The TEES dated March 12th, 2009, Chapter 4 (BBS) dated July 7, 2009 and Errata No. 1 dated January 21st, 2010 shall be modified as specified in this Errata No. 2.
1.4.8 Thumb Screw Devices

Thumb Screw Devices (TSDs) shall be of the following type: retractable screw fastener with projecting stainless steel screw, spring and natural aluminum knob finish. (TSD No. 2 shall be flat black.)

TSD No.1 - 8-32 SOUTHCO #47-62-301-20 or equal.
TSD No.2 - 8-32 SOUTHCO #47-62-301-60 or equal.
TSD No.3 - M3 SOUTHCO #47-81-181-10 or equal.

1.4.9 PCB Modules

All PCB Modules shall be mounted vertically in their corresponding host assembly.
2.5.3 Functional Requirements

The Model 400N Ethernet Module shall interface to the 170 controller using controller’s Main Port EIA-232.

The Main and User Serial Ports shall operate EIA-232 Asynchronous communications and shall support data rates of 1.2, 2.4, 9.6, 19.2, 38.4, 57.5 and 115.2Kbps.

The Model 400N Ethernet Module Network Interface shall meet IEEE 802.3 and ANSI 8802-3 Standards and support 10/100 Mbps.

The Auxiliary Port shall be configurable to operate as a DCE or DTE.

The Model 400N shall have an option to enable or disable Dynamic DCD.

4.1.2 Battery Backup System Configuration

The Battery Backup System (BBS) shall include (See A4-1 – BBS Block Diagram), but not be limited to the following:

- Inverter/Charger
- Installation Wiring Kit
- Power Transfer Relay
- Hardware Kit
- Manual Bypass Switch
- Battery Cable Harness
- EIA mounting Brackets
- Manuals

The Installation Wiring Kit shall include all necessary 10 AWG color-coded wiring for all required 18 AWG wiring for relays contacts, and a minimum of twenty (20), cable ties and/or adhesive backed panel mount style cable tie holders.

The Hardware Kit shall include all necessary bolts and washers for mounting all BBS components.

The Manuals shall include (2 each per BBS Unit) Operational and Maintenance Manuals.

4.3.4 Display

The BBS shall have a backlit LCD type display that is easily seen in both bright sunlight and in darkness. The screen shall be a minimum of a 4 line display. The following information shall be displayed on a continuous basis; operating mode (STANDBY, Buck/Boost), utility input voltage, BBS output voltage, charger status, percent battery
charge, battery voltage, BBS status (Standby, Backup, Buck, Boost), any alarms and faults, and relay status information.

4.3.13 System Configuration Mode
The BBS shall provide the user with a system configuration mode that would allow the user to view system configuration parameters on the front panel display. As a minimum, network settings shall be displayed under the systems configuration mode.
CHAPTER 5-SECTION 1
GENERAL REQUIREMENTS

Delete Chapter 5-Section 1, Paragraph 5.1.4

CHAPTER 5-SECTION 4
MODEL 242L TWO-CHANNEL DC ISOLATOR REQUIREMENTS

5.4.1 Model 242 DC Isolator Channel
The Model 242 DC Isolator Channel shall provide isolation between a VDC input circuit (external electrical switch closure) and the controller unit input. The minimum isolation shall be 1000 MegaOhms and 2,500 VDC measured between the input and the output of the same channel.

5.4.2 Test Switch
Each isolation channel shall have a front panel mounted test switch to simulate valid input. The test switch shall be a single-pole double-throw, three position CONTROL test switch: The position assignment shall be UP – constant ON; MIDDLE – OFF; and DOWN – momentary ON.

5.4.3 Power Source
The DC Isolator operating voltage shall be obtained from the cabinet’s 24 VDC power supply. The isolator shall have an internal isolated dc-dc power supply supplying 20 +/- 4 VDC to the field input side of the isolation channels. This internal isolated power supply shall provide at least 1500 Vrms of isolation from the cabinet 24 VDC power supply. The isolator shall not draw more than 2.0 watts of DC power. PCB should be two layer design minimum, using plated-thru vias, and Gold Plated Fingers on Both Sides of PCB.

5.4.4 Onboard Jumper
An onboard two-post shunt jumper shall be provided to allow for minimized output durations of less than 100 ms when the jumper is in the OPEN position.

5.4.5 Channel Contact Closure Input
A valid channel input shall cause a channel Ground True Output to the controller unit of a minimum 100 ms in duration. A channel contact closure input of 5 ms or less shall not cause an output (ground true) to the controller. A contact closure between 5 and 10 ms may or may not cause an output to the controller. A contact closure input of 10 ms or greater shall cause an output to the controller. The output pulse width shall be a minimum of 100ms upon a valid input, unless onboard jumper is in the OPEN position, in which
case the output pulse width shall be minimized, and return to a false state immediately following completion of valid input.

5.4.6 **Field Input**
Each isolation channel field input shall be turned on (true) when a contact closure causes an input voltage of less than 8 VDC, and shall be turned off (false) when the contact opening causes the input voltage to exceed 12 VDC. Each input shall deliver no less than 15 mA nor more than 40 mA to an electrical contact closure or short from the power supply. Each input shall be provided with electrical transient protection.

5.4.7 **Outputs**
Each isolation channel output shall be an opt-isolated NPN open collector capable of sinking 50 mA at 30 Volts. The outputs shall be compatible with Model 2070 controller.
CHAPTER 5-SECTION 5
MODEL 252 TWO-CHANNEL AC ISOLATOR

5.5.1 Model 252 Two-Channel AC Isolator
The Model 252 Two-Channel AC Isolator shall contain 2 isolation channels which provide isolation between external 120 VAC input circuits and the controller unit input circuits.

5.5.2 Channel Input Voltage “Von”
A channel input voltage “Von” of 80 +/- 5 VAC applied for a minimum duration of 110 ms ± 10 ms shall cause an output (Ground True) to the controller unit.

5.5.3 Channel Input Voltage “Voff”
A channel input voltage “Voff” (Von minus 10 VAC) applied for a minimum duration of 110 ms ± 10ms shall cause an output (Ground False) to the controller unit.

5.5.4 Post Jumper
A two post jumper shall be provided to select inverted output states for Von and Voff. When in CLOSED position (Grounded) Von shall cause a Ground False output. An indicator shall be provided on the front panel labeled ‘RR” which shall indicate a Voff input, Ground True output.

5.5.5 Input Impedance
The input impedance of each channel shall be between 6,000 - 15,000 Ohms at 60 Hz.

5.5.6 Minimum Isolation
The minimum isolation shall be 1000 MegaOhms between the input and output terminals at 500 AC applied voltage.

5.5.7 Power Source
The AC Isolator operating voltage shall be obtained from the cabinet’s 24 VDC power supply. The isolator shall not draw more than 2.0 watts of DC power. PCB should be two layer design minimum, using plated-thru vias, and Gold Plated Fingers on Both Sides of PCB.

5.5.8 Outputs
Each isolation channel output shall be an opt-isolated NPN open collector capable of sinking 50 mA at 30 Volts. The outputs shall be compatible with Model 2070 controller.

5.5.9 Input Transient Protection
Each isolation channel shall be provided with electrical transient protection.
CHAPTER 6
CABINET SPECIFICATIONS
MODELS 332L, 334L, 336L, 342LX, 344LX & 346LX
CHAPTER 6-SECTION 1
GENERAL REQUIREMENTS AND
CABINET MODEL COMPOSITION

6.1.1 Composition
Unless otherwise specified the model shall be furnished, ready for operation with the following composition.

6.1.2 Model 332L Cabinet
Model 332L Cabinet shall consist of:
- Housing 1 B
- Mounting Cage 1
- Power Distribution Assembly #2L
- Input Files I & J
- C11 Harness

6.1.2.1 Model 334L Cabinet
Model 334L Cabinet shall consist of:
- Housing 1 B
- Mounting Cage 1
- Power Distribution Assembly #3L
- Input File I
- C11 Harness

6.1.2.2 Model 336L Cabinet
MODEL 336L CABINET shall consist of:
- Housing 2
- Power Distribution Assembly #2L
- Input File I
- C11 Harness

6.1.2.3 Model 342LX Cabinet
Model 342LX Cabinet shall consist of Housing 3 and two ITS Mounting Cages.
First Mounting Cage shall consist of:
- Power Distribution Assembly #2LX
- Input Files LX I & J
- Output File #1LX
- C11 Harness

Second Mounting Cage shall consist of:
- (2) Blank Side Panels
- (2) Shelves
- Service / PDA Assembly
6.1.4 **Model 344LX Cabinet**
Model 344L Cabinet shall consist of Housing 3 and two ITS Mounting Cages.
First Mounting Cage shall consist of:
- Input File LX 1  
- Input Panel #3  
- PDA Assembly #3LX

C1 Harness #2  
Service Panel #1  

Second Mounting Cage shall consist of:
- (2) Blank Side Panels  
- Service / PDA Assembly  
- (2) Shelves

6.1.5 **Model 346LX Cabinet**
Model 346LX Cabinet shall consist of Housing 4 and two ITS Mounting Cages.
First Mounting Cage shall consist of:
- Power Distribution Assembly #2LS  
- Input Files LX I  
- Output File #1LX  
- C11 Harness

C1 Harness #3  
Service Panel #2  
Input Panel #4

6.1.6 **Assemblies and Files**
All assemblies and files shall be mounted on the cage mounting rails per cabinet model detail. Cabinet model interface wiring shall be per specified C1 Harness, detailed wiring lists and required One Line Wiring.

6.1.3 **Cabinet Shipping Requirements**
The cabinet shall be delivered mounted on a plywood shipping pallet. The pallet shall be bolted to the cabinet base. The cabinet shall be enclosed in a slipcover cardboard packing shell. The housing doors shall be blocked to prevent movement during transportation.

6.1.4 **Cabinet Adaptors**
When specified, adaptors shall be provided. The adaptor shall be fabricated of the same material and finish as the cabinet housing.

6.1.5 **Stainless Steel**
All bolts, nuts, washers, screws (size 8 or larger), hinges and hinge pins shall be stainless steel unless otherwise specified.

6.1.6 **Cage Mounting**
A cage mounting clear area for the controller unit shall be provided. The area shall extend 1.5 inches in front of and 16 inches behind the front EIA mounting angles.
6.1.7 Protection
All conductors, terminals and parts which could be hazardous to maintenance personnel shall be protected with suitable insulating material.
CHAPTER 6-SECTION 2
HOUSING REQUIREMENTS

6.2.1 Housing
The housing shall include, but not be limited to, the following:
- Enclosure
- Police Panel
- Doors
- Ventilation
- Latches/Locks
- Gasketing
- Hinges and Door Catches
- Cage Supports and Mounting

6.2.2 Housing Construction

6.2.2.1 Waterproof
The housing shall be rainproof with the top of the enclosure crowned to prevent standing water. It shall have single front and rear doors, each equipped with a lock.

6.2.2.2 Fabricating
The enclosure, doors, lifting eyes, gasket channels, police panel, and all supports welded to the enclosure and doors shall be fabricated of 0.125 in minimum thickness aluminum sheet. Bolted on supports shall be either the same material and thickness as the enclosure or 0.105 in minimum steel. The side panels and filter shell shall be fabricated of 0.125 in minimum thickness aluminum sheet.

6.2.2.3 Exterior
All exterior seams for enclosure and doors shall be continuously welded and shall be smooth. All edges shall be filed to a radius of 0.03125 in minimum. Exterior cabinet welds shall be done by gas Tungston arc TIG process only. ER5356 aluminum alloy bare welding electrodes conforming to AWS A5.10 requirements shall be used for welding on aluminum. Procedures, welders and welding operators shall conform to the requirements and practices in AWS B3.0 and C5.6 for aluminum. Internal cabinet welds shall be done by either gas metal arc MIG or gas Tungston arc TIG Process.

6.2.2.4 Aluminum surfaces
Aluminum surfaces shall conform to the following:

6.2.2.4.1 Anodic Coating
An anodic coating shall be applied to the aluminum surface after the surface has been cleaned and etched. The cleaning and etching procedure shall be to immerse in inhibited alkaline cleaner at 159.8 °F for 5 minutes (Oakite 61A, Diversey 909 or equivalent in mix of 6 ounces to 8 ounces per gallon to distilled water). Rinse in cold water. Etch in a sodium solution at 150.8 °F for 5 minutes 0.5 ounce sodium fluoride plus 5 ounces of sodium hydroxide mix per gallon to distilled water. Rinse in cold water. Desmut in a 50% by volume nitric acid solution at 68 °F for 2 minutes. Rinse in cold water.

6.2.2.4.2 Conforming
The anodic coating shall conform to MIL-A-8625F (Anodic Coatings for Aluminum and Aluminum Alloys) for Type II, Class I Coating except the outer housing surface coating shall have a 0.0007 inch minimum thickness and a 0.952 ounces per square inch minimum coating weight. The anodic coating shall be sealed in a 5% aqueous solution of nickel acetate (PH 5.0 to 6.5) for 15 minutes at 210.2°F.

6.2.2.4.3 **Powder Coating**
The Model 342LX, 344LX and 346LX Cabinets shall be Powder Coated with a coating that is at least 2 mils thick. The color shall be an Aluminum finish, Federal Standard 595C, # 17178.

6.2.2.5 **Enclosure Doorframes**
The enclosure doorframes shall be double flanged out on all 4 sides and shall have strikers to hold tension on and form a firm seal between the door gasketing and the frame. The dimension between the door edge and the enclosure external surface when the door is closed and locked shall be 0.156 (+/- 0.08) in.

6.2.2.6 **Gasketing**
Gasketing shall be provided on all door openings and shall be dust-tight. Gaskets shall be 0.25 inch minimum thickness closed cell neoprene or silicone (BOYD R-10480 or equal) and shall be permanently bonded to the metal. If neoprene is used the mating surface of the gasketing shall be covered with a silicone lubricant to prevent sticking to the mating metal surface. A Gasket Top Channel shall be provided to support the top gasket on the door (prevent gasket gravitational fatigue).

6.2.2.7 **Cage Bottom Support Mounting Angles**

**The Model 332L, 334L & 336L**
Cage bottom support mounting angles shall be provided on either side, level with the bottom edge of the door opening, for horizontal support and bolt attachment; side cage supports shall be provided for the bracket cage supports; and bracket cage support attachments.

**Model 342LX, 344LX and 346LX**
Cage bottom supports shall be provided on either side, level with the bottom edge of the door opening, for horizontal support and bolt attachment. In addition, side cage supports shall be provided for the upper cage bolt attachments. Spacer brackets between the side cage supports and the cage shall be a minimum thickness of either 0.188 in aluminum or 0.105 in steel.

6.2.2.8 **Lifting Eyes**
The housing shall be provided with 2 lifting eyes for placing the cabinet on its foundation. Each eye opening shall have a minimum diameter of 0.75 in. Each eye shall be able to support a weight load of 1000 pounds.

6.2.2.9 **Exterior Bolt Heads**
All exterior bolt heads shall be tamperproof type.
6.2.3 Door Latches & Locks

6.2.3.1 Latching Handles
The latching handles shall have provision for padlocking in the closed position. Each handle shall be 0.75 in minimum diameter stainless steel with a minimum 0.5 in shank. The padlocking attachment shall be placed at 4.0 in from the handle shank center to clear the lock and key. An additional 4.0 in minimum gripping length shall be provided.

6.2.3.2 Latching Mechanism
The latching mechanism shall be a three-point draw roller type. The pushrods shall be turned edgewise at the outward supports and have a cross section of 0.25 in thick by 0.75 in wide, minimum.

6.2.3.3 Locks and Handles for Model 332L, 334L and 336L
When the door is closed and latched, the door shall be locked. The locks and handles shall be on the right side of the front door and left side of the rear door. The lock and lock support shall be rigidly mounted on the door. In the locked position, the bolt throw shall extend a minimum of 0.25 ± 0.03125 in into the latch Cam area. A seal shall be provided to prevent dust or water entry through the lock opening.

6.2.3.4 Locks
The locks shall be Corbin 2 type, or equal. Two keys shall be supplied with each cabinet. The keys shall be removable in the locked position only.

6.2.3.5 Bolts
The locks shall have rectangular, spring-loaded bolts. The bolts shall have a 0.281 in throw and shall be 0.75 in wide by 0.75 in thick (tolerance is ±0.035 in).

6.2.3.6 Center Latch Cam
The center latch cam shall be fabricated of a minimum thickness 0.1875 in steel or aluminum. The bolt surface shall horizontally cover the cam thickness. The cam shall be structured to only allow the door to open when the handle is moved toward the center of the door.

6.2.3.7 Rollers
Rollers shall have a minimum diameter of 0.875 in with nylon wheels and steel ball bearings.

6.2.4 Ventilation
The housing ventilation including intake, exhaust, filtration, fan assembly and environmental control are as follows:

6.2.4.1 Front Door
The Model 332L, 334L and 336L front door shall be provided with louvered vents. The louvered vent depth shall be a maximum of 0.25 in. A removable and reusable air filter shall be housed behind the door vents. The filter filtration area shall cover the vent opening area. A filter shell shall be provided that fits over the filter providing mechanical
support for the filter. The shell shall be louvered to direct the incoming air downward. The shell sides and top shall be bent over a minimum of 0.25 in to house the filter. The filter resident in its shell shall be held firmly in place with a bottom bracket and a spring loaded upper clamp. No incoming air shall bypass the filter. The bottom filter bracket shall be formed into a waterproof sump with drain holes to the outside housing. The Model 342LX, 344LX and 346LX left front door and right rear door shall be provided with louver vents.

6.2.4.2 Intake and Exhaust Areas
The intake (including filter with shell) and exhaust areas shall pass a minimum of 60 cubic feet of air per minute for housing #1, 26 cubic feet of air per minute for housing #2 and 120 cubic feet of air per minute for housing #3.

6.2.4.3 Electric Fan
The Model 332L, 334L and 336L housing shall be equipped with an AC powered electric fan with ball or roller bearings and a capacity of at least 100 cubic feet of free air delivery per minute. The fan shall be mounted within the housing and vented. The Model 342LX, 344LX and 346LX housing shall be equipped with two AC powered electric fans.

6.2.4.4 Temperature Controlling
Each fan shall be thermostatically controlled and shall be manually adjustable to turn on between 32 °F and 140 °F with a differential of not more than 20 °F between automatic turn on and off. The fan circuit shall be protected at 125% of the fan motor ampacity. The manual adjustment shall be graded in 20 °F increment scale. The Thermostat shall be an Omega KT01101141900 or equal.

6.2.4.5 Filter
The filter shall be 16 in wide by 12 in high by 0.875 in thick. The filter shall be an ECO-AIR Products E35S or equal.

6.2.5 Hinges & Door Catches

6.2.5.1 Leave Hinges
Two-bolt per leave hinges shall be provided to bolt the enclosure to the door. Housing 1B and 3 shall have 4 hinges and Housing 2 three hinges. Each hinge shall be 3.5 in minimum length and have a fixed pin. The pin ends shall be welded to the hinge and ground smooth. The pins and bolts shall be covered by the door edge and not accessible when the door is closed.

6.2.5.2 Front and Rear Doors
Front and rear doors shall be provided with catches to hold the door open at both 90 and 180 ±10 degrees. The catch minimum diameter shall be either 0.375 in for plated steel or aluminum rods or 0.25 in for Stainless steel. The catches shall be capable of holding the door open at 90 degrees in a 60 mph wind acting at an angle perpendicular to the plane of the door.
6.2.6 Police Panel

6.2.6.1 Police Panel Assembly
A police panel assembly shall be provided to allow the police officers limited access to intersection control. The police panel assembly including switches shall not extend into the cabinet more than 2.5 in.

6.2.6.2 Police Panel Door
The police panel door shall be equipped with a lock. The lock shall be keyed for a master police key. One key shall be furnished with each police lock. Each police key shall have a shaft at least 1.75 inches in length.

6.2.6.3 Toggle Power Switches
The police panel shall contain 2 DPST Toggle Power Switches.

6.2.6.3.1 Model 334L and 344LX
One switch shall be labeled "ON-OFF LIGHTS" and the other "POLICE CONTROL ON-OFF".

6.2.6.3.2 Models 332L, 336L, 342LX and 346LX
One switch shall be labeled “ON-OFF" and the other "FLASH/AUTOMATIC".

6.2.6.3.3 Front and Back of the Panel
The front and back of the panel shall be enclosed with a rigid metal covering so that no parts having line voltage are exposed.

6.2.6.3.4 Panel Assembly
The panel assembly shall have a drain to prevent water collecting within the assembly. The drain shall be channeled to the outside.
CHAPTER 6-SECTION 3
CABINET CAGE REQUIREMENTS

6.3.1 EIA 19-inch Rack Cage
A standard EIA 19-in rack cage shall be installed inside the Model 332L, 334L, and 336L housing for mounting of the controller unit and cabinet assemblies. Two standard EIA 19-in rack cages shall be installed inside the Model 342LX, 344LX and 346LX housing for mounting of the controller unit and cabinet assemblies.

6.3.2 EIA Cage Rack Portion
The EIA rack portion of the cage shall consist of 2 pairs of continuous, adjustable equipment mounting angles. The angles nominal thickness shall be either 0.1345 in plated steel or 0.105 Stainless Steel. The angles shall be tapped with 10-32 threads with EIA universal spacing. The angles shall comply with Standard EIA RS-310-D and shall be supported at the top and bottom by either welded or bolted support angles to form a cage.

6.3.3 Clearance
Clearance between rails for mounting assemblies shall be 17.75 in.

6.3.4 Angles
Two steel supporting angles extending from the front to the back rails shall be supplied to support the controller unit. The angles shall be designed to support a minimum of 50 pounds each. The horizontal side of each angle shall be a minimum of 3 in. The angles shall be vertically adjustable.

6.3.5 Cage
The cage shall be bolted to the cabinet at 4 points, via the housing cage supports and associated spacer brackets, 2 at the top and 2 at the bottom of the rails.

6.3.6 Cage Position
The cage(s) shall be centered within the cabinet(s).
CHAPTER 6-SECTION 4
CABINET ASSEMBLIES

6.4.1 General

6.4.1.1 Equipment
The following equipment shall be completely removable from the cabinet without removing any other equipment and using only a slotted or Phillips screwdriver:
- Power Supply Assembly
- Power Distribution Assembly
- Input File
- Output File
- Monitor Unit Assembly

6.4.1.2 Fuses, Circuit Breakers, Switches and Indicators
All fuses, circuit breakers, switches (except Police Panel Switches and Fan Fuse) and indicators shall be readily visible and accessible when the cabinet front door is open.

6.4.1.3 Equipment in the Cabinet
All equipment in the cabinet, when required shall be clearly and permanently labeled. The marker strips shall be made of material that can be easily and legibly written on using a pencil or ballpoint pen. Marker strips shall be located immediately below the item they are to identify and must be clearly visible with the items installed.

6.4.1.4 Resistor-Capacitor Transient Suppression
Resistor-capacitor transient suppression shall be provided at all AC relay sockets (across relay coil) except for the Flash Transfer Relays (FTR) in the output files where one suppression device may be common for all.

6.4.1.5 Leakage Resistor
A leakage resistor, which permits a small amount of current to pass through the heavy duty relay coil, shall be installed across the terminals of a relay socket to overcome the residual magnetism.

6.4.1.6 Assembly
Assembly or file depth dimension shall include terminal blocks.

6.4.1.7 Air Circulation
All assemblies and files shall allow air circulation through its top and bottom unless specifically called out otherwise.

6.4.1.8 Socket Types
Socket types for the following equipment shall be
Switch Pack BEAU S-5412-XX (or equal)
Heavy Duty Relay BEAU S-5408-XX (or equal)
Flasher Unit & Power Sup Mod BEAU S-5406-XX (or equal)
208 Monitor Unit PCB 22/44S
210 Monitor Unit PCB 28/56S

6.4.1.9 Mounting
Connector sockets for Flasher Unit, Power Supply, and Switch Pack modules shall be mounted with their front face 7.5 in deep from assembly or file front panel (Note: Output File Exception).

6.4.1.10 Guides
Guides (Top and Bottom) shall be provided for Switch Pack Modules, Flasher Units, Monitor Unit, Watchdog Timer Module, Detector & Isolator Modules, and Power Supply Module (Bottom only). The guides shall begin 1.0±0.5 inches in from the front panel surface and extend to within 0.5 inches from the connector socket face.

6.4.1.11 Fabricating
Assemblies and Files shall be fabricated of 0.060 in minimum thickness aluminum or stainless steel sheet. The metal surface shall be treated with clear chromate.

6.4.2 Power Supply Assembly

6.4.2.1 Power Supply
A power supply shall be provided to supply +24 VDC to the Input and Output Files for use by their associated devices. The power supply shall be compliant with Chapter 3, Section 4 under Model 206L Power Supply Unit of these specifications.

6.4.3 Power Distribution Assembly (PDA)

6.4.3.1 Equipment
The following equipment shall be provided with the power distribution assemblies:

6.4.3.1.1 PDA #1L

1 -- Duplex NEMA 5-15R Controller Receptacle
2 -- Duplex NEMA 5-15R Equipment Receptacle (one with GFCI)
1 -- 1 Pole 15 Amperes minimum, 120 VAC Clean Power Circuit Breaker
1 -- 1 Pole 15 Amperes, 120 VAC Equipment Circuit Breaker
1 -- 6 Pole Ganged, 10 Amperes, 120 VAC Signal Bus Circuit Breaker
1 -- 2 Pole Ganged, 10 Amperes, 120 VAC Flash Bus Circuit Breaker
1 -- Solid State Relay (Normally Closed) - rated minimum 50 Amperes, 120 VAC, Crydom A2450-B or equal.
2 -- Model 204 Flasher Unit and Socket
1 -- AUTO/FLASH Control Switch
1 -- FLASH Indicator Light
1 -- Model 430 Heavy Duty Relay (Transfer Relay) & Socket
2 -- 10 Position Terminal Blocks (TBK) T1 & T2

6.4.3.1.2 PDA #2L/2LX

1 -- Duplex NEMA 5-15R Controller Receptacle
2 -- Duplex NEMA 5-15R Equipment Receptacle (one with GFCI)
1 -- 1 Pole 15 Amperes minimum, 120 VAC Signal Bus Circuit Breaker
1 -- 1 Pole 15 Amperes minimum, 120 VAC Clean Power Circuit Breaker
6 -- 1 Pole Ganged, 10 Amperes, 120 VAC Signal Bus Circuit Breaker
with Auxiliary Switch
1 -- 1 Pole 15 Amperes, 120 VAC Equipment Circuit Breaker
1 -- 2 Pole Ganged, 10 Amperes, 120 VAC Flash Bus Circuit Breaker
1 -- Solid State Relay (Normally Closed) - rated minimum 50 Amperes,
120 VAC, A2450-B or equal.
2 -- Model 204 Flasher Unit and Socket
1 -- Model 206L Power Supply Module and Socket
1 -- AUTO/FLASH Control Switch
1 -- Flash On Indicator Light
3 -- 10 Position TBK T1, T2 & T4
1 -- 4 Position TBK T3
1 -- SSR Fault Indicator Light
1 -- HI Health Indicator Relay
1 -- K24 VDC Controlled Relay

6.4.3.1.3 PDA #2LS

1 -- Duplex NEMA 5-15R Controller Receptacle
2 -- Duplex NEMA 5-15R Equipment Receptacle (one with GFCI)
1 -- 1 Pole 15 Amperes minimum, 120 VAC Signal Bus Circuit Breaker
1 -- 1 Pole 15 Amperes minimum, 120 VAC Clean Power Circuit Breaker
6 -- 1 Pole Ganged, 10 Amperes, 120 VAC Signal Bus Circuit Breaker
with Auxiliary Switch
1 -- 1 Pole 15 Amperes, 120 VAC Equipment Circuit Breaker
1 -- 2 Pole Ganged, 10 Amperes, 120 VAC Flash Bus Circuit Breaker
1 -- Solid State Relay (Normally Closed) - rated minimum 50 Amperes,
120 VAC, A2450-B or equal.
2 -- Model 204 Flasher Unit and Socket
1 -- Model 206LS Power Supply Module and Socket
1 -- AUTO/FLASH Control Switch
1 -- Flash On Indicator Light
3 -- 10 Position TBK T1, T2 & T4
1 -- 4 Position TBK T3
1 -- SSR Fault Indicator Light
1 -- HI Health Indicator Relay
6.4.3.1.4 PDA #3L/3LX

1 -- Duplex NEMA 5-15R Controller Receptacle
2 -- Duplex NEMA 5-15R Equipment Receptacle
1 -- 1 Pole 15 Amperes, 120 VAC Equip. Circuit Breaker
2 -- 1 Pole 10 Amperes, 120 VAC Field Circuit Breakers
1 -- 1 Pole 15 Amperes, 120 VAC Clean Power CB
1 -- Model 206L Power Supply Module and Socket
1 -- Model 208 Monitor Unit and Socket
1 -- Model 430 Heavy Duty Relay and Socket (Transfer Relay)
1 -- Watchdog Timer ON/OFF-RESET Control Switch
3 -- Model 200 Switch Pack Sockets
3 -- 10 Position TBK T1, T2 & T4
1 -- 4 Position TBK T3

6.4.3.2 Rating of Breakers
Rating of breakers shall be shown on face of breaker or handle. Breaker function shall be labeled below breakers on front panel.

6.4.3.3 Equipment Receptacle
The first equipment receptacle in the circuit shall have ground-fault circuit interruption as defined in the National Electrical Code. Circuit interruption shall occur on 6 mA of ground-fault current and shall not occur on less than 4 mA of ground-fault current.

6.4.3.4 AUTO/FLASH Switch
The AUTO/FLASH Switch when placed in FLASH position (down) shall energize the Solid State Relay (SSR). When the switch is placed in the AUTO Position (up) the switch packs shall control the signal indications. The switch shall be a SPST Toggle Control Switch.

6.4.3.5 FLASH Indicator Light
The FLASH Indicator Light labeled "Flash On" shall be mounted on the PDA Front Panel. The lamp shall be driven by Flasher Unit/Output through Flash Relay Circuit No. 1 or per Circuit Breaker.

6.4.3.6 SSR Fault Indicator Light
The SSR Fault Indicator Light labeled “SSR Fault” shall be mounted on the PDA Front Panel. The lamp shall be driven by the SSR output when the Health Indicator Relay is energized.

6.4.3.7 Conductors
All conductors from the power distribution assembly routed to the cabinet wiring shall be connected to the terminal block on the common side, except for the AC power conductor between the service terminal block and main circuit breaker. All internal conductors terminating at the blocks shall be connected to the other side of the blocks.

6.4.3.8 Ganged Circuit Breakers
Ganged Circuit Breakers shall be certified by the circuit breaker manufacturer that their circuit breakers shall gang trip.

6.4.3.9 Monitor Unit
The Monitor Unit ON/OFF-RESET Switch shall be a DPST Toggle Control mounted on the PDA #3L's front panel. When placed in DOWN Position (OFF-RESET) a grounded input shall be presented at the Monitor Unit Pin 22 (resetting the WDT Circuitry) and the other side switch circuit closes by passing the Monitor Unit.

6.4.3.10 Circuit Breaker with Auxiliary Switch

6.4.3.10.1 Single Pole
Six Single Pole 10 Ampere Circuit Breakers with Auxiliary Switch Feature and Medium Trip Delay Characteristic shall be provided.

6.4.3.10.2 Breakers
The six breakers shall be wired and routed per the Option One Line Diagram. The breaker auxiliary switch circuit shall be open when the breaker is in ON Position. The auxiliary circuits shall be wired in parallel so that any tripped breaker shall energize the Solid State Relay input, Flash Transfer Relay Coils and the "FLASH ON" Indicator. The Auxiliary Contacts shall be rated at 5 Amperes, 120 VAC Minimum (fast on type connection).

6.4.3.10.3 Terminals
Breaker switches shall be bussed using straight solid non-insulated bus wire which is soldered directly to the “fast-on” terminals.

6.4.3.11 Model 206L/LS Power Supply Module

6.4.3.11.1 Requirements
The module shall meet the requirements specified in 6.4.2.1.

6.4.3.11.2 Module Chassis
The module chassis shall be vented. Its top and sides shall be open except for unit supports.
6.4.3.11.3 PDA Assembly
When resident in the PDA assembly, the module shall be held firmly in place by its stud screw, assembly connector support panel and a wing nut.

6.4.3.11.4 Wire-Wound Power Resistors
Two 0.5 Ohm, 10 watt minimum wire-wound power resistors with a 0.2uH inductance shall be provided (1 on the AC+ power line and 1 on the AC- line). Three MOV surge arrestors rated for 20 Joules minimum shall be supplied between AC+ and EG, AC- and EG, and between AC+ and AC-. A 0.68uF capacitor shall be placed across AC+ and AC- between the two power resistors and the MOV's.

6.4.3.12 Terminal Screw Sizes
Terminal screw size shall be 10-32 for TBK T1, T2 & T4 and 6-32 for TBK T3.

6.4.4 Input File

6.4.4.1 Depth
The file shall have a maximum depth of 8.5 in and shall intermit with and support 14 two-channel detector sensor or isolator units.

6.4.4.2 Connectors
The file shall provide a PCB 22/44S connector centered vertically for each two-channel detector. The associated number and letter side connectors shall be shorted internally. Pins D, E, F, J, K, L and W shall be brought out to a 8 position terminal block on the back of the file. The output emitters shall be common grounded with the ground terminating at TB 15, Position 4. Position 8 of the terminal block is assigned to Equipment Ground and is used to terminate lead in shields.

6.4.4.3 Marker Strips
The input file shall be provided with marker strips to identify isolators and detectors in the file.

6.4.4.4 Screw Size
Terminal Block (TB) terminal screw size shall be 8-32.

6.4.5 Output File

6.4.5.1 General Requirements

6.4.5.1.1 Marker Strips
The Output File shall be provided with marker strips to identify switch packs when mounted in the file.

6.4.5.1.2 Connectors
Switch pack connectors, monitor unit connectors, flash transfer relay sockets and flash programming connectors shall be accessible from the back of the Output File without the use of tools or removal of any other equipment.

6.4.5.1.3 **Terminal Positions**
TBK O1 and O3 terminal positions shall be labeled functionally. A permanent label reading "Channels 9 & 10 Separated" placed on the right Output File mounting flange.

6.4.5.1.4 **Field Wire**
Field wire terminal blocks shall be mounted vertically on the back of the assembly. Output File #1 shall have 3 terminal blocks with 12 positions and Output File #2 shall have 3 terminal blocks with 6 positions. Terminal position screw size shall be 10-32.

6.4.5.1.5 **Flash Transfer Relays**
The Flash Transfer Relays shall be Heavy Duty Type. The coil of the relay shall be energized only when the signals are in flashing operation and the police panel ON/OFF switch is ON. The relay shall transfer the field outputs from switch pack output to flash control. The transfer shall not interrupt the controller unit operation.

6.4.5.1.6 **Depth**
The depth of the file shall not exceed 14.5 in.

6.4.5.1.7 **Flash Programming Connectors**
The flash programming connectors shall be Molex Type 1375 or equal. The receptacle shall be mounted on the file with a programmable plug connected. The plug connector, with programming jumpers, shall be furnished for each circuit to allow red or yellow flash programming. Plug pins shall be crimped and soldered.

6.4.5.1.8 **TB O1, O2, O3 & O4 Terminal Screw Sizes**
Terminal Block (TB) O1 and O3 terminal screw size shall be 8-32 and TBK O2 & O4 shall be 6-32.

6.4.5.2 **Output File #1L**

6.4.5.2.1 **Containing**
The output file shall be capable of containing 12 Model 200 Switch Packs, 4 Flash Transfer Relays, and the Model 210 Monitor Unit. Four Flash Transfer Relays and 1 Model 210 Monitor Unit shall be furnished with each output file.

6.4.5.2.2 **Output Circuits**
The red and yellow output circuits of switch packs 1, 2, 3, 4, 5, 6, 7 and 8 shall be made available at individual pack Molex receptacle/plug connection for flash select-ability. Eight red & 4 yellow Molex Plugs shall be provided.

6.4.5.2.3 **Model 210 Monitor Unit**
It shall be possible to remove the Model 210 Monitor Unit without causing the intersection to go into flashing operation. The cabinet shall be wired so that with the front cabinet door closed and with the monitor unit removed, the intersection shall go into flashing operation (See One Line Diagram). The cabinet shall contain a conspicuous warning against operation with the Model 210 Monitor Unit removed.

### 6.4.5.2.4 Monitor Unit Compartment
The monitor unit compartment including the housed Model 210 Monitor Unit exclusive of handle shall extend no farther than 1.25 in front of the 19-in rack front surface. The switch pack socket connector front surface shall be no more than 8.5 inches in depth from the front surface of the output file.

### 6.4.5.3 Output File #2L (Model 420)

#### 6.4.5.3.1 Switch Packs and Flash Transfer Relays
The Output File #2 shall be capable of containing 6 Model 200 Switch Packs and 2 Flash Transfer Relays. Two Flash Transfer Relays shall be provided with the file.

#### 6.4.5.3.2 Output Circuits
The red and yellow output circuits of Switch Packs No. 1, 2, 4 and 5 shall be made available at a Molex receptacle/plug connection for flash select ability.

### 6.4.5.4 Output File #1LX
The Output File #1LX shall meet the requirements as specified in Section 6.4.5.2 except that it shall be touch safe as indicated in the plan details.

### 6.4.5.5 Output File #2LX
The Output File #2LX shall meet the requirements as specified in Section 6.4.5.3 except that it shall be touch safe as indicated in the plan details.

### 6.4.6 Heavy Duty Relay (Model 430)

#### 6.4.6.1 Electromechanical Type
Heavy duty relays shall be the electromechanical type designed for continuous duty.

#### 6.4.6.2 Enclosing
Each relay shall be enclosed in a removable, clear plastic cover. The manufacturer’s name, electrical rating and part number shall be placed on the cover. They shall be permanent, durable and readily visible.

#### 6.4.6.3 DPDT Contacts
Each relay shall be provided with DPDT contacts. Contact points shall be of fine silver, silver alloy or superior alternative material. Contact points and arms shall be capable of switching a 20 Amperes at 120 VAC tungsten load per contact once every 2 seconds with
a 50% duty cycle for at least 250,000 operations without contact welding or excessive burning, pitting or cavitation.

6.4.6.4 Relay Coil
The relay coil shall have a power consumption of 10 Volt-Amperes maximum.

6.4.6.5 Potential & Surge Rating
Each relay shall withstand a potential of 1500 VAC at 60 Hz between insulated parts and between current carrying or non-carrying parts. Each relay shall have a 1 cycle surge rating of 175 Amperes RMS.

6.4.7 Side Panels

6.4.7.1 Viewing
Two panels shall be provided and mounted on the cage parallel to the cabinet sides. In viewing from the back door, the left side panel shall be designated as the "Input Panel" and the right side panel shall be designated as the "Service Panel".

6.4.8 Cabinet Harnesses

6.4.8.1 C1 Harness
The C1 Harness shall be a minimum of 4 ft in length. The harness wire bundle shall be provided with external protection and routed on the Input Panel Side of the cabinet. Adequate length shall be provided to allow the C1P Connector to properly connect any State Approved Model 2070 Controller Unit mounted in the cabinet.

6.4.8.2 Ends
One end of the C1 Harness shall be the C1P Connector with pin contacts wired per the detail assignment. The other ends of the harnesses shall terminate as follows:
- Harness #1 - C4S Connector (connected to C4P on Output File #1)
  - C5S Connector (connected to C5P on either the Input Panel or Output File #2)
  - Assigned Input Files I & J Positions and Logic Ground Bus

- Harness #2 - C5S Connector (same as Harness #1)
  - C6S Connector (connected to C6P on the Output/PDA Assembly)
  - Assigned Input File I Positions and Logic Ground Bus

- Harness #3 - C4S Connector (same as Harness #1)
  - Assigned Input File I Positions
  - Input Panel Terminal Block and Logic Ground Bus

6.4.8.3 C1 Harness #3/Output File #2 Adaptor
C1 Harness #3/Output File #2 Adaptor shall be comprised of a C4P Connector on one end and a C5S on the other. The adaptor shall interface the first 24 pins of C4 Connector to the 24 pins of C5.
6.4.8.4 Conductors
Conductors between the C1 Connector and the Input File(s) shall be of adequate length to allow any conductor to be connected to any detector output terminal (Positions S, F, or W).
CHAPTER 6-SECTION 5
CABINET WIRING

6.5.1 Cabinet Wiring Diagram

6.5.1.1 Diagrams/Drawings Supply
Four sets of nonfading (comparable to Xerox 2080) cabinet wiring diagram and drawing sheets shall be supplied with each cabinet. The diagrams shall be nonproprietary. They shall identify all circuits in such a manner as to be readily interpreted. The cabinet drawing sheets shall show the equipment layout in an elevation view as viewed from the rear of the cabinet with the left and right cabinet walls shown in their relative positions. The diagram and drawing sheets shall be placed in a heavy duty side opening clear plastic pouch and attached to the front cabinet door.

6.5.1.2 Pouch
A pouch that would hold the Cabinet Manuals, Cabinet Wiring and Drawing Sheets, and Cabinet Keys shall be provided as part of the Cabinet. The pouch shall be of such design and material that it provides adequate storage and access to the wiring diagram sheets and cabinet manuals. The pouch shall be of size and strength to easily hold the documents and keys without tearing.

6.5.1.3 Manuals
Two cabinet manuals shall be provided in the pouch together with the wiring diagram and drawing sheets.

6.5.2 Conductors

6.5.2.1 General
All conductors used in cabinet wiring shall terminate with properly sized non-insulated (if used, for DC Logic Only) or clear insulated spring-spade type terminals except when soldered to a through-panel solder lug on the rear side of the terminal block or as specified otherwise. All crimp-style connectors shall be applied with a power tool which prevents opening of the handles until the crimp is completed.

6.5.2.2 Sizes
Conductors between the service terminal AC- and Equipment Ground and their associated bus, the equipment ground bus conductor to Power Distribution Assembly and cage rail, AC- Bus to Power Distribution Assembly shall be No. 8 or larger.

6.5.2.3 Types
All conductors unless otherwise specified shall be No. 22, or larger, with a minimum of 19 copper strands. Conductors shall conform to Military Specification: MIL-W-16878D, Type B, or better. The insulation shall have a minimum thickness of 10 mils and shall be
nylon jacketed polyvinyl chloride except that Conductors No. 14 and larger may have Type THHN insulation (without Nylon Jacket), and shall be stranded with a minimum of 7 copper strands.

6.5.2.4 Labels
All conductors, except those which can be readily traced, shall be labeled. Labels attached to each end of the conductor shall identify the destination of the other end of the conductor.

6.5.2.5 Color-Code Requirements
All conductors shall conform to the following color-code requirements:

6.5.2.5.1 Grounded Conductors
The grounded conductors of AC circuits shall be identified by a solid white or solid gray color.

6.5.2.5.2 Equipment Grounding
The equipment grounding conductors shall be identified by a solid green color or by a continuous green color with 1 or more yellow stripes.

6.5.2.5.3 DC Logic Ground
The DC logic ground conductors shall be identified by a continuous white color with a red stripe.

6.5.2.5.4 Ungrounded AC+ Conductors
The ungrounded AC+ conductors shall be identified by a solid black or continuous black with colored stripe.

6.5.2.5.5 Logic Ungrounded Conductors
The logic ungrounded conductors shall be identified by any color not specified above.

6.5.2.6 DC Logic Ground and Equipment Ground
Within the cabinet, the DC logic ground and equipment ground shall be electrically isolated from the AC grounded conductor and each other by 500 Mega Ohms when tested at 250 VDC.

6.5.2.7 AC- Copper Terminal Bus
The AC- copper terminal bus shall not be grounded to the cabinet or connected to logic ground. Nylon screws with a minimum diameter of 0.25 in shall be used for securing the bus to the service panel.

6.5.2.8 Power Supply DC Ground
The cabinet power supply DC Ground shall be connected to the DC logic ground bus using a No. 14, or larger, stranded copper wire.

6.5.2.9 Input Terminal
Each detector lead-in pair, from the field terminals in the cabinet to the sensor unit rack connector, shall be a cable of UL Type 2092 or better. The stranded tinned copper drain wire shall be connected to a terminal on the input file terminal block. This input terminal shall be connected to the equipment grounding bus through a single conductor.

6.5.3 **Terminal Blocks**

6.5.3.1 **Terminal Screws**
The terminal blocks shall be barrier type rated at 20 Amperes, 600 volts RMS minimum. The terminal screws shall be 0.3125 in minimum length nickel plated brass binder head type with screw inserts of same material. Screw size is called out under associated cabinet assembly, file or side panel.
CHAPTER 6-SECTION 6
SERVICE PANEL ASSEMBLY

6.6.1 **General Requirements**
A Service Panel Assembly shall be provided. The assembly shall function as the entry point for AC Power to the cabinet including main and secondary circuit breakers, cabinet transient and voltage surge protection, clean power filtering, and Raw and Clean AC Power Sources.

6.6.2 **Location**
The assembly shall be located on the lower right Cage when viewed from the back door.

6.6.3 **Service Terminal Block**
The terminals of the Block shall be labeled AC+, AC-, AC+ In , AC+ Out and EQ GND and shall be covered with a clear insulating material to prevent inadvertent contact. The Terminating Lugs shall be large enough to accommodate # 2 conductors. A AWG #8 Jumper Conductor shall be provided between AC+ In and AC+ Out.

6.6.4 **Surge Protector**
The surge protector shall be the EDCO Model SHA-1250 ITS or equal.

6.6.4.1 **Impulse Breakdown**
Less than 1,000 volts in less than 0.1 us at 10 kilovolts/us.

6.6.4.2 **Standby Current**
Less than 1 mA.

6.6.4.3 **Striking Voltage**
Greater than 212 VDC.

6.6.4.4 **Ranges**
Capable of withstanding 15 pulses of peak current each of which will rise in 8 us and fall in 20 us to 0.5 of the peak voltage at 3-minute intervals. Peak current rating shall be 20,000 Amperes.

CHAPTER 6-SECTION 7
SERVICE POWER DISTRIBUTION ASSEMBLY

6.7.1 **General Requirements**
A Service Power Distribution Assembly (Service PDA) shall be provided. The assembly shall function as the entry point for AC Power to the LX cabinets including main and secondary circuit breakers, cabinet transient and voltage surge protection, clean power filtering, and Raw and Clean AC Power Sources.
6.7.2 **Location**
The Service PDA shall be located on the lower left rack when viewed from the back door.

6.7.3 **Service Terminal Block**
The terminals of the Block shall be labeled AC+, AC-, EQ GND , AC+ , AC- and EQ GND and shall be covered with a clear insulating material to prevent inadvertent contact. The Terminating Lugs shall be large enough to accommodate # 2 conductors.

6.7.4 **Surge Protector**
The surge protector shall be the EDCO Model SHA-1250 ITS or equal.

6.7.4.1 **Impulse Breakdown**
Less than 1,000 volts in less than 0.1 us at 10 kilovolts/us.

6.7.4.2 **Standby Current**
Less than 1 mA.

6.7.4.3 **Striking Voltage**
Greater than 212 VDC.

6.7.4.4 **Ranges**
Capable of withstanding 15 pulses of peak current each of which will rise in 8 us and fall in 20 us to 0.5 of the peak voltage at 3-minute intervals. Peak current rating shall be 20,000 Amperes.
CHAPTER 6-SECTION 8
332L, 334L, 336L, 342LX, 344LX & 346LX CABINET DETAILS

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6.8.11 PDA #2L & #3L Details sheet 2 of 8
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CHAPTER 9-SECTIONS 1, 2, 3, 4 & 5

9.1.1 Controller Unit

The Controller Unit shall be composed of the Unit Chassis, modules and assemblies per their version. The following is a list of 2070 Versions, their interface rolls and composition:

<table>
<thead>
<tr>
<th>UNIT VERSION</th>
<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>2070V UNIT</td>
<td>Provides directly driven VME and mates to 170 &amp; ITS cabinets. It consists of: UNIT CHASSIS, 2070-1A TB, 2070-1A MCB, 2070-2E+ FI/O, 2070-3A FRONT PANEL, 2070-4A POWER SUPPLY, and 2070-5 VME CAGE ASSEMBLY.</td>
</tr>
<tr>
<td>2070E UNIT</td>
<td>LITE Unit mates to the 170 &amp; ITS cabinets. It consists of: UNIT CHASSIS, 2070-1E CPU, 2070-2E+ (2C if ITS CABINET), FI/O, 2070-3B FRONT PANEL and 2070-4A POWER SUPPLY</td>
</tr>
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<td>2070EC UNIT</td>
<td>LITE unit mates to ITS cabinets only. It consists of: UNIT CHASSIS, 2070-1E CPU, 2070-2E+ FI/O, 2070-3C FRONT PANEL and 2070-4A POWER SUPPLY</td>
</tr>
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<td>2070LX UNIT</td>
<td>LX Unit mates to the 170 &amp; ITS cabinets. It consists of: UNIT CHASSIS, 2070-1C CPU, 2070-2E+ (2C if ITS CABINET), FI/O, 2070-3B FRONT PANEL and 2070-4A POWER SUPPLY</td>
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Note: See Chapter 11 for 2070 NEMA Versions
9.1.6 EIA-485 Communications Links
All circuitry associated with the EIA-485 Communications links shall be capable of reliably passing a minimum of 1.0 Mbps. Isolation circuitry shall be by optical/digital isolator technologies.

9.2.4.3 Ram Memory
A minimum of 32 MB of DRAM/pseudo SRAM memory, organized in 32-bit words, shall be provided. A minimum of 512 KB of SRAM will be available for agency use, organized in 16 or 32-bit words shall be provided. The time from the presentation of valid RAM address, select lines, and data lines to the RAM device to the acceptance of data by the RAM device shall not exceed 80 ns and shall be less as required to fulfill zero wait state RAM device write access under all operational conditions.

9.2.4.6 CPU_Reset
A software-driven CPU_Reset signal (Active LOW) shall be provided to reset other controller systems, such as the FCU and FPA. The signal output shall be driver capable of sinking 30 mA at 30 VDC. Execution of the program module “cpureset” in the boot image shall assert the CPU_Reset signal once. The assertion of the CPU_Reset signal shall cause the FCU firmware to reset. The FCU shall become operational and respond to the Modules Status Request with the P bit set, within 33ms after a firmware reset. The cpureset shall be executed when the controller starts up or is rebooted using the OS-9 break command.

9.2.4.10 Network Switch, Model 2070-1E
The Model 2070-1E CPU Module shall be provided with an integrated Store-and-Forward Network Switch per the IEEE 802.3, 802.3u and 802.3 x specifications. The switch shall be configured with two ports connected to the front panel RJ-45 connectors (C14S) and a third port shall be connected to the CPU. A fourth Port on the Network Switch shall be used to route, via magnetics, to Ethernet across the Motherboard to the “A” Connector’s Network Lines. DC Grounding around the network connectors and lines shall be provided. The Network Lines shall be assigned as: NetP5 TX+, TX-, RX+ and RX- respectively.

9.2.6 Datakey
When programmed, Byte 3 of the header shall contain the Key Type value as defined in the following table:

<table>
<thead>
<tr>
<th>Key</th>
<th>Model No.</th>
<th>Memory Size</th>
<th>Sector Size</th>
<th>Part Number</th>
<th>Color</th>
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<td>2Mb</td>
<td>64KBytes</td>
<td>611-0089-004A</td>
<td>Yellow</td>
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<tr>
<td>SFK4Mb</td>
<td>4Mb</td>
<td>64KBytes</td>
<td>611-0104-002A</td>
<td>Red</td>
</tr>
<tr>
<td>SFK8Mb</td>
<td>8Mb</td>
<td>64KBytes</td>
<td>611-0132-006A</td>
<td>Blue</td>
</tr>
<tr>
<td>SFK32Mb</td>
<td>32Mb</td>
<td>64KBytes</td>
<td>611-0164-005A</td>
<td>Green</td>
</tr>
</tbody>
</table>

### 9.2.7.1 Operating System

The CPU Module shall be supplied with Microware Embedded OS-9 Release 1.3.1 or later with kernel edition #380 or later. The following modules shall be included:

- Embedded OS-9 Real Time Kernel
- Sequential Character File Manager (SCF)
- Stacked Protocol File Manager (SPF)
- Pipe File Manager (PIPEMAN)
- Random Block File Manager (RBF)
- C Shared Library (CSL)

Boot Image shall include the following utility modules:

- Break
- Date
- Deiniz
- Devs
- Free
- Copy
- Dir
- Tmode
- Edt
- List
- Load
- Deldir
- Dump
- Del
- Ident
- Iniz
- Irqs
- Events
- Echo
- Format
- Dcheck
- Login
- Link
- Kermit
- Tsmon
- Mdir
- Mfree
- Pd
- Makdir
- Save
- Attr
- Rename
- Procs
- Unlink
- Sleep
- Xmode
- Shell
- Build
- Setime
- Merge
- Grep
- Mat
- Tee
- Printenv
- Chown
- Cudo
- Mkdatmod

The Boot Image with the above utilities and including the network driver and descriptor shall be loaded into RAM as part of OS-9 initialization as defined in Section 9.2.7.3.2.

### 9.2.7.2 Memory Drivers

Drivers shall be provided to access the FLASH, SRAM, and DRAM memories. The following descriptors shall apply:

- `/f0` FLASH drive non-volatile, writeable
- `/dd` FLASH drive OS-9 default device for `/f0`
- `/f0wp` FLASH Drive as `/f0` except write protected
- `/f0fmt` FLASH Drive as `/f0` except format enabled
- `/r0` SRAM Drive non-volatile ramdisk
- `/r0fmt` SRAM Drive as `/r0` except format enabled
- `/r2` DRAM Drive volatile 2 MB ramdisk, not automatically initialized
9.2.7.5.3 Multi-user functionality

The boot image init module shall be configured with a “default directory name” as /f0wp. This will allow login and tsmon to provide the user with login prompt from the terminal port or from the network via a telnet session. The login and tsmon OS-9 modules should be included in the operating system boot image for the implementation of multi-user mode. A “.login” file with an entry of date shall be included in the /f0 directory. The attributes of the .login file shall be set using the command “attr –pwprwr .login “ and the ownership shall be set to group.user ID of “0.0”

The following startup file shall be provided resident in the /f0 directory. The startup file shall have the ownership group.user ID of “20.70”.

Include the following startup file:

* 
* -t –np 
* 
* Startup File 
*/f0/sys/startspf 
*/f0/sys/startnfs 
ex tsmon /sp4 
* 
*

9.2.7.5.4 Network Configuration

The modules inetdb, inetdb2 and rpcdb shall be generated by the make utility via the use of a makefile and the network configuration files residing the /f0/ETC directory. The generated inetdb, inetdb2 and rpcdb modules should be re-located to the /f0/CMDS/BOOTOBS directory where they will be pick-up by the network configuration shell scripts located at /f0/SYS. The modules shall be configured with the network default values as defined in Section 9.2.6 (Data Key) or via the interfaces.conf shell script and all services shall be comment out in the Internet Daemon Services List inetd.conf located in the /f0/ETC directory.

9.2.7.5.6 ETC
A set of example configuration files consistent with the above networking modules shall be provided in the /f0/ETC directory. This directory shall contain following standard of OS-9 files: hosts, hosts.equiv, networks, protocols, services, inetd.conf, resolv.conf, hosts.conf, rpc, interfaces.conf, routes.conf., nfs.map, nfsd.map in addition to the following makefile:

Include the following makefile:

```
###                    Model 2070 Controller
#
#                           Makefile
#
# This makefile will make the inetdb, inetdb2 and rpcdb data modules
#
-#

TRGTS = inetdb rpcdb
DEL = del -qf
COPY = copy
RPCDBGEN = rpcdbgen
ATTR = attr -rweprpwpe
IDBGEN = idbgen
OS = OSK
CPU = 68k

ODIR = /f0/CMDS/BOOTOBJS
SDIR = /f0/ETC

SFILES = $(SDIR)/hosts $(SDIR)/hosts.equiv $(SDIR)/networks $(SDIR)/services $(SDIR)/inetd.conf \
        $(SDIR)/resolv.conf $(SDIR)/host.conf \ $(SDIR)/interfaces.conf $(SDIR)/routes.conf
RFILES = $(SDIR)/nfs.map $(SDIR)/nfsd.map
RPCOPT = # -s -c -d

all: $(TRGTS)
   $(COPY) -f $? -w=$(ODIR)
   $(COPY) -f inetdb2 -w=$(ODIR)
rpcdb: $(RFILES)
   $(DEL) $@
   $(RPCDBGEN) -to=$(OS) -tp=$(CPU) -w=$(SDIR) -o=$@ $(RPCOPT)
   $(ATTR) $@
```
inetdb:  $(SFILES)
    $(DEL)  $@
    $(DEL)  $@2
    $(IDBGEN) -to=$(OS) -tp=$(CPU) -d=$(SDIR) $@
    $(ATTR)  $@
    $(ATTR)  $@2

clean:
    $(DEL)  $(ODIR)/inetdb
    $(DEL)  $(ODIR)/inetdb2
    $(DEL)  $(ODIR)/rpcdb

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

9.2.7.6.1  Directories

The 2070 shall follow Standard Microware File System Configuration. A /f0/CMDS, 
/f0/CMDS/BOOTOBJS, /f0/ETC and /f0/SYS directories shall be implemented. Execute 
permission shall be included in the attributes of files in the /f0/CMDS directory. Sysgo 
should set its execution directory to /f0wp/CMDS prior to spawning opexec or other 
processes. The /f0/CMDS/BOOTOBJS shall contain the modules as identified above and 
other customizable descriptors and modules. The /f0/SYS shall contain the files named 
“motd” and “errmsg” as defined elsewhere in this section and the following four standard 
OS-9 network configuration shell script files: startspf, startnfs, loadspf and loadnfs.

Include the following startspf file:

*  -t  -np
*  *
*  startspf
*  Shell Script to Start SPF System
*  *
*  Set default directories before starting daemon programs
*  *
*  chd  /h0
*  chx  /h0/cmds
*  *
*  Load SPF modules
*  /
f0/sys/loadspf
*  *
*  Load and start mbuf handler (May be done via p2 list in init module)
*  Allow for error returned in case sysmbuf is already initialized.
*  *
*  -*nx
*  mbinstall
*  -x
*  *
*  Start SPF system using ipstart
*  ipstart

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* Add interfaces not specified in inetdb2
* 
*ifconfig enet0 <my_address> binding /<dev>/enet 
*ifconfig ppp0 binding /ipcp0
* 
* Add any static routes. Even if running routed it may be useful 
* to add multicast routes.
* 
*route add -net 224.0.0.0 <my_address>
* 
* Start service daemons
* routed: Dynamic routing server
* inetd: FTP/Telnet and other protocols server
* telnetd: Remote terminal server
* ftpd: Remote file-transfer server (FTP)
* bootpd: Network boot protocol server
* tftpd: Trivial file transfer protocol server
* 
*routed <>>>/nil&
inetd <>>>/nil&
telnetd <>>>/nil &
ftpd <>>>/nil &
*bootpd /h0/TFTPBOOT/bootptab <>>>/nil&
tftpd /h0/TFTPBOOT <>>>/nil &
* 
* spfndpd: Hawk User state debugging daemon
* spfnppd: Hawk Profiling daemon
* 
*spfndpd <>>>/nil &
*spfnppd <>>>/nil &
* 
* End
* 
Include the following loadspf file:

*-t -np
* 
* loadspf for SPF LAN Communication Package
* Load SPF System Modules
* 
load -d /f0wp/cmds/bootobjs/inetdb
load -d /f0wp/cmds/bootobjs/inetdb2
*load -d sysmbuf * System Mbuf module
load -d /f0wp/cmds/bootobjs/pkman
load -d /f0wp/cmds/bootobjs/pkdvr
load -d /f0wp/cmds/bootobjs/pk
load -d /f0wp/cmds/bootobjs/pks
*load -d spf * SPF file manager
load -d /f0wp/cmds/bootobjs/spip
load -d /f0wp/cmds/bootobjs/ip0
load -d /f0wp/cmds/bootobjs/sptcp
load -d /f0wp/cmds/bootobjs/tcp0
load -d /f0wp/cmds/bootobjs/spudp
load -d /f0wp/cmds/bootobjs/udp0
load -d /f0wp/cmds/bootobjs/spraw
load -d /f0wp/cmds/bootobjs/raw0
load -d /f0wp/cmds/bootobjs/sproute
load -d /f0wp/cmds/bootobjs/route0

* Load LAN Trap library and Commands
* Load one of the following Netdb name resolution trap handlers
* load -d /f0wp/cmds/bootobjs/netdb_local
* Load trap handler for DNS name resolution
* load -d /f0wp/cmds/bootobjs/netdb_dns
* Load SPF Ethernet Drivers and Descriptors
* load -d /f0wp/cmds/bootobjs/spenet
load -d /f0wp/cmds/bootobjs/enet

* Serial Drivers and Descriptors
* load -d spslip sps10 * Slip /t1
*load -d spipcp icp0 * PPP IPCP
*load -d splcp lcp0 * PPP LCP
*load -d sphdlc hdlc0 * PPP HDLC
* chd ../..
*load -d chat pppd pplog ppauth; chd BOOTOBS/SPF * PPP Utilities
* *
* Chd up to CMDS directory
* load -d mbindinstall * Load mbinstall memory handler
* (or can be done within init)
* load -d /f0wp/cmds/ipstart
* *
*load -d /f0wp/cmds/routed
*load -d telnet telnetd telnetdc ;* Telnet support modules
*load -d ftp ftphd ftpdc ;* FTP support modules
*load -d tftp tftpd bootpd ;* Bootp/TFTP support modules
load -d /f0wp/cmds/inetd

*load -d idbgen idbdump ndbmod ;* Development tools
load -d /f0wp/cmds/ifconfig
load -d /f0wp/cmds/route
*load -d route hostname ifconfig arp ;* Runtime tools
load -d /f0/cmmds/ping
load -d /f0/cmds/netstat
*
* Loads the Hawk Daemons.
*
*load -d /f0/cmmds/spfndpd
*load -d /f0/cmmds/ndpio
*load -d /f0/cmmds/spfndpdc
*
Include the following startnfs file:

```bash
*-t -np

* startnfs for NFS provided with LAN Communication Package

* Shell Script to Start NFS Client System and mount file systems

* NOTE: NFS client modules may be loaded into memory using loadnfs

chd /f0    ;* Set default directories for NFS mounts
chx /f0/cmds   ;* Programs are located in CMDS directory
SYS/loadnfs

* Start NFS client and mount remote file systems

iniz nfs_devices   ;* attach NFS client devices

* Example mount commands to connect to server systems remote device

*mount -m peer:/peer   ;* mount remote file systems
*mount alpha:/h0 /alpha <>>/nil&
*mount electron:/home/joe/dat/Modules  /h0 <>>/nil&

* Start NFS Server System

* Specify file systems to export (Necessary if acting as a NFS Server)

*exportfs -s /f0      ;* specify remote mountable devices
*exportfs -s /r0      ;* specify remote mountable devices

* start rpc services daemons
* Uncomment portmap, mountd and nfsd if acting as a NFS Server

*portmap<>>/nil&  ;* start portmap server    (rpcinfo)
*mountd<>>/nil&    ;* mount server          (mount, showmount)
*nfsd<>>/nil&      ;* nfs server                (..)

* End

Include the following loadnfs file:

*-t -np

* loadnfs for NFS modules provided with LAN Communication Package

* Load NFS Client Modules

* chd /f0/cmds/bootobjs
* NFS file manager, driver and descriptor
load -d /f0wp/cmds/bootobjs/nfs
load -d /f0wp/cmds/bootobjs/nfsnul
load -d /f0wp/cmds/bootobjs/nfs_devices
load -d /f0wp/cmds/bootobjs/rpcdb
*
* Load NFS Client Commands
*
* chd /f0wp
*
*load -d nfsc mount * Client connection handler
*load -d rpcdbgen rpcdump nfsstat * RPC data module utilities
*load -d rpcinfo
*
* Load NFS Server Modules
*
*load -d exportfs portmap * NFS server required utilities/daemons
*load -d nfssd mountd * NFS server required utilities/daemons
*load -d showmount
*
* Load RPC Client Modules
*
*load -d rcopy rload rpr on rup rusers spray
*
* Load RPC Server Modules
*
*load -d rldd rexdc rexd rstatd rusersd sprayd
*
*
* End
*

The motd file shall contain the Manufacturer’s Name and TEES and Erratas Release information. The attributes of the motd file shall be set using the command attr –pwprwr motd and the ownership shall be set to group.user ID of “0.0”

Include the following motd file:

************************************************************
******     Manufacturer’s Name
******        **
**     TEES Release 2009, Errata No.1 and Errata No. 2
************************************************************

The errmsg file shall be the standard OS-9 errormsg file which defines OS-9 error codes 000:001 through 010:068. The attributes of the errormsg file shall be set using the command attr –pwprwr errormsg and the ownership shall be set to group.user ID of “0.0”

9.2.7.6.2 Password
The /f0/SYS shall contain a "password" file with one entry, reg user. The password file should follow Microware's password file format for the addition and configuration of
multiuser functionality and password protection. A user account with the name “reg”, the password as “user” shall be defined as listed in the password file. The attributes of all files in the /f0/sys directory, except for those files as mentioned elsewhere in these specifications, shall be set using the following command:

$ attr -nprpwnpnewr *
and the ownership shall be group.user ID of “0.0”.

Include the following password file:

* * Password File
* Model 2070 Controller*  
* reg,user,20.70,128,/f0wp/cmds,/f0,shell -p="Reg:"  
* *

A Termcap text file shall be include in the /f0/SYS directory. This Termcap file shall contain description fields defining the capability names and values of the front panel DISPLAY.

9.3.8.3 Outputs
Simultaneous assertion of all outputs shall occur within 100 µs. Each output shall be capable of being individually configured in state to ON, OFF (Cases A and D), or an optional state synchronized with either phase of LINESYNC (Cases B and C). The condition of the outputs shall only be "ON" if the FI/O continues to receive active communications from the CPU Module. If there is no valid communications with the CPU Module for 2.0 seconds, all outputs shall revert to the OFF condition, and the Module Status Byte shall be updated to reflect the loss of communication from the CPU Module.
9.3.8.4 Standard Function
Each output shall be controlled by the data and control bits in the CPU Module Field I/O frame protocol as follows:

Output Bit Translation

<table>
<thead>
<tr>
<th>Case</th>
<th>Output Data Bit</th>
<th>Output Control Bit</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>0</td>
<td>Output in the OFF state</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>1</td>
<td>Output is a square wave, synchronized to the LINESYNC signal. When LINESYNC is ON (1), the output is OFF, and when LINESYNC is OFF (0), the output is ON.</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>1</td>
<td>Output is a square wave, synchronized to the LINESYNC signal. When LINESYNC is ON (1), the output is ON, and when LINESYNC is OFF (0), the output is OFF</td>
</tr>
<tr>
<td>D</td>
<td>1</td>
<td>0</td>
<td>Output is in the ON state.</td>
</tr>
</tbody>
</table>

9.3.8.4.1 Case A
In Case A above, the corresponding output shall be turned OFF if previously ON and if previously OFF remain OFF until otherwise configured. For optional half-cycle switching (Cases B and C), all outputs to be changed shall be changed within 50 µs after the corresponding LINESYNC transition and shall remain in the same state during the entire half cycle. In Case D above, the corresponding output shall be turned ON if previously OFF and if previously ON should remain ON until otherwise configured. All outputs shall neither glitch nor change state unless configured to do so.
9.3.8.7 Communication Processing
This task shall be to process the command messages received from the CPU Module, prepare, and start the response transmission. The response message transmission shall begin within 4 ms of the receipt of the last byte of the command message for all command message types.

Processing time for the Set Outputs command shall be less than 1.5 ms. The FI/O shall be able to process 1000 Set Outputs command messages within 1.5 seconds, where each command toggles all outputs utilizing Case A and D as defined elsewhere in these specifications. Each output shall consist of a square wave with a 50% duty cycle and a time period of less than 3 ms.

9.4.5.16 C50 Enable Function
C50 ENABLE function when grounded by Connector C50 Pins 1 and 5 shall be brought to Connector A1 Pin B21 for the purpose of disabling the module Channel 2.

9.5.5.1 AC Fail/Power Down Output Lines
The AC Fail/Power Down Output Lines shall go Low (ground true) immediately upon Power Failure. The Lines shall transition to High within 50 ms after both Power Restoration and supply is fully recovered. The Lines shall be driven separately. The Sysreset/Powerup Output Lines shall transition to Low 525 +/- 25 ms after AC Fail/Power Down transition to Low. The Lines shall transition to HIGH 225 +/- 25 ms after both Power Restoration and the supply is fully recovered (e.g. after +5 VDC is within the range specified in section 9.5.6). The Lines shall be driven separately.
CHAPTER 10-SECTION 2
MODEL 2070-7A & 7B ASYNC / SYNC
SERIAL COMM MODULE

10.2.1 Circuits
Two opto-isolated independent circuits designated circuits #1 (Channel 1) and circuits #2 (Channel 2), shall be provided. Their functions are identical, except for the CPU Serial Communications Port and external connector (circuits #1 to SP1 [or SP3] and Connector C21S and circuits #2 to SP2 [or SP4] and Connector C22S). Line drivers/receivers shall be socket or surface mounted.

The 2070-7x module’s isolation circuitry shall be capable of reliably passing a minimum of 1.0 Mbps. The EIA-485 drivers to the external connectors must be capable of supporting either two times the maximum applicable baud rate for the port or 1Mbps, which ever is less. The EIA-232 drivers to the external connectors must be capable of supporting a minimum of 115,200 bits per second.

10.2.2 2070 -7A
Each circuit shall convert its EIA-485 signal lines (RX, TX, RTS, CTS and DCD) to/from board TTL Level Signals; isolate both signal and ground; and drive / receive external EIA-232 devices via C21 / C22 Connectors. Connectors shall be DB-9S type.

<table>
<thead>
<tr>
<th>2070-7A (DB-9S)</th>
<th>C21S &amp; C22S CONNECTOR PINOUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIN</td>
<td>FUNCTION</td>
</tr>
<tr>
<td>1</td>
<td>DCD</td>
</tr>
<tr>
<td>2</td>
<td>RXD</td>
</tr>
<tr>
<td>3</td>
<td>TXD</td>
</tr>
<tr>
<td>4</td>
<td>NA</td>
</tr>
<tr>
<td>5</td>
<td>IFC GND</td>
</tr>
<tr>
<td>6</td>
<td>NA</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
</tr>
<tr>
<td>9</td>
<td>NA</td>
</tr>
</tbody>
</table>

IFC GND is isolated from the internal ground system & is the voltage reference for the EIA-232 & EIA-485 signals.

10.2.3 2070 - 7B
Each circuit’s drivers/receivers and associated signal ground shall be matched with an associated EIA-485 receiver/driver; isolating both signal and ground, and driver/receiver
Each circuit EIA-485 signal lines, (RX, TX, TXC (I), TXC (O) and RXC) and associated signal ground shall be board terminated to matching drivers/receivers; isolating both signal and ground, and drive/receiver external EIA-485 devices via C21/C22 Connectors. Connectors shall be DB-15S type.

<table>
<thead>
<tr>
<th>2070-7B (DB-15S)</th>
<th>C21S &amp; C22S CONNECTOR PINOUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIN</td>
<td>FUNCTION</td>
</tr>
<tr>
<td>1</td>
<td>TXD +</td>
</tr>
<tr>
<td>2</td>
<td>IFC GND</td>
</tr>
<tr>
<td>3</td>
<td>TXC +</td>
</tr>
<tr>
<td>4</td>
<td>IFC GND</td>
</tr>
<tr>
<td>5</td>
<td>RXD +</td>
</tr>
<tr>
<td>6</td>
<td>IFC GND</td>
</tr>
<tr>
<td>7</td>
<td>RXC +</td>
</tr>
<tr>
<td>8</td>
<td>NA</td>
</tr>
</tbody>
</table>

10.2.4 EIA-485 Termination Requirements
The EIA-485 Line Drivers/Receivers shall be socket mounted or Surface mounted and shall not draw more than 35 mA in active state and 20 mA in inactive state. A 100-Ohm Termination Resistor shall be provided across each Differential Line Receiver Input.

10.2.5 LED Indicator
Each circuit signal TX and RX line shall have an LED Indicator mounted on the front plate and labeled according to function.

10.2.6 Enable/Disable Features
The 2070-7x modules shall provide circuitry to disable their Channel 2 and EIA 232 control lines when a ground-true state is presented at Connector A1 Pin B21 (C50 Enable). C50 Enable shall disable Channel 2 via disabling the RS-485 signals to and from the motherboard. The Disable line shall be pulled up on these modules.
The 2070-7x modules shall provide circuitry to manually disable Channel 1. When Channel 1 is manually disable, the "Ch. A Disable" LED indicator shall be turn ON.

The Enable/Disable function shall be controlled from an option switch or jumper located on the PCB. Channel A denotes C21S and Channel B denotes C22S.

10.2.7 **Hot Swappable**

The 2070-7x module shall be “Hot” swappable without damage to its circuitry or operations. A communication “glitch” occurring during insertion/removal is acceptable since the application program should be able to recover/retry. Power-on and hot-swap current surges shall not exceed a 10 ms surge at three times (3x) the maximum rating of each voltage supply used by the module.

10.2.8 **Power Requirements**

The power requirements of the 2070-7x Module shall be within the power limitations of the Model 2070 Unit as described in Section 9.2.5 of these specifications.

<table>
<thead>
<tr>
<th>Models</th>
<th>+5 VDC</th>
<th>+12 VDC iso</th>
<th>+12 VDC ser</th>
<th>-12 VDC ser</th>
</tr>
</thead>
<tbody>
<tr>
<td>2070-7 All Comm</td>
<td>250mA</td>
<td>50 mA</td>
<td>50 mA</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 10-SECTION 9
MODEL 2070-7G UNIVERSAL TIME BASE MODULE

10.9.1 Model 2070-7G Universal Time Base Module

The Model 2070-7G Universal Time Base Module shall consist of a GPS receiver with antenna and a microprocessor-based circuit. It shall read raw GPS time data and accept user commands via Com 2 as defined elsewhere in these specifications. The Model 2070-7G Universal Time Base Module shall be a Plug-in Style Card version for the Model 2070 Controller. The Model 2070-7G shall be provided with two communications channels Com 1 and Com 2. Com 1 shall be use to establish serial communications between the Model 2070 Controller and a GPS receiver resident in the Model 2070-7G Universal Time Base Module. Com 2 shall be switch selectable between a Config Mode to the GPS receiver and a straight serial port for the Model 2070 Controller.

10.9.2 GPS Receiver/Antenna

The Model 2070-7G shall be provided with a Land-Based L1, C/A code GPS Receiver operating at a frequency of 1575.42MHz. The GPS Receiver shall contain a minimum of 16 Channels. The receiver shall have a tracking sensitivity level greater than -141dBm at the receiver input.

The Model 2070-7G shall be provided with an active permanently mount GPS Antenna. The Antenna mount shall consist of GPS roof-mount antenna with double threaded bolt, through hole, wing nut fastener, and locking nuts. The mounting shall consist of a Bulkhead mount with 0.8 inch threaded wing nut.

The Antenna System shall be comprised of an Antenna Element, Cable and Connector, and Low Noise Amplifier (LNA).

The Cable and Connector shall consist of a 2 Meter RG174/U Coaxial cable terminated at the non-antenna end with a BNC male/SMA female straight connector.

The Antenna Element shall use Right Handed Circular Polarization (R.H.C.P) and shall have a minimum Gain of +5 dBi. The antenna shall have a VSWR of 1.5:1 max. and an output impedance of 50 Ohms.

The Low Noise Amplifier shall operate from a 3.3 to 5.5 V DC source and shall provide an Outer Band Attenuation of 20 dB min. at Fo ± 50 MHz and a Gain of 31 dB min.
The Overall Performance of the Antenna System including Antenna Element, LNA and Coax Cable shall be as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center Frequency</td>
<td>1575.42 MHz</td>
</tr>
<tr>
<td>Gain</td>
<td>26 dB min.</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>2.0 dB max.</td>
</tr>
<tr>
<td>Axial Ratio</td>
<td>3.0 dB max.</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>2 MHz min.</td>
</tr>
<tr>
<td>VSWR</td>
<td>2.0:1 max.</td>
</tr>
<tr>
<td>Output Impedance</td>
<td>50 Ohms</td>
</tr>
</tbody>
</table>

10.9.3 Default Configurations

The Model 2070-7G Universal Time Base Module shall have the following default configuration parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud Rate</td>
<td>1200 bps</td>
</tr>
<tr>
<td>Time Zone</td>
<td>8, Pacific Time Zone</td>
</tr>
<tr>
<td>New Line Character</td>
<td>ASCI Carriage Return, Except QC, which CR+LF</td>
</tr>
<tr>
<td>Hour Format</td>
<td>24 hour (Military Time)</td>
</tr>
<tr>
<td>Daylight Savings Time</td>
<td>Enabled</td>
</tr>
<tr>
<td>Begin DST Clock Correction</td>
<td>March, Second Sunday at 02:00AM</td>
</tr>
<tr>
<td>End DST Clock Correction</td>
<td>November, First Sunday at 2:00 AM</td>
</tr>
</tbody>
</table>

These parameters shall configurable using the Q & S Command Set as defined in Section 10.9.4 of these specifications.

10.9.4 Q & S Command Set
The “Q” Commands

“Q” commands shall be used to request information from the Model 2070-7G, such as global position, date and time. The Model 207-7G shall support the “Q” commands as listed in the following table.

<table>
<thead>
<tr>
<th>Model 2070-7G &quot;Q&quot; COMMANDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMAND</td>
</tr>
<tr>
<td>QA n1 n2 0 0</td>
</tr>
<tr>
<td>QD</td>
</tr>
<tr>
<td>QT</td>
</tr>
<tr>
<td>QC</td>
</tr>
<tr>
<td>QD, QT, QL &amp; QC</td>
</tr>
<tr>
<td>QM</td>
</tr>
<tr>
<td>QV</td>
</tr>
<tr>
<td>QI</td>
</tr>
<tr>
<td>QL</td>
</tr>
</tbody>
</table>

**“Q” Commands**

**QD** When the “QD” command is received by the Model 2070-7G it shall respond with either the ASCII message “NOT LOCKED ON” or with the date in the format YY/MM/DD/day followed by the new line character. “doy” is the day of the year in a 3 digit format, January 1 being 001. If the Model 2070-7G has not yet found at least one satellite to insure correct data, the response shall be “NOT LOCKED ON”.
An example of a normal response from the Model 2070-7G to a “QD” command sent to it would be “02/02/05/036(new line character)”. This sample data stream would represent February 5, 2002 and that date would be the 36th day of the year 2002.

Note: If the device is configured for a time zone other than the local time zone, the date and “doy” shown could differ from the local date, depending on the time of day.

QT  When the “QT” command is received by the Model 2070-7G it shall respond with either the ASCII message “NOT LOCKED ON” or with the time of day in the format of an A or a P or an ASCII space (to signify A.M. or P.M. or 24 hour time format) immediately followed by “HH:MM:SS:Tht” and a “D”, if Daylight Savings Time function is “Enabled” and ending with the new line character.

Two sample “QT” responses are:
“A10:51:21:697{NEW LINE}”, which could be interpreted as 10:51 A.M. plus 21.697 seconds and not corrected for daylight savings time.
“ 17:45:05:489D{new line}”, which could be interpreted as 1745 plus 5.489 seconds (using the 24 hour format), with Daylight Savings Time Enabled. The “_” represents an ASCII “space” character and signifies that the output is in 24 hour format.

As with the “QD” command, if the Model 2070-7G is not receiving a valid signal from at least one satellite, the response to a “QT” command shall be the ASCII message “NOT LOCKED ON”.

QC  This command reply shall provide a combination of the information found in the “QT” and “QD” commands but in slightly different format and with some additional information.

As with the “QT”, “QL” and “QD” commands, the message “NOT LOCKED ON” shall be the reply if the Model 2070-7G does not have at least one satellite in view to determine the precise time and date.

A special synchronization character in the data stream (either Y or N) shall signify whether or not the date and time data are synchronized with UTC (Universal Coordinated Time).

In order for the Model 2070-7G to report fully synchronized data with the special character changed to “Y”, the unit must be tracking at least 4 satellites. If the synchronization character is “N” the time reported will be less precise but still within a few milliseconds of the UTC synchronized time. The “QC” command hour format is always 24 hour (military time) since there is no character in the data stream to indicate A.M. or P.M. An additional bit of information included in the “QC” data stream is a “day of the week” number. The number 0 (zero) indicates Sunday, 1 indicates Monday and so on through 6, which indicates Saturday. Unlike the “QT” and “QD” commands, the “new line” character shall not be changed. It shall always be ASCII “carriage return
+ line feed”. The format of the “QC” data stream shall be YYMMDDHHmmSThtLW followed by an ASCII carriage return and line feed.

A sample “QC” data stream generated by the Model 2070-7G would be:

“02032123176945Y6{cr+lf}”. This data stream would be interpreted as March 21, 2002, the time, in 24 hour format, would be 2317 plus 6.945 seconds, the time is synchronized to UTC (Y) and the day of the week is Saturday (6). Note that the data stream does not indicate whether or not Daylight savings time is “Enabled or Disabled”.

**QM** The “QM” command shall reply with the parameters stored in non-volatile memory, which shall be the baud rate, daylight savings time enable/disable, time format, new line character and time zone. Parameters shall be separated by a colon and the data stream shall be terminated with the new line character. The data stream B7:DO:M1:Ncr:O6{newline} would represent a baud rate = 19200 bps, Daylight savings time = disabled, 12 hour time reporting format, new line character = carriage return and Time Zone = Central. This command shall be used to determine the current configuration.

**QV** When the “QV” command is received by the Model 2070-7G it shall reply with the firmware version number. The format for the firmware version shall be as VX.X where X.X shall digits from 0 to 9. An example of a response to the QV command would be “V1.2” without the quotation marks. The “NOT LOCKED ON” message shall never reply to this query command.

**QI** The “QI” command shall replay the currently loaded Daylight saving time parameters; these shall be stored in the non-volatile memory. A total of 8 parameters are shall be sent. The data stream is bMbsbhbmsehem{newline} and the parameters are as follow:

Begin Month (bM). The month when starts to observe the DST changes. This value shall be a two digits number. 01 means January, 02 February, 03 March and so on.
Begin Sunday (bs). The Sunday number of “begin month (bM)”. This value shall be a two digits number.
Begin Hour (bh) and Begin Minutes (bm). The time when starts to observe the DST. This time shall be expressed in a 24 hour format.
End Month (eM). The month when ends the DST changes. This value shall be a two digits number. 01 means January, 02 February, 03 March and so on.
End Sunday (es). The Sunday number of “end month (eM)”. This value shall be a two digits number.
End Hour (eh) and End Minutes (em). The time when the DST observation ends. This time shall be expressed in a 24 hour format.
An example data stream 0302020011010200\{newline\} would represent DST clock adjust will begin at second Sunday of March at 02:00 AM and DST will end at first Sunday of November at 02:00 AM.

When the Model 2070-7G module detects any of both DST conditions, either Begin or End, it corrects the time by adding or subtracting one hour to local time. Once “begin DST” conditions met (Month, Sunday and time) it adds one hour to local time. When “end DST” conditions met (Month, Sunday and time) it subtracts one hour to local time. The Model 2070-7G shall always respond to this command.

**QL** The “QL” command will replay the latitude and longitude of the current Global Position expressed in degrees, minutes, seconds and milliseconds, north (N) or south(S) for Latitude, east (E) or west (W) for longitude. The data stream shall be expressed as follows, DD.MM.SS.THTA_ddd.mm.ss.thtO\{newline\}.

- DD = latitude degrees
- MM = latitude minutes
- SS = latitude seconds
- THT = latitude milliseconds
- A = latitude, North or South
- ddd = longitude degrees
- mm = longitude minutes
- ss = longitude seconds
- tht = longitude milliseconds
- O = longitude, East or West

An example data stream 38.53.23.123N_077.00.27.123W\{newline\} would represent 38 degrees latitude north, with 53 minutes, 23 seconds and 123 milliseconds and 077 degrees longitude west with 00 minutes, 27 seconds and 123 milliseconds. As with the “QT”, “QC” and “QD” commands, the message “NOT LOCKED ON” shall be the response if the Model 2070-7G does not have at least one satellite in view to determine the precise position.

Please note: the “_” represent an ASCII space.

**QA** The “QA” command differs from the other Q commands in that it must include two additional user selected variables n1 and n2, and two fixed variables n3 and n4, which are always zero. The output from the QA command depends on the variables sent with the command. It also differs from the other Q commands in that the information returned is not ASCII but rather binary. A list of the user defined variables and the information returned follows.

**User defined variables**

- n1– Time zone. The variable entered must be the sum of an ASCII 0 + (0 – 11) depending on the time zone desired. For example ASCII 38 signifies time zone 8, Pacific.
- n2 – Daylight savings time correction, 0 = disabled, 1 = enabled.
Possible replies from the Model 2070-7G to a QA command

Byte 0
Bits 1-3 are not used.
Bit 4 is 0 if valid time is not currently available and 1 if time is valid.
Bit 5 is 1 during the initialization phase only (before first lock on, i.e. LED changes to
green for the first time. This bit changes to 0 at the first lock on and never changes
even in subsequent amber conditions.
Bit 6 is 1 if GPS detects internal fault that could affect time reporting, otherwise is 0.
Bit 7 is normally 0 but if no satellite information is received for 24 hours, this bit will be
1.
Bit 8 is not used.

Byte 1
Bits 1-4 are not used, always zero.
Bits 5-6 are always 0 indicating that the time is in 24-hour format.
Bit 7, Daylight Savings Time indicator is 1 when DST is enabled and the date is within
the DST period. This bit is 0 if DST correction is disabled or the date is outside of
the DST period.
Bit 8 is not used, always zero.

Bytes 2 and 3
Milliseconds portion of current time, the Hex equivalent of BCD.

Byte 4
Seconds portion of current time, the Hex equivalent of BCD.

Byte 5
Minutes portion of current time, the Hex equivalent of BCD.

Byte 6
Hours portion of current time, the Hex equivalent of BCD.

Bytes 7 and 8
Day of Year, the Hex equivalent of BCD.

Byte 9
Year (this byte is actually the offset from 1986) i.e. 18 = 2004, the Hex equivalent of
BCD.

Bytes 10 and 11
Always zero.

Byte 12
Always a new line character (CR).

The “S” Commands
The Model 2070-7G shall accept instructions from the user in the form of “S” (Set) commands. The “S” commands, their variables, and their meanings that shall be supported shall consist of the following:

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>NAME OF COMMAND</th>
<th>&quot;n&quot; variable</th>
<th>SETTING (default)</th>
<th>(Notes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBn</td>
<td>SET BAUD RATE</td>
<td>0</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>(1200)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>2400</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>4800</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>9600</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>19200</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>38400</td>
<td></td>
</tr>
<tr>
<td>SDn</td>
<td>SET DAYLIGHT SAVINGS TIME</td>
<td>0</td>
<td>Disabled</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>(Enabled)</td>
<td></td>
</tr>
<tr>
<td>SMn</td>
<td>SET 12 OR 24 HOUR TIME FORMAT</td>
<td>0</td>
<td>(24 Hour)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>12 Hour (AM/PM)</td>
<td></td>
</tr>
<tr>
<td>SNn</td>
<td>SET NEW LINE CHARACTER</td>
<td>ASCII</td>
<td>(carriage return)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>except colon and /</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0</td>
<td>Time zone 0</td>
<td>UTC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Time zone 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Time zone 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Time zone 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Time zone 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Time zone 5</td>
<td>Eastern</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>Time zone 6</td>
<td>Central</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>Time zone 7</td>
<td>Mountain</td>
</tr>
<tr>
<td>SOn</td>
<td>SET TIME ZONE</td>
<td>0</td>
<td>Time zone 0</td>
<td>UTC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Time zone 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Time zone 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Time zone 5</td>
<td>Eastern</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>Time zone 6</td>
<td>Central</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>Time zone 7</td>
<td>Mountain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>(Time zone 8)</td>
<td>Pacific</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>Time zone 9</td>
<td>Alaska</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(colon)</td>
<td>Time zone 10</td>
<td>Hawaii</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(semicolon)</td>
<td>Time zone 11</td>
<td></td>
</tr>
<tr>
<td>SI1</td>
<td>SET DAYLIGHT SAVING TIME</td>
<td>bM</td>
<td>03</td>
<td></td>
</tr>
</tbody>
</table>
“S” Commands

“S” Commands shall be sent to the Model 2070-7G without an “end of line” character.

The Model 2070-7G shall not send any acknowledgement when it receives an “S” command however the QM command can be used to confirm the change was made. All setting changes shall be stored in non-volatile memory and used in place of the factory default settings.

The following describes the “S” commands that shall be supported by Model 2070-7G:

**SBn (Set Baud Rate).** This command shall be used to change the Model 2070-7G’s serial communication speed. The baud rate of the controller and the Model 2070-7G must be the same. When the unit is first powered up it shall be configured with the factory default baud rate of 1200.

When communications between the Model 2070-7G and the controller is established, the SB command can be used to change the baud rate to the preferred speed. The available baud rates are shown in "S" Commands table. Generally the highest baud rate, that provides reliable communication, should be used. For example, to change the unit’s default baud rate to 4800 baud, the proper “S” command to send would be “SB5” (without quotation marks). Any baud rate changes will go onto effect immediately.

<table>
<thead>
<tr>
<th>CONFIGURATION</th>
<th>month)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>bs</td>
<td>02</td>
<td></td>
</tr>
<tr>
<td>(Begin Sunday)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bh</td>
<td>02</td>
<td></td>
</tr>
<tr>
<td>(Begin hour)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bm</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>(Begin minutes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eM</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>(End month)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>es</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>(end Sunday)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eh</td>
<td>02</td>
<td></td>
</tr>
<tr>
<td>(end hour)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>em</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>(End minutes)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**SDn** (Enable/Disable Daylight Savings Time). This command shall be used to enable or disable the device’s one hour offset to accommodate Daylight Savings Time rules. If the unit is to be used to output local time in an area that observes Daylight Savings Time rules, the “SD1” command should be used. The factory default setting is “Enabled”, which means the Model 2070-7G will automatically adjust the local time output by one hour at the beginning and end of the Daylight Savings Time period. Users can change the configuration when these changes must occur with the SI1 command. If the unit will be used in areas that do not observe Daylight Savings Time, the appropriate “S” command to use would be “SD0”.

**SMn** (Set time output format). This command shall be used to specify how the time of day data will be formatted. The factory default setting is the 24 hour, Military Time, format. If the user prefers to have the data output in a 12 hour format, (with A.M. or P.M. noted) the “SM1” (without the quotation marks) command must be sent once to change the format setting.

**SNn** (Set new line character). The Model 2070-7G’s response to a valid “Q” command shall be a data stream that ends with a “new line” character. The default new line character is an ASCII carriage return. If the user prefers to have the data stream end in different ASCII character it can be changed using the “SN” command. Any ASCII character except the “/” (slash) and the “:” (colon) characters may be used as the variable. For example to use “#” as the new line character the proper command to send would be “SN#” (without the quotation marks). Only one “new line character” is permitted.

**SOn** (Set time zone). This command allows the user to set the Model 2070-7G’s output to reflect the local time. Each time zone is assigned a number or ASCII character that is used as the variable for the “SO” command. The Model 2070-7G firmware shall accommodate time zones 0 through 11. Time zone 0 shall be used to output UTC (Universal Coordinated Time) or GMT (Greenwich Mean Time) if the user prefers that reference instead of local time. The default factory value shall be 8, as listed under default configurations, which shall represent Pacific Standard Time in the United States.

**SI1** (Set daylight savings time parameters). This command shall allow the user to set the Model 2070-7G’s daylight saving time settings. The modification of these parameters will determine when DST begin & end:

- **Begin Month**(bM). The month when starts to observe the DST changes. This value shall be a two digits number. 01 means January, 02 February, 03 March and so on.
- **Begin Sunday**(bs). The Sunday number of “begin month (bM)”. This value shall be a two digits number.
- **Begin Hour**(bh) and **Begin Minutes**(bm). The time when starts to observe the DST. This time shall be expressed in a 24 hour format.
- **End Month**(eM). The month when ends the DST changes. This value shall be a two digits number. 01 means January, 02 February, 03 March and so on.
End Sunday(es). The Sunday number of “end month(eM)”. This value shall be a two digits number.
End Hour(eh) and End Minutes(em). The time when the DST observation ends. This time shall be expressed in a 24 hour format.
These parameters shall be set in the Non-Volatile memory.

10.9.5 Config Mode

The Model 2070-7G Module shall be provided with a switch allowing the user to switch Com 2 into Config Mode. In Config Mode, Com 2 loops back to the GPS Receiver and provides the user with a communications port to run Q and S Commands to configure the GPS receiver or query it for data. During Config Mode, the Config Mode LED indicator shall be turn ON to indicate configuration mode. When the Config Model is OFF, Com 2 shall consist of a serial port (serial pass through) to the Model 2070 Controller.

10.9.6 Connectors

The Model 2070-7G Universal Time Base Module shall contain the following connectors in the Faceplate:

<table>
<thead>
<tr>
<th>Antenna</th>
<th>SMA Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Com 2 Port (C22S)</td>
<td>DB9 Female Connector</td>
</tr>
</tbody>
</table>

10.9.7 Data Output

When communicating to the GPS Receiver, the Date, Time, Day of Week, Signal Status, and Global Position shall be available. Data format shall be as defined in Section 10.9.4 of these specifications and the NMEA 0183 Standard. Serial Communications shall be software selectable at 1200, 2400, 4800, 9600, 19200 or 38400 bps.

10.9.8 Protocols

The Model 2070-7G shall support the NMEA 0183 Standard, Version 2.1 or later, as defined by the National Marine Electronics Association and the QC Command Set as defined in Section 10.9.4 of these specifications. A dipswitch marked "CMode" shall be provided which allows for the selection of one of three modes. The communication modes shall consist of a "NORM" (Normal Mode), "NB" (Normal Broadcast Mode) and GPS. When the CMode is in the "NORM" (Normal Mode) ON position, the Model 2070-7G shall respond to the QS command set as defined elsewhere in these specifications. When the dipswitch CMode is in the "NB", (Normal Broadcast Mode) ON Position, and the Model 2070-7G shall operate in a broadcast mode and shall not
respond to the QS command set. When operating in the NB mode, the Model 2070-7G shall use the default settings as defined in section 10.9.2.

When the CMode is in the "GPS", (GPS pass through mode) ON position, the Model 2070-7G shall act like a standard NMEA 0183 compliant GPS receiver. As a minimum, when set on GPS mode, the Model 2070-7G shall support the following NMEA 2.0 Standard sentences: RMC, GGA, GSA, GSV, GLL and ZDA. The sentences shall be preceded by the standard generic Global Positioning System (GPS) talker ID "GP".

=== GLL - Geographic Position - Latitude/Longitude ===

\[
\begin{array}{cccccccc}
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\
$--$ & GLL & ,llll.ll & ,a & ,yyyyy.yy & ,a & ,hhmmss.ss & ,a & ,m &,*hh \\
\end{array}
\]

$--GLL,llll.ll,a,yyyyy.yy,a,hhmmss.ss,a,m,*hh<CR><LF>

Field Number:

1. Latitude
2. N or S (North or South)
3. Longitude
4. E or W (East or West)
5. Universal Time Coordinated (UTC)
6. Status A - Data Valid, V - Data Invalid
7. FAA mode indicator (NMEA 2.3 and later)
8. Checksum

=== GGA - Global Positioning System Fix Data ===

Time, Position and fix related data for a GPS receiver.

\[
\begin{array}{cccccccccccccccc}
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 1 & 11 & 1 & 13 & 14 & 1 \\
\end{array}
\]
$--GGA,hhmmss.ss,llll.ll,a,yyyy.yy,a,x,xx,xx,xx.xx,M,x,x,M,x,x,xxxx*hh<CR><LF>

Field Number:

1. Universal Time Coordinated (UTC)
2. Latitude
3. N or S (North or South)
4. Longitude
5. E or W (East or West)
6. GPS Quality Indicator,
   - 0 - fix not available,
   - 1 - GPS fix,
   - 2 - Differential GPS fix
     (values above 2 are 2.3 features)
   - 3 = PPS fix
   - 4 = Real Time Kinematic
   - 5 = Float RTK
   - 6 = estimated (dead reckoning)
   - 7 = Manual input mode
   - 8 = Simulation mode
7. Number of satellites in view, 00 - 12
8. Horizontal Dilution of precision (meters)
9. Antenna Altitude above/below mean-sea-level (geoid) (in meters)
10. Units of antenna altitude, meters
11. Geoidal separation, the difference between the WGS-84 earth
    ellipsoid and mean-sea-level (geoid), "-" means mean-sea-level
    below ellipsoid
12. Units of geoidal separation, meters
13. Age of differential GPS data, time in seconds since last SC104
    type 1 or 9 update, null field when DGPS is not used
14. Differential reference station ID, 0000-1023
15. Checksum

Example:
$GPGGA,180844.000,3211.10532,N,11055.20380,W,0,00,99.0,779.59,M,-27.7,M,*,69
### RMC - Recommended Minimum Navigation Information ###

<table>
<thead>
<tr>
<th>Field Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC Time</td>
</tr>
<tr>
<td>2</td>
<td>Status, V=Navigation receiver warning A=Valid</td>
</tr>
<tr>
<td>3</td>
<td>Latitude</td>
</tr>
<tr>
<td>4</td>
<td>N or S</td>
</tr>
<tr>
<td>5</td>
<td>Longitude</td>
</tr>
<tr>
<td>6</td>
<td>Speed over ground, knots</td>
</tr>
<tr>
<td>7</td>
<td>Track made good, degrees true</td>
</tr>
<tr>
<td>8</td>
<td>Date, ddmmyy</td>
</tr>
<tr>
<td>9</td>
<td>Magnetic Variation, degrees</td>
</tr>
<tr>
<td>10</td>
<td>E or W</td>
</tr>
<tr>
<td>11</td>
<td>FAA mode indicator (NMEA 2.3 and later)</td>
</tr>
<tr>
<td>12</td>
<td>Checksum</td>
</tr>
<tr>
<td>13</td>
<td>A status of V means the GPS has a valid fix that is below an internal quality threshold, e.g. because the dilution of precision is too high or an elevation mask test failed.</td>
</tr>
</tbody>
</table>

A status of V means the GPS has a valid fix that is below an internal quality threshold, e.g. because the dilution of precision is too high or an elevation mask test failed.

Example:

```
$GPRMC,180845.000,V,3211.105,N,11055.204,W,0.0,0.0,271009,9.4,E*6E
```
### ZDA - Time & Date - UTC, day, month, year and local time zone

<table>
<thead>
<tr>
<th>Field Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC time (hours, minutes, seconds, may have fractional subsecond)</td>
</tr>
<tr>
<td>2</td>
<td>Day, 01 to 31</td>
</tr>
<tr>
<td>3</td>
<td>Month, 01 to 12</td>
</tr>
<tr>
<td>4</td>
<td>Year (4 digits)</td>
</tr>
<tr>
<td>5</td>
<td>Local zone description, 00 to +- 13 hours</td>
</tr>
<tr>
<td>6</td>
<td>Local zone minutes description, apply same sign as local hours</td>
</tr>
<tr>
<td>7</td>
<td>Checksum</td>
</tr>
</tbody>
</table>

Example: $GPZDA,160012.71,11,03,2004,-1,00*7D

#### 10.9.9 LED Indicators

<table>
<thead>
<tr>
<th>Function</th>
<th>LEDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Com 1 TxD</td>
<td>Green or Red</td>
</tr>
<tr>
<td>Com 1 RxD</td>
<td>Green or Red</td>
</tr>
<tr>
<td>Com 2 TxD</td>
<td>Green or Red</td>
</tr>
<tr>
<td>Com 2 RxD</td>
<td>Green or Red</td>
</tr>
<tr>
<td>Config Mode</td>
<td>Green or Red</td>
</tr>
<tr>
<td>Tracking</td>
<td>Tri-Color</td>
</tr>
</tbody>
</table>

#### 10.9.10 Model 2070-7G Tracking

The Model 2070-7G Universal Time Base Module shall be provided with the following tracking functionality:
The Model 2070-7G shall be equipped with a tri-color LED (Light Emitting Diode) to indicate the unit’s status during operation; the LED shall be located at the faceplate and labeled as TRACKING as shown in detail A10-9.

The various states of the TRACKING LED indicator and their meanings shall be as described in the section below.

**Power up phase:** At power up, the 2070-7G’s microprocessor shall read the five parameters stored in the unit’s non-volatile memory. These parameters are Baud Rate, Daylight Savings Time mode and configuration, Time Zone, Military Time format and new line character. The default values shall be read from memory if they have not been modified. Next, the communications port shall be initialized and the speed set to the stored baud rate parameter. The remaining three communications parameters shall be fixed at 8 data bits, no parity and 1 stop bit.

The power up process shall take no more than 200 milliseconds. During this period the unit may not respond to any “S” or “Q” commands and the LED shall be amber for less than one second.

**GPS initialization phase:** After the power up phase is complete the unit will query the GPS receiver to see if it is already initialized. This is usually the case when the unit is powered up. If there is no data output, the GPS receiver will be initialized by the firmware program, using initialization commands and known variables. This process shall not take longer than 6 seconds. During this period, the Model 2070-7G reply to the commands “QA”, “QD”, “QT”, and “QC” shall be the message “NOT LOCKED ON” and the LED shall flash red, once per second.

**Signal acquisition phase:** Once the GPS initialization phase is complete, it shall take from 3 to 180 seconds for the unit to acquire and process the first satellite’s signal. When the Model 2070-7G has received and processed the first satellite’s information, unsynchronized time/date information shall be available using the “QC” data stream and the synchronization character shall be “N”. When the synchronization character is “N”, the “QC”, and “QT” and “QD” replies will be complete but time is not fully synchronized to UTC. When unsynchronized data is available, the LED shall flash amber, once per second.

**Fully synchronized phase:** When the 2070-7G has acquired information from 4 satellites its output will be synchronized to UTC (Universal Coordinated Time). When the unit is synchronized to UTC it is said to be “LOCKED ON”. At this point the “QT”, “QD”, “QL” and “QC” replies will contain the most accurate information (time and location) possible. When the unit is fully synchronized (LOCKED ON); the synchronization character shall the letter “Y” in the “QC” data stream and the LED indicator shall flash green, once per second.
10.9.11 **Power Requirements**

The power requirements of the Model 2070-7G Universal Time Base Module shall be within the power limitations of the Model 2070 UNIT as describe elsewhere in this specifications.

10.9.12 **Environmental**

The Model 2070-7G Universal Time Base Module shall operate within the specifications listed in Chapter 1 Section 1.8.4.

10.9.13 **Form Factor**

See A10-9 for Details
CHAPTER 10-SECTION 10
MODEL 2070-EX NETWORK SWITCH MODULE

Model 2070-Ex Network Switch Module

The Model 2070-Ex Module shall provide 4 ports for Network Communications to and from the Model 2070 Controller.

An integrated Store-and-Forward Network Switch shall be used as the core for the Model 2070-Ex Module. A network port shall be used to route Ethernet Traffic across the Motherboard to the “A” Connector’s Network Lines. DC Grounding around the network connectors and lines shall be provided. The Network Lines shall be assigned as: NetP5 TX+, TX-, RX+ and RX- respectively. Three network ports shall be brought to RJ-45 Connectors on the Front Panel.

The Model 2070-Ex Module shall be a Plug-in Card style version for the 2070 Controller.

Mechanical/Electrical Requirements.

The Model 2070-Ex Modules card edge connector shall be fully compatible with the 2070 Controller’s Motherboard Ax Card Slots.

The Model 2070-Ex Module shall be powered direct from the 2070 Controller’s edge connector.

Model 2070-Ex Module Requirements

The Model 2070-Ex shall be provided with Network Magnetics for each port including the network port routed to the Controller's Motherboard.

Network Standards

The Model 2070-Ex Module shall meet the IEEE802.3 10Base-T, IEEE 802.3u, and IEEE 802.3x.

Modes of Operation
The Model 2070-Ex Module shall have auto-negotiation for 10/100 Mbps Connection speed and Half/Full-Duplex modes on all RJ-45 ports.

The Model 2070-Ex Module shall be provided with Auto-MDIX for all RJ-45 ports.

The network port routed to the Controller's Motherboard shall have Auto-negotiation for 10/100Mbps connection speed and the Half/Full-Duplex communications mode shall be manually settable.

**Network Media Support**

The Model 2070-Ex Module shall be configured as a Multiple Channel Media Converter to route network traffic between the Model 2070 CPU, Three RJ-45 Front Panel Connectors.

The Model 2070-Ex Module shall support the following Media:

100Baset-TX: Cat. 5, EIA/TIA-568B, 100-Ohm UTP cables.

**LED Indicators**

The Model 2070-Ex Module shall be provided with RJ-45 Connectors containing Link/Activity and 10/100 Speed LED indicators. Network Link/Activity and 10/100 Speed indicators for the port routed to the Controller's Motherboard shall be provided on the Front Plate of the Model 2070-Ex Module.

**Form Factor**

See A10-10 for Details

**Power Requirements**

The power requirements of the 2070-Ex Module be within the power limitations of the Model 2070 Unit as describe in Section 9.2.5 of these specifications.

<table>
<thead>
<tr>
<th>Models</th>
<th>5 VDC</th>
<th>+12 VDC iso</th>
<th>+12 VDC ser</th>
<th>-12 VDC ser</th>
</tr>
</thead>
<tbody>
<tr>
<td>2070-6A &amp; Others</td>
<td>900mA</td>
<td>300 mA</td>
<td>300 mA</td>
<td></td>
</tr>
</tbody>
</table>

**Environmental**

TEES 2009 ERRATA NO.2 December 5th, 2014
The 2070-Ex Module shall operate within the specifications listed in Chapter 1 Section 1.8.4.
APPENDIX A3
CHAPTER 3 DETAILS
<table>
<thead>
<tr>
<th>Connector Details</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 200 Switch Pack, 204 &amp; 205 CONDUCTOR DETAILS</td>
<td>A3-1</td>
</tr>
<tr>
<td>Model 208 T170 Monitor Unit</td>
<td>A3-2</td>
</tr>
<tr>
<td>Model 210 T170 Monitor Unit Programming Card Connector &amp; Wiring Assignments</td>
<td>A3-4</td>
</tr>
<tr>
<td>C2 Modem Harness</td>
<td>A3-5</td>
</tr>
<tr>
<td>C2 Serial Harness</td>
<td>A3-8</td>
</tr>
<tr>
<td>C1 Cable Harness</td>
<td>A3-9</td>
</tr>
<tr>
<td>Model 206LS Power Supply</td>
<td>A3-10</td>
</tr>
</tbody>
</table>
NOTES:
1. "U" shape rod handle shall be fabricated of 0.18in to 0.26in diameter, aluminum stock to form a handle.
2. All dimensions shown are in inches.
MODEL 208 MONITOR UNIT PIN ASSIGNMENT

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 / A</td>
<td>DC GROUND</td>
</tr>
<tr>
<td>2 / B</td>
<td>WDT Ext. Reset</td>
</tr>
<tr>
<td>5 / E</td>
<td>WDT IN</td>
</tr>
<tr>
<td>10 / L</td>
<td>+24 VDC</td>
</tr>
<tr>
<td>15 / S</td>
<td>AC-</td>
</tr>
<tr>
<td>17 / U</td>
<td>Normally Open, Circ. #2</td>
</tr>
<tr>
<td>19 / W</td>
<td>AC+</td>
</tr>
<tr>
<td>20 / X</td>
<td>WDT Lamp (External)</td>
</tr>
<tr>
<td>21 / Y</td>
<td>Circ. Common #1 &amp; #2</td>
</tr>
<tr>
<td>22 / Z</td>
<td>Normally Closed, Circ. #1</td>
</tr>
</tbody>
</table>

NOTES:
1. "U" shape rod handle shall be fabricated of 0.18 to 0.26 in diameter, aluminum stock to form a handle.
2. All dimensions shall be in inches.
<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Channel #2 Green</td>
<td>A</td>
<td>Channel #2 Yellow</td>
</tr>
<tr>
<td>2</td>
<td>Channel #13 Green</td>
<td>B</td>
<td>Channel #6 Green</td>
</tr>
<tr>
<td>3</td>
<td>Channel #6 Yellow</td>
<td>C</td>
<td>Channel #15 Green</td>
</tr>
<tr>
<td>4</td>
<td>Channel #4 Green</td>
<td>D</td>
<td>Channel #4 Yellow</td>
</tr>
<tr>
<td>5</td>
<td>Channel #14 Green</td>
<td>E</td>
<td>Channel #8 Green</td>
</tr>
<tr>
<td>6</td>
<td>Channel #8 Yellow</td>
<td>F</td>
<td>Channel #16 Green</td>
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<tr>
<td>7</td>
<td>Channel #5 Green</td>
<td>H</td>
<td>Channel #5 Yellow</td>
</tr>
<tr>
<td>8</td>
<td>Channel #13 Yellow</td>
<td>J</td>
<td>Channel #1 Green</td>
</tr>
<tr>
<td>9</td>
<td>Channel #1 Yellow</td>
<td>K</td>
<td>Channel #15 Yellow</td>
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<td>10</td>
<td>Channel #7 Green</td>
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<td>Channel #7 Yellow</td>
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<td>11</td>
<td>Channel #14 Yellow</td>
<td>M</td>
<td>Channel #3 Green</td>
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<tr>
<td>12</td>
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<td>N</td>
<td>Channel #16 Yellow</td>
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<td>NA</td>
</tr>
<tr>
<td>14</td>
<td>NA</td>
<td>R</td>
<td>Channel #10 Green</td>
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<tr>
<td>15</td>
<td>Channel #11 Yellow</td>
<td>S</td>
<td>Channel #11 Green</td>
</tr>
<tr>
<td>16</td>
<td>Channel #9 Yellow</td>
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<td>NA</td>
</tr>
<tr>
<td>17</td>
<td>NA</td>
<td>U</td>
<td>Channel #10 Yellow</td>
</tr>
<tr>
<td>18</td>
<td>Channel #12 Yellow</td>
<td>V</td>
<td>Channel #12 Green</td>
</tr>
<tr>
<td>19</td>
<td>NA</td>
<td>W</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>Equipment Ground</td>
<td>X</td>
<td>NA</td>
</tr>
<tr>
<td>21</td>
<td>AC—*</td>
<td>Y</td>
<td>DC Ground</td>
</tr>
<tr>
<td>22</td>
<td>Watchdog Timer</td>
<td>Z</td>
<td>External Reset</td>
</tr>
<tr>
<td>23</td>
<td>+24 VDC</td>
<td>AA</td>
<td>+24 VDC</td>
</tr>
<tr>
<td>24</td>
<td>(Pins 24 &amp; 25)</td>
<td>BB</td>
<td>Stop Time</td>
</tr>
<tr>
<td>25</td>
<td>Tied together</td>
<td>CC</td>
<td>NA</td>
</tr>
<tr>
<td>26</td>
<td>NA</td>
<td>DD</td>
<td>NA</td>
</tr>
<tr>
<td>27</td>
<td>NA</td>
<td>EE</td>
<td>Output SW, Side #2</td>
</tr>
<tr>
<td>28</td>
<td>Output SW, Side #1</td>
<td>FF</td>
<td>AC+</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION (Circuit Side)</th>
<th>PIN</th>
<th>FUNCTION (Component Side)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Channel #2 Green</td>
<td>A</td>
<td>Channel #1 Green</td>
</tr>
<tr>
<td>2</td>
<td>Channel #3 Green</td>
<td>B</td>
<td>Channel #2 Green</td>
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<td>3</td>
<td>Channel #4 Green</td>
<td>C</td>
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<tr>
<td>4</td>
<td>Channel #5 Green</td>
<td>D</td>
<td>Channel #4 Green</td>
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<td>Channel #9 Green</td>
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<td>9</td>
<td>Channel #10 Green</td>
<td>I</td>
<td>Channel #9 Green</td>
</tr>
<tr>
<td>10</td>
<td>Channel #11 Green</td>
<td>J</td>
<td>Channel #10 Green</td>
</tr>
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<td>11</td>
<td>Channel #12 Green</td>
<td>K</td>
<td>Channel #11 Green</td>
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<td>12</td>
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<td>M</td>
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<td>Channel #16 Green</td>
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</tr>
<tr>
<td>16</td>
<td>DC Ground</td>
<td>P</td>
<td>CONFLICT</td>
</tr>
<tr>
<td>17</td>
<td>Channel #1 Yellow</td>
<td>Q</td>
<td>Channel #9 Yellow</td>
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<td>18</td>
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<td>Channel #5 Yellow</td>
<td>U</td>
<td>Channel #13 Yellow</td>
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<td>V</td>
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<td>23</td>
<td>Channel #7 Yellow</td>
<td>W</td>
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<td>Channel #16 Yellow</td>
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<td>25</td>
<td>Channel #9 Yellow</td>
<td>Y</td>
<td>Channel #17 Yellow</td>
</tr>
<tr>
<td>26</td>
<td>NA</td>
<td>Z</td>
<td>NA</td>
</tr>
<tr>
<td>27</td>
<td>NA</td>
<td>AA</td>
<td>Output SW, Side #2</td>
</tr>
<tr>
<td>28</td>
<td>Output SW, Side #1</td>
<td>BB</td>
<td>AC+</td>
</tr>
</tbody>
</table>

**Title:** MODEL 210 T170 MONITOR UNIT & PROGRAMMING CARD CONNECTOR & WIRING ASSIGNMENTS

**Errata:**

**Tees 2009:** A3–4
### C2 MODEM HARNESS

**C2P CONNECTOR ASSIGNMENT**

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
<th>PAIR</th>
<th>WIRE COLOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>AUDIO IN</td>
<td>PAIR 2</td>
<td>WHITE</td>
</tr>
<tr>
<td>B</td>
<td>AUDIO IN</td>
<td>PAIR 1</td>
<td>GREEN</td>
</tr>
<tr>
<td>C</td>
<td>AUDIO OUT</td>
<td>PAIR 1</td>
<td>RED</td>
</tr>
<tr>
<td>D</td>
<td>AUDIO OUT</td>
<td>PAIR 1</td>
<td>BLACK</td>
</tr>
</tbody>
</table>

**CONNECTOR C2 DETAIL**

**CONNECTOR C2S**

**NOTES:**

1. Cable length shall be 36.00in minimum. The cable shall be 2-pair #20 cable conductors, Belden 9402 or equal. The field end connections shall be #8 stud spring spade type.
2. Each conductor (AUDIO IN or AUDIO OUT) shall be labeled.
3. All dimensions shown are in inches.

<table>
<thead>
<tr>
<th>TITLE</th>
<th>C2 MODEM HARNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERRATA 2</td>
<td>NO SCALE</td>
</tr>
<tr>
<td>TEES 2009</td>
<td>A3-5</td>
</tr>
</tbody>
</table>
C2 SERIAL HARNESS

![Diagram of C2 serial harness with labels and dimensions.]

### C2P Connector Assignment

<table>
<thead>
<tr>
<th>PIN</th>
<th>Function</th>
<th>PIN</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>NA</td>
<td>J</td>
<td>RTS</td>
</tr>
<tr>
<td>B</td>
<td>NA</td>
<td>K</td>
<td>RXD</td>
</tr>
<tr>
<td>C</td>
<td>NA</td>
<td>L</td>
<td>TXD</td>
</tr>
<tr>
<td>D</td>
<td>NA</td>
<td>M</td>
<td>CTS</td>
</tr>
<tr>
<td>E</td>
<td>NA</td>
<td>N</td>
<td>GND</td>
</tr>
<tr>
<td>F</td>
<td>NA</td>
<td>P</td>
<td>NA</td>
</tr>
<tr>
<td>H</td>
<td>DCD</td>
<td>R</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Connector C2S Details

- **Dimensions:**
  - C2S (14-Contact Socket): 0.915 in x 0.16 in
  - Guide pin (Near Contact pin A): 0.365 in
  - Guide socket (Near Contact pin P): 0.94 in
  - Locking Latches: 0.44 in
  - Backplane of Controller Unit: 1.25 in

### Notes:

1. Cable length shall be 36.00 in minimum. The cable shall be 24AWG, 6 conductors, Belden 9536 or equal. The field end connections shall be #6 stud spring spade type.
2. Each conductor (DCD, RTS, RXD, TXD, CTS, GND) shall be labeled.
3. All dimensions shall be inches.

---

**Title:** C2 SERIAL HARNESS

<table>
<thead>
<tr>
<th>ERRATA 2</th>
<th>NO SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEES 2009</td>
<td>A3-8</td>
</tr>
</tbody>
</table>
NOTE:
1. Input Panel #1, TB1 (+24VDC) to C5S, pin #24.
NOTE:

1. "U" shaped rod handle fabricated of 0.25±0.05 diameter, aluminum stock, with 4.00±0.125 length, & rod center to center shall be provided. The handle shall be vertically centered. The depth from the vertical centerline of the handle rod to the faceplate shall be 1.25±0.125.

2. Power supply module dimension, from faceplate to connector plug, shall be 8.64 ±0.000, −0.125.

3. Thumb screw device.

4. Connector BEAU P–5406 or equivalent.

5. All dimensions shown are in inches.
### MODEL 222, 224 & 232 CONNECTOR ASSIGNMENTS

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION (SENSORS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*A</td>
<td>DC GROUND</td>
</tr>
<tr>
<td>*B</td>
<td>+24 VDC</td>
</tr>
<tr>
<td>---</td>
<td>DETECTOR RESET</td>
</tr>
<tr>
<td>D</td>
<td>INPUT #1</td>
</tr>
<tr>
<td>E</td>
<td>INPUT #1</td>
</tr>
<tr>
<td>F</td>
<td>OUTPUT #1 (C)</td>
</tr>
<tr>
<td>H</td>
<td>OUTPUT #1 (E)</td>
</tr>
<tr>
<td>J</td>
<td>INPUT #2</td>
</tr>
<tr>
<td>K</td>
<td>INPUT #2</td>
</tr>
<tr>
<td>L</td>
<td>EQUIPMENT GROUND</td>
</tr>
<tr>
<td>M</td>
<td>AC-</td>
</tr>
<tr>
<td>---</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>AC+</td>
</tr>
<tr>
<td>P</td>
<td>INPUT #3</td>
</tr>
<tr>
<td>R</td>
<td>INPUT #3</td>
</tr>
<tr>
<td>S</td>
<td>OUTPUT #3 (C)</td>
</tr>
<tr>
<td>T</td>
<td>OUTPUT #3 (E)</td>
</tr>
<tr>
<td>U</td>
<td>INPUT #4</td>
</tr>
<tr>
<td>V</td>
<td>INPUT #4</td>
</tr>
<tr>
<td>W</td>
<td>OUTPUT #2 (C)</td>
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<tr>
<td>X</td>
<td>OUTPUT #2 (E)</td>
</tr>
<tr>
<td>Y</td>
<td>OUTPUT #4 (C)</td>
</tr>
<tr>
<td>Z</td>
<td>OUTPUT #4 (E)</td>
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### MODEL 242L & 252 CONNECTOR ASSIGNMENTS

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<td>DC GROUND</td>
</tr>
<tr>
<td>B</td>
<td>+24 VDC</td>
</tr>
<tr>
<td>---</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>NA</td>
</tr>
<tr>
<td>D</td>
<td>INPUT #1</td>
</tr>
<tr>
<td>E</td>
<td>INPUT #1</td>
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<tr>
<td>F</td>
<td>OUTPUT #1 (C)</td>
</tr>
<tr>
<td>H</td>
<td>OUTPUT #1 (E)</td>
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<tr>
<td>J</td>
<td>INPUT #2</td>
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<tr>
<td>K</td>
<td>INPUT #2</td>
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<tr>
<td>L</td>
<td>EQUIPMENT GROUND</td>
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<tr>
<td>M</td>
<td>AC-</td>
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<td></td>
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<td>N</td>
<td>AC+</td>
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<tr>
<td>P</td>
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<tr>
<td>R</td>
<td>NA</td>
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<tr>
<td>S</td>
<td>NA</td>
</tr>
<tr>
<td>T</td>
<td>NA</td>
</tr>
<tr>
<td>U</td>
<td>NA</td>
</tr>
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<td>V</td>
<td>NA</td>
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<tr>
<td>W</td>
<td>OUTPUT #2 (C)</td>
</tr>
<tr>
<td>X</td>
<td>OUTPUT #2 (E)</td>
</tr>
<tr>
<td>Y</td>
<td>NA</td>
</tr>
<tr>
<td>Z</td>
<td>NA</td>
</tr>
</tbody>
</table>

### NOTES:

1. Tolerance dimensions are ±0.02 in except as noted.
2. Sheet definitions:
   - "--" = Slotted for keying
   - (C) = Collector
   - (E) = Emitter
   - * = NA for these connections on Models 232 & 242L
3. "U" shape rod handle shall be fabricated of 0.18 in to 0.26 in diameter, aluminum stock.
4. All dimensions shall be in inches.

### TITLE: SENSOR UNIT AND ISOLATOR DETAILS

<table>
<thead>
<tr>
<th>ERRATA 2</th>
<th>NO SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEES 2009</td>
<td>A5-1</td>
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Cabinet Housing Details - sheet 2 of 4 A6-2
Cabinet Equipment Mounting Details sheet 2 of 4 A6-5
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PDA #2L SSR Installation Details A6-8
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PDA #2LS Details – sheet 7 of 8 A6-48
1. Cabinet base to door opening.
2. The locks & handles shall be on right side of the front door & the left side of the rear door (viewed externally).
3. All dimensions shown are in inches.
4. The locks & handles shall be on left side of the front door & the right side of the rear door (viewed externally).
5. Upper and lower catches must hold the door open at multiple positions.
NOTE:
1. Drawer Shelf details, A6–6
2. All dimensions shown are in inches
NOTE:
1. SPA shall be bolted on the rail and firmly attached to the Service Panel.
2. All dimensions shown are in inches.
NOTE:
All dimensions shown are in inches.
NOTE:
All dimensions shown are in inches.
NOTES: (FOR THIS DETAIL)

1. Place label "FOR BBS REMOVE JUMPER"
2. The SPA shall be mounted at least 4.25in above the bottom of the cabinet shelf, except the 336L.
3. All dimensions shown are in inches.
NOTE:

1. Remove jumper when connecting BBS.
2. SHA–1250–ITS connector BEAU S–5412 or equivalent
3. Surge protection shall be provided of indicators
   GREEN LED Indicator ON= ok, OFF= error.
   YELLOW LED ON= error, Off= ok.
4. Red insulation for both conductors

SHA–1250–ITS CONNECTOR DETAIL

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
<th>PIN</th>
<th>FUNCTION</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>AC+ RAW</td>
<td>2</td>
<td>AC+ RAW</td>
</tr>
<tr>
<td>3</td>
<td>EQ. GND</td>
<td>4</td>
<td>EQ. GND</td>
</tr>
<tr>
<td>5</td>
<td>AC+ CLEAN</td>
<td>6</td>
<td>AC+ RAW</td>
</tr>
<tr>
<td>7</td>
<td>AC– CLEAN</td>
<td>8</td>
<td>NA</td>
</tr>
<tr>
<td>9</td>
<td>EQ. GND</td>
<td>10</td>
<td>EQ. GND</td>
</tr>
<tr>
<td>11</td>
<td>AC– RAW</td>
<td>12</td>
<td>AC– RAW</td>
</tr>
</tbody>
</table>

TBS = Terminal Block Service
All dimensions shown are in inches.
FLASH RELAY CONNECTOR SOCKET
WIRING DETAIL

CKT 1

CKT 2

TO TRM COILS

AC+

FR COIL

FLASHER UNIT 1,
PIN 7

PANEL FLASH LIGHT

FLASHER UNIT CONNECTOR SOCKET
WIRING DETAIL

<table>
<thead>
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<th>PIN NO.</th>
<th>FUNCTION</th>
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<tbody>
<tr>
<td>7</td>
<td>LD Ckt #1</td>
</tr>
<tr>
<td>8</td>
<td>LD Ckt #2</td>
</tr>
<tr>
<td>9</td>
<td>EG</td>
</tr>
<tr>
<td>10</td>
<td>AC- CLEAN</td>
</tr>
<tr>
<td>11</td>
<td>AC+ CLEAN</td>
</tr>
<tr>
<td>12</td>
<td>NA</td>
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</tbody>
</table>

REAR VIEW

TITLE: PDA #2L & #3L DETAILS

SHEET 2 OF 8

ERRATA 2

TEES 2009

NO SCALE

A6-14
## POWER DISTRIBUTION ASSEMBLY TERMINAL BLOCK ASSIGNMENT DETAIL

<table>
<thead>
<tr>
<th>PDA’s</th>
<th>2L(X,S)</th>
<th>2L(X,S)</th>
<th>3L(X)</th>
<th>2L(X,S) &amp; 3L(X)</th>
<th>2L(X,S)</th>
<th>3L(X)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
<td>T4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SIDE</strong></td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td><strong>POS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>EG BUS / EG</td>
<td>*</td>
<td>ER AC-</td>
<td>EG BUS / EQ GND</td>
<td>24VDC BUS / PS-7</td>
<td>NA</td>
</tr>
<tr>
<td>2.</td>
<td>AC- BUS / AC-</td>
<td>01-5</td>
<td>FUI-7</td>
<td>AC- BUS / AC-</td>
<td>24VDC (CONTROLLED)</td>
<td>NA</td>
</tr>
<tr>
<td>3.</td>
<td>CR AC- / AC- CLEAN</td>
<td>01-6</td>
<td>FUI-8</td>
<td>*</td>
<td>AC- CLEAN</td>
<td>DC GND BUS / PS 8</td>
</tr>
<tr>
<td>4.</td>
<td>*</td>
<td>SCB CKT 5</td>
<td>01-7</td>
<td>FUI-2-7</td>
<td>*</td>
<td>AC+ RAW</td>
</tr>
<tr>
<td>5.</td>
<td>*</td>
<td>AC+ RAW</td>
<td>01-8</td>
<td>FUI-2-8</td>
<td>*</td>
<td>MU</td>
</tr>
<tr>
<td>6.</td>
<td>CR AC+ / AC+ CLEAN</td>
<td>*</td>
<td>FTR DRIVE</td>
<td>*</td>
<td>TR COIL</td>
<td>NA</td>
</tr>
<tr>
<td>7.</td>
<td>*</td>
<td>SSR</td>
<td>01-1</td>
<td>SCB CKT 1</td>
<td>NA</td>
<td>TRC2ND</td>
</tr>
<tr>
<td>8.</td>
<td>*</td>
<td>SCB CKT 6</td>
<td>01-2</td>
<td>SCB CKT 2</td>
<td>NA</td>
<td>TRC2NC</td>
</tr>
<tr>
<td>9.</td>
<td>*</td>
<td>FCB1 (SEC)</td>
<td>01-3</td>
<td>SCB CKT 3</td>
<td>03-5</td>
<td>FLD2</td>
</tr>
<tr>
<td>10.</td>
<td>*</td>
<td>ER AC+</td>
<td>01-4</td>
<td>SCB CKT 4</td>
<td>SPA AC- CLEAN</td>
<td>NA</td>
</tr>
</tbody>
</table>

**A = EXTERNAL SIDE | B = INTERNAL SIDE | * = WIRE PER ONE LINE DIAGRAM**

### NOTES: (FOR DETAILS A6-13 TO A6-15)

1. All dimensions shown are in inches.
2. SHEET DEFINITIONS:

   - **CKT** = CIRCUIT
   - **EG** = EQUIPMENT GROUND
   - **FL1** = FIELD LOAD 1
   - **FUI-7** = FLASHER UNIT #1, PIN 7
   - **L** = LAMP
   - **L0 CT#1** = LOAD CIRCUIT #1
   - **SSR** = SOLID STATE RELAY
   - **CR** = CONTROLLER RECEPTACLE
   - ** MN** = MAIN
   - **DD** = OUTSIDE DIMENSION
   - **PS-7** = POWER SUPPLY PIN 7
   - **SP 3-3** = SWITCH PACK 3, PIN 3
   - **TR** = TRANSFER RELAY
   - **D1-8** = OUTPUT FILE TB 01, POSITION 8
   - **FCB1** = FIELD CIRCUIT BREAKER 1

3. Thumb screw device.
4. Transfer relay in PDA #2L(X,S) & #3L(X) shall extend no more than 1.0 inch out from the assembly front face.
5. Slack shall be provided in the wiring for the circuit breakers and GFCI receptacle to allow for the removal and repair. Excess bends and stress on the wiring shall be minimized.
6. See Output File plan sheet for heavy duty relay and switch pack wiring assignments and connector mounting location.
7. Wiring shall be routed (with extra length) to minimize movement when front panel door is opened. The wiring going to the front panel shall be routed such that it does not cause undue twisting or bending of the wires.
8. No ventilation hole shall be large enough to place a 0.375 inch diameter object through.
9. If PDA #2L, #2LX or #2LS is installed, park the C1 harness #1 – CSS connector at the Input Panel’s CSP.
   - If PDA #3L or #3LX is installed, the C1 harness #2 – CSS connector shall be connected to the PDA’s C6P connector, support bracket and wiring shall be installed.

### TITLE:

**PDA #2L(X,S) & #3L(X) DETAILS**

**SHEET 3 OF 8**

**ERRATA 2**

**NO SCALE**

**TEES 2009**

**A6-15**
NOTE:
All dimensions shown are in inches.
NOTE:

1. Thumb screws device
2. Panel stamped for OL Monitor Input Cable and Red Monitor Program Board, but board not installed.
3. Panel stamped for IR & LR relay sockets, but relays not installed
4. All dimensions shown are in inches

TITLE:

INPUT/OUTPUT FILE DETAILS

SHEET 2 OF 9

<table>
<thead>
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<th>ERRATA</th>
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### OUTPUT FILE #1 TERMINAL ASSIGNMENT DETAIL

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<td>PDA CKT1/SWPKS 1,2,2P-1</td>
</tr>
<tr>
<td>2</td>
<td>PDA CKT2/SWPKS 3,4,4P-1</td>
</tr>
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<td>3</td>
<td>PDA CKT3/SWPKS 5,6,6P-1</td>
</tr>
<tr>
<td>4</td>
<td>PDA CKT4/SWPKS 7,8,8P-1</td>
</tr>
<tr>
<td>5</td>
<td>PDU FU1 CKT1/TR1</td>
</tr>
<tr>
<td>6</td>
<td>PDU FU1 CKT2/TR2</td>
</tr>
<tr>
<td>7</td>
<td>PDU FU2 CKT1/TR3</td>
</tr>
<tr>
<td>8</td>
<td>PDU FU2 CKT2/TR4</td>
</tr>
<tr>
<td>9</td>
<td>EQUIP. GROUND</td>
</tr>
<tr>
<td>10</td>
<td>AC-</td>
</tr>
<tr>
<td>11</td>
<td>AC+ (FROM PDA)</td>
</tr>
<tr>
<td>12</td>
<td>SSR (TO PDA)</td>
</tr>
<tr>
<td>13</td>
<td>DOOR SW. (FROM POL PAN)</td>
</tr>
<tr>
<td>14</td>
<td>FTR COILS (TO)</td>
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<td>TERM</td>
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<tr>
<td>101</td>
<td>113</td>
<td>125</td>
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<tr>
<td>SWPK 4–RED</td>
<td>SWPK 2P–RED</td>
<td>SWPK 1–RED</td>
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<td>102</td>
<td>114</td>
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<td>SWPK 4–YEL</td>
<td>SWPK 2P–YEL</td>
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<td>115</td>
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<td>SWPK 4–GRN</td>
<td>SWPK 2P–GRN</td>
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<td>128</td>
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<td>SWPK 3–YEL</td>
<td>SWPK 2–YEL</td>
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<tr>
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<td>SWPK 3–GRN</td>
<td>SWPK 2–GRN</td>
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<td>107</td>
<td>119</td>
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<td>SWPK 8–RED</td>
<td>SWPK 6P–RED</td>
<td>SWPK 5–RED</td>
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<td>108</td>
<td>120</td>
<td>132</td>
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<tr>
<td>SWPK 8–YEL</td>
<td>SWPK 6P–YEL</td>
<td>SWPK 5–YEL</td>
</tr>
<tr>
<td>109</td>
<td>121</td>
<td>133</td>
</tr>
<tr>
<td>SWPK 8–GRN</td>
<td>SWPK 6P–GRN</td>
<td>SWPK 5–GRN</td>
</tr>
<tr>
<td>110</td>
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<td>SWPK 7–RED</td>
<td>SWPK 6–RED</td>
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<td>111</td>
<td>123</td>
<td>135</td>
</tr>
<tr>
<td>SWPK 8P–YEL</td>
<td>SWPK 7–YEL</td>
<td>SWPK 6–YEL</td>
</tr>
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<td>112</td>
<td>124</td>
<td>136</td>
</tr>
<tr>
<td>SWPK 8P–GRN</td>
<td>SWPK 7–GRN</td>
<td>SWPK 6–GRN</td>
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</table>

### OUTPUT FILE #2 TERMINAL ASSIGNMENT DETAIL

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<tr>
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<th>FUNCTION</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>PDA FU1 CKT1/TR5</td>
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<tr>
<td>2</td>
<td>PDA FU2 CKT2/TR6</td>
</tr>
<tr>
<td>3</td>
<td>FTR COILS (TO)</td>
</tr>
<tr>
<td>4</td>
<td>AC-</td>
</tr>
<tr>
<td>5</td>
<td>PDA CKT5/SWPKS 9,10,11–1</td>
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<td>AC+ (FROM PDA)</td>
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</table>

### TITLE: INPUT/OUTPUT FILE DETAILS SHEET 3 OF 9
- ERRATA 2
- ND SCALE
- TEES 2009
- A6-18

### NOTE:
1. Thumb screws device.
2. All dimensions shown are in inches.
SWITCH PACK MOUNTING DETAIL

HEAVY DUTY RELAY SOCKET DETAIL

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<tr>
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REAR VIEW

SWITCH PACK SOCKET DETAIL

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<tr>
<td>12</td>
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</table>

REAR VIEW

NOTE: All dimensions shown are in inches

ISOLATION RELAY (IR) DETAIL

LOGIC RELAY (LR) DETAIL

(Refer to detail A6-16)

INPUT/OUTPUT FILE DETAIL

Sheet 4 of 9

Title

ERRATA 2

NO SCALE

TEES 2009

A6-19
# Model 210 Monitor Unit Pin Assignment

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<th>Termination</th>
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<td>SWPKN BP GRN</td>
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<td>FF</td>
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**Notes:**

1. Top of relays shall be flush with face of file.
2. The isolation relay shall be Potter & Brumfield R10-E1-X2-115 (or equal). The logic relay (LR) shall be Potter & Brumfield KUP11(D11 or 15) or equal.
3. See connectors C4 & C5 wiring lists for connector/file interface.
4. Sheet definitions:
   - CKT = CIRCUIT
   - FTR = FLASH TRANSFER RELAY
   - IFI-140 = INPUT FILE "I", TB 14, POSITION D
   - SSR = SOLID STATE RELAY
   - MU = MONITOR UNIT
   - N.C. = NORMALLY CLOSED RELAY CIRCUIT
   - N.O. = NORMALLY OPEN RELAY CIRCUIT
   - PDA FU1 CKT1 = PDA FLASHER UNIT 1, OUTPUT CIRCUIT 1
   - POL PAN = POLICE PANEL
   - SW = SWITCH
   - SWP(K(S)) = SWITCH PACK(S)
   - T&B = CONDUCTORS CONNECTED TO PIN, TWO FEET IN LENGTH WITH RING LUG ON UNCONNECTED END, TIED & BUNDLED SEPARATELY.
5. For details, see A3-3 & A3-4.
6. All dimensions shown are in inches.

**Title:**

**Input/output File Details**

**Sheet 5 of 9**
NOTES:

1. 10 terminal (#8 wire) minimum copper bus.
3. The terminal block shall have terminal positions necessary to match position assignments. Terminal position screws shall be 8–32 except for TBS, TBO, TB3, which shall be 10–32
4. SPA shall be bolted on the Rail and firmly attached to the Service Panel.
5. All dimensions shown are in inches.
NOTES:

1. Provide and install a 30 position TB1 Terminal Block & three circular connectors, C5P, C7P & C10P (no contacts), TB1 shall be Open Construct Phoenix Contact Terminal Block UT 6, Weidmuller Terminal Block WDU 10 or equal, mounted on DIN Rail (supported every 6 inches with position function label tabs and positions commoned and end locks.

2. A 4 foot length "CMS" Harness of 14 #20 (or larger) Conductors shall be furnished and installed in the cabinet. One end of the harness shall be the C10S Connector resting in C10P (mounted on the Input Panel #3) when not in used. The other end shall be stripped (according to manufacturers requirements) and connected to the "B Side" of TB1. The conductor bundle shall have external protection.

3. All dimensions shown are in inches.
NOTES:
1. Provide and install a 73 position TB2 Terminal Block. TB2 shall be Open Construction Phoenix Contact Terminal Block UT 8, Weidmuller Terminal Block WDU 10 or equal, mounted on DIN Rail (supported every 6 inches) with position function label tabs and positions commoned and end locks.
2. All terminals to be labeled using manufacturer recommended plastic labels as shown above.
3. All dimensions shown are in inches.
### Terminal Block Assignment

#### 332L, 342LX Input Panel #1

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<th>POS</th>
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#### 334L, 344LX Input Panel #3, TB 1

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#### 334L, 344LX Input Panel #3, TB 2

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#### 334L, 344LX Input Panel #4

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#### 336L, 346LX Input Panel #4

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#### 33L, 34LX Service Panel 1, 336L, 346LX Service Panel 2

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**Notes:**

1. Sheet Definitions:
   - 11 COM = DC Common
   - COMM = Communication
   - DET1 = Detector #1
   - EVA = Emergency Vehicle Preemption A
   - IFI-10 = Input File 1, Slot 1, Connector Pin D
   - OF = Output File
   - M = Monitor Module
   - NA = Not Assigned
   - RR1 = Railroad Preemption 1
   - MBPS = Manual Bypass Switch
   - BBS = Battery Back-Up System
   - PDA = Power Distribution Assembly
   - x = 2, 4

2. All dimensions shown are in inches.
## C1 Harness Wiring List #1

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<th>Source</th>
<th>Destination</th>
<th>Function</th>
<th>PIN</th>
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**Title:** C1 HARNESS WIRING LIST

**Sheet:** 2 of 5

**Page:** 612.0x792.0

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**Data Source:** TEES 2009
C11P HARNESS

ADJUSTABLE LABELS

J INPUT FILE (REAR VIEW)

I INPUT FILE (REAR VIEW)

CALTRANS MODEL 33xL, 34xLX CABINETS
I & J INPUT FILE

NOTE:
1. No AC power at the Input File for the LX cabinet, see A6-50.
2. For C15S and C11S Pin Assignment, see A9-9.
NOTES:
1. Perforated Screen
2. From Cabinet base to door lip
3. After center post is installed a sealant shall be applied to prevent leakage.
4. The locks & handles shall be centered vertically on the door opposite from the hinges on both, the rear & front.
CABINET HOUSING #3 & #4
POLICE PANEL DETAIL

Police Panel Shall Be 3.00" Deep

CABINET HOUSING #3 & #4 BOTTOM DETAIL

HOLE SLOT DETAIL

0.375X1.250 OBROUND

CAGE SUPPORT DETAIL

Note 1

Bolt Access Cutout

NOTES:
1. Tac Weld Cage Support to bottom assembly front and rear. See Cage Support Assembly Detail.
2. Uses Type LX Foundation.
NOTES
1. Hole Slot Detail B, Cage #1 details A6–2.
2. TOP, Refers to the bottom lip of the top hat. BOTTOM, Refers to the top lip of the bottom hat.
3. Controller unit support drawer shelf assembly, A6–6.

TITLE:
CABINET HOUSING #3 DETAILS
SHEET 3 OF 7

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NOTES:

1. Hole Slot Detail B see Cabinet Housings 3 Detail 2
2. Hole Slot Detail A see Cabinet Housings 3 Detail 2
3. All dimensions shown are in inches.
NOTES:

1. 10 terminal (#8 wire) minimum copper bus.
2. The terminal block shall have terminal positions necessary to match position assignments. Terminal position screws shall be 8–32 except for TBS, TBO, TB3, which shall be 10–32.
3. SPA and the Service PDA shall be bolted on the Rail and firmly attached to the Service Panel.
4. All dimensions shown are in inches.
NOTES:
1. 10 terminal (#8 wire) minimum copper bus.
2. The terminal block shall have terminal positions necessary to match position assignments.
   Terminal position screws shall be 8–32 except for TBS, TBO, TB3, which shall be 10–32
3. SPA and the Service PDA shall be bolted on the Rail and firmly attached to the Service Panel.
4. All dimensions shown are in inches.
NOTE:
1. Controller unit support drawer shelf assembly.
2. All dimensions shown are in inches.
NOTES:
1. The Service PDA shall be mounted at least 4.25in above the bottom of the LX cabinet.
2. All dimensions shown are in inches.
Rack #1 EQUIPMENT SHELF INSTALLATION DETAILS
(FOR CABINET HOUSING #3)

NOTE:
1. Cabinet Housing #3 details, A6-32 & A6-34.
2. Equipment Shelf with Air Vents
3. All dimensions shown are in inches

| TITLE: RACK #1 DRAWER AND SHELF INSTALLATION DETAILS |
| ERRATA 2 | NO SCALE |
| TEES 2009 | A6-41 |
NOTES:

1. Handle shank, 0.5 inch minimum
2. Provision for padlock, horizontal or verticle position.
3. Door lock, Corbin 2 Type or equal.
4. All dimensions shown are in inches.
344LX CABINET ONE LINE DIAGRAM

POWER DISTRIBUTION ASSEMBLY #3LX

TEC TERMINAL BLOCK - SERVICE

ERRATA 2
NO SCALE
TECS 2009 A6-44
NOTE:

See A6-14 and A6-15 for sheets 3 & 4.
NOTE:
See A6-14 and A6-15 for sheets 3 & 4.
NOTE:
1. PDA top and bottom vented.
2. All dimensions shown are in inches.
NOTE:
1. See A6-14 and A6-15 for sheets 4 & 5.
2. All dimensions shown are in inches.
NOTE:
See A6-14 and A6-15 for sheets 4 & 5.
NOTE:
All dimensions shown are in inches.
NOTE:

1. Thumb screws device
2. Panel stamped for OL Monitor Input Cable and Red Monitor Program Board, but Board not installed.
3. For Terminal Assignment, see Output File #1L detail.
5. Field Terminal contacts shall be 5-pin screw type Weidmuller BLT–C36, Phoenix Contact, or equivalent.
6. Height = 8.2 – 8.5, Width = 8
7. All dimensions shown are in inches

TITLE: INPUT/OUTPUT FILE #1LX DETAILS

SHEET 7 OF 9

ERRATA 2

NO SCALE

TEES 2009

A6–51
NOTE:

1. Thumb screws device
2. Panel stamped for OL Monitor Input Cable and Red Monitor Program Board, but board not installed.
3. For Terminal Assignment, see Output File #1 detail.
5. Holes 0.2 Dia. for Field Terminal Panel & Output Panels.
6. Cut-out Height = 7 - 7.3, Width = 7
7. All dimensions shown are in inches
NOTE:

1. Thumb screws device
2. Back Panel Drop 90 Deg.
3. Panel stamped for IR & LR relay sockets, but relays not installed
4. For Terminal Assignment, see Output File #2L detail.
6. Field Terminal contacts shall be 5-pin screw type, Weidmuller BLT–C18, Phoenix or equivalent.
7. Height = 4.6 – 4.8, Width = 8
8. All dimensions shown are in inches
NOTES:
1. Perforated Screen
2. From Cabinet base to door lip
3. After center post is installed a sealant shall be applied to prevent leakage.
4. The locks & handles shall be centered vertically on the door opposite from the hinges on both, the rear & front.
NOTES
1. Hole Slot Detail B, Cage #2 details A6-2.
2. TOP, Refers to the bottom lip of the top hat.
   BOTTOM, Refers to the top lip of the bottom hat.
3. Controller unit support drawer shelf assembly, A6-6.
4. Equipment shelf, A6-41.

TITLE:
CABINET HOUSING #4 DETAILS
SHEET 6 OF 7

ERRATA 2  NO SCALE
TEES 2009  A6-55
NOTES:

1. Hole Slot Detail B see Cabinet Housings 3 Detail 2

2. Hole Slot Detail A see Cabinet Housings 3 Detail 2

3. All dimensions shown are in inches.

CENTER CHANNEL PART IS WELDED TO BOTTOM PLATE
NOTES:

1. 10 terminal (#8 wire) minimum copper bus.
2. The terminal block shall have terminal positions necessary to match position assignments.
3. Terminal position screws shall be 8–32 except for TBS, TBO, TB3, which shall be 10–32
4. SPA and the Service PDA shall be bolted on the Rail and firmly attached to the Service Panel.
5. All dimensions shown are in inches.
NOTE:
1. Controller unit support drawer shelf assembly.
2. All dimensions shown are in inches.
Model 500, 510 & 520 CMS System Wiring Diagram  A7-2
Model 500/510 CMS System TxFrm to CIP Wiring Detail, Option 1  A8-3A
Model 500/510 CMS System TxFrm to CIP Wiring Detail, Option 2  A8-3B
NOTES:
1. AC Service is shown only to complete diagram and is not provided in CMS Model 500/510 or 520 package.
2. Incoming power to Service Cabinet is 120/240 Single Phase.
3. Secondary side of Main Disconnect shall be #2 AWG or equivalent capacity multiple wires.
4. Secondary side of the thirty 1P-20A Circuit Breakers shall be a minimum #12 AWG conductors.
5. AC on CIP shall be routed to PXDA1-5.
APPENDIX A9
CHAPTER 9 DETAILS
<table>
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<tr>
<td>Model 2070 - Chassis Rear View</td>
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<td>Model 2070 - Chassis Motherboard</td>
<td>A9-4</td>
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<td>Model 2070 – 2, Field I/O Module</td>
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<tr>
<td>Model 2070 – 2E+ Field I/O Module, C1 &amp; C11 Connectors</td>
<td>A9-9</td>
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<td>Model 2070 – 4 Power Supply Module</td>
<td>A9-13</td>
</tr>
<tr>
<td>Model 2070 – Power Failure Reaction</td>
<td>A9-17</td>
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</tbody>
</table>
NOTES: (FOR THIS DETAIL)

1. Four permanently attached 8in long Card Guides SAE 1800F (OR EQUAL) beginning 0.51in from the backplane mounting surface.
2. TB – TRANSITION BOARD
   MCB – MAIN CONTROLLER BOARD
3. Maximum length of harness shall be 4in, and shall not protrude beyond the back of the 2070 unit.
4. The VME Cage Assembly Opening shall be delivered covered by a blank panel. Matching M3 PEM fasteners shall be provided on the backplane surface for panel mounting.
5. Blank plates shall cover all unused module openings.
6. All Module Front Plates thickness shall be (0.08+0.005)
7. All dimensions shown are in inches.
NOTES: (FOR THIS DETAIL)

1. The Motherboard shall be a 0.125 inch minimum thickness pcb mechanically mounted in a vertical position.
2. A1 to A5 receptacle connectors shall be 96 socket contact DIN 41612 connectors (ROBINSON NUGENT #DIN 96RSC or ELCO Series 8477 Three Row Inverted Socket OR EQUAL).
3. The FP Harness shall be connected to the Motherboard via a header connector. Pin 1 shall be in the lower right hand corner.
4. Front Panel Harness Connector shall intermate with AMP 102-160-9 or equal located on Front Panel PCB.
5. Angle Brackets shall support the Motherboard to the Model 2070 chassis.
6. All dimensions shown are in inches.
NOTES: (FOR THIS DETAIL)

1. 2070-2E+ Faceplate shall be 4X wide. 2070-2C Faceplate shall be 2X wide. 
   (SEE SYSTEM PCB MODULE, GENERAL DETAILS.)
2. Dark Circles in the C1S Connector denote guide pin locations and open circles denote guide 
   socket locations.
3. Dimension "A" shall be a minimum of 0.5in.
   C12S – 25-Pin DB Socket Type
5. C12S pin 12 (BIAS +5VDC) at 50mA maximum is derived from the ISO +12 VDC Power Supply. 
   BIAS +5VDC refers to voltage required for a Line Terminator device.
6. EG (Equipment Ground) pin is electrically connected to the faceplate.
7. LED indicators Tx & Rx for SP3 (field site) and SP5 shall be provided.
8. C1 connector shall be bolted to the Faceplate.
9. Angle Brackets shall support main board to the Faceplate.
### CIS PIN ASSIGNMENT

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**TITLE:** MODEL 2070-2E+
FIELD I/O MODULE
CIS & CIIS CONNECTORS

**ERRATA 2**
TEES 2009

**NO SCALE**
A9-9
NOTES: (FOR THIS DETAIL)

1. Power switch shall be mounted vertically. Power On shall be in the up position.
2. Fuse shall be a replaceable 3AG Slow Blow type resident in a fuse holder. Fuse label shall indicate rating.
3. Three conductor #16 power cable, 4 feet (48 inch) minimum length and permanently attached to the Module with strain relief. The end plug connector shall be a three blade NEMA 5–15P grounding plug type.
4. PS1 and PS2 Receptacle Connectors shall be AMP Mini–Universal Double row MATE–N–LOK 2 CAP Connectors with locking latch devices (OR EQUAL).
   PS1 connector shall be a 10 position PLUG connector.
   PS2 connector shall be a 12 position PLUG connector.
6. Mounting Plate shall conform to the 4X Wide Module dimensions.
7. A LED indicator shall be provided for each DC power source (+5, ISO +12, +12 SER, −12 SER).
8. Power Supply shall be marked as 2070–4A.
9. All dimensions shown are in inches.
**AC FAIL EVENT**

1
0

Event is set to '1'

Since AC came back, event is set to '0'

**AC POWER**

97±2 VAC

Below 92±2 for 3 cycles

92±2 VAC

Power Fail

97±2 VAC

Power Restored

**AC FAIL/POWER DOWN**

HI

LOW

If AC is HI before SYSRESET goes LOW, Power’s still up & continues

**SYSRESET/POWER UP**

HI

LOW

0 → 525 ms

START OF PROGRAM

4 secs.  → 5 secs.

Load & Execute

ONLED

(See sec. 9.2.7.3.2)

**LINESYNC**

---

**NOTES:**

**Power Failure:** A Power Failure is said to have occurred when the incoming line voltage falls below 92±/-2 VAC for 50ms. See Power Conditions.

**Power Restoration:** Power is said to be restored when the incoming line voltage equals or exceeds 97±/-2 VAC for 50ms. See Power Conditions.

**Power Conditions:** A 16.7 ms (one 60 Hz cycle) reaction period is allowed to be included in the 50 ms timing or added to (67 ms duration). The hysteresis between power failure and power restoration voltage settings shall be a min. of 5 VAC with a threshold drift of no more than 0.2 VAC.
Model 2070-Ex Network Switch Module
### PORT 2, 3, 4 RJ45 PIN ASSIGNMENTS

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