AUTOMATION PRODUCTS GROUP, INC.

Operator's Manual

DCR-WEB

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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.

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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

The DCR-WEB is a non-contact loop control system that is shipped ready to be put into service. It has been completely tested at the factory and is easily configured to any application. The sensor is fully programmable to meet the needs of all different kinds of loop control applications. Operating parameters are modified using 4 push buttons and a 2 X 8 alphanumeric display. The controls are accessed by removing the front cover. It is recommended that this manual be read before attempting to make any changes to the default parameters.

The unit is available in a clear plastic enclosure. There are two types of transducers availably. The electrostatic type in a 2 in. x 3.3 in. x 1.6 in. enclosure. The ceramic type in a 3 in. x 3 in. x 2 in. enclosure. Both types are attached to the controller with a 6 ft. length of RG6 coaxial cable.

Two outputs can be wired by the customer are labeled “RLY1” and “RLY2”. These outputs are 5 A relays suitable for 120 VAC and up to 5 A continuous. They are fully programmable outputs.

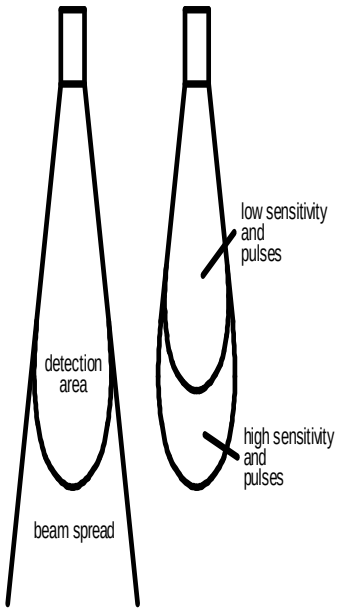
There are two terminal sections on the board. Each can be wired to a switch.

- **INV-SW** allows the user to invert the 0-10 V output without changing software settings.
- **AP-SW** allows the user to switch between two different pre-programmed settings. For example, two different filter settings and trip distances for different materials can be stored and selected with a switch.

• Understanding Ultrasonics

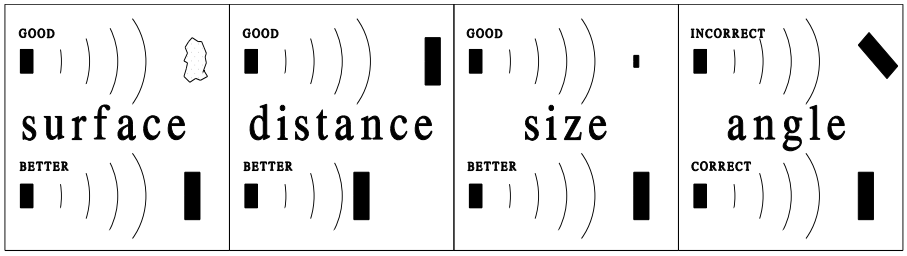
Ultrasonic sensors measure distance using a transducer to send out ultrasonic bursts. Each burst contains a series of 1-20 pulsed sound waves that emit in the shape of a cone, reflect off the target, and are received by the sensor. The time required for the sound burst to travel to and from the target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

Accurate readings require a clear sound path to the intended target. The path should be free from obstructions and as open as possible. Follow the guidelines mentioned in “Understanding Ultrasonics”.

The DCR-WEB should be installed using the 4 screws through 4 holes in the bottom of the enclosure.

Inputs

- 110 VAC Power
- 4 button Key Pad
  Mode Up, Mode Down, Number Up and Number Down Keys.
- 0-10 V Invert
  When a switch is closed across the INV-SW terminals, the port on the processor is pulled low the distance programmed in the 0 V distance becomes the 10 V distance and the distance programmed in the 10 V distance becomes the 0 V distance.
- Alternate Program
  When a switch is closed across the AP-SW terminals the DCR can be programmed with a second setup that will be stored for that switch position.

Outputs

- Isolated 0-10 V output
  To connect to a variable speed drive for loop control.
- Two 5 A Relays
  Fully programmable.
  Can be jumpered Normally Open or Normally Closed
  (Default = NO) *See drawing on next page
- Display
  2 X 8 LCD alphanumeric display that displays the detected distance or the mode value on the top and the parameter on the bottom.

- **Wiring**

Step 1: Mount sensor so that transducer has a clear path to the target.

Step 2: To obtain access to the terminal strip, remove the front cover by turning out the 4 screws. This will expose the terminal strip and 2 X 8 character display.

Step 3: Wires can be pulled into the DCR-WEB through the strain reliefs on the enclosure.

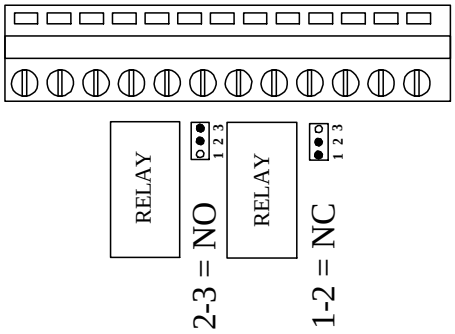
The screw terminal can be wired using solid or stranded wire between 16 - 20 AWG. Wires should be stripped, leaving a 0.4 in. bare wire.

Follow the legend on the circuit board when wiring. The DCR-WEB should never be used without the earth ground terminal being connected.

Step 4: Perform an internal check to ensure that all wires are properly connected and secured.

Relay Jumper Settings

Default = NO



• Programming

The DCR-WEB has a two line by eight character alphanumeric display. Four momentary push-buttons located under the cover, are used to program the sensor. The cover prevents the buttons from being accidentally bumped.

The different modes can be easily accessed using the mode buttons,

M-UP and M-DN. They operate similar to a digital watch. To cycle forward through the modes, hold down the M-UP key. To cycle backward through the modes, hold down the M-DN key.

To select a mode, press the M-UP or M-DN key until the desired mode name is displayed on the lower line of the display. The upper line will show the current setting of that mode.

To change the selected mode setting , hold down the N-UP or N-DN key until the desired setting is displayed. Enter the new value by pressing either of the mode keys.

Program Switch

It is possible to save two separate setups in the sensor. The programmed setups are selected using a program switch. The switch (supplied by the customer) is wired to the terminal strip labeled AP-SW.

When programming the controller the values in the modes that are displayed are those that are associated with the position of the application switch. To save parameters in “Program 1” flip the switch to “Program 1” and make the necessary changes. The changes will be saved in EEprom associated with Program 1. To save a program in “Program 2” change the switch to the “Program 2” position and the changes will be saved in the EEprom associated with this position.

Invert Switch

There are two terminals on the terminal strip, labeled inv-sw, if they are connected to a SPST switch and the switch is closed the end points for the analog slope will be reversed.

• Programming Modes

For ease of programming, the DCR-WEB modes are grouped into phases of an application setup. The phases are:

1) Operation
2) Filtering
3) Outputs
4) Calibration
5) Utilities

This order should be followed for setting up any application.

Operation

The operation modes are used to perform basic initialization of the DCR-WEB.

MODE	DESCRIPTION	PARAMETERS	EXPLANATION
SENSITIV	*Sensitivity*	Units = % Range = 0 - 100 % Default = 50	Adjust responsiveness to outside stimuli, KEEP AS LOW AS POSSIBLE,
BLANKING	*Blanking*	Units = Inches Range = 6 - 99 Default= 6 in.	Sets a dead zone in front of the transducer where echoes are ignored.
PULSES	*Pulses*	Range = 1-20 Default = 10	Sets the number of times the transducer is pulsed for each ultrasonic burst. Adjusts the strength of the transmitting signal.

• Higher number of pulses allows the sensor to detect smaller objects better.

Filtering

The filtering modes are provided to change how fast the system will respond to changes. The default settings should be appropriate for most level applications, however, the delays and windows can be changed to increase or decrease reaction time and filtering.

MODE	DESCRIPTION	PARAMETERS	EXPLANATION
SAMP RAT	*Sample Rate*	Units = milliseconds Range = 40 - 120 Default = 75	Sets the delay between sensor samples.
(Higher number = Slower Response Time)			
AVERAGE	*Sample Averaged*	Units = Samples Range = 1 - 20 Default = 5	Sets the number of samples to be averaged in the buffer.
(Higher number = Slower Response Time)			
OOR SAMP	*Out-of-Range*	Units = samples Range = 1 - 50 Default = 10	Sets the number of out-of range samples in succession that will be ignored before the new target is accepted.
(Higher number = Slower Response Time)			
OOR SPAN	*Filter Window*	Units = Inches Range = 0 - 120 Default = 12 in.	Sets the window of acceptance. The window is + or - this distance from the current reading. If a sample distance is outside of this window it will be ignored the number of times set in OUTRANGE SAMP.
TARGE	*Target Threshold*	Units = Targets Range = 0 - 100 Default = 50	Sets the maximum number of targets that can be detected before the sensor considers the readings noise.
Set to 10 to 15% above view target reading (Noise Level)			
VIEW TAR	*View Number of Targets*	Units = Targets	This mode is used only to view the number of target detected by the sensor.

Example: Ignoring Intermittent Noise

The transceiver in the DCR-WEB is tuned to detect sound waves within a range. There are certain external sources of noise in that range that can affect the proper operation of the sensor, high pressure air escaping is the most common source. In order to have the sensor ignore this noise a filter has been installed. It allows the operator to set a threshold of the number of target that can be received. If the number of targets exceed that threshold the sensor will hold the last reading until the number of targets detected moves below it.

Filtering

MODE	VALUE	DESCRIPTION
VIEW TAR	20	View the number of targets that are detected when the material that is to be monitored is at the closest acceptable point to the sensor. If the number of target is higher than 75 it may be advisable to reduce sensitivity.
TARGETS	26	Set the number of targets slightly higher than the reading obtained above so that the sensor will not be affected by external sources of 50khz noise.

Example: Rapid Level Changes

If the DCR-WEB's filtering is too slow the distance being monitored is changing rapidly, the display will seem to jump between readings instead of scrolling smoothly as the level changes. To make the detected distance follow the target better the amount of filtering will have to be reduced.

MODE	VALUE	DESCRIPTION
SAMPLE RATE	50	Set the sampling interval to a shorter time requirement. This will provide more reading in a given period of time to the sensor.
AVERAGE	5	The number of samples averaged can be reduced providing less of a lag in updating the sensor.
OUT-RANGE SAMP	24	Increasing the filter window for good readings. This will increase the update time but decrease the filtering of unwanted echoes.

Outputs

The DCR-WEB contains 2 relays which are capable of handling a 5 A load. These relays have programmable BEGIN and END points as well as TYPE of operation. The relays can also be jumpered NO (default) or NC. *see drawing on earlier page of this manual.

MODE	DESCRIPTION	PARAMETERS	EXPLANATION
BEGRLY 1	*Begin Trip 1*	Units = inches Default = 24	Sets the begin point of Trip 1.

• Straight line from inlet of press to reel or straightener exit point.
• Distance from transducer to material that is taut or no loop - condition that could cause damage.

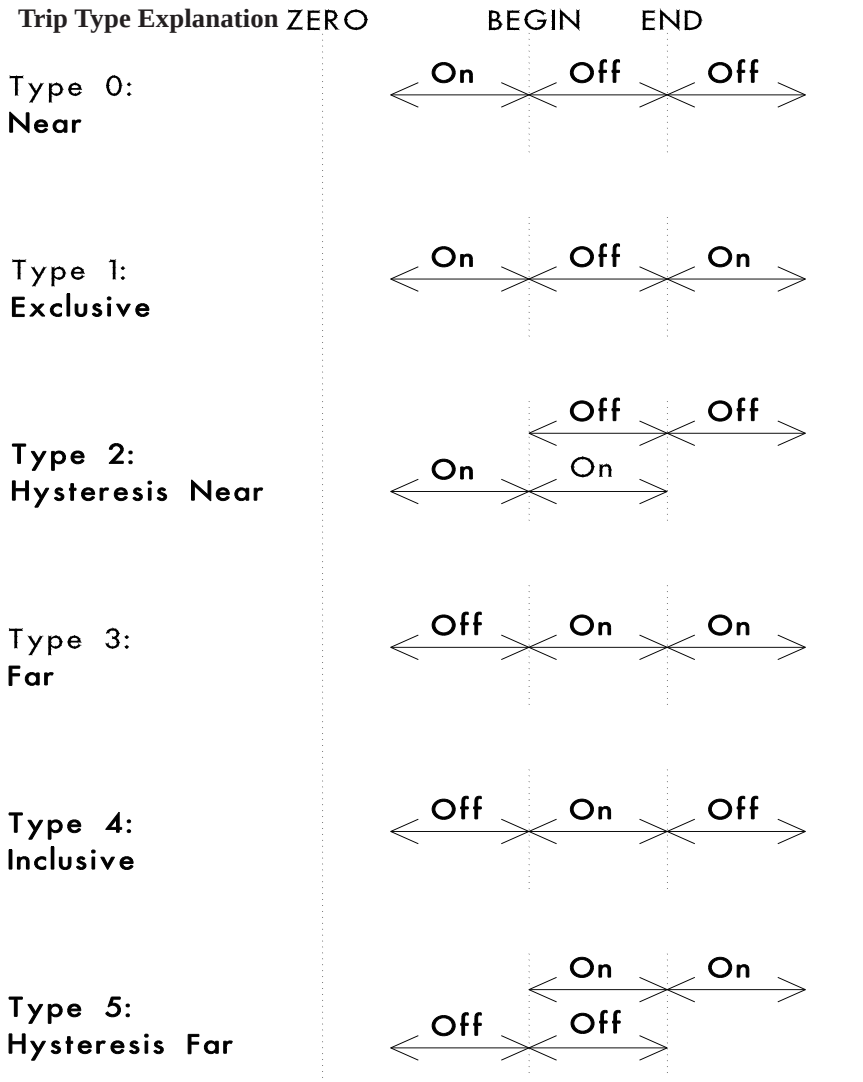
ENDRLY 1	*End Trip 1*	Units = inches Default = 36	Sets the endpoint of Trip 1.
TYPE 1	*Trip 1 Type*	Range = 0 - 7 Default = 0	Selects the type of function Trip 1 will perform.

See Trip Type Explanation for details.

BEGRLY2	*Begin Trip 2*	Units = inches Default = 40	Sets the begin point of Trip 2.
ENDRLY 2	*End Trip 2*	Units = inches Default = 48	Sets the end point of of Trip 2.
TYPE 2	*Trip 2 Type*	Range = 0 - 7 Default = 0	Selects the type of function Trip 2 will perform.

See Trip Type Explanation for details.

Trip Type Explanation



NOTE: The Zero line represents the face of the sensor.

Type 6:
Trip Point Disable

Example: Relay Settings For High and Low Level Indication

With the sensor mounted at 52.5 in. off of the floor looking down. An indication is needed if the material being monitored is detected closer than 13 in. or lower than 39 in. from the sensor. Relay number 1 will be used to activate an alarm.

To program the DCR-WEB for this application, the following modes must be set:

MODE	VALUE
BEGRLY 1	13.0
ENDRLY 2	39.0
TYPE 1	1

If it is desired that the relays be wired in a fail-safe configuration so that the relays are closed during normal operation and open if the material is detected outside of the normal window of operation. This setup also provides for alarm indication in the event of a loss of power to the sensor.

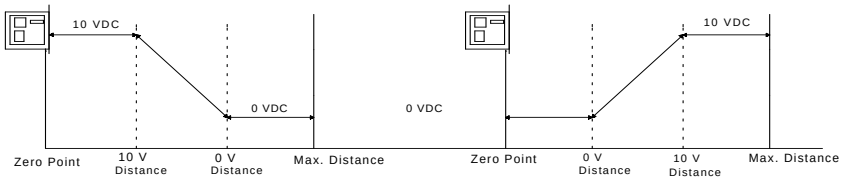
To program the DCR-WEB for this application the following modes must be set:

MODE	VALUE
BEGRLY 1	13.0
ENDRLY 2	39.0
TYPE 1	4

Calibration

Analog

The DCR-WEB has an Isolated 0-10 V output. To set up this feature, enter the two end points. If the level is beyond the bounds of the window created by the two end points the voltage level will stay at the voltage level of the point it is nearest to. Refer to the diagram below.



MODE	DESCRIPTION	PARAMETERS	EXPLANATION
0V DIST	*0 V Distance*	Units = inches Default = 24.0	Sets the distance where the 0 V point of the analog slope will begin. Sets the distance for the maximum voltage of the analog output slope.
10V DIST	*10 V Distance*	Units = inches Default = 48.0	Distance from transducer to the floor.

The sensor can be programmed to any maximum voltage desired from 1 to 10.45 VDC. The calibration numbers are used to set the maximum and minimum voltage levels of the analog slope. In most cases the minimum voltage is desired to be 0 so the value for 0 V CAL mode is set to 0. However, if it was desired to have the minimum voltage be 1.0 volts the value of this mode would be set to 4095(1)/10.45=391. The same is true for the maximum voltage levels. If the maximum voltage is to be 6 VDC then 4095(6.0)/ 10.45=2351 would be entered into the 10 V CAL mode.

MODE	DESCRIPTION	PARAMETERS	EXPLANATION
0V CAL	*0 V Calibration*	Units = 0-4095	Adjusts the minimum voltage on the analog output.
10V CAL	*10 V Calibration*	Units = 0-4095 2351 = 6 VDC 3919 = 10 VDC	Adjusts the maximum voltage on the analog output.

Utilities

Temperature Compensation

As air temperature changes, so does the speed of sound. This change can cause 0.18% drift in distance for every °C change. The TEMPCOMP Mode allows compensation in the readings for this change. The DCR-WEB contains an internal thermistor which measures temperature in °F. By turning temperature compensation on, the effects of temperature changes will be reduced.

MODE	DESCRIPTION	PARAMETERS
TEMPCOMP	*Temperature Compensation*	Range = ON-OFF Default = OFF
VIEWTEMP	*Displays Detected Temperature*	Range = -20 to +140

Reset

If the mode adjustments get scrambled or if the factory preset values are wanted, Change this mode to 1 and press M-UP or M-DN and all of the parameters will be “RESET” to their factory defaults.

MODE	DESCRIPTION	PARAMETERS	EXPLANATION
RESET	*Reset*	Range = 0,1	Entering a 1 will RESET the Controller to Factory Defaults.

Calibration

The Calibration parameter is used to adjust the unit for the change in speed of sound due to environments other than air. For example, units operating in a heavy fuel or gaseous environment may wish to calibrate the controller output distance with a measured distance. For most applications, this parameter will remain at 1.000.

MODE	DESCRIPTION	PARAMETERS	EXPLANATION
Calib	*Calibration*	Range = 0.000 - 9.999 Default = 1.000	Allows user to calibrate controller output distance with a measured distance. Usually used for mediums other than air.

Max Gain

This parameter is used to limit the maximum amount of amplification available to the micro-processor. This is factory preset at 7 and should not need adjustment.

MODE	DESCRIPTION	PARAMETERS	EXPLANATION
Max Gain	*Max Gain*	Range = 1 - 8 Default = 7	Used to limit the maximum amount of gain desired in an application. This setting should be left at 7.

• Specifications

Operating Range ..... 6 in. to 120 in.

Sample Rate ..... 40 to 120 msec

Outputs ..... Isolated 0 to 10 VDC
2 relays (5 A 120 VAC)

Enclosure ..... Poly-Carbonate

Transducer Type ..... Electrostatic/Ceramic

Ratings ..... NEMA 4

Operating Temperature .... -20 to 140°F

Internal Temperature

Compensation ..... yes

Accuracy ..... ± 0.25% of range

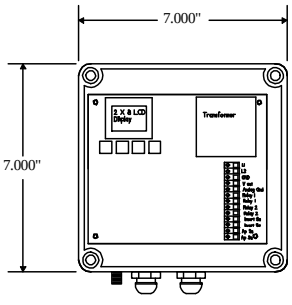
Resolution ..... 0.1 in.

Beam Pattern ..... 8° Electrostatic / 9° Ceramic

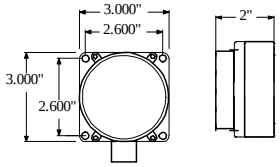
Display ..... 2 line x 8 character alphanumeric LCD

Supply Voltage ..... 110 VAC or 220 VAC

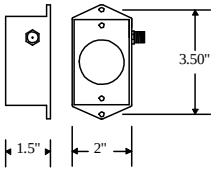
• Dimensions



Controller



Ceramic Transducer



Electrostatic Transducer

• Maintenance

The DCR-WEB sensor does not require maintenance. However, a periodic visual inspection of the system would be in order.

The transducer should be kept as clean as possible for optimum performance. Dust buildup may be removed from the transducer with a cloth or by low pressure air.

Notes

Notes

Notes

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