

SCOUT Projects: *Exhaust Elbow Temperature Sensors*



m/v SCOUT (Great Harbour N37)

Ray Henry

Description

We recently had both engines' impellers destroy themselves upon re-splashing after work in a boatyard. This caused a lack of cooling water to the engine and exhaust system. I wanted an early-warning scheme for this case.

We do have three Borel exhaust temperature alarms (http://www.borelmfg.com/products_alarm.htm) already on the boat (2 engines and generator). My concern about these alarms are that they are quite far down the chain of the exhaust system – attached to the rubber hose going to the water-lift muffler – and have fixed a temperature set alarm set point of 167 degrees. Once this point gets that hot, things are going downhill pretty quickly.

I was interested in an earl(ier) warning alarm - closer to the raw water injection point – right on the exhaust elbow. As soon as there was limited or no cooling water, the temperature of the mass of metal at the exhaust elbow should rise quickly.

This is a project to install three early-warning temperature monitors for the three engines. We will, of course, keep the Borel alarms as a backup.

Parts Ordered

1. Temperature Monitor/Controller (Qty 3)



5 of DZS Elec Temperature Controller -50 to 110 Celsius (-58 to 230 F) DC 12V Programmable Heating/Cooling Thermostat Control Switch Module NTC Waterproof Sensor Probe Dual Color LED Display Monitor

Sold by: DZS Elec

5 Return eligible through Mar 19, 2020

\$11.98

2. Junction Box (Qty 3)



3 of Junction Box Outdoor Waterproof IP68 3 Way Plug Line M25 Coaxial Cable Connector Wire Range 4 to14mm Electrical External Power Cord Junction Boxes

Sold by: ViGo High Quality Store

3 Return eligible through Mar 22, 2020

\$9.98

3. 4-conductor Cable



250ft 18AWG 4 Conductors (18/4) CL2 Rated Loud Speaker Cable Wire, Pull Box (for in-Wall Installation) (18AWG / 4 Conductors, 250ft)

Sold by: Cables-Direct-Online

Return eligible through Mar 22, 2020

\$37.95



4. Extended Length Sensors



DROK 5Pcs 10k B3950 Temperature Probe, -25 to 125 Degree Celsius Temp Sensor, 3 Meters 9.8 Feet Sensitive Stainless Steel NTC Temperature Sensor Probe

Sold by: DROK
Return eligible through Mar 19, 2020
\$12.99

5. Custom Alarm Panel (customsigns.com)

PRODUCT	SKU	QTY	PRICE
Horizontal Engraved Plastic Sign	1007044-1	1	\$3.95



Material Colors: Black w/ White Letters
Corners: Small Rounded Corners
Mounting Option: Adhesive Tape
Design: Custom Design
Product Size: 1" x 2"

6. Alarm LEDs



2 of 3 Pack of PLUG-N-PLAY Instrument Cluster LED Indicator Light Dash Bulbs. Aluminum Pilot Lights. Color Acrylic Lens. Flush Panel Mount 5/16" 8mm 12V for Speedometer Odometer (Black Bezel, Red LED)

Sold by: Ozniium | Product question? Ask Seller
Return eligible through Mar 19, 2020
\$21.99

7. Alarm Buzzers



Cylewet 5Pcs SFM-27 DC 3-24V Electronic Buzzer Alarm Sounder Continuous Sound Beep (Pack of 5) CYT1083

Sold by: Aloway
Return eligible through Mar 19, 2020
\$7.99

8. Test Push Button



Clyxgs Momentary Push Button Switch, SPST Mini Switches with No Lock Round 3A AC250V / 6A AC125V Black & Red Cap

Sold by: clyxgs
\$9.99

9. Other

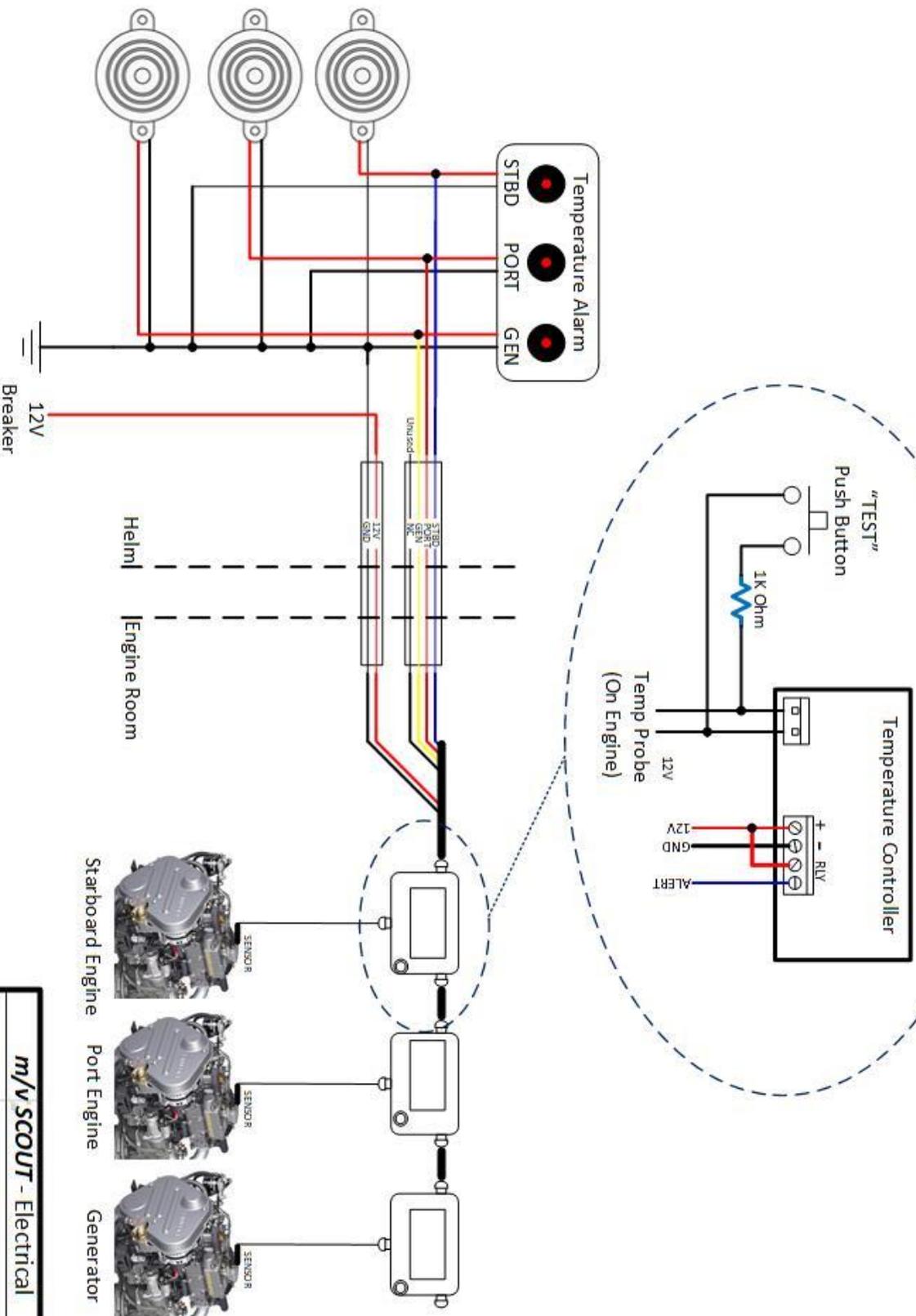
Mounting screws, 12V DC wire, 1K Ohm resistor, heat-shrink, etc.

Design

The temperature controllers I chose were very inexpensive and are typically used to cycle heating/cooling systems on and off based on a temperature setpoint. Once the setpoint is reached, a relay is open or closed depending on programming. The control relay can be used to sound an alarm and light an alert indicator when the setpoint is crossed. These provide a lot of functionality for only \$12.

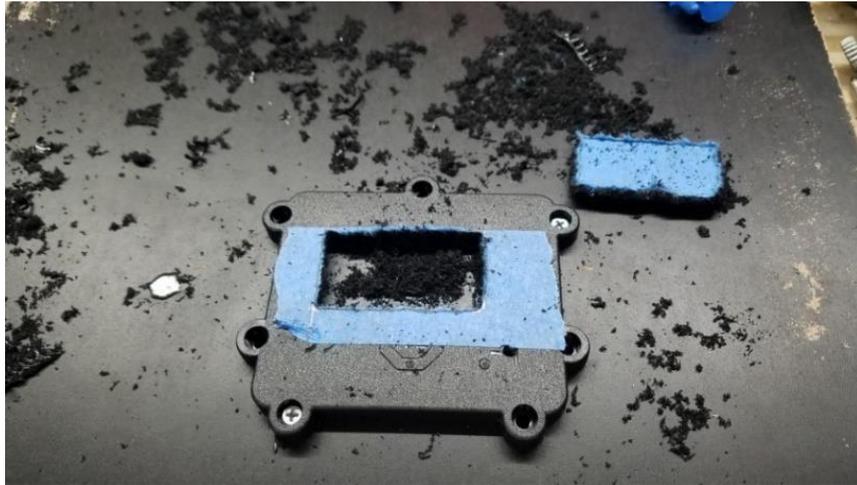
I wanted the temperature controllers to be co-located in the engine room so they could be checked at a glance during an inspection (separate from the alarm buzzer function). To do this, I needed some longer temperature probe cables since the ones that came with the control module was only 3ft long.

The schematic below shows how I connected all of the components.



m/v SCOUT - Electrical
 Engine Temperature Alarm System
 02/24/2020

I used the water-tight electrical junction boxes to mount the temperature controllers and push buttons. I cut the cover plate with a Dremel and drilled the pushbutton hole.



For the helm station alerts, I used an online sign manufacturer to design and order a very inexpensive alarm panel for the three engines' lighted alarms. Once I received the panel, I drilled the light holes and installed the LEDs. I few small strips of double-sided adhesive and the panel was installed at the helm.



On the engines, I clamped the temperature probe to the exhaust elbow fitting shoulder right where the raw water is injected.



In the engine room, I mounted the boxes on the aft bulkhead with the controllers in the same order as the engines – starboard, port, then generator. The power and 4-conductor cable are daisy-chained through to each controller.



I wanted a way to easily test the integrity of the system periodically.

Researching the temperature probe, I observed that the measured temperature is inversely proportional to the resistance seen by the controller at the probe connections. This means that as the temperature increases, the measured resistance of the probe goes down.

So I added a “TEST” button to the front cover. When pressed, the button places a low-value resistance across the temperature probe wires (see schematic above). By pushing the button, the controller is “faked” into seeing the temperature as very high (about 200degF) and causes the alert to go off as a test. Releasing the button deactivates the alarm.

Here is the wiring of the controller and push button ready to be closed up into the junction box.



Completion

The set point on the controllers can be programmed to any level (-58 to 230 F). The units seem to work well by manually heating the probe. I will have to run the engines under load for an hour or more to decide where I want to set the alert threshold.

I confirmed the absolute temperature reading with a handheld IR laser tool and they seem very accurate. If needed, they have a programmable calibration offset that can be added or subtracted as well. Since they are three separate units, I can set different thresholds for each of the engines and generator if needed.



Do-Overs and Comments

I will report back after some long-term testing.

For only \$12 each, I bought several spare controller units in case of a failure.