

SECTION 28 00 00 – ELECTRONIC SAFETY AND SECURITY

PART 1- GENERAL

1.1 DESCRIPTION

- A. This document contains the General and Supplementary Conditions that are a part of the requirements for the work under this Division of the Specifications to install a commercial Electronic Safety and Security Systems and Components.
- B. The term “Electronic Safety and Security Systems and Components” are understood to include Electronic Monitoring and Control as well as Fire Alarm systems and components when such systems and/or components are part of the Cal Poly Campus Project.
- C. The content in the Division 28 specification is based on national standards and guidelines for Electronic Safety and Security systems, including those developed by the Electronic Industry Association (EIA), Institute of Electrical and Electronic Engineers (IEEE) and UL 681. Great emphasis is placed herein on the idea that taking guidance from such sources is generally more desirable than using specific manufacturer's proprietary designs which may quickly become outdated or may be incompatible with other needed equipment.
- D. To better clarify guidance, should a conflict between documents arise, the order of precedence shall be as follows:
 - 1. Appropriate Application of Conduit. Refer to Division 26 conduit applications unless where specifically identified in the Division 27. Refer to Division 27 for conduit requirements specific to low voltage cabling system
 - 2. This Division 28 specification, Division 27, Division 26, Division 08, Division 33, Division 1.
 - 3. Electronic Industry Association (EIA), Institute of Electrical and Electronic Engineers (IEEE)
 - 4. Section 07 84 00 – Firestopping
 - 5. Section 27 05 37 - Firestopping Systems for Communications Cabling. *Note, Section 27 05 37 takes precedence over Section 07 84 00 in the event of a conflict.
 - 6. Division 33 – Utilities

- E. The precedence can be overridden in the case where an item is disallowed by an applicable building code and/or with the approval in writing of the Cal Poly Facilities Project Manager.
- F. Referenced Individuals in this Document.
 - 1. Following is a list of the individuals referenced in this document:
 - a. University: California Polytechnic State University
 - b. Design team: The facility planners, architects, consultants, information technology managers, or designers who are working on this project to develop the Electronic Safety and Security Systems design, drawings, and specifications.
 - c. Cal Poly Facilities Department: The Cal Poly Facilities Department will oversee all aspects of this project.
 - d. Cal Poly Facilities Project Manager: The Cal Poly Facilities Project Manager is assigned to this project by the Cal Poly Facilities Department. This is the only authorized person who can approve the Contractor's work. Approvals by another person is not allowed without written consent by the Cal Poly Facilities Project Manager or written replacement by the Cal Poly Facilities Department.
 - e. Contractor: The general contractor and all subcontractors working for the general contractor on this project.

1.2 INTERDISCIPLINARY INFRASTRUCTURE

- A. Comments regarding infrastructure installed by other Specification sections:
 - 1. The Division 28 specification includes comments and requirements for infrastructure that would be installed by contractors installing other Division Specification sections.
 - 2. The success of the Division 28 installation depends on infrastructure installed by other Specification sections such as grounding rods, grounding connection to building steel, MDF, IDF, or SDF room construction, electrical in rooms, low voltage pathways, etc. Submit proposed installation location of any equipment and/or infrastructure located in MDF, IDF, or SDF for formal review and approval by a Cal Poly Representative.
 - 3. If the Division 28 Contractor identifies infrastructure that was not designed and installed as shown in this Division 28 specification, the Division 28 Contractor should contact the Cal Poly Facilities Project Manager immediately.

4. Division 28 cabling or equipment should not be installed within infrastructure that was not installed as described in this Division 28 specification without the express written consent of the Cal Poly Facilities Project Manager.
- B. Interdisciplinary infrastructure to be included in the Division 28:
1. Division 28 drawings should show all cabling needed for Electronic Safety and Security, even the cabling and hardware needed for other systems shown in other Specification sections such as door locks, door hardware, security cameras, Fire Alarm panels, and Fire Alarm sensors, etc.
 2. Whether shown in the Division 28 drawings or not, it is the responsibility of the Division 28 Contractor to confirm that the cabling needed for those other interdisciplinary systems has been included in the Division 27 scope of work.

1.3 QUALITY ASSURANCE

- A. Comply with the current applicable codes, ordinances, and regulations of the authority or authorities having jurisdiction, the rules, regulations, and requirements of the utility companies serving the project and the Universities insurance underwriter.
- B. Drawings, specifications, codes, and standards are minimum requirements. Where requirements differ, the most stringent apply.
- C. All equipment and installations shall meet or exceed minimum requirements of ADA, ANSI, ASTM, IEEE, NEC, NEMA, NFPA, OSHA, UL, and the State Fire Marshal.
- D. Refer to Division 01 - General Requirements and Section 01 45 00 Quality Control.
- E. Should any change in drawings or specifications be required to comply with governing regulations, notify and receive written approval from the Cal Poly Facilities Project Manager prior to submitting your bid.
- F. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, workmanlike manner by competent workmen. Provide a competent, experienced, full-time Superintendent and Project Manager who are authorized to make decisions on behalf of the Contractor.
- G. All Electronic Safety and Security technicians must have a manufacturer's certification for the System components that they are installing as part of the Electronic Safety and Security System and Components.
- H. Provide all components of a complete system specified within all project documents, specifications, and drawings.
- I. All unused component parts from all system installations shall be delivered to the Cal Poly Facilities Project Manager and shall not be disposed of or thrown away.

1.4 CODES, STANDARDS, AND GUIDELINES

- A. The references to the following codes and standards are meant to represent the most current and up-to-date revisions, adoption, or printing as of the issue of this document. The Contractor is responsible for following the latest revision or printing (UON).
- B. UL 681 Installation and Classification of Burglar and Holdup Alarm Systems
- C. NEC
- D. Comply with the current Office of State Fire Marshal adopted NFPA with California Amendments.
- E. Comply with the current Office of State Fire Marshal adopted California Building Code and California Fire Code.
- F. Comply with the current TIA/EIA CSU TIP Standard.

1.5 SUBMITTALS

- A. General
 - 1. Refer to Division 01 - General Requirements and 01 33 00 Submittal Procedures.
 - 2. Review of submittals shall be for general compliance with the design concept and Contract Documents.
 - 3. Comments or absence of comments shall not relieve the Contractor from compliance with the Contract Documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.
 - 4. Submittals will be stamped as follows:

Stamp	Interpretation
No Exceptions Noted	Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents.

<p>Exceptions Noted <input type="checkbox"/> Resubmit for Record <input type="checkbox"/> No Resubmission Required</p>	<p>Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents and the Engineer's notations are complied with.</p>
<p>Revise and Resubmit</p>	<p>The submittal does not comply with the Contract Documents; do not proceed with fabrication, manufacture, or construction. The work and shop drawings are not permitted at the job site. Resubmit appropriate shop drawings.</p>

5. No part of the work shall be started in the shop or in the field until the shop drawings and samples for that portion of the work have been submitted and accepted by the Cal Poly Facilities Project Manager.
6. A minimum period of five working days, exclusive of transmittal time, shall be required in the Cal Poly Facilities Project Manager's office each time a shop drawing, product data and/or samples shall be submitted for review. This time period shall be considered by the Contractor in the scheduling of the work.
7. Submit materials and equipment by manufacturer, trade name, and model number. Include copies of applicable brochure or catalog material.
8. Maintenance and operating manuals shall not be acceptable substitutes for shop drawings.
9. Identify each sheet of printed submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information. Note specified features such as materials or paint finish.
10. Maintain a complete set of reviewed and stamped shop drawings and product data on site.

B. Samples

1. Samples as requested shall be physical examples that represent materials, equipment or workmanship and establish standards by which the work will be judged. Samples shall not be returned to the Contractor.

C. Test Reports

1. Pre-Installation Testing Reports: Submit two sets of manufacturers or field-testing reports for those materials identified in the individual system Specification Sections as requiring that such reports shall be submitted.
 2. Post-Installation Testing Reports: Submit a minimum of two sets of field-testing reports for those materials identified in the individual system Specification Sections as requiring that such reports shall be submitted.
- D. Vender/Contractor/Supplier Information
1. Submit a complete typed list of all Electronic Safety and Security Systems equipment manufacturers and material suppliers for the equipment proposed to be provided on this project, as well as names of all subcontractors.
 2. Contractor must supply current manufacturer's certification for all employees involved in the installation of all materials contained as part of the System.
- E. Warranty info
1. Submit a copy of all relevant warranty information. Refer also to Division 01 - General Requirements and 01 78 33 Product Warranties and Bonds.
- F. Product Documentation:
1. Documentation for submittals in the form of catalog cuts, manufacturer specifications, and other supporting printed material shall be bound in a single binder, tabbed, and separated by specification section, and submitted in its entirety for review and eventual delivery to the Cal Poly Facilities Project Manager.
- G. Shop Drawings
1. After the Contract is awarded, provide complete shop drawings as requested for each relevant section. Prior to submission, certify that the shop drawings shall be in compliance with the Contract Documents. Modify any work, which proceeds prior to receiving accepted shop drawings as required to comply with the Contract Documents and the shop drawings.
 2. Shop drawings for each location layout, specifically including details for wall-fields and rack mounting layouts shall be formally submitted for review and approved by a representative of the Cal Poly Facilities Project Manager prior to installation.
 3. For each room or area of the building containing Electronic Safety and Security equipment, submit the following:
 - a. Floor plans, at not less than 1/8" scale, showing routing of ###.
 - b. Enlarged plan views and elevation layout drawings for each ### indicating the equipment in the exact location in which it is intended to

be installed. These plans shall be of a scale not less than $\frac{1}{4}$ inch = 1'-0". They shall be prepared in the following manner:

- 1) Indicate the physical boundaries of the space including door swings and ceiling heights and ceiling types (as applicable).
 - 2) Illustrate all hardware proposed to be contained therein. Include top and bottom elevations of all hardware. The Drawings shall be prepared utilizing the dimensions contained in the individual equipment submittals. Indicate code and manufacturer's required clearances.
 - 3) Illustrate all other equipment therein such as ###, etc.
 - 4) Indicate dimensions to confirm compliance with code-required clearances.
4. The work described in shop drawing submissions shall be carefully checked by all trades for clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and coordination with other trades on the job.
 5. Each submitted shop drawing shall include a certification that related job conditions have been checked by the Contractor and each Subcontractor and that conflicts do not exist.
 6. The Contractor shall not be relieved of the responsibility for dimensions or errors that may be contained on submissions, or for deviations from the requirements of the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and shall be neither waived nor superseded in any way by the review of shop drawings, product data and samples.
 7. Inadequate or incomplete shop drawings, product data and/or samples shall not be reviewed and shall be returned to the Contractor for resubmittal.
 8. Indicate the following on the lower right-hand corner of each shop drawing and on the front cover of each product data brochure cover: The submittal identification number; title of the sheet or brochure; name and location of the project; names of the Architect, Engineer, Contractor, Subcontractor, manufacturer, and supplier; the date of submittal; and the date of each correction, version and revision. Number all pages and drawings in product data brochures consecutively from beginning to end. Unless the above information is included, the submittal shall be returned for re-submission. Resubmittals of product data or brochures shall include a cover letter summarizing the corrections made in response to the review comments.

9. The layout submittals and the related equipment submittals shall be submitted concurrently. Failure to submit concurrently shall result in the immediate return of the submittal marked REVISE AND RESUBMIT.

1.6 IDENTIFICATION

- A. Also refer to Section 27.
- B. Label and identify each element as required for those individual system specification sections.

1.7 ABBREVIATIONS AND DEFINITIONS

A. ABBREVIATIONS

1.	ADA	Americans with Disabilities Act
2.	AFF	Above Finished Floor
3.	ANSI	American National Standards Institute
4.	ASTM	American Society for Testing and Materials
5.	AVIXA	Audio Visual and Integrated Experience Association
6.	EIA	Electronic Industries Alliance
7.	ETL	Electrical Testing Laboratories, Inc.
8.	FCC	Federal Communications Commission
9.	FM	Factory Mutual
10.	IEEE	Institute of Electrical and Electronic Engineers
11.	LED	Light Emitting Diode
12.	NEC	National Electric Code
13.	NEMA	National Electrical Manufacturers Association
14.	NFPA	National Fire Protection Association
15.	NRTL	Nationally Recognized Testing Laboratory
16.	OEM	Original Equipment Manufacturer
17.	OSHA	Occupational Safety and Health Administration
18.	PBB	Primary Bonding Busbar, See UTIP for samples
19.	SCC	Security Control Center
20.	UL	Underwriters Laboratories
21.	UON	Unless Otherwise Noted

B. Electronic Safety and Security Definitions

1. ###

1.8 WARRANTY

- A. Submit a single guarantee stating that the work is in accordance with the Contract Documents. The warranty shall include all labor to replace any defective components as well as the component replacement at current market price. Guarantee work against faulty and improper material and workmanship for a period of one year from the date of final acceptance by the University and/or the Cal Poly Facilities Department, except where guarantees or warranties for longer terms shall be provided or specified herein, the longer term shall apply. Correct any deficiencies, which occur during the guarantee period, within 24 hours of notification, without additional cost to the University, and to the satisfaction of the Cal Poly Facilities Project Manager. Obtain similar guarantees from subcontractors, manufacturers, suppliers, and sub-trade specialists. Refer also to Division 01 - General Requirements and 01 78 33 Product Warranties and Bonds.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. SECTION 28 06 00 - SCHEDULES FOR COMMUNICATIONS
1. It is recommended that the reader examine Section 28 06 00 - Schedules for Electronic Safety and Security before continuing.
 2. Section 27 06 00, Schedules for Communications presents the Cal Poly Facilities Department's pre-approved Product/Material Listing by Division 27 Section number. In this specification set product/material shall be specified by reference to the Product/Materials Schedule contained in Section 27 06 00.
 3. The Contractor shall supply a complete and functioning system; if a product/material required for this project is not listed in Section 27 06 00 - Schedules for Communications, Products and Materials Schedule, it shall be furnished by Contractor with submittal approval by the Cal Poly Facilities Project Manager.
- B. Use only products listed for their intended use by a Nationally Recognized Testing Laboratory, except products for which no relevant standards exist.
- C. Provide products and materials that are new, clean, free of defects, and free of damage and corrosion.

- D. Products and materials shall not contain asbestos, PCB, or any other material, which shall be considered hazardous by the Department of Environmental Protection or any other authority having jurisdiction.
- E. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.
- F. Follow manufacturer's instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.
- G. Enclosures for Electronic Safety and Security Systems and Components equipment installed in mechanical equipment rooms shall be NEMA type 1 with gasket. Enclosures for Electronic Safety and Security Systems equipment installed outdoors shall be NEMA type 4.
- H. Ship and store all products and materials in a manner that will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain a replacement. Repairs of damaged goods shall only be permitted with prior written permission of the Cal Poly Facilities Project Manager.
- I. Part numbers and product codes in these specifications shall be correct as of the time of writing. Manufacturers may, however, change part numbers and product codes on short notice. In cases where part numbers or product codes differ from technical specifications for a particular product, provide products that meet the minimum technical specifications of the products in the specifications. The contractor shall notify the Cal Poly Facilities Project Manager of any product code and or part number changes on the material list submittal.
- J. Product Consistency: Any given item of equipment or material shall be the product of one manufacturer throughout the project. Multiple manufacturers of any one item will not be permitted, unless specifically noted otherwise on approved drawings or contract documents.

2.2 SPECIAL TOOLS

- A. Deliver to Cal Poly Facilities Project Manager two complete sets of all special tools and small equipment items needed for proper ongoing operation, adjustment, and maintenance of cabling and equipment installed under this work.
- B. All tools to be new and still in manufacturers packaging. The cost for these tools is to be included within the bid price for this work.
- C. The terms "special tools" and "small equipment items" is meant to include such items as punch down tools, connector assembly tools, etc. with each individual item having a retail replacement cost not exceeding five hundred dollars (\$500.00). It is NOT meant to include common hand tools such as standard screwdrivers, pliers, wrenches, etc.

- D. Submit the tool list along with the bid for this work. Include add/delete unit pricing for all tools on the list.

2.3 SUBSTITUTIONS

- A. Contract Documents shall be based on equipment manufacturers as called out in the Specifications and indicated on the Drawings. Acceptance of substitute equipment manufacturers shall not relieve Contractor of the responsibility to provide equipment and materials, which meet the performance as stated or implied in the Contract Documents. All substitution requests shall follow Division 01 - General Requirements and 01 63 00 Product Substitution Procedures.
- B. Submit proposals to provide substitute materials or equipment, in writing, with sufficient lead-time for review prior to the date equipment is ordered to maintain project schedule.
- C. Substitutions that increase the cost of the work and related trades shall not be permitted.
- D. Proposals for substitutions shall include the following information:
 - 1. A description of the difference between the Contract Document requirements and that of the substitution, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on other contractors and acknowledge the inclusion of additional costs to the other trades.
 - 2. Schematic drawings and details.
 - 3. List of revisions to the Contract Documents that must be made if the substitution is accepted.
 - 4. Estimate of costs the University may incur in implementing the substitution, such as test, evaluation, operating and support costs.
 - 5. Statement of the time by which a Contract modification accepting the substitution must be issued, noting any effect on the Contract completion time or the delivery schedule.
 - 6. A statement indicating the reduction to the Contract price if the Cal Poly Facilities Project Manager accepts the substitution. Include required modifications to all related trades.
- E. Final acceptance of Electronic Safety and Security Systems and Components designs, and substitutions shall be as follows:
 - 1. Final acceptance/approval of all Electronic Safety and Security Systems and Components designs and substitutions shall be at the sole discretion of the Cal Poly Facilities Project Manager.

PART 3 – EXECUTION

3.1 GENERAL

- A. Work Included
 - 1. Provide labor and materials required to install, test, and place into operation the Electronic Safety and Security Systems as called for in the Contract Documents, and in accordance with applicable codes and regulations.
 - 2. Provide labor, materials, and accessories required to provide complete, operating Electronic Safety and Security Systems.
 - 3. Labor, materials, or accessories not specifically called for in the Contract Documents, but required to provide complete, operating infrastructure systems shall be provided without additional cost to the University.
- B. Fees and Permits
 - 1. Pay all required fees and obtain all required permits related to the Electronic Safety and Security Systems installation.
 - 2. Pay royalties or fees in connection with the use of patented devices and systems.
 - 3. Provide controlled inspection where required by the authority having jurisdiction or by these specifications.
- C. Coordination of work
 - 1. The Contract Documents establish scope, materials, and quality, but are not detailed installation instructions. Drawings are diagrammatic.
 - 2. Coordinate work with related trades and furnish, in writing, any information necessary to permit the work of related trades to be installed satisfactorily and with the least possible conflict or delay.
 - 3. The Electronic Safety and Security Systems drawings show the general arrangement of equipment and appurtenances. Follow the appropriate drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories, which may be required but not shown on the Drawings. Investigate the site, and review drawings of other trades to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.
 - 4. The locations of cable termination fields, faceplates, patch panels, equipment racks and other equipment indicated on the Drawings are approximately

correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of faceplates, or in order to meet field conditions, or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes. The final designs shall be accepted by the Cal Poly Facilities Project Manager prior to installation.

5. Exercise particular caution with reference to the location of outlets/faceplates, racks, blocks, patch panels, control panels, switches, etc., and have precise and definite locations accepted by the Cal Poly Facilities Project Manager before proceeding with the installation.
6. The Drawings show only the general run of raceways and approximate locations of faceplates. Any significant changes in location of faceplates, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Cal Poly Facilities Project Manager for review before such alterations are made. Modifications shall be made at no additional cost to the University.
7. Verify with the Cal Poly Facilities Project Manager the exact location and mounting height of faceplates and equipment not dimensionally located on the Drawings.
8. Faceplate/cable labels in the form of alpha/numeric characters are used where shown to indicate the faceplate and cable designation numbers in cable termination fields (terminal blocks and/or patch panels). Show the actual faceplate/cable numbers on the as-built Record Drawings, on the associated typed termination field labels and in the printed and computer readable cabling schedules. Where faceplate/cable-numbering information is not indicated, request clarification from the Cal Poly Facilities Project Manager.
9. Wherever work interconnects with work of other trades, coordinate with other trades to ensure that they have the information necessary so that they may properly install the necessary connections and equipment. Identify items (remote ballast, pull boxes, etc.) requiring access in order that the Ceiling Trade will know where to install access doors and panels.
10. Furnish and set sleeves for passage of Electronic Safety and Security Systems risers through structural masonry and concrete walls and floors and elsewhere as required for the proper protection of each Electronic Safety and Security Systems raceway passing through building surfaces.
11. Provide appropriate firestop materials around all pipes, conduits, ducts, sleeves, etc. which pass through rated walls, partitions, and floors.
12. Provide detailed information on openings and holes required in precast members for Electronic Safety and Security Systems work.

13. Provide required supports and hangers for conduit and equipment, designed so as not to exceed allowable loadings of structures.
 14. Examine and compare the Contract Drawings and Specifications with the Drawings and Specifications of other trades and report any discrepancies between them to the Cal Poly Facilities Project Manager and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.
 15. Before commencing work, examine adjoining work on which this work is in any way affected and report conditions, which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
 16. Adjust location of conduits, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication.
 - a. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch.
 - b. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
 - c. Provide offsets, transitions and changes in direction of conduit as required to maintain proper headroom and pitch on sloping lines.
 17. In cases of doubt as to the work intended, or in the event of need for explanation, request supplementary instructions from the Cal Poly Facilities Project Manager.
 18. Coordinate with Cal Poly Facilities Project Manager for access into existing campus Electronic Safety and Security Systems spaces.
- D. Cutting and Patching
1. Where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings or other surfaces shall be necessary for the proper installation, support or anchorage of conduit or other equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment and/or defaced finished plaster, woodwork, metalwork, etc. using skilled tradespeople of the trades required at no additional cost to the University.
 2. Do not cut, channel, chase or drill unfinished masonry, tile, etc., unless permission from the Cal Poly Facilities Project Manager is obtained. If

permission is granted, perform this work in a manner acceptable to the Cal Poly Facilities Project Manager.

3. Where conduit or equipment is mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.
 - a. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the University.

E. Cleaning Up

1. Avoid accumulation of debris, boxes, loose materials, crates, etc., resulting from the installation of this work. Remove from the premises each day all debris, boxes, etc., and keep the premises clean and free of dust and debris.
2. Clean all fixtures and equipment at the completion of the project. Wipe clean exposed lighting fixture reflectors and trim pieces with a non-abrasive cloth just prior to occupancy.
3. All MDF, IDF, and SDF spaces shall be thoroughly vacuumed and wiped clean prior to bringing online and at the completion of the project. Equipment shall be opened for observation by the Cal Poly Facilities Project Manager as required.

F. Delivery, Drayage and Hauling

1. Provide drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and installation of equipment as required by the construction schedule. If any item of equipment is received prior to the time that it is required, the Contractor shall be responsible for its proper storage and protection until the time it is required. Pay for all costs of demurrage or storage.
2. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, the Contractor shall be responsible for resulting disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the University.

G. Equipment and Material Protection

1. Protect the work, equipment, and material of other trades from damage by work or workmen of this trade and correct damaged caused without additional cost to the University.
2. It is the contractor's responsibility for work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or

damage, and carefully store material and equipment received on site, which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. Cover and protect equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc.

3. Provided adequate means for fully protecting finished parts of materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred and are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair.

3.2 QUANTITIES

- A. N/A

3.3 INSTALLATION

- A. Mounting Heights

1. Mounting heights shall conform to ADA requirements.
2. Contractor responsible for the physical mounting of devices must have knowledge and understanding of ADA requirements.
3. Mounting heights shall be from floor to center of outlet, unless otherwise noted. Verify exact locations and mounting heights with the Cal Poly Facilities Project Manager before installation.
4. Wall mounted devices requiring operational access shall be mounted a minimum of 15 inches above finished floor to bottom of device and a maximum of 48 inches above finished floor to the operating mechanism.

- B. Waterproofing

1. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, make penetration prior to the waterproofing and furnish all sleeves or pitch-pockets required. Contact and obtain written permission from the Cal Poly Facilities Project Manager before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
2. Restore waterproofing integrity of walls or surfaces after they have been penetrated without additional cost to the University.

- C. Supports

1. Support work in accordance with the strictest manufacturer written recommendation per code or the best industry practice. Provide supports,

hangers, auxiliary structural members, and supplemental hardware required for support of the work.

2. Provide supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. Provide such frames or racks in MDF, IDF, or SDF rooms.
3. Provide supporting frames or racks for equipment, which is installed in a freestanding position meeting Seismic Zone 4 requirements.
4. Supporting frames or racks shall be plumb and square with parallel side rails of standard angle, standard channel, or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.
5. Adequate support of equipment (including faceplate, back, pull and junction boxes and fittings) shall not depend on electric conduits, raceways, or cables for support.
6. Electronic Safety and Security Systems equipment shall not rest on or depend for support on suspended ceiling media. Provide independent support of Electronic Safety and Security Systems equipment. Do not attach to supports provided for ductwork, piping, or work of other trades.
7. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure. Electronic Safety and Security Systems equipment and supports shall not come in contact with the work of other trades.

D. Fastenings

1. Fasten equipment to building structure in accordance with the strictest manufacturer written recommendation, per code or the best industry practice and while meeting Seismic Zone 4 requirements.
2. Where weight applied to the attachment points is 100 pounds or less, conform to the following as a minimum:
 - a. Wood: Wood screws.
 - b. Concrete and solid masonry: Bolts and expansion shields.
 - c. Hollow construction: Toggle bolts.
 - d. Solid metal: Machine screws in tapped holes or with welded studs.
 - e. Steel decking or sub-floor: Fastenings as specified below for applied weights more than 100 pounds.

3. Where weight applied to building attachment points exceeds 100 pounds, but is 300 pounds or less, conform to the following as a minimum:
 - a. At concrete slabs provide 24-inch x 24-inch x ½ inch steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top of slab screed line, where no fill is to be applied.
 - b. At steel decking or sub-floor for all fastenings, provide through bolts or threaded rods.
 - c. The tops of bolts or rods shall be set at least one inch below the top fill screed line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or sub-floor manufacturer produces specialty hangers to work with his decking or sub-floor such hangers shall be provided.
 4. Where weight applied to building attachment points exceeds 300 pounds, coordinate with, and obtain the approval of the Cal Poly Facilities Project Manager and conform to the following as a minimum:
 - a. Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.
 5. For items, which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.
 6. Wall mounted equipment may be directly secured to wall by means of steel bolts. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars.
- E. Equipment pads and Anchor Bolts
1. Provide concrete pads under all floor-mounted Electronic Safety and Security Systems equipment where specifically required by the Specifications or shown on the Drawings. Equipment pads shall conform to the shape of the piece of equipment it serves with a minimum 1-inch margin around the equipment and supports. Pads shall be a minimum of 4 inches high and made of a minimum 28 day, 2500psi concrete reinforced with 6-inch x 6-inch 6/6-gauge welded wire mesh. Trowel tops and sides of pad to smooth finishes, equal to those of the floors, with all external corners bull-nosed to a ¾ inch radius.

Shop drawings stamped NO EXCEPTIONS NOTED shall be used for dimensional guidance in sizing pads.

2. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Provide bolts of the size and number recommended by the manufacturer of the equipment and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured to the isolator. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation manufacturer.
3. Where equipment is mounted on gypsum board partitions, the mounting screws shall pass through the gypsum board and securely attach to the partition studs. As an alternative, the mounting screws may pass through the gypsum board and be securely attached to 6 inches square, 18-gauge galvanized metal back plates, which are attached to the gypsum board with an approved non-flammable adhesive. Toggle bolts installed in gypsum board partitions are not acceptable.

3.4 GROUNDING & BONDING

- A. See individual sections for specific details.
- B. Refer to Section 27 05 26 for additional details.

3.5 TESTING

- A. Comply with the project construction schedule for the date of final performance and acceptance testing, and complete work sufficiently in advance of the Contract completion date to permit the execution of the testing prior to occupancy and Contract Closeout. Complete any adjustments and/or alterations, which the final acceptance tests indicate as necessary for the proper functioning of all equipment prior to the completion date. Refer also to Division 01 - General Requirements.
- B. Provide a detailed schedule of completion indicating when each system is to be completed and outlining when field-testing will be performed. Submit completion schedule for review within six months after the notice to proceed by Cal Poly Facilities Project Manager has been given. Update this schedule periodically as the project progresses.

3.6 ACCEPTANCE

- A. Perform all tests required by local authorities, in addition to tests specified herein.
- B. Technicians shall be ready with all necessary tools, test equipment, and supplies necessary to troubleshoot and correct cabling system faults.
- C. Upon receipt of the Contractor's documentation of cable testing, the Cal Poly Facilities Project Manager will review/observe the installation and randomly request tests of the cables/wires installed. Once the testing has been completed

and the Cal Poly Facilities Project Manager is satisfied that all work is in accordance with the Contract Documents, the Cal Poly Facilities Project Manager will notify the Contractor or Cal Poly Facilities Project Manager in writing.

- D. Specific system acceptance requirements are listed in the appropriate specification section.
- E. Final Punch List
 - 1. Prior to the Final Punch list, certify that all Electronic Safety and Security Systems and Components and equipment are complete, operational, and are in compliance with the Contract Documents.
 - 2. Any deficiencies noted on the Final Punch list shall be expeditiously corrected and certified in writing.
- F. Operating and Maintenance manuals
 - 1. Provide Operating and Maintenance Manuals and Training of maintenance personnel for equipment and materials furnished under each Division.
 - 2. Maintenance manuals shall include complete cleaning and servicing data compiled in a clear and easily understandable format. Show model numbers of each piece of equipment, complete lists of replacement parts, capacity ratings, and actual loads.

3.7 RECORD (AS-BUILT) DRAWINGS

- A. Record dimensions clearly and accurately to delineate the work as installed; suitably identify locations of all equipment by at least two dimensions to permanent structures. In addition, mark the Record Drawings to show the precise location of concealed work and equipment, including concealed or embedded raceways and cables and all changes and deviations in the Electronic Safety and Security Systems and Components work form that shown on the Contract Documents. All faceplates and Wireless Access Points shall be indicated with label IDs and noted on the Record Drawings . Refer also to Division 01 - General Requirements and 01 78 39 Project Record Documents.
 - 1. This requirement shall not be constructed as authorization to make changes in the layout or work. All proposed changes must be submitted for formal review to Cal Poly for acceptance. In a neat and accurate manner, provide a complete record of all revisions of the original drawings, as actually installed. The cost for these documents shall be included in the Contract. Submit drawings in AutoCAD and PDF format on CD for review. After review, make necessary changes to documents and then deliver three CD copies of the final documentation to the Cal Poly Facilities Project Manager.

- a. Submit three copies on CD's and two copies on USB of the final record drawings in AutoCAD and PDF format.
- b. Submit three copies of the as-built Electronic Safety and Security Systems cabling schedules as comma delimited ASCII format files (or other mutually acceptable media and format).
- c. Provide Copy of Test results

END OF SECTION

Master Pre-Approved Product, Material, or Manufacturer List Index

Important Notes

1. SUBMITTALS REQUIRED - See specifications, Section 27 00 00, PART 1 - GENERAL, SUBMITTALS.
2. Any submittal of an "or equal" product must contain the product manufacturer's performance specifications cut sheet for that product.
3. Items not showing manufacturer and part # shall be furnished by the Contractor with submittal approval by the Cal Poly Designated Telecommunications Representative.
4. Not all items listed are necessarily required for this project
5. If Line #s appear not to be sequential, those items have been removed since they are not required for this project.

Line #	Division 28 Section Number	Division 27 Section Name	Approved Manufacturer	Part #	As Specified, Or Equal	Description
1						
2						
3						
4						
5						
6						

All MDF and IDF will have the appropriate sized APC UPS (rack mountable). APC 5000 (3-U) UPS for MDFs with a 30 AMP twist lock receptor (LG-30) and APC 1500 (3-U) UPS for IDFs or APC 3000 (if a Cisco 4000 or greater switch is in the IDF rack). If an APC 5000 is needed a 30AMP twist lock receptor (LG-30) will need to be installed by the contractor as well.

Data COMM

Part#:	Description	Mfg.
2071E BL 4/23 WI000	CAT-6 DATA CABLE - PVC	SYSTIMAX
MGS400-318	CAT 6 RJ-45 -BLUE	SYSTIMAX
MIXL-246	FACEPLATE	SYSTIMAX SYSTIMAX
360-IPR-1100-E-GS3-	CAT-6 PATCH PANEL-24 PORT	SYSTIMAX IU-24
360-IPR-I 100-E-GS3- 2U-48	CAT-6 PATCH PANEL-48 PORT	SYSTIMAX
HTK-19-SS-2U	2-U WIRE MANAGEMENT PANEL	SYSTIMAX

FIBER MATERIAL:

Part#:	Description	Mfg.
R-006-LN-5L- F06BK/25D	6 STRAND M/M IN/OUT FIBER CABLE	SYSTIMAX
MFC-SCR-16-BG 360DP-6SC-LS	SIC MULTIMODE ANAEROBIC CONN.	SYSTIMAX
360G2-1U-MOD-FX	Distribution Panel 6 SC LazrSPEED® Aqua 360G2 1U Fixed Modular Cassette Shelf	SYSTIMAX
IDF		
360G2-2U-MOD-FX	360G2 2U Fixed Modular Cassette Shelf	SYSTIMAX
SYSTIMAX 360G2 2U Fixed Modular Cassette		
MDF		

DATA CABINETS:

Part#:	Description	Mfg.
SWE-4000-12UD	24HX24WX24D	SOUTHWEST DATA
SWE-4000-18UD	36HX24WX24D	SWDP
SWE-4000-26UD	48HX24WX24D	SWDP
CH-415	Front & REAR LOCK KIT (key-415)	SWDP

DATA CABINETS:

Part#:	Description	Mfg.
AR3307	APC NETSHELTER SX 48U	APC

AP9567
AR8112BLK
AR7600

14 outlet PDU (1 for each rack)
Seismic Kit (1 for each rack)
Baying kit (to bond multiple racks 1 per 2 racks)

APC
APC
APC

Data Station Jack Specification:

Rating: Category 6
Jack Type: RJ-45
Pinning Config: EIA/TIA 568B
Jack Color: Blue

Faceplate Specifications:

Size: Single Gang USO Bezel
Ports: Two (2) four (4) or six (6)
Color: Almond/Electric Ivory
Insert Color: Blue

SECTION 28 13 00 – ACCESS CONTROL SYSTEMS

PART 1- GENERAL

1.1 DESCRIPTION

- A. The work covered by this section of the Specifications includes all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform a complete installation of the Access Control System and Components.
- B. Those specification Sections of this Division 28 and Division 27, if issued in conjunction with this Division 28 specification, that are particularly applicable to this Section include, but are not limited to, the following:
 - 1. Appropriate Application of Conduit. Refer to Division 26 conduit applications unless where specifically identified in the Division 27. Refer to Division 27 for conduit requirements specific to low voltage cabling systems.
 - 2. Division 01 - General Requirements
 - 3. Section 07 84 00 – Firestopping
 - 4. Section 08 00 00 - Openings
 - 5. Division 25 - Integrated Automation
 - 6. Section 26 00 00 – Electrical
 - 7. Section 27 05 26 - Grounding and Bonding for Communications Systems
 - 8. Section 27 05 33 - Conduits and Backboxes for Communications Systems
 - 9. Section 27 05 37 - Firestopping Systems for Communications Cabling. *Note, Section 27 05 37 takes precedence over Section 07 84 00 in the event of a conflict.
 - 10. Section 27 08 13 - Testing of Copper Cables
 - 11. Section 27 11 00 - Communications Equipment Room Fittings
 - 12. Section 27 15 13 - Copper Station Cable

13. Section 27 15 43 - Communications Faceplates and Modular Jacks
14. Section 28 06 00 - Schedules for Electronic Safety and Security
15. Section 28 23 00 - Video Surveillance Systems
16. Division 33 – Utilities

1.2 QUALITY ASSURANCE

1. Refer to Section 28 00 00 for general details. Refer also to Division 01 - General Requirements and Section 01 45 00 Quality Control.

1.3 CODES, STANDARDS, AND GUIDELINES

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations in Section 28 00 00.
- B. For category type cabling refer to Division 27 for requirements.
- C. Comply with the current Office of State Fire Marshal adopted NFPA with California Amendments.
- D. Comply with the current Office of State Fire Marshal adopted California Building Code and California Fire Code.
- E. Comply with the current TIA/EIA CSU TIP Standard.

1.4 SUBMITTALS

- A. Refer to Section 28 00 00 for general details. Refer also to Division 01 - General Requirements and 01 33 00 Submittal Procedures.
- B. **ACCESS CONTROL SYSTEM COMPONENTS**
 1. System Components: Contractor to furnish all access control system electronics to include, but not necessarily limited to, any battery or UPS support requirements, hardware, software coordination, cable, and piece parts required by this project.
 2. Cable and Cable Pathway: Contractor shall furnish all necessary wire, cable, connectors, and cable pathway required for the proper installation of a complete working system. Coordinate supply and installation of cable and cable pathway components with other trades.

- a. Cable management devices must be sized to accommodate 100% spare capacity of the final installed cable base.
- b. Bridle rings shall not be acceptable.
- C. Submit Manufacturer's Cut Sheets for the following:
 - 1. Any products not specifically listed in the PRODUCTS section shall require a submittal of the manufacturer's cut sheets and approval by the Cal Poly Facilities Project Manager.

1.5 WARRANTY

- A. Refer to Section 28 00 00 for general details. Refer also to Division 01 - General Requirements and 01 78 33 Product Warranties and Bonds.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS AND MATERIAL

- A. See Section 28 06 00 – Schedules for Communications for approved manufacturers and material to be supplied for this section. All substitution requests shall follow Division 01 - General Requirements and 01 63 00 Product Substitution Procedures.

PART 3- EXECUTION

3.1 GENERAL

- A. Install systems in accordance with UL, NEC, and all other applicable codes. Install system to comply with drawings and final shop drawings in compliance with manufacturer instructions. Provide all required hardware and labor for rack mounting of head-end system components.
- B. Refer to plans for locations and quantities of equipment. Equipment locations shown on plans will be required to be field coordinated to ensure proper system operation.
- C. No items of equipment shall be installed in such a manner as to void or reduce the proper operating characteristics of individual components or of the system. Devices such as motion detectors, audio detectors, glass break sensors, etc. shall be installed following the manufacturer's recommendations.
- D. Perform all work under the onsite supervision of a factory authorized trained technician. It shall be the responsibility of the technician to check, inspect, and adjust this installation to the Cal Poly Facilities Project Managers approval. If required, a Customer Service Representative of the installing contractor or

manufacturer shall train University personnel assigned by the Cal Poly Facilities Project Manager on the proper operation and maintenance of the equipment. Perform all work in conjunction with this installation in accordance with good engineering practices.

3.2 CABLING

- A. All wiring between devices shall be run open wired above accessible ceilings. Where existing cable management systems are in place and there is adequate capacity to install the system wiring, the contractor may utilize these pathways providing they have coordinated with all other wiring contractors on site.
- B. Where pathways do not exist for access system wiring, the Contractor shall be responsible for providing all required cable management systems such as sleeves, conduits, J-hooks, etc. to support communications cabling to meet building codes and manufacturer's recommendations.
- C. All cabling installed in ceiling spaces that are used for air distribution plenums shall be UL plenum rated.
- D. The Contractor shall be responsible for furnishing and installing all required cabling between components to form a complete and operational system meeting all the requirements of this specifications and conjoined construction drawings.
- E. The Contractor shall be responsible for interconnection and signaling including all wiring and terminations at both ends for the following auxiliary systems:
 - 1. Fire Alarm – for control of doors during fire alarm and for release of door hold-opens connected directly to the fire alarm system;
 - 2. Paging System – Connection to the building wide paging system for pre-alarm all-call tone/announcement;
 - 3. Building Automation System – Connection to the building automation system for signaling for morning entry (first valid swipe and alarm de-activation) and evening vacancy (alarm activation);
 - 4. Elevator – Connection to the elevator controller for card reader access to the elevator;
 - 5. Intercom – Connection to the intercom system panel for signaling of electronic door locks via pushbutton operation of intercom master stations;
 - 6. IP CCTV – Connection to the IP CCTV system for video file links and live video icons on the graphical floor plans.

3.3 MDF, IDF, or SDF ROOMS

- A. Coordinate with Division 26 - Electrical, Division 27 – Communications, and the Cal Poly Facilities Project Manager for control panel and electrical locations in each MDF, IDF, or SDF room.
- B. Submit proposed installation location of the controller panels for formal review and approval by a Cal Poly Representative. It shall not be within the MDF, IDF, or SDF rooms that service the floor where the access control and card readers are located. Controller Panels shall be securely separated from network equipment (e.g. cabinet, fence, gate).
- C. Submit proposed installation and method (e.g. wall mounted) of the access control and card reader controller panels for formal review and approval by a Cal Poly Representative. Controller Panels shall be securely separated from network equipment (e.g. cabinet, fence, gate).
- D. The access control and card reader control panels shall be mounted in a 4-foot wide by 4 feet tall wall area within the proposed location.
- E. The lay-out of the MDF, IDF, or SDF as depicted on the drawings shall be utilized as a general guide for bidding purposes. The final room layout shall be carefully coordinated with input from the Cal Poly Facilities Project Manager and from other trades with equipment and/or cabinets to be placed in the room. Prior to permanent mounting of equipment or termination of cabling, obtain approval of MDF, IDF, or SDF, or other location layout space assignments from the Cal Poly Facilities Project Manager through the Submittal process in accordance with Division 01 - General Requirements and 01 33 00 Submittal Procedures.
- F. Grounding
 - 1. The installing contractor shall be responsible for ensuring the grounding integrity of all installed equipment to eliminate the potential for equipment or personnel hazards due to improperly or inadequately grounded systems.
 - 2. All grounding and bonding shall be in conformance with the National Electric Code, article 250, NFPA 70, and as recommended by ANSI/EIA/TIA-607.

3.4 INSTALLATION

- A. Follow manufacturers installation requirements.

3.5 LABELING

- A. Reference construction drawings accompanying this Division 28 specification.
- B. Comply with 28 00 00 - Electronic Safety and Security.

- C. Contractor shall identify all major items of equipment and tag all cables with permanent type markers to denote equipment served. Cables shall be tagged at both ends and at each point where the cable is administered.
- D. All labeling and recording shall be approved by the Cal Poly Facilities Project Manager prior to application.

3.6 TESTING

- A. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The Cal Poly Facilities Project Manager will witness all performance verification. Original copies of all data produced during performance verification shall be turned over to the Cal Poly Facilities Project Manager at the conclusion of testing prior to final approval. Refer also to Division 01 - General Requirements.
- B. The field testing shall as a minimum include:
 - 1. Verification that alarm points are received, annunciated properly, and transmitted through the central monitoring station.
 - 2. Verification that all motion detectors have the proper coverage patterns and that false alarms are not being generated due to motion coverage patterns into adjacent areas.
 - 3. Verification that all user input and control features are accessible at each keypad and at the control station.
 - 4. Verification that the final system programming including schedules and sequence of operation are performing as expected.
 - 5. Verification that access control features including door control and door position sensing are operating properly and as required by the Cal Poly Facilities Project Manager and as established during the programming phase.
- C. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Cal Poly Facilities Project Manager that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.

3.7 ACCEPTANCE

- A. Once the testing has been completed and the Cal Poly Facilities Project Manager is satisfied that all work is in accordance with the Contract Documents, the Cal Poly Facilities Project Manager will notify the Contractor in writing or via email.

3.8 RECORD (AS-BUILT) DRAWINGS

- A. Comply with Section 28 00 00 - Electronic Safety and Security. Refer also to Division 01 - General Requirements and 01 78 39 Project Record Documents.

END OF SECTION

SECTION 28 23 00 – VIDEO SURVEILLANCE SYSTEMS

PART 1- GENERAL

1.1 DESCRIPTION

- A. The work covered by this section of the Specifications includes all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform a complete installation of the Video Surveillance Systems and Components.
- B. Those specification Sections of this Division 28 and Division 27, if issued in conjunction with this Division 28 specification, that are particularly applicable to this Section include, but are not limited to, the following:
 - 1. Appropriate Application of Conduit. Refer to Division 26 conduit applications unless where specifically identified in the Division 27. Refer to Division 27 for conduit requirements specific to low voltage cabling systems.
 - 2. Division 01 - General Requirements
 - 3. Section 07 84 00 – Firestopping
 - 4. Division 26 00 00 – Electrical
 - 5. Section 27 05 26 - Grounding and Bonding for Communications Systems
 - 6. Section 27 05 33 - Conduits and Backboxes for Communications Systems
 - 7. Section 27 05 37 - Firestopping Systems for Communications Cabling. *Note, Section 27 05 37 takes precedence over Section 07 84 00 in the event of a conflict.
 - 8. Section 27 08 13 - Testing of Copper Cables
 - 9. Section 27 11 00 - Communications Equipment Room Fittings
 - 10. Section 27 15 13 - Copper Station Cable
 - 11. Section 27 15 43 - Communications Faceplates and Modular Jacks
 - 12. Section 28 06 00 - Schedules for Electronic Safety and Security

13. Section 28 13 00 - Access Control Systems

C. Video Surveillance System Description

1. The new system shall be an IP based, POE powered camera Video Surveillance Security system. The System shall include site preparation, running of system wires and cables, system component installation, component testing, and system acceptance. Each system shall be complete and ready for operation.
2. In-line powered (POE) data network connection capable of 1 Gigabit network speed will be provided by the University ITS Department for each IP camera.

1.2 QUALITY ASSURANCE

- A. Refer to Section 28 00 00 for general details. Refer also to Division 01 - General Requirements and Section 01 45 00 Quality Control.

1.3 CODES, STANDARDS, AND GUIDELINES

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations in Section 28 00 00.

1.4 SUBMITTALS

- A. Refer to Section 28 00 00 for general details. Refer also to Division 01 - General Requirements and 01 33 00 Submittal Procedures.
- B. Submit Manufacturer's Cut Sheets for the following:
1. Any products not specifically listed in the PRODUCTS section shall require a submittal of the manufacturer's cut sheets and approval by the Cal Poly Facilities Project Manager.

1.5 WARRANTY

- A. Refer to Section 28 00 00 for general details. Refer also to Division 01 - General Requirements and 01 78 33 Product Warranties and Bonds.

PART 2 - PRODUCTS

2.1 VIDEO SURVEILLANCE SYSTEM COMPONENTS

- A. System Components: Contractor to furnish all video surveillance system cameras and electronics to include, but not necessarily limited to, any battery or UPS support requirements, enclosures, software, cable, and piece parts required by this project.

- B. Cable and Cable Pathway: Contractor shall furnish all necessary wire, cable, accessories, and cable pathway components required for the proper installation of a complete working system. Coordinate supply and installation of cable and cable pathway components with other trades.
 - 1. Cable management devices must be sized to accommodate 100% spare capacity of the final installed cable base.
 - 2. Bridle rings shall not be acceptable.

2.2 APPROVED MANUFACTURERS AND MATERIAL

- A. See Section 28 06 00 – Schedules for Communications for approved manufacturers and material to be supplied for this section. All substitution requests shall follow Division 01 - General Requirements and 01 63 00 Product Substitution Procedures.

PART 3- EXECUTION

3.1 GENERAL

- A. Install systems in accordance with Underwriter Laboratories (UL), National Electric Code (NEC), and all other applicable codes. Install system to comply with drawings and final shop drawings in compliance with manufacturer instructions. Provide all required hardware and labor for rack mounting of head-end system components.
- B. Refer to plans for locations and quantities of equipment. Equipment locations shown on plans will be required to be field coordinated to ensure proper system operation.
- C. No items of equipment shall be installed in such a manner as to void or reduce the proper operating characteristics of individual components or of the system. All devices shall be installed following the manufacturer's recommendations.
- D. Perform all work under the onsite supervision of a factory authorized, certified technician. It shall be the responsibility of the technician to check, inspect and adjust this installation to the Cal Poly Facilities Project Managers approval. If required, a Customer Service Representative of the installing contractor or manufacturer shall train University personnel assigned by the Cal Poly Facilities Project Manager on the proper operation and maintenance of the equipment. Perform all work in conjunction with this installation in accordance with good engineering practices.

3.2 CABLING

- A. All wiring between devices shall be run open wired above accessible ceilings. Where existing cable management systems are in place and there is adequate capacity to install the video surveillance system wiring system wiring, the contractor may utilize these pathways providing they have coordinated with all other wiring contractor on site.
- B. Where pathways do not exist for video surveillance system wiring, the Contractor shall be responsible for providing all required cable management systems such as sleeves, conduits, J-hooks, etc. to support communications cabling to meet building codes and manufacturer's recommendations.
- C. All cabling installed in ceiling spaces that are used for air distribution plenums shall be UL plenum rated.
- D. Cables shall not be laid upon ceilings or supported in a manner that would violate any codes or standards.
- E. All control and signal cable shall be installed continuous and without splices. Furnish appropriate connectors or pre-manufactured cables for each application.
- F. The Contractor shall be responsible for furnishing and installing all required cabling between components to form a complete and operational system meeting all the requirements of this specifications and conjoined construction drawings.

3.3 MDF, IDF, or SDF ROOMS

- A. Digital Video Recorder (DVR), Network Video Recorder (NVR), or Server equipment shall not be located in a MDF, IDF, or SDF Room. DVR, NVR, or Server equipment must be located in an approved University data center. Submit proposed location and installation of this equipment or formal review and approval by a Cal Poly Representative.
- B. The lay-out of the MDF, IDF, or SDF Rooms as depicted on the drawings shall be utilized as a general guide for bidding purposes. The final room layout shall be carefully coordinated with input from the Cal Poly Facilities Project Manager and from other trades with equipment and/or cabinets to be placed in the room. Final configuration of MDF, IDF, or SDF Rooms shall be submitted to the Cal Poly Facilities Project Manager as a coordination drawing with information from all other trades occupying the same room for review prior to permanent mounting of equipment or termination of cabling.
- C. Coordinate surveillance system power requirements with electrical plans and locations of electrical outlets.

D. Grounding

1. The installing contractor shall be responsible for ensuring the grounding integrity of all installed equipment to eliminate the potential for equipment or personnel hazards due to improperly or inadequately grounded systems.
2. All grounding and bonding shall be in conformance with the National Electric Code, article 250 and as recommended by ANSI/EIA/TIA-607.

3.4 LABELING

- A. Reference construction drawings accompanying this Division 28 specification.
- B. Comply with 28 00 00 - Electronic Safety and Security.
- C. Contractor shall identify all major items of equipment and tag all cables with permanent type markers to denote equipment served. Cables shall be tagged at both ends and at each point where the cable is administered.
- D. The contractor shall be responsible for generating and programming the labeling for camera information within the recorder software.
- E. All labeling and recording shall be approved by the Cal Poly Facilities Project Manager prior to application.

3.5 TESTING

A. System Startup

1. The Contractor shall not apply power to the video surveillance system until the following items have been completed:
 - a. Video Surveillance system equipment items and circuitry have been set up in accordance with manufacturer's instructions.
 - b. A visual inspection of the video surveillance system has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
 - c. System wiring has been tested and verified as correctly connected as indicated.
 - d. All system grounding and transient protection systems have been verified as properly installed and connected as indicated.
 - e. Power supplies to be connected to the video surveillance system have been verified as the correct voltage, phasing, and frequency as indicated.

2. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work/equipment.

B. Site Testing

1. General: The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The Cal Poly Facilities Project Manager will witness all performance verification. Original copies of all data produced during performance verification shall be turned over to the Cal Poly Facilities Project Manager at the conclusion of testing prior to final approval.
2. Performance verification testing shall as a minimum include:
 - a. Verification that the video transmission system and any signal or control cabling have been installed, tested, and approved.
 - b. Verification that the Digital Video Recorder (DVR) is fully functional and that the DVR has been programmed as needed for the site configuration.
 - c. Verify that each IP camera is network enabled, verify network settings (IP address, Compression, Video Streaming, etc.), confirm video stream is available at the DVR/NVR and at the remote network clients. Provide digital image from each camera documenting original field of view and lens setting.
3. The Contractor shall deliver a report describing results of functional tests, diagnostics, and network settings including written certification to the Cal Poly Facilities Project Manager that the installed complete system has been tested and is ready to begin operation. The report shall also include the following:
 - a. A copy of the performance verification test procedures.
 - b. Note any objects in the field of view that might produce highlights that could cause camera blinding.
 - c. Note any objects in the field of view or anomalies that may cause blind spots.
 - d. Note if a camera cannot be aimed to cover the zone.
 - e. Note night assessment capabilities and whether lights or vehicle headlights cause blooming or picture degradation.

- f. Note camera locations where low light levels may require supplemental sight lighting or possibly IR Illuminators.

3.6 ACCEPTANCE

- A. Once the testing has been completed and the Cal Poly Facilities Project Manager is satisfied that all work is in accordance with the Contract Documents, the Cal Poly Facilities Project Manager will notify the Contractor in writing or via email.

3.7 RECORD (AS-BUILT) DRAWINGS

- A. Comply with Section 28 00 00 - Electronic Safety and Security. Refer also to Division 01 - General Requirements and 01 78 39 Project Record Documents.

END OF SECTION

SECTION 28 31 16 – MULTIPLEXED FIRE DETECTION AND ALARM SYSTEMS

PART 1- GENERAL

1.1 DESCRIPTION

- A. The work covered by this section of the Specifications includes all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform a complete installation of the Multiplexed Fire Alarm System and Components. In general, the work consists of:
1. Furnish and install complete Multiplexed Fire Alarm System as shown on plans.
 2. System shall:
 - a. Be an intelligent analog system.
 - b. Allow for loading and editing special instructions and operating sequences as required.
 - c. Be capable of on-site programming to accommodate system expansion and facilitate changes in operation.
 - d. Be wired, connected, and left in operating condition.
 - e. Reporting: Public Safety Answering Point (PSAP) shall be to the University Police (UPD).
 3. System includes:
 - a. Control Panel(s)
 - b. Annunciator Panel(s)
 - c. Manual Stations
 - d. Heat Detectors
 - e. Smoke Detectors
 - f. Alarm Indicating Devices
 - g. Terminations

- h. Other necessary material for complete operating systems
- 4. Software operations shall be stored in non-volatile programmable memory within fire alarm control panel. Loss of primary and secondary power shall not erase instructions stored in memory.

1.2 QUALITY ASSURANCE

- A. Refer to Section 28 00 00 for general details. Refer also to Division 01 - General Requirements and Section 01 45 00 Quality Control.

1.3 CODES, STANDARDS, AND GUIDELINES

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations in Section 28 00 00.
- B. Reference Standards
 - 1. IBC - International Building Code
 - 2. IFC - International Fire Code
 - 3. NECA 305 - Standard for Fire Alarm System Job Practices
 - 4. NFPA 72 - National Fire Alarm and Signaling Code
 - 5. NFPA 101 - Life Safety Code
 - 6. UL 268 - Smoke Detectors for Fire Protective Signaling Systems
 - 7. UL 497B - Protectors for Communications and Fire Alarm Circuits
 - 8. UL 521 - Heat Detectors for Fire Protective Signaling Systems
 - 9. UL 864 - Control Units for Fire Protective Signaling Systems
 - 10. UL 1480 - Speakers for Fire Protective Signaling Systems
 - 11. UL 1481 - Power Supplies for Fire Protective Signaling Systems
 - 12. UL 1711 - Amplifiers for Fire Protective Signaling Systems

1.4 QUALIFICATIONS

- A. Equipment shall be supplied by company specializing in fire alarm and smoke detection systems with 5 years documented experience.
- B. Work shall be performed by licensed contractor, regularly engaged in installation and servicing of fire alarm systems.

- C. Furnish proof of 5 years documented experience and factory authorization to furnish and install equipment proposed.
- D. Contractor shall be located within 100 miles of Project site.

1.5 SUBMITTALS

- A. Refer to Section 28 00 00 for general details. Refer also to Division 01 - General Requirements and 01 33 00 Submittal Procedures.
- B. Submit bill of materials listing part number and quantity of components and devices.
- C. Submit general catalog cutsheets of all devices that are to be provided as part of system. Mark cutsheets with items specific to the project when multiple items are identified.
- D. Submit block diagrams showing layout and operation of entire system.
- E. Submit schematic diagrams, of circuits from field devices to terminal strip(s) associated with control panel.
 - 1. Diagrams shall show schematic wiring of equipment; and connections to be made to devices.
 - 2. Terminal connections in equipment shall be numbered to correspond to diagrams.
 - 3. Wiring diagrams shall be coordinated so that terminal numbering, circuit designation and equipment or device designations are same on drawings.
- F. Submit standby battery power calculations.
- G. Submit sound amplifier and strobe power supply calculations showing current draws for every device and module during standby, alarm and trouble conditions.
- H. Submit voltage drop calculations for both initiating and alarming circuits.
- I. Submit list of device addresses with location labeling as they will appear in 2 line, 40 character display of fire alarm panel and remote annunciator.
- J. Submit to Authority Having Jurisdiction (AHJ):
 - 1. Copy of shop drawings as required to show component locations.
 - 2. Upon receipt of comments from AHJ, make resubmissions if required to make clarifications or revisions to obtain approval.
 - 3. All fees associated with this shall be included in the bid.

- K. Submit Manufacturer's Cut Sheets for the following:
 - 1. Any products not specifically listed in the PRODUCTS section shall require a submittal of the manufacturer's cut sheets and approval by the Cal Poly Facilities Project Manager.

1.6 IDENTIFICATION

- A. Coordinate with the Cal Poly Facilities Project Manager and Cal Poly ITS for Identification Requirements and Device Addressing prior to Pre-testing or final testing with local fire deputy.

1.7 DEFINITIONS – Not Used.

1.8 WARRANTY

- A. Refer to Section 28 00 00 for general details. Refer also to Division 01 - General Requirements and 01 78 33 Product Warranties and Bonds.

PART 2 - PRODUCTS

2.1 SYSTEM OPERATIONS

- A. Alarm Initiation
 - 1. System alarm operation after activation of any manual station, automatic detection device, or sprinkler flow switch shall be:
 - a. Appropriate initiating device circuit red LED shall flash on Control Panel and remote annunciator until the alarm has been acknowledged at Control Panel or remote annunciator.
 - b. Once acknowledged, this same LED shall latch on.
 - c. Subsequent alarm received after acknowledging shall flash subsequent zone alarm LED on Control Panel and remote annunciator.
 - d. Acknowledgment of alarm shall not reset activated device.
 - e. Pulsing alarm tone shall occur within Control Panel and remote annunciator until event has been acknowledged.
 - f. Alarm audible-indicating devices shall sound in three pulse temporal pattern until silenced by alarm silence switch at Control Panel or remote annunciator.
 - g. Visual alarm indicating devices shall operate in continuous flashing pattern until system is reset.

- h. Signal to notify the supervising station shall be activated.
 - i. Doors held open by door control devices shall close.
 - j. Mechanical controls shall activate air handling systems as specified by Division 23.
 - 2. System shall have single key to allow operator to display alarms, troubles, and supervisory service conditions, including time and date of each occurrence.
 - 3. Alarm shall be displayed on an 80-character LCD display as follows:
 - a. 40 characters for:
 - 1) Point address and loop number
 - 2) Type of device
 - 3) Point status
 - b. 40 characters for:
 - 1) Custom location label
- B. Silencing
 - 1. Alarm audible indicating devices shall be silenced by operating alarm silence switch or by use of key operated switch at remote annunciator.
 - 2. Strobes shall remain active until system is reset.
 - 3. Subsequent zone alarm shall reactivate alarm signals.
- C. Reset
 - 1. SYSTEM RESET button shall return system to its normal state after an alarm condition has been remedied.
- D. Supervision
 - 1. System shall independently supervise:
 - a. Initiating device circuits.
 - b. Sprinkler flow and tamper switches.
 - c. Independently fused indicating appliance circuits for alarm horn/strobe units.
 - d. Auxiliary manual controls. "Off normal" position of any switch shall cause an "off normal" system trouble.

- e. Auxiliary circuits for addressable relays. Blown fuse or open in circuit shall be visibly and audibly annunciated.
 - f. Remote annunciator panel. Any ground, short, or open in the wiring to fire alarm Control Panel, as well as malfunction of the annunciator panel, shall be annunciated at control panel.
 - g. Incoming power. Power failure shall be audibly and visually indicated at Control Panel and remote annunciator. Green "power on" LED shall be displayed continuously while incoming power is present.
 - h. System Modules for module placement. Should modules become disconnected, system trouble indicator shall illuminate and audible trouble signal shall sound.
 - i. System batteries. Low battery condition or disconnection of battery shall be audibly and visually indicated at Control Panel and remote annunciator.
2. Device activation shall be annunciated at Control Panel and remote annunciator.
 3. Independently supervised circuits shall include visible amber "Trouble" LED to indicate disarrangement conditions per circuit.
 4. Disarrangement conditions of any circuit shall not affect operation of other circuits.
 5. Alarm activation of any initiation circuit shall not prevent subsequent alarm operation of any other initiation circuit.
 6. System shall have provisions for disabling and enabling circuits individually for maintenance or testing purposes.
- E. Power Requirements
1. Provide 120 VAC power via dedicated branch circuit in emergency panel.
 2. Branch circuit shall have "breaker lock" to prevent accidentally de-energizing of power to fire alarm panel.
 3. Circuit breaker shall be painted red and labeled "FIRE ALARM."
 4. Provide disconnect switch for AC power near panel or within Fire Alarm Control Panel itself. Switch shall be labeled "Fire Alarm Power Disconnect."

5. Where new Control Panel is to remain at same location as existing panel, contractor may use existing branch circuit, if it meets requirements stated above.
 6. Provide power surge and transient protection.
 7. Provide back-up battery capacity to operate entire system in normal supervisory mode for period of 24 h with 10 minutes of alarm operation at end of period.
 8. System shall automatically transfer to standby batteries upon power failure.
 - a. Battery charging and recharging operations shall be automatic.
 9. Provide power limited, filtered and regulated battery charger.
 - a. Charger shall:
 - 1) Be combination high rate/float maintenance type
 - 2) Charge fully discharged battery to 70% in 12 h
 - 3) Monitor for AC fail/disconnect, low/no battery, and high battery level
 - 4) Include switches and associated LEDs for high rate and AC disconnect
 - 5) Provide 5 amps of regulated 24 VDC for peripheral devices requiring $\pm 5\%$ regulation and 8 amps at 24 VDC for standard peripheral devices.
 - 6) Be compatible with lead acid batteries
 10. External circuits requiring system operating power shall be 24 VDC and shall be individually supervised and fused at Control Panel.
- F. Smoke Detection Operation
1. Smoke detector alarms shall be processed and reported immediately.
 2. Upon building completion, alarm verification shall be added to detector(s) as directed by project engineer.
 3. Control Panel shall:
 - a. Be capable of displaying number of times (tally) detector has gone into verification mode from the system history.
 - b. Download alarm set point to detector.

- c. Determine condition of each detector by comparing detector's value to stored values.
 - d. Maintain moving average of detectors' smoke chamber value to automatically compensate for dust and dirty conditions.
 - e. Continuously perform an automatic self-test routine on each detector.
 - f. Have capability of being programmed for pre-alarm or two-stage function.
 - g. Clear "detector dirty" trouble after detector has been removed from its base cleaned and replaced.
4. System shall maintain constant smoke obscuration sensitivity for each detector by compensating for environmental factors.
 5. Photoelectric detector's smoke obscuration sensitivity shall be adjustable to within 0.3% of either limit of UL window (0.5% to 4.0%) to compensate for any environment.
 6. System shall indicate when individual detector needs cleaning. When detector's average value reaches predetermined level, trouble MESSAGE shall be audible and visibly indicated at Control Panel. LED on detector base shall glow steady giving visible indication.
 7. For scheduling of maintenance, Control Panel shall generate MESSAGE indication for any detector approaching trouble condition due to dirt or contamination.
 8. Operator shall have capability to manually access the following information for each detector:
 - a. Primary status
 - b. Device type
 - c. Present average value
 - d. Present sensitivity value selected
 - e. Detector range (normal, dirty, etc.)
 9. Values at Control Panel shall be in "percent of smoke obscuration" format, so that no interpretation is required by operator.
 10. Operator shall be able to manually control following for each detector:

- a. Enable or disable detector
 - b. Establish alarm sensitivity
 - c. Control detector's relay driver output
11. It shall be possible to program Control Panel to automatically change sensitivity settings of each detector based on time-of-day and day-of-week. There shall be 3 sensitivity settings available for each detector.
- G. Elevator Recall Operation
1. When an elevator lobby or machine room smoke detector alarm is activated it shall cause Phase I Emergency Recall Operation according to following sequence:
 - a. If alarmed detector is on any floor other than main level of egress, elevator car(s) shall be recalled to main level of egress.
 - b. If alarmed detector is on main level of egress, elevator car(s) shall be recalled to predetermined alternate recall level as determined by the Cal Poly Facilities Project Manager.
 2. Elevator lobby smoke detector shall annunciate on separate zone from other devices.
 3. Zoning shall be done by floor.
 4. Upon reset of Fire Alarm Control Panel, elevators shall automatically resume normal operations.
- H. Elevator Shunt Trip (When required by code)
1. After elevator machine room or elevator shaft heat detector is activated, elevator control panel shall deactivate shunt trip breaker supplying power to elevator.
 2. Specific elevator shaft zone shall be put into alarm and sound general fire alarm.
- I. System Response
1. Maximum elapsed time from sensing fire at non-smoke detector initiating device or second smoke detector until it is recorded at Control Panel and remote annunciator shall not exceed 5 seconds, and not exceed 15 seconds for remote station reporting.

2. Maximum elapsed time for first smoke detector shall not exceed 35 seconds including verification period and not to exceed 40 seconds for remote station reporting.
- J. Air Handling Unit System Operation/Interface
1. Control Panel shall provide alarm interface to air handling/energy management system controllers, which shall perform automatic functions as specified in Division 23.
 2. Fire Alarm Control Panel shall provide manual control mode to override fire alarm panel's signal so that air handling units can be restarted.
 3. New Fire Alarm Control Panel shall provide AHU fan shutdown functions identical to existing. Reconnect existing fan shutdown wiring to new panel.
- K. Sprinkler System Operation/Interface
1. Activation of any standpipe or sprinkler system tamper or water flow switch shall activate system supervisory service audible signal and illuminate LED at Control Panel and remote annunciator.
 2. Control Panel shall provide differentiation between switch operation and opens and/or grounds on initiation circuit wiring.
 3. Pressing acknowledge key will silence audible signal while maintaining supervisory service LED "on" indicating off-normal condition.
 4. Restoring valve to normal position shall cause supervisory service audible signal to pulse indicating restoration to normal position.
 5. Acknowledge key shall silence audible signal.
- L. Manual Evacuation (Drill) Operation
1. Manual evacuation (drill) switch shall be provided to operate alarm indicating appliances without causing other control circuits to be activated.
 2. Should true alarm occur, alarm functions would occur.
- M. LED and LCD Test Operation
1. Activation of Lamp Test switch shall turn on all LED indicators, LCD display, and the local sounder and then return to previous condition.
- N. System Diagnosis

1. System shall include special software to detect, diagnose and report failures and isolate such failures to printed circuit board level.
- O. Watch-Dog Timers
1. System shall include independent "Watch-Dog" timers to detect and report failure of any microprocessor circuit, memory, or software.
- P. Walk Test Operation
1. Actuation of "Walk Test" switch/program at Control Panel shall activate "Walk Test" mode of system, which shall cause following to occur:
 - a. Supervising station circuit connection shall be bypassed.
 - b. Control relay functions shall be bypassed, such as door holders, elevator capture, fan shut down, etc.
 - c. Audio and visual circuits shall be bypassed.
 - d. Control Panel shall show trouble condition.
 - e. Alarm activation of initiation device shall cause audible signals to sound for 2 seconds.
 - f. Control Panel shall automatically reset itself after signaling is complete.
 - g. Momentary opening of initiating or indicating appliance circuit wiring shall cause audible signals to sound for 2 seconds indicating trouble condition.
 - h. If system becomes inactive for period of longer than 30 minutes, Control Panel shall default to normal fire alarm functions.
 - i. Activation of any initiation device shall be silently logged as an alarm condition in historical data file.
 2. Panel shall have capability of dividing system into distinctive walk test groups, minimum of 8 groups.
- Q. One-Way Voice Communications
1. Automatic voice evacuation sequence shall be as follows:
 - a. Audio alarm signal shall consist of alarm tone for maximum of 2 seconds followed by temporal code-three. Temporal code-three shall sound until alarm silence switch at Fire Alarm Control Panel or the remote annunciator has been operated.

- b. Audio alarm operations of speaker circuit selection and alarm tone timing variations shall be activated by system software so that required future changes to evacuation sequence or re-arrangements of audio circuits can be facilitated by authorized personnel without additional components or rewiring.
 - c. System shall be configured to allow for "All Call" and selective voice paging] from the main Control Panel and remote annunciator panel.
2. Selective Paging:
- a. Upon activation of any speaker manual control switch(es), 2 seconds of tone shall sound over selected speakers. At end of this tone, operator shall be able to make announcements via push-to-talk paging microphone over pre-selected speakers.
 - b. Strobes shall flash only in selected area(s) or floor(s).
 - c. Each floor, stairwell and elevator car shall be separate selectable zones.
3. All Call:
- a. Upon activation of "All Call" switch, 2 seconds of tone shall sound over all speakers in system. At end of this tone, the operator shall be able to make announcements via pushto- talk paging microphone overall system speakers.
 - b. Strobes shall flash in all areas or floors.
 - c. System shall default to normal operations if the microphone becomes inactive for more than 1 minute.
- R. Documentation Cabinet
- 1. Provide cabinet to meet 2016 NFPA 72 Section 7.7.2 Document Accessibility:
 - a. Section 7.7.2.1 With every new system, a documentation cabinet shall be installed at the system control unit or at another approved location at the protected premises.
 - b. Section 7.7.2.2 The documentation cabinet shall be sized so that it can contain all necessary documentation.
 - c. Section 7.7.2.3* All record documentation shall be stored in the documentation cabinet.

- d. Section 7.7.2.4 Where the documentation cabinet is not in the same location as the system control unit, its location shall be identified at the system control unit.
- e. Section 7.7.2.5 The documentation cabinet shall be prominently labeled SYSTEM RECORD DOCUMENTS.
- f. Provide wall mounted document tube for the construction record drawings. Ensure access to document tube for retrieval of the construction record drawings.

2.2 ENCLOSURE

- A. Provide cabinets of sufficient size to accommodate equipment.
- B. Cabinet shall be equipped with door, with lock and transparent door panel, providing tamper proof enclosure and allowing full view of various lights and controls.

2.3 CONTROL PANEL

- A. Control Panel shall be modular, expandable with solid state, microprocessor-based electronics.
- B. Control Panel shall provide the following features:
 - 1. Support intelligent (analog) detection devices.
 - 2. Number of initiating device loops required for specified quantity of initiating devices plus 1 spare loop for each 5 active loops. Each active loop shall include 5% spare capacity.
 - 3. Number of indicating device (horn/speaker) circuits required for quantity of horns/speakers alarm, plus 1 spare circuit for each 10 active circuits. Each active circuit shall include 25% spare capacity.
 - 4. Number of indicating device (strobe) circuits required for specified quantity of strobes plus one (1) spare circuit for each 10 active circuits. Each active circuit shall include 25% spare capacity.
 - 5. 80-character liquid crystal display
 - 6. Printer interface
 - 7. History log file with minimum of 600 events
 - 8. Field programmable

9. Drift compensation
 10. Sensitivity display in %
 11. Sensitivity adjustment
 12. Day/night sensitivity adjustment
 13. Auto detector test
 14. Silent walk test
 15. Maintenance alerts
- C. System shall provide ability to recall alarms and trouble conditions in chronological order.
- D. Under normal condition viewing window shall display "System is Normal" message and current time and date.
- E. When an abnormal condition occurs appropriate LED (Alarm, Supervisory or Trouble) shall flash.
- F. Audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
- G. Panel shall display the following information relative to abnormal condition of a point in system prior to acknowledgement:
1. 40 characters for:
 - a. Point address and loop number
 - b. Type of device (i.e. smoke, pull station, water-flow)
 - c. Point status (i.e. alarm, trouble)
 2. 40 characters for:
 - a. Custom location label (i.e. 4th Floor - Room 444)
- H. Keyboards or keypads shall not be required to operate the system during fire alarm conditions.
- I. Following software functions shall be provided:
1. Setting of time and date
 2. LED testing
 3. Alarm, trouble, and abnormal condition listing

4. Enabling and disabling of each monitor point separately
 5. Activation and deactivation of each control point separately
 6. Changing operator access levels
 7. Walk Test enable
 8. Running diagnostic functions
 9. Displaying historical logs
 10. Point listing
- J. Following hardware functions shall be provided:
1. Acknowledge alarm or trouble
 2. Silence alarm or trouble
 3. Reset system after alarm
 4. Provide manual evacuation (drill)
 5. Bypass elevator recall and shunt trip operation
 6. Bypass door holders
 7. Allow computer interface

2.4 STATUS INDICATORS AND DISPLAYS

- A. Audible device shall sound during Alarm, Trouble or Supervisory conditions.
- B. Audible device shall sound during each key-press.
- C. Visual display shall distinguish between alarm, trouble and supervisory conditions.
- D. Indicators and displays to be visible:
 1. One red system alarm LED
 2. One yellow supervisory service LED
 3. One yellow trouble LED
 4. Green "power on" LED
 5. Eighty-character LCD
- E. 2-line by 40-character LCD shall be backlit.
- F. Cursor shall be visible on LCD when entering information.

- G. Scrolling through menu options shall be in self-directing manner in which prompting messages shall direct user.
- H. Controls shall be located behind an access door.
- I. Status data to be available on display:
 - 1. Initiating device circuits
 - 2. Indicating device circuits
 - 3. Auxiliary relays
 - 4. Primary State of point
 - 5. Zone information
 - 6. Class "A" Status
 - 7. Current priority of outputs
 - 8. Disable/Enable status
 - 9. Automatic/Manual Control Status of output points
 - 10. Acknowledge status

2.5 **CONTROLS**

- A. Controls (one switch per function per system) visible through front viewing window:
 - 1. Alarm Acknowledge key
 - 2. Trouble Acknowledge key
 - 3. Alarm Silence key
 - 4. System Reset key
- B. Controls accessible with front door open:
 - 1. Supervising station disconnect/switch
 - 2. Manual evacuation (drill)
 - 3. Elevator bypass
 - 4. Fan shut down override/bypass switches
 - 5. Door holder release bypass
 - 6. Key pad for data input and microprocessor control

2.6 LED SUPERVISION

- A. Slave module LEDs shall be supervised. When problem occurs, LCD shall display module and LED location.

2.7 ACKNOWLEDGMENT

- A. Two methods of acknowledgment for each abnormal condition shall be provided:
 - 1. Acknowledge one event at a time from an unacknowledged list of events.
 - 2. Pressing acknowledge button shall display first unacknowledged condition in list (either alarm, supervisory or trouble), and require another acknowledge button. Press to acknowledge only displayed point.
- B. After all points have been acknowledged, LEDs shall glow steadily, and alarm will be silenced. Total number of alarms, supervisory and trouble conditions shall be displayed.
- C. Pressing appropriate acknowledge button shall acknowledge all points.
- D. Acknowledge functions shall be behind locked door or pass-code protected.

2.8 SILENCING

- A. If an alarm condition exists and "Alarm Silence" button is pressed, all alarm signals shall cease operation. Strobes shall remain active until system is reset.
- B. If trouble conditions exist in system and "Trouble Silence" button has been pressed, audible trouble signal shall cease, but shall resound at timed intervals to act as reminder that fire alarm system is not in normal operating mode.

2.9 RESET

- A. SYSTEM RESET button shall be used to return system to normal state after alarm condition has been remedied.
- B. Should an alarm condition continue to exist, system shall provide indications that resetting cannot be completed and shall remain in an abnormal state.
- C. Sonalert and Alarm LED shall remain activated.
- D. Display shall indicate total number of alarms and troubles present in system along with prompt to use ACK keys to review points.
- E. Points shall not require acknowledgment if they were previously acknowledged.

- F. Should Alarm Silence Inhibit function be active, system shall ignore all key presses. An indication of enabling and disabling inhibit state shall be provided as feedback to operator.

2.10 ACCESS LEVELS

- A. Provide 4 access levels with level 4 being highest level. Level 1 actions shall not require pass-code.
- B. Pass-codes shall consist of up to 5 digits.
- C. Pass-code digits entered shall be displayed as an X to indicate that digit has been accepted.
- D. Key presses shall be acknowledged by local audible sound.
- E. When correct pass-code is entered, system shall indicate to operator "Access Granted."
- F. Access level shall be in effect until operator manually logs out or keypad has been inactive for 5 minutes.
- G. Operator entering invalid code shall be notified with message "Incorrect Pass-Code" and shall be allowed three chances to enter valid code. After three unsuccessful tries, the message "Access Denied" shall be displayed.
- H. Following keys/switches shall have associated access levels:
 - 1. Alarm Silence
 - 2. System Reset
 - 3. Set Time/Date
 - 4. Manual Control
 - 5. On/Off/Auto Control
 - 6. Disable/Enable
 - 7. Programming functions
 - 8. Clear Historical Alarm Log
 - 9. Clear Historical Trouble Log
 - 10. Walk Test

- I. Acknowledge keys shall require pass code access to acknowledge points. If operator presses an (ACK) key with insufficient access, an error message shall be displayed.

2.11 POINT LISTING

- A. Point list menu includes:
 1. All points list by address
 2. Monitor point list
 3. Signal/speaker list
 4. Auxiliary control list
 5. Feedback point list

2.12 HISTORY LOGGING

- A. System shall be capable of logging and storing the last 400 events (alarm and trouble) in history log. These events shall be stored in battery protected random access memory.
- B. Following historical alarm log events shall be stored:
 1. Alarms
 2. Alarm Acknowledgment
 3. Alarm Silence
 4. System Reset
 5. Alarm Historical log cleared
- C. Following historical trouble log events shall be stored:
 1. Trouble conditions
 2. Supervisory alarms
 3. Trouble acknowledgment
 4. Supervisory acknowledgment
 5. Walk Test results
 6. Trouble Historical log cleared

2.13 COMPUTER INTERFACE

- A. Control Panel shall operate as proprietary local system with capability of sending status data to and receiving control data from Central Processing Unit (CPU).
- B. CPU shall monitor all alarms and troubles and control selected functions of Control Panel.
- C. CPU shall supervise all data communication wiring between CPU and Control Panel for opens, shorts and grounds.

2.14 FIELD PROGRAMMING

- A. System shall be fully programmable, configurable, and expandable in field and shall not require replacement of memory IC's.
- B. Programming may be accomplished through Control Panel keyboard or keyboard at printer or use of PC.
- C. Programs shall be stored in non-volatile memory.
- D. Programming or reprogramming shall be done by supplier at no charge until system is accepted by the Cal Poly Facilities Project Manager.

2.15 TERMINAL/PRINTER INTERFACE

- A. Control Panel shall be capable of operating remote monitors and/or printers.
- B. Output shall be ASCII from RS-232-C connection with an adjustable baud rate.
- C. Each RS-232-C port shall be capable of supporting and supervising up to 4 remote CRTs and Printers.
- D. Data amplifiers shall be used to increase CRT or printer line distance.

2.16 INTELLIGENT NETWORK

- A. System shall provide communications with intelligent initiating and control devices individually.
- B. Devices shall be individually annunciated at control panel.
- C. Annunciation shall include the following conditions for each point:
 - 1. Alarm
 - 2. Trouble
 - 3. Open
 - 4. Short
 - 5. Device missing/failed

- D. Devices shall have capability of being disabled or enabled individually.
- E. There shall be no limit to number of detectors, stations, or addressable modules, which may be activated or "in alarm" simultaneously.
- F. Multiple intelligent devices shall be connected to a single pair of wires.
- G. Communication format must be completely digital poll/response protocol to allow t-tapping of circuit wiring.

2.17 ONE-WAY VOICE COMMUNICATION SYSTEM

- A. Provide central audio control module for:
 - 1. Alarm message/tone generation
 - 2. Main and remote microphone connections
 - 3. Mixer/pre-amplifier circuits
 - 4. Continuous supervision shall be provided for all circuits, amplifiers and modules.
- B. Hand-held, push-to-talk microphone:
 - 1. Recessed in panel-mounted enclosure
 - 2. Dynamic communication type with frequency range of 200 Hz to 4000 Hz
 - 3. Equipped with self-winding 5' coiled cable
 - 4. LED indicator shall be provided to indicate microphone push-to-talk button has been pressed and speaker circuits are ready for transmission.
 - 5. Supervised for disconnection
- C. Audio control switch module:
 - 1. Provide manual access to audio operations personnel.
 - 2. Include "All circuits" switch, "Aux Tone" switch and tone generator stop switch.
 - 3. Switches and LED indicators shall be supervised for disarrangement on failure.
- D. Automatic message player:
 - 1. Provide a pre-recorded digitized voice message to building occupants during alarm conditions.

2. Not rely on tape or other mechanical means of transmitting evacuation message.
3. Be capable of transmitting a custom message of up to 3 minutes long.
- E. Self-contained speaker and switching arrangement shall provide testing of message(s) without disturbing occupants of the facility.
- F. Provide standard message, approved by Authority Having Jurisdiction.
- G. Audio power amplifiers:
 1. Be furnished with self-contained filtered 24 VDC power supply, transformer and amplifier monitoring circuits.
 2. Provide 25 or 75 VRMS output with frequency response of 100 Hz to 7000 Hz.
 3. Be constantly monitored.
 4. Be current limited or disconnected from circuit should a short develop on speaker circuit.
 5. Individual speaker circuits shall not be loaded more than 70% of rated amplifier power output.
- H. Provide amplifiers to operate system speakers at 1-watt tap simultaneously plus 50% reserve capacity.
- I. Provide at least one back-up amplifier capable of automatically replacing any failed amplifier. Standby amplifier shall be rated at same output capacity as the largest amplifier in evacuation system.
- J. Speaker and strobe circuits shall be zoned by floor or as noted on plans, with isolating module on each circuit.
- K. Audio Evacuation Supervision:
 1. Each speaker zone, amplifier, preamplifier, and power supply shall be supervised for component or circuit failure.
 2. Detection of amplifier failure shall automatically cause substitution of stand-by amplifier and shall activate trouble light and audible signal at console and initiate trouble alarm on fire alarm system.
 3. Provide minimum of one circuit for each zone or area of distinct communication.

- L. Manual Voice Paging Sequence
 - 1. System shall allow selective voice paging.
 - 2. An "All Call" switch shall be provided to allow for activation of all speakers.
 - 3. Control Panel shall provide a method for remote fire fighters telephone patch-in to one-way voice communication speakers.
 - 4. Manual operation shall be controlled at Fire Alarm Control Panel, or remote microphone; if provided.

- M. Tones
 - 1. Main evacuating tone shall be temporal code-three.
 - 2. Optional tones shall include:
 - a. Hi/Lo
 - 1) Free running tone with high frequency of 544 Hz and low frequency of 440 Hz.
 - 2) "On time" (Hi) shall be 100 milliseconds while the "off time" (Lo) is 400 milliseconds.
 - b. Slow whoop
 - 1) Slowly ascending tone from 200 to 830 Hz in 2.5 seconds.
 - 3. One primary and one secondary tone generator shall be furnished.
 - a. Automatic transfer to secondary unit should primary unit fail.
 - b. Trouble signals shall indicate a failure of either primary or secondary unit.

2.18 REMOTE ANNUNCIATOR PANEL

- A. Provide 80-character LCD remote annunciator panel.
 - 1. LED annunciators will not be accepted.

- B. Annunciator shall provide:
 - 1. Control push-button switches for; alarm silence, trouble silence, system reset and LED and LCD test.
 - 2. Tone Alert - Duplicates Control Panel tone alert during alarm and trouble conditions.
 - 3. System trouble LED

4. System alarm LED
 5. Power on LED
 6. 4 programmable control switches for other functions.
 7. To accommodate and facilitate job site changes control switches shall have capability of being programmed on site to provide additional or nonstandard operations and functions.
- C. Annunciator shall communicate to Control Panel over one shielded twisted pair cable.
- D. Operating power shall be 24 VDC and be fused at control panel.
- E. Annunciator shall have finish approved by architect.
- F. Wiring between annunciator panel and Control Panel shall be supervised for opens, grounds and shorts.
- G. Under normal operating conditions, LCD shall indicate time, date and "SYSTEM IS NORMAL" label.
- H. During abnormal conditions, LCD shall indicate type and number of abnormal conditions, such as alarms, troubles, and supervisory services.

2.19 MULTIPLEXED PERIPHERAL DEVICES

- A. Devices shall be supervised for trouble conditions.
- B. Failure of device shall not hinder operation of other system devices.
- C. Device Identification
1. Each intelligent device shall be identified by an address code.
 2. Location of end-of-line device shall be indicated on device that containing same.
 3. System must verify that proper type device is in place and matches software configuration.
- D. Intelligent Detector Bases
1. Either base or head shall contain electronic circuits that communicate detector's status (normal, alarm, sensitivity status, trouble) to Control Panel over two wires. Same two wires shall also provide power to base and detector.

2. Contacts between base and head shall be of bifurcated type using spring-type, self-wiping contacts.
 3. Base shall have locking capability. Locking feature must be field removable when not required.
 4. Upon removal of detector's head, trouble signal shall be transmitted to Control Panel.
 5. Detector base or head shall contain LED(s) that flash when detector is being scanned by Control Panel.
 6. LED(s) shall turn on steady when detector is in alarm condition.
- E. Intelligent Detector Heads - General
1. Intelligent detector heads shall be low-profile type.
 2. Heads shall be plug-in units, which mount to common base.
 3. Heads shall be 24 VDC type.
 4. Heads may be reset by actuating Control Panel reset switch.
 5. To minimize false alarms, voltage and RF transient suppression techniques shall be employed.
 6. Smoke detectors:
 - a. Listed for sensitivity testing from Control Panel. Sensitivity test results shall be logged and downloaded to printer.
 - b. Include an insect screen.
 - c. Communicate actual smoke chamber values to Control Panel.
 - d. Covered with plastic bags after installation to maintain cleanliness. Bags shall be red for quick visual identification for removal at time of occupancy.
 7. Install smoke detectors on circuits with alarm verification modules.
- F. Intelligent Photoelectric Smoke Detectors
1. Detectors:
 - a. Contain no radioactive material
 - b. Be of solid-state photoelectric type and shall operate on light scattering photodiode principle using pulsed infrared LED light.

G. Intelligent Heat Detectors

1. Detectors:

- a. A combination rate-of-rise and fixed temperature (135°F unless noted).
- b. Sense within temperature range of 32° to 158°F. The control panel shall be capable of sensing either a set point of 135°F, or a rate-of-rise of [15°F] [20°F] per minute for fire sensing.

H. Intelligent Duct Smoke Detectors:

1. Duct detectors shall be of photoelectric ionization type.
2. Detectors shall be rated for air velocity to be expected.
3. It shall be possible to alarm duct detector by using remote or local test switch.
4. It shall be possible to clean sampling tubes by access through duct housings front cover.
5. Provide relays adjacent to motor controller, and remote keyed test switch and alarm LED indicator.
6. In mechanical rooms, alarm LED indicators shall be grouped on a stainless-steel cover plate.
 - a. Mount adjacent to main mechanical room door.
 - b. Each LED shall be labeled with detectors loop and address.
 - c. Floor plan of room showing detectors and addresses shall be located adjacent to cover plate.
 - d. Provide Plexiglas cover over plan.

I. Manual Stations

1. Manual stations:

- a. Double action.
- b. Constructed of high impact, red Lexan with raised white lettering and smooth high gloss finish.
- c. Contain circuits that communicate station's status (alarm, normal) to Control Panel over two wires.

- d. Mechanically latch upon operation and remain so until manually reset. Stations that use Allen wrenches or special tools to reset shall not be accepted.
 - e. Fitted with screw terminals for field wire attachment.
 - 2. Address shall be field programmable on station.
 - J. Interface Modules - General
 - 1. Interface Modules:
 - a. Receive 24 VDC power from separate two wire circuit.
 - b. Available in either Class B or Class A supervision version.
 - c. Supervised and identified by Control Panel.
 - d. Capable of being programmed for its "address" location.
 - e. Compatible with addressable manual stations and intelligent detectors on same intelligent initiating circuit.
 - 2. Class A wiring shall be looped back and connected to module.
 - 3. Class B wiring shall be supervised by an end-of-line device.
 - 4. Should interface module become non-operational or removed, trouble signal shall be transmitted to Control Panel.
 - 5. Interface module LED's shall be clearly visible on the face of the trim plate.
 - K. Interface Modules - Supervised Control
 - 1. Interface Modules shall be used for control of indicating appliances, door holders, and AHU systems.
 - 2. For signals, speakers, fire fighter phone jacks and other device control interface module shall provide double-pole/double-throw relay switching that can connect any of the following through 2 amp fuses:
 - a. Zone of signals to power source.
 - b. Speakers to audio source.
 - c. Fire fighter phone jacks to communications channel.
 - d. Variety of controlled devices to appropriate controlling circuits.
 - 3. Interface modules:

- a. Communicate supervised wiring status (normal, trouble) to fire alarm control panel.
 - b. Receive from fire alarm control panel command to transfer relay.
- L. Interface Modules - Supervised Monitoring
1. Interface Modules:
 - a. Suited for monitoring of water-flow, valve tamper, and non-intelligent detectors.
 - b. Addressable interface module shall be provided for interfacing normally open- direct contact devices to an intelligent initiating circuit.
 - c. Provide power to and monitor status of zone consisting of conventional 2-wire smoke or heat detectors and N/O contact devices.
 - d. Communicate zone's status (normal, alarm, trouble) to Control Panel.
 2. Supervision of zone wiring shall be Class B or Class A.
- M. Interface Modules - Non-Supervised Control
1. Interface module shall provide double-pole/double-throw relay switching for loads up to 120VAC. It shall contain 2 amp fuses, one on each common leg of relay.

2.20 SPEAKER/STROBE DEVICES

- A. Combination Speaker/Strobe Devices
1. Speakers:
 - a. Operate on 24 V DC circuit.
 - b. Include separate wire leads for in/out wiring for each leg of associated signal circuit. T-tappings of signal device conductors shall not be acceptable.
 - c. Be suitable for rear mounting behind audio-visual assemblies, which shall be flush or semi-flush mounted, with manufacturer back boxes and flush trim ring.
 - d. Have field adjustable output taps, 3 taps minimum.
 - e. Provide minimum sound pressure level of 85.7 dBA at 10' using 1-watt tap.

- f. Speakers located in mechanical room shall have 3 taps minimum with 8W being the highest.
 - g. Provide a minimum sound pressure level of 90 dBA at 10' using the 2-watt tap.
 - h. Include a blocking capacitor for line supervision and screw terminal for in-out wiring.
2. Strobes shall be:
- a. Multi-tap units with taps at 15, 30, 75, and 110 cd.
 - b. Tapped at 15-candela peak power or as noted on drawings.
 - c. Have flash synchronization module on circuit when more than one strobe is visible at a time.
 - d. On separate supervised circuit from speaker circuit.
3. White Lexan lens shall have "FIRE" in red lettering visible from a 180-degree field of view.
4. Have off-white semi flush housing.
5. Strobe circuit loading shall be calculated at 75 cd tap for all devices, except in mechanical, interstitial spaces where circuit loading shall be calculated at 110 cd tap.
- B. Speaker Devices
- 1. Speakers without strobe units:
 - a. Include above-listed features
 - b. Flush ceiling mounted white baffle and recessed back box for installation in suspended ceiling system.
 - c. Red baffle with surface mounted back box, furnished by speaker manufacturer, where installed in areas with exposed structure.
 - d. Cast metal grille and back box where installed in mechanical/interstitial spaces.

2.21 CONVENTIONAL PERIPHERAL DEVICES

- A. Sprinkler Waterflow Switches - Wet Systems
- a. To be furnished and installed by Fire Protection Contractor under Division 21.

- b. To prevent false alarms, flow switch shall incorporate adjustable time delay mechanism between the paddle-operated stem and alarm initiating contacts.
 - c. Tapped 1/2" conduit connection.
- B. Sprinkler Valve Tamper Switches - Wet Systems
 - 1. Sprinkler valve tamper switches shall be furnished and installed by Fire Protection Contractor under Division 21.
 - 2. Switch shall be provided with either 1 or 2 sets of S.P.D.T. micro switches as required.
- C. Door Holders
 - 1. Magnetic door holders:
 - a. Provided by the General Contractor.
 - b. Capable of being surface, flush, or semi-flush mounted as required.
 - 2. Power for door holders shall be 24 V.
- D. Fault Isolator Module
 - 1. Provide Fault Isolator Module (FIM) on initiating device circuits in following situations:
 - a. Loop extends to another floor
 - b. Loop extends to another building
 - c. For each 25 devices on a loop
 - 2. Fault Isolator Module shall:
 - a. Automatically re-connect isolated section of loop upon correction of fault conditions.
 - b. Not require any address setting.
 - c. Operations shall be totally automatic. It shall not be necessary to replace or reset FIM after its normal operation.
 - d. Include LED, which shall flash under normal operation and illuminate steady to indicate short circuit.

2.22 ISOLATED LOOP CIRCUIT PROTECTORS (ILCP)

- A. Fire Alarm Control Panel shall include Isolated Loop Circuit Protector (ILCP) on circuits which extend beyond building. Circuits include, initiating device circuits, alarm notification appliance circuits, and signaling line circuits.
- B. ILCP shall:
 - 1. Be located as close as practical to point where circuits leave or enter building.
 - 2. Have line-to-line response time of less than 1 nanosecond.
 - 3. Have #12 AWG grounding conductor with maximum length of 25'. It shall be run in straight line and connected to building grounding electrode system.
- C. Spark gap devices or devices incorporated in or installed within control panel in lieu of ILCP are not acceptable.

2.23 PRINTERS AND TERMINALS

- A. Multiplex/intelligent systems shall be provided with printer and terminal (keyboard and CRT).
- B. Printer
 - 1. Desktop 80-column, impact dot matrix printer.
 - 2. Printer shall receive English language text from Control Panel in standard ASCII format via RS-232-C connection.
 - 3. Printed information shall include time, date, status, point number, label, and device type identifier.
 - 4. Printer shall have the following features:
 - a. 120 VAC input power
 - b. 180 characters per second printing speed
 - c. 3 kilobytes buffer capacity
 - d. Cartridge type ribbon
 - e. Friction feed for cut forms
 - f. Tractor feed for continuous 9-1/2" wide pin-to-pin fanfold paper
- C. Terminal
 - 1. Desktop terminal (monitor with detachable keyboard) with English language and display of time and date of system events.

2. Monitor shall be tilt/swivel, with 14", green phosphor, non-glare CRT.
3. Displayed information shall include time, date, status, point number, label, and device type identifier.
4. Information on screen shall not scroll off until an acknowledge key is pressed.
5. Terminal shall include composite video output to drive slave monitors.
6. Terminals shall provide and control the following:
 - a. Acknowledgment of alarms, troubles and supervisory conditions
 - b. Alarm silence
 - c. System Reset
 - d. Time and Date
 - e. Alarm, Trouble and Supervisory service conditions summary screens

2.24 APPROVED MANUFACTURERS AND MATERIAL

- A. See Section 28 06 00 – Schedules for Communications for approved manufacturers and material to be supplied for this section.

PART 3- EXECUTION

3.1 GENERAL

- A. Class A circuiting shall be used.
- B. Installation shall be done in neat, workmanlike manner in accordance with manufacturer's recommendations.
- C. Smoke detectors shall not be mounted until construction is completed.

3.2 RACEWAYS

- A. Fire Alarm Panel risers shall be in conduit system separate from other building wiring.
- B. Wiring shall be in conduit system separate from other building wiring. See Section 26 05 33 - Raceway and Boxes for Electrical Systems.
- C. Minimum 3/4" steel raceway.
- D. Contractor shall size conduit and boxes by circular mil size of cable in conduit or box.

- E. Surface access to existing alarm initiating circuits in public areas shall be via surface metal raceways (minimum equivalent to 3/4" conduit) and box extensions.
- F. Existing conduit and surface metal raceway that are not 3/4" size may be reused if found to have adequate space for existing and new conductors.

3.3 CONDUCTORS

- A. Cables and wires shall be provided per manufacturer shop drawings.
- B. Conductors shall be color-coded. Coding shall be consistent throughout the facility.
- C. Green wire shall be used only for equipment ground.
- D. Control Panel power wiring shall be #12 AWG.
- E. Control Panel shall have #12 AWG equipment ground wire.
- F. Where fire alarm circuits enter or leave building, additional transient 75 to 90 V gas tube protection shall be provided for each conductor.
- G. Cable Detector Loops shall be twisted pair with shield jacket. Shield shall be connected to earth ground only at control panel.
- H. Detector wiring shall not be in same conduit with 120/240 VAC wiring or other high current circuits.
- I. T-taps or branch circuit connections allowed for class B intelligent loop circuits.
- J. Leave 8" wire tails at each device box and 36" wire tails at Control Panel and Remote Annunciator Panel(s).
- K. Cable for RS 232-c devices (CRT, PRINTER) shall be two, shielded twisted pair.
- L. Cable for RS 485 devices (Remote Annunciators) shall be shielded-twisted pair for data signal.
- M. Wiring of initiating device circuits, alarm horn circuits, and alarm strobe circuits shall be #14 AWG minimum.
- N. Fire alarm cable shall be held in place at device box by means of 2-screw connector, (do not use squeeze or crimp type connectors).
- O. Splices or connections shall be made within approved junction boxes and with approved fittings.

- P. Boxes shall be red and labeled "FIRE ALARM SYSTEM" by decal or other approved markings.
- Q. Horn and strobe circuits shall have separate conductors and shall operate independently of each other.
- R. Tray cable is not acceptable for use as fire alarm systems raceway.

3.4 DEVICE MOUNTING

- A. Recommended mounting heights, and requirements are as follows:
 - 1. Fire Alarm Control Panels
 - a. Mount control panel so visual indicators and controls at 60" above floor level.
 - 2. Remote Annunciators
 - a. Mount panel so visual indicators and controls at 60" above floor level.
 - b. Install multi-gang box as required by manufacturer, flush or surface mounted.
 - 3. Audio-Visual Devices
 - a. Install flush, semi-flush or surface mount 6" below finished ceiling or 80" from bottom of device to finished floor.
 - b. No devices protruding 4" or more shall be installed lower than 80".
 - c. Audio/visual devices may be installed on the ceilings in accordance with NFPA 72 - Table 2-A.
 - d. For surface mounting, use manufacture-supplied backboxes and trim plates.
 - e. Mark each device with its circuit number.
 - 4. Manual Stations
 - a. Operable part of manual stations shall be installed not less than 3-1/2' (42") and not more than 4-1/2' (54") above finished floor.
 - b. Manual stations shall be in unobstructed locations.
 - c. For surface mounting, use manufacturers supplied backboxes and trim plates.
 - d. Mark unit's address on inside and outside of housing.

5. Heat and Smoke Detectors

- a. Location of detectors shown on plans is schematic only. Detectors must be located according to code requirements.
- b. Surface mounted detectors shall be installed using back boxes equal to base size. Standard octagon and square boxes are not acceptable.
- c. Detectors shall be located on the highest part of smooth ceiling so that edge of detector is no closer than 4" from sidewall.
- d. Ceilings with beams, joists or soffits that exceed 8" in depth require special planning and closer spacing.
- e. Mount detectors on sidewalls with top of detector no closer than 4" from ceiling and no further away than 12".
- f. Smoke detectors shall not be installed closer than 3' from air supply diffusers.
- g. No detectors shall be installed in direct airflow.
- h. Heat and smoke detectors should be located near center of open area, which they protect.
- i. Mark zone number and ranking of each detector on its base.
- j. For intelligent systems, mark address and loop number on each detector's base.

3.5 DEMOLITION

- A. Existing equipment that is removed shall be inventoried and turned over to the Cal Poly Facilities Project Manager.
- B. Upon inspection by the Cal Poly Facilities Project Manager, Contractor shall dispose of equipment that is deemed useless to the University.
- C. Contractor shall remove abandoned devices and conduit not being reused.

3.6 IDENTIFICATION LABELS

- A. Junction boxes shall be painted red and labeled "Fire Alarm."
- B. Circuits must be labeled with name of circuit and area being served by circuit.
- C. Labels shall be permanent, and be machine generated. NO HANDWRITTEN OR NONPERMANENT LABELS SHALL BE ALLOWED.

- D. Labels shall be self-laminating, white/transparent vinyl and be wrapped around cable.
- E. Flag type labels are not allowed.
- F. Labels shall be of adequate size to accommodate circumference of cable being labeled and properly self-laminate over full extent of printed area of label.
- G. Adhesive type labels not permitted except for phase and wire identification.
- H. Wiring color code shall be maintained throughout installation.
- I. Green wire shall be used only for equipment ground.

3.7 MANUFACTURER'S SERVICES

- A. Supervision of installation shall be provided by trained service technician from manufacturer of fire alarm equipment.
- B. Technician shall be US certified and have had minimum of 2 yrs of service experience in fire alarm industry.
- C. Technician's name shall appear on equipment submittals, and letter of certification from fire alarm manufacturer shall be sent to project engineer.
- D. Manufacturer's service technician shall be responsible for following items:
 - 1. Pre-installation visit to job site to review equipment submittals and verify method by which system shall be wired.
 - 2. Make periodic job site visits to verify installation and wiring of system.
 - 3. Upon completion of wiring, final connections shall be made under supervision of technician.
 - 4. At time of final checkout, technician shall give operational instructions to the Cal Poly Facilities Project Manager.
 - 5. Job site visits shall be dated and documented in writing and signed by Electrical contractor.
 - 6. Discrepancy shall be noted on document and copy kept in system job folder, which shall be available to project Engineer any time during project.

3.8 INSTALLATION

- A. To be completed in accordance with the Manufacturers requirements.

3.9 GROUNDING AND BONDING

- A. To be completed in accordance with the Manufacturers requirements.

3.10 TESTING

- A. Manufacturer's authorized representative shall perform complete functional test of each system and submit written report to Contractor attesting to proper operation of completed system prior to final inspection.
- B. Contractor shall test each device in system before system is considered substantially complete.
- C. Contractor shall formally request pre-inspection by Cal Poly Construction Inspector for 100% device testing (e.g. pull stations, fire smoke dampers, duct detectors, smoke detectors, heat detectors, interconnected systems such as Ansul systems) prior to the local Fire Marshal testing. Contractor shall provide filled out Pre-Test Sheet noting the Device, Address, and Description at the start of the to the Cal Poly Construction Inspector pre-inspection.
- D. Completed fire alarm system shall be fully tested by Contractor in presence of the Cal Poly Facilities Project Manager and local Fire Marshal.
- E. Upon completion of successful test, Contractor shall:
 - 1. Certify system to the Cal Poly Facilities Project Manager in writing.
 - 2. Complete NFPA 1-7.2.1 record of completion form.
 - 3. Provide as-builts and O&M manuals.
 - 4. Provide Record Drawings in AutoCAD and PDF format on CD for review
 - 5. Submit three copies on CD's and two copies on USB of the final record drawings in AutoCAD and PDF format.

3.11 WARRANTY

- A. Warrant completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of 2 years from the date of substantial completion of project.
- B. Post warranty period along with company's name and telephone number inside fire alarm panel.
- C. Warranty service for equipment shall be provided by system supplier's factory trained representative.
- D. Warranty shall include parts, labor, and necessary travel.

- E. Occupied facility shall not be without UL and NFPA approved and fully operational fire alarm system for period longer than 2 h. Emergency response shall be provided within 2 h of notification, to contractor, of failure of system to perform operationally per UL and NFPA standards.
- F. Non-emergency service calls shall be responded to within 24 h of notification to contractor.
- G. Repairs and/or replacement shall be completed within 72 h of time of notification. Other than emergency, actual repairs and/or replacement shall be provided during normal working hours, Monday through Friday, excluding holidays.
- H. If repair and/or replacement cannot be made within prescribed time, other means and methods of protection shall be provided to ensure safety of building occupants during which time system is not in compliance with standards. This may involve up to and include hiring University approved qualified personnel to stand fire watch, at contractor's expense.
- I. Refer also to Division 01 - General Requirements and 01 78 33 Product Warranties and Bonds.

3.12 TRAINING

- A. Contractor shall provide minimum of 4 h system operation training for the University, Architect/Engineer, and fire department personnel.
- B. Training session shall be at a time to be stipulated by the Cal Poly Facilities Project Manager and videotaped by the contractor and a copy shall be provided to the Owner.
- C. Training shall be completed prior to final inspection.

3.13 MAINTENANCE CONTRACT

- A. Equipment manufacturer shall make available to the Cal Poly Facilities Project Manager, maintenance contract proposal to provide minimum of 2 inspections and tests per year in compliance with NFPA-72 Codes.

3.14 SPECIAL CONSIDERATIONS

- A. Contractor shall refer to Division 01, General Requirements "SPECIAL SITE CONDITIONS."

- B. Contractor shall notify the Cal Poly Facilities Project Managers appointed security officer 24 h in advance of any zones inoperative for a period of time exceeding 2 h.
- C. Existing fire alarm systems must be returned to full operation at end of each working day, or notification to campus security of what zones are inoperative on a daily basis in writing, hand delivered.

3.15 SPARE PARTS

- A. Contractor shall provide the following spare parts in quantities shown, with a minimum of:

List of spare part specific to the project

3.16 ACCEPTANCE

- A. Once the testing has been completed and the Cal Poly Facilities Project Manager is satisfied that all work is in accordance with the Contract Documents, the Cal Poly Facilities Project Manager will notify the Contractor in writing or via email.

3.17 RECORD (AS-BUILT) DRAWINGS

- A. Refer to Division 01 - General Requirements and 01 78 39 Project Record Documents.

END OF SECTION