SECTION 281111 – ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Related Documents: Conditions of the Contract, Division 1 - General Requirements and Drawings apply to the Work of this Section.

1.02 SUMMARY

A. Section includes the following:

1. Addressable Fire Alarm Control Panels
2. Cellular Communicator
3. IP Communicator
4. Power Supplies
5. Circuits
6. System Smoke Detectors
7. Manual Pull Stations
8. Addressable Interface Modules
9. Notification Appliances
10. HVAC Shutdown
11. Remote Annunciators
12. Documentation Cabinet
13. Transient Suppression Modules
14. Phone Suppression Modules

ENGINEER OF RECORD:
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1.03 DEFINITIONS

A. AHJ: Authority Having Jurisdiction

B. DACT: Digital Alarm Communicator Transmitter

C. FACP: Fire Alarm Control Panel

D. FAEM: Fire Alarm Equipment Manufacturer

E. FM Global: Factory Mutual Global

F. IDC: Initiating Device Circuit

G. NAC: Notification Appliance Circuit

H. NICET: National Institute for Certification in Engineering Technologies

I. NFPA: National Fire Protection Association

J. NRTL: Nationally Recognized Testing Laboratory

K. SLC: Signaling Line Circuit

L. UL: Underwriters Laboratories, Inc.

1.04 REFERENCES

A. All work shall be installed in accordance with all applicable codes and referenced design standards indicated on the engineering drawings.

1.05 SYSTEM OPERATIONAL DESCRIPTION

A. The fire alarm system shall be a non-coded, documented addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire alarm service only.

B. System Operation shall be as follows:

1. Upon loss of building power, the entire system shall transfer to secondary power within ten (10) seconds, and without loss of signals. The system shall operate under secondary power in normal or trouble conditions in accordance with NFPA 72.

2. Abnormal circuit conditions or devices, as required for the Class of the circuit, shall initiate a "trouble" condition at the control panels and remote annunciator for that specific circuit or device. The “trouble” indication shall describe the nature of the condition on the affected circuit or device. The fire alarm system shall transmit a general "trouble" condition to an approved supervising station.

3. Activation of any supervisory device as indicated on the engineering drawings shall initiate a "supervisory" condition at the control panels and remote annunciators for that specific device. The "supervisory" indication shall describe the nature of the condition and specific address and alphanumeric description of the device affected. The fire alarm system shall transmit a supervisory by device address to an approved supervising station.

4. Activation of any alarm device as indicated on the engineering drawings shall initiate an "alarm" condition at the control panels and remote annunciator for that specific device. The "alarm" indication shall describe the nature of the condition and specific address and alphanumeric description of the device affected. The fire alarm system shall transmit an alarm by device address to an approved supervising station.

C. Initiation of an "alarm" condition shall result in the following functions to be performed by the system:

1. Initiate an alarm indication on the control panel by tone and illuminate the corresponding device specific alphanumeric LCD description. Manually activating the "Alarm Silence" shall silence the tone at the panel. The alarm alphanumeric display shall remain "On" at the control panel until the condition causing the alarm has been cleared and reset. An additional alarm reported to the panel subsequent to activating the "Alarm Silence" shall reactivate the control panel tone.

2. Activate the audible and visual notification appliances throughout the Academy Sports + Outdoors space.

3. Manually activating the "Alarm Silence" at the panel shall de-energize the occupant notification appliances in accordance with NFPA 72. An additional alarm reported to the panel subsequent to activating the "Alarm Silence" shall re-energize the audible and visual notification appliances throughout the Academy Sports + Outdoors space.

4. Transmit a specific “alarm” signal to an approved supervising station as indicated on the engineering drawings.

D. Actuation of alarm notification appliances, fire safety functions, and annunciation at the protected premises shall occur within ten (10) seconds after the activation of an initiating device.

E. Additional indications, notifications, enabling functions or control functions shall be as indicated on the engineering drawings.

1.06 DESCRIPTION OF WORK

A. Provide all required labor, warranty labor, materials, equipment, system programming, testing, submittals and services necessary for a complete and operational fire alarm system as hereinafter described, and as shown on the engineering drawings.

B. The equipment supplier’s factory trained technician shall train the Owner’s personnel in the proper use and maintenance of the system. Training sessions shall be conducted as needed, not to exceed a total of two (2) sessions, with each session lasting a maximum of four (4) hours each.

C. It is intended that the engineering drawings and specifications shall describe and provide for a working installation complete in every detail and all items necessary for such complete installation shall be provided whether or not specifically mentioned herein or shown on the engineering drawings.

1.07 PERFORMANCE REQUIREMENTS

A. Seismic Performance

1. The fire alarm control panel and raceways shall withstand the effects of earthquake motions as determined by SEI/ASCE 7.

a. The term "withstand" is defined as "the panel will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will remain fully operational after the seismic event."

1.08 SUBMITTALS

A. The engineering drawings have been prepared using Revit. These documents will be made available either in electronic or hard copy form. Utilization of these documents for the development of shop drawings and submittals does not relieve the Contractor from any responsibilities required herein.

B. In the submittals, the Contractor must clearly identify all areas and sections of this specification to which they take exception or are not capable of providing.

C. Submittals will be disapproved unless required equipment literature, calculations, and complete shop drawings are submitted together as one package for review.

D. The Engineer shall review the Contractor’s submittals to verify conformance to the project specifications and design concepts expressed in the contract documents. The Contractor shall allow sufficient time to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of details and dimensions, or substantiating installation or performance of equipment and systems designed by the Contractor, all of which remain the Contractor’s responsibility to the extent required by the contract documents. The Engineer's review shall not constitute approval of safety precautions of construction, means, methods, techniques, sequences of procedures, or approval of a specific assembly.

E. Prior to release of equipment for shipment or installation, submit to the Engineer the following:

1. Shop Drawings. The specific quantity to be submitted shall be confirmed with the General Contractor and Owner. Electronic submittals are acceptable. Submittal must be comprehensive of the entire project, complete in all detail, and include, but not be limited to, the following:

    a. Floor plans showing equipment placement, point to point wiring, wiring types and sizes, conduit types and sizes, wiring and raceway routes, and proposed mounting methods for conduit and backboxes. Floor plans shall be AutoCAD generated.
    b. Sequence of Operations in Matrix form to include a detailed description of the operation of each system function for all possible conditions.
    c. Audibility and intelligibility testing procedures. Testing procedures shall include a list of testing equipment, certificates of calibration, methods of measurement with minimum score, acceptability criteria and calibration procedure.
    d. Design minimum for audibility level for occupant notification.

    e. Riser diagram showing typical wiring connections for each type of device and module.
    f. Detailed wiring diagrams for major system components (control panels, transponder panels, power supplies, amplifiers, etc.).
    g. Supervisory and alarm current calculations for primary power and emergency battery sizing of all control panels and auxiliary power supplies.

        1) Battery calculations shall list the type of devices and modules, quantities, amperage draw for standby and alarm conditions for each device, the total amperage draw for each panel, and each panel’s battery amp/hour rating.
        2) The calculated load shall be the design load, including all required spare capacity.
        3) The battery calculations shall include a twenty-five (25) percent correction factor for aging to ensure the battery can meet its current demand at the end of service life.
        4) Audio amplifier load calculations for each audio amplifier in the system. Load calculations shall be provided for each audio circuit connected to the amplifier, shall indicate the load and percent spare capacity per circuit, the total load on each amplifier, and the spare capacity of each amplifier.

    h. A complete list of all proposed alphanumeric descriptions and their associated point address and circuit number.
    i. Voltage drop calculations for all notification appliance circuits.

        1) Calculations shall follow the voltage drop calculation criteria as outlined in NFPA 72 and UL 864.
        2) Calculations shall use the worst case operating voltage of each control panel or power supply as a starting voltage. The starting voltage shall be 20.4 VDC, unless written documentation is provided confirming that the specific control panel or power supply is capable of maintaining a voltage higher than 20.4 VDC.

3) Calculations shall use the lowest operating voltage of the notification appliances and the associated increased current draw. The lowest operating voltage shall be the UL standard operating voltage of 16 VDC, unless approved otherwise by the Engineer.

2. Manufacturer's literature on all system equipment. The specific quantity to be submitted shall be confirmed with the General Contractor and Owner. Electronic submittals are acceptable.

   a. Literature shall include specification and description of recommended supporting methods, enclosures or boxes, and wiring connections.
   b. The exact components to be utilized on this specific project shall be indicated, by highlighting or arrows, on each data sheet of the equipment literature.
   c. Literature which is not clearly identified will be rejected.

3. Qualifications and authorization of the representative of the FAEM.

F. The Engineer shall review for accuracy all submittals required to be received by the Engineer prior to equipment release or installation. The Owner, Owner's Representative, or design firms retained by the Owner shall not be responsible for any additional costs resulting from replacement of equipment or materials not reviewed prior to installation.

G. After satisfactory review of the submittals by the Engineer, the Contractor shall submit all required drawings, manufacturers' literature, calculations and any other materials required by the AHJ to obtain a permit to the appropriate party for review.

H. Forward to the Engineer a copy of the transmittal of the permit application.

I. Forward to the Engineer, in writing, any comments from the AHJ or the Insurance Underwriter within five (5) working days after the receipt of their comments.

1.09 PROJECT RECORD DOCUMENTS

A. The Contractor shall provide and maintain on site an up-to-date record set of satisfactory shop drawings which shall be marked to show each and every change made to the fire alarm system from the original approved shop drawings. This shall not be construed as authorization to deviate from or make changes to the shop drawings reviewed by the Engineer without written instructions from the Engineer in each case. This set of drawings shall be issued only as a record set. These drawings shall be made available to the Owner, or the Owner's Representative, upon request.

B. The preparation of a record of completion shall be the responsibility or the qualified and experienced installation personnel, as indicated in NFPA 72.

C. The preparation of a record of completion shall be in accordance with NFPA 72. Record of completion shall include, but not be limited to, the following:

1. A final copy of the record of completion shall be provided after completion of the operational acceptance tests.

2. This copy shall be updated to reflect all system additions or modifications and maintained in a current condition at all times.

3. All documents shall be located in separate enclosure or cabinet. Location of documentation cabinet shall be coordinated with AHJ prior to installation and labeled “SYSTEM RECORD DOCUMENTS”.

D. The Contractor shall continually document software and programming changes. This documentation shall include:

1. A complete printout of the system prior to the change.

2. A complete printout of the system program subsequent to the change, with all modifications highlighted.

3. A letter prepared and signed by the individual who made the changes, describing each change made and the reason for the change. This letter shall certify that the programmer has personally reviewed and compared the before and after program printout and verified the correctness of the modification(s).

4. An equivalent means performed automatically in computer software, which verified the results of changes made is acceptable.

E. All fire alarm system modifications made after the initial installation shall be recorded on a revised version of the original record of completion, as indicated in NFPA 72.

F. Once the fire alarm system is put into service, in whole or in part, and the associated building(s) are partially or wholly occupied, no software changes shall be performed without prior written permission of the Owner, or Owner’s Representative.

G. Only a certified manufacturer's representative trained in the specific programming software shall make changes to the fire alarm system software once the system is in service.

H. Each revision to the software shall be identified by a unique version number and date.

I. Prior to final payment for the fire alarm system and the beginning of the warranty period, submit a flash drive and two (2) sets (or as directed by the Owner’s Representative) of the following completed project record documents to the Owner’s Representative:

1. Copies of all test and inspection reports as required by the AHJ and NFPA 72:

a. The Record of Completion form shall be in the format as outlined in NFPA 72.
b. The Inspection and Testing form shall be in the format as outlined in NFPA 72.

2. All permits and licenses required to be in the possession of the Owner by the AHJ.

3. Accurate record (as-built) drawings of the complete installation to include, but not be limited to, the information required for the shop drawings. Record drawings of the floor plans shall be AutoCAD generated.

4. Original warranty documents including, but not limited to, those of the FAEM. Warranty documents shall reference and be binding to the warranty provisions specified in the warrant portion of this specification.

5. Submit to the Engineer a copy of the transmittal to the Owner's Representative for all final complete project record documents.

J. Upon completion of construction, submit two (2) sets and a flash drive of equipment warranties and two (2) sets and a flash drive of installation, operations and maintenance instructions to the Owner's Representative. This manual shall reflect the completed installation and include, but not be limited to the following information:

1. A detailed narrative description of the systems architecture, inputs, evacuation signaling, auxiliary functions, annunciation, sequence of operation, expansion capability, application considerations and limitations.

2. A detailed description of routine maintenance required or recommended, or as would be provided under a maintenance contract, including a testing schedule and detailed maintenance instructions for each type of device installed

3. Detailed troubleshooting instructions for each possible trouble condition.

4. An equipment list/schedule detailing all equipment and quantities installed. The manufacturer's product model/identification number shall be shown next to each piece of equipment on the list.

5. Updated manufacturer's data sheets and installation manuals/instructions for all equipment installed.

6. Updated list of spare parts and accessories recommended by the manufacturer shall be stocked for maintenance of the system.

7. A detailed description of the operation of the systems, including operator responses. Copies of the approved sequence of operation shall be placed in, or adjacent to the control panel.

K. A copy of all software documentation required by this section shall be maintained on-site by the Contractor, in a binder, arranged in chronological order. This binder shall be provided to the Owner's Representative at the completion of the project.

1.10 QUALITY ASSURANCE

A. All work shall meet the requirements of the Owner, Architect, Engineer and Authority Having Jurisdiction (AHJ).

B. All equipment and components shall be UL listed and approved by FM Global for the actual intended use, unless hereinafter specifically excluded from such a listing.

C. Installation and supervision of installation shall be in strict compliance with the requirements of the regulations, licenses, and permits for fire alarm system installers in this jurisdiction.

D. Installer must have been actively engaged in the business of selling, installing, and servicing fire alarm systems for at least five (5) years.

E. Installer must be an authorized representative of the FAEM and have technical factory training specifically for the system proposed.

F. The FAEM shall have a representative supervise the final connection of devices, wiring, and programming of the control panels. The FAEM representative shall be NICET certified as Level II or higher Fire Alarm Protection / Fire Alarm Systems Engineering Technician.

1.11 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Beginning with Substantial Completion (as determined by the Owner), provide software support for two (2) years.

C. Update software to latest version at Project completion. Install and program software upgrades that become available within two (2) years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide minimum thirty (30) days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.12 REGULATORY REQUIREMENTS

A. All work shall meet the requirements of all applicable codes and referenced design standards.

B. No approvals or interpretations of the design documents shall be pursued except through the Engineer.

C. Any work performed prior to the satisfactory review of the shop drawings by the Engineer, approval by the AHJ, and determined to be noncompliant with the contract documents or applicable codes by the Owner or AHJ will be replaced at the Contractors' expense.

D. The system will not be acceptable until final testing and receipt of the Inspection and Testing Form has been obtained.

1.13 WARRANTY

A. Repair all defective workmanship or replace all defective materials for a period of one (1) year from the date of acceptance by the Owner's Representative. Workmanship or equipment found to be defective during that period shall be replaced at no additional cost to the Owner.

B. The warranty or any part of the warranty shall not be made void by any required

operation or inspection of the system after acceptance during the warranty period. The Owner may select qualified firms other than Warrantor to provide required tests and inspections. System testing and inspections will be conducted only by a duly licensed company under contract with the Owner to perform scheduled testing and inspections as required by the AHJ. The Owner may elect to have a representative present at the scheduled testing during the warranty period.

1.14 POST CONTRACT MAINTENANCE

A. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (5) years Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

B. As part of the bid/proposal, include a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Edwards Systems Technologies (EST)

B. Fike

C. Farenhyt

D. Gamewell-FCI

E. Notifier

F. Siemens, Fire Safety

G. SimplexGrinnell

H. Approved Equal - Will not be considered unless formally submitted during the bidding process as an RFI.

2.02 FIRE ALARM CONTROL PANELS

A. General Requirements for the FACP:

1. Provide control panels that consist of modular components, utilizing solid state programmable microprocessors, to accomplish all system functions. The main control panel and any additional control panels shall be provided in sufficient quantity as to perform all functions in this specification. Transponders will be acceptable in lieu of additional control panels if the main control panel and transponder panels are capable of performing all of the functions in this specification. The components shall include but not be limited to the following items:

    a. Non-volatile RAM memory that provides for no program loss if a primary and secondary power loss occurs.
    b. An integral display with a minimum eighty (80) characters liquid crystal display (LCD). Provide light-emitting diodes (LED) for AC power, system alarm, system trouble, display trouble and disable. The display shall be visible through the control panel cabinet's transparent window. The processor shall be capable of displaying historical log data; current system status information; and all individual device addresses, descriptions and conditions on the integral display.
    c. The system shall provide a four hundred (400) event historical log on command of all alarms signals, supervisory signals, trouble signals, monitor point changes-in-state, operator commands and system initiated control functions.
    d. System core shall have processing capability to support the addressable points including the necessary software, programming, and motherboard/expansion card sockets. Core system shall include signaling line circuits (SLC) as indicated on the engineering drawings. Total system capacity shall support a minimum one hundred ninety-eight (198) addressable points including a minimum ninety-nine (99) addressable detection devices and ninety-nine (99) addressable input modules and/or output modules. No SLC device or module loop shall be assigned more than eighty (80) percent of its point capacity unless approved in writing by the Engineer.
    e. System processing capable of supporting initiation data circuits which can be "T-tapped" at any location on the signaling line circuit (SLC). Any additional modules, programming, or circuits required to achieve the specified system capacity shall be provided and installed at no cost to the Owner.
    f. Interface for peer-to-peer operation with automatic default to stand-alone mode if failure occurs in any processor, internal connection, or module.
    g. Control panels shall be capable of including an interface for supervised remote annunciators.
    h. System processing capable of supporting addressable analog smoke detection, addressable analog heat detection, addressable pull stations, addressable monitoring modules, and remote addressable control modules.
    i. Capability of controlling the state of contacts located in remote addressable modules, detector base-mounted programmable relays, and outputs on the panel including all necessary hardware and software.

j. Detection of removal, disconnection, or failure of any control panel module.

k. Capability of adjusting the smoke detector sensitivity from the control panel. The control panel shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings.

1) The control panel shall be capable to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups.
2) Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

l. Provide a "maintenance alert" feature whereby the detector initiates a trouble condition should the detectors' sensitivity approach the outside limits of the normal sensitivity window.

m. Control panel shall be capable of including an integral module for serial data output (RS-232) to an ASCII based printer. This module shall be in addition to other RS-232 outputs (if any) required for other devices. The contractor shall assure proper operation of the output transmissions.

1) Upon receipt of signal, print alarm, supervisory, and trouble events, the printer shall identify zone, device, and function and include the type of signal (alarm, supervisory, or trouble) along with the date and time of occurrence.
2) The printer shall differentiate alarm signals from all other printed indications.

a) Print system reset events, including same information for device, location, date, and time.
b) Print the commands that initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

n. Provide power supplies, transformers, batteries, battery chargers and modules required for a complete and operational system.

1) Primary power shall be 24 VDC obtained from 120 VAC dedicated service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and supervisory signals shall be powered by 24-V dc source.
2) Secondary power shall be 24 VDC supply system with batteries, automatic battery charger, and automatic transfer switch.
3) Batteries: Sealed lead calcium
4) Power supply capacity shall not exceed eighty (80) percent of its rated (continuous) capacity
5) Alarm current draw of entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
6) Provide sufficient output power to the devices to perform the specified functions as shown on the engineering drawings.

o. Provide a UL listed cabinet with sufficient space and circuit board slots for the specified equipment. The cabinet shall have a hinged door keyed in common with all other keyed devices throughout the system. If multiple cabinets are required in one location, the cabinets shall be located adjacent to each other and match in finish and design.

B. Circuits:

1. Initiating Device Circuits (IDC) shall meet the minimum requirements of the engineering drawings.

2. Notification Appliance Circuits (NAC) shall meet the minimum requirements of the engineering drawings.

3. Signaling Line Circuits (SLC) shall meet the minimum requirements of the engineering drawings. A single fault on a pathway connected to the addressable devices shall not cause the loss of the devices in more than one (1) zone.

4. Circuits for relay coil operation shall be 24 volt maximum with a separate or integral field collapsing diode.

5. The control panels and auxiliary power supplies shall receive their power from 120 volt AC dedicated branch circuits. The circuit disconnecting means shall:

a. Have a red marking
b. Have a listed breaker locking device
c. Be accessible only to authorized personnel
d. Be identified as “FIRE ALARM”.

6. The 24 volt DC power for all system initiation, supervisory, notification and control circuits shall be provided by the fire alarm control panel power supplies or listed auxiliary power supplies.

2.03 CELLULAR / IP COMMUNICATOR

A. Provide an approved cellular/IP communicator to transmit fire alarm, supervisory and trouble signals to an approved off-site monitoring station. The cellular/IP communicator shall be UL listed for commercial fire reporting to an approved off-site monitoring station, and shall conform to the requirements of NFPA 72.

B. The cellular/IP communicator shall operate from a dedicated 120 volt AC or 24 volt DC source with a listed secondary power source conforming to the same alarm and standby time requirements as the FACP.

C. The cellular/IP communicator shall have the capability of providing dual path communications.

D. The cellular/IP communicator shall have the ability to verify of communications path at maximum five (5) minute intervals in accordance with NFPA 72.

E. The cellular/IP communicator shall be able to transmit all signals in the Standard SIA (Security Industry Association) format.

F. Shall be Honeywell HWF2-COM series or equal.

2.04 AUXILIARY POWER SUPPLIES

A. Provide each auxiliary power supply (APS) in an individual, single, self-contained, lockable cabinet.

B. Input shall be 120 volt AC nominal with an output of regulated 24 volt DC. The APS shall operate from a dedicated 120 volt AC source with a listed secondary power source conforming to the same alarm and standby time requirements as the FACP.

C. Each APS shall be capable of actuation from either the control panel notification circuit, or programmed dry contacts.

D. Each APS shall provide “trouble” indication to the control panel upon loss of AC power, low battery or abnormal conditions on individual output circuits.

E. Each APS shall have a minimum of four (4) Class B and/or two (2) Class A supervised output notification circuits rated individually at a minimum of two (2.0) amperes available per circuit, with a total output of eight (8.0) amps. The Contractor shall be responsible for all redesign, circuiting, and additional equipment costs to provide the necessary output amperage.

F. Each APS shall have a minimum of twenty (20) percent spare capacity on each circuit, unless otherwise shown on the engineering drawings. The twenty (20) percent spare capacity shall be applied assuming the total available current is divided equally between all available circuits.

2.05 SYSTEM SMOKE DETECTORS

A. Intelligent Photoelectric Smoke Detectors

1. Provide analog photoelectric type smoke detectors with the capability to send data, on command, to the control panel representing the analog level of smoke density.

2. Provide a "maintenance alert" feature whereby the detector initiates a trouble condition should the detectors’ sensitivity approach the outside limits of the normal sensitivity window.

3. Provide address-setting means and store an internal identification code for each detector which the control panel can use to identify the type and precise location of the detector.

4. Provide dual alarm and power/status LED's. Flash status LED's under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected and verified.

5. Provide a low profile design modular detector head with twist-lock base.

2.06 INTELLIGENT DETECTOR BASES

A. Intelligent Detector Base

1. Provide a UL listed low profile twist-lock detector base with screw terminals. Provide an output connection in the base to connect an external remote alarm LED.

2. Detector base shall be capable of connecting to the control panel.

3. Provide supervision as required by NFPA 72 and the manufacturer's equipment literature.

2.07 MANUAL PULL STATIONS

A. Addressable Manual Pull Stations

1. Provide dual action type manual pull stations. Manual pull stations shall be designed that upon activation, shall initiate a change of status at the control panel. The manual pull stations shall not be automatically resettable and shall include a visible indication of the manual pull station being activated.

2. Provide address-setting means and store an internal identification code which the control panel can use to identify the type of device.

3. Construct of hi-impact red molded Lexan with instructions for station operation in raised white letters.

4. Provide flush mounting of pull stations. Where flush mounting is not possible, bring to the immediate attention of the Engineer of Record for resolution.

5. Provide mounting on backboxes UL listed for use with the pull station.

6. Provide a keyed reset on each pull station.

2.08 ADDRESSABLE INTERFACE MODULES

A. Monitor Modules

1. Provide addressable monitor modules where required to interface with contact alarm devices, or to connect a supervised zone of conventional initiating devices (any normally open dry contact device) to an intelligent SLC loop.

2. Provide address-setting means and store an internal identification code which the control panel shall use to identify the type of device.

3. The addressable module must provide a monitor LED that is visible from outside the cover plate unless otherwise noted or approved. Flash status/power LED under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.

4. Provide an automatic test feature to permit functional testing of the device from the main control panel. Indicate results of the test on the LCD display at the

control panel.

5. Monitor modules with multiple input contact connections are acceptable if each input is capable of independent programming and functional operation.

6. The factory provided cover plate shall be used.

B. Control/Relay Modules

1. Provide addressable control/relay modules where required to interface with a dry contact (Form C) relay. Provide power for the relay actuation from the intelligent SLC loop.

2. Minimum rating of Form C contacts shall be two (2.0) amperes at 24 volts and one half (0.5) amperes at 120 volts AC.

3. Provide address-setting means and store an internal identification code which the control panel shall use to identify the type of device.

4. The addressable module must provide a monitor LED that is visible from outside the cover plate unless otherwise noted or approved. Flash status LED under normal conditions, indicating that the control module is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.

5. Control/relay modules with multiple output contact connections are acceptable if each output is capable of independent programming and functional operation.

6. The factory provided cover plate shall be used.

2.09 NOTIFICATION APPLIANCES

A. Visual Notification Appliances - Ceiling Mounted

1. Provide visual notification appliances operable at 24 volt DC and polarized supervision. The appliances shall utilize a high intensity solid state LED strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall indicate “FIRE”, and shall be UL listed for ceiling mounted applications.

2. Where possible, provide flush mounting of appliances. Where flush mounting is not possible, bring to the immediate attention of the Engineer of Record for resolution. Where surface mounting is necessary or as indicated on the engineering drawings, provide a decorative backbox skirt covering the appliance backbox.

3. Provide synchronization of all visual notification appliances. The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.

B. Audible/Visual Notification Appliances - Ceiling Mounted

1. Provide solid state electronic audible notification appliances with integral visual notification appliance operable at 24 volt DC and polarized supervision. The appliances shall utilize a high intensity solid state LED strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact white thermoplastic, shall indicate “FIRE”, and shall be UL listed for ceiling mounted applications.

2. Where possible, provide flush mounting of appliances. Where flush mounting is not possible, bring to the immediate attention of the Engineer of Record for resolution. Where surface mounting is necessary or as indicated on the engineering drawings, provide a decorative backbox skirt covering the appliance backbox.

3. Provide synchronization of all audible and visual notification appliances. Provide a synchronized temporal pattern audible tone producing a minimum sound pressure level of seventy-five (75) dB reverberant per UL 464 using the A-weighted scale (dBA). The synchronization modules shall be capable of synchronizing appliances with candela ratings ranging from 15 cd to 185 cd.

C. Exterior Audible/Visual Notification Appliances - Wall Mounted

1. Provide solid state electronic audible notification appliances with integral visual notification appliance operable at 24 volt DC and polarized supervision. The appliances shall utilize a high intensity solid state LED strobe tube with associated lens/reflector system. The appliances shall be constructed of high-impact red thermoplastic, shall indicate “FIRE”, and shall be UL listed for wall mounted applications.

2. Provide appliances UL listed for outdoor weatherproof application.

3. Provide mounting on backboxes UL listed for outdoor weatherproof application and for use with the appliances.

2.10 ANNUNCIATORS

A. Remote LCD Annunciator Panel

1. Provide a remote annunciator with a minimum eighty (80) character liquid crystal display (LCD) which mimics the fire alarm control panel display. The remote annunciator shall have an enable key for operation of integral acknowledge, reset and silence switches. The remote annunciator shall derive all operational power from the fire alarm control panel.

2.11 MISCELLANEOUS

A. Alternating Current Transient Voltage Surge Suppression Modules (TSM)

1. Provide transient voltage surge suppression modules consisting of silicon avalanche suppressor diode (SASD) technology. Modules shall be designed, manufactured and installed in accordance with UL 1449, the National Electrical Code, and the manufacturer’s instructions.

2. Performance specifications shall include a Response Time of less than one (1) nanoseconds.

B. Transient Voltage Surge Suppression Modules (TSM)

1. Provide transient voltage surge suppression modules consisting of silicon avalanche suppressor diode (SASD) technology. Modules shall be designed, manufactured and installed in accordance with UL 497B, the National Electrical Code, and the manufacturer's instructions.

2. Performance specifications shall include a Response Time of less than five (5) nanoseconds.

C. Duct Smoke Detector Accessories

1. Provide remote test station/annunciator for concealed detectors.

D. Documentation Cabinet

1. Provide a documentation cabinet of 16 Gauge Steel construction.

2. Where possible, provide flush mounting of documentation cabinet. Where flush mounting is not possible, bring to the immediate attention of the Engineer of Record for resolution.

3. The documentation cabinet shall be red in color with contrasting text indicating FIRE ALARM DOCUMENTS.

4. The documentation cabinet shall be lockable and keyed in common with all other keyed devices throughout the system.

5. The documentation cabinet shall be sized to contain the following: full size record drawing, equipment data sheets, firmware and software control documentation.

2.12 CONDUCTORS

A. Cable and conductors for any power limited circuits shall be type FPL, FPLP, or FPLR. When circuits are installed above a ceiling, conductors shall be type FPLP.

B. Cable and conductors for any non-power limited circuits shall be type NPLF, NPLFP, NPLFR or THHN installed in conduit. When circuits are installed above a ceiling, conductors shall be type NPLFP.

C. Where the size or type of conductor hereinafter specified conflicts with the FAEM's requirements, the larger size or more specialized conductor type will be used.

D. Cable and conductors for wet locations shall be as follows:

1. Types RHW, TW, THW, THHW, THWN, XHHW or other type listed for use in wet locations.

2. Type listed for direct burial.

E. All electrical characteristics (conductor-to-conductor capacitance, DC resistance, etc.) of the fire alarm Cable and conductors shall meet the requirements of the selected FAEM for the intended application.

F. All fire alarm Cable and conductors shall conform to the requirements of Article 760 of the National Electrical Code, and all local codes and standards.

G. All fire alarm cabling shall be permanently labeled with industry standard labels to clearly indicate the associated circuits. At a minimum, labels shall be provided at each junction box and as necessary to ensure the maximum distance of twenty (20) feet between labels. Handwritten labels are not acceptable.

2.13 RACEWAY

A. The following raceway types shall be permitted:

1. Non-continuous raceway (open air)

2. EMT conduit (3/4 inch minimum).

3. RIGID conduit (3/4 inch minimum).

4. Non-Metallic conduit for wet locations (3/4 inch minimum).

5. Surface mounted metallic raceway with a minimum size equivalent to three quarter (3/4) inch nominal conduit.

6. Other means as approved by Engineer or Owner’s Representative.

B. All raceway types shall be new. Installing used raceway is unacceptable.

C. Using existing raceway is unacceptable without prior written permission of the Engineer or Owner's Representative.

D. Boxes, supports, and other accessories for the raceway installation shall be listed for the intended application.

2.14 CABLE MANAGEMENT WRAPS

A. Hook and Loop Cable Ties

1. Re-usable Velcro® strap for routing and securing cables and conductors.

2. Single piece strap with front side (hook material) that mates to its own rear side (loop material).

PART 3 - EXECUTION

3.01 COORDINATION WITH OTHER TRADES

A. Coordinate closely with all other trades to expedite construction, accurately interface with related systems, and avoid interferences.

3.02 INSTALLATION / APPLICATION

A. Furnish and install all control wiring, raceway, and outlet boxes for the fire alarm system.

B. Furnish and install all backboxes, equipment and devices for the fire alarm system.

1. Backboxes shall be of the exact type recommended by the FAEM as shown on the equipment and device submittals.

2. Backboxes shall be installed per the manufacturer's installation recommendations.

3. Devices and equipment must be installed by personnel legally permitted and currently licensed to install the devices and equipment. The cost of installation, warranty of installation and equipment, coordination of the installation, and supervision of the installation are responsibilities of the Contractor.

C. All fire alarm conduit, junction boxes, pull boxes, cable splices and terminal cabinets shall be accessible, painted red or clearly marked “Fire Alarm”. The Contractor shall comply with any local codes or AHJ requirements for circuit identification. Any access panels required for the accessibility to the junction boxes, pull boxes, cable splices and terminal cabinets shall be the responsibility of the Fire Alarm Contractor.

D. All cable and conductors not in conduit shall be installed in a neat and workmanlike manner utilizing a non-continuous pathway compliant with NEC requirements.

E. All conduit, cable and conductors shall be run at right angles (while maintaining manufacturers recommended bend radius specifications) to the building walls, floors, and ceilings. Connecting hardware shall be properly supported from the building structure at intervals compliant with NEC requirements.

F. All cable and conductors within fire alarm equipment enclosures shall be in the vertical or horizontal plane. Make all turns at right angles and tightly bundled and wrapped while maintaining manufacturers recommended bend radius specifications.

G. Cables and conductors shall be installed in a path that will provide proper spacing from electromagnetic interference in accordance with the NEC.

H. Identify all cable and conductors with permanent markings. Cable and conductor markings shall be printed labels, permanently affixed to the conductor via shrink wrap.

I. All power limited cable and conductors for the fire alarm system shall be installed in conduit in the following locations:

1. Below the structure.

2. Electrical and mechanical rooms (subject to physical damage).

3. Concealed above ceilings or in partitions (subject to physical damage).

4. Where required by applicable codes.

5. Cabling and conductors in finished areas that cannot be concealed are allowed to be installed in surface-mounted metallic raceway only upon approval of the Owner’s Representative.

J. All non-power limited cable and conductors for the fire alarm system shall be installed in conduit.

K. Power limited cable and conductors for the fire alarm system are not required to be installed in conduit in the following locations:

1. Above the structure

2. Above lay-in ceilings.

3. Concealed in ceilings or partitions not subject to damage.

L. Exposed cable, conductors and conduits shall be concealed from public view at all locations by routing on the inside of joists, above lay-in ceilings, over girders, within partitions or in any other manner acceptable to the Owner’s Representative.

M. Cable, conductors, and conduits installed above lay-in ceilings shall be supported from the building structure and shall not be permitted less than nine (9) inches above or behind removable panels or ceiling tiles.

N. Cables shall not rest directly on or be supported by ceiling panels, T-bars, ceiling support wires or any components of the suspended ceiling.

O. If support wires are necessary to properly support fire alarm cabling, independent support wires shall be attached to the building structure to carry the load and attached to the suspended ceiling grid to act as "sway control". When independent support wires are used, they must be distinguishable by color, tagging or other effective means.

P. Fire alarm cabling shall not be hung from any piping, ductwork or any hangers supporting piping or ductwork.

Q. Cables shall be installed utilizing a non-continuous pathway that must be attached to the building structure or walls with hardware specifically designed and listed to support the cable and its weight.

1. Hardware used to attach cable to structure shall be installed in a manor to ensure cable manufacturers recommended bend radius is maintained.

2. Non-continuous cable supports shall have flared edges to prevent damage to cable and conductors during installation.

3. Cables shall be installed such that the cable performance is not degraded or compromised.

4. Cable ties and wire straps shall not be used to attach cable to building structure where the cable ties or wire straps is bearing the weight of the cable.

5. Hardware used to attach cable to structure shall be engineered and designed for such purpose. Hardware shall be installed and utilized per manufacturer’s specifications.

6. Cables shall not be installed in a manner such that the cable or conductors rest directly on building structure where damage to the cable may be caused by normal building movement and use.

7. Cable support hardware shall have a wide enough surface area of support to not affect the geometry or performance of the cable.

8. All cable and conductors not in conduit shall be supported from the building structure at intervals of no more than five (5) feet and ensure that midspan sag does not exceed 12 inches.

R. Cable management wraps shall be used to bundle and manage multiple fire alarm cables connected to the same system and sharing a common pathway.

S. Cable ties should be installed with the proper tension to not crimp or effect the geometry of the cable. The use of a Cable Tie tensioning tool is recommended.

1. Cable ties excess must be cut flush to remove any sharp edges that could cause harm to people, hardware, and connectivity.

2. Cable ties shall meet the appropriate listing for the environment in which they are installed.

T. Ground fire alarm control panel and associated circuits shall comply with IEEE 1100. Install a ground wire from main service ground to fire alarm control panel.

U. All cable and conductors shall be tagged at all junction points and shall test free from grounds or crosses between conductors.

V. All cable and conductors shall be pulled splice free. Cable and conductors shall be run continuous from device to device. The use of wire nuts, crimped connectors, or twisting of conductors is prohibited. All terminations shall be at a terminal strip utilizing screw terminals.

W. Cable and conductors that are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting, or junction box shall be connected to screw-type terminal blocks.

X. Power-limited wiring conductors shall not be installed in conduits with electric light, power Class 1, non-power-limited fire alarm and medium power network-powered broadband communications circuits.

Y. Final connections between equipment and the wiring system shall be made under direct supervision of a representative of the FAEM. If other personnel are required by the AHJ to be present during final connections, this shall not relieve the Contractor of the responsibility of providing a representative of the FAEM for direct supervision.

Z. Fire alarm cabling shall not be painted.

AA. Conduits shall enter the control panel enclosures only in the approved locations, as identified in the FAEM installation instructions.

3.03 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire alarm equipment.

B. The control panels and auxiliary power supplies shall be surface mounted with no operational parts which may require maintenance mounted greater than seventy-two (72) inches above the finished floor. The control panel annunciator shall be mounted so that no switch, manually operated device, display or LED is greater than sixty (60) inches above the finished floor.

1. Installing the fire alarm control panels on concrete base the installation shall comply with requirements for concrete base."

a. Install seismic bracing.
b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on eighteen (18) inch centers around the full perimeter of concrete base.
c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
e. Install anchor bolts to elevations required for proper attachment to supported equipment.

2. Comply with requirements for seismic-restraint devices.

C. The remote annunciator shall be flush mounted so that no switch, manually operated device, display, or LED is greater than sixty (60) inches above the finished floor. The remote annunciator shall be located at the entrance designated for responding personnel or as otherwise acceptable to the AHJ.

D. The documentation cabinet shall be surface mounted.

E. Mount the cellular communicator within the enclosure at a location with acceptable signal strength from the wireless network connection. The cellular communicator shall not be installed above a suspended ceiling.

F. Remote test stations, where shown on the floor plans, shall be mounted in proximity of the associated device or unit, and with the final locations acceptable to the AHJ. Remote Status and Alarm Indicators shall be installed adjacent to each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

G. Smoke detectors shall be mounted on the underside of the ceiling or deck. Locate detectors more than three (3) feet from air supply diffusers or return air openings. The smoke detector and fire alarm cabling shall be installed and supported a minimum 1 ½ inches from the lowest surface of the roof decking in accordance with National Electrical Code. Locate detectors not closer than one (1) foot from any part of a lighting fixture.

H. Smoke and duct detectors shall not be installed until after the construction clean-up of all trades is complete and final. Detectors that have been installed prior to final clean-up by all trades shall be cleaned or replaced in accordance with NFPA 72.

I. Manual pull stations shall be securely mounted with the operable part of the manual pull station no greater than forty-eight (48) inches above the finished floor and no less than forty-two (42) inches above the finished floor. Provide semi-flush mounted on standard electrical boxes.

J. Wall mounted audible/visual and visual appliances shall be flush mounted such that the entire lens is not less than eighty (80) inches and not greater than ninety-six (96) inches above the finished floor or at the mounting height specified using the performance-based alternative. Where low ceiling heights do not permit wall mounting at a minimum of eighty (80) inches, wall mounted appliances shall be mounted within six (6) inches of the ceiling.

K. Ceiling mounted audible/visual and visual appliances shall be mounted as shown on the engineering drawings with their visual lenses having an unobstructed line of site in all directions. Exact locations of appliances shall be sufficiently distant from vertical surfaces and hanging items to permit maximum viewing from all directions.

L. Weatherproof audible/visual notification appliances shall be surface mounted at the fire department connection on the building exterior and with the final location as acceptable to the AHJ.

M. Devices and appliances shall be installed in the center or quarter point of the ceiling tiles as shown on the engineering drawings. Devices and appliances shall not be supported by ceiling tiles. Devices and appliances must be attached to backbox supported by the ceiling grid.

N. All initiating devices and addressable modules shall be mounted in a location accessible for testing and maintenance.

O. Provide a computer generated label for each initiating device indicating the specific address for that device. The label shall include the node number, loop number and device number where applicable. The label shall be located on the base of all detectors and the cover plates of addressable modules. Hand written labels are not acceptable.

P. Provide a computer generated label for each notification appliance indicating the circuit number, appliance number, and location of the end of line resistor. The label shall be located on the base of all notification appliances. Hand written labels are not acceptable.

3.04 IDENTIFICATION

A. Comply with requirements for identification for system components, wiring, cabling, and terminals.

B. When required, install framed instructions in a location visible from the fire alarm control panel.

1. Instructions shall be computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

3.05 RESTORATION OF SITE

A. Where sidewalks, curbs, and lawns are excavated by the Fire Alarm Contractor, these areas shall be backfilled and replaced to the original condition and to the satisfaction of the Owner, Architect and AHJ.

3.06 PAINTING AND PATCHING

A. All fire alarm conduit shall be thoroughly cleaned, removing all dirt, oil, etc. and made ready to receive paint.

B. Holes in walls or floors cut during the performance of this work shall be patched or covered with standard escutcheon plates so as to completely conceal the cuts where they would otherwise be exposed to view.

C. Holes in walls and ceilings created by the removal of fire alarm equipment no longer used shall be patched and painted to match the existing walls and ceilings, or covered with standard escutcheon plates so as to completely conceal the “holes” where they would otherwise be exposed to view.

D. All penetrations of fire rated assemblies (wall or floor construction) shall be firestopped to preserve the original fire resistance and smoketight integrity of the assembly. All firestopping methods shall be UL listed Through Penetration Firestop Systems or otherwise approved by the Owner, Architect, Engineer, and AHJ. Specific firestop assembly shall be identified at the penetration location with a sticker or other approved identification means.

3.07 SYSTEM TESTS

A. All test and inspections specified in this section shall be reported in writing and submitted in accordance with this specification section.

B. The system shall meet all the requirements of the listed applicable codes and the requirements of the AHJ. The system tests and test documents, including those required for and by the approved remote monitoring station, shall meet the requirements of the AHJ.

C. Provide one hundred (100) percent initial acceptance testing of the entire fire alarm system prior to the required AHJ acceptance testing. Before requesting the AHJ acceptance testing, furnish a written statement to the Owner’s Representative indicating that the system has been installed in accordance with the approved documents and tested in accordance with the manufacturer’s specifications and the applicable NFPA requirements. The Record of Completion shall be completed and submitted as part of the written statement.

1. System tests shall be witnessed by Authorities Having Jurisdiction.

2. Manufacturer's factory-authorized service representative shall be engaged to inspect and adjust components, assemblies, and equipment installations, including connections, and to assist in testing.

D. All testing, inspection and retesting required for certification and required for all warranty work or replacements shall meet the requirements of the AHJ. This certification, inspection, or testing shall be completed at no additional cost to the Owner.

E. Provide the testing date in writing to the Owner a minimum of two (2) weeks before the date. The Owner may elect to have a representative present for testing.

F. The fire alarm system will not be acceptable until final testing and receipt of the testing certificates have been obtained.

G. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

H. Testing and Inspections:

1. Visual Inspection shall be conducted prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing shall comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.

4. Test audible appliances for the private operating mode according to manufacturer's written instructions.

5. Test visible appliances for the public operating mode according to manufacturer's written instructions.

I. Reacceptance Testing shall be performed to verify the proper operation of added or replaced devices and appliances.

J. Fire alarm system will be considered defective if it does not pass tests and inspections.

K. Maintenance Test and Inspection:

1. A proposal to perform annual testing and/or inspection services shall be submitted to the Owner a minimum of three (3) weeks before the date of initial acceptance testing. The proposal shall include all testing and/or inspection services required by the AHJ for the two (2) year period beginning at final acceptance of the system. The Owner has the option to accept or reject the proposal.

2. Maintenance Test and Inspection shall be performed as listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

3. Annual Test and Inspection shall be performed one (1) year after date of Substantial Completion. The fire alarm system shall comply with all visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.08 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire alarm system.

END OF SECTION 281111