



**FirePro.**

# FPX103C

## Fire Control Panel

Issue December 2017



Reinventing  
**Fire Suppression**

# FirePro.

## FPX-103C

# Dual Loop (Auto/Manual) Fire Control Panel Operation and User Manual

Issue December 2017  
Version 2.1



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## 1. Overview

This Manual provides information about the FPX-103C detection and activation panel for its use in marine and/or land applications.

## 2. Technical Characteristics Summary

- Dual detection loops with full fault monitoring.
- Automatic extinguishing operation after shutdown.
- “Double knock” automatic activation logic.
- Automatic Engine/fuel/fan shutoff capability.
- “Spin-down” delay ensures extinguishant is not vented.
- Extinguishing activation button with anti-tamper tag.
- Universal 12 or 24Vdc electrical power.
- Low power consumption in “PARKED” mode.
- Full fault monitoring on all detector and “firex” circuits.
- Supports up to 4 aerosol fire extinguishing units.
- Very low false activation potential, tamper seal on “ManOp”
- The unit is reverse polarity, transient and EMC protected.
- Custom behaviour logic available on request.



Shutdown and delayed “firex” activation improves effectiveness and saves cost of extra extinguishant. Most existing extinguishing systems release the agent into a high airflow environment which makes it almost completely ineffective. Given that a 7 Liter 4 stroke engine at 3000RPM (that’s 50revs/sec) aspirates 175 Liters or 0.175m<sup>3</sup> of air per second, add to this the ventilation fan flow and the necessity for a shutdown with engine/fan spin-down delay before activation becomes obvious.

The FPX103C Fire Control panel aims to effectively eliminate false activation warranty costs which are regularly caused by the inherent characteristics of microprocessors, semiconductor power switches and inquisitive fingers. Our tamper evident tag technology and our strict electronic design rules have proven highly effective in achieving this. To eliminate the inherent hazards of microprocessor control, the FPX103C uses a fully parallel path programmable logic device, which is coded using VHDL programming language, commissioned by US DOD and used for high reliability and safety critical applications.

## 3. Technical Features

- 2-wire Smoke, Thermal or Linear Heat Sensors up to 50 meters are continuously monitored for alarms, open circuit and chassis faults.
- LED flash codes indicate the location of an alarm or fault condition.
- An internal alarm sounder and relay to drive a loud external audible alarm unit up to 2Amps.
- Uncommitted relay change-over contacts are available for fuel shutoff, engine/fan shutdown.
- The delay option provides a selectable spin-down time so that the extinguishant is not wasted. "PARKED MODE" is entered when the panel senses that ignition is turned off and provides automatic extinguishing operation should both loops alarm - switching off engine during a double alarm will also enter timed auto activation mode (aka driver "legging it" protection).

There is an electrical input for an override key-switch to circumvent shutdown circuits for restarting.

## 4. Functional Notes

Any loop alarm condition will operate audible and visual alarm indications as follows:

- Single loop alarm condition produces internal pulsed alarm (1 per sec) and fan shutdown.
- Dual loop alarm condition produces internal pulsed alarm (2 per sec) and automatic extinguishing and fuel solenoid operation after spin-down delay (user set on dip switches), audible alarm goes continuous.
- Alarm LED flash code indicates which loop is in alarm (1=1blink, 2=2blinks, 1&2=3blinks).

The spin-down delay allows time for fan and engine to stop before extinguishing units are activated. This is to save extinguishing agent that would otherwise be wasted through venting.

The timer tracks the spin-down of engine/fan(s) as a result of ignition switch-off or shutdown by FPX103C as a result of an alarm (from either detectors or manual operate switch). With the ignition off the unit enters low power mode and the ON LED will flash to conserve power.

Single flash shows the spin-down timer is still counting (fans still turning), then adopts a double flash "heartbeat" indicating that "parked mode" is active and extinguishing operation will be immediate on double alarm or manual operate. In "parked mode" (ignition off for longer than spin-down delay) then the fuel solenoid will operate on first alarm and extinguishing immediately on second alarm.

Switching on the ignition even for a short time will restart the spin-down timer which is also active on initial power-on.

Spin-down timer is selectable:

NoAUTO, IMMEDIATE, 5 to 30 seconds, 5 seconds increments. A fault in one detector loop will cause the auto mode to fail (because of the double knock logic) however a manufacturing option can allow PARKED mode to auto operate the extinguishing after single loop alarm if the other loop is faulty.



Manual operate command must also wait for the engine/fan spin-down before extinguishing activation. After 125ms filter time the unit will confirm activation request by flashing 2ALARM=AUTO LED and internal beeper, fan and fuel solenoid shutdown relays are activated immediately. After spin-down timeout the extinguishing will operate and beeper will go continuous.

## 5. Panel LED indications

The panel layout has two distinct areas for extinguishing and detection status with separate LED flash pattern indications for each detection loop (1 and 2):

- Power On (Green LED)
- Detector Alarm (Red LED) - inverse flash pattern indicating affected loop
- Detector Loop Fault (Red AMBER) - inverse flash pattern indicating affected loop
- 2 Alarms=Auto Active (Red LED)
- Extinguishing output Fault (Red AMBER)

Internal sounder will operate on anything that requires user attention (alarm or fault).

## 6. Controls

- Extinguishing manual operate button (behind tamper evidence tag).
- Auto mode time delay selector DIP switch on panel rear (delay = binary\_value \* 5 seconds):  
SW1-3 off-off-off = immediate, on-on-on = AutoDisabled, on-off-off=5sec, off-on-off=10sec, etc (see Section 9 below).  
SW4 on = vfc operates on single alarm, off = vfc operates on double alarm.

## 7. Connections

<b>BLOCK 1 (6 way)</b>	<b>BLOCK 2 (6 way)</b>	<b>BLOCK 3 (6 way)</b>
GND	Detector Loop1A	FirexA
External Alarm Output (Power via 2A N.O. relay contact)	Detector Loop1B	FirexB
GND	Detector Loop2A	GND
Ignition input (sets auto PARKED mode when off)	Detector Loop2B	VFC (2Amps Max)
Power (11-32vdc via 4A fuse)	GND	NO VFC (2Amps Max) COM
GND	Aux input	VFC (2Amps Max) NC



## 8. Electrical Specification (at 24VDC supply unless otherwise stated)

Power Supply	Operating Voltage	11 to 32V DC
	Quiescent Current Ign Off	8.5mA Typ (excluding external load currents)
	Ign On	16mA Typ (excluding external load currents)
	Maximum Alarm Current Draw	100mA (excluding external load currents)
	Maximum Current draw	3A (including extinguishing output operating current)
	Parked current draw	8.5mA Typ
Suppressor Activation	Discharge Current	1A to 4A depending on voltage and number of extinguishing units (1.6 – 3 Ohms nominal each unit) Up to 2 extinguishing units on 12V Up to 4 extinguishing units max on 24V Connect in series with bi-directional catch diodes across each extinguishing unit
	Current/Time Limit	Output is Vin via switch with 6 Ohms in series. Constant I2T limit = 9 Amp2*Seconds
	Monitoring current	<4mA, Fault if loop R>300, 12Vmax o/c voltage
Aux In (Override key)	Monitoring current	1.2mA Nominal
	Sense Logic	Norm S/C, >1K active typ.
Sensor Loop Inputs 1+2	Max Output voltage	12VDC regulated, filtered and transient protected
	Output current limit	25mA per loop
	Alarm condition threshold	<700 Ohms Nominal
	Fault condition threshold	Approximately 20K Ohms
	End Of Line Resistor	10K Ohms
	Fault monitoring	Open circuit or ground fault = fault indication
Alarm Output	Relay Contacts	2A @ VinDC (Vin thru NO relay circuit)
VFC Output	Relay Contacts (volt free)	2A @ 24VDC (relay changeover circuit)
Mechanical	Dimensions	H=82mm * W=83mm * D=25mm
	Mounting	75mm diameter round hole, retained by four #6*25 self-tapping screws
	Connections	Via 3 * 6 way terminal block accepting <1mm2 wires with ferrules

## 9. DIP Switch Settings (Black = switch tab)



DIP switches 1, 2, and 3 set a delay time between shutdown (VFC) and subsequent extinguishing automatic activation. Delay can be set at 0 to 30 seconds in 5 second steps. Manual only mode can be set with ON.ON.ON.OPT



DIP switch 4 defines critical alarm Option.

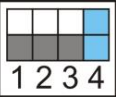
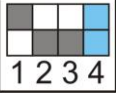
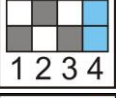
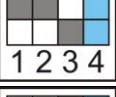



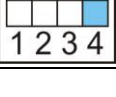
The default setting is OFF which requires 2 loops to be in alarm (OPT="double knock") before shutdown and time delayed extinguishing activation.

Moving to ON position requires only one loop to be in alarm (OPT="single knock") before shutdown and time delayed extinguishing activation.

Note that the panel commences activation delay following depowering of ignition input. The instant mode is indicated by flashing green PWR LED which gives double flash whilst moving through the delay and single flash on reaching zero delay instant mode.

Fan/Engine “Spin-down” delay time before automatic release.

**Note: Spin-down delay only when ignition is ON**

DIP Switch setting		Time Delay
OFF.OFF.OFF.OPT	ON OFF 	0 Sec = Immediate
ON.OFF.OFF.OPT	ON OFF 	5 Sec
OFF.ON.OFF.OPT	ON OFF 	10 Sec
ON.ON.OFF.OPT	ON OFF 	15 Sec
OFF.OFF.ON.OPT	ON OFF 	20 Sec
ON.OFF.ON.OPT	ON OFF 	25 Sec
OFF.ON.ON.OPT	ON OFF 	30 Sec
ON.ON.ON.OPT	ON OFF 	No Automatic Operation / Manual Activation Only

## 10. Installation Notes

Ensure that Linear Heat Detectors are suitably mounted to withstand vibration levels.

Front of panel is splash proof but it must be located/installed in such a way as to prevent excessive moisture or water getting to the unit, especially the rear connections. Also install at locations where excessive direct solar exposure is avoided.

### **WARNING!.**

System installation must be verified by a competent technician familiar with regulations governing such installations.

Do not install in Engine, bilge, fuel or gas storage compartments (see RCD and ISO9094).

In the event of an alarm, shutdown the engines and ventilation immediately.

The cause of the activation must be found and corrected before restarting.

**DO NOT PROCEED TO OVERRIDE UNLESS IT HAS BEEN DETERMINED SAFE TO DO SO.**





## 11. Outline & Mounting drawings

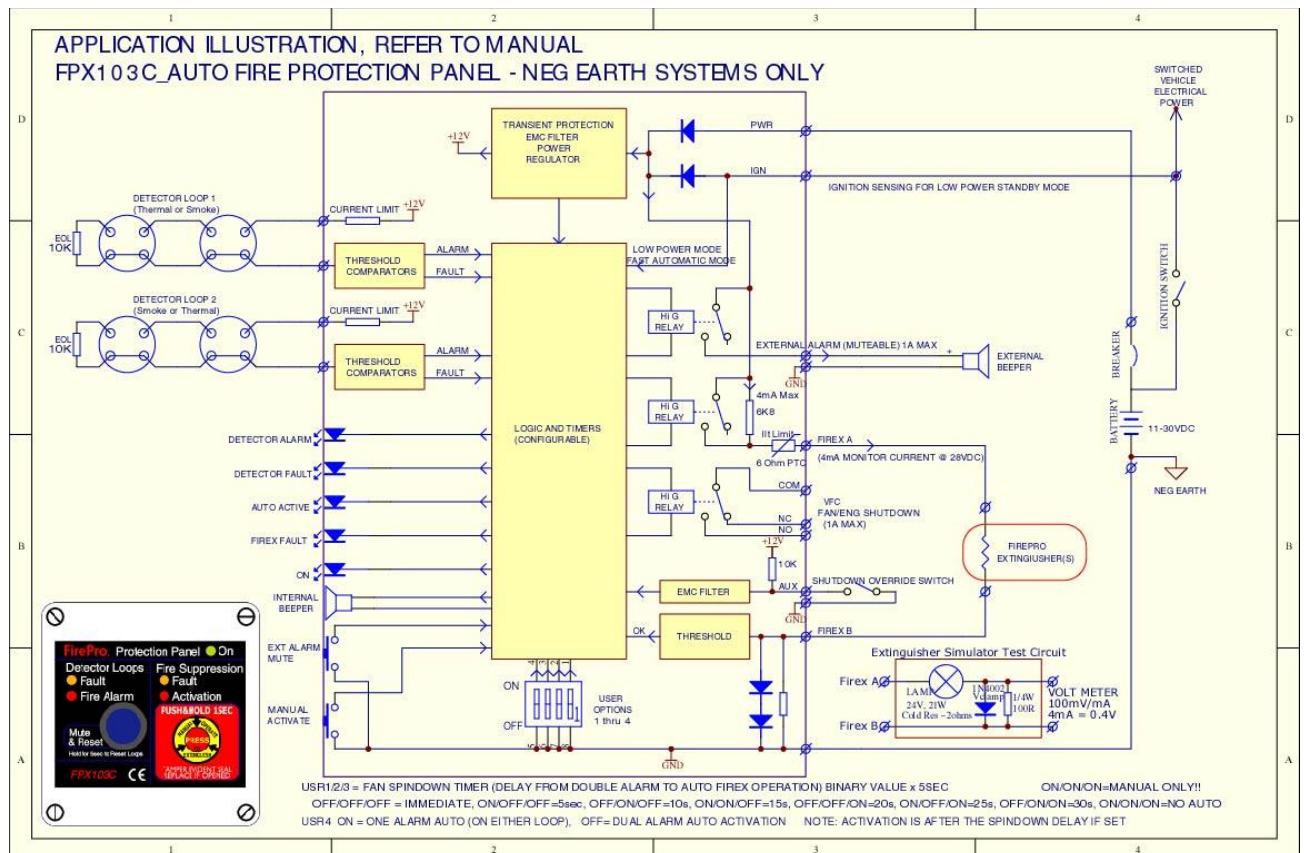
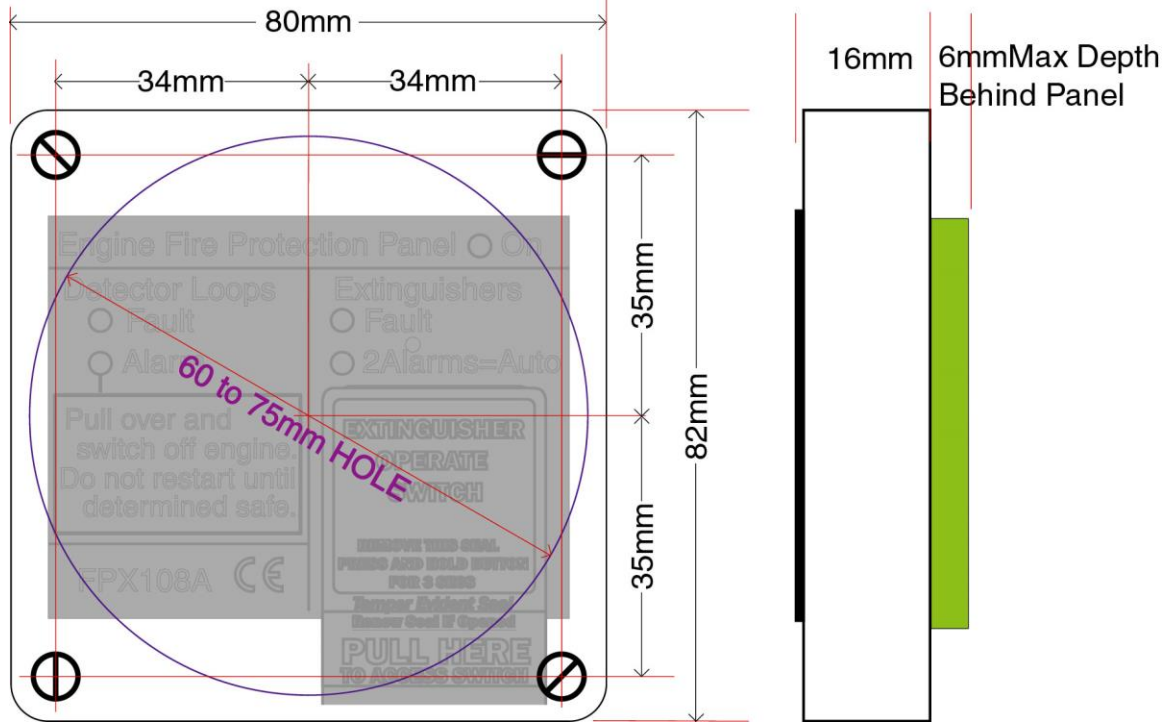


Figure 1: Panel internal logic

## 12. Typical Application wiring

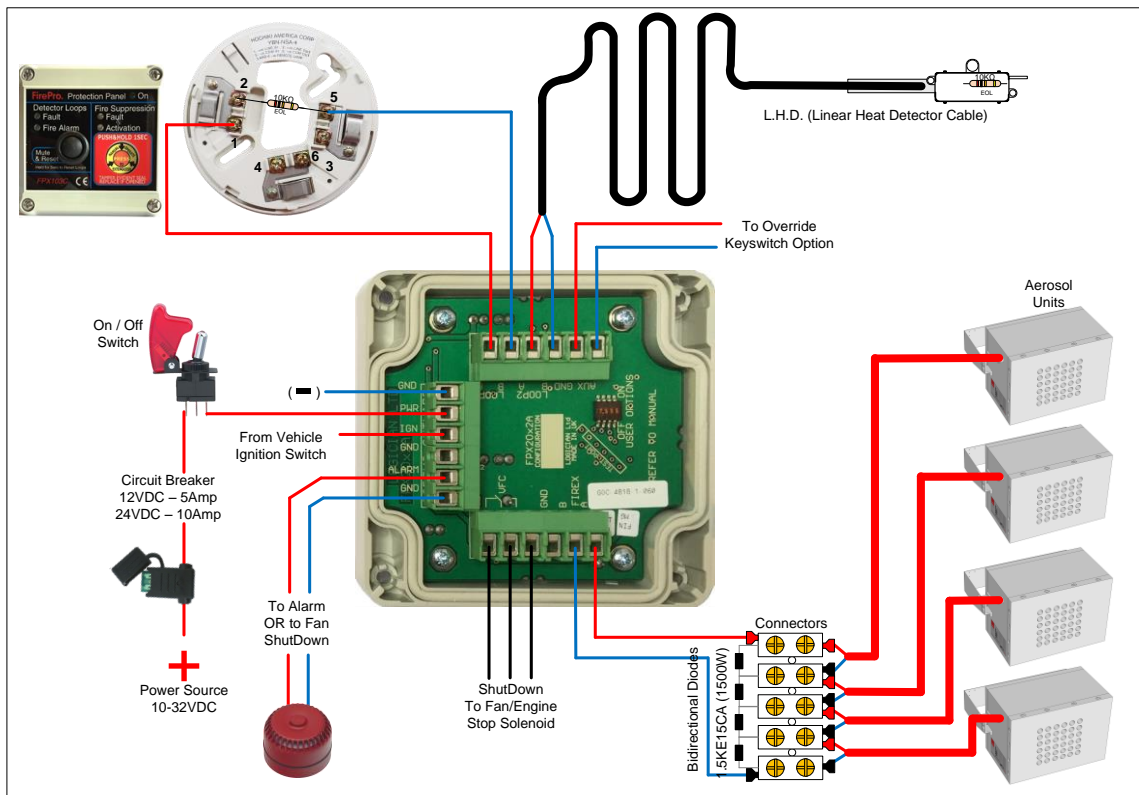


Figure2: Typical application wiring

## 13. Typical Application wiring – Marine Applications

The FPX-103C Fire Control panel is a Maritime and Coastguard Agency (MCA) approved panel along with the FirePro aerosol units for machinery spaces of small crafts, for vessels of less than 24 metres load line length, where the space to be protected does not exceed a deck height of 4 meters or an area of 63 square meters (please refer to the attached MCA certificate).

In marine applications, the fire-fighting systems are **manually operated**. But in some cases it could be a requirement for **automatic activation**. If the system is required to be designed for automatic activation, then the discharge of the FirePro aerosol extinguishing units should be prevented by means of an isolation switch, when there is a possibility of people entering the protected enclosure, as clarified in the attached certificate section 5. "System Isolation Switch".

Below you can find two typical examples for manual and automatic activation systems.

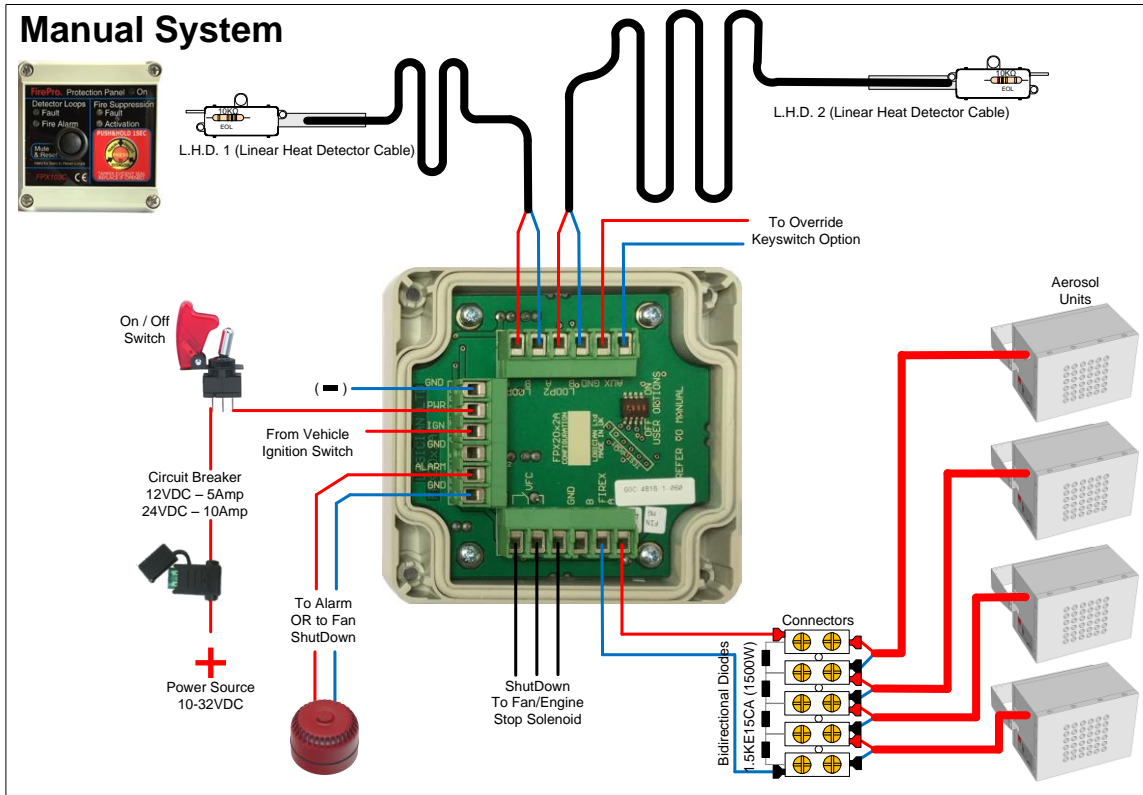


Figure 3: Typical application – Manual system

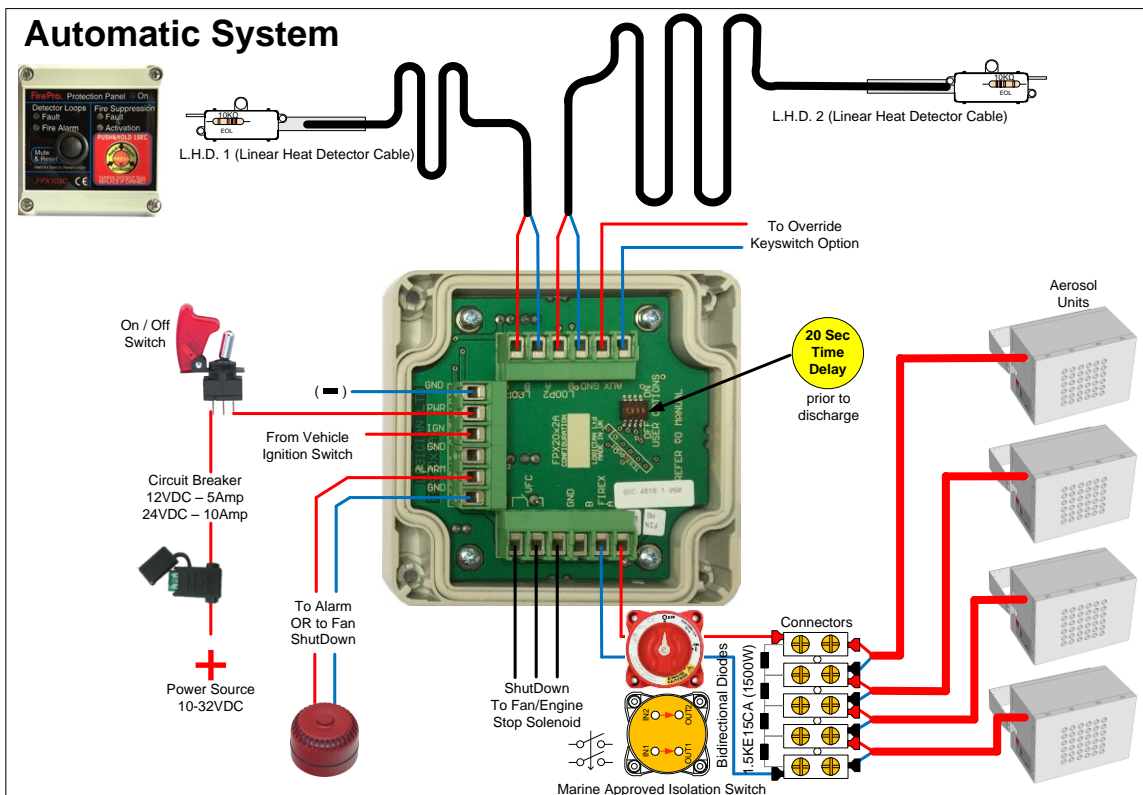


Figure 4: Typical application – Automatic system

## 14. Testing and Commissioning

### 14.1 Testing the Detection line

In a system where automatic detection is used:

1. Connect the End of Line (EOL) termination resistance (supplied with the FPX-103C panel) at the end of the Detection Zone/Loop 1 (*the detection loop can be comprised of a Linear Heat Detection cable or conventional Smoke or Heat Detectors or other conventional detectors, suitable for use in the specific application, connected in a Zone/Loop*).
2. Confirm that the panel detects the presence and the absence of the EOL resistance → the “**Detector Loop(s) Fault**” LED indicator will turn OFF and the buzzer will stop sounding, if the detection loop identifies the presence of the EOL resistance. Similarly, the “**Detector Loop Fault**” LED indicator will turn ON (Red AMBER) and the buzzer will start sounding if the detection loop identifies the absence of the EOL resistance.
3. Upon completion of the above (i.e. testing of Detection Zone/Loop 1), repeat steps 1 and 2 to test Detection Zone/Loop 2, if used.

### 14.2 Testing Detection line Alarm conditions

In order to test whether the panel correctly identifies Fire Alarm conditions:

1. Short circuit the LHD cable (or other detectors) installed on Zone/Loop 1, at the End of Line (EOL) \* → If the “**Detector Loop(s) Fire Alarm**” LED indicator turns ON (Red) and the buzzer sounds, then the Fire Alarm conditions have been correctly confirmed.
2. Repeat step 1 above to test Detection Zone/Loop 2, if used, for Fire Alarm conditions in the same way.
3. Ensure that the (post-)Alarm Outputs are activated upon verification of Fire Alarm conditions (as per steps 1 and/or 2) → Shut Down Relay output has latched and the Alarm (Siren) output has been activated.

\* *The detection loop resistance drops below the 700 Ohm Alarm condition threshold when short circuited*

### 14.3 Commissioning and Testing of correct Aerosol unit(s) connection

In order to test whether the condensed Aerosol units have been correctly connected at the Fire Suppression loop make sure you have installed the Bidirectional Diodes of type 1.5KE15CA (1500W) in parallel to each Aerosol unit as per the below schematic diagram:

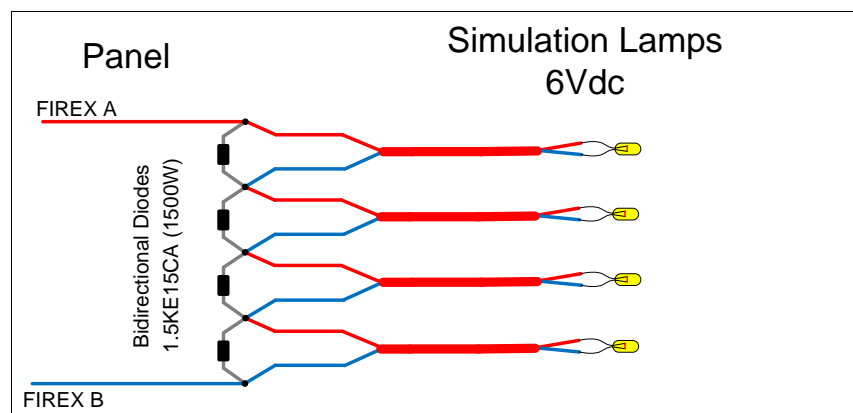


Figure 5: Typical connection of bidirectional diodes and aerosol units

For Testing and Simulation purposes, each Aerosol unit is disconnected and replaced by a simulation lamp as per the following guidelines, **after switching** the panel and the whole system **OFF**:

- If 4 Aerosol units are connected – replace with 4 lamps rated 6 Volts each
- If 2 Aerosol units are connected – replace with 2 lamps rated 12 Volts each
- If 1 Aerosol units are connected – replace with 1 lamp rated 24 Volts

**NOTE:** If 3 Aerosol units are connected, you can use either 6 Volt or 12V simulation lamps, which will illuminate either slightly brighter or dimmer respectively, when connected.

The above used simulation lamps should have a Resistance rating between 40 and 70 Ohms.

#### 14.4 Testing Fault conditions

In order to test whether the panel correctly identifies Fault conditions on the Extinguishing line/loop, follow the steps below:

1. Upon correctly commissioning and testing the simulation lamps in place of the Aerosol units, as per section 14.3 above, disconnect 1 or more of the simulation lamps (one by one alternatively and/or more than one at the same time). This should initiate Fault conditions
2. The “**Fire Suppression Fault**” LED indicator should turn ON (Red AMBER) and the buzzer should sound → This means that the panel has correctly identified the Fault.
3. Upon completion of thorough testing as per steps 1 and 2 above, reconnect the simulation lamps.

#### 14.5 Testing of Fire Suppression procedure

In order to test whether the panel correctly simulates fire suppression procedure:

1. According to the pre-programming of the panel – i.e. if it is set on Manual or Automatic mode – initiate Fire Alarm and Suppression conditions as follows:
  - a. Manual mode: Press the Manual Release button (“Push & Hold for 1 sec”) and observe whether the panel “**Fire Suppression Activation**” LED illuminates and the simulation lamps also turn on.
  - b. Automatic mode: Initiate Fire Alarm conditions according to the detection used (see section 14.2) and observe whether the panel “**Fire Suppression Activation**” LED illuminates and the simulation lamps turn on (after the pre-programmed time delay, if any, as set by the dip switches – see section 9 above)

#### 14.6 Return to operating conditions

After you perform the above testing/commissioning procedures and have verified the correct operation of the panel/system:

1. Reset the panel to normal operating conditions.
2. Power OFF the panel/system completely and remove the simulation lamps.



3. Before re-connecting the Aerosol units, ensure that the resistance at the electrical actuator terminals lies within the acceptable limits – i.e. between 1.6 and 3.6 Ohms – as demonstrated by the schematic below:

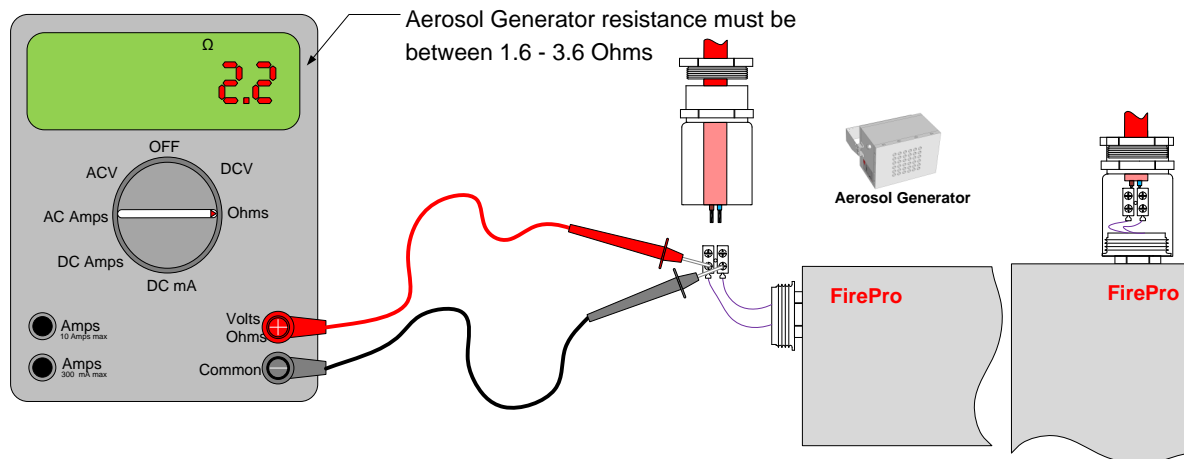


Figure 6: Measuring the Aerosol unit resistance

4. Re-connect the Aerosol units.
5. Power ON the panel/system.

## 15. Additional Technical information

### 15.1 FPX-103C Panel operating temperature range:

Designed and tested to meet temperature range -20 to +71C.

### 15.2 FPX-103C IP rating:

IP65 with back box, cable glands and tamper tag correctly fitted.

IP rating with direct panel mount depends primarily on seal achieved with panel surface (use a gasket to seal if required).

### 15.3 FPX-103C Shock and vibration rating:

We can only comment on the panel as a component, wiring and peripheral components will be more susceptible to mechanical agitation, good installation and wiring practice suitable for the application environment must be observed.

We have not issued any specific ratings for the panel and every application has a different characteristic frequency/amplitude spectrum which must be evaluated for each application.

The unit is configured to provide maximum reliability possible using the surface mount assembly technology. Good design practice and quality control of soldering and final assembly gives durability appropriate to envisaged application.

We once did a demonstration of throwing a panel out of an upstairs window on to concrete (=3.5Mtr drop test). Case was dented but unit was still fully functional.

We have not seen any vibration or shock induced field failures of the panel.

Note that all critical circuit paths are monitored for continuity with failure mode effects analysis carried down to PCB component level.

## 15.4 FPX-103C EMI/EMC standards met:

The susceptibility to electromagnetic interference is largely dependent on the specific installation – wire harness lengths and structure materials involved.

Any meaningful EMC qualification must be performed on an installed system. There are no specific level requirements in CE root documents Recreational Craft Directive.

There is extensive EMC protection on all inputs, outputs and power connections for 20V/m radiated emissions 500KHz – 5GHz.

Upset tests for specific threat frequencies have been performed on first article product - mobile phones/3G also VHF (160MHz marine band) and UHF (446MHz PMR and 462MHz FRS/GMRS).

Field experience over several years and thousands of units verifies environmental suitability unlike competitors panels that have proven susceptibility to marine VHF transmitter.

Conducted susceptibility is to MIL-STD-1275 “Characteristics of 28VDC electrical systems in military vehicles”.

## 15.5 Dirty Electricity on Systems:

Dirty electricity is a form of electromagnetic pollution or radiation. It is also called electromagnetic interference (EMI) or electrical “noise”.

Dirty Electricity is actually a Mid-high frequency (100Hz-100000KHz) electric noise that makes its way over the electric wires and that is created because of the way that electronics and non-linear electric devices operate and also from external sources (like RF sources and Electromagnetic Fields next to power lines).

This noise is carried over the electric wires all around the room/vessel and since the noise frequency is higher than 50Hz (relatively to 50 or 60 Hz mains frequency) the electric and magnetic fields that are created by these currents can spread all over the room/vessel.

The dirty earth circuit, is an electronic filter to stop feeding back to the system Radio Frequencies through the earthing point.

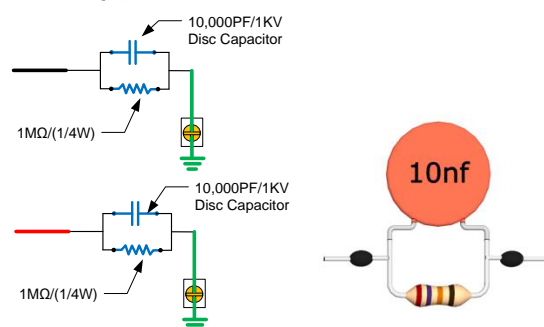


Figure 5: Dirty Electricity filter

For more information regarding EMI interference in systems and methods to reduce the effect of electromagnetic interference please refer to FirePro guideline “Technical guidelines for the prevention of EMI signals in Fixed Fire Fighting Systems”.



## 15.6 Automatic changeover power sources

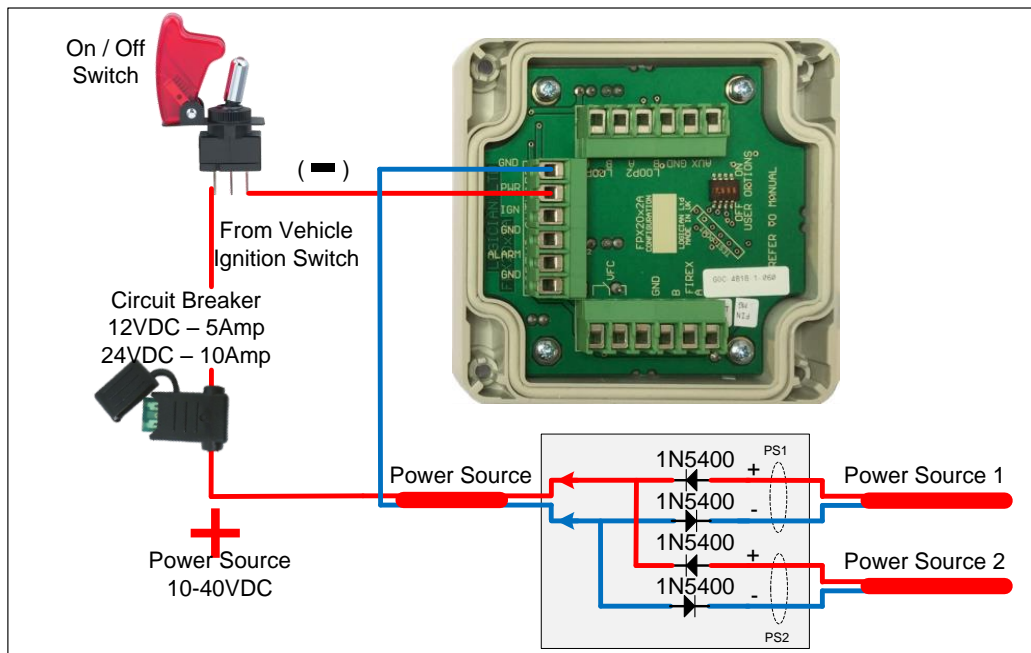


Figure 6: Automatic changeover power sources with diodes

## 15.7 Impact of non-isolation of the power supply network from shore to vessel

When a boat/vessel is connected to a shore supply of mains power, it is vulnerable to certain sources of corrosive damage not faced by boats/vessels that have no shore connection.

This is because safely wired boats/vessels will be connected to the mains Earth, and this can create a corrosion risk in one of the following ways:

All the boats/vessels in a marina that have a mains electricity connection will effectively share a physical connection with each other via the Earth wire of the supply cable.

They also share a physical connection through the water, and this can lead to a flow of electrons from the metal parts of one boat/vessel, (usually the sacrificial anodes) to the metal parts of another.

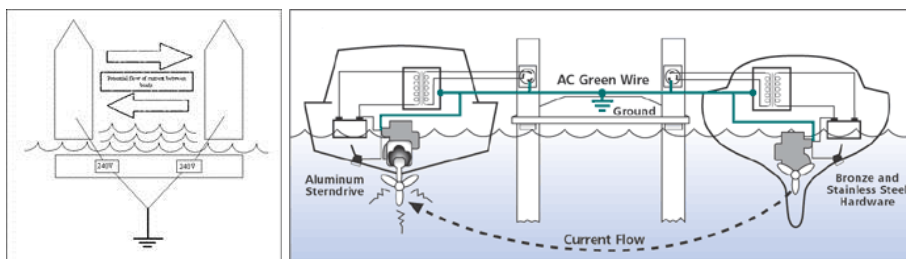


Figure 7: Potential flow of current between boats

A secondary corrosion risk exists in the difference between the Electrical Earth, which is the potential of Earth at the hook up point, and the True Earth, which is the potential of the water that the boat/vessel floats in.



The boat/vessel creates a circuit between the two potentials. At the electricity power station, the potential of Electrical Earth is the same as True Earth.

However, as the power cables make their way across the country/land, the Earth can pick up an electrical charge from stray currents in the cable.

This can lead to a difference at the mooring power point between the two Earths, causing current to flow from the boat/vessel, through the hull and into the water.

At the points where the current flows, there is a risk of corrosion.

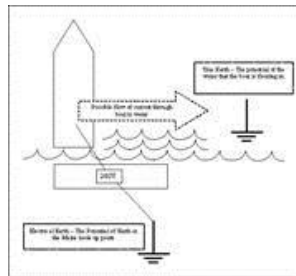


Figure 8: Potential flow of current through boat to water

To prevent such problems and avoid further electrical problems an Isolation Transformer should be used. This type of problem is not unique but appears worldwide and there are solutions to overcome this problem.

An Isolation Transformer has no physical connection between its Primary and Secondary coils. This means that it can sever connection between moored boats/vessels whilst they are still able to draw power and be safely connected to earth.

A simple wiring diagram showing an Isolation Transformer.

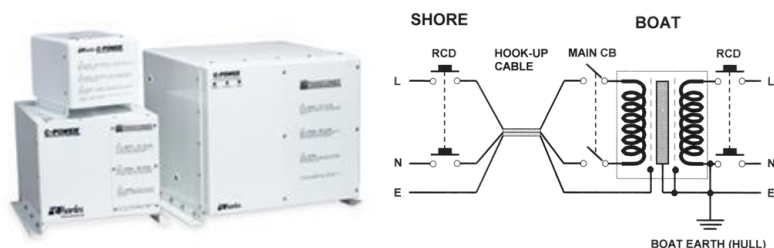


Figure 9: Isolation Transformer wiring diagram

To identify and confirm that this is the problem then check if the voltage difference between the neutral cable (on the boat/vessel) and ground (keel of the vessel), is not zero volts (0V).

When the boat/vessel mains power cables (Live, Neutral, and Earth) are connected to the shore mains power, there is a voltage difference between the neutral voltage and keel of the vessel.

When the boat/vessel mains power cables (Live, Neutral, Earth) are disconnected from the shore mains power, the voltage difference between the neutral voltage and the ground (keel of the vessel), disappears.

This proves that the voltage of the neutral cable on the boat/vessel, is not zero volts (0V).

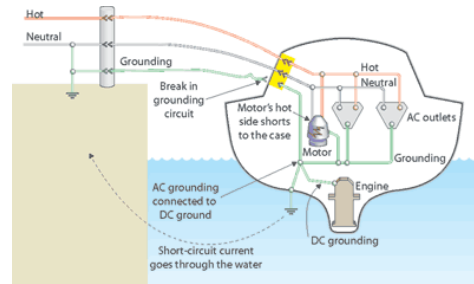


Figure 10: Short circuit current goes through the water

If the isolation transformer is not possible to be installed as a total solution for the boat/vessel, a second solution is also applicable.

An isolated DC-to-DC converter can be used to protect the fire fighting system. Isolated dc-dc converters provide full dielectric isolation (no electric contact) between input and output circuits by means of a high frequency transformer.

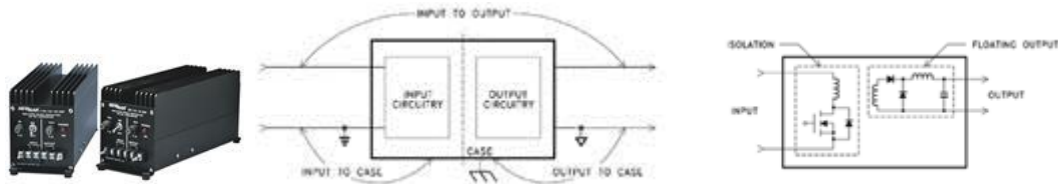


Figure 11: Isolated dc-dc converter

Problems or malfunctions that may arise in electrical / electronic systems (such as the firefighting system) maybe consequences of non-isolation of the power supply network from shore to boat/vessel.



## 16. Regulation and Certification information

### 16.1 Regulation

The revised Statutory guidance "Fire protection arrangements (MSIS 12)" issued by the UK Maritime Coastguard Agency (MCA), incorporates the requirements of the latest IMO SOLAS amendments and Circulars, and new EN / ISO standards for these systems/equipment. (categorised under "FIXED FIRE EXTINGUISHING INSTALLATIONS" for marine applications)

Excerpts from the relevant section of this Circular – Chapter 7 in particular (MSIS 12/CH 7/REV 1012 ) – read as follows:

#### Part 7.0

...

#### 7.7 Aerosol Systems

...

7.7.1.3 The MCA is prepared to accept systems:

- a) Approved by the MCA for small vessels; or
- b) Approved under MSC/Circular 1270 – "Revised Guidelines for the Approval of Fixed Aerosol Fire-Extinguishing Systems as equivalent to Gas Fire-Extinguishing Systems, as Referred to in SOLAS 74, for Machinery Spaces" as being equivalent to the fixed fire extinguishing systems specified in MSN 1666 for Machinery Spaces, whether as halon system replacements or new installations. This being an internationally sanctioned equivalent the procedure in OAN 463 does not need to be followed and no exemption certificate is to be issued.

7.7.2 Applicable agents

7.7.2.1 The MCA has approved:

...

**FirePro Aerosol Approval MS 22/3/910**

...

for use on vessels under 24m in length.

7.7.2.2 Currently, the following aerosol system is MED approved under MSC/Circular 1270:

**FirePro Aerosol MED Cert: BSI/A.1/3.46/560436**

7.7.4 System layout

7.7.4.1 For SOLAS ships, systems must meet the requirements of Circular 1270, plus any interpretations below. For ships <24m length the following should be applied, except where contradicted by the conditions on the MED or Type Approval certificate for the aerosol agent under consideration.



...

7.7.4.7 Aerosols are typically non-corrosive, non-toxic and non-conductive.

...

7.7.4.11 Aerosol systems used to protect normally occupied spaces shall have a time delay, and audible and visual pre-discharge alarms that sound in the protected space for at least 20 seconds prior to discharge. It is preferable that the alarms should continue to operate after agent discharge until positive action has been taken to acknowledge the alarms.

***Automatic operation***

*Automatic operation may be accepted for any space of 170 m<sup>3</sup> or less (NFPA 2010 Standard)*

7.7.4.12 Automatic release is only acceptable for normally unmanned spaces. A manual release must also be fitted.

7.7.4.13 An isolation switch should be fitted near the door to any protected space large enough to enter, so that any automatic system can be isolated before entry. Systems for larger spaces, and all normally occupied spaces, should employ two separate controls for releasing the extinguishing medium.

7.7.4.14 Interlocks shall be provided to shut down pressurised fuel systems and power operated ventilation systems, including fire dampers, serving the protected space prior to agent discharge.

***Power supplies***

7.7.4.15 At least two independent power supplies, with automatic changeover, are required for the controls and alarm system. The primary source shall be from the vessel's emergency supply. For vessels with an emergency supply or battery, the backup source shall be either the vessel's general alarm battery or an internal battery within the system. Internal batteries shall be capable of operating the system for a minimum of 24 hours. For vessels under 24m which are not required to have an emergency supply or battery, the primary source may be permitted to be the main electrical supply.

7.7.4.16 The discharge time should not exceed 120 seconds. Systems may need to discharge in a shorter time for other reasons than for fire extinguishing performance (MSC/Circular 1270)

7.7.4.17 Condensed aerosol systems – discharge time required to achieve 95% of the design application density shall not exceed 60 seconds.

...

(NFPA 2010 Standard)

7.7.5 System monitoring. All power sources shall be monitored for faults which should be indicated by visual and audible alarms.



...

## 16.2 Certification

### FirePro Certificates and Approved Applications

#### Certificates:

Certification Body: **British Standards Institution (BSI)** – Certificate No.: **BSI/A.1/3.46/560436**

Certification Body: **Maritime Coastguard Agency (MCA)** – Certificate No.: **MS 22/3/910**

#### Applications covered by BOTH Certificates (BSI & MCA):

- MCA MGN 280 - Small Vessels in Commercial Use for Sport or Pleasure, Workboats and Pilot Boats - Alternative Construction Standards - Machinery Spaces.
- MCA MSN 1813 (F) - The Fishing Vessels Code of Practice for the Safety of Small Fishing Vessels - Machinery Spaces.
- MCA MSN 1770 (F) - The Fishing Vessels Code of Safe Working Practice for the Construction and Use of 15 metre length overall (LOA) to less than 24 metre registered length (L) Fishing Vessels - Machinery Spaces.
- MCA - The Codes of Practice for Police Boats - Machinery Spaces.
- MCA - Inland Waters Small Passenger Boat Code - Machinery Spaces.

#### Applications covered by the BSI Certificate only:

- MCA - The Large Commercial Yacht Code (LY2 Code) - Machinery Spaces.
- The Merchant Shipping (Fire Protection: Large Ships) Regulations 1998, SI 1012 - Machinery Spaces and Cargo Pump-rooms.
- The Merchant Shipping (Fire Protection: Small Ships) Regulations 1998, SI 1011 - Machinery Spaces and Cargo Pump-rooms.
- The International Convention for the Safety of Life at Sea consolidated text of the 1974 SOLAS Convention, the 1978 SOLAS protocol, as amended - Machinery Spaces and Cargo Pump-rooms.
- The International Code of Safety for High Speed Craft 2000 Code - Resolution MSC.97(73), as amended - Machinery Spaces.
- The International Maritime Organisation MSC/Circ.848 on Revised Guidelines for the Approval of Fixed Gas Fire Extinguishing Systems, as referred to in SOLAS 74, for Machinery Spaces and Cargo Pump rooms; as amended, Chapter II-2/10.5 and 10.9 (SOLAS Chapter II-2, 2002), and cargo compressor & pump rooms of LNG & LPG carriers.



**17. Annex 1 - UK Maritime Coastguard Agency (MCA) Certificate**



**Maritime and  
Coastguard Agency**





# CERTIFICATE OF INSPECTION AND TESTS

Issued under the authority of  
 the Government of the United Kingdom of Great Britain and Northern Ireland,  
 by the Maritime and Coastguard Agency,  
 an Executive Agency of the Department for Transport

**The Secretary of State in exercise of statutory powers is satisfied that  
 information relating to the product below has been reviewed.**

Information or Sample

**SECTION 1. PRODUCT DETAILS**

Product Name / Model	Small Boat Machinery Space FirePro Fixed Aerosol Fire Suppression System		
Manufacturer Details	FirePro Systems, 6 Koumandarias Street, PO Box 54080, CY-3720 Limassol. Cyprus		
	UK Distributor - FirePro UK Ltd		
	Leigh House, Weald Road, Brentwood		
	Essex		
	CM14 4SX		
MCA File Reference	MS 22 / 3 /	0910	



**SECTION 2. Under powers conferred by**

SI 1998 No. 1609 Reg 8(1), SI 1998 No. 2771 Reg 6, SI 2001 No. 0009 Reg 7(1), SI 2002 No. 2201 Reg 5(1)

Statutory Instrument No.	No.		Act year and ch.		
--------------------------	-----	--	------------------	--	--

and has been found satisfactory for the purposes of:- Continued  (continued overleaf)

1. MGN 280 - Small Vessels in Commercial Use for Sport or Pleasure, Workboats and Pilot Boats - Alternative Construction Standards;

provided that the conditions attached to the Schedule are fulfilled and the product remains satisfactory in service.

**SECTION 3. SCHEDULE including conditions or terms, if any, on which the certificate is issued:**

**1.0 PERFORMANCE TESTING**

1.1 The FirePro aerosol system has been accepted on the basis of its satisfactory performance during a series of trials devised to simulate typical fire scenarios that can occur in the machinery space of small craft. The trials were carried out on 14th July 2005 at the Fire Test Ground, Biggin Hill Airport, Kent. The results are contained in the document:- Fire Test Report: PC/9348 - dated 8th September 2005. Certificates can be renewed on the basis of Test reports that are less than 15 years old after which re-testing will be required.

This Certificate is valid until **10 May 2021** Continued  (continued overleaf)

**NOTE:** This certificate does not apply to a product which has been varied or modified from the product assessed. The manufacturer must submit modified products for consideration by this Agency if they wish to obtain for them a valid Certificate of Inspection and Test.



Issued at **MCA HQ (UK)**

Signed   
 (Signature of Authorised Official issuing the certificate)

Date **06 July 2016**

Name **IAN LARDNER**

## SECTION 2. (Continued from Page 1)

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2. The Codes of Practice for the Safety of Small Commercial Motor or Sailing Vessels of up to 24 metres Load Line length;
3. The Codes of Practice for the Safety of Small Workboats and Pilot Boats;
4. MSN 1813 (F) -The Fishing Vessels Code of Practice for the Safety of Small Fishing Vessels;
5. MSN 1770 (F) - The Fishing Vessels Code of Safe Working Practice for the Construction and Use of 15 metre length overall (LOA) to less than 24 metre registered length (l) Fishing Vessels; and
6. The Codes of Practice for Police Boats.

Note: The FirePro Fixed Aerosol System is considered suitable for installation in normally unoccupied spaces containing fuel having a flash point of not less than 43 degrees C (closed cup test), of vessels of less than 24 metres load line length, where the space to be protected does not exceed a deck height of 4 metres, or an area of 64 square metres.



## SCHEDULE including conditions or terms, if any, on which the certificate is issued (Continued from Page 1)

1.2 A series of eight tests were requested, which were combined into four fire tests, as follows:-

- 1.2.1 Open pool fire - diesel fuel (Test 3);
- 1.2.2 Hidden spray fire- diesel fuel (Test 1);
- 1.2.3 Hidden pool fire - lube oil (Test 1);
- 1.2.4 Combined open pool/hidden spray - diesel fuel (Test 3);
- 1.2.5 Combined open pool/hidden spray - lube oil/diesel fuel (Test 2);
- 1.2.6 Combined hidden pool/hidden spray - lube oil/diesel fuel (Test 3);
- 1.2.7 Combined open pool/hidden pool/hidden spray - diesel fuel/lube oil/diesel fuel (Test 3);
- 1.2.8 Wood crib (Class A fire) (Test 4)

Note: Tests 1.2.1 - 1.2.7 are for Class B fires

1.3 The tests were carried out in a combined format agreed with the MCA as follows:-

- 1.3.1 Fire 1: Combined hidden pool and hidden spray fire (lube oil/ diesel fuel); this test 1 - was given a 2 minute pre-burn.
- 1.3.2 Fire 2: Combined open pool fire, hidden pool fire and hidden spray fire (lube oil/ diesel fuel); this test 2 - was given a 2 minute pre burn.
- 1.3.3 Fire 3: Combined open pool fire, hidden pool fire and hidden spray fire (diesel fuel/ lube oil/ diesel fuel); this test 3 - was given a 2 minute pre burn.
- 1.3.4 Fire 4: Wood crib (class A fire); this test 4 -was given a 4 minute pre burn.

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1.3.5 Metholated spirits were used as the accelerant agent for pre-ignition.

1.4 The test enclosure comprised a compartment (7850 mm long x 2280 mm wide x 2300 mm high) of a steel container, with a viewing window on one side and double doors at one end. The diesel engine mock-up was constructed of sheet steel, together with a floor plate system surrounding the mock-up to represent a bilge mock-up. A fuel tray was placed underneath the engine mock-up. A diesel fuel spray nozzle was situated at the forward end of the engine mock-up, aiming across the engine and hidden under a plate cover. A further steel tray was placed in the open area beyond the engine. In all four corners of the enclosure, small lit can fires were placed to check the distribution of the extinguishing agent.

1.5 Four FirePro Aerosol extinguishers were installed in the container to provide the appropriate level of protection. The FirePro extinguishers used were 2 x FP1200c and 2 x FP500 and were mounted just below the ceiling of the container.

1.6 The container doors remained open prior to, and during, the 2 minute and 4 minute pre-burn period to ensure that the fires were well established. As the system was designed as a total flooding system, the doors were closed immediately prior to the system activation. The system was activated with a discharge time of less than 10 seconds, the time of extinguishment was recorded via data recorders. No re-ignition occurred. All fires were extinguished with a design concentration of 82 grams per cubic metre.

1.7 The hidden pool fire - the tray was 500 mm x 1020 mm x 90 mm deep and was filled with a mixture of 5 litres diesel fuel and 5 litres of engine oil on a water base. The tray was located under the engine mock-up.

1.8 The hidden pool spray fire - fed from an oil pump connected to a 6 mm bundy tube to a 1 mm nozzle mounted to the engine mock-up and covered from above by a steel plate. The pump provided approximately 1 litre of diesel fuel per minute at 3 bar.

SCHEDULE including conditions or terms, if any, on which the certificate is issued (Continued from Page 1)

1.9 The open pool fire - the tray was 800 mm x 1200mm x 90 mm deep and was filled with 10 litres of diesel fuel on a water base. The tray was located on the floor of the container in the open area beyond the engine and bilge mock-up.

1.10 The wood crib fire - the crib was constructed of 9 pieces of kiln dried wood measuring 34 mm x 34 mm x 190 mm and placed over a steel tray. Diesel fuel was poured over the wood crib with metholated spirits to aid ignition.

## 2.0 PRODUCT DESCRIPTION

FirePro is a fire extinguishing aerosol system consisting of a non-pyrotechnicaerosol forming solid compound together with the non-pyrotechnic natural mineral coolant and egress chambers which are contained within a non-pressurised canister with one or two discharge outlets.

The FirePro non-pyrotechnicaerosol forming solid compand is made up mainly of potassium nitrate 77%, potassium carbonate 4%, magnesium 1% and an epoxy resin polymer 18%. Once activated the SBK solid compound is turned into a rapidly expanding aerosol gas comprising of nitrogen(N<sub>2</sub>), Carbon dioxide (CO<sub>2</sub>), water vapour (H<sub>2</sub>O) and solid particles of potassium salts (K<sub>2</sub>C<sub>03</sub>).


FirePro tackles fire on a molecular level, by inhibiting the chain chemical reaction present within combustion.

The FirePro aerosol generators are available in various sizes depending on the mass of aerosol forming solid compound contained in the canister. Operation of the generator is electrical, manual and thermal automatic. The aerosol gas-like medium is close in density to air and is non-toxic, non-corrosive and non-conductive.

The FirePro aerosol forming generators consist of eight main elements:-

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- |                                   |                                    |
|-----------------------------------|------------------------------------|
| 1. Canister                       | 2. Thermal activation port         |
| 3. Electrical activation port     | 4. Activator                       |
| 5. Non-pyrotechnic solid compound | 6. Non-pyrotechnic mineral coolant |
| 7. Egress chamber                 | 8. Delivery nozzle                 |

## 3.0 FIREPROGENERATORS

Model	Activation	Dimensions (mm)	Capacity (grams)	Gross weight (grams)	Discharge time (secs)
FP8	TH	14 x 52 dia	8	14	3-6
FP20S	TH	165 x 32 dia	20	290	3-6
FP40S	E&TH	140 x 51 dia	40	590	5-10
FP80S	E&TH	185 x 51 dia	80	820	5-10
FP100S	E&TH	120 x 84 dia	100	1270	5-10
FP200M	M	150 x 84 dia	200	1630	10-15
FP200S	E&TH	150 x 84 dia	200	1630	5-10
FP500S	E&TH	260 x 84 dia	500	2850	5-10
FP1200	E&TH	216 x 300 x 167	1200	10050	10-15
FP2000	E&TH	300 x 300 x 185	2000	14100	10-15
FP3000	E&TH	300 x 300 x 185	3000	15000	15-20
FP5700	E&TH	300 x 300 x 300	5700	23700	15-20

Where:- E = Electrical TH = Thermocord M = Manual



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## 4.0 DESIGN

The FirePro fire extinguishing aerosol system is to be installed in accordance with the manufacturer's design, operating and maintenance manual: FP/MarineInstall/0305

The design of a FirePro fire extinguishing aerosol system should involve the following as a minimum:-

- 4.1 Identify all possible fire hazards within the engine enclosure. Refer to the manufacturer's manual for installation requirements for use with specific hazards/fuel types that may require additional quantities of agent.
- 4.2 Identify possible points of agent loss within the engine enclosure and adjust the quantity of agent required to compensate for the calculated loss.
- 4.3 Determine the volume of the engine enclosure. Identify if the required coverage extends to the full deck-head void and raised deck, and determine the protected volume as required.
- 4.4 Calculate the quantity of agent required for the fuel type and hazards within the engine enclosure. The minimum system design quantity for Class B fires is 82 g/m<sup>3</sup>, and the minimum for surface Class A fires is 100g/m<sup>3</sup>. Factors such as non-closeable openings, forced ventilation, low altitude, low temperature and other conditions may effect the quantity of agent required, and need to be considered when calculating the minimum system design factor.
- 4.5 Select the model and quantity of generators required and the method of activation.

## 5.0 SYSTEM ISOLATION SWITCH

In some cases, it will be a requirement for the discharge of a FirePro aerosol generator to be prevented by means of an isolation switch, or other means, that shall be manually operated when personnel are present within the protected engine

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enclosure, or adjacent areas, which could be rendered hazardous by the discharge of the system.

The system isolation switch shall be situated outside the protected area close to the system control panel, or adjacent to the main entrance to the engine enclosure, and protected for accidental operation.

While the system isolation switch is active, and the discharge of the system is inhibited, the fire detection and alarm system shall continue to function and the system shall return to manual control when the switch is reactivated.

The operation of the system isolation switch shall electrically isolate and earth each conductor of the wiring to the extinguishant discharge device and initiate a visual fault indicator at the system control panel.

The system isolation switch shall be used when there is a possibility of people entering the protected enclosure for whatever reason.

## 6.0 CONTROL PANELS

6.1 FPX103C control panel manufactured by Logician Ltd - Basic panel for use with automatic and manual activation of up to four FirePro aerosol generators within the engine or machinery enclosure. Installation and user manual, FPX103CIIInstalV0305

6.2 FPX104C control panel manufactured by Logician Ltd - Panel providing fire detection and manual activation of up to four FirePro aerosol generators within the engine or machinery enclosure. Installation and user manual, FPX104CIIInstal/0305

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## 7.0 SYSTEM MAINTENANCE

The user should carry out monthly inspections of the FirePro aerosol generator system installed. This should include looking out for obstructions of the discharge nozzles, extension/alteration of the protected enclosure, openings left unclosed that were not catered for during the design, and that the position and orientation of the FirePro aerosol generators remain in their installed position.

## 8.0 SERVICE LIFE

The FirePro aerosol generators have a service life and should be renewed in accordance with the manufacturer's recommendations.

9.0 IN ADDITION TO THE GENERAL SYSTEM APPROVAL DESCRIBED ABOVE, THE FOLLOWING CONDITIONS ARE TO BE COMPLIED WITH:-

9.1 Plans for each intended system, together with details of components used and test certificates, are to be submitted to the Maritime and Coastguard Agency prior to installation and survey on the vessel.

9.2 The installation is to be to the satisfaction of the attending surveyor. Certificates of commissioning and acceptance testing are to be submitted on completion.

9.3 Clear and legible instructions for installation, maintenance, testing and operation, and applicable to the specific system fitted on the vessel, are to be provided onboard.

9.4 Clear and legible safety labels shall be placed at the entrance to the protected enclosure, inside the protected enclosure, at the system isolate switch and the manual release point. Also simple operating instructions are to be

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placed at the system operating position.

9.5 Means are to be provided to close all openings, which may admit air in to the protected enclosure.

9.6 A normally unoccupied area is an area that is not occupied by humans under normal circumstances but may be entered occasionally for brief periods. Whenever the space is entered then the isolation method is to be used to deactivate the generators within the protected enclosure.



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**Manufacturer: Logician Ltd**  
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Maidenhead Berks, SL6 6SD  
United Kingdom  
Tel: +44 (0) 162 8630891

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