TRANSPORTATION ELECTRICAL EQUIPMENT
SPECIFICATIONS

TEES 2009 ERRATA No.3

January 10th, 2019
# Table of Contents

TEES 2009 ERRATA No.3 ................................................................. 1

CHAPTER 3 .................................................................................. 18

AUXILIARY CABINET SPECIFICATIONS .................................... 18

CHAPTER 3-SECTION 1 ............................................................... 19

GENERAL REQUIREMENTS ......................................................... 19

3.1.1 Models 200 and 204 General ........................................... 19

3.1.1.1 Unit Chassis .............................................................. 19

3.1.1.2 Unit Control Circuitry and Switches .............................. 19

3.1.1.3 Unit Handle ............................................................. 19

3.1.1.4 Unit Lower Surface ................................................... 19

3.1.1.5 Edge Guides ............................................................ 19

3.1.1.6 Switching .............................................................. 19

3.1.1.7 Operations ............................................................. 19

3.1.1.8 Positions ............................................................... 19

CHAPTER 3-SECTION 2 ............................................................ 20

MODEL 200 SWITCH PACK UNIT ........................................... 20

3.2.1 Switches ............................................................................ 20

3.2.2 Grounds ............................................................................ 20

3.2.3 Maximum Currents ........................................................ 20

3.2.4 Rating .............................................................................. 20

3.2.5 Unit Front Panel ............................................................. 20

3.2.6 Resistance ....................................................................... 20

CHAPTER 3-SECTION 3 ............................................................ 21

MODELS 204 - FLASHER UNIT and 205 – TRANSFER RELAY UNIT ........................................................................... 21

3.3.1 Model 204 Flasher Unit .................................................... 21

3.3.1.1 Flasher Unit .............................................................. 21

3.3.1.2 Internal DC Power ...................................................... 21

3.3.1.3 Flashing ....................................................................... 21

3.3.1.4 Rating ....................................................................... 21

3.3.1.5 Indicator ................................................................. 21

3.3.1.6 Operation ............................................................... 21

3.3.1.7 Arrestor ................................................................. 21

3.3.2 Model 205 Transfer Relay Unit ....................................... 21

3.3.2.1 Type ......................................................................... 21

3.3.2.2 Cover ........................................................................ 21

3.3.2.3 Contacts .................................................................... 21

3.3.2.4 Relay Coil .............................................................. 21

3.3.2.5 Relay Potential and Rating ....................................... 22

CHAPTER 3-SECTION 4 ............................................................ 23

MODEL 206L POWER SUPPLY UNIT ....................................... 23

3.4.1 Unit Chassis .................................................................... 23

3.4.2 Unit Design ...................................................................... 23

3.4.2.1 Input Protection ......................................................... 23

3.4.2.2 Output Protection ..................................................... 23

3.4.2.3 Input and Output fuses ............................................. 23

3.4.2.4 Line and Load Regulation ......................................... 23
CHAPTER 3-SECTION 7

3.6.1 Monitor Unit Conditions
3.6.2 Requirements
3.6.3 Conflict Monitoring
3.6.4 Conflict Programming Card
3.6.5 Indicators
3.6.6 Output Relay Contact
3.6.7 Second Output Circuit
3.6.8 LOGIC Toggle Switch
3.6.9 RESET Switch

CHAPTER 3-SECTION 6

3.6.1 Monitor Unit Conditions
3.6.2 Requirements
3.6.3 Conflict Monitoring
3.6.4 Conflict Programming Card
3.6.5 Indicators
3.6.6 Output Relay Contact
3.6.7 Second Output Circuit
3.6.8 LOGIC Toggle Switch
3.6.9 RESET Switch

CHAPTER 3-SECTION 5

3.5.1 Monitoring
3.5.2 WDT Monitor Requirements
3.5.3 Power Supply Monitor Requirements
3.5.4 Failed State Output Circuits
3.5.5 Monitor Unit Reset
3.5.6 Provision
3.5.7 PDA #3 WDT Reset Input
3.5.8 Output Relay

CHAPTER 3-SECTION 6

3.4.2.5 Design Voltage
3.4.2.6 Full Load Current
3.4.2.7 Ripple Noise
3.4.2.8 Efficiency
3.4.2.9 Power Factor Correction
3.4.2.10 Circuit Capacitors
3.4.3.1 LED Indicators

COMMUNICATIONS AND CABINET HARNESS

3.7.1 C1 Harness
3.7.2 C1 Ends
3.7.3 C1 Harness #3/Output File #2 Adaptor
3.7.4  C1 Conductors.................................................................................................................. 29
CHAPTER 3-SECTION 8 ........................................................................................................... 30
MODEL 280 INPUT FILE ETHERNET SWITCH UNIT ................................................................. 30
3.8.1  Model 280 Network Switch Unit ......................................................................................... 30
3.8.2  Mechanical/Electrical Requirements ................................................................................ 30
3.8.3  Network Standards ........................................................................................................... 30
3.8.4  Modes of Operation .......................................................................................................... 30
3.8.5  Network Media Support .................................................................................................. 30
3.8.6  LED Indicators ................................................................................................................ 31
3.8.7  Form Factor .................................................................................................................... 31
3.8.8  Power Requirements ....................................................................................................... 31
3.8.9  Environmental ................................................................................................................ 31
CHAPTER 3-SECTION 9 ........................................................................................................... 32
MODEL 206E POWER SUPPLY UNIT ...................................................................................... 32
3.9.3.1  Unit Chassis .................................................................................................................. 32
3.9.3.2  Unit Design .................................................................................................................. 32
3.9.3.3  Input Protection ............................................................................................................ 32
3.9.3.4  Output Protection ........................................................................................................ 32
3.9.3.5  Input and Output fuses ................................................................................................ 32
3.9.3.6  Line and Load Regulation .......................................................................................... 32
3.9.3.7  Design Voltage ............................................................................................................ 32
3.9.3.8  Full Load Current ........................................................................................................ 32
3.9.3.9  Ripple Noise ................................................................................................................. 32
3.9.3.10  Efficiency .................................................................................................................... 32
3.9.3.11  Power Factor Correction ............................................................................................ 32
3.9.3.12  Circuit Capacitors ..................................................................................................... 33
3.9.3.13  Front Panel and Terminals ......................................................................................... 33
3.9.3.14  LED Indicators .......................................................................................................... 33
CHAPTER 3-SECTION 10 .......................................................................................................... 34
AUXILIARY EQUIPMENT & HARNESS DETAILS ................................................................. 34
CHAPTER 4-SECTION 12 ........................................................................................................... 35
LX BBS CABINET ....................................................................................................................... 35
4.12.1  LX BBS Cabinet .............................................................................................................. 35
4.12.2  LX-BBS Materials .......................................................................................................... 35
4.12.3  LX-BBS Cabinet Mounting Hardware .......................................................................... 35
4.12.4  LX-BBS Cabinet Shelves .............................................................................................. 36
4.12.5  EIA Angle Rails ............................................................................................................. 36
4.12.6  AC-Operated Fan .......................................................................................................... 36
CHAPTER 4-SECTION 13 .......................................................................................................... 38
LX-BBS CABINET DETAILS .................................................................................................... 38
CHAPTER 5-SECTION 7 .............................................................................................................. 39
MODEL 222i & 224i INTELLIGENT LOOP DETECTOR .............................................................. 39
SENSOR UNIT REQUIREMENTS ............................................................................................... 39
5.7.1  General .......................................................................................................................... 39
5.7.2  Temperature Compensation ......................................................................................... 39
5.7.3  Network ......................................................................................................................... 39
5.7.4  Display .......................................................................................................................... 39
5.7.5  Configuration and Output ............................................................................................. 39
5.7.6  Lead-in Cable ............................................................................................................... 39
5.7.7  Selectable Sensitivity Settings ..................................................................................... 40
TEES 2009 Errata No. 3 5
CHAPTER 6-SECTION 1

CHAPTER 6

GENERAL REQUIREMENTS AND MODELS 332LS, 334LS, 336LS, 342LX, 344LS & 346LX

CABINET SPECIFICATIONS

CABINET MODEL COMPOSITION

6.1.1 Composition

6.2.2.1 Cabinet Model

6.2.2.2 PDA

6.2.2.3 Output Files

6.2.2.4 Power Supply

6.2.2.5 332LS

6.2.2.6 2LX

6.2.2.7 1LX

6.2.2.8 2LX(Model 520)

6.2.2.9 206L

6.2.2.10 334LS

6.2.2.11 3LX

6.2.2.12

6.2.2.13

6.2.2.14 206L

6.2.2.15 336LS

6.2.2.16 2LS

6.2.2.17 1LX

6.2.2.18

6.2.2.19 206LS

6.2.2.20 342LX

6.2.2.21 2LX

6.2.2.22 1LX

6.2.2.23 2LX(Model 520)

6.2.2.24 206E

6.2.2.25 344LX

6.2.2.26 3LX

6.2.2.27

6.2.2.28

6.2.2.29 206E

6.2.2.30 346LX

6.2.2.31 2LS

6.2.2.32 1LX

6.2.2.33

6.2.2.34 206LS

6.1.2 Model 332LS Cabinet

6.1.1.1 Model 334LS Cabinet

6.1.1.2 Model 336LS Cabinet

6.1.1.3 Model 342LX Cabinet

6.1.1.4 Model 344LS Cabinet

6.1.1.5 Model 346LX Cabinet
6.1.1.6 Assemblies and Files ................................................................. 44
6.1.3 Cabinet Shipping Requirements ............................................... 44
6.1.4 Cabinet Adaptors ................................................................. 45
6.1.5 Stainless Steel ................................................................. 45
6.1.6 Cage Mounting ................................................................ 45
6.1.7 Protection ........................................................................ 45

CHAPTER 6-SECTION 2 .................................................................. 46
HOUSING REQUIREMENTS ............................................................... 46
6.2.1 Housing ........................................................................ 46
6.2.2 Housing Construction ......................................................... 46
6.2.2.35 Waterproof .................................................................... 46
6.2.2.36 Fabricating .................................................................... 46
6.2.2.37 Exterior .......................................................................... 46
6.2.2.38 Aluminum surfaces ......................................................... 46
6.2.2.4.1 Powder Coating .......................................................... 46
6.2.2.39 Enclosure Doorframes ..................................................... 46
6.2.2.40 Gasketing ..................................................................... 47
6.2.2.41 Cage Bottom Support Mounting Angles ......................... 47
6.2.2.42 Lifting Eyes .................................................................... 47
6.2.2.43 Exterior Bolt Heads .......................................................... 47
6.2.3 Door Latches & Locks ........................................................... 47
6.2.3.1 Latching Handles ............................................................. 47
6.2.3.2 Latching Mechanism ......................................................... 47
6.2.3.3 Locks and Handles for Model 332LS, 334LS and 336LS .... 47
6.2.3.4 Locks ............................................................................... 48
6.2.3.5 Bolts ................................................................................ 48
6.2.3.6 Center Latch Cam .............................................................. 48
6.2.3.7 Rollers ............................................................................. 48
6.2.4 Ventilation ......................................................................... 48
6.2.4.1 Front Door ......................................................................... 48
6.2.4.2 Intake and Exhaust Areas .................................................. 48
6.2.4.3 Electric Fan ........................................................................ 48
6.2.4.4 Temperature Controlling .................................................. 49
6.2.4.5 Filter ................................................................................. 49
6.2.5 Hinges & Door Catches ......................................................... 49
6.2.5.1 Leave Hinges ................................................................. 49
6.2.5.2 Front and Rear Doors ....................................................... 49
6.2.6 Police Panel ......................................................................... 49
6.2.6.1 Police Panel Assembly ....................................................... 49
6.2.6.2 Police Panel Door .............................................................. 49
6.2.6.3 Toggle Power Switches ....................................................... 49
6.2.6.3.1 Model 334LS and 344LS ............................................ 50
6.2.6.3.2 Models 332LS, 336LS, 342LX and 346LX ....................... 50
6.2.6.3.3 Front and Back of the Panel ........................................... 50
6.2.6.3.4 Panel Assembly .............................................................. 50

CHAPTER 6-SECTION 3 .................................................................. 51
CABINET CAGE REQUIREMENTS ................................................... 51
6.3.1 EIA 19-inch Rack Cage ......................................................... 51
6.3.2 EIA Cage Rack Portion .......................................................... 51
6.3.3 Clearance ......................................................................... 51
6.3.4 Angles ................................................................. 51
6.3.5 Cage .................................................................. 51
6.3.6 Cage Position ...................................................... 51

CHAPTER 6-SECTION 4 ............................................. 52
CABINET ASSEMBLIES ............................................... 52
6.4.1 General ............................................................... 52
6.4.1.1 Equipment ....................................................... 52
6.4.1.2 Fuses, Circuit Breakers, Switches and Indicators ..... 52
6.4.1.3 Equipment in the Cabinet .................................. 52
6.4.1.4 Resistor-Capacitor Transient Suppression ......... 52
6.4.1.5 Leakage Resistor ............................................. 52
6.4.1.6 Assembly ....................................................... 52
6.4.1.7 Air Circulation ................................................ 52
6.4.1.8 Socket Types .................................................. 52
6.4.1.9 Mounting ........................................................ 53
6.4.1.10 Guides .......................................................... 53
6.4.1.11 Fabricating .................................................... 53
6.4.2 Power Supply Assembly ....................................... 53
6.4.2.1 Power Supply ................................................... 53
6.4.3 Power Distribution Assembly (PDA) ...................... 53
6.4.3.1 Equipment ....................................................... 53
6.4.3.1.1 PDA #1LX .................................................. 53
6.4.3.1.2 PDA #2LX .................................................. 53
6.4.3.1.3 PDA #2LS .................................................. 54
6.4.3.1.4 PDA #3LX .................................................. 55
6.4.3.2 Rating of Breakers .......................................... 55
6.4.3.3 Equipment Receptacle ....................................... 55
6.4.3.4 AUTO/FLASH Switch ...................................... 55
6.4.3.5 FLASH Indicator Light ..................................... 55
6.4.3.6 SSR Fault Indicator Light ............................... 55
6.4.3.7 Conductors ..................................................... 55
6.4.3.8 Ganged Circuit Breakers ................................. 56
6.4.3.9 Monitor Unit ................................................... 56
6.4.3.10 Circuit Breaker with Auxiliary Switch ............ 56
6.4.3.10.1 Single Pole ............................................... 56
6.4.3.10.2 Breakers ................................................... 56
6.4.3.10.3 Terminals ................................................ 56
6.4.3.11 Model 206L/E/LS Power Supply Module ....... 56
6.4.3.11.1 Requirements ........................................... 56
6.4.3.11.2 Module Chassis .......................................... 56
6.4.3.11.3 PDA Assembly .......................................... 56
6.4.3.11.4 Wire-Wound Power Resistors ...................... 56
6.4.3.12 Terminal Screw Sizes .................................... 57
6.4.4 Input File .......................................................... 57
6.4.4.1 Depth ............................................................ 57
6.4.4.2 Connectors ..................................................... 57
6.4.4.3 Marker Strips ................................................ 57
6.4.4.4 Screw Size ..................................................... 57
6.4.5 Output File ......................................................... 57
6.4.5.1 General Requirements .................................... 57
6.4.5.1.1 Marker Strips ...................................................... 57
6.4.5.1.2 Connectors ...................................................... 57
6.4.5.1.3 Terminal Positions ........................................... 57
6.4.5.1.4 Field Wire ....................................................... 57
6.4.5.1.5 Flash Transfer Relays ......................................... 58
6.4.5.1.6 Depth .............................................................. 58
6.4.5.1.7 Flash Programming Connectors ......................... 58
6.4.5.1.8 TB O1, O2,O3& O4 Terminal Screw Sizes .......... 58
6.4.5.2 Output File #1LX ................................................ 58
6.4.5.2.1 Containing ....................................................... 58
6.4.5.2.2 Output Circuits ............................................... 58
6.4.5.2.3 Model 210 Monitor Unit ..................................... 58
6.4.5.2.4 Monitor Unit Compartment ............................... 58
6.4.5.3 Output File #2LX (Model 420) ............................ 58
6.4.5.3.1 Switch Packs and Flash Transfer Relays .......... 59
6.4.5.3.2 Output Circuits ............................................... 59
6.4.5.4 Output File #2LX (Model 520) ............................ 59
6.4.6 Heavy Duty Relay (Model 430) .............................. 59
6.4.6.1 Electromechanical Type ....................................... 59
6.4.6.2 Enclosing .......................................................... 59
6.4.6.3 DPDT Contacts .................................................... 59
6.4.6.4 Relay Coil .......................................................... 59
6.4.6.5 Potential & Surge Rating ...................................... 59
6.4.7 Side Panels ............................................................ 59
6.4.7.1 Viewing .............................................................. 60
6.4.8 Cabinet Harnesses .................................................. 60

CHAPTER 6-SECTION 5 ......................................................... 61
6.5.1 Cabinet Wiring Diagram .......................................... 61
6.5.1.1 Diagrams/Drawings Supply ................................. 61
6.5.1.2 Pouch ................................................................. 61
6.5.1.3 Manuals ............................................................ 61
6.5.2 Conductors ............................................................. 61
6.5.2.1 General ............................................................. 61
6.5.2.2 Sizes ................................................................. 61
6.5.2.3 Types ................................................................. 61
6.5.2.4 Labels ............................................................... 62
6.5.2.5 Color-Code Requirements .................................. 62
6.5.2.5.1 Grounded Conductors .................................... 62
6.5.2.5.2 Equipment Grounding ..................................... 62
6.5.2.5.3 DC Logic Ground ........................................... 62
6.5.2.5.4 Ungrounded AC+ Conductors ....................... 62
6.5.2.5.5 Logic Ungrounded Conductors ....................... 62
6.5.2.6 DC Logic Ground and Equipment Ground .......... 62
6.5.2.7 AC- Copper Terminal Bus ................................. 62
6.5.2.8 Power Supply DC Ground .................................. 62
6.5.2.9 Input Terminal ................................................... 62
6.5.3 Terminal Blocks ..................................................... 63
6.5.3.1 Terminal Screws ............................................... 63

CHAPTER 6-SECTION 6 ......................................................... 64
SERVICE PANEL ASSEMBLY ............................................. 64

TEES 2009 Errata No. 3 9
CHAPTER 9-SECTION 2 ................................................................. 68
MODEL 2070-1 CPU MODULE .................................................... 68
9.2.1 Model 2070-1A CPU Module........................................ 68
  9.2.1.1 Main Controller Board (MCB) ................................. 68
  9.2.1.2 Controller ................................................................ 68
  9.2.1.3 Memory Address Organization ................................ 68
  9.2.1.4 Transition Board ...................................................... 68
  9.2.1.5 Shielded Interface Harness ....................................... 68
9.2.2 Model 2070-1E CPU Module .......................................... 68
  9.2.2.1 Dual SCC Device .................................................... 69
  9.2.2.2 68EN360 SCC1 ......................................................... 69
  9.2.2.3 Module 2070-1E Power Requirements ...................... 69
  9.2.2.4 The C13S Connector ................................................. 69
    9.2.2.4.1 Serial Port SP8 .................................................. 69
    9.2.2.4.2 LINESYNC and POWERDOWN ......................... 69
    9.2.2.4.3 NRESET ............................................................ 69
9.2.3 Model 2070-1C CPU Module ........................................ 69
  9.2.3.1 Engine Board ......................................................... 70
  9.2.3.2 Ethernet Ports ...................................................... 70

TEES 2009 Errata No. 3  

9.2.3.3  Network Switches, Module 2070-1C .................................................. 70
9.2.3.4  Universal Serial Bus (USB) ................................................................. 70
9.2.3.5  Host Module ....................................................................................... 70
9.2.4  Model 2070-1A and 2070-1E CPU Module ........................................ 70
9.2.4.1  Contiguous Addresses ....................................................................... 70
9.2.4.2  Incoming +5 VDC ............................................................................. 70
9.2.4.3  Ram Memory ...................................................................................... 71
9.2.4.4  Flash Memory .................................................................................... 71
9.2.4.5  Time-of-day Clock ............................................................................ 71
9.2.4.6  CPU_Reset ......................................................................................... 71
9.2.4.7  CPU_ACTIVE LED Indicator ............................................................ 71
9.2.4.8  Tick Timer ......................................................................................... 71
9.2.4.9  SRAM and TOD Clock ...................................................................... 71
9.2.4.10  Network Switch, Model 2070 -1E .................................................. 72
9.2.5  Model 2070-1C CPU Engine Board ................................................... 72
9.2.6  Data Key ............................................................................................... 73
9.2.7  Model –1A and 2070-1E CPU Module Software .................................. 74
9.2.7.1  Operating System ............................................................................. 74
9.2.7.2  Drivers and Descriptors .................................................................... 75
9.2.7.2.1  Supplied Modules ......................................................................... 75
9.2.7.2.2  Memory Drivers .......................................................................... 75
9.2.7.2.3  MC68360 Internal Timers ............................................................... 76
9.2.7.2.3.1  Descriptor .................................................................................. 76
9.2.7.2.3.2  Timer Standard .......................................................................... 76
9.2.7.2.3.3  Time Extension ......................................................................... 76
9.2.7.2.3.4  Timer Extension ........................................................................ 77
9.2.7.2.3.5  Timer Period .............................................................................. 78
9.2.7.2.4  CPU Datakey ............................................................................... 79
9.2.7.2.5  Flow Control Modes .................................................................... 79
9.2.7.2.5.1  Serial Device Driver .................................................................. 80
9.2.7.2.5.2  Supported Setstat ...................................................................... 81
9.2.7.2.5.3  Supported Getstat ...................................................................... 82
9.2.7.2.6  Device Drivers Compliant ............................................................. 83
9.2.7.2.7  Manufacturer Support .................................................................. 83
9.2.7.2.7.1  Leap Year and Daylight Savings Time ........................................ 83
9.2.7.2.7.2  Setting Hardware Clock ............................................................. 83
9.2.7.2.7.3  Setting OS-9 System Clock ......................................................... 83
9.2.7.2.8  Flash Ram Drive .......................................................................... 83
9.2.7.3  OS-9 Application Kernel ................................................................... 84
9.2.7.3.1  Boot Sysreset ............................................................................... 84
9.2.7.3.2  Hardware Initialization ................................................................. 84
9.2.7.3.3  Startup Procedure ....................................................................... 84
9.2.7.3.4  Short Out ...................................................................................... 85
9.2.7.3.5  Long Out ....................................................................................... 86
9.2.7.4  Error Handler ................................................................................... 86
9.2.7.4.1  Initialization and Power-Up Test ................................................... 86
9.2.7.5  Network Requirements ................................................................... 86
9.2.7.5.1  BOOTOBJS .................................................................................. 86
9.2.7.5.2  CMDS ........................................................................................... 86
9.2.7.5.3  Multi-user functionality ............................................................... 87
10.11.1 Model 2070-WE Wireless Ethernet Communications Module

10.5.1 Model 2070-6W Wireless Modem
CHAPTER 11-SECTION 5 .................................................................................. 144
2070N1 DETAILS ......................................................................................... 144
11.5.1 Front View .................................................................................. 144
11.5.2 Side View .................................................................................. 144
11.5.3 ISO View .................................................................................. 144
11.5.4 2070-8 Field I/O Module, Connector A & B ................................. 144
11.5.5 2070-8 Field I/O Module, Connector C & D ................................. 144
11.5.6 2070-8 Field I/O Module, EX1 & EX2 Connectors ...................... 144
11.5.7 2070-2N Field I/O Module ........................................................... 144
CHAPTER 12 .......................................................................................... 145
REFER TO GREEN TECHNOLOGY BATTERY BACKUP SYSTEM .......................... 145
SPECIFICATIONS .................................................................................. 145
CHAPTER 13 .......................................................................................... 146
REFER TO MODEL 700 CHANGEABLE MESSAGE ........................................ 146
SPECIFICATIONS .................................................................................. 146
APPENDIX A ......................................................................................... 147
CHAPTER DETAILS ................................................................................ 147
APENDIX A3 .......................................................................................... 148
CHAPTER 3 DETAILS ................................................................................ 148
Model 200 Switch Pack, 204 & 205 CONNECTOR DETAILS .......................... 149
Model 208 T170 Monitor Units ................................................................. 149
Model 210 T170 Monitor Unit ................................................................. 149
Model 210 T170 Monitor Unit ................................................................. 149
Programming Card Connector & Wiring Assignments ............................. 149
C2 Modem Harness .............................................................................. 149
Model 206L Power Supply ..................................................................... 149
C11 Harness .......................................................................................... 149
C2 Serial Harness ................................................................................. 149
C1 Harness .......................................................................................... 149
Model 206LS Power Supply ................................................................... 149
Model 280 Input File Ethernet Switch Unit ............................................ 149
C16 Railroad Harness ........................................................................... 149
Model 206E Power Supply ..................................................................... 149
APPENDIX A4, B4 & C4 ......................................................................... 160
CHAPTER 4 DETAILS ................................................................................ 160
APPENDIX A4 ........................................................................................ 161
BBS INVERTER/CHARGER DETAILS .......................................................... 161
TEES 2009 Errata No. 3 15
Cabinet Housing # 3 Details - sheet 3 of 7 .......................................................... 179
Cabinet Housing # 3 Details - sheet 4 of 7 .......................................................... 179
Model 342LX Side Panel Details ........................................................................... 179
Model 344LX Side Panel Details ........................................................................... 179
Cabinet Equipment Mounting Details 2 of 3 ........................................................ 179
Service PDA Details sheet 1 of 2 .......................................................................... 180
Service PDA Details sheet 2 of 2 .......................................................................... 180
Rack #2 Equipment Shelf Installation Details ...................................................... 180
Cabinet Door Handle Details sheet 1 of 1 .............................................................. 180
Input/Output File LX Details sheet 1 of 12 ............................................................ 180
Input/Output File #1LX Details sheet 2 of 12 ....................................................... 180
Input/Output File #1LX Details sheet 3 of 12 ....................................................... 180
Input/Output File #2LX Details sheet 4 of 12 ....................................................... 180
Input/Output File #2LX Details sheet 5 of 12 ....................................................... 180
Input/Output File #2LX Details sheet 6 of 12 ....................................................... 180
Input/Output File Details sheet 7 of 12 ................................................................. 180
Input/Output File Details sheet 8 of 12 ................................................................. 180
Input/Output File Details sheet 9 of 12 ................................................................. 180
Input/Output File HSR Details sheet 10 of 12 ...................................................... 180
Input/Output File Details sheet 11 of 12 ............................................................... 180
Input/Output File Details sheet 12 of 12 ............................................................... 180
Cabinet Housing #4 Details sheet 5 of 7 .............................................................. 180
Cabinet Housing #4 Details sheet 6 of 7 .............................................................. 180
Cabinet Housing #4 Details sheet 7 of 7 .............................................................. 180
Model 346LX Side Panel Details ......................................................................... 180
Cabinet Equipment Mounting Details sheet 3 of 3 .............................................. 180
Fan Cover and LED Lighting Housing 3, 4 .......................................................... 180
Circuit Breaker Switch Guard Details .................................................................. 180
APPENDIX A9 ........................................................................................................ 242
CHAPTER 9 DETAILS .......................................................................................... 242
  Model 2070 – 2, Field I/O Module ...................................................................... 243
  Model 2070 – 4 Power Supply Module ............................................................... 243
  Model 2070 – Serial Port Descriptors Defaults ................................................... 243
APPENDIX A10 ...................................................................................................... 247
CHAPTER 10 DETAILS ........................................................................................ 247
  Model 2070-6W Wireless Modem Communications Module ............................. 248
  Model 2070-WE Wireless Ethernet Communication Module ............................ 248
  Model 2070-J Network Jack Module ................................................................ 248
APPENDIX A11 ...................................................................................................... 252
CHAPTER 11 DETAILS ....................................................................................... 252
  2070 (E or LX) N1 Controller Unit - Front View ................................................. 253
  2070 (E or LX) N1 Controller Unit - Side View .................................................. 253
  2070 (E or LX) N1 Controller Unit - ISO View ................................................... 253
  2070-8 Field I/O Module, Connector A & B ....................................................... 253
  2070-8 Field I/O Module, Connector C & D ....................................................... 253
  2070-8 Field I/O Module, EX1 & EX2 Connectors .............................................. 253
  2070-2N Field I/O Module ................................................................................. 253
CHAPTER 3
AUXILIARY CABINET SPECIFICATIONS
CHAPTER 3-SECTION 1
GENERAL REQUIREMENTS

3.1.1 Models 200 and 204 General

3.1.1.1 Unit Chassis
The unit chassis shall be made of metal suitable to meet rigid support and
environmental requirements. Where electrical isolation is the only requirement, plastic
insulation material can be used in lieu of metal.

3.1.1.2 Unit Control Circuitry and Switches
The unit control circuitry and switches shall be readily accessible by the use of a
screwdriver or wrench. Only one type of screw head end (Slotted or Phillips) shall be
used.

3.1.1.3 Unit Handle
The unit shall be so constructed that no live voltage is exposed. A handle shall be
attached to the front panel for insertion or removal from the unit mating connector.

3.1.1.4 Unit Lower Surface
The unit shall be so constructed that its lower surface shall be no more than 2.06 in
below the centerline of the connector and no part shall extend more than 0.9 in to the
left or 1.1 in to the right of the connector centerline.

3.1.1.5 Edge Guides
Continuous edge guides shall be provided on the unit.

3.1.1.6 Switching
Each switch shall be capable of switching any Current from 0.050 to 10.0 Amperes
(AC) load with power factor of 0.85 or higher.

3.1.1.7 Operations
Each switch shall be designed for a minimum of 300 Million operations while
switching a tungsten load of 1000 Watts at 158°F. Switch isolation between DC input
and AC output circuit shall be at least 10,000 Mega Ohms at 2000 VDC.

3.1.1.8 Positions
Each switch shall turn ON within ± 5 degrees of the zero voltage point of the AC
sinusoidal line, and shall turn OFF within ± 5 degrees of the zero-current point of the
alternating current sinusoidal line. After power restoration, the zero voltage turn ON
may be within ± 10 degrees of the zero voltage point only during the first half cycle of
line voltage during which an input signal is applied. Turn ON and OFF shall be
within 8.33 ms following application or removal of the logic signal, respectively.
CHAPTER 3-SECTION 2
MODEL 200 SWITCH PACK UNIT

3.2.1 Switches
The Model 200 Switch Pack Unit shall be a modular plug-in device containing three solid-state switches. Each switch shall open or close a connection between applied power and external load.

3.2.2 Grounds
A Ground True Controller Unit Input (0 to 6 VDC) shall cause the switch to energize and a Ground False (16 VDC or more) shall cause it to de-energize, State transition shall occur between 6 and 16 VDC. The input shall not sink more than 20 ma or be subjected to more than 30 VDC. The input shall have reverse polarity protection.

3.2.3 Maximum Currents
With all switches on, the unit shall not draw more than 60 mA at +16 VDC or more from the +24 VDC cabinet supply.

3.2.4 Rating
Each switch shall have an OFF state dv/dt rating of 100 V/µs or better. Each switch shall be isolated so that line transients or switch failure shall not alter the controller unit.

3.2.5 Unit Front Panel
The unit front panel shall have an indicator on the input to each switch. The indicator shall be labeled or color-coded “Red”-top switch, “Yellow”-middle switch, and “Green”-bottom switch. The middle switch indicator shall be vertically centered on the unit front panel with the other indicators positioned 1 inches above and below.

3.2.6 Resistance
The resistance between the AC+ input terminal and the AC+ output terminal of each switch shall be a minimum of 15K Ohms when the switch is in open state. When the switch is in off state the output current through the load shall not exceed 10 mA peak.
CHAPTER 3-SECTION 3
MODELS 204 - FLASHER UNIT AND
205 – TRANSFER RELAY UNIT

3.3.1 Model 204 Flasher Unit

3.3.1.1 Flasher Unit
The Flasher Unit shall be a modular plug-in device containing a flasher control circuit and two solid-state switches. The unit's function is to alternatively open and close connections between applied power and external load.

3.3.1.2 Internal DC Power
The unit shall generate its own internal DC power from the AC Line.

3.3.1.3 Flashing
The unit shall commence flashing operation when AC power is applied providing 50 to 60 flashes per minute per switch with a 50 % duty cycle.

3.3.1.4 Rating
Each switch shall have an OFF state dv /dt rating of 200 V/µs or better.

3.3.1.5 Indicator
An indicator showing the switch's output state shall be provided. The two indicators shall be centered with 1 in minimum spacing.

3.3.1.6 Operation
Each circuit shall be designed to operate in an open-circuit condition without load for 10 years minimum.

3.3.1.7 Arrestor
A surge arrestor shall be provided between AC (pin 11) and Flasher Output (pins 7 & 8). The arrestor shall meet the following requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Varistor Voltage</td>
<td>212 Volts</td>
</tr>
<tr>
<td>Average Power Dissipation</td>
<td>0.85 Watts</td>
</tr>
<tr>
<td>Peak I for pulses less than 6 us</td>
<td>3kA</td>
</tr>
<tr>
<td>Standby I</td>
<td>less than 1 mA</td>
</tr>
</tbody>
</table>

3.3.2 Model 205 Transfer Relay Unit

3.3.2.1 Type
The Transfer Relay Unit shall be of electromechanical type, designed for continuous duty:

3.3.2.2 Cover
Each unit 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 durable, permanent and readily visible.

3.3.2.3 Contacts
Each unit shall be provided with DPDT contacts. The contact points shall be of fine silver, silver alloy or a superior alternate material. Contact points and arms shall be capable of switching 20 Amperes or 1 Kilowatt Tungsten Load at 120 VAC per contact at least 100,000 operations without contact welding or excessive burning, pitting or cavitation. The points and arms shall be able to withstand 0.1 DA or 10 Gs, 10 –55 Hz without contact chatter.

3.3.2.4 Relay Coil
The relay coil shall have a power consumption of 2.0 Volt - Ampere maximum.

3.3.2.5 Relay Potential and 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 one cycle surge rating of 175 Amperes RMS and pickup and drop out within 20 ms.
CHAPTER 3-SECTION 4
MODEL 206L POWER SUPPLY UNIT

3.4.1 Unit Chassis
The unit chassis shall be vented. The power supply cage and transformers shall be securely braced to prevent damage in transit. When resident in the PDA, the units shall be held firmly in place by its stud screws and wing nut.

3.4.2 Unit Design
The unit shall provide +24 VDC to the cabinet files. The unit shall be a Switch-Mode design. It shall conform to the following requirements:

3.4.2.1 Input Protection
Two 0.5 Ohm, 10-watt wire-wound power resistors with a 0.2 μh inductance shall be provided (one on the AC+ Line & on the AC- Line). Three UL 1449 Varistors (MOVs), with a Nominal Discharge Current Rating (In) of 3kA shall be provided between AC+ to AC, AC+ to EG, and AC- to EG. A 0.68 μf. capacitor shall be placed between AC+ & AC- (between the resistors & arrestors).

3.4.2.2 Output Protection
The output shall be fused for over-current protection. The output shall also be protected against voltage transients by a suppressor with minimum rating of 1400 Watts.

3.4.2.3 Input and Output fuses
Input/Output fuse protection shall comply with IEC-60127.

3.4.2.4 Line and Load Regulation
Line and Load Regulation- shall not exceed +23 to + 25 VDC (4.2%) with a design voltage of +24 VDC at full load. This includes ripple noise; from 90 to 135 VAC at 60 Hz, plus an additional 1.6% for each additional 1.0% frequency change; and current range from 1 to 5 Amperes with a maximum temperature rise of 86 °F above ambient.

3.4.2.5 Design Voltage
Design Voltage +24 ± 0.5 VDC at full load, 86 °F, 115 VAC incoming voltage.

3.4.2.6 Full Load Current
Full Load Current 5 Amperes each for +24 VDC, minimum.

3.4.2.7 Ripple Noise
Ripple Noise - 2 volts peak-to-peak and 500 mV RMS at full load.

3.4.2.8 Efficiency
Efficiency (at full load) - 80% minimum.

3.4.2.9 Power Factor Correction
The Model 206L Power Supply shall include power factor correction circuitry resulting in a minimum full load power factor of 0.96.

3.4.2.10 **Circuit Capacitors**
Circuit capacitors shall be rated for 40 volts minimum.

3.4.3 **Front Panel and Terminals**
The front panel shall include AC and DC fuses, power ON light and test points for monitoring the output voltages. The unit including terminals shall be protected to prevent accidental contact with energized parts.

3.4.3.1 **LED Indicators**
LED indicators shall be provided on the Front Panel indicating AC Line input status and fuse integrity. The indicators shall also display output status and fuse integrity of the 24VDC output.
CHAPTER 3-SECTION 5
MODEL 208 MONITOR UNIT

3.5.1 Monitoring
The Model 208 Monitor Unit shall reliably sense and cause a relay output contact (Failed State) when monitoring the following:

1. A Watchdog Timer (WDT) Timeout Condition
2. Cabinet +24 VDC Power Supply below specified threshold

3.5.2 WDT Monitor Requirements

3.5.2.1 WDT Circuitry
WDT Circuitry shall be provided to monitor a controller unit output line state routed to the monitor unit at its assigned pin. The WDT Circuitry shall sense any line state change and the time between the last change. No state change for $1.5 \pm 0.1$ seconds shall cause a Failed State. The timer shall reset at each state change in a Non Failed state.

3.5.2.2 Unit Reset / WDT
Only the Unit Reset or a WDT inactive due to the voltage sense shall reset the WDT from a failed state.

3.5.2.3 Failed State
A Failed state caused by the WDT shall illuminate a front panel indicator light labeled “WDT ERROR”. The indicator shall remain ON until Unit Reset Issuance.

3.5.2.4 WDT Circuitry
The WDT Circuitry shall sense the incoming VAC Line and when the voltage falls below $98 \pm 2$ VAC for $50 \pm 17$ ms shall inhibit the WDT Function. When the WDT Circuitry senses the incoming VAC Line rise above $103 \pm 2$ VAC for $50 \pm 2$ ms the WDT shall become active. A hysteresis between the Voltage Inhibit and the Voltage Active Settings shall be a minimum of 3 Volts.

3.5.3 Power Supply Monitor Requirements

3.5.3.1 Monitor Unit
The monitor unit shall sense the Cabinet +24 VDC Power Supply Output Voltage. Voltages sensed at +18 VDC or below for a duration of 500 ms or longer shall cause a Failed state. Voltages sensed at +22 VDC or above shall NOT cause a failed state. Voltages sensed below +22 VDC for a duration of 200 ms or less shall NOT cause a Failed state. All timing and voltages conditions other than those specified above may or may not cause a failed state.

3.5.3.2 Indicator
A Failed state caused by sensing the power supply shall illuminate a front panel indicator light labeled “VDC FAILED”. The indicator shall remain ON until Unit Reset.

3.5.3.3 Unit Reset
Only Unit Reset shall reset the power supply sense circuitry from a Failed State.

3.5.4 Failed State Output Circuits
An electro-mechanical relay shall be provided to switch an output circuit during a Failed State. The relay coil shall be energized in a Non- Failed State. The relay
contacts shall be rated for a minimum of 3 Amperes at 120 VAC and 100,000 operations. Contact opening/closing time shall be 30 ms or less.

3.5.5 Monitor Unit Reset
A momentary SPST Control switch labeled “RESET” shall be provided on the unit front panel to reset the monitor unit circuitry to a Non-Failed state. The switch shall be so positioned on the front panel that the switch can be operated while gripping the front panel handle.

3.5.6 Provision
The unit shall be provided with provision to drive an external NE2H light through a 56 K Ohm, 1/2-Watt series resistor (resident on unit).

3.5.7 PDA #3 WDT Reset Input
The PDA #3 WDT Reset Input shall not be sensed by the unit.

3.5.8 Output Relay
The output relay Contact for Failed State shall be Open.
CHAPTER 3-SECTION 6
MODEL 210 MONITOR UNIT

3.6.1 Monitor Unit Conditions
The Monitor Unit shall sense the following conditions and cause a FAILED STATE should any of the conditions exist:
1. The cabinet +24 VDC power supply below the voltage threshold.
2. The WDT Timeout Condition.
3. Conflicting field Output Circuit ON Condition.

3.6.2 Requirements
See Chapter 3, Section 5 Model 208 Monitor Unit for requirements on Power Supply Monitoring, Watchdog Timer, Failed State Output Circuits and Monitor Unit Reset.

3.6.3 Conflict Monitoring
The monitor shall sense up to 16 Channels for conflict (32 field outputs of Green and Yellow). The Green and Yellow are Logically OR’d together. The associated cabinet output file assignment or operator selected output switches shall determine channel assignment.

3.6.3.1 Monitored Field Output Voltages
All monitored field output voltages shall be measured as true RMS responsive (up to 3 KHz) to both positive and negative alternations of the sine wave and the full cycle. The calculated value shall be averaged over a minimum of 2 cycles. If digital means are used in calculating RMS, a minimum of 2 samples shall be taken per alternation.

3.6.3.2 Sensed Conflicting Field Output Voltages
Sensed conflicting field output voltages 25 VAC or greater for a duration of 500 ms or longer shall cause a Failed state. Sensed conflicting field output voltages between 15 VAC or less OR any voltage having a duration of 200 ms or less shall NOT cause a Failed state(s).

3.6.3.3 Conflict Monitoring Circuitry
The Conflict Monitoring Circuitry shall be capable of detecting both a positive and negative half-wave failure under the foregoing conditions.

3.6.3.4 Failed State
A Failed state caused by sensing voltage conflicts shall be reset only by the Unit Reset.

3.6.3.5 Indicators
Sixteen indicators shall be provided on the unit front panel to indicate if the channel output is sensed ON. The indicators shall remain ON in a latched state during a Failed state unless unlatched by Unit Reset or a unit loss of power during said Failed state.

3.6.4 Conflict Programming Card

3.6.4.1 PCB Programming Card
A plug-in PCB Programming Card shall be provided in the monitor unit. The card shall plug into the unit through a slot in the unit front panel. The card shall contain 120 diodes (#1N4148 or equal). Each diode shall match 1 through 16 channels of possible conflict. The programming card shall be logically labeled and laid out for easy identification of the diodes by channel. With diodes in place all output channels being
monitored shall be in conflict. When the diode (anode to numerical pins and cathode to alphabetical pins) has been removed the channels shall be defined as non-conflict.

3.6.4.2 Pad / Placement
A pad for 16 yellow inhibit jumpers shall be provided. Placement of the associated channel jumpers shall be provided. Placement of the associated channel jumper between the channel yellow pin the yellow inhibit common shall disable sensing the said channel yellow.

3.6.4.3 Connection
The programming card shall intermate with a PCB 28/56S Connector. The card shall be provided with card ejectors. The monitor unit shall provide a mechanically sound card and connector support including continuous card guides. When the programming card is resident in the unit, the card’s front end shall be flushed with the unit’s front panel.

3.6.4.4 Pins 16 and T
Pins 16 and T shall be connected together on the programming card. Removal of the card shall be sensed as a conflicting FAILED state.

3.6.5 Conflicting
A front panel indicator labeled “CONFLICT” shall be provided. The indicator shall illuminate when there is a FAILED state caused by conflicting channels and go off only by Unit Reset Issuance.

3.6.6 Output Relay Contact
The output relay contact for FAILED State shall be “CLOSED”.

3.6.7 Second Output Circuit
A second output circuit (STOPTIME controller input) shall be provided to sink a NPN Open Collector Transistor upon FAILED state. The transistor shall be rated to sink a minimum of 50 mA at up to 30 VDC. A blocking diode shall be provided on the transistor output to prevent it from souring power into the controller unit.

3.6.8 LOGIC Toggle Switch
An internal SPST LOGIC toggle switch shall be provided on the Model 210 Monitor Unit to activate the WDT function. When the switch is ON the WDT Circuitry shall be active. The switch shall be mounted on the module PCB in a readily accessible location.

3.6.9 RESET Switch
The Front Panel RESET Switch shall be tied to the External Test Reset Input Line (Pin Z). The External Line shall be optically isolated from internal circuitry.
CHAPTER 3-SECTION 7
COMMUNICATIONS AND CABINET HARNESS

3.7.1 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 170 Controller Unit mounted in the cabinet.

3.7.2 C1 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 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

3.7.3 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.

3.7.4 C1 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 3-SECTION 8
MODEL 280 INPUT FILE ETHERNET SWITCH UNIT

3.8.1 Model 280 Network Switch Unit

The Model 280 Unit shall provide 8 Ethernet Network Communications ports and two fiber optics communication ports. The Fiber Optics Communications shall meet the requirements of Chapter 10 Section 4 for the Model 2070-FX Network Communications Module.

3.8.2 Mechanical/Electrical Requirements.

The Model 280 Unit card edge connector shall be fully compatible with the Caltrans Cabinet Input File.

The Model 280 Unit shall be powered direct from the 206L, 206LS or 206E Power Supply.

3.8.3 Network Standards

The Model 280 Unit shall meet the IEEE802.3 10Base-T, IEEE 802.3u, and IEEE 802.3x.

3.8.4 Modes of Operation

The Model 280 Unit shall have auto-negotiation for 10/100 Mbps Connection speed and Half/Full-Duplex modes on all RJ-45 ports.

The Model 280 Unit shall be provided with Auto-MDIX for all RJ-45 ports.

3.8.5 Network Media Support

The Model 280 Unit shall be configured as a Multiple Channel Media Converter, three RJ-45 Front Panel Connectors.

The Model 280 Unit shall support the following Media:

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

The Model 280 Unit shall be provided with RJ-45 Connectors containing Link/Activity and 10/100 Speed LED indicators.

3.8.7 Form Factor

See A3-11 for Details

3.8.8 Power Requirements

The power requirements of the 280 Unit shall be within the power limitations of the Model 206 Power Supply as describe in Section 3.4 of these specifications.

3.8.9 Environmental

The Model 208 Unit shall operate within the specifications listed in Chapter 1 Section 1.8.4.
CHAPTER 3-SECTION 9
MODEL 206E POWER SUPPLY UNIT

3.9.3.1. **Unit Chassis**
The unit chassis shall be vented. The power supply cage and transformers shall be securely braced to prevent damage in transit. When resident in the PDA, the units shall be held firmly in place by its stud screws and wing nut.

3.9.3.2. **Unit Design**
The unit shall provide +24 VDC to the cabinet files. The unit shall be a Switch-Mode design. It shall conform to the following requirements:

3.9.3.3. **Input Protection**
Two 0.5 Ohm, 10-watt wire-wound power resistors with a 0.2 µh inductance shall be provided (one on the AC+ Line & on the AC- Line). Three UL 1449 Varistors (MOVs), with a Nominal Discharge Current Rating (In) of 3kA shall be provided between AC+ to AC, AC+ to EG, and AC- to EG. A 0.68 µf. capacitor shall be placed between AC+ & AC- (between the resistors & arrestors).

3.9.3.4. **Output Protection**
The output shall be fused for over-current protection. The output shall also be protected against voltage transients by a suppressor with minimum rating of 1400 Watts.

3.9.3.5. **Input and Output fuses**
Input/Output fuse protection shall comply with IEC-60127.

3.9.3.6. **Line and Load Regulation**
Line and Load Regulation- shall not exceed +23 to + 25 VDC (4.2%) with a design voltage of +24 VDC at full load. This includes ripple noise; from 90 to 135 VAC at 60 Hz, plus an additional 1.6% for each additional 1.0% frequency change; and current range from 1 to 5 Amperes with a maximum temperature rise of 86 °F above ambient.

3.9.3.7. **Design Voltage**
Design Voltage +24 ± 0.5 VDC at full load, 86 °F, 115 VAC incoming voltage.

3.9.3.8. **Full Load Current**
Full Load Current 10 Amperes each for +24 VDC, minimum.

3.9.3.9. **Ripple Noise**
Ripple Noise - 2 volts peak-to-peak and 500 mV RMS at full load.

3.9.3.10. **Efficiency**
Efficiency (at full load) - 80% minimum.

3.9.3.11. **Power Factor Correction**
The Model 206E Power Supply shall include power factor correction circuitry resulting in a minimum full load power factor of 0.96.

3.9.3.12. Circuit Capacitors
Circuit capacitors shall be rated for 40 volts minimum.

3.9.3.13. Front Panel and Terminals
The front panel shall include AC and DC fuses, power ON light and test points for monitoring the output voltages. The unit including terminals shall be protected to prevent accidental contact with energized parts.

3.9.3.14. LED Indicators
LED indicators shall be provided on the Front Panel indicating AC Line input status and fuse integrity. The indicators shall also display output status and fuse integrity of the 24VDC output.
# CHAPTER 3-SECTION 10

## AUXILIARY EQUIPMENT & HARNESS DETAILS

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.10.1</td>
<td>Model 200 Switch Pack &amp; Model 204 &amp; 205 Connector Details</td>
<td>A3-1</td>
</tr>
<tr>
<td>3.10.2</td>
<td>Model 208 Monitor Units</td>
<td>A3-2</td>
</tr>
<tr>
<td>3.10.3</td>
<td>Model 210 T170 Monitor Unit</td>
<td>A3-3</td>
</tr>
<tr>
<td>3.10.4</td>
<td>Model 210 T170 Monitor Unit &amp; Programming Card &amp; Connector Wiring Assignments</td>
<td>A3-4</td>
</tr>
<tr>
<td>3.10.5</td>
<td>C2 Modem Harness</td>
<td>A3-5</td>
</tr>
<tr>
<td>3.10.6</td>
<td>Model 206L Power Supply</td>
<td>A3-6</td>
</tr>
<tr>
<td>3.10.7</td>
<td>C11 Harness</td>
<td>A3-7</td>
</tr>
<tr>
<td>3.10.8</td>
<td>C2 Serial Harness</td>
<td>A3-8</td>
</tr>
<tr>
<td>3.10.9</td>
<td>C1 Harness</td>
<td>A3-9</td>
</tr>
<tr>
<td>3.10.10</td>
<td>Model 206LS Power Supply</td>
<td>A3-10</td>
</tr>
<tr>
<td>3.10.11</td>
<td>Model 280 Input File Ethernet Switch Unit</td>
<td>A3-11</td>
</tr>
<tr>
<td>3.10.12</td>
<td>C16 Railroad Harness</td>
<td>A3-12</td>
</tr>
<tr>
<td>3.10.13</td>
<td>Model 206E Power Supply</td>
<td>A3-13</td>
</tr>
</tbody>
</table>
CHAPTER 4-SECTION 12
LX BBS CABINET

4.12.1 LX BBS Cabinet
The LX BBS (LX-BBS) Cabinet shall be used for housing batteries and/or BBS, which includes inverter/charger unit, power transfer relay, manually operated bypass switch, any other control panels, and all wiring and harnesses.

4.12.2 LX-BBS Materials
The LX-BBS Cabinet shall be a NEMA 3R rated cabinet that can be mounted to the side of the Model 342LX or 344LX Cabinet.

The LX-BBS Cabinet shall conform to TEES, March 12, 2009 Chapter 6, Section 2-Housings for the construction and finish of the cabinet, in the following specific areas:

- Material used and the thickness of material
- Powder coating, for both the housing shell and door
- Welds
- Door Frames and gasketing
- Door latch and locking mechanism
- Door hinges and catches – in addition, hinge may also be continuous stainless steel piano hinge
- Door louvered vents and filter assembly
- Thermostatically controlled fan

4.12.3 LX-BBS Cabinet Mounting Hardware
The LX-BBS Cabinet must include all bolts, washers, nuts, and cabinet-to-cabinet coupler fittings necessary for mounting it to the Model 342LX or 344LX Cabinet.

Fasteners for the LX-BBS Cabinet must include:

- (8) cabinet mounting bolts that are 18-8 stainless steel hex head, fully threaded, and 3/8” – 16 x 1”
- (2) washers per bolt designed for 3/8” bolt and are 18-8 stainless steel 1-inch OD round flat type
- (1) K-lock nut per bolt that are 18-8 stainless steel, Hex nut, assembled with free-spinning tooth washer, 3/8” – 16 screw size
4.12.3.1 **LX-BBS Cabinet to Model 342LX, 344LX Cabinet Coupling**

LX-BBS Cabinet to Model 342LX or 344LX Cabinet coupling must include a conduit for power connections between the 2 cabinets.

Couplings must include:

- 2-inch nylon-insulated steel chase nipple
- 2-inch sealing, steel locknut
- 2-inch nylon-insulated steel bushing

4.12.4 **LX-BBS Cabinet Shelves**

Four shelves shall be provided. There shall be a minimum of 304.8mm (12”) clearance between shelves. Each shelf shall be a minimum of 304.8mm (12”) x 584.2mm (23”), and capable of supporting a minimum of 57Kg (125 lbs.) Shelf edges shall be turned down on all four sides for support and to provide a flat top surface. Shelves shall be predrilled with EIA rail mounting holes.

4.12.4.1 **LX-BBS Cabinet Bottom Shelf**

The bottom shelf shall be removable.

4.12.5 **EIA Angle Rails**

Two EIA angle rails, along with all necessary mounting hardware (4 sets of 10-32 stainless steel bolts and nuts with captive washers), shall be provided with the LX-BBS Cabinet, and shall be preinstalled in the top shelf position.

4.12.5.1 **Rail Symmetry**

EIA angle rails shall be symmetric to allow for installation on either right or left sides of the cabinet. Shelf mounting holes and bracket shall allow EIA rail installation at any other shelf position.

4.12.5.2 **Rail Thickness**

The EIA angle rail nominal thickness shall be either 3.4163mm (0.1345”) plated steel or 2.667mm (0.105”) stainless steel.

4.12.5.3 **Rail Mounting Bracket**

The EIA rail Mounting Bracket shall be of continuous, one-piece design bolted into the cabinet to provide adequate support for rail-mounted equipment.

4.12.5.4 **Screw Posts**

Pressed-in, flush-head threaded screw posts shall be inserted into the front face of the cabinet enclosure top sill. These threaded posts shall be used to mount both the fan panel and the EIA rail mounting bracket. The screw posts shall be 10-32 thread size PEM Studs.

4.12.6 **AC-Operated Fan**
Fan must be AC-operated from the same line output as the Model 342LX or 344LX Cabinet. A 2-position terminal block must be provided on the fan panel, along with 10 feet of connected hookup wire.
4.13.1 LX-BBS Cabinet
5.7.1 General
The sensor unit must comply with section 5.2 requirements for Model 222 and 224 detectors and the enhancements described in this specification. The unit must be a scanning detector with 2 or 4 channels. Each unit must have the capability to detect any type of vehicle reliably, including bicycles.

5.7.2 Temperature Compensation
Temperature changes as described in 5.2.15 must be compensated for by the unit circuitry rather than by creating a housing for the circuit. Unit must also include LCD heater.

5.7.3 Network
Each unit must have an RJ45 Ethernet port compliant with EIA 568B standard for communication.

The unit must be provided with a Web-Based-Interface (WBI) allowing the user to observe data output and configure any channel through a Web browser.

The unit shall have a default IP address of 192.168.222.51, subnet mask 255.255.255.0, with username “admin” and password “user”.

5.7.4 Display
As a minimum, the WBI shall display:
1. Settings for each channel as described in “Configuration and Output”: operating mode, sensitivity level, frequency, network parameters, firmware version
2. Real-time traffic data: inductance change or percent inductance change, vehicle count, speed, and occupancy of vehicles traveling over the loop (single or dual loops)

5.7.5 Configuration and Output
As a minimum, the user must be able to use the Web browser for the following:
1. Change operating modes (presence or pulse)
2. Change sensitivity level
3. Configure network parameters
4. Program new images to device
5. Upgrade firmware
6. Reset the device
7. Output session data to .txt file

5.7.6 Lead-in Cable
The unit shall be able to detect vehicles with a 2500-foot lead-in cable.
5.7.7 Selectable Sensitivity Settings
There shall be a minimum of 15 selectable sensitivity settings including specified sensitivity settings.

<table>
<thead>
<tr>
<th>SETTING</th>
<th>SENSITIVITY</th>
<th>SETTING</th>
<th>SENSITIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.64%</td>
<td>9</td>
<td>0.08%</td>
</tr>
<tr>
<td>2</td>
<td>0.56%</td>
<td>10</td>
<td>0.06%</td>
</tr>
<tr>
<td>3</td>
<td>0.48%</td>
<td>11</td>
<td>0.04%</td>
</tr>
<tr>
<td>4</td>
<td>0.40%</td>
<td>12</td>
<td>0.02%</td>
</tr>
<tr>
<td>5</td>
<td>0.32%</td>
<td>13</td>
<td>0.01%</td>
</tr>
<tr>
<td>6</td>
<td>0.24%</td>
<td>14</td>
<td>0.005%</td>
</tr>
<tr>
<td>7</td>
<td>0.16%</td>
<td>15</td>
<td>0.0025%</td>
</tr>
<tr>
<td>8</td>
<td>0.12%</td>
<td>Off</td>
<td>Channel Off</td>
</tr>
</tbody>
</table>

5.7.8 Bicycle Detection
Each unit must be able to detect bicycles reliably using the standard Type D loops. The reference bicycle defined by the California MUTCD has a minimum 16-inch wheel size with aluminum rims and stainless steel spokes. The frame, fork, and cranks are non-ferromagnetic.

5.7.9 Vehicle Classification
The sensor unit shall have vehicle classification capability as described by the Federal Highway Administration (FHWA) Traffic Monitoring Guide (TMG). The vehicle classification data must include the following information: location ID, direction of travel code, lane of travel/channel, date (month, day, year), time, total internal volume/occupancy, restrictions, and vehicle class.

The traditional classified by the FHWA are described in Appendix C of the TMG; the classes are:
- Class 1: Motorcycles
- Class 2: Passenger Cars
- Class 3: Two-Axle, Four-Tire Single Unit
- Class 4: Buses
- Class 5: Two-Axle, Six-Tire Single Unit
- Class 6: Three-Axle, Single Unit
- Class 7: Four or More Axle, Single Unit
- Class 8: Four or Less Axle, Single Trailer
- Class 9: Five-Axle Tractor Semitrailer
- Class 10: Six or More Axle, Single Trailer
- Class 11: Five or Less Axle, Multi Trailer
- Class 12: Six-Axle, Multi Trailer
- Class 13: Seven or More Axle, Multi Trailer
In addition to FHWA’s axle-based classifications the Model 222i shall include the following length-based classifications:

<table>
<thead>
<tr>
<th>Length-based Vehicles</th>
<th>Length (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorcycles</td>
<td>&lt; 7</td>
</tr>
<tr>
<td>Small</td>
<td>7 - 22</td>
</tr>
<tr>
<td>Medium</td>
<td>22 - 49</td>
</tr>
<tr>
<td>Large</td>
<td>49 - 85</td>
</tr>
<tr>
<td>Very Large</td>
<td>85 +</td>
</tr>
</tbody>
</table>

The unit must be able to classify a minimum of 5 length-based vehicle types, plus bicycles.

5.7.10 **Warranty**

Each unit shall have a manufacturer’s warranty of at least 4 years covering defects and impairment of operation discovered during normal, expected use of the device. Under the warranty, the manufacturer shall repair or replace the unit within 60 days of receiving the unit.
CHAPTER 6
CABINET SPECIFICATIONS
MODELS 332LS, 334LS, 336LS, 342LX, 344LS & 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.

<table>
<thead>
<tr>
<th>Cabinet Model</th>
<th>PDA</th>
<th>6.2.2.3</th>
<th>Output Files</th>
<th>Power Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>332LS</td>
<td>2LX</td>
<td>1LX</td>
<td>2LX(Model 520)</td>
<td>206L</td>
</tr>
<tr>
<td>334LS</td>
<td>3LX</td>
<td></td>
<td></td>
<td>206L</td>
</tr>
<tr>
<td>336LS</td>
<td>2LS</td>
<td>1LX</td>
<td></td>
<td>206L</td>
</tr>
<tr>
<td>342LX</td>
<td>2LX</td>
<td>1LX</td>
<td>2LX(Model 520)</td>
<td>206E</td>
</tr>
<tr>
<td>344LX</td>
<td>3LX</td>
<td></td>
<td></td>
<td>206E</td>
</tr>
<tr>
<td>346LX</td>
<td>2LS</td>
<td>1LX</td>
<td></td>
<td>206LS</td>
</tr>
</tbody>
</table>

6.1.2 Model 332LS Cabinet
Model 332LS Cabinet shall consist of:
- Housing 1 B
- Mounting Cage 1
- PDA #2LX
- Input Files I & J
- C11 Harness
- Service Panel #1
- C16 Harness
- Output File #2LX (Model 520)

6.1.1.1 Model 334LS Cabinet
Model 334LS Cabinet shall consist of:
- Housing 1 B
- Mounting Cage 1
- PDA #3LX
- Input File I
- Input Panel #3
- C1 Harness #2
- Service Panel #1

6.1.1.2 Model 336LS Cabinet
MODEL 336LS CABINET shall consist of:
- Housing 2
- Mounting Cage 2
- PDA #2LS
- Input File I
- Output File #1LX
- C1 Harness #3
- Service Panel #2
- Input Panel #4

6.1.1.3 Model 342LX Cabinet
Model 342LX Cabinet shall consist of Housing 3 and two ITS Mounting Cages.
First Mounting Cage shall consist of:

- PDA #2LX
- Input Files I & J
- Output File #1LX
- C11 Harness
- Output File #2LX (Model 520)
- C1 Harness #1
- Service Panel #1
- Input Panel #1
- C16 Harness

Second Mounting Cage shall consist of:

- (2) Blank Side Panels
- Service / PDA Assembly
- (2) Shelves

6.1.4 Model 344LS Cabinet
Model 344LS Cabinet shall consist of Housing 3 and two ITS Mounting Cages. First Mounting Cage shall consist of:

- Input File I
- 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:

- PDA #2LS
- Input Files I
- Output File #1LX
- 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 plyboard 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

6.2.2.35 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.

6.2.2.36 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.

6.2.2.37 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 Tungsten 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.

6.2.2.38 Aluminum surfaces
Aluminum surfaces shall conform to the following:

6.2.2.4.1 Powder Coating
The 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.

6.2.2.39 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.

6.2.2.40 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).

6.2.2.41 Cage Bottom Support Mounting Angles
The Model 332LS, 334LS & 336LS
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.

6.2.2.42 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.

6.2.2.43 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 332LS, 334LS and 336LS
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 $0.25 \pm 0.03125$ 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 332LS, 334LS and 336LS 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 332LS, 334LX and 336LS 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, 344LS and 346LX housing shall be equipped with four 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 334LS and 344LS**
One switch shall be labeled "ON-OFF LIGHTS" and the other "POLICE CONTROL ON-OFF".

6.2.6.3.2 **Models 332LS, 336LS, 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 332LS, 334LX, and 336LS 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
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 #1LX

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 #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, Crydom A2450-B or equal.
2 -- Model 204 Flasher Unit and Socket
1 -- Model 206L/E 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, Crydom 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
1 -- K24 VDC Controlled Relay
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/E/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 UL 1449 Varistors (MOVs) with a Nominal Discharge Current Rating (In) of 3kA 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 Relay, Model 430. 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 #1LX**

**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 #2LX (Model 420)**
6.4.5.3.1 Switch Packs and Flash Transfer Relays
The Output File #2LX shall contain 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 #2LX (Model 520)

6.4.5.4.1 Switch Packs and Flash Transfer Relays
The Output File #2LX (Model 520) shall contain 5 Model 200 Switch Packs and 4 Transfer Relays. Four Flash Transfer Relays shall be provided with the file.

6.4.5.4.2 Output Circuits
Shall meet Section 6.4.5.3.2

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 switch 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
Harnesses shall meet the specifications as listed in Chapter 3 Section 7.
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.
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 AC.

6.6.4.3 Minimum Varistor 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
**332LS, 334LS, 336LS, 342LX, 344LX & 346LX CABINET DETAILS**

<table>
<thead>
<tr>
<th>Appendix</th>
<th>6.8.1</th>
<th>Cabinet Housing #1 &amp; #2 Details sheet 1 of 4</th>
<th>A6-1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.8.2</td>
<td>Cabinet Housing #1 &amp; #2 Details sheet 2 of 4</td>
<td>A6-2</td>
</tr>
<tr>
<td></td>
<td>6.8.3</td>
<td>Cabinet Housing Details sheet 3 of 4</td>
<td>A6-3</td>
</tr>
<tr>
<td></td>
<td>6.8.4</td>
<td>Cabinet Housing Details sheet 4 of 4</td>
<td>A6-4</td>
</tr>
<tr>
<td></td>
<td>6.8.5</td>
<td>Cabinet Equipment Mounting Details sheet 1 of 3</td>
<td>A6-5</td>
</tr>
<tr>
<td></td>
<td>6.8.6</td>
<td>Drawer Shelf Details</td>
<td>A6-6</td>
</tr>
<tr>
<td></td>
<td>6.8.7</td>
<td><strong>Traffic Signal Cabinets</strong> One Line Diagram</td>
<td>A6-7</td>
</tr>
<tr>
<td></td>
<td>6.8.8</td>
<td>PDA #2LX SSR Installation Details</td>
<td>A6-8</td>
</tr>
<tr>
<td></td>
<td>6.8.9</td>
<td><strong>Ramp Meter Cabinets</strong> One Line Diagram</td>
<td>A6-9</td>
</tr>
<tr>
<td></td>
<td>6.8.10</td>
<td>Service Panel Assembly (SPA) Details sheet 1 of 3</td>
<td>A6-10</td>
</tr>
<tr>
<td></td>
<td>6.8.11</td>
<td>Service Panel Assembly (SPA) Details sheet 2 of 3</td>
<td>A6-11</td>
</tr>
<tr>
<td></td>
<td>6.8.12</td>
<td>Service Panel Assembly (SPA) Details sheet 3 of 3</td>
<td>A6-12</td>
</tr>
<tr>
<td></td>
<td>6.8.13</td>
<td>PDA #2LX &amp; #3LX Details sheet 1 of 8</td>
<td>A6-13</td>
</tr>
<tr>
<td></td>
<td>6.8.14</td>
<td>PDA #2LX Details sheet 2 of 8</td>
<td>A6-14</td>
</tr>
<tr>
<td></td>
<td>6.8.15</td>
<td>PDA #3LX Details sheet 3 of 8</td>
<td>A6-15</td>
</tr>
<tr>
<td></td>
<td>6.8.16</td>
<td>PDA #2LX &amp; #3LX Details sheet 4 of 8</td>
<td>A6-16</td>
</tr>
<tr>
<td></td>
<td>6.8.17</td>
<td>PDA #2LX, #2LS &amp; #3LX Details sheet 5 of 8</td>
<td>A6-17</td>
</tr>
<tr>
<td></td>
<td>6.8.18</td>
<td>PDA #2LS Details sheet 6 of 8</td>
<td>A6-18</td>
</tr>
<tr>
<td></td>
<td>6.8.19</td>
<td>PDA #2LS SSR Installation Details sheet 7 of 8</td>
<td>A6-19</td>
</tr>
<tr>
<td></td>
<td>6.8.20</td>
<td>PDA #2LS Details sheet 8 of 8</td>
<td>A6-20</td>
</tr>
<tr>
<td></td>
<td>6.8.21</td>
<td>Side Panel Details sheet 1 of 4</td>
<td>A6-21</td>
</tr>
<tr>
<td></td>
<td>6.8.22</td>
<td>Side Panel Details sheet 2 of 4</td>
<td>A6-22</td>
</tr>
<tr>
<td></td>
<td>6.8.23</td>
<td>Side Panel Details sheet 3 of 4</td>
<td>A6-23</td>
</tr>
<tr>
<td></td>
<td>6.8.24</td>
<td>Side Panel Details sheet 4 of 4</td>
<td>A6-24</td>
</tr>
<tr>
<td></td>
<td>6.8.25</td>
<td>Harness Wiring Details sheet 1 of 5</td>
<td>A6-25</td>
</tr>
<tr>
<td></td>
<td>6.8.26</td>
<td>Harness Wiring Details sheet 2 of 5</td>
<td>A6-26</td>
</tr>
<tr>
<td></td>
<td>6.8.27</td>
<td>Harness Wiring Details sheet 3 of 5</td>
<td>A6-27</td>
</tr>
<tr>
<td></td>
<td>6.8.28</td>
<td>Harness Wiring Details sheet 4 of 5</td>
<td>A6-28</td>
</tr>
<tr>
<td></td>
<td>6.8.29</td>
<td>Harness Wiring Details sheet 5 of 5</td>
<td>A6-29</td>
</tr>
<tr>
<td></td>
<td>6.8.30</td>
<td>Fan and Thermostat Details</td>
<td>A6-30</td>
</tr>
<tr>
<td></td>
<td>6.8.31</td>
<td>C11 Harness Termination Details</td>
<td>A6-31</td>
</tr>
<tr>
<td></td>
<td>6.8.32</td>
<td>Cabinet Housing # 3 Details- sheet 1 of 7</td>
<td>A6-32</td>
</tr>
<tr>
<td></td>
<td>6.8.33</td>
<td>Cabinet Housing # 3 &amp; #4 Details - sheet 2 of 7</td>
<td>A6-33</td>
</tr>
</tbody>
</table>
6.8.34 Cabinet Housing #3 Details - sheet 3 of 7 A6-34
6.8.35 Cabinet Housing #3 Details - sheet 4 of 7 A6-35
6.8.36 Model 342LX Side Panel Details A6-36
6.8.37 Model 344LX Side Panel Details A6-37
6.8.38 Cabinet Equipment Mounting Details 2 of 3 A6-38
6.8.39 Service PDA Details sheet 1 of 2 A6-39
6.8.40 Service PDA Details sheet 2 of 2 A6-40
6.8.41 Rack #2 Equipment Shelf Installation Details A6-41
6.8.42 Cabinet Door Handle Details sheet 1 of 1 A6-42
6.8.43 Input/Output File LX Details sheet 1 of 12 A6-43
6.8.44 Input/Output File #1LX Details sheet 2 of 12 A6-44
6.8.45 Input/Output File #1LX Details sheet 3 of 12 A6-45
6.8.46 Input/Output File #2LX Details sheet 4 of 12 A6-46
6.8.47 Input/Output File #2LX Details sheet 5 of 12 A6-47
6.8.48 Input/Output File #2LX Details sheet 6 of 12 A6-48
6.8.49 Input/Output File Details sheet 7 of 12 A6-49
6.8.50 Input/Output File Details sheet 8 of 12 A6-50
6.8.51 Input/Output File Details sheet 9 of 12 A6-51
6.8.52 Input/Output File HSR Details sheet 10 of 12 A6-52
6.8.53 Input/Output File Details sheet 11 of 12 A6-53
6.8.54 Cabinet Housing #4 Details sheet 5 of 7 A6-54
6.8.55 Cabinet Housing #4 Details sheet 6 of 7 A6-55
6.8.56 Cabinet Housing #4 Details sheet 7 of 7 A6-56
6.8.57 Model 346LX Side Panel Details A6-57
6.8.58 Cabinet Equipment Mounting Details sheet 3 of 3 A6-58
6.8.59 Fan Cover and LED Lighting Housing 3, 4 A6-59
6.8.60 Circuit Breaker Switch Guard Details A6-60
6.8.61 Input/Output File Details sheet 12 of 12 A6-61
CHAPTER 9-SECTION 2
MODEL 2070-1 CPU MODULE

9.2.1 Model 2070-1A CPU Module
The Model 2070-1A CPU Module shall consist of the Main Controller Board, Transition Board, Board Interface Harness, and CPU Module Software.

9.2.1.1 Main Controller Board (MCB)
The MCB shall be a 3U VME bus compliant board and contain a system controller, an A24-D16 interface, a Master& Slave bus interface, a Multilevel VMEbus Arbiter, a FAIR VMEbus Requester and BTO (64)

9.2.1.2 Controller
The Controller Device shall be a Motorola MC68360 or equal, clocked at 24.576 MHz minimum. The Fast IRQ Service System is reserved for State use only. The Interrupts shall be configured as follows:
- Level 7 - VMEbus IRQ7
- Level 6 - VMEbus IRQ6 - ACFAIL
- Level 5 - VMEbus IRQ5 - CPU: Module Counters Timers, LINESYNC
  (auto vectored), Serial Interface Interrupts
- Level 4 - VMEbus IRQ4
- Level 3 - VMEbus IRQ3
- Level 2 - VMEbus IRQ2
- Level 1 - VMEbus IRQ1

9.2.1.3 Memory Address Organization

<table>
<thead>
<tr>
<th>Address</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8000 0000</td>
<td>80FF FFFF</td>
</tr>
<tr>
<td>9000 0000</td>
<td>9000 FFFF</td>
</tr>
</tbody>
</table>

9.2.1.4 Transition Board
A Transition Board (TB) shall be provided to transfer serial communication and control signals between the MCB and the Interface Motherboard. Said signal and communication lines shall be driven/received off and on the module compliant to EIA-485. The Transition Board shall provide a 1 K-Ohm pull-up resistor for the A2 &A3 Installed lines. If the DC Ground is not present (slot not occupied) at the CPU EIA-485 line drivers/receivers, the drivers/receivers shall be disabled (inactive).

9.2.1.5 Shielded Interface Harness
A Shielded Interface Harness shall be provided. It shall include MCB and Transition Board connectors with strain relief, lock latch, mating connectors, and harness conductors. A minimum of 25 mm (0.984 in) of slack shall be provided. No power shall be routed through the harness. The harness shall be 100% covered by an aluminum Mylar foil and an extruded black 0.8 mm (0.0315 in) PVC jacket or equal.

9.2.2 Model 2070-1E CPU Module
The Model 2070-1E CPU Module shall be a single board module meeting the 2X WIDE Board requirements. The module shall be furnished normally resident in the Motherboard Slot A5. The module shall meet all the requirements listed under this section and Chapter Details Section 7. The Model 2070-1E Module shall have a Motorola MC68EN360 CPU or equal, clocked at 24.576 MHz minimum.

9.2.2.1 Dual SCC Device
A Dual SCC Device (asynch/synch) and associated circuitry shall be furnished to provide two additional system serial ports. The Dual SCC1 shall be assigned to the System Serial Port SP1 meeting all requirements called out for SP1 except where noted. The Dual SCC2 shall be assigned as System Serial Port SP8. The SP8 and associated circuitry shall interface with the MC68EN360 address and data structure and serially be connected to the external world via the DB 25 Pin C13S Connector located on the module front panel. The SP8 shall meet all SP2 Port requirements except where noted, including EIA 485 drivers / receivers and synchronous data rate of 153.3 Kbps.

9.2.2.2 68EN360 SCC1
The 68EN360 SCC1 shall be reassigned to Ethernet (ENET) Network meeting Ethernet 10 Mbps IEEE 802.3 (TP) 10 BASE T Standard Requirements, both hardware and software. The CPU network lines shall be connected to a port on the Network Switch. Four LEDs labeled “10/100 and Link/Act” shall be mounted on the front panel signifying Ethernet operational conditions between the CPU and the Network Switch.

9.2.2.3 Module 2070-1E Power Requirements.
The 2070-1E CPU Module shall not draw more than 1.00 A of +5VDC & 250 mA of ISO+12 VDC.

9.2.2.4 The C13S Connector
The C13S Connector shall be a DB25S connector and shall be located on the Module 2070-1X CPU front panel and shall contain signals for SP8, LINESYNC, NRESET, POWERDOWN, and an isolated BIAS +5VDC as specified in the following subsections and as listed in A9-7. TX and RX LEDs shall be provided as show in A9-7.

9.2.2.4.1 Serial Port SP8
System Serial Port 8 (SP8) shall be isolated, converted to EIA-485, and then routed to Connector C13S. SP8 shall meet all SP2 Port requirements except where noted.

9.2.2.4.2 LINESYNC and POWERDOWN
LINESYNC and POWERDOWN lines shall each be isolated, converted to EIA-485, and then routed to connector C13S for external module use.

9.2.2.4.3 NRESET
CPU_Reset and POWER UP lines shall be isolated, then OR’d to form NRESET. NRESET shall then be converted to EIA-485 and routed to connector C13S for external module use.

9.2.3 Model 2070-1C CPU Module
The TYPE 2070-1C CPU Module shall be a single board module meeting the 2X WIDE board requirements. The module shall be furnished normally resident in MOTHERBOARD Slot A5. The module shall meet the requirements as listed in Section 9.2.2.4 of these specifications.

9.2.3.1 Engine Board
The TYPE 2070-1C CPU shall use an Engine Board compliant to the AASHTO/ITE/NEMA Next Generation ATC Standard with the exceptions as defined in Sections 9.2.5 and 9.2.8. The Engine Board shall be used for execution of the application software. No other microprocessor or memory of the 2070-1C CPU shall be used for execution of the application software.

9.2.3.2 Ethernet Ports
The ETHERNET ports of the Engine Board shall be brought out on RJ 45 Connectors mounted on the 2070-1C front panel. The front panel LED indicators for the two CPU Ethernet ports shall be provided as indicated in drawing A9-15.

9.2.3.3 Network Switches, Module 2070-1C
The Model 2070-1C CPU Module shall be provided with two integrated Store-and-Forward Network Switches per the IEEE 802.3, 802.3u and 802.3 x specifications. One switch shall be configured with port 1 and 2 connected to the front panel RJ-45 connectors and port 3 shall be connected to the CPU ENET 1 port. The second switch shall be configured with port 1 connected to the front panel RJ-45, port 2 shall be connected to the CPU ENET 2 port. Port 3 shall be used to route Ethernet across the Motherboard to the “A” Connectors. DC Grounding plane around the network connectors and lines shall be provided. Port 3 Network Lines shall be assigned to: NetP5 TX+, TX-, RX+ and RX- respectively.

9.2.3.4 Universal Serial Bus (USB)
The TYPE 2070-1C CPU Module shall include a USB port compliant to the AASHTO/ITE Next Generation ATC Standard with the exceptions that USB shall conform to the appropriate sections of the USB v2.0 specification for both hardware and software operations. USB shall be brought out from the Engine Board to a USB Connector mounted on the 2070-1C front panel.

9.2.3.5 Host Module
The 2070-1C CPU Module shall use a Host Module that provides the mechanical and electrical interfaces to the Engine Board and Motherboard.
The TYPE 2070-1C CPU Module shall implement the host module identification using the Engine Board SPI serial port, compliant to the AASHTO/ITE Next Generation ATC Standard.

9.2.4 Model 2070-1A and 2070-1E CPU Module

9.2.4.1 Contiguous Addresses
16 megabytes of contiguous address space for each specified memory (DRAM, SRAM and FLASH) shall be allocated on an even boundary. The SRAM and FLASH memories shall be accessed through the OS-9 Operating System's Supplied File Manager.

9.2.4.2 Incoming +5 VDC
When the incoming +5 VDC falls below its operating level, the SRAM shall drop to its standby state and the SRAM and TOD Clock shall shift to the +5 VDC Standby Power. An on-board circuit shall sense the +5 VDC Standby Power and shift to an On-board CPU Power Source. When the incoming +5 VDC rises to within its operating level, the appropriate MCB Circuitry shall shift from standby power to incoming +5 VDC.

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.

9.2.4.4 Flash Memory
A minimum of 8 MB of FLASH memory, organized in 16- or 32-bit words, shall be provided. The MCB shall be equipped with all necessary circuitry for writing to the FLASH memory under program control. No more than 2 MB of FLASH Memory shall be used for the Boot Image and a minimum of 6 MB shall be available for Agency use. A maximum of 2 MB of Flash Memory shall be reserved the Boot Image only. Flash memory shall have a minimum rated capacity of 100,000 read/write cycles and be industrial grade or better.”

9.2.4.5 Time-of-day Clock
A software settable hardware Time-of-Day (TOD) clock shall be provided. It shall, under on-board standby power maintain an accuracy of ±1 minute per 30 days at 25°C. The clock shall provide a minimum fractional second resolution of 10 ms and shall track seconds, minutes, and hours, day of month, month, and year.

9.2.4.6 CPU_Reset
A software-driven CPU_Reset signal (Active LOW) shall be provided to reset other controller systems. The signal output shall be a 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. CPU_Reset shall be executed when the controller starts up or is rebooted using the OS-9 break command. 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.

9.2.4.7 CPU_ACTIVE LED Indicator
An open-collector output, capable of sinking 30 mA at 30 VDC, shall be provided to drive the Front Panel Assembly CPU_ACTIVE LED Indicator. The LED shall default to ON when the controller starts up.

9.2.4.8 Tick Timer
The OS-9 Operating System Tick Timer interrupt shall be derived from each transition of LINESYNC signal, with a tick rate of 120 ticks per second.

9.2.4.9 SRAM and TOD Clock
The SRAM and TOD Clock Circuitry under Standby mode shall draw no more than 8uA at 2.5 VDC and 35 degrees C. An On Board Capacitor supply shall hold up SRAM and TOD for a minimum of 7 days.

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 forth Port on the Network Switch shall be used to route, via magnetics, 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.

9.2.5 Model 2070-1C CPU Engine Board

9.2.5.1 Model 2070-1C CPU Module Processor
The Model 2070-1C CPU Module Processor shall utilize a NXP series MPC 82xx / 83xx /85xx or QorIQ with a minimum MIPS of 400 calculated using the Dhrystone v2.1 benchmark at 25°C. The CPU shall provide support for all single or double-precision floating-point operations.

9.2.5.2 Ram Memory (DRAM)
The Model 2070-1C CPU Module shall contain a minimum of 64Mbytes of DRAM or equivalent volatile memory for application and OS program execution.

9.2.5.3 Flash Memory
The Model 2070-1C CPU Module shall contain a minimum of 32Mbytes of FLASH for storage of OS Software and user application.

9.2.5.4 Static Memory (SRAM)
The Model 2070-1C CPU Module shall contain a minimum of 1MB minimum of SRAM memory for non-volatile parameter storage.

9.2.5.5 Standby Power
The Model 2070-1C CPU Module Engine Board shall provide the Standby Power required for supporting the SRAM and RTC.

9.2.5.6 Real-Time Clock (RTC)
The Model 2070 -1C Module shall be provided with a software settable, hardware RTC that meets the requirements of the ASHTO/ITE/NEMA ATC Standard except that in the absence of VPRIMARY, the RTC shall operate from VSTANDBY as listed in A9-16 of these specifications. Also Operating System Time shall be maintained by utilizing the RTC and LINESYNC as defined in Section 9.5.5.3.

9.2.5.7 CPU_Reset
A software-driven CPU_Reset Signal (Active Low) shall be provided to reset other system devices and shall be accessible by application programs as well as by the command line as “cpureset”. CPU_Reset shall be executed when the Controller starts up or is rebooted using the reboot command.

9.2.5.8 CPU_ACTIVE
An Active Low signal shall be provided to drive the Front Panel Assembly CPU_ACTIVE LED indicator. This signal shall cause the LED to default to ON when the controller starts up.

9.2.5.9 Application Program Interface (API)
An optional installed copy of the Application Program Interface (API) compliant to the latest ASHTO/ITE ATC API Standard shall be provided upon request.

9.2.5.10 Integrated Security
The Model 2070-1C Module shall be implemented with integrated security support for the AES encryption algorithm as well as a public key accelerator and an on-chip random number generator.

9.2.5.11 SD Card Support
The Model 2070-1C Module shall support SD Card Memory and shall be provided with an industry standard SD Card socket.

9.2.6 Data Key
A Datakey Keyceptacle™ (KC4210, KC4210PCB or equal) shall be mounted on the CPU module front panel (or the Transition Board of MODEL 1A). Power shall not be applied to the receptacle if the key is not present.

The contractor shall supply a 8Mb Memory Size Datakey (SFK8Mb or equal) with each MODEL 1A TB (Transition Board) or 1E and 1C CPU module unless specified otherwise. The Datakey shall be temperature rated for –40 °C to +85 °C (–40°F to 185 °F) operation, shall be blue in color, and shall be initialized to the format and default values defined below. External capability to program the CPU Datakey shall be provided by the contractor.

When programmed, the memory on the key of header shall be organized as follows:

<table>
<thead>
<tr>
<th>Bytes</th>
<th>Description</th>
<th>Default Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>16-bit Frame Check Sequence (FCS) calculated as defined in clause 4.6.2 of ISO/IEC 3309. This FCS is calculated across bytes 3-64</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Key Type</td>
<td>See table below</td>
</tr>
<tr>
<td>4</td>
<td>Header Version</td>
<td>2</td>
</tr>
<tr>
<td>5-8</td>
<td>Latitude</td>
<td>0.0</td>
</tr>
<tr>
<td>9-12</td>
<td>Longitude</td>
<td>0.0</td>
</tr>
<tr>
<td>13-14</td>
<td>Controller ID</td>
<td>0xFFFF</td>
</tr>
<tr>
<td>15-16</td>
<td>Communication drop number</td>
<td>0xFFFF</td>
</tr>
<tr>
<td>17-20</td>
<td>IP Address</td>
<td>10.20.70.51</td>
</tr>
<tr>
<td>21-24</td>
<td>Subnet Mask</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>25-28</td>
<td>Default Gateway</td>
<td>10.20.70.254</td>
</tr>
<tr>
<td>29</td>
<td>Startup Override</td>
<td>0xFF</td>
</tr>
</tbody>
</table>
When programmed, Byte 3 of the header shall contain the Key Type value as defined in the following table:

<table>
<thead>
<tr>
<th>Key Type</th>
<th>Model No.</th>
<th>Memory Size</th>
<th>Sector Size</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DK1000</td>
<td>1Kb</td>
<td>2 Byte</td>
<td>611-0006-002A</td>
</tr>
<tr>
<td>2</td>
<td>LCK16000</td>
<td>16Kb</td>
<td>2 Byte</td>
<td>611-0070-008A</td>
</tr>
<tr>
<td>3</td>
<td>SFK2Mb</td>
<td>2Mb</td>
<td>64KBytes</td>
<td>611-0089-004A</td>
</tr>
<tr>
<td>4</td>
<td>SFK4Mb</td>
<td>4Mb</td>
<td>64KBytes</td>
<td>611-0104-002A</td>
</tr>
<tr>
<td>5</td>
<td>SFK8Mb</td>
<td>8Mb</td>
<td>64KBytes</td>
<td>611-0132-006A</td>
</tr>
<tr>
<td>6</td>
<td>SFK32Mb</td>
<td>32Mb</td>
<td>64KBytes</td>
<td>611-0164-005A</td>
</tr>
</tbody>
</table>

The data format in the CPU Datakey header for the Latitude and Longitude fields shall comply with IEEE/ANSI 754-1985 STD. All the other fields shall follow a Big-Endian Format as implemented by Motorola CPUs.

The Startup Override byte, not the Key Type, may be used to override the default controller startup procedure, as described in section 9.2.7.3.3.

### 9.2.7 Model –1A and 2070-1E CPU Module Software

The following shall be supplied:

1. Operating System
2. Drivers and Descriptors
3. Application Kernel
4. Deliverables
5. Error Handler

#### 9.2.7.1 Operating System

The CPU Module shall be supplied with Microware Embedded OS-9 Release 4.02 or later with kernel edition #384 or later and CSL edition 29 or later. The following modules shall be included:

1. Embedded OS-9 Real Time Kernel
2. Sequential Character File Manager (SCF)
3. Stacked Protocol File Manager (SPF)
4. Pipe File Manager (PIPEMAN)
5. Random Block File Manager (RBF)
6. C Shared Library (CSL)

Boot Image shall include the following utility modules:

<table>
<thead>
<tr>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Break</td>
<td>Date</td>
<td>Deiniz</td>
<td>Devs</td>
<td>Free</td>
<td>Copy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dir</td>
<td>Tmode</td>
<td>Edt</td>
<td>List</td>
<td>Load</td>
<td>Deldir</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dump</td>
<td>Del</td>
<td>Ident</td>
<td>Iniz</td>
<td>Irqs</td>
<td>Events</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echo</td>
<td>Format</td>
<td>Dcheck</td>
<td>Login</td>
<td>Link</td>
<td>Kermit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tsmon</td>
<td>Mdir</td>
<td>Mfree</td>
<td>Pd</td>
<td>Makdir</td>
<td>Save</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attr</td>
<td>Rename</td>
<td>Proc</td>
<td>Unlink</td>
<td>Sleep</td>
<td>Xmode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shell</td>
<td>Build</td>
<td>Setime</td>
<td>Merge</td>
<td>Grep</td>
<td>Mat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 Drivers and Descriptors

9.2.7.2.1 Supplied Modules
Supplied modules shall be re-entrant, address independent, and shall not contain self-modifying code. Device drivers which require extensions to the standard Microware libraries shall use the _os_getstat() and _os_setstat() functions.
A custom setstat code and parameter structure are defined as follows:

```c
#define SS_2070 0x2070
error_code _os_getstat(path_id path, SS_2070, PB2070 *pb);
error_code _os_setstat(path_id path, SS_2070, PB2070 *pb);

typedef struct
{
    u_int32 code;
    u_int32 param1;

    union
    {
        u_int32 param;
        void  *pointer;
    } param2;
} PB2070, *pb;
```

The following subcodes for use with PB2070.code are also defined:

```c
#define GS2070_Status 0x1C
#define SS2070_SSig 0x1A
#define SS2070_IFC 0x22
#define SS2070_OFC 0x23
#define SS2070_Timer_Null 0x0000 (Default State)
#define SS2070_Timer_Sig 0x1000
#define SS2070_Timer_Cyc 0x1001
#define SS2070_Timer_Start 0x1002
#define SS2070_Timer_Stop 0x1003
#define SS2070_Timer_Reset 0x1004
```

Note: When PB2070.param2.pointer is used, PB2070.param1 should be loaded with the size of what PB2070.param2.pointer is referencing. When calling _os_getstat() or _os_setstat(), all reserved or unused parameters and fields in PB2070 should be loaded with 0 (zero).

9.2.7.2.2 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
```
9.2.7.2.3 MC68360 Internal Timers
A driver to handle each of the four internal timers under the OS-9 Kernel shall be provided. Timer resolution shall be one count equals 100 μS and all timer periods shall be specified in units of hundreds of microseconds (μS).

A signal of "0" shall be an invalid signal and the driver shall return an E$PARAM error if received.

Access to the MC68360 internal timers shall be through the descriptors as listed under Descriptors.

The timers should be set to SS2070_Timer_Null Mode upon initialization.

9.2.7.2.3.1 Descriptor
Descriptor names for each timer:
- timer1 = access to MC68360's internal timer #1
- timer2 = access to MC68360's internal timer #2
- timer3 = access to MC68360's internal timer #3
- timer4 = access to MC68360's internal timer #4
- timer12 = access to MC68360's internal timer #1 & #2 [cascaded]
- timer34 = access to MC68360's internal timer #3 & #4 [cascaded]

9.2.7.2.3.2 Timer Standard
Timer Standard OS-9 Function Calls:
```c
error_code _os_open (char *timer_desc_name, path_id *path);
error_code _os_read (path_id path, void *timer_value, u_int32 *size);
```
Note: Prior to calling _os_read(), size must be loaded with the value 4 and timer value must be pointed to a u_int32. _os_read() shall read the current timer value and load it into timer_value as μS x 100.
```c
error_code _os_close (path_id path);
```

9.2.7.2.3.3 Time Extension
Timer Extension to Standard OS-9 Function Calls:
The timer drivers shall support the following modes using the following function with the SS_2070 option code and a custom parameter block structure:
```c
error_code _os_setstat(path_id path, SS_2070, PB2070 *pb);
a. Send signal after specified time interval. Sets timer to zero and schedules individual one-shot signal. After one-shot signal is sent, timer shall stop (SS2070_Timer_Stop).
```
b. Send recurring periodic signal. Sets timer to zero and schedules repeating periodic signal.

```c
pb→ code = SS2070_Timer_Cyc (0x1001); /* request for periodic signal */
pb→ param1 = signal;
pb→ param2.param = period;
```

c. Start timer. Starts the timer if stopped or null. Timer will free run in a periodic mode, starting at the current timer value as its initial value and timer’s maximum allowable time as its timer period. Timer will not send a signal and any pending signals will be cancelled.

```c
pb→ code = SS2070_Timer_Start; /* start timer if stopped */
```


```c
pb→ code = SS2070_Timer_Stop; /* stop timer if running */
```

e. Reset timer. Stops timer if running, resets timer value to zero, and cancels any pending signals.

```c
pb→ code = SS2070_Timer_Reset; /* reset timer (stop and zero) */
```

### 9.2.7.2.3.4 Timer Extension

#### Timer Extension to Standard OS-9 Function Calls:

The timer driver shall support the following function with the SS_2070 option code and custom parameter block structure:

```c
error_code _os_getstat(path_id path, SS_2070, PB2070 *pb);
```

Retrieve current timer configuration.

```c
typedef struct
{
    u_int32 value;
    u_int32 mode;
    u_int32 signal;
    u_int32 period;
} Timer_status;
```

```c
pb→ code = GS2070_Status (0x1C) /* Request timer status data */
pb→ param1 = sizeof(Timer_status)
pb→ param2.pointer = &Timer_status *
```
Status data shall be returned in the structure pointed to by pb→param2.pointer as follows:

\[\text{pb} \rightarrow \text{param2.pointer} \rightarrow \text{value} \quad /* \text{current timer value in } \mu\text{S} \times 100 */\]

\[\text{pb} \rightarrow \text{param2(pointer)} \rightarrow \text{mode} \quad /* \text{SS2070_Timer_Sig if one-shot signal pending, }\]
\[\text{SS2070_Timer_Cyc if periodic signal pending, }\]
\[\text{SS2070_Timer_Start if free running, }\]
\[\text{SS2070_Timer_Stop if not active }\]
\[\text{SS2070_Timer_Reset if timer is reset }\]
\[\text{SS2070_Timer_Null when timer is first initialized */}\]

\[\text{pb} \rightarrow \text{param2(pointer)} \rightarrow \text{signal} \quad /* \text{signal code pending if }\]
\[\text{SS2070_Timer_Sig or }\]
\[\text{SS2070_Timer_Cyc, 0 otherwise */}\]

\[\text{pb} \rightarrow \text{param2(pointer)} \rightarrow \text{period} \quad /* \text{timer period in } \mu\text{S} \times 100 \text{ if }\]
\[\text{SS2070_Timer_Sig or }\]
\[\text{SS2070_Timer_Cyc and }\]
\[\text{Maximum Timer Period if }\]
\[\text{SS2070_Timer_Start }\]
\[\text{SS2070_Timer_Null when timer is first initialized */}\]

The following values shall be returned when the timer is in the SS2070_Timer_Null (Timer initialized) Mode:

\[\text{Timer Mode} = \text{SS2070_Timer_Null}\]
\[\text{Timer Value} = 0\]
\[\text{Timer Period} = 0\]
\[\text{Timer Signal} = 0\]

The following values shall be returned when the timer is in the SS2070_Timer_Start Mode:

\[\text{Timer Mode} = \text{SS2070_Timer_Start}\]
\[\text{Timer Value} = \text{Running Timer Value}\]
\[\text{Timer Period} = \text{Maximum Timer Period}\]
\[\text{Timer Signal} = 0\]

The following values shall be returned when the timer is in the SS2070_Timer_Stop Mode:

\[\text{Timer Mode} = \text{SS2070_Timer_Stop}\]
\[\text{Timer Value} = \text{Current Timer Value}\]
\[\text{Timer Period} = 0\]
\[\text{Timer Signal} = 0\]

The following values shall be returned when the timer is in the SS2070_Timer_Reset Mode:

\[\text{Timer Mode} = \text{SS2070_Timer_Reset}\]
\[\text{Timer Value} = 0\]
\[\text{Timer Period} = 0\]
\[\text{Timer Signal} = 0\]

9.2.7.2.3.5 Timer Period
All timer periods are specified in units of hundreds of microseconds (μS), i.e. a timer period of $7 = 700μS$. The minimum allowed timer period shall be $500μS$. The maximum timer period for timers 1-4 shall be 6.5535 seconds (0xFFFF). The maximum timer period for timer12 and timer34 shall be 429496.7295 seconds (0xFFFFFFFF). The driver shall return error E$Param from _os_setstat() if the requested timer period is outside the allowable range.

9.2.7.2.4 CPU Datakey
Access and control to the CPU Datakey shall be provided through the following descriptor name and OS-9 functions:
Descriptor name:
datakey = access to the CPU Datakey

Function Calls:

error_code = _os_open (char *datakey_desc_name, path_id *path);
error_code = _os_close (path_id path);
error_code = _os_read (path_id path, void *data_buffer, u_int32 *data_size);
error_code = _os_write (path_id path, void *control, u_int32 *data_size);
error_code = _os_seek(path_id path, u_int32 *position); sets read / write offset
error_code = _os_ss_erase(path_id path, u_int32 num_sec_erase); erases sector(s) if pointer is on a block boundary, returns E$PARAM error if not on a boundary */
error_code = _os_gs_pos(path_id path, u_int32 *position); /* gets current file pointer position */
error_code = _os_gs_size(path_id path, u_int32 *size); /* gets current datakey size */

Error codes returned by Function calls:

E$NotRdy if datakey is not inserted
E$Seek if Offset plus *data_size is beyond end of CPU Datakey.
E$EOF if upon read or write, the last byte of CPU Datakey has previously been processed.
Note: Use of SCF to implement the datakey driver is not allowed.

9.2.7.2.5 Flow Control Modes
The asynchronous serial communications device drivers shall support the six flow control modes (FCM#) described below:

<table>
<thead>
<tr>
<th>FCM#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Flow Control Mode: The driver transmits data regardless of the state of CTS. Upon a write command, the driver asserts RTS, and de-asserts RTS when data transmission is completed. This is the default mode. When user programs issue the first RTS related command, the driver switches to Manual Flow Control Mode (FCM# 1).</td>
</tr>
<tr>
<td>1</td>
<td>Manual Flow Control Mode: The driver transmits data regardless of the state of CTS. The user program has absolute control of the RTS state. The driver doesn’t automatically assert or de-assert RTS.</td>
</tr>
<tr>
<td>2</td>
<td>Auto-CTS Flow Control Mode: The driver transmits data only when CTS is externally asserted. The user program has absolute control of the RTS state. The driver doesn’t automatically assert or de-assert RTS.</td>
</tr>
<tr>
<td>3</td>
<td>Auto-RTS Flow Control Mode: The driver transmits data regardless of the state of CTS. Upon a write command, the driver asserts RTS, and de-asserts RTS when data transmission is completed and any configured RTS extension is elapsed. If the user program asserts RTS, then RTS remains on until the user program de-asserts RTS. If the user program de-asserts RTS before the transmission buffer is empty, the driver holds RTS on until the transmission buffer is empty and any configured RTS extension is elapsed.</td>
</tr>
<tr>
<td>4</td>
<td>Fully Automatic Flow Control Mode: The driver transmits data only when CTS is externally asserted. Upon a write command, the driver asserts RTS and waits for CTS, starts data transmission when CTS is asserted, and de-asserts RTS when data transmission is completed and any configured RTS extension is elapsed. If user program asserts RTS, then RTS remains on until the user program de-asserts RTS. If the user program de-asserts RTS before the transmission buffer is empty, the driver holds RTS on until the transmission buffer is empty and any configured RTS extension is elapsed.</td>
</tr>
<tr>
<td>5</td>
<td>Dynamic Flow Control Mode: The driver transmits data only when CTS is externally asserted. The driver controls RTS based on the status of its receiving buffer. The driver asserts RTS continuously as long as its receiving buffer has sufficient capacity to store incoming data. If the receiving buffer approaches full, the driver de-asserts RTS until enough data has been read from the buffer to create sufficient receive capacity.</td>
</tr>
</tbody>
</table>

9.2.7.2.5.1 Serial Device Driver

The serial device driver shall be able to set user options via _os_setstat() and return status via _os_getstat(). To support legacy application programs, the device driver shall also be able to set user options via _os_ss_size() and to return status via _os_gs_size():

- error_code_os_setstat(path_id path, SS_2070, void *pb);
- error_code_os_getstat(path_id path, SS_2070, void *pb);
- error_code_os_ss_size(path_id path, u_int32 size);
- error_code_os_gs_size(path_id path, u_int32 *size);
Note: The preferred method of accessing serial device drivers is through _os_setstat() and _os_getstat(). The _os_ss_size() and _os_gs_size() interface may not be required by future versions of this specification and is therefore not recommended for new development.

The option subcodes to be passed in pb->code and the data to be contained in pb->param1 are defined as follows. pb->param2 is unused here and should be set to 0 (zero). For _os_ss_size() and _os_gs_size(), the size argument is the same format as pb->param1.

9.2.7.2.5.2 Supported Setstat
The supported _os_setstat() / _os_ss_size() options shall be as follows.

a. **Subcode passed in pb->code is SS2070_OFC (0x23).**

   **Data passed in pb->param1 is defined as follows:**

<table>
<thead>
<tr>
<th>Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-24</td>
<td>Auto RTS turn-off extension in number of characters (range:0-255, 0=default).</td>
</tr>
<tr>
<td>23-14</td>
<td>Reserved for future use.</td>
</tr>
<tr>
<td>13</td>
<td>Inhibit return of error E$Write from _os_write() when transmit buffer full in FCM# 2, 4, 5 (default=0, 0=error, 1=block)</td>
</tr>
<tr>
<td>12</td>
<td>Inhibit variable SCC MRBLR (default=0; 0=NO; 1=inhibit).</td>
</tr>
<tr>
<td>11</td>
<td>Inhibit SCC TODR (default=0; 0=NO; 1=inhibit).</td>
</tr>
<tr>
<td>10-8</td>
<td>Flow Control Mode Number (FCM#) (range:0-5).</td>
</tr>
<tr>
<td>7-0</td>
<td>Subcode SS2070_OFC (0x23).</td>
</tr>
</tbody>
</table>

**Variable MRBLR (68360 SCC)**
To reduce the IRQ handler overhead, the 68360 SCC driver shall use variable MRBLR as follows. If SS2070_OFC bit 12 is set to 1, the MRBLR shall be fixed at 16 for all baud rates. Variable MRBLR is not required for SP1 or SP8 on the 2070-1B CPU Module.

<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>MRBLR Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200</td>
<td>1</td>
</tr>
<tr>
<td>2400</td>
<td>2</td>
</tr>
<tr>
<td>4800</td>
<td>4</td>
</tr>
<tr>
<td>9600</td>
<td>8</td>
</tr>
<tr>
<td>19200 &amp; Higher</td>
<td>16</td>
</tr>
</tbody>
</table>

**TODR (68360 SCC)**
TODR requests processing a new TX buffer immediately. To reduce impact on other serial channel operations, SS2070_OFC bit 11 may be set to 1 to prevent assertion of TODR. TODR is not required for SP1 or SP8 on the 2070-1B CPU Module.

b. **Subcode passed in pb->code is SS2070_IFC (0x22).**

   **Data passed in pb->param1 is defined as follows:**

<table>
<thead>
<tr>
<th>Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-11</td>
<td>Reserved for Future Use.</td>
</tr>
<tr>
<td>10</td>
<td>DCD must be asserted to receive data (default=0; 0=NO; 1=YES).</td>
</tr>
<tr>
<td>9-8</td>
<td>Reserved for Future Use.</td>
</tr>
<tr>
<td>7-0</td>
<td>Subcode = SS2070_IFC (0x22).</td>
</tr>
</tbody>
</table>
c. **Subcode passed in pb→code is SS2070_SSig (0x1A).**

1. If CTS is currently negated and bits 16-31 are not all 0:
   - Setting the SS2070_SSig parameter block bit 11 (send when CTS is asserted) will cause the controller to send a one-shot signal as soon as CTS is asserted.
   - Setting the SS2070_SSig parameter block bit 12 (send when CTS is negated) will cause the controller to send a one-shot signal immediately.

2. If CTS is currently asserted and bits 16-31 are not all 0:
   - Setting the SS2070_SSig parameter block bit 11 (send when CTS is asserted) will cause the controller to send a one-shot signal immediately.
   - Setting the SS2070_SSig parameter block bit 12 (send when CTS is negated) will cause the controller to send a one-shot as soon as CTS is negated.

3. If both bits 11 and 12 of the SS2070_SSig parameter block are set, and bits 16-31 are not all 0:
   - The controller will send a one-shot signal upon the next change of CTS state

**Data passed in pb→param1 is defined as follows:**

<table>
<thead>
<tr>
<th>Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-16</td>
<td>A signal number to be sent to calling process when the state of an input changes.</td>
</tr>
<tr>
<td>15-13</td>
<td>Reserved for Future Use.</td>
</tr>
<tr>
<td>12</td>
<td>Send signal when CTS is de-asserted.</td>
</tr>
<tr>
<td>11</td>
<td>Send signal when CTS is asserted.</td>
</tr>
<tr>
<td>10-8</td>
<td>Reserved for Future Use.</td>
</tr>
<tr>
<td>7-0</td>
<td>Subcode = SS2070_SSig (0x1A).</td>
</tr>
</tbody>
</table>

9.2.7.2.5.3 Supported Getstat
The supported _os_getstat() / _os_gs_size() options shall be as follows.

a. **Subcode passed in pb→code is GS2070_Status (0x1C).**
   - **Data returned in pb→param1 is defined as follows:**

<table>
<thead>
<tr>
<th>Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-16</td>
<td>Current unfilled transmit buffer character count of the serial device driver.</td>
</tr>
<tr>
<td>15-11</td>
<td>Reserved for Future Use.</td>
</tr>
<tr>
<td>10-8</td>
<td>Current Flow Control Mode Number (FCM#).</td>
</tr>
<tr>
<td>7</td>
<td>Reserved for Future Use.</td>
</tr>
<tr>
<td>6</td>
<td>Overrun error –0=no error; 1=error has occur since last GS2070_Status call.</td>
</tr>
<tr>
<td>5</td>
<td>Frame error –0=no error; 1=error has occurred since last GS2070_Status call.</td>
</tr>
</tbody>
</table>
9.2.7.2.6 Device Drivers Compliant
Device drivers compliant with the OS-9 SCFMAN shall be provided for CPU Activity LED Indicator and Day Light Savings time correction features. The descriptor names shall be as follows:

- led = access to CPU Activity LED Indicator
- dstclck = access to Daylight Savings Time Clock correction

The standard OS-9 SCFMAN library calls and their functions are as follows:

- error_code _os_open (char *desc_name, path_id *path);  //open descriptor for command
- error_code _os_close (path_id path);               //close descriptor
- error_code _os_write (path_id path, void *value, u_int32 *data_size);  //set value of function
- *value = 1, turn on LED or enable DST correction (default)
- *value = 0, turn off LED or disable DST correction set u_int32*data_size to 1
- error_code _os_read (path_id path, void *value, u_int32 *data_size);     //get current state set
- u_int32*data_size to 1

9.2.7.2.7 Manufacturer Support
The manufacturer shall provide the following features to support the TOD operation and synchronization.

9.2.7.2.7.1 Leap Year and Daylight Savings Time
Leap Year and Daylight Savings Time (DST) Adjustments - The OS-9 System clock / calendar shall automatically be adjusted to account for DST and leap years.

9.2.7.2.7.2 Setting Hardware Clock
Setting Hardware Clock from OS-9 System Clock - A device driver compatible with the OS-9 SCFMAN shall be provided to allow the hardware TOD clock/calendar to be updated from the OS-9 system clock under application control. The descriptor name shall be “ClockUpdate.” Opening the descriptor shall cause the driver to synchronize the clock to a minimum of 10 ms resolution. The driver shall compensate for any time elapsed during the process of updating the hardware clock.

9.2.7.2.7.3 Setting OS-9 System Clock
Setting OS-9 System Clock from Hardware Clock - At system power up, the OS-9 system TOD clock/calendar shall automatically be updated from the hardware TOD clock. The clocks shall be synchronized to a minimum of 10 ms resolution.

9.2.7.2.8 Flash Ram Drive
The FLASH drive shall be protected from corruption. It shall be protected using the Write Protect (WP) bit of the Base Register. When writing to the FLASH drive the current sector of FLASH being written shall first be backed up in SRAM. The backup sector copy shall be invalidated when FLASH write operation is completed. In case of power failure, the FLASH driver shall detect the presence of the valid backup sector copy in SRAM and shall read sector data from the valid backup sector copy.
A user write operation shall restore the valid backup sector copy first. Execution of the program module, “FLRESTORE,” in the Boot Image shall also restore the valid backup sector copy to FLASH drive after a specified delay. “FLRESTORE” shall accept a delay parameter in seconds ranging from 0 to 600 seconds. The default delay factor is 30 seconds.

9.2.7.3  OS-9 Application Kernel

9.2.7.3.1  Boot Sysreset
The provided software shall boot OS-9 from SYSRESET. The entire program shall be resident in FLASH Memory. The serial port descriptors shall be configured with the default parameters as listed in A9-16.

9.2.7.3.2  Hardware Initialization
Hardware initialization, preliminary self-test, OS-9 initialization (except Extended Memory Test), and forking OPEXEC shall be completed in less than 4 seconds. This startup time shall be measured from the release of SYSRESET to the turn on of the CPU_ACTIVE LED using a user level program named ONLED. The ONLED program shall be the last module loaded into RAM and executed using opexec or a startup file.

9.2.7.3.3  Startup Procedure

The boot image init module shall be configured with the default directory name as /f0wp and sysgo as the first executable module.

Sysgo shall operate as follows:
1. Sysgo shall set the execution directory to /f0wp/CMDS
2. Sysgo shall check if the backspace key (0x08) is being received on /sp4 (c50j). If received, Sysgo shall:
   a. Fork a shell with no arguments on /sp4 using the current directory.
   b. Remain an active process and monitor the shell for termination.
      If the shell does terminate, Sysgo shall fork another shell with no arguments on /sp4. Unless Sysgo dies, a shell shall always be provided on /sp4.
3. If the backspace key was not received, Sysgo shall check for the presence of a Datakey. If present and valid (Datakey Header Version 2 or greater), Sysgo shall check the Startup Override Byte in the Datakey header.
   If Startup Override is 0x01, Sysgo shall:
   a. Fork a shell that executes a shell script stored on the Datakey in the following format. Immediately following the key header shall be the size of the script in bytes. The script shall immediately follow the length value, and shall be stored as ASCII text.
b. If there is any error reading or starting the script or if the shell terminates with an error, Sysgo shall display an error message on /sp4 and fork another shell as described in step 2. If there are no errors executing the script, Sysgo shall exit without forking another shell.

If Startup Override is 0x02, Sysgo shall:

a. Fork an executable module stored on the Datakey immediately following the header.

b. If there is any error loading or forking the module, Sysgo shall display an error message on /sp4 and fork a shell as described in step 2. If there are no errors forking the module, Sysgo shall then exit without forking a shell.

4. If the backspace key was not received and Startup Override Byte is 0xFF:

a. Sysgo shall fork the module named /f0wp/OPEXEC if present at /f0wp.

b. If there is any error loading or forking OPEXEC, Sysgo shall display an error message on /sp4 and fork a shell as described in step 2. If there are no errors forking OPEXEC, Sysgo shall then exit without forking a shell.

5. If the backspace key was not received, Startup Override Byte is 0xFF, and there is no OPEXEC file:

a. Sysgo shall fork a shell that executes a shell script named /f0wp/startup if present at /f0wp.

b. If there is any error reading or starting the script or if the shell terminates with an error, Sysgo shall display an error message on /sp4 and fork another shell as described in step 2. If there are no errors executing the script, Sysgo shall exit without forking another shell.

6. If the backspace key was not received, Startup Override Byte is 0xFF, and there is no OPEXEC and no startup file:

a. Sysgo shall fork a shell as described in step 2.

9.2.7.3.4 Short Out

A Short Out is defined as the period of time between ACFAIL/POWER DOWN transition to LOW and back to HIGH without a SYSRESET transition to LOW. ACFAIL/POWER DOWN transitions shall generate an interrupt. The interrupt shall update an OS-9 event named "ACFAIL". The "ACFAIL" event shall set a value 1 indicating an ACFAIL condition occurred for the DOWN transition and set 0 indicating non-ACFAIL condition for the HIGH transition. The IRQ7 and auto-vector 31(7) shall not be used to update the "ACFAIL" event.

In addition, the ACFAIL condition shall generate the OS-9 auto-vector 30(6) interrupt service. Each interrupt service installed shall exit with the "Carry Bit" set allow OS9 to propagate the ACFAIL
interrupt. The Contractor shall supply an interrupt handler at priority 255 that acknowledges and clears
the interrupt.
Priority 1 shall be reserved for the OS-9 system.

9.2.7.3.5 Long Out
A Long Out is defined as ACFAIL transitions to LOW follow by a SYSRESET going LOW. The
SYSRESET going HIGH shall be followed by an operating system reboot.

9.2.7.4 Error Handler

9.2.7.4.1 Initialization and Power-Up Test
A manufacturer may include an error handling routine to save troubleshooting data regarding
initialization, power-up test abnormalities and other error conditions. If used, the error report shall be
stored in the file /r0/ErrorReport and shall not exceed 11kb in size.

9.2.7.5 Network Requirements

On the MODEL 2070-1E CPU module, an OS-9 SPF Ethernet hardware driver and descriptor for the
68360 (SCC1) shall be provided in the operating system Boot Image. The descriptor shall be named
spqe0.

9.2.7.5.1 BOOTOBJS

The following OS-9 modules should be included in the /f0/CMDS/BOOTOBJS flash disk directory to
allow for standard TCP/IP network communications using Ethernet Protocol over Ethernet hardware
and/or Serial Line Internet Protocol (SLIP) or Point-to-Point Protocol over serial links:
1. Drivers and Descriptors for PPP.
2. Drivers and Descriptors for SLIP.
3. LAN Comm Pak modules: spenet, enet, spip, ip4_timeslice, sptcp, tcp0, spudp,
   udp0, spraw, raw0, sproute, route0, spipcp, ipcp0, splcp, lcp0, sphdlc, hdlc0,
   spslip, sps10
4. Network modules pkman, pkdvr, pk, pks
5. Network Trap Handler: netdb_local, netdb_dns
6. NFS Modules: nfs, nfsnul and nfs_devices.

The PPP and SLIP descriptors shall have baud rates and ports set as follows and be stored in the
/f0/CMDS/BOOTOBJS directory,
   hdlc0 and sps10 configured to use /sp1 and 38400 bps
   hdlc1 and sps11 configured to use /sp2 and 115200 bps
   hdlc2 and sps12 configured to use /sp3 and 115200 bps
   hdlc3 and sps13 configured to use /sp4 and 38400 bps

9.2.7.5.2 CMDS

The following Network utilities shall be included and shall reside in the /f0/CMDS directory as
identified in this specification.
arp, dhcp, idbdump, idbgen, rpcdbgen, ifconfig, inetd, ipstart, ndbmod, netstat, ping, route, routed, hostname, nfs, mount, rpcdump, nfsstat, exportfs, portmap, ppp, chat, pppauth, nfs, mountd, and showmount, sshd, sshkeygen, sftp, sftpserver, openssl, scp, passutil, useradd, userdel, usermod.

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
*/f0wp/sys/startspf
*/f0wp/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/BOOTOBJ 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) via the interfaces.conf shell script. 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.

9.2.7.5.5 Netcfg
A Utility Program named netcfg shall be provided that reads the CPU Datakey for an IP Address, Subnet Mask and Default Gateway. If the Datakey is present and valid (Datakey Header Version 2 or greater), netcfg shall set the IP Address, Subnet Mask and Default Gateway of the Model 2070 Controller when executed by a user at the command line. The netcfg utility shall create a new inetdb, inetdb2 and rpcdb database module based on the Datakey network parameters or network parameters from the command line. The new inetdb, inetdb2 and rpcdb modules should be re-located to the /f0/CMDS/BOOTOBJS directory where they will be pick-up by the network configuration shell scripts located at /f0/SYS. The netcfg shall also allow the user to read, write and display network parameters to and from the Datakey via the command line prompt. If the Datakey is not present or invalid and the flag option is not “n” netcfg shall display an error and exit without altering the network configuration. The netcfg utility shall reside in /f0/CMDS.

Netcfg options:

- `a=` Write IP Address in Datakey
- `m=` Write Netmask Address in Datakey
- `g=` Write Gateway Address in Datakey

If the checksum is incorrect when executing the –a, -m or –g option the following will occur:

1. The default Datakey data will be loaded.
2. The networking changes will be made to the default networking parameters.
3. The CRC will be recalculated.
4. The networking parameters will be written to the Datakey.

This option loads default networking parameters into the Datakey.

- `d=` Write Default Networking Parameters in the Datakey

This option will display the networking information contained in the Datakey.

- `i=` Reads Networking Parameters from the Datakey

This option will set the networking parameters permanently on the controller using values from the Datakey.

- `c=` Changes interfaces.conf and builds inetdb, inetdb2 and rpcdb.
Normal operation of this option will be:

1. Read the Datakey networking parameters
2. Delete interfaces.conf and routes.conf from /f0/etc
3. Write new interfaces.conf and routes.conf in /f0/etc.
4. Execute idbgen to create new inetdb and inetdb2
5. Execute rpcdbgen to create a new rpcdb
6. Delete inetdb, inetdb2 and rpcdb in /f0/cmds/bootobjs.
7. Relocate inetdb, inetdb2 and rpcdb in /f0/cmds/bootobjs.

This option will display the current Controller Network Parameters such as the IP Address, Netmask, Gateway and MAC Address. This requires the network Stack to be initialized.

-\(r\)= Reads current Networking Configuration.

This option will set the networking parameters dynamically on the controller using values from the Datakey

-\(s\)= Sets Network Configuration Dynamically from the Datakey.

This option will set the networking parameters permanently on the controller using values from the command line. The option will do the same functions as option “c” with network parameters from the command line.

\(-n\)= Set Controller Network Parameters without the Datakey

The netcfg -n -a [opts] -m [opts] -g [opts] shall allow the user to permanently set the IP Address, Subnet Mask and Gateway of the Model 2070 Controller when executed by the user at the command line using parameters provided by the user at the command line.

Where opts may be IP Address in the format xxx.xxx.xxx.xxx, netmask in the format xxx.xxx.xxx.xxx and gateway as xxx.xxx.xxx.xxx.

Example, the following sets the IP Address, Netmask and Gateway permanently in the Model 2070 Controller to 10.20.70.51, 255.255.255.0 and 10.20.70.254:

netcfg -n -a 10.20.70.51 -m 255.255.255.0 - g 10.20.70.254
These options will display the help menu on how to use the netcfg utility.

h, ?, blank = displays the help menu

The help menu shall consist of the following:

Netcfg Usage:

netcfg [-a] [-m] [-g] [-n] [-d] [-i] [-r] [-s]

-a follows Ip Address ; Write IP Address in Datakey
-m follows Netmask ; Write Netmask Address in Datakey
-g follows Gateway ; Write Gateway Address in Datakey
-d ;Write Default Networking Parameters in the Datakey
-i ;Reads Networking Parameters from the Datakey
-c ;Changes interfaces.conf and builds inetdb, inetdb2 and rpcdb.
-r ;Reads current Controller Networking Configuration.
-s ;Sets Network Configuration Dynamically from the Datakey.

-n <network parameters> ;Set Controller Network Parameters without Datakey

Example of option –n:
netcfg -n –a 10.20.70.51 –m 255.255.255.0 –g 10.20.70.254

See Section 9.2.6 for additional information.

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.

The attributes of all files in the /f0/ETC directory shall be set using the following command:

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

TEES 2009 Errata No. 3 90
This directory shall contain the following text files: hosts, hosts.equiv, networks, protocols, services, inetd.conf, resolv.conf, hosts.conf, rpc, interfaces.conf, routes.conf, makefile, 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
#
#************************************************************************

-b
-bo

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

ODIR = /f0/CMDS/BOOTOBJ
SDIR = /f0/ETC

SFFILES = $(SDIR)/hosts $(SDIR)/hosts.equiv $(SDIR)/protocols \
        $(SDIR)/networks $(SDIR)/services $(SDIR)/inetd.conf \
        $(SDIR)/resolv.conf $(SDIR)/host.conf \
        $(SDIR)/interfaces.conf $(SDIR)/routes.conf $(SDIR)/rpc

RFILES = $(SDIR)/nfs.map $(SDIR)/nfsd.map
RPCOPT =  

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: $(SFFILES)
   $(DEL) @
   $(DEL) @
   $(IDBGEN) -to=$(OS) -tp=$(CPU) -d=$(SDIR) @
   $(ATTR) @
   $(ATTR) @

clean:
   $(DEL) $(ODIR)/inetdb
```

The /f0/ETC/SSH directory shall be provided with the ssh configuration file named sshd_config.

9.2.7.6 Standard Microware File System Configuration

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:

```bash
*-t -np
*    startspf
*    Shell Script to Start SPF System
*    Set default directories before starting daemon programs
*    chd /h0
*    chx /h0/cmds
*    Load SPF modules
*    /f0wp/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
*    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
* bootpd: Network boot protocol server
*
routed <>>>/nil&
inetd <>>>/nil&
*bootpd /h0/TFTPBOOT/bootptab <>>>/nil&
sshd <>>>/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/pkdrv
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/ip4_timeslice
load -d /f0wp/cmds/bootobjs/sp/tcp
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 ipcp0 * PPP IPCP
*load -d spipcp lcp0 * PPP LCP
*load -d sphdlc hdlc0 * PPP HDLC
*chd ..../..
*load -d chat pppd pplog pppauth; chd BOOTOBJ/SPF * PPP Utilities
* 
* Chd up to CMDS directory
* 
*load -d mbinstall * Load mbinstall memory handler
* (or can be done within init)
* load -d /f0wp/cmds/ipstart
* 
*load -d /f0wp/cmds/routed
load -d /f0wp/cmds/inetd
*load -d /f0wp/cmds/rout
*load -d /f0wp/cmds/ifconfig
load -d /f0/wp/cmds/route
*load -d route hostname ifconfig arp * Runtime tools
load -d /f0/wp/cmds/ping
load -d /f0/wp/cmds/netstat
* Loads ssl/ssh Daemons and libraries.
load -d /f0/wp/cmds/ssh
* 
* Loads the Hawk Daemons.
* 
*load -d /f0/wp/cmds/spfndpd
*load -d /f0/wp/cmds/ndpio
*load -d /f0/wp/cmds/spfndpdc
* 
* End
* 
Include the following startnfs file:

*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 /f0wp          ;* Set default directories for NFS mounts
chx /f0wp/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 /f0wp         ;* 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 /f0wp/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 nisd 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. 3  
***************************************************
```

The errmsg file shall be the standard OS-9 errmsg file which defines OS-9 error codes 000:001 through 010:068. The attributes of the errmsg 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 encrypted "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 encrypted password “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 –nmpwpwnenewr *
and the ownership shall be group.user ID of “0.0".
Include the following password file:

* * Password File
* Model 2070 Controller*
* 
Reg,X............X,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.

9.2.7.6.3 utilities

The utilities tar, make, fixmod, mshell and vi shall be included in the /f0/CMDS directory.

9.2.7.6.4 Ver

A Ver utility shall be provided as part of the OS-9 Image and shall allow access to Controller’s Manufacturer Name, Image Build Number, TEES Version, Image Build Date and CPU Module Type. Ver should display the contents of a data module named “bootid” which contains in its data area the following structure:

/* bootid_body*/
Struct bootid_body {
    char *mfgname; /* Manufacturer Name */
    char *cpumoduletype; /* CPU Module Type */
    char *teesrelease; /* TEES Release */
    char *imagebuilddate; /* Image Build Date */
    u_int 16 majv; /* Major Version*/
    u_int 16 minv; /* Minor Version */
    u_int 16 sv1; /* Sub-Version 1 */
    u_int 16 sv2; /* Sub-Version 2 */
    u_int 16 sv3 /* Sub-Version 3 */
    u_int 16 dv; /* Development Version */
};

When run via the command line the Ver utility shall display the following:
Ver options:
-a   Shows all information
-b   CPU Module Type
-d   Image Build Date
-m   Controller’s Manufacturer Name
-t   TEES Version
-v   Image Build Version Number
-?   Display Help

CPU Type shall display 2070-1A, 2070-1E.
Image Build Date shall be in the form of mm/dd/yyyy
Manufacturer’s name shall be shown as one word only.
TEES Version shall be “TEES XXXX EY” where XXXX is the
is the year of the TEES and Y is any Erratas if applicable.
Ver without an option shall be the same as Ver -a.

Ver –a shall display all information as shown by the following example:

2070 -1E
03/06/2008
Vendor Name
TEES 2008 E5 ; E5 Would be blank if there are no Erratas.
Build 2.7.3.0.0.0

The help menu shall consist of the following:

Ver Usage:


-a   Shows all information
-b   CPU Module Type
-d   Image Build Date
-m   Controller’s Manufacturer Name
-t   TEES Release
-v   Image Build Version Number
-?   Display Help

Os9 Edimod shall be used to generate the heater file and the
"bootid" module using the following config.des file:

#include "defines.h" /*this file contains customization for the module */
#include <module.des> /* required for module definitions in modhcom */
struct bootid_body /* this is the bootid module structure */
{
    pointer u_int32 mfgname = mn, "Manufacturer Name";
    pointer u_int32 cpumoduletype = cmt, "CPU Module Type";
    pointer u_int32 teesrelease = tr, "TEES Release";
    pointer u_int32 imagebuilddate = ibd, "Image Build Date ";
    u_int16 majv, "Major Version";
    u_int16 minv, "Minor Version";
        u_int16 sv1, "Sub-Version 1";
        u_int16 sv2, "Sub-Version 2";
        u_int16 sv3, "Sub-Version 3";
        u_int16 dv, "Development Version";
}, "bootid_body";

string mn = MfgName;
string cmt = CPUModuleType;
string tr = TEESRelease;
string ibd = ImageBuildDate;
string mod_name = "bootid";

init bootid_body
{
    majv = MajorVer;
    minv = MinorVer;
    sv1 = SubVer1;
    sv2 = SubVer2;
    sv3 = SubVer3;
};

init modhcom
{
    _maccess = 0x555;
    _mtype = MT_DATA;
    _mlang = 0;
    _mattr = 0x80;
    _mrev  = 1;
    _medit = 1;
};
module
{
    modhcom,
    bootid_body
};

9.2.8 Model 2070-1C CPU Software

9.2.8.1 Linux Operating System

The model 2070-1C CPU Module shall be supplied with Linux 2.6.35 kernel or later. Platform specific options shall be selected by the manufacturer based on the requirements of the MPC 82xx/83xx/85xx, or QorIQ (Power-Architecture-based).

The items marked with an asterisk (*) shall be the minimum Linux kernel configuration features that shall be included in the kernel build; others shall be included when possible:

```
# Automatically generated make config: don't edit
# Linux kernel version: 2.6.35
# Thu May 24 21:11:56 2018

# General setup
# CONFIG_LOCK_KERNEL=y
CONFIG_INIT_ENV_ARG_LIMIT=32
CONFIG_CROSS_COMPILE=""
CONFIG_LOCALVERSION=""
# CONFIG_LOCALVERSION_AUTO is not set
CONFIG_SWAP=y
CONFIG_SYSVIPC=y
CONFIG_SYSVIPC_SYSCTL=y
CONFIG_POSIX_MQUEUE=y
CONFIG_POSIX_MQUEUE_SYSCTL=y
# CONFIG_BSD_PROCESS_ACCT is not set
# CONFIG_TASKSTATS is not set
# CONFIG_AUDIT is not set

# RCU Subsystem

CONFIG_MODULES=y *
CONFIG_MODULE_UNLOAD=y *
CONFIG_MODVERSIONS=y
CONFIG_MODULE_SRCVERSION_ALL=y
```
# CONFIG_TREE_RCU_TRACE is not set
CONFIG_IKCONFIG=y *
CONFIG_IKCONFIG_PROC=y *
CONFIG_LOG_BUF_SHIFT=17
CONFIG_CGROUPS=y
# CONFIG_CGROUP_DEBUG is not set
CONFIG_CGROUP_NS=y
CONFIG_CGROUP_FREEZER=y
CONFIG_CGROUP_DEVICE=y
CONFIG_CPUSETS=y
CONFIG_PROC_PID_CPUSET=y
CONFIG_CGROUP_CPUACCT=y
CONFIG_RESOURCE_COUNTERS=y
CONFIG_CGROUP_MEM_RES_CTLR=y
CONFIG_CGROUP_MEM_RES_CTLR_SWAP=y
CONFIG_CGROUP_SCHED=y
CONFIG_FAIR_GROUP_SCHED=y
CONFIG_RT_GROUP_SCHED=y
CONFIG_BLK_CGROUP=m
# CONFIG_DEBUG_BLK_CGROUP is not set
CONFIG_MM_OWNER=y
# CONFIG_SYSFS_DEPRECATED_V2 is not set
CONFIG_RELAY=y
CONFIG_NAMESPACES=y
CONFIG_UTS_NS=y
CONFIG_IPC_NS=y
# CONFIG_USER_NS is not set
# CONFIG_PID_NS is not set
CONFIG_NET_NS=y
CONFIG_BLK_DEV_INITRD=y
CONFIG_INITRAMFS_SOURCE=""
CONFIG_RD_GZIP=y
CONFIG_RD_BZIP2=y
CONFIG_RD_LZMA=y
CONFIG_RD_LZO=y
# CONFIG_CC_OPTIMIZE_FOR_SIZE is not set
CONFIG_SYSCALL=y
CONFIG_ANON_INODES=y
CONFIG_EMBEDDED=y *
CONFIG_SYSCALL_SYSCALL=y
CONFIG_KALLSYMS=y
CONFIG_KALLSYMS_ALL=y
# CONFIG_KALLSYMS_EXTRA_PASS is not set
CONFIG_HOTPLUG=y *
CONFIG_PRINTK=y
CONFIG_BUG=y
CONFIG_ELF_CORE=y
CONFIG_BASE_FULL=y
CONFIG_FUTEX=y
CONFIG_EPOLL=y
CONFIG_SIGNALFD=y
CONFIG_TIMERFD=y
CONFIG_EVENTFD=y
CONFIG_SHMEN=y *

# GCOV-based kernel profiling
#
CONFIG_GCOV_KERNEL=y
# CONFIG_GCOV_PROFILE_ALL is not set
CONFIG_SLOW_WORK=y
# CONFIG_SLOW_WORK_DEBUG is not set
# CONFIG_HAVE_GENERIC_DMA_COHERENT is not set
CONFIG_SLABINFO=y
CONFIG_RT_MUTEXES=y
CONFIG_BASE_SMALL=0
CONFIG_MODULES=y *
# CONFIG_MODULE_FORCE_LOAD is not set
CONFIG_MODULE_UNLOAD=y *
# CONFIG_MODULE_FORCE_UNLOAD is not set
# CONFIG_MODVERSIONS is not set
CONFIG_MODULE_SRCVERSION_ALL=y
CONFIG_STOP_MACHINE=y
CONFIG_BLOCK=y
CONFIG_BLK_DEV_BSG=y
CONFIG_BLK_DEV_INTEGRITY=y
CONFIG_BLOCK_COMPAT=y

# # Processor type and features
#
# Kernel options
#
CONFIG_TICK_ONESHOT=y *
CONFIG_NO_HZ=y *
CONFIG_HIGH_RES_TIMERS=y *
CONFIG_GENERIC_CLOCKEVENTS_BUILD=y
# CONFIG_HZ_100 is not set
CONFIG_HZ_250=y *
# CONFIG_HZ_300 is not set
# CONFIG_HZ_1000 is not set
CONFIG_HZ=250
CONFIG_SCHED_HRTICK=y
# CONFIG_PREEMPT_NONE is not set
CONFIG_PREEMPT_VOLUNTARY=y
# CONFIG_PREEMPT is not set
CONFIG_BINFMT_ELF=y
CONFIG_COMPAT_BINFMT_ELF=y

# # Bus options (PCI, PCMCIA, EISA, MCA, ISA)
#
CONFIG_PCI=y
CONFIG_PCI_GOANY=y
CONFIG_PCI_BIOS=y
CONFIG_PCI_DIRECT=y

#
# Executable file formats
# CONFIG_BINFMT_ELF=y *

# Networking
# CONFIG_NET=y

# Networking options
# CONFIG_PACKET=y *
# CONFIG_PACKET_MMAP=y *
# CONFIG_UNIX=y *
# CONFIG_INET=y *
# CONFIG_IP_MULTICAST=y *
# CONFIG_IP_FIB_HASH=y
# CONFIG_IP_PNP=y *
# CONFIG_IP_PNP_DHCP=y *
# CONFIG_IP_PNP_BOOTP=y *
# CONFIG_IP_PNP_RARP=y
# CONFIG_SYN_COOKIES=y *
# CONFIG_TCP_CONG_BIC=y

# IP: Virtual Server Configuration
# CONFIG_IPV6=y
# CONFIG_NETFILTER=y *

# Generic Driver Options
# CONFIG_STANDALONE=y
# CONFIG_PREVENT_FIRMWARE_BUILD=y
# CONFIG_FW_LOADER=m

# Block devices
# CONFIG_BLK_DEV_FD=y
# CONFIG_BLK_DEV_LOOP=y *
# CONFIG_BLK_DEV_NBD=m
# CONFIG_BLK_DEV_RAM=y *
# CONFIG_BLK_DEV_RAM_COUNT=16
# CONFIG_BLK_DEV_RAM_SIZE=4096
# CONFIG_BLK_DEV_RAM_BLOCKSIZE=1024
# CONFIG_BLK_DEV_INITRD=y *
# SCSI device support
# CONFIG_SCSI=y *
# CONFIG_SCSI_PROC_FS=y *

# SCSI support type (disk, tape, CD-ROM)
# CONFIG_BLK_DEV_SD=y *

# Network device support
# CONFIG_NETDEVICES=y
CONFIG_DUMMY=y
# Ethernet (10 or 100Mbit)
# CONFIG_NET_Ethernet=y *
CONFIG_MII=y
# Wan interfaces
# CONFIG_WAN=y
CONFIG_PPP=y
CONFIG_PPP_FILTER=y
CONFIG_PPP_ASYNC=y
CONFIG_PPP_SYNC_TTY=y
CONFIG_PPP_DEFLATE=y
CONFIG_PPP_BSDCOMP=y
CONFIG_SLIP=y
CONFIG_SLIP_COMPRESSED=y
CONFIG_SLIP_MODE_SLIP6=y
# Input device support
# CONFIG_INPUT=y
# Serial drivers
# # Non-8250 serial port support
# CONFIG_UNIX98_PTYS=y *
CONFIG_LEGACY_PTYS=y *
CONFIG_LEGACY_PTY_COUNT=256 *

# # # #
# CONFIG_RTC=y
# # I2C support
#
CONFIG_I2C=y
#
# I2C Algorithms
#
CONFIG_I2C_ALGOBIT=m
CONFIG_I2C_ALGOPCF=m
#
# SPI support
#
CONFIG_SPI=y
CONFIG_SPI_MASTER=y
#
# USB support
#
CONFIG_USB_ARCH_HAS_HCD=y
CONFIG_USB_ARCH_HAS_OHCI=y
CONFIG_USB_ARCH_HAS_EHCI=y
CONFIG_USB=y *
#
# Miscellaneous USB options
#
CONFIG_USBDEVICEFS=y *
#
# NOTE: USB_STORAGE enables SCSI, and 'SCSI disk support'
#
# may also be needed; see USB_STORAGE Help for more information
#
CONFIG_USB_STORAGE=y *
CONFIG_USB_STORAGE_FREECOM=y *
CONFIG_USB_STORAGE_ISD200=y *
CONFIG_USB_STORAGE_DPCM=y *
#
# USB Input Devices
#
CONFIG_USB_HID=y
CONFIG_USB_HIDINPUT=y
#
#
#
#
# File systems
#
CONFIG_EXT2_FS=y *
CONFIG_EXT3_FS=y
CONFIG_JBD=y
CONFIG_INOTIFY=y
CONFIG_INOTIFY_USER=y
CONFIG_DNOTIFY=y
#
# DOS/PAT/NT Filesystems
#
CONFIG_FAT_FS=y *
CONFIG_MSDOS_FS=y *
CONFIG_VFAT_FS=y *
CONFIG_FAT_DEFAULT_CODEPAGE=437 *
CONFIG_FAT_DEFAULT_IOCHARSET="iso8859-1" *
CONFIG_NTFS_FS=m
CONFIG_NTFS_RW=y

# Pseudo filesystems
#
CONFIG_PROC_FS=y *
# CONFIG_PROC_KCORE is not set
CONFIG_SYSFS=y *
CONFIG_TMPFS=y *

# Miscellaneous filesystems
#

# Network File Systems
#
CONFIG_NFS_FS=y *
CONFIG_NFS_V3=y *
CONFIG_NFSD=y *
CONFIG_NFSD_V3=y *
CONFIG_NFSD_TCP=y *
CONFIG_ROOT_NFS=y *
CONFIG_LOCKD=y *
CONFIG_LOCKD_V4=y *
CONFIG_EXPORTFS=y *
CONFIG_NFS_COMMON=y *
CONFIG_SUNRPC=y *

# Native Language Support
#
CONFIG_NLS=y
CONFIG_NLS_DEFAULT="iso8859-1" *

# Security options
# CONFIG_KEYS is not set
# CONFIG_SECURITY is not set

# Library routines
CONFIG_CRYPTO=\nCONFIG_CRYPTO_HMAC=\nCONFIG_CRYPTO_MD4=\nCONFIG_CRYPTO_MD5=\nCONFIG_CRYPTO_SHA1=\nCONFIG_CRYPTO_DES=\nCONFIG_CRYPTO_AES=\nCONFIG_CRYPTO_ARC4=

# Security options
CONFIG_DEFAULT_SECURITY_DAC=\nCONFIG_DEFAULT_SECURITY="\nCONFIG_CRYPTO=

# Crypto core or helper
CONFIG_CRYPTO_ALGAPI=\nCONFIG_CRYPTO_ALGAPI2=\nCONFIG_CRYPTO_AEAD=m\nCONFIG_CRYPTO_AEAD2=y\nCONFIG_CRYPTO_BLKCIPHER=\nCONFIG_CRYPTO_BLKCIPHER2=\nCONFIG_CRYPTO_HASH=\nCONFIG_CRYPTO_HASH2=\nCONFIG_CRYPTO_RNG=\nCONFIG_CRYPTO_RNG2=\nCONFIG_CRYPTO_PCOMP=\nCONFIG_CRYPTO_MANAGER=\nCONFIG_CRYPTO_MANAGER2=\nCONFIG_CRYPTO_WORKQUEUE=\nCONFIG_CRYPTO_AUTHENC=m

# Authenticated Encryption with Associated Data
CONFIG_CRYPTO_CCM=m\nCONFIG_CRYPTO_GCM=m\nCONFIG_CRYPTO_SEQIV=m
# # Block modes
# CONFIG_CRYPTO_CBC=y
CONFIG_CRYPTO_CTR=m
CONFIG_CRYPTO_ECB=y
CONFIG_CRYPTO_PCBC=m

# # Hash modes
# CONFIG_CRYPTO_HMAC=y *

# # Digest
# CONFIG_CRYPTO_CRC32C=m
CONFIG_CRYPTO_GHASH=m
CONFIG_CRYPTO_MD5=y
CONFIG_CRYPTO_SHA256=m

# # Ciphers
# CONFIG_CRYPTO_AES=y *

# # Compression
# CONFIG_CRYPTO_DEFLATE=m

# # Random Number Generation
# CONFIG_CRYPTO_ANSI_CPRNG=m
CONFIG_CRYPTO_HW=y

9.2.8.2 Linux Drivers

All Linux Drivers provided in the Model 2070-1C CPU shall be compliant to the latest version of the AASHTO, ITE and NEMA ATC Standard Annex B and as defined in these specifications. In case of conflict these specifications shall govern over ATC Standard.

9.2.8.2.1 GPIO

The GPIO driver allows the user to control the CPU active LED, determine if the Datakey is present, reset peripheral devices, and power down peripheral devices.

The following dev entries shall exist:
/dev/datakeypresent
/dev/cpuactive
/dev/powerdown
/dev/cpureset

int read(int filp, void *buf, int count);

This allows for reading the state of the power down pin and for reading the state of the whether the Datakey is inserted. The value passed in the count parameter must be 1 or no bytes will be read.

int write(int filp, void *buf, int count);

Allows changing the state of the CPU Active LED and the CPU reset signal. Writing a binary one to the /dev/cpuactive device shall turn on the CPU active LED and writing zero will turn off the LED.

Closes the file descriptor.

9.2.8.2.2 Timers
The Linux Kernel shall be configured to support high resolution timers by setting the CONFIG_HIGH_RES_TIMERS = y as per Section 9.2.8.1.

9.2.8.2.3 Time of Day
The Time of Day driver overrides the operating system internal time of day to utilize AC line sync pulses or square wave pulses from the RTC. The time source can be changed via an ioctl command.

The dev entry for the timer driver shall be /dev/tod. The device can be opened for read, write, or read/write.

Closes the file descriptor.

int read(int filp, void *buf, int count);
int write(int filp, void *buf, int count);

Reads / Writes the current time of day value in the following format:
YYYYMMDDHHMMSSFFF
Y = year  M = month  D = day  H = hour  M = minute  S = second  F = fraction

The fractional field shall be a value from 0 to 127 in RTC Square Wave Mode and a value from 0 to 2
* AC Line Sync Frequency - 1 in AC Line Sync Mode.

If the count passed to the read() function is greater than 18, only 18 bytes will be read. A read always
starts with the 4 byte year in ASCII decimal. If the count is less than 18, then read shall modify count
bytes in buf.

If the count passed to write() is less than 17 or the data in buf is not in the proper format, then write
shall return an error of EINVAL.
ioctl(int fd, unsigned int cmd, unsigned long param);

The ioctl function supports multiple different commands, each described separately.

These commands get and set the time and time zone atomically. The parameter to both functions is the same and defined below:

Parameter Data:

typedef struct {
    struct timeval *tv;
    int *tzsec_offset;
    int *dst_offset;
} atc_time_t

The ATC_SET command is only concerned with the 
and tzsec_offset parameters. If the tv member is non-zero and the command is ATC_SET, then the time is set according to the tv_sec and tv_usec members of the struct timeval *tv. Additionally if the tzsec_offset parameter is non-zero the time zone offset is also set. The ATC_GET command sets the data pointed to by the tv, tzsec_offset, and dst_offset for each of those members that are non-zero.

These commands get and set the time source. The time source may use AC line sync pulses or the RTC square wave output.

This command gets the current frequency that is driving the time of day clock.
This command requests a signal to be sent at each tick of the time of day clock as long as the file device remains opened. The *param* value passed to ioctl is the signal number that should be sent to the calling process at each time of day clock tick.

This releases the signal from being sent when the time of day clock ticks. If the file device is closed, the signal is automatically released.

This command requests a signal to be sent each time the time of day clock is changed by more than one tick. The *param* value passed to ioctl is the signal number that should be sent to the calling process.

This releases the signal from being sent when the time of day is changed by more than one tick. If the file device is closed, the signal is automatically released.

These commands enable and disable daylight saving time to be in effect.
9.2.8.2.4 glibc and Busybox

The Model 2070 LX shall use the GNU C Library (glibc) release v 2.23 or later. The Linux system shall use Busybox v1.22.1 or later for all Linux utilities except for those listed on Section 9.2.8.4.

9.2.8.2.5 Datakey

This driver provides full capability for manipulating Datakey devices. Datakeys of size 2Mbit and above, as listed in Section 9.2.6 of these specifications, shall be supported.

Supported Device File Operations:

- open()
- close()
- read()
- write()
- lseek()
- ioctl()

**open()**
The dev entry for the Datakey shall be /dev/datakey. The Datakey can be opened for Read, Write, or Read/Write.

Examples:

```
fd = open("/dev/datakey", O_RDONLY);
fd = open("/dev/datakey", O_WRONLY);
fd = open("/dev/datakey", O_RDWR);
```

**read()**

```
int read(int filp, void *buf, int count);
```

Reads up to `count` bytes into `buf` and returns the number of bytes read. The read occurs at the current position within the device.

*Note: The current position can be determined using the ioctl. The current position can be changed using the lseek() function.*

Possible Errors:

- ENXIO if Datakey is not present
- EBUSY if the signature changes
- EIO if end of file condition has already been reached

**write()**

```
int write(int filp, void *buf, int count);
```

Writes `count` bytes to the device at the current file position within the device. If all of the bytes specified by `count` cannot be written before the end of the device no bytes shall be written and an error shall be returned. The number of bytes written shall be returned. If the value returned is less than `count`, then the returned value of bytes was written correctly, but the remaining bytes contain errors.
In this case it is necessary to try the write again for the remaining bytes or repeat the same write again until the number of bytes returned matches the count.

Possible Errors:
- ENXIO if Datakey is not present
- EBUSY if the device signature changes (i.e. Someone switched devices really fast)
- EIO if end of file condition would occur writing the number of bytes specified.

Closes the file descriptor.

```
lseek(int fd, int pos, int type);
```

Seeks to a specified position in the device. Both absolute and relative types of seeking are supported. If relative seeking is specified the pos value may be positive or negative. If absolute seeking is specified the file position is assigned to the pos value. If seeking outside the device size is attempted an error is returned and no change to the file position takes place.

```
ioctl(int fd, unsigned int cmd, unsigned long param);
```

The ioctl function supports multiple different commands, each described separately. If the Datakey is not inserted ENXIO is returned as the error code.

```
ATC_DATAKEY_GET_FILE_POS
ATC_DATAKEY_ERASE_ALL
ATC_DATAKEY_ERASE_SECTOR
ATC_DATAKEY_READ_PROTECT_BITS
ATC_DATAKEY_WRITE_PROTECT_BITS
ATC_DATAKEY_GET_DEVICE_SIZE
ATC_DATAKEY_GET_SECTOR_SIZE
```

Returns the current file position. The param value is ignored.

```
ATC_DATAKEY_ERASE_ALL
```

Erases all data on the Datakey. The param value is ignored. Always returns 0.

Note: When data is erased, all values are read as 0xFF.
Erases all data in the sector containing the address specified by \textit{param}. Returns 0 on success or \texttt{EINVAL} on invalid address. The sector size can be determined using the appropriate \texttt{ioctl()} in order to know what address ranges will be erased by this command.

Returns the value of the protect bits directly read from the Datakey. The data format will be in accordance with the datasheet for the Datakey being used (not the same for different device sizes). This function is provided so the user can ensure that the device is not protected. The \textit{param} value is ignored.

Writes the value specified in \textit{param} directly to the Datakey protection byte. The data format varies in accordance with the datasheet for the Datakey being used. This function is provided primarily so that the user can remove protection if writing is being prevented.

Returns the size of the Datakey device in bytes. The \textit{param} value is ignored.

Returns the sector size of the Datakey in bytes. The \textit{param} value is ignored.

9.2.8.2.6 \textbf{Constants Defined by this specification}

\begin{verbatim}
#ifndef __ATC_SPXS_H
#define __ATC_SPXS_H

#define ATC_SPXS_WRITE_CONFIG   0
#define ATC_SPXS_READ_CONFIG    1
#define ATC_LKM_SP1S            1
#define ATC_LKM_SP2S            2
#define ATC_LKM_SP3S            3
#define ATC_LKM_SP5S            5
#define ATC_LKM_SP8S            8

#endif
\end{verbatim}
#define ATC_SDLC                0
#define ATC_SYNC                1
#define ATC_HDLC                2

#define ATC_B1200               0
#define ATC_B2400               1
#define ATC_B4800               2
#define ATC_B9600               3
#define ATC_B19200              4
#define ATC_B38400              5
#define ATC_B57600              6
#define ATC_B76800              7
#define ATC_B115200             8
#define ATC_B153600             9
#define ATC_B614400             10

const int ATC_B[] = { 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200, 153600, 614400 };
#ifndef __ATC_H
#define __ATC_H

// Device File Names
#define ATC_DATAKEY_DEV  "/dev/datakey"
#define ATC_GPIO_POWERDOWN_DEV  "/dev/powerdown"
#define ATC_GPIO_DATAKEY_DEV  "/dev/datakeypresent"
#define ATC_GPIO_CPUACTIVE_DEV  "/dev/cpuactive"
#define ATC_GPIO_CPURESET_DEV  "/dev/cpureset"
#define ATC_TIMING_TOD_DEV  "/dev/tod"

#define ATC_SP1  "/dev/sp1"
#define ATC_SP2  "/dev/sp2"
#define ATC_SP3  "/dev/sp3"
#define ATC_SP4  "/dev/sp4"
#define ATC_SP5  "/dev/sp5"
#define ATC_SP6  "/dev/sp6"
#define ATC_SP8  "/dev/sp8"

#define ATC_SP1S  "/dev/sp1s"
#define ATC_SP2S  "/dev/sp2s"
#define ATC_SP3S  "/dev/sp3s"
#define ATC_SP4S  "/dev/sp4s"
#define ATC_SP5S  "/dev/sp5s"
#define ATC_SP6S  "/dev/sp6s"
#define ATC_SP8S  "/dev/sp8s"

// DATAKEY IOCTL CONSTANTS
#define ATC_DATAKEY_GET_FILE_POS 3
#define ATC_DATAKEY_ERASE_ALL 6
#define ATC_DATAKEY_ERASE_SECTOR 7
#define ATC_DATAKEY_READ_PROTECT_BITS 8
#define ATC_DATAKEY_WRITE_PROTECT_BITS 9
#define ATC_DATAKEY_GET_DEVICE_SIZE 10
#define ATC_DATAKEY_GET_SECTOR_SIZE 11

// DATAKEY LSEEK CONSTANTS
#define ATC_DATAKEY_SEEK_REL 0
#define ATC_DATAKEY_SEEK_ABS 1

// Time of Day driver Definitions
#define ATC_TOD_SET_TIMESRC 1
#define ATC_TOD_GET_TIMESRC 2
#define ATC_TOD_GET_INPUT_FREQ 3
#define ATC_TOD_REQUEST_TICK_SIGNAL 5
#define ATC_TOD_CANCEL_TICK_SIGNAL 6
#define ATC_TOD_DST_ENABLE 10
#define ATC_TOD_DST_DISABLE 11
#define ATC_TOD_DST_SETINFO 12
#define ATC_TOD_DST_GETINFO 13

#define ATC_SET_TIMESRC 1
#define ATC_TIMESRC_LINESYNC 0
#define ATC_TIMESRC_RTCSQWR 1

typedef struct atc_datakey_t {
    unsigned int16 fcs;
    unsigned int8 type;
    unsigned int8 version;
    unsigned int32 latitude;
    unsigned int32 longitude;
    unsigned int16 id;
    unsigned int16 drop;
    unsigned int32 ipaddress;
    unsigned int32 subnet;
    unsigned int32 gateway;
    unsigned int8 reserved[36];
} atc_datakey;

#define atc_datakey

9.2.8.3 Linux Application Kernel

9.2.8.3.1 Boot Sysreset

The provided software shall boot Linux from SYSRESET. The entire program shall be resident in FLASH Memory. The serial port descriptors shall be configured with the defaults parameters as listed in A9-16.

The default configuration settings for the console port, /dev/sp4, shall be 115.2 kbps, no parity, 8 data bits, and 1 stop bit. The default condition of the console output shall be enabled at power up and the controller shall send any external output to /dev/sp4 during bootup.

9.2.8.3.2 Hardware Initialization

The Engine Board low-level hardware and O/S software initialization shall be completed within a maximum of 4.5 seconds from the release of STARTUP/SYSRESET as shown in A9-17. This startup time shall be measured from the release of STARTUP/SYSRESET to the turn on of the cpuactive LED using a user level program named onled.

9.2.8.3.3 Startup Procedure and initialization

The Linux boot image shall startup as described in the latest version of the AASHTO, ITE and NEMA ATC Standard Section 4.3.5.1. The boot up process shall be completed within the time period specified in Section 9.2.8.3.2 of these specifications. The Linux System shall use a scripted method for initialization compatible with SysVinit methods. Init script names shall take the form 'S' followed by a 2-digit number in the range 00-99 (giving a relative starting order), followed by the service name, e.g. "S40network". The init scripts shall reside in "/etc/init.d/". The /etc/init.d directory shall store various shell scripts which can be used for the following functions:

1. Load kernel drivers (modules).
2. Check and mount file systems.
4. Mount remote file systems (such as nfs).
5. Start web server and other services.
6. Run applications

The following syntax shall control various services:

# /etc/init.d/NAME start|stop|restart|status
OR
# /sbin/service NAME start|stop|restart|status
Where,

1. **start**: Start a service (such as Secure Shell by typing ‘services sshd start’)
2. **stop**: Stop a service (such as Secure Shell by typing ‘services sshd stop’).
3. **restart**: Restart (stop and then start) a service (such as Secure Shell by typing ‘service sshd restart’).
4. **status**: Find out whether a service is currently running or not (such as Secure Shell by typing ‘services sshd status’)

The Service Command shall be used to run a System V init scripts.

Linux startup shall be configured to auto run a script or execute Linux binary named startup residing in the USB Memory upon power up with USB Memory inserted. If there is no USB Memory inserted in the Model 2070-1C Module, Linux shall boot normally.

### 9.2.8.4 Linux Utilities

The following Linux utilities shall be provided resident in the Model 2070-1C CPU Module:

- onled
- cpureset
- fl
- vi
- bash

The Model 2070LX shall use the GNU Bash v4.3.33 or later as the default Linux shell.

ONLED (onled) program shall be provided in the /bin directory. The onled program shall be a Linux binary and shall toggle the cpuactive LED when executed.

The onled, cpureset and fl utilities shall be resident in the /usr/bin directory per the FHS-3.0 as reference in section 9.2.8.8.

### 9.2.8.5 Linux Ver

A **Ver** utility and a Dynamically Linked “Shared Object” Library, libbootid.so shall be provided as part of the Linux Image. The library shall be resident in the /usr/lib directory. The Ver utility shall be used to display the contents of a shared memory library libbootid.so:

* Controller’s Manufacturer Name
* CPU Module Type
* TEES Conformance Version
* ATC Std Version
* System Image Version
* System Image Build Date
The Shared Object library shall contain the *bootid_body* structure, and shall be readable by all applications.

The **Ver** utility shall have the following required options with the listed functions. Additional manufacturer-specific options are permitted.

- `-a` shall display **All** the information from the *bootid_body* structure in shared memory; this is the default if no command options are given
- `-c` shall display the **CPU** module type, Example “2070-1C”
- `-d` shall display the build **Date** of the system image in ISO 8601 extended format: `yyyy-mm-dd`
- `-m` shall display the **Manufacturer's name**
- `-s` shall display the **ATC Standard Version**
- `-t` shall display the applicable **TEES** conformance document in the format: **TEES yyyy[ En]**, where `yyyy` is the year of the TEES and `n` is the Errata number, if applicable; examples: "TEES 2009", "TEES 2009 E3"
- `-v` shall display the **Version** of the system
- `-h` shall display a command **Help** message
The C header file bootid.h shall be as follows:

/* bootid.h */

#ifndef _BOOTID_H
#define _BOOTID_H

typedef struct _BootId_t
{
    char *mfgname;       /* Manufacturer Name */
    char *cpumoduletype; /* CPU Module Type */
    char *teesrelease;   /* TEES Release */
    char *atcstdversion; /* ATC Std Version */
    char *imagebuilddate; /* Image Build Date */
    unsigned short majv;  /* Major Version */
    unsigned short minv;  /* Minor Version */
    unsigned short sv1;   /* Sub-Version 1 */
    unsigned short sv2;   /* Sub-Version 2 */
    unsigned short sv3;   /* Sub-Version 3 */
    unsigned short dv;    /* Development Version */
} const BootId_t;

extern BootId_t* get_boot_id(void);

#endif /*_BOOTID_H */

The default output of Ver:

Manufacturer Name: Company X
CPU Module Type:  2070-1C
TEES Release:    TEES 2009 Erratum 3
ATC Std Version: Std 6.31
Image Build Version: 1.1.1.1.14.1
Image Build Date:  June 30 2018

The Ver usage information shall be as follows:

Usage: ver [options] Options:
-a All information (default)
-c CPU module type
-d Date of system image
-m Manufacturer name
-s ATC Standard Version
-t TEES release
-v  Version of system image
-h  This Help message
Usage Examples

Usage help:
[admin]$ Ver -h

Usage: Ver [options]
Options:
- a All information (default)
- c CPU module type
- d Date of system image
- m Manufacturer name
- s ATC Std Version
- t TEES release compliance
- v Version of system image
- h This help message

Run with specific information flags: [admin]$ Ver -mvd
Company X
1.4.0.0.0.0
2016-08-01

9.2.8.6 Linux cpuinfo

In addition to the default parameters, the following configurable information shall be provided in the content of the /proc/cpuinfo file:

Platform : ATC Engine Board
Model : MPCXXXX, PXXXX, or TXXXX

Where XXXX is the Model number of the MPC or the QorIQ processor family.
Example: MPC8340

9.2.8.7 Linux Network Requirements

The following Network utilities not listed under FHS-3.0 shall be provided resident in the Model 2070-1C CPU Module:

arp, ifconfig, netstat, ping, showmount, ntpdate, ntpq, ntptime ntp-wait, and rpcinfo

Full support for NFS and shall have the following daemons resident:

rpc.mountd, and rpc.nfsd
Full support for OpenSSH 7.6 or later and shall have the following daemons and utilities resident:

ssh, scp, sftp, ssh-add, ssh-keysign, ssh-keyscan, ssh-keygen,
sshd, sftp-server and ssh-agent.

Full support for VSFTP in addition to sftp-server and shall have the following daemons resident:

vsftpd release v3.0.3

Full support for NTP and shall have the following daemons resident:

ntpd and ntdpc

9.2.8.8 Linux File System
The Model 2070-1C CPU Module Linux File System Configuration shall meet the requirements and guidelines for files, directories and utility commands as per the Filesystem Hierarchy Standard (FHS-3.0) dated March 15, 2015. The Linux Kernel shall be configured to use the Unsorted Block Image File System (UBIFS).

9.2.9 Re-Flash Utility
A Utility Program shall be provided that would allow the user to upgrade (re-flash) the Boot Image for the Model 2070-1A and E CPU as defined in section 9.2.7. This utility shall provide the capabilities for upgrading the Operating System and drivers when available by the manufacturer. The Utility Program shall provide the capability for the user to dynamically upgrade the Boot Image via the command prompt. The contractor shall also provide a copy in CD-ROM Memory of all files originally stored in the flash drive /f0 so that they can be reloaded as needed.

9.2.10 Communications Loading Test
The Model 2070 Controller using the Model 2070-1A and 1E CPU shall pass a Communications Loading Test consisting of Serial and Network Communications. The test shall run Sp1, Sp2, Sp3, and Sp8 at 9600 bytes per second in a continuous full duplex asynchronous/synchronous communications loop with the network stack initialized and a telnet session established for each port with standard out, in and standard error directed to the telnet session port. The test shall not exceed a maximum CPU load of 30% during test
duration of 96 hours for Model 2070 -1E Module. The controller using Model -1C Module shall have a maximum CPU load of 10% for the above test and shall meet all test requirements as defined in Section 8.1.1 of the latest ATC Standard.

9.2.11 Diagnostic Acceptance Test (DAT)
The standard Caltrans DAT Program shall be provided resident in the 2070 Unit as the application program.

9.2.12 QPL or Purchasing Agency
Source and object Software shall be provided to the QPL or Purchasing Agency on both document listing and CD-ROM Memory. It shall provide user descriptions of test logic and reports. The Agency shall possess non- exclusive rights to this program suite.

9.2.13 Deliverables

9.2.13.1 Copies Delivery
Two copies of the following items will be provided to the purchasing AGENCY on a CD disk readable by a PC compatible computer.
1. Specific hardware memory addresses, including FLASH, SRAM, and DRAM starting addresses, shall be specified and provided. Written documentation of addresses shall be in PDF form and will have the file name of “Memory Map.pdf”
2. Copies of the vendor kernel, platform drivers and OS-9 utility executable modules.
3. Copy of all provided written manuals in PDF form.
4. RE-FLASH Utility and the procedures for its use in PDF form. The PDF documentation of the procedures shall have the file name of “Reflash Utility Procedures.pdf”.

9.2.13.2 Software Delivery
All Linux Software, except for loadable modules, shall be compliant to the GPL 2.0/3.0 license as published by the Free Software Foundation.
CHAPTER 10-SECTION 5
MODEL 2070-6W WIRELESS MODEM COMM MODULE

10.5.1 Model 2070-6W Wireless Modem

The Model 2070-6W Wireless Modem shall provide two EIA-485/ EIA-232
Asynchronous communications channels. The Model 2070-6W Wireless Modem shall be
a 2070 plug-in module with EIA-232 activity LEDs on the front edge. The Model 2070-
6W Wireless Modem shall convert EIA-485 data to frequency hopping spread spectrum
data.

10.5.2 Circuits

Two circuits, designated Circuits #1 and Circuits #2, shall be provided. Both circuits
functions shall be identical, except for Circuit #1 which shall be routed to a Spread
Spectrum Radio and Circuit #2 shall route directly to the front panel’s DB-9 connector.
Each circuit shall provide full isolation from the Model 2070 Motherboard.
Line drivers/receivers shall be socket or surface mounted.

The Model 2070-6W Wireless Modem’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, whichever is less. The EIA-232 drivers to the external connectors must be
capable of supporting a minimum of 115,200 bits per second.

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.

10.5.3 Mechanical/Electrical Requirements

The Model 2070-6W Wireless Modem shall be designed to fit in a single slot of a Model
2070 Controller.

The Model 2070-6W Wireless Modem shall be provided with LED indicators for as
shown in detail A10-5 of these specifications.

The User Serial port shall be a DB9 Female connector accessible from the front and shall
be used to configure the Spread Spectrum Radio and as Serial Port Com2.

The Model 2070-6W Wireless Modem shall be powered direct from the 2070
Controller’s edge connector.

The Model 2070-6W Wireless Modem shall have a MTBF of over 60,000 hours.
10.5.4 **Functional Requirements.**

The Card Edge (EIA-485) and the Serial Ports front panel connector (EIA-232) shall operate Asynchronous communications and shall encompass all ITS standard rates of 1200 bps, 2400 bps, 9600 bps, 19.2 Kbps, 38.4 Kbps, 56 Kbps and 115.2 Kbps.

10.5.5 **Local Mode**

The Model 2070-6W Wireless Modem shall be provided with a switch allowing the user to switch Com 2 into local mode. Local mode shall allow the user to perform modem configuration on the Spread Spectrum Radio. On non-local mode, Com 2 shall meet the requirements as specified for the Model 2070-7A Module as specified elsewhere in these specifications.

10.5.6 **Spread Spectrum Radio**

The Model 2070-6W Wireless Modem shall meet the following Spread Spectrum Radio requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency Range</strong></td>
<td>902-928 MHz</td>
</tr>
<tr>
<td><strong>Output Power</strong></td>
<td>100mW to 1000mW</td>
</tr>
<tr>
<td><strong>Software Programmable</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Min Hop Patterns</strong></td>
<td>Based on Network Address, &gt; 4 Million</td>
</tr>
<tr>
<td><strong>Number of RF Channels</strong></td>
<td>90</td>
</tr>
<tr>
<td><strong>RF Channel Spacing</strong></td>
<td>280KHz</td>
</tr>
<tr>
<td><strong>Error Checking</strong></td>
<td>32Bit-CRC</td>
</tr>
<tr>
<td><strong>Encryption</strong></td>
<td>128 Bit, AES Encryption</td>
</tr>
<tr>
<td><strong>Receiver Sensitivity/BER</strong></td>
<td>-108dBm @ 10-6 BER</td>
</tr>
<tr>
<td><strong>System Gain</strong></td>
<td>36dBm</td>
</tr>
<tr>
<td><strong>Antenna Port</strong></td>
<td>RP TNC-F</td>
</tr>
<tr>
<td><strong>Certification</strong></td>
<td>FCC Approved</td>
</tr>
<tr>
<td><strong>Operation Mode</strong></td>
<td>Transceiver</td>
</tr>
<tr>
<td><strong>Error Correction</strong></td>
<td>Forward Error Correction</td>
</tr>
<tr>
<td><strong>System Configuration</strong></td>
<td>Point-to-Point, Point-to-Multipoint</td>
</tr>
</tbody>
</table>
10.5.7 **Modem Configuration**

The Model 2070-6W shall be configurable as a master, repeater or slave using the AT command set.

The modems shall have the default configuration as set as a slave with the following S-Register Parameters (AT&V):

| &F2 |
|---|---|---|
| E1 DCD &C1 DTR &D0 Handshaking &K0 DSR &S1 |
| Operating Mode | S101=2 | Serial Baud Rate | S102=7 |
| Wireless Link Rate | S103=2 | Network Address | S104=1234567890 |
| Unit Address | S105=2 | Static Mask | S107=0 |
| Output Power (dBm) | S108=30 | Output Power (dBm) | S108=30 |
| Packet Retransmissions | S113=5 | Data Format | S110=1 |
| Repeat Interval | S115=3 | Character Timeout, ms | S116=2 |
| Average RSSI value (dBm) | S123=-255 | Destination Address | S140=1 |
| Serial Channel Mode | S142=0 | Protocol Type | S217=0 |
| Roaming | S118=1 | Fast Sync Timeout, hops | S151=100 |
| Sleep Mode | S143=0 | Sync mode | S150=0 |
| Network Type | S133=0 | Address Tag | S153=0 |
| Sync Timeout | S248=512 | FEC Mode | S158=0 |

10.5.8 **Data Interfaces**

Channel 1 and 2 Model 2070 Card Edge Connector

User Serial Port EIA-232 (DB9 Female)

10.5.9 **LED Indicators**
TXD  Green or Red: DTE Transmit EIA-232 Data
RXD  Green or Red: DTE Receive EIA-232 Data

Multiple Mini-LEDs indicating Field Strength.

10.5.10  Power Requirements

The power requirements of the Model 2070-6W Wireless Modem shall be within the
power limitations of the Model 2070 UNIT as describe elsewhere in this specification.

10.5.11  Environmental

The Model 2070-6W Wireless Modem shall operate within the specifications listed in
Chapter 1 Section 1.8.4.

10.5.12  Form Factor

See A10-5 Details
CHAPTER 10-SECTION 11
MODEL 2070-WE WIRELESS ETHERNET COMM MODULE

10.11.1 Model 2070-WE Wireless Ethernet Communications Module

The Model 2070-WE Wireless Ethernet Communications Module shall provide a channel for Ethernet communications over wireless between the Model 2070 controller and other remote controllers/network devices. A second channel shall be provided for serial communications from and to the Model 2070 controller. The Model 2070-WE Wireless Ethernet Communications Module shall be a 2070 plug-in module. The Model 2070-WE Wireless Ethernet Communications Module shall convert Ethernet data to frequency hopping spread spectrum data.

10.11.2 Channels

The two Channels shall be designated as Comm 1 and Comm 2. Comm 1 shall be routed, via magnetic, to the integrated switch in the Model 2070 controller. Comm 1 shall be used for Ethernet communications over Spread Spectrum Radio. Comm 1 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.

Comm 2 shall route directly to the front panel’s DB-9 connector. Comm 2 circuit shall provide full isolation from the Model 2070 Motherboard.

Line drivers/receivers shall be socket or surface mounted.

The Model 2070-WE Wireless Ethernet Communications Module’s Comm 2 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, whichever is less. The EIA-232 drivers to the external connectors must be capable of supporting a minimum of 115,200 bits per second.

The channel shall convert its EIA-485 signal lines (RX, TX, RTS, CTS and DCD) to/from board TTL Level Signals; isolate both signal and ground.

10.11.3 Mechanical/Electrical Requirements
The Model 2070-WE Wireless Ethernet Communications Module shall be designed to fit in a single slot of a Model 2070 Controller.

The Model 2070-WE Wireless Ethernet Communications Module shall be provided with LED indicators for as shown in detail A10-11 of these specifications.

The Comm 2 port shall be a DB9 Female connector accessible from the front and maybe be used to configure the Spread Spectrum Radio.

The Model 2070-WE Wireless Ethernet Communications Module shall be powered direct from the 2070 Controller’s edge connector.

The Model 2070-WE Wireless Ethernet Communications Module shall have a MTBF of over 60,000 hours.

10.11.4 **Functional Requirements.**

The Card Edge (EIA-485) and the Serial Ports front panel connector (EIA-232) shall operate Asynchronous communications and shall encompass all ITS standard rates of 1200 bps, 2400 bps, 9600 bps, 19.2 Kbps, 38.4 Kbps, 56 Kbps and 115.2 Kbps.

10.11.5 **Local Mode**

The Model 2070-WE Wireless Ethernet Communications Module shall be provided with a switch allowing the user to switch Comm 2 into local mode. Local mode shall allow the user to perform Ethernet configurations on the Spread Spectrum Radio. On non-local mode, Comm 2 shall meet the requirements as specified for the Model 2070-7A Module as specified elsewhere in these specifications.

10.11.6 **Spread Spectrum Radio**

The Model 2070-WE Wireless Ethernet Communications Module shall meet the following Spread Spectrum Radio requirements:

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>902-928 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Power</td>
<td>100mW to 1000mW</td>
</tr>
<tr>
<td>Software Programmable</td>
<td>Yes</td>
</tr>
<tr>
<td>Min Hop Patterns</td>
<td>Based on Network Address</td>
</tr>
<tr>
<td></td>
<td>(&gt; 4 Million)</td>
</tr>
<tr>
<td>Number of RF Channels</td>
<td>90</td>
</tr>
<tr>
<td>RF Channel Spacing</td>
<td>280KHz</td>
</tr>
<tr>
<td>Error Checking</td>
<td>32Bit-CRC</td>
</tr>
<tr>
<td>Encryption</td>
<td>128 Bit, AES Encryption</td>
</tr>
<tr>
<td>Receiver Sensitivity/BER</td>
<td>-108 dBm/BER=10-6</td>
</tr>
<tr>
<td>System Gain</td>
<td>36 dBm</td>
</tr>
<tr>
<td>Antenna Port</td>
<td>RP TNC-F</td>
</tr>
</tbody>
</table>
10.11.7 Ethernet Communications Module Configuration

The Model 2070-WE shall be configurable as a master, repeater or slave using the Ethernet Web Interface.

10.11.8 Ethernet Web Interface

The Model 2070-WE shall support the following features:

Provide TCP and UDP over IP protocol communications.

Subnet masks for Class A, B, and C networks (See Table Below):

<table>
<thead>
<tr>
<th>Network Class</th>
<th>Host BITS</th>
<th>Subnet Mask</th>
<th>Example IP Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>24</td>
<td>255.0.0.0.0</td>
<td>10.0.0.100</td>
</tr>
<tr>
<td>B</td>
<td>16</td>
<td>255.255.0.0</td>
<td>172.31.0.100</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>255.255.255.0</td>
<td>192.168.0.100</td>
</tr>
</tbody>
</table>

The Model 2070-WE shall be provided with Web-Based-Interface (WBI). The WBI shall allow the user to set Network Configuration Parameters and all system configurations using a Web Browser.

As a minimum a user shall be able to do the following via the Web Browser:

1. System Configuration
2. Network Configuration
3. Radio Configuration
4. Security Configuration
5. Comm Port Configuration
6. Network Status
The Model 2070-WE shall have a default IP Address of 192.168.11.51, Subnet Mask as 255.255.255.0 with username as "admin" and password as "user".

10.11.9 **Data Interfaces**

Channel 1 and 2  Model 2070 Card Edge Connector

User Serial Port  EIA-232 (DB9 Female)

10.11.10 **LED Indicators**

TXD  Green or Red: DTE Transmit EIA-232 Data

RXD  Green or Red: DTE Receive EIA-232 Data

Multiple Mini-LEDs indicating Field Strength.

10.11.11 **Power Requirements**

The power requirements of the Model 2070-WE Wireless Ethernet Communications Module shall be within the power limitations of the Model 2070 UNIT as describe elsewhere in this specification.

10.11.12 **Environmental**

The Model 2070-WE Wireless Ethernet Communications Module shall operate within the specifications listed in Chapter 1 Section 1.8.4.

10.11.13 **Form Factor**

See A10-11 Details
CHAPTER 10-SECTION 12
MODEL 2070-J ETHERNET JACK MODULE

10.12.1 Model 2070-J Ethernet Jack Module

The Model 2070-J Ethernet Jack Module shall provide an interface for Ethernet communications to the Model 2070 controller via the Motherboard. The Model 2070-J Module shall function as an extended third Ethernet port for the Model 2070-1E/IC CPU.

10.12.2 Channels

The Model 2070-J’s RJ-45 Jack and Network Magnetics shall interface with the Network Lines, NetP5 TX+, TX-, RX+ and RX- respectively of the Model 2070 controller.

10.12.3 Mechanical/Electrical Requirements

The Model 2070-J Module shall be designed to fit in a single slot of a Model 2070 Controller.

10.12.4 Power Requirements

The power requirements of the Model 2070-j Module shall be within the power limitations of the Model 2070 Unit as describe elsewhere in this specification.

10.12.5 Environmental

The Model 2070-J Module shall operate within the specifications listed in Chapter 1 Section 1.8.4.

10.12.6 Form Factor

See A10-12 Details
11.1.1 2070 / NEMA Standard Controller Units
This specification covers two versions of 2070 / NEMA Standard Controller Units. The versions associate with NEMA TS1/TS2 Type 2 and NEMA TS2 Type 1 Standards. They are as follows:

Model 2070 (E or LX) N1 Controller Unit (TS1/TS2 Type 2)
Model 2070 (E or LX) N2 Controller Unit (TS2 Type-1)

11.1.2 N1 Unit Consisting
The Model 2070 (E or LX) N1 Controller Unit consists of:

Unit Chassis
2070-1E or 1C CPU Module
2070-2C Field I/O Module
2070-3B Front Panel Module
2070-4NA Power Supply Module
2070-5 VME Cage Assembly, if required
2070-8 Field I/O Module

11.1.3 N2 Unit Consisting
The MODEL 2070 (E or LX) N2 CONTROLLER UNIT consists of:

Unit Chassis
2070-1E or 1C CPU Module
2070-2N Field I/O Module
2070-3B Front Panel Module
2070-4N (A or B) Power Supply Module
2070-5 VME Cage Assembly, if required

11.1.4 Address
The Serial Port 5 Frame Address for 2070-2N and 2070-8 shall be “20”.

CHAPTER 11-SECTION 1
NEMA 2070
CHAPTER 11-SECTION 2
2N FIELD IO MODULE

11.2.1 2070-2N Field I/O Module
The 2070-2N Field I/O Module provides a TS2 Type 1 compatible SDLC interface via 2070 Serial Port 3, AC Power to the 2070 Unit and Fault Monitor LOGIC Output via SP5 on output O78 (similar to the 2070-8) to the NEMA TS2 Malfunction Management Unit (MMU). The communications timeout operation shall function in a manner similar to the 2070-8 (see sections 11.4.11.6 and 11.4.11.7 for details).

11.2.2 Requirements Exceptions
The Module shall meet the 2070–2E+ Module Requirements with the following exceptions:
- No C1, C11 and C12 Connectors on the front panel of the module
- No 64 inputs / 64 outputs requirements
- Serial Port 5 routed to the FCU MPU Device only
- Serial Port 3 shall not have a disabling switch
- No Watchdog output
- No Muzzle Shunt

11.2.3 Types
The module shall be a 4X type board/front panel with three connectors. The connectors are 10 Pin Connector A, a NEMA 5-15 Receptacle and a Port 1 DA-15S connector labeled as either “C15S” or “Port 1”. The Port 1 (C15S) connector shall be a 15 pin metal shell DA-15 connector with female contacts. The connector shall be equipped with latching blocks and shall intermate with a 15 pin D type connector, Amp Incorporated part number 205206-1, or equivalent, which is equipped with spring latches, Amp Incorporated part number 745012-1, or equivalent.

11.2.4 Power
Incoming 2070 AC Power is derived from Connector A Pin C (AC+), Pin A (AC-), and Pin H (Equipment Ground). The power is directly routed to the NEMA 5-15 Receptacle with equipment ground also connected to the face plate. Connector A shall intermate with a NEMA TS2 Type 1 (MS3106(-18-1S) cable.

11.2.5 Isolation
The module shall isolate 2070 Serial Port 3 from the A3 Connector and reconvert the lines to external EIA 485 drivers/receivers which shall be terminated at C15S Connector. The Port shall be clocked at 153.6 Kbps.

11.2.6 FCU Output
An FCU output shall drive an open collector transistor whose output shall be routed to Connector A Pin F for use as a FAULT MONITOR Output. The transistor shall be capable of sinking 200 mA at 30 VDC.

11.2.7 Connectors A, C15S pin out and functions
Connectors A and C15S pin-out and functions are as follows:

**CONNECTOR A**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>AC Neutral</td>
<td>E</td>
<td>NA</td>
<td>I</td>
<td>NA</td>
</tr>
<tr>
<td>B</td>
<td>NA</td>
<td>F</td>
<td>Fault Monitor</td>
<td>J</td>
<td>NA</td>
</tr>
<tr>
<td>C</td>
<td>AC Line</td>
<td>G</td>
<td>DCG #2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>NA</td>
<td>H</td>
<td>EG (Equip Ground)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONNECTOR C15S:**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SP3TXD+</td>
<td>6</td>
<td>DCG #2</td>
<td>11</td>
<td>SP3TXC-</td>
</tr>
<tr>
<td>2</td>
<td>DCG #2</td>
<td>7</td>
<td>SP3RXC+</td>
<td>12</td>
<td>EG (Equip Ground)</td>
</tr>
<tr>
<td>3</td>
<td>SP3TXC+</td>
<td>8</td>
<td>DCG #2</td>
<td>13</td>
<td>SP3RXD-</td>
</tr>
<tr>
<td>4</td>
<td>DCG #2</td>
<td>9</td>
<td>SP3TXD-</td>
<td>14</td>
<td>NA</td>
</tr>
<tr>
<td>5</td>
<td>SP3RXD+</td>
<td>10</td>
<td>Port 1 Disable</td>
<td>15</td>
<td>SP3RXC-</td>
</tr>
</tbody>
</table>

**11.2.8 Serial Port 3**

Serial Port 3 shall control the TS2 BIU Units using SDLC Protocol that meets the NEMA TS2 Type 1 Frame Command / Response Standards. SP3DCD shall be allocated to Port 1 Disable where 0 VDC input on C15S pin 10 equals DCD inactive (False). SP3DCD shall be opto-isolated from Port 1 Disable.
CHAPTER 11-SECTION 3
4N (A) POWER SUPPLY MODULE

11.3.1 2070-4N Power Supply Module
The 2070-4N Power Supply Module supports the NEMA TS 1 and TS2 Standards. The module is identical to the 2070-4A Power Supply Requirements except for the following:

The power cord shall have a 15 inch ± 1-inch length as measured from the panel to the plug tips.

The AC Power Fail voltage shall be 85VAC ±2VAC.

The AC Power Restore voltage shall be 90VAC ±2VAC.

The 2070-4N (A) power supply shall have proper marking Example “2070 4N (A)”. A permanent sticker shall be an acceptable marking method.
CHAPTER 11-SECTION 4
MODEL 2070-8 FIELD I/O MODULE

11.4.1 **Module Consisting**
The Module shall consist of the Module Chassis, Module Power Supply, FCU Controller, Parallel Input/Output Ports, Serial Communications Circuits and Module Connectors. The Module CHASSIS shall be made of 0.06 in. minimum aluminum sheet and treated with clear chromate. All external screws, except where called out, shall be countersunk and shall be Phillips flat head stainless steel. The matching nuts shall be permanently captive on the mating surfaces.

11.4.2 **Module Front Panel**
The Module Front Panel shall be furnished with the following:

1. **ON/OFF POWER Switch** mounted vertically with ON in the UP position.

2. **LED DC Power Indicator.** The indicator shall indicate that the required +5 VDC is within 3% and the +24 VDC is within 8%.

3. **Incoming VAC fuse protection.**

4. Two DB-25S COMM connectors labeled "EX1" & "EX2."

5. Four NEMA Connectors A, B, C, & D.

11.4.3 **Label**
A permanent Label shall be affixed to the Front Panel. The label shall display the unit's serial number. The number shall be permanent and easy to read.

11.4.4 **Module Power Supply**
A Module Power Supply shall be provided and located on the right side of the module as viewed from the front. The supply shall provide the necessary module internal circuitry DC power plus 2.0 Amperes minimum of +24 VDC for external logic, detector inputs, and output load control. The supply shall meet the following requirements:

- **Input Protection**
  - Specification 9.5.3 Input Protection

- **Power Supply Requirements**
  - The Power Supply shall meet the specification as listed in Section 9.5.6 Power Supply.

- **Tolerances**
  - DC Voltage tolerances shall be ±3% for 5 VDC and ±8% for 24 VDC.

11.4.5 **Incoming AC Power**
The supplied Incoming AC Power shall be derived from Connector A Pins "p" (AC+) and "U" (AC Neutral). External +24 VDC shall be at Connector A, Pin "B" and Connector D Pin "NN." AC Power for the 2070 receptacle shall be tapped off from the secondary side of the ON Switch / Fuse configuration.

11.4.6 **Module PC Boards**
All Module PC Boards shall be mounted vertically.

11.4.7 **POWERDOWN, NRESET, and LINESYNC**
POWERDOWN, NRESET, and LINESYNC are incoming EIA-485 differential signals and shall be routed to the module via C12S Connector. The state of the module output ports at the time of POWERDOWN transition to LOW State and until NRESET goes HIGH shall be an open circuit.

11.4.8 Requirements
The Module shall meet all requirements under CHAPTER 9 SECTION 3 with the following exceptions:

11.4.8.1 Parallel Ports
118 Bits of Input and 102 bits of Output shall be provided. Specification for inputs applies except the voltage is +24 in lieu of +12, Ground False ("0") exceeds 16.0 VDC, and Ground True ("1") is less than 8.0 VDC.

11.4.8.2 Serial Communication Circuitry
The module shall interface with the 2070-2B Field I/O module via HAR 1 Harness meeting EIA-485 Requirements. HAR 1 Harness shall be 23 lines minimum with a C12P Connector on one end and soldered with strain relief on the other. In addition to SP5 being routed to the FCU Controller interface, the SP3 EIA-485 Signal lines shall be routed only to the EX1 Connector.

11.4.9 EIA-232 Serial Port
An EIA-232 Serial Port on the FCU shall be provided with baud rate selection by Shunt of 0.3, 1.2, 2.4, 4.8, 9.6, 19.2, & 38.4 Kbps asynchronous and shall be connected at EX1 Connector. This hardware is provided for future expansion capability and its use/protocol is currently undefined.

11.4.10 HAR 2 Harness
A 22-line minimum HAR 2 Harness shall be provided between EX2 Connector and Model 2070-6 Serial COMM Module in the 2070 UNIT. This provides two Modems or EIA-232 Interfaces between the 2070 UNIT and the outside world. The two EG (Equipment Ground) lines within HAR 2 shall be connected between EX2 and the 2070-8 module chassis.

11.4.11 Fault and Voltage Monitor Circuitry
NEMA TS1 Controller Fault and Voltage Monitor functions (outputs to cabinet monitor) shall be provided.

11.4.11.1 OR Gates
Conceptually, two 3-input OR gates shall be provided. The gate 1 output shall be connected to Connector A, Pin A (Fault Monitor) and gate 2 output shall be connected to Connector A, Pin C. Any False state input shall cause a gate output False (+24VDC) state.

11.4.11.2 FCU Output O78
The FCU output O78 shall normally change its state every 100 ms. A module Watchdog circuit shall monitor the output. No state change for 2 ±0.1 seconds shall cause the circuit output to generate a FALSE (+24 VDC) output (input to gates 1 and 2). Should the FCU begin changing state, the Watchdog output shall return to TRUE (0 VDC) state.

11.4.11.3 Operation
The module shall have a +5 VDC monitoring circuit which monitors the module’s +5 VDC (±0.25). If the voltage exceeds the limits, the circuit output shall generate a False output (input to gates 1 and 2). Normal operation shall return the output state to TRUE state.

11.4.11.4 Microprocessor Output
The FCU microprocessor output shall be assigned to FAULT Monitor (input to gate 1) and another output shall be assigned to VOLTAGE Monitor (input to gate 2).

11.4.11.5 **Message Outputs**

CPU Port 5 Set Output Command Message Outputs O78 and O79 shall be assigned to FAULT (O78) and VOLTAGE (O79). The bit logic state “1” shall be FCU output FALSE.

11.4.11.6 **CPU / FCU Operations**

CPU / FCU operation at POWER UP shall be as follows:

1. FCU Comm Loss Flag set. FAULT and VOLTAGE MONITOR outputs set to FALSE state.
2. CPU REQUEST MODULE STATUS COMMAND Message with “E” bit set is sent to FCU to clear Comm Loss Flag and FCU responds to CPU with “E” bit reset.
3. Before the Comm Loss timer expires, the SET OUTPUT COMMAND data must be sent. In that data, the 078 and 079 logically set to “0” will cause the FCU microprocessor port pins assigned for FM and VM outputs to go to their TRUE state. At this point, the signal outputs defined in the message will be permitted at the output connectors. Any number of other messages may be sent between the MODULE STATUS COMMAND and SET OUTPUTS COMMAND.
4. * If the above message sequence is not followed, Comm Loss Flag shall be set (or remain) and VM & FM shall retain the FALSE output state.
5. Performs items 2 & 3 above User Software.

11.4.11.7 **CPU / FCU Communications**

A CPU / FCU Communications Loss during normal operation shall cause all outputs to go blank (FALSE state) and shall set the Comm. Loss Flag. FM and VM outputs shall be in FALSE state.
CHAPTER 11-SECTION 5
2070N1 DETAILS

11.5.1 Front View  
11.5.2 Side View  
11.5.3 ISO View  
11.5.4 2070-8 Field I/O Module, Connector A & B  
11.5.5 2070-8 Field I/O Module, Connector C & D  
11.5.6 2070-8 Field I/O Module, EX1 & EX2 Connectors  
11.5.7 2070-2N Field I/O Module  

*Notes: Module sheet metal tolerance shall be 0.015 inch or less.
CHAPTER 12
REFER TO GREEN TECHNOLOGY BATTERY BACKUP SYSTEM SPECIFICATIONS
CHAPTER 13
REFER TO MODEL 700 CHANGEABLE MESSAGE SPECIFICATIONS
APPENDIX A
CHAPTER DETAILS
<table>
<thead>
<tr>
<th>Component</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 200 Switch Pack, 204 &amp; 205 CONNECTOR DETAILS</td>
<td>A3-1</td>
</tr>
<tr>
<td>Model 208 T170 Monitor Units</td>
<td>A3-2</td>
</tr>
<tr>
<td>Model 210 T170 Monitor Unit</td>
<td>A3-3</td>
</tr>
<tr>
<td>Model 210 T170 Monitor Unit</td>
<td>A3-4</td>
</tr>
<tr>
<td>Programming Card Connector &amp; Wiring Assignments</td>
<td></td>
</tr>
<tr>
<td>C2 Modem Harness</td>
<td>A3-5</td>
</tr>
<tr>
<td>Model 206L Power Supply</td>
<td>A3-6</td>
</tr>
<tr>
<td>C11 Harness</td>
<td>A3-7</td>
</tr>
<tr>
<td>C2 Serial Harness</td>
<td>A3-8</td>
</tr>
<tr>
<td>C1 Harness</td>
<td>A3-9</td>
</tr>
<tr>
<td>Model 206LS Power Supply</td>
<td>A3-10</td>
</tr>
<tr>
<td>Model 280 Input File Ethernet Switch Unit</td>
<td>A3-11</td>
</tr>
<tr>
<td>C16 Railroad Harness</td>
<td>A3-12</td>
</tr>
<tr>
<td>Model 206E Power Supply</td>
<td>A3-13</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. Front Panel shall be aluminum stock or stainless steel.
3. All dimensions shown are in inches.

**PLUG CONNECTOR LIST**

MODEL 200 - BEAU P-5412-LAB (Or Equivalent)
MODEL 204 - BEAU P-5406-LAB (Or Equivalent)
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 fabricate of 0.18 to 0.26 in diameter, Aluminum stock to form a handle.
2. Front panel shall be Aluminum stock or Stainless Steel.
3. All dimensions shall be in inches.
NOTES: (FOR DETAILS A3–3 & A3–4):

1. "U" shape rod handle shall be fabricated of 0.18in to 0.26 diameter Aluminum stock or Stainless Steel to form a handle.
2. Model 210 tolerance dimensions are +/− 0.02 in except as noted.
3. Sheet definitions:
   − = Slotted for keying.
   (C) = Collector
   (E) = Emitter
   * = NA for these connections on models 232 & 242.
4. All dimensions shown are in inches.
C2 MODEM HARNESS

C2P CONNECTOR ASSIGNMENT

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

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.

TITLE:
C2 MODEM HARNESS
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 module from panel shall be 1.25±0.125.
2. The power supply module dimension, from front panel to connector plug, shall be 7.375 ±0.000, -0.125.
3. A standard 8-32 metal stud retaining screw shall provide proper securing of the power supply when installed in the PDA using washers and a wingnut.
4. Connector BEAU P-5406 or equivalent.
5. Front panel shall be Aluminum stock or Stainless Steel.
6. All dimensions shown are in inches.
### C11P PIN ASSIGNMENT & LABELS

<table>
<thead>
<tr>
<th>PIN</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIN 1</td>
<td>08–1</td>
</tr>
<tr>
<td>PIN 2</td>
<td>08–2</td>
</tr>
<tr>
<td>PIN 3</td>
<td>08–3</td>
</tr>
<tr>
<td>PIN 4</td>
<td>08–4</td>
</tr>
<tr>
<td>PIN 5</td>
<td>08–5</td>
</tr>
<tr>
<td>PIN 6</td>
<td>08–6</td>
</tr>
<tr>
<td>PIN 7</td>
<td>08–7</td>
</tr>
<tr>
<td>PIN 8</td>
<td>08–8</td>
</tr>
<tr>
<td>PIN 9</td>
<td>DCG #2</td>
</tr>
<tr>
<td>PIN 10</td>
<td>14–1</td>
</tr>
<tr>
<td>PIN 11</td>
<td>14–2</td>
</tr>
<tr>
<td>PIN 12</td>
<td>14–3</td>
</tr>
<tr>
<td>PIN 13</td>
<td>14–4</td>
</tr>
<tr>
<td>PIN 14</td>
<td>DCG #2</td>
</tr>
<tr>
<td>PIN 15</td>
<td>17–1</td>
</tr>
<tr>
<td>PIN 16</td>
<td>17–2</td>
</tr>
<tr>
<td>PIN 17</td>
<td>17–3</td>
</tr>
<tr>
<td>PIN 18</td>
<td>17–4</td>
</tr>
<tr>
<td>PIN 19</td>
<td>17–5</td>
</tr>
<tr>
<td>PIN 20</td>
<td>17–6</td>
</tr>
<tr>
<td>PIN 21</td>
<td>17–7</td>
</tr>
<tr>
<td>PIN 22</td>
<td>17–8</td>
</tr>
<tr>
<td>PIN 23</td>
<td>18–1</td>
</tr>
<tr>
<td>PIN 24</td>
<td>18–2</td>
</tr>
<tr>
<td>PIN 25</td>
<td>18–3</td>
</tr>
<tr>
<td>PIN 26</td>
<td>18–4</td>
</tr>
<tr>
<td>PIN 27</td>
<td>18–5</td>
</tr>
<tr>
<td>PIN 28</td>
<td>18–6</td>
</tr>
<tr>
<td>PIN 29</td>
<td>18–7</td>
</tr>
<tr>
<td>PIN 30</td>
<td>18–8</td>
</tr>
<tr>
<td>PIN 31</td>
<td>DCG #2</td>
</tr>
<tr>
<td>PIN 32</td>
<td>NC</td>
</tr>
<tr>
<td>PIN 33</td>
<td>NC</td>
</tr>
<tr>
<td>PIN 34</td>
<td>NC</td>
</tr>
<tr>
<td>PIN 35</td>
<td>NC</td>
</tr>
<tr>
<td>PIN 36</td>
<td>NC</td>
</tr>
<tr>
<td>PIN 37</td>
<td>NC</td>
</tr>
</tbody>
</table>

#### TABLE 1

### NOTES:
1. C11 label.
2. Heat shrinkable tubing.
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 front panel shall be 1.25±0.125.

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

3. Thumb screw device, #10−32.

4. Connector BEAU P−5406 or equivalent.

5. Front panel shall be Aluminum stock or Stainless Steel.

6. All dimensions shown are in inches.

<table>
<thead>
<tr>
<th>PIN NO.</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>+24 VDC</td>
</tr>
<tr>
<td>8</td>
<td>DC GND</td>
</tr>
<tr>
<td>9</td>
<td>EG</td>
</tr>
<tr>
<td>10</td>
<td>NA</td>
</tr>
<tr>
<td>11</td>
<td>AC− CLEAN</td>
</tr>
<tr>
<td>12</td>
<td>AC+ CLEAN</td>
</tr>
</tbody>
</table>

MODEL 206LS POWER SUPPLY

ERRATA 3

TEES 2009

A3−10
NOTES: (FOR THIS DETAIL)
1. Four-channel card space, see A5-1 for dimensions.
2. Front panel shall be Aluminum stock or Stainless Steel.
### C16 HARNESS

![Diagram of C16 Harness](image)

**C16 Harness Pin Assignment**

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
<th>LABEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>APP IN</td>
<td>J-12J</td>
</tr>
<tr>
<td>2</td>
<td>GD IN</td>
<td>J-12J</td>
</tr>
<tr>
<td>3</td>
<td>SIM PRI</td>
<td>J-13J</td>
</tr>
<tr>
<td>4</td>
<td>SIM SEC</td>
<td>J-13J</td>
</tr>
<tr>
<td>5</td>
<td>ADV PRI</td>
<td>J-14J</td>
</tr>
<tr>
<td>6</td>
<td>ADV SEC</td>
<td>J-14J</td>
</tr>
<tr>
<td>7</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>8</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>9</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

**TYCO/AMP — Circular Plastic Connector (CPC)**

<table>
<thead>
<tr>
<th>SHELL SIZE</th>
<th>NO. OF POSITION</th>
<th>KEY</th>
<th>RECEPTACLE</th>
<th>PLUG</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>9</td>
<td>-</td>
<td>206705-1</td>
<td>206708-1</td>
</tr>
</tbody>
</table>

**NOTE:**
1. Panel Mount Receptacle, see A1-2 and A6-46 for details.
2. All dimensions shown are in inches.

**TITLE:**
C16 HARNESS DETAIL

<table>
<thead>
<tr>
<th>ERRATA 3</th>
<th>NO SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEES 2009</td>
<td>A3-12</td>
</tr>
</tbody>
</table>
MODEL 206E POWER SUPPLY MODULE

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 module from panel shall be 1.25±0.125.
2. The power supply module dimension, from front panel to connector plug, shall be 7.375 +0.000, -0.125.
3. A standard 8-32 metal stud retaining screw shall provide proper securing of the power supply when installed in the PDA using washers and a wingnut.
4. Connector BEAU P-5406 or equivalent.
5. Front panel shall be Aluminum stock or Stainless Steel.
6. All dimensions shown are in inches.
APPENDIX A4
BBS INVERTER/CHARGER DETAILS
BBS System Block Diagram  A4-1
BBS Utility Power Connection Diagram  A4-2
BBS Relay Contact Terminal Block  A4-3
NO/NC Relay Contacts – Six (6) sets of user programmable relay contacts made available on front panel terminal blocks.

* Manual Bypass Switch (must be external to Inverter), and Power Transfer Relay must be separate functional units, but may share a common enclosure.

Note:

* Manual Bypass Switch (Must be external to Inverter) & Power Transfer Relay must be separate functional units, but may be inside a common enclosure.
Note:
1. See A6–12 for conductor insulation colors.
2. All dimensions shown are in inches.

* As a minimum, these wires shall be provided in 9 ft lengths as part of the interconnect wiring kit.
Note:

2. 0.197 inch (5mm) spacing
3. Allows wire size 24–12 AWG
4. Screw and wire entrance are on the same face.
5. All dimensions shown are in inches.
<table>
<thead>
<tr>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-BBS Cabinet</td>
<td>B4-1</td>
</tr>
<tr>
<td>EIA Rail Mounting and Angle Bracket Details B</td>
<td>B4-2</td>
</tr>
<tr>
<td>EIA Rail Mounting and Angle Bracket Details C</td>
<td>B4-3</td>
</tr>
</tbody>
</table>
Note:
1. For detail B, see B4-2.
2. For detail C, see B4-3.
3. For detail D, see C4-1.
4. Door handle details, see A6-42.
5. All dimensions shown are in inches.
Notes:
1. Material used shall be 0.125 inch aluminum sheet
2. All dimensions shown are in inches.
Detail C: EIA Angle Rail with EIA Universal Hole Spacing

(Refer to EIA-310-B)

Note:
1. Material used shall be either 0.1345 inch plated steel or 0.105 inch Stainless Steel.
2. EIA Rail to be used inside External BBS Cabinet for mounting Inverter or PTR.
3. All dimensions shown are in inches.
Note:
1. For detail B, see B4–2.
2. For detail C, see B4–3.
3. Door handle details, see A6–42.
4. All dimensions shown are in inches.
APPENDIX A5
CHAPTER 5 DETAILS
Sensor Unit and Isolator Details
DC and AC Isolator Details
MODEL 222, 222i, 224, 224i & 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>C</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>NA</td>
</tr>
<tr>
<td>N</td>
<td>NA</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>
</tr>
<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>
</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 Model 232.
3. i=Intelligent
4. "U" shape rod handle shall be fabricate of 0.18 in to 0.26 in diameter, Aluminum stock.
5. RJ45 Ethernet port
6. All detectors shall be of the scanning type.
7. Front panel shall be Aluminum stock or Stainless Steel.
8. All dimensions shown are in inches.
NOTES:
1. Tolerance dimensions are ±0.02 in except as noted.
2. Sheet definitions:
   --- = Slotted for keying
   (C) = Collector
   (E) = Emitter
3. "U" shape rod handle shall be fabricated of 0.18 in to 0.26 in diameter, Aluminum stock.
4. Label "RXR" on model 252.
5. Front panel shall be Aluminum stock or Stainless Steel.
6. All dimensions shown are in inches.

MODEL 242L & 252
CONNECTOR ASSIGNMENTS

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION (ISOLATORS)</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></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>
</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>NA</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>NA</td>
</tr>
<tr>
<td>P</td>
<td>NA</td>
</tr>
<tr>
<td>R</td>
<td>NA</td>
</tr>
<tr>
<td>S</td>
<td>NA</td>
</tr>
<tr>
<td>T</td>
<td>NA</td>
</tr>
<tr>
<td>U</td>
<td>NA</td>
</tr>
<tr>
<td>V</td>
<td>NA</td>
</tr>
<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>

DC AND AC ISOLATOR DETAILS

<table>
<thead>
<tr>
<th>TITLE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERRATA 3</td>
<td>NO SCALE</td>
</tr>
<tr>
<td>TEES 2009</td>
<td>A5-2</td>
</tr>
<tr>
<td>Topic</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Cabinet Housing Details #1 &amp; #2 - sheet 1 of 4</td>
<td>A6-1</td>
</tr>
<tr>
<td>Cabinet Housing Details #1 &amp; #2 - sheet 2 of 4</td>
<td>A6-2</td>
</tr>
<tr>
<td>Cabinet Housing Details - sheet 3 of 4</td>
<td>A6-3</td>
</tr>
<tr>
<td>Cabinet Housing Details - sheet 4 of 4</td>
<td>A6-4</td>
</tr>
<tr>
<td>Cabinet Equipment Mounting Details</td>
<td>A6-5</td>
</tr>
<tr>
<td>Drawer Shelf Details</td>
<td>A6-6</td>
</tr>
<tr>
<td>Traffic Signal Cabinets One Line Diagram</td>
<td>A6-7</td>
</tr>
<tr>
<td>PDA # 2LX SSR Installation Details</td>
<td>A6-8</td>
</tr>
<tr>
<td>Ramp Meter Cabinets One Line Diagram</td>
<td>A6-9</td>
</tr>
<tr>
<td>Service Panel Assembly Details – sheet 1 of 3</td>
<td>A6-10</td>
</tr>
<tr>
<td>Service Panel Assembly Details – sheet 2 of 3</td>
<td>A6-11</td>
</tr>
<tr>
<td>Service Panel Assembly Details - sheet 3 of 3</td>
<td>A6-12</td>
</tr>
<tr>
<td>PDA #2LX &amp; #3LX Details – sheet 1 of 8</td>
<td>A6-13</td>
</tr>
<tr>
<td>PDA #2LX Details – sheet 2 of 8</td>
<td>A6-14</td>
</tr>
<tr>
<td>PDA #3LX Details – sheet 3 of 8</td>
<td>A6-15</td>
</tr>
<tr>
<td>PDA #2LX &amp; #3LX Details sheet 4 of 8</td>
<td>A6-16</td>
</tr>
<tr>
<td>PDA #2LX, 2LX &amp; #3LX Details sheet 5 of 8</td>
<td>A6-17</td>
</tr>
<tr>
<td>PDA #2LS Details sheet 6 of 8</td>
<td>A6-18</td>
</tr>
<tr>
<td>PDA #2LS SSR Installation Details sheet 7 of 8</td>
<td>A6-19</td>
</tr>
<tr>
<td>PDA #2LS Details sheet 8 of 8</td>
<td>A6-20</td>
</tr>
<tr>
<td>Side Panel Details - sheet 1 of 4</td>
<td>A6-21</td>
</tr>
<tr>
<td>Side Panel Details - sheet 2 of 4</td>
<td>A6-22</td>
</tr>
<tr>
<td>Side Panel Details - sheet 3 of 4</td>
<td>A6-23</td>
</tr>
<tr>
<td>Side Panel Details - sheet 4 of 4</td>
<td>A6-24</td>
</tr>
<tr>
<td>Hardness Wiring Details - sheet 1 of 5</td>
<td>A6-25</td>
</tr>
<tr>
<td>Hardness Wiring Details - sheet 2 of 5</td>
<td>A6-26</td>
</tr>
<tr>
<td>Hardness Wiring Details - sheet 3 of 5</td>
<td>A6-27</td>
</tr>
<tr>
<td>Hardness Wiring Details - sheet 4 of 5</td>
<td>A6-28</td>
</tr>
<tr>
<td>Hardness Wiring Details - sheet 5 of 5</td>
<td>A6-29</td>
</tr>
<tr>
<td>Fan and Thermostat Details</td>
<td>A6-30</td>
</tr>
<tr>
<td>C11 Harness Termination Details</td>
<td>A6-31</td>
</tr>
<tr>
<td>Cabinet Housing # 3 Details- sheet 1 of 7</td>
<td>A6-32</td>
</tr>
<tr>
<td>Cabinet Housing # 3 &amp; #4 Details - sheet 2 of 7</td>
<td>A6-33</td>
</tr>
<tr>
<td>Cabinet Housing # 3 Details - sheet 3 of 7</td>
<td>A6-34</td>
</tr>
<tr>
<td>Cabinet Housing # 3 Details - sheet 4 of 7</td>
<td>A6-35</td>
</tr>
<tr>
<td>Model 342LX Side Panel Details</td>
<td>A6-36</td>
</tr>
<tr>
<td>Model 344LX Side Panel Details</td>
<td>A6-37</td>
</tr>
<tr>
<td>Cabinet Equipment Mounting Details 2 of 3</td>
<td>A6-38</td>
</tr>
</tbody>
</table>
Service PDA Details sheet 1 of 2
Service PDA Details sheet 2 of 2
Rack #2 Equipment Shelf Installation Details
Cabinet Door Handle Details sheet 1 of 1
Input/Output File LX Details sheet 1 of 12
Input/Output File #1LX Details sheet 2 of 12
Input/Output File #1LX Details sheet 3 of 12
Input/Output File #2LX Details sheet 4 of 12
Input/Output File #2LX Details sheet 5 of 12
Input/Output File #2LX Details sheet 6 of 12
Input/Output File Details sheet 7 of 12
Input/Output File Details sheet 8 of 12
Input/Output File Details sheet 9 of 12
Input/Output File HSR Details sheet 10 of 12
Input/Output File Details sheet 11 of 12
Input/Output File Details sheet 12 of 12
Cabinet Housing #4 Details sheet 5 of 7
Cabinet Housing #4 Details sheet 6 of 7
Cabinet Housing #4 Details sheet 7 of 7
Model 346LX Side Panel Details
Cabinet Equipment Mounting Details sheet 3 of 3
Fan Cover and LED Lighting Housing 3, 4
Circuit Breaker Switch Guard Details
NOTE:
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. The handles shall be placed centered vertically on the doors.
6. 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:
All dimensions shown are in inches.
A = 0.50 in DIA.
B = 1 in DIA.
C = 5 in DIA.

NOTE: (FOR DETAILS A6–1 to A6–4)

1. Housing 1B used in cabinets 332LS & 334LS and Housing 2 in cabinet 336LS.
   Housing 3 used in cabinets 342LX & 344LX and Housing 4 in cabinet 346LX.
2. Adaptors delivered separately shall be delivered centered and bolted on a plywood shipping pallet.
3. Dashed lines on cabinet cage support detail delineates the cabinet side wall.
4. The bottom cabinet cage supports shall be continuously welded along the sides of the cabinet & extended to the inside corner of door openings.
   The top cabinet cage supports shall be continuously welded along the sides of the cabinet.
5. Cage support hole slots dimension shall be common for top & bottom.
6. All dimensions shown are in inches.
NOTE:
1. SPA shall be bolted on the rail and firmly attached to the Service Panel.
2. For Switch Guard details, see A6–60.
3. All dimensions shown are in inches.
NOTE:
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 336LS.
3. See Switch Guard details, sheet A6–60
4. Clear plastic cover shall protect the terminal blocks.
5. All dimensions shown are in inches.
NOTE:

BBS = Battery Back-up System
TBS = Terminal Block Service

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 conductor

NOTE 1 BBS JUMPER #8 AWG
NOTE 4

SHA-1250-ITS CONNECTOR DETAIL

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</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>

BEAU S-5412

FRONT VIEW

UTILITY SERVICE

SERVICE PANEL ASSEMBLY (SPA) DETAILS

ERRATA 3

TEES 2009
A6-12
NOTE:
1. See A6-17 for notes.
2. All dimensions shown are in inches.
NOTE:
1. See A6-17 for notes.
2. All dimensions shown are in inches.
NOTE:

1. See A6–16 and A6–17 for more details.
2. All dimensions shown are in inches.
MODEL 204 FLASHER UNIT
CONNECTOR SOCKET WIRING DETAIL

<table>
<thead>
<tr>
<th>PIN NO.</th>
<th>FUNCTION</th>
</tr>
</thead>
<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- RAW</td>
</tr>
<tr>
<td>11</td>
<td>AC+ RAW</td>
</tr>
<tr>
<td>12</td>
<td>NA</td>
</tr>
</tbody>
</table>

MODEL 205 FLASH TRANSFER
(HEAVY DUTY) RELAY
SOCKET DETAIL

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COIL</td>
</tr>
<tr>
<td>2</td>
<td>COIL</td>
</tr>
<tr>
<td>3</td>
<td>N.C. CIRCUIT #1</td>
</tr>
<tr>
<td>4</td>
<td>N.C. CIRCUIT #2</td>
</tr>
<tr>
<td>5</td>
<td>COMMON CIRCUIT #1</td>
</tr>
<tr>
<td>6</td>
<td>COMMON CIRCUIT #2</td>
</tr>
<tr>
<td>7</td>
<td>N.O. CIRCUIT #1</td>
</tr>
<tr>
<td>8</td>
<td>N.O. CIRCUIT #2</td>
</tr>
</tbody>
</table>

NOTE:
1. MODEL 205 – BEAU P-5408-LAB, Or Equal.
2. All dimensions shown are in inches
# POWER DISTRIBUTION ASSEMBLY TERMINAL BLOCK ASSIGNMENT DETAIL

<table>
<thead>
<tr>
<th>PDA's</th>
<th>2LX, 2LS</th>
<th>2LX, 2LS</th>
<th>3LX</th>
<th>2LX, 2LS &amp; 3LX</th>
<th>2LX, 2LS</th>
<th>3LX</th>
</tr>
</thead>
<tbody>
<tr>
<td>TERMINAL BLOCK</td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
<td>T4</td>
<td>T5</td>
<td>T6</td>
</tr>
<tr>
<td>POSITION</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1. EG BUS / EG</td>
<td>*</td>
<td>ER AC-</td>
<td>EG</td>
<td>BUS / EQ GND</td>
<td>24VDC BUS / PS-7</td>
<td>NA / NA</td>
</tr>
<tr>
<td>2. AC- BUS / AC-</td>
<td>01-5</td>
<td>FU1-7</td>
<td>AC-</td>
<td>BUS / AC-</td>
<td>24VDC (CONTROLLED) / PS-7</td>
<td>NA / NA</td>
</tr>
<tr>
<td>3. CR AC- / AC-</td>
<td>01-6</td>
<td>FU1-8</td>
<td>*</td>
<td>/ AC+ RAW</td>
<td>DC GND BUS / PS 8</td>
<td>NA / NA</td>
</tr>
<tr>
<td>4. * / SCB CKT 5</td>
<td>01-7</td>
<td>FU2-7</td>
<td>*</td>
<td>/ AC+ CLEAN</td>
<td>DC GND BUS / PS-8</td>
<td>NA / NA</td>
</tr>
<tr>
<td>5. + / AC+ RAW</td>
<td>01-8</td>
<td>FU2-8</td>
<td>+</td>
<td>/ MU</td>
<td>NA / NA</td>
<td>NA / NA</td>
</tr>
<tr>
<td>6. CR AC+ / AC+</td>
<td>*</td>
<td>/ FTR DRIVE</td>
<td>*</td>
<td>/ TR COIL</td>
<td>NA / NA</td>
<td>NA / NA</td>
</tr>
<tr>
<td>7. * / SSR</td>
<td>01-1</td>
<td>SCB CKT 1</td>
<td>NA</td>
<td>/ TRC1NO</td>
<td>NA / NA</td>
<td>NA / NA</td>
</tr>
<tr>
<td>8. * / SCB CKT 6</td>
<td>01-2</td>
<td>SCB CKT 2</td>
<td>NA</td>
<td>/ TRC2NC</td>
<td>NA / NA</td>
<td>NA / NA</td>
</tr>
<tr>
<td>9. + / FCB1 (SEC)</td>
<td>01-3</td>
<td>SCB CKT 3</td>
<td>03-5</td>
<td>/ FLD2</td>
<td>NA / NA</td>
<td>NA / NA</td>
</tr>
<tr>
<td>10. + / ER AC-</td>
<td>01-4</td>
<td>SCB CKT 4</td>
<td>SPA</td>
<td>AC- CLEAN / AC-</td>
<td>CLEAN</td>
<td>NA / NA</td>
</tr>
</tbody>
</table>

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

NOTES: (FOR DETAILS A6-13 TO A6-17)

1. All dimensions shown are in inches.
2. Sheet Definitions:
   - CKT = CIRCUIT
   - EG = EQUIPMENT GROUND
   - FLD1 = FIELD 1 CIRCUIT BREAKER
   - FL1 = FIELD LOAD 1
   - FU1-7 = FLASHER UNIT #1, PIN 7
   - ER = EQUIPMENT RECEPTACLE
   - LD CBT1 = LOAD CIRCUIT 1
   - SSR = SOLID STATE RELAY
   - CR = CONTROLLER RECEPCTACLE
   - MN = MAIN
   - OD = OUTSIDE DIMENSION
   - POS = POSITION
   - PS-7 = POWER SUPPLY PIN 7
   - SCB = SIGNAL CIRCUIT BREAKER
   - SP 3-3 = SWITCH PACK 3, PIN 3
   - TR = TRANSFER RELAY
   - TRC1NO = TRANSFER RELAY CIRCUIT 1
   - FCB1 = FIELD CIRCUIT BREAKER

3. Thumb screw device.
4. Transfer relay in PDA #2LX, #2LS & #3LX 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 the wiring diagram 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 #2LX or #2LS is installed, park the C1 harness #1 - C55 connector at the Input Panel’s C55. If PDA #3LX is installed, the C1 harness #2 - C55 connector shall be connected to the PDA’s C6P connector, support bracket and wiring shall be installed.
10. Hinge shall fasten to PDA chassis with two acorn Stainless Steel nuts.
11. Terminal shall be 5-pin screw type, Weidmuller BLT-C10 or equivalent.

**TITLE:**
PDA #2LX, #2LS & #3LX DETAILS
** SHEET 5 OF 8

**ERRATA:**

**TEES 2009**

A6-17
NOTE:
1. See A6-16 and A6-17 for more details.
2. All dimensions shown are in inches.
NOTE:
1. PDA top and bottom vented.
2. All dimensions shown are in inches.

TITLE:
PDA #2LS
SSR INSTALLATION DETAILS
SHEET 7 OF 8

ERRATA 3
NO SCALE
TEES 2009
A6-19
NOTE:
See A6-16 and A6-17 for more details.
NOTES:

1. 10 terminal (#8 wire) minimum copper bus.
2. See service panel assembly details A6-10, A6-11 & A6-12.
3. The terminal block shall have terminal positions necessary to match position assignments.
   Terminal position screws shall be 8–32 except for TBS, TBO, TBO, TB3, which shall be 10–32
4. The AC terminal blocks shall have touch-safe contacts, Weidmuller or equal.
5. SPA shall be bolted on the Rail and firmly attached to the Service Panel.
6. All dimensions shown are in inches.
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 Railing (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 U 6, Weidmuller Terminal Block WDU 10 or equal, mounted on DIN Rail (supported every 6 inches) with position function label tabs and positions commmoned 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

#### 332LS, 342LX INPUT PANEL #1

<table>
<thead>
<tr>
<th>POS A</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1-2</td>
<td>1-1D</td>
<td>TB3-1</td>
</tr>
<tr>
<td>TB1-2</td>
<td>1-1E</td>
<td>TB3-1</td>
</tr>
<tr>
<td>TB1-2</td>
<td>1-1J</td>
<td>TB3-2</td>
</tr>
<tr>
<td>TB1-2</td>
<td>1-1K</td>
<td>TB3-2</td>
</tr>
<tr>
<td>TB1-2</td>
<td>1-2D</td>
<td>TB3-3</td>
</tr>
<tr>
<td>TB1-2</td>
<td>1-2E</td>
<td>TB3-3</td>
</tr>
<tr>
<td>TB1-2</td>
<td>1-2J</td>
<td>TB3-4</td>
</tr>
<tr>
<td>TB1-2</td>
<td>1-2K</td>
<td>TB3-4</td>
</tr>
</tbody>
</table>

#### 334LS, 344LX INPUT PANEL #3, TB #1

<table>
<thead>
<tr>
<th>POS A</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1-1</td>
<td>+24 VDC</td>
<td>TB1-1</td>
</tr>
<tr>
<td>TB1-1</td>
<td>I/O FILES</td>
<td>TB1-1</td>
</tr>
<tr>
<td>TB1-1</td>
<td>CAB. HARNESS #5</td>
<td>TB1-1</td>
</tr>
<tr>
<td>TB1-1</td>
<td>CAB. HARNESS #5</td>
<td>TB1-1</td>
</tr>
</tbody>
</table>

### TERMINAL BLOCK ASSIGNMENT

#### 336LS, 346LX INPUT PANEL #4

<table>
<thead>
<tr>
<th>TER A</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1-1</td>
<td>(x+24 VDC)</td>
<td>TB1-2</td>
</tr>
<tr>
<td>TB1-2</td>
<td>02-1/TS-1</td>
<td>TB1-2</td>
</tr>
<tr>
<td>TB1-3</td>
<td>C5-24</td>
<td>TB1-4</td>
</tr>
<tr>
<td>TB1-4</td>
<td>RESERVED</td>
<td>TB1-5</td>
</tr>
<tr>
<td>TB1-5</td>
<td>RESERVED</td>
<td>TB1-6</td>
</tr>
<tr>
<td>TB1-6</td>
<td>RESERVED</td>
<td>TB1-7</td>
</tr>
<tr>
<td>TB1-7</td>
<td>RESERVED</td>
<td>TB1-8</td>
</tr>
<tr>
<td>TB1-8</td>
<td>RESERVED</td>
<td>TB2-1</td>
</tr>
</tbody>
</table>

#### 33xLS, 34xLS SERVICE PANEL 1, 336LS, 346LS SERVICE PANEL 2

<table>
<thead>
<tr>
<th>TER A</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBS-1</td>
<td>AC+</td>
<td>TBS-1 \ TO PDA (without BBS) \ TO BBS-1 (with BBS)</td>
</tr>
<tr>
<td>TBS-2</td>
<td>AC-</td>
<td>TBS-2 \ AC- BUS</td>
</tr>
<tr>
<td>TBS-3</td>
<td>GND</td>
<td>TBS-3 \ GND \ TO EQ.GND BUS</td>
</tr>
<tr>
<td>BBS-1</td>
<td>AC+ IN</td>
<td>BBS-1 \ MBPS AC+ IN</td>
</tr>
<tr>
<td>BBS-2</td>
<td>MBPS AC+ OUT \ TO PDA</td>
<td></td>
</tr>
<tr>
<td>TBO-1 TO 12</td>
<td>NA</td>
<td>TBO-1 TO 12</td>
</tr>
<tr>
<td>TB3-1 TO 6</td>
<td>NA</td>
<td>TB3-1 TO 6</td>
</tr>
</tbody>
</table>

### ERRATA

- **33xLS, 34xLS SERVICE PANEL 1, 336LS, 346LS SERVICE PANEL 2**
  - TBS-2 \ AC- BUS
  - BBS-2 \ MBPS AC+ OUT \ TO PDA

### NOTES:

1. **Sheet Definitions:**
   - 11 COM = DC COMMON
   - COMM = COMMUNICATION
   - DET = DETECTOR
   - EVA = EMERGENCY VEHICLE PREEMPTION
   - IFI-1D = INPUT FILE 1, SLOT 1, CONNECTOR PIN D
   - OF = OUTPUT FILE
   - M = MONITOR MODU
   - NA = NOT ASSIGNED
   - RR1 = RAILROAD PREEMPTION
   - MBPS = MANUAL BYPASS SWITCH
   - BBS = BATTERY BACK-UP SYSTEM
   - PDA = POWER DISTRIBUTION ASSEMBLY
   - x = 2, 4
   - ADV = Advance
   - APP = Advance Pedestrian Preemption
   - GD = Gate Down, ISL = Island
   - SIM = Simultaneous, PRI = Primary, SEC = Secondary
2. **All dimensions shown are in inches.**
<table>
<thead>
<tr>
<th>PIN</th>
<th>SOURCE</th>
<th>DESTINATION</th>
<th>FUNCTION</th>
<th>PIN</th>
<th>SOURCE</th>
<th>DESTINATION</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DC</td>
<td>GND</td>
<td>BUS</td>
<td>53</td>
<td>I2-7</td>
<td>IFJ-11W</td>
<td>SPARE #1</td>
</tr>
<tr>
<td>2</td>
<td>01-1</td>
<td>C4-1</td>
<td>SWPK</td>
<td>54</td>
<td>I2-8</td>
<td>IFJ-11F</td>
<td>EVB</td>
</tr>
<tr>
<td>3</td>
<td>01-2</td>
<td>C4-2</td>
<td>SWPK</td>
<td>55</td>
<td>I3-1</td>
<td>IFJ-1F</td>
<td>5 CE</td>
</tr>
<tr>
<td>4</td>
<td>01-3</td>
<td>C4-3</td>
<td>SWPK</td>
<td>56</td>
<td>I3-2</td>
<td>IFJ-1F</td>
<td>1 CE</td>
</tr>
<tr>
<td>5</td>
<td>01-4</td>
<td>C4-4</td>
<td>SWPK</td>
<td>57</td>
<td>I3-3</td>
<td>IFJ-5F</td>
<td>7 CE</td>
</tr>
<tr>
<td>6</td>
<td>01-5</td>
<td>C4-5</td>
<td>SWPK</td>
<td>58</td>
<td>I3-4</td>
<td>IFJ-5F</td>
<td>3 CE</td>
</tr>
<tr>
<td>7</td>
<td>01-6</td>
<td>C4-6</td>
<td>SWPK</td>
<td>59</td>
<td>I3-5</td>
<td>IFJ-9F</td>
<td>5 CE</td>
</tr>
<tr>
<td>8</td>
<td>01-7</td>
<td>C4-7</td>
<td>SWPK</td>
<td>60</td>
<td>I3-6</td>
<td>IFJ-9F</td>
<td>1 CE</td>
</tr>
<tr>
<td>9</td>
<td>01-8</td>
<td>C4-8</td>
<td>SWPK</td>
<td>61</td>
<td>I3-7</td>
<td>IFJ-9W</td>
<td>7 CE</td>
</tr>
<tr>
<td>10</td>
<td>02-1</td>
<td>C4-9</td>
<td>SWPK</td>
<td>62</td>
<td>I3-8</td>
<td>IFJ-9W</td>
<td>3 CE</td>
</tr>
<tr>
<td>11</td>
<td>02-2</td>
<td>C4-10</td>
<td>SWPK</td>
<td>63</td>
<td>I4-5</td>
<td>IFJ-3F</td>
<td>2 CE</td>
</tr>
<tr>
<td>12</td>
<td>02-3</td>
<td>C4-11</td>
<td>SWPK</td>
<td>64</td>
<td>I4-6</td>
<td>IFJ-3F</td>
<td>6 CE</td>
</tr>
<tr>
<td>13</td>
<td>02-4</td>
<td>C4-12</td>
<td>SWPK</td>
<td>65</td>
<td>I4-7</td>
<td>IFJ-7F</td>
<td>4 CE</td>
</tr>
<tr>
<td>14</td>
<td>DC</td>
<td>GND</td>
<td>IFJ-15-4</td>
<td>66</td>
<td>I4-8</td>
<td>IFJ-7F</td>
<td>8 CE</td>
</tr>
<tr>
<td>15</td>
<td>02-5</td>
<td>C4-13</td>
<td>SWPK</td>
<td>67</td>
<td>I5-1</td>
<td>IFJ-12F</td>
<td>2 PED</td>
</tr>
<tr>
<td>16</td>
<td>02-6</td>
<td>C4-14</td>
<td>SWPK</td>
<td>68</td>
<td>I5-2</td>
<td>IFJ-13F</td>
<td>6 PED</td>
</tr>
<tr>
<td>17</td>
<td>02-7</td>
<td>C4-15</td>
<td>SWPK</td>
<td>69</td>
<td>I5-3</td>
<td>IFJ-12W</td>
<td>4 PED</td>
</tr>
<tr>
<td>18</td>
<td>02-8</td>
<td>C4-16</td>
<td>SWPK</td>
<td>70</td>
<td>I5-4</td>
<td>IFJ-13W</td>
<td>8 PED</td>
</tr>
<tr>
<td>19</td>
<td>03-1</td>
<td>C4-17</td>
<td>SWPK</td>
<td>71</td>
<td>I5-5</td>
<td>IFJ-12F</td>
<td>APP</td>
</tr>
<tr>
<td>20</td>
<td>03-2</td>
<td>C4-18</td>
<td>SWPK</td>
<td>72</td>
<td>I5-6</td>
<td>IFJ-13F</td>
<td>SIM PRI</td>
</tr>
<tr>
<td>21</td>
<td>03-3</td>
<td>C4-19</td>
<td>SWPK</td>
<td>73</td>
<td>I5-7</td>
<td>IFJ-12W</td>
<td>GD/ISL</td>
</tr>
<tr>
<td>22</td>
<td>03-4</td>
<td>C4-20</td>
<td>SWPK</td>
<td>74</td>
<td>I5-8</td>
<td>IFJ-13W</td>
<td>SIM SEC</td>
</tr>
<tr>
<td>23</td>
<td>03-5</td>
<td>C4-21</td>
<td>SWPK</td>
<td>75</td>
<td>I6-1</td>
<td>IFJ-11W</td>
<td>EVD</td>
</tr>
<tr>
<td>24</td>
<td>03-6</td>
<td>C4-22</td>
<td>SWPK</td>
<td>76</td>
<td>I6-2</td>
<td>IFJ-3W</td>
<td>2 CE</td>
</tr>
<tr>
<td>25</td>
<td>03-7</td>
<td>C4-23</td>
<td>SWPK</td>
<td>77</td>
<td>I6-3</td>
<td>IFJ-3W</td>
<td>6 CE</td>
</tr>
<tr>
<td>26</td>
<td>03-8</td>
<td>C4-24</td>
<td>SWPK</td>
<td>78</td>
<td>I6-4</td>
<td>IFJ-7W</td>
<td>4 CE</td>
</tr>
<tr>
<td>27</td>
<td>04-1</td>
<td>C4-25</td>
<td>SWPK</td>
<td>79</td>
<td>I6-5</td>
<td>IFJ-7W</td>
<td>8 CE</td>
</tr>
<tr>
<td>28</td>
<td>04-2</td>
<td>C4-26</td>
<td>SWPK</td>
<td>80</td>
<td>I6-6</td>
<td>IFJ-11F</td>
<td>ADVANCE</td>
</tr>
<tr>
<td>29</td>
<td>04-3</td>
<td>C4-27</td>
<td>SWPK</td>
<td>81</td>
<td>I6-7</td>
<td>IFJ-14F</td>
<td>FLASH SENSE</td>
</tr>
<tr>
<td>30</td>
<td>04-4</td>
<td>C4-28</td>
<td>SWPK</td>
<td>82</td>
<td>I6-8</td>
<td>IFJ-14W</td>
<td>STOP TIME</td>
</tr>
<tr>
<td>31</td>
<td>04-5</td>
<td>C4-29</td>
<td>SWPK</td>
<td>83</td>
<td>O6-1</td>
<td>C5-1</td>
<td>SWPK 14-RED N/A</td>
</tr>
<tr>
<td>32</td>
<td>04-6</td>
<td>C4-30</td>
<td>SWPK</td>
<td>84</td>
<td>O6-2</td>
<td>C5-2</td>
<td>SWPK 14-GRN N/A</td>
</tr>
<tr>
<td>33</td>
<td>04-7</td>
<td>C4-31</td>
<td>SWPK</td>
<td>85</td>
<td>O6-3</td>
<td>C5-3</td>
<td>SWPK 13-RED</td>
</tr>
<tr>
<td>34</td>
<td>04-8</td>
<td>C4-32</td>
<td>SWPK</td>
<td>86</td>
<td>O6-4</td>
<td>C5-4</td>
<td>SWPK 13-YEL</td>
</tr>
<tr>
<td>35</td>
<td>05-1</td>
<td>C4-33</td>
<td>SWPK</td>
<td>87</td>
<td>O6-5</td>
<td>C5-5</td>
<td>SWPK 13-GRN</td>
</tr>
<tr>
<td>36</td>
<td>05-2</td>
<td>C4-34</td>
<td>SWPK</td>
<td>88</td>
<td>O6-6</td>
<td>C5-6</td>
<td>SWPK 12-RED</td>
</tr>
<tr>
<td>37</td>
<td>05-3</td>
<td>C4-35</td>
<td>SWPK</td>
<td>89</td>
<td>O6-7</td>
<td>C5-7</td>
<td>SWPK 12-YEL</td>
</tr>
<tr>
<td>38</td>
<td>05-4</td>
<td>C4-36</td>
<td>SWPK</td>
<td>90</td>
<td>O6-8</td>
<td>C5-8</td>
<td>SWPK 12-GRN</td>
</tr>
<tr>
<td>39</td>
<td>11-1</td>
<td>IFI-2F</td>
<td>2 CE</td>
<td>91</td>
<td>O7-1</td>
<td>C5-9</td>
<td>SWPK 11-RED HS</td>
</tr>
<tr>
<td>40</td>
<td>11-2</td>
<td>IFJ-2F</td>
<td>6 CE</td>
<td>92</td>
<td>DC</td>
<td>DC GND</td>
<td>DC GND BUS</td>
</tr>
<tr>
<td>41</td>
<td>11-3</td>
<td>IFI-6F</td>
<td>4 CE</td>
<td>93</td>
<td>07-2</td>
<td>C5-10</td>
<td>SWPK 11-GRN GP02</td>
</tr>
<tr>
<td>42</td>
<td>11-4</td>
<td>IFJ-6F</td>
<td>8 CE</td>
<td>94</td>
<td>07-3</td>
<td>C5-11</td>
<td>SWPK 10-RED</td>
</tr>
<tr>
<td>43</td>
<td>11-5</td>
<td>IFI-2W</td>
<td>2 CE</td>
<td>95</td>
<td>07-4</td>
<td>C5-12</td>
<td>SWPK 10-YEL</td>
</tr>
<tr>
<td>44</td>
<td>11-6</td>
<td>IFJ-2W</td>
<td>6 CE</td>
<td>96</td>
<td>07-5</td>
<td>C5-13</td>
<td>SWPK 10-GRN</td>
</tr>
<tr>
<td>45</td>
<td>11-7</td>
<td>IFI-6W</td>
<td>4 CE</td>
<td>97</td>
<td>07-6</td>
<td>C5-14</td>
<td>SWPK 9-RED</td>
</tr>
<tr>
<td>46</td>
<td>11-8</td>
<td>IFJ-6W</td>
<td>8 CE</td>
<td>98</td>
<td>07-7</td>
<td>C5-15</td>
<td>SWPK 9-YEL</td>
</tr>
<tr>
<td>47</td>
<td>12-1</td>
<td>IFI-4F</td>
<td>2 CALL</td>
<td>99</td>
<td>07-8</td>
<td>C5-16</td>
<td>SWPK 9-GRN</td>
</tr>
<tr>
<td>48</td>
<td>12-2</td>
<td>IFJ-4F</td>
<td>6 CALL</td>
<td>100</td>
<td>05-5</td>
<td>C5-17</td>
<td>SWPK 14-YES N/A</td>
</tr>
<tr>
<td>49</td>
<td>12-3</td>
<td>IFI-8F</td>
<td>4 CALL</td>
<td>101</td>
<td>05-6</td>
<td>C5-18</td>
<td>SWPK 11-YEL GP01</td>
</tr>
<tr>
<td>50</td>
<td>12-4</td>
<td>IFJ-8F</td>
<td>8 CALL</td>
<td>102</td>
<td>05-7</td>
<td>IFI&amp;J-15-3</td>
<td>DETECTOR RESET</td>
</tr>
<tr>
<td>51</td>
<td>12-5</td>
<td>IFJ-14F</td>
<td>ADV. PRI</td>
<td>103</td>
<td>05-8</td>
<td>C4-37</td>
<td>WDT-MU</td>
</tr>
<tr>
<td>52</td>
<td>12-6</td>
<td>IFJ-14W</td>
<td>ADV. SEC</td>
<td>104</td>
<td>DC</td>
<td>IFJ-15-4</td>
<td>INPUT DC GND</td>
</tr>
</tbody>
</table>

**Title:** Harness Wiring Details  
**Sheet 1 of 5**
<table>
<thead>
<tr>
<th>PIN</th>
<th>SOURCE</th>
<th>DESTINATION</th>
<th>FUNCTION</th>
<th>PIN</th>
<th>SOURCE</th>
<th>DESTINATION</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DC GND</td>
<td>TB1/3-7</td>
<td>DC GND BUS</td>
<td>53</td>
<td>I2-7</td>
<td>IFI-11F</td>
<td>RATE CODE 2</td>
</tr>
<tr>
<td>2</td>
<td>01-1</td>
<td>C6-1</td>
<td>SWPK 1-RED</td>
<td>54</td>
<td>I2-8</td>
<td>IFI-11W</td>
<td>RATE CODE 1</td>
</tr>
<tr>
<td>3</td>
<td>01-2</td>
<td>C6-2</td>
<td>SWPK 1-GRN</td>
<td>55</td>
<td>I3-1</td>
<td>IFI-4F</td>
<td>MAIN 9</td>
</tr>
<tr>
<td>4</td>
<td>01-3</td>
<td>C6-3</td>
<td>SWPK 2-RED</td>
<td>56</td>
<td>I3-2</td>
<td>IFI-4W</td>
<td>MAIN 10</td>
</tr>
<tr>
<td>5</td>
<td>01-4</td>
<td>C6-4</td>
<td>SWPK 2-YEL</td>
<td>57</td>
<td>I3-3</td>
<td>IFI-6F</td>
<td>MAIN 3</td>
</tr>
<tr>
<td>6</td>
<td>01-5</td>
<td>C6-5</td>
<td>SWPK 2-GRN</td>
<td>58</td>
<td>I3-4</td>
<td>IFI-6W</td>
<td>MAIN 4</td>
</tr>
<tr>
<td>7</td>
<td>01-6</td>
<td>C6-6</td>
<td>SWPK 3-RED</td>
<td>59</td>
<td>I3-5</td>
<td>IFI-7F</td>
<td>MAIN 5</td>
</tr>
<tr>
<td>8</td>
<td>01-7</td>
<td>C6-7</td>
<td>SWPK 3-YEL</td>
<td>60</td>
<td>I3-6</td>
<td>IFI-7W</td>
<td>MAIN 6</td>
</tr>
<tr>
<td>9</td>
<td>01-8</td>
<td>C6-8</td>
<td>SWPK 3-GRN</td>
<td>61</td>
<td>I3-7</td>
<td>IFI-8F</td>
<td>MAIN 11</td>
</tr>
<tr>
<td>10</td>
<td>02-1</td>
<td>TB1/22</td>
<td>CIA CONTROL</td>
<td>62</td>
<td>I3-8</td>
<td>IFI-8W</td>
<td>MAIN 12</td>
</tr>
<tr>
<td>11</td>
<td>02-2</td>
<td>C7-25</td>
<td>CMS CLOCK</td>
<td>63</td>
<td>I4-5</td>
<td>TB1/24</td>
<td>MAIN 17</td>
</tr>
<tr>
<td>12</td>
<td>02-3</td>
<td>C7-26</td>
<td>CMS ENABLE</td>
<td>64</td>
<td>I4-6</td>
<td>TB1/25</td>
<td>MAIN 18</td>
</tr>
<tr>
<td>13</td>
<td>02-4</td>
<td>C7-27</td>
<td>CMS CLEAR</td>
<td>65</td>
<td>I4-7</td>
<td>TB1/26</td>
<td>POL. CONTR’L SW.</td>
</tr>
<tr>
<td>14</td>
<td>DC GND</td>
<td>IFI-15-4</td>
<td>INPUT DC GND</td>
<td>66</td>
<td>I4-8</td>
<td>TB1/27</td>
<td>POL. LIGHTS SW.</td>
</tr>
<tr>
<td>15</td>
<td>02-5</td>
<td>C7-28</td>
<td>CMS DIM LEVEL 1</td>
<td>67</td>
<td>I5-1</td>
<td>C7-16</td>
<td>CIA SENSE 1</td>
</tr>
<tr>
<td>16</td>
<td>02-6</td>
<td>C7-29</td>
<td>CMS DIM LEVEL 2</td>
<td>68</td>
<td>I5-2</td>
<td>C7-31</td>
<td>CIA SENSE 2</td>
</tr>
<tr>
<td>17</td>
<td>02-7</td>
<td>C7-30</td>
<td>CMS DIM LEVEL 3</td>
<td>69</td>
<td>I5-3</td>
<td>C7-32</td>
<td>CIA SENSE 3</td>
</tr>
<tr>
<td>18</td>
<td>02-8</td>
<td>TB1/23</td>
<td>-</td>
<td>70</td>
<td>I5-4</td>
<td>C7-33</td>
<td>CIA SENSE 4</td>
</tr>
<tr>
<td>19</td>
<td>03-1</td>
<td>C7-9</td>
<td>CMS ADDRESS 1</td>
<td>71</td>
<td>I5-5</td>
<td>C7-34</td>
<td>CIA SENSE 5</td>
</tr>
<tr>
<td>20</td>
<td>03-2</td>
<td>C7-10</td>
<td>CMS ADDRESS 2</td>
<td>72</td>
<td>I5-6</td>
<td>C7-35</td>
<td>CIA SENSE 6</td>
</tr>
<tr>
<td>21</td>
<td>03-3</td>
<td>C7-11</td>
<td>CMS ADDRESS 3</td>
<td>73</td>
<td>I5-7</td>
<td>C7-36</td>
<td>CIA SENSE 7</td>
</tr>
<tr>
<td>22</td>
<td>03-4</td>
<td>C7-12</td>
<td>CMS ADDRESS 4</td>
<td>74</td>
<td>I5-8</td>
<td>C7-37</td>
<td>CIA SENSE 8</td>
</tr>
<tr>
<td>23</td>
<td>03-5</td>
<td>C7-13</td>
<td>CMS ADDRESS 5</td>
<td>75</td>
<td>I6-1</td>
<td>C7-5</td>
<td>CMS LATCH</td>
</tr>
<tr>
<td>24</td>
<td>03-6</td>
<td>C7-14</td>
<td>CMS ADDRESS 6</td>
<td>76</td>
<td>I6-2</td>
<td>C7-6</td>
<td>PHASE FIRE</td>
</tr>
<tr>
<td>25</td>
<td>03-7</td>
<td>C7-15</td>
<td>CMS ADDRESS 7</td>
<td>77</td>
<td>I6-3</td>
<td>TB1/29</td>
<td>MAIN 19</td>
</tr>
<tr>
<td>26</td>
<td>03-8</td>
<td>C7-4</td>
<td>CIA CONTROL 5</td>
<td>78</td>
<td>I6-4</td>
<td>C7-8</td>
<td>CMS TEST REQ.</td>
</tr>
<tr>
<td>27</td>
<td>04-1</td>
<td>C7-17</td>
<td>CMS DATA 1</td>
<td>79</td>
<td>I6-5</td>
<td>IFI-10F</td>
<td>MAIN 15</td>
</tr>
<tr>
<td>28</td>
<td>04-2</td>
<td>C7-18</td>
<td>CMS DATA 2</td>
<td>80</td>
<td>I6-6</td>
<td>IFI-9W</td>
<td>MAIN 14</td>
</tr>
<tr>
<td>29</td>
<td>04-3</td>
<td>C7-19</td>
<td>CMS DATA 3</td>
<td>81</td>
<td>I6-7</td>
<td>IFI-9F</td>
<td>MAIN 13</td>
</tr>
<tr>
<td>30</td>
<td>04-4</td>
<td>C7-20</td>
<td>CMS DATA 4</td>
<td>82</td>
<td>I6-8</td>
<td>IFI-10W</td>
<td>MAIN 16</td>
</tr>
<tr>
<td>31</td>
<td>04-5</td>
<td>C7-21</td>
<td>CMS DATA 5</td>
<td>83</td>
<td>O6-1</td>
<td>C5-1</td>
<td>SWPK 14-RED</td>
</tr>
<tr>
<td>32</td>
<td>04-6</td>
<td>C7-22</td>
<td>CMS DATA 6</td>
<td>84</td>
<td>O6-2</td>
<td>C5-2</td>
<td>SWPK 14-GRN</td>
</tr>
<tr>
<td>33</td>
<td>04-7</td>
<td>C7-23</td>
<td>CMS DATA 7</td>
<td>85</td>
<td>O6-3</td>
<td>C5-3</td>
<td>SWPK 13-RED</td>
</tr>
<tr>
<td>34</td>
<td>04-8</td>
<td>C7-24</td>
<td>CMS DATA 8</td>
<td>86</td>
<td>O6-4</td>
<td>C5-4</td>
<td>SWPK 13-YEL</td>
</tr>
<tr>
<td>35</td>
<td>05-1</td>
<td>C7-1</td>
<td>CIA CONTROL 1</td>
<td>87</td>
<td>O6-5</td>
<td>C5-5</td>
<td>SWPK 13-GRN</td>
</tr>
<tr>
<td>36</td>
<td>05-2</td>
<td>C7-2</td>
<td>CIA CONTROL 2</td>
<td>88</td>
<td>O6-6</td>
<td>C5-6</td>
<td>SWPK 12-RED</td>
</tr>
<tr>
<td>37</td>
<td>05-3</td>
<td>C6-9</td>
<td>SWPK 1-YEL</td>
<td>89</td>
<td>O6-7</td>
<td>C5-7</td>
<td>SWPK 12-YEL</td>
</tr>
<tr>
<td>38</td>
<td>05-4</td>
<td>C7-3</td>
<td>CIA CONTROL 3</td>
<td>90</td>
<td>O6-8</td>
<td>C5-8</td>
<td>SWPK 12-GRN</td>
</tr>
<tr>
<td>39</td>
<td>I1-1</td>
<td>IFI-1W</td>
<td>PASSAGE 1</td>
<td>91</td>
<td>O7-1</td>
<td>C5-9</td>
<td>SWPK 11-RED</td>
</tr>
<tr>
<td>40</td>
<td>I1-2</td>
<td>IFI-12W</td>
<td>PASSAGE 2</td>
<td>92</td>
<td>DC GND</td>
<td>TB1/3-7</td>
<td>-</td>
</tr>
<tr>
<td>41</td>
<td>I1-3</td>
<td>IFI-12F</td>
<td>DEMAND 2</td>
<td>93</td>
<td>O7-2</td>
<td>C5-10</td>
<td>SWPK 11-GRN</td>
</tr>
<tr>
<td>42</td>
<td>I1-4</td>
<td>IFI-13W</td>
<td>OFF RAMP 2</td>
<td>94</td>
<td>O7-3</td>
<td>C5-11</td>
<td>SWPK 10-RED</td>
</tr>
<tr>
<td>43</td>
<td>I1-5</td>
<td>IFI-13F</td>
<td>QUE 2</td>
<td>95</td>
<td>O7-4</td>
<td>C5-12</td>
<td>SWPK 10-YEL</td>
</tr>
<tr>
<td>44</td>
<td>I1-6</td>
<td>IFI-14W</td>
<td>PASSAGE 3</td>
<td>96</td>
<td>O7-5</td>
<td>C5-13</td>
<td>SWPK 10-GRN</td>
</tr>
<tr>
<td>45</td>
<td>I1-7</td>
<td>IFI-14F</td>
<td>DEMAND 3</td>
<td>97</td>
<td>O7-6</td>
<td>C5-14</td>
<td>SWPK 9-RED</td>
</tr>
<tr>
<td>46</td>
<td>I1-8</td>
<td>IFI-1F</td>
<td>DEMAND 1</td>
<td>98</td>
<td>O7-7</td>
<td>C5-15</td>
<td>SWPK 9-YEL</td>
</tr>
<tr>
<td>47</td>
<td>I2-1</td>
<td>IFI-2W</td>
<td>OFF RAMP 1</td>
<td>99</td>
<td>O7-8</td>
<td>C5-16</td>
<td>SWPK 9-GRN</td>
</tr>
<tr>
<td>48</td>
<td>I2-2</td>
<td>IFI-3W</td>
<td>MAIN 7</td>
<td>100</td>
<td>O5-5</td>
<td>C5-17</td>
<td>SWPK 14-YEL</td>
</tr>
<tr>
<td>49</td>
<td>I2-3</td>
<td>IFI-3F</td>
<td>MAIN 8</td>
<td>101</td>
<td>O5-6</td>
<td>C5-18</td>
<td>SWPK 11-YEL</td>
</tr>
<tr>
<td>50</td>
<td>I2-4</td>
<td>IFI-2F</td>
<td>QUE 1</td>
<td>102</td>
<td>O5-7</td>
<td>IFI-15-3</td>
<td>DETECTOR RESET</td>
</tr>
<tr>
<td>51</td>
<td>I2-5</td>
<td>IFI-5F</td>
<td>MAIN 1</td>
<td>103</td>
<td>O5-8</td>
<td>C6-10</td>
<td>WDT</td>
</tr>
<tr>
<td>52</td>
<td>I2-6</td>
<td>IFI-5W</td>
<td>MAIN 2</td>
<td>104</td>
<td>DC GND</td>
<td>TB1/3-7</td>
<td>DC GND BUS</td>
</tr>
<tr>
<td>PIN</td>
<td>SOURCE</td>
<td>DESTINATION</td>
<td>FUNCTION</td>
<td>PIN</td>
<td>SOURCE</td>
<td>DESTINATION</td>
<td>FUNCTION</td>
</tr>
<tr>
<td>-----</td>
<td>--------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>--------</td>
<td>-------------</td>
<td>----------</td>
</tr>
<tr>
<td>1</td>
<td>DC GND</td>
<td>DC GND BUS</td>
<td>BUS</td>
<td>53</td>
<td>I2-7</td>
<td>TB2-5</td>
<td>SPARE #1</td>
</tr>
<tr>
<td>2</td>
<td>01-1</td>
<td>C4-1</td>
<td>SWPK 4P-RED</td>
<td>54</td>
<td>I2-8</td>
<td>TB2-6</td>
<td>SPARE #2</td>
</tr>
<tr>
<td>3</td>
<td>01-2</td>
<td>C4-2</td>
<td>SWPK 4P-GRN</td>
<td>55</td>
<td>I3-1</td>
<td>IFI-5F</td>
<td>5 CE</td>
</tr>
<tr>
<td>4</td>
<td>01-3</td>
<td>C4-3</td>
<td>SWPK 4-RED</td>
<td>56</td>
<td>I3-2</td>
<td>IFI-1F</td>
<td>1 CE</td>
</tr>
<tr>
<td>5</td>
<td>01-4</td>
<td>C4-4</td>
<td>SWPK 4-YEL</td>
<td>57</td>
<td>I3-3</td>
<td>IFI-7F</td>
<td>7 CE</td>
</tr>
<tr>
<td>6</td>
<td>01-5</td>
<td>C4-5</td>
<td>SWPK 4-GRN</td>
<td>58</td>
<td>I3-4</td>
<td>IFI-3F</td>
<td>3 CE</td>
</tr>
<tr>
<td>7</td>
<td>01-6</td>
<td>C4-6</td>
<td>SWPK 3-RED</td>
<td>59</td>
<td>I3-5</td>
<td>IFI-1SP</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>01-7</td>
<td>C4-7</td>
<td>SWPK 3-YEL</td>
<td>60</td>
<td>I3-6</td>
<td>IFI-2SP</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>01-8</td>
<td>C4-8</td>
<td>SWPK 3-GRN</td>
<td>61</td>
<td>I3-7</td>
<td>IFI-3SP</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>02-1</td>
<td>C4-9</td>
<td>SWPK 2P-RED</td>
<td>62</td>
<td>I3-8</td>
<td>IFI-4SP</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>02-2</td>
<td>C4-10</td>
<td>SWPK 2P-GRN</td>
<td>63</td>
<td>I4-5</td>
<td>IFI-5SP</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>02-3</td>
<td>C4-11</td>
<td>SWPK 2-RED</td>
<td>64</td>
<td>I4-6</td>
<td>IFI-6SP</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>02-4</td>
<td>C4-12</td>
<td>SWPK 2-YEL</td>
<td>65</td>
<td>I4-7</td>
<td>IFI-7SP</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>DC GND</td>
<td>IFI-15-4</td>
<td>INPUT DC GND</td>
<td>66</td>
<td>I4-8</td>
<td>IFI-8SP</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>02-5</td>
<td>C4-13</td>
<td>SWPK 2-GRN</td>
<td>67</td>
<td>I5-1</td>
<td>IFI-12F</td>
<td>2 PED</td>
</tr>
<tr>
<td>16</td>
<td>02-6</td>
<td>C4-14</td>
<td>SWPK 1-RED</td>
<td>68</td>
<td>I5-2</td>
<td>IFI-13F</td>
<td>6 PED</td>
</tr>
<tr>
<td>17</td>
<td>02-7</td>
<td>C4-15</td>
<td>SWPK 1-YEL</td>
<td>69</td>
<td>I5-3</td>
<td>IFI-12W</td>
<td>4 PED</td>
</tr>
<tr>
<td>18</td>
<td>02-8</td>
<td>C4-16</td>
<td>SWPK 1-GRN</td>
<td>70</td>
<td>I5-4</td>
<td>IFI-13W</td>
<td>8 PED</td>
</tr>
<tr>
<td>19</td>
<td>03-1</td>
<td>C4-17</td>
<td>SWPK 8P-RED</td>
<td>71</td>
<td>I5-5</td>
<td>IFI-10F</td>
<td>EVA PREEMPT</td>
</tr>
<tr>
<td>20</td>
<td>03-2</td>
<td>C4-18</td>
<td>SWPK 8P-GRN</td>
<td>72</td>
<td>I5-6</td>
<td>IFI-11F</td>
<td>EVB PREEMPT</td>
</tr>
<tr>
<td>21</td>
<td>03-3</td>
<td>C4-19</td>
<td>SWPK 8-RED</td>
<td>73</td>
<td>I5-7</td>
<td>IFI-10W</td>
<td>EVC PREEMPT</td>
</tr>
<tr>
<td>22</td>
<td>03-4</td>
<td>C4-20</td>
<td>SWPK 8-YEL</td>
<td>74</td>
<td>I5-8</td>
<td>IFI-11W</td>
<td>EVD PREEMPT</td>
</tr>
<tr>
<td>23</td>
<td>03-5</td>
<td>C4-21</td>
<td>SWPK 8-GRN</td>
<td>75</td>
<td>I6-1</td>
<td>IFI-9SP</td>
<td>SPARE #3</td>
</tr>
<tr>
<td>24</td>
<td>03-6</td>
<td>C4-22</td>
<td>SWPK 7-RED</td>
<td>76</td>
<td>I6-2</td>
<td>IFI-10SP</td>
<td>2 CE</td>
</tr>
<tr>
<td>25</td>
<td>03-7</td>
<td>C4-23</td>
<td>SWPK 7-YEL</td>
<td>77</td>
<td>I6-3</td>
<td>IFI-11SP</td>
<td>6 CE</td>
</tr>
<tr>
<td>26</td>
<td>03-8</td>
<td>C4-24</td>
<td>SWPK 7-GRN</td>
<td>78</td>
<td>I6-4</td>
<td>IFI-12SP</td>
<td>4 CE</td>
</tr>
<tr>
<td>27</td>
<td>04-1</td>
<td>C4-25</td>
<td>SWPK 6P-RED</td>
<td>79</td>
<td>I6-5</td>
<td>IFI-13SP</td>
<td>8 CE</td>
</tr>
<tr>
<td>28</td>
<td>04-2</td>
<td>C4-26</td>
<td>SWPK 6P-GRN</td>
<td>80</td>
<td>I6-6</td>
<td>IFI-14SP</td>
<td>ADVANCE</td>
</tr>
<tr>
<td>29</td>
<td>04-3</td>
<td>C4-27</td>
<td>SWPK 6-RED</td>
<td>81</td>
<td>I6-7</td>
<td>IFI-14F</td>
<td>FLASH SENSE</td>
</tr>
<tr>
<td>30</td>
<td>04-4</td>
<td>C4-28</td>
<td>SWPK 6-YEL</td>
<td>82</td>
<td>I6-8</td>
<td>IFI-14W</td>
<td>STOP TIME</td>
</tr>
<tr>
<td>31</td>
<td>04-5</td>
<td>C4-29</td>
<td>SWPK 6-GRN</td>
<td>83</td>
<td>O6-1</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>04-6</td>
<td>C4-30</td>
<td>SWPK 5-RED</td>
<td>84</td>
<td>O6-2</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>04-7</td>
<td>C4-31</td>
<td>SWPK 5-YEL</td>
<td>85</td>
<td>O6-3</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>04-8</td>
<td>C4-32</td>
<td>SWPK 5-GRN</td>
<td>86</td>
<td>O6-4</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>05-1</td>
<td>C4-33</td>
<td>SWPK 2P-RED</td>
<td>87</td>
<td>O6-5</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>05-2</td>
<td>C4-34</td>
<td>SWPK 2P-GRN</td>
<td>88</td>
<td>O6-6</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>05-3</td>
<td>C4-35</td>
<td>SWPK 4P-RED</td>
<td>89</td>
<td>O6-7</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>05-4</td>
<td>C4-36</td>
<td>SWPK 4P-GRN</td>
<td>90</td>
<td>O6-8</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>I1-1</td>
<td>IFI-2F</td>
<td>2 CE</td>
<td>91</td>
<td>O7-1</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>I1-2</td>
<td>IFI-6F</td>
<td>6 CE</td>
<td>92</td>
<td>DC GND</td>
<td>DC GND BUS</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>I1-3</td>
<td>IFI-4F</td>
<td>4 CE</td>
<td>93</td>
<td>O7-2</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>I1-4</td>
<td>IFI-8F</td>
<td>8 CE</td>
<td>94</td>
<td>O7-3</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>I1-5</td>
<td>IFI-2W</td>
<td>2 CE</td>
<td>95</td>
<td>O7-4</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>I1-6</td>
<td>IFI-6W</td>
<td>6 CE</td>
<td>96</td>
<td>O7-5</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>I1-7</td>
<td>IFI-4W</td>
<td>4 CE</td>
<td>97</td>
<td>O7-6</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>I1-8</td>
<td>IFI-8W</td>
<td>8 CE</td>
<td>98</td>
<td>O7-7</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>I2-1</td>
<td>IFI-1W</td>
<td>2 CALL</td>
<td>99</td>
<td>O7-8</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>I2-2</td>
<td>IFI-5W</td>
<td>6 CALL</td>
<td>100</td>
<td>O5-5</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>I2-3</td>
<td>IFI-3W</td>
<td>4 CALL</td>
<td>101</td>
<td>O5-6</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>I2-4</td>
<td>IFI-7W</td>
<td>8 CALL</td>
<td>102</td>
<td>O5-7</td>
<td>IFF-15-3</td>
<td>DETECTOR RESET</td>
</tr>
<tr>
<td>51</td>
<td>I2-5</td>
<td>IFI-9F</td>
<td>RR1 PREEMPT</td>
<td>103</td>
<td>O5-8</td>
<td>C4-37</td>
<td>WDT-MU</td>
</tr>
<tr>
<td>52</td>
<td>I2-6</td>
<td>IFI-9W</td>
<td>RR2 PREEMPT</td>
<td>104</td>
<td>DC GND</td>
<td>IFJ-15-4</td>
<td></td>
</tr>
</tbody>
</table>
## C4 Harness Wiring List #1 and #3

<table>
<thead>
<tr>
<th>PIN</th>
<th>Source</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C1-2</td>
<td>SWPK 4P-RED</td>
</tr>
<tr>
<td>2</td>
<td>C1-3</td>
<td>SWPK 4P-GRN</td>
</tr>
<tr>
<td>3</td>
<td>C1-4</td>
<td>SWPK 4-RED</td>
</tr>
<tr>
<td>4</td>
<td>C1-5</td>
<td>SWPK 4-YEL</td>
</tr>
<tr>
<td>5</td>
<td>C1-6</td>
<td>SWPK 4-GRN</td>
</tr>
<tr>
<td>6</td>
<td>C1-7</td>
<td>SWPK 3-RED</td>
</tr>
<tr>
<td>7</td>
<td>C1-8</td>
<td>SWPK 3-YEL</td>
</tr>
<tr>
<td>8</td>
<td>C1-9</td>
<td>SWPK 3-GRN</td>
</tr>
<tr>
<td>9</td>
<td>C1-10</td>
<td>SWPK 2P-RED</td>
</tr>
<tr>
<td>10</td>
<td>C1-11</td>
<td>SWPK 2P-GRN</td>
</tr>
<tr>
<td>11</td>
<td>C1-12</td>
<td>SWPK 2-RED</td>
</tr>
<tr>
<td>12</td>
<td>C1-13</td>
<td>SWPK 2-YEL</td>
</tr>
<tr>
<td>13</td>
<td>C1-15</td>
<td>SWPK 2-GRN</td>
</tr>
<tr>
<td>14</td>
<td>C1-16</td>
<td>SWPK 1-RED</td>
</tr>
<tr>
<td>15</td>
<td>C1-17</td>
<td>SWPK 1-YEL</td>
</tr>
<tr>
<td>16</td>
<td>C1-18</td>
<td>SWPK 1-GRN</td>
</tr>
<tr>
<td>17</td>
<td>C1-19</td>
<td>SWPK 8P-RED</td>
</tr>
<tr>
<td>18</td>
<td>C1-20</td>
<td>SWPK 8P-GRN</td>
</tr>
<tr>
<td>19</td>
<td>C1-21</td>
<td>SWPK 8-RED</td>
</tr>
<tr>
<td>20</td>
<td>C1-22</td>
<td>SWPK 8-YEL</td>
</tr>
<tr>
<td>21</td>
<td>C1-23</td>
<td>SWPK 8-GRN</td>
</tr>
<tr>
<td>22</td>
<td>C1-24</td>
<td>SWPK 7-RED</td>
</tr>
<tr>
<td>23</td>
<td>C1-25</td>
<td>SWPK 7-YEL</td>
</tr>
<tr>
<td>24</td>
<td>C1-26</td>
<td>SWPK 7-GRN</td>
</tr>
<tr>
<td>25</td>
<td>C1-27</td>
<td>SWPK 6P-RED</td>
</tr>
<tr>
<td>26</td>
<td>C1-28</td>
<td>SWPK 6P-GRN</td>
</tr>
<tr>
<td>27</td>
<td>C1-29</td>
<td>SWPK 6-RED</td>
</tr>
<tr>
<td>28</td>
<td>C1-30</td>
<td>SWPK 6-YEL</td>
</tr>
<tr>
<td>29</td>
<td>C1-31</td>
<td>SWPK 6-GRN</td>
</tr>
<tr>
<td>30</td>
<td>C1-32</td>
<td>SWPK 5-RED</td>
</tr>
<tr>
<td>31</td>
<td>C1-33</td>
<td>SWPK 5-YEL</td>
</tr>
<tr>
<td>32</td>
<td>C1-34</td>
<td>SWPK 5-GRN</td>
</tr>
<tr>
<td>33</td>
<td>C1-35</td>
<td>SWPK 2P-YEL</td>
</tr>
<tr>
<td>34</td>
<td>C1-36</td>
<td>SWPK 6P-YEL</td>
</tr>
<tr>
<td>35</td>
<td>C1-37</td>
<td>SWPK 4P-YEL</td>
</tr>
<tr>
<td>36</td>
<td>C1-38</td>
<td>SWPK 8P-YEL</td>
</tr>
<tr>
<td>37</td>
<td>C1-103</td>
<td>SWPK WDT-MU</td>
</tr>
</tbody>
</table>

## C5 Harness Wiring List #1 and #2

<table>
<thead>
<tr>
<th>PIN</th>
<th>Source</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C1-83</td>
<td>SWPK 14-RED N/A</td>
</tr>
<tr>
<td>2</td>
<td>C1-84</td>
<td>SWPK 14-GRN N/A</td>
</tr>
<tr>
<td>3</td>
<td>C1-85</td>
<td>SWPK 13-RED</td>
</tr>
<tr>
<td>4</td>
<td>C1-86</td>
<td>SWPK 13-YEL</td>
</tr>
<tr>
<td>5</td>
<td>C1-87</td>
<td>SWPK 13-GRN</td>
</tr>
<tr>
<td>6</td>
<td>C1-88</td>
<td>SWPK 12-RED</td>
</tr>
<tr>
<td>7</td>
<td>C1-89</td>
<td>SWPK 12-YEL</td>
</tr>
<tr>
<td>8</td>
<td>C1-90</td>
<td>SWPK 12-GRN</td>
</tr>
<tr>
<td>9</td>
<td>C1-91</td>
<td>SWPK 11-RED HS</td>
</tr>
<tr>
<td>10</td>
<td>C1-93</td>
<td>SWPK 11-YEL GPO2</td>
</tr>
<tr>
<td>11</td>
<td>C1-94</td>
<td>SWPK 10-RED</td>
</tr>
<tr>
<td>12</td>
<td>C1-95</td>
<td>SWPK 10-YEL</td>
</tr>
<tr>
<td>13</td>
<td>C1-96</td>
<td>SWPK 10-GRN</td>
</tr>
<tr>
<td>14</td>
<td>C1-97</td>
<td>SWPK 9-RED</td>
</tr>
<tr>
<td>15</td>
<td>C1-98</td>
<td>SWPK 9-YEL</td>
</tr>
<tr>
<td>16</td>
<td>C1-99</td>
<td>SWPK 9-GRN</td>
</tr>
<tr>
<td>17</td>
<td>C1-100</td>
<td>SWPK 14-YEL N/A</td>
</tr>
<tr>
<td>18</td>
<td>C1-101</td>
<td>SWPK 11-YEL GPO1</td>
</tr>
<tr>
<td>19</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>21</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>22</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>23</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>24</td>
<td>+24 VDC</td>
<td>PIN 9, ALL SOCKETS</td>
</tr>
</tbody>
</table>

## C6 Harness Wiring List #2

<table>
<thead>
<tr>
<th>PIN</th>
<th>Source</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C1-2</td>
<td>SWPK 1-RED</td>
</tr>
<tr>
<td>2</td>
<td>C1-3</td>
<td>SWPK 1-GRN</td>
</tr>
<tr>
<td>3</td>
<td>C1-4</td>
<td>SWPK 2-RED</td>
</tr>
<tr>
<td>4</td>
<td>C1-5</td>
<td>SWPK 2-YEL</td>
</tr>
<tr>
<td>5</td>
<td>C1-6</td>
<td>SWPK 2-GRN</td>
</tr>
<tr>
<td>6</td>
<td>C1-7</td>
<td>SWPK 3-RED</td>
</tr>
<tr>
<td>7</td>
<td>C1-8</td>
<td>SWPK 3-YEL</td>
</tr>
<tr>
<td>8</td>
<td>C1-9</td>
<td>SWPK 3-GRN</td>
</tr>
<tr>
<td>9</td>
<td>C1-37</td>
<td>SWPK 1-RED</td>
</tr>
<tr>
<td>10</td>
<td>C1-103</td>
<td>WDT</td>
</tr>
<tr>
<td>11</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>12</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>13</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>14</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>15</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>16</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>17</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>18</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>19</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>21</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>22</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>23</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>24</td>
<td>+24 VDC</td>
<td>PIN 9, ALL SOCKETS</td>
</tr>
</tbody>
</table>

---

**Title:** Harness Wiring Details  
Sheet 4 of 5

**Errata:** 3

**No Scale**

**Tees 2009**: A6–28
CONNECTORS C4, C5 AND C6

NOTE: (FOR DETAILS A6-25 TO A6-29)

1. Sheet definitions:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1-2</td>
<td>CONNECTOR C1, PIN 2</td>
</tr>
<tr>
<td>EVA</td>
<td>EMERGENCY VEHICLE A</td>
</tr>
<tr>
<td>I1-1</td>
<td>INPUT PORT 5001, BIT 1</td>
</tr>
<tr>
<td>IFI-2F, SP</td>
<td>INPUT FILE 1, TERMINAL BLOCK 2, TERMINAL DESIGNATION F (CHANNEL 1 OUTPUT), SPARE</td>
</tr>
<tr>
<td>IFJ-6W</td>
<td>INPUT FILE J, TERMINAL BLOCK 6, TERMINAL DESIGNATION W (CHANNEL 2 OUTPUT)</td>
</tr>
<tr>
<td>O1-1</td>
<td>OUTPUT PORT 5001, BIT 1</td>
</tr>
<tr>
<td>TB1/26</td>
<td>TERMINAL BLOCK 1 POSITION 26</td>
</tr>
<tr>
<td>RR1</td>
<td>RAILROAD 1</td>
</tr>
<tr>
<td>SWPK 2P-GRN</td>
<td>SWITCHPACK 2 PEDESTRIAN, GREEN</td>
</tr>
<tr>
<td>WDT-MU</td>
<td>WATCHDOG TIMER, MONITOR UNIT</td>
</tr>
<tr>
<td>2 CE</td>
<td>PHASE 2 COUNT &amp; EXTENSION</td>
</tr>
</tbody>
</table>
NOTE:
1. All dimensions are in inches
NOTE:
1. See A6-43 for details.
2. For CIS 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 handles shall be placed centered vertically on the doors opposite from the hinges on both, the rear & front.
5. Two fans each side.
6. All dimensions shown are in inches.

SECTION A—A DETAIL
Flange Around Door Opening
0.375±0.125
1.00* MIN.

* TOLERANCE +0.0625
-0
CABINET HOUSING #3 & #4
POLICE PANEL DETAIL

Police Panel Shall Be 3.00" Deep

CABINET HOUSING #3 & #4 BOTTOM DETAIL

HOLE SLOT DETAIL

R0.50

0.375X1.250 O/BROUND

CAGE SUPPORT DETAIL

Bolt Access Cutout

NOTES:
1. Tack Weld Cage Support to bottom assembly front and rear. See Cage Support Assembly Detail.
2. Uses Type LX Foundation.

TITLE: CABINET HOUSING #3 & #4
DETAILS
SHEET 2 OF 7

ERRATA 3
ND SCALE

TEES 2009
A6-33
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.
5. All dimensions shown are in inches.
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. Terminal position screws shall be 8–32 except for TBS, RTBO, TB3, which shall be 10–32.
3. The AC terminal blocks shall have touch-safe contacts, Weidmuller or equal.
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.
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, TB0, TB3, which shall be 10–32.
3. The AC terminal blocks shall have touch-safe contacts, Weidmüller or equal.
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.
MODEL 342LX

TOP OF EIA MOUNTING SURFACE

14.00

EQUIPMENT SHELF

14.00

Note 3

SPDA

17.00 MAX.

7.25

4.25

FRONT VIEW (Rack 2)

7.00

OPENING

MODEL 2070/170 CONTROLLER UNIT

DRAWER SHELF

INPUT FILE #1

INPUT FILE #3

PDA # 2LX

1.0 OPENING

10.50

MONITOR

OUTPUT FILE #1L

OUTPUT FILE #2LX

SPA, notes 2,3

FRONT VIEW (Rack 1)

MODEL 344LX

TOP OF EIA MOUNTING SURFACE

14.00

EQUIPMENT SHELF

14.00

Note 3

SPDA

17.00 MAX.

7.25

4.25

FRONT VIEW (Rack 2)

7.00

OPENING

MODEL 2070/170 CONTROLLER UNIT

DRAWER SHELF

INPUT FILE #1

INPUT FILE #3

BLANK PANEL

PDA # 3LX

OPENING

Note 1

4.25

SPA, notes 2

FRONT VIEW (Rack 1)

NOTE:
1. Controller unit support, drawer shelf assembly.
2. SPA shall be bolted on the rail and firmly attached to the Service Panel.
3. Switch Guard, see A6-60.
4. All dimensions shown are in inches.
NOTES:

1. The Service PDA shall be mounted at least 4.25 in above the bottom of the LX cabinet.
2. Switch Guard, see A6-60.
3. All dimensions shown are in inches.
NOTE:
2. Equipment Shelf with Air Vents
3. All dimensions shown are in inches
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. Door lock shall be above the the door handle to avoid key blocking the handle.
5. Door handle shall be Stainless Steel.
6. All dimensions shown are in inches.
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
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. HSR=Health Status Relay,
4. For Terminal Assignment, see A6–50.
5. Health Status SWPK
6. Field Terminal contacts shall be 5-pin screw type, Weidmuller BLT–C18, Phoenix or equivalent.
7. TB03 and TB04 are inside the back panel.
8. All dimensions shown are in inches
NOTE: (This sheet only)
1. Field Terminal Panel, see A6-48 for details.
2. Panel cutout, see A6-48 for details.
3. All fuses shall be 0.5 Amps.
4. For Terminal Assignment, see A6-50.
5. TB03 and TB04 are inside the back panel.
6. All dimensions shown are in inches.
NOTE: (This sheet only)

1. Field Terminal Panel Height = 4.6 - 4.8, Width = 10.25
2. For Terminal Assignment, see A6-50.
3. Field Terminal contacts shall be 5-pin screw type, Weidmuller BLT-C18, Phoenix or equivalent.
4. 11GPO1 = General Purpose Output #1
   11GPO2 = General Purpose Output #2
5. All dimensions shown are in inches.
### OUTPUT FILE #1LX TERMINAL ASSIGNMENT DETAIL

<table>
<thead>
<tr>
<th>TERM</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PDA CKT1/SWPKS 1,2,2P-1</td>
</tr>
<tr>
<td>2</td>
<td>PDA CKT2/SWPKS 3,4,4P-1</td>
</tr>
<tr>
<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>PDA T1 U1 CKT1/FTR1</td>
</tr>
<tr>
<td>6</td>
<td>PDA T1 U1 CKT2/FTR2</td>
</tr>
<tr>
<td>7</td>
<td>PDA T1 U2 CKT1/FTR3</td>
</tr>
<tr>
<td>8</td>
<td>PDA T1 U2 CKT2/FTR4</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>
</tr>
</tbody>
</table>

### FUNCTION

<table>
<thead>
<tr>
<th>TERM</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24VDC TO LOGIC RELAY (LR) COIL</td>
</tr>
<tr>
<td>2</td>
<td>DC GROUND</td>
</tr>
<tr>
<td>3</td>
<td>IFT–14J, STOP TIME (FROM M.U)</td>
</tr>
<tr>
<td>4</td>
<td>IFT–14D, FLASH SENSE (FROM I.R)</td>
</tr>
<tr>
<td>5</td>
<td>EXTERNAL (M.U) RESET</td>
</tr>
<tr>
<td>6</td>
<td>NA</td>
</tr>
<tr>
<td>7</td>
<td>+24VDC (CONTROLLED) TO SWITCHPKS (1–12) POSITION 9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TERM</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>SWPK 4–RED</td>
</tr>
<tr>
<td>102</td>
<td>SWPK 4–YEL</td>
</tr>
<tr>
<td>103</td>
<td>SWPK 4–GRN</td>
</tr>
<tr>
<td>104</td>
<td>SWPK 4P–RED</td>
</tr>
<tr>
<td>105</td>
<td>SWPK 4P–YEL</td>
</tr>
<tr>
<td>106</td>
<td>SWPK 4P–GRN</td>
</tr>
<tr>
<td>107</td>
<td>SWPK 8–RED</td>
</tr>
<tr>
<td>108</td>
<td>SWPK 8–YEL</td>
</tr>
<tr>
<td>109</td>
<td>SWPK 8–GRN</td>
</tr>
<tr>
<td>110</td>
<td>SWPK 8P–RED</td>
</tr>
<tr>
<td>111</td>
<td>SWPK 8P–YEL</td>
</tr>
<tr>
<td>112</td>
<td>SWPK 8P–GRN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TERM</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>113</td>
<td>SWPK 2P–RED</td>
</tr>
<tr>
<td>114</td>
<td>SWPK 2P–YEL</td>
</tr>
<tr>
<td>115</td>
<td>SWPK 2P–GRN</td>
</tr>
<tr>
<td>116</td>
<td>SWPK 3–RED</td>
</tr>
<tr>
<td>117</td>
<td>SWPK 3–YEL</td>
</tr>
<tr>
<td>118</td>
<td>SWPK 3–GRN</td>
</tr>
<tr>
<td>119</td>
<td>SWPK 8P–RED</td>
</tr>
<tr>
<td>120</td>
<td>SWPK 8P–YEL</td>
</tr>
<tr>
<td>121</td>
<td>SWPK 8P–GRN</td>
</tr>
<tr>
<td>122</td>
<td>SWPK 7–RED</td>
</tr>
<tr>
<td>123</td>
<td>SWPK 7–YEL</td>
</tr>
<tr>
<td>124</td>
<td>SWPK 7–GRN</td>
</tr>
<tr>
<td>125</td>
<td>SWPK 1–RED</td>
</tr>
<tr>
<td>126</td>
<td>SWPK 1–YEL</td>
</tr>
<tr>
<td>127</td>
<td>SWPK 1–GRN</td>
</tr>
<tr>
<td>128</td>
<td>SWPK 2–RED</td>
</tr>
<tr>
<td>129</td>
<td>SWPK 2–YEL</td>
</tr>
<tr>
<td>130</td>
<td>SWPK 2–GRN</td>
</tr>
<tr>
<td>131</td>
<td>SWPK 5–RED</td>
</tr>
<tr>
<td>132</td>
<td>SWPK 5–YEL</td>
</tr>
<tr>
<td>133</td>
<td>SWPK 5–GRN</td>
</tr>
<tr>
<td>134</td>
<td>SWPK 6–RED</td>
</tr>
<tr>
<td>135</td>
<td>SWPK 6–YEL</td>
</tr>
<tr>
<td>136</td>
<td>SWPK 6–GRN</td>
</tr>
</tbody>
</table>

### NOTE:

1. Thumb screws device.
2. All dimensions shown are in inches.

---

**TITLE:** INPUT/OUTPUT FILE DETAILS  
**SHEET 7 OF 12**

<table>
<thead>
<tr>
<th>ERRATA 3</th>
<th>NO SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEES 2009</td>
<td>A6-49</td>
</tr>
</tbody>
</table>
## OUTPUT FILE #2LX TERMINAL ASSIGNMENT DETAIL

<table>
<thead>
<tr>
<th>O3 TERM</th>
<th>FUNCTION</th>
<th>O4 TERM</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PDA FU1 CKT1/FRS5</td>
<td>1</td>
<td>+24VDC (controlled)</td>
</tr>
<tr>
<td>2</td>
<td>PDA FU2 CKT2/FRS8</td>
<td>2</td>
<td>DC GROUND</td>
</tr>
<tr>
<td>3</td>
<td>FTR COILS (TO)</td>
<td>3</td>
<td>IFI=14J, STOP TIME (FROM M.U)</td>
</tr>
<tr>
<td>4</td>
<td>AC-</td>
<td>4</td>
<td>IFI=14D, FLASH SENSE (FROM LR)</td>
</tr>
<tr>
<td>5</td>
<td>PDA CKT5/SWPKS 9,10,11-1</td>
<td>5</td>
<td>EXTERNAL (M.U) RESET</td>
</tr>
<tr>
<td>6</td>
<td>PDA CKT6/SWPKS 12,13</td>
<td>6</td>
<td>WDT INPUT</td>
</tr>
<tr>
<td>7</td>
<td>EQUIP. GROUND</td>
<td>7</td>
<td>LR COIL (UNIT IN)</td>
</tr>
<tr>
<td>8</td>
<td>AC+ (FROM PDA)</td>
<td>8</td>
<td>SSR (PDA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>+24VDC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### FT4 TERM | FUNCTION
---|-----------------------------
A101 | SWPK 13-RED
A102 | SWPK 13-YEL
A103 | SWPK 13-GRN
A104 | SWPK 12-RED
A105 | SWPK 12-YEL
A106 | SWPK 12-GRN

### FT5 TERM | FUNCTION
---|-----------------------------
A111 | SWPK 9-RED
A112 | SWPK 9-YEL
A113 | SWPK 9-GRN
A114 | SWPK 10-RED
A115 | SWPK 10-YEL
A116 | SWPK 10-GRN

### FT6 TERM | FUNCTION
---|-----------------------------
A121 | SWPK 11-GPO1
A122 | SWPK 11-GPO2
A123 | N/A
A124 | N/A
A125 | N/A
A126 | N/A

### FT7 TERM | FUNCTION
---|-----------------------------
A131 | ADV DC-
A132 | ADV PRI
A133 | ADV SEC
A134 | SIM DC-
A135 | SIM PRI
A136 | SIM SEC
A137 | HS +24DC (Out)

### FT8 TERM | FUNCTION
---|-----------------------------
A141 | APP DC-
A142 | APP IN
A143 | GD DC-
A144 | GD/ISL
A145 | HS +24DC (Out)

### HEALTH STATUS CIRCUIT

<table>
<thead>
<tr>
<th>PDS/SIDE</th>
<th>FT7</th>
<th>FT8</th>
<th>HEALTH STATUS CIRCUIT</th>
<th>C16P</th>
<th>TB03</th>
<th>TB04</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>B</td>
<td>Contact</td>
<td>Pin</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>B</td>
<td>A</td>
<td>B</td>
<td>Contact</td>
<td></td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>1</td>
<td>A131</td>
<td>A141</td>
<td>Contact</td>
<td>A145</td>
<td>HSR1,6</td>
<td>A142</td>
</tr>
<tr>
<td>2</td>
<td>A132</td>
<td>A142</td>
<td>Contact</td>
<td>HSR1,4</td>
<td>HSR2,6</td>
<td>A144</td>
</tr>
<tr>
<td>3</td>
<td>A133</td>
<td>A143</td>
<td>Contact</td>
<td>HSR2,4</td>
<td>FUSE H,2</td>
<td>A135</td>
</tr>
<tr>
<td>4</td>
<td>A134</td>
<td>A144</td>
<td>Contact</td>
<td>SWPK 11,3</td>
<td>HSR1,2</td>
<td>A136</td>
</tr>
<tr>
<td>5</td>
<td>A135</td>
<td>A145</td>
<td>Contact</td>
<td>N/A</td>
<td>N/A</td>
<td>A132</td>
</tr>
<tr>
<td>6</td>
<td>A136</td>
<td>A146</td>
<td>Contact</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>N/A</td>
<td>N/A</td>
<td>Contact</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>8</td>
<td>N/A</td>
<td>N/A</td>
<td>Contact</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>9</td>
<td>N/A</td>
<td>N/A</td>
<td>Contact</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>10</td>
<td>N/A</td>
<td>N/A</td>
<td>Contact</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### NOTE:
1. A=external side, B=internal side.
   GPO2=General Purpose Output #2
   HSR1=Health Status Relay #1
2. See Health Status Circuit sheet and HSR Connector Wiring sheet for more details.
3. All dimensions shown are in inches.
NOTES: (FOR THIS DETAIL)

1. HS=Health Status, HSR1=Health Status Relay 1, FTR=Flash Transfer Relay, Aux. File=Auxiliary Output File or Output File #2
2. Fuse H shall be 0.5 Amp.
3. All dimensions shown are in inches.
HSR1 RELAY SOCKET DETAIL

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COIL</td>
</tr>
<tr>
<td>2</td>
<td>COIL</td>
</tr>
<tr>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>4</td>
<td>RR</td>
</tr>
<tr>
<td>5</td>
<td>N/A</td>
</tr>
<tr>
<td>6</td>
<td>RR</td>
</tr>
<tr>
<td>7</td>
<td>N/A</td>
</tr>
<tr>
<td>8</td>
<td>N/A</td>
</tr>
</tbody>
</table>

MODEL 205 - REAR VIEW
BEAU P-5408-LAB (Or Equal)

HEALTH STATUS RELAY (HSR1) CONNECTOR WIRING DETAIL

7 8 (N.O.)
5 6 (Common) AI45
3 4 (N.C.) HSR2, 6
(AC-) 1 FTR COIL
2 (AC+) TB03, 3

NOTE:
1. FT = Field Terminal,
   HSR=Health Status Relay
   RR=Railroad
2. All dimensions shown are in inches

HSR2 RELAY SOCKET DETAIL

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COIL</td>
</tr>
<tr>
<td>2</td>
<td>SWPK 11, RED</td>
</tr>
<tr>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>4</td>
<td>DC+</td>
</tr>
<tr>
<td>5</td>
<td>N/A</td>
</tr>
<tr>
<td>6</td>
<td>RR</td>
</tr>
<tr>
<td>7</td>
<td>N/A</td>
</tr>
<tr>
<td>8</td>
<td>N/A</td>
</tr>
</tbody>
</table>

MODEL 205 - REAR VIEW
BEAU P-5408-LAB (Or Equal)

HEALTH STATUS RELAY (HSR2) CONNECTOR WIRING DETAIL

7 8 (N.O.)
5 6 (HSR1, 4)
3 4 (N.C.) Fuse H
(AC-) 1 FTR COIL
2 (Red) SwPk 11

TITLE: INPUT/OUTPUT FILE HSR DETAILS
SHEET 10 OF 12

ERRATA 3 NO SCALE
TEES 2009 A6-52
### MODEL 200 SWITCH PACK

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC+</td>
</tr>
<tr>
<td>2</td>
<td>EQUIP. GROUND</td>
</tr>
<tr>
<td>3</td>
<td>RED OUTPUT</td>
</tr>
<tr>
<td>4</td>
<td>NA</td>
</tr>
<tr>
<td>5</td>
<td>YELLOW OUTPUT</td>
</tr>
<tr>
<td>6</td>
<td>RED INPUT</td>
</tr>
<tr>
<td>7</td>
<td>GREEN OUTPUT</td>
</tr>
<tr>
<td>8</td>
<td>YELLOW INPUT</td>
</tr>
<tr>
<td>9</td>
<td>+24 VDC</td>
</tr>
<tr>
<td>10</td>
<td>GREEN INPUT</td>
</tr>
<tr>
<td>11</td>
<td>NA</td>
</tr>
<tr>
<td>12</td>
<td>NA</td>
</tr>
</tbody>
</table>

**NOTES:**

1. Flash Transfer Relay, see A6–16.
2. All dimensions shown are in inches.
## MODEL 210 MONITOR UNIT PIN ASSIGNMENT

<table>
<thead>
<tr>
<th>CONNECTOR PIN No.</th>
<th>MONITOR FUNCTION</th>
<th>TERMINATION</th>
<th>CONNECTOR PIN No.</th>
<th>MONITOR FUNCTION</th>
<th>TERMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SWPKS 2 GRN</td>
<td>A</td>
<td>SWPKS 2 YEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SWPKS 2P GRN</td>
<td>B</td>
<td>SWPKS 6 GRN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SWPKS 6 YEL</td>
<td>C</td>
<td>SWPKS 6P GRN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>SWPKS 4 GRN</td>
<td>D</td>
<td>SWPKS 4 YEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>SWPKS 4P GRN</td>
<td>E</td>
<td>SWPKS 8 GRN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SWPKS 8 YEL</td>
<td>F</td>
<td>SWPKS 8P GRN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>SWPKS 5 GRN</td>
<td>G</td>
<td>SWPKS 5 YEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>T&amp;B</td>
<td>H</td>
<td>SWPKS 1 GRN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>SWPKS 1 YEL</td>
<td>I</td>
<td>T&amp;B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>SWPKS 7 GRN</td>
<td>J</td>
<td>SWPKS 7 YEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>T&amp;B</td>
<td>K</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>SWPKS 3 YEL</td>
<td>L</td>
<td>T&amp;B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>T&amp;B</td>
<td>M</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>NA</td>
<td>N</td>
<td>T&amp;B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>T&amp;B</td>
<td>P</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>T&amp;B</td>
<td>Q</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>NA</td>
<td>R</td>
<td>T&amp;B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>T&amp;B</td>
<td>S</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>NA</td>
<td>T</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>EQUIP. GROUND</td>
<td>U</td>
<td>T&amp;B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>AC+</td>
<td>V</td>
<td>T&amp;B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>AC-</td>
<td>W</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>WATCHDOG TIMER</td>
<td>X</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>+24 VDC</td>
<td>Y</td>
<td>DC GROUND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>LOGIC RELAY COIL</td>
<td>Z</td>
<td>EXTERNAL RESET</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>STOPTIME</td>
<td>AA</td>
<td>T&amp;B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>OUTPUT SW-SIDE 1</td>
<td>BB</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>OUTPUT-SW SIDE 1</td>
<td>CC</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>OUTPUT-SW SIDE 1</td>
<td>DD</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>OUTPUT-SW SIDE 1</td>
<td>EE</td>
<td>OUTPUT SW-SIDE 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FF</td>
<td>AC+</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NOTES: (FOR THIS DETAIL)

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–14D = INPUT FILE "I", TB 14, POSITION D
   - SSR = SOLID STATE RELAY
   - MU = MONITOR UNIT
   - N.C. = NORMALY CLOSED RELAY CIRCUIT
   - N.O. = NORMALY OPEN RELAY CIRCUIT
   - PDA FJ1 CKT1 = PDA FLASHER UNIT 1, OUTPUT CIRCUIT 1
   - POL PAN = POLICE PANEL
   - SW = SWITCH
   - SWPK(S) = SWITCH PACK(S)
   - T&B = CONDUCTORS CONNECTED TO PIN, TWO FEET IN LENGTH WITH RING LUG ON UNCONNECTED END, TIED & BUNDLED SEPARATELY.
   - 2P–2 = PHASE 2 PED. PIN 2
5. For details, see A3–3 & A3–4.
6. All dimensions shown are in inches.

### TITLE:

**INPUT/OUTPUT FILE DETAILS**

**SHEET 12 OF 12**

<table>
<thead>
<tr>
<th>ERRATA 3</th>
<th>ND SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEES 2009</td>
<td>A6–54</td>
</tr>
</tbody>
</table>
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 handles shall be centered vertically on the door opposite from the hinges on both, the rear & front.
5. Two fans each side.
6. All dimensions shown are in inches.
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.

HOLE SLOT DETAIL B
0.375X1.250 OBOUND

(TOP VIEW)

(RACK 1 & 2)
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

TITLE:
CABINET HOUSING #4 DETAILS
SHEET 7 OF 7

ERRATA 3
TEES 2009
A6–57
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 RTBO, TBS, TB0, 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. The AC terminal blocks shall have touch—safe contacts, Weidmuller or equal.
6. All dimensions shown are in inches.
NOTE:

1. Controller unit support drawer shelf assembly.
2. SPA shall be bolted on the rail and firmly attached to the Service Panel.
3. Switch Guard, see A6–60.
4. All dimensions shown are in inches.
CIRCUIT BREAKER SWITCH GUARD

NOTES: (FOR THIS DETAIL)
1. Circuit Breaker Switch Guard for SPA and Service PDA.
2. All dimensions shown are in inches.
NOTE:
1. LED Lights for 342LX, 344LX and 346LX cabinets
2. The LED switch shall be labeled cabinet lights.
3. Fan cover made of Aluminum
4. All dimensions are in inches

HARNESS JACK/PLUG NO. 3
HJ3 HP3

FUSE F3

FUSE F4

LED LIGHTING DETAILS
See note 1
| Model 2070 – 2, Field I/O Module | A9-8 |
| Model 2070 – 4 Power Supply Module | A9-13 |
| Model 2070 – Serial Port Descriptors Defaults | A9-16 |
FIELD I/O FACE PANELS

NOTES: (FOR THIS DETAIL)

1. 2070–2E+ front panel shall be 4X wide. 2070–2C front panel shall be 2X wide.
   (SEE SYSTEM PCB MODULE, GENERAL DETAILS.)
2. Dark Circles in the C1S Connector denote guide pin locations and opencircles denote guide
   socket locations.
3. Dimension “A” shall be a minimum of 0.5in.
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 front panel.
10. Front panel shall be stock Aluminum or Stainless Steel.
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, +12, +12 SER, -12 SER).
8. Power Supply shall be marked as 2070-4A.
9. The Cord shall be rated for SJT, SJ or Equal.
10. All dimensions shown are in inches.
### SERIAL PORT DESCRIPTORS DEFAULTS

<table>
<thead>
<tr>
<th>SP1, SP2, SP3 and SP5</th>
<th>SP4</th>
<th>SP6</th>
<th>SP8</th>
</tr>
</thead>
<tbody>
<tr>
<td>noupce</td>
<td>noupce</td>
<td>noupce</td>
<td>noupce</td>
</tr>
<tr>
<td>bsbe</td>
<td>bsbe</td>
<td>bsbe</td>
<td>bsbe</td>
</tr>
<tr>
<td>bsl</td>
<td>bsl</td>
<td>bsl</td>
<td>bsl</td>
</tr>
<tr>
<td>noecho</td>
<td>echo</td>
<td>echo</td>
<td>noecho</td>
</tr>
<tr>
<td>if</td>
<td>if</td>
<td>if</td>
<td>if</td>
</tr>
<tr>
<td>null=0</td>
<td>null=0</td>
<td>null=0</td>
<td>null=0</td>
</tr>
<tr>
<td>nopause</td>
<td>nopause</td>
<td>nopause</td>
<td>nopause</td>
</tr>
<tr>
<td>pag=24</td>
<td>pag=24</td>
<td>pag=24</td>
<td>pag=24</td>
</tr>
<tr>
<td>bsp=08</td>
<td>bsp=08</td>
<td>bsp=08</td>
<td>bsp=08</td>
</tr>
<tr>
<td>del=18</td>
<td>del=18</td>
<td>del=18</td>
<td>del=18</td>
</tr>
<tr>
<td>eor=0D</td>
<td>eor=0D</td>
<td>eor=0D</td>
<td>eor=0D</td>
</tr>
<tr>
<td>eof=1B</td>
<td>eof=1B</td>
<td>eof=1B</td>
<td>eof=1B</td>
</tr>
<tr>
<td>reprint=04</td>
<td>reprint=04</td>
<td>reprint=04</td>
<td>reprint=04</td>
</tr>
<tr>
<td>dup=01</td>
<td>dup=01</td>
<td>dup=01</td>
<td>dup=01</td>
</tr>
<tr>
<td>psc=17</td>
<td>psc=17</td>
<td>psc=17</td>
<td>psc=17</td>
</tr>
<tr>
<td>abort=03</td>
<td>abort=03</td>
<td>abort=03</td>
<td>abort=03</td>
</tr>
<tr>
<td>quit=05</td>
<td>quit=05</td>
<td>quit=05</td>
<td>quit=05</td>
</tr>
<tr>
<td>bse=08</td>
<td>bse=08</td>
<td>bse=08</td>
<td>bse=08</td>
</tr>
<tr>
<td>bell=07</td>
<td>bell=07</td>
<td>bell=07</td>
<td>bell=07</td>
</tr>
<tr>
<td>type=00</td>
<td>type=00</td>
<td>type=00</td>
<td>type=00</td>
</tr>
<tr>
<td>baud=1200</td>
<td>baud=9600</td>
<td>baud=38400</td>
<td>baud=9600</td>
</tr>
<tr>
<td>xon=11</td>
<td>xon=11</td>
<td>xon=11</td>
<td>xon=11</td>
</tr>
<tr>
<td>xoff=13</td>
<td>xoff=00</td>
<td>xoff=13</td>
<td>xoff=13</td>
</tr>
<tr>
<td>tabc=09</td>
<td>tabc=09</td>
<td>tabc=09</td>
<td>tabc=09</td>
</tr>
<tr>
<td>tabs=4</td>
<td>tabs=4</td>
<td>tabs=4</td>
<td>tabs=4</td>
</tr>
</tbody>
</table>

**NOTES: (FOR THIS DETAIL)**

1. All serial port descriptors shall be set with 8 Bit Word, 1 Stop & no Parity.
2. Model 2070–1C sp4 shall be set to 115.2 Kbps.
3. sp3s & sp5s shall be set to 614.4 Kbps.
<table>
<thead>
<tr>
<th>Module Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 2070-6W Wireless Modem Communications Module</td>
<td>A10-5</td>
</tr>
<tr>
<td>Model 2070-WE Wireless Ethernet Communication Module</td>
<td>A10-11</td>
</tr>
<tr>
<td>Model 2070-J Network Jack Module</td>
<td>A10-12</td>
</tr>
</tbody>
</table>
NOTES (FOR THIS DETAIL)

1. 2X Faceplate (See 2070 System PCB Module, Detail A9-6).
2. IFC GND is isolated from the internal ground system & is the voltage reference for the EIA-232 & EIA-485 signals.

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<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>
NOTES (FOR THIS DETAIL)

1. 2X Faceplate (See 2070 System PCB Module, Detail A9–6).
2. IFC GND is isolated from the internal ground system & is the voltage reference for the EIA–232 & EIA–485 signals.
3. WE = Wireless Ethernet

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BCD</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>
NOTES: (FOR THIS DETAIL)

1. Front panel shall be Aluminum stock or Stainless Steel.

RJ45 PIN ASSIGNMENTS

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX +</td>
<td>5</td>
<td>NA</td>
</tr>
<tr>
<td>2</td>
<td>TX -</td>
<td>6</td>
<td>RX -</td>
</tr>
<tr>
<td>3</td>
<td>RX +</td>
<td>7</td>
<td>NA</td>
</tr>
<tr>
<td>4</td>
<td>NA</td>
<td>8</td>
<td>NA</td>
</tr>
<tr>
<td>Description</td>
<td>Page</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------------</td>
<td>------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2070 (E or LX) N1 Controller Unit - Front View</td>
<td>A11-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2070 (E or LX) N1 Controller Unit - Side View</td>
<td>A11-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2070 (E or LX) N1 Controller Unit - ISO View</td>
<td>A11-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2070-8 Field I/O Module, Connector A &amp; B</td>
<td>A11-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2070-8 Field I/O Module, Connector C &amp; D</td>
<td>A11-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2070-8 Field I/O Module, EX1 &amp; EX2 Connectors</td>
<td>A11-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2070-2N Field I/O Module</td>
<td>A11-7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NOTES: (FOR THIS DETAIL)

1. The Model 2070 Controller Unit is shown only for reference.
2. The bottom supports shall be double flanged.
3. A = Connector A (MS–3112–22–55P Type)
   B = Connector B (MS–3112–22–55S Type)
   C = Connector C (MS–3112–24–61S Type)
   D = Connector D (MS–3112–24–61P Type)
   EX1 = Connector EX1 (DB–25S Type)
   EX2 = Connector EX2 (DB–25S Type)
4. All dimensions shown are in inches.
NOTES: (FOR THIS DETAIL)

1. The Model 2070 Controller Unit is shown only for reference.
2. TDS #3 Thumbscrew Devices. Module shall provide mating nuts permanently mounted on the module.
3. All dimensions shown are in inches.

<table>
<thead>
<tr>
<th>TITLE:</th>
<th>2070 (E or LX) N1 CONTROLLER UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIDE VIEW</td>
<td></td>
</tr>
<tr>
<td>ERRATA 3</td>
<td>NO SCALE</td>
</tr>
<tr>
<td>TEES 2009</td>
<td>A11-2</td>
</tr>
</tbody>
</table>
NOTES: (FOR THIS DETAIL)

1. The module housing bottom shall be slot vented. The top shall be open.
2. All dimensions shown are in inches.
<table>
<thead>
<tr>
<th>PIN</th>
<th>NAME</th>
<th>PORT</th>
<th>FUNCTION</th>
<th>PORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Fault Monitor</td>
<td>---</td>
<td>Phase 1 Next</td>
<td>08-1</td>
</tr>
<tr>
<td>B</td>
<td>+24 VDC External</td>
<td>---</td>
<td>Reserved</td>
<td>19-5</td>
</tr>
<tr>
<td>C</td>
<td>Voltage Monitor</td>
<td>---</td>
<td>Phase 2 Next</td>
<td>08-2</td>
</tr>
<tr>
<td>D</td>
<td>Phase 1 Red</td>
<td>01-1</td>
<td>Phase 3 Green</td>
<td>03-3</td>
</tr>
<tr>
<td>E</td>
<td>Phase 1 Don’t Walk</td>
<td>04-1</td>
<td>Phase 3 Yellow</td>
<td>02-3</td>
</tr>
<tr>
<td>F</td>
<td>Phase 2 Red</td>
<td>01-2</td>
<td>Phase 3 Red</td>
<td>01-3</td>
</tr>
<tr>
<td>G</td>
<td>Phase 2 Don’t Walk</td>
<td>04-2</td>
<td>Phase 4 Red</td>
<td>01-4</td>
</tr>
<tr>
<td>H</td>
<td>Phase 2 Ped Clear</td>
<td>05-2</td>
<td>Phase 4 Ped Clear</td>
<td>05-4</td>
</tr>
<tr>
<td>J</td>
<td>Phase 2 Walk</td>
<td>06-2</td>
<td>Phase 4 Don’t Walk</td>
<td>04-4</td>
</tr>
<tr>
<td>K</td>
<td>Phase 2 Vehicle Detector</td>
<td>11-2</td>
<td>Phase 4 Check</td>
<td>07-4</td>
</tr>
<tr>
<td>L</td>
<td>Phase 2 Pedestrian Detector</td>
<td>12-2</td>
<td>Phase 4 Vehicle Detector</td>
<td>1-4</td>
</tr>
<tr>
<td>M</td>
<td>Phase 2 Hold</td>
<td>13-2</td>
<td>Phase 4 Pedestrian Detector</td>
<td>12-4</td>
</tr>
<tr>
<td>N</td>
<td>Stop Timing (Ring 1)</td>
<td>16-2</td>
<td>Phase 3 Vehicle Detector</td>
<td>1-3</td>
</tr>
<tr>
<td>P</td>
<td>Inh Max Term (Ring 1)</td>
<td>16-3</td>
<td>Phase 3 Pedestrian Detector</td>
<td>1-3</td>
</tr>
<tr>
<td>R</td>
<td>External Start</td>
<td>18-1</td>
<td>Phase 3 Dinit</td>
<td>15-3</td>
</tr>
<tr>
<td>S</td>
<td>Interval Advance</td>
<td>18-2</td>
<td>Phase 2 Dinit</td>
<td>15-2</td>
</tr>
<tr>
<td>T</td>
<td>Indicator Lamp Control</td>
<td>18-3</td>
<td>Phase 5 Ped Dinit</td>
<td>14-5</td>
</tr>
<tr>
<td>U</td>
<td>AC Neutral</td>
<td>---</td>
<td>Phase 1 Dinit</td>
<td>15-1</td>
</tr>
<tr>
<td>V</td>
<td>Chassis Ground</td>
<td>---</td>
<td>Ped Recycle (Ring 2)</td>
<td>17-5</td>
</tr>
<tr>
<td>W</td>
<td>2070N DC Ground</td>
<td>---</td>
<td>Reserved</td>
<td>19-6</td>
</tr>
<tr>
<td>X</td>
<td>Flashing Logic Out</td>
<td>011-7</td>
<td>Reserved</td>
<td>19-7</td>
</tr>
<tr>
<td>Y</td>
<td>Coded Status Bit C (Ring 1)</td>
<td>012-3</td>
<td>Phase 3 Walk</td>
<td>06-3</td>
</tr>
<tr>
<td>Z</td>
<td>Phase 1 Yellow</td>
<td>02-1</td>
<td>Phase 3 Ped Clear</td>
<td>05-3</td>
</tr>
<tr>
<td>a</td>
<td>Phase 1 Ped Clear</td>
<td>03-1</td>
<td>Phase 3 Don’t Walk</td>
<td>04-3</td>
</tr>
<tr>
<td>b</td>
<td>Phase 2 Yellow</td>
<td>02-2</td>
<td>Phase 4 Green</td>
<td>03-4</td>
</tr>
<tr>
<td>c</td>
<td>Phase 2 Green</td>
<td>03-2</td>
<td>Phase 4 Yellow</td>
<td>02-4</td>
</tr>
<tr>
<td>d</td>
<td>Phase 2 Check</td>
<td>07-2</td>
<td>Phase 4 Walk</td>
<td>16-4</td>
</tr>
<tr>
<td>e</td>
<td>Phase 2 On</td>
<td>09-2</td>
<td>Phase 4 On</td>
<td>09-4</td>
</tr>
<tr>
<td>f</td>
<td>Phase 1 Vehicle Detector</td>
<td>11-1</td>
<td>Phase 4 Next</td>
<td>08-4</td>
</tr>
<tr>
<td>g</td>
<td>Phase 1 Pedestrian Detector</td>
<td>12-1</td>
<td>Phase 4 Dinit</td>
<td>15-4</td>
</tr>
<tr>
<td>h</td>
<td>Phase 1 Hold</td>
<td>13-1</td>
<td>Phase 4 Hold</td>
<td>13-4</td>
</tr>
<tr>
<td>i</td>
<td>Force Off (Ring 1)</td>
<td>16-1</td>
<td>Phase 3 Hold</td>
<td>13-3</td>
</tr>
<tr>
<td>j</td>
<td>Min Recall All Phases</td>
<td>18-4</td>
<td>Phase 3 Ped Dinit</td>
<td>14-3</td>
</tr>
<tr>
<td>k</td>
<td>Manual Control Enable</td>
<td>18-5</td>
<td>Phase 6 Ped Dinit</td>
<td>14-6</td>
</tr>
<tr>
<td>m</td>
<td>Call To Non-Actuated I</td>
<td>18-6</td>
<td>Phase 7 Ped Dinit</td>
<td>14-7</td>
</tr>
<tr>
<td>n</td>
<td>Test Input A</td>
<td>19-1</td>
<td>Phase 8 Ped Dinit</td>
<td>14-8</td>
</tr>
<tr>
<td>p</td>
<td>AC Power</td>
<td>---</td>
<td>Overlap A Yellow</td>
<td>012-2</td>
</tr>
<tr>
<td>q</td>
<td>I/O Mode Bit A</td>
<td>18-6</td>
<td>Overlap A Red</td>
<td>013-3</td>
</tr>
<tr>
<td>r</td>
<td>Coded Status Bit B (Ring 1)</td>
<td>012-2</td>
<td>Phase 3 Check</td>
<td>07-3</td>
</tr>
<tr>
<td>s</td>
<td>Phase 1 Green</td>
<td>03-1</td>
<td>Phase 3 On</td>
<td>09-3</td>
</tr>
<tr>
<td>t</td>
<td>Phase 1 Walk</td>
<td>06-1</td>
<td>Phase 3 Next</td>
<td>08-3</td>
</tr>
<tr>
<td>u</td>
<td>Phase 1 Check</td>
<td>07-1</td>
<td>Overlap D Red</td>
<td>011-6</td>
</tr>
<tr>
<td>v</td>
<td>Phase 2 Ped Dinit</td>
<td>14-2</td>
<td>Reserved</td>
<td>19-8</td>
</tr>
<tr>
<td>w</td>
<td>Dinit All-Red Clear (Phase 1)</td>
<td>16-7</td>
<td>Overlap D Green</td>
<td>011-4</td>
</tr>
<tr>
<td>x</td>
<td>Red Rest Mode (Ring 1)</td>
<td>16-4</td>
<td>Overlap D Ped Dinit</td>
<td>14-4</td>
</tr>
<tr>
<td>y</td>
<td>I/O Mode Bit B</td>
<td>18-7</td>
<td>Not Assigned</td>
<td>---</td>
</tr>
<tr>
<td>z</td>
<td>Call To Non-Actuated II</td>
<td>17-8</td>
<td>Max II Selection (Ring 2)</td>
<td>17-6</td>
</tr>
<tr>
<td>AA</td>
<td>Test Input B</td>
<td>19-2</td>
<td>Overlap A Green</td>
<td>010-1</td>
</tr>
<tr>
<td>BB</td>
<td>Walk Rest Modifier</td>
<td>19-4</td>
<td>Overlap B Yellow</td>
<td>010-5</td>
</tr>
<tr>
<td>CC</td>
<td>Coded Status Bit A (Ring 1)</td>
<td>012-1</td>
<td>Overlap B Red</td>
<td>010-6</td>
</tr>
<tr>
<td>DD</td>
<td>Phase 1 On</td>
<td>09-1</td>
<td>Overlap C Red</td>
<td>011-3</td>
</tr>
<tr>
<td>EE</td>
<td>Phase 1 Ped Dmit</td>
<td>14-1</td>
<td>Overlap D Yellow</td>
<td>011-5</td>
</tr>
<tr>
<td>FF</td>
<td>Pedestrian Recycle (Ring 1)</td>
<td>16-5</td>
<td>Overlap C Green</td>
<td>011-1</td>
</tr>
<tr>
<td>GG</td>
<td>Max II Selection (Ring 1)</td>
<td>16-6</td>
<td>Overlap B Green</td>
<td>010-4</td>
</tr>
<tr>
<td>HH</td>
<td>I/O Mode Bit C</td>
<td>18-8</td>
<td>Overlap C Yellow</td>
<td>011-2</td>
</tr>
<tr>
<td>PIN</td>
<td>NAME</td>
<td>FUNCTION</td>
<td>PORT</td>
<td>CONNECTOR C</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------</td>
<td>------------------</td>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>A</td>
<td>Coded Status Bit A (Ring 2)</td>
<td>012-4</td>
<td>Detector 9</td>
<td>110-1</td>
</tr>
<tr>
<td>C</td>
<td>Phase 8 Don't Walk</td>
<td>04-8</td>
<td>Detector 11</td>
<td>110-3</td>
</tr>
<tr>
<td>E</td>
<td>Phase 7 Yellow</td>
<td>02-7</td>
<td>Detector 13</td>
<td>110-5</td>
</tr>
<tr>
<td>G</td>
<td>Phase 6 Red</td>
<td>01-6</td>
<td>Detector 15</td>
<td>110-7</td>
</tr>
<tr>
<td>J</td>
<td>Phase 5 Yellow</td>
<td>02-5</td>
<td>Detector 17</td>
<td>111-1</td>
</tr>
<tr>
<td>L</td>
<td>Phase 5 Don't Walk</td>
<td>04-5</td>
<td>Detector 19</td>
<td>111-3</td>
</tr>
<tr>
<td>N</td>
<td>Phase 5 On</td>
<td>09-5</td>
<td>Detector 21</td>
<td>111-5</td>
</tr>
<tr>
<td>R</td>
<td>Phase 5 Pedestrian Detector</td>
<td>12-5</td>
<td>Detector 23</td>
<td>111-7</td>
</tr>
<tr>
<td>T</td>
<td>Phase 6 Pedestrian Detector</td>
<td>12-6</td>
<td>Clock Update</td>
<td>112-1</td>
</tr>
<tr>
<td>V</td>
<td>Phase 7 Vehicle Detector</td>
<td>11-7</td>
<td>Cycle Advance</td>
<td>112-3</td>
</tr>
<tr>
<td>X</td>
<td>Phase 8 Hold</td>
<td>13-8</td>
<td>Max 4 Selection</td>
<td>112-5</td>
</tr>
<tr>
<td>Z</td>
<td>Stop Timing (Ring 2)</td>
<td>17-2</td>
<td>Not Assigned</td>
<td>112-7</td>
</tr>
<tr>
<td>b</td>
<td>Test Input C</td>
<td>09-3</td>
<td>Alarm 1</td>
<td>113-1</td>
</tr>
<tr>
<td>d</td>
<td>Phase 8 Walk</td>
<td>06-8</td>
<td>Alarm 3</td>
<td>113-3</td>
</tr>
<tr>
<td>f</td>
<td>Phase 7 Green</td>
<td>03-7</td>
<td>Alarm 5</td>
<td>113-5</td>
</tr>
<tr>
<td>h</td>
<td>Phase 6 Yellow</td>
<td>02-6</td>
<td>Conflict Monitor Status</td>
<td>113-7</td>
</tr>
<tr>
<td>j</td>
<td>Phase 5 Walk</td>
<td>06-5</td>
<td>Special Function 1</td>
<td>114-1</td>
</tr>
<tr>
<td>m</td>
<td>Phase 5 Hold</td>
<td>13-5</td>
<td>Special Function 3</td>
<td>114-3</td>
</tr>
<tr>
<td>p</td>
<td>Phase 6 Hold</td>
<td>13-6</td>
<td>Special Function 5</td>
<td>114-5</td>
</tr>
<tr>
<td>r</td>
<td>Phase 7 Unit</td>
<td>15-7</td>
<td>Special Function 7</td>
<td>114-7</td>
</tr>
<tr>
<td>t</td>
<td>Phase 8 Vehicle Detector</td>
<td>11-8</td>
<td>Preempt 1 In</td>
<td>115-1</td>
</tr>
<tr>
<td>v</td>
<td>Don't All Red (Ring 2)</td>
<td>17-7</td>
<td>Preempt 3 In</td>
<td>115-3</td>
</tr>
<tr>
<td>x</td>
<td>Phase 8 Green</td>
<td>03-8</td>
<td>Preempt 5 In</td>
<td>115-5</td>
</tr>
<tr>
<td>z</td>
<td>Phase 6 Don't Walk</td>
<td>04-6</td>
<td>Alarm 1 Out</td>
<td>012-7</td>
</tr>
<tr>
<td>AA</td>
<td>Phase 6 Ped Clear</td>
<td>05-6</td>
<td>Alarm 2 Out</td>
<td>012-8</td>
</tr>
<tr>
<td>BB</td>
<td>Phase 6 Check</td>
<td>07-6</td>
<td>Special Function 1 Out</td>
<td>013-1</td>
</tr>
<tr>
<td>DD</td>
<td>Phase 6 Next</td>
<td>08-6</td>
<td>Special Function 3 Out</td>
<td>013-3</td>
</tr>
<tr>
<td>FF</td>
<td>Phase 8 Check</td>
<td>07-8</td>
<td>Special Function 5 Out</td>
<td>013-5</td>
</tr>
<tr>
<td>HH</td>
<td>Phase 8 Next</td>
<td>08-8</td>
<td>Special Function 7 Out</td>
<td>013-7</td>
</tr>
<tr>
<td>KK</td>
<td>Phase 7 Ped Clear</td>
<td>05-7</td>
<td>Not Assigned</td>
<td>---</td>
</tr>
<tr>
<td>MM</td>
<td>Phase 7 Check</td>
<td>07-7</td>
<td>Not Assigned</td>
<td>---</td>
</tr>
<tr>
<td>PP</td>
<td>Phase 7 Next</td>
<td>08-7</td>
<td>2070N DC Gnd</td>
<td>---</td>
</tr>
</tbody>
</table>
### EX1 Connector Pinout

<table>
<thead>
<tr>
<th>PIN</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EQ GND</td>
</tr>
<tr>
<td>2</td>
<td>TXD (FCU)</td>
</tr>
<tr>
<td>3</td>
<td>RXD (FCU)</td>
</tr>
<tr>
<td>4</td>
<td>RTS (FCU)</td>
</tr>
<tr>
<td>5</td>
<td>CTS (FCU)</td>
</tr>
<tr>
<td>6</td>
<td>NA</td>
</tr>
<tr>
<td>7</td>
<td>2070-8 DC GND</td>
</tr>
<tr>
<td>8</td>
<td>DCD (FCU)</td>
</tr>
<tr>
<td>9</td>
<td>2070-8 DC GND</td>
</tr>
<tr>
<td>10</td>
<td>SP3TXD+</td>
</tr>
<tr>
<td>11</td>
<td>SP3TXD-</td>
</tr>
<tr>
<td>12</td>
<td>SP3TXC+</td>
</tr>
<tr>
<td>13</td>
<td>SP3TXC-</td>
</tr>
<tr>
<td>14</td>
<td>2070-8 DC GND</td>
</tr>
<tr>
<td>15</td>
<td>SP3RXD+</td>
</tr>
<tr>
<td>16</td>
<td>SP3RXD-</td>
</tr>
<tr>
<td>17</td>
<td>2070-8 DC GND</td>
</tr>
<tr>
<td>18</td>
<td>SP3RXC+</td>
</tr>
<tr>
<td>19</td>
<td>SP3RXC-</td>
</tr>
<tr>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>21</td>
<td>NA</td>
</tr>
<tr>
<td>22</td>
<td>NA</td>
</tr>
<tr>
<td>23</td>
<td>NA</td>
</tr>
<tr>
<td>24</td>
<td>NA</td>
</tr>
<tr>
<td>25</td>
<td>NA</td>
</tr>
</tbody>
</table>

### EX2 Connector Pinout

<table>
<thead>
<tr>
<th>PIN</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EG (Equipment Ground)</td>
</tr>
<tr>
<td>2</td>
<td>TXD (Channel 1)</td>
</tr>
<tr>
<td>3</td>
<td>RXD (Channel 1)</td>
</tr>
<tr>
<td>4</td>
<td>RTS (Channel 1)</td>
</tr>
<tr>
<td>5</td>
<td>CTS (Channel 1)</td>
</tr>
<tr>
<td>6</td>
<td>NA</td>
</tr>
<tr>
<td>7</td>
<td>IFC GND</td>
</tr>
<tr>
<td>8</td>
<td>DCD (Channel 1)</td>
</tr>
<tr>
<td>9</td>
<td>AUDIO IN (Channel 1)</td>
</tr>
<tr>
<td>10</td>
<td>AUDIO IN (Channel 1)</td>
</tr>
<tr>
<td>11</td>
<td>AUDIO OUT (Channel 1)</td>
</tr>
<tr>
<td>12</td>
<td>AUDIO OUT (Channel 1)</td>
</tr>
<tr>
<td>13</td>
<td>NA</td>
</tr>
<tr>
<td>14</td>
<td>EG (Equipment Ground)</td>
</tr>
<tr>
<td>15</td>
<td>TXD (Channel 2)</td>
</tr>
<tr>
<td>16</td>
<td>RXD (Channel 2)</td>
</tr>
<tr>
<td>17</td>
<td>RTS (Channel 2)</td>
</tr>
<tr>
<td>18</td>
<td>CTS (Channel 2)</td>
</tr>
<tr>
<td>19</td>
<td>NA</td>
</tr>
<tr>
<td>20</td>
<td>IFC GND</td>
</tr>
<tr>
<td>21</td>
<td>DCD (Channel 2)</td>
</tr>
<tr>
<td>22</td>
<td>AUDIO IN (Channel 2)</td>
</tr>
<tr>
<td>23</td>
<td>AUDIO IN (Channel 2)</td>
</tr>
<tr>
<td>24</td>
<td>AUDIO OUT (Channel 2)</td>
</tr>
<tr>
<td>25</td>
<td>AUDIO OUT (Channel 2)</td>
</tr>
</tbody>
</table>
NOTES: (FOR THIS DETAIL)

1. 2070N Faceplate shall be 4X wide.
2. RS-485 Termination Resistors (120 Ohms) provided external to module.
3. Dimension "X" shall be minimum of 1.00 in.
4. A – Intermate with MS3106()-18-1S.
   C15S – 15-Pin DB Socket Type.
5. EG (Equipment Ground) pin is electrically connected to the faceplate.
6. Port 1 Disable: OVDC = Disable.
7. Front panel shall be Aluminum stock or Stainless Steel.
8. All dimensions shown are in inches.