HEAVY VEHICLE FIRE SUPPRESSION SYSTEM

FSI FOAM-GUARD INSTALLATION & COMMISSIONING MANUAL - V5.2



Fire & Safety Industries Pty Ltd
Global Fire Solutions
www.fireandsafety.com.au

THINK WORK HOME SAFE

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ABBREVIATIONS

2C	2-Core Fire Harness
4C	4-Core Fire Harness
AS	Australian Standards
BSP	British Standard Pipe
CPS	Cylinder Pressure and Solenoid Enclosure
EHP	Extreme High Pressure
EOL	End of Line
F3	Fluorine Free Foam
IL	In Line
JIC	Joint Industry Council
LI	Lithium
LHD	Linear Heat Detector
LOP	Loss of Pressure
MSM	Mechanical Sensor Module
PME	Pressure Monitoring Enclosure
PRV	Pressure Relief Valve
PTFE	Poly-Tetra-Fluoro-Ethylene Tape
ROP	Rise of Pressure
RTC	Real Time Clock
SME	System Monitoring Enclosure

SYMBOLS

CO_2	Carbon Dioxide
˚C	Degrees Celsius
ID	Internal Diameter
LGTH	Length
OD	Outside Diameter
N_2	Nitrogen Gas

UNITS

g	Gram
kPa	Kilopascal
L	Litre
m	Metre
mm	Millimetres
Nm	Newton metres
Ω	Ohms
psi	Pounds per square inch
V (DC)	Volts (Direct Current)

1.0 INTRODUCTION

This FSI Foam-Guard Installation & Commissioning Manual V5.2 (AS5062-2016) provides Installation & Commissioning procedures for FSI Foam-Guard Rise of Pressure (ROP), Loss of Pressure (LOP) & Electric Actuation FSI fire suppression systems.

2.0 DISCLAIMER

Fire & Safety Industries Pty Ltd disclaims any liability for use of data contained within this manual by any other party. This manual is an uncontrolled document when printed. FSI reserves the right to modify this manual at any time without prior notice.

All FSI personnel, FSI accredited distributors or other competent personnel shall ensure appropriate site safety procedures are always adhered to when installing Foam-Guard systems.

Any modifications to the Pre-Engineered Foam-Guard System that occurs after commissioning shall first be approved by Fire & Safety Industries Pty Ltd.

In addition, it is important for owners, operators, hirers, and suppliers to provide details of all fire incidents to the vehicle manufacturer and the fire protection system manufacturer.

The technical data contained within this manual is to be used as a guide ONLY. The configuration of each FSI Foam-Guard system may vary depending on each customer's requirements. FSI Foam-Guard systems are to be installed, commissioned, inspected, and maintained ONLY by suitably trained and qualified FSI personnel and FSI accredited distributors.

FSI Foam-Guard systems are to be Installed by suitably trained and qualified FSI personnel, FSI accredited distributors or other formally qualified and competent personnel who are maintaining vehicle fire suppression systems on a full-time basis.

3.0 SYSTEM OVERVIEW

FSI Foam-Guard Fire Suppression Systems are available in four configuration types: Rise of Pressure (ROP), Loss of Pressure (LOP), Electric Actuation, and ROP/Electric Actuation.
Regardless of configuration type, there are four main sub-systems that go into creating the fire suppression system:

The component parts required are as follows:

FOAM STORAGE CYLINDER containing Foam-Guard Fluorine Free Foam (F3) concentrate, Drinkable/Potable water and compressed with dry nitrogen.

MONITORING SYSTEM comprising of V5 Fire Alarm Module located in the operator's cab which provides audible and visual signals of both fire system status, activation, system faults and engine shutdown integration.

ACTUATION AND DETECTION SYSTEM comprising either a Foam-Guard Mechanical Sensor Module (MSM), Foam-Guard LOP Tubing, Foam-Guard Linear Heat Detector (LHD), or Foam-Guard Thermal Probes to automatically initiate activation. Activation may also be initiated manually via pneumatic or electrically operated manual actuators.

DISCHARGE NETWORK includes discharge hoses, ring-main hoses and discharge nozzles to distribute the foam solution throughout the risk area.

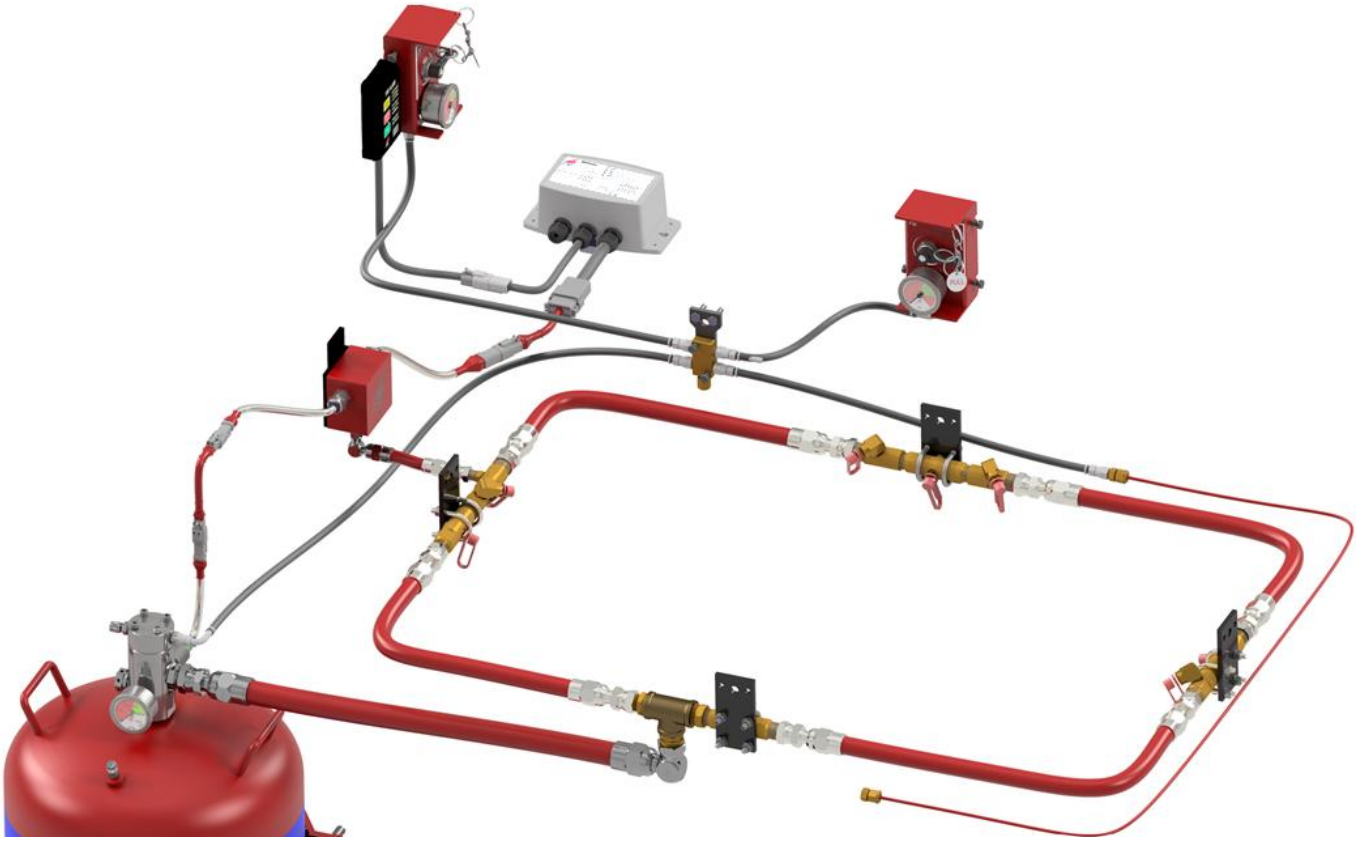


Figure 1
System Overview

3.1 RISE OF PRESSURE SYSTEM (ROP)

FSI ROP Foam-Guard Fire Suppression Systems operate via an increase in actuation line pressure. This system is manually activated by an operator striking the ROP manual actuator or automatically by an increase in temperature within the risk area, activating the Mechanical Sensing Module (MSM). This activates the ROP discharge valve located on the cylinder.
Foam solution is then distributed via discharge hosing and nozzle assemblies to cover the risk area. Pressure switches are also activated to initiate an audible and visual alarm via the V5 Display Module indicating a system discharge.



Figure 2
ROP System Layout

3.2 LOSS OF PRESSURE SYSTEM (LOP)

FSI LOP Foam-Guard Fire Suppression Systems operate via a loss of actuation line pressure. This is manually activated by an operator turning the LOP manual actuator lever, or automatically by an increase in temperature within the risk area, rupturing the LOP detection tube. This activates the LOP discharge valve located on the cylinder.
Foam solution is then distributed via discharge hosing and nozzle assemblies to cover the risk area. Pressure switches are also activated to initiate an audible and visual alarm via the V5 Display Module indicating a system discharge.



Figure 3
LOP System Layout

3.3 ELECTRIC ACTUATION

FSI Electric Foam-Guard Fire Suppression Systems operate via an electrical signal. This is manually activated by an operator using the manual actuator switch, or automatically by an increase in temperature within the risk area activating the Linear Heat Detector (LHD) and/or Thermal Probes. This activates the solenoid on the discharge valve located on the cylinder.
Foam solution is then distributed via discharge hosing and nozzle assemblies to cover the risk area. Pressure switches are also activated to initiate an audible and visual alarm via the V5 Display Module indicating a system discharge.

CAUTION
Before carrying out any maintenance on an electric actuation system, the control module SHALL BE ISOLATED to prevent an accidental discharge. Disconnecting the main power supply WILL NOT reset the system. Isolating the electric system will disable all input and outputs



Figure 4
Electric Actuation System Layout

3.4 ROP ELECTRIC ACTUATION

FSI ROP Electric Foam-Guard Fire Suppression Systems operate via an increase in actuation line pressure. This is manually activated by an operator striking the ROP manual actuator, or automatically by an increase in temperature within the risk area activating the Linear Heat Detector (LHD) and/or Thermal Probes. This activates the solenoid on the ROP discharge valve located on the cylinder.
Foam solution is then distributed via discharge hosing and nozzle assemblies to cover the risk area. Pressure switches are also activated to initiate an audible and visual alarm via the V5 Display Module indicating a system discharge.

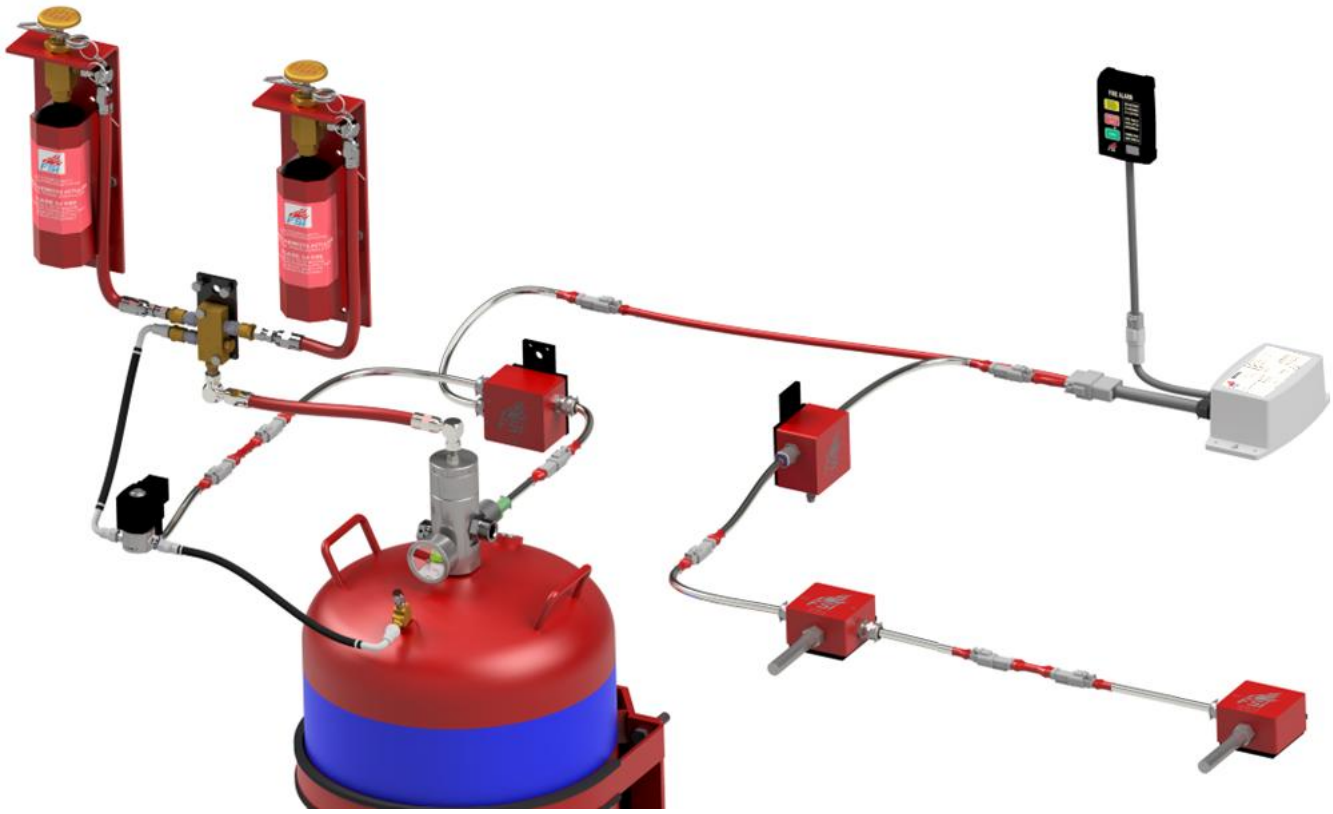


Figure 5
ROP Electric Actuation System Layout

4.0 INSTALLATION PROCEDURES

4.1 CYLINDER VALVE

The Cylinder Discharge Valve is manufactured from a solid piece of nickel-plated brass which houses the Burst Disc/Pressure Relief Valve (PRV), Cylinder Low-Pressure Switch, Pressure Gauge, Charging Port and Shuttle assembly. The Syphon Tube is threaded into the base of the Cylinder Discharge Valve.

The Cylinder Discharge Valve has two variations, Rise of Pressure and Loss of Pressure, an electric solenoid can be connected to either valve to allow for electric actuation.

Cylinder Discharge Valves installed to Horizontal Cylinders and Cylinders with a 216mm diameter utilise a Pressure Relief Valve (PRV) and all other 360mm diameter cylinders utilise a burst disk as a means of pressure relief.

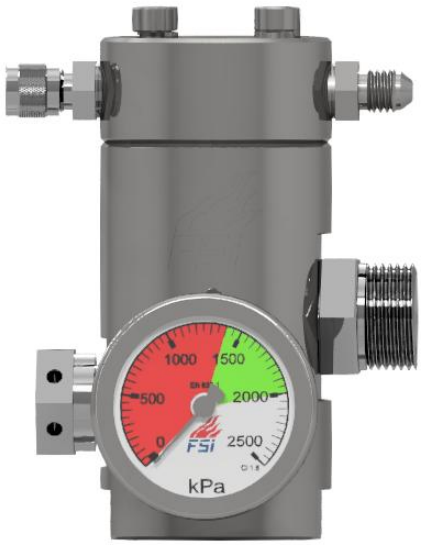


Figure 6
Cylinder Discharge Valve (LOP)

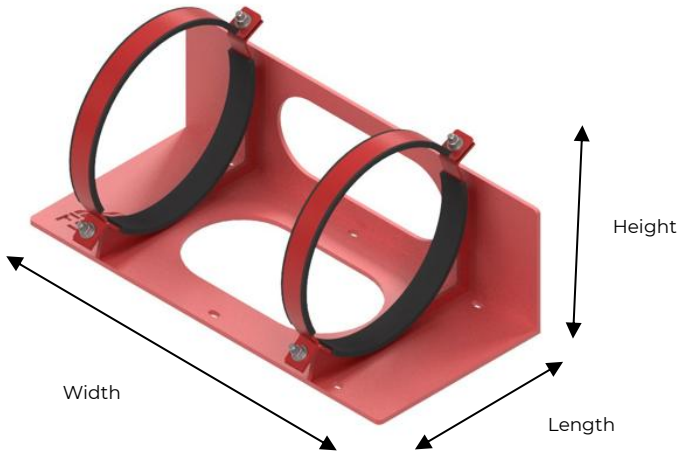


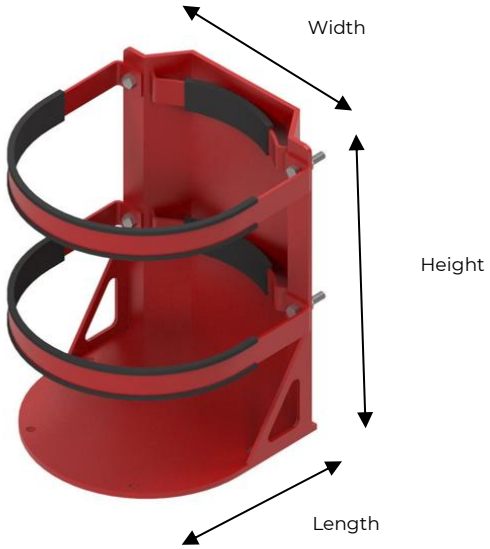
Figure 7
Cylinder Discharge Valve (ROP)

CAUTION
Always depressurise cylinder pressure prior to removal of cylinder assembly components.

4.2 CYLINDER BRACKET

The FSI Cylinder Bracket is constructed of steel and powder coated Blue or Red. They are available in various configurations and sizes; vertical, horizontal, slimline, and extra heavy duty. The Cylinder is secured to the Bracket using steel Cylinder Bands and protected with rubber moulded Band Rubbers.





The methods of securing the bracket to the machine are.

- Drill and secure using high tensile M12 nuts, bolts, and washers.
- Drilling and taping M12 high tensile hex bolts.
- Welding FSI Mounting Blocks to machine and securing with high tensile M12 Cap screws and washers.
- Welding optional FSI Intermediate Deck Plate and securing with high tensile M12 Cap screws and washers.
- Welding on a deck plate or mounting blocks.

CAUTION
Consideration shall be given to the use of lifting aids due to the weight of the bracket assembly.

Table 1
Bracket Dimensions

Bracket Part Number	Bracket Description	Height. (mm)	Width (mm)	Length (mm)	Bracket Weight (kg)	Assembly Weight (kg)
FSI 10021	16L & 23L	495	200	250	9	16L-30/23L-38
FSI 10018	45L & 65L	490	460	380	29	45L-77/65L-101
FSI 10020	106L Bracket	785	460	380	36	156
FSI 10020 HD	106L Heavy Duty	795	480	400	48	168
FSI 10020 XHD	3 Band 106L Extra HD	970	480	400	58	178
FSI 10018SLB	SLIMLINE 45L& 65L	475	360	395	26	45L-74/65L-98
FSI 10020SLB	SLIMLINE 106L	965	360	395	42	162
FSI 10021H	HORIZONTAL 23L	275	250	490	9	38
FSI 10018ASLB	HORIZONTAL 65L	400	430	805	34	106
FSI 10020HB-D65	106L – EPIROC D65	400	425	1220	86	206
FSI 10020HB-T45	106L – EPIROC T45	400	460	1255	65	185

Note: Assembly weight includes approximate weight of Bracket, Cylinder, Solution and Valve Assembly.

4.3 CYLINDERS

FSI Cylinders are constructed of Stainless Steel and powder coated red. A blue band is fitted to the cylinder to identify FSI Foam-Guard Fluorine Free Foam (F3). Cylinders are available in various configurations and sizes. 16L, 23L, 45L, 65L, 106L for vertical configuration and 23L, 65L, 106L for horizontal configurations.
Vertical cylinders shall be mounted no greater than 30° off vertical and horizontal cylinders shall be mounted horizontally.





The height clearances shown below indicates Cylinder and LOP valve assembly and minimum clearances required for maintenance. (Add 60mm to **A** for ROP assemblies and 50mm to **A** for electric actuation systems)

A = Cylinder + LOP Valve + Bracket
B = Minimum clearance for maintenance

Table 2
Cylinder Dimensions

Cylinder Part Number	Capacity (L)	Height. (mm)	Diameter (mm)	Length (mm)	A (mm)	B (mm)	Weight (kg) Empty/Full
FSI 10000A	16	527	216	-	662	970	6/21
FSI 10001A	23	727	216	-	862	1170	9/29
FSI 10002A	45	577	360	-	712	1020	15/48
FSI 10003A	65	777	360	-	912	1220	19/72
FSI 10004A	106	1192	360	-	1327	1630	27/120
FSI 10001H	H23	245	216	695	390	570	9/29
FSI 10003H	H65	380	360	725	525	620	19/72
FSI 10004H	H106	380	360	1140	525	620	27/120

Note: Full weight includes approximate weight of Cylinder, Solution and Valve Assembly.

CAUTION
DO NOT remove any parts from the cylinder prior to fully depressurising the cylinder. Failure to comply with these instructions may result in personal injury. Depress Schrader valve cores to ensure the cylinder is fully depressurised.

1. Locate mounting position inboard of the vehicle structure ensuring not to obstruct any machine access doors, operator vision or egress paths, ensuring access for prestart inspections and maintenance.
2. Ensure the mounting position has enough strength to support the weight of the assembly, communicate with an engineer or OEM/client to determine if an intermediate bracket or deck plate is required on an uneven or structurally weak location.
3. Secure bracket to mounting blocks, deck plate or intermediate bracket with high tensile M12 bolts, washers, spring washers and nuts. Bolts shall be torque to the correct specification as per table 6.
4. Apply Molykote 111 to the beveled edge of cylinder neck and firmly hand-torque the discharge valve until the cylinder gauge is visible during prestart inspections.
5. Secure the cylinder with M12 band bolts to the correct torque specification as per table 6.



Figure 8
Cylinder And Bracket Assembly

CAUTION
Consideration shall be given to situations when the machine is subjected to extreme vibration to ensure the reliability of the cylinder assembly.

CAUTION
Each cylinder handle has a Working Load Limit (WLL) of 30 kg and must not be used to lift loads exceeding this capacity

4.4 NOZZLE ASSEMBLY

Nozzle assemblies are available in three (3) standard configurations. They are constructed from brass tubes secured by two ¼'' U-bolts to a powder coated steel mounting plate.
The nozzle assemblies are fully adjustable and are fitted with 120-degree cone spray nozzles. To prevent the ingress of dust and other foreign objects, a high temperature silicone cap is installed to protect the nozzle.

Nozzles shall be secured so they will not move out of alignment under normal operating conditions.
The methods of securing nozzle brackets are.

- Drilling Two x holes and securing with M6 nuts & bolts
- Drilling and tapping
- Using pre-existing machine M10 step outs

It is best practise to use two (2) nuts, bolts, and spring washers to secure nozzle brackets to eliminate bracket rotation. Drilling and tapping is only recommended when it is not possible to install a nut and washer.

The nozzles are aligned to target high-risk areas with solution as determined by the Fire Risk Assessment and FSI Foam-Guard System Design Manual.

1. Locate the risk area as determined by the Fire Risk Assessment and Foam-Guard system design manual.
2. Select a suitable mounting location for the nozzle assembly to allow the correct application of foam solution to the risk area.
3. Ensure the nozzle assemblies do not obstruct any machine access doors, components or access for prestart inspections and maintenance.
4. Mount the nozzle assembly using the correct mounting hardware.
5. Ensure each nozzle spray pattern is not obstructed by machine components and is aligned correctly towards the risk area it is protecting.

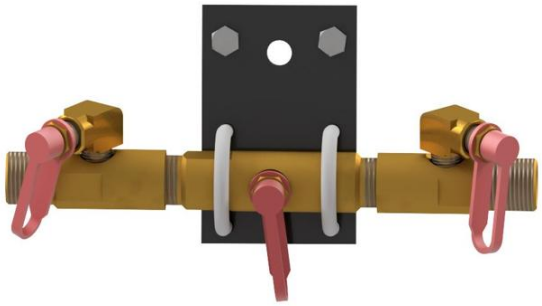


Figure 9
Nozzle Assembly

4.5 DISCHARGE AND ACTUATION HOSES

FSI Foam-Guard fire suppression systems utilise flexible hoses for discharge and actuation hosing. Flexible hose is used due to ease of installation and high resistance to vibration and corrosion.

When installing hose assemblies, it is imperative hose lengths are accurate. Careful consideration shall be given to the routing of hoses in order to avoid areas where they are likely to sustain damage or require additional means of protection. When hose lengths are required to pass through machine panelling, bulkheads shall be used.

In areas where additional protection is required, supplementary means of protection shall be used.

- Where there is a possibility of hoses rubbing against hard surfaces or exposed to UV damage, then spiral guard shall be used.
- Where there is a possibility of hoses rubbing against other hoses, these shall be segregated via the use of p-clamps.
- Where high temperatures can occur, fire sleeve shall be used to protect hoses.

Hoses should be installed in accordance with industries best practice to achieve a neat finish to maximise system performance.

FSI Foam-Guard systems utilise flexible single wire braid flame resistant hose for.

- 6.3mm (1/4”) – Actuation hose (ROP Only) and Foam lines
- 12.5mm (1/2”) – Discharge hose
- 19mm (3/4”) – Discharge hose

FSI Foam-Guard LOP systems utilise non wire braided actuation hose.

- 4.8mm (3/16’’) LOP Actuation hose

FSI Foam-Guard systems utilise reusable and crimp type hose fittings.

- 3/4’’ and 1/2’’ BSP Hose Ends are used to connect discharge hoses to ring main assemblies.
- 7/16’’ JIC and 1/4’’ BSP Hose ends are used for ROP actuation hoses lengths and Foam lines.
- 7/16’’ JIC hose end for LOP systems.

NOTE
• Ensure adequate flexing or changes in length due to articulation or expansion/contraction from temperature. • Ensure all hosing is correctly segregated from machine fuel or hydraulic hose assemblies and/or wiring. • If hose lengths are within approximately 300mm of high heat areas, then fire sleeve shall be installed. • Ensure hosing is not twisted or excessive in length. • Ensure all hose lengths are secured by p-clamps at the required spacing. • Ensure all hose fittings are correctly fitted and secured. • Ensure protective spiral guard has been fitted to prevent rubbing. • Ensure protective spiral guard has been fitted to hose in areas exposed to high UV.

The diagram shows examples of correct and incorrect hose installations requirements.

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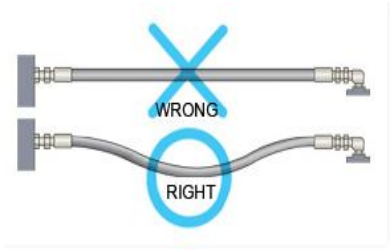
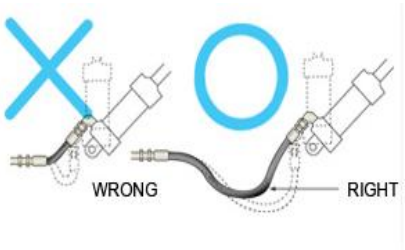
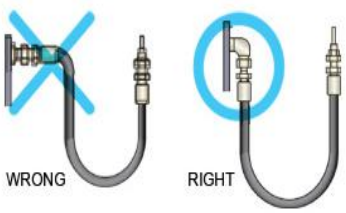
<td>

When hose installation is straight, allow enough slack in hose to provide for length changes which will occur when pressure is applied</td>
<td>

Adequate hose length is necessary to distribute movement on flexing applications and to avoid abrasion</td>
<td>

Use correct adaptors to avoid sharp twists or bend in hose</td>
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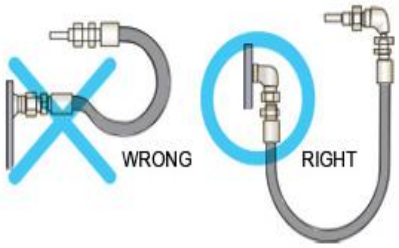
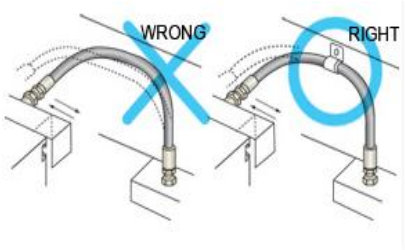
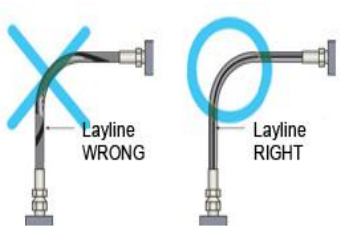
<td>

When radius is below the required minimum, use an angle adaptor to avoid sharp bends.</td>
<td>

Avoid twisting of hose lines bent in two planes by clamping hose at change of plane</td>
<td>

When installing hose, make sure it is not twisted. Pressure applied to a twisted hose can result in hose failure.</td>
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4.6 BULKHEADS & GLANDS

BULKHEADS FITTINGS

Bulkheads are utilised as disconnection points through panelling, and a means of separating sections of the system for maintenance or transport.

CABLE GLANDS

Cable glands shall be used when routing Fire Harness through panelling. The plastic gland offers protection to the Fire Harness while keeping sealed cabinets airtight.



Figure 10
Bulkheads & Glands

4.7 HOSE/ FIRE HARNESS CLAMPING

Hose clamps are the preferred method for securing hose, Fire Harness and LOP Tube, to prevent damage caused by vibration and heat during normal operational conditions.

Some sites require physical separation of Hosing and Cabling, refer to MDG15.

The correct size Hose clamps for the application shall be located at the recommended maximum spacing intervals, at each side of any radius section and each side of a DT Connector.

Table 3
Maximum Unsupported Hose/Harness Lengths

HOSE DIAMETER ID (INCH)	MAXIMUM UNSUPPORTED HOSE AND WIRING LENGTH (mm)
19mm - (¾")	750
12.5mm - (½")	500
6.3mm - (¼")	400
Fire Harness	400
LOP Tube	400
LHD	400
DT plug from Enclosure	200
Each side of DT plug Disconnection	50

Securing components with cable ties is not recommended unless listed below.

- When using Cable ties, they shall only be used in conjunction with swivel cable tie mounts and only where P-clamps cannot be utilised.
- Used to hold runs of Fire Harness and hosing while conducting the install.
- When securing wiring inside of cabs near wiring harness.
- When running hose with multiple hydraulic hoses.
- When damage could be caused by the metal P-clamps.
- Shall not be used in high heat areas.

CAUTION
Failure to secure correctly can lead to premature damage of components.

4.8 SPIRAL GUARD

FSI Spiral Guard is installed to hosing when there is a chance of rubbing against other hoses, hard surfaces or where a hose will be exposed to direct sunlight.

Spiral Guard is available in various sizes, 12mm, 16mm, 20mm, 32mm.

Spiral Guard shall be installed neatly to industry best practices.



Figure 11
Spiral Guard

CAUTION
Do not use spiral guard in high heat areas as it will melt. If hose is likely to be subject to excessive physical damage, then it may need to be re-routed.

4.9 FIRE SLEEVE

Fire Sleeve is a flame-resistant sheath which protects hoses from extreme temperatures, generally within 300mm of the high heat area.

Stainless steel cable ties secure the ends of the Fire Sleeve to the metal Hose Ends. A Stainless-Steel Cable Tie Tensioner Gun is required.



Figure 12
Fire Sleeve

CAUTION
Do not use cable ties to clamp fire sleeve as they will quickly soften (due to heat) and fall off. Use metal clamps or high temperature tape to secure the ends of the fire sleeve.

4.10 MECHANICAL SENSOR MODULE (MSM)

The FSI ROP Foam-Guard fire suppression system utilises a Mechanical Sensor Module (MSM) to automatically discharge the system. It is manufactured from stainless steel tube and available in two lengths 1.0 meter and 1.5 meters. It incorporates a pyrotechnic wick, at approximately 220˚C it converts to a gas generating pressure to actuate the discharge valves.

MSMs are mounted above the hazard. The distance from the surface of the hazard should be approximately 300mm to 1000mm. MSM's within high heat areas can in-avertedly actuate the system.

Multiple MSMs can be connected via a ROP manifold with check valves and can be bent to suit machinery layouts using a 1/4" pipe bending tool. A minimum of three (3) mounting points are used, maximum 100mm from each end and in the centre. An MSM support kit is used for this purpose.

The MSM detection circuit is connected via 6.3mm (1/4'') Single Wire Braded hose with 7/16'' JIC fittings. This hose runs to a stainless-steel check valve which is installed in the ROP Manifold. The Check Valve ensures the pressure from each actuation circuit is channelled correctly to the Cylinder Discharge Valve.

Maximum combined length of hose from any MSM to the cylinder discharge valve shall not exceed 25m.

1. Locate the risk area as determined by the Fire Risk Assessment and Foam-Guard system design manual.
2. Select a suitable mounting location for the MSM to cover the risk area.
3. If required, bend the MSM tube using a 1/4'' pipe bending tool.
4. Secure the MSM with an MSM support kit, 100mm from each end and in the centre a minimum of three (3) mounting points are required.
5. Ensure 6.3mm (1/4'') Single Wire Braded hose with 7/16'' JIC fittings are connected, and check valves are in the correct configuration.
6. Conduct a clear passage test of the ROP actuation circuit to ensure all check vales are unobstructed and installed correctly.



Figure 13
Mechanical Sensor Module (MSM)

4.11 LOP DETECTION TUBING

The FSI LOP Foam-Guard fire suppression system utilises LOP detection tube to automatically discharge the system. It is manufactured from a specially modified Polymer with a melting point of approximately 180˚C.

LOP detection tube is mounted above the hazard. The distance from the surface of the hazard should be approximately 300mm to 1000mm. LOP detection tube within high heat areas can in-avertedly actuate the system.

The LOP Detection Tubing is secured in position using 6mm sheathed P-clamps. The distance between support clamps should be 400mm or less and have a minimum internal bend radius of 50mm. A single length of LOP Detection Tubing may be used to cover more than one fire hazard.

Compression fittings are used to connect LOP detection tubing to actuation hose.

1. Locate the risk area as determined by the Fire Risk Assessment and Foam-Guard system design manual.
2. Select a suitable mounting location for the LOP Detection Tubing to cover the risk area.
3. Mount the LOP Detection Tubing using 6mm sheathed P-clamps at the required spacing.
4. Ensure compression fittings are correctly fitted and secured 10mm - 50mm from each fitting.
5. Ensure there is no chance of the LOP tube rubbing.
6. Ensure the hose and fittings are connected and sealed.
7. Conduct an Actuation line clear passage test and leak test.



Figure 14
LOP Detection Tubing

4.12 LINEAR HEAT DETECTOR (LHD)

FSI Foam-Guard fire suppression system can utilise Linear Heat Detector (LHD) to actuate the system on an electric actuation system. The length of the LHD depends on the size of the risk area.

The LHD is monitored by a 10kΩ (+/- 10%) resistor. At approximately 180˚C the LHD outer sheath melts causing the contacts to close circuit (CC). The FSI V5 Control Module will then energise an electric solenoid.

If there is an Open Circuit (OC) or Closed Circuit (CC) detected, the FSI V5 control module will output a shutdown signal (Shutdown Module only).

Foam-Guard Linear Heat Detection (LHD) is to be mounted above the hazard. The distance from the surface of the hazard should be approximately 300mm and 1000mm. LHD within high heat areas can in-avertedly actuate the system.

The Foam-Guard Linear Detection (LHD) is secured in position using LHD grommets and P-clamps. The distance between support clamps should be 400mm or less and have a minimum internal bend radius of 50mm.

1. Locate the risk area as determined by the Fire Risk Assessment and system design manual.
2. Select a suitable location for mounting the LHD and it is covering the risk area adequately.
3. Mount the LHD grommets and P-clamps at the required spacing.
4. Secure the EOL resistor encloser in an accessible location.
5. Fill enclosures with BIZGEL to prevent water ingress.
6. Ensure there is no chance of the LHD rubbing.
7. Test circuit for correct resistance.

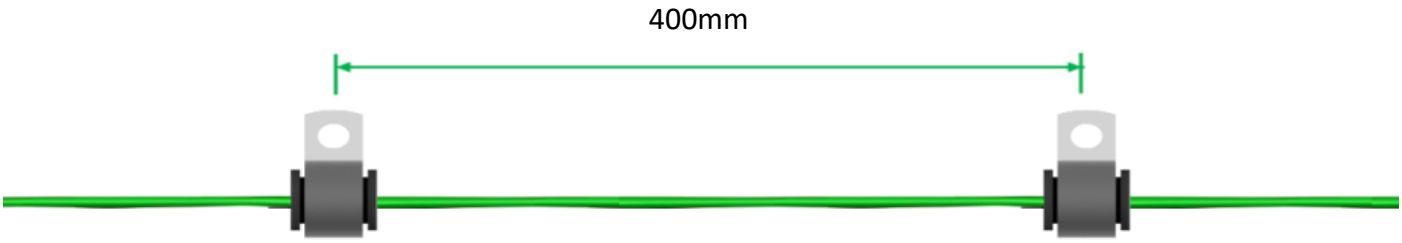


Figure 15
Linear Heat Detector
(LHD)

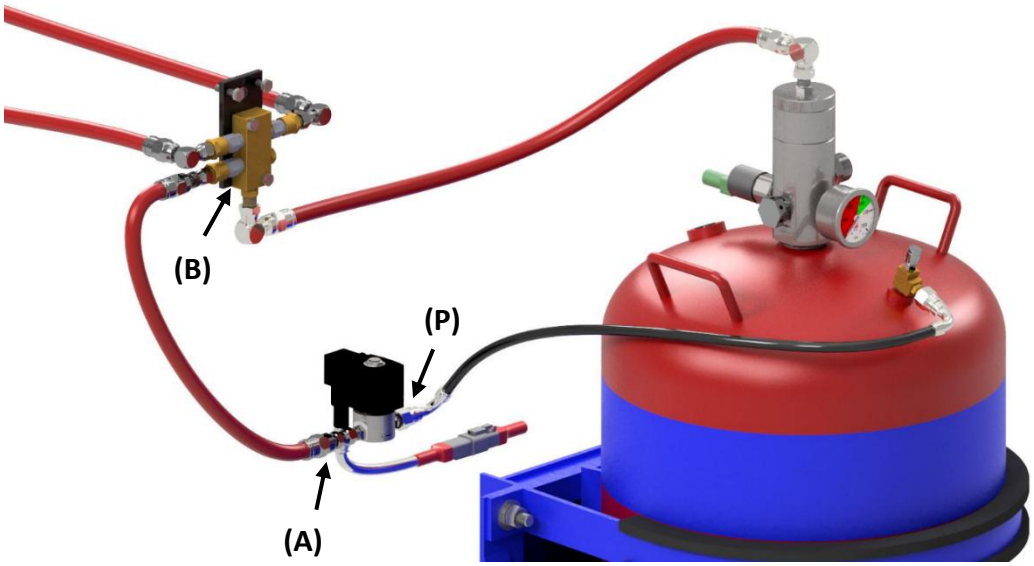
4.13 SOLENOID

The FSI Foam-Guard Electric fire suppression system can utilise a solenoid to electrically actuate and discharge the system on both LOP and ROP type valve assemblies.

ROP SYSTEM.

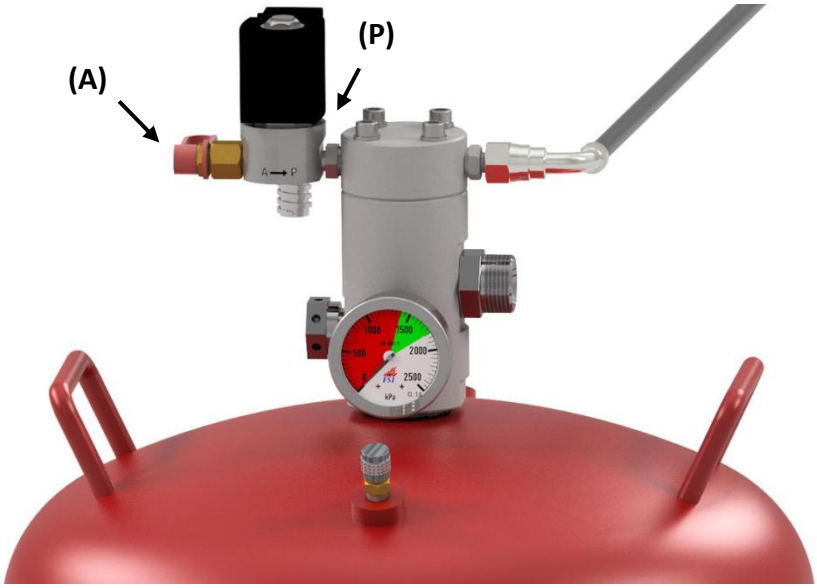
The Solenoid should be located on a hard rigid surface free from excessive vibration and damage, in close proximity to the cylinder discharge valve and the ROP manifold.

Port **(P)** of the solenoid is connected to cylinder via 4.8mm **LOP** Actuation hose to a 1/8" x 1/8" MALE RUN TEE in the cylinder Schrader port. Outlet Port **(A)** is then connected into a ROP manifold via a check valve **(B).**



LOP SYSTEM.

The Solenoid should be located in the LOP discharge valve via Inlet Port **(P)** or in close proximity to the LOP discharge valve via a short length of actuation hose from the LOP discharge valve to Inlet Port **(P).** Outlet Port **(A)** is installed with a relief port and cap and vents to atmosphere.



1. Mount and secure the solenoid in a location free from excessive vibration in a practical location for inspection and maintenance.
2. Wire in the solenoid ensuring the polarity is correct as per the wiring diagrams.
3. Ensure the Hirschmann plug outlet is facing downwards to prevent the ingress of water.
4. Secure 50mm either side of the DT connector with the receptacle facing downwards or horizontally
5. Apply dielectric grease to the DT plug seal.
6. Conduct a clear passage test of the solenoid assembly to ensure there are no contaminates.

CAUTION
Consideration shall be given to situations when the machine is subjected to extreme vibration to ensure the reliability of the solenoid assembly.

4.14 THERMAL PROBES

FSI Foam-Guard fire suppression system can utilise thermal probes to monitor ambient temperature or actuate the system on an electric actuation system.

The EOL Thermal Probe contains a 10kΩ (+/- 10%) resistor to monitor the circuit. A number of additional Inline Thermal Probes can be installed depending on the size of the risk area.

Below 163°C the Thermal Probe contacts are open, above 163°C the contacts within the Thermal Probe will close. The Control Module will detect this condition, initiate an alarm, energise the solenoid (if fitted) and output a shutdown signal (Shutdown Module only).

If there is an Open Circuit (OC) or Closed Circuit (CC) detected from a Thermal Probe. The FSI V5 control module will output a shutdown signal (Shutdown Module only).

It is best practise to use two (2) nuts, bolts, and spring washers to eliminate bracket rotation. Drilling and tapping is only recommended when it is not possible to install a nut and washer.

Thermal Probes shall be mounted on a hard rigid surface free from excessive vibration and damage. The distance above the hazard should be approximately 300mm and 1000mm. Thermal Probes within high heat areas could inadvertedly actuate the system.

1. Locate the risk area as determined by the Fire Risk Assessment and Foam-Guard system design manual.
2. Select a suitable mounting location free from excessive vibration and damage above the risk area.
3. Mount the Thermal Probe using the correct mounting hardware.
4. Secure the Fire Harness 200mm from the enclosure and 50mm either side of the DT connector with the receptacle facing downwards or horizontally.
5. Apply dielectric grease to the DT plug seal.



Figure 16
In Line Probe (IL)

4.15 FIRE HARNESS AND CONNECTORS

DT PLUG

FSI Foam-Guard fire suppression system utilises DT Plug Connectors with heat shrink adaptors to prevent the ingress of contaminants and support the Fire Harness. DT plugs are used as disconnection points and connections to low pressure switches, Thermal Probes, PME, SME, CPS, Electric Actuators and V5 control module. These are to be used sparingly to maintain the integrity of the circuits.

FIRE HARNESS

FSI Foam-Guard fire suppression system utilises 2-core and 4-core Fire Harness. Fire Harness provides thermal protection within the risk area and is used to provide electrical connection between low pressure switches, Thermal Probes, PME, SME, CPS, and control module.

1. Select a suitable location for securing the Fire Harness ensuring it is routed away from high heat areas and is not prone to damage.
2. Securely mount the Fire Harness at the required spacing with the receptacle facing downwards or horizontally using the correct p-clamps. Refer to table 3.
3. Secure the Fire Harness 200mm from the enclosure and 50mm either side of the DT connector.
4. Apply dielectric grease to the DT plug seal.

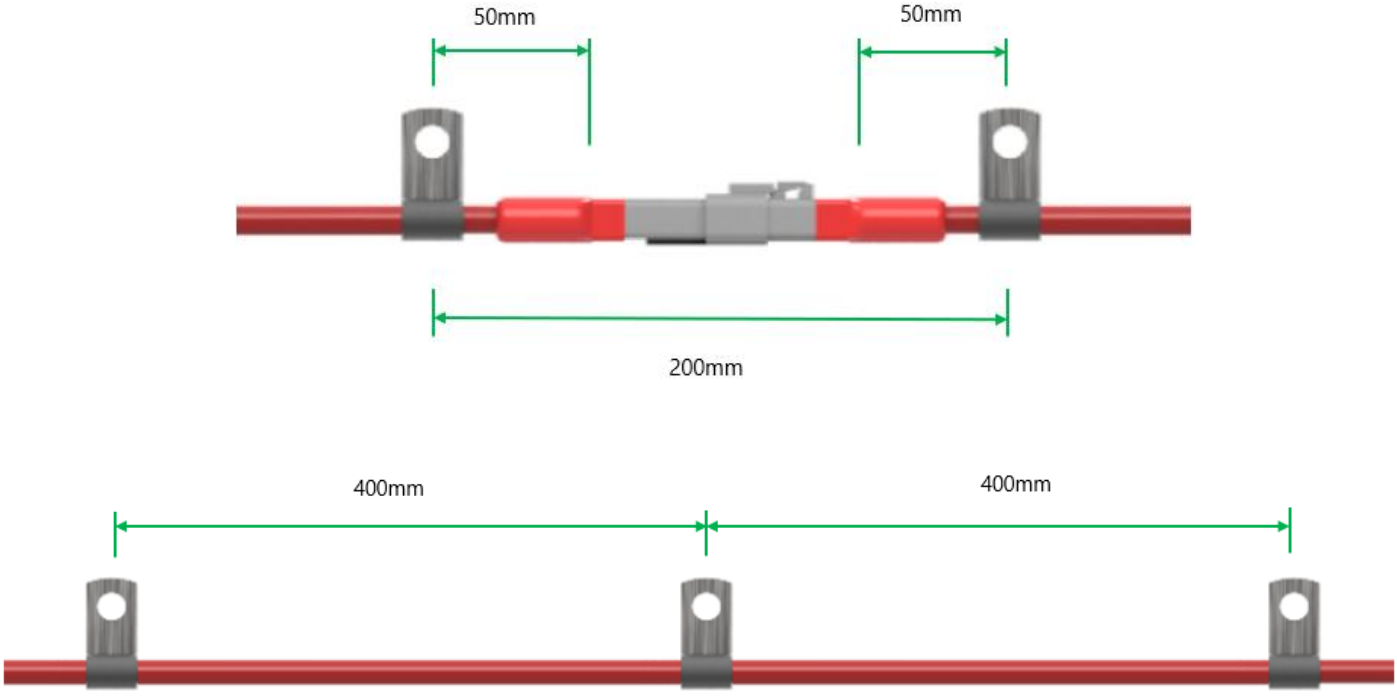


Figure 17
DT Plug and Fire Harness

4.16 MANUAL ACTUATOR

Manual actuators shall be located as determined by a risk assessment and Foam-Guard system design manual. One actuator shall be within reach and clearly visible from the operator's normal operating position and an additional actuator should be provided at ground level near egress paths and emergency stop points.

ROP MANUAL ACTUATOR

FSI Foam-Guard ROP system utilises a striker pin type actuator to actuate the system manually.

The ROP actuator assembly uses a high-pressure CO_2 cartridge to manually actuate the system.

A strike knob and pin are used to pierce the CO_2 cartridge causing gas to release and pressurise the actuation circuit.

The pull-pin is used in all ROP Manual Actuator assemblies to secure the striker pin to prevent an accidental discharge of the CO_2 cartridge.

A securitie is used on ROP Manual Actuator assemblies to hold the pull pin in place.



Figure 18
ROP Actuator and CO_2 Cartridge

NOTE - ROP SYSTEM
Maximum combined length of 1/4'' hose from the actuator to the cylinder discharge valve should not exceed 25m. Actuators require mounting securely to withstand a striking force of 180N.

LOP MANUAL ACTUATOR

FSI Foam-Guard LOP system utilises a ball valve type manual actuator to actuate the system manually.

The actuator is comprised of a pressure gauge to monitor actuation circuit pressure. This is represented by the GREEN sector on the pressure gauge.

The pull-pin is used in all Manual Actuator assemblies to secure the lever and prevent an accidental discharge.

A securitie is in place on Manual LOP Actuators to secure the pull pin.



Figure 19
LOP Manual Actuator F3

ELECTRIC MANUAL ACTUATOR

FSI V5 Foam-Guard fire suppression system can utilise electric actuators to actuate the system in conjunction with a solenoid and back up battery.

A safety pull-pin and securitie can be used to prevent an accidental discharge.

A red cover protects the switch from accidental actuation. When the pull pin is removed, the red safety cover can be flipped up, and the switch underneath can be switched to the on position actuating the fire suppression system.

The EOL Electric Actuator contains a 10kΩ (+/- 10%) resistor to monitor the circuit. A number of additional Inline Electric Actuators can be installed depending on the size of the risk area.



Figure 20
Electric Manual Actuator

The electric actuator in the off position has open contacts, upon activation the contacts within the electric actuator will close. The FSI V5 Control module will detect this condition and initiate the electric solenoid.

If there is an Open Circuit (OC) or Closed Circuit (CC) detected from the from an actuator. The FSI V5 control module will out-put a shutdown signal (Shutdown Module only).

There are 3 configurations of V5 Foam-Guard electric actuator, Electric Remote Actuator I/L (FSI21101). Electric Remote Actuator EOL (FSI21100). Electric Remote Actuator I/L Cab (FSI21102)

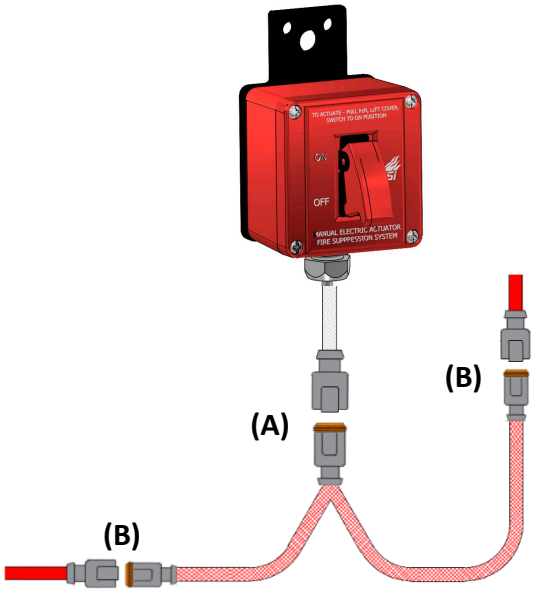
Electric Remote Actuator I/L (FSI21101) and Electric Remote Actuator EOL (FSI21100) are resin filled and non-field serviceable. Electric Remote Actuator I/L Cab (FSI21102) is filled with Bizgel Express Sealing Gel at the time of installation.

NOTE – CAB ELECTRIC ACTUATOR
The electric cab actuator does not come resin filled from the factory, once the actuator has been installed it will require BIZGEL EXPRESS SEALING GEL installed into the actuator.

Y HARNESS

The Electric Manual Actuator Y Cable is used to connect Electric Manual Actuators together in series when 3 or more Electric Manual Actuators are required in a system.

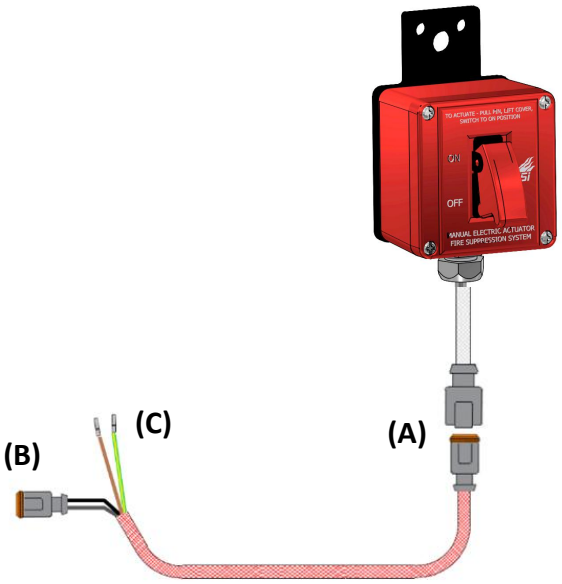
The Y Cable consists of a 4 Pin DT plug **(A)** which is connected to the 4 Pin DT Receptacle of the In Line Electric Manual Actuator and 2 x 2 Pin DT plugs **(B)** which are connected to the additional Electric Manual Actuators.



ACTUATOR CAB HARNESS

Electric Manual Actuator Cab Harness (3.0m) is used to connect the Electric Manual Cab Actuator to the V5 Control Module within the cabin area.

The Actuator Cab Harness consists of a 4 pin DT plug **(A)** which connects to the 4 Pin DT Receptacle of the cab actuator, 1 x 2 pin DT plug **(B)** connects to additional Electric Manual Actuators and 2 x bare sockets **(C)** to connect to terminals 3 & 4 of the 12 pin DT Receptacle plug of the FSI V5 control module.



1. Select a suitable location for securing the Electric Manual Actuator ensuring it not prone to damage.
2. Securely mount the Electric Manual Actuator using the correct mounting hardware.
3. Terminate Fire Harness wiring as per wiring diagrams.
4. Secure the Harness 200mm from the enclosure and 50mm either side of the DT connector with the receptacle facing downwards or horizontally.
5. Apply dielectric grease to the DT plug seal.

4.17 CAB ACTUATOR

The Manual Cabin Actuator shall be accessible, clearly visible and in reach of the operator during normal operating conditions (within 180 degrees of the operator's normal field of vision) although shall not restrict the operator's path of egress in an emergency.
Consideration should also be given to accessibility of the actuator assembly during maintenance and service.

1. Select a suitable location for mounting the Cab Actuator as per the risk assessment and Foam-Guard system design manual.
2. Do not mount the cabin actuator in a location that could restrict the operator's path of egress in an emergency.
3. Ensure space around the actuator so it can be easily actuated.
4. Ensure the actuator does not interfere with any operator's controls.
5. Consider the location of the actuator for service and maintenance.



Figure 21
Cab Actuator

4.18 EXTERNAL ACTUATOR

The external actuator should be accessible from ground level and where practicable close to Emergency Stops and points of egress. On larger assets with multiple egress points additional actuators are recommended.

When selecting a mounting location for the external actuator, consideration should be given to the fact that they shall be accessible but not prone to damage and build-up of contaminants, which could obstruct the operation.

Actuator signage is required for ALL external activation points.

1. Select a suitable location for mounting the external Actuator as per the risk assessment.
2. Do not mount the external actuators in a location that would restrict the operator's path of egress in an emergency.
3. Allow space around the actuator so it can be easily actuated.
4. Ensure the actuator does not interfere with the operator's controls.
5. Consider the location of the actuator for service and maintenance.
6. Actuator location signage is required for all external activation points.



Figure 22
External Actuator

4.19 ROP ACTUATION MANIFOLD

The ROP manifold contains Stainless steel check valves, brass plugs or brass nipples that can be configured for different machinery layouts.

The Check Valve ensures pressure is directed into the manifold correctly. Pressure from actuators, MSM or solenoid is directed via 6.3mm - (1/4'') steel braded hose with 7/16'' JIC fittings and check valve into the manifold.

Pressure is then directed through 6.3mm - 1/4'' steel braded hose with a 1/4'' BSP fitting to the ROP Cylinder discharge valve.

ROP Manifold configurations can vary depending on system configuration, ports can be blanked off when not utilised.

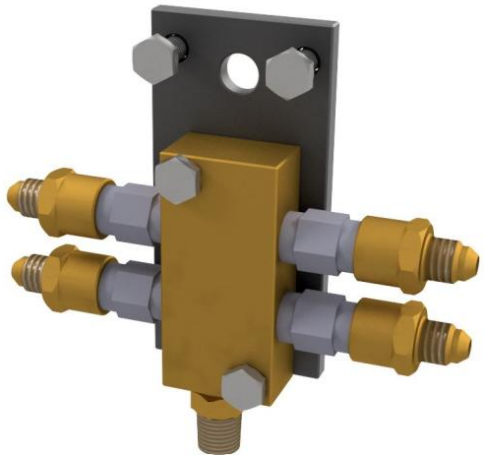


Figure 23
ROP Manifold

All 6.3mm - 1/4'' steel braded hose fittings connections from MSMs, solenoids, and actuators shall have a check valve flowing into the manifold assembly.

All 6.3mm - 1/4'' steel braded hose fitting connections which flow from a manifold to the discharge valve shall be connected with a 1/4" BSP fitting, no check valve shall be installed.

It is best practise to use two (2) nuts, bolts, and spring washers to eliminate bracket rotation. Drilling and tapping is only recommended when it is not possible to install a nut and washer.

CAUTION
It is important to clear passage test the manifold and actuation hoses with nitrogen. This is done to confirm the check valves are installed correctly and ensure there are no obstructions in the actuation hose or check valve.

4.20 LOP ACTUATION MANIFOLD

The LOP manifold is made from a solid piece of brass with 7/16'' JIC fittings, check valves are NOT required.

The manifold is used to connect Detection and Actuation Lines. Additional manifolds can be linked together on lager machines.

A 7/16'' JIC Tee can be used as a replacement or in conjunction with a LOP manifold. They must only be mounted off a JIC bulkhead attached to a panel.

It is best practise to use two (2) nuts, bolts, and spring washers to eliminate bracket rotation. Drilling and tapping is only recommended when it is not possible to install a nut and washer.

LOP Manifold configurations can vary depending on system configuration, ports can be capped off when not utilised.

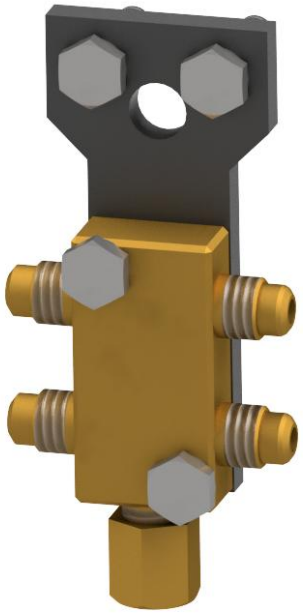


Figure 24
LOP Manifold

CAUTION
It is important to clear passage test the manifold and actuation hoses with compressed air or nitrogen to ensure there are no obstructions.

4.21 V5 - FIRE ALARM MODULE

The FSI V5 Fire Alarm Module is designed and tested to comply with the requirements of AS 5062, is available in both Indicator and Shutdown versions and is fully configurable via the display module.

The FSI V5 Display Module utilises visual and audible alarms to monitor system pressure, system discharge, ambient engine bay temperatures, solenoid activation, electric actuation, system faults, and supply voltages. These can be identified on the display window via a code.

FSI V5 Fire Alarm Modules with Firmware version 17 have been updated with an acknowledgement mode. This feature allows non-critical system faults to be acknowledged and temporarily silenced until they can be rectified. Firmware versions are displayed in the window upon initial power-up or resetting of the display module.

When the system is in operational condition, NORMAL and MAIN POWER ON are illuminated green. If activated, the FIRE ALARM illuminates red, and the engine shutdown timer counts down in the display window. This timer varies depending on configuration parameters. Once the shutdown counter reaches "00," it will be displayed for 2 minutes, during which time the system cannot be isolated until the display window is blank.

V5 Control Modules are supplied with individual serial numbers located on the module. The serial number format is: 24A001 – indicating the manufacture year (2024), fortnight (A-Z, 26 per year), and unit number produced in that fortnight.

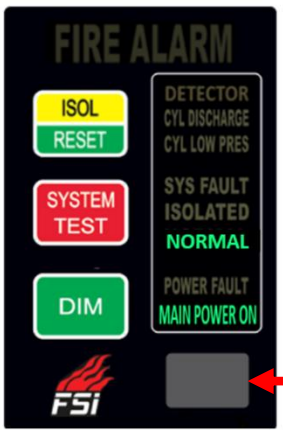


Figure 25
V5 - Indicator Display Module

Display Window



Figure 26
V5 - Shutdown Display Module

FSI V5 DISPLAY

- The FSI V5 display module is connected to the control module using a 3.6m 4 core loom which is monitored for disconnection, this can initiate the engine shutdown output where configured.
- FSI V5 Modules may run a maximum of two Display Modules. Dual display systems require two additional communication cables and a "Y" adaptor.
- Touch buttons are backlit by LED light bars and can be dimmed for night-time operation.
- A range of tests and isolations can be controlled via the Display Module.

FSI V5 MODULE

- The FSI V5 Module comes with pre-configured 4pin, 8pin and 12 pin DT plug connections for mains power, pressure switches, thermal probes, display module, electric actuation, solenoid valve and remote telemetry.
- The FSI V5 Control module will operate using either 12VDC or 24VDC.
- The control module incorporates a Real Time Clock (RTC) to save programming configurations when 12VDC or 24VDC is disconnected.

FSI V5 ELECTRIC ACTUATION CONTROL MODULE

- FSI V5 Electric Actuation Control Modules are supplied with an internal rechargeable battery (FSI 16003) and requires >12.5 VDC for approximately 2 hours to correctly charge the internal Lithium-Ion backup battery when first installed. This will provide enough power to control all required functions in accordance with AS 5062.
- When 12/24VDC main power supply is deenergised and backup battery (FSI 16003) is enabled, this will initiate the pre-set vehicle shutdown timer. Once the shutdown sequence is complete it will illuminate NORMAL every 1 minute to indicate the loss of main power supply. All fault and alarm conditions will still be detected in accordance with AS 5062.
- FSI V5 Electric Actuation system operates via an electrical signal, manually activated by the operator using the FSI Electric Manual Actuator, or automatically by Foam-Guard Linear Detection (LHD) and/or FSI Thermal Probes. Once the V5 control module receive an input signal it then energises the 12 VDC 1/8", 0-2.5MPa electric solenoid with (11.2 VDC) for 2 minutes at this time the V5 display window will illuminate "00", this allows time for the system to completely depressurise the actuation circuit.
- The FSI V5 Control module monitors the solenoid circuit (when enabled) with a 1v reference voltage. If there is an Open Circuit (OC) or Closed Circuit (CC) detected, the V5 control module will output a shutdown signal (Shutdown Module only).

SHUTDOWN RELAY CONFIGURATION

- The engine shutdown timer can be programmable from 0 to 30 seconds in 5 second increments, a maximum of 3 x 10 second shutdown delays extensions are available, before the shutdown relay is de-energised.
- As represented on the wiring schematic, the relay is in the de-energised state.
- The Shutdown Relay should be configured as follows:
  - For ignition or E-Stop circuits that are N.O. in the run condition use Pins 5 (N.C.) and 6 (COM)
  - For ignition or E-stop circuits that are N.C. in the run condition use Pins 6 (COM) and 7 (N.O.)
- When 12/24VDC power is supplied to the Control Module the internal relay becomes energised, Pin 5 (N.C.) will switch open and Pin 7 (N.O.) will switch closed.
- The FSI V5 control module internal shutdown relay is rated to 10 amps. It is also recommending an external 10amp fuse is installed to the shutdown circuit. If machine ignition or E-stop circuits have increased current draw above 10 amps in normal operational conditions, an external 25-30 amp 12 or 24V relay (depending on machine supply voltage) is used. Under these circumstances the FSI V5 controller should supply an earth signal through the appropriately selected V5 shutdown relay terminals to the external relay.

AUX DIGITAL IN

- For automated or remote telemetry control machinery, the Aux Digital-In Circuit should be used to activate the fire system remotely, in conjunction with an electric solenoid and battery backup (FSI 16003).
- This can be achieved using a 12/24VDC connected to pins 5 & 6 of the 12-pin plug (Aux Digital In) and configuring as required.

ELECTRICAL DATA

- The V5 Control Module requires a 10-28 VDC 3A Fused power supply on its own dedicated circuit free from electrical interference from other electrical components.

Power Requirement	10-28 VDC 3A Fused
Back up Battery Charging Temperature Range	0°c to 50°c
Internal Shutdown Control Relay	10 Amp Max
Internal Aux Control Relay	5 Amp Max
External Aux Digital In (Remote Activation)	External 12/24VDC Input
Solenoid	G1/8" 2-way NC 0-2.5MPa 12VDC 50Hz
Backup Battery Service Life	2 Yearly from installation
Backup Battery Specification	7.2V (Nominal) 2.5Ah 18Wh Lithium
Real Time Clock (RTC) Battery	BR2032 3V
Real Time Clock (RTC) Battery Service Life	5 Yearly from installation
IP Rating	Module – IP66, Display - IP65

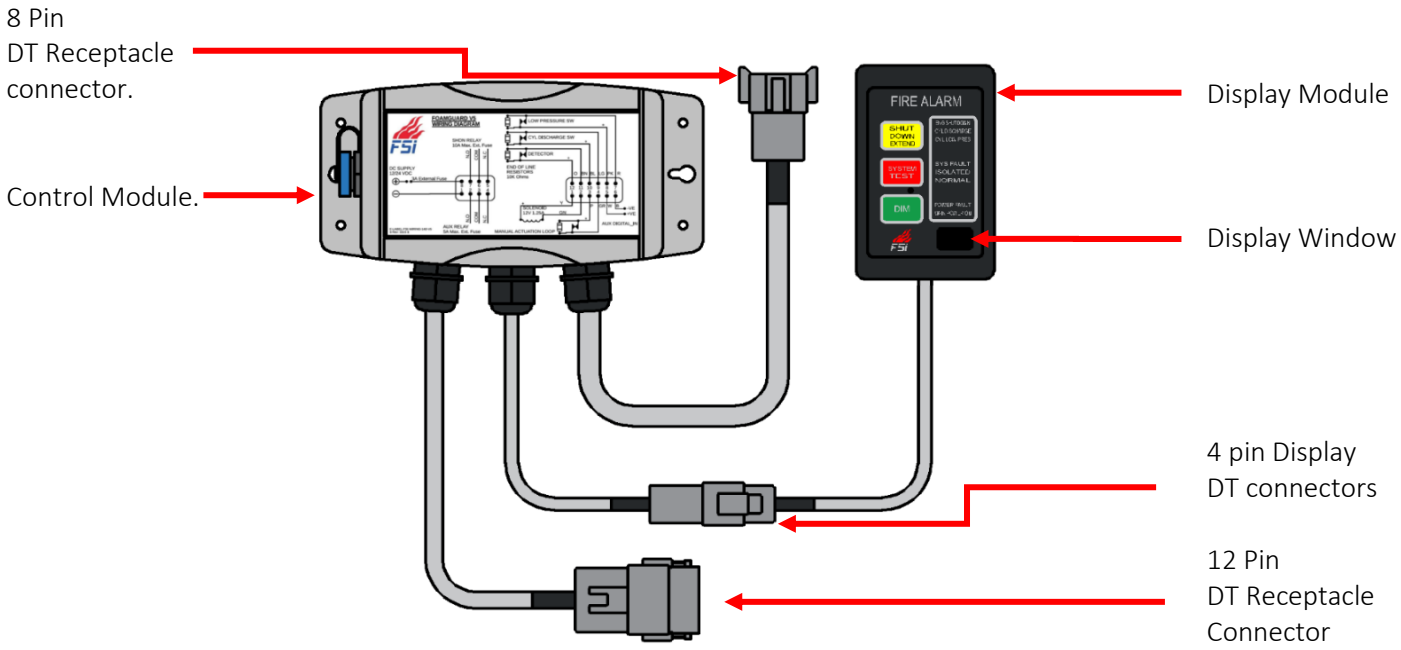


Figure 27
V5 FSI Control and Display Modules

4.22 DISPLAY MODULE

The V5 Display Module has a IP Rating of IP64 and should be mounted in a protected location within reach and clearly visible from the operator's normal operating position adjacent to the actuator.

1. The Display Module assembly shall be within reach and clearly visible from the operator's normal operating position.
2. The preferred method is to mount the display on a display bracket off the actuator adjacent to the cab actuator.
3. Secure the display module with double side tape ensuring the surface is clean.
4. Connect the display to the control modal via the display cable, prior to powering up the control module.
5. Carry out programming as per procedure.
6. Test all functions and operations



Figure 28
V5 Display

4.23 FIRE ALARM CONTROL MODULE

The V5 Control Module has an IP Rating of IP66 and shall be installed in a protected location within the main cabin. The V5 Control Module doesn't require mounting in a conspicuous location however it does need to be accessible for preventative maintenance and testing. All wiring and electrical connections shall be installed in accordance with this manual, and OEM specifications.

1. Select a suitable location for mounting the control module i.e., within the cabin and accessible for maintenance.
2. Mount the control module in a protected location securely mounted to a solid surface.
3. Route and terminate cabling to detection and monitoring circuits as per wiring diagrams.
4. Test all functions and operations of the circuits to ensure correct operation.

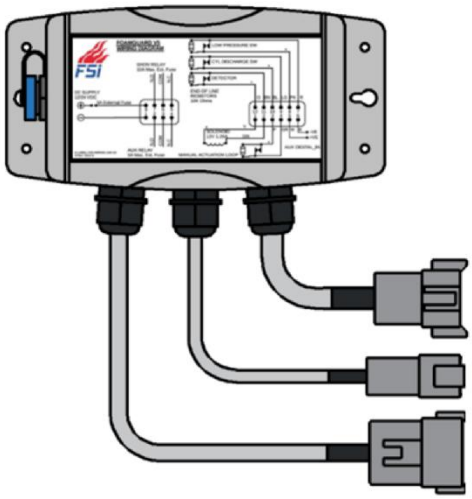


Figure 29
V5 Control Module

NOTE
It is recommended the FSI V5 Control Module is connected to its own dedicated uninterrupted power supply from the main battery isolators, in line with customer and OEM specifications.

4.24 PRESSURE MONITORING ENCLOSURE (PME)

FSI Foam-Guard fire suppression system utilises a discharge pressure switch located in the Pressure Monitoring Enclosure (PME) to detect system discharge on ROP, LOP and Electric Actuation systems.
The discharge pressure switch contains a 10kΩ resistor to monitor the circuit. The discharge pressure switch is normally open (OC). When the system is discharging, and the pressure applied to the discharge pressure switch exceeds 50kPa the contacts will close. The FSI V5 control module will detect this condition and initiate a system discharge alarm.

The PME also includes wiring connections to the Thermal Probe, LHD circuit or cylinder low pressure switch.

The PME is generally mounted in the engine bay above the ring main at a central point to allow for the wiring to run the shortest and best path from cylinders to cab.

It is best practise to use two (2) nuts, bolts, and spring washers to eliminate bracket rotation. Drilling and tapping is only recommended when it is not possible to install a nut and washer.

1. Select a suitable location for securing the PME ensuring it is away from high heat areas and is not prone to damage.
2. Securely mount the PME using the correct mounting hardware.
3. Terminate Fire Harness wiring as per wiring diagrams.
4. Secure the Fire Harness 200mm from the enclosure and 50mm either side of the DT connector with the receptacle facing downwards or horizontally.
5. Apply dielectric grease to the DT plug seal.

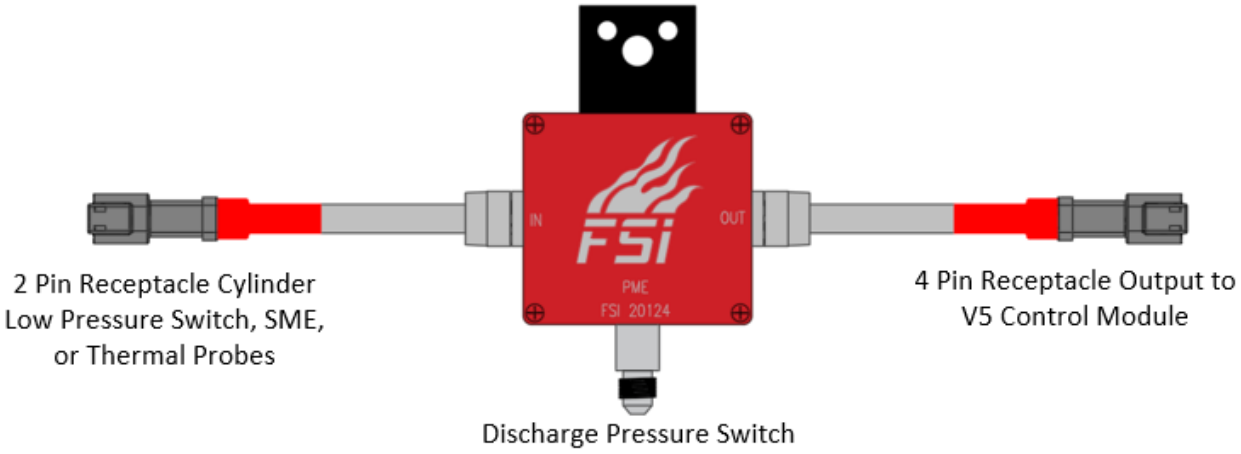


Figure 30
PME

4.25 CYLINDER LOW PRESSURE SWITCH

SINGLE CYLINDER SYSTEM

FSI Foam-Guard fire suppression systems utilise a low-pressure switch located in each discharge valve.
On a single cylinder system, a normally open two pin pressure switch containing a 10kΩ resistor is used to monitor for an open circuit condition. Below 1400kPa contacts within the pressure switch will close and the control module will detect this condition which will initiate a low-pressure alarm.

MULTI CYLINDER SYSTEM

FSI Foam-Guard fire suppression systems with two or more cylinders utilise a 4-pin change over pressure for each additional cylinder.
Below 1400kPa the 4-pin pressure switch internal contacts will change over and close, the control module will detect this condition and will initiate a low-pressure alarm.

Multiple low-pressure switches are terminated together within a SME (System Monitoring Enclosure)

1. Securely mount the Low-pressure switch using the correct mounting hardware and clamps.
2. Terminate Fire Harness wiring as per wiring diagrams.
3. Secure 50mm either side of the DT connector with the receptacle facing downwards or horizontally
4. Apply dielectric grease to the DT plug seal.



Figure 31
Cylinder Low Pressure Switches

4.26 SYSTEM MONITORING ENCLOSURE (SME)

FSI Foam-Guard multicylinder fire suppression systems utilise 2 and 3-cylinder System Monitoring Enclosures (SME's) to connect cylinder pressure switches.
Twin cylinder systems utilise a single 2-cylinder SME and 3-cylinder systems utilise a single 3-cylinder SME. Where the FSI fire suppression system has 4 or more cylinders the cylinders should be grouped into banks of 2. The end of line bank will use a 2-cylinder SME, and the following inline banks will use 3-cylinder SME's. The SMEs can then be joined and run back to either a Cylinder Pressure and Solenoid Enclosure (CPS) in the case of electric operated systems or directly back to the FSI V5 control module if the system is pneumatic.

It is best practise to use two (2) nuts, bolts, and spring washers to eliminate bracket rotation. Drilling and tapping is only recommended when it is not possible to install a nut and washer.

The SME is ideally mounted in close proximity to the low-pressure switch.

1. Select a suitable location for securing the SME ensuring it is away from areas prone to damage.
2. Securely mount the SME using the correct mounting hardware.
3. Connect the SME directly to the Low-Pressure Switch's or Terminate Fire Harness wiring as per wiring diagrams.
4. Secure the Fire Harness 200mm from the enclosure and 50mm either side of the DT connector with the receptacle facing downwards or horizontally.
5. Apply dielectric grease to the DT plug seal.

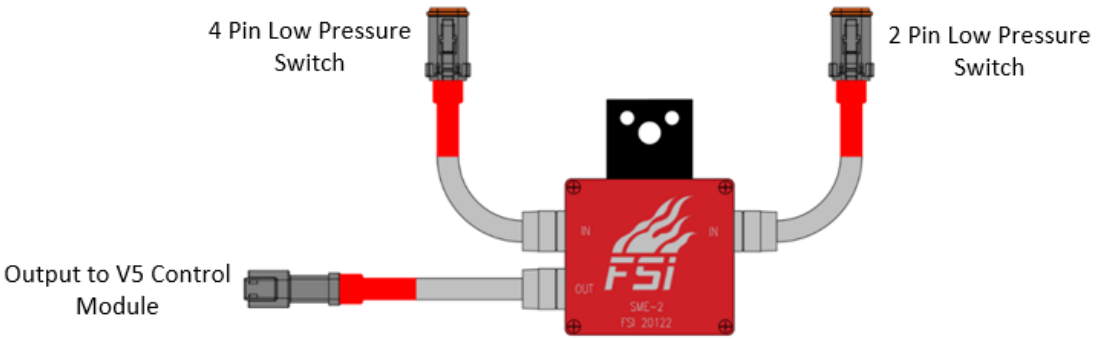


Figure 32
2 Cylinder SME

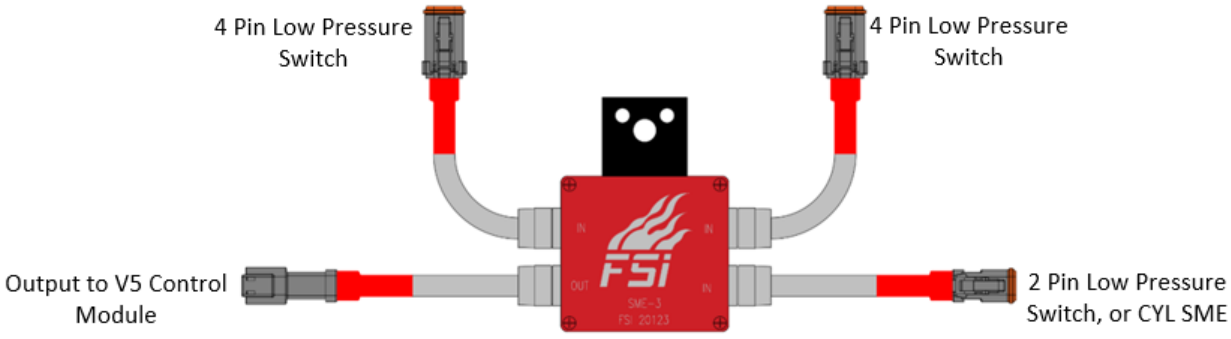


Figure 33
3 Cylinder SME

4.27 CYLINDER PRESSURE AND SOLENOID ENCLOSURE (CPS)

FSI Foam-Guard fire suppression system utilises a Cylinder Pressure and Solenoid Enclosure (CPS) to terminate solenoid and low-pressure switch connections on electric actuation systems. The CPS is ideally mounted in close proximity to the low-pressure switch and solenoid.

It is best practise to use two (2) nuts, bolts, and spring washers to eliminate bracket rotation. Drilling and tapping is only recommended when it is not possible to install a nut and washer.

1. Select a suitable location for securing the CPS ensuring it is away from areas prone to damage.
2. Securely mount the CPS using the correct mounting hardware.
3. Connect the CPS directly or Terminate Fire Harness wiring as per wiring diagrams.
4. Secure the Fire Harness 200mm from the enclosure and 50mm either side of the DT connector with the receptacle facing downwards or horizontally.
5. Apply dielectric grease to the DT plug seal.

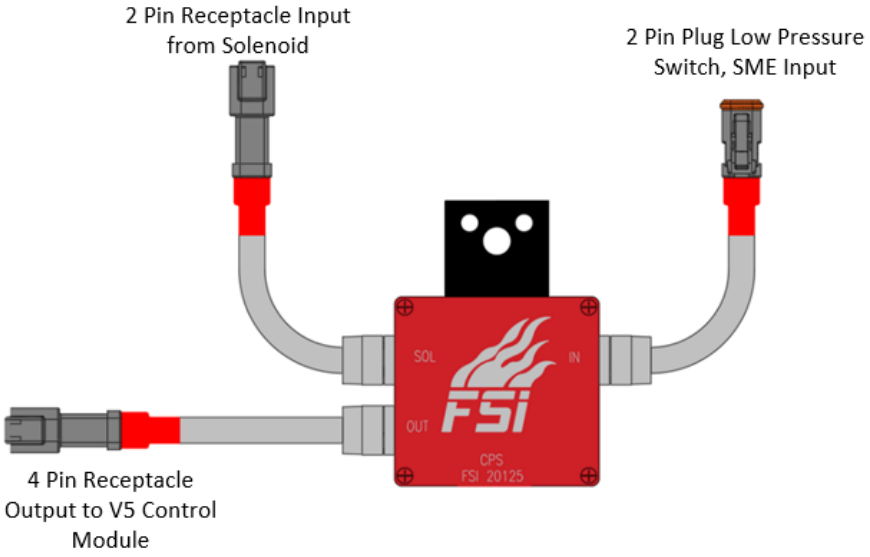


Figure 34
CPS

4.28 SYSTEM MONITORING ENCLOSURE/CYLINDER PRESSURE & SOLENOID ENCLOSURE (SME/CPS)

FSI Foam-Guard fire suppression system (as an option) can combine the System Monitoring Enclosure (SME) and Cylinder Pressure and Solenoid Enclosure (CPS) on electric actuation system. This incorporates two enclosures into one.

It is best practise to use two (2) nuts, bolts, and spring washers to eliminate bracket rotation. Drilling and tapping is only recommended when it is not possible to install a nut and washer.

1. Select a suitable location for securing the SME/CPS ensuring it is away from areas prone to damage.
2. Securely mount the SME/CPS using the correct mounting hardware.
3. Connect the SME/CPS directly or Terminate Fire Harness wiring as per wiring diagrams.
4. Secure the Fire Harness 200mm from the enclosure and 50mm either side of the DT connector with the receptacle facing downwards or horizontally.
5. Apply dielectric grease to the DT plug seal.

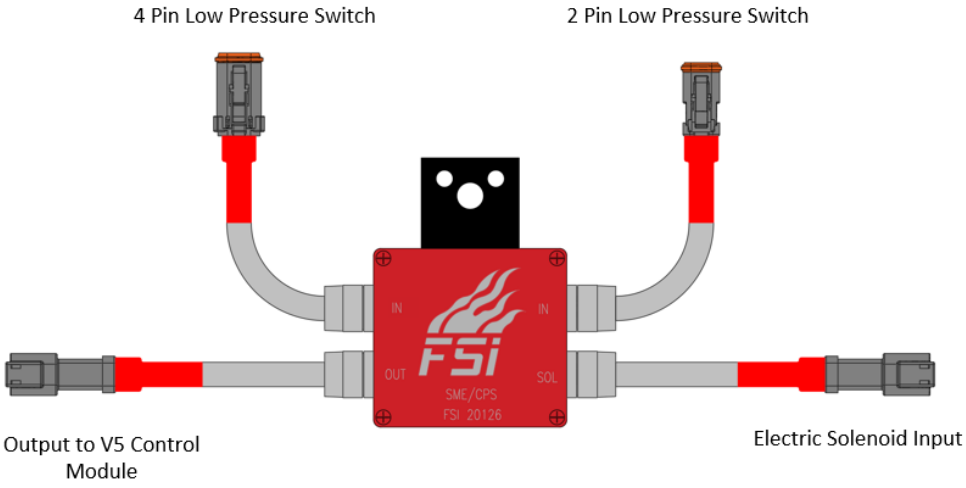


Figure 35
SME/CPS

4.29 SYSTEM IDENTIFICATION LABEL

FSI Foam-Guard fire suppression system utilises a range of information and warning labels to inform operators and maintenance personnel on important system information and operational requirements.

CYLINDER LABELS

The cylinder Labels contain important information relating to the system and shall be displayed on each Cylinder. The System Identification and Compliant Labels are located horizontally on the Cylinder along with the Maintenance label and AS5062 Maintenance Record label.



Figure 36
Cylinder Labels

CAB LABELS

The operators cab shall display a Red INCASE OF FIRE LABEL, Yellow WARNING LABEL and Yellow SHUTDOWN TIME DELAY LABEL (if fitted). These labels shall be positioned so they are clearly visible, but dos does not obstruct the operator's vision.



Figure 37
Cabin Information & Warning Labels

ACTUATOR LABELS

All Actuators are to be fitted with an Operator Action Sign. Actuators must display AS5062 Maintenance Record label.
Externally mounted Actuators shall be identified with a Reflective Location Sign.



Figure 38
Manual Actuator Labels

MAINTENANCE RECORD LABEL

Service labels/tags shall be located on each of the manual actuators and on each cylinder.

This label/tag shall be stamped with Hole or a 0 indicating the month and year the installation was completed.



Figure 39
Maintenance Record Label

5.0 V5 FIRE ALARM MODULE

FSI V5 Fire Alarm Modules are configurable via the Display Module and will require configuring upon installation. When a new module initially receives a 12/24V connection. The ISOLATED and MAIN POWER ON LED's will illuminate. This indicates an unconfigured state. Once the module is configured it will retain this information until the RTC battery is removed.

5.1 V5 CONFIGURATION PARAMETERS

PNEUMATIC SYSTEM (LOP/ROP) – NO SECONDARY DETECTION (NO PROBES INSTALLED)			
CIRCUIT NAME	DISPLAY	ASSETCONNECT	DESCRIPTION
SOLENOID	S 0	Pneumatic Actuation	Solenoid Disabled/Not installed.
BACKUP BATTERY	b 0	Disabled	Backup Battery Disabled/Not Installed.
DISPLAY SYSTEM	d 1	1 Display	1 or 2 Display Connected.
SHUTDOWN COUNTER	0 -30 NA	0-10-15-20-25-30 NA – Indicate Only	Varies by site, Default 10sec. NA – Indicator Module Installed.
MONITORING CIRCUIT	P 3	P3	Low pressure switch installed. Discharge switch installed.

PNEUMATIC SYSTEM (LOP/ROP) – SECONDARY DETECTION (PROBES INSTALLED)			
CIRCUIT NAME	DISPLAY	ASSETCONNECT	DESCRIPTION
SOLENOID	S 0	Pneumatic Actuation	Solenoid Disabled/Not installed.
BACKUP BATTERY	B 0	Disabled	Backup Battery Disabled/Not Installed.
DISPLAY SYSTEM	D 1	1 Display	1 or 2 Display Connected.
SHUTDOWN COUNTER	0 -30 NA	0-10-15-20-25-30 NA – Indicate Only	Varies by site, Default 10sec. NA – Indicator Module Installed.
MONITORING CIRCUIT	P 4	P4	Low pressure switch installed. Discharge switch installed. Probes/LHD installed.

LOP or ROP PNEUMATIC ACTUATORS & ELECTRIC DETECTION (PROBES AND/OR LHD)			
CIRCUIT NAME	DISPLAY	ASSETCONNECT	DESCRIPTION
SOLENOID	S 1	Electric Actuation	Solenoid Enabled/Solenoid Installed.
BACKUP BATTERY	b 1	Enabled	Backup Battery Enabled/Battery Installed.
DISPLAY SYSTEM	d 1	1 Display	1 or 2 Display Connected.
SHUTDOWN COUNTER	0 -30 NA	0-10-15-20-25-30 NA – Indicate Only	Varies by site, Default 10sec. NA – Indicator Module Installed.
MONITORING CIRCUIT	P 4	P4	Low pressure switch installed. Discharge switch installed. Probes/LHD installed.

ELECTRIC ACTUATORS & LOP/ROP PNEUMATIC DETECTION			
CIRCUIT NAME	DISPLAY	ASSETCONNECT	DESCRIPTION
SOLENOID	S 1	Electric Actuation	Solenoid Enabled/Solenoid Installed.
BACKUP BATTERY	b 1	Enabled	Backup Battery Enabled/Battery Installed.
DISPLAY SYSTEM	d 1	1 Display	1 or 2 Display Connected.
SHUTDOWN COUNTER	0 -30 NA	0-10-15-20-25-30 NA – Indicate Only	Varies by site, Default 10sec. NA – Indicator Module Installed.
MONITORING CIRCUIT	P5	P5	Low pressure switch installed. Discharge switch installed. Electric actuators installed.

FULL ELECTRIC			
CIRCUIT NAME	DISPLAY	ASSETCONNECT	DESCRIPTION
SOLENOID	S 1	Electric Actuation	Solenoid Enabled/Solenoid Installed.
BACKUP BATTERY	b 1	Enabled	Backup Battery Enabled/Battery installed.
DISPLAY SYSTEM	d 1	1 Display	1 or 2 Display Connected.
SHUTDOWN COUNTER	0 -30 NA	0-10-15-20-25-30 NA – Indicate Only	Varies by site, Default 10sec. NA – Indicator Module Installed.
MONITORING CIRCUIT	P 6	P6	Low pressure switch installed. Discharge switch installed. Probes/LHD installed. Electric actuators installed.

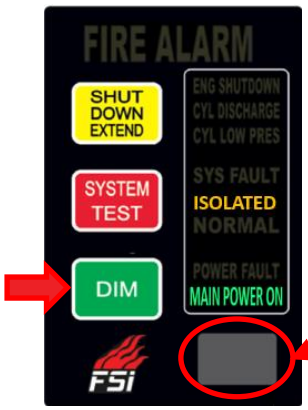
5.2 V5 SHUTDOWN MODULE

5.2.1 V5 SHUTDOWN MODULE - SYSTEM CONFIGURATIONS

- FSI V5 Fire Modules require programming upon installation or removal of the RTC battery.
- All configuration parameters shall be set correctly for the FSI V5 module to enter the Normal operation.
- Configuration parameters are accessed from the ISOLATED mode only.
- Unconfigured parameters are identified by a "-" symbol in the display window when in that parameter menu.
- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode where more parameters may be accessed.
- If all programming is not completed the display will not de isolate.

STEP 1 DISPLAY SYSTEM

To configure a Display Module, select either **d1** for one display module or **d2** for two display modules, depending on how many displays are installed.



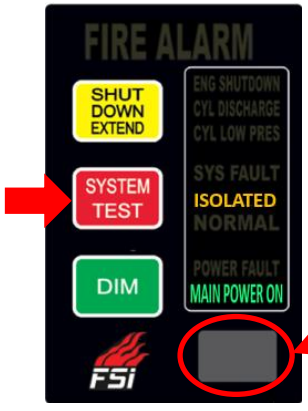
1. Press and hold **DIM** button for 7 seconds from within isolated mode.
2. Press **DIM** to cycle between the listed settings.

- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode.

d-	Display Unconfigured
d1	1 X Display Module Configured
d2	2 X Display Module Configured

STEP 2 BATTERY INSTALLED - ELECTRIC ACTUATION

For electric systems or systems with a solenoid installed, set the installed backup battery to **b1** (enabled). If it is a pneumatically actuated system, disable the backup battery by setting it to **b0** (disabled)



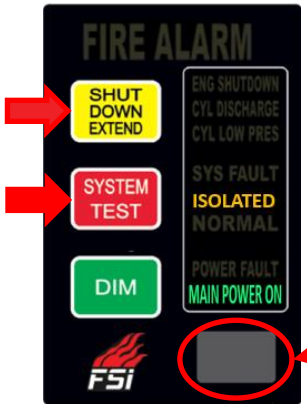
1. Press and hold **SYSTEM TEST** button for 7 seconds from within isolated mode.
2. Press **SYSTEM TEST** to cycle between the listed settings.

- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode.

b-	Backup Battery Unconfigured
b0	Backup Battery Disabled
b1	Backup Battery Enabled/Installed

STEP 3 SOLENOID – ELECTRONIC ACTUATION

For systems with a solenoid installed, set the solenoid to **S1** (enabled). If a solenoid is not installed, set it to **S0** (disabled).



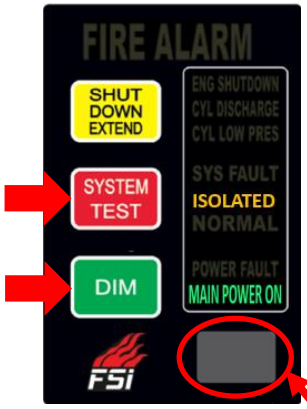
1. Press and hold **SHUTDOWN EXTEND** and **SYSTEM TEST** buttons for 7 seconds from within isolated mode.
2. Press **SHUTDOWN EXTEND** to cycle between the listed settings.

- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode.

S-	Solenoid Unconfigured
S0	Solenoid Disabled
S1	Solenoid Enabled/Installed

STEP 4 MONITORING CIRCUIT SETTINGS

Refer to the chart below to select and enable the correct **P** channel **1 – 6** based on the detection or actuation method installed:



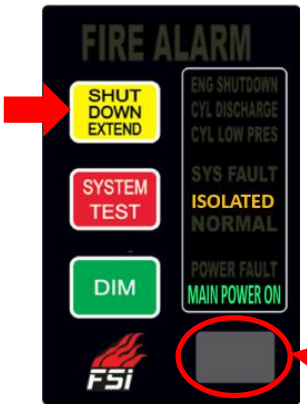
1. Press and hold **SYSTEM TEST** and **DIM** buttons for 7 seconds from within isolated mode.
2. Press **SYSTEM TEST** to cycle between the listed settings.

- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode.

	Detector (LHD/Thermal Probes)	Cylinder Low Pressure Switch	Discharge Pressure Switch	Manual Electric Actuation
P-	Unconfigured	Unconfigured	Unconfigured	Unconfigured
P1	Disabled	Disabled	Enabled	Disabled
P2	Enabled	Disabled	Enabled	Disabled
P3	Disabled	Enabled	Enabled	Disabled
P4	Enabled	Enabled	Enabled	Disabled
P5	Disabled	Enabled	Enabled	Enabled
P6	Enabled	Enabled	Enabled	Enabled

STEP 5 SHUTDOWN COUNTER SETTING

Refer to the chart below to select the shutdown time, which can be set between 0 and 30 seconds. The shutdown time will vary depending on the risk assessment. Ensure the shutdown display module is not set to "NA."



1. Press and hold **SHUTDOWN EXTEND** button for 7 seconds from within isolated mode.
2. Press **SHUTDOWN EXTEND** to cycle between the listed settings.

- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode.

--	Unconfigured
0	Immediate Shutdown
10	10 second delay
15	15 second delay
20	20 second delay
25	25 second delay
30	30 second delay
nA	Set when an indicator Module is installed

NOTE

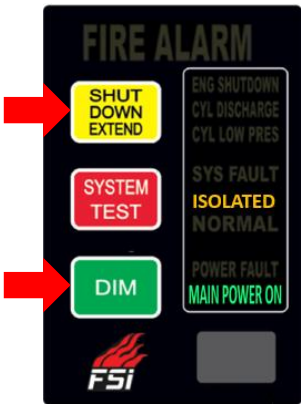
If a shutdown Display Module is programmed to "nA" fault codes F4 and F9 will register in the display window when reset to the Normal operational mode.

NOTE

Reset the module to its normal mode. If the module does not return to normal, verify all configuration have been complete.

5.2.2 V16 - SYSTEM ISOLATION/ RESET PROCEDURE

Isolation Mode is used to disable the detection and actuation circuits of the fire suppression system, preventing accidental discharges during maintenance or testing. When Isolation Mode is activated, the ISOLATED indicator will illuminate, to indicate the system is isolated.

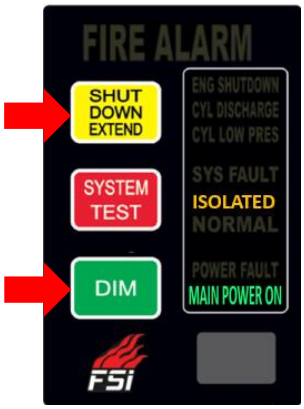


- **ISOLATION**
  1. Press and hold **SHUTDOWN EXTEND** and **DIM** buttons for 7 seconds.
  2. ISOLATED will illuminate.

- **RESET**
  1. Press and hold **SHUTDOWN EXTEND** and **DIM** buttons for 7 seconds.
  2. This will reset any non-latched faults or alarms and illuminate NORMAL

5.2.3 V17 - ACKNOWLEDGMENT MODE PROCEDURE

Acknowledgment Mode allows operators to acknowledge non-critical faults without affecting the systems operation. When a fault is detected on the Discharge/Low-Pressure circuits or a battery fault, activating this mode mutes the audible tone for 12 minutes. During this period, the circuit indicator remains illuminated while the SYS FAULT light flashes once per second. If the fault persists after 12 minutes, the system resumes beeping every 2 minutes. All shutdown inputs remain active, ensuring the system will discharge as required. Entering or exiting Acknowledgment Mode also resets any latched faults or alarms, and the mode cannot be activated if no faults are present. If no faults are detected when the 12-minute period expires, the system resets automatically.

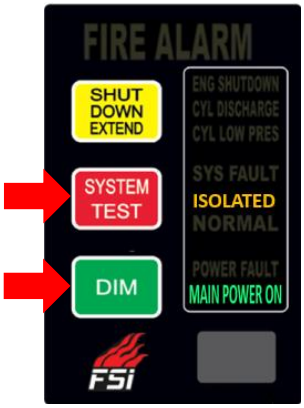


- **ENTER ACKNOWLEDGMENT MODE**
  1. Press and hold SHUTDOWN EXTEND and DIM buttons for 7 seconds.
  2. This will mute any non-critical system faults 12 minutes

- **EXIT ACKNOWLEDGMENT MODE**
  1. Press and hold SHUTDOWN EXTEND and DIM buttons for 7 seconds.
  2. This will reset any non-latched faults or alarms and illuminate NORMAL

5.2.4 V17- ISOLATION MODE PROCEDURE

Isolate Mode is used to disable the detection and actuation circuits of the fire suppression system, preventing accidental discharges during maintenance or testing. When Isolate Mode is activated, the ISOLATED indicator will illuminate, and the system will beep once every two minutes to indicate that the system is isolated. If the system is operating on the back-up battery, the beep will not occur. Programming access and Bluetooth connectivity are restricted to Isolated Mode.

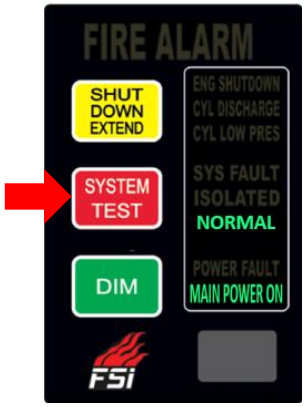


- **ENTER ISOLATION MODE**
  1. Press and hold SYSTEM TEST and DIM buttons for 10 seconds, 1 beep to confirm and ISOLATED Flashes rapidly
  2. Enter the below sequence (beeping after each press)
     1) SYSTEM TEST (RED)
     2) SHUT DOWN EXTEND (YELLOW)
     3) SHUT DOWN EXTEND (YELLOW)
     4) SHUT DOWN EXTEND (YELLOW)
     5) DIM (GREEN)
     6) SHUT DOWN EXTEND (YELLOW)

     If the sequence is entered incorrectly or takes longer than 30 seconds, the process will exit, and the procedure can be repeated.

- **EXIT ISOLATION MODE**
  1. Press and hold SHUTDOWN EXTEND and DIM buttons for 7 seconds.
  2. This will reset any non-latched faults or alarms and illuminate NORMAL

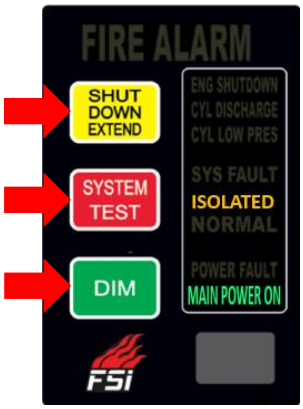
5.2.5 SYSTEM TEST



- Under normal operational conditions momentarily pressing the **SYSTEM TEST** button will cycle the Module through a system check
- Upon completion, provided no faults are detected, the display will return to the normal and main power on condition when 12/24VDC mains power is supplied.
- In the Alarm or Fault modes pressing the **SYSTEM TEST** button will cycle through all latched faults and/or alarms in the display window.

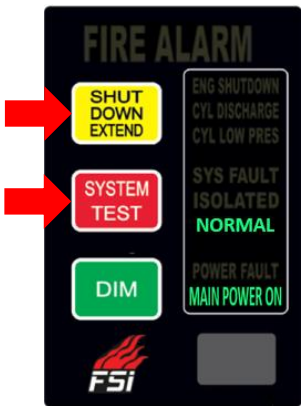
5.2.6 SLEEP MODE (Back up Battery Only)

Sleep mode electronically disconnects the internal backup battery, conserving battery life when the machine's batteries are isolated for extended periods. This prevents unnecessary power consumption from the V5 module while the main power supply is disconnected. Once vehicle power (12/24V) is restored, the internal backup battery automatically reconnects, allowing the system to resume normal operation without manual intervention.



1. Disconnect the main power supply to the V5 Module.
2. Place the module into isolate
3. Press and hold **SHUTDOWN EXTEND, SYSTEM TEST** and **DIM** buttons for 30 seconds until the 5 second countdown has timed out
4. Once the countdown completes, the system will electronically disconnect the internal back-up battery, putting the unit into sleep mode

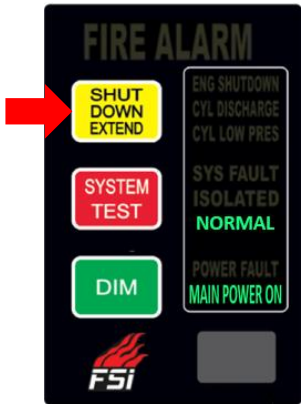
5.2.7 SHUTDOWN TEST



- Ensure that vehicle engine is on and running normally.
- Press and hold the **SYSTEM TEST** and **SHUTDOWN EXTEND** buttons simultaneously for 7 seconds, this will start the shutdown timer. This will in turn test the engine shutdown output function which should shut down the engine after the pre-set time delay.
- A System isolation and reset procedures is required to reset Module back to its normal mode.

NOTE
Ensure to comply with all OEM and/or site requirements for functional testing of equipment.

5.2.8 SHUTDOWN EXTEND



- It is possible to press the **SHUTDOWN EXTEND** button to extend the shutdown delay to get the vehicle to safe location.
- Each time the **SHUTDOWN EXTEND** button is pressed the timer is reset to delay the shutdown a further 10 seconds.
- Maximum number of three 10 second shutdown delays.
- At the end of the shutdown delay the vehicle shutdown signal is activated.

SYSTEM NORMAL



NORMAL and **MAIN POWER** ON indications are illuminated when the system is in operational condition.

FIRE ALARM



If a Thermal Probe/LHD operates due to a rise in temperature the **NORMAL** will go out, **FIRE ALARM** and **ENG SHUTDOWN** will flash red, at this time the engine shutdown timer will initiate accompanied by the pre-programmed count down in the display window.

SYSTEM FAULT



If a system fault is detected on a circuit the **NORMAL** will go out and the **SYS FAULT** will illuminate.

Pressing **SYSTEM TEST** will display a fault code in the display window.

SYSTEM POWER FAILURE (BACK UP BATTERY)



If the main power supply is lost when the backup battery is enabled **NORMAL** will illuminate every 1 min to indicate the loss of main power. All fault and alarm conditions will still be detected.

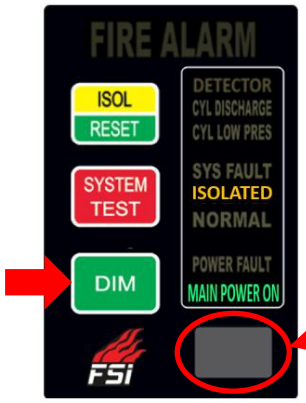
5.3 V5 INDICATOR MODULE

5.3.1 V5 INDICATOR MODULE - SYSTEM CONFIGURATIONS

- FSI V5 Fire Modules require programming upon installation or removal of the RTC battery.
- All configuration parameters shall be set correctly for the FSI V5 module to enter the Normal operation.
- Configuration parameters are accessed from the ISOLATED mode only.
- Unconfigured parameters are identified by a "-" symbol in the display window when in that parameter menu.
- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode where more parameters may be accessed.
- If all programming is not completed the display will not de isolate.

STEP 1 DISPLAY SYSTEM

To configure a Display Module, select either **d1** for one display module or **d2** for two display modules, depending on how many displays are installed.



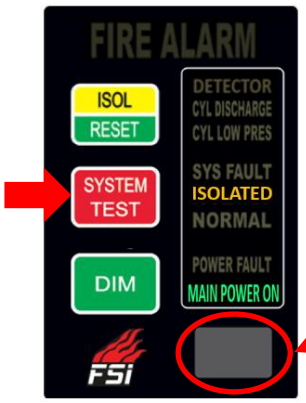
1. Press and hold **DIM** button for 7 seconds from within isolated mode.
2. Press **DIM** to cycle between the listed settings.

- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode.

d-	Display Unconfigured
d1	1 x Display Module Configured
d2	2 x Display Module Configured

STEP 2 BATTERY INSTALLED - ELECTRIC ACTUATION

For electric systems or systems with a solenoid installed, set the installed backup battery to **b1** (enabled). If it is a pneumatically actuated system, disable the backup battery by setting it to **b0** (disabled)



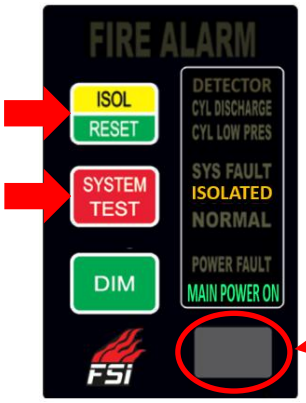
1. Press and hold **SYSTEM TEST** button for 7 seconds from within isolated mode.
2. Press **SYSTEM TEST** to cycle between the listed settings.

- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode.

b-	Backup Battery Unconfigured
b0	Backup Battery Disabled
b1	Backup Battery Enabled/Installed

STEP 3 SOLENOID – ELECTRONIC ACTUATION

For systems with a solenoid installed, set the solenoid to **S1** (enabled). If a solenoid is not installed, set it to **S0** (disabled).



1. Press and hold **ISOL/RESET** and **SYSTEM TEST** buttons for 7 seconds from within isolated mode.
2. Press **ISOL/RESET** to cycle between the listed settings.

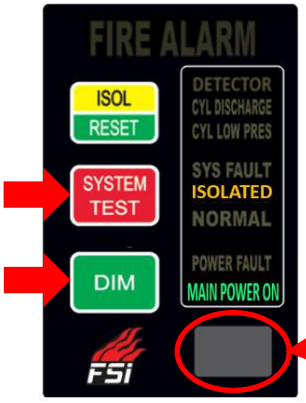
- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode.

S-	Solenoid Unconfigured
S0	Solenoid Disabled
S1	Solenoid Enabled/Installed

NOTE
If set to S1, the control module will expect a solenoid to be connected and will fault and perform vehicle shutdown if not installed.

STEP 4 MONITORING CIRCUIT SETTINGS

Refer to the chart below to select and enable the correct **P** channel **1 – 6** based on the detection or actuation method installed



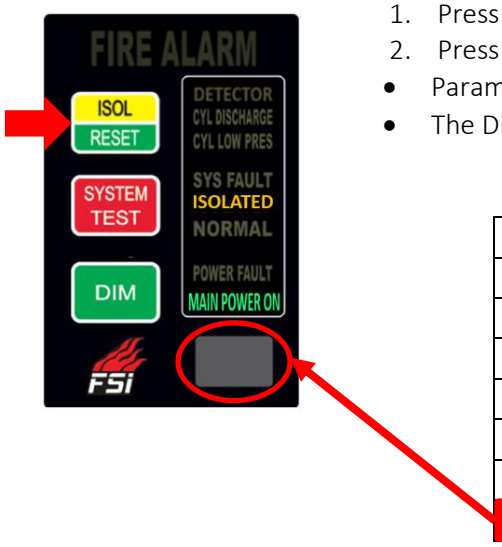
1. Press and hold **SYSTEM TEST** and **DIM** buttons for 7 seconds from within isolated mode.
2. Press **SYSTEM TEST** to cycle between the listed settings.

- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode.

	Detector (LHD/Thermal Probes)	Cylinder Low Pressure Switch	Discharge Pressure Switch	Manual Electric Actuation
P-	Unconfigured	Unconfigured	Unconfigured	Unconfigured
P1	Disabled	Disabled	Enabled	Disabled
P2	Enabled	Disabled	Enabled	Disabled
P3	Disabled	Enabled	Enabled	Disabled
P4	Enabled	Enabled	Enabled	Disabled
P5	Disabled	Enabled	Enabled	Enabled
P6	Enabled	Enabled	Enabled	Enabled

STEP 5 SHUTDOWN COUNTER SETTING

For indicator display modules set the shutdown counter to NA only.



1. Press and hold **ISOL/RESET** buttons for 14 seconds from within isolated mode.
2. Press **ISOL/RESET** to cycle between the user adjustable settings.

- Parameters are saved automatically after 7 seconds of standby.
- The Display Module will beep twice and return to the isolated mode.

--	Unconfigured
0	Immediate Shutdown
10	10 second delay
15	15 second delay
20	20 second delay
25	25 second delay
30	30 second delay
nA	Set when an indicator Module is installed

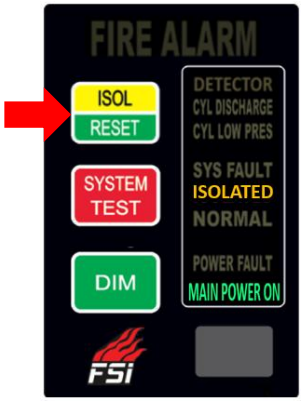
NOTE

Reset the module to its normal mode. If the module does not return to normal, verify all configuration have been complete.

NOTE

If a shutdown time is selected when programming an indicator module fault codes F4 and F9 will register in the display window when the display is reset to the Normal operational mode.

5.3.2 V16 - SYSTEM ISOLATION/ RESET PROCEDURE

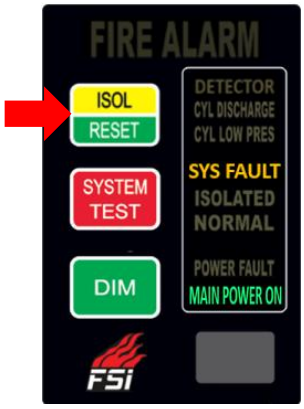


- **ISOLATION**
  To isolate the Indicator Module, press and hold the **ISOL/RESET** for 7 seconds. This will illuminate the Amber ISOLATED display and allow maintenance to be carried out, all three (3) detector circuits are isolated.

- **RESET**
  To reset the Indicator Module, press and hold the **ISOL/RESET** for 7 seconds. This will illuminate the NORMAL on the display.

5.3.3 V17 - ACKNOWLEDGMENT MODE PROCEDURE

Acknowledgment Mode allows operators to acknowledge non-critical faults without affecting the systems operation. When a non-critical fault is detected on the Discharge/Low-Pressure circuits or back-up battery, activating this mode mutes the audible tone for 12 minutes. During this period, the circuit indicator remains illuminated while the SYS FAULT light flashes once per second. If the fault persists after 12 minutes, the system resumes beeping every 2 minutes. All inputs remain active, ensuring the system will discharge as required. Entering or exiting Acknowledgment Mode also resets any latched faults or alarms, and the mode cannot be activated if no faults are present. If no faults are detected when the 12-minute period expires, the system resets automatically.

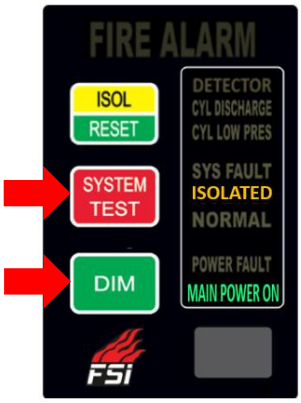


- **ENTER ACKNOWLEDGMENT MODE**
  1. Press and hold ISOL/RESET button for 7 seconds.
  2. This will mute any non-critical system faults 12 minutes

- **EXIT ACKNOWLEDGMENT MODE**
  1. Press and hold ISOL/RESET button for 7 seconds.
  2. This will reset any non-latched faults or alarms and illuminate NORMAL

5.3.4 V17 -ISOLATION MODE PROCEDURE

Isolate Mode is used to disable the detection and actuation circuits of the fire suppression system, preventing accidental discharges during maintenance or testing. When Isolate Mode is activated, the ISOLATED indicator will illuminate, and the system will beep once every two minutes to indicate that the system is isolated. If the system is operating on the back-up battery, the beep will not occur. Programming access and Bluetooth connectivity are restricted to Isolate Mode.

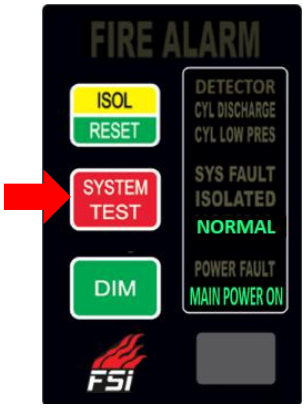


- **ENTER ISOLATION MODE**
  1. Press and hold SYSTEM TEST and DIM buttons for 10 seconds, 1 beep to confirm and ISOLATED Flashes rapidly
  2. Enter the below sequence (beeping after each press)
     1. SYSTEM TEST (RED)
     2. ISOL/RESET (YELLOW/GREEN)
     3. ISOL/RESET (YELLOW/GREEN)
     4. ISOL/RESET (YELLOW/GREEN)
     5. DIM (GREEN)
     6. SHUT DOWN EXTEND (YELLOW)

     If the sequence is entered incorrectly or takes longer than 30 seconds, the process will exit, and the procedure can be repeated.

- **EXIT ISOLATION MODE**
  1. Press and hold ISOL/RESET buttons for 7 seconds.
  2. This will reset any non-latched faults or alarms and illuminate NORMAL

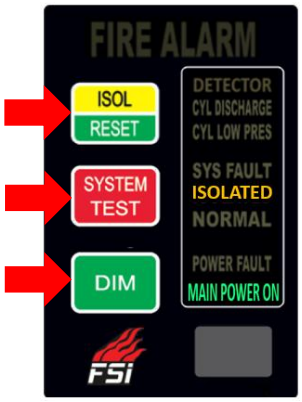
5.3.5 SYSTEM TEST



- Under normal operational conditions momentarily pressing the **SYSTEM TEST** button will cycle the Module through a system check.
- Upon completion, provided no faults are detected, the display will return to the normal and main power on condition when 12/24VDC mains power is supplied.
- In the Alarm or Isolated mode pressing the **SYSTEM TEST** button will cycle through all latched faults and/or alarms on the display window.

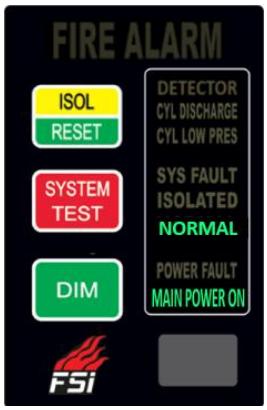
5.3.6 SLEEP MODE (Back up Battery Only)

Sleep mode electronically disconnects the internal backup battery, conserving battery life when the machine's batteries are isolated for extended periods. This prevents unnecessary power consumption from the V5 module while the main power supply is disconnected. Once vehicle power (12/24V) is restored, the internal backup battery automatically reconnects, allowing the system to resume normal operation without manual intervention.



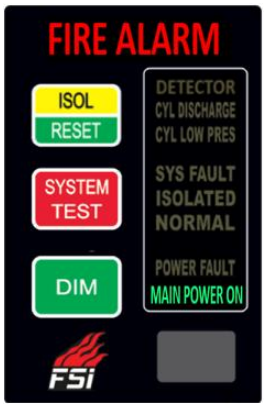
1. Disconnect the main power supply to the V5 Module.
2. Place the module into isolate
3. Press and hold **ISOL/RESET, SYSTEM TEST** and **DIM** buttons for 30 seconds until the 5 second countdown has timed out
4. Once the countdown completes, the system will electronically disconnect the internal back-up battery, putting the unit into sleep mode

SYSTEM NORMAL



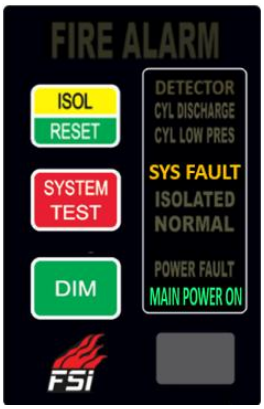
NORMAL and **MAIN POWER ON**, indications are illuminated when the system is in operational condition.

ALARM



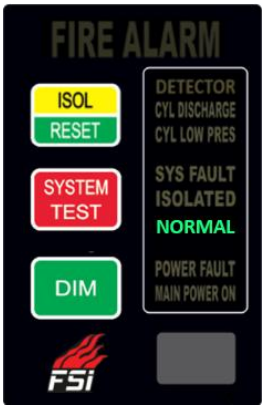
If an alarm is activated due to a thermal probe, cylinder low pressure or system discharge the **NORMAL** will go out and the alarm circuit that has activated will illuminate. Pressing **SYSTEM TEST** will display a fault code in the display window.

SYSTEM FAULT



If a system fault is detected on a circuit the **NORMAL** will go out and the **SYS FAULT** will illuminate.
Pressing **SYSTEM TEST** will display a fault code in the display window.

SYSTEM POWER FAILURE (BACK UP BATTERY)



If the main power supply is lost when the backup battery is enabled **NORMAL** will illuminate every 1 min to indicate the loss of main power. All fault and alarm conditions will still be detected.

6.0 ALARM AND FAULT CODES

When the FSI Foam-Guard V5 Control Module is in an alarm or fault condition the applicable codes will be displayed in the display window, this is accessed by pressing the **SYSTEM TEST** button.

- An alarm condition will override any pre-existing fault conditions.
- All alarms and fault conditions are latching until reset.
- Resetting the Module is done by entering and then exiting the isolated mode.

6.1 ALARM CODES

A0	Detector Circuit Alarm
A1	Discharge Switch Alarm
A2	Low Pressure Switch Alarm
A3	Remote Trigger Alarm – Aux Digital In
AA	Electric Manual Actuation Circuit Alarm
00	Solenoid is energised (2 Mins)

6.2 FAULT CODES

F0	Detector Circuit Fault
F1	Discharge Pressure Switch Circuit Fault
F2	Low Pressure Switch Circuit Fault
F3	Solenoid Circuit Fault (Set when Driven)
F4	Display Cable Fault
F5	Internal Supply Fault
F6	Backup Battery Fault
F7	Battery Charge Fault
F8	RTC Battery Fault
F9	General System Fault
FA	Manual Actuation Circuit Fault
F4 + F9	Incorrect Configuration of Display Module

6.3 DIAGNOSTIC TABLE - ALARMS

ALARM		CAUSE	REPAIR
A0	Detector Circuit Alarm	• Detection circuit has activated • Faulty probes/LHD. • Faulty plugs/wiring.	• Check for system activation. • Check probes/LHD. • Check plugs/wiring. • Reset Module.
A1	Discharge Switch Alarm	• System has been discharged. • Faulty pressure switch. • Faulty plugs/wiring.	• Check for system discharge. • Check pressure switch. • Check plugs/wiring. • Reset Module.
A2	Low Pressure Switch Alarm	• System is low pressure. • Faulty pressure switch. • Faulty plugs/wiring.	• Check for system pressure. • Check pressure switch. • Check plugs/wiring. • Reset Module
A3	Remote Trigger Alarm – Aux Digital In	• System has been activated. • Faulty plugs/wiring.	• Check for system activation. • Check plugs/wiring. • Reset Module.
AA	Electric Manual Actuation Circuit Alarm	• System has been actuated. • Faulty electric actuator. • Faulty plugs/wiring.	• Check for system actuation. • Check electric actuator. • Check plugs/wiring. • Reset Module.

6.4 DIAGNOSTIC TABLE - FAULTS

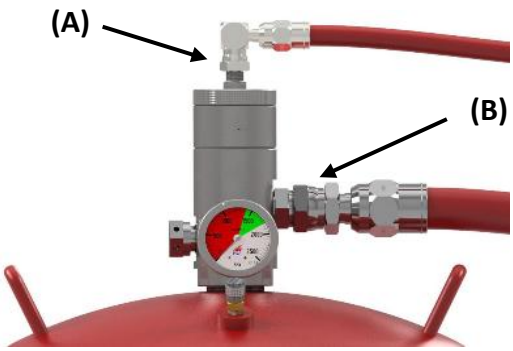
FAULTS		CAUSE	REPAIR
F0	Detector Circuit Fault.	• Faulty probes/LHD. • Faulty plugs/wiring. • System configuration.	• Check probes/LHD. • Check plugs/wiring. • Check system configuration. • Reset Module.
F1	Discharge Pressure. Switch Circuit Fault.	• Faulty pressure switch. • Faulty plugs/wiring.	• Check pressure switch. • Check plugs/wiring. • Reset Module
F2	Low Pressure Switch. Circuit Fault.	• Faulty pressure switch. • Faulty plugs/wiring. • System configuration.	• Check pressure switch. • Check plugs/wiring. • Check system configuration. • Reset Module.
F3	Solenoid Circuit Fault. (Set when driven)	• Faulty solenoid. • Faulty plugs/wiring. • System configuration.	• Check Solenoid. • Check plugs/wiring. • Check system configuration. • Reset Module.

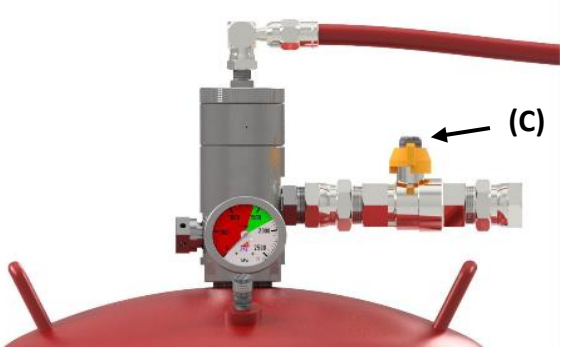
F4	Display Fault	• Faulty Display cable. • Faulty plugs.	• Reset Module. • Replace display cable/plugs.
F5	Internal Supply Fault.	• Incorrect voltage supply	• Reset Module. • Return to FSI.
F6	Backup Battery Fault.	• Battery is low voltage. • Battery not connected, battery is faulty, or a board fault exists. • System configuration.	• Allow battery to charge with voltage >12.5 volts for 2 hours. • Check system configuration. • Reset Module. • Return to FSI.
F7	Battery Charge Fault.	• Ambient Temp below 0˚C or above 47˚C. • Battery not connected. • Battery is faulty. • CPU fault exists.	• Check system configuration. • Check Ambient Temp • Reset Module. • Return to FSI.
F8	RTC Battery Fault.	• Battery fault. • RTC Voltage below 1.8 volts.	• Replace RTC battery. • Reset Module.
F9+F4	Incorrect Configuration	• nA selected for a shutdown Module.	• Carry out correct shutdown timer configuration procedure.
FA	Manual Actuation Circuit Fault	• Faulty Electric actuator. • Faulty plugs/wiring. • System configuration.	• Check Electric actuator. • Check plugs/wiring. • Check system configuration. • Reset Module.
U	Unconfigured (Isolated mode)	• System not configuration.	• Carry out configuration procedure.
U	Display will not program (No display illumination)	• CPU frozen.	• Cycle main power supply • Remove RTC battery to hard reset. • Reprogram all configurations.
	Display Module will not deisolate	• All configurations not programmed.	• Check system configuration. • Reset Module.

7.0 INSTALL PROCEDURES

7.1 ROP – ISOLATION PROCEDURE

NOTE
This procedure is also applicable to FSI ROP Electric systems.





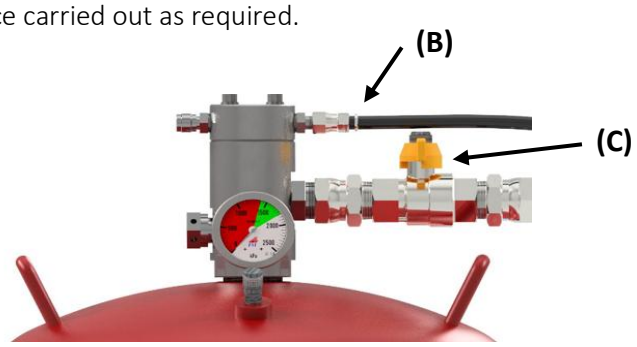
1. Locate all FSI fire suppression cylinders.
2. Disconnect the actuation hose **(A)** and discharge hose **(B)** from each cylinder valve and cover hose inlet to prevent the ingress of contaminants.
3. Unplug DT plug(s) from all pressure switches.
4. Connect (FSI 51004) FSI Discharge Isolation cap **(C)** to the ROP discharge valve outlet.
5. Remove cap from the lower Schrader valve located in the cylinder crown.
6. Slowly vent the nitrogen until the cylinder is completely depressurised and the cylinder gauge is reading 0kPa prior to removing any part of the valve of cylinder assembly.
7. Carry out all required work as required.

7.2 LOP - ISOLATION PROCEDURE

NOTE
These procedures are also applicable to FSI Electric systems.

1. Locate all FSI fire suppression cylinders.
2. Disconnect the discharge hose **(A)** from the discharge nipple on each discharge valve.
3. Unplug DT plugs from pressure switch.
4. Connect (FSI 51004) FSI Cylinder Isolation Caps **(C)** to the LOP discharge valve outlet.
5. Remove cap from the lower Schrader valve located in the cylinder crown.
6. Slowly vent the nitrogen until the cylinder is completely depressurised and the cylinder gauge is reading 0kPa prior to removing any part of the valve of cylinder assembly.
6. The actuation hose **(B)** can be removed, and maintenance carried out as required.





7.3 FILLING WITH SOLUTION

NOTE
Refer to the Foam-Guard F3 foam SDS. Clean Drinkable/Potable water shall be used when testing or refilling.

1. Select the correct sized FSI Fill Tube for the cylinder being refilled.
2. Screw the correct FSI Fill Tube onto the cylinder neck ensuring it is seated and firmly hand tight.
3. Fill with Drinkable/Potable water using a hose or container until water is sitting at the top of the fill tube.
4. Remove FSI Fill Tube.
5. Accurately measure out the correct amount of F3 concentrate as stated on the cylinder label or manual.
6. Using a funnel pour slowly into the cylinder.
7. Ensure the O-ring at the top of the syphon tube is in operational condition and there is Molykote 111 on the bevelled lip of the cylinder neck.
8. Carefully reinstall the valve and hand tighten only.
9. Carry out same procedure for multiple cylinders.

CAUTION
Horizontal cylinders shall be level when filling with solution to ensure the correct volume is achieved.

Table 3
Solution Capacities

CYLINDER CAPACITY (L)	SOLUTION CAPACITY (L)	DRINKABLE/POTABLE WATER (L)	F3 (L)
16	12	11	1
23	17	15.5	1.5
45	30	28	2
65	50	46	4
106	90	84	6

7.4 DISCHARGE HOSE CLEAR PASSAGE TEST

1. Remove discharge hose **(A)** from the cylinder valve.
2. Plug remaining discharge hoses on multi cylinder configurations.
3. Connect (FSI 51010) FSI Line Flushing Adaptor **(B)** to compressed air or nitrogen and then connect to the discharge hose.
4. Clear passage test the discharge hoses including the foam line to PME, of all residual solution. On larger systems separate sections may need to be clear passage tested individually.
5. Refit all silicone nozzle caps.

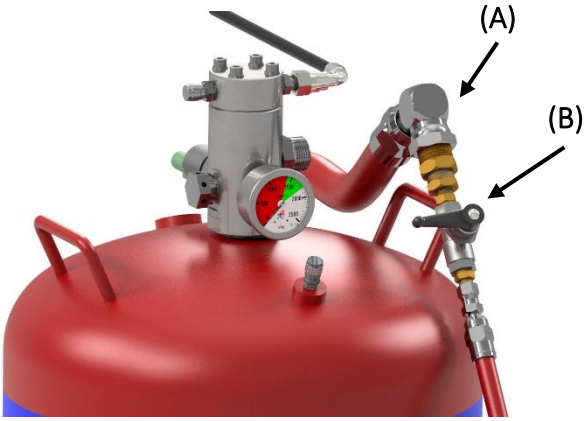


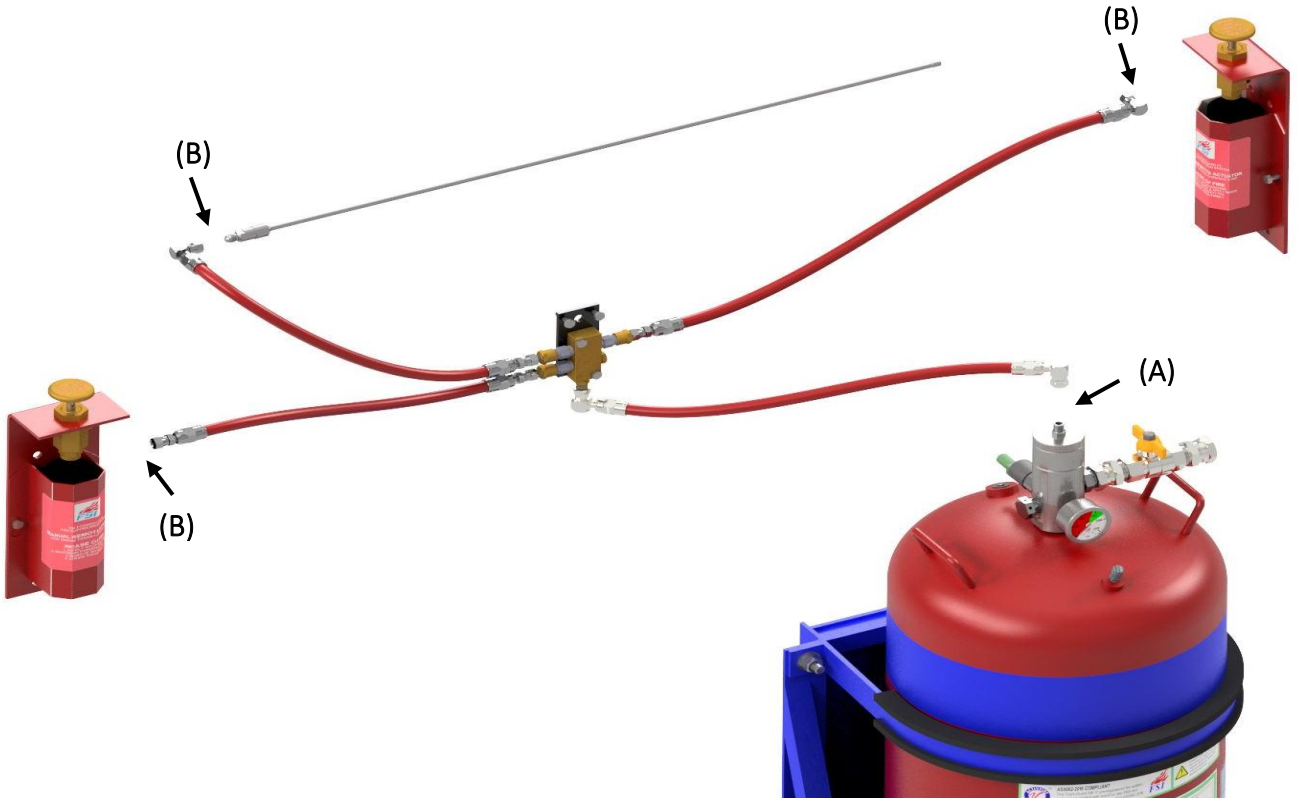
Figure 40
Line Flushing Adaptor

7.5 ROP ACTUATION HOSES - CLEAR PASSAGE TEST

CAUTION
Inadvertent discharge of the system may occur if the actuation hoses are not flushed as per the procedure. Nitrogen shall be used to conduct this procedure

1. To prevent accidental discharge, connect a (FSI 51004) FSI Cylinder Isolation cap to the discharge outlet
2. Disconnect the ROP actuation hoses from the cylinder discharge valves. **(A)**
3. Disconnect the ROP actuation hoses from ALL actuation points, manual actuators, and Mechanical Sensor Module (MSM) **(B).**
4. Connect (FSI 51005) FSI Actuation Line Tester to an actuation hose and clear passage test the hose assembly ensuring adequate pressure is venting from the actuation hoses at the cylinder valves.
5. Ensure No pressure is venting from any other actuation hose assembly. This can indicate a check valve is damaged.
6. Repeat step 3 and 4 for all individual actuation hose assemblies.
7. Connect (FSI 51010) FSI Line Flushing Adaptor to the actuation hose located at the cylinder discharge valve.
8. With all actuators and MSM's disconnected, pressurise the actuation hose from each cylinder discharge valve. This will test the operation and orientation of the check valves situated in the manifold. Ensure the actuation line maintains pressure and is not venting from the actuators or MSM hose assemblies.
9. Reinstall all actuation hoses.

CAUTION
To avoid personal injury, ensure all disconnected actuation hose assemblies are adequately secured with suitable P clamps or cable ties for this procedure.



7.6 LOP ACTUATION - HOSES CLEAR PASSAGE TEST

CAUTION
Do not remove the actuation line from the actuator to conduct a clear passage test, as this does not test for obstruction within the actuator.

1. The FSI system shall be isolated and depressurised to prevent an uncontrolled discharge.
2. Disconnect the actuation hose **(A)** at the cylinder discharge valve.
3. Connect (FSI 51005) FSI Actuation Line Tester **(B)** to the nitrogen supply.
4. Conduct the clear passage test with nitrogen on the actuation circuits by opening each LOP Manual Actuator one at a time, to ensure contaminants are removed from the internals of the hose, and there are no restrictions.
5. Remove actuator cover and reinstall the relief port silicone cap.
6. Remove the EOL LOP cap and conduct a clear passage test of the LOP detection circuits.
7. After the system has been inspected carry out an actuation line leak.

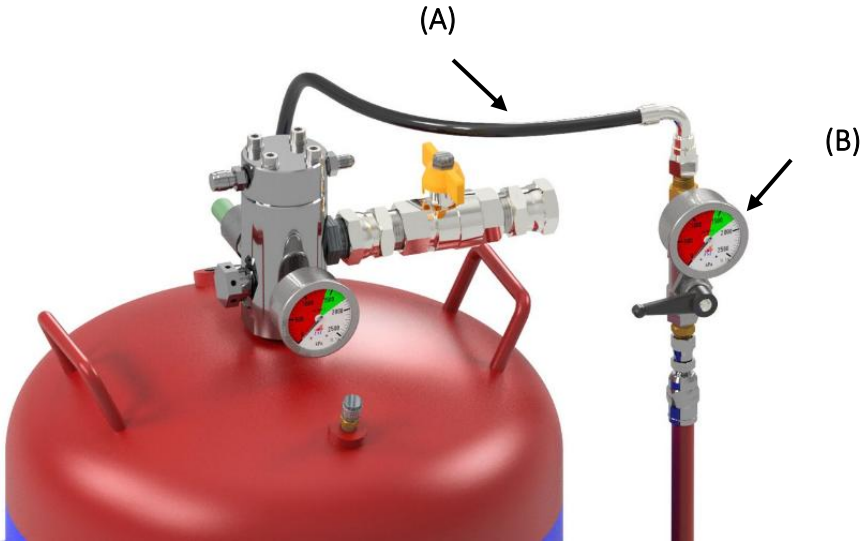


Figure 41
Actuation Circuit Tester

7.7 ELECTRIC SOLENOID - CLEAR PASSAGE TEST

CAUTION
Ensure the fire suppression system is isolated and depressurised to prevent accidental discharge.

1. The FSI system shall be isolated, depressurised and empty of solution to prevent an uncontrolled discharge.
2. Connect (FSI 51005) FSI Actuation Line Tester **(A)** to the nitrogen supply.
3. Actuate the electric actuator to energise the solenoid and conduct a clear passage test of the solenoid and hose assembly to ensure contaminants are removed from the internals of the hose and solenoid.
4. Reinstall the relief port silicone cap (LOP).
5. Isolate the system and reconnect components.



Figure 42
Solenoid clear passage

7.8 LOP - SEALING FITTINGS

1. Remove and clean off all Nylog Blue from the JIC thread and check inside the JIC fitting for blockages.
2. Ensure the JIC fitting surface is clean before applying the Nylog Blue.
3. Apply Nylog Blue to the JIC sealing surface and the threads of the male JIC fitting.
4. Reinstall the actuation circuit hose.

CAUTION
Ensure that excessive Nylog Blue is not applied which can cause the orifice to become obstructed.



Figure 43
Applying Nylog Blue

7.9 LOP - LEAK TESTING ACTUATION CIRCUIT

1. Ensure the cylinder has been isolated/depressurised.
2. Remove the LOP actuation hose from the top of the discharge valve **(A).**
3. Connect (FSI 51005) FSI actuation line Test Rig **(B).**
4. Set the pressure to **2000kPa for a minimum of 30 minutes** and monitor for a pressure drop.
5. Using Leak Detector Fluid spray all connection fittings and hose assemblies.
6. If there is a pressure drop or a leak is found, safely depressurise the actuation circuit. Remove the leaking fitting or hose assembly, replace, and reseal with Nylog Blue.
7. Repeat step 4 - 5 and retest the actuation circuit to confirm the repair is correct and there are no further leak points in the system.

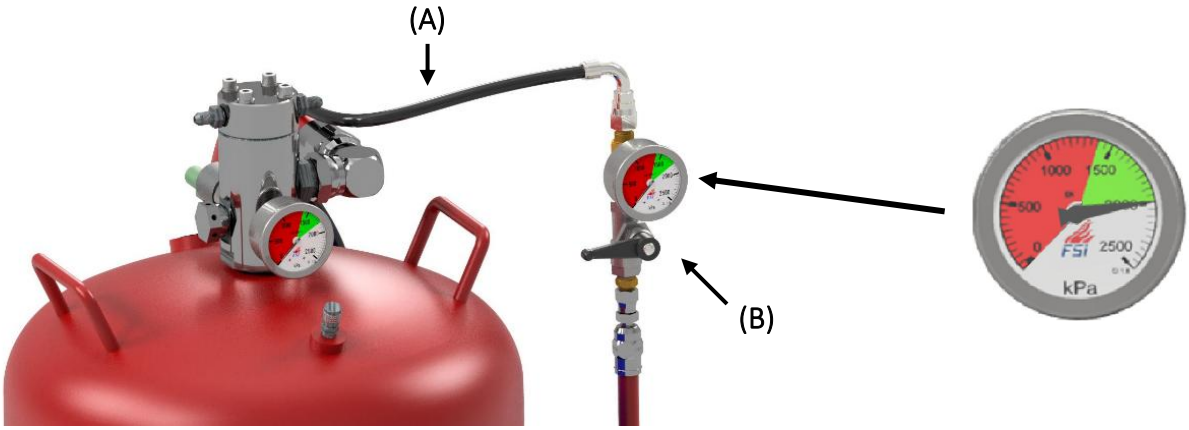


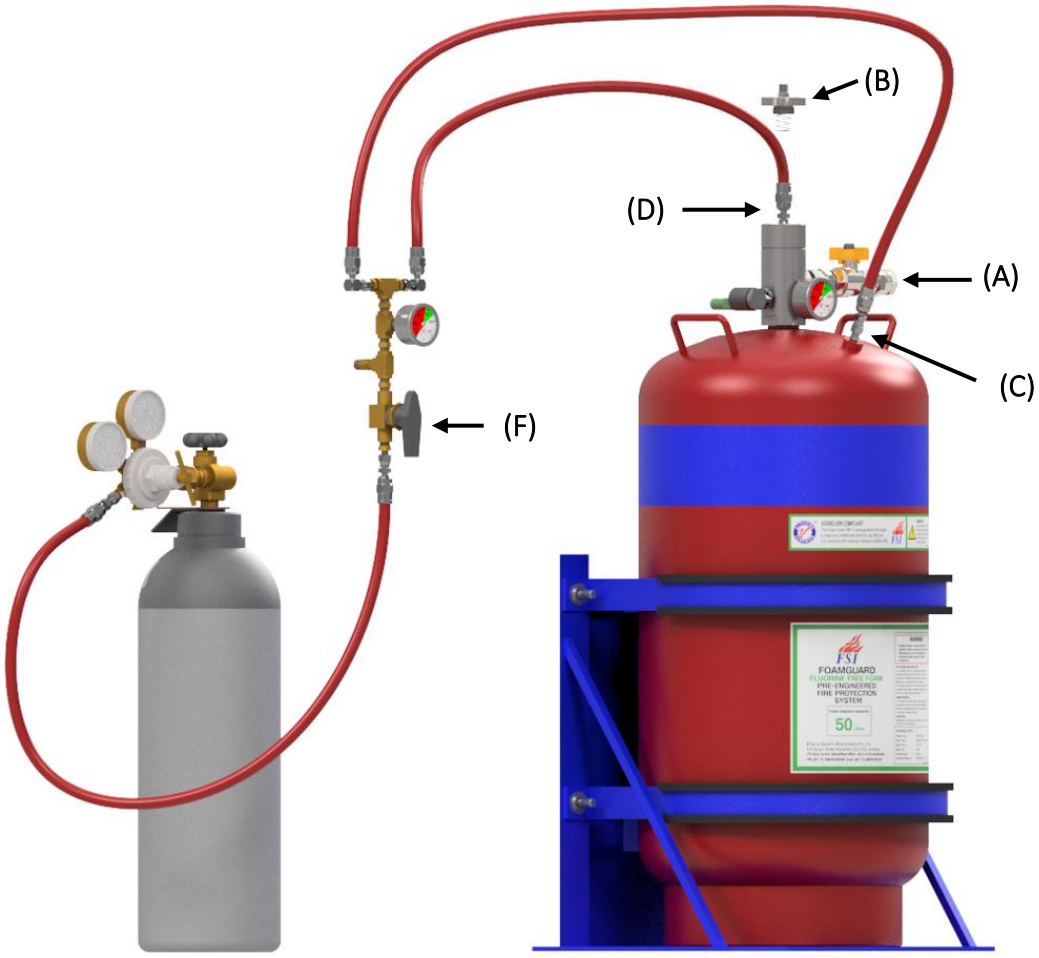
Figure 44
FSI Actuation Line Test Rig set to 2000kpa

7.10 ROP - CHARGING PROCEDURE

1. To prevent accidental discharge, connect (FSI 51004) FSI Cylinder Isolation cap **(A)** to the discharge outlet
2. Remove the 1/4" BSP actuation line from the top of the discharge valve assembly.
3. Unscrew the actuation cap **(B)** and spring from the discharge valve assembly.
4. Remove the Schrader valve cap from the lower Schrader valve **(C)** on the cylinder crown.
5. Connect (FSI 50001) FSI Charge Rig to a Nitrogen Regulator and set the Nitrogen Regulator to a pressure of 2200kPa.

CAUTION
EHP nitrogen regulators **shall NOT** be used.

6. Connect hoses from (FSI 50001) FSI Charge Rig to the Schrader valves on the discharge valve **(D)** and cylinder crown **(C).**
7. Open charge rig ball valve **(F)** by turning 90 degrees. Monitor cylinder gauge until cylinder pressure reaches the correct pressure for the ambient temperature as per table 5.
8. Allow a minimum of **10 minutes** for cylinder pressure to stabilise. Depending on ambient temperature this time may vary.



9. Disconnect (FSI 50001) FSI Charge Rig hoses from the upper Schrader valve **(D)** and lower Schrader valve **(C).**
10. Re-fit a Schrader valve cap to the lower Schrader valve **(C)** only**.**

CAUTION
A Schrader valve cap **shall NOT** be fitted to the Upper Schrader valve on a ROP system.

11. Check valve and cylinder assembly for leaks using leak detection fluid. If a leak is present system shall be depressurised and the leak rectified.
12. Re-fit the actuation spring into the discharge valve end cap and re-fit the actuation cap **(B)** onto the discharge valve assembly.
13. Disconnect (FSI 51004) FSI cylinder isolation cap **(A)** from the discharge outlet and reconnect discharge and actuation hoses.
14. Reset fire alarm Display Module to its normal operation condition.

NOTE
The control Module SHALL BE ISOLATED prior to recharging the fire suppression cylinders. Disconnecting any power supply WILL NOT reset the electric actuation solenoid valve. For multi cylinder ROP systems each cylinder is charged individually.

CAUTION - ELECTRIC ACTUATION SYSTEMS
Ensure the control module is configured, isolated and the back-up battery is adequately charged prior to conducting the cylinder recharge procedure.

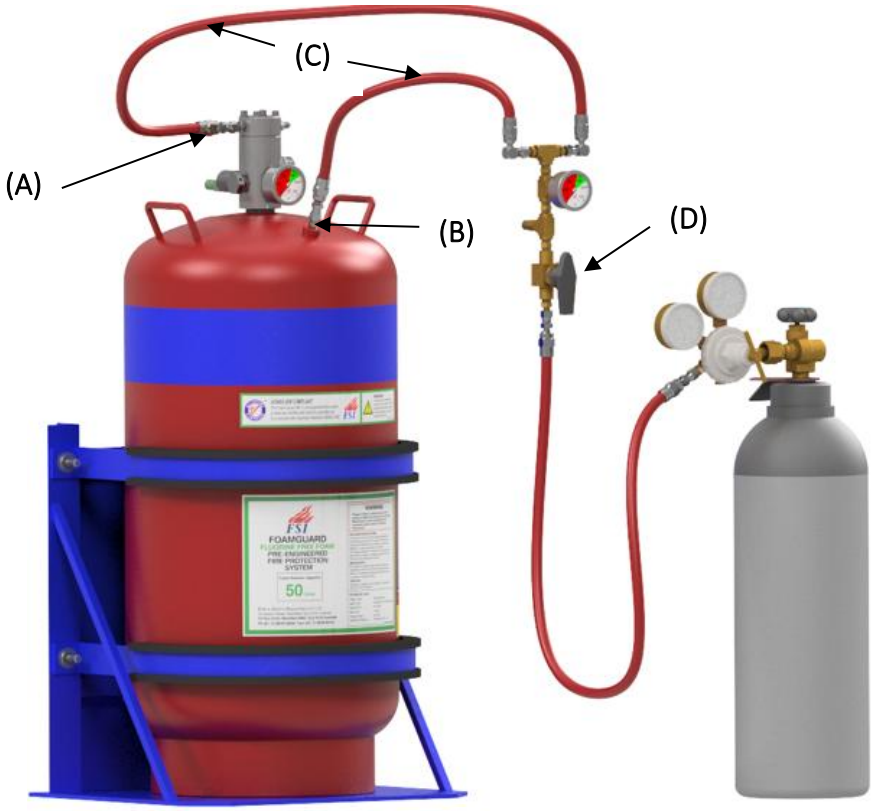
7.11 LOP - CHARGING PROCEDURE - SINGLE CYLINDER

CAUTION
Before refilling and charging a LOP system it is highly recommended to carry out a full actuation leak test to prevent accidental discharges due to lose connections.

1. Ensure the actuation hose is fitted and sealed with Nylog Blue to the top of the valve.
2. To prevent accidental discharge, connect (FSI 51004) FSI cylinder isolation cap to the discharge outlet on the LOP discharge valve.
3. Remove the Schrader valve cap from the upper Schrader valve **(A)** and lower Schrader valve **(B)**
4. Connect the (FSI 50001) FSI Charge Rig to the nitrogen regulator and set the nitrogen regulator to a pressure of 2200kPa.

CAUTION
EHP nitrogen regulators **shall not** be used.

5. Connect (FSI 50001) FSI Charge Rig hoses **(C)** to the upper Schrader valve **(A)** and lower Schrader valve **(B).**
6. Open charge rig ball valve **(D)** by turning 90 degrees. Monitor cylinder gauge until cylinder pressure reaches the correct pressure for the ambient temperature as per table 5.
7. Allow a minimum of **10 minutes** for cylinder pressure to stabilise. Depending on ambient temperature this time may vary.



8. Disconnect both (FSI 50001) FSI Charge Rig hoses **(C)** from the upper Schrader valve **(A)** and lower Schrader valve **(B).**
9. Check all connections at valve assembly for leaks using leak detection fluid. If a leak is present system shall be depressurised and the leak rectified.
10. Re-fit Schrader valve caps to the Schrader valves.
11. Disconnect (FSI 51004) FSI cylinder isolation cap from the discharge valve outlet and reconnect discharge hoses.
12. Reset fire alarm Display Module to its normal operation condition.

NOTE -ELECTRIC ACTUATION
The control Module SHALL BE ISOLATED prior to recharging the fire suppression cylinders. Disconnecting any power supply WILL NOT reset the electric actuation solenoid valve.

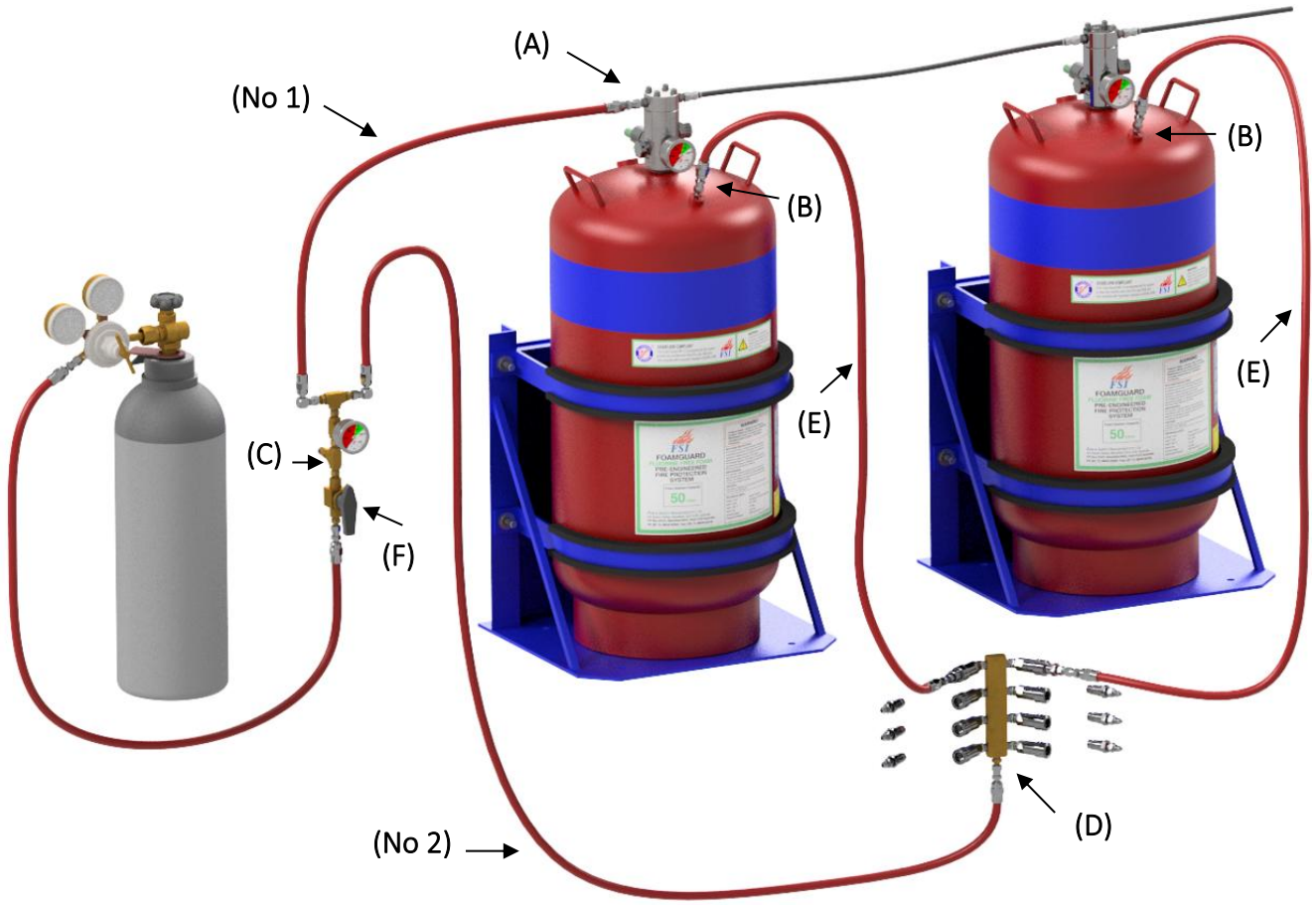
CAUTION - ELECTRIC ACTUATION SYSTEMS
Ensure the control module is configured, isolated and the back-up battery is adequately charged prior to conducting the cylinder recharge procedure.

7.12 LOP - CHARGING PROCEDURE - MULTI CYLINDER

1. Ensure the actuation hoses are fitted and sealed with Nylog Blue to the top of the valves.
2. To prevent accidental discharge, connect (FSI 51004) FSI cylinder isolation caps to the LOP discharge valves.
3. Remove the Schrader valve cap from the upper Schrader valve **(A)** and lower Schrader valves **(B).**
4. Connect (FSI 50001) FSI Charge Rig **(C)** to (FSI 50001/B) FSI Multi Cylinder Charge Adaptor **(D)** and nitrogen regulator and set the nitrogen regulator to a pressure of 2200kPa.

CAUTION
EHP nitrogen regulators **shall not** be used.

5. Connect hose **(No 1)** from the (FSI 50001) FSI Charge Rig to the upper Schrader Valve **(A)**.
6. Connect hose **(No 2)** from the (FSI 50001) FSI Charge Rig to (FSI 50001/B) FSI Multi Cylinder Charge Adaptor **(D).**
7. Connect FSI Multi Cylinder Charge Adaptor hoses **(E)** connect to the lower Schrader valve **(B)** on each lower cylinder Schrader valve.
8. Open charge rig ball valve **(F)** by turning 90 degrees. Monitor cylinder gauge until cylinder pressure reaches the correct pressure for the ambient temperature as per table 5.
9. Allow a minimum of **10 minutes** for cylinder pressure to stabilise. Depending on ambient temperature this time may vary.



10. Disconnect (FSI 50001) FSI Charge Rig and (FSI 50001/B) FSI Multi Cylinder Charge Adaptor hoses.

11. Check all connections at valve assembly for leaks using leak detection fluid.
12. Re-fit Schrader valve caps to the Schrader valves.
13. Disconnect the (FSI 51004) FSI cylinder isolation caps from the discharge outlet and reconnect discharge hoses.
14. Reset fire alarm Display Module to its normal operation condition.

NOTE- ELECTRIC ACTUATION
The control Module SHALL BE ISOLATED prior to recharging the fire suppression cylinders. Disconnecting any power supply WILL NOT reset the electric actuation solenoid valve.

CAUTION - ELECTRIC ACTUATION SYSTEMS
Ensure the control module is configured, isolated and the back-up battery is adequately charged prior to conducting the cylinder recharge procedure.

Table 4
Maximum Unsupported Hose and Wiring

HOSE DIA ID (INCH)	MAX UNSUPPORTED HOSE/WIRING (mm)
19mm - (¾")	750
12.5mm - (½")	500
6.3mm - (¼")	400
Fire Harness	400
LOP Tube	400
LHD Wire	400
DT Plug from Enclosure	200
DT plug Disconnection Point	50

Table 5
Charge Pressure Vs Temperature

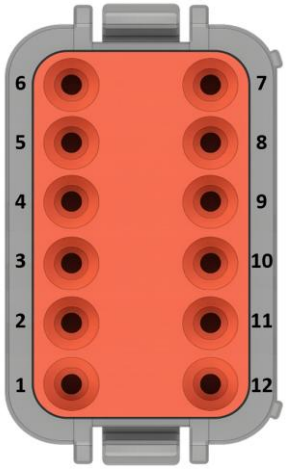
TEMPERATURE (°C)	CHARGE PRESSURE (KPA)
1	1527
5	1549
10	1577
15	1605
20	1633
25	1661
30	1689
35	1716
40	1744
45	1772
50	1800
55	1829
60	1857

Table 6
Recommended Torque Setting

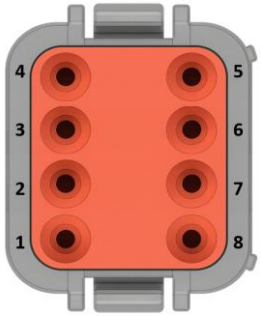
THREAD	RECOMMENDED TORQUE	SEALANTS
1/8" BSP or 1/8" NPT	10 to 15 Nm	577
1/4" BSP	10 to 15 Nm	577
1/2" BSP	25 to 30 Nm	Thread Tape
3/4" BSP	45 to 50 Nm	Thread Tape
1/4" BSP Hose End	7 to 9 Nm	N/A
1/2" BSP Hose End	40 to 50 Nm	N/A
3/4" BSP Hose End	50 to 55 Nm	N/A
7/16" JIC	10 to 15 Nm	Nylog Blue
1/4" Bolt	17 to 23 Nm	N/A
M6 Bolt	17 to 23 Nm	N/A
M10 Bolt	75 to 85 Mn	N/A
M12 Bolt	160 to 170 Nm	N/A
M12 High Tensile	142 to 152 Nm	N/A

8.0 WIRING DIAGRAMS

8.1 12 PIN DT PLUG

6	AUX Digital in (-)		CYL Low Pressure Switch (-) (WHITE)	7
5	AUX Digital in (+)		CYL Low Pressure Switch (+) (RED)	8
4	Electric Actuator (-) (YELLOW/GREEN)		Discharge Pressure Switch (-) (BLACK)	9
3	Electric Actuator (+) (BROWN)		Discharge Pressure Switch (+) (BLUE)	10
2	Solenoid (-) (BLACK)		LHD/Thermal Probes (-) (WHITE)	11
1	Solenoid (+) (BLUE)		LHD/Thermal Probes (+) (RED)	12

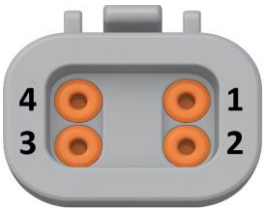
8.2 8 PIN DT PLUG

4	AUX Relay – N.C		Shutdown Relay – N.C	5
3	AUX Relay – COM		Shutdown Relay – COM	6
2	AUX Relay – N. O		Shutdown Relay – N. O	7
1	DC Negative		DC Supply 12/24 VDC	8

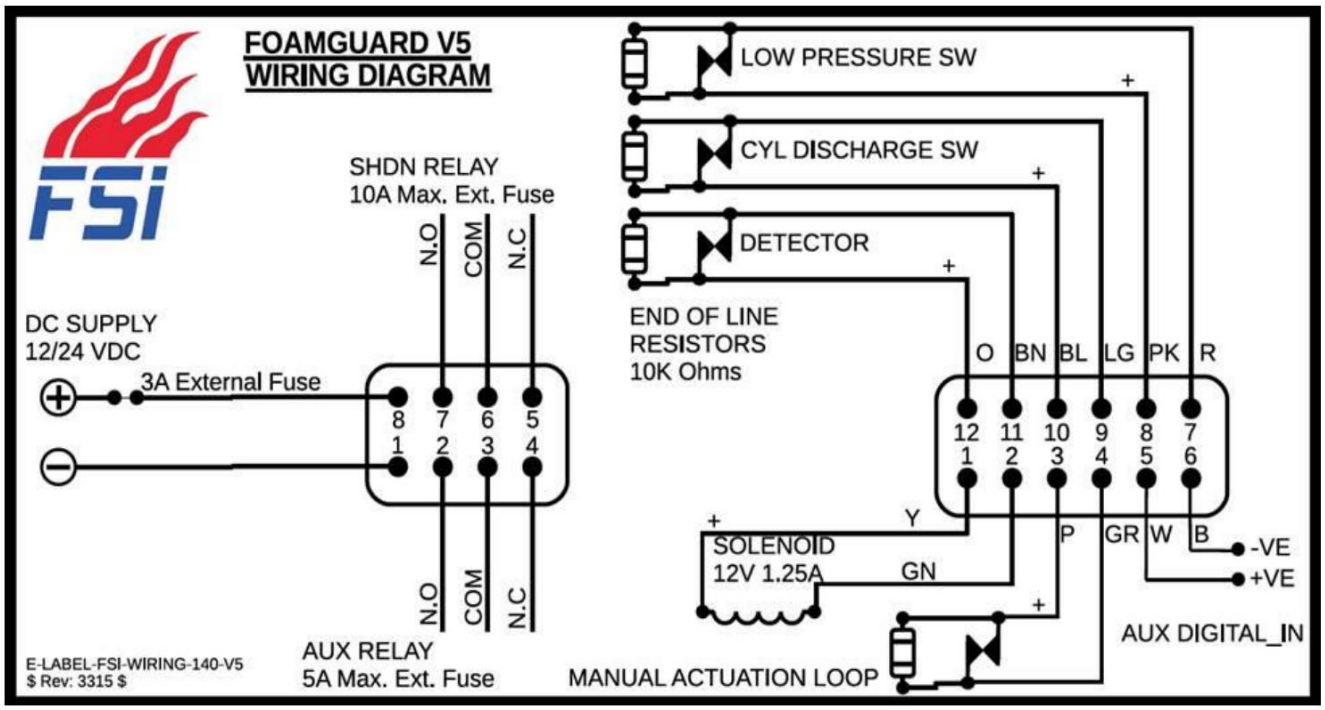
8.3 2 PIN DT PLUG AND RECEPTACLE

1	RED		WHITE	2

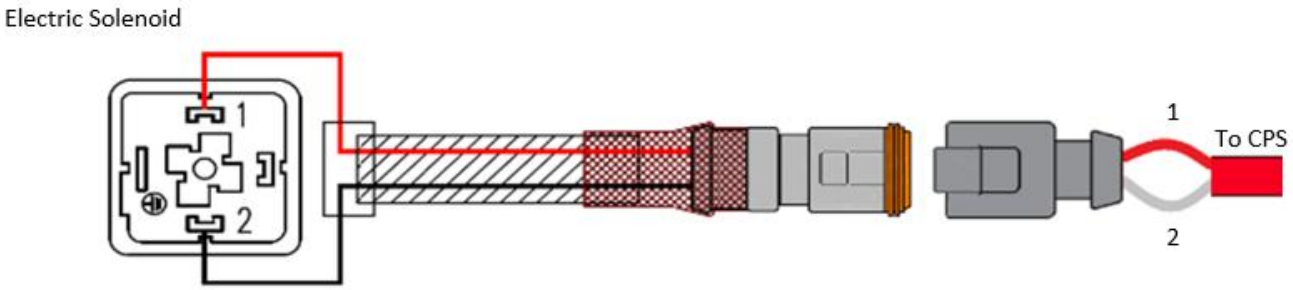
8.4 4 PIN DT PLUG AND RECEPTACLE

4	WHITE		BLACK	1
3	BLUE		RED	2

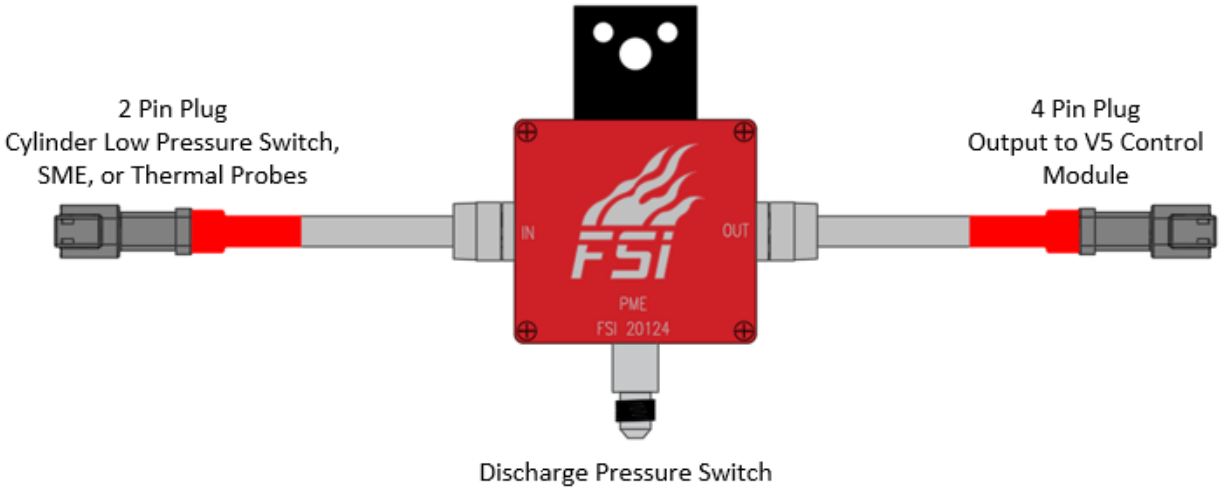
8.5 FSI V5 WIRING DIAGRAM



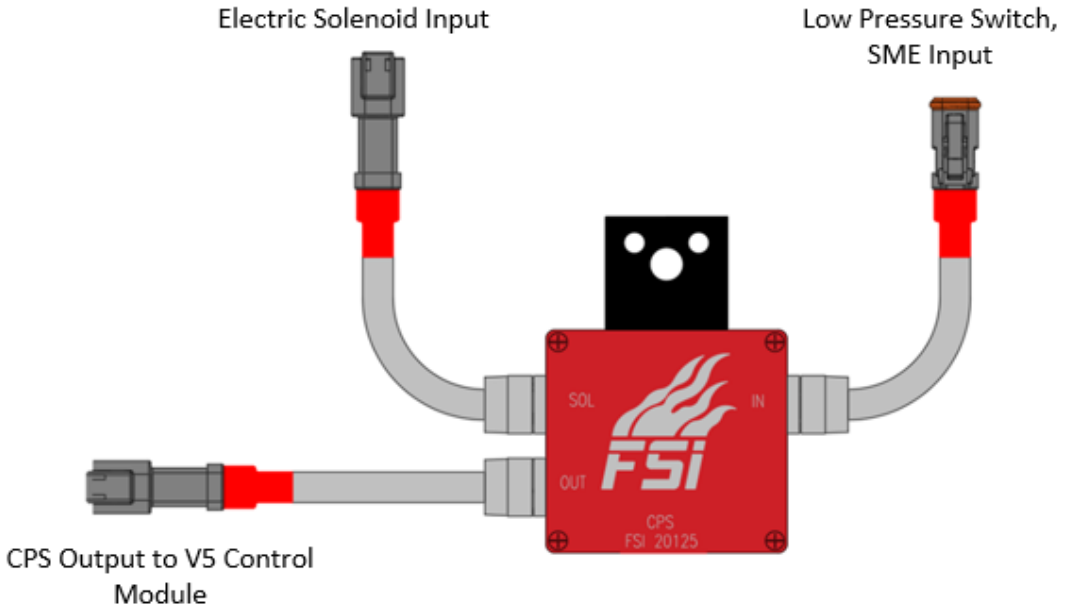
8.6 SOLENOID HIRSCHMAN PLUG



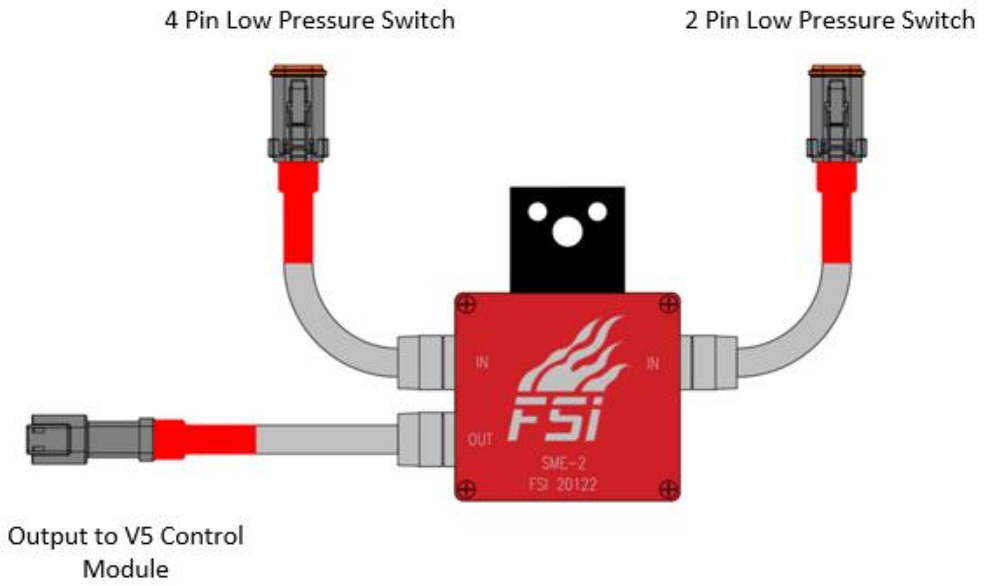
8.7 PME


2 Pin Plug
Cylinder Low Pressure Switch,
SME, or Thermal Probes
4 Pin Plug
Output to V5 Control
Module
IN
OUT
PME
FSI 20124
Discharge Pressure Switch

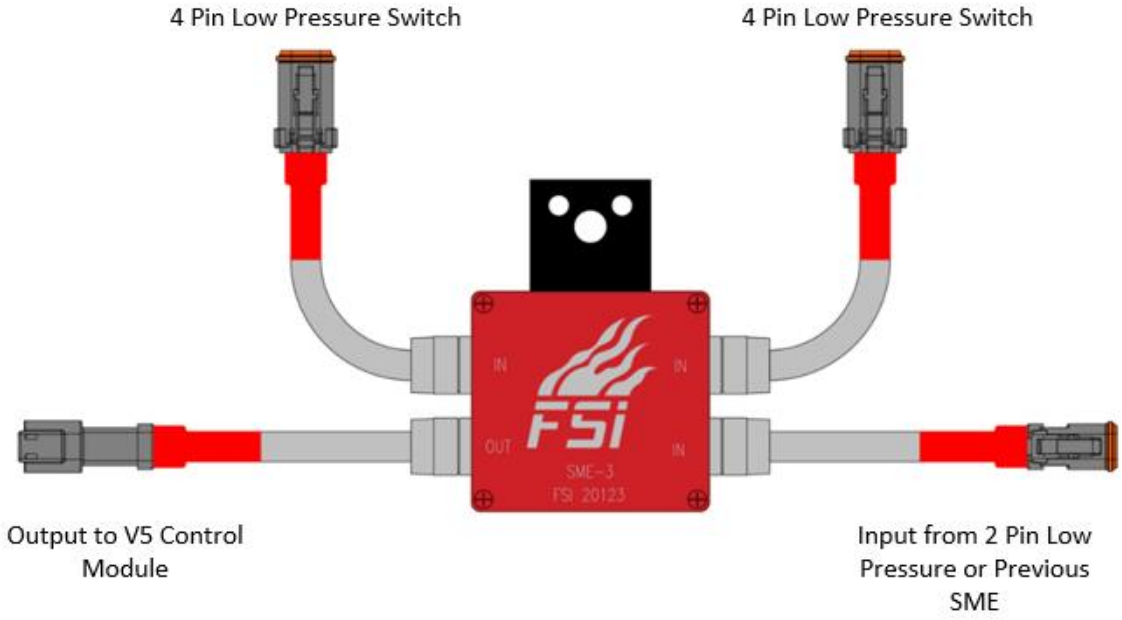
8.8 CPS


Electric Solenoid Input
Low Pressure Switch,
SME Input
SOL
IN
OUT
CPS
FSI 20125
CPS Output to V5 Control
Module

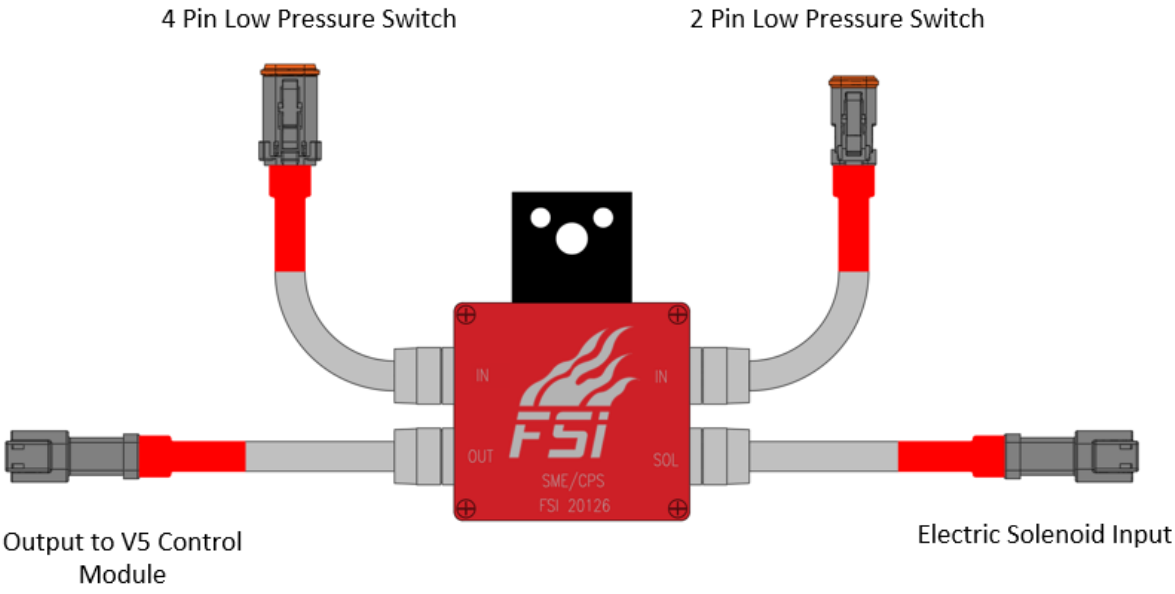
8.9 2 CYLINDER SME



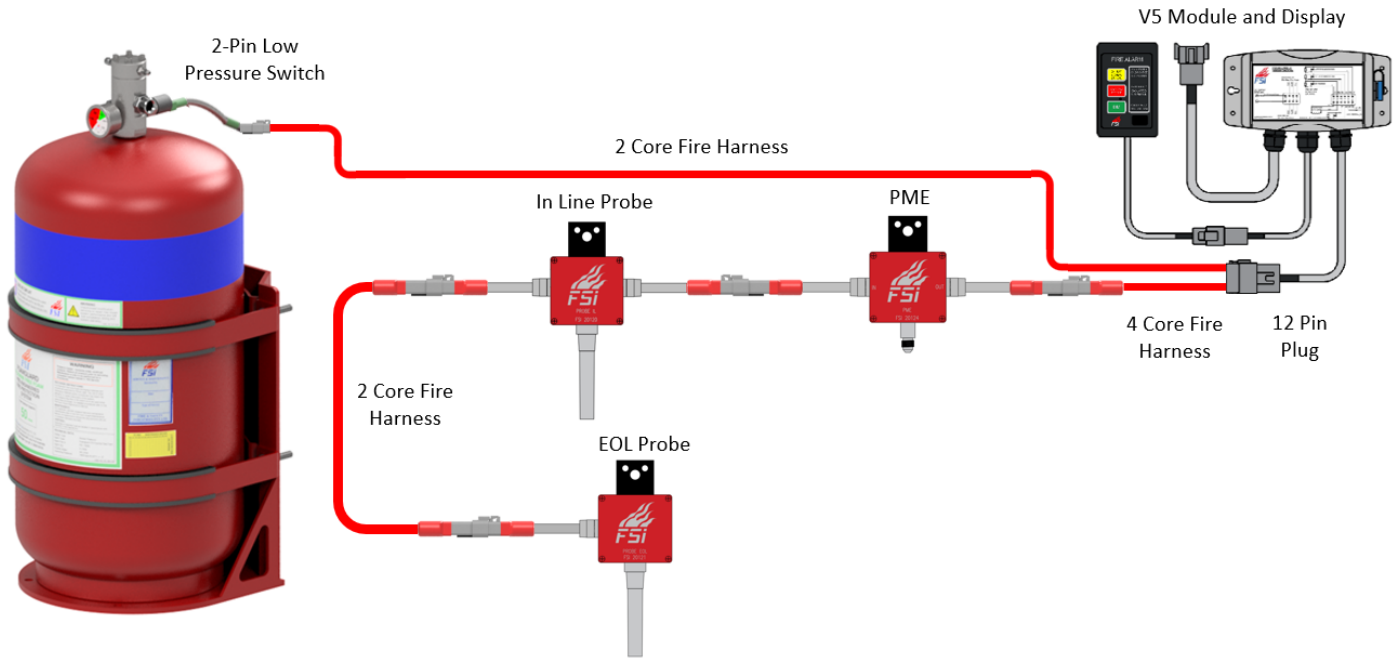
8.10 3 CYLINDER SME



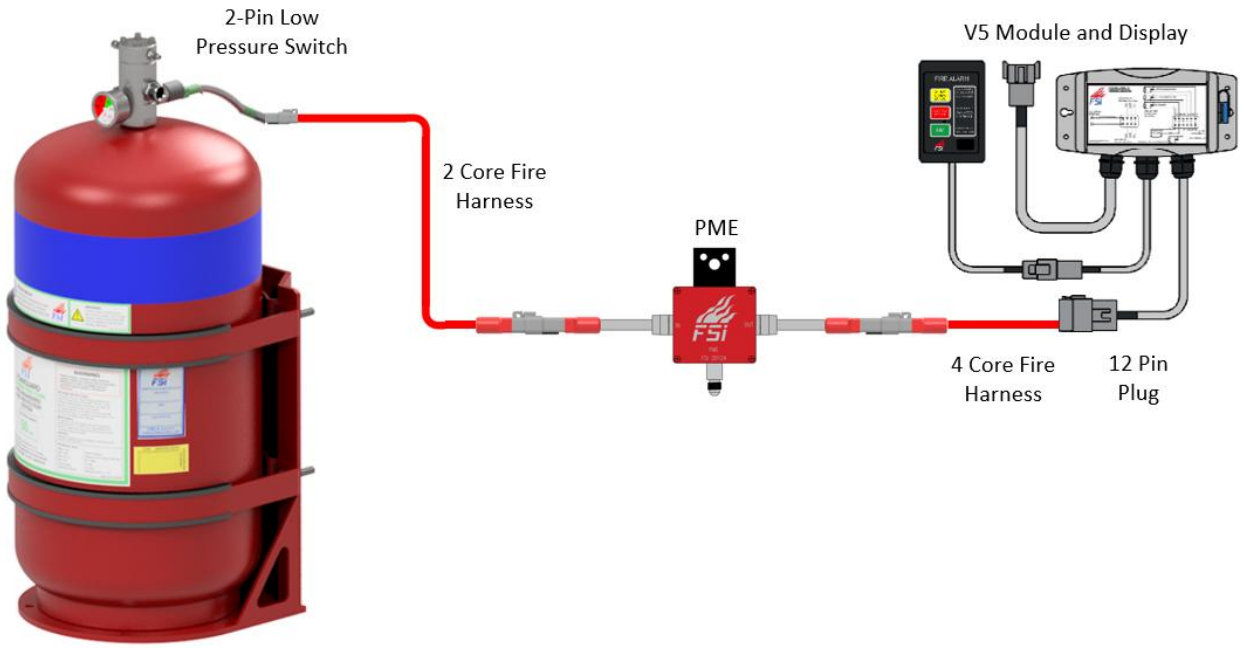
8.11 CPS/SME


4 Pin Low Pressure Switch
2 Pin Low Pressure Switch
IN
IN
OUT
SOL
SME/CPS
FSI 20126
Output to V5 Control Module
Electric Solenoid Input

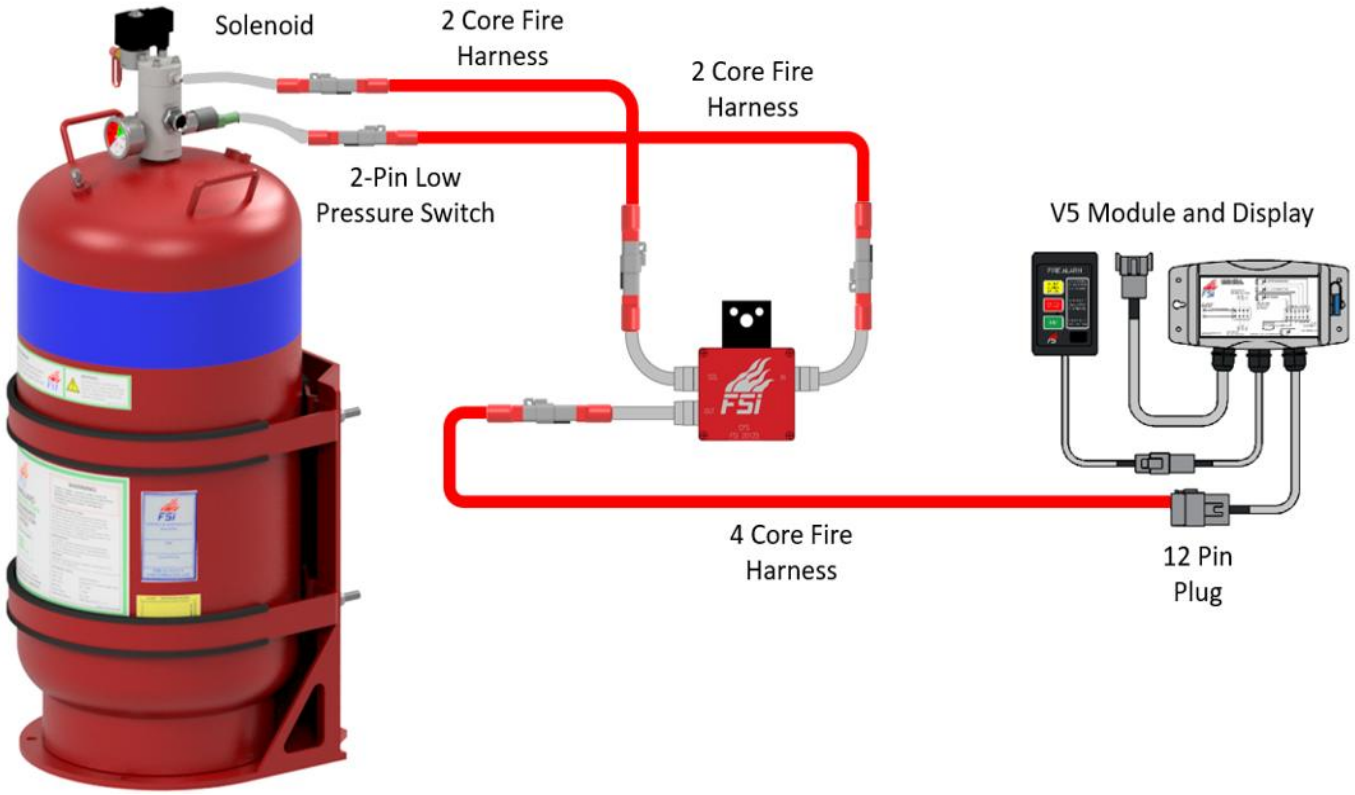
8.12 SECONDARY DETECTION AND LOW PRESSURE SWITCH WIRING



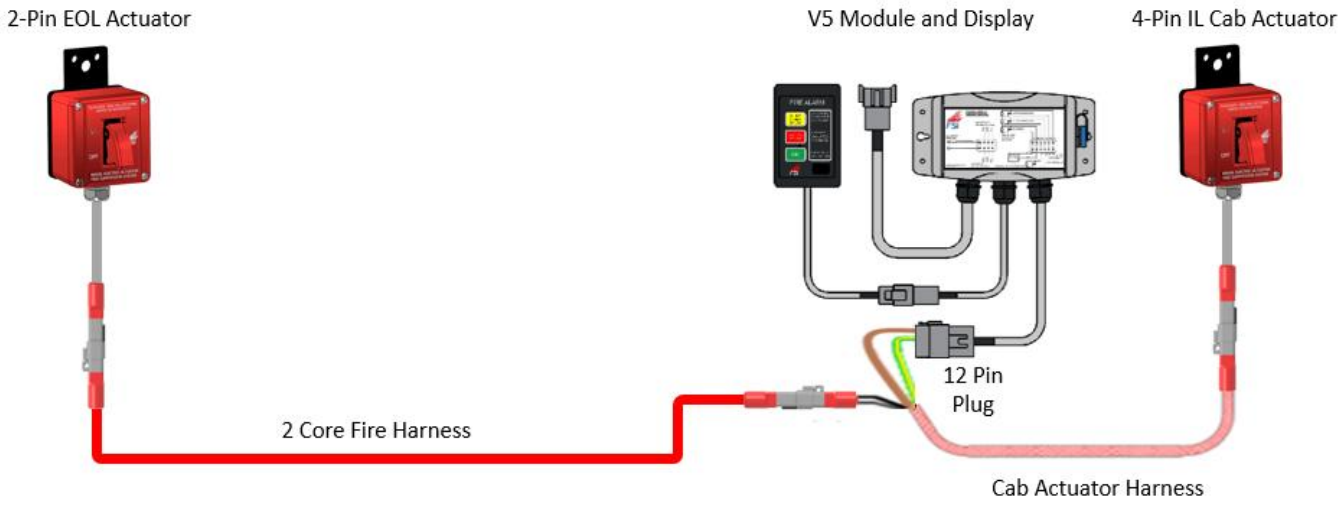
8.13 LOW PRESSURE SWITCH WIRING



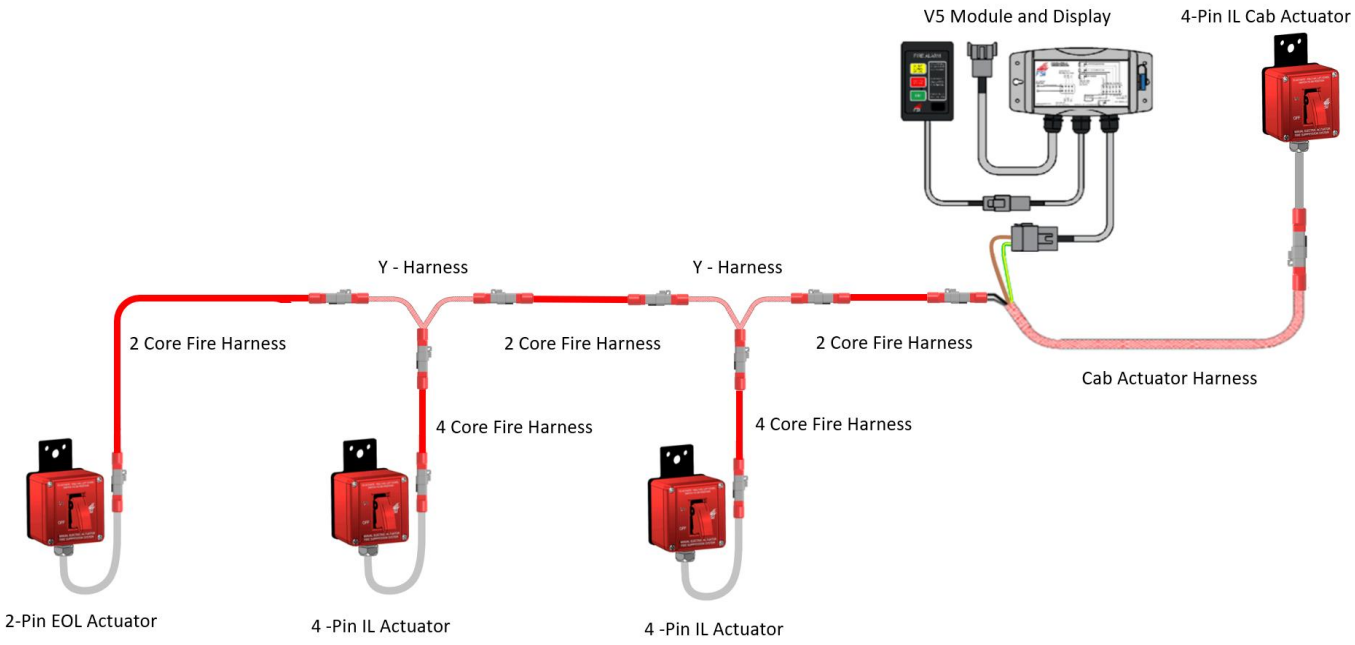
8.14 CPS AND SOLENOID



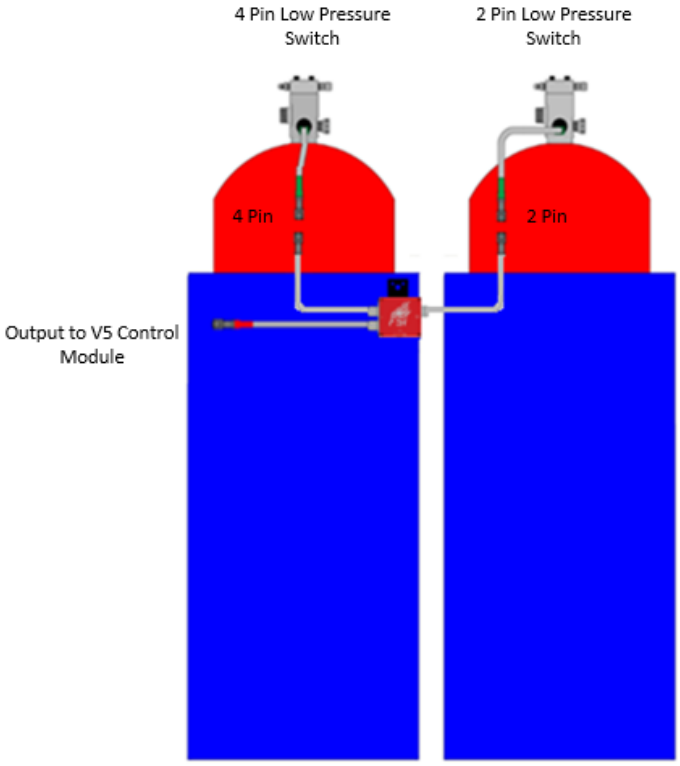
8.15 2 ELECTRIC ACTUATORS CONFIGURATION



8.16 3 OR MORE ELECTRIC ACTUATORS CONFIGURATION

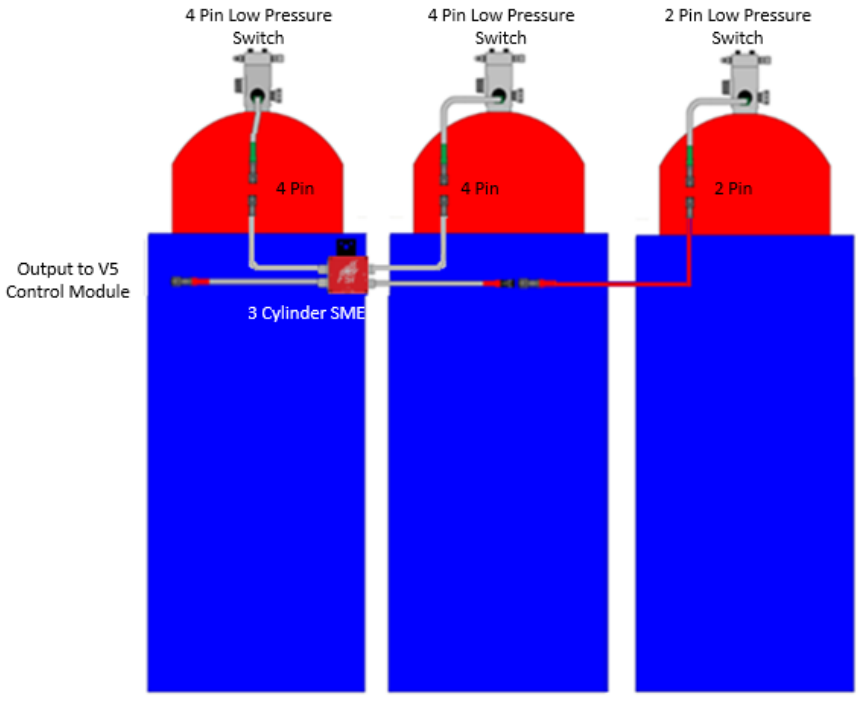


8.17 2 CYLINDER



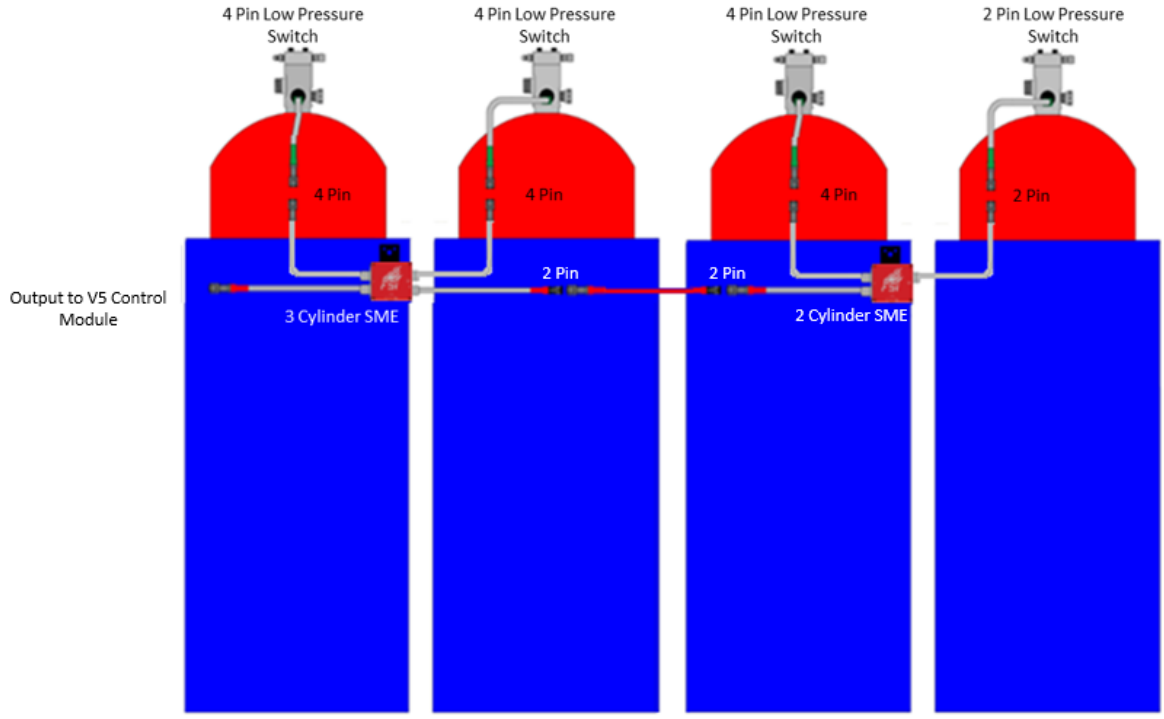
106L EXTRA HEAVY DUTY CYLINDER BRACKET (3 BANDS)

8.18 3 CYLINDER



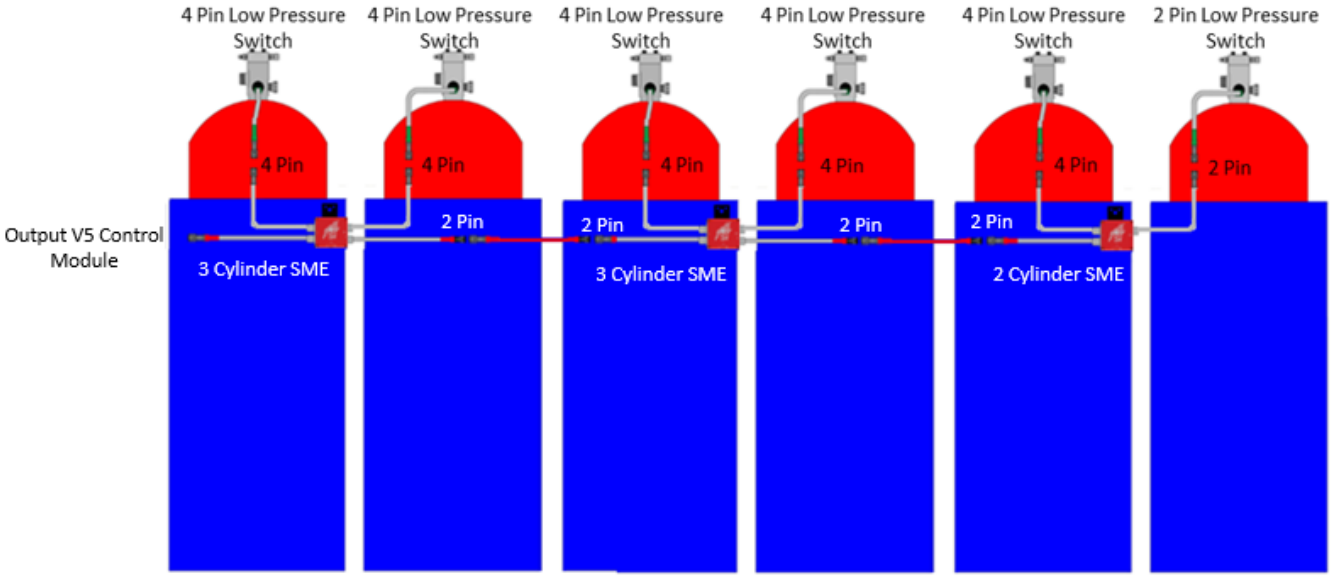
106L EXTRA HEAVY DUTY CYLINDER BRACKET (3 BANDS)

8.19 4 CYLINDER



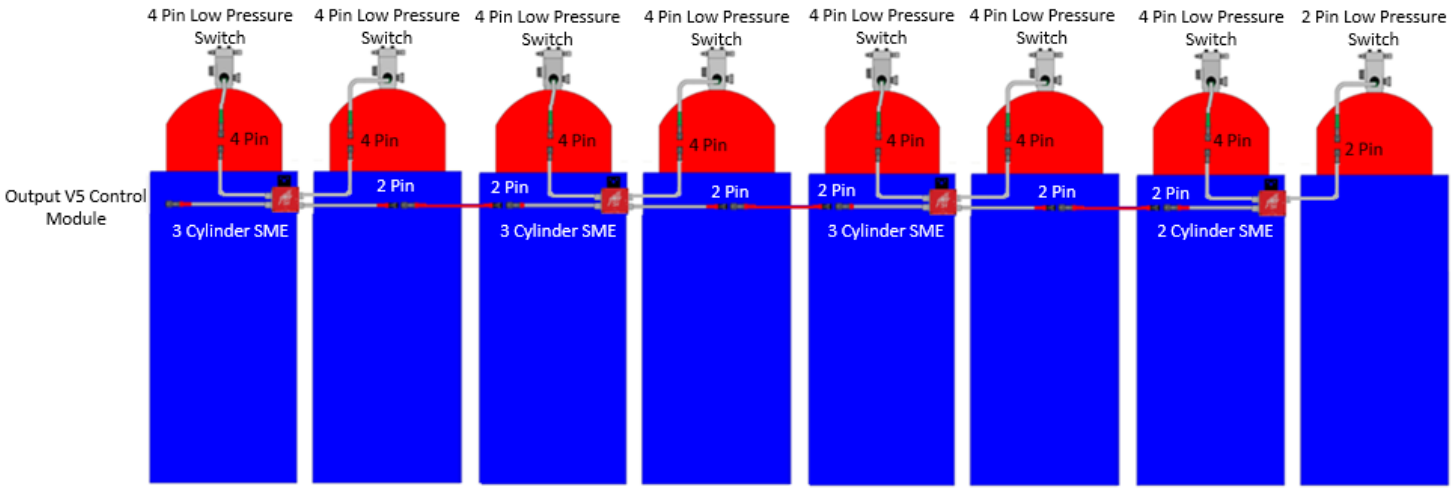
106L EXTRA HEAVY DUTY CYLINDER BRACKET (3 BANDS)

8.20 6 CYLINDER



106L EXTRA HEAVY DUTY CYLINDER BRACKET (3 BANDS)

8.21 8 CYLINDER



106L EXTRA HEAVY DUTY CYLINDER BRACKET (3 BANDS)

9.0 COMMISSIONING PROCEDURES

9.1 COMMISSIONING CHECKLIST

1. Cylinder, valve, and bracket assemblies firmly secured.
2. Nozzle assemblies secured and correctly aligned.
3. Hoses correctly supported and fittings secure.
4. MSM, LOP, LHD and/or Probes correctly secured.
5. Manual actuator assemblies correctly mounted and accessible.
6. Control Module /Display Module correctly mounted configured and tested.
7. ROP actuation cartridges weighed.
8. ROP actuation hoses flushed check valves/manifold correct.
9. LOP actuation hoses flushed, fittings sealed, and leak tested.
10. Electric Solenoid clear passage tested, and leak tested.
11. System filled with potable water; discharge test completed.
12. Discharge time / shutdown time.
13. Actual engine shutdown test conducted and passed.
14. All discharge hose assemblies air flushed.
15. Nozzle caps in place.
16. System refilled with water foam solution.
17. Cylinder charged, and pressure stabilised.
18. All systems labels, tags, safety pins and securities in place.
19. Machine components resecured.
20. Extinguishers secured and tagged.
21. System in fully operational condition.

9.2 COMMISSIONING

1. CYLINDER, VALVE AND BRACKET ASSEMBLIES FIRMLY SECURED

- Ensure the valve is tight and the gauge is easy assessable for inspection.
- Ensure the cylinder is well secured and the band bolts are torqued to the correct specification.
- Ensure the M12 bracket mounting bolts are torqued to the correct specifications.
- Ensure the assembly is not obstructing access panels.

2. NOZZLE ASSEMBLIES SECURED AND CORRECTLY ALIGNED

- Ensure that each nozzle is aligned correctly, i.e., directed toward the hazard it is protecting.
- Ensure the direction of the spray outlet of each nozzle is unobstructed and that there are no obstructions between the nozzle and the hazard.
- Ensure all nozzle assemblies are firmly secured, and all hose assemblies are correctly connected and tight to the nozzle assembly.

3. HOSES CORRECTLY SUPPORTED AND FITTINGS SECURE

- Ensure all discharge and actuation hose fittings are correctly fitted and secured.
- Ensure all discharge and actuation hose lengths are correctly segregated from other machine/vehicle fuel, hydraulic hoses or wiring harnesses.
- Ensure all discharge and actuation hose lengths are secured by P-clamps at the required spacing.
- Ensure where required a protective spiral guard has been fitted to prevent damage.
- Ensure protective spiral guard has been fitted to hose in areas exposed to high UV.
- Ensure protective fire sleeve is fitted to hose in close proximity to high heat risk areas.

4. MSM, LOP, LHD, PROBES CORRECTLY SECURED

- Ensure all Enclosures are correctly secured, and DT connectors are correctly assembled and secured with a p clamp 50mm either side of the DT connector.
- Ensure there is no chance of the detection circuit rubbing on any machine component.
- Ensure the Fire Harness is secured with a p-clamp every 400mm and at change of direction.
- Ensure LOP fittings are correctly assembled and are checked for leaks.
- Ensure Low pressure switch wiring is correctly secured 50mm with a p clamp on either side of the connector.

5. MANUAL ACTUATOR ASSEMBLIES CORRECTLY MOUNTED AND ACCESSIBLE

- Ensure all manual actuators are securely mounted and they are not obstructing any operators controls or access panels.
- Ensure the cab actuator is within the operator's reach during normal operating conditions.
- Ensure the securitie & pull-pins are in place on all manual actuators.
  - **ROP** – Ensure the CO2 cartridges are within 5-grams of the measured weight.
    Ensure LOCTITE has been used to secure the striker pin and striker knob.
  - **LOP** – Compare all manual actuator pressure gauges to confirm they are all indicating the same pressure and in the green sector.
  - **ELECTRIC ACTUATORS –** Check for the correct actuation signal of each electric actuator with a multimeter
- Ensure a manual actuator label and AS5062 maintenance label/tag is attached and marked.
- Ensure that reflective Activate Fire System signage is fitted to all external actuation points.

6. CONTROL MODULE & DISPLAY MODULE CORRECTLY MOUNTED AND ALL FUNCTIONS TESTED

- Ensure the display module is within the operators reach during normal operating conditions and adjacent to the actuator.
- Ensure the display module and control module is secured and all functions and operations are checked.
- Ensure all cabling and plugs are correctly wired, secured, and connected.
- Ensure the V5 module is configured for the correct application and all monitoring circuits are operational.
- Test the operation of the display module by pressing the System Test button.
- Check all visual and audible alarms.

CAUTION
Conformation shall be made by a competent auto electrical technician on shut down circuit current draw prior to powering the V5 module.

7. ROP ACTUATION CARTRIDGES WEIGHED

- Weigh ROP actuator cartridges with digital scales (accurate to 1.0g).

8. ROP ACTUATION HOSES FLUSHED, CHECK VALVES/MANIFOLDS CORRECT

- Clear passage test each 1/4" hose assembly to ensure pressure is venting from the actuation hoses at the cylinder valves and all check valves are correctly installed.

9. LOP ACTUATION HOSES FLUSHED, FITTINGS SEALED, AND LEAK TESTED

- Conduct a clear passage test on each actuation hose assembly.
- Apply Nylog Blue to the JIC sealing surface ensuring it does not block any orifices.
- Conduct a LOP actuation circuit leak test.

10. ELECTRIC SOLENOID CLEAR PASSAGE TESTED, AND LEAK TESTED.

- Check operation of solenoid
- Clear passage test solenoid assembly.

11. SYSTEM FILLED WITH POTABLE WATER; DISCHARGE TEST COMPLETED.

- Fill the cylinder(s) with potable water using the correct fill tubes.
- Ensure all discharge hoses are connected, and nozzle caps are in place prior to discharge of system.
  - **LOP** systems are discharged using a manual actuator.
  - **ROP** Systems are discharge by means of the FSI leak tester from an actuation point.
  - **ELECTRIC ACTUATION** and detection shall be discharged via the electric circuitry to ensure the discharge solenoid operates correctly (for full electric systems, both the detection and actuation circuits shall be tested).
- Check all nozzle caps have blown off and that ALL nozzles are discharging potable water correctly.
- Confirm that all fire risk areas are adequately protected.

12. DISCHARGE TIME / SHUTDOWN TIME

- Effective discharge is determined by timing the discharge from the most hydraulically disadvantaged nozzle from commencement of discharge to the first time there is a break in the flow or spluttering at that nozzle.

- The shutdown time is determined by starting the machine and activating the shutdown circuit. Timing starts from the time the fire alarm module activates/sounds to the time the fire alarm module outputs the shutdown signal.

13. ENGINE SHUTDOWN TEST CONDUCTED AND PASSED.

- Conduct an engine shutdown test to ensure the system operates as required and the shutdown time is correctly programmed.

CAUTION
Conformation shall be made by a competent auto electrical technician on shut down circuit current draw prior to powering the V5 module.

14. ALL DISCHARGE HOSE ASSEMBLIES FLUSHED.

- Clear passage test the discharge hoses including the foam line to PME, of all residual solution.
- Ensure all hoses are resecured and connected.

15. NOZZLE CAPS IN PLACE

- Ensure all nozzle caps are correctly fitted with the cap tail facing down to prevent obstruction to the spray pattern.

16. SYSTEM REFILLED WITH WATER FOAM SOLUTION

- Refill cylinders with the correct quantity of foam and potable/drinkable water.

17. CYLINDER CHARGED, AND PRESSURE STABILIZED

- Charge system to correct pressure for ambient temperature.

18. SYSTEMS LABELS, TAGS, SAFETY PINS AND SECURITIES IN PLACE

- Ensure all cab labels are filled out correctly and fitted cleanly and neatly.
- Ensure cylinder labels are filled out correctly and fitted cleanly, neatly and in the correct configuration.
- Ensure the reflective sign is mounted adjacent to the ground actuator.
- Ensure all service tags are marked with a '0' in the correct month and year of the commissioning.
- Ensure all safety pins and security ties are installed correctly.

19. MACHINE COMPONENTS RESECURED

- Ensure all machine components are reinstated to original condition and the work area is left clean.

20. EXTINGUISHERS SECURED AND TAGGED

- Ensure all extinguishers are serviced and tagged as per AS 1851

21. SYSTEM IN FULLY OPERATIONAL CONDITION.

- Ensure the system has been commissioned correctly and all functions of the system have been tested.

CAUTION
If the FSI Foam-Guard Fire Suppression system is not fully commissioned or components have been disconnected for transport, then it shall be appropriately documented, and an "Out of Service" tag installed as required.

10.0 RECOMMENDED TOOLING

HAND TOOLS

- Spanner Set – Metric & Imperial/Ratchet
- Shifter
- 1/4 - 3/8 - 1/2 Socket set Metric/Imperial
- Pliers - Side cutters
- Pliers - needle nose
- Pliers - combination
- Pliers - multi grips
- Pliers - Vice grips
- Deutsch pliers
- Wire stripers
- Industrial scissors (Black Panthers)
- Allen Key set - Metric- Imperial
- Torx Bit set
- Screwdriver Set & Jewellers screwdrivers.
- 1/4, 3/8, 1/2 drive torque wrench
- 5mm Allen socket – 1/4 drive (Valve)
- 1 '' socket - 3/8 drive (Burst Disc)
- Digital Multi meter
- Metal cable tie gun
- Stillsons large
- Pipe bender (MSM)
- Schrader Valve Tool
- Seal Pick Set
- Tape Measure - 8M
- Stanley Knife
- File Set
- Steel Ruler
- LED Torch
- Stick Magnet
- Ball Pin Hammer
- Centre punch
- LOP/Tube cutters.
- T-handle Tap
- Drill bit set

BATTERY TOOLS

- Battery Grinder - 18V
- Battery Rattle Gun - 18V
- Battery Drill - 18V
- Milwaukee Heat Gun – 18V
- Battery Charger, 3 x batteries - 18V

DRILL BIT SIZES

- 3mm Pilot Bit
- 5mm
- 8.5mm
- 10mm
- 11.5mm
- 13mm

HOLE SAWS

- 16mm
- 22mm
- 26mm
- Step Drill Bit

TAPS

- M12
- M10
- M6

FSI TOOLS

- FSI DT Plug Breakout kit.
- FSI Multi LOP Cylinder Charge Rig
- FSI Line Flushing Adaptor Kit
- FSI Actuation Line Test Rig
- FSI Charge Rig
- FSI Fill tube set.
- FSI Isolation Caps
- Nitrogen Regulator 4000kpa
- Burgaflex Crimpers

SPECIAL TOOLS

- Digital scales (ROP Cartridge)
- Handheld scales (Extinguishers)
- Caulking/Silicon Gun
- Watering can/Measuring Jug
- Funnel
- Number Pliers (Extinguishers)
- Marker/texter
- Tool Bag
- Dustpan & Brush

CONSUMABLES

- Leak Detector Liquid - Big Blue
- LOCTITE 577 High Pressure Sealant
- LOCTITE 263 + 563
- Molykote 111
- Dielectric grease
- Nylog Blue
- Rags/Cloths
- Cleaning Solution
- Cutting Compound
- WD-40
- 2mm Cutting Disc
- Metal cable ties (Heat Sleave)