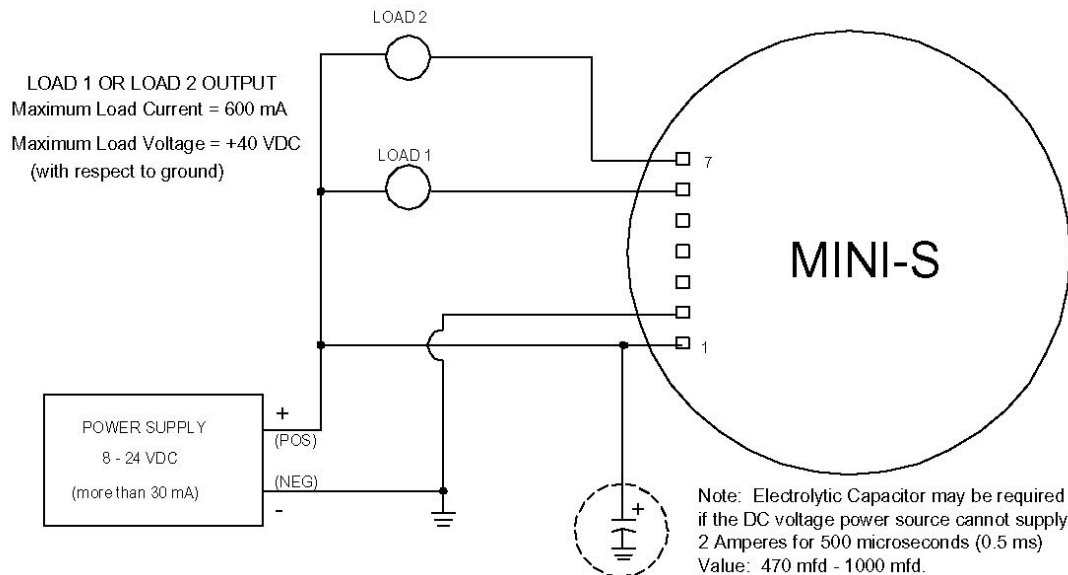


## INSTRUCTIONS – SonaSwitch® MINI-S / MINI-SE SENSOR Push Button Settable



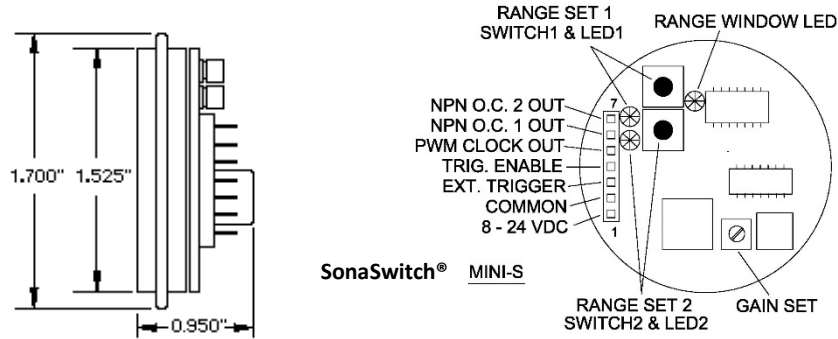
### General Installation Procedures

1. Always mount the SonaSwitch® MINI-S in a suitable dry location. The SonaSwitch® MINI-S is designed to be used in an indoor or protected environment only. The SonaSwitch® MINI-SE is suitable for harsher environments and higher humidity conditions. Excessive moisture on the circuit board (and the SonaSwitch® MINI-S transducer) will result in damage and improper operation and will void all warranties.
2. Mount the SonaSwitch® MINI-S as far off the ground as practical.
3. Mount the SonaSwitch® MINI-S in a location where environmental interference sources are minimized (examples are EMI sources, air nozzles, excessive air turbulence, etc.)
4. Mount the SonaSwitch® MINI-S 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-S.
5. As supplied, the SonaSwitch® MINI-S has been calibrated and should function without further calibration at the following ranges:
  - SonaSwitch® MINI-S - 12-inch version: Range Set 1 - 1 inch; Range Set 2 - 12 inches
  - SonaSwitch® MINI-S - 20-foot version: Range Set 1 - 6 inches; Range Set 2 - 20 feet.
  - SonaSwitch® MINI-S - 40-foot version: Range Set 1 - 12 inches; Range Set 2 - 40 feet
6. The two (2) NPN open collector digital outputs need to be “pulled up” (through a resistance and/or impedance) to an external positive power source of less than 40 VDC (typically 4700 ohms when connected to an external +5 VDC power source for testing or for interfacing to TTL Logic level circuits). Each output can supply up to a maximum output current of 600 mA.

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7. The “RANGE SET 1” and “RANGE SET 2” LED indicators do not require a pull-up resistor and

can be used for setup calibration before connecting the SonaSwitch® MINI-S to external equipment.



### **System Wiring Information**

- Pin 1** – Power Supply – Requires a +8 to +24 VDC regulated power source supplying 30 mA of current (2.0 Amperes during the 0.5 ms transmit pulse).
- Pin 2** – Power Supply Common (Ground) – Common Return for DC power supply, switched outputs, and clock signals.
- Pin 3** – External Trigger – Accepts TTL compatible logic level clock signals. A low to high (0 to +5 VDC) transition triggers the SonaSwitch® MINI-S.
- Pin 4** – Trigger Enable – Allows the SonaSwitch® MINI-S 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 is received.
- Pin 6** – NPN Output 1 – This NPN open collector output turns on and off when a target is detected (on) or missing (off) as set by the “Range Set 1” push button switch.
- Pin 7** – NPN Output 2 – This NPN open collector output turns on and off when a target is detected (on) or missing (off) as set by the “Range Set 2” push button switch.

### **Calibration Procedures**

1. Apply DC power (+8 to +24 VDC) to the SonaSwitch® MINI-S (connector header pin 1) (DC Power Ground connects to connector header pin 2)
2. Allow five to ten minutes warm-up time for the SonaSwitch® MINI-S to reach operating temperature before calibrating the unit.
3. If desired for testing, connect the two NPN Open Collector Outputs to an external positive power supply through appropriate impedances. Since they are open collector, they will always read zero volts until connected to a pull-up load (See General Installation Procedures – Step 6)

## Calibration Procedures (cont)

### 4. NPN Output 1 Adjustment (pin 6)

- Place the target at the desired detection distance from the face of the SonaSwitch® MINI-S
- Depress and hold the “RANGE SET 1” push button switch. Wait for the “Range Window” LED indicator to flash three times, followed by a “chirp” sound from the sensor before releasing.
- The SonaSwitch® MINI-S is now calibrated to your desired target distance for NPN Output 1.
  - LED 1 ON – NPN Output 1 is a Logic Low (0 VDC) when target is detected (closer than set point 1)
  - LED 1 OFF – NPN Output 1 is a Logic High (+ power source) when target is not detected (further than set point 1).

### 5. NPN Output 2 Adjustment (pin 7)

- Place the target at the desired detection distance from the face of the SonaSwitch® MINI-S
- Depress and hold the “RANGE SET 2” push button switch. Wait for the “Range Window” LED indicator to flash three times, followed by a “chirp” sound from the sensor before releasing.
- The SonaSwitch® MINI-S is now calibrated to your desired target distance for NPN Output 2.
  - LED 2 ON – NPN Output 2 is a Logic Low (0 VDC) when target is detected (closer than set point 1)
  - LED 2 OFF – NPN Output 2 is a Logic High (+ power source) when target is not detected (further than set point 1).

### 6. Gain Adjustment

Note: The “Gain Set” Potentiometer has been pre-set at the factory to provide the best performance for the range of your SonaSwitch® MINI-S. If it is changed, the steps below will assist you in returning it to the proper value:

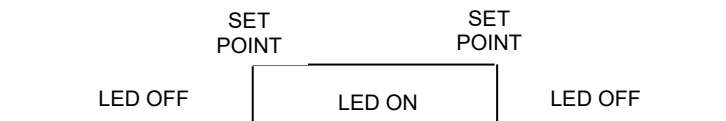
- To calibrate “GAIN SET”, place the target at the maximum desired detection distance.
- Rotate the 1-turn “GAIN SET” potentiometer fully counterclockwise (CCW).
- Slowly rotate “GAIN SET” clockwise (CW) until detection occurs.
- Rotate “GAIN SET” clockwise (CW) an additional 1/16 turn.

*Note: Always calibrate the GAIN control for 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 (ON) when a target is detected between the two set points and is off for targets outside this region.



### **Internal/External Triggering**

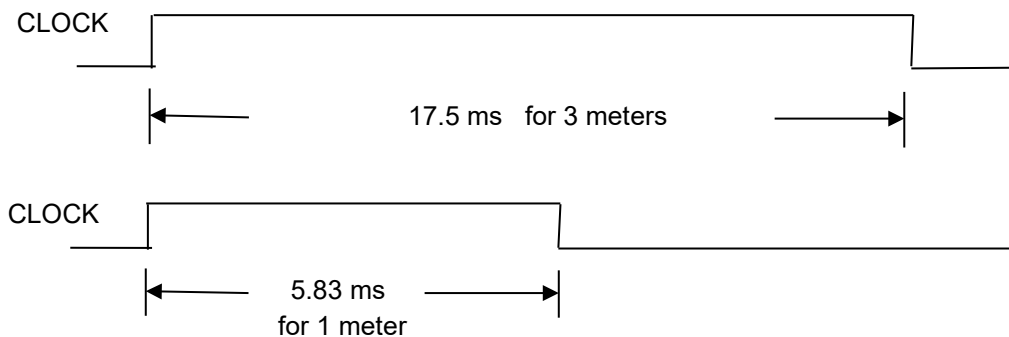
The SonaSwitch® MINI-S has an internal triggering circuit that performs a write/read cycle 10 times a second (10Hz). Provisions for external triggering are available on the 7-pin connector:

- Trigger Enable -- Allows the SonaSwitch® MINI-S 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-S, which then performs a write/read cycle. You can trigger the SonaSwitch® MINI-S up to 50 times a second (50 Hz)

### **Pulse Width Modulation (PWM) Output (CLOCK)**

The SonaSwitch® MINI-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-S (+ to pin 1, - to pin 2). Using a DC voltmeter, verify the voltage is correct directly at the SonaSwitch® MINI-S 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-S. 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.
5. After verifying the “ticking”, place a large, flat, stiff piece of paper in front of the face of the transducer. Verify that each Output turns on and off at the desired set-point distance as the paper is moved away from the sensor. By moving the paper away from the transducer, the output LED indicators should change from “ON” at points closer than the set point, to “OFF” at points beyond the set point.

## **Troubleshooting Procedures (cont)**

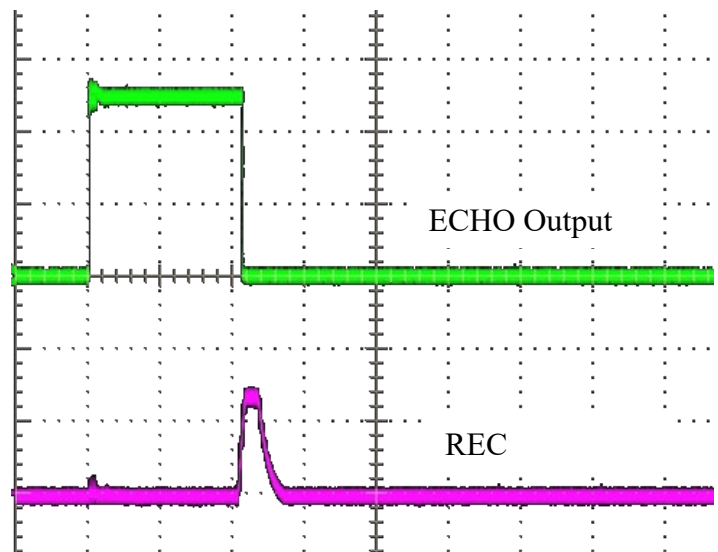
6. To verify the NPN output 1 and 2 operation, connect external pull-up load to the output (refer to “General Installation Procedures” – Step 6) and check that the output is LO when that output’s corresponding LED is “On”, and is HIGH when that output’s corresponding LED is “Off”.
7. If you cannot obtain the set-point outputs, 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 5.83 milliseconds for a 1-meter distance between the transducer and the target, and 17.5 milliseconds for a 3-meter distance (see Clock Waveform above).
  - 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.

## **Returning Echo Adjustment Procedures**

*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.*

Connect the oscilloscope vertical channel 1 to ECHO output (J1-Pin 5). Use this channel as the oscilloscope trigger, triggering on the waveform’s rising edge.

Place another oscilloscope channel’s probe on Pin #9 of U2 (TL852) chip, this is the REC output signal. 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.



## **Returning ECHO Adjustment Procedures (cont)**

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

The received echo (REC) amplitude will vary with the returning echo signal strength from the target and with the GAIN SET potentiometer. By adjusting this potentiometer (see "Calibration Procedures – Step 6"), you can set the optimum point for consistent detection at the desired distances.