



Very Early Warning Air Sampling
Fire and Smoke Detection
Cirrus Hybrid (non-scanning)
Engineering Specification
February 2023



Contents

1	GENERAL	4
1.1	Scope	4
1.2	ASD System Information.....	4
1.3	Approvals and Standards	4
1.4	Codes, Standards or Regulations	4
1.5	Quality Assurance	5
1.5.1	Manufacturer	5
1.5.2	Equipment Supplier	5
1.5.3	Installer	5
1.5.4	Warranty	5
1.5.5	Training.....	5
1.6	Documentation.....	5
2	SYSTEM DESCRIPTION	6
2.1	ASD System Features.....	6
2.2	Detection Technology	6
2.2.1	Light Source	6
2.2.2	Detection Method	6
2.3	Peer-to-Peer Communications Networking.....	7
2.4	Secondary Communications	7
3	PRODUCTS	7
3.1	Manufacturer	7
3.2	Manufactured Units(s).....	7
3.3	Detector Features	8
3.4	Displays	9
3.5	Monitoring	9
3.6	Configuration and Programming	9
3.7	Security.....	10
3.8	Upgrading	10
4	APPLICATION	10
4.1	Detection Alarm Levels	10
4.2	Initial Detection Alarm Settings.....	11
4.3	Initial (factory default) settings for the alarm/fault delays.....	11
4.4	Faults.....	11
4.5	Power Supply and Batteries	11



4.6	Sampling Pipe Design	11
4.6.1	Sampling Pipe	11
4.6.2	Sampling Holes	12
5	EXECUTION	12
5.1	System Installation	12
5.1.1	ASD Detector Mounting.....	12
5.1.2	The Capillary Sampling Network.....	13
5.1.3	Air Sampling Pipe Network Calculations.....	13
5.2	System Commissioning	13
5.2.1	Detector commissioning.....	13
5.2.2	Commissioning Tests	13
5.2.3	System Checks	14
5.2.4	Final Tests.....	14
5.3	Maintenance and Service	14
5.3.1	Sample Filter	14
5.3.2	Spare Parts.....	15



1 GENERAL

1.1 Scope

This document provides specification details of the Hybrid Air-sampling Fire and Smoke Detection (ASD) products to assist in their installation and commissioning. Hybrid range provides a single pipe through four pipe products. Hybrid ASD is referred to as ASD throughout this document.

1.2 ASD System Information

1. A Very Early Warning Fire Detection System like the Hybrid System shall be installed throughout the areas nominated on the drawings.
2. The ASD system shall consist of highly sensitive cloud chamber and optical-based Detectors in one enclosure with aspirators connected to networks of sampling pipes.
3. When required, an optional Display unit may be provided to monitor each ASD detector.

1.3 Approvals and Standards

The ASD must be of a type submitted to, tested, approved, and/or listed to the Standards mentioned below by a Nationally Recognized Testing Laboratory (NRTL):

1. UL268 and UL268A: UL (Underwriters Laboratories Inc), USA
2. UL268: ULC (Underwriters Laboratories Canada), Canada
3. FM3230 (Factory Mutual)
4. CSFM (California State Fire Marshall, USA)

1.4 Codes, Standards or Regulations

The ASD shall be installed to comply with one or more of the following codes or standards:

1. AS 1670.1-2004, AS1603.8 – 1996, ASNZS 3000
2. Fire Industry Association (FIA), Code of Practice for Design, Installation, Commissioning & Maintenance of Aspirating Smoke Detector (ASD) Systems
3. NFPA Standards, US
4. NEC Standards, US
5. Local codes and standards



1.5 Quality Assurance

1.5.1 Manufacturer

1. The manufacturer shall have a minimum of 28 years production experience in the design and manufacture of high sensitivity air sampling smoke detection systems.
2. The manufacturer shall be certified as meeting ISO 9001:2015.

1.5.2 Equipment Supplier

1. The equipment supplier shall be authorized trained by the manufacturer to calculate/design, install, test and maintain the ASD system.
2. The equipment supplier shall be able to produce a certificate of training from the manufacturer.

1.5.3 Installer

1. The equipment installer shall be authorized and trained by the manufacturer and shall have the ability to design a system based on code requirements.
2. The installer shall be capable of providing calculations, design, and testing documents upon request.

1.5.4 Warranty

1. The manufacturer shall guarantee the product by warranty for a period of one year.
2. Any damage to the ASD due to poor handling or operating outside its operation limits will void its warranty.
3. The installation and programming of the ASD shall be completed by a factory-trained installer.

1.5.5 Training

1. The manufacturer and their representatives shall make available adequate training to all personnel involved in the supply, installation, commissioning, operation and maintenance of the ASD system.

1.6 Documentation

The following documentation shall be supplied.

1. Product data and site drawings shall be submitted and shall include pipe layout, operational calculations and performance criteria. Tools such as ProFlow may be used to generate this material.
2. A copy of the manufacturer's installation, operation and maintenance manuals shall be supplied upon completion of the installation.
3. System commissioning data shall be supplied (in a format recommended by the manufacturer and per the instructions provided by the manufacturer) within 30 days of completion of the installation.



2 SYSTEM DESCRIPTION

2.1 ASD System Features

The ASD system shall:

1. Consist of a highly sensitive, optical-based, light scattering smoke detector, Cloud chamber-based fire detector, aspirator, and SCD.
2. Be modular, with each detector having a display with indicator LEDs, and a reset control button on the 7" touch screen Display showing detector status including fault categories and smoke level.
3. Consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design modelling tool.
4. Support optional equipment which may include intelligent remote displays and/or a high level interface (HLI) with the building fire alarm system, or a dedicated graphics package such as H6.
5. Be tested and approved to cover up to 28,800 sq. ft. for four pipe Hybrid
6. Be approved to provide Very Early Warning Fire Detection (VEWFD) / Class A, Early Warning Fire Detection (EWFD) / Class B and Standard Fire Detection (SFD) / Class C.
7. Provide five output levels corresponding to Pre-alarm, Fire 1, Fire 2, and Fire 3. These levels shall be programmable and able to be set at sensitivities ranging from 1-1000 CFS.
8. Report any fault on the detector by using configurable fault relay outputs, via a peer-to-peer network or by communications to a monitoring software tool running on a PC or hand-held device such as a tablet or smart phone.
9. Incorporate a flow sensor in each pipe inlet and provide staged airflow faults against flow fault thresholds that may be determined and set for each pipe individually.
10. Be commissionable without an additional device for programming.
11. Capability to connect directly to 6 IP cameras
12. Include troubleshooting videos built into the detector
13. Be able to provide relay outputs for both detection technologies allowing cross zoning with a single pipe on a single detector

2.2 Detection Technology

2.2.1 Light Source

The Detection Chamber shall employ a highly sensitive, optical light source.

2.2.2 Detection Method

The detection sensing method shall include using a cloud chamber; as well as, photodiodes spaced inside the chamber to detect various scattering angles.



The output data from the sensing method shall include both particle counting as well as measured obscuration level, viewable both separately and as a combined CFS.

2.3 Peer-to-Peer Communications Networking

A peer-to-peer networking facility shall be provided for the purposes of reporting alarms, faults and monitoring status, history and for potential configuration of devices.

The peer-to-peer network shall:

1. Be able to support up to 100 devices (detectors, displays)
2. Be configurable at the detector, at the remote displays, and by PC based configuration tools that are available to configure and manage the network of detectors.

2.4 Secondary Communications

Detectors shall provide inbuilt secondary communications for monitoring and configuration using the following physical media:

1. USB
2. 10/100 BaseT Ethernet (2 ports)
3. RS485

3 PRODUCTS

3.1 Manufacturer

Air Sampling Smoke Detection System: Acceptable Manufacturer.

Safe Fire Detection, 5915 Stockbridge Dr., Monroe, NC 28110

3.2 Manufactured Units(s)

The Hybrid ASD system can be supplied in the following configurations:

Part Number	Description
61986H4-FMUL1	CIRRUS HYBRID 1 (1 PIPE) ASPIRATING 'FIRE & SMOKE' DETECTOR WITH DISPLAY FM UL APPROVED
61986H4-FMUL2	CIRRUS HYBRID 2 (2 PIPE) ASPIRATING 'FIRE & SMOKE' DETECTOR WITH DISPLAY FM UL APPROVED
61986H4-FMUL3	CIRRUS HYBRID 3 (3 PIPE) ASPIRATING 'FIRE & SMOKE' DETECTOR WITH DISPLAY FM UL APPROVED



61986H4- FMUL4	CIRRUS HYBRID 4 (4 PIPE) ASPIRATING 'FIRE & SMOKE' DETECTOR WITH DISPLAY FM UL APPROVED
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3.3 Detector Features

The detector shall incorporate the following features.

1. The Detector, SCD, CCD, Aspirator, Touchscreen Display, Vacuum Pump, Water cartridge and Relay Outputs shall be housed in a plastic enclosure and shall be arranged in such a way that air is drawn from the fire risk area by an aspirator and a sample passed through a sample filter and detection chamber.
2. The Detector shall employ a Cloud Chamber Detector (CCD) in addition to an optical light source and incorporate light scattering using a scatter pattern measurement using photodiodes.
3. The detector shall have an obscuration sensitivity range of 0.01%-20% obs/m (0.03%-6.6% obs/ft) and a CFS range of 1-1000.
4. The Detector shall have four independent field programmable smoke alarm thresholds across its sensitivity range with adjustable time delays for each threshold between 0-2000 seconds.
5. The detector shall employ modular construction allowing field replacement of the SCD, CCD, touchscreen display, vacuum pump, water cartridge, and aspirator.
6. The detector shall allow future hardware expansion via modular SCDs inside detector enclosure up to four.
7. The Detector shall also incorporate facilities to transmit the following fault categories:
 - a) Detector
 - b) Air flow
 - c) System
 - d) Network
 - e) Power
 - f) Chamber
 - g) Module
8. The detector shall support the generation and transmission of urgent and minor faults. Minor faults shall be considered as servicing or maintenance signals. Urgent faults indicate the unit may not be able to detect smoke.
9. The single through four pipe Hybrid shall include up to four sample pipe inlets respectively, and must contain a flow sensor and optical based smoke detector for each pipe inlet; as well as, a shared CCD for all used inlets.
10. The filter shall be a disposable filter and shall be capable of filtering particles in excess of 20 microns from the air sample and shall be installed outside the detector and inside the CCD.
11. An additional filter shall be optional and installed outside the detector to provide a clean air barrier around the detector's optics to prevent contamination and increased service life.
12. The aspirator shall be a centrifugal blower with the ability to allow up to 800ft of pipe, subject to local codes and calculations.



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13. The Assembly must contain nine (9) or more relays for inputs, alarm conditions, and fault conditions. The relays shall be software programmable to the required functions. The relays must be rated 1 Amp at 30 VDC. Remote relays can be offered as an option and either configured to replicate those on the detector or programmed differently.
 14. The detector shall incorporate a replaceable and recyclable water cartridge.
 15. The detector shall have built-in event and smoke logging. It shall store smoke levels, alarm conditions, operator actions and faults. The date and time of each event shall be recorded. Each detector shall allow storage of up to 256 events and does not require the presence of a display in order to do so.
 16. The detector shall have built-in graphical airflow and smoke logging for both the CCD and SCD. The data logged every 10 seconds to 4 minutes, and shall include CCD and SCD levels along with date and times. Each detector shall allow storage of approximately 24,000 data points (about 1 months' of data).
 17. The detector shall incorporate 3 Inputs which can be assigned by configuration to activate one of several functions including (Isolate, Silence, Reset, Mains Fault, Battery Fault, Pause AF, Disable AF).
 18. The detector shall incorporate two levels of logins to protect against unauthorized access.

3.4 Displays

The single through four pipe Hybrid detectors shall provide a 7" touchscreen display and LED user interface support commands; LEDs to indicate alarm events; trouble LED; and power On / Off indication. All LEDs shall have appropriate symbols without any text.

In addition to the LED user interface, the touch screen user interface with following characteristics:

1. Full color touch screen user interface with the ability to see the level of each pipe and all other menus
2. Program and commission the detector from solely the touch screen.
3. Alarm threshold indicators for Pre-alarm, Fire 1, Fire 2, and Fire 3
4. Fault indicating the fault condition.
5. Include built in troubleshooting videos
6. Include the available view up to 6 color IP cameras
7. A remotely mounted Display may be optionally equipped with an alarm and fault output.

3.5 Monitoring

The system shall have available software to monitor all devices connected to a system. Such software shall be provided to run on:

1. Windows Operating System

3.6 Configuration and Programming

Configuration and programming may be performed at the detector without needing any additional software, hardware, or programmers; by accessing the detector through a remote display; or by direct connection to a detector or through Ethernet network.

Configuration and programming tool shall support the following features at a minimum:



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1. Programming of the device.
 2. Viewing of the status of the device in the system.
 3. Adjustment of the alarm thresholds of the detector.
 4. Setting of Day/Night, weekend sensitivity threshold settings.
 5. Multi-level password control.
 6. Programmable latching or non-latching relay operation.
 7. Programmable energized or de-energized relays.
 8. Programmable high and low flow settings for airflow supervision.
 9. Programmable aspirator speed control.
 10. Testing of relays assigned to a specific pipe to aid commissioning.
 11. Viewing built in troubleshooting videos
 12. Commissioning and Viewing optional IP cameras

3.7 Security

The following security measures shall be provided.

1. Access to a detector via Ethernet shall be protected using a detector password specific to the detector

3.8 Upgrading

There shall be provision for field upgrading the firmware in the system using a PC for this function.

4 APPLICATION

4.1 Detection Alarm Levels

Each pipe shall have four (4) independently programmable alarm thresholds. The four alarm levels may be used as follows:

- 1 Alarm Level 1 (Pre-Alarm) - Activate a visual and audible alarm in the fire risk area.
- 2 Alarm Level 2 (Fire 1) - Activate the electrical/electronic equipment shutdown relay and activate visual and audible alarms in the Security Office or other appropriate location.
- 3 Alarm Level 3 (Fire 2) - Initiate an alarm condition in the Fire Alarm Control Panel to call the Fire Brigade and activate all warning systems.
- 4 Alarm Level 4 (Fire 3) - Activate a suppression system and/or other suitable countermeasures.



4.2 Initial Detection Alarm Settings

Initial settings for the alarm levels shall be determined by the requirements of the protected environment. Default settings of the unit shall be:

- | | | |
|----|---------------------------|---------|
| 1. | Alarm Level 1 (Pre-alarm) | 300 CFS |
| 2. | Alarm Level 2 (Fire 1) | 400 CFS |
| 3. | Alarm Level 3 (Fire 2) | 500 CFS |
| 4. | Alarm Level 4 (Fire 3) | 600 CFS |

4.3 Initial (factory default) settings for the alarm/fault delays

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|----|---------------------------|-----------|
| 1. | Alarm Level 1 (Pre-Alarm) | 0 seconds |
| 2. | Alarm Level 2 (Fire 1) | 0 seconds |
| 3. | Alarm Level 3 (Fire 2) | 0 seconds |
| 4. | Alarm Level 4 (Fire 3) | 0 seconds |

4.4 Faults

The Detector Fault relay shall be connected to the appropriate alarm zone on the Fire Alarm Control Panel (FACP) in such a way that a Detector Fault would register a fault condition on the FACP.

(Check local Codes, Standards or Regulations to determine whether compliance with this set up is required).

4.5 Power Supply and Batteries

The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Typically 24 hours standby battery backup is required followed by 5 minutes in an alarm condition.

Local Power Supply Standards that may apply:

1. UL 1481 Listed - provided the power supply and standby batteries have been appropriately sized / rated to accommodate the system's power requirements.
2. US Telecommunication Central Office Power Supply - the system shall operate on negative 48 VDC (provided continuously from the telephone central office power source) converted to 24VDC.

4.6 Sampling Pipe Design

4.6.1 Sampling Pipe

The sampling pipe shall comply with the following requirements.

1. The sampling pipe shall be smooth bore RedPipe. Normally, pipe with an outside diameter (OD) of 25mm or 1.05" and internal diameter (ID) of .87" should be used. It should be marked along its length with "RedPipe Smoke Detector Sampling Tube Do Not Disturb" via printing directly on the pipe.



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2. The pipe material should be suitable for the environment in which it is installed, or should be the material as required by the specifying body.
 3. All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.
 4. The pipe shall be identified as Air Sampling/Aspirating Smoke Detector Pipe (or similar wording) along its entire length printed directly onto the pipe at regular intervals not exceeding the manufacturer's recommendation or that of local codes and standards.
 5. All piping should be supported at centers of the lesser of 1.5m (5ft) apart or that specified by local codes or standards.
 6. The end of each trunk or branch pipe shall be fitted with an end-cap and made air-tight by using solvent cement. Use of a hole in the end-cap will be dependent on the network design (see ProFlow calculations).

4.6.2 Sampling Holes

The sampling holes shall comply with the following requirements.

1. Sampling holes shall not be separated by more than the maximum distance allowed for conventional point detectors as specified in the local codes and standards. Intervals may vary according to calculations.
2. Each sampling hole shall be identified and in accordance with Codes or Standards.
 - a) It is manufacturer's recommendation to use the correct size Sample Hole Markers (SHM) for identification as it provides hole size verification from a distance, and are visually distinct from the pipe network.
3. Consideration shall be given to the manufacturer's recommendations and standards in relation to the number of sampling holes and the distance of the sampling holes from the ceiling or roof structure and forced ventilation systems.
4. Sample point size and indeed the entire pipe design and installation design shall be supported by ProFlow calculations.

5 EXECUTION

5.1 System Installation

The contractor shall install the entire detection system in accordance with the national and local codes and manufacturer's System Design Manual.

5.1.1 ASD Detector Mounting

- 1 The detector shall be capable of vertical mounting with sample air inlet port(s) directed up toward the ceiling (normal mounting).
- 2 The detector shall be capable of mounting directly to a wall using screw fasteners.



5.1.2 The Capillary Sampling Network

The capillary sampling network shall comply with the following requirements:

1. Where false ceilings are installed, the sampling pipe shall be installed above the ceiling, and Capillary Sampling Points shall be installed on the ceiling and connected by means of a capillary tube.
2. The typical internal diameter of the capillary tube shall be 5mm or 3/8", the maximum length of the capillary tube shall be 8m (26 ft) unless otherwise specified in consultation with the manufacturer.
3. The Capillary tube shall terminate at a Ceiling Sampling Point specifically designed and approved by the manufacturer. The performance characteristics of the Sampling Points shall be taken into account during the system design.

5.1.3 Air Sampling Pipe Network Calculations

Air Sampling Pipe Network Calculations shall be provided by Air Sampling Pipe Network modelling program such as ProFlow. Pipe network calculations shall be supplied with the proposed pipe layout design to indicate the following performance criteria:

5.1.3.1 Transport Time

Wherever possible the transport time (i.e. the time taken by smoke sampled to reach the detector) for the least favorable sampling point shall be less than 120 seconds for open hole sampling and capillary tubes. Longer transport times may be tolerated where long pipe runs are required and local codes and standards permit.

Local codes and standards may also apply. For example:

1. NFPA 72 The Americas 120 Seconds
2. NFPA 76 The Americas 60 Second

5.1.3.2 Balance %

1. The balance is the ratio of lowest sampling hole flow rate to the highest, expressed as a percentage. The sampling hole balance for the pipe shall not be less than 60%.

5.2 System Commissioning

5.2.1 Detector commissioning

The detector shall incorporate a 7-inch color touch screen to allow full commissioning and programming of the detector without the need of additional hardware, software, or programmers.

5.2.2 Commissioning Tests

1. The contractor shall allow for the manufacturer's representative to attend commissioning of the entire installation in the presence of the owner and/or their representative.
2. All necessary instrumentation, equipment, materials and labor shall be provided by the Contractor.



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- 3 The Contractor shall record all tests and system configuration and a copy of these results shall be retained on site in the System Log Book.

5.2.3 System Checks

Visually check all pipes to ensure that all joints, fittings, bends, sampling points, SHMs, etc., comply with the Specification.

Check the system to ensure the following features are operational and programmed in accordance with the specification.

1. Alarm threshold levels (for both day and night settings),
2. Touchscreen operable
3. Time delays,
4. Pipes in use,
5. Detector address,
6. Display address where applicable,
7. Clock time and date,
8. Air flow fault thresholds,
9. IP Cameras viewable
10. Referencing
11. Check to ensure that all ancillary warning devices operate as specified.
12. Check interconnection with Fire Alarm Control Panel to ensure correct operation.

5.2.4 Final Tests

The contractor shall:

1. Introduce smoke into the detector assembly to provide a basic Go / No-Go functional test.
2. Verify that the transport time from the farthest sampling hole does not exceed the local code requirements using a transport time test while monitoring the CFS signal from the display.
3. Activate the appropriate Fire Alarm zones and advise all concerned that the system is fully operational. Fill out the logbook and commissioning report accordingly.

5.3 Maintenance and Service

5.3.1 Sample Filter

1. The detector shall incorporate a replaceable filter inline with pipe such as the RP7125 to remove large contaminants from the sampled air.
2. The filter shall be accessible by opening the cover.
3. Once accessible, the filter shall be removable and replaceable by hand without the need of a tool.



5.3.2 Spare Parts

1. The detector shall incorporate a replaceable Aspirator. The manufacturer's instructions for replacing the Aspirator shall be followed.
2. The detector shall incorporate a replaceable SCD Assembly. The manufacturer's instructions for replacing the SCD Assembly shall be followed.
3. The detector shall incorporate a replaceable, and recyclable, water cartridge. The manufacturer's instructions for replacing the water cartridge shall be followed.
4. The detector shall incorporate replaceable Front Covers. The manufacturer's instructions for replacing the Front Cover shall be followed.

