FIRE FIGHTING & ALARM INSTALLATION

SECTION 5 - ADDRESSABLE FIRE ALARM SYSTEM

5.1 General

The entire automatic fire alarm system shall be of microprocessor based for individual addressable function and with data communication capability to enable centralised monitoring and controlling of the system. The system shall comprise smoke detectors, heat detectors, manual call points, interfacing modules, alarm bells, Main Alarm Panel (MAP), Sub Alarm Panels (SAP), batteries and chargers, relays, all necessary wirings and software for a complete operable system as shown in this Specification and Drawings.

All equipment/components to be used for this system shall be listed/approved by a recognised institution. Documentary proof of such listing/approval shall be submitted to the Architect for review.

All main equipment and devices shall be produced by the same manufacturer. This applies particularly to detectors, manual call points, inter-facing modules, control units and central data processing equipment. System formed by equipment from different manufacturers will not be accepted.

The fire alarm system shall be installed in accordance with the latest edition of Singapore Standard CP 10: Code of Practice for the Installation and Servicing of Electrical Fire Alarm Systems and comply with all regulations, orders and requirements of the relevant Local Authorities. The Sub-Contractor shall be wholly responsible for the entire installation to meet these requirements.

The Sub-Contractor shall also be responsible for making necessary applications and arrangements with the Authorities concerned for the provision of a direct telephone line for alarm signal transmission to an approved monitoring station and all costs connected therewith for the full maintenance period are deemed to have been included in the Sub-Contract Sum.

5.2 System of Operation

The smoke detectors, heat detectors, manual call points and interfacing modules for sprinkler flow switches in the building are divided into zones and connected directly to the respective Class A individual addressable loops from the Main Alarm Panel (MAP).

The system of operation shall be such that a fire alarm shall be initiated by actuating any of the manual call points, smoke/heat detectors or sprinkler flow switches. Such actions shall then energise the buzzer at the MAP and the related SAP. The corresponding LED indicators at the Fire Mimic Board and the related SAP shall be lighted and the zone location as well as the point location of the device which activated the fire alarm shall be indicated on the LCD of the MAP in plain text form. At the same time, all the fire alarm bells in the building shall sound simultaneously and all interlocking control functions such as lift homing, fans control, etc. shall perform as required automatically.

The operation of fire alarm cut-off key switch at the MAP shall mute the buzzers and the alarm bells. However, the operation of the fire alarm cut-off key switch shall not cancel the visual indications on the MAP, Fire Mimic Board and related SAP. Visual indications shall be cancelled only when the circuit has been reset by a reset key switch on the MAP. In the event of receipt of a second or subsequent fire alarm during this period, the fire alarm bells and buzzers shall be energised again and the origin of the second and subsequent fire alarm shall be registered visually on the boards as before.

The entire fire alarm system shall be of the close circuit electrically supervised type so that should fault develops in any of the circuit, it will be detected immediately whereupon the fault

buzzers and corresponding LED indicators at the MAP, Fire Mimic Board and the related SAP shall be energised. The zone location as well as the point location of the fault and the type of fault shall be indicated on the LCD of the MAP in plain text form. A muting switch shall be incorporated at the MAP and the related SAP to enable the audible fault alarm to be cut-off but the visual fault alarm shall persist until the fault is cleared.

A silencing switch shall be provided and linked to the MAP for silencing all the fire alarm bells in the building when the Voice Communication System (provided by the Electrical Sub-Contractor) is in use; however the switch shall be effective only after the bells have operated initially for not less then one minute. Visual flashing signal shall be provided to indicate when this switch is operated.

A pre-setting time shall be incorporated in the MAP to automatically restore the sounding of the fire alarm bells after a pre-determine time period of between 0 - 3 minutes has elapsed.

Operation of the silencing switch during 'alarm' condition shall not cancel the visual indications of the alarm, nor shall it prevent the proper registration of subsequent alarms at the MAP.

Any changes of status, namely alarm, fault or abnormal mode occurred in the system shall be processed by the MAP and printed on the system logging printer as well as displayed in plain text form at the LCD in addition to all the abovementioned functions.

5.3 Smoke Detectors

Smoke detectors shall be of addressable solid state ionisation type suitable for installation in the intended environment. All smoke detectors shall meet the requirements of EN54 Pt.7 and have a sensitivity sufficient to be classified as 'B' or better in EN54 Pt.9.

The smoke detector shall be neat and compact in appearance, finished in light colour, suitable for ceiling mounting. It shall be installed in such a way that each may be readily withdrawn from the base for service or testing or replacement without affecting the effectiveness of the remaining detectors and installation. All smoke detectors shall be suitable for operation on 24 volt D.C. power supply.

All smoke detectors shall fit into a common standard type base and have a built-in LED which shall flash upon activation.

The type of smoke detector used shall be acceptable to Fire Safety and Shelter Department.

Analogue Smoke Detectors
Note: To specify only for analogue addressable systems.
30/11/95

The smoke detector shall be of analogue addressable type suitable for automatic compensation of signal deviation caused by contamination and ageing so that the detector shall be able to maintain its response behaviour for a long period of time.

5.4 Heat Detectors

Heat detectors shall be of addressable solid state type with combined rate-of-rise and fixed temperature response and be suitable for installation in the intended environment. The response sensitivity of the heat detector shall conform to EN54 Pt.5 as Grade 1 for normal application and EN54 Pt.8 for high temperature application.

The heat detector shall be neat and compact in appearance, finished in light colour, suitable for ceiling mounting. It shall be installed in such a way that each may be readily withdrawn from the base for service or testing or replacement without affecting the effectiveness of the remaining detectors and installation. All heat detectors shall be suitable for operation on 24 volt D.C. power supply.

All heat detectors shall fit into a common standard type base and shall have a built-in LED which shall flash upon activation.

The type of heat detector used shall be acceptable to Fire Safety Bureau.

Analogue Heat Detectors
Note: To specify only for analogue addressable systems.
30/11/95

The heat detector shall be of analogue addressable type suitable for automatic compensation of signal deviation caused by contamination and ageing so that the detector shall be able to maintain its response behaviour for a long period of time.

5.5 Addressable Interfacing Modules

Addressable Interfacing Module shall be used for the interfacing of external signal, i.e. flow switches, pressure switches, etc. with the individual addressable loop.

It shall be able to connect directly along the individual addressable loop.

The Addressable Interfacing Module shall have a built-in LED which shall flash upon activation.

5.6 Isolator Modules

Isolator modules shall be used to isolate wire-to-wire short circuits on an addressable loop to limit the number of devices/detectors that are incapacitated by the short circuit fault. Upon correction of the short circuit, the isolator modules shall automatically re-connect the isolated section of the addressable loop.

Isolator modules shall be provided in the addressable loops such that the failure or short circuit in one alarm zone shall not affect another alarm zone. Isolator modules shall also be provided before the first device and after the last device on the addressable loops to protect the module card from being damaged by power surge due to short circuits in the addressable loops.

The indicator module shall have a built-in LED which shall flash upon activation.

All activation of isolator module shall generate a fault alarm at the MAP and respective SAP.

5.7 Addressable Manual Call Points

Manual call points shall be fixed at a height of 1,400 mm above floor level and shall be of individual addressable type suitable for direct connection to the Class A individual addressable loop. It shall be neat and compact in appearance suitable for flush and/or surface mounting and finished in signal red colour with bold lettering inscribed 'FIRE ALARM - IN CASE OF FIRE BREAK GLASS'.

All addressable manual call points shall comply with the requirements of BS 5839 Pt.2.

It shall be able to test for alarm at the addressable manual call point without opening the call point cover or breaking the glass.

Manual call points to be installed at positions which are exposed to outdoor climate shall be of weatherproof type.

5.8 Alarm Bells

Fire alarm bells shall be the weatherproof type suitable for wall mounting at ceiling height and shall comprise a gravity cast aluminium base with tapped 20 mm E.T. entry containing a single bobbin movement, having enamelled copper wire wound for continuous operation on 24 volt D.C. supply and provided with phosphor bronze armature and contact springs, heavy duty silver contacts, two pole terminal block and 150 mm diameter harden steel strident tone type gong painted to signal red in accordance with SS CP10.

The sounding of bell shall be of a general alarm basis. Push button for actuation of bells shall be provided.

5.9 Main Alarm Panels

5.9.1 General

The Main Alarm Panel (MAP) shall be micro-processor based type with software contained in non-volatile memory.

It shall be of modular design by means of plug-in cards onto a single motherboard to allow ease of maintenance and future system expansion.

The MAP shall be suitable for use in individual addressable system with possibilities to increase the number of the individual addressable loops by means of additional plug-in cards. The integration of additional individual addressable loops shall not involve changes in the existing modules.

The micro-processor shall be capable of performing continuous scanning of all the individual addressable loops simultaneously. The time to complete the scanning of all the addressable points within each of the individual addressable loop shall be less than 2 seconds.

All sensing devices such as detectors, manual call points, interfacing modules etc. shall be connected along the Class A addressable loop disregard of the nos. of zones which shall be formed by programming at the MAP. The number of individual addressable loops required shall be determined by the Sub-Contractor on the condition that each loop shall have a spare capacity for connecting 15 additional individual addressable points for each floor. The same loop shall be restricted for connecting of individual addressable points on the same floor.

Forming of zones within each loop shall be done by means of programming keypad which forms part of the MAP. Numbers of software programmable zone provided must be corresponding to the Specification drawings. Each software zone shall be able to provide a potential free zone alarm output when required.

The MAP shall have provisions for connections to a Colour Graphics Display and Control System.

The modular design of the MAP shall be such that it consists of minimum two major autonomous modules, i.e. Central Processing Module and Main Mimic Module. This shall thus enable the failure of either one of the module to be detected by the other module and thus giving off an audible and visual alarm to the operator.

All user data shall be stored in non-volatile memory or RAM with minimum 22 hrs of battery back-up to maintain the user data in case of total power failure or when any of the module card is removed.

All outputs for signalling or interlocking control functions shall be freely programmable via the programming keypad.

The MAP shall contain software function for continuous scanning of fault with self-diagnosis. The type of fault shall be indicated at the LCD by means of plain text.

The casing for the indicator board shall be dust-proof wall mounted type fabricated from sheet steel of suitable thickness with hinged lockable door upon which are mounted the indicator lamps and all other external control.

All metal work shall be treated against corrosion, painted with primer, undercoat and finished outside with signal red glazed enamels.

Wiring shall be neatly bundled and secured by means of self-locking nylon cable ties. Cable terminations involving different voltages shall be properly segregated and labelled.

Analogue Main Alarm Panels
Note: To specify only for analogue addressable systems.
29/10/09

The MAP shall have the intelligence to process the analogue signal from the detectors and perform automatic compensation of signal deviation caused by contamination and ageing of the detectors. The amount of compensation shall be limited up to a certain threshold value whereupon this value is reached; the MAP shall prompt the operator to perform servicing on the detector(s) involved.

The MAP shall have the intelligence to give a pre-alarm signal to the operator based on the analogue signal from the detectors.

The pre-alarm shall be confined to the operators only and shall not actuate any general alarm until the actual alarm conditions have been reached.

5.9.2 Signal Display and Control Functions

The following indications shall be provided at the MAP:

* All system status signals shall be displayed by LCD in plain text. The signals to be displayed includes:

(a) Current day, month, year and time

(b) Current status summary for:

(i) nos. of alarm remains in system
(ii) nos. of fault remains in system
(iii) nos. of zone isolated
(iv) nos. of zone in test mode

(c) Display of zone and point fault condition with minimum 32 characters space for description of zone location and minimum 32 characters space for description of point location.

(d) Display of alarm signal with minimum 32 characters space for description of zone location and minimum 32 characters for description of point location.

(e) Display of guided text for system programming functions.

(f) The characters display on the LCD shall be in black with background colour in YELLOW or WHITE for easy reading.

* The following master LED indications shall be provided:

(a) 'System on' with green LED

(b) 'Master fault' in yellow LED

(c) 'Part of system off' in yellow LED

(d) 'Detector zone off' in yellow LED

(e) 'Detector test' in yellow LED

(f) 'Emergency power' in yellow LED

(g) 'Alarm' word display in red

(h) 'Fault' word display in yellow

The following control functions shall be provided for the MAP:

* Alarm acknowledgement key switch

* Alarm reset key switch

* Function buttons to recall details of current status

* Key-pad for the following functions:

(a) Entering of passwords

(b) Programming and editing of user data

(c) To perform lamp test

(d) To isolate entire zone

(e) To isolate a point or points within zone

(f) To switch zone to test mode

(g) To simulate zone alarm or fault condition

(h) To enquire for fault diagnosis functions

5.9.3 Programming Functions

The MAP shall provide sufficient programmable outputs to perform the required control functions. Isolation switch shall be provided for manual isolation of the control function during servicing or testing of the system.

The following function buttons shall form part of the MAP:

* A latching type push button and relay circuit to enable manual starting of the smoke stop lobby fan, smoke extract fan, staircase pressurisation fan and carpark ventilation fan, wet riser pump, sprinkler pump and hosereel pump.

* A red push button for manual actuation of the alarm bells.

The MAP shall be capable to perform the following programming functions via an integrated keypad which form part of the MAP:

* To create zones within each addressable loop.

* To form cross zoning arrangement between zones.

* To programme any zone for pulse memory operation.

* To define priority level of individual zone.

* To define access password.

* To define delay time for fault signal upon AC power failure to prevent unnecessary fault message while the emergency generator is being started.

* To assign activation of individual output contact to perform specific control functions in relation to the actuation of alarm zones.

* To programme timing of alarm organisation.

* To define type of addressable loops.

Analogue Main Alarm Panels
Note: To specify only for analogue addressable systems.
29/10/09

* To define the threshold value for detectors' automatic compensation and pre-alarm level.

5.9.4 Main Mimic Module

The Main Mimic Module shall be of micro-processor based with sufficient outputs including 30% spare capacity shall be provided to fulfil the specified requirements.

The operation of the Main Mimic Driver shall be totally autonomous and consist of its own hardware and software such that in case of failure in the Central Processing Module, the Main Mimic Module shall remain fully operational and is able to produce an audible and visual alarm of the fault.

All outputs of the Main Mimic Module shall be freely programmable to the assigned LED indicator and it shall be possible to program for individual zone to an output or a combination of zones to an output.

Different mode of indication shall be provided to identify new incoming signal and acknowledged signal. The new incoming signal shall cause the appropriate LED indicator to flash and acknowledged signal shall be indicated by steady LED indicator.

The Main Mimic Module shall consist of the following functions:

(a) Programmable micro-processor

(b) LED indicator driver output module

(c) Lamp test device

(d) Connected to power supply with stand-by batteries

5.9.5 Main Control Module

Main Control Module shall be used to perform the automatic control of other services during fire alarm condition such as lift homing, activation of staircase pressurization fans, smoke-stop lobby fans. etc.

The Main Control Module shall be micro-processor based and consist of its own hardware and software to enable its autonomous operation despite of failure of the Central Processing Module. It shall provide sufficient numbers of programmable inputs and outputs to fulfil the requirements of the specification and drawings including 30% spare capacity for future usage.

All outputs shall be freely programmable to provide appropriate fire alarm signals by 'Voltage Free' normally open contacts. The contact rating shall be less than 40mA/Vdc.

All input shall be freely programmable for connection of external contact to provide status monitoring signal at the Fire Mimic Board in the Fire Command Centre to confirm the intended control function is carried out.

Manual push buttons shall be provided at the MAP to provide manual actuation to each system with the following functions. The manual push buttons shall be designed and arranged such that the function of each push buttons is clearly indicated and shall not cause any confusion to the operator to avoid false manipulation of commands.

5.9.5.1 Lift Homing

In the event of any fire alarm, a signal from the MAP (normally open or normally close contact) shall be made available in the lift machine rooms for each group of lifts to initiate the emergency homing of lifts. The Sub-Contractor shall supply and install one set of signal cable (1 x 2.5mm²/2C PVC cable in conduit) to each of the lift machine rooms.

The Sub-Contractor shall liaise with the Lift Sub-Contractor for exact requirements in order to fulfil this function and shall terminate the signal in the Fire Alarm Contactor Panel (FACP) adjacent to the Lift Control Panel for final connection by the Lift Sub-Contractor. The connections between the MAP and the FACP shall be electrically supervised.

5.9.5.2 Fan Control

In the event of any fire alarm, a signal (normally open contact) shall be made available to initiate the operation of each system of the staircase ventilation/pressurisation fans and smoke-stop lobby ventilation fans.

The Sub-Contractor shall supply and install one set of signal cable (1 x 2.5 mm²/2C PVC cable in conduit) to each fan and shall terminate the signal cables in the Fire Alarm Contactor Panel (FACP) adjacent to the Subsidiary Contractor Panel (SCP) for final connection by the Air Conditioning & Ventilation Installation (ACVI) Sub-Contractor.

5.9.5.3 Smoke Control System

In the event of any fire alarm, a signal (normally open or normally close contact) shall be made available to trip all AHUs serving the smoke control areas and to initiate the operation of each system of smoke extract fans, automatic smoke dampers, etc.

The Sub-Contractor shall supply and install one set of signal cable (1 x 2.5 mm²/2C PVC cable in conduit) to each AHU, fan, damper, etc. and shall terminate the signal cables in the Fire Alarm Contactor Panel (FACP) adjacent to the Subsidiary Control Panel (SCP) for final connection by the Air Conditioning & Ventilation Installation (ACVI) Sub-Contractor.

5.9.5.4 Automatic Sliding Doors

Where automatic sliding doors are installed a signal shall be made available to the doors to hold these doors in the open position in the event of any fire alarm.

The Sub-Contractor shall supply and install one set of signal cable (1 x 2.5 mm²/2C PVC cable in conduit) to each door and shall terminate the signal cables in the Fire Alarm Contactor Panel (FACP) above each door for final connection by the other Sub-Contractor.

5.9.5.5 Gas Solenoid Valve Control

In the event of any fire alarm, a signal shall be made available to the gas solenoid valves to shut off the gas.

Status of the gas solenoid valves shall be indicated clearly with LED indicators on the Fire Mimic Board. The designation and location of the solenoid valves shall be clearly indicated at the appropriate LED indicators.

The Sub-Contractor shall supply and install one set of signal cables (3 x 2.5 mm²/2C PVC cables in conduit) to each valve to provide the fire alarm signal and also to monitor the status of the valve.

The signal cable shall be terminated in the Fire Alarm Contactor Panel (FACP) near the gas control panel for final connection by the other Sub-Contractor.

5.9.5.6 Interfacing Signal to Computer-Based Control System

Interfacing signal contacts with the Computer-Based Control System shall be provided and all contacts shall be freely programmable.

The Sub-Contractor shall liaise with the respective Sub-Contractor and provide all the necessary information to ensure satisfactory interfacing between the two systems.

5.9.6 Sub Alarm Panel (SAP)

Sub-Alarm Panel shall be provided as shown in the Specification Drawings. The SAP shall be constructed in the form of a mimic showing the floor layout in reduced scale with built-in LED indicators for indicating the alarm status of each individual addressable point. The mimic shall be of suitable perspex with colour and reversed engraved diagram.

The signal to drive the corresponding LED indicator of the mimic board shall be derived from the respective MAP via data transmission line. Hardwire method will not be accepted.

The SAP shall consist of metal housing with lockable door. Details of the SAP and mimic layout shall be reviewed by the Architect.

The SAP shall be provided with an alarm acknowledgement key switch and lamp test button.

Each SAP shall be autonomous (independent) in its operation such that it will not be affected by failures in other SAPs.

5.9.7 Fire Alarm Signal Transmission Module

Transmission Module shall be used to send an alarm signal to an approved monitoring station via a direct telephone line.

The Transmission Module shall be of a code-wheel transmitter or other suitable relays and include facilities for line testing and line isolation during system testing.

The Transmission Module shall be housed within a separate tamper proof box or housed within the Main Alarm Panel.

5.10 Fire Mimic Board

The Fire Mimic Board shall indicate the following status by means of built-in LED indicators:

(a) Alarm from Detectors at each floor

(b) Alarm from Manual Call Points at each floor

(c) Alarm from Sprinkler Flow Switches

(d) Alarm from Gas Extinguishing System (if any)

(e) Fault from Detectors at each floor

(f) Status of Gas Solenoid Valves

(g) Alarm from Sprinkler Control Valve (valve operation status)

(h) Fire Pumps Status (ON/OFF/Fault)

(i) Fire Fighting Water Tank Status (High/Low)

(j) Master Fault for MAP

The Fire Mimic Board shall display the above status on a sectional elevation of the building. The final arrangement of the Fire Mimic Board shall be submitted to the Architect for review before fabrication.

The Fire Mimic Board shall be mounted onto a supporting frame with a metal housing suitable for wall mounting. The facial of the Fire Mimic board shall be of aesthetically pleasing design with reversed engraved silk screen printing with minimum of 5 different colours on suitable perspex.

Lamp test function shall be provided for testing of all LED indicators of the Fire Mimic Board.

The LED indicators shall be driven by the Main Mimic Module of which the outputs are freely programmable.

5.11 System Logging Printer

The System Logging Printer shall log the following change-of-status signals with time and date for each individual event:

(a) Alarm messages

(b) Fault messages

(c) Status messages (i.e. zone isolated, zone test, etc)

(d) Description of related alarm location in area, building, floor and room

Each message shall be printed in maximum two lines and shall contain a reduced plain text related to the type and location of the event and descriptions of operator activities.

Each alarm message printout shall be distinguished from the messages either by different type of text size, font and/or colour.

Each alarm message printout shall contain the following information:

(a) Time and date of event

(b) Type of alarm

(c) Origin of alarm

(d) Description of related alarm location in area, building, floor and room

The printer shall be of 24 pin dot matrix type with 80 or 132 characters per line and minimum printing speed of 180 characters per second in draft mode. An audible alarm shall be generated upon end of paper and printer off-line.

5.12 D.C Power Supply Units

Independent D.C. power supply units shall be provided for MAP, Fire Mimic Board, etc. Each D.C power supply unit shall comprise 24 volt nickel cadmium batteries of sufficient capacity such that it is capable of maintaining the standing loss or losses of the portion of the system for at least 72 hours plus the maximum alarm load for at least one hour. For each D.C. power supply unit, a proprietary make fully automatic two rate battery trickler charger (constant voltage type) comprising double-wound vacuum impregnated transformer, full-wave bridge connected rectifier and relays, etc. shall be provided to keep the batteries fully charged under all condition of service for all the panels.

The battery and charger shall be supplied complete with HRC fuse distribution board, first grade MISC ammeters to read D.C. charging current and D.C. load current, D.C. voltmeter marked to indicate both float and boost charge voltages, mains on indicating lamp, non-locking load test switch and suitable rates test load with the voltmeter scale clearly marked in red showing the terminal voltage considered desirable when feeding the test load, float/manual selector switch, battery charger failure alarm, battery cut-off alarms, battery earth leakage detector, engraved instruction labels for manner and duration of test labels, all necessary cable connections etc. and these items shall be mounted in the top compartment of the unit concerned or in the associated Main Alarm Panel. The compartment housing the batteries shall be fitted with vermin proof louvres at the front plate. The internal shall be fully lined with formica or other materials against corrosive elements from the batteries.

The D.C. power supply unit shall be the floor standing type and shall be provided for the Main Alarm Panel (MAP) and its associated equipment. The unit may be integrated to form part of the Main Alarm Panel in separate compartments.

5.13 Testing Unit

One set of portable testing unit shall be provided to enable any detector to be tested. The testing unit shall be designed and calibrated to suit the detectors installed.

5.14 Wiring System

All wirings shall be enclosed in conduit run in the following manner:

(a) Wiring within false ceiling spaces, riser ducts, electrical switchrooms, sub-stations, and mechanical plantrooms shall be in surface mounted G.I. conduits.

(b) Wiring for all other areas shall be in heavy duty UPVC concealed conduits to be chased in wall cast in columns/concrete slabs, etc.

(c) Where part of the conduit run is on surface and part concealed, then the entire run shall be of G.I. conduit to assure electrical continuity.

Fire alarm circuits shall be separated from other circuit runs and conduit/trunking for fire alarm system shall not in any circumstances contain wiring other than that associated with the fire alarm system. Wiring shall be multi-strand of sizes to suit the system but shall not be less than 1.5 sq. mm section, of high conductivity copper wire insulated with 450/750 volt grade PVC to BS 6004 or SS 50.