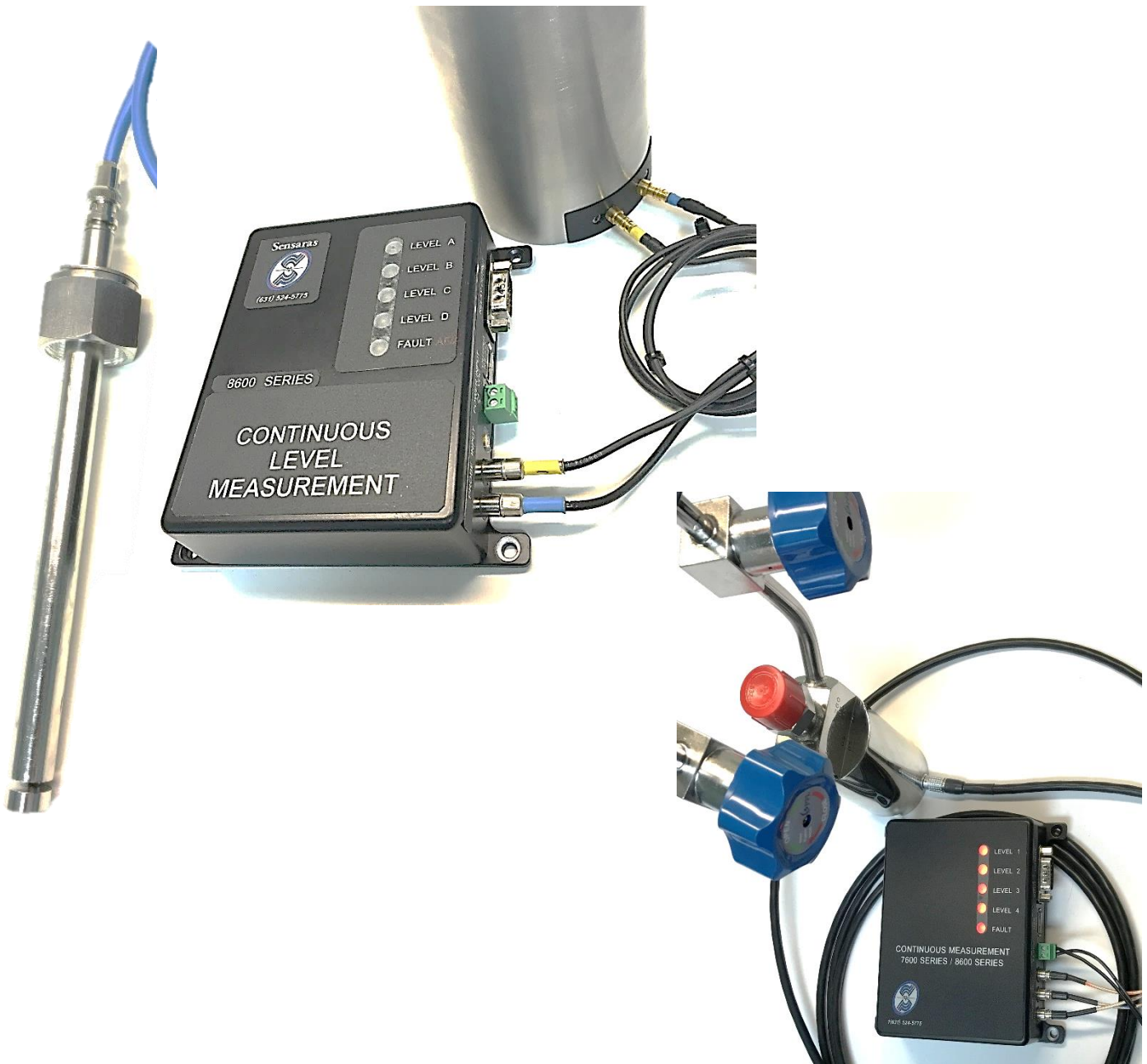


# INSTRUCTION MANUAL

## 7600/8600

(CONTINUOUS LEVEL MEASUREMENT SYSTEM)



## SYSTEM SPECIFICATIONS

Input Power:	24VDC to board
Output:	Four NPN set points, one continuous output of 4-20mA current output or 0-10VDC voltage output, RS-232 (PC compatible), Digital LED Display (Optional).
Programmability:	via USB (Hyper Terminal)
RS-232 settings:	9600 baud, 8 data bits, 1 stop bit, no parity, full duplex, hardware none,
Set points (Alarms):	Four NPN outputs. Each alarm point can be individually.
Operation Mode:	Distance measurement, Height measurement, and Acceptance Band (contact factory for volume measurement capabilities).
Operating Range:	0.5" to 20" (Dependent on installed sensor)
Accuracy:	$\pm 0.005"$ ( $\pm 0.127\text{mm}$ ) or 0.1% of full scale (temperature compensation optional) at room temperature.
Repeatability:	$\pm 0.05\%$ of full scale range.

## SYSTEM DESCRIPTION

The Sensaras model 7600/8600 is a state-of-the-art level measurement instrument based on the latest ultrasonic technologies. The 7600/8600 provides an efficient, reliable and cost-effective means of level control. The 7600/8600 consists of two major components: the sensor and the electronic control board.

The sensor is available in a variety of sizes and materials to suit virtually any application. The size of the sensor is dependent on the needed range and the material required depends on the environment in which the unit is intended to be used. Sensor materials include, but are not limited to 316SS, CPVC, Kynar and Teflon®. Contact the factory for assistance in sensor selection.

## **PRINCIPLES OF OPERATION**

In operation the electronics generate an electronic signal which is converted by the sensor to an ultrasonic burst. This burst is then transmitted through the air towards the target surface. When the burst reaches the surface it is reflected back to the sensor. The received echo is converted by the sensor to an electronic signal and then amplified and digitized before being sent to the microprocessor. The microprocessor uses the echo signal to calculate the transit time of the ultrasonic burst. This transit time is directly proportional to the target's distance from the sensor. The microprocessor then compares the calculated values with the user programmed settings to provide the required control of the system.

## **SETUP CONSIDERATIONS**

The Electronic module can be mounted in any position without detriment to its operation.

The sensor should be mounted perpendicular to the surface it is detecting.

An error of a few degrees from perpendicular will adversely affect the effective range of the unit.

The design of the sensor mounting should be that no physical contact with the sensor face is ever encountered.

While casual contact with the sensor or the sensor face has no lasting adverse effects on the sensor,

contact of a forceful nature can permanently damage the sensor.

The sensor cable should not be bent without allowing a radius of one inch or more.

Bending the cable excessively can cause an internal break in the cable.

The 7600 series sensor should be mounted in a plastic holder of some nature.

The use of metal is not recommended.

When using the Temperature Compensation option, the remote temperature sensor should be mounted / placed as close to the area that actual measurements are to be performed as possible. Mounting the sensor away from the actual measurement location can result in erroneous temperature corrections being made.

## CUSTOMER PROGRAMMING SECTION

The customer programming section allows the user to access the parameters which are used to control the operation of the 7600/8600 unit. The user can access the parameters by sending the character via the USB connection to a PC.

The following letters followed by the carriage return access the settings:

"M" for the MAIN menu.

"I or V" for the ANALOG menu.

"L" for the SET POINT menu.

"C" for the CALIBRATION menu.

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The parameters available are, in their programming order:

"M" Menu

- Number of channels to operate. CH = (1→2)
- Auto calibration AC = Y= Yes, N= No
- Repetition Rate RR = (1→100) mSec
- Number of samples. SA = (5→500)
- Frequency. XF\_1 = (0.05→2.5) MHz
- Transmit width. XW\_1 = (1→50) μSec
- Adjustable Gain Control AG\_1 = (5→500) μSec
- Window opened. WO\_1 = (5→500) μSec
- Window closed. WC\_1 = (5→500) μSec
- Temperature compensation. TC = D (Enabled /Disabled)
- Velocity of sound (VO Factor). VO\_1 = (15.0→500.0) μSec
- Data Acquisition. C = Continuous, S = Software, H = Hardware

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"U" Menu

- Set Units of measure M= Metric, I= Inches

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"I" or "V" Menu

- Set Zero Zero\_1 = (0.5"→39.33" or 12.71mm→999mm)
- Set Span Span\_1 = (0.5"→39.33" or 12.71mm→999mm)
- DAC output H/D\_1 = H= Height, D= Distance
- Last value on loss of signal Hold\_1 = Y= Yes, N= No
- Current or Voltage I/V\_1 = I= 4-20mA, V= 0-10V (Temp and Distance)

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"L" Menu

- NPN out Level A LED\_1 = (0.5"→39.33" or 12.71mm→999mm) > Level B
- NPN out Level B LED\_2 = (0.5"→39.33" or 12.71mm→999mm) > Level C
- NPN out Level C LED\_3 = (0.5"→39.33" or 12.71mm→999mm) > Level D
- NPN out Level D LED\_4 = (0.5"→39.33" or 12.71mm→999mm)

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"C" Menu

- Calibration window CF = (0.000 → 1.000)
- ~~~~~

## **NUMBER OF CHANNELS**

The 7600/8600 electronic module is equipped with 2 channels. Only Channel 1 has the Analog Output. Channel 1 & 2 has the RS-232 output.

**VALID SETTINGS: from 1 to 2**

**FACTORY DEFAULT: 1**

## **AUTO CALIBRATION**

When Auto Calibration is selected Channel 2 is used to calibrate for the speed of sound.

**VALID SETTINGS: Y or N**

**FACTORY DEFAULT: N**

## **REPETITION RATE**

The Repetition Rate parameter controls the frequency at which readings are taken. The lower the value of the Rep Rate parameter, the more often a reading will be taken. The higher the value of the Rep Rate, the less often a reading will be taken. This parameter directly reflects the perceived speed of the unit.

**VALID SETTINGS: from 1 to 100 mSecs**

**FACTORY DEFAULT: 5 mSecs**

## **NUMBER OF SAMPLES**

The Samples parameter dictates the number of samples which will be used in the processing method selected.

**VALID SETTINGS: from 5 to 500 (median)**

**FACTORY DEFAULT: 10**

## **SENSOR FREQUENCY IN MHZ**

The 7600/8600 is a factory set parameter and controls the transmit frequency of the unit. Normally, this parameter should never be changed by the operator/user. This value should only be changed if told to do so by Sensoras.

**VALID SETTINGS: from 0.5 to 2.5 MHz**

**FACTORY DEFAULT: 0.714**

## **TRANSMIT WIDTH**

The transmit width parameter controls the width of the pulse which is sent from the face of the sensor to the target and then reflected back. The wider the width the more signal which is then reflected back to the sensor. The width is set according to the type of sensor being used and the application.

**VALID SETTINGS: from 1 to 50.0 µsecs**

**FACTORY DEFAULT: 10 µsecs**

## **AUTOMATIC GAIN CONTROL WIDTH**

The AGC width parameter controls the time at which the automatic gain is used in controlling the signals at the sensor face. The lower the value of the AGC parameter, the more signal will be seen as a receive signal from the sensor. The higher the value of the AGC parameter, the less signal will be observed at the sensor face.

**VALID SETTINGS: from 5 to 500 µsecs**

**FACTORY DEFAULT: 50 µsecs**

## **WINDOW OPENED**

The Window Open parameter signifies the time at which a received pulse is recognized as a return, or stop signal, in the near field of the sensor. Only after the Window Open value will a pulse be detected as a return signal and therefore be recognized as a stop signal, if a signal is present in the near field. The Window Open needs to be greater than the ringing of the sensor. If the Window Open parameter is set too small, then erroneous results will be reported. This has a direct correlation to the type of sensor and the setting of the Transmit Width parameter.

**VALID SETTINGS: from 5 to 500  $\mu$ Sec**

**FACTORY DEFAULT: 30  $\mu$ Sec**

## **WINDOW CLOSED**

The Window Close parameter signifies the time at which a received pulse is no longer recognized as a return, or stop signal. After the Window Close value a pulse is no longer detected as a return signal and is therefore not recognized as a stop signal. The Window Close needs to be greater than the maximum distance you wish to measure, otherwise erroneous results will be reported for distance.

**VALID SETTINGS: from 5 to 500  $\mu$ Sec**

**FACTORY DEFAULT: 500  $\mu$ Sec**

## **TEMPERATURE COMPENSATION**

This parameter provides a means of distinguishing through air or bottom-up operation when the built-in temperature compensation is set to Yes.

**VALID SETTINGS: Y = Yes, N = No**

**FACTORY DEFAULT: N = No**

## **MEDIA (VELOCITY OF SOUND FACTOR) (FACTORY SET)**

The Media VO Factor parameter lets the operator enter in a specific factor for the medium in which measurements are to be made. This parameter will not appear if temperature compensation is enabled (Air is assumed). Setting the Media VO Factor to a lower value indicates that the medium being used allows sound to travel faster than in air. Setting the Media VO Factor to a higher value indicates that the medium being used allows sound to travel slower than in air. NOTE: Enabling the temperature compensation parameter automatically resets the Media VO Factor to that in air at sea level (147.76  $\mu$ secs/inch).

**VALID SETTINGS: from 15.0 to 500.0  $\mu$ secs/inch**

**FACTORY DEFAULT: 147.76  $\mu$ secs/inch (air) 33.8  $\mu$ secs/inch (liquid)**

## DATA ACQUISITION

The data acquisition parameter selects how and when readings are to be taken. When the parameter is set to Continuous then readings are performed at the rate specified by the Rep Rate parameter and all enabled outputs are written to or updated (RS232, current / voltage output, relay outputs). When the parameter is set to Software Strobe, then the unit waits for a strobe input (command "X") to the unit to perform a reading. When the parameter is set to Hardware Strobe, then the unit waits for a strobe input from hardware strobe input to perform a reading.

### **Strobe Modes (Hardware & Software) vs. Continuous Output**

The use of the 7600/8600 is accomplished in one of two ways. Continuous operation allows the unit to run continuously at the set repetition rate and outputting the results in a constant manner. Selecting one of the strobe modes allows an outside device to dictate when a reading will be taken and output. The two types of strobes are discussed further below.

The **Software Strobe** is used when it is desired for the data collection computer to signal the 7600/8600 board when to take a reading. A software strobe is initiated when the computer sends the "S" character followed by a carriage return (note the capital "S") to the 7600/8600 unit. The 7600/8600 then processes a single reading according to the parameters set and outputs the results as per those parameters. The 7600/8600 will then enter an idle mode where no updating or outputting will result until the next software strobe or another valid RS-232 command is received.

The **Hardware Strobe** is an optional feature that takes the place of the current / voltage output. It behaves very similar to the software strobe. The 7600/8600 unit acts in the same manner when receiving a hardware strobe as it does when receiving a software strobe. The hardware strobe is a signal hardwired to the 7600/8600 board (see Appendix A for wiring diagram) and triggers the unit to perform a reading according to the parameters set and outputs the results as per those parameters. The hardware strobe is a normally high line (+5VDC) which is pulled low (<0.2VDC) to initiate a hardware strobe signal. This line must be held low for a minimum of 10 milliseconds and must be released high and allowed to remain high for a minimum of 10 milliseconds before another hardware strobe sequence can be initiated.

**VALID SETTINGS: C = CONTINUOUS,  
S = SOFTWARE STROBE,  
H = HARDWARE STROBE  
FACTORY DEFAULT: C = CONTINUOUS**

## OUTPUT UNITS

The Output Units parameter dictates in what units the system will report the readings. Currently the choices are millimeters and inches. The millimeters setting reports readings in the format XXX.XXX. The inches setting formats its output as XX.XXX.

**VALID SETTINGS: M = MM, I = INCHES  
FACTORY DEFAULT: I = INCHES**

## **SET ZERO**

The point from the face of the sensor at which the current output will read 4mA in Distance Mode, or 20mA in Height mode.

**VALID SETTINGS: from 0.20 to 150.00 inches**

**FACTORY DEFAULT: 1.00 inch**

## **SET SPAN**

The point from the zero point at which the current output will read 20mA in Distance Mode, or 4mA in Height mode.

**VALID SETTINGS: from 0.20 to 150.00 inches**

## **DAC OUTPUT**

The DAC Output Mode controls how the current / voltage output is used. When set to Distance mode, the Zero point (nearest the sensor face) will be 4mA and the Span + Zero point will be 20mA. When used in Height mode, the Zero point will be 20mA and the Span + Zero point will be 4mA.

**VALID SETTINGS: D = Distance or H = Height**

**FACTORY DEFAULT: D = Distance**

## **LAST VALUE ON LOST ECHO HOLD**

This parameter allows the operator to select the desired function of the DAC when a lost echo condition occurs. A lost echo condition can occur due to sloshing of liquid, air currents, or a number of other conditions. With this parameter set to No the DAC output will swing to the full scale extreme. With this parameter set to Yes the DAC output will remain at its last value for which a valid reading was received.

**VALID SETTINGS: Y = YES, N = NO**

**FACTORY DEFAULT: N = NO**

## **CURRENT OR VOLTAGE**

This parameter allows the operator to select the desired function of the DAC in current (4-20Ma) or Voltage (0-10V).

**VALID SETTINGS: I = CURRENT (4-20mA), V = Voltage (0-10V)**

**FACTORY DEFAULT: I = CURRENT**

## **LED AND SET POINTS PARAMETERS**

This parameter allows the operator to select the desired set points. The LED correspond to the set points. Each set point has an NPN output, when the desired number is reached the transistor output goes LOW. The LED corresponding to the set-point changes from RED to GREEN. The Higher set point must be set to a value greater than the set point it.

**VALID SETTINGS: (0.5" → 39.33" or 12.71mm → 999mm)**

**FACTORY DEFAULT: 1,2,3,4"**



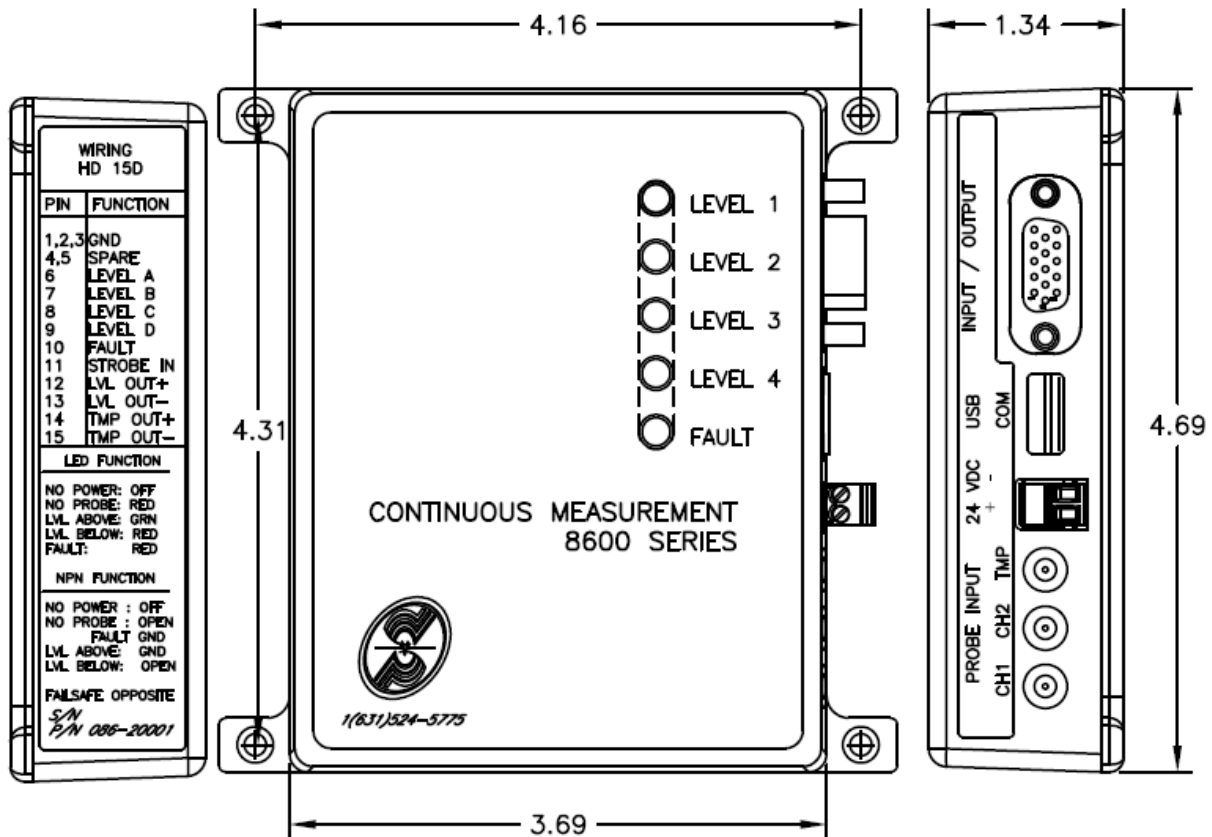
## DISTANCE CORRECTION

The Distance Correction parameter allows the operator to select a positive value between 0.000 and 1.000 to be subtracted from the actual reading the unit develops. This feature is helpful in correcting a fixed offset which may be encountered in an application. For non-invasive, bottom-up applications this is usually the bottom wall of the vessel which has a different velocity of sound than the liquid itself.

**VALID SETTINGS: from 0.000 to 1.000**

**FACTORY DEFAULT: 0.000**

## DIMENSIONS AND WIRING



### WIRING 15 PIN HD MALE RELAY OUTPUT

| PIN | FUNCTION              |
|-----|-----------------------|
| 1   | SPARE                 |
| 2   | GND                   |
| 3   | GND                   |
| 4   | RS-232 TX             |
| 5   | RS-232 RX             |
| 6   | LEVEL A OUTPUT (SINK) |
| 7   | LEVEL B OUTPUT (SINK) |
| 8   | LEVEL C OUTPUT (SINK) |
| 9   | LEVEL D OUTPUT (SINK) |
| 10  | FAULT OUTPUT (SINK)   |
| 11  | SPARE                 |
| 12  | ANALOG LVL OUTPUT (+) |
| 13  | ANALOG LVL OUTPUT (-) |
| 14  | ANALOG TMP OUTPUT (+) |
| 15  | ANALOG TMP OUTPUT (-) |

**Warranty:**

Sensaras LLC, products are warranted to be free from defects in material and workmanship for a period of 12 months from the date of shipment of the original Purchaser and Order. This warranty applies to the general purchaser and to components installed, serviced and operated according to the instruction manual. Sensaras will repair or replace at its option.

Claims are to be made in the warranty period. It does not apply to any component that has been damaged due to improper installation, exposed to unusual atmospheric conditions, misuse, misapplied or damage due to neglect, damage, abuse, altering or repairing.

- The Sensaras products must be maintained and installed in strict accordance with the National Electrical Code and the applicable.
- The Sensaras Product Instruction Bulletin that covers installation, operation and proper maintenance. Failure to observe this information may result in serious injury or damages.
- Please adhere to the pressure and temperature limitations shown in drawings and specifications. These limitations must not be exceeded. These pressures and temperatures take into consideration possible system surge pressures / temperatures and their frequencies.
- Selection of materials for compatibility with the media is critical to the life and operation of the Sensaras products.
- Ambient temperature changes do affect switch set points, since the gravity of a liquid can vary with temperature.
- Our sensors have been designed to resist shock and vibration. However, shock and vibration should be minimized.
- Filter liquid media containing particulate and/or debris to ensure the proper operation of our products.
- Our sensors must not be field-repaired.
- Physical damage sustained by product may render it unserviceable.

**Material Returns:**

Returns are accepted on stock items up to 30 days from date of order. You must contact our Returns Department for a Return Material Authorization (RMA) # Return the goods - freight prepaid - in the original container and include original packing slip.

C. O. D. returns are not accepted. Sensaras reserves the right to apply restocking charges.

Telephone: 1-631-524-5775.

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