

APPENDIX

SECTION 16720 – FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations in connection with the installation of the Fire Alarm Systems, Clean Agent Systems, Hood Suppression Systems and Mass Notification Systems as shown on the drawings and as herein specified.
- B. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.
- C. The intent of this project is to provide a complete networked fire alarm and mass notification system for this building.

1.2 RELATED WORK

- A. The drawings, general requirements, conditions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. The work described in this section has related work with:
 - Section _____ Electrical General Provisions
 - Section _____ Identification
 - Section _____ Electrical Demolition
 - Section _____ Conduit Systems
 - Section _____ Wire and Cable
 - Section _____ Grounding

1.3 FIRE ALARM SYSTEM DESCRIPTION

- A. Furnish a complete Audio Fire Alarm System as described herein and as shown on the plans; wire, connect, and leave in first class operating condition. Include a Fire Alarm Control Panel, manual pull stations, automatic fire detectors, speakers, clear and amber strobes, combination speaker/strobes, and remote control devices. Use closed loop initiating device circuits with individual zone supervision, individual indicating appliance circuit supervision, and incoming and standby power supervision.
Provide Style D initiating circuits, Style Z signaling circuits, Style 6 communications circuits, all wiring, connections to devices, outlet boxes, junction boxes, and all other necessary material for a complete operating system.
- B. Allow for loading or editing special instructions and operating sequences in the Fire Alarm Control Panel as required. Provide a system capable of on-site programming to accommodate and facilitate expansion, building parameter changes or changes as required by the owner, authorities having jurisdiction and code requirements. Provide storage for all fire alarm system software operations in a non-volatile, programmable memory within the Fire Alarm Control Panel. Loss of primary and secondary power will not erase the instructions stored in memory.
- C. Provide final as built in .dxf file format, sized and scaled for 11" wide by 8.5" tall.
- D. Incorporate in the resident software programming of the system the full ability for selective input/output control functions based on ANDing, ORing, NOTing, timing and special coded operations.
- E. Provide a system that communicates with all initiating and control devices via intelligent communications.. Annunciate all initiating and control devices individually at the Fire Alarm Control Panel. Include the following annunciation conditions for each point:
 - Alarm

- Trouble
 - Open
 - Short
 - Ground
 - Device Fail or Incorrect Device
- F. Provide a system capable of individually disabling or enabling all addressable devices. Field configure all devices to allow for the addition of devices on a circuit after the initial installation.
- G. Provide a system capable of multi-dropping up to 250 addressable devices from a single pair of wires using intelligent communications only.
- H. Provide a system capable of having software programming modified and initiating or control devices added or deleted in the field. Systems that require factory reprogramming to add or delete devices are unacceptable.
- I. Provide all necessary software with any required software keys to allow the University to program changes, additions, removals or re-labels. This includes the programming software for the FACP's and command centers.
- J. Provide a system with a completely digital, poll/response protocol communications format. System to use parity data bit error checking routines for address codes and check sum routines for the data transmission protocol to achieve a high degree of communication reliability. Systems that do not utilize full digital transmission protocol (i.e. that may use time pulse width methods to transmit data etc.) are not acceptable.
- K. Provide a system where each addressable device is uniquely identified by an address code entered on the base of each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.
- L. Provide a system capable of supporting up to 10,000 feet wire length for each class "A" initiation circuit loop.
- M. **MINIMUM DETECTION REQUIREMENTS**
1. Provide automatic smoke detection in all hallways, common areas, electric rooms, telecommunication rooms, and along all paths of egress. Beam smoke detectors and/or fire detection cameras may be used in place of spot type smoke detectors.
 2. Provide heat detection in all mechanical and janitor rooms. Fire detection cameras may be used in place of spot type heat detectors.
 3. Provide supply side duct smoke detectors on all air handlers and fan coils over 1999cfm, also provide return side duct smoke detectors on all air handlers and fan coils over 14,999cfm.
 4. Provide manual double action pull stations protected by a sounder cover at all floor level exits and all ground level exits.
 5. Provide monitoring of all fire sprinkler flow switches, valve tamper switches, air bleeders, fire pump status points, and chemical injection systems.
- N. **ALARM SEQUENCE**
1. The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch is to be as follows:
 - a. Sound a ANSI 3.14 compliant fire alarm signal on all audible alarm indicating appliances until silenced by the alarm silence button at the Fire Alarm Control Pane.
 - b. Flash all strobes synchronized and continuously on all visual alarm indicating appliances until system is reset.
 - c. Release all doors normally held open by door control devices to include all electronically controlled access doors.
 - d. Activate/deactivate mechanical controls on the air handling systems per specifications of the owner and in accordance with the State of Arizona Fire Code and the University of Arizona Fire Code. Sequentially restart air handling units upon system reset to reduce electrical demand.
 - e. Display an alarm condition on the Fire Alarm Control Panel display per 2.3.A of these specifications. Flash the alarm LED on the Fire Alarm Control Panel until the alarm has been acknowledged at the Fire Alarm Control Panel. Latch the alarm LED on upon

alarm acknowledgement. After the alarm has been acknowledged, flash the alarm LED on the Fire Alarm Control Panel again upon receipt of a subsequent alarm from another device/zone. Display the new alarm information on the Fire Alarm Control Panel display.

- f. Provide a pulsing alarm tone that will occur within the Fire Alarm Control Panel until acknowledged. Provide a pulsing alarm tone that is capable of being disabled or removed if so specified by the owner.
2. All elevator connections shall be per schematic diagram 16720-D3 and block diagram both located at end of this section, below is a sequence of operations for the elevator connections:
 - a. The alarm activation of any elevator lobby smoke detector will cause the elevator cabs to be recalled according to the following sequence:
 1. Recall the elevator cabs to the main egress floor (as indicated by the owner and authority having jurisdiction) upon the activation of an elevator lobby smoke detector on any floor other than the main level of egress.
 2. Recall the elevator cabs to the predetermined (as indicated by the owner and authority having jurisdiction) alternate level of egress upon the activation of the elevator lobby smoke detector on the main egress level.
 - b. The alarm activation of any elevator machine room or hoist way heat detector will cause the shunt trip control to be activated.
 - c. The loss of shunt trip control power will cause a supervisory condition to be displayed on the Fire Alarm Control Panel.
 - d. The alarm activation of any elevator machine room or hoist way smoke detector will cause the fireman's hat in the cab to flash.
3. Provide a manual evacuation switch to operate the systems alarm indicating appliances only, leaving other control circuits in their normal state.
4. Override the automatic alarm functions either selectively or throughout the system upon activation of auxiliary bypass keys or bypass groups.
5. Immediately display alarm and trouble conditions on the Fire Alarm Control Panel front alphanumeric display. If more alarms or troubles are in the system the operator may scroll to display new alarms.
6. Provide a system with a list key that will allow the operator to display all alarms, troubles, and supervisory service conditions with the time of occurrence. This shall allow for the determination of not only the most recent alarm but also may indicate the path that the fire is taking.
7. All doors normally held open by door control devices shall release upon AC power failure.
8. Generator Controls and Monitoring. (This applies to each generator installed).
 - a. Provide an IAM connected to the generator controls to monitor if the generator is running.
 - b. Provide an IAM connected to the generator controls to monitor if the generator system has a fault.
 - c. Provide an IAM connected to the Automatic Transfer Switch (ATS) to monitor if the ATS is connected to the emergency source.

O. SUPERVISION

1. Provide a system with Class 'A' (Style 'D') independently supervised initiating circuits so that a fault in any one zone/device does not affect any other zone/device and so that an alarm activation of any initiation circuit does not prevent the subsequent alarm operation of any other initiation circuit.
2. Provide sprinkler supervisory initiation device circuits for connection of all sprinkler valve tamper switches to perform the Supervisory Service Operation. Wiring methods which affect any fire alarm initiation circuits to perform this function will be deemed unacceptable; i.e.: sprinkler and standpipe tamper switches (N/C contacts) shall NOT be connected to circuits with fire alarm initiation devices (N/O contacts). Label this independent initiation circuit as Supervisory Service and provide differentiation between tamper switch activation and wiring faults.

3. Provide independently supervised and independently fused indicating appliance circuits for speakers and strobes. Disarrangement conditions of any of these circuits will not affect the operation of other circuits.
4. Supervise all auxiliary manual controls so that all switches must be returned to the normal automatic position to clear system trouble.
5. Include a discrete Fire Alarm Control Panel readout for each independently supervised circuit to indicate disarrangement conditions per circuit.
6. Supervise the incoming power to the system so that any power failure must be audibly and visually indicated at the Fire Alarm Control Panel. A green "power on" LED shall be displayed continuously while incoming power is present.
7. Supervise the system batteries so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the Fire Alarm Control Panel.
8. Supervise any system expansion modules for module placement. Should a module become disconnected from the controls, the system trouble indicator must illuminate, and audible trouble signal must sound.
9. Provide independent supervision for opens of the air handling on/off/auto switch control output wiring. Provide a discrete trouble panel readout per output circuit for indication. Provide indication of a common ground trouble on the Fire Alarm Control Panel in the presence of a ground condition of the air handling control output wiring.
10. Supervise all slave module LEDs for burnout or disarrangement. Should a problem occur, the Fire Alarm Control Panel shall display the module and the LED location numbers to facilitate location of that LED.

P. POWER REQUIREMENTS

1. Provide each Fire Alarm Control Panel, Fire Alarm Miniplex, and Fire Alarm NAC Extender with an individual 120VAC 20AMP power circuit via a dedicated disconnect means that includes over-current protection. Ensure that the panel location, panel identifier, and circuit number is clearly identified at each Fire Alarm Control Panel, Fire Alarm Miniplex, and Fire Alarm NAC Extender. Ensure that the electric panel schedules are labeled with "FIRE ALARM" on all circuits supplying fire alarm equipment. Ensure each circuit breaker supplying fire alarm equipment is locked in the "ON" position with a lock dog.
2. Provide the system with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty-four (24) hours with 15 minutes of alarm operation at the end of this period. Automatically transfer the system to the standby batteries upon primary power failure. All battery charging and recharging operations shall be automatic.
3. Provide 24VDC from the Fire Alarm Control Panel to all circuits requiring system operating power. Individually fuse all these circuits at the Fire Alarm Control Panel.

1.4 CLEAN AGENT SYSTEM DESCRIPTION

A. SYSTEM REQUIREMENTS

1. Provide approved Ecaro or Inergen based suppression equipment that reports to the existing building fire alarm system.
2. Acceptable clean agent control panel manufactures and models are the SimplexGrinnell 4000 series and the Fike Cheetah
3. All equipment must directly control any related systems for the protected space such as Emergency Power Off, Air Handler Shutdown, Damper Controls, Door Releases, or similar.

1.5 HOOD SUPPRESSION SYSTEM DESCRIPTION

A. SYSTEM REQUIREMENTS

1. Provide approved hood suppression equipment that reports to the existing building fire alarm system.
2. All equipment must directly control any related systems for the protected space such as Emergency Power Off, Air Handler Shutdown, Damper Controls, Door Releases, or similar.

1.6 MASS NOTIFICATION SYSTEM DESCRIPTION

A. SYSTEM REQUIREMENTS

1. Speaker arrays shall be manufactured by HyperSpike.
2. Mass notification systems equipment shall be connected to and controlled by the building fire alarm system.

1.7 QUALITY ASSURANCE

- A. Provide each and all items of the Fire Alarm System that are the products of a SINGLE fire alarm system manufacturer, unless otherwise required by this specification, under the appropriate category by Underwriters' Laboratories, Inc. (U.L.), and bearing the "UL" label. Provide control equipment that is all listed under UL category UOJZ as a single control unit. Partial listing is NOT be acceptable.
- B. Dealers, manufacturers, and/or distributors shall have fully equipped service organization within one hundred (100) miles of this installation.
- C. Furnish fire alarm equipment installation supervision from a factory trained and certified manufacturer's representative.
- D. Provide system controls that are UL listed for Power Limited Applications per NEC 760, in addition to the UL-UOJZ requirement mentioned above. Mark all circuits in accordance with 1996 NEC article 760-23 and these specifications.
- E. Provide transient protection devices on all control equipment to comply with UL864 requirements.
- F. Transient protection must be provided for each circuit, where fire alarm circuits leave the building. Provide devices that are UL listed under Standard 497B (Isolated Loop Circuit Protectors).

1.8 REFERENCES

- A. Install the complete system in conformance with the applicable sections of the Arizona State Fire Code and referenced codes and standards, University of Arizona Fire Code and referenced codes and standards and other standards listed in Section 16010.
- B. Install and configure the entire fire alarm system and integrated system operations in conformance with the State of Arizona Fire Code and the University of Arizona Fire Code.

1.9 SUBMITTALS

- A. Submit complete fire alarm layout drawings and equipment cut sheets prior to beginning any construction work on the Fire Alarm System. Depict on the layout drawings all equipment and field devices, routing of wiring, connection information, address identification number for each device, etc.
- B. Submit fire alarm shop drawings to the University of Arizona Fire Marshal and receive approval prior to beginning any construction work on the Fire Alarm System.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store all fire alarm and mass notification equipment (Fire Alarm Control Panel, all peripheral devices, equipment enclosures, etc.) in an environmentally controlled location until required on project site. Store all fire alarm equipment at the project site in an environmentally controlled location until installed.

1.11 WARRANTY

- A. Provide a warranty for the completed fire alarm system wiring and equipment to be free from inherent mechanical, electrical, and software programming defects for a period of two (2) years from the date of the completed and certified test by the Authority Having Jurisdiction.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide fire alarm panels and fire alarm peripheral devices that are all the standard product of a single manufacturer, displaying the manufacturer's brand name on each component. Provide a fire alarm system that is Simplex, Autocall, Gamewell, Notifier, or EST branded. The catalog numbers specified under this section are those of the Simplex brand and constitute the type, product quality, material, and desired operating features.
- B. The University of Arizona maintains multiple fire alarm networks and monitoring infrastructures, as such the University of Arizona Fire Safety team will identify what brand is acceptable at each project location to ensure compatibility with the existing network or monitoring infrastructure, **no fire system brand may be selected without approval from the University of Arizona Fire Safety team.**

2.2 MATERIALS

- A. WIRING
 1. The following wiring requirements apply in addition to other wiring requirements found elsewhere in these specifications.
 2. Use only wiring type approved by the fire alarm equipment manufacturer.

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3. Color Coding for fire alarm wiring is listed below. Use solid color compound or solid color coating on all conductors. Identify with colored tape wire sizes for which colored insulation is not available.

Circuit Type	Color Code	To What	Wire Size
Agent Signal Wiring A/Vs & V/Os	Red / Black	Signal Module	#14
Agent Low Tank Pressure Switch	Orange / Brown	IAM	#14
Agent Tank Discharge Switch	Orange / Brown	IAM	#14
Agent Pull Station	Yellow / Blue	IAM	#14
Agent Abort Switch	Yellow / Blue	IAM	#14
Agent Bell	Red / Black	Signal ZAM	#14
Pre-Action Low Air Pressure	Orange / Brown	IAM	#14
Pre-Action Discharge Switch	Orange / Brown	IAM	#14
Solenoid Wiring	Red / Black	Signal ZAM	#14
Solenoid Disconnect Switch	Red / Black	Coil Module	#14
Water Flow Bell	Red / Black	Signal ZAM	#14
Water Flow Switch	Orange / Brown	IAM	#14
Valve Tamper Switch	Orange / Brown	IAM	#14
Smoke Detector	Mapnet	FACP	#18 T/S/P
Beam Detector	Yel / Blu / Wht / Vio	IAM	#14
Heat Detector	Mapnet	FACP	#18 T/S/P
Flame Detector	Yel / Blu / Wht / Vio	IAM	#14
Hood Suppression Systems	Yellow / Blue	IAM	#14
Cable Smoke Detectors (VESDA)	Yel / Blu / Wht / Vio	IAM	#14
Pull Station	Mapnet	FACP	#18 T/S/P
Duct Detector	Mapnet / Wht / Vio	FACP	#18 T/S/P - #14
ZAM (All types)	Mapnet / Wht / Vio	FACP	#18 T/S/P - #14
IAM	Mapnet	FACP	#18 T/S/P
Relays	White / Violet	Control Point	#14
120VAC Door Holders	White / Phase Color	Control Point	#12
120VAC Dampers	White / Phase Color	Control Point	#12
AHU Contactor / MCC Shutdown	Phase Color / Sw Leg	Relay	#12
AHU VFD Shutdown	Red / Red	Relay	#14 or #12
Audio Visual	Red / Black	Sync Module	#14 T/P
Visual Only	Red / Black	Sync Module	#14 T/P
Sync Module	Red / Black	Signal Circuit	#14
Ground / Bond	Green	Grounds/Bonds	#14

Mapnet is defined as Power Limited or Non-Power Limited Twisted Shielded #18 Pair Cable.

Phase Color is defined as the primary phase color used to power the controlled device.

Sw Leg is defined as the switch leg color used to power the controlled device.

2.3 EQUIPMENT

A. FIRE ALARM CONTROL PANEL

Where shown on the plans, provide and install the Fire Alarm Control Panel called for in these specifications. Provide a Fire Alarm Control Panel compatible as a pier with the reporting network or monitoring infrastructure as selected by the University of Arizona Fire Safety team, this includes total exchange of all analog, digital, pseudo, and control data.

1. Control Panel:

- a. This system shall be used for all fire alarm speaker installations.
 - b. This system shall be used for all fire alarm fire phone installations.
 - c. This system shall be used for all addressable detection installations.
 - d. Panel shall include the required Communications hardware to be compliant with the requirements of the University of Arizona Fire Safety identified network or monitoring system.
 - e. If fire alarm system is not directly connected to the campus reporting system, panel shall include two, (2,) Network TCP/IP bridge cards with four, (4,) RS-485 Hardwire Media Cards.
 - f. Panel shall include three, (3,) Ethernet jacks connected per section 16700. Only one (1) Ethernet jack is required if the fire alarm system is directly connected to the campus reporting system.
2. Additional Control Panel Equipment and Capacities:
- a. Fire alarm panels shall be provided with twenty-five, (25,) percent spare capacity installed on the following components:
 - i. Audio circuits.
 - ii. Visual circuits.
 - iii. Speaker circuits.
 - iv. Fire Phone circuits.
 - v. Addressable Detection points.
 - vi. Hard-wire Detection points.
 - vii. Auxiliary Control circuits.
 - viii. Graphic I/O points.
 - b. Power supplies:
 - i. Shall be sized as necessary to provide all the power required in section 16720-2.3, A, 2.) with an additional twenty-five, (25,) percent spare capacity.
 - ii. And shall provide two, (2,) amps of power for each and every installed Notification Appliance Circuit, Auxiliary Control Circuit, Auxiliary Relay Zone Addressable Module, and Signal Zone Addressable Module.
 - c. Batteries:
 - i. Shall be sized as to provide twenty-four (24) hours of standby operation for the load handled by the power supplies.
 - ii. Shall be sized as to provide fifteen (15) minutes of alarm as required in 16720 1.3, O, 2 for the load handled by the power supplies after twenty-four (24) hours of standby operation.
 - iii. The only acceptable batteries are listed here by manufacturer, amperage and voltage.
 - 1. Eagle Pitcher, Simplex, Interstate
 - a. 7A 12VDC.
 - b. 12A 12VDC.
 - c. 18A 12VDC.
 - d. 33A 12VDC Square case or Long case.
 - e. 55A 6VDC.
 - f. 58A 6VDC.
 - g. 58A 12VDC
 - 2. Sonnenschein, Simplex, Interstate
 - a. 115A 12VDC.
3. Auxiliary Bypass Keys
- Provide five (5) auxiliary bypass keys on the Fire Alarm Control Panel. Activation of these keys to be password protected. When activated, the normal alarm sequence operations of the programmed devices/control functions will not occur. Upon activation of these keys, a trouble condition will be present on the Fire Alarm Control Panel. Indicate on the Fire Alarm Control Panel one (1) trouble condition for each signal circuit/type of device/control function that is effected by the bypass.
- Program the keys to accommodate bypassing the following devices/control functions (in order, from top to bottom):

- Air Handler Unit Shut Down and Door Holder Release
 - Sprinkler System Water Flow Switches
 - Audible and Visual Signaling Devices
 - Duct Smoke Detectors
 - Elevator Recall
4. Device Bypass Groups
Provide the Fire Alarm Control Panel with the capability of supporting separate lists of device groups whereby particular groups of devices may be bypassed and the rest of the system will remain active and operate as programmed per normal system operation. Program the groups to operate upon activation of a single point, negating the need to deactivate/ reactive each individual device in the group. Provide the following groups of devices:
- Smoke detectors by floor, in groups as designated by the Owner.
- B. FIRE ALARM NON-ADDRESSABLE PERIPHERAL DEVICES
1. Speaker Visual – 75 candela units – Model #4903-9357
Provide polarized fire alarm speaker/strobe that operates with 25VDC. Provide separate wire leads for in/out wiring for each leg of the associated signal (speaker) circuit.
 2. Sprinkler System Water flow switches - Equipment from Division 15 or existing
Monitor automatic sprinkler system water flow switches with Individual Adaptor Modules (IAMs). Provide water flow switches consisting of a cast aluminum pipe saddle housing an electromechanical device to which is attached a corrosion-free, flexible, low-density polyethylene paddle. The paddle conforms to the inside diameter of the sprinkler pipe and senses all water movements. To prevent false alarms, incorporate an adjustable time delay mechanism in the flow switch between the paddle-operated stem and the alarm initiating contacts. Provide a tapped 1/2" conduit connection. Provide a flow switch with a UL listing for the intended purpose.
 3. Sprinkler System Valve Tamper Switches - Equipment from Division 15 or existing
Monitor automatic sprinkler system valve tamper switches with Individual Adaptor Modules (IAMs). Provide valve tamper switches consisting of an acid treated, cast aluminum housing with nickel plated parts to resist corrosion. Supervise the removal of the switch housing cover. Provide the switch with either one or two sets of S.P/D.T. micro switches as required. Provide a switch with a UL listing for its intended purpose.
 4. Door Holders - 120VAC - Model #DH24120RPC (Flush), #DH24120SPC (Surface) or Model #DH24120FPC (Semi-flush)
Control door holders with Zone Adaptor Modules (ZAMs). Provide magnetic door holders with an approximate holding force of 35 lbs. Provide the door portion with a stainless steel pivotal mounted armature with shock absorbing nylon bearing. Provide a door holder unit capable of being either surface, flush, semi-flush or floor mounted as required. Provide door holders with a UL listing for their intended purpose.
 5. Photoelectric Projected Beam Detectors - Transmitter/Receiver Set - Model #D296
Provide photoelectric, projected beam detectors capable of being monitored by Individual Adaptor Modules (IAMs) or Zone Adaptor Modules (ZAMs). Provide photoelectric projected beam detectors with the UL #268 listing. Provide separate transmitters/receivers capable of long range coverage of up to 328 ft (100M), and have seven (7) sensitivity settings. Incorporate automatic compensation for lens contamination. Include a normal status indicator (Green Pulsing LED), an alarm indicator (Red LED) and a trouble indicator (Amber LED) on the detector. Provide dedicated, resettable, operating power for the detectors from the Fire Alarm Control Panel. Provide 24VDC operating voltage (Nominal).
 6. Fire Alarm Auxiliary Relay - Part #2088-9007
Provide one or two single pole, double throw relay switches for loads up to 120VAC in its own enclosure. Provide a separate 24 VDC output relay with 10A, 120VAC rated contacts with a 7A in-line fuse for control of each type of equipment indicated to have relays. Provide power to this relay from the 24VDC power for the fire alarm device that controls the relay. Control this relay from duct detector auxiliary contacts or ZAM contacts.

Provide relays for interfacing the fire alarm system with the following equipment:

- air handling system motor control centers
- door holder circuits
- shunt trip circuits

Route circuits from controlled equipment and fire alarm device (duct detector or ZAM) into relay box. Orient relay so any 120VAC (or greater) circuit does not cross the 24VDC fire alarm circuit inside the relay box. Route ONLY 24VDC into the fire alarm device boxes.

C. FIRE ALARM ADDRESSABLE DEVICE TYPES

1. General - The system Fire Alarm Control Panel, over its two wire multi-drop channel, must be capable of communicating with the types of addressable devices specified below.
2. Addressable Sensor Bases - Model #4098-9792
Provide sensor bases containing an integral LED that will flash each time it is scanned by the Fire Alarm Control Panel (once every 4 seconds). Turn the sensor base LED "ON" when the Fire Alarm Control Panel determines that a sensor is in the alarm or a trouble condition. Sensor bases which do not provide a visible indication of an abnormal condition at the sensor location are not acceptable.
3. TrueAlarm Smoke Sensors - Model #4098-9714
Provide photoelectric type, addressable smoke sensors that communicate actual smoke chamber values to the system Fire Alarm Control Panel. Provide solid state, photoelectric type sensors containing no radioactive material. Use a pulsed infrared LED light source and be sealed against rear air flow entry for sensor operation.
Interrupt the supervisory current of the fire alarm detection loop upon removal of the detector head and cause a trouble signal at the Fire Alarm Control Panel. Provide a plug-in sensor unit which mounts to a twist-lock base.
Provide sensors with a UL #268 listing and documented as compatible with the control equipment to which they are connected. Provide sensors listed for both ceiling and wall mount applications. Provide sensors containing a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
Scan each sensor by the Fire Alarm Control Panel for its type identification to prevent inadvertent substitution of another sensor type. Permit continued operation of the Fire Alarm Control Panel but initiate a "WRONG DEVICE" trouble condition until the proper type is installed or the programmed sensor type is changed.
Provide sensors with electronics immune to false alarms caused by EMI and RFI.
Provide sensors that fit into a base that is common with both the heat detector and photoelectric type detector and non-addressable bases capable of being monitored by an Zone Adaptor Module (ZAM) or Individual Addressable Module (IAM). Provide sensors compatible with other addressable detectors, addressable manual stations, and addressable Zone Adaptor Modules on the same circuit.
There will be no limit to the number of detectors, stations, or Zone Adaptor Modules, which may be activated or "in alarm" simultaneously.
4. Addressable Thermal Detector Head - Model #4098-9733
Provide UL listed, combination rate-of-rise and fixed temperature (135 F) type, automatically restorable thermal sensing heads.
Interrupt the supervisory current of the fire alarm detection loop upon removal of the heat sensor head and cause a trouble signal at the Fire Alarm Control Panel.
Provide a plug-in heat sensor unit which mounts to a twist-lock base. Provide sensors listed for both ceiling and wall mount applications.
Provide heat sensor units with a UL #268 listing and documented as compatible with the control equipment to which they are connected.
Scan each sensor by the Fire Alarm Control Panel for its type identification to prevent inadvertent substitution of another sensor type. Permit continued operation of the Fire Alarm Control Panel but initiate a "WRONG DEVICE" trouble condition until the proper type is installed or the programmed sensor type is changed.
Provide sensors with electronics immune to false alarms caused by EMI and RFI.
5. Addressable Pull Stations - Model #4099-9003

Provide double action, push-pull type, addressable pull stations containing electronics that communicate the station's status (alarm, normal) to the Fire Alarm Control Panel over two wires which also provide power to the pull station. Set the address for the device on the station itself. Provide pull stations manufactured from high impact red Lexan with raised lettering painted white with a UL listing for the devices intended purpose.

Provide pull stations with a "front" that is hinged to a back plate assembly that will mechanically latch upon operation and remain so until manually reset by opening with a key common to all pull stations. Provide pull stations with the Simplex Series "B" key locksets. Stations which use allen wrenches or special tools to reset are NOT acceptable. Provide an addressable pull station capable of field programming its "address" location on an addressable signaling line circuit.

There will be no limit to the number of stations which may be activated or "in alarm" simultaneously.

6. Addressable Photoelectric Duct Detector - Model #4098-9756 (uses TrueAlarm Smoke Sensor Model #4098-9714), Remote Test Switch Model #2098-9806 and Sample Tube Kit Model #4098-9857.

Provide solid state, non-polarized, 24VDC, photoelectric type duct detector compatible with the Fire Alarm Control Panel that obtains its operating power from the supervisory current in the fire alarm detection loop.

Provide duct detectors that operate on the light scattering, photodiode principle. Provide an insect screen to minimize nuisance alarms. Provide duct detectors designed to ignore invisible particles or smoke densities that are below the factory set point. Provide duct detectors with sensor heads that are directly interchangeable with an ionization detector type. The 24VDC detector may be reset by actuating the Fire Alarm Control Panel reset switch.

Provide duct detectors with a mounting base with a twist-lock detecting head that is lockable. The locking feature must be field removable when not required. Provide contacts between the base and head of the bifurcated type utilizing spring type, self-wiping contacts. Interrupt the supervisory current of the fire alarm detection loop upon removal of the detector head and cause a trouble signal at the Fire Alarm Control Panel. Provide compatibility of the detector design with other normally open fire alarm detection loop devices (heat detectors, pull stations, etc.).

Provide duct detector housings capable of being alarmed by using a test switch.

Provide duct detector housings that provide access through the front cover for cleaning the detector sampling tubes.

Employ voltage and RF suppression techniques to minimize false alarms.

Install, where indicated on the plans, remote LED alarm indicators and key operated test stations. Locate test stations along foot traffic routes within the space in which the duct detector is located and mount where accessible without the use of a ladder.

7. Individual Adaptor Module (IAM) - Model #4090-9001

Use Individual Adaptor Modules for monitoring water flow switches, valve tamper switches and (if called for) non-addressable detectors.

Use IAMs for conventional 2-wire detection devices and/or contact devices monitored with Style D monitoring. These IAMs will monitor and communicate the device/zone's status (normal, alarm, trouble) to the Fire Alarm Control Panel.

Uniquely identify IAMs at the Fire Alarm Control Panel. Transmit device identification to the Fire Alarm Control Panel for processing according to the program instructions. Should an IAM become non-operational, tampered with, or removed, a discrete trouble signal, unique to the device, shall be transmitted to, and annunciated at, the Fire Alarm Control Panel.

Provide the capability of programming IAMs for their "address" location on the addressable device signaling line circuit. IAMs are to be compatible with addressable manual stations and addressable detectors on the same addressable circuit.

- Supervise the IAM for all trouble conditions. Indicate the type of trouble condition (open, short, device missing/failed) at the Fire Alarm Control Panel. Should an IAM fail, it will not hinder the operation of other system devices.
8. Relay Zone Adaptor Module (ZAM) – Model #4090-9008
 Use ZAMs for control of door hold opens, elevator functions during alarm conditions, control of air handling unit systems. Provide an addressable interface module for interfacing normally open, direct contact devices to an addressable signaling line circuit. Provide ZAMs capable of mounting in an outlet box (4 11/16" square x 2 1/8" deep). Include cover plates for ZAMs to allow surface or flush mounting. Provide 24VDC power to a ZAM from a separate two wire pair running from an appropriate power supply. Provide ZAMs with two easily replaceable, 2 amp fuses, one on each common leg of the relay. Provide each module with Style Z version wiring supervision, looping the wiring back and connecting to the module to allow continual operation of the controlled devices even if the wiring sustains a single break. 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. Uniquely identify ZAMs at the Fire Alarm Control Panel. Transmit device identification to the Fire Alarm Control Panel for processing according to the program instructions. Should the ZAM become non-operational, tampered with, or removed, transmit a discrete trouble signal, unique to the device, to the Fire Alarm Control Panel. Provide the capability to program the ZAMs for their "address" location on the addressable device signaling line circuit. Provide ZAMs compatible with addressable manual stations and addressable detectors on the same addressable circuit. Supervise the ZAM for all trouble conditions. Indicate at the Fire Alarm Control Panel the type of trouble condition (open, short, device missing/failed). Should a ZAM fail, it will not hinder the operation of other system devices.
9. Visual Only - Multi candela units – Model #4906-9208 Wall Mount or 4906-9204 with a 4906-9207 Ceiling Mount (Requires Model #4009-9401 and Model #4009-9812)
 Provide, UL Listed, entirely sold state, visual only indicating appliances comprised of a synchronized xenon flashtube, compatible with ADA requirements for the occupancy in which the devices are installed. Synchronize all visuals to flash simultaneously. Transmit device identification to the Fire Alarm Control Panel for processing according to the program instructions. Should the Visual Only become non-operational, tampered with, or removed, transmit a discrete trouble signal, unique to the device, to the Fire Alarm Control Panel.
10. Speaker Visual – Multi candela units – Model #4906-9251 with a 4906-9205 Wall Mount or 4906-9254 with a 4906-9207 Ceiling Mount (Requires Model #4009-9401 and Model #4009-9812) The preferred design is to provide a wall mounted multi candela unit Model #4906-9208 with a ceiling mounted speaker Model #4902-9721
 Provide polarized fire alarm speaker visuals that operate with 24VDC. Provide separate wire leads for in/out wiring for each leg of the associated signal (speaker or visual) circuit. Provide integral, synchronized, xenon strobe compatible with ADA requirements for the type of occupancy in which the speaker visual devices are installed. Provide 8000 peak candela power for each speaker visual and make adjustable from 1 to 3 flashes per second. Synchronize all visuals to flash simultaneously. Transmit device identification to the Fire Alarm Control Panel for processing according to the program instructions. Should the Speaker Visual become non-operational, tampered with, or removed, transmit a discrete trouble signal, unique to the device, to the Fire Alarm Control Panel.

D. FIRE ALARM EQUIPMENT ENCLOSURES

Provide cabinet(s) of sufficient size to accommodate the following equipment:

- Fire Alarm Control Panels
- Fire Alarm Control Panel associated electronic components
- Remote Annunciators

Provide doors, with locks and MEDECO cylinders, for all cabinets. Provide cabinet covers (inside cabinet doors) for all cabinets.

For the Fire Alarm Control Panel cabinet, provide openings in the cabinet cover necessary to manipulate/access all the Fire Alarm Control Panel controls and a transparent door panel to allow freedom from tampering and full view of the various lights and controls. For all other cabinets, provide covered openings in the cabinet cover (for potential future modifications) and solid doors. Provide cabinet(s) of sufficient size to accommodate the following equipment:

- Fire Alarm Control Panels
- Fire Alarm Control Panel associated electronic components
- Remote Annunciators

Provide doors, with locks and MEDECO cylinders, for all cabinets. Provide cabinet covers (inside cabinet doors) for all cabinets.

For the Fire Alarm Control Panel cabinet, provide openings in the cabinet cover necessary to manipulate/access all the Fire Alarm Control Panel controls and a transparent door panel to allow freedom from tampering and full view of the various lights and controls. For all other cabinets, provide covered openings in the cabinet cover (for potential future modifications) and solid doors.

F. MASS NOTIFICATION EQUIPMENT

1. High Powered Speaker Array – MA-2 or MA-1

Provide where indicated on the plans a speaker array shall provide maximum coverage area and excellent voice clarity for outdoor mass notification applications where intelligibility of pre-recorded voice messages and live Public Address (PA) is important. The HPSS32 shall include 1600 watts of continuous audio output and is battery powered for reliable outdoor alerting even when AC power is lost as is often the case during an emergency. The HPSA shall come with all brackets and hardware suitable for pole mounting.

2. Test Messaging Appliance (Message Board)

Provide where indicated on the plans a Text Messaging Appliance (Message Board) Simplex Model 4907-0001. Each unit shall be connected to the building fire alarm system and to the campus Ethernet. Message Board must be delivered to UofA FM Fire Safety for pre-programming and configuration prior to installation.

PART 3 - EXECUTION

1.1 INSTALLATION

- A. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations.
- B. Install all wiring 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. Adhere to all other applicable NEC wiring methods.
- C. Install wiring that is approved by the fire alarm equipment manufacturer.
- D. Install Class A (Style 6 Signaling Line Circuit as defined by NFPA-72) communications.
- E. Install all Class A circuits such that the outgoing and return conductors, exiting from and returning to the control unit respectively, are routed separately. Do not run the outgoing and return circuit conductors in the same cable assembly (multiconductor cable), enclosure or raceway. Separate the field outgoing and return wiring by at least 6 feet or by 1-hour fire rated construction. Outgoing and return wiring does not have to be separated where:
 1. The circuit is installed underground
 2. The circuit is encased in 2 hour fire resistive construction
 3. The circuit makes a single drop to an individual device within 10 feet of the loop
 Exceptions to the 6 foot/1-hour fire rated construction separation of outgoing and returning conductors will be considered by the Owner in unique device location circumstances. Request exceptions to this requirement in writing to the Owner.
- F. Individually configure circuits on site to provide either alarm/trouble operation, alarm only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching circuit or a alarm verification circuit, to accommodate and facilitate job site changes.
- G. Provide separate circuits for the audible and visual portions of all alarm indicating appliances.
- H. Arrange wiring of the circuits for strobe devices such that adjacent strobe devices are on separate circuits. Limit the number of strobe devices on any one circuit to 12 devices.
- I. Provide a manufacturer's authorized representative on-site for supervision of the installation.

- J. Install all devices and fire alarm equipment in accordance with the current NEC, the manufacturer's recommendations, NFPA 72, the plans, these specifications and the requirements outlined below. Notify the Owner if the plans indicate (or field conditions necessitate) locating/positioning any devices contrary to the manufacturer's recommendations, NFPA 72, or the requirements outlined below.
1. Locate smoke detectors as follows:
No closer than 3 feet from any air supply diffuser.
No farther than 15 feet from a wall or end of a corridor.
No farther than 30 feet between detectors.
 2. Locate manual pull stations such that the operable portion of the pull station (the center of the handle) located at 48" above the finished floor level.
 3. Locate visual only devices such that the device is 80 inches above the finished floor level OR 6" below the finished ceiling level, whichever is lower. Measure height above/below the floor/ceiling to the center of the device.
 4. Locate audio/visual devices such that the device is 80 inches above the finished floor level or 6" below the finished ceiling level, whichever is lower. Measure height above floor/below ceiling to the center of the visual component of the device.
 5. Locate test switches for duct smoke detectors such that the device is adjacent to a traveled access aisle/path near the air handler served by the test switch and positioned not more than 48" above the finished floor level. Measure height above the floor to the center of the switch.
 6. Locate Fire Alarm equipment enclosures such that the center of the display portion of the panel is 60" above the finished floor.
 7. Locate Fire Alarm message boards in such a way that a building occupant in a common area, (hallway, classroom, large meeting room, or similar space,) shall be no more than 100' line of sight from a message board.
- K. Elevator Interface with Fire Alarm System –to facilitate elevator recall, install smoke detectors at each elevator lobby, in the elevator equipment room, and at the top of the elevator shaft as indicated on the plans. This interface shall be provided regardless of the existing elevator operation. Program the Fire Alarm Control Panel to use these devices to perform the elevator recall function as outlined in Section 1.3.K.2 of these specifications.
Connect the fire alarm system to the elevator controls for elevator recall with ZAMs. Pull three wires (a common, a normally open, and a normally closed) from each elevator recall ZAM into the elevator controls cabinet. If elevator equipment does not facilitate the actual recall function all preparations and installations shall be made to accommodate these functions.
Where there are sprinkler heads in the elevator shaft, elevator pit, or elevator equipment room, install heat detectors, as indicated on the plans, within 2 feet (measured horizontally) of each sprinkler head. For these specific locations, provide heat detectors with a lower temperature rating and higher sensitivity (response time index), as compared to the sprinkler heads.
Provide an auxiliary alarm relay to interlock with the elevator power shut-off/shunt trip unit. Provide an IAM and a Fire Alarm Auxiliary Relay to monitor the presence of shunt trip power.
Provide a shunt trip circuit breaker on the elevator equipment power circuit in the elevator equipment room. Extend the interlock conductors from the Fire Alarm Control Panel to the new shunt trip circuit breaker.
Provide control ZAM or Relay IAM to activate car fire alarm light if an alarm has been detected in the machine room or hoistway.
- L. Air Handler Motor Control Interface with Fire Alarm System
1. Provide a single pole, double throw relay switch for loads up to 120VAC for each air handling unit's motor control center that is equipped with duct smoke detection. Provide a separate 24 VDC output relay with 10A, 120VAC rated contacts with a 7A in-line fuse for control of each type of equipment shown. Provide power to this relay from the 24VDC power to the relay ZAM. Control this relay from the type 2 control ZAM contacts. Locate relays in a separate electrical outlet box (4 11/16" square x 2 1/8" deep) adjacent to the air handling unit motor control center. Route circuits from motor controls and duct detector relay box. Route ONLY 24VDC into the control ZAM box.
- M. Door Holder Control
1. Provide ZAMs for the fire alarm system's control of door holders.

2. Provide a double pole, double throw relay capable of switching for loads up to 120VAC for each door holder circuit.
3. Locate relay in a separate electrical box (4" square standard) adjacent to the ZAM box. Route 120VAC circuits from door holders and 24VDC circuit from ZAM into relay box. Orient relay so 120VAC circuit does not cross the 24VDC circuit inside the relay box. Route ONLY 24VDC into the ZAM box.
4. Provide power to relay from the 24VDC power to the ZAM. Provide the output relay with 10A, 120VAC rated contacts with a 7 Amp in-line fuse for control of each door holder circuit. Control this relay from the ZAM contacts.
5. Provide door holder control ZAM with Style Z version wiring supervision, looping the wiring back and connecting to the module to allow continual operation of the controlled devices even if the wiring sustains a single break. Communicate the ZAM's supervised wiring status (normal, trouble) to the Fire Alarm Control Panel and receive commands to transfer the relay from the Fire Alarm Control Panel.

N. After the completion of the installation, clean all dirt and debris from the inside and the outside of the fire alarm equipment.

3.3 ACCEPTANCE INSPECTION AND TESTING

- A. Perform testing during hours approved by the Owner.
- B. Fully test every function, every device, and the operation of the completed fire alarm system in the presence of the Owner and the equipment manufacturer's representative.
- C. During the testing outlined above, the Owner will direct the contractor and equipment manufacturer's representative as to the Custom Labels to be programmed into the fire alarm system for identification of each device. This process will involve the contractor inspecting and activating each device in the presence of the owner's representative, the manufacturer's representative noting the Custom Label designation as directed by the Owner and programming this information into the Fire Alarm Control Panel.
- D. Certify, in writing, to the Owner that the fire alarm system is fully functional at the completion of the test. In addition to this written certification, provide the owner with a printout and a computer disc of the Fire Alarm Control Panel's programming documentation.
- E. Fully test the system in the presence of, and as directed by, the Authority Having Jurisdiction representative and the Owner. Should the system fail this test, make all repairs and upon receipt by the Owner of notification in writing by the contractor of compliance with the required repairs.

3.4 LABELING/MARKING

- A. Paint red all fire alarm pull and junction boxes and associated covers that will be located in concealed spaces **prior** to their installation.
- B. Identify the fire alarm system wiring on the pull or junction box cover by printing "FA" with an indelible felt tip pen. Print the identification neatly and legibly.
- C. Maintain wiring color code as indicated in 2.2.A and Section 16127 of these specifications throughout the installation.
- D. Maintain label tags on all wiring at junction points, per these specifications and 1996 NEC Article 760-10.
- E. Mark, with an indelible felt tip pen, the panel box and circuit number on the junction and pull boxes covers of all non-fire alarm wiring connected to the fire alarm system. Print the number of the panel box and circuit number neatly and legibly.
- F. Mark each fire alarm device with its IDNET circuit and device number as indicated below with an indelible felt tip pen. Print the IDNET circuit and device number neatly and legibly.
 - Pull stations - On the inside of the pull station face plate, visible when pull station opened with key.
 - ZAMs) - On cover of ZAM box. (Include ZAM function, i.e., shunt trip, air handler shut down, etc.
 - IAMs - On the IAM body.
 - Duct Detectors - On the duct detector housing
- G. Mark each fire alarm smoke detector and heat detector with its IDNET circuit and device number as indicated below with Kroy (or equal) self-adhesive tape with minimum 3/16" high black text. Cover identification text on smoke and heat detectors with Highsmith (or equal) pre-cut, 4 mil, non-glare, self-adhesive vinyl label protectors (item number L97-16140). Locate identification tape on detector base.



