PESA Switching Systems

RCP-242

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1.1 Manual Overview

This manual provides detailed instructions for installing and operating the PESA RCP–242. This manual is divided into seven sections as shown.

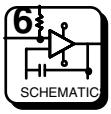
Section 1, **INTRODUCTION**, summarizes the manual, describes the RCP–242, presents a list of terms, and provides the panel specifications.

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

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

Section 4, **FUNCTIONAL DESCRIPTIONS**, presents an in-depth description of each RCP–242 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–242 is designed to provide fast intuitive control of one or two destinations. This button-per-source panel features direct take operation for applications requiring minimum keystrokes and access to a limited number of sources. Any source available on the switching system can be assigned to any of the 24 pushbuttons. Each of the pushbuttons are relegendable. An LED is incorporated into each pushbutton for display of status. Up to 16 independent levels of control are available.

The four control pushbuttons support several full function operational modes including: Select Salvo, Select Level, and Chop.

The unit is powered by a 7.5VDC Plug-in-the-Wall type Power Pack and communicates with the System controller via Standard RS485 Interface.

The RCP–282 is packaged in a standard 19 inch 1RU chassis requiring only three inches of depth.

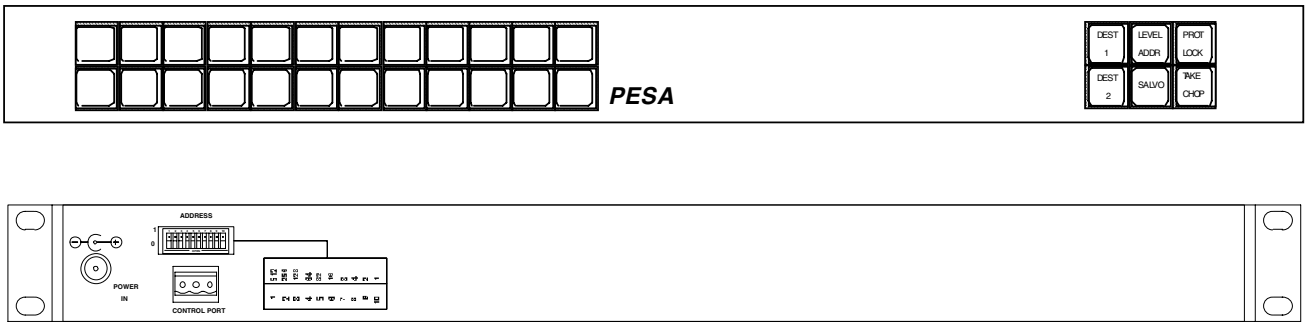


Figure 1–1 RCP–242 Front and Rear Views

1.3 Specifications

GENERAL	
Mounting	Standard 19" Rack
Pushbuttons	LED Illuminated
INPUT	RS485
POWER	
Voltage Requirements	+7.5 VDC @ 800 mA
MECHANICAL	
One Rack Unit	**19"W x 1 1/2"D x 1 3/4"H (482.6mmx38.1mmx44.45mm)**
ENVIRONMENTAL	
Temperature	0°C to 40°C
Humidity	20% to 90% Non-Condensing

2.1 Introduction

This section details RCP–242 installation procedures. The following topics are discussed:

- Receipt Inspection
- Location and Mounting
- Polling Address
- Control Panel/Controller Interconnection
- Power Connections

2.2 Receipt Inspection

The RCP–242 was inspected and tested prior to leaving 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 RCP–242 has been designed to fit in a standard E.I.A. 19" equipment rack and uses 1 rack unit of space (1 3/4"). An area should be selected where temperature does not exceed 40°C inside the equipment rack, and where air can circulate freely. The unit should be mounted in an area convenient to control and power connections. Sufficient space must be provided behind the rack to allow for the control and power cables. When the RCP–242 is supplied as part of a system including interconnecting cables, a rack layout drawing is usually provided. While adherence to this drawing is not required, it will ensure that the cables are of proper length. All mounting holes should be utilized and hardware tightened securely. All cable should be strained relieved and secured to racks or other supporting structures. Failure to provide adequate cable support can result in cables separating from connectors. If cable runs are to be stored under an elevated floor, they should be tied to the racks as a guide. If cables are run along the floor, do not allow them 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.

Location and Mounting Continued:

Figure 2–1 illustrates chassis installation.

To install the RCP–242 chassis follow these steps:

1. Align the chassis with the slotted opening in the rack.
2. Install the bottom screws first.
3. Install the two top screws
4. Tighten all four screws securely.

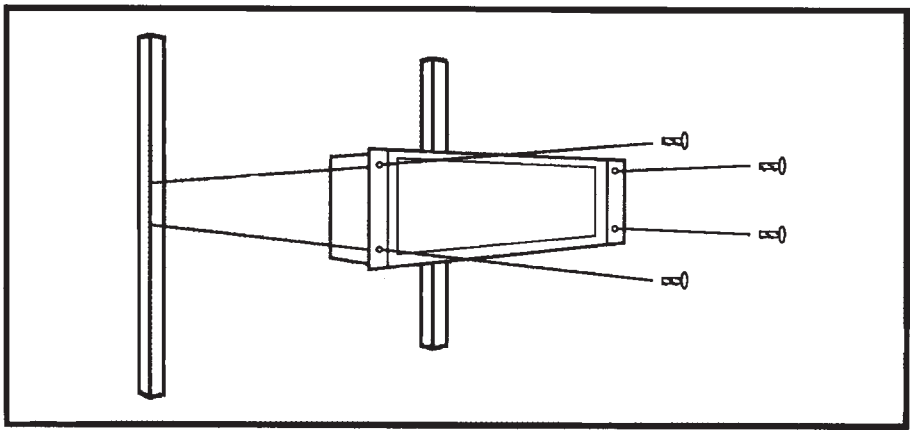


Figure 2–1 RCP–242 Chassis Installation

2.4 Polling Address

For the controller to identify a particular control panel, a specific device number or polling address must be assigned to each panel. Valid polling addresses are in the range of 1 to 128. Systems requiring more than 128 panels are possible with enhanced controllers, refer to your Pesa Sales Representative for details. The appropriate binary number is entered into the control panel by setting a 10-position DIP switch to the 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.

2.4 Polling Address (Device Number) Continued:

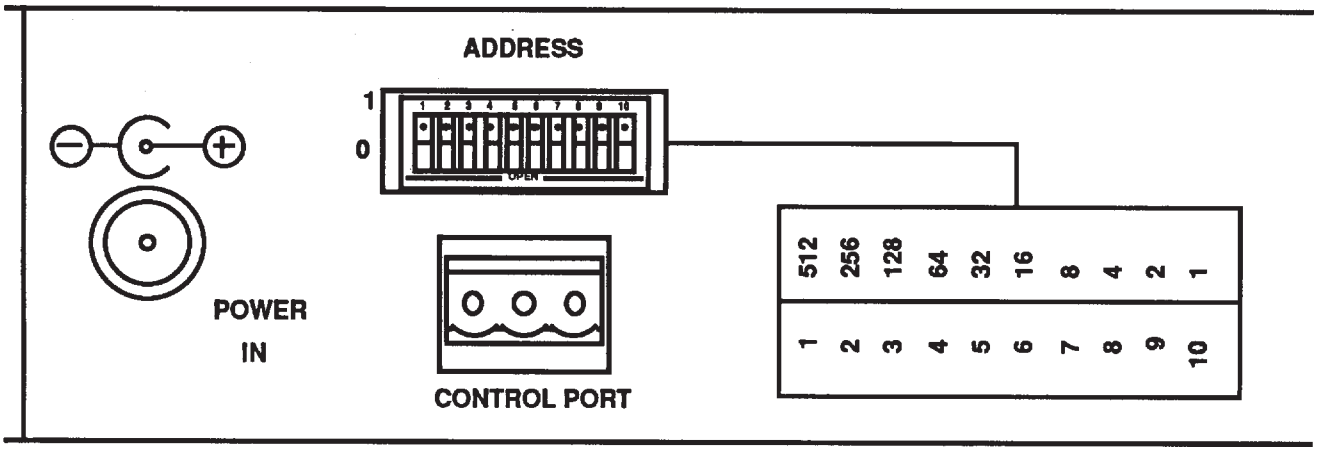


Figure 2-2 DIP Switch Location

2.5 Control Panel/Controller Interconnection

Each panel has a single 3-pin MTA connector located on the rear panel. Control panels are daisy chained to a port on the rear of the Controller. Use shielded twisted pair cable. See Figure 2–3.

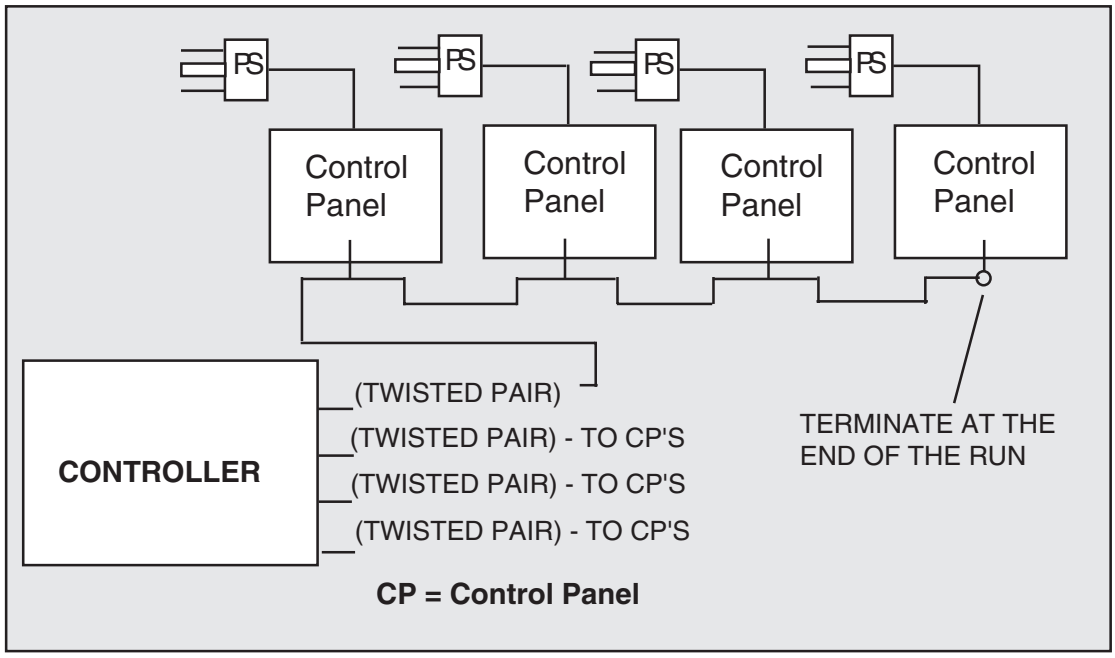


Figure 2-3 Typical Control Panel Controller Interconnection

2.6 Wiring the Control Panel Connector

Should an additional control 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. See Figure 2–4.

1. Remove approximately 1 1/2" of insulating jacket from each of the two wires.
2. Remove approximately 1/2" of wire insulation from the black and red wires.
3. Twist together and insert the two black wire ends into positon 1. Crimp down using a screw driver.
4. Twist together and insert the two shield wires into position 2. Crimp down using a screwdriver.
5. Twist together and insert the two red wire ends into position 3. Crimp down using a screwdriver.

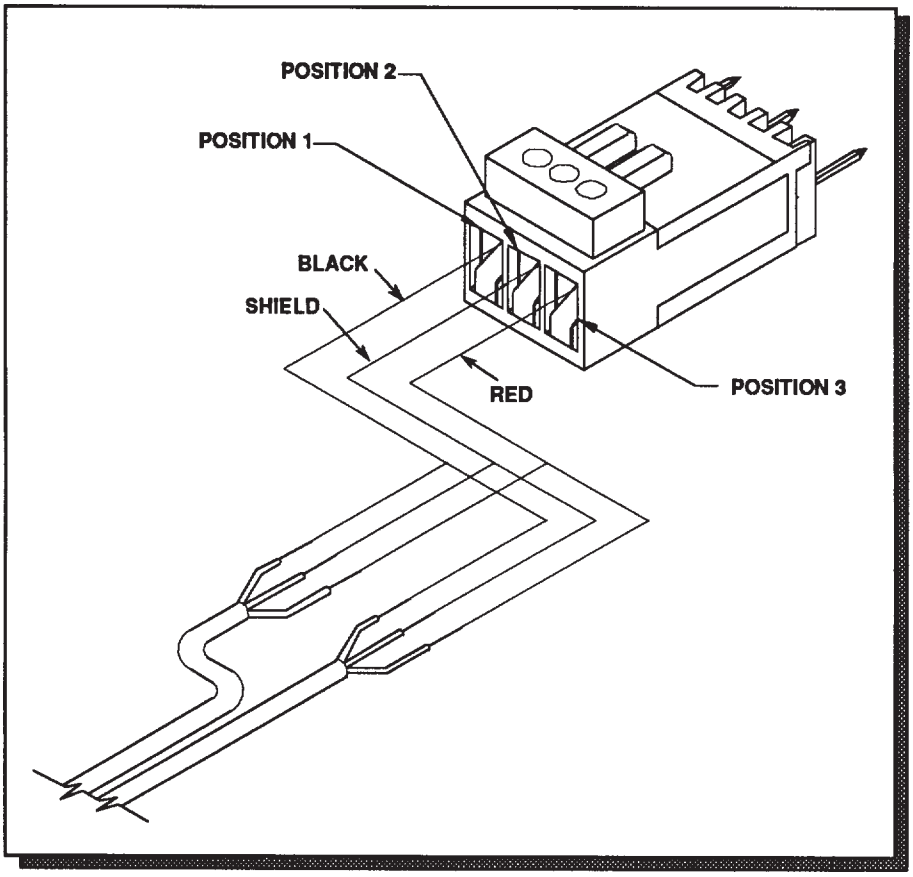


Figure 2-4 Wiring the Control Panel Connector

2.7 Terminating Cable Runs

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

1. Uncrimp the black and red leads in position 1 and 3.
2. Insert the resistor ends into position 1 and position 3 along with the black and red leads.
3. Crimp down using a screwdriver.
4. The shield wire remains in position 2.

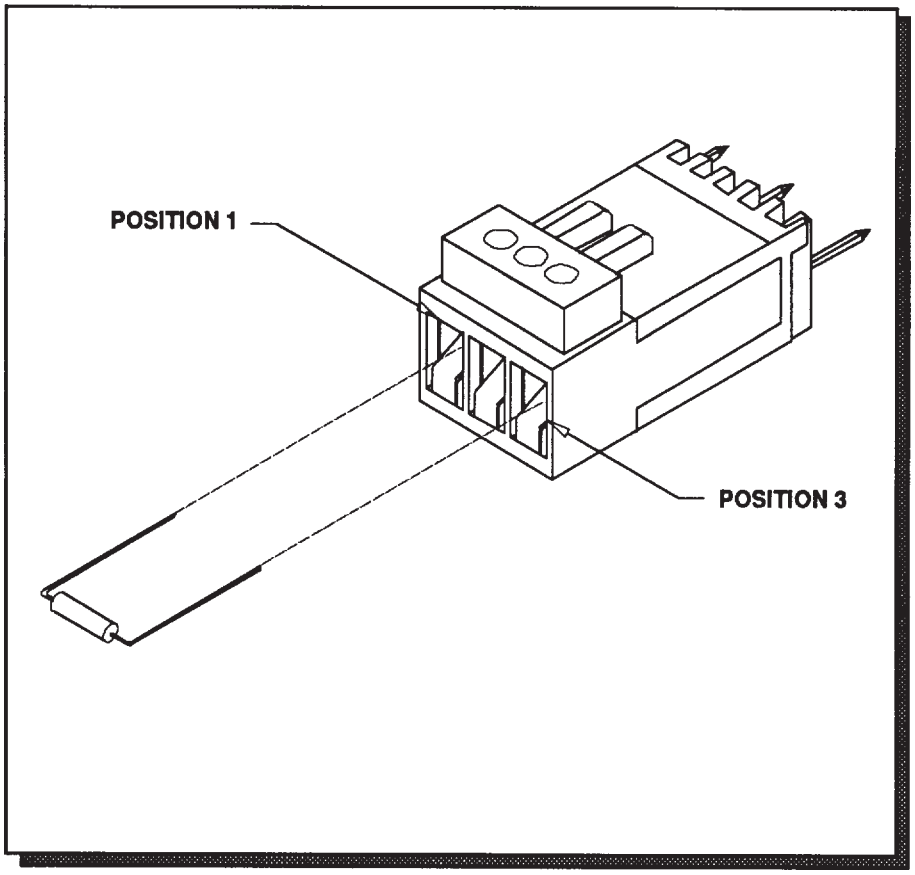


Figure 2–5 Terminating Cable Runs

2.8 Power Connections

Power for the RCP–242 is supplied by an external 7.5 Vdc, 800 mA power supply.

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 voltage. The power connector can now be plugged into the **POWER IN** position on the RCP–242. The Power Pack will immediately power the unit upon connections to AC Voltage. See Figure 2–6.

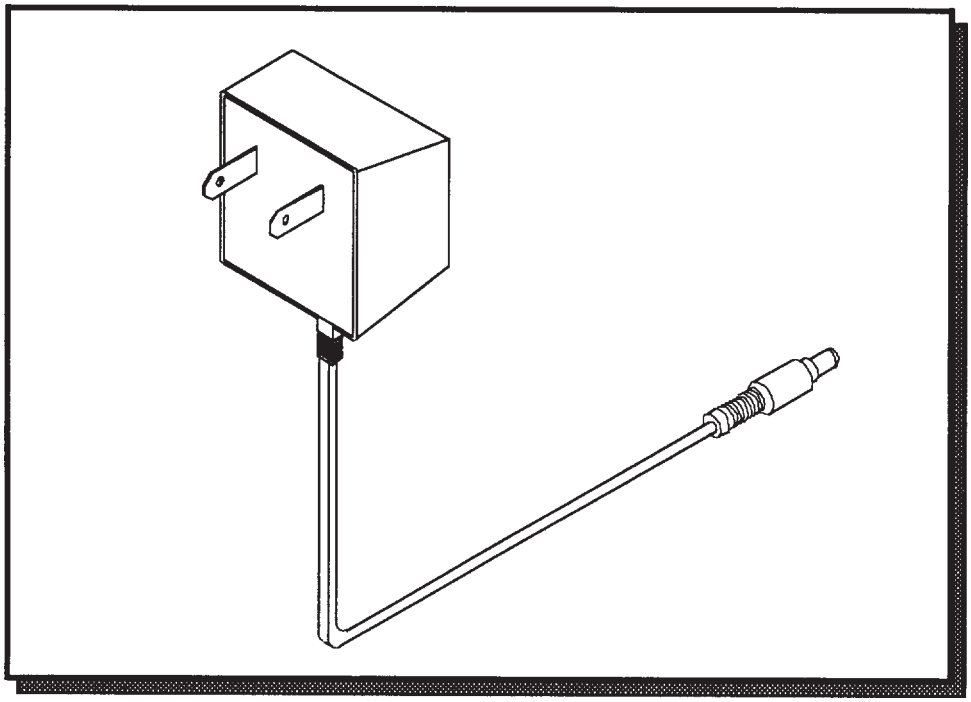


Figure 2-6 Typical Panel Power Supply

3.1 Operations of the RCP–242

Introduction

Operations of the RCP–242 require that it be configured at the controller and have the appropriate polling address assigned. Connections and power up procedures should be performed on each panel controlled. *Refer to the Operations Section of your controller manual for setup.*

General

All RCP–242 panels in a routing switcher system are custom configured at the factory prior to shipment. The information needed to configure the panels comes from the System Design Guide filled out by the customer.

Breakaway/Split Operation

Breakaway allows you to select an input on a specific level to be taken to an output on that level. Use the following steps:

To Make a Breakaway Switch: Depress Level Select Key	**Results:** Level Select Key lights. Panel enters Level Select Mode. Data Keys represent Levels.
Depress Data Key associated with level(s) you wish to breakaway	Data Key(s) selected light to show level selection(s). Level selection is toggle action.
Depress Level Select Key again	Level Select Key blinks rapidly. Panel returns to Direct Take Mode.
Depress the Data Key associated with the input you desire on the level(s) currently selected	The input chosen is switched to the output the panel controls on the currently selected level(s). This step may be repeated while in a breakaway condition.
To Return to Follow Operation: Depress the Level Select Key again	**Results:** Level Select Key lights solid. Data Keys associated with currently selected level(s) light.
Depress Data Key(s) currently lit	Data Key LEDs are extinguished and associated levels are no longer selected for breakaway operation.

The RCP-242 has 4 Modes of Operation:

Direct Take - Selects sources to be switched to the destination controlled by the panel by pressing associated Data Keys. Switch requests are sent immediately. Direct Take is the default mode. Deselecting all other modes will return you to the Direct Take mode. The Level/Address is not illuminated if the panel is in follow or blinks if you have selected breakaway level(s).

Level Select - Selects which levels are to be affected when making switches in Direct Take mode. Enter Level Select mode by pressing the Level/Address Key less than 2 seconds. The Level/Address Key is always illuminated in Level Select mode.

Salvo Select - Selects salvoes to be executed by pressing associated Data Keys. Salvo requests are sent immediately. Enter the Salvo Select mode by pressing the Salvo Key for more than 2 seconds. The Salvo LED blinks when the panel is in the Salvo Select mode.

Chop - Panel will alternately switch the destination currently being controlled between the last two selected sources for the level(s) currently being controlled (about every 1/2 second). Enter the Chop mode by pressing the Take/Chop Key for more than 2 seconds. The Take/Chop LED blinks and any Data Key associated with either source currently being “Chopped” will blink.

Key Type:

Data Keys - The panel has 24 Data Keys located towards the left of the panel - 2 rows of 12 keys each. Data Keys are associated with sources in Direct Take mode, Salvoes in Salvo Select mode, and Levels in Level Select mode. The sources and salvoes assigned to each Data Key are configurable from the controller.

Destination Keys - The panel has 2 Destination Keys located in the 3rd column from the right side of the panel.

Function Keys - The panel has 4 function keys located on the far right side of the panel. Most function keys are associated with 2 possible functions. **NOTE: The primary function is executed when the key is held down less than 2 seconds. The secondary function is executed when the key is held down more than 2 seconds.** Each Function Key works as a toggle. If a function is currently enabled, pressing the associated Function Key in the same fashion as before (less than or greater than 2 seconds) will disable it.

CONFIGURATION:

Address - A decimal number from 1 to 128 which is used to distinguish each panel on the panel communications bus. The address must match the dip switch settings on the rear of the panel. Systems requiring more than 128 panels are possible with enhanced controllers; refer to your PESA Sales Representative for details.

Panel Name - Any 8 alphanumeric characters. Currently used only by the controller configuration program to provide a user-friendly method of referring to each panel.

Priority - Choice of 3 priorities: Master, Supervisory or Non-Supervisory. Priorities are used when panel attempts to set or clear a destination Lock. Only the panel which set a Lock or someone of higher priority can unlock a destination once it is locked. The default setting is Non-Supervisory.

Status Method - The panel displays status differently based on whether the panel is set for Follow (changing all levels assigned to panel) or Breakaway (changing only selected levels) operation. In addition, you may select between 2 methods of displaying status when in Follow (NOTE: these methods only apply when the panel is set for Follow operation):

1. **Group Status** - Panel will display status based on the Source Group which changed the current destination. If the panel receives status due to a breakaway change request or due to a change made elsewhere in the system, the panel will display the status of the Default Status Level (refer to the Controller Operations Manual for more details).

2. **Default Status Level Status** - Panel will always display the status of the Default Status Level.

Default Status Level - Level to be statused when the panel is in Follow operation and status is not determined by Group Status.

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 in the assigned Level List will not be accessible to, or affected by, panel operations.

Dedicated Destination Key Assignment List - List containing the assignment of destination groups to the 2 Destination Keys.

Key Assignment List - List containing the assignment of source groups and salvoes to each of the 24 Data Keys.

STATUSING:

Status by Group Status

LED Illuminated Solid (not blinking) - The current status matches the source(s) assigned to the Data Key.

LED Blinking - The current status matches the source(s) assigned to the Data Key on some, *but not all*, levels.

No LED Illuminated - The current status does not match the source(s) assigned to any Data Key.

Status by Default Status Level

LED Illuminated Solid (not blinking) - The current status matches the source assigned to the Data Key for the default status level and the source(s) assigned to the Data Key for 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(s) assigned to the Data Key for at least one other level does not match the status on the default status level.

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

Breakaway Statusing

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 highest priority) and the source(s) assigned to the Data Key for other levels selected either match the current status or are not configured.

LED Blinking - The current status matches the source assigned to the Data Key for the highest priority level selected (level 1 is the highest priority) but the source(s) assigned to the Data Key for at least one other selected level does not match the current status.

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).

Direct Take Mode:

Data Keys: In this mode, Data Keys are associated with sources. Pressing a Data Key will switch the source(s) assigned to the Data Key on all selected levels to the destination controlled by the panel. The method of statusing used by the panel is determined by configuration at the controller and whether break-away levels are currently selected.

Destination Key: Changes the destination currently being controlled by the panel to the destination assigned to the key pressed.

Level/Address Key:

Level - Activates the Level Select mode. Illuminates the Level/Address LED. Displays the currently selected level(s) by lighting the associated Data Key LEDs. The first Data Key on the top row corresponds to level 1 and proceeds left to right, top to bottom. If no level is selected, no Data Key will be illuminated (refer to the Level Select Mode description).

Display Address - Displays the panel address on the top row of Data Key LEDs while the key is held down. The address displayed will be a binary representation of the panel address with the MSB=3 and the LSB=12.

Protect/Lock Control Key:

PROTect - 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. Protect/Lock LED is illuminated to show the destination currently being controlled by the panel is Protected.

LOCK - Locks the destination currently being controlled by the panel. Any switch request attempting to affect this destination will be disallowed. Protect/Lock LED blinks to show the destination currently being controlled by the panel is Locked.

When the panel is unlocked, pressing the PROTect/LOCK key quickly will take the panel into PROTECT. Pressing the PROTect/LOCK key for > 2 seconds will take the panel into LOCK. When the panel is already protected or locked, pressing the PROTect/LOCK key quickly will clear PROTECT or LOCK.

Salvo Key: If you press and hold the Salvo Key for more than 2 seconds, the panel will enter the Salvo Select mode. The Salvo LED will blink indicating the Salvo Select mode is enabled. All Data Key LEDs will be extinguished since Data Keys are now associated with salvoes and not sources (refer to Salvo Select Mode description).

Take/Chop Key:

TAKE - Pressing the Take/Chop Key for less than 2 seconds toggles the source selection for the currently controlled destination between what is currently on-line and the source which was previously selected by the panel for all levels being controlled. Pressing TAKE repeatedly will repeat this toggle (refer to the description of CHOP which follows).

CHOP - Pressing and holding the Take/Chop Key for more than 2 seconds places the panel in the CHOP mode. The panel will continue to toggle (every 1/2 second) the source selection for the currently controlled destination between what is currently on-line and the source which was previously selected by the panel for all levels being controlled.

Level Select Mode:

Data Keys: In this mode, Data Keys are associated with levels. The top left Data Key corresponding to level 1 and proceeding left to right, top to bottom. If the panel is in Follow (no breakaway level[s] selected), no Data Key will be illuminated. If a Data Key is illuminated, the corresponding level is selected. Pressing a Data Key will toggle the selection of the corresponding level (if level is controllable by this panel) by either deselecting it if the Data Key was already illuminated, or selecting it and illuminating its associated Data Key if not.

Destination Key: Changes the destination currently being controlled by the panel to the destination assigned to the key pressed.

Level/Address Key:

Level - Deactivates the Level Select mode and returns you to Direct Take mode. Turns off the Level/Address LED and displays the status of the destination currently controlled by the panel by lighting the associated Data Key's LED (refer to the Direct Take Mode description).

Display Address - Displays the panel address on the top row of Data Key LEDs while the key is held down. The address displayed will be a binary representation of the panel address with the MSB=3 and the LSB=12.

Protect/Lock Control Key:

PROTect - 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 Protect/Lock LED is illuminated to show the destination currently being controlled by the panel is Protected.

LOCK - Locks the destination currently being controlled by the panel. Any switch request attempting to affect this destination will be disallowed. The Protect/Lock LED blinks to show the destination currently being controlled by the panel is Locked.

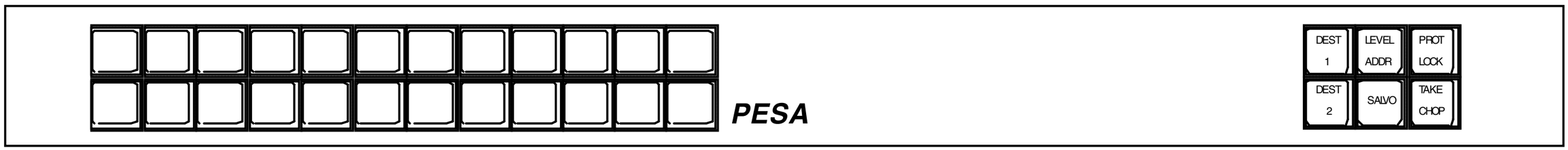
When the panel is unlocked, pressing the PROTect/LOCK key quickly will take the panel into PROTECT. Pressing the PROTect/LOCK key for > 2 seconds will take the panel into LOCK. When the panel is already protected or locked, pressing the PROTect/LOCK key quickly will clear PROTECT or LOCK.

Salvo Key: If you press and hold the Salvo Key for more than 2 seconds, the panel will enter the Salvo Select mode. The Salvo LED will blink indicating the Salvo Select mode is enabled. All Data Key LEDs will extinguish since Data Keys are now associated with salvoes and not levels (refer to Salvo Select Mode description).

Take/Chop Key:

TAKE - Pressing the Take/Chop Key for less than 2 seconds toggles the source selection for the currently controlled destination between what is currently on-line and the source which was previously selected by the panel for all levels being controlled. Pressing the TAKE repeatedly will repeat this toggle (refer to the description of CHOP which follows).

CHOP - Pressing and holding the Take/Chop Key for more than 2 seconds places the panel in CHOP mode. The panel will continue to toggle (every 1/2 second) the source selection for the



currently controlled destination between what is currently on-line and the source which was previously selected by the panel for all levels currently being controlled.

Salvo Select Mode:

Data Keys: In this mode, Data Keys are associated with salvoes. Pressing a Data Key will send a request to the controller to execute the salvo assigned to the Data Key pressed. Assignment or configuration of salvoes to the Data Keys is made at the controller.

Destination Key: Changes the destination currently being controlled by the panel to the destination assigned to the key pressed.

Level/Address Key:

Level - Toggles the selection of the Level Select mode. This is done by extinguishing the Level/Address LED if previously illuminated or by illuminating the Level/Address LED if previously extinguished. The toggle will not affect the mode of the panel until you exit the Salvo Select mode. If the Level/Address LED is illuminated at that time, the panel will enter Level Select mode. Otherwise, the panel will return to Direct Take mode.

Display Address - Displays the panel address on the top row of Data Key LEDs while the key is held down. The address displayed will be a binary representation of the panel address with the MSB=3 and the LSB=12.

Protect/Lock Control Key:

PROTect - 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. Protect/Lock LED illuminates to show the destination currently being controlled by the panel is Protected.

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Salvo Key: If you press and hold the Salvo Key for more than 2 seconds, the panel will exit the Salvo Select mode and return to either the Direct Take mode or Level Select mode depending on the state of the Level/Address LED. The Salvo LED will extinguish.

Take/Chop Key:

TAKE - Pressing the Take/Chop Key for less than 2 seconds toggles the source selection for the currently controlled destination between what is currently on-line and the source which was previously selected by the panel for all levels currently being controlled. Pressing the TAKE repeatedly will repeat this toggle (refer to the description of CHOP which follows).

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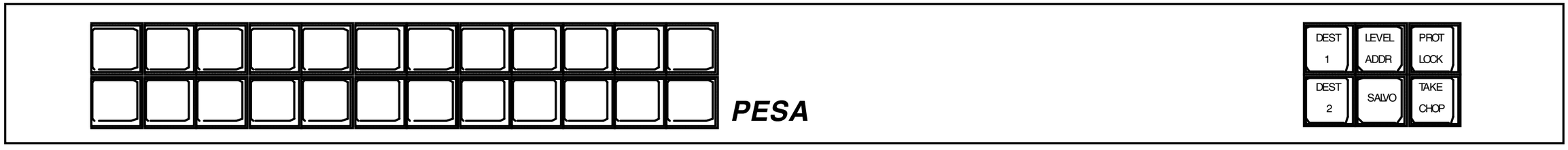


DATA KEYS FUNCTION KEYS

the currently controlled destination between which it currently is on-line and the source which was previously selected by the panel for all levels being controlled.

Chop Mode:

Data Keys: Exits the Chop mode and returns the panel to the Direct Take mode. Takes the Source assigned to the Data Key on-line on the levels currently controlled by the panel. In this mode, if either source currently being “Chopped” between is associated with a Data Key, that Data LED will be illuminated.

Destination Keys: Exits the Chop mode and returns the panel to the Direct Take mode. Changes the destination currently being controlled by the panel to the destination assigned to the key pressed.

Level/Address Key:

Level - Toggles the selection of the Level Select mode. This is done by extinguishing the Level/Address LED if previously illuminated or by illuminating the Level/Address LED if previously extinguished. The toggle will not affect the mode of the panel until you exit the Salvo Select mode. If the Level/Address LED is illuminated at that time, the panel will enter the Level Select mode. Otherwise, the panel will return to the Direct Take mode.

Display Address - Displays the panel address on the top row of Data Key LEDs while the key is held down. The address displayed will be a binary representation of the panel address with the MSB=3 and the LSB=12.

Protect/Lock Control Key:

PROTect - 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. Protect/Lock LED is illuminated to show the destination currently being controlled by the panel is Protected.

LOCK - Locks the destination currently being controlled by the panel. Any switch request attempting to affect this destination will be disallowed. Protect/Lock LED blinks to show the destination currently being controlled by the panel is Locked.

When the panel is unlocked, pressing the PROTect/LOCK key quickly will take the panel into PROTECT. Pressing the PROTect/LOCK key for > 2 seconds will take the panel into LOCK. When the panel is already protected or locked, pressing the PROTect/LOCK key quickly will clear PROTECT or LOCK.

Salvo Key: Exits the Chop mode and places the panel in the Salvo Select mode.

Take/Chop Key:

TAKE - Pressing the Take/Chop Key for less than 2 seconds exits the Chop mode leaving the on-line status and preset in the state they were in prior to entering the Chop mode. In this mode, the Take/Chop LED blinks.

CHOP - Pressing and holding the Take/Chop Key for more than 2 seconds exits the Chop mode leaving the on-line status and preset in the state they were in prior to entering the Chop mode. In this mode, the Take/Chop LED blinks.

4.1 Introduction

The RCP–242 panel consists of two printed circuit boards. The CPU board contains a microprocessor that controls the panel's operation and communicates with the control system. The Switchcard contains pushbuttons and indicators used by the operator to control the routing switcher. The following is a detailed description of each of these boards.

4.2 CPU Board

The CPU board contains all circuitry necessary to communicate with the system controller and to interface to a front panel switchcard. The circuitry on the CPU board 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.

Power Supply

The power supply circuit on the CPU 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 J3. The voltage regulator U7 reduces the voltage to 5.0 Vdc. C10 and C12 provide filtering for the input and output of the regulator, respectively. Bypass capacitors (.1 uF) are scattered about the board to provide power supply bypassing for individual chips. The regulated voltage is available to external board on both J1 and J2, pins 31 and 32. The unregulated voltage is available to external board on both J1 and J2, pins 29 and 30.

Microprocessor

The heart of the CPU board is the Motorola 68HC11 microprocessor (U1). This IC contains the microprocessor and peripheral circuitry used to operate the panel. In addition, the 68HC11 contains a PROM with the software used to operate the panel. The 68HC11 is operated in the expanded multiplexed mode. In this mode port B (U1 pins 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.

CPU Board 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 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 external boards via J1.

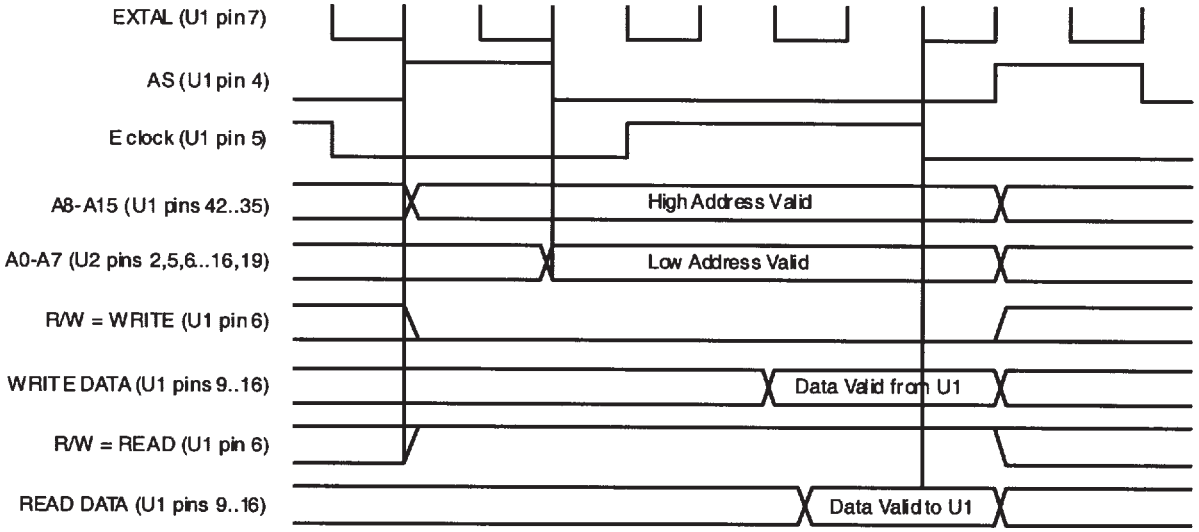


Figure 4-1 Idealized Bus Cycle Timing Diagram

Clock

The master system clock is provided by oscillator U6 pin 8. SYSCLK is available to the processor (U1 pin 7) and to external boards 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 CPU board and is available to external boards via J1 pin 28.

CPU Board Continued:

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 internal EEPROM 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 external boards via J2 pin 11.

Memory

The CPU board 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 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 and C000h to FFFFh. U3 is selected when both CS1 and CS2 are asserted. This occurs 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 write cycles by the U8 pin 8. This WE signal is also availably to external boards via J1 pin 25.

LED Driver Support

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

CPU Board Continued:

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 (U4) chip is used to convert between RS-485 and the levels required by the SCI. Transmit data (TXD) is presented by the SCI on U1 pin 21. This signal drives the input to the RS-485 transceiver on U4 pin 4. Data received from the system controller is converted to the appropriate levels by the RS-485 transceiver and presented on U4 pin 1. This received data (RXD) signal is then fed to the SCI receiver at U1 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 U1 pin 25. This signal is connected to the RS-485 transceiver at U4 pin 3. When TX_ENABLE is asserted (high), U4 drives the RS-485 bus (U4 pins 6 and 7 to J4 pins 1 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 RS-485 bus during power-up or other reset conditions. A shield connection is provides for the RS-485 bus on J4 pin 2. The shield is connected to ground through R1.

I/O

Circuitry is included on the CPU board to support I/O expansion via J1 and J2. Decoder U9 provides eight chip select signals SEL0..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 T1 lists active address range for each select signal. Currently, the CPU board 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..SWX10 on the data bus. If the corresponding switch for each bit is closed, a logic low is presented. If the switch is open, pullup 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 an external board. The ID field should be driven by an external board. A logic low is generated by grounding the ID pin. A logic high is generated by leaving the ID pin floating. Pullup resistor RP3 generates the high logic when a pin is floating.

CPU Board Continued:

Signal	Start	End
SEL0	0000h	07FFh
SEL1	0800h	0FFFh
SEL2	1000h	17FFh
SEL3	1800h	1FFFh
SEL4	2000h	27FFh
SEL5	2800h	2FFFh
SEL6	3000h	37FFh
SEL7	3800h	3FFFh

Table 4–1 Decoder Addressing

Miscellaneous

The CPU board provides some special function signals for use by external boards. R3/R4 provide a contrast adjustment for LCD displays. The CONTRAST signal is available for use by external boards on J2 pin 13. Likewise, R5 provides a brightness control signal for use by external boards. It is available on J2 pin 14. J2 pin 9 is a signal named DSP_RS. This signal is a register select signal for external LCD displays. The processor interrupt request line IRQ is not currently used, but is available for use by external board on J2 pin 12. The CPU board accepts input from a rotary encoder in the form of two signals named KNOB0 and KNOB1. The CPU software expects quadrature-encoded signals to indicate direction of travel from the rotary encoder. These two signals are present on J2 pins 5 and 6.

4.3 Switchcard

RCP–242 Switchcard

The switchcard for the RCP–242 panel contains circuitry to provide a switchcard ID for the CPU board, scan a keyboard, light the keyboard LEDs, and interface to an optional I/O board. The following is a description of each of these circuits.

Switchcard ID

The RCP–242 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

Switchcard Continued:

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 RCP–242 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–242 has circuitry for 34 pushbuttons and uses only 30 of these pushbuttons. To scan the keyboard, the microprocessor on the CPU board performs read cycles that enable SEL1. This occurs for addresses 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 4–2 contains the addresses used to access each row of the keyboard circuit.

Address	Row	U2 pin #
800h	KB_ROW0	15
801h	KB_ROW1	14
802h	KB_ROW2	13
803h	KB_ROW3	12
804h	KB_ROW4	11
805h	KB_ROW5	10
806h	KB_ROW6	9
807h	KB_ROW7	7

Table 4–2 Keyboard Memory Map

Although the RCP–242 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

Switchcard Continued:

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 address 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 RCP–242 switchcard contains circuitry capable of lighting up to 34 pushbuttons. The RCP–242 uses only 30 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.

I/O Board Interface

Connector J4 provides the signals necessary to interface to an optional I/O board. The connector provides +5 Vdc (pin 1) and ground (pin 6) to power the external board. In addition, data bit D0 (pin 2), address bit A0 (pin 3), and chip select SEL5 (pin 4) are present on the connector. Pin 5 of the connector is connected to ID0, and is used to detect the presence or absence of the external board (see Switchcard ID, above).

5.1 General

THE RCP–242 Control Panel is a solid state electro-mechanical device 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 the manual.

5.2 Preventive Maintenance

There is little need for preventive maintenance on the RCP–242 other than the normal care which should be given to any quality electronic equipment.

5.3 Test Equipment

The test equipment recommended for servicing the RCP–242 is listed below. Equivalent test equipment may be used.

EQUIPMENT	FUNCTION
Oscilloscope - 20 MHz or higher	Waveform Monitoring and Tracing
VOM - 20,000 Ω per volt or higher	Voltage and Resistance Measurements

5.4 Corrective Maintenance

The following paragraphs provide information to assist the servicing technician in maintenance of the RCP–242. The functional description (Section 4) contains board/circuit level information to help identifying specific problems.

5.4 Corrective Maintenance Continued:

Factory Repair Service

If desired, equipment or boards may be returned to the factory (transportation prepaid) for repair. Refer to the General Assistance and Service information sheet in the front of this manual.

5 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–242 has no adjustments.

Troubleshooting

Troubleshooting an RCP–242 requires the routing switcher system to be used as a test fixture. The Panel does not function except as part of the system. The only troubleshooting which can be accomplished without opening the Control Panel is to check input power (from plug-in power module).

To open the 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 boards. Place the disassembled panel on a non-conducting surface and arrange the parts so the unit can be operated. You must be able to operate the pushbuttons and observe the resulting status indicators. You must also have sufficient access to the boards to measure voltage or observe waveforms.

Procedure: Put the RCP–242 through the operating sequence described in the operation section. Refer to Section 3.

Troubleshooting Continued:

If the Panel is nonresponsive, there may be a power problem or the CPU is not operating.

1. Refer to the POWER DISTRIBUTION discussion in Section 4. Refer to the remote CPU schematic in Section 6 if it is necessary to make voltage checks at the chip or component level.

2. If power is functioning properly, the CPU is not operating. The CPU requires a clock, a power-up reset, communications from the Controller. Refer to the CPU Board functional description in Section 4.

For partial failures:

1. Pushbutton switches fail to initiate desired operation. Refer to the CPU Board functional description in Section 4.

> ❺ If a source input fails to function it may be a blocked input. Check the system configuration at the 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.

6.0 Schematics

General

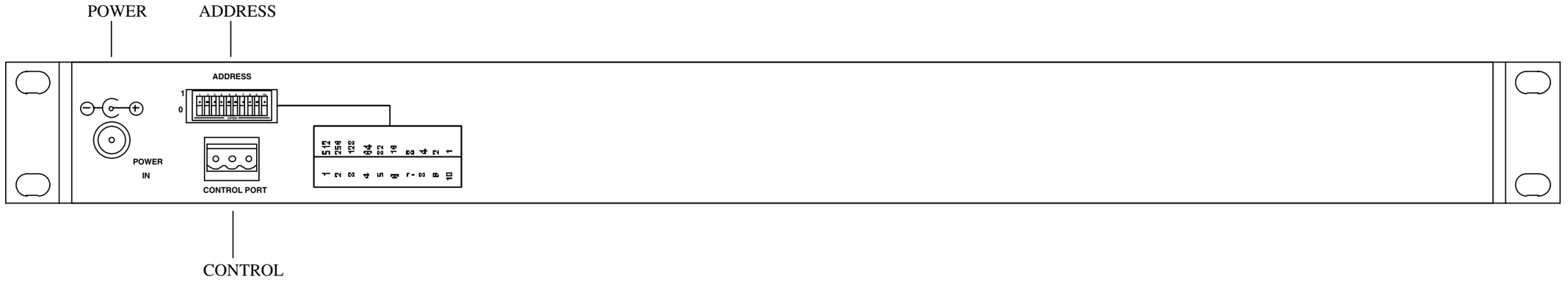
This section contains the schematic diagrams and parts location diagrams for the RCP–242. Refer to this section when trobleshooting the equipment or replacing defective parts.

Description	Dwg No.	Page No.
RCP–242 Front View		6.2
RCP–242 Rear View		6.3
Mainframe Assembly	CD63-0702	6.4
Switchcard Assembly	CA25-1189	6.5
	SC33-1186	6.6
CPU Assembly	CA25-1190	6.7
	SC33-1190	6.8

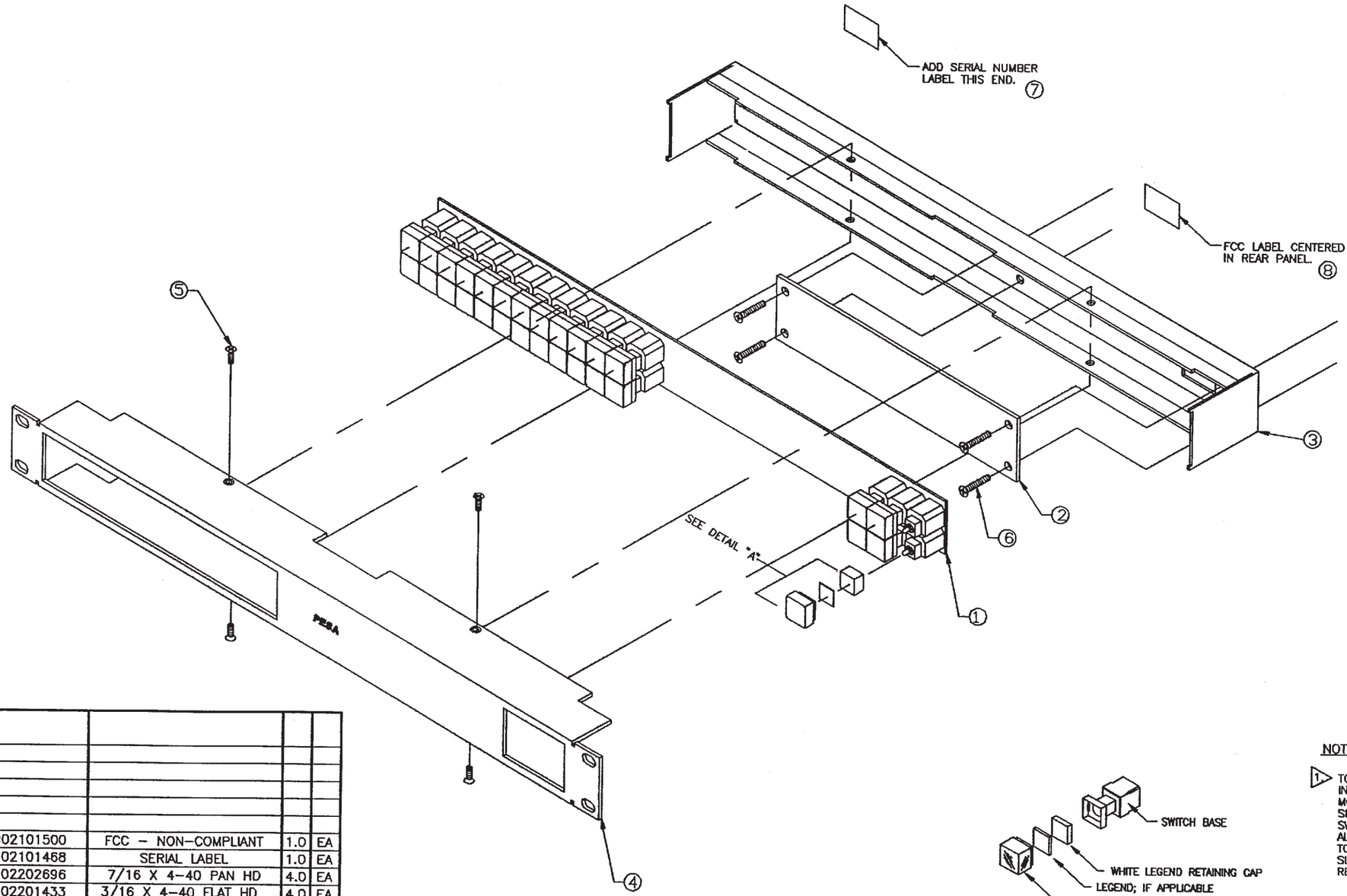
RCP-242: 24 X 2 PUSHBUTTON PANEL

RCP–242 Front View

7/93
P/N 81905902210



RCP–242: 24 X 2 PUSHBUTTON PANEL



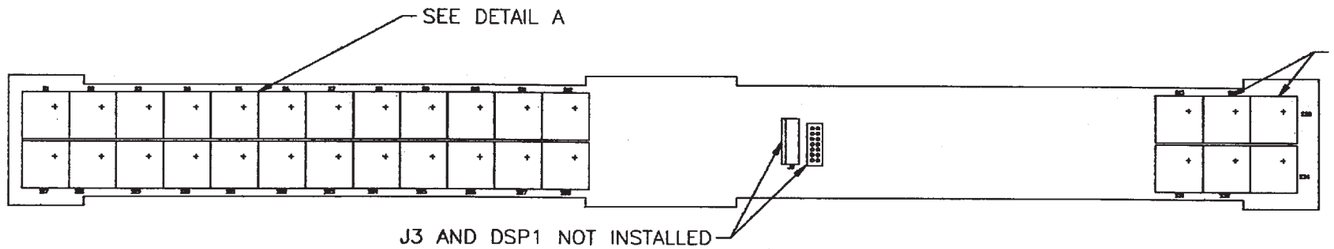
8	81902101500	FCC – NON–COMPLIANT	1.0	EA
7	81902101468	SERIAL LABEL	1.0	EA
6	81902202696	7/16 X 4–40 PAN HD	4.0	EA
5	81902201433	3/16 X 4–40 FLAT HD	4.0	EA
4	81903462270	FRONT PANEL	1.0	EA
3	81903462300	REAR	1.0	EA
2	81906515410	PCB ASSY. CPU	1.0	EA
1	81906515390	SWITCHCARD ASSY	1.0	EA
NO	PART NUMBER	DESCRIPTION	QTY	UNIT

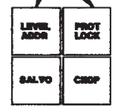
HARDWARE SCHEDULE

SWITCH CAP ASSEMBLY – DETAIL "A"
30 PLACES

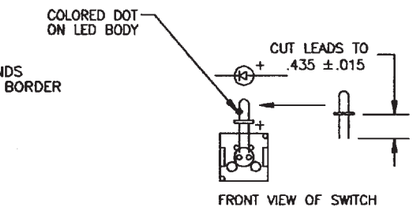
NOTES:

1. 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.

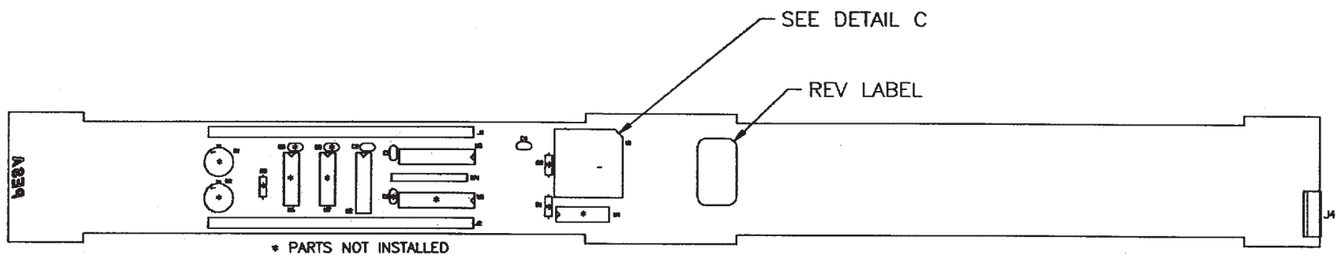


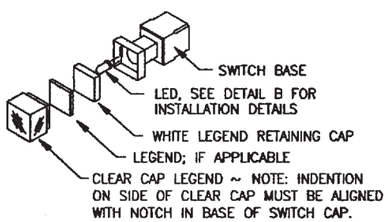


NOTE: WHEN CUTTING LEGENDS COMPLETELY REMOVE BORDER

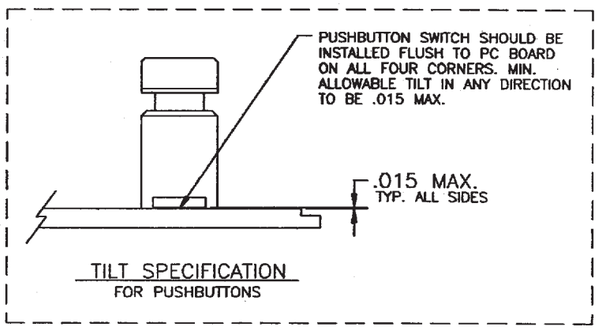


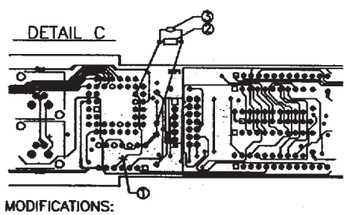
LED INSTALLATION – DETAIL B





SWITCH CAP ASSEMBLY – DETAIL A





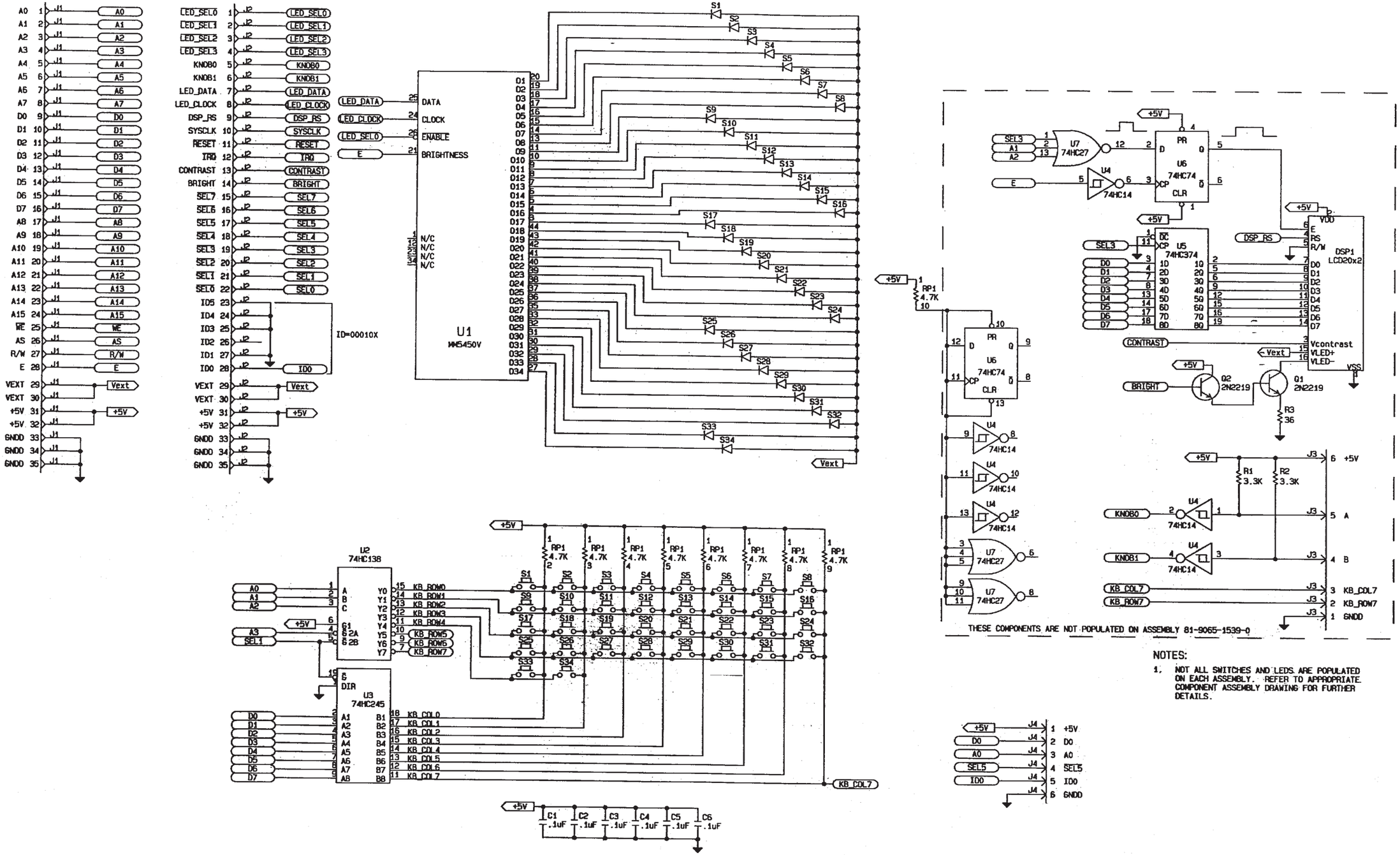
MODIFICATIONS:

①CUT THE TRACE GOING FROM U1 PIN 21 TO U4 PIN 5 (ON LAYER 1 OF 4)

②ADD 3.3K RES. FROM U1 PIN 21 TO TRACE CONNECTING U4 PIN 14 TO R1 AND R2 (+5V) ON SIDE 1 OF PCB.

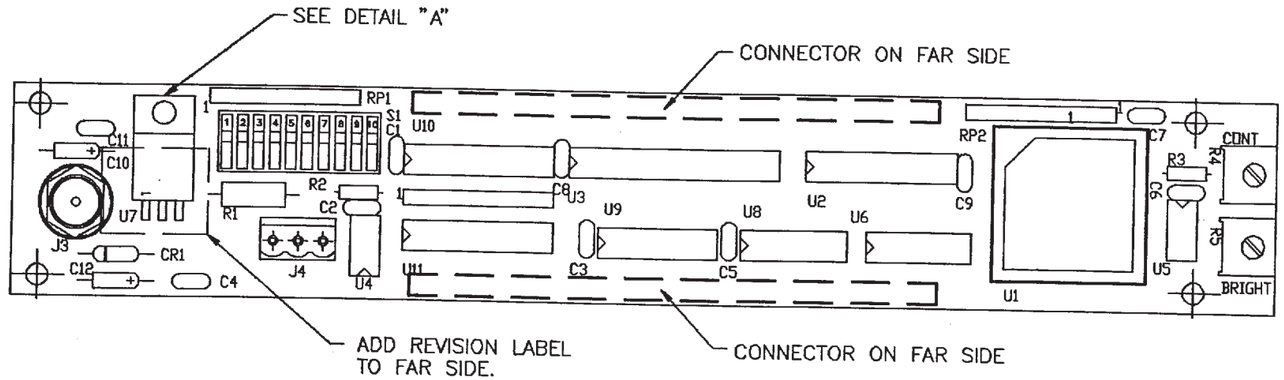
③ADD .001UF CAP FROM U1 PIN 21 TO TRACE CONNECTING U4 PIN 14 R1 AND R2 (+5V) ON SIDE 1 OF PCB.

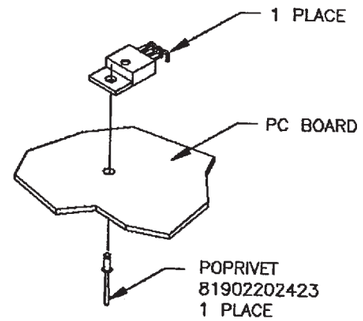
COMPONENTS NOT INSTALLED
Q1, Q2, R4, R5, R6, C5, U6, U7, U5, R3, C6, C3, R2, R1, U4, S13, S14, S29, S30, J3, DSP1



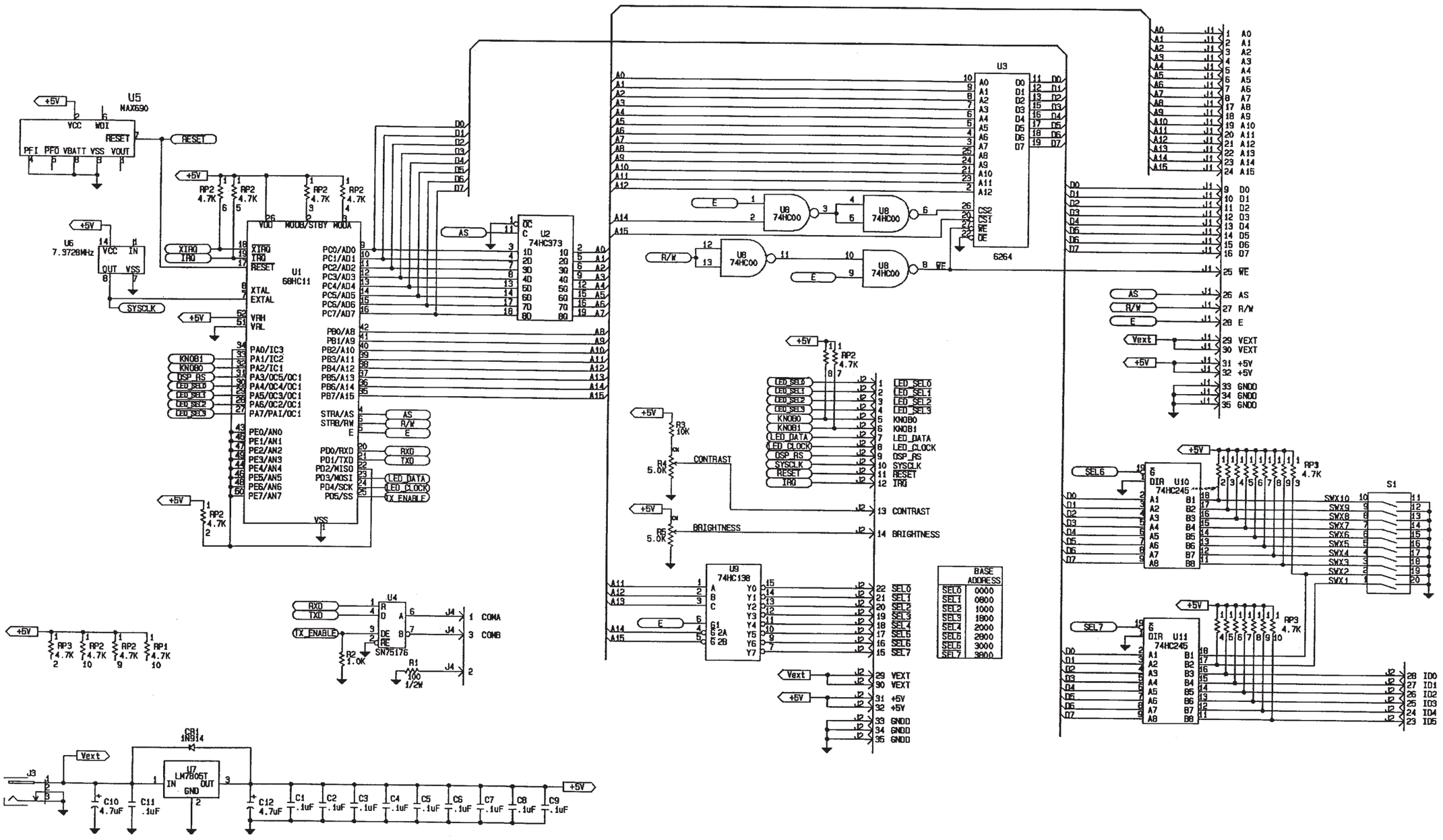
NOTES:

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


SEE DETAIL "A"
CONNECTOR ON FAR SIDE
RP1
S1
C1
U10
C11
C10
U7
J3
CR1
C12
C4
R2
C2
R1
J4
U4
U11
C8
U3
U9
U8
U6
U2
C9
C3
C5
RP2
C7
U1
R3
D6
U5
CONT
R4
R5
BRIGHT
ADD REVISION LABEL
TO FAR SIDE.
CONNECTOR ON FAR SIDE


1 PLACE
PC BOARD
POPRIVET
81902202423
1 PLACE

DETAIL "A"


U5
MAX690
VCC WDI RESET
PFI PFO VBATT VSS VOUT
RESET
+5V
RP2 4.7K
U6
7.3728MHz
VCC IN OUT VSS
SYSCLK
U1
68HC11
XTAL
EXTAL
XIRQ
IRQ
RESET
VRH
VRL
MODB/STBY MODA
VDD
PA0/IC3
PA1/IC2
PA2/IC1
PA3/OC5/OC1
PA4/OC4/OC1
PA5/OC3/OC1
PA6/OC2/OC1
PA7/PAI/OC1
KNOB1
KNOB0
DSP_RS
LED_SEL0
LED_SEL1
LED_SEL2
LED_SEL3
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
RXD
TXD
LED_DATA
LED_CLOCK
TX_ENABLE
VSS
U2
74HC373
AS
D0
D1
D2
D3
D4
D5
D6
D7
U3
6264
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
D0
D1
D2
D3
D4
D5
D6
D7
WE
CS1
CS2
OE
U8
74HC00
R/W
E
U4
SN75176
TX_ENABLE
R2
1.0K
R1
100
1/2W
COMA
COMB
U9
74HC138
SEL0
SEL1
SEL2
SEL3
SEL4
SEL5
SEL6
SEL7
BASE ADDRESS
SEL0 0000
SEL1 0800
SEL2 1000
SEL3 1800
SEL4 2000
SEL5 2800
SEL6 3000
SEL7 3800
R3
10K
R4
5.0K
R5
5.0K
CONTRAST
BRIGHTNESS
Vext
VEXT
GNDD
U10
74HC245
U11
74HC245
DIR
SEL6
SEL7
RP3
4.7K
S1
SWX1
SWX2
SWX3
SWX4
SWX5
SWX6
SWX7
SWX8
SWX9
SWX10
ID0
ID1
ID2
ID3
ID4
ID5
CR1
1N914
U7
LM7805T
IN OUT GND
J3
C10
4.7uF
C11
.1uF
C12
4.7uF
C1
.1uF
C2
.1uF
C3
.1uF
C4
.1uF
C5
.1uF
C6
.1uF
C7
.1uF
C8
.1uF
C9
.1uF

7.0 Parts List

General

The Parts List in this section have been grouped according to each assembly associated with the RCP–242. Refer to each list by name of card, board, or section of the equipment requiring replacement parts.

Part	Part Number	Page
Mainframe Assembly: RCP–242	81906515340	7.2
Switchcard Assembly	81906515390	7.3
CPU Assembly	81906515410	7.4

RCP–242 Mainframe Assembly – 81906515340

81902101468	Serial Label	1	Ea
81902101500	FCC Non-Compliance Label	1	Ea
81902201433	Screw, 3/16 X 4-40 Flat Head	4	Ea
81902202696	Screw, 7/16 X 4-40 Panhead	4	Ea
81903462270	Front, 24x2 Pushbutton	1	Ea
81903462300	Rear, 1RU Chassis	1	Ea
81906515390	Switchcard Assy, 24x2 Pushbutton	1	Ea
81906515410	PCB Assy, CPU Board	1	Ea
81902906070	3-Position Plug	1	Ea
81902003420	4-40 x 15/16 Round Nylon Standoff	1	Ea

Switchcard Assembly – 81906515390

81900600958	Res, 4.7K Sip, 10 Pin 9 Res	Rp1	1	Ea
81900700055	Cap, .1UF	C1, C2, C4	3	Ea
81901604314	IC, 74HC245 Octal Bus Tranciever	U3	1	Ea
81901604827	IC, 74HC138 1 Of 8 Decoder	U2	1	Ea
81901606870	IC, MM5450V Led Driver	U1	1	Ea
81902101930	Key Cap		30	Ea
81902104890	Legend Set		1	Ea
81902411860	PCB, SRU Switchcard		1	Ea
81902600584	Switch, Mechanical Enterprises	S1-12,15-28,30-34	30	Ea
81902907430	Conn, 35x1 Receptacle	J1 J2	2	Ea
81902907400	Socket, 44 Pin PLCC	U1	1	Ea
81902907440	Conn, 6x1 Receptacle	J4	1	Ea
81903200301	LED	S1-12,15-28,30-34	30	Ea
PK65-1539	Packet		1	Ref

CPU Board – 81906515410

81900200668	Res, 1K, 1/2 W, 5%	R2	1	Ea
81900200908	Res, 10K, 1/2W, 5%	R3	1	Ea
81900300427	Res, 100 Ohm, 1/2 W, 5%	R1	1	Ea
81900500125	Pot, 5K Single Turn	R4, R5	2	Ea
81900600958	Res, 4.7K Sip, 10 Pin 9 Res	RP1, RP2, RP3	3	Ea
81900700055	Cap, .1 Uf	C1-C9, C11	10	Ea
81900900309	Cap, 4.7 Uf Tantalum	C10, C12	2	Ea
81901500017	Diode, 1N914	CR1	1	Ea
81901601187	IC, LM7805 +5V Regulator	U7	1	Ea
81901604314	IC, 74HC245 Octal Transceiver	U10, U11	2	Ea
81901604579	IC, 74HC373 Octal Latch	U2	1	Ea
81901604827	IC, 74HC138 1 Of 8 Decoder	U9	1	Ea
81901604850	IC, 74HC00 Quad 2 Input Nand	U8	1	Ea
81901606061	IC, MAX690 Supervisory Circuit	U5	1	Ea
81901606820	IC, 8K X 8 Ram, Skinny Dip Package	U3	1	Ea
81901606830	Oscillator, 7.3728 Mhz	U6	1	Ea
81901606880	IC, SN75ALS176 RS485 Transceiver	U4	1	Ea
81902411900	PCB, CPU Board		1	Ea
81902600543	Switch, 10 Position Dip	S1	1	Ea
81902905991	Socket, 52 Pin PLCC	U1	1	Ea
81902906353	Conn, 3 Pos MTA	J4	1	Ea
81902907420	Conn, 35x1 Header	J1, J2	2	Ea
81902907460	Conn, 2.5 Mm Power	J3	1	Ea
81902202423	Pop Rivet		1	Ea
81906515550	68HC711E9 CPU, Programmed		1	Ea
PK65-1541	Packet		1	Ref