



**Automatic Fire Detection and
Suppression System**

for

The Crew and Engine Compartments

of

Military Vehicles

System No. 711530

User Manual

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Scope of Manual

This manual is designated for the crew of vehicles, in which the fire suppression system has been installed.

The manual is divided into the following chapters:

Chapter 1 – System Description

Provides general description of the system, its purpose, use and operating principles.

Chapter 2 – System Components

Provides description and features of the system components, their specifications and physical properties.

Chapter 3 – Safety Precautions

Provides safety instructions related to the system and its components and behavior rules after system activation.

Chapter 4 – Operating and Maintenance Procedures

Provides procedures for the weekly inspection and instructions for manual activation of the system.

1 System Description

1.1 General

This chapter explains the purpose and provides a general description of the system, its configuration, use and operating principles.

1.2 Purpose and Features

The system protects the vehicle and crew against fires that may occur in the vehicle's crew compartment and engine compartment.

One automatic or manual activation is available for each compartment.

In the crew compartment – the system protects personnel by reducing pressure build-up resulting from fuel explosions, limiting skin damage and minimizing formation of toxic gaseous by-products. The system is capable of effectively detecting and suppressing all possible types of fires, i.e. small or large, slow or rapidly growing, limited in area or widely spreading, as well as fuel explosions, which may occur during combat or training service of military vehicles.

In the engine compartment – the system has the capability of detecting fires and successfully extinguishing those fires, at all working conditions of the engine.

1.3 System Configuration and Description

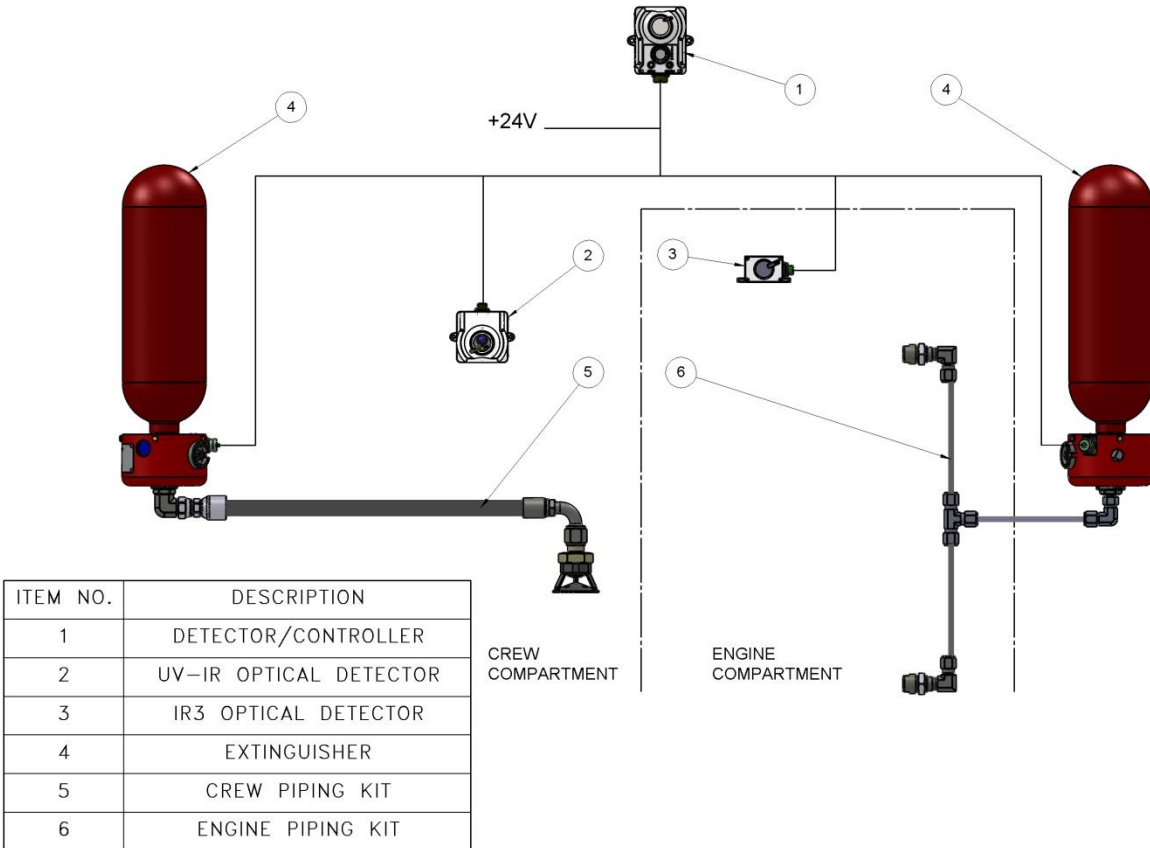


Figure 1: System Layout

The system consists of the following components and sub-systems:

- a **One UV-IR Optical Fire Detector (P/N 764002-0-4209)**, mounted in the crew compartment. This detector is used, together with the optical fire detector inside the detector/controller unit, to detect fire within the volume of the crew compartment.
- b **One IR3 Optical Fire Detector (P/N 760102-4-4209)**, mounted in the engine compartment. This detector is used for fire detection within the engine compartment.
- c **Two Fire Extinguishers (P/N 710250-5)**, mounted in the crew compartment. One extinguisher is used for fire extinguishment in the crew compartment. The other extinguisher is used for fire extinguishment in the engine compartment.
- d **One Dispersion Piping Kit (P/N 711535)**, for the crew compartment. It consists of a rubber hose, connected to the discharge port of the crew extinguisher on one side, and a dispersion deflector, connected to the hose on the other side. The dispersion deflector (P/N 765470) is used for fast and homogeneous distribution of the extinguishing agent throughout the volume of the crew compartment, upon activation of the crew extinguisher.

- e One Dispersion Piping Kit (P/N711536)**, for the engine compartment. One side of the piping is connected to the discharge port of the engine extinguisher in the crew compartment. The other side of the piping is connected to four discharge nozzles inside the engine compartment. The nozzles (P/N 710235) are used for fast and homogeneous distribution of the extinguishing agent throughout the volume of the engine compartment.
- f One Detector/Controller Unit (P/N 711540-0-4219)**, mounted in the crew compartment. The unit contains the control and display facilities of the whole system and a UV-IR optical fire detector (identical to the other IV-IR detector), in the same housing. The control facilities provide the following functions:
 - Automatic activation for the crew sub-system.
 - Automatic activation for the engine sub-system.
 - Manual activation for both extinguishers.
 - Alarm and fault indications.
 - Monitoring of the status of the extinguishers and detectors.
 - Built-In-Test.The panel of the detector/controller unit incorporates a guarded push button for a manual activation of the extinguishers and two indication LEDs – POWER LED (green) and FAULT LED (yellow). In addition, the unit contains another LED (red), behind the detector's window, for fire alarm.
- g Electrical Harness (P/N 711531)**, for the electrical connection of all system components and to supply power to the system.
- h Installation Kit (P/N 711532)**, including brackets and fastening equipment, to connect the system components to the vehicle's structure.

1.4 Operating Principles

1.4.1 Automatic Activation for the Crew Sub-System

A detection signal, received from the UV-IR optical detector and/or the detector in the detector/controller unit, results in the immediate activation of the extinguisher, assigned for the crew and sub-system.

1.4.2 Automatic Activation for the Engine Sub-System

A detection signal, received from the IR3 optical detector in the engine compartment, results in the immediate activation of the extinguisher, assigned for the engine and sub-system.

1.4.3 Manual Activation

Operation of the MANUAL push button, on the detector/controller panel, results in the immediate activation of both extinguishers.

1.4.4 Continuous Monitoring

The following is continuously monitored by the detector/controller unit:

- a Extinguishers operational status – proper pressure and electrical continuity of all leads.
- b UV-IR and IR3 optical detectors operational status – electrical continuity of all leads and non-short-circuit condition, proper power supply and portion of the detector functions.
- c Proper power supply to the system.

1.4.5 Built-In-Test

At power-up of the system, the detector/controller unit performs an automatic built-in-test. The test provides:

- a Operational status of the LEDs on the detector/controller panel.
- b Comprehensive testing of the electrical circuitry and cleanliness of the window for the IR3 and UV-IR optical detectors and the detection section in the detector/controller unit.
- c Operational status of portion of the control electrical circuitry in the detector/controller unit.

Upon power-up, both POWER and FAULT LEDs, on the detector/controller panel, flash for approximately 7 seconds. Afterwards, only the POWER LED lights constantly.

1.4.6 Fault and Alarm Indications

a **POWER LED (Green)**

The LED lights constantly when proper power is supplied to the system. The LED flashes when the input voltage drops below the permissible level.

b **FAULT LED (Yellow)**

The LED flashes to indicate a fault condition within the system. Each flashing cycle lasts 2.5 seconds.

The number of flashes in each cycle identifies the faulty component or a fault in the leads of the harness leading to that unit.



The following fault code is used:

Table 1: Fault Indications

Number of Flashes	Faulty Unit
1	Crew Extinguisher
2	Engine Extinguisher
3	Both Extinguishers
4	UV-IR Crew Detector
5	IR3 Engine Detector
6	Detector/Controller Unit
7	Two or more of the malfunctions above

c ALARM LED (Red)

The alarm LED is located behind the window of the detector/controller unit. The LED lights constantly as long as fire is detected in the crew compartment. The LED flashes as long as fire is detected in the engine compartment.

2 System Components

2.1 General

This chapter provides description and technical specifications for all system components.

2.2 UV-IR Optical Detector

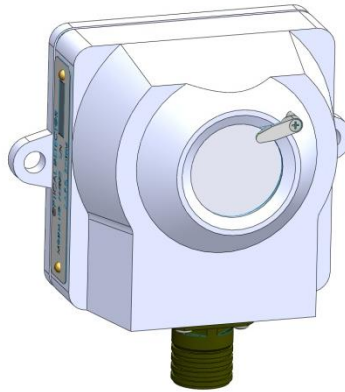


Figure 2: UV-IR Optical Detector

2.2.1 Description and Features

The UV-IR optical detector is used for fire/fuel explosion detection in occupied compartments.

The UV-IR optical detector comprises the following features:

- Fast response time for explosive fires and vehicle penetration.
- High sensitivity to small and slow growing fires.
- High reliability and immune to false alarm.

The detector is sensitive to radiation in two frequency ranges of the electromagnetic spectrum (the IR and the UV). Only simultaneous detection of radiation in the two ranges and above pre-set threshold will result in a detector output signal. Since these dual range and level of radiation, are characteristics of actual fires only, all other types of radiation sources, not identified as fires, will not be detected.

The detector contains built-in test capability for the electrical circuitry and cleanliness of the window.

2.2.2 Specifications

- Response Time – less than 5 milliseconds.
- Sensitivity Threshold – at least one detection signal every 5 seconds, when the detector is aimed to a 12.5 centimeter diameter gasoline pan fire at a distance of 80 centimeter.
- Optical Field of View – 90 degree cone of vision.

2.2.3 Physical Properties

- Weight – 0.55 kg.
- Dimensions – 110 x 103 x 60 mm.
- Mechanical Installation – the unit is connected to the vehicle's structure by means of two M5 or 3/16 inch screws, through two mounting holes located on the detector's cover.
- Electrical Interface – the electrical interface between the unit and the control box is achieved by one electrical connector MS3112E10-6P.

2.3 IR3 Optical Detector



Figure 3: IR3 Optical Detector

2.3.1 Description and Features

The IR3 optical detector is designed in particular for the tough environmental conditions, in engine compartments of military vehicles.

The detector incorporates a modern and sophisticated triple IR technology, in order to achieve high sensitivity to small fires and excellent immunity to false alarm, due to hot parts and various illuminations and radiation sources that may be presented inside and outside of military vehicles.

The detector contains built-in test capability for the electrical circuitry, fire sensors and cleanliness of the window.

2.3.2 Specifications

- Response Time for fire detection – less than 3 seconds when exposed to a round 16 centimeter diameter gasoline pan fire at a distance of 80 centimeter.
- Sensitivity Threshold – at least one detection signal every 5 seconds, when the detector is aimed to a round 12.5 centimeter diameter gasoline pan fire at a distance of 80 centimeter.
- Optical Field of View – 90 degree cone of vision.

2.3.3 Physical Properties

- Weight – 0.27 kg.
- Dimensions – 94 x 67 x 43 mm.
- Mechanical Installation – the unit is connected to the vehicle's structure by means of two M6 or 1/4 inch screws, through two mounting holes located on the detector.
- Electrical Interface – the electrical interface between the unit and the control box is achieved by one electrical connector MS3112E10-6P.

2.4 Fire Extinguisher



Figure 4: Fire Extinguisher

2.4.1 Description and Features

The extinguisher contains the extinguishing agent and includes a dedicated valve, to release the agent very rapidly when activated.

The extinguisher agent is HFC-227 ea (FM-200), super-pressurized with dry Nitrogen.

The extinguisher is activated by an electrical signal, transmitted by the detector/controller unit.

A pressure switch, designed as an integral part of the extinguisher valve, enables the detector/controller unit to continuously monitor the extinguisher status.

An anti-recoil device for the outlet port and a protective cover for the electrical connector are provided within the extinguisher, in order to increase safety and to prevent injury and damage in case of accidental discharge during shipping, installation and maintenance.

2.4.2 Specifications

- Extinguishing Agent – HFC-227 ea (FM-200)
- Extinguisher Capacity – 4.8 kg.
- Super-pressurization – dry Nitrogen.
- Extinguisher Nominal Pressure – 41.4 bar.
- Valve Operation – electrical squib.
- Average Firing Time – 2.5 milliseconds.
- Valve Operation Time – approximately 5 milliseconds.

2.4.3 Physical Properties

- Weight – 13.7 kg.
- Dimensions – diameter 144 x 540 mm.
- Mechanical Installation – the extinguisher is mounted to the vehicle with the extinguisher holding bracket.
- Electrical Interface – the electrical interface is achieved by one electrical MS3102R10SL-3P.

2.5 Detector/Controller Unit

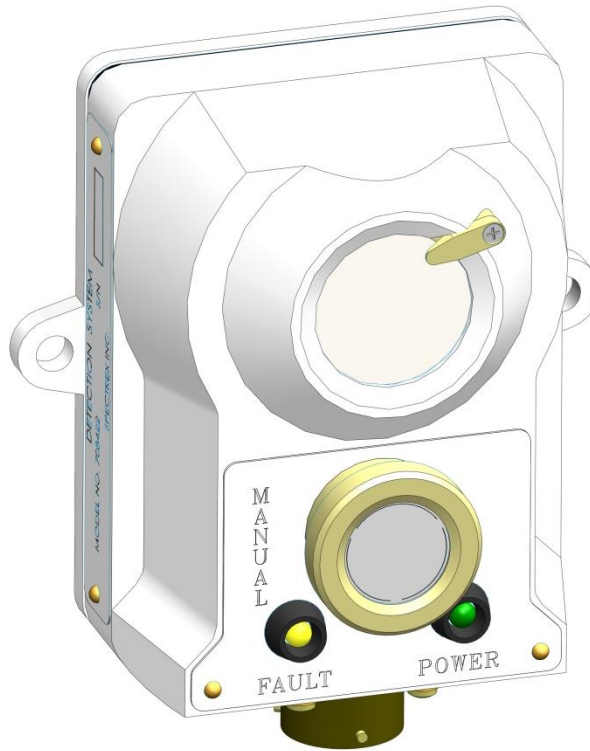


Figure 5: Detector/Controller Unit

2.5.1 Description and Features

The detector/controller unit contains the control and display facilities of the whole system and a UV-IR optical fire detector (identical to the detector described in Section 2.2), in the same housing.

The control facilities provide the following functions:

- Automatic activation for the crew sub-system.
- Automatic activation for the engine sub-system.
- Manual activation for both extinguishers.
- Alarm and fault indications.
- Monitoring of the status of the extinguishers and detectors.
- Built-In-Test.

The panel of the detector/controller unit incorporates a guarded push button for a manual activation of the extinguishers and two indication LEDs – POWER LED (green) and FAULT LED (yellow).

In addition, the unit contains another LED (red), behind the detector's window, for fire alarm.

2.5.2 Physical Properties

- Weight – 0.62 kg.
- Dimensions – 130 x 103 x 60 mm.
- Mechanical installation – the unit is connected to the vehicle's structure by means of two M6 or 1/4 inch screws, through two mounting holes located on the unit cover.
- Electrical Interface – the electrical interface between the unit and the other components and the vehicle's electrical system, is achieved by one electrical connector MS3112E14-19P.

2.6 Dispersion Deflector



Figure 6: Dispersion Deflector

2.6.1 Description and Features

The deflector is used in the crew compartment system. It is installed on the outlet of the rubber hose, connected to the discharge port of the extinguisher.

The deflector provides circular and wide range dispersion, resulting in rapid and homogenous agent distribution in the protected volume as well as minimal impact on the troop.

2.6.2 Physical Properties

- Weight – 0.22 kg.
- Dimensions – diameter 78 x 49 mm.
- Mechanical Installation – the unit is installed on the edge of the hose by a 1 3/4" - 18 UNS – 2B thread.

2.7 Dispersion Nozzle

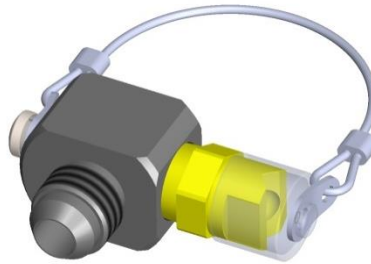


Figure 7: Dispersion Nozzle

2.7.1 Description and Features

The dispersion nozzle is used for the discharge of the extinguishing agent in the engine compartment, to achieve fast and efficient distribution.

The nozzle is equipped with a cover to prevent accumulation of dirt and liquids. At agent discharge, the cover is ejected but remains connected to the nozzle housing by a holding cable.

2.7.2 Physical Properties

- Weight – 0.1 kg.
- Dimensions (without the cable) – 55 x 31 x 20 mm.
- Mechanical Installation – the unit is connected to the distribution piping, using a standard 37 degree flare connection with nominal diameter of 3/8 inch.

3 Safety Precautions

3.1 General

This chapter provides a set of safety precautions and behavior rules, to be observed in vehicles in which the system has been installed.

The extinguishing agent, used in the system, is stored in high pressure cylinders. The operation of the system is based on the rapid discharge of the extinguishing agent into the confines of the vehicle.

In order to avoid accidents and injury to the troop, the following safety and precaution rules should be strictly observed.

3.2 General Precautions

- Do not light a match or cigarette lighter, or smoke inside the vehicle.
- During welding operation or utilization of high intensity illumination or radiation sources, inside or outside the vehicle, turn the master switch of the vehicle to the OFF position.
- During maintenance activities, including connectors tightening and replacement of components, turn the master switch of the vehicle to the OFF position.

3.3 Extinguishing Cylinders and Dispersion Systems

- Before any maintenance activity related to an extinguishing cylinder, turn the master switch of the vehicle to the OFF position and disconnect the harness connected to this extinguisher. Install the protective cover on the electrical outlet of the extinguisher.
- Do not try to dismount/replace any part related to the extinguisher or to remove the extinguisher from its place.
Only the maintenance echelon is authorized for these operations.
- Do not bring your head close to any of the discharge nozzles or the dispersion deflectors. In any case, do not look into the nozzle or the deflector outlet.
Do not introduce fingers inside the nozzle or the deflector.
- Do not leave equipment, objects or tools near the discharge nozzles or the deflectors.
- When the extinguisher is not firmly mounted in its place in the vehicle, the following precautions should be observed:
 - a Make sure that the anti-recoil device is installed on the discharge fitting and the electrical connector is protected by the cover.
 - b Do not leave the extinguisher proximate to fire or heat.
 - c Do not expose the extinguisher to sunlight for extended periods of time.

- d During transportation, special attention must be given for proper and careful handling of the extinguisher. The extinguisher should be packaged in an appropriate packaging, suitable for pressure vessels.

3.4 UV-IR and IR3 Optical Detectors

- Do not light a match or cigarette lighter, or smoke near the optical detector.
- Do not approach any kind of high-radiation or high intensity illumination source close to any detector.

3.5 Manual Activation Switch on the Detector/Controller Unit

- Make sure that an unbroken plastic diaphragm is installed on the manual activation push button. Only the maintenance echelon is authorized to replace a plastic diaphragm.
- Activate the manual switch only when required for extinguishing purpose.

3.6 Behavior After System Activation in the Crew Compartment

- The extinguishing agent used in the system is non-toxic and does not constitute any danger for the crew when exposed at the concentrations resulting from the system activation.
- As a rule, there is no need to evacuate the vehicle after the activation of the system. However, if as a result of the system activation, symptoms such as strong irritation in the eyes and the respiratory tract or a feeling of dizziness appear, if possible leave the vehicle until the gases are evacuated from the confines of the crew compartment. If the battle condition does not allow, open hatches to enable vehicle ventilation.
- The extinguishing agent is much heavier than air. Following the discharge it sinks and accumulates at the lower area of the compartment. As a result, buildup of high concentration may be created close to the compartment floor. Therefore, the crew should remain in their seats with their heads up.
Do not lay injured or unhealthy soldiers on the vehicle floor.

4 Operating and Maintenance Procedures

4.1 General

This chapter provides operating and maintenance procedures for the crew, in vehicles in which the system has been installed.

When the system functions properly, only the POWER LED (green) lights constantly and the other LEDs do not light.

In case of another indication by the LEDs, notify the maintenance personnel.

4.2 Weekly Inspection

- a Turn the master switch of the vehicle to the OFF position and visually check all system components.

Verify that there is no damage and all components are properly mounted to their brackets.

Make sure that the manual switch, on the detector/controller unit, is guarded by an unbroken diaphragm.

Only the maintenance personnel are authorized to replace a plastic diaphragm.

- b Clean the window of the IR3 optical detector, mounted in the engine compartment, and the UV-IR optical detector and the detector/controller unit, in the crew compartment.

The window should be carefully wiped with a dry soft rag. If necessary, a wet rag with detergent could be used. Rinse with water and clean up with a dry rag afterwards.

Do not use oily rags to clean the optical detector

- c Turn the master switch of the vehicle to the ON position, while observing the detector/controller panel.

Verify that proper indications are displayed as follows:

- At the moment of power-up, the POWER and FAULT LEDs flash for approximately 7 seconds.
- Afterwards, only the POWER LED lights constantly.

If other indications are obtained, notify the maintenance personnel.

4.3 Manual Activation

- Manual activation of the extinguishers should be used only when a fire is discovered in one of the compartments.
- The system contains one manual activation switch located on the detector/controller panel.



- The manual push button is protected with a plastic diaphragm, to prevent accidental operation.
- In order to activate the manual switch, the diaphragm should be broken by the finger. The diaphragm is equipped with breakaway cuts to ease the activation.