# TSP-M

Touch Screen Panel for Mechanical Engines

# Operation Manual

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This manual covers content for TSP-M installed on Clarke Fire engine models:
JU4-, JU6-, KA4-, DP-, DQ-, DR-, DS-, DT-

IMPORTANT: LEVEL 2 DOCUMENT
FOR SERVICE DEALER USE ONLY

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# 1. Introduction

## 1.1. Engine Operators Manual Reference

This document contains information only for the TSP-M (Touch Screen Panel for Mechanical Engines). For engine model specific operations manual refer to ClarkeFire.com.

## 1.2. Warning Notice

1.2.1. Electrical Shock Hazard – DC voltage is present in the TSP. Improper use of tools may cause sparks which could result in burns. Disable the pump controller battery chargers and disconnect the negative battery cable to de-energize the TSP-M.

1.2.2. Improper Protection of TSP – The standard configuration of the TSP and associated electrical components on the engine are not designed for outdoor installation. Failures related to improper protection may result in a non-warrantable situation.

1.2.3. Precautions for Welding – Always disconnect TSP engine harness connector before welding. High currents or electrostatic discharge in electronic components from welding may cause permanent damage. Connect welder ground close to the welding point and be sure electrical components are not in ground path.

1.2.4. Improper Installation of TSP – Use of a TSP on a non-compatible engine or improper installation may result in a non-warrantable situation. Contact Clarke Fire customer support for confirmation on combability and/or installation procedures.
IMPORTANT: Modifications should NOT be made to the TSP, including drilling entry holes into the enclosure (reference section 2.7 for wiring entrance). [only standard connections]
IMPORTANT: AC voltage should NOT be routed through the TSP. The only AC voltage requirement for the engine is the block heater which requires dedicated conduit.

## 1.3. Support Contacts

CLARKE FIRE PROTECTION PRODUCTS, INC.
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CLARKE FIRE PROTECTION PRODUCTS, LTD.
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COATBRIDGE, SCOTLAND ML5 2NN
UNITED KINGDOM

## 1.4. Glossary

### Acronyms, Abbreviations and Common Terms

| Term | Definition | Description |
|---|---|---|
| AC | Alternating Current | Electrical current in contrast to DC |
| CAC | Charge Air Cooler | An engine cooling system component that cools compressed air from the turbo. |
| CL | Cooling Loop | An engine cooling system component that receives raw water from the pump discharge and directs it to the HX. |
| CS | Constant Speed | An engine model that runs at a constant speed. |
| Data Logs | | A function of the TSP-M that provide historical logs and events in reviewable file formats. |
| DC | Direct Current | Electrical current in contrast to AC |
| ETR | Energized to Run | Engine configuration requiring an energized signal to start and run the engine. |

| | | |
|---|---|---|
| ETS | Energized to Stop | Engine configuration requiring an energized signal to stop the engine. |
| FIM | Fuel Injection Malfunction (Common Fault) | An alarm notification for common fault (or low fuel pressure on KA engine models). |
| FM | Factory Mutual | |
| HWT | High Water Temperature (Coolant) | An alarm notification of engine coolant temperature rising beyond the configured setpoint. |
| HX | Heat Exchanger | An engine cooling system component that transfers heat from the coolant to raw water. |
| Hz | Hertz | Unit of electrical frequency and is defined as one cycle per second. |
| IC | Interconnect | Wiring connections between the engine and pump controller that allow the systems to communicate. |
| IP | Ingress Protection | Level of protection offered by the enclosure against solids and liquids. |
| LED | Light Emitting Diode | A semiconductor light source that emits light when current flows through it. |
| LOP | Low Oil Pressure | An alarm notification of engine oil pressure falling below the configured setpoint. |
| LWT | Low Water Temperature (Coolant) | An alarm notification of engine coolant temperature falling below the configured setpoint. |
| NC, N/C, N.C. | Normally Closed | A contact that flows current in its normal state. Energizing it will open the contact and not allow current flow. |
| NFPA | National Fire Protection Agency | An international nonprofit organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. |
| NO, N/O, N.O. | Normally Open | A contact that is open in its normal state. Energizing it will close the contact and allow current flow. |
| NPT | National Pipe Thread | American National Standard Pipe Thread standards. |
| Over Speed | | A scenario in which an engine accelerates past a designed threshold limit. |
| PLD | Pressure Limiting Driver | An engine configuration with discharge pressure limiting capabilities. |
| Pump Controller | | Fire Protection system component responsible for monitoring system statuses and controlling engine functions while in the automatic mode. |
| Raw Water | | Water supplied by the pump discharge, used for cooling the engine. |
| Snapshot | | A function of the TSP-M that records engine parameters and alarm statuses. |
| TSP | | Touch Screen Panel |
| TSP-M | | Touch Screen Panel for Mechanical Engine |
| UL | Underwriter's Laboratories | A global safety certification. |
| VBAT | Voltage Battery | Engine system voltage supply from battery. (12 or 24 VDC) |
| VS | Variable Speed | An engine model that runs at a variable speed. |

# 2. Hardware

## 2.1. TSP-M

The touch screen panel for mechanical engines features a standard NEMA 4 / IP66 rated enclosure and intuitive touch screen design with easy to read engine performance and troubleshooting graphics. For specialized applications, a NEMA 4X / IP66 (316 stainless steel) enclosure is also available.

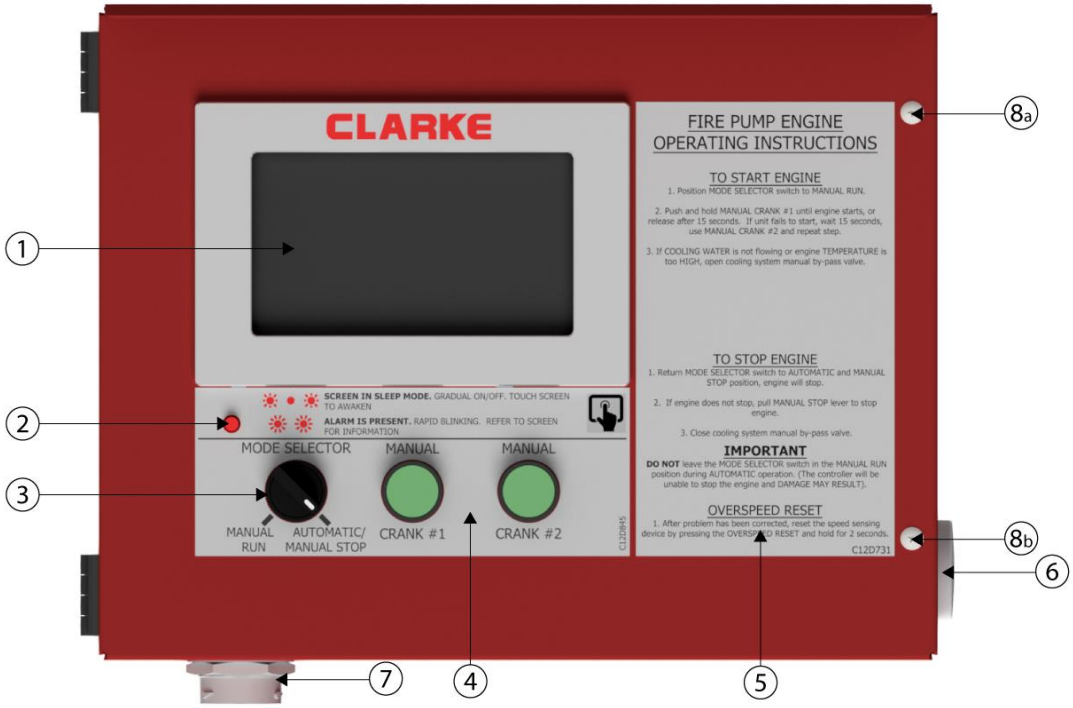



*Figure 2-1*

1. Touch Screen Display
2. Panel Status LED Indicator
3. Mode Selector Switch
4. Manual Crank Buttons
5. Operating Instructions Label
6. Field Service Wiring Entrance
7. Engine Harness Connector
8. Access Screws

## 2.2. Touch Screen Display

The Touch Screen Display is in the center of the panel. For navigation and menu details refer to section 3.

## 2.3. Panel Status LED Indicator

The Panel Status LED Indicator (*Figure 2-1 item 2)* is located below the touch screen display.

2.3.1. If the red light is **not illuminated** it indicates that the system is not energized.

2.3.2. A continuous increase and decrease in brightness which is referred to as a "**breathing**" mode, the red-light blinks once every 2 seconds to show the engine is connected to the pump controller. In this status, the screen is timed out and not displaying.

2.3.3. If the red light is **continuous,** this indicates the engine is ready for testing and normal operation. In this status, the screen is displaying engine information.

2.3.4. If the red light is **flashing rapidly** (5 times per second) indicating an engine alarm which needs to be reviewed. In this status the screen will display a message regarding what is triggering the alarm.

## 2.4. Engine Mode Selector Switch

The Engine Mode Selector Switch (*Figure 2-1 item 3)* is located below the Panel Status LED Indicator. Positioning the switch to the left will place the engine in Manual Mode. Positioning the switch to the right will put the engine in the Automatic Mode or Manual Stop. **IMPORTANT**: Do not leave the mode selector switch in the manual run position during automatic operation. The fire pump controller will be unable to stop the engine and damage may occur.

## 2.5. Manual Crank Buttons

The Manual Crank #1 and Manual Crank #2 buttons (*Figure 2-1 items 4)* are the right of the Mode Selector Switch. Only when operating the engine in the manual mode, these buttons are used to start the engine on start circuit 1 or 2 separately. The starters should not be engaged for more than 15 seconds.

## 2.6. Operating Instructions Label

The Operating Instructions Label (*Figure 2-1 item 5)* is to the right of the Manual Crank buttons and touch screen display. The label includes instructions on how to run the engine in the manual mode, a warning for the mode selector switch and overspeed reset instructions.

## 2.7. Field Service Wiring Entrance

The Field Service Wiring Entrance (*Figure 2-1 item 6)* for the pump controller interconnect wiring is located on the right side of the TSP enclosure. Use the dedicated entrance, do not drill into the panel enclosure to prevent possible damage and ensure longevity of the TSP. When ready to install wiring, the hole plug is removed and a 1" (25mm) conduit fitting can be secured to the hole. IMPORTANT: Modifications to the enclosure voids engine panel warranty.

## 2.8. Engine Harness Connector

The Engine Harness Connector (*Figure 2-1 item 7)* is located on the bottom side of the TSP. The Panel uses this twist lock connector to connect to the engine harness to communicate with the engine sensors. This connector should never be removed unless diagnosing possible connection faults.

## 2.9. Access Screws

On the front of the panel, towards the right-hand side are two Access Screws (*Figure 2-1 items 8a and 8b)*. Using a Philips head screw driver, you can loosen the access screws and open the enclosure to access more panel components.

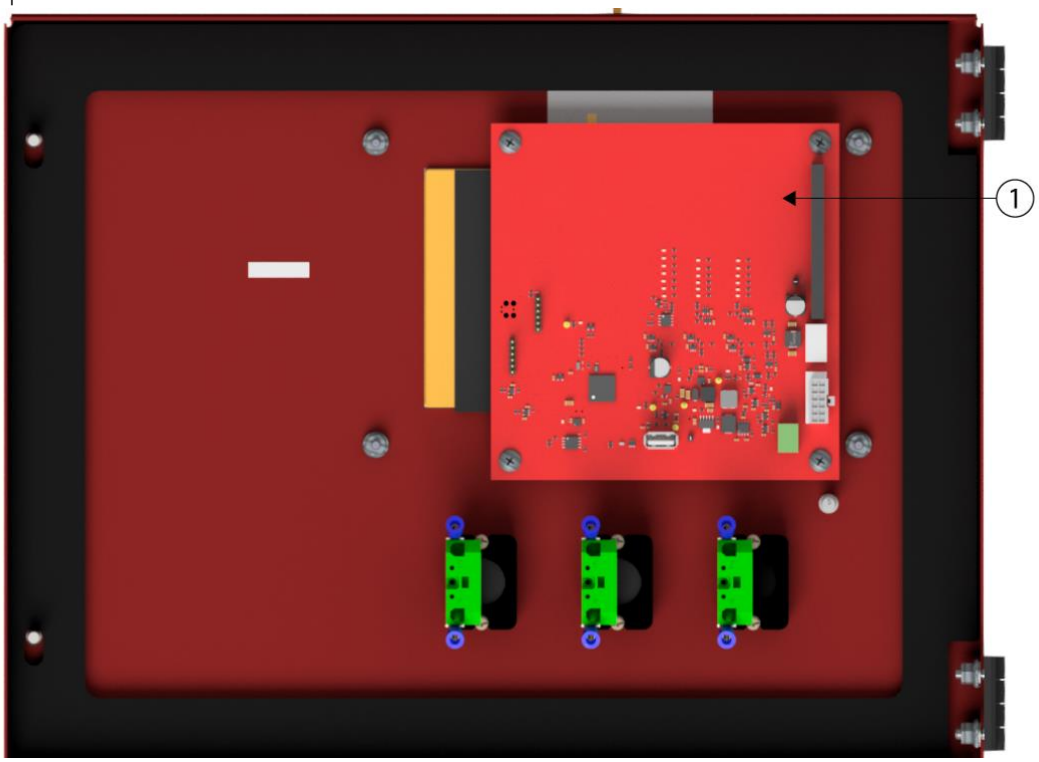



*Figure 2-2*

## 2.10. Control Board

The Control Board (*Figure 2-2 item 1)* is located on the right side of TSP enclosure door. The "brain" of the TSP, the control board houses all the memory. It receives and interprets signals from all the engine sensors, triggering alarms if needed.

2.10.1. The **J13 USB Connection Port** (*Figure 2-3 item 2)* is located on the bottom of the control board. The USB connection port is used by authorized service dealers to extract event log data files.

2.10.2. The TSP Control Board contains an array of **LED indicators** (*Figure 2-3 item 1a & 1b)*.

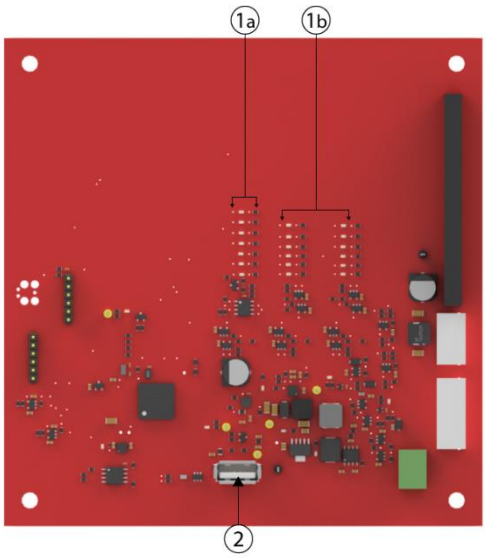



*Figure 2-3*

The two columns of **LED indicators** (*Figure 2-3 area 1b)* on the right side are labelled with a corresponding fire pump controller interconnect terminal.

| LED | Label | Purpose | Description |
|---|---|---|---|
| LED8 | #1 | Fire Pump Interconnect Terminal 1 | Raw Water & ETR Fuel Solenoid |
| LED16 | #2 | Fire Pump Interconnect Terminal 2 | Engine Run Signal |
| LED17 | #3 | Fire Pump Interconnect Terminal 3 | Engine Over Speed Alarm |
| LED19 | #4 | Fire Pump Interconnect Terminal 4 | Low Oil Pressure Alarm |
| LED23 | #5 | Fire Pump Interconnect Terminal 5 | High Engine Temperature Alarm |
| LED6 | #9 | Fire Pump Interconnect Terminal 9 | Start Circuit Signal Starter #1 |
| LED10 | #10 | Fire Pump Interconnect Terminal 10 | Start Circuit Signal Starter #2 |
| LED9 | #12 | Fire Pump Interconnect Terminal 12 | ETS Fuel Solenoid |
| LED24 | #302 | Fire Pump Interconnect Terminal 302 | Fuel Injection Malfunction Alarm |
| LED20 | #310 | Fire Pump Interconnect Terminal 310 | High Raw Water Temperature Alarm |
| LED21 | #311 | Fire Pump Interconnect Terminal 311 | Low Raw Water Flow Alarm |
| LED22 | #312 | Fire Pump Interconnect Terminal 312 | Low Engine Temperature Alarm |

To the left of the fire pump controller interconnect terminal LED indicators, are a single column of **LED troubleshooting indicators** (*Figure 2-3 area 1a)* related to engine functions.

| | |
|---|---|
| LED15 | ETS Pull + |
| LED14 | ETR |
| LED13 | Raw Water Excite |
| LED12 | ETS Hold+ |
| LED25 | ETS Hold- |
| LED11 | Manual Mode Select |

For detailed information regarding the LED indicators, refer to Troubleshooting section 5.

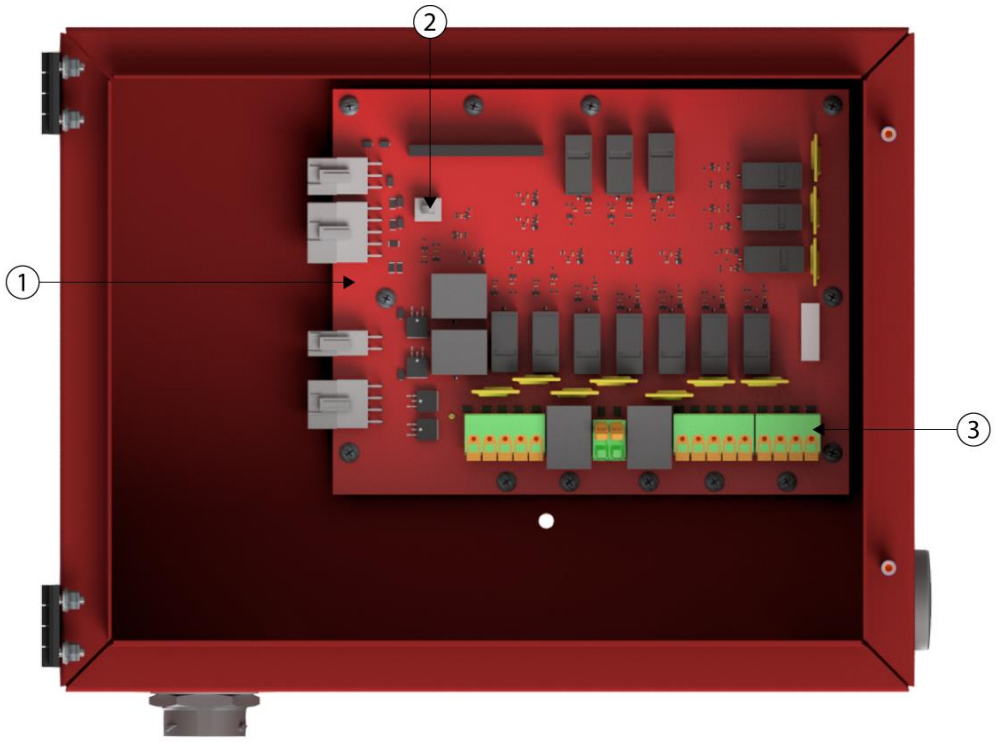



*Figure 2-4*

## 2.11. Terminal Board

The **Terminal Board** (*Figure 2-4 item 1)* is located on the back wall of the TSP-M enclosure**.** Receiving instructions from the control board, the terminal board activates relays and resistors in higher current and voltage requirements for engine functions.

2.11.1. The **Emergency Run Override** (*Figure 2-4 item 2)*, utilized only on energized to run engines, will manually switch battery voltage to the fuel run solenoid. (Positioning the switch to the right is ON.) IMPORTANT: This override should ONLY be used if the engine is configured as ETR (energized to run) AND the control board is nonfunctional.

2.11.2. The **Interconnect terminals** (*Figure 2-4 area 3)* are located on the bottom edge of the TSP-M Terminal Board. The terminal board features individual lever actuated spring cage connections. Fire pump controller wiring will no longer need to be screwed into the terminal strip.

2.11.2.1. Terminals 6, 8, 11A, 11B maximum wire size: 8 AWG (10 $mm^2$)

2.11.2.2. Terminals 1, 9, 10,12 maximum wire size: 10 AWG (6 $mm^2$)

2.11.2.3. Terminals 2, 3, 4, 5, 310, 311, 312 maximum wire size: 14 AWG (2.5 $mm^2$)

**Installation Note**: The Interconnect terminal lever actuated connections accommodate wire installation with ferrules but are not required. Wire insulation can be stripped and installed on bare wire. Reference Figure 2-5

**Step 1**: Open the orange lever to the fully open position.

**Step 2**: Insert the wire into the terminal.

**Step 3**: Close the lever into the locked position and confirm the wire is secured in place.

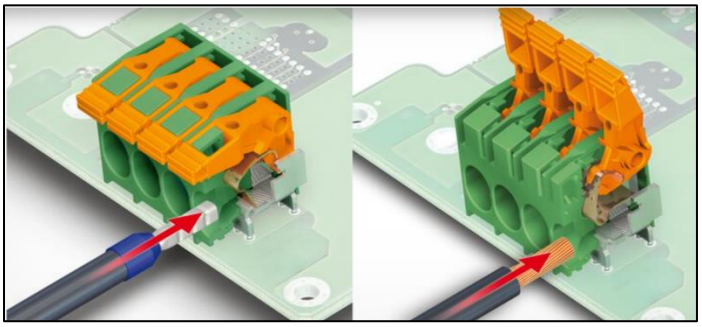


*Figure 2-5*

## 2.12. Control Board (Level 2)

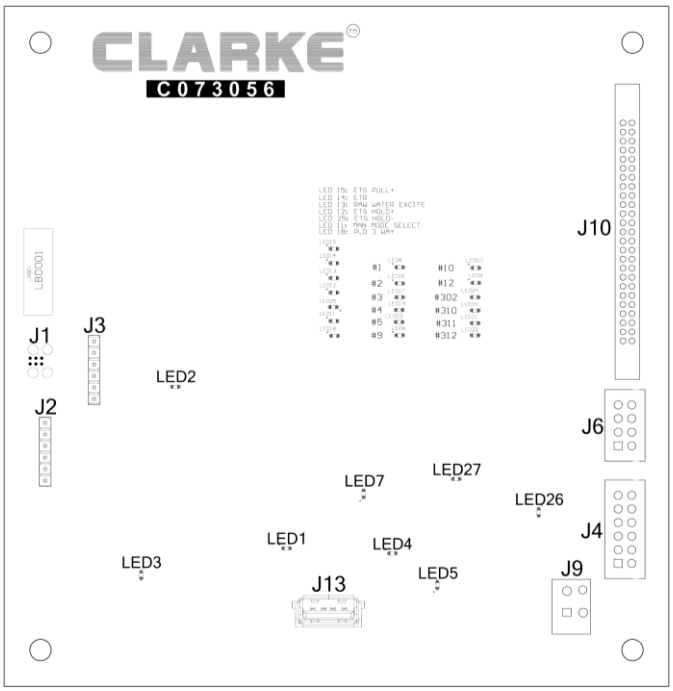



*Figure 2-6*

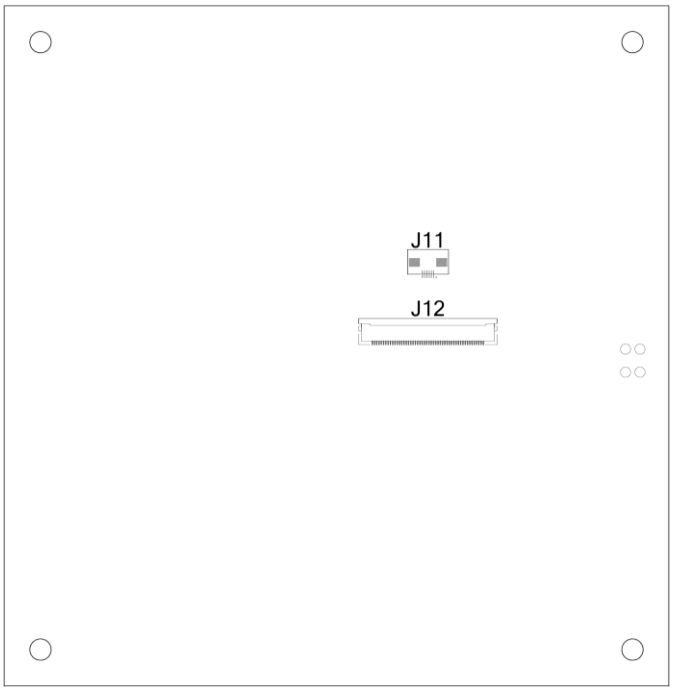



*Figure 2-7*

### 2.12.1. Control Board Connections (Front) *Figure 2-6*

| Label | |
|---|---|
| J1 | Factory Use Only |
| J2 | Not Utilized |
| J3 | Factory Use Only |
| J4 | Connection for engine sensors to provide excitation voltage and monitor return signals. |
| J6 | Not Utilized |
| J9 | Panel Status LED indicator output wire connection. |
| J10 | Connection to the TSP Terminal Board, sends command signals to energize relays and monitor the switched conditions. |
| J13 | USB connection port is used by authorized service dealers to extract event log data files. |

### 2.12.2. Control Board LEDs *Figure 2-6*

| LED | |
|---|---|
| LED1 | Factory Use Only |
| LED2 | Factory Use Only |
| LED3 | 1.8V Voltage Regulator |
| LED4 | 3.3V Voltage Regulator |
| LED5 | 5V Voltage Regulator |
| LED7 | Boost Switching Regulator |
| LED26 | PLD Over-Pressure Monitor |
| LED27 | Manual Fuel Pressure Monitor |

### 2.12.3. Control Board (Back) *Figure 2-7*

| Label | |
|---|---|
| J11 | Connector (6 pins) for display haptics / touch. |
| J12 | Connector (50 pins) for display data. |

## 2.12.4. Control Board Connection Pins

2.12.4.1.J4

| Pin | |
|---|---|
| 1 | 5V |
| 2 | PLD Pressure Switch In |
| 3 | Fuel Pressure Switch In |
| 4 | Coolant Thermistor In |
| 5 | Mag Pickup In |
| 6 | Raw Water Thermistor In |
| 7 | NA |
| 8 | Ground |
| 9 | Ground |
| 10 | Oil Pressure Sensor |
| 11 | Water Pressure Sense 1 |
| 12 | Water Pressure Sense 2 |

2.12.4.2.J9

| Pin | |
|---|---|
| 1 | 5V |
| 2 | LED |

2.12.4.3.J10

| Pin | | Pin | |
|---|---|---|---|
| 50 | VBAT | 1 | LET Alarm Set |
| 49 | Ground | 2 | Engine Stop Mon |
| 48 | VBAT | 3 | LRWF Alarm Mon |
| 47 | Ground | 4 | LRWF Alarm Set |
| 46 | 12V | 5 | PLD 3way Valve Set |
| 45 | 5V | 6 | LET Alarm Mon |
| 44 | 12V | 7 | Spare Dig Set1 |
| 43 | 5V | 8 | PLD 3way Valve Mon |
| 42 | 3.3V | 9 | HRWT Alarm Set |
| 41 | Battery 2 + | 10 | Crank Disconnect Alarm Mon |
| 40 | 3.3V | 11 | Crank Disconnect Alarm Set |
| 39 | Battery 1 + | 12 | HRWT Alarm Mon |
| 38 | NA | 13 | Overspeed Alarm Set |
| 37 | NA | 14 | Crank 1 Mon |
| 36 | ETS Hold (-) Set | 15 | LOP Alarm Mon |
| 35 | ETR Set | 16 | Overspeed Alarm Mon |
| 34 | ETS Hold (+) Set | 17 | Spare Dig In1 Mon |
| 33 | Manual Mode Select Mon | 18 | Engine Run Mon |
| 32 | ETS Hold (-) Mon | 19 | ETS Pull (+) Set |
| 31 | ETS Hold (+) Mon | 20 | Spare Dig in2 Mon |
| 30 | ETS Pull (+) Mon | 21 | RWF Excite Mon |
| 29 | ETR Mon | 22 | Crank 2 Mon |
| 28 | FIM Alarm Set | 23 | LOP Alarm Set |
| 27 | FIM Alarm Mon | 24 | RWF Excite Set |
| 26 | HET Alarm Set | 25 | HET Alarm Mon |

## 2.13. Terminal Board (Level 2)

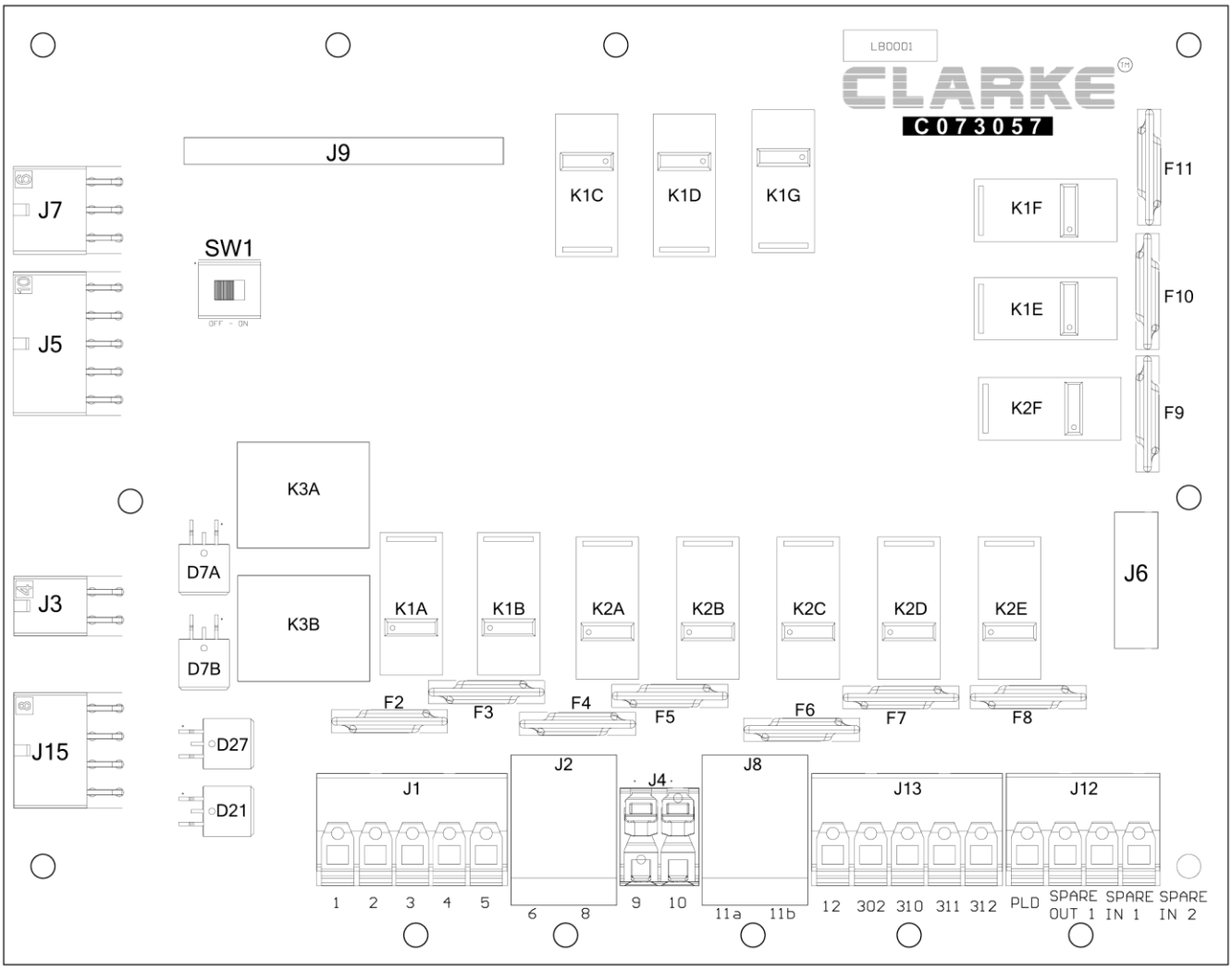



*Figure 2-8*

### 2.13.1. Terminal Board Connections Figure 2-8

| Label | |
|---|---|
| J1 | Terminal Board connection for Interconnect terminals 1-5 |
| J2 | Terminal Board connection for Interconnect terminals 6 and 8 |
| J3 | Engine harness connector for ETS Pull + and ETR circuits. |
| J4 | Terminal Board connection for Interconnect terminals 9 and 10 |
| J5 | Mode selector switch and manual crank buttons, provides excitation to the engine harness connector for the start contactors. |
| J6 | Factory Use Only |
| J7 | Engine harness connector for the PLD pressure switch (if applicable), raw water solenoid excitation, ETS Hold – and ETS Hold +. |
| J8 | Terminal Board connection for Interconnect terminals 11a and 11b |
| J9 | Connection to the TSP Control Board and receives command signals to energize relays and transistors. |
| J12 | Terminal Board connection for PLD and spare terminals. |
| J13 | Terminal Board connection for Interconnect terminals 12, 302, 310, 311 and 312 |
| J15 | Engine harness connector to battery positive and battery ground. |
| SW1 | Engine run override. (Left is Off/Normal Position. Right is On/Emergency use only on ETR engines.) |

2.13.2. Terminal Board Components *Figure 2-8*

| Diode | Relay | SRCB* | |
|---|---|---|---|
| | K1A | F2 | Crank Disconnect Alarm Circuit / Interconnect terminal 2 |
| | K1B | F3 | Overspeed Alarm Circuit / Interconnect terminal 3 |
| | K2A | F4 | LOP Alarm Circuit / Interconnect terminal 4 |
| | K2B | F5 | HET Alarm Circuit / Interconnect terminal 5 |
| | K2C | F6 | FIM Alarm Circuit / Interconnect terminal 302 |
| | K2D | F7 | HRWT Alarm Circuit / Interconnect terminal 310 |
| | K2E | F8 | LRWF Alarm Circuit / Interconnect terminal 311 |
| | K2F | F9 | LET Alarm Circuit / Interconnect terminal 312 |
| | K1E | F10 | PLD 3 way Solenoid Circuit |
| | K1F | F11 | Spare Circuit Out 1 |
| | K1C | | Energized to stop Hold + |
| | K1D | | Raw water flow excite |
| | K2G | | Energized to Stop Hold (-) |
| D7A | K3A | | Energize to Run |
| D7B | K3B | | Energize to Stop Pull + |
| D27 | | | VBAT to J15 pin6 |
| D21 | | | VBAT to J15 pin5 |

*Self-Resetting Circuit Breaker

2.13.3. Terminal Board Connection Pins

2.13.3.1. J1

| Pin | |
|---|---|
| 1 | Engine Run |
| 2 | Crank Disconnect |
| 3 | Overspeed Alarm |
| 4 | LOP Alarm |
| 5 | HET Alarm |

2.13.3.2. J2

| Pin | |
|---|---|
| 1 | Battery 1 + |
| 2 | Battery 2 + |

2.13.3.3. J3

| Pin | |
|---|---|
| 1 | Energize to Stop Pull + |
| 2 | Energize to Run |
| 3 | Energize to Run |
| 4 | Energize to Stop Pull + |

2.13.3.4. J4

| Pin | |
|---|---|
| 1 | Crank 1 |
| 2 | Crank 2 |

2.13.3.5.J5

| Pin | |
|---|---|
| 1 | Crank 1 Manual Switch Out |
| 2 | NA |
| 3 | Ground |
| 4 | Manual Mode Select |
| 5 | Crank 2 |
| 6 | |
| 7 | Mode Select Out |
| 8 | Crank 1 Manual Switch Return |
| 9 | Crank 1 |
| 10 | Crank 2 Manual Switch Return |

2.13.3.6.J6 - Factory Use Only

2.13.3.7.J7

| Pin | |
|---|---|
| 1 | NA |
| 2 | VBAT |
| 3 | Energized to Stop Hold (-) |
| 4 | Energized to Stop Hold (+) |
| 5 | NA |
| 6 | Raw Water Flow Excite |

2.13.3.8.J8

| Pin | |
|---|---|
| 1 | Ground |
| 2 | Ground |

2.13.3.9.J9

| Pin | | Pin | |
|---|---|---|---|
| 1 | VBAT | 50 | LET Alarm Set |
| 2 | Ground | 49 | Engine Stop Mon |
| 3 | VBAT | 48 | LRWF Alarm Mon |
| 4 | Ground | 47 | LRWF Alarm Set |
| 5 | 12V | 46 | PLD 3way Valve Set |
| 6 | 5V | 45 | LET Alarm Mon |
| 7 | 12V | 44 | Spare Dig Set1 |
| 8 | 5V | 43 | PLD 3way Valve Mon |
| 9 | 3.3V | 42 | HRWT Alarm Set |
| 10 | Battery 2 + | 41 | Crank Disconnect Alarm Mon |
| 11 | 3.3V | 40 | Crank Disconnect Alarm Set |
| 12 | Battery 1 + | 39 | HRWT Alarm Mon |
| 13 | NA | 38 | Overspeed Alarm Set |
| 14 | NA | 37 | Crank 1 Mon |
| 15 | ETS Hold (-) Set | 36 | LOP Alarm Mon |
| 16 | ETR Set | 35 | Overspeed Alarm Mon |
| 17 | ETS Hold (+) Set | 34 | Spare Dig In1 Mon |
| 18 | Manual Mode Select Mon | 33 | Engine Run Mon |
| 19 | ETS Hold (-) Mon | 32 | ETS Pull (+) Set |
| 20 | ETS Hold (+) Mon | 31 | Spare Dig in2 Mon |
| 21 | ETS Pull (+) Mon | 30 | RWF excite mon |
| 22 | ETR Mon | 29 | Crank 2 mon |
| 23 | FIM Alarm Set | 28 | LOP alarm set |
| 24 | FIM Alarm Mon | 27 | RWF excite set |
| 25 | HET Alarm Set | 26 | HET alarm mon |

2.13.3.10. J12

| Pin | |
|---|---|
| 1 | PLD 3way valve |
| 2 | Spare dig out1 |
| 3 | Spare dig in1 |
| 4 | Spare dig in2 |

2.13.3.11. J13

| Pin | |
|---|---|
| 1 | Engine Stop / Interconnect terminal 12 |
| 2 | FIM |
| 3 | HRWT alarm |
| 4 | LRWF alarm |
| 5 | LET alarm |

2.13.3.12. J15

| Pin | |
|---|---|
| 1 | Battery 1 + |
| 2 | Battery 2 + |
| 3 | Ground |
| 4 | Ground |
| 5 | Battery 1 + |
| 6 | Battery 2 + |
| 7 | Ground |
| 8 | Ground |

## 2.14. Engine Harness Connector (Level 2)

| Pin | Description | Start Location |
|---|---|---|
| 1 | Battery 1 + | TB J15-1,5 |
| 2 | Battery 2 + | TB J15-6,2 |
| 3 | Ground | TB J15-3,7 |
| 4 | Ground | TB J15-4,8 |
| 5 | Energized to Run Fuel Solenoid (and fuel pump on KA engines) | TB J3-2 |
| 6 | Energize to Stop Pull + | TB J3-4 |
| 7 | Energized to Stop Hold (+) | TB J7-4 |
| 8 | Energized to Stop Hold (-) | TB J7-3 |
| 9 | VBAT | TB J7-2 |
| 10 | Raw Water Flow Excite | TB J7-6 |
| 11 | Mag Pickup In (sine wave signal) | CB J4-5 |
| 12 | Mag Pickup Ground | CB J4-8 |
| 13 | Mag Pickup Noise Ground | CB J4-9 |
| 14 | Crank 2 (Start Contactor 2 coil) | TB J5-5 |
| 15 | Crank 1 (Start Contactor 1 coil) | TB J5-9 |
| 16 | PLD Pressure Switch In | CB J4-2 |
| 17 | Terminal Board PLD terminal | TB PLD |
| 18 | 5 VDC Excitation for engine sensors | CB J4-1 |
| 19 | Fuel Pressure Switch In | CB J4-3 |
| 20 | Oil Pressure Sensor Return Signal | CB J4-10 |
| 21 | | NA |
| 22 | | NA |
| 23 | Water Pressure Sensor Return Signal (High Input / Cooling Loop) | CB J4-11 |
| 24 | Water Pressure Sensor Return Signal (Low Input / HX Outlet) | CB J4-12 |
| 25 | | NA |
| 26 | | NA |
| 27 | Engine Coolant Temperature Sensor Return Signal | CB J4-4 |
| 28 | | NA |
| 29 | Raw Water Temperature Sensor Return Signal | CB J4-6 |

# 3. Menu Navigation

## 3.1. Boot Screen

The TSP-M has an easy to use interface. Upon energizing the display, the first screen will be the **Boot Screen** (*Figure 3-1)*. After approximately 10 seconds the screen will display the home screen.


*Figure 3-1*

## 3.2. Home Screen

The **Home Screen** (*Figure 3-2)* is divided into six sectors.

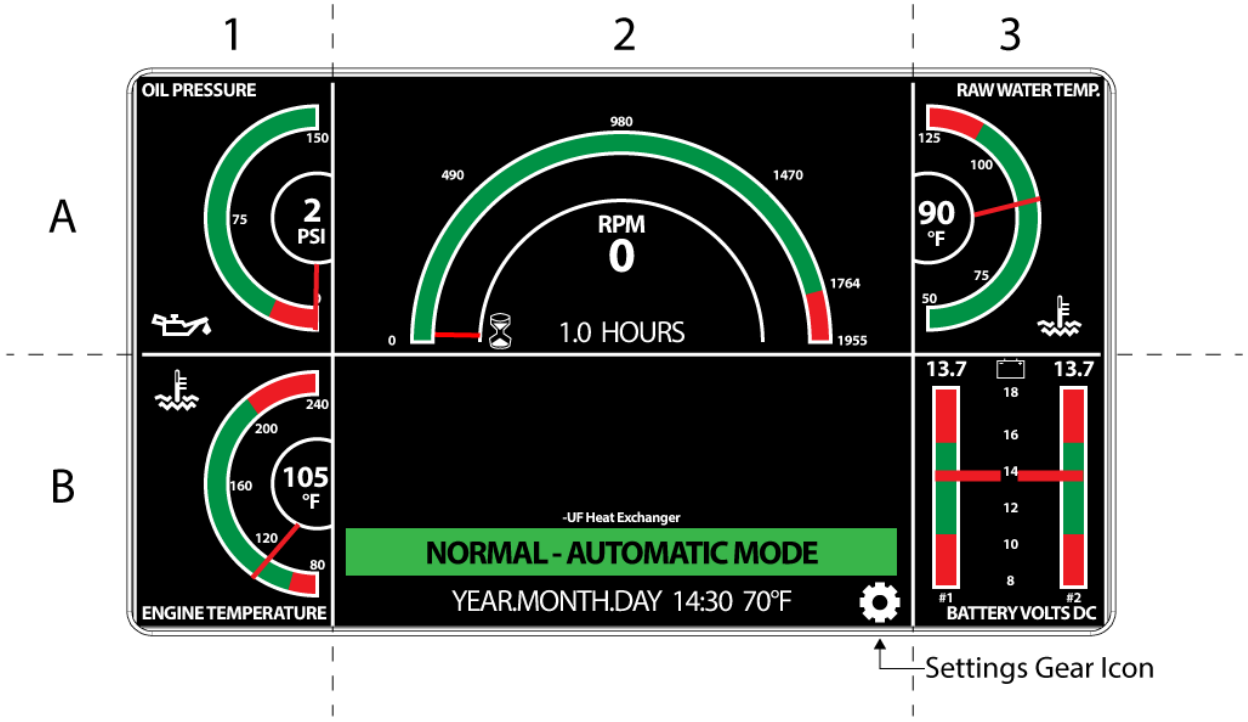



*Figure 3-2*

3.2.1. The **Oil Pressure Gauge** is in sector A1 (*Figure 3-2)*. The numerical value of the engine oil pressure is displayed in PSI, BAR or kPa. A corresponding digital needle gauge will display the oil pressure value. If the digital needle location is in the green, the oil pressure is satisfactory. If the digital needle location is in the red, the oil pressure is unsatisfactory.

3.2.2. The **Tachometer** and **Hour Meter** are in sector A2 (*Figure 3-2)*. The numerical value of the engine speed is displayed in the center of A2. A corresponding digital needle gauge will display the engine speed. The engine run hours are displayed in the bottom-center of sector A2. If the engine shuts down due to over speed or over speed verification, an **overspeed reset button** will appear in the top-left corner of sector A2.

3.2.3. The Raw Water Temperature Gauge is in sector A3 (*Figure 3-2)*. The numerical value of the raw water temperature is displayed in Fahrenheit or Celsius. A corresponding digital needle gauge will display the raw water temperature. If the digital needle location is in the green, the raw water temperature is satisfactory. If the digital needle location is in the red, the raw water temperature is unsatisfactory.

3.2.4. The Engine Temperature Gauge is in sector B1 (*Figure 3-2)*. The numerical value of the engine (coolant) temperature is displayed in Fahrenheit or Celsius. A corresponding digital needle gauge will display the engine temperature. If the digital needle location is in the green, the engine temperature is satisfactory. If the digital needle location is in the red, the engine temperature is unsatisfactory.

3.2.5. The Engine Status is in sector B2 (*Figure 3-2)*. The date, time and ambient air temperature is displayed on the bottom of sector B2. The Engine Mode Status Bar is located just above the date and time. A green bar displaying "NORMAL – AUTOMATIC MODE" will be shown when the engine mode selector switch is in the automatic mode position. A yellow bar displaying "WARNING – MANUAL MODE" will be shown when the engine mode selector switch is in the manual mode position. The Engine Cooling Configuration is displayed just above the engine mode status bar. Alarm Notifications will be displayed towards the top of sector B2. (Example: Low Oil Pressure Alarm *Figure 3-6)*. The Gear Icon is in the bottom right corner of sector B2. Pressing the gear icon will navigate to the settings menu screen. Refer to section 3.3 for more details.

3.2.6. The Battery Volt Gauges are in sector B3 (*Figure 3-2)*. The engine battery voltage readings will be displayed in either 12 or 24 vdc. The horizontal lines display the battery volts and the vertical bar graphs display satisfactory and unsatisfactory voltage levels. The battery voltage reading numerical value is displayed above the vertical bar graphs.

## 3.3. Settings Menu Screen

Pressing the gear icon will navigate to the Settings Menu Screen (*Figure 3-3)*. Six options will be displayed on the Settings Menu Screen: Verification Tests, User Settings, Service Settings, Factory Settings, Home Button and Back Button.

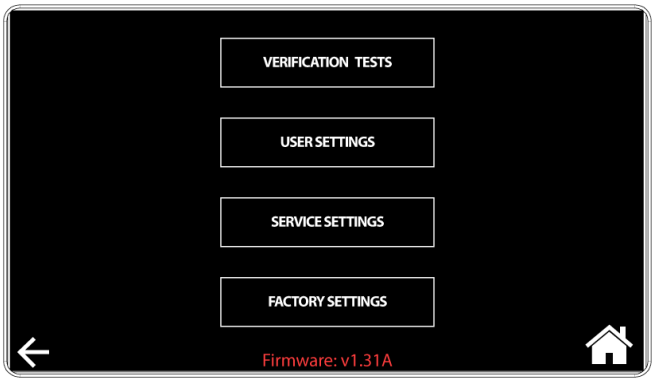



*Figure 3-3*

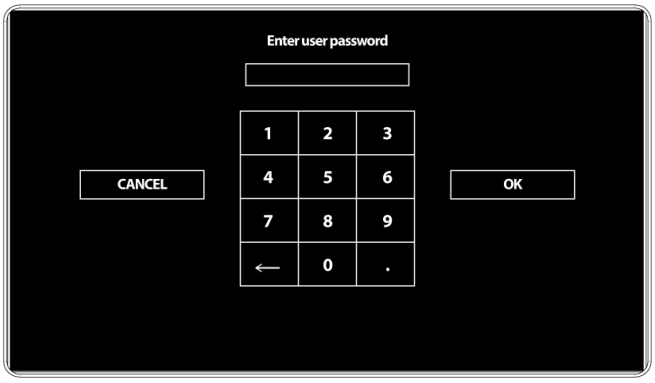



*Figure 3-4*

3.3.1. Selecting Verification Tests will navigate to the Verification Tests Password Screen (*Figure 3-4)*. Enter 8 7 0 5 and press OK. The Verification Tests Screen (*Figure 3-5)* will display 9 options: Low oil pressure, Low Engine Temperature, High engine temperature, Engine Over Speed, Low Raw Water Flow, High Raw Water Temp, back, capture and home.

3.3.1.1. With the engine running, selecting "Run Test" for **Low Oil Pressure** (*Figure 3-5)* the display will go to the **home screen** and generate a low oil pressure alarm. The screen will highlight the oil pressure gauge and generate a verification warning message. An alarm signal will be sent to the pump controller on interconnect terminal #4. The alarm will be active for approximately 30 seconds. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

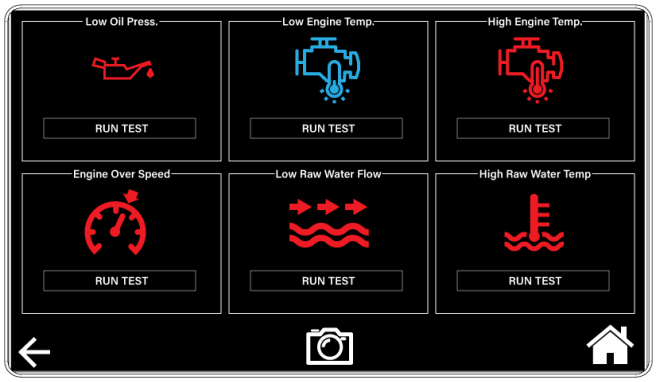



*Figure 3-5*

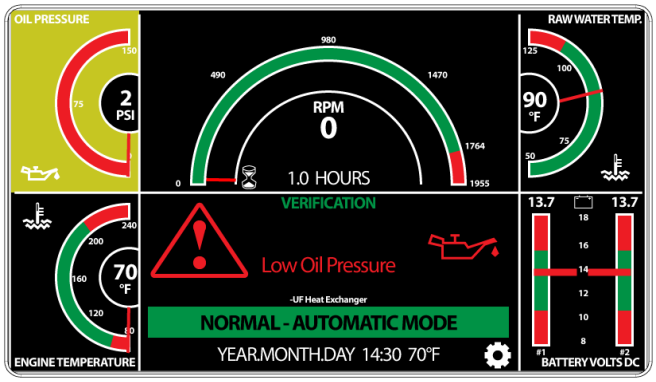



*Figure 3-6*

3.3.1.2. With the engine NOT running, navigating to the verification tests screen and selecting "Run Test" for **Low Engine Temperature** (*Figure 3-5)* the display will go to the **Home Screen** (*Figure 3-7)* and generate a low engine temperature alarm. The screen will highlight the engine temperature gauge and generate a verification warning message. An alarm signal will be sent to the pump controller on interconnect terminal #312. The alarm will be active for approximately 30 seconds. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

3.3.1.3. With the engine running, navigating to the verification tests screen and selecting "Run Test" for **High Engine Temperature** (*Figure 3-5)* the display will go to the **Home Screen** (*Figure 3-8)* and generate a high engine temperature alarm. The screen will highlight the engine temperature gauge and generate a verification warning message. An alarm signal will be sent to the pump controller on interconnect terminal #5. The alarm will be active for approximately 30 seconds. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

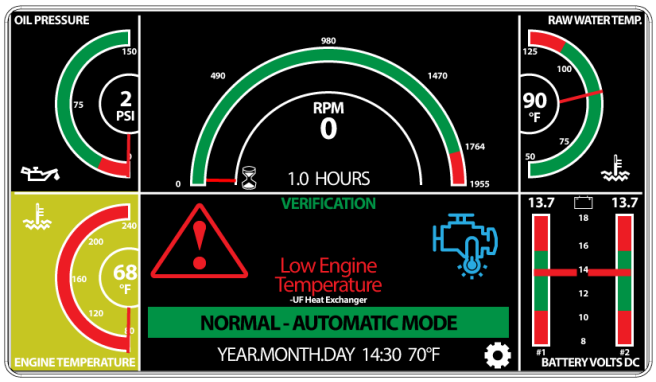



*Figure 3-7*

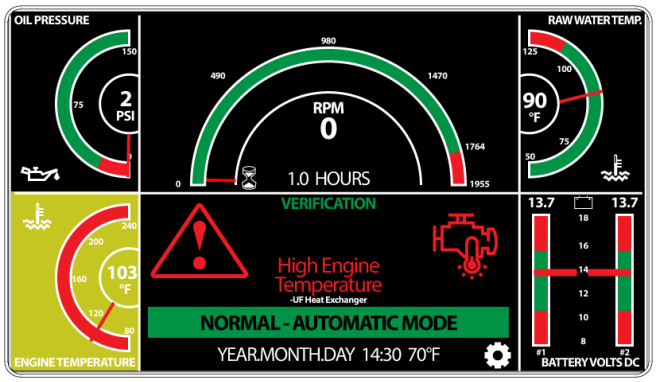



*Figure 3-8*

3.3.1.4. With the engine running, navigating to the verification tests screen and selecting "Run Test" for **Engine Over Speed** (*Figure 3-5)* the display will go to the **Home Screen** (*Figure 3-9)*, shut the engine down and generate an engine over speed alarm. The screen will highlight the tachometer gauge and generate a verification warning message. The engine will be locked-out from restarting until the **Over Speed Reset** button is pressed and the pump controller is reset to normal operation. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

3.3.1.5. With the engine running, navigating to the verification tests screen and selecting "Run Test" for **Low Raw Water Flow** (*Figure 3-5)* the display will go to the **Home Screen** (*Figure 3-10)* and generate a Low Raw Water Flow Alarm. The screen will display a low raw water flow verification warning message. An alarm signal will be sent to the pump controller on interconnect terminal #311. The alarm will be active for approximately 30 seconds. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

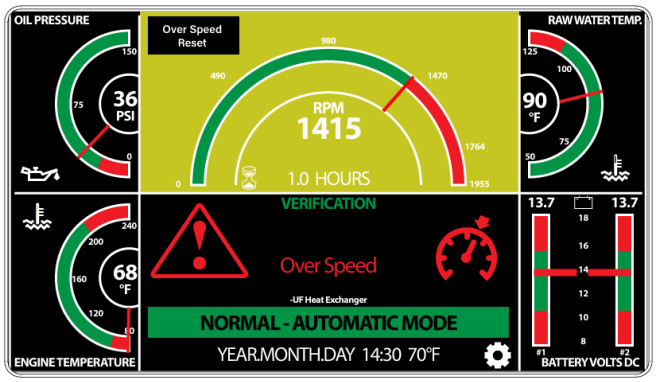



*Figure 3-9*

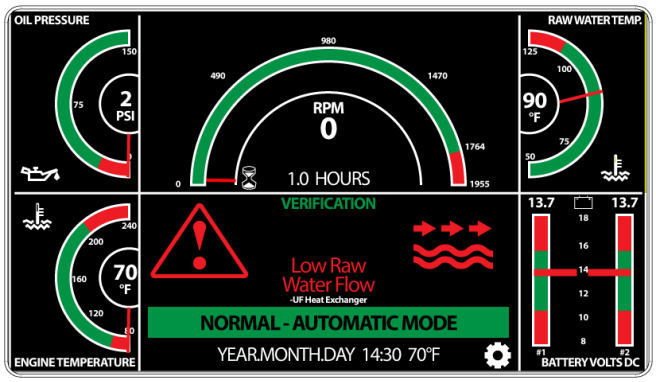



*Figure 3-10*

3.3.1.6. With the engine running, navigating to the verification tests screen and selecting "Run Test" for **High Raw Water Temperature** (*Figure 3-5)* the display will go to the **Home Screen** (*Figure 3-11)* and generate a High Raw Water Temperature Alarm. The screen will highlight the raw water temperature gauge and generate a verification warning message. An alarm signal will be sent to the pump controller on interconnect terminal #310. The alarm will be active for approximately 30 seconds. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

3.3.1.7. Navigating to the verification tests screen after all six alarm verifications have been performed and with the engine running at normal pump conditions*, selecting **Snapshot** (*Figure 3-12)* will record and timestamp all engine parameters and alarm statuses. The snapshot data will serve as proof of engine running conditions during commissioning. The initial snapshot will change the icon from black to white. *(*Normal pump conditions: Engine RPM set at a speed that the pump is producing 100% flow.)*

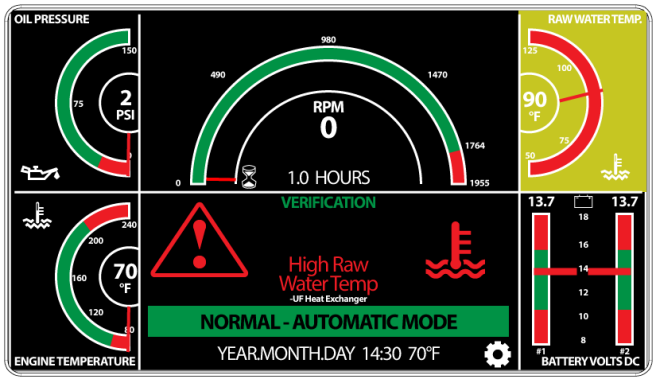



*Figure 3-11*

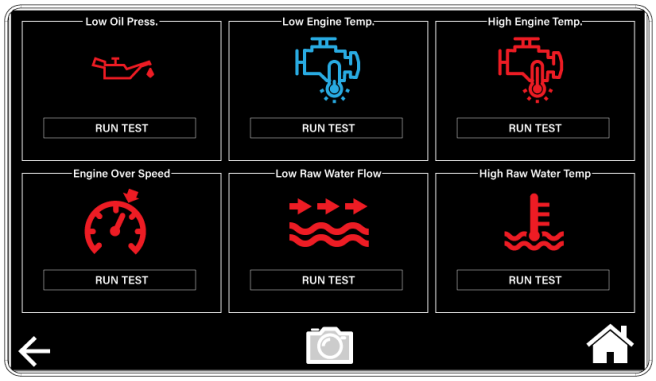



*Figure 3-12*

3.3.2. Navigating to the Menu Settings Screen (*Figure 3-13)* and selecting User Settings will navigate the display to the User Settings Password Screen (*Figure 3-14)*. Enter 8 7 0 5 and press OK. The User Settings screen will display 6 customization options. (*Figure 3-15)*

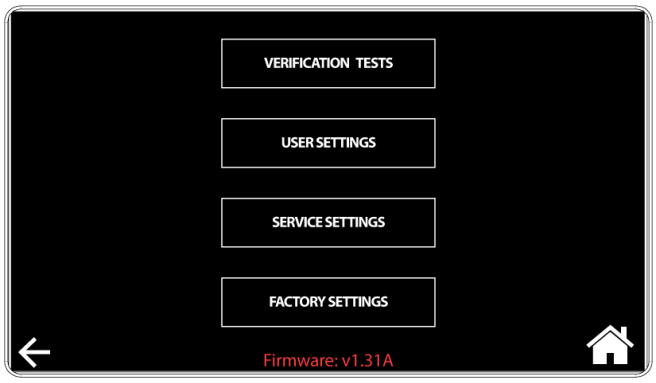



*Figure 3-13*

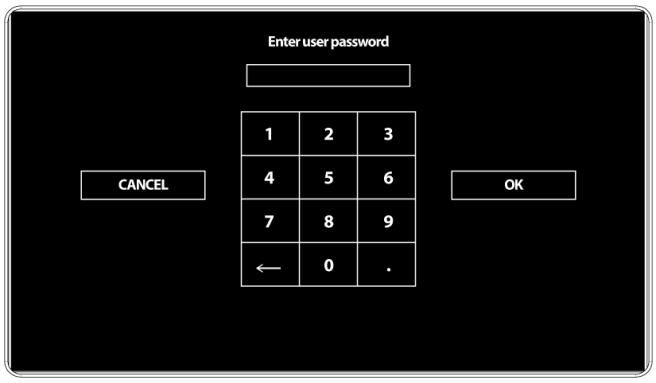



*Figure 3-14*

3.3.2.1. Brightness adjusts the screen brightness level. The default brightness is 100%.
3.3.2.2. Time Format changes the time display to 12 or 24-hour format. The default time format selection is 24-hour.
3.3.2.3. Temp Unit changes the Temperature Unit to display Fahrenheit or Celsius. The default selection is Fahrenheit.
3.3.2.4. Language changes the display language to English, French, Spanish or German. The default language is English.
3.3.2.5. Date/Time Set changes the current date and time.
NOTE: The date and time will be reset to the default (2020 NOV 30 / 10:40) upon loss of DC power.
3.3.2.6. Pressure Unit changes the selection of pressure unit between PSI, BAR or kPa. The default selection is PSI.

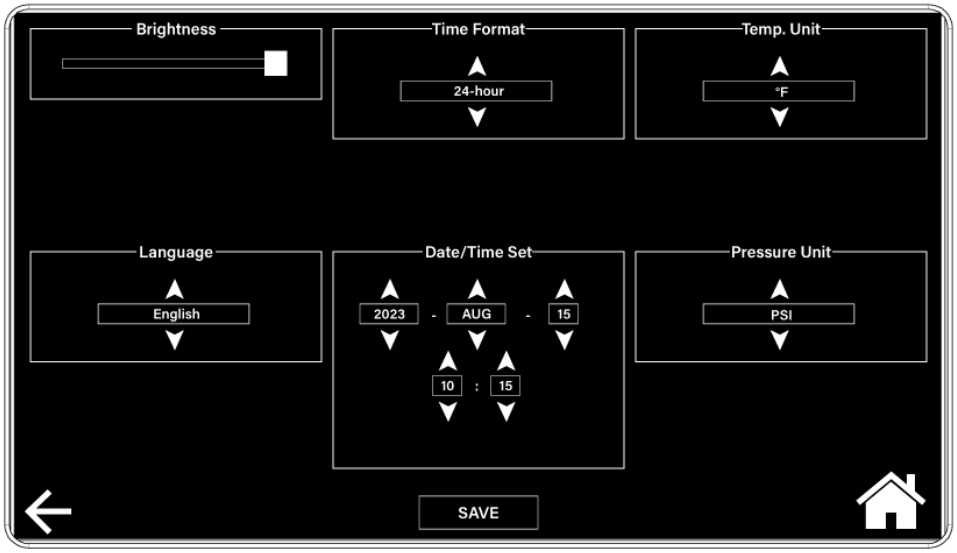
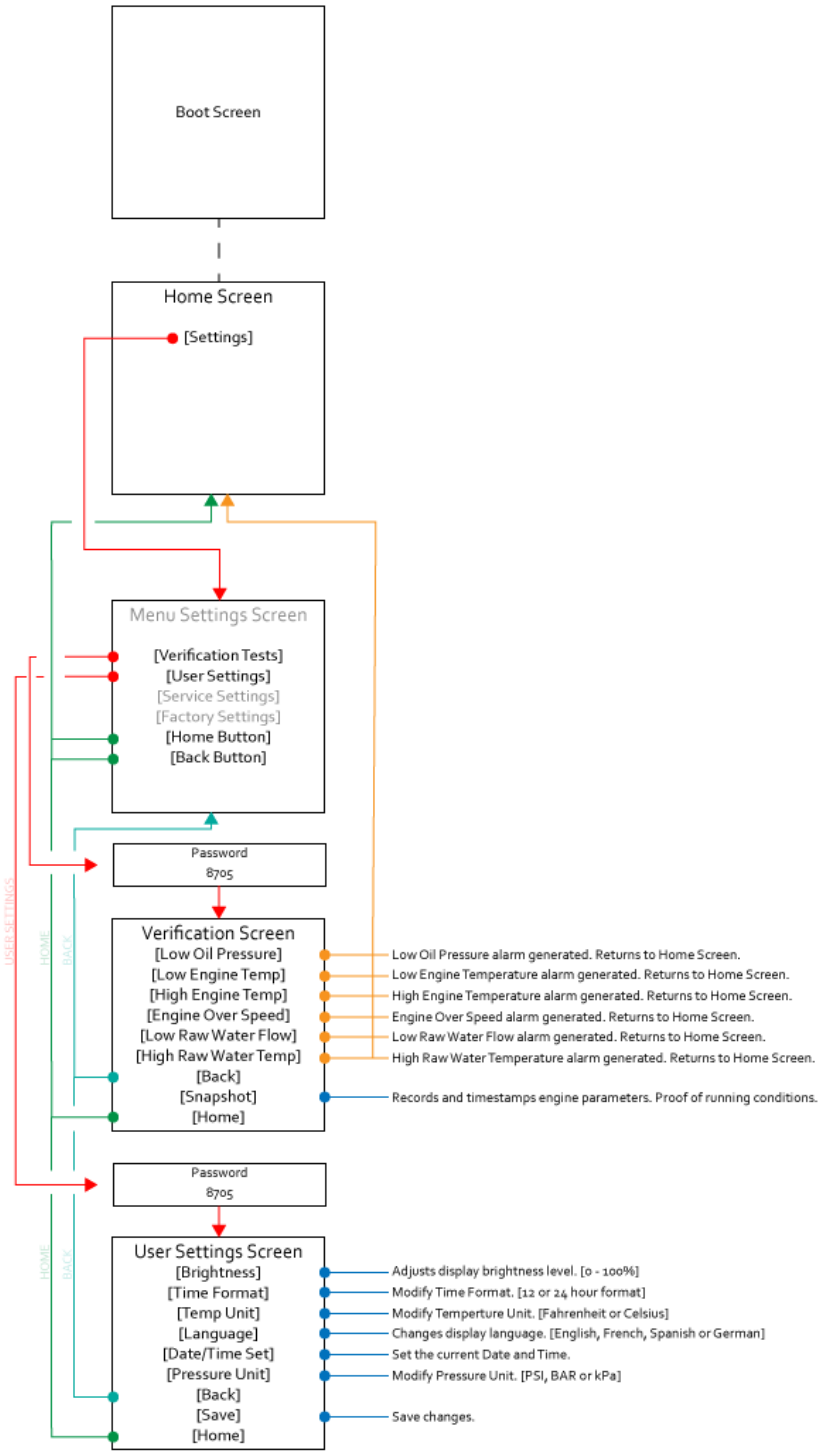



*Figure 3-15*

3.3.3. Service Settings is a password protected menu that is for Clarke Fire service dealer use only.
3.3.4. Factory Settings is a password protected menu that is for Clarke Fire factory use only.

## 3.4. Menu Navigation Map



## 3.5. Service Settings Screen – Event Log Extraction

3.5.1. Navigating to the Settings Menu Screen (*Figure 3-16)* and selecting **Service Settings** will send the display to the Service Settings Password Screen (*Figure 3-17)*. Enter 3 5 5 6 and press OK.

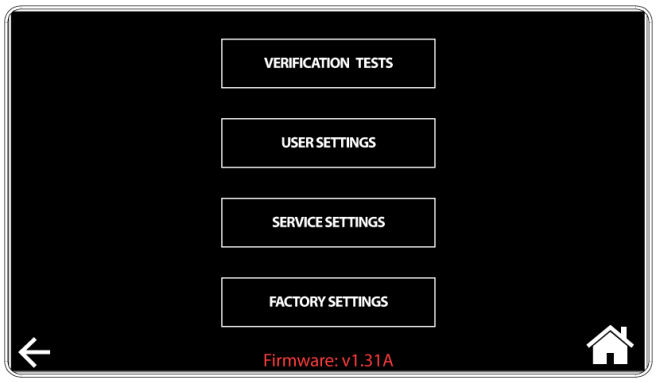



*Figure 3-16*

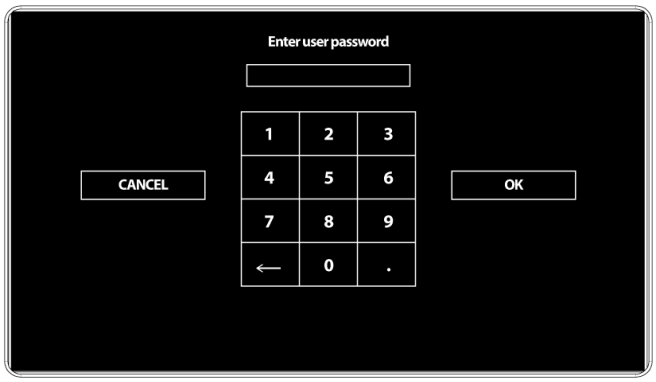


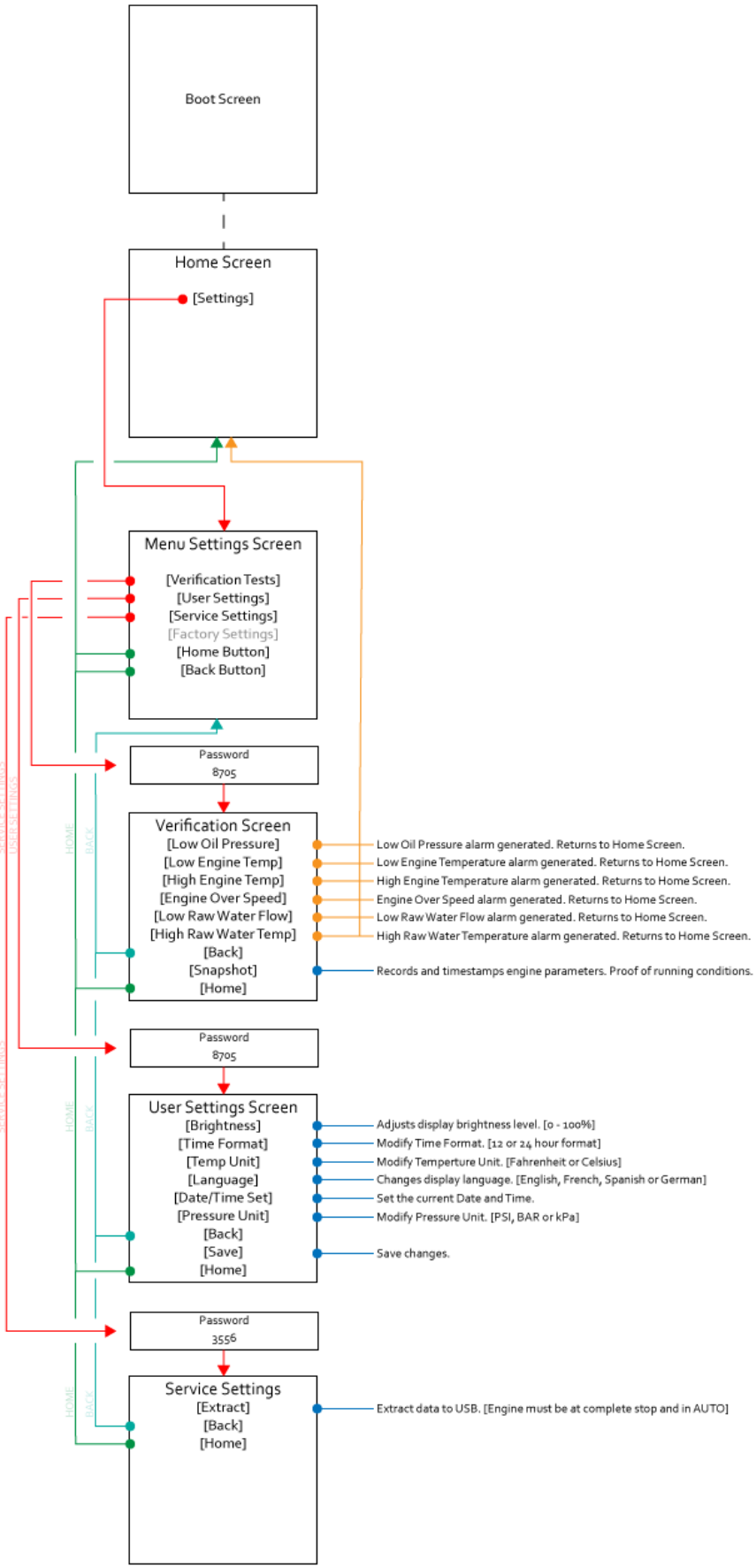

*Figure 3-17*

3.5.1.1. The **Service Settings Screen** (*Figure 3-18)* will display three options; back, home and **Extract**. This feature allows users to extract event log data to a compatible USB storage device. **NOTE:** In order to extract the event log data, the engine rpm must be at 0 RPM, the system mode must be in automatic and the engine run input #1 is deactivated. The screen will display a "Ready" message when the event log data is available to extract. All exported event log files will include the engine serial number in the filename. Refer to section 4.6 for event log data file details.

Compatible USB specifications: super speed USB 3.1 GEN 1 (reference Clarke Fire part number 0C073059)


*Figure 3-18*

## 3.6. Service Settings Menu Navigation Map FOR SERVICE DEALER USE ONLY



# 4. Functions

## 4.1. Operating Instructions

NOTE: This engine is designed to operate at rated load conditions. For testing purposes, the engine can be run at lower load conditions (lower flow). Running times in any one period should not exceed 30 minutes maximum. Before starting the engine make sure of the following:

- The operator has free access to stop the engine in an emergency.
- The pump room ventilation ducts are open, and the engine has good access for air.
- All the guards are in position. If the guards are removed for maintenance or troubleshooting, ensure any rotating parts will be free and clear without restriction.
- Battery covers are in place and there is nothing on top of or touching the engine which is not part of the original supply specification.
- The raw water supply for cooling is available without restriction.

When the engine is running make sure that the coolant temperature, oil pressure and raw water flow and raw water temperature are within limits specified on the relevant Installation & Operation Data Sheet.


*Figure 4-1*

1. Mode Selector Switch
2. Manual Crank #1 Button
3. Manual Crank #2 Button
4. Access Screws

### 4.1.1. Manual Start at the engine.

NOTE: The pump controller mode selector should be in the Off position when starting from the engine panel. Ensure to return the pump controller mode to Auto after completing the manual run.

To manually start the engine with the TSP controls, position the mode selector switch to manual run *(Figure 4-1 item 1)*.

Press and hold the manual crank #1 button *(Figure 4-1 item 2)* until the engine starts, or release after 15 seconds. If the engine fails to start, wait 15 seconds. Press and hold the manual crank #2 button *(Figure 4-1 item 3)* until the engine starts, or release after 15 seconds. Repeat. If the raw water is not flowing or the engine temperature is too high, open the cooling loop bypass manual valves. (applies to heat exchanger cooled engines only).

To stop the engine, position the mode selector switch to automatic / manual stop *(Figure 4-1 item 1)*.

IMPORTANT: Do not leave the mode selector switch in the manual run position during automatic operation. The fire pump controller will be unable to stop the engine and damage may occur.

### 4.1.2. Emergency Run Override Operation (ETR Engines Only)

In the event that the TSP fails to energize the engine's fuel injection pump solenoid, the terminal board is equipped with an emergency run override switch. This switch sends battery voltage directly to the fuel injection pump solenoid which allows for operation of the engine. Additionally, the emergency run switch will activate the cooling loop raw water solenoid (if equipped).

If the engine fails to start with standard starting procedures, follow these steps to start the engine with the emergency run override switch:

- Place the TSP mode selector switch in the Manual Mode. *(Figure 4-1 item 1)*
- Open the TSP door by removing the two access screws. *(Figure 4-1 items 4a & 4b)*
- Locate the emergency run override switch on the TSP terminal board. *(Figure 4-2 item 1)*
- Toggle the emergency run override switch to the on position.
- Press and hold the manual crank #1 button until the engine starts, or release after 15 seconds. If the engine fails to start, wait 15 seconds. Press and hold the manual crank #2 button until the engine starts, or release after 15 seconds. Repeat.
- To shut the engine down, ensure the mode selector switch is set to Auto/Manual Stop, the fire pump controller is keyed to OFF and toggle the emergency run override switch to the OFF position.

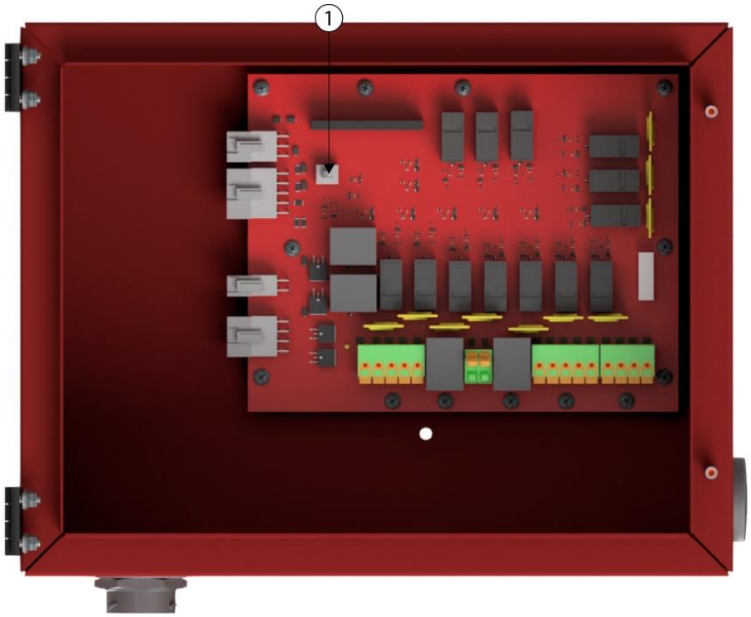



*Figure 4-2*

### 4.1.3. Automatic Start

Ensure the TSP mode selector switch is in the automatic / manual stop position *(Figure 4-1 item 1)*. Follow the pump controller instructions for starting the engine manually or with test features. IMPORTANT: Do not leave the mode selector switch in the manual run position during automatic operation. The fire pump controller will be unable to stop the engine and damage may occur.

## 4.2. Alarm Verification Procedures

For details on menu navigation refer to section 3.

### 4.2.1. Low Engine Coolant Temperature Alarm Verification

- With the engine NOT running (0 RPM), Press the gear icon on the Home Screen.
- Press the Verification Tests button on the Settings Menu Screen.
- Enter 8705 on the Password Screen. Press OK.
- Press "Run Test" for Low Engine Temp.

The display will go to the Home Screen, highlight the engine temperature gauge and display a verification warning message for Low Engine Temperature Alarm. An alarm signal will be sent to the fire pump controller on interconnect terminal #312. The alarm will be active for approximately 30 seconds. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

### 4.2.2. Low Oil Pressure Alarm Verification

- With the TSP in the Automatic Mode, start the engine from the fire pump controller.
- Press the gear icon on the Home Screen.
- Press the Verification Tests button on the Settings Menu Screen.
- Enter 8705 on the Password Screen. Press OK.
- Press "Run Test" for Low Oil Press.

The display will go to the Home Screen, highlight the engine oil pressure gauge and display a verification warning message for Low Oil Pressure Alarm. An alarm signal will be sent to the fire pump controller on interconnect terminal #4. The alarm will be active for approximately 30 seconds. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

### 4.2.3. High Engine Temperature Alarm Verification

- With the TSP in the Automatic Mode, start the engine from the fire pump controller.
- Press the gear icon on the Home Screen.
- Press the Verification Tests button on the Settings Menu Screen.
- Enter 8705 on the Password Screen. Press OK.
- Press "Run Test" for High Engine Temp.

The display will go to the Home Screen, highlight the engine temperature gauge and display a verification warning message for High Engine Temperature Alarm. An alarm signal will be sent to the fire pump controller on interconnect terminal #5. The alarm will be active for approximately 30 seconds. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

### 4.2.4. Over Speed Alarm Verification

- With the TSP in the Automatic Mode, start the engine from the fire pump controller.
- Press the gear icon on the Home Screen.
- Press the Verification Tests button on the Settings Menu Screen.
- Enter 8705 on the Password Screen. Press OK.
- Press "Run Test" for Engine Over Speed.

The display will go to the Home Screen, highlight the tachometer and display a verification warning message for Over Speed Alarm. The engine will shut down and remain locked out from re-starting. An alarm signal will be sent to the fire pump controller on interconnect terminal #3. Press the Over Speed Reset Button *(Figure 4-3)* on the home screen to return the engine to normal function. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

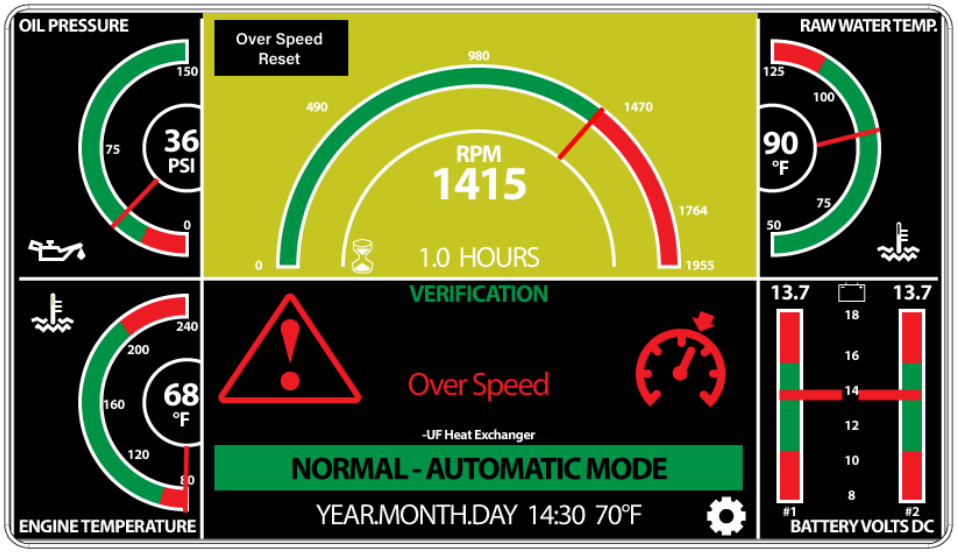



*Figure 4-3*

### 4.2.5. Low Raw Water Flow Alarm Verification

- With the TSP in the Automatic Mode, start the engine from the fire pump controller.
- Press the gear icon on the Home Screen.
- Press the Verification Tests button on the Settings Menu Screen.
- Enter 8705 on the Password Screen. Press OK.
- Press "Run Test" for Low Raw Water Flow.

The display will go to the Home Screen and display a verification warning message for Low Raw Water Flow Alarm. An alarm signal will be sent to the fire pump controller on interconnect terminal #311. The alarm will be active for approximately 30 seconds. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

### 4.2.6. High Raw Water Temperature Alarm Verification

- With the TSP in the Automatic Mode, start the engine from the fire pump controller.
- Press the gear icon on the Home Screen.
- Press the Verification Tests button on the Settings Menu Screen.
- Enter 8705 on the Password Screen. Press OK.
- Press "Run Test" for High Raw Water Temp.

The display will go to the Home Screen, highlight the raw water temperature gauge and display a verification warning message for High Raw Water Temperature Alarm. An alarm signal will be sent to the fire pump controller on interconnect terminal #310. The alarm will be active for approximately 30 seconds. Follow the pump manufacturer's instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.)

### 4.2.7. Over-crank Test (Fail to Start)

NOTE: Never shut off the fuel supply to the engine to prevent it from starting. Shutting off the fuel supply will cause an air lock condition in the fuel system and possibly cause fuel system component damage.

- [ETS] Use the manual stop override to prevent the engine from starting during the cycle-crank testing. Override must be held continuously each time the engine attempts a crank start. This will allow the engine to crank only but will prevent it from running.
- [ETR] Disconnect the J3 wiring connector (refer to 6.4 item 4) on the TSP terminal board. The J3 wiring connector must be disconnected during the entire crank cycle. IMPORTANT: Reconnect the J3 wiring connector after completion of over-crank test.

### 4.2.8. Fuel Injection Malfunction (Low Fuel Pressure) (KA4H Engine Model Only)

- With the TSP in the Automatic Mode, start the engine from the fire pump controller.
- Disconnect "J3" wiring connector (blue and purple wires) inside engine panel. This will de-energize and simulate failure of electric fuel transfer pump.

The Home Screen will display Fuel Injection and an alarm signal will be sent to the fire pump controller on interconnect terminal #302.

Reconnect J3 wiring connector after completion of test. Follow manufacturer's instructions to reset the main fire pump controller and re-instate normal operation of engine and controller. Typically, this involves switching the selector switch to OFF.

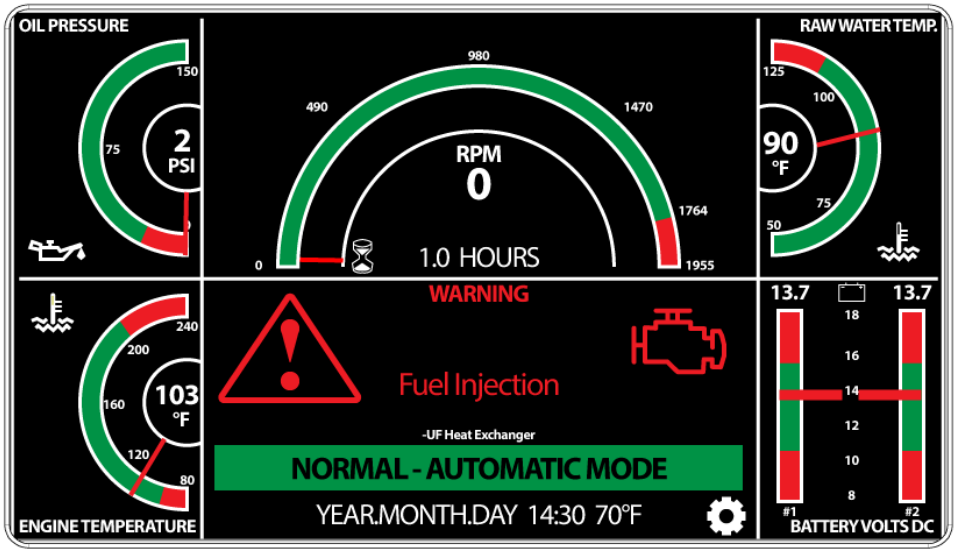



*Figure 4-4*

### 4.2.9. Snapshot Feature

- After all six alarm verifications have been performed and with the TSP in the Automatic Mode, start the engine from the fire pump controller.
- Press the gear icon on the Home Screen.
- Press the Verification Tests button on the Settings Menu Screen
- Enter 8705 on the Password Screen. Press OK.
- Press the Snapshot icon at the bottom of the Verification Tests Screen.

The Snapshot will record and timestamp engine parameters as proof of running conditions during the verification tests. The initial snapshot will change the icon from black to white.

## 4.3. Raw Water Solenoid Time Delay

Following an engine shutdown sequence, the raw water solenoid will remain energized for 60 seconds [standard factory setting] to allow raw water to flow through the heat exchanger and reduce the *heat soak* rise caused in the engine.

## 4.4. Display Behaviors

4.4.1. **Sleep** – The display will sleep when the engine is in standby and there have been no touches for 300 seconds.

4.4.2. **Alarm wakeup** – The display will wake up for 3 seconds every 60 seconds if there are any active alarms while the display is sleeping.

4.4.3. **Display wakeup input delay** – The display will not respond to touches for 0.5 seconds to prevent accidental inputs.

4.4.4. **Panel Status LED –** refer to section 2.3 for more information.

| | |
|---|---|
| Not Illuminated | System is not energized. |
| Breathing | Engine is connected to the controller. Display sleeping. |
| Continuous | Engine is ready for testing. Normal Operation. Display on. |
| Flashing Rapidly | Indicates an engine alarm condition. |

## 4.5. KA Engine Fuel Priming

KA engine models may require operators to bleed air from the fuel system. Loosen the air bleed vent screw on the fuel injection pump. Press and hold the "fuel prime" button on the TSP home screen (located above the tachometer. *Figure 4-4)* to activate the electronic fuel transfer pump. Releasing the button will deactivate the transfer pump. After air is vented, tighten the vent screw securely. Start the engine and check for leaks.

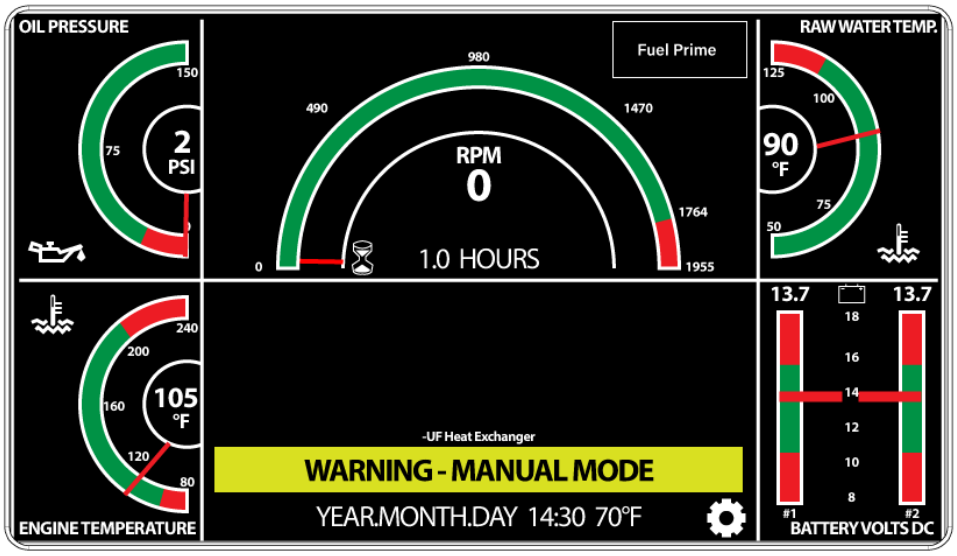



*Figure 4-4*

## 4.6. Retrofitting TSP to Compatible Mechanical Engine.

Refer to Clarke Fire Document 0C138518 (ClarkeFire.com/TSPretrofit)

## 4.7. Data Logs

Navigating to the Settings Menu Screen and selecting **Service Settings** will send the display to the Service Settings Password Screen. Enter 3 5 5 6 and press OK. The **Service Settings Screen** will display three options; back, home and **Extract**. This feature allows users to extract event log data to a compatible USB storage device. **NOTE:** In order to extract the event log data, the engine rpm must be at 0 RPM, the system mode must be in automatic and the engine run input #1 is deactivated. The screen will display a "Ready" message when the event log data is available to extract. All exported event log files will include the engine serial number in the filename. Compatible USB specifications: super speed USB 3.1 GEN 1 (reference Clarke Fire part number 0C073059).

**NOTE:** The date and time will be reset to the default (2020 NOV 30 / 10:40) upon loss of DC power.

4.7.1. **Event Log** – Records and timestamps configuration change events related to user settings and factory settings. (500 Entry Limit) Reference Figure 4-5

4.7.2. **Manual Log** – Records and timestamps engine parameters and alarm statuses when the snapshot feature is activated during engine startup inspection. The snapshot data will serve as proof of engine running conditions during commissioning. (reference menu navigation section X.3.1.7). This data needs to be recorded on the startup inspection form. Reference Figure 4-5

4.7.3. **Performance Log** – Records and timestamps engine parameters every 30 seconds, during an automatic or manual run event, to provide an overview of engine performance history. (1000 Entry Limit) Reference Figure 4-5

**Event Log, Manual log, and Performance data files include**: Event Number, Date and time, Ambient temperature, Screen action, Battery 1 voltage, Battery 2 voltage, Engine speed, Engine temperature, Oil pressure, Raw water temperature, Raw water flow, Engine run (#1), Crank disconnect alarm (#2), Over speed alarm (#3), Low oil pressure alarm (#4), High engine temperature alarm (#5), Crank 1 (#9), Crank 2 (#10), Engine stop (#12), Fuel injection alarm (#302), High raw water temperature alarm (#310), Low raw water flow alarm (#311), Low engine temperature alarm (#312), Engine state, System mode.

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Number | Date and time | Ambient t | Screen act | Battery 1 v | Battery 2 v | Engine spi | Engine tei | Oil pressu | Raw wate | Raw wate | Engine rui | Crank disc | Over spee | Low oil pr | High engi | Crank 1 (# | Crank 2 (# | Engine stc | Fuel injec | High raw v | Low raw v | Low engir | Engine sta | System mode |
| 2 | 1 | 11/30/2020 10:40 | 70 | none | 14.01 | 14.05 | 2325 | 1159 | 2 | 1159 | 65519 | off | on | on | on | off | off | off | off | off | off | on | off | on | on |
| 3 | 2 | 11/30/2020 10:41 | 76 | factory se | 14.03 | 14.07 | 1860 | 1159 | 2 | 1159 | 65519 | off | on | on | on | off | off | off | off | off | off | on | off | on | on |
| 4 | 3 | 11/30/2020 10:40 | 32 | none | 0 | 0 | 0 | 32 | 0 | 32 | 0 | off | off | off | off | off | off | off | off | off | off | off | off | off | on |
| 5 | 4 | 11/30/2020 10:40 | 68 | none | 12.93 | 0 | 0 | 1159 | 2 | 1159 | 65517 | off | off | off | on | off | off | off | off | off | off | off | off | off | off |
| 6 | 5 | 11/30/2020 10:40 | 71 | factory se | 12.96 | 0 | 0 | 1159 | 2 | 1159 | 65518 | off | off | off | on | off | off | off | off | off | off | off | off | off | off |
| 7 | 6 | 11/30/2020 10:41 | 73 | none | 12.96 | 0 | 0 | 1159 | 2 | 1159 | 65518 | off | off | off | on | off | off | off | off | off | off | off | on | off | off |
| 8 | 7 | 11/30/2020 10:45 | 86 | factory se | 12.97 | 0 | 0 | 1159 | 2 | 1159 | 65516 | off | off | off | on | off | off | off | off | off | off | off | on | off | off |
| 9 | 8 | 11/30/2020 10:46 | 87 | none | 12.97 | 0 | 0 | 1159 | 2 | 1159 | 65516 | off | off | off | on | off | off | off | off | off | off | off | on | off | on |
| 10 | 9 | 11/30/2020 10:46 | 87 | none | 12.96 | 0 | 0 | 1159 | 2 | 1159 | 65517 | off | off | off | on | off | off | off | off | off | off | off | on | off | off |

*Figure 4-5*

4.7.4. **Verification Log** - Records and timestamps alarm verification events. (10 Entry Limit per verification type) Reference Figure 4-6

**Verification data files include**: Event Type, Event Number, Date and time, Ambient temperature.

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Type | Number | Date and time | Ambient temperature | | | | | | | | | | | | | | | | | | | | |
| 2 | Overspeed | 1 | 2022-02-30 10:45:48 | 86 | | | | | | | | | | | | | | | | | | | | |
| 3 | Low oil pres | 1 | 2022-02-30 10:42:02 | 78 | | | | | | | | | | | | | | | | | | | | |
| 4 | High enging temp | 1 | 2022-02-30 10:42:49 | 80 | | | | | | | | | | | | | | | | | | | | |
| 5 | High raw water temp | 1 | 2022-02-30 10:44:11 | 84 | | | | | | | | | | | | | | | | | | | | |
| 6 | High raw water temp | 2 | 2022-02-30 10:45:15 | 86 | | | | | | | | | | | | | | | | | | | | |
| 7 | Low raw water pres | 1 | 2022-02-30 10:43:20 | 82 | | | | | | | | | | | | | | | | | | | | |
| 8 | Low engine temp | 1 | 11/30/2020 10:41 | 76 | | | | | | | | | | | | | | | | | | | | |
| 9 | Low engine temp | 2 | 11/30/2020 10:46 | 87 | | | | | | | | | | | | | | | | | | | | |
| 10 | Low engine temp | 3 | 2022-02-30 11:13:54 | 93 | | | | | | | | | | | | | | | | | | | | |

*Figure 4-6*

# 5. Troubleshooting

## 5.1. Low Raw Water Flow Alarm

### 5.1.1. Low Raw Water Flow Alarm Theory of Operation

5.1.1.1. Low Raw Water Flow Alarm Condition - The engine utilizes two (0-60 psi) pressure transducers to monitor the raw water flow. The first pressure transducer (high input) is in the automatic line of the cooling loop after the pressure regulator. The second pressure transducer (low input) is located on the heat exchanger discharge. The TSP energizes the transducers with a 5 VDC excitation signal. The pressure sensors will return a 0.5 to 4.5 VDC signal depending on the pressure. (0.5 VDC equals 0 psi and 4.5 VDC equals 60 psi). The TSP configuration will be calibrated to the appropriate settings to account for the cooling loop size, engine model and engine speed. The selected configuration will determine what transducer signal values are acceptable.

5.1.1.2. No Flow Alarm Condition – In the event that the raw water flow is restricted after the first transducer (high input), the TSP raw water flow calculation will recognize 0 psi on the second transducer (low input) and the Low Raw Water Flow Alarm will be activated on basis of a no flow condition.

5.1.1.3. Low Raw Water Flow Alarm Reset – The Low Raw Water Flow Alarm will reset when the required raw water flow is within the minimum and maximum percentage for 2 seconds.

### 5.1.2. Low Raw Water Flow Alarm Circuit

5.1.2.1. Cooling Loop Pressure Transducer (High Input) signal return wire 23 connects to TSP engine harness connector pin 23. The internal circuit of TSP engine harness connector pin 23 connects to the TSP control board terminal J4 pin 11. Measuring DC voltage, the signal return should be between 0.5 and 4 VDC.

5.1.2.2. Heat Exchanger Outlet Pressure Transducer (Low Input) signal return wire 24 connects to TSP engine harness connector pin 24. The internal circuit of TSP engine harness connector pin 24 connects to the TSP control board terminal J4 pin 12. Measuring DC voltage, the signal return should be between 0.5 and 4 VDC.

5.1.2.3. Pressure Transducers Excitation wire 18 connects to TSP engine harness connector pin 18. The internal circuit of TSP engine harness connector pin 18 connects to the TSP control board terminal J4 pin 1. Measuring DC voltage, the excitation to the transducers should be 5 VDC.

## 5.2. High Raw Water Temperature Alarm

### 5.2.1. High Raw Water Temperature Alarm Theory of Operation

5.2.1.1. High Raw Water Temperature Alarm Activation- The High Raw Water Temperature Alarm utilizes a single temperature sensor to monitor the raw water temperature. The sensor receives a 5 VDC excitation from the TSP controller board and returns a signal between 0.5 and 4.5 VDC. The High Raw Water Temperature Alarm will be activated when the raw water temperature exceeds the factory alarm setpoint (standard 105°F) for 30 seconds (standard time delay setting).

5.2.1.2. High Raw Water Temperature Alarm Reset – The High Raw Water Temperature Alarm will reset when the raw water temperature is below the configured alarm setpoint for 2 seconds.

### 5.2.2. High Raw Water Temperature Alarm Circuit

5.2.2.1. High Raw Water Temperature Sensor signal return wire 29 connects to TSP engine harness connector pin 29. The internal circuit of TSP engine harness connector pin 29 connects to the TSP control board terminal J4 pin 6. Measuring DC voltage, the signal return should be between 0.5 and 4.5 VDC.

5.2.2.2. High Raw Water Temperature Sensor Excitation wire 18 connects to TSP engine harness connector pin 18. The internal circuit of TSP engine harness connector pin 18 connects to the TSP control board terminal J4 pin 1. Measuring DC voltage, the excitation to the transducers should be 5 VDC.

## 5.3. Low Oil Pressure Alarm

### 5.3.1. Low Oil Pressure Alarm Theory of Operation

5.3.1.1. Low Oil Pressure Alarm Activation- The Low Oil Pressure Alarm utilizes a single pressure sensor to monitor the engine oil pressure. The sensor receives a 5 VDC excitation from the TSP controller board and returns a signal between 0.5 and 4.5 VDC.

5.3.1.2. Low Oil Pressure Alarm Reset – The Low Oil Pressure Alarm will reset when the engine oil pressure is above the configured alarm setpoint for 2 seconds.

### 5.3.2. Low Oil Pressure Alarm Circuit

5.3.2.1. Oil Pressure Sensor signal return wire 20 connects to TSP engine harness connector pin 20. The internal circuit of TSP engine harness connector pin 20 connects to the TSP control board terminal J4 pin 10. Measuring DC voltage, the signal return should be between 0.5 and 4.5 VDC.

5.3.2.2. **Oil Pressure Sensor Excitation** wire 18 connects to TSP engine harness connector pin 18. The internal circuit of TSP engine harness connector pin 18 connects to the TSP control board terminal J4 pin 1. Measuring DC voltage, the excitation to the transducers should be 5 VDC.

## 5.4. High Engine Temperature Alarm

### 5.4.1. High Engine Temperature Alarm Theory of Operation

5.4.1.1. **High Engine Temperature Alarm Activation**- The High Engine Temperature Alarm utilizes a single temperature sensor to monitor the engine coolant temperature. The sensor receives a 5 VDC excitation from the TSP controller board and returns a signal between 0.5 and 4.5 VDC.

5.4.1.2. **High Engine Temperature Alarm Reset** – The High Engine Temperature Alarm will reset when the engine temperature is below the configured alarm setpoint for 2 seconds.

### 5.4.2. High Engine Temperature Alarm Circuit

5.4.2.1. **Engine Temperature Sensor** signal return wire 27 connects to TSP engine harness connector pin 27. The internal circuit of TSP engine harness connector pin 27 connects to the TSP control board terminal J4 pin 4. Measuring DC voltage, the signal return should be between 0.5 and 4.5 VDC.

5.4.2.2. **Engine Temperature Sensor Excitation** wire 18 connects to TSP engine harness connector pin 18. The internal circuit of TSP engine harness connector pin 18 connects to the TSP control board terminal J4 pin 1. Measuring DC voltage, the excitation to the transducers should be 5 VDC.

## 5.5. PLD Failure

### 5.5.1. PLD Failure Alarm Theory of Operation

5.5.1.1. **PLD Failure Activation-** The PLD Failure Alarm utilizes a normally open 75 PSI pressure switch. If the PLD cylinder pressure exceeds 75 PSI, the pressure switch will close and energize wire 16, engine harness pin 16 to Control Board J4 pin 2. The Control Board will energize J10 pin 5. The PLD three-way solenoid will energize, directing water to drain. The engine will run at rated speed.

5.5.1.2. **PLD Failure Alarm Reset –** Investigate the cause of the PLD failure and make necessary corrections. Press the PLD reset button on the display above the tachometer. *(figure 5-2)*

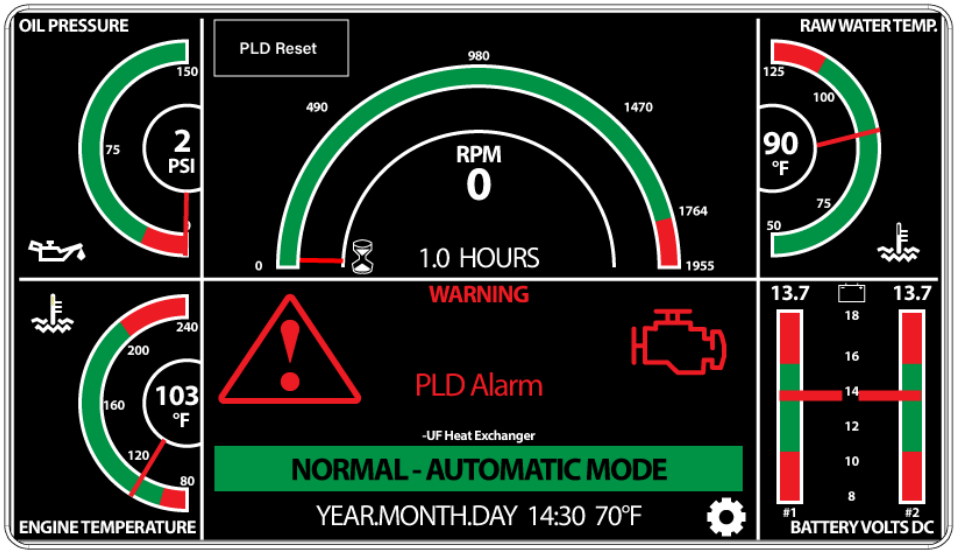



*Figure 5-2*

### 5.5.2. PLD Failure Alarm Circuit

5.5.2.1. **PLD Cylinder Pressure Switch** wire 16 connects to TSP engine harness connector pin 16. The internal circuit of TSP engine harness connector pin 16 connects to the TSP control board terminal J4 pin 2. Measuring DC voltage, wire 16 will be engine system voltage (12 or 24 VDC) when the switch is closed to VBAT wire 9.

5.5.2.2. **PLD Three-way Solenoid** wire 17 connects to TSP harness connector pin 17. The internal circuit of TSP engine harness connector pin 17 connects to the TSP terminal board interconnect terminal PLD (spare). Measuring DC voltage when energized, this circuit will be system voltage (12 or 24 VDC).

## 5.6. Start Circuit #1

5.6.1. Manual Crank Button #1 – (For Manual Mode Operation Only) Terminal Board J5 pin 1 is a voltage output to manual crank button #1. When the manual crank button #1 is pressed, the internal contact will close and send the voltage to terminal board J5 pin 8. Terminal Board J5 pin 8 and pin 9 are *common* to each other internal to the board. Terminal Board J5 pin 9 will energize start contactor #1 (see 5.6.3).

5.6.2. Automatic Mode Interconnect Terminal #9 – (For Automatic Mode Operation Only) In Automatic mode, the pump controller will energize interconnect terminal #9 and the TSP terminal board will relay this voltage to J5 pin 9, engine harness connector pin 15 to the start contactor coil.

5.6.3. Start Contactor #1 – The start contactor coil is energized by wire 15, engine harness connector pin 15 via terminal board connector J5 pin 9. When the contactor coil is energized, the starter contactor closes and will supply battery voltage to the starter.

## 5.7. Start Circuit #2

5.7.1. Manual Crank Button #2 – (For Manual Mode Operation Only) Terminal Board J5 pin 6 is a voltage output to manual crank button #1. When the manual crank button #2 is pressed, the internal contact will close and send the voltage to terminal board J5 pin 10. Terminal Board J5 pin 10 and pin 5 are *common* to each other internal to the board. Terminal Board J5 pin 5 will energize start contactor #2 (see 5.7.3).

5.7.2. Automatic Mode Interconnect Terminal #10 – (For Automatic Mode Operation Only) In Automatic mode, the pump controller will energize interconnect terminal #10 and the TSP terminal board will relay this voltage to J5 pin 5, engine harness connector pin 14 to the start contactor coil.

5.7.3. Start Contactor #2 – The start contactor coil is energized by wire 14, engine harness connector pin 14 via terminal board connector J5 pin 14. When the contactor coil is energized, the starter contactor closes and will supply battery voltage to the starter.

## 5.8. Engine Speed Sensor

5.8.1. Noise Ground – Control Board J4 pin 9, engine harness connector pin 13 is a drain wire responsible for filtering out ambient noise.

5.8.2. Ground – Control Board J4 pin 8, engine harness connector pin 12 is the ground connection for the speed sensing circuit.

5.8.3. Magnetic Pickup – Control Board J4 pin 5, engine harness connector pin 11 is the sine wave signal that is interpreted by the TSP control board to compute revolutions per minute (RPM).

## 5.9. ETR Fuel Solenoid

5.9.1. ETR – Terminal Board J3 pin 2, engine harness connector pin 5

## 5.10. ETS Fuel Solenoid (JU, KA)

5.10.1. ETS Hold (+) – Terminal Board J7 pin 4, engine harness connector pin 7

## 5.11. ETS Fuel Solenoid (DP)

5.11.1. ETS Hold (+) – Terminal Board J7 pin 4, engine harness connector pin 7

5.11.2. VBAT – Terminal Board J7 pin 2, engine harness connector pin 9

## 5.12. ETS Fuel Solenoid (DQ, DR, DS, DT)

5.12.1. ETS Hold (-) – Terminal Board J7 pin 3, engine harness connector pin 8

5.12.2. VBAT – Terminal Board J7 pin 2, engine harness connector pin 9

## 5.13. Raw Water Solenoid

5.13.1. Raw Water Solenoid wire 10 connects to TSP engine harness connector pin 10. The internal circuit of TSP engine harness connector pin 10 connects to the TSP control board terminal J7 pin 6. Measuring DC voltage, wire 10 will be engine system voltage (12 or 24 VDC) and energized in the following scenarios:

- TSP is in Manual, Pump controller is OFF.
- TSP is in Auto, Pump controller is in Manual.
- TSP is in Auto, Pump controller is in Auto and there is a call to start.
- Following an engine shutdown sequence for 60 seconds [standard setting for water solenoid time delay]. For more info refer to

## 5.14. KA Fuel Transfer Pump

5.14.1. Fuel Transfer Pump wire 5 connects to TSP engine harness connector pin 5. The internal circuit of TSP engine harness connector pin 5 connects to the TSP terminal board terminal J3 pin 2. Measuring DC voltage wire 5 will be engine system voltage (12 or 24 VDC) and energized when the ETR signal is on.

5.14.2. Timing advance solenoid wire 5 connects to TSP engine harness connector pin 5. The internal circuit of TSP engine harness connector pin 5 connects to the TSP terminal board terminal J3 pin 2. Measuring DC voltage wire 5 will be engine system voltage (12 or 24 VDC) and energized when the ETR signal is on. The timing advance solenoid de-energizes when the engine temperature reaches operating temperature (>165°F / 74°C) from open ground circuit via timing advance switch.

5.14.3. Timing advance switch [0C072543] is a normally closed switch providing a ground to the timing advanced solenoid. The timing advance switch will open when the engine reaches operating temperature (> 165°F / 74°C) breaking the timing advance solenoid's path to ground and cause the solenoid to de-energize.

## 5.15. KA Fuel Pressure Switch

5.15.1. Fuel Pressure Switch [0C072521] is a normally closed 5 PSI pressure switch providing a ground path on wire 19 to TSP engine harness connector pin 19. The internal circuit of TSP engine harness connector pin 19 connects to the TSP control board terminal J4 pin 3. When fuel pressure is above 5 PSI the pressure switch will be open and the *low fuel pressure* alarm will be inactive.

## 5.16. LED indicators.

5.16.1. LED 8, labelled **#1** is an indicator for the fire pump controller interconnect terminal 1.
Turns on when: The fire pump controller energizes interconnect terminal 1.
Action: [the fire pump controller is set to Manual] OR [the fire pump controller is set to Auto and a command to start via pressure drop occurs].
Turns off when: The fire pump controller de-energizes interconnect terminal 1.
Action: [the fire pump controller is set to shut down the engine via Manual/Off/Auto or Stop button].
Circuit involved: Terminal Board interconnect terminal 1

5.16.2. LED 16, labelled **#2** is an indicator for the fire pump controller interconnect terminal 2.
Turns on when: The TSP energizes interconnect terminal 2 for the *engine run signal*.
Action: The engine speed exceeds 1000 rpm.
Turns off when: The TSP de-energizes interconnect terminal 2.
Action: The engine speed falls below 1000 rpm during shutdown.
Circuit involved: Terminal Board interconnect terminal 2

5.16.3. LED 17, labelled **#3** is an indicator for the fire pump controller interconnect terminal 3.
Turns on when: The TSP energizes interconnect terminal 3 for the *engine over speed*.
Action: The engine speed exceeds the over speed trip point.
Turns off when: The TSP de-energizes interconnect terminal 3.
Action: Overspeed is reset and normal operation is reinstated.
Circuit involved: Terminal Board interconnect terminal 3

5.16.4. LED 19, labelled **#4** is an indicator for the fire pump controller interconnect terminal 4.
Turns on when: The TSP energizes interconnect terminal 4 for the *low oil pressure alarm*.
Action: The engine is running, and the oil pressure is below the alarm trip point.
Turns off when: The TSP de-energizes interconnect terminal 4.
Action: The engine oil pressure normalizes (or the engine is off).
Circuit involved: Terminal Board interconnect terminal 4

5.16.5. LED 23, labelled **#5** is an indicator for the fire pump controller interconnect terminal 5.
Turns on when: The TSP energizes interconnect terminal 5 for the *high engine temperature alarm*.
Action: The engine is running, and the coolant temperature exceeds the alarm trip point.
Turns off when: The TSP de-energizes interconnect terminal 5.
Action: The engine coolant temperature normalizes (or the engine is off).
Circuit involved: Terminal Board interconnect terminal 5

5.16.6. LED 6, labelled **#9** is an indicator for the fire pump controller interconnect terminal 9.
Turns on when: The fire pump controller energizes interconnect terminal 9 for *start circuit starter #1*.
Action: [the fire pump controller is set to Manual and an operator presses the manual crank #1 button on the pump controller] OR [the fire pump controller is set to Auto and a command to start via pressure drop occurs] The fire pump controller will energize interconnect terminal 9.
Turns off when: The fire pump controller de-energizes interconnect terminal 9
Action: [The fire pump controller receives an engine run signal] or [the fire pump controller cranks for 15 seconds, it will rest for 15 seconds.]
Circuit involved: Terminal Board interconnect terminal 9.

5.16.7. LED 10, labelled #10 is an indicator for the fire pump controller interconnect terminal 10.
Turns on when: The fire pump controller energizes interconnect terminal 10 for *start circuit starter #2*.
Action: [the fire pump controller is set to Manual and an operator presses the manual crank #1 button on the pump controller] OR [the fire pump controller is set to Auto and a command to start via pressure drop occurs] The fire pump controller will energize interconnect terminal 9.
Turns off when: The fire pump controller de-energizes interconnect terminal 9
Action: [The fire pump controller receives an engine run signal] or [the fire pump controller cranks for 15 seconds, it will rest for 15 seconds.]
Circuit involved: Terminal Board interconnect terminal 10.

5.16.8. LED 9, labelled #12 is an indicator for the fire pump controller interconnect terminal 12.
Turns on when: The engine is running and, the fire pump controller energizes interconnect terminal 12 for *energized to stop fuel solenoid*.
Action: The fire pump controller is set to shut the engine down via MANUAL/OFF/AUTO selector switch OR stop button.
Turns off when: The fire pump controller de-energizes interconnect terminal 12.
Action:
Circuit involved: Terminal Board interconnect terminal 12.

5.16.9. LED 24, labelled #302 is an indicator for the fire pump controller interconnect terminal 302.
Turns on when: The TSP energizes interconnect terminal 302 for the *fuel injection malfunction (KA engine model low fuel pressure)*.
Action: (KA engine model only) Engine running and Fuel pressure switch closes (5 PSI or below), grounding control board J4 pin 3.
Turns off when: The TSP de-energizes interconnect terminal 302.
Action: Fuel pressure switch opens (above 5 PSI), breaking path to ground to control board J4 pin 3.
Circuit involved: Fuel Pressure Switch wire 19 to engine harness connector pin 19 to Control Board J4 pin 3. Terminal Board interconnect terminal 302.

5.16.10. LED 20, labelled #310 is an indicator for the fire pump controller interconnect terminal 310.
Turns on when: The TSP energizes interconnect terminal 310 for the *high raw water temperature alarm*.
Action: The engine is running, and the temperature of the cooling loop raw water exceeds the high raw water alarm setpoint.
Turns off when: The TSP de-energizes interconnect terminal 310.
Action: The temperature of the cooling loop raw water normalizes (or the engine is off).
Circuit involved: Terminal Board interconnect terminal 310.

5.16.11. LED 21, labelled #311 is an indicator for the fire pump controller interconnect terminal 311.
Turns on when: The TSP energizes interconnect terminal 311 for the *low raw water flow alarm*.
Action: The engine is running and, the flow of the cooling loop raw water falls below the low raw water flow alarm setpoint. See section 5.1 for more details.
Turns off when: The TSP de-energizes interconnect terminal 311.
Action: The flow of the cooling loop raw water normalizes (or the engine is off).
Circuit involved: Terminal Board interconnect terminal 311.

5.16.12. LED 22, labelled #312 is an indicator for the fire pump controller interconnect terminal 312.
Turns on when: The TSP energizes interconnect terminal 312 for the *low engine temperature alarm*.
Action: The engine is off and, the engine temperature falls below the low engine temperature alarm setpoint for one hour (or specified time setting).
Turns off when: The TSP de-energizes interconnect terminal 312.
Action: The engine temperature normalizes (or the engine is running).
Circuit involved: Terminal Board interconnect terminal 312.

5.16.13. LED 15, is an indicator for ETS Pull +.
Turns on when: The engine is running and is commanded to be shut down.
Action: Shutdown mode occurs when [the TSP mode selector switch is set to Auto / Manual Stop] & [the fire pump controller is set to shut down the engine via Manual/Off/Auto or Stop button]. The fire pump controller will de-energize interconnect terminal 1 and energize interconnect terminal 12.
Turns off when: The engine is running and is commanded to be shut down.
Action: Shutdown mode occurs when [the TSP mode selector switch is set to Auto / Manual Stop] & [the fire pump controller is set to shut down the engine via Manual/Off/Auto or Stop button]. The fire pump controller will de-energize interconnect terminal 1 and energize interconnect terminal 12.
Circuit involved: TSP terminal board connector J7 pin 4 to TSP bulkhead connector pin 7.

5.16.14. LED 14, is an indicator for ETR.
Turns on when: The engine is commanded to be run or is running.
Action: Commanded to be run or is running occurs when [the TSP mode selector switch is set to Manual Run] OR [the fire pump controller is set to Manual] OR [the fire pump controller is set to Auto and a command to start via pressure drop occurs] The fire pump controller will energize interconnect terminal 1.
Turns off when: The engine is running and is commanded to be shut down.
Action: Shutdown mode occurs when [the TSP mode selector switch is set to Auto / Manual Stop] & [the fire pump controller is set to shut down the engine via Manual/Off/Auto or Stop button]. The fire pump controller will de-energize interconnect terminal 1 and energize interconnect terminal 12.
Circuit Involved: TSP terminal board connector J3 pin 2 to TSP bulkhead connector pin 5.

5.16.15. LED 13, is an indicator for Raw Water Excite.
Turns on when: The engine is commanded to be run or is running.
Action: Commanded to be run or is running occurs when [the TSP mode selector switch is set to Manual Run] OR [the fire pump controller is set to Manual] OR [the fire pump controller is set to Auto and a command to start via pressure drop occurs] The fire pump controller will energize interconnect terminal 1.
Turns off when: 60 seconds after the engine has come to a complete stop. (Keeping the raw water flowing after engine shutdown aids in extracting heat from the engine.)
Circuit Involved: TSP terminal board connector J3 pin 2 to TSP bulkhead connector pin 5.

5.16.16. LED 12 and LED 25, are indicators for ETS Hold + and ETS Hold -.
Turns on when: The engine is running and is commanded to be shut down.
Action: Shutdown mode occurs when [the TSP mode selector switch is set to Auto / Manual Stop] & [the fire pump controller is set to shut down the engine via Manual/Off/Auto or Stop button]. The fire pump controller will de-energize interconnect terminal 1 and energize interconnect terminal 12.
Turns off when: Directly after the shutdown sequence.
Action: 12 seconds (standard setting) after the shutdown sequence begins.
Circuits involved:
(LED 12, ETS Hold+) TSP terminal board connector J7 pin 4 to TSP bulkhead connector pin 7.
(LED 25, ETS Hold-) TSP terminal board connector J7 pin 3 to TSP bulkhead connector pin 8.

5.16.17. LED 11, is an indicator for Manual Mode Select.

Turns on when: The TSP mode selector switch is set to Manual Run.

Turns off when: The TSP mode selector switch is set to Auto/Manual Stop.

Circuit Involved: Brown wire from TSP mode selector switch to TSP terminal board connector J5 pin 4.

5.16.18. LED 18, is an indicator for PLD 3 Way.

Turns on when: (For -P1 PLD engines only) The PLD pressure switch activates for excessive PLD pressure.

Action: If the pressure in the PLD cylinder exceeds 75 psi, a PLD failure will occur, the 3-way valve will be energized and direct the water to drain.

Turns off when: The PLD pressure switch is de-activated.

Action: The PLD reset switch is selected on the display and the PLD pressure has normalized.

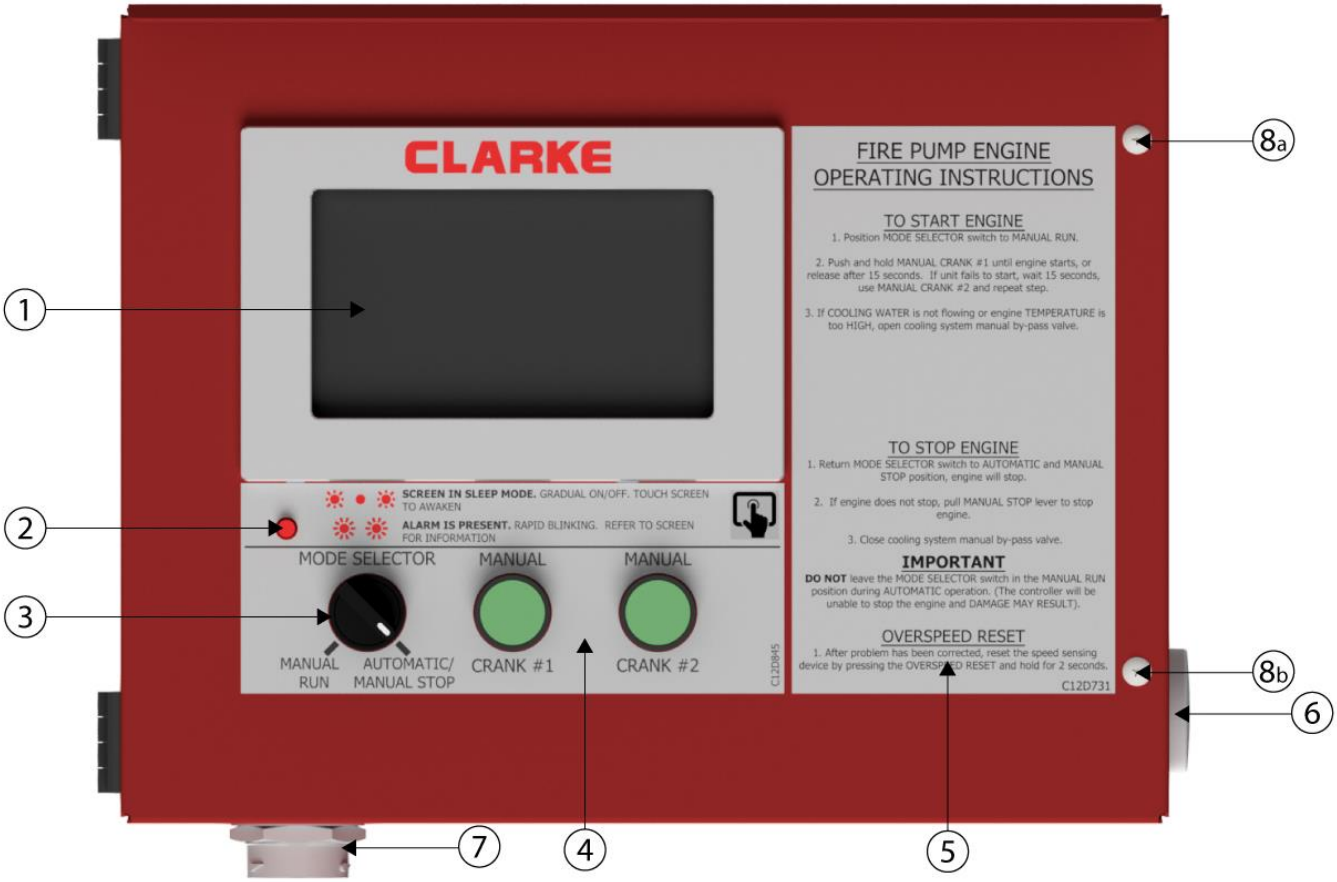
Circuit Involved: wire at TSP bulkhead connector pin 17 to "PLD" terminal block.

## 5.17. Data Log Extraction Error

In order to extract the event log data, the engine rpm must be at 0 RPM, the system mode must be in automatic and the engine run input #1 is deactivated. The screen will display a "Ready" message when the event log data is available to extract. All exported event log files will include the engine serial number in the filename. Compatible USB specifications: super speed USB 3.1 GEN 1 (reference Clarke Fire part number 0C073059).

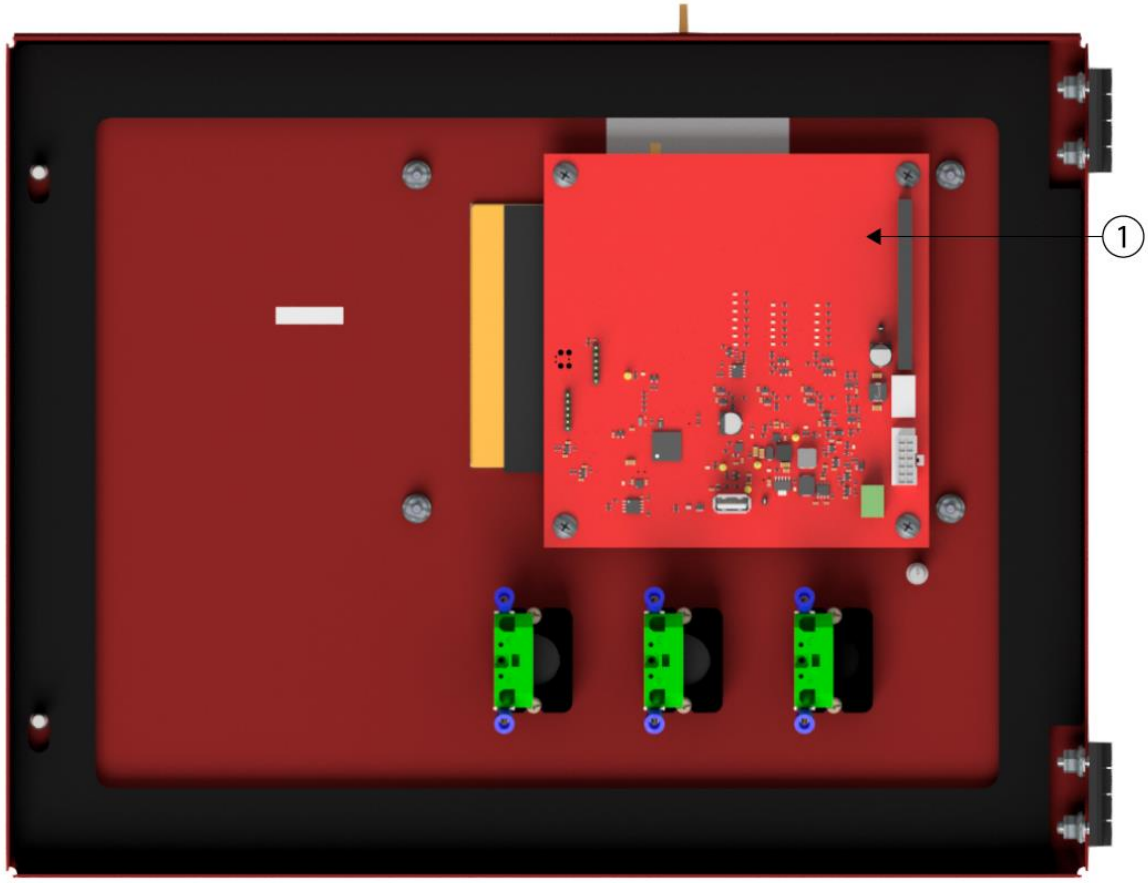
# 6. Appendix

## 6.1. TSP Interface



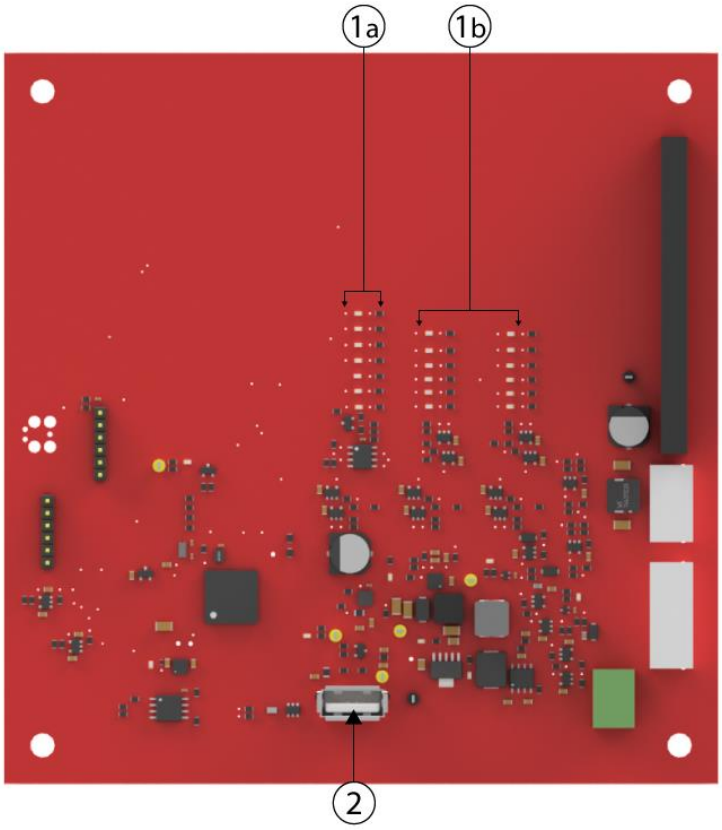

1. TSP Display
2. Panel Status LED
3. Mode Selector Switch
4. Manual Crank Buttons
5. Operating Instructions Label
6. Interconnect Wiring Service Entrance
7. Engine Harness Connector
8. Access Screws

## 6.2. TSP Door Interior



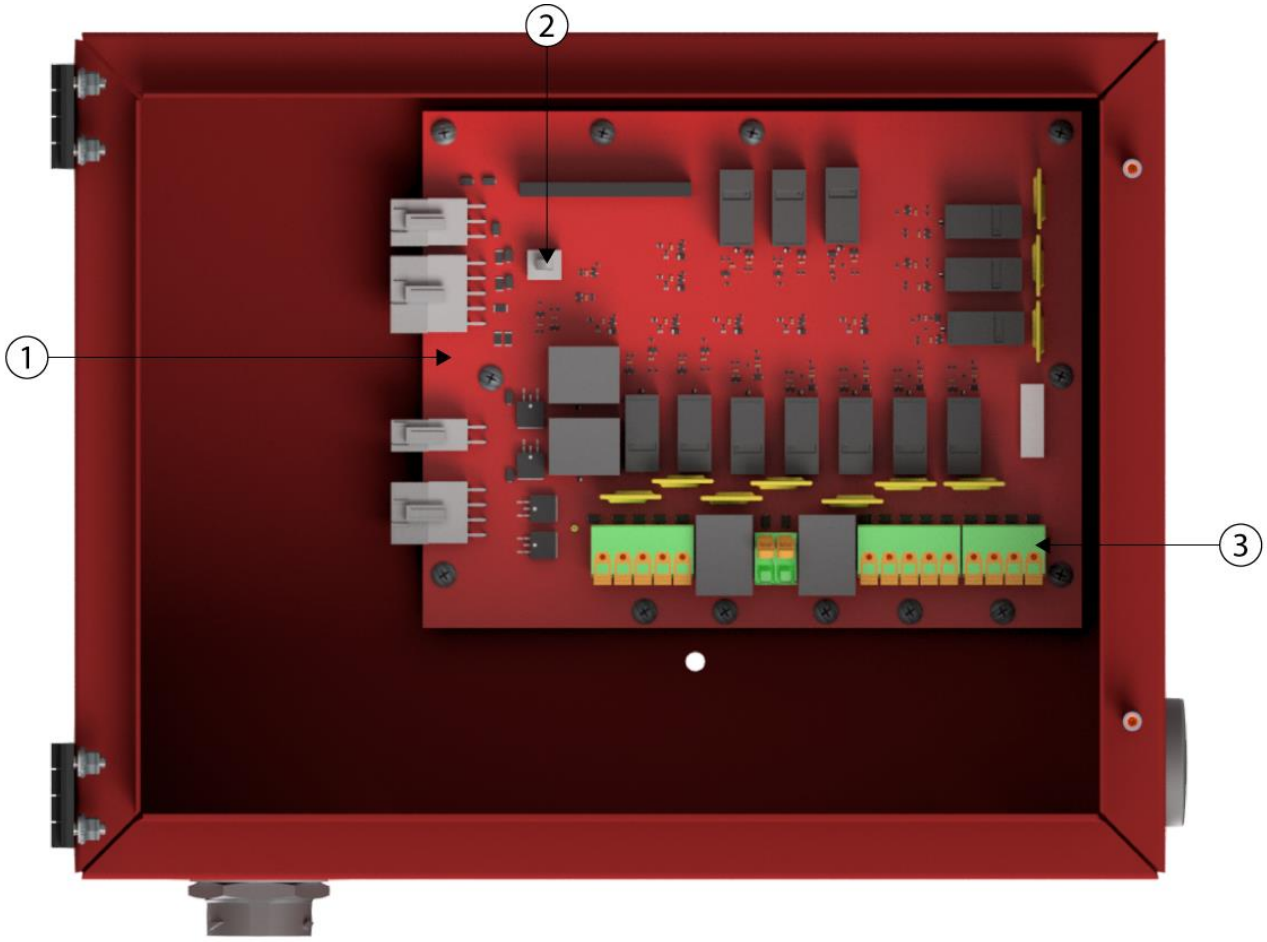

1. TSP Control Board

## 6.3. TSP Control Board



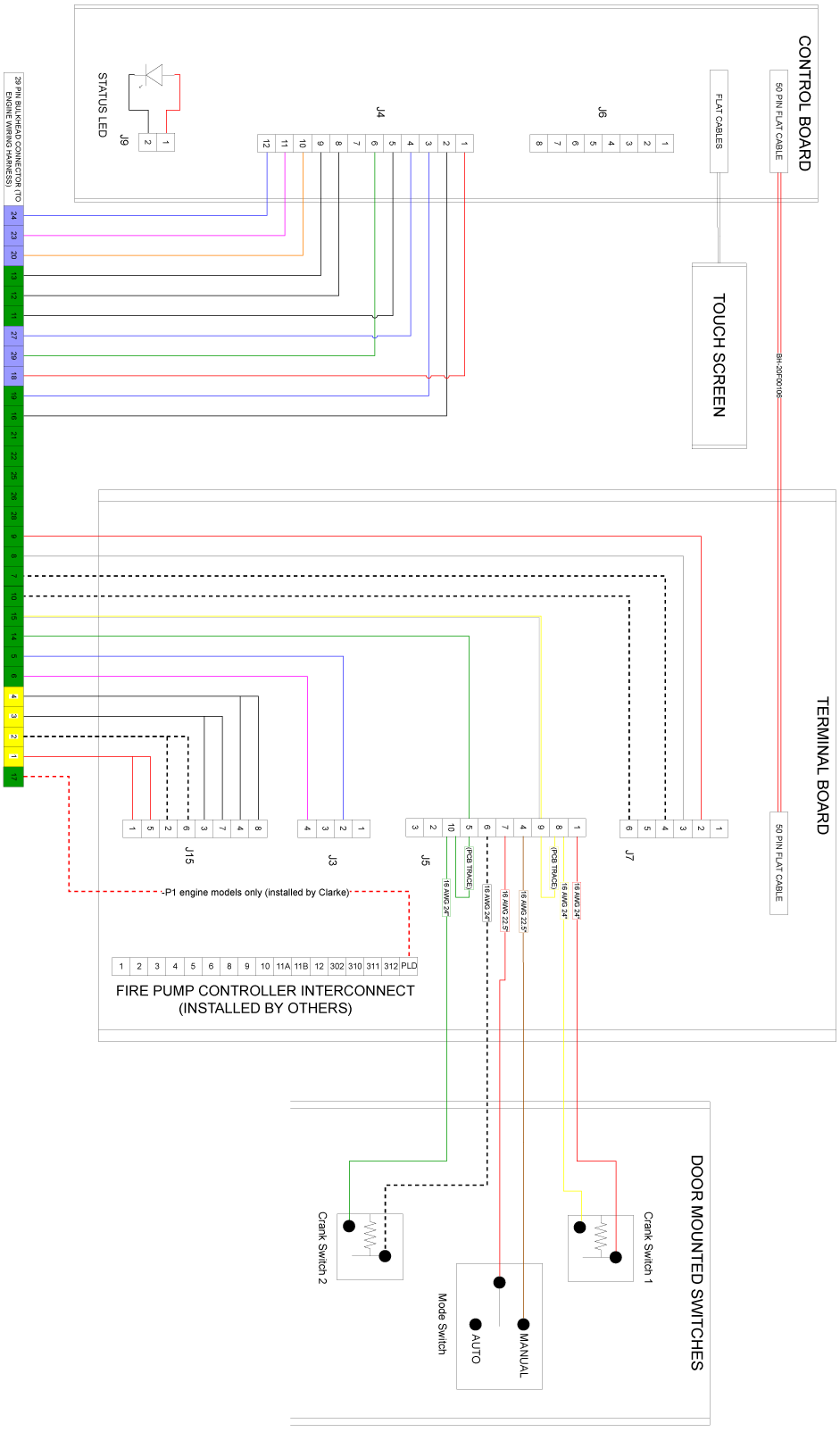

1. Troubleshooting LED Indicators (Reference section 5.16)
2. J13 USB Connection Port (Reference section 2.10.1)

## 6.4. TSP Enclosure Interior



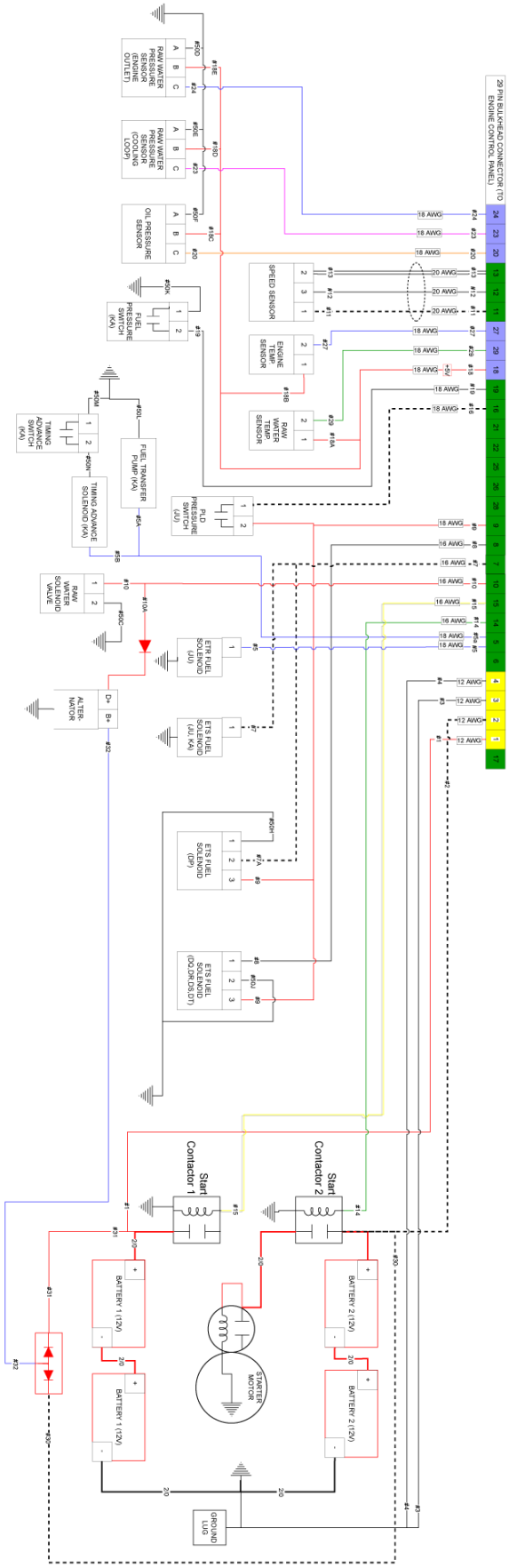

1. TSP Terminal Board (Reference section 2.11)
2. Emergency Run Override (Reference section 2.11.1)
3. Interconnect Terminals (Reference section 2.11.2)

## 6.5. Wiring Diagram 0C073082 – Page 1 of 3



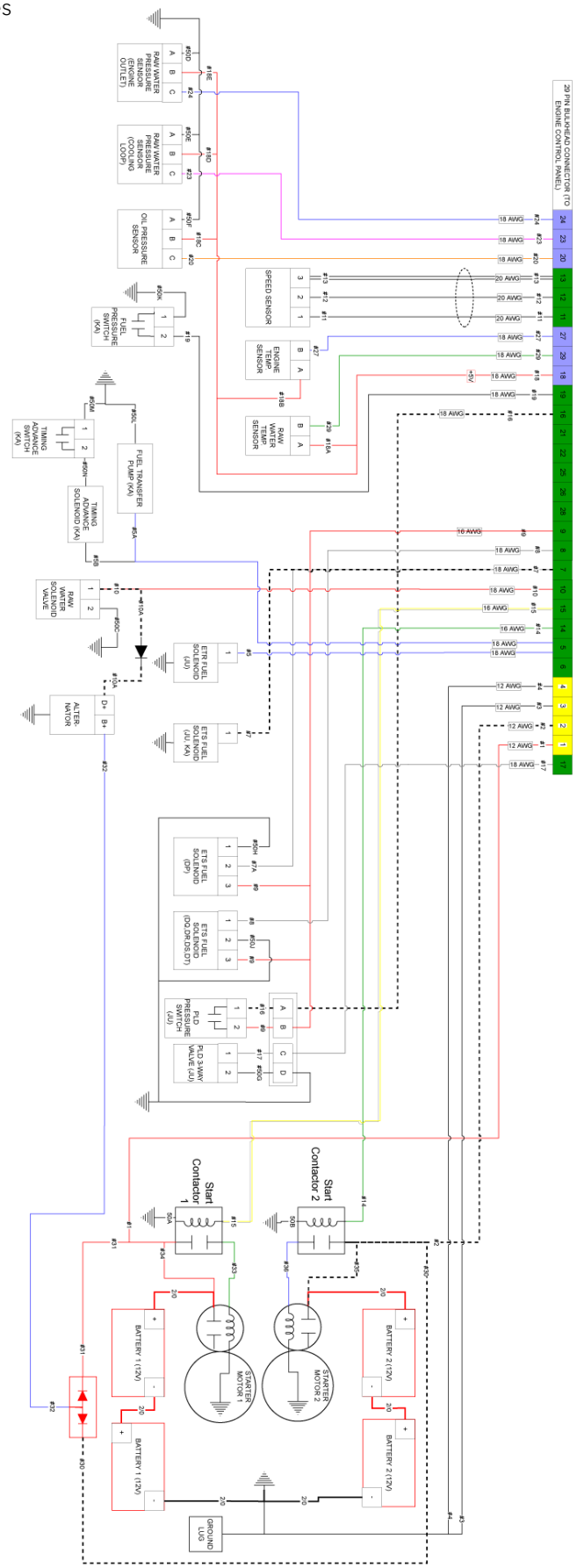
## 6.6. Wiring Diagram 0C073082 – Page 2 of 3

Single starter engines



## 6.7. Wiring Diagram 0C073082 – Page 3 of 3

Dual starter engines



## 6.8. IMAGES