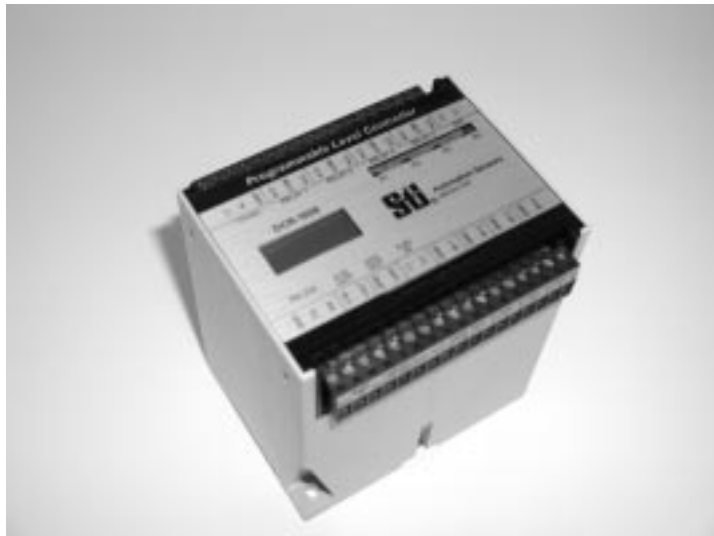


# **OPERATORS MANUAL**

## **DCR-1008**

### **PROGRAMMABLE LEVEL CONTROLLER**



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**WARRANTY**

The manufacturer has warranted this product for 18 months from date of purchase. This warranty is limited to the products manufactured by STI Automation Sensors, which under normal use and service, appear to have been defective in materials or workmanship. Defective products shall be returned to Automation Sensors for inspection by the service department. Automation Sensors will repair or replace, at no charge to the customer, any products which are found to be defective in material or workmanship. This warranty does not apply if the products are misused, damaged or installed in applications not suited for this ultrasonic unit. The seller is not authorized to make any warranty on any device manufactured by Automation Sensors other than specified above. The seller makes no warranty whatever in regard to trade accessories, such being subject to the warranty of their respective manufacturers, and the seller's warranty does not obligate it to bear the cost of labor in replacement parts. Before any product can be returned to the factory, a returned materials authorization (RMA) number must be obtained from Automation Sensors's Customer Service Department at (888) 525-7300 or (435) 753-7300. Be sure to include the RMA number on the mailing label of the returned product. The returned product should be packaged securely and shipped insured and prepaid.

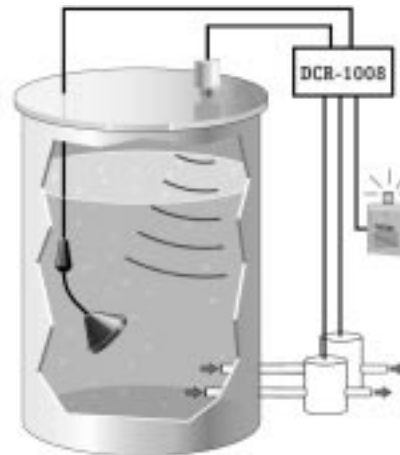
# 1 INTRODUCTION

The DCR-1008 is a programmable level controller that is specifically designed for rugged and reliable pump control. It accepts inputs from a variety of floats and sensors including 4-20mA devices, STI's DST series ultrasonic sensors, and discrete switches. It's configurable outputs include four 10A SPDT relays and one isolated 4-20mA output. The controller can be configured to monitor distance, level, or volume. Features like dual input control, pump alternation, volumetric calculations, and a high degree of user input/output control allow the DCR-1008 to be used in a wide range of applications.

The DCR-1008 can easily be programmed using STI controller software on a PC with the Windows operating system. The software tabs categorize the controller's functions in logical groups and easily readable formats for simple data entry. In addition a status window provides continuous readouts of the units measurement and relay status. Controller setups can be saved to the PC and loading again at a later date. The DCR-1008 can also be modified without the PC using the on-board keypad and LCD display. Four LED's show the status of the four output relays.

## FEATURES

- Designed for pump and lift station control and alarm
- Lead - Lag pump alternation
- Volume, distance, and level measurement modes
- Ultrasonic / 4-20ma and discrete input control
- Programmable control options for use in many applications
- Simplified programming with PC or onboard keypad
- 2 line x 8 character LCD
- DIN-rail or thru-hole mount



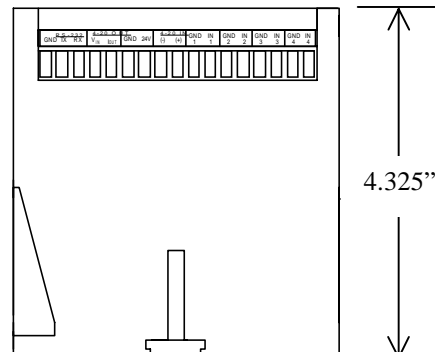
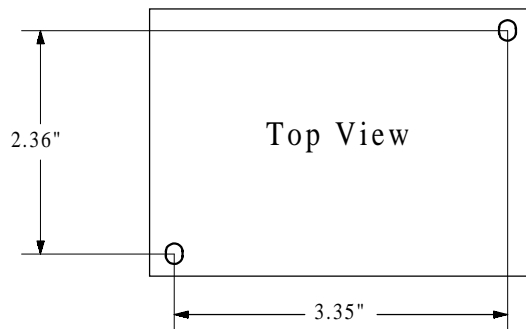
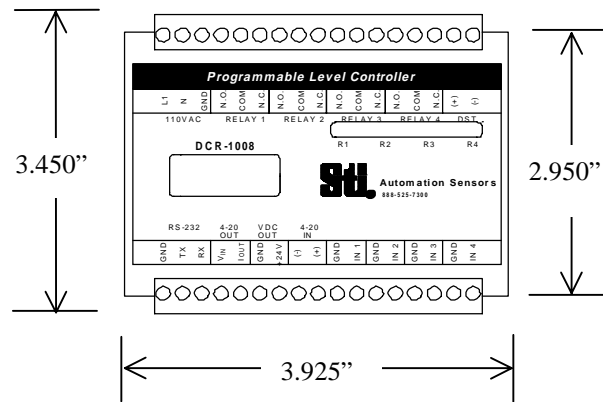
**Dual Input Control Feature**

## 2 SPECIFICATIONS

<b>Inputs</b> <ul style="list-style-type: none"> <li>• (1) DST Ultrasonic</li> <li>• (1) 4-20 mA</li> <li>• (4) Discrete</li> <li>• RS-232 Communication</li> <li>• Power (Line, Neutral, Ground)</li> </ul>	<b>Environmental</b> <ul style="list-style-type: none"> <li>• Indoor/Outdoor use (out of weather)</li> <li>• Ambient Temperature -10° to 50° C</li> <li>• Relative Humidity 80% for temperatures up to 31 ° C</li> </ul>
<b>Outputs</b> <ul style="list-style-type: none"> <li>• (4) Relays <ul style="list-style-type: none"> <li>- Control / Alarm, Form "C" SPDT contacts</li> <li>- Rated 10A @ 110 Vac, non-inductive, 30 Vdc</li> <li>- Normally open and normally closed outputs</li> </ul> </li> <li>• (1) 4-20 mA <ul style="list-style-type: none"> <li>- Optically isolated 4-20 mA</li> <li>- Max load 750 ohms</li> </ul> </li> <li>• 24 Volt Supply power for isolated 4-20mA output</li> </ul>	<b>Power</b> <ul style="list-style-type: none"> <li>• 110 Vac <math>\pm</math> 10%, 50/60 Hz, 100ma max (Default)</li> <li>• 220 Vac <math>\pm</math> 10%, 50/60 Hz, 100ma max (Optional)</li> <li>• 24 Vdc <math>\pm</math> 20%, 100 mA max (Optional)</li> </ul>
<b>Memory</b> <ul style="list-style-type: none"> <li>• Flash (non-volatile), no back-up battery required</li> </ul>	<b>Measurement Modes</b> <ul style="list-style-type: none"> <li>• Distance (From sensor face)</li> <li>• Level (From tank bottom)</li> <li>• Volume (From tank bottom)</li> </ul>
<b>Programming</b> <ul style="list-style-type: none"> <li>• Integrated keypad and LCD display</li> <li>• PC, STI software, Windows 95,98,2000,NT 9600 baud rate</li> </ul>	<b>Control Modes</b> <ul style="list-style-type: none"> <li>• Dual input control</li> <li>• Individual output control</li> <li>• Programmable input / output logic</li> <li>• Lead-Lag pump alternation</li> </ul>
<b>Display</b> <ul style="list-style-type: none"> <li>• LCD with 2 lines x 8 characters each 1.25x.55 in.</li> </ul>	<b>Response Time</b> <ul style="list-style-type: none"> <li>• Programmable</li> </ul>
<b>Enclosure</b> <ul style="list-style-type: none"> <li>• ABS thermoplastic molded enclosure</li> <li>• NEMA 1, IP10</li> <li>• DIN rail and thru-hole mounting</li> <li>• 3.925L x 3.450H x 4.325D</li> </ul>	<b>4-20 mA Specifications</b> <b>Resolution</b> <ul style="list-style-type: none"> <li>• Input: 10 bit A/D converter</li> <li>• Output: 12 bit D/A converter</li> </ul>
<b>Weight</b> <ul style="list-style-type: none"> <li>• 1.16 lbs (.52 kg)</li> </ul>	<b>Ultrasonic Specifications</b> <b>Range</b> <ul style="list-style-type: none"> <li>• 1 – 16 ft. max DST2007, DST2008</li> <li>• .6 – 35 ft. max DST2001</li> <li>• 1.5 – 35 ft. max DST2002, DST2004</li> <li>• 2 – 50 ft. max DST1006, DST1006-F</li> </ul> <b>Accuracy</b> <ul style="list-style-type: none"> <li>• 0.25% of range (with no temperature gradient)</li> </ul> <b>Temperature Compensation</b> <ul style="list-style-type: none"> <li>• Internal</li> </ul>
<b>Wiring</b> <ul style="list-style-type: none"> <li>• Terminal strip with clamping yoke</li> <li>• 14 gauge wire max</li> </ul>	

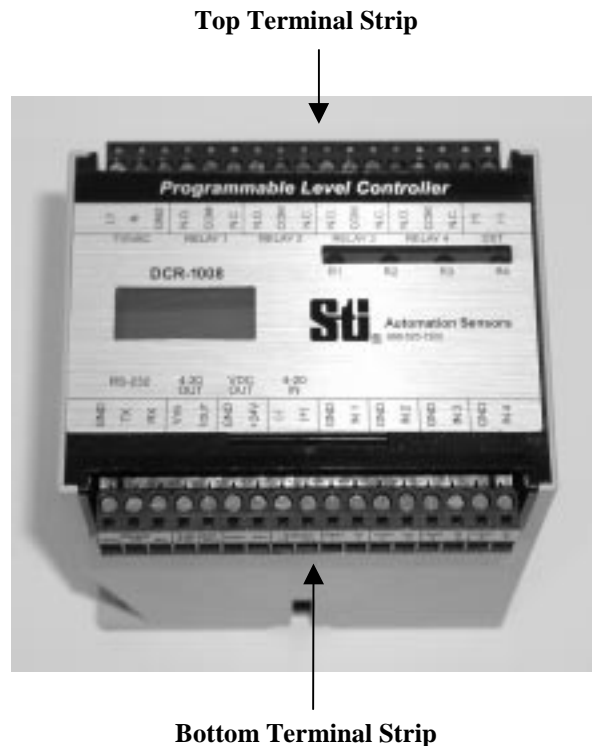
### 3 INSTALLATION

The DCR-1008 is designed to be mounted to a Din-Rail (DIN 46277 and DIN EN 50022), or to a wall or panel by using the two mounting holes on the back of the enclosure (DIN 46121 and DIN 43660). The DCR-1008 is rated for NEMA 1 (IP10) applications. If it is mounted outside it should be placed in an environmentally sealed NEMA 4 type enclosure, providing adequate protection from direct sunlight and the elements.



## 4 WIRING

All connections to the DCR-1008 are made on the terminal strips located on the top and bottom of the enclosure as shown.

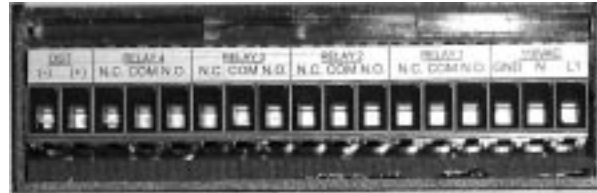


The terminal strips are removable for ease of wiring or for removal of the controller. The wires are secured to the terminal strip with a clamping yoke that is tightened by a screw on the top of each yoke. The clamping yokes can accommodate wire sizes up to 12 gauge. The wire insulation should be stripped exposing 0.25" of bare wire. Make sure the yoke is fully opened and the wire is between the clamps of the yoke before tightening the screw. Be careful not to clamp the yoke down on the wire insulation as this could result in a poor connection.

**CAUTION!** Verify all wires are connected to the proper terminal and securely clamped in the yoke before applying power.



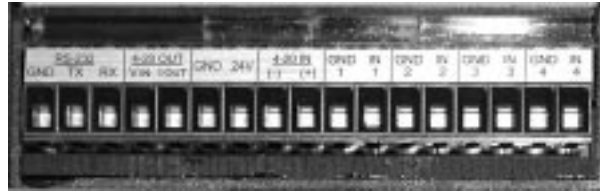
## 4.1 Top Terminal Strip Connections



DST	RELAY 4	RELAY 3	RELAY 2	RELAY 1	110VAC
(-) (+)	N.C. COM N.O.	N.C. COM N.O.	N.C. COM N.O.	N.C. COM N.O.	GND N L1

I/O	CONNECTION	DESCRIPTION
	<b>DST</b>	<b>STI ULTRASONIC SENSORS (DST35, DST50)</b>
Output/Input	(-)	Ultrasonic Sensor Ground
Output/Input	(+)	Ultrasonic Sensor Power and Communication
	<b>RELAY 4</b>	<b>Relay 4</b>
Output	N.C.	Normally Closed Contact
Output	COM	Common
Output	N.O.	Normally Open Contact
	<b>RELAY 3</b>	<b>Relay 3</b>
Output	N.C.	Normally Closed Contact
Output	COM	Common
Output	N.O.	Normally Open Contact
	<b>RELAY 2</b>	<b>Relay 2 / Lag Pump Relay</b>
Output	N.C.	Normally Closed Contact
Output	COM	Common
Output	N.O.	Normally Open Contact
	<b>RELAY 1</b>	<b>Relay 1 / Lead Pump Relay</b>
Output	N.C.	Normally Closed Contact
Output	COM	Common
Output	N.O.	Normally Open Contact
	<b>110VAC</b>	<b>The DCR-1008 operates on 110VAC @ 60 Hz Optional units can be ordered for 220Vac or 24Vdc power</b>
Input	GND	Ground
Input	N	Neutral
Input	LI	Power

## 4.2 Bottom Terminal Strip Connections



RS-232			4-20 OUT		GND 24V	4-20 IN		GND IN	IN 1	GND IN	IN 2	GND IN	IN 3	GND IN	IN 4
GND	TX	RX	VIN	IOUT		(-)	(+)								

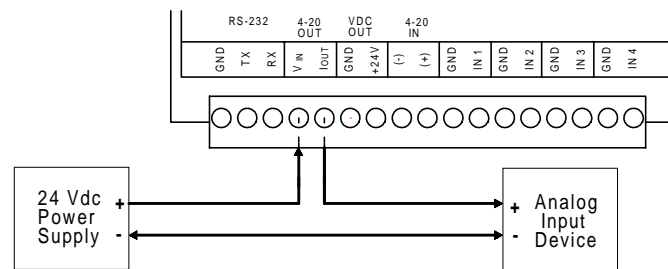
I/O	CONNECTION	DESCRIPTION
<b>RS-232</b>		
PC Computer Interface		
Input	GND	Ground
Input	TX	Transmit
Input	RX	Receive
<b>4-20 OUT</b>		
Isolated 4-20ma Output To External Device *		
Input	Vin	24 Vdc Input Source Current
Output	Iout	4-20 milli-amps Output Current
<b>24 VDC VOLTAGE SOURCE</b>		
Output	GND	24 Volt DC Ground
Output	24 V	24 Volt DC to provide power to Isolated 4-20ma Circuit
<b>4-20 IN</b>		
<b>4-20ma Sensor Device Input</b>		
Input	(-)	4-20 milli-amp Input Device Ground
Input	(+)	4-20 milli-amp Input Device Current
<b>Discrete Switch 1</b>		
Input	GND 1	Contact 2 (Internally Grounded)
Input	IN 1	Contact 1
<b>Discrete Switch 2</b>		
Input	GND 2	Contact 2 (Internally Grounded)
Input	IN 2	Contact 1
<b>Discrete Switch 3</b>		
Input	GND 3	Contact 2 (Internally Grounded)
Input	IN 3	Contact 1
<b>Discrete Switch 4</b>		
Input	GND 4	Contact 2 (Internally Grounded)
Input	IN 4	Contact 1

### 4.3 4-20mA Output Wiring

The DCR-1008 has an isolated 4-20mA output. The 4-20mA output's circuitry and ground plane are isolated from the other DCR-1008 circuits by opto-isolators. Power (24 VDC) must be supplied to the 4-20mA output circuit before it will output the 4-20mA current. Two options exist for supplying power to the circuit.

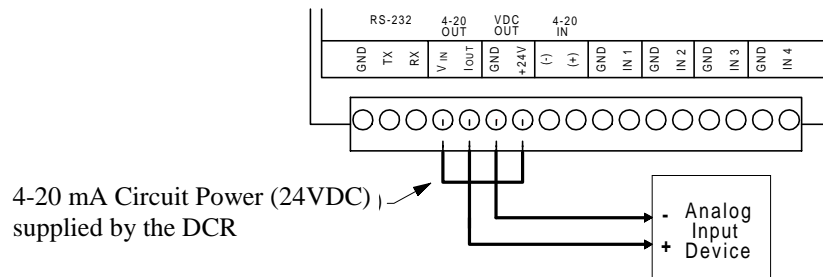
#### *Option 1:*

**Isolated 4-20mA output** with 24 VDC provided by an external source. Wire the 4-20mA output as shown below.



#### *Option 2:*

**Sourced 4-20mA output** with 24 VDC supplied by the DCR-1008. Wire the 4-20mA output as shown below.



## 4.4 RS-232 Connection

Connect the DCR-1008 to the PC RS-232 communication port with the following steps.

1. Disconnect power from the DCR-1008.
2. Connect a RS-232 interface cable to the GND, TX, and RX RS-232 inputs on the bottom terminal strip as follows.

<u>Female 9 Pin D Connection to PC</u>	<u>Wire Color</u>	<u>Connection to DCR-1008</u>
Pin 2	White	TX
Pin 3	Red	RX
Pin 5	Black	GND

<u>RS-232</u>			<u>4-20 OUT</u>			<u>4-20 IN</u>			<u>GND</u>		
GND	TX	RX	V <sub>IN</sub>	I <sub>OUT</sub>		(-)	(+)		1	1	2
									2	2	3
									3	3	4
									4	4	

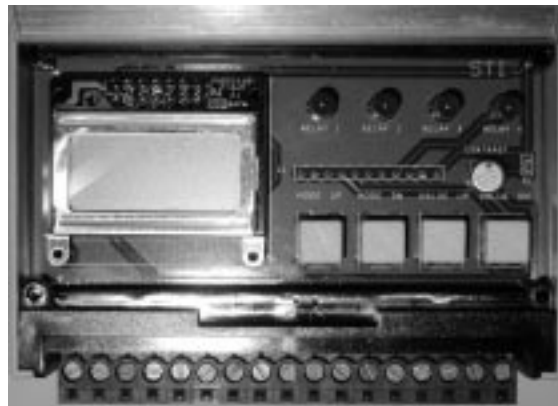
3. Connect the 9-pin female D-type connector to the PC communication port 1 or 2
4. Reconnect power to the DCR-1008.

## 5 PROGRAMMING

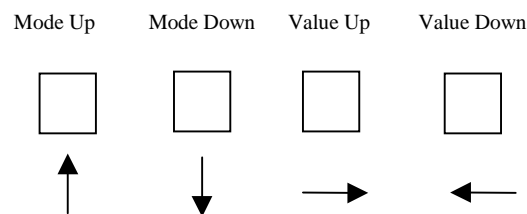
The DCR-1008 can be programmed using the on-board keypad and LCD display or using a PC with DCR-1008 windows based software.

### 5.1 Keypad Programming

The on-board keypad allows the user to sequence through the DCR-1008's 52 operational modes and enter setup parameters that can be viewed on the 2-line by 8-character LCD readout. The keypad is typically only used when no PC is available to program the DCR-1008. To access the keypad, open the cover by inserting a flat bladed object or coin into the slot at the bottom of the cover and prying up. The cover is hinged at the top and opens up to expose the keypad, LCD, and LEDs as shown below.



Four momentary push-buttons makeup the keypad and are used to program the DCR-1008.



Program the DCR-1008 by performing the following steps:

1. Press the Mode Up or Mode Down button to change from run-time to program mode.
2. Press the Mode Up or Mode Down button until the desired mode is displayed.
3. Press the Value Up or Value Down button once to display the current setting stored in that mode.
4. Press the Value Up or Value Down button until the setting is changed to the desired value.
5. Press the Mode Up or Mode Down button to enter the new mode setting. This will return the DCR-1008 to run-time operation with the new mode setting in effect.

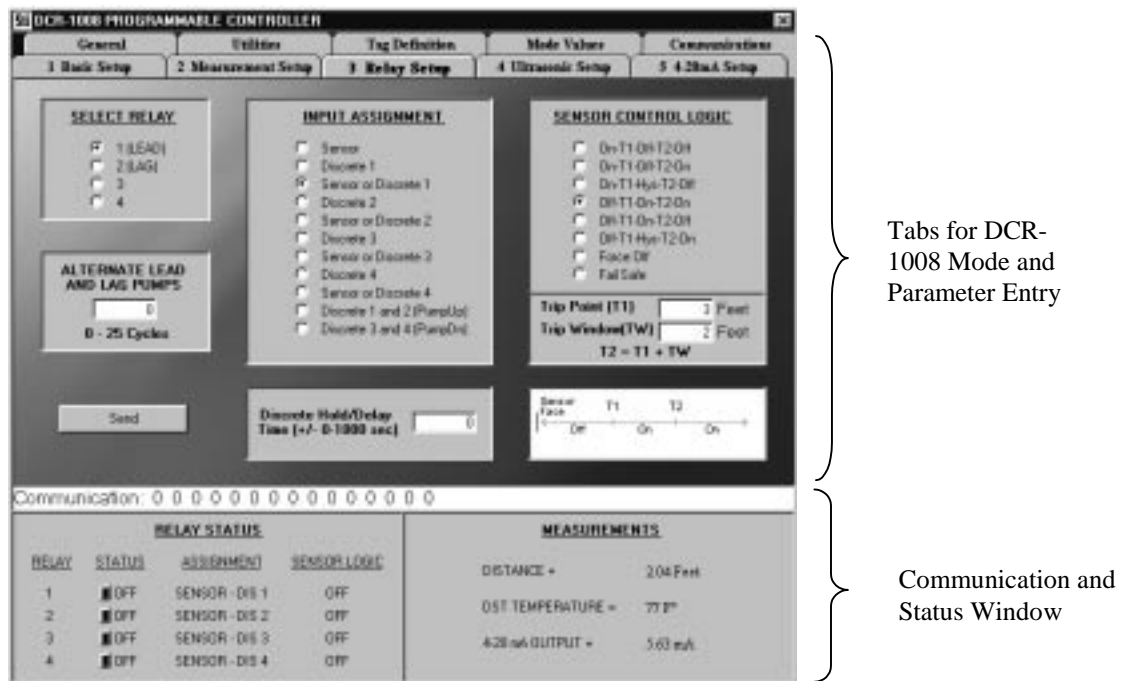
The modes accessed from the keypad are shown in the following table.

Keypad	Description	Range	Default
Units	Units	Inches, Feet, Meters	Feet
InputSel	Sensor Type	35' DST, 50' DST, 4-20mA	35' DST
DecPoint	Decimal Point	00000, 0000.0, 0000.00, 00.000	000.00
4mA In	4mA Input Point	0-65535 (Limited by Decimal Point)	3.00
20ma In	20 mA Input Point	0-65535 (Limited by Decimal Point)	10.00
Lead Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	2.50
Lead Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50
LeadCtrl	Control Logic	OnOffOff, OnOff, On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off
Lead Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D1
LeadTime	Hold / Delay Time	+/- 0-1000 Seconds	+0
Lag Trip	Trip Point (T1)	0-65535 ((Limited by Decimal Point))	3.00
Lag Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50
Lag Ctrl	Control Logic	OnOffOff, OnOff, On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off
Lag Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D2
Lag Time	Hold / Delay Time	+/- 0-1000 Seconds	+0
R3 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.50
R3 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50
R3 Ctrl	Control Logic	OnOffOff, OnOff, On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off
R3 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D3
R3 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0
R4 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	4.00
R4 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50
R4 Ctrl	Control Logic	OnOffOff, OnOff, On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off
R4 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D4
R4 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0
Alt Pump	Alternate Pumps	0-25 Cycles	0
4mA Out	4mA Output Point	0-65535 (Limited by Decimal Point)	3.00
20mA Out	20 mA Output Point	0-65535 (Limited by Decimal Point)	10.00
Tank Type	Measurement and Tank Types	Distance, Level, RecTank, SphrTank, VertFlat, VertCone, HoriFlat, HoriSphr	Distance
ConvMult	ConversionMultiplier	0-65.535	1.000
TankSpan	Sensor face to bottom	0-669 Inches, 0-58.25 feet, 0-17.75 meters	12.00
Tank Len	Tank Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	10.00
SpherLen	Sphere Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.0
Rad/Wid	Radius / Width	0-669 Inches, 0-58.25 feet, 0-17.75 meters	5.00
UltSensit	Sensitivity	0-100	75
UltBlank	Blanking	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00
UltPulse	Pulses	1-20	13
SampRate	Sample Rate	0-9999 msec	120
SampAve	Sample Average	1-50	20
SampOOR	SamplesOutOf Range	1-50	10
SampWin	Sample Window	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00
LossEcho	Loss of Echo Delay	0-1000 sec	5
Max Dist	Maximum Distance	35' DST = 5-35 feet, 50' DST = 5-100 feet	35
AutSense	Auto Sense	Off, On	Off
TempComp	Temperature Comp	Off, On	Off
OffstDis	Offset Distance	0-669 Inches, 0-58.25 feet, 0-17.75 meters	0
OffstPol	Offset Polarity	Positive, Negative	Positive
Calibrat	Calibration Factor	0-1.999	1.000
4ma Cal	4ma Calibration	0-9999 (Units Selected)	5000
20ma Cal	20ma Calibration	0-9999 (Units Selected)	5000
Reset	Set Factory Settings	No, Yes	No

## 5.2 PC Programming

The DCR-1008's parameters can be easily entered using the Windows based PC software provided with the unit. Software tabs categorize the controller's functions into easy to read formats making it easy to find and change parameters quickly. The status screen provides continuous readouts of measurement and relay status. Controller setups can be saved to the PC and loaded again at a later date.

The layout of the software tabs is shown below.



### 5.2.1 Tab Selections

A brief description of the options and data on each Tab is given below.

TAB	FUNCTION
1 Basic Setup	<ul style="list-style-type: none"> <li>Select sensor input type</li> <li>Select units</li> <li>Set decimal point</li> </ul>
2 Measurement Setup	<ul style="list-style-type: none"> <li>Choose between distance, level or volume measurement</li> <li>Select measurement type being used</li> <li>Enter tank parameters</li> <li>Enter volume multiplier</li> </ul>

3 Relay Setup	<ul style="list-style-type: none"> <li>• Configure relays 1-4</li> <li>• Select input control for each relay</li> <li>• Select output logic for each relay</li> <li>• Setup trip points for sensor inputs</li> <li>• Setup discrete switch hold and delay values</li> <li>• Enable pump alternation</li> </ul>
4 Ultrasonic Setup	<ul style="list-style-type: none"> <li>• Setup ultrasonic sensor parameters</li> <li>• Calibrate ultrasonics</li> </ul>
5 4-20 mA Setup	<ul style="list-style-type: none"> <li>• Set 4-20 mA input range</li> <li>• Set 4-20 mA output range</li> <li>• Calibrate 4-20 mA output</li> </ul>
General	<ul style="list-style-type: none"> <li>• Company contact information</li> <li>• Software version</li> <li>• Hardware controller version</li> </ul>
Utilities	<ul style="list-style-type: none"> <li>• Send / Receive data to DCR-1008</li> <li>• Load factory settings</li> <li>• Set communication port</li> <li>• Read / Write setup files</li> </ul>
Tag Definition	<ul style="list-style-type: none"> <li>• Enter Names for inputs and outputs</li> </ul>
Mode Values	<ul style="list-style-type: none"> <li>• Information page only</li> <li>• Translates software tab inputs to keypad mode data</li> <li>• Print mode data to printer</li> <li>• Save mode data information to file</li> </ul>
Communications	<ul style="list-style-type: none"> <li>• Status of software communications to the DCR-1008. Indicates whether the communication was successful or had problems.</li> </ul>

### 5.2.2 Communication and Status Window

The communication and status window is displayed at the bottom of the tab windows. It contains the following data.

Communication Bar	<ul style="list-style-type: none"> <li>• Displays the following communication messages.  <b>Communication 0 0 0 0 0 0 ...</b> The PC and DCR-1008 are communicating  <b>Error No Communication</b> The PC and DCR-1008 are not communicating  <b>File Created</b> The "Write file" command was successful  <b>File Read</b> The "Read file" command was successful  <b>Sending Data / Data Sent</b> The "Send to DCR" command was successful  <b>Receiving Data</b> The "Receive from DCR" command was successful  <b>Factory Settings Sent</b> The "Reset to Defaults" command was successful </li> </ul>
Relay Status	<ul style="list-style-type: none"> <li>• Colors indicate status of the relays. (Green = relay on, Black = relay off)</li> <li>• Displays information about input assignments for each relay</li> <li>• Displays information about sensor logic used for each relay</li> </ul>
Measurements	<ul style="list-style-type: none"> <li>• Displays current measurement for distance, level or volume</li> <li>• Displays temperature for DST Ultrasonics with thermistors</li> <li>• Displays the 4-20mA output current value</li> </ul>



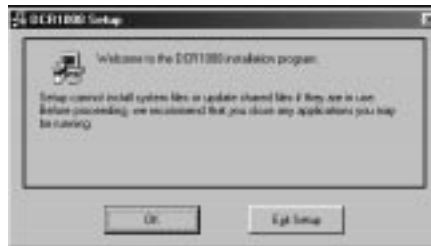
**5.2.3 Software Tab Correlation to Keypad Modes**

Software Tab	Keypad	Description	Range	Default
<b>Basic Setup</b>	Units	Units	Inches, Feet, Meters	Feet
	InputSel	Sensor Type	35' DST, 50' DST, 4-20mA	35' DST
	DecPoint	Decimal Point	00000, 0000.0, 0000.00, 00.000	000.00
<b>4-20 mA Setup</b>	4mA In	4mA Input Point	0-65535 (Limited by Decimal Point)	3.00
	20ma In	20 mA Input Point	0-65535 (Limited by Decimal Point)	10.00
<b>Relay Setup / Relay 1</b>	Lead Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	2.50
	Lead Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50
	LeadCtrl	Control Logic	OnOffOff, OnOff, On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off
	Lead Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D1
	LeadTime	Hold / Delay Time	+/- 0-1000 Seconds	+0
<b>Relay Setup / Relay 2</b>	Lag Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.00
	Lag Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50
	Lag Ctrl	Control Logic	OnOffOff, OnOff, On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off
	Lag Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D2
	Lag Time	Hold / Delay Time	+/- 0-1000 Seconds	+0
<b>Relay Setup / Relay 3</b>	R3 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.50
	R3 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50
	R3 Ctrl	Control Logic	OnOffOff, OnOff, On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off
	R3 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D3
	R3 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0
<b>Relay Setup / Relay 4</b>	R4 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	4.00
	R4 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50
	R4 Ctrl	Control Logic	OnOffOff, OnOff, On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off
	R4 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D4
	R4 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0
<b>Relay Setup</b>	Alt Pump	Alternate Pumps	0-25 Cycles	0
<b>4-20 mA Output Setup</b>	4mA Out	4mA Output Point	0-65535 (Limited by Decimal Point)	3.00
	20mA Out	20 mA Output Point	0-65535 (Limited by Decimal Point)	10.00
<b>Measurement Setup</b>	Tank Type	Measurement and Tank Types	Distance, Level, RecTank, SphrTank, VertFlat, VertCone, HoriFlat, HoriSphr	Distance
	ConvMult	ConversionMultiplier	0-65.535	1.000
	TankSpan	Sensor face to bottom	0-669 Inches, 0-58.25 feet, 0-17.75 meters	12.00
	Tank Len	Tank Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	10.00
	SpherLen	Sphere Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.0
	Rad/Wid	Radius / Width	0-669 Inches, 0-58.25 feet, 0-17.75 meters	5.00
<b>Ultrasonic Setup</b>	UltSensit	Sensitivity	0-100	75
	UltBlank	Blanking	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00
	UltPulse	Pulses	1-20	13
	SampRate	Sample Rate	0-9999 msec	120
	SampAve	Sample Average	1-50	20
	SampOOR	SamplesOutOf Range	1-50	10
	SampWin	Sample Window	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00
	LossEcho	Loss of Echo Delay	0-1000 sec	5
	Max Dist	Maximum Distance	35' DST = 5-35 feet, 50' DST = 5-100 feet	35
	AutSense	Auto Sense	Off, On	Off
	TempComp	Temperature Comp	Off, On	Off
	OffstDis	Offset Distance	0-669 Inches, 0-58.25 feet, 0-17.75 meters	0
	OffstPol	Offset Polarity	Positive, Negative	Positive
	Calibrat	Calibration Factor	0-1.999	1.000
	4-20mA Setup	4ma Cal	4ma Calibration	5000
		20ma Cal	20ma Calibration	5000
<b>Utilities</b>	Reset	Set Factory Settings	No, Yes	No

## 6 SOFTWARE INSTALLATION

The software works on PC's running the Windows 95, 98, 2000 and XP operating system. Install the DCR-1008 software using the following steps.

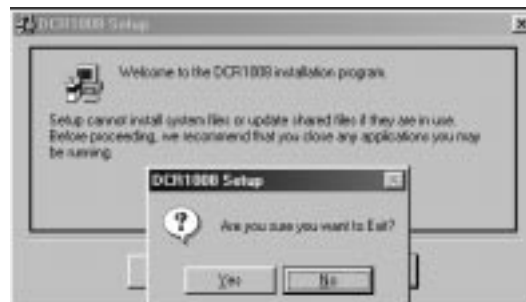
1. Insert the DCR-1008 software CD into the PC's CD-Rom drive.
2. Double click on the CD icon to open the CD and display the files.
3. Double click on the file "setup.exe" to start the DCR-1008 install program. The following screen is displayed.

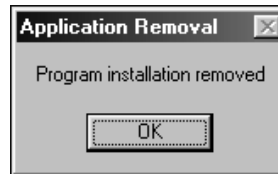
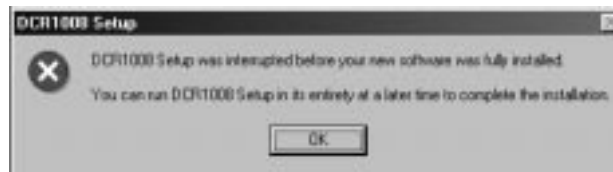


4. Click on the "OK" button to continue. The following screen will be displayed.



5. If you click on the "Exit Setup" button you will exit the installation program. The following screens will be displayed. Answer yes or okay to all the questions to exit correctly.





6. To begin the installation click on the button with the computer. The files will be put in the c:\Program Files\DCR1008 directory. To put them in a different directory specify the path name by clicking on the "Browse" button. When the setup is complete the following screen will be displayed.



7. Click "OK" to exit the installation program.

## 7 STARTUP

When the unit is powered on it is programmed to come up in the run mode. Four red LEDs indicate the status of relays 1 through 4. If the light is on, the relay contact is closed. The LCD will display a distance, volume, or error reading on power up. If no settings have been previously programmed in the non-volatile memory it will power up using factory settings.

### 7.1 Error Indicators

There are 4 error indicators that may appear on the DCR-1008's LCD if an error occurs.

“**Short**” indicates a short in the DST Power connection or termination.

“**No Comm**” indicates a DST sensor is not connected or the sensor is not communicating.

“**LossEcho**” indicates a DST Loss of Echo condition. The sensor is not able to acquire a target within the range of the sensor.

“**OvrLimit**” indicates the number being calculated is too large to be displayed on the LCD display. To correct this condition, try adjusting the decimal position or changing the units. This indication may also result from a negative number being displayed.

### 7.2 PC Communications Test

Make sure the RS232 communication cable is connected between the PC and the controller and the DCR-1008 software has been installed. Verify the communications using the following steps.

1. Bring up the DCR-1008 software by clicking on the windows START button, selecting Programs and then selecting DCR-1008.
2. The following software screen will come up.



3. If the DCR-1008 and PC are connected correctly you will see “Communication: 0 0 0 0 0 ...” in the communication window.
4. If you see “Error No Communication” in the communication window check the following items.
  - a. Select the DCR-1008 Software Utilities Tab. Verify the com port is set correctly to match the PC port connected to the DCR-1008.
  - b. Make sure the PC com port parameters are set as follows:

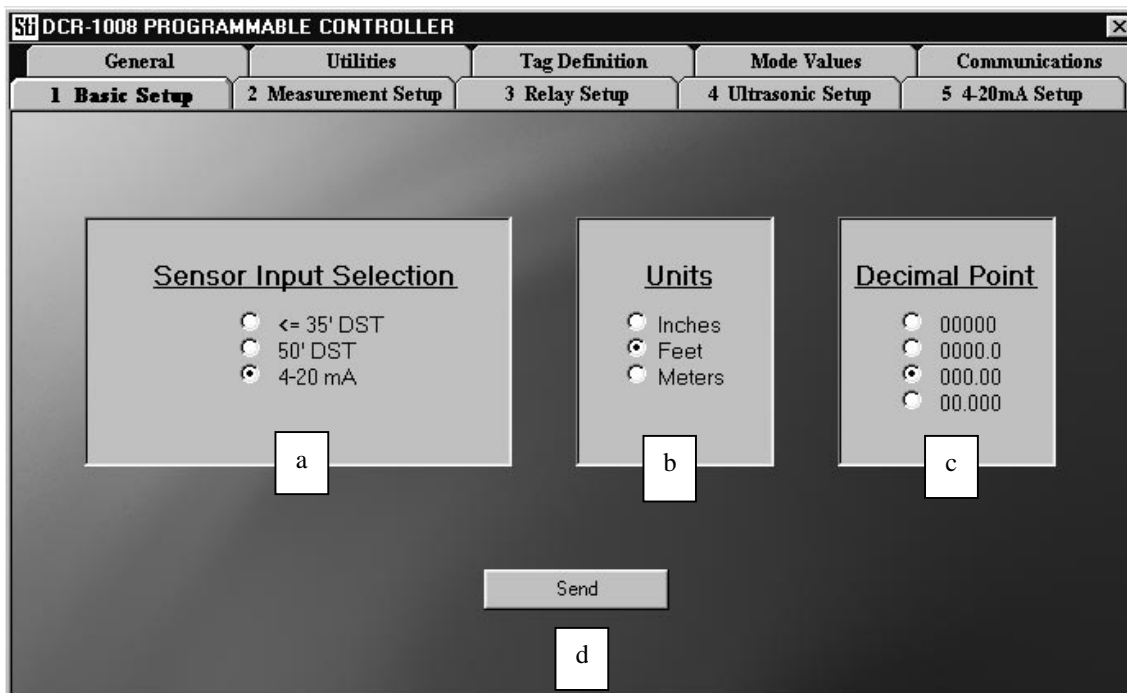
Baud Rate=	9600
Bits=	8
Stop Bit=	1
Parity=	No

5. If you are still having troubles contact STI Technical Support (435) 753-5300.

## 8 SOFTWARE TABS

This section gives an overview of the software tabs provided for the DCR-1008. The modes referenced in these tabs are described in detail in Chapter 10 “Operational Mode Description”. The selections in the Basic Setup Tab 1 must be entered first before entering data in the remaining tabs 2-5. Setups can be saved or loaded to the PC from the Utilities Tab.

### 8.1 Tab 1 Basic Setup



The Basic Setup Tab provides the following setup and programming capabilities. Ignore all settings for features not being used.

**NOTE:** See Section 10.1 “Basic Setup” for detailed mode and parameter explanations.

- a. The Sensor Input Selection window is used to select the type of sensor input device that will be used. Choose the 35' DST option for sensors with ranges 35' or less. Choose the 50' DST option for sensors with ranges greater than 35'. Select the 4-20 mA option if you are using 4-20 mA input devices. If only discrete contacts are being used ignore this field. If a DST sensor is selected but not connected the following error message will be displayed.



- b. The Units window is used to select the units to be displayed and used throughout the setup process. All other setup parameters must be programmed using the selected units.

**Note: If the units are changed they will effect data entered on other pages. Always set the units first before entering data on other pages.**

- c. The Decimal Point window is used select the decimal point resolution to be used. If the calculated number is too large for the decimal point selected the software will display the following message and the LCD display will show an “OvrLimit” message.



**Note: If the decimal point is changed it will effect data entered on other pages. Always set the decimal point first before entering data on other pages.**

- d. Use the Send button to send the settings on this page to the DCR-1008.

## 8.2 Tab 2 Measurement Setup

The Measurement Setup Tab provides the following programming capabilities for the type of measurements the DCR-1008 will perform. Ignore all settings for features not being used.

**NOTE:** See Section 10.5 “Measurement Setup” for detailed mode and parameter explanations.

- The Measurement Type window is used to select the type of measurement you want to perform. Choose between distance, level or volume measurements.
- This picture gives an illustration of the measurement type selected and the parameters that need to be entered in the Tank Parameters window.
- The Tank Parameters window is used to enter the tank dimensions that are required for the selected measurement type. If a parameter is not required it is grayed out. The following table shows the parameters required for the different measurement types.

Measurement Type	DST Tank Parameters	4-20 mA Tank Parameters
<b>Distance</b>		
• Distance from sensor face	• N/A	• N/A
<b>Level</b>		
• Tank Bottom to level	• Tank Span	• N/A



<b>Volume</b>	<b>DST Tank Parameters</b>	<b>4-20 mA Tank Parameters</b>
<ul style="list-style-type: none"> <li>Rectangle Tank</li> </ul>	<ul style="list-style-type: none"> <li>Tank Span</li> <li>Tank Length</li> <li>Tank Width</li> </ul>	<ul style="list-style-type: none"> <li>Tank Length</li> <li>Tank Width</li> </ul>
<ul style="list-style-type: none"> <li>Spherical Tank</li> </ul>	<ul style="list-style-type: none"> <li>Tank Span</li> <li>Tank Radius</li> </ul>	<ul style="list-style-type: none"> <li>Tank Radius</li> </ul>
<ul style="list-style-type: none"> <li>Vertical cylinder with flat bottom</li> </ul>	<ul style="list-style-type: none"> <li>Tank Span</li> <li>Tank Radius</li> </ul>	<ul style="list-style-type: none"> <li>Tank Radius</li> </ul>
<ul style="list-style-type: none"> <li>Vertical cylinder with cone bottom</li> </ul>	<ul style="list-style-type: none"> <li>Tank Span</li> <li>Tank Length</li> <li>Tank Radius</li> <li>Length of Ends</li> </ul>	<ul style="list-style-type: none"> <li>Tank Length</li> <li>Tank Radius</li> <li>Length of Ends</li> </ul>
<ul style="list-style-type: none"> <li>Horizontal Cylinder with Flat Bottom</li> </ul>	<ul style="list-style-type: none"> <li>Tank Span</li> <li>Tank Length</li> <li>Tank Radius</li> </ul>	<ul style="list-style-type: none"> <li>Tank Length</li> <li>Tank Radius</li> </ul>
<ul style="list-style-type: none"> <li>Horizontal Cylinder with Spherical Ends</li> </ul>	<ul style="list-style-type: none"> <li>Tank Span</li> <li>Tank Length</li> <li>Tank Radius</li> <li>Length of Ends</li> </ul>	<ul style="list-style-type: none"> <li>Tank Length</li> <li>Tank Radius</li> <li>Length of Ends</li> </ul>

The **volume multiplier** allows the units to be changed from cubic inches, feet or meters to other units.

- d. Use the Send button to send the settings on this page to the DCR-1008.

### 8.3 Tab 3 Relay Setup

The Relay Setup Tab provides the following programming capabilities for setting up the logic and conditions that will be used to control the four relay outputs.

**NOTE:** See Section 10.3 “Relay Setup” for detailed mode and parameter explanations.

- a. The Select Relay window is used to select the relay output to be programmed. The following parameters can be set for each relay independent of the other relays.
  - Input Assignment
  - Sensor Control Logic (Used only if sensor inputs are used)
  - Trip Point and Window (Used only if sensor inputs are used)
  - Discrete Hold/Delay time (Used only with discrete inputs to create hysteresis)

Select each relay to be programmed one at a time and enter the parameters for that relay. The values for each relay are held in memory and are displayed when you select the relay. The Relay Status screen will show the input assignment and control logic selected after the data has been sent to the controller.

- b. The Input Assignment window is used to select the input(s) that will control the selected relay.
- c. The Sensor Control Logic window is used to select the logic that will control the relay. This is only applicable when sensor inputs are being used
- d. The Trip Point window is used to set the trip points T1 and the trip window (TW) for use with sensors. Trip point 2 is equal to trip point 1 plus the trip window value
- e. This window gives an illustration of the control type logic selected.

- f. The Discrete Hold/Delay window is used to set a hold/delay time for the selected relay when a discrete input is used. A + value holds the relay closed after the switch opens for that time, a – value delays the relay from closing for that time after the switch is closed.
- g. Use the Send button to send the settings on this page to the DCR-1008.
- h. The Alternate Pumps window is used to enter the number of cycles that the lead pump relay will make before it alternates with the lag pump relay. A value of 0 will disable the pump alternation feature.

## 8.4 Tab 4 Ultrasonic Setup

**DCR-1008 PROGRAMMABLE CONTROLLER**

General Utilities Tag Definition Mode Values Communications

1 Basic Setup 2 Measurement Setup 3 Relay Setup **4 Ultrasonic Setup** 5 4-20mA Setup

**a** Ultrasonic Setup

Sensitivity (0 - 100)

Blanking (0 - 58.25)  Feet

Pulses (1 - 20)

Sample Rate (0 - 9999)  mSec

Samples Averaged (1 - 50)

Samples Out of Range (1 - 50)

Sample Window (0 - 58.25)  Feet

Loss of Echo (0 - 1000)  Secs

Max Distance (5 - 100)  Feet

**b** Auto Sense ☒ Off ☐ On

**c** Ultrasonic Calibration

Calibration (0-1.999)

Offset Distance (0 - 58.25)  Feet

Offset Polarity ☐ Negative ☒ Positive

Temperature Comp ☒ Off ☐ On **d**

**e**

The Ultrasonic Setup Tab provides the following setup and programming capabilities for use with the DST series ultrasonic sensors. Refer to the DST ultrasonic sensor documentation when deciding what values to enter on this page. Ignore all settings for features not being used.

**NOTE:** See Section 10.6 "Ultrasonic Setup" for detailed mode and parameter explanations.

- The Ultrasonic Setup window is used to setup the DST ultrasonic sensor parameters. Make sure the correct ultrasonic sensor type, DST 35' or DST 50', is selected on the Basic Setup Tab first before entering values in other tabs.
- The Auto Sense feature is used only if your sensor is a DST 50' and has the auto gain feature built in. With auto sense on the Sensitivity and Pulses are automatically calculated.
- The Ultrasonic Calibration window is used to adjust the ultrasonic sensor readings to match the measured distance when a high degree of accuracy is needed.
- Temperature Compensation is used to enable/disable the DST sensor's built-in temperature compensation. This allows the sensor to adjust for the speed of sound at different temperatures.
- Use the Send button to send the settings on this page to the DCR-1008.

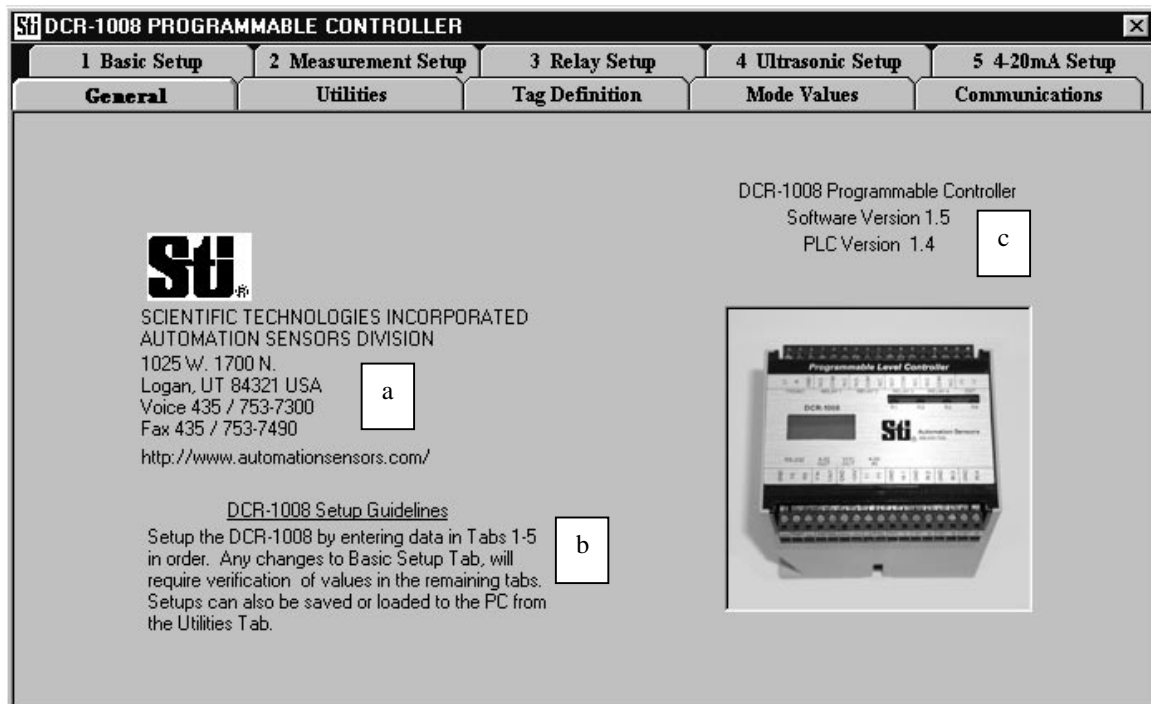
## 8.5 Tab 5 4-20mA Setup

The 4-20mA Setup Tab provides the following programmable capabilities for the 4-20mA Input and Output. Ignore all settings for features not being used.

**NOTE:** See Section 10.2 “4-20 mA Input Setup”, Section 10.4 “4-20 mA Output Setup” and Section 10.7 “4-20mA Output Calibration” for detailed mode and parameter explanations.

- Defines the 4mA and 20mA Input set points. Make sure 4-20 mA option is selected on the Basic Setup Tab page first before entering values. The units on the Basic Setup Tab will be used for the set point units.
- Use the Send button to send the settings in this window to the DCR-1008.
- Defines the 4mA and 20mA Output set points. The units on the Basic Setup Tab will be used for the set point units.
- Use the Send button to send the settings in this window to the DCR-1008.
- These values can be adjusted to fine tune the 4-20mA current at the 4 and 20 mA end points. The 4mA and 20mA calibration settings are set at the factory and typically should not need adjustment.
- Use the Send button to send the settings in this window to the DCR-1008.

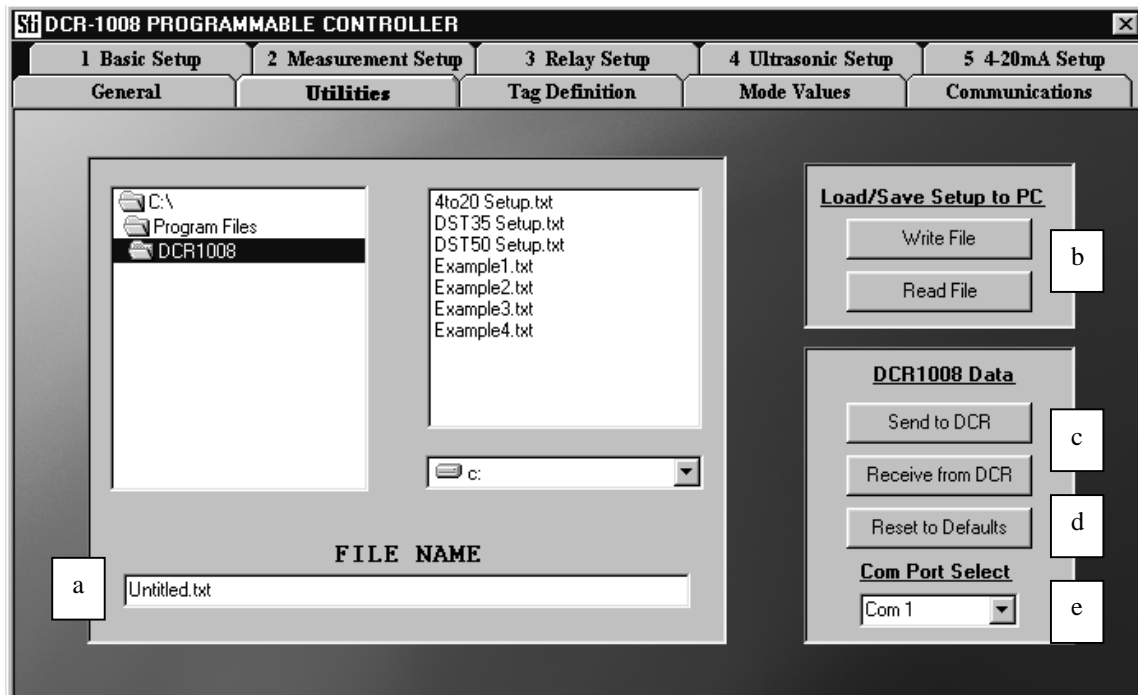
## 8.6 General Tab



The General Tab provides the following information:

- Company contact information
- DCR-1008 Setup Guidelines
- The version of the DCR-1008 visual basic software and the hardware's programmable logic controller (PLC).

## 8.7 Utilities Tab



The Utilities Tab provides the following setup and programming capabilities:

- a. The PC directory window is used to enter file names for reading and writing files to the PC.
- b. The Write/Read File buttons allow the user to save current software settings to a PC file or read a file from the PC with previously saved setup information.
- c. The Send to DCR / Receive from DCR buttons are used to send and receive data to the DCR-1008. The Send command allows the user to quickly program the DCR-1008 with data that has been read from the PC. The Receive command allows the user to quickly retrieve the current DCR-1008 mode settings from the DCR-1008. The data can then be looked at on different tabs or saved to a file.
- d. The Reset to Defaults button allows the user to restore the factory default settings to the DCR-1008. All tabs will be updated with the factory setting information. The factory defaults are listed in Appendix A.
- e. The Com Port tab is used to select the correct PC com port that is connected to the DCR-1008.

## 8.8 Tag Definition Tab

Input Definition		Output Definition	
<b>Discrete Inputs</b>	<b>User Name</b>	<b>Relay Outputs</b>	<b>User Name</b>
Discrete Contact 1	<input type="text"/>	Relay 1	<input type="text"/>
Discrete Contact 2	<input type="text"/>	Relay 2	<input type="text"/>
Discrete Contact 3	<input type="text"/>	Relay 3	<input type="text"/>
Discrete Contact 4	<input type="text"/>	Relay 4	<input type="text"/>
<b>Sensor Input</b>	<b>User Name</b>	<b>4-20 mA Output</b>	<b>User Name</b>
4-20 mA or Ultrasonic	<input type="text"/>	4-20 mA	<input type="text"/>

The Tag Definition Tab allows the user to label the input and output connections to the DCR-1008. This is used for reference only.



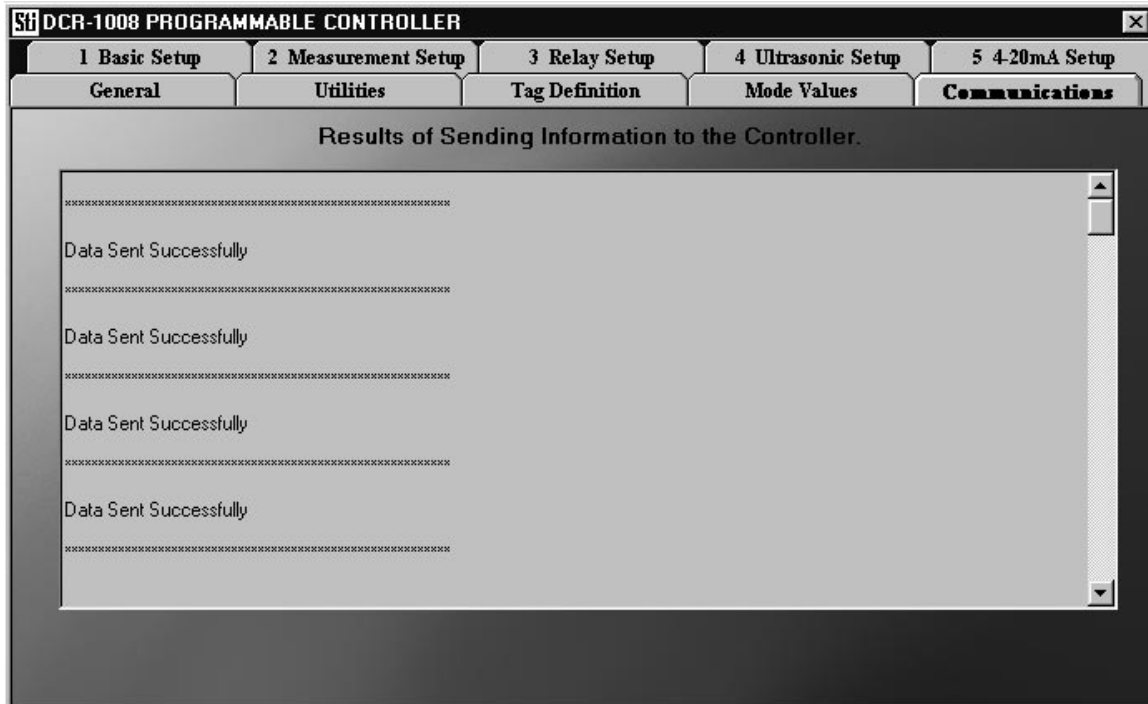
## 8.9 Mode Values Tab

DCR-1008 Modes	DCR-1008 Values	Screen Settings
Units=	Feet	Feet
Sensor Selection=	35' DST	35' DST
Decimal Point=	000.00	000.00
4 mA Input Point=	3.00	3.00
20 mA Input Point=	10.00	10.00
Relay 1(Lead) Trip Point=	2.50	2.50
Relay 1(Lead) Window=	0.50	0.50
Relay 1(Lead) Logic Control=	OFF	OFF
Relay 1(Lead) Assignment=	Sensor or Discrete 1	Sensor or Discrete 1
Relay 1(Lead) Hold/Delay Time=	0	0
Relay 2(Lag) Trip Point=	3.00	3.00

Save Print

The Mode Values Tab allows the user to see what values the DCR-1008 and the software screen are set too in a one-page summary. This is useful for comparing the values in the DCR against a setup file on the PC. The modes are displayed in the order they occur in the DCR-1008 and can be viewed from the screen, saved to a file, or printed to a default printer. The printed data is useful for documenting the DCR-1008 settings.

## 8.10 Communications Tab



The Communications window shows the status of data writes to the DCR-1008 from the PC. When data is sent successfully a “Data Sent Successfully” message is displayed. If a communication error occurs it will be displayed on this page. Try resending the data.

## 9 OPERATION MODES TABLE

The DCR-1008 has 52 modes that allow the user to configure it for many different applications. Only the modes required for a specific application need to be set. The modes are listed below in the order they appear in the controller. The keypad names are abbreviated and may be slightly different then the software tab names.

No	FOR DETAILS SEE SECTION	SOFTWARE TAB	KEYPAD	RANGE	DEFAULT
		<b>BASIC SETUP TAB</b>			
1	10.1.1	Units Window	Units	Inches Feet Meters	Feet
2	10.1.2	Sensor Input Selection Window	InputSel	35ft DST 50ft DST 4to20 ma	35ftDST
3	10.1.3	Decimal Point Window	DecPoint	00000 0000.0 000.00 00.000	000.00
		<b>4-20mA SETUP TAB</b>			
		<b>4-20mA Input Range Window</b>			
4	10.2.1	4mA Input Set Point	4ma In	0-65535 Limited by Decimal Point	3.00
5	10.2.2	20mA Input Set Point	20ma In	0-65535 Limited by Decimal Point	10.00
		<b>RELAY SETUP TAB</b>			
		Select Relay Window Relay 1			
6	10.3.1	Trip Point (T1) Window	LeadTrip	0-65535 Limited by Decimal Point	2.50
7	10.3.2	Trip Window (TW) Window	Lead Win	0-65535 Limited by Decimal Point	0.50
8	10.3.3	Sensor Control Logic Window	LeadCtrl	OnOffOff OnOffOn OnHysOff OffOnOn OffOnOff OffHysOn Off FailSafe	Off
9	10.3.4	Input Assignment Window	Lead Asn	Sensor D1 Sensr/D1 D2 Sensr/D2 D3 Sensr/D3 D4 Sensr/D4 D1D2PmUp D3D4PmDn	Sensor/D1
10	10.3.5	Discrete Hold/Delay Time Window	LeadTime	+/- 0-1000 seconds	+ 0
		Select Relay Window Relay 2			
11	10.3.1	Trip Point (T1) Window	Lag Trip	0-65535 Limited by Decimal Point	3.00
12	10.3.2	Trip Window (TW) Window	Lag Win	0-65535 Limited by Decimal Point	0.50

No	FOR DETAILS SEE SECTION	SOFTWARE TAB	KEYPAD MENU	RANGE	DEFAULT
13	10.3.3	Sensor Control Logic Window	Lag Ctrl	OnOffOff OnOffOn OnHysOff OffOnOn OffOnOff OffHysOn Off FailSafe	Off
14	10.3.4	Input Assignment Window	Lag Asn	Sensor D1 Sensr/D1 D2 Sensr/D2 D3 Sensr/D3 D4 Sensr/D4 D1D2PmUp D3D4PmDn	Sensor/D2
15	10.3.5	Discrete Hold/Delay Time Window	Lag Time	+/- 0-1000 seconds	+ 0
		Select RelayWindow Relay 3			
16	10.3.1	Trip Point (T1) Window	R3 Trip	0-65535 Limited by Decimal Point	3.50
17	10.3.2	Trip Window (TW) Window	R3 Win	0-65535 Limited by Decimal Point	0.50
18	10.3.3	Sensor Control Logic Window	R3 Ctrl	OnOffOff OnOffOn OnHysOff OffOnOn OffOnOff OffHysOn Off FailSafe	Off
19	10.3.4	Input Assignment Window	R3 Asn	Sensor D1 Sensr/D1 D2 Sensr/D2 D3 Sensr/D3 D4 Sensr/D4 D1D2PmUp D3D4PmDn	Sensr/D3
20	10.3.5	Discrete Hold/Delay Time Window	R3 Time	+/- 0-1000 seconds	+ 0
		Select RelayWindow Relay 4			
21	10.3.1	Trip Point (T1) Window	R4 Trip	0-65535 Limited by Decimal Point	4.00
22	10.3.2	Trip Window (TW) Window	R4 Win	0-65535 Limited by Decimal Point	0.50
23	10.3.3	Sensor Control Logic Window	R4 Ctrl	OnOffOff OnOffOn OnHysOff OffOnOn OffOnOff OffHysOn Off FailSafe	Off

No	FOR DETAILS SEE SECTION	SOFTWARE TAB	KEYPAD MENU	RANGE	DEFAULT
24	10.3.4	<b>Input Assignment Window</b>	R4 Asn	Sensor D1 Sensr/D1 D2 Sensr/D2 D3 Sensr/D3 D4 Sensr/D4 D1D2PmUp D3D4PmDn	Sensor/D4
25	10.3.5	<b>Discrete Hold/Delay Time Window</b>	R4 Time	+/- 0-1000 seconds	+ 0
26	10.3.6	<b>Alternate Lead and Lag Pumps Window</b>	Alt Pump	0-25 Cycles (0=Off)	0
		<b>4-20mA SETUP TAB</b>			
		<b>4-20mA Output Range Window</b>			
27	10.4.1	4mA Output Set Point	4ma Out	0-65535 Limited by Decimal Point	3.00
28	10.4.2	20mA Output Set Point	20ma Out	0-65535 Limited by Decimal Point	10.00
		<b>MEASUREMENT SETUP TAB</b>			
29	10.5.1	<b>Measurement Type Window</b> Distance from Sensor Face Tank Bottom to Level Rectangle Tank Spherical Tank Vertical Cylinder with Flat Bottom Vertical Cylinder with Cone Bottom Horizontal Cylinder with Flat Ends Horizontal Cylinder with Spherical Ends	TankType	Distance Level RecTank SphrTank VertFlat VertCone HoriFlat HoriSphr	Distance
		<b>Tank Parameters Window</b>			
30	10.5.2	Conversion Multiplier	ConvMult	0-65.535	1.000
31	10.5.3	Tank Span	TankSpan	0-669 Inches, 0-58.25 feet, 0-17.75 meters	12.00
32	10.5.4	Tank Length	Tank Len	0-669 Inches, 0-58.25 feet, 0-17.75 meters	10.00
33	10.5.5	Length of Ends	SpherLen	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00
34	10.5.6	Tank Radius/Width	Rad/Wid	0-669 Inches, 0-58.25 feet, 0-17.75 meters	5.00
		<b>ULTRASONIC SETUP TAB</b>			
		<b>Ultrasonic Setup Window</b>			
35	10.6.2	Sensitivity	UltSensit	0-100	75
36	10.6.3	Blanking	UltBlank	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00
37	10.6.4	Pulses	UltPulse	1-20	13
38	10.6.5	Sample Rate	SampRate	0-9999 milliseconds	120
39	10.6.6	Samples Averaged	SampAve	1-50	20
40	10.6.7	Samples Out of Range	SampOOR	1-50	10
41	10.6.8	Sample Window	SampWin	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00
42	10.6.9	Loss of Echo	LossEcho	0-1000 seconds	5
43	10.6.10	Max Distance	Max Dist	35' DST = 5-35 feet 50' DST = 5-100 feet	35
44	10.6.11	<b>Auto Sense Window</b>	AutSense	Off	Off

No	FOR DETAILS SEE SECTION	SOFTWARE TAB	KEYPAD MENU	RANGE	DEFAULT
				On	
		<b>Ultrasonic Calibration Window</b>			
45	10.6.12	Temperature Comp	TempComp	Off On View	Off
46	10.6.13	Offset Distance	OffstDis	0-669 Inches, 0-58.25 feet, 0-17.75 meters	0
47	10.6.14	Offset Polarity	OffstPol	Positive Negative	Positive
48	10.6.15	Calibration	Calibrat	0-1.999	1.000
		<b>4-20mA SETUP TAB</b>			
		<b>4-20mA Output Range Window</b>			
49	10.7.1	4mA Calibration	4ma Cal	0-9999	5000
50	10.7.2	20mA Calibration	20ma Cal	0-9999	5000
		<b>UTILITIES TAB</b>			
51	10.8.1	<b>Send/Receive Data Window</b>	Reset	No Yes	No
52	10.9.1	<b>GENERAL TAB</b>	Version	Read Only	

## 10 OPERATION MODES DESCRIPTION

The operation modes and their descriptions are listed in the order they occur in the DCR-1008 controller. Both the controller keypad names and the PC software paths are given. The keypad name is listed using the heading (Keypad). The PC software path is listed using the heading (SW:).

### 10.1 Basic Setup

The basic setup modes should be initialized first before the other mode parameters are entered. Three modes are used to perform the basic setup of the DCR-1008.

#### 10.1.1 Keypad: Units SW: Basic Setup->Units

Range = Inches, Feet, Meters (Default = feet)

The *Units* mode is used to select the units of measure that will be used in setting up the controller. All outputs must use the same units of measurement. Typically if you are displaying distance or level you will use the units selected in the units mode. If you are displaying volume you can convert to other units (i.e. gallons, liters, etc) by using the Conversion Multiplier to convert from (units selected)<sup>3</sup> to the desired units.

#### 10.1.2 Keypad: InputSel SW: Basic Setup->Sensor Input Selection

Range = <=35ft DST, 50ft DST, 4-20mA (Default = 35ft DST)

The *Sensor Input Selection* mode is used to select the type of linear or analog sensor that is being used with the controller. Choose the <=35' DST option for sensors with ranges 35' or less. Choose the 50' DST option for sensors with ranges greater than 35'. Select the 4-20 mA option if you are using 4-20 mA input devices. If only discrete contacts are being used ignore this field.

#### 10.1.3 Keypad: DecPoint SW: Basic Setup->Decimal Point

Range = 00000, 0000.0, 000.00, 00.000 (Default = 000.00)

The *Decimal Point* mode is used to select the decimal point position for the DCR-1008 display. It must be set before the parameters on the other tabs are set. The largest number the DCR-1008 can display with the different decimal point settings is shown in the following table.

Decimal Point Placement	Largest Number Displayable
00000	65535
0000.0	6553.5
000.00	655.35
00.000	65.535

If the number is greater than the decimal range selected the software will display the message.



The LCD display will display “OvrLimit”.

If these messages occur you must either change the decimal point setting or change the units so that the number can be displayed.

## 10.2 4-20 mA Input Setup

The DCR-1008's 4-20mA input must be selected before it can be used. To select it see Section 10.1.2 Basic Setup/Sensor Input Selection (InputSel). The following modes are used to scale the 4mA and 20mA-input end-point values. The units for these values will be the units selected on the Basic Setup Tab (See Section 10.1.1 Basic Setup/Units (Units). The same units must be used consistently throughout the setup process.

### 10.2.1 Keypad: 4mA In      SW: 4-20mA Setup->4-20mA Input Range->4mA Input Set Point

Range = 0-65535 in units selected. Limited by the decimal point. (Default = 3.00)

The *4mA Input Set Point* is used to define what distance, level, or volume value is associated with an input of 4mA.

### 10.2.2 Keypad: 20mA In      SW: 4-20mA Setup->4-20mA Input Range->20mA Input Set Point

Range = 0-65535 in units selected. Limited by the decimal point. (Default = 10.00)

The *20mA Input Set Point* is used to define what distance, level, or volume value is associated with an input of 20mA.



## 10.3 Relay Setup

The DCR-1008 has four SPDT relays that can be independently programmed for use as a pump or alarm control. Each relay is rated to handle a 10 amp load. The first two relays, #1 and #2, can be used for pump alternation and are designated as **Lead** and **Lag** pumps respectively. The last two relays are simply designated as relays #3 and #4. The four LEDs on the DCR-1008 indicate the status of the corresponding relay.

The relay setups are dependent on the type of input devices used. The trip point, trip window, and sensor control logic parameters are used only when DST ultrasonic sensors or 4-20 mA input devices are used. If only discrete inputs are used these parameters are not used. The following table shows the parameters that must be set on the Relay Setup tab for each type of input selected.

Input Assignment	Sensor Control Logic	Trip Point & Window	Discrete Delay/Hold Time
Sensor (Ultrasonic or 4-20mA)	Required	Required	Not Applicable
Discrete 1, 2, 3, 4	Not Applicable	Not Applicable	Used for hysteresis
Sensor (Ultrasonic or 4-20mA) or Discrete 1, 2, 3, 4	Required for Sensor	Required for Sensor	Used for discrete contact hysteresis
Discrete 1 and 2 (PumpUp) Discrete 3 and 4 (PumpDn)	Not Applicable	Not Applicable	Used for hysteresis

The trip point and trip window values must be in the same units of measurements for all relays. If the distance measurements are in feet all relay trip points must be entered in feet. If volume measurements are being made in gallons then all the relay trip points must be entered in units of gallons. The trip points will always correspond with the measurements being displayed on the Software Measurements window and the LCD display.

The modes occur in the controller in the following order.

### Relay 1 Setup

Keypad: LeadTrip	SW: Relay Setup->Select Relay->1
Keypad: Lead Win	SW: Relay Setup-> Trip Point
Keypad: LeadCtrl	SW: Relay Setup-> Trip Window
Keypad: Lead Asn	SW: Relay Setup-> Sensor Logic Control
Keypad: LeadTime	SW: Relay Setup-> Input Assignment
	SW: Relay Setup-> Discrete Hold/Delay Time

### Relay 2 Setup

Keypad: LagTrip	SW: Relay Setup->Select Relay->2
Keypad: Lag Win	SW: Relay Setup-> Trip Point
Keypad: LagCtrl	SW: Relay Setup-> Trip Window
Keypad: Lag Asn	SW: Relay Setup-> Sensor Logic Control
Keypad: LagTime	SW: Relay Setup-> Input Assignment
	SW: Relay Setup-> Discrete Hold/Delay Time

**Relay 3 Setup**

Keypad: R3 Trip	SW: Relay Setup->Select Relay->3
Keypad: R3 Win	SW: Relay Setup-> Trip Point
Keypad: R3 Ctrl	SW: Relay Setup-> Trip Window
Keypad: R3 Asn	SW: Relay Setup-> Sensor Logic Control
Keypad: R3Time	SW: Relay Setup-> Input Assignment
	SW: Relay Setup-> Discrete Hold/Delay Time

**Relay 4 Setup**

Keypad: R4 Trip	SW: Relay Setup->Select Relay->4
Keypad: R4 Win	SW: Relay Setup-> Trip Point
Keypad: R4 Ctrl	SW: Relay Setup-> Trip Window
Keypad: R4 Asn	SW: Relay Setup-> Sensor Logic Control
Keypad: R4Time	SW: Relay Setup-> Input Assignment
	SW: Relay Setup-> Discrete Hold/Delay Time

The modes are described below.

**10.3.1 Keypad: LeadTrip, Lag Trip, R3 Trip, R4 Trip SW: Relay Setup-> Trip Point**

Range = 0-65535 in units selected. Limited by decimal point. (Default = 2.50, 3.00, 3.50, 4.00)

The *Trip Point* mode is used to set trip point 1 for the relay when using the DST ultrasonic or 4-20ma inputs. The trip point is measured from the sensor face if in distance measurement mode or from the tank bottom if in level or volume measurement mode.

**10.3.2 Keypad: Lead Win, Lag Win, R3 Win, R4 Win SW: Relay Setup-> Trip Window**

Range = 0-65535 in units selected. Limited by decimal point. (Default = 0.50)

The *Trip Window* mode is used to define a value that will be added to the *Trip Point* (T1) to define the second trip point (T2) for the relay logic control. Trip point 2 (T2) = Trip Point 1 (T1) + Trip Window (TW).

**10.3.3 Keypad: LeadCtrl, Lag Ctrl, R3 Ctrl, R4 Ctrl SW: Relay Setup-> Sensor Control Logic**

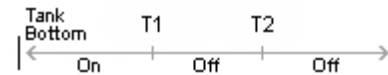
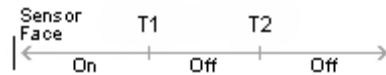
Range = OnOffOff, OnOffOn, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe (Default = Off)

The *Sensor Control Logic* mode is used with DST Ultrasonic or 4-20 mA sensors. It is used to select the type of logic function the relay will perform at the specified trip points T1 and T2. With DST ultrasonic sensors the trip points are measured from the sensor face if distance measurements are being made. The trip point is measured from the tank bottom if level or volume measurements are being made. The control logic for these types is shown in the following illustrations.

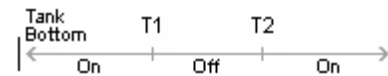
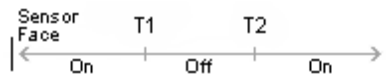
**Measurement Mode Set For Distance**

**Measurement Mode Set For Level or Volume**

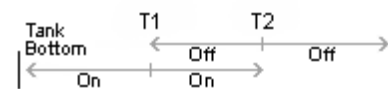
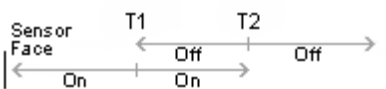
**On-T1-Off-T2-Off**



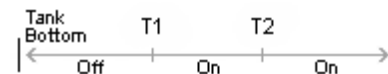
**On-T1-Off-T2-On**



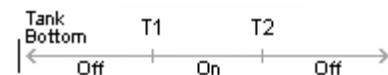
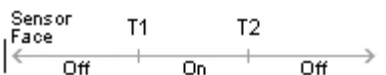
**On-T1-Hys-T2-Off**



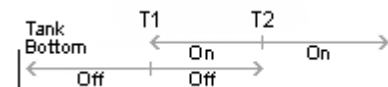
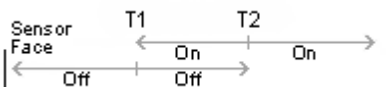
**Off-T1-On-T2-On**



**Off-T1-On-T2-Off**



**Off-T1-Hys-T2-On**



**Force Off**

Force Relay Off

Force Relay Off

**Fail Safe**

Relay remains closed (Trip Light On) unless an error is detected in communication, loss of echo, or loss of power.

Relay remains closed (Trip Light On) unless an error is detected in communication, loss of echo, or loss of power.

### 10.3.4 Keypad: Lead Asn, Lag Asn, R3 Asn, R4 Asn SW: Relay Setup-> Input Assignment

Range = Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn  
(Default = Sensor/D1, Sensor/D2, Sensor/D3, Sensor/D4 respectively)

The *Input Assignment* mode is used to select which input or combination of sensor and digital inputs will control the relay.

The following table summarizes the control options for each input type.

Input Type Selected	Normally Open, N.O., Output Control *		
Sensor (Sensor)	Relay is controlled by Sensor Control Logic selected		
Discrete 1 (D1)	Relay is controlled by the discrete contact. Closed contact: Output will close Open contact: Output will open Hysteresis can be added by setting the discrete hold/delay time		
Discrete 2 (D2)			
Discrete 3 (D3)			
Discrete 4 (D4)			
Sensor or Discrete 1 (Sensr/D1) Sensor or Discrete 2 (Sensr/D2) Sensor or Discrete 3 (Sensr/D3) Sensor or Discrete 4 (Sensr/D4)	Relay is controlled by the Sensor Control Logic OR the discrete contact.  If sensor condition is true OR switch is closed the N.O. relay will be closed. If sensor condition is false AND switch is open the relay will be open.		
Discrete 1 and 2 (PumpUp) (D1D2PmUp)	<u>Input 1</u>	<u>Input 2</u>	<u>Relay</u>
	Open	Open	Closed
	Open	Closed	No Change from Previous State
	Closed	Open	No Change from Previous State
	Closed	Closed	Open
Discrete 3 and 4 (PumpDn) (D3D4PmDn)	<u>Input 3</u>	<u>Input 4</u>	<u>Relay</u>
	Open	Open	Open
	Open	Closed	No Change from Previous State
	Closed	Open	No Change from Previous State
	Closed	Closed	Closed

\* N.C. Output will be inverse of N.O. Output

#### Examples:

#### Sensor or Discrete Input Selection

By selecting the sensor input and a discrete input, a discrete device can be used as a safety backup to the sensor input. For example, a float could be used to turn on or off the pump in the event the sensor input device fails or malfunctions. The relay is controlled by the OR of the sensor control logic and the discrete switch. If either condition is true the relay will close. If both conditions are false the relay will open.

#### Input Pump Up or Input Pump Dn Selection

The input-pump-up and input-pump-down options are intended to control a pump(s) using a dual-level float system. A high level float and a low level float are connected to inputs 1 & 2, or inputs 3 & 4. In PumpUp mode when both float switches are open the relay will close allowing the pump to fill the tank. The relay will remain closed until both float switches are closed indicating the tank is full. In PumpDn mode when both float switches are closed the relay will close allowing the pump to empty the tank. The relay will remain closed until both float switches are open indicating the tank is empty.

**10.3.5 Keypad: LeadTime, Lag Time, R3 Time, R4 Time SW: Relay Setup->Discrete Hold/Delay Time**

Range = +/- 0-1000 Seconds (Default = 0)

The *Discrete Hold/Delay Time* mode is used to set a hold/delay time for a relay controlled by a discrete input.

The positive and negative time values control the relay outputs as follows:

+ Time	Contact Closed	- Close the relay immediately
	Contact Opened	- <b>Hold the relay closed</b> the time selected before opening
- Time:	Contact Closed	- <b>Delay closing the relay</b> the time selected
	Contact Opened	- Open the relay immediately

The *Hold/Delay Time* mode is intended for use with discrete float switches as a high or low level safety backup to a continuous level monitoring device. If the continuous level device fails, then the float switch would activate/deactivate a pump for the amount of time specified in the time mode.

**10.3.6 Keypad: Alt Pump SW: Relay Setup->Alternate Lead and Lag Pumps**

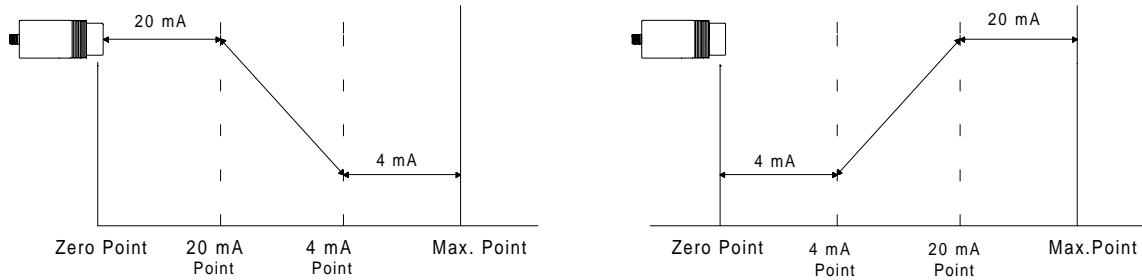
Range = 0-25 Cycles (Default = 0)

The Alternate Lead and Lag Pumps mode is used to alternate between the Lead and Lag relays. A value of zero will disable the alternation. A value other than zero will alternate the lead and lag pumps after relay 1, the lead pump, goes on and off the selected number of cycles. Relay 2 will then become the lead pump and relay 1 will become the lag pump. This is useful for dual pump systems where it is desirable for both pumps to have an equal amount of running time. The lead and lag will alternate only when both relays are not active.

## 10.4 4-20 mA Output Setup

The DCR-1008 has an isolated 4-20mA output that can be used with 4-20mA devices. The 4-20mA output must have +24 VDC applied to the 4-20mA Vin terminal in order for it to operate. The +24 VDC may be sourced from the +24 VDC terminal on the DCR-1008 or from a separate power supply. (See wiring diagram in Section 4).

The 4mA and 20 mA points can be defined in relation to the sensor as shown in the following diagram.



The 4mA and 20mA points are defined using the following modes.

### 10.4.1 Keypad: 4ma Out

**SW: 4-20mA Setup->4-20mA Output Range->4mA Output Point**

0-65535 in units selected. Limited by decimal point. (Default = 3.00)

The *4mA Output* mode sets the point the user wishes to associate with a 4mA output. The units must be the same that the DCR-1008 is using for making measurements and displaying on the Software Measurements window and the LCD display.

### 10.4.2 Keypad: 20ma Out

**SW: 4-20mA Setup->4-20mA Output Range->20mA Output Point**

0-65535 in units selected. Limited by decimal point. (Default = 10.00)

The *20mA Output* mode sets the distance or volume the user wishes to associate with a 20mA output. The units must be the same that the DCR-1008 is using for making measurements and displaying on the Software Measurements window and the LCD display.

## 10.5 Measurement Setup

The DCR-1008 can be configured to measure distance, level, or volumes of liquids or solids in several different types of tanks. The measurement type and tank parameters can be selected using the modes described in this section. If the DCR-1008 is being used with discrete inputs only, or with a sensor to measure distance only the parameters in this section can be ignored.

### 10.5.1 Keypad: TankType

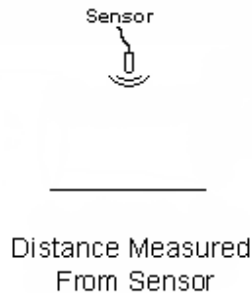
**SW: Measurement Setup->Measurement Type**

Range = Distance, Level, RecTank, SphrTank, VertFlat, VertCone, HoriFlat, HoriSphr  
(Default = Distance)

The *Measurement Type* mode is used to setup both the type of measurement to be performed and the tank type that will be used if any. The following illustrations show the measurement types and tank types available.

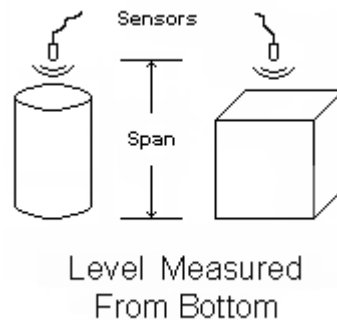
#### Distance Measurement:

##### Distance from Sensor Face (Distance)



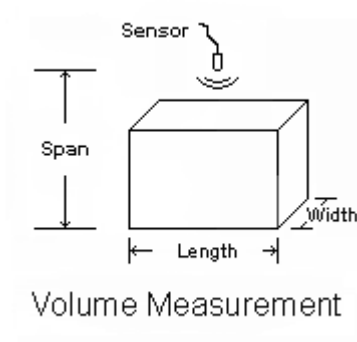
#### Level Measurement:

##### Tank Bottom to Level (Level)

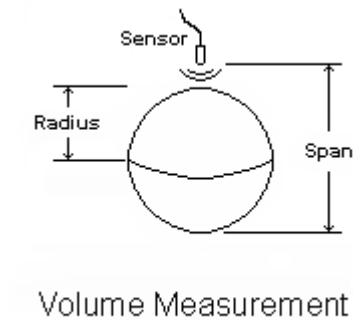


## Volume Measurements

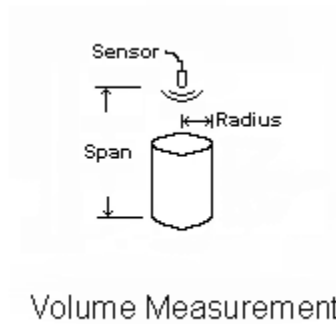
### Rectangle Tank (RecTank)



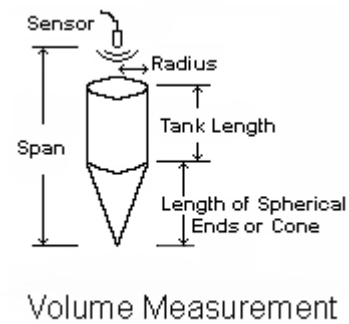
### Spherical Tank (SphrTank)



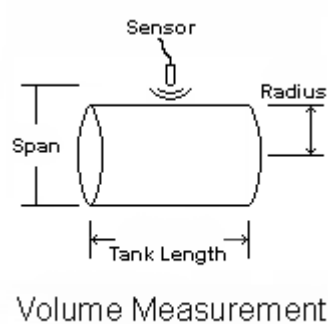
### Vertical Cylinder with Flat Bottom (VertFlat)



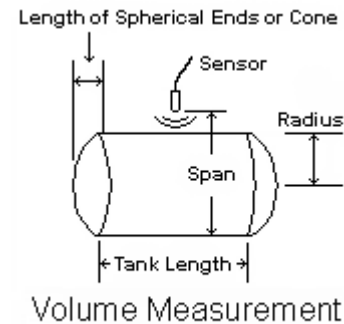
### Vertical Cylinder with Cone Bottom (VertCone)



### Horizontal Cylinder with Flat Ends (HoriFlat)



### Horizontal Cylinder with Spherical Ends (HoriSphr)





**10.5.2 Keypad: ConvMult****SW: Measurement Setup/Tank Parameters->Conversion Multiplier**

Range = 0-65.535 in units selected. Limited by Decimal Point. (Default = 1.00)

Multiplier for converting from units of inches, feet, or meters to other units.

It is often desirable to display a volume in units of measurement other than cubic inches, feet, or meters. To do this the DCR-1008 uses the conversion multiplier. The conversion multiplier will be applied to the DCR-1008 distance, level, or volume calculations. All sensor trip points and 4-20ma points must be entered based on the conversion multiplier changes.

Common Conversion Multipliers

From	Multiplier	To
Cubic Feet (ft <sup>3</sup> ) x	<b>7.4805</b>	= Gallons
Cubic Feet (ft <sup>3</sup> ) x	<b>28.317</b>	= Liters
Cubic Inches (in <sup>3</sup> ) x	<b>0.00433</b>	= Gallons
Gallons x	<b>3.7854</b>	= Liters

**Tank Parameters**

There are several tank parameters specified in the drawings that need to be entered into the DCR-1008 for it to calculate volumes. If a tank parameter is not shown it is not required for the calculation. For example, if a spherical tank type is selected, then only the tank radius and tank span will be used in the calculations. It is not necessary to set unused parameters to 0.

The following modes are used to enter the tank parameters.

**10.5.3 Keypad: TankSpan****SW: Measurement Setup->Tank Parameters->Tank Span**

Range = 0-699 inches, 0-58.25 feet, 0-17.75 meters, (Default = 12 feet)

Used to input the distance from the sensor face to the tank bottom

**10.5.4 Keypad: Tank Len****SW: Measurement Setup->Tank Parameters->Tank Length**

Range = 0-1398.0 inches, 0-116.50 feet, 0-35.509 meters, (Default = 10 feet)

Used to input the length of the horizontal or vertical tank. (Do not include spherical ends or conical bottom lengths)

**10.5.5 Keypad: SpherLen****SW: Measurement Setup->Tank Parameters->Length of Ends**

Range = 0-1398.0 inches, 0-116.50 feet, 0-35.509 meters, (Default = 2 feet)

Used to input the length of the bottom cone or spherical end.

**10.5.6 Keypad: Rad/Wid**

**SW: Measurement Setup->Tank Parameters->Tank Radius/Width**

Range = 0-1398.0 inches, 0-116.50 feet, 0-35.509 meters, (Default = 5 feet)

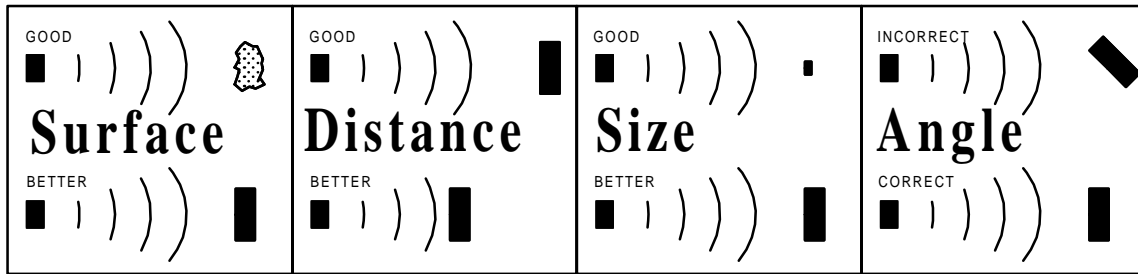
Used to input radius of the cylinder or the width of a rectangle depending upon the tank type selected.

## 10.6 Ultrasonic Setup

### 10.6.1 Understanding DST Series Ultrasonic Sensors

Ultrasonic sensors measure distance by using a transducer to send out ultrasonic bursts. Each burst contains a series of pulsed sound waves. The ultrasonic burst emits in the shape of a cone, reflects off the detected target, and is received by the transducer. The time required for this burst to travel to and from the target is measured and converted into a distance measurement by the sensor.

Ultrasonic sensing is affected by several factors including the target's surface, size, angle and the distance from the sensor. Environmental conditions such as temperature, humidity, gases, and pressure may also affect the measurement. Most sensors automatically compensate for many of these varied environments. The following considerations will help ensure the best possible sensing conditions.



#### Surface

The ideal target surface is hard and smooth. This surface will reflect a greater amount of signal than a soft, rough surface. A weak echo, which is the result of small or soft object, will reduce the operating distance of the sensor and decrease its accuracy.

#### Distance

The shorter the distance from the sensor to an object, the stronger the returning echo will be. Therefore, as the distance increases, the object requires better reflective characteristics to return a sufficient echo.

#### Size

A large object will have more surface to reflect the signal than a small one. The surface area recognized as the target is generally the portion closest to the sensor.

#### Angle

The inclination of the objects' surface facing the ultrasonic sensor affects the reflectivity of the object. The portion perpendicular to the sensor returns the echo. If the entire surface is at a great enough angle, the signal will be reflected away from the sensor and no echo will be detected.

## General Setup

The general setup includes tuning the sensitivity, blanking and pulses for the specific type of DST sensor. Refer to the DST ultrasonic user's manual when inputting these values.

### **10.6.2 Keypad: *UltSensit*      SW: *Ultrasonic Setup->Ultrasonic Setup->Sensitivity***

Range = 0-100 (Default = 75)

The *Sensitivity* mode is used to set the level of gain/amplification that is applied to the return signal. Sensitivity is set as a percentage of maximum.

### **10.6.3 Keypad: *UltBlank*      SW: *Ultrasonic Setup-> Ultrasonic Setup->Blanking***

Range = 0-1398.0 inches, 0-116.50 feet, 0-35.509 meters (Default = 2 feet)

The *Blanking* mode is used to set the distance of the dead band in front of the sensor where echoes will be ignored. The Blanking should never be set lower than the minimum specification of the DST sensor.

### **10.6.4 Keypad: *UltPulse*      SW: *Ultrasonic Setup-> Ultrasonic Setup->Pulses***

Range = 1-20 (Default = 13)

The *Pulses* mode is used to set the number of pulse waves set in each ultrasonic burst. The pulse settings control the strength of the output signal.

## Filtering Modes

The filtering modes are provided to control how quickly the sensor will respond to changes. The default settings are appropriate for many applications. The filtering modes are useful for stabilizing a turbulent output, and for ignoring intermittent objects that enter the detection area.

### **10.6.5 Keypad: *SampRate*      SW: *Ultrasonic Setup->Ultrasonic Setup->Sample Rate***

Range = 0-9999 milliseconds (Default = 120)

The *Sample Rate* mode is used to set the delay (in milliseconds) between sensor readings. The sample rate is the primary speed setting of the sensor.

### **10.6.6 Keypad: *SampAve*      SW: *Ultrasonic Setup->Ultrasonic Setup->Samples Averaged***

Range = 1-50 (Default = 20)

The *Samples Averaged* mode is used to set the number of sensor readings that will be averaged together in the buffer memory and displayed as the output. The readings are averaged on a first-in-first-out basis.

**10.6.7 Keypad: SampOOR      SW: Ultrasonic Setup->Ultrasonic Setup->Samples Out-of-Range**

Range 1-50 (Default = 10)

The Samples Out of Range mode is used to set the number of samples detected (in succession) outside the target window, that will be ignored before being accepted as a new target.

**10.6.8 Keypad: SampWin      SW: Ultrasonic Setup->Ultrasonic Setup->Sample Window**

Range = 0-1398.0 inches, 0-116.50 feet, 0-35.509 meters, (Default = 2 ft.)

The *Sample Window* mode is used to set a window of acceptance for valid readings. The window is a distance + and - from the current sensor reading. If a sample is returned from outside the window, then it will be ignored until sampled consecutively the number of time set in the "Samples Out-of-Range" mode.

**10.6.9 Keypad: LossEcho      SW: Ultrasonic Setup->Ultrasonic Setup->Loss of Echo Delay**

Range 0-1000 Seconds (Default = 5 ft.)

The *Loss of Echo Delay* mode is used to set a delay before the output will show a loss of echo condition. This allows the controller to maintain the current level reading during temporary loss of signal.

**10.6.10 Keypad: Max Dist      SW: Ultrasonic Setup->Ultrasonic Setup->Maximum Distance**

Range = 5-100 feet, (Default = 35 ft.)

Some models of the DST sensor have a detection range up to 72 ft. The *MaximumDistance* mode allows the user to program the DCR-1008 to display longer ranges. Increasing the maximum distance value however will NOT increase the sensor's range.

**10.6.11 Keypad:      SW: Ultrasonic Setup->Auto Sense**

Range = Off, On (Default = Off)

The *Auto Sense* mode is used to turn auto sense on or off for these sensors that have the auto sense feature.

Note: Some models of the DST sensors have auto sense permanently enabled and it cannot be turn off. . The sensitivity and pulses modes are view only for these models and are not user adjustable. Most models of the DST series do not have auto sense and are permanently in the manual mode.

## Calibration Modes

For many open-air applications, the factory default calibration is adequate. Variation between the distance measured by the DCR-1008 controller and the DST ultrasonic sensor and the true measured distance are caused by environmental conditions such as temperature, humidity, and chemical atmospheres. These conditions can be compensated for by using the calibration modes which alter the reading to match the application conditions.

### **10.6.12 Keypad: TempComp**

**SW: Ultrasonic Setup->Ultrasonic Calibration->Temperature Compensation**

Range = Off, On, View (Default = Off)

The *Temperature Compensation* mode is used to turn on and off the DST's internal temperature compensation. It can also be used to view the current temperature.

As air temperature changes, so does the speed of sound. This can cause a 0.18% drift in the distance reading for every degree C of change. The DST series sensors contain an internal thermistor that measures the temperature in degrees F at the face of the sensor. By turning on the sensor's temperature compensation, the effects of temperature changes will be reduced.

**NOTE:** *The sensor must be shielded from radiant heat. The radiant heat from the sun can heat the sensor above the ambient temperature, causing the sensor to over compensate. Because the temperature sensor is internal to the DST, it will require several minutes to react to changes in air temperature.*

### **10.6.13 Keypad: OffstDis**

**SW: Ultrasonic Setup->Ultrasonic Calibration->Offset Distance**

Range = 0-1398.0 inches, 0-116.50 feet, 0-17.75 Meters (Default = 0)

The *Distance Offset* mode is used to adjust the zero point of the sensor. A value of 1 will set the zero point 1 unit in front or behind the face of the sensor depending on the Offset Polarity.

### **10.6.14 Keypad: OffstPol**

**SW: Ultrasonic Setup->Ultrasonic Calibration->Offset Polarity**

Range = Positive, Negative (Default = Positive)

The *Offset Polarity* mode is used to select the direction of the *Distance Offset*. Positive moves the *Distance Offset* in front of the sensor face, Negative moves it behind.

### **10.6.15 Keypad: Calibrat**

**SW: Ultrasonic Setup->Ultrasonic Calibration->Calibration Factor**

Range 0-1.999 (Default = 1.000)

The *Calibration Factor* mode is used to set a calibration factor for aligning the sensor's measured distance with the true measured distance

## Calculating the Calibration Factor

### ***1 POINT CALIBRATION***

The Calibration Factor is used to bring the displayed reading in line with the measured distance. To obtain the measured distance, measure from the level to be detected to 0.5 inches behind the DST face. (0.5" behind the DST face is the electrical zero of the sensor.) The calibration factor is determined by dividing the actual distance measured, by the displayed distance. Enter this number for the calibration factor.

### ***2 POINT CALIBRATION***

If a more precise calibration is required, a two point calibration should be used. This is accomplished by using the linear equation of  $Y = AX + B$  where;

Y = Measured distance	X = DCR-1008 Reading
A = Multiplier	B = Offset

The multiplier (A) can be determined by taking ultrasonic readings at two known distances and dividing the difference of the known distances (D) by the difference of the ultrasonic (U) readings  $A = (D2-D1)/(U2-U1)$  where;

D2 = far known distance	U2 = Ultrasonic reading at D2
D1 = close known distance	U1 = Ultrasonic reading at D1

Enter this multiplier for the calibration factor. The multiplier can then be entered in the above equation to calculate the offset  $B = D2 - (A)U2$ . The result should be entered into the offset mode.

## 10.7 4-20 mA Output Calibration

The 4-20 mA output calibration modes allow for the adjustment of any deviations between the desired 4-20mA end points and the actual readings. The calibration is done at the factory and typically will not need further adjustment.

### **10.7.1 Keypad: 4ma Cal**

**SW: 4-20mA Setup->4-20mA Output Range->4mA Calibration**

Range 0-9999 in units selected in mode 1. (Default = Tuned at company)

The 4mA Calibration mode is used to fine-tune the measured 4mA current reading to match the displayed 4mA reading.

### **10.7.2 Keypad: 20ma Cal**

**SW: 4-20mA Setup->4-20mA Output Range->20mA Calibration**

Range 0-9999 in units selected in mode 1. (Default = Tuned at Company)

The 20mA Calibration mode is used to fine-tune the measured 20mA current reading to match the displayed 20mA reading.

## 10.8 Factory Settings

The DCR-1008 can be reset with factory settings with this mode.

### **10.8.1 Keypad: Reset**

**SW: Utilities->DCR-1008 Data->Reset to Defaults**

Range = No, Yes (Default = No)

The *Reset* mode resets the DCR-1008's parameters to the factory defaults. These can be seen in the Operation Mode Table in Section 9.

## 10.9 Software Version

### **10.9.1 Keypad: Version**

**SW: General**

Range = Read Only

The *Software Version* mode is used to view the software version being used in the DCR-1008.

The controller software version can be seen on the General Tab page above the picture of the DCR-1008. It can also be viewed on the DCR-1008 under the mode named (Version). The mode is read only.



## 11 APPLICATION EXAMPLES

Refer to other sections of this manual for detailed information on wiring the DCR-1008, installing the PC software, programming the DCR-1008 and mode descriptions.

The examples in this document can be programmed using the PC Software Tabs or using the onboard keypad and LCD display.

It is assumed that the DCR-1008 has been set to the factory settings before the parameters for the examples are entered. This minimizes the amount of data that needs to be entered. The factory settings can be loaded into the DCR-1008 by going to the Utilities Tab and selecting the Reset to Defaults button. They can also be loaded from the keypad by going to the Reset Mode selecting the Yes option.

For each example a mode table has been provided that shows all the DCR-1008 modes, the options for each mode and the default settings. If any changes are made from the default value it is put in the Change column. All modes not grayed out are applicable to the example being shown.

The example files can be loaded into the DCR-1008 by using the following steps.

1. Go to the Software Utilities Tab
2. Select the example that you want to load. I.E. Example1.txt
3. Press the Read File button. The data will be loaded into the DCR-1008 software tabs.
4. To load the DCR-1008 with the selected file press the Send to DCR button. The data will be loaded into the DCR-1008.

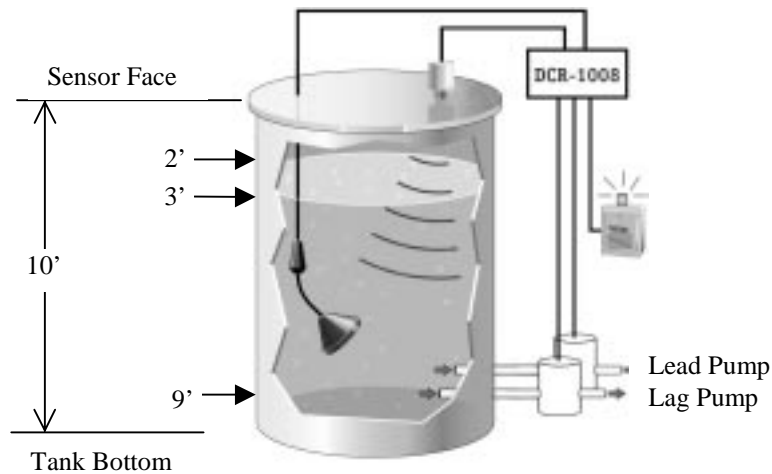
## 11.1 Example 1 - Distance Measurement with Lead/Lag Alternation

### Variables

- Tank: 10' Vertical Cylinder
- Inputs: 35' DST Sensor, N.O. High-level float
- Outputs: Lead and Lag Pumps, Safety Alarm

### Requirements

- The lead pump must turn on when the level gets 3 ft from the DST.
- The lead pump must stay on until the level drops below 9 ft from the DST.
- The lag pump must turn on if the water is rising faster then the lead pump can handle and gets closer than 2 ft from the DST.
- If the lag pump turns on it must stay on until the level drops to 3 ft from the DST.
- Each time the lead pump cycles, the lead and lag pumps must alternate to allow for equal run time on both pumps (lead becomes lag, and lag becomes lead).
- A high-level float switch is to be used as a safety alarm. The float is wired to discrete input 1 and is set to control relay 3.



### DCR-1008 Settings

- Basic Setup:** Input =  $\leq 35'$ Dst      Units = Feet      Decimal = 000.00
- Measurement Setup:** Measurement Type = Distance from Sensor Face
- Tank Parameters:** Not required for distance measurements
- Relay Setup**

Relay	Wired	Device Name	Input Assignment	Sensor Control Logic	Trip 1 (T1)	Trip 2 (T2)	TW= T2-T1	Discrete Time
1	N.O.	Lead Pump	Sensor	OnHysOff	3'	9'	6'	N/A
2	N.O.	Lag Pump	Sensor	OnHysOff	1'	2'	1'	N/A
3	N.O.	Alarm	Discrete 1	N/A	N/A	N/A	N/A	0

Alternate Lead and Lag Pumps = 1 (change every cycle)

- Ultrasonic Setup:** Blanking = 1.5, Use defaults for other parameters
- 4-20mA Setup:** Not Required for this example

**Programming the DCR-1008 for Example 1**

All fields not colored out are required to be set. Use default settings unless changes are shown.

Software Tab	Keypad	Description	Range	Default	Changes
<b>Basic Setup</b>	Units	Units	Inches, Feet, Meters	Feet	
	InputSel	Sensor Type	35' DST, 50' DST, 4-20mA	35' DST	
	DecPoint	Decimal Point	00000, 0000.0, 0000.00, 00.000	000.00	
<b>4-20 mA Setup</b>	4mA In	4mA Input Point	0-65535 (Limited by Decimal Point)	3.00	
	20ma In	20 mA Input Point	0-65535 (Limited by Decimal Point)	10.00	
<b>Relay Setup / Relay 1</b>	Lead Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	2.50	3.00
	Lead Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	6.00
	LeadCtrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	OnHysOff
	Lead Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D1	Sensor
	LeadTime	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 2</b>	Lag Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.00	2.00
	Lag Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	1.00
	Lag Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	OnHysOff
	Lag Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D2	Sensor
	Lag Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 3</b>	R3 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.50	
	R3 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	R3 Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	R3 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D3	D1
	R3 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 4</b>	R4 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	4.00	
	R4 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	R4 Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	R4 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D4	
	R4 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup</b>	Alt Pump	Alternate Pumps	0-25 Cycles	0	1
<b>4-20 mA Output Setup</b>	4mA Out	4mA Output Point	0-65535 (Limited by Decimal Point)	3.00	
	20mA Out	20 mA Output Point	0-65535 (Limited by Decimal Point)	10.00	
<b>Measurement Setup</b>	Tank Type	Measurement and Tank Types	Distance, Level, RecTank, SphrTank, VertFlat, VertCone, HoriFlat, HoriSphr	Distance	
	ConvMult	ConversionMultiplier	0-65.535	1.000	
	TankSpan	Sensor face to bottom	0-669 Inches, 0-58.25 feet, 0-17.75 meters	12.00	
	Tank Len	Tank Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	10.00	
	SpherLen	Sphere Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.0	
	Rad/Wid	Radius / Width	0-669 Inches, 0-58.25 feet, 0-17.75 meters	5.00	
<b>Ultrasonic Setup</b>	UltSensit	Sensitivity	0-100	75	
	UltBlank	Blanking	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00	1.5
	UltPulse	Pulses	1-20	13	
	SampRate	Sample Rate	0-9999 msec	120	
	SampAve	Sample Average	1-50	20	
	SampOOR	SamplesOutOf Range	1-50	10	
	SampWin	Sample Window	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00	
	LossEcho	Loss of Echo Delay	0-1000 sec	5	
	Max Dist	Maximum Distance	35' DST = 5-35 feet, 50' DST = 5-100 feet	35	
	AutSense	Auto Sense	Off, On	Off	
	TempComp	Temperature Comp	Off, On	Off	
	OffstDis	Offset Distance	0-669 Inches, 0-58.25 feet, 0-17.75 meters	0	
	OffstPol	Offset Polarity	Positive, Negative	Positive	
	Calibrat	Calibration Factor	0-1.999	1.000	
<b>4-20mA Setup</b>	4ma Cal	4ma Calibration	0-9999 (Units Selected)	5000	
	20ma Cal	20ma Calibration	0-9999 (Units Selected)	5000	
<b>Utilities</b>	Reset	Set Factory Settings	No, Yes	No	

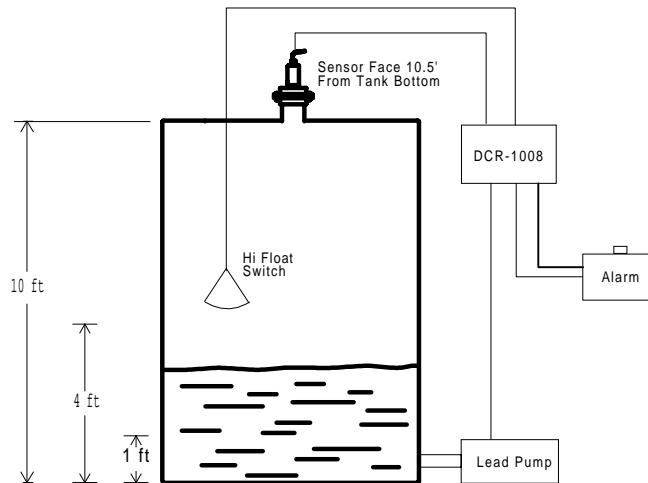
## 11.2 Example 2 - Level Measurement with Alarms

### Variables

- Tank: 10' Vertical Cylinder
- Inputs: 35' DST sensor mounted 10.5 from the bottom of the tank, N.C. Float Switch
- Outputs: Lead Pump, Dual Input Alarm

### Requirements

- The pump will turn on when the level reaches a depth of 1 ft from the tank bottom and stay on until the level rises to a depth of 4 ft.
- A fail safe alarm relay will be energized under normal operation and should open for power failures, sensor problems.
- A float switch will be used as a high level alarm. The float switch will be wired to Discrete Input 1



### DCR-1008 Settings

- Basic Setup:** Input = <=35'Dst Units = Feet Decimal = 000.00
- Measurement Setup:** Measurement Type = Tank Bottom to Level  
Tank Parameters: Tank Span=10.5, Other parameters not required
- Relay Setup**

Relay	Wired	Device Name	Input Assignment	Sensor Control Logic	Trip 1 (T1)	Trip 2 (T2)	TW= T2-T1	Discrete Time
1	N.O.	Lead Pump	Sensor	OnHysOff	1'	4'	3'	N/A
2	N.O.	Alarm 1	Sensor	FailSafe	N/A	N/A	N/A	N/A
3	N.O.	Alarm 2	Discrete 1	N/A	N/A	N/A	N/A	N/A

Alternate Lead and Lag Pumps = 0 (Disabled)

- Ultrasonic Setup:** Blanking =1.5, Use defaults for other parameters
- 4-20mA Setup:** Not Required for this example

**Programming the DCR-1008 for Example 2**

All fields not colored out are required to be set. Use default settings unless changes are shown.

Software Tab	Keypad	Description	Range	Default	Changes
<b>Basic Setup</b>	Units	Units	Inches, Feet, Meters	Feet	
	InputSel	Sensor Type	35' DST, 50' DST, 4-20mA	35' DST	
	DecPoint	Decimal Point	00000, 0000.0, 0000.00, 00.000	000.00	
<b>4-20 mA Setup</b>	4mA In	4mA Input Point	0-65535 (Limited by Decimal Point)	3.00	
	20mA In	20 mA Input Point	0-65535 (Limited by Decimal Point)	10.00	
<b>Relay Setup / Relay 1</b>	Lead Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	2.50	1.00
	Lead Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	3.00
	LeadCtrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	OnHysOff
	Lead Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D1	Sensor
	LeadTime	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 2</b>	Lag Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.00	
	Lag Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	Lag Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	FailSafe
	Lag Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D2	Sensor
	Lag Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 3</b>	R3 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.50	
	R3 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	R3 Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	R3 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D3	D1
	R3 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 4</b>	R4 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	4.00	
	R4 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	R4 Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	R4 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D4	
	R4 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup</b>	Alt Pump	Alternate Pumps	0-25 Cycles	0	
<b>4-20 mA Output Setup</b>	4mA Out	4mA Output Point	0-65535 (Limited by Decimal Point)	3.00	
	20mA Out	20 mA Output Point	0-65535 (Limited by Decimal Point)	10.00	
<b>Measurement Setup</b>	Tank Type	Measurement and Tank Types	Distance, Level, RecTank, SphrTank, VertFlat, VertCone, HoriFlat, HoriSphr	Distance	Level
	ConvMult	Conversion Multiplier	0-65.535	1.000	
	TankSpan	Sensor face to bottom	0-669 Inches, 0-58.25 feet, 0-17.75 meters	12.00	10.5
	Tank Len	Tank Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	10.00	
	SpherLen	Sphere Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.0	
	Rad/Wid	Radius / Width	0-669 Inches, 0-58.25 feet, 0-17.75 meters	5.00	
<b>Ultrasonic Setup</b>	UltSensit	Sensitivity	0-100	75	
	UltBlank	Blanking	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00	1.5
	UltPulse	Pulses	1-20	13	
	SampRate	Sample Rate	0-9999 msec	120	
	SampAve	Sample Average	1-50	20	
	SampOOR	Samples Out Of Range	1-50	10	
	SampWin	Sample Window	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00	
	LossEcho	Loss of Echo Delay	0-1000 sec	5	
	Max Dist	Maximum Distance	35' DST = 5-35 feet, 50' DST = 5-100 feet	35	
	AutSense	Auto Sense	Off, On	Off	
	TempComp	Temperature Comp	Off, On	Off	
	OffstDis	Offset Distance	0-669 Inches, 0-58.25 feet, 0-17.75 meters	0	
	OffstPol	Offset Polarity	Positive, Negative	Positive	
	Calibrat	Calibration Factor	0-1.999	1.000	
<b>4-20mA Setup</b>	4ma Cal	4ma Calibration	0-9999 (Units Selected)	5000	
	20ma Cal	20ma Calibration	0-9999 (Units Selected)	5000	
<b>Utilities</b>	Reset	Set Factory Settings	No, Yes	No	

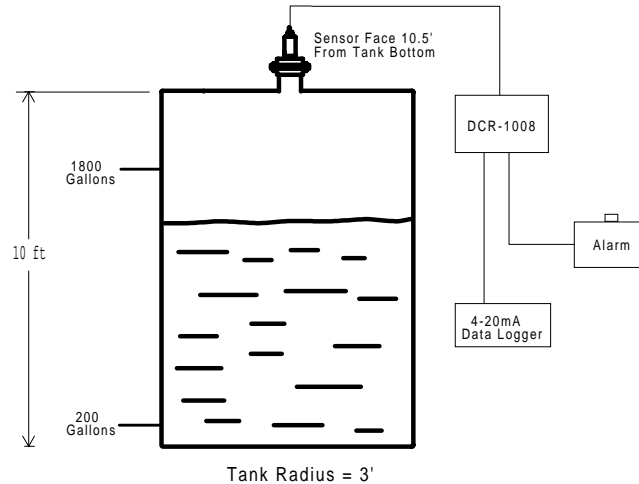
### 11.3 Example 3 - Volume in a Vertical Cylinder Tank with 4-20mA Output

#### Variables

- Tank: 2000 Gallon Vertical Tank With Flat Bottom, 3' Radius
- Inputs: 35' DST sensor mounted 10.5' from bottom of the tank
- Outputs: 4-20mA Data Logger, High/Low Alarm

#### Requirements

- Water will be measured in a 2000 gallon cylindrical flat bottom tank.
- We want to chart the volume in gallons using a 4-20mA input data logger. A 20mA corresponds to a volume of 1750 gallons, and 4mA corresponds to 250 gallons.
- A normally closed contact should open (setting off an alarm) for levels above and below 1800 gallons and 200 gallons respectively.



#### DCR-1008 Settings

- Basic Setup:** Input = <=35'Dst      Units = Feet      Decimal = 0000.0
- Measurement Setup:** Measurement Type = Vertical Cylinder with Flat Bottom  
**Tank Parameters:** Tank Span=10.5, Tank Radius =3, Conversion multiplier = 7.4805 (Cubic feet to gallons), Other parameters not required
- Relay Setup**

Relay	Wired	Device Name	Input Assignment	Sensor Control Logic	Trip 1 (T1)	Trip 2 (T2)	TW= T2-T1	Discrete Time
1	N.C.	Alarm	Sensor	OffOnOff **	200'	1800'	1600'	N/A

Alternate Lead and Lag Pumps = 0 (Disabled)

\*\* Settings for N.O. Circuit. (N.C. output will be OnOffOn)

- Ultrasonic Setup:** Blanking =1.5, Use defaults for other parameters
- 4-20mA Setup:** 4ma Output Set Point = 250 Gallons, 20ma Output Set Point = 1750 Gallons

**Programming the DCR-1008 for Example 3**

All fields not colored out are required to be set. Use default settings unless changes are shown.

Software Tab	Keypad	Description	Range	Default	Changes
<b>Basic Setup</b>	Units	Units	Inches, Feet, Meters	Feet	
	InputSel	Sensor Type	35' DST, 50' DST, 4-20mA	35' DST	
	DecPoint	Decimal Point	00000, 0000.0, 0000.00, 00.000	000.00	0000.0
<b>4-20 mA Setup</b>	4mA In	4mA Input Point	0-65535 (Limited by Decimal Point)	3.00	
	20ma In	20 mA Input Point	0-65535 (Limited by Decimal Point)	10.00	
<b>Relay Setup / Relay 1</b>	Lead Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	2.50	200
	Lead Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	1600
	LeadCtrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	OffOnOff
	Lead Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D1	Sensor
	LeadTime	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 2</b>	Lag Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.00	
	Lag Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	Lag Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	Lag Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D2	
	Lag Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 3</b>	R3 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.50	
	R3 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	R3 Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	R3 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D3	
	R3 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 4</b>	R4 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	4.00	
	R4 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	R4 Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	R4 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D4	
	R4 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup</b>	Alt Pump	Alternate Pumps	0-25 Cycles	0	
<b>4-20 mA Output Setup</b>	4mA Out	4mA Output Point	0-65535 (Limited by Decimal Point)	3.00	250
	20mA Out	20 mA Output Point	0-65535 (Limited by Decimal Point)	10.00	1750
<b>Measurement Setup</b>	Tank Type	Measurement and Tank Types	Distance, Level, RecTank, SphrTank, VertFlat, VertCone, HoriFlat, HoriSphr	Distance	VertFlat
	ConvMult	ConversionMultiplier	0-65.535	1.000	7.4805
	TankSpan	Sensor face to bottom	0-669 Inches, 0-58.25 feet, 0-17.75 meters	12.00	10.5
	Tank Len	Tank Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	10.00	
	SpherLen	Sphere Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.0	
	Rad/Wid	Radius / Width	0-669 Inches, 0-58.25 feet, 0-17.75 meters	5.00	3.00
<b>Ultrasonic Setup</b>	UltSensit	Sensitivity	0-100	75	
	UltBlank	Blanking	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00	1.5
	UltPulse	Pulses	1-20	13	
	SampRate	Sample Rate	0-9999 msec	120	
	SampAve	Sample Average	1-50	20	
	SampOOR	SamplesOutOf Range	1-50	10	
	SampWin	Sample Window	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00	
	LossEcho	Loss of Echo Delay	0-1000 sec	5	
	Max Dist	Maximum Distance	35' DST = 5-35 feet, 50' DST = 5-100 feet	35	
	AutSense	Auto Sense	Off, On	Off	
	TempComp	Temperature Comp	Off, On	Off	
	OffstDis	Offset Distance	0-669 Inches, 0-58.25 feet, 0-17.75 meters	0	
	OffstPol	Offset Polarity	Positive, Negative	Positive	
	Calibrat	Calibration Factor	0-1.999	1.000	
<b>4-20mA Setup</b>	4ma Cal	4ma Calibration	0-9999 (Units Selected)	5000	
	20ma Cal	20ma Calibration	0-9999 (Units Selected)	5000	
<b>Utilities</b>	Reset	Set Factory Settings	No, Yes	No	

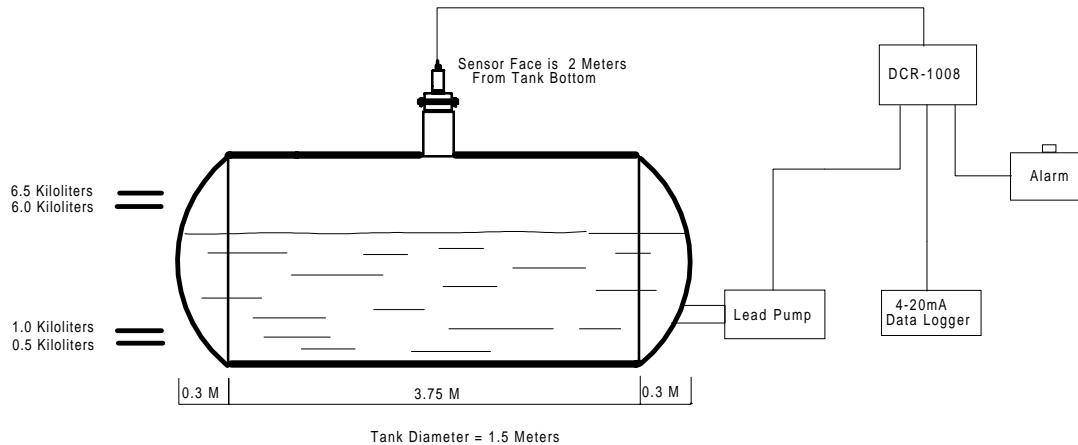
## 11.4 Example 4 - Volume in a Horizontal Tank with Spherical Ends

### Variables

- Tank: 9 kiloliter horizontal tank with spherical ends.  
Diameter = 1.5m, Length = 3.75m, Spherical End Length = 0.3m
- Inputs: 35' DST sensor mounted 2 meters from bottom of the tank
- Outputs: 20mA Data Logger, Lead Pump, High/Low Alarm

### Requirements

- Kiloliters of oil are to be displayed and controlled in a 9 kiloliter horizontal tank with spherical ends.
- A 4-20mA data logger is used to display the volume. 4ma = 1kiloliter, 20mA=6 kiloliters
- If the volume drops below 1 kiloliter a pump must activate until the volume reaches 6 kiloliters.
- If the volume drops below .5 kiloliters or reaches more that 6.5 kiloliters, a normally closed contact should open (setting off an alarm)



### DCR-1008 Settings

- Basic Setup:** Input = <=35'Dst Units = Meters Decimal = 000.00
- Measurement Setup:** Measurement Type = Horizontal Cylinder with Spherical Ends
- Tank Parameters:** Tank Span=2, Tank Length = 3.75, Sphere Length = .3, Tank Radius = .75, Conversion multiplier = 1 (Cubic meters to Cubic Kilo-Liters)
- Relay Setup**

Relay	Wired	Device Name	Input Assignment	Sensor Control Logic	Trip 1 (T1)	Trip 2 (T2)	TW= T2-T1	Discrete Time
1	N.O.	Lead Pump	Sensor	OnHysOff	1	6	5	N/A
2	N.C.	Alarm	Sensor	OffOnOff **	.5	6.5	6	N/A

Alternate Lead and Lag Pumps = 0 (Disabled)

\*\* Settings for N.O. Circuit. (N.C. output will be OnOffOn)

- Ultrasonic Setup:** Blanking =1.5, Use defaults for other parameters
- 4-20mA Setup:** 4ma Output Set Point = 1 kiloliter, 20ma Output Set Point = 6 kiloliters



**Programming the DCR-1008 for Example 4**

All fields not colored out are required to be set. Only variances from the default settings are shown. .

Software Tab	Keypad	Description	Range	Default	Changes
<b>Basic Setup</b>	Units	Units	Inches, Feet, Meters	Feet	Meters
	InputSel	Sensor Type	35' DST, 50' DST, 4-20mA	35' DST	
	DecPoint	Decimal Point	00000, 0000.0, 0000.00, 00.000	000.00	
<b>4-20 mA Setup</b>	4mA In	4mA Input Point	0-65535 (Limited by Decimal Point)	3.00	
	20ma In	20 mA Input Point	0-65535 (Limited by Decimal Point)	10.00	
<b>Relay Setup / Relay 1</b>	Lead Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	2.50	1.00
	Lead Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	5.00
	LeadCtrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	OnHysOff
	Lead Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D1	Sensor
	LeadTime	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 2</b>	Lag Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.00	0.5
	Lag Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	6.00
	Lag Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	OffOnOff
	Lag Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D2	Sensor
	Lag Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 3</b>	R3 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.50	
	R3 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	R3 Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	R3 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D3	
	R3 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 4</b>	R4 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	4.00	
	R4 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	R4 Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	R4 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D4	
	R4 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup</b>	Alt Pump	Alternate Pumps	0-25 Cycles	0	
<b>4-20 mA Output Setup</b>	4mA Out	4mA Output Point	0-65535 (Limited by Decimal Point)	3.00	1.00
	20mA Out	20 mA Output Point	0-65535 (Limited by Decimal Point)	10.00	6.00
<b>Measurement Setup</b>	Tank Type	Measurement and Tank Types	Distance, Level, RecTank, SphrTank, VertFlat, VertCone, HoriFlat, HoriSphr	Distance	HoriSphr
	ConvMult	ConversionMultiplier	0-65.535	1.000	
	TankSpan	Sensor face to bottom	0-669 Inches, 0-58.25 feet, 0-17.75 meters	12.00	2
	Tank Len	Tank Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	10.00	3.75
	SpherLen	Sphere Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.0	0.3
	Rad/Wid	Radius / Width	0-669 Inches, 0-58.25 feet, 0-17.75 meters	5.00	0.75
<b>Ultrasonic Setup</b>	UltSensit	Sensitivity	0-100	75	
	UltBlank	Blanking	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00	.457
	UltPulse	Pulses	1-20	13	
	SampRate	Sample Rate	0-9999 msec	120	
	SampAve	Sample Average	1-50	20	
	SampOOR	SamplesOutOf Range	1-50	10	
	SampWin	Sample Window	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00	
	LossEcho	Loss of Echo Delay	0-1000 sec	5	
	Max Dist	Maximum Distance	35' DST = 5-35 feet, 50' DST = 5-100 feet	35	
	AutSense	Auto Sense	Off, On	Off	
	TempComp	Temperature Comp	Off, On	Off	
	OffstDis	Offset Distance	0-669 Inches, 0-58.25 feet, 0-17.75 meters	0	
	OffstPol	Offset Polarity	Positive, Negative	Positive	
	Calibrat	Calibration Factor	0-1.999	1.000	
<b>4-20mA Setup</b>	4ma Cal	4ma Calibration	0-9999 (Units Selected)	5000	
	20ma Cal	20ma Calibration	0-9999 (Units Selected)	5000	
<b>Utilities</b>	Reset	Set Factory Settings	No, Yes	No	

**APPENDIX A: DCR-1008 SETUP WORKSHEET**

Software Tab	Keypad	Description	Range	Default	Changes
<b>Basic Setup</b>	Units	Units	Inches, Feet, Meters	Feet	
	InputSel	Sensor Type	35' DST, 50' DST, 4-20mA	35' DST	
	DecPoint	Decimal Point	00000, 0000.0, 0000.00, 00.000	000.00	
<b>4-20 mA Setup</b>	4mA In	4mA Input Point	0-65535 (Limited by Decimal Point)	3.00	
	20ma In	20 mA Input Point	0-65535 (Limited by Decimal Point)	10.00	
<b>Relay Setup / Relay 1</b>	Lead Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	2.50	
	Lead Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	LeadCtrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	Lead Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D1	
	LeadTime	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 2</b>	Lag Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.00	
	Lag Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	Lag Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	Lag Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D2	
	Lag Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 3</b>	R3 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	3.50	
	R3 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	R3 Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	R3 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D3	
	R3 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup / Relay 4</b>	R4 Trip	Trip Point (T1)	0-65535 (Limited by Decimal Point)	4.00	
	R4 Win	Trip Window (TW)	0-65535 (Limited by Decimal Point)	0.50	
	R4 Ctrl	Control Logic	OnOffOff, OnOff,On, OnHysOff, OffOnOn, OffOnOff, OffHysOn, Off, FailSafe	Off	
	R4 Asn	Input Assignment	Sensor, D1, Sensr/D1, D2, Sensr/D2, D3, Sensr/D3, D4, Sensr/D4, D1D2PmUp, D3D4PmDn	Sensr/D4	
	R4 Time	Hold / Delay Time	+/- 0-1000 Seconds	+0	
<b>Relay Setup</b>	Alt Pump	Alternate Pumps	0-25 Cycles	0	
<b>4-20 mA Output Setup</b>	4mA Out	4mA Output Point	0-65535 (Limited by Decimal Point)	3.00	
	20mA Out	20 mA Output Point	0-65535 (Limited by Decimal Point)	10.00	
<b>Measurement Setup</b>	Tank Type	Measurement and Tank Types	Distance, Level, RecTank, SphrTank, VertFlat, VertCone, HoriFlat, HoriSphr	Distance	
	ConvMult	ConversionMultiplier	0-65.535	1.000	
	TankSpan	Sensor face to bottom	0-669 Inches, 0-58.25 feet, 0-17.75 meters	12.00	
	Tank Len	Tank Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	10.00	
	SpherLen	Sphere Length	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.0	
	Rad/Wid	Radius / Width	0-669 Inches, 0-58.25 feet, 0-17.75 meters	5.00	
<b>Ultrasonic Setup</b>	UltSensit	Sensitivity	0-100	75	
	UltBlank	Blanking	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00	
	UltPulse	Pulses	1-20	13	
	SampRate	Sample Rate	0-9999 msec	120	
	SampAve	Sample Average	1-50	20	
	SampOOR	SamplesOutOf Range	1-50	10	
	SampWin	Sample Window	0-669 Inches, 0-58.25 feet, 0-17.75 meters	2.00	
	LossEcho	Loss of Echo Delay	0-1000 sec	5	
	Max Dist	Maximum Distance	35' DST = 5-35 feet, 50' DST = 5-100 feet	35	
	AutSense	Auto Sense	Off, On	Off	
	TempComp	Temperature Comp	Off, On	Off	
	OffstDis	Offset Distance	0-669 Inches, 0-58.25 feet, 0-17.75 meters	0	
	OffstPol	Offset Polarity	Positive, Negative	Positive	
	Calibrat	Calibration Factor	0-1.999	1.000	
<b>4-20mA Setup</b>	4ma Cal	4ma Calibration	0-9999 (Units Selected)	5000	
	20ma Cal	20ma Calibration	0-9999 (Units Selected)	5000	
<b>Utilities</b>	Reset	Set Factory Settings	No, Yes	No	

**APPENDIX B: DST SPECIFICATIONS**

	<b>DST-1001</b>	<b>DST-1002</b>	<b>DST-1004</b>	<b>DST-1006</b>	<b>DST-1007</b>
<b>Application</b>	Dry stable Environments	Wet corrosive Environments	Corrosive Environments	Wet corrosive Environments	Wet Corrosive Environments
<b>Operating (ft)</b>	0.6 to 35	1.5 to 35	1.5 to 35	1.5 to 50	1.0 to 16
<b>Range (m)</b>	0.18 to 10.6	0.4 to 10.6	0.4 to 10.6	0.4 to 15.2	0.3 to 4.8
<b>Enclosure</b>	304 Stainless	PVC	PVC	PVC	PVC
<b>Transducer Type</b>	Electrostatic	Ceramic	Ceramic	Ceramic	Ceramic
<b>Transducer Material</b>	Gold on Kapton	PVC	Teflon	PVC	PVC
<b>Ratings</b>	NEMA12, IP53	NEMA 4X, IP65	NEMA 4X, IP65	NEMA 4X, IP65	NEMA 4X IP65
<b>Operating</b>	-30 to 70 ° C	-30 to 60 ° C	-30 to 60 ° C	-30 to 60 ° C	-30 to 60 ° C
<b>Internal Temperature Compensation</b>	Yes	Yes	Yes	Yes	Yes
<b>Accuracy</b>	0.2% of range*	0.25% of range*	0.25% of range*	0.25% of range*	0.25% of range*
<b>Dimensions (in)</b>	3.5x 2.35	7 X 3.5	7 x 3.5	10.0 x 3.5	7 x 2.35
<b>len x diam (mm)</b>	89 x 59	178 x 89	178 x 89	254 x 89	178 x 60
<b>Beam Pattern</b>	8 degrees	9 degrees	9 degrees	9 degrees	9 degrees
<b>Supply Voltage</b>	(12-24 V DC)	(12-24 V DC)	(12-24 V DC)	(12-24 V DC)	(12-24 V DC)
<b>Current Draw</b>	(25-60mA)	(25-60mA)	(25-60mA)	(25-60mA)	(25-60mA)
<b>Cable</b>	Coaxial RG-6	Coaxial RG-6	Coaxial RG-6	Coaxial RG-6	Coaxial RG-6

**AUTOSENSE SOFTWARE OPTION** ~The *AutoSense* software is available for all of the above DST sensor models. It provides automatic sensitivity adjustment and is preferable in tank and level applications. Please use the following part numbers when ordering a DST with the *AutoSense* option.

DST-2001, DST2002, DST-2004, DST-1006, DST-2007