SECTION 16622

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings, Division 0, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 16010, Basic Electrical Requirements.

C. Section 16050, Basic Electrical Materials and Methods.

1.02 WORK INCLUDED

A. New building fire alarm system, including materials, labor, services of a manufacturer trained installer, and related work.

B. Final adjustment and test of system.

C. Letter certifying that system has been properly installed and operates in accordance with applicable codes and these specifications.

1.03 SUBMITTALS

A. Deliver submittals as directed in Section 16010 for:
1. Fire alarm control panel
2. Notification device power extenders
3. Manual stations
4. Smoke detectors
5. Duct smoke detectors
6. Heat detectors
7. Monitor modules
8. Control modules
9. Audible/visual devices
10. Graphic annunciator
11. LCD annunciator
12. Voice alarm control
13. Wire and cable

B. Provide shop drawings and product data to indicate system components, size of components, location, floor plan drawings, and full one line schematic of wiring system showing every fire device and building and operation details. Indicate every fire alarm device, wire type, wire size, number of conductors, device location and room name for approval by the local Fire Department, Engineer, and Owner's representative.

C. Subject to authorization of Owner, Engineer may provide building floor plans and device locations in AutoCAD ADwg@ format for use by contractor in preparing shop drawings. If such drawing files are offered, it will be with the understanding that contractor is responsible for any necessary format changes, and that contractor will remove any information not pertinent to contractor=s work, and as may be requested by the Engineer. Contractor=s drawings shall be issued with Contractor=s title block and logo; use of A/E=s title block is prohibited. No extra cost shall accrue to Owner in the event such files are not offered or for format and/or editing work that may be required.

D. Submit manufacturer's descriptive literature, operating instructions, and maintenance and repair data.

E. Have manufacturer submit, on completion of system verification, a point by point check list indicating the date and time of each item inspected and issue a certificate, confirming that the inspection has been completed and the system is installed and functioning in accordance with the specifications.

F. Submit final test report and letter signed by an authorized representative of the manufacturer and installing company.

1.04 REFERENCES

A. NFPA 70, National Electrical Code, 2002.

B. NFPA 72, Fire Alarm Code, 1999.

C. NFPA 101, Life Safety Code, 2000.

1.05 REGULATORY REQUIREMENTS

A. Installation subject to approval, inspection, and test by manufacturer certified installer.

B. Provide equipment listed by UL and FM, tested by a nationally recognized fire test laboratory, and compatible with the integrated fire alarm system.

C. Equipment, wiring, and installation shall meet the requirements of NFPA 70, 72, 101, and Americans with Disabilities Act (ADA).

1.06 SYSTEM DESCRIPTION

A. Supervised, addressable, annunciated, power limited 24 volt AC/DC system.

B. Provide fully supervised fire alarm control panel, power extenders, manual fire alarm stations, smoke detectors, heat detectors, audio/visual alarms, and sprinkler circuits.

C. Design the system to operate such that on receipt, over the addressable network, of a positive indication from one or more of the manual stations, automatic smoke and heat detectors, and sprinkler circuits the following will occur:

D. Indication of the zone and initiating device in alarm on the LCD display on the front of the fire alarm control panel, and on remote annunciators.

E. The audible temporal pattern shall be synchronized for all devices on a floor, and the visible pattern shall be synchronized for all devices on a floor.

F. Audible and visual signals shall be on separate circuits to allow silencing of the audible signals while maintaining an active visual indication.

G. Shut down heating and ventilating equipment fans.

H. Tie-in to building wide fire alarm notification system.

I. Summon the local fire department via existing Digitizemaster box and city fire alarm circuit.

J. Transmit signal to elevator controller for automatic homing to designated floor and annunciation as required by NFPA72.

K. Close doors that are held open electrically.

L. Initiating device, notification appliance, and signaling line circuits shall be Class B as defined in NFPA 72.

M. Operating power failure or disarrangement of the supervised circuits shall cause audible signal to sound, and lamp to indicate, until all circuits are restored to normal, except equip the audible signal with a silencing switch. The audible signal shall resound in the event of a subsequent trouble event on another circuit.

N. In the event commercial power is lost, the system shall automatically transfer to standby battery power. Transfer shall not cause disarrangement except trouble lamp shall indicate loss of prime power.

O. FACP, power extenders, zone addressable monitor and control modules, heat and smoke detectors, manual pull stations, audible/visible devices, and other fire alarm system related devices are shown on the drawings. Locations are approximate unless dimensioned.

PART 2 - PRODUCTS

2.01 GENERAL

A. Acceptable Manufacturers
1. Cerberus/Pyrotronics
2. Fire Control Instruments
3. Gamewell
4. Honeywell
5. Notifier
6. Simplex
7. Securitron

B. Manufacturer, or manufacturer's authorized representative shall have a minimum of five years experience and maintain a full-time service office within 150 miles of the building site. Service office shall be staffed with trained technicians and stocked with sufficient spare parts so as to provide repairs within 24 hours of time reported outage.

C. Fire alarm system components shall be by a single acceptable manufacturer, except as specifically approved by Engineer for unusual accessories.

2.02 GENERAL

A. Furnish and install a complete Fire Alarm System to be wired, connected, and left in first class operating condition. The system shall use closed loop initiating device circuits with individual zone supervision, individual indicating appliance circuit supervision, incoming and standby power supervision.

B. Include provisions for selective input/output control functions based on ANDing, ORing, NOTing, timing, and special coded operations in the system resident software.

C. Include capability for on-site program changes, with appropriate operator password safeguards to prevent unauthorized changes.

D. Include system capacity to store in the FACPs a minimum of 500 each of alarm and trouble reports in a historical data file for access by service technicians.

E. All software programmed operations shall be stored in a non-volatile memory within the satellite fire alarm control panels. Loss of primary and secondary power shall not erase the instructions stored in memory.

2.03 POWER SUPPLIES

A. The following specifications apply to power supplies for the fire alarm control panels and the notification appliance circuit power extenders.

B. Power to be supplied from a dedicated 120 volt, 20 ampere circuit.

C. Provide power supply unit as an integral part of the device or as a separate unit. The power supply in any given unit shall be capable of supplying all required operational and supervisory power to connected devices, circuit loads and other units as required for a complete and fully operational fire alarm system. In addition, the power supply will automatically maintain the standby battery bank fully charged under normal conditions and be sized to recharge standby batteries in 12 hours maximum, following emergency operation. Power supply to operate the system when batteries are disconnected.

D. In each device, provide a standby battery bank floating across the line. Provide sealed nickel cadmium or lead acid batteries of sufficient capacity to operate entire system in a normal supervisory mode for a period of 60 hours and then have sufficient power left to operate all alarm devices at full specified output for ten minutes. Batteries shall be warranted for 5 years full plus 5 years pro rata, total of 10 years. Gelled electrolyte batteries are not permitted. Mount batteries in a steel locked enclosure located 6 inches minimum or 6 feet maximum above floor in a dry, clean location where ambient temperatures will be 40 degrees F minimum. Protect enclosure so that spillage of electrolyte will not damage FACP interior. The system shall automatically transfer to the standby batteries, with no loss of data, upon power failure. All battery charging and recharging operations shall be automatic.

E. All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.

F. Provide a voltmeter and ammeter to indicate battery voltage and charging current.

G. All power supplies shall incorporate sufficient surge suppression so that the device remains operable following the application of the IEEE Standard #587/ANSI C62.41 Category A&B testing protocols.

H. Provide transient protection devices for all power and control devices to comply with UL864 requirements.

2.04 FIRE ALARM CONTROL PANEL

A. Steel construction, painted manufacturer's standard finish, hinged front cover, key locked.

B. Design control panel for connection to existing Digitize city master box.

C. Equip panel with:
1. 80 character (2 lines x 40 characters) minimum LCD panel to indicate point status (alarm, trouble, etc.), type of alarm (smoke detector, manual station, etc.), number of alarms in system, and alarm location.
2. 500 event historical log.
3. Separate trouble light for each supervised circuit.
4. Trouble buzzer light and trouble silence switch.
5. Separate pilot lamp to supervise standby power.
6. System reset switch.
7. Alarm horn silence switch.

D. Provide supervision of system as follows: A break or a ground on any supervised circuit causes trouble signal and trouble lamp illumination. Trouble signal silence switch silences buzzer but lamp remains illuminated. On restoration of the system, the trouble signal shall remain energized until trouble signal silence switch is restored to normal. On loss of normal AC power, the trouble alarm operates and illuminates emergency power supervisory pilot lamp. Operation of the trouble alarm silence switch silences trouble signal but power supervisory lamp remains illuminated. On restoration of normal power, trouble alarm remains energized until the silence switch is restored to normal.

E. The fire alarm control panel (FACP) shall be a microprocessor-based panel approved per UL 864 for fire alarm applications. The system shall be capable of full analog functions, automatic system programming, alarm verification by device or zone, and provide a serial interface to remote annunciators, printers or alphanumeric displays.

F. The FACP shall be of modular construction, consisting of a central processing module and an adequate number of alarm initiating modules, signaling modules, power supplies, relay modules, control switches, and LED indicators. The panel shall support sufficient analog addressable initiating devices to be able to service a complete building. The system shall be capable of automatic system programming with the ability to conduct a walk test feature as well as control by event, cross zoning, and timed control programming functions. Operating and programming features shall be subject to four access levels to prevent unauthorized use. Provide each zone with test switch and zone disconnect switch mounted internally to prevent unauthorized use and include indicating LEDs.

G. Input modules and signal modules shall provide LED status indication of alarm and trouble, and manual bypass of each zoned initiating and signal circuit. Subsequent to an alarm, signaling devices in any or all alarm zones may be actuated.

H. Include in the control panel the necessary modules for supervised alarm signal circuits, each provided with an internally mounted circuit trouble LED. The control panel shall contain the necessary power supplies, auxiliary relay modules, diode matrix panels, zone and signal supervisory modules, and any network cards required for FACP-NCP communication. Include all other components required for a complete and operable fire alarm control panel.

I. Provide a visual alarm synchronizer device so that all strobes on a floor flash simultaneously at a one hertz rate whether connected to the FACP or the Power Extender. The maximum pulse duration shall be 0.2 seconds.

J. Provide an audible alarm synchronizer device so that all audible alarms on a floor sound the ANSI 53.41 3-pulse temporal code in synchronism, whether connected to the FACP or the Power Extender.

2.05 REMOTE ANNUNCIATOR

A. Provide a type LCD-80 alphanumeric annunciator in semi-flush beige enamel cabinet. The annunciator shall communicate to the control panel over one twisted shielded pair cable. Operating power, 24 VDC, fused at the control panel.

B. The serial annunciator shall provide a common alarm and trouble circuit including:
1. Tone Alert to duplicate the control panel alarm functions.
2. System trouble LED.
3. Power on LED.
4. Name and location of device in alarm.

2.06 GRAPHIC ANNUNCIATOR

A. Standard LED graphic annunciator like XL8 Series by Space Age Electronics, Inc., provide floor plan graphic of building at no less than 1/16" = 1'-0" scale, indicate zone areas and location of special devices not part of multiple device zone. Building floor plans only are available in Autocad DWG or DXF format upon request.
Include lamp test circuit with key switch, audio alarm circuit with ring back, flush mounted, black textured epoxy finish, hinged lockable door, and 1/8" thick acrylic sheet panel

2.07 NOTIFICATION APPLIANCE CIRCUIT POWER EXTENDER

A. Remote signal unit with local power supply and batteries, and notification appliance circuit cards.

B. Provide visual alarm synchronizer device so that all strobes on a floor flash simultaneously, whether connected to the FACP or the Power Extender.

C. Provide audible alarm synchronizer device so that all audible alarms on a floor sound the ANSI 53.41 3-pulse temporal code in synchronism, whether connected to the FACP or the Power Extender.

D. The Power Extenders shall be located such that the length of power runs to controlled notification appliances is minimized.

2.08 FIRE ALARM BOXES

A. Manual alarm stations shall be addressable type, dual action, ADA approved, non-coded, stations, with lockable institutional security cover. Station shall remain actuated until the station is reset by means of a key furnished with each station. Manual fire alarm stations shall be keyed alike with the fire alarm console.

B. Back Boxes: For recessed applications, provide 4" x 4" x 2.5" deep, or larger, flush back box. For surface mounted applications, provide matching back box so that face of manual station does not overhang the box. Do not mount on standard electrical box.

C. To assure ADA compliance, no part of the fire alarm box and back box assembly shall protrude more than 0'-4" from the surface on which it is mounted.

2.09 HEAT DETECTORS

A. 135°F Detector:
1. Low profile analog addressable self-restoring, rate compensated, fixed temperature sensing,.
2. Rate of Rise: 15°F per minute.
3. Detector to be complete with plug-in detector and addressable base for ceiling surface mounting on a 4" square or octagonal outlet box.
4. Color to be matte white.

B. 200°F Detector:
1. Low profile self-restoring, rate compensated combined rate-of-rise and fixed temperature sensing.
2. Rate of Rise: Between 15°F and 25°F per minute.
3. Detector to be complete with plug-in detector and base compatible with 2-wire initiating device circuits for surface mounting on a 4" square or octagonal outlet box.
4. Associated addressable monitor module to be remotely located in an electronics compatible environment.
5. Color to be matte white.

2.10 PHOTOELECTRIC SMOKE DETECTORS

A. Area photoelectric smoke detectors shall be low profile, matte white, analog addressable type. They shall be listed by Underwriters Laboratories under UL 268 for the purpose of area fire detection. The detector shall respond to a wide range of both flaming and smouldering fires. The detectors shall be interchangeable and compatible with ionization detectors using the same type bases. Their light source shall be a pulsed infrared LED for low power consumption under standby conditions at 24 VDC. Internal detector circuits shall be shielded against electrical interference. It shall be resistant to transients, "noise" and RF interference. Regardless of sensitivity setting, the detector's stability shall be unaffected by high air velocity, or by changes in environmental temperature, humidity, and pressure. Head design shall provide 360° smoke entry. Provide complete with plug-in detector base for surface mounting on outlet box.

B. Equip detectors with 30 mesh insect screen and closed back to prevent entry of dust and air turbulence.

C. Equip detector with a red LED which shall pulse to indicate power on and glow continuously to indicate alarm. For concealed detectors, provide a red LED remote indicator installed in a visible location where directed by Engineer.

D. Include magnetically operated test switch for the purpose of functional testing of electronics in the unit to simulate alarm conditions.

E. Design detector to be easily disassembled to facilitate cleaning.

F. Sensor, in conjunction with FACP, shall provide:
   1. Individual sensitivity selection for each sensor.
   2. Individual sensitivity selection for each sensor versus time (day/night mode).
   3. Sensitivity monitoring satisfying NFPA 72 sensitivity testing requirements.
   4. Automatic, daily individual sensor calibration check to verify sensor integrity.
   5. Automatic environmental compensation.
   6. Display of sensitivity in percent per foot.
   7. Multi-stage alarm operation
   8. Ability to display and print detailed sensor information in plain language.

G. Duct smoke detectors shall:
   1. Be analog addressable type, with sampling tube duct housing and photoelectric smoke detectors.
   2. Operate on 24 VDC power from the supervisory current in the fire alarm detection loop.
   3. Be combination detector head and twist-lock base type, UL listed , and compatible with the fire alarm panel.
   4. Be directly interchangeable with an ionization type detector head, and interchangeable with area detectors specified above.
   5. Have a flashing status indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady.
   6. Include auxiliary contacts to shut down H&V units.
   7. Be factory or FACP set to detect smoke at nominal 1.4% light obscuration per foot regardless of the rate of combustion, the distance between the detector and the fire source, the combustible material, and the temperature or velocity of the smoke.
   8. Be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point.
   9. Include a remote test/alarm station with each duct detector at a location specified by the Engineer.

2.11 MONITOR AND CONTROL MODULES

A. The monitor module shall provide the addressable communication interface between non-addressable initiating devices and the FACP and shall be of the same manufacturer as the FACP to ensure communications protocol compatibility.

B. The control module shall provide the addressable communication interface between the FACP and controlled devices.

C. Monitor module power to be supplied separately from the FACP.

D. Operating voltage shall be 19-32 VDC (nominal 24VDC).

E. The monitor module shall fit in a 4" square box with 2 1/8" minimum depth and be protected by a blank 2-gang cover plate. Devices that are designed to fit behind the controlled device in the same outlet box may also be used.

2.12 AUDIBLE/VISUAL ALARM DEVICES

A. Provide combination vibrating horn/flashing strobe alarm devices mounted on a common housing, except where indicated, provide strobe unit without horn. Provide matching back box for all surface mounted units; do not mount on standard electrical box. In flush mounted applications, provide matching back box, or standard electrical box as needed.

B. Design horns for parallel type operation, with audio output of not less than 95 db at 10 feet on axis except 87 db rating may be used where the higher rated output is excessive. Provide synchronizing control so that all audible notification devices on a floor sound the ANSI S3.41 3-pulse temporal code in synchronism.

C. Strobes shall be Xenon flash tube type meeting UL 1971 and NFPA 72 and having a minimum flash intensity of 15 candela polar distribution, or higher where indicated on drawings, with a maximum pulse duration of 0.2 second and maximum duty cycle of 40 percent. Strobes shall meet the ADA required 75 candela on axis distribution. The flash repetition rate shall be a minimum of 1 and maximum of 2 per second. Provide synchronizing control so that strobes on a floor flash simultaneously. Provide higher flash intensity units as indicated and/or as necessary to meet the requirements of NFPA 72 in large spaces.

D. Back Boxes: For recessed applications, provide 4" x 4" x 2.5" deep, or larger as needed, flush back box. For surface mounted applications, provide matching back box so that face of a/v unit does not overhang the box.

E. Notification device rated voltage range shall be 23.5 to 29 VDC (nominal 24 VDC).

2.13 VOICE ALARM AND CONTROL

A. Provide voice alarm control panel to issue prerecorded voice evacuation message to assembly area upon alarm activation by FACP.

B. Provide combination voice/flashing strobe alarm devices mounted on a common housing to match audible/visual devices.

C. Design voice system with adequate power to be intelligible under all noise conditions in accordance with NFPA 72.

2.14 MAGNETIC DOOR HOLDERS

A. Wall/Door mounted, 24 volts DC, 25 lb. minimum holding force, low power consumption, provide matching backbox for surface mounted applications. UL Listed, FM approved.

2.15 SPRINKLER DEVICES

A. Provide addressable tamper switches for each OS&Y valve in sprinkler system. Use monitor module as required.

B. Sprinkler system supplier will provide addressable flow and pressure switches for wiring under this section. Use monitor modules as required.

2.16 WIRE AND CABLE

A. Type THHN building wire, minimum #14 AWG, stranded copper conductor, per Section 16050.

B. Twisted or twisted shielded pair, as required by fire alarm system manufacturer, minimum #18 AWG, stranded copper conductor for digital circuits, and #16 AWG for alarm notification circuits, include overall PVC jacket.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The manual stations, detectors, audiovisual units, control panel, other devices, and batteries are approximately located on the drawings. Minor rearrangements to adjust for appearance and structural conditions are to be expected. Detectors have been arranged on the floor plan to meet or exceed code required minimum spacing. Provide additional detectors where location adjustments prevent meeting these requirements. Provide additional audiovisual units as required to meet minimum evacuation alarm audible sound level or strobe visibility requirements.

B. Install fire alarm wiring in raceway per Wiring Standard, Section 16010.

C. Paint all fire alarm junction boxes red and stencil "FIRE ALARM" on each box cover.

D. Wire shall be #18/2 twisted or twisted shielded pair (as required by the fire alarm manufacturer) for interconnection of addressable initiating devices and the FACP and for interconnection of FACPs, Power Extenders and Network Control Units. #14 AWG THHN shall be used for the 24 volt DC system when sufficient voltage can properly be maintained in the run as shown; otherwise, use #12 or larger wire and/or relocate Power Extenders..

E. Fire alarm conductor terminations in control panel and annunciator panels to be made on terminal strips with a separate point for each conductor. All such strips to be number identified as shown in wiring diagram attached to inside of door of control panel. Connect wiring neatly to terminal strips; bundle wires, neatly arrange in straight runs with square corners and secure with nylon cable straps or lace with jute cord. Set up termination of cabling so that sections of the system may be isolated or shorted out for servicing.

F. Provide circuiting to permit Class B operation of all FACPs, power extenders, initiating devices and indicating devices.

G. Mount end-of-line resistor for each circuit in control panel.

H. From fire alarm control panel provide one 3/4 inch conduit with a 4 pair category 3 cable to nearest telephone backboard or panel location for tie-in to central station.

I. Provide signal connection to elevator controller.

J. Mount fire alarm boxes at 48 inches above finished floor. Fire alarm boxes shall not protrude more than 0'-4" from the mounting surface.

K. Fire alarm control panels mounted in halls and lobbies shall not protrude more than 0'-4" from mounting surface. The top of the panel shall be 6'-0" above finished floor.

L. Protect smoke detectors from contamination due to construction dust or the like. In the event of false alarms due to dirty detectors, remove all detectors and clean or replace them and reinstall at no extra cost to Owner.

M. Mount audiovisual devices 6'-8" AFF to underside of visual device, or 6" below the ceiling, whichever is lower, per ADA requirements. Any wall mounted device mounted less than 6'-8" AFF shall not protrude more than 0'-4" from the mounting surface.

N. Zoning shall be as indicated except adjust to optimize utility of areas covered and logic of zones. Final zone arrangement shall be reviewed and approved by Engineer.

O. Install power supply circuit disconnect in a location that is accessible only to authorized personnel. Circuit breakers supplying fire alarm loads shall be dedicated and supply no other loads. Provide all circuit breakers supplying FACP and power extenders with screw-set handle locks to prevent accidental shut-off of power. Fire alarm circuit disconnecting means shall be identified with red marking as FIRE ALARM CIRCUIT CONTROL. The location of the circuit disconnecting means shall be permanently identified at the fire alarm control unit.

3.02 FIELD QUALITY CONTROL

A. Supplier and installer shall have factory trained NICET Fire Alarm Certified engineers and technicians. The supplier shall provide 24-hour service 365 days a year. The supplier shall respond to service calls within 48 hours of verbal notification of system trouble.

B. Have fire alarm equipment supplier's technician make a thorough inspection of the complete installed fire alarm systems including operation of all components such as manual stations, thermal detectors, smoke detectors, sprinkler flow valves, and controls to ensure the following:
1. Complete and functional system.
2. Underwriters Laboratories requirements.
3. Installed in accordance with manufacturer's instructions.
4. Regulations covering supervision of components are adhered to.
5. Make changes necessary to conform to Items 1, 2, 3, and 4 with technical assistance from the manufacturer.

C. The final acceptance test protocol shall be as follows:
1. The contractor's job foreman, in the presence of a representative of the manufacturer, a representative of the Owner, and the fire department shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel.
2. At least one half of all tests shall be performed on battery standby power.
3. Where application of heat would destroy any detector, it may be manually activated.
4. The signaling line circuits and notification appliance circuits shall be opened in at least two (2) locations per zone to check for the presence of correct supervisory circuitry.

D. When the testing has been completed to the satisfaction of both the contractor's job foreman and the representatives of the manufacturer and Owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the Owner and the fire department.

E. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the Owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance by the awarding authority.

F. Prior to final test the fire department must be notified in accordance with local requirements.

G. Provide a control panel generated report of the complete system test indicating all initiation devices tested. A copy of this report shall be included with the letters to the Owner and to the fire department.

H. Have fire alarm technician prepare a test report certifying that the system has been successfully tested in accordance with these specifications and regulatory requirements.

I. Submit manufacturer's warranty for equipment and wiring to be free from mechanical and electrical defects for a period of one year from the date of acceptance. At the conclusion of the warranty period, manufacturer's technician shall reinspect and service the system and furnish a letter to the Owner certifying that 100% of the system is operating properly.

J. Upon completion and final test of the system, submit corrected as-built one-line schematic and floor plans indicating the ID number for each addressable device in the system and the correct location for all devices and wiring.

END OF SECTION