

ANALOGUE ADDRESSABLE FIRE ALARM SYSTEM

1. Scope of Work

The contractor shall supply, install, test and commission a modern Analogue Addressable Fire Detection and Alarm System of an approved manufacturer and design in accordance with the local civil defence requirements to protect the risk area set out in the drawings.

The contractor shall submit a complete proposal with schematic drawings, cause / effect logic chart, list of materials and original detailed catalogues of the equipment for consultant/client approval before starting the work.

The supplier and installer of the system should be approved by the local civil defence authority.

2. General

2.01 The system shall comprise the following:

- Main Fire Alarm Control Panel (FACP) with charger and batteries located at the entrance of the building.
- Automatic Field Devices (Smoke, Heat, Break Glass Unit etc.), manual call points, interface module and audible devices.

2.02 It shall be possible to monitor and control the fire alarm system from the repeater panel.

3. Functional Description

The system shall include the following system functions and operating features plus those additional functions and features required by the authorities having jurisdiction:

3.01 Priority of signals: Accomplish automatic response functions by the first device initiated. Alarm functions resulting from initiation by the first device are not altered by subsequent alarms. The highest priority is an alarm signal. Supervisory and trouble signals have a second-and third-level priority. Higher priority signals take precedence over signals with lower priority, even though the lower priority condition occurred first.

3.02 Non-interfering: Loop, power, wire, and supervise the system so a signal on one device does not prevent the receipt of signals from any other device. All devices are manually resettable from the FACP after the initiating device or devices are restored to normal.

3.03 Fire Alarm Control Panel (FACP) Response: The manual or automatic operation of an alarm-initiating or supervisory operating device causes the FACP to transmit an appropriate signal including the following:

- a. General alarm.

- b. Smoke or heat detector alarm.
- c. Valve temper supervisory.
- d. Elevators recall.
- e. Elevators shut down.
- f. System trouble.
- g. Fan shut down.

3.04 Silencing at the FACP Switches: Provide capability for acknowledgement of alarm, supervisory, trouble, and other specified signals at the FACP, and capability to silence the load audible signal and light-emitting diode (LED). Subsequent zone alarms cause the audible signal to sound again until silenced by switch operation. Restoring alarm, supervisory and trouble conditions to normal; extinguishes the associated LED and causes the audible signal to sound again until restoring restoration is acknowledged by switch operation.

3.05 Loss of primary power shall make the system operating on an alternate power supply.

3.06 Annunciation: Manual-automatic operation of alarm and supervisory-initiating devices is annunciated both on the FACP and on the repeater panel, indicating zone where device(s) is initiated.

3.07 General Alarm: A system general alarm includes the following:

- a. Indicating the general alarm condition at the FACP and the annunciator.
- b. Identifying the device and giving character label displaying the location of the activated device that is the source of the alarm at the FACP and the repeater panel via 4x20 character LCD.
- c. Initiating audible and visible alarm signals throughout the building as a general alarm of as sector or as required.
- d. Initiating elevators automatic recall.
- e. Stopping supply and return fans.

3.08 Manual station alarm operation initiates a general alarm condition.

3.09 Water-flow alarm switch operation shall initiate a general alarm.

3.10 Smoke detection initiates a general alarm.

3.11 Sprinkler valve tamper switch operation causes or initiates a fault signal at the FACP and the repeater.

3.12 Fire pump power failure, including a dead phase or phase reversal condition, causes or initiates a fault signal at the FACP and the repeater.

4. Control panel

(Analogue addressable) :

4.0.1 The control panel should be housed in a slim surface/semi-flush wall mounting cabinet, the panel should be membrane facia and switches should be of tactile type. The control panel should be LPCB approved to EN54 parts 2 and 4 and complies with EMC and LVD Directives.

- The system equipment shall be **CE tested and certified** and the CE marking shall appear on the packaging and/or included in the operating instructions.

The control panel should be user-friendly and the display should be clear, the panel should operate 1-4 loops with hardware addressing facility and the output per loop shall be 500 mA maximum with highly stable voltage platform – even under mains-failed conditions -, panel shall be windows based, full upload / download PC software package, panel should derive its power from an internal power supply. The internal power supply shall also provide battery back up facility in the event of mains failure.

The batteries shall be maintenance free sealed lead acid type.

The system shall provide two way communication between the control panel and each device on the loop(s).

4.02 The Fire System shall comprise a two-wire circuit (a loop) starting at and returning to the Fire Alarm Control Panel (FACP).

4.03 The loop shall be capable of monitoring and controlling a maximum of 126 addressable devices over a maximum loop distance of 2 kilometers.

4.04 It shall be possible to expand the panel with a minimum of 248 programmable alarms / relays and 248 programmable fire / non-fire panel inputs.

4.05 There shall be no predetermined order of polling devices. Each device will be polled in a sequence appropriate to site conditions. These sequences will be determined at the commissioning stage and the FACP shall have the facility to override the sequence in the event of any device initiating an alarm flag or interrupt onto the data stream.

4.06 Communication from the FACP to all field devices shall be provided by Voltage Pulse Position Modulation on the two wires used to supply DC power to the devices. Communication from field devices to the FACP will be in the form of Current Pulse Response of the order of 20mA amplitude on the two DC supply wires.

4.07 The FACP shall be capable of receiving and processing information from devices other than smoke and heat detectors, and will be capable of controlling external equipment, e.g., a sprinkler system, by means of interface units.

4.08 The FACP shall be able to identify each type of device connected to the loop, in order to protect against accidental installation of an inappropriate sensor.

- 4.09** The FACP shall be able to identify the absence of any device from the loop.
- 4.10** Short circuit isolators shall be fitted at a minimum of one per 20 field devices. The isolators will protect against short circuit faults by isolating the part of the loop, which has the fault, thus maintaining the function and integrity of the remainder of the loop.
- 4.11** The text display shall be a 4 x 20 character alphanumeric LCD display divided into an upper and lower half. Line 'one' of the upper half of the display shall provide device number, type of device and type of alarm. Line two shall be user definable. The lower half of the display is a repeat of the top half and is for indication of second and subsequent alarms. When more than two alarms are present; the cycle display indication shall pulse. The display shall also be used for Engineering functions.
- 4.12** The control panel shall be available with "plug in" individual loop cards, which can be subdivided into zones defined by the user. There shall be a maximum of 32 groups (zones) indication on the panel, which can be divided between the loops, as the user requires.
- 4.13** Each loop card shall be capable of providing 500mA current and shall maintain a minimum of 24 volts on the loop up to the full extent of the battery standby period.
- 4.14** The fire alarm control panel shall interrogate each addressable detection device and provide alarm indication within 3 seconds of a manual call point operation and 10 seconds for all other devices.
- 4.15** The fire alarm control panel shall have an event log capable of storing up to the last 200 events. These events shall be individually time and date stamped. It shall be possible to view and print the content of the event log.
- 4.16** Events shall be displayed in chronological order with the newest events first. It shall be possible to scroll through the events when viewed on the LCD display.
- 4.17** The fire alarm control panel shall be capable of disabling an individual detector, a group and or zone of for building maintenance purposes.
- 4.18** The fire alarm control panel shall have a facility to enable the user to easily change the time and date settings of the system 'real time' clock. It shall also be possible for the user to change the alpha-numeric text message by means of an additional QWERTY keyboard.
- 4.19** It shall be possible for the end user to perform a non-latching one person device test without sounder or cause/effect operation or access to the engineers' configuration menu.
- 4.20** The panel shall provide 32 indication zones with a minimum of 255 groups overall available for cause / effect programming. It shall be possible to allocate every loop and panel input in to at least 8 different groups for indication and cause / effect programming.

- 4.21 User controls shall be provided in the form of membrane push button switches. A printer shall also be mounted on the panel to provide a hard copy of all information that is shown on the LCD display.
- 4.22 Two fully monitored alarm outputs shall be provided.
- 4.23 All fire condition LED indication shall be reset from the control panel without removing power from the loop.
- 4.24 The address data for each device shall be stored in the base of smoke or heat detectors but there shall be no electronics or electronic components in the mounting bases of any field devices. These bases will have a coding feature fitted as a standard. The terminals for the supply/signal wires shall not be polarity sensitive.
- 4.25 Provision should be available in the control panel to connect an Alphanumeric repeater panel via an RS 485 output.
- 4.26 The cause/effect logic in the control panel should be programmable by the user.
- 4.27 It should be possible to isolate any detector/device from the control panel by software.
- 4.28 It should be possible to test the system using a 'One Man Test' mode. In this mode, on receipt of a fire signal the panel should sound the external alarms for 10 seconds and reset automatically.
- 4.29 The panel should be flexible with provision to expand the system in the future.
- 4.30 It should be possible to test the analogue output of each detector from the control panel without initiating an alarm.
- 4.31 The pre-alarm and fire alarm levels on the panel should be selectable.

5. Repeater Panel

- 5.01 An alphanumeric LCD repeater panel shall be located at the security/guard room. This should be connected to the main FAC panel located at the entrance of building using a 2-core cable if the slave panel powered from the local mains, or 4 cores if the slave panel is to be powered by the main control panel. This panel should repeat all the information displayed on the LCD display of the main control panel. The repeater panel shall have LCD display, Control keys, access switch and zonal LED's.

6. Specification of Analogue Detectors

Common Properties:

- 6.01** Detectors shall comply with and be type certified to prEN 54 (1997), Part 7 for smoke detectors and Part 5 for heat detectors.
- 6.02** Detectors shall be suitable for connection to a two-wire 24V (nominal) DC supply and will operate satisfactorily within a voltage range of 14 to 28V DC.
- 6.03** Detectors shall have five response modes, which cover a range of sensitivities and response times. The mode of each individual detector shall be set via the FACP during a polling cycle of the communication protocol defined in paragraph 5.06. The response mode of any detector may be changed via the FACP at any time.
- 6.04** Communication between detectors and the FACP shall be in the form using the communication protocol defined in paragraph 5.06. All circuits used in data communication shall be designed and manufactured by the original manufacturer and will be a complete and integral part of the detector.
- 6.05** If, within one second of last being polled by the FACP a detector reaches its own predetermined fire threshold the detector will place an alarm flag and its own address on the data stream to facilitate location by the FACP.
- 6.06** Each detector shall have a non-volatile memory, which will have areas capable of being written to and read from by the FACP, using the communication protocol. The memory will contain information and control data in the form of 8-bit bytes.
- 6.07** The FACP shall be capable of operating in three modes, normal, read and write. In normal mode, devices are polled in the order set at the time of system commissioning. In read mode, the FACP shall poll a device and write commands or data into the control or storage bytes in the device memory.
- 6.08** Information bytes, which shall be read-only to the FACP, will include fixed parameters (type code, month of manufacture of the device, approval data) and variable parameters (drift data and drift flag).
- 6.09** Control bytes, which the FACP can write to and read from, shall include a rapid compensation facility bit, sensitivity setting bit and an LED flashing control bit.
- 6.10** Four eight-bit bytes shall be provided for user data, which can be written to and read by the FACP. Such data could be test dates, servicing dates, site or location codes etc.
- 6.11** Detectors shall be capable of generating an alarm signal in the event of loss communication protocol (but not loss of power). This alarm will be a 500 μ Sec current pulse with a mark/space ratio of 1:3 and will be generating continuously for the duration of the alarm condition.
- 6.12** Each detector shall have its own mounting base, which, with the exception of isolating bases, will not contain any electronic components. Detectors will be capable of being locked into the bases to avoid unauthorised removal of the detector.

- 6.13 The loop address of detectors shall be set by inserting a coded plastic card into each mounting base, allowing up to a maximum of 126 unique address codes. The address will be a simple seven bit binary code, set at the time of commissioning. The detectors address card will be held in the base so that it cannot be accidentally removed with the detector. Each address card will provide a space visible from below when the detector is in place. The loop number and individual address or any other information can be written in the space.
- 6.14 Two alarms LEDs shall be provided on each detector. The LEDs will be controlled by the FACP, independently of the device. LEDs shall be capable of being reset by the FACP without removing power from the loop.
- 6.15 Provision shall be made for an output from each detector such that a remote indicator with a current limitation of 4mA at 5V DC may be operated. Switching of the remote indicator will be independent of the detector, and will be controlled by the FACP.
- 6.16 Detectors shall be capable of being remotely tested from the FACP by transmission of a single bit in the communication protocol. Detectors will respond by providing an analogue value in excess of the recommended fire threshold to indicate a healthy condition. The FACP will recognise this response as a test signal and will not raise a general alarm.
- 6.17 Detectors housing shall be moulded in pure white self-extinguishing polycarbonate, V-O rated to UL 94. Detectors will be unobtrusive when installed.

7. Optical (Photo-electric) Smoke Detector:

- 7.00 The following specifications are in addition to the common specifications of detectors and apply to optical (Photo-electric) smoke detectors only.
- 7.01 Optical smoke detectors shall be of analogue addressable, suitable for detection of visible products of combustion, and will be of the light scattering type using a pulsed internal infra-red LED and a silicon photodiode receiver.
- 7.02 The optical sensing chamber shall be configured such that the horizontal optical bench housing the LED emitter and sensor is arranged radially to detect forward scattered light.
- 7.03 Optical smoke detectors shall be capable of operating within the following environmental parameters:
 - Temperature range -20⁰C to +60⁰C (no condensation or icing)
 - Humidity 0%to95%RH (no condensation)
 - Wind speed No effect
 - Atmosph. Pressure No effect
- 7.04 Response Modes (Selected via the FACP)

Mode	%/m Alarm threshold	Minimum time to alarm (sec)	Compensation rate (Y/hr)
1	1.4	5	0.07
2	1.4	30	0.07
3	2.1	5	0.07
4	2.1	30	0.07
5	2.8	5	0.07

- 7.05** Smoke entry points shall be protected against ingress of dust and insects by corrosion resistant gauze.
- 7.06** The detector shall be capable of protecting an area up to 100 m² at a height of up to 10.5m when general limits apply, and up to 15m where rapid attendance limits are in operations.
- 7.07** Build up of drift or other environmental contamination on optical chamber may cause a variation in the analogue output from the detector. The detector shall apply compensation to this variation, and will record the level of compensation in non volatile memory. When drift compensation reaches a preset level, the detector will set the drift compensation flag, which the FACP will identify and initiate a visible signal to indicate that the detector is in need of service. The FACP shall, when one detector signals a high drift level, be capable of checking the non-volatile memory of other detectors to see if they are nearing a state where service is required.

8. Temperature (Heat) Detector:

- 8.00** The following specifications are in addition to the common specifications of detectors and apply to temperature (Heat) detectors only.
- 8.01** The temperature detectors shall be analogue addressable, suitable for detection of rate of rise of ambient temperature and fixed temperature threshold. Detection will be by means of single NTC thermistor.
- 8.02** The detector shall be capable of protecting an area up to 50 m² at a height of up to 13.5m using the maximum sensitivity setting.
- 8.03** Temperature detector shall be capable of operating within the following environmental parameters:
- Temperature range -20⁰C to +60⁰C (no condensation or icing)
 - Humidity 0%to95%RH (no condensation)
 - Wind speed No effect in fixed temperature mode.
 - Atmosph. Pressure No effect
- 8.04** Response Modes (Selected via the FACP)

	Fixed Temp.	Rate of rise alarm	Classifications
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Mode	Threshold (C°)	threshold from 25° C (ΔC°)	prEN 54-5 Other
1	57	$\Delta 26$	AIR UL 135F
2	61	$\Delta 26$	A2 UL 150F
3	61	n/a	A2S UL 150F
4	90	$\Delta 32$	CR UL 200F
5	90	n/a	CS UL 200F

9. **Manual Call Point (MCP):**

- 9.01** Manual call points shall be suitable for connection to a two wire 24V (nominal) DC supply and will operate satisfactorily within a voltage of 14 to 28V DC.
- 9.02** Each Manual call point on the loop shall have a unique address, set at the commissioning stage by means of a seven-segment DIL switch.
- 9.03** If a manual call point is activated it shall place an interrupt bit in the current polling cycle and will transmit it's address as the final seven bits of the protocol, but set all its other bits to 0. It will repeat this for a further seven polling cycles and thereafter revert to normal polling response and return an analogue value to 64.
- 9.04** The elapsed time between activation of the manual call point and initiation of the sounders in an alarm condition via command from the FACP shall not exceed 3 seconds to conform to BS 5839.
- 9.05** Manual call point shall contain electronics circuit similar to those in detection equipment, so that the communication protocol and fast response to the alarm state of the device are observed. The manual call point housing and electronic circuits will be supplied by the manufacturer of the detection and interface units.
- 9.06** A single alarm LED shall be provided on the manual call point. This LED will be controlled, independently of the device, by the FACP.
- 9.07** Manual call point shall be capable of operating within the following environmental parameters:
- Temperature range : -20°C to +60°C (no condensation or icing)
 - Humidity : 0%to95%RH (no condensation)
 - Wind speed : No effect
 - Atmosphere Pressure : No effect
- 9.08** Communication between the manual call point and the FACP shall be in the form using the communication protocol defined in paragraph 5.05. All circuits used in data communication will be designed and manufactured by the original manufacturer and will be a complete and integral part of the manual call point.
- 9.09** Manual call point shall be capable of being remotely tested from the FACP by transmission of a single bit in the communication port. The FACP will respond by providing an analogue value of 64 to indicate a healthy test condition. The

FACP shall recognise this response as a test signal and will not raise a general alarm.

9.10 The manual call point housing shall be a self-coloured red plastic moulding and will have dimensions not exceeding 87mm x 87mm x 52mm.

10. Alarm bell :

10.01 The alarm bells shall be of 6 inch diameter suitable for mounting direct to a wall or conduit box.

10.02 The bell gongs should be constructed of steel with bases molded in glass filled polypropylene.

10.03 The bell shall operate using a motor/solenoid and should be polarized.

10.04 The bells may be operated either from a separate alarm output in the control panel or via an interface on the loop.

10.05 The number of alarm bells used should be sufficient to produce a sound level of 65 dBA or 5 dBA above any other noise level likely to persist for a period longer than 30 sec.

11. Sounders :

11.01 The sounders shall be loop powered ie., powered & controlled via the loop by the control and indicating equipment.

11.02 The sounders shall have an output of 85 dB at 1 m.

11.03 The sounders shall be combined to use together with a beacon or detector if required .

11.04 The sounder shall operate at temperatures -20°C to +60°C.

12. Flasher:

12.01 The flashers shall be loop powered ie., powered & controlled via the loop by the control and indicating equipment.

12.02 The sounders shall be combined to use together with a beacon or detector if required .

12.03 The sounders shall meet the requirements of EN54, Part 3.

13. Isolators :

13.00 Isolators should be provided to protect the loop in the event of a short circuit fault.

13.01 Isolators should be fitted between each zone and at a maximum spacing of one per 20 devices so that in the event of a short circuit fault not more than 20 devices will be isolated.

14. Interface Unit:

14.00 Interface units shall be provided as required to monitor and/or control systems other than addressable equipment, such as sprinkler system.

14.01 The unit shall provide a voltage free, single pole, change over relay output and/or a single, monitored switch input.

Bill of materials:

SI No.	Description	Unit	Qty	Rate	Total
	Analogue Addressable Fire Alarm System : Supply, installation, testing and commissioning of a complete analogue addressable fire-alarm system as shown on the drawings & described in the specifications to the approval of the civil defence authority :				
1.	Analogue Addressable Fire alarm control panel with the required sealed lead acid batteries.	No.			
2.	Analogue addressable Optical smoke detector complete with base.	Nos.			
3.	Analogue addressable heat detector, complete with base.	Nos.			
4.	Isolator.	Nos.			
5.	Analogue addressable manual call-point.	Nos.			
6.	6" dia. fire alarm bell.	Nos.			
7.	Sounder.	Nos.			
8.	Flasher.	Nos.			
9.	Interface unit.	Nos.			
10.	Fireproof cable as approved by civil defence authority.	Lot	LS		
11.	Supply, installation, testing and commissioning of the above system with all necessary accessories as specified.	Lot	LS		