

**FIRE ALARM SYSTEM
SECTION 283100**

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. The requirements of Division 1, General Requirements and other provisions of the contract documents apply to this work.
- B. This Section intends to describe an integrated fire detection and voice evacuation system to be intelligent device addressable, analog detecting, low voltage and modular with multiplex communication techniques, in full compliance with all applicable codes and standards. The features described in this specification are a requirement for this project and shall be furnished by the successful contractor. The contractor is responsible for the design and installation of the fire alarm system. A fire alarm design is not shown on the plans. The system shall be designed by the fire alarm manufacturer to meet the requirements of the latest edition of NFPA 13, 25, 72, 90A, 101, International Building Code, ASME A17.1, ADA/TDLA and any other local and state codes. Refer to mechanical, plumbing and security plans for coordination of those systems with the fire alarm system.
1. The system as described shall be installed, tested, and delivered in full operating condition. The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether itemized or not.
 2. All equipment furnished shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years. The equipment manufacturer shall have an installed base of analog systems as a reference. In the interest of job coordination, the installing contractor shall contract with a single source for supplying job materials, services, and programming, including final inspection/test services for the fire alarm system.
 3. The equipment, space requirements, expansion capabilities and features specified were selected to meet the requirement for this project
 - a. Manufacturers:
 - 1) Notifier NFS2-3030, no exception. Panel shall be campus standard and include:
 - i. Notifier embedded gateway (NFN-GW-EM-3)
 - ii. Notifier high speed network communications module (HS-NEM-W)
 - iii. Digital Voice Communication EM
 - iv. DAA Series digital Audio amplifiers

1.2 MATERIALS AND SERVICES

- A. The system shall include, but not be limited to the following elements:
1. Master system CPU including all fire detection, voice/audio and visual evacuation alarm control modules, supervised power amplifiers with the required back up modules.
 2. Circuit interface panels including all modules.
 3. Power supplies, batteries and battery chargers.
 4. Pre-amplifiers, amplifiers, and tone generators.
 5. Equipment enclosures.
 6. Intelligent addressable manual pull stations, heat detectors, analog smoke detectors, alarm monitoring modules, and supervised control modules.
 7. Annunciator panel and printer.
 8. Voice/Audible and visual evacuation signals.
 9. Color graphic displays and historical archiving.
 10. Software and firmware as required to provide a complete functioning system.

11. Wiring and raceway.
12. Installation, testing and certification and training.
13. Interface with security system per Paragraph 1.10.
14. Interface with air handling units.
15. Connection to MDF room via fiber for remote monitoring by the UNT Fire Systems Group.
16. Remote annunciator panels at each building entrance door or as required by the AHJ.

1.3 REFERENCE STANDARDS

A. The publications listed below form a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.

1. Texas Department of Insurance (TDI) State Fire Marshal's Office
2. Factory Mutual (FM). FM AG Approval Guide.
3. National Fire Protection Association (NFPA).
 - a. NFPA 13 Standard for the Installation of Sprinkler Systems.
 - b. NFPA 25 Recommended Practice for the Inspection, Testing and Maintenance of Sprinkler Systems.
 - c. NFPA 70 National Electrical Code.
 - d. NFPA 72 Standard for the Installation, Maintenance and use of Protective Signaling Systems.
 - e. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
 - f. NFPA 101 - Life Safety Code.
4. Underwriter's Laboratories, Inc. (UL).
 - a. Appropriate UL Standards.
 - b. UL FPED.
5. Texas Department of Licensing and Regulation.
6. Americans with Disabilities Act.
7. Texas Accessibility Standards (TAS)
8. International Building Code (IBC).

1.4 QUALIFICATIONS OF THE INSTALLER

A. Before commencing work, submit data showing that the contractor has successfully installed fire alarm systems of the same type and design as specified, or that they have a firm contractual agreement with a subcontractor having the required manufacturers' training and experience. The contractor shall include the names and locations of at least two installations where the contractor, or the subcontractor above, has installed such systems. Specify the type and design for each system and furnish documentation that the system has performed satisfactorily for the preceding 18 months.

1.5 MANUFACTURER'S REPRESENTATIVE

A. Provide the services of a representative or technician from the manufacturer of the system, experienced in the installation and operation of the type of system provided. The representative shall be licensed in the State of Texas. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the Owner's personnel in the system operation, maintenance and programming.

1.6 SUBMITTAL

- A. The contracting firm shall submit copies of its Texas Department of Insurance (TDI) Fire Alarm Contractor Registration (ACR), Fire Alarm Planning Superintendent License (APS) and the required TDI's Liability Insurance Certificate, signed by a Texas Insurance Agent.
- B. The contractor shall include the following information in the equipment submittal:
1. Power calculations.
 - a. Battery capacity calculations. Battery size shall be a minimum of 150% of the calculated requirement.
 - b. Supervisory power requirements for all equipment.
 - c. Alarm power requirements for all equipment.
 - d. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst case condition.
 - e. Justification showing power requirements of the system amplifiers.
 - f. Voltage drop calculations for wiring runs demonstrating worst case condition.
 2. Complete manufacturer's catalog data including supervisory power usage, alarm power usage, physical dimensions, finish and mounting requirements.
 3. Submit panel configuration and interconnection of modules and all other data as required to make an informed judgment regarding product suitability. At a minimum, data shall be submitted on the following:
 - a. Master system CPU including all fire detection, voice/audio and visual evacuation alarm control modules, and supervised power amplifiers with the required back up modules.
 - b. Circuit interface panels including all modules.
 - c. Power supplies, batteries and battery chargers.
 - d. Pre-amplifiers, amplifiers, tone generators, master microphone and master telephone.
 - e. Equipment enclosures, including dimensions and weights of completed units.
 - f. Intelligent addressable manual pull stations, heat detectors, analog smoke detectors, alarm monitoring modules, and supervised control modules.
 - g. Annunciator panel and printer.
 - h. Audible and visual evacuation signals and devices.
 - i. Software and firmware as required to provide a complete functioning system.
 - j. Circuiting, including conduit and wire sizes.
 4. Data describing more than one type of item shall be clearly marked to indicate the type the contractor intends to provide for options not crossed out in submittal material will be furnished for the project. All submittal material shall be complete. Partial submittal will not be evaluated and will be rejected without comment. The contractor shall submit copies of UL listing or FM approval data showing compatibility of the proposed device or appliance and the panel being provided.
 5. Complete drawings covering the following shall be submitted by the contractor for the proposed system:
 - a. Floor plans showing all communicating, initiating, end of line, supervisory, indicating appliances, and output control devices; including circuit interface panels, message digitizers, amplifiers, annunciators, printers, video display terminals, color graphic displays, transponders and the main CPU locations. Raceways shall be shown, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used. Drawings shall indicate ambient sound levels used by the system installer for sound level calculations and mathematical justification

- for signal placement to meet the code required 15dBA above ambient for audible warning signals.
- b. Wiring diagrams showing points of connection and terminals used for all electrical connections to the system devices and panels.
6. A complete proposed system database including a description of all logic strings, control by event programming and point identification labels on a 3.5" high density floppy disk or CD ROM and in a formatted printed form, as required for offsite editing, uploading and downloading shall be submitted for evaluation by the owner. A programming manual shall accompany the submitted program and shall be adequate to allow understanding, operation and editing by the system owner.
 7. Statements shall be included, with copies of required licensing, verifying the qualifications of the installer as specified.
 8. The fire alarm system subcontractor or manufacturer shall offer, for the owner's consideration at the time of system submittal, a priced inspection, maintenance, testing and repair contract in full compliance with the requirements of NFPA 72.
- B. For use in system test, a complete operation and maintenance manual with two sets of proposed installation drawings shall be submitted.
1. The following information shall be inscribed on the cover:
 - a. "OPERATION AND MAINTENANCE MANUAL"
 - b. Building location.
 - c. The name of the contractor, system manufacturer and system subcontractor.
 - d. The name and phone number of the fire department required to respond to alarms at the project location.
 2. The manual shall be legible and easily read with large drawings folded and contained in pockets. Included in the manual shall be circuit drawings, wiring and control diagrams with data to explain detailed operation and control of each item of equipment and a control sequence describing start up instructions. Included shall be installation instructions, maintenance instructions, safety precautions, test procedures, performance data, and software documentation.
- C. Upon completion of the installation, record drawings shall be submitted on each system before final acceptance of the work. The contractor shall furnish to the Owner a set of record drawings including system diagrams for each system. The record drawings masters shall be on reproducible mylar film, uniformly sized as required for legibility and reproduction and on high density floppy disks or CD ROM in an AutoCAD DXF format.

1.7 SYSTEMFUNCTION

- A. The system shall be a complete, electrically supervised multiplex style fire detection and voice evacuation system with intelligent analog alarm initiation, to be device addressable and annunciated as described and shown on the drawings.
1. The maximum number of devices on a single signaling circuit shall not exceed 60, in order to avoid catastrophic loss of device communications in the event of a raceway destruction, with a capacity of 60 reporting system inputs and 60 system control outputs. Systems capable of serving in excess of 60 devices to be addressed on as single analog communications network shall be wired and controlled in a Style 7 configuration including isolation circuitry limiting any short circuit fault to a maximum of 60 addresses and/or a single smoke zone, whichever is less. Device wiring in the Style 7 configuration shall be installed in a manner eliminating the possibility of exiting wiring sharing the same raceway as the entry wiring for any device.
 - a. Devices attached to the signaling circuit shall be individually identifiable at the control panel for alarm and trouble indication. Smoke detectors shall be interrogated for sensitivity settings from the control panel, logged for sensitivity changes indicating the

- requirement for cleaning, and tested by a single technician using the panel field test routine.
- b. Sensitivity settings of individual detectors shall be automatically or manually adjustable from the control panel to reduce the incidence of false alarms caused by environmental conditions.
 - c. The analog signaling circuits shall be installed in the fire alarm control panel enclosure or in remote circuit interface panel enclosures.
 - d. Analog signaling circuits shall support selectable Style 4 or Style 7 wiring using loop isolator modules.
2. The system shall support intelligent analog smoke detection, manual station, water flow, supervisory, security, and status monitoring devices. Fire alarm, supervisory, trouble, security and status shall each be treated as a separate level of alarm, each with its own level of priority. The system shall also support amplifiers, voice/visual circuits, telephone system and smoke control fans and dampers.
3. The panel shall be UL listed as a test instrument for the measurement and logging of the sensitivity of connected intelligent analog ionization and photoelectric smoke detectors connected to the control panel or any remote circuit interface panel to comply with the bi-annual sensitivity logging requirements of NFPA 72E.
- a. The measurements shall be discrete voltage readings, accurate to .01 VDC. The readings shall be dynamic, providing a constant display of voltage shifts of the device being tested when in the sensitivity voltage list mode.
 - b. The control panel shall provide a display and a printed list of these sensitivity measurements as a permanent record of the required sensitivity testing. An output shall be provided, together with a Windows XP based utility program to allow the data acquired in the sensitivity testing mode to be downloaded into a laptop computer and utilized in a data base program to formulate a complete system history.
 - c. When programmed, any system connected light refraction style smoke detector shall be capable of self adjustment to compensate for the accumulation of contaminants that would change the detector sensitivity in either a more or less sensitive direction. This adjustment shall keep the relationship between the sensing chamber voltage and the programmed alarm threshold voltage constant to prevent false indications or failure to alarm in the presence of smoke. Data contained in a memory bank on each detector so programmed, shall maintain an average of the chamber voltage in determining the threshold setting for the device. The threshold setting installed in memory within each device shall maintain programmed operation in all cases, including default and default alarm modes. All devices programmed with this feature shall be automatically tested by the control panel once every twenty four hours to assure their ability to detect and report an alarm condition. This test shall be done as a background routine and shall remain transparent to the user. In the event of a test failure, the control panel shall report a trouble message for the failed device.
 - d. Trouble messages displayed by the system LCD displays and logged to system printers and memory shall be programmed with a custom label as selected by the owner to identify the origin by cabinet, room number or other information meaningful to assist maintenance employees.
4. The system shall annunciate a pre-clean trouble condition when any smoke detector reaches 80% of the allowable threshold movement within the prescribed UL window due to gradual contamination, signaling the need for service, and eliminating unwanted alarms. Upon reaching 100% of the allowable movement, a second "Detector Dirty" message with a trouble condition shall be displayed.
- a. The trouble report shall annunciate the specific location of the smoke detector requiring service. All analog smoke detectors installed in the system shall include this feature.

- b. Upon completion of the cleaning of the device, the system shall reestablish the average chamber voltage file, determining if the detector sensitivity falls within the required window, and display a "Detector Cleaned" message. The detector cleaning shall be logged to the system history file.
5. Any intelligent analog smoke detector shall include a selectable alarm verification capability. This feature shall provide automatic verification of smoke detector alarms as described by NFPA 72. The system shall have the capability of logging to historical memory, the time and date of all unverified alarm events in order to track activity and generate reports indicating maintenance requirements prior to failures within the system.
6. All external circuits shall be listed as power limited circuits per the National Electric Code. Power limitation shall be provided using on board, self-restoring solid state thermal devices. Units using fuses or manually restorable circuit breakers for this purpose or requiring board replacement or exchange will not be acceptable.
7. The system shall recognize initiating of an alarm and indicate the alarm condition in a degraded mode of operation, in the event of processor failure or the loss of system communications to the circuit interface panels.
 - a. Each circuit interface panel shall be capable of operation in its own degrade mode. In this mode, the system shall receive an alarm from any intelligent analog or conventional initiating device. It shall activate local indicating appliances and remote or auxiliary connect circuits.
 - b. The system shall indicate a trouble condition during degrade mode operation and shall give a visual indication of an alarm condition.
 - c. Detector operation in the degrade mode shall continue at the alarm threshold previously programmed. Systems returning detectors to a common default value in degrade mode shall not be acceptable.
8. The system shall provide a default operation program to allow reporting of alarms from installed devices before loading of custom system software.
9. The system shall report alarms from installed devices but not yet added to the system custom program. Alarm reports from these devices shall activate indicating appliance circuits.
10. The system shall perform time based control functions including automatic changes of specified smoke detector sensitivity settings. Time based functions shall be controlled by specifying time periods or actual dates. It also shall provide the ability to control these functions on an exception basis using a holiday schedule.
11. The system shall provide a one person field test initiated from the control panel of either the complete system or a specified area supported from either the master control panel or any remote circuit interface panel, maintaining full function of areas not under test.
 - a. Field test shall be usable in a silent or audible mode. When in the audible mode, the signals shall audibly annunciate alarms, troubles and device types, each in a way identifiable by the testing technician.
 - b. All field test activity shall be logged to the system printer and historical memory. It shall be possible to download historic memory to a data base program prior to, and subsequent to the walk test in order to establish a continuous system history. Historic memory shall accommodate a minimum of 800 events to prevent overflow during testing.
12. The system shall be provided with eight levels of password protection with up to forty passwords. In addition the system shall provide for up to sixty four password protected sublevels protecting functions or groups of functions under operator control. Passwords and functions shall be field programmable.
13. The system shall be programmed in the field via a laptop computer. All programmed information shall be stored in nonvolatile memory after loading into the control panel. No special programming terminal or prom burning shall be required and the system shall continue in service during reprogramming. Systems requiring on line terminal programming or not

capable of mass reading of panel software for offsite documentation or editing will not be considered acceptable.

- a. During program reading or loading, the system shall retain the capability for alarm reporting.
 - b. The system shall read to a PC for program editing. System program shall be stored on a floppy disk or CD ROM and all programming shall be multilevel password protected.
 - c. A.U.L. recognized programming utility shall be furnished to compare all altered functions, and input or output addresses, listing all related functions, inputs and output addresses that are effected by the program changes. These items shall constitute a minimum for required certification re-testing of the system in addition to the system device percentage mandated by the codes. Systems not providing this utility shall not be acceptable due to the expense related to complete re-testing for re-certification after program changes. The system shall consist of a central or distributed multiplex architecture using a centrally located control unit with interconnection to remote circuit interface panels containing any combination of pluggable intelligent analog signaling circuits and plug in relays.
 - d. The remote circuit interface panels shall as a minimum, provide a power supply, microprocessor controlled bus structure, battery and automatic charger, and communication link to the main CPU through a high speed 19.2K baud RS-485 network.
 - 1) The high speed communications network shall be capable of Style 7 configuration, and when wired in this configuration, both outgoing and incoming paths shall be used for system activity as a means of assuring system response in the event of a loss of wiring continuity.
 - 2) The high speed communications network shall support the use of fiber optics transmission techniques for the elimination of all electrostatic and electromagnetic induced electrical interference configured as a star loop.
 - e. The network communications format shall include error checking of the installation location of each module address to verify the agreement between programmed software and installed hardware as a protection against card installation in incorrect plug in slots. Module printed circuit cards shall be configured within each cabinet to physically prevent the installation of a card in an incorrect slot in that cabinet.
14. The system shall support a UL listed supervised printer at any designated alpha-numeric annunciator.
 15. The system shall provide status indicators and control switches for all of the following functions:
 - a. Audible and visual evacuation alarm circuit zone control.
 - b. Status indicators for sprinkling system waterflow and valve supervisory devices.
 16. The system as installed shall be expandable to its predetermined maximum capacity of 200 initiation devices and/or 200 combined zones of speakers, and visual devices using installed software, with no chip changes or additions required for expansion.
 17. The system shall support a UL listed supervised printer. Multiple unsupervised ancillary printers also shall be supported as approved or required by the authority having jurisdiction.
 18. The system shall be listed by the UL for configuration as an approved NFPA 13 fire sprinkler system deluge and pre-action releasing system.

1.8 SYSTEM ZONING

- A. Each intelligent addressable device on the system shall be displayed at the fire alarm control panel by a unique alpha numeric label identifying its location.

1.9 SYSTEM OPERATION

- A. Activation of any fire alarm initiating device shall cause the following actions and indications, unless otherwise noted below:
1. Display a custom message, describing the device originating the alarm condition at the main fire alarm control panel and remote annunciator.
 2. Report to the UNT Police via dialer. Two telephone lines shall be provided. Coordinate requirements with UNT and telecom plans.
 3. Sound an alarm tone for a maximum of five seconds followed by an automatic digital voice message over all alarm circuits. At the end of the voice message, the alarm tone shall resume. The audio alarm signals shall sound alternately until the signal silence switch is operated.
 - a. All audio operations (speaker circuit selection and alarm tone/voice messages and timing variations) shall be activated by the system software, so that future changes can be implemented without rewiring or hardware additions. Audible signals shall be silenceable from the fire alarm control panel by an alarm silence switch. The alarm indication shall be transferred to a visual indicator on the control panel and the alarm signals shall resound for a subsequent alarm condition, reported by a different device. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.
 - b. A signal dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow greater than or equal to a single head.
 - c. Status lights next to speaker selection switches on the control panel shall indicate which of the three messages each speaker circuit is distributing.
 - d. Provisions for total building paging shall be accomplished by an 'All circuits switch'.
 4. Record within the non-volatile system historical memory, the occurrence of the event, the time and date of occurrence and the device initiating the event. In addition, all operator actions shall be logged to system history with time and date.
 5. Activation of an AHU duct detector shall shutdown that AHU only and shall not sound a general alarm.
- B. Activation of any alarm verified smoke detector in a single elevator lobby or an elevator equipment room shall, in addition to the actions described in 1.9A above, cause the recall of that bank of elevators to the terminal floor and the lockout of controls. In the event of recall initiation by a detector in the terminal floor lobby, the recall shall be to the alternate floor. Activation of any heat detector in the elevator machine room/pit shall shunt trip the circuit breaker serving the associated elevators.
- C. Activation of any air duct detectors shall shutdown that unit.
- D. Activation of any supervisory circuit; i.e., supervised valve closure, air pressure abnormal, low temperature, fire pump trouble shall cause the following actions and indications:
1. Display the origin of the supervisory condition report at the main fire alarm panel and remote annunciator alphanumeric LCD display.
 2. Activate supervisory audible and visual signals as indicated on the drawings. Audible signals shall be silenced from the fire alarm control panel by an alarm acknowledge switch. The supervisory indication shall be transferred to a visual indicator on the control panel and the supervisory signals shall resound for a subsequent supervisory condition, reported by a different device.
 3. Record within system history the occurrence of the event, the time of occurrence and the device initiating the event.
- E. Receipt of a trouble report; i.e., primary power loss, open or grounded initiating or signaling circuit wiring, open, grounded or shorted indication system wiring, device communication failure, battery disconnect at the fire alarm control panel shall cause the following actions and alarms.
1. Display at the main fire alarm panel and remote annunciator alphanumeric LCD display, the origin of the trouble condition report.

2. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.
 - a. Audible signals shall be silenced from the fire alarm control panel and remote annunciator by a trouble acknowledge switch. The trouble indication shall be transferred to a visual indicator on the control panel and the trouble signals shall resound for a subsequent trouble condition reported by a different device.
 - b. Trouble conditions which have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature shall be software selectable and shall not preclude the logging of trouble events to the historical file.
3. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.

1.10 SECURITY SYSTEM INTERFACE

- A. Automatic Unlock of Electric Locking Mechanisms.
 1. Fail-safe security electric locking mechanisms as indicated on the security plans shall be automatically unlocked by the security system upon a fire alarm condition.
 2. To provide for automatic unlocking, the fire alarm contractor shall provide a normally closed auxiliary dry output contact from the fire alarm system. Upon a fire alarm condition the contact shall open and the security system shall unlock the electric locking mechanisms. The contact shall remain open until the fire alarm system is manually reset.
- B. Manual Release of Electric Locking Mechanisms.
 1. Security electric locking mechanisms as indicated on the security plans shall be manually unlocked from a switch at the main fire alarm control panel.
 2. To provide for manual unlocking the fire alarm contractor shall provide a toggle switch in the main fire alarm control panel. Upon activation of the switch a normally closed dry contact shall open and the security system shall unlock the electric locking mechanisms. The contact shall remain open until the switch is returned to the locked position.
 3. The fire alarm contractor shall provide an additional normally closed dry contact from the switch for security system monitoring of the position status of the switch.
- C. Automatic Bypass of Card Reader Control of Elevators.
 1. The card reader control of elevators shall be automatically bypassed by the security system upon a fire alarm condition.
 2. To provide for automatic bypass the fire alarm contractor shall provide a normally closed dry output contact from the fire alarm system. Upon a fire alarm condition the contact shall open and the security system shall bypass the card reader control of elevators. The contact shall remain open until the fire alarm system is manually reset.
- D. Submittal.
 1. Submit product specifications, fabrication shop drawing, and wiring diagrams for the following:
 - a. Interface terminal box
 - b. Manual unlock switch

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL PANEL

- A. Fire alarm control panel shall be designed for mounting where indicated on the drawings.

- B. The control panel shall be modular in construction and shall include, but not be limited to; the hardware, software and firmware required to perform the following major system functions:
1. Surface mounted steel cabinet with indicator viewing window, hinged door and cylinder lock, dead front construction with outer door open, and factory finished in baked black enamel.
 2. System power supplies, including necessary transformers, rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the system in a worst case condition with all devices in alarm and all local indicating appliances active without exceeding the listed ratings. The system devices shall display normal and alarm conditions consistently whether operating from normal power or reserve (standby) power.
 3. System 16 bit core processor, with internal operating system to process incoming alarm signals and issue output commands required as a result of the alarm reception, by system programming or manual commands. Total system response time shall not exceed 2.5 seconds on a system configured to the 3000 address maximum capacity. All system processors shall be supervised by individual watchdog circuitry furnishing automatic restart after loss of activity. Systems with a single watchdog circuits for all processors shall not be acceptable.
 4. NFPA 72 Style 4 system digital communication capabilities required for the control panel to communicate with remote circuit interface panels, annunciators, and displays. All communications shall be conducted in a digital format. Systems utilizing communications signals of pulse width or voltage level techniques are not considered acceptable.
 5. NFPA 72 Style 4 operation with loop isolator analog signaling circuitry required to communicate with, and receive alarms from 120 points, consisting of a maximum of sixty intelligent analog alarm initiating and sixty intelligent controllable output devices. Analog loops shall be configured with loop isolators and wired in a manner that prevents a catastrophic wiring event on a floor from effecting the performance of other floors.
 - a. Systems allowing more than sixty devices per addressable loop shall be wired in a Style 7 configuration with raceway design configured to allow a maximum of one section of the loop within a single raceway.
 - b. All communications shall be conducted in a digital format. Systems processing signals using pulse width or voltage level techniques are not considered acceptable.
 6. A limited energy output circuit for operation of direct current audible or visual devices.
 7. A drill function on the panel that is easily identifiable and only initiates notification appliances on all floors.
 8. A programmable bypass function for AHU shut down, elevator recall, stairwell pressurization fans, notification appliances and alarm verification.
 9. Where control of operations requiring switching functions is required, there shall be provided a software controllable relay module.
 10. Mother boards shall be provided as the system bus furnishing systems communications to the various plug in modules required for system operation and expansion.
 11. The integrated voice system shall operate up to three voice channels simultaneously; Evacuation, Alert and Auxiliary. Systems using a dedicated paging channel shall not be considered equal.
 12. The integrated voice system shall utilize local and distributed amplification as required for optimum system performance and configuration.
 13. The voice system amplifiers shall be capable of operating 25vrms and/or 70vrms speakers as required to optimize system performance. The amplifiers shall provide a minimum of 100 watts of power each. Amplifiers shall automatically transfer to battery when power fails or is disconnected. The amplifier shall have LED's indicating "AC power fail" and "Battery trouble". Sufficient amplifier power shall be provided to furnish a minimum average of 2 watts of power to all connected speakers on each channel, and in all spaces, provide the code mandated 15Db above the prevailing equivalent sound level or 5Db above the maximum sound level whichever is louder. Sound levels as specified by the NFPA 72, chapter 10, A-10-

- 4.6.2 shall be furnished throughout. Amplifiers shall be protected by a back up amplifier capable of assuming the load of a failed amplifier automatically.
14. An audio control module shall be supplied as the master control module for all voice related functions. The audio control module shall communicate with the fire alarm master via high speed network communications lines.
 - a. A supervised tone generator capable of providing a variety of tones for use in the system shall be included within the capabilities of this module. Software configuration shall determine which tone the system uses. Minimum available signal configurations shall be:
 - 1) Slow Whoop.
 - 2) 900Hz Steady, pulsed at 120 ppm, pulsed at 30 ppm, coded, temporal code 3, California code, zone code, or 4-4-4.
 - 3) Chime, pulsed at 120 ppm, pulsed at 30 ppm, coded, temporal code 3, California code, zone code, or 4-4-4.
 - 4) Horn Steady, pulsed at 120 ppm, pulsed at 30 ppm, coded, temporal code 3, California code, zone code, or 4-4-4.
 - 5) 2000Hz Steady, pulsed at 120 ppm, pulsed at 30 ppm, coded, temporal code 3, California code, zone code, or 4-4-4.
 - 6) Hi/Lo
 - 7) Wail.
 - b. A backup tone card shall be furnished for the audio control module.
 15. The master microphone module shall be permanently mounted behind the locked access door, visible through the viewing window and provide firefighters with the means of issuing voice message instructions to specific audio zones, groups of zones or all zones. The microphone and the press-to-talk switch shall be supervised. This module shall contain a local speaker with volume control to monitor selected audio channels.
 16. The amplifier supervision modules shall supervise the output of all amplifiers, providing automatic switching of backup amplifier output when required.
 17. Manual control and annunciator modules shall be provided on the face of the control panel in quantities required by the system. Module circuit labels shall be color coded to indicate speaker control, waterflow indication and valve supervision.
 - a. Furnish for the indication and control of all system speaker zones, modules comprised of eight software programmed switches, each capable of displaying status of the controlled zone via LED's capable of displaying three different colors in both the steady and flashing state to denote the active status circuit and indicate trouble. All switch activation and LED status indications shall be software mapped to any system functions desired. Systems requiring the use of multiple switches to activate groups of zones or functions shall not be acceptable.
 - 1) Speakers shall be located where indicated on plans.
 - 2) Strobe visual signals shall operate in conjunction with the automatic activation of the speaker zones. Visual signals shall be programmable to remain activated until system reset or system acknowledgment, as required.
 - b. Furnish for the display of fire sprinkler system status, annunciator modules comprised of eight software programmed switches, each capable of displaying status of the controlled zone via led's capable of displaying three different colors in both the steady and flashing state to denote the status and indicate trouble, shall be provided in quantities as required to indicate real time status of each system waterflow switch and valve supervisory switch.
 18. Provide as required, speaker/strobe zone modules providing 8 zones Style Y for either supervised speaker circuits or 24 VDC strobe light or combination of the two indicating type signals. Modules shall incorporate solid state self-restoring current limiting. Equipment

- requiring fuse replacement, manual resetting, or card replacement will not be considered acceptable.
19. The enclosure for the system shall provide complete dead front construction when the outer cabinet door is opened, with no wiring, terminals, batteries or electronic components visible. Human interface modules shall be on a frame hinge mounted to provide easy access to wiring and system plug in cards. Enclosure door shall be pin hinged and removable, for easy system operation by firefighters and technicians in testing and maintenance modes.
 20. The system shall include a real time link to the system database, historical event log, logic, and operating system. The system shall require no manual input to initialize in the event of a complete power down condition. It shall return to an on line state as an operating system performing all programmed functions upon power restoration. Systems requiring battery backed-up memory devices shall not be acceptable.
 21. System display consisting of an 80 character back lighted alphanumeric super twist LCD display readable at any angle. Thirty-two character customer defined custom messages shall describe the location of the active device.
 - a. The system shall be capable of programming to allow troubles occurring and restored in the system to be automatically removed from the display queue, eliminating the necessity for individual acknowledging of these events. This feature shall not affect the historical logging of events as programmed.
 - b. As a minimum, an LED display for "ALARM", "AUDIBLES SILENCED", "SUPERVISORY", "TROUBLE", "SECURITY", "POWER ON" and "PARTIAL SYSTEM DISABLED".
 - c. Touch activated membrane switches for "ALARM ACKNOWLEDGE", "AUDIBLE SILENCE", "SUPERVISORY ACKNOWLEDGE", "TROUBLE ACKNOWLEDGE", "SECURITY ACKNOWLEDGE", "RESET", "DISPLAY HOLD" and "DISPLAY NEXT".
 - d. All membrane switches shall be tactile with audible feed back when pressed.
 - e. Touch activated membrane switches, programmable to perform a minimum of twelve custom designed and programmed functions such as drill, disable, bypass automatic control commands or other special functions as required by the system user. The membrane switches shall also be used for the entry of up to 128 individual pass codes, allowing for an individual code for each operator allowed to perform security bypass functions.
 - f. Ten digit keypad for pass code entry to perform programming and maintenance functions.
 - g. The system shall support a minimum of three supervised remote alpha- numeric annunciators as full function remote control points. Each supervised annunciator shall support a printer.
 22. Software defined logic module as required for each alarm initiation point, capable of controlling any combination of the system output functions using as logic factors; counting, verification, time, day, holiday, type of device, "and", "or", "not", "timer", "all", "any", flip-flop, D latch, and up to 32 levels of programming shall be possible.
 23. Selective historical log, up to 800 events of all types, shall be stored in flash memory and displayed, printed or downloaded by classification for selective event reports. Systems requiring segregated storage for classifications of event history shall be equipped with a hard drive storage device allowing the storage of a utility program for event sorting and a minimum of up to 800 events each for alarm, supervisory, status, security, trouble, operator actions and control outputs.
 - a. The system shall allow selection of events to be logged, including inputs, as; alarms, troubles, supervisories, securities, status changes, walk tests and device verification, outputs as: audible control and output activation, actions as; reset, set sensitivity, arm/disarm, override, password, set time and acknowledge.

- b. Data format for downloading shall be compatible with the data base handling program, allowing custom report generation to track alarms, troubles and maintenance.
 - c. Audible and visual indications shall be generated when memory is 80% and 90% full to allow downloading of data. The system shall be programmable circular logging, assuring that at least the last 400 events will always be stored in non-volatile memory.
 - d. Downloading historical events shall set a system flag at the last event downloaded to allow future retrieval to start at that point, assuring a continuous history log.
24. Environment compensating, software driven logic for adjusting the alarm threshold windows on detectors to compensate for accumulating contamination and keep detector response sensitivity constant. The software shall compensate for either over-sensitized or de-sensitized units, raising a system flag when a detector approaches the allowable limits of adjustment, indicating a requirement for cleaning.
- a. Environment compensation values shall be stored in non-volatile memory allowing activation of all tracking functions within 90 seconds of system initiation from a "cold boot". During the boot sequence, alarms from detectors programmed with the feature shall be suppressed. When the full data history is active all devices shall be checked and any active alarms displayed.
 - b. The control panel shall place each detector in the system in an alarm condition, transparent to the system user, every twenty-four hours as a dynamic check of the accuracy of the alarm threshold setting. Upon reception of the alarm report, the system detector shall be restored to its pretest state.
 - c. The system shall be capable of monitoring the state of detectors and displaying a message when a detector is approaching the limits of adjustment as a result of contaminates. A second message shall be displayed when the detector reaches the limits of adjustment due to these contaminates.
 - d. The system shall recognize that a detector has been cleaned, initiating a series of tests to determine if the cleaning was successful and display a detector cleaned message, readjusting that detectors normal sensitivity setting reference based on a new cumulative average.

2.2 FIRE ALARM SYSTEM POWER SUPPLIES

- A. System primary power. Primary power for the FACP and the secondary power battery chargers shall each be obtained from the nearest 120V emergency panel. See plans for the exact location of the 120V power panel.
- B. Secondary power supply. Provide sealed gelled electrolyte batteries as the secondary power supply for the fire alarm control panel and each system circuit interface panel. The battery supply shall be calculated to operate its load in a supervisory mode for twenty four hours with no primary power applied and, after that time, operate its alarm mode for two hours. Batteries shall be sized at no larger than 80% of the calculated size to compensate for deterioration and aging during the battery life cycle. Battery calculations shall be submitted to justify the battery size. Batteries shall be housed in the control cabinet or a separate cabinet with adequate cell separation to prevent accidental discharge.

2.3 SPARE BOX

- A. Provide a separate box located adjacent to the main fire alarm panel. The box shall be sufficiently sized (16" X 16" C 6" minimum) to hold all spare detectors and paperwork. This box shall match the main fire alarm panel in appearance and be keyed the same.

2.4 REMOTE CIRCUIT INTERFACE PANELS

- A. Remote circuit interface panels shall consist of an enclosure, a remote power supply, digital communications circuitry, mother boards, batteries and hardware, modules and circuitry described for inclusion in the fire alarm control panel as required to function as specified.
 - 1. Circuit interface panels, when required, include conventional zone module, analog loop drivers, indicating appliance circuits, output circuitry to perform actions, speaker supervisory and distribution circuits. All fire detection, alarm and indicating devices supported by the circuit interface panel shall function as a self standing system in the failsafe mode upon loss of the central fire alarm control panel processing, communications or the communications wiring between them.
 - 2. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the default mode.
 - 3. Circuit interface panels shall support remote system displays, annunciators and printers. Test procedures shall be capable of initiation at the main fire control panel, any remote LCD annunciator or any remote interface panel equipped with a keypad.

2.5 DETECTORBASES

- A. Detector Bases – Detector bases shall be low profile, surface or flush mounted in a standard 4” square by 2-1/8” deep box. Bases shall be able to accept photoelectric, ionization or heat detectors.

2.6 SMOKE DETECTORS-PHOTOELECTRIC

- A. Furnish and install where indicated on the drawings, intelligent analog smoke detectors
 - 1. Manufacturers:
 - a. System Sensor, no exception, equipped as follows:
 - i. have an LED that flashed during normal operation;
 - ii. be self-adjusting for airborne contaminants;
 - iii. have clear, distinct visual alarm indication;
 - iv. be programmed to have alarm verification.

2.7 DUCT DETECTORS-PHOTOELECTRIC

- A. Furnish and install where indicated on the drawings, intelligent analog smoke detectors
 - 1. Manufacturers:
 - a. System Sensor, no exception. Detectors shall be campus standard System Sensor equipped as follows:
 - i. have clear, distinct visual power and alarm indications;
 - ii. be programmed to have alarm verification;
 - iii. if mounted where not readily accessible or not within normal view, have extended visual indicators and capability of re-setting the duct detector.

2.8 HEAT DETECTORS, INTELLIGENT RATE COMPENSATED

- A. Furnish and install where indicated on the drawings, intelligent analog smoke detectors
 - 1. Manufacturers:
 - a. System Sensor, no exception. Detectors shall be campus standard System Sensor equipped as follows:
 - i. shall be of the dual element, self-restoring type;
 - ii. have a flashing LED for normal operation;
 - iii. have clear, distinct alarm visual indication.

2. The detectors furnished shall have a listed spacing for coverage up to 2,500 square feet for use in environments as covered by Factory Mutual and UL (UQGS) and shall be installed according to the requirements of NFPA 72E for open area coverage.

2.9 MANUAL STATIONS, INTELLIGENT

- A. Provide single action intelligent manual stations where shown on the drawings, to be flush or surface mounted as required.
 1. Shall be high impact plastic, red in color.
 2. Provide a clear indication when activated.
 3. Station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring.
 4. The manual stations shall be addressable and identifiable by the master fire alarm control panel. Address assignments shall be set electronically and reside within the station in non-volatile memory. Devices using rotary switches, pins, jumpers or staples are not acceptable.
 5. Surface mounted stations where indicated on the drawings shall be mounted using a manufacturer's prescribed matching baked red enamel outlet box.

2.10 MAGNETIC HOLD OPEN DEVICE

- A. Provide 120VAC magnetic hold open devices where indicated in architectural door hardware specification and where required by Code. Devices shall close on an alarm.

2.11 INTELLIGENT SYSTEM INTERFACE MODULE

- A. Furnish and install, for the monitoring of contact type initiation devices and for the control of electrical devices where required, intelligent analog signaling circuit interface module. Modules shall be supplied to meet the project requirements as follows:
 1. A single circuit intelligent signaling circuit interface module for monitoring alarm, trouble, supervisory security or status contact type devices.
 2. Unit as above with form C software programmable control contacts for the management of specified electrical loads as required by this specification.
- B. The module shall be addressed, tested and programmed prior to installation using a UL listed programmer/tester.
- C. The module shall be suitable for two wire, two way communications on the intelligent analog signaling circuit. The module shall display a steady LED for each circuit, in the normal power or standby power condition, when in the alarm state or during control circuit activation.
- D. Modules shall incorporate triple technology microprocessor chips including analog, digital and EEROM technologies on the single device. Address assignments shall be set electronically and devices requiring dip switches, rotary switches, staples or jumpers are not acceptable.

2.12 FIRE SPRINKLER SYSTEM DETECTION AND SUPERVISION

- A. Furnish sensors for installation by the fire sprinkler system contractor and provide system interconnection for the following functions. See plumbing plans for requirements.
 1. Waterflow switches, vane type, with adjustable pneumatic retard of 0 - 75 seconds, single pole double throw switch calibrated for actuation when flow rate equals 10 GPM or greater.
 2. Outside screw and yoke valve supervisory switches in sizes as required for monitoring valves as indicated on the drawings. The single pole double throw supervisory switch shall activate an off normal report within one half turn of the valve.

2.13 INTELLIGENT SUPERVISED CONTROL MODULE

- A. Furnish and install for the control of supervised relays, contactors, audible signal circuits, visual signal circuits, distributed speaker circuits and two way fire fighters communication circuits, intelligent supervisory and control modules including features as follows:
1. The modules shall be suitable for two wire operation and communications on intelligent analog alarm detection loops. Address assignments shall be accomplished electronically. Devices requiring dip switches, rotary switches, staples and/or jumpers are not acceptable.
 2. The module shall display a steady LED in the normal power or standby power condition, when in the activated state.
 3. The module shall be suitable for semi-flush or surface mounting in a 2" deep, 4" square or double gang electrical outlet box having a depth of 3 1/2".
- B. Modules shall be available to supervise reverse polarity supervised indicating circuits utilizing 24VDC, two way supervised fireman's communication circuits or audio circuits utilizing 25VRMS or 70.7VRMS. It shall be possible to configure the module for control of motor contactors and AC voltages to 115VAC.
1. All connected field wiring shall be supervised for opens, short circuits and grounded circuits.
 2. All controlled circuits shall be power limited at 1.5A, produced by self restoring thermal components. Units requiring circuit replacement for restoration of outputs are not acceptable.
 - a. Signal outputs shall be supported in either Style "Y" or Style "Z" configuration.
 - b. The module shall report a trouble condition in the event of loss of the 24VDC signal operating supply voltage.

2.14 EVACUATION SIGNALS

- A. Speakers: Shall be of the polarized 24-Vdc type. Speaker shall be UL listed for fire alarm voice evacuation use. Speakers shall be designed to be mounted on a wall, ceiling or other suitable rigid surface and shall be capable of being surface, semi flush, or flush mounted. Speakers shall be multi-tap. Settings shall be 1/16, 1/8, 1/4, 1/2, 1, 2 or 4 watts.
- B. Strobe Light: ADA visual notification appliances shall be comprised of a xenon flashtube and be entirely solid state. These devices shall be UL listed and be capable of either ceiling or wall mounting. Provide a unit that is ADA compliant with an output no less than 15 candela. The Lexan lens shall be pyramidal in shape to allow better visibility. Provide a red lens on selected strobes where indicated on plans. Strobe light candela ratings have been shown on the plans. However, contractor is responsible for sizing strobes per NFPA 72 based on room size and device location. Units shall be installed 80" above finished floor. All strobes within the same line of site shall be synchronized. Candela ratings have been shown on the plans. These ratings shall be verified based on the room size and NFPA requirements. Where there are discrepancies The NFPA requirements for candela rating shall take precedence over the values shown on the plans. Provide multi-tap strobes to allow for a full range of candela settings. Settings shall be 15/75, 30/75, 75 or 110 candela. Circuits for strobes shall allow for capacity to increase strobe intensities one setting for all strobes. Provide spare devices equal to 1% of the total number of new devices provided for this project.
- C. Speaker/Strobe combination: Standard, ADA Audio/Visual units shall provide a common enclosure for the fire alarm audible and visual alarm devices. The housing shall be designed to accommodate either horns, bells, chimes or speakers. The unit shall be complete with a tamper resistant, Pyramidal shaped lexan lens with Fire lettering visible from a 180-degree field of view. The front panel or bezel that is constructed of UL Listed Noryl, may be inverted so that the lens is below the audible device. Integral Xenon strobe shall provide 8000 peak candlepower and be adjustable from 1 to 3 flashes per second. Provide a unit approved for ADA compliance. Strobe shall be multi-tap type to allow for a full range of candela settings as indicated in paragraph G. Xenon strobe shall provide

4-wire connection to insure properly supervised in/out system connection. Unit shall be complete with all mounting hardware including backbox. Audio/visual unit shall be UL listed for its intended purpose. Speaker shall be multi-tap type to allow for different audio settings as indicated in paragraph F. Provide spare devices equal to 1% of the total number of new devices provided for this project.

- D. The evacuation signals shall be available in flush, semi-flush, or surface versions as required for signal locations shown on the contract documents. Signals shall be mounted using a listed outlet box, and as required, tile bridges. Signals shall be available in visual only and combination to satisfy all required project applications. Visual only and combination audio/visual alarms shall be white with red "FIRE" lettering.

2.15 SECURITY INTERFACE TERMINAL BOX

- A. The interface terminal box shall be a lockable continuous hinge cover NEMA Type 4 enclosure. The cover of the enclosure shall be labeled to identify its function.
- B. Dual screw barrier type terminal strips shall be provided within the interface terminal box. Terminals shall be provided for each interface output from the fire alarm system and the manual unlock keyswitch. All terminals shall be labeled to identify their function.
- C. The output contacts from the fire alarm system shall be rated for 1A at 120V.

PART 3 - EXECUTION

3.1 DESIGN AND INSTALLATION DRAWINGS

- A. Show a general layout of the complete system including equipment arrangement. It shall be the responsibility of the fire alarm contractor to verify dimensions and assure compatibility with all other systems interfacing with the fire alarm system.
 - 1. Identify on the drawings, conduit and conductor sizes and types with number of conductors in each conduit. Provide each conduit and device with a unique identification. For addressable alarm initiation devices, the system identifier shall be the system address for that device. Signals shall be sequentially numbered as the address of the controlling module.
 - 2. Indicate on the point to point wiring diagrams, interconnecting wiring within the panel between modules, and connecting wiring to the field device terminals.
 - 3. Provide mounting details of FACP and other boxes to building structure, showing fastener type, sizes, material and embedded depth where applicable.

3.2 INSTALLATION

- A. Perform work in accordance with the requirements of NEC, NFPA 70, and NFPA 72.
- B. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.
 - 1. Use clamping devices for attaching to structural steel, or when clamping is impractical, obtain written authority to weld or to drill.
 - 2. Fasten equipment to concrete or masonry with expansion anchors.
 - 3. Fasten equipment to drywall by screws into studs, and to metal wall panels by weld studs, bolts or self-taping metal screws.
 - 4. Do not install conduit raceways and boxes in positions that interfere with the work of other trades.
 - 5. Attach nameplates on panels or other components as specified.

3.3 CONDUIT

Project Name, Project Location
Architect Name, Project No.

283100
FIRE ALARM SYSTEMS
UNIVERSITY OF NORTH TEXAS

- A. All wiring shall be installed in conduit, minimum ¾" EMT. Plenum rated cable with J-hooks may be used above ceilings.

3.4 BOXES, ENCLOSURES AND WIRING DEVICES

- A. Boxes shall be installed plumb and firmly in position.
 - 1. Extension rings with blank covers shall be installed on junction boxes where required.
 - 2. Junction boxes served by concealed conduit shall be flush mounted
 - 3. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.
 - 4. "Fire alarm system" decal or silk-screened label shall be applied to all junction box covers. All boxes shall be red.

3.5 CONDUCTORS

- A. Each conductor shall be identified as shown on the shop drawings with wire markers at every splice and terminal point. Attach permanent wire markers within 2 inches of each wire termination. Marker legends shall be visible.
 - 1. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.
 - 2. Wiring for analog loop circuits and speaker circuits shall be 18 AWG twisted. Wiring for strobe circuits shall be a minimum 14 AWG.
 - 3. Splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturer's recommendations.
 - 4. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.
- B. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.
- C. Provide Type CI, 2 hour rated circuit integrity cable for riser wiring and wherever else required per code.

3.6 CERTIFICATE OF COMPLIANCE

- A. Complete and submit to the Owner in accordance with NFPA 72.

3.7 FIELD QUALITY CONTROL

- A. Testing, General.
 - 1. All intelligent analog devices shall be tested and logged for correct address and sensitivity using test equipment specifically designed for that purpose. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the system address, initials of the installing technician and date.
 - 2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
 - a. A systematic record shall be maintained of all readings using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.

- b. The acceptance inspector shall be notified before the start of the required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector, shall be corrected.
- c. Test reports shall be delivered to the acceptance inspector as completed.
3. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum for conducting the tests:
 - a. Ladders and scaffolds as required to access all installed equipment.
 - b. Multimeter for reading voltage, current and resistance.
 - c. Intelligent device programmer/tester.
 - d. Laptop computer with programming software for any required program revisions.
 - e. Two way radios, flashlights, smoke generation devices and supplies.
 - f. Spare printer paper.
 - g. A manufacturer recommended device for measuring air flow through air duct smoke detector sampling assemblies.
 - h. Decibel meter.
4. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.
5. System wiring: fire alarm circuits shall be tested for continuity, grounds, and short circuits.

B. Acceptance testing.

1. A written acceptance test procedure (ATP) for testing the fire alarm system components and installation will be prepared by the Acceptance Inspector in accordance with NFPA 72, and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.
2. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input. In the case of outputs programmed using more complex logic functions involving "any", "or", "not", "count", "time", and "timer" statements; the complete output equation shall be referenced in the matrix.
3. A complete listing of all device labels for alpha numeric annunciator displays and logging printers shall be prepared by the installing contractor prior to the ATP.
4. The acceptance inspector shall use the system record drawings in combination with the documents specified under Paragraph 3.1 during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
 - a. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
 - 1) Open, shorted and grounded intelligent analog signaling circuit.
 - 2) Open, shorted and grounded network signaling circuit.
 - 3) Open, shorted and grounded conventional zone circuits.
 - 4) Open, shorted and grounded speaker, telephone circuits.
 - 5) Intelligent device removal.
 - 6) Primary power or battery disconnected.
 - 7) Incorrect device at address.
 - 8) Printer trouble, off line or out of paper.
 - b. System evacuation alarm indicating appliances shall be demonstrated as follows:
 - 1) All alarm notification appliances actuate as programmed
 - 2) Audibility and visibility at required levels.

- c. System indications shall be demonstrated as follows:
 - 1) Correct message display for each alarm input at the control panel, each remote alphanumeric display and each CRT terminal.
 - 2) Correct annunciator light for each alarm input at each annunciator and color graphic terminal as shown on the drawings.
 - 3) Correct printer logging for all system activity.
- d. Secondary power capabilities shall be demonstrated as follows:
 - 1) System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
 - 2) System primary power shall be restored for forty-eight hours and system charging current shall be normal trickle charge for a fully charged battery bank.
 - 3) System battery voltages and charging currents shall be checked at the fire alarm control panel using the test codes and displayed on the LCD display.
- 5. In the event of system failure to perform as specified and programmed during the ATP procedure, at the discretion of the acceptance inspector, the test shall be terminated.
 - a. The installing contractor shall retest the system, correcting all deficiencies and providing test documentation to the acceptance inspector.
 - b. In the event that software changes are required during the ATP, a utility program shall be furnished by the system manufacturer to compare the edited program with the original. This utility shall yield a printed list of the changes and all system functions, inputs and outputs effected by the changes. The items listed by this program shall be the minimum acceptable to be re-tested before calling for resumption of the ATP. The printed list and the printer log of the retesting shall be submitted before scheduling of the ATP.
 - c. The acceptance inspector may elect to require the complete ATP to be performed again if, in his opinion, modifications to the system hardware or software warrant complete re-testing.

3.8 DOCUMENTATION

- A. System documentation shall be furnished to the owner and shall include but not be limited to the following:
 - 1. System record drawings and wiring details including one set of reproducible masters and drawings on 3-1/2 inch floppy disks or CD ROM in a DXF format suitable for use in a CAD drafting program.
 - 2. System operation, installation and maintenance manuals
 - 3. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.
 - 4. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.
 - 5. System program showing system functions, controls and labeling of equipment and devices. Also provide a 3.5" floppy or CD ROM diskette with system file.

3.9 TEST EQUIPMENT

- A. Refer to Division 01 91 13 for General commissioning requirements.
- B. The Contractor shall furnish all test equipment as required to program devices and test the system, specifically an intelligent device tester and programmer.

3.10 INTERFACE TERMINAL BOX

- A. The fire alarm system contractor shall install the interface terminal box at the main fire alarm control panel in a readily accessible location no more than 8'-0" A.F.F.
- B. The fire alarm contractor shall wire from the fire alarm system to the interface terminal box.
- C. The security contractor shall wire from the security system to the interface terminal box.

3.11 INTERFACE CONDUIT, POWER AND WIRING

- A. The fire alarm contractor shall provide all conduit, power and wiring required for the installation of the terminal box, manual unlock switch and interfacing to the fire alarm system. All wiring shall be UL listed for the fire alarm applications.
- B. The security contractor shall provide all wiring from the interface terminal box to the security system. All wiring shall be UL listed for fire alarm applications.

3.12 WARRANTY AND SERVICES

- A. The contractor shall warrant the entire system against mechanical and electrical defects for a period of 18 months. This period shall begin upon completed certification and test of the system.
- B. During the warranty period, the fire alarm system subcontractor or manufacturer shall provide at no additional charge the inspection, parts, maintenance, testing and repair in full compliance with the requirements of NFPA 72.
- C. The installation contractor shall furnish training as follows for a minimum of four employees of the system user:
 - 1. Training in the receipt, handling and acknowledgement of alarms.
 - 2. Training in the system operation including manual control of output functions from the system control panel.
 - 3. Training in the testing of the system including logging of detector sensitivity, field test of devices and response to common troubles.
 - 4. The total training requirement shall be a minimum of 6 hours but shall be sufficient to cover all items specified.

END OF SECTION