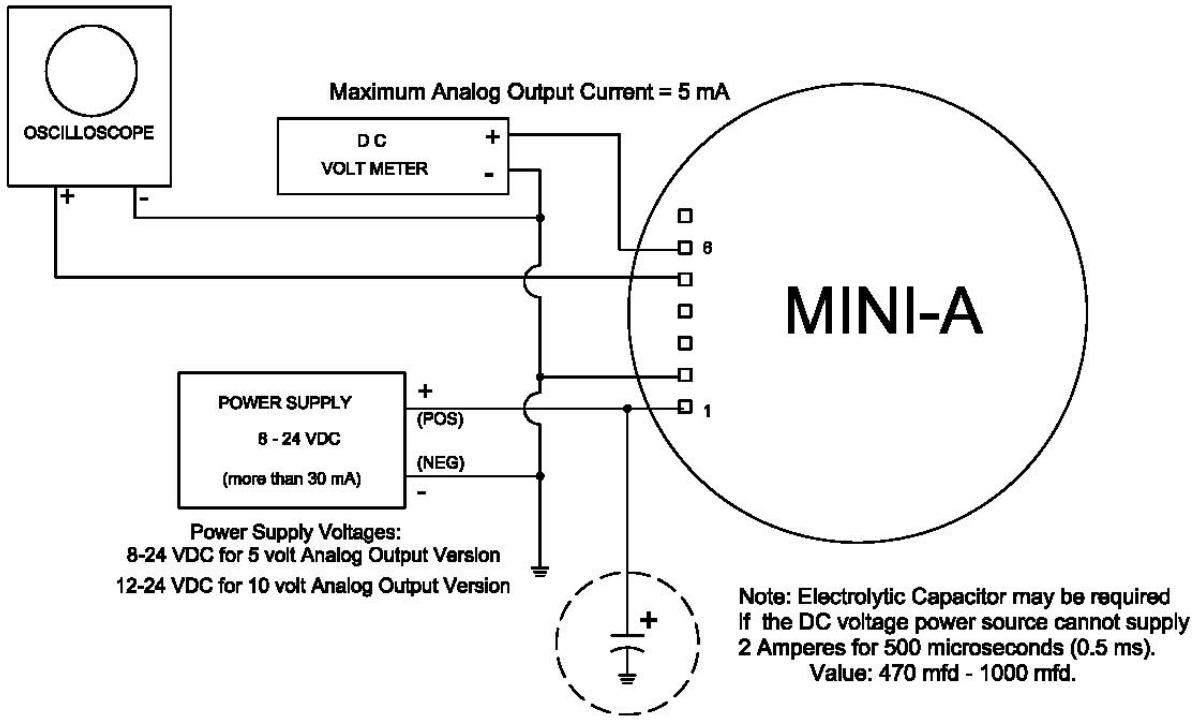
SonaSwitch® Mini-A
Instructions

SensComp, Inc.
36704 Commerce Rd.
Livonia, MI 48150
Telephone: (734) 953-4783
Fax: (734) 953-4518
www.senscomp.com

INSTRUCTIONS - SONASWITCH® MINI-A / SONASWITCH® MINI-AE SENSOR
Push Button Settable



General Installation Procedures

1. Always mount the SONASWITCH® MINI-A in a suitable dry location. The SONASWITCH® MINI-A is designed to be used indoors or in protected environments only. The SONASWITCH® MINI-AE is suitable for harsher environments and higher humidly conditions. Excessive moisture on the circuit board (and the SONASWITCH® MINI-A transducer) will result in damage and improper operation and will void all warranties.
2. Mount the SONASWITCH® MINI-A as far off the ground as practical.
3. Mount the SONASWITCH® MINI-A in a location where environmental interference sources are SonaSwitch® Minimized (examples are EMI sources, air nozzles, excessive air turbulence, etc.).
4. Mount the SONASWITCH® MINI-A in a 1.575-inch diameter hole, using RTV silicone or edge clips to secure the sensor in place. You can also use our Series 600 Housing unit, PID# 619395, to house the SONASWITCH® MINI-A.

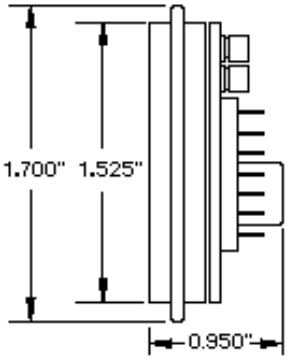
 Copyright © 2004-2022 SensComp, Inc

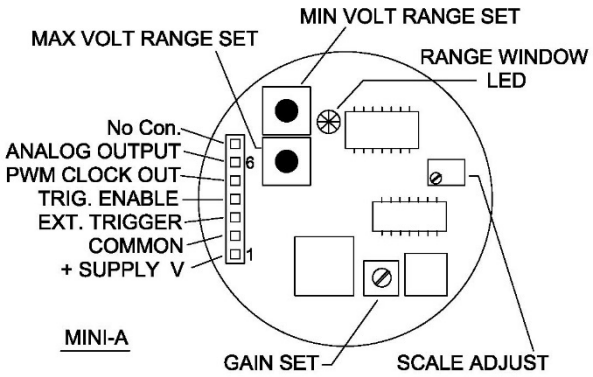
5. As supplied, the SONASWITCH® MINI-A has been calibrated and should function without further calibration at the following ranges:

   SONASWITCH® MINI-A - 12-inch version: 0 volts at 1 inch; +5 VDC (or +10 VDC) at 12 inches

   SONASWITCH® MINI-A - 20-foot version: 0 volts at 6 inches; +5 VDC (or +10 VDC) at 20 feet.

   SONASWITCH® MINI-A - 40-foot version: 0 volts at 12 inches; +5 VDC (or +10 VDC) at 40 feet.





System Wiring Information

Pin 1 – Power Supply – supplying 30 mA of current (2.0 Amperes during the 0.5 ms transmit pulse).
- The 0 to 5 VDC analog output model requires a +8 to +24 VDC regulated power source.
- The 0 to 10 VDC analog output model requires a +12 to +24 VDC regulated power source.

Pin 2 – Power Supply Common (Ground) – Common Return for DC power supply, analog output, triggering, and clock signals.

Pin 3 – External Trigger – Accepts TTL compatible logic level clock signals. A low to high (zero to +5 VDC) transition triggers the SONASWITCH® MINI-A.

Pin 4 – Trigger Enable – Allows the SONASWITCH® MINI-A to accept an external trigger signal. Enabled by connecting this pin (pin 4) to common (pin 2).

Pin 5 – Clock Output – Delivers a TTL compatible Pulse Width Modulated (PWM) clock signal. This signal goes high at the start of a cycle and returns to a low state when the returning echo signal is received.

Pin 6 – Analog Output – 0 to +5 VDC (or 0 to +10 VDC) analog voltage output. Maximum analog output current is 5 mA.

Pin 7 – no connection.

 Copyright © 2004-2022 SensComp, Inc

Calibration Procedures

Note: The SONASWITCH® MINI-A Sensor is calibrated before it leaves the factory for the following settings:

- SONASWITCH® MINI-A - 12-inch version: 0 volts at 1 inch; maximum voltage at 12 inches
- SONASWITCH® MINI-A - 20-foot version: 0 volts at 6 inches; maximum voltage at 20 feet.
- SONASWITCH® MINI-A - 40-foot version: 0 volts at 12 inches; maximum voltage at 40 feet.

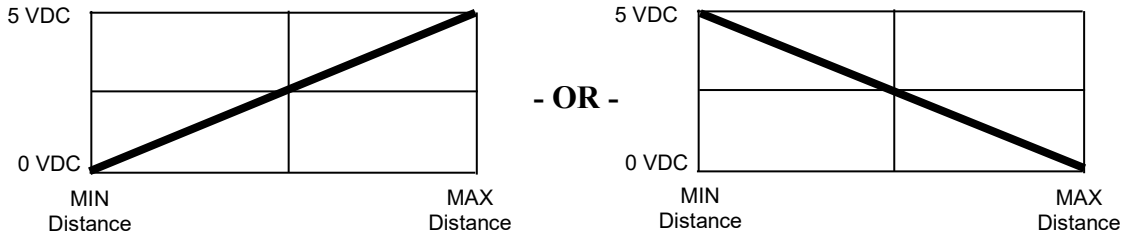
The following information provides calibration techniques to obtain a more precise analog voltage output, adjusting the SonaSwitch® Minimum and maximum target points, and to adjust the gain of the returning echo signal.

1. Apply DC power (see requirements above) to the SONASWITCH® MINI-A (connector header pin 1 and pin 2).
2. Connect a DC Digital Volt Meter's (DVM) Plus (+) lead to the Analog Output (pin 6) and the Minus (-) lead to Common (pin 2).
3. Allow five to ten minutes warm-up time for the SONASWITCH® MINI-A to reach operating temperature before calibrating the unit.

Analog Output Voltage Adjustment (pin 6)

- Press a stiff piece of flat paper tight against the sensor's face, covering the entire front of the sensor.
- Verify the analog voltage output is +5.0 VDC (or +10.0 VDC).
- Adjust the "Scale Adjustment" Potentiometer to the full-scale voltage desired (+5.00 VDC or +10.00 VDC), if needed.

4. Setting SonaSwitch® Minimum and Maximum Ranges
   - You set the SONASWITCH® MINI-A's analog voltage output using two push buttons. These independent range settings allow setting the analog voltage output to change from zero volts to full scale voltage output at desired SonaSwitch® Minimum and maximum distances between the SONASWITCH® MINI-A sensor and the detected object.



 Copyright © 2004-2022 SensComp, Inc

5. Maximum Voltage Range Setting
    - Place the target at the desired distance for the full-scale voltage output. This can be either the SonaSwitch® Minimum distance or the maximum distance between the sensor and the target (see step 5 above).
    - Depress and hold the "MAX VOLT RANGE SET" push button and wait for the "RANGE WINDOW LED" indicator to stop flashing and the transducer generates a "chirp" sound before releasing.
    - The SONASWITCH® MINI-A is now calibrated to your desired target distance for full scale analog voltage output.
6. SonaSwitch® Minimum Voltage Range Setting
    - Place the target at the desired distance for the SonaSwitch® Minimum voltage output. This can be either the SonaSwitch® Minimum distance or the maximum distance between the sensor and the target (see step 5 above).
    - Depress and hold the "MIN VOLT RANGE SET" push button and wait for the "RANGE WINDOW LED" indicator to stop flashing and the transducer generates a "chirp" sound before releasing.
      Note: The SonaSwitch® Minimum voltage output will be a value between 0.00 and 0.05 volts (50 mv), due to the output's operational amplifier offset voltage.
    - The SONASWITCH® MINI-A is now calibrated to your desired target distance for zero analog voltage output.
7. Gain Adjustment

    Note: The "GAIN SET" Potentiometer has been preset at the factory to provide the best performance for the range of your SONASWITCH® MINI-A. In the advent that it is changed, the steps below will assist you in returning it to the proper value
    - To calibrate "GAIN SET", place the target at the maximum desired detection distance.
    - Rotate "GAIN SET" fully counterclockwise (CCW).
    - Slowly rotate "GAIN SET" clockwise (CW) until detection occurs.
    - Rotate "GAIN SET" CW an additional 1/16 turn

      Note: Always calibrate "GAIN SET" for SonaSwitch® Minimum gain required for reliable detection. Excessive gain may result in false target detection.

Range Window LED

The Range Window LED performs two indication functions:

- During Setup procedures, the LED will flash as the set-up values are programmed into the sensor.
- During normal operation, the LED will illuminate, indicating that a target is detected between the "SonaSwitch® Minimum Volts Range Set" point and the "Maximum Volts Range Set" point. For targets outside this range, the LED will be off.

 Copyright © 2004-2022 SensComp, Inc

Internal/External Triggering

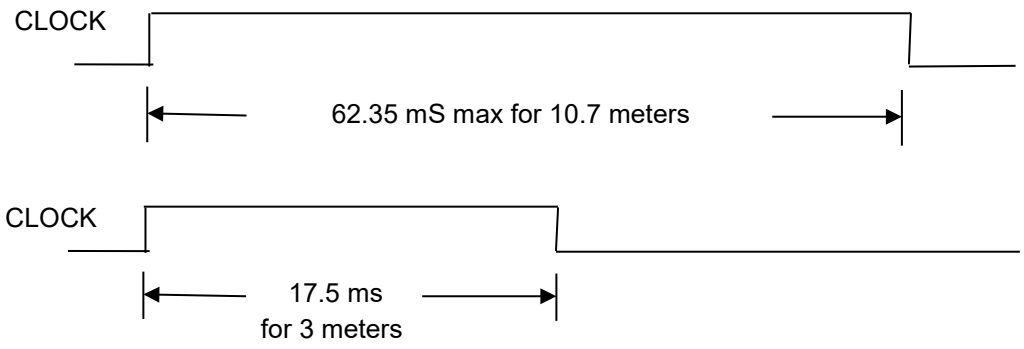
The SONASWITCH® MINI-A has an internal triggering circuit that performs a write/read cycle 10 times a second (10Hz). Provisions for external triggering are available on the 6-pin connector:

- Trigger Enable -- Allows the SONASWITCH® MINI-A to accept an external trigger signal. Enabled by connecting pin 4 to common (pin 2).
- External Trigger -- Accepts TTL compatible logic level clock signals. A low to high (zero to +5 VDC) transition triggers the SONASWITCH® MINI-A, which then performs a write/read cycle. You can trigger the SONASWITCH® MINI-A up to 50 times a second (50 Hz)

Pulse Width Modulation (PWM) Output (CLOCK)

The SONASWITCH® MINI-A's "CLOCK" output provides a Pulse Width Modulated (PWM) TTL-compatible digital waveform that varies in time with the distance between the sensor and the target. This Time of Flight (TOF) signal is not temperature compensated.

Clock (pin 5) Waveforms



Troubleshooting Procedures

1. Connect Power Supply to SONASWITCH® MINI-A (+ to pin 1, - to pin 2). Using a DC voltmeter, verify the voltage is correct directly at the SONASWITCH® MINI-A header, pins 1 and 2.
2. If connected, disconnect EXT TRIG (pin 3) and TRIG ENABLE (pin 4). When not using external triggering, these pins can be left un-connected.
3. Re-Check all connections. Many suspected problems have been resolved because of wiring corrections.
4. Apply power to SONASWITCH® MINI-A. You should hear a "ticking" sound, occurring approximately 10 times a second. If not, re-check the power voltage input. The ticking sound is created every time the Sensor transmits an ultrasonic pulse out.

 Copyright © 2004-2022 SensComp, Inc

5. After verifying the "ticking", cover the face of the transducer with a stiff piece of flat paper. Verify the analog voltage output is either 5VDC or 10VDC, depending on which SONASWITCH® MINI-A version you have purchased. By moving the paper away from the transducer, the analog voltage should change from the voltage set for SonaSwitch® Minimum range to the voltage set for the far range of the sensor, as set by the "zero" and "full-scale" push button settings.

6. If you cannot obtain an analog output, verify the digital operation of the sensor with an oscilloscope as follows:
   - Connect the oscilloscope vertical channel 1 to CLOCK (Pin 5). Use this channel as the oscilloscope trigger. Trigger on the waveform's rising edge.
   - Verify that the Pulse Width Modulated (PWM) output waveform varies with the distance between the transducer and the target. The time that the waveform is a Logic 1 (High) will be approximately 17.5 milliseconds for a 3-meter distance between the transducer and the target, and 62.3 milliseconds for a 10.7-meter distance.
   - If the PWM signal remains a constant length and does not vary when the distance to the target varies, the sensor may be receiving an echo from a target that is too close to the sensor. If you have verified that there is not a target close to the sensor, then you may have the GAIN SET potentiometer set too low. Try re-adjusting the gain (Calibration Procedures, Step 7).
   - If the CLOCK (PWM) output never changes logic level but remains constantly in a low or a high state, and you have verified that the oscilloscope is operating correctly, please contact SensComp for repair.

Full Scale Voltage Adjustment (1 inch to 12 inch option)

If you have difficulty setting the "SCALE ADJUST" (Calibration Procedure, Step 6) you may either reduce the setting of the "GAIN SET" potentiometer or by placing the SONASWITCH® MINI-A at least 2 feet away from a reflected target.

Note: We suggest that you return "GAIN SET" to its original position after calibrating "Scale Adjust" maximum voltage output.

 Copyright © 2004-2022 SensComp, Inc

CAUTION: The following steps should only be undertaken by personnel experienced in electronic Surface Mount Technology (SMT) troubleshooting techniques and using probes on SMT components. Incorrect probe handling can result in component damage to the sensor, voiding all warranties.

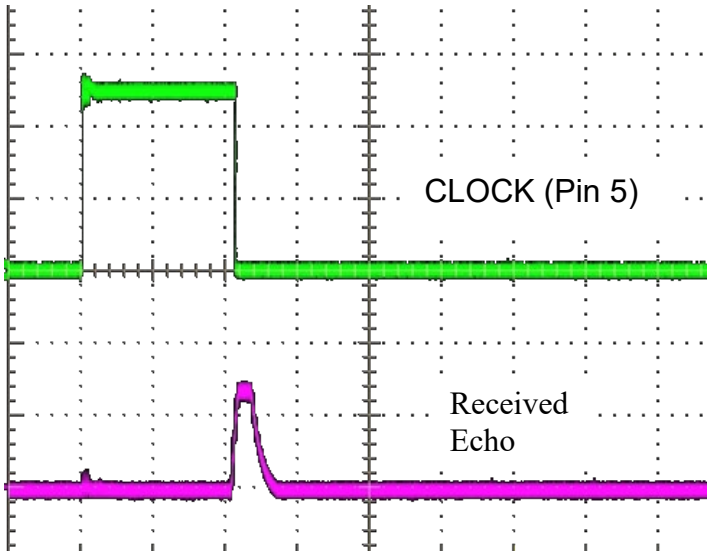
Returning ECHO Adjustment Procedures

Connect the oscilloscope vertical channel 1 to CLOCK (Pin 5). Use this channel as the oscilloscope trigger, triggering on the waveform's rising edge.

Place another oscilloscope channel's probe on the collector of Q5. This is the center pin of the transistor immediately below the SCALE ADJUST potentiometer. This signal is the processed analog returning ECHO received by the sensor. This signal will vary in both time and in amplitude with the changing distance between the sensor and the target.

The sensor's internal electronics requires the received analog ECHO signal to be at least a 2 volts peak voltage with respect to ground. CLOCK should return to a Logic 0 when the leading edge of ECHO rises above 2.0 volts. If ECHO is less than 2.0 volts then it is not processed, the target is not detected, and the CLOCK remains high.

The Received ECHO amplitude will vary with the distance between the sensor and the target, and also with the GAIN SET potentiometer. By adjusting this potentiometer (see "Calibration Procedures – Step 7"), you can set the optimum point for consistent detection at the desired distances.



 Copyright © 2004-2022 SensComp, Inc