

\*\*\*\*\*

## 00369 COMMUNICATIONS SYSTEMS

Communication technologies have become a critical element in the design of virtually all new and renovation building projects. Whether it be voice, data and video transmission, security and fire alarm systems, audio/visual systems, or other communication technologies, it is important that a team of experienced professionals be involved in the design of these complex systems. The architects design team shall include a BICSI Certified RCDD (Registered Communications Distribution Designer) with proven installation experience in communication cabling and equipment.

Communications systems must follow the policies set forth in the Administrative Manual of the Michigan Department of Management and Budget, Chapter 10 Section 4 Subject 2 which applies to all state buildings. Also the TIA Telecommunications Infrastructure Standards and BICSI Telecommunications Distribution Methods Manual shall be used as a reference.

The MTU Primary Telecommunications Cabling subsystem for new buildings and buildings undergoing major renovation includes:

- 1) A Building Entrance Room (BER) shall be provided for the communications entrance facilities. The size of this BER will be dependent on the purpose of the building but should have an area of at least eight (8) by ten (10) feet unless designated otherwise. This room can be collocated with a Satellite Equipment Room (SER), (see below).
  
- 2) A per floor centrally located data communications wiring/equipment room in and of itself only, and not shared with other physical plant systems or otherwise physically separated from these systems shall be provided for in the design of the building. This facility will henceforth be referred to as the Satellite Equipment Room or "SER". The size of this SER will be dependent on the purpose of the building but should have an area of at least eight (8) by ten (10) feet unless designated otherwise. The design of the SER shall provide for a means of mounting electronic communications distribution equipment, punch down blocks, cross-connect/patch panels and other telecommunications distribution. The design of the SER shall also provide for ventilation to remove excess heat generated by electronic equipment installed in the SER. The SER shall have a means to access the per floor wiring raceways/ducts. The SER shall have a means to access the SER's on the floor above and below via metal conduits. The SER shall contain a fire/smoke detector/sensor as part of the overall building fire/smoke alarm system.

3) At least one double gang telecommunication outlet box shall be installed for every 150 square feet of office space unless otherwise designated. Classrooms, laboratories, and all other rooms not otherwise designated except for bathrooms, janitor closets, etc., should contain at least one double gang telecommunication outlet box. Telecommunication outlets will be housed in double gang outlet boxes with double gang plaster rings.

4) A "home run" one inch conduit shall connect this double gang outlet box to the SER.

5) A conduit system shall be installed such that all areas have a path to the per floor SER.

6) Four (4) 4-pair Category 6 riser rated communications cable is to be run from these double gang outlet boxes to a point designated by MTU Telcom in the SER.

7) One (1) additional outlet box with its corresponding one inch conduit shall be installed in every conference room. Installed in this conduit is one RG6 coax cable and shall be "home run" to the per floor SER as designated.

8) A twisted pair riser, fiber optic riser, broadband riser and ground system shall be provided to interconnect the Building Entrance Room (BER) to all Satellite Equipment Rooms (SER's).

9) Fiber optic trunk cable installed from the new building to an existing point in the MTU fiber optic campus backbone as designated by MTU Telcom. The minimum fiber count shall be 48 singlemode and 48 multimode.

10) Fiber optic patch panel(s) to be installed in the BER of the new building along with fiber optic patch panel(s) at the point where it attaches to the existing MTU fiber optic campus backbone as designated by MTU Telcom.

11) Two (2) broadband CATV trunk cables shall be installed from the BER of the new building to an existing point in the MTU broadband campus backbone as designated by MTU Telcom. Riser and per floor distribution cables shall be installed as designated by MTU Telcom.

12) Installation of card readers for the door control system as designated.

13) Ameritech (Local Exchange Carrier) shall install the main telephone service cable into the building and terminate at the demarcation point in

the Building Entrance Room.

#### 00369.10 BUILDING ENTRANCE ROOM (BER)

A room of sufficient size (minimum 8 feet by 10 feet) shall be provided for at the communication entrance facilities to the building. This room known as the Building Entrance Room (BER) will contain the cable protection devices, demarcation equipment of the local exchange carrier, and the ground bonds required by the NEC for all outside plant cables entering the building. The BER must also be capable of housing five 24" by 7' communication equipment racks. All wall space of the BER shall be covered with 3/4" X 4' X 8' fire retardant plywood, painted ivory with fire retardant paint, placed with the 8' edge vertical, fastened securely with a minimum of five (5) equally spaced fasteners along each vertical edge and one column of five (5) equally spaced fasteners centered on each sheet of plywood. A large building containing more than one closet riser will require more floor space depending on the pair count and equipment installed.

Power requirements for wall mounted electronic interface devices would include at least two double duplex outlets on each wall, supplied by two or more circuits, mounted near the bottom edge of the plywood. A four foot fluorescent light with two fluorescent tubes or equivalent, controlled by a switch, shall be installed in the BER. A larger room will require more lighting to give an intensity of illumination of not less than 10 lumens/sq.ft. at floor level.

There shall be four (4) four inch conduits connecting the BER to the nearest SER, if the BER is not collocated with a SER.

A Satellite Equipment Room (SER) can be collocated with this BER if the BER is provided with additional space for this equipment.

#### 00369.20 PER FLOOR SATELLITE EQUIPMENT ROOM (SER)

There shall be a wiring closet centrally located on every floor that is sufficient in size (minimum 8 feet by 10 feet) and contain at least 4 sheets of 3/4" X 4' X 8' fire retardant plywood, painted ivory with fire retardant paint, placed with the 8' edge vertical, fastened securely with a minimum of five (5) equally spaced fasteners along each vertical edge and one column of five (5) equally spaced fasteners centered on each sheet of plywood. Mounted on this plywood will be the 110 blocks for riser cable termination, the 110 blocks for the AMP Category 3 modular jack to RJ21 panel cable terminations, telephone equipment, the broadband taps and amplifiers, and the card reader and door control system electronics. Each closet must also be capable of housing a minimum of three 24" by 7' communication equipment racks. A large building will require more equipment rack space and plywood depending on the number of telecommunication outlets installed on the floor, the riser fiber and pair counts installed, and the voice and data equipment installed.

There shall be two (2) four inch conduits connecting each SER to the SER above and

below along with a conduit system connecting the per floor telecommunications outlets to the SER. If there are two or more risers of SER's in a building, the mid point riser SER's shall be connected with two (2) four inch conduits.

Power requirements for wall mounted or rack mounted electronic interface devices would include at least one double duplex outlet for each sheet of plywood, supplied by two or more circuits, mounted near each bottom corner or edge of the plywood sheet. A four foot fluorescent light with two fluorescent tubes or equivalent, controlled by a switch, shall be installed in each SER. A larger room will require more lighting to give an intensity of illumination of not less than 10 lumens/sq.ft. at floor level.

Each SER shall have a minimum of two (2) 300 pair Siemon 110 WIRING BLOCK WITH LEGS, Siemon part number S110AW2-300 and sufficient 110 5-pair connect blocks, Siemon part number S110C-5, to terminate the 100 pair category 3 riser cable and the AMP Category 3 modular jack to RJ21 panel cables. More than two (2) 300 pair 110 WIRING BLOCK WITH LEGS may be needed depending on the amount of riser cable and AMP Category 3 modular jack to RJ21 panels to be installed. Five (5) 5-pair connect blocks will be needed for each 25 pair group of riser cable and AMP Category 3 modular jack to RJ21 panel cables to be terminated. A 110 4-pair connect block, Siemon part number S110C-4, will be needed for termination of each payphone, TDD, and card reader data 4-pair cable to be terminated.

AMP Quantum patch panels will be used to terminate the telecommunication outlet category 6 cables and the category 6 riser cables in the SER. The patch panel layout will consist of the following part numbers:

Chatsworth rack 19" x 7'	55053-103
Panduit cable manager	WMP1
AMP Quantum patch panel 24 port Category 6	1116027-1
AMP Category 3 modular jack to RJ21 panel	556186-1

Each 12 telecommunication outlet locations will require one (1) Panduit cable manager, two (2) AMP Quantum patch panels, and one (1) AMP Category 3 modular jack to RJ21 panel. Arrangement of these panels in the Chatsworth rack starting at the top of the rack working down, will be: a Panduit cable manager, a AMP Quantum patch panel, a second AMP Quantum patch panel, and a AMP Category 3 modular jack to RJ21 panel. This arrangement will repeat down the rack as necessary for each 12 telecommunication outlets to be terminated. One additional Panduit cable manager will be installed below the last jack panel.

AMP Quantum patch panels will be required for termination of the Category 6 riser cable. These patch panels will be installed in a Chatsworth rack as designated by MTU Telcom.

Each AMP Category 3 modular jack to RJ21 panel will require four (4) 25-pair connectorized cables to connect the patch panel to the 110 blocks.

A 19" x 7' rack can accommodate the jack panels for 96 telecommunication outlet locations.

See MICHIGAN TECH UNIVERSITY PATCH PANEL LAYOUT on page 17.

Each SER shall contain a smoke/fire sensor as part of the overall building fire alarm system.

### 00369.30 COMMUNICATIONS CONDUIT SPECIFICATIONS

The minimum conduit specifications for communication cabling are as follows:

The communication entrance conduit shall consist of four (4) four inch conduits run from the nearest existing MTU manhole to the BER of the new facility. This run of conduit shall contain no 90 degree bends and be placed with a minimum of 1/4 inch per foot slope to allow proper water drainage from the ducts. No run of conduit shall exceed 500 feet between manholes. New manholes installed shall contain permanent ladders, pull rings, grounding system, a sump pit, and a floor drainage system to drain water from them.

Conduit run outdoors for other communication purposes, such as parking gates, shall be a minimum of two inch diameter, and be placed with a minimum of 1/4 inch per foot slope to allow proper water drainage from the ducts. No run of conduit shall exceed 500 feet between pull points and contain no 90 degree bends. If pull boxes are installed the conduits shall enter the pull box one foot above the bottom and the pull box shall have a means to drain water from them.

The conduits entering from outside of the building shall be rigid metal conduit or intermediate metal conduit and contain no 90 degree bends within the building. If the BER is not located at the conduit entrance point or conduit bends are necessary between the conduit entrance and the BER, accessible pull box/boxes of sufficient size shall be provided for at the point of conduit entrance. If 90 degree bends are necessary only four foot radius bends shall be used and only one 90 degree bend allowed between pull points. These conduits shall be bonded to ground per NEC.

The minimum size conduit run from the SER to the telecommunication outlet shall be one inch steel conduit.

Each run of conduit to the telecommunication outlet shall contain not more than two 90 degree bends and no run shall exceed 295 feet in length. Provide pullboxes in readily accessible locations in communication conduit runs more than 100 feet in length, spaced not greater than 100 feet apart, and on runs with more than two 90 degree bends. The installation of pullboxes in the run of conduit must be placed in line with the conduit run such that wire or fiber optic cable can be pulled through the pullbox without incurring damage to the cable. No turns or bends of the conduit run are allowed with pullboxes.

No LB type fittings of any size are to be used for communication conduit.

No PVC conduit or PVC sleeves are to be used for communication conduit within the confines of a building.

Minimum radii for bends shall be 9-1/2 inches for 3/4 inch conduit, 10-1/2 inches for one inch conduit and the equivalent of long radius factory bends for larger sizes. The short radius bends of larger diameter conduit normally installed for electrical installations is not sufficient for communication cabling. Four (4) inch conduit installed for communication cabling will have a four foot radius bend.

Place TELCOM label on pull and junction boxes.

Provide nylon pull cord in each empty conduit run.

Conduit installation for communication purposes shall be installed with the probability of fiber optic cable being installed in it and pulling tension and minimum bend radius being critical factors for installing usable fiber optic cable as well as the new category 6 cable.

#### 00369.40 PER FLOOR TELECOMMUNICATIONS WIRING SYSTEMS

Installation and physical protection of Category 6 cable is a very critical element for the cable to deliver its rated bandwidth. A "kink", "pinch", bend radius less than 1.25 inches in diameter, or stretching of the cable by exceeding the 25 pound maximum pulling tension during installation will damage the cable to the point that it will not meet rated specifications and must be replaced. Requirements for terminating of Category 6 cable require no more than three inches of common sheath be removed and no more than 1/2 inch of untwisting of conductors. Installation personnel shall be BICSI certified installers or equivalent and provide proof of certification.

In order to meet the proposed category 6 standards, a vendor end to end solution with matched components will be required. The category 6 cable and jack installation at MTU shall be an AMP Corporation end to end solution.

Communication cable shall be AMP Quantum Category 6 unshielded twisted-pair cable each consisting of four twisted pairs of No. 23 AWG solid conductors, 100 ohm, type CMR or CMP. AMP part numbers for this cable are as follows:

Type CMR, Grey 57543-3 or 57543-4 (The -3 or -4 specifies reel or box)

Type CMP, Blue 57544-5 or 57544-6 (The -5 or -6 specifies reel or box)

The CMR rated cable will be used in non-plenum areas or in conduit and its outer sheath will be gray in color. The CMP rated cable will be used in all plenum areas where there is no conduit and its outer sheath will be blue in color. This cable shall be supported every 32 inches with CADDY CableCat Jhook fasteners or equivalent.

The cable run from the SER to the telecommunications outlet, consisting of four cables, shall not exceed 295 feet and contain no splices. These cables are to provide service for both voice and data communications as a integrated telecommunications system.

These four cables shall be "home run" from the per floor SER to the user locations on each floor via the 1 inch conduit serving the four inch square, deep device outlet box with 2 gang device ring. The user location end of the cable in the outlet box shall have sufficient excess cable (no less than 18 inches) so that certified installation personnel can install the telecommunication outlet. The SER end of the wire must reach the punch down blocks as designated by MTU Telcom.

Each of these four cables will be labeled on each end with a telecommunication outlet number and White, Red, Black, or Yellow. The telecommunication outlet numbering will start at 0001 for each SER and be terminated in the patch panel in numerical order as designated by MTU Telcom.

The installation of this communication cable shall conform to the following minimum clearances:

Unshielded power lines or electrical equipment of 480 volts or less in proximity to open or non-metal communication pathways

- At least 127 millimeters (5 inches) from power lines carrying 2KVA or less
- At least 305 millimeters (12 inches) from power lines carrying from 2 to 5KVA
- At least 610 millimeters (24 inches) from power lines carrying more than 5KVA
- At least 127 millimeters (5 inches) from all fluorescent lights and other sources of electromagnetic interference such as electric motors, HVAC equipment, arc welders, intercoms, etc.

Unshielded power lines or electrical equipment of 480 volts or less in proximity to grounded metal communication pathways

- At least 64 millimeters (2.5 inches) from power lines carrying 2KVA or less
- At least 152 millimeters (6 inches) from power lines carrying from 2 to 5KVA
- At least 305 millimeters (12 inches) from power lines

carrying more than 5KVA

Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to grounded metal conduit communication pathways

- At least 76 millimeters (3 inches) from power lines carrying from 2 to 5KVA
- At least 152 millimeters (6 inches) from power lines carrying more than 5KVA

Power wiring of more than 480 volts will require greater separation from communication pathways.

A single RG6 coax cable will be installed from each conference room to the telecommunication closet in addition to the four (4) 4-pair communication cables. Beldon 9116 CM rated, or Commscope 5726 CM rated will be used in nonplenum areas or in conduit and Commscope 2275V, CMP or CATVP rated in all plenum areas where there is no conduit. Each end of the RG6 coax cable will be terminated with "F" connectors type GILBERT GF-6-AHS-322. The telecommunication outlet end shall have no less than 12 inches of excess cable and terminate in an "F" barrel connector mounted in a ivory faceplate and the telecommunication closet end shall have excess cable of 24 inches plus the length needed to reach the designated tap.

The telecommunication outlet will consist of four (4) AMP category 6, 8 conductor jacks wired with 4-pair to each jack using the 568B wiring standard. See MICHIGAN TECH UNIVERSITY TELECOMMUNICATION OUTLET LAYOUT on page 16. These jacks will be mounted in a four port faceplate. The cable labeled "White" will terminate on the white upper left jack, the cable labeled "Red" will terminate on the red bottom left jack, the cable labeled "Black" will terminate on the black upper right jack, and the cable labeled "Yellow" will terminate on the yellow bottom right jack. A printed label shall be placed on the faceplate of each telecommunication outlet and shall contain a two character closet designation and a four digit telecommunication outlet number separated by a dash. Example: 2N-0001 Second floor north closet, telecommunication outlet number 0001. This same information, along with "Cat6" shall be installed on the telecommunication outlet backplate with a printed tag or written legibly with a permanent marker.

Each telecommunication outlet will consist of the following AMP part numbers:

Faceplate, Multimedia Outlet Almond color Double Gang 406188-1

White Cat 6 jack 1116048-3

Red Cat 6 jack 1116048-7

Black Cat 6 jack	1116048-2
Yellow Cat 6 jack	1116048-8

Each payphone location shall require one (1) four-pair cable from the nearest SER and terminate on 110 blocks in the SER as designated by MTU Telcom. Excess cable of 36 inches shall be left at the payphone location.

Each TDD location shall require one (1) four-pair cable from the nearest SER and terminate on 110 blocks in the SER as designated by MTU Telcom. Excess cable of 36 inches shall be left at the TDD location.

All cable runs must be concealed. No open wiring or conduit permitted below finished ceilings. Ivory colored surface raceway, such as Hubbell Mediatrak 4 with a Hubbell mediatrak surface two gang box can be used in places where "fishing" of walls is not possible. This raceway must be of sufficient size to contain four Category 6 cables, one RG6 coax, and one fiber optic cable.

Each basic link shall be tested and certified to 250 MHz and all industry standard test data recorded and supplied to MTU Telecommunications in ASCII format on 3.5 inch HD computer disks or a printed copy.

#### 00369.50 BUILDING RISER SPECIFICATIONS

A minimum of one 100 pair category 3 and twelve 4-pair category 6 cables shall be installed from the Building Entrance Room (BER) to each Satellite Equipment Room (SER). A minimum of twenty-four 4-pair category 6 cables shall be installed as to connect each SER to the SER above and to the SER below as well as to any other SER on the same floor.

Each category 6 cable shall be tested and certified to 250 MHz and all industry standard test data recorded and supplied to MTU Telecommunications in ASCII format on 3.5 inch HD computer disk or a printed copy. Each pair of the 100 pair category 3 cable shall be tested for continuity and polarity.

A minimum fiber optic riser consisting of Siecor 12 strand multi-mode, part number 12K82-31141-00 or equivalent and Siecor 12 strand single-mode, part number 12R82-31131-00 or equivalent will be installed from the BER to each SER. This fiber optic riser will be terminated in 72 position fiber optic distribution enclosures in the BER (See Fiber Optic System section for these part numbers) and in 36 position rack mount panels, Hubbell part number FCR350SP36, equipped with four six pack SC duplex adapters per panel, Hubbell part number FSPSCD3, in the SER's. A SC multimode connector, Amp part number 503-948-1, a SC singlemode connector, Amp part number 504-646-1, and a 900 micron fiber boot, Amp part number 503-628-2 will be required for each fiber end to be terminated. There shall be left an excess of fiber optic cable in these patch centers of 20 feet in addition to the length needed to reach the patch panel.

Two broadband riser rated cables, Commscope part number P-3 500JCAR, shall be installed from the BER to the first SER in the closet riser leaving sufficient excess cable for terminating. Two broadband riser rated cables, Commscope part number P-3 500JCAR, shall also be installed as to connect each SER to the SER on the floor above as well as to the floor below leaving sufficient excess cable for terminating as designated by MTU Telcom.

#### 00369.60 FIBER OPTIC SYSTEM (Interbuilding)

A hybrid 48 fiber multimode 48 fiber singlemode fiber optic cable, Optical Cable Corporation part number Dx96-140D-48W3SB/1UC-48SymC/YmD-900-OFNR, shall be installed from the BER of the new building to an existing fiber optic patch panel center at a point where it attaches to the existing MTU fiber optic campus backbone as designated by MTU Telcom. This run of cable shall have no splices or connections other than at the designated patch centers. There shall be left an excess of fiber optic cable in these patch centers of 40 feet in addition to the length needed to reach the patch panel as designated by MTU Telcom, from the building entrance conduit. All other aspects of the installation of these cables shall follow the manufacturer's recommendations for installation of fiber optic cable.

The fiber cables shall terminate in 72 position fiber optic distribution enclosures in the BER of the new building and 72 position enclosures in an existing building BER. This fiber optic distribution patch panel system will consist of the following Sycor part numbers:

- FDF-000-10 Fiber Distribution Frame
- FDF-EC-7 End Cap for FDF-000-10 (need 2 for each frame)
- FDF-JC-02 Jumper Cover for FDF-000-10 (need 2 for each frame)
- CPH-072 72 Fiber Panel
- FDC-CP1P-57 DPLX SC/3 Connector/MM (need 1 for each 6 MM fibers)
- FDC-CPIP-59 DPLX SC/3 Connector/SM (need 1 for each 6 SM fibers)

The following AMP part numbers will be needed to terminate the fiber optic cable:

- 503-948-1 SC Multimode connectors (need 1 for each MM fiber end)
- 504-646-1 SC Singlemode connectors (need 1 for each SM fiber end)
- 503-628-2 900 micron fiber boots (need 1 for each connector)

All terminating, testing, and documentation of the fiber optic cable system shall adhere to the manufactures recommended specifications. Each fiber optic strand shall be tested to determine length and end to end loss in both directions and what frequency of light used for the test. Test data will be recorded for each fiber strand and supplied to MTU Telecommunications in ASCII format on 3.5 inch HD computer disks or a printed copy.

#### 00369.70 BROADBAND CABLE SYSTEM (Interbuilding)

A broadband cable system shall be installed consisting of two Commscope part number P-3 75-500JCA cables to be installed from the designated point in the existing broadband system to the new facility. This cable will be installed from the designated existing building or communication manhole to the BER of the new building. There shall be left an excess of cable of at least 25 feet at these locations. These locations shall be designated by MTU Telcom.

P-3 75-500CA is 1/2" copper clad aluminum center conductor with a solid aluminum sheath. P-3 75-500JCA is the same as P-3 75-500CA except with a outer jacket of polyethylene.

A broadband amplifier, Anixter part number 076866 (vender number LAN-101-2RV) with standard 117vac power cord, shall be provided for each new building. MTU Telecommunications will install this amplifier.

#### 00369.80 CARD READER AND DOOR CONTROL SYSTEM

Installation requirements if card reader is within 100 feet cable distance of telecommunications closet (BER or SER):

A 4 inch by 4 inch electrical J-box with single gang plaster ring will be installed flush with wall surface at card reader location.

A one inch conduit shall be installed, using the same minimum conduit specifications for communication cabling, from this J-box to the telecommunications closet (BER or SER) for data lines. Also a 1/2 inch conduit will be installed from this J-box to the door strike.

The cable used for the data lines shall be two (2) 4-pair unshielded twisted-pair cable, the same as used for data and voice wiring. One cable will be used for the door strike and one cable for the card reader. Leave sufficient excess cable at each end so cable can be terminated by MTU Telcom.

A dedicated circuit of 120vac to supply a single gang outlet mounted within five (5) feet of the door control equipment. If several controllers are mounted in the same area, five (5) single gang outlets can be supplied from the same 120vac circuit.

Installation requirements if card reader is more than 100 feet cable distance of telecommunications closet (BER or SER):

A 12 inch by 14 inch by 6 inch enclosure, Hoffman A-14N126 or

equivalent, containing a plywood backboard and a dedicated circuit of 120vac to supply a single gang outlet mounted horizontally centered in top or bottom of the enclosure. The enclosure will be located in a secure, accessible location. This enclosure shall not be installed in a ceiling and top of enclosure shall not exceed six feet above finished floor.

A one inch conduit shall be installed, using the same minimum conduit specifications for communication cabling, from the enclosure to the telecommunications closet (BER or SER) for data lines. The cable used for the data lines shall be one (1) 4-pair unshielded twisted-pair cable, the same as used for data and voice wiring. This cable shall be terminated on 110 blocks in the SER as designated by MTU Telcom.

A 4 inch by 4 inch electrical J-box with single gang plaster ring will be installed flush with wall surface at card reader location. A 3/4 inch conduit to be installed from this J-box to enclosure. Installed in this conduit will be one (1) 4-pair unshielded twisted-pair cable, the same as used for data and voice wiring.

A 1/2 inch conduit to be installed from the enclosure to door strike. Installed in this conduit will be one (1) 4-pair unshielded twisted-pair cable, the same as used for data and voice wiring.

See ENCLOSURE AND CONDUIT SYSTEM drawing on page 15.

All door strikes shall be 24vdc operation and contain normally open and normally closed contacts for sensing door ajar conditions. A separate 24vdc power adaptor will be needed for each door strike. The door strike and DC Adaptor is not included as part of the Diebolt DAC-5000 system and must be purchased separately.

On exterior doors that will require card access, the door strike hardware shall be a panic bar style door strike operated by a 24 vdc power supply. The door strike shall contain normally open and normally closed contacts for sensing door ajar conditions. The Panic Bar shall have a way to secure the door latch in an open unlocked position either through a Best Key cylinder (compatible with existing MTU keys and cylinders, provided by the door strike company) or through a hex key.

One each of the following will be required for each card reader location:

Model AC-5000 controller with power supply Catalog# DAC-001 Part#  
677-1322

Model AR-5000 card reader Catalog# DAC-004 Part# 677-1727  
Installation Kit of parts Catalog# DAK-001 Part# 676-1151

Power supply 24vdc @ 1.2A, Beam DC Adaptor model DU-24120 Part#  
TM94ADR2734 or equivalent for powering door strike.

Door strike - Folger Adam 310 series electric strike on interior doors and  
panic bar style strikes for exterior doors.

Door strike lock guard - Folger Adam 310-2-3 Astragal

One Model BC-1000 building controller Catalog# BLC-007 will be required for each 16  
card reader locations.

The BC-1000, AC-5000, AR-5000, and Installation Kit shall be coordinated with MTU  
Auxiliary Technologies as MTU has an ongoing contract with Diebolt.

The 24vdc power supply can be purchased from:

Herback and Rademan  
18 Canal St. P.O.Box 122  
Bristol, PA 19007-0122  
800-848-8001

The door strike and lock guard can be purchased from:

Architectural Security Products  
16300 West 103rd St.  
Lemont, IL 60439-9653  
708-739-3900

## 00369.90 GROUNDING AND LIGHTNING PROTECTION

An insulated copper equipment ground conductor shall be run from the building main  
electrical ground bus to the Building Entrance Room (BER) with no splices or  
connections other than the designated end points or conduit bonds if run in metal conduit  
more than three feet in length. An insulated copper equipment ground conductor shall be  
run from the BER Telecommunications Main Grounding Busbar (TMGB) to  
the Telecommunications Grounding Busbar (TGB) of the top floor closet, looping  
through each closet in the riser with one continuous conductor containing no splices. In  
the intermediate closets, the TGB shall be connected to this conductor with a "tap"  
connection.

If there is more than one closet riser in a building, each closet riser shall have the same  
ground system installed as stated in the previous paragraph. In addition, an insulated  
copper equipment ground conductor shall be run to connect together the TGB of each top  
floor closet and at a minimum every third closet in between.

The routing path of these ground conductors should be as direct as possible. The minimum conductor size for these ground cables shall be a number 6 AWG insulated. Considerations should be given to sizing these ground conductors as large as a number 3/0 AWG. The Telecommunications Main Grounding Busbar (TMGB) for the Building Entrance Room (BER) shall be B-Line SB-476 (4"x23") or equivalent and the Telecommunications Grounding Busbar (TGB) for each Satellite Equipment Room (SER) shall be B-Line SB-477 (2"x13.5") or equivalent. If a ground conductor passes through metal conduit or metal enclosures greater than three feet in length, each end of the conduit or enclosure must be bonded to the ground conductor by approved means. This ground system must follow the requirements of Telecommunications Industry Association standard TIA-607 Grounding and Bonding.

The metallic cable sheath of all outside plant cable as well as any metal conduit entering the building must be bonded to this ground by approved means. "Exposed" outside plant multi-conductor cable entering the building is required by the NEC to have approved lightning protection applied to each conductor within the cable sheath.

If a new facility will be directly connected to an existing building with new conduit and metallic communication cabling within the "cone of protection" and considered non-exposed cable, a ground bond connecting the power ground grids of each facility will be required.

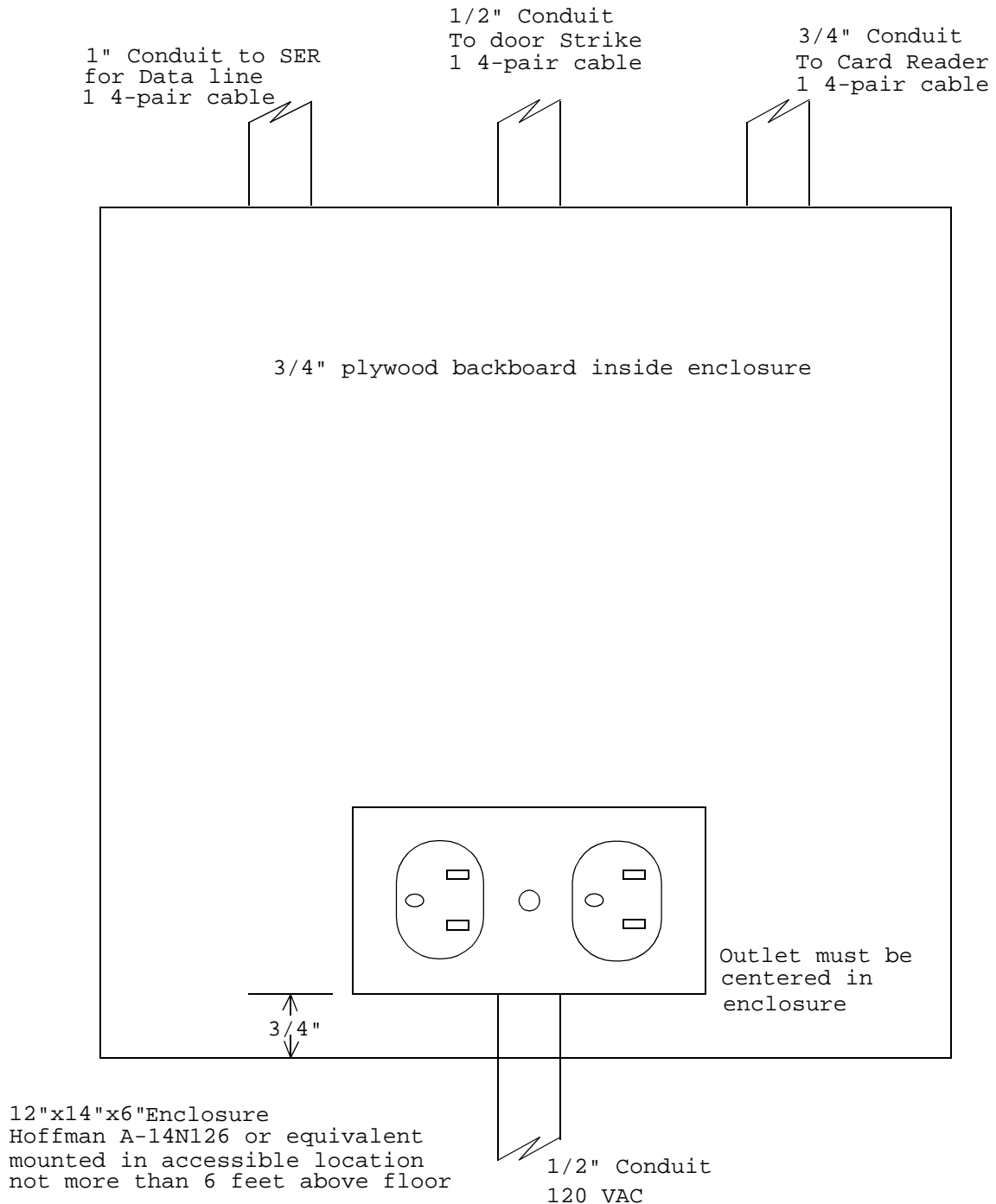
#### 00369.95 OTHER ITEMS

Contract installation personnel shall be BICSI certified installers or equivalent and provide proof of certification. The contractor must provide a minimum of five (5) reference accounts at which similar work has been completed by the contractor within the last five years. The selected contractor shall be fully capable and experienced in the telecommunication system specified.

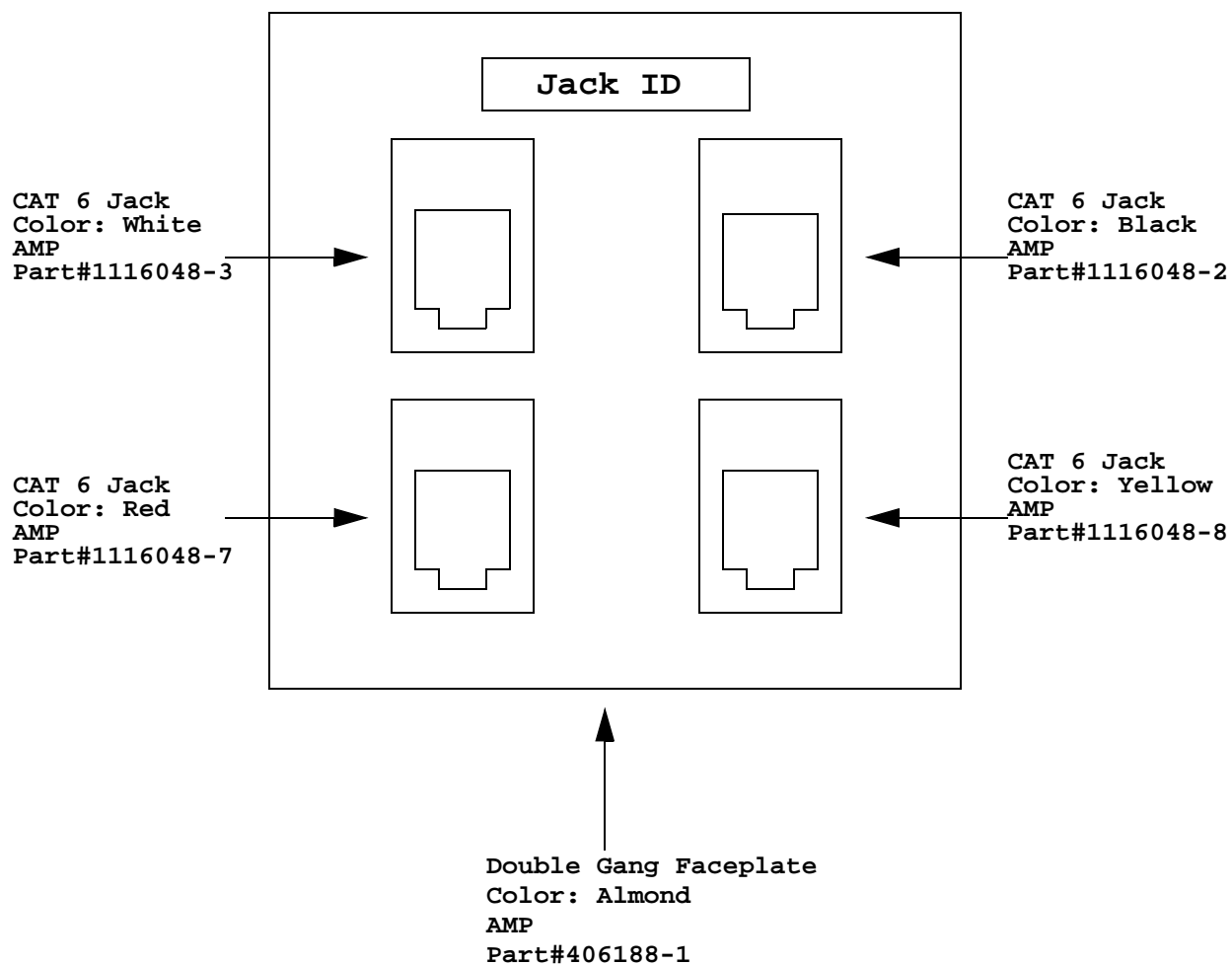
The contractor shall furnish and install all material required, including installation of communication cable, installation of communication outlets, and termination of all cable in the BER and SER's as designated by MTU Telcom. The contractor shall test and certify all cable installed by the contractor and provide documented results of the testing. The documented results of the testing can be supplied in ASCII format on 3.5 inch computer disks or a printed copy. All category 6 cable shall be certified to 250 Mhz. If any cable run tests defective, the contractor shall replace defective cable. A one year warranty shall be included on all cable and hardware installed by the contractor.

## Enclosure and Conduit System Drawing

Enclosure and conduit system drawing for card reader and door control system where card reader location is more than 100 cable feet from a telecommunication closet.



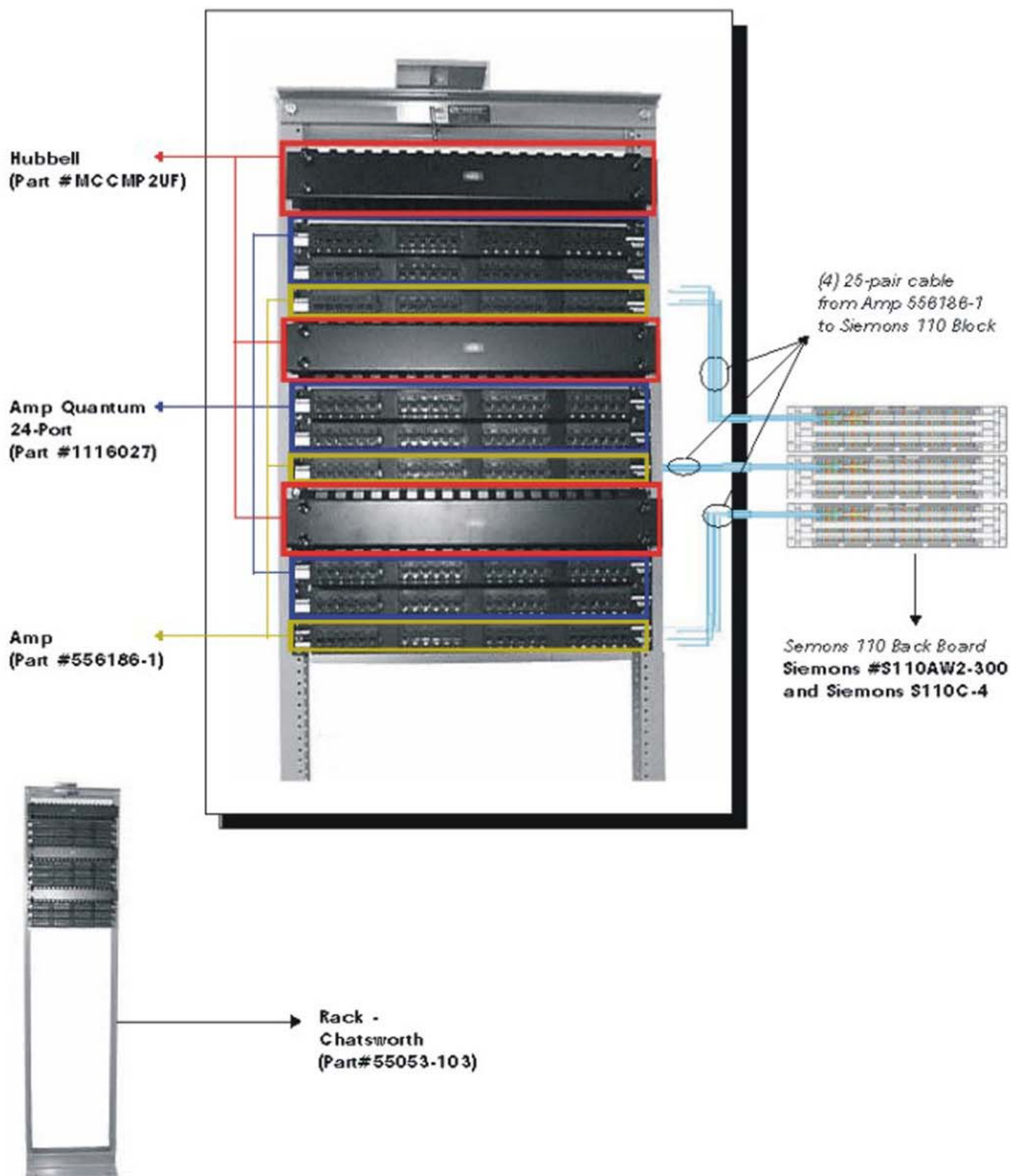
# Michigan Tech University Telecommunication Outlet Layout



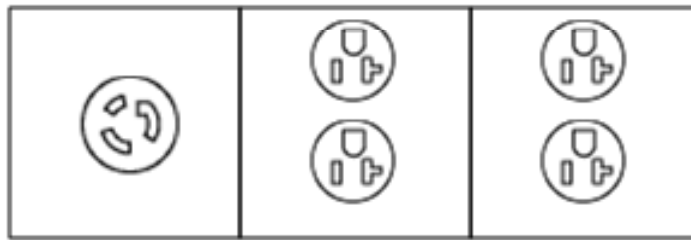
## NOTE:

One AMP Quantum Category 6 4-pair to each of four jacks.  
Four AMP Quantum Category 6 4-pair to each telecommunication outlet.

# Michigan Tech University Patch Panel Layout



# I.T. - Telecom Equipment Room Electrical Specifications



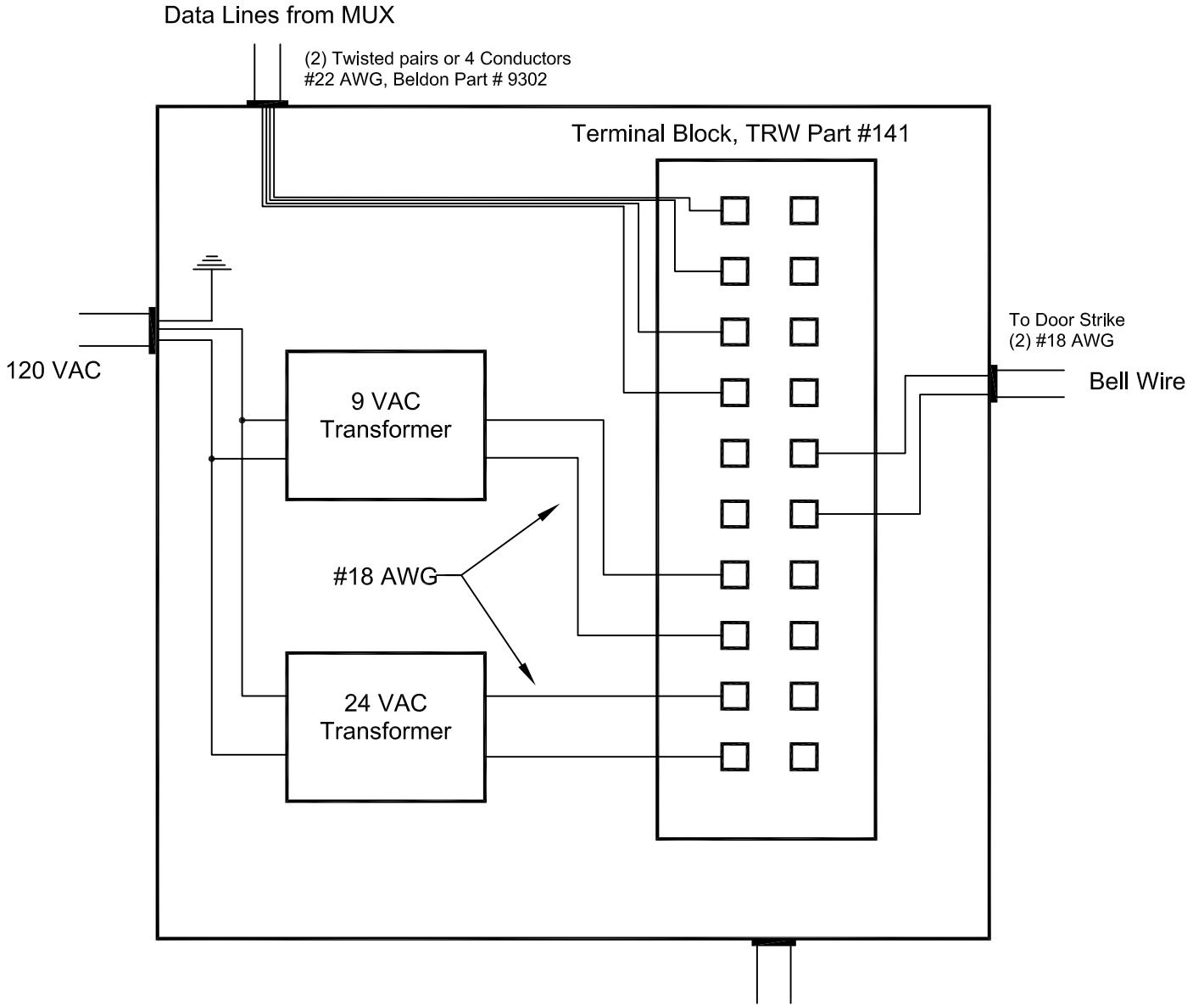
NEMA L5-30  
(Twistlock)

NEMA 5-20  
(Two Circuits)

*NOTE: All circuits shall be connected to emergency power.*

Revision: October, 2002 (sg)

# DOOR CONTROL SYSTEM



12" x 12" x 6" Enclosure  
MTU will wire from card reader  
to enclosure above ceiling.

To Card Reader