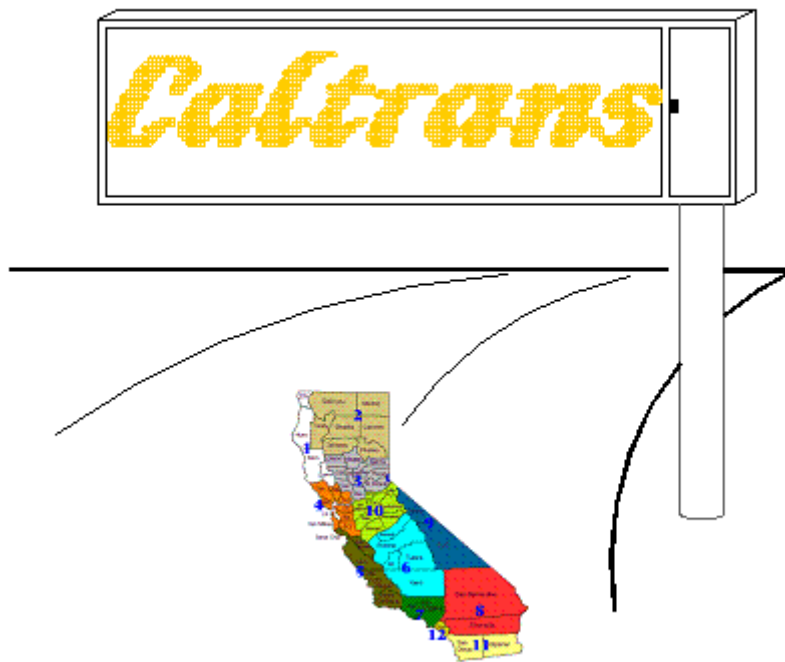




# **SPECIFICATIONS FOR CHANGEABLE MESSAGE SIGN SYSTEM**

## **TEES CHAPTER 8**



**June 4, 2009**

**STATE OF CALIFORNIA  
DEPARTMENT OF TRANSPORTATION**



**Arnold Schwarzenegger**  
*Governor*

**Dale Bonner**  
*Secretary*  
*Business, Transportation & Housing*  
*Agency*

**Will Kempton**  
*Director*  
*Department of Transportation*

**Michael Miles**  
*Deputy Director*  
*Maintenance and Operations*

**Robert Copp**  
*Program Manager*  
*Traffic Operations*

**Jeff McRae**  
*Chief, Office ITS Projects and Standards*

**Herasmo Iñiguez**  
*Sr. TEE, Office ITS Projects and Standards*

# TABLE OF CONTENTS

<b>TEES</b>	<b>1</b>
<b>CHAPTER 8</b>	<b>1</b>
<b>CHANGEABLE MESSAGE</b>	<b>1</b>
<b>SPECIFICATIONS</b>	<b>1</b>
<b>CHAPTER 8-SECTION A</b>	<b>2</b>
<b>GLOSSARY</b>	<b>2</b>
<b>CHAPTER 8-SECTION 1</b>	<b>4</b>
<b>GENERAL</b>	<b>4</b>
8.1.1 Model 500 and 510 CMS Configuration .....	4
8.1.2 Model 520 CMS Configuration .....	4
8.1.3 Model 500 and 510 Control Compartment .....	4
8.1.4 Model 520 Control Compartment .....	4
8.1.5 Model 500 and 510 CMS Service Power.....	4
8.1.6 Model 520 CMS Service Power .....	4
8.1.7 CMS Total Weight.....	4
8.1.8 CMS Serial Numbers .....	4
8.1.9 CMS Items Supplied .....	5
8.1.10 CMS Harness .....	5
8.1.10.1 Harness No.1 .....	5
8.1.10.2 Harness No. 2.....	5
8.1.10.3 Harness No. 3.....	5
8.1.10.4 Harness No. 4.....	6
8.1.10.5 Harness No. 5.....	6
8.1.10.6 Harness No. 4 and 5 Shipping.....	6
8.1.10.7 Harness No. 4 and 5 Access Holes .....	6
8.1.10.8 Harness Minimum Slack.....	6
8.1.10.9 Harness No. 1 and 2 Slack .....	6
8.1.11 Spare Parts .....	6
<b>CHAPTER 8-SECTION 2</b>	<b>8</b>
<b>PIXEL MATRIX MODULE</b>	<b>8</b>
8.2.1 General.....	8
8.2.2 Formed Plastic Cover.....	8
8.2.3 Pixels.....	8
8.2.3.1 General and mechanical.....	8
8.2.3.2 LED Pixel TYPE 1 or Equal .....	8
8.2.3.3 LED Pixel TYPE 2 or equal.....	9
8.2.3.4 Light Emitting Diodes.....	9

8.2.3.5	Photometric Requirements.....	9
8.2.3.6	Power and Control .....	10
8.2.4	Module Panel .....	10
<b>CHAPTER 8-SECTION 3</b>		<b>11</b>
<b>SIGN STRUCTURE AND HOUSING</b>		<b>11</b>
8.3.1	Housing Requirements.....	11
8.3.1.1	Housing Construction .....	11
8.3.1.1.1	Model 500 .....	11
8.3.1.1.2	Model 510 & 520 .....	11
8.3.1.2	Welding.....	11
8.3.1.3	Access Door and Panels.....	12
8.3.1.3.1	Front Access Door .....	12
8.3.1.3.1.1	Model 500 .....	12
8.3.1.3.1.2	Model 510 & 520 .....	12
8.3.1.3.2	Side Access Panels.....	13
8.3.2	Surface Treatment.....	13
8.3.3	Anodizing.....	14
8.3.4	Painting .....	14
8.3.4.1	General.....	14
8.3.4.2	Application.....	15
8.3.4.3	Second Finish.....	15
8.3.5	Ventilation.....	16
<b>CHAPTER 8-SECTION 4</b>		<b>17</b>
<b>CONTROL COMPARTMENT</b>		<b>17</b>
8.4.1	General.....	17
8.4.2	19-Inch EIA Racks.....	17
8.4.3	CMS Interface Panel (CIP) .....	18
8.4.4	Controller Interface .....	18
8.4.5	Power Distribution Assembly No. 4L (PDA #4L) .....	19
8.4.6	CMS Isolation Module (CIM) .....	19
8.4.7	Pixel Driver Assembly (PxDA) .....	20
8.4.8	Pixel Driver Module (PxDM) .....	20
8.4.8.1	General Requirements.....	20
8.4.8.2	Feature Requirements .....	21
<b>CHAPTER 8-SECTION 5</b>		<b>22</b>
<b>MODEL 500, 510 AND 520 CMS SYSTEM INTERCONNECTION</b>		<b>22</b>
8.5.1	General.....	22
8.5.2	CMS Control Isolation Assembly (CIA) .....	22
<b>CHAPTER 8-SECTION 6</b>		<b>24</b>
<b>CONTROLLER CABINET</b>		<b>24</b>

8.6.1	334LC Cabinet.....	24
8.6.2	Light Level Control System.....	24
8.6.2.1	General Requirements.....	24
8.6.2.2	Feature Requirements .....	24
8.6.2.2.1	Background Light Sensing Circuitry .....	24
8.6.2.2.2	Pixel Dimming Circuitry - CIA .....	24
<b>CHAPTER 8-SECTION 7</b>		<b>26</b>
<b>GENERAL DETAILS</b>		<b>26</b>
8.7.1	CMS System Block Diagram.....	26
8.7.2	CMS System AC Wiring Diagram .....	26
8.7.3	Pixel Driver Module Circuit Block Diagram.....	26
8.7.4	Pixel Driver Assembly, Front View.....	26
8.7.5	Pixel Driver Assembly, Rear View.....	26
8.7.6	Pixel Driver Module .....	26
8.7.7	Controller Isolation Assembly .....	26
8.7.8	Model 334LC Cabinet, Input File # 3 -- Upper Part.....	26
8.7.9	Model 334LC Cabinet, Input File # 3 -- Lower Part .....	26
8.7.10	CMS Interface Panel .....	26
8.7.11	CMS Interface Panel Terminal Block.....	26
8.7.12	PDA # 4L .....	26
8.7.13	CMS Isolation Module.....	26
8.7.14	Address and Pixel BIT Configuration.....	26
8.7.15	CMS Device Address Assignment.....	26
8.7.16	CMS Timing Diagram .....	26
8.7.17	CMS Connector Details .....	26
8.7.18	Harness # 1 Wiring Diagram .....	26
8.7.19	Harness # 2 Wiring Diagram .....	26
8.7.20	Harness # 3 Wiring Diagram .....	26
8.7.21	CMS Harness # 4 and # 5 Wiring Lists .....	26
8.7.22	CMS Harness # 4 and # 5 Color Code Wiring Lists.....	26
8.7.23	CMS Harness # 5 and TB1 Wiring Lists .....	26
8.7.24	Model 334LC C1 Harness # 2 .....	26
8.7.25	PDA #4L CIM and CFP Connector Assignments .....	26
8.7.26	PDA # 4L CMS CE (A to E) and Terminal Block Connector Assignments .....	27
8.7.27	Pixel Driver Module Connector Assignments .....	27
8.7.28	Controller Isolation Assembly Connector PIN Assignments for C8P AND C9P Connectors .....	27
8.7.29	Direct Mode DB9 Communications Cable .....	27
8.7.30	Modem DB9 Communications Cable.....	27
8.7.31	Direct Mode DB-25 Communications Cable.....	27
8.7.32	Modem DB-25 Communications Cable.....	27
8.7.33	GDI Modem DB9 Communications Cable.....	27
<b>CHAPTER 8-SECTION 8</b>		<b>28</b>

<b>MODEL 500 CMS DETAILS</b>	<b>28</b>
8.8.1 Sign Housing Details, Elevation, Side Doors and End Cap	28
8.8.2 Sign Housing Details, Elevation, Rear, Plan and Z-Bar	28
8.8.3 Transformers To CIP Wiring Details.....	28
8.8.4 CMS System, LED Wiring Diagram .....	28
8.8.5 Pixel Matrix Module, Front View.....	28
8.8.6 Pixel Matrix Module, Rear View.....	28
8.8.7 Pixel Matrix Module, Type 1, End View.....	28
8.8.8 Pixel Matrix Module, Type 2, End View.....	28
8.8.9 CMS Control Compartment Mounting Details.....	28
8.8.10 Testing Stand, Elevation View .....	28
8.8.11 Testing Stand, Plan View.....	28
8.8.12 CMS Lifting Bracket.....	28
8.8.13 Shipping Pallet Dimensions.....	28
8.8.14 Palletized CMS Shipping Method .....	28
<b>CHAPTER 8-SECTION 9</b>	<b>29</b>
<b>MODEL 510 CMS DETAILS</b>	<b>29</b>
Sign Housing Details, Outside Dimensions.....	29
Sign Housing Details, Elevation, Side Door, End Cap, Screens .....	29
Pixel Matrix Module, LEDS and Thumbscrews Spacing.....	29
CMS Control Compartment Mounting Details.....	29
CMS Lifting Bracket.....	29
Shipping Pallet Dimensions.....	29
<b>CHAPTER 8-SECTION 10</b>	<b>30</b>
<b>MODEL 520 CMS DETAILS</b>	<b>30</b>
8.10.1 Sign Housing Detail, Front and Side Views .....	30
8.10.2 Sign Housing Detail, Rear and Top Views .....	30
8.10.3 Transformers To CIP Wiring Details.....	30
8.10.4 CMS Control Compartment Mounting Details.....	30
8.10.5 Pixel Matrix Module, Front View.....	30
8.10.6 Pixel Matrix Module , Rear View .....	30
8.10.7 CMS Shipping Pallet.....	30
<b>APPENDIX A</b>	<b>31</b>
<b>CHAPER 8 DETAILS</b>	<b>31</b>
<b>APPENDIX A7</b>	<b>32</b>
<b>GENERAL DETAILS</b>	<b>32</b>
CMS System Block Diagram.....	33

CMS System AC Wiring Diagram .....	33
PxDM Circuit Block Diagram .....	33
Pixel Driver Assembly, Front View.....	33
Pixel Driver Assembly, Rear View.....	33
Pixel Driver Module .....	33
Controller Isolation Assembly .....	33
Model 334LC Cabinet, Input File #3 -- Upper Part.....	33
Model 334LC Cabinet, Input File # 3 -- Lower Part .....	33
CMS Interface Panel .....	33
CMS Interface Panel Terminal Block.....	33
PDA # 4L      33	
CMS Isolation Module.....	33
Address and Pixel BIT Configuration.....	33
CMS Device Address Assignment.....	33
CMS Timing Diagram .....	33
CMS Connector Details .....	33
Harness# 1 Wiring Diagram .....	33
Harness # 2 Wiring Diagram .....	33
Harness # 3 Wiring Diagram .....	33
Harness # 4 and # 5 Wiring Lists.....	33
Harness # 4 and # 5 Color Code Wiring Lists .....	33
Harness # 5 and TB1 Wiring Lists.....	33
Model 334LC C1 Harness # 2 .....	33
PDA #4L CIM and CFP Connector Assignments .....	33
PDA #4L CMS CE (A to E) and Terminal Block .....	33
Connector Assignment.....	33
Pixel Driver Module Connector Assignments .....	33
Controller Isolation Assembly Connector PIN.....	34
Assignment For C8P and C9P Connectors .....	34
Direct Mode DB9 Communications Cable .....	34
Modem DB9 Communications Cable.....	34
Direct Mode DB-25 Communications Cable.....	34
Modem DB-25 Communications Cable.....	34
GDI Modem DB9 Communications Cable.....	34
<b>APPENDIX A8</b>	<b>68</b>
<b>MODEL 500 CMS DETAILS</b>	<b>68</b>
Sign Housing Details, Elevation, Side Doors and End Cap .....	69
Sign Housing Details, Elevation, Rear and Z-Bar .....	69
Transformers to CIP Wiring Details .....	69
CMS System, LED Wiring Diagram .....	69
Pixel Matrix Module, Front View.....	69
Pixel Matrix Module, Rear View.....	69
Pixel Matrix Module, Type 1, End View.....	69
Pixel Matrix Module, Type 2, End View.....	69
CMS Control Compartment Mounting Details.....	69

CMS Testing, Elevation View .....	69
CMS Testing, Plan View .....	69
CMS Lifting Bracket.....	69
Shipping Pallet Dimensions.....	69
Palletized CMS Shipping Method .....	69
<b>APPENDIX A9</b>	<b>84</b>
<b>MODEL 510 CMS DETAILS</b>	<b>84</b>
Sign Housing Details, Outside Dimensions.....	85
Sign Housing Details, Elevations, Side Door, End Cap and Screens .....	85
Pixel Matrix Module, LED and Thumbscrew Spacing.....	85
CMS Control Compartment Mounting Details.....	85
CMS Lifting Bracket.....	85
Shipping Pallet Dimensions.....	85
<b>APPENDIX A10</b>	<b>92</b>
<b>MODEL 520 CMS DETAILS</b>	<b>92</b>
Sign Housing Details, Front and Side Views.....	93
Sign Housing Details, Rear and Top Views .....	93
Transformers To CIP Wiring Details.....	93
Pixel Matrix Module, Front View.....	93
CMS Control Compartment Mounting Details.....	93
Pixel Matrix Module, Rear View.....	93
CMS Shipping Pallet.....	93



**CHAPTER 8**  
**CHANGEABLE MESSAGE**  
**SPECIFICATIONS**

## **CHAPTER 8-SECTION A**

### **GLOSSARY**

<b>AASHTO</b>	American Association of State Highway and Transportation Officials
<b>AC</b>	Alternating Current
<b>AllnGaP</b>	Aluminum Indium Gallium Phosphide. Refer to the chemical composition of an LED
<b>ANSI</b>	American National Standards Institute
<b>ASTM</b>	American Society for Testing and Materials
<b>AWS</b>	American Welding Society
<b>AWG</b>	American Wire Gage
<b>CA</b>	Connector A
<b>CAS</b>	Connector A Socket
<b>CB</b>	Connector B
<b>CBS</b>	Connector B Socket
<b>CC</b>	Connector C
<b>CD</b>	Connector D
<b>CDS</b>	Connector D Socket
<b>CE</b>	Connector E
<b>CES</b>	Connector E Socket
<b>CFP</b>	Connector F Plug
<b>CFS</b>	Connector F Socket
<b>CIA</b>	Controller Isolation Assembly
<b>CIM</b>	CMS Isolation Module
<b>CIP</b>	CMS Interface Panel
<b>CMS</b>	Changeable Message Sign
<b>CITB</b>	CMS Interface Panel Terminal Block
<b>DAT</b>	Diagnostic and Acceptance Test Program
<b>DC</b>	Direct Current
<b>DIM</b>	A low level of illumination (lighting)
<b>EIA</b>	Electronic Industries Association
<b>ITE</b>	Institute of Transportation Engineers
<b>ITS</b>	Intelligent Transportation System
<b>KVA</b>	Kilovolt-Ampere
<b>LDM</b>	Lamp Driver Module
<b>LED</b>	Light Emitting Diode
<b>METS</b>	Materials Engineering and Testing Services, Caltrans Division
<b>MIG</b>	Metal Insert Gas
<b>MTBF</b>	Mean Time Between Failures
<b>NEMA</b>	National Electrical Manufacturers Association
<b>PDA</b>	Power Distribution Assembly
<b>PCB</b>	Printed Circuit Board
<b>PxDA</b>	Pixel Driver Assembly
<b>PxDM</b>	Pixel Driver Module

<b>PxMM</b>	Pixel Matrix Module
<b>RMS</b>	Root-Mean-Square
<b>TB</b>	Terminal Block
<b>TIG</b>	Tungsten Inert Gas
<b>TSD</b>	Thumb Screw Device
<b>UV</b>	Ultraviolet Light
<b>VA</b>	Voltage Ampere
<b>VAC</b>	Voltage Alternating Current

## **CHAPTER 8-SECTION 1 GENERAL**

### **8.1.1 Model 500 and 510 CMS Configuration**

The Models 500 and 510 CMS shall have a configuration of 5 Pixel Matrix Modules high by 12 Pixel Matrix Modules across (60 modules) forming a continuous matrix display of 96 pixels across by 25 pixels high (2400 pixels).

### **8.1.2 Model 520 CMS Configuration**

The Model 520 shall have a configuration of 5 Pixel Matrix Modules high by 6 Pixel Matrix Modules across (30 modules) forming a continuous matrix display of 48 pixels across by 25 pixels high (1200 pixels).

### **8.1.3 Model 500 and 510 Control Compartment**

The Models 500 and 510 CMS shall have a Control Compartment on the front right side of its housing. The Control Compartment shall be accessible through panels on the sign's right end side and the compartment front door.

### **8.1.4 Model 520 Control Compartment**

The Model 520 shall have a Control Compartment on the rear side of its housing. The Control Compartment shall be accessible through the compartment back door.

### **8.1.5 Model 500 and 510 CMS Service Power**

The Models 500 and 510 CMS systems shall be designed to operate on a Single Phase 120/240VAC Service, rated at 5KVA (minimum) LED pixels.

### **8.1.6 Model 520 CMS Service Power**

The Model 520 CMS system shall be designed to operate on a Single Phase, 120/240 VAC Service, [rated at 5KVA \(minimum\) LED pixels](#).

### **8.1.7 CMS Total Weight**

The total weight of the supplied CMS shall not exceed:

Model 500	-	2400 pounds (1089.6kg)
Model 510	-	2000 pounds (908kg)
Model 520	-	1000 pounds (454kg)

A verification of the total weight shall be documented and included in the Certificate of Compliance.

### **8.1.8 CMS Serial Numbers**

Serial numbers of the CMS units shall be displayed on a metal plate attached to the inside of the front door panel, and outside upper right side.

Plate shall be 3in x 5in (7.62cm x 12.7cm) with the serial number stamped in 2in (5.08cm) numbers.

## **8.1.9 CMS Items Supplied**

### **8.1.9.1 CMS System**

The CMS System shall include the Model 500 CMS or Model 510 CMS or Model 520 CMS as per contract.

### **8.1.9.2 CMS System Components**

Controller, Controller Cabinet, Controller Isolation Assembly (CIA), CMS Harnesses #4 and #5 and all other required equipment and wiring necessary to operate the system. The Controller shall be State Furnished unless called out in Contract Special Provisions.

### **8.1.9.3 Step Down Transformer**

Step down transformer where LED pixels are used:

Model 500, 510, 520 - One - 5KVA - 120VAC to 20VAC

## **8.1.10 CMS Harness**

### **8.1.10.1 Harness No.1**

A Harness No. 1 shall be provided between each PMM connector assembly (CA and CB connectors) and its associated PxDM CC connector in the associated PxDA.

Each harness shall consist of:	Required conductor quantity
	No. 22 AWG or larger conductors
	1 CAS Connector
	1 CBS Connector
	1 CCP Connector

Each harness shall be routed in properly supported cable trays.

### **8.1.10.2 Harness No. 2**

A Harness No. 2 shall be provided between each PxDA CD connector and the associated PxDA No. 4 CE connector.

Each harness shall consist of:	Required conductor quantity
	No. 22 AWG or larger conductors
	1 CDS Connector
	1 CES Connector

### **8.1.10.3 Harness No. 3**

A Harness No. 3 shall be provided between the PDA No. 4 CF connector and the associated Controller Interface Terminal Block Positions on the CIP.

The harness shall consist of:	Required conductor quantity
	No. 22 AWG or larger conductors
	1 CFS Connector

#### 8.1.10.4 Harness No. 4

A Harness No. 4 shall be provided to interconnect the CMS CIP Panel Terminal Position to the Controller Cabinet CIA Assembly (via C8S and C9S connectors).

The harness shall consist of: 300 feet (91.46m) of **Ledstar or McCain**,

Type A-881 or equal

(24 pr. #18 AWG, multicolored pairs)

1 C8S Connector

1 C9S Connector

Logic Signal & DC Logic Ground

Conductors - Stripped and tinned

#### 8.1.10.5 Harness No. 5

A Harness No. 5 shall be provided to interconnect the CMS CIP Panel Terminal Positions (Current Monitor Circuits) to the TB1 in the **Model 334L Controller Cabinet**.

The harness shall consist of: 300 feet (91.46m) of **Ledstar or McCain**,

Type A-881 or equal

(6 pr. #18 AWG, multicolored pairs)

Conductors - Stripped and tinned

#### 8.1.10.6 Harness No. 4 and 5 Shipping

The harnesses #4 and #5 shall be neatly rolled up on a wooden reel and prepared for shipping. It shall be so designated and labeled with the associated CMS.

#### 8.1.10.7 Harness No. 4 and 5 Access Holes

Access holes for harness #4 & #5 shall be at the rear of controller compartment on CMS housing.

#### 8.1.10.8 Harness Minimum Slack

All harnesses shall have a minimum of 2 feet (0.610m) of slack available on each connector or connector assembly end and shall be permanently labeled according to connector pin assignments, device addressing and/or function.

#### 8.1.10.9 Harness No. 1 and 2 Slack

Harnesses #1 and #2 shall provide enough slack, to completely pull the PxDas out of the equipment rack, to facilitate maintenance.

#### 8.1.11 Spare Parts

Spare parts shall meet the requirements of these specifications. **The CIA and Pixel Driver Assembly (PxDA) with 5 Pixel Driver Modules (PxDM) shall be mounted inside the 334L Controller Cabinet.** The following items shall be included per each delivered Model 500, 510 or 520 CMS system:

2 each - Pixel Matrix Module with pixels (PMM)

5 each -	Pixel Driver Module (PDM)
1 each -	Pixel Driver Assembly (PXDA)
1 each -	CMS Isolation Module (CIM)
1 each -	Controller Isolation Assembly (CIA)

## CHAPTER 8-SECTION 2

### PIXEL MATRIX MODULE

#### 8.2.1 General

Each PxMM shall consist of 40 LED pixels, module panel, 4 - TSD No. 2, and Connectors CAP and CBP. Each PxMM shall be interchangeable.

Each PxMM shall be secured to the sign support framing at each of its four corners by the TSD No. 2 Devices.

All PMM wiring shall be No. 22 AWG or larger.

#### 8.2.2 Formed Plastic Cover

Formed Plastic Cover (FPC) shall be coated or treated to reduce glare off of PxMM.

The coating or treatment shall not diminish light output by more than 15%. The outside of the FPC shall be smooth. The FPC shall maintain a watertight seal against the PxMM panel.

#### 8.2.3 Pixels

##### 8.2.3.1 General and mechanical

Each pixel shall consist of light emitting diodes (LED's).

The maximum weight of a LED PxMM shall be 7 lbs. (3.178kg).

Pixel Matrix Modules shall conform to all applicable dimensions as specified in details sections 8-8, 8-9 and 8-10.

Each pixel panel module shall have the manufacturer's name, trademark, model number, and serial number permanently marked on the back of the panel. Rated voltage, current, power consumption and volt-amperes (VA) shall also be identified.

The PxMM's shall be rated for a minimum useful life of 48 months.

The maximum luminosity degradation shall be less than 15% after 48 month of operation.

All PxMM's shall meet all parameters of this specification during this period.

##### 8.2.3.2 LED Pixel TYPE 1 or Equal

Each LED pixel shall be mounted in a 44.5 mm (1.75 in) (diameter or on a side) x 44.9 mm (1.77 in) (maximum dimensions) length hooded visor shell as shown in Fig 8-8-9.

Each LED pixel shall be mounted 6 degree down off-axis mounting plane (vertical).

The shape of an individual pixel shall be square or circular and the LED's shall be evenly



distributed in the pixel.

Each LED pixel (measured from LED to LED on the outside) shall be no larger than 38 mm (1.5 in.) (either on the diameter or on a side).

Each LED pixel shall be encapsulated for water resistance.

Each LED pixel shall be attached to the module panel using a single crew (M-3) mounting with locating pin

Each pixel shall have two 300 mm (12 in.) leads for electrical connection.

The wiring shall be color coded per TEES Section 1.3.13.6.

The wiring shall be fixed to the back of the PxMM to prevent snagging during installation or removal per TEES Section 1.3.13.3

Electronics shall be encapsulated in each pixel, or covered if a separate, intermediated PC board is used.

#### **8.2.3.3 LED Pixel TYPE 2 or equal**

Each LED pixel shall consist of an array of LED's mounted on a PC board as shown in Fig 8-8-10.

Entire Pixel Matrix Module shall be sealed and coated for water resistance.

The shape of an individual pixel shall be square or circular and the LED's shall be evenly distributed in the pixel.

Each LED pixel shall be no larger than 38 mm (1.5 in.) (either diameter or on a side).

The electronics on the PC board shall not be visible looking through the FPC except for the LED's.

Wiring and electronics on the back of the PC board shall be covered.

#### **8.2.3.4 Light Emitting Diodes**

LED shall be ultra-bright type, AlInGaP

Color shall be yellow,  $592 \pm 5$  nm

All LED's for each pixel shall be from the same manufacturer and same color bin.

The MTBF of the LED devices should exceed 100,000 hrs of operation.

#### **8.2.3.5 Photometric Requirements**

All measurements shall be performed after environmental testing, 24 hours each at  $-40^{\circ}\text{C}$  (-40

<sup>0</sup>F) and 74 <sup>0</sup>C (165.2 <sup>0</sup>F), and at 25 <sup>0</sup>C (77 <sup>0</sup>F) (normal operating temperature).

Each pixel shall have a minimum initial brightness of 40 candela, at full bright dimming level (level 7), over the temperature range of -40 <sup>0</sup>C to +74 <sup>0</sup>C (-40 <sup>0</sup>F to 165.2 <sup>0</sup>F).

Each pixel shall maintain a brightness of 34 **candelas** throughout the minimum useful life of 48 months at a temperature of 25 <sup>0</sup>C (77 <sup>0</sup>F).

Each pixel shall have a viewing angle of 30 degrees or more.

A failure of one LED shall not result in a loss of more than 25% of light output

#### **8.2.3.6 Power and Control**

Maximum power consumption shall be 2.0 watts per pixel.

Each pixel shall accept 18 VAC to 28 VAC (22 VAC nominal) as input voltage.

The minimum power factor shall be 0.95.

Each LED pixel shall be compatible with existing PDM (see TEES Section 8.4.6).

Each pixel shall respond to dimming control using the stepped triac modes (pulse width modulation) as defined in TEES Section 8.6.2.

#### **8.2.4 Module Panel**

The panel shall be fabricated from 1.588mm (0.0625 inch) minimum thick aluminum sheet. After fabrication the panel and support shall be treated with a black color according to Section 5 - Structures and Housing Surface Treatment Requirements.

## **CHAPTER 8-SECTION 3**

### **SIGN STRUCTURE AND HOUSING**

#### **8.3.1 Housing Requirements**

The housing shall include, but not be limited to, the following:

Doors    Ventilation  
Latches/Handles        Gasketing  
Hinges and Door Catches    Cage Supports  
and Mounting for PxMMs and CMS  
Equipment

##### **8.3.1.1 Housing Construction**

The CMS housing shall be constructed to present a clean, neat appearance.

The CMS housing shall be fabricated from 0.125-inch (3.17mm) minimum thick 5052-H32 aluminum alloy and shall be designed to withstand 33 pounds (14.97kg) per square foot as specified in the latest AASHTO publication entitled "**Standard Specification for Structural Supports for Highway Signs, Luminaries and Traffic Signals**".

The CMS housing shall have interior cage support frames to mount the PxMMs. The cage support frame shall withstand or minimize vibration when the sign is mounted with any number of PxMMs.

The doors, lifting eyes, gasket channels, dual tracks and all supports welded to the housing shall be fabricated of 0.125 inch (3.17mm) minimum thickness aluminum sheet. Bolted on supports shall be either the same material and thickness as the housing or 0.105 inch (2.67mm) minimum steel sheet.

The exterior Z-bar supports shall be fabricated of 0.250 inch (6.35mm) minimum thickness and the material shall be the same as the CMS housing.

##### **8.3.1.1.1 Model 500**

A 6 inch (152.4mm) wide border made of the same material as the housing shall encompass the Pixel Matrix Module Section/Array and enclose any open areas around the section/array. The border shall be uniform and painted or treated according to specifications under this section.

##### **8.3.1.1.2 Model 510 & 520**

A 5-inch (127mm) wide border made of the same material as the housing shall encompass the Pixel Matrix Module Section/Array and enclose any open areas around the section/array. The border shall be uniform and painted or treated according to specifications under this section.

##### **8.3.1.2 Welding**

All exterior seams shall be continuously welded and each weld shall be uniform flow.

Welding on aluminum housings shall be done as follows:

On all exterior seams the gas tungsten arc (TIG) process using bare aluminum welding electrodes shall only be used.

On all interior seams the gas metal arc (MIG) or gas tungsten arc (TIG) process using bare aluminum welding electrodes shall be used.

The aluminum welding electrodes shall conform to the requirements of the American Welding Society (AWS) A5.10 for ER5356 aluminum alloy bare welding electrodes. Procedures, welders and welding operators for welding on aluminum shall be qualified in accordance with the requirements of AWS B3.0, "Welding Procedure and Performance Qualification", and to the practices recommended in AWS C5.6.

The housing front door frames 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 housing external surface when the door is closed and latched shall be  $0.156 \pm 0.08$  inch ( $3.96\text{mm} \pm 2.03\text{mm}$ ).

Gasketing shall be provided on all door openings and shall be dust-tight. Gaskets shall be 0.25 inch (6.35mm) 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).

### **8.3.1.3 Access Door and Panels**

#### **8.3.1.3.1 Front Access Door**

##### **8.3.1.3.1.1 Model 500**

For the Model 500, the latching handle shall be on the left side of the front door with hinges on the right side. The latching handle shall be turned clockwise to an angle of  $90 \pm 5$  degrees from the closed position in order to open the door. Latching the door closed from the open position shall be only performed in the counterclockwise direction.

##### **8.3.1.3.1.2 Model 510 & 520**

The Models 510 and 520 shall have double compartment doors. The latching handle of the right door shall be on the left side with hinges on the right side. The latching handle shall be turned clockwise to an angle of  $90 \pm 5$  degrees from the closed position in order to open the door. Latching the door closed from the open position shall be only performed in the counterclockwise direction. The left door shall be a mirror image of the right door.

The latching handle shall have provision for padlocking in the closed position. Each handle shall be 0.75 inch (19.05mm) minimum diameter stainless steel with a minimum 0.5 inch

(12.7mm) shank. The padlocking attachment shall be placed at 4.0 to 5.0 inches (101.6mm to 127.0mm) minimum gripping length shall be provided.

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 inch (6.35mm) thick by 0.75 inch (19.05mm) wide, minimum.

Two-bolt per leave hinges shall be provided to bolt the CMS Housing (at the Control Compartment Section) to the doors. The housing shall have 4 hinges per door. Each hinge shall be 3.5 inches (88.9mm) 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.

The door 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 inch (9.53mm) for plated steel or aluminum rods or 0.25 inch (6.35mm) for stainless steel. The catches shall be capable of holding the door open at 90 degrees in a 80-mph (128.82 km/h) wind acting at an angle perpendicular to the plane of the door.

#### **8.3.1.3.2 Side Access Panels**

There shall be two side access panels (top and bottom) for the Model 500 and one side access panel for the Model 510 on the CMS housing right end side adjacent to the Control Compartment. The panels shall be detailed as per Appendix Detail. The panels shall have louvered vents as specified under these specifications.

The CMS housing shall be provided with 2 lifting eyes Models 500 and 510, and **one** lifting eye Model 520 to be used when placing the housing on the sign structure. The lifting eyes shall be located where required. Each eye shall have a minimum diameter of 1.00 inch (25.4mm). The fully assembled sign shall have sufficient structural strength to be lifted and moved by either lifting eye, or both lifting eyes, without damage or permanent deformation to any part of the sign. A label shall be attached near each lifting eye reading, "Lift Vertically to Prevent Damage".

#### **8.3.2 Surface Treatment**

The Contractor shall have the option of Surface Treatment and Painting described herein or Anodizing.

The CMS unit assemblies such as the PMM panels, front and side access doors, etc. shall be treated prior to painting. The treatment steps are as follows:

Surface treat aluminum in accordance with the provisions of ASTM D-1730, Type B, Method 6 or Method 7. Immediately prior to treatment, the aluminum surfaces shall be cleaned following the procedures in either ASTM D-1730, Type A, Method 3 or ASTM D-1730, Type B, Method 1.

Alternative surface treatment and painting methods must equal or exceed those specified and be

approved by CALTRANS Division of **Materials Engineering and Testing Services (METS)** - Chemical Branch.

### **8.3.3 Anodizing**

An anodic coating shall be applied to the aluminum surface after the surface has been cleaned and etched. The cleaning and etching procedure shall be to immerse in inhibited alkaline cleaner at 71 degrees C for 5 minutes (Oakite 61A, Diversey 909 or equivalent in mix of 6 to 8 ounces per gallon (45.26gram to 60.34gram per liter) to distilled water). Rinse in cold water. Etch in a sodium solution at 66 degrees C for 5 minutes (0.5 ounce (14.18gram) sodium fluoride plus 5 ounces (141.75gram) of sodium hydroxide mix per gallon (3.79liter) to distilled water). Rinse in cold water. Desmut in a 50% by volume nitric acid solution at 20 degrees C for 2 minutes. Rinse in cold water.

The anodic coating shall conform to MIL-A-8625C (Anodic coatings for Aluminum and Aluminum Alloys) for Architectural Class II A34 Coating with flat black dye required on the CMS front surface. The black surface coating shall have a design life of a minimum of 10 years.

The anodic coating shall be sealed in a 5% aqueous solution of nickel acetate (pH 5.0 to 6.5) for 15 minutes at 99 degrees C.

Black anodic coating shall be applied to the 6-inch border on the entire front face of the CMS housing, screen assembly frames, the 60 **PxMM** panels and front access door. All other surfaces shall be treated with clear anodic coating.

### **8.3.4 Painting**

#### **8.3.4.1 General**

After applications of the primer all exposed area of primed surfaces shall receive a minimum of 2 finish coats of paint conforming to the requirements for White Tintable Finish Paint Waterborne, Formula PWB-164, Revised or exterior grade latex paint conforming to the following:

Property	Value	ASTM Designation
Pigment content,%	24 Max	D3723
Nonvolatile content Wt%	49 Min.	D2369
Viscosity, KU	75 Min. to 90 Max.	D 562
Fineness of grind Hegman	6 Min.	D1210
Drying time at 77 degrees F 50% RH, 4 mil wet film Set to touch, minutes	30 Max.	D1640
Dry through, hours	1 Max.	

No visible color change in the finish coats shall occur when tested according to ASTM Designation: G 53 using FS 40 UV- B bulbs for a min. of 38 cycles. The cycle shall be 4 hours UV exposure at 60 degrees C and 4 hours condensate exposure at 40 degrees C. The vehicle shall consist of 100% acrylic latex with a minimum of necessary additives.

Individual batches/lots of paints will require testing by the METS – Chemical Branch to assure compliance with specification requirements prior to use unless otherwise approved by the engineer. 8in x 8in (203.2mm x 203.2mm) sample panels coated according to the requirements of these specifications and the following shall be provided for testing and approval with 90 days of award of contract. Two sample panels shall be provided for each color of finish paint. Each color panel shall be the same type aluminum specified to receive that color finish. When more than one type aluminum is required 2 panels of each color on each type shall be submitted.

#### **8.3.4.2 Application**

After a complete Surface Treatment process, one coat of vinyl wash primer with one part acid and four parts resin shall be applied. One part of acid is to be slowly added with constant stirring to four parts by volume of the resin just before use. The mixed components must be used within 8 hours. Vinyl wash primer is formulated for spray application only and shall be applied to a dry film thickness of 0.3 to 0.5 mils.

After application of the vinyl wash primer all exposed surfaces shall receive a minimum of 2 finish coats of an exterior grade acrylic latex paint. The first finish coat shall be tinted by the manufacturer to provide a color to contrast with the final finish coat. The total dry film of the first finish coat shall be not less than 2 mils.

#### **8.3.4.3 Second Finish**

The second finish coat color shall match the following:

Federal Standard 595a No. 37038 to be applied to the 6-inch (152.4mm) border on the front face of the CMS housing including, screen assemblies Control Cabinet Door and the 60 Pixel Matrix Module Panels.

Federal Standard 595a No. 37769 to be applied to the CMS housing including Z-Bars.

The total dry film thickness of all applications of the second finish coat shall be not less than 2 mils or more than 4 mils.

The 2 finish coats shall be applied in 2 or more applications to a total dry film thickness of not less than 4 mils or more than 8 mils.

The total dry film thickness of all paint applications shall be not less than 4.3 mils or more than 8.5 mils.

A minimum drying time of 12 hours shall be allowed between finish coats.

After finish paint has cured adequately, the adhesion of the coating to the substrate when tested according to ASTM Designation: D 3359, Test Method A shall be 4A or higher.

### **8.3.5 Ventilation**

The CMS housing shall be provided with the necessary louvered vents on both sides of the housing and below the housing to provide sufficient ventilation as described below.

There shall be no active ventilation such as electric fans or other devices in the CMS housing except in the CMS Control Compartment.

The CMS Control Compartment shall have a ventilation system including intake, exhaust, filtration, fan assembly and environmental control. A louvered vent of 0.25 inches (6.35mm) in depth maximum shall be provided and positioned near the bottom on the lower panel of the CMS Sign Housing rightside. A removable and reusable filter filtering in a fan mounting shell shall cover the vents and shall be held in place with bottom and side brackets and a spring-loaded top clamp.

The intake (including filter) and exhaust areas shall pass a minimum of 60 cubic feet (1.69 m<sup>3</sup>) of air per minute.

The fan assembly shall have ball or roller bearings and a capacity of at least 60 cubic feet (1.69 m<sup>3</sup>) of free air delivery per minute.

The fan assembly shall be a thermostatically controlled device adjustable to turn ON between 33 degrees C and 65 degrees C with a differential of not more than 6 degrees C between automatic turn ON and OFF. Thermostat indication shall be marked in 10 degrees C increments. Manual adjustment shall be provided.

The filter material shall be a McMaster-Carr Permanent Washable Air Filter No. 2069K12 or equal.

The fan assembly shall be mounted on the CMS Control Compartment lower right side and exhaust into the Pixel Matrix Module Section.



## CHAPTER 8-SECTION 4 CONTROL COMPARTMENT

### 8.4.1 General

CMS Control Equipment and associated wiring shall be furnished and installed in the Control Compartment. The equipment shall consist of:

- One - CMS Interface Panel (CIP)
- One - Power Distribution Assembly **No.4L(PDA #4L)**
- Five - Pixel Driver Assemblies (PxDAs)

#### MODEL 500 & 510

- Sixty - Pixel Driver Modules (PxDM)
- One - 5 KVA Transformer (LED pixels)**

#### MODEL 520

- Thirty - Pixel Driver Modules (PxDM)
- One - 5 KVA Transformer (LED pixels)**

All panels and assemblies shall be mounted on the 19-inch (482.6mm) Rack.

All circuit breakers, fuses, switches and indicators shall be readily visible and accessible when the CMS Control Compartment Front Door is open except for the PxDM fuses which shall be located near the PxDM connector.

All equipment when called out shall be clearly and permanently labeled. Marking 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 to be identified and must be clearly visible with the item installed.

The assembly or panel depth dimension shall include the terminal blocks and assembly mounted part of the connectors.

All assemblies and panels shall allow air circulation through its top and bottom unless specifically called out otherwise.

Assemblies shall be fabricated of 0.0625-inch (1.59mm) minimum thickness aluminum sheet with metal surface treated with either clear chromate or anodized.

### 8.4.2 19-Inch EIA Racks

The 482.6mm (19-inch) EIA Rack shall be installed a minimum of 25.4mm (1.0 inch) inside the Control Compartment Front Door for mounting of the Control Equipment.

The 482.6mm (19-inch) EIA Rack shall consist of a pair of continuous adjustable equipment mounting angles. The angle nominal thickness shall be either 3.42mm (0.1345 inch) plated steel or 2.67mm (0.105") stainless steel. The angles shall be tapped with 10 - 32 threads with EIA universal spacing. The angle shall comply with Standard EIA RS-310-B and shall be supported at the top and bottom.

Clearance between the mounting angles for mounting equipment shall be 450.85mm (17.75 inches).

The Model 500 vertical mounting surface shall be a minimum of 1689.10mm (66.5 inch) and the Models 510 and 520 vertical mounting surface shall be a minimum of 1168.4mm (46 inch).

The top of the mounting area to the center of the first screw hole shall be a minimum of 9.53mm (0.375 inch).

#### **8.4.3 CMS Interface Panel (CIP)**

The CIP mounting surface used for required equipment shall be recessed if necessary so that the equipment front surface is even with the CIP rack mounting front surface. The CIP shall have a maximum depth of 203.2mm (8 inch).

Service equipment and conductors shall be separated and isolated from the Controller Interface Terminal Blocks and Harness No.3.

A Twenty (20) Position minimum AC- Copper Bus(es) shall be provided. Two (2) 1/0 AWG wiring lugs shall be available on the Bus for AC Neutral Service Termination. The Bus shall have minimum ampacity capability of 400 Amperes. Nylon screws or standoffs shall be used to provide 500 megaohms isolation between AC- and Equipment Ground & DC Logic Ground when tested at 250 VDC.

A Two (2) Position termination lug shall be provided for Equipment Ground on the CIP. A #10 AWG Conductor shall be routed from the CMS frame termination to the CIP and from the CIP to PDA #4, T2 Block Position #8.

The Equipment Ground shall be connected directly to the CMS Frame.

LED Pixels are used; a 2-Pole 30 Ampere minimum rated circuit breaker shall be installed on the panel and designated for CMS Main Disconnect.

Disconnect Line and Load Side Lugs shall accommodate No. 1/0 AWG Conductors.

LED Pixels are used, thirty 1 Pole 20 Ampere PxDA Circuit Breakers shall be furnished and installed to protect the PxDA Busses, 6 per PxDA. The Breakers shall be split into 15 breakers per lines L1 and L2 (120 VAC leg). See detail 8-8-3 & 8-8-4 for Assignments.

#### **8.4.4 Controller Interface**

A 44 Position Phoenix Contact, Type MBK 2.5/E, DIN Terminal Block or equal (CITB) shall be installed on the panel for CMS Harnesses #3, #4 and #5 termination.

CITB Terminals shall accommodate No.18 AWG conductors. Strain relief shall be provided for incoming Harnesses #4 & 5 Cable(s).

#### **8.4.5 Power Distribution Assembly No. 4L (PDA #4L)**

The **PDA No. 4L** shall meet all the requirements of the Power Distribution Assembly as specified in the **TEES 2009 (Chapter 6)** including details as applicable except for the following:

The **PDA #4L** shall consist of:

- 1 - Duplex NEMA 5-15R Equipment Receptacle with GFI
- 1 - 1 Pole 15 Amperes, 120 VAC Equipment Circuit Breaker
- 1 - **1 Pole 15 Amperes, 120 VAC Main CB (includes Model 206L and Temp Control) Circuit Breaker**
- 1 - Model **206L** Power Supply Module (+24 VDC) and Socket
- 1 - 10 Position Terminal Block T2
- 1 - 4 Position Terminal Block T3
- 1 - CFP Connector
- 5 - CEP Connector
- 1 - CMS Isolation Module (**CIM**) and Socket Connector

Retaining Devices shall be provided mounted above the **CIM** and **Model 206L** Power Supply Module. Each device when locked down shall prevent the module from backing out of its connector. When not in use the device shall rest in a position allowing the module removal or insertion.

#### **8.4.6 CMS Isolation Module (CIM)**

The module shall optically isolate, receive/drive and condition DC Logic Signals from the Controller Cabinet (CIA) complying to RS 423 Standards at a minimum distance of 152.40m (500 Feet).

The total module load current shall not exceed 100 mA of +24 VDC power. Logic Voltage between the **CIM** and the LDMS shall be +12 VDC. The CIA Assembly shall supply the power for interface circuitry between the **CIM** and the CIA.

The front panel shall be fabricated of 2.29mm (0.090 inch) minimum thickness aluminum or stainless steel sheet. A momentary toggle switch shall be provided on the module front panel for Sign Lamp Test Function. Five indicators shall be provided on the front panel of the module to indicate the Dimming Signal, Clear State, Clock Signal, Device Enable and PxDA Latched State.

The addressing of the PxDAs shall be implemented on the module by decoding the upper three binary bits 5, 6 and 7 of the address bus to generate the PxDA select lines designated 1 through 5 (See Appendix details).

The **CIM** and PxDMs shall have exclusive use of the Model 206 Power Supply.

A Gas Tube type Surge Protector shall be provided across T2 terminal positions 8(**GND**), 9(**AC+**), and 10(**AC-**).

#### **8.4.7 Pixel Driver Assembly (**PxDA**)**

The assembly shall have a maximum depth of 241.3mm (9.5 inch) (includes connector assemblies on rear of assembly).

The assembly shall intermate and support 12 PxDMs, provide interface between the PxDMs to the associated **PxMM**, route AC and DC power to the PxDMs and interface control signal lines to the PxDMs.

The assembly shall have a PCB Motherboard for routing circuits to and from the lamp driver assembly connectors; PxDM Connectors (1 through 12), CC Connectors (1 through 12), CD Connector, and the 6-position terminal blocks (or four 3 position).

Intercomponent wiring shall be by laminated copper clad track having a minimum weight of 4 ounces per square foot with adequate cross section for current to be carried.

All assembly connectors shall be mechanically supported to the frame of the assembly.

The PxDA-PxDM connector shall be a 43/86S PCB Connector vertically centered. Guides, top and bottom, shall be provided to insert and support the PxDM. The connector contacts shall start with pin 1 at the upper left when viewed from the PxDA front.

The AC+ and AC- Buses shall be routed across the PxDA from both sides (Terminal Block TBA1 assigned to PxDM Connectors 7 to 12 and TBA2 assigned to PxDM Connectors 1 to 6). The AC-Bus(s) and return shall be able to carry a minimum 60 Ampere Load. TB1 and TB2 blocks may be divided into four(4) 3 position Terminal Blocks, two for power and two for AC neutral.

#### **8.4.8 Pixel Driver Module (PxDM)**

##### **8.4.8.1 General Requirements**

The module PCB connector shall be a 43/86P.

Each module shall be interchangeable without modification or alteration to the module connectors and/or circuitry.

One PxDM shall exclusively control and operate one PMM.

Address lines incoming from the **CIM** (The 4-bit PxDM Address lines and the associated PxDA Select line) shall be compared with the PxDM slot address I.D. lines and PxDA Select I.D. lines on the module.

The slot address I.D. lines shall be decoded and implemented using hard-wire logic on the PxDA Motherboard adjacent to the PCB 43/86S connector. Five I.D. lines minimum shall be used as follows; the first four I.D. lines 1 to 4 shall be compared to the incoming PxDM

Address lines and the I.D. line 5 shall be compared to the incoming PxDA Select line.

Jumper wires, dip switches, and shunt jumpers shall not be used to decode and implement the hard-wire logic. Permanent solder traces with a resistor network or equal may be allowed.

The module shall be fused protected on the three incoming AC+ traces with three-5 Amperes Medium Blow Type Fuses. The Triac Load shall be evenly divided through the fuses and the three power buses (14, 13 and 13). The pattern shall be the same for all LDMs.

No more than 80 mA of +24 VDC power shall be used by each PxDM.

#### **8.4.8.2 Feature Requirements**

The module shall consist of serial shift registers with parallel and latched tri-state outputs, 40 optically coupled triac drivers, 40 pixel load triacs and support circuitry to interface and control DC logic control signals to an external pixel load.

Pixel Load Triac Ratings:

1. 8 Amp On- State RMS Current
2. 40 Amp Peak Surge Current for 1 full AC Cycle
3. 400 Volt RMS Blocking Voltage minimum
4. Maximum 1 ma Leakage Current either direction
5. Maximum 3 us Turn On Time
6. Maximum 5 Amp DC Gate Trigger Current
7. The Triac shall not be a sensitive gate type

## CHAPTER 8-SECTION 5

### MODEL 500, 510 AND 520 CMS SYSTEM INTERCONNECTION

#### 8.5.1 General

The CMS System consists of the Model 500, 510 or 520 CMS, Harnesses No. 4 and No. 5 Interconnect, the CIA resident in the Controller Cabinet and the Controller. This section shall detail the interface and control requirements that mate the controller to the CMS.

A systems check shall consist of running the Caltrans' DAT CMS (Diagnostic and Acceptance Testing for the Changeable Message Sign) Software Program with the CMS (Complete interconnection and interface of CMS, Controller, CIA, Controller Cabinet and associated equipment).

Prior to the delivery of the Model 500, 510 or 520 CMS, a verification certificate shall be submitted to the Engineer. The certificate shall show that a systems check has been performed and the system has functioned properly under the Engineer's guidelines.

CIA AC+ power shall be connected to cabinet **PDA #3L** via a 3-foot (9.15m) NEMA Type 5-15P grounding type plug. The controller duplex receptacle shall be used for power source.

#### 8.5.2 CMS Control Isolation Assembly (CIA)

The CIA shall function as the isolation / driver interface between the Controller and the CMS, Sense light and AC voltage levels, sense the 4 power line current levels, read the Controllers Dim Level Select Lines and via selected level points control the Triac Turn On Point and provide CMS Soft Start Feature.

The CIA shall optically isolate, receive / EIA drive and condition DC Logic Signals to and from the **CIM** complying to 423 Standards at a minimum of 500 ft (152.40m). The system shall be capable of writing to all 60 **PxDMs** within 100 ms.

The CIA shall sense the 5 CIA Control Lines (Line 4 is reserved) and react as follows:

CIA CONTROL LINES	FUNCTION	RANGE
3 2 1 5		
0 0 0 0*	Power Line 1	0 - 100 <b>Amps</b> *
0 0 1 0*	Power Line 2	0 - 100 Amps *
0 1 0 0*	Power Line 3	0 - 100 Amps *
0 1 1 0*	Power Line 4	0 - 100 Amps *
1 0 0	Photo Cell	0 - 5 VDC
1 0 1	AC+ Line	75 - 150 VAC
1 1 0	Test	+5 VDC
1 1 1	Test	0 VDC

Line 5 Logic 1 shall decode Power Line Range to 0 - 10 AMPs

The selected function shall present to the controller via the 8 Sense Lines its range in 256 increments (binary with Line 1 equal to the least significant bit). The Values shall be linear over the range. Sense output shall be compatible with the controller unit. The A/D convertor shall be a ADC 804 or equal with conversion triggered by a CLOCK Input. Conversion shall be completed within 250 us.

DIM Control shall be as called out under Specifications 2.4. The CIA shall read the Photo Cell Sensor Output and the incoming AC Voltage report to the controller. The controller shall decode the Dim Control Level via the three DL Lines as Follows:

LINES	FUNCTION
1 2 3	
0 0 0	Turn Sign Off, NO ON PULSE
1 0 0	Adjustment Level 1 (Lowest intensity Level)
010 to 110	Adj. Levels 2 to 6
1 1 1	Adjustment Level 7 (Highest intensity Level)

The selected level shall be matched to a DIM Control Phase Triggering Point adjustable by an individual 10 turn (min.) discrete potentiometer accessible from the front panel The Phase Triggering Pulse shall be mirrored back to the controller.

Four toroidal current monitoring devices (BICRON ELECTRONICS B5303 or equal) installed on the secondary side on each of the Four Power Lines (CMS Main Disconnect) shall input via C10 Connector to the current sensing circuitry and upon request to the A/D Convertor.

The CIA shall upon request run a self check on the A/D Convertor - Sense Lines. A +5 VDC Request shall provide a "FF" Response. A 0 VDC Request shall provide a "00" Response.

## CHAPTER 8-SECTION 6 CONTROLLER CABINET

### 8.6.1 334LC Cabinet

The 334LC Cabinet and the Model 334L Cabinet shall comply with chapters 1, 3 & 6 of the Transportation Electrical Equipment Specifications (TEES), dated May 12, 2009.

Amend Specification 6.1.1.2 "Model 334L Cabinet" to read "Model 334LC Cabinet".

### 8.6.2 Light Level Control System

#### 8.6.2.1 General Requirements

The Light Level Control System shall consist of the Photo electric sensor, the incoming AC power line sense, the comparator / controller report circuitry and the Dimmer Control Circuitry all resident in the CIA Unit. The system shall sense the background ambient light level (range 0 to 5 Volts) and provide sense levels to the controller via the 8 Sense Lines. The AC Line shall be sensed between 75 to 150 VAC and reported back to the controller via sense lines. The Dimmer Control Circuit shall read the three Dim Level select lines from the controller and control the Triac Turn On Point.

Background ambient light levels for pixel dimming and background light sensing shall be adjusted and pre-set at the factory prior to delivery to the STATE. Potentiometer settings shall match each light level setting designated by number from level 1 to 7, where level 1 is lowest light level and level 7 is highest (brightest) light level.

#### 8.6.2.2 Feature Requirements

##### 8.6.2.2.1 Background Light Sensing Circuitry

A commercially available photo-electric sensor in a EEI-NEMA type twist lock receptacle or equal, metal enclosure shall be installed on the Controller Cabinet, where the sensor shall not be affected by artificial lighting.

The photo-electric sensor shall be a EG and G VACTEC Type VT521H or equal.

The photo-electric sensor shall be capable of being continually exposed to direct sunlight without impairment of its performance.

The watertight metal enclosure shall have a 1.00 square inch (2.54cm<sup>2</sup>) glass window area to assure full exposure of photocell to ambient light.

The Photo- electric sensor output lines shall be routed to Cabinet Terminal Block TB1 and via C10 to the CIA. The outputs shall be electrical compatible with the CIA Input circuitry.

##### 8.6.2.2.2 Pixel Dimming Circuitry - CIA



The pixel dimming circuit shall allow the AC power to be switched at any point from 10 degrees to 120 degrees and from 190 degrees to 300 degrees for each pixel intensity.

Each pixel intensity sine wave switch point shall vary 5 degrees (maximum) when the dimming circuit is exposed to temperature changes ranging from +25<sup>0</sup>C to +65<sup>0</sup>C and from +25<sup>0</sup>C to – 30<sup>0</sup>C.

Each pixel intensity shall be adjusted by a discrete wirewound 10-turn potentiometer. Each potentiometer shall use 90% (maximum) of its adjustment range throughout the sine wave switching range specified.

The pixel dimming circuit shall read 3 Dimmer Level inputs (read in binary, Line 1 least significant), from the controller to select the 8 set conditions of dim control for the CMS (Selection "0" shall allow no Dim Control output or BLANK Sign).

The pixel dimming circuit shall have electrical devices installed to minimize 60 Hz noise on the AC load lines.

Each noise eliminator shall cause the slope of the switch-on across the pixels to rise at between 8V per degree and 20V per degree across the AC voltage sine wave.

Each noise eliminator shall eliminate overshoot across the AC voltage sine wave when the pixel load voltage reaches its maximum.

The DIM Control Line shall control all 60 PxDM Triac Turn On Points. The DIM Control Circuitry shall relay back to the Controller a Phase Fire Pulse of 200 us nominal indicating Triac Turn On pulse. The DIM Control shall, also, provide Soft Start Feature. Soft Start shall use the DIM Control line to reduce in rush current at pixel turn on or message change. Soft Start shall have a six AC cycle minimum step between 160 deg to 10 deg and 340 deg to 190 deg.

## **CHAPTER 8-SECTION 7**

### **GENERAL DETAILS**

	<b>Appendix</b>
<b>8.7.1 CMS System Block Diagram</b>	<b>A7-1</b>
<b>8.7.2 CMS System AC Wiring Diagram</b>	<b>A7-2</b>
<b>8.7.3 Pixel Driver Module Circuit Block Diagram</b>	<b>A7-3</b>
<b>8.7.4 Pixel Driver Assembly, Front View</b>	<b>A7-4</b>
<b>8.7.5 Pixel Driver Assembly, Rear View</b>	<b>A7-5</b>
<b>8.7.6 Pixel Driver Module</b>	<b>A7-6</b>
<b>8.7.7 Controller Isolation Assembly</b>	<b>A7-7</b>
<b>8.7.8 Model 334LC Cabinet, Input File # 3 -- Upper Part</b>	<b>A7-8</b>
<b>8.7.9 Model 334LC Cabinet, Input File # 3 -- Lower Part</b>	<b>A7-9</b>
<b>8.7.10 CMS Interface Panel</b>	<b>A7-10</b>
<b>8.7.11 CMS Interface Panel Terminal Block</b>	<b>A7-11</b>
<b>8.7.12 PDA # 4L</b>	<b>A7-12</b>
<b>8.7.13 CMS Isolation Module</b>	<b>A7-13</b>
<b>8.7.14 Address and Pixel BIT Configuration</b>	<b>A7-14</b>
<b>8.7.15 CMS Device Address Assignment</b>	<b>A7-15</b>
<b>8.7.16 CMS Timing Diagram</b>	<b>A7-16</b>
<b>8.7.17 CMS Connector Details</b>	<b>A7-17</b>
<b>8.7.18 Harness # 1 Wiring Diagram</b>	<b>A7-18</b>
<b>8.7.19 Harness # 2 Wiring Diagram</b>	<b>A7-19</b>
<b>8.7.20 Harness # 3 Wiring Diagram</b>	<b>A7-20</b>
<b>8.7.21 CMS Harness # 4 and # 5 Wiring Lists</b>	<b>A7-21</b>
<b>8.7.22 CMS Harness # 4 and # 5 Color Code Wiring Lists</b>	<b>A7-22</b>
<b>8.7.23 CMS Harness # 5 and TB1 Wiring Lists</b>	<b>A7-23</b>
<b>8.7.24 Model 334LC C1 Harness # 2</b>	<b>A7-24</b>
<b>8.7.25 PDA #4L CIM and CFP Connector Assignments</b>	<b>A7-25</b>

<b>8.7.26 PDA # 4L CMS CE (A to E) and Terminal Block Connector Assignments</b>	<b>A7-26</b>
<b>8.7.27 Pixel Driver Module Connector Assignments</b>	<b>A7-27</b>
<b>8.7.28 Controller Isolation Assembly Connector PIN Assignments for C8P AND C9P Connectors</b>	<b>A7-28</b>
<b>8.7.29 Direct Mode DB9 Communications Cable</b>	<b>A7-29</b>
<b>8.7.30 Modem DB9 Communications Cable</b>	<b>A7-30</b>
<b>8.7.31 Direct Mode DB-25 Communications Cable</b>	<b>A7-31</b>
<b>8.7.32 Modem DB-25 Communications Cable</b>	<b>A7-32</b>
<b>8.7.33 GDI Modem DB9 Communications Cable</b>	<b>A7-33</b>

## **CHAPTER 8-SECTION 8 MODEL 500 CMS DETAILS**

	<b>Appendix</b>
<b>8.8.1 Sign Housing Details, Elevation, Side Doors and End Cap</b>	<b>A8-1</b>
<b>8.8.2 Sign Housing Details, Elevation, Rear, Plan and Z-Bar</b>	<b>A8-2</b>
<b>8.8.3 Transformers To CIP Wiring Details</b>	<b>A8-3</b>
<b>8.8.4 CMS System, LED Wiring Diagram</b>	<b>A8-4</b>
<b>8.8.5 Pixel Matrix Module, Front View</b>	<b>A8-5</b>
<b>8.8.6 Pixel Matrix Module, Rear View</b>	<b>A8-6</b>
<b>8.8.7 Pixel Matrix Module, Type 1, End View</b>	<b>A8-7</b>
<b>8.8.8 Pixel Matrix Module, Type 2, End View</b>	<b>A8-8</b>
<b>8.8.9 CMS Control Compartment Mounting Details</b>	<b>A8-9</b>
<b>8.8.10 Testing Stand, Elevation View</b>	<b>A8-10</b>
<b>8.8.11 Testing Stand, Plan View</b>	<b>A8-11</b>
<b>8.8.12 CMS Lifting Bracket</b>	<b>A8-12</b>
<b>8.8.13 Shipping Pallet Dimensions</b>	<b>A8-13</b>
<b>8.8.14 Palletized CMS Shipping Method</b>	<b>A8-14</b>

## **CHAPTER 8-SECTION 9 MODEL 510 CMS DETAILS**

	<b>Appendix</b>
<b>Sign Housing Details, Outside Dimensions</b>	<b>A9-1</b>
<b>Sign Housing Details, Elevation, Side Door, End Cap, Screens</b>	<b>A9-2</b>
<b>Pixel Matrix Module, LEDS and Thumbscrews Spacing</b>	<b>A9-3</b>
<b>CMS Control Compartment Mounting Details</b>	<b>A9-4</b>
<b>CMS Lifting Bracket</b>	<b>A9-5</b>
<b>Shipping Pallet Dimensions</b>	<b>A9-6</b>

## **CHAPTER 8-SECTION 10**

### **MODEL 520 CMS DETAILS**

	<b>Appendix</b>
<b>8.10.1 Sign Housing Detail, Front and Side Views</b>	<b>A10-1</b>
<b>8.10.2 Sign Housing Detail, Rear and Top Views</b>	<b>A10-2</b>
<b>8.10.3 Transformers To CIP Wiring Details</b>	<b>A10-3</b>
<b>8.10.4 CMS Control Compartment Mounting Details</b>	<b>A10-4</b>
<b>8.10.5 Pixel Matrix Module, Front View</b>	<b>A10-5</b>
<b>8.10.6 Pixel Matrix Module , Rear View</b>	<b>A10-6</b>
<b>8.10.7 CMS Shipping Pallet</b>	<b>A10-7</b>

## **APPENDIX A CHAPTER 8 DETAILS**

## **APPENDIX A7**

### **GENERAL DETAILS**

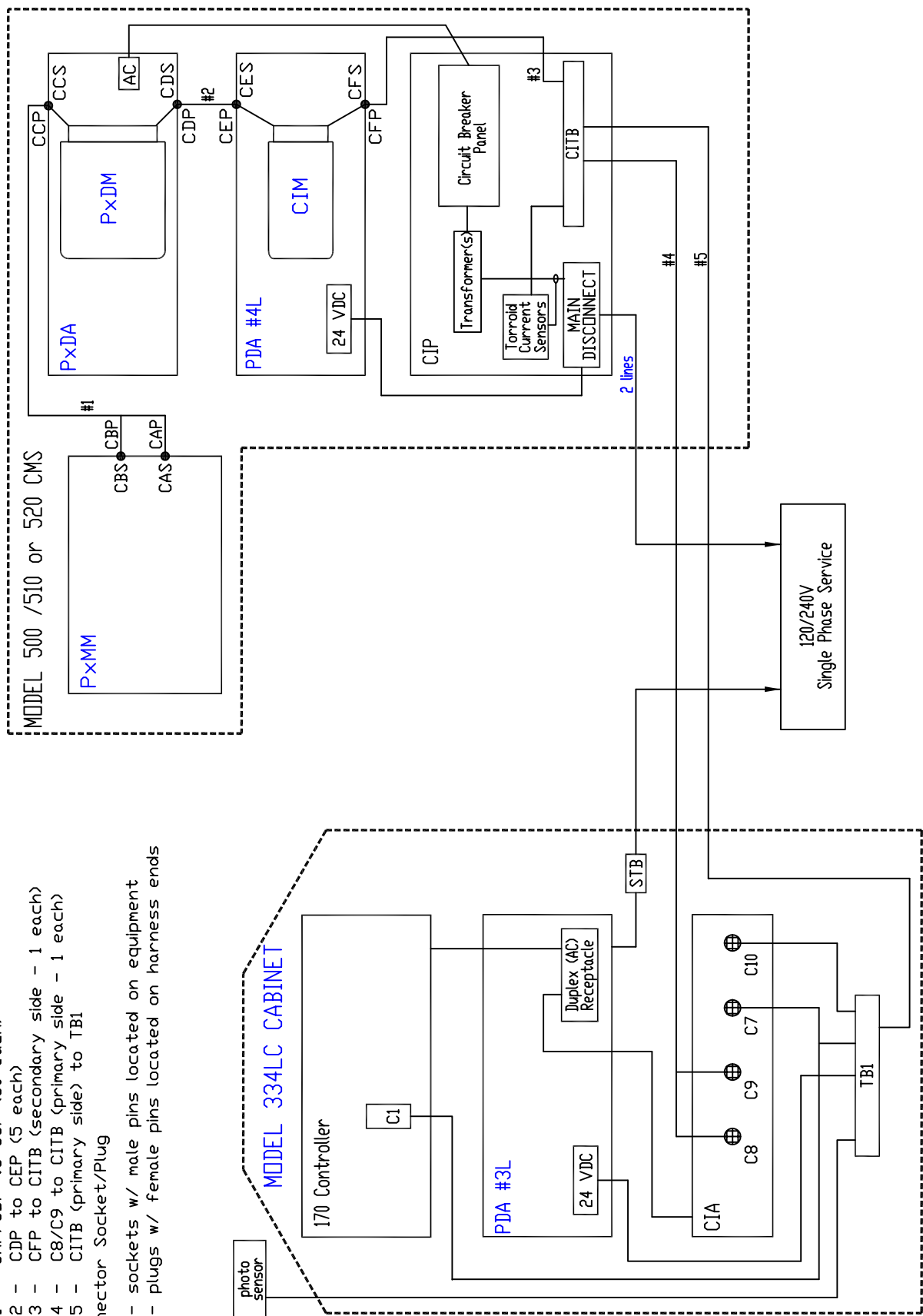


<b>CMS System Block Diagram</b>	<b>A7-1</b>
<b>CMS System AC Wiring Diagram</b>	<b>A7-2</b>
<b>PxDM Circuit Block Diagram</b>	<b>A7-3</b>
<b>Pixel Driver Assembly, Front View</b>	<b>A7-4</b>
<b>Pixel Driver Assembly, Rear View</b>	<b>A7-5</b>
<b>Pixel Driver Module</b>	<b>A7-6</b>
<b>Controller Isolation Assembly</b>	<b>A7-7</b>
<b>Model 334LC Cabinet, Input File #3 -- Upper Part</b>	<b>A7-8</b>
<b>Model 334LC Cabinet, Input File # 3 -- Lower Part</b>	<b>A7-9</b>
<b>CMS Interface Panel</b>	<b>A7-10</b>
<b>CMS Interface Panel Terminal Block</b>	<b>A7-11</b>
<b>PDA # 4L</b>	<b>A7-12</b>
<b>CMS Isolation Module</b>	<b>A7-13</b>
<b>Address and Pixel BIT Configuration</b>	<b>A7-14</b>
<b>CMS Device Address Assignment</b>	<b>A7-15</b>
<b>CMS Timing Diagram</b>	<b>A7-16</b>
<b>CMS Connector Details</b>	<b>A7-17</b>
<b>Harness# 1 Wiring Diagram</b>	<b>A7-18</b>
<b>Harness # 2 Wiring Diagram</b>	<b>A7-19</b>
<b>Harness # 3 Wiring Diagram</b>	<b>A7-20</b>
<b>Harness # 4 and # 5 Wiring Lists</b>	<b>A7-21</b>
<b>Harness # 4 and # 5 Color Code Wiring Lists</b>	<b>A7-22</b>
<b>Harness # 5 and TB1 Wiring Lists</b>	<b>A7-23</b>
<b>Model 334LC C1 Harness # 2</b>	<b>A7-24</b>
<b>PDA #4L CIM and CFP Connector Assignments</b>	<b>A7-25</b>
<b>PDA #4L CMS CE (A to E) and Terminal Block</b>	<b>A7-26</b>
<b>Connector Assignment</b>	
<b>Pixel Driver Module Connector Assignments</b>	<b>A7-27</b>

<b>Controller Isolation Assembly Connector PIN</b>	<b>A7-28</b>
<b>Assignment For C8P and C9P Connectors</b>	
<b>Direct Mode DB9 Communications Cable</b>	<b>A7-29</b>
<b>Modem DB9 Communications Cable</b>	<b>A7-30</b>
<b>Direct Mode DB-25 Communications Cable</b>	<b>A7-31</b>
<b>Modem DB-25 Communications Cable</b>	<b>A7-32</b>
<b>GDI Modem DB9 Communications Cable</b>	<b>A7-33</b>

# NOTES:

- Harness #1 - CAP/CBP to CCP (60 each)
- Harness #2 - CDP to CEP (5 each)
- Harness #3 - CFP to CITB (secondary side - 1 each)
- Harness #4 - C8/C9 to CITB (primary side - 1 each)
- Harness #5 - CITB (primary side) to TB1
- - Connector Socket/Plug
- S - sockets w/ male pins located on equipment
- P - plugs w/ female pins located on harness ends



TITLE:  
MODELS 500, 510 & 520 CMS SYSTEM  
SYSTEM BLOCK DIAGRAM

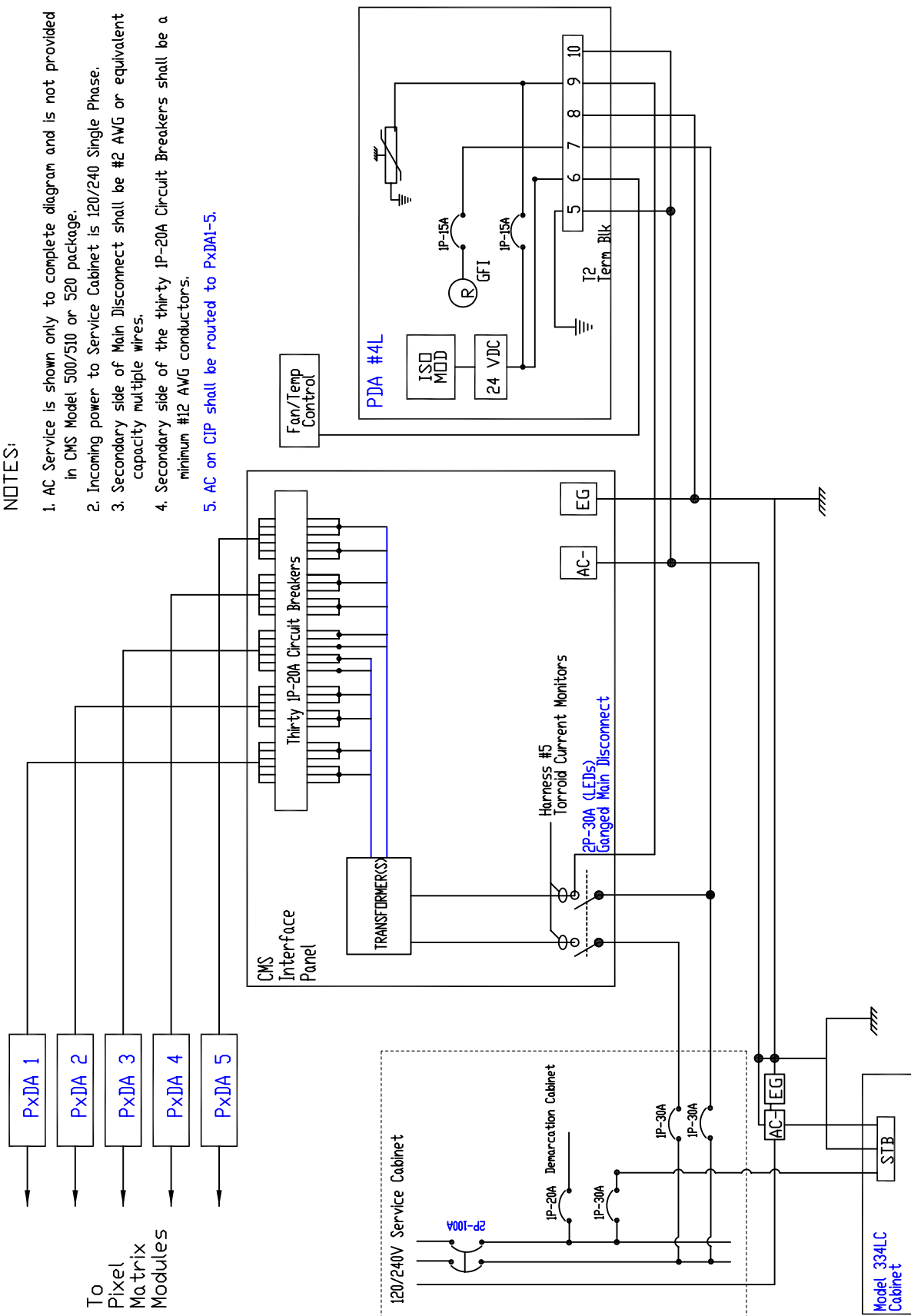
NO SCALE

CMS 2009

A7-1

NOTES:

1. AC Service is shown only to complete diagram and is not provided in CMS Model 500/510 or 520 package.
2. Incoming power to Service Cabinet is 120/240 Single Phase.
3. Secondary side of Main Disconnect shall be #2 AWG or equivalent capacity multiple wires.
4. Secondary side of the thirty 1P-20A Circuit Breakers shall be a minimum #12 AWG conductors.
5. AC on CIP shall be routed to PxDA1-5.



TITLE:

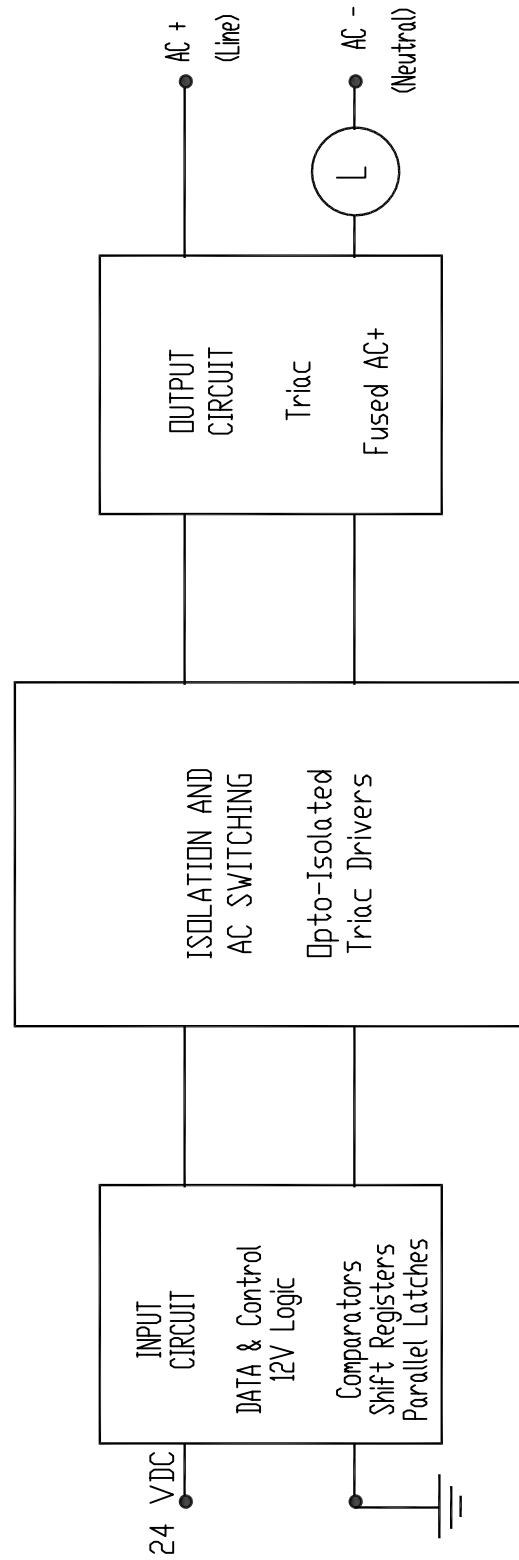
MODELS 500, 510 & 520 CMS SYSTEM  
SYSTEM WIRING DIAGRAM

NO SCALE

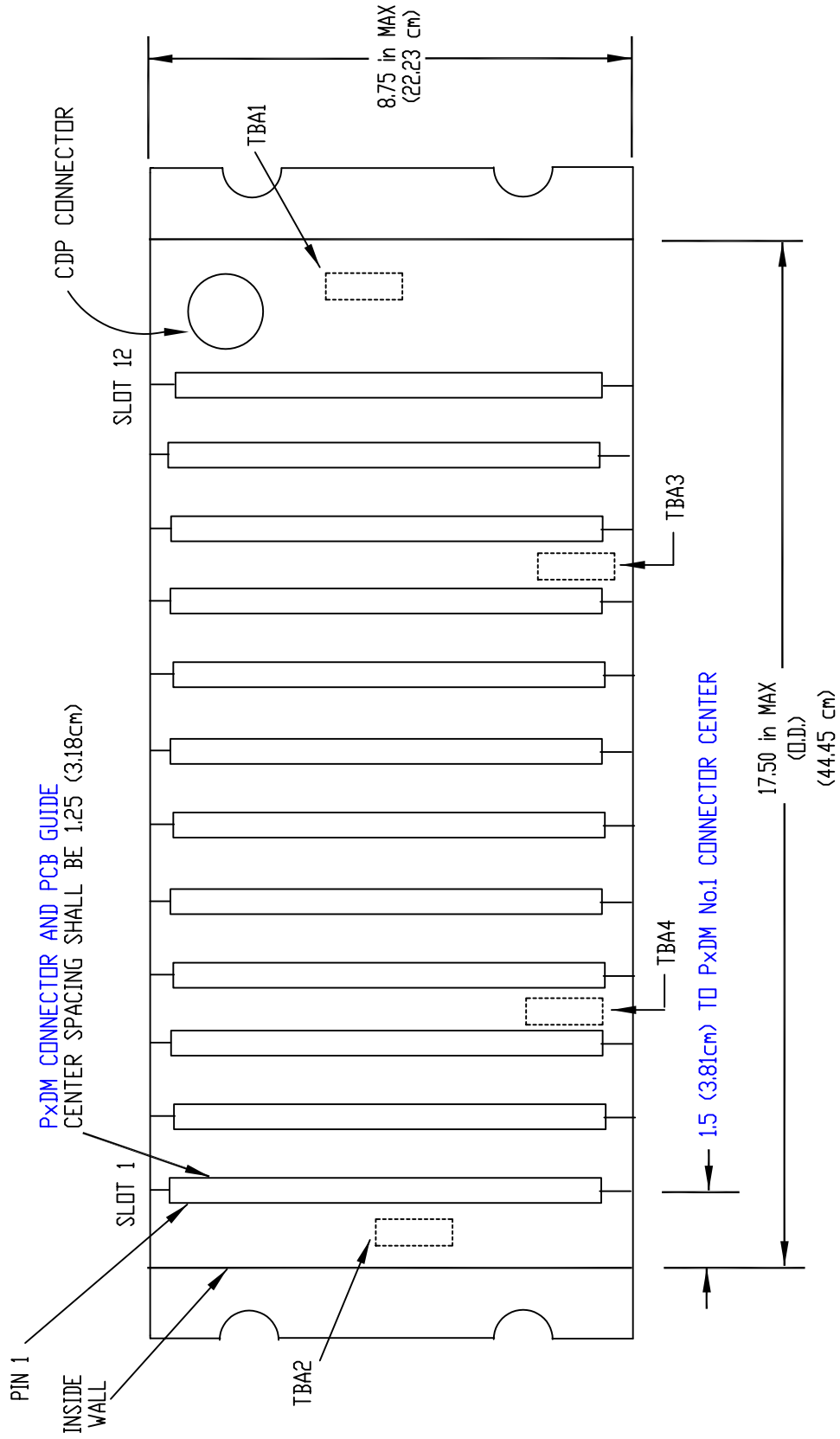
CMS 2009

A7-2

# PIXEL DRIVER MODULE CIRCUIT BLOCK DIAGRAM



TITLE: MODELS 500, 510 & 520 CMS SYSTEM PIXEL DRIVER MODULE CIRCUIT	
NO SCALE	A7-3
CMS 2009	

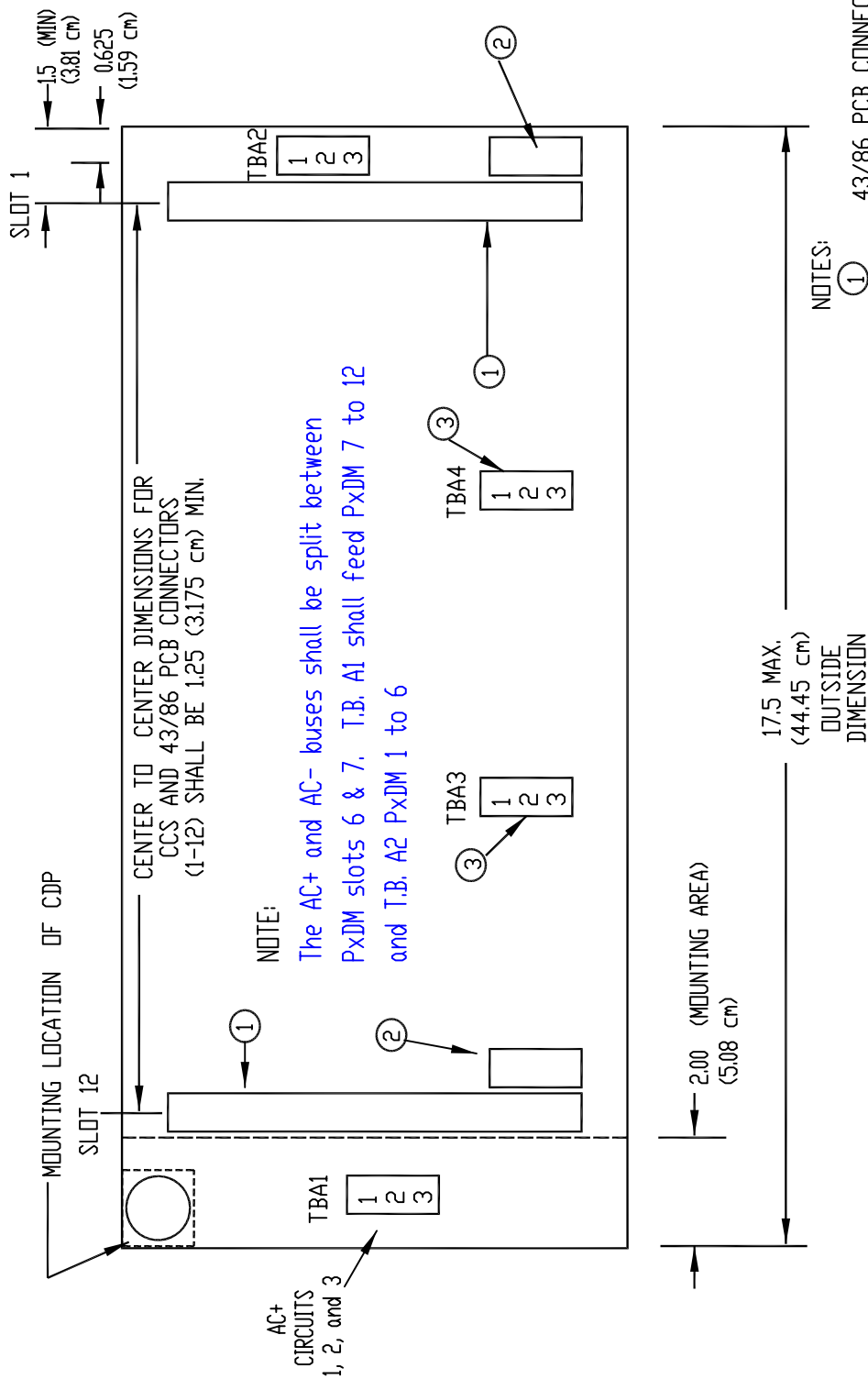


TITLE: PIXEL DRIVER ASSEMBLY DETAIL  
FRONT VIEW

NO SCALE

CMS 2009

A7-4



NOTES:

- ① 43/86 PCB CONNECTOR
- ② CCS CONNECTOR
- ③ AC- TB

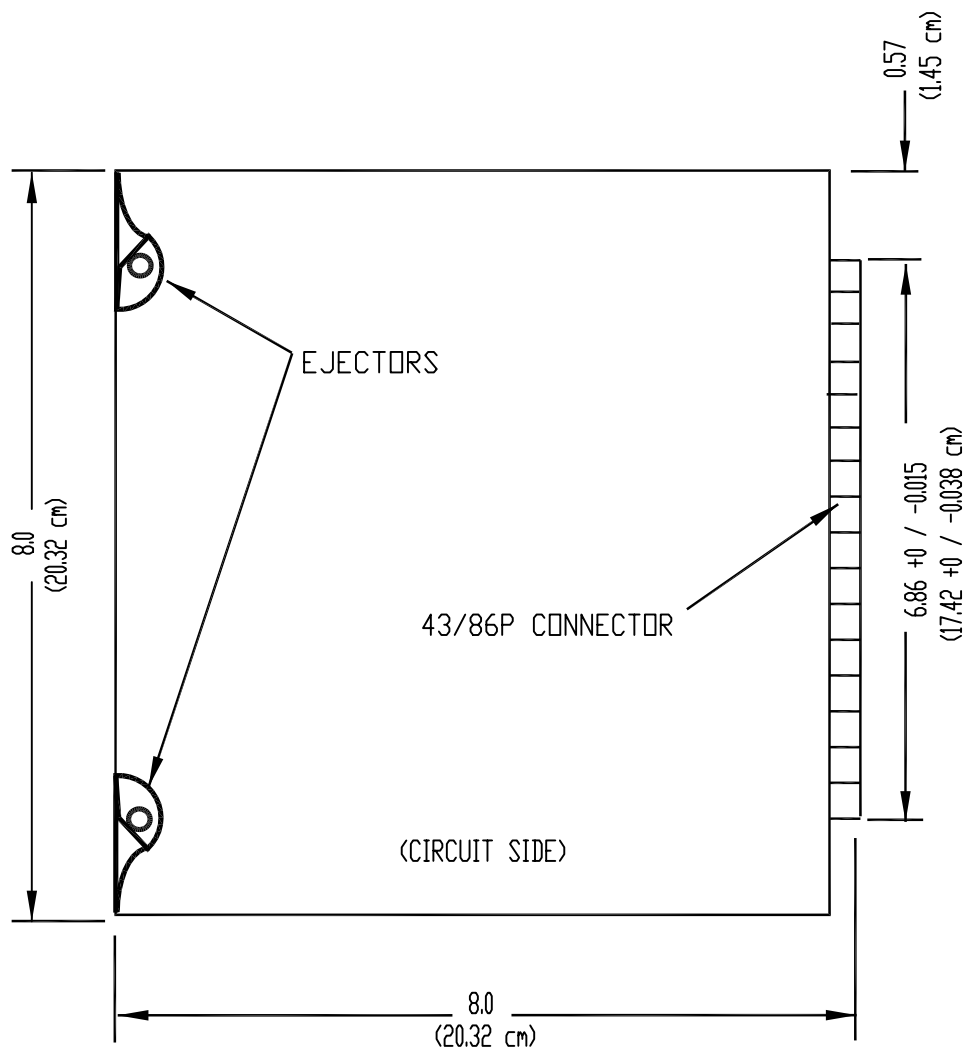
TITLE:

PIXEL DRIVER ASSEMBLY DETAIL  
REAR VIEW

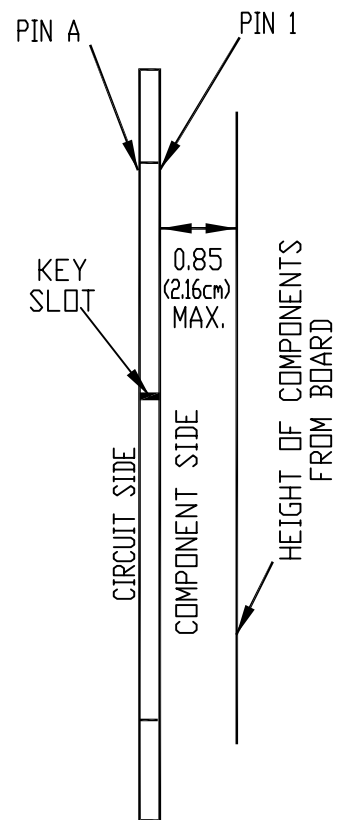
NO SCALE

CMS 2009

A7-5



PLANE  
VIEW

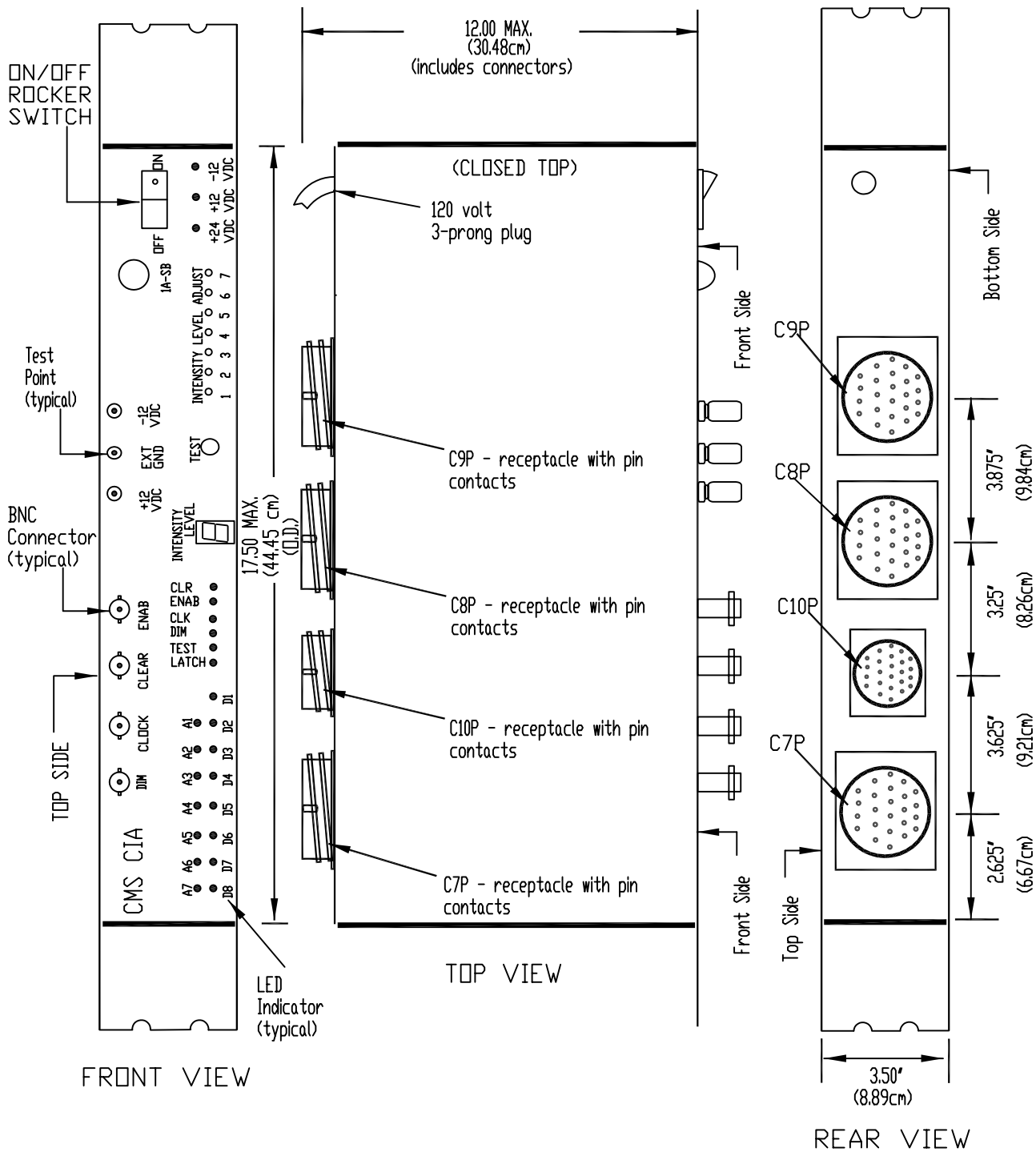


CONNECTOR  
END  
VIEW

NOTE: PxDM shall be keyed between pins 17 and 18.

TITLE:		
PIXEL DRIVER MODULE		
ND SCALE	A7-6	
CMS 2009		





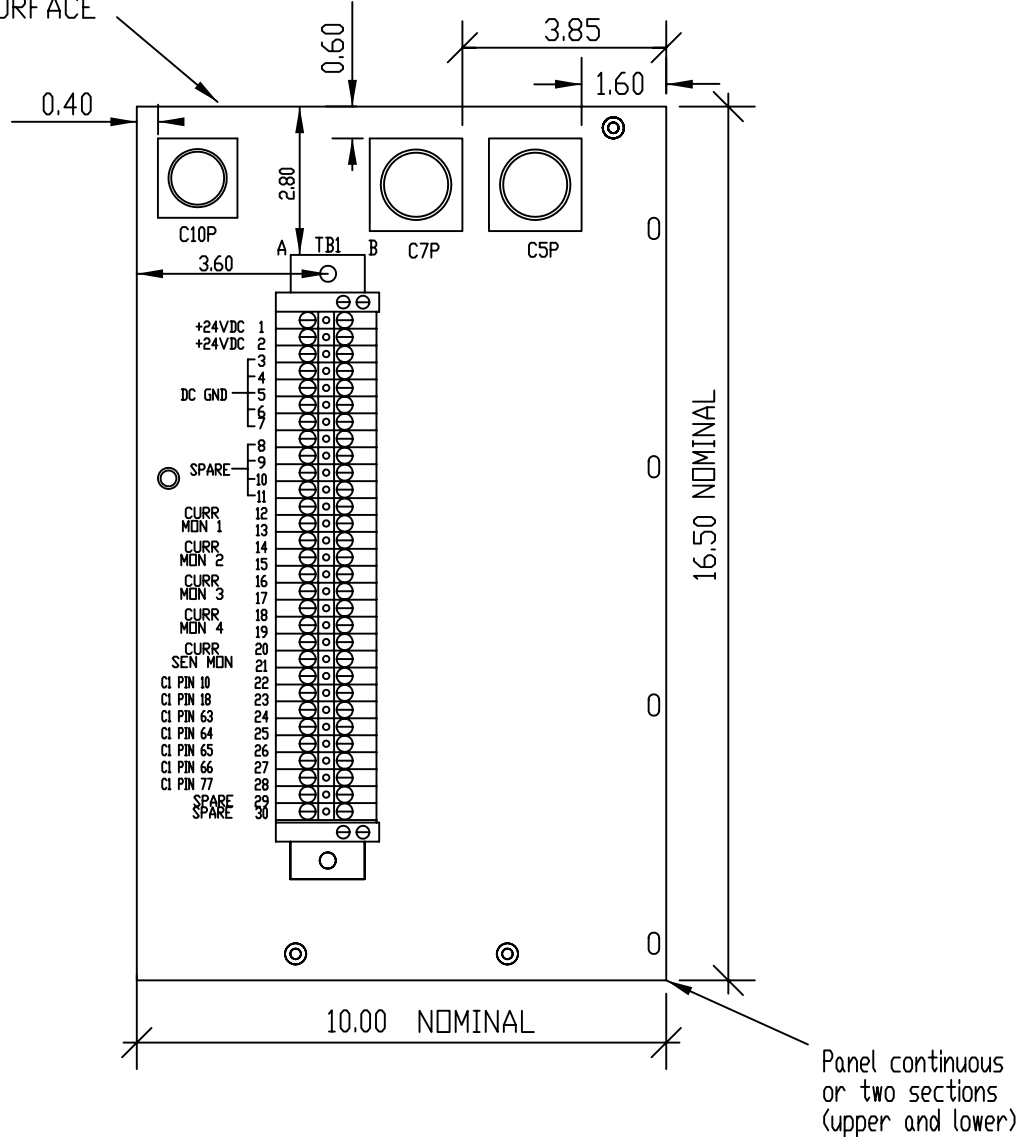
TITLE:  
CONTROLLER ISOLATION ASSEMBLY  
(CIA)

NO SCALE

CMS 2009

A7-7

TOP OF EIA  
MOUNTING SURFACE



#### NOTES:

1. Provide and install a 30 position TB1 Terminal Block & three circular connectors, C5P, C7P & C10P (no contracts), TB1 shall be a USK 10 Open Construct Phoenix Contact Terminal Block (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.

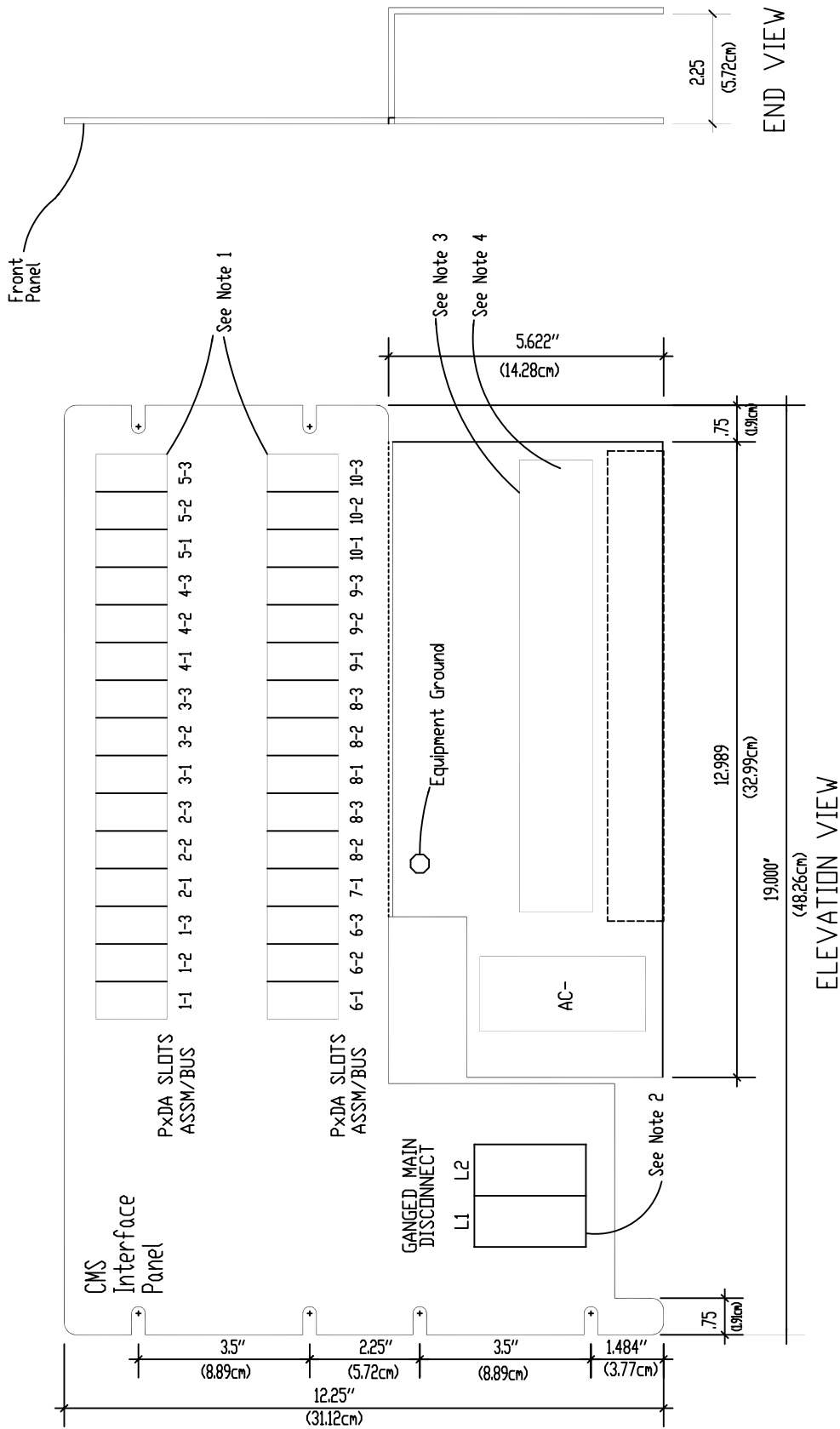
TITLE: MODEL 334LC CABINET  
INPUT FILE #3  
UPPER PART

No Scale

CMS 2009

A7-8





NOTES:

1. Total 30-20A Circuit Breakers
2. 2-30A Ganged Main Disconnect Switches
3. Opening for secondary side of CITB for Harness #3.
4. Opening for secondary side of AC- conductors.

TITLE: MODEL 500/510 CMS SYSTEM  
CMS INTERFACE PANEL  
FRONT AND SIDE VIEW

NO SCALE

CMS 2009

A7-10



ELEVATION VIEW

END VIEW

1. CITB- CMS Interface Terminal Block
2. This side of bracket to be mounted to CIP.

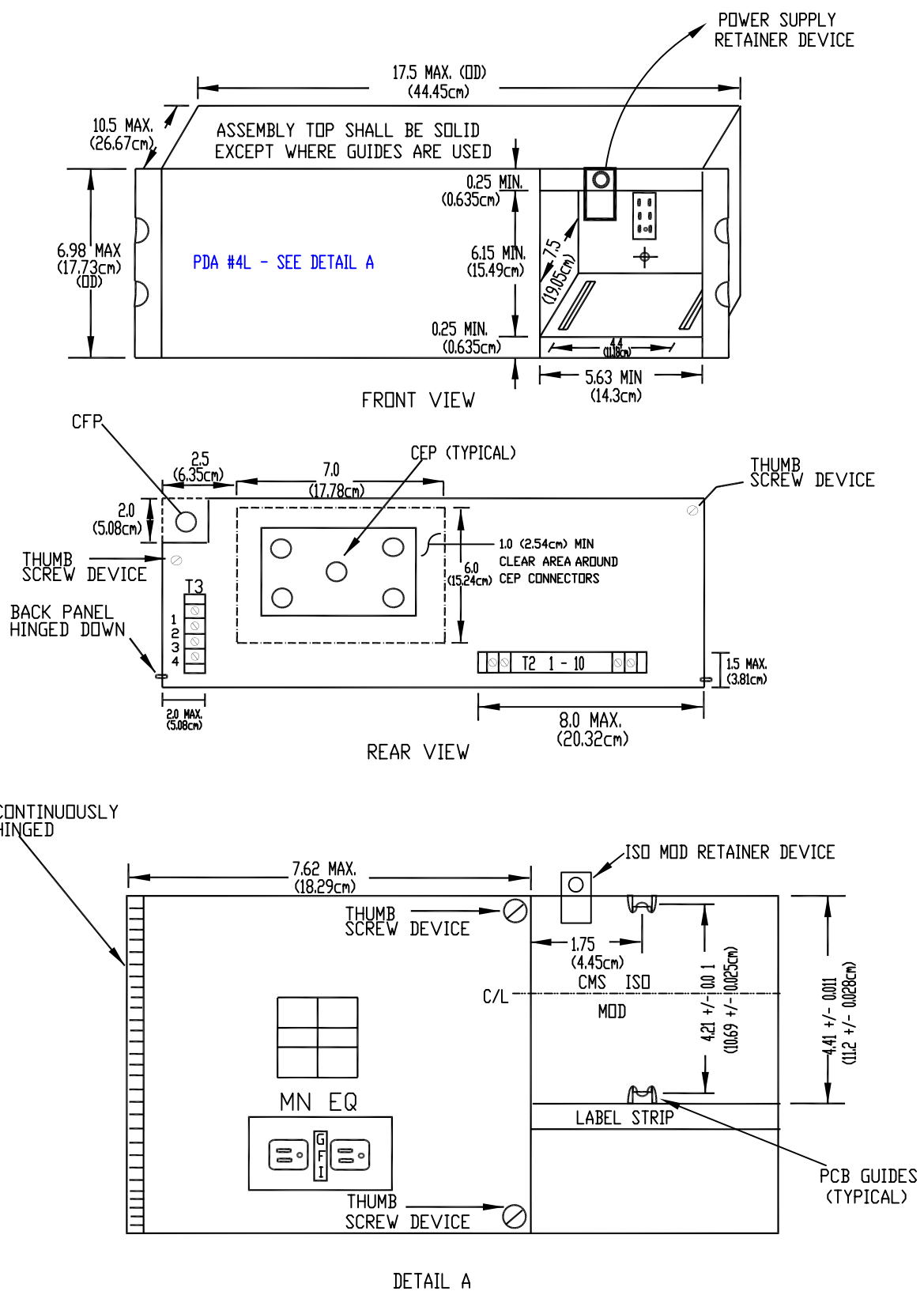
E_GND	1
CM 1	2
CM 1	3
CM 2	4
CM 2	5
CM 3	6
CM 3	7
CM 4	8
CM 4	9
E_GND	10
PxDMA-1	11
GND	12
PxDMA-2	13
PxDMA-3	14
GND	15
PxDMA-4	16
PxDA-1	17
GND	18
PxDA-2	19
PxDA-3	20
GND	21
DI1	22
CLOCK	23
GND	24
ENABLE	25
CLEAR	26
GND	27
DATA 1	28
DATA 2	29
GND	30
DATA 3	31
DATA 4	32
GND	33
DATA 5	34
DATA 6	35
GND	36
DATA 7	37
DATA 8	38
GND	39
LATCH	40
TEST	41
GND	42
+12 VDC	43
-12 VDC	44

## DETAIL B

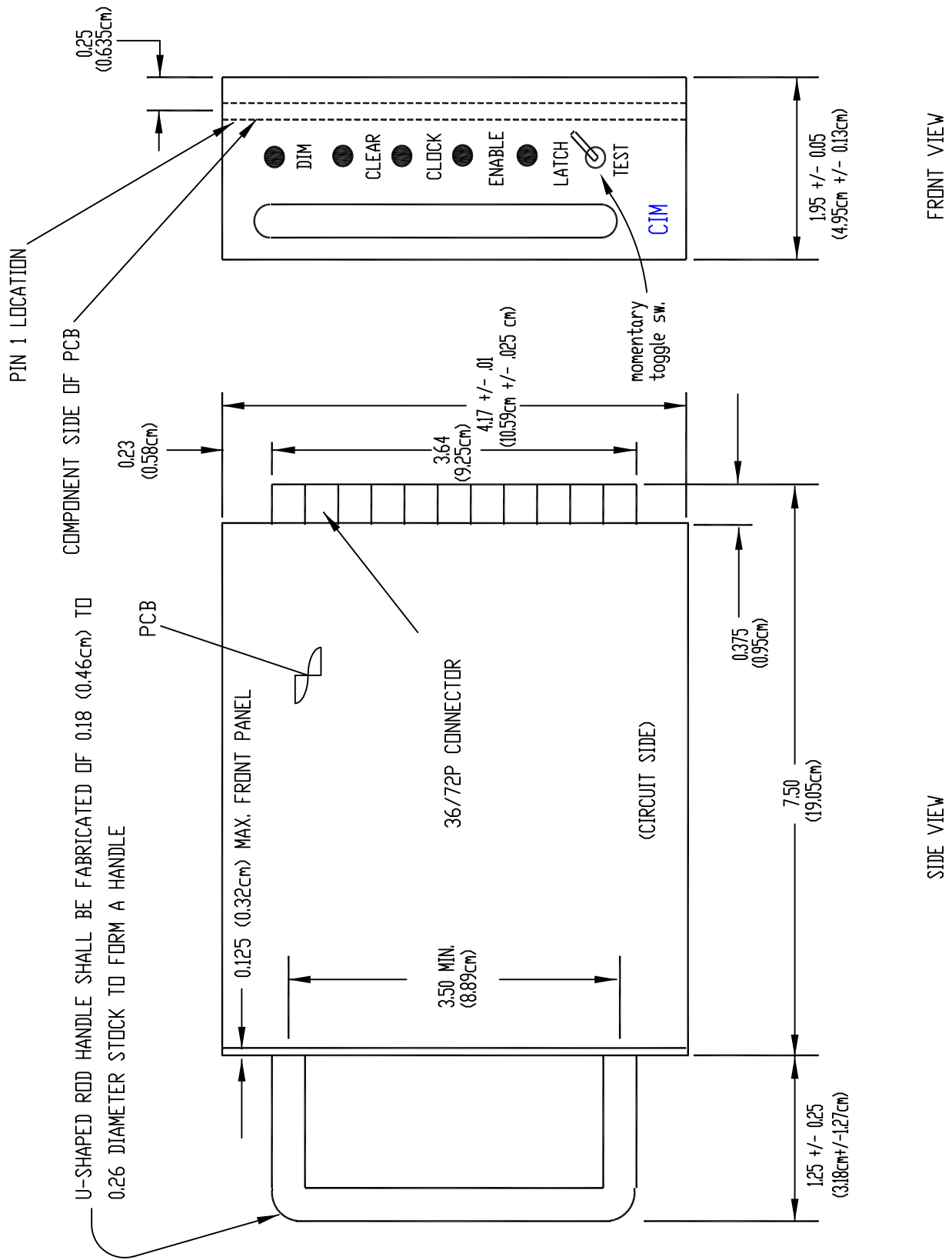
### DIN TERMINAL BLOCK AND LABELING

CITB

TITLE: MODEL 500/510 OR 520 CMS SYSTEM CMS INTERFACE PANEL TERMINAL BLOCK CITB BRACKET AND LABELING	
NO SCALE	A7-11
CMS 2009	



TITLE:	
PDA #4L POWER DISTRIBUTION ASSEMBLY	
NO SCALE	A7-12
CMS 2009	



TITLE:	
CMS ISOLATION MODULE	
NO SCALE	A7-13
CMS 2009	





# **CMS DEVICE ADDRESS ASSIGNMENT**

Device Designation	PxDA Address (3 bits)			PxDM Slot Address (4 bits)			
	7	6	5	4	3	2	1
PxDA1 - PxDM 1	0	0	1	0	0	0	1
PxDA1 - PxDM 2	0	0	1	0	0	1	0
PxDA1 - PxDM 3	0	0	1	0	0	1	1
PxDA1 - PxDM 4	0	0	1	0	1	0	0
PxDA1 - PxDM 5	0	0	1	0	1	0	1
PxDA1 - PxDM 6	0	0	1	0	1	1	0
PxDA1 - PxDM 7	0	0	1	0	1	1	1
PxDA1 - PxDM 8	0	0	1	1	0	0	0
PxDA1 - PxDM 9	0	0	1	1	0	0	1
PxDA1 - PxDM 10	0	0	1	1	0	1	0
PxDA1 - PxDM 11	0	0	1	1	0	1	1
PxDA1 - PxDM 12	0	0	1	1	1	0	0
PxDA2 - PxDM 1	0	1	0	0	0	0	1
PxDA2 - PxDM 2	0	1	0	0	0	1	0
PxDA2 - PxDM 3	0	1	0	0	0	1	1
PxDA2 - PxDM 4	0	1	0	0	1	0	0
PxDA2 - PxDM 5	0	1	0	0	1	0	1
PxDA2 - PxDM 6	0	1	0	0	1	1	0
PxDA2 - PxDM 7	0	1	0	0	1	1	1
PxDA2 - PxDM 8	0	1	0	1	0	0	0
PxDA2 - PxDM 9	0	1	0	1	0	0	1
PxDA2 - PxDM 10	0	1	0	1	0	1	0
PxDA2 - PxDM 11	0	1	0	1	0	1	1
PxDA2 - PxDM 12	0	1	0	1	1	0	0
PxDA3 - PxDM 1	0	1	1	0	0	0	1
PxDA3 - PxDM 2	0	1	1	0	0	1	0
PxDA3 - PxDM 3	0	1	1	0	0	1	1
PxDA3 - PxDM 4	0	1	1	0	1	0	0
PxDA3 - PxDM 5	0	1	1	0	1	0	1
PxDA3 - PxDM 6	0	1	1	0	1	1	0
PxDA3 - PxDM 7	0	1	1	0	1	1	1
PxDA3 - PxDM 8	0	1	1	1	0	0	0
PxDA3 - PxDM 9	0	1	1	1	0	0	1
PxDA3 - PxDM 10	0	1	1	1	0	1	0
PxDA3 - PxDM 11	0	1	1	1	0	1	1
PxDA3 - PxDM 12	0	1	1	1	1	0	0
PxDA4 - PxDM 1	1	0	0	0	0	0	1
PxDA4 - PxDM 2	1	0	0	0	0	1	0
PxDA4 - PxDM 3	1	0	0	0	0	1	1
PxDA4 - PxDM 4	1	0	0	0	1	0	0
PxDA4 - PxDM 5	1	0	0	0	1	0	1
PxDA4 - PxDM 6	1	0	0	0	1	1	0
PxDA4 - PxDM 7	1	0	0	0	1	1	1
PxDA4 - PxDM 8	1	0	0	1	0	0	0
PxDA4 - PxDM 9	1	0	0	1	0	0	1
PxDA4 - PxDM 10	1	0	0	1	0	1	0
PxDA4 - PxDM 11	1	0	0	1	0	1	1
PxDA4 - PxDM 12	1	0	0	1	1	0	0
PxDA5 - PxDM 1	1	0	1	0	0	0	1
PxDA5 - PxDM 2	1	0	1	0	0	1	0
PxDA5 - PxDM 3	1	0	1	0	0	1	1
PxDA5 - PxDM 4	1	0	1	0	1	0	0
PxDA5 - PxDM 5	1	0	1	0	1	0	1
PxDA5 - PxDM 6	1	0	1	0	1	1	0
PxDA5 - PxDM 7	1	0	1	0	1	1	1
PxDA5 - PxDM 8	1	0	1	1	0	0	0
PxDA5 - PxDM 9	1	0	1	1	0	0	1
PxDA5 - PxDM 10	1	0	1	1	0	1	0
PxDA5 - PxDM 11	1	0	1	1	0	1	1
PxDA5 - PxDM 12	1	0	1	1	1	0	0

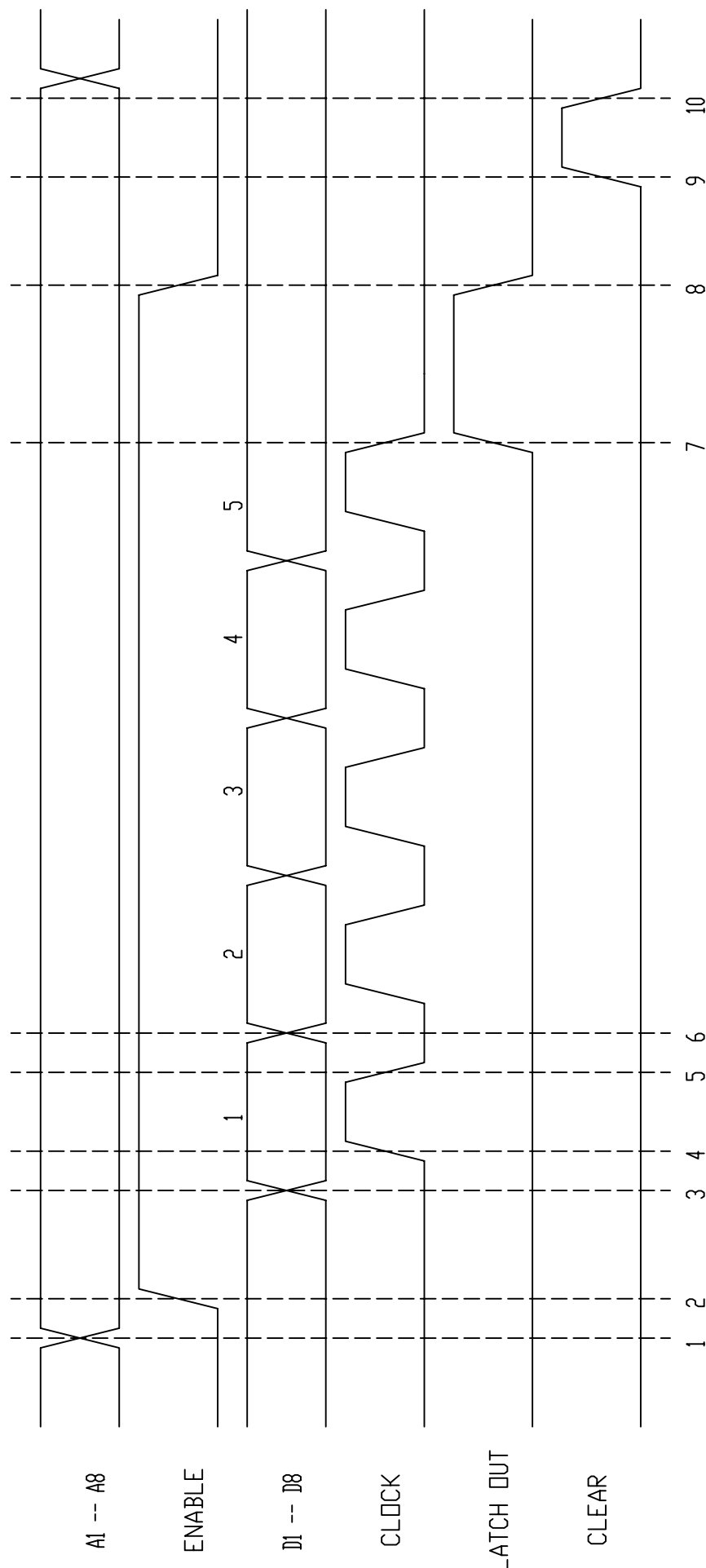
TITLE:

CMS DEVICE ADDRESS ASSIGNMENT

NO SCALE

CMS 2009

A7-15



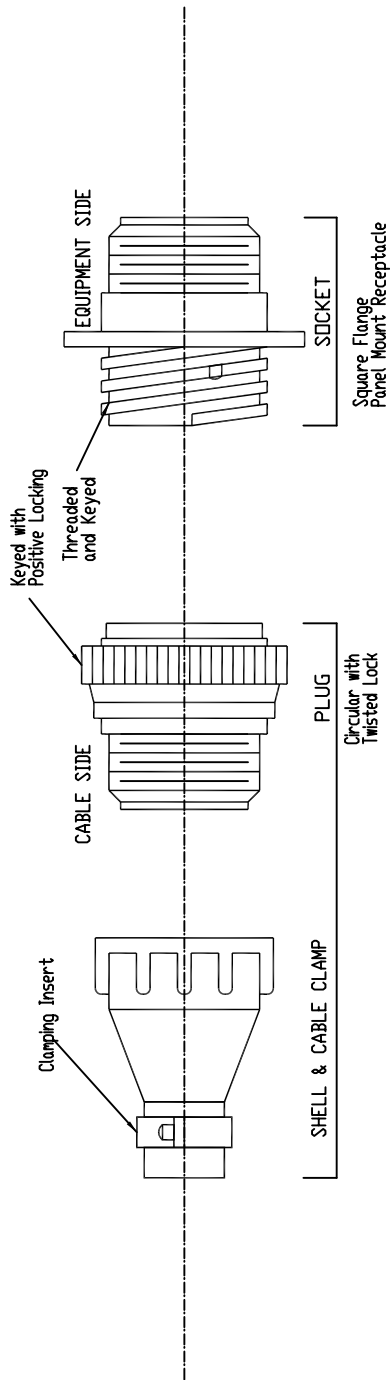
# NOTE:

Logic is Ground True, For this detail, up is True(1) and down is False(0).  
Rise and Fall timer shall stabilize within 10μ seconds.

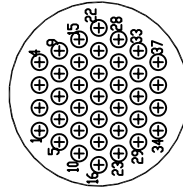
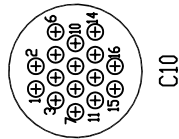
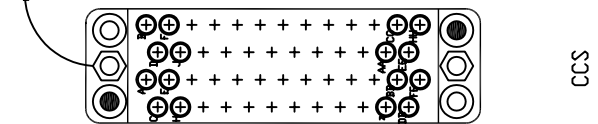
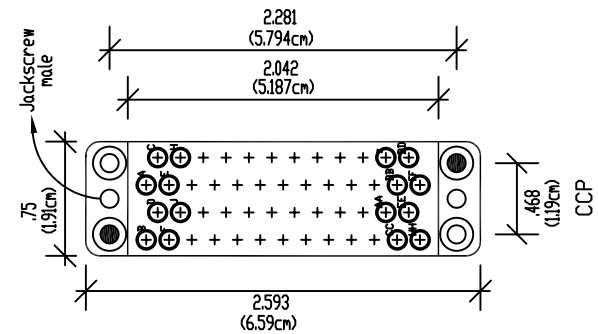
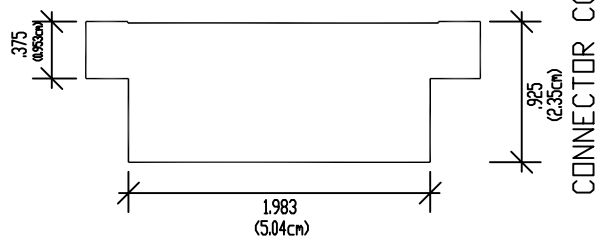
## SEQUENCE OF OPERATION

1. Place Address on Address Lines.
2. Set the Enable Line to True.
3. Begin Data transfer loop, place Data on Data Lines. First word/Fifth row onto Fifth word/First row of Pixels.
4. Set the Clock Line to True. The leading edge will shift data in shift register.
5. Set the Clock Line to False.
6. Place the next Data on the Data Lines and loop until all 5 bytes of data are transferred.
7. The trailing edge of the Clock Line will cause the Latch Line to go True.
8. Set the Enable Line to False. The Latch Line will go False.
9. Set the Clear Line to True. This will turn off Pixel Load Triacs and transfer data from shift registers to output latches.
10. Set the Clear Line to False. This enables Pixel Load Triacs with new message.

TITLE:		CMS TIMING DIAGRAM
NO SCALE	A7-16	
CMS 2009		



CONNECTORS CA, CB, CD, CE, CF, C7, C8, C9, & C10



CA, CB, CD, CE, CF, C7, C8 & C9

CONNECTOR PIN ARRANGEMENT

NOTE:  
Guide Pins & Sockets, and Jackscrews  
are centered symmetrical to connector.

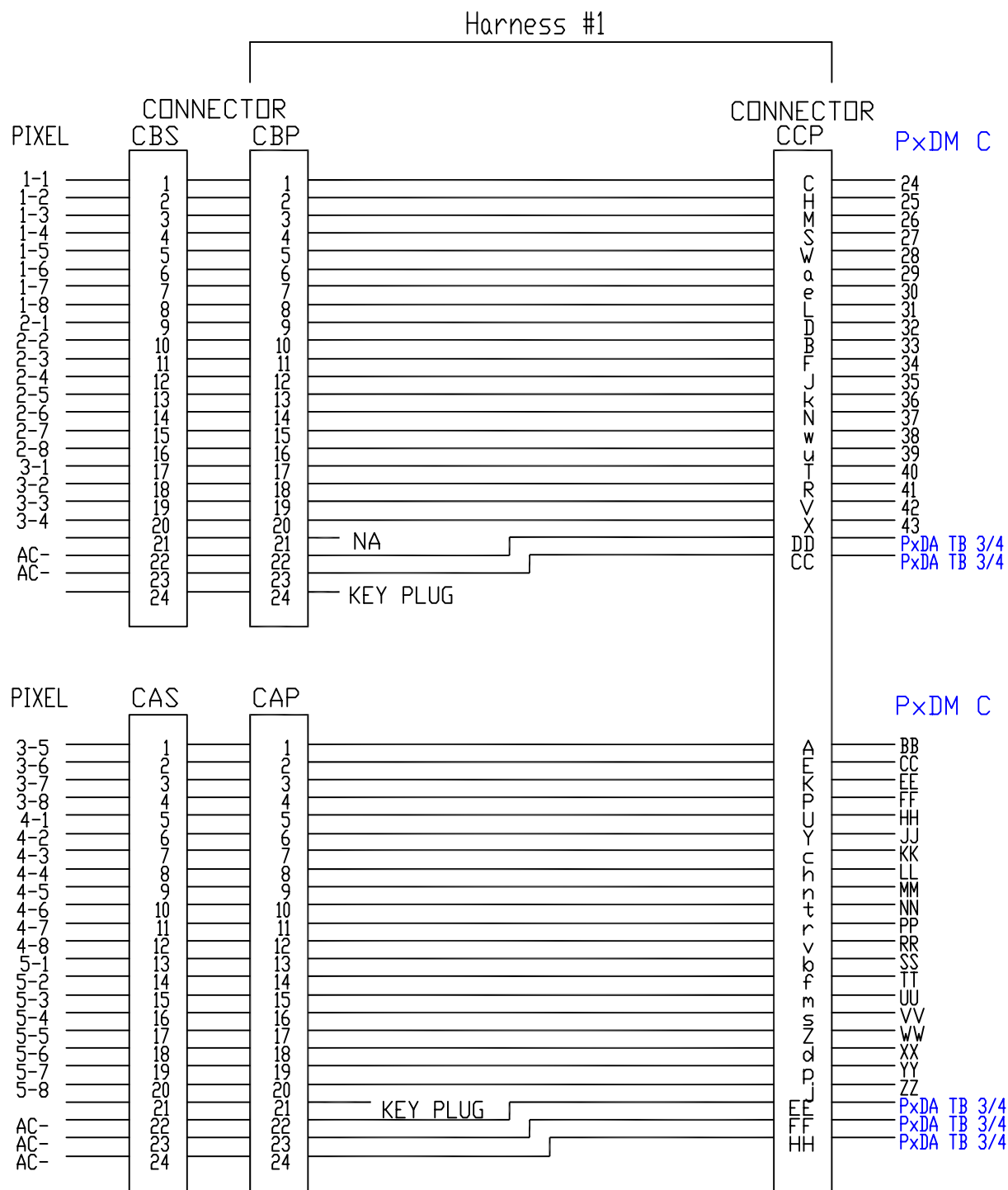
KEY:  
○ - socket  
● - pin (male)

TITLE:  
MODEL 500/510 OR 520 CMS SYSTEM  
CONNECTOR DETAIL

NO SCALE

CMS 2009

A7-17



#### NOTES:

Diagram is for interconnection between Pixel Matrix Module and Pixel Driver Assembly.  
Pins x,y,z and AA are Not Assigned on CC connector.

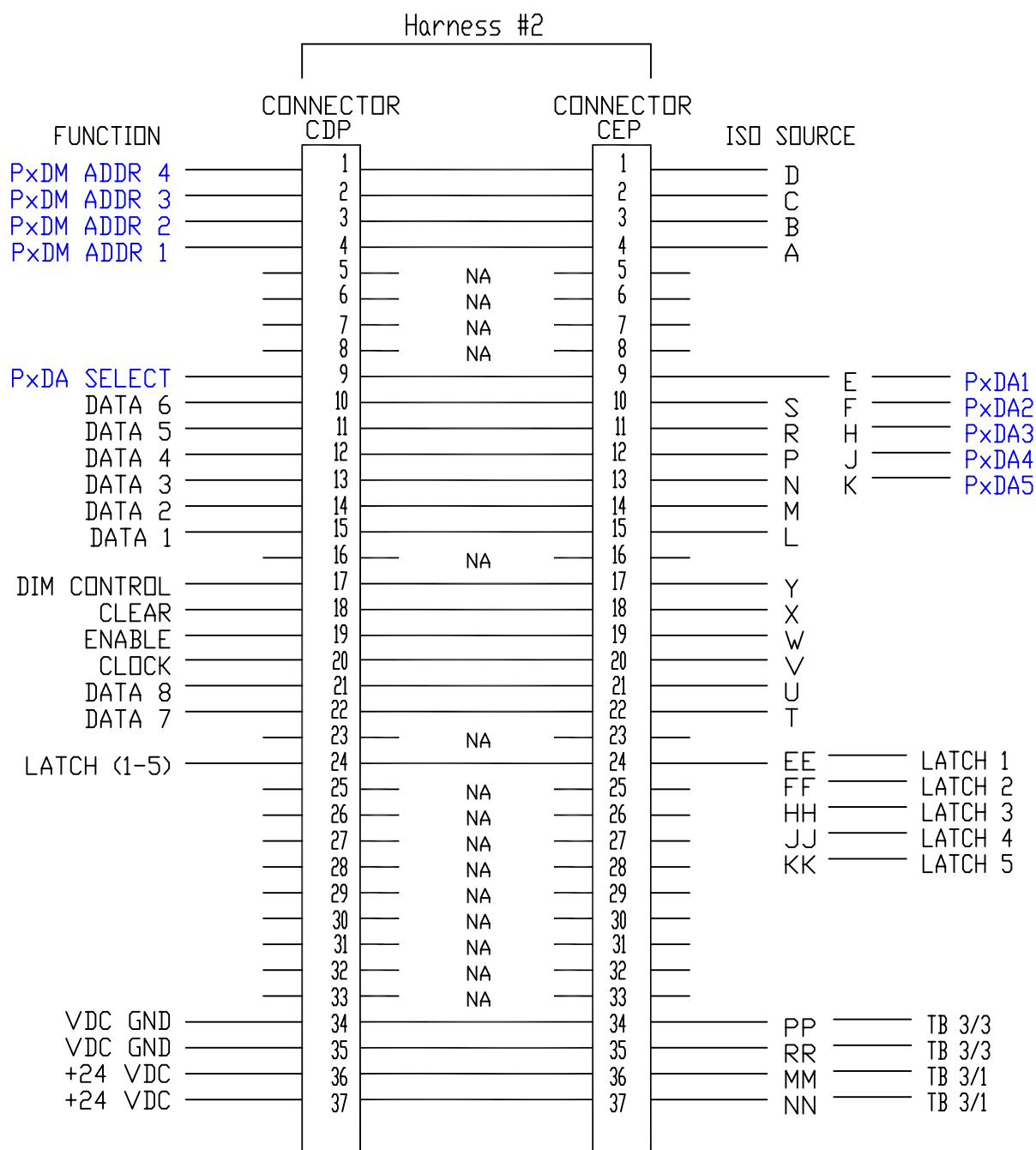
PxDA C 24 - Pixel Driver Module Connector pin 24  
PxDA TB 3 - Pixel Driver Assembly Terminal Block position 3  
NA - Not Assigned

TITLE: HARNESS #1 WIRING DIAGRAM  
CAP/CBP TO CCP PIN ASSIGNMENTS

NO SCALE

CMS 2009

A7-18



NOTES:

Diagram is for interconnection between Pixel Driver Assembly and PDA #3L  
 ISO-54, LATCH 1 pertains to PxDA 1; ISO-56, LATCH 2 pertains to PxDA 2, etc.  
 ISO SOURCE-60 - Isolation Module Connector pin 60  
 PxDA TB 3 - Pixel Driver Assembly Terminal Block position 3  
 NA - Not Assigned

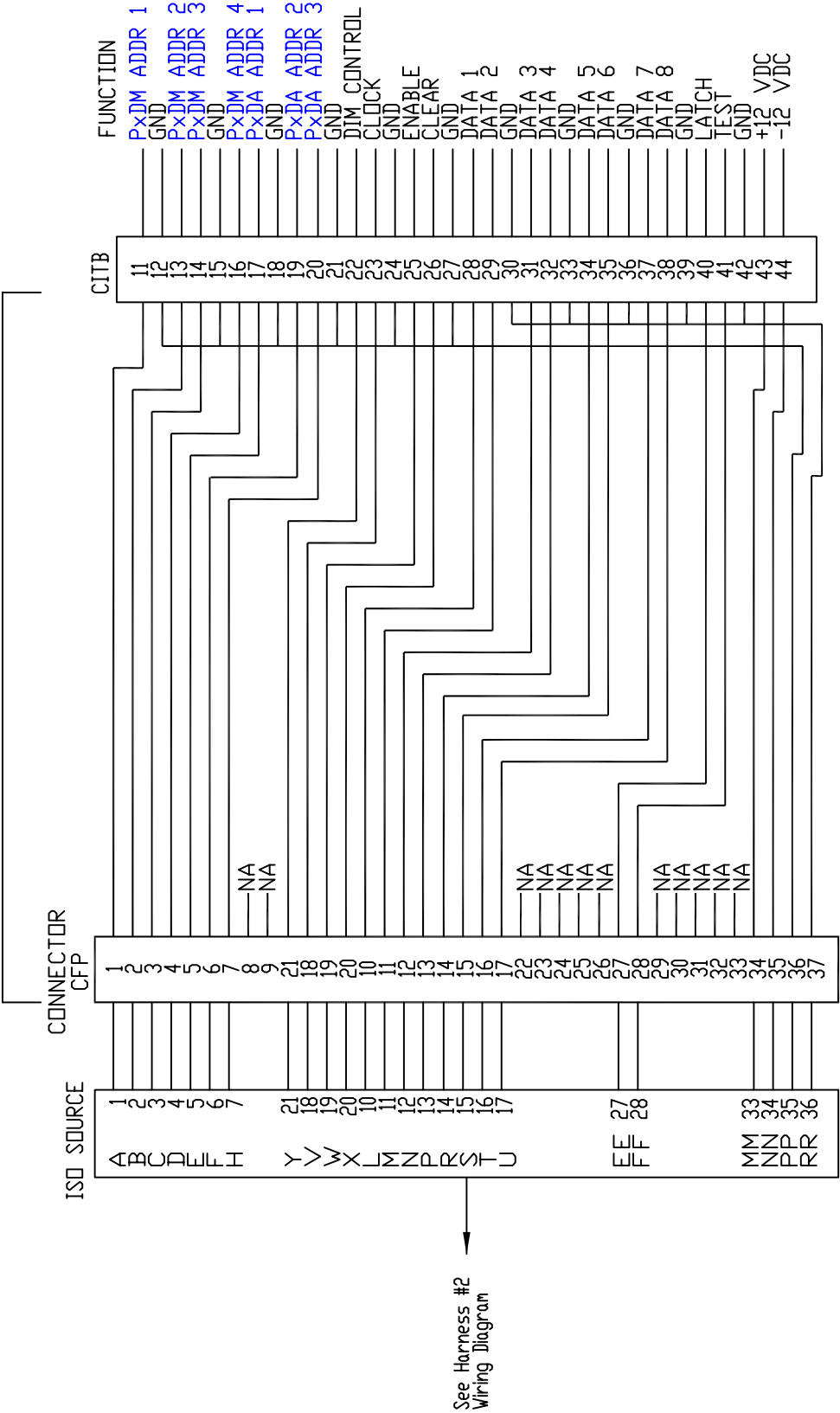
TITLE: HARNESS #2 WIRING DIAGRAM  
 CDP TO CEP PIN ASSIGNMENTS

NO SCALE

CMS 2009

A7-19

Harness #3



See Harness #2  
Wiring Diagram

NOTES:

Diagram is for interconnection between PDA #31 to secondary side of CITB on the CIP.  
Harness #3 connection ends on secondary side of CITB shall be stripped  
and connected to manufacturer specifications.

- ISD SOURCE-35 - Isolation Module Connector pin 35  
CITB - CMS Interface Terminal Block  
NA - Not Assigned

TITLE: HARNESS #3 WIRING DIAGRAM CFP TO CITB PIN ASSIGNMENTS		
NO SCALE	A7-20	
CMS 2009		

# **CONTROLLER INTERFACE PANEL TERMINAL BLOCK (CITB)**

# **CAB/CIA CONNECTORS**

## **HARNESS NO. 4**

TERMINAL BLOCK	POSITION	FUNCTION	CONNECTOR	PIN
CITB.....	11	PxDM Addr 1	C8.....	1
CITB.....	13	PxDM Addr 2	C8.....	3
CITB.....	14	PxDM Addr 3	C8.....	5
CITB.....	16	PxDM Addr 4	C8.....	7
CITB.....	17	PxDA Addr 1	C8.....	9
CITB.....	19	PxDA Addr 2	C8.....	11
CITB.....	20	PxDA Addr 3	C8.....	13
CITB.....	22	DIM CONTROL	C9.....	7
CITB.....	23	CLOCK	C9.....	1
CITB.....	25	ENABLE	C9.....	3
CITB.....	26	CLEAR	C9.....	5
CITB.....	12,15,18,21,24,27	EXT VDC GND	C8.....	*
CITB.....	28	DATA 1	C8.....	19
CITB.....	29	DATA 2	C8.....	21
CITB.....	31	DATA 3	C8.....	23
CITB.....	32	DATA 4	C8.....	25
CITB.....	34	DATA 5	C8.....	27
CITB.....	35	DATA 6	C8.....	29
CITB.....	37	DATA 7	C8.....	31
CITB.....	38	DATA 8	C8.....	33
CITB.....	40	LATCH LINE	C9.....	13
CITB.....	41	TEST	C9.....	15
CITB.....	43	EXT +12 VDC	C9.....	34
CITB.....	44	EXT -12 VDC	C9.....	35
CITB.....	30,33,36,39,42	EXT VDC GND	C8 & 9.....	*

## **HARNESS NO. 5**

TERMINAL BLOCK	POSITION	FUNCTION	CONNECTOR-PIN
CITB	1 & 10	EQUIP. GROUND	
CITB	2 & 3	CURRENT MONITOR 1	TB1A-12&13/C10-1&2
CITB	4 & 5	CURRENT MONITOR 2	TB1A-14&15/C10-3&4
CITB	6 & 7	CURRENT MONITOR 3	TB1A-16&17/C10-5&6
CITB	8 & 9	CURRENT MONITOR 4	TB1A-18&19/C10-7&8

\* VDC LOGIC GND WIRES, (refer to page 8-7-28).

**DEFINITIONS:**    PxDM Addr 1    - Lamp Driver Module Address Line 1.  
                          PxDA Addr 1    - Lamp Driver Assembly Address Line 1.

TITLE:  
CMS HARNESS #4 AND #5 WIRING LIST

NO SCALE

CMS 2009

A7-21

## CMS HARNESS # 4

### COLOR CODED WIRING LIST

FUNCTION	CIP/CITB POSITION	COLOR PAIRS (gnd w/logic)	CONNECTOR-PINS (logic, gnd)
PxDM Addr 1	11	BLACK W/RED	C8-1,2
PxDM Addr 2	13	BLACK W/WHITE	C8-3,4
PxDM Addr 3	14	BLACK W/GREEN	C8-5,6
PxDM Addr 4	16	BLACK W/BLUE	C8-7,8
PxDA Addr 1	17	BLACK W/YELLOW	C8-9,10
PxDA Addr 2	19	BLACK W/BROWN	C8-11,12
PxDA Addr 3	20	BLACK W/ORANGE	C8-13,14
DIM CONTROL	22	RED W/WHITE	C9-7,8
CLOCK	23	RED W GREEN	C9-1,2
ENABLE	25	RED W/BLUE	C9-3,4
CLEAR	26	RED W/YELLOW	C9-5,6
DATA 1	28	RED W/BROWN	C8-19,20
DATA 2	29	RED W/ORANGE	C8-21,22
DATA 3	31	GREEN W/WHITE	C8-23,24
DATA 4	32	GREEN W/BLUE	C8-25,26
DATA 5	34	GREEN W/YELLOW	C8-27,28
DATA 6	35	GREEN W/BROWN	C8-29,30
DATA 7	37	GREEN W/ORANGE	C8-31,32
DATA 8	38	WHITE W/BLUE	C8-33,34
LATCH LINE	40	WHITE W/YELLOW	C9-13,14
TEST	41	WHITE W/BROWN	C9-15,16
EXT+12 VDC	43	WHITE W/ORANGE	C9-34,36
EXT-12 VDC	44	BLUE W/YELLOW	C9-35,37

\*CIP/CITB VDC LOGIC GND POSITIONS: 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42

## CMS HARNESS # 5

### COLOR CODED WIRING LIST

FUNCTION	CIP/CITB POSITION	COLOR PAIRS	CONNECTOR (TB1A-C10)
CURR. MONITOR 1	2 & 3	BLACK W/RED	12&13-1&2
CURR. MONITOR 2	4 & 5	BLACK W/WHITE	14&15-3&4
CURR. MONITOR 3	6 & 7	BLACK W/GREEN	16&17-5&6
CURR. MONITOR 4	8 & 9	BLACK W/BLUE	18&19-7&8

#### DEFINITIONS:

TB1A-Terminal Block 1A in [334LC cabinet](#).

TB1A-C10: terminal block 1A position 1&2 connected to C10 connector pins 1&2.

TITLE:

CMS HARNESS #4 & #5  
COLOR CODED WIRING LIST

NO SCALE

CMS 2009

A7-22



# MODEL 334LC CONTROLLER CABINET HARNESS #5 AND TB1 WIRING LIST

## CABINET TB1A TERMINAL BLOCK

POSITION	SIDE A	SIDE B	C10 CONNECTOR
1	+24 VDC (PDA #3L)	I/O FILES	
2	+24 VDC (POS. 1)	CAB. HARNESS #5	PINS 13 & 14
3 - 7	DC GND (PDA #3L)	C1 PINS 1 & 104, I/O FILES & CAB. HARNESS #5	
8 - 11	NA	NA	PINS 15 & 16
12 & 13	CURR. MONITOR 1*	CAB. HARNESS #5	PINS 1 & 2
14 & 15	CURR. MONITOR 2*	CAB. HARNESS #5	PINS 3 & 4
16 & 17	CURR. MONITOR 3*	CAB. HARNESS #5	PINS 5 & 6
18 & 19	CURR. MONITOR 4*	CAB. HARNESS #5	PINS 7 & 8
20 & 21	PHOTO SEN. MON.	CAB. HARNESS #5	PINS 9 & 10
22	C1 PIN 10	CIA CONTROL 4	PIN 11
23	C1 PIN 18	NA	
24	C1 PIN 63	NA	
25	C1 PIN 64	NA	
26	C1 PIN 65	POL. CONTROL SWITCH	
27	C1 PIN 66	POL. LIGHTS SWITCH	
28	C1 PIN 76	NA	
29	C1 PIN 77	NA	
30	NA	NA	

\* Refers to CMS HARNESS #5.

**NOTES:** All C1 PINS refer to C1 HARNESS #2.

TITLE: CMS HARNESS #5 AND TB1 WIRING LIST	
NO SCALE	A7-23
CMS 2009	

# MODEL 334LC CONTROLLER CABINET HARNESS #5 AND TB1 WIRING LIST

PIN	SOURCE	DESTINATION	FUNCTION	PIN	SOURCE	DESTINATION	FUNCTION
1	DC GND	TB1/3-7	DC GND BUS	53	I2-7	IFI-11F	RATE CODE 2
2	O1-1	C6-1	SWPK 1-RED	54	I2-8	IFI-11W	RATE CODE 1
3	O1-2	C6-2	SWPK 1-GRN	55	I3-1	IFI-4F	MAIN 9
4	O1-3	C6-3	SWPK 2-RED	56	I3-2	IFI-4W	MAIN 10
5	O1-4	C6-4	SWPK 2-YEL	57	I3-3	IFI-6F	MAIN 3
6	O1-5	C6-5	SWPK 2-GRN	58	I3-4	IFI-6W	MAIN 4
7	O1-6	C6-6	SWPK 3-RED	59	I3-5	IFI-7F	MAIN 5
8	O1-7	C6-7	SWPK 3-YEL	60	I3-6	IFI-7W	MAIN 6
9	O1-8	C6-8	SWPK 3-GRN	61	I3-7	IFI-8F	MAIN 11
10	O2-1	TB1/22	CIA CONTROL 4	62	I3-8	IFI-8W	MAIN 12
11	O2-2	C7-25	CMS CLOCK	63	I4-5	TB1/24	MAIN 17
12	O2-3	C7-26	CMS ENABLE	64	I4-6	TB1/25	MAIN 18
13	O2-4	C7-27	CMS CLEAR	65	I4-7	TB1/26	POL CONT'L SW
14	DC GND	IFI-15-4	INPUT DC GND	66	I4-8	TB1/27	POL LIGHTS SW
15	O2-5	C7-28	CMS DIM LEVEL 1	67	I5-1	C7-16	CIA SENSE 1
16	O2-6	C7-29	CMS DIM LEVEL 2	68	I5-2	C7-31	CIA SENSE 2
17	O2-7	C7-30	CMS DIM LEVEL 3	69	I5-3	C7-32	CIA SENSE 3
18	O2-8	TB1/23	--	70	I5-4	C7-33	CIA SENSE 4
19	O3-1	C7-9	CMS ADDRESS 1	71	I5-5	C7-34	CIA SENSE 5
20	O3-2	C7-10	CMS ADDRESS 2	72	I5-6	C7-35	CIA SENSE 6
21	O3-3	C7-11	CMS ADDRESS 3	73	I5-7	C7-36	CIA SENSE 7
22	O3-4	C7-12	CMS ADDRESS 4	74	I5-8	C7-37	CIA SENSE 8
23	O3-5	C7-13	CMS ADDRESS 5	75	I6-1	C7-5	CMS LATCH
24	O3-6	C7-14	CMS ADDRESS 6	76	I6-2	C7-6	PHASE FIRE
25	O3-7	C7-15	CMS ADDRESS 7	77	I6-3	TB1/29	MAIN 19
26	O3-8	C7-4	CIA CONTROL 5	78	I6-4	C7-8	CMS TEST REQ.
27	O4-1	C7-17	CMS DATA 1	79	I6-5	IFI-10F	MAIN 15
28	O4-2	C7-18	CMS DATA 2	80	I6-6	IFI-9W	MAIN 14
29	O4-3	C7-19	CMS DATA 3	81	I6-7	IFI-9F	MAIN 13
30	O4-4	C7-20	CMS DATA 4	82	I6-8	IFI-10W	MAIN 16
31	O4-5	C7-21	CMS DATA 5	83	O6-1	C5-1	SWPK 14-RED
32	O4-6	C7-22	CMS DATA 6	84	O6-2	C5-2	SWPK 14-GRN
33	O4-7	C7-23	CMS DATA 7	85	O6-3	C5-3	SWPK 13-RED
34	O4-8	C7-24	CMS DATA 8	86	O6-4	C5-4	SWPK 13-YEL
35	O5-1	C7-1	CIA CONTROL 1	87	O6-5	C5-5	SWPK 13-GRN
36	O5-2	C7-2	CIA CONTROL 2	88	O6-6	C5-6	SWPK 12-RED
37	O5-3	C6-9	SWPK 1-YEL	89	O6-7	C5-7	SWPK 12-YEL
38	O5-4	C7-3	CIA CONTROL 3	90	O6-8	C5-8	SWPK 12-GRN
39	I1-1	IFI-1W	PASSAGE 1	91	O7-1	C5-9	SWPK 11-RED
40	I1-2	IFI-12W	PASSAGE 2	92	DC GND	TB1/3-7	--
41	I1-3	IFI-12F	DEMAND 2	93	O7-2	C5-10	SWPK 11-GRN
42	I1-4	IFI-13W	OFF RAMP 2	94	O7-3	C5-11	SWPK 10-RED
43	I1-5	IFI-13F	QUE 2	95	O7-4	C5-12	SWPK 10-YEL
44	I1-6	IFI-14W	PASSAGE 3	96	O7-5	C4-13	SWPK 10-GRN
45	I1-7	IFI-14F	DEMAND 3	97	O7-6	C5-14	SWPK 9-RED
46	I1-8	IFI-1F	DEMAND 1	98	O7-7	C5-15	SWPK 9-YEL
47	I2-1	IFI-2W	OFF RAMP 1	99	O7-8	C5-16	SWPK 9-GRN
48	I2-2	IFI-3W	MAIN 7	100	O5-5	C5-17	SWPK 14-YEL
49	I2-3	IFI-3F	MAIN 8	101	O5-6	C5-18	SWPK 11-YEL
50	I2-4	IFI-2F	QUE 1	102	O5-7	IFI-15-3	DET. RESET
51	I2-5	IFI-5F	MAIN 1	103	O5-8	C6-10	WDT
52	I2-6	IFI-5W	MAIN 2	104	DC GND	TB1/3-7	DC GND BUS

## NOTES:

C7S CONNECTOR PIN 7 is not assigned.  
TB1/26 - TERMINAL BLOCK 1 POSITION 26.

TITLE: C1 HARNESS #2 WIRING LIST  
(interconnection between CABINET and  
CONTROLLER)

NO SCALE

CMS 2009

A7-24

# PDA #4L CMS ISO MOD & CFP CONNECTOR ASSIGNMENTS

## CFP Connector

## CMS Isolation Module

PIN	FUNCTION	PIN	PIN	FUNCTION	SOURCE
1	PxDM Addr 1 IN	1	2	PxDM Addr 1 OUT	CEX - 4
2	PxDM Addr 2 IN	3	4	PxDM Addr 2 OUT	CEX - 3
3	PxDM Addr 3 IN	5	6	PxDM Addr 3 OUT	CEX - 2
4	PxDM Addr 4 IN	7	8	PxDM Addr 4 OUT	CEX - 1
5	PxDA Addr 1 IN	9	10	PxDA 1 Select OUT	CEA - 9
6	PxDA Addr 2 IN	11	12	PxDA 2 Select OUT	CEB - 9
7	PxDA Addr 3 IN	13	14	PxDA 3 Select OUT	CEC - 9
8	NA	15	16	PxDA 4 Select OUT	CED - 9
9	NA	17	18	PxDA 5 Select OUT	CEE - 9
10	Data 1 IN	19	20	Data 1 OUT	CEX - 15
11	Data 2 IN	21	22	Data 2 OUT	CEX - 14
12	Data 3 IN	23	24	Data 3 OUT	CEX - 13
13	Data 4 IN	25	26	Data 4 OUT	CEX - 12
14	Data 5 IN	27	28	Data 5 OUT	CEX - 11
15	Data 6 IN	29	30	Data 6 OUT	CEX - 10
16	Data 7 IN	31	32	Data 7 OUT	CEX - 22
17	Data 8 IN	33	34	Data 8 OUT	CEX - 21
18	CLOCK IN	35	36	CLOCK OUT	CEX - 20
19	ENABLE IN	37	38	ENABLE OUT	CEX - 19
20	CLEAR IN	39	40	CLEAR OUT	CEX - 18
21	Dim Control IN	41	42	Dim Control OUT	CEX - 17
22	NA		43		NA
23	NA		45		NA
24	NA		47		NA
25	NA		49		NA
26	NA		51		NA
27	PxDA LATCH OUT	53	54	PxDA 1 LATCH IN	CEA - 24
28	TEST REQUEST	55	56	PxDA 2 LATCH IN	CEB - 24
29	NA	57	58	PxDA 3 LATCH IN	CEC - 24
30	NA	59	60	PxDA 4 LATCH IN	CED - 24
31	NA	61	62	PxDA 5 LATCH IN	CEE - 24
32	NA	63	64	NA	
33	NA				
34	EXT +12 VDC	65	66	CMS +24 VDC	TB 3 / 1
35	EXT -12 VDC	67	68	CMS +24 VDC	TB 3 / 1
36	EXT VDC GND	69	70	CMS VDC GND	TB 3 / 3
37	EXT VDC GND	71	72	CMS VDC GND	TB 3 / 3

### NOTES:

1. The CMS Isolation Module's PC socket connector pin location shall be positioned as viewed from the PDA #4L front.
2. The CMS Isolation Module's card connector shall be keyed between pins 8 and 9.

### DEFINITIONS:

PxDM Addr 1	- Pixel Driver Module Address Line 1.
PxDA Addr 1	- Pixel Driver Assembly Address Line 1.
CEX - 6	- Assigned to all 5 CE Connectors Pin 6.
TB 3 / 1	- Terminal Block 3 Position No.1.
Dim Control	- Dimmer Control.
PxDA 1 Select	- PxDA No.1 Select Line.
IN	- Into Module and/or Connector.
OUT	- Out from Module and/or Connector.

### TITLE:

PDA #4L CMS ISO MOD and CFP  
CONNECTOR ASSIGNMENTS

NO SCALE

CMS 2009

A7-25

# PDA #4L CMS CE(A to E) TERMINAL BLOCK CONNECTOR ASSIGNMENTS

## CEP CONNECTORS

PIN	FUNCTION	SOURCE	PIN	FUNCTION
4	PxDA Addr 1	ISO - 2	19	ENABLE
3	PxDA Addr 2	ISO - 4	18	CLEAR
2	PxDA Addr 3	ISO - 6	17	DIM CONTROL
1	PxDA Addr 4	ISO - 8	22	NA
9	PxDA SELECT	ISO - 10 to 18	23	NA
6	NA		24	NA
7	NA		25	NA
8	NA		26	NA
9	NA		24	*PxDA 1 LATCH
15	DATA 1	ISO - 20	24	*PxDA 2 LATCH
14	DATA 2	ISO - 22	24	*PxDA 3 LATCH
13	DATA 3	ISO - 24	24	*PxDA 4 LATCH
12	DATA 4	ISO - 26	24	*PxDA 5 LATCH
11	DATA 5	ISO - 28	32	NA
10	DATA 6	ISO - 30	33	NA
22	DATA 7	ISO - 32	34	VDC GND
21	DATA 8	ISO - 34	35	VDC GND
20	CLOCK	ISO - 36	36	+ 24 VDC
			37	+ 24 VDC

## TERMINAL BLOCKS

TB NO.	POSITION	SOURCE
T2	1	NA
T2	2	NA
T2	3	NA
T2	4	NA
T2	5	AC-
T2	6	FAN
T2	7	CB EQUIP.
T2	8	EQ. GND BUS
T2	9	MAIN
T2	10	AC-
T1 & T4	1 to 10	NA
T3	1 to 2	+ 24 VDC P.S.
T3	3 to 4	VDC GND P.S.

### NOTE:

\*Each Latch Line is a decoded line from the CMS ISO MOD and each line shall be connected to the appropriate CE Connector Pin per PxDA Assignment.

### DEFINITIONS:

CIM C-A	-	CMS Isolation Module Connector Pin A.
PxDA SELECT	-	PxDA Select Line.
PxDA Addr 1	-	Pixel (Lamp) Driver Module Address Line 1.
P.S.	-	Model 206 Power Supply.
TB 3 / 1	-	Terminal Block 3 Position 1.
CB EQUIP	-	Equipment Circuit Breaker

### TITLE:

PDA #4L CMS CE (A to E) and TERMINAL  
BLOCK CONNECTOR ASSIGNMENTS

NO SCALE

CMS 2009

A7-26

PIN	FUNCTION	SOURCE	PIN	FUNCTION	SOURCE
1	PxDM Addr 1	CDX - 4	A	DATA 1	CDX -15
2	PxDM Addr 2	CDX - 3	B	DATA 2	CDX -14
3	PxDM Addr 3	CDX - 2	C	DATA 3	CDX -13
4	PxDM Addr 4	CDX - 1	D	DATA 4	CDX -12
5	PxDA SELECT	CDX - 9	E	DATA 5	CDX -11
6	ID. SLOT 1	PxDA MB	F	DATA 6	CDX -10
7	ID. SLOT 2	PxDA MB	H	DATA 7	CDX -22
8	ID. SLOT 3	PxDA MB	J	DATA 8	CDX -21
9	ID. SLOT 4	PxDA MB	K	CLOCK	CDX -20
10	DC GND	CDX -34 to 35	L	ENABLE	CDX -19
11	NA		M	PxDA LATCH	CDX -24
12	NA		N	CLEAR	CDX -18
13	NA		P	+ 24 VDC	CDX -36 to 37
14	NA		R	DC GND	CDX -34 to 35
15	NA		S	DIM CONTROL	CDX -17
16	NA		T	NA	
17	NA		U	NA	
18	AC + 1	PxDA TB 1-1	V	AC + 1	PxDA TB 1-1
19	AC + 1	PxDA TB 1-1	W	AC + 1	PxDA TB 1-1
20	AC + 2	PxDA TB 1-2	X	AC + 2	PxDA TB 1-2
21	AC + 2	PxDA TB 1-2	Y	AC + 2	PxDA TB 1-2
22	AC + 3	PxDA TB 1-3	Z	AC + 3	PxDA TB 1-3
23	AC + 3	PxDA TB 1-3	AA	AC + 3	PxDA TB 1-3
24	CCS 1	P1-1	BB	CC S21	P3-5
25	CCS 2	P1-2	CC	CC S22	P3-6
26	CCS 3	P1-3	EE	CC S23	P3-7
27	CCS 4	P1-4	FF	CC S24	P3-8
28	CCS 5	P1-5	HH	CC S25	P4-1
29	CCS 6	P1-6	JJ	CC S26	P4-2
30	CCS 7	P1-7	KK	CC S27	P4-3
31	CCS 8	P1-8	LL	CC S28	P4-4
32	CCS 9	P2-1	MM	CC S29	P4-5
33	CCS 10	P2-2	NN	CC S30	P4-6
34	CCS 11	P2-3	PP	CC S31	P4-7
35	CCS 12	P2-4	RR	CC S32	P4-8
36	CCS 13	P2-5	SS	CC S33	P5-1
37	CCS 14	P2-6	TT	CC S34	P5-2
38	CCS 15	P2-7	UU	CC S35	P5-3
39	CCS 16	P2-8	VV	CC S36	P5-4
40	CCS 17	P3-1	WW	CC S37	P5-5
41	CCS 18	P3-2	XX	CC S38	P5-6
42	CCS 19	P3-3	YY	CC S39	P5-7
43	CCS 20	P3-4	ZZ	CC S40	P5-8

**NOTES:** 1. The Pixel Driver Module Connector shall be a 43/86 Edge Connector.  
2. AC+ 1, AC+ 2 and AC+ 3 and associated AC-Bus of T.B. A1 & 2 shall be routed to associated PxD MB connectors, T.B. A1 to PxD MB connectors 7 to 12 and T.B. A2 to PxD MB connectors 1 to 6.

**DEFINITIONS:**

PxDM Addr 1	- Pixel Driver Module Address Line 1.
PxDA SELECT	- PxDA Address Enable Line.
PxDA MB	- PxDA Motherboard Network.
CDX-1	- Assigned to all 5 CD Connectors (A to E) Pin 1.
CCS 1	- CC Socket Connector Pin 1.
P1-1	- Pixel 1-1 (As designated from Detail 8-7-14).
PxDA TB 1-2	- PxDA Terminal Block 1 Position 2.

TITLE:  
PIXEL DRIVER MODULE CONNECTOR  
ASSIGNMENTS

NO SCALE

CMS 2009

A7-27

CONNECTOR	PIN	FUNCTION	CONNECTOR	PIN	FUNCTION
C8	1	PxDMA Addr 1	C9	1	CLOCK
C8	2	Ground	C9	2	Ground
C8	3	PxDMA Addr 2	C9	3	ENABLE
C8	4	Ground	C9	4	Ground
C8	5	PxDMA Addr 3	C9	5	CLEAR
C8	6	Ground	C9	6	Ground
C8	7	PxDMA Addr 4	C9	7	Dim Control Line
C8	8	Ground	C9	8	Ground
C8	9	PxDA Addr 1	C9	9	NA
C8	10	Ground	C9	10	NA
C8	11	PxDA Addr 2	C9	11	NA
C8	12	Ground	C9	12	NA
C8	13	PxDA Addr 3	C9	13	LATCH
C8	14	Ground	C9	14	Ground
C8	15	NA	C9	15	TEST
C8	16	NA	C9	16	Ground
C8	17	NA	C9	17	NA
C8	18	NA	C9	18	NA
C8	19	Data 1	C9	19	NA
C8	20	Ground	C9	20	NA
C8	21	Data 2	C9	21	NA
C8	22	Ground	C9	22	NA
C8	23	Data 3	C9	23	NA
C8	24	Ground	C9	24	NA
C8	25	Data 4	C9	25	NA
C8	26	Ground	C9	26	NA
C8	27	Data 5	C9	27	NA
C8	28	Ground	C9	28	NA
C8	29	Data 6	C9	29	NA
C8	30	Ground	C9	30	NA
C8	31	Data 7	C9	31	NA
C8	32	Ground	C9	32	NA
C8	33	Data 8	C9	33	NA
C8	34	Ground	C9	34	EXT +12 VDC
C8	35	NA	C9	35	EXT - 12 VDC
C8	36	NA	C9	36	Ground
C8	37	NA	C9	37	Ground

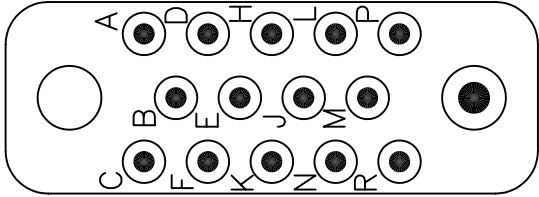
**DEFINITIONS:** Ground - DC Ground.

PxDMA Addr 1 - Pixel Driver Module Address Line 1.

PxDA Addr 1 - Pixel Driver Assembly Address Line 1.

**NOTE:** C8 keyed at pin 17, and C9 keyed at pin 12.

TITLE: CONTROLLER ISOLATION ASSEMBLY CONNECTOR PIN ASSIGNMENTS FOR C8 & C9 CONNECTORS	
NO SCALE	A7-28
CMS 2009	



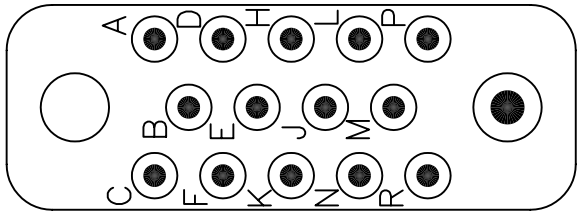
DB-9  
CONNECTOR

C2  
CONNECTOR

TITLE: DIRECT MODE DB9 COMMUNICATION CABLE (BETWEEN LAPTOP AND 170 CONTROLLER)	
NO SCALE	A7-29
CMS 2009	

(Rx)	2	K	(DATA OUT)
(Tx)	3	L	(DATA IN)
(DTR)	4	J	(RTS)
(DSR)	6	M	(CTS)
(GND)	5	N	(GND)
(RTS)	7	H	(CD)
(CTS)	8		

NOTE:  
Pins Not Shown Are Not Connected.



DB-9  
CONNECTOR

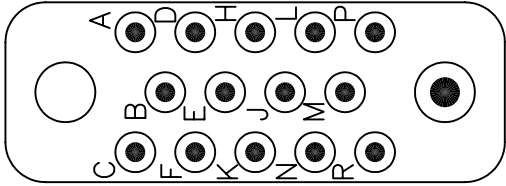
C2  
CONNECTOR

(Rx)	2	_____	K	(DATA OUT)
(Tx)	3	_____	L	(DATA IN)
(RTS)	7	_____	J	(RTS)
(CTS)	8	_____	M	(CTS)
(GND)	5	_____	N	(GND)
(CDC)	1	_____	H	(CD)

NOTE:  
Pins Not Shown Are Not Connected.

TITLE: MODEM DB9 COMMUNICATION CABLE (BETWEEN MODEM AND 170 CONTROLLER)	
NO SCALE	A7-30
CMS 2009	





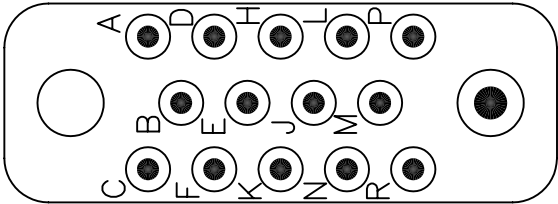
DB-25  
CONNECTOR

C2  
CONNECTOR

(Rx) 3	K (DATA OUT)
(Tx) 2	L (DATA IN)
(RTS) 4	J (RTS)
(CTS) 5	M (CTS)
(GND) 7	N (DC GND)
(DSR) 6	H (CD)
(DTR) 20	

NOTE:  
Pins Not Shown Are Not Connected.

TITLE: DIRECT MODE DB25 COMMUNICATION CABLE (BETWEEN PC AND 170 CONTROLLER)		
NO SCALE	A7-31	
CMS 2009		



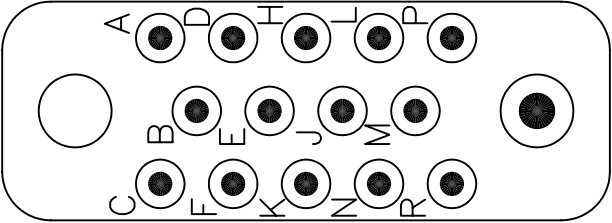
DB-25  
CONNECTOR

C2  
CONNECTOR

(Rx)	3	_____	K	(DATA OUT)
(Tx)	2	_____	L	(DATA IN)
(RTS)	4	_____	J	(RTS)
(CTS)	5	_____	M	(CTS)
(GND)	7	_____	N	(DC GND)
(CDC)	8	_____	H	(CD)

NOTE:  
Pins Not Shown Are Not Connected.

TITLE: MODEM DB25 COMMUNICATION CABLE (BETWEEN MODEM AND 170 CONTROLLER)	
NO SCALE	A7-32
CMS 2009	



DB-9  
CONNECTOR

C20 or C2  
CONNECTOR

(Rx)	2	—	L	(DATA OUT)
(Tx)	3	—	K	(DATA IN)
(CTS)	8	—	M	(CTS)
(GND)	5	—	N	(GND)
(CDC)	1	—	H	(CD)

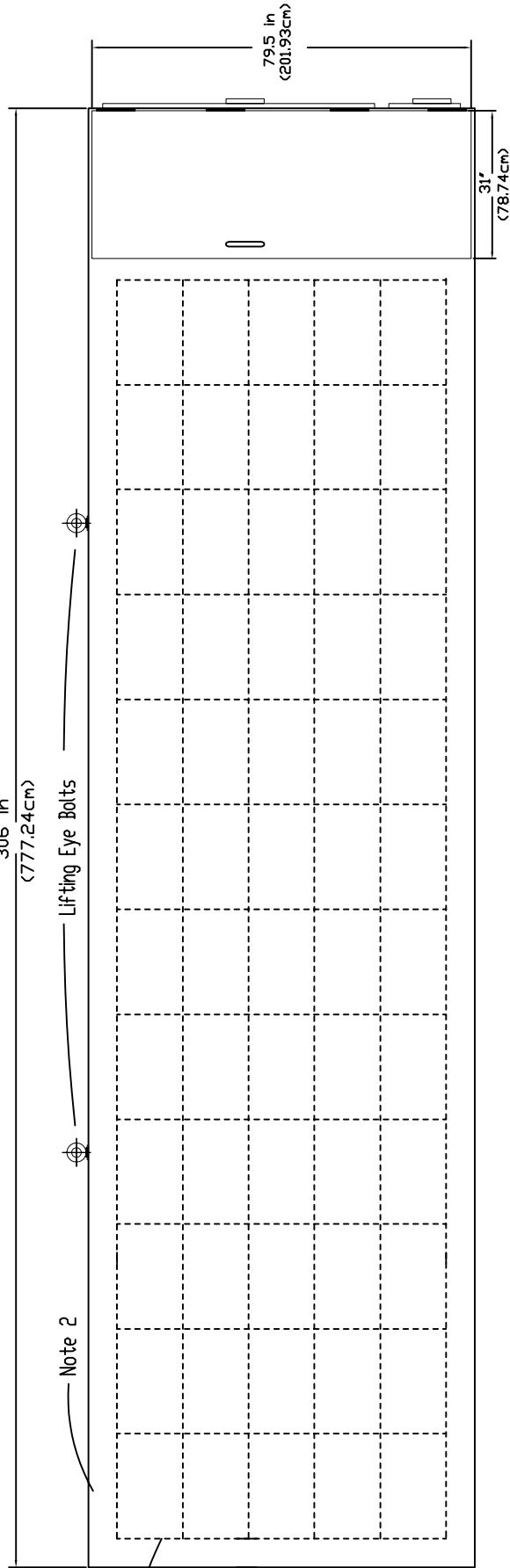
NOTE:  
Pins Not Shown Are Not Connected.

TITLE: GDI MODEM DB9 COMMUNICATION CABLE (BETWEEN GDI MODEM AND 170 CONTROLLER)	
NO SCALE	A7-33
CMS 2009	

## **APPENDIX A8**

### **MODEL 500 CMS DETAILS**

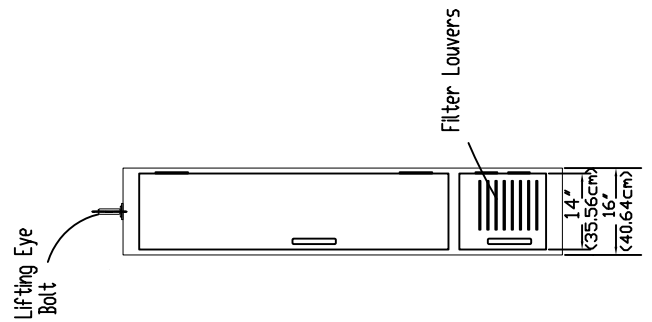
<b>Sign Housing Details, Elevation, Side Doors and End Cap</b>	<b>A8-1</b>
<b>Sign Housing Details, Elevation, Rear and Z-Bar</b>	<b>A8-2</b>
<b>Transformers to CIP Wiring Details</b>	<b>A8-3</b>
<b>CMS System, LED Wiring Diagram</b>	<b>A8-4</b>
<b>Pixel Matrix Module, Front View</b>	<b>A8-5</b>
<b>Pixel Matrix Module, Rear View</b>	<b>A8-6</b>
<b>Pixel Matrix Module, Type 1, End View</b>	<b>A8-7</b>
<b>Pixel Matrix Module, Type 2, End View</b>	<b>A8-8</b>
<b>CMS Control Compartment Mounting Details</b>	<b>A8-9</b>
<b>CMS Testing, Elevation View</b>	<b>A8-10</b>
<b>CMS Testing, Plan View</b>	<b>A8-11</b>
<b>CMS Lifting Bracket</b>	<b>A8-12</b>
<b>Shipping Pallet Dimensions</b>	<b>A8-13</b>
<b>Palletized CMS Shipping Method</b>	<b>A8-14</b>



ELEVATION VIEW

NOTES:

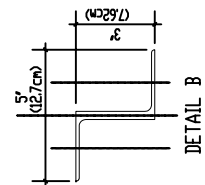
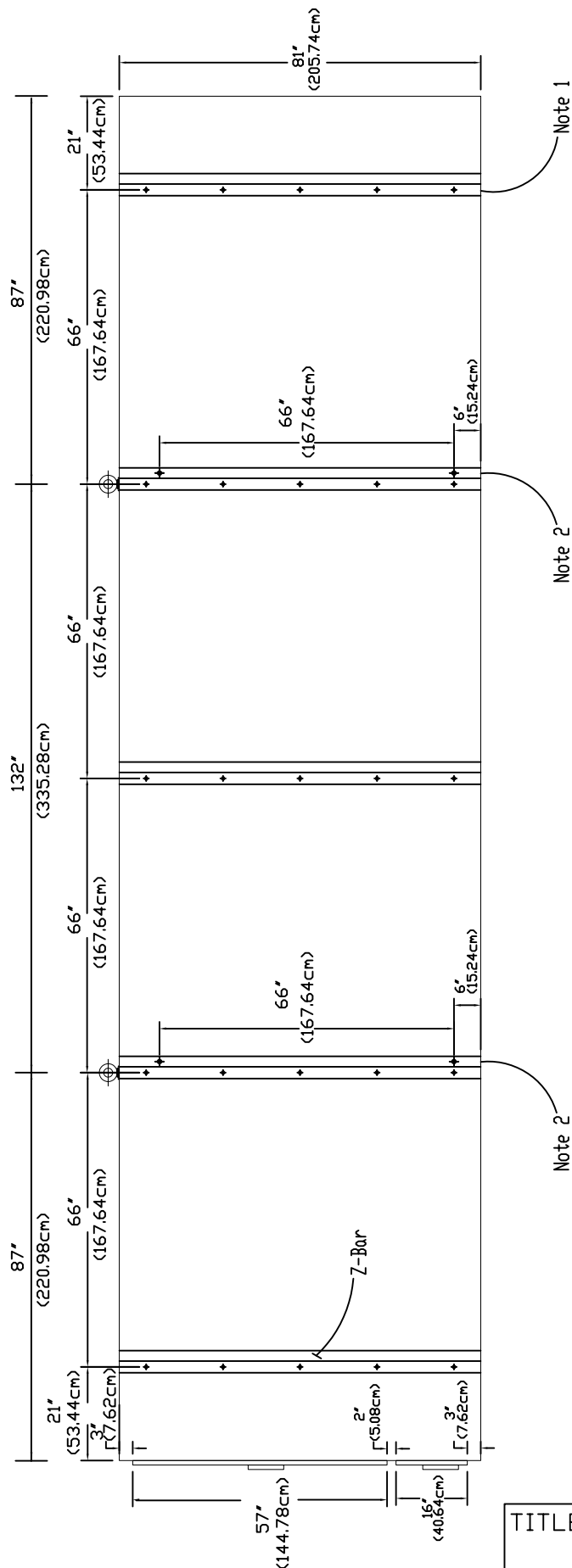
1. Dimension between display area and top and bottom edge is 6' (1524cm).



SIDE VIEW

Display Area  
(Note 1)

TITLE: MODEL 500 CMS SYSTEM SIGN HOUSING DETAIL ELEVATION, SIDE DOORS AND END CAP	
NO SCALE	A8-1
CMS 2009	



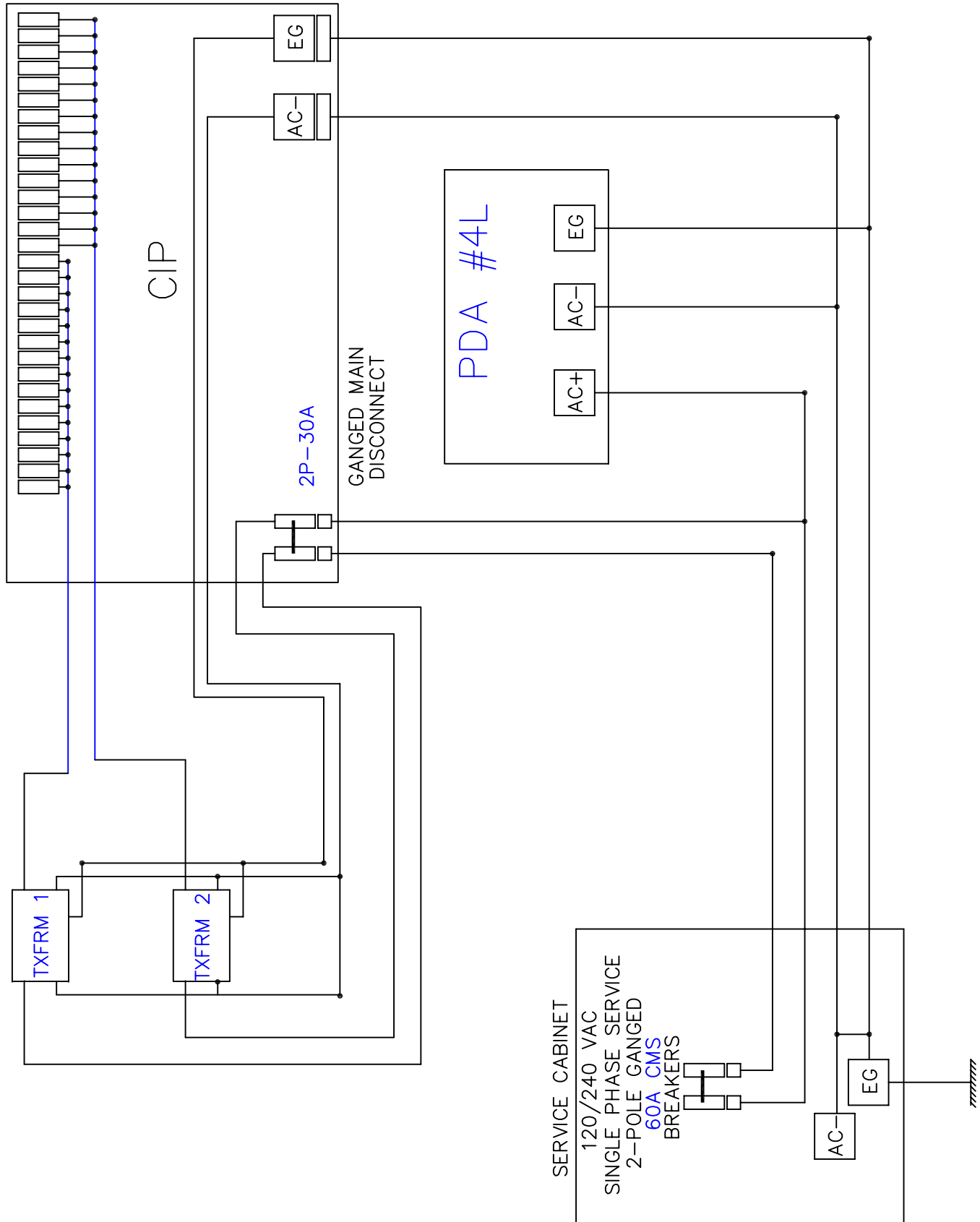
**NOTES/KEY:**

1. Bolt supports to CMS housing, minimum 5 bolts per Z-Bar.
2. 3/4" (1.905cm) DIA holes for Mounting Bolts to CMS Test Stand
3. Z-Bar shall be made of 0.25" (0.635cm) aluminum.

TITLE:	MODEL 500 CMS SYSTEM SIGN HOUSING DETAIL ELEVATION-REAR, PLAN AND Z-BAR
--------	---

NO SCALE
CMS 2009

A8-2



TITLE: MODELS 500/ 510 CMS SYSTEM  
TRANSFORMERS TO CIP  
WIRING DETAIL

NO SCALE

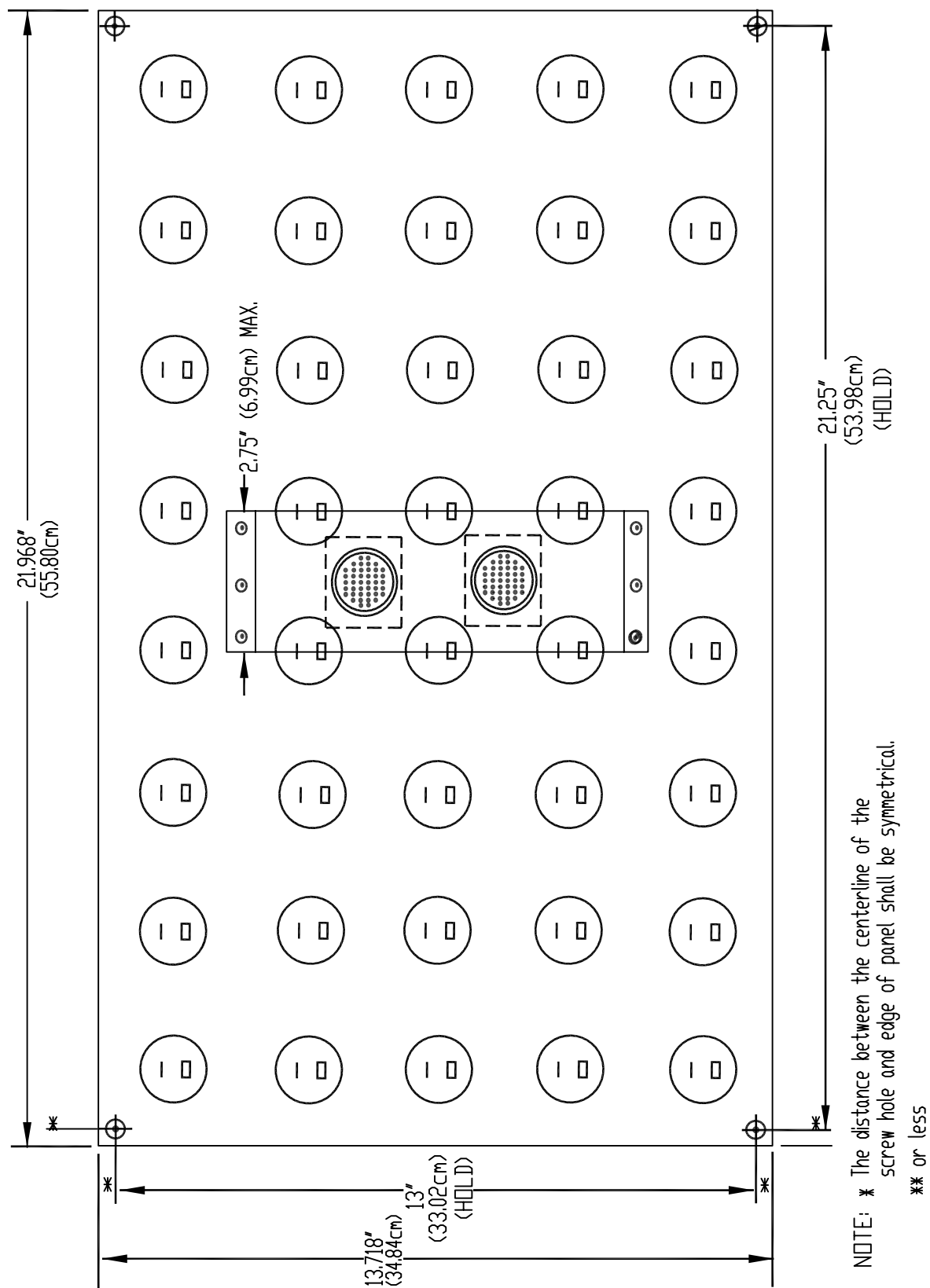
CMS 2009

A8-3





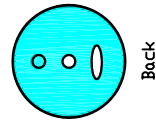
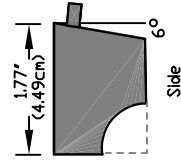
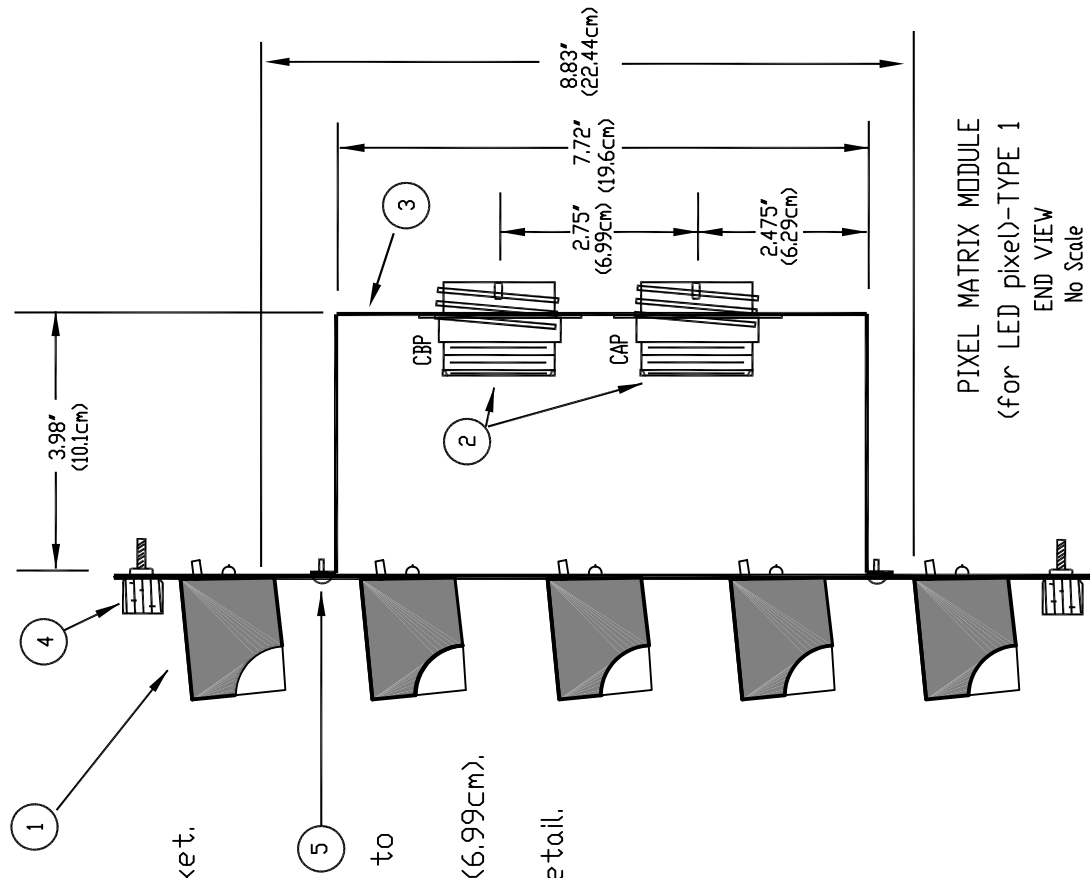




TITLE: MODEL 500 CMS SYSTEM PIXEL MATRIX MODULE REAR VIEW	
NO SCALE	A8-6
CMS 2009	

NOTES:

1. LED "Pixel" Assembly.
  2. Plastic connector plug.
  3. 0.0625-inch (0.159 cm) min. aluminum U-shaped bracket.
  4. Thumb screw device (TSD No. 2)-typical.  
(Southco No. 47-62-301-60 or equal).
  5. Universal head aluminum drive rivet-typical.  
(Southco No. 38-104-04-13 or equal).
  6. Each Pixel shall have two 30.5 cm (12.02 in) leads to connect to the CAP or CBP as per section 8-8.
- Nominal center to center spacing of pixel: 2.75" (6.99cm).  
See CMS Model 500 Specifications, Section 8,  
Figures 8-8-5 & 8-8-6 for addition dimensional Detail.



Front

Back

LED pixel (example)

TITLE:

PIXEL MATRIX MODULE  
TYPE 1  
END VIEW

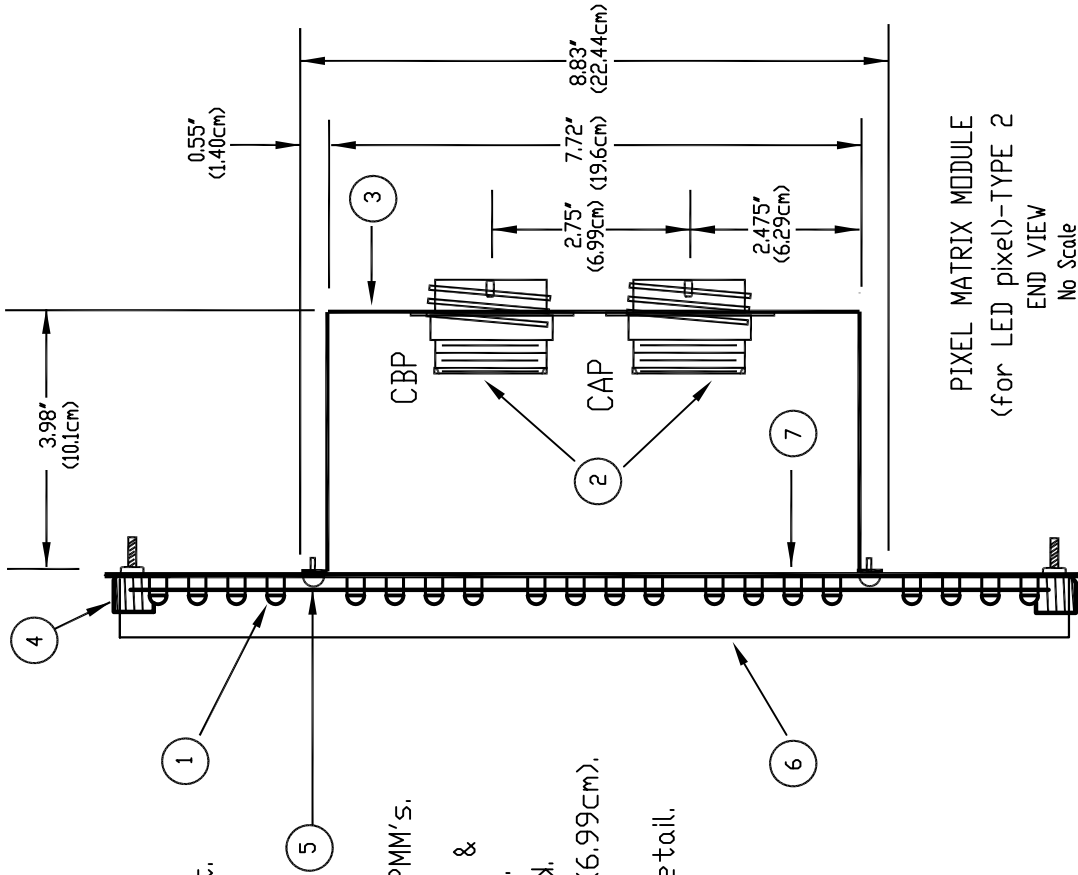
NO SCALE

CMS 2009

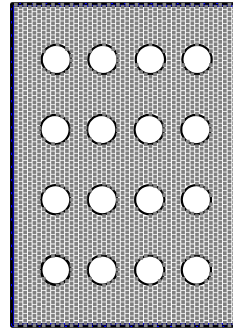
A8-7

# NOTES:

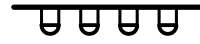
1. LED "Pixel" Assembly.
  2. Plastic connector plug.
  3. 0.0625-inch (0.16cm) min. aluminum U-shaped bracket.
  4. Thumb screw device (TSD No. 2)-typical. (Southco No. 47-62-301-60 or equal).
  5. Universal head aluminum drive rivet-typical. (Southco No. 38-104-04-13 or equal).
  6. Formed plastic cover similar to cover on Xenon PMM's. See Section 8-8-8 for more details. The cover shall be coated or treated for glare & shall not diminish light output by more than 15%.
  7. All pixels shall be mounted to the same PC board.
- \* Nominal center to center spacing of pixel: 2.75" (6.99cm).
- \* See CMS Model 500 Specifications, Section 8, Figures 8-8-5 & 8-8-6 for addition dimensional Detail.



PIXEL MATRIX MODULE  
(for LED pixel)-TYPE 2  
END VIEW  
No Scale



Front



Side

LED Pixel Dimensions and Shape (example)

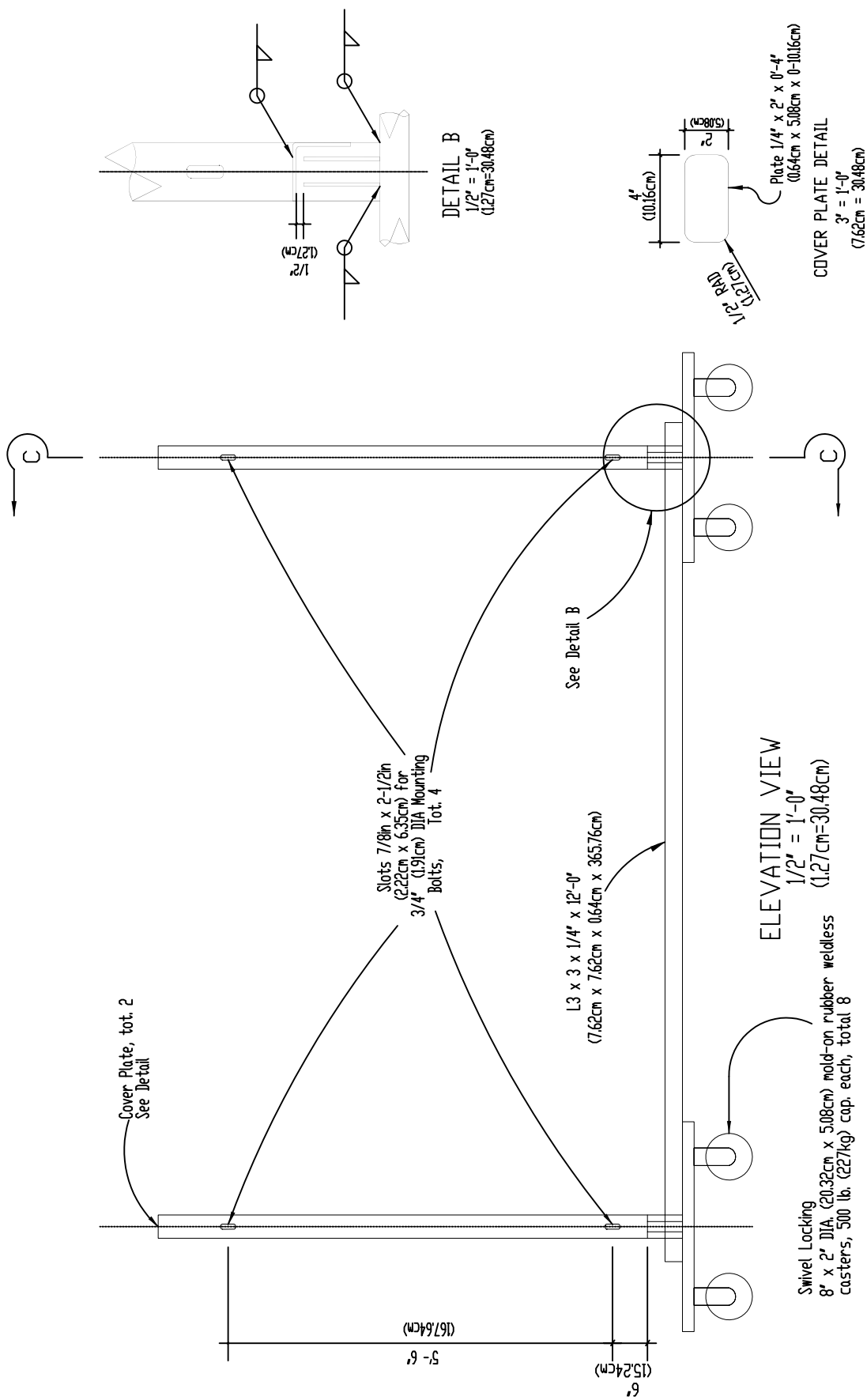
TITLE: PIXEL MATRIX MODULE  
TYPE 2  
END VIEW

NO SCALE

CMS 2009

A8-8

TITLE: MODEL 500 CMS SYSTEM CMS CONTROL COMPARTMENT MOUNTING DETAIL	
NO SCALE	A8-9
CMS 2009	



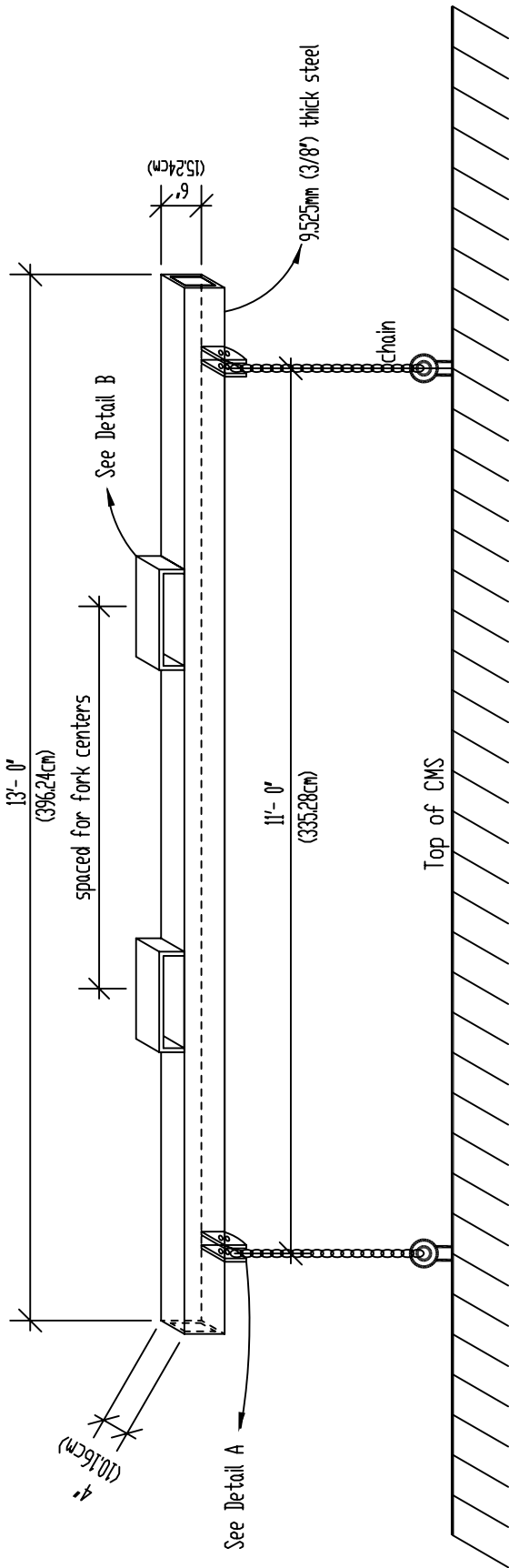
**NOTES:**

1. Drill L3's x 3" x 1/4" (7.62cm x 7.62cm x 0.64cm) & vertical posts as necessary to accommodate different sized signs.
2. All steel is A36.
3. All steel to be galvanized after fabrication.

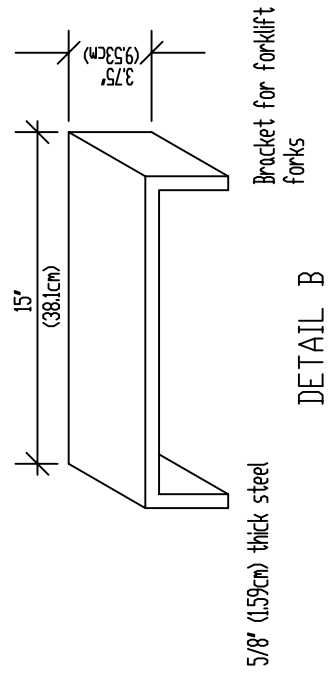
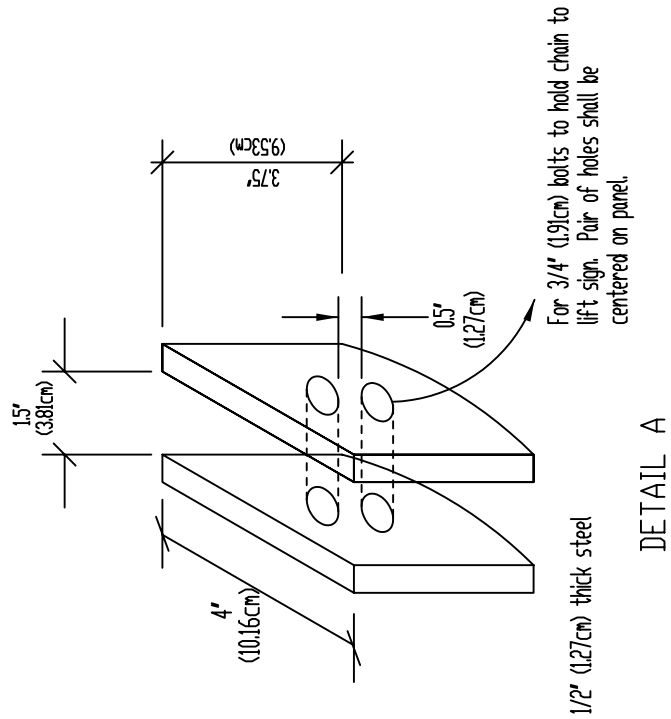
TITLE: MODEL 500 CMS SYSTEM TEST STAND ELEVATION VIEW	
NO SCALE	A8-10
CMS 2009	







THIS BRACKET IS USED BY THE CALTRANS WAREHOUSE FOR LOADING AND UNLOADING OF MODEL 500 CMS USING A FORKLIFT. VARIATIONS MAY BE USED DEPENDING ON REQUIREMENTS OR CONSTRAINTS.

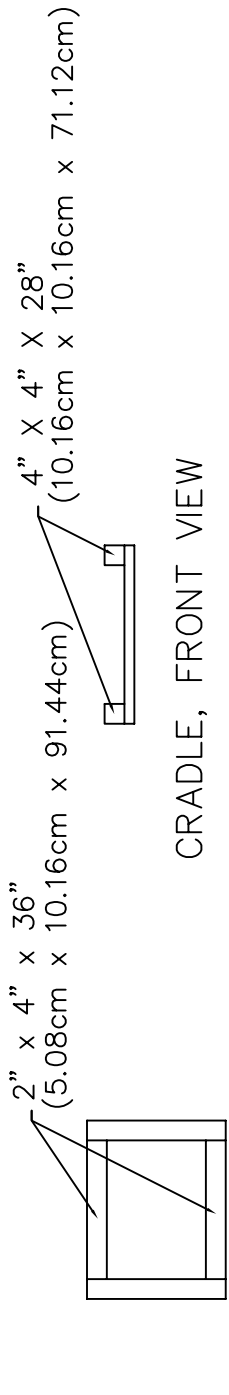


TITLE: MODEL 500 CMS SYSTEM  
CMS LIFTING BRACKET

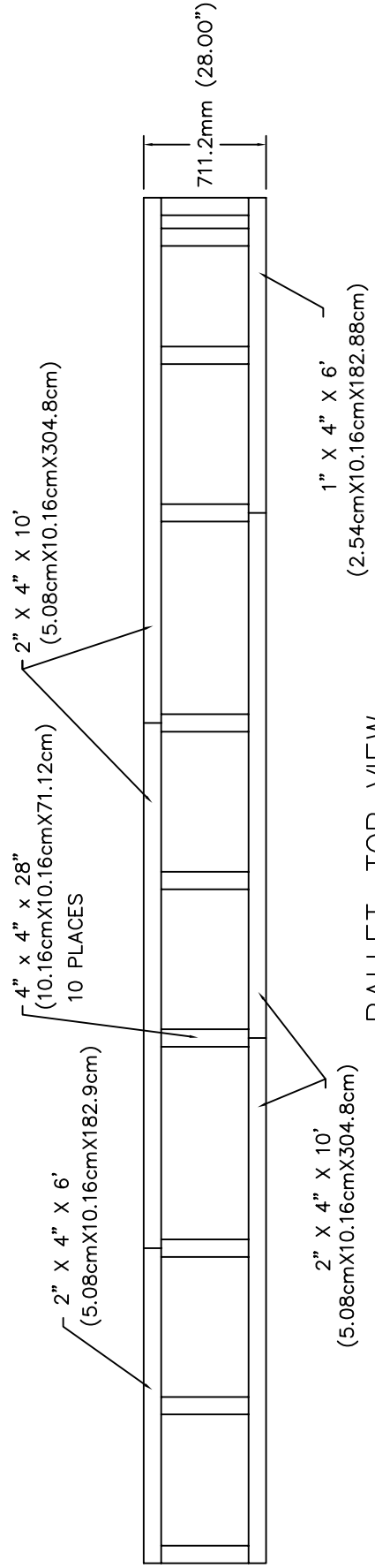
NO SCALE

CMS 2009

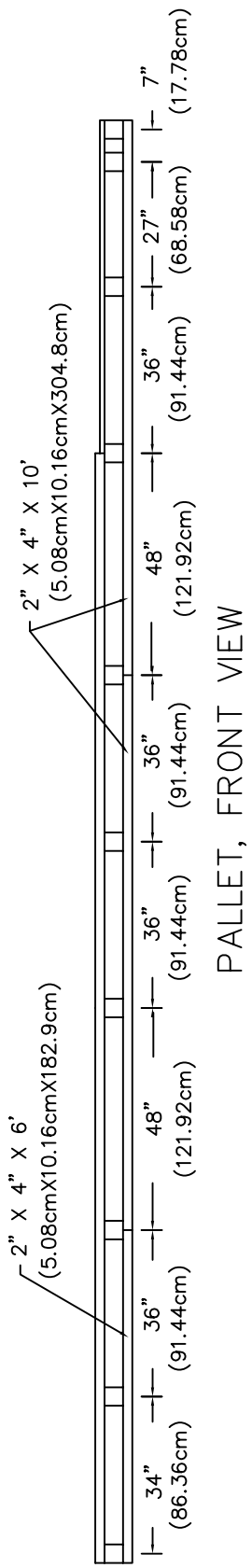
A8-12



CRADLE, FRONT VIEW



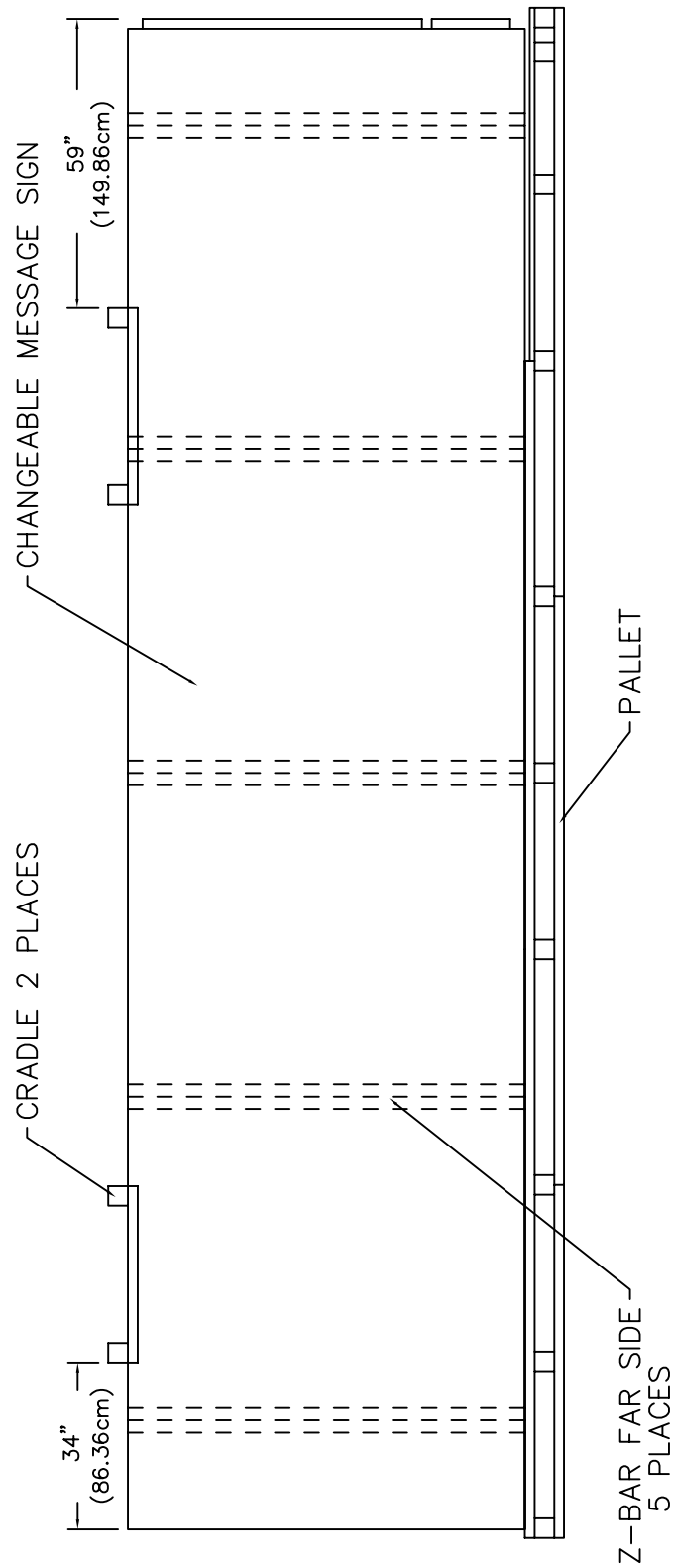
PALLETT, TOP VIEW



PALLETT, FRONT VIEW

**NOTES:**  
 APPLY 1/2" (12.7mm) THICK RUBBER GASKET TO ALL SURFACES WHICH CONTACT THE SIGN.

TITLE: MODEL 500 CMS SYSTEM SHIPPING PALLET DIMENSIONS		A8-13
NO SCALE	CMS 2009	



# PALLETIZED CMS FRONT VIEW

TITLE: MODEL 500 CMS SYSTEM  
PALLETIZED CMS  
SHIPPING METHOD

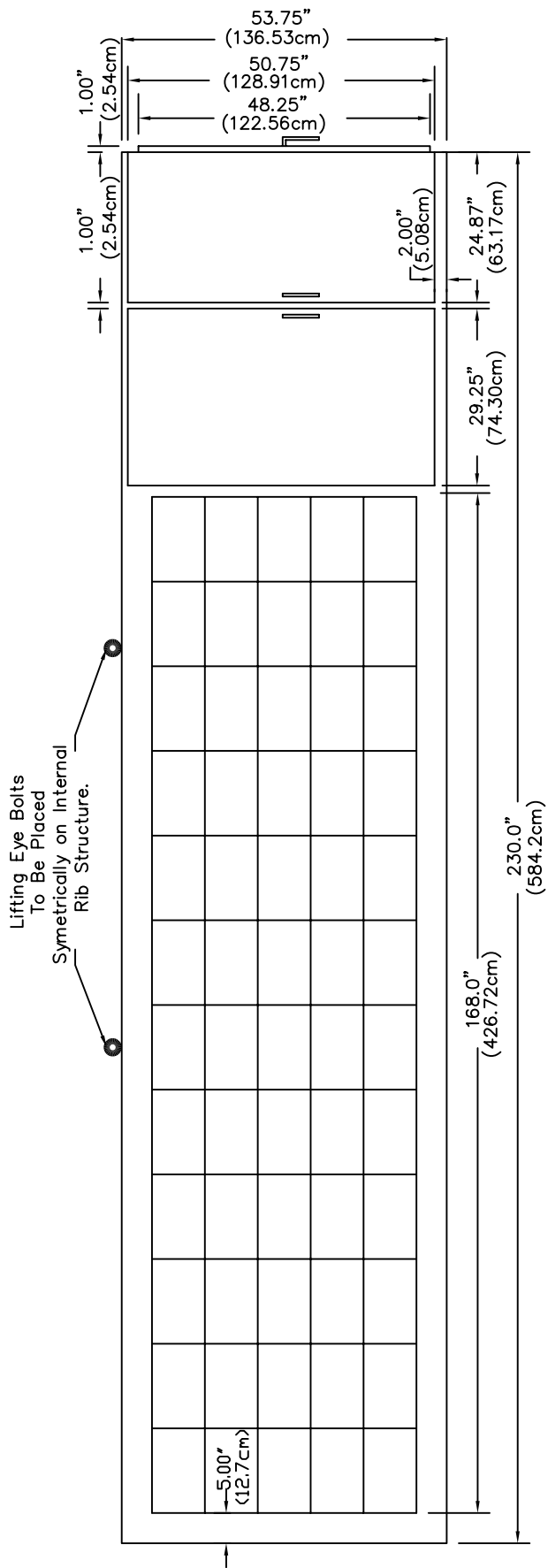
NO SCALE

CMS 2009

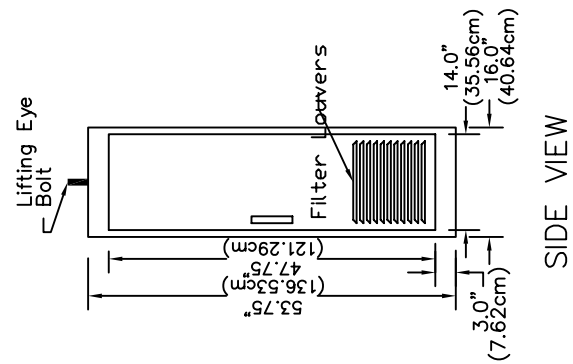
A8-14

**APPENDIX A9**  
**MODEL 510 CMS DETAILS**

<b>Sign Housing Details, Outside Dimensions</b>	<b>A9-1</b>
<b>Sign Housing Details, Elevations, Side Door, End Cap and Screens</b>	<b>A9-2</b>
<b>Pixel Matrix Module, LED and Thumbscrew Spacing</b>	<b>A9-3</b>
<b>CMS Control Compartment Mounting Details</b>	<b>A9-4</b>
<b>CMS Lifting Bracket</b>	<b>A9-5</b>
<b>Shipping Pallet Dimensions</b>	<b>A9-6</b>



ELEVATION VIEW



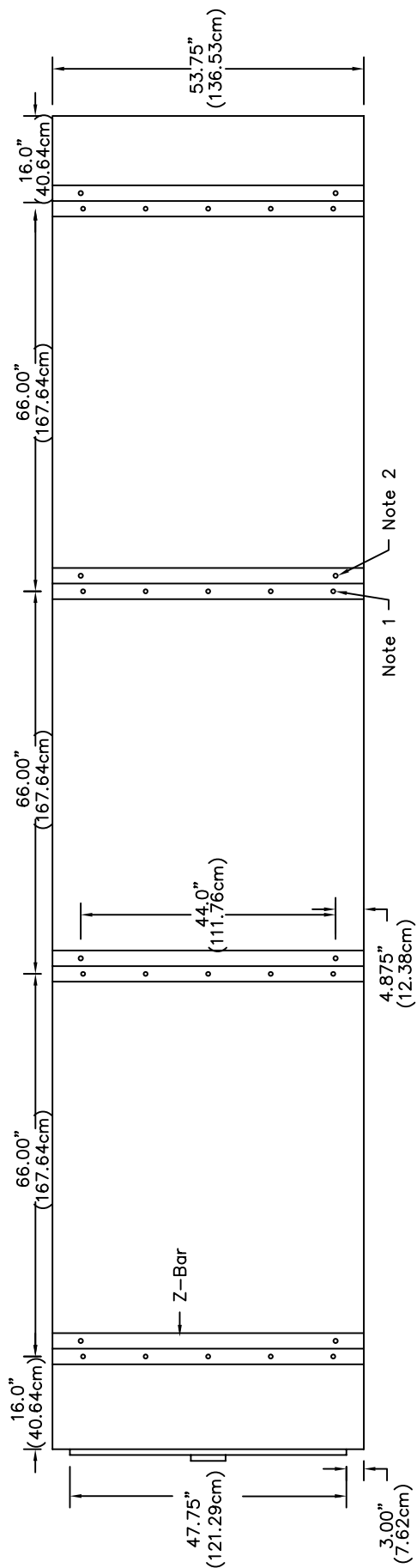
SIDE VIEW

TITLE: MODEL 510 CMS SYSTEM  
SIGN HOUSING DETAIL  
OUTSIDE DIMENSION

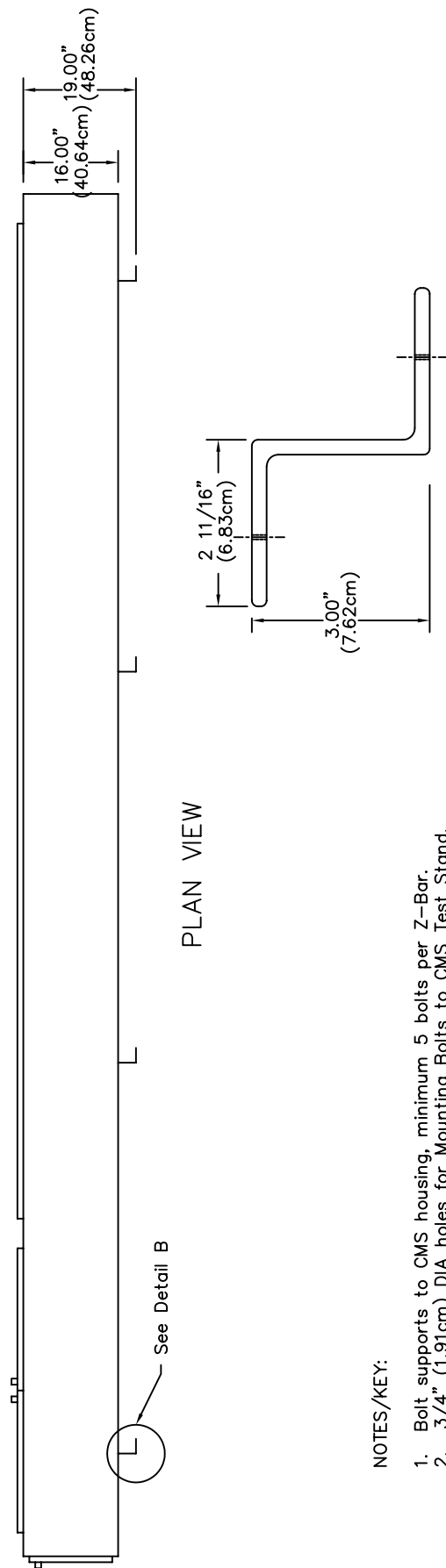
NO SCALE

CMS 2009

A9-1



ELEVATION VIEW-REAR



PLAN VIEW

DETAIL B

NOTES/KEY:

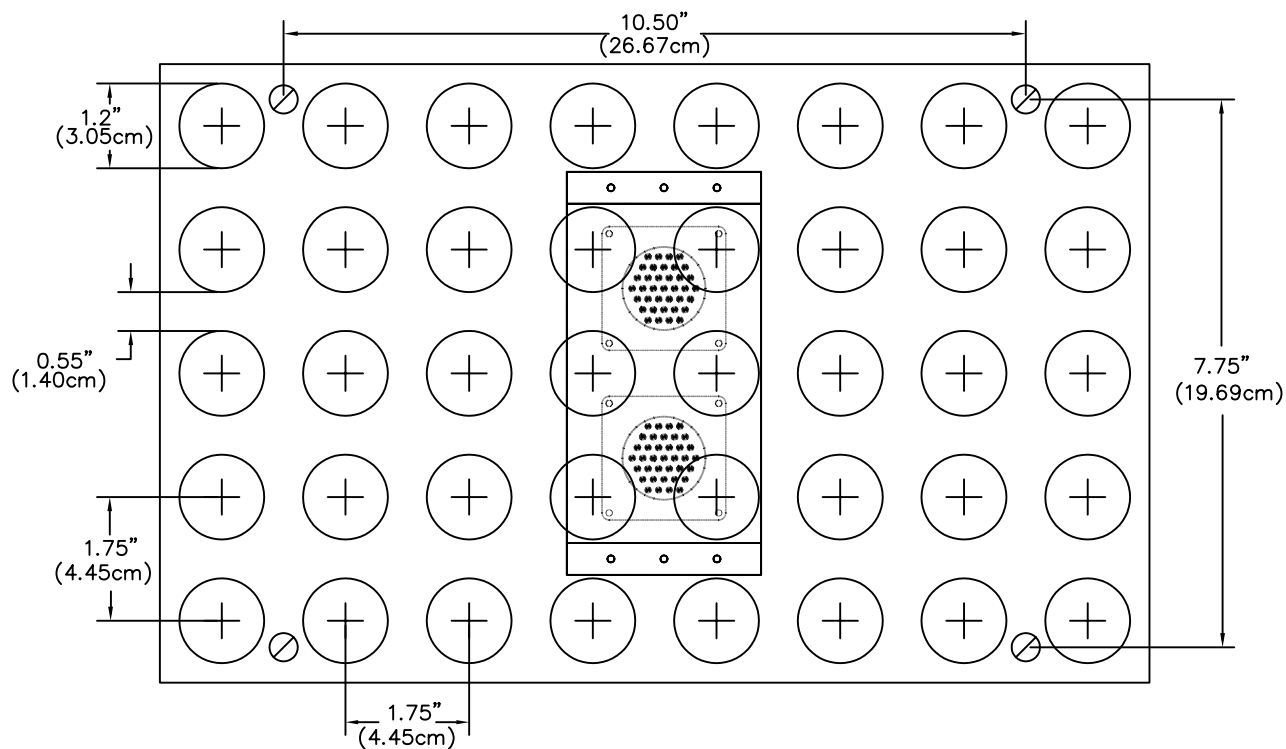
1. Bolt supports to CMS housing, minimum 5 bolts per Z-Bar.
2. 3/4" (1.91cm) DIA holes for Mounting Bolts to CMS Test Stand.
3. Z-Bar shall be made of 0.25" (0.64cm) aluminum.

TITLE: MODEL 510 CMS SYSTEM  
SIGN HOUSING DETAIL  
ELEVATION, SIDE DOOR, END CAP, SCREEN

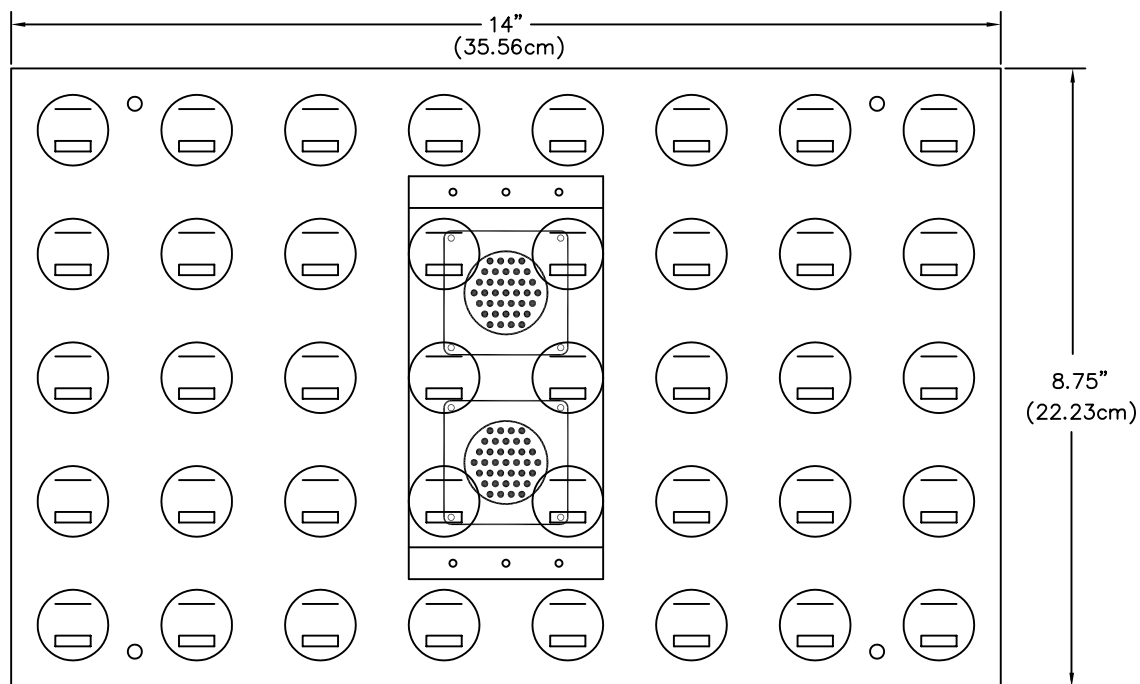
NO SCALE

CMS 2009

A9-2



FRONT VIEW



REAR VIEW

NOTES/KEY:

1. Outer dimensions include tolerance.
2. Center of pixel sockets – 40 total.
3. Captive thumbscrew device.
4. Spacing of thumbscrews within panel shall be symmetrical.
5. Connector support shall be symmetrical within the panel.
6. Pixel array shall be symmetrical within the panel.

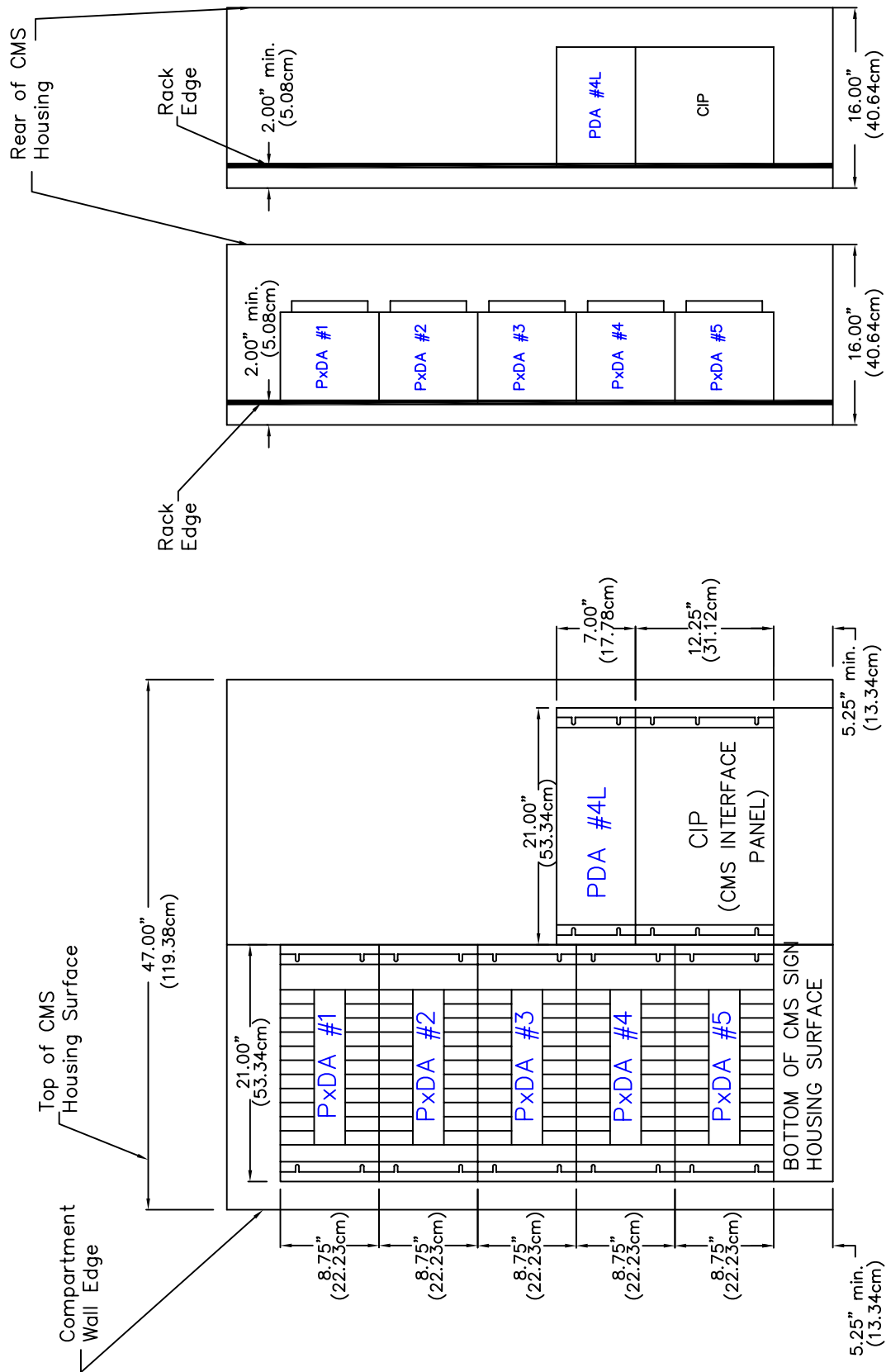
TITLE: MODEL 510 CMS SYSTEM  
PIXEL MATRIX MODULE  
LED AND THUMBSCREW SPACING

NO SCALE

CMS 2009

A9-3





SIDE VIEW  
(BOTH RACKS)

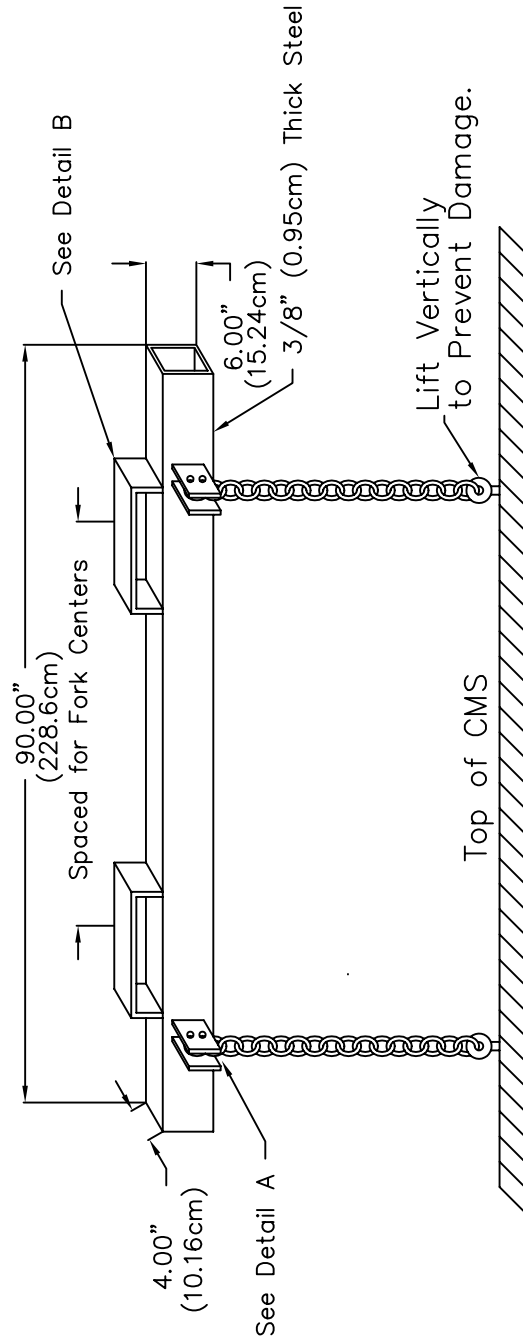
FRONT VIEW

TITLE: MODEL 510 CMS SYSTEM  
CMS CONTROL COMPARTMENT  
MOUNTING DETAIL

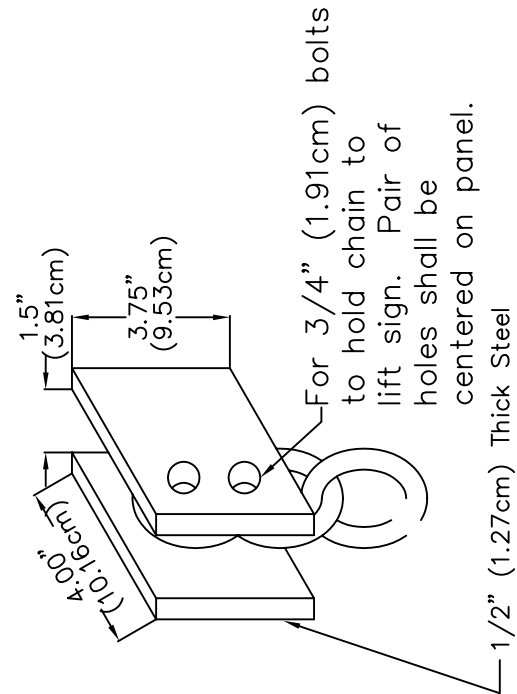
NO SCALE

CMS 2009

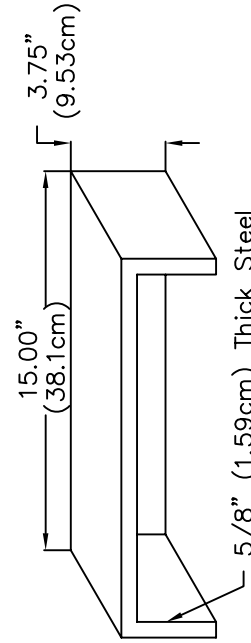
A9-4



THIS BRACKET IS USED BY  
FOR LOADING AND UNLOADING  
OF MODEL 510 CMS USING A  
FORKLIFT. VARIATIONS MAY  
BE USED DEPENDING ON  
REQUIREMENTS OR CONSTRAINTS.



DETAIL A



Bracket for Forklift Forks

DETAIL B

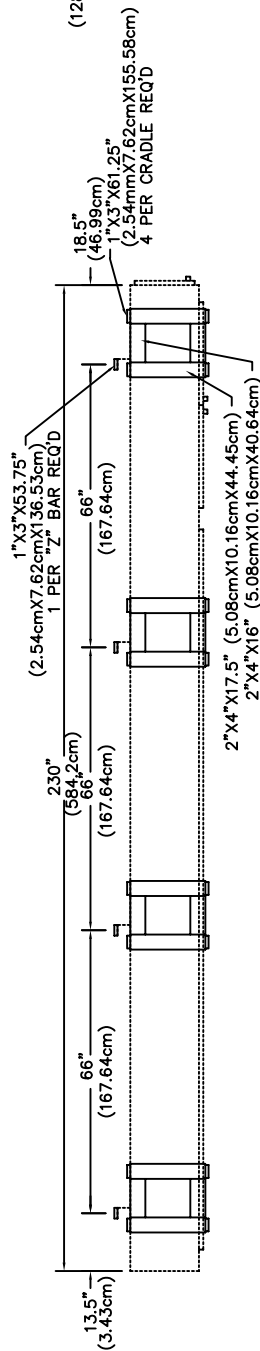
TITLE:

MODEL 510 CMS SYSTEM  
CMS LIFTING BRACKET

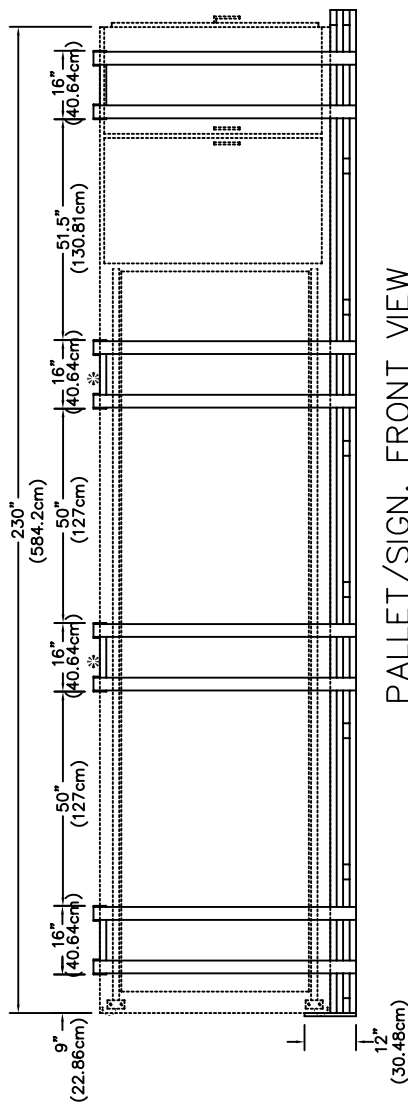
NO SCALE

CMS 2009

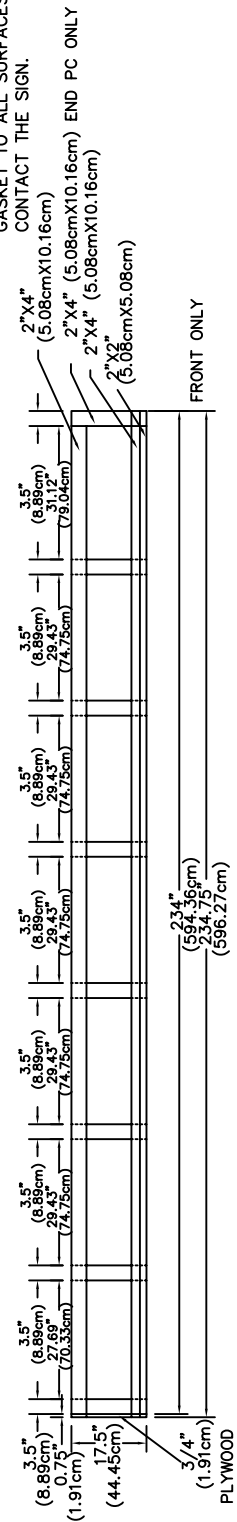
A9-5



CRADLE/SIGN, TOP VIEW



PALLET/SIGN, FRONT VIEW



PALLET, TOP VIEW



PALLET/SIGN, SIDE VIEW

## NOTES:

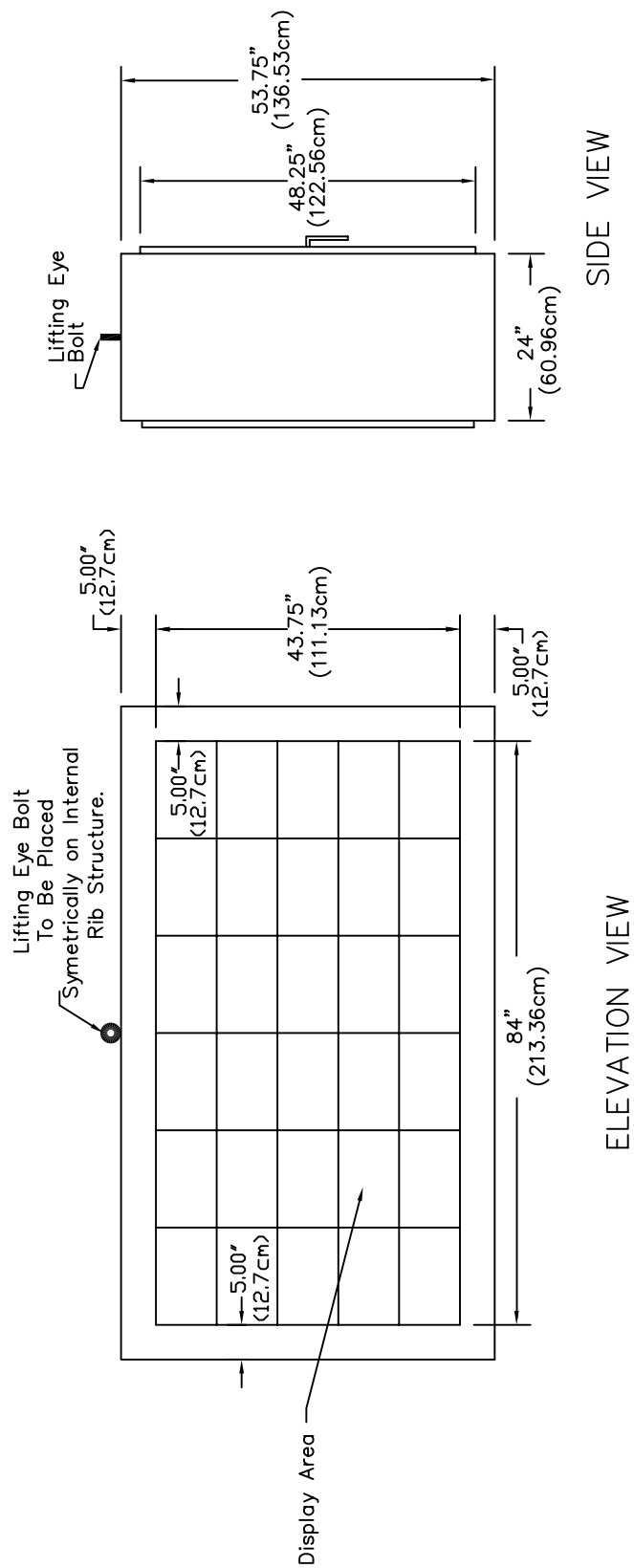
APPLY 0.125" (0.32cm) THICK WHITE MICRO FOAM GASKET TO ALL SURFACES WHICH CONTACT THE SIGN.

6cm)  
cmX10.16cm) END PC ONLY  
X10.16cm)

TITLE: MODEL 510 CMS SYSTEM SHIPPING PALLET DIMENSIONS	
NO SCALE	A9-6
CMS 2009	

**APPENDIX A10**  
**MODEL 520 CMS DETAILS**

<b>Sign Housing Details, Front and Side Views</b>	<b>A10-1</b>
<b>Sign Housing Details, Rear and Top Views</b>	<b>A10-2</b>
<b>Transformers To CIP Wiring Details</b>	<b>A10-3</b>
<b>Pixel Matrix Module, Front View</b>	<b>A10-4</b>
<b>CMS Control Compartment Mounting Details</b>	<b>A10-5</b>
<b>Pixel Matrix Module, Rear View</b>	<b>A10-6</b>
<b>CMS Shipping Pallet</b>	<b>A10-7</b>

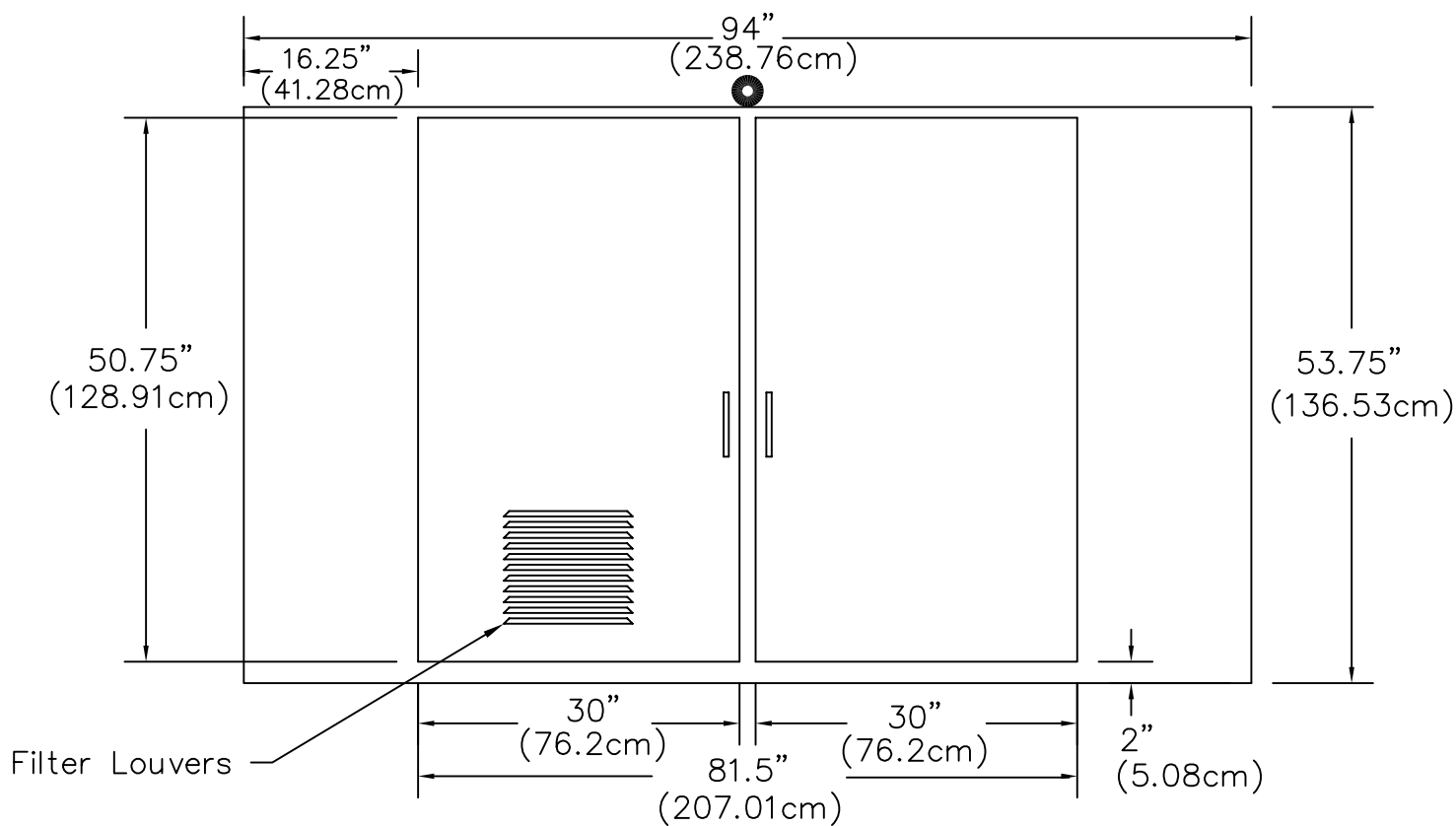


TITLE: MODEL 520 CMS SYSTEM  
SYSTEM HOUSING DETAIL  
FRONT AND SIDE VIEWS

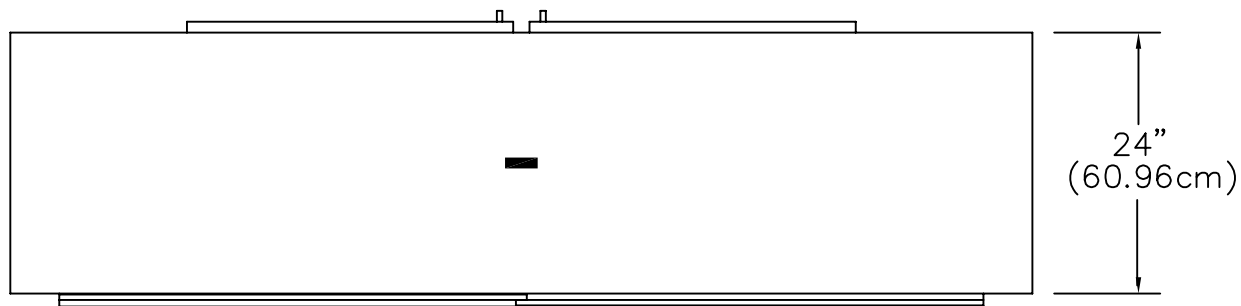
NO SCALE

CMS 2009

A10-1

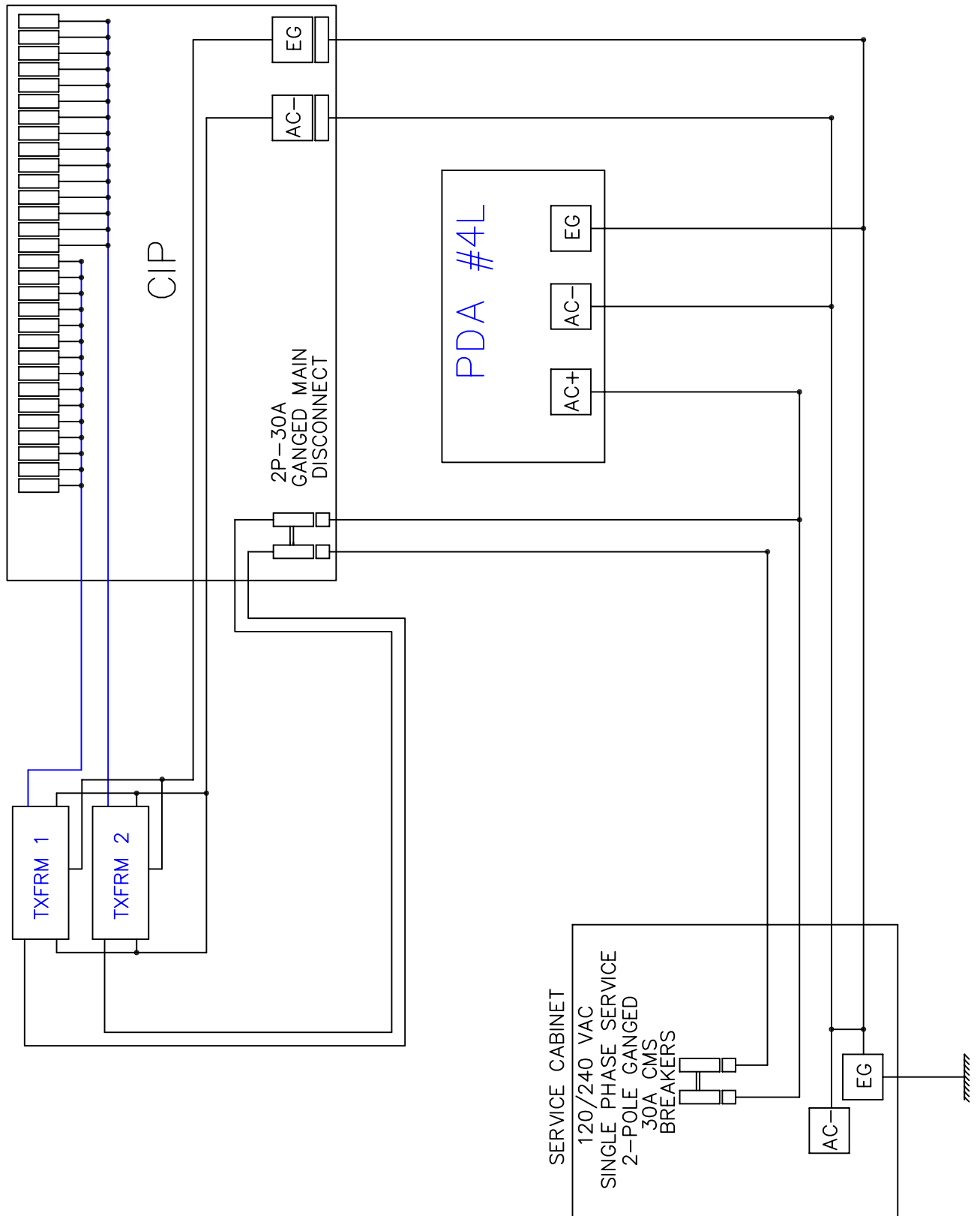


REAR VIEW



TOP VIEW

TITLE: MODEL 520 CMS SYSTEM SIGN HOUSING DETAIL REAR AND TOP VIEWS	
NO SCALE	A10-2
CMS 2009	



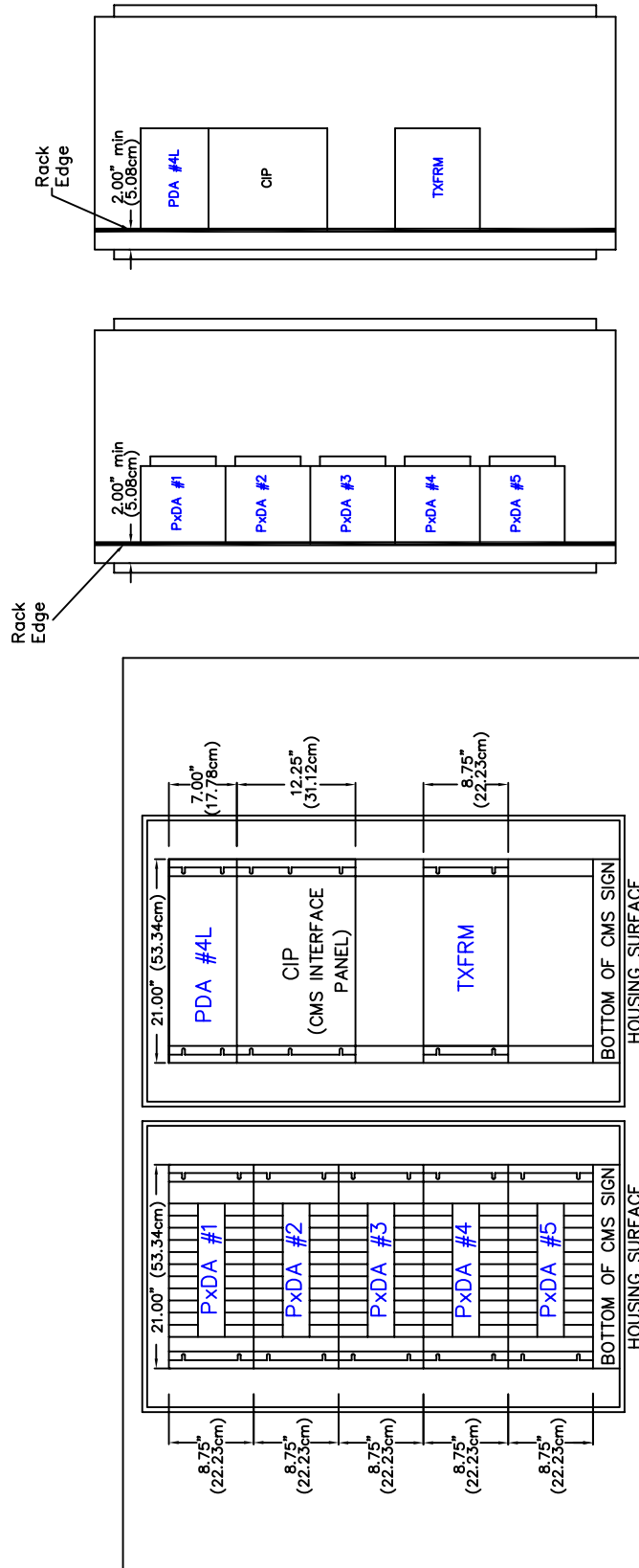
TITLE: MODEL 520 CMS SYSTEM  
TRANSFORMERS TO CIP  
WIRING DETAIL

NO SCALE

CMS 2009

A10-3

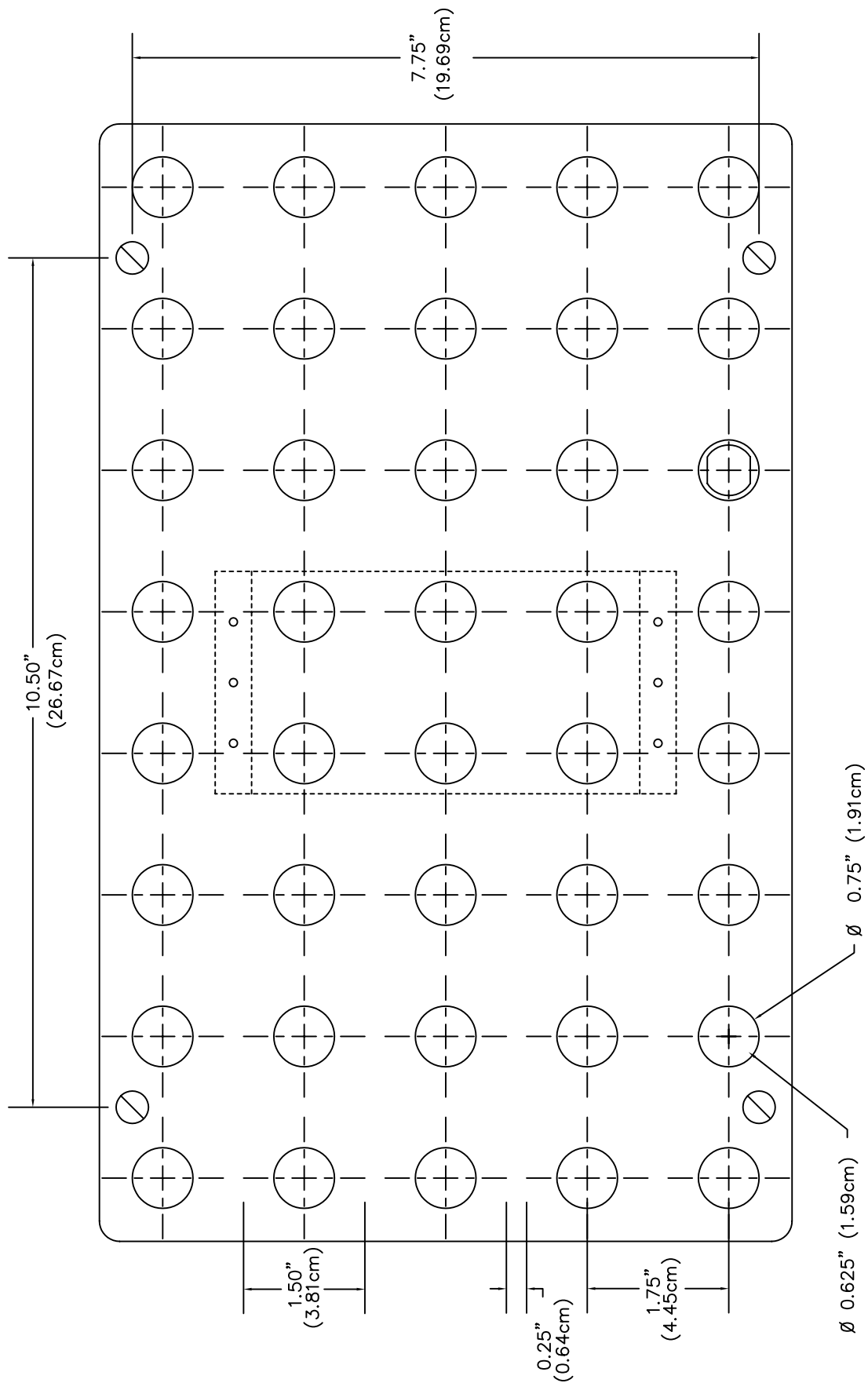




SIDE VIEW  
(BOTH RACKS)

FRONT VIEW

TITLE: MODEL 520 CMS SYSTEM CMS CONTROL COMPARTMENT MOUNTING DETAIL	
NO SCALE	A10-4
CMS 2009	

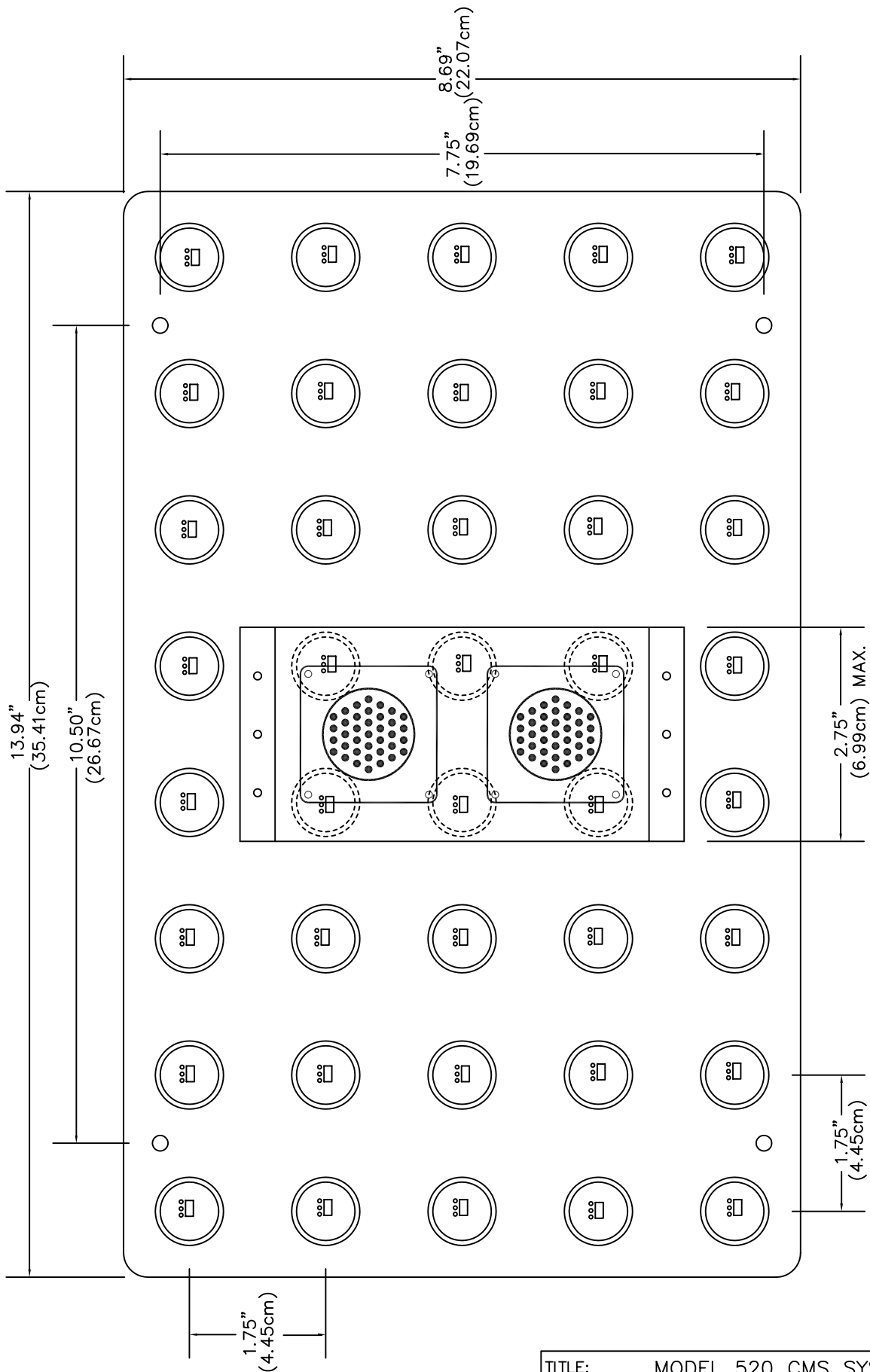


TITLE: MODEL 520 CMS SYSTEM  
PIXEL MATRIX MODULE  
FRONT VIEW

NO SCALE

CMS 2009

A10-5

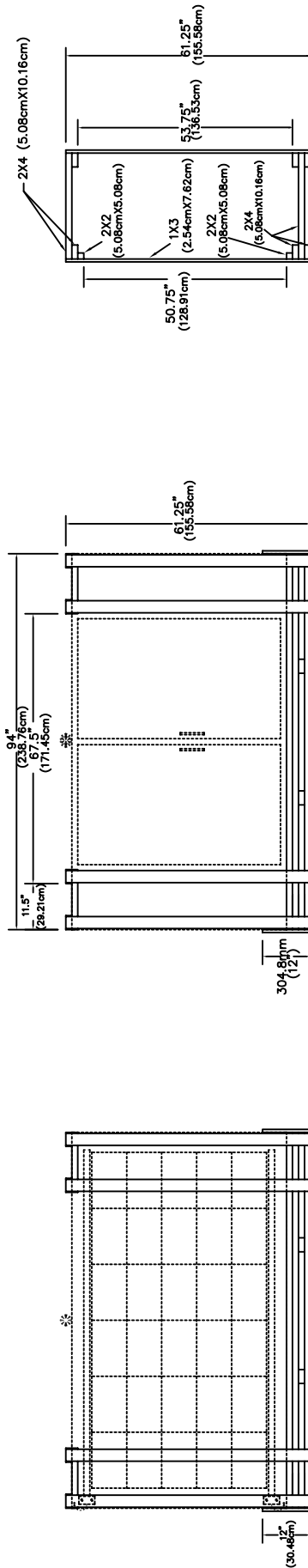


TITLE: MODEL 520 CMS SYSTEM  
PIXEL MATRIX MODULE  
REAR VIEW

NO SCALE

CMS 2009

A10-6

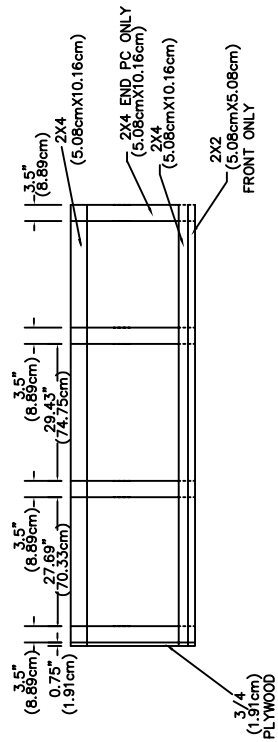


PALLET/SIGN, FRONT & REAR VIEW

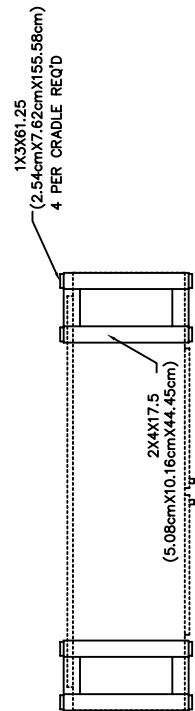
PALLET, SIDE VIEW



PALLET/SIGN, SIDE VIEW



PALLET, TOP VIEW



CRADLE/SIGN, TOP VIEW

NOTES:  
APPLY 0.125" (0.32cm) THICK WHITE MICRO FOAM GASKET TO ALL SURFACES WHICH CONTACT THE SIGN.

TITLE: MODEL 520 CMS SYSTEM  
SHIPPING PALLET DIMENSIONS

NO SCALE  
CMS 2009

A10-7