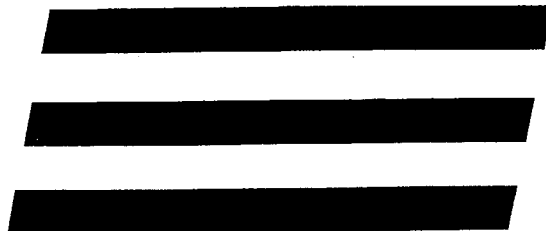




# Switcher 410

Operation and  
Maintenance Manual

**HUNTRON<sup>®</sup>**





# HUNTRON<sup>®</sup> SWITCHER

## LIMITED WARRANTY

For a period of one year from the date of its purchase new and undamaged from Huntron Instruments, Inc. HUNTRON INSTRUMENTS, INC. will without charge, repair or replace, at its option, this product if found by it to be defective in materials or workmanship. Products purchased in the United States are to be returned to Huntron Instruments, Inc. at its factory, transportation prepaid. Products purchased outside the United States are to be returned to the source of purchase. This limited warranty is expressly conditioned upon the product having been used only in normal usage and serviced in accordance with instruction of HUNTRON INSTRUMENTS, INC. and not having been altered in any way or subject to misuse, negligence or damage, and not having been repaired or attempted to be repaired by anyone other than HUNTRON INSTRUMENTS, INC. or its authorized agents. **EXCEPT FOR THE FOREGOING EXPRESS WARRANTY OF REPAIR OR REPLACEMENT, HUNTRON INSTRUMENTS, INC. MAKES NO WARRANTY OF ANY KIND, INCLUDING BUT NOT LIMITED TO, ANY EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, AND HUNTRON INSTRUMENTS, INC. SHALL NOT BE LIABLE FOR ANY DAMAGES, WHETHER DIRECT OR INDIRECT, CONSEQUENTIAL OR INCIDENTAL, FORESEEABLE OR NOT, OR OTHERWISE, BEYOND REPAIRING OR REPLACING THIS PRODUCT. THIS WARRANTY IS NOT APPLICABLE TO EXTERNAL CABLES, CLIPS, WIRING OR POWER SUPPLY.**

## CHANGE INFORMATION

P/N: 21-1208

ISSUE NO: 3 4/00

This change contains information necessary to ensure the accuracy of the following manual:

Title: **410 OPERATION AND MAINTENANCE MANUAL**  
Print date: **December 1983**  
P/N: **21-1030**  
Revision: **5**  
Revision Date: **8/94**

### CHANGE #1

EFFECTIVITY: 21-1030 MANUAL REV. 5

On Page 5-3:

CHANGE: MAIN PCA PARTS LIST

CHANGE: The following information to the list.

REF	DESCRIPTION	HUNTRON	CAGE	
MANUFACTURERS				
DES		P/N		PART NUMBER
1.A1.C3 <sup>4</sup>	Cap, Tant 4.7uF, 25V	03-3088	31433	T350C475K025AS

### CHANGE #2

EFFECTIVITY: 21-1030 MANUAL REV. 5

On Page 1-2:

CHANGE: Table 1-1. The "Alternation Rate" under **ELECTRICAL** should read "adjustable from 0.5Hz to 5Hz".

### CHANGE #3

EFFECTIVITY: ALL UNITS STARTING WITH S/N 310-11847

On Page 5-3:

CHANGE: MAIN PCA PARTS LIST

CHANGE: The following information to the list.

REF MANUFACTURERS DES	DESCRIPTION	HUNTRON P/N	CAGE	PART NUMBER
1.A1.R3 <sup>9</sup>	Res, MF 30.1K $\Omega$ 0.1% 1/4W	02-2365	09021	MF55E3012B

On Page 5-4:

CHANGE: MAIN PCA PARTS LIST

CHANGE: The following information to the list.

REF MANUFACTURERS DES	DESCRIPTION	HUNTRON P/N	CAGE	PART NUMBER
1.A1.U2 <sup>8</sup>	IC, 74HC14 Tested	05-5181	57705	05-5181

### CHANGE #3 (cont.)

On Page 5-5:

CHANGE: Notes to MAIN PCA PARTS LIST

CHANGE: The following note

<sup>8</sup>Serial numbers prior to S/N 310-20829 use IC, Schmitt Trigger Inverter, Huntron P/N 05-5018, CAGE 27014, Manufacturers P/N 74C14. Serial numbers from S/N 310-10829 to S/N 310-11846 use IC, Hex Schmitt Trigger, Huntron P/N 05-5062, CAGE 27014, Manufacturers P/N 74HC14.

ADD: The following note

<sup>9</sup>Serial numbers prior to S/N 310-11847 use Res, CF 47K $\Omega$ , 5%, 1/4 W, Huntron P/N 02-2143, CAGE 09021, Manufacturers P/N CF 1/4 47K J.

On Page 6-4:

CHANGE: FIGURE 6-2. MAIN PCA SCHEMATIC

CHANGE: The value of R3 (near U2A)

FROM: 47K

TO: 30.1K 0.1%

## **CHANGE #4**

EFFECTIVITY: 21-1030 MANUAL REV. 5

On the title page's overleaf, change the CONTACTING HUNTRON information to:

"To obtain information about service, accessories and other products, contact:

Huntron, Inc.  
15720 Mill Creek Blvd., Suite #100  
Mill Creek, WA 98012  
U.S.A.

In North America, call 800-426-9265 or 425-743-3171

Huntron is also accessible by:

- ◆ FAX: 425-743-1360
- ◆ Internet E-mail: [huntron@huntron.com](mailto:huntron@huntron.com)
- ◆ Internet Home Page: <http://www.huntron.com>

On page 4-1, Section 4-2, replace the second paragraph with:

"For in-warranty or out-of-warranty factory service in the United States, call (toll-free) 800-426-9265 to describe the malfunction and obtain an RMA Number and shipping instructions prior to shipment. This number must be clearly displayed on the exterior of the shipping carton. Only parcels displaying an RMA number will be accepted. Huntron is also accessible by FAX at 425-743-1360, by Internet E-mail at [huntron@huntron.com](mailto:huntron@huntron.com), and on our Internet Home Page at <http://www.huntron.com>"

## **CHANGE #5**

EFFECTIVITY: 10/94

On page 2-1 make the following changes:

Remove: 07-1229 qty 2  
98-0032 qty 1  
98-0033 qty 1

Add: 07-1234 qty 2  
98-0214 qty 2  
98-0215 qty 2

# **HUNTRON SWITCHER 410**

## **OPERATION AND MAINTENANCE MANUAL**

**December 1983  
P/N 21-1030  
Rev. 5, 8/94**

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## **ABOUT THIS MANUAL**

This instruction manual is divided into six sections and covers the general operation and maintenance of your instrument.

## **CONTACTING HUNTRON**

For technical support or to obtain information about service, accessories, and other products contact:

Huntron, Inc.  
15720 Mill Creek Blvd., Suite #100  
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Outside North America, call your local distributor for assistance or service.



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**NOTES:**

# SECTION 1

## INTRODUCTION AND SPECIFICATIONS

### 1-1. INTRODUCTION

The Huntron Switcher 410, shown in Figure 1-1, has been designed as a compatible interface for the Huntron Tracker 1000 and Huntron Tracker 2000. Together, they create an effective test system for component troubleshooting. The Switcher 410 allows faster comparison testing of components by the use of ZIF (zero insertion force) sockets for out of circuit components and by the use of DIP clip cables for in-circuit ICs (Integrated Circuits).



Figure 1-1. Huntron Switcher 410 and Huntron Trackers.

**1-2. SPECIFICATIONS**

The specifications for the Switcher 410 are listed in Table 1-1.

**Table 1-1. Switcher 410 Specifications.**

<b>ELECTRICAL</b>	
Alternation Rate .....	adjustable from 0.5 Hz to 10 Hz
Number of Test/Common Pins .....	40
Means of pin selection:	
Test Pins .....	momentary pushbutton switches
Common Pins .....	jumper wires
Connectors:	
(2) 40 Pin ZIF sockets (for 0.6" wide devices)	
(2) 20 Pin ZIF sockets (for 0.3" wide devices)	
Power Requirements:	
Input Voltage .....	8 VDC to 12 VDC
Input Current .....	200 mA (max)
<b>GENERAL</b>	
Size .....	10"W x 2"H x 7.5"D (25cm W x 5cm H x 19cm D)
Weight .....	2lbs. 4oz. (1.0 kg)
Shock and Vibration.....	will withstand shock and vibration encountered in commercial shipping and handling.
<b>ENVIRONMENTAL</b>	
Operating Temperature.....	0°C to + 50°C ( 32°F to 122°F )
Storage Temperature .....	- 50°C to + 60°C ( - 58°F to + 140°F )
Relative Humidity.....	0 to 70% R.H.

### 1-3. SAFETY CONSIDERATIONS

This manual contains information, cautions, and warnings the user must follow to ensure safe operation, and to keep the instrument in safe condition.

#### WARNING

**A warning denotes a hazard. It calls attention to a procedure or practice which, if not correctly performed or adhered to, could result in personal injury.**

#### CAUTION

**A caution also denotes a hazard. It calls attention to a procedure or practice which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the instrument.**

### 1-4. LIST OF ACCESSORIES

The following accessories are available:

HUNTRON P/N	DESCRIPTION
98-0037	20 Pin DIP Clip Cables (1 pair)
98-0038	24 Pin DIP Clip Cables (1 pair)

To order any of the above items, or for further information, please contact Huntron.

**NOTES:**



# SECTION 2

## OPERATING INSTRUCTIONS

### 2-1. INTRODUCTION

This section describes the basic operation of the Switcher 410. Throughout the rest of this manual the Switcher 410 will be referred to simply as a "410". Take time to read this section carefully so that you can take full advantage of all the troubleshooting capabilities of the 410.

### 2-2. UNPACKING YOUR INSTRUMENT

Your instrument was shipped with the following items:

QTY	DESCRIPTION	HUNTRON P/N
1	Overlay, 6 & 8 Pin	01-2010
1	Overlay 14 & 16 Pin	01-2011
1	Overlay, 24 & 28 Pin	01-2012
2	16 Pin DIP Clip	07-1229
2	40 Pin DIP Clip	07-1230
1	Operation & Maintenance Manual	21-1030
1	Common Pin Jumper Set	98-0020
1	Power/Clock Cable	98-0031
1	16 Pin DIP Clip Cable	98-0032
1	40 Pin DIP Clip Cable	98-0033
1	Dual Banana Cable (red/black)	98-0035
1	10 k $\Omega$ Resistor Jumper Set	98-0085

Check the shipment carefully and contact the place of purchase if anything is missing or damaged in shipment. If reshipment is necessary, please use the original shipping carton and packing foam. If these are not available, be sure that adequate protection is provided to prevent damage during shipment. See section 4-2 for shipping information.

### 2-3. PHYSICAL FEATURES

Before you begin to use the 410, please take a few minutes to familiarize yourself with the instrument. All of the externally accessible features are shown in Figure 2-1 and summarized in Table 2-1.

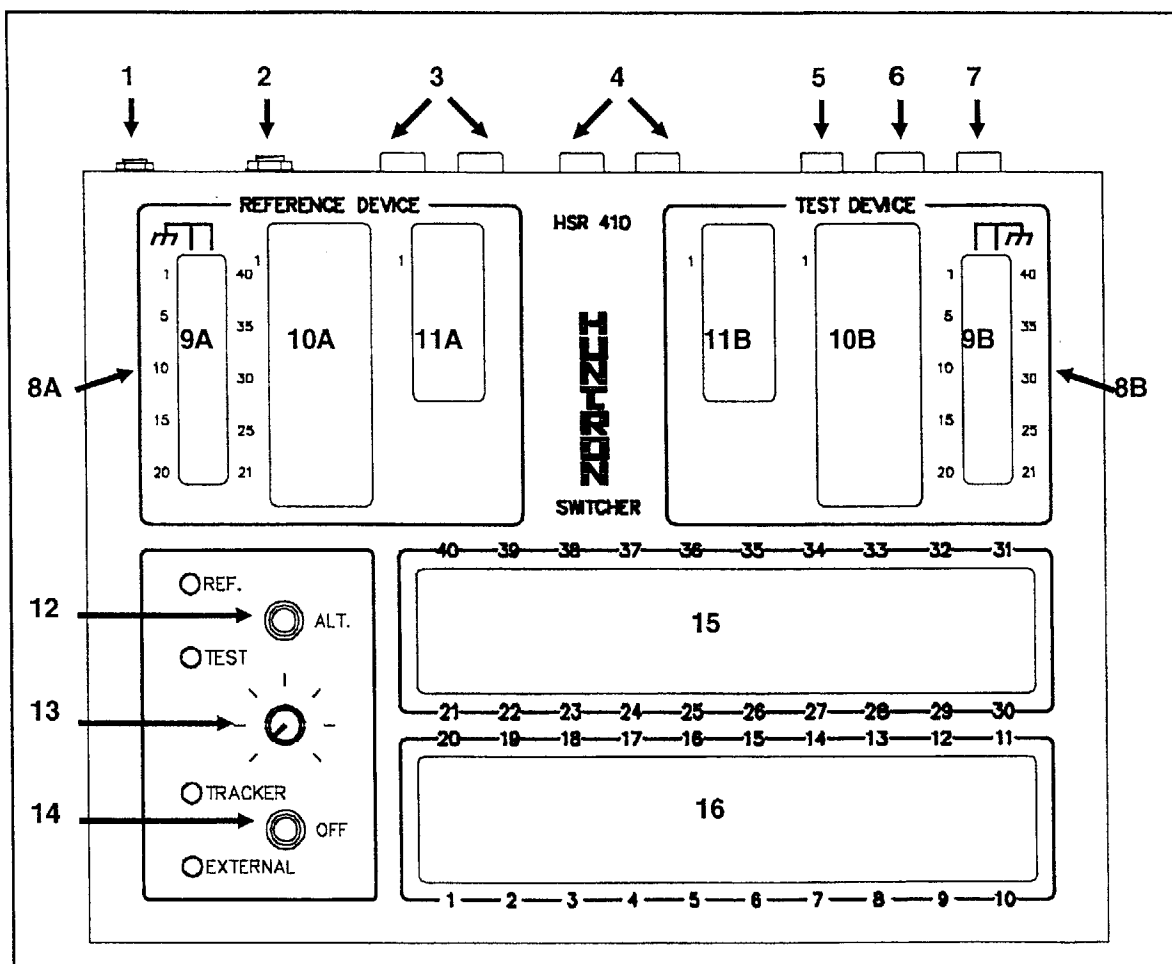


Figure 2-1. External Features

Table 2-1. Controls and Connectors.

Item No.	Name	Function
1	Ext CLK Jack	Provides connections for an external clock source from the Huntron Tracker 2000.
2	Power Jack	Provides connection for an external source of low voltage DC to power the 410.
3	TRACKER Jacks	Provides connection to a Huntron Tracker.
4	EXTERNAL Jacks	Provides connection to another test instrument (e.g. a digital multimeter).
5	Reference Device Probe Jack	Provides connection for Huntron Microprobe used to access reference device for pin by pin testing.
6	Common Probe Jack	Provides connection for test lead used to select Common Pins directly on test device and reference device.
7	Test Device Probe Jack	Provides connection for Huntron Microprobe used to access test device for pin by pin testing.
8A	Reference Device Section	Section containing features for connecting to the reference or "known-good" device.
8B	Test Device Section	Section containing features for connecting to the test device which is to be compared to the reference device.
9A	Reference Device Common Pin Jumper Socket	Socket used with a jumper wire to select the common pin on the reference device.
9B	Test Device Common Pin Jumper Socket	Socket used with a jumper wire to select the common pin on the test device.
10A	Reference Device 40 Pin ZIF Socket	Zero Insertion Force (ZIF) socket for cable connection to the reference device or for insertion of a reference device with up to 40 pins.
10B	Test Device 40 Pin ZIF Socket	ZIF Socket for cable connection to the test device or for insertion of a test device with up to 40 pins.
11A	Reference Device 20 Pin ZIF Socket	Same as 10A except for reference devices of 20 pins or less.
11B	Test Device 20 Pin ZIF Socket	Same as 10B except for test devices of 20 pins or less.
12	REF/ALT/TEST Select Switch	Toggle switch that is used to select the reference device, the test device, or to alternate between the two at a speed determined by the RATE control.
13	RATE Control	Controls the rate of device alternation.
14	TRACKER/OFF/EXTERNAL Select Switch	Toggle switch that turns 410 power off in the middle position and turns the 410 power on in the other two positions. The TRACKER position activates the TRACKER jacks (see item 3) and the EXTERNAL position activates the EXTERNAL jacks (see item 4).
15	Pins 21 - 40 Select Buttons	Momentary push buttons that connect the same pin (in the range from 21 to 40) on the reference device and the test device to the instrument connected to the 410 depending on the setting of the REF/ALT/TEST switch.
16	Pins 1 - 20 Select Buttons	Same as 15 except for pins in the range from 1 to 20.

## 2-4. SETUP AND OPERATION

The following procedure details how to setup and operate the 410 with a Tracker for in-circuit comparisons of a 14 pin ICs on different boards. Although other modes can be used with the 410, this procedure is the one most commonly used for troubleshooting.

1. Connect the power/clock cable supplied with your 410 to the accessory output on the back panel of the Tracker. Connect the other end of the power/clock cable to the 410 as follows:
  - If you are using a Tracker 2000, connect the two plugs to the power jack and the EXT CLK jack.
  - If you are using a Tracker 1000, connect the proper plug to the power jack and do not plug anything into the EXT CLK jack.
2. Connect the dual banana cable from the channel A jack and common jack on the Tracker to the TRACKER jacks on the 410. Keep the colors matched up i.e. red to red and black to black. Turn the Tracker power on. Select channel A on the Tracker.
3. Set the TRACKER/OFF/EXTERNAL switch to TRACKER. The Tracker LED should illuminate.
4. Set the REF/ALT/TEST switch to ALT (Alternate). This switch can be used to stop on either the reference device or the test device when a longer viewing time is needed. Adjust the RATE control to select a desired alternation rate. When using the Tracker 2000 use the RATE control on the 2000 (the RATE control on the 410 is disabled in this mode).
5. Place the 14 pin overlay over the top panel of the 410. Refer to the 14 pin graphics on the overlay when selecting pins.
6. Connect the two 16 pin DIP clip cables to the two 20 pin ZIF sockets on the 410. Be sure pin 1 is on top (red stripe on cable) and is aligned with pin 1 on the socket when a cable or device of less than 20 pins is used.

### CAUTION

**The devices to be tested must have all power turned off, and have all capacitors discharged before connecting the Tracker / 410 to the devices.**

7. Connect the DIP clip end of the cable that is connected to the reference device section on the 410 to a 14 pin IC on a known-good board. The red stripe end of the clip is pin 1 so be sure that end of the clip is connected to pin 1 of the IC. Since this is a 16 pin clip the two pins on the opposite end of the clip will not be connected to anything.
8. Connect the DIP clip end of the test device cable to the 14 pin IC that is in the same location on the unknown board as the IC on the known-good board e.g. if you hooked up to U9 or IC9 on one board, hook up to U9 or IC9 on the other board.

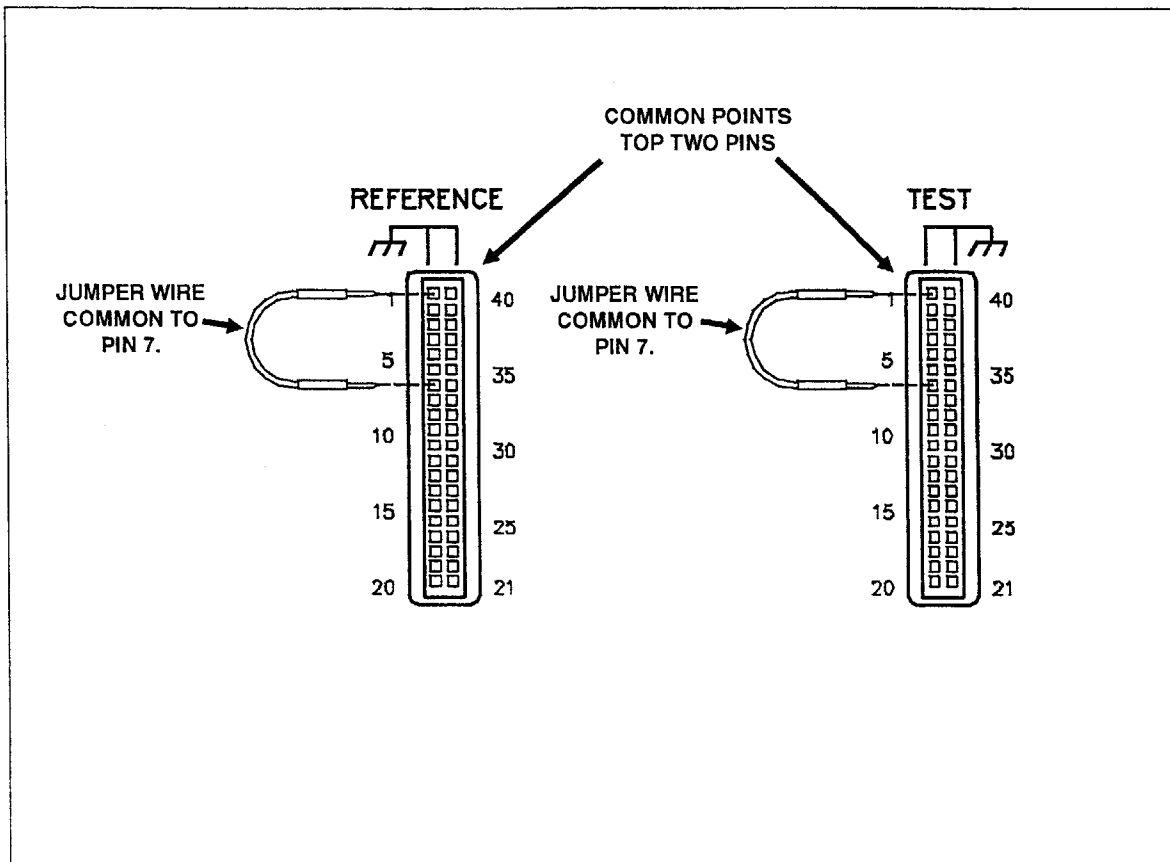





Figure 2-2. Common Pin Selection.

9. Usually on 14 pin ICs, pin 7 is ground and that is a good selection for the common pin. The common pin is that pin which the test is made "with respect to". In other words, if pin 7 is common and you test pin 1 of an IC you will see the analog signature of pin 1 with respect to pin 7. Like any other two terminal test instrument you must make two connections to the device under test. To select pin 7 as the common pin on the 410, use the Common Pin jumper wires and the Common Pin Jumper Sockets (see Figure 2-2). Connect the jumper wires between pin 7 and the top pins labeled  on each of the two sockets. All points marked  on the 410 are the common points (NOTE:  is not earth ground).
10. Next, press the pin 7 button on the 410. The Tracker should display a vertical line which is the signature of a short circuit. This does not test the devices on the board but it does make sure that the 410 is set up correctly. You are now ready to begin comparing the signatures between the two boards.
11. Pressing the buttons for pins 1 to 7 in the lowest row of the 410 and pins 8 to 14 in the next row up will produce alternating displays of each pin on the Tracker CRT. Be sure to select an appropriate impedance range on the Tracker for the type of device being examined (consult your Tracker manual for more information on range selection).

It can now be seen that the advantage of using the 410 with a Tracker is that only one finger is used to examine the signatures of the same pin on two different ICs. If you were using probes, both hands must be used to do the same operation.

The topics that follow clarify various points and expand into other areas.

**CIRCUIT SIMILARITY** - Devices and circuits being compared should be as nearly identical as possible, otherwise differences may be present which could give misleading signatures. Try to use the same PCB revision level when comparing boards or verify by schematic diagram that the device being examined is wired the same on boards of different revision level.


**NUMBER OF PINS** - When testing 20 pin ICs or 40 pin ICs use the graphics on the top panel of the 410 to select the proper button for a given pin. For devices with 6 and 8 pins, 14 and 16 pins, or 24 and 28 pins, use one of the three overlays supplied with the 410. Place the appropriate overlay over the top panel of the 410 and use the graphics on the overlay to select the proper button for a given pin.

**SELECTING COMMON PINS** - In theory any pin on an IC that is not an open circuit could be used for the common pin. In practice, however, the normal procedure is to use one of the power supply pins on an IC as the common pin.  $V_{SS}$ ,  $V_{DD}$ ,  $V_{CC}$ , and Ground are some typical names for power supply pins. There is one situation where it is sometimes useful to not use a power supply pin. When testing boards where bus architectures are in use most of the pins on one IC will be connected in parallel with the same pins on other devices. Using the normal procedure above you can see a fault on one bus line, but you do not know which IC is causing it since they are all in parallel. In this event try using one of the "non-bussed" pins on the IC as the common pin. A non-bussed pin is any one that is not connected in parallel with all other ICs. Examples include "Chip Select" and "Enable" lines.

**OUT OF CIRCUIT COMPONENTS** - When comparing ICs that are not soldered in a board, place the components directly into the ZIF sockets and do not use the DIP clip cables. Then follow all the other steps of the procedure in the normal manner.

**NON-COMPARISON TESTING** - When you want to examine the signatures of only one board, select REF or TEST and connect the appropriate cable to the board. Then use the pin selection buttons to look for opens, shorts, leakage, and so on.

**POWER ON TESTING** - While the Tracker and 410 are setup as above, another test instrument (e.g. a digital multimeter) can be connected to the EXTERNAL jacks. When the TRACKER/OFF/EXTERNAL switch is set to EXTERNAL, the reference board and test board can be powered up and parameters (e.g. voltage) can be examined and compared. Before going back to use the Tracker, be sure to power down both boards.

**TESTING CMOS DEVICES** - CMOS ICs sometimes produce unstable signatures especially when tested out of circuit in the ZIF sockets of the 410. Whether the device is in-circuit or out of circuit, if instability occurs it is advisable to connect the 10k $\Omega$  resistor jumpers provided across the  $V_{DD}$  and  $V_{SS}$  pins of the device. This will help to reduce or eliminate the unstable signatures. To use the resistor jumpers, first select  $V_{DD}$  or  $V_{SS}$  as the common pin in the normal manner (see Figure 2-2). Then connect one end of the resistor jumper to the second hole labeled  on the Common Pin Jumper Socket. The other end is connected to the  $V_{SS}$  or  $V_{DD}$  pin whichever is not being used as the common pin.

## 2-5. EXTERNAL CLEANING AND LUBRICATION

### CAUTION

To avoid instrument damage, never get water inside the case or apply solvents to the instrument.

Should the 410 case require cleaning, wipe the instrument with a cloth that is lightly dampened with water or mild detergent solution. The 410 requires no lubrication.

## 2-6. STORAGE INSTRUCTIONS

For optimum protection, store unit indoors in a dry place.

**NOTES:**



# SECTION 3 THEORY OF OPERATION

## 3-1. INTRODUCTION

This section describes how the 410 works. A detailed schematic diagram of the 410 appears in Section 6.

## 3-2. FUNCTIONAL DESCRIPTION

The 410 is designed to augment the troubleshooting capabilities of a Huntron Tracker to form a complete analog signature analysis system. This is achieved by making it easier for the user to examine and compare the signatures of DIP ICs when compared to using a Tracker with probes to do pin by pin troubleshooting.

First, the 410 has 40 pushbutton switches that enable the user to connect any pin on a device (up to a maximum of 40 pins) to the Tracker. A simplified version of this is shown in Figure 3-1.

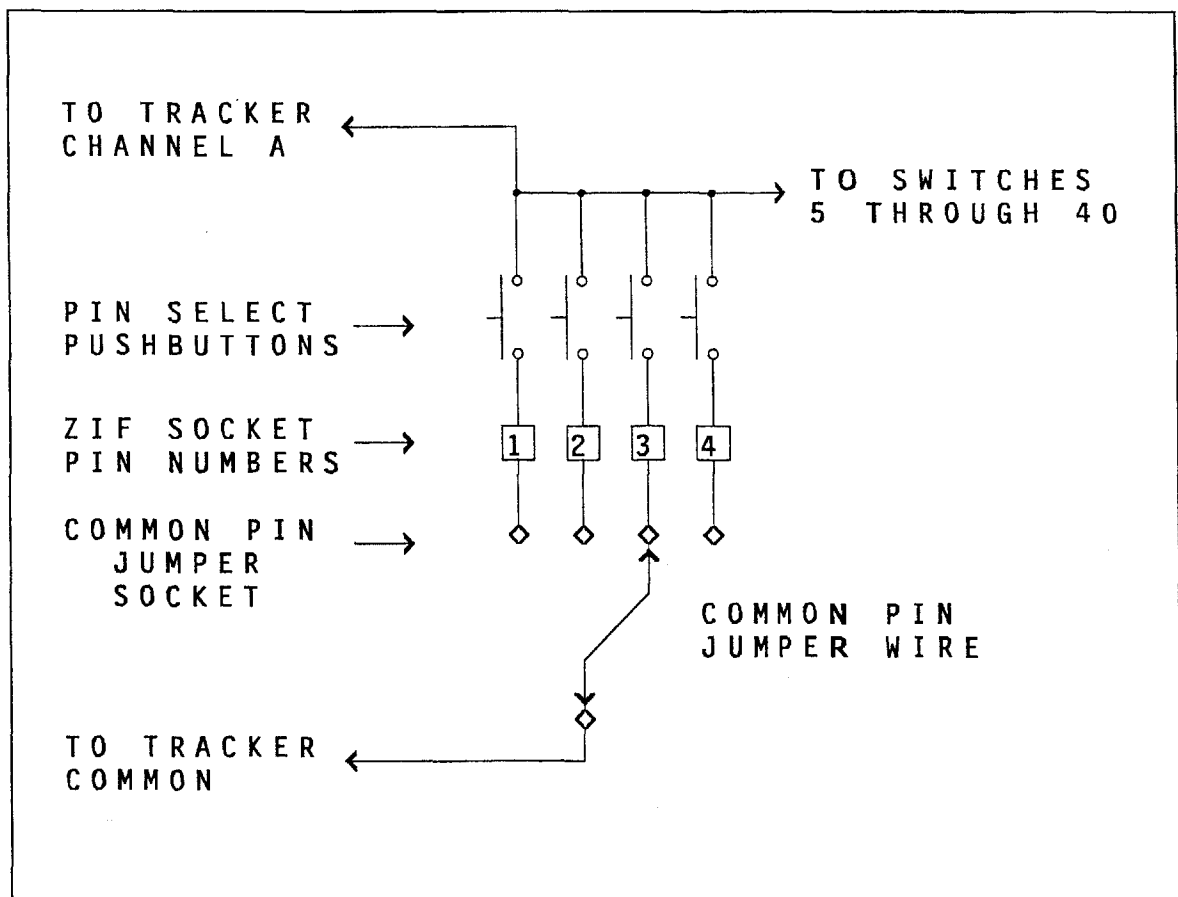


Figure 3-1. Simplified Diagram

In actual operation, the user must first select a common pin by plugging a jumper wire into the Common Pin Jumper Socket. All tests are then made with respect to the selected common pin. Next, the user connects the device to the 410 either by DIP clip cable for an in-circuit IC, or by inserting the loose device into one of the ZIF sockets. The user then pushes the Pin Select buttons one by one to view the signatures of each pin. It can be seen from the circuit in Figure 3-1 that when the pin select button that is the same as the common pin is pressed, the Tracker will display a short circuit regardless of whether a device is hooked up to the 410 or not.

The simplified circuit of Figure 3-1 actually depicts one of two identical sections. Each of the pin select push buttons is a double pole switch so that connections to both the REFERENCE DEVICE section and the TEST DEVICE section can be made at the same time. Then the alternation relay selects which section will be displayed on the Tracker. Figure 3-2 shows the simplified comparison circuit.

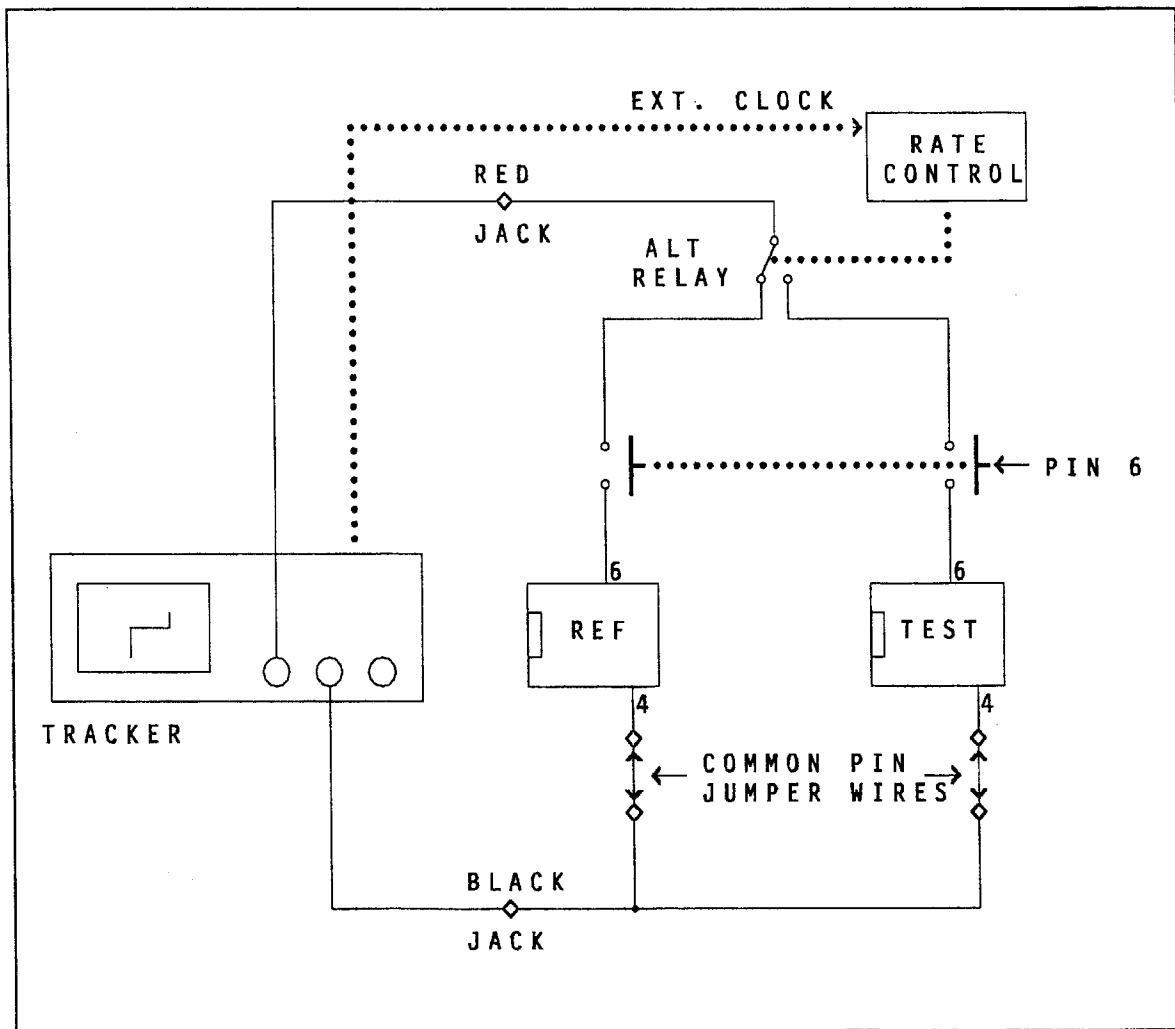


Figure 3-2. Comparison Circuit.

The figure shows the circuit for testing pin 6 on an 8 pin DIP with pin 4 as common. When the pin 6 button is pressed and the relay alternates from one device to the other, the signatures of each device will alternate on the Tracker CRT so that the comparison can be made. If the signatures are essentially the same, then that pin is OK. However, if there is significant difference between the reference and test devices, then the user must stop and see if the difference is due to normal device variations or is indicating that a fault is present.

The alternation relay is controlled by the REF/ALT/TEST switch. REF connects the relay as shown in Figure 3-2 so that only the signatures of the reference device are examined. The TEST position of the switch causes the relay to connect the TEST device to the Tracker. When the switch is moved to the middle or ALT position the relay alternates at a rate set by the RATE control on the 410 (note: when using a Huntron Tracker 2000 the internal rate control is disabled and the RATE control on the 2000 controls the alternation relay - this is shown by the EXT CLOCK dashed line in Figure 3-2). The user should adjust the rate control to a comfortable alternation rate.

The paragraphs above describe the normal use of the 410. Other features include probe jacks for point to point testing and the EXTERNAL jacks which provide an easy way to connect a different test instrument into the system without disturbing the Tracker/410 connection.

**NOTES:**

# SECTION 4 MAINTENANCE

## WARNING

**These service instructions are for use by qualified service personnel only.**

### 4-1. INTRODUCTION

This section presents maintenance information for the 410. The section includes service information, disassembly/reassembly instructions, performance tests, and troubleshooting information. This manual gives instructions for all revisions. Instructions may vary slightly for different revisions, so read all instructions and see notes on Page 5-5 before attempting to perform maintenance.

### 4-2. SERVICE INFORMATION

The conditions of the 410 warranty are given at the front of this manual. Malfunctions that occur within the limits of the warranty will be corrected at no cost to the purchaser exclusive of one-way shipping costs to Huntron Instruments, Inc. Huntron service is also available for repair of instruments that are beyond the warranty period. In either case, please describe clearly the problems encountered with the instrument.

For in-warranty or out of warranty factory service in the United States, call (toll-free) 800-426-9265 and receive an RMA number and shipping instructions prior to shipment. This number must be clearly displayed on the exterior of the shipping carton. Only parcels displaying an RMA number will be accepted. For service outside the U.S., contact your local Huntron distributor for information.

When packing the unit for shipment, use the original shipping container to provide protection during transit. If original container is not available, package the unit in a box with a minimum of two inches (5 cm) of cushioning material on all sides.

### 4-3. CMOS HANDLING PRECAUTIONS

#### CAUTION

**This instrument contains CMOS components which can be damaged by static discharge.**

To prevent damage, take the following precautions when troubleshooting and/or repairing the instrument:

- Perform all work at a static-free work station.
- Do not handle components or PCAs by their connectors.
- Wear static ground straps.
- Remove all plastic, vinyl and styrofoam from the work area.
- Use a grounded, temperature-regulated soldering iron.

#### 4-4. DISASSEMBLY AND REASSEMBLY

The following paragraphs present a disassembly procedure for the 410. The procedure should be performed in the order presented. To reassemble the 410, follow the steps in reverse order.

##### Case Bottom Removal:

Refer to Figure 4-1.

1. Turn unit over and place on a flat surface. Remove four screws (1.MP3) and four rubber feet (1.MP2) from case bottom.
2. Lift case bottom (1.MP1) away from face plate assembly.
3. Turn case top over.

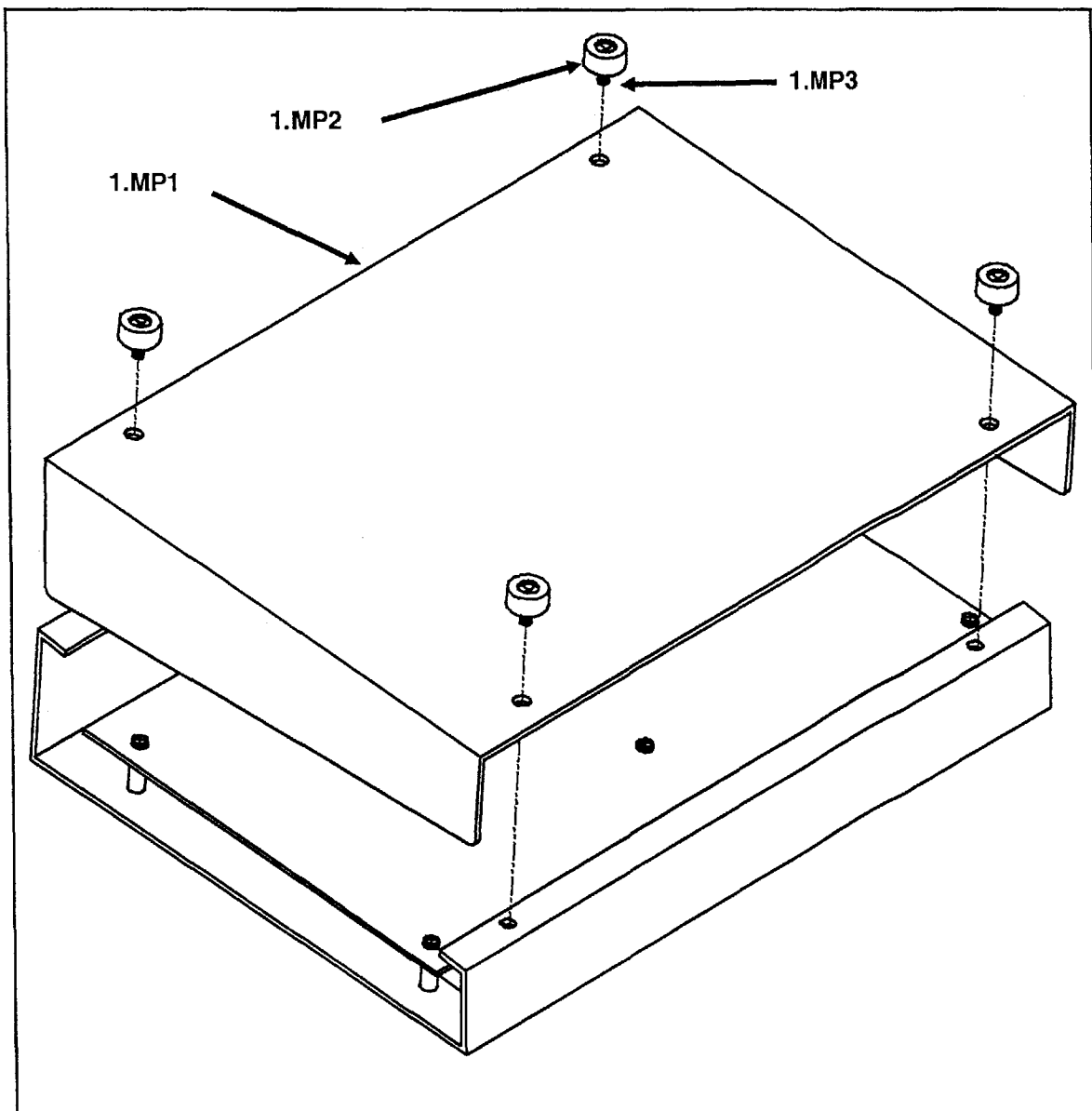


Figure 4-1. Case Bottom Removal.

### Case Top Hardware Removal:

Refer to Figure 4-2.

1. Set both toggle switches to the middle position (handle straight up). Remove the two dressnuts (1.MP7) from the switches using the proper tool.
2. Carefully use a knife edge to pry the knob cap (1.MP6) away from the knob (1.MP5).

Note: When reassembling the knob cap, first turn the knob fully counter-clockwise. Then install the knob cap with the white line even with the left lower mark on the top panel.

3. Using a notched screwdriver, loosen the nut inside the knob (1.MP5) and pull it off the potentiometer shaft.

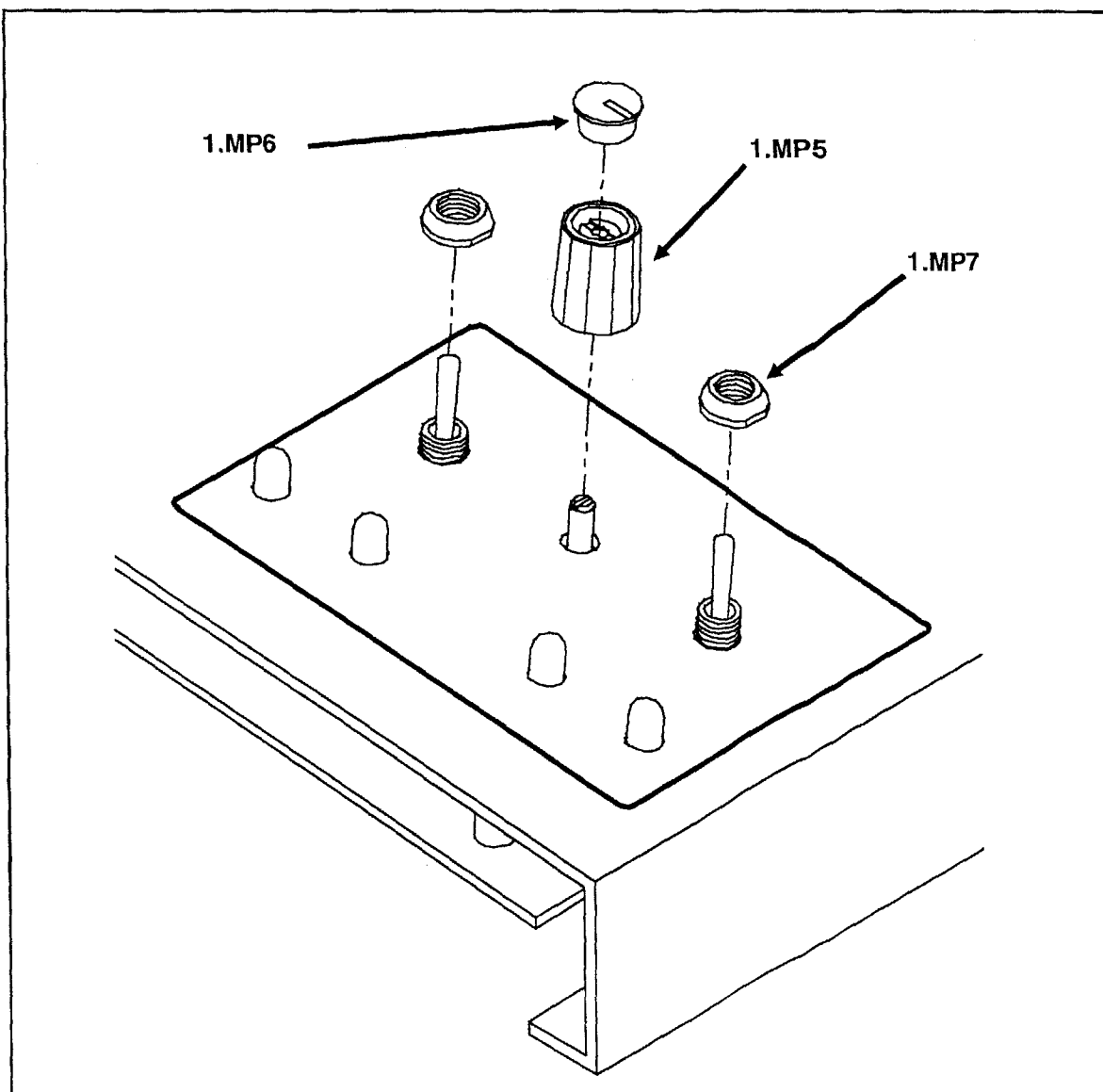


Figure 4-2. Case Top Hardware Removal.

### ZIF Socket Removal:

Refer to Figure 4-3.

1. The four ZIF sockets are pressed into internal sockets. They can be removed by carefully working each one straight out.
2. Remove the two 40 pin ZIF sockets (1.J14 and 1.J15).
3. Remove the two 20 pin ZIF sockets (1.J12 and 1.J13).

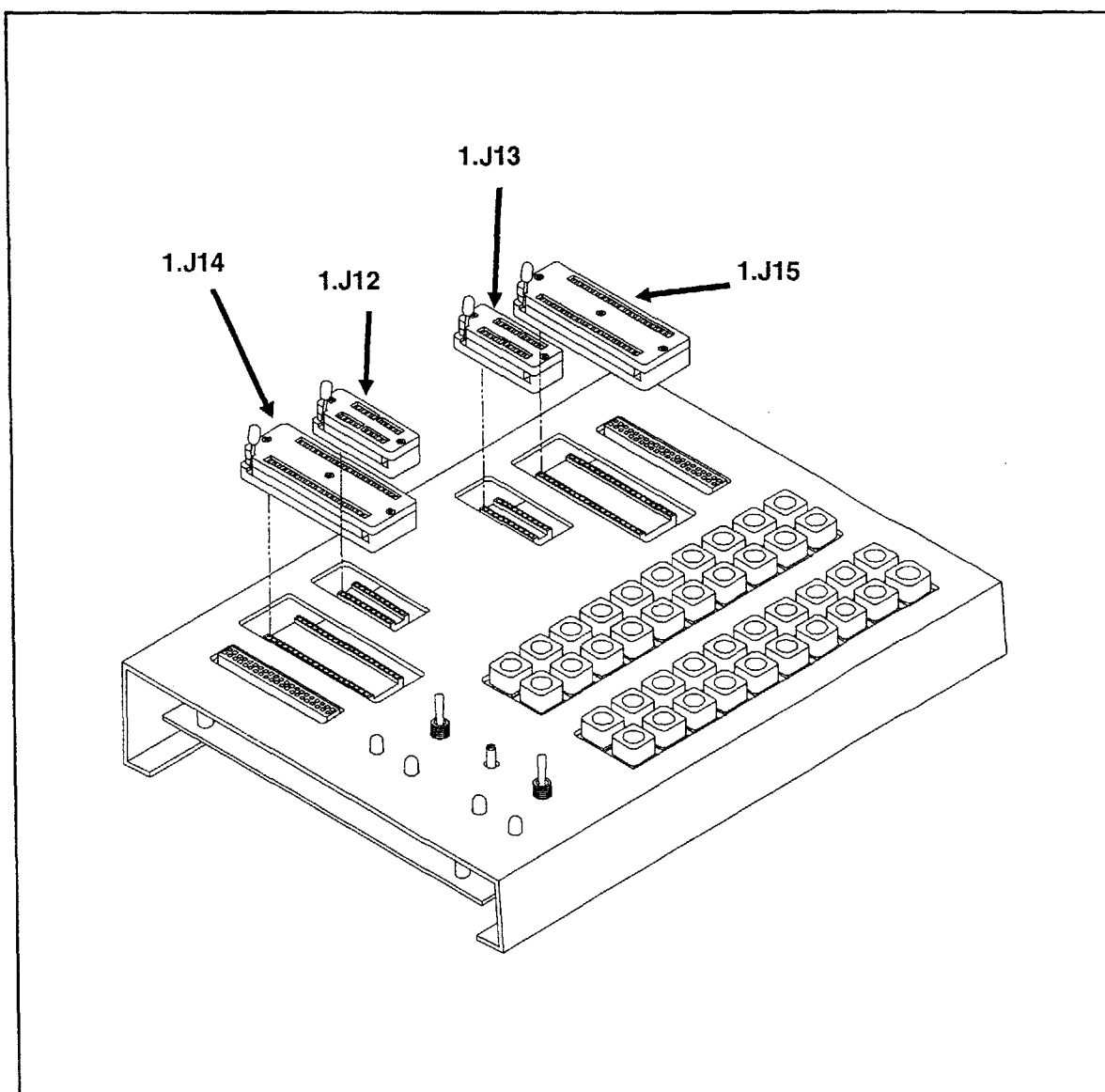


Figure 4-3. ZIF Socket Removal.



### PCA Mounting Screws/Connector Removal:

Refer to Figure 4-4.

1. Turn case top over.
2. Remove the 6 screws with washers (1.MP3) that hold the Main PCA to the case top.
3. Disconnect assembly 1.A2.A2 from 1.A1.J16 and assembly 1.A2.A1 from 1.A1.J17. Serial numbers prior to S/N 310-11230 do not have these connectors or assemblies (they are hardwired). Remove the wires only if necessary.

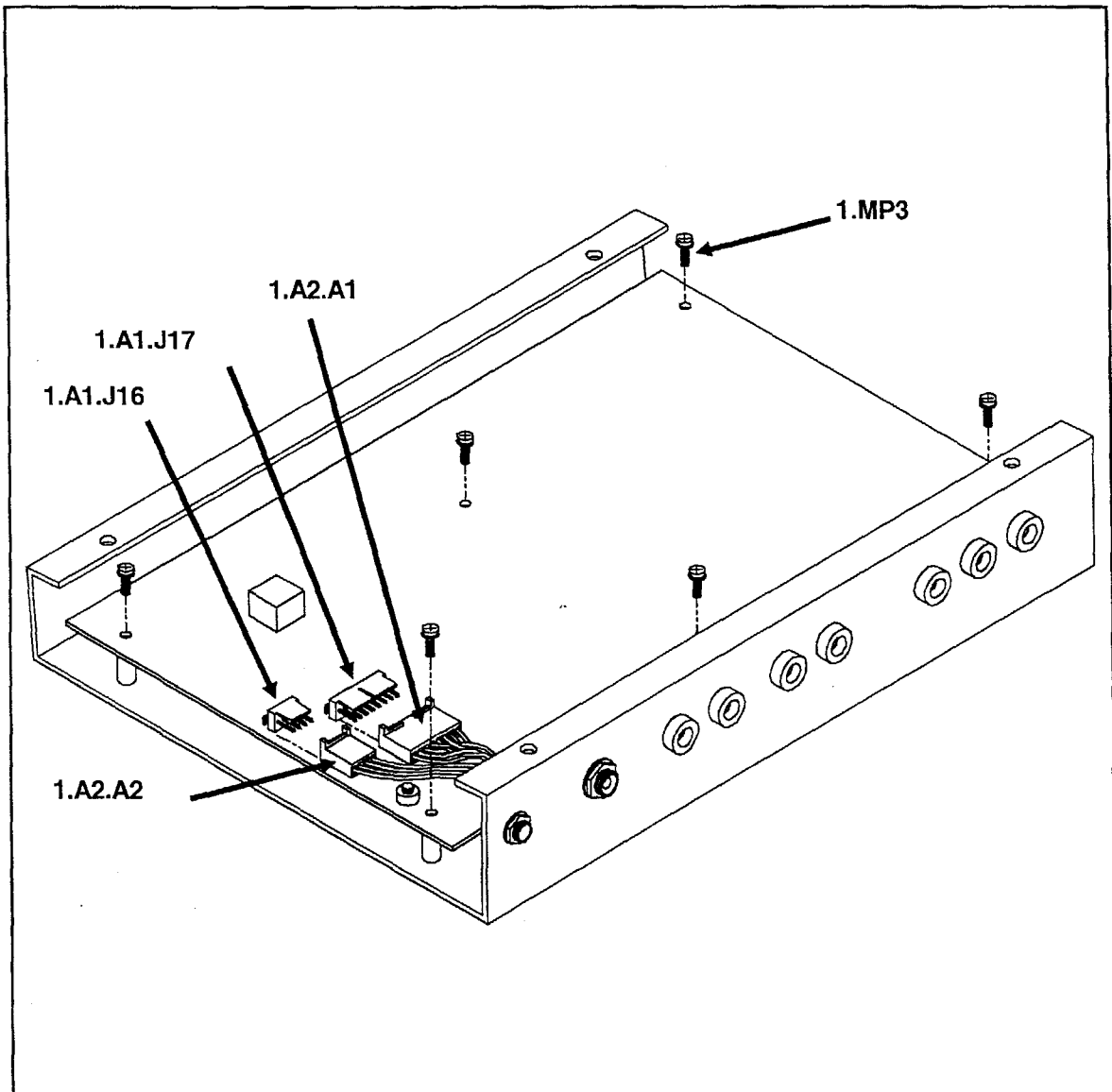


Figure 4-4. PCA Mounting Screws/Connector Removal.

## Main PCA Removal

Refer to Figure 4-5.

1. Rotate the Main PCA (1.A1) away from the Face Plate Assembly (1.A2.MP1). Components can now be accessed for troubleshooting. In versions prior to S/N 310-11230 care should be taken to insure wires to the Face Plate Assembly (1.A2) are not broken. In versions after S/N 310-11230 the PCA may be completely removed from the Face Plate Assembly.

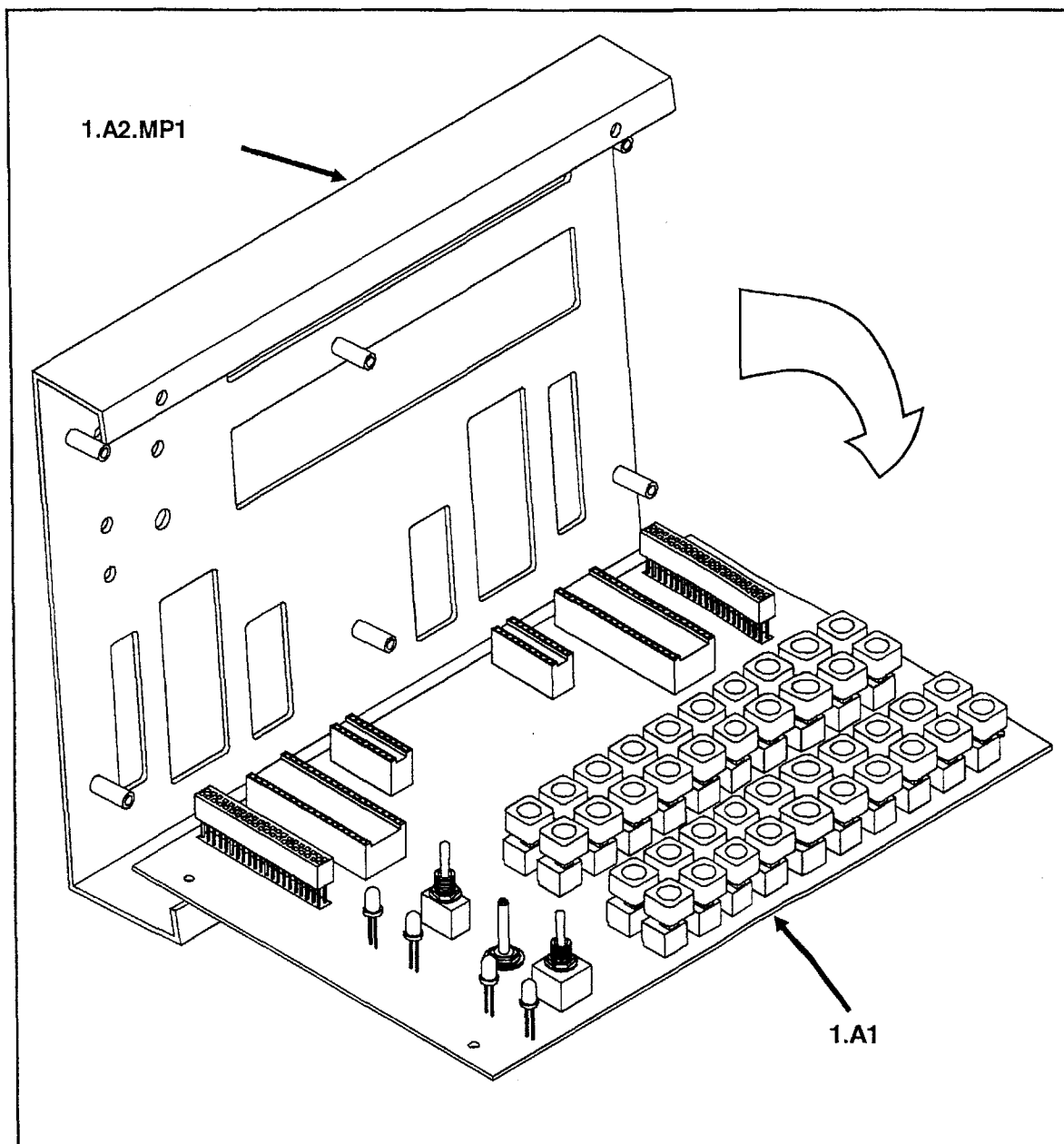


Figure 4-5. Main PCA Removal.

## 4-5. PERFORMANCE TESTS

The following procedure allows you to check whether or not your 410 is working properly. If a problem is found, use Section 4-6 (Troubleshooting) and Section 4-4 (Disassembly and Reassembly) to locate and repair the problem. The 410 has no internal adjustments so no calibration is required.

First, connect the 410 to a Huntron Tracker using the dual banana cable (red and black) and the power/clock cable (see Section 2). Turn the Tracker power on and select the LOW range.

1. Set the TRACKER/OFF/EXTERNAL switch to TRACKER. The red LED labeled TRACKER should illuminate.
2. Set the REF/ALT/TEST switch to REF. The red LED labeled REF should illuminate.
3. Using a cable with banana plugs on both ends, short the red and black probe jacks under TEST PROBES. The Tracker should indicate a short circuit.
4. Set the REF/ALT/TEST switch to TEST. The Tracker should indicate an open circuit.
5. Remove the short between the red and black probe jacks, and short the yellow and black probe jacks. The Tracker should indicate a short circuit.
6. Set the REF/ALT/TEST switch to ALT. The Tracker should alternate between a short and an open. The rate of alternation should be controlled by the RATE control if you are using a Tracker 1000. When using a Tracker 2000, the alternation rate will be set by the RATE control on the front panel of the Tracker 2000 and the 410 RATE control should have no effect.
7. Set the REF/ALT/TEST switch back to TEST so that the Tracker again indicates a short circuit.
8. Remove the dual banana cable from the jacks marked "TRACKER" on the 410. Plug the cable into the jacks marked "EXTERNAL". Set the TRACKER/OFF/EXTERNAL switch to EXTERNAL. The Tracker should indicate a short circuit.
9. If no problem has been found with Steps 1 through 8, the 410 is functioning properly except for the COMMON PIN JUMPER SOCKETS and the TEST PIN SELECT SWITCHES. To test those items, first remove the short between the yellow and black probe jacks and move the dual banana cable back to the TRACKER jacks. Then set the TRACKER/OFF/EXTERNAL switch to TRACKER. The Tracker should display an open circuit. Set the REF/ALT/TEST switch to ALT.
10. The COMMON PIN jumpers and the TEST PIN SELECT switches are checked at the same time by selecting a common pin for both reference and test and then pressing the TEST PIN switch for that same pin. The Tracker should then alternate between two short circuits. For example, if you use the jumper wires to select Common pin # 1 and then press Test pin # 1, you should see short circuits on the Tracker.
11. To fully verify the 410, step 10 must be done for each pin. However, it is usually sufficient to check 5 different pins and assume the rest are ok. Then when using the 410 on an actual device, simply make sure the Test pin switch that matches the Common pin you have selected produces a short circuit in the Low range.

## 4-6. TROUBLESHOOTING

After doing the initial setup below, use Table 4-1 to troubleshoot a defective unit.

Initial Setup: 410 is connected to Tracker with Dual Banana cable and power/clock cable, Tracker power is on, and 410 is set to TRACKER.

Note: 1.A1 is the Main PCA.

Table 4-1. Troubleshooting Guide.

SYMPTOM	POSSIBLE CAUSE
Dead Unit - No LEDs On	No +5V supply: Check power/clock cable for broken power wire. Check 1.A1.U1. Check for short between +5V and ground.
When set to ALT:  No RATE adjustment with internal RATE control (non-Tracker 2000 mode). TEST LED and REF LED do not switch.	Check the following parts:  1.A1.R4    1.A1.Q1 1.A1.U2    1.A1.Q2 1.A1.R3    1.A1.C3
When set to ALT:  No RATE adjustment when using a Tracker 2000. TEST LED and REF LED do not switch but internal RATE control works.	Check power/clock cable for broken clock wire.
When set to ALT:  Channels A and B not switching (TEST LED and REF LED do switch). Signatures on the Tracker do not change.	Check 1.A1.K2.
No continuity between 410 and board under test.	Check for defective Common Pin Jumper or defective DIP Clip Cable.

## SECTION 5

# LIST OF REPLACEABLE PARTS

### 5-1. INTRODUCTION

This section contains the parts list for the 410. The components of each assembly are listed alphanumerically by reference designation. Both electrical and mechanical components are listed by reference designation, and can be referenced to illustrations and schematics.

Parts lists include the following information:

1. Reference Designation (REF DES)
2. Description of each part (Description)
3. Huntron Part Number (Huntron P/N)
4. Commercial And Government Entity (CAGE)
5. Manufacturer's Part Number

Numbers in parenthesis following the description refer to the total quantity of the part for that assembly.

### 5-2. HOW TO OBTAIN PARTS

Components may be ordered directly from a manufacturer by using the part description, or from Huntron Instruments, Inc. or its authorized distributors by using the HUNTRON PART NUMBER. In the event the part you order has been replaced by a new part, the replacement will be accompanied by an explanatory note and installation instructions if necessary.

To ensure prompt and efficient handling of your order, please include the following information:

1. Quantity
2. Huntron Part Number
3. Part Description
4. Reference Designation
5. Printed Circuit Board Part Number and Revision Letter
6. Instrument Model and Serial Number

#### CAUTION

**Devices indicated by an asterisk (\*) in the list of replaceable parts are subject to damage by static discharge.**

**LIST OF REPLACEABLE PARTS**

FINAL ASSEMBLY PARTS LIST (refer to Figures 4-1 through 4-5)

REF DES	DESCRIPTION	HUNTRON P/N	CAGE	MANUFACTURERS PART NUMBER
1	Final Assembly			
1.A1 <sup>1</sup>	Main PCA	06-3076	57705	06-3076
1.A2	Face Plate Assembly	06-2087	57705	06-2087
1.J1-	Not Used			
1.J11				
1.J12	Socket, Zero Insertion 20 Pin	07-1164	19613	220-3342-00-0602
1.J13	Socket, Zero Insertion 20 Pin	07-1164	19613	220-3342-00-0602
1.J14	Socket, Zero Insertion 40 Pin	07-1165	19613	220-3346-00-0602
1.J15	Socket, Zero Insertion 40 Pin	07-1165	19613	220-3346-00-0602
1 MP1	Case, Bottom	01-3003	57705	01-3003
1.MP2	Feet, Rubber (4)	07-2062	83330	2192
1.MP3 <sup>2</sup>	Screw 6-32 x 3/8" PH Phil w/Wash(10)	07-3061	73734	19044
1.MP4	Button, Switcher, Blk (40)	07-2078	N/A	094 BLK
1.MP5	Knob, Blk	07-2064	59270	S100.125-Black
1.MP6	Knob Cap, Blk w/Line	07-2067	59270	C101-Black
1.MP7	Nut, Dress, thru thd 1/4-40ns (2)	07-2063	09353	7807

## MAIN PCA PARTS LIST (refer to Figure 6-1)

REF DES	DESCRIPTION	HUNTRON P/N	CAGE	MANUFACTURERS PART NUMBER
1.A1	Main PCA	06-3076	57705	06-3076
1.A1.C1 <sup>3</sup>	Cap, Electrolytic, 470 $\mu$ F, 16V Radial	03-3107	00199	CESEM1C471A
1.A1.C2	Cap, Ceramic 0.1 $\mu$ F, 50V	03-3028	54583	FK20Y5V1H104M
1.A1.C3 <sup>4</sup>	Cap, Tant 4.7 $\mu$ F, 50V	03-3088	31433	T350G475M050AS
1.A1.D1	Diode, 50V	04-4006	71744	1N4001
1.A1.D2	Diode, Red	04-4013	N/A	L53RD
1.A1.D3	Diode, Green	04-4014	N/A	L53GD
1.A1.D4 <sup>4</sup>	Diode, Signal	04-4007	31433	1N914
1.A1.D5 <sup>4</sup>	Diode, Signal	04-4007	31433	1N914
1.A1.D6	Diode, Green	04-4014	N/A	L53GD
1.A1.D7	Diode, Red	04-4013	N/A	L53RD
1.A1.D8 <sup>5</sup>	Diode, Signal	04-4007	31433	1N914
1.A1.D9 <sup>5</sup>	Diode, Signal	04-4007	31433	1N914
1.A1.J1 - 1.A1.J9	Not Used			
1.A1.J10	Socket, 42 Pin	07-1168	52072	CA-D42VSC-41B
1.A1.J11	Socket, 42 Pin	07-1168	52072	CA-D42VSC-41B
1.A1.J12	Socket, 20 Pin	07-1171	52072	CA-20S-T2WW-LC
1.A1.J13	Socket, 20 Pin	07-1171	52072	CA-20S-T2WW-LC
1.A1.J14	Socket, 40 Pin	07-1169	52072	CA-40S-T2WW-LC
1.A1.J15	Socket, 40 Pin	07-1169	52072	CA-40S-T2WW-LC
1.A1.J16 <sup>6</sup>	Header 4 Pin RA Pol	07-1289	27264	22-05-3041
1.A1.J17 <sup>6</sup>	Header 8 Pin RA Pol	07-1290	27264	22-05-3081
1.A1.K1	Relay, DPDT	07-4031	N/A	D52 MDC 5VC
1.A1.K2 <sup>7</sup>	Relay, 1 Form C, DIP	07-4034	95348	831C-1
1.A1.MP1 <sup>2</sup>	Screw, 4-40 x 3/8" PH Phil w/Washer	07-3051	73734	19024
1.A1.MP2	Base, 20 Pin (2)	07-1172	52072	CA-20S
1.A1.MP3	Base, 40 Pin (2)	07-1170	52072	CA-40S
1.A1.Q1	Transistor, NPN	05-5013	27014	PN2222
1.A1.Q2	Transistor, NPN	05-5013	27014	PN2222
1.A1.R1	Res, CF 220 $\Omega$ , 5%, 1/4 W	02-2158	09021	CF 1/4 220 J
1.A1.R2	Res, CF 220 $\Omega$ , 5%, 1/4 W	02-2158	09021	CF 1/4 220 J
1.A1.R3	Res, CF 47K $\Omega$ , 5%, 1/4 W	02-2143	09021	CF 1/4 47K J
1.A1.R4	Pot, Control, 1M $\Omega$ , Rev. Z Taper	02-1034	12697	388NRZ 1M
1.A1.R5	Res, CF 3K $\Omega$ , 5%, 1/4 W	02-2126	09021	CF 1/4 3K J
1.A1.R6	Res, CF 220 $\Omega$ , 5%, 1/4 W	02-2158	09021	CF 1/4 220 J
1.A1.R7	Res, CF 3K $\Omega$ , 5%, 1/4 W	02-2126	09021	CF 1/4 3K J
1.A1.R8	Res, CF 220 $\Omega$ , 5%, 1/4 W	02-2158	09021	CF 1/4 220 J
1.A1.R9	Res, CF 10K $\Omega$ , 5%, 1/4 W	02-2137	09021	CF 1/4 10K J
1.A1.R10	Res, CF 10K $\Omega$ , 5%, 1/4 W	02-2137	09021	CF 1/4 10K J

LIST OF REPLACEABLE PARTS

MAIN PCA PARTS LIST (Con't.)

REF DES	DESCRIPTION	HUNTRON P/N	CAGE	MANUFACTURERS PART NUMBER
1.A1.S1	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S2	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S3	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S4	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S5	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S6	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S7	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S8	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S9	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S10	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S11	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S12	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S13	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S14	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S15	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S16	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S17	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S18	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S19	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S20	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S21	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S22	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S23	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S24	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S25	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S26	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S27	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S28	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S29	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S30	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S31	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S32	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S33	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S34	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S35	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S36	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S37	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S38	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S39	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S40	Switch, Push Button, DPST	07-4020	N/A	SPH 122A
1.A1.S41	Switch, Toggle, DPDT	07-4022	N/A	8A2022
1.A1.S42	Switch, Toggle, SPDT	07-4021	N/A	8A1022
1.A1.U1	IC, Regulator + 5V	05-5017	27014	LM7805CT
1.A1.U2 <sup>8</sup>	*IC, Hex Schmitt Trigger Inverter	05-5062	27014	74HC14



## FACE PLATE ASSEMBLY PARTS LIST (Refer to figures 4-4 and 4-5)

REF DES	DESCRIPTION	HUNTRON P/N	CAGE	MANUFACTURERS PART NUMBER
1.A2	Face Plate Assembly	06-2087	57705	06-2087
1.A2.A1 <sup>6</sup>	Harness, Input	06-4069	57705	06-4069
1.A2.A2 <sup>6</sup>	Harness, Power/Clock	06-4070	57705	06-4070
1.A2.J1	Jack, Power w/Hex Nut	07-1150	82389	712A
1.A2.J2	Jack, Phono w/Hex Nut	07-1151	82389	142A
1.A2.J3	Jack, Banana, Red w/Hex Nut	07-1147	83330	1509-102
1.A2.J4	Jack, Banana, Black w/Hex Nut	07-1148	83330	1509-103
1.A2.J5	Jack, Banana, Red w/Hex Nut	07-1147	83330	1509-102
1.A2.J6	Jack, Banana, Black w/Hex Nut	07-1148	83330	1509-103
1.A2.J7	Jack, Banana, Red w/Hex Nut	07-1147	83330	1509-102
1.A2.J8	Jack, Banana, Black w/Hex Nut	07-1148	83330	1509-103
1.A2.J9	Jack, Banana, Yellow w/Hex Nut	07-1149	83330	1509-107
1.A2.MP1	Top Panel	01-3002	57705	01-3002

<sup>1</sup>Serial numbers prior to S/N 310-11230 use Main PCB Assembly, Huntron P/N 06-3033, CAGE 57705, Manufacturers P/N 06-3033.

<sup>2</sup>In prior versions the washer may have been a separate part. However, replacement with this part is equivalent to both the screw and washer.

<sup>3</sup>Serial numbers prior to S/N 310-11230 use Cap, Electrolytic 1000 $\mu$ F, 16V, Huntron P/N 03-3047, CAGE 57705, Manufacturers P/N CEUST1C102.

<sup>4</sup>Serial numbers prior to S/N 310-10829 use Cap, Electrolytic 2.2 $\mu$ F, 50V, Huntron P/N 03-3046, CAGE 00199, Manufacturers P/N CEUSM1H2R2.

<sup>5</sup>Serial numbers prior to S/N 310-11230 use Diode, 50V, Huntron P/N 04-4006, CAGE 71744, Manufacturers P/N 1N4001.

<sup>6</sup>Serial numbers prior to S/N 310-11230 strike these parts. For the aforementioned S/N hard wiring was used in place of harnesses and connectors.

<sup>7</sup>Serial numbers prior to S/N 310-11230 use Relay, 1 Form C, DIP, Huntron P/N 07-4030, CAGE 95348, Manufacturers P/N 835C-1.

<sup>8</sup>Serial numbers prior to S/N 310-10829 use IC, Schmitt Trigger Inverter, Huntron P/N 05-5018, CAGE 27014, Manufacturers P/N 74C14.

**NOTES:**

# SECTION 6 SCHEMATIC DIAGRAM

## 6-1. INTRODUCTION

The following list shows the component location diagram and schematic diagram for the 410.

Figure No.	Title	Page
6-1	Main PCA Component Locations .....	6-2
6-2	Main PCA Schematic .....	6-4/6-5

In both figures 6-1 and 6-2 components may vary for different revisions. For information on changes see notes on page 5-5.

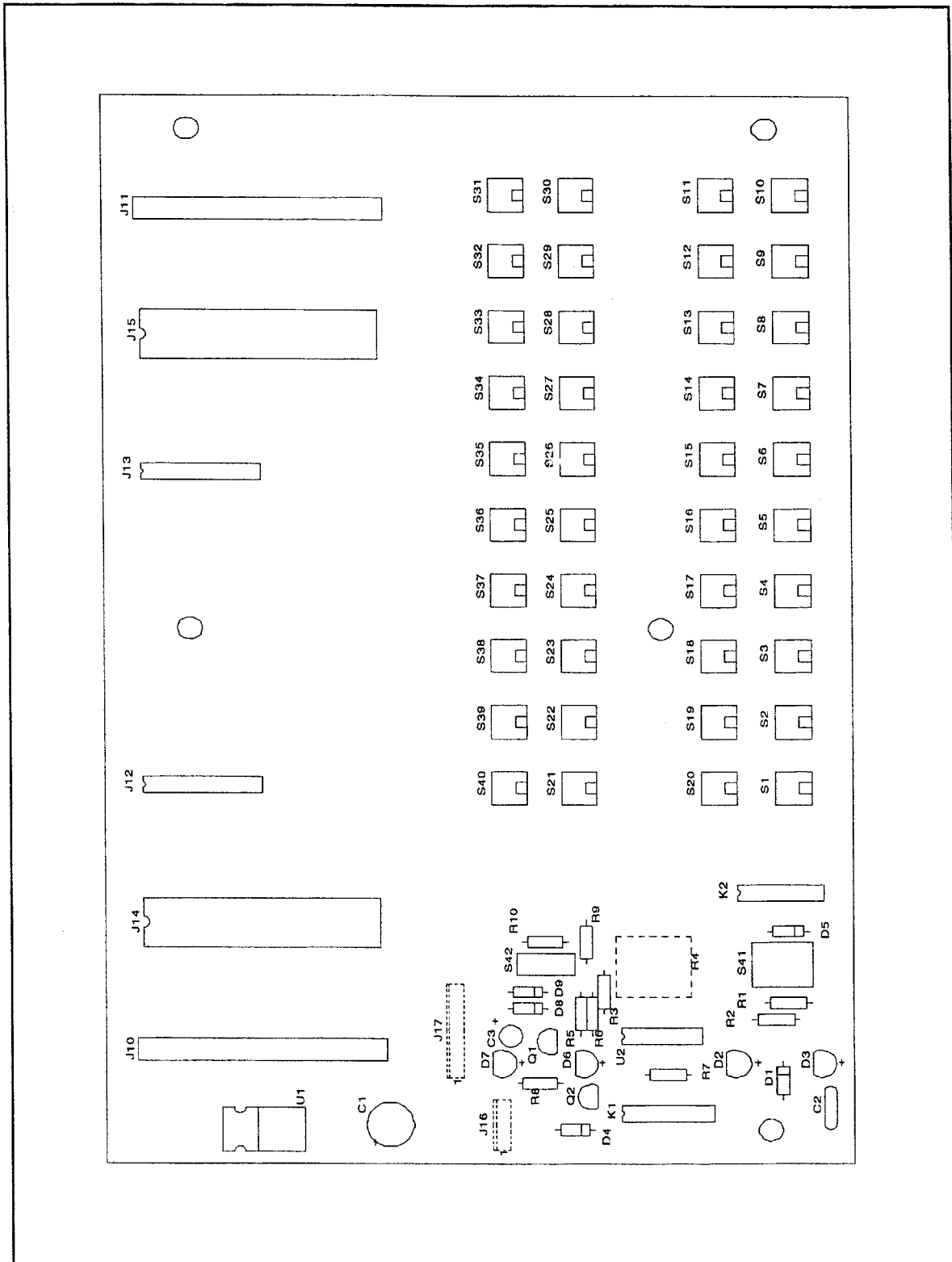
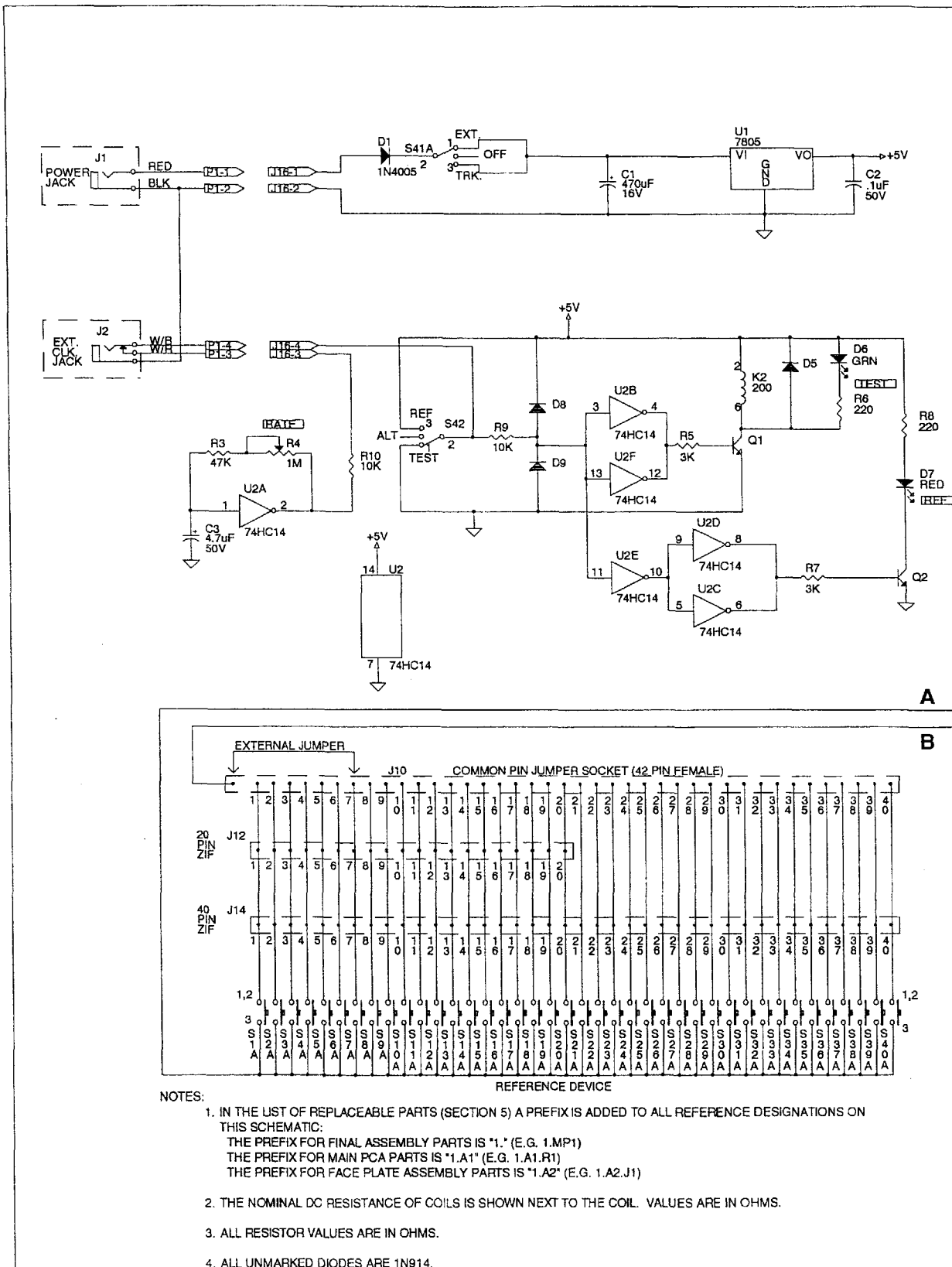


Figure 6-1. Main PCA Component Locations.

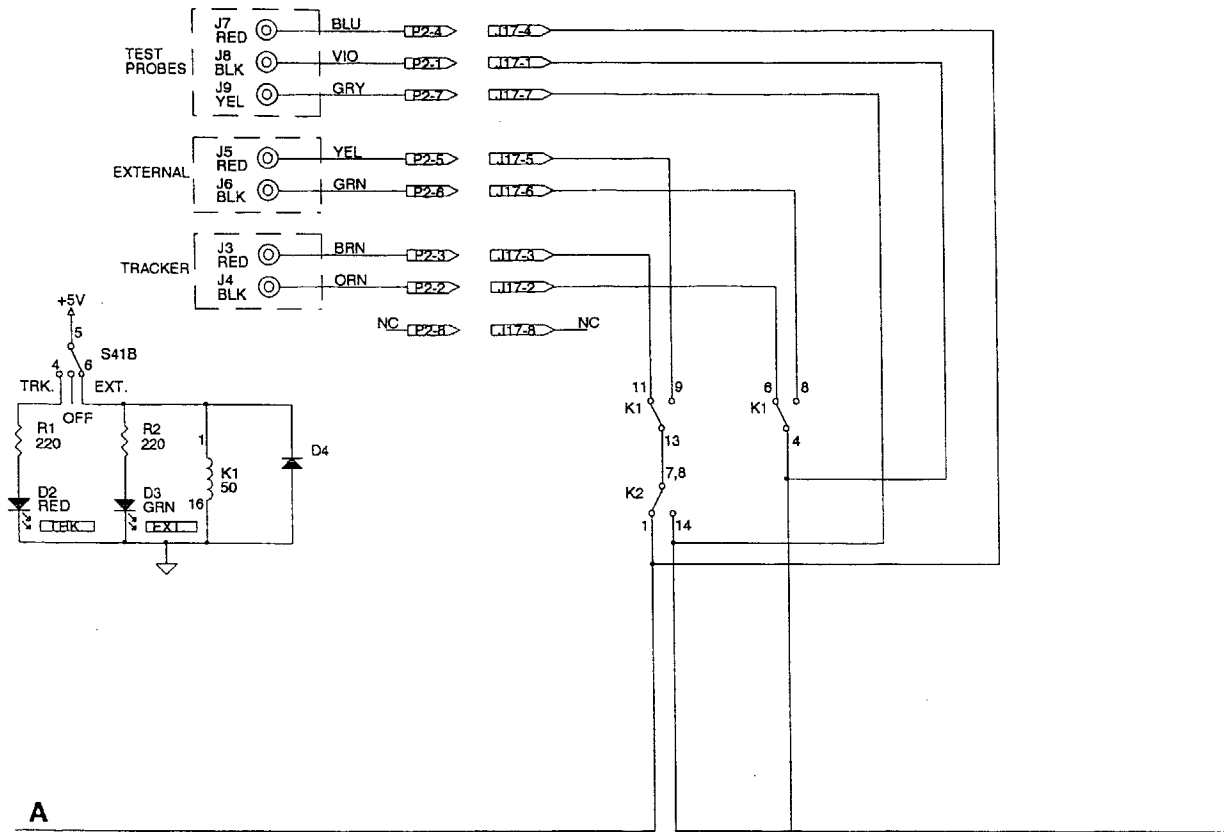
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**SCHEMATIC DIAGRAM**



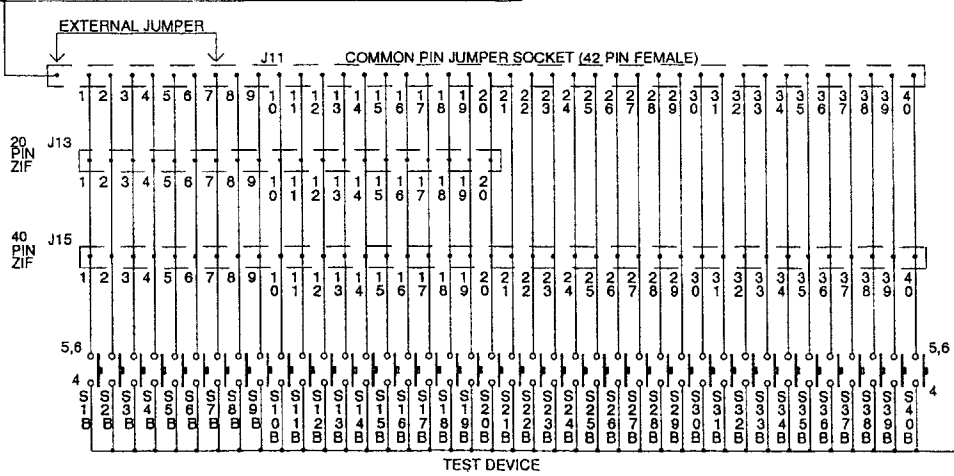
- NOTES:**
1. IN THE LIST OF REPLACEABLE PARTS (SECTION 5) A PREFIX IS ADDED TO ALL REFERENCE DESIGNATIONS ON THIS SCHEMATIC:  
 THE PREFIX FOR FINAL ASSEMBLY PARTS IS "1." (E.G. 1.MP1)  
 THE PREFIX FOR MAIN PCA PARTS IS "1.A1" (E.G. 1.A1.R1)  
 THE PREFIX FOR FACE PLATE ASSEMBLY PARTS IS "1.A2" (E.G. 1.A2.J1)
  2. THE NOMINAL DC RESISTANCE OF COILS IS SHOWN NEXT TO THE COIL. VALUES ARE IN OHMS.
  3. ALL RESISTOR VALUES ARE IN OHMS.
  4. ALL UNMARKED DIODES ARE 1N914.

Figure 6-2. Main PCA Schematic



A

B



**NOTES:**