RCP-MLTP Control Panels

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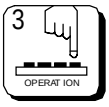
1.1 Manual Overview

This manual provides detailed instructions for installing and operating the PESA RCP-MLTP Control Panels. This manual is divided into seven sections as shown. Sections 3 and 4 contain operational and functional descriptions of the RCP-MLTP Control Panels and their associated circuit cards.

Section 1, **INTRODUCTION**, summarizes the manual, describes the product, presents a list of terms, and provides the panel specifications.

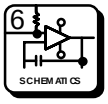
Section 2, **INSTALLATION**, provides installation and setup instructions.



Section 3, **OPERATION**, describes system operation procedures.

Section 4, **FUNCTIONAL DESCRIPTIONS**, presents an in-depth description of each component.

Section 5, **MAINTENANCE**, explains procedures for maintenance.



Section 6, **SCHEMATICS**, gives a complete package of technical documents such as schematics, and assembly drawings.

Section 7, **PARTS LIST**, provides a detailed list of system parts and components.

1.2 General Description

The RCP-MLTP Control Panels are multilevel direct take XY control panels with a full complement of features which allow access to all outputs for full matrix control or to a selected subset for limited control. All models of the RCP-MLTP Control Panel can be access limited to a single output if desired. The RCP-MLTP Control Panels can be configured to operate in a variety of selection modes including, but not limited to: category/index, direct access button-per-source, and button-per-destination. The RCP-MLTP Control Panel offers 24 user definable push-buttons and the RCP-MLTP2 Control Panel offers 26 user definable push-buttons for maximum versatility. All models of the MLTP have direct control of up to 8 independent levels.

The RCP-MLTP2 Control Panel can be purchased in five different 2RU configurations dependent upon customer needs. These configurations are: (1) Half-Rack, (2) Right-Hand, (3) Left-Hand, (4) Dual, and (5) Desk Mount. Each configuration of the RCP-MLTP2 Control Panel requires 3" of depth. The RCP-MLTP Control Panels comes packaged in a standard 19" 1RU chassis requiring 3" of depth.

The RCP-MLTP Control Panels feature a large display area for the immediate viewing of panel Destination, Status, Level, and Preset. Full function operational modes include Preset Select, Destination Select, Salvo Select, Display Preset, Store, Take, and Chop. The RCP-MLTP Control Panels also provide the ability to Protect or Lock selected outputs and to limit access to selected sources.

The RCP-MLTP2 Control Panels come packaged per customer requirements and require 3" of depth. Power is supplied to the control panels through plug-in-the-wall type power packs.

1.3 Specifications

GENERAL	
Mounting	Per Customer Requirements
Push-buttons	Illuminated and Legend-able
INPUT	
Communications Port	RS485
POWER	
Voltage Requirements	+7.5VDC @ 800mA
MECHANICAL	
Physical Dimensions	Per Customer Requirements As Follows
RCP-MLTP	19"W X 3"D X 1.75"H 482.6mm X 76.2mm X 24.45mm
RCP-MLTP2 Half Rack	9.5"W X 3"D X 3.5"H 241.3mm X 76.2mm X 48.9mm
RCP-MLTP2 Right Hand	19"W X 3"D X 3.5"H 482.6mm X 76.2mm X 48.9mm
RCP-MLTP2 Left Hand	19"W X 3"D X 3.5"H 482.6mm X 76.2mm X 48.9mm
RCP-MLTP2 Dual	19"W X 3"D X 3.5"H 482.6mm X 76.2mm X 48.9mm
RCP-MLTP2 Desk Mount	9.5"W X 3"D X 3.5"H 241.3mm X 76.2mm X 48.9mm
ENVIRONMENTAL	
Temperature	0°C to 40°C
Humidity	20% to 90% (Non-Condensing)

2.1 Introduction

This section details the RCP-MLTP Control Panels installation procedures. The following topics are discussed:

- Receipt Inspection
- Location and Mounting
- Polling Address
- Control Panel and Controller Interconnection
- Wiring the Control Panel Connector
- Terminating Cable Runs
- Power Connections

2.2 Receipt Inspection

The RCP-MLTP Control Panels are inspected and tested prior to shipment from the PESA factory. Upon receipt, please inspect the unit for shipping damage. If damage is detected, notify the carrier immediately and hold all packing material for inspection. If assistance is required, please contact PESA Customer Service at the telephone number listed in the front of this manual.

After unpacking, compare all parts received against the packing list. If the unit is undamaged and all components have been received, proceed with installation.

2.3 Location and Mounting

The right-hand, left-hand, and dual models of the RCP-MLTP2 Control Panel have been designed to fit in a standard E.I.A. 19" equipment rack and use two rack units of space (3.5"). The half-rack model of the RCP-MLTP2 Control Panel is designed to fit in a non-standard 9.5" equipment rack and use two rack of space (3.5"). The desk mount model of the RCP-MLTP2 Control Panel can be located on any convenient desk or work surface. The RCP-MLTP Control Panel has been designed to fit in a standard E.I.A. equipment rack and use one rack unit of space (1.75"). An area should be selected where the ambient temperature will not exceed 40°C, and where air can circulate freely. The control panels should be mounted in an area convenient to control and power connections. Sufficient space must be provided behind the equipment rack to allow for the control and power cables.

2.3 Location and Mounting Continued:

When the RCP-MLTP Control Panels are supplied as part of a system including interconnecting cables, rack layout drawings are usually provided. While adherence to the rack layout drawings is not required, it will ensure that the interconnection cables are the proper lengths. All mounting holes should be utilized and the hardware be securely tightened.

All interconnection cables should be strain relieved and secured to the equipment racks or other supporting structures. Failure to provide adequate cable support may result in cables separating from connectors. If cables are to be run under elevated flooring, they should be laid out in cable racks if possible and tied to the cable racks as a guide. If cables are run along the floor, do not allow then to lay in the work area behind the racks. Stepping or tripping on the cables may result in connections being pulled free or wire breakage inside the insulation. Figure 2-1 illustrates the chassis installation.

To install the rack mounted models of the RCP-MLTP Control Panels take the following steps:

1. Align the control panel chassis with a slotted opening in the rack.

2. Install the bottom screws first.

3. Install the top two screws.

4. Tighten all four screws securely.

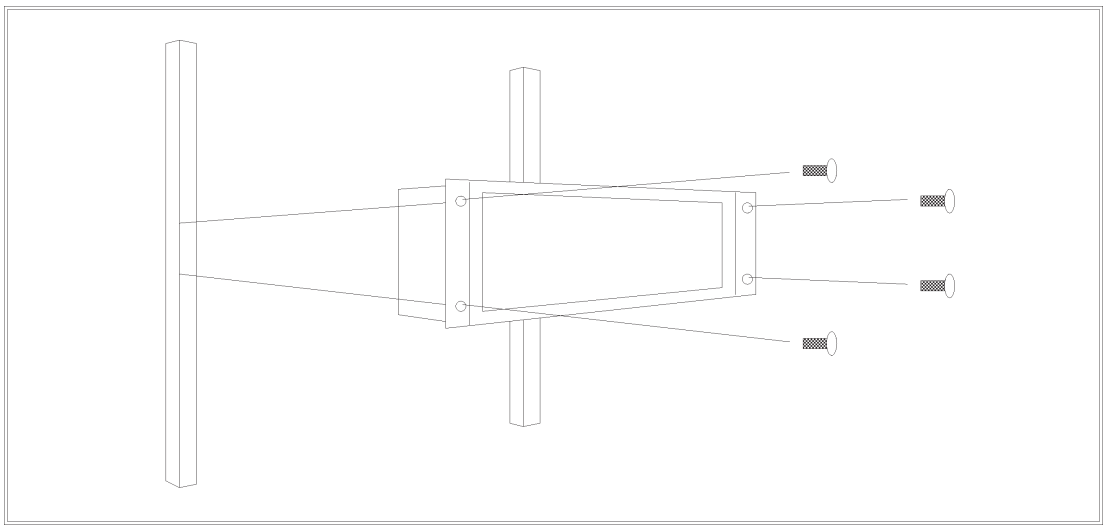


Figure 2-1 Control Panel Chassis Installation

2.4 Polling Address

For the system controller to identify a particular control panel, a specific device number or polling address must be assigned to each panel. Sequential binary numbers (1 thorough 1023) are used for this purpose. The appropriate binary number is entered into the control panel by setting an internal 10-position DIP switch to the selected binary number. The DIP switch is located on the Remote CPU Board and is accessible from the rear of the unit. The panel address is normally assigned and entered at the factory if the panel is purchased as part of a system and a design guide has been completed by the user. If the panel is purchased separately, the user may be required to set the panel address.

EXAMPLE: To select polling address 21, set switches 6, 8, and 10 in the "ON" or "1" position. See Figure 2-2.

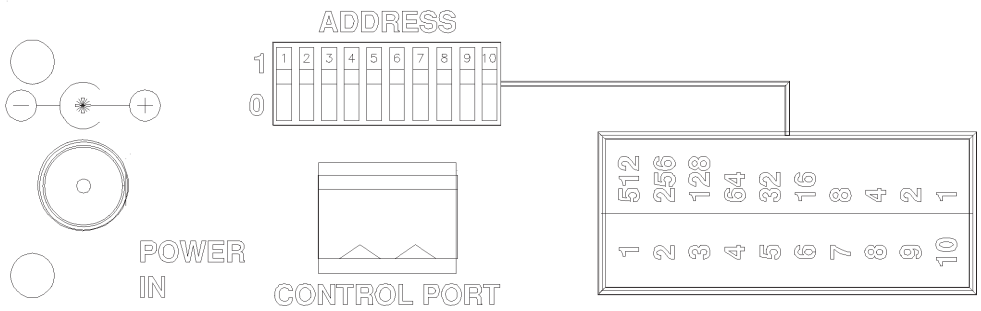


Figure 2-2 DIP Switch Location

2.5 Control Panel/Controller Interconnection

Each control panel has a single 3-pin MTA connector located on its rear panel which is utilized for system communications to and from the controller. Control panels are daisy-chained to a communications port on the rear panel of the system controller or to a communications port on the rear panel of the routing switcher containing the system controller. Use shielded twisted pair cable for all control panel communication port connections. See Figure 2-3.

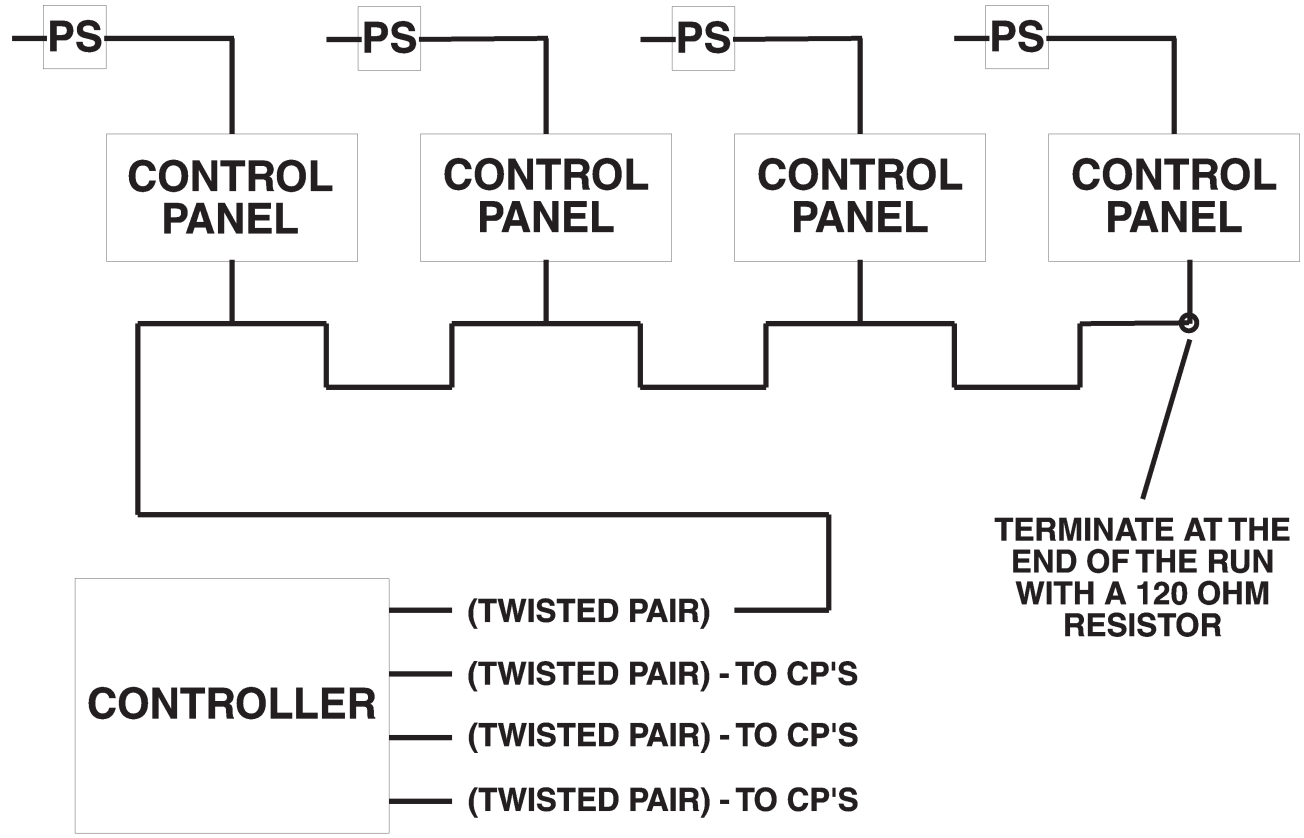


Figure 2-3 Typical Control Panel Controller Interconnection

2.6 Wiring the Control Panel Connector

Should an additional panel be added to your system, it will be necessary to wire the connector using shielded twisted pair cable and a 3-pin MTA connector using the following instructions. See Figure 2-4.

1. Remove approximately 1.5" of insulation from each of the two cables.

2. Remove approximately 0.5" of insulation from the black and red wires.

3. Twist together and insert the two black wire into position one. Crimp down using a screwdriver.

4. Twist together and insert the two shield wires into position two. Crimp down using a screwdriver.

5. Twist together and insert the two red wires into position three. Crimp down using a screwdriver.

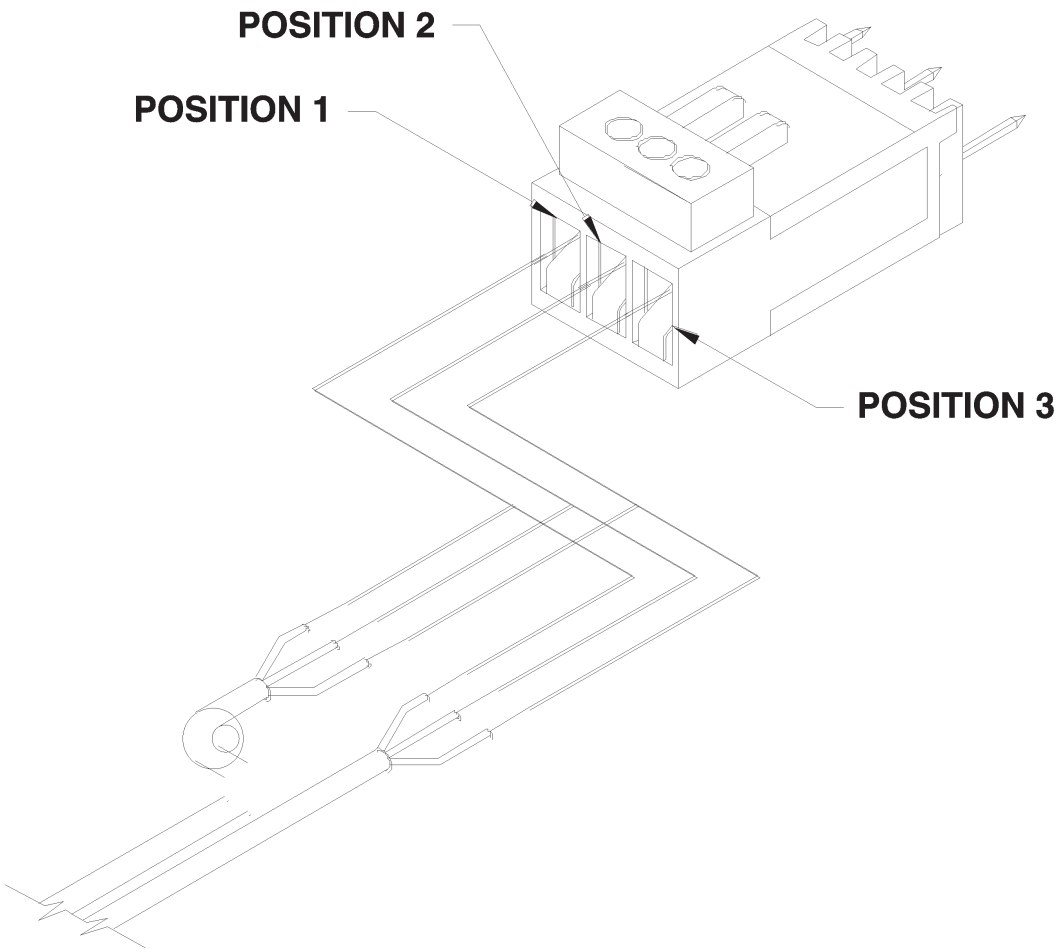


Figure 2-4 Wiring the Control Panel Connector

2.7 Terminating Cable Runs

Each cable run should be terminated with a 120 ohm, 1/4 watt 5% resistor. The cable is terminated internally at the controller. See Figure 2-5.

1. Un-crimp the black and red leads in positions one and three.
2. Insert the resistor leads into positions one and three along with the black and red leads.
3. Crimp down using a screwdriver.
4. The shield wire remains in position two.

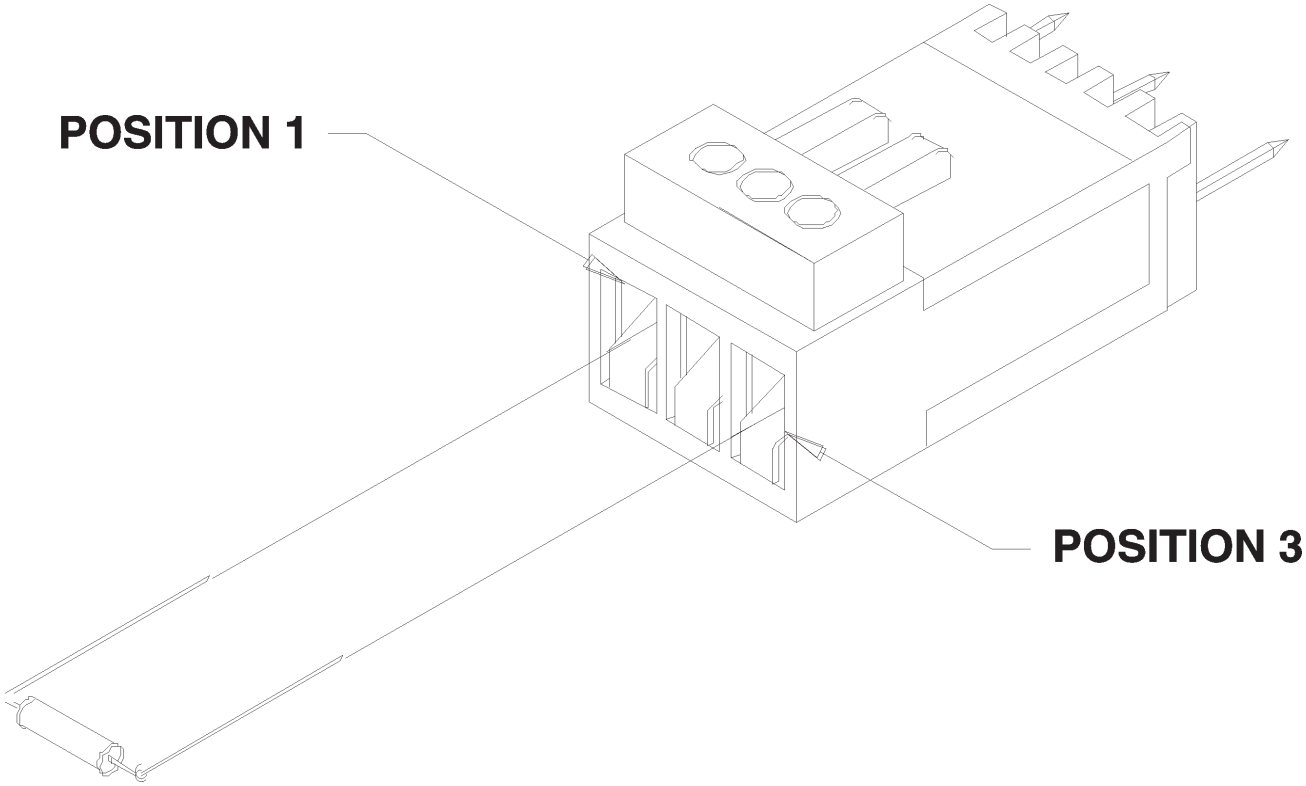


Figure 2-5 Terminating Cable Runs

2.8 Power Connections

Power for the RCP-MLTP Control Panels is supplied by external 7.5 VDC, 800 mA power supplies.

Remove the power supply from the box it was shipped in and check to insure that no damage has occurred in shipping. Verify that the power supply is rated for the proper AC voltage (i.e. 115 VAC or 230 VAC) before connection to the AC line voltage. The power connector can now be plugged into the **POWER IN** connector on the rear of the control panel. The power supply will immediately power the unit upon connection to the AC line voltage. See Figure 2-6.

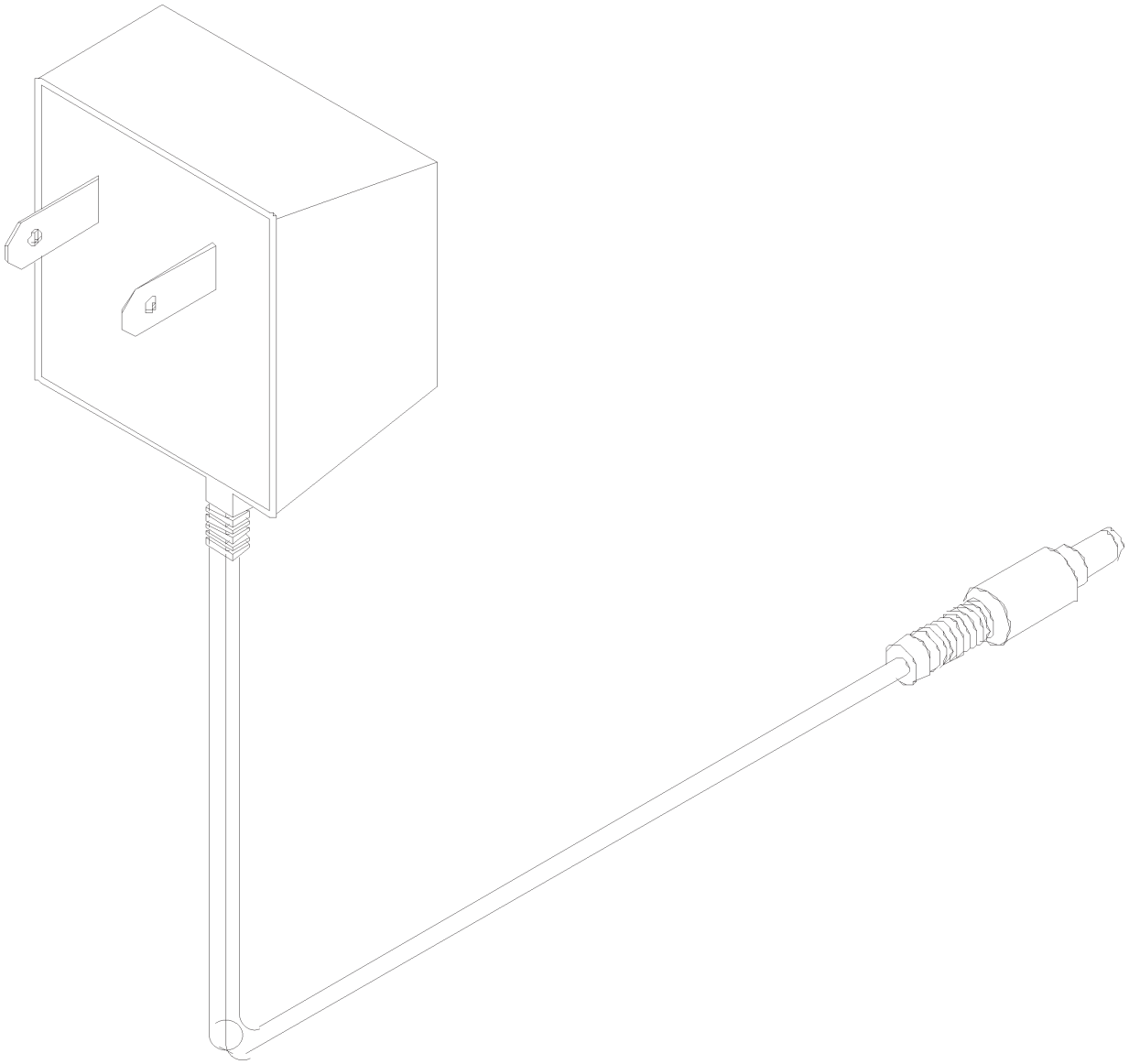


Figure 2-6 Typical Control Panel Power Supply

3.1 Introduction

The RCP-MLTP Control Panels are designed to be controlled by the 3300 Controller. Operations of the RCP-MLTP Control Panels require that they be configured at the system controller utilizing the Win3300 Control System. *Refer to the Operations Section of the Win3300 Control System Manual for configuration instructions.*

General

All RCP-MLTP Control Panels in a routing switcher system are custom configured at the factory prior to shipment. The information needed to configure the control panels comes from the System Design Guide filled out by the customer. However, if the system configuration changes, the RCP-MLTP Control Panels can be re-configured on site using the control system configuration software.

3.2 Breakaway Operation

Breakaway allows you to select a source on a specific level to be taken to a destination on that level. Breakaways can be accomplished in the Direct Take Mode.

Direct Take Mode

Action:	Results:
1. Press the desired Level Key.	The level names are shown in the Level Display. The Level Key is illuminated.
2. Select the desired source by pressing a Data Key.	Takes the source on-line at the specified level(s) to the active destination.

3.3 Split Operation

Split operation is like breakaway operation but it allows you to perform a breakaway on more than one level simultaneously.

To Make a Split Breakaway:	Results:
1. Depress the CLEAR Key.	Clears the contents of the Preset Register.
2. Press PRESET SELECT Key	Places panel Preset Select Mode. Preset Select LED will be illuminated.
3. Enter a source selection using the Data Keys or PREV/NEXT Keys.	The source name will be shown in the Preset Display.
4. Depress the desired Level Key.	The level names are shown in the Level Display. The "ALL LEVS" selection represents all levels assigned to the panel. This is the default level selection. The Level Key is illuminated.
5. Repeat steps 3-4 again.	Enters a breakaway source selection on all levels desired.
6. Press TAKE Key	Takes all levels with a breakaway source selection on-line to the active destination.
7. Press PRESET SELECT Key	Places panel in the Hot Take Mode. Turns off the Preset Select LED.

3.4 Key Types

Data Keys - The RCP-MLTP Control Panel has 24 data keys located towards the left side of the panel. The RCP-MLTP Control Panel's data keys are arranged in two rows of 12 keys. The RCP-MLTP2 Control Panel has 26 data keys; 24 data keys are located towards the left side of the panel and two data keys are located to the left of the function keys at the bottom right of the control panel. The RCP-MLTP2 Control Panel's data keys are arranged in four rows of 6 keys.

PREV Key - The PREV Key is used to scroll to the *previous* valid source, destination, or salvo selection depending on the active mode of the panel.

NEXT Key - The NEXT Key is used to scroll to the *next* valid source, destination, or salvo selection depending on the active mode of the panel.

Function Keys - The RCP-MLTP Control Panel has six function keys located to the right of the 20X2 LED Display and two function keys located to the left of the 20X2 LED Display. The RCP-MLTP2 Control Panel has eight function keys located below the 20X2 LED Display. Most of the function keys are associated with two possible functions. **NOTE: The primary function is executed when the key is held down less than one second. The secondary function is executed when the key is held down more than one second. Each function key works as toggle switch. If a function is currently enabled, pressing the associated function key in the same fashion as before (less than or greater than one second) will disable it.**

3.5 Modes of Operation

Direct Take - The Direct Take Mode enables selected sources to be switched to the destination controlled by the panel by pressing the associated source or soft source data keys. Switch requests are sent immediately. Direct Take is the default mode of operation. Deselecting all other modes of operation will return you to the Direct Take Mode. The level keys are either not illuminated if the panel is in "All Levs" or illuminated if you have selected a breakaway level or breakaway levels. In addition, you may change the destination controlled by the panel by pressing a destination or soft destination key. Sources may be selected in the Preset Display by scrolling using the PREV/NEXT Keys.

3.5 Modes of Operation Continued:

Preset Select - The Preset Select Mode enables selected sources to be switched to the destination controlled by the panel the next time the TAKE/CHOP Key is pressed. The selected sources are loaded into the Preset and are shown by name in the Preset Display; on-line status is not affected until a take is executed. To enter the Preset Select Mode press the PRESET Key. The PRESET Key LED is illuminated in this mode. You may select a source or sources by scrolling using PREV or NEXT Keys, pressing source or soft source data keys, or by entering the name of the desired source using category/index data keys. You may take the preset source selection on-line by pressing the TAKE/CHOP Key. No data keys LEDs are illuminated in the Preset Select Mode.

Store - The Store Mode stores the current selection for preset source or destination to an appropriately configured soft data key. Sources may only be stored to soft source data keys and destinations may only stored to soft destination data keys. Enter the Store Mode by first entering a valid selection in the appropriate mode of operation (Preset or Destination Select). Then press and hold the CLEAR/STORE Key for more than one second to enter the Store Mode. **NOTE:** Pressing the CLEAR/STORE Key for less than one second can clear the selection. The CLEAR/STORE LED blinks while in this mode. Exit the Store Mode by either successfully storing your selection to a soft data key or by pressing and holding the CLEAR/STORE Key for more than one second again. Pressing the CLEAR/STORE Key for more than one second in the Direct Take Mode will place the panel in the Preset Store Mode.

Destination Select - The Destination Select Mode enables the selection of the destination group the panel will control. Enter the Destination Select Mode by pressing the DEST/SALVO Key for less than one second. The DEST/SALVO Key LED is illuminated in this mode. You may select a destination by using the PREV or NEXT Keys, by pressing destination or soft destination data keys, or by entering the name of the desired destination using category/index data keys. Whenever a valid destination is entered, the panel immediately switches control from the previously controlled destination to the new selection. The name of the destination selected is shown in the Destination Display. You may take the preset source selection to the new destination by pressing the TAKE/CHOP Key for less than one second. Any destination or soft destination data key matching the currently controlled destination will be illuminated in this mode. Exit the Destination Select Mode by pressing the DEST/SALVO Key again.

3.5 Modes of Operation Continued:

Salvo Select - The Salvo Select Mode enables the selection of a salvo to be executed. Enter the Salvo Select Mode by pressing and holding the DEST/SALVO Key down for more than one second. The DEST/SALVO Key LED blinks in this mode. You may select salvoes by using the PREV or NEXT keys or by pressing salvo data keys. The name of the salvo selected, via PREV/NEXT Keys, is shown in the Preset Display. You may execute the salvo by pressing the TAKE/CHOP Key or by pressing a salvo key. No data keys are illuminated in this mode. Exit the Salvo Select Mode by pressing and holding the DEST/SALVO Key for more than one second.

Chop - In the Chop Mode the panel will alternately switch (about every frame) the destination currently being controlled between the current on-line source and the preset source. Enter the Chop Mode by pressing and holding the TAKE/CHOP Key down for more than one second. The TAKE/CHOP LED blinks when the panel is in the Chop Mode. Exit the Chop Mode by pressing the TAKE/CHOP Key again.

3.6 Panel Configuration

Address: Decimal number from 1 to 1023 which is used to distinguish each panel on the panel communications bus. Address must match the DIP switch settings on the rear of the panel.

Requestor Code: Decimal number from 1 to 65535 which is used to distinguish the ownership of locks and protects. For example, if two or more panels are assigned the same requestor code and one of the control panels locks or protects a destination the other control panels with the same assigned requestor code and an equal or higher lock priority code may unlock or unprotect the destination. The assignment of the same requestor code to two or more control panels allows all of the panels with the same requestor code assigned to take switches on a protected destination if the destination was protected by one of the panels.

Panel Name: Any eight alphanumeric characters. Currently used only by the controller configuration program to provide a user friendly method of referring to each panel.

Priority: Priorities are used when a panel attempts to set or clear a destination protect or lock. Only the panel which set a protect or lock or a panel of higher priority can un-protect or unlock a destination once it is locked. Priorities range from 0 (master) to 255. The default setting is master.

3.6 Panel Configuration Continued:

Status Method: The way the panel displays status is based on whether the panel is set for "All Levs" (changing all levels assigned to the panel) or "Breakaway" (changing only the selected levels) operation. While in the All Levs Mode, the panel is statused by default status level.

Default Status Level: Level to be statused when the panel is in "All Levs" operation.

Default Destination Group: Destination group to be controlled by the panel when first powered up.

Level List: List of levels to be controlled by the panel. Any level not assigned in the Level List will not be accessible to or affected by panel operations.

Include Source List: List of all source groups accessible by the panel.

Exclude Source List: List of any source groups to be unaccessible from the panel. This list is not required if no source group is to be excluded from the panel access is included in the Include Source List.

Include Destination List: List of all destination groups controllable by the panel.

Exclude Destination List: List of any destination groups to be excluded from control by the panel. This list is not required if no destination group to be excluded from panel control is included in the Include Destination List.

Salvo List: List of all salvoes the panel can execute.

Key Assignment List: List containing the assignment of all data keys (24 for the RCP-MLTP Control Panel and 26 for the RCP-MLTP2 Control Panel) as configured by the user. Each data key is individually configurable as one of the following:

1. Source Selection
    A. Non Soft - Not locally reconfigurable
    B. Soft - Locally reconfigurable

2. Destinations Selection
    A. Non Soft - Not locally reconfigurable
    B. Soft - Locally reconfigurable

3.6 Panel Configuration Continued:

3. Salvo Selection
   A. Non Soft - Not locally reconfigurable (**NOTE:** Each data key can also be configured as a salvo key.)

4. Category/Index Selection

5. Level Selection
   A. Non Soft - Not locally reconfigurable

3.7 Statusing

Status by Default Status Level

Status Display - The name shown in the Status Display represents the source switched to the destination controlled by the panel on the default status level. If "All Levs" is displayed in the Level Display and an "#" character is at the end of the Status/Preset Display, then a source on at least one level is different in the Status/Preset Registers. To view the source assigned on each level, press the level keys. As you select levels, the displays will change to show the source assigned for the level currently selected. If the destination currently selected has no output on the default status level or there is no source information to display (initial start-up condition) or no display level can be selected, the panel will show "No Level" (where Level is the name assigned to the selected level - i.e. "No Video") in the display.

NOTE: To display status on individual levels the user should place the control panel in the Display Preset Mode.

Data Keys:

LED Illuminated Solid (not blinking) - The current status matches the source assigned to the data key for the default status level and the source or sources assigned to the data key for the other levels either match the status on the default status level or are not configured.

LED Blinking - The current status matches the source assigned to the data key for the default status level and the source or sources assigned to the data key for at least one other level does not match the status on the default status level.

3.7 Statusing Continued:

Status by Default Status Level Continued:

No LED Illuminated - The current status does not match the source assigned to any data key on the default status level.

Breakaway Statusing

Status Display - The name shown represents the source switched to the destination currently controlled by the panel on the currently selected level. To determine the status level controlled by the panel, enter the Display Preset Mode and press the level keys. As you select the levels, the display will change to show the source switched to the output controlled by the panel for the level currently selected. If the destination currently selected has no output on the currently selected level, the panel will blank the Status Display.

Data Keys:

LED Illuminated Solid (not blinking) - The current status matches the source assigned to the data key for the highest priority level selected (level 1 is the highest priority level).

No LED Illuminated - The current status does not match the source assigned to any data key on the highest priority level selected (level 1 is the highest priority level).

Error Statusing

The panel will display "CONF ERR" or "READBACK" whenever an error is detected on the level currently being displayed. "CONF ERR" indicates that there is a confidence error on the destination currently controlled by the panel. "READBACK" indicates that the source readback from the router was not the same as the source requested.

3.8 Direct Take Mode

Level Data Keys - Selects level(s) to perform a Hot Take Breakaway on. The keys act as toggles.

Source and Soft Source Data Keys - Switches the source(s) assigned to the data key on all selected levels to the destination currently controlled by the panel. The method of statusing used by the panel is determined by the configuration at the controller and whether breakaway levels are currently selected.

3.8 Direct Take Mode Continued:

Destination and Soft Destination Data Keys - Changes the destination currently controlled by the panel to the destination group assigned to the data key pressed.

Salvo Data Keys - No effect.

Category/Index Data Keys - If a category has already been selected, the index assigned to the data key pressed (if any) is appended to the preset source name displayed in the Preset Display. If the name displayed is a valid source name, the name is displayed solid (not blinking). Otherwise, the name entered blinks. **NOTE:** For a valid source name to be displayed, it must be a current source group that is in the panel's Include Sources List.

PREV Key - Scrolls preset source selection to the previous source accessible to the panel. Sources are presented in alphabetical order. **NOTE:** For a valid source name to be displayed, it must be a current source group that is in the panel's Include Sources List.

NEXT Key - Scrolls preset source selection to the next source accessible to the panel. Sources are presented in alphabetical order. **NOTE:** For a valid source name to be displayed, it must be a current source group that is in the panel's Include Sources List.

PRESET Key - Exits the Direct Take Mode and enters the Preset Select Mode.

CLEAR/STORE Key:

CLEAR - Returns the panel to "All Levs" if in breakaway. If in "All Levs", the preset source is cleared.

STORE - Places the panel in the Store Preset Mode.

DSP PRS/ADDR Key:

DSP PRS - Exits the Direct Take Mode and enters the Display Preset Mode.

ADDR - Displays the panel's address in the Preset Display while the key is held down.

DEST/SALVO Key:

DEST - Exits the Direct Take Mode and enters Destination Select Mode.

SALVO - Exits the Direct Take Mode and enters Salvo Select Mode.

3.8 Direct Take Mode Continued:

PROT/LOCK Key:

PROT - Protects the destination currently being controlled by the panel. Any switch request attempting to affect this destination made at any location other than this panel will be disallowed. The PROT/LOCK Key LED is illuminated to show the destination currently being controlled by the panel is protected. An "!" is displayed before the destination name if the destination is protected, i.e. "!VTR01". **NOTE:** Two or more panels with the same requestor code will display "!" if "PROT" is selected. The requestor code is defined as a number from 1 to 65535 which allows two or more panels to take switches on a protected destination.

LOCK - Locks the destination being currently controlled by the panel. Any switch request attempting to affect this destination will be disallowed. The PROT/LOCK Key LED blinks to show the destination currently being controlled by the panel is locked. An "*" is displayed before the destination name if the destination is locked, i.e. "*VTR01".

TAKE/CHOP Key:

TAKE - Toggles preset and on-line sources: 1) sends a switcher change request to take preset source to the currently controlled destination on the levels selected, 2) saves the current on-line source to the preset on the levels selected. Since take toggles the on-line and preset sources, pressing the TAKE Key again returns the on-line status to its previous state.

CHOP - Continuously toggles preset and on-line sources once every frame (refer to preceding TAKE description.

3.9 Preset Select Mode

Level Data Keys - Loads the selected preset to the selected level.

Source and Soft Source Data Keys - Loads the preset with the source(s) assigned to the data key pressed. Updates the Preset Display to show the name of the sources loaded.

Destination and Soft Destination Data Keys - No effect.

Salvo Data Keys - No effect.

3.9 Preset Select Mode Continued:

Category/Index Data Keys - If a category has already been selected, the index assigned to the data key pressed (if any) is appended to the preset source name displayed in the Preset Display. If the name displayed is a valid source name, the name is displayed solid (not blinking). Otherwise, the name entered blinks. **NOTE:** For a valid source name to be displayed, it must be a current source group that is in the panel's Include Sources List.

PREV Key - Scrolls preset source selection to the previous source accessible to the panel. Sources are presented in alphabetical order. **NOTE:** For a valid source name to be displayed, it must be a current source group that is in the panel's Include Sources List.

NEXT Key - Scrolls preset source selection to the next source accessible to the panel. Sources are presented in alphabetical order. **NOTE:** For a valid source name to be displayed, it must be a current source group that is in the panel's Include Sources List.

PRESET Key - Use to exit Preset Select Mode and return to Direct Take Mode.

CLEAR/STORE Key:

CLEAR - Returns the panel to "All Levs" if in breakaway. If in "All Levs" clears the preset source.

STORE - If the preset contains a valid source selection on any level, panel enters the Store Mode.

DSP PRS/ADDR Key:

DSP PRS - Exits Preset Select Mode and enters Display Preset Mode.

ADDR - Displays the panel's address in the Preset Display while the key is held down.

DEST/SALVO Key:

DEST - Use to exit the Preset Select Mode and enter Destination Select Mode.

SALVO - Use to exit the Preset Select Mode and enter Salvo Select Mode.

3.9 Preset Select Mode Continued:

PROT/LOCK Key:

PROT - Protects the destination currently being controlled by the panel. Any switch request attempting to affect this destination made at any location other than this panel will be disallowed. The PROT/LOCK Key LED is illuminated to show the destination currently being controlled by the panel is protected. An "!" is displayed before the destination name if the destination is protected, i.e. "!VTR01". **NOTE:** Two or more panels with the same requestor code will display and affect a protected destination. The requestor code is defined as a number from 1 to 65535 which allows two or more panels to take switches on a protected destination.

LOCK - Locks the destination being currently controlled by the panel. Any switch request attempting to affect this destination will be disallowed. The PROT/LOCK Key LED blinks to show the destination currently being controlled by the panel is locked. An "*" is displayed before the destination name if the destination is locked, i.e. "*VTR01".

TAKE/CHOP Key:

TAKE - Toggles preset and on-line sources: 1) sends a switcher change request to take preset source to the currently controlled destination on the levels selected, 2) saves the current on-line source to the preset on the levels selected. Since take toggles the on-line and preset sources, pressing the TAKE Key again returns the on-line status to its previous state.

CHOP - Continually toggles preset and on-line sources once every frame (refer to preceding TAKE description.

3.10 Display Preset Mode

Level Data Keys - Selects level to view status and preset source. Only one level at a time is viewed.

Source and Soft Source Data Keys - No effect.

Destination and Soft Destination Data Keys - Changes the destination currently controlled by the panel to the destination group assigned to the data key pressed.

Salvo Data Keys - No effect.

3.10 Display Preset Mode Continued:

Category/Index Data Keys - No effect, category/index data keys are only active in Preset Select Mode, Destination Select Mode, and Direct Take Mode.

PREV Key - No effect.

NEXT Key - No effect.

PRESET Key - Exits Display Preset Mode and enters Preset Select Mode.

CLEAR/STORE Key:

CLEAR - Returns the panel to "All Levs" if in breakaway.

STORE - If the preset contains a valid source selection on any level, panel enters the Store Mode.

DSP PRS/ADDR Key:

DSP PRS - Exits Display Preset Mode and enters Direct Take Mode.

ADDR - Displays the panel's address in the Preset Display while the key is held down.

DEST/SALVO Key:

DEST - Exits Display Preset Mode and enters Destination Select Mode.

SALVO - Exits Display Preset Mode and enters Salvo Select Mode.

TAKE/CHOP Key:

TAKE - No effect.

CHOP - No effect.

3.11 Store Mode

Source Store - You were in the Preset Select Mode, selected a valid preset source, pressed and held the CLEAR/STORE Key for more than one second. Pressing any data key configured as a soft source will store the contents of the preset to the data key on all levels. Pressing any other type of data key has no effect. After successfully storing the source definition into the soft source data key, the panel exits the Store Mode and returns to the Preset Select Mode. Alternately, you may decide not to store the preset source to a data key and exit from the Store Mode by pressing and holding the CLEAR/STORE for more than one second.

Destination Store - You were in the Destination Select Mode, selected a valid destination and pressed and held the CLEAR/STORE Key more than one second. Pressing any data key configured as a soft destination will store the current destination controlled by the panel to the data key. Pressing any other type of data key has no effect. After successfully storing the destination definition into the soft destination data key, the panel exits the Store Mode and returns to the Destination Select Mode. Alternately, you may decide not to store the destination to a data key and exit the Store Mode by pressing and holding the CLEAR/STORE Key for more than one second.

PREV Key - No effect.

NEXT Key - No effect.

PRESET Key - Exits the Store Mode and enters the Preset Select Mode.

CLEAR/STORE Key:

CLEAR - No effect.

STORE - *Source Store* - Exit the Store Mode and return to the Preset Select Mode.

Destination Store - Exit the Store Mode and return to the Destination Select Mode.

DSP PRS/ADDR Key:

DSP PRS - Exits Store Mode and enters Display Preset Mode.

ADDR - Displays the panel's address in the Preset Display while the key is held down.

3.11 Store Mode Continued:

DEST/SALVO Key:

DEST - Exits the Store Mode and enters the Destination Select Mode.

SALVO - Exits the Store Mode and enters the Salvo Select Mode.

PROT/LOCK Key:

PROT - Protects the destination currently being controlled by the panel. Any switch request attempting to affect this destination made at any location other than this panel will be disallowed. The PROT/LOCK Key LED is illuminated to show the destination currently being controlled by the panel is protected. An "!" is displayed before the destination name if the destination is protected, i.e. "!VTR01".

LOCK - Locks the destination being currently controlled by the panel. Any switch request attempting to affect this destination will be disallowed. The PROT/LOCK Key LED blinks to show the destination currently being controlled by the panel is locked. An "*" is displayed before the destination name if the destination is locked, i.e. "*VTR01".

TAKE/CHOP Key:

TAKE

Source Store - Returns the panel to the Preset Select Mode. Toggles preset and on-line sources: 1) sends a switcher change request to take preset source to the currently controlled destination on the levels selected, 2) saves the current on-line source to the preset on the levels selected. Since take toggles the on-line and preset sources, pressing the TAKE Key again returns the on-line status to its previous state.

Destination Store - Returns the panel to the Destination Select Mode. Toggles preset and on-line sources: 1) sends a switcher change request to take preset source to the currently controlled destination on the levels selected, 2) saves the current on-line source to the preset on the levels selected. Since take toggles the on-line and preset sources, pressing the TAKE Key again returns the on-line status to its previous state.

3.11 Store Mode Continued:

CHOP

Source Store - Takes panel to the Chop Mode. Continually toggles preset and on-line sources once every frame.

Destination Store - Takes panel to the Chop Mode. Continually toggles preset and on-line sources once every frame.

3.12 Destination Select Mode

Level Data Keys - Selects level to view. Only one level at a time is viewed (the lowest number level has highest display priority).

Source and Soft Source Data Keys - No effect.

Destination and Soft Destination Data Keys - Changes the destination controlled by the panel to the destination assigned to the data key pressed. Updates the Destination Display to show the name of the newly selected destination.

Salvo Data Keys - No effect.

Category/Index Data Keys - If a category has already been selected, the index assigned to the data key pressed (if any) is appended to the destination name displayed in the Destination Display. If the name displayed is a valid destination name, it will be illuminated solid (not blinking). Otherwise, the name entered will blink. **NOTE:** For a valid destination to be displayed, it must be a current destination group that is in the panel's Include Destinations List.

PREV Key - Scrolls destination selection to the previous destination controllable by the panel. Destinations are presented in alphabetical order. **NOTE:** For a valid destination name to be displayed, it must be a current destination group that is in the panel's Include Destinations List.

NEXT Key - Scrolls destination selection to the next destination controllable by the panel. Destinations are presented in alphabetical order. **NOTE:** For a valid destination name to be displayed, it must be a current destination group that is in the panel's Include Destinations List.

PRESET Key - Exits the Destination Select Mode and enters the Preset Select Mode.

3.12 Destination Select Mode Continued:

CLEAR/STORE Key:

CLEAR - Clear the destination selection from the Destination Display.

STORE - If the destination name displayed is a valid destination (not blinking), enters the Store Mode.

DSP PRS/ADDR Key:

DSP PRS - Exits the Destination Select Mode and enters the Display Preset Mode.

ADDR - Displays the panel's address in the Preset Display while the key is held down.

DEST/SALVO Key:

DEST - Exits the Destination Select Mode and returns to the Direct Take Mode.

SALVO - Exits the Destination Select Mode and enters Salvo Select Mode.

PROT/LOCK Key:

PROT - Protects the destination currently being controlled by the panel. Any switch request attempting to affect this destination made at any location other than this panel will be disallowed. The PROT/LOCK Key LED is illuminated to show the destination currently being controlled by the panel is protected. An "!" is displayed before the destination name if the destination is protected, i.e. "!VTR01".

LOCK - Locks the destination being currently controlled by the panel. Any switch request attempting to affect this destination will be disallowed. The PROT/LOCK Key LED blinks to show the destination currently being controlled by the panel is locked. An "*" is displayed before the destination name if the destination is locked, i.e. "*VTR01".

3.12 Destination Select Mode Continued:

TAKE/CHOP Key:

TAKE - Toggles preset and on-line sources: 1) sends a switcher change request to take preset source to the currently controlled destination on the levels selected, 2) saves the current on-line source to the preset on the levels selected. Since take toggles the on-line and preset sources, pressing the TAKE Key again returns the on-line status to its previous state.

CHOP - Continually toggles preset and on-line sources once every frame (refer to preceding TAKE description.

3.13 Salvo Select Mode

Level Data Keys - No effect.

Source and Soft Source Data Keys - No effect.

Destination and Soft Destination Data Keys - No effect.

Salvo Data Keys - Executes the salvo assigned to the data key.

Category/Index Data Keys - No effect.

PREV Key - Scrolls salvo selection to the previous salvo executable by the panel. Salvoes are presented in alphabetical order. **NOTE:** For a valid salvo name to be displayed, it must be a current salvo that is in the panel's Salvo List.

NEXT Key - Scrolls salvo selection to the next salvo executable by the panel. Salvoes are presented in alphabetical order. **NOTE:** For a valid salvo name to be displayed, it must be a current salvo that is in the panel's Salvo List.

PRESET Key - Exits the Salvo Select Mode and enters the Preset Select Mode.

CLEAR/STORE Key:

CLEAR - Clear the salvo selection from the Preset Display.

STORE - No effect.

3.13 Salvo Select Mode Continued:

DSP PRS/ADDR Key:

DSP PRS - Exits the Salvo Select Mode and enters the Display Preset Mode.

ADDR - Displays the panel's address in the Preset Display while the key is held down.

DEST/SALVO Key:

DEST - Exits the Salvo Select Mode and returns to the Destination Select Mode.

SALVO - Exits the Salvo Select Mode and enters Direct Take Mode.

PROT/LOCK Key:

PROT - Protects the destination currently being controlled by the panel. Any switch request attempting to affect this destination made at any location other than this panel will be disallowed. The PROT/LOCK Key LED is illuminated to show the destination currently being controlled by the panel is protected. An "!" is displayed before the destination name if the destination is protected, i.e. "!VTR01".

LOCK - Locks the destination being currently controlled by the panel. Any switch request attempting to affect this destination will be disallowed. The PROT/LOCK Key LED blinks to show the destination currently being controlled by the panel is locked. An "*" is displayed before the destination name if the destination is locked, i.e. "*VTR01".

TAKE/CHOP Key:

TAKE - If a salvo name is selected in the Preset Display, sends a request to execute the salvo. If no salvo is currently selected, no effect.

CHOP - If a salvo name is selected in the Preset Display, sends a request to execute the salvo. If no salvo is currently selected, no effect.

3.14 Chop Mode

Level Data Keys - No effect.

Source and Soft Source Data Keys - Exits the Chop Mode and returns the panel to the previous mode. **NOTE:** In this mode, if either source currently being "chopped" between is associated with a data key, the data key LED will be illuminated (blinking).

Destination and Soft Destination Data Keys - Exits the Chop Mode and returns the panel to the previous mode.

Salvo Data Keys - Exits the Chop Mode and returns the panel to the previous mode.

Category/Index Data Keys - Exits the Chop Mode and returns the panel to the previous mode.

PREV Key - No effect.

NEXT Key - No effect

PRESET Key - Exits the Chop Mode and enters the Preset Select Mode.

CLEAR/STORE Key:

CLEAR - No effect.

STORE - No effect.

DSP PRS/ADDR Key:

DSP PRS - Exits the Chop Mode and enters the Display Preset Mode.

ADDR - Displays the panel's address in the Preset Display while the key is held down.

DEST/SALVO Key:

DEST - Exits the Chop Mode and enters Destination Select Mode.

SALVO - Exits the Chop Mode and enters Salvo Select Mode.

3.14 Chop Mode Continued:

PROT/LOCK Key:

PROT - Protects the destination currently being controlled by the panel. Any switch request attempting to affect this destination made at any location other than this panel will be disallowed. The PROT/LOCK Key LED is illuminated to show the destination currently being controlled by the panel is protected. An "!" is displayed before the destination name if the destination is protected, i.e. "!VTR01".

LOCK - Locks the destination being currently controlled by the panel. Any switch request attempting to affect this destination will be disallowed. The PROT/LOCK Key LED blinks to show the destination currently being controlled by the panel is locked. An "*" is displayed before the destination name if the destination is locked, i.e. "*VTR01".

TAKE/CHOP Key:

TAKE - Exits the Chop Mode and returns the state of the destination currently controlled by the panel to the on-line status it was in before entering Chop Mode.

CHOP - Exits the Chop Mode and returns the state of the destination currently controlled by the panel to the on-line status it was in before entering Chop Mode.

4.1 Introduction

The RCP-MLTP Control Panel contains two printed circuit board assemblies; a MLTP Switchcard Assembly and a MLTP Remote CPU Assembly. The Remote CPU Assembly contains a microprocessor that controls the panel's operation and communicates with the routing switching system controller. The MLTP Switchcard Assembly contains the push-buttons and indicators used by the system operator to the control the routing switcher system. All models of the RCP-MLTP2 Control Panel contain a printed board assembly; a MLTP2 Switchcard Assembly. The MLTP2 Switchcard Assembly contains a microprocessor that controls the panel's operation and communicates with the routing switcher system. The MLTP2 Switchcard Assembly also contains the push-buttons and indicators used by the system operator to control the routing switcher system. The following manual sections contain a detailed description of each of these assemblies.

4.2 MLTP Switchcard Assembly

The switchcard for the RCP-MLTP Control Panel contains circuitry to provide a switchcard ID for the CPU board, scan a keyboard, light the keyboard LEDs, interface to an LCD display, and interface to an optional I/O board. The following is a description of each of these circuits.

Switchcard ID

The MLTP Switchcard provides a six-bit ID available to be read by the CPU board. This ID is available on J2, pins 23-28. The least significant bit (ID0) is provided by the optional I/O board on J4 pin 5. If the I/O board is not installed, then ID0 is pulled high by a pullup resistor on the CPU board. If the I/O board is installed, then the ID0 pin is grounded. The CPU may use this bit to detect the presence or absence of the I/O board. The remainder of the ID bits (ID1-ID5) are either floating or grounded by the switchcard. Floating pins are pulled high by pullup resistors on the CPU board. The CPU may use these bits to detect what switchcard is attached.

Keyboard Scan

The MLTP Switchcard contains circuitry capable of scanning up to 64 pushbuttons. The scan circuit is arranged as an eight row by eight column array. While the circuitry is capable of serving 64 pushbuttons, the RCP-MLTP Control Panel has circuitry for 34 pushbuttons and uses only 32 of these pushbuttons. To scan the keyboard, the microprocessor on the CPU board performs read cycles that enable SEL1. This occurs for addresses

4.2 MLTP Switchcard Assembly Continued:

Keyboard Scan Continued:

in the range of 800h to FFFh. SEL1 provides a low-active chip select for a 3 to 8 line decoder (U2 pin 5). A second low-active chip select is provided by address bit A3 at U2 pin 4. The three least significant address bits (A0-A2) are connected to the input of the decoder (U2 pins 1, 2, and 3). One of the eight low-active outputs of the decoder is selected by placing the appropriate address on the input of the decoder. Since partial decoding is used, the keyboard circuitry is mapped to several addresses within the SEL1 address range. The software in the CPU only uses the lowest available addresses to access the keyboard. Table 4-1 contains the addresses used to access each row of the keyboard circuit.

Table 4-1 Keyboard Memory Map

ADDRESS	ROW	PIN
800h	KB_ROW0	U2 pin # 15
801h	KB_ROW1	U2 pin # 14
802h	KB_ROW2	U2 pin # 13
803h	KB_ROW3	U2 pin # 12
804h	KB_ROW4	U2 pin # 11
805h	KB_ROW5	U2 pin # 10
806h	KB_ROW6	U2 pin # 9
807h	KB_ROW7	U2 pin # 7
808h	KB_ROW8	U9 pin # 15
809h	KB_ROW9	U9 pin # 14

Although the RCP-MLTP Control Panel only uses rows 0-4, the CPU still scans all eight rows. Each row of pushbuttons contains up to eight individual switches. Example: KB_ROW0 will simultaneously enable pushbuttons S1-S8. If any of these switches are pressed, the low-active signal will be passed through the pushbutton contacts to one of the eight column signals (KB_COL0-KB_COL7). If the pushbutton is not pressed, the switch contacts are broken and the column signal will be pulled high by resistor pack RP1. The SEL1 signal also enables U3 to place the KB_COL signals on the data bus. Thus, by performing a read cycle at ad-

4.2 MLTP Switchcard Assembly Continued:

Keyboard Scan Continued:

dress 800h, the CPU can determine the state of pushbuttons S1-S8 by looking at the state of data bits D0-D7. If S1 is pressed, then D0 will be low. Likewise, if S2 is pressed, D1 will be low. The status of the entire keyboard array may be determined by performing successive reads of each row of the array.

LED Driver

The MLTP Switchcard contains circuitry capable of lighting up to 34 pushbuttons. The RCP-MLTP Control Panel uses only 32 of these LEDs, one per pushbutton. The drive for each LED is provided by U1. The CPU sends a serial data stream to U1 by using the LED_DATA (U1 pin 25) and LED_CLOCK (U1 pin 24) signals. The LED_SEL0 chip select (U1 pin 26) must be asserted (low active) to select the LED driver chip. The output current used to drive each LED is enabled by the brightness pin of the LED driver (U1 pin 21). This pin is driven by the system E clock to provide 50% duty cycle drive current for each LED that is turned on. The LED_DATA line is latched into U1 on the rising edge of LED_CLOCK while LED_SEL0 is asserted.

LCD Display

The MLTP Switchcard contains circuitry for interfacing to an LCD display (DSP1). Because of the relatively slow timing parameters needed to write to this display, additional circuitry was added to slow down the write cycle to the display. The low-active select line SEL3 is used to address the display circuit. SEL3 is asserted for addresses in the range of 1800h to 1FFFh. All writes to any address in this range cause the data bus to be latched into U5 on the rising edge of SEL3. Since U5 is edge triggered, the output of U5 will remain valid until the next rising edge of SEL3. Data is latched into the LCD display on the falling edge of the flip-flop Q output (U6 pin 5). Refer to Figure xx for an idealized write cycle timing diagram for the LCD display. Address bits A1 and A2 are used to provide additional address decoding for the display. A1 and A2 must be low (see U7 pins 2 and 13) to enable DSP1. In conjunction with SEL3, these conditions result in a base address of 1800h for DSP1.

It should be noted that since the write cycle to an LCD display is not completed until the end of the next bus cycle, back-to-back writes to the display are not possible. The software must make sure that there is at least one bus cycle between successive writes to a display. Because of the timing characteristics of the display, circuitry to support reads as well as

4.2 MLTP Switchcard Assembly Continued:

LCD Display Continued:

writes becomes very cumbersome and costly. Because of this, the display is write-only. The R/W line of the display is tied to ground (write). The CPU board provides a register select line DSP_RS to the display on pin 4.

Contrast adjustment is made to the display by applying a varying voltage to pin 3. This pin is controlled by a voltage source on the MLTP Remote CPU Assembly. Brightness control for the LED backlight is provided by a variable current source (Q1/Q2). A variable voltage is provided by the CPU board to the base of Q2. The emitter of Q1 will be two base-emitter junction drops (approximately 1.3V) below the base of Q2. A maximum base voltage of 5 V results in approximately 3.7 V across R3. With R3 = 36 ohms, Ohm's law yields approximately 100 mA through the emitter/collector of Q1 and the cathode of the LED in DSP1 (pin 16). Since this current will be relatively independent of the value of the voltage on the anode of the LEDs, the unregulated power supply Vext is used to power the LEDs (pin 15). This off-loads the LED current from the +5 V regulator on the CPU board.

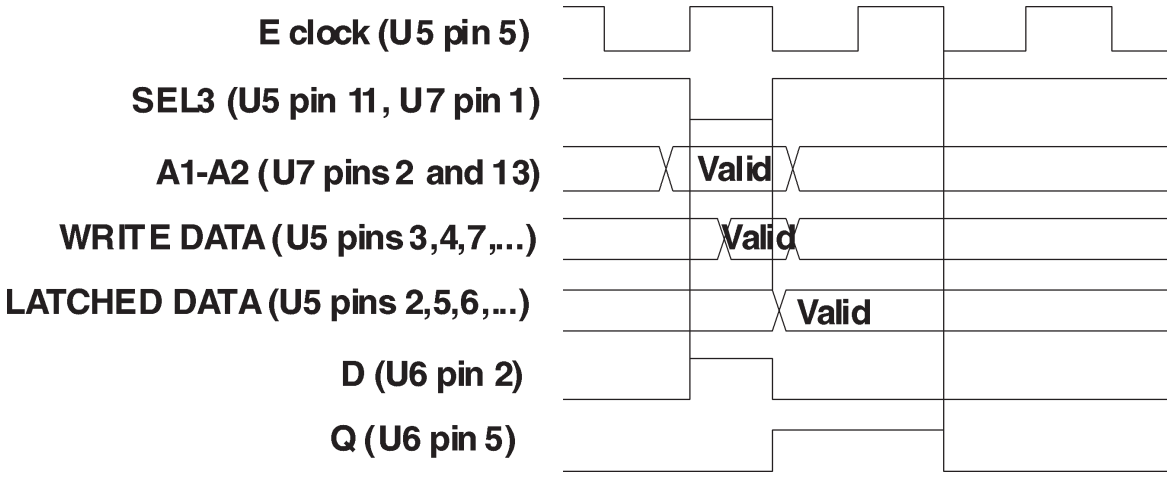


Figure 4-1 Idealized LCD Write Cycle Timing

4.3 MLTP Remote CPU Assembly

The Remote CPU Assembly contains all of the circuitry necessary to communicate with the system controller and to interface with the Switchcard Assembly. The circuitry on the Remote CPU Assembly may be divided into the following sections: Power Supply, Microprocessor, Clock, Reset, Memory, LED Driver Support, RS-485 Communications, I/O, and Miscellaneous. The following paragraphs explain each section in detail.

4.3 MLTP Remote CPU Assembly Continued:

Power Supply

The power supply circuit on the Remote CPU Assembly consists of a 7805 +5V regulator and filter capacitors. Unregulated DC voltage (7.5 to 9 VDC) is supplied by an external power supply via J3. The voltage regulator (U7) reduces the voltage to 5.0 VDC. C10, C11, and C12 provide filtering for the input and output of the regulator. Bypass capacitors (0.1 uF) are scattered about the assembly to provide power supply bypassing for the individual integrated circuits (ICs). The regulated voltage is available to the Switchcard Assembly on both J1 and J2, pins 31 and 32. The unregulated voltage (Vext) is available to the Switchcard Assembly on both J1 and J2, pins 29 and 30.

Microprocessor

The heart of the Remote CPU Assembly is the Motorola 68HC11 microprocessor (U1). This IC contains the microprocessor and peripheral circuitry used to operate the control panel. In addition, the 68HC11 contains a PROM loaded with the software used to operate the control panel. The 68HC11 is operated in the expanded multiplexed mode. In this mode port B (U1 pin 35-42) provides the upper address byte (A8-A15). Port C (U1 pins 9-16) provides both the lower address byte (A0-A7) and the data byte (D0-D7). U2 is used to latch the lower address byte. Figure 4-1 shows an idealized timing diagram for external bus cycles.

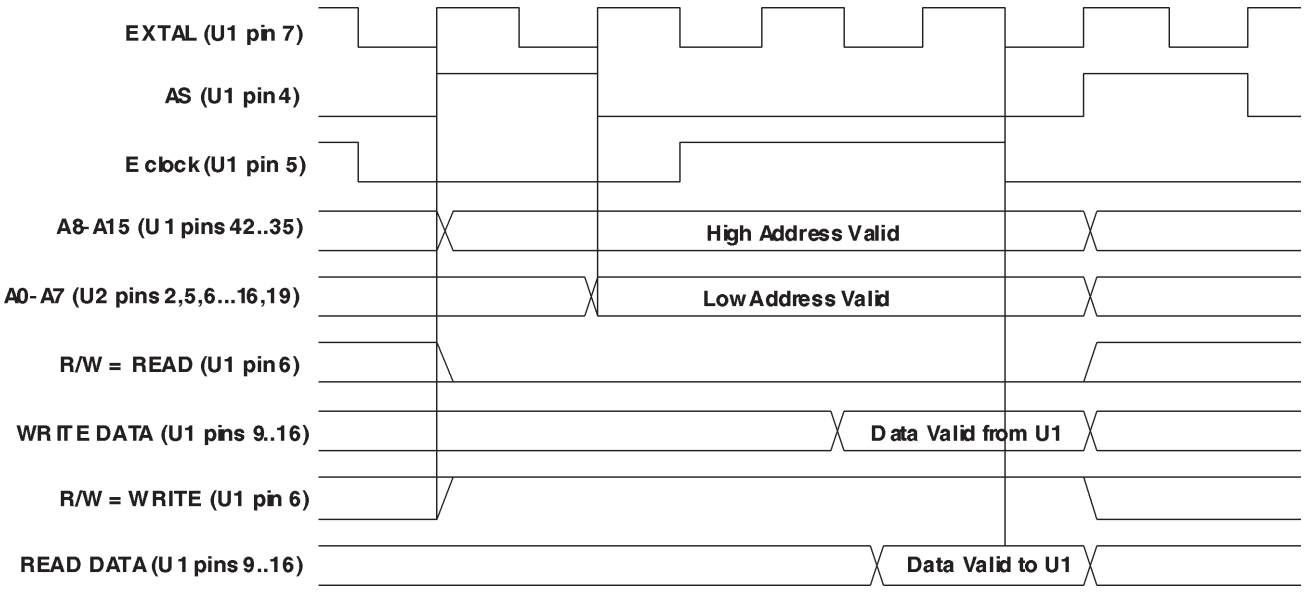


Figure 4-2 Idealized Bus Cycle Timing Diagram

4.3 MLTP Remote CPU Assembly Continued:

Microprocessor Continued:

During the first half of the bus cycle, port C presents the lower address byte (A0-A7). This information is latched into U2 on the falling edge of the address strobe, AS (U1 pin 4 to U2 pin 11), and remains stable until the beginning of the next bus cycle when AS is driven high by the processor. During the last half of the bus cycle port C presents data during write cycles and accepts data from an external device during read cycles. The address bus (A0-A15), the data bus (D0-D7), AS, R/W, and E clock are available to the Switchcard Assembly via J1.

Clock

The master system clock is provided by oscillator U6 pin 8. SYSCLK is available to the processor (U1 pin 7) and the Switchcard Assembly via J2 pin 10. The frequency of SYSCLK is 7.3728 MHz. This value was chosen to provide an appropriate frequency for the baud rate generator inside the 68HC11. The 68HC11 internally divides SYSCLK by four to derive the bus operating frequency. U1 pin 5 is the E clock used to synchronize all external bus cycles. The frequency of the E clock is 1.8432 MHz (SYSCLK/4). The E clock is used to derive control signals on the Remote CPU Assembly and is available to the Switchcard Assembly via J1 pin 28.

Reset

As with all microprocessors, the 68HC11 requires initialization during power-up. The 68HC11 requires that the RESET pin (U1 pin 17) be held low for 4064 cycles of E clock (2.2 mS @ 1.8432 MHz E clock). In addition the RESET pin must be held low while VDD is below legal limits to protect the internal EPROM register contents. A Maxim MAX690 chip (U5) performs the reset function for the 68HC11. The MAX690 monitors the supply voltage and asserts RESET (U5 pin 7) whenever VCC falls below 4.5 VDC. The RESET signal is guaranteed to be asserted for a minimum of 50 mS after VCC rises above 4.75 VDC. This is more than adequate to meet the 2.2 mS requirement of the 68HC11. The RESET signal is available to the Switchcard Assembly via J2 pin 11.

Memory

The Remote CPU Assembly contains 8K of static RAM (U3). The RAM is selected when both CS1 (U3 pin 20) and CS2 (U3 pin 26) are asserted. CS1 is low active and is driven by address bit A15. Whenever A15 is low, CS1 is asserted. This occurs for addresses in the range of 0000h to 7FFFh. CS2 is high active and is asserted when address bit A14 is high

4.3 MLTP Remote CPU Assembly Continued:

Memory Continued:

and E clock is high (note the AND gate formed by U8 pins 1, 2, and 3 followed by inverter stage U8 pins 4, 5, and 6). CS2 is active for addresses in the range of 4000h to 7FFFh. This encloses an address space of 16K. Since U3 is only 8K in length, it is dually mapped at base addresses of 4000h and 6000h. This means that the same location in the RAM may be accessed either at 4000h or at 6000h. The write enable pin WE (U3 pin 27) is driven low during the last half of the write cycles by U8 pin 8. This WE is also available to the Switchcard Assembly via J1 pin 25.

LED Driver Support

The 68HC11 processor uses the internal synchronous peripheral interface (SPI) under software control to drive Switchcard Assembly's LED circuitry. LED_DATA is presented as serial bit stream on U1 pin 23 and is available to the Switchcard Assembly via J2 pin 7. LED_CLOCK is presented on U1 pin 24 and is available to the Switchcard Assembly via J2 pin 8. The Switchcard Assembly's circuitry should accept LED_DATA on the rising edge of LED_CLOCK. To allow multiple LED drivers to be serviced, the Remote CPU Assembly provides four select lines labelled LED_SEL0 through LED_SEL3. These active low signals are presented at U1 pins 27-30 and are available to the Switchcard Assembly via J2 pins 1-4. The data stream generated is compatible with that required by National MM5450 LED driver chips.

RS485 Communications

Communication between the panel and the system controller is accomplished by the 68HC11 internal serial communications interface (SCI). The SCI is an asynchronous receiver/transmitter, sometimes referred to as a UART. The RS485 standard is used for the electrical interface between control panels and the system controller. A 75ALS176 (U4) chip is used convert between RS485 and the levels required by the SCI. Transmit data (TXD) is presented by the SCI on U4 pin 21. This signal drives the input to the RS485 transceiver on U4 pin 4. Data received from the system controller is converted to the appropriate levels by the RS485 transceiver and is presented on U4 pin 1. This received data (RXD) signal is then fed to the SCI receiver at U1 pin 20. Since the RS485 interface requires the transmitter to be tri-stated when not is use, a third signal is required to enable/disable the RS485 transmitter. The processor provides the TX_ENABLE signal under software control at U1 pin 25. This signal is connected to the RS485 transceiver at U4 pin 3. When TX_ENABLE is asserted (high), U4 drives the RS485 bus (U4 pins 6 and 7 to J4 pins 1

4.3 MLTP Remote CPU Assembly Continued:

RS485 Communications Continued:

and 3). When TX_ENABLE is negated (low), U4 ceases driving the bus and allows other devices to drive the bus. During reset, the TX_ENABLE signal from the processor is initialized to an input and is not driven to a particular state. A pull-down resistor (R2) has been added to ensure that U4 does not drive the RS485 bus during power-up or other reset conditions. A shield connection is provided for the RS485 bus on J4 pin 2. The shield is connected to ground through R1.

I/O

Circuitry is included on the Remote CPU Assembly to support I/O expansion via J1 and J2. Decoder U9 provides eight chip select signals (SEL0 through SEL7) for use by I/O devices. U9 is selected when A14 and A15 are both low and E is high. This occurs during the last half of each external bus cycle addressing in the range of 0000h to 3FFFh. Table 4-1 lists the active address range for each select signal. Currently, Remote CPU Assembly uses two of these eight signals for on-board circuitry. SEL6 is used to select eight bits of the address DIP switch S1. When SEL6 is asserted, U10 places the state of signals SWX3 through SWX10 on the data bus. If the corresponding switch for each bit is closed, a logic low is presented. If the switch is open, pull-up resistor RP1 presents a logic high. SEL7 is used to select the remaining two bits of the address switch and the six bit ID field from the Switchcard Assembly. The ID field is driven by the Switchcard Assembly. A logic low is generated by grounding the ID pin. A logic high is generated by leaving the ID pin floating. Pull-up resistor RP3 generates the logic high when a pin is floating.

Table 4-2 Decoder Addressing

SIGNAL	START	END
SEL0	0000h	07FFh
SEL1	0800h	0FFFh
SEL2	1000h	17FFh
SEL3	1800h	IFFFh
SEL4	2000h	27FFh
SEL5	2800h	2FFFh
SEL6	3000h	37FFh
SEL7	3800h	3FFFh

4.3 MLTP Remote CPU Assembly Continued:

Miscellaneous

The Remote CPU Assembly provides some special function signals for use by the Switchcard Assembly. On J2 pin 9 resides a signal named DSP_RS. This signal is a register select signal for the Switchcard Assembly's LCD display. The processor interrupt request line (IRQ) is currently not used, but is available for use by the Switchcard Assembly on J2 pin 12.

4.4 MLTP2 Switchcard Assembly

The MLTP2 Switchcard Assembly contains all circuitry necessary to communicate with the system controller, to scan 34 pushbuttons, to drive 34 LEDs, and to operate a LCD display. The circuitry on the Switchcard Assembly may be divided into the following sections: Power Supply, Microprocessor, Clock, Reset, LED Driver, Keyboard Scan, LCD Display, and RS-485 Communications. The following paragraphs explain each section in detail.

Power Supply

The power supply circuit on the display board consists of a 7805 +5V regulator and filter capacitors. Unregulated DC voltage (7.5 to 9 VDC) is supplied by an external power supply via J1. The voltage regulator U2 reduces the voltage to 5.0 VDC. The output voltage (+5VDC) from U2 provides regulated to all of the circuits on the MLTP2 Switchcard. C1 and line filters provide filtering for the input of the regulator. Bypass capacitors (.1 uF) are scattered about the board to provide power supply bypassing for individual chips.

Microprocessor

The heart of the display board is the Motorola 68HC11 microprocessor (U7). This IC contains the microprocessor and peripheral circuitry used to operate the panel. In addition, the 68HC11 contains a PROM containing the software used to operate the panel. The 68HC11 is operated in single chip mode, where the address and data busses are never brought external to the microprocessor. In this mode, most of the pins on the IC package are used to provide discrete inputs and/or outputs between the microprocessor and the peripheral circuitry. These pins are under software control of the microprocessor.

4.4 MLTP2 Switchcard Assembly Continued:

Clock

The master system clock is provided by oscillator U8 pin 8. SYSCLK is available to the processor (U7 pin 7). The frequency of SYSCLK is 7.3728 MHz. This value was chosen to provide an appropriate frequency for the baud rate generator inside the 68HC11. The 68HC11 internally divides SYSCLK by four to derive the bus operating frequency. The frequency of E clock (bus operating frequency) is 1.8432 MHz (SYSCLK/4).

Reset

As with all microprocessors, the 68HC11 requires initialization during power-up. The 68HC11 requires that the RESET pin (U7 pin 17) be held low for 4064 cycles of E clock (2.2 mS @ 1.8432 MHz E clock). In addition the RESET pin must be held low while VDD is below legal limits to protect internal EEPROM register contents. A Maxim MAX690 chip (U6) performs the reset function for the 68HC11. The MAX690 monitors the supply voltage and asserts RESET (U7 pin 17) whenever VCC falls below 4.5 VDC. The RESET signal is guaranteed to be asserted for a minimum of 50 mS after VCC rises above 4.75 VDC. This is more than adequate to meet the 2.2 mS requirement of the 68HC11.

LED Driver

The MLTP2 Switchcard circuitry capable of lighting up to 34 pushbuttons. The drive for each LED is provided by U5. The CPU sends a serial data stream to U5 by using the LDATA (U1 pin 25) and LCLK (U1 pin 24) signals. The output current used to drive each LED is enabled by the brightness pin of the LED driver (U1 pin 21). This pin is driven by +5VDC through a 3.3 ohm resistor (R7). The LDATA line is latched into U1 on the rising edge of LCLK.

Keyboard Scan

The MLTP2 Switchcard contains circuitry capable of scanning up to 64 pushbuttons. The scan circuit is arranged as an eight row by eight column array. While the circuitry is capable of serving 64 pushbuttons, the RCP-MLTP Control Panel has circuitry for 34 pushbuttons. To scan the keyboard, the microprocessor on the CPU board performs read cycles that enable KRD_SEL. The three least significant address bits (A0-A2) are connected to the input of the decoder (U4 pins 1, 2, and 3). One of the eight low-active outputs of the decoder is selected by placing the appropriate address on the input of the decoder.

4.4 MLTP2 Switchcard Assembly Continued:

Keyboard Scan Continued:

Although the RCP-MLTP2 Control Panel only uses rows 0-4, the CPU still scans all eight rows. Each row of pushbuttons contains up to eight individual switches. Example: KB_ROW0 will simultaneously enable pushbuttons S1-S8. If any of these switches are pressed, the low-active signal will be passed through the pushbutton contacts to one of the eight column signals (KB_COL0-KB_COL7). If the pushbutton is not pressed, the switch contacts are broken and the column signal will be pulled high by resistor pack RP11. The KRD_SEL signal enables U3 to place the KB_COL signals on the data bus. Thus, by placing 000 on A0, A1, and A2 and then asserting KRB_SEL, the CPU can determine the state of pushbuttons S1-S8 by looking at the state of data bits D0-D7. If S1 is pressed, then D0 will be low. Likewise, if S2 is pressed, D1 will be low. The status of the entire keyboard array may be determined by performing successive reads of each row of the array.

LCD Display

The input signals to the LCD display are provided by U7. U7, the microprocessor, places a eight bit ASCII character on signal lines D0-D7 (U1 pins 7-14). U7 also drives the DSP_RS, register select, line. When DSP_RS is in the high logic state U1, the LCD display, is receiving commands. When DSP_RS is in the low logic state U1 is interpreting data. U7 provides the DSP_RW , display read/write signal to U1 pin 5. As DSP_RW pulses U1 reads the data on D0-D7 and writes the data to the selected display. As a final step, U7 pulses DSP_SEL (U1 pin 6) low to latch the data on DO-D7 into the display chip. The LCD chip contains the decoding and drive circuitry necessary to translate the ASCII character code into the segment drive signals. Variable resistor R2 provides a means to adjust the contrast of the LCD display. Q1, Q2, and their associated resistors provide a current source for the LCD backlight. Brightness of the backlight is controlled by R10.

RS-485 Communications

Communication between the panel and the system controller is accomplished by the 68HC11 internal Serial Communication Interface (SCI). The SCI is an asynchronous receiver/transmitter, sometimes referred to as a UART. The RS-485 standard is used for the electrical interface between panels and the system controller. A 75ALS176 (U9) chip is used to convert between RS-485 and the levels required by the SCI. Transmit data (TXD) is presented by the SCI on U7 pin 21. This signal drives the input to

4.4 MLTP2 Switchcard Assembly Continued:

RS-485 Communications Continued:

the RS-485 transceiver on U9 pin 4. Data received from the system controller is converted to the appropriate levels by the RS-485 transceiver and presented on U9 pin 1. This received data (RXD) signal is then fed to the SCI receiver at U7 pin 20. Since the RS-485 interface requires the transmitter to be tri-stated when not in use, a third signal is required to enable/disable the RS-485 transmitter. The processor provides the TX_ENABLE signal under software control at U7 pin 25. This signal is connected to the RS-485 transceiver at U9 pin 3. When TX_ENABLE is asserted (high), U9 drives the RS-485 bus (U9 pins 6 and 7 to J2 pins 1 and 3). When TX_ENABLE is negated (low), U9 ceases driving the bus and allows other devices to drive the bus. During reset, the TX_ENABLE signal from the processor is initialized to an input and is not driven to a particular state. A pull-down resistor R6 has been added to ensure that U9 does not drive the RS-485 bus during power-up or other reset conditions. A shield connection is provided for the RS-485 bus on J2 pin 2. The shield is connected to ground through a input filter. Input filters are also used to eliminate unwanted noise on the RS-485 data signals.

5.1 General

The RCP-MLTP Control Panels are solid state electro-mechanical devices designed to give long, trouble free service with minimum maintenance requirements. If problems do occur, follow the troubleshooting procedure provided. If additional technical assistance is required, refer to the general assistance and service information in the front of this manual.

NOTICE

THIS EQUIPMENT CONTAINS STATIC SENSITIVE DEVICES. IT IS RECOMMENDED THAT A GROUNDED WRIST STRAP AND MAT BE USED WHILE MAKING REPAIRS.

5.2 Preventive Maintenance

There is little need for performing preventive maintenance on the RCP-MLTP Control Panels other than the normal care which should be given to any high quality electronic equipment.

5.3 Test Equipment

The test equipment recommended for servicing the RCP-MLTP Control Panels is listed in Table 5-1. Equivalent test equipment may be used.

Table 5-1 Test Equipment Table

EQUIPMENT	FUNCTION
Oscilloscope - 20MHz or Higher	Waveform Monitoring and Tracing
VOM - 20,000 Ohm per Volt or Higher	Voltage and Resistance Measurements

5.4 Corrective Maintenance

The following paragraphs provide information to assist the servicing technician in the maintenance of the RCP-MLTP Control Panels. The functional description (Section 4) contains assembly and circuit level information to help identify specific problems.

5.4 Corrective Maintenance Continued:

Factory Repair Service

If desired, equipment items or assemblies may be returned to the PESA factory (transportation prepaid) for repair. Refer to the General Assistance and Service Information Sheet found in the front of this manual. Call the PESA Service Department (the phone number is listed on Service Information Sheet) for a RMA number prior to shipping an equipment item to the PESA factory for repair.

NOTE

PACK THE EQUIPMENT SECURELY AND LABEL WITH THE CORRECT ADDRESS. PROPER PACKAGING SAVES MONEY. THE SMALL AMOUNT OF EXTRA CARE AND TIME IT TAKES TO CUSHION A PART OR UNIT PROPERLY MAY PREVENT COSTLY DAMAGE WHILE IN TRANSIT. MAKE CERTAIN THAT THE ADDRESS IS BOTH LEGIBLE AND COMPLETE. FAILURE TO DO SO OFTEN RESULTS IN DELAY OR EVEN LOSS.

Adjustment/Alignment

The RCP-MLTP Control Panels provide adjustment for LCD display brightness and contrast through the front of the control panels. Adjust per your preference.

Troubleshooting

Troubleshooting the RCP-MLTP Control Panels requires the routing switcher system to be used as a test fixture. The RCP-MLTP Control Panels will not function except as part of routing switcher system. The only troubleshooting which can be accomplished without opening the control panels is to check input power (from plug-in power supply).

To open a control panel for troubleshooting, remove the front cover and disassemble the unit as far as required to gain access to the component side of the circuit assemblies. Place the disassembled panel on a nonconductive surface and arrange the parts so the unit can be operated. You must be able to operate the push-buttons and observe the resulting status indicators. You must also have sufficient access to the circuit assemblies to measure voltage or observe waveforms.

Procedure: Put the RCP-MLTP Control Panels through the operating sequence as described in operation section of this manual. Refer to Section 3.

5.4 Corrective Maintenance Continued:

Troubleshooting Continued:

If the control panel is unresponsive, there may be a power problem of the microprocessor on the Remote CPU Assembly is not operating.

1. Refer to the **Power Distribution** discussion in Section 4. Refer to the **Remote CPU Assembly Schematic** in Section 6 if it is necessary to make voltage checks at the chip or component level.

2. If the power functioning properly, the microprocessor is not functioning. The microprocessor requires a clock, a power-up reset, and communications from the system controller. Refer to the Remote CPU Assembly functional description in Section 4.

For partial failures:

1. Push-button switches fail to initiate the desired operation. Refer to the Remote CPU Assembly functional description in Section 4. **NOTE:** If a source input fails to function it may be a blocked input. Check the system configuration at the system controller.

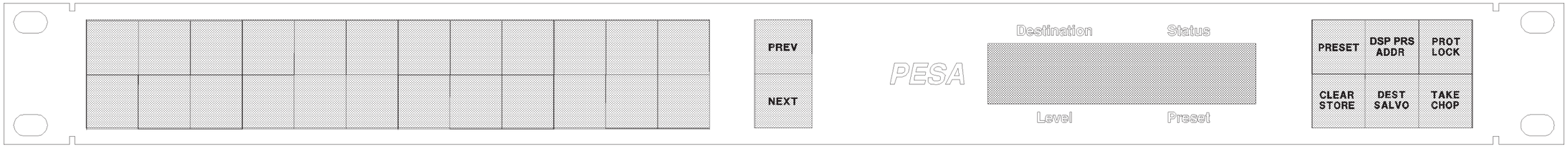
2. Control indicators fail to light. Refer to the LED Driver discussion in the functional description section.

3. Almost any type of functional failure can be caused by a memory failure. This type of failure can easily be checked if a substitute chip is available.

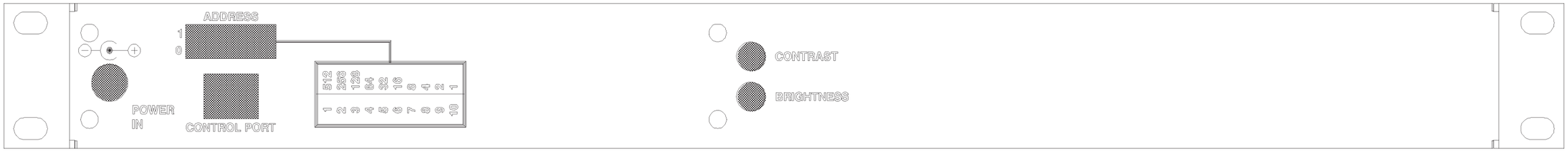
6.1 Schematics

General

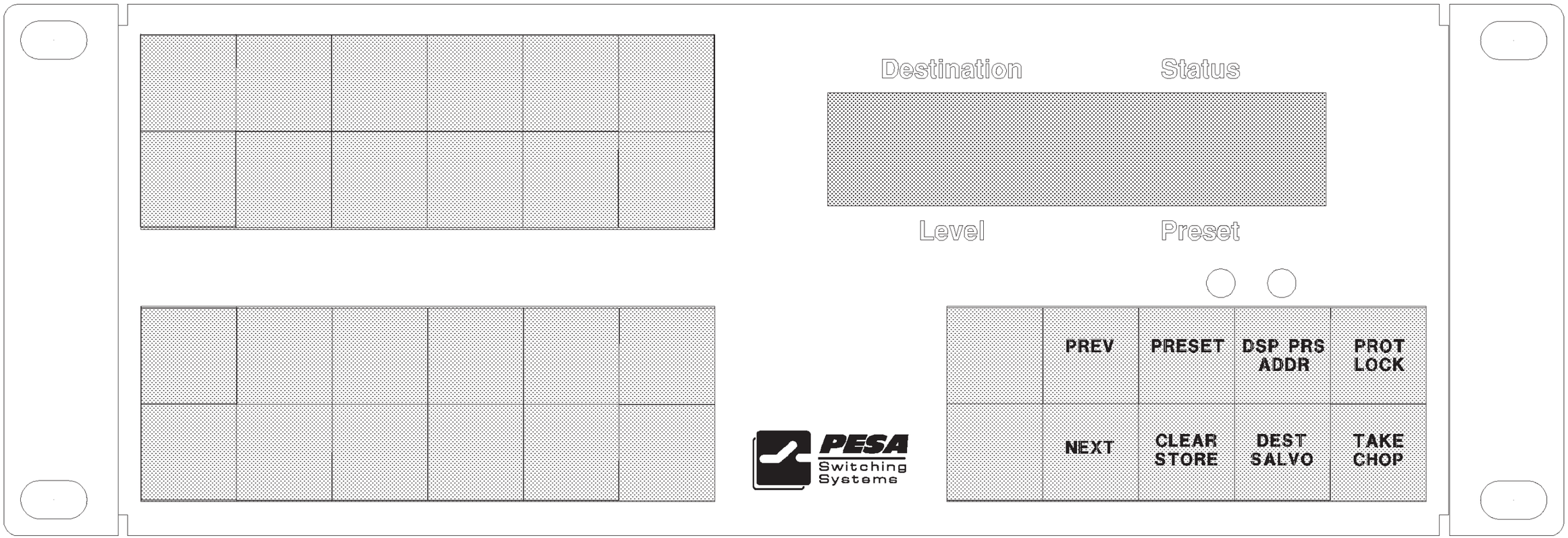
This section contains the schematic diagrams and parts location diagrams for the RCP-MLTP Control Panels. Please refer to this section when troubleshooting the equipment or replacing defective parts.



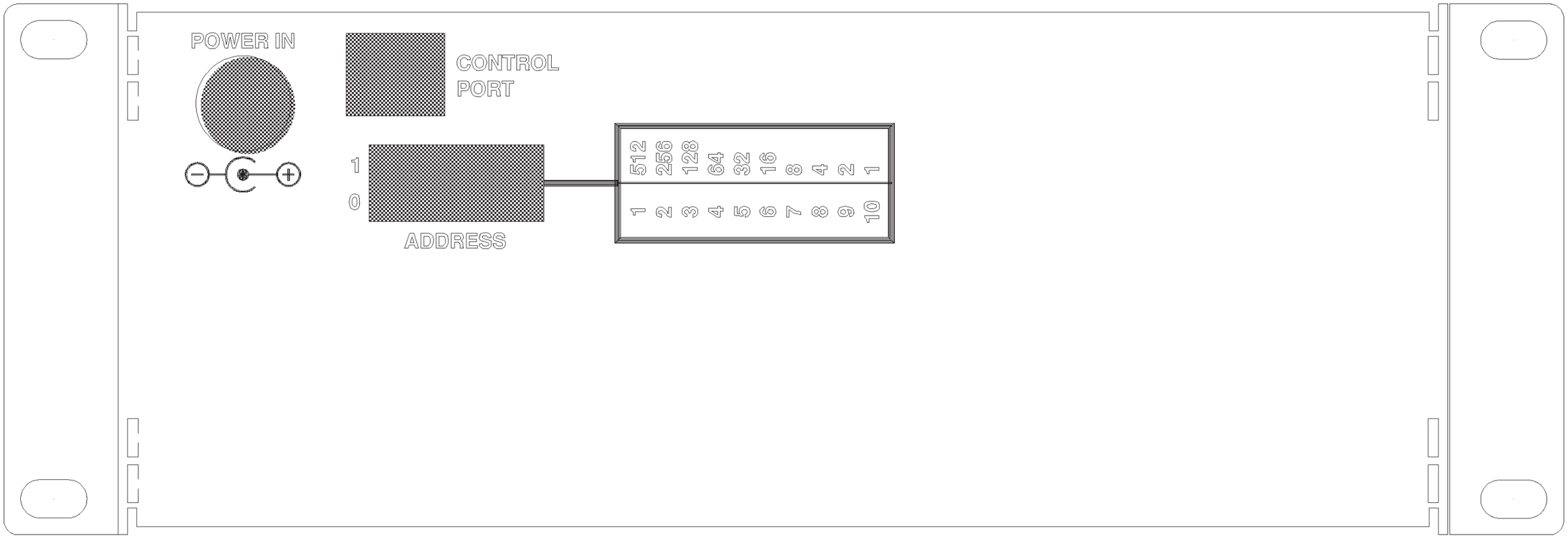
RCP-MLTP Control Panel Front View



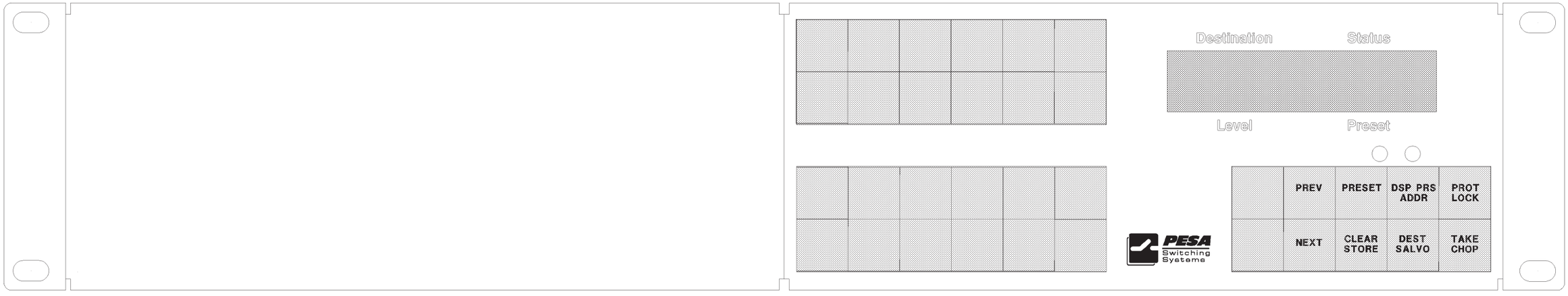
RCP-MLTP Control Panel Rear View



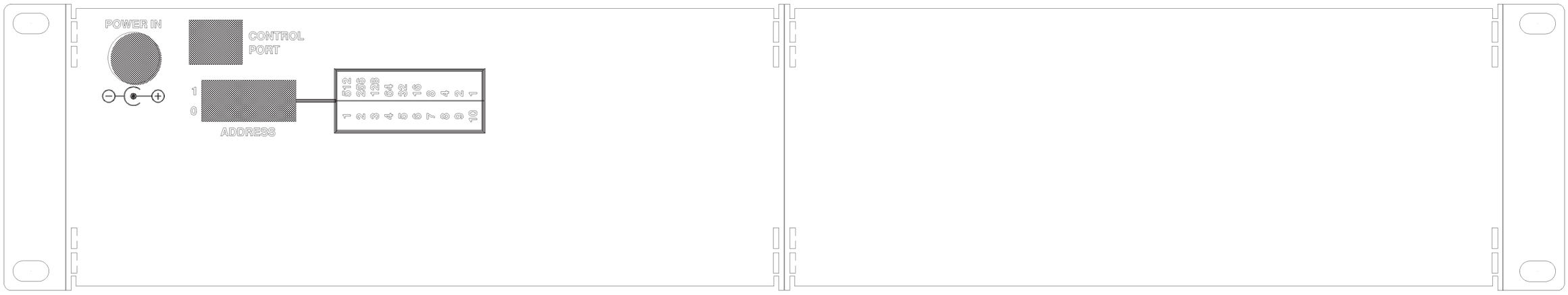
RCP-MLTP2 Half Rack Front View



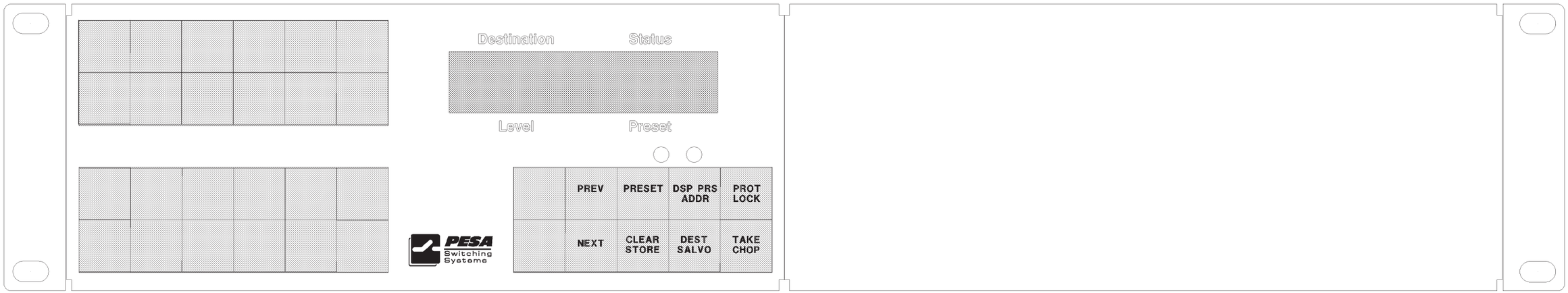
RCP-MLTP2 Half Rack Rear View



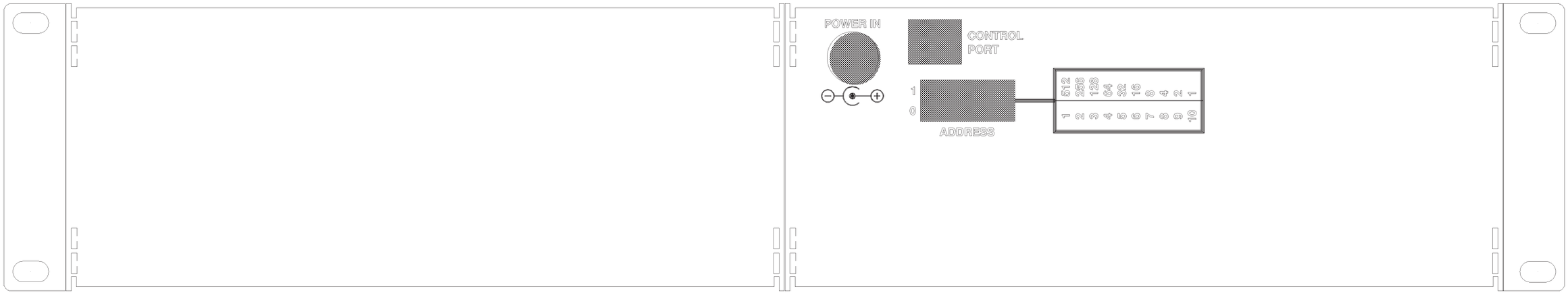
RCP-MLTP2 Right Hand Front View



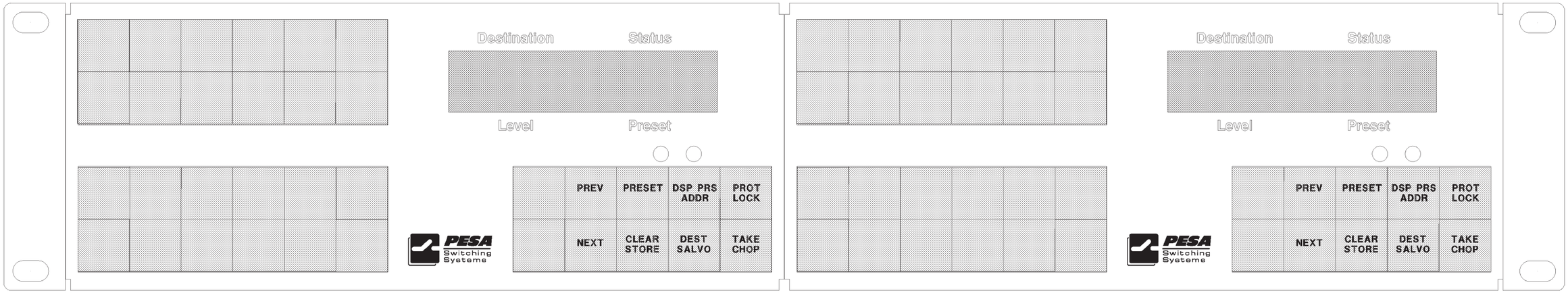
RCP-MLTP2 Right Hand Rear View



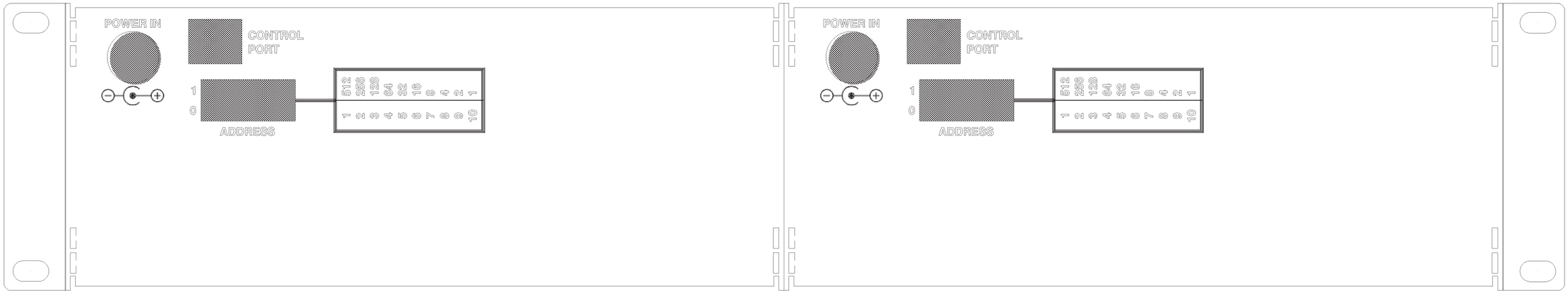
RCP-MLTP2 Left Hand Front View



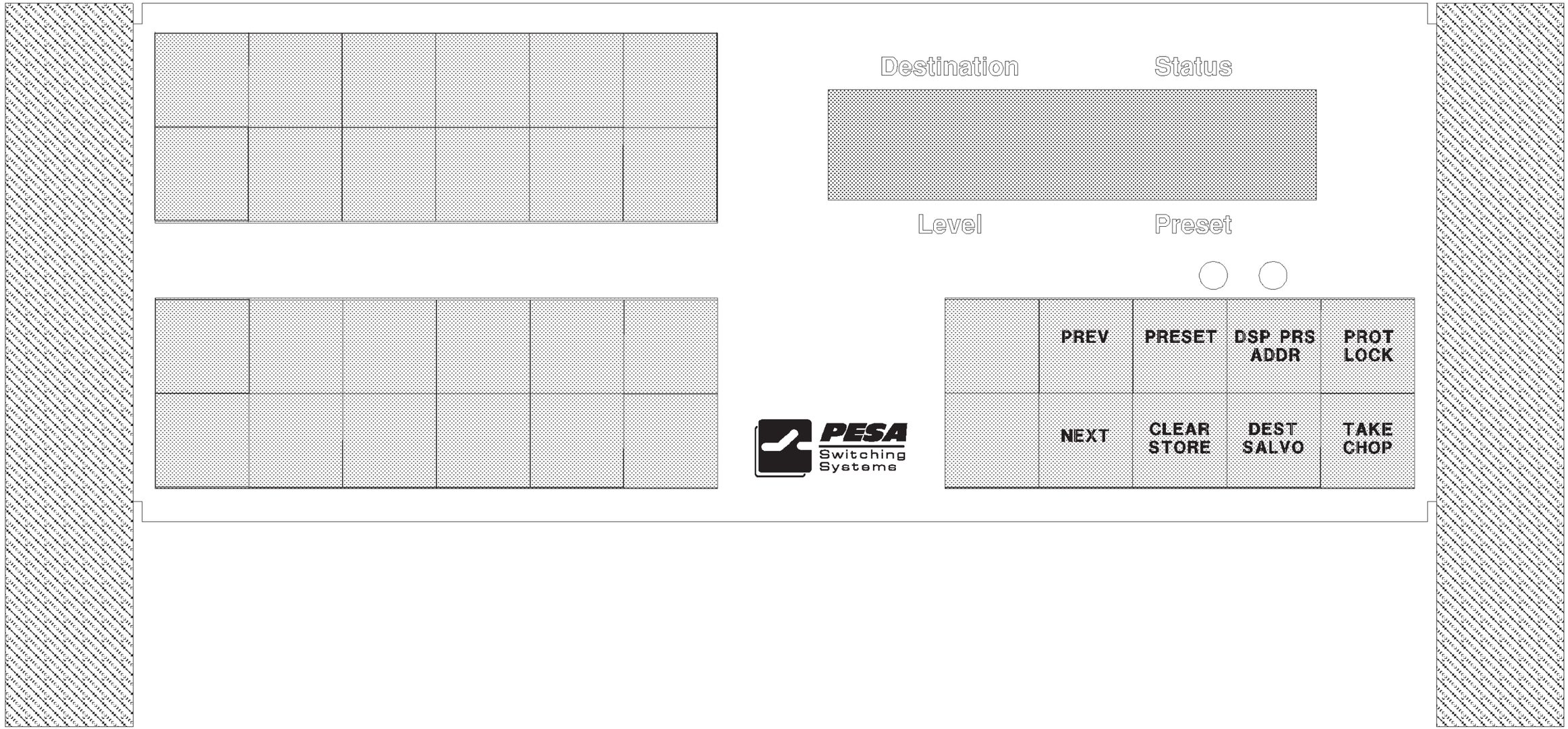
RCP-MLTP2 Left Hand Rear View



RCP-MLTP2 Dual Front View



RCP-MLTP2 Dual Rear View

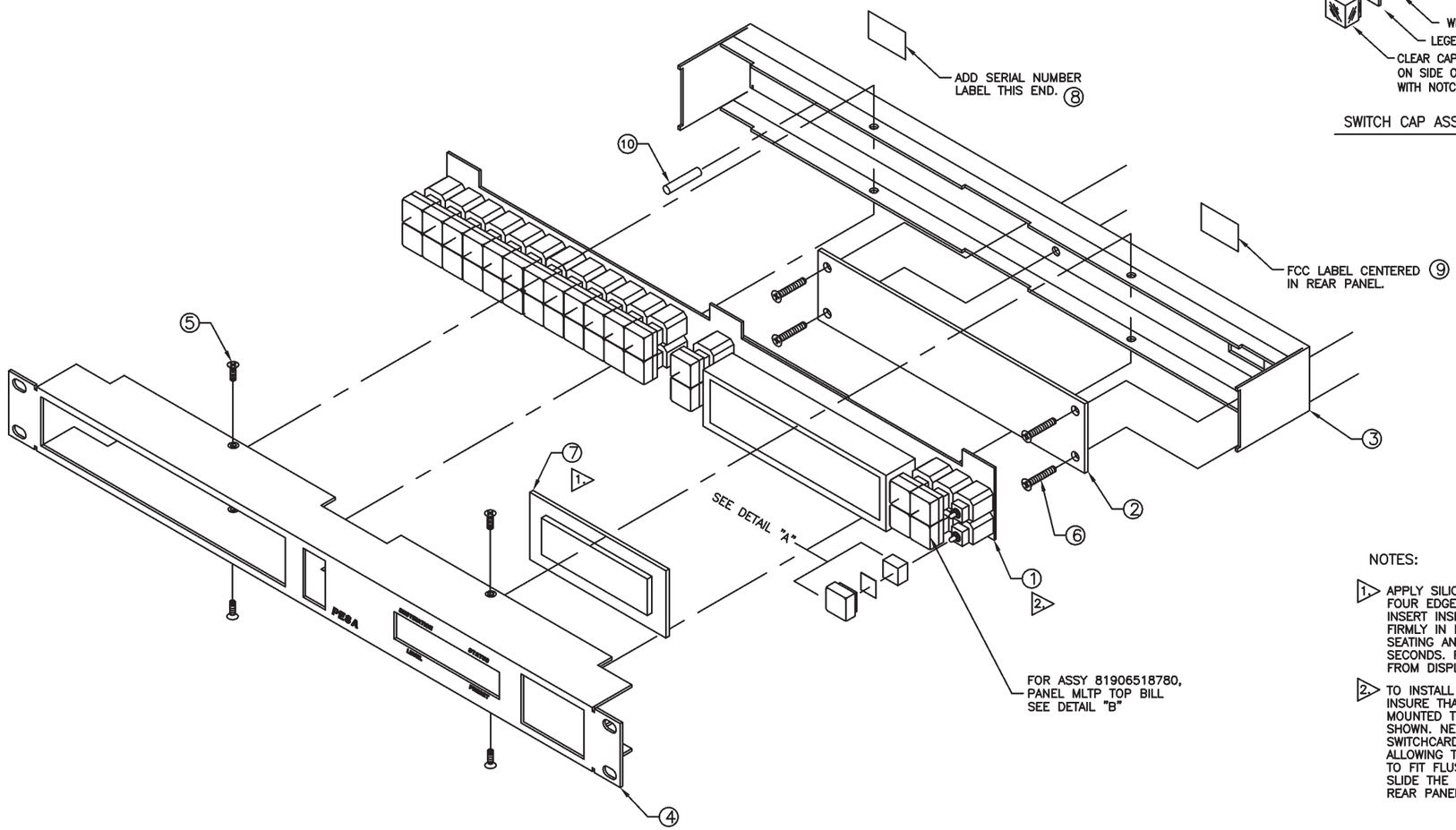


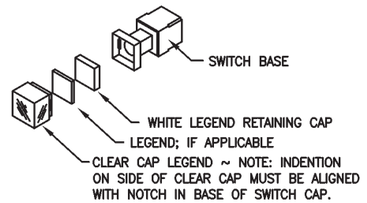
RCP-MLTP2 Desk Mount Front View

RCP-MLTP2 Desk Mount Rear View

NO	PART NUMBER	DESCRIPTION	QTY	UNIT
10	81902003420	STANDOFF 15/16	1.0	EA
9	81902101500	FCC – NON–COMPLIANT	1.0	EA
8	81902101468	SERIAL LABEL	1.0	EA
7	81903462320	DISPLAY COVER	1.0	EA
6	81902202696	7/16 X 4–40 PAN HD	4.0	EA
5	81902201433	3/16 X 4–40 FLAT HD	4.0	EA
4	81903462260	FRONT PANEL	1.0	EA
3	81903462300	REAR	1.0	EA
2	81906515410	PCB ASSY. CPU	1.0	EA
1	81906515380	SWITCHCARD ASSY	1.0	EA

HARDWARE SCHEDULE

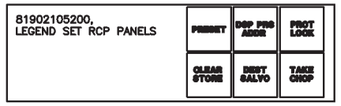




SWITCH CAP ASSEMBLY – DETAIL "A"

NOTES:

1. APPLY SILICON ADHESIVE AROUND ALL FOUR EDGES OF DISPLAY WINDOW AND INSERT INSIDE METAL OPENING, PRESS FIRMLY IN PLACE INSURING PROPER SEATING AND HOLD TIGHT FOR THIRTY SECONDS. REMOVE ANY EXCESS SILICON FROM DISPLAY WINDOW IMMEDIATELY.
2. TO INSTALL SWITCHCARD TO REAR PANEL, FIRST INSURE THAT THE CPU BOARD, ITEM 2, HAS BEEN MOUNTED TO THE REAR PANEL WITH 4 SCREWS AS SHOWN. NEXT, ALIGN THE CONNECTOR PINS ON THE SWITCHCARD TO THE CPU CARD AND PRESS FIRMLY ALLOWING THE NOTCHED EDGES OF THE SWITCHCARD TO FIT FLUSH INSIDE THE REAR PANEL SLOTS. SLIDE THE FRONT PANEL OVER THE INDENTS OF THE REAR PANEL AND SECURE WITH 4 SCREWS AS SHOWN.



NOTE: WHEN CUTTING LEGENDS, COMPLETELY REMOVE BORDER

BUTTON LEGEND SET – DETAIL "B"

Configuration Drawing • RCP-MLTP Control Panel Assembly • CD63-0701

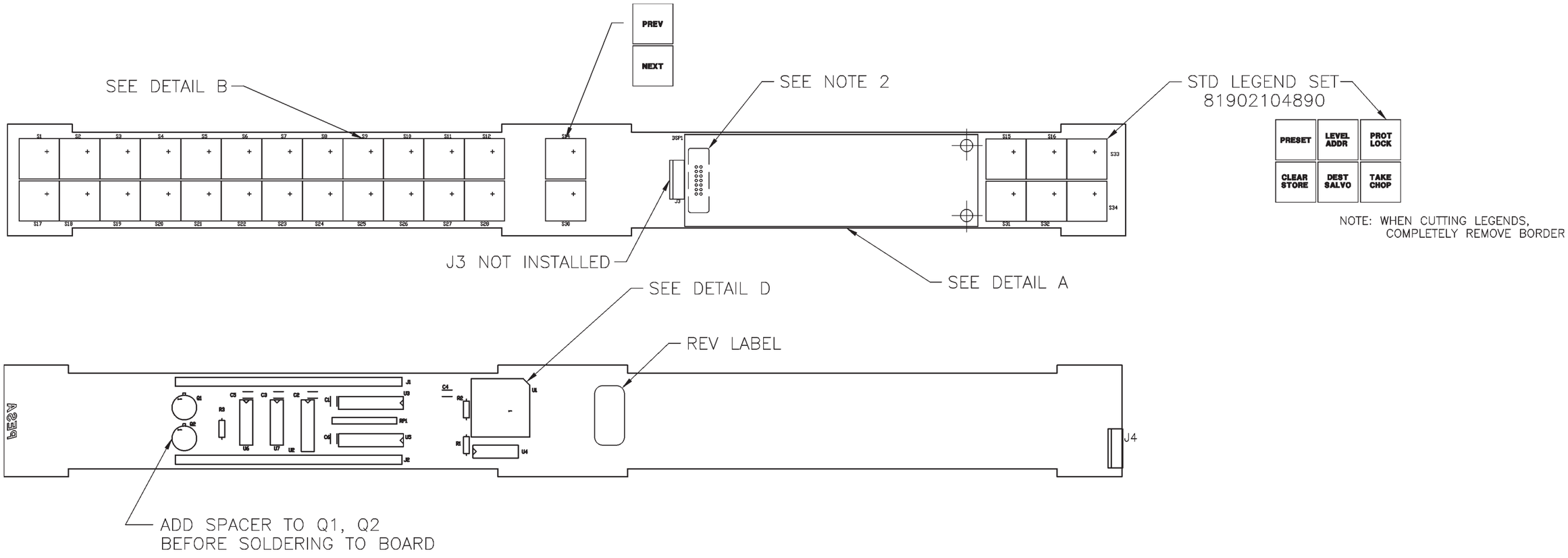
DRAWING NOT AVAILABLE AT THE TIME OF PRELIMINARY PRINTING

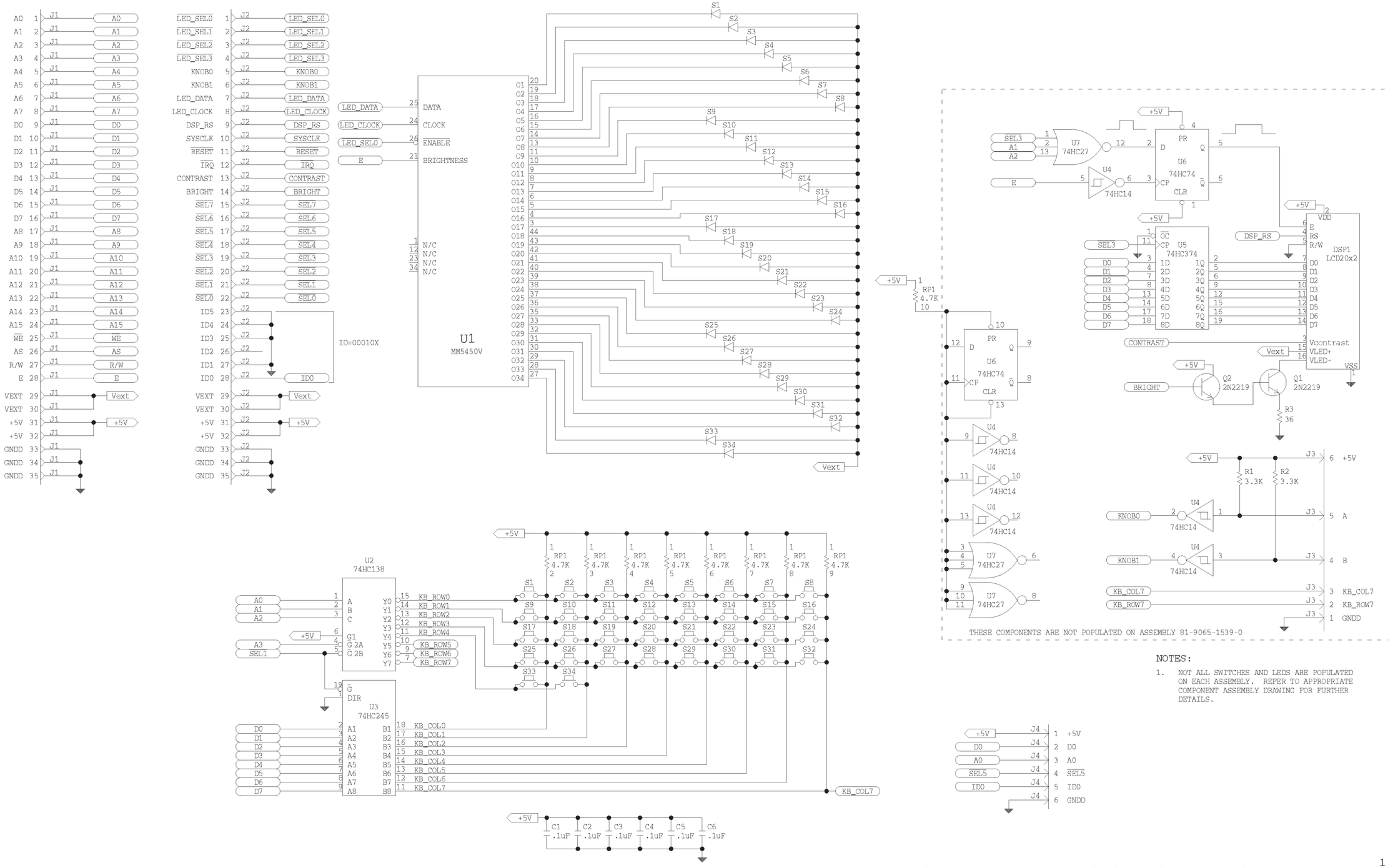
DRAWING NOT AVAILABLE AT THE TIME OF PRELIMINARY PRINTING

DRAWING NOT AVAILABLE AT THE TIME OF PRELIMINARY PRINTING

DRAWING NOT AVAILABLE AT THE TIME OF PRELIMINARY PRINTING

DRAWING NOT AVAILABLE AT THE TIME OF PRELIMINARY PRINTING

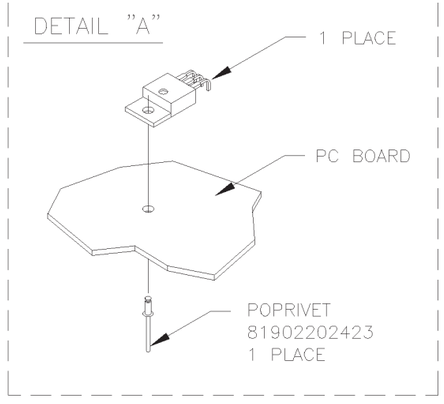

PREV
NEXT
SEE DETAIL B
SEE NOTE 2
STD LEGEND SET
81902104890
PRESET
LEVEL ADDR
PROT LOCK
CLEAR STORE
DEST SALVO
TAKE CHOP
NOTE: WHEN CUTTING LEGENDS, COMPLETELY REMOVE BORDER
J3 NOT INSTALLED
SEE DETAIL A
SEE DETAIL D
REV LABEL
J4
ADD SPACER TO Q1, Q2
BEFORE SOLDERING TO BOARD

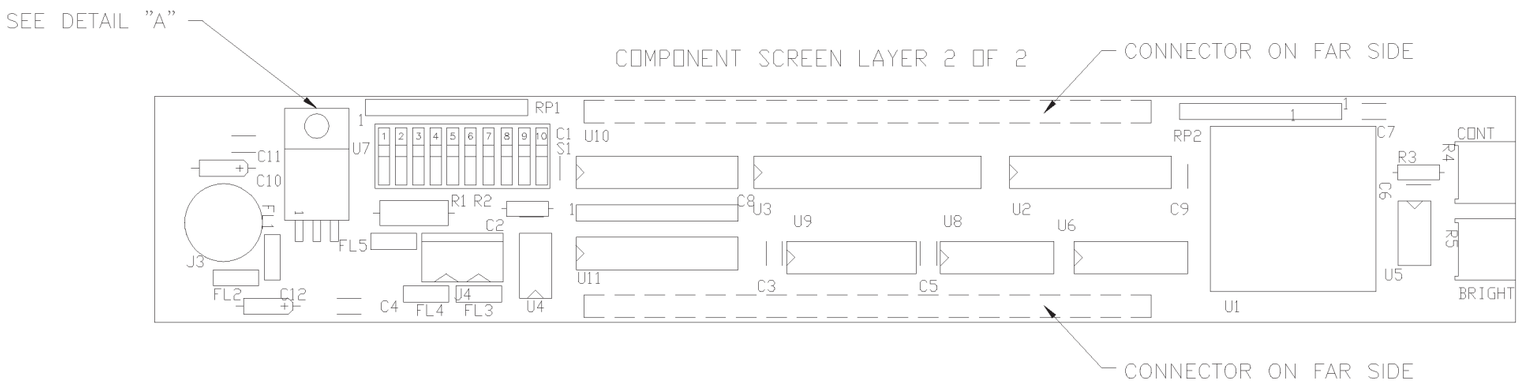


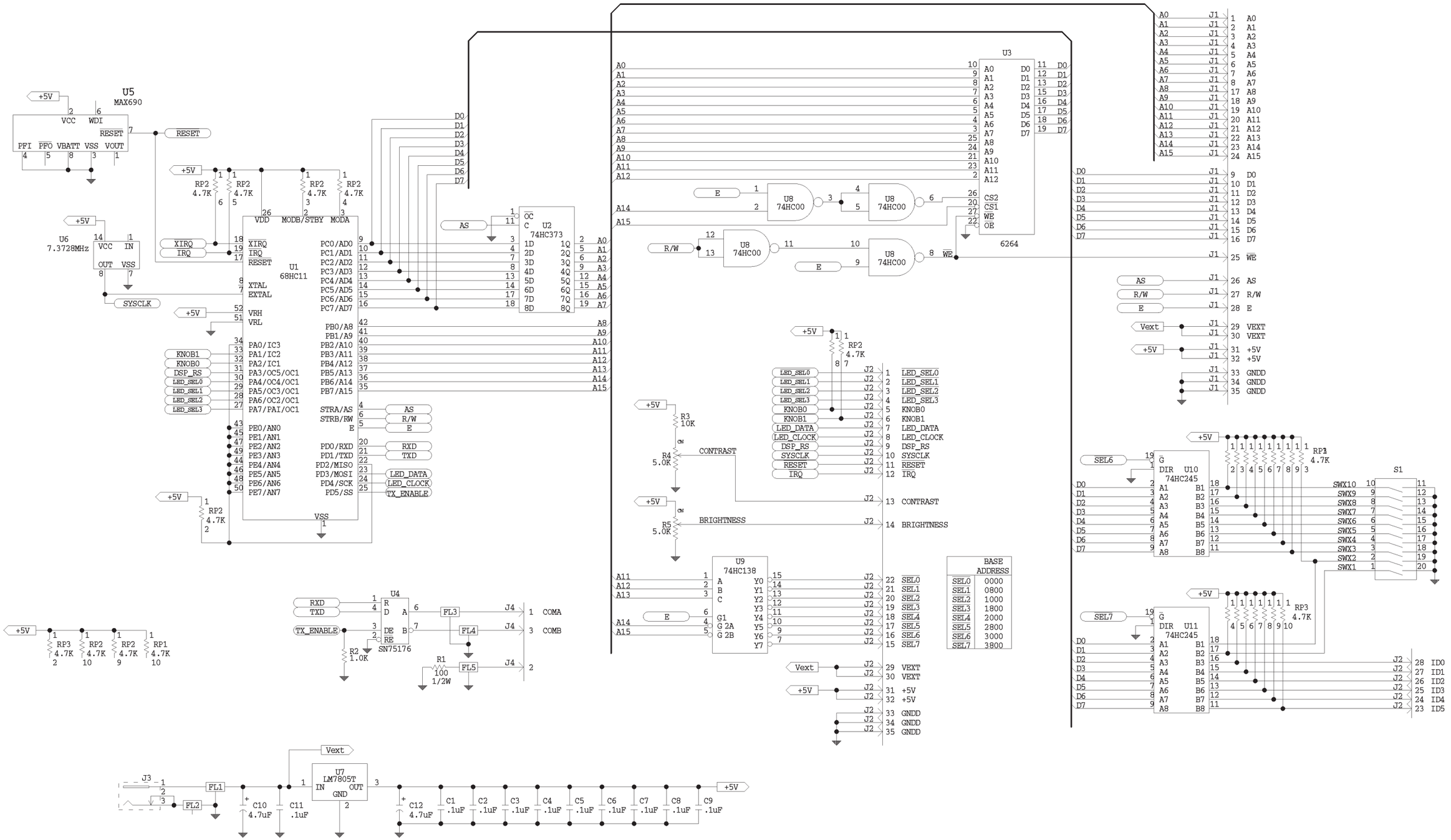
NOTES:

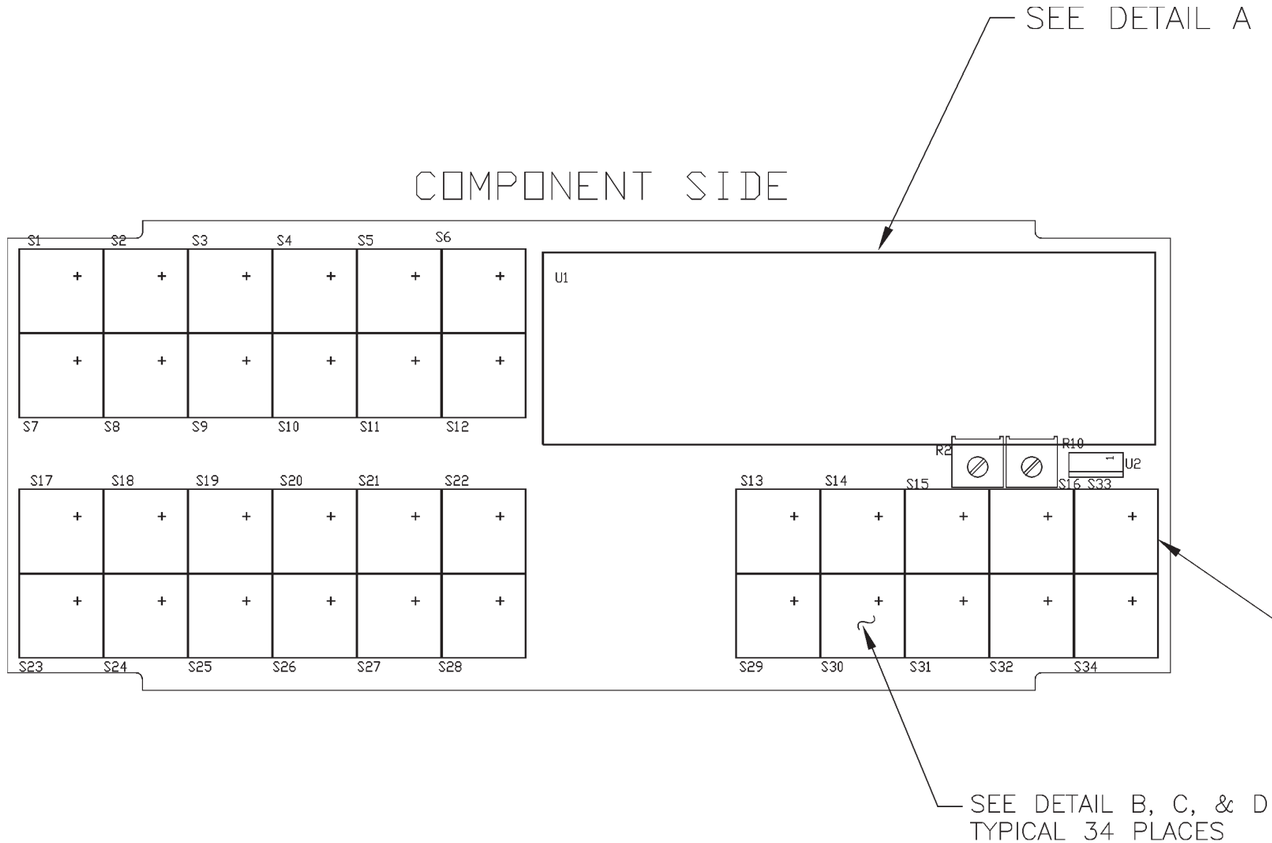
1. NOT ALL SWITCHES AND LEDS ARE POPULATED ON EACH ASSEMBLY. REFER TO APPROPRIATE COMPONENT ASSEMBLY DRAWING FOR FURTHER DETAILS.


COMPONENT SCREEN LAYER 1 OF 2
J1
J2
ADD REVISION LABEL
TO NEAR SIDE.


DETAIL "A"
1 PLACE
PC BOARD
POPRIVET
81902202423
1 PLACE


SEE DETAIL "A"
COMPONENT SCREEN LAYER 2 OF 2
CONNECTOR ON FAR SIDE
CONNECTOR ON FAR SIDE
RP1
U10
C1
S1
U7
C11
C10
J3
FL1
FL2
C12
FL5
R1 R2
C2
C4
FL4
FL3
U4
U4
C8
U3
U9
U11
C3
U8
C5
U6
U2
C9
RP2
U1
C7
C6
R3
U5
CONT
K2
K5
BRIGHT

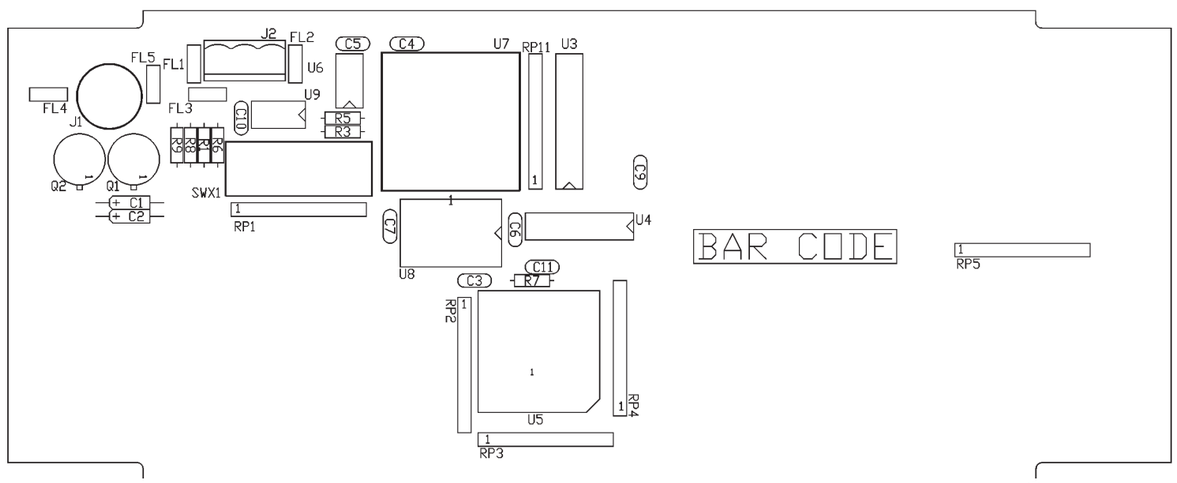

U5
MAX690
+5V
VCC
WDI
RESET
PFI
PFO
VBATT
VSS
VOUT
U6
7.3728MHz
SYSCLK
U1
68HC11
VDD
MODB/STBY
MODA
XTAL
EXTAL
VRH
VRL
XIRQ
IRQ
RESET
PA0/IC3
PA1/IC2
PA2/IC1
PA3/OC5/OC1
PA4/OC4/OC1
PA5/OC3/OC1
PA6/OC2/OC1
PA7/PAI/OC1
PE0/AN0
PE1/AN1
PE2/AN2
PE3/AN3
PE4/AN4
PE5/AN5
PE6/AN6
PE7/AN7
PC0/AD0
PC1/AD1
PC2/AD2
PC3/AD3
PC4/AD4
PC5/AD5
PC6/AD6
PC7/AD7
PB0/A8
PB1/A9
PB2/A10
PB3/A11
PB4/A12
PB5/A13
PB6/A14
PB7/A15
STRA/AS
STRB/RW
E
PD0/RXD
PD1/TXD
PD2/MISO
PD3/MOSI
PD4/SCK
PD5/SS
VSS
KNOB1
KNOB0
DSP_RS
LED_SEL0
LED_SEL1
LED_SEL2
LED_SEL3
RXD
TXD
LED_DATA
LED_CLOCK
TX_ENABLE
RP2
4.7K
U2
74HC373
AS
U3
6264
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A14
A15
D0
D1
D2
D3
D4
D5
D6
D7
CS2
CS1
WE
OE
R/W
U8
74HC00
J1
Vext
GNDD
R3
10K
R4
5.0K
CONTRAST
R5
5.0K
BRIGHTNESS
J2
U9
74HC138
SEL0
SEL1
SEL2
SEL3
SEL4
SEL5
SEL6
SEL7
BASE ADDRESS
0000
0800
1000
1800
2000
2800
3000
3800
U4
SN75176
R2
1.0K
R1
100
1/2W
FL3
FL4
FL5
J4
COMA
COMB
U7
LM7805T
IN
OUT
GND
J3
FL1
FL2
C10
4.7uF
C11
.1uF
C12
4.7uF
C1
C2
C3
C4
C5
C6
C7
C8
C9
U10
74HC245
U11
74HC245
SEL6
SEL7
RP1
RP3
S1
SWX1
SWX2
SWX3
SWX4
SWX5
SWX6
SWX7
SWX8
SWX9
SWX10
ID0
ID1
ID2
ID3
ID4
ID5



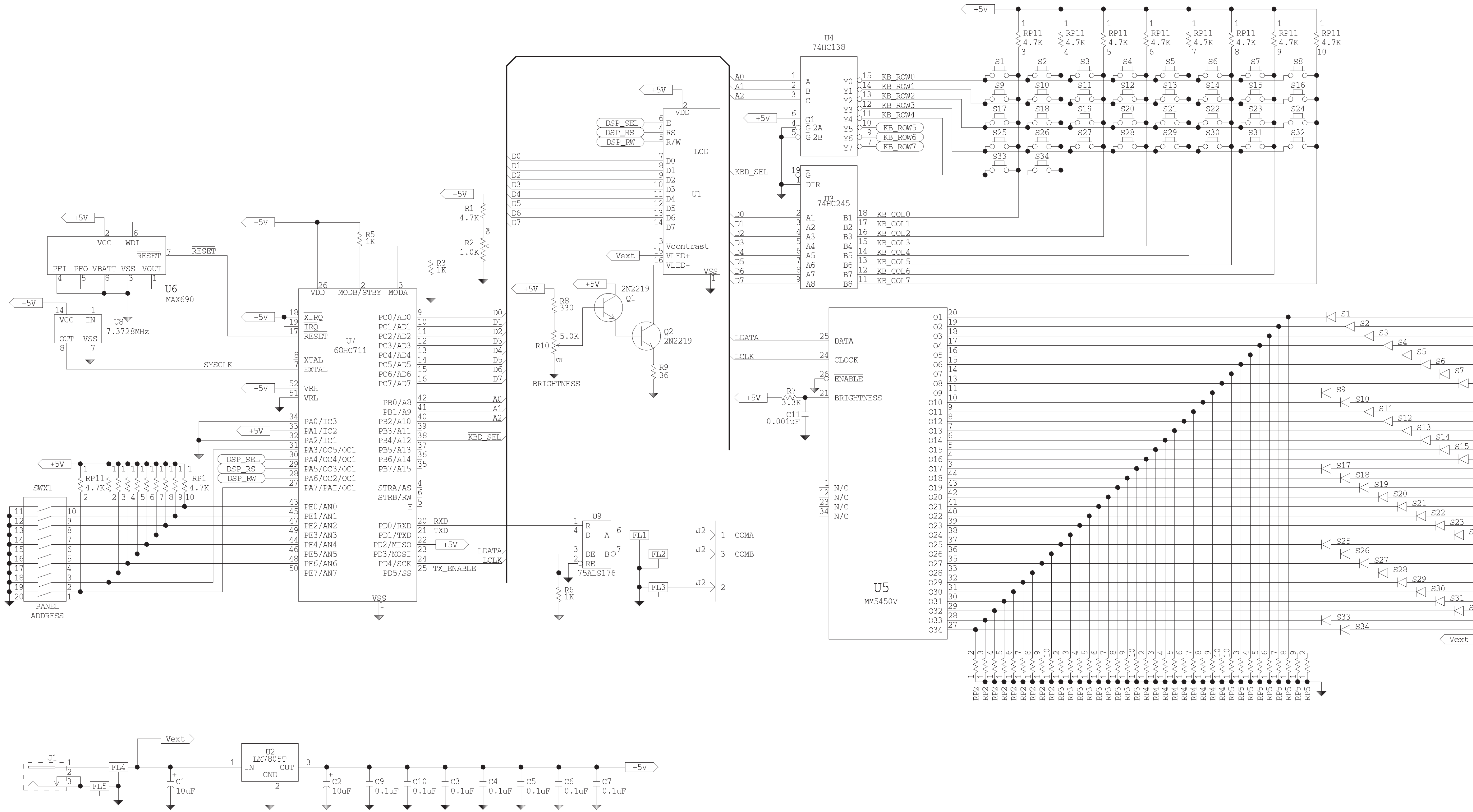
BUTTON LEGEND 81902105200

S14	S15	S16	S33
PREV	PRESET	DSP PRS ADDR	PROT LOCK
NEXT	CLEAR STORE	DEST SALVO	TAKE CHOP
S30	S31	S32	S34

NOTE: WHEN CUTTING LEGENDS, COMPLETELY REMOVE BORDER



Component Assembly • RCP-MLTP2 Switchcard Assembly • CA25-1348



Schematic • RCP-MLTP2 Switchcard Assembly • SC33-1348

7.1 Parts List

General

The Parts List in this section have been grouped according to each assembly associated with the RCP-MLTP Control Panels. Refer to each list by name of card, board, or section of the equipment requiring replacement parts.

RCP-MLTP Control Panel Assembly - 81906515330

81902003420	STANDOFF 4-40x15/16 NYLON	1	EA
81902101468	LABEL EQUIP SERIALIZATION	1	EA
81902101500	LABEL WARNING FCC-EMI	1	EA
81902105290	MAGNETIC STRIP FOR RCP'S	2	EA
81902201433	SCREW 4-40x3/16 FLT HD PH	4	EA
81902202696	SCREW 4-40x7/16 SIMM PANH	4	EA
81902907800	CONN 3 POS w/STRAIN RELIE	1	EA
81903462260	FRONT PANEL TOUCHPAD X/Y	1	EA
81903462300	REAR PANEL 1 RU CHASSIS	1	EA
81903462320	DISPLAY COVER 20x2 X/Y	1	EA
81906515380	SWITCH CARD TOUCHPAD RC50	1	EA
81906515410	REMOTE CPU ROTARY MB CARD	1	EA
81906515550	SOFT ASSY RCP PANELS 93	1	EA
CD63-0701	DOC PANEL TOUCHPAD X/Y	0	EA

RCP-MLTP2 Half Rack Assembly - 81906518950

81902101468	LABEL EQUIP SERIALIZATION	1	EA
81902101500	LABEL WARNING FCC-EMI	1	EA
81902202647	SCREW 4-40x1/4 SIMM PANHD	8	EA
81902907800	CONN 3 POS w/STRAIN RELIE	1	EA
81903462630	SHIELD SDA5000 MATRIX CD.	1	EA
81903464750	MOUNTING BRACKET MLTP2	2	EA
81903464760	REAR MLTP2 PANEL	1	EA
81903464770	FRONT MLTP2 PANEL	1	EA
81906516860	SOFT ASSY RCP-STAT PANEL	0	EA
81906518770	SWITCH CARD MLTP ASSEMBLY	1	EA

RCP-MLTP2 Right Hand Assembly - 81906518970

81902101468	LABEL EQUIP SERIALIZATION	1	EA
81902101500	LABEL WARNING FCC-EMI	1	EA
81902202647	SCREW 4-40x1/4 SIMM PANHD	12	EA
81902907800	CONN 3 POS w/STRAIN RELIE	1	EA
81903462630	SHIELD SDA5000 MATRIX CD.	1	EA
81903464750	MOUNTING BRACKET MLTP2	2	EA
81903464760	REAR MLTP2 PANEL	2	EA
81903464770	FRONT MLTP2 PANEL	1	EA
81903464880	BLANK FRONT MLTP2 PANEL	1	EA
81906516860	SOFT ASSY RCP-STAT PANEL	0	EA
81906518770	SWITCH CARD MLTP ASSEMBLY	1	EA

RCP-MLTP2 Left Hand Assembly - 81906518960

81902101468	LABEL EQUIP SERIALIZATION	1	EA
81902101500	LABEL WARNING FCC-EMI	1	EA
81902202647	SCREW 4-40x1/4 SIMM PANHD	12	EA
81902907800	CONN 3 POS w/STRAIN RELIE	1	EA
81903462630	SHIELD SDA5000 MATRIX CD.	1	EA
81903464750	MOUNTING BRACKET MLTP2	2	EA
81903464760	REAR MLTP2 PANEL	2	EA
81903464770	FRONT MLTP2 PANEL	1	EA
81903464880	BLANK FRONT MLTP2 PANEL	1	EA
81906518770	SWITCH CARD MLTP ASSEMBLY	1	EA

RCP-MLTP2 Dual Assembly - 81906518980

81902101468	LABEL EQUIP SERIALIZATION	1	EA
81902101500	LABEL WARNING FCC-EMI	1	EA
81902202647	SCREW 4-40x1/4 SIMM PANHD	12	EA
81902907800	CONN 3 POS w/STRAIN RELIE	1	EA
81903462630	SHIELD SDA5000 MATRIX CD.	2	EA
81903464750	MOUNTING BRACKET MLTP2	2	EA
81903464760	REAR MLTP2 PANEL	2	EA
81903464770	FRONT MLTP2 PANEL	2	EA
81906516860	SOFT ASSY RCP-STAT PANEL	0	EA
81906518770	SWITCH CARD MLTP ASSEMBLY	1	EA

RCP-MLTP2 Desk Mount Assembly - 81906518940

81902101187	RUBBER FEET FOR DM 831203	4	EA
81902101468	LABEL EQUIP SERIALIZATION	1	EA
81902101500	LABEL WARNING FCC-EMI	1	EA
81902201748	SCREW 4-40x1 BTN HD BLK	8	EA
81902907800	CONN 3 POS w/STRAIN RELIE	1	EA
81903462630	SHIELD SDA5000 MATRIX CD.	1	EA
81903464760	REAR MLTP2 PANEL	1	EA
81903464770	FRONT MLTP2 PANEL	1	EA
81903464800	WOOD END MLTP2 DESK TOP	1	EA
81906516860	SOFT ASSY RCP-STAT PANEL	0	EA
81906518770	SWITCH CARD MLTP ASSEMBLY	1	EA

RCP-MLTP Switchcard Assembly - 81906515380

81900200312	RESISTOR 36 OHM 5% 1/4W	1	EA
81900200783	RESISTOR 3.3K 5% 1/4W	3	EA
81900600958	SIP 4.7K 10-PIN 9 RESISTR	1	EA
81900700055	CAP 0.1MF 50V CERAM RADIL	6	EA
81900700238	CAP 0.001MF 1000V CERAM	1	EA
81901400010	TRANS 2N2219A NPN TO-5	2	EA
81901604314	IC 74HC245 CMOS BUSTRANSV	1	EA
81901604777	IC 74HC74 DUAL D FLIP FLO	1	EA
81901604827	IC 1of8 DECODER/MULTIPLXR	1	EA
81901605139	IC 74HC374 OCTL D-FLIP FL	1	EA
81901606850	IC 74HC14 HEX SCHMTT TRGR	1	EA
81901606870	IC 5450 34 SEG LED DRVR	1	EA
81901606890	IC 74HC27 TRIPEL 3-IN NOR	1	EA
81902000546	STANDOFF 7/16x4-40 ROUND	2	EA
81902001122	STANDOFF 9/16x4-40 ROUND	1	EA
81902101930	LENS ASSY BKC-6	32	EA
81902104890	LEGEND SET CONTROL PANEL	1	EA
81902202647	SCREW 4-40x1/4 SIMM PANHD	5	EA
81902411860	PCB SWXCARD ROTARY X/Y	1	EA
81902600584	SWITCH PB	32	EA
81902800044	SHRINK TUBING 3/64 BLACK	1	IN
81902800507	WIRE 22AWG BUSS	2	IN
81902901271	SOCKET TRANS(INDIC)	2	EA
81902907400	CONN SOCKET PLCC 44-PIN	1	EA
81902907410	CONN HEADER 7x2 UNSHROUD	1	EA
81902907430	CONN RECEPTACLE 35x1	2	EA
81902907440	CONN RECEPTACLE 6x1	1	EA
81902907450	CONN RECEPTACLE 7x2	1	EA
81903200301	LED YELLOW U-BRITE	32	EA
81903200590	DISPLAY 20 CHAR 2 ROW LCD	1	EA
PK65-1538	DOC SWXCARD TOUCHPAD X/Y	0	EA

RCP-MLTP Remote CPU Assembly - 81906515410

81900200668	RESISTOR 1K 5% 1/4W	R2	1	EA
81900200908	RESISTOR 10K 5% 1/4W	R3	1	EA
81900300427	RESISTOR 100 OHM 5% 1/2W	R1	1	EA
81900500125	POT 5K OHM	R4 R5	2	EA
81900600958	SIP 4.7K 10-PIN 9 RESISTR	RP1 RP2 RP3	3	EA
81900700055	CAP 0.1MF 50V CERAM RADIL	C1-C9 C11	10	EA
81900900309	CAP 4.7MF 20V TANTLM AXIL	C10 C12	2	EA
81901601187	REG MC7805C +5V 1A TO-220	U7	1	EA
81901604314	IC 74HC245 CMOS BUSTRANSV	U10 U11	2	EA
81901604579	IC 74HC373 OCTL D LATCH	U2	1	EA
81901604827	IC 1of8 DECODER/MULTIPLXR	U9	1	EA
81901604850	IC 74HC00 2-IN NAND QUAD	U8	1	EA
81901606061	IC MAX690CPA PWR SUP MONI	U5	1	EA
81901606820	IC 8Kx8 SRAM 150ns SKINNY	U3	1	EA
81901606830	IC 7.3728 MHZ OSCILLATOR	U6	1	EA
81901606880	IC 75ALS176 RS485 TRANSCV	U4	1	EA
81902202423	RIVET 1/8" DIA CLOSED		1	EA
81902411900	PCB CPU ASSY RCP		1	EA
81902600543	SWITCH 10 POS DIP PC-MT	S1	1	EA
81902905991	SOCKET 52-PIN PLCC PC MT	(U1)	1	EA
81902906353	CONN 3 POS MALE POLAR STR	J4	1	EA
81902907420	CONN HEADER 35x1 UNSHROUD	J1 J2	2	EA
81902907460	CONN POWER JACK PCB MOUNT	J3	1	EA
81903900740	FILTER EMI SUPPRESSION	FL1-FL5	5	EA
CA25-1190	DOC REMOTE CPU RCP PANELS		0	EA
DD52-1190	DOC PCB CPU REMOTE RCP		0	EA
SC33-1190	DOC REMOTE CPU RCP PANELS		0	EA

RCP-MLTP2 Switchcard Assembly - 81906518770

81900200312	RESISTOR 36 OHM 5% 1/4W	R9	1	EA
81900200544	RESISTOR 330 OHM 5% 1/4W	R8	1	EA
81900200668	RESISTOR 1K 5% 1/4W	R3 R5 R6	3	EA
81900200783	RESISTOR 3.3K 5% 1/4W	R7	1	EA
81900200825	RESISTOR 4.7K 5% 1/4W	R1	1	EA
81900500117	POT 1K BOURNS	R2	1	EA
81900500125	POT 5K OHM	R10	1	EA
81900600669	SIP 680OHM 10-PIN 9 RESIS	RP2-RP5	4	EA
81900600958	SIP 4.7K 10-PIN 9 RESISTR	RP1 RP11	2	EA
81900700055	CAP 0.1MF 50V CERAM RADIL	C3-C7 C9 C10	7	EA
81900700238	CAP 0.001MF 1000V CERAM	C11	1	EA
81900900291	CAP 10MF 20V TANTLM AXIAL	C1 C2	2	EA
81901400010	TRANS 2N2219A NPN TO-5	Q1 Q2	2	EA
81901601187	REG MC7805C +5V 1A TO-220	U2	1	EA
81901604314	IC 74HC245 CMOS BUSTRANSV	U3	1	EA
81901604827	IC 1of8 DECODER/MULTIPLXR	U4	1	EA
81901606061	IC MAX690CPA PWR SUP MONI	U6	1	EA
81901606830	IC 7.3728 MHZ OSCILLATOR	U8	1	EA
81901606870	IC 5450 34 SEG LED DRVR	U5	1	EA
81901606880	IC 75ALS176 RS485 TRANSCV	U9	1	EA
81902000546	STANDOFF 7/16x4-40 ROUND	REF:U1	2	EA
81902001122	STANDOFF 9/16x4-40 ROUND	REF:U1	1	EA
81902101930	LENS ASSY BKC-6	REF:S1-S34	34	EA
81902105200	LEGEND SET RCP PANELS		1	EA
81902202647	SCREW 4-40x1/4 SIMM PANHD	REF: U1	5	EA
81902413480	PCB MLTP SWITCHARD		1	EA
81902600543	SWITCH 10 POS DIP PC-MT	SWX1	1	EA
81902600584	SWITCH PB	S1-S34	34	EA
81902800507	WIRE 22AWG BUSS	REF:U1	2	IN
81902901271	SOCKET TRANS(INDIC)	REF:Q1 Q2	2	EA
81902905991	SOCKET 52-PIN PLCC PC MT	REF:U7	1	EA
81902906353	CONN 3 POS MALE POLAR STR	J2	1	EA
81902907400	CONN SOCKET PLCC 44-PIN	REF:U5	1	EA
81902907410	CONN HEADER 7x2 UNSHROUD	REF:U1	1	EA
81902907450	CONN RECEPTACLE 7x2	REF:U1	1	EA
81902907460	CONN POWER JACK PCB MOUNT	J1	1	EA
81903200301	LED YELLOW U-BRITE	S1-S34	34	EA
81903200590	DISPLAY 20 CHAR 2 ROW LCD	U1	1	EA
81903900740	FILTER EMI SUPPRESSION	FL1-FL5	5	EA
81906516860	SOFT ASSY RCP-STAT PANEL	REF:U7	1	EA
CA25-1348	DOC MLTP SWITCHARD		0	EA
DD52-1348	DOC MLTP SWITCHARD		0	EA
SC33-1348	DOC MLTP SWITCHARD		0	EA