

SECTION 16721

FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

- A. Furnish all labor, material and accessories necessary to extend, furnish and install a complete fire alarm system. The system shall be addressable, multiplexed, zoned, electrically supervised, have closed circuits and left in first class operating condition. The equipment and complete installation shall be in compliance with local and national codes and the authorities having jurisdiction.
- B. The following is intended to describe the minimum functional requirements for a multiplex, integrated, proprietary, monitor and control system.

1.2 SYSTEM DESCRIPTION

- A. The work includes the system equipment specified, installation, wiring, testing and commissioning. The initial installation shall include all memory and software, pushbuttons, switches, indicating lamps, and electronic hardware for a completely operable system per these specifications.
- B. The system shall utilize distributed processing techniques, be totally solid state except for control panel relay associated outputs, microprocessor based and use digital transmission techniques.
- C. The system shall be UL listed, reference NFPA 72, 90A, 101 and ADA for fire alarm and UL 1076 for security. All equipment shall be UL listed for the purpose intended and labeled under product category code UOJZ as an integrated control unit system.
- D. The system communication format shall provide for priorities of different types of alarms such that, fire alarm points shall have the highest priority, with other designated types of alarms, such as security, having a second level and other types, such as guard patrol, having a third level of priority assigned which do not require operator involvement. Additionally, control points shall be assigned priorities to guarantee operation as required during emergency conditions.
- E. The system shall be modular in design to allow future expansion with a minimum of hardware additions. The system shall be equipped with battery standby and charging circuits for system operation during commercial power outages. When the system is operating on a battery supply, either the control panel or any transponder, a trouble condition shall be generated at the control panel. When commercial power is restored, the system shall revert back to the 120V, 60Hz without any manual restart procedures. The control panel and all transponders shall be equipped with a minimum of 24 hours of battery standby and 15 minutes of alarm

power. The control panel shall be equipped with battery charging circuits sufficient to recharge fully depleted batteries within 70 percent of their maximum capacity within 12 hours.

- F. System connections for alarm-initiating and alarm-indicating circuits:
 - 1. Initiating Device Loops-Class "A" (Addressable).
 - 2. Signaling Line Circuits-Class "B". (Speakers).
 - 3. Notification Appliance Circuits (strobe lights)-Class "B".
 - 4. Head-end CPU to Transponders Data Communication Loop – Class "A".

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Basic Materials and methods, SECTION - 16050.
- B. Wire and cable (600 volts and less), SECTION - 16120.
- C. Fire Protection System - SECTION 15300.

1.4 SOURCE QUALITY CONTROL

- A. Furnish equipment and materials listed in the current, latest issue having a date prior to issue date of SPECIFICATIONS, of Equipment Publications and Underwriters' Laboratories, Inc., bearing the UL Label and wherever standards have been established by NFPA, IEEE, ASTM, ANSI, ICEA and NEMA for equipment referenced to such standards in this document. Furnish equipment and materials conforming to the requirements of the National Electrical Code and the requirements of the Contract Documents.

1.5 FIELD QUALITY CONTROL

- A. Install equipment and material in compliance with the regulations of Local, State and Governmental laws governing electrical installations, the latest edition of the National Electrical Code and the requirements of the CONTRACT DOCUMENTS.

1.6 QUALITY ASSURANCE

- A. All tradesmen shall review the specifications herein with particular attention paid to the related sections. **CLOSE COORDINATION IS ESSENTIAL TO THIS PROJECT!**
- B. Completely review all functions and layout of fire alarm and control unit components prior to permitting installation.
- C. Bench test all components prior to installation.
- D. Provide factory-trained personnel to conduct final site inspection, testing, start-up and programming.

1.7 CERTIFICATION

- A. Submit to the office of the local authority having jurisdiction all documents required for review. Manufacturer must be licensed by the State of New York to supervise and certify life

safety systems. Submit certified duplicate copies of state submittals, correspondence and acceptance to OWNER's REPRESENTATIVE.

1.8 EQUIPMENT SUPPLIER QUALIFICATIONS

- A. The supplier of the system shall maintain permanent service facilities in the area of the installation. The facilities shall include a permanent source of factory trained service technicians on 24 hour call experienced in servicing this type of equipment and shall provide warranty and routine maintenance service to afford the OWNER maximum coverage. He shall also provide a central source of support to guarantee immediate answers to the OWNER's problems resulting from malfunctioning and/or misunderstanding of the operation of the equipment.

1.9 EQUIPMENT INSTALLER QUALIFICATIONS

- A. The installation of the system shall be performed by fully qualified personnel having had experience on the installation of this type of system and able to certify that they have had no less than five years of continuous experience in this area and have made installations similar to this and of this size or larger.
- B. CONTRACTOR shall install the system under the supervision of the manufacturer and test the system in the presence of the OWNER. CONTRACTOR shall submit all test reports to the OWNER.

1.10 WIRING

- A. All wiring shall be in accordance with the manufacturers recommendation. All wiring must be installed in conduit or approved raceway. All wiring shall be suited for the use intended. Wiring shall have **N.E.C. Type FPLR or FPLP** designation for general, plenum and riser use of indoor use. Cables used in underground ducts shall be rated for use in flooded applications. Wiring shall be run continuous from terminal to terminal without splices. Where wire lengths are limited by reel length or where taps are required, provide red NEMA 12 enclosure with terminal blocks mounted at floor level and accessible without the use of ladders or other special equipment.
- B. Each field device shall have a red phenolic label with white letters 1/8" high minimum, describing the device number.
- C. All wiring within the enclosure shall be identified with wire markers and shall terminate on terminal strips. Any wiring entering or exiting control enclosure shall land on terminal strips. External wiring routed directly to a device or splicing of wires within the enclosure will not be acceptable.

1.11 SURGE PROTECTION

- A. All electronic equipment for all systems shall be equipped with UL listed surge protection.

- B. Provide lightning protection for all wiring entering or leaving building. Surge protection shall be installed in a junction box at floor level. Label box as “FIRE SYSTEM SURGE PROTECTION”.

1.12 UNIT PRICES

- A. Submit unit prices for furnishing and installing each component specified in this SECTION. Each unit price includes all charges for General and Supplementary Conditions, incidental expenses, supervision, materials, labor, testing as required, applicable taxes, insurance, and overhead.

1.13 STANDARDS

- A. Standards
 - 1. All applicable regulations and laws shall apply to any installations. The standards indicated below are referenced as minimum requirements for installation and operation of the Fire Alarm System, unless otherwise noted, and not intended to be inclusive of all requirements. Requirements of appropriate authorities having jurisdiction shall supplement these specifications and indicated standards, and shall take precedence in case of conflict.
 - 2. All materials and equipment shall comply with the latest revision of the applicable standard(s) in every case where such a standard has been established for the particular type of material in question.
 - a. Federal Communication Commission (FCC)
 - b. National Fire Protection Association (NFPA)
 - c. National Electric Code (NEC)
 - d. I.C.C. 2003
 - e. Underwriter’s Laboratories (UL)
 - f. Institute of Electrical and Electronic Engineers (IEEE)
 - g. American National Standards Institute (ANSI)
 - h. Uniform Building Code, by the International Congress of Building Officials (ICBO)
 - i. Industrial Risk Insurers (IRI)
 - j. Factory Mutual (FM)
 - k. Americans with Disabilities Act (ADA)
 - l. Occupational Safety and Health Act (OSHA)
 - m. International Fire Code.
 - n. International Building Code.
 - o. State of New York Local Codes.
 - 3. Clarification of differences between standards, codes, Drawings, and/or Specifications will be made by the purchaser’s representative.
- B. Approval Drawings And Specifications
 - 1. Approval Drawings and Specifications: The Contractor shall provide detailed installation Drawings indicating equipment and device locations with detailed routing locations for necessary conduit, cable and wiring. Installation Drawings shall include connection details for all wiring and cable terminations.
 - 2. All Drawings and Specifications shall be developed through computer based media. Electronic Drawings shall be prepared in a format which can be used directly (without

conversation) by Brookhaven's standard CAD software, "AutoCAD" 2005 or later, for Windows. Drawings and Specifications shall be maintained on CD ROM disk in a self extracting format.

3. The Contractor shall, upon completion of the work, furnish to the Owner, 2 complete sets of 'As Installed' Drawings in the 24 in. x 36 in. size. The Contractor shall also furnish the Owner with 1 complete set of the same Drawings on CD ROM disk as drawn with the latest version of AutoCAD brand software.
 - a. The following items shall be included in the Drawings and Specifications:
 - b. Names, addresses and phone numbers of Manufacturer's Rep, Engineer and Manufacturer's Service Center.
 - c. Detailed system operation.
 - d. System block diagram.
 - e. System riser diagram with E.O.L. resistors marked.
 - f. Device, appliance, control unit and terminal panel mounting details.
 - g. Device, appliance, control unit and terminal panel wiring details.
 - h. Device, appliance, control unit and terminal panel location details.
 - i. Complete Bill of Materials for the Project.
 - j. Device list with address and instructions for addressing points.
 - k. Complete set of battery calculations for system.
 - l. All power requirements, descriptions and sequences.
 - m. All wire and symbol legends.
 - n. All manufacturer's notes and recommendations.
 - o. Capacity of the system is installed and total system capability.

C. Testing and Acceptance

1. All system equipment and required functionality shall be tested after installation in the presence of the Owner and authority having jurisdiction.
2. The system installation shall meet all requirements of the Owner, required standards and approving authorities prior to acceptance.
3. All system components, devices and appliances shall be tested after installation to ensure that:
 4. All required systems and devices are connected.
 5. All connected systems and devices respond and report actual alarm conditions.
 6. All connected systems, devices and appliances respond and report trouble conditions, including circuit conditions.
 7. All alarm monitoring and processing equipment and control units perform under loss of primary power conditions.
 8. All required notification appliance control units and appliances perform under loss of primary power conditions.
 9. All notifications appliances perform in the appropriate manner with minimum required signal levels.
 10. All timed, automatic or interactive system functions perform as required.
11. For final acceptance, the system must operate for thirty (30) consecutive days without malfunction of any kind, including any function not performed as a part of routine system administration.

- D. Training
1. The Contractor shall provide, at the Owner's facility, the training necessary for the Owner's personnel to perform installation, setup, data input, configuration, operation and maintenance of the system, components and devices. Adequate hands-on training shall be included for system operators. The Contractor shall provide an outline of proposed training for review by the Owner, prior to the commencement of actual training. The training shall be provided in 3 categories:
 - a. Installation and Maintenance: For system administrators and personnel responsible for installation and maintenance of system hardware, devices, appliances and circuits.
 - b. System Administration: For personnel responsible for total system administration, including software maintenance, setup, configuration and support.
 - c. Supervising Station Operator: For supervisors and personnel to be assigned daily operator responsibilities.
 2. The Owner shall identify the numbers of personnel to be trained in each category. (min 24 hours)
 3. Shop Drawings And Product Data
- E. Furnish submittals for items that are identified in this SECTION by a different typeface and a bracketed code (e.g., *Item [L]*). Refer to SECTION 01340 for definition of codes for types of submittals and the administrative requirements governing submittal procedure. Additional submittal requirements pertaining to this SECTION are specified herein under this Article.
- F. *Shop Drawings [D,P]*: Submit customized wiring diagrams, component product data and installation and operating instructions. Wiring diagrams shall show color coding of connections and mounting dimensions of equipment.
- G. *Guarantee [G]*: The entire system and its operation shall be warranted for a period of two years from date of OWNER's acceptance.
- H. Submit shop drawings for approval and include complete data on each item. Coordinate the items, as they relate to the WORK, prior to submittal. Shop drawings shall be approved at least 30 days prior to commencement of work and shall include:
1. *System Plans and Riser Diagrams [D]*: including sizing and routing of all conduits and wire, location of all equipment and devices, junction and pull boxes, and device address.
 2. Data catalog cuts or brochures on all equipment.
 3. Installation hardware and requirements.
 4. Wire and cable.
 5. Complete wiring and connection diagrams of all equipment per JIC EMP-1-1967 interconnect wiring guidelines.
 6. Manufacturers state of New York license number.
 7. Panel layouts, device identification and bill of materials per JIC EMP-1-1967 documentation requirements.

1.14 MAINTENANCE DATA AND OPERATING INSTRUCTIONS

- A. Furnish to the OWNER five sets of instruction manuals covering complete operating, service and repair instructions for the equipment furnished and complete illustrated parts breakdown

with manufacturer's name, nomenclature and part number for each component part and assembly, include current unit prices for parts and supplies along with the location of the nearest source of supply and service.

- B. During system commissioning and at such time acceptable performance of the system hardware and software has been established, the system supplier shall provide on-site operator instruction to the OWNER's operating personnel. Operator instruction during normal working hours will be performed by competent representatives familiar with the system software, hardware and accessories.
- C. At a time mutually agreed upon, the system supplier shall give 80 hours of instruction to the OWNER's designated personnel on the maintenance and trouble shooting of all equipment within the system and describe its intended use with respect to the programmed functions specified. Maintenance and trouble shooting orientation of the system shall include the overall operational program. Equipment functions, commands, advisories and appropriate operator intervention required in responding to the system operation. An OWNER's manual prepared for this project shall be used in addition to the instruction.
- D. Additional instruction time as deemed necessary by the OWNER shall be made available by the system supplier on a negotiated basis with the OWNER.

1.15 GUARANTEE

- A. The manufacturer shall warrant, *[G]* in writing, all equipment and wiring to be free from all inherent mechanical and electrical defects in material and workmanship for a period of two years commencing at the time of system turnover to the OWNER.
- B. If the system fails to completely perform in accordance with the CONTRACT DOCUMENTS, the CONTRACTOR shall take all necessary action to repair or replace parts and wiring modification, at no additional cost to the OWNER, to restore the system to perform in accordance with the CONTRACT DOCUMENTS.

1.16 ENGINEERING FIELD SERVICE

- A. The Supplier shall furnish engineering field service as required.

1.17 MAINTENANCE CONTRACT

- A. *Maintenance and Service Contract [G]*: shall be submitted with service rates covering all labor and materials necessary to maintain the system and annual testing. The contract shall include a differentiation between and definitions of "emergency" and "non-emergency" service with applicable rates for each.

1.18 SPARE PARTS LIST

- A. *Bill of Material [B]*: The supplier shall enclose a complete parts list of the equipment installed with vendor's names, address, telephone number, part numbers, prices and lead time.

1.19 SYSTEM OPERATION

- A. The system shall detect changes in status of the monitoring points within the system and shall indicate any such changes at the Fire Alarm Control Panel. The receipt of an alarm shall cause the following.
 - 1. Display the alarm condition on the alphanumeric display.
 - 2. Activate evacuation signals assigned through event-initiated programs.
 - 3. The audio alarm signal shall consist of an alarm tone. The audio alarm signals shall sound until the signal silence switch has been operated.
 - 4. Activate any assigned control points (addressable control module) through event-initiated programs.
 - 5. Print the assigned English language message with time and date for the monitored point in alarm on the printer. Exact text for message print out will be provided by the OWNER.
 - 6. Log the alarm in the historic reporting terminal and generate any action messages.
 - 7. Sound the alarm signal at the Fire Alarm Control Panel and illuminate the system alarm LED. The alarm signal and LED shall pulse until the appropriate acknowledge switch is depressed which shall cause the alarm signal to be silenced. The system alarm LED shall remain illuminated and the system all clear LED shall not extinguish until the alarm condition has been corrected.
 - 8. When the alarm condition has been corrected, Fire Alarm Control Panel shall display and print the assigned message for the point in alarm with the suffix "CLR" (clear) and deactivate assigned control points through event-initiated-programs, provided control point priorities allow.

- B. The CPU shall supervise the entire operation. Assigned messages shall be displayed for all supervisory trouble conditions. Supervision of the monitor points for trouble shall be on a per point basis.

- C. The system shall be capable of providing the following summary print-outs via keyboard required requests:
 - 1. Alarm Summary - prints all points that are in alarm.
 - 2. Control Summary - prints all activated (on) control points.
 - 3. System Summary - prints status of all system points.
 - 4. Trouble Summary - prints status of any supervisory problem within the system.
 - 5. Time Summary - prints system time.
 - 6. Cancel - terminates any requested reports.
 - 7. In addition, the operator may request the status of any individual monitor or control point using the "list" command and the point ID.
 - 8. Time Control Summary - prints all assigned time for a respective control point, or prints all control functions for a specific time.

- D. Signal Transmission: A combination of hard-wired, using separate individual circuits for each zone of alarm device operation as required, and multiplexing signal transmission for addressable alarm initiation and alarm device operation, dedicated to fire alarm service only.

- E. Data Communication Transmission: The peer-to-peer network communication channel shall operate using digital token-ring communication techniques. Communications shall be dedicated to fire alarm service only.
- F. The system shall also have provisions for an “alert” message, which will provide specific instructions for the operator on duty. These messages may be up to 5 lines with up to 70 characters in each line. Each system monitor point may have 5 specific alert messages when in alarm. Control points may be assigned alert messages. Control points shall be capable of initiating remote alarm signals or systems, and providing a momentary pulse to allow reset of remotely located fire, security, or other types of local controls by using the manual control feature of the system keyboard. Print-outs shall occur to indicate the status of any such point. Operator message text will be provided by OWNER and shall be input into the system by the unit manufacturer at the factory.
- G. The programming language shall consist of simple English language words of 3 or 5 letters and include the ability to create functional operating equations using the following logic elements:
 - 1. ANDing - The ability to require 2 or more points in an alarm state before control point(s) activation.
 - 2. ORing - The ability to allow any number of points to cause control point activation.
 - 3. NOTing - The ability to prevent control activation if a monitor or control is NOT in its normal state.
 - 4. DELAY - The ability to delay control point activation.
 - 5. COUNT - The ability to require more than 1 point in alarm before control point activation.
 - 6. TIMING - The ability to cause control point activation for a specified period.
- H. The CPU shall have the ability to accept up to 64 independent programs. Each program shall have (“No Edit” or “Edit”) capability. Each program shall be written in an equation format comparable to ladder logic equations. The equations shall consist of an input statement and an output statement.
- I. The input statement defines the condition(s) required to activate the associated statement. The input statement may consist of single or multiple monitor point status, software pseudo point status, time comparison and the utilization of AND, OR, NOT, COUNT, and DELAY logic functions.
- J. The output statement defines the action to be taken by the CPU. The output statement may consist of activation/deactivation of single or multiple control functions, pseudo points and SCC LED status indicators. Output statements may also include the “ALERT” message.
- K. CPU shall include the following pushbutton, lamps and audible devices:
 - 1. Priority 1 alarm LED and acknowledge button.
 - 2. Priority 2 alarm LED and acknowledge button.
 - 3. Signal silence push button.
 - 4. Trouble LED and acknowledge button.
 - 5. System reset push button.
 - 6. Sonalert to indicate alarm and trouble conditions.

7. LED test push button.
 8. Location information.
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- L. CPU must incorporate circuitry to continuously monitor the communications and data processing cycles of the microprocessor. On CPU failure, an audible and visual signal shall operate to alert on duty personnel.
 - M. The CPU shall also be equipped with software routines to provide time control allowing a preset program for both on/off and cycling operations to be set in a memory for the operation of electrical loads connected to the FACU control points. Time control shall be totally field programmable utilizing Random-Access-Memory (RAM) and the system keyboard. The CPU shall include software and hardware to maintain accurate information of time of day, day of week, day of month, month and year. In addition, it may be programmed with up to 15 holidays for special time control programs. Program shall provide Julian 365 day year and eight-day week programmability. Also, the real time program shall include leap year capability through the year 2020. System shall have capability of reprogramming for years beyond 2020. Time and date information will be included in all printer and CRT output messages.
 - N. Permissible Signal Elapse Time: The maximum permissible elapsed time between the actuation of any fire alarm or fire-detection system alarm-initiating device and its indication at the control panel shall be five seconds.

1.20 UNIT PRICES

- A. Provide unit prices as required.

PART 2 PRODUCTS

2.1 MANUFACTURER AND MATERIALS

- A. Submit with the bid the manufacturer's name & address, and the service facility's name, address & phone number.
- B. The manufacturer must be capable of receiving service calls 24 hours a day, 7 days a week with a maximum of 4 hour response time during normal working hours. The manufacturer's service office must be within a radius of 100 miles from the job site.
- C. Manufacturers:
 1. Siemens XLS-500

2.2 SYSTEM COMPONENTS

- A. *Fire Alarm Control Panel (FACP) [D,P]* shall contain the following features:
 1. 80 column by 2 line back-lighted LCD readout of point status.
 2. Capacity to annunciate 1000 network point and/or point lists.
 3. Historical event logs shall maintain separate 600 Alarm and 600 Trouble events.

4. RS232 ports shall be provided:
 - a. Interface to serial printer to record network information as programmed at the control panel.
 - b. Interface to CRT/Keyboard to display network information as programmed at the control panel.

B. Panel:

1. Control panel construction shall be modular with solid state, microprocessor based electronics. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions. A local audible device shall sound during Alarm, Trouble or Supervisory conditions. This audible device shall also sound during each keypress to provide an audible feedback to ensure that the key has been properly.
2. The following primary controls shall be visible through a front access Unit:
 - a. Eighty character liquid crystal display
 - b. Red fire alarm LED
 - c. Red priority 2 alarm LED
 - d. Yellow supervisory service LED
 - e. Yellow trouble LED
 - f. Green "power on" LED
 - g. Yellow signals silenced LED
 - h. Fire alarm acknowledge key
 - i. Priority 2 alarm acknowledge key
 - j. Supervisory service acknowledge key
 - k. Trouble acknowledge key
 - l. Alarm silence key
 - m. System reset key
3. The following programmable secondary control switches and LED's shall be available behind an access door:
 - a. [City disconnect/switch]
 - b. [Manual evacuation (drill)]
4. The control panel shall provide the following:
 - a. Setting of time and date
 - b. LED testing
 - c. Alarm, trouble, and abnormal condition listing.
 - d. Enabling and disabling of each monitor point separately.
 - e. Activation and deactivation of each control point separately.
 - f. Changing operator access levels.
 - g. One Person test enable
 - h. Running diagnostic functions
 - i. Displaying software revision level
 - j. Displaying historical logs
 - k. Displaying card status
 - l. Point listing
5. For maintenance purposes the following lists shall be available from the point lists menu:
 - a. Monitor point list
 - b. Signal/horn list

- c. Auxiliary control list
 - d. Feedback point list
 - e. Pseudo point list
 - f. LED/switch status list
6. Primary Keys, LED's and LCD Display
 - a. The Control Panel shall have a 80 character liquid crystal display which shall be backlit for enhanced readability. So as to conserve battery standby power, it shall not be lit during an AC power failure unless an alarm condition occurs or there is keypad activity.
 - b. The display shall support both upper and lower case letters. Lowercase letters shall be used for softkey titles and prompting the user. Uppercase letters shall be used for System Status Information. A cursor shall be visible when entering information.
 7. Under normal conditions the front Unit shall display a "System is Normal" message and the current time and date.
 8. 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.
 9. The LCD shall display the following information relative to the abnormal condition of a point in the system:
 - a. 40 character custom location label
 - b. Type of device (i.e. smoke, pull station, waterflow)
 - c. Point status (i.e. alarm, trouble)
 10. Two methods of acknowledgment for each abnormal condition shall be provided. One may be chosen depending on the NFPA requirements.
 11. These acknowledge functions may be pass code protected if the user has insufficient privilege to acknowledge such conditions. A message shall indicate insufficient privilege but allow the user to view the points without acknowledging them. Should the user have sufficient privilege to acknowledge, a message will be displayed informing the user that the condition has been acknowledged.
 12. After all points have been acknowledged, the LEDs shall glow steady and the tone alert will be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be indicated by an end of list message "END of LIST".
 13. Alarm Silencing:
 - a. Should the "Alarm Silence" button be pressed all alarm signals shall cease operation and a signals silenced LED will illuminate.
 - b. Signals shall not be silenced during alarm silence inhibit mode.
 14. System Reset:
 - a. The SYSTEM RESET button shall be used to return the system to its normal state after an alarm condition has been remedied. The LCD display shall step the user through the reset process with simple English Language messages. Messages, "SYSTEM RESET IN PROGRESS", will first be displayed followed by the message, "SYSTEM RESET COMPLETED", and finally, "SYSTEM IS NORMAL", should all alarm conditions be cleared.
 - b. Should an alarm condition continue to exist the message, "SYSTEM RESET IN PROGRESS", will be followed by the message, "SYSTEM RESET ABORTED", and the system will remain in an abnormal state. System control relays shall not reset. The tone alert and the Alarm LED will be on. The display will indicate the

- total number of alarms and troubles present in the system along with a prompt to use the ACK keys to review the points. These points will not require acknowledgment if they were previously acknowledged.
- c. Should the Alarm Silence Inhibit function be active, the (SYSTEM RESET) key press will be ignored. The message, "SYSTEM RESET INHIBITED", will be displayed for a short time to indicate the action was not taken. As feedback to the operator, the message "SYSTEM RESET NO LONGER INHIBITED" will be displayed when the inhibit function times out.
15. Function Keys:
 - a. Additional function keys shall be provided to access status data for the following points:
 - 1) Initiating device circuits
 - 2) Indicating appliance circuits
 - 3) Auxiliary relays
 - 4) Feedback points
 - 5) All other input/output points
 - b. The following status data shall be available:
 - 1) Primary state of point
 - 2) Zone, PID and card type information
 - 3) Class "A" status
 - 4) Current priority of outputs
 - 5) Disable/Enable status
 - 6) Verification tallies of initiating devices
 - 7) Automatic/Manual control status of output points
 - 8) Acknowledge status
 - 9) Relay status
 16. The system shall be capable of logging and storing 600 events in an alarm log and 600 events in a trouble log. Each recorded event shall include the time and date of that event's occurrence.
 - a. The following Historical Alarm log events shall be stored:
 - 1) Alarms
 - 2) Alarm acknowledgment
 - 3) Alarm Silence
 - 4) System reset
 - 5) Alarm historical log cleared
 - b. The following Historical Trouble log events shall be stored:
 - 1) Trouble conditions
 - 2) Supervisory alarms
 - 3) Trouble acknowledgment
 - 4) Supervisory acknowledgment
 - 5) Alarm verification tallies
 - 6) One Person test results
 - 7) Trouble historical log cleared
 17. LED Supervision: All control module LEDs shall be supervised for burnout or disarrangement. Should a problem occur the LCD shall display the module and LED location numbers to facilitate location of the LED.
 18. System Trouble Reminder: Should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at preprogrammed

time intervals to act as a reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable to suit the OWNER's application.

19. Access Levels:
 - a. There shall be four (4) access levels with level 4 being the highest level. Level 1 actions shall not require a passcode. Passcodes shall consist of up to ten (10) digits. Changes to passcodes shall only be made by authorized personnel.
 - b. In order to maintain security when entering a passcode the digits entered will not be displayed but a cursor will move along filling the position with an x to indicate that the digit has been accepted.
 - c. When a correct passcode is entered, the message "Access Granted" shall be displayed. The new access level shall be in effect until the operator manually logs out or the keypad has been inactive for ten (10) minutes.
 - d. Should an invalid code be input, the operator shall be notified with the message, "ERROR INCORRECT PASSCODE", and shall be allowed up to three chances to enter a valid code. After three unsuccessful tries, the message, "ACCESS DENIED", shall be displayed. The level shall not be altered, and the operator shall no longer be in the menu option.
20. Access to a level will only allow the operator to perform all actions within that level plus all actions of lower levels, not higher levels.
21. The following keys/switches shall have access levels associated with them:
 - a. Alarm silence
 - b. System reset
 - c. Set time/date
 - d. Manual control
 - e. On/off/auto control
 - f. Disable/enable
 - g. Clear historical alarm log
 - h. Clear historical trouble log
 - i. One person testing
 - j. Change alarm verification
22. The FACP cabinet shall be mounted in a NEMA 12 Enclosure and shall be painted "FIRE ALARM RED".

C. *Addressable Interface Module [D,P]:*

1. Communication with addressable devices: The system must provide communication with all initiating and control devices individually. All of these devices are to be individually annunciated at the control panel. Annunciation shall include the following conditions for each point:
 - a. Alarm
 - b. Trouble
 - c. Open
 - d. Short
 - e. Ground
 - f. Device Fail/or Incorrect Device
2. All addressable devices are to have the capability of being disabled or enabled individually.
3. Up to 127 addressable devices may be multidropped from a single pair of wires.

4. Isolator Module - A Isolator module shall be required to isolate each (zone) (floor) of addressable devices. The Isolator module shall operate as an addressable device with the same capabilities of enable, disable and annunciation.
5. Format: The communication format shall completely digital. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission protocol. systems that do not utilize full digital transmission protocol (i.e., that may use time pulse width methods to transmit data etc.) will not be acceptable (since they are considered unreliable and prone to errors).
6. Identification of Addressable Devices: Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.
7. Wiring Type, Distances, Survivability and Configurations: Wiring types will be approved by the equipment manufacturer. The system must allow up to 2,500 feet wire length to the furthest addressable device. Class A communication will be provided where shown on the DRAWINGS. Wire will be so routed to maintain sufficient distance between the forward and return loop as called for by the Authority Having Jurisdiction (AHJ).

D. *Addressable Pull Stations [D,P]:* Addressable pull stations shall contain electronics that communicate the station's status (alarm, normal) to the transponder over two wires which also provide power to the pull station. The address will be set on the station. They will be manufactured from high impact red lexan type of plastic. Lettering will be raised and painted white. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. Pull stations will be dual (push/pull) action.

E. *Detector Bases [D,P]:* Detector bases shall contain electronics that communicate the detector status (normal, alarm, trouble) to the transponder over two wires. The same two wires shall also provide power to the base and detector. A trouble signal will be transmitted to the transponder and CPU if a detector is removed from the base. The following detector heads shall be provided.

1. Photoelectric Detector [D,P] shall be UL listed. They shall work on the photoelectric principle, use a stable LED light source and silicon photodiode as the receiving element to form a highly accurate means of smoke detection. The detector shall be sealed against rear air flow and have a 30-mesh insect guard.
2. Thermal sensors shall operate on the "Rate of Riser" principles. The sensor shall also contain state-of-the-art dual thermistor sensing circuitry for fast response.
3. A LED visual indicators providing local 360-degree visibility of operating status and alarm indication shall be provided on each sensor. The LED's shall pulse periodically indicating that power and communication is being supplied to the sensor. This feature shall be field programmable. Upon alarm these two LED's shall light continuously. A visible alarm signal shall be capable of being remotely annunciated.
4. Smoke Sensor Sensitivity Adjustment:
 - a. Authorized operation of controls at the control panel shall cause the selection of specific addressable smoke sensors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings.
 - b. Remote Controllability: Individually monitor sensors at the control panel for calibration, sensitivity, and alarm condition, and individually adjust for sensitivity

from the control panel. The alarm decision for each sensor shall be determined by the control panel. The control panel shall determine the condition of each sensor by comparing the sensor value to the stored values.

- c. The sensitivity of each sensor will be as high as it can possibly be for its location without being so sensitive that it will be nuisance alarm-prone.
 - d. Smoke Sensor Sensitivity: Between .2-and 3.7-percent-per-foot smoke obscuration when tested according to UL 268.
 - e. The control panel shall maintain a moving average of the sensors smoke chamber value to automatically compensate (move the threshold) for dust, dirt, and component degradation conditions that could affect detection operations. The control panel shall automatically maintain a constant smoke obscuration sensitivity for each sensor (via the floating threshold) by compensating for environmental factors.
 - f. The control panel shall automatically indicate when an individual sensor needs cleaning. When a sensors average value reaches a predetermined value, a “DIRTY SENSOR” trouble condition shall be audibly and visually indicated at the Network Display Unit. Additionally, the LED on the sensor base shall glow steady giving a visible indication at the sensor location. If a “DIRTY SENSOR” is left unattended, and its average value increases to a second predetermined value, an “EXCESSIVELY DIRTY SENSOR” trouble condition shall be indicated at the control panel. To prevent false alarms, these “DIRTY” conditions shall in no way decrease the amount of smoke obscuration necessary for system activation.
 - g. The control panel shall continuously perform an automatic self-test routine on each sensor which will functionally check sensor electronics and ensure the accuracy of the values being transmitted to the control panel. Any sensor that fails this test shall indicate a “SELF TEST ABNORMAL” trouble condition.
5. Smoke detectors shall be resettable from the control panel.

- F. *Photoelectric Smoke Duct Detectors [D,P]:* Smoke duct detectors shall be 4 wire, 24 V DC. They shall have an air tight rugged constructed housing with a see-through face plate. They shall have an auxiliary relay rated 10 amps and sampling and exhaust tubes. Where duct detectors are not accessible, a remote alarm indicator shall be supplied. Detectors shall be furnished, installed and wired by this Contractor.
- G. *Audible Signaling Devices [D,P]:* Audible signaling devices for high noise areas shall be UL listed speakers. They shall be all metal construction with built-in high efficiency tone driver. It shall be constructed to be water, humidity and vermin proof, and all components shall be enameled or plated to assure protection against corrosion. The speaker shall have a variable position switch providing a quick method of changing taps. It shall have a omni-purpose mounting bracket. Speakers shall be Fire Alarm Red tapped at 7.5 Watts.
- H. *Audible Signaling Devices [D,P]:* Audible signaling devices for the building shall have a die cast red housing and a high efficiency multitone driver. They shall be moisture, corrosion, vibration and vermin resistant. They shall have multi-tap power selection and be flush mounted. Speakers shall be Fire Alarm Red tapped at 4 Watts.

- I. Visual Signaling Devices:
 - 1. *Visual Signaling Devices [D,P]: Visual Signaling Devices [D,P]* shall be xenon flasher type. In building areas the visual signaling device shall be in a common enclosure with the audible signaling device. Single hi-intensity strobe shall be in a single enclosure. Strobe lights shall meet ADA requirements.

- J. *Addressable Monitor and Control Modules [D,P]:* Modules shall be used for monitoring of waterflow, valve tamper, fire extinguishing control units.
 - 1. Addressable monitor modules shall be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line.
 - 2. There shall be two types of modules:
 - a. Type 1: Monitor Modules: This type of module is an individually addressable module that has both its power and its communications supplied by the two wire multiplexing signaling line circuit. It provides location specific address ability to an initiating device by monitoring normally open dry contacts. This module is required for monitoring waterflow and tamper switches.
 - b. Type 2: Control Circuit Interface Module: Module for other device control with Class B wiring supervision.
 - 3. The monitor and control 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. Should the module become non-operational, tampered with, or removed, a discrete trouble signal, unique to the module, shall be transmitted to, and annunciated at, the control panel. The modules shall be capable of being programmed for its “address” location on the multiplexing signaling line circuit. The modules shall also be compatible with addressable manual stations and addressable detectors on the same multiplexing signaling line circuit.

- K. *Annunciator [D,P]:* Annunciator shall be LCD Type, Semi-flush mounted in finished areas and Surface Mounted in unfinished areas.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Furnish and install in accordance with manufacturer’s instructions, all wiring, conduit and outlet boxes required for the erection and operation of a complete system as shown on the DRAWINGS. All wiring shall meet all the requirements of national, state and local electrical codes.

- B. Addressable pull stations and smoke detectors shall have integral electronics to monitor the device. All other devices shall be wired to field mounted addressable monitor modules.

- C. Wiring shall be run for all lengths less than 1000 feet without splices. Where wire runs are of lengths greater than 1000 feet, cable pulling tension calculations shall be submitted to the OWNER prior to installation. Where splicing is necessary, splicing shall be only in junction boxes at floor level on terminals.

- D. "Tee" tapping of device wiring will not be permitted. Daisy chain connection will only be allowed.
- E. Final connections between the equipment shall be made under direct supervision of a representative of the manufacturer.
- F. Contractor shall submit installation schedule to the OWNER 30 days prior to commencement of work to provide for coordination of system interruption.

3.2 CABLE INSTALLATION

- A. All circuits shall be protected to avoid interruption of service due to short-circuiting or other conditions which might adversely affect the connected devices. Each individual signaling circuit shall be classified as a circuit pair.
- B. All cabling in racks, cabinets and junction boxes shall be neatly strapped, dressed and adequately supported. Cable installation shall conform to good engineering practices and to the standards of the most current National Electrical Code.
- C. Cables shall be terminated with the proper connector required for the associated operation of the equipment to which it is connected. Screw terminal blocks shall be furnished for all cables which interface with racks, cabinets, consoles or equipment modules. Wire shall be interfaced with screw terminal blocks with an installation tool specifically recommended by the manufacturer of the lug. Evidence of the installation of cable and wires without the appropriate connectors, shall be sufficient cause for rejection of the work and reinstallation of the cables or wires.
- D. Where cables or wires require soldering, the soldering shall be done using rosin core solder and controlled temperature soldering equipment. Evidence of solder joints not made with rosin core solder or with non-temperature controlled tools shall be sufficient cause for rejection of the work and resoldering of all connections.
- E. Every cable or wire shall be labeled or coded at each end. Each terminal of each field terminal strip shall be permanently labeled or coded to show the zone, instrument of item served.
- F. All cables within a rack, console or junction box shall be grouped according to the signals being carried to reduce signal contamination.
- G. All wiring shall be in conduits.
- H. Cables shall be run in continuous lengths except for terminations. No splices shall be permitted in any conduit run, terminal cabinets or control enclosures.

3.3 INSTALLATION AND TESTING

- A. Every device shall be physically tested, and the results recorded. The system shall demonstrate a minimum of 30 days trouble free operation before acceptance by the Owner. A report shall be given to the Owner's Representative record at the office of the architect. Each indicating

and signaling circuit shall be tested to verify monitoring of electrical supervision for opens, shorts and grounds. Provide training to the Owner's personnel in the system operation. At the conclusion of testing and the completion of training, present the system to the Owner for final acceptance. Turn over to the Owner's Representative all keys, 3 copies of system literature, including training manuals, testing reports, system riser diagrams and a complete set of accurate as built plans. An electronic copy of all information including Drawings and product data shall be provided to the Plant's Electrical Engineer on CD ROM.

- B. **Adjust the sound level of each speaker to produce a sound level 15 dB over the expected ambient sound level in each area under normal plant operating conditions.** After completion of testing of the fire alarm signaling system, readjust the sound level of the horns and speakers as required to meet this criterion. For bidding purposes, assume that 10 percent of the speakers will require readjustment after testing.
- C. Upon completion of the installation the Contractor shall provide as built drawings of all wiring diagrams, conduit layouts, device locations and addresses, and locations of all equipment associated with the system.
- D. The following summary of system features shall be duplicated, completed and returned to the purchaser. Attach pages for additional information

3.4 ON-SITE ASSISTANCE

- A. **Occupancy Adjustments:** When requested within 1 year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide a separate price for up to 3 requested adjustment visits to the Site for this purpose.

END OF SECTION

Revision History	
Date	Rev. No.
D	0
E	0
F	0
02-19-09	0

RGM/ca

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