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SMARTSONIC INTEGRAL ACOUSTIC WAVE LEVEL / OPEN CHANNEL FLOW TRANSMITTER INSTALLATION / OPERATION INSTRUCTIONS

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GENERAL DESCRIPTION

The SmartSonic Acoustic Wave Transmitter is designed for high accuracy level measurement of a variety of liquids. The SmartSonic Integral can also be used for Open Channel Flow Measurement.

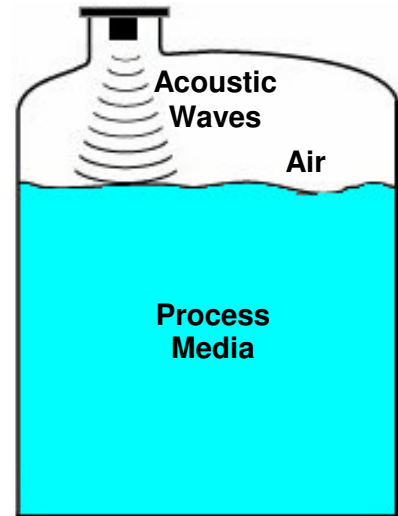
PRINCIPLE OF OPERATION

The SmartSonic Transmitters consist of two main components:

- The Electronics
- The Sensor (Transducer)

The transducer contains a piezoelectric crystal that converts an electrical signal from the electronics, into acoustic (sound) waves. These acoustic waves are directed through the air toward the process media surface. They are then reflected off of this surface and returned to the transducer. The piezoelectric crystal then converts the received waves into an electrical signal which is analyzed by the electronics.

The time difference between the transmitted wave and the received wave is proportional to the distance from the face of the transducer to the process media surface. This distance is used by the electronics to calculate level or open channel flow in the units selected by the operator.



MODEL DESCRIPTION

- P2W-L1-ABF-NE – Integral with 2” Polypropylene Sensor
- P2W-L1-AKF-NE – Integral with 2” PVDF (Kynar) Sensor

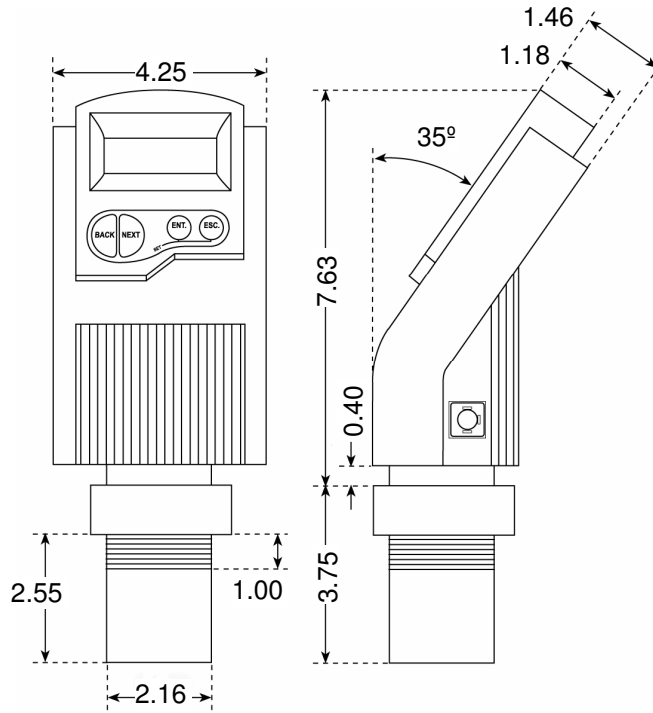
INSTALLATION

Unpack the transmitter carefully. Inspect all units for damage. Report any damage to carrier immediately. Check the contents against the packing slip and purchase order. Kenco’s SmartSonic Acoustic Wave Transmitters are manufactured to the highest quality standards. These instruments use electronic components that can be damaged by static electricity. Make sure that you are properly grounded before starting installation. Insure that all electrical connections are properly made, and that there are no “floating” connections.

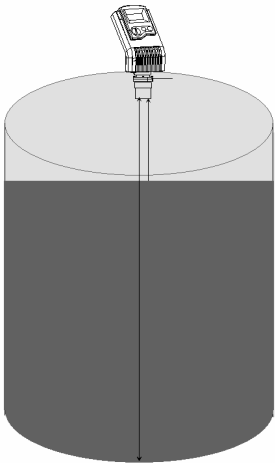
SPECIFICATIONS

Description		Specification
Power Supply		12-28 Vdc
Maximum Range	Short Range	16 feet
	Long Range	49 feet
Minimum Dead Zone	Short Range	0.8 feet
	Long Range	1.9 feet
Maximum Span	Short Range	15.2 feet
	Long Range	47.1 feet
Frequency		25 kHz
Output Signal		4-20mA
Loop Resistance		750Ω @ 28Vdc
Diagnostic / Failure Alarm		22 mA
Wave Angle		5° @ 3db
User Interface	Display	4 Character LCD
	Keypad	4 Button
Process Connection		2” NPT
Temperature Range		-40°F to 158°F
Pressure Range		-2 to 30psig
Accuracy		±0.25% of max. range
Resolution		0.04” (1 mm)
Enclosure Material		ABS + UV
Transducer Material		ECTFE coated aluminum
Cable Entry		½” NPT
Weight		3.1 lbs

DIMENSIONS

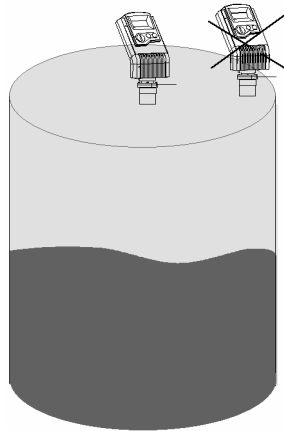


MOUNTING GUIDELINES

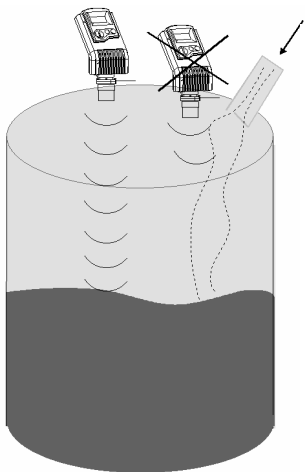


The transmitter must be mounted in such a way, as to avoid the process fluid level from entering the Dead Zone.

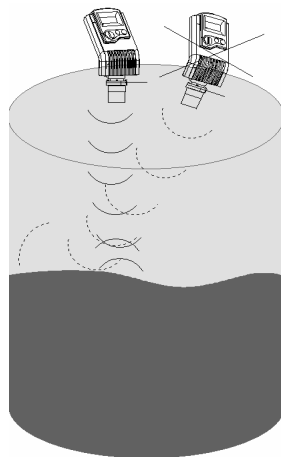
If the level enters the Dead Zone, an error will occur, and the transmitter will not measure the fluid level



While the narrow wave diameter of the Kenco Acoustic Wave Transmitters allows you to mount the sensor closer to the vessel wall, than other Ultrasonic transmitters, it is recommended to mount the sensor at least 1.64 feet away from the wall.



The sensor needs to be mounted as far away as possible from processes that can interfere with the Acoustic Wave. This example shows a fluid filling inlet.

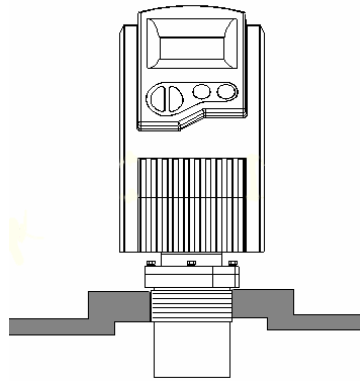


The sensor must be mounted perpendicular with the process fluid level. Even the slightest mounting off perpendicular will affect the measurement. Anything over 4° will usually result in a loss of echo or at the very least, an inaccurate reading

MOUNTING INSTRUCTIONS

Precautions:

- Ensure that the transmitter is mounted in an area that meets the stated temperature, pressure and technical specifications.
 - Ensure that high voltage (ac) sources or cables are at least 1 yard away from the transmitter and its cable.
 - Installation and Operation of this transmitter must conform to the National Electric Code and any applicable local codes.
- 1.) If this transmitter is to be flange mounted, screw the 2" NPT transmitter process connection into the flange. Hand tighten only. Non-metallic flanges are recommended. If a metallic flange is used, a soft gasket is recommended to eliminate the transmission of sound through the flange to the vessel wall.
 - 2.) Bolt the flange to the vessel.
 - 3.) If no flange is used, screw the transmitter into the 2" NPT vessel connection. Hand tighten only.



- 4.) If you are planning to mount the transmitter into a standpipe (stilling well) contact Kenco Technical Support for directions prior to proceeding.

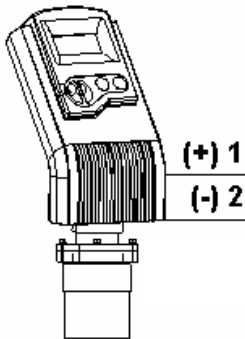
WIRING

It is recommended that flexible conduit be installed onto the 1/2" NPT connection on the transmitter housing. A seal drain fitting should be used to prevent moisture from entering the transmitter. In high humidity areas, use a breather drain to minimize moisture intrusion

All wiring, conduit, and fittings must conform to local electrical codes for the location selected. If the transmitter is to be used in a Hazardous Area, the applicable sections of the National Electric Code must be followed as well.

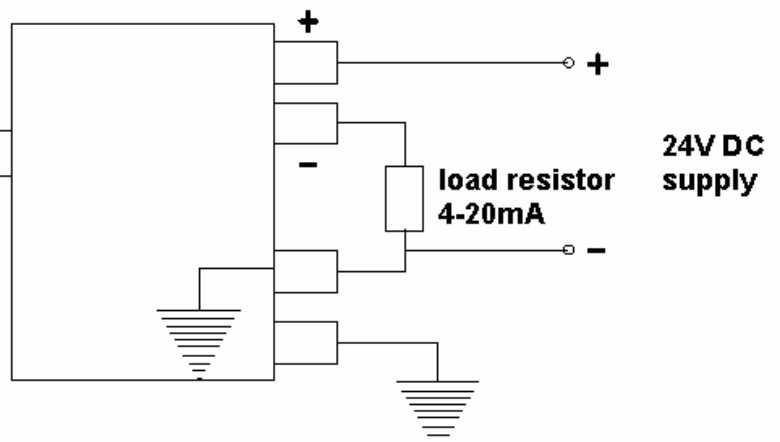
See the following for the Hazardous area installation drawing:

Hazardous area



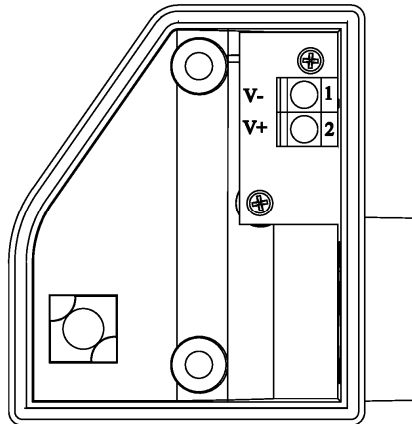
Entity Parameters:
 $V_i = 28 \text{ V}$ $C_i = 0 \text{ pF}$
 $I_i = 93 \text{ mA}$ $L_i = 0 \text{ } \mu\text{H}$
 $P_i = 1.71 \text{ W}$

Nonhazardous area



Wiring Connections

Before starting installation procedures in hazardous areas, insure that all power sources have been turned off and locked out. "Live" electrical circuits can ignite flammable gasses and dusts. Do not apply more than 28Vdc to the transmitter, as this may damage the instrument.



- 1.) Remove the (4) retaining screws from the wiring compartment.
- 2.) Connect the conduit (preferably flexible) to the 1/2" NPT conduit opening.
- 3.) Pull the loop wires through the conduit, into the wiring compartment.
- 4.) Connect the negative lead to Terminal #1; connect the positive lead to Terminal #2. If the wires are reversed, the transmitter's display will be blank. If this occurs, reverse the wiring.
- 5.) Install the wiring compartment cover. Make sure that the O-Ring is in place. Attach and tighten the (4) retaining screws.

Loop Resistance Table (Intrinsically Safe Installation)

Power Supply Voltage	Minimum Resistance	Maximum Resistance
12 - 18 Vdc	41 Ω	220 Ω
18.1 - 24 Vdc	41 Ω	310 Ω
24.1 - 28 Vdc	68 Ω	520 Ω

Loop Resistance Table (Non-Intrinsically Safe Installation)

Power Supply Voltage	Minimum Resistance	Maximum Resistance
12 Vdc	0 Ω	50 Ω
12.1 - 15 Vdc	0 Ω	220 Ω
15.1 - 24 Vdc	41 Ω	610 Ω
24.1 - 28 Vdc	68 Ω	820 Ω

CALIBRATION

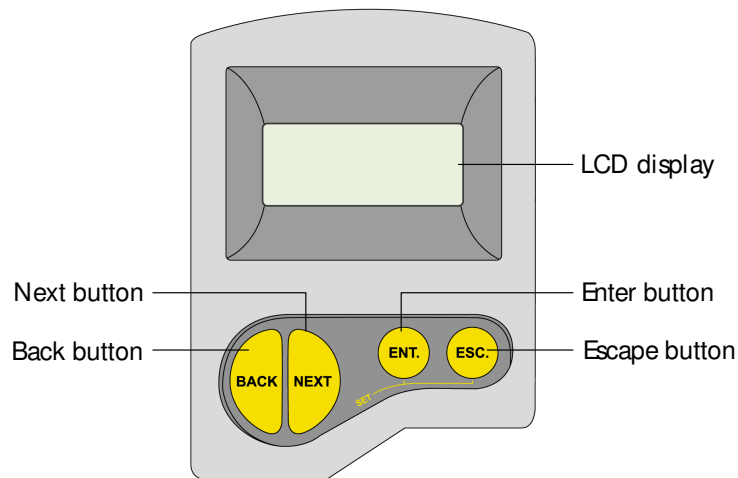
This section explains how to set up and calibrate the SmartSonic for accurate measurement monitoring. SmartSonic is supplied with preprogrammed default settings, making it ready for immediate operation. It is recommended that you check the Initial Set-up Menu, to verify that the transmitter is set for your Application Type and Measurement Range. Also, you should replace the default tank height value with the actual tank height (**Pr. 02**). When using SmartSonic, the tank height is calculated as the distance from the surface of the sensor to the bottom of the tank. You should enter this value whenever tank height is required. (For flow measurement, enter the precise flume height.)

SmartSonic contains eleven Standard Programs, and five Initial Set-up Programs, which enable you to change the default settings and calibrate SmartSonic as required. These functions are accessed from a functions menu. The functions **Pr.01**, **Pr.02**, **Pr.04**, **Pr.05**, **Pr.23**, and **Pr.24** are the most important to ensure correct usage of your SmartSonic device (with the addition of **Pr.00** if using the Open Channel Flow software). Function **Pr.03** may be used if there are interfering signals.



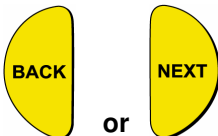
The remaining functions (**Pr.06**, **Pr.07**, **Pr.08**, **Pr.09**, **Pr.10**, **Pr.20**, **Pr.21**, and **Pr.22**) enable you to customize SmartSonic for your monitoring requirements or to restore factory default settings.

Display / Keypad

The LCD display screen functioning in “Normal” mode provides continuously updated measurement readings. This display is also used to view the program menus, options, settings, and data values. These are accessed by using the keypad. The picture below shows the display and keypad of the SmartSonic:



The keypad buttons are used to perform various operations, summarized in the following table

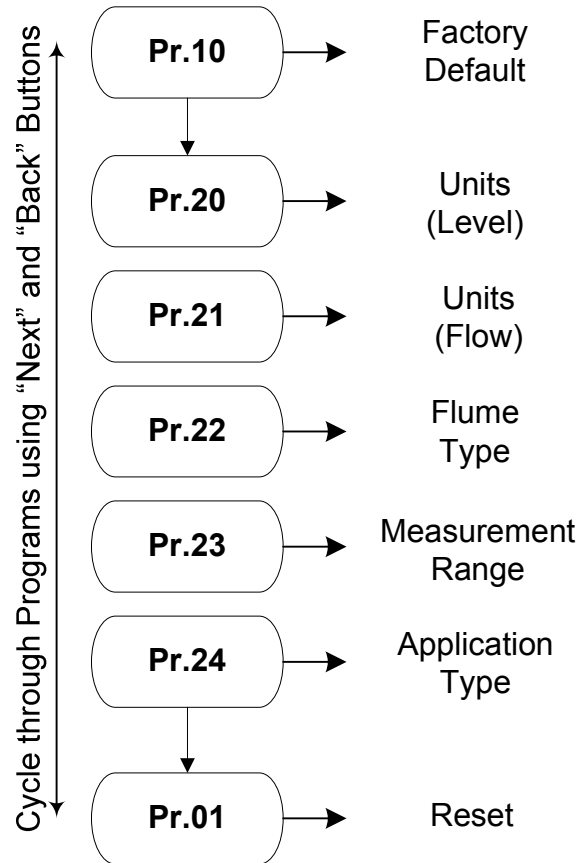
Button	Uses Include:
	<ul style="list-style-type: none"> • Accessing the program menu (when pressed simultaneously with “ESC.”) • Selecting Programs. • Progressing to the next step of a program. • Moving from left to right between displayed digits. • Saving changes to data.
	<ul style="list-style-type: none"> • Accessing the program menu (when pressed simultaneously with “ENT.”) • Exiting the program menu to return to the “Normal” mode. • Moving from right to left between displayed digits. • Exiting a program without saving changes. • Clearing error messages.
	<ul style="list-style-type: none"> • Scrolling through program menu. • Scrolling through data values in programs.

NOTE: Within some programs, the digits in the display can be individually modified. This is indicated by a flashing digit. In this case the **ENT** and **ESC** buttons are used to move between digits. The **BACK** and **NEXT** buttons are used to change the value of the flashing digit.

INITIAL SET-UP PROGRAM

Prior to calibration, you must verify that the SmartSonic is set for your application. There are five settings to consider. These settings can be accessed through the **Pr.02** Program.

Initial Set-up Program Menu













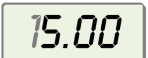





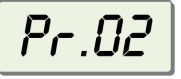
Here are the settings to consider:

- Application Type – **Pr.24**
- Measurement Range – **Pr.23**
- Flume Type (Open Channel Flow only) – **Pr.22**
- Units (Flow) (Open Channel Flow only) – **Pr.21**
- Units (Level) – **Pr.20**

The following pages will take you through this process. Start with **Pr.24**. If you select Level (L), **Pr.22** and **Pr.21** will not be available.




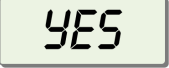
Five Initial Programs

While the **Pr.02** Program is normally used to set the Tank Height, there is a special code that is used to enter this Initial Set-up Program. The following directions show you how to get into the Initial Set-up Program:

Press / Action	Display	Description
Connect SmartSonic to power supply		Temporary display while SmartSonic takes a reading
After a brief pause	For Example: 	Measurement reading; Normal Mode
 and  simultaneously		Enter the Program Menu
 One Time		Used to search for the required menu selection. For this step, find Program Pr.02
		Indicates the measurement units: meters (shown) or feet (H F).
	For Example: 	Displays last saved Tank Height or Maximum Range
   and 		Change the display to read 00.18
		Now use the "Back" button to go to Pr. 24





Initial Set-up Program Pr.24 (Application Type)

This program allows you to set the transmitter to either Level (L) or Flow (F) Measurement. DO NOT select "S", as this function is not activated at this time.

Press / Action	Display	Description
	Pr.24	Program #24
 or 	L, F, S	Cycle between Level (L), Open Channel Flow (F). DO NOT select "S"
		Accepting the new "Application Type" Value
After a brief time	Pr.24	





Initial Set-up Program Pr.23 (Measurement Range)

This program allows you to set the transmitter to either Standard or Short Range. The Standard range is 49.22ft., while the Short Range is 16.41ft. If your Tank Height is less than 16.41ft. select the Short Range, as this will give you better accuracy.

Press / Action	Display	Description
	Pr.23	Program #23
 or 	S, r	Cycle between Standard (S), and Short (r). DO NOT select COdE.
		Accepting the new "Application Type" Value
After a brief time	Pr.23	




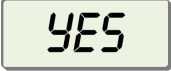
Initial Set-up Program Pr.22 (Flume Type)

This program is only available if you selected Flow in Program 24. This is where you select either European or U.S. Flume/Weir types.

Press / Action	Display	Description
	Pr.22	Program #22
 or 	E, U	Cycle between European (E) and U.S. (U) Flume/Weir types
		Accepting the new "Application Type" Value
After a brief time	Pr.22	




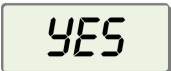
Initial Set-up Program Pr.21 (Flow Measurement Units)

This program is only available if you selected Flow in Program 24. This is where you select either Gallons per Minute or Cubic Meters per Hour (m³).

Press / Action	Display	Description
	Pr.21	Program #21
 or 	6Pnn, nn3	Cycle between Gallons per Minute (6Pnn) and Cubic meters per Hour (nn3).
		Accepting the new "Application Type" Value
After a brief time	Pr.21	

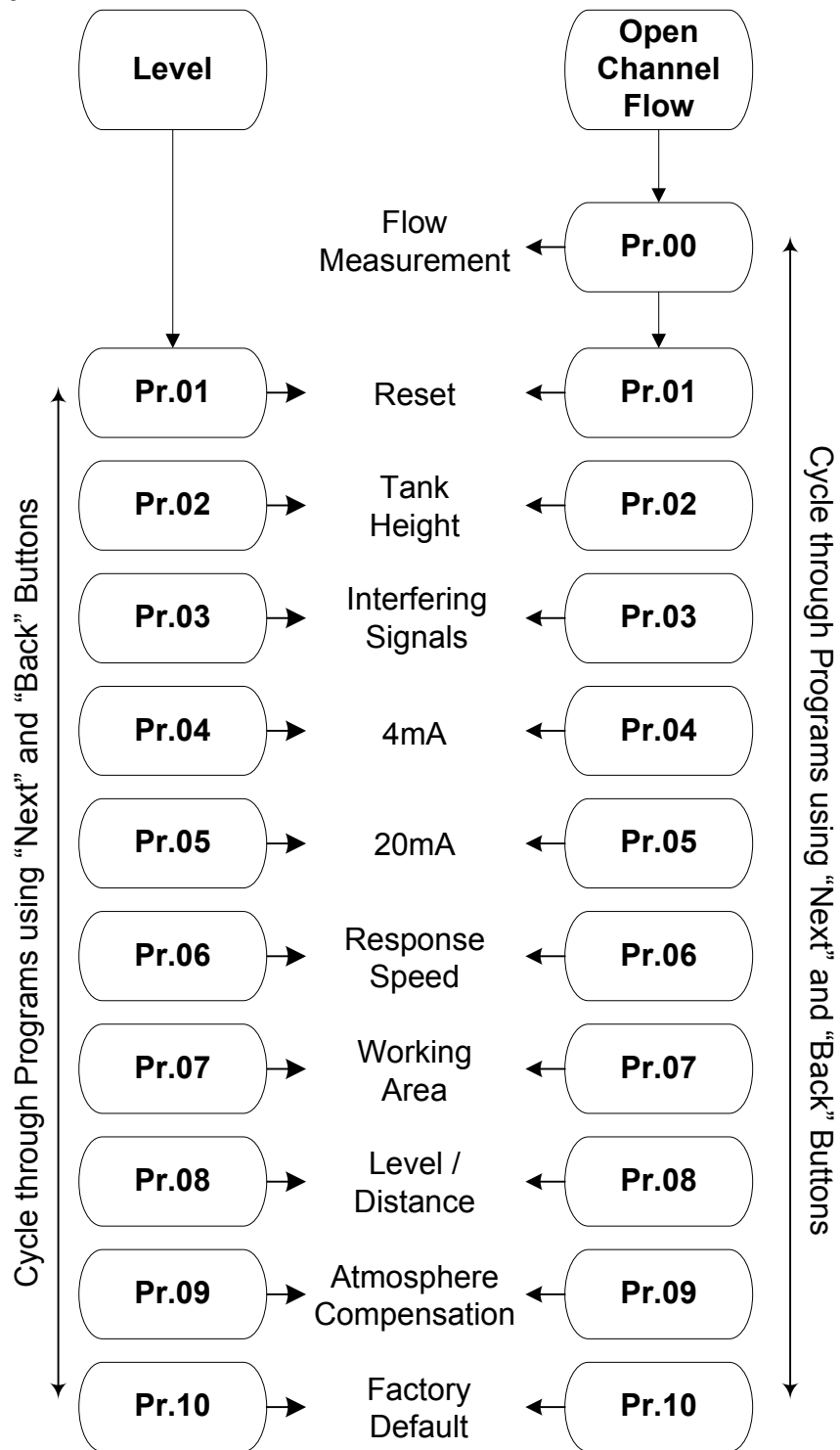
Initial Set-up Program Pr.20 (Level Measurement Units)

This is where you select either Feet or meters.

Press / Action	Display	Description
	Pr.20	Program #20
 or 	F, nn	Cycle between Feet (F) and meters (nn)
		Accepting the new "Application Type" Value
After a brief time	Pr.20	

After accessing any of these Initial Set-up programs, it is recommended that you run program **Pr.01** to reset the transmitter. See the following section for directions on running **Pr.01**.

STANDARD PROGRAMS
Standard Program Menu








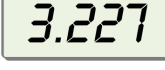
The Standard Program menu allows you to change the operating parameters of the transmitter. The following pages explain the use of each program. Pr.00 (Open Channel Flow) is discussed in a separate section.

Pr.01

Reset Program

The **Pr.01** program enables you to do a reset, refreshing the SmartSonic measurement reading, while not changing data saved in other programs. After resetting, the actual reading is shown on the LCD, and SmartSonic begins to scan. This program has the same effect as turning the unit off then on.

NOTE: During the reset, SmartSonic will display **8.8.8.8** and the output current will be 22mA.

Press / Action	Display	Description
 and  simultaneously		Enter the Program Menu
		Enter Pr.01 . This display indicates that the SmartSonic is scanning for the process media
After a brief pause		Normal Mode

Pr.02

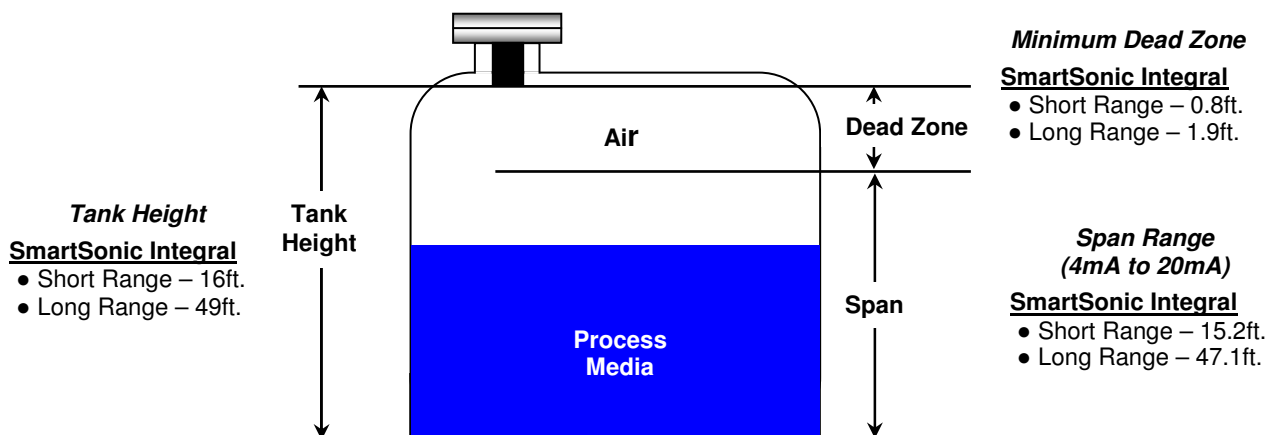
Tank Height Program

The **Pr.02** program enables you to enter the Tank Height. The default value is the maximum measurement range selected for your unit (**Pr.23**). If you enter a value that exceeds this highest value, the Err error message is displayed, and the value is not saved.



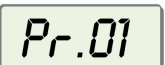

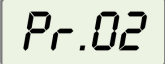

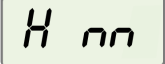







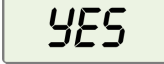
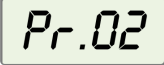


NOTE: For the Tank Height you should enter the distance from the edge of the sensor housing (not the face of the transducer) to the bottom of the tank. For Open Channel Flow, precisely measure to the bottom of the flume or weir directly below the sensor.

The **Pr.02** program also gives you access to the Initial Set-up Programs (previous section). There are also other functions that can be accessed through the **Pr.02** Program (these will be discussed later in this section).

The following shows the potential values for “Tank Height”, “Span Range” (the difference between 4mA and 20mA points), and “Minimum Dead Zone” (the Dead Zone can be expanded up to 4.9 ft.).



The next table shows how to set the Tank Height:

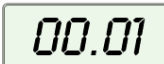

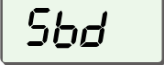






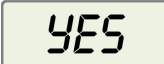
Press / Action	Display	Description
 and  simultaneously		Enter the Program Menu
 One Time		Cycle to Program #2
		Enter Pr.02 . This indicated the measurement unit; meters (shown) or feet (H F).
	For Example: 	Displays last saved Tank Height or Maximum Range
   and 		Change the display to read the Tank Height
		Accepting the new "Tank Height" Value
Wait a brief time		Back to the Program Menu
	For Example: 	Measurement reading; Normal Mode

Special Functions of Pr.02

This program also allows you to access additional functions of the transmitter. Using the procedure above, instead of entering the Tank Height, enter the following function codes to access these functions.

Function 00.01 (Adjusting the Dead Zone)

This function allows you to increase the Dead Zone. This can be useful if there are obstructions between the maximum fluid level and the transducer. The Dead Zone can be increased up to 4.9 ft.

Press / Action	Display	Description
		Enter this code in place of Tank Height.
		This message will flash for a few seconds, indication an entry to the Dead Zone area.
   and 	For Example: 	This would shift the Dead Zone to 3.227 ft.
		Saves this entry, and returns to Pr.02

The Dead Zone adder is limited to 4.9 ft. Pr.10 (Factory Default) changes this value to 0.000 ft (the basic Dead Zone; no adder). Any echo received from the Dead Zone is ignored. Make sure that the Dead Zone does not overlap the maximum fluid height.

Function 00.16 (22mA Error Signal)

This function allows you to define if “Near Zone” and “Lost Echo” are allowable errors, and if the result is a 22mA output. The default has the display and 22mA turned on for these errors:







Near Zone – Whenever the fluid level is within the Dead Zone. The display will show **F.F.F.F**

Lost Echo – Whenever the echo is lost, or the measurement results exceed the tank height, or when a returned echo is not received. The display will show **E.E.E.E**

You can choose to enable or disable the 22mA current output as follows:

d000 – Disable

E000 – Enable (default)






Press / Action	Display	Description
	00.16	Enter 00.16 in place of Tank Height
		Indicates that the transmitter is set for Disable
 or 	d000, E000	Used to toggle between the modes
		Saves this entry, and returns to Pr.02

When the 22mA error signal is disabled, the following current outputs will be displayed:

- When the transmitter is set to Level or Flow, then F.F.F.F will indicate 20mA, and E.E.E.E will indicate 4mA.
- When the transmitter is set to Distance, then F.F.F.F will indicate 4mA, and E.E.E.E will indicate 20mA.

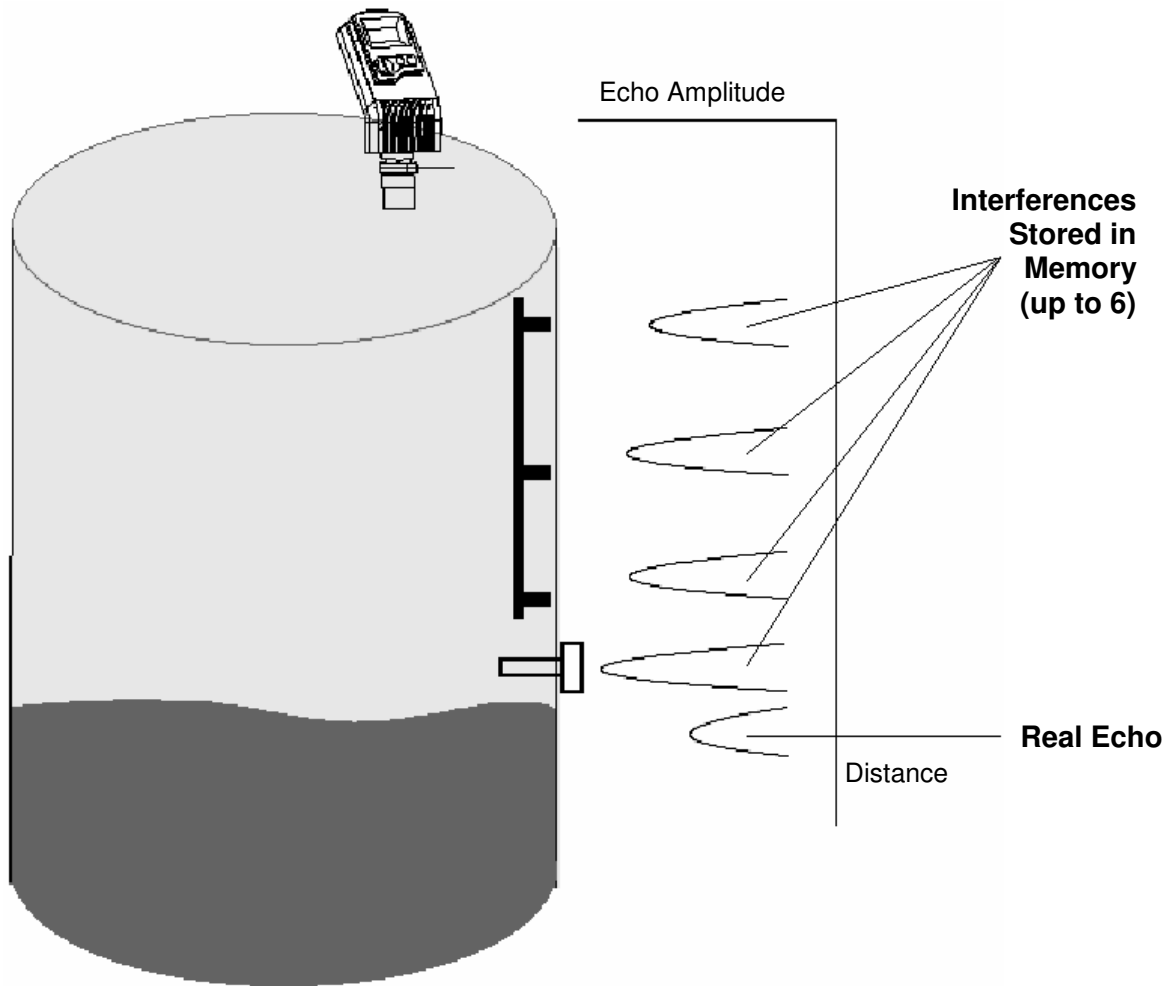
Function 00.17 (Checking the Version Number)

This function is helpful during troubleshooting. Knowing the software version will allow Kenco Technical Support to assist you better.

Press / Action	Display	Description
	00.17	Enter 00.17 in place of Tank Height
		
	For Example: 4.090	Displays the Version Number. Pressing the “NEXT” button will display the value in Hexadecimal.
		Returns to Pr.02



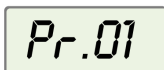

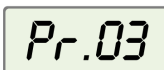

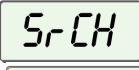
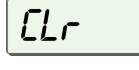

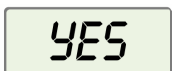
 **Blocking Interfering Signals**









The **Pr.03** program enables you to locate and store up to six interfering signals (false echoes) in the SmartSonic memory. This avoids obstructions such as, a tank agitator, internal ladder, other sensors mounted on the side wall, etc. and prevent them from interfering with the measurement of the vessel’s contents. This program can only be run with the vessel empty.



Each reading (scan distance) taken using the **Pr.03** program is stored as an interfering signal, until a reading is achieved that indicates the real echo. Prior to running this program, you must verify the distance to the bottom of the tank (i.e. stick the tank). If six interfering signals are already stored, any additional interfering signals will not be stored. If this occurs, the process fluid level in the tank must not go below this point. The reading of the actual target may not be exact. For example a target at 6 feet may give a reading in the range of 5.95 to 6.05.

NOTE: THE DISPLAY IN Pr.03 IS IN DISTANCE (FROM THE SENSOR), NOT LEVEL OR FLOW.

Press / Action	Display	Description
 and  simultaneously		Enter the Program Menu
 Two Times		Cycle to Program #3
	 	Enter Pr.03 . Use BACK or NEXT buttons to cycle between Search (SrCH) – to search for Interference Signals; or Clear (CLr) – to clear all existing Interference Signals
		Displayed for approximately 3 seconds. Goes to Pr.03 if you selected Clear. Goes to the next step if you selected Search

		Temporary display while SmartSonic searches for Interfering Signals
After a brief pause	For Example: 	Distance to Interfering Signal
		Saves the Interfering Signal, then searches again and displays the next reading. Continue to press this button to save up to six interference readings. If you get to the real echo, go to the following steps.
	For Example: 	Real echo reading (confirmed by manually measuring the distance from the sensor to the bottom of the tank). The correct reading indicates that there are no more Interfering Signals
		Saves the entered values.
		Returns to Pr.03











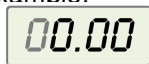
NOTE: If the value represents an interference or false echo, press **NEXT**. If the value represents the real target, real distance, or real echo, press **ENT**.

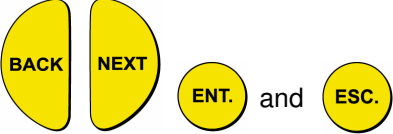
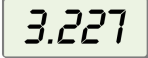



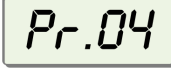
Configuring the 4mA Point

The **Pr.04** program enables you to set the location of the 4mA output. You can define the location of 4mA in Level, Flow, or Distance measurements. The selection of Level, Flow, or Distance will also apply to program **Pr.05** (20mA Point).

For example, if you set a Tank Height (**Pr.02**) of 15 feet, and you have selected **LEVEL**, the 4mA Point will be at or near the minimum fluid level (for example, 0.000 ft.). The 20mA Point will be the maximum fluid level (15.00 ft. – Dead Zone). In other words, 4mA represents an empty tank, and 20mA represents a full tank. Level and Flow work the same.

However, if you select **DISTANCE**, with a Tank Height of 15.00 ft., the 4mA Point is the maximum fluid level (15.00 – Dead Zone), and the 20mA Point is the minimum fluid level (for example, 0.000 ft.). In other words, 4mA represents a full tank, and 20mA represents an empty tank.

Press / Action	Display	Description
 and  simultaneously		Enter the Program Menu
 Three Times		Cycle to Program #4
	For Example: 	Use BACK or NEXT buttons to cycle between Level (L000), Distance (d000), and Flow (F000)
		Indicates that you are about to change the 4mA Point
	For Example: 	Displays either the last entered, or default value.




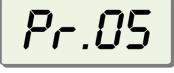

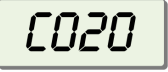


	For Example: 	Change the value to represent the desired 4mA Point in either: Level, Distance, or Flow units.
		To save the new value, press ENT. when the far right digit (4mA value) is flashing. Returns to Pr.04
OR		
		To return to the main menu without saving, press ESC. when the far left digit (4mA value) is flashing. Returns to Pr.04

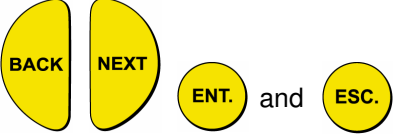


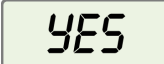

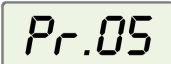
NOTES:

- The values for 4mA and 20mA must be different; otherwise an **Err** error message is displayed.
- The values for 4mA and 20mA should not be greater than the value used for the tank height (**Pr02**). Because of the dead-zone, the distance between the sensor and the surface of the target at its highest level should be a minimum of 0.8 ft for Short-Range models, or 1.96 ft for Standard-Range models. These values can be greater if you increased the Dead Zone (see Special Functions of **Pr.02**).
- After accessing the **Pr04** function, the unit generates a fixed current of 22mA on the 4-20mA line. When the SmartSonic reverts to regular scanning mode, the 4-20mA line returns to regular functioning.
- The default measurement for 4mA and 20mA in Level SmartSonic models is level.
- The default measurement for 4mA and 20mA in Flow SmartSonic models is flow.
- When changing from one measurement mode to another, the measurement units will be changed automatically (for example, when changing from level mode to flow mode, the units will change from feet to GPM.)
- The measurement mode selected for the 4-20mA values will not influence the measurement mode selected for the display (**Pr.08**).
- In case of power reset, measurement configuration (level, distance, flow) will be saved according to the unit's last configuration.

 **Configuring the 20mA Point**

The **Pr.05** program enables you to set the location of the 20mA Point.

Press / Action	Display	Description
 simultaneously		Enter the Program Menu
 Four Times		Cycle to Program #5
		Indicates that you are about to change the 20mA Point
	For Example: 	Displays either the last entered, or default value.

	For Example: 	Change the value to represent the desired 2mA Point in either: Level, Distance, or Flow units (selected in Pr.04).
		To save the new value, press ENT. when the far right digit (20mA value) is flashing. Returns to Pr.05
OR		
		To return to the main menu without saving, press ESC. when the far left digit (20mA value) is flashing. Returns to Pr.05

NOTES:


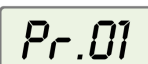

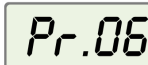

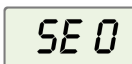
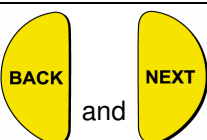


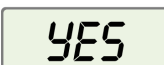

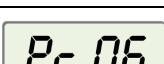
- Type of measurement (level, distance, flow) selected in **Pr.04** is also applicable for **Pr.05**.
- The values for 4mA and 20mA must be different; otherwise an **Err** error message is displayed.
- The values for 4mA and 20mA should not be higher than the value used for the tank height (**Pr.02**).
- After accessing the **Pr.05** function, the unit generates a fixed current of 22mA on the 4-20mA line. When the SmartSonic reverts to regular scanning mode, the 4-20mA line returns to regular functioning.

Pr.06

Selecting Response Speed

The **Pr.06** program allows you to select the rate of level change in the vessel, flume, or weir. There are three settings available:

- **SE 0:** Low dynamic mode (default setting). This mode provides slower readings with a greater degree of accuracy. Level change rates up to 30"/min. There is an error timer that determines the waiting period from loss of echo to transmission of an error signal. For SE 0 this time is 10 minutes.
- **SE 1:** High Dynamic Mode. This mode provides faster readings, but with less accuracy. Level change rates up to 39"/min. The error timer is set for 3 minutes.
- **SE 2:** Process Measurement Mode. This mode provides for rapid level changes (fast dynamic). Level change rates up to 98"/min. The error timer is set for 1 minute.




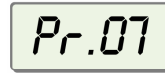

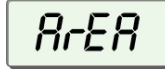

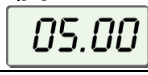
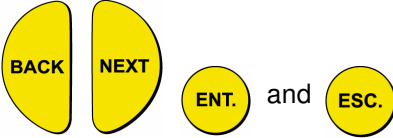



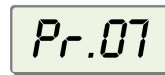
Press / Action	Display	Description
		Enter the Program Menu
		Cycle to Program #6
		Displays the current mode setting
	For Example: 	Cycle between SE 0, SE 1, and SE 2.
		Select the desired response mode.
		Returns to Pr.06

Pr.07

Working Area

The **Pr.07** program allows you to add a distance range that exceeds the tank's height, thus enabling accurate readings of complicated tank shapes with conic bottoms. This may be required when the vessel has a conical shape which is causing false echoes and faulty measurements.

The minimum value is the Tank Height; the maximum value is 2X Tank Height. However this value cannot exceed the maximum measurement range (16.41 ft. or 49.22 ft depending on the setting of **Pr.23**)


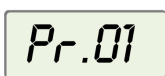

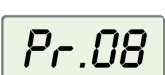
Press / Action	Display	Description
 and simultaneously		Enter the Program Menu
 Six Times		Cycle to Program #7
		Displayed when entering the program
	For Example: 	Displays the last entered value or the Tank Height (default)
		Change the display to the desired value. The minimum value is the Tank Height; the maximum value is 2X Tank Height. However this value cannot exceed the maximum measurement range (16.41 ft. or 49.22 ft depending on the setting of Pr.23)
		Saves the entered value.
		Returns to Pr.07






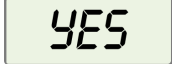

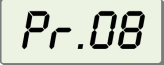
Pr.08

Selecting Level or Distance for the Display

The **Pr.08** program enables you to choose whether the SmartSonic display shows either distance or level measurements. The setting of **Pr.08** does not affect the measurement selected in **Pr.04**, for the 4-20mA output. The two settings are:

- **d000**: Distance mode (default): In this mode, the SmartSonic displays the distance from the sensor to the surface of the process fluid
- **L000**: Level mode: In this mode, the SmartSonic displays the level from the bottom of the tank.

Press / Action	Display	Description
 and simultaneously		Enter the Program Menu
 Seven Times		Cycle to Program #8

	For Example: 	Displays the current distance/level mode setting
 and 		Used to cycle between Distance (d000) and Level (L000)
		Select the desired response mode.
		Returns to Pr.08

Atmosphere Compensation



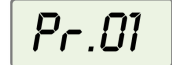

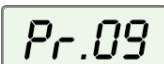

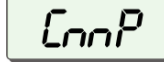






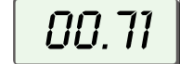



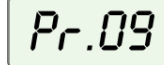
The **Pr.09** program enables you to compensate for speed of sound changes in different atmospheres, for example, 100% methane instead of air. See Appendix A for a list of Gasses and their compensation factors.

To calculate the Gas compensation factor divide the sound velocity of the actual atmosphere by 343 m/sec (sound velocity in air). For example, if your vessel's atmosphere is 100% Methane (CH₄), the factor is:

$$445.82m/sec / 343m/sec = 1.29$$

Therefore, 1.29 should be entered to compensate for Methane.

If the Gas cannot be found in Appendix A., or if the atmosphere is not a pure gas, there is another process to follow. Measure the distance from the transducer to the fluid level, and by trial and error, try to enter different compensation factors, until the transmitter reads the measured level. This method will be accurate as long as the atmosphere does not change.

Press / Action	Display	Description
 and  simultaneously		Enter the Program Menu
 Eight Times		Cycle to Program #9
		Default Screen (while entering program)
		Default Value
   and 	For Example: 	Enter the calculated factor, or measure the tank and estimate a factor. This example shows the factor for ethanol
		Select the desired response mode.
		Returns to Pr.09



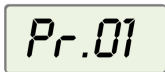

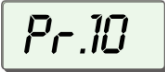





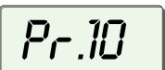
Pr.10

Restoring the Default Settings

The Pr.10 program allows you to clear programs Pr.00, Pr.02 – Pr.09, and reverts to Factory Settings:

- **Pr.00** – GPM 1U01 or M3/Hr 1E01
- **Pr.02** – Sbd 00.00, E000, Tank Height = Default
- **Pr.03** – Resets all interfering signals
- **Pr.04** – Level device L000 and 00.00; Flow Device F000 and 00.00
- **Pr.05** – Level device Tank Height = **Pr.02**; Flow device 55500 M3/Hr or 244400 GPM
- **Pr.06** – SE 0
- **Pr.07** – Tank Height = **Pr.02**
- **Pr.08** – d000
- **Pr.09** – 01.00

The **Pr.10** program does not affect the Initial Set-up Programs (**Pr.20 – Pr.24**)

Press / Action	Display	Description
 and  simultaneously		Enter the Program Menu
 Nine Times		Cycle to Program #10
		Default Screen (while entering program)
		Reverts settings to Factory Settings
		Returns to Pr.10


OPEN CHANNEL FLOW MEASUREMENT

This section describes how to set the flow measurement parameters for Open Channel Flow measurement. It also covers the flume/weir codes used when selecting the flume or weir of your application.

Pr.00

Selecting the Open Channel Flow Settings

The **Pr.00** program enables you to select one of the preset flumes/weirs for Open Channel Flow measurement. This program is only available when Flow is selected in **Pr.23** (Initial Set-up Programs).



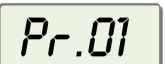

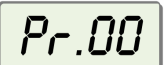



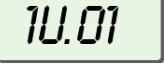


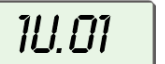

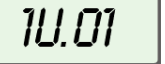


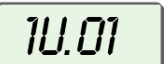




Using **Pr.00** program, the data is entered in the following format: , where:

X = Flume / Weir Style


U = U.S. Standard (U) or European (E) type flume / weir

FF = The specific flume / weir dimensions

The “X” and “FF” codes are found on the following pages, grouped by “U” U.S. Standard and “E” European types. Refer to the **CALIBRATION** section for an explanation of accessing and using the SmartSonic program menu.

Press / Action	Display	Description
 and  simultaneously		Enter the Program Menu
 One Time		Cycle to Program #00
	For Example: 	Indicates the flow measurement version (selected in Pr.21). Gallons per Minute (GPM) shown.
		Displays the last saved flow measurement value. The first digit is flashing.
 or 		Enter the "Style" (X) number of the desired flume or weir type (see the following section on Flume / Weir Styles and Dimensions)
		Last two digits are flashing.
 		Enter the specific flume / weir (FF) dimension code (see the following section on Flume / Weir Styles and Dimensions).
		Selected values are saved.
		Returns to Pr.00

Flume / Weir Styles and Dimensions

Using **Pr.00** program, The data is entered in the following format: , where:

X = Flume / Weir Style

U = U.S. Standard (U) or European (E) type flume / weir

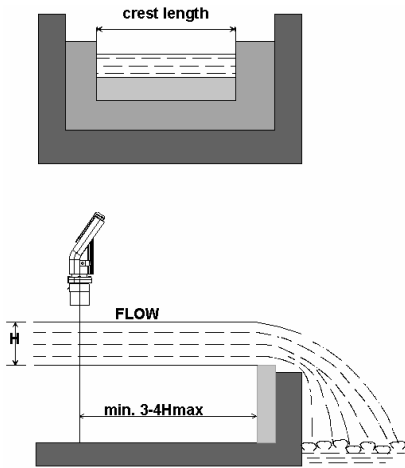
FF = The specific flume / weir dimensions

The U.S. or European types are selected in **Pr.22** (see Initial Set-up Programs). The following pages show the flumes weirs by Style (X) and Dimensions (FF).

Code (X)	U.S Standard (Page #)	European (Page #)
1	Rectangular Suppressed Sharp-Crested Weir (23)	Rectangular Suppressed Sharp-Crested Weir (26)
2	Rectangular Contracted Sharp-Crested Weir (23)	Rectangular Contracted Sharp-Crested Weir (26)
3	Trapezoidal (Cipolletti) Sharp-Crested Weir (23)	Trapezoidal (Cipolletti) Sharp-Crested Weir 26()
4	V-notch (Triangular) Sharp-Crested Weir (24)	V-notch (Triangular) Sharp-Crested Weir (27)
5	Parshall Flume (24)	Khafagi-Venturi Flume (27)
6	Palmer-Bowlus Flume (24)	Parshall Flume (27)
7	H-Flume (25)	Palmer-Bowlus Flume (28)
8	Leopold-Lagco Flume (25)	H-Flume (28)
9	NONE	Neyrpic-Venturi Flume / Long Base Weir (28)

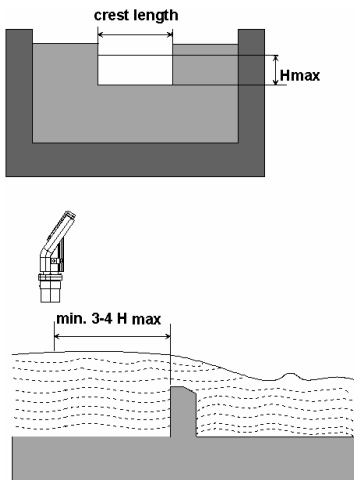
Flumes / Weirs – U.S. Standard (dimensions are in inches unless otherwise indicated)

Type 1 (X) – Rectangular Suppressed Sharp-Crested Weir



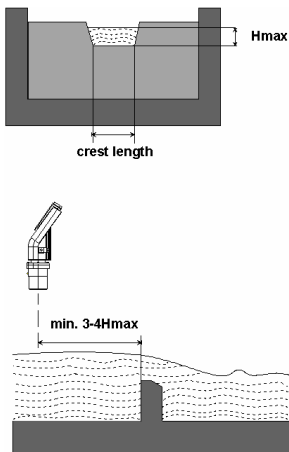
Code (FF)	Crest Length
01	12.00
02	18.00
03	24.00
04	30.00
05	36.00
06	48.00
07	60.00
08	72.00
09	96.00

Type 2 (X) – Rectangular Contracted Sharp-Crested Weir



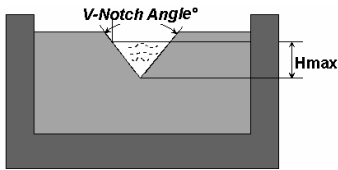
Code (FF)	Crest Length
01	12.00
02	18.00
03	24.00
04	30.00
05	36.00
06	48.00
07	60.00
08	72.00
09	96.00

Type 3 (X) – Trapezoidal (Cipolletti) Sharp-Crested Weir

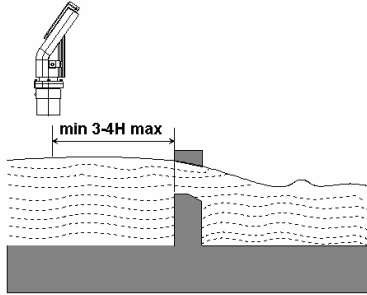


Code (FF)	Crest Length
01	12.00
02	18.00
03	24.00
04	30.00
05	36.00
06	48.00
07	60.00
08	72.00
09	96.00

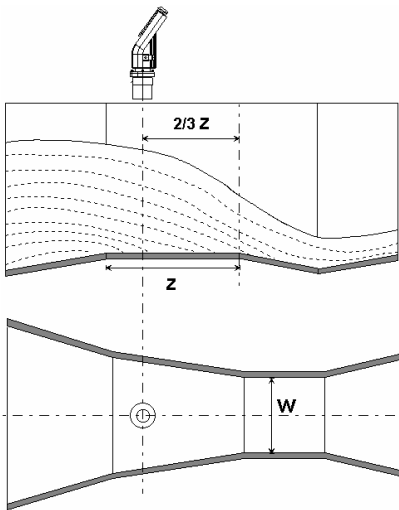
Type 4 (X) – V-notch (Triangular) Sharp-Crested Weir



Code (FF)	V-notch Angle
01	90°
02	60°
03	45°
04	30°
05	22.5°

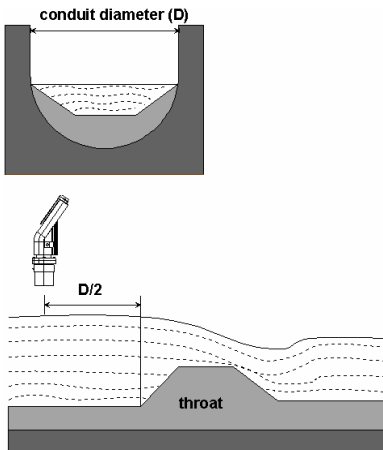


Type 5 (X) - Parshall Flume



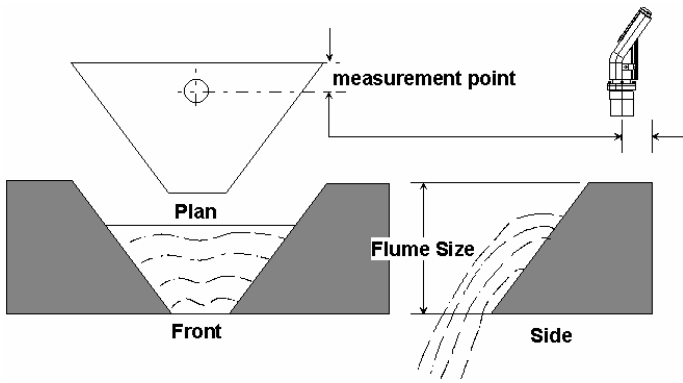
Code (FF)	Throat Width	Code (FF)	Throat Width
01	1	09	30
02	2	10	36
03	3	11	48
04	6	12	60
05	9	13	72
06	12	14	96
07	18	15	120
08	24	16	144

Type 6 (X) – Palmer-Bowlus Flume



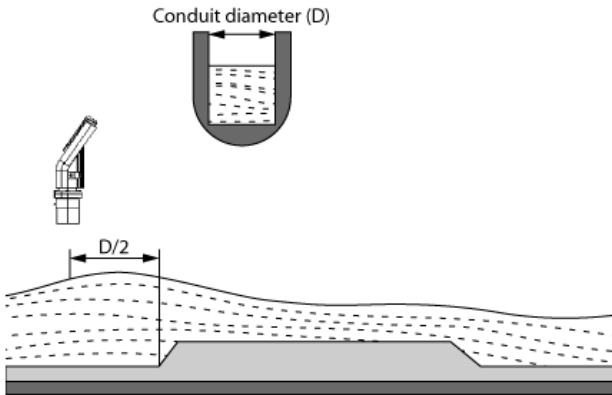
Code (FF)	Conduit Diameter	Code (FF)	Throat Width
01	1	09	30
02	2	10	36
03	3	11	48
04	6	12	60
05	9	13	72
06	12	14	96
07	18	15	120
08	24	16	144

Type 7 (X) – H-Flume



Code (FF)	Flume Size	Measurement Point
01	6	1.96
02	9	2.75
03	12	3.54
04	18	5.51
05	24	7.08
06	30	9.05
07	36	11.02
08	54	16.14

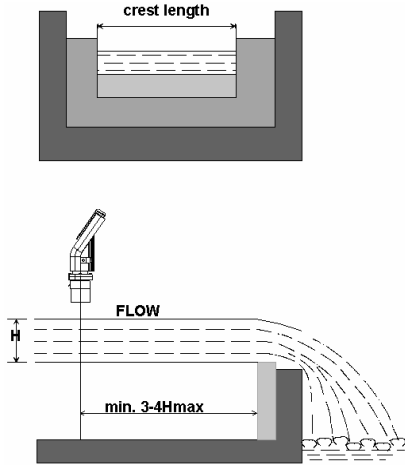
Type 8 (X) – Leopold-Lagco Flume



Code (FF)	Crest Length	Code (FF)	Crest Length
01	4	10	30
02	6	11	36
03	8	12	42
04	10	13	48
05	12	14	54
06	15	15	60
07	18	16	66
08	21	17	72
09	24		

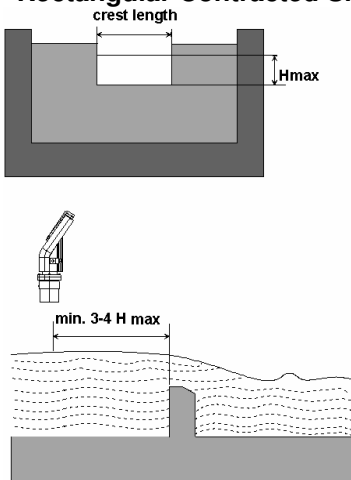
Flumes / Weirs – European (dimensions are in centimeters unless otherwise indicated)

Type 1 (X) – Rectangular Suppressed Sharp-Crested Weir



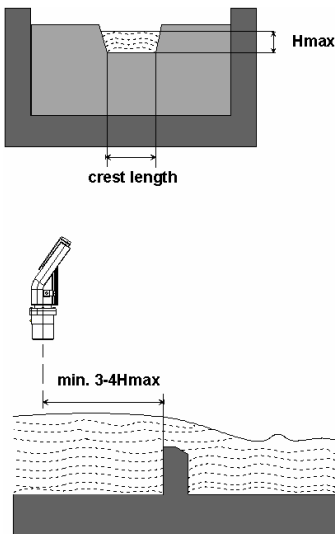
Code (FF)	Crest Length
01	20
02	40
03	60
04	80
05	100
06	150
07	200
08	300

Type 2 (X) – Rectangular Contracted Sharp-Crested Weir



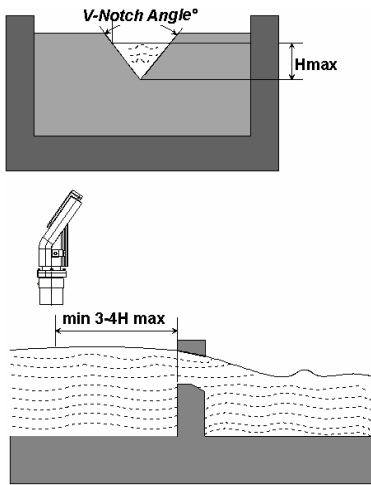
Code (FF)	Crest Length
01	20
02	30
03	40
04	50
05	60
06	80
07	100
08	150
09	200
10	300

Type 3 (X) – Trapezoidal (Cipolletti) Sharp-Crested Weir



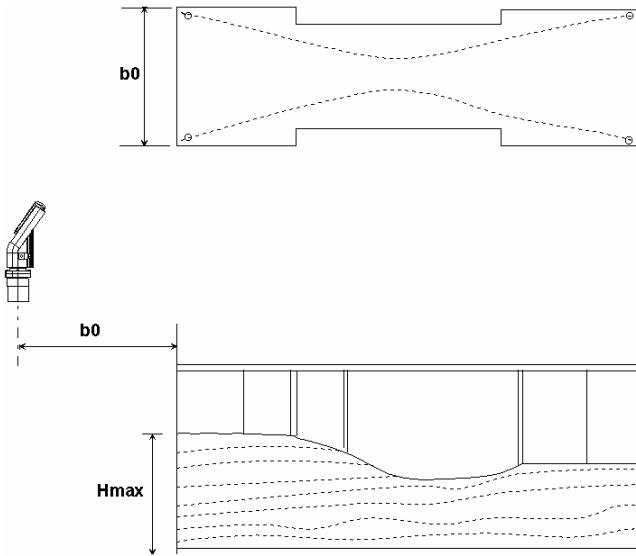
Code (FF)	Crest Length
01	35
02	45
03	60
04	80
05	100
06	150
07	200
08	300

Type 4 (X) – V-notch (Triangular) Sharp-Crested Weir



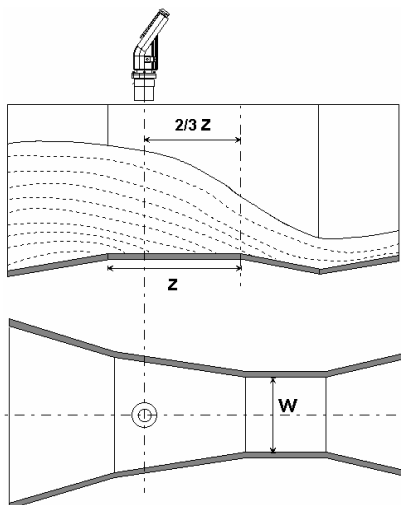
Code (FF)	V-notch Angle
01	90°
02	60°
03	53.8°
04	45°
05	30°
06	28.4°
07	22.5°
British Standard	
08	90°
09	45°
10	22.5°

Type 5 (X) – Khafagi-Venturi Flume



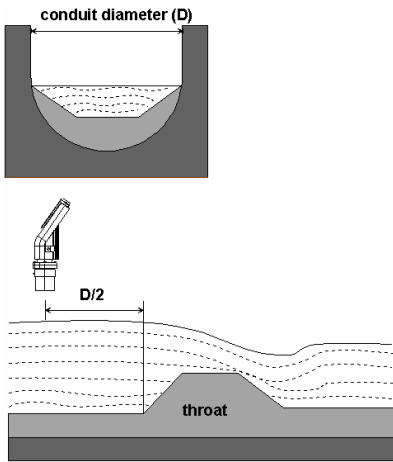
Code (FF)	Flume Type	b0
01	QV 302	12
02	QV 303	30
03	QV 304	40
04	QV 305	50
05	QV 306	60
06	QV 308	80
07	QV 310	100
08	QV 313	130
09	QV 316	160

Type 6 (X) – Parshall Flume



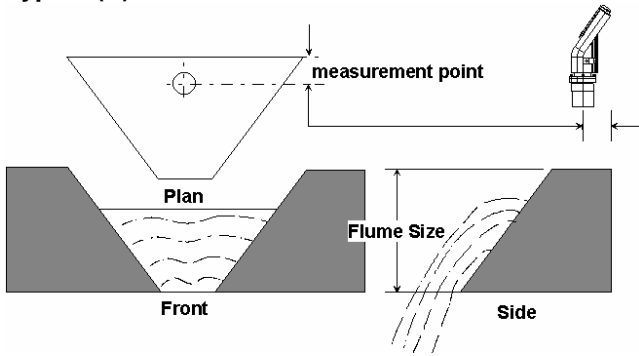
Code (FF)	Throat Width (in)	Code (FF)	Throat Width (in)
01	1	09	36
02	2	10	48
03	3	11	60
04	6	12	72
05	9	13	96
06	12	14	120
07	18	15	144
08	24		

Type 7 (X) – Palmer-Bowlus Flume



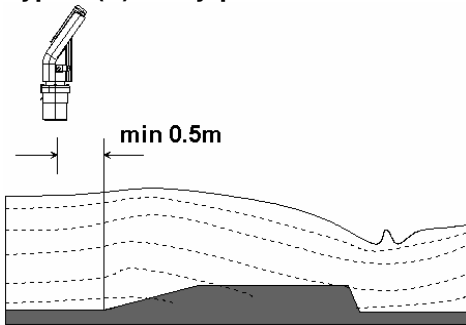
Code (FF)	Conduit Diameter (in)
01	6
02	8
03	10
04	12
05	15
06	18
07	21
08	24
09	27
10	30

Type 8 (X) – H-Flume

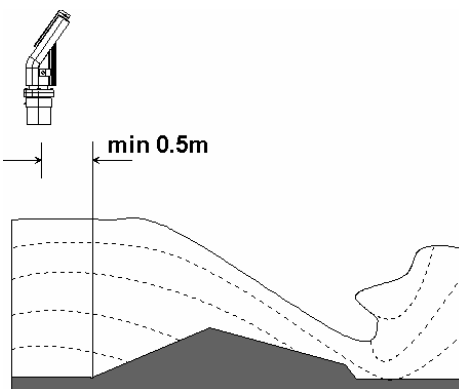


Code (FF)	Flume Size (in)	Measurement Point (cm)
01	6	5
02	9	7
03	12	9
04	18	14
05	24	18
06	30	23
07	36	28
08	54	41

Type 9 (X) – Neyrpic-Venturi Flume / Long Base Weir




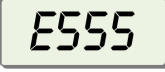
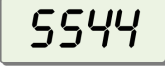



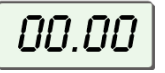
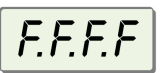
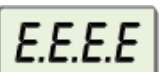
Code (FF)	Flume Type	Code (FF)	Flume Type
01	1253AX	06	1253C
02	1253AY	07	1253D
03	1253AZ	08	1253E
04	1253A	09	1253F
05	1253B		



Code (FF)	Conduit Diameter (in)
10	1245A
11	1245B
12	1245C
13	1245D

TROUBLESHOOTING

This section describes how to resolve problems that may occur when calibrating / operating the SmartSonic. If the following information does not lead to a resolution of the problem, contact Kenco for assistance.

Error	Description	Solution
	Electrical Noise in Area	Check the Power Supply. If needed, install a voltage “snubber”. When active, the output will be 22mA
	Faulty Power Supply	Make sure that the Power Supply conforms to the SmartSonic Specifications. If the problem persists, replace the Power Supply. When active, the output will be 22mA
	Sensor disconnected	Contact Kenco for further instructions. When active, the output will be 22mA
	Any combination of (3) 8's and a 1, indicates an electrical short caused by depressing the buttons too long	Contact Kenco for further instructions
	Appears for several seconds after restarting the unit. If it is displayed for more than several seconds, it may be due to one of the following: <ul style="list-style-type: none"> • Power supply voltage is too low • Load resistor resistance is too high or unnecessary A random pulse that causes the unit to automatically restart	Make sure that the Power Supply conforms to the SmartSonic Specifications. If the problem persists, replace the Power Supply
	Measurement value is greater than 9999	Double check the unit configuration (Pr.02 – Pr.09)
	In Flow Mode, appears when the entered tank height is incorrect	Decrease the Tank Height Value
	Target in Dead Zone	Move sensor further away from process fluid.
	Level below “Tank Height”, or tank empty (causing false echoes).	Check the level of the tank. Make sure that there is some fluid below the sensor.

Appendix A. – Gas Factor Table

Atmosphere (Gas)	Factor	Atmosphere (Gas)	Factor
Acetic Acid	0.62	Ethane	0.90
Acetone	0.63	Ethanol	0.71
Acetaldehyde	0.74	Ethylene	0.95
Acetyl Chloride	0.54	Helium	2.93
Acetylene	0.99	Hydrogen	3.79
Ammonia	1.26	Hydrogen Sulfide	0.89
Argon	0.92	Isopropyl Alcohol	0.62
Benzene	0.53	Methane	1.29
Bromine	0.41	Methyl Hydrazine	0.71
Bromochlorodifluoromrthane	0.37	Neon	1.30
Butanone	0.56	Nitrogen	1.01
Carbon Dioxide	0.77	Nitromethane	0.63
Carbon Monoxide	1.01	Oxygen	1.02
Carbon Tetrachloride	0.38	Propane	0.72
Chlorine	0.68	Propanol	0.61
Dimethyl Ether	0.71	Tetrahydrofuran	0.57