PART 1 - GENERAL

1.01 SUMMARY
A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.
C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
   1. Fire alarm and detection operations
   2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, fire suppression systems, emergency power systems, and other equipment as indicated in the drawings and specifications.
   3. One-way supervised automatic voice alarm operations.

1.02 ACCEPTABLE MANUFACTURERS
A. Manufacturers: The equipment and service described in this specification are those supplied and supported by SimplexGrinnell and represent the base bid for the equipment. Equal equipment by Edwards is the only substitutes that will not considered as these companies have existing campus.

1.03 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
   1. Division 26: "Basic Electrical Materials and Methods."
   2. Division 26: "Wiring Methods."
   3. Division 21: "Fire Protection"
   4. Division 23: "HVAC Systems"
C. The system and all associated operations shall be in accordance with the following:
   1. Guidelines of the following Building Code: BOCA
   2. NFPA 72, National Fire Alarm Code
   3. NFPA 70, National Electrical Code
   5. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
   6. Other applicable NFPA standards
   7. Local Jurisdictional Adopted Codes and Standards
   8. ADA Accessibility Guidelines

1.04 SYSTEM DESCRIPTION
A. General: Provide a complete, non-coded, addressable microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein. Connect the new fire alarm panel to the existing toke and ring fire alarm network via fiber optic cable, make any and all fiber connections necessary for a complete fire alarm network.
B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download.

C. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

D. Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout differentiates alarm signals from all other printed indications.

E. Wiring/Signal Transmission:
   1. Transmission shall be hard-wired, using separate individual circuits for each zone of alarm operation as required or addressable signal transmission, dedicated to fire alarm service only.
   2. System connections for initiating (signaling) circuits and notification appliance circuits shall be Class B.
   3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone.

F. Remote Access:
   1. FACP shall have the capability to provide Remote Access through a Dial-Up Service Modem using the public switched telephone system of a private switched telephone system.
   2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.
   3. FACP shall have the capability to provide Remote Access through a listed Internet Interface via a standard web browser user interface.

G. Required Functions: The following are required system functions and operating features:
   1. Priority of Signals: Alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
   2. Noninterfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent activations.
   3. Transmission to Remote Central Station: Automatically route alarm, supervisory, and trouble signals to a remote central station service transmitter provided under another contract.
   4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the location and type of device.
   5. General Alarm: A system general alarm shall include:
      a) Indication of alarm condition at the FACP and annunciator(s).
      b) Identification of the device or zone that is the source of the alarm at the FACP.
      c) Operation of audible and visible notification devices throughout the building until silenced at FACP.
      d) Closing doors normally held open by magnetic door holders.
e) Unlocking designated doors.
f) Shutting down supply and return fans serving zone where alarm is initiated.
g) Closing smoke dampers on system serving zone where alarm is initiated.
h) Initiation of smoke control sequence through the building temperature control system.
i) Notifying the local fire department.
j) Initiation of elevator recall in accordance with ASME/ANSI A17.1, when specified detectors or sensors are activated.

6. Supervisory Operations: Upon activation of a supervisory device such as fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:
   a) Activate the system supervisory service audible signal and illuminate the LED at the control unit and the graphic annunciator.
   b) Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
   c) Record the event in the FACP historical log.
   d) Transmission of supervisory signal to remote central station.
   e) Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.

8. System Reset
   a) The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
   b) Should an alarm condition continue, the system will remain in an alarmed state.

9. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.

10. WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:
   a) The city circuit connection and suppression release circuits shall be bypassed for the testing group.
   b) Control relay functions associated to one of the 8 testing groups shall be bypassed.
   c) The control unit shall indicate a trouble condition.
   d) The alarm activation of any initiation device in the testing group shall cause the audible notification appliances to sound a voice announcement code to identify the device or zone.
   e) The unit shall automatically reset itself after signaling is complete.
   f) Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to voice announce sound for 4 seconds indicating the trouble condition.

H. Analog Smoke Sensors:
1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.

4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a CRT Display or printed for annual recording and logging of the calibration maintenance schedule.

5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to indicate that a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate that a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a dirty sensor without creating a trouble in the system. If this indicator is ignored, a second level "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.

6. The FACP shall continuously perform an automatic self-test on each sensor which will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.

7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.

8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.

9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

I. Smoke Detectors: A maintenance and testing service providing the following shall be included with the base bid:
1. Biannual sensitivity reading and logging for each smoke sensor.
2. Scheduled biannual threshold adjustments to maintain proper sensitivity for each smoke sensor.
3. Threshold adjustment to any smoke sensor that has alarmed the system without the presence of particles of combustion.
4. Scheduled biannual cleaning or replacement of each smoke detector or sensor within the system.
5. Semi-annual functional testing of each smoke detector or sensor using the manufacturer's calibrated test tool.
6. Written documentation of all testing, cleaning, replacing, threshold adjustment, and sensitivity reading for each smoke detector or sensor device within the system.
7. The initial service included in the bid price shall provide the above listed procedures for a period of five years after owner acceptance of the system.

J. Audible Alarm Notification: By voice evacuation and tone signals on loudspeakers in areas as indicated on drawings.
1. Automatic Voice Evacuation Sequence:
   a) The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall resume. This sequence shall sound continuously until the "Alarm Silence" switch is activated.
b) All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.

K. Speaker: Speaker notification appliances shall be listed to UL 1480.
   1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.
   2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
   3. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.

L. Manual Voice Paging
   1. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.
   2. The control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers.
   3. Facility for total building paging shall be accomplished by the means of an "All Call" switch.

M. Fire Suppression Monitoring:
   1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
   2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
   3. WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.

N. Power Requirements
   1. The control unit shall receive AC power via a dedicated fused disconnect circuit.
   2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
   3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.
   4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously while incoming power is present.
   5. The system batteries shall be supervised so that a low battery or depleated battery condition or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
   6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control
   7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary(AC) and secondary (battery) power conditions.]
   8. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.05 SUBMITTALS
A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
2. Wiring diagrams from manufacturer.
3. Shop drawings showing system details including location of FACP, all devices, circuiting and details of graphic annunciator.
4. System Power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, NAC, relay, sensor, and auxiliary control circuits.
6. Operating instructions for FACP.
7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
8. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
9. Record of field tests of system.

B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions if required to make clarifications or revisions to obtain approval.

1.06 QUALITY ASSURANCE
A. Installer Qualifications: A factory authorized installer is to perform the work of this section.
B. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

1.07 MAINTENANCE SERVICE
A. Maintenance Service Contract: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives.
B. Basic Services: Systematic, routine maintenance visits on a quarterly basis at times scheduled with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.
C. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.

PART 2 - PRODUCTS

2.01 FIRE ALARM CONTROL PANEL (SIMPLEX 4100-series, compatible with campus fiber network)
A. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."
B. The following FACP hardware shall be provided:
   1. Power Limited base panel with beige cabinet and door, 120 VAC input power.
   2. 2,000 point capacity where (1) point equals (1) monitor (input) or (1) control (output).
3. 2,000 points of Network Annunciation at FACP Display when applied as a Network Node
4. 2000 points of annunciation where one (1) point of annunciation equals:
   a) 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
   b) 1 LED on panel or 1 switch on panel.
5. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FCP LCD Display.
6. Municipal City Circuit Connection with Disconnect switch, 24VDC Remote Station (reverse polarity), local energy, shunt master box, or a form "C" contact output.
7. One Auxiliary electronically resetable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.
8. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
9. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries.
10. Power Supplies with integral intelligent Notification Appliance Circuit Class B for system expansion.
11. Four (4) form "C" Auxiliary Relay Circuits (Form C contacts rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory of other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC, inductive.
12. The FACP shall support (6) RS-232-C ports and one service port.
13. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
14. Programmable DACT for either Common Event Reporting or per Point Reporting.
15. Service Port Modem for dial in passcode access to all fire control panel information.

C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.

D. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

E. Voice Alarm: Provide an emergency communication system, integral with the FACP, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:
   1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface.
   2. All announcements are made over dedicated, supervised communication lines. All risers shall support Class B wiring for each audio channel.
   3. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone.

F. Fiber Optic Modem: Network communications shall be via Simplex 4100U Fiber Optic Modems. The fiber modems shall allow Full Duplex/Bi-Directional Network and Audio Communications over a single Fiber Optic Cable. Modems shall use Type ST fiber connections. Modems shall use Multi-Mode 62.5 micron fiber cable. Fiber transmission shall be via split frequency utilizing 1310nm and 1550nm. 4100-6074 Left Port Fiber Modem Assembly, and 4100-6075 Right Port Fiber Modem Assembly.
2.02 REMOTE CRTS, PC ANNUNCIATOR AND PRINTERS

A. Fire Alarm Control Unit shall be capable of operating remote CRT’s and/or printers; output shall be ASCII from an RS-232-C connection with an adjustable baud rate.

B. Fire Alarm Control Unit shall be capable of operating a PC Annunciator which provides status annunciation and limited system control using a convenient and familiar Microsoft Windows® 2000 operating system based interface. PC Annunciator shall provide the following functions:
   1. Login/logout password protection with time duration selectable automatic logout
   2. Displays Alarm, Supervisory, Priority 2, and Trouble conditions with numerical tallies for each
   3. Displays first and last alarms
   4. Different event types have separate visible indicators with a common audible indicator
   5. Event logs can be searched and printed
   6. View and/or print TrueAlarm status reports and service reports (printing requires an available local or network printer)
   7. Alarm Silence; System Reset; and Priority 2 Reset
   8. Global and individual point acknowledge
   9. Set system time and date; and clear event log
   10. Individual point access for control or parameter revisions

C. Each RS-232-C port shall be capable of supporting and supervising a remote Printer; the FACP shall support as many as two (2) remote displays. The Fire Alarm Control Panel shall support five (5) RS-232-C ports.

2.03 REMOTE LCD ANNUNCIATOR (SIMPLEX 4603-9101)

A. Provide Remote LCD Annunciator with the same "look and feel" as the FACP operator interface. The Remote LCD Annunciator shall use the same Primary Acknowledge, Silence, and Reset Keys, Status LEDs and LCD Display as the FACP.

B. Annunciator shall have super-twist LCD display with two lines of 40 characters each. Annunciator shall be provided with four (4) programmable control switches and associated LEDs.

C. Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.

D. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

E. The LCD shall display the following information relative to the abnormal condition of a point in the system:
   1. 40 character custom location label.
   2. Type of device (e.g., smoke, pull station, waterflow).
   3. Point status (e.g., alarm, trouble).

F. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge, Silence and Reset operation shall be the same as the FACP.

G. General: Components include battery, charger, and an automatic transfer switch.

H. Battery: (SIMPLEX 2081-9276) Sealed lead-acid. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 15 minutes.

2.04 ADDRESSABLE MANUAL PULL STATIONS (SIMPLEX 4099-9001)

A. Description: Addressable single-action type, red LEXAN, with molded, raised-letter operating
instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

B. Protective Shield: Where required provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

2.05 SMOKE SENSORS

A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
   1. Factory Nameplate: Serial number and type identification.
   2. Operating Voltage: 24 VDC, nominal.
   3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
   4. Each sensor base (SIMPLEX 4098-9792) shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
   5. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
   6. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
   7. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
   8. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
   9. Removal of the sensor head for cleaning shall not require the setting of addresses.

B. Type: Smoke sensors shall be of the photoelectric (SIMPLEX 4098-9792) or combination photoelectric / heat type (SIMPLEX 4098-9602). Where acceptable per manufacturer specifications, ionization type sensors may be used.

C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.

D. Duct Smoke Sensor: (SIMPLEX 4098-9756) Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.
   1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
   2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
   3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
   4. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
   5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
   6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
   7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
8. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.
9. Where indicated a NEMA 4X weatherproof duct housing enclosure shall provide for the
   circulation of conditioned air around the internally mounted addressable duct sensor
   housing to maintain the sensor housing at its rated temperature range. The housing shall be
   UL Listed to Standard 268A.]

2.06 HEAT SENSORS (SIMPLEX 4098-9733)
A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm
   indication lamp; 135-deg F fixed-temperature setting except as indicated.
B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based,
   rate-compensated, self-restoring and shall not be affected by thermal lag.
C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable
   to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable
   at the FACP for either 15-deg F or 20-deg F per minute.
D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for
   temperature extremes in the range from 32-deg F to 155-deg F.

2.07 ADDRESSABLE CIRCUIT INTERFACE MODULES (SIMPLEX 4090-9001)
A. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that
   are not otherwise equipped for addressable communication. Modules shall be used for monitoring
   of waterflow, valve tamper, non-addressable devices, and for control of evacuation indicating
   appliances and AHU systems.
B. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit.
   Module identification shall be transmitted to the control unit for processing according to the
   program instructions. Modules shall have an on-board LED to provide an indication that the
   module is powered and communicating.

2.08 MAGNETIC DOOR HOLDERS (SIMPLEX 2088-9608)
A. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as
   indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a
   24VAC or a 24VDC source, and develops a minimum of 25 lbs. holding force.
B. Material and Finish: Match door hardware.

2.09 STANDARD ALARM NOTIFICATION APPLIANCES
A. VISIBLE ONLY: (SIMPLEX 4906-9101) Strobe shall be listed to UL 1971. The V/O shall
   consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount
   directly to standard single gang, double gang or 4" square electrical box, without the use of
   special adapters or trim rings. V/O appliances shall be provided with selectable flash intensities of
   15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of
   the specific Visible/Only appliance.
B. SPEAKER/VISIBLE: (SIMPLEX 4906-9151) Combination Speaker/Visible (S/V) units combine
   the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and
   UL 1480.
1. Twisted/shielded wire is required for speaker connections on a standard 25VRMS or
   70.7VRMS NAC using and UTP conductors, having a minimum of 3 twists per foot is
   required for addressable strobe connections.
2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the
   speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
3. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.

4. The S/V installs directly to a 4" square, 1 1/2 in. deep electrical box with 1 1/2" extension

C. Accessories: The contractor shall furnish the necessary accessories.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
   1. Factory trained and certified personnel.
   2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
   3. Personnel licensed or certified by state or local authority.

C. The system shall be connected to the campus fire alarm network. The system function shall match the existing function of other networked control panels for reporting, annunciation, etc.

3.02 EQUIPMENT INSTALLATION

A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

B. All fire alarm panels shall be monitored and networked via the existing campus fiber optic network.

C. Equipment Removal: After acceptance of the new fire alarm system, disconnect and remove the existing fire alarm equipment and restore damaged surfaces. Package operational fire alarm and detection equipment that has been removed and deliver to the Owner. Remove from the site and legally dispose of the remainder of the existing material. Remove all associated conduit and wiring. Provide blank cover plate over all abandoned outlets recessed in walls.

D. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.

3.03 WIRING INSTALLATION

A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AH and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).

B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing,
adjustment of the system.

B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
   1. Factory trained and certified.
   2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
   3. International Municipal Signal Association (IMSA) fire alarm certified.
   4. Certified by a state or local authority.
   5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.

C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.

H. Final Test, Certificate of Completion, and Certificate of Occupancy:
   1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

3.05 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.

B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.06 TRAINING

A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
   1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.
   2. Schedule training with the Owner at least seven days in advance.

END OF SECTION