

SECTION 16721

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 PRINCIPAL WORK IN THIS SECTION

- A. This section of the specification includes the furnishing, installation, and connection of the microprocessor-controlled fire alarm equipment required to form a complete coordinated system ready for operation. Provide a complete and operable active multiplex, addressable fire alarm system for the protected premises as part of the Campus Proprietary Supervising Station Fire Alarm System, as specified herein and as represented within the drawings. The system shall comprise all necessary component parts to provide the functions and facilities described and obtain the required approvals.
1. Fire Alarm Control Panel (FACP)
 2. Alarm Initiating Devices.
 - a. Manual stations.
 - b. Area photoelectric smoke detectors.
 - c. Duct photoelectric smoke detectors (*verify with local jurisdiction*).
 - d. Heat detectors - fixed and combination.
 - e. Sprinkler water flow and valve tamper switches.
 3. Fire alarm terminal and power supply cabinets.
 4. Remote control relays for air handling fans and dampers.
 5. Alarm audio/visual notification appliances (horns and strobe lights).
 6. Auxiliary control devices and modules.
 7. Conduit, wiring, outlets, wire, etc. required to provide power to and interconnect all components listed above.
 8. Conduit, wiring, outlets, wire, etc. required to monitor the emergency generator.
 9. Conduit, wiring, outlets, etc. required to provide power to and interconnect devices supplied under other Divisions, including:
 - a. Electric door locks, release controls.
 - b. Electric/magnetic door holders.

- c. Sprinkler water flow switches.
 - d. Sprinkler valve supervisory switches.
 - e. Damper limit switches and control electric pneumatic relays.
 - f. Elevator status/control panel.
 - g. Elevator recall control relays.
 - h. Integral fire door smoke detectors and magnetic hold-opens.
10. All submittals required by the University Representative and local authorities, and the obtaining of all approvals there from.
- B. Related Work in other Sections or Divisions:
Coordinate with work of all other trades as required, including but not limited to:
- 1. Electric door locks (Hardware Division).
 - 2. Electric/magnetic door holders (Hardware Division).
 - 3. Integral fire door smoke detectors and magnetic hold-opens (Hardware Division).
 - 4. Water flow switches (Division 15).
 - 5. Sprinkler valve supervisory switches (Division 15).
 - 6. Damper switches and EP switches (Division 15).
 - 7. Elevator monitor/control panel (Elevator Division).
 - 8. Raceways, boxes, outlets and terminal cabinets (Division 16).
 - 9. Mechanical HVAC (Division 15).

1.2 QUALITY ASSURANCE

- A. All equipment and materials used shall be standard components, regularly manufactured and of the same manufacturer.
- B. All systems and components shall have been thoroughly tested and proven in actual use.
- C. All equipment shall be listed by Underwriters' Laboratories and the California State Fire Marshall.
- D. All systems shall be designed, installed, and perform in accordance with appropriate statutory codes and referenced standards. Editions or versions of such codes and/or standards shall be as accepted as those legally adopted by the Building Standards Commission, enforced by the Office of the State Fire Marshal (OSFM), in effect at the time the plans for the proposed project were approved by the

Regents of the University of California and preliminary plans were submitted to the Office of the Campus Fire Marshal. The contractor, subcontractor, supplier, designer, technician, and any other involved parties shall also perform their respective scope of work in conformance with acceptable industry practices, as necessary to the satisfaction of the Owner.

- E. The system of this project shall be classified as a protective premise (local) fire alarm system and shall also be a component of the Campus proprietary supervising station fire alarm system, as defined by NFPA 72, 1999 Edition with State amendments.
- F. Equipment shall be manufactured by the indicated suppliers, or others as allowed by U.L. listing. All equipment shall be supplied and warranted by the system installer for no less than two years from date of completion of acceptance testing. Such warranty shall be required of the installing contractor, even if in excess of original manufacture warranties.
- G. The responsible installing contractor shall hold a current California C-10 Electrical Contracting license.
- H. Contractor shall demonstrate satisfactory installations of comparable systems within the immediately preceding five years, including references.
- I. Contractor shall demonstrate ability to provide response to affect repair within 4 hours by factory certified personnel, during the warranty period.

1.3 SUBMITTALS

- A. Descriptive data for all products and materials.
- B. Recommended application and installation methods, including area coverage for smoke detectors.
- C. Information and data, such as drawings showing device locations and types, riser diagrams, wiring diagrams, approvals, test data, etc. required by local Authorities.
- D. Contractor shall prepare and submit detailed shop drawings meeting the provisions of NFPA 72 and California Fire Code to the Office of the Campus Fire Marshal, and obtain approvals prior to proceeding with installation. The University Representative and Campus Fire Marshal approval of submittals and/or shop drawings is for permission to proceed with installation and does not authorize design, products, or installation not conforming to referenced codes and standards and this specification. The installing contractor shall be responsible for submitting revisions as necessary during course of installation and maintaining a current and accurate set of revised drawings at the job site. As-built drawings shall be prepared and operation and maintenance manuals shall be prepared and provided for approval prior to requesting acceptance testing from the office of the Campus Fire Marshal. The installing contractor shall prepare required Certificate of Compliance per NFPA 72, prior to requesting acceptance testing from the office of the Campus Fire Marshal.
- E. Drawings identifying all terminals and illustrating all device wiring connections.
- F. Elevations and plans detailing the FACP.
- G. Operating instructions.

- H. Copies of as-built drawings shall be provided as computer aided drafting (CAD) files, compatible with the AutoCAD, *.dwg file format. The content of the CAD files shall include only fire alarm system elements and contain no proprietary fonts or features.
- I. Contractor shall design and provide a complete supervised fire detection and alarm system consisting of metallic conduit, boxes, wiring, terminal cabinets, control panels, annunciator panels, initiating devices, notification devices, and other components as required for a functional system. This shall specifically include any and a portable or laptop computer compatible with manufactures software, all hardware, software, devices, or equipment to allow the Owner to interrogate, add, delete, disable, or evaluate any device in the system, at no additional costs to the Owner. Any software licensing agreements, releases, and fees shall be included as necessary.

1.4 APPROVALS

- A. Obtain all necessary approvals and permits from local Authorities, for all materials to be supplied, methods of installation and system operations, as required herein and by the local Authorities.
- B. The entire installation, including materials and equipment shall meet or exceed the minimum standards and requirements of the following:
 - 1. Underwriters' Laboratories, Inc. listing service.
 - 2. NFPA 72 and National Fire Codes.
 - 3. Codes as accepted and/or modified by the local Authorities:
 - a. California Building Code.
 - b. California Fire Code.
 - c. California Electrical Code.
 - 4. American Disabilities Act (ADA).
 - 5. Underwriters' Laboratories, UL 1971 for Hearing Impaired.

1.5 SYSTEM OPERATION

- A. General Operation
 - 1. Alarm Verification Operation
 - a. When an alarm condition is detected on an Initiating Device Circuit which has been programmed for Alarm Verification, the system will automatically enter the ALARM verification mode. If the alarm condition is still present after a preset time period of 30 seconds, the system will automatically enter the alarm mode. If a second alarm occurs during the verification period, the system will immediately enter alarm mode. If both smoke detectors and dry contact devices are connected to the same verified circuit, the smoke detectors will be verified but not the dry contact devices.

2. Signal Silence Operation

- a. All Notification Appliance Circuits shall have the option to turn off if the panel signal silence switch is manually activated.

PART 2 - PRODUCTS

2.1 MULTIPLEX TYPE SYSTEM

- A. The equipment described in this specification is for a multiplex microprocessor-controlled Fire Alarm System. Systems that do not meet the following criteria shall not be considered:
 1. The system shall be fully reprogrammable by onsite personnel using equipment available at all times from the local supplier.
 2. All memories shall be maintained during loss of all power supplies, (including batteries), and the system shall automatically restore to its normal operating mode upon restoration of power.
 3. Serial links shall be UL Style 7.
 4. Remote data gathering panels shall be capable of operating all critical functions required for safe evacuation while disconnected from the main processing unit due to communications link or main processor derangement.

2.2 EQUIPMENT

- A. Fire Alarm Control Panel (FACP):
 1. The system control panel shall be a Simplex Model 4100u and shall be configured with all required components, modules, etc. to provide for the complete operation of the system. The system shall also be configured to support 6 mapnet circuits, support 2 remote annunciators, and be connected to the existing campus fiber optic fire alarm network, at the point of connection identified. Point of connection to the Campus fire alarm fiber optic network exists in Bannockburn G Building approximately 600 feet from the project electrical room. Installing contractor responsible for all coordination, site work, trenching, conduit, fiber optic cable, cutting/patching of existing surfaces, installation, and labor to complete such connection. Additionally, the system shall be provided with no less than 16 programmable, form "C", dry relay outputs. Such contacts shall be pre-wired by the installing contractor using a style D, IDC, for each contact to a dedicated junction box, sized per CEC, Article 370 for 1.5 times the number of conductors required. Such junction box shall be located within 3 feet of the control panel and no greater than 5 feet above finished floor. Fire alarm control panel cabinet shall be surface mounted, red in color. The control panel cabinet shall contain required space for all components involved and shall be sized for required expansion to include spare capacities as indicated within this specification or construction drawings.
 2. System Capacity and General Operation
 - a. The control panel shall be capable of expansion as specified above.

- b. The CPU shall provide the following controls and indicators used by the system operator:

AC POWER	(Green LED)
SYSTEMS ALARM	(Red LED)
SUPERVISORY	(Yellow LED)
SYSTEM TROUBLE	(Yellow LED)
SIGNALS SILENCED	(Yellow LED)
POWER TROUBLE	(Yellow LED)
ACKNOWLEDGE	(Momentary Switch)
SIGNAL SILENCE	(Momentary Switch)
SYSTEM RESET	(Momentary Switch)
DISABLE/ENABLE	(Momentary Switch)
EVACUATION DRILL (Function Key)	(Momentary Switch)

- c. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools or PROM programmers and shall not require replacement of memory ICs.
- d. All programming shall be accomplished through manufactures listed instructions with all required computer hardware and software provided to the owner as specified above.
- e. Entry into program mode, if requiring a special key and/or a special password, shall be provided to the owner.

3. Central Processing Unit Module

- a. The central processing unit (CPU) module shall be Simplex 4100u, and will communicate, monitor and control all other modules in the panel. Removal, disconnection, failure, or change of type of any control panel module shall be detected and reported by the CPU as a module failure. The CPU shall contain and execute all custom programs for specific action to be taken if a fire situation is detected in the system. Programming shall be held in non-volatile memory, and shall not be lost even if system primary and secondary power failure occurs.

4. Enclosures:

- a. The control panel shall be housed in the manufacturer's UL-listed cabinet suitable for surface or semi-flush mounting.
- b. The back box and door shall be constructed of .060 steel with provisions for electrical

conduit connections into the sides and top.

- c. The door shall provide a key lock matching Campus standard and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door shall be selectable for either right or left-hand hinging.

5. Power Supply:

- a. The main power supply for the fire alarm control panel shall provide all control panel and peripheral device power needs.
- b. All Power Supplies shall meet current UL 864 Standards and NFPA requirements for power-limited operation on all notification and initiating circuits.
- c. Positive-temperature-coefficient thermistors, circuit breakers, and other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 100 AH, or may be used with external battery and charger systems. Battery arrangement may be configured in the field.
- d. The main power supply shall continuously monitor all field wires for Earth Ground conditions and shall have the following LED indications:
 - 1) Ground Fault
 - 2) Battery Fail
 - 3) AC Power Fail
- e. The power supply shall include provisions to add a battery voltmeter and ammeter.

- 6. The Campus receivers (3) shall be provided with the current version of IMS software. A portable or laptop computer including software shall be provided for field programming.

B. Batteries

- 1. Battery shall have sufficient capacity to power the fire alarm system for not less than 24-hours plus 5 minutes of alarm upon a normal AC power failure.
- 2. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.
- 3. In necessary to meet requirements, external battery and charger systems may be used.

C. Notification Appliances

- 1. Programmable Electronic Horns:
 - a. Electronic horns shall be System Sensor, SpectrAlert model H12/24 (no known equal).

Sounders (mini-horns) shall be System Sensor, SpectrAlert model PA400R. (no known equal)

- b. Electronic horns shall be field programmable without the use of special tools, to provide temporal (Uniform Fire Alarm Signal) slow whoop, or continuous tone with an output sound level of at least 90 dBA measured at 10 feet from the device.
 - c. Shall be flush or surface mounted as shown on plans.
- 2. Electric strobes shall be system Sensor, SpectrAlert model S1224MC (no known equal), and shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:
 - 3. Horn Strobe Combination Devices:
 - a. Combination horn – Strobe devices shall be System Sensor, Spectr Alert model P1224MC. (no known equal)
 - 4. Notification Appliances shall be powered from an Altronix model AL800UL-ADA power supply, or equal of the same manufacture. The quantity of power supplies shall be based upon no less than two notification appliance circuits per floor or as necessary to maintain a maximum calculated point-to-point voltage drop of less than 10 percent, of the normal operating voltage of the circuit. Voltage drop is subject to field verification during acceptance testing. Power supply NAC circuits shall be individually monitored for trouble conditions by the Simplex control panel.
 - 5. All NAC device locations shown on construction documents are considered as representative locations. The installing contractor is responsible for providing sufficient audible devices to meet the requirements of NFPA 72 for a system operating in the public mode and sufficient visible devices to comply with the provisions of NFPA 72 and ADAAG, at no additional costs to the owner.

D. Additional System Components

- 1. Bells shall be Wheelock Series MB, 6" in diameter unless otherwise shown on the drawings and shall be of the underdome continuous ringing type. The operation mechanism shall be continuous duty rated and enclosed in rugged housing. The unit shall have minimum sound output of 91 db at 10 feet.
- 2. Weatherproof Equipment:
 - a. Devices mounted in non standard environments shall be approved for the use and similar to the specified units.
- 3. Waterflow Switches:
 - a. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.

- b. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
 - c. All waterflow switches shall come from a single manufacturer and series.
 - d. Waterflow switches and valve tamper switches shall be provided and connected under this section but installed by the fire sprinkler contractor.
 - e. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow, a minimum of three (3) feet from a valve, and manufactures listed instructions.
 - f. The fire sprinkler system shall be provided with vane type water flow switches as necessary to indicate only the floor with water flow occurring, per NFPA 13.
 - g. Any required time delays for water surge shall be provided by the water flow switch. No delays shall be used by the programming of the software of the fire alarm control panel.
4. Sprinkler and Standpipe Valve Supervisory Switches:
- a. Any above ground fire sprinkler control valves shall be provided with appropriate tamper switches that provide a distinct supervisory alarm at the control panel and off - site retransmission of the distinct supervisory alarm.
 - b. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
 - c. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
 - d. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
 - e. The switch housing shall be finished in red baked enamel.
 - f. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting. The owner shall be provided three of any specialized tools used for normal access of the device.
 - g. Valve supervisory switches shall be provided and connected under this section and installed by fire sprinkler contractor.

5. Remote Annunciators:

- a. LCD type alphanumeric 80 character remote annunciators shall be provided as shown on drawings. Display shall be mounted so that the viewing window is located between 4'9" and 5'0" above finished floor.
- b. Remote annunciators shall be programmed to allow acknowledgement and review of alarm activity without the use any key or tool. All functions other then review shall require the switches be activated/enabled from an integral key switch, keyed to match Campus standard.
- c. Mounted on the unit shall be an audible signaling device, which shall be activated upon any alarm or trouble condition, and a buzzer silencing switch. Switch shall be automatically restoring type, after correction of alarm or trouble condition, such that any subsequent alarm or trouble will sound the buzzer. All components to be compatible with Fire Control Station and Building System Alarm and operation and U.L. listed.

6. Remote Control Relays:

- a. DPDT relays, suitable for 24 volt DC coil operation and with 5 amp contacts resistive load at 120 volt AC. One required for each fan and/or damper to be controlled, and for other devices as noted.

7. Electric Door Locks: Supplied and installed under the Hardware Division of work. All electrical connections and wiring to the devices shall be provided as part of the work of this Division.

8. Electric/Magnetic Door Holders: Door holders controlled by the fire alarm system shall not be powered from the fire alarm system. Door holders shall be de-energized by opening of a normally closed dry contact provided by the control panel and shall release automatically on power failure. Supplied under the Hardware Division of work but installed along with all necessary wiring as part of the work of this Division.

9. Damper Limit Switches and Control Electric Pneumatic Relays: Supplied and installed as part of the Mechanical Division of work. All electrical connections and wiring to the devices shall be provided as part of the work of this Division.

10. Elevator Status/Control Panel: Supplied under the Elevator Division of work. All wiring between this panel and the Elevator Controllers will be supplied and installed by the Elevator Contractor. Empty conduits from this panel to each elevator shaft, and conduit and wiring between this panel and the FCS shall be provided as part of the work of this Division.

E. System Components - Addressable Devices

1. Addressable Devices - General

- a. Addressable devices shall use the manufacturers address setting method, such as a Dip switch.

- b. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel signaling line circuits.
- c. Addressable smoke and thermal detectors shall provide alarm and power/polling LED's. LED's shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and LED's shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED if required.
- d. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.
- e. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA 72.
- f. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
- g. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
- h. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
- i. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
- j. Detectors shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. LED's shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.

2. Manual Fire Alarm Pull Stations

- a. Manual fire alarm pull stations shall be addressable double action break glass type, and on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, matching Campus standard, and shall be designed so that after

- actual emergency operation, they cannot be restored to normal use except by the use of a key.
- b. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
 - c. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letter.
3. Intelligent Photoelectric Smoke Detector
- a. Smoke sensors shall be analog addressable photoelectric type, using an independent base. The base shall be of a common type from the manufacturer so as to allow for either smoke or heat sensors to be installed, without replacement of the base. The detectors shall be Simplex or equal and use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
4. Intelligent Heat Detectors
- a. Where shown on the contract documents or deemed necessary, use of heat sensors shall be a combination rate of rise and fixed temperature type. The fixed temperature element shall be selected based upon maximum anticipated ceiling temperature. In locations where weatherproof devices are required, heat sensors shall be of rate compensation type. Heat detectors shall be Simplex or equal, intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.
5. Intelligent Duct Smoke Detector (if indicated)
- a. The in-duct smoke detector housing provided under Division 15 Section shall be Simplex or equal and accommodate either an intelligent ionization detector or an intelligent photoelectric detector, of that provides continuous analog monitoring and alarm verification from the panel.
 - b. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.
 - c. Design including location and length of sensing tube shall be indicated in submittals.
6. Addressable Dry Contact Monitor Module
- a. Addressable monitor modules shall be Simplex or equal and provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC's.

- b. The monitor module shall mount in a 4-inch square (101.6 mm square), 2 1/8 inch (54 mm) deep electrical box.
- c. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- d. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

7. Addressable Control Module

- a. Addressable control modules shall be Simplex or equal and provided to supervise and control the operation of one conventional Maccs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay.
- b. The control module shall mount in a standard 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box, or to a surface mounted backbox.
- c. The control module NAC may be wired for Class A/B with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NAC's may be energized at the same time on the same pair of wires.
- d. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised, UL listed remote power supply.
- e. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

8. Isolator Module

- a. Isolator modules shall Simplex or equal and be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch and NAC circuit. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each SLC loop and each NAC circuit. Location of module shall be clearly indicated in the shop drawing submittals.
- b. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
- c. The isolator module may require a distinct address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.

- d. The isolator module shall mount in a standard 4-inch (101.6 mm) deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.3 MANUFACTURERS

- A. Simplex.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the CEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is on going during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. Conduit: All conduit and its installation shall be in accordance with Section 16110. All fire alarm system conduits shall be externally identified at no greater than 20 ft. intervals, and at junction boxes by permanent red paint suitable for the purpose. Box cover shall be red in color. Exposed flexible conduit shall be liquid tight and shall not exceed 3 ft in length and shall transition properly into metallic conduit.
- D. Wire and cable: All wiring shall be installed in metal conduit or within equipment. Conductors shall be installed in accord with Section 16120. Conductors within equipment enclosures shall be carefully cabled and laced. Minimum conductor size for NAC circuits shall be No. 14 AWG, stranded copper, THHN insulation, installed within metallic conduit. Sizing of wire shall be subject to a maximum voltage drop of 10 percent. Conductors for SLC shall be as specified by the control panel manufacture. Metallic conduit systems shall be no smaller than ¾" or sized as to not to exceed 40 percent fill per CEC. Color-coding of wire insulation shall be as directed by practice of Campus Electric Shop. Installing contractor is responsible for coordinating prior to preparation of shop drawings.
- E. Outlet pull and junction boxes shall be painted red on the exterior and shall be installed in accord with Section 16110.
- F. Pigtail and/or tapped connection will not be allowed on supervised circuit. Connections shall be made directly to and from device terminal screws.
- G. All fire detection, alarm system devices, and control panels shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- H. Manual Pull Stations shall be suitable for semi-flush mounting on standard single gang box, and shall be installed not less than 42 inches (106.68 cm) or more than 48 inches (1.22 m) above the finished floor.

- I. All devices located at exterior or areas subject to damp conditions shall be listed for outdoor or weatherproof locations. Backboxes for such devices shall be confirmed with manufacture and shall be installed per listing requirements.
- J. The Office of the Campus Fire Marshal, prior to system programming, shall approve all fire alarm addressable custom labels.
- K. Installing contractor shall be responsible for coordination meetings with other appropriate trades to confirm operation of smoke/fire dampers, energy management systems, access control systems, intrusion systems, elevator, or other fire and life safety systems prior to and as needed during course of installation.
- L. Installing contractor shall coordinate and shall have programmable attributes of the fire alarm system reviewed by the Office of the Campus Fire Marshal prior to system programming.

3.2 TESTING AND REPORTS

- A. Upon completion of the system's installation, a representative of the system manufacturer shall conduct a thorough test of the system and submit a written report of the finding to the University Representative. The test shall include at least, verifying the following:
 - 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
 - 2. Close each sprinkler system control valve and verify proper supervisory alarm at the FACP.
 - 3. Verify activation of all flow switches.
 - 4. Open initiating device circuits and verify that the trouble signal actuates.
 - 5. Open and short notification appliance circuits and verify that the trouble signal actuates.
 - 6. Ground initiating device circuits and verify response of trouble signals.
 - 7. Check all alarm notification devices.
 - 8. Check installation, supervision, and operation of smoke detectors.
 - 9. Verify that each initiating device alarm signal is properly received and processed by the fire alarm control panel (Walk Test).
 - 10. Functional operation of each alarm device and circuit.
 - 11. Functional operation of each monitored device circuit.
 - 12. Functional operation of each control circuit.
 - 13. Supervision and automatic replacement functions for audio amplifier, preamplifiers and tone generators.

14. Conduct tests to verify trouble indications for common mode failures, such as alternating current power failure. Consult the manufacturer's manual for other common mode failures and conduct the described testing procedures.

3.3 TRAINING

- A. Corporate training shall be provided to certify up to three University employees on all installed equipment and software. If more than 30 miles from site, supplier must provide all expenses for training.

END OF SECTION