
DIVISION 280000 – FIRE ALARM, SAFETY AND SECURITY

Latest Update: 09-12-2022 See Underlined Text for Edits.

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off “Underlines”)

PART 1 – GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the General and supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 8 Architectural Specifications, Door Hardware.
- C. Division 26 Electrical Specifications and Division 27 Communications Specifications.

1.2 SCOPE: <Edit for Project Requirements>

- A. The [electrical contractor],[and],[security contractor] shall furnish all labor, material, tools, equipment and services necessary and incidental for installing all [Fire Alarm, Safety and Security] system(s) shown on the drawings, indicated in the specifications, or necessary to provide a finished installation. The finished installation shall be in perfect working condition and be ready for continuous and satisfactory operation. The project area is located in:

Note: Engineer to complete above paragraph.

- B. This section includes Fire Alarm devices and programming to be connected to fire alarm system, access control devices to be connected to Access Control System and video surveillance system (VSS) which consists of cameras, data transmission wiring, storage, software, and a control station with its associated equipment. The VSS shall be integrated with monitoring and control system.

1.3 CODES & REGULATIONS

- A. All materials furnished and all work installed shall comply with the latest rules, regulations, and recommendations of the following bodies:
 - 1. International Building Code
 - 2. International Mechanical Code
 - 3. National Electric Code
 - 4. Maryland State Health Department
 - 5. National Fire Protection Association
 - 6. Fire Prevention Bureau Baltimore City
 - 7. Fire Protection Bureau State of Maryland

8. Underwriters Laboratories
9. National Electrical Manufacturer Association
10. National Electrical Testing Agency
11. Insulated Power Cable Engineers Association
12. American National Standard Institute (ANSI)
13. ASTM
14. Electronics Industries Association (EIA)
15. IEEE
16. Telecommunication Industry Association (TIA)
17. Federal Communication Commission (FCC)

1.4 RESPONSIBILITY

- A. The construction manager/general contractor (CM/GC) shall be responsible for all work included in Division 28. The delegation of work to contractors shall not relieve him of this responsibility. Contractors who perform work under these sections shall be responsible to the CM/GC.

1.5 SITE EXAMINATION

- A. Failure to visit the site and become familiar with existing project conditions prior to bidding will not relieve the Contractor of responsibility for complying with the Contract Documents.

1.6 OUTAGES <Edit for Project Requirements>

- A. For all work requiring an outage, the [electrical contractor],[and],[security contractor] shall submit an outage request to the UMB Project Manager, using the UMB Standard Request for Outage Form which is available through the UMB Design and Construction Web Site at <https://www.umaryland.edu/designandconstruction/design-and-construction-documents/umb-standard-project-forms---current-editions/>
- B. The existing systems shall remain operational unless turned off by University personnel during the construction of the project. For each outage request include a photograph or description of the area affected by the outage.
- C. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled at least ten business days (10) days in advance with the UMB Design and Construction Department. Outages shall be performed during normal duty hours. If necessary some outage work may be performed outside normal hours if approved by UMB.
- D. The [electrical contractor],[and],[security contractor] shall include in his price the cost of all premium time required for outages and other work which interferes with the normal use of the building, which will be performed, in most cases, during other than normal work time and at the convenience of the UMB Design and Construction Department.

- E. The operation of electrical/fire alarm/safety/security panels or power switches; required to achieve an outage must be accomplished by University personnel only. Unauthorized operation of electrical/fire alarm/safety/security panels and power switches, by contractors their personnel will result in extremely serious consequences for which the contractor will be held accountable.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions:
 - 1. Notify UMB Project Manager no fewer than ten (10) days in advance of proposed interruption of fire-alarm service.
 - 2. Do not proceed with fire-alarm outage without UMB Project Manager's written permission.
 - 3. Where a required existing fire protection system is out of service or during system Outage, the contractor shall provide fire watch as required by the UMB Fire Marshal until the existing system is restored.
<http://www.umd.edu/media/umb/af/ehs/firesafety/FireWatchProcedures.pdf>

1.8 SUBMITTALS

- A. General Requirements: For general requirements see Architectural Specification Division 01 Section "Submittal Procedures" and the following:
 - 1. After contract award and before material is ordered submit electrically all product data, shop drawings, drawings and other such descriptive data as the Engineer may require to demonstrate compliance with the contract documents as required by the contract clauses for review and approval.
 - 2. Submittals shall include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable publication references, years of satisfactory service, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish.
 - 3. All equipment shall be approved and listed by Underwriters' Laboratories (UL) and shall bear nameplate indicating same.
 - 4. Submittals will be reviewed for general compliance with design concept in accordance with contract documents, but dimensions, quantities, or other details will not be verified.
 - 5. Submittals shall include the following items: **Note: Engineer must edit the list for the project requirements.**

- a. Article 2.2, Fire Stops, Smoke Seals and Rated Wall/Floor Penetrations
 - b. Article 2.3, Sleeves
 - c. Article 2.4, Fire Alarm System
 - d. Article 2.5, Interface Connections to Existing Campus Fire Alarm System Central Network Stations
 - e. Article 2.6, Access Control System
 - f. Article 2.7, Video Surveillance System
 - g. Article 2.8, Raceway
 - h. Article 2.9, Boxes and Enclosures
 - i. Article 2.10, Wire and Cable
 - j. Article 2.11, General Wire and Cable Requirements
 - k. Article 2.12, Identification
 - l. Article 2.13, O & M Manual Do not include this data in the Fire Alarm Submittal.
 - m. Warranties and maintenance instructions shall be included in the O & M Manual only. Do not include this data in the Fire Alarm Submittal.
6. Submittal File Format: File formats and names for each submittal shall be electronically as follows:
- a. File Formats:
 - 1) Product Data: “pdf” file format.
 - 2) Design Shop Drawings: “pdf” and “dwg” file formats.
 - 3) Coordinated Drawings: “pdf” or “dwg” file formats.
 - 4) Schedules: “xl” file format.
- B. Fire Alarm Submittal: In addition to the requirements identified in paragraph 1.8.A the fire alarm contractor shall also comply with the following: **<Delete if not required>**
1. UMB requires the Fire Alarm Submittal to be submitted electronically as one (1) complete submission as a “pdf” file for review. Partial Submittals will be rejected.
 - a. The complete submittal must be reviewed and approved by the A/E and the UMB Fire Marshal before installation can take place. The submission shall include the following:
 - 1) Product data for each type of product specified.
 - 2) Shop drawings (See Paragraph ‘2’ below for requirements)
 - 3) Voltage drop calculations
 - 4) Installers qualifications
 - b. The warranty information and maintenance manuals shall be included in the Division 28 Project O & M Manual. Do not include this data in the Fire Alarm Submittal.

2. Shop Drawings shall be prepared by persons trained and certified by the manufacturer in fire-alarm system design. Shop drawings shall be signed or stamped by an individual with one of the following qualifications:
 - a. NICET fire-alarm technician, Level IV minimum.
 - b. Professional Engineer registered in the State of Maryland.
 - c. The qualified individual signing the shop drawings must attend any and all review comment resolution meetings requested by the University.

3. Submittal drawings must include the following:
 - a. Provide floor plans with all device locations and their associated addresses. Floor plans must be drawn to scale. Provide graphic scales on the drawings.
 - 1) For new building construction projects or replacement of existing building entire fire alarm system projects, use NFPA 170 symbols.
 - 2) For renovation projects match the symbols used on As-Builts.
 - 3) Provide a riser diagram regardless of system size.
 - 4) Wiring Diagrams: Provide the following:
 - a) Detail wiring and differentiate between manufacturer-installed and field-installed wiring.
 - b) Include diagrams for equipment and for system with all terminals and interconnections identified.
 - c) Include all internal network cards and boards in FACP and Transponder Panels.
 - b. Calculations shall include the following:
 - 1) Battery: Sizing calculations.
 - 2) Load Calculations - Provide load calculations for all NAC circuits while noting both current demand future capacity in amperes.
 - c. Device Address List shall include the following:
 - 1) Coordinate with final system programming.
 - 2) Floor plans shall include address numbers for all devices.
 - d. System Sequence of Operation: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 - e. Details of graphic and alphanumeric annunciators.

4. Renovation Projects: For projects involving only modifications to the existing FAS, the University will provide electronic copies to the FAS manufacturer of their latest version of the FAS As-Builts. The FAS manufacturer will make all necessary revisions to the FAS as-builts and submit them for review/approval. Once the project is completed, the FAS manufacturer will update the copies for forwarding

electronically to the University for archiving. In revising the electronic copies of the University's as-builts, please perform the changes in the following format:

- a. CAD Dwg Format: Show all new wiring and equipment in BOLD so it is convenient to differentiate between new and existing.
5. Submissions to UMB Fire Marshal:
- a. Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Resubmit if required to make clarifications or revisions to obtain approval.
- C. Safety System (SAF) Submittals: In addition to the requirements identified in paragraph 1.8.A the safety system contractor shall also comply with the following: <Delete if not required>
1. UMB requires the Safety System Submittal to be submitted electronically as one (1) complete submission as a "pdf" file for review. Partial Submittals will be rejected.
 - a. The complete submittal must be reviewed and approved by the A/E and UMB before installation can take place. The submission shall include the following:
 - 1) Product data for each type of product specified.
 - 2) Shop drawings (See Paragraph '2' below for requirements)
 - 3) Installers qualifications
 - b. The warranty information and maintenance manuals shall be included in the Division 28 Project O & M Manual. Do not include this data in the Safety System Submittal.
 2. Shop Drawings shall be prepared by persons trained and certified by the manufacturer in safety system design.
 3. Submittal drawings must include the following:
 - a. Provide floor plans with all device locations and their associated addresses. Floor plans must be drawn to scale. Provide graphic scales on the drawings.
 - 1) Provide a riser diagram regardless of system size.
 - 2) Wiring Diagrams: Provide the following:
 - a) Detail wiring and differentiate between manufacturer-installed and field-installed wiring.
 - b) Include diagrams for equipment and for system with all terminals and interconnections identified.
 - c) Include all internal network cards and boards in the Safety Control Panel.

- b. Calculations shall include the following:
 - 1) Battery: Sizing calculations.
 - c. Device Address List shall include the following:
 - 1) Coordinate with final system programming.
 - 2) Floor plans shall include address numbers for all devices.
- D. Security System (SEC) Submittals: In addition to the requirements identified in paragraph 1.8.A the security system contractor shall also comply with the following: <Delete if not required>
- 1. UMB requires the Security System Submittal to be submitted electronically as one (1) complete submission as a “pdf” file for review. Partial Submittals will be rejected.
 - a. The complete submittal must be reviewed and approved by the A/E and UMB before installation can take place. The submission shall include the following:
 - 1) Product data for each type of product specified.
 - 2) Shop drawings (See Paragraph ‘2’ below for requirements
 - 3) Installers qualifications
 - b. The warranty information and maintenance manuals shall be included in the Division 28 Project O & M Manual. Do not include this data in the Security System Submittal.
 - 2. Shop Drawings shall be prepared by persons trained and certified by the manufacturer in security system design.
 - 3. Submittal drawings must include the following:
 - a. Provide floor plans with all device locations and their associated addresses. Floor plans must be drawn to scale. Provide graphic scales on the drawings.
 - 1) Provide a riser diagram regardless of system size.
 - 2) Wiring Diagrams: Provide the following:
 - a) Detail wiring and differentiate between manufacturer-installed and field-installed wiring.
 - b) Include diagrams for equipment and for system with all terminals and interconnections identified.
 - c) Include all internal network cards and boards in the Control Panels.
 - b. Calculations shall include the following:
 - 1) Battery: Sizing calculations.

- c. Device Address List shall include the following:
 - 1) Coordinate with final system programming.
 - 2) Floor plans shall include address numbers for all devices.

- E. Informational Submittals: Submit following:
 - 1. Operating Instructions: For mounting at FACP.
 - 2. Product Certificates: Signed by manufacturers of system components certifying that products furnished comply with requirements.
 - 3. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.
 - 4. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Comply with NFPA 72.

- F. Project Closeout Submittals: Submit the following in accordance with the UMB General Conditions.
 - 1. Electronic Copies of Each System Program: Provide a minimum of two (2) electronic copies of the system program on USB Flash Drive. Store one (1) USB Flash Drive copy of the program at the FACP and hand the other copy over to the Project Manager. Besides being required by NFPA 72, the purpose for this requirement is to ensure the owner always has on hand a “bug free” copy of the original.
 - 2. Manufacturer’s As-Built Drawings: Upon successful testing and commissioning of the FAS and approval by the University’s Fire Marshal, the FAS manufacturer shall provide the following:
 - a. As-Built Drawings: The [FAS] [SAF] [SEC] Manufacturer shall revise/update the [FAS] [SAF] [SEC] Shop Drawings to accurately reflect the following field installation data/conditions:
 - 1) All individual device addresses on the floor plans.
 - 2) Conduit/SLC & NAC Loop Wiring Layout - Show routing of all FAS wiring and raceway including riser runs and while noting all FAS device and panel locations. Identify all panels with their respective ID numbers/lettering as entered in the FAS programming software. Where multiple FAS circuits are run in parallel and/or grouped together, attach drawing notes to the runs to identify the individual FAS circuits in the grouped or parallel run. Delineate overhead versus underground runs by using dashed lines for underground.
 - 3) Riser and/or connection diagram.
 - 4) Equipment Data - Provide Manufacturer’s catalog information on all internal network cards/option modules in the system.

- 5) Provide both paper copies and electronic files in AutoCAD 2018 or latest edition used by UMB in “dwg” and “PDF” file formats. Provide two (2) full-size paper copies (24 inches x 36 inches) and three (3) half-size copies for UMB review personnel only. Provide graphic scales on the drawings.
 - b. Updated copies of load calculations, System Program and Sequence of Operation as submitted during in the shop drawing phase.
 - c. Maintenance Data: For fire alarm systems. Comply with NFPA 72.
 - d. Certificate of Completion: Comply with NFPA 72.

1.9 WORK PERFORMANCE

- A. All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K in addition to other references required by the contract.
- B. Before initiating any work, a job specific work plan must be developed by the contractor. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, and safety equipment to be used and exit pathways.
- C. Job site and worker safety are the responsibility of the contractor. Compliance with the requirements of NFPA 70E is subject to ongoing inspection by University personnel and failure to comply will result in an immediate Stop Work order being issued and enforced at the contractor’s expense.
- D. Energized electrical conductors and circuit parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee performs work any time the employee is within the limited approach boundary or, where an increased risk of injury from an exposure to an arc flash hazard exists.
- E. Outages should be scheduled a minimum of ten (10) days in advance.
- F. Mandatory Requirements: The following requirements are mandatory:
 1. Protective Equipment: Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
 2. UMB Energized Work Permit: A UMB Energized Work Permit is required for any work on energized circuits or equipment. Permit must be approved by UMB Department of Operations and Maintenance prior to performing energized work. Submit the work permit with the outage request.

1.10 QUALITY ASSURANCE

A. Installer's Qualifications:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years' experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Electronics Safety and Security manufacturers.
 2. The Contractor shall only utilize factory-trained technicians to install, program, and service the Electronic Safety and Security systems. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. Upon request the Contractor shall provide copies of system manufacturer certification for all technicians.
 3. Copy of Maryland Master Electrician's License.
 4. Local of State license where required.
 5. BICSI and NICET certification, where required by these specifications.
 6. The Fire Alarm contractor shall have (or contractually be supported by a company who has) on staff and assigned to the project a NICET Level IV certified person for fire alarm systems. <Consult with UMB Fire Marshal and Edit for Project Requirements>
 7. The Fire Alarm contractor shall have (or contractually be supported by a company who has) on staff and assigned to the project a NICET Level III certified person for fire alarm systems. <Consult with UMB Fire Marshal and Edit for Project Requirements>
 8. A NICET Level II or higher Fire Alarm Technician or a Fire Alarm Technician with minimum of two (2) years' experience shall install and terminate fire alarm devices, cabinets and panels. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings
 9. An electrician or NICET Level II Fire Alarm Technician shall install conduit for the fire alarm system.
- 1.11 SYSTEM DESCRIPTION <Consult with UMB Project Manager and Edit as directed by UMB>
- A. Fire Alarm System Non-coded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

- B. Fire Alarm System Non-coded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.
- C. Presently, UMB has a contract to upgrade the existing buildings FACP and Network Stations with the latest version of Software/Firmware. Under this project, the contractor shall coordinate with the UMB Project Manager for the programming of the building panel and the correct version of Software/Firmware must be provided prior to programming.
- D. Security system is an existing campus wide enterprise security system consisting of Lenel Access Control and Pelco video systems. All components shall match existing system components.
- E. Programming and interface connection to communications link for the Access Control shall only be done by Stanley Security Solutions. Prior to programming the contractor shall coordinate with UMB Project Manager and Campus Police.
- F. Programming and interface connections to communications link for video system shall only be done by S3 Integration. Prior to programming the contractor shall coordinate with UMB Project Manager and Campus Police.

1.12 IDENTIFICATION BADGES

- A. Contractors must obtain photo identification cards for all employees who will be at the construction site. The University will charge the contractor twenty five (\$25.00) dollars for each badge as a deposit of which twenty (\$20.00) dollars will be returned when the badge is returned. Lost photo I.D. card will cost twenty five (\$25.00) dollars for another replacement card. (The above charges are subject to change without notice.)

1.13 HAZARDOUS MATERIALS

- A. Identification and removal of hazardous materials (asbestos, lead paint, PCBs) is not part of this contract. If questionable material is encountered, notify the University Project Manager and the University Environmental Health and Safety in writing immediately. The University shall then arrange for investigation and possible abatement of the material. Contractor shall schedule his work to accommodate hazardous material removal by the Owner.

1.14 COMMISSIONING NEW FIRE ALARM, SAFETY AND SECURITY SYSTEMS

- A. Summary: This section includes the requirements for commissioning electrical systems, assemblies and equipment related to the project area.
- B. Commissioning Agent (CxA): The CxA for the project shall be [as assigned by UMB.] [a third party consultant.] <Consult with UMB Project Manager and Edit as directed by UMB>

C. Description: The following equipment and/or accessories shall be commissioned as part of this project: <Edit for Project Requirements>

1. Access Control.
2. Card Readers.
3. Communications Link interface.
4. Video Surveillance.
5. Uninterruptible power systems.
6. Fire Alarm System.

1.15 GUARANTEE/WARRANTEE:

- A. All materials, equipment, etc. provided by the general contractor and/or his subcontractors shall be guaranteed and warranted to be free from defects in workmanship and materials for a period of two (2) years from the date of substantial completion and acceptance of work by UMB. Any defects in workmanship, materials, or performance which appear within the guarantee period shall be corrected by the contractor without cost to the owner, within a reasonable time, to be specified by UMB. In default thereof, owner may have such work done and charge the cost of same to the contractor. In addition to the above statement the Guarantee/Warranty Period shall include all labor cost related to all warranty work.
- B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of guarantee shall be delivered to the Owner.

PART 2 – PRODUCTS:

2.1 LISTED MANUFACTURERS

- A. The manufacturers indicated in Part 2 represent the design and identify the minimum level of quality for materials and equipment, specified in this section, that are acceptable to UMB. All submitted materials and equipment are subject to approval by the A/E and UMB.

2.2 FIRE STOPS & SMOKE SEALS FOR WALL & FLOOR SLEEVE APPLICATIONS

<Delete if Section 260000 is used for the Project>

- A. General: Provide fire stops, and smoke sealant materials for all electrical services penetrating through rated assemblies. See Architectural Specification Division 07, Section “Penetration Firestopping” for sealant material requirements. Services include:
1. Electrical penetrations include conduits and cables.
- B. New Construction: All new penetrations shall be provided with a pipe sleeve and sealant materials.
- C. Existing Construction: All new service penetrations through existing rated assemblies shall be provided with a pipe sleeve and sealant materials. All existing unsealed penetrations for

services passing through existing rated assemblies within the project area shall be provided with sealant materials.

- D. Project Area: The project area shall include the finished spaces and related sections of the utility shafts within the project area footprint.
- E. Wall Pipe Sleeve Applications: Pipe sleeves shall be required for all new conduit penetrations through rated wall assemblies and non-rated CMU walls. Where pipe sleeves are installed in non-rated CMU walls fire rated sealant materials are not required. Provide acoustical caulking to seal the annular spaces between the sleeve and the bare pipe or pipe insulation on each end with one half (1/2) inch caulking all around the annular space.
- F. Floor Pipe Sleeves Applications: Pipe sleeves are required for all new conduit risers passing through floor slabs.

2.3 SLEEVES

- A. Steel Pipe Sleeves: Steel pipe sleeves shall be standard black steel pipe Type E, Grade B, with plain ends conforming to ASTM A53/A53M.

2.4 FIRE ALARM SYSTEM

A. General Requirements:

1. UMB does not have a service contract with any other company to work on the existing fire alarm system. Any certified Notifier Fire Alarm System distributor can work on the existing system. Upon request the contractor shall provide proof of their Notifier Engineered System Distributor Agreement to the University.
2. The existing UMB Campus Notifier Network System is under warranty with MC Dean. Any required work with the Network System must be coordinated with the UMB Project Manager.

B. Existing Fire Alarm System NOTIFIER:

<Engineer to Coordinate with UMB and Edit for Project Requirements>

1. Fire Alarm Control Panel Model [NFS2-640] [NFS2-3030] with display.
2. Digital Voice Command (DVC), Voice Evacuation Control System.

C. System Expansion: Confirm existing Signaling Line Circuit (SLC) and Notification Appliance Circuit(s) (NAC) will support the additional fire alarm devices shown on the contract drawings. Provide additional circuits and/or amplifier boards where necessary.

D. Prior to programming of the new/existing FACP, the contractor shall verify in field exact room numbers and names for all initiating devices, elevator numbers and stair numbers to program the correct device address.

- E. [Horn/strobes], [Speaker/strobes] shall be semi-flush mounted with red covers and clear strobe lens. Ceiling mounted devices are acceptable. <Engineer to Edit for Project Requirements>
- F. [Horn/strobes], [Speaker/strobes] signals shall comply with the requirements of the ADA. Ceiling mounted devices are acceptable. <Engineer to Edit for Project Requirements>
- G. Strobe units shall consist of a red cover and clear lens. Strobe signals shall comply with the requirements of the ADA.
- H. Strobes shall be provided with a candela rating as indicated.
- I. Analog smoke detectors shall be addressable photoelectric where indicated on the Drawings, plug-in type with base. The detector base shall be of the twist/lock type with screw terminals for field wiring. An automatic gain control circuit shall be provided to compensate for detector aging and dirt accumulation and maintain the detector within the correct sensitivity range. A critical reduction of sensitivity caused by dirt accumulation shall initiate a trouble signal. Detector sensitivity shall be capable of being read and adjusted from the control panel.
- J. Interface monitor modules shall be addressable, mounted in standard four (4) inch x four (4) inch square or octagonal electrical boxes with covers. Cover shall be labeled or embossed with fire alarm system interface module designation. A solid state LED indicator lamps shall be visible in the cover. These modules are to be used for connection of conventional alarm devices such as water flow switches, valve tamper switches, fire pump alarms and other non-addressable devices. Connections between devices and modules shall be integrally supervised for open and ground faults. Monitor and control functions may be integrated in a single interface module if listed and approved for this purpose.
- K. Duct type detector assemblies shall consist of an addressable analog photoelectric detector, an air duct sampling tube and detector housing. Provide a remote alarm indicating lamp for all duct detectors installed in concealed spaces.
- L. Manual Pull Stations: Addressable, red in color, non-coded, double-action type. Manual station covers shall be hinged and secured with a lockset. Lockset shall be keyed the same as the control unit lockset. Manual pull stations installed at stairwell and exterior exits, building interconnection points, parking garages (or other outdoor locations) etc. must also include tamper-resistant protective cover with audible alarm. For pull stations installed at building perimeter exits with access control and/or electro-mechanical locking, provide a non-addressable pull station with a minimum of two (2) dry contact outputs.
- M. Heat detectors shall be addressable, plug-in type with base. The detector base shall be of the twist lock type with screw terminals for field wiring. Detectors shall be rate compensation, fixed temperature type, rated at 135°F. Detector element shall be self-restoring after operation.

2.5 INTERFACE CONNECTIONS TO EXISTING CAMPUS FIRE ALARM SYSTEM
CENTRAL NETWORK STATIONS <Engineer to consult with UMB Fire Marshal and
UMB Project Manager and retain this paragraph related to upgrade of existing network
stations>

A. General:

The existing Campus – wide Central Fire Alarm Monitoring & Control (FAMC) and Mass Notification System (MNS) is Class A, dedicated campus fiber network. The FAMC system consist of four (4) Network Command Centers (NCC) with PC based head-end work stations with graphical user interfaces that allow for centralized alarm annunciation, monitoring and control at each NCC of all building fire alarm systems, their respective individual signaling line circuits, notification appliance circuit loops and associated individual devices. The NCC's also has the capability to remotely broadcast real-time and pre-recorded voice messages via a microphone at Campus Police. The four (4) NCC's are located at Campus Police, UMB Fire Marshal's Office, Pearl Street Garage Electronics Shop and Pearl Street Garage Work Control Center.

B. The existing FAMC, MNS & NCC is Notifier ONYX WORKS – NW Work Stations with NFN wire PC Card, Graphic User Interface software and hardware for NOTI-FIRE NET (NFN) with Gateway.

1. For building renovation projects existing NCC's must be upgraded with new and latest floor plans with device locations. These modifications only applies to where initiating devices are added or being replaced.

C. The existing four (4) Network Command Centers (NCC) have been upgraded under a separate contract and are still under warranty with M.C. Dean, Inc. All work associated with the connections, programming, and modifications to the existing NCC's must be performed by M.C. Dean, Inc. UMB will hire M.C. Dean, Inc. under a separate service contract to perform all work. This contractor will be responsible for coordinating all work with M.C. Dean, Inc to perform all work related to upgrading/modifications to four (4) NCC's. M.C. Dean, Inc. will provide the work as follows:

1. Programming of the NCC's to communicate with building Fire Alarm Control Unit/Fire Alarm Control Panel.
2. Convert CADD files to META files for Graphic User Interface and upload on to NCC's.
3. Provide complete Point ID descriptions and locations of devices for new graphic screen shots.
4. Program and test all new Point ID's.
5. Program and test Mass Notification Message Broadcast.
6. Provide all hardware, software, programming tools and documentation necessary to modify the system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for

devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site.

- D. Before M.C. Dean, Inc. can perform the work on the existing NCC's, the contractor shall provide M.C. Dean, Inc. updated and approved as-built fire alarm system shop drawings hard copy and CADD files, with exact device locations and addresses, as well as the updated building FACP program.

2.6 ACCESS CONTROL SYSTEM

- A. Approved Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Access Control System Software:
 - a. Existing Lenel System.
2. Access Control System Field Hardware
 - a. Lenel, no exceptions.
3. Access Control System Field Power Supplies
 - a. Lenel or approved equivalent.
 - b. Altronix or approved equivalent

- B. Access Control – Data Gathering Panel (DGP)/Reader Module (RM) Enclosure:

1. The enclosure shall be a wall mounted unit and shall meet the following requirements:
 - a. Capable of accommodating 6 access control boards (1 DGP and 5 RMs or 6 RMs)
 - b. Includes a 12VDC Power Supply meeting the specifications outlined in the power supply specification section
 - c. 115VAC input power
 - d. Lockable enclosure
 - e. Approved Equipment:
 - 1) Lenel LNL-AL600ULX-4CB6 or approved equivalent.

- C. Access Control - DGP/RM Power Supply:

1. Each DGP and supporting network equipment; including but not limited to hubs, routers, switches, data converters, and other data transmission media, shall be provided with a minimum of eight (8) hours of backup battery power. The battery backup power shall maintain the DGP and supporting network equipment fully operational during any power outage or period of degraded normal power (brown out). The DGP power supply shall have an integral battery charger. The charger shall maintain the battery in the fully charged state and supervise its condition at all times. The charger shall be capable of restoring the battery from the fully discharged

to the fully charged state in forty eight (48) hours. The DGP shall switch to backup power and back to normal power without any loss of DGP operations or functions including receipt and processing of alarms, issuing Commands, processing access card activity, and all supervisory and monitoring functions. The Contractor shall provide all support hardware necessary for the battery backup including cables, charger, cooling and heating as necessary for outdoor operation. The Contractor shall provide battery calculations for each DGP. The power supply shall report AC fail, battery low, and battery fail.

D. Access Control - Data Gathering Panel (Security Control Panel):

1. The Data Gathering Panel (DGP) shall be capable of integrating with the existing access control system and shall meet the following requirements:
 - a. 12/24VDC Input.
 - b. Eight (8) Inputs.
 - c. Four (4) Form C relay outputs.
 - d. Support for two (2) card readers.
 - e. Support for thirty two (32) downstream devices by RS-485 connection.
 - f. Support for up to sixty four (64) doors using downstream devices.
 - g. Support for specified card reader communication protocol.
 - h. Approved Equipment:
 - 1) The DGP shall be Lenel LNL-2220 or approved equivalent.

E. Access Control - Dual Reader Modules (RM):

1. The RM shall be capable of integrating with the owner's existing access control system and shall meet the following requirements:
 - a. 12/24VDC Input.
 - b. Ten (10) Input six (6) Form C relay outputs.
 - c. Support for two (2) card readers.
 - d. Support for specified card reader communication protocol.
 - e. Approved Equipment:
 - 1) The RM shall be Lenel LNL-1320 or approved equivalent.

F. Access Control - Card Reader:

1. Proximity technology card readers shall meet the following specifications.
 - a. Proximity RF technology
 - b. Suitable for surface, semi-flush, pedestal, or weatherproof mounting as required
 - c. Read range minimum two (2) inches (51 mm (two (2) inches)) with ISO Prox card
 - d. Read time maximum ninety four (94) milliseconds for twenty six (26) bit card
 - e. Integral multicolor LED and beeper
 - f. Operating temperature -30C to 65C

- g. Wiegand format output
- h. Powered from the Power Supply 6-12 VDC plus or minus ten percent ($\pm 10\%$) as shown and shall not dissipate more than 150 watts.
- i. Color beige
- j. Approved Equipment:
 - 1) HID 5355.

G. Access Control - REX PIR Motion Detector:

- 1. The REX PIR motion detector shall be used as a mean to allow egress from the secure side to the unsecure side of an access controlled door and shall meet the following requirements:
 - a. 12VDC Input.
 - b. Two (2) Form C Relay outputs.
 - c. Installable over single gang back box with use of trim ring.
 - d. Adjustable and maskable coverage pattern.
 - e. Light Gray or Beige in color.
 - f. Approved equipment:
 - 1) Bosch DS160 or approved equivalent.

H. Access Control - Line Supervision:

- 1. Communications between the host computer and the data gathering panels shall be protected against compromise. The system shall detect substitution of resistance or electrical potential, substitution of like equipment, and introduction of synthesized signals. Protective circuits (alarm inputs) shall be protected between the data gathering panel and the sensing devices (door contacts, motion detectors, etc.). Each circuit shall be supervised by end or line resistors located at the sensing device. The contractor must receive written approval from SI to locate the resistor elsewhere unless the drawings require this. The system shall detect resistance changes and report alarm and trouble signals at designated values defined by the system manufacturer. The system shall register a minimum of four (4) states: normal, alarm, trouble open (cut), and trouble closed (shorted). Trouble signals shall be displayed to the operator in a format readily identifiable by the operator as a supervisory condition.

I. Access Control - Delayed Egress (DE):

- 1. Access Control Interface
 - a. The delay egress device shall be capable of interface with card access control systems.
 - b. The system shall include a bypass feature that is activated via a dry contact relay output from the access control system. This bypass shall allow authorized personnel to pass through the controlled portal without creating an alarm condition or activating the delay egress cycle. The bypass shall include internal electronic shunts or door switches to prevent activation (re-

arming) until the door returns to the closed position. An unused access event shall not cause a false alarm and shall automatically rearm the delay egress lock upon expiration of the programmed shunt time. The delay egress access control interface shall support extended periods of automated and/or manual lock and unlock cycles.

- c. Provide interface connections to fire alarm system as necessary.

2.7 VIDEO SURVEILLANCE SYSTEM (VSS)

- A. Approved Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

1. Pelco, no exceptions.

- B. VSS – Cameras: <Consult with UMB Project Manager and Edit as directed by UMB>

1. Interior Cameras:

- a. Dome IP Camera; Fixed, Wide Dynamic Range, Vandal Proof:
 - 1) The camera shall meet or exceed the following specifications:
 - a) Vandal proof housing
 - b) 1280 x 720 Resolution
 - c) Varifocal lens
 - d) Motorized autofocus
 - e) H.264 Video Encoding
 - f) Wide Dynamic Range
 - g) 16:9 Aspect Ratio
 - h) PoE Powered (IEEE 802.3af)
 - i) ONVIF profile S conformant
- b. Approved Equipment:
 - 1) Pelco IME119-1V or approved equivalent.

2. Dome IP Camera; Fixed, High Definition, Vandal Proof:

- a. The camera shall meet or exceed the following specifications:
 - 1) Vandal proof housing
 - 2) 1280 x 720 Resolution
 - 3) Varifocal lens
 - 4) Motorized autofocus
 - 5) H.264 Video Encoding
 - 6) 16:9 Aspect Ratio
 - 7) PoE Powered (IEEE 802.3af)
 - 8) ONVIF profile S conformant
- b. Approved Equipment:
 - 1) Pelco IMPS110-1ERS or approved equivalent.

3. Exterior and Weather Protected Area Cameras:

- a. Dome IP Camera; Fixed, Wide Dynamic Range, Weather Proof

- b. The camera shall meet or exceed the following specifications:
 - 1) Weather protected housing
 - 2) Operating Temperature: -40° to 122°F
 - 3) Operating Humidity: 10 to 95%, RH condensing
 - 4) 1280 x 720 Resolution
 - 5) Varifocal lens
 - 6) Motorized autofocus
 - 7) H.264 Video Encoding
 - 8) Wide Dynamic Range
 - 9) 16:9 Aspect Ratio
 - 10) PoE Powered (IEEE 802.3af)
 - 11) ONVIF profile S conformant
 - c. Approved Equipment:
 - 1) Pelco IME119-1E or approved equivalent.
2. Dome IP Camera; PTZ, High Definition, Weather Proof:
- a. The camera shall meet or exceed the following specifications:
 - 1) Weather protected housing
 - 2) PTZ drive
 - 3) Operating Temperature: -50° to 122°F
 - 4) Operating Humidity: 10 to 100%, RH condensing
 - 5) 1280 x 720 Resolution
 - 6) Varifocal lens
 - 7) Motorized autofocus
 - 8) H.264 Video Encoding
 - 9) Wide Dynamic Range
 - 10) 16:9 Aspect Ratio
 - 11) ONVIF profile S conformant
 - 12) RJ-45 connector for IP connectivity
 - 13) 24VAC input power
 - b. Approved Equipment
 - 1) Pelco S5118-EGO or approved equivalent.
3. Camera Power Supply:
- a. 24VAC Camera Power Supply:
 - 1) The power supply shall meet or exceed the following specifications:
 - a) 24/28VAC Output voltage selectable based on wiring distance
 - b) 120VAC Input voltage
 - c) Self-resetting circuit breaker protection (one per output)
 - b. Approved Equipment:
 - 1) Pelco MCS16-10B or approved equivalent.
- C. VSS - Camera Mount:
- 1. All camera mounts shall be of the type specified in the drawings, and provided by the manufacturer of the camera.

- D. VSS - Network Video Recorder (NVR): <Consult with UMB Project Manager and Edit as directed by UMB>
1. The NVR shall be compatible with the existing university VSS system and shall meet the following requirements:
 - a. Storage capacity for thirty (30) days of backup on all cameras.
 - b. RAID 6 Storage configuration.
 - c. Pelco Endura compatible.
 - d. Rack mount configuration.
 - e. 120VAC Input.
 2. Approved equipment:
 - a. Pelco NSM5200 or approved equivalent.
- E. Network Switches: <Consult with UMB Project Manager and Edit as directed by UMB>
1. PoE Network Switch:
 - a. PoE Network Switches shall meet the following requirements:
 - b. One (1) U Rack Mountable
 - c. Twelve (12) CAT5e Ports IEEE 802.3at PoE+
 - d. Twenty four (24) total CAT5e PoE IEEE 802.3at PoE Ports
 - e. Dual redundant power supplies
 - f. Two (2) SFP Uplink ports with LC Multimode Transceivers
 2. Approved Equipment:
 - a. Cisco 2960XR-24PD-I or approved equivalent.
- F. Network Aggregation Switch: <Consult with UMB and Edit as directed by UMB>
1. Network Aggregation Switches shall meet the following requirements:
 - a. One (1) U Rack Mountable
 - b. Twelve (12) GE SFP Ports with LC Multimode Transceivers
 - c. Dual redundant power supplies
 - d. Two (2) SFP Uplink ports with LC Multimode Transceivers
 2. Approved Equipment:
 - a. Cisco WS-3750X-12S-S or approved equivalent.
- G. Equipment Racks:
1. Wall Mounted Tilt Out Rack:
 - a. Wall mounted tilt out racks shall be located in all Security closets requiring security networking equipment per floor plans. Wall mounted tilt out racks shall be installed on a three quarter (3/4) inch fire rated plywood backboard and shall meet the following requirements:
 - 1) Surface mounted enclosure
 - 2) Three (3) rack units of space
 - 3) Include electrical box and 20A receptacle for UPS
 - 4) Conduit knock outs
 - 5) Vented design
 - b. Approved Equipment:
 - 1) Middle Atlantic Products TOR-3-20SP, or approved equivalent.

H. Vertical Equipment Rack:

1. The vertical equipment rack shall be located in the basement security room and shall meet the following requirements:
 - a. Free standing cabinet
 - b. Lockable doors and side panels (if removable)
 - c. Forty two (42) Rack Units of usable space
2. Approved Equipment:
 - a. Belden XUS Series or approved equivalent

I. Uninterruptible Power Supply: <Consult with UMB Project Manager and Edit as directed by UMB>

1. The UPS shall be used in the vertical equipment rack located in the basement and the tilt out racks in all security closets and shall meet the following requirements:
2. 2150VA minimum base capacity.
3. Additional battery backup or UPS units to be provided to the unit in the security room as necessary to match the minimum run time of all security closets.
4. Eight (8) NEMA 5-20R Receptacles.
5. Rack mountable unit.
6. Input plug shall be NEMA 5-20P.
7. Approved Equipment:
 - a. Middle Atlantic Products UPS-2200R or approved equivalent.

J. Workstation With Keyboard and Mouse:

1. The workstation and peripherals shall be located at the security desk and shall meet the following requirements:
 - a. Intel Core 2 Quad Processor
 - b. Four (4) GB RAM
 - c. DVD / CD RW Drive
 - d. Graphics card with 512MB dedicated memory
 - e. Two (2) DVI outputs
 - f. Meet all system requirements and recommendations for Pelco Endura
2. Approved Equipment:
 - a. Pelco WS5070 or approved equivalent.

K. LCD Monitor:

1. There shall be two LCD monitors located at the security desk connected to the workstation and they shall meet the following requirements:

- a. Twenty two (22) inch Diagonal Size
- b. DVI Input
- c. 1920X1080 Resolution
- d. Desktop stand
2. Approved Equipment:
 - a. HP E2T08A6#ABA or approved equivalent.

L. Patch Panel:

1. The patch panel shall meet the following requirements:
 - a. Twenty four (24) Port, CAT6 rated, one (1) Rack Unit
2. Approved Equipment:
 - a. Ortronics OR-PHD66U24 or approved equivalent.

M. Power Surges And Grounding:

1. Transient Voltage Surge Suppression:
 - a. All cables and conductors extending beyond building perimeter, except fiber optic cables, shall be protected against Transient Voltage surges and have Transient Voltage surge suppression protection (TVSS) UL listed in accordance with Standard 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 915 mm (36 in) of the building cable entrance. Fuses shall not be used for surge protection.
2. Intercom Systems:
 - a. Suppressors shall be installed on the AC power at the point of service and shall meet the following criteria:
 - 1) UL 1449 Listed
 - 2) UL 1449 S.V.R. of 400 Volts or lower
 - 3) Diagnostic Indicator Light(s)
 - 4) Integrated ground terminating post (where case/chassis ground exists)
 - 5) Minimum Surge Current Capacity of 13,000 Amps (8 x 20 μ Sec)
 - 6) Ten (10) Year Limited Warranty
 - 7) Approved Equipment:
 - a) DITEK CORP. DTK 3GTP, DTK-3GTPX, or approved equivalent.
 - b. Suppressors shall be installed on incoming central office lines and shall meet the following criteria:
 - 1) UL 497A Listed
 - 2) Multi Stage protection design
 - 3) Auto-reset current protection not to exceed 2 Amps per pair

- 4) Minimum Surge Current of 500 Amps per pair (8 x 20 μ Sec)
 - 5) Ten (10) Year Limited Warranty
 - 6) Acceptable Manufacturer:
 - a) DITEK CORP. DTK-SL Series or DTK- MT_SCP Series, or approved equivalent.
- c. Suppressors shall be installed on all telephone/intercom circuits that enter or leave separate buildings and shall meet the following criteria:
- 1) UL 497A Listed (where applicable)
 - 2) UL 497B Listed (horns, strobes, speakers or communication circuits over 300 feet)
 - 3) Multi Stage protection design
 - 4) Auto-reset over-current protection not to exceed 5 Amps per pair
 - 5) Minimum Surge Current of 1000 Amps per pair (8 x 20 μ Sec)
 - 6) Ten (10) Year Limited Warranty
 - 7) Acceptable Manufacturer:
 - a) DITEK CORP., or approved equivalent
 - b) DTK-SL Series
 - c) DTK-MT_SCP Series
 - d) DTK-2MHLP/2MHTP Series
 - e) DTK-LVLP Series
- N. Video Surveillance Systems:
1. Protectors shall be installed on all camera cabling which exits the building perimeter. Suppressors shall be installed at each exterior camera location and include protection for 12 and/or 24 volt power, data signal and motor controls (for Pan, Tilt and Zoom systems). Protection for all systems mentioned above shall be incorporated at the head end equipment. Protectors shall meet the following criteria:
 - a. Camera Power and Data:
 - 1) Peak Surge Current: 2,000 Amp/Pair (Power), 30A/Pair (Data)
 - 2) Clamp Voltage: 47V (Power), 72V (Data)
 - 3) Screw Terminal Connection for 24VAC Power
 - 4) RJ45 Connection for Data
 - 5) Acceptable Equipment:
 - a) Ditek Corp. DTK-PVPIP or approved equivalent.
 - b. Grounding and Surge Suppression
 - 1) The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. This is to ensure the operation of over current devices, such as fuses, circuit breakers, and relays, underground-fault conditions.
 - 2) The Contractor shall engineer, provide, and install proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards, referenced in this document.

- 3) Principal grounding components and features shall include: main grounding buses, grounding, and bonding connections to service equipment.
- 4) The Contractor shall provide detail drawings of interconnection with other grounding systems including lightning protection systems.
- 5) The Contractor shall provide details of locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
- 6) AC power receptacles are not to be used as a ground reference point.
- 7) Any cable that is shielded shall require a ground in accordance with applicable codes, the best practices of the trade, and all manufacturers' installation instructions.

2.8 RACEWAY <Delete if Section 260000 is used for the Project>

- A. For indoors above floor slab, use EMT conduit with compression fittings with a minimum size of three quarter (3/4) inch (regardless of function/purpose) and maximum size of two (2) inches. Above two (2) inches, conduit shall be rigid steel conduit, zinc coated with threaded type fittings.
 1. For low-voltage, special systems provide the following color-coated EMT raceway:
 - a. Security - White.
 - b. Fire Alarm System – Red.
- B. Non-Metallic Raceway: Provide expansion joints in every twenty (20) foot of run and at least once in every run in all outdoor, rooftop, and garage locations. Provide PVC 40 pipe, non-metallic NEMA 4X boxes and non-metallic NEMA 4X enclosures supported via non-metallic fiberglass strut and/or pipe clamps at the following locations:
 1. All outdoor locations including, but not limited to, inside garages and on rooftops.
 2. Embedded in concrete, brick, CMU or other structural material.
 3. Below-slab and –grade.
 4. All unconditioned-air spaces/rooms in Parking Garages.
- C. Utilize PVC-Coated Rigid Galvanized Steel in exterior locations above grade where there is a potential for damage or below 8 feet in vehicle/cart traffic areas and where otherwise required by the NEC.
- D. Supports: For all indoor, conditioned-space locations utilize conduit clamps, conduit straps, bean clamps, etc. and/or channel strut supports. For all outdoor applications (as specified above for PVC 40) and where non-metallic raceway is provided, provide only non-metallic fiberglass (or other non-metallic material) or PVC-Coated Galvanized Steel conduit supports and/or channel strut. Support conduits at a minimum of two (2) times per ten (10) ft. length and at a frequency rate as directed by the NEC.

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- E. Bushings: Provide only threaded type for IMC, RGS and PVC-RGS raceway. Provide only steel compression type for all EMT raceway systems. Provide insulated-throat, threaded type bushings for all tel/data raceway systems.
- F. Surface metal raceways shall be used only in finished areas and only where specifically noted on the drawings. Surface mounted raceways shall be Wiremold 500, 700, 1000, or 4000 series or pre-approved equivalent with buff finish used as follows:
1. # 500: 2-#10 or 3-#12 wires maximum.
 2. # 700: 3-#10 or 4-#12 wires maximum.
 3. #1000: 9-#10 or 12-#12 wires maximum.
 4. Other combinations of conductors shall be in accordance with the manufacturer's published data and the National Electrical Code.
 5. All elbows, boxes fittings supports, etc., shall be by the raceways manufacturer. Finish shall match that of the raceway.
 6. Wire trough shall be steel enclosed wireway meeting all UL requirements.
- G. All new raceways in finished areas shall be concealed unless specifically noted otherwise.
- H. Grout around all conduits at ceiling, floor, and wall penetrations to provide airtight seal. All floor slab and fire-rated wall penetrations shall be sealed with a rated system/installation that is pre-approved by the UMB Fire Marshal. Submit manufacturer's engineering drawing of the proposed fire-proofing system to the UMB Project Manager for approval.
- I. Group together exposed conduit insofar as possible. Install all conduits parallel or perpendicular to the building surfaces. Maintain minimum six (6) inch spacing from parallel flues, steam pipes, or hot water pipes and two (2) inches from perpendicular flues, steam or hot water pipes.
- J. All conduits shall be rigidly supported to building structure. Conduits shall not be supported from suspended ceiling support wires.
- K. All conduit bends shall be made with an approved conduit bender and no bend shall have a centerline radius less than six times the diameter of the conduit.
- L. Core Drilling/Floor Penetrations: Coordinate with the UMB Project Manager prior to making any core drills for floor penetrations. Prior to core drilling/floor penetrations provide X-ray examination/GPD of the floor structure to locate structural steel for avoidance. The contractor is responsible for maintaining structural integrity of all floors and walls after core drills for conduits are made.
- 2.9 BOXES AND ENCLOSURES <Delete if Section 260000 is used for the Project>
- A. Indoor Applications: Provide NEMA 250 interior galvanized steel, minimum 14 gauge, outlet boxes, no less than four (4) inches square with extension rings and mounting brackets at the following locations:

1. Dry and Clean Locations: NEMA Type 1.
 2. Locations with Dust, Falling Dirt and Dripping Noncorrosive Liquids: NEMA Type 12.
 3. Mechanical and Electrical Rooms: NEMA Type 12.
- B. Outdoor Applications: Provide NEMA 4X non-metallic weatherproof boxes and enclosures supported via non-metallic fiberglass strut at the following locations:
1. All outdoor locations including, but not limited to, inside garages and on rooftops
 2. Where raceway is embedded in concrete, brick, CMU or other structural material
 3. Below slab and grade.
 4. All unconditioned air spaces/rooms in Parking Garages.
- C. Outlet boxes shall be rigidly and securely fastened in place. Outlet boxes in finished areas shall be flush mounted unless otherwise noted.
- D. Boxes shall be sized in accordance with NEC Article 370.
- E. All conduit connectors and entry hubs shall be insulated or have insulated bushings.
- F. Outlets shown adjacent to one another on the plans at the same mounting height shall be ganged except where noted.
- G. Outlets shown adjacent to one another on the plans at different mounting heights shall be located with the upper outlet centered directly over the lower outlet.
- H. GEM Boxes – Recessed GEM Boxes are prohibited.
- 2.10 WIRE AND CABLE
- A. All wire shall be copper with insulation rated at 600 volts, 75°C minimum. Aluminum wire is strictly prohibited.
 - B. Minimum wire sizes shall be #12 for power wiring, #14 for control wiring and as specially noted for systems wiring.
 - C. Molded connectors (wire nuts) may be used for splicing size 10 AWG or smaller wires on lighting and receptacle circuits only. “Scotch Blocks” must be submitted for prior approval. All other wiring shall be spliced only with lugs and/or terminal blocks.
 - D. Terminal lugs shall be mechanical clamp or compression type.
 - E. Pre-insulated crimp connectors and terminals shall be used on low voltage wiring.
 - F. UTP Cable:

1. Four (4) pair unshielded twisted pair (22-24AWG), solid copper conductors, 100 ohms nominal impedance +/- 15%, minimum bandwidth 500 MHz, green CMP Plenum jacket. Complies with EIA/TIA 568 Category 6 performance specifications.
2. Manufacturer: CommScope, BerkTek (LAN Mark-1000), General Cable, Superior Essex

G. UTP Cable Hardware:

1. Eight (8) pin modular outlet, non-keyed, flat front. Complies with EIA/TIA 568-B.2 Category 6 performance. Outlet wired standards compliant 568B pinning. Outlets must be white.
2. Manufacturer: The Siemon Company, Ortronics

H. Fiber Optic Cable:

1. Shall be a hybrid cable containing multimode under a single plenum jacket, orange color unless otherwise noted.
Multimode - 62.5/125 μm tight buffer construction with aramid yarn strength member (ie Kevlar™), plenum jacket, indoor/outdoor rated (-20°C to +85°C). 900 μm buffer diameter, numerical aperture .29 +/- .02, minimum bandwidth of 200 MHz at 850 nm, 500 MHz at 1300 nm, maximum attenuation 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm
2. Manufacturer: OCC or approved equivalent, Part # DX012KSLX9RP16. <Consult with UMB Project Manager and Edit as directed by UMB>

I. Fiber Optic Termination Hardware:

1. Wall mounted optical fiber patch panel with hinged front door, mounting guides, and designation panels. Populate panels complete with coupler panels and LC couplers.
2. Manufacturer: Siecor/Corning or approved equivalent
Part Number: Wall mounted Panel Housing # WCH-049
Connector Panels # (2) – CCH-CP12-A9

2.11 GENERAL WIRE AND CABLE REQUIREMENTS

- A. Fire Alarm System:
- B. Fire Alarm Control Cable Type MC

1. For use on fire alarm circuits as required and as recommended by the manufacturer.
 2. Interlocking galvanized steel armor, steel strip (painted red).
 3. Conductor insulation – TFN/THHN solid copper.
 4. Copper grounding conductor.
 5. Polyester assembly tape.
 6. Neutral conductor.
 7. UL Listed Fire Alarm Cable.
 8. Rated for use in plenums.
 9. Rated for through penetration of 1, 2, and 3-hour fire walls.
 10. Individual twisted pairs and shielding, as required per fire alarm system manufacturer.
 11. UL 66, 83, 1424, 1569, 1581, and 2556 listed.
 12. NEC 300.22, 362, 330, 430.2, 501, 502, 503, 530, 504, 505, 518, 530, 645, 725, 760, 760.154(A) compliant
 13. AFC Type MC Fire Alarm/Control Cable.
- C. Non-Power –Limited Circuits: Solid copper conductors with 600v rated, 75°C, color coded insulation.
1. Low-Voltage Circuits: No. 16 AWG, minimum.
 2. Line-Voltage Circuits: No. 12 AWG, minimum.
- D. Security and Access Control Systems:
1. General: All wire and cable components shall be able to withstand the conditions under which the wire or cable is installed in for a minimum of twenty (20) years without degradation. All wiring shall meet or exceed manufacturers recommended wire specifications and be listed for intended operation. Provide distinct color coding system for all wiring. Each cable shall be numbered at each end with permanent labels.
 - a. Primary transmission media used for the CCTV System shall be coaxial cable.
 - b. The use of coaxial cable is for switcher interconnection, monitor and interface at cameras.
 - c. The Contractor shall furnish all wire conductors, cables, interfaces, and connectors as required by the system.
 - d. Any sensor wire run in wire ducts or troughs where other wiring is present shall be shielded with the shield grounded only at the panel end.
 - e. 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 current NFPA 70.
 - f. In all cases, wire conductors and all cables utilized for the connection of the various components as specified herein, including those components provided by others, shall comply with or exceed the recommendations of the component manufacturers.
 - g. All wire and cable provided by the Security Contractor shall comply with all

- h. applicable codes and ordinances.
 - h. It shall be the Security Contractor's responsibility to perform all engineering calculations required to ensure the proper cable sizes are provided, so the specified equipment will perform as shown in the manufacturer's specifications. All engineering calculations shall be provided with the prefabrication submittals. It shall be the Security Contractor's responsibility to obtain and verify the power requirement of NIC electrified locksets, electrified panic device, egress magnet locks before carrying out any engineering calculations.
 - i. Independent of manufacturer's recommendations, cables utilized for signal circuits shall incorporate stranded conductors of not less than 22 AWG. Conductor sizes shall be increased as required to accommodate specific applications and unusual distances.
 - j. Independent of manufacturer's recommendations, cables utilized for low voltage power circuits shall incorporate stranded conductors of not less than 18 AWG with red and black colored insulation. The red conductor shall be connected as the positive (+) polarity and the black conductor shall be connected as the negative (-) polarity. Conductor sizes shall be increased as required to accommodate specific applications.
2. Specific Requirements:
- a. Wire and cable shall be Belden Corporation, Alpha Wire Company, West Penn Wire or equivalent
 - b. Wire and cable jacket color shall comply with the facility standard.
 - c. Minimum wire and cable requirements for selected equipment and devices are per manufacture recommendation.
- E. VSS and Access Control Systems:
1. Digital Data Wiring:
- a. Cables serving interconnects of digital data between components at the security center or at remote control/monitoring station shall comply with manufacturers requirements and be standard copper wire for each conductor. The hardwire cable shall contain a 100 percent shielding when shielding is specified. Wires with a single overall shield shall have a tinned copper shield drain wire. Shields shall be grounded at the connecting panel end only and in accordance with manufacturer's recommendations.
 - 1) Twist-on connectors are prohibited.
 - 2) The BNC Connectors shall be appropriately sized to fit the cable.
 - 3) The Contractor is to use the proper crimping tool that fits the wire and connector and recommended by the wire and connector manufacturer.
2. RS-232 Cable:
- a. Standard Cable: NFPA 70, Type CM.

- 1) Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Polypropylene insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. PVC jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - f. Flame Resistance: Comply with UL 1581.
3. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Plastic insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100% shield coverage.
 - d. Plastic jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - f. Flame Resistance: Comply with NFPA 262.
4. RS-485 Cable:
 - a. Standard Cable: NFPA 70, Type CM or CMG.
 - 1) Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - 2) PVC insulation.
 - 3) Unshielded.
 - 4) PVC jacket.
 - 5) Flame Resistance: Comply with UL 1581.
 - b. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1) Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - 2) Fluorinated ethylene propylene insulation.
 - 3) Unshielded.
 - 4) Fluorinated ethylene propylene jacket.
 - 5) Flame Resistance: NFPA 262, Flame Test.
5. Low-Voltage Control Cable:
 - a. Card Reader Cable: NFPA 70, CM (2 Cables).
 - 1) RS485: one (1) pair, twisted shielded, No. 22 AWG, Stranded tinned copper conductors.
 - 2) 12VDC Power: one (1) pair, twisted, No 18 AWG, Stranded tinned copper conductors,
 - 3) PVC Insulation.
 - 4) Flame Resistance: Comply with UL 1581.
 - b. Paired Lock Power Cable: NFPA 70, Type CMG.

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- 1) One (1) pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
 - 2) PVC insulation.
 - 3) Unshielded.
 - 4) PVC jacket.
 - 5) Flame Resistance: Comply with UL 1581.
- c. Plenum-Rated, Paired Lock Power Cable: NFPA 70, Type CMP.
- 1) One (1) pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
 - 2) PVC insulation.
 - 3) Unshielded.
 - 4) PVC jacket.
 - 5) Flame Resistance: Comply with NFPA 262.
- d. Paired Lock Power Cable: NFPA 70, Type CMG.
- 1) One (1) pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
 - 2) PVC insulation.
 - 3) Unshielded.
 - 4) PVC jacket.
 - 5) Flame Resistance: Comply with UL 1581.
- e. Plenum-Rated, Paired Lock Power Cable: NFPA 70, Type CMP.
- 1) One (1) pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
 - 2) Fluorinated ethylene propylene insulation.
 - 3) Unshielded.
 - 4) Plastic jacket.
 - 5) Flame Resistance: NFPA 262, Flame Test.
6. Control-Circuit Conductors:
- a. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.
 - b. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway or conduit complying with UL 83.
 - c. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.
7. Cable Identification Products:
- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Brady Corporation
 - 2) HellermannTyton.

- 3) Kroy LLC.
 - 4) Panduit Corp.
 - 5) EZ Label.
 - 6) Or equivalent.
- b. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
 - c. Comply with requirements in Division 26.
8. Source Quality Control:
- a. Testing Agency: Engage a qualified testing agency to evaluate cables.
 - b. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
 - c. Factory test UTP cables according to TIA/EIA-568-B.2.
 - d. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
 - e. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
 - f. Cable will be considered defective if it does not pass tests and inspections.
 - g. Prepare test and inspection reports.

2.12 IDENTIFICATION

- A. Coordinate names, abbreviations and other designations used with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment.
- B. Delay installation of identification until painting is complete.
- C. Comply with governing regulations and requests of governing authorities for identification of work.
- D. Install engraved plastic-laminate nameplates on all electrical boxes and cabinets installed under this contract (black letters on white background).
- E. Where conduit is exposed, apply identification on conduit. Except as otherwise indicated, use permanent vinyl, self-adhering markers with black letters on orange background.
- F. Apply self-adhering vinyl or heat-shrink plastic cable/conductor identification markers on each cable and conductor in each box, enclosure or cabinet where wires of more than one circuit are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings and contract documents.

- G. All field installed control circuits shall have tubular sleeve-type wire markers at each end of the circuit and at all splice points. Wire markers shall be permanently stamped with a numbering system selected by the Contractor. The numbering system shall be thoroughly documented and provided to the Engineer.
- H. Dymo (or equivalent) labels shall not be used.
- I. Ceiling Markers: Provide labels on ceiling grid for accessible electrical equipment that is installed above the ceiling.

2.13 PROJECT OPERATION AND MAINTENANCE MANUAL – ELECTRONIC FILES

- A. Project O & M Manual File: The project OM Manual shall include one (1) electronic copy of each approved submittal and any manufacturer’s maintenance manuals, and all warranty certificates included in Division 28. Also include the address, phone number and contact person for each supplier. Using the current UMB Standard O&M Manual Template referenced in Division 01 Closeout Procedures insert the submittal files include bookmark and tree structure for accessing each submittal file in the manual.

2.14 COMMISSIONING NEW FIRE ALARM, SAFETY AND SECURITY SYSTEMS

- A. Test Equipment: Refer to Division 01 Section 019113 “General Commissioning Requirements” for requirements pertaining to testing equipment.

PART 3 – EXECUTION:

3.1 GENERAL REQUIREMENTS – EXECUTION

- A. All construction work that creates excessive noise will not be permitted during normal business hours. See Division 01 Specification Section “Cutting and Patching” for requirements.
- B. General provisions of the contract apply. All work performed and materials provided shall conform to all applicable codes and standards and the National Electrical Code (NEC).
- C. Prior to starting work, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- D. Avoid interference with structure and with work of other trades, preserving adequate headroom and clearing all doors and passageways.
- E. Confirm the locations of all existing utilities. Repair any damage to existing utilities caused by construction forces.

- F. Leave all areas broom clean daily. Remove all construction debris and trash from the site daily.
- G. Before ordering any materials or equipment, submit to the engineer data for all materials and equipment. Check equipment dimensions of proposed substitute equipment. The cost of any redesigning caused by a substitution shall be borne by the Contractor.
- H. Contractor shall do all cutting, drilling and patching required by his work. All repairs to finish shall be of like kind, color and quality as existing. Structural members shall not be cut without approval from the architect.
- I. Take necessary precautions to protect building's occupants and contents, and prevent the spread of dust and dirt into occupied areas.

3.2 SLEEVES

- A. Non-Fire-Rated Sound Proof Partition Penetrations: Where new and existing conduits pass through interior partitions with sound proofing provide a pipe sleeves. Seal the annular spaces between construction openings, the sleeves, and conduits with sound proof insulation material equal to the width of the opening. The sound proof insulation shall match the insulation in the partition.

3.3 CONTRACT DOCUMENTS:

- A. Contract drawings for the work are diagrammatic, intended to convey scope and general arrangement.
- B. Correction of faulty work due to resolving discrepancies without authorization shall be the responsibility of the Contractor.
- C. Should the Contractor discover any discrepancies or omissions on the drawings or in the specifications, he shall notify the Engineer of such conditions prior to the bid date. Otherwise, it will be understood that the drawings and specifications are clear as to what is intended and shall be as interpreted by the Engineer.

3.4 COORDINATION:

- A. Coordinate all work and cooperate with all other trades to facilitate execution of work.

3.5 GENERAL WIRING REQUIREMENTS

- A. Door Hardware: Door hardware is provided and installed under Division 8 of these documents. The security contractor shall coordinate with the Division 8 contractor for the locations of all door hardware requiring connections to the security system and shall provide all connections between power supplies and the locking equipment.

B. Wire: The following security provisions apply to systemizing requirements:

1. All security system wiring must be new. All existing wiring not noted for reused and replaced shall be removed.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer and compatible with the security system. Number and size and type of conductors shall be as recommended by the security system manufacturer, but not less than 22 AWG twisted shield pair. Network and computer devices may require 24 AWG solid copper conductors for video/data transmission (e.g., TCP/IP, VGA Video) as recommended by the equipment manufacturer.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for intended application and use with a protective signaling system. Provide 300 VAC/60° C rated insulated conductors unless noted otherwise.
4. Wire and cable in air circulation areas which is not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. Wiring used for the multiplex communication loop shall be twisted and shielded and installed in conduit unless specifically accepted by the security equipment manufacturer.
6. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring, a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.
7. Wiring conductors provided in elevator hoist ways and traveling cables shall be listed and approved for elevator use. Conductor insulation shall be TFN, TFFN, THWN, THHN or other insulation designated as Flame Retardant. Insulation rating shall equal or exceed the maximum normal circuit voltage applied to any conductor within the cable or raceway.

C. Fiber Optic Cable

1. The Contractor shall utilize BICSI certified personnel for fiber optic installation and terminations. The OWNER shall be provided with evidence of certification. The Fiber Optic installation shall meet or exceed all minimal requirements of State, National, and manufacturer codes as applicable. The Contractor shall furnish and install all necessary appurtenances to make a complete and operating installation in accordance with the plans, standard sheets, standard specifications, special provisions, and accepted good practice of the industry.
 - a. For Cable Installed in Ducts and Conduits: A suitable cable feeder guide shall be used between the cable reel and the face of the duct and conduit to protect the cable and guide it into the duct from the reel. It shall be carefully inspected for jacket defects. If defects are noticed, the pulling operation shall be stopped immediately and the OWNER notified. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. A pulling swivel shall be used to

eliminate twisting of the cable. As the cable is played off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. A dynamometer or break away pulling swing shall be used to ensure the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed on a cable during installation shall not be such that the cable is twisted or stretched. The pulling of cable shall be hand assisted at each controller cabinet. The cable shall not be crushed, kinked or forced around a sharp corner. If a lubricant is used it shall be of water based type and approved by the cable manufacturer. Sufficient slack shall be left at each end of the cable to allow proper cable termination.

- b. Placement of Cable into Conduit Risers: The Contractor shall provide conduit risers as indicated on the plans. Kellum grips and/or other hanger devices shall be used to support the vertical drop of cable and prevent any possible kinking of the cable after installation.
- c. Minimum Bend Radius: For static storage, the cable shall not be bent at any location to less than ten times the outside diameter of the cable or as recommended by the manufacturer. During installation, the cable shall not be bent at any location to less than twenty times the outside diameter of the cable or as recommended by the manufacturer.
- d. Prior to the Fiber Optic Cable Installation: Prior to the installation of the cable, the manufacturer shall submit to the Contractor a factory-performed Optical Time Domain Reflectometer (OTDR) trace result for each reel of cable. The Contractor shall in turn submit the trace results to the OWNER for approval.

D. Method of Wiring

1. General: Wire each alarm, trouble, and supervisory signal, initiating circuit, communication circuit, and each security notifying appliance circuit for supervised operation.
2. Wiring within Cabinets: Provide wiring within cabinets installed parallel with or at right angles to the sides and back of the enclosure. All conductors which are terminated, spliced, or otherwise interrupted in any enclosure associated with the security system shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make all connections with either crimp-on terminal spade lugs or approved pressure type terminal blocks. Terminal blocks shall be secured in each junction box to the junction box cover plate.
3. Interior Work: Cables installed in plenums shall meet UL 910, and cables to be installed in risers shall meet UL 1666.
4. Installation in Ducts or Conduits: A cable lubricant compatible with the cable sheathing material shall be used on all cables pulled. Pulling fixtures shall be attached to the cable strength members. If indirect attachments are used, the grip diameter and length shall be matched to the cable diameter and characteristics. If indirect attachment is used on cables having only central strength members, the pulling forces shall be reduced to ensure the fibers are not damaged from forces

being transmitted to the strength member. During pulling the cable pull line tension shall be continuously monitored and not exceed the maximum tension as given by the cable manufacturer. The mechanical stress placed upon a cable during installation shall not twist or stretch the cable.

- a. A cable feeder guide shall be used between the cable reel and the face of the duct or conduit to protect the cable and guide it into the duct or conduit as it is played off the reel. As the cable is played off the reel, it shall be carefully inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being kinked or crushed and the minimum bend radius of the cable is not exceeded at any time. Cable shall be hand fed and guided through each manhole and additional lubricant shall be applied at all intermediate manholes.
 - b. When practicable, the center pulling techniques shall be used to lower pulling tension. That is, the cable shall be pulled from the center point of the cable run towards the end termination points. The method may require the cable to be pulled in successive pulls. If the cable is pulled out of a junction box or manhole the cable shall be protected from dirt and moisture by laying the cable on a ground covering.
5. Vertically Run Cable: When possible, use gravity to assist in cable pulling; pull cable from top of run to bottom of run. Hand-pull cables if possible; if machine assistance is required, monitor tension and do not exceed the specific cable tension limits. After installation, the vertical tension on the cable shall be relieved at maximum intervals of 30.48 m (100 ft) using a split support grip.
 6. Cable Taps: The Contractor shall provide a terminal cabinet where any circuit tap is made.
 7. Color Coding: The Contractor shall distinctively color code all wiring differently from the normal building wiring. Identify conductors by plastic-coated, self-sticking, printed markers or by heat-shrink type sleeves. Wire the alarm initiating and notification signal devices so removal will cause the system trouble device to sound. Each conductor used for the same specific function shall be distinctively color coded. Use two (2) different color codes for each interior alarm circuit; one (1) for each loop. Each circuit color code wire shall remain uniform throughout the circuit.
 8. Termination: End-of-line supervisory resistors or devices are to be provided at the sensor device location. The end of line resistor network shall be per manufacturer's recommendations; in the absence of such, it shall consist of two (2) 1k resistors, one (1) across the normally closed contact of the device and the other in series with the normally closed circuit. See drawing details for further information. Use of GRI Resistor Packs is preferred.
 9. No "stick-on" cable ties shall be used within the enclosure.

E. Cable Installation

1. All field wiring required for interconnection of the various security system components shall be installed within conduit.
2. All circuits shall be protected to avoid interruption of service due to short-circuiting or other conditions which may adversely affect the connecting devices.

- Each individual signaling circuit shall be classified as a circuit pair.
3. Screw terminal blocks or connectors shall be furnished for all cables which interface with racks, cabinets, consoles or equipment modules. No more than 2 mm of exposed bare wire may show when either crimped or fastened to a connector block or terminal strip.
 4. Care shall be exercised in wiring to avoid damage to the cables or the equipment. All joints and connections shall be made with mechanical butt splice connectors. The crimping tool used shall be recommended by the manufacturer. Wire nuts shall not be an acceptable splice method.
 5. To reduce the possibility of signal contamination, all cables shall be grouped according to the signals being carried. The horizontal and vertical cable runs should be bundled or grouped as follows:
 - a. Low Voltage Power
 - b. Signal, Control Cables, and Video Cables
 6. All cabling shall be U.L. listed for its intended application and meet or exceed the standards as recommended by the manufacturers of the components being interconnected. All shielded cabling used shall be 100 percent shielded.
 7. All system wiring shall be installed in accordance with the instructions provided by the manufacturers of the components being used in the system and in accordance with codes, specifications, and standards as referenced herein.
 8. Splices shall not be permitted in system wiring between components which are incorporated in the system. Wiring runs must terminate at either a system component or a junction box where wiring is interconnected using terminal strips or connectors. Wire ends shall be prepared for attachment to component terminals in accordance with the recommendations of the equipment manufacturers. If there is no alternative and a wire/cable splice must be made, the Contractor shall notify the OWNER and request approval through a formal RFI process prior to making the wire splice.
 - a. The RFI shall include the following:
 - 1) The Contractor shall identify the device and/or system affected by the proposed splice and why the splice is required.
 - 2) Provide in detail the methodology which shall be utilized for the wire/cable splice. A diagram may be used to demonstrate methodology but shall not replace the written methodology requirement.
 - 3) If splicing is required for more than five (5) wires/cables, a formal wire management plan shall be developed to provide methodology for maintaining wire/cable consistency and performance.
 - 4) In all instances the Contractor shall provide the OWNER with a mock-up of the proposed splice and samples of the materials to be used.
 - 5) The Contractor shall not proceed until written approval has been received from the OWNER for the splice and the splice materials.
 - b. The following criteria shall be utilized for installing wire/ cable splices.
 - 1) Twist type connectors shall not be used for wire splicing.

- 2) Wire splices shall be made on binding screw captive mechanical compression terminal strips.
- 3) Soldered and crimped connections are allowed and shall be accomplished with crimping Lug Manufacturers Calibrated Tool.
- 4) Solder connections shall be applied in accordance with BICSI standards.
- 5) Mechanical splices shall utilize a UL listed ratchet type connector. The Contractor shall select the appropriate connector size based on gauge of the wire/cable being spliced. The Contractor shall only use manufacture approved full cycle ratchet crimping devices.
- 6) The Contractor shall utilize appropriately sized UL listed heat shrink tubing. Splices shall be encapsulated with an epoxy or ultraviolet light cured splice encapsulator, particularly if the spliced wire/cable is direct-buried, environmentally exposed, or located in an exterior hand hold.
- 7) The Contractor shall ensure all completed splices are accessible. Splices shall be made in lockable/tampered security enclosures or in security junction/pull boxes. At no time shall spliced wires/cables be permitted to be pulled into the conduit system.
- 8) All spliced wires/cables shall be tested in witness of the OWNER to ensure system performance is not adversely affected by the splices' presence.
- c. All copper conductor splices shall be accomplished in the following method:
 - 1) Strip insulation from wires to be spliced using caution not to score or strip away the actual conductor.
 - 2) Twist together the stripped conductors for a minimum of four rotations.
 - 3) Solder the twisted conductors using rosin core solder.
 - 4) Trim the twisted and soldered conductors to a length accommodated by the vinyl insulated closed end splice or butt splices in the next step. Trimmed bare conductors shall not extend beyond the insulated closed end splice (or equal).
 - 5) Crimp insulated closed end splice utilizing a full cycle ratchet crimp tool approved by the splice manufacturer. The crimped connections shall be free of any movement between the wire and crimp splice device.
9. Connections at devices shall be soldered or fastened with approved crimp connectors. No wire nuts will be permitted. Wire should be twisted four times before a crimp connector is applied. The Manufacturers crimping tool shall be utilized for the crimp connectors of choice. Environmental connectors shall be used in harsh or outdoor environments. Devices requiring connections within metal extrusions associated with perimeter windows and doors are considered to be a harsh environment.
10. All mounted wire ties shall be the screw down type. Wire ties utilizing only an adhesive back are not acceptable.

11. Heat shrink tubing must be installed on all cable ends within cabinets.
12. Cable shields are to be grounded only at the DGP end, for alarms and CCTV. Shields are to be carefully insulated to prevent conductor shorts.

F. Grounding Practices:

1. The existing single system ground point shall be maintained for all security and security related systems described in the BICSI guidelines and is to be provided and installed by the Contractor.
2. Under no circumstances shall either the conduit or AC neutral be used for the security system ground reference point.

G. Control of Electromagnetic Interference (EMI):

1. The control of EMI is critical to the reliable operations of the systems described in these specifications. It is the responsibility of the Security Contractor to ensure all equipment and systems proposed meet FCC requirements and certifications for type regarding electromagnetic emissions. The Security Contractor shall submit evidence of such certifications with their pre-fabrication submittals.
2. All equipment shall be installed in accordance with manufacturers' specifications and recommendations to assure compliance with FCC certifications and requirements. This shall include proper installation to maintain case integrity; proper fastening of conductors, wires, cables, and connectors; use of appropriate connectors and fasteners; and following manufacturers' recommendations for grounding practices.
3. The Security Contractor shall certify the installed system is in compliance with the manufacturers' recommendations and specifications regarding control of EMI.

3.6 INSTALLATION – FIRE ALARM SYSTEM

A. Updates to Annunciator Panels and Network Command Centers:

<Consult with UMB and Edit for Project Requirements>

1. Annunciator Panels: Include updates to the existing Graphic Annunciator Panels as necessary for updated floor plans and/or changes to device locations.
2. Network Command Centers: Include upgrades to the four (4) existing Network Command Centers as necessary for updated floor plans and/or changes to device locations.

B. All field wiring shall be installed in conduit. Conduit and boxes shall be sized according to National Electrical Code requirements based on the number of conductors. Initiating device circuit wiring shall be two-conductor twisted with integral shield and ground. Indicating appliance circuits shall be minimum 14 AWG. Provide new wiring as necessary and extend and connect to the nearest SLC/NAC loop. **Do not T-TAP to existing wiring. T-TAP is not allowed.**

C. Fire alarm circuits shall be identified by red junction box covers stenciled in white letters "fire alarm". Fire alarm wiring shall be color coded in accordance with requirements of local authority having jurisdiction.

- D. Final Acceptance test shall be witnessed by the UMB Fire Marshal.
- E. Prior to testing of the system with UMB Fire Marshal, the contractor shall conduct pre-testing of the system and correct all deficiencies.
- F. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- G. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
- H. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- I. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- J. Prepare test and inspection reports.
- K. Contractor Pretesting: After installation, align, adjust, and balance system and perform complete pretesting. Determine, through pretesting, compliance of system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results. Provide documentation summarizing pretesting to UMB Fire Marshal. Documentation should include statement that system is working properly and summary of corrections made during pretesting. Project Manager may attend contractor pretesting as desired.
- L. The contractor shall have a fire alarm technician present during all tests and shall have laptop with them to modify and program changes during the tests.
- M. Final acceptance testing with the UMB Fire Marshal: After installation, align, adjust, and balance system and perform complete pretesting with the University Fire Marshal. Determine, through pretesting, compliance of system with requirements of Drawings and Specifications. After pretesting is completed, correct deficiencies observed in pretesting for final testing. Replace malfunctioning or damaged items with new ones, and retest until

satisfactory performance and conditions are achieved. Remove existing devices after pretesting has been completed with the UMB Fire Marshal.

- N. Final acceptance testing: After final acceptance testing is complete, provide letter certifying installation is complete and fully operable, including names and titles of witnesses to preliminary tests.
- O. Final Test Notice: Provide minimum of ten business (10) days' notice in writing when system is ready for final acceptance testing.
- P. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by system test that total system meets Specifications and complies with applicable standards.

3.7 FEES

- A. A fee applies if testing with the Fire Marshal reveals that the fire alarm system does not meet applicable codes and standards, the project specifications and/or the design documents. Each failed test will result in a \$250 fee.
 - 1. If any programming changes are required during the test or after, the test is considered a failed test.
 - 2. Any issue that requires re-testing is considered a failed test.
 - 3. Any test in which the contractor fails to show at the scheduled start time or is not prepared to perform the test with testing materials is considered a failed test.
- B. Invoices will be sent to the contract holder from the University of Maryland, Baltimore Central Administration Support Services (CASS) Department. Payment must be made electronically with credit card or via check. Cash payment is not acceptable.
- C. Failure to pay the fee within 30 days of receipt will result in appropriate administrative and/or legal action. Further inspection or testing may not take place until the fee is paid in full. This may result in delay of the issuance of a use and occupancy permit for the building or facility.

3.8 INSTALLATION OF PATHWAYS – VSS AND ACCESS CONTROL SYSTEMS

- A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- B. Comply with requirements in Division 26.
- C. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- D. Pathway Installation in Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of the room where multiple sheets of

- plywood are installed around perimeter walls of room.
1. Install cable trays to route cables if conduits cannot be located in these positions.
 2. Secure conduits to backboard when entering room from overhead.
 3. Extend conduits 75 mm (3 in) above finished floor (AFF).
 4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- E. Backboards: Install backboards with 2440 mm (96 in) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.
- 3.9 INSTALLATION OF CONDUCTORS AND CABLES – VSS AND ACCESS CONTROL SYSTEMS
- A. Comply with NECA 1.
- B. General Requirements for Cabling:
1. Comply with TIA/EIA-568-B.1.
 2. Comply with BICSI ITSIM, Ch. 6, and “Cable Termination Practices.”
 3. Install 110-style IDC termination hardware unless otherwise indicated.
 4. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 760 mm (30 in) and not more than 150 mm (6 in) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 9. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, “Pulling Cable”. Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
 2. Do not untwist UTP cables more than 12 mm (0.5 in) from the point of termination to maintain cable geometry.
- D. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-B.3.
 2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend copper cable not in a wire way or pathway a minimum of 200 mm (8 in) above ceilings by cable supports not more than 1525 mm (60 in) apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- F. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable 1830 mm (72 in) long shall be neatly coiled not less than 300 mm (12 in) in diameter below each feed point.
- G. Outdoor Coaxial Cable Installation:
1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 2. Attach antenna lead-in cable to support structure at intervals not exceeding 915 mm (36 in).
- H. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 127 mm (5 in).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 300 mm (12 in).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 600 mm (24 in).
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 64 mm (2.5 in).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 150 mm (6 in).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 300 mm (12 in).
 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.

- b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 75 mm (3 in).
- c. Electrical Equipment Rating More Than 5 kVA: A minimum of 150 mm (6 in).
- 5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 1200 mm (48 in).
- 6. Separation between Cables and Fluorescent Fixtures: A minimum of 127 mm (5 in).

3.10 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

- 1. Class 1 remote-control and signal circuits, No. 14 AWG.
- 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
- 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.11 FIRESTOPPING

- A. Apply fire stopping to penetrations of fire-rated floor and wall assemblies for electronic security installations to restore original fire-resistance rating of assembly.
- B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.12 GROUNDING

- A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Division 26.

3.13 CABLE IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26.

3.14 FIELD QUALITY CONTROL

A. Tests and Inspections:

- 1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
- 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 4. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Multimode Link Measurements: Test at 850 or 1,300 nm (wavelength) in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.15 WIRELINE DATA TRANSMISSION

- A. Installation: The Contractor shall install all system components including Owner furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ANSI C2 and as shown, and furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable data transmission system.
- B. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing.

3.16 DEMOLITION

- A. The demolition in the renovation areas indicated on the drawings shall be complete and include all work in the area unless noted otherwise.
- B. Existing systems passing through areas of demolition to serve equipment beyond the demolition areas shall remain in service, or be suitably relocated and restored to normal

operation, throughout the demolition and reconstruction of the area. The Contractor shall investigate and identify such equipment prior to demolition.

- C. Provide temporary service to equipment disturbed by the demolition until such time as the permanent service can be restored.
- D. Where conduit and wiring is to remain are inadvertently damaged or disturbed, cut out and remove damaged portion and all damaged wiring from the source to the destination connection point. Provide new wiring of equal capacity.
- E. Exposed conduit to be demolished shall be removed in its entirety. Concealed conduit, abandoned in place, shall be cut out approximately two (2) inches beyond the face of adjacent construction, plugged, and the adjacent surface patched to match existing.
- F. Wiring to be demolished shall be removed from both concealed and exposed conduit. No wiring which becomes unused as a result of the contract shall be abandoned in place.
- G. Equipment specified or indicated to be demolished, shall be removed from the project site and shall not be reused.

3.17 COMMISSIONING NEW FIRE ALARM, SAFETY AND SECURITY SYSTEMS

- A. Testing Preparation:
 - 1. Certify in writing to the CxA that the systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
 - 2. Place systems, subsystems, and equipment into operating mode to be tested.
 - 3. Inspect and verify the position of each device and interlock identified on checklists.
 - 4. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.
- B. General Testing Requirements:
 - 1. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
 - 2. Test all operating modes and verify proper response of controllers and sensors.
 - 3. Tests will be performed using design conditions whenever possible.

3.18 CUTTING AND PATCHING

- A. Cutting and patching associated with the work in the existing structure shall be performed

a neat and workmanlike manner. Existing surfaces that are damaged by the contractor shall be repaired or provided with new materials to match existing.

- B. Structural members shall not be cut or penetrated. Holes cut through concrete and/or masonry to accommodate new work shall be cut by reciprocating or rotary, non-percussive methods.
- C. Patching of areas disturbed by installation of new work and/or required demolition shall match existing adjacent surfaces as to material, texture and color.

3.19 CLEAN – UP

- A. Excessive debris and dirt, such as occurs from cutting through masonry or plaster walls shall be cleaned up from the equipment and removed immediately after the work of cutting through the walls.
- B. Debris shall be removed from UMB property.
- C. Ceiling panels shall be replaced as soon as work is finished in the area, and shall be kept free of dirty finger prints. Where work is being done in corridors used by patients and visitors, ceiling panels shall be replaced at the close of the day's work even if work is at the particular location is incomplete.
- D. All areas shall be left broom-clean at the end of the work period.

END OF DIVISION 280000