INSTRUCTIONS FOR MAINTENANCE AND INSPECTIONS
of
S E R V O "9 0 0 0" HOTBOX DETECTOR

I. Weekly Inspections and Tests performed by Signal Maintainer:

A. Clean sensors optical lens and reflector. Use anti-fog cleaning solution (Item No. 4724800063). Do not apply ammonia or alkaline solutions to reflector. Dry reflector with soft cloth applying only light pressure. Also clean hot wheel lens and lens cap, replace lens cap if torn or scratched.

B. Inspect transducers, scanners, deflecting guards and track fittings to see if properly secured and no external damage visible. Read resistance of all transducers. With test clips open, each transducer should read 600 Ohms.

Note: Push "Reset" on C P U after test.

C. Check track conditions: If track is "pumping" or "running" more than two inches, contact Section gang for repair.

D. Run self-test by pushing "Test" button on D P U Power Supply (or do an "S" command on printer), and observe proper operation.

E. Change recorder tape (as required) check time and date on recorder or do an "R" command on printer and send tapes to Signal Inspectors' Office for their inspection.

F. Watch train by detector, observe that normal levels are seen on recorder or printout, and listen for radio message on Road channel..

II. Monthly Inspections and Tests performed by Signal Maintainer:

A. Using a digital meter, Fluke 8 0 2 4 B or equivalent, check supply voltages, make any necessary adjustments and enter on inspection record.

Note: For Readings 1. through 8., below, T B 3 - 1 5 is "ground". This T B 2 and T B 3 are on back of Power Supply.

1. +12 Volts D C Unregulated: T B 3 - 1
2. + 5 Volts D C Regulated: T B 3 - 4
3. +18 Volts D C Unregulated T B 3 - 5
4. +12 Volts D C Unregulated T B 3 - 6
5. -18 Volts D C Unregulated T B 3 - 7
6. +24 Volts D C Unregulated T B 3 - 11
7. -300 Volts D C Unregulated T B 2 - 1
8. +300 Volts D C Unregulated T B 2 - 2

Note: For readings 9. through 11., below, Mother Board Pins 3 and 4 are "ground". Take these readings by installing Extender Card in spare slot in D P U and reading voltages on exposed tail plug.

Caution: Pens 55 and 56 are across from each other and, if you stick meter probe in slot, you will short out +12 and -12 Volt supplies.

9. +5 Volts D C Regulated Mother Board Pins 1 and 2
10. +12 Volts D C Regulated Mother Board Pin 55
11. -12 Volts D C Regulated Mother Board Pin 56
12. Inverter A C output Output Plug on Inverter
13. 24-Volt D C: twelve (12) cells lead battery.
14. If hot wheel detector is installed, read +15 and +24 volts on front panel with Gnd as negative.

B. Alarm Levels:

Record alarm levels printed on recorder tape or printout when self-test is run or do an "E" command on printer. Should be 9 m m Differential and 15 m m Absolute. If not correct, adjust switch on Alarm Select Card until proper level is obtained.

C. Dragging Equipment Test:

1. Activate track circuit.
2. Turn on Power and Gate Switches On Function Simulator.
3. Kick dragging equipment detector.
4. Verify system alarmed and H B P dropped, mars light came on and dispatcher got indication if applicable.
5. Deactivate track circuit.

D. Alarm Verification (Ramp Function):

1. Push the reset button on the C P U Card.
2. Push "S 1" on the Bearing Identification Card, or push "RA" on printer.
3. Watch the "ramp" function and observe that Rail One and Rail Two Absolute and Differential Alarms occur at 15 m m and 9 m m, respectively.
4. Verify HBP relay drops and stays down during test.
5. Push reset button on the CPU and verify that HBP relay picks up.

E. Make Standard Cross and Grounds Test.

III. Quarterly Inspections and Tests performed by Signal Inspector and Signal Maintainer:

A. All weekly and monthly tests should be performed before continuing with Quarterly Tests.

B. Check alignment:

Note: (Use Optical Alignment Fixture P N - 2 0 0 0 9 9 - 8 1 - 5)

1. Install mirror cap on front of bolometer lens.

Note: Insure that cap fits securely and is flush to top of bolometer.

2. Install alignment fixture on rail on same side as transducers, and adjust to a point 20 inches from center of scanner to center of alignment target and seven inches from gage. Center of Scanner must be 8 inches from center of near transducer.

3. Site through alignment target hole and see if red dot appears inside circle of target.

4. If alignment is not correct, adjust cant nuts on the scanner clamp to achieve proper alignment.

5. Check by triangulation that the opposite scanner is directly across from the scanner you started with. If not, move and, then, do Steps B.-2 through B.-4, above, for second scanner.

6. Remove mirror cap and replace scanner lids.

C. Analog Signal Conditioning Card Adjustment:

1. Turn power off on D P U.

2. Remove Analog Card.

3. Install Extender Card and put Analog Card on Extender Card and install extender ribbon connector on front of cards.

4. Turn power back on.

5. Using T P 1 5 as "common": Make the following adjustments:

a. Rail 1 Threshold: Read T P 1 and adjust R 4 for -.1 V DC, +/- .01 V DC.

b. Rail 2 Threshold: Read T P 9 and adjust R 8 for -.1 V DC +/- .01V DC.

c. Rail 1 Sky Shot: Read T P 18 and adjust R 25 for +.4 V DC +/- .01V DC.

d. Rail 2 Sky Shot: Read T P 19 and adjust R 73 for +.4 V DC +/- .01V DC.

e. Transducer Threshold: Read T P 3 and adjust R 38 for +2.0 V DC +/- .01V DC, and test transducer polarity per instructions A-185.

f. Recorder Pedestal Adjustment: adjust R 84 for 1 m m with Function Simulator running as gate source.

NOTE: 1. If no recorder is used, no adjustment is needed.

2. If you are continuing to Item 8, skip Items 6 & 7.

6. Turn power off on D P U and remove extender board and ribbon, and re-install Analog Card in D P U and install Standard ribbon connector.

7. Turn power back "On" on D P U.

8. Check scanner calibration:

a. Turn on power on Function Simulator and set temperature for 130° over ambient.

b. When temperature has stabilized, push "Reset" button on C P U Card and turn on "Gate" on Function Simulator.

c. Set Function Simulator on Rail 1 and observe level seen on recorder and listen to speaker for digital readout.

d. Watch recorder if used, and observe that you see 10 m m and the system says "10.0 m m" when the Function Simulator is at the top of the heating cycle and has just turned back off. If 10 m m is not observed, adjust Pot R 31 until proper level is seen.

e. Do Steps III-C.-8.-c. and -d. for Rail 2 and adjust R 81, if necessary.

Note: Rail 1 is North Rail; and, Rail 2 is South Rail.

f. Turn off Function Simulator.

D. Bearing Identification Card:

1. Turn power off on D P U and put bearing I D Card on extender and install extender ribbon.
2. Turn power back on.
3. Check Rail 1 "D" to "A" Converter by reading T P 5 with T P 15 as "ground" and adjust R 17 until +10 V DC +/- .05 V DC is seen.
4. Check Rail 2 "D" to "A" Converter by reading T P 13 with T P 15 as "ground" and adjusting R 37 until +10 V DC +/- .05 V DC is seen.
5. Turn power off and remove Extender Card and re-install the bearing I D Card and Standard ribbon connector.

E. Check Integrity Heater Heating Time:

1. Remove Alarm Level Select Card.
2. On SW 7, on the Alarm Level Select Card, check that switch is set for three or four seconds' heating time.

a. For three seconds: Set for 1-closed; 2-closed; 3-open.

For four seconds: Set for 1-open; 2-open; 3-closed.

3. Observe self-test level and verify level is between 18 and 24 mm. If not, adjust SW 7 until this level is seen.

Note: 1. This adjustment may require a switch setting of more than 4 seconds. The time is not critical, just make sure time is long enough to give proper self test level.

2. When making test, heaters will retain heat from previous test, so allow at least 5 min between tests before making adjustments.

F. Radio and Alarm Checkout:

1. Activate track circuit.
2. Push CPU Reset.
3. Turn on Power and Gate Switches in Function Simulator.

NOTE: Any time in any test when function simulator is used, when it is turned on and nothing happens, turn off and push CPU reset, and start test over.

4. Put heat in front of Rail 1 Scanner (cigarette or soldering iron).
5. Move heat in and out of scanner and observe that four (4) alarms are seen.
6. Turn off Function Simulator.
7. Deactivate track circuit.
8. Listen to readout and verify that alarms are correct for "left" or "right" designation and count is correct.
9. Push "S1" on Bearing Identification Card and compare printout with alarm read out in Item III F.8.
10. Do Steps 1 through 7, above, for Rail 2.

11. On one of the above tests, kick the dragger and verify alarm is given and count is correct.

12. On one of the above tests, listen to readout on truck radio set on Road channel to verify radio is "keying" and audio quality is good.

G. Additional Tests Performed When Hot Wheel Detector Option is Used:

1. Alignment:

a. The center of the scanner is six feet from gage.

b. The perpendicular distance from centerline of scanner to alignment point on far rail is 77 inches.

c. Remove scanner cover and install mirror cap on front of bolometer lenses.

d. Install the target at the Alignment Point on the far rail. This is at the 77-inch point on the far rail and is midway between "A" and "B" Transducers on near rail and 2-1/2 inches above crown of rail. Look through the target; the red circle should be in the center of the circle.

e. Make any adjustments necessary and re-install scanner cover when done.

2. Calibration:

a. Install function simulator mounting bracket on front of H W D Scanner.

b. Turn ratio adjusting pot full counter clockwise.

c. Using a Simpson Model 260 or Fluke Model 8 0 2 4 B Meter, read "alarm level." Put BLACK lead in "Gnd" jack and RED lead in "Alarm Level Adj Jack." Adjust "Alarm Level Adj" Pot until 1.5 V D C is seen.

d. Set function simulator for 100° over ambient and, when stabilized, set on mounting bracket with gate off.

e. Disconnect the 620 ohm Resistor from the hot wheel chassis TB2-5.

f. Press and hold Cal Pushbutton Switch and adjust "Cal Adj" until alarm is firing intermittently.

g. Release Cal Pushbutton and readjust Function Simulator to 110° F. over ambient.

h. When temperature is again stabilized, push reset on CPU, turn on gate on function simulator and push Cal Pushbutton and adjust "Ratio Adj" Pot until alarm is again firing intermittently.

i. Release Cal Pushbutton, turn off Function Simulator and remove mounting bracket.

j Reconnect the resistor removed from the hot wheel chassis TB2-5.

3. Alarm Level Adjustment:

a. Using a Simpson Model 260 or Fluke Model 8 0 2 4 B Meter, again read alarm level.

b. Adjust "Alarm Level Adj" until you see 4.5 V D C.

Note: This level is determined by the following procedure: We want to alarm at 650° F., above ambient. With near/far rail sensitivity compensation, you set alarm for 90% of alarm level, i e. 585°; then, you go to Table 2-1 in Manual, Page 2-12, to find the Alarm Level to correspond with 585°. You will see it is between 550° and 620°, which corresponds with 4.0 Volts to 5.0 Volts. To interpolate for 585°, you find the change in both and apply the ratio of temperature change, i.e.

620	5.0
- 550	- 4.0
= 70	= 1.0 V

You have a ratio of 1.0 V/70 = .014

For 585°:

- 550
= 35 degrees (35 x .014 = .5 V)

4.0 V for 550°
+ .5 V for 35° above 550°
4.5 V for 585° Alarm Level

4. "Talker" Check:
   a. Push reset on CPU
   b. Install function simulator on front of scanner, turn on power and adjust for 130° over ambient.
   c. Activate the track circuit.
   d. Disconnect the 620 ohm resistor from HWD-TB2-5.
   e. Set alarm level to 1.5 V DC as in G.2.C.
   f. Turn on gate on Function Simulator.
   g. Push Cal Pushbutton.
   h. System should alarm.
   i. Turn off gate and deactivate track circuit.
   j. Listen to "Talker" and verify only four alarms are given and that count is correct.
   k. Remove Function Simulator.
   l. Reinstall the resistor removed in G.4.d.
   m. Set alarm level back to 4.5 V DC as in step G.3.b.

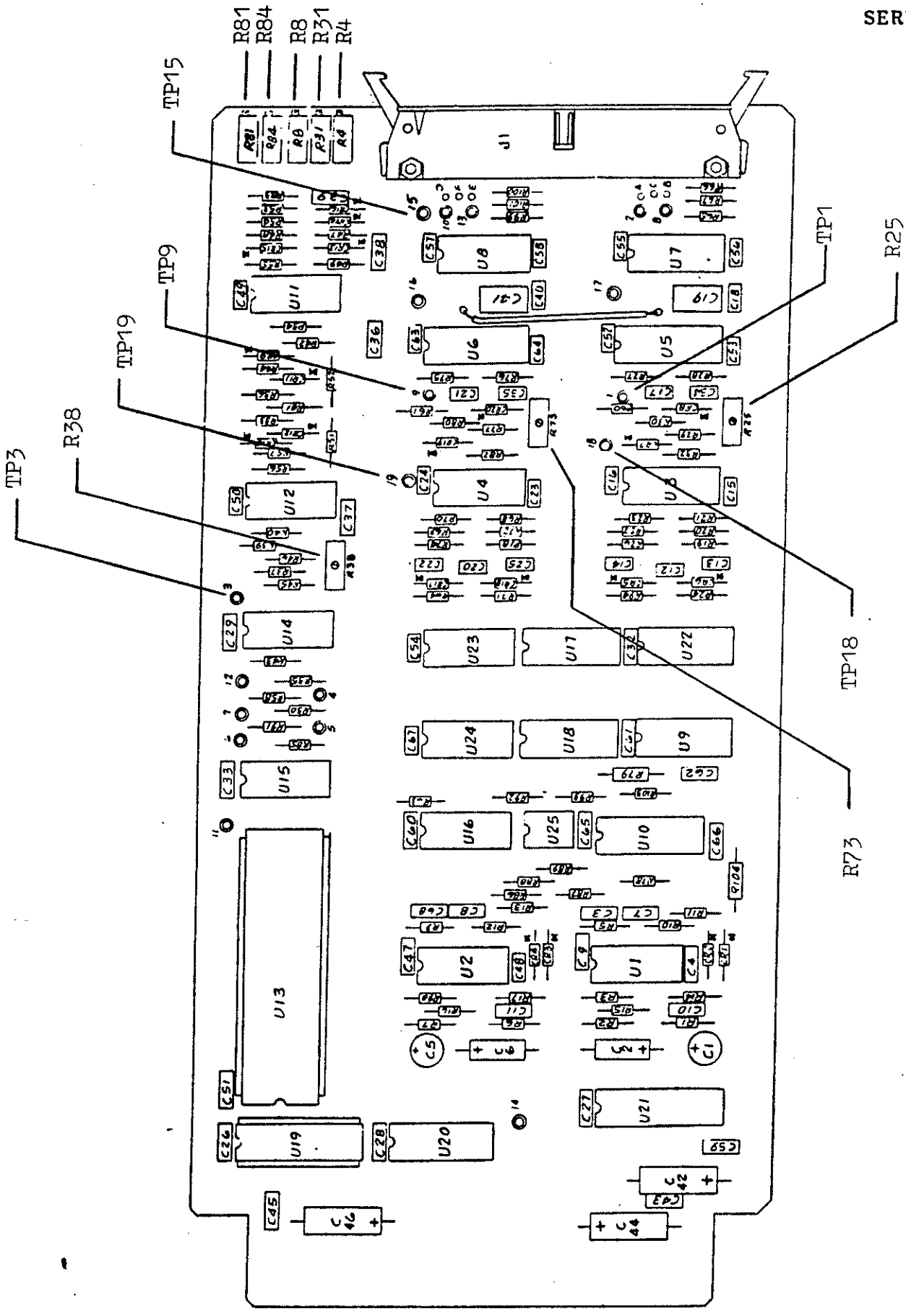

Figure 5-23. Circuit Card Assembly Layout, Analog Signal Conditioning

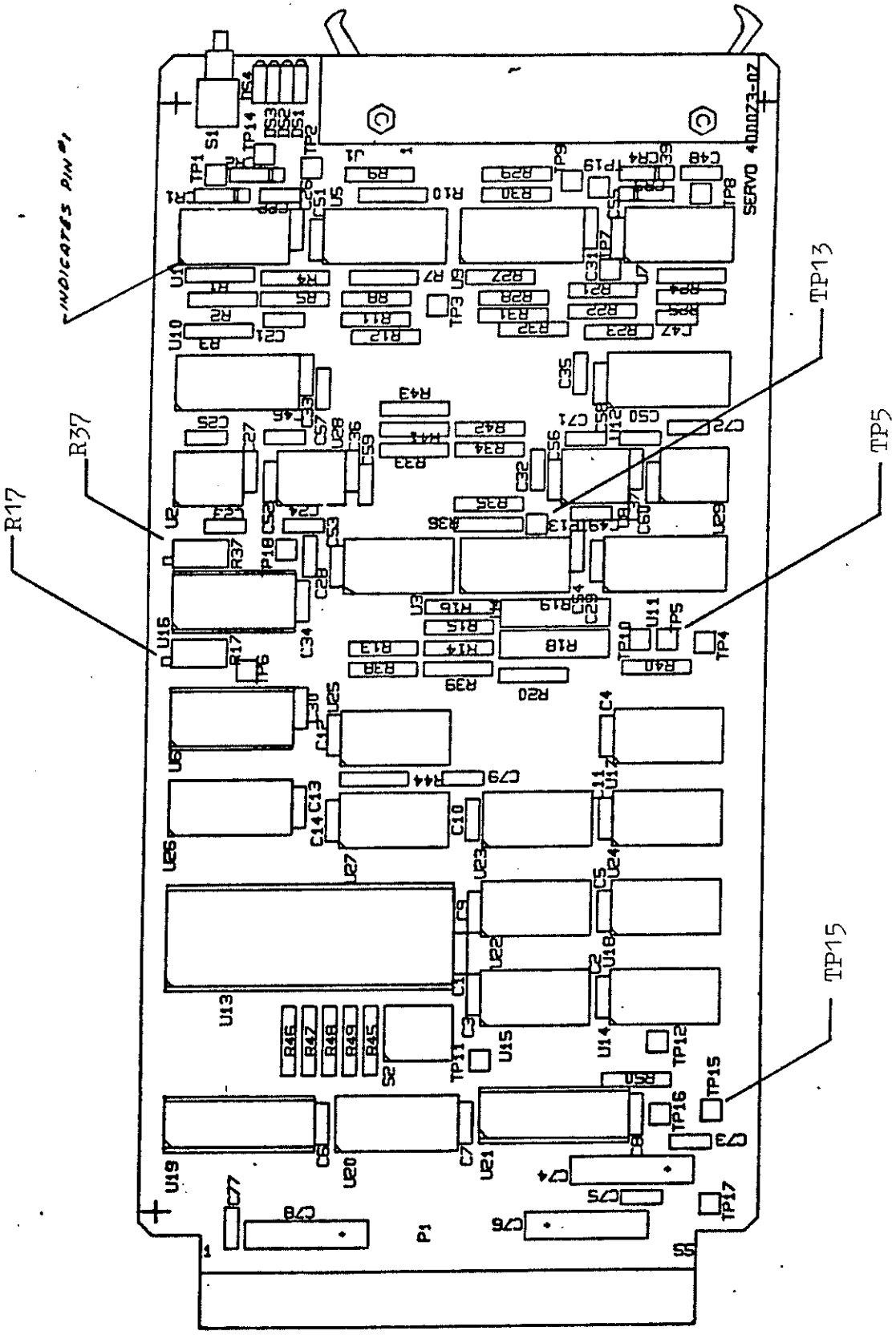

Figure 5-23A. Circuit Card Assembly Layout, Bearing Identification

SERVO "9000" Hotbox Detector Inspection Record

(to be sent to Signal Supervisor's Office monthly)

Location: _____ Division: _____
District: _____ Milepost/s: _____
Month: _____ Name: _____

WEEKLY INSPECTIONS ("Yes" or "No")

	Week 1	Week 2	Week 3	Week 4	Week 5
Clean lens					
Inspect transducers and scanners					
Check track conditions					
Run self-test ("Pass" or "Fail")					
Watch train and observe normal levels					
Date and Initials					

MONTHLY INSPECTIONS

		Typical Levels	Found	Left
+ 12 V UnReg	TB 3 - 1	17.7		
+ 5 V Reg	TB 3 - 4	5.0		
+ 18 V UnReg	TB 3 - 5	20.7		
+ 12 V UnReg	TB 3 - 6	15.9		
- 18 V UnReg	TB 3 - 7	- 20.7		
+ 24 V Reg	TB 3 - 11	24.5		
- 300 V DC	TB 2 - 1	- 347		
+ 300 V DC	TB 2 - 2	347		
+ 5 V Reg	Mother Board Pins 1 and 2	5.0		
+ 12 V Reg	Mother Board Pin 55	12		
- 12 V Reg	Mother Board Pin 56	- 12		
Inverter A C Output		120		
24 V Battery		26.4 V		
Hot Wheel Detector +15 VDC Reg		15.0		
Hot Wheel Detector +24 VDC Reg		24.0		
Differential Alarm		9 mm		
Absolute Alarm		15 mm		
Dragging Equipment Test		OK		
Indication and Mars Light Test		OK		
Cross and Grounds Test		OK		

List repairs made during month (Note: Use other side of page, if required):

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SERVO "9000" Hotbox Detector

Quarterly Inspection Record

(Send to Signal Supervisor upon completion of test)

Location: _____ Division: _____

District: _____ Milepost/s: _____

Date: _____ Name: _____

QUARTERLY INSPECTION

	Typical Levels	Found	Left
Alignment	7" x 20"		
Threshold Rail 1: T P 1 and R 4	- .1 V +/- .01		
Threshold Rail 2: T P 9 and R 8	- .1 V +/- .01		
Sky Shot Rail 1: T P 1 8 and R 25	+.4 V +/- .01		
Sky Shot Rail 2: T P 1 9 and R 73	+.4 V +/- .01		
Transducer Threshold T P 3 and R 38	+ 2.0 +/- .01		
Calibration (130° above ambient) Rail 1 adj R 31; Rail 2 adj R 81	10 mm		
D to A Converter: Rail 1: T P 5 and R 17	+ 10 V +/- .05		
D to A Converter: Rail 2: T P 1 3 and R 37	+ 10 V +/- .05		
Integrity Heater Heating Time(SW7 1, 2, 3)	3 to 4 Seconds		
Radio and Alarm Check	O K		
Hot Wheel Detector - Alignment	72"x77"x2-1/2"		
Hot Wheel Detector - Calibration	1.5 V D C		
Hot Wheel Detector - Alarm	4.5 V D C		

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