The equipment must not be installed directly in any process where the enclosure might be charged by the rapid flow of non-conductive media.
7. The equipment must only be cleaned with a damp cloth.
8. The Transducer has been supplied with a grounding connection. Check the local codes or authority having jurisdiction for grounding requirements.
9. Dust tight conduit seal must be used when installed in Class II and Class III environments

### Section 3: LCD Display

1. 10 digit Alpha numeric - Displays Data such as Units of Measurement and Description of Menu Item
2. 7 Digit Numeric - Displays the numeric values such as distance and Menu item number.
3. Channel - Displays the current input channel being viewed. If this display item is blank, the item being displayed is an Analog output or a differential value such as Traveling screen.
4. Range meter (0 - 100%) - To change the scale of the Range meter, change the Range setting in the Range Configuration menu. **Refer to Menu Item n.3.00 Range - Config Menu.** (Where *n* is the Channel Number).
5. Relays - The outer ring indicates that the relay is configured. The inner dot indicates the relay is in the alarm condition.



## Section 3: LCD Display (Continued)

### Using the Keypad in the Configuration Mode

- The “ENTER” button is used to access the configuration menu, and select items to be modified
- The UP and DOWN arrows are used in the configuration menu to change selections, and modify numeric values.
- Press and HOLD the ENTER button for 5 seconds to access the configuration menu.
- Use the UP and DOWN buttons to select menu items
- Press the ENTER button to change the selected item
- Press and HOLD the enter button to get to the previous menu, or continue to hold to exit the configuration menu.

### Using the Keypad While in the Operating Mode

- Tapping the ENTER button changes the Displayed Channel (1 or 2), Differential Level, or the Analog Output Value (1 or 2)
- Tapping the UP or DOWN button changes the displayed variable (level, distance, temperature, etc)
- Pressing the UP and DOWN buttons simultaneously, forces target aquisition of current channel displayed
- Pressing the ACKNOWLEDGE button clears any previously un-acknowledged alarms.



## Section 4: Configuration

### 4.1 System Configuration with Display / Keypad

#### **Application Type:**

Allows the user to select an appropriate "Application Type" for the application. The valid Application Types are:

- *LEVEL*
- *FLOW*

Only one "Application Type" may be selected for each Channel. Once selected, only the Functions of the selected Application Type will be available.

#### **Channel Settings**

The USonic-R Channel Settings are made up of 6 separate functions for application set-up.

#### **Strapping Table:**

Allows the user to edit the 21-Point user defined table that can provide output signal as a percent of volume or flow.

#### **Point Calibration:**

Allows a 1-Point calibration based on a known distance from the transducer face. This can adjust for any possible variations that may exist in the speed of sound, or to provide an optimized calibration data point in difficult applications, such as vapor.

#### **System Settings:**

Allows setting changes to the system configuration.

#### **Display Settings:**

Allows the system to Display or Hide different readings. Any or All may be selected and the display may automatically "cycle" for a selected interval.

## 4.2 Configuration Menu

### To enter the Configuration Menu:

- Press and hold "ENTER" button for 5 seconds to access configuration menu.
- Use "UP" and "DOWN" buttons to select menu.
- Press "ENTER" button to change selected item.
- Press and Hold "ENTER" button to go to the previous menu, or continue to Hold to exit configuration menu.
- Press "UP" and "DOWN" buttons simultaneously to force target acquisition.



### 1.00.00 CHANNEL 1

<b>1.01.00</b>	<b>ENABLE</b>	
1.01.01	ENABLE	YES / NO
<b>1.02.00</b>	<b>APPLICATION TYPE</b>	
1.02.01	APP TYPE	LEVEL / FLOW
<b>1.03.00</b>	<b>LEVEL</b>	
1.03.01	UNITS	IN / FT / MM / CM / M
1.03.02	TANK HEIGHT	USER DEFINED NUMERIC VALUE (360")
1.03.03	OFFSET	USER DEFINED NUMERIC VALUE (0")
<b>1.04.00</b>	<b>VOLUME</b>	
1.04.01	VESSEL TYPE	VERTICAL / HOR CYL FLAT / HOR CYL DISHED / HOR CYL HEMI / SPHERE / CUSTOM
1.04.02	LOAD STANDARD TABLE	VERTICAL / HOR CYL FLAT / HOR CYL DISHED / HOR CYL HEMI / SPHERE
1.04.03	VESSEL UNITS	GALLONS / M3 / LITERS / BARRELS / IMPERIAL GALLONS
1.04.04	MAX CAPACITY	USER DEFINED NUMERIC VALUE (1000GAL)

## 4.2 Configuration Menu (Continued)

### 1.00.00 CHANNEL 1 (Continued)

<b>1.05.00</b>	<b>FLOW (FLOW MENU SHOWN ONLY WHEN FLOW IS SELECTED IN 1.02.01)</b>	
1.05.01	FLOW TYPE	PARSHALL/ SUB FLOW PARSHALL/ PALMER BOWLUS/ TRAPEZ FLUME / RECT WEIR W/WO END
1.05.02	FLUME SIZE	CODE FROM TABLE OR NUMERIC VALUE - <i>See Section 4.8</i>
1.05.03	FLOW UNITS	GPM / MGD / M3/ HR
1.05.04	MAX FLOW	USER DEFINED NUMERIC VALUE
1.05.05	HEAD UNITS	IN / FT / MM / CM / M
1.05.06	ZERO DISTANCE	USER DEFINED NUMERIC VALUE (ENTER DISTANCE FROM SENSOR FACE TO ZERO FLOW)
1.05.07	OFFSET	USER DEFINED NUMERIC VALUE (USED ONLY WITH CUSTOM FLUMES - <i>See Section 1.4</i> )
1.05.08	DELAY	USER DEFINED NUMERIC VALUE, 0-10 SECONDS
1.05.09	TOTALIZER SCALE	X100 / X1K / X10K / X100K
1.05.10	RESET TOTALIZER	NO / YES
<b>1.06.00</b>	<b>RANGE CONFIG</b>	
1.06.01	RANGE ASSIGN	LEVEL / VOLUME / FLOW / DISTANCE
1.06.02	LRV (Lower Range Value)	USER DEFINED NUMERIC VALUE (0")
1.06.03	URV (Upper Range Value)	USER DEFINED NUMERIC VALUE (348")
<b>1.07.00</b>	<b>STRAPPING</b>	
1.07.01	MAX POINTS	2...21
1.07.02	IN PT 1	USER DEFINED NUMERIC VALUE
1.07.03	OUT PT 1	USER DEFINED NUMERIC VALUE
1.07.04 - 1.07.43	IN / OUT POINTS	USER DEFINED NUMERIC VALUE
<b>1.08.00</b>	<b>SENSOR</b>	
1.08.01	GAIN	SG/ 100% / 84% / 67% / 50% / 32% / 17% / 8%
1.08.02	SG ADJUST	NUMERIC VALUE (CONSULT FACTORY)
1.08.03	REP RATE	300MS / 400MS
1.08.04	NEAR ZONE FAULT	HIGH / LOW (22mA / 3.7mA)
1.08.05	LOST ECHO FAULT	HIGH / LOW (22mA / 3.7mA)
1.08.06	SW REV	READ ONLY DATE CODE (TRANSDUCER SOFTWARE VERSION)
<b>1.09.00</b>	<b>CALIBRATION</b>	
1.09.01	POINT	CONSULT MANUAL (FACTORY CALIBRATED) - <i>See Section 8.2</i>
1.09.02	TEMPERATURE	ENTER ACTUAL TEMP AT TRANSDUCER

## 4.2 Configuration Menu (Continued)

### 2.00.00 CHANNEL 2

2.01 - 2.09	CHANNEL 2	(SAME AS AS CHANNEL 1)
-------------	-----------	------------------------

### 3.00.00 RELAYS

<b>3.01.00</b>	<b>RELAY 1</b>	
3.01.01	ENABLE	YES / NO
3.01.02	RELAY TYPE	ALARM / CONTROL / SAMPLE / PUMP 1,2,3,4,5,6
3.01.03	CHANNEL ASSIGNMENT	CHANNEL 1 / CHANNEL 2
3.01.04	ASSIGNMENT	LEVEL / VOLUME / FLOW / RANGE / FLOW SUM / FLOW DIFF / SUBMG / TRAV SCREEN / L.E / N.Z / DIST
3.01.05	SETPOINT	USER DEFINED NUMERIC VALUE
3.01.06	DEADBAND	USER DEFINED NUMERIC VALUE
3.01.07	SAMPLE VALUE	USER DEFINED NUMERIC VALUE
3.01.08	TIME DELAY	USER DEFINED NUMERIC VALUE, 0-99 SECONDS
3.01.09	TIME DELAY MODE	FORWARD / REVERSE
3.01.10	FAILSAFE	HLFS / LLFS
<b>3.02 - 3.06</b>	<b>RELAYS 2 - 6</b>	SAME AS ABOVE

### 4.00.00 ANALOG OUT

<b>4.01.00</b>	<b>AO #1</b>	
4.01.01	CHANNEL ASSIGN	CHANNEL 1 / CHANNEL 2
4.01.02	ASSIGNMENT	LEVEL / VOLUME / FLOW / RANGE / FLOW SUM / FLOW DIFF / SUBMG / TRAV SCREEN / DIST
4.01.03	ZERO	USER DEFINED NUMERIC VALUE (0%)
4.01.04	SPAN	USER DEFINED NUMERIC VALUE (100%)
4.01.05	DAMPING	USER DEFINED NUMERIC VALUE, 0-99 SECONDS
4.01.06	LOCK MA	USER DEFINED NUMERIC VALUE
4.01.07	TRIM 4MA	CONSULT MANUAL - <b>See Section 8.3</b>
4.01.08	TRIM 20MA	CONSULT MANUAL - <b>See Section 8.3</b>
<b>4.02.00</b>	<b>AO #2</b>	SAME AS ABOVE

## 4.2 Configuration Menu (Continued)

### 5.00.00 SYSTEM

<b>5.01.00</b>	<b>PASSWORD</b>	
5.01.01	PASSWORD ENABLE	NO / YES
5.01.02	CHANGE PASSWORD	ENTER NEW KEY SEQUENCE
<b>5.02.00</b>	<b>MISCELLANEOUS</b>	
5.02.01	SET CLOCK	
5.02.02	RESET FACTORY DEFAULTS?	NO / YES
5.02.03	SW REV	READ ONLY DATE CODE (RECEIVER SOFTWARE VERSION)
5.02.04	SERIAL NUMBER	READ ONLY ALPHA-NUMERIC VALUE
<b>5.03.00</b>	<b>DATA LOGGER</b>	
5.03.01	ENABLE	NO / YES
5.03.02	INTERVAL	5 SECONDS - 12 HOURS
5.03.03	DURATION	READ ONLY DURATION OF DATALOGGER
5.03.04	OVERWRITE	NO / YES
<b>5.04.00</b>	<b>COMMUNICATIONS</b>	
5.04.01	BAUD RATE	9600 / 19200 (19200)
5.04.02	COMMUNICATIONS TYPE	RS232 / RS485 (RS232)
5.04.03	DEVICE ID	1-32 (1)

## 4.2 Configuration Menu (Continued)

### 6.00.00 DISPLAY

<b>6.01.00</b>	<b>CONFIGURE</b>	
6.01.01	AUTOSCROLL	ENABLE / DISABLE
6.01.02	SCROLL RATE	USER DEFINED NUMERIC VALUE (10 sec)
6.01.03	HIDE ALL	YES / NO
6.01.04	SHOW ALL	YES / NO
<b>6.02.00</b>	<b>CHANNEL 1</b>	
6.02.01	RANGE	SHOW / HIDE
6.02.02	LEVEL	SHOW / HIDE
6.02.03	DISTANCE	SHOW / HIDE
6.02.04	VOLUME	SHOW / HIDE
6.02.05	FLOW	SHOW / HIDE
6.02.06	TOTALIZER	SHOW / HIDE
6.02.07	RESETTABLE TOTALIZER	SHOW / HIDE
6.02.08	TEMPERATURE	SHOW / HIDE
<b>6.03.00</b>	<b>CHANNEL 2</b>	
6.03.01	RANGE	SHOW / HIDE
6.03.02	LEVEL	SHOW / HIDE
6.03.03	DISTANCE	SHOW / HIDE
6.03.04	VOLUME	SHOW / HIDE
6.03.05	FLOW	SHOW / HIDE
6.03.06	TOTALIZER	SHOW / HIDE
6.03.07	RESETTABLE TOTALIZER	SHOW / HIDE
6.03.08	TEMPERATURE	SHOW / HIDE
<b>6.04.00</b>	<b>BOTH</b>	
6.04.01	FLOW SUM	SHOW / HIDE
6.04.02	FLOW DIFF	SHOW / HIDE
6.04.03	SUBMERGED FLOW	SHOW / HIDE
6.04.04	TRAVELLING SCREEN	SHOW / HIDE
<b>6.05.00</b>	<b>ANALOG OUTPUT 1</b>	
6.05.01	SHOW AO1	SHOW / HIDE
<b>6.06.00</b>	<b>ANALOG OUTPUT 2</b>	
6.06.01	SHOW AO2	SHOW / HIDE

## 4.2 Configuration Menu (Continued)

### PRIMARY DEVICE CODES

TRAPEZOIDAL FLUME	
CODE	SIZE
1	SMALL 60 DEG16
2	LARGE 60 DEG
3	X-LARGE 60 DEG
4	3 FT 60 DEG
5	2 IN 45 DEG WSC
6	12 IN 45 DEG SRCRC
7	24 SRCRC

PALMER BOWLUS	
CODE	SIZE (IN)
1	4
2	6
3	8
4	10
5	12
6	15
7	18
8	21
9	24
10	27
11	30

PARSHALL	
CODE	THROAT (IN)
1	1
2	2
3	3
4	6
5	9
6	12
7	18
8	24
9	36
10	48
11	60
12	72
13	96

H - FLUME	
CODE	SIZE (IN)
1	6
2	9
3	12
4	18
5	24
6	30
7	36
8	54

V-NOTCH WEIR	
CODE	SIZE
1	22.5 DEG
2	30 DEG
3	45 DEG
4	60 DEG
5	90 DEG
6	120 DEG

**Rectangular Weir - with or without End Contractions:** Enter Crest Length

**Trapezoidal Weir:** Enter Crest Length

**Leopold Lagco Flume:** Enter Flume Size

### 4.3 Level Application (output increases as liquid level increases)

**Configure as follows:**

1. Select the desired channel to configure.  
 $n$  = either Channel 1.00.00 or Channel 2.00.00
2. Ensure the desired channel is enabled  $n.01.01$
3. Select LEVEL in the application type menu  $n.02.01$
4. Set the Range assignment to LEVEL in menu  $n.03.01$
5. Assign the desired LRV (4mA value) in menu  $n.03.02$
6. Assign the desired URV (20mA value) in menu  $n.03.03$
7. Select the units of measurement in menu  $n.04.01$
8. Enter the tank height in menu  $n.04.02$  (for applications where tank dimensions are not important, you may enter in the distance from the transducer face to the 4mA point)
9. Enter an Offset (if needed) in menu  $n.04.03$ . (this value is used to compensate for differences in elevation between the top of the tank and the transducer face. It is only changed when the displayed level must agree with the actual tank height. In simple applications, where the tank height is not important, enter 0. - *See Section 1.4* for more details.
10. Configure the analog output using menu 4.0 $n$ .00. Assignment should be set to LEVEL to provide a 4-20mA signal proportional to the level in the vessel.  $n$  = Analog Output Signal 1 or 2

#### **4.4 Distance Application** (Indication referenced from the transducer face)

**Configure as follows:**

1. Select the desired channel to configure.  
*n* = either Channel 1.00.00 or Channel 2.00.00
2. Ensure the desired channel is enabled *n*.01.01
3. Select LEVEL in the application type menu *n*.02.01
4. Set the Range assignment to DISTANCE in menu *n*.03.01
5. Assign the desired LRV (4mA value) in menu *n*.03.02 (referenced from the transducer face)
6. Assign the desired URV (20mA value) in menu *n*.03.03 (referenced from the transducer face)
7. Select the units of measurement in menu *n*.04.01
8. Enter the tank height in menu *n*.04.02
9. Enter an Offset (if needed) in menu *n*.04.03 (typically set to 0).
10. Configure the analog output using menu 4.0*n*.00. (Assignment should be set to DISTANCE to provide a 4-20mA signal proportional to the distance from the transducer face) *n* = Analog Output Signal 1 or 2

## 4.5 Standard Flow Application

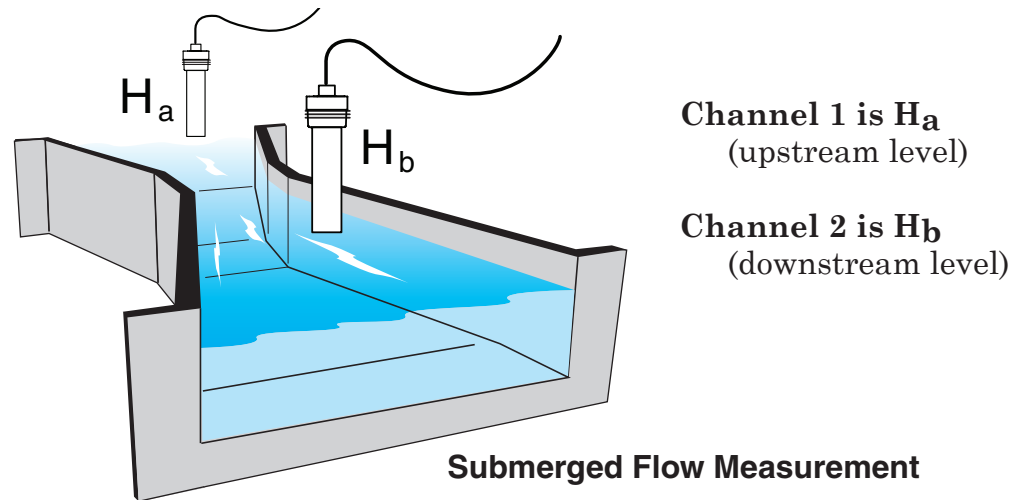
Standard Flow uses the head height/level of the selected channel and converts it to an output of flow. The relationship is determined by selecting the proper flume or weir used for the application. - **See Section 4.8** for the list of available flumes and weirs. The strapping table may be used to create a custom flow table if a flume or weir is not available in the USonic-R.

### Configure as follows:

1. Select the desired channel to configure.  
 $n$  = either Channel 1.00.00 or Channel 2.00.00
2. Ensure the desired channel is enabled  $n.01.01$
3. Select FLOW in the application menu  $n.02.01$
4. Select the FLOW TYPE in menu  $n.06.01$
5. Select the FLUME SIZE in menu  $n.06.02$  (see table for valid sizes)
6. Select FLOW UNITS in menu  $n.06.03$
7. Enter the MAX FLOW rate in menu  $n.06.04$
8. Select HEAD UNITS in menu  $n.06.05$
9. Enter the distance from the transducer face to the zero-flow point (zero distance) in menu  $n.06.06$
10. Enter the OFFSET value in menu  $n.06.07$  (Used with custom flumes only. **When using standard flumes selected from Section 4.8 – offset MUST be set to 0**)
11. Enter damping time in seconds (if desired) in menu  $n.06.08$
12. Select the totalizer scale if desired in menu  $n.06.09$
13. Assign the RANGE to FLOW in menu  $n.03.01$
14. Assign the desired LRV (4mA value) in menu  $n.03.02$
15. Assign the desired URV (20mA value) in menu  $n.03.03$
16. Configure the analog output using menu 4.0 $n$ .00. (Assignment should be set to FLOW to provide a 4-20mA signal proportional to the flow rate.)  $n$  = Analog Output Signal 1 or 2

## 4.6 Submerged Flow in Parshall Flumes

The submerged flow selection uses both input channels per application. The submerged flow requires the measurement of both an upstream level ( $H_a$ ) and a downstream level ( $H_b$ ) to determine the actual flow rate. This relationship is submergence ( $H_b/H_a$ ).



### Configure as follows:



Refer to menu items 1.00.00 for channel 1 and menu items 2.00.00 for channel 2

1. Select FLOW in the Application Type menu of both channels (menu item 02.00).
2. Select the SUBMERGED PARSHALL flume type for channel 1 (menu item 06.01).
3. Select the desired FLUME SIZE for channel 1 (menu item 06.02)



**See Section 4.8** for the proper flume size code for the Parshall flume.

4. Select the desired FLOW UNITS of channel 1 (menu item 06.03)
5. Select the desired HEAD UNITS for both channels (menu item 06.05)
6. Select the distance from bottom of the flume (0 head height) to the face of the transducer of channel 1 (menu item 06.06)
7. Select the distance from bottom of the flume (0 head height) to the face of the transducer of channel 2 (menu item 06.06)
8. Assign the desired relays and analog channels to the flow of channel 1 or % submergence ( $H_b/H_a$ ).
9. To show the flow of channel 1 or % submergence values on the LCD display, enable these values in menu item 6.00.00

## 4.7 Flow Sum and Flow Difference

Flow sum computes the sum of channel 1 and channel 2, each of which are configured as individual channels. Flow difference computes the difference of the two channels (Channel 1- Channel 2)

Standard Flow uses the head height/level of the selected channel and converts it to an output of flow. The relationship is determined by selecting the proper flume or weir used for the application. **See Section 4.8** for the list of available flumes and weirs. The strapping table may be used to create a custom flow table if a flume or weir is not available in the USonic-R.

### Configure as follows:



Refer to menu items 1.00.00 for channel 1 and menu items 2.00.00 for channel 2

1. Select FLOW in the Application Type Menu of both channels (menu item 02.00).
2. Select the Flow Type for the Application of both channels (menu item 06.01).
3. Select Flume/Weir size for both channels (menu item 06.02)



The flume/weir size menu item will be a value in head height units or as a code. **See Section 4.8** for proper flume/weir size codes.

4. Select the desired flow units for both channels (menu item 06.03)
5. Select the maximum flow rate (menu item 06.04)
6. Select the desired head units for both channels (menu item 06.05)
7. Select the distance from bottom of the flume/weir (0 flow) to the face of both USonic-R Transducers (menu item 06.06)



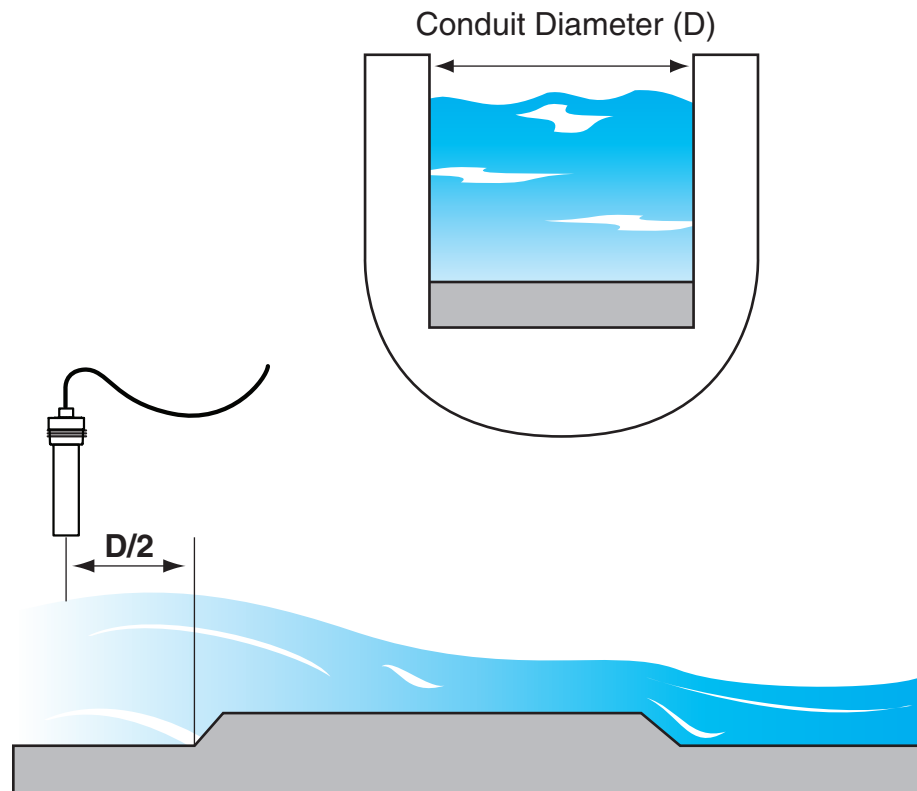
For custom flume applications, this menu item determines the maximum head height of the custom flume. If the distance to the USonic-R Transmitter is greater than the maximum head height, an offset must be added (menu item 06.07)

8. Assign the desired relays and analog channels to FLOW SUM or FLOW DIFF.
9. To show the flow sum or difference values on the LCD display, enable these values in menu item 6.00.00

## 4.8 Types of Flumes and Weirs

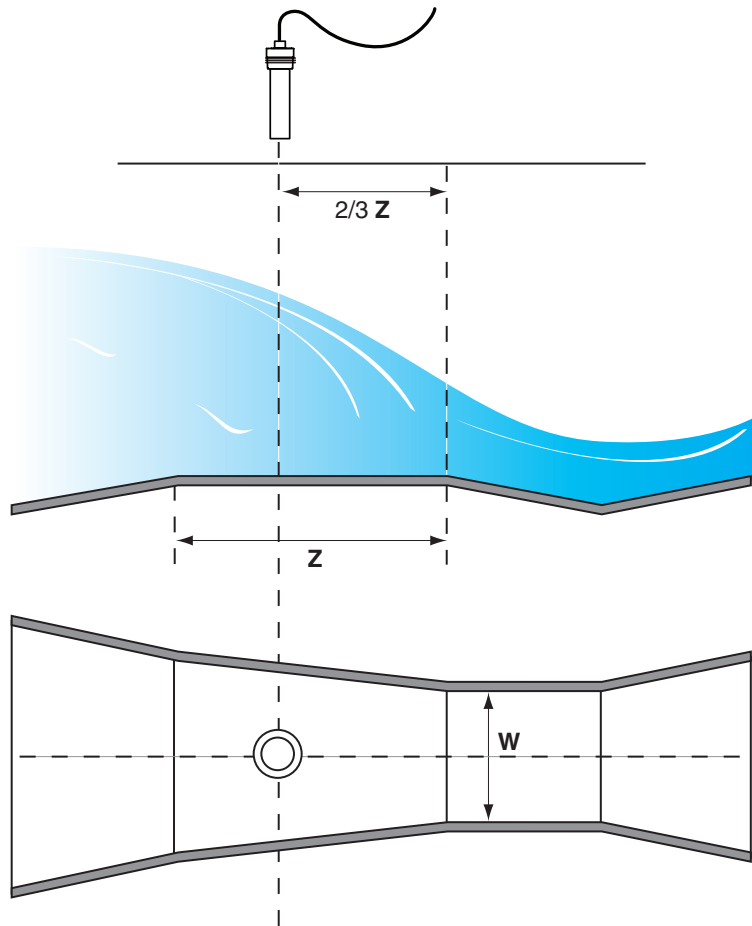
The USonic-R™ Supports the Following Flumes and Weirs:

### Leopold-Lagco Flumes (Variable Sizes):



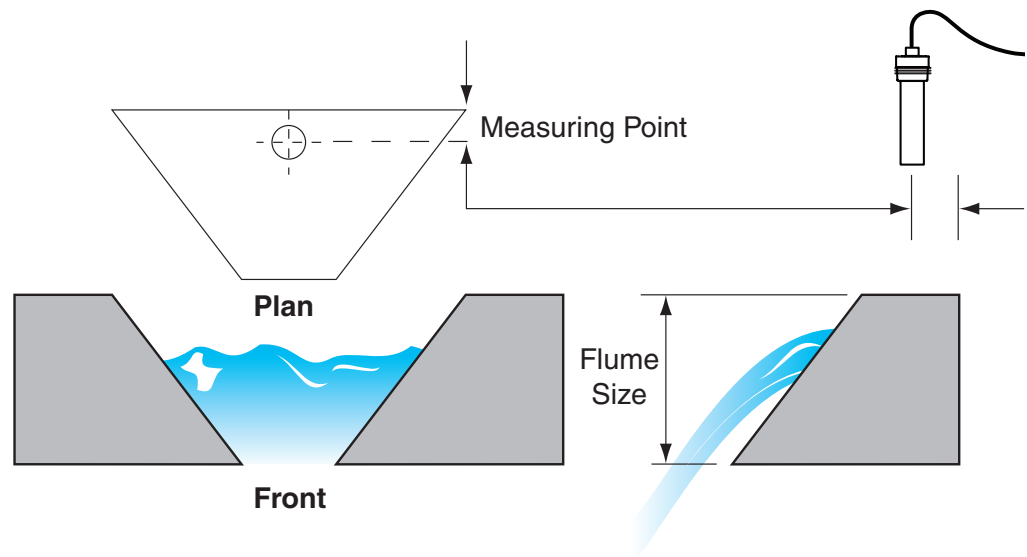
Parshall Flumes

Code	Inches	Millimeters
1	1	25
2	2	51
3	3	76
4	6	152
5	9	229
6	12	305
7	18	457
8	24	610
9	36	914
10	48	1219
11	60	1524
12	72	1829
13	96	2438



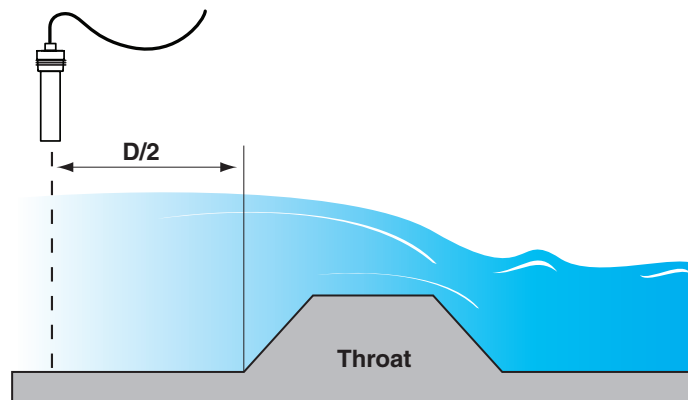
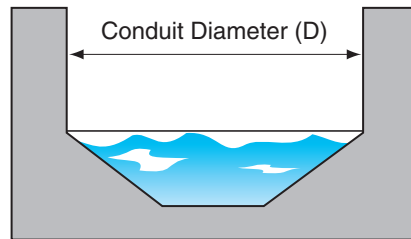
“H” Flumes

Code	Inches	Millimeters
1	6	152
2	9	229
3	12	305
4	18	457
5	24	610
6	30	762
7	36	914
8	54	1372



## Palmer Bowlus Flumes

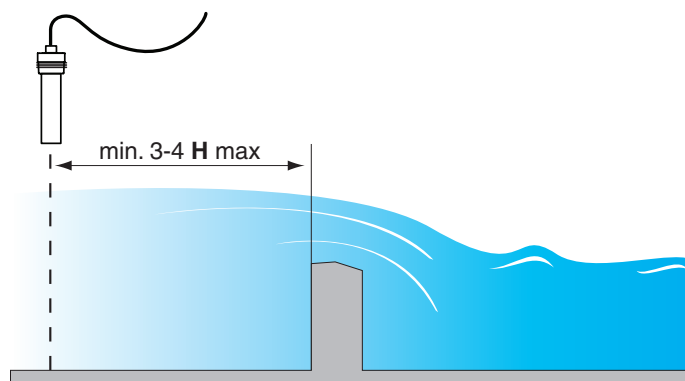
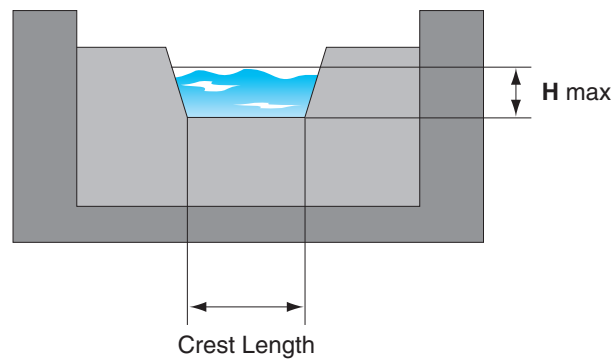
Code	Inches	Millimeters
1	4	102
2	6	152
3	8	203
4	10	254
5	12	305
6	15	381
7	18	457
8	21	533
9	24	610
10	27	686
11	30	762



## Trapezoidal (Cipolletti ) Weir (Variable Sizes)

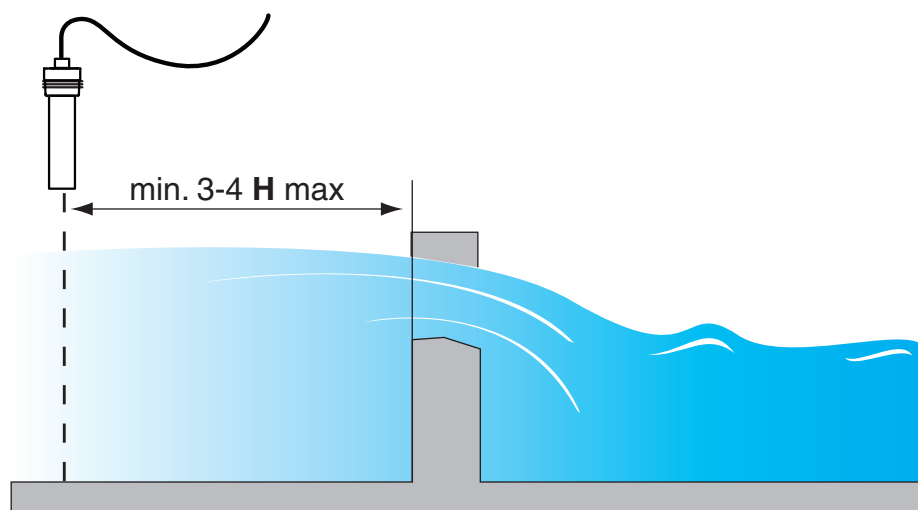
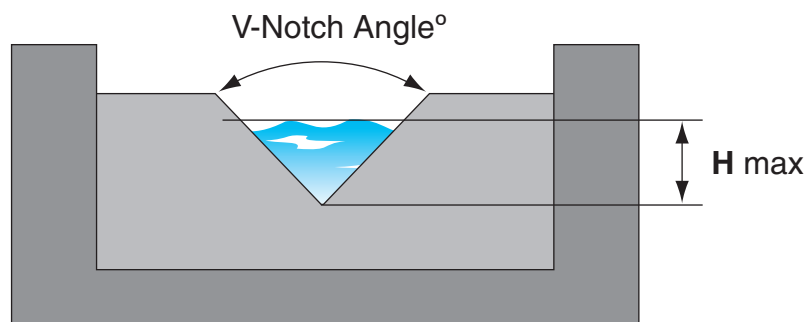
### Trapezoidal (Cipolletti ) Flume

Code	Size
1	Small 60° V
2	Large 60° V
3	X Large 60° V
4	3 ft 60° V
5	2 in 45° WSC
6	12 in 45° SRCRC
7	24 in SRCRC



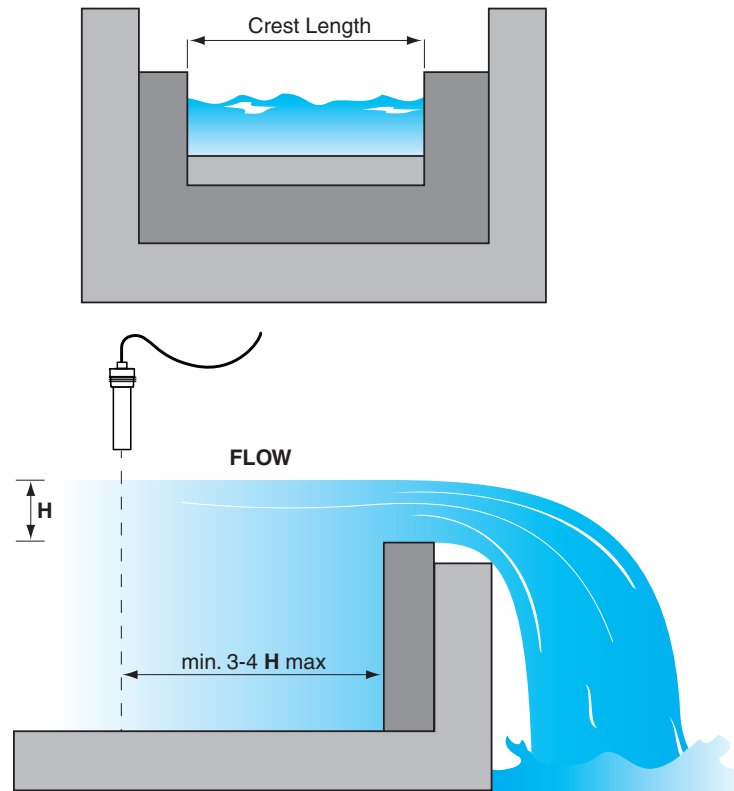
## V-Notch Weirs

Code	Size
1	22.5°
2	30°
3	45°
4	60°
5	90°
6	120°

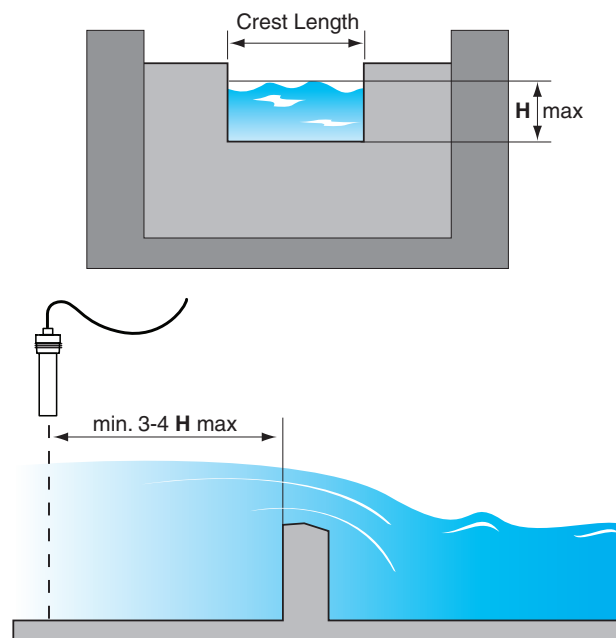


## Rectangular Weirs (Variable Sizes)

### Rectangular Weir with End Contractions



### Rectangular Weir without End Contractions



## 4.9 Traveling Screen

The traveling screen measurement monitors the stream head height of both the upstream and downstream sides of the screen using both channel 1 and channel 2.

Channel 1 is  $H_a$  (upstream head height)

Channel 2 is  $H_b$  (downstream head height)

The relationship between the upstream and downstream sides is  $H_a - H_b$ .

### Configure as follows:



Refer to menu items 1.00.00 for channel 1 and menu items 2.00.00 for channel 2

1. Select LEVEL in the Application Type menu of both channels (menu item 02.00).
2. Select the desired LEVEL UNITS for channel 1 (menu item 04.01)
3. Select the distance from 0 head height to the face of the transducer of both channels in the tank height menu item (menu item 04.02)
4. Assign the desired relays and analog channels to TRAV SCRN
5. To show the traveling screen value on the LCD display, enable this value in menu item 6.00.00

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## 4.10 Relays

The USonic-R includes 6 relays that may be configured for a number of different functions. These functions include Alarm, Control, Batch Sample Activation, and Pump Alternation. All relays may be configured independently for any output assignment such as level, flow, volume, etc. The relay state depends on the set point, dead band, and failsafe settings of the selected relay. All relays may have a time delay of up to 99 seconds, and may be enabled or disabled (all relays are enabled by default).



If the USonic-R loses power, all relays will change to the Alarm condition.

### Glossary of Relay Terms

#### Set Point

The set point parameter is the upper value at which the relays change state (Alarm for HLFS or Normal for LLFS).

#### Dead Band

The dead band parameter determines the lower value at which the relays reset (Normal for HLFS or Alarm for LLFS). The lower value is calculated as Set Point - Dead Band.

#### Failsafe

The failsafe parameter determines the relationship between the assigned output value and the Alarm state of the relay. If failsafe is configured for LLFS, an Alarm condition will occur when the output value falls below the lower value (Set Point - Dead Band). If failsafe is configured for HLFS, an Alarm condition will occur when the output value exceeds the set point value.

#### Time Delay Mode

The time delay mode parameter determines when the time delay function will be active. If the time delay mode is set to FORWARD, the time delay function will delay the transition from Alarm to Normal. If the time delay mode is set to REVERSE, the time delay function will delay the transition from Normal to Alarm.

### 4.10.1 Relay Alarm Function (Latching)

Each relay may be configured for an alarm scenario. When a relay changes to the Alarm state, the relay will remain in the Alarm state until the user presses the Acknowledge button.



When a system fault occurs, Alarm relays will automatically change to the Alarm condition.

#### Configure the relay(s) as follows:



All relay parameters are configured in menu item 3.0*n*.00, where *n* is relays 1-6.

1. Change the RELAY TYPE to ALARM (menu item 0*n*.02)
2. Assign the desired input channel to the relay (menu item 0*n*.03)
3. Assign the desired output value to the relay (menu item 0*n*.04)
4. Change the SETPOINT value (menu item 0*n*.05)
5. Change the DEADBAND value (menu item 0*n*.06)
6. Change the Time delay, Time Delay Mode, and Failsafe as needed (menu items 0*n*.08, 0*n*.09, and 0*n*.10 respectively).



When leaving the menu, the user may need to press the Acknowledge button to reset the relays.

### 4.10.2 Relay Control Function (Non-Latching)

Each relay may be configured for a control scenario. A relay configured as a control relay, will not latch in the Alarm state. When a normal condition occurs, the relay will change to the Normal condition. A control relay would be used for pump control, etc.



When a system fault occurs, Control relays will automatically change to the Alarm condition.

#### Configure the relay(s) as follows:



All relay parameters are configured in menu item 3.0*n*.00, where *n* is relays 1-6.

1. Change the RELAY TYPE to CONTROL (menu item 0*n*.02)
2. Assign the desired input channel to the relay (menu item 0*n*.03)
3. Assign the desired output value to the relay (menu item 0*n*.04)
4. Change the SETPOINT value (menu item 0*n*.05)
5. Change the DEADBAND value (menu item 0*n*.06)
6. Change the Time delay, Time Delay Mode, and Failsafe as needed (menu items 0*n*.08, 0*n*.09, and 0*n*.10 respectively).

### 4.10.3 Batch Sample Activation Function

Each relay may be configured for Batch Sample Activation. The activator operates according to a defined totalizer value. The assigned input channel must be configured for a flow application *See Section 4.5*. The normally off state of the relay is HLFS Normal. When a sample activation occurs, the relay changes to the Alarm condition for 70 milliseconds minimum to activate the sampling.

#### Configure as follows:



All relay parameters are configured in menu item 3.0*n*.00, where *n* is relays 1-6.

1. Change the RELAY TYPE to SAMPLE (menu item 0*n*.02)
2. Assign the desired input channel to the relay (menu item 0*n*.03)
3. Change the SAMPLE VALUE to the desired sample interval (menu item 0*n*.07)

#### Example configuration:

1. Set the Totalizer Scale of the assigned input channel to x1000
2. Assign the Flow units to gallons/minute.
3. Change the SAMPLE VALUE to 10 (gal x1000).

With this configuration, the relay will activate every 10,000 gallons



All other relay parameters will have no effect.

#### 4.10.4 Pump Alternation

The pump alternator allows the user to alternately turn on and off a set of up to six relays successively from one or more set points.

The number of PUMP Relay Types will determine the number of alternating relays. For a 2-pump alternator, one relay would be assigned as PUMP 1 Relay Type and another relay would be assigned as PUMP 2 Relay Type. The setpoint of PUMP 1 would be the pump-activate setpoint and the setpoint of PUMP 2 would be the high-level failsafe. If the level rises/falls too fast for pump 1 to handle, both relays will activate when the high-level failsafe setpoint is reached.



1. At least two relays must be assigned for pump alternation.
2. The setpoint of PUMP 1 must be the setpoint with the lowest Activate value.
3. The high-level failsafe setpoints should be arranged in increasing order (e.g., PUMP 2 setpoint < PUMP 3 setpoint < PUMP 4 setpoint < PUMP 5 setpoint < PUMP 6 setpoint).
4. The relays may be assigned to pumps in any order. However, no two relays may be assigned to the same PUMP.

**For a 3-pump alternator starting with relay #1, configure:**

1. Change the RELAY TYPE of relay #1 to PUMP 1 (menu item 01.02)
2. Change the SETPOINT and DEADBAND values of relay #1 to the desired Activation point (menu items 01.05 and 01.06, respectively)
3. Change the RELAY TYPE of relay #2 to PUMP 2 (menu item 02.02)
4. Change the SETPOINT and DEADBAND values of relay #2 to the desired high-level failsafe (menu items 02.05 and 02.06, respectively)
5. Change the RELAY TYPE of relay #3 to PUMP 3 (menu item 03.02)
6. Change the SETPOINT and DEADBAND values of relay #1 to the desired second high-level failsafe (menu items 03.05 and 03.06, respectively).

## Section 5: Communications

### 5.1 Description

The USonic-R uses the Modbus protocol for communicating with a PC or devices such as a programmable logic controller. Modbus is a master-slave protocol that is openly published. Many PC programs currently exist for communicating with Modbus supported devices. The USonic-R supports the RTU transmission mode over RS-485 or RS-232.

### 5.2 Compatibility

The USonic-R supports all the required specifications and is conditionally complaint.

### 5.3 Implementation Class

The USonic-R uses the Basic Implementation Class of the Modbus protocol. The table below shows configurations capabilities of the basic implementation class.

	<b>Basic</b>
<b>Addressing</b>	Configurable address from 1 to 247
<b>Broadcast</b>	Yes
<b>Baud Rate</b>	9600, 19200 (19200 is default)
<b>Mode</b>	RTU
<b>Parity</b>	EVEN
<b>Electrical Interface</b>	RS485 2W-cabling <b>or</b> RS232
<b>Connector Type</b>	3 wire terminal (Adapter Cable Required for RS232)

## 5.4 Wiring



**WARNING!** If the USonic-R Series transmitter is located in a hazardous environment, do not open the enclosure cover or make/break any electrical connections without first disconnecting electrical power at the source.



Ensure that wiring, electrical fittings and conduit connections conform to electrical codes and Approval Agency Control Drawings for specific location and environment.

### 5.4.1 Wiring for RS232

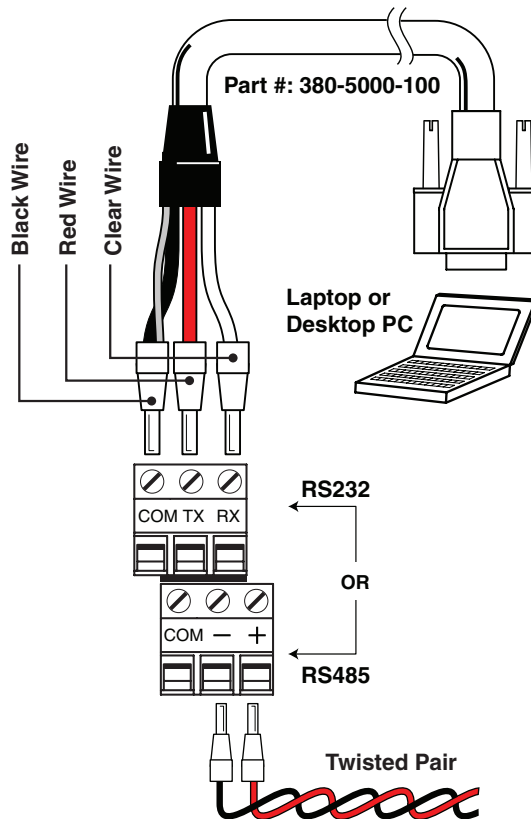
RS232 is designed for a cable length of 25 feet or less and is only used for point-to-point communications with a PC. An adapter cable must be used such as the 380-5000-100 to convert the DB9 connector of the PC to the 3 wire terminal on the USonic-R. The diagram below shows the proper wiring.

### 5.4.2 Wiring for RS485

RS485 is designed for cable lengths of to 4,000 feet. As many as 32 Modbus devices may be multi-dropped on the same bus. A twisted pair is used to connector the USonic-R to a host such as a PC with a RS485 converter or PC card. It is recommended that the twisted pair be shielded and at least 24 AWG. The shield should be connected to common only at one end.



If the RS485 bus already has terminating resistors installed, the jumper JP2 on the motherboard must be set to position 2-3. This will remove the built-in terminating resistor that is connected by default.



## **5.5 Configuration**

### **5.5.1 Baud Rate**

The Baud Rate may be changed in menu item 5.04.01. The default baud rate is 19200 bps.

### **5.5.2 Hardware Interface**

The USonic may be configured for RS485 or RS232 in menu item 5.04.02. The default interface is RS232.

### **5.5.3 Device ID**

The USonic may be configured for a Device ID of 1 to 247 in menu item 5.04.03. The Device ID is a unique address used to multi-drop the USonic-R with up to 32 Modbus devices using the RS485 Interface. For RS232, it is recommended to leave the Device ID set to 1 since RS232 cannot be multi-dropped. The default Device ID is 1.

# Section 6

## Section 6: Modbus Tables

### 6.1 Modbus Register Address Map

Channel Parameters			
<i>n</i> = Channel - 1			
Parameter	Address	Data Type	Valid Values
Range	30 <i>n</i> 001	Float	Read Only
Level	30 <i>n</i> 003	Float	Read Only
Dist	30 <i>n</i> 005	Float	Read Only
Volume	30 <i>n</i> 007	Float	Read Only
Flow	30 <i>n</i> 009	Float	Read Only
Totalizer	30 <i>n</i> 011	Long	Read Only
Resettable Totalizer	30 <i>n</i> 013	Long	Read Only
Temperature	30 <i>n</i> 015	Float	Read Only
Status	30 <i>n</i> 017	Word	Read Only
Channel Enabled	00 <i>n</i> 001	Boolean	0=False; 1=True
Application Type	40 <i>n</i> 001	Word	0-1 ( <i>See Section 6.2.1</i> )
Range Assignment	40 <i>n</i> 002	Word	0-3 ( <i>See Section 6.2.2</i> )
LRV (Lower Range Value)	40 <i>n</i> 003	Float	
URV (Upper Range Value)	40 <i>n</i> 005	Float	
Level/Head Units	40 <i>n</i> 007	Word	( <i>See Section 6.2.16</i> )
Tank Height/0 Distance	40 <i>n</i> 008	Float	
Sensor Offset	40 <i>n</i> 010	Float	
Vessel Type	40 <i>n</i> 012	Word	0-5 ( <i>See Section 6.2.3</i> )
Load Standard Vessel	40 <i>n</i> 013	Word	0-4 ( <i>See Section 6.2.4</i> )
Vessel Units	40 <i>n</i> 014	Word	( <i>See Section 6.2.17</i> )
Max Capacity	40 <i>n</i> 015	Float	
Flow Type	40 <i>n</i> 017	Word	0-10 ( <i>See Section 6.2.5</i> )
Flume Size	40 <i>n</i> 018	Float	
Flow Units	40 <i>n</i> 020	Word	( <i>See Section 6.2.18</i> )
Max Flow	40 <i>n</i> 021	Float	
Flow Delay	40 <i>n</i> 023	Word	0-10 seconds
Totalizer Scale	40 <i>n</i> 024	Word	0-4 ( <i>See Section 6.2.6</i> )
Reserved	40 <i>n</i> 025	Word	
Reset Resettable Totalizer	40 <i>n</i> 026	Word	1
Reserved	40 <i>n</i> 027	Word	
Max. Strapping Points Defined	40 <i>n</i> 028	Word	2 - 21 points
Reserved	40 <i>n</i> 029	Word	
In Point 1	40 <i>n</i> 030	Float	
Out Point 1	40 <i>n</i> 032	Float	
In Point 2	40 <i>n</i> 034	Float	
Out Point 2	40 <i>n</i> 036	Float	
In Point 3	40 <i>n</i> 038	Float	
Out Point 3	40 <i>n</i> 040	Float	
In Point 4	40 <i>n</i> 042	Float	
Out Point 4	40 <i>n</i> 044	Float	

## 6.1 Modbus Register Address Map (Continued)

In Point 5	40n046	Float	
Out Point 5	40n048	Float	
In Point 6	40n050	Float	
Out Point 6	40n052	Float	
In Point 7	40n054	Float	
Out Point 7	40n056	Float	
In Point 8	40n058	Float	
Out Point 8	40n060	Float	
In Point 9	40n062	Float	
Out Point 9	40n064	Float	
In Point 10	40n066	Float	
Out Point 10	40n068	Float	
In Point 11	40n070	Float	
Out Point 11	40n072	Float	
In Point 12	40n074	Float	
Out Point 12	40n076	Float	
In Point 13	40n078	Float	
Out Point 13	40n080	Float	
In Point 14	40n082	Float	
Out Point 14	40n084	Float	
In Point 15	40n086	Float	
Out Point 15	40n088	Float	
In Point 16	40n090	Float	
Out Point 16	40n092	Float	
In Point 17	40n094	Float	
Out Point 17	40n096	Float	
In Point 18	40n098	Float	
Out Point 18	40n100	Float	
In Point 19	40n102	Float	
Out Point 19	40n104	Float	
In Point 20	40n106	Float	
Out Point 20	40n108	Float	
In Point 21	40n110	Float	
Out Point 21	40n112	Float	
Gain Mode	40n114	Word	0-7 ( <i>See Section 6.2.7</i> )
Smart Gain Adjustment	40n115	Word	
Repetition Rate	40n116	Word	0-1 ( <i>See Section 6.2.8</i> )
Near Zone Analog Output	40n117	Word	0-1 ( <i>See Section 6.2.9</i> )
Lost Echo Analog Output	40n118	Word	0-1 ( <i>See Section 6.2.9</i> )
Point Calibration	40n119	Float	
Temp Calibration	40n121	Float	
Reacquire Target	40n123	Word	1
Temp Units	40n124	Word	( <i>See Section 6.2.19</i> )
SW Revision	40n125.12H	String	Read Only

## 6.1 Modbus Register Address Map (Continued)

<b>Relay Parameters</b> <i>n = Relay - 1</i>			
<b>Parameter</b>	<b>Address</b>	<b>Data Type</b>	<b>Valid Values</b>
Enable	050 <i>n</i> 01	Boolean	0=False; 1=True
Relay Status	150 <i>n</i> 01	Boolean	Read Only
Relay Type	450 <i>n</i> 01	Word	0-8 ( <i>See Section 6.2.10</i> )
Channel Assignment	450 <i>n</i> 02	Word	0-1 ( <i>See Section 6.2.11</i> )
Variable Assignment	450 <i>n</i> 03	Word	0-10 ( <i>See Section 6.2.12</i> )
Setpoint	450 <i>n</i> 04	Float	
Dead Band	450 <i>n</i> 06	Float	
Sample Value	450 <i>n</i> 08	Long	
Time Delay	450 <i>n</i> 10	Word	0-99 seconds
TD Mode	450 <i>n</i> 11	Word	0-1 ( <i>See Section 6.2.13</i> )
Failsafe	450 <i>n</i> 12	Word	0-1 ( <i>See Section 6.2.14</i> )

<b>Analog Output Parameters</b> <i>n = Analog Output Channel - 1</i>			
<b>Parameter</b>	<b>Address</b>	<b>Data Type</b>	<b>Valid Values</b>
Analog Output	351 <i>n</i> 01	Float	Read Only
Channel Assignment	451 <i>n</i> 01	Word	0-1 ( <i>See Section 6.2.11</i> )
Variable Assignment	451 <i>n</i> 02	Word	0-8 ( <i>See Section 6.2.12</i> )
Zero	451 <i>n</i> 03	Float	
Span	451 <i>n</i> 05	Float	
Damping	451 <i>n</i> 07	Word	0-99 seconds
Lock Analog Output Value	451 <i>n</i> 08	Float	
Trim 4mA	451 <i>n</i> 10	Float	
Trim 20mA	451 <i>n</i> 12	Float	

<b>System Parameters</b>			
<b>Parameter</b>	<b>Address</b>	<b>Data Type</b>	<b>Valid Values</b>
Software Revision	453001.12H	String	Read Only
Serial Number	453007.12H	String	Read Only
Reset Factory Defaults	453013	Word	1

<b>Data logging Parameters</b>			
<b>Parameter</b>	<b>Address</b>	<b>Data Type</b>	<b>Valid Values</b>
Enable	053101	Boolean	0=False; 1=True
Interval	453101	Word	0-35 ( <i>See Section 6.2.15</i> )
Duration	453102.12H	String	Read Only
Overwrite Data Log Data	453114	Word	0=No; 1=Yes
Restart	453115	Word	1

## 6.2 Code and Unit Tables

The code and unit tables give meaning to the some of the parameters listed in the register map.

### 6.2.1 Application Type Codes

Code	Meaning
0	Level Application
1	Flow Application

### 6.2.2 Range Assignment Codes

Code	Meaning
0	Distance
1	Level
2	Volume
3	Flow

### 6.2.3 Vessel Type Codes

Code	Meaning
0	User Defined
1	Linear Vessel
2	Horizontal Cylinder
3	Horizontal Cylinder with Dished Ends
4	Horizontal Cylinder with Hemispherical Ends
5	Sphere

### 6.2.4 Load Standard Vessel Codes

Code	Meaning
0	Linear Vessel
1	Horizontal Cylinder
2	Horizontal Cylinder with Dished Ends
3	Horizontal Cylinder with Hemispherical Ends
4	Sphere

## 6.2 Code and Unit Tables (Continued)

### 6.2.5 Flume/Weir Type Codes

Code	Meaning
0	Cutthroat Flume
1	H Flume
2	Leopold Lagco Flume
3	Parshall Flume
4	Palmer Bowlus Flume
5	Trapezoidal Flume
6	Rectangular Weir With End Contractions
7	Rectangular Weir Without End Contractions
8	Cippoletti Weir
9	V Notch Weir
10	User Defined

### 6.2.6 Totalizer Scale Codes

Code	Meaning
0	x100
1	x1,000
2	x10,000
3	x100,000
4	x1,000,000

### 6.2.7 Gain Mode Codes

Code	Meaning
0	Smart Gain
1	Standard 100%
2	Standard 84%
3	Standard 67%
4	Standard 50%
5	Standard 32%
6	Standard 17%

### 6.2.8 Repetition Rate Codes

Code	Meaning
0	300ms
1	400ms

### 6.2.9 Analog Output Codes

Code	Meaning
0	down-scale current (3.7mA)
1	up-scale current (22mA)

## 6.2 Code and Unit Tables (Continued)

### 6.2.10 Relay Type Codes

Code	Meaning
0	Alarm
1	Control
2	Sample
3	Pump 1 (For Pump Alternation)
4	Pump 2 (For Pump Alternation)
5	Pump 3 (For Pump Alternation)
6	Pump 4 (For Pump Alternation)
7	Pump 5 (For Pump Alternation)
8	Pump 6 (For Pump Alternation)

### 6.2.11 Channel Assignment Codes

Code	Meaning
0	Channel 1
1	Channel 2

### 6.2.12 Variable Assignment Codes

Code	Meaning
0	Distance
1	Level
2	Volume
3	Flow
4	Percent of Range
5	Flow Sum
6	Flow Difference
7	Submergence
8	Traveling Screen
9	Lost Echo (Not Valid for Analog Outputs)
10	Near Zone (Not Valid for Analog Outputs)

### 6.2.13 Time Delay Mode Codes

Code	Meaning
0	Forward Acting
1	Reverse Acting

### 6.2.14 Failsafe Codes

Code	Meaning
0	High Level Failsafe
1	Low Level Failsafe

---

## 6.2 Code and Unit Tables (Continued)

---

### 6.2.15 Data Log Interval Codes

Code	Meaning
0	5 Seconds
1	10 Seconds
2	15 Seconds
3	20 Seconds
4	25 Seconds
5	30 Seconds
6	35 Seconds
7	40 Seconds
8	45 Seconds
9	50 Seconds
10	55 Seconds
11	1 Minute
12	5 Minutes
13	10 Minutes
14	15 Minutes
15	20 Minutes
16	25 Minutes
17	30 Minutes
18	35 Minutes
19	40 Minutes
20	45 Minutes
21	50 Minutes
22	55 Minutes
23	1 Hour
24	1.5 Hours
25	2 Hours
26	3 Hours
27	4 Hours
28	5 Hours
29	6 Hours
30	7 Hours
31	8 Hours
32	9 Hours
33	10 Hours
34	11 Hours
35	12 Hours

## 6.2 Code and Unit Tables (Continued)

### 6.2.16 Level Unit Codes

Code	Meaning
44	feet
45	meters
47	inches
48	centimeters
49	millimeters

### 6.2.17 Volume Unit Codes

Code	Meaning
40	gallons
41	liters
42	imperial gallons
43	cubic meters
46	barrels

### 6.2.18 Flow Unit Codes

Code	Meaning
16	gallons per minute
19	cubic meters per hour
23	million gallons per day

### 6.2.19 Temperature Unit Codes

Code	Meaning
32	degrees Celsius
33	degrees Fahrenheit

## Section 7: Data Logger

### 7.1 Description

The USonic-R has the ability to record over 24 months of time-stamped data. This data is extracted using DataView™. DataView™ is a PC program that will download the logged data from the USonic-R, and save it in a Comma Separated File (.csv) for opening in programs such as Microsoft® Excel®. The USonicR Data Logger allows 36 different time intervals ranging from 5 seconds to 12 hours. The duration of data logging will depend on the interval selected.

**The following data is logged:**

Parameter/Value	Description
Channel Enable	Y=Yes; N=No
Application Type	L=Level; F=Flow
Distance	
Level	
Volume/Flow	Depends on Application Type
Percent of Range	%
Status	LE=Lost Echo; NZ=Near Zone
Temperature	°C or °F
Submergence	%
Analog Output 1	mA
Analog Output 2	mA
Relay Status 1-6	A=Alarm; N=Normal
Time Stamp	Time Format: M-D-YY H:MM:SS a/p

### 7.2 Configuration

#### 7.2.1 Data Logger Enable

The Data Logger may be enabled or disabled in menu item 5.03.01. The Data Logger is disabled by default.

#### 7.2.2 Logging Interval

The Data Logging Interval may be changed in menu item 5.03.02. The USonic-R allows 36 different interval values ranging from 5 seconds to 12 hours.

### 7.2.3 Logging Duration

This Parameter is read only. It indicates the logging duration based off of the interval.

Example:

1. If the Logging Interval was set to 5 seconds, the Duration value would be 2H 50M, for 2 hours and 50 minutes.
2. If the Logging Interval was set to 12 hours, the Duration value would be 2Y 294D, for 2 years and 294 days.



Due to the limited number of characters available on the LCD display, the duration values may not have space to display the nearest minute, if the duration is greater than 1 day.

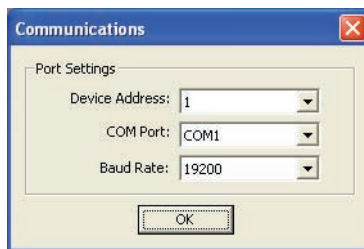
## 7.3 Using DataView™

### 7.3.1 Overview

DataView™ is a PC program that will download the logged data from the USonic-R, and save it in a Comma Separated File (.CSV) for opening in programs such as Microsoft® Excel®.

### 7.3.2 Configuration

Choose Options->Communications in the menu to open the communications dialog box. The Communications dialog box allows the user to change the Device Address (Same as Device ID), the COM Port, and the Baud Rate. Change the Baud Rate and the Device Address to match the settings on the USonic-R that you wish to communicate with. DataView™ will communicate with either RS232 or RS485. An RS485 converter or PC card will be required for RS485.

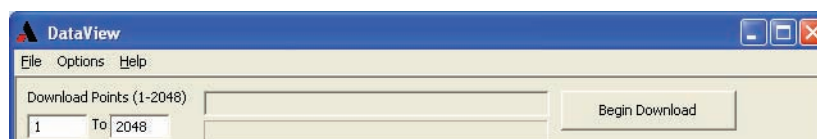


### 7.3.3 Downloading Log Data

The USonic-R has a maximum of 2048 possible log points. You may select the starting and ending points to download. Point 1 is the oldest point. If the user chooses to download points lowest to highest, the data will be downloaded as oldest to newest. The user may also download points highest to lowest. This will give the user the most recent logged data first.

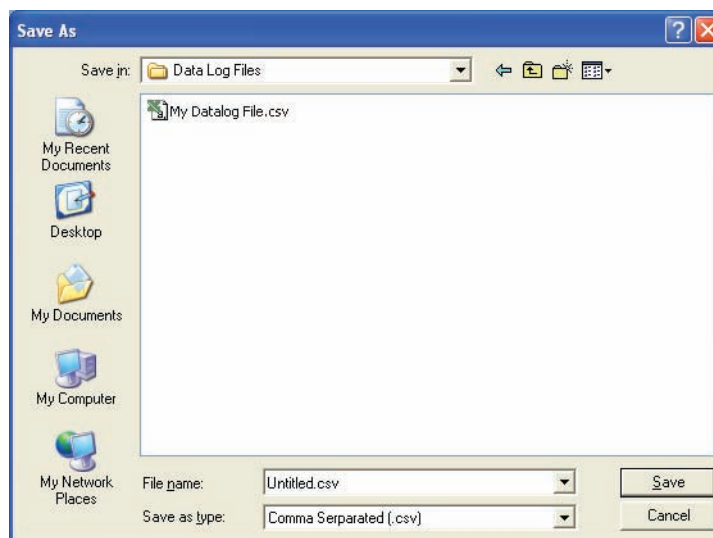


Point 2048 will not be the newest point if the USonic-R has not yet logged at least 2048 points. For example, if the USonic has only logged 5 points since the first power-up, the newest point would be Point 5.



### 7.3.4 Saving Log Data

Choose File-> Save As to save the data to a CSV (Comma Separated Variable) file. This file may then be opened using programs such as Microsoft® Excel® for analysis of the log data.



## **Section 8**

## Section 8: Troubleshooting

The USonic-R™ Series Ultrasonic Level system is designed to give years of unattended service. No periodic or scheduled maintenance is required.

### 8.1 Troubleshooting Procedures

If a problem should occur with the operation of the transmitter, use the following procedure for troubleshooting.

1. Ensure wiring connections are correct.
2. If the liquid surface has severe turbulence in the area where the ultrasonic beam hits, consider increasing damping time.
3. Splashing of material or condensation on the transducer face could cause unreliable measurements.
4. Any continuous ultrasonic transmitter signal/echo can be adversely affected by significant foam on the liquid level surface. If this condition exists, please consult the factory for further application review and advice.
5. Ensure that the transducer face is not recessed into a mounting nozzle, unless a SmartGain™ setting is used. Spurious reflections from the nozzle can cause faulty operation.  
Maximum Nozzle Length = 18.5" (470 mm)
6. To indicate a fault condition, the 4-20 mA signal locks to 22 mA (or 3.7 mA) . If output is locked at 22 mA (or 3.7 mA), check that:
  - A) The level of the material has not violated the near zone (12 inches, 30 cm) from the transducer face.
  - B) The low calibration setting is not more that 360 inches (30 ft., 914 cm) from the transducer face.
7. Test for 4 mA and 20 mA.
  - A) Using the Display Keypad to force the output signal to a constant 4 mA or 20 mA.
8. If attempts to locate the difficulty fail, notify the local factory representative, or call Drexelbrook directly.

To aid in troubleshooting, please complete the information in **Section 8.4** before calling the factory service department.

### 8.2 Optimized Field Calibration

The Configuration Menu Allows a 1-Point calibration based on a known actual distance. This can adjust for any possible variations that may exist in the speed of sound, or to provide an optimized calibration data point in difficult applications.

- Using the Display Keypad, enter the correct actual distance from the transducer face to level. The USonic-R will use this data point as reference on all future readings, unless "Restore Factory Settings" is selected.

### 8.3 Analog Output Adjustment

Trimming the analog output to match a loop meter (This function is factory calibrated, and generally does not have to be adjusted)

#### TRIM 4mA (4.0n.07)

1. Measure the loop current (mA dc) on the desired analog output channel.
2. Menu 4.0n.07 will force the loop current to 4.00mA.
3. Using the keypad, enter the actual loop current indicated on your device (multimeter)
4. The receiver will recalibrate the analog output to match your entered value.

#### TRIM 20mA (4.0n.08)

1. Measure the loop current (mA dc) on the desired analog output channel.
2. Menu 4.0n.08 will force the loop current to 20.00mA.
3. Using the keypad, enter the actual loop current indicated on your device (multimeter)
4. The receiver will recalibrate the analog output to match your entered value.

### 8.4 Telephone Assistance



If you have questions about your AMETEK Drexelbrook equipment:

- Contact your local Drexelbrook representative
- Call the Drexelbrook Service department toll-free at:  
1-800-527-6297 (US and Canada) or  
215-674-1234 (Outside North America)
- Fax the following information to the Service department at:  
215-443-5117.

To expedite assistance, please provide the following information:

Instrument Model Number: \_\_\_\_\_

Original Purchase order number: \_\_\_\_\_

Material being measured: \_\_\_\_\_

Temperature: \_\_\_\_\_

Pressure: \_\_\_\_\_

Agitation: \_\_\_\_\_

Brief description of the problem: \_\_\_\_\_

Checkout procedures that have failed: \_\_\_\_\_

8.5 Equipment Return / Warranty

In order to provide the best service, any equipment being returned for repair or credit must be pre-approved and have a return number issued by the factory.

In many applications, the equipment is exposed to hazardous materials.

- OSHA mandates that our employees be informed and protected from hazardous materials.
- Material Safety Data Sheets (MSDS) listing the hazardous material that the system has been exposed to must accompany any return.
- It is your responsibility to fully disclose all chemicals and decontaminate the returned items.

To obtain a return authorization number (RA#), contact the Service department at:



1-800-527-6297 (US and Canada) or  
215-674-1234 (Outside North America).

Please provide the following information:

Model Number of Returned Equipment: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Original Purchase Order Number: \_\_\_\_\_

Process Material that the equipment has been exposed: \_\_\_\_\_

MSDS for any hazardous materials

Billing Address: \_\_\_\_\_

Shipping Address: \_\_\_\_\_

Purchase Order Number for Repairs: \_\_\_\_\_

Please include a purchase order number even if the repair is under warranty. If repair is covered under warranty, you will not be charged.

**Ship equipment freight prepaid to:**

AMETEK Drexelbrook  
205 Keith Valley Road  
Horsham, PA 19044

COD shipments will not be accepted.

AMETEK Drexelbrook warrants its products free of material defects or manufacturing defects for a period of 1 year after date of shipment.

## 8.6 Field Service

Trained field service personnel are available on a time-plus-expense basis to assist in start-ups, diagnosing difficult application or equipment problems, or in-plant training of personnel. Preventive Maintenance and Calibration Certification service contracts are also available to maintain plant efficiency. Contact the Service department for further information.

## Section 9: System Specifications

### 9.1 Transmitter Specifications

#### Power Requirement

24 VDC (1A), 120 VAC or 240 VAC - Jumper Selectable  
Maximum analog output load resistance = 1000 ohms.

#### Power Consumption

12 Watts

#### Ambient Operating Temperature

Electronics: -40°F to 158°F (-40°C to 70°C)  
LCD Display: -4°F to 158°F (-20°C to 70°C)

#### Ambient Temperature Effect

+/- 0.1% per 1°F

#### Repeatability

0.1 inch (3 mm)

#### Resolution

0.125 inch (3 mm)

#### Response Time

Less than 1 second

#### Calibration

Zero & Span: to nearest .01 inch (3 mm)  
Near Zone: 12 inches (305 mm)  
Minimum span: 3 inches (76 mm)  
Maximum span: 30 feet (9.1 m)

#### Output

4–20 mA DC (isolated)

#### Accuracy

0.15% of maximum sensor range, or 0.2" (5mm) whichever is greater

#### Temperature compensation

Automatic

#### Damping

0 to 99 seconds

#### Lost Echo

22 mA or 3.7 mA – field selectable

#### Near Zone

22 mA or 3.7 mA – field selectable

#### Pulse Repetition Rate

300 or 400 msec – field selectable

#### Fail Safe

22 mA

## 9.1 Transmitter Specifications (Continued)

### Relays

(6) SPDT @ 5A 250VAC with 10 user defined trip points.

### Enclosure

Fiberglass reinforced Polyester (FRP) to NEMA 4X (IP-66)

## 9.2 Transducer Specifications

### Sensor

Material: CPVC

Pressure: -10 to 50 psig

### Operating Temperature

-40 to 158°F (-40°C to 70°C)

### Beam Angle

Conical, 10° typical, at the 3 db down point

### Sensor Ingress Protection Rated to

NEMA 4X, NEMA 6/6P, IP 68

## 9.3 Software

Level, Distance, Volume, Flow rate via user selectable Flume and Weir characterizations or 21-Point strapping table, Totalization via 1 resettable and 1 non-resettable totalizer. Differential Level (Channel#1 vs. Channel #2) for Submerged Flow, Sum, Difference, and Traveling Bar Screen Control, Pump Alternation, Batch Sample Activation.

### Data Logger

Up to 24 Month. Maximum time period dependant on sample rate. Requires digital communications option. Consult Factory for Availability

## 9.4 Approvals

**PENDING** - FM, CSA, ATEX, CE Mark, IEC Ex, CEPEL, GOST  
For Class I, Div. 2, Zone 2 hazardous locations with sensors suitable for Class I, Div. 1, Zone 0, Zone 1 hazardous locations.







**AMETEK<sup>®</sup>**  
**DREXELBROOK**  
*An ISO 9001 Certified Company*

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E-mail: [drexelbrook.info@ametek.com](mailto:drexelbrook.info@ametek.com)  
Website: [www.drexelbrook.com](http://www.drexelbrook.com)