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SECTION 16720
FIRE ALARM SYSTEM

PART 1 GENERAL

1.01 SCOPE & RELATED DOCUMENTS

- A. The work covered by this section of the specifications includes furnishing all labor, equipment, materials and performance of all operations associated with the installation of the Fire Alarm System as shown on the drawings and as herein specified.
- B. Comply with Section 16010-General Electrical Requirements
- C. The complete installation shall conform to the applicable sections of NFPA 72, NFPA 101, Local Code Requirements, ADA Requirements and the National Electrical Code with particular attention to NFPA 70, Article 760 and the Portland Fire Alarm Ordinance.
- D. Appendix A – SideBand Systems Report

1.02 QUALITY ASSURANCE

- A. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.
- B. All control equipment shall have transient protection to comply with UL864 requirements.
- C. Where Fire Alarm circuits leave the building, additional transient protection shall be provided for each circuit. Devices shall be UL listed under standard #497B (Isolated Loop Circuit Protectors).
- D. (Option) In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications and all circuits must be marked in accordance with NEC article 760-23.

1.03 GENERAL

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans; to be wired, connected and left in first class operating condition. Include sufficient control panel (s), annunciators (s), manual stations, automatic fire detectors, smoke detectors, alarm indicating appliances, wiring, termination's, electrical boxes, and all other necessary material for a complete and operational system.
 - 1. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of on site programming to accommodate system expansion and facilitate changes in

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operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

Full flexibility for selective input/output control functions based on ANDing, ORing, Noting, timing, and special coded operations shall also be incorporated in the resident system software program.

- B. Resident software shall allow for full configuration of initiating circuits so that additional hardware shall not be necessary to accommodate changes in; for instance, sensing of normally open contact devices to sensing of normally closed contact devices, or from sensing of normally open contact devices to sensing a combination of current limited and non-current limited devices on the same circuit and being able to differentiate between the two, or changing from a non-verification circuit to a verification circuit or vice-versa.
- C. Submit shop drawings and product data under provisions of Section 01300.
- D. Provide wiring diagrams, data sheets, equipment ratings, battery backup, calculations, layout, dimensions, and finishes.
- E. Submit manufacturer's installation instructions under provisions of Section 01300.
- F. Submit manufacturer's certificate under provisions of Section 16010 that system meets or exceeds specified requirements.
- G. Resident software shall also allow for configuration of indicating appliance and control circuits so that additional hardware shall not be necessary to accommodate changes in, for instance changing a non-coded indicating appliance circuit to a coded circuit, or from a slow march time (20 BPM) to a fast march time (120 BPM).
- H. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history.
- I. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacture's name on each component.

1.04 OPERATION

- A. A system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch shall be as follows:
 - 1. All audible alarm indicating appliances shall:
 - a. (Sound a continuous fire alarm signal until silenced by the alarm silence switch at the control panel (or at the remote annunciator) .)
 - b. (Sound a march time pattern until silenced by the alarm silence switch at the control panel (or at the remote annunciator).)
- B. Alarm indicating appliances shall operate selectively by floor in accordance with NFPA 72.

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1. Any subsequent alarm shall reactivate the alarm indicating appliances
 2. All doors normally held open by door control devices shall release
 3. A supervised signal to notify the local fire department or an approved central station shall be activated
 4. The mechanical controls shall activate the air handling systems in accordance with NFPA 90
- C. The control panel:
1. A “positive feedback” input shall be provided to indicate true “on” or “off” status from a contact closure of the air handling system. This positive feedback indication shall take precedence in determining true on/off status
 2. Supervised “positive feedback” inputs shall be provided to indicate true “on” and “off” status from designated contact closures in the air handling system. This positive feedback indication shall take precedence in determining true “on/off” status.
 3. PROVISIONS MUST BE MADE FOR NORMALLY OPEN CONTACTS IN THE AIR HANDLING SYSTEM (E.G. SAIL SWITCHES, PRESSURE DIFFERENTIAL SWITCHES, LIMIT SWITCHES) TO BE FURNISHED AND INSTALLED BY THE MECHANICAL CONTRACTOR AND WIRED BY THE ELECTRICAL CONTRACTOR
- D. The alarm shall be displayed on an 80 character LCD display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The system alarm LED shall flash on the control panel (and the remote annunciator) until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel (and remote annunciator). The LCD display shall show the new alarm information
- E. A pulsing alarm tone shall occur within the control panel (and the remote annunciator) until the event has been acknowledged
- F. The alarm activation of any elevator lobby smoke detector shall, in addition to the operations listed above cause the elevator cabs to be recalled according to the following sequence
1. If the alarmed detector is on any floor other than the main level of egress, the elevator cabs shall be recalled to the main level of egress.
 2. If the alarmed detector is on the main egress level, the elevator cabs shall be recalled to the predetermined alternate recall level as determined by the local authority having jurisdiction.
- G. If, within one (1) minute after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within one minute the system shall resume normal operation. The Alarm Verification shall operate only on smoke detector

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alarms. Other activated initiating devices shall be processed immediately. The alarm verification operation shall be selectable by zone.

1. The control panel shall have the capability to display the number of times (tally) a zone has gone into a verification mode. Should this smoke verification tally reach a pre-programmed number, a trouble condition shall occur.
 2. Alarm verification zones shall be able to be divided into eight separate groups whereby only verification zones from the same group will confirm the first activation and cause the alarm sequence to occur
- H. The control panel shall have a dedicated supervisory service Led and a dedicated supervisory service acknowledge switch .
1. The activation of any standpipe or sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the control panel (and the remote annunciator). Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided
 - a. Pressing the Supervisory Service Acknowledge Key shall silence the supervisory audible signal while maintaining the Supervisory Service LED “on” indicating the off-normal condition
 - b. Restoring the valve to the normal position shall cause the Supervisory Service LED to extinguish, indicating restoration to normal
 - c. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse indicating the restoration to normal position. The Supervisory Service Acknowledge Key shall silence the audible signal.
 2. A manual evacuation (drill) switch shall be provided to operate the alarm indicating appliances without causing other control circuits to be activated. However, should a true alarm occur, all alarm functions would occur as described previously
 3. Activation of an auxiliary bypass switch shall override the selected automatic functions.
 4. The system shall have a single key that will allow the operator to display all alarms, troubles and supervisory service conditions including the time of each occurrence
 5. All doors normally held open by door control devices shall release upon AC power failure
 6. The actuation of the “enable walk test” program at the control panel shall activate the “Walk Test” mode of the system which shall cause the following to occur:
 - a. The city circuit connection shall be bypassed
 - b. Control relay functions shall be bypassed
 - c. The control panel shall show a trouble condition
 - d. The alarm activation of any initiation device shall cause the audible signals to

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activate for two seconds

- or -

The alarm activation of any initiation device shall cause the audible signals to code a number of pulses to match the zone number.

- a. The panel shall automatically reset itself after signaling is complete.
- b. Any momentary opening of an initiating or indicating appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating a trouble condition.
- c. The system shall have capacity of 8 distinctive walk test groups. Such that only a portion of the system need be disabled during testing.

1.04 SUPERVISION

- A. The system shall contain independently supervised initiating device circuits. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.
- B. There shall be supervisory service initiation device circuits for connection of all sprinkler valve supervisory (tamper). Device activation shall cause a supervisory alarm at the control panel.
- C. There shall be independently supervised and independently fused indicating appliance circuits for alarm (horns) (bells) and (chimes) speakers: as required (and flashing alarm lamps). Disarrangement conditions of any circuit shall not affect the operation of other circuits.
- D. Auxiliary manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off Normal" system trouble.
- E. Each independently supervised circuit shall include a discrete LCD readout to indicate disarrangement conditions per circuit.
- F. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the control panel (and the remote annunciator). A green "power on" LED shall be displayed continuously while incoming power is present.
- G. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel (and the remote annunciator).
- H. The System Modules shall be electrically supervised for module placement. Should a module become disconnected the system trouble shall illuminate and the audible trouble signal shall sound.
- I. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

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- J. Wiring to a hardwired (non-serial) remote annunciator shall be supervised for open and ground conditions. A separate annunciator trouble LCD Readout must be provided. It shall illuminate and an audible trouble signal shall sound at the control panel upon the detection of an open or ground condition.

1.06 POWER REQUIREMENTS

- A. The control panel shall receive 120 VAC power (as noted on the plans) via a dedicated fused disconnect circuit.
- B. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode to comply with NFPA. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic.
- C. All external circuits requiring system operating power shall be 24VDC and shall be individually fused at the control panel.

PART 2 PRODUCTS

2.01 FIRE ALARM CONTROL PANEL

- A. System Manufacturers shall be Simplex Grinnell, Notifier, Edwards, Gamewell or approved equal
- B. Control Panel construction shall be modular with solid state, microprocessor based electronics. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions.
 - 1. A local audible device shall sound during Alarm, Trouble or Supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible device shall also sound during each keypress to provide an audible feedback to ensure that the key has been pressed properly
- C. The following Primary Controls shall be visible through a front access panel
 - 1. Eighty Character liquid crystal display
 - 1. Individual red system alarm LED
 - 2. Individual yellow supervisory service LED
 - 3. Individual yellow trouble LED
 - 4. Green "power on" LED
 - 5. Alarm Acknowledge key
 - 6. Supervisory Acknowledge key
 - 7. Trouble Acknowledge key
 - 8. Alarm Silence key
 - 9. System Reset key
- D. The control panel shall provide the following
 - 1. Display of time and date
 - 2. LED testing

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3. Alarm, trouble, and abnormal conditions listing
 4. Enabling and disabling of each monitor point separately
 5. Activation and deactivation of each control point separately
 6. Changing operator access levels
 7. Walk test enable
 8. Running diagnostic functions
 9. Displaying software revision level
 10. Displaying historical logs
 11. Displaying card status
 12. Point listing
- E. For maintenance purposes the following list shall be available from the point lists menu
1. All points list by address
 2. Monitor point list
 3. Signal/speaker list
 4. Auxiliary control list
 5. Feedback point list
 6. Pseudo point list
 7. LED/switch status list - Scrolling thru menu options or lists shall be accomplished in a self-directing manner in which prompting messages shall direct the user. These controls shall be located behind an access door.
- F. Primary Keys, LED's and LCD Display
1. The Control Panel shall have a 2 line x 40 character liquid crystal display which shall be backlit for enhanced readability. So as to conserve battery standby power, it shall not be lit during an AC power failure unless an alarm condition occurs or there is keypad activity
 2. The display shall support both upper and lower case letters. Lowercase letters shall be used for softkey titles and prompting the user. Uppercase letters shall be used for System Status Information. A cursor shall be visible when entering information

2.02 SYSTEM FRONT PANEL OPERATION AND CAPABILITIES

- A. Under normal conditions the front panel shall display a "System is Normal" message and the current time and date
- B. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions
- C. The LCD shall display the following information relative to the abnormal condition of a point in the system
1. 40 character custom location label
 2. Type of device (i.e. smoke, pull station, waterflow)
 3. Point status (i.e. alarm, trouble)
- D. Two methods of acknowledgment for each abnormal condition shall be provided. One may be chosen depending on the NFPA requirements

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E. For NFPA 72 requirements

1. Pressing the appropriate acknowledge button shall display the first unacknowledged condition in the appropriate list (either alarm, supervisory or trouble), and require another acknowledge button. Press to acknowledge only the displayed point

- or -

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1. For NFPA 72 requirements:

- a. Pressing appropriate acknowledge button shall globally acknowledge every point in the list.
 - b. These acknowledge functions may be password protected if the user is insufficient privilege to acknowledge such conditions. A message shall indicate insufficient privilege but allow the user to view the points without acknowledging them. Should the user have sufficient privilege to acknowledge, a message will be displayed informing the user that the condition has been acknowledged
2. After all points have been acknowledge, the LEDs shall glow steady and the Sonalert will be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be indicated by an end of list message "END of LIST"

F. Alarm Silencing

- a. Should the "Alarm Silence" button be pressed all alarm signals shall cease operation
- b. Signals shall not be silenced during alarm silence inhibit mode

G. System Reset

1. The SYSTEM RESET button shall be used to return the system to its normal state after an alarm condition has been remedied. The LCD display shall step the user thru the reset process with simple English Language messages. Messages, "SYSTEM RESET IN PROGRESS", will first be displayed followed by the message, "SYSTEM RESET COMPLETED", and finally, "SYSTEMS IS NORMAL", should all alarm conditions be cleared
2. Should an alarm condition continue to exist the message, "SYSTEM RESET IN PROGRESS", shall be followed by the message, "SYSTEM RESET ABORTED", and the system shall remain in an abnormal state. System control relays shall not reset. The Sonalert and the Alarm LED shall be on. The display shall indicate the total number of alarms and troubles present in the system along with a prompt to use the ACK keys to review the points. These points shall not require acknowledgment if they were previously acknowledged
3. Should the Alarm Silence Inhibit function active the (SYSTEM RESET) key press

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shall be ignored. The message, "SYSTEM RESET INHIBITED", shall be displayed for a short time to indicate the action was not taken. As feedback to the operator, the message "SYSTEM RESET NO LONGER INHIBITED" shall be displayed when the inhibit function times out

H. The following status data shall be available

1. Primary State of point
2. Zone, PID and Card type information
3. Class "A" Status
4. Current priority of outputs
5. Disable/Enable status
6. Verification tallies of initiating devices
7. Automatic/Manual Control Status of output points
8. Acknowledge status
9. Relay Status

I. History Logging

1. The system shall be capable of logging and storing 300 events in an alarm log and 300 events in a trouble log. These events shall be stored in a battery protected random access memory. Each recorded event shall include the time and date of that event's occurrence.
2. The following Historical Alarm log events shall be stored:
 - a. Alarms
 - b. Alarm Acknowledgment
 - c. Alarm Silence
 - d. System Reset
 - e. Alarm Historical log cleared
3. The following Historical Trouble log events shall be stored
 - a. Trouble conditions
 - b. Supervisory alarms
 - c. Trouble acknowledgment
 - d. Supervisory acknowledgment
 - e. Alarm Verification Tallies
 - f. Walk Test results
 - g. Trouble Historical log cleared

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K. Silent Walktest with History Logging

1. The system shall be capable of being tested by one person. While in testing mode the alarm activation of an initiating device circuit shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after logging of the alarm.
2. The momentary disconnection of an initiating or indicating device circuit shall be silently logged as a trouble condition in the historical data file. The panel shall automatically reset itself after logging of the trouble condition.
3. Should the walktest feature be on for an inappropriate amount of time it shall revert to the normal mode automatically.
4. The control panel shall be capable of supporting up to 8 separate testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.
5. Should an alarm condition occur from an active point, not in walk test mode, it shall perform operations described in section 1.04.

L. LED Supervision

1. All slave module LEDs shall be supervised for burnout or disarrangement. Should a problem occur the LCD shall display the module and LED location numbers to facilitate location of that LED

M. System Trouble Reminder

1. Should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at preprogrammed time intervals to act as reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable to suit the owner's application

N. Access Levels

1. There shall be four (4) access levels with level 4 being the highest level. Level 1 actions shall not require a passcode. Passcodes shall consist of up to ten digits. Changes to passcodes shall only be made by authorized personnel
2. In order to maintain security when entering a passcode the digits entered will not be displayed but a cursor shall move along filling the position with an X to indicate that the digit has been accepted. All key presses shall be acknowledged by a low audible sound.
3. When a correct password is entered, the message "Access Granted" shall be displayed. The new access level shall be in effect until the operator manually logs out or the keypad has been inactive for ten (10) minutes. Should an invalid code be input, the operator shall be notified with the message "ERROR...INCORRECT PASSCODE", and shall be allowed up to three chances to enter a valid code. After three unsuccessful tries, the message, "ACCESS DENIED", shall be displayed. The level shall not be altered, and the operator shall no longer be in the menu option.

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4. Access to a level shall only allow the operator to perform all actions within that level plus all actions of lower levels, not higher levels.
5. The following key/switches shall have access levels associated with them
 - a. Alarm Silence
 - b. System Reset
 - c. Set Time/Date
 - d. Manual Control
 - e. On/Off/Auto Control
 - f. Disable/Enable
 - g. Clear Historical Alarm Log
 - h. Clear Historical Trouble Log
 - i. Walk Test
 - j. Change Alarm Verification
6. Acknowledge keys shall also require privileged access to acknowledge points. If the operator presses an (ACK) key with insufficient access, an error message will be displayed. The points shall scroll with (ACK) key presses to view the points on the list, but the points shall not get acknowledged in the database.

O RS-232-C Output

1. Fire Alarm Control Panel shall be capable of operating remote CRT's and/or printers; output shall be ASCII from an EIA RS-232-C connection with an adjustable baud rate
2. Each RS-232-C port shall be capable of (supporting and supervising a remote (CRT) (Printer)) (supporting as many as four (4) remote CRT displays or printers). Data amplifiers shall be used to increase CRT or printer line distance. Each RS-232-C port shall only communicate with one keyboard. The Fire Alarm Control Panel shall support up to five (5) RS-232-C ports.

P REMOTE ANNUNCIATOR (S)

1. Where shown on the plans, provide and install an LED annunciator. The annunciator (s) shall have a (beige enamel) (stainless steel) finish and shall provide one alarm lamp (and one trouble lamp) per initiation device circuit. The annunciator shall communicate to the control panel over one twisted shielded pair of wire and operating power shall be 24VDC and be fused at the control panel. Point-wired annunciators shall not be considered as equal

Q The serial annunciator shall provide a common alarm and trouble circuit consisting of:

1. Control push-button switches - for; alarm silence, trouble silence, system reset and manual evacuation duplicating the control panel switches. A key "enable" switch shall be provided to activate or deactivate the control switches.
2. Tone Alert - Duplicates the control panel tone alert during alarm and trouble conditions.
3. System trouble LED

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4. Power on LED
5. (option) To accommodate and facilitate job site changes the control switches shall have the capability to be programmed on site to provide for manual switch input operation other than their standard purpose
6. Annunciator:
 - a. (Option) Annunciator shall indicate each alarm initiating device graphically. Alarm and trouble conditions shall be indicated for each alarm initiating
 - b. (option) Manual Control Switches shall be provided for the following device
 - c. functions:
 - (1) System reset
 - (2) Alarm Silence
 - (3) Trouble Silence
 - (4) Manual Evacuation
 - (5) (Option) 72D Alarm Acknowledge
 - (6) (Option) 72D Trouble Acknowledge
 - (7) (Option) 72D Supervisory Service Acknowledge
 - (8) (Option) Elevator Bypass (explanation required)
 - (9) (Option) AHU Control (explanation required)
 - (10) (Option) City Disconnect
 - (11) (Option) "Other" (explanation required)

T MULTIPLE ADDRESSABLE PERIPHERAL NETWORK (MAPNET)

1. Communication with addressable devices.
 - a. The system must provide communication with initiating and control system devices individually. All of these devices will be individually annunciated at the control panel. Annunciation shall include the following conditions for each point:
 - (1) Alarm
 - (2) Trouble
 - (3) Open
 - (4) Short
 - (5) Device missing/failed
2. All addressable devices shall have the capability of being disabled or enabled individually.
3. Up to 254 addressable devices may be multidropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices are unacceptable.
4. Format
 - a. The communication format must be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol. Systems that do not utilize full digital transmission protocol are

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not acceptable.

5 Identification of Addressable Devices

a. Each addressable device must be uniquely identified by an address code entered on each device at the time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact. Device identification schemes that do not use uniquely set addresses but rely on electrical position along the communication channel are unacceptable. These systems cannot accommodate t-tapping and the addition of an addressable device between existing devices requires reprogramming all existing electrically further devices. The system must verify that proper type device is in place and matches the desired software configuration.

6. Wiring Type, Distances, Survivability and Configurations

a. Wiring types will be approved by the equipment manufacturer. Existing wiring will be utilized in retrofit applications. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Class B circuit. (Class A communications will be provided where shown on the drawings. Wire will be so routed to maintain sufficient distance between the forward and return loop as called for by the authority having jurisdiction.) To minimize wire routing and to facilitate future additions, t-tapping of the communications channel will be supported except where Class A wiring is required.

7. Addressable Device Types

a. General

(1) The system control panel, shall be capable of communicating with types of addressable devices specified below. (Addressable devices shall be locate as shown on drawings.) (The location of addressable devices shall be selected along with conventional devices to optimize the system layout in order to provide the level of protection, zone identification and control as shown on drawings.)

b. Addressable Detector Bases

(1) All addressable smoke and heat detector heads as specified below shall be plugable into their bases. The base shall contain electronics that communicate the detector status (normal, alarm, trouble) to the control panel over two wires. The same two wires shall also provide power to the base and detector. Different detector heads (smoke or heat) shall be interchangeable. Upon removal of the head, a trouble signal shall be transmitted to the control panel.

c. Ionization Detector Heads

- (1) The ionization type detector shall be plug-in unit which mounts to a twist-lock base and shall be UL listed.
- (2) In order to provide stability over wide changes in environmental conditions such as temperature, humidity and pressure, they will be of dual chamber type: one chamber for sampling, one chamber for reference. They will be sealed against rear air flow entry.
- (3) There shall be no limit to the number of detectors, stations, or Zone Adapter modules, which may be activated or "in alarm" simultaneously.
- (4) The detector shall fit into a base that is common to both heat detector and

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photoelectric type detector and shall be compatible with other addressable detectors, addressable manual stations, and addressable Zone Adapter Modules on the same circuit. The detector shall also fit into non-addressable base that is capable of being monitored by an addressable Zone Adapter Module.

- (5) Cover all smoke detection devices with plastic bags immediately after installation to maintain cleanliness, if field conditions so require.
- d. Photoelectric Detector head
- (1) The photoelectric type detector shall be a plug-in unit which mounts to a twist-lock base, and shall be UL approved.
 - (2) The detectors shall be of the solid state photoelectric type and shall contain no radioactive material. They will use a pulsed infrared LED light source and be sealed against rear air flow entry.
 - (3) The detector shall fit into a base that is common with both the heat detector and ionization type detector and shall be compatible with other addressable detectors, addressable manual stations, and addressable Zone Adapter Modules on the same circuit. The detector shall also fit into a non-addressable base that is capable of being monitored by an addressable Zone Adapter Module.
 - (4) There shall be no limit to the number of detectors or Zone Adapter Modules which may be activated or "in alarm" simultaneously.
- e. Addressable Thermal Detector Head
- (1) Thermal detector heads must be UL listed. They will be a combination rate-of-use and fixed temperature (135° F type, automatically restorable).
- f. Addressable Pull Stations
- (1) Addressable pull stations will contain electronics that communicate the station's status (alarm, normal) to the transponder over two wires which also provide power to the pull station. The address will be set on the station. They will be manufactured from high impact red Lexan. Station will mechanically latch upon operation and shall remain so until manually reset by opening with a key common to all system locks. Pull stations will be (single action) (double action) (and) (as identified by a schedule on the prints).
 - (2) The front station is to be hinged to a backplate assembly and must be opened with a key to reset the station. The key shall be common with the control panels. Stations which use Allen wrenches or special tools to reset, will not be accepted. The station shall consist of high impact Lexan plastic, red in color.
 - (3) The addressable manual station shall be capable of field programming of its "address" location on an addressable initiating circuit. The manual station shall be fitted with screw terminals for field wire attachment.
 - (4) There shall be no limit to the number of stations, detectors, or Zone Adapter modules, which may be activated or "in alarm" simultaneously.
 - (5) The addressable manual station shall be Underwriters' Laboratories Inc. Listed
 - (6) . Mounting Height: 48" AFF to centerline of device
- g. Addressable Photoelectric Duct Detector
- (1) The detector shall be non-polarized 24VDC type which is compatible with the Fire Alarm Panel and, obtains its operating power from supervisory current in the fire alarm detection loop.

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- (2) Detectors shall be of the solid state photoelectric type and shall operate on the light scattering, photodiode principle. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.
 - (3) The detector shall be directly interchangeable with an ionization detector type. The 24VDC detector may be reset by actuating the control panel reset switch.
 - (4) Detector construction shall have a mounting base with a twist-lock detecting head that is lockable. The locking feature must be field removable when not required. Contact between the base and head shall be of the bifurcated type utilizing spring type, self wiping contacts. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop. And cause a trouble signal at the control panel. Detector design shall provide compatibility with other normally open fire alarm detection loop devices (heat detectors, pull stations, etc.)
 - (5) It shall be possible to alarm the duct housing by using a test switch.
 - (6) For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
- h. Addressable Ionization Duct Detector
- (1) The detector shall be a non-polarized 24VDC type which is compatible with the Fire Alarm Panel and obtains its operating power from the supervisory current in the fire alarm detection loop.
 - (2) The detector shall be directly interchangeable with a photoelectric detector type 2098-9636. The 24VDC detector may be reset by actuating the control panel reset switch.
 - (3) Detector construction shall have a mounting base with a twist-lock detecting head that is lockable. The locking feature must be field removable when not required. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel. Detector design shall provide compatibility with other normally open fire alarm detection loop devices (heat detectors, pull stations, etc.).
 - (4) It shall be possible to alarm the duct housing by using a test switch.
 - (5) For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
 - (6) To minimize false alarms, voltage and RF transient suppression techniques shall be employed as-well-as smoke signal verification circuit and an insect screen.
 - (7) Auxiliary SPDT relays and or remote LED alarm indicators and key operated test stations shall be installed where indicated.
- i.. Zone Adapter Module
- (1) Zone Adapter Modules shall be used for monitoring of waterflow, valve tamper, Halon Control Panels, non-addressable detectors, and for control of evacuation indicating appliances and AHU systems).
 - (a) An addressable interface module shall be provided for interfacing normally open direct contact devices to an addressable initiating circuit
 - (b) ZAMs will receive their 24VDC power from a separate two wire pair running from an appropriate power supply.
- j. There shall be two types of devices:
- a. Type 1: Monitor Zam
 - b. Type 2: Control Zam

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- (1) For Type 1 above:
 - (a) For conventional 2-wire smoke detector and/or contact device monitoring with class B or class A wiring supervision.
 - (b) This type of addressable device module will provide power to and monitor the status of a zone consisting of conventional 2-wire smoke detectors and/or N/O contact devices as specified elsewhere [and identified in a schedule on the plans]. The supervision of the zone wiring will be [Class B] [and/or] [Class A] [as identified in the schedule on the plans]. These ZAMs will communicate the zone's status (normal, alarm, trouble) to the transponder.
 - (c) For conventional 4-wire smoke detector with Class B wiring supervision.
 - (d) This type of addressable device will provide power to and monitor the contact status of a zone consisting of conventional 4-wire smoke detectors as specified elsewhere [and identified in a schedule on the plans]. The ZAM will provide detector reset capability and a 2-amp fuse to provide over-current power protection for the 4-wire detector. These ZAMs will communicate the zone's status (normal, alarm, trouble) to the transponder.
 - (2) For Type 2 above:
 - (a) Zone Adaptor Module
 - (b) For signals, speakers, fire fighter phone jacks and other device control with Class B or Class A wiring supervision.
 - (c) This type of addressable device will provide double pole double throw relay switching that can be used to connect through easily replaceable 2 amp fuses: a zone of signals to a power source; speakers to a audio source; fire fighter phone jacks to a communications channel or activate a variety of controlled devices. The module will be available in either a Class B or Class A supervision version. In the Class B version the wiring will be supervised by an end-of-line device. In the Class A version the wiring will be looped back and connected to the module to allow continual operation of the controlled devices even if the wiring sustains a single break. [Class B] [and/or] [Class A] devices will be provided [as identified in a schedule on the plans]. These ZAMs will communicate the supervised wiring status (normal, trouble) to the fire alarm control panel and will receive a command to transfer the relay from the fire alarm control panel.
- k. Zone Adaptor Module
- (1) For non-supervised control.
 - (a) This type of addressable device will provide double pole double throw relay switching for loads up to 120VAC. It will contain easily replaceable 2 amp fuses, one on each common leg of the relay.
- U. The Zam shall be supervised and uniquely identified by the control panel. Device identification shall be transmitted to the control panel for processing according to the program instructions. Should the ZAM become non-operational, tampered with, or removed, a discrete trouble signal, unique to the device shall be transmitted to, and annunciated at, the control panel
1. The ZAM Shall be capable of being programmed for its "address" location on the addressable device initiating circuit. The ZAM shall be compatible with

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addressable manual stations and addressable detectors on the same addressable initiating circuit.

V . Sensor Set Points

1. The smoke sensor shall be a smoke density measuring device having no self contained alarm set-point. The alarm decision for each sensor shall be determined by the control panel. The control panel shall determine the condition of each sensor by comparing the sensor value to stored values
2. The control panel shall maintain a moving average of the sensors smoke chamber value. Systems that do not automatically maintain a constant smoke obscuration sensitivity for each sensor by compensating for environmental factors and are deemed unacceptable
3. The system shall automatically indicate when an individual sensor needs cleaning. When a sensor's average value reaches a predetermined value, a "Dirty Sensor" trouble condition shall be audibly and visually indicated at the control panel for the individual sensor. Additionally, the LED on the sensor base shall glow steady giving a visible indication at the sensor location.
4. If a "Dirty Sensor" is left unattended, and its average value increases to a second predetermined value, an "Excessively Dirty Sensor" trouble condition shall be indicated at the control panel for the individual sensor
5. The control panel shall automatically perform a daily self-test on each sensor. Checking the electronics in the sensor's base ensures the accuracy of the values being transmitted to the control panel. A sensor which fails the self-test will cause a 'Self Test Abnormal' trouble condition at the control panel. A sensor self-test which must be manually initiated by the operator shall not be acceptable
6. An operator at the control panel, having a proper access level, shall have the capability to manually access the following information for each sensor
 - a. Primary status
 - b. Device type
 - c. Present average value
 - d. Present sensitivity select *
 - e. Peak detection values *
 - f. Sensor range (normal, dirty, etc.)
 - g. *Values shall be in "percent of smoke obscuration" format so that no interpretation is required by the operator.
7. An operator at the control panel, having a proper access level, shall have the capability to manually control the following for each sensor
 - a. Clear peak detection values
 - b. Enable or disable the point
 - c. Clear verification tally
 - d. Control a sensor's relay driver output
8. It shall be possible to program the control panel to automatically change the sensitivity settings of each sensor based on time-or-day and day-of-week. (For example, to be more sensitive at during unoccupied times and less sensitive

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during occupied periods.) There shall be seven sensitivity settings available for each sensor.

9. The control panel shall have the capability of being programmed for a pre-alarm or tow-stage function. This function allows an indication to occur when for example, a 3% sensor reaches a threshold of 1.5% smoke obscuration.
10. At least 500 individually identified sensors as well as conventional initiating device and indicating appliance circuits shall be supported within a single control panel
11. For increased smoke detection assurance, all individually addressed smoke sensors shall be provided with alarm verification. Only a verified alarm shall initiate the alarm sequence operation.

A. TRUE ALARM SMOKE SENSOR AND ADDRESSABLE SENSOR BASES

1. The addressable smoke sensors shall be of the photoelectric type and shall communicate actual smoke chamber values to the system control panel.
2. The sensors shall be Listed to UL Standard 268 and shall be documented compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications.
3. Each sensor base shall contain a LED that will flash each time it is scanned by the control panel (once every 4 seconds). When the control panel determines that a sensor is in an alarm or a trouble condition, the control panel shall command the LED on that sensor's base to turn on steady indicating the abnormal condition. Sensors which do not provide a visible indication of an abnormal condition at the sensor location shall not be acceptable.
4. [Sensor bases, as shown on the plans, shall be provided with a relay driver output that is to be controlled either automatically or manually from the control panel.]
5. Each sensor shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
6. Each sensor shall be scanned by the control panel for its type identification to prevent inadvertent substitution of another sensor type. The control panel shall operate with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed or the programmed sensor type is changed.
7. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
8. Addressable Device Supervision
 - a. All devices shall be supervised for trouble conditions. The system control panel will be capable of displaying the type of trouble condition (open, short, device missing/failed).
 - b. Should a device fail it will not hinder the operation of other system devices.

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2.02 CRT'S

- A Where shown on the plans, provide and install a CRT.
- B All information shall include time and date
- C A desk top CRT (Cathode Ray Tube) with detachable key board shall provide and English language display with time and date of system events. CRT shall be a tilt/swivel, 14 inch monitor with capability to
- F. display 24 lines of information. Information on the screen shall not scroll off until an acknowledge key is pressed. Display shall be easy-to-read green phosphor, non-glare. CRT shall include a composite video output to drive slave CRT's.
- G. CRT's with key boards shall provide the following functionality:
 - 1. Acknowledgment of alarms, troubles and supervisory conditions
 - 2. Alarm silence
 - 3. System Reset
 - 4. Time & Date
 - 5. Alarm, Trouble, and Supervisory service condition summary screens

PART 3 EXECUTION

3.01 INSTALLATION

- A Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacture's recommendations. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760 A and C, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC-Article 760 A and B. Upon completion, the contractor shall so certify in writing to the owner and general contractor. All junction boxes shall be sprayed red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the installation.
- B Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.
- C The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation. Do not install smoke detectors until after space in complete and all painting and sanding is complete.
- D The manufacture's authorized representative shall provide onsite supervision of installation.

3.02 TESTING

- A The completed fire alarm system shall be fully tested in accordance with NFPA-72 by the contractor, with the assistance of the manufacturer's representative, in the presence of the owner's representative and the Portland Fire Department. Perform a sound test with all HVAC equipment and ambient noise present. Take dbA readings to demonstrate compliance with NFPA 72 requirements. Upon completion of a

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successful test, the contractor shall so certify in writing to the owner and general contractor.

3.03 WARRANTY

- A The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.

END OF SECTION