USL1000 DETECTOR

ULTRASONIC LEVEL/FLOW METER

S-VERSION

TECHNICAL REFERENCE MANUAL

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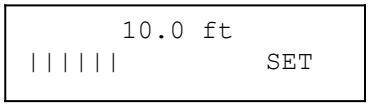
The USL1000 is an ultrasonic transducer meter that furnishes up to four set points and an isolated 4-20mA output. A flow-meter (USF1000) application is also supported.

ULTRASONIC MAIN SCREENS

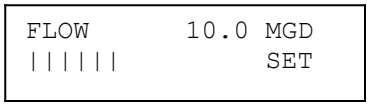
The ultrasonic run screen displays the ultrasonic input (PV2), US-2000, or US-3000 in user selectable units and a 4-20mA-output bar graph. Note: The US-2000 is obsolete but will still function.

LEVEL METER SCREEN



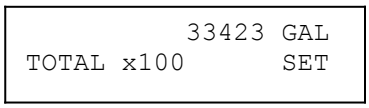
- Press SET to enter ultrasonic setup.
- Press the leftmost pushbutton to switch to unit 2. Press again to switch back to unit 1 (level application). The flow meter displays one unit.

FLOW METER SCREEN (flow meter application only)



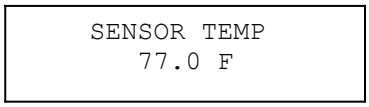
- Press SET to enter ultrasonic/flow-meter setup.
- Press the left pushbutton to view the level.

TOTALIZER SCREEN (flow meter application only)



- Press SET to enter ultrasonic/flow-meter setup.
- The flow meter totalizer (if enabled) is displayed/ on the bottom line and can be cleared by pressing the SET pushbutton, entering the correct password and pressing ENT, and pressing ESC. The CLEAR TOTALIZER prompt will then be displayed. Press YES to clear the totalizer or NO to not clear the totalizer.

ULTRASONIC TEMPERATURE SCREEN (US-3000 option)



- From any of the above screens, press the second to the left pushbutton to view the ultrasonic transducer temperature in degrees Fahrenheit for two-seconds. If the thermistor is open or shorted, the appropriate message is displayed in lieu of the temperature.

TooCls = Too close
NoEcho = No echo
ComErr = Communications error

ULTRASONIC SETUP

From the main operating screen, press the SET pushbutton and enter the password (default 000). Press ENT to, if a valid password was entered, enter the main ultrasonic setup menu.

CAL	Calibrate the ultrasonic input (IN) & PO1 4-20mA output. The user is prompted to change the password upon exiting this menu.
ALM	Set K1, K2, K3 & K6 (if enabled) set points. Note: Set point values are set using the primary units. Set point values are accessed from the LEVELMETER/FLOWMETER SETUP->ALM menu (US SETPOINT).
PARM	Set the **zero** (tank zero) & **span** (4-20mA range) values.
ESC	Return to main operating screen.

MESSAGES

NoEcho
No echo was received by the transducer.

TooCls
The target is too close to the sensor. There is a typical dead-band of 12", which is dependent on the DEAD TIME parameter. If the TooCls message is displayed at all times, increase the dead time parameter my 0.05ms until the message is no longer shown.

ComErr
The US-3000 is not communicating with the PS-1000 meter.

PARAMETER LIST PARM MENU

To access these parameters from the main operating screen, press SET and enter the password, now the ultrasonic setup menu will be displayed. Press the PARM push button to view and possibly change the parameters listed below.

Parameter: **ZERO**
Sets the tank zero point in UNIT 1; see the LEVEL APPLICATION section.
When the flow meter application is enabled, set to the crest threshold (in feet).
When adjusting the zero point, one can press the RD pushbutton to sample the ultrasonic input, which is copied into the zero value.

Parameter: **PO1** (**SPAN)/FM SPAN**
Sets the PO1, 4 to 20mA output range in UNIT 1; see the LEVEL APPLICATION section.
When the flow meter application is enabled, set to the flow rate in FLOW UNITS that should represent a 20mA output.

PARAMETER LIST IN RNG MENU

To access these parameters from the main operating screen, press SET and enter the password, now the ultrasonic setup menu will be displayed. Press CAL, IN, and RNG push buttons. One can now view and, possibly, change the parameters listed below. **Parameters that are not needed for the particular mode of operation will not be available.**

Parameter: **APP (application)**
LEVEL METER = Level meter with set points
FLOW METER = Flow meter with volume/time display and totalizer
HORZ TANK = Horizontal tank application

LEVEL METER PARAMETERS

Parameter: **UNIT 1**
Sets the ultrasonic units. Choices are ft, in, m, cm, mm, GAL, & L.

Parameter: **UNIT 1 DP**
Sets the decimal point to 0, 0.0, 0.00, or 0.000 for unit 1

Parameter: **UNIT 2**
Sets the secondary ultrasonic units. Choices are ft, in, m, cm, mm, GAL, & L.

Parameter: **UNIT 2 DP**
Sets the decimal point to 0, 0.0, 0.00, or 0.000 for unit 1

Parameter: **kFACTOR**
Converts unit 1 to unit 2. **U_2/U_1 = kFACTOR**

FLOW METER PARAMETERS

Parameter: **FLOW DP (DECIMAL POINT)**
0, 0.0, 0.00, 0.000

Parameter: **DSP (display) NEGATIVE**
YES or NO – If this parameter is set to YES, the level display (not flow) will display negative numbers to aid in determining the zero-level during installations. Normally, this parameter should be set to NO.

Parameter: **TYPE**
Selects the weir type for the flowmeter.

TYPE	DESCRIPTION
W-CONTR	Rectangular weir with end contractions
W-SUPR	Rectangular weir without end contractions (suppressed)
V-NOTCH	V-notch (triangular)
PARSHALL	Parshall Flume
PAL-BWLS	Palmer-Bowlus Flume
COMP-VR	Compound weir – V-notch and rectangular with end contractions.

The Isco Open Channel Flow Measurement Handbook by Douglas M. Grant should be referenced for details about the above weirs and flumes.

https://info.teledyneisco.com/flowhandbook (purchase)
https://archive.org/details/iscoopenchannelf0000gran/page/n5/mode/2up (sign-up required)

Copies may be able to be found on eBay for lower cost than new.

Parameter: **ALPHA**
22.5, 30, 45, 60, 90, 120 degrees
Available if needed (V-notch).

Parameter: **CREST**
Crest in feet (0.00)
Available if needed (Weir).

Parameter: **THROAT W**
Throat width in inches.
Available if needed (Parshall Flume)

Parameter: **V-HEIGHT**
V-notch height in inches.
Available if needed (COMP-VR)

Parameter: **UNITS**
Sets the flow units – selections are:
CFS (cubic-ft/sec), MGD (million-gallons/day), or GPM (gallons/minute)

TOTALIZER PARAMETERS

Parameter: **FM TOTALIZER**
ON/OFF – A twelve or eleven (w/ decimal point) totalizer can be selected via the left-most pushbutton while viewing the main flow/level screen.

Parameter: **FM MULT**
This parameter allows one to multiply the flow-meter output by a whole number. This is useful if the application contains two or more weir, flume, etc. and only one site contains an ultrasonic device.

Parameter: **TTL MULT** (x1, x10, x100, x1000)
This selection allows the MGD totalizer to display a slower changing output for MGD.

Parameter: **TTL RELAY**
Turns the totalizer relay output (PS-1000 K4 or PS-1000S K6) on or off. One relay pulse is sent for each "tick" of the totalizer. Note: The relay is enabled for 25ms and disabled for 25ms or higher (20 pulses/sec). It is important that the totalizer will not increment more than 20 times/second when this output is enabled or missed pulses will result.

ULTRASONIC DEVICE PARAMETERS (4-20mA TYPE)

Common to both the level and flow meter applications… If the US-2000 or US-3000 is he US sensor, these parameters are not available.

Parameter: **PV2 @ 4mA**
Set the length (volume) that a 4mA signal from the ultrasonic represents. This value could be a minimum or maximum distance. This parameter is available for the 4-20mA ultrasonic sensors. *

Parameter: **PV2 @ 20mA**
Set the length (volume) that a 20mA signal from the ultrasonic represents. This value could be a minimum or maximum distance. This parameter is available for the 4-20mA ultrasonic sensors. *

**The ultrasonic sensor provider furnishes the engineering unit (i.e., ft) and minimum and maximum distance points.*

Parameter: **INVERT US**
Inverts the output of the ultrasonic sensor… This is available for 4-20mA devices.

US-3000 SPECIFIC PARAMETERS

These parameters are available when a US-3000 is the ultrasonic sensor. Most are set by the factory and need no further adjustment. The DAMPING parameter is usually the only parameter that would be field adjusted.

Parameter: **TEMP COMP**
Activates or deactivates temperature compensation.

ADV PARM: Set this parameter to YES to access the additional parameters for the US-3000. These parameters are seldom accessed.

Parameter: **US FW VER: x.xx**
Displays the US-3000 firmware version number….

Parameter: **Rx GAIN**
Receive gain: 1 through 12

Parameter: DEADtNEAR
Sets the dead-band for the near power mode in milliseconds.

Parameter: DEADt FAR
Sets the dead-band for the far power mode in milliseconds.

Parameter: DAMPING
Sets a filter for the ultrasonic reading. The range is from zero (no filter) and 99.

Parameter: **Tx PULSES**
Number of pulses that are transmitted: 1 through 32

Parameter: **DEAD TIME**
Ultrasonic dead-time: 1 to 20ms

Parameter: **POWER**
Sets the strength of the pulses… Range is 1 to 50.

The following values are for information about the limits of the sensor for diagnostic purposes. Press ADJ to cycle through the values.

MIN DIST	This is the distance in inches (in) that an object can be detected by the sensor.
LRNG THD	This is the distance (in) where the sensor switches to a higher power mode to measure the distance.
THD F→N	Far to near distance (in) threshold.
THD N→F	Near to far distance (in) threshold.

US-2000/US-3000 CALIBRATION

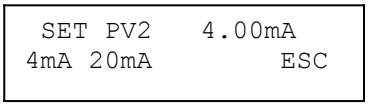
If the US-2000 board is installed or the US-3000 is present, the calibration procedure is accomplished as follows:

1. Enter the calibration screen from the main screen by pressing SET, entering the correct password, pressing ENT, pressing CAL, pressing IN, and then pressing SNS. The screen to the right should be displayed.
2. Position the sensor to a distance 12” or greater. Press P1 and adjust the distance in inches to the correct value and then press SET.
3. Position the sensor to a distance greater than P1. Press P2 and adjust the distance in inches to the correct value and then press SET.

RESET: Press the reset pushbutton to reset the calibration to the default value.

CALIBRATION OF PV2 4-20mA INPUT

To increase the accuracy of the PV2 4-20mA input, one must use a 4-20mA generator connected to the PV2 input. The ultrasonic must be disconnected to complete this procedure. If possible, the best results will be achieved if the user can generate the 4mA and 20mA signals from the ultrasonic sensor.



- Power down the USL1000 instrument.
- Disconnect the ultrasonic input PV2.
- Connect the mA (current) generator to the PV2 input.
- Power the USL1000 instrument.
- Go to SETUP->CAL->IN->mA (password must be entered).
- Set the mA generator to 4.00mA and press the pushbutton under the 4mA label to set the zero mA point. The display should read 4.00mA.
- Set the mA generator to 20.00mA and press the pushbutton under the 20mA label to set the span mA point. The display should read 20.00mA.
- Repeat to verify calibration. However, the zero and span points are not interactive so one can skip this step.
- Press the ESC pushbutton to exit to the calibration menu until the main operating display is shown.
- Power down the USL1000 instrument.
- Disconnect the mA (current) generator.
- Reconnect the ultrasonic sensor to input PV2.
- Power the USL1000 instrument.

CALIBRATE PO1

To calibrate the process output (PO1), one must connect either a DMM (mA input) or other device that can read the PO1 current output. The device should have, at least, 0.01mA precision.

1. From the CALIBRATE menu (entered by pressing CAL from the ultrasonic setup menu), press the PO1 pushbutton to enter the SET ANALOG OUT screen.
2. Press the 4mA pushbutton and the mA meter should read around 4.00mA.
3. Use the UP & DOWN pushbuttons to set the output to exactly 4.00mA and press set when done. This is the zero point.
4. Press the 20mA pushbutton; the mA meter should read around 20.00mA.
5. Use the UP & DOWN pushbuttons to set the output to exactly 20.00mA and press set when done. This is the span point.
6. The two points are not interactive so one should not need to readjust each point again. Press the EXIT pushbutton to go back to the CALIBRATE menu.

END OF CALIBRATION

ENGINEERING SETUP

To select the instrument as a ultra sonic meter (USL1000), do as follows: From the current main operating screen, press SET and enter the password “1?1” and press the ENT pushbutton. Alternatively, if one is in the setup menu, press the right most pushbutton until the password screen is displayed, enter the password “1?1” and press the ENT pushbutton.

Parameter: **MODE**
Selects the instrument-operating mode. Press the ADJ pushbutton to set the choice to ULTRASONIC (USL1000).

Parameter: **US SOURCE:**
Selects the ultrasonic transducer connected to the USL1000.
If a US-2000 board is installed, set this parameter to US2k. Note: The US-2000 is obsolete and replaced by the US-3000. If the US-3000 is connected to the USL1000, set this parameter to US3k. If a 4-20mA sensor is connected to PV2 (used by sensors from other manufacturers), select PV2.

Parameter: **BUZZER**
Enables (ON) for ACK type of set points or disables (OFF) the audible alarm.

Parameters: **K1, K2, K3 & K6**
Sets the operating mode of the selected relay.

K1, K2, K3, K6	ENERGIZED	DE-ENERGIZED
OFF	NEVER	ALWAYS
LOW	INPUT <= SP	INPUT > SP
LOW /w ACK	INPUT <= SP	INPUT > SP *OR* Acknowledged by USER
HIGH	INPUT >= SP	INPUT < SP
HIGH /w ACK	INPUT >= SP	INPUT < SP *OR* Acknowledged by USER
HIGH ACK ON	INPUT >= SP	The alarm is acknowledged but the relay output remains energized. This mode is used when the BUZZER is enabled.

After one is finished, press the ESC pushbutton to return to the main operating screen.

Parameters: **K1 POLARITY, K2 POLARITY, K3 POLARITY, and K6 POLARITY**
These parameters set the relay polarity.

N/O:	Normally open
N/C	Normally closed

Note: Set point values are set using the primary units. Set point values are accessed from the LEVELMETER/FLOWMETER SETUP->ALM menu (US SETPOINT).

FAILURE RELAYS (K5 & K4)

Failure relays are K5 (N/O) and K4 (N/C emulation).
K5 is closed when there is a COM loss, too close, or no signal error conditions.
K4 will be closed when the US sensor is reading a distance.

ANALOG OUTPUT DURING SIGNAL LOSS

The level-meter application will not drop the analog output, PO1, to 4mA when a “no-echo” condition occurs; it will hold the last valid reading.

PASSWORD

After one exits the CALIBRATION menu, one is first prompted to change the stored password. If one does not want to change the password, press the NO pushbutton. If the YES pushbutton is pressed, the SET new password screen is entered and now one can set the new password.

APPLICATION: HORIZONTAL TANK

Make sure the RANGE switch on the CPU board is set to B. The other setting is for development purposes only. Values displayed are (top row) h (ft), angle (radians), max. volume (ft^3), (bottom row) b (ft) and area of segment (ft^2).

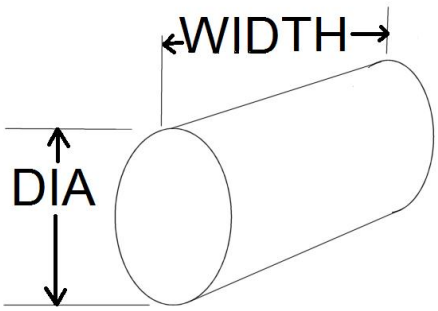
Parameters under the SET→PW→CAL→IN→RNG menu (APP = HORZ TANK)

VOL DP – Sets the volume decimal point

VOL UNITS – Selects cubic-feet (ft^3), cubic-meters (m^3), gallons (GAL), and liters (LTR).

DIA – Sets the diameter of the horizontal tank in feet.

WIDTH – Sets the width of the horizontal tank in feet.



KFACTOR – Allows one to alter the cubic feet to another volume constant. Set the value to less than 0.005 to use the default constant. For example, one may need imperial gallons (6.2288 gal/ft^3) in lieu of US fl gallons (7.4805 gal/ft^3).

Notes:

4. The 4-20mA output is scaled to the volume calculated by the DIA (diameter) and WIDTH parameters. For example: DIA=8ft & WIDTH=15ft The PO1 @ 20mA volume is about 754ft^3. **PO1 @ 20mA = W × (½D)^2 × π × k**
   W = Width (ft), D = Diameter (ft), k = ft^3 to volume constant.
   k=1.0 ft^3/ft^3(no change), k=28.32 L/ft^3, k= 7.481 US fl gal/ft^3, 6.229 Imp. gal/ft^3

5. The ALM set points reference the level of the tank and not the volume. Press the right-most push button (PB4) to toggle between volume and level.

Temperature Compensation

Setting parameter “TEMP COMP” to YES will enable temperature compensation.

It’s recommended that when turning on temperature compensation that one recalibrate the sensor.

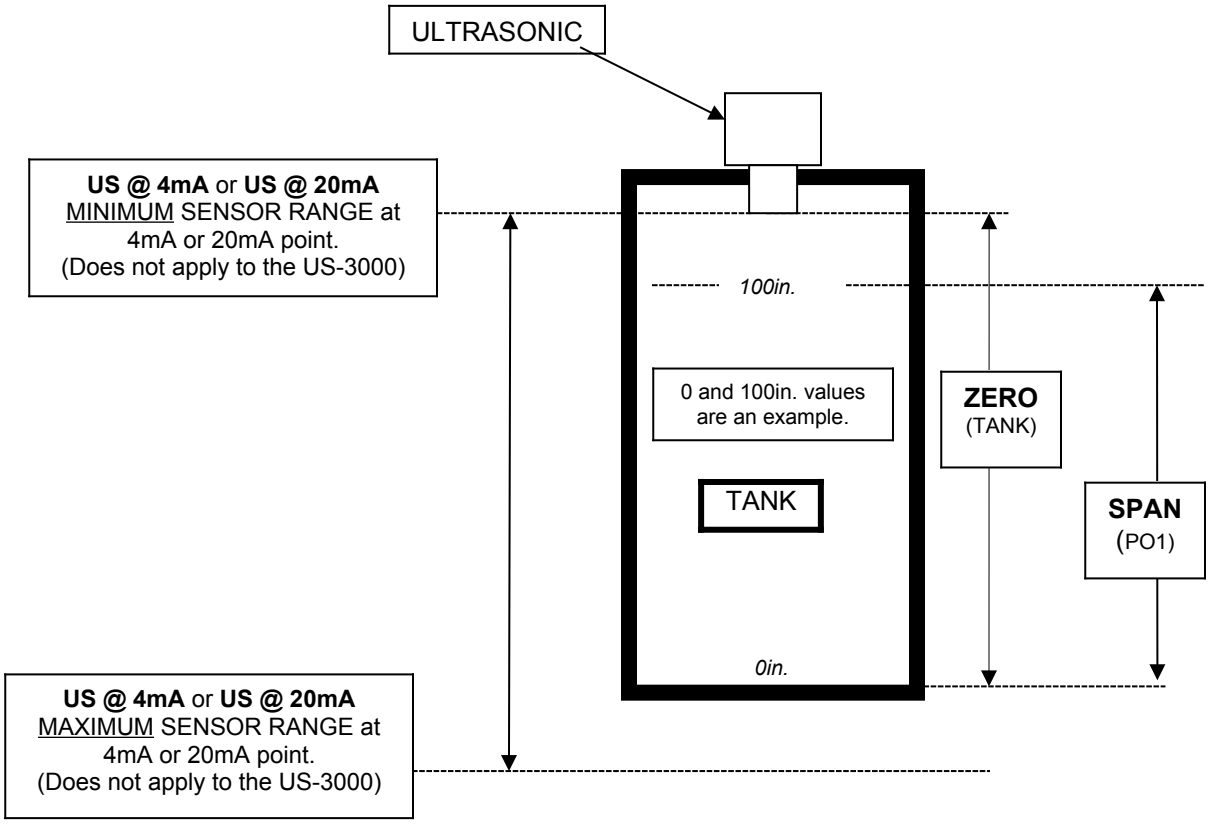
Important: Enabling temperature compensation can produce additional issues.

- If the sun is shining on the sensor, it will heat the sensor causing worse results. Installing a protective shield around the sensor will reduce that issue. The sensor MUST be able sense the temperature inside the tank or the ambient temperature which should be the same around the tank to provide an accurate distance reading.
- Do not touch the bottom of the sensor (below the 2” NPT) when calibrating the sensor or while it is measuring the distance. Handle it by the top 1”NPT. The temperature sensor will react to the minute heating or cooling of the sensor and produce inaccurate results.
- After installing the sensor, allow at least fifteen minutes for the sensor to reach thermal equilibrium with the mounting hardware before calibrating the sensor.

SPEED OF SOUND IN AIR

Deg C	Deg F	ft/sec	Deg C	Deg F	ft/sec	Deg C	Deg F	ft/sec	Deg C	Deg F	ft/sec
0	32.0	1087.0	25	77.0	1135.7	50	122.0	1182.3	75	167.0	1227.2
1	33.8	1089.0	26	78.8	1137.6	51	123.8	1184.1	76	168.8	1229.0
2	35.6	1091.0	27	80.6	1139.5	52	125.6	1186.0	77	170.6	1230.7
3	37.4	1093.0	28	82.4	1141.4	53	127.4	1187.8	78	172.4	1232.5
4	39.2	1094.9	29	84.2	1143.2	54	129.2	1189.6	79	174.2	1234.2
5	41.0	1096.9	30	86.0	1145.1	55	131.0	1191.4	80	176.0	1236.0
6	42.8	1098.9	31	87.8	1147.0	56	132.8	1193.2	81	177.8	1237.7
7	44.6	1100.8	32	89.6	1148.9	57	134.6	1195.0	82	179.6	1239.5
8	46.4	1102.8	33	91.4	1150.8	58	136.4	1196.9	83	181.4	1241.2
9	48.2	1104.8	34	93.2	1152.7	59	138.2	1198.7	84	183.2	1243.0
10	50.0	1106.7	35	95.0	1154.5	60	140.0	1200.5	85	185.0	1244.7
11	51.8	1108.7	36	96.8	1156.4	61	141.8	1202.3	86	186.8	1246.4
12	53.6	1110.6	37	98.6	1158.3	62	143.6	1204.1	87	188.6	1248.2
13	55.4	1112.6	38	100.4	1160.1	63	145.4	1205.9	88	190.4	1249.9
14	57.2	1114.5	39	102.2	1162.0	64	147.2	1207.6	89	192.2	1251.6
15	59.0	1116.4	40	104.0	1163.9	65	149.0	1209.4	90	194.0	1253.3
16	60.8	1118.4	41	105.8	1165.7	66	150.8	1211.2	91	195.8	1255.1
17	62.6	1120.3	42	107.6	1167.6	67	152.6	1213.0	92	197.6	1256.8
18	64.4	1122.2	43	109.4	1169.4	68	154.4	1214.8	93	199.4	1258.5
19	66.2	1124.2	44	111.2	1171.3	69	156.2	1216.6	94	201.2	1260.2
20	68.0	1126.1	45	113.0	1173.1	70	158.0	1218.3	95	203.0	1261.9
21	69.8	1128.0	46	114.8	1175.0	71	159.8	1220.1	96	204.8	1263.7
22	71.6	1129.9	47	116.6	1176.8	72	161.6	1221.9	97	206.6	1265.4
23	73.4	1131.8	48	118.4	1178.6	73	163.4	1223.7	98	208.4	1267.1
24	75.2	1133.7	49	120.2	1180.5	74	165.2	1225.4	99	210.2	1268.8
25	77.0	1135.7	50	122.0	1182.3	75	167.0	1227.2	100	212.0	1270.5

LEVEL APPLICATION



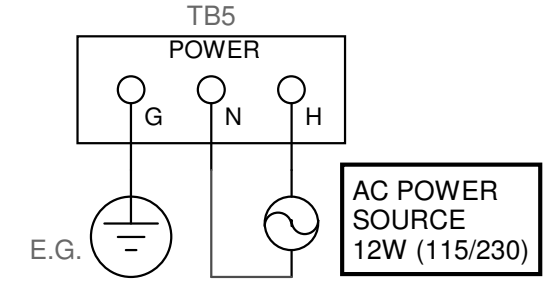
- Go to SETUP->CAL->IN->RNG: Enter the ultrasonic 4mA & 20mA points (US @4mA and US @ 20mA) provided by the ultrasonic sensor provider (Does not apply to the US-3000). If other units are needed (i.e. meters), one may have to convert the points by multiplying a constant, see table 1. *NOTE: Before entering these two points, set the UNITS and DP settings.*
- To increase the accuracy of the system, one may calibrate the 4mA and 20mA points by using a current source calibration device, see OPTIONAL: CALIBRATION OF PV2 4-20mA INPUT.
- SETUP->PARM->ZERO sets the tank zero.
- SETUP->PARM->SPAN sets the PO1, 4-20mA analog output range.

Convert	Multiply by		
feet to inches	12		
feet to yards	0.33333		
feet to meters	0.3048		
feet to centimeters	30.48		
feet to millimeters	304.8		

TABLE 1

END OF DOCUMENT

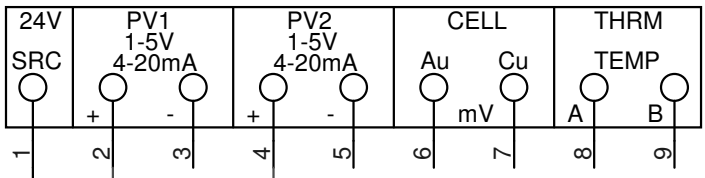
PS-1000S-CPU ALTERNATE CALIBRATION

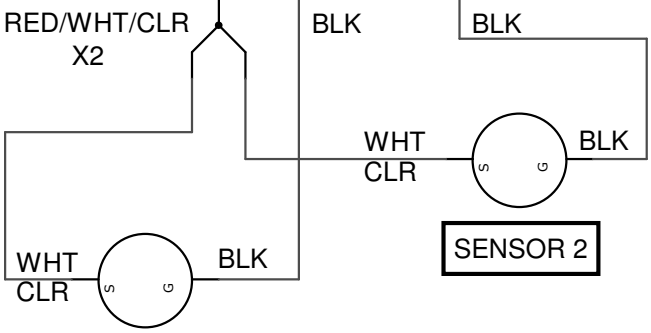


AC POWER SOURCE
12W (115/230)

S1 (V.SELECT)
SELECTS 115V OR 230V A.C. POWER

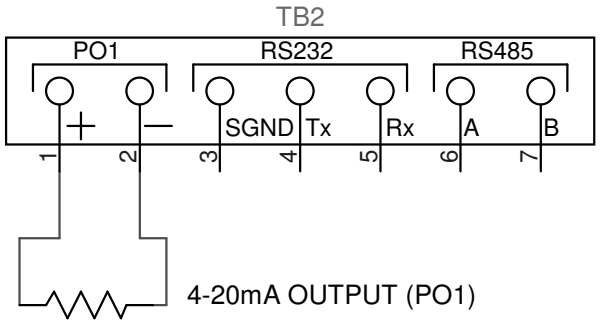
NOTE: PV1 & PV2 share common negative (TB3-3 & 5) if J1 and J2 both have G selected.





SENSOR 2

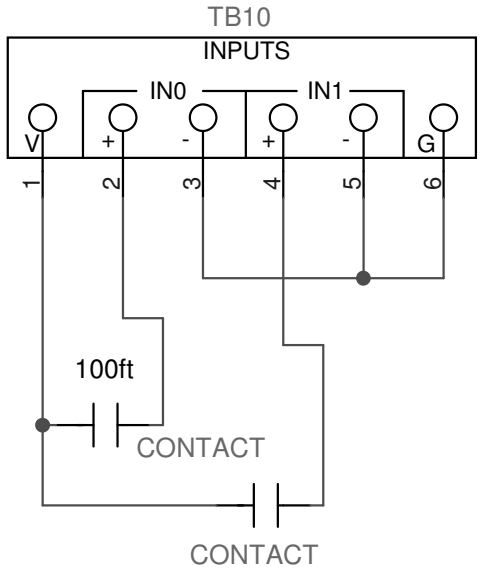
SENSOR 1



4-20mA OUTPUT (PO1)

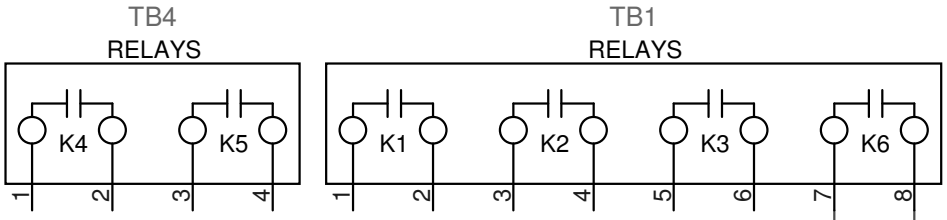
4-20mA SELF POWERED SOURCES & 4-20 CALIBRATOR WIRING

CONTROLLER 4-20mA LOAD (VALVE, PUMP, ETC.)
SCADA SYSTEM, CHART RECORDER, ETC.

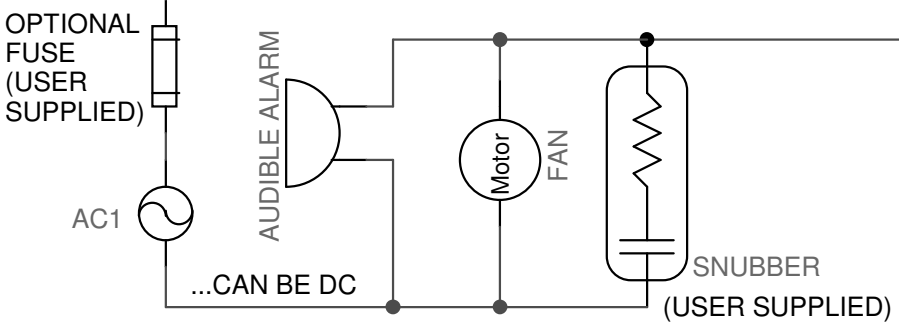


RELAY FUNCTION LIST
K1 - DANGER - CH1 & CH2
K2 - CRITICAL - CH1 ONLY
K3 - CRITICAL - CH2 ONLY
K4 -
K5 -
K6 - FAILURE

WIRING AN AUDIBLE ALARM AND/OR FAN TO ACTIVATE ON ANY ALARM CONDITION



WARNING
THE CONTACT CANNOT SUPPLY ANY POTENTIAL



BOARD REVISION (REV):
1636 AND ABOVE

EAGLE MICROSYSTEMS, INC

PS-1000S-CPU-B

AC POWER & RELAY CONNECTIONS ARE
NOT SHOWN ON THIS PAGE.

TO DISPLAY
PS-1000S-DSP

PS-1000 FIRMWARE MUST BE V3.00 OR HIGHER.

P3

PS-1000S-CPU

TB2

PO1 RS232 RS485

\+ − SGND Tx Rx A B

1 2 3 4 5 6 7

TB3

24V SRC | PV1 1-5V 4-20mA | PV2 1-5V 4-20mA | CELL Au Cu mV | THRM TEMP A B

1 2 3 4 5 6 7 8 9

P2

1x5

BK GN WH RD

4-20mA LOAD (<=600ohms)
TRACKS FLOWMETER/LEVEL
USER SUPPLIED

GN WH RD BK YL

D+ D- RS-485 V+ V- 12-28 VDC

US-3000
ULTRASONIC
SENSOR

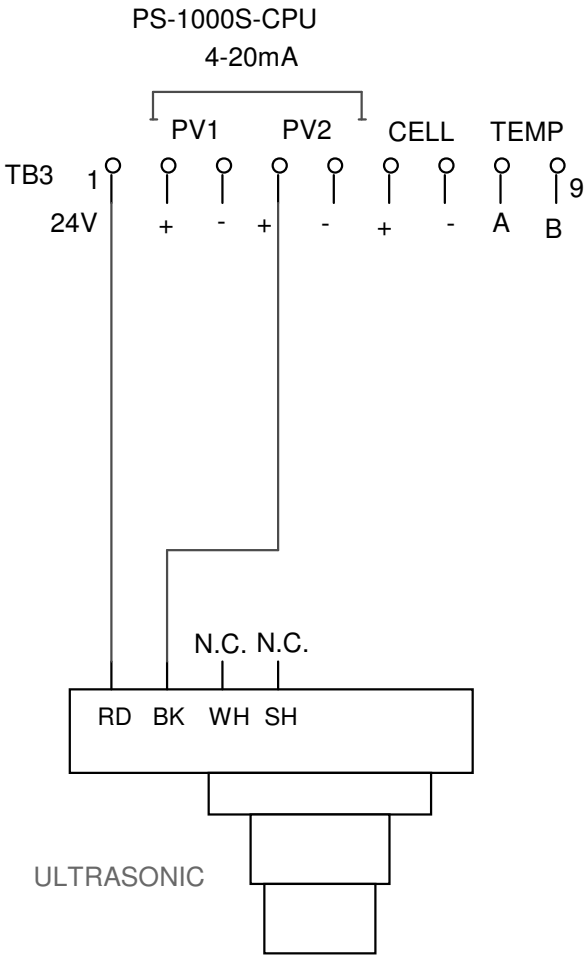
CABLE LENGTH CAN BE UP TO 1000ft (305m)

THE EXTENDED CABLE SHOULD CONSIST
OF TWO TWISTED PAIRS:
ONE SET FOR D+/D-
ONE SET FOR V+/V-

PS-1000S w/ US-3000

50kHz ULTRASONIC
FLOW/LEVEL METER
TRANSDUCER

FLOWLINE SENSOR WIRING

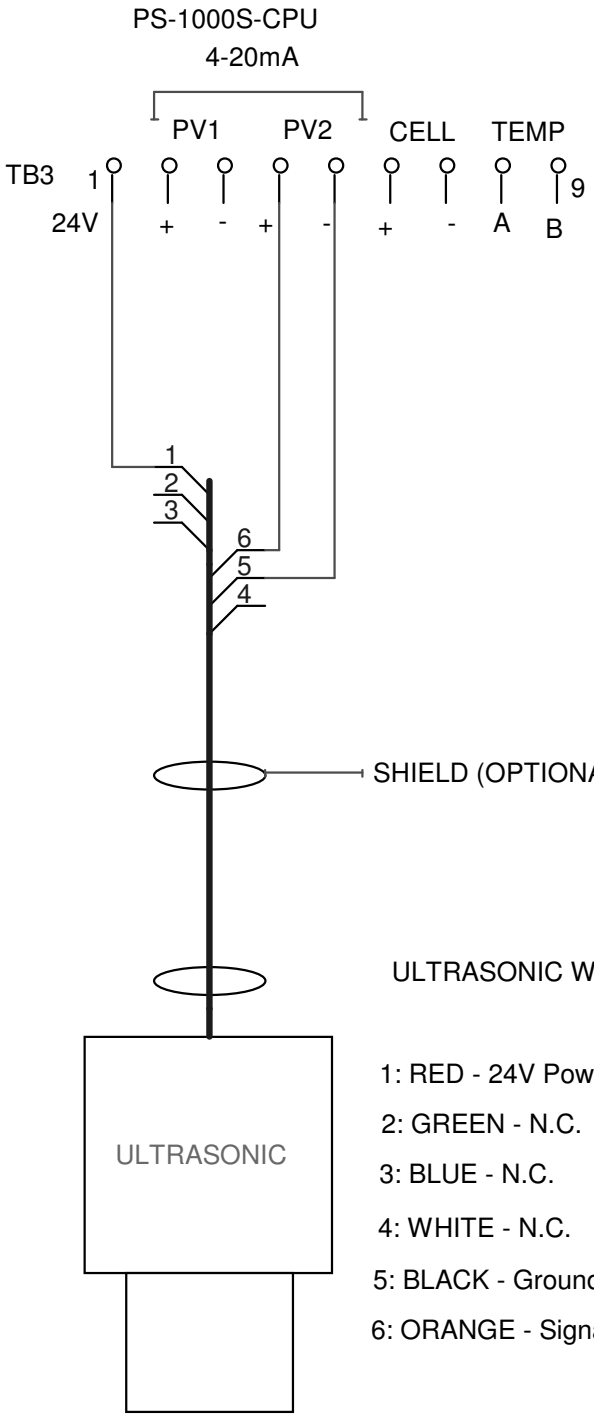


1: RED - 24V Power

2: BLACK - Signal

3: WHITE - N.C.

APG SENSOR WIRING



ULTRASONIC WIRING

1: RED - 24V Power

2: GREEN - N.C.

3: BLUE - N.C.

4: WHITE - N.C.

5: BLACK - Ground

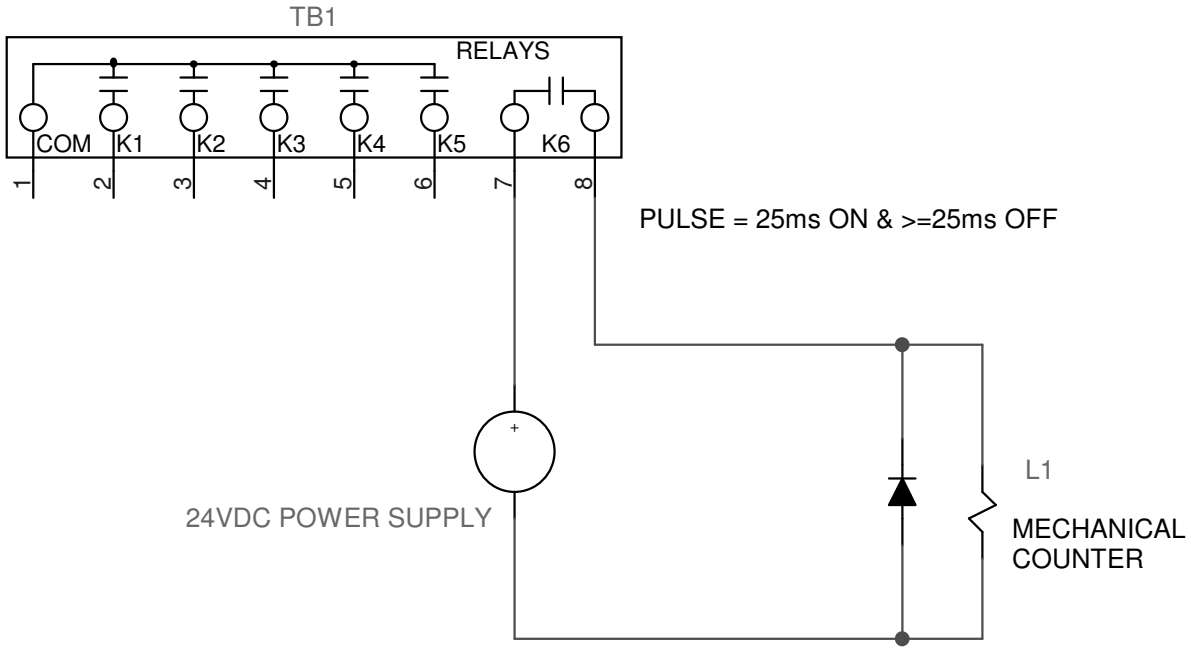
6: ORANGE - Signal

EAGLE MICROSYSTEMS, INC

USL1000

ULTRASONIC WIRING

REV: 04/22/08



PS-1000S-CPU
TOTALIZER RELAY OUTPUT

BOARD REVISION (REV):
0644 AND ABOVE

Notes:

USL1000/USF1000 ROUTING TICKET (ULTRASONIC)

SO#: _____ DATE: _____

PROGRAM: _____ SERIAL #: _____

VERSION: _____ PCB REV: _____

US P/N: _____ US S/N: _____

ENGINEERING		PROGRAMMING	
MODE:	ULTRASONIC	APP:	
US SOURCE:		UNIT 1:	
		(FLOW DP) UNIT 1 DP:	
K1:		UNIT 2:	
K1 POLARITY:		UNIT 2 DP:	
K2:		K FACTOR:	
K2 POLARITY:		AVERAGE:	
K3:		DSP NEGATIVE:	
K3 POLARITY:		TEMP COMP:	
K4:			
K4/K6 POLARITY:		TYPE:	
		ALPHA:	
PASSWORD:	0 0 0	CREST:	
		V-HEIGHT	
ZERO:		THROAT W:	
PO1 SPAN:		UNITS:	
		FL MULT:	
US SP 1:		FM TOTALIZER:	
US SP 2:		TTL MULT:	
US SP 3:		TTLk:	
US SP 4:		TTL RELAY:	
		PV2 @ 4mA:	
		PV2 @ 20mA:	
		INVERT US:	
VOL DP:			
VOL UNITS:		Rx GAIN:	
DIA:		DEADtNEAR:	
WIDTH:		DEADt FAR:	
KFACTOR:		DAMPING:	
		Tx PULSES:	
		POWER:	

HARDWARE OPTIONS

PS-1000-AOUT ☐ APG ☐ US-3000 ☐ ☐

S1 =115V		S1 = 230V	