



RAIL FIRE & MAINTENANCE

Fire Detection & Suppression System

System Sensor Panel
Operators Manual

Product Overview

The system sensor fire panel is used to provide an updated version of an existing fire detection system. The panel is software driven and is compatible with all existing installation of diesel locomotive since the introduction back in the 1980 with the FP280 (SD range and EVO range of locomotives); the detection, actuators, and control lines used in the existing locomotive installation can be used with the system sensor panel. The system sensor panel can also be used with the new electric locomotive.

The lower part of the panel has been specifically designed to look the same as the existing fire panels; this is to ensure that the locomotive drivers remain familiar with the system across all of the fleet, as this section forms part of the drivers pre start checks.

Behind the outer door is an easy-to-use colour graphic touch screen to display or control the locomotive detection, actuators, and control lines. The panel can be configured through the graphic touch screen to change some of the basic parameters.

The panel can be easily configured to display and operate in any desired manner by simply upgrading the software this allows for future electric locomotives.

The panel has been loaded with software for monitoring and controlling the detection system in a locomotive north west of Australia.

Hardware Compatibility Table

Every effort has been made to ensure the product remain backwards compatible with all existing equipment; below is a hardware compatibility table. The system sensor panel use a large LCD screen the same hardware can be used of the new electric locomotives by simple upgrade of the software this provides a distinct advantage as on one lot of spares PCB need to be carried.

	LFS001 Original Panel FP280	LFS006 Original Junction Box JB1	LFS002 Original LED Remote Station	LFS007, LFS007R, LFS007/90 Original Detection System	Original Suppression System Actuators 12vdc	Original Suppression System Pressure Switches	LFS030 Remote Release Station
System Sensor Panel	Yes Straight Swap the System sensor will fit in the existing orange enclosure	Yes Straight Swap the System sensor use same cable looms and will mount in the same enclosure	Yes Straight Swap the System sensor use same cable looms and will mount in same location	Yes All existing heat probes or liner heat cable and EOL remain the same	Yes	Yes	Yes
System Sensor Junction Box	Yes Straight Swap	Yes Straight Swap	Yes Straight Swap	Yes	Yes	Yes	Yes
System Sensor LCD Remote Station	Only If Using System Sensor Junction Box	No	Yes Straight Swap Uses existing cable and terminations	Yes	Yes	Yes	Yes
System Sensor Heat Probe Detection System	Yes	Yes	Yes	Yes	Yes	Yes	Yes
System Sensor Suppression System Pressure Switches	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Functionality Compatibility.

The system sensor panel has been designed to operate for both diesel and electric locomotive.

System sensor panel for diesel locomotive has a simple jumper link to operate in the original mode and the compliant AS5062 mode.

In the original mode FP280 (Non-Compliant) the panel will operate as followed.

The suppression system only had a single low-pressure switch that when activated would drive an Alarm indication on the panel but a fault train line.

The alternative mode by default (AS5062 Compliant) requires two different types of pressure switch.

1. Raise in pressure on the release port to indicate suppression has been discharged
This when activated cause an alarm on the panel and drives the alarm train line.
2. The low-pressure switch indicates a fault in the cylinder pressure, causing a fault to be displayed on the panel and the fault train line to be activated.



Document Copyright Statement

Product Name: - System sensor
Data Gathering Panel
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Manufactured to: - Conform to Clients Specification
Distributed By: - Rail Fire and Maintenance

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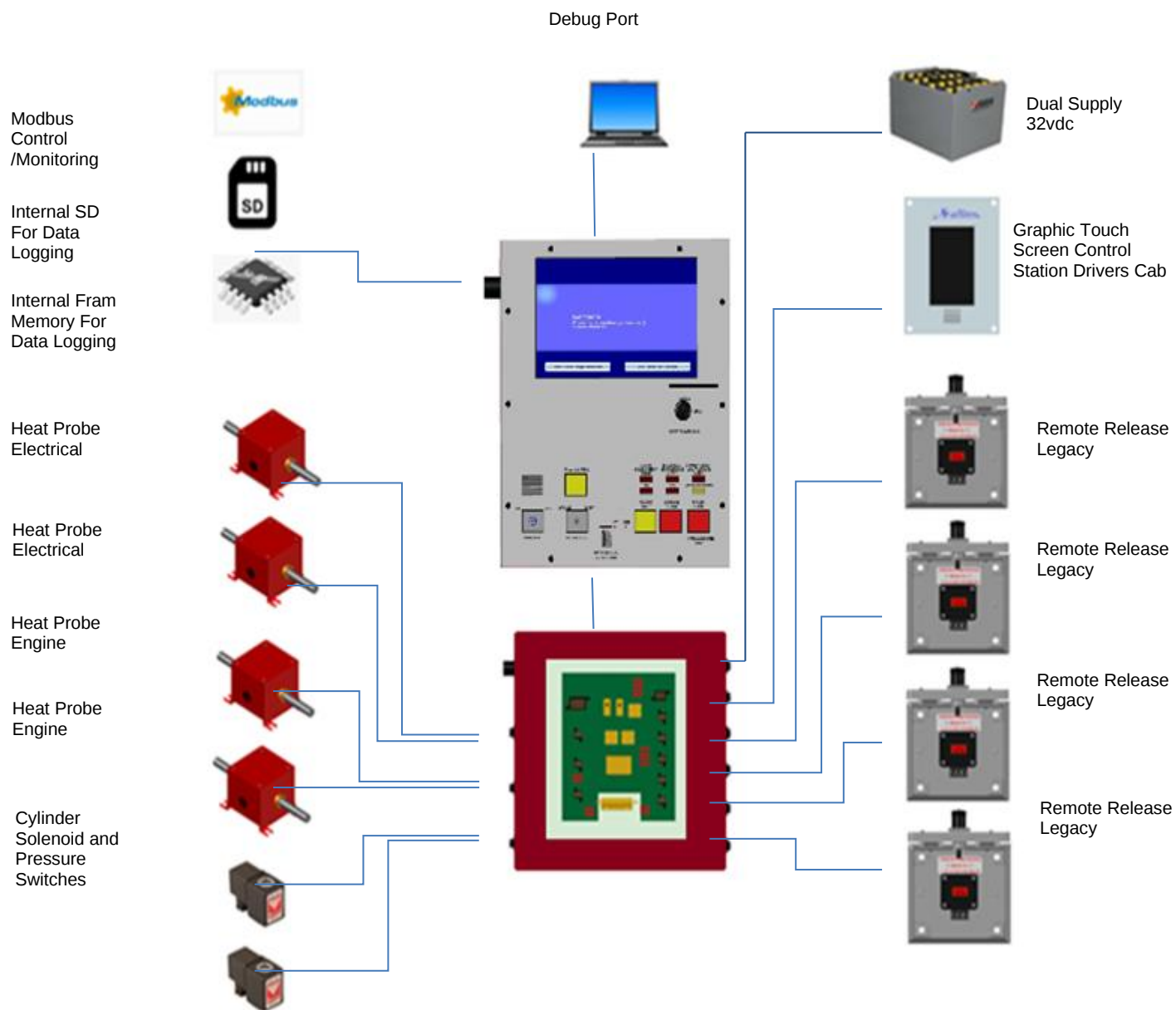
Section 1.0 Human Machine Interface Overview

The locomotive system sensor fire detection panel is used to provide an easy-to-use dynamic graphical interface to legacy equipment, whether they are manned by an operator or monitored by a central control room for an unmanned locomotive. In the case of a confirmed alarm the system sensor panel will send the information to the control centre as well as perform a series of preprogrammed event to protect the locomotive by releasing a suppression agent.

The following details the requirements for the system sensor panel for sensors and controlling the system.

1. A total of eight (8) monitored circuits;
 - 1a) Four used for detection
 - 1b) One for Suppression System Pressure Switches
 - 1c) One for the manual switches
 - 1d) Two trainlines
2. Two expansion cards can be fitted for the additional
 - 2a) Eight (8) monitored inputs per expansion card
 - 2b) Eight (8) Relays change over contacts
 - 2c) Four reserved inputs used for legacy system detection
3. Two (2) monitored outputs switch 12vdc at 1Amp for suppression actuators
4. Colour graphic touch screen for user controls, indications, basic configuration changers and tip on fault finding based on current event.
5. Micro SD flash card to log events in ASCII plain text with time date stamp
6. RS485 modbus for remote monitoring and control
7. MP3 audio voice player
8. Five (5) emergency activation switched input no monitored (legacy)
9. Smartphone or PC connection via Bluetooth BLE for reading history logs from SD Card.
10. Software update can be done using a Smartphone or PC running a terminal emulator
11. Power supply monitoring for primary and secondary Rail Compliant

12. Internal memory 32Kbytes of non-volatile ferroelectric random-access memory (FRAM) which will provide 100 years back up with no power or internal battery this FRAM will sorting the last 250 event in case microSD is damaged or missing.



Section 1.2 Front Screen User Configuration Settings

The locomotive control panel has been designed to allow for some basic user configuration setting, whilst still conforming to client's specification.

By navigating to the configuration screen, we are presented with the system current configuration see below. Pressing the “next button” twice will take you to the configuration log in screen. This is where the setting can be changed once a password of “0000” has been entered.



- **Engine compartment detection trigger dual gate:** this can be either “enabled or disabled”

Selecting enabled – allow for a dual gate where both detection zone are in alarm at the same time to cause a full alarm.

Selecting disabled– allow for a single shot where any detection zones are in alarm to cause a full alarm this is handy if using a single liner heat wire setup.

- **Electrical compartment detection triggers dual gate:** this can be either “enabled or disabled”

Selecting enabled – allow for a dual gate where both detection zone are in alarm at the same time to cause a full alarm.

Selecting disabled– allow for a single shot where any detection zones are in alarm to cause a full alarm this is handy if using a single liner heat wire setup.

- **Engine Override:** this can be either “enabled or disabled”

Selecting enabled – this prevent any alarm from activating the shutdown relay within junction box allowing the engine to be restarted.

Selecting disabled – this allows for any alarm to activate the shutdown relay within junction box cause the fuel pump to shutdown.

- **System Panel Configuration:** This can be ether compliant or non compliant.

Selecting Compliant– the panel operates as per AS5062 with low pressure switch and a release pressure switch on cylinders.

Selecting Non Compliant – the panel operates in the original mode where only a single low pressure switch was used.

- **System Primary and Secondary:** - Non configurable this is a status on the main supply and battery supply terminated at junction box
- **Serial Number:** Non configurable this is generated with hardware IC installed on the PCB.
- **Shutdown Signal On Manual Release Push Button:** this can be either “enabled or disabled”

Selecting enabled – This causes the shutdown relay activate on when pressed.

Selecting Disabled – This prevents the shutdown relay activate on when pressed.

- **Shutdown Signal On Engine Compartment Alarm:** this can be either “enabled or disabled”

Selecting enabled – This causes the shutdown relay activate on when alarm is present.

Selecting Disabled – This prevents the shutdown relay activate on when alarm is present.

- **Shutdown Signal On Electrical Compartment Alarm:** this can be either “enabled or disabled”

Selecting enabled – This causes the shutdown relay activate on when alarm is present.

Selecting Disabled – This prevents the shutdown relay activate on when alarm is present.

- **Alarm Circuit Set To Latching Fault / Alarm:** this can be either “enabled or disabled”

Fault Selecting enabled – This causes the fault to be latch on to help with finding intermittent faults.

Fault Selecting Disabled – This is the normal operation where faults are free to clear them self's.

Alarm Selecting enabled – This causes the fault to be latch on to help with finding intermittent faults.

Alarm Selecting Disabled – This is the normal operation where faults are free to clear them self's.

- **Suppression Time Delay:** This is a value entered between 0-255 Seconds, before the suppression system is activated on an alarm within the engine compartment.
- **Any Circuit in Alarm:** this show if an alarm is present on the system.
- **Any Circuit in fault:** this show if a fault is present on the system.
- **Any Circuit in Isolated:** this show if a circuit has been manually isolated.
- **ME1 Engine Time delay:** This is a value entered between 0-99 and is the number of seconds before a heat probe is regressed on the panel. This delay is handy if you have a hotspot occurs during high revs.

- **ME2 Engine Time delay:** This is a value entered between 0-99 and is the number of seconds before a heat probe is regressed on the panel. This delay is handy if you have a hotspot occurs during high revs.
- **EC1 Engine Time delay:** This is a value entered between 0-99 and is the number of seconds before a heat probe is regressed on the panel. This delay is handy if you have a hotspot occurs during high revs.
- **EC2 Engine Time delay:** This is a value entered between 0-99 and is the number of seconds before a heat probe is regressed on the panel. This delay is handy if you have a hotspot occurs during high revs.
- **Pressure Switch Open or Closed:** this can be configured to operated in two modes

Open – Similar to the detection circuit where a short circuit is reported as an alarm or open circuit as a fault.

- 1K – Normal
- Short Circuit - Alarm
- Open Circuit - Fault

Closed Circuit – Similar to a PEFS where the pressure switch are normaly closed and open when activated.

- 1K – Cylinder Low Pressure switch activated (fault)
- Short Circuit - Normal
- Open Circuit – Alarm (rise of pressure switch activated)

Note an alarm will override a fault see below for sequence

- Low pressure switch activated will cause a fault to be displayed.
- Discharge pressure switch activated will cause a Alarm to be displayed.
- Fault reported followed by alarm both events will be reported.
- Fault event after an alarm only the alarm will be reported.
This is to ensure when a cylinder discharge occurs the loss in pressure is not reported as this is normal operation.

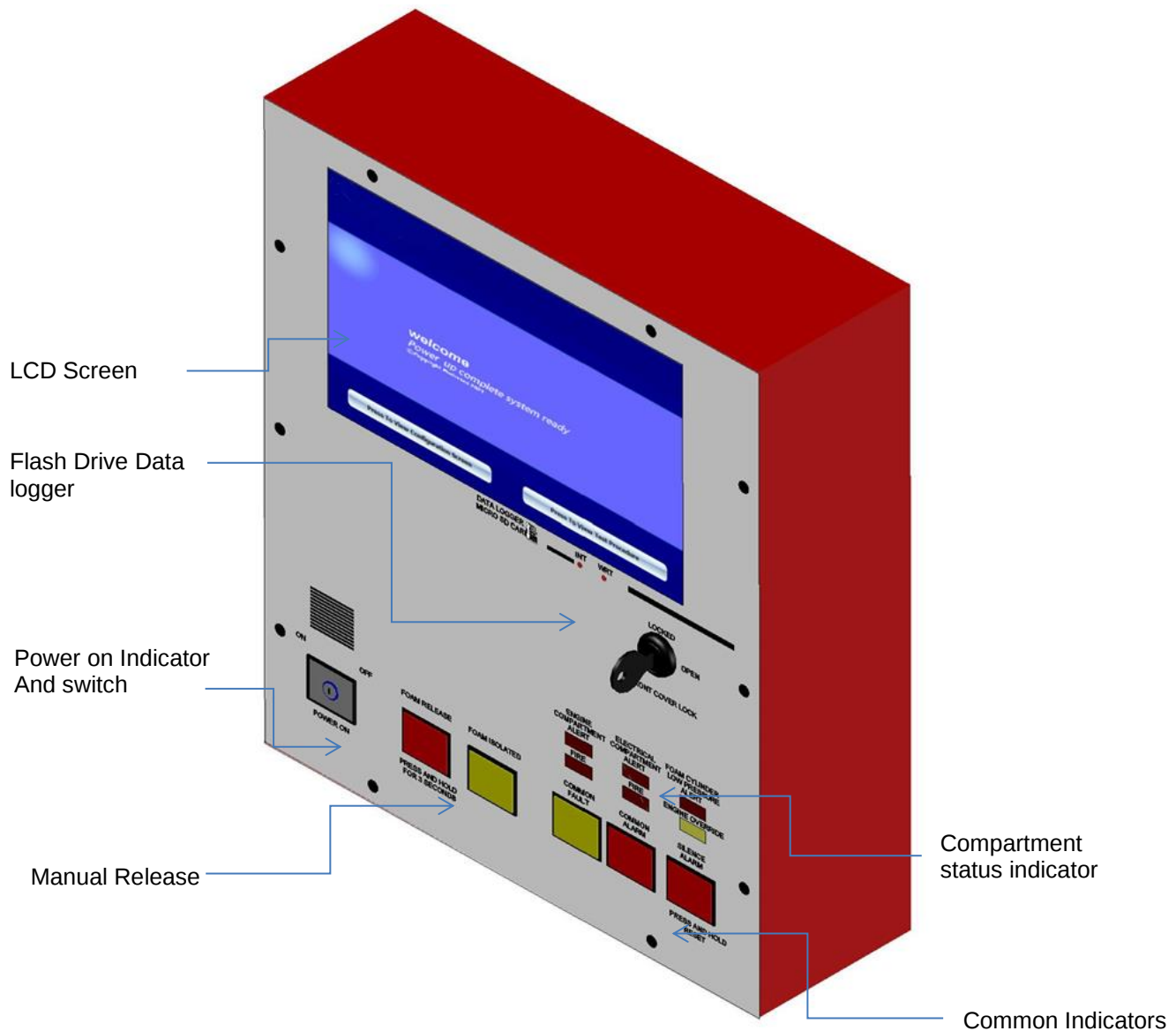
- **Suppression Actuator Short Circuit Fault:** this can be configured to operate in two modes
 - Selecting enabled** - This allow for the system to monitor the actuator for open or short circuit on the cable this set up requires a small PCB to be fitted in the actuator socket with a 1K EOL Fitted. This mode is required to meet AS5062
 - Selecting Disabled** – The early panel FP280 does not monitor the actuator for short circuit as the coil itself is of low DC resistance. If using this set up select the Suppression Actuator Short Circuit Fault setting to disabled.

Section 2.0 System sensor Data Gathering Panel System

Section 2.1 System Data Gathering Panel

The locomotive system sensor control panels constructed from metal enclosure measuring 370mm High by 320mm wide and 112mm deep this enclosure with a hinged front cover. The enclosure contains a total six (6) printed circuit board (PCB) that make up the entire control panel. Five (5) printed circuit boards are mounted to the front stainless steel fascia metal plate and one (1) to the rear of the enclosure.

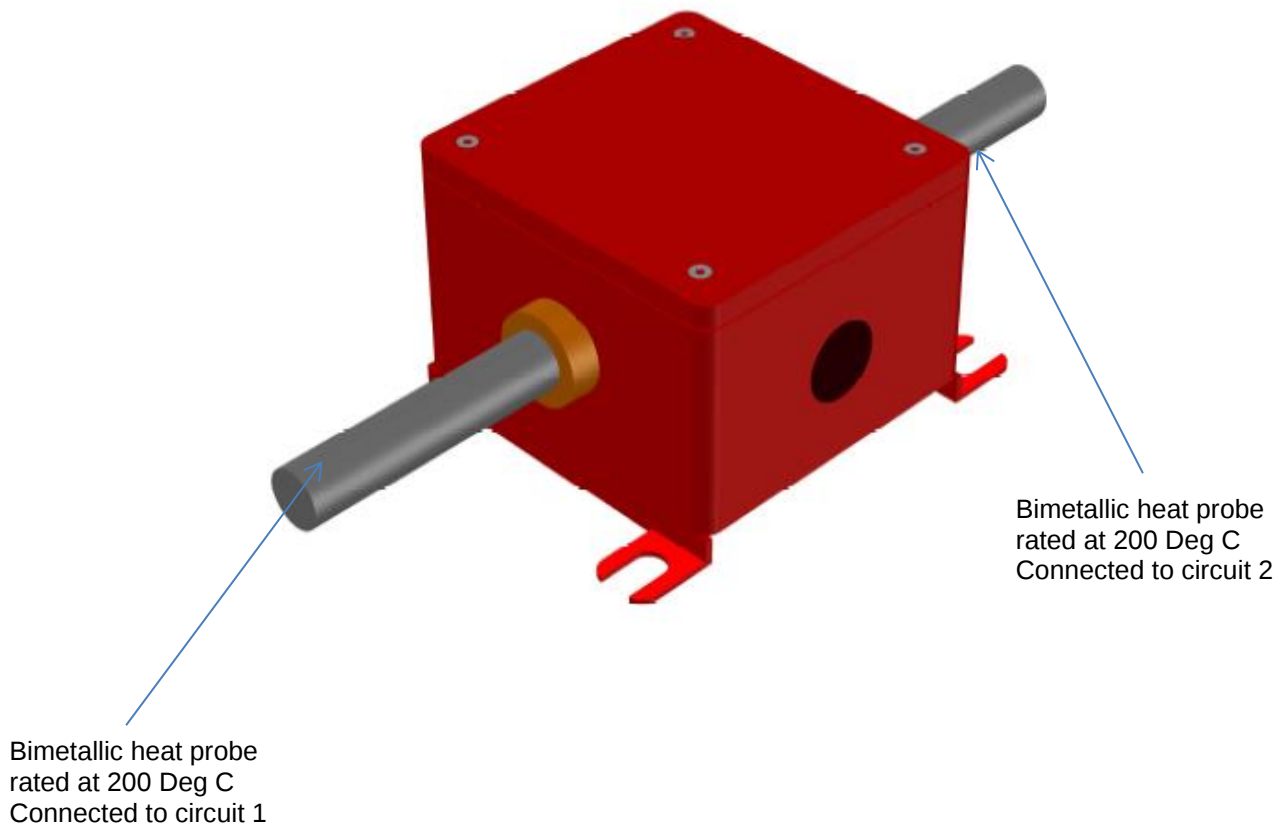
Below is an overview of the front fascia of the System sensor control panel. With the front protective cover opened showing the colour graphic touch screen the operator buttons and indicators are all located end the bottom of the panel.



Section 2.2 Detection System

Temperature detectors are a legacy device made up of a bimetallic strip of metal these detectors have been used through the locomotive for nearly 40 years are used to detector presence of heat using a dual detection circuit. The thermal detectors are brass probes with a fixed temperature rating set at 200°C. The locomotive is fitted with a total of eighteen (18) detectors in the following compartments.

Typical drawing of a heat probe junction box installed with the engine compartment. Each enclosure has two type “E” probes (rated at 200deg C) fitted connected to apposing detection circuit.



Section 2.3 Automatic Operation

The Detection System employs thermal detectors located in the engine compartment, electrical compartment & engine cooling hood. These detectors are arranged in a dual sensing mode. i.e. 2 detectors must be in alarm mode before extinguishing release cycle can be initiated if the system is configured as single shot, then any probe in alarm is required to release the extinguishing agent.

Section 2.3.1 Automatic Operation Details

The detection and initiation cycle are as follows:

Upon one thermal detector sensing an abnormal condition, a signal is transmitted to the control panel located in the locomotive cabin. This signal is then sampled for a period of four (4) seconds (configurable). If after this time the signal is still present, the 'alert light' for the particular area and the circuit alarm light is illuminate;

Upon the second thermal detector on an alternate alarm circuit sensing an abnormal condition, a signal is to be transmitted to the control panel and after the hold period of four (4) seconds (configurable), the " light' for the affected area is illuminate and commence flashing, as will the 'common alarm light' and the 'cancel alarm light'; and a thirty (30) sec time delay (configurable) start to release the suppression system.

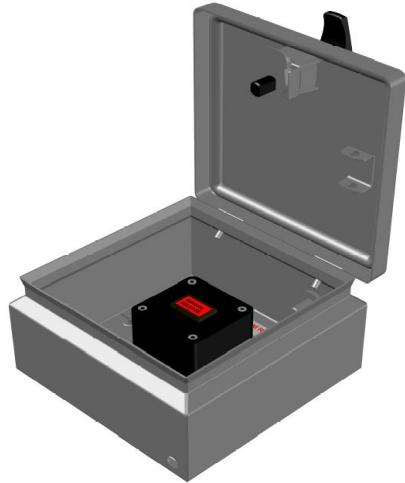
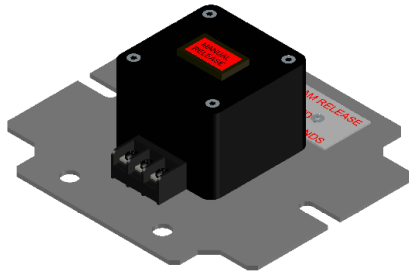
Upon the second thermal detector on an alternate alarm circuit the locomotive fuel pump is shutdown, this will prevent fuel been continually pump into the risk. A manual over ride switch is provided on the remote-control station to restart the fuel pump. This allows the locomotive to be moved off the tracks if required.

Audible alarm sounder is also commenced operating and the locomotive will be shut down due to lack fuel and after a thirty (30) second delay (configurable) the suppression system activated. At any time during the alarm cycle audible alarm can be silenced by pressing the 'cancel alarm light' causing the alarm sounder to stop and all lights to go to a steady state.

Section 2.4 Manual Operation

Manual activation is a legacy push button switch to activate the suppression into the main engine compartment is from any of the five (5) remote release stations.

Section 2.4.1 Manual Operation Details



Pressing any one of the five (5) illuminated remote release stations switches for two (2) seconds, the agent suppression is to be released into the engine compartment, after release of the agent suppression system the light is to go out confirming suppression release. After a period of four(4) seconds (configurable), the engine compartment alarm light, common alarm light and cancel alarm light is illuminate and commence flashing, the alert sounder is operate, and agent suppression is be released into the affected area. By pressing the cancel alarm light, the alert sounder is silence and all lights go to a steady state.

If a fault condition occurs in the system due to damaged wiring or failure of components, the fault affected circuit fault light will illuminate along with common fault on the front facia of the control panel.

Locomotives are connected in a consist, the common fault and alarms are relayed to each locomotive control panel, causing the common fault or common lights to illuminate and the 'common light to commence flashing in those locomotives. Also, in the event of a common alarm, the alert sounder will operate and the cancel alarm will illuminate and commence flashing. The alert sounder is to be able to be silenced by pressing the cancel alarm light in the particular locomotive required.

All events received by the panel will be logged to a SD flash drive fitted to the front facia prefixed with a time date stamp to provide a history of event that have occurred in real time.

All events received by the panel can be monitored by a third party SCADA system using Modbus over RS485 utilizing registers in the range of 40001 through to 40018.

The panel is fully automatic and monitors all conditions in the engine compartment, electrical compartment and the suppression system. The suppression is to be restricted to the engine compartment only.

Note

- The conformation light illuminating the manual release switch goes out when the switch is pressed.
- Suppression 1 and Suppression 2 Red icon will illuminate on the screen status page.

Section 2.5 ME1 and ME2 Zone Splitter Expiation Card

The zone splitter expansion card has been provided to accommodate the future electric locomotive by providing eight (8) monitored inputs and eight (8) voltage free relay outputs at junction box JB1.

Two (2) expiation card can be fitted into the existing JB1 enclosure allowing for ME1 to be split into eight (8) sub zones and ME2 to be also spit into eight sub zones give a total of 16 sub zones and 16 voltage free relay contacts.

Section 2.5.1 ME1 and ME2 Zone Splitter Expiation Card Thermal Runway

Electric Locomotive (future)

ME2 - Provides eight monitored inputs of the thermal runaway.
Provides eight voltage free relay contacts of control of the thermal runaway.

ME1 - Provides eight monitored inputs of the thermal runaway.
Provides eight voltage free relay contacts of control of the thermal runaway.

Section 2.5.2 ME1 and ME2 Zone Splitter Expiation Card Diesel System

The same expiation card can be used on the diesel locomotive to provided more clarity on which heat probe is in alarm, by allowing the heat probe to be wire back onto JB1 individually on their own circuit.

Example

Activation of a sub zone will

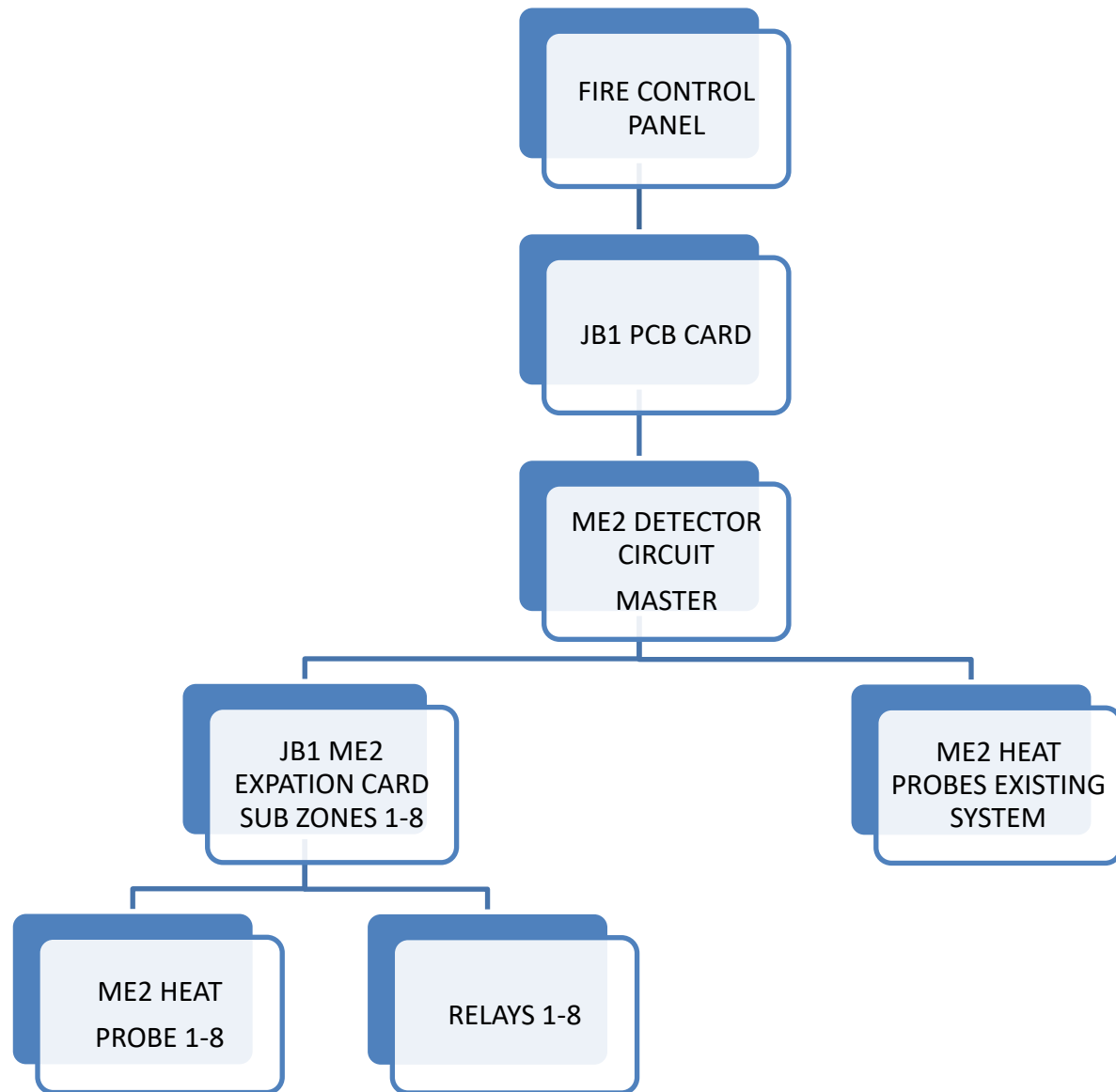
1. Activate the Alarm zone on the main LCD and the LED mimic
2. On the main LCD screen Group Zone Icon
 - The main fire alarm icon 
 - The group zone inspection icon 

Pressing the group inspection icon will change the screen to show which of the group sub zone circuits have been activated.

- Isolating the sub zone will only disable that sub zone circuit.
- Isolating the Main ME2 circuit will disable all 1-8 sub zones.

Section 2.5.3 ME1 and ME2 Zone Splitter Expiation Card hierarchy

Below is a basic flow diagram of the zone and sub zone setup



Section 3.0 Drivers Control Station

The drivers cab control station is used to provide the driver with conformation on the status of the locomotive detection system and also a means to manually release the extinguishing agent. The drivers cab control station will annunciate the following signals. The same control station can be used on the all-prior and for the new electric locomotive installation provided the new JB1 is used with the plugin controller.

A manual link is provided on the back to provide the use with the ability to hide or display some of the user buttons or change the operation to work with the new electric locomotive that have no suppression fitted.

Section 3.1 LCD Control Station



The revised local drivers cab control station can be used with any of the legacy control panels produced since 1980; the drives cab control station now incorporates 5" Colour graphic touch screen similar to the screen on the control panels shown below.

To use this new driver, cab control station the JB1 printed circuit board will need to be replaced in the early models as a small plug-in micro controller card is required to communicate the drivers cab control station.

The new JB1 circuit board is computable within the early legacy control panel and remote station control station.



The LCD control station will provide the driver the following information on the home screen

1. Alarm Local Panel
2. Fault Condition on the Local Panel
3. Engine Shutdown Signal is Activated
4. Trainline Alarm Condition Activated
5. Trainline Fault Condition Activated
6. Primary Power Fault
7. Secondary Power Fault
8. Virtual Pushbutton For Manual Release
9. Virtual Pushbutton For Engine Override
10. Sounder Isolate
11. Local Engine Override

The drivers cab control station has a small MP3 player fitted that access and industrial micro-SD card detailed in section 5.9 when an event occurs. The audio files can be changed to play specific tone or voice warning in any language as long as it a MP3 or wav format.

File Name	Message Played	File Name	Message Played
1	Power Up Complete	6	Trainline Fault Activated
2	Alarm Detected	7	Engine Shutdown Override Activated
3	System Fault	8	Foam Release Activated
4	Fuel Pump Shutdown	9	Primary Power Supply Failure
5	Trainline Alarm Activated	10	Secondary Power Supply Failure

Audio Message Saved To Drivers Cab Remote Control Station

Section 3.1.1 LCD Control Station Display Home Screen



The local drivers cab control station shown to the left is in the normal working condition where the screen back light will be driven to max during the day, as the light dims the control station back light will also dims, this is to ensure during night time operations the drivers are not distracted by the unit. However, if any event is been displayed the back light will revert to full brightness.

Section 3.1.3 LCD Control Station Display in Alarm



The local drivers cab control station shown to the left is in the alarm condition where the screen back light will be driven to maximum brightness an addable buzzer will sound and audible message will be played at a repeated three second intervals.

Red indicators show local panel in alarm and fuel shutdown is activated.

Note

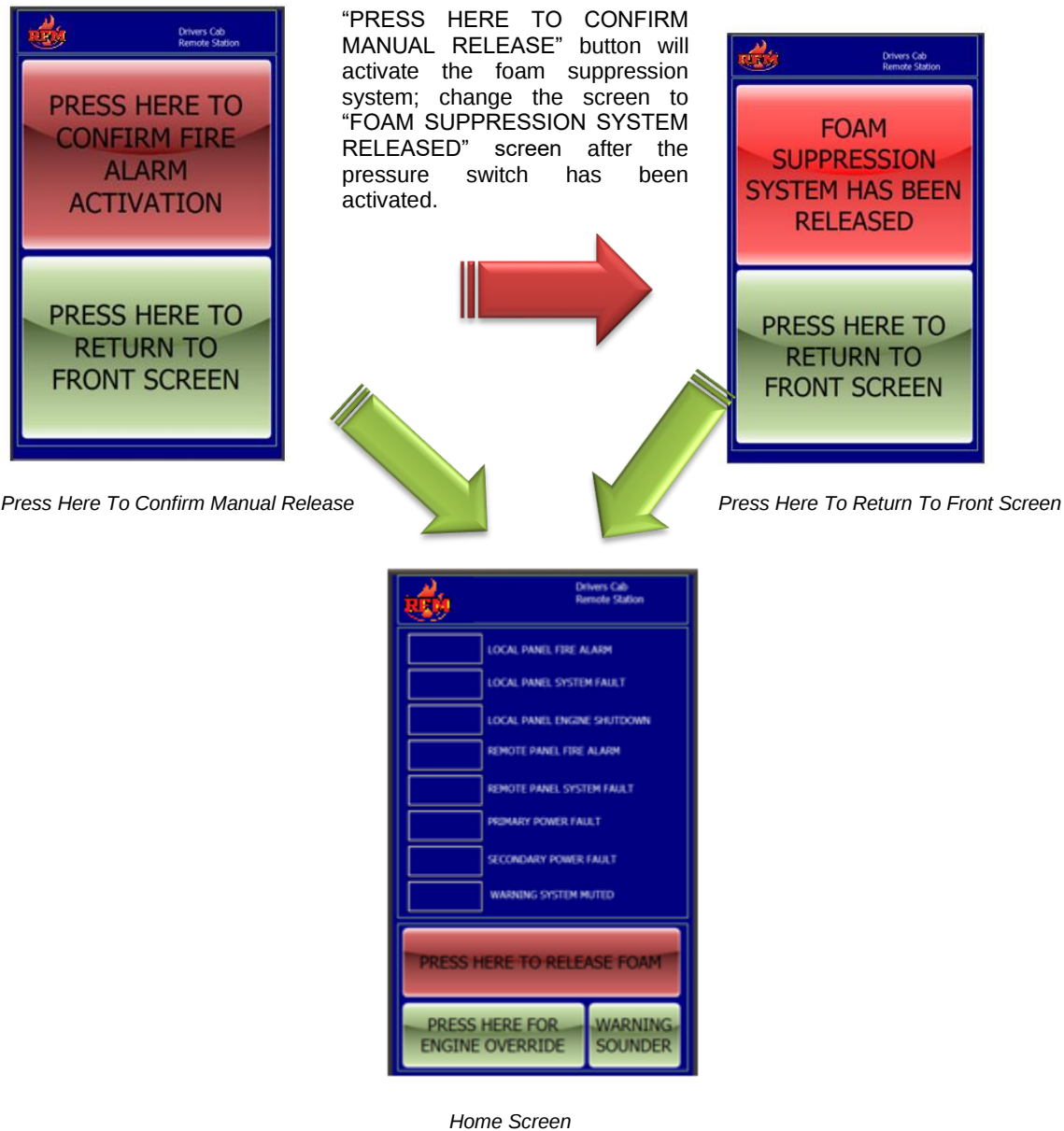
The buzzer and audible message is played continuously at three seconds intervals until the system has been reset, whilst the trainline alarm, trainline fault, alarm system fault and shutdown alarm only an audible message will be played for a period of time so as not to distract the driver.

Section 3.1.3 LCD Control Station Display Release Screens

The manual suppression release button is a two stage process to ensure that the suppression is not released by mistake.

Pressing the virtual button “PRESS HERE TO RELEASE FOAM” on the home screen, the screen will change to the conformation screen shown below. Pressing the virtual red button “PRESS HERE TO CONFIRM MANUAL RELEASE” on this screen will activate the suppression system; the screen will now change to the screen to “FOAM SUPPRESSION SYSTEM RELEASED” screen, once the pressure switch circuit has been activated along three very short beeps and audible message will be played as conformation back to the driver.

Pressing the virtual button “PRESS HERE TO RETURN TO FRONT SCREEN” will cancel the command and return you to the home screen.

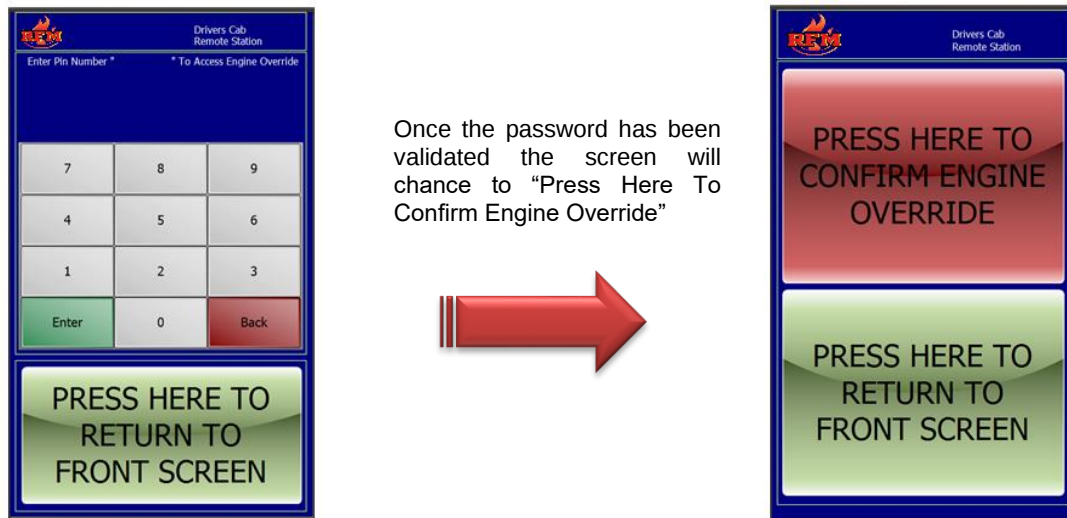


Section 3.1.4 LCD Control Station Display Engine Override Screen

The engine override button is a two stage process to ensure that the locomotive is not restated by mistake.

Pressing the virtual button “PRESS HERE FOR ENGINE OVERRIDE” on the home screen, will the screen will change to the conformation screen shown below.

A password has been added for conform to AS5062 to enable the engine override function Enter using the numeric keypad “0000” and press enter.



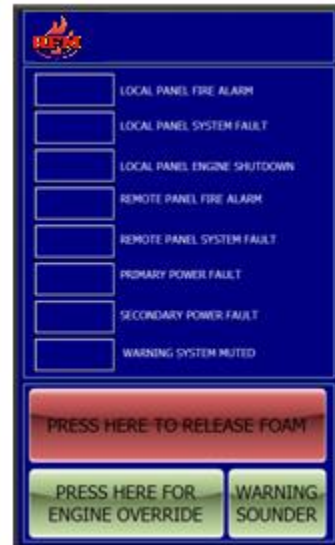
Pressing the virtual red button “PRESS HERE TO CONFIRM ENGINE OVERRIDE” on this screen will re activate the fuel pump and allow the locomotive to be moved.

Pressing the virtual button “PRESS HERE TO RETURN TO FRONT SCREEN” will cancel the command and return you to the home screen.



Press Here To Confirm Engine Override

“PRESS HERE TO CONFIRM ENGINE OVERRIDE” button will reactive the fuel pump

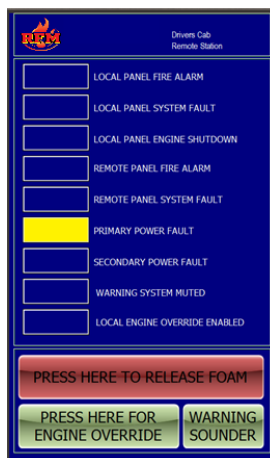


Home Screen

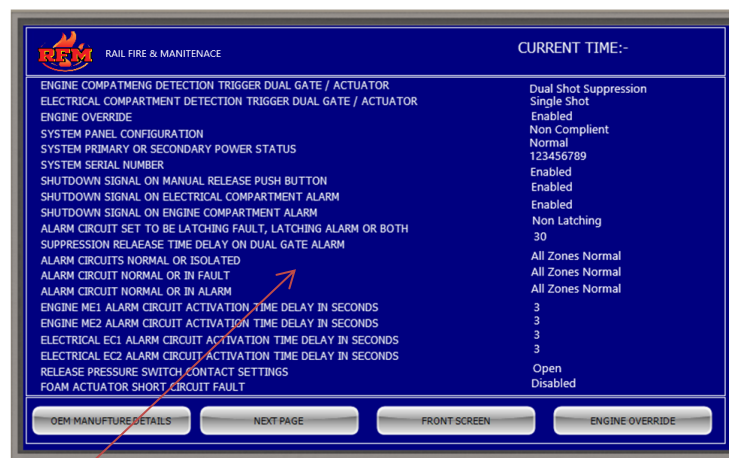
Section 3.1.5 LCD Control Station Display Power Supply Fault

The primary and secondary power supply is feed directly into JB1, the primary power is obtained from a 72vdc to 32vdc converter, whereas the secondary power supply is obtained by a centre tap from the locomotive bank of batteries.

If ether power supply voltage drop below the minimum required operating the panel, an indicator on the control station will be illuminated and a description on the main home screen displayed, as shown below.



Control Station PSU Fault



Home Screen

Power Supply Fault on the Primary supply

Section 3.1.6 LCD Control Station Display Communication Error

The communication error screen is shown when there is no communication between the alarm system and the drivers control station for more than 20 seconds. Once communication is established the screen will clear and return to the home screen.



Home Screen

Communication Error for more than 20 seconds



Error Screen



Error Screen

Communication established



Home Screen

Section 3.1.6 LCD Control Station Back Light Set Point

The remote station has back light contrast set point can be adjusted via the communication port using TTL logic level 0-5v only “DO NOT CONNECT PC DIRECT TO THIS PORT” A FTDI Chip, 5 V TTL USB to UART Cable, TTL-232R-5V must be used to connect to a PC running any terminal program.



The six way header is connected to the main cpu card making note of the orientation of the connector green wire closest to the relay, also note the description on the PCB. See image below.

The serial port will send data out at 57600, N,8,1 and can be viewed on any terminal window such as Terminal 1.9, PUTTY or HyperTerminal.

During power the terminal program will display what process is been performed. When ask to “Set The Back Light” you have 5 sec to send a lower case “**setup**” to the remote station. This will suspended the start-up process and you will be asked to enter two values, the first been the up threshold where the display is it brightest and a lower threshold where the display is at its dimmest.

1. The upper and lower threshold can be set to any value from 0-1023
2. By default this is set to 800 for the lower and 1000 for the upper

Section 3.1.6 LCD Control Station Communication counter

The remote station has back light contrast set point can be adjusted via the communication port using TTL logic level 0-5v only “DO NOT CONNECT PC DIRECT TO THIS PORT” A FTDI Chip, 5 V TTL USB to UART Cable, TTL-232R-5V must be used to connect to a PC running any terminal program.



The six way header is connected to the main cpu card making note of the orientation of the connector green wire closest to the relay, also note the description on the PCB. See image below.

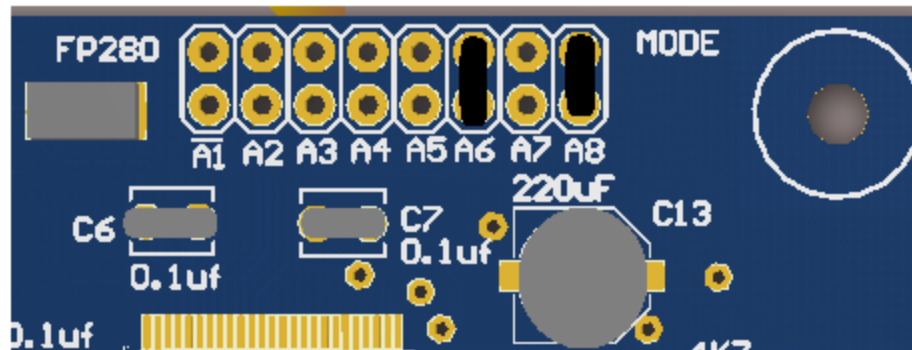
The serial port will send data out at 57600, N,8,1 and can be viewed on any terminal window such as Terminal 1.9, PUTTY or HyperTerminal.

During power the terminal program will display what process is been performed. When ask to “Set The Back Light” you have 5 sec to send a lower case “**erase**” to the remote station will clear the counter and continue to start up.

Section 3.1.6 LCD Control Station Jumper Settings.

The control station has eight jumper setting on the top of the PCB (Mode) see the image below.

Placing a jumper link vertical joining the top pin with the bottom pin has the following effect



Jumper No	Function
A1	Put the control station in the original mode, this is a legacy setting as the pressure switch is reported as a fault
A2	Fitted the warning system isolate icon is removed from the front screen And replaced with a blue icon indicated it disabled
A3	Fitted engine override icon is removed from the front screen And replaced with a blue icon indicated it disabled
A4	Fitted the foam release icon is removed from the front screen And replaced with a blue icon indicated it disabled
A5	Switch between Diesel and Electric trains this is to allow for future builds where locomotive are no longer required to have foam suppression.
A6	Enable 1Hz Buzzer on Fault
A7	Disable Voice Message Playback
A8	Fitted the bug port will send status message continuously show event that have occurred or the current back light raw data

Jumper Function

Below is a serial capture of the debug port during power up. The text highlighted in blue show the user inputs

```
GF001_Remote_Station_V00-00-01
Compiled on: Aug 15 2021 at 15:01:14<LF>
Setting Password To Eprom
Configuring Port for MP3, LCD, JB1
Setting MP3 Port
Default Mode Remote Control Station Set For AS5062
Setting Internal Buzzer Port
Setting Manual Release Port
Ensure Release Output Is set To Normal
Setting Manual Release Indicator Port
Fuses
Low: 0xFF
High: 0xD8
Ext: 0xFC
Lock: 0xFC
Waiting For LCD To Power Up
Setting MP3 Amplifier To High
Getting Serial Number
Already Unlock
Insert Link On A8 Mode Pins To Enable Setup Mode, Power Down, Add Link
Power Up !!
Set Up Mode Enabled
```

To Enter back Light Setup Type Lower Case 'setup' OR
erase' To Erase Coms Fault Log Then Press Enter

erase

```
Resetting Comms Fault Counter Loading Upper Back Light Limit to - 700
Loading Lower Back Light Limit to - 10
Starting LCD Event Handler
Hardware Check :- Hardware Match !!
Waiting For FIP To Be Switch On !!
Fire System Is Now On !! Manual Release Line ON
Flushing Input Buffer Out
**
Flushing Input Buffer Out
```

```
Waiting for JB1 To Send Heat Beat
Byte Revived for JB1 0x80
Remote Station Sync Now Sync To JB1
Flushing Input Buffer Out
*
```

```
Remote Station Sync Now Sync To JB1
Comms Error Timer Started
System Ready Show Home Screen
Sunder Isolate Button Enabled
Engine Override Button Enabled
Foam Release Button Enabled
Serial Number 280377fd0c00002c
Power Up Fire System Normal
Play Power Up Message
```



```
<LF>Arduino is running Sketch: GF001_Remote_Station_V00-00-01
Compiled on: Aug 15 2021 at 15:01:14<LF>
Setting Password To Eprom
Configuring Port for MP3, LCD, JB1
Setting MP3 Port
Default Mode Remote Control Station Set For AS5062
Setting Internal Buzzer Port
Setting Manual Release Port
Ensure Release Output Is set To Normal
Setting Manual Release Indicator Port
Fuses
Low: 0xFF
High: 0xD8
Ext: 0xFC
Lock: 0xFC
Waiting For LCD To Power Up
Setting MP3 Amplifier To High
Getting Serial Number
Already Unlock
Insert Link On A8 Mode Pins To Enable Setup Mode, Power Down, Add Link
Power Up !!
Set Up Mode Enabled
```

To Enter back Light Setup Type Lower Case 'setup' OR
erase' To Erase Coms Fault Log Then Press Enter

setup

The Back Light Level Upper Limit by default is 700
Enter New Background Light Level Upper Limit For Full Brightness
The Range Can be Between 10 and 1023
>?

700

700<CR>The Background Upper Light Level Full Brightness is: 700
<LF>

The Back Light Level Lower Limit default is 50
Enter New Background Light Level Lower Limit For Dim
The Range Can Be Between 10 to 700
>?

50

50<CR>Lower Level Value Set : 50
Set Up Complete Ensure Link A8 is Now Removed
<LF>Loading Upper Back Light Limit to - 700
Loading Lower Back Light Limit to - 50
Starting LCD Event Handler
Hardware Check :- Hardware Match !!
Waiting For FIP To Be Switch On !!
Fire System Is Now On !! Manual Release Line ON
Flushing Input Buffer Out

Flushing Input Buffer Out

Waiting for JB1 To Send Heat Beat
Byte Revived for JB1 0x80
Remote Station Sync Now Sync To JB1
Flushing Input Buffer Out
*
Remote Station Sync Now Sync To JB1
Comms Error Timer Started



System Ready Show Home Screen
Sounder Isolate Button Enabled
Engine Override Button Enabled
Foam Release Button Enabled
Serial Number 280377fd0c00002c
Power Up Fire System Normal
Play Power Up Message

Backlight Valve:- Raw Value 168 , Lower Limit 50 , Upper Limit 700
Current Level 14 , Last Level 14 , Final Level 3

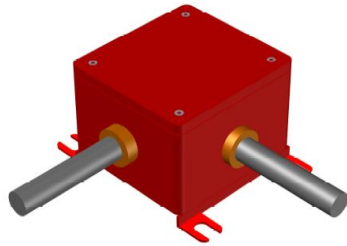
Heat Beat Received is- 0x80
Heart Beat Data Valid
JB1 Status Data Received is- 0x00
Fire System Normal
Flushing Input Buffer Out

Heat Beat Received is- 0x80
Heart Beat Data Valid
JB1 Status Data Received is- 0x00
Fire System Normal
Flushing Input Buffer Out

Backlight Valve: - Raw Value 167 , Lower Limit 50 , Upper Limit 700
Current Level 13 , Last Level 13 , Final Level 3

Section 3.2 Heat Probes

Section 3.2.1 Overview



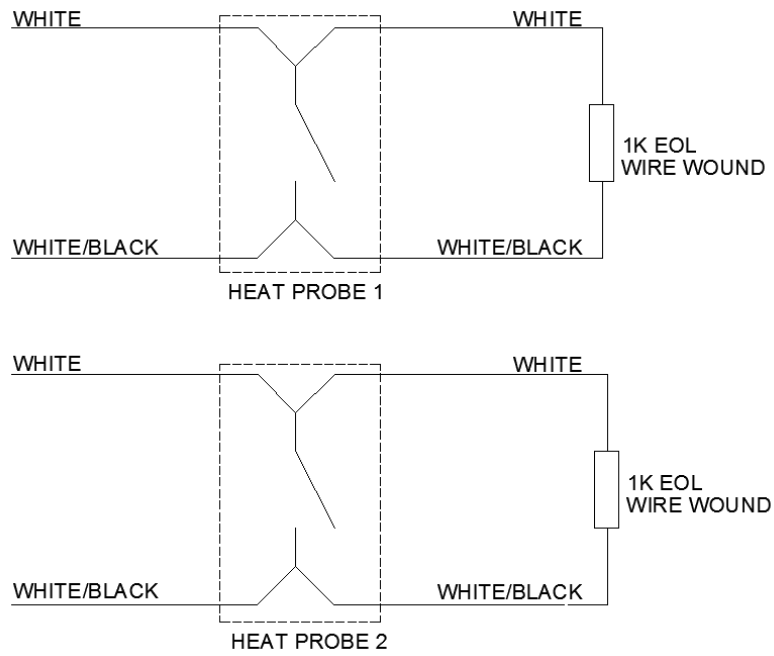
The control panel used to monitor and control an alarm within the risk area; this method is achieved by monitoring a series of fixed thermal detectors set at 200°C that are placed within perceived risk area. The thermal detectors monitor the environment within the risk for increases in ambient temperature. Once the thermal detector set point has been reached, the control panel respective circuit will be activated and pre-determined series of event will occur, depending on the alarm location.

Section 3.2.2 Description

The heat detectors are the “heart” of many protection systems. These highly reliable devices have been the standard for over 65 years. In alarm system these heat detectors are used as an ALARM device, to sense overheat and alert personnel. Heat detectors have met with wide acceptance because they are designed with rate compensation.

This type of provides a unique advantage over both fixed temperature and rate-of-rise types of detectors accurately senses the surrounding air temperature regardless of the growth rate. At precisely the pre-determined danger point, the system is activated. Fixed temperature detectors must be completely heated to alarm temperature and therefore a lag in response time may occur with a fast rate. Rate-of-rise devices, on the other hand, are triggered by the rate of increase in ambient temperature and are subject to false alarms caused by harmless, transient thermal gradients such as the rush of warm air from process ovens. The key to the unit’s sensitivity is in the design. The outer shell is made of a rapidly expanding alloy which closely follows changes in surrounding air temperature. The inner struts are made of a slower expanding alloy. Designed to resist thermal energy absorption and sealed inside the shell, the struts follow temperature changes more slowly. A slow rate will heat the shell and struts together. At the “set point”, the unit will trigger, actuating the alarm or releasing the extinguishing. A transient rush of warm air up to 40°F/min. may expand the shell, but not enough to trigger the unit. By ignoring transient warm air excursions, the heat detector virtually eliminates false alarms prevalent with rate-of-rise devices. If a fast rate starts, the shell will expand rapidly. The struts will close, actuating the alarm and/or releasing the agent. The faster the rate of growth, the sooner the heat detector will react.

Section 3.2.3 Termination Schematic



Section 3.3 Suppression Actuator

Section 3.3.1 Overview



The Australian standards AS5062 requires the actuator line to be monitored for open and short circuit fault. This is achieved by switch the polarity of the actuator line and the use of a blocking diode and a 1K End of Line configuration as shown below.

Jumper link JP8 and JP9 on the main CPU card have been provided to disable the short circuit monitoring when using the panel on an existing system that has not been fitted with any blocking diodes.

- User configurable through the display enable / disable short circuit monitor on Suppression System actuators lines
Or individually via the jumper links
- JP8 is used to enable / disable short circuit monitor on Suppression 1
- JP9 is used to enable / disable short circuit monitor on Suppression 2

The link position E – Enable short circuit monitoring, D- Disable Short Circuit Monitoring

Alternatively this short circuit monitoring can be disabled via the user configuration settings this save time in removing the PCB and changing jumper settings

Note The alarm system will not provide any power to the actuator if there is a short circuit on the actuator cable. Therefore it is recommended to always fit the blocking diode and back EMF diode to each actuator as shown below.

Section 3.3.1 Description

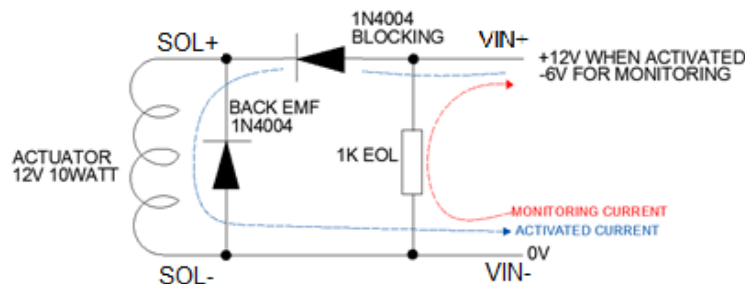
The actuator coil has a low resistance of approx 14 ohms, this low resistance makes monitoring of the actuator line difficult for a short circuit. The panel uses a simple technique of reversing polarity and including a blocking diode at the actuator. This will ensure all the monitoring current is directed through the 1K end of line resistor, (red line) current now flows from 0v to -6v, as current will always flow to the lesser potential voltage.

When the control panel system requires the actuator to be released, the polarity changes from -6v to +12v and the current now flows in the other direction, most of which will pass through the actuator coil and the blocking diode (blue line) again current flows to the lesser potential which is now 0v rail.

When control panel system is reset, power is removed from actuator a magnetic field generated by the coil will start collapse, this will now induces current into the cable and in turn into the monitoring circuit.

By adding a back EMF diode across the coil of the actuator, all the current generated by the collapsing magnetic field is channelled through the back EMF diode rather than back into the alarm system.

Section 3.3.2 Termination Schematic



Section 4.0 System Sensor Panel

The system sensor control panels fully automatic and monitors all conditions in the engine compartment, electrical compartment and the suppression system. The suppression is to be restricted to the engine compartment only.

The control panel system consists of eleven (11) main parts:

1. Two (2) 12-volt DC to DC electrically isolated regulators one (1) regulated power source is for the control panel internal solid state logic the second (2) for the external equipment connected to the control panel.
2. Five (5) conventional circuits each circuit having three functions Alarm, Fault, isolate these alarm circuit are connected to bimetallic conventional thermal temperature detector installed with the locomotive engine and electrical compartment.
3. Two (2) output to drive the warning lights on the driver's overhead console one (1) light, one (1) fault light.
4. One (1) Input to monitor each of the four (4) remote release stations switches external to the locomotive driver's cabin located on each corner of the locomotive and one (1) release switch fitted to the driver console with the driver's cabin.
5. Two (2) Monitored power 12vdc 1A output to release the suppression system.
6. Two (2) inputs for monitoring a remote control panel, one input for common alarm the second input used for common fault there signal are sent between control panel using the interconnecting train lines.
7. Five (5) indicators for monitoring for displaying circuit ground faults.

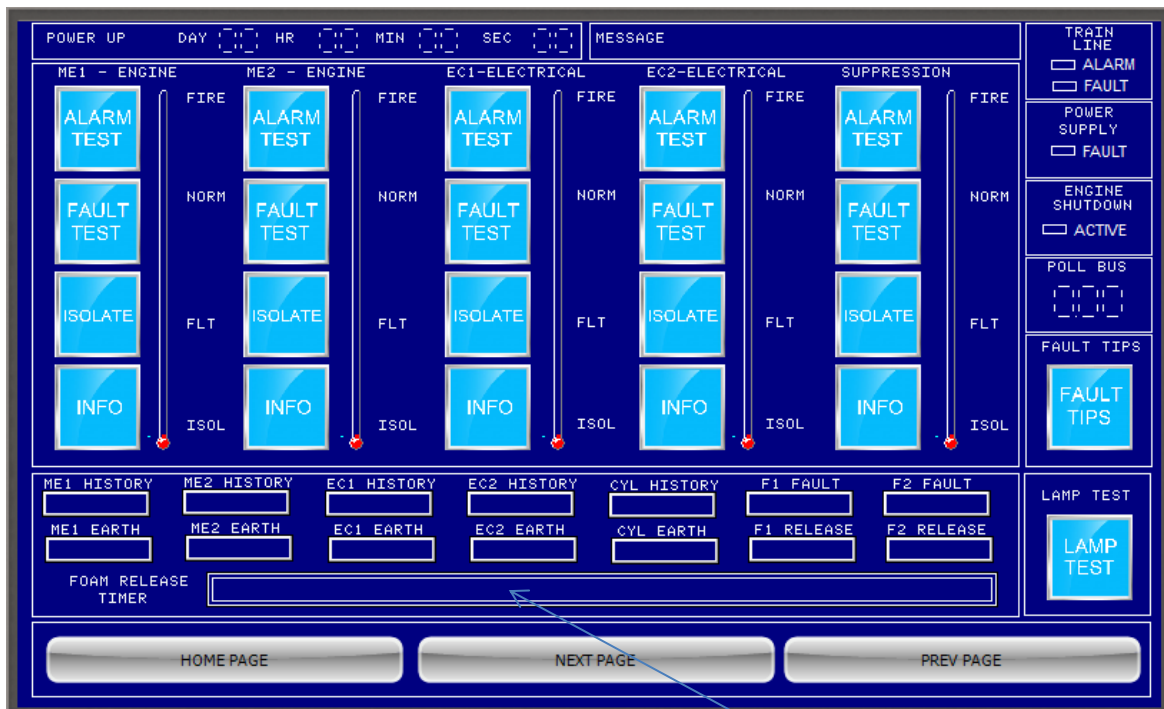
8. Five (5) latched indicator for the five (5) alarm circuit (history lights) this light will remain illuminated even if the alarm has cleared until such time the control panel is manually reset or powered down.
9. RS485 serial Modbus monitoring and control using function 15 using a register 40001 to 40016.
10. One (1) SD flash drive data logging plan text (ASCII format).
11. One (1) voltage free contact to shut down the locomotive fuel pump.

The control panel is to be located in a suitable location within the locomotive and connect to junction box with a 24 core and earth cable used to connect all ancillary detection equipment installed with the locomotive (See cable schematic Section 9.1).

The control panel power supply input is nominal 32vdc supply which is filtered, regulated and feed into the panel where two electrically isolated dc to dc converter to produce a regulated 12Vdc supply by the control panel internal circuit and second 12vdc regulator for the external equipment.

The of the five (5) conventional alarm circuit, two (2) suppression solenoid circuits and one (1) manual release switch circuit are monitored using a leakage current circuit through the 1K ohm resistor the circuit continually monitors the current been drawn at approximately 6mA for a normal condition.

The control panel has five (5) earth fault monitoring indicators that are active during the lamp test and are viewed on the main status screen.



Earth Fault Active On
0V Rail

EARTH MONITORING INDICATOR ON FRONT PANEL

When the lamp test button is pressed an internal relay will operate, this disconnects the detector external 0v rail (DET-). The external 0volt is then connected to the locomotive earth once the lamp test is complete the DET- is reconnected.

During a lamp test the follow two possible events could occur.

1. Earth fault on 0V rail or DET- rail all five (5) indicators will illuminate.
2. Earth fault on DET+ rail, that indicator only will illuminate.

That circuit will also be in alarm prior to pressing the lamp test button.

The control panel front facia a colour graphic touch screen liquid crystal display connected to the display card see table one below of basic functions and controls.

Table 1 LCD Menus

LCD screen	Function
Home Screen	Soft Touch Buttons for navigating Provides system configuration details 1. Serial number (random generated) 2. Latching or non-latching faults 3. Activate alarm time delay 4. Suppression system release time delay 5. Time of day 6. Engine shutdown output operated form 6a) Engine compartment 6b) Electrical compartment 6c) Manual release
Status Screen	Soft Touch Buttons for navigating 1. Colour graphic moving bar graph of each of the 5 conventional circuit 2. Graphic LED Indicator for remote alarm / fault 3. Run time DD:HH:MM:SS the system has been powered up 4. Rolling over heat beat Indicator 0 -255 between two micro controllers (control card to display card) 5. Dynamic touch switches for Alarm, Fault, Isolate, Information and Lamp Test 6. Graphic alarm history led 7. Graphic earth fault led 8. Graphic foam release led 9. Graphic foam fault led 10. Fault Help Button

Configuration Screen

1. Soft touch buttons for navigating graphic screens.
2. 12-digit keypad for data entry password protected. (0000)

Table 2 General user control and indications

Function	Colour	Action
Power on/off	Green	Indicator / Key Switch
Manual Release	Red	Switch / Indicator
Main Engine Alert / Alarm	Red	Indicator
Electrical Compartment Alert / Alm	Red	Indicator
Low Pressure Alarm	Red	Indicator
Engine Override	Amber	Indicator
Common Fault	Amber	Indicator
Common Alarm	Red	Indicator
Cancel Alarm	Red	Indicator

The user controls and indicator description has been detailed below.

1. The 'power on' is a green indicator / switch to show that electrical power is available to the Data Gathering Panel and suppression system. The panel can be shut down by pressing the latching switch, pressing again will restore power.
2. The 'Suppression isolate' is to be an amber indicator show when the system is been operated manually by the service tech.
3. The manual release switch has been provided as an emergency alternative point to release the foam should the cable be damaged due to fire for the other manual release switch located on each corner and control station.
4. The 'engine compartment alert and Alarm indicator' are red LED's with two (2) legends - 'alert' and 'Alarm' and its associated circuitry monitor the state of the Alarm detectors circuits in the engine compartment. The 'alert' LED is illuminated on any engine compartment alarm whereas the 'Alarm' LED is illuminated on having both engine compartment circuits in alarm at the same time.
5. The 'electrical compartment alert and Alarm indicator' are red LED's with two (2) legends - 'alert' and 'Alarm' and its associated circuitry monitor the state of the Alarm detectors circuits in the electrical compartment. The 'alert' LED is illuminated on any engine compartment alarm, whereas the 'Alarm' LED is illuminated on having both engine compartment circuits in alarm at the same time.
6. The 'Suppression low pressure Alarm' is to be a red indicator to monitor the state of the suppression system circuit. The 'Alarm' red LED will be illuminated on release of the suppression system.
7. An local engine override indicator is provided to show that the system has bypassed the shutdown allowing the locomotive to be stated up.

8. The 'common fault' is to be an amber indicator that illuminates if a fault occurs in the wiring to any of the detectors in the system or any of the extinguishing release actuators.

9. The 'common Alarm' is to be a red indicator, which is to illuminate upon any alarm condition from the locomotive in which the panel is located and any alarms from other locomotives in consist.

10. The 'silence alarm' is to be a red momentary press indicator switch that is to illuminate on any dual alarm condition. By pressing this switch the audible alarm is to be cancelled and all lights are to go to a steady state. Hold this switch down for more than 5 sec will cause the Alarm panel to reset.

Main LCD screen

11. The 'engine compartment Alarm test' 1 and 2, is a red alternate illuminate icons. Upon pressing one switch, that switch is to lock on and illuminate after four (4) - seconds and the 'main Alarm alert' indicator is to illuminate. On pressing the second switch, after a four (4) second delay, the Alarm indicator is to illuminate and the 'main Alarm alert' indicator will commence to flash and in addition the 'common Alarm' and 'cancel alarm' indicators are to illuminate. The panel is then to go through its complete sequence but not activate the extinguishing agent, as the system is to be isolated by the isolate multiplexer. Upon releasing the two icons and operating the power on / off switch, the panel is to reset to normal.

12. The 'engine compartment fault test' 1 and 2 is an amber momentary indicator icons. Upon pressing one switch the fault light is to illuminate, and a common fault alarm is to activate. By depressing both icons, the first light will stay illuminated and the common fault will still be activated.

13. The 'engine compartment isolate' 1 and 2 is a white alternate indicator icons. Upon pressing one switch, the switch is to illuminate and isolate that detector from the main system. Upon leaving the switch depressed, the main system will now become a single alarm system. Upon pressing both icons, the detectors to the main area will become inoperative.

14. The 'electrical compartment Alarm test' 1 and 2, is a red alternate illuminate icon. Upon pressing one switch, that switch is to lock on and illuminate after four (4) - seconds and the 'main Alarm alert' indicator is to illuminate. On pressing the second switch, after a four (4) second delay, the Alarm indicator is to illuminate and the "electrical compartment alert" indicator will commence to flash and in addition the 'common Alarm' and 'cancel alarm' indicators are to illuminate. The panel is then to go through its complete sequence but not activate the extinguishing agent, as the system is to be isolated by the isolate multiplexer. Upon releasing the two icons and operating the power on / off switch, the panel is to reset too normal.

15. The 'electrical compartment fault test' 1 and 2 is an amber momentary indicator icon. Upon pressing one switch the fault light is to illuminate, and a common fault alarm is to activate. By depressing both icons, the first light will stay illuminated and the common fault will still be activated.

16. The 'electrical compartment isolate' 1 and 2 is a white alternate indicator icon. Upon pressing one switch, the switch is to illuminate and isolate that detector from the main system. Upon leaving the switch depressed, the main system will now become a single alarm system. Upon pressing both icons, the detectors to the main area will become inoperative.

17. The 'foam cylinder low pressure test' is a red alternate indicator switch which, when pressed is to illuminate itself and the 'common Alarm' lights.

18. The 'foam cylinder low pressure fault test' - is an amber momentary indicator switch which when pressed is to illuminate the electrical fault lamp as well as itself and the 'common fault' lamp will activate.

19. The 'foam cylinder low pressure isolate' is a white alternative indicator switch which when pressed is to isolate the electrical compartment detectors from the system.

LCD Status User Indicator / switches

1. The 'foam 1 and foam 2' is dual red graphic indicators that are to monitor the state of the control panel. If extinguishing is released into the engine compartment, the foam 1 or foam 2 lamps are to illuminate. These indicators are to only be reset pressing and holding the reset button or by powering down the control panel.
2. The 'lamp test' is a light blue graphic switch. Upon pressing this switch, all lamps on the panel are to be illuminated in sequences and the ground leak indicators will illuminate if a ground fault is detected and graphic image will be displayed on the LCD this process will take about 20 sec.
3. The 'Alarm LED's (5)' are light blue; the image will change to a red flame if any detector circuit goes into alarm condition. These LED's are to stay locked on until reset by the power on switch or the reset button.
4. The 'ground graphic LED's (5)' are red LED's that are to illuminate when the 'lamp test' switch is operated. If any circuit wiring is grounded.
5. The 'suppression LED's (2)' are red LED's that are to illuminate if any actuator circuit is open or the actuator is operated, and are to remain so until the actuator or the open circuit has been repaired or replaced.
6. The 'power on / off' is an alternate operated switch to turn supply power off the panel and also to reset lock on facilities.
7. The colour liquid crystal display used to configure and monitor the Alarm system.

Section 5.0 Custom Configuration

The Alarm panel can be configured to change some of the operating parameters via the liquid crystal display.

Section 5.1 Power up Screen

During power up the LCD display will show the software running (indicated below).



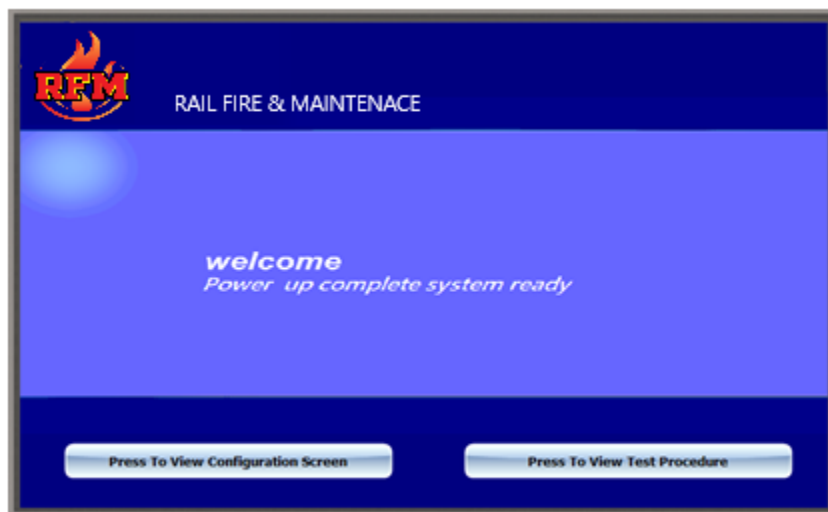
Shows System
Information

Section 5.1.1 Power up Welcome Screen

Once the system has powered up a audible message will be heard and the screen will change to the welcome screen shown below, two software buttons are now available, the “View Configuration” and “Test Procedure”

The view configuration will take to the home screen where the system configuration can be viewed the “Test Procedure” will take you to a screen that details the test to be performed on the system this is just an information page to help service personnel.

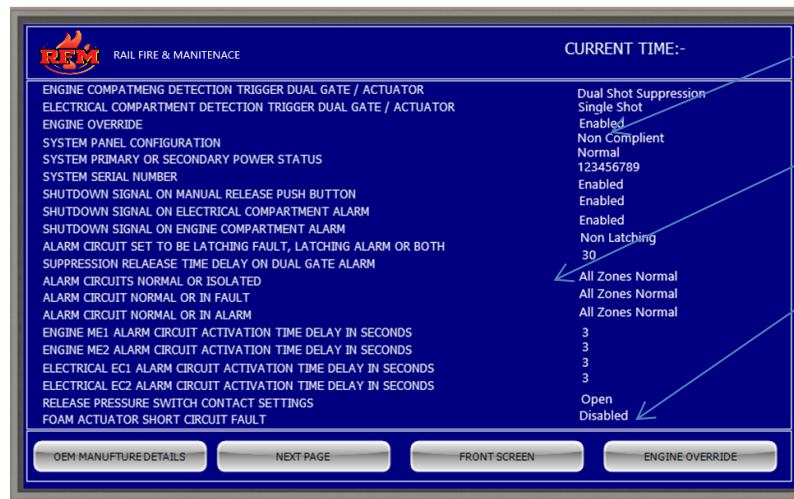
The “Test Procedure Screen” also provides access to the Asset / Information and JB1 relay control screens



Welcome Screen

Section 5.2 Home Screen

The Home screen shown below, provides the basic configuration of the Alarm system



Panel serial number

Shows the configuration of the panel and zone status

Soft key to move between screens note if the key is greyed out that key is not an option

Functions shown on this screen are detailed below

Soft button – next page moves to status screen.

Soft button – front screen shows the welcome screen.

Soft button – engine override show engine override control screen.

Configuration- This indicates if the panel is operating in the original mode as specified by the client's specification or with additional feature as indicated in AS5062.

Engine compartment detection trigger dual gate: This is an enable or disable option, by selecting “enable” the system will work with both zone within that compartment been active at the same time for an alarm to be generated.

Selecting “disabled” remove the dual gate part and ether zone will generate a condition.

Electrical compartment detection triggers dual gate: This is an enable or disable option, by selecting “enable” the system will work with both zone within that compartment been active at the same time for an alarm to be generated.

Selecting “disabled” remove the dual gate part and ether zone will generate a condition.

System Panel Configuration- This indicates that the system will operate in accordance with AS5062 used with the cylinders are fitted with a discharge pressure switch, the original system only had low pressure

Loco Primary and Secondary Power- This indicates if either of the power supply is operating above the mini voltage level.

Loco Panel Serial Number - This number is generated are manufacture and burnt into the software once generated the number cannot be changed and remains with the panel printed circuit boards.

Loco Shutdown on Manual release - This is ether “Enabled” or “Disabled” function and will activate the shutdown signal if enabled and the manual release button pressed.

Loco Shutdown on Electrical Compartment - This is ether “Enabled” or “Disabled” function and will activate the shutdown signal if enabled and the detector in the electrical compartment are activated.

Loco Shutdown on Mechanical Compartment - This is ether “Enabled” or “Disabled” function and will activate the shutdown signal if enabled and the detector in the mechanical compartment are activated.

Circuit Time Delay – This will provide a delay in sec from 0 - 99sec that the detector can be activated for before the alarm is registered on the panel by default this is set to 3 sec.

Latching Fault – This is either an enable or disables function and will latch the fault if a fault is reported on the panel.

Suppression Release Time Delay – This will provide a delay in sec from 0-255sec that the panel will wait until the solenoid are activated and the suppression is discharged.

Zone isolated or Normal – This will indicate if there is a zone that has been isolated

Zone Fault or Normal – This will indicate if there is a zone that is in fault

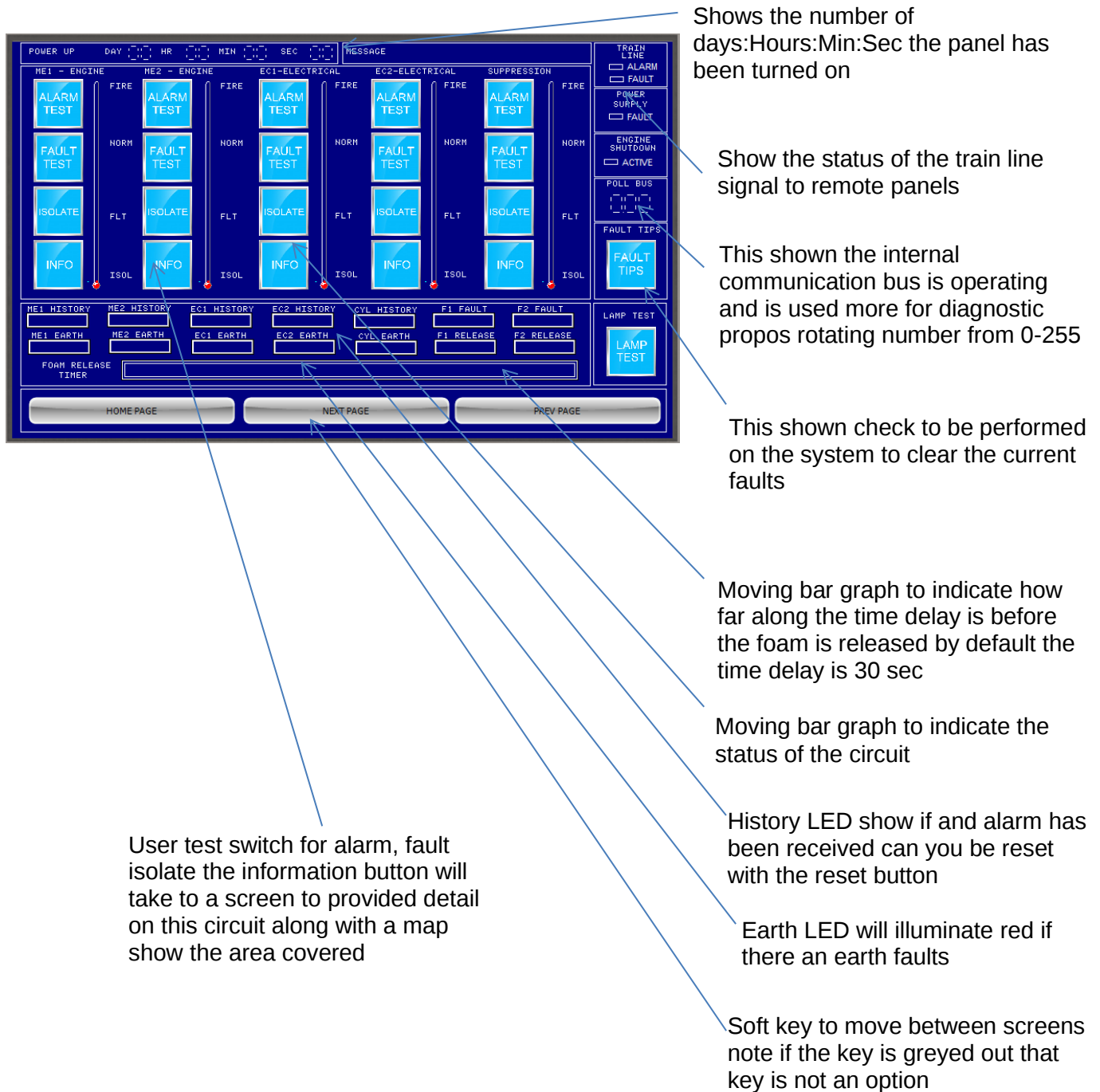
Zone Alarm or Normal – This will indicate if there is a zone that is in alarm

Release Pressure Switch – The pressure switch is fitted on the discharge line where as the low pressure are on the cylinder low pressure head port. The release pressure switch activates on rise of pressure the contacts can be set up as open or closed type the open switch contacts will close when activated whilst the closed switch contact will open.

Suppression actuator short circuit fault – the original control heads did not have a small PCB fitted to allow the system to monitor for short circuit, since the actuator coils have a low DC resistance the option to monitor without any changers can't not be achieved so an option to disable the short circuit monitoring is given.

Section 5.3 Monitor Screen

The monitor screen provided an overview of the system to the operator



Section 5.3.1 Monitor Screen Icons

The following details the dynamic icons used for the control or monitoring of the control panel



Alarm Test Icon: This is the normal condition for the detection circuit



Alarm Test Icon: The flame will be placed over the top of the alarm test icon to show that a fire alarm condition exists on that circuit or sub circuit if expansion card is fitted



Fault Test Icon: This is the normal condition for the detection circuit and the control panel is able to detect the 1k end of line resistor



Fault Test Icon: The explanation mark is placed over the top of the fault test icon to show there a fault with that circuit ie the 1k end of line is missing or cable is broken



Isolate Icon: This is the normal condition for the control panel should the user press the icon the control panel will disable the circuit and prevent alarm be reported



Isolate Icon: The pad lock is placed over the top of the isolate icon to show the detection circuit is disabled



Zone Group Icon: This replaces the INFO icon to show that an expiation card has been fitted and the circuit is now split into eight (8) monitored inputs is the normal condition for the control panel when an expansion card be fitted



Zone Group Icon: This replaces the Zone Group icon to show that an expiation card has a condition present, this could be any thing from Alarm, Fault, Isolate.by pressing this icon the control panel will show the status of each sub zones.

The expansion card is ideal was of having each heat probe wired back individually so the user know not only the area but the specific heat probe in alarm or fault



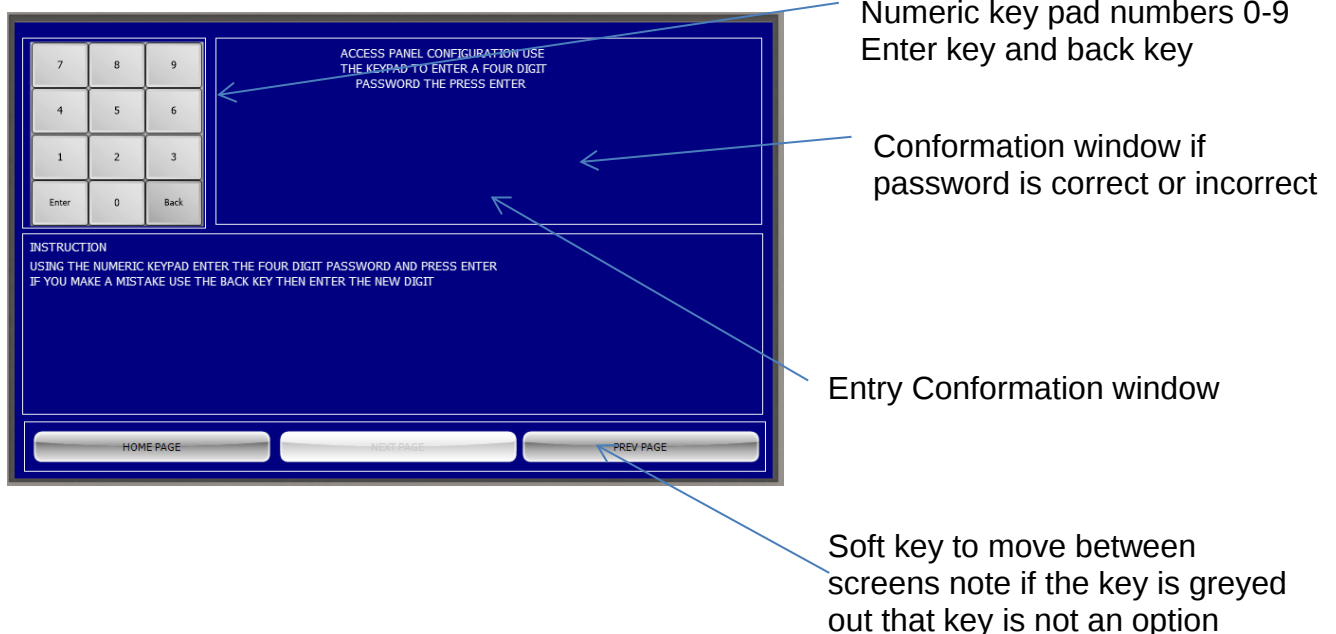
Info Icon: This will provide information to the user on what the circuit does where the detectors are located and how to test them



Lamp Test Icon: This will place the panel into a test mode to check that the power rails are not connected to earth due to a fault condition, a lamp test that flashes each indicator in a sequence and an industry stranded test pattern used for monitors and screen

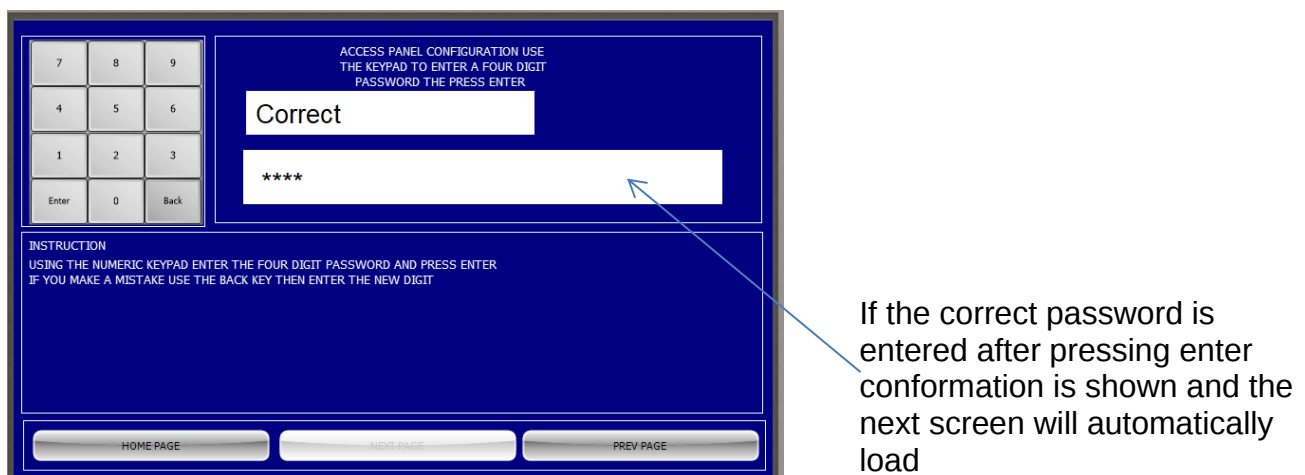
Section 5.4 Password Screen

The password screen has been provided to limit access to the configuration screen the password is generic to all panels.



Using the numeric key pad enter the 4-digit password and press “Enter”, if a mistake is made the “back” key can be used to erase the last entry or entries.

The password is set to “0000”

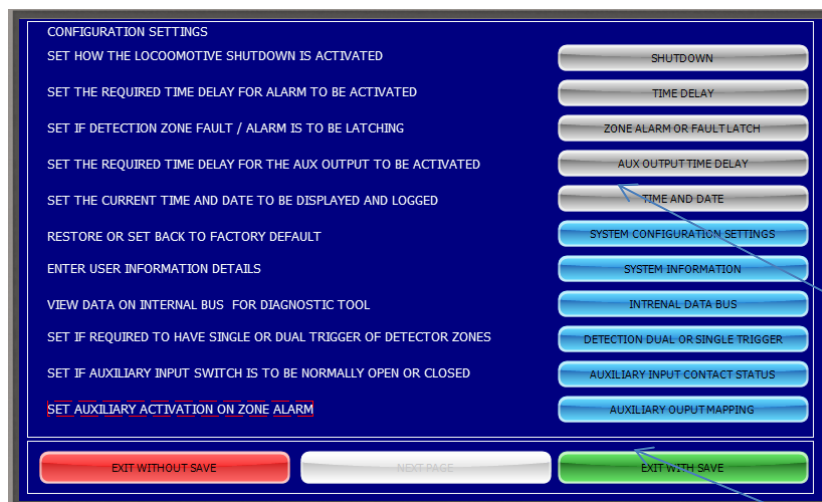


Section 5.5 Configuration Screen

The configuration screen is used to set up the basic operation of the panel.

Options available are

- Set Loco Fuel Shutdown - Used to set the parameters on when fuel shutdown relay will be activated.
- Set Time Delay for Alarm – Used to increase the delay time before an alarm is received by the panel this option is used to help prevent false alarm.
- Set Circuit Fault Latch – Used to latch any faults on the system this option can be used to determine the location of an intermittent fault
- Set Suppression Release Time Delay- Used to increase the delay before the suppression is released after both circuits are in alarm simultaneously
- Set Time Date – Used to set the time and date of the real time clock
- Resort back to factory default or save current settings
- Enter system information such as asset / locomotive number
- Internal data bus information



Using any of the eight soft keys select the option that requires changes to be made

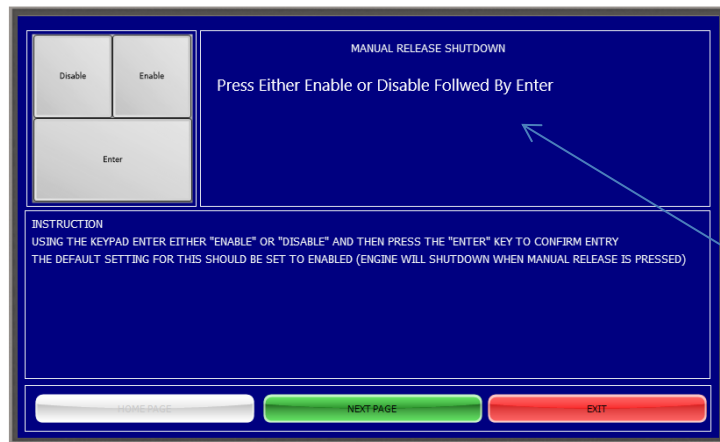
Once all the changes have been made press the soft key "Exit With Save" or "Exit Without Save"

Note

When all the changes have been made, press the "EXIT WITH SAVE" pressing the "EXIT WITHOUT SAVE" will retain the original settings.

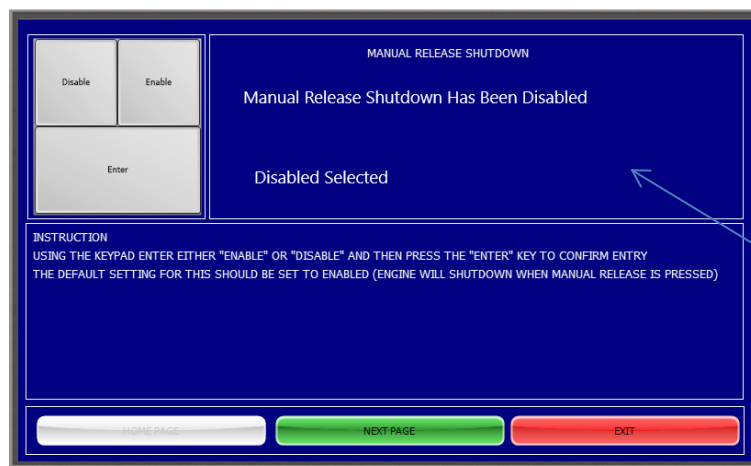
Section 5.5.1 Engine Shutdown

The following window is for the panel to perform an engine shutdown when any of the five manual release buttons have been pressed.



Using the keypad select either “Enable” or a “Disabled” and press enter

Once the “Enter” key has been pressed the display will confirm that the entry has been set.



Conformation the setting has been completed

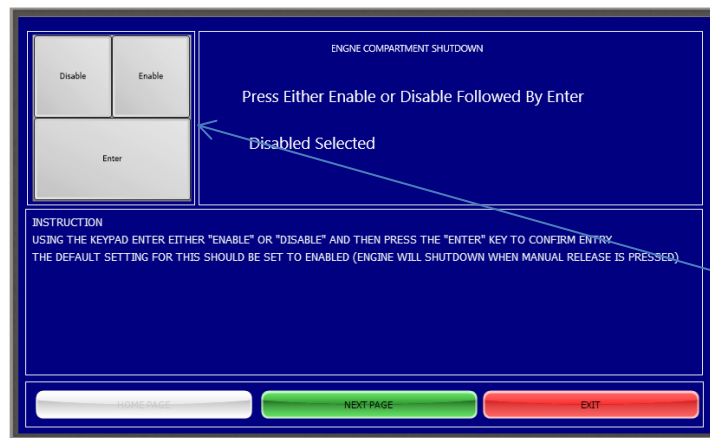
Note
This is the default setting having the shutdown disabled

Pressing the “Next Page” Key will move to the next screen which is engine shutdown on engine compartment alarm.

Pressing the “Perv Page” Key will move back to the main configuration screen.

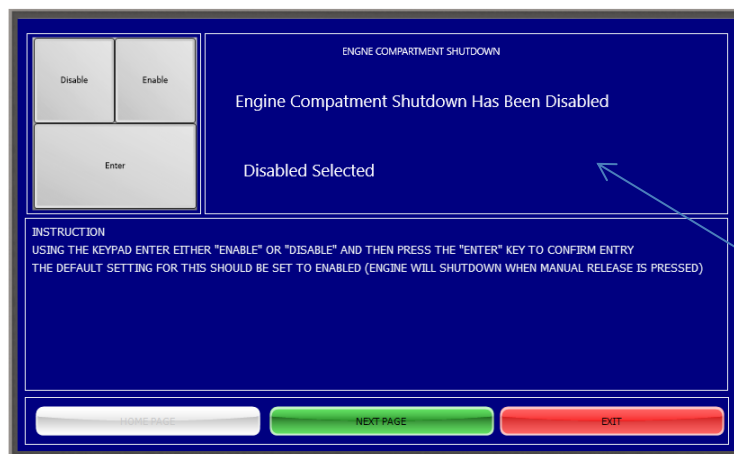
Pressing Exit will take you back to the main configuration screen.

The following window is for the panel to perform an engine shutdown when two circuits are in alarm with the engine compartment.



Using the keypad select either “Enable” or a “Disabled” and press enter

Once the “Enter” key has been pressed the display will confirm that the entry has been set.



Conformation the setting has been completed

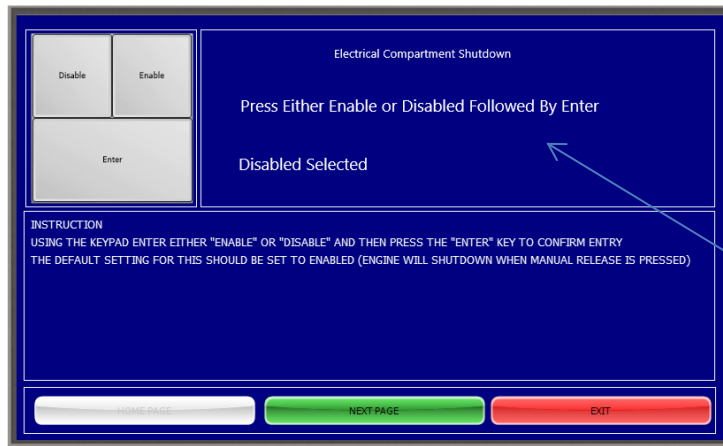
*Note
This is the default setting having the shutdown disabled*

Pressing the “Next Page” Key will move to the next screen which is electrical shutdown on electrical compartment alarm.

Pressing the “Prev Page” Key will move back to the previous screen which is manual release screen.

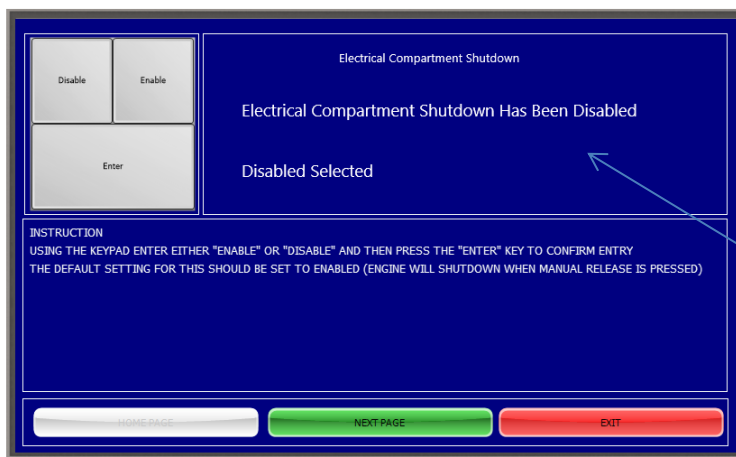
Pressing “Exit” will take you back to the main configuration screen.

The following window is for the panel to perform an electrical shutdown when two circuits are in alarm with the electrical compartment.



Using the keypad select either “Enable” or a “Disabled” and press enter

Once the “Enter” key has been pressed the display will confirm that the entry has been set.



Conformation the setting has been completed

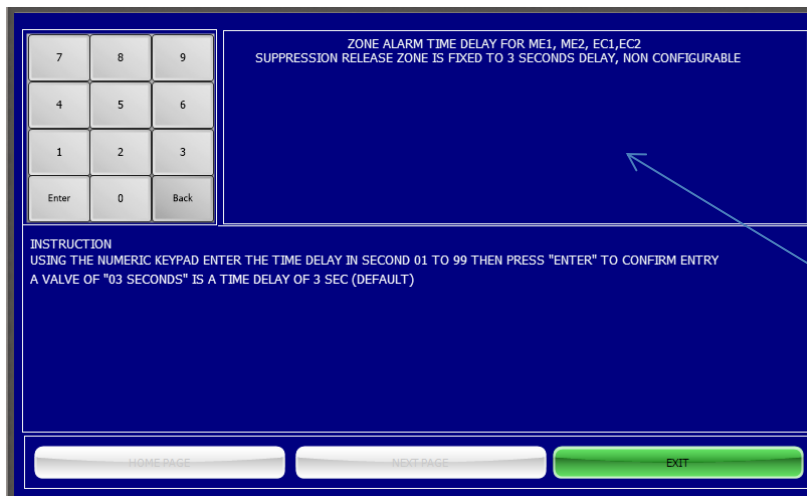
*Note
This is the default setting having the shutdown disabled*

Pressing the “Prev Page” Key will move back to the previous screen which is engine shutdown on electrical compartment alarm.

Pressing “Exit” will take you back to the main configuration screen.

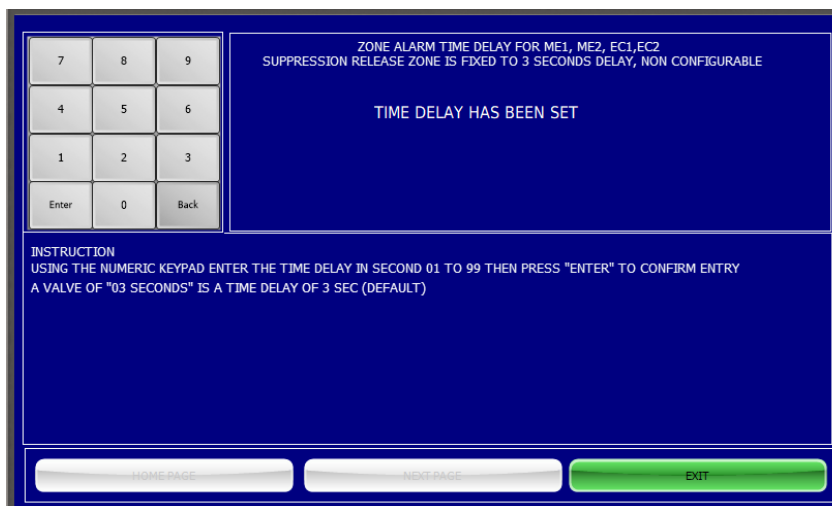
Section 5.5.2 Time Delay

The following detail on setting a time delay to the alarm circuits by default this is 3 seconds however the panel will allow for 0 through to 99 sec.



Using the numeric keypad select the required delay 0-99 and press enter default is 3

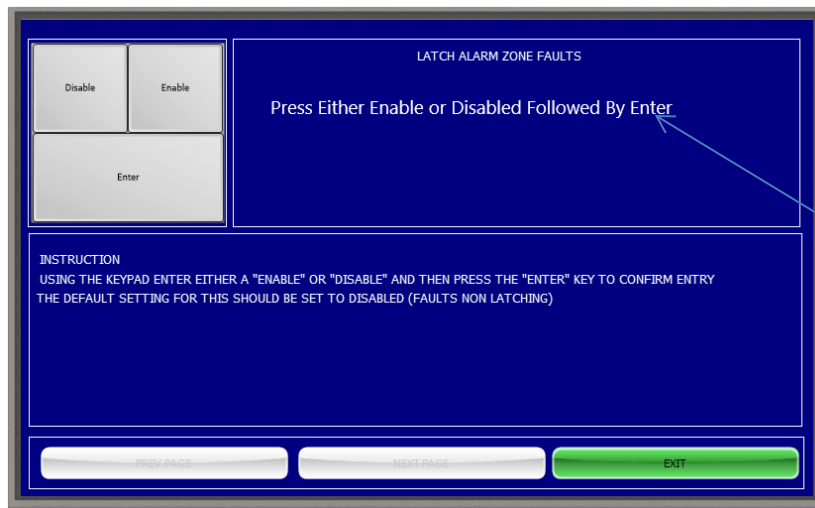
Once the “Enter” key has been pressed the display will confirm that the entry has been set.



Pressing “Exit” will take you back to the main configuration screen.

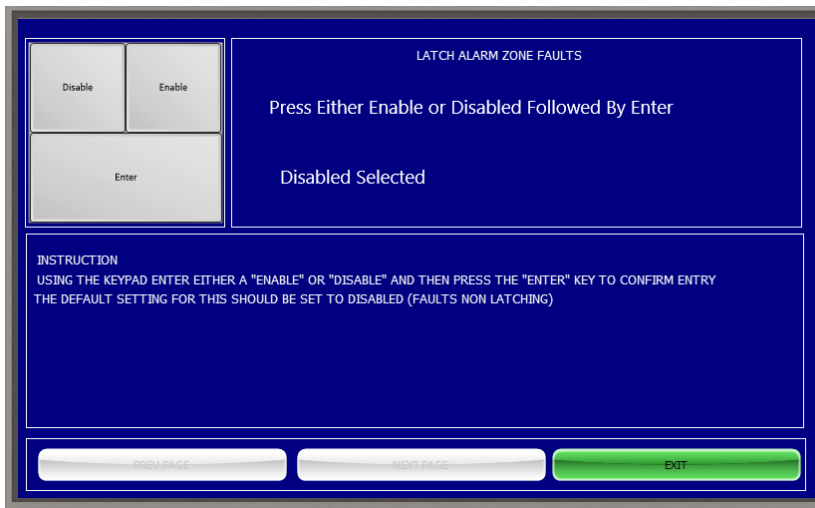
Section 5.5.3 Circuit Latching

The following detail on setting the alarm circuit and actuator circuit to latch any intermittent faults.



Using the keypad select either “Enable” or a “Disabled” and press enter

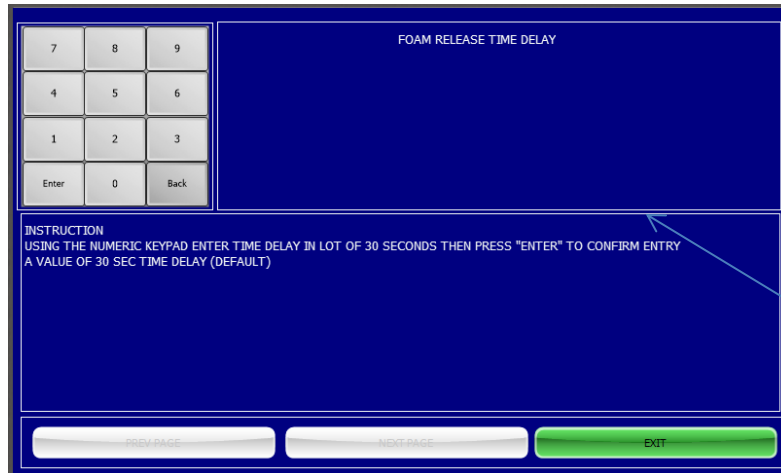
Once the “Enter” key has been pressed the display will confirm that the entry has been set.



Pressing “Exit” will take you back to the main configuration screen.

Section 5.5.4 Suppression Time Delay

The following detail on setting a suppression time delay default this is 30 seconds however the panel will allow for 0 seconds through to 255seconds.



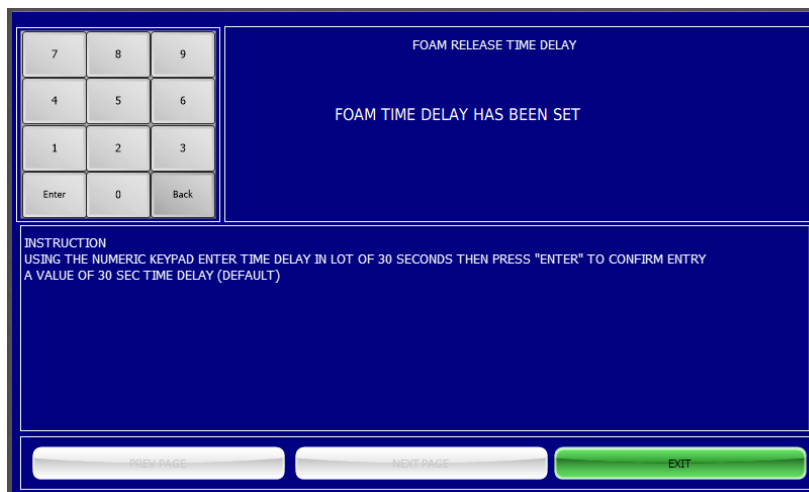
FOAM RELEASE TIME DELAY

INSTRUCTION
USING THE NUMERIC KEYPAD ENTER TIME DELAY IN LOT OF 30 SECONDS THEN PRESS "ENTER" TO CONFIRM ENTRY
A VALUE OF 30 SEC TIME DELAY (DEFAULT)

PREV PAGE NEXT PAGE EXIT

Using the numeric keypad enter either a value from 0 through to 255.
Default should be 30

Once the "Enter" key has been pressed the display will confirm that the entry has been set.



FOAM RELEASE TIME DELAY

FOAM TIME DELAY HAS BEEN SET

INSTRUCTION
USING THE NUMERIC KEYPAD ENTER TIME DELAY IN LOT OF 30 SECONDS THEN PRESS "ENTER" TO CONFIRM ENTRY
A VALUE OF 30 SEC TIME DELAY (DEFAULT)

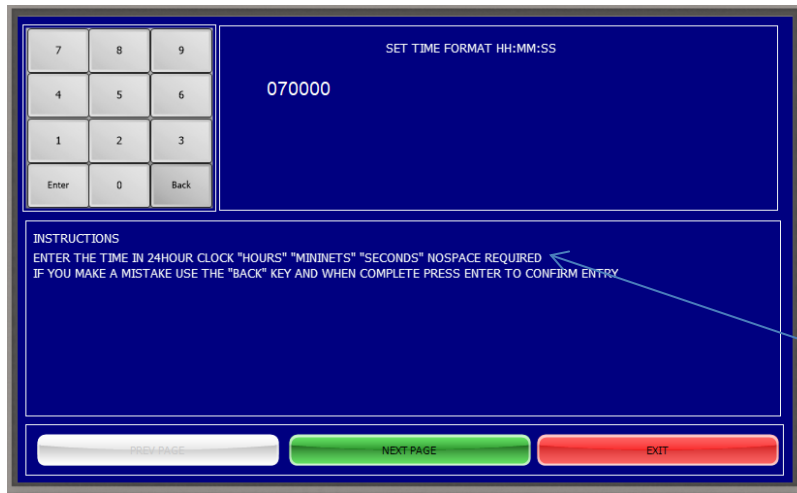
PREV PAGE NEXT PAGE EXIT

Pressing "Exit" will take you back to the main configuration screen.

Section 5.5.5 Time and Date

The following detail on setting the time and date time is primarily used for logging events.

Setting the time



Using the numeric keypad enter a six digit number for the time (24hour clock) in the format of HHMMSS
In this case 23min pass 2 in the afternoon.

Once the “Enter” key has been pressed the display will confirm that the entry has been set.



Pressing “Exit” will take you back to the main configuration screen.

Pressing the “Next Page” Button the screen with change to setting the date

Setting the date

Using the numeric keypad enter a six digit number for the date in the format DDMMYY

Once the “Enter” key has been pressed the display will confirm that the entry has been set.

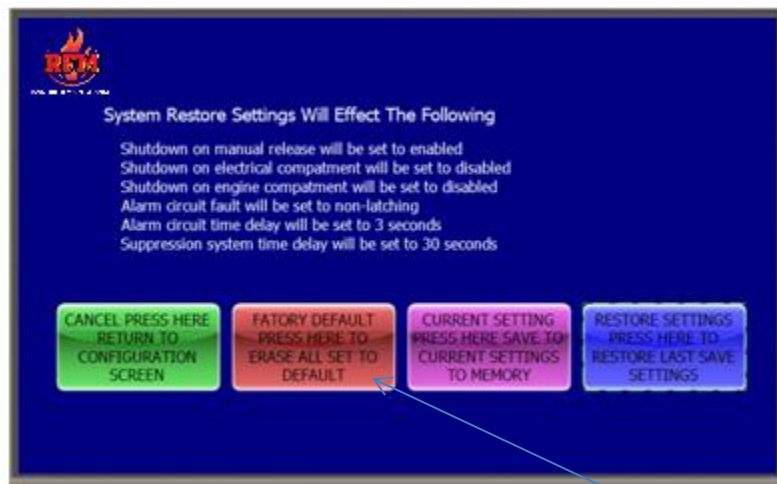
Pressing “Exit” will take you back to the main configuration screen.

Pressing the “Prev Page” Button the screen will move back to the time page.

Section 5.5.6 Restore Factory Default Settings

Pressing “Restore Factory Default Settings” will take you a to a conformation screen where to can proceed or cancel.

- Pressing the green cancel button will return you back to the configuration screen.
- Pressing the red restore button will change the setting back to factory default.
- Pressing the pink save settings button save the current settings.
- Pressing the blue restore button load the previously saved settings.



Configuration setting buttons

Section 5.5.6.1 Factory Default Settings

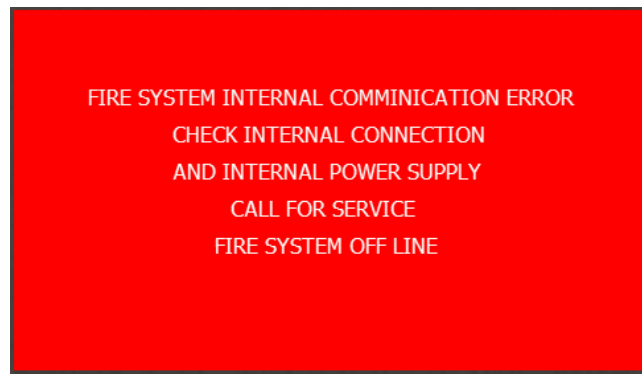
- *Shutdown on Manual release is enabled.*
- *Shutdown on electrical compartment alarm is disabled*
- *Shutdown on engine compartment alarm is disabled*
- *Alarm circuit fault is set to non-latching*
- *Alarm circuit delay is set to 3 seconds*
- *Suppression system time delay for release is 30 seconds*

Section 5.5.7 Internal Error

The control panel is made of two main printed circuit boards the Display Card is used to monitor and control all the front panel switch and indicators. Whilst the Main Control card monitors the detection circuit, relay and the SD logging.

The display card micro controller is polled every 500 milliseconds to pass information between the two cards, if this communication fails the system will fail to operate as intended.

If this event does occur the LCD will display a red screen and a voice message will be played on a regular basis until the fault is fix. The main control card will continue to poll internally and if communication is re-established the LCD will return to normal front screen.



Internal Error Screen

Section 5.5.8 Information screen

The control panel provided the service personnel with some basic information about the five (5) detection circuit, along with a locomotive overview on the coverage area.

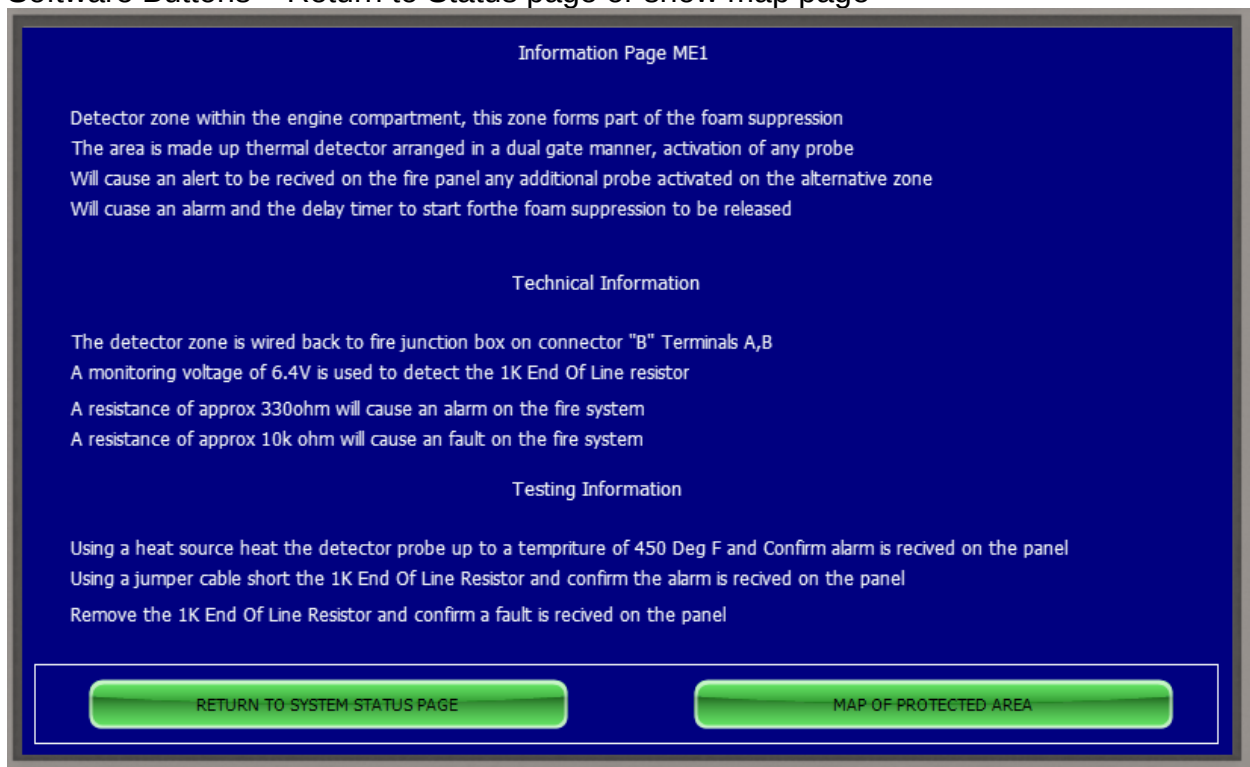
Below is the information screen for the ME1 engine compartment detection circuit. The screen covers the following areas

Information – Where the circuit is installed and how it is configured

Technical – The monitoring voltage, the end of line resistor value, the alarm and fault threshold values.

Testing- How to test the circuit

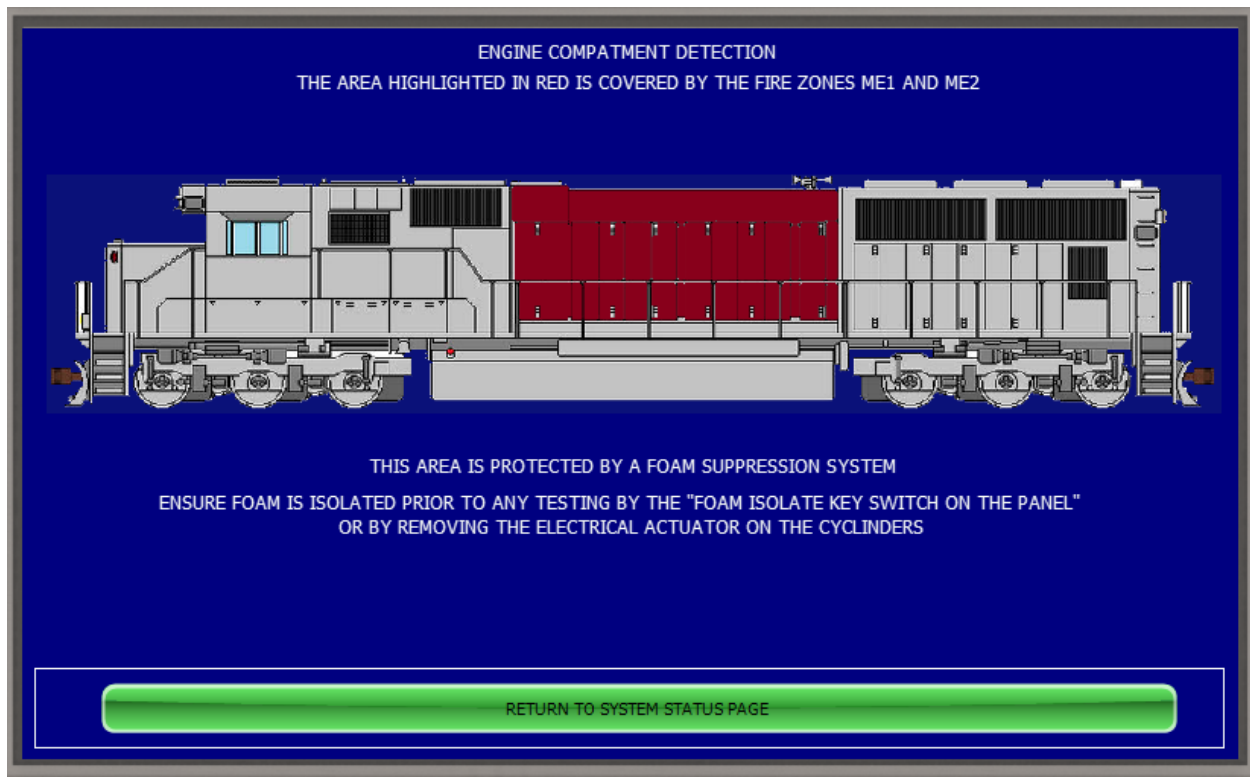
Software Buttons – Return to Status page or show map page



Information page ME1

Pressing the "MAP OF PROTECTED AREA" icon shows a side view of the locomotive on the protected area

The screen below shows a side view of the locomotive, and the section, protected by the thermal detection circuit.



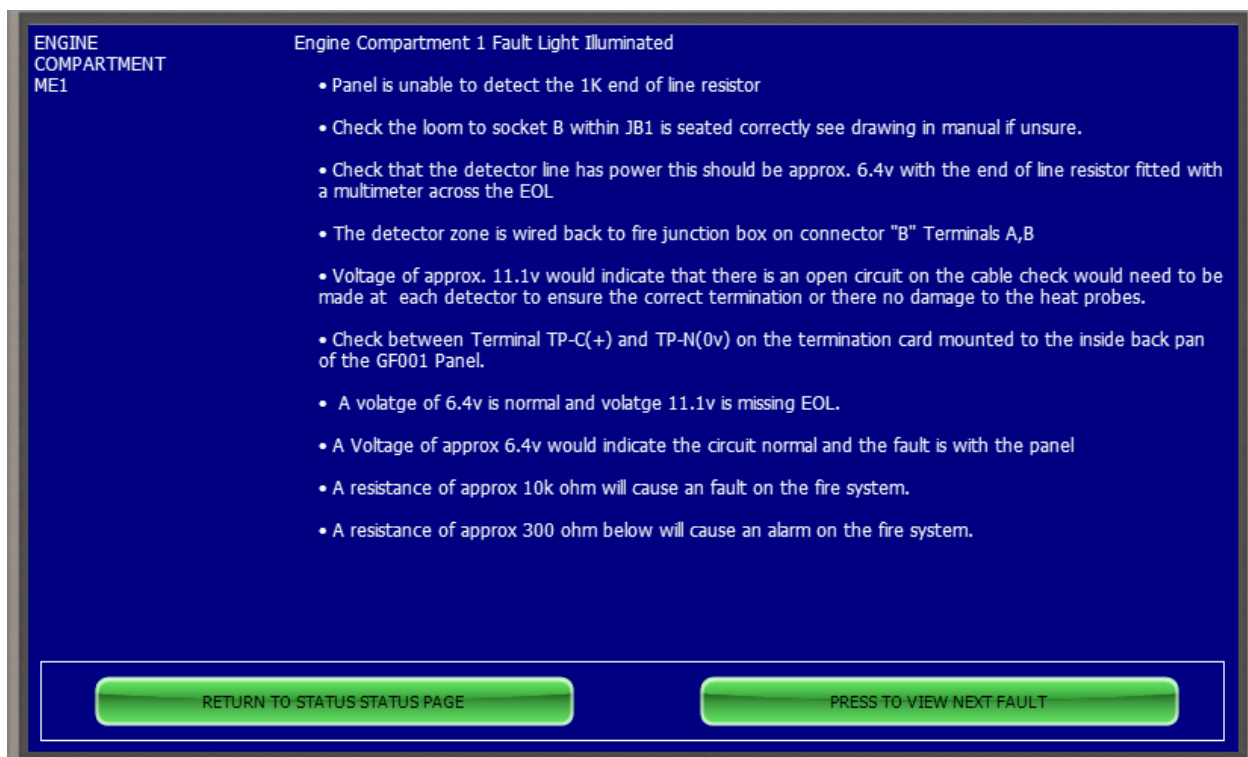
Pressing the "RETURN TO SYSTEM STATUS PAGE" exit the screen

Section 5.5.9 Fault Finding screen

The fault-finding screen is a dynamic list of pagers that show simple ratification to be done on the specific fault on the system

When the fault tip button is press on the status screen a check is performed on what faults are on the system and a list of pages loaded to details what and how to help repair that faults or faults

Below is an example of a ME1 fault. As always humans make the best fault finders as and can interpret fault better than machines, however this page is designed to provide basic information on the fault present with the objective of minimizing down time.



ME1 fault page

Section 5.5.10 Engine Override

The engine override button is part of AS5062 and is required to allow the user the ability to override the shutdown and restart the engine.

Selecting the “Engine Override” button from the configuration screen to show the following page.



The engine override screen has two (2) soft buttons

1. “Return To Configuration Screen”
2. “Toggle Engine Override”

The return to configuration screen is use to simply exit this page, whilst the toggle button is used to either “enable” or disable the shutdown relay within JB1.

Note

An audible instruction will be given if you exit this screen with the engine override still enabled along with the status shown on the configuration screen.

The engine override will either de-energize the shutdown relay or prevent it from operating in the first place.

Section 5.5.11 Engine and Electrical Compartment Trigger

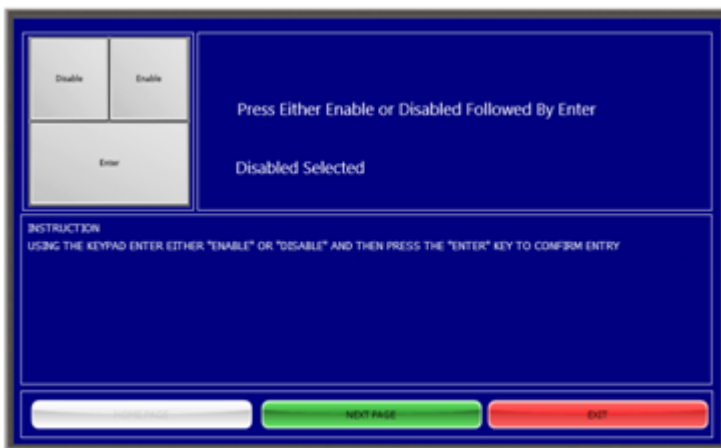
This option allows, for the operator to select on how the system will operate, on either a single detector probe or a dual detector probe.

From the configuration screen select the option “Detector Trigger Dual or Single”

Thos will show a screen giving the option to select either of the following

The selection of single shot allows for though installation that may have only a single circuit or liner heat wire in a compartment. That the system is been upgraded to comply with AS5062 or been fitted with a suppression system.

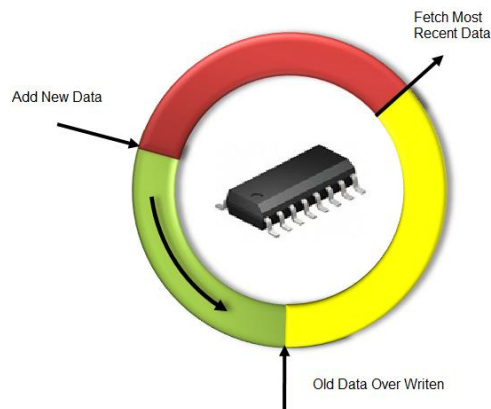
- Disabled – Any detector probe within that compartment will activate the Alarm Condition
- Enable – Any detector probe on operate circuits are required to activate activate the Alarm Condition
- Pressing the enter button will confirm the selection



Pressing the next page will allow the same to be configure for the electrical compartment, whilst exit leave this page and returns back to the configuration screen.

Section 5.6 Internal Non Volatile Ram (FRAM)

The panel has been fitted with a non-volatile ram FM25W256-GTR that will hold the last 250 event; any new event will over write the existing in a circular buffer.



The FM25W256 is a serial F-RAM memory. The memory array is logically organized as $32,768 \times 8$ bits and is accessed using an industry standard serial peripheral interface (SPI) bus. The functional operation of the F-RAM is similar to serial flash and serial EEPROMs. The major difference between the FM25W256 and a serial flash or EEPROM with the same pin out is the F-RAM's superior write performance, high endurance, and low power consumption.

FM25W256 It provides reliable data retention for 151 years without any power or battery while eliminating the complexities, overhead, and system level reliability problems caused by serial flash, EEPROM, and other non-volatile memories. Unlike serial flash and EEPROM, the FM25W256 performs write operations at bus speed. No write delays are incurred. The FM25W256 is capable of supporting 1^{14} or 1,000,000,000,000,000 read/write cycles, or 100 million times more write cycles than EEPROM can manage.

Section 5.7 Debug Port

The panel has been fitted limited debug port for monitoring the system the port is TTL logic level 0-5v only “**DO NOT CONNECT PC DIRECT TO THIS PORT**” A FTDI Chip, 5 V TTL USB to UART Cable, TTL-232R-5V must be used to connect to a PC running any terminal program.



The six-way header is connected to the main CPU card making note of the orientation of the connector green wire closest to the relay, also note the description on the PCB. See image below.

The serial port will send data out at 57600, N, 8, 1 and can be viewed on any terminal window such as Terminal 1.9, PUTTY or HyperTerminal. On power up the following is made available.

1. Software Version Bootloader and configuration.
2. Conformation that the SD “Flash Drive” card is fitted.
3. Conformation at the internal non-volatile memory is working.
4. RTC reading the current time and data from the real time clock module.
5. Address number / Serial Number.

A user banner is provided with five options that can be selected by pressing the required option. If no option is selected the panel will continue to reboot within ten seconds

1. Dump the contents of non-volatile ram.
2. Erase the entire non-volatile ram.
3. Exit and continue to reboot.
4. Copy the non-volatile ram to the flash drive.
5. View Manufacture Details.

Note

Dumping, Erasing, and copying the internal ram can take about 50 sec depending on the amount of data stored.

Section 5.7.1 Debug Port Register Status

The debug port also sends data out in real time during normal operations, this data showing the status of the internal registers as shown below in the table. This is sent every 60 sec or when an event has caused a change in any of the bits

The data is shown in binary “Little Endian” which means bit 0 is the left most and bit 8 is the right most.

Example of the status bit with system Normal operation		Example of the status bit with system Loco Shutdown Relay Activated	
ME1 Actual:-	00000000	ME1 Actual:-	00 1 00000
ME2 Actual:-	00000000	ME2 Actual:-	00000000
EC1 Actual:-	00000000	EC1 Actual:-	00000000
EC21 Actual:-	00000000	EC21 Actual:-	00000000
LP Actual:-	00000000	LP Actual:-	00000000
TL Actual:-	00000000	TL Actual:-	00000000
Relay:-	00000000	Relay:-	1 0000000
JB1 Status:-	00000000	JB1 Status:-	00000000
FIP Mode:-	00000000	FIP Mode:-	00000000

Section 5.8 MP3 Audio Files

The panel has been fitted with MP3 Audio player, where sixteen audio files are store on Micro SD Card; these files are used to provide the operator with audio feed back on the status of the system, as well as audio feedback during the configuring the system.

TheMP3 audio files can be changed to meet any client's requirement for that event. For example, feedback could be provided in native language. Below is a list of audio files.

CAUTION

If you changing the MP3 Player files, you know that the filenames of sound files must be named "001.mp3" "002.mp3" and so on, then copied to the SD card and then you can play them by their number. The files, need to copied in the right order hence the 001.mp3,002.mp3,003.mp3, so you have more than ten file windows OS will copy file 010.mp3,011.mp3,012.mp3,... before 002.mp3.

Because MP3 Player does not read the names, it simply lists the directory.

DO NOT TRY AND INSERT A NEW FILE INBETWEEN OTHERS, or COPY OUT OF ORDER This will throw out the play order.

You can use a utility call "CopyInOrder" download from
"www. compulsivecode.com/Project_CopyInOrder.aspx"

1. Powerup complete, system ready
2. Fire detected in main engine compartment
3. Fire detected in main electrical compartment
4. Foam suppression system released
5. Trainline activated
6. Fire system internal error
7. Lamp and earth fault test complete
8. Resetting fire system
9. Configure, engine fire shutdown
10. Configure, electrical fire shutdown
11. Configure, manual release shutdown
12. Set time, hours, minutes and seconds

13. Set Date, Day, Month and year
14. Configure, Fire alarm time delay
15. Configure, Fire zone fault to latching
16. Configure, Foam release time delay
17. Lamp test started, check image on screen and each indicator
18. Configuration settings, select any of the four options, cancelled, Resort Default, Save Current Setting, retrieve last Saved
19. Button disabled, return all switches to normal before proceeding
20. Date is invalid, please re-enter date
21. Junction box, relay control and indication
22. System information, use arrow keys to move between lines, press enter when complete and exit to leave page
23. Enable selected
24. Disabled selected
25. Engine override is enabled, press again to disable
26. Engine override is disabled, press again to enable
27. Caution, engine override is still enabled
28. Enable selected
29. Disabled selected
30. Configure, Engine compartment detection to be single or dual activation
31. Configure, Electrical compartment detection to be single or dual activation
32. Pressure Switch set to open
33. Pressure switch set to close
34. Configure, pressure switch to be open or closed contact
35. Configure, if the compartment is to be part of the suppression system
36. Bluetooth is connected, history log on micro SD card is now granted
37. Configure, if the foam suppression system actuator line is to be short circuit fault monitored
38. Configure, Fire zone alarm to latching

The Micro SD card is located on the front internal PCB next to the power on lamp indicator.

Section 5.9 Micro SD card

Any micro SD card can be used in the panel. However not all flash card are the same or manufactured to the same standards or features. The panel is supplied from the factory with Samsung High Endurance SD Card or similar.

High endurance SD cards are tested in rugged conditions and have enhanced specifications, like those found in industrial settings. These conditions include extreme temperatures and temperature fluctuations, high levels of shock, and high levels of vibration. These cards are also waterproof and will not be damaged by x-rays.

Performance

- Speed Read : up to 100 MB/s, Write : up to 30MB/s * Performance results are based on internal testing conditions. Read/write speeds may vary by host device.
- Speed Class Class 10

Environment

- 4-proof1) Temperatures : Withstands -25°C to 85°C (-13°F to 185°F) operating, -40°C to 85°C (-40°F to 185°F) non-operating 2) Water : IEC60529, IPX7 / up to 72 hours in salt water 3) X-ray : Airport X-ray machines (up to 50 Roentgen) 4) Magnet : The equivalent of a high-field MRI scanner (up to 15,000 gauss)
- Operating Voltage 2.7~3.6V
- Humidity Up to 40°C, 93%, 500hr (storage)
- Durability Up to 10,000 insertion/removal cycles

Certification

- EMC FCC, CE, VCCI, NATA

Section 5.10 Suppression Actuator

The panel is fitted with dual suppression output release circuit F1 and F2, the actuator line is monitored by a 1K end of line resistor and when activated 12vdc power is supplied to release the suppression.

The actuator specification is as followed.

Manufacture: -	Baccara
Part No: -	GE-B-23
Coil winding insulation: -	H 180°C
Temperature range Coil: -	-20°C to 150°C , Ambient : -20°C to 70°C
Duty cycle *:-	100% ED
Electrical connection: -	AMP pins, DIN 46242, 2 poles + 1 earths
Assembly: -	In any position
Coil fixing: -	One nut G1/4" hexagonal 19mm
Coil voltage: -	Voltage 12vdc
	Power 10W
	Resistance 14Ω
	Current ≈ 0.8A
Standard / Certification: -	CE
Standard protection class: -	IP65 with connector *
	Option: IP68 (please refer to GEM-BP Coil)

Note

The coil should not be energized without being assembled on the operator.

Section 5.11 Manufacture Setup and User Information

The panel has been fitted with 32K of internal non-volatile ram as described in section 5.7 of this manual.

When the USB to serial communication cable (FTDI Chip, 5 V TTL USB to UART Cable, TTL-232R-5V) is connected to the debug port during power up the following initial configuration option is available.

1. Dump the contents of non-volatile ram.
2. Erase the entire non-volatile ram.
3. Exit and continue to reboot.
4. Copy the non-volatile ram to the flash drive.
5. View Manufacture Details
6. Manufacture Details
7. Unlock Code (Used to Unlock The software at manufacture time)

Section 5.11.1 Power Up Options

Section 5.11.1.1 Access The Micro SD card: - This option allow access to the micro SD card ether via a laptop or over Bluetooth with a smart phone.

Section 5.11.1.2 Power Up Option 1 Dump Fram:- This option dumps the entire 250 event from the internal memory out through the debug port, regardless of the number of event saved this will take approx. 50 sec to complete and you should wait until the “completed” statement is received.

Section 5.11.1.3 Power Up Option 2 Erase Fram:- This option erases the entire non-volatile ram this will take approx. 50 sec to complete and you should wait until the “completed” statement is received.

Section 5.11.1.4 Power Up Option 3 Exit:- This allows the system to continue booting

Section 5.11.1.5 Power Up Option 4 Copy Fram:- This option will dump the entire 250 events from the internal memory to the SD card a file will be created in the format of Log#####.txt size of 32k bits this will take approx. 50 sec to complete and you should wait until the “completed” statement is received.

Section 5.11.1.6 Power Up Option 5 View Manufacture Details:- This option will show the information entered during initial factory testing.

Date- The date the panel was manufactured.
Name- Name of the technician who tested the system
Client Name- The owner or company of the panel
Notes- This section allows of any additional information

Section 5.11.1.7 Power Up Option 6 Enter Manufacture Details:- This option allow for the following details to be added into the internal memory of the system for tracking details.

Date- The date the panel was manufactured.
Name- Name of the technician who tested the system
Client Name- The owner or company of the panel
Notes- This section allows of any additional information

Section 5.11.1.8 Power Up Option 7 Unlock Number:- This option displays the hardware serial number and waits for the user to enter a 16 digit number / lower case letter to unlock the software. This set an internal flag within the microcontroller to unlock the software once set this never has to be done again and the options 7 and 6 will not be displayed again but can always be accessed.

Section 5.12 PCB Links and Jumper Settings

Section 5.12.1 *Open Log PCB*

- CN3 –This DTR jumper is used to reset the micro controller when software is been uploaded this link should always be in the 3v3 position due to the compotes used.
- CN1 –This TX jumper is used to set the voltage level of the serial data been sent to the main micro controller this can be in either the 3v3 or 5v position by default it set to 3v3.
- CN2 –This RX jumper is used to set the voltage level of the serial data been sent to the open log controller this link should always be in the 3v3 position due to the compotes used.

Section 5.12.2 *Main Controller Card*

JP2 RS485 - This jumper is used to control the flow of RS485 data used for the Modbus interface

- ON - This position holds the transceiver permanently on.
- MCU- This allow the micro controller to control the direction of data this is the default position.
- OFF- This position disables the RS485 by turning off the transceiver.

JP1 MODE - This link is located in the bottom left side has been provided to ensure the new system operate exactly are the FP280panel to ensure backwards compatibility is maintained.

- Link on the bottom two pins original mode (FP280)
- Link in the top two pins the system will operate AS5602 mode
- Removing the Link altogether fall back to default mode AS5602
- Link in the middle position is for custom configuration (Future)

JP8- Suppression 1 Actuator Short Circuit Enable or Disable

- E- Allow the system to monitor the actuator line for short circuit this is required as part of AS5062 but the actuator must be fitted with a blocking diode for this to work correctly.
- D- This disables the short circuit fault monitoring.

JP9- Suppression 2 Actuator Short Circuit Enable or Disable

- E- Allow the system to monitor the actuator line for short circuit this is required as part of AS5062 but the actuator must be fitted with a blocking diode for this to work correctly.
- D- This disables the short circuit fault monitoring.

Relay RL2 Fault

- Lk1- Switch either 0v or 12v through the relay set to 12v by default.
- Lk4- Set if the relay is Normally Open or Normally Closed the link is set to Normally Open By Default.

Relay RL3

- Lk2- Switch either 0v or 12v through the relay set to 12v by default.
- Lk5- Set if the relay is Normally Open or Normally Closed the link is set to Normally Open By Default.

Relay RL4 Release Indicator

- Lk3- Switch either 0v or 12v through the relay set to 12v by default.
- Lk8- Set if the relay is Normally Open or Normally Closed the link is set to Normally Closed By Default.

Relay RL5 Shutdown

- Lk6- Switch either 0v or 12v through the relay set to 12v by default
- Lk10- Set if the relay is Normally Open or Normally Closed the link is set to Normally Open By Default

Relay RL6 Suppression 2

- Lk7- Switch either 0v or 12v through the relay set to 12v by default
- Lk12- Set if the relay is Normally Open or Normally Closed the link is set to Normally Open By Default

Relay RL7 Suppression 1

- Lk9- Switch either 0v or 12v through the relay set to 12v by default
- Lk11- Set if the relay is Normally Open or Normally Closed the link is set to Normally Open By Default

Section 5.12.3 *Display Card*

LCD Prog – These two jumpers are used to connect the LCD screen to the serial consumption port

- LK1,2- Links data from the main micro controller to the LCD this is the default position

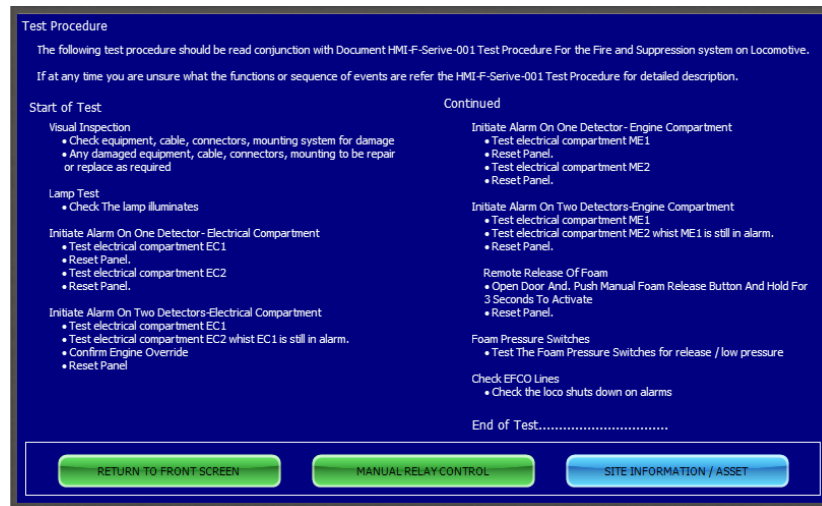
- LK7,8-Links data from the main micro controller to the LCD this is the default position

Serial 0

- ON - This position holds the transceiver permanently on.
- MCU- This allow the micro controller to control the direction of data this is the default position.
- OFF- This position disables the RS485 by turning off the transceiver

Section 5.13 Site Test Procedure Screen

The test procedure screen simply details the procedure required for the testing of the locomotive system.



ME1 fault page

Pressing the “Return To Front Screen” button Exit and display the front screen

Pressing the “Manual Relay Control” button give the user access to the following function on JB1 which is idle for fault finding and testing

- Toggle The Alarm Relay
- Toggle The Fault Relay
- Toggle The Shutdown Relay
- Toggle Both Suppression Outputs

Pressing The “Site Information / Asset” button display the system information

Section 5.14 JB1 User Control

The following screen enable the user to toggle the following relay with JB1, this makes it idle for a service tech to test or fault find a specific function.



Junction Box Control Screen

Toggle Switches for JB1:-
Alarm Relay
Fault Relay
Shutdown Relay
Both Foam Outputs

Caution

When toggling the foam button ensure head are removed from the cylinders as this will dive the direct with no delay.

Section 5.15 Asset / Site information

The asset page, enable the user to enter any specific information about the system.

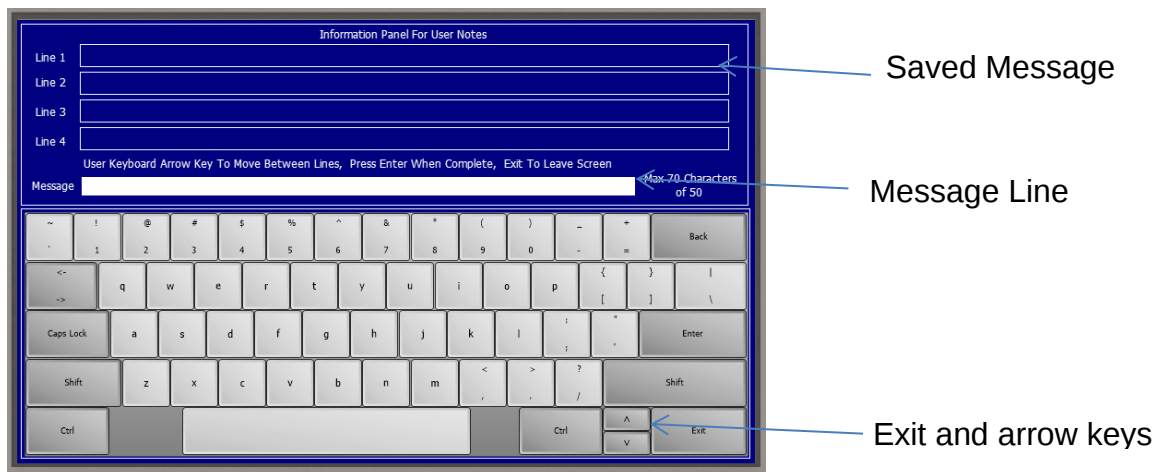
For example

- Line 1 - Service Company
- Line 2 - Client / Client Contact Name
- Line 3 –Locomotive Number
- Line 4 – Site Asset Number

The details are entered in a line at a time using the QWERTY virtual keyboard, the characters entered are shown on the message line, and saved one the enter key is pressed.

Note

- To clear a line just press enter on that line without entering anything.
- Maximum number of characters per line is 50.
- Pressing enter will save the typed line in the message field.
- The arrow key moves the point between lines.
- The exit key completes the session and exit the screen.



Asset /Information Screen

Section 6.0 Modbus Registers

The panel has been fitted with a RS485 Modbus interface for monitoring and control by third party system, if other means of communication is required moxa media converts or similar can be used.

Section 6.1 Modbus Specification

Serial Communication

- Serial Port 0
- Communication RS485
- Modbus Slave
- Baud Rate 19200
- Number of Bits 8
- Parity Bit None
- Stop Bit 1

Section 6.2 Modbus RTU protocol description

Modbus -communication protocol is based on the master-slave architecture. It uses RS-485, RS-422, RS-232 interfaces, as well as Ethernet TCP / IP networks (Modbus TCP protocol) for data transfer.

The Modbus RTU message consists of the address of the Slave ID device, the function code, the special data, depending on the function code and the CRC of the checksum.

Slave ID	Function code	Special data	CRC
----------	---------------	--------------	-----

If you discard the Slave ID address and the CRC checksum, you get the PDU, Protocol Data Unit. Slave ID is the address of the device, it can take a value from 0 to 247, and addresses from 248 to 255 are reserved. Data in the module is stored in 4 tables. Two tables are read-only and two are read-write. 9999 values are placed in each table.

REGISTER NUMBER	REGISTER ADDRESS HEX	TYPE	NAME	TYPE
1-9999	0000 to 270E	read-write	Discrete Output Coils	DO
10001-19999	0000 to 270E	read	Discrete Input Contacts	DI
30001-39999	0000 to 270E	read	Analog Input Registers	AI
40001-49999	0000 to 270E	read-write	Analog Output Holding Registers	AO

Section 7.0 SD Flash Drive Data Logging

The panel front facia has been fitted with a SD Card port to allow data logging of unusual events that occur in real time. All data logged s stored on the micro SD card that involves the following features:

- 64MB to 64GB
- FAT16 or FAT32

The system is monitored every second of any unusual event, such as alarm, faults, isolate etc..If an event is registered the message is automatically sent to the flash drive and saved to a file in plain text format with a time date stamp that that event occurred on.

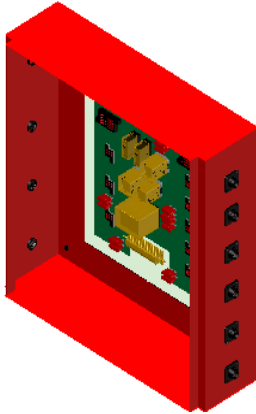
Sample of data log file to file name Log00001.txt

Sample of log events

25-01-18 07.00.00 Electrical Compartment Circuit 1 Alarm.....
25-01-18 07.00.03Electrical Compartment Circuit 2 Alarm.....
25-01-18 07.00.04Panel Loco Shutdown Activated.....

The SD card is inserted through the front facia in a push in push out manner and has been designed to be completely flush to prevent any damage.

Section 8.0 Alarm Junction Box



The Alarm Junction Box (JB1-P) is constructed from a metal enclosure measuring 400mm High by 400mm wide and 130mm deep this enclosure has a removable front cover. The enclosure contains a single printed circuit board. The JB1-P enclosure located between the HVAC and Battery compartment under the drivers cabin of the locomotive, and provides a central point for all the cables to connect through.

The Alarm Junction Box contains a printed circuit card, Interface relay, interconnection sockets and fuses for the entire system, which is made up of the following equipment.

- Plug “A” control panel
- Plug “B” Heat Detections Probes Engine Compartment
- Plug “C” Heat Detectors Probes Electrical Compartment
- Plug “D” Suppression System AFFF Solenoid and Pressure Switch
- Plug “E” Train line Alarm, Train line Fault, Fuel Pump Shutdown
- Plug “F” Drivers Cab Control Station
- Plug “G” Manual Release Station
- Plug “H” Manual Release Station
- Plug “J” Manual Release Station
- Plug “K” Manual Release Station

Junction box printed circuit board contain ten (10) fuses and two (2) of which are spare to protect the system from excessive current draw damage by third party equipment each fuse is rated at 10A and have been placed in all thirdparty outgoing and incoming interface connection as indicated below.

- Train lines “Alarm”
- Train Line “Fault”
- Fuel Shutdown relay
- Locomotive 0v reference Line
- 32vdc Power from converter
- 0vdc Power from converter
- 32vdc Centre tap from battery back
- 0vdc From Negative terminal battery back

Junction box has previous to control the LCD remote display card by the use of a plug-in micro controller.

Section 8.1 JB1 Micro Controller

The microcontroller monitors the following signal and sends the information out over an opt coupled serial connection to the remote control station.

1. Local Alarm (Engine or Electrical dual gate or pressure switch)
2. Local Fault (Fault with the panel In this locomotive)
3. Fuel Shutdown (The engine fuel pump is switch off)
4. Trainline Alarm (Alarm that is generated at the local or remote panel)
5. Trainline Fault (Fault that is generated at the local or remote panel)
6. Secondary Power Supply (Issue with the battery connection)
7. Primary Power Supply (Issue with the Main PSU power Supply)

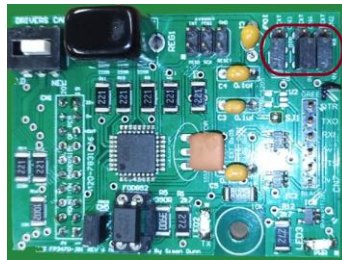
The micro controller card has a built-in time delay for the Secondary / Primary power supply alarm point by default this is 30 Seconds this is to prevent intermittent drop in power. (A primary or secondary power supply fault must be present for the entire

duration). By using a terminal program and an FTDI Chip, 5 V TTL USB to UART Cable, TTL-232R-5V Serial cable the time delay can be adjusted from 1sec to 4,000,000,000 Seconds. Event can also be masked out if there are not required to be transmitted to the Remote Control Station in the drivers cab

Section 8.2 Event Masking

To Mask out any event (Alarm, Fault, Trainline Shutdown, PSU, Battery)

1. Remove the fixing M3 screw from the micro controller card if already fitted
2. Remove the Microcontroller from the JB1 PCB
3. Ensure Coms jumps are installed CN2,CN3,CN4



4. Plug the serial cable into the laptop or smart phone
5. Open your provided serial program
 - For laptop recommended “Real Term”
<https://learn.sparkfun.com/tutorials/terminal-basics/real-term-windows>
 - For Android Smart Phone “USB Terminal” From the play store
6. Set the communication port
7. Set the board rate to 300,8,n,1
8. Plug the micro controller card and open communication port
9. You will have approx. 5 sec to send a command for set up or erase back to default
 Send lower case “**setup**” for set up
 Send lower case “**erase**” for erase to default (all events active)

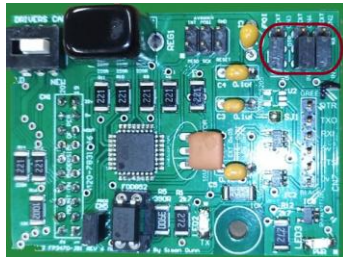
Once in the set-up mode you will need to enter either an “e” to enable or “d” to disable to each of the event indicated below each one will be shown consecutive order.

1. Local Alarm (Engine or Electrical dual gate or pressure switch)
2. Local Fault (Fault with the panel In this locomotive)
3. Fuel Shutdown (The engine fuel pump is switch off)
4. Trainline Alarm (Alarm that is generated at the local or remote panel)

5. Trainline Fault (Fault that is generated at the local or remote panel)
6. Secondary Power Supply (Issue with the battery connection)
7. Primary Power Supply (Issue with the Main PSU power Supply)

Once complete the primary and secondary time delay will need to be set if no change is required just reenter the current delay again.

8. Remove the three jumper links CN2,CN3,CN4.

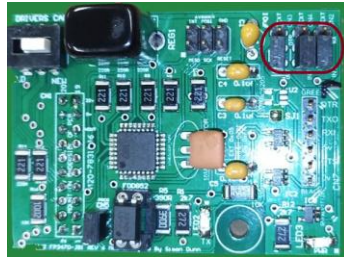


9. Replace the micro controller back on JB1 ensuring the screw hole is perfectly allied
10. Replace the locking M3 Screw.

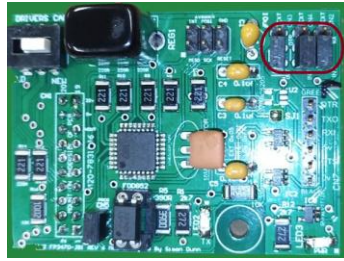
Section 8.3 JB1 Primary and Secondary Power Fault Time Delay

To adjust the time delay to a custom setting.

1. Remove the fixing M3 screw from the micro controller card if already fitted
2. Remove the Microcontroller from the JB1 PCB
3. Ensure Coms jumps are installed CN2,CN3,CN4



4. Plug the serial cable into the laptop or smart phone
5. Open your provided serial program
6. For laptop recommended any of the following
 - a. <https://learn.sparkfun.com/tutorials/terminal-basics/real-term-windows>
 - b. <https://learn.sparkfun.com/tutorials/terminal-basics/yat---yet-another-terminal-windows>
 - c.
7. For Android Smart Phone “USB Terminal” From the play store
8. Set the communication port
9. Set the board rate to 300,8,n,1
10. Plug the micro controller card and open communication port
11. You will have approx. 5 sec to send a command for set up or erase back to default
 - a. Send lower case “s” for set up
 - b. Send lower case “e” for erase to default
 - c. When the card is entering set up wait until the text has all been displayed and the card is asking you to enter the time delay in seconds from 1 to 4,000,000,000 (126 Years)
12. Enter the required time delay
13. The card will send conformation that the new time delay has been set
14. Remove the three jumper links CN2,CN3,CN4.



15. Replace the micro controller back on JB1 ensuring the screw hole is perfectly allied
16. Replace the locking M3 Screw.

Section 9 Bluetooth Connection

The panel has been fitted with a Bluetooth module (BLE Bluetooth 4.0), used to provide access to the following for retrieving history logs from the internal memory or from the SD card.

- Micro SD card plug in to the front of the panel.
- Internal Memory last 250 event.

Any serial terminal Bluetooth software that supports.

- Bluetooth Classic.
- Bluetooth LE / Bluetooth Low Energy / BLE / Bluetooth Smart.

Software set up

-  Download the Bluetooth application and install on device.
 - Recommended “Serial Bluetooth Terminal by Kai Morich”
- After installation check setting for the following

Terminal

- | | |
|--------------------------------|--------|
| ◦ Font Size | 10 |
| ◦ Font Style | Normal |
| ◦ Charset | UTF-8 |
| ◦ Display | Text |
| ◦ Auto Scroll to end of buffer | On |
| ◦ Show connection message | On |
| ◦ Show timestamps | Off |
| ◦ Buffer Size | 10Kb |

Receiver

- Newline CR+LF

Send

- Newline Auto
 - Edit Mode Text
 - Line Delay 0ms
 - Character Delay 0ms
 - Loco Echo Show Send Data On
 - Clear Input on Send Off
-
- Using the CL001 key open the outdoor.
 - From the “welcome screen press the left soft button “Configuration Screen”. Press the left soft button “OEM Manufacture”. Make note of the 7-digit Bluetooth access code.
 - If using “Serial Bluetooth Terminal by Kai Morich” Connect to the panel be pressing on the two serial plug image in the top right of your smart phone. Select the scan form the device menu
 - Select the SSID “FIP-Locomotive” and allow the panel to connect
 - Enter the seven-digit code to access the Bluetooth module.
 - The panel will close off the current log file with access by user line.
 - The panel will start to boot into a user option mode.

Note

If no data been sent to the panel after 5min the system will log you off and reset.

The following option will be displayed.

- “0” To Accessed the internal SD Card file
- “1” Display History From Internal Memory
- “2” Erase Internal Memory
- “3” Exit and Continue to boot up
- “4” Copy Internal Memory to SD Card
- “5” View Manufacture / Clients Details

Selecting "0" to access the SD card, will display the following option to be preformed

- new File- Creates a new file named File in the current directory. filenames are supported. For example, "87654321.123" is acceptable, while "987654321.123" is not.
Example: new file1.txt
- rm File - Deletes File from the current directory. Wildcard "*" are supported.
Example: rm Log00001.txt
Example: rm Log****1.txt
- Append File - Append text to the end of File. Serial data is then read from the UART in a stream and adds it to the file. It is not echoed over the serial terminal. If File does not exist when this function is called, the file will be created.
- ls - Lists all contents of the current directory. Wildcards are supported.
Example: ls
- ? - This command will pull up a list of available commands on the OpenLog.
- disk - Show card manufacturer ID, serial number, manufacture date and card size. Example output is:
- Basic read + omitted flags:
Example: read LOG00001.txt
- q- Quit

Section 10 Trouble Shooting Guide Loco System

The panel termination card has the following test point (TP) made available on the PCB. This makes fault find simpler as the entire system control line pass through.

Test Point	Description
TP- A	32VDC POWER IN
TP- B	0VDC POWER IN
TP- C	ENGINE COMPARTMENT 1 DETECTION +
TP- D	ENGINE COMPARTMENT 2 DETECTION +
TP- E	ELECTRICALCOMPARTMENT 1 DETECTION +
TP- F	ELECTRICAL COMPARTMENT 2 DETECTION +
TP- G	LOW PRESSURE DETECTION +
TP- H	SPARE
TP- J	FOAM ACTUATOR No 1 + (MONITORING VOLTAGE -)
TP- K	FOAM ACTUATOR No 2 + (MONITORING VOLTAGE -)
TP- L	
TP- M	
TP- N	COMMON 0V
TP- P	COMMON 0V
TP- R	REMOTE ACTUATOR RELEASE
TP- S	
TP- T	REMOTE ACTUATOR INDICATOR
TP- U	
TP- V	COMMONSIGNAL OUT
TP- W	COMMON FAULT SIGNAL OUT
TP- X	SHUTDOWN SIGNAL OUT
TP- Z	COMMONINPUT
TP- a	COMMON FAULT INPUT
TP- b	0V POWER (12VRAIL)
TP- c	0V POWER (12VRAIL)
TP- d	EARTH
TP- e	
TP- f	
TP- g	
TP- h	

Fault	Description	Remark
Panel has no power No green power light	The system obtains it power from:- 32vdc Powers Supply Unit (primary source) 32vdc from a centre tap of the battery (secondary supply)	• Check that 32v is present on JB1 Connector E terminals A (+) and B (-) Primary Source. • Check that 32v is present on JB1 Connector E terminals C (+) and D (-) Secondary Source. • Check that 32v Is present on JB1 Connector A Terminal A(+) and B(-) • Check the cable looms with JB1 are seated correctly • Check relay "H" the four pole change over relay is seated correctly • Check the PSU1,2 BAT1,2 fuses are not blown • Check the fuse on the Termination card is not blown. • Check the panel power key switch is turned on • Check for power on Termination Card TP-A and TP-B should be 32vdc • Check the 40 way ribbon cable with the panel is connected to the Main CPU card and the Termination card • Check CN2 on the termination card has 12vdc power on Ext and Int <i>Note ensure you measure with respect of the correct 0v as they are isolated supplies</i> • Check 10way and 20way ribbon cable are connected between the two large PCB within the panel • Check that two internal regulator are working by viewing two red leds, on the front card

Engine
Compartment1 Fault
Light Illuminated

Panel is unable to detect
the 1K end of line
resistor

- Check the loom to socket B with JB1 is seated correctly see drawing -E-08.
- Check that the detector line has power this should be approx. 6.4v with the end of line resistor fitted with a multimeter check between Terminal TP-C(+) and TP-N(0v) on the termination card mounted to the inside back pan of the Panel.
- Voltage of approx. 11.1v would indicate that there is an open circuit on the cable check would need to be made at each detector to ensure the correct termination or there no damage to the heat probes.

Engine
Compartment2 Fault
Light Illuminated

Panel is unable to detect
the 1K end of line
resistor

- Check the loom to socket B with JB1 is seated correctly see drawing -E-08.
- Check that the detector line has power this should be approx. 6.4v with the end of line resistor fitted with a multimeter check between Terminal TP-D(+) and TP-N(0v).on the termination card mounted to the inside back pan of the Panel
- Voltage of approx. 11.1v would indicate that there is an open circuit on the cable check would need to be made at each detector to ensure the correct termination or there no damage to the heat probes.

Electrical
Compartment 1 Fault
Light Illuminated

Panel is unable to detect
the 1K end of line
resistor

- Check the loom to socket C with JB1 is seated correctly see drawing -E-08.
- Check that the detector line has power this should be approx. 6.4v with the end of line resistor fitted with a multimeter check between Terminal TP-E(+) and TP-N(0v)on the termination card mounted to the inside back pan of the Panel.
- Voltage of approx. 11.1v would indicate that there is an open circuit on the cable check would need to be made at each detector to ensure the correct termination or there no damage to the heat probes.

Electrical Compartment 2 Fault Light Illuminated

Panel is unable to detect the 1K end of line resistor

- Check the loom to socket C with JB1 is seated correctly see drawing -E-08.
- Check that the detector line has power this should be approx. 6.4v with the end of line resistor fitted with a multimeter check between Terminal TP-F(+) and TP-N(0v) on the termination card mounted to the inside back pan of the Panel
- Voltage of approx. 11.1v would indicate that there is an open circuit on the cable check would need to be made at each detector to ensure the correct termination or there no damage to the heat probes.

Low Pressure Fault Light Illuminated

Panel is unable to detect the 1K end of line resistor

- Check the loom to socket D with JB1 is seated correctly see drawing -E-08.
- Check that the detector line has power this should be approx. 6.4v with the end of line resistor fitted with a multimeter check between Terminal TP-G(+) and TP-N(0v) on the termination card mounted to the inside back pan of the Panel
- Voltage of approx. 11.1v would indicate that there is an open circuit on the cable check would need to be made at each detector to ensure the correct termination or there no damage to the heat probes.

F1 Actuator Fault

Panel is unable to detect the 1K end of line resistor or monitor the actuator coils

- Check the loom to socket D with JB1 is seated correctly see drawing -E-08.
- Check that the actuator line has power this should be approx. -6.4v with the end of line resistor fitted with a multimeter check between Terminal TP-J(+) and TP-N(0v) on the termination card mounted to the inside back pan of the Panel
- Check that the actuator has the correct 1k resistor, the back EMF diode, and a monitoring blocking diode fitted a small PCB that has all three comports on is fitted with the socket of the actuator
- Voltage of approx. -11.1v would indicate that there is an open circuit on the cable check would need to be made at each through junction box.

F2 Actuator Fault

Panel is unable to detect the 1K end of line resistor or monitor the actuator coils

- Check the loom to socket D with JB1 is seated correctly see drawing -E-08.
- Check that the actuator line has power this should be approx. -6.4v with the end of line resistor fitted with a multimeter check between Terminal TP-J(+) and TP-N(0v) on the termination card mounted to the inside back pan of the Panel
- Check that the actuator has the correct 1k resistor, the back EMF diode, and a monitoring blocking diode fitted a small PCB that has all three components on is fitted with the socket of the actuator
- Voltage of approx. -11.1v would indicate that there is an open circuit on the cable check would need to be made at each through junction box.

Manual Release
Hand switch indicator
not illuminated

Manual release indicator
is not illuminated at the 5
remote stations

- Check the loom with JB1 is seated correctly
Loom to socket K is for back right
Loom to socket J is for back left
Loom to socket H is for Front right
Loom to socket G is for back left
Loom to socket F is control Station
- Using a multi meter check that that power is been provided by measuring 12VDC between Terminal TP-T(+) and TP-b(0v) on the termination card mounted to the inside back pan of the Panel

Manual Release
Hand switch not
working

Manual release hand
switch not working

- Check the loom with JB1 is seated correctly
Loom to socket K is for back right
Loom to socket J is for back left
Loom to socket H is for Front right
Loom to socket G is for back left
Loom to socket F is control Station
- This is a monitored circuit however to ensure backwards compatibility the monitoring resistor has been placed within the panel. Using a multi meter check that that power is been provided from the PANEL by measuring 6.4VDC between Terminal TP-R(+) and TP-b(0v) on the termination card mounted to the inside back pan of the Panel

