

AUTOMATION PRODUCTS GROUP, INC.

Operator's Manual

DCU-1104 and DCU-1108

Rev. A2, 11/06
Doc. 9002660



Automation Products Group, Inc.

APG...Providing tailored solutions for measurement applications

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• Warranty and Warranty Restrictions

APG warrants its products to be free from defects of material and workmanship and will, without charge, replace or repair any equipment found defective upon inspection at its factory, provided the equipment has been returned, transportation prepaid, within 24 months from date of shipment from factory.

THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESSED OR IMPLIED BY OPERATION OF LAW OR OTHERWISE INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

No representation or warranty, express or implied, made by any sales representative, distributor, or other agent or representative of APG which is not specifically set forth herein shall be binding upon APG. APG shall not be liable for any incidental or consequential damages, losses or expenses directly or indirectly arising from the sale, handling, improper application or use of the goods or from any other cause relating thereto and APG's liability hereunder, in any case, is expressly limited to the repair or replacement (at APG's option) of goods.

Warranty is specifically at the factory. Any on site service will be provided at the sole expense of the Purchaser at standard field service rates.

All associated equipment must be protected by properly rated electronic/electrical protection devices. APG shall not be liable for any damage due to improper engineering or installation by the purchaser or third parties. Proper installation, operation and maintenance of the product becomes the responsibility of the user upon receipt of the product.

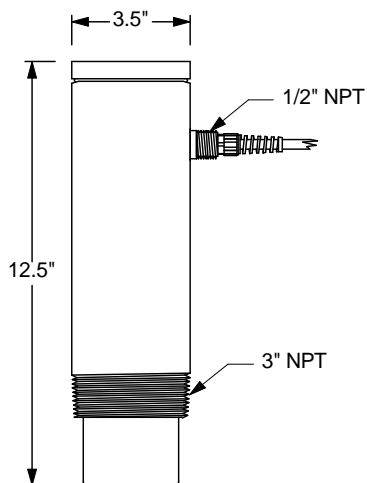
Returns and allowances must be authorized by APG in advance. APG will assign a Return Material Authorization (RMA) number which must appear on all related papers and the outside of the shipping carton. All returns are subject to the final review by APG. Returns are subject to restocking charges as determined by APG's "Credit Return Policy".

• Introducing

Thank you for purchasing the DCU-11 Programmable Ultrasonic Sensor. These sensors combine a versatile range of features to handle even the toughest measuring challenges in tank and environmental monitoring and control.

Sensor features include:

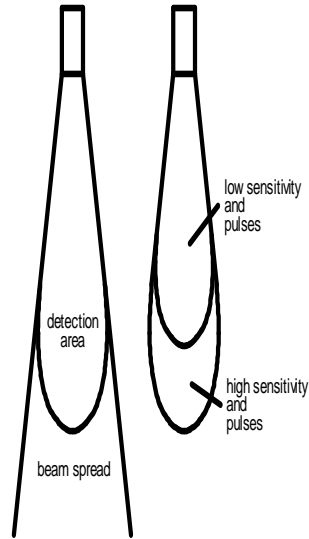
- Total Programmability
- Built-in display for easy setup and distance readings
- Rugged, PVC housing for harsh environments with polyurethane encased electronics for moisture, shock, and vibration resistance
- Microprocessor-controlled with analog and relay outputs
- PVC enclosed ceramic transducer for use in wet or dry applications
- Distance range of 2 ft. to 50 ft.



• **Understanding Ultrasonics**

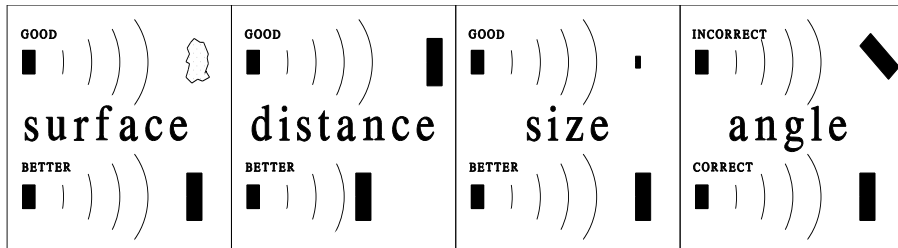
Ultrasonic sensors measure distance using a transducer to send out ultrasonic bursts. Each burst contains a series of 1-20 pulsed sound waves that emit in the shape of a cone, reflect off the target, and are received by the sensor. The time required for the sound burst to travel to and from the target is converted into a distance measurement by the sensor.

Ultrasonic sensing is affected by several factors including the target surface, distance, size, and angle. The following considerations will help ensure the best possible target conditions.



Surface

The ideal target surface is hard and smooth and perpendicular to the face of the transducer. This surface will reflect a greater amount of signal than a soft, sound wave absorbent surface. A target with poor sound wave reflection characteristics 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 a greater surface area to reflect the signal than a small one, therefore, a large target will be detected at a greater distance than a small target. The surface area recognized as the target is generally the portion closest to the sensor.

Angle

The inclination of the object's 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. Generally a target at an angle greater than 5 degrees off perpendicular will not be detected.

- **Installation**

1. Installation, use and maintenance shall be in accordance with the manufacturer's instructions, the National Electrical Code and any applicable local codes.
2. Electrical equipment connected to associated apparatus should not use or generate more than 250Vrms.
3. Tampering or replacement with nonfactory components may adversely affect the safe use of the system.

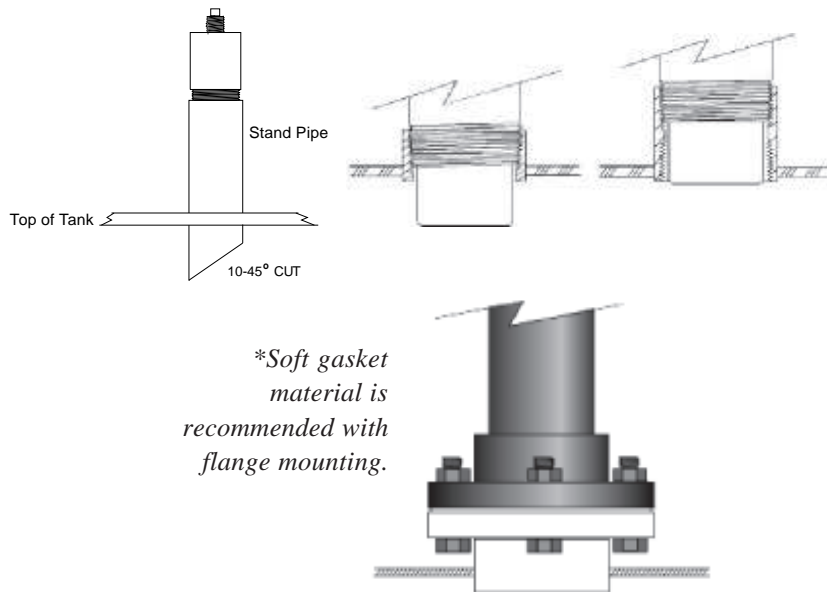
• Installation

The DCU-11 sensor should be mounted so that it has a clear sound path to the level monitored. Mount the sensor away from tank walls and inlets. The path should be free from obstructions and as open as possible for the 18° beam pattern (9° off axis). Follow the guidelines mentioned in "Understanding Ultrasonics", earlier in this manual. When using a stand pipe to mount the sensor above the tank, the stand pipe should be seamless and no longer than 4 in. to provide a smooth path for the sound waves to propagate into the tank. Seams from couplers, nipples or gaskets can cause erroneous echoes and degrade the sensors performance.

The DCU-11 can be mounted in a coupler, or flange by using the 3 in. threaded case. It can also be mounted using a Uni-Strut mounting bracket.

The minimum detection range of the DCU-11 is 2 ft. **The sensor should be mounted to ensure the target does not come closer than the minimum range or erroneous readings may result.**

To mount the DCU-11 for Class 1 Division 2 Groups A, B, C, and D, see the Hazardous Mounting section of this manual.



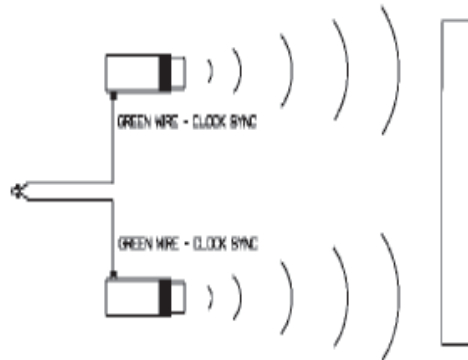
• Wiring

RED	10 - 30 VDC (24 VDC recommended)
BLACK	POWER SUPPLY GROUND
YELLOW	ANALOG GROUND
ORANGE	4-20 mA ANALOG OUTPUT
BLUE	RELAY 1 COMMON
GRAY	RELAY 1 NORMALLY OPEN
PURPLE	RELAY 2 COMMON
BROWN	RELAY 2 NORMALLY OPEN
GREEN	CLOCK SYNCHRONIZATION
WHITE	DIGITAL OUT
SHIELD	TERMINATE AT POWER SOURCE *

- Cable is a 10 conductor with shield, 22 AWG, 6 ft. (1.83 m) length.
- Ground and Analog ground are connected internal to the DCU-11.
- * Shield is not connected in the DCU-11 and should be grounded at the power source.

Wiring for Clock Synchronization

The DCU-11 has the capability to synchronize the transmit pulses of multiple sensors. When sensors are mounted in close proximity to one another the sensors should be synchronized to help prevent cross talk between sensors.



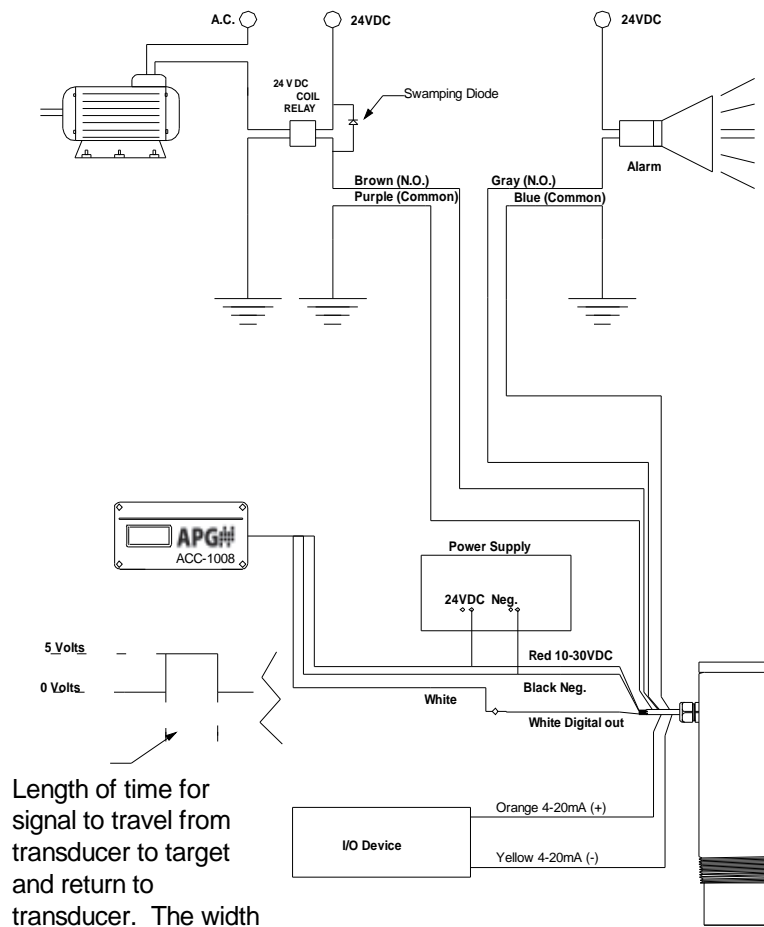
Wiring for a Digital Out

The digital output is a pulse width signal which corresponds to the distance being detected by the DCU-11 sensor. The digital signal is typically used in conjunction with a APG (ACC-1007) or (ACC-1008) remote readout.

Wiring for a Relay Output

When switching a highly capacitive or inductive load, a swamping diode should be used. This will protect the internal relay from possible damage and prevent electrical noise from being introduced to the sensor which could result in false readings.

DCU-11 Wiring Diagram



Length of time for signal to travel from transducer to target and return to transducer. The width varies and is proportional to the target distance.

• Programming

The DCU-11 display and control buttons can be accessed by unscrewing the sealed cap on the rear of the sensor. The membrane display has two lights indicating the status of Trip Points 1 and 2. The LED display shows distance measurements. The display is also used when programming to display the individual modes and their values.

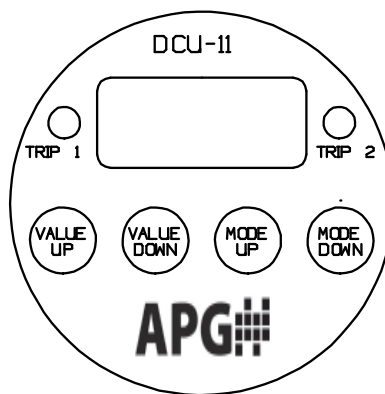
The DCU-11 has four programming buttons, VALUE UP, VALUE DOWN, MODE UP and MODE DOWN. They are accessed similar to a digital watch. To cycle forward through the 27 modes, hold down the MODE UP button. To cycle backwards through the modes, hold down the MODE DOWN button.

To select a mode, press the MODE UP or MODE DOWN button until the desired mode is displayed. Press either the VALUE UP or VALUE DOWN button once to view the selected mode setting.

To change the selected mode setting, hold down the VALUE UP or VALUE DOWN button until the desired setting is displayed.

To STORE or SAVE the desired change, press the MODE UP or MODE DOWN button. The display will return to displaying the distance measurement. The value is also permanently stored in the EE memory and will not be lost when power is turned off. If a button is not pressed for 2 minutes, the display will turn off to reduce power requirements. Pressing any button will return the display to showing it's distance reading.

A list of the 27 modes is located on the DCU-11 MODE SHEET provided with this manual.



Operation

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
1	<i>Units</i>	Range = 1-3 1- inches 2- feet 3- meters

The first thing to set up on the DCU-11 is the *Units to be Displayed*. The *Units Mode* is used to select the type of measurement and setup units in which you will operate. The units will also determine the resolution of the display and the outputs. The resolution is: inches .1, feet .01, and meters .01.

NOTE: All modes must be set using the units in Mode 1.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
2	<i>*Sensitivity</i>	Units = % Range = 0000 - 9999

The *sensitivity* setting adjusts the level of gain/amplification (as a percentage of maximum) that is applied to the return signal. To avoid amplifying unwanted noise, set the sensitivity to the minimum value that will allow the target to be reliably tracked through the full range of environmental conditions. It is often wise to add another 10% as a buffer.

*NOTE: FOR VIEWING ONLY IN AUTOSENSE MODE (mode- 27). The first two digits on the display will read the highest sensitivity the sensor can operate at effectively. The last two digits display the currently operating sensitivity level of the sensor. The numbers displayed are used to help with installation.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
3	<i>Blanking</i>	Units = Mode 1 Range = 2-50 ft. Default = 2.00

The *blanking* distance is the zone from the sensor to a point where the first echo will be accepted. Because of the physical properties of an ultrasonic sensor, objects cannot be detected closer than 2 ft. from the end of the transducer. This distance varies according to how much energy is being transmitted (Mode 4) and the installation. Ensure this parameter is entered after

the Units (Mode 1) have been set. The blanking distance can also be used to ignore unwanted targets close to the sensor such as welds, seams, pipe fittings, or gaskets.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
4	<i>Pulses</i>	Units = 42 Khz soundwaves Range = 1-20 Default = 20

The *Pulses* mode controls how many pulsed soundwaves are transmitted in each ultrasonic burst. The DCU-11 sends out a transmission burst of pulses and measures the time it takes for the echo to return. Up to a certain point, the more pulses that are sent in a burst, the stronger the returning echo. When detecting a soft target in damping environments, increase the strength of the echo by increasing the number of pulses. In acoustically active environments, small enclosed areas, or hard surface areas, decrease the number of pulses in order to decrease the energy transmitted and reduce multiple echoes.

Filtering

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
5	<i>Sample Rate</i>	Units = Seconds Range = 0.120-1 (1- 8 in AutoSense mode) Default = 1

The *sample rate* or time between ultrasonic bursts can be adjusted to achieve the reaction time needed for the application. Typically, product levels change slowly requiring a slow sample rate (1-8 seconds).

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
6	<i>Averaging</i>	Units = Samples Range = 1-50 Default = 10

Averaging sets the number of samples that will be averaged in the first-in-first-out (FIFO) average buffer. The DCU-11 will take readings at the rate determined by Mode 5. Therefore, a setting of 10 in Mode 6 with a 1 second sample rate, would result in a 10 second average updated once each second.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
7	<i>Out-of-Range Samples</i>	Units = Samples Range = 1-200 Default = 5

This mode is used in conjunction with *Out-of Range Span* (Mode 8) to set an effective window for valid readings. Setting the *Out-of-Range Samples* to 10 would require that a target be detected 10 times in succession outside of the window (Mode 8) before the sensor will recognize it as a new valid target and enter it into the FIFO buffer.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
8	<i>Out-of-Range Span</i>	Units = Mode 1 Range = 0-9999 Default = 2.00 ft.

The *Out-of-Range Span* will set a certain size window (+/-) the current reading. If the echo received is within this window, it will be considered valid and is averaged in the FIFO buffer.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
9	<i>Loss of Echo Delay</i>	Units = seconds Range = 0-9999 Default = 5

This mode sets the delay in seconds before the output will show a loss of echo condition. When the DCU-11 does not receive an echo, it will hold the last valid condition for the number of seconds entered in Mode 9. When this time has expired, the display and trip points will change to their maximum distance reading.

Outputs

Relay

The two relays are fully programmable for BEGIN and END points and their Type of operation. The LEDs on the DCU-11 display labeled TRIP 1 and TRIP 2 indicate the status of the normally open relay contacts. When the LED is on, the relay is energized and the contact is closed. All distance settings will be in the UNITS selected in Mode 1.

The relays are rated for 200 mA @ 24 VDC. Switching A.C. through the relay is not recommended.

NOTE: Outputs do not automatically convert to units used in Mode 1. All outputs must be changed, if Mode 1 has been changed.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
10	<i>Begin Trip 1</i>	Units = Mode 1 Range = 0 - 9999 Default = 3.00
Sets the Begin point for Trip 1 Relay Output.		

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
11	<i>End Trip 1</i>	Units = Mode 1 Range = 0 - 9999 Default = 4.00
Sets the End point for Trip 1 Relay Output.		

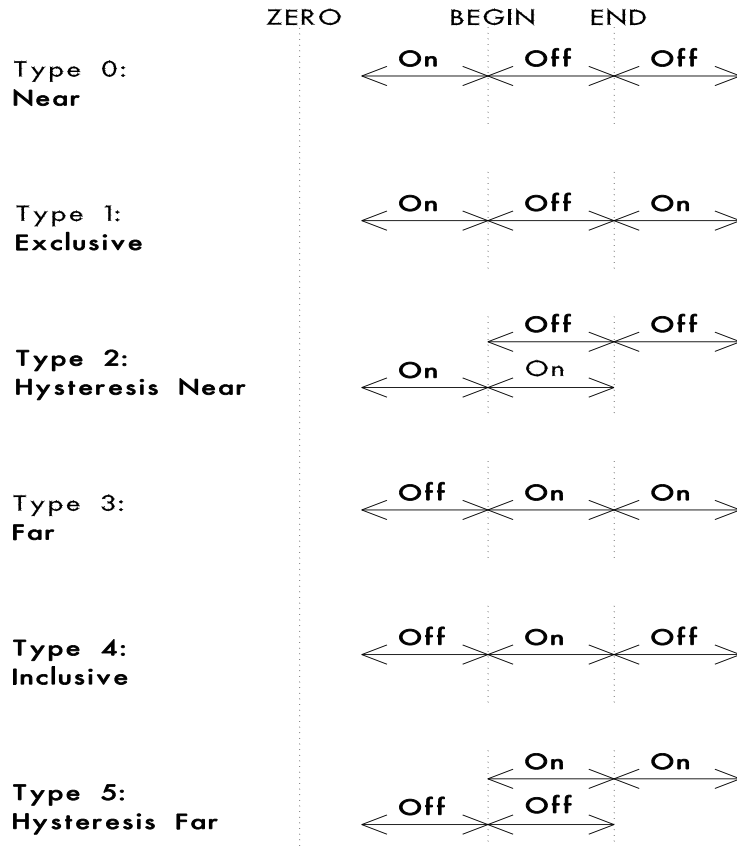
<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
12	<i>Trip 1 Type</i>	Range = 0 - 7 0 - near 1 - exclusive 2 - hysteresis near 3 - far 4 - inclusive 5 - hysteresis far 6 - disable 7 - loss of echo Default = 0
Selects the output type for Trip 1.		

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
13	<i>Begin Trip 2</i>	Units = Mode 1 Range = 0 - 9999 Default = 3.50
Sets the Begin point for Trip 2 Relay Output.		

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
14	<i>End Trip 2</i>	Units = Mode 1 Range = 0 - 9999 Default = 4.50
Sets the End point for Trip 2 Relay Output.		

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
15	<i>Trip 2 Type</i>	Range = 0 - 7 0 - near 1 - exclusive 2 - hysteresis near 3 - far 4 - inclusive 5 - hysteresis far 6 - disable 7 - loss of echo Default = 0
Selects the output type for Trip 2.		

Trip Type Explanation



Type 6: Trip Point Disable

Type 7: Relay remains closed (trip light on) unless an error is detected in communication, loss of echo, or loss of power.

NOTE: The Zero line represents the face of the sensor when operating in "Distance" mode and the bottom of the tank when operating in "Tank" mode.

Analog

The 4-20 mA analog output can be configured anywhere over the range of the DCU-11. The 4 mA end point is entered in mode 16 and the 20 mA end point in mode 17. The 4 and 20 mA values are calibrated at the factory but can be fine tuned by Modes 18 and 19. The DCU-11 will digitally create a straight line between the two points for the analog output. The resolution of the output will be the same as the displayed resolution.

To fine tune the analog output a current meter should be connected between the yellow and orange wires. The sensor should be aimed at a target outside the 4mA distance setting (Mode 16). The meter should read near 4 mA. If the output requires adjustment, go to Mode 18 then press either the Value Up or Value Down button until the meter reads 4 mA. The same can be done for the 20 mA setting using Mode 19. 4-20 mA calibration will be lost upon resetting the sensor.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
16	<i>4 mA distance</i>	Units = Mode 1 Range = 0-9999 Default = 3.00 ft.

Sets the 4 mA distance.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
17	<i>20 mA distance</i>	Units = Mode 1 Range = 0-9999 Default = 4.00 ft.

Sets the 20 mA distance.

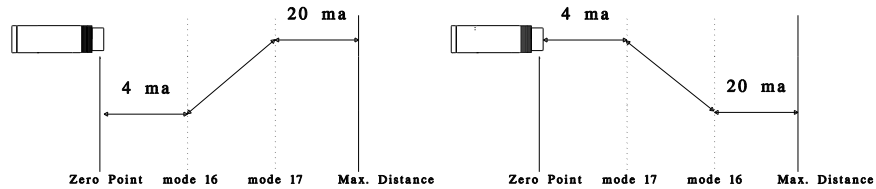
<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
18	<i>4 mA Trim</i>	Range = 0-9999 Default = 5200

Fine tunes the minimum current sourced on the analog output.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
19	<i>20 mA Trim</i>	Range = 0-9999 Default = 9208

Fine tunes the maximum current sourced on the analog output.





Calibration

For most open air applications, the factory-set calibration should be correct. Variations between the distance measured by the DCU-11 and the actual distance are caused by environmental conditions such as temperature, humidity, or chemical atmosphere. These environments can be compensated for by using a calibration factor which calibrates the reading to match the actual distance.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
20	<i>Distance Offset</i>	Units = Mode 1 Range = 0-9999 Default = 0

Sets an offset for the display when measuring distance to a level.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
21	<i>Offset Polarity</i>	Range = NEG, POS Default = NEG

Selects the direction of the offset. Adds or subtracts offset to reading.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
22	<i>Calibration above the Decimal Point</i>	Range = 0-9999 Default = 1

Sets the integer portion of the calibration factor.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
23	<i>Calibration below the Decimal Point</i>	Range = 0-9999 Default = 0

Sets the fractional portion of the calibration factor. (Decimal point is assumed

to be in the far left position. So a value of 53 would correspond to 0.0053, whereas 5300 would correspond to 0.5300.)

EXAMPLE:

The Calibration Factor is used to bring the displayed reading in line with the measured distance. To obtain the measured distance, measure from the target to be detected to .5 in. behind the DCU-11 face. (.5 in. behind the DCU-11 face is the electrical zero point of the sensor.)

1 Point Calibration

The calibration factor is determined by dividing the actual distance measured by the displayed distance. Enter this number in the calibration Modes 22 and 23. Then the displayed readings should match the measured distance.

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;

$$\begin{array}{ll} Y = \text{measured distance} & X = \text{DCU-11 reading} \\ A = \text{Multiplier} & B = \text{Offset} \end{array}$$

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 $(A) = (D_2 - D_1) / (U_2 - U_1)$ where;

$$\begin{array}{ll} D_2 = \text{far known distance} & U_2 = \text{Ultrasonic reading at } D_2 \\ D_1 = \text{close known distance} & U_1 = \text{Ultrasonic reading at } D_1 \end{array}$$

Enter this multiplier in Modes 22 and 23. The multiplier can then be entered in the above equation to calculate the offset $B = D_2 - (A)U_2$. The offset should be entered using Modes 20 and 21.

Utilities

Temperature Compensation

As air temperature changes, so does the speed of sound. This change can cause 0.1% drift in distance for every °F change. Mode 24 allows compensation for this change. The DCU-11 contains an internal thermistor which measures temperature. By turning temperature compensation ON, the effects of temperature changes may be reduced by 50% or better.

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
24	<i>Temperature Compensation</i>	Range = OFF/ ON, Temp in °C Default = OFF

Selects internal *temperature compensation* for changes in the speed of sound. Set to ON, OFF, or VIEW sensor temperature.

EXAMPLE:

Temperature Compensation is turned ON by pressing the VALUE UP button when in Mode 24. Pressing the VALUE UP button one more time will display the present temperature of the sensor in Fahrenheit. Place this mode in the ON position if temperature compensation is desired.

For the DCU-11 temperature sensor to operate properly, it must be shielded from direct sun radiation. Because the temperature sensor is internal to the DCU-11, it requires several minutes to react to air temperature changes.

Reset

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>
25	<i>Reset</i>	Range = No/Yes Default = No

Reset the mode parameters to their factory preset values (default).

EXAMPLE:

When the DCU-11 is powered up, NO is loaded in Mode 25. This saves the user-selected modes into the DCU-11. If the factory preset values are wanted, press the VALUE UP button to load YES in Mode 25. If YES is entered, the DCU-11 will perform a reset when the mode UP or mode DOWN key is pressed, loading all the modes with the default parameters.

Software**MODE DESCRIPTION**26 *Software Version*

Mode 26 displays the software version for the DCU-11. The value corresponds to the operating version and the approximate date of manufacture.

MODE DESCRIPTION PARAMETERS27 *Autosense*

Range = 0-1

0 = Manual (user controls Sensitivity and Pulses)

1 = Autosense (sensor controls Sensitivity and Pulses)

Autosense mode sets control of the sensitivity and pulses to the sensor. The DCU-11 will automatically change the sensitivity to match the application.

MODE DESCRIPTION28 *Password*

Mode 28 is used to access factory adjustment modes in the sensor.

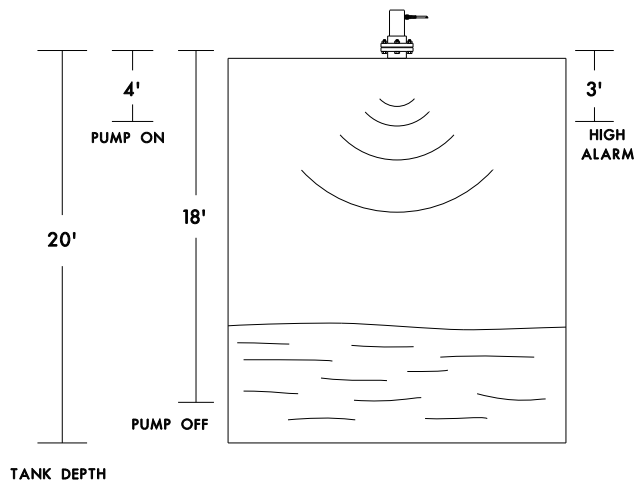
Lift Station Example

A 20 ft. deep lift station requires that a pump turn ON when a level is closer than 4 ft. to the DCU-11. The pump must stay on until the level drops to 18 ft. from the DCU-11. An alarm relay is to be energized under normal operation and should open for failure in power, communication, invalid readings, high level above 3 ft. from sensor, or loss of echo.

Setting the averaging in Mode 6 at 10 to 20 samples will give a good stable reading. In most tank level applications, we can have high averaging (Mode 6) and slow sample rate times (Mode 5) because the levels change slowly. To calculate the time

required to completely fill the averaging buffer, take the sample rate times the number of samples averaged. For example, if the sample rate is 5.00 seconds and the averaging is 10, it would take 50 seconds to fill the buffer resulting in a 50 second average.

The Out-of-Range samples (Mode 7) are the number of successive samples outside of the window specified in Mode 8 that the sensor will ignore. After this number of successive samples have been discarded the ones following will be sent to the averaging buffer. This allows the sensor to ignore objects that move into the area between the sensor and the target for short periods of time. To figure the time period that the sensor will ignore these objects before locking onto them, take the sample rate (Mode 5) times the number of Out-of-Range samples (Mode 7). An example of where this would be used would be an agitator in a tank. Every time the agitator goes around it passes directly



under the sensor. With the correct settings in Modes 7 and 8 the sensor will ignore the agitator when it passes in front of the sensor and stay locked on the level of the product in the tank. However, if the agitator stops directly below the sensor for a long period of time, eventually the number of Out-of-Range samples in Mode 7 will be exceeded and the sensor could start displaying the top of the agitator.

To program the DCU-11 for this application, the following modes must be set:

<u>MODE</u>	<u>VALUE</u>	<u>DESCRIPTION</u>
1	2	Set units to feet because the output is to be displayed in feet.
2	0%	NOT A SETTABLE VALUE. Displays the sensitivity of the returning echo. 50% or less indicates a good application.
3	2.00	Do not set closer than the minimum distance recommended for the DCU-11 sensor.
5	4	Sample once every 4 seconds.
6	15	Average 15 samples in the FIFO buffer.
7	30	Ignore 30 consecutive samples outside the window set in Mode 8.
8	.5 ft.	If the tank has some turbulence between +/- .5 ft., the DCU-11 will average these readings in. If a reading comes back outside the value in Mode 8 ($\pm .5$ ft.), the DCU-11 will ignore this reading.
9	120	Loss of echo will show in output after 120 seconds.
10	4 ft.	Begin Trip 1 at 4 feet from sensor.
11	18 ft.	End trip 1 at 18 feet from sensor.
12	2	Use the hysteresis near type of gate to keep the pump on while pumping the level down.
13	3 ft.	Trip 2 begins at 3 ft. from the sensor.
14	20 ft.	Trip 2 ends at 20 ft. because any signal greater will indicate a loss of echo or communication.
15	4	Any signal higher than 3 ft. or lower than 20 ft. will cause the alarm relay to open.
24	ON	Turn temperature compensation on for best accuracy.

• **Mode Sheet**

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>	<u>EXPLANATION</u>
1	Units	Range = 1 - 3 1 - inches 2 - feet 3 - meters Default = 2	Select the units to be displayed and used in setup. NOTE: * Set Mode 1 first before any other modes.
2	Sensitivity	Units = % Range = 0000-9999	FOR VIEWING ONLY. The first two digits display highest operating sensitivity and the last two digits display current sensitivity level.
3	Blanking	Units = Mode 1 Range = 2.0 to 50 ft. Default = 2.00	Sets a dead zone in front of the transducer where echoes are ignored. The minimum dead zone is required for the transducer to change from a transmitter to a receiver.
4	Pulses	Units = Pulses Range = 1 - 20 Default = 20	Sets the number of ultrasonic pulses transmitted in each burst. 20 being the strongest transmit setting.
5	Sample Rate	Units = Seconds Range = 0.120-1 Default = 0.120	Sets how fast the DCU-11 samples. (1-8 sec. in autosense mode)
6	Average	Units = Samples Range = 1 - 200 Default = 10	Sets the averaging size for the FIFObuffer.
7	Out-Of-Range Samples	Units = Samples Range = 1 - 200 Default = 5	Sets the number of out-of-range samples required before updating the average (MODE 6).
8	Out-of-Range Span	Units = Mode 1 Range = 0 - 9999 Default = 2.00	Sets a window of acceptance for the average (MODE 6). If a reading is out of this window then it must be followed by (MODE 7) more readings before the average can be changed.

• **Mode Sheet (continued)**

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>	<u>EXPLANATION</u>
9	Loss of Echo Delay	Units = seconds Range=0-9999 Default = 5	Set the delay in seconds before the output will show a loss of echo condition.
10	Trip 1 Begin	Units = Mode 1 Range = 0 - 9999 Default = 3.00	Sets the BEGIN point for Trip 1 Relay output.
11	Trip 1 End	Units = Mode 1 Range = 0 - 9999 Default = 4.00	Sets the END point for Trip 1 Relay output.
12	Trip 1 Type	Range = 0 - 7 0 - near 1 - exclusive 2 - hysteresis near 3 - far 4 - inclusive 5 - hysteresis far 6 - disable 7 - loss of echo Default = 0	Selects the output type for Trip 1.
13	Trip 2 Begin	Units = Mode 1 Range = 0 - 9999 Default = 3.50	Sets the BEGIN point for Trip 2 Relay output.
14	Trip 2 End	Units = Mode 1 Range = 0 - 9999 Default = 4.50	Sets the END point for Trip 2 Relay output.

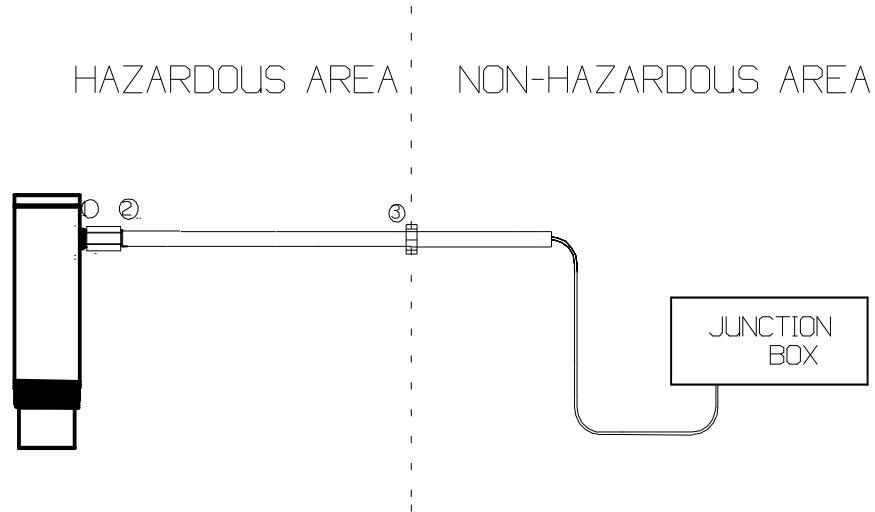
• **Mode Sheet (continued)**

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>	<u>EXPLANATION</u>
15	Trip 2 Type	Range = 0 - 7 0 - near 1 - exclusive 2 - hysteresis near 3 - far 4 - inclusive 5 - hysteresis far 6 - disable 7 - loss of echo Default = 0	Selects the output type for Trip 2.
16	4mA*	Units = Mode 1 Range = 0 - 9999 Default = 3.00	Sets the end point for the 4 mA analog limit.
17	20mA*	Units = Mode 1 Range = 0 - 9999 Default = 4.00	Sets the end point for the 20 mA analog limit.
18	4mA Trim	Range = 0 - 9999 Default = 5200	Fine tunes the 4 mA analog output. (calibrated at the factory)
19	20mA Trim	Range = 0 - 9999 Default = 9208	Fine tunes the 20 mA analog output. (calibrated at the factory)
20	Offset	Range = 0 - 9999 Default = 0	Sets an offset for the display.
21	Offset Polarity	Range = neg, pos Default = neg	Selects the direction of the offset. Add or Subtract the offset from the distance before displaying.
22	Calibration Above the Decimal Point	Range = 0 - 9999 Default = 1	Sets the integer portion of the calibration factor.
23	Calibration Below the Decimal Point	Range = 0 - 9999 Default = 0	Sets the fractional portion of the calibration factor. (decimal point is assumed, 9999)

• **Mode Sheet (continued)**

<u>MODE</u>	<u>DESCRIPTION</u>	<u>PARAMETERS</u>	<u>EXPLANATION</u>
24	Temperature Compensation	Range = On/Off view Default = Off	Selects internal temperature compensation for changes in the speed of sound caused by changing temperatures. On, Off, or View sensor temperature.
25	Reset	Range = No/Yes Default = No	Resets the mode parameters to their default values.
26	Software Version		Displays the Software Version
27	AutoSense	Range = 0-1 Default = 0	Turns on and off the autosense feature. 0 = off; 1 = on
28	Password		For factory use only

- **Hazardous Mounting**

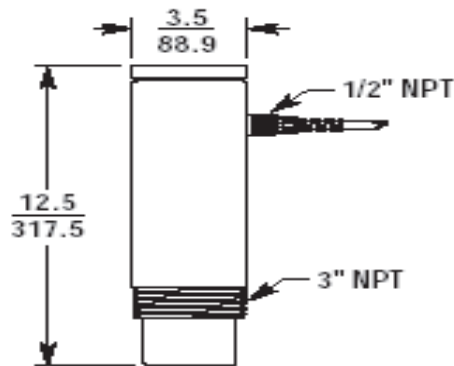


- APPROVED CONDUIT SEALS AT LOCATIONS 1, 2, AND 3.
- THE CABLE IS POTTED INTO THE SENSOR AND RUNS CONTINUOUSLY FROM THE SENSOR INSIDE A SEALED CONDUIT THROUGH THE HAZARDOUS AREA AND INTO THE NON-HAZARDOUS AREA WHERE IT IS CONNECTED TO OTHER WIRING INSIDE A JUNCTION BOX.

• **Specifications — DCU-1104, DCU-1108**

- Operating Range 2 ft. to 50 ft. (0.6 m - 15.24 m)
- Supply Voltage 12 to 30 VDC
(24 VDC recommended for maximum performance)
- Outputs • 4-20 mA
• 2 solid state relays
(130 mA max)
- Resolution 0.1 in. (2.54 mm)
- Accuracy 0.25% of range with no temp gradient
- Sensor Adjustments programmable modes
- Total Current Draw 180 mA max @ 24 VDC
- Transducer Type flat ceramic sealed PVC face
- Operating Temp. -30 to 70°C
- Internal Temp.
- Compensation yes
- Sample Rate programmable 0.120 - 1 sec.
(1-8 sec. in AutoSense mode)
- Beam Pattern 9° off axis
- Enclosure PVC, NEMA 4X , IP65
- Cable 10 conductor 22 AWG with shield
PVC jacketed, 6 ft. length (1.8 m)
- To order bracket for DCU-11, order BRK-3 (ACC-1003)

• **Dimensions**



Notes

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