ET 710-BP-OMI-010/E110-01824

TECHNICAL MANUAL

# OPERATION AND MAINTENANCE INSTRUCTIONS

## ORGANIZATIONAL AND INTERMEDIATE/DEPOT LEVEL

# MASTER REGULATING CLOCK

# 0-1824/U

Frequency Electronics Inc.

(Model FE-5440A)

N00039-83-C-0346

Distribution limited to U.S. Government agencies and their contractors. Other requests for this document shall be referred to Department of the Navy, Space and Naval Warfare Systems Command.

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## SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that presonnel must understand and apply during many phases of operation and maintenance.

### KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside the equipment with the high voltage supply turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position, due to charges retained by capacitors. To avoid casualties, always remove power and discharge and ground a circuit before touching it.

### DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person reach into or enter the enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

### RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

The following warnings appear in the text in this volume, and are repeated here for emphasis.

**WARNING**

1. High voltages capable of causing death are used in this equipment. Use extreme caution when handling/servicing either the power supplies or their load components. (Pages 5-16, 6-3)

2. Voltage dangerous to life exists when equipment is open and energized. Do not work alone. (Pages 4-7, 4-9)

3. Wear protective equipment and clear immediate area of personnel when using LP air. (Pages 4-7, 4-11)

SAFETY SUMMARY - (Continued)

The following cautions appear in the text and are repeated here for emphasis.

**CAUTION**

1. To prevent equipment from being dropped, ensure that MRC is supported during these procedures. (Page 6-2)

2. In the following steps, one or more of the waveguide capacitive screws will be adjusted. Do not allow the screw to "bottom out." (Page 6-5)

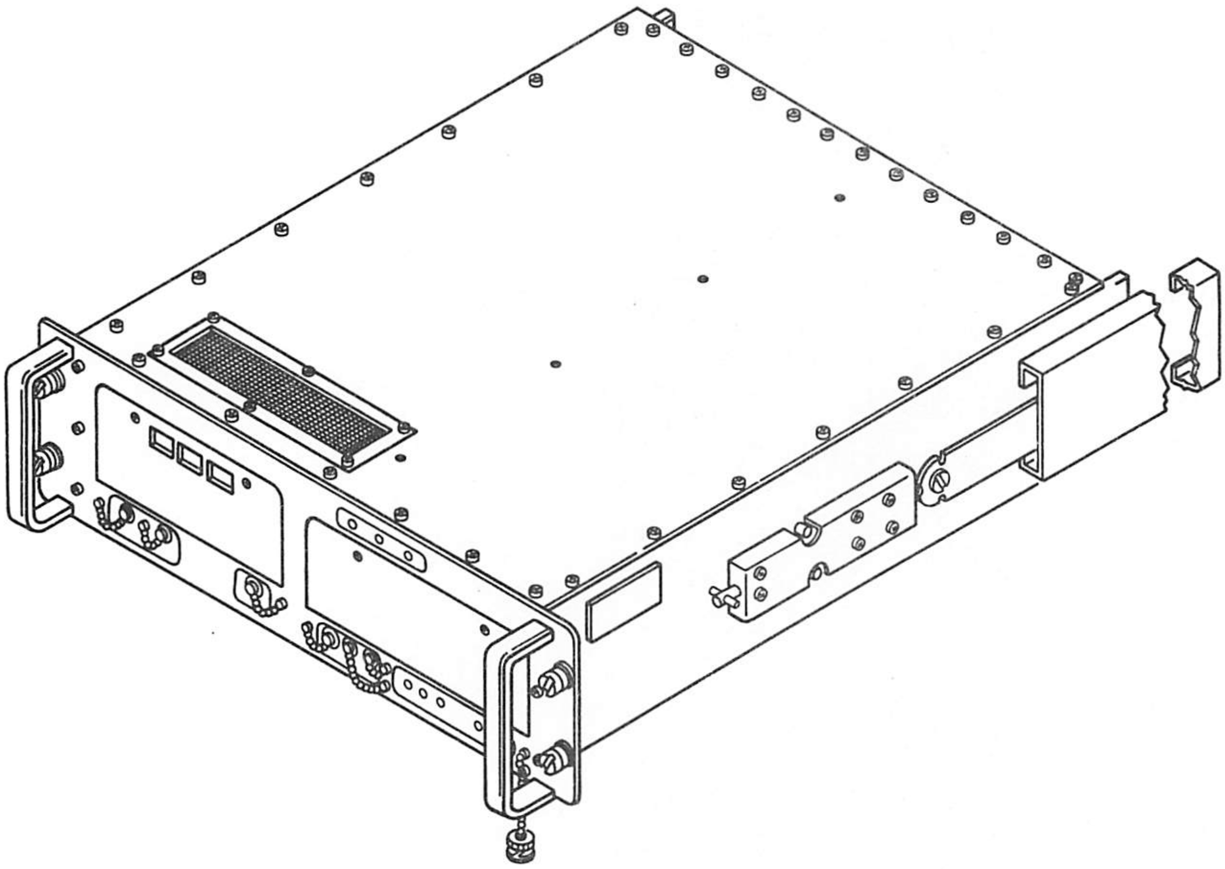



Figure 1-1. Master Regulating Clock 0-1824/U

# CHAPTER 1

# GENERAL INFORMATION AND SAFETY PRECAUTIONS

1-1. WARRANTY. Seller warrants that the master regulating clock (MRC) units will be free from defects in material and workmanship under normal service and use for which it was designed for a period of one year after shipment. Seller's obligation under this warranty is limited to replacement or repair of a part or parts determined by Seller to be defective. Such warranty is limited to the value of the individual part or parts. The unit must be returned to seller freight prepaid.

1-2. SAFETY PRECAUTIONS. A safety summary is provided in the front matter on page vii listing all general precautions, warnings and cautions with page number locations where referenced in this manual.

1-3. INTRODUCTION. This manual provides organizational, intermediate, and depot level maintenance information for Master Regulating Clock O-1824/U. This manual is applicable for all configurations of MRC.

1-4. EQUIPMENT DESCRIPTION. The MRC, figure 1-1, is a self-contained, solid-state, atomic frequency standard and real time-of-day clock. The atomic frequency standard portion of the MRC provides standard output frequencies at 5 MHz, 1 MHz, and 100 kHz available through front and rear panel connectors. The real time-of-day clock provides a front panel visual display of hours, minutes, and seconds; electrical timing information in the form of 1 pulse-per-second (PPS) and 1 pulse-per-minute (PPM); and digital time data outputs available through front and rear panel connectors. Since all outputs are referenced to an atomic primary frequency standard, the precise frequency and time signals are obtained without reference to another standard. The atomic clock as a standard is based on one of the several natural resonant frequencies of one isotope of the Cesium atom (specifically, the frequency is 9192631771.59 Hz for Cesium 133).

1-5. REFERENCE DATA. Reference data applicable to the MRC are listed in table 1-1. The data includes output signal characteristics, environmental requirements and input power requirements.

1-6. EQUIPMENT, ACCESSORIES, AND DOCUMENTS SUPPLIED. All equipment, accessories, and documents supplied with the MRC are listed in table 1-2.

1-7. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED. All equipment and publications required but not supplied for operation and maintenance of the MRC are presented in table 1-3.

1-8. FIELD CHANGES AND FACTORY CHANGES. There are no outstanding field changes or installed factory changes to the MRC as of the date of issue of this manual.

Table 1-1. Reference Data

| Parameter | Specification |
|---|---|
| Warm-up time | 20 minutes at $-28^{\circ}C$ ($-18^{\circ}F$) to $+65^{\circ}C$ ($+149^{\circ}F$) ambient |
| Accuracy, $\Delta f/f$ | $\pm 3 \times 10^{-11}$ |
| Reproducibility, $\Delta f/f$ | $\pm 1 \times 10^{-11}$ |
| Settability, $\Delta f/f$ | $\pm 2 \times 10^{-12}$ |
| Range, $\Delta f/f$ | $6 \times 10^{-11}$ |
| Stability: | |
| Long Term, $\Delta f/f$ | $\pm 1 \times 10^{-11}$ for life of Cesium beam tube |
| Short Term, $\Delta f/f$ | $7 \times 10^{-11}/\sqrt{\tau}$ |
| Stability vs. operating temperature ($-28^{\circ}C$ ($-18^{\circ}F$) to $+65^{\circ}C$ ($+149^{\circ}F$) ambient), $\Delta f/f$ | $< \pm 2 \times 10^{-11}$ |
| Stability vs. humidity (50% to 90% relative humidity), $\Delta f/f$ | $< \pm 1 \times 10^{-11}$ |
| Stability vs. magnetic field (any orientation in a 2 gauss dc field or 2 gauss peak 50, 60, or 400 Hz ac field), $\Delta f/f$ | $< \pm 2 \times 10^{-12}$ |
| Output signals (sinusoidal): | |
| Frequencies | 5 MHz, 1 MHz, 100 kHz |
| Amplitude (50 ohm termination) | 1 to 1.5 V rms |
| Harmonic distortion | <-40 dB |
| Nonharmonic distortion | <-80 dB |
| Signal-to-phase noise ratio frequency bands (1 MHz and 5 MHz only, in the frequency bands ($f_c \pm 1$ Hz) to ($f_c \pm 15$ KHz) | <-80 dBc |

Table 1-1. Reference Data - Continued

| Parameter | Specification |
|---|---|
| Output Signals (Pulse): | |
| Clock outputs, both 1 PPS, 1 PPM (50 ohm termination) | +10 V ±1 V peak pulse 20 usec wide, rise time 50 nanosec, fall time 1 usec |
| Time code output, 1 word/sec | 24 bit serial BCD word "1" = +6 ±1 V, "0" = -6 ±1 V via 9616 line driver |
| Environmental: | |
| Operating temperature | Over -28°C (-18°F) to +65°C (+149°F) |
| CAUTION<br>When stored at temperatures above 35°C (95°F) the VAC-ION pump of the Cesium beam tube must be operated. | |
| Nonoperating temperature | -62°C (-80°F) to +75°C (+167°F) |
| Storage temperature | -62°C (-80°F) to +75°C (+167°F) (without batteries)<br>-40°C (-40°F) to +75°C (+167°F) (with batteries) |
| Humidity | 95% |
| Standby battery: | |
| Battery capacity | 1 hour at 25°C (+77°F), +65°C (+149°F) 0.5 hour at -28°C (-18°F) |
| Time to recharge a completely discharged battery | 16 hours |
| Battery switchover | Automatic |
| Power required to trickle charge battery from 115 Vac line | 6W |
| Power required to recharge a completely discharged battery from 115 Vac line | 50W |

Table 1-1. Reference Data - Continued

| Parameter | Specification |
|---|---|
| Power: | |
| Voltage required ac | 115 or 230 Vac ±10% single phase, 50, 60, or 400 Hz, ±10%, 185 watts maximum |
| Voltage required dc | 22 to 30 Vdc, 75 watts maximum |
| Power consumption (Frequency/Time Standard only): | |
| Warmup (115 Vac) | 135W |
| Warmup (24 Vdc) | 75W |
| Operating (115 Vac) | 60W |
| Operating (24 Vdc) | 45W |

NOTE: Total power consumption is above power plus power required by standby battery.

Table 1-2. Equipment, Accessories, and Documents Supplied

| Quantity | Nomenclature | CID Number | Dimensions (in inches) | Weight and volume |
|---|---|---|---|---|
| 1 | Master Regulating Clock, Unit 1 0-1824/U | 14844 | W = 19<br>H = 5.5<br>D = 21 | 62 pounds<br>1.27 cubic feet |
| 1 | Cesium Beam Resonator, 1A1 | 14844 | W = 2.29<br>H = 3.06<br>D = 15.19 | 12.5 pounds<br>106.4 cubic inches |
| 1 | High Voltage Power Supply Module, VAC-ION, 1A2 | 14844 | W = 1.34<br>H = 0.73<br>D = 3.65 | 0.2 pounds<br>3.6 cubic inches |
| 1 | High Voltage Power Supply Module, Electron Multiplier, 1A3 | 14844 | W = 1.47<br>H = 0.76<br>D = 3.88 | 0.2 pounds<br>4.3 cubic inches |

Table 1-2. Equipment, Accessories, and Documents Supplied - Continued

| Quantity | Nomenclature | CID Number | Dimensions (in inches) | Weight and volume |
|---|---|---|---|---|
| 1 | OCVCXO Oven Controlled, Voltage Controlled, Crystal Oscillator, 5 MHz, 1A4 | 14844 | W = 2.19<br>H = 5.83<br>D = 3.75 | 1.1 pounds<br>47.9 cubic inches |
| 1 | Modulator/Multiplier Module 1A5 | 14844 | W = 1.05<br>H = 2.75<br>D = 6.90 | 0.8 pounds<br>19.9 cubic inches |
| 1 | Power Supply Module, 1A6 | 14844 | W = 1.84<br>H = 4.15<br>D = 7.69 | 2 pounds<br>58.7 cubic inches |
| 1 | Synthesizer Module, 1A7 | 14844 | W = 0.85<br>H = 3.70<br>D = 10.48 | 1.3 pounds<br>33 cubic inches |
| 1 | Buffer Amplifier Module, 1A8 | 14844 | W = 5.0<br>H = 4.36<br>D = 1.0 | 0.5 pounds<br>21.8 cubic inches |
| 1 | Real Time-of-Day Module, 1A9 | 14844 | W = 7.75<br>H = 4.31<br>D = 9.87 | 3.4 pounds<br>329 cubic inches |
| 1 | Generator Module, 1 MHz, 100 kHz, 1A10 | 14844 | W = 5<br>H = 4<br>D = 1 | 0.5 pounds<br>20 cubic inches |
| 1 | Battery Charger/Logic Module 1A14 | 14844 | W = 5<br>H = 3.9<br>D = 1 | 0.5 pounds<br>19.3 cubic inches |
| 1 | Amplifier Meter Drive Assembly, 1A16 | 14844 | W = 2.1<br>H = 4.1<br>D = 0.5 | 0.1 pounds<br>4.3 cubic inches |
| 1 | Battery Power Supply, 1A17 | 14844 | W = 5.3<br>H = 2.7<br>D = 7.4 | 9 pounds<br>106.9 cubic inches |

Table 1-2. Equipment, Accessories, and Documents Supplied - Continued

| Quantity | Nomenclature | CID Number | Dimensions (in inches) | Weight and volume |
|---|---|---|---|---|
| 2 | Technical Manual, Organization, Intermediate and Depot Level Maintenance Instructions, Master Regulating Clock 0-1824/U | 14844 | W = 8.5<br>H = 11.0 | |
| 1 | Overhaul Manual, Master Regulating Clock 0-1824/U | 14844 | W = 8.5<br>H = 11.0 | |

Table 1-3. Equipment Required But Not Supplied

| SCAT Code | Category | Manufacture and model number | Test parameters | Application |
|---|---|---|---|---|
| 4307 | Oscilloscope | Tektronix 475 | Frequency range: 50 Hz to 7.4 MHz<br>Amplitude range: 20 mV to 12 V<br>Rise Times: 20 nanoseconds | Used to observe ac and digital waveforms |
| | RF Voltmeter | Boonton 92B-S5 | Frequency range: 7.4 MHz to 100 MHz<br>Amplitude range: 1.2 V p-p ±0.1 V<br>Power: -4 to +13 dbm | Measures RF voltage/power |
| | Counter | Hewlett-Packard 5328A | Frequency range: 100 kHz to 200 MHz | Measures frequency of parameters |
| | Spectrum Analyzer | Tektronix 492-02 | Frequency range: 9.2 GHz ±1 Hz<br>Power level range: -5.0 to +1.0 dbm | Measures frequency and power level |
| 42.2 | Digital Volt-meter | Fluke 8600A-01 | Voltage range: -18 Vdc to +45 Vdc<br>Resistance range: 0 to 8 kohms | Measures dc voltage, resistance |
| N/A | Master Regulating Clock | 0-1824/U (FEI FE-5440A) | See table 1-1 | Provides test bed for module troubleshooting |
| N/A | BNC Jack, OSM Plug Adapter | Omni-Spectra 3282-2241-00 | N/A | Used with patch cable |
| N/A | Test Cable Assembly for 1A6 | FEI P/N C52086-9406 | See paragraph 5-2.1 for fabrication data | Module 1A6 extender cable |

Table 1-3. Equipment Required But Not Supplied - Continued

| SCAT Code | Category | Manufacture and model number | Test parameters | Application |
|---|---|---|---|---|
| N/A | Test Cable Assembly for 1A7-1 | FEI P/N C52087-9407-1 | See paragraph 5-2.1 for fabrication data | Module 1A7 extender cable |
| N/A | Test Cable Assembly for 1A7-2 | FEI P/N C52087-9407-2 | See paragraph 5-2.1 for fabrication data | Module 1A7 extender cable |
| N/A | Test Cable Assembly for 1A8 | FEI P/N C52088-9408 | See paragraph 5-2.1 for fabrication data | Module 1A8 extender cable |
| N/A | Test Cable Assembly for 1A10 | FEI P/N C52090-9410 | See paragraph 5-2.1 for fabrication data | Module 1A10 extender cable |
| N/A | Test Cable Assembly for 1A14 | FEI P/N C52094-9414 | See paragraph 5-2.1 for fabrication data | Module 1A14 extender cable |
| N/A | Test Cable Assembly (2) 12-inch test lead wire with alligator clips at each end | N/A | | General image |
| N/A | Power Cable | MIL-C-3432 type CO-03 MGF (3/14) 0500 | 3-wire (5 feet) | For testing and fault isolation. Fabricate in accordance with Maintenance Requirement Card U-1 in Chapter 4 |

Table 1-3. Equipment Required But Not Supplied - Continued

| SCAT Code | Category | Manufacture and model number | Test parameters | Application |
|---|---|---|---|---|
| N/A | Electric Wire | M5086/1-22-0 | Copper Teflon insulated (5 feet) | Card U-1 in Chapter 4 |
| N/A | Electric Wire | M5086/1-22-2 | Copper Teflon insulated (5 feet) | Card U-1 in Chapter 4 |
| N/A | Electric Wire | 22 AWG | Bare copper, tin-plated (1 foot) | Card U-1 in Chapter 4 |
| N/A | RF Cable | M17/028-RG058 | Flexible coaxial (15 feet) | Card U-1 in Chapter 4 |
| N/A | RF Connector Plug | M39012/16-0101 | Coaxial BNC (3) | Card U-1 in Chapter 4 |
| N/A | Clip | N/A | Alligator style, electrical (2) | Card U-1 in Chapter 4 |
| N/A | Connector Plug | WC596/13-3 | General purpose electrical, 2-pole, 3-wire | Card U-1 in Chapter 4 |
| N/A | Connector Plug | MS3106F10SL-3S | N/A | Card U-1 in Chapter 4 |
| N/A | Connector Plug | MS3106F10SL-4S | N/A | Card U-1 in Chapter 4 |
| N/A | Connector Plug | MS3126F14-12S | N/A | Card U-1 in Chapter 4 |
| N/A | Connector Plug | MS81511/26EB02P1 | N/A | Card U-1 in Chapter 4 |
| N/A | Connector, TEE, BNC Termination | Type UG-274A/U | 50 Ω feedthru | General Purpose |

# CHAPTER 2

# OPERATION

2-1. INTRODUCTION. This chapter contains operating instructions for the Master Regulating Clock (MRC). Included in this chapter are tabular descriptions and illustrations of all controls and indicators, input and output connectors, operating procedures presented in step-by-step sequence for turn-on and turn-off, and operator maintenance instructions and schedules.

2-2. CONTROLS, INDICATORS, AND CONNECTORS. Controls, indicators, and connectors for the MRC are located on both the front and rear panels. Figure 2-1 and table 2-1 illustrate and describe the front panel controls, indicators, and connectors. Figure 2-2 and table 2-2 illustrate and describe the rear panel controls, indicators, and connectors. Access to the front panel controls and indicators are obtained by opening the doors protecting these components.

2-3. OPERATION. The MRC requires a minimum of operator attention. Normally, the unit is left in an energized condition to prolong the life of the Cesium beam tube and to eliminate the warm-up time necessary for MRC stabilization. Under circumstances, where the MRC is deenergized, perform the preoperational, turn-on and turn-off procedures in this chapter.

2-4. PREOPERATIONAL PROCEDURE. Perform the following procedure prior to turning on the MRC.

NOTE

When shipped from manufacturer, the MRC is normally set for 115 Vac, 1Φ, 47 Hz to 400 Hz operating power. It can, however, also be operated at 230 Vac. To operate the MRC from a 230 Vac power source, remove the locking switch plate on rear panel and set LINE SELECTOR switch S3 (7, figure 2-2) to the left. Replace locking switch plate so that LINE SELECTOR 230 VAC is indicated and LINE SELECTOR switch (7) is locked in position.

a. Check that LINE SELECTOR switch S3 (7) is set for proper ac power source (115 VAC or 230 VAC).

b. At rear panel, connect external ac power source to AC POWER IN connector J14 (6).

c. At rear panel, connect external +22 Vdc to +30 Vdc power source to DC POWER IN connector J13 (5).

d. Connect cables from applicable MRC output signal connectors to external equipment.

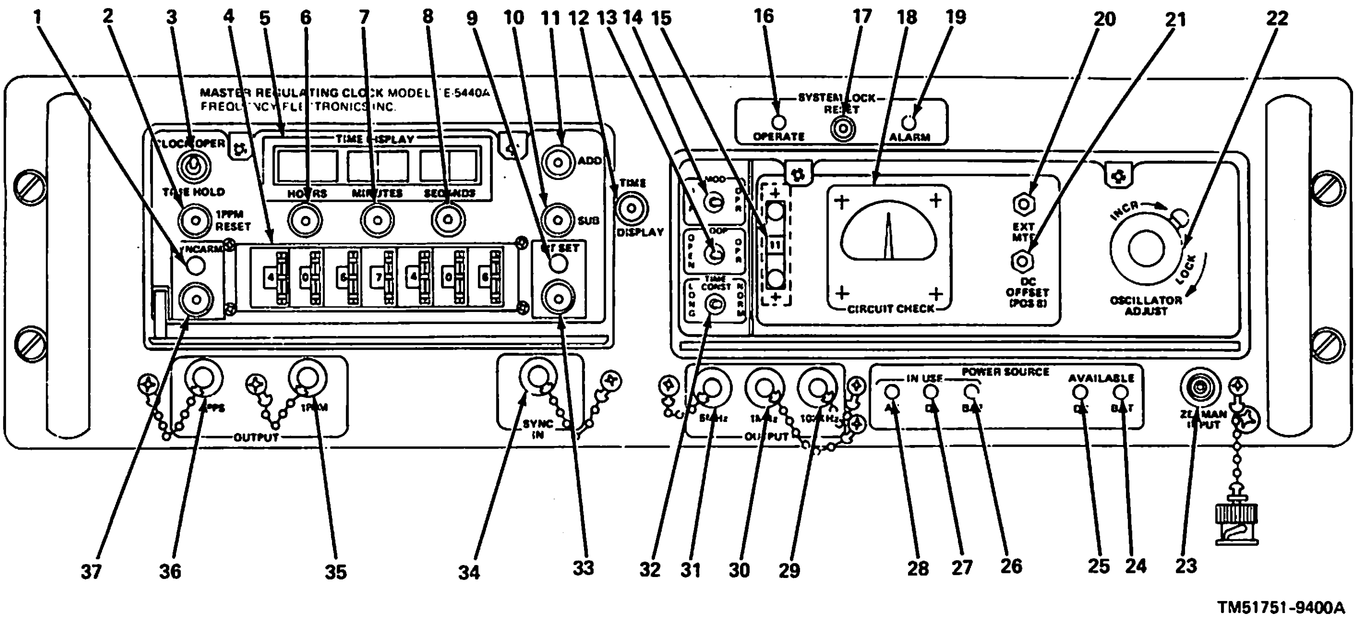



Figure 2-1. Master Regulating Clock Front Panel View

Table 2-1. Master Regulating Clock Front Panel Operator Controls, Indicators, and Connectors

| Figure 2-1 index no. | Control, indicator, or connector | Function |
|---|---|---|
| 1 | SYNC ARM indicator (1A9CR2) | Indicator lights when external sync (TTL level pulse, 1 PPM or 1 PPS) is applied via SYNC IN connector (34) and SYNC ARM switch (37) is momentarily pressed. Indicator will remain lit until synchronization has occurred. |
| 2 | 1PPM RESET switch (1A9S3) | Advances TIME DISPLAY indicator (5) by one minute and returns seconds display to 00. Also changes time code and 1 PPM outputs similiarly. |
| 3 | CLOCK OPER/ TIME HOLD switch (1A9S2) | In CLOCK OPER position TIME DISPLAY clock display operates normally. In TIME HOLD position, clock operation is stopped to allow clock setting. |
| 4 | PULSE ADVANCE, MICROSEC thumbwheel switch (1A9S1) | Provides capability of advancing 1 PPS and 1 PPM outputs over a range of 1 second in discrete steps of 100, 10, and 1 millisecond, and 100, 10, and 1 microsecond. |

Table 2-1. Master Regulating Clock Front Panel Operator Controls, Indicators, and Connectors - Continued

| Figure 2-1 index no. | Control, indicator, or connector | Function |
|---|---|---|
| 5 | TIME DISPLAY indicator (1A9U1-U6) | Provides LED numerical display of time. |
| 6 | TIME DISPLAY HOURS switch (1A9S5) | When pressed, allows HOURS portion of TIME DISPLAY indicator (5) to be reset by using ADD and SUB switches (11 and 10). |
| 7 | TIME DISPLAY MINUTES switch (1A9S6) | When pressed, allows MINUTES portion of TIME DISPLAY indicator (5) to be reset by using ADD and SUB switches (11 and 10). |
| 8 | TIME DISPLAY SECONDS switch (1A9S7) | When pressed, allows SECONDS portion of TIME DISPLAY indicator (5) to be reset by using ADD and SUB switches (11 and 10). |
| 9 | UT SET indicator (1A9CR1) | When UT SET switch (33) is pressed, indicator lights, and TIME DISPLAY indicator (5), 1 PPM and 1 PPS clock outputs, and time code output, are delayed by one second. |
| 10 | SUB switch (1A9S10) | Subtracts from TIME DISPLAY indicator (5), when used in conjunction with HOURS, MINUTES, and SECONDS switches (6 thru 8). |
| 11 | ADD switch (1A9S9) | Adds to TIME DISPLAY indicator (5), when used in conjunction with HOURS, MINUTES, and SECONDS switches (6 thru 8). |
| 12 | TIME DISPLAY switch (1A9S8) | When pressed lights TIME DISPLAY indicator (5) when operating with internal battery. |
| 13 | LOOP OPEN/OPR switch (1A7S1) | In OPEN position opens frequency lock loop circuits for maintenance and adjustment. In OPR position, closes frequency lock loop. |
| 14 | MOD OFF/OPR switch (1A7S3) | In OFF position removes 83+ Hz modulation input signal to modulator/multiplier (1A5) for testing and adjustments. In OPR position applies 83+ Hz modulation input signal to modulator/multiplier (1A5). |

Table 2-1. Master Regulating Clock Front Panel Operator Controls, Indicators, and Connectors - Continued

| Figure 2-1 index no. | Control, indicator, or connector | Function |
|---|---|---|
| 15 | CIRCUIT CHECK switch (1A16S1) | Selects function to be displayed on CIRCUIT CHECK meter (18). |
| | Switch pos / Function name | |
| | 0 +18 V | Provides indication of +18 Vdc bus. |
| | 1 SUPPLY VOLTAGE | Provides indication of dc voltage generated by 115/230 Vac source. |
| | 2 +5 V | Provides indication of +5 Vdc bus. |
| | 3 2ND HARMONIC LEVEL | Provides indication of second harmonic level (166+ Hz), generated by Cesium beam resonator 1A1. |
| | 4 BATTERY CURRENT CHARGE/DISCHARGE | Provides indication of internal battery charging/discharging current. |
| | 5 CESIUM OVEN TEMP | Provides indication of Cesium oven temperature (P/O Cesium beam resonator 1A1). |
| | 6 OSC OVEN TEMP | Provides indication of oscillator 1A4 inner oven temperature. |
| | 7 VAC-ION CURRENT | Provides indication of VAC-ION pump anode current (P/O Cesium beam resonator 1A1). |
| | 8 CESIUM ION CURRENT | Provides indication of Cesium beam resonator 1A1 dc output level. |
| | 9 OSC CONTROL VOLTAGE | Provides indication of voltage applied to oscillator 1A4 to maintain frequency lock. |
| | 10 5 MHz SIGNAL LEVEL | Provides indication of 5 MHz output level from buffer amplifier 1A8. |
| | 11 SYNTHESIZER LOCK IND | Provides indication that phase lock of 7.368+ MHz local oscillator has occurred. |

Table 2-1. Master Regulating Clock Front Panel Operator Controls, Indicators, and Connectors - Continued

| Figure 2-1 index no. | Control, indicator, or connector | Function |
|---|---|---|
| 16 | SYSTEM LOCK OPERATE indicator (DS3) | When lit, indicates that system is operating normally maintaining frequency lock. |
| 17 | SYSTEM LOCK RESET switch (S1) | Resets alarm circuits after they have been activated and after frequency lock has reoccurred. |
| 18 | CIRCUIT CHECK meter (M1) | Indicates the value of the function selected via the CIRCUIT CHECK switch (15). |
| 19 | SYSTEM LOCK ALARM indicator (DS1) | When lit, indicates that the frequency lock loop has been momentarily or permanently opened. |
| 20 | EXT MTR connector (J28) | Provides capability to substitute a more sensitive external meter for CIRCUIT CHECK meter (18). |
| 21 | DC OFFSET (POS8) potentiometer (R2) | Adjusts meter indication for ion current measurement of Cesium beam resonator 1A1. |
| 22 | OSCILLATOR ADJUST INCR/LOCK control (R1) | Adjusts 5 MHz oven controlled, voltage controlled, crystal oscillator frequency when frequency lock loop is open. |
| 23 | ZEEMAN INPUT connector (J10) | Provides input for Zeeman frequency signal during maintenance or troubleshooting of the MRC. |
| 24 | POWER SOURCE AVAILABLE, BAT indicator (DS5) | When lit, indicates internal batteries are available for powering MRC. |
| 25 | POWER SOURCE AVAILABLE, DC indicator (DS4) | When lit, indicates external dc power is available for powering MRC. |
| 26 | POWER SOURCE IN USE, BAT indicator (DS2) | When lit, indicates internal batteries are providing power to operate MRC. |
| 27 | POWER SOURCE IN USE, DC indicator (DS6) | When lit, indicates dc power source is providing power to operate MRC. |
| 28 | POWER SOURCE IN USE, AC indicator (DS7) | When lit, indicates ac power source is providing power to operate MRC. |

Table 2-1. Master Regulating Clock Front Panel Operator Controls, Indicators, and Connectors - Continued

| Figure 2-1 index no. | Control, indicator, or connector | Function |
|---|---|---|
| 29 | 100 KHz OUTPUT connector (J27) | Provides 100 kHz output signal. |
| 30 | 1 MHz OUTPUT connector (J9) | Provides 1 MHz output signal. |
| 31 | 5 MHz OUTPUT connector (J8) | Provides 5 MHz output signal. |
| 32 | TIME CONSTANT LONG/ NORM switch (S2) | In NORM position sets time constant to approximately one second. In LONG position sets time constant to approximately ten seconds. |
| 33 | UT SET switch (1A9S11) | When pressed, retards TIME DISPLAY indicator (5), 1 PPM and 1 PPS clock outputs, and time code output by one second. Also lights UT SET indicator (9). |
| 34 | SYNC IN connector (1A9J4) | Provides connection for MRC synchronization from external reference signal (TTL level pulse, 1 PPM, or 1 PPS). |
| 35 | 1 PPM OUTPUT connector (1A9J3) | Provides one pulse-per-minute (1 PPM) standard output signal. |
| 36 | 1 PPS OUTPUT connector (1A9J2) | Provides one pulse-per-second (1 PPS) standard output signal. |
| 37 | SYNC ARM switch (1A9S4) | Used to synchronize MRC to an external signal. |

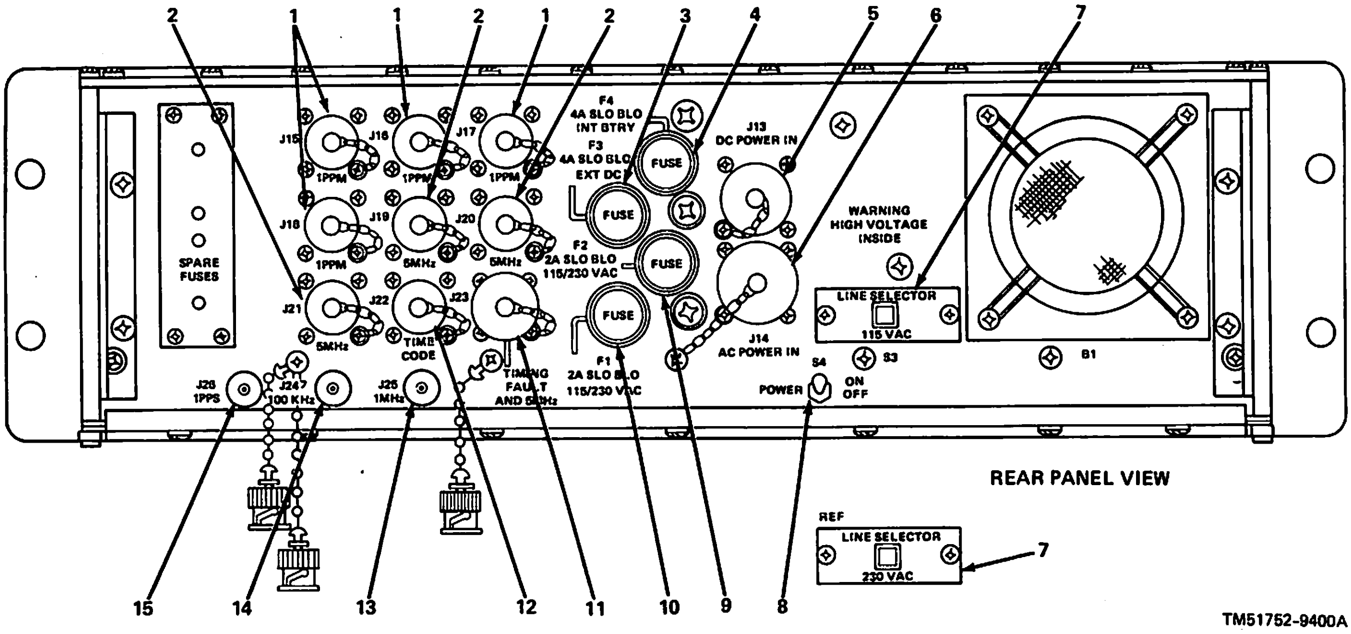



Figure 2-2. Master Regulating Clock Rear Panel View

Table 2-2. Master Regulating Clock Rear Panel Operator Controls, Indicators, and Connectors

| Figure 2-2 index no. | Control indicator, or connector | Function |
|---|---|---|
| 1 | 1PPM connectors (J15 thru J18) | Provides for 1 PPM output signals. |
| 2 | 5MHz connectors (J19 thru J21) | Provides coaxial connections for 5 MHz output signals. |
| 3 | 4A SLO BLO EXT DC fuse (F3) | Provides overload protection for external dc input circuit. |
| 4 | 4A SLO BLO INT BTRY fuse (F4) | Provides overload protection for internal battery. |
| 5 | DC POWER IN connector (J13) | Input connector for dc power. |
| 6 | AC POWER IN connector (J14) | Input connector for ac power. |
| 7 | LINE SELECTOR (115 VAC or 230 VAC) switch (S3) | With locking plate removed, switch may be positioned to select either a 115 Vac or 230 Vac power source. Attaching locking plate secures switch in selected position. |

Table 2-2. Master Regulating Clock Rear Panel Operator Controls, Indicators, and Connectors - Continued

| Figure 2-2 index no. | Control, indicator, or connector | Function |
|---|---|---|
| 8 | POWER ON/OFF switch (S4) | Applies or removes operating power to unit (ac, dc, and internal battery power). |
| 9 | 2A SLO BLO 115/ 230 VAC (F2) | Provides overload protection for ac input. |
| 10 | 2A SLO BLO 115/ 230 VAC (F1) | Provides overload protection for ac input. |
| 11 | TIMING FAULT AND 5MHz connector (J23) | Provides signal for external SYSTEM LOCK, ALARM circuit; also provides 5 MHz output signal. |
| 12 | TIME CODE connector (J22) | Provides 24 bit serial BCD word, one word per second, representing time-of-day. |
| 13 | 1MHz connector (J25) | Provides 1 MHz standard output signal. |
| 14 | 100 KHz connector (J24) | Provides 100 kHz output signal. |
| 15 | 1PPS connector (J26) | Provides 1 PPS output signal. |

2-5. TURN-ON PROCEDURE. To turn on the MRC, proceed as follows:

NOTE

Fan will not operate (see step a.) and POWER SOURCE IN USE AC indicator (28, figure 2-1) will not light (see step a.(3)) if 115/230 Vac supply is not used.

a. Set S4 POWER ON/OFF switch (8, figure 2-2) to ON. Fan B1, located on the rear panel, should operate and the following indicators should light:

NOTE

TIME DISPLAY (5, figure 2-1) will not light if MRC is operating on internal battery.

(1) TIME DISPLAY (5).

(2) SYSTEM LOCK ALARM (19).

(3) POWER SOURCE IN USE AC (28).

NOTE

POWER SOURCE AVAILABLE DC (25) indicator will not be lit if external dc supply is not connected.

(4) POWER SOURCE AVAILABLE DC (25).

NOTE

POWER SOURCE AVAILABLE BAT (25) indicator will not be lit if battery power supply module 1A17 is not charged.

(5) POWER SOURCE AVAILABLE BAT (24).

b. Observe that the following indicators are out:

(1) POWER SOURCE IN USE BAT (26).

NOTE

POWER SOURCE IN USE DC (27) indicator will be lit if 115/230 Vac supply is not used.

(2) POWER SOURCE IN USE DC (27).

NOTE

Access to the CIRCUIT CHECK switch and CIRCUIT CHECK meter, both located on the front panel, are obtained by opening the door protecting these components. Indications observed, in response to selected switch positions, should fall within limits specified on the CIRCUIT CHECK table located on the inside of the door. Meter indications observed outside of specified limits are indicative of equipment or circuit malfunction.

c. Set CIRCUIT CHECK switch (15) to position 0. Observe that CIRCUIT CHECK meter (18) indicates between 40 and 80.

2-6. OPERATIONAL CHECKOUT AND ADJUSTMENT. Immediately after energizing the MRC, perform the following steps:

NOTE

CIRCUIT CHECK meter will not provide indication for CIRCUIT CHECK switch position 1 unless 115/230 Vac supply is used.

a. Set CIRCUIT CHECK switch (15, figure 2-1) to positions 0, 1, 2, 4, 10, and 11. For each switch position, observe corresponding reading on CIRCUIT CHECK meter (18) for correct indication. If readings are not within specified limits, equipment malfunction is indicated and repair action necessary.

b. Set LOOP OPEN/OPR switch (13) to the OPR position.

c. Set MOD OFF/OPR switch (14) to OPR position.

d. Set TIME CONST LONG/NORM switch (32) to NORM position.

e. Following 20 minute warm-up period, observe that SYSTEM LOCK OPERATE indicator (16) lights.

f. Press SYSTEM LOCK RESET switch (17) and observe that SYSTEM LOCK ALARM indicator (19) goes out. If the ALARM indicator (19) remains out, and the SYSTEM LOCK OPERATE indicator (16) remains lit, the MRC is operating in frequency lock and no further adjustments are required. If the ALARM indicator (19) remains lit, perform steps g. and h. If frequency lock has been established go to paragraph 2-7 (if required).

g. Recheck MRC frequency locking ability by momentarily setting the LOOP OPEN/OPR switch (13) to the OPEN position and then returning the switch to the OPR position. Observe that the SYSTEM LOCK OPERATE indicator (16) lights within two minutes.

h. Press SYSTEM LOCK RESET switch (17) and observe that the SYSTEM LOCK ALARM indicator (19) goes out. If the ALARM indicator (19) remains out, and the SYSTEM LOCK OPERATE indicator (16) is lit, the MRC is operating in frequency lock and no additional adjustments are required. If the ALARM indicator (19) is still lit, perform steps i. and j. If frequency lock has been established proceed to paragraph 2-7 (if required).

i. Set CIRCUIT CHECK switch (15) to positions 3, 5, 6, 7, and 9. For each switch position, observe corresponding reading on CIRCUIT CHECK meter (18) for correct indication. If readings are not within specified limits, equipment malfunction is indicated and repair action is required.

j. Perform the following procedures to verify that the 5 MHz voltage controlled crystal oscillator is properly tuned so that frequency lock can occur:

(1) Set LOOP OPEN/OPR switch (13) to the OPEN position.

(2) Set MOD OFF/OPR switch (14) to the OFF position.

(3) Set CIRCUIT CHECK switch (15) to position 8.

(4) While observing CIRCUIT CHECK meter (18), rotate OSCILLATOR ADJUST INCR/LOCK control (22) for maximum positive meter indication.

(5) If required, adjust DC OFFSET (POS 8) potentiometer (21) to place the maximum positive meter indication within the operating range of CIRCUIT CHECK meter (18).

(6) Set both LOOP OPEN/OPR switch (13) and MOD OFF/OPR switch (14) to the OPR positions.

(7) Press SYSTEM LOCK RESET switch (17). Observe that the SYSTEM LOCK OPERATE indicator (16) lights and the SYSTEM LOCK ALARM indicator (19) goes out, indicating that frequency lock has occurred.

2-7. CLOCK SETTING AND SYNCHRONIZATION. The following steps define the procedures for setting and synchronizing the time-of-day (TOD) clock.

NOTE

Prior to performing procedures, verify that frequency lock exists by observing that SYSTEM LOCK OPERATE indicator (16, figure 2-1) is lit and SYSTEM LOCK ALARM indicator (19) is out. If the MRC is not operating in frequency lock, the TOD clock will be operating from a free running 5 MHz crystal oscillator and timing errors will occur.

2-7.1 Setting Time Display Indicator (5, figure 2-1). Set the hours, minutes, and seconds of the TIME DISPLAY indicator (5) in accordance with the following procedures:

a. Set CLOCK OPER/TIME HOLD switch (3) to the TIME HOLD position.

b. Set HOURS portion of TIME DISPLAY indicator (5) by observing reference time and, while simultaneously pressing the TIME DISPLAY HOURS switch (6), press as applicable, the SUB switch (10) or ADD switch (11) to synchronize the HOURS portion of the TIME DISPLAY (5) with the reference time.

c. Set MINUTES portion of TIME DISPLAY indicator (5) by observing reference time and, while simultaneously pressing the TIME DISPLAY MINUTES switch (7), press as applicable, the SUB switch (10) or ADD switch (11) to synchronize the MINUTES portion of the TIME DISPLAY (5) with the reference time.

d. Set SECONDS portion of TIME DISPLAY indicator (5) by observing reference time and, while simultaneously pressing the TIME DISPLAY SECONDS switch (8), press as applicable, the SUB switch (10) or ADD switch (11) to advance the SECONDS portion of the TIME DISPLAY indicator (5) several seconds ahead of reference time.

e. When reference time advances to the time indicated on the TIME DISPLAY indicator (5), set the CLOCK OPER/TIME HOLD switch (3) to the CLOCK OPER position. The TIME DISPLAY indicator (5) should now be precisely synchronized with the reference time.

2-7.2 1PPM RESET.

NOTE

After pressing the 1PPM RESET switch (2, figure 2-1), the TIME DISPLAY indicator (5) will not indicate correct time since the SECONDS count returns to 00 and the MINUTES count advances to the next minute. Consequently, the TIME DISPLAY indicator (5) must be reset (see para. 2-7.1) after performing this operation.

The 1PPM RESET function enables the operator to monitor the time interval of an event with zero time when concurrently pressing the 1PPM RESET switch (2). The elapsed time, is indicated on the TIME DISPLAY indicator (5) and as digital time code data via TIME CODE connector J22 (12, figure 2-2). To reset the 1 PPM pulse to within $\leq$100 nanoseconds delay from time coincidence with any selected 1 PPS output over a one minute period, perform the following procedure:

a. Press the 1PPM RESET pushbutton (2, figure 2-1).

b. Verify the SECONDS count goes to 00.

c. Verify the MINUTES count advances to the next minute.

2-7.3 Universal Time (UT) Set. The Universal Time (UT) SET switch (33, figure 2-1) allows for correction of the SECONDS timing in accordance with National Bureau of Standards corrections issued periodically for variances in standard time. Each depression of the UT SET switch (33) will subtract one second from the TIME DISPLAY indicator (5), 1 PPM and 1 PPS clock outputs, and from the digital Time Code data output. The UT SET indicator (9) will light when the UT SET switch command has been received.

2-7.4 Clock Synchronization. Synchronize the clock 1 PPS and 1 PPM outputs to an external sync pulse as follows:

a. Apply TTL level, 1 PPM, or 1 PPS synchronizing pulse to SYNC IN connector (34, figure 2-1).

b. Press SYNC ARM switch (37). SYNC ARM indicator (1) will light.

c. Upon synchronization, the SYNC ARM indicator (1) will go out.

2-8. TURN-OFF PROCEDURE. Turn off power to the MRC by setting the POWER ON/OFF switch (8, figure 2-2) to the OFF position. This results in disabling ac and dc power, including internal battery power, to the MRC.

2-9. EMERGENCY TURN-OFF PROCEDURE. There are no special emergency turn-off procedures for the MRC. Should an emergency condition exist, perform the turn-off procedure referenced in paragraph 2-8. There are no battle shorts built into the MRC for emergency operation.

2-10. TURN-ON PROCEDURE AFTER PROLONGED STORAGE. There are no special turn-on precautions to be considered following prolonged MRC storage. During operational checkout and adjustment (see para. 2-6) however, acceptable CIRCUIT CHECK meter indications for CIRCUIT CHECK switch positions 7 and 8 as well as frequency lock may not be obtained following 20 minute warmup period. If this condition occurs, perform the following procedure:

NOTE

Procedure should be performed by depot level maintenance personnel.

a. Set POWER ON/OFF switch (8, figure 2-2) to the OFF position.

b. Disconnect external dc power from DC POWER IN connector J13 (5, figure 2-2).

c. For a minimum period of 24 hours, apply 22 to 30 volts dc to DC POWER IN connector J13 (5) (+22 V to +30 V to J13-E; return J13-C) to energize the Cesium beam ion pump.

d. Following the minimum 24 hour period of pump operation, reconnect external dc power source to connector J13.

e. Set POWER ON/OFF switch (8) to the ON position.

f. Perform procedures referenced in paragraphs 2-5 through 2-7.

2-11. MAINTENANCE INSTRUCTIONS AND SCHEDULES. The MRC maintenance tasks are listed in table 2-3. The table defines the maintenance tasks, the frequency, and provides reference to the appropriate maintenance procedure. Refer to the Maintenance Requirement Cards in Chapter 4 for further checks and procedures. The daily checks consist of monitoring MRC operate, alarm, and power source indicators. The monthly checks consist of built-in-test equipment (BITE) operability test. These daily and monthly maintenance tasks are performed using front panel indicators and controls to determine the MRC operating condition. There are no special safety precautions required.

Table 2-3. Maintenance Instructions and Schedules

| Maintenance task | Frequency | Maintenance procedure reference |
|---|---|---|
| Conduct MRC check | Daily | Refer to paragraph 2-11.1 |
| Conduct MRC check | Monthly | Refer to paragraph 2-11.2 |

2-11.1 Daily MRC Check. Perform the daily MRC check as follows:

a. Observe that SYSTEM LOCK ALARM indicator (19, figure 2-1) is out. If the indicator is lit, a frequency lock failure is indicated since the previous check.

b. Observe that SYSTEM LOCK OPERATE indicator (16) is lit. If both the SYSTEM LOCK ALARM indicator (19) and the SYSTEM LOCK OPERATE indicator (16) are lit, press SYSTEM LOCK RESET switch (17) and observe that the SYSTEM LOCK ALARM indicator (19) goes out.

c. If SYSTEM LOCK OPERATE indicator (16) is out, open right-hand access panel and verify that LOOP OPEN/OPR switch (13) and MOD OFF/OPR switch (14) are both set to OPR positions.

d. Press SYSTEM LOCK RESET switch (17) and observe that SYSTEM LOCK OPERATE indicator (16) lights and SYSTEM LOCK ALARM indicator (19) goes out. If both indicator conditions do not occur, perform Operational Checkout and Adjustment as specified in para. 2-6. If both indicator conditions still do not occur, refer to troubleshooting information in Chapter 5.

e. Observe that applicable POWER SOURCE IN USE indicator (26, 27, or 28) lights for corresponding power source being used.

f. Close and secure access panel.

2-11.2 Monthly MRC Check. Perform the monthly MRC check as follows:

a. Open both front access panels by loosening 4 screws and lowering panels.

b. Set CIRCUIT CHECK switch (15, figure 2-1) successively to the positions listed in table 2-4, observe that CIRCUIT CHECK meter (18) indications are within the range indicated in the table. If any readings are out-of-range, refer to the troubleshooting section in Chapter 5.

c. Observe TIME DISPLAY readout (5). Verify that SECONDS and low-order MINUTES readouts increment. Ensure that CLOCK OPER/TIME HOLD switch (3) is set to CLOCK OPER position.

d. Close and secure access panels.

2-11.3 MRC Log Form. Readings observed during the performance of the daily and monthly checks described in paragraphs 2-11.1 and 2-11.2, respectively, are entered on the Master Regulating Clock Log Form in the appropriate column. A sample form is shown in figure 2-3. If any reading is outside the specified range, circle it and refer to chapter 5 for troubleshooting procedures.

Table 2-4. Monthly Check

| Circuit check switch | | Circuit check meter indication |
|---|---|---|
| Pos | Function | Range |
| 0 | +18 V | +40 to +80 |
| 1 | SUPPLY VOLTAGE | +40 to +80 |
| 2 | +5 V | +40 to +80 |
| 3 | 2ND HARMONIC LEVEL | +40 to +80 |
| 4 | BATTERY CURRENT CHARGE / DISCHARGE | CHG: 0 to +80<br>DISCHG: -40 to -80 |
| 5 | CESIUM OVEN TEMP | +40 to +80 |
| 6 | OSC OVEN TEMP | +40 to +80 |
| 7 | VAC-ION CURRENT | 0 to -20 |
| 8 | CESIUM ION CURRENT | Set to 0 (midrange) with DC-offset adjustment |
| 9 | OSC CONTROL VOLTAGE | 0 to ±40 |
| 10 | 5 MHz SIGNAL LEVEL | +40 to +80 |
| 11 | SYNTHESIZER LOCK IND. | +40 to +80 |

MASTER REGULATING CLOCK O-1824/U

SERIAL NO.________________

USS________________ (SSSN-______) DATE ________

| | SHUTDOWN | NORM * | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DAILY CHECKS | | | | | | | | | | | | | | | | | | | | | | | |
| REAL TIME OF DAY DISPLAY ADVANCES | | | | | | | | | | | | | | | | | | | | | | | |
| OPERATE LIGHT [a] | | ON | | | | | | | | | | | | | | | | | | | | | |
| ALARM LIGHT [a] | | OFF | | | | | | | | | | | | | | | | | | | | | |
| OPERATE AND ALARM LIGHTS [a] | | ON, OFF | | | | | | | | | | | | | | | | | | | | | |
| POWER SOURCE INDICATORS [b] | | ON | | | | | | | | | | | | | | | | | | | | | |
| MONTHLY CHECKS [b] | | | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 0 | | +40 - +80 | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 1 | | +40 - +80 | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 2 | | +40 - +80 | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 3 | | +40 - +80 | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 4 (CHG) | | 0 - +80 | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 4 (DISCH) | | -40 - -80 | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 5 | | +40 - +80 | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 6 | | +40 - +80 | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 7 | | 0 - -20 | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 8 | | MIDRANGE | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 9 | | -40 - +40 | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 10 | | +40 - +80 | | | | | | | | | | | | | | | | | | | | | |
| CIRCUIT CHECK SWITCH POS 11 | | +40 - +80 | | | | | | | | | | | | | | | | | | | | | |

*CIRCLE LOG VALUES WHICH ARE OUTSIDE NORMAL RANGE.

[a] ATTEMPT RESET (SEE TECH MANUAL).

[b] REFER ANY OUT OF RANGE INDICATIONS TO HIGHER LEVEL MAINTENANCE.

TM51753-9400A

Figure 2-3. Master Regulating Clock Log Form

# CHAPTER 3

# FUNCTIONAL DESCRIPTION

3-1. INTRODUCTION. Chapter 3 provides an overview of the 5 MHz frequency lock loop operation and the ancillary circuits necessary to support the loop. This is followed by a similar discussion for the Time-of-Day Clock. Circuit operation of each assembly is then discussed in greater detail. Finally, an overview of operation, followed by a detailed discussion of the theory of operation for the MRC power distribution circuits are provided.

A listing of the assemblies comprising the MRC are referenced in table 1-2.

3-2. OVERVIEW OF SIGNAL CIRCUITS OPERATION. The following paragraphs provide an operational overview of the various MRC signal circuits.

3-2.1 Frequency Lock Operation. The MRC uses the property of atomic resonance in the Cesium beam resonator (1A1) to control, via a frequency lock loop, the frequency of a 5 MHz oscillator (1A4). Frequency locking of the 5 MHz crystal oscillator is accomplished by operating the cesium beam resonator and associated electronics as a frequency discriminator; i.e. departures of frequency of an input signal from a defined center frequency will produce a dc output signal from the discriminator. This dc output signal will have a magnitude and polarity related to the extent and direction of departure from the defined center frequency.

The defined center frequency of the MRC Cesium beam resonator, is 9192631771.59 Hz (figure 3-1), and departure from this center frequency will yield signal output currents less than maximum obtainable from the resonator. This characteristic of the resonator is made to behave as a frequency discriminator by use of a modulation/demodulation technique.

If the 9.192+ GHz resonator input signal is frequency modulated, the resonator beam current will contain the modulation frequency signal at $0^{\circ}$ or $180^{\circ}$ phase depending upon whether the modulated microwave resonator signal is above or below the center frequency as shown in D and B of figure 3-2. At the center frequency, resonator beam current will contain a component of twice modulation frequency as shown in C of figure 3-2. Components of twice modulation frequency also occur at other microwave frequencies, such as A and E of figure 3-2.

Between microwave frequencies A and C, and similarly, between microwave frequencies C and E, the modulation frequency component of resonator beam current will attain a maximum. If these modulation frequency components, A, B, C, D and E of figure 3-2 are phase detected with respect to the original modulation frequency signal, the resulting output from the phase detector will have, as a function of microwave resonator frequency, the discriminator characteristic of figure 3-3.

Implementation of the MRC frequency lock loop is shown in figure 3-4. Output from oscillator 1A4 is frequency modulated at an 83+ Hz rate in a phase modulator circuit (for small indices of modulation, the spectra of FM and PM are similar) multiplied to 9.2 GHz and offset to 9.192+ GHz by a local oscillator in modulator, multiplier 1A5. The 83+ Hz frequency modulated microwave signal is detected by the Cesium beam resonator resulting in, at the output of preamplifier 1A1A2, an 83+ Hz

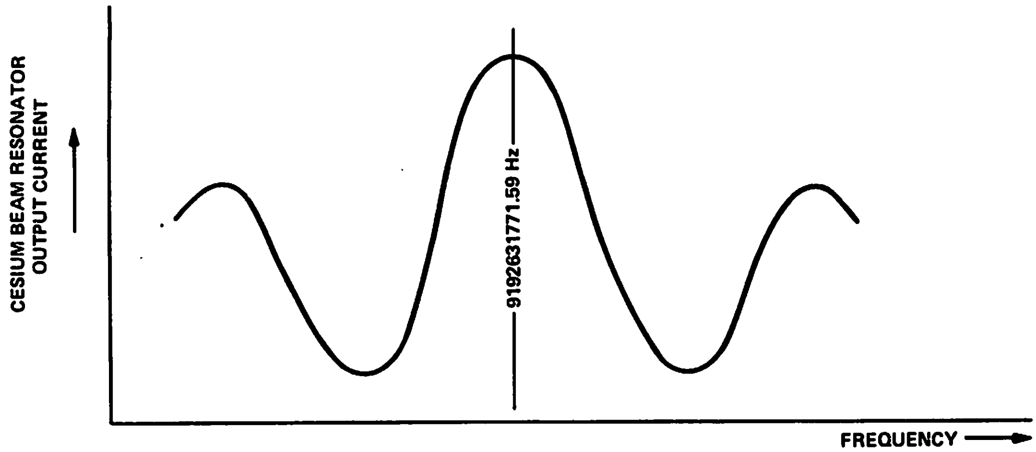



Figure 3-1. Cesium Beam Resonator Transfer Characteristic

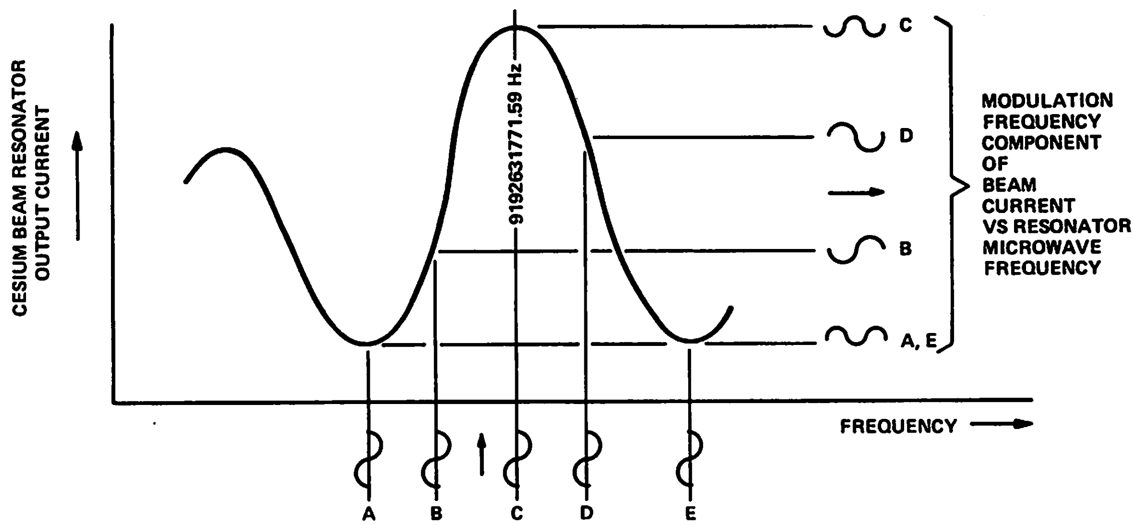



Figure 3-2. Frequency Modulation of Resonator Microwave Input Signal

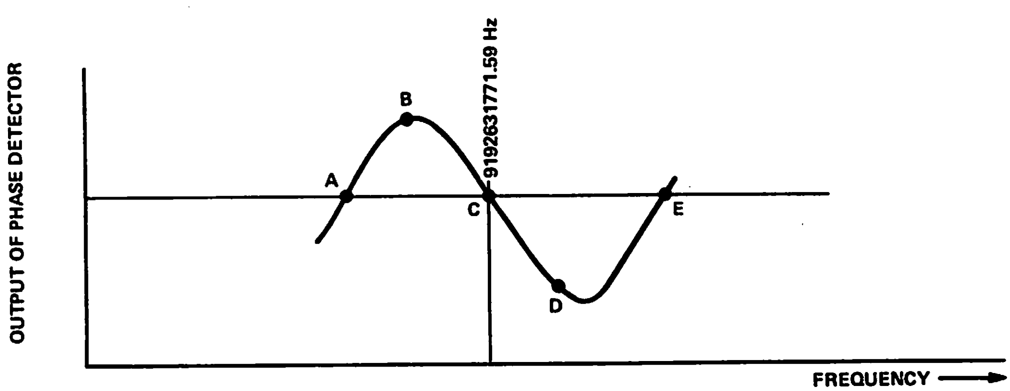



Figure 3-3. Derived Discriminator Characteristic

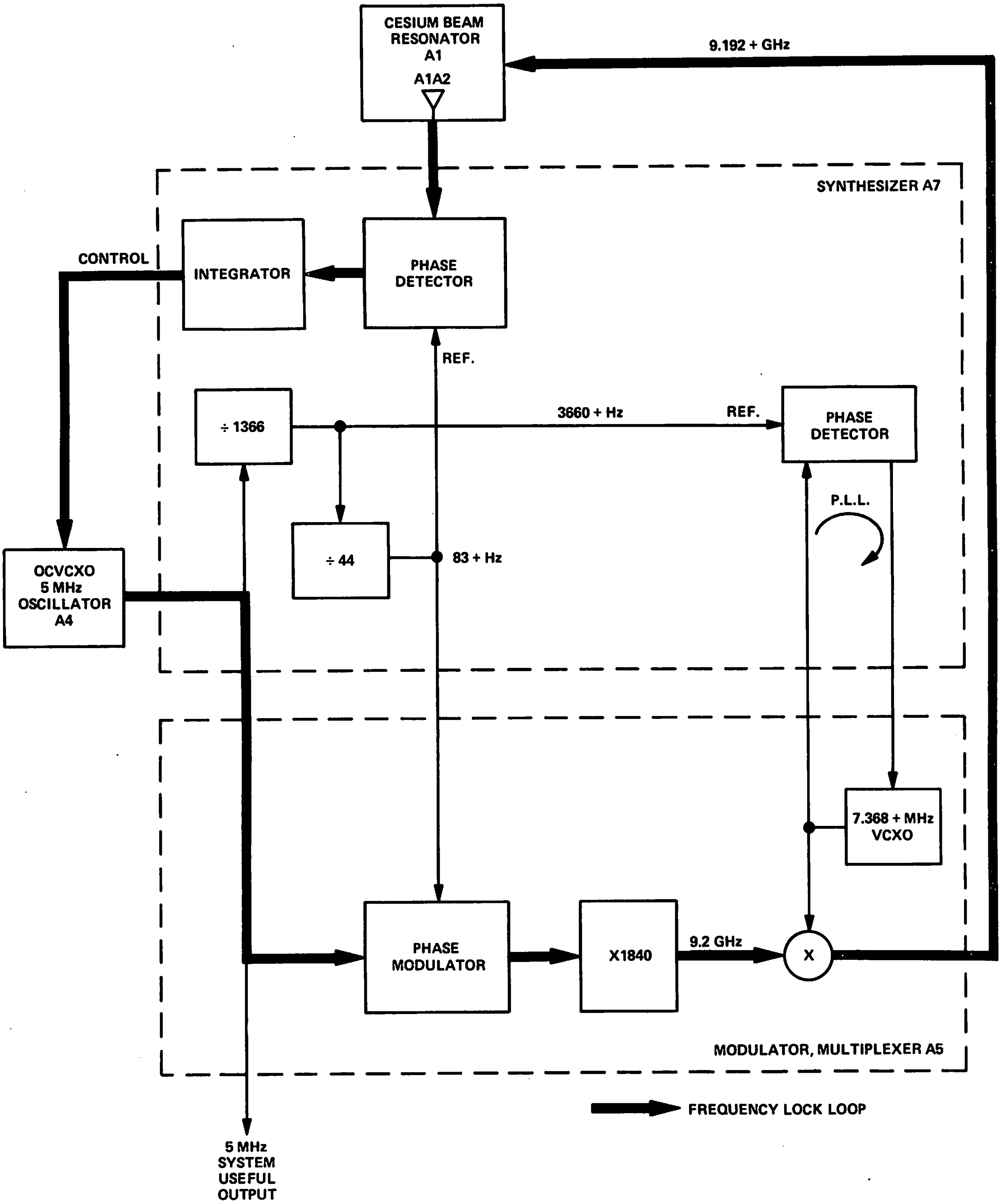



Figure 3-4. MRC Frequency Lock Loop

signal whose behavior with regard to amplitude and phase is like that depicted in figure 3-2. Phase detection (figure 3-4) of the 83+ Hz signal from preamplifier 1A1A2, with respect to the 83+ Hz modulation signal and filtering, will yield a dc signal to keep oscillator module 1A4 in frequency lock. Since 9.192+ GHz is not an integer multiple of 5 MHz, it is necessary to use a local oscillator in modulator/multiplier module 1A5 to "offset" the generated (9.2 GHz) microwave signal to 9.192+ GHz. The offset frequency, 7.368+ MHz, is made coherent with the 5 MHz oscillator signal by phase locking the 7.368+ MHz VCXO to a noninteger multiple 2013-1366 of 5 MHz. This is accomplished in synthesizer module 1A7 by dividing 5 MHz by 1366 and using the resulting 3660+ Hz as a reference signal for a phase detector. The phase detector is part of a phase lock loop system wherein the control voltage (for locking the 7.368+ MHz VCXO located in modulator/multiplier module 1A5) is derived from a phase comparison of every 2013th cycle of 7.368+ MHz against the 3660+ Hz reference.

The signals (83+ Hz) used by the phase modulator in modulator/multiplier 1A5 as well as a reference for the phase detector in synthesizer module 1A7 are derived, in 1A7, by division of the 3660+ Hz signal by 44.

In the above described system, all signals are coherent with the 5 MHz oscillator signal.

3-2.2 Time-Of-Day Clock Operation. The time-of-day clock is an assembly of TTL logic circuits whose function is to generate the 1PPS, 1PPM, and time code signals available on the front and rear panels of the MRC as well as the signals to operate the LED numeric TIME DISPLAY on the front panel of the MRC. All time signals are derived from the stabilized 5 MHz OCVCXO and consequently have the accuracy and stability of the cesium beam resonator.

3-3. DETAILED THEORY OF SIGNAL CIRCUITS OPERATION. Figure 5-10, illustrating the major signal blocks of the MRC, is an expansion of figure 3-4 used in describing the operation of the frequency lock loop. The method of generation of the various MRC output signals, the error and alarm blocks to establish whether frequency lock has occurred and has not been broken (even momentarily), and the circuit check block for MRC performance evaluation and testing, are illustrated in figure 5-10.

All MRC outputs are derived from oscillator 1A4. The functional requirements of each block comprising the signal portion of the MRC are described in the following paragraphs.

3-3.1 Cesium Beam Resonator Module 1A1. The major component of cesium beam resonator 1A1 is the cesium beam tube, 1A1A1, consisting of a cesium oven, an input selector magnet, an atom-microwave interaction region, an output selector magnet, a hot wire ionizer, and an electron multiplier. A vacuum-ion pump with integral magnet is attached to the tube housing to maintain a relatively high vacuum within the tube. The vacuum-ion pump is powered by +3 kilovolts dc from high voltage power supply 1A2, while the electron multiplier is powered by - (adjustable) kilovolts dc from high voltage power supply 1A3.

Another component of the Cesium beam resonator is the C-field and Cesium oven control, 1A1A3. The C-field portion of 1A1A3 provides a stabilized, adjustable current to generate a magnetic field (the "C" field) in the atom-microwave interaction region of the tube. The Cesium oven control portion of 1A1A3 maintains a constant temperature in the cesium oven.

The cesium oven, is heated to 85°C and a collimated beam of cesium atoms is effused towards the first selector magnet. This magnet will select the desired atoms for deflection into the atom-microwave interaction region. If the microwave input to the cesium beam resonator is at the correct frequency, the atoms in the atom-microwave interaction region will acquire another energy level and these atoms will be deflected by the output selector magnet to a hot wire ionizer. Upon striking the ionizer, Cesium atoms are ionized and are attracted to, and strike, the first dynode plate of an electron multiplier whereupon amplification, similar to that of an electron multiplier vacuum tube, occurs to generate the output signal of the cesium beam tube 1A1A1.

If the microwave input to the Cesium beam resonator 1A1 is frequency modulated at an 83+ Hz rate, then the output signal from the Cesium beam tube is a dc level with an 83+ Hz component provided the microwave signal is close to 9192631771.59 Hz. When the microwave signal is exactly on 9192631771.59 Hz, the output from the cesium beam tube contains an ac component at 166+ Hz. Preamplifier A1A2, also a component of the Cesium beam resonator 1A1, amplifies the 83+ Hz signal output of the Cesium beam tube and applies the resulting signal to the phase detector in synthesizer 1A7. A second output from preamplifier 1A1A2 is a dc signal proportional to the level of 166+ Hz appearing in the output from the Cesium beam tube which is used in synthesizer 1A7 to indicate that frequency lock of the MRC has occurred. The Cesium beam resonator is not field-repairable.

3-3.2 Oscillator Module 1A4. Oscillator 1A4 is an oven controlled, voltage controlled crystal oscillator (OCVCXO) operating at nominally 5 MHz. The oscillator assembly is protected against ambient temperature changes by the use of two ovens, each with its own temperature controller, and protected against ambient mechanical perturbations by suitable shock and vibration cushioning within the housing.

Oscillator 1A4 has two isolated outputs; one output provides a signal for synthesizer 1A7, the second output provides a signal for buffer amplifier 1A8.

The oscillator is a sealed unit and is subject to factory repair only.

3-3.3 Modulator/Multiplier Module 1A5. Modulator/multiplier module 1A5 generates the modulated microwave signal required by Cesium beam resonator module 1A1. This is accomplished by multiplying a 5 MHz signal from oscillator 1A4 obtained via synthesizer 1A7, by 2 x 10 x 2 x 46 = 1840 times. The resulting 9.2 GHz signal is mixed with a local oscillator signal (7.368+ MHz) to obtain the 9.192 GHz signal required by 1A1.

The local oscillator in 1A5 is a voltage controlled crystal oscillator that is phase locked, via a phase detector and digital frequency dividers in 1A7, to a non-integer multiple of 5 MHz.

Frequency modulation of the 83+ Hz microwave signal is accomplished by generating the modulation signal by digital frequency division in 1A7 and applying the 83+ Hz modulation signal to the phase modulator in 1A5. Phase modulation is performed on a 5 MHz carrier.

The modulator/multiplier module 1A5 is primarily comprised of hybrid integrated circuits and, depending upon facilities available, repair by replacement of an hybrid integrated circuit may be possible.

3-3.4 Synthesizer Module 1A7. Synthesizer module 1A7 performs the following functions:

a. Accepts a 5 MHz signal from oscillator module 1A4 and, from which three 5 MHz signals are generated for input to modules modulator/multiplier 1A5, time-of-day clock 1A9, and generator 1A10.

b. Accepts the error signals generated by Cesium beam resonator module 1A1 (83+ Hz, and detected 166+ Hz) which, is used to generate the frequency locking control signal for 1A4 and the frequency lock loop status information (via front panel indicators).

c. Derives the 83+ Hz modulation signal required by modulator/multiplier module 1A5.

d. Provides a phase locking means for the 7.368+ MHz local oscillator by (1) accepting a sample of the local oscillator signal from modulator/ multiplier module 1A5 and (2) generating a control voltage for delivery to 1A5.

e. Provides SYSTEM LOCK OPERATE and SYSTEM LOCK ALARM indications to front panel LEDs.

A 5 MHz signal from oscillator module 1A4 is split two ways in a passive 50 ohm power splitter. One output from the power splitter is the 5 MHz signal delivered to 1A5; the second output from the power splitter is the 5 MHz signal input to synthesizer hybrid circuit 1A7Z1. Two 5 MHz square wave signals are obtained from synthesizer 1A7Z1. One 5 MHz square wave signal is delivered to the time-of-day clock, 1A9; the second square wave signal goes to generator 1A10.

The 83+ Hz error signal from Cesium beam resonator module 1A1 is compared in the phase detector in 1A7 and detected with respect to an 83+ Hz reference signal which is obtained by division of 5 MHz by 60104 in synthesizer 1A7Z1. The output from the phase detector, after filtering (integration), becomes the control voltage output from 1A7 applied to 1A4.

This same 83+ Hz signal, obtained from 1A7Z1 by dividing 5 MHz by 60104 in 1A7Z1, is also applied to the phase modulator in modulator/multiplier module 1A5.

The detected 166+ Hz error signal is a dc signal whose level is proportional to the level of 166+ Hz appearing in the output from the Cesium beam tube. An amplitude comparator in 1A7Z1 monitors the level of this signal (as well as the level of another signal whose derivation is not shown in 1A7) and derives, as an output from 1A7Z1, a SECOND HARMONIC ALARM signal when input amplitudes are not correct. Logic processing of the SECOND HARMONIC ALARM and SYNTHESIZER FAIL signals generates the voltages that ultimately light the OPERATE and ALARM front panel indicators. The SYNTHESIZER FAIL signal indicates when the 7.368+ MHz local oscillator is improperly phase locked.

The 7.368+ MHz local oscillator, in 1A5, is phase locked by a phase detector in 1A7. The reference signal for the phase detector, 3660+ Hz, is obtained by dividing 5 MHz by 1366 in 1A7Z1. The input signal for the phase detector is a sample of the 7.368+ MHz oscillator signal; the output from the phase detector becomes the control voltage for phase locking the local oscillator. The SYNTHESIZER FAIL signal generated in 1A7Z1 is used by the alarm circuits discussed above.

With the exception of synthesizer hybrid circuit 1A7Z1, the synthesizer is field-repairable. Depending upon facilities available, repair by replacement of 1A7Z1 may be possible.

3-3.5 Buffer Amplifier Module 1A8. Buffer amplifier module 1A8 generates the multiple, isolated, 5 MHz outputs required by the MRC. The buffer amplifier consists of five identical output amplifiers that amplify the 5 MHz signal from oscillator 1A4 for application to the front and rear panel connectors.

This module is completely field-repairable.

3-3.6 Real Time-Of-Day Module 1A9. The real time-of-day module 1A9 provides the following outputs from a 5 MHz input signal:

a. Five 1 PPM outputs

b. Two PPS outputs

c. One output of digital time code data

d. A visual hours, minutes and seconds time display with controls for manual setting of time. Module 1A9 also provides for synchronization of all timing signals, as well as the TIME DISPLAY, to an external time signal.

A 5 MHz signal is applied to a times-2 multiplier (figure 5-12) and the resulting 10 MHz output is then applied to a main counter where it is divided to provide outputs of 100 kHz, and 1 PPS. These signals are used as time bases for the preset advance counter, the hours, minutes, seconds counter and the real-time data output.

The 1 PPS signal from the main counter is applied, via the manual clock controls, to hours, minutes, and seconds counters where the pulses are counted. The counter is arranged to provide BCD time signals for driving the TIME DISPLAY 1A9A1 and the real-time data output.

The preset advance counter and manual clock controls are used to set the hours, minutes, and seconds counters for the TIME DISPLAY 1A9A1. These controls include HOURS, MINUTES, SECONDS, CLOCK OPER/TIME HOLD, ADD and SUB switches. The TIME DISPLAY switch is used to illuminate the TIME DISPLAY when the MRC is operated from battery power.

The real-time data output receives BCD time signals from the hours, minutes, seconds counters and 100 kHz from the main counter. The 100 kHz signal is divided to provide a 50 PPS timing signal to synchronize the real-time data output. The BCD time signals are applied to a shift register where they are converted to a serial data stream at the 50 PPS rate.

The TIME DISPLAY 1A9A1 receives BCD time signals from the hours minutes seconds counters. The BCD time signals are applied directly to LED displays to provide the visual readout.

3-3.7 Generator Module 1A10. Generator module 1A10 generates two isolated 1 MHz outputs and two isolated 100 KHz outputs. Excitation for module 1A10 is obtained from synthesizer module 1A7.

This module is completely field-repairable.

3-3.8 Amplifier Meter Drive Assembly 1A16. Amplifier meter drive assembly 1A16 monitors the internal functions of the MRC. The CIRCUIT CHECK meter displays indication of +18 Vdc, and +5 Vdc output voltages from power supply 1A6, input supply voltage applied to power supply 1A6, battery current, the second harmonic frequency signal level, Cesium ion current, vac-ion current, and Cesium oven temperature (all relating to performance of the Cesium beam resonator 1A1), oscillator oven temperature, oscillator control voltage, 5 MHz signal level from buffer amplifier 1A8 and the synthesizer fail signal from synthesizer module 1A7. The function to be displayed is selected by setting the CIRCUIT CHECK pushbutton switch on the front panel. An external meter may be connected to the EXT MTR connector on the front panel.

This module is completely field-repairable.

3-4. POWER DISTRIBUTION OVERVIEW OF OPERATION. The MRC may be operated from either 115/230 Vac, 22-30 Vdc external power, or internal battery power. A switch on the rear panel of the MRC selects either 115 Vac or 230 Vac operation. The external 115/230 Vac as well as the external 22-30 Vdc are fed to the MRC via rear panel connectors. Internal battery power is available to operate the MRC for a maximum of one hour in the event of loss of both external power sources. Status lamps on the front panel indicate primary power usage and availability in the MRC. Power sequencing is such that with all three (external ac, external dc, and internal battery) sources available, the MRC will operate on external ac; loss of external ac will result in the MRC operating on external dc; and finally, loss of both external sources will result in the MRC operating on its internal battery. Full recharging of, or maintaining a trickle charging current in, the internal battery requires use of the external ac supply.

AC power supply components, consisting of power transformer, rectifier, inductor/capacitor filter and emitter follower regulator, are mounted directly on the MRC chassis. The power supply generating the several low voltages required by the MRC is a pulse-width-modulated switching regulator supply operating at approximately 25 KHz. This power supply is a plug-in unit. Higher voltage supplies to support the Cesium beam resonator are of the blocking oscillator type that generate the required high voltage output from a low voltage input.

3-5. POWER DISTRIBUTION DETAILS OF OPERATION. Distribution of power within the MRC will be briefly discussed, followed by a detailed discussion of the functional operation of each block relating to the power supply. The relationship between the "power supply blocks" and the "signal blocks" is shown in figure 5-11. The ac power supply accepts 115/230 Vac and generates 42 Vdc (used by blower 1B1 and battery charger 1A14) and 34 Vdc (used by the Cesium oven of 1A1A1, vac ion high voltage power supply 1A2, and power supply 1A6). If ac power is not used, the external dc will substitute for the 34 Vdc and support the Cesium oven of 1A1A1, vac ion high voltage power supply 1A2 and power supply 1A6. Blower 1B1 and battery charger/logic module 1A14 will not operate if ac is not used. Switch S4, located on the MRC rear panel, disconnects all power sources. Power supply module 1A6 outputs the following dc voltages to the MRC subassemblies referenced below:

| Voltage | Ref Des | Subassembly |
|---|---|---|
| +18 V | 1A1A2 | Preamplifier |
| | 1A1A3 | "C" field and oven controller |
| | 1A3 | Electron multiplier high voltage power supply |
| | 1A4 | Oven controlled, voltage controlled, crystal oscillator (OCVCXO) |
| | 1A5 | Modulator/multiplier |
| | 1A7 | Synthesizer |
| | 1A8 | Buffer amplifier |
| | 1A14 | Battery charger/logic |
| | 1A16 | Amplifier meter drive |
| -18 V | 1A1A2 | Preamplifier |
| | 1A7 | Synthesizer |
| | 1A9 | Real time-of-day clock |
| | 1A16 | Amplifier meter drive |
| +5 V | 1A9 | Real time-of-day clock |
| | 1A14 | Battery charger/logic |
| +7.6 V (isolated) | 1A7 | Synthesizer |
| +7.6 V | 1A10 | Generator, 1 MHz, 1 KHz |
| +13.5 V | 1A9 | Real time-of-day clock PC assembly |
| +4.6 V to +6.2 V (variable) | 1A1A1 | Cesium beam tube |

Vac-ion high voltage power supply 1A2 generates approximately +3 Kv to support the vac-ion pump affixed to the Cesium beam tube. Also, electron multiplier high voltage power supply 1A3 generates an adjustable (approximately -1000 to -2500 v) voltage for use by the electron multiplier in the Cesium beam tube.

Battery power supply 1A17 is supported by battery charger/logic module 1A14; it is through 1A14 that 1A17 is charged and is connected to power the MRC when required.

3-5.1 Vac-Ion High Voltage Power Supply 1A2. Vac-ion high voltage power supply 1A2 is a blocking oscillator type power supply generating approximately +3 Kv for use by the ion pump of the Cesium beam tube. The input voltage for this supply is the +34 V generated by the chassis subassembly from the ac supply or +22 V to 30 V dc, from the external dc supply. The input to this supply is AND gated so that an external dc supply may be used to energize 1A2 without energizing the remainder of the MRC (for long term MRC storage).

This unit is sealed and is not repairable.

3-5.2 Module 1A3 Electron Multiplier High Voltage Power Supply. Electron Multiplier High Voltage Power Supply, 1A3, is also a blocking oscillator type power supply, generating an adjustable negative voltage (approximately -1000 to -2500 V) for use by the electron multiplier in the Cesium beam tube. The input voltage for this supply is +18 V generated by power supply 1A6.

This unit is sealed and is not repairable.

3-5.3 Power Supply Module 1A6. Power supply 1A6 is a pulse-width-modulated switching regulator supply whose input voltages consist of one of the following:

a. +34 V via the Chassis Assembly

b. +22 to +30 V from external supply via chassis subassembly

c. 17 V minimum from battery power supply 1A17

The output voltages from 1A6 are shown in figure 5-11. These voltages are maintained by the switching regulator over the input voltage range of +17 V to +34 V. This module is completely field-repairable.

3-5.4 Battery Power Supply 1A17. Battery power supply 1A17, is an assembly of nickel cadmium cells with a fully charged no load voltage of approximately 22 V. Two protective devices are a part of this assembly; a 20 ampere fuse to protect the battery against short circuits and a thermistor to sense possible overheating during charging. Repairs are limited to the replacement of the thermistor or fuse. The battery is sealed and is not repairable.

3-5.5 Battery Charger/Logic Module 1A14. The functions of battery charger/logic module 1A14 are as follows:

a. Holds the regulator that charges battery power supply 1A17.

b. Accepts connection to temperature sensing thermistor (in 1A17) and controls charging of battery in 1A17.

c. Delivers battery voltage via chassis subassembly to operate the MRC upon loss of both external ac and dc supplies.

d. Disconnects battery voltage from MRC when battery voltage reaches a level too low (approximately 17 V) to operate MRC.

e. Holds logic for power source status indicators and driver for TIME DISPLAY relay.

f. Accepts an external dc source sense signal for power source status indication.

Normally, the regulator maintains a trickle charge current into battery power supply 1A17. If the battery is discharged, the regulator will operate in a current limited mode to supply a larger current for fast recharging. The temperature sensing thermistor in 1A17 monitors battery temperature and reduces charging current if excess heat is detected.

When the MRC is operating from battery power supply 1A17, the battery voltage is monitored in 1A14. When the voltage drops to approximately 17 volts, the relay in 1A14 disconnects the battery. When the MRC is operating from battery power supply 1A17, logic is used to turn off the TIME DISPLAY in 1A9 to conserve battery power.

A logic gate array is used to drive the POWER SOURCE status indicators. Inputs to all logic circuits are dc voltages consisting of the following:

a. AC IN USE monitors +42 V (from ac power supply)

b. DC AVAILABLE monitors external dc supply voltage

c. BAT AVAILABLE monitors battery voltage (from 1A17)

d. DC IN USE monitors both +42 V and battery voltage

e. BAT IN USE monitors both +42 V and battery voltage

This module is completely field-repairable.

3-5.6 <u>Power Supply (Part of Chassis Subassembly)</u>. The functions of the power supply circuitry within the chassis subassembly are as follows:

a. Accepts 115/230 Vac

b. Generates +42 V for operation of blower B1 and charges the battery in 1A17

c. Generates +34 V for use by the following:

(1) Cesium oven of 1A1A1

(2) Vac Ion High Voltage Power Supply 1A2

(3) Power Supply 1A6

d. Accepts a 22 V to 30 V external dc power source and substitutes this for +34 V normally generated by 115/230 Vac.

e. Generates an external dc power source sense voltage for 1A14

f. Accepts voltage from battery power supply 1A17 (via 1A14) to operate the MRC when both 115/230 Vac and external 22 V - 30 V dc sources are not available.

Both +42 V and +34 V are generated by a conventional transformer-rectifier-filter combination applying power to an emitter-follower regulator. The output from the emitter-follower regulator is +34 V; filter output of +42 V is applied to the regulator and is also used to operate blower B1 and charge the battery in 1A17 via battery charger/logic module 1A14.

A diode AND gate connects the +34 V generated by the ac power source, the external dc source, and the battery power supply 1A17, to power supply 1A6, Vac Ion High Voltage Power supply 1A2, and the Cesium oven of 1A1A1. If the 115/230 Vac source is not used, i.e. if +34 V is not used, the AND gate will allow the external dc source to operate the MRC. Similarly, if both 115/230 Vac and external dc source are not used, then battery power supply 1A17 will operate the MRC. The module is completely field-repairable.

3-6. DETAILED CIRCUIT DESCRIPTIONS. The following paragraphs contain detailed circuit level descriptions for each repairable module in the MRC. In this section, the major signal blocks of figure 5-10, that are field-repairable, are discussed.

3-6.1 Preamplifier 1A1A2. Preamplifier 1A1A2, part of Cesium beam resonator 1A1 is mounted on the Cesium beam tube 1A1A1 at the electron multiplier end of the tube. The preamplifier (figure 5-43) consists of a multifunction hybrid circuit which processes the output signal from the Cesium beam tube into two output functions; 83+ Hz error signal and detected 166+ Hz signal, both delivered to 1A7 and two test point functions, both being measures of signal obtained from the tube. One test point is accessible locally at the assembly; another signal is delivered to 1A16 via 1A1P1 pins 4 and 5. Power for hybrid 1A1A2Z1 is provided via connector 1A1P1 and regulators 1A1A2U1 and 1A1A2U2. Potentiometer 1A1A2R1 sets the gain obtained from hybrid circuit 1A1A2Z1.

3-6.2 Modulator/Multiplier 1A5. The 5 MHz and 83+ Hz signals from synthesizer module 1A7 (figure 5-13) are applied via connectors J1 and J2 of 1A5 to modulator/times 20 multiplier 1A5A1. Hybrid 1A5A1Z1 is a hybrid phase modulator and times 2 multiplier. The modulated 10 MHz signal from 1A5A1Z1 is multiplied by 10 in hybrid multiplier 1A5A1Z2 and the resulting modulated 100 MHz signal is applied to crystal filter 1A5A2. After filtering, the modulated 100 MHz signal is multiplied by 2 in hybrid multiplier 1A5A3Z3 and the resulting modulated 200 MHz signal is amplified by 1A5A3Q3. The output of 1A5A3Q3 is then fed to a times-46 multiplier 1A5CR1, a step recovery diode, to generate a modulated 9200 MHz signal.

In addition, diode 1A5CR1 is fed a 7.368+ MHz signal obtained from oscillator hybrid 1A5A4Z4. Mixing occurs in diode 1A5CR1; the resulting modulated 9.192+ GHz signal is filtered by a coupled pair of microwave coaxial cavities (part of 1A5 housing) and is then routed to Cesium beam resonator 1A1 via a coaxial-to-waveguide transition.

The 7.368+ MHz local oscillator signal must be made coherent with the 5 MHz signal. This is accomplished by phase locking the 7.368+ MHz oscillator by a phase detector located in Synthesizer 1A7.

Oscillator 1A5Z4 generates the 7.368+ MHz signal that is routed to Synthesizer 1A7. A control signal is developed by 1A7 and returned to hybrid 1A5Z4 to accomplish phase locking of the oscillator.

Potentiometer 1A5A3R15 adjusts the level of 7.368+ MHz signal injected into diode (mixer) 1A5CR1. Potentiometer 1A5A1R1 optimizes the operation of the phase modulator in hybrid 1A5Z1. Power for the modulator/multiplier is provided via 1A5FL1 and regulator 1A5U1.

3-6.3 Synthesizer 1A7. A 5 MHz signal from 1A4 is applied to connector 1A7P2-A1 (figure 5-15) and is split 2 ways in passive power splitter DC1. One output becomes the 5 MHz signal fed to 1A5 via connector 1A7P2-A2; the other output is the 5 MHz input to hybrid 1A7Z1. Hybrid 1A7Z1 generates two 5 MHz square wave signals from the 5 MHz input. These signals, obtained at 1A7Z1 pins 27 and 28, are the 5 MHz signals fed to 1A10 (100 KHz, 1 MHz generator) and 1A9 (time-of-day clock) respectively.

The 83+ Hz error signal from 1A1 is applied to 1A7P2-A4 and then fed to phase detector 1A7U1 where it is compared in phase to an 83+ Hz reference signal generated in 1A7Z1 (available at 1A7Z1 pins 8 and 9) occurs. The output from 1A7U1, ac with a dc component, is integrated by integrator 1A7U8. The output from 1A7U8, available at 1A7P1-A2, is the control voltage for frequency locking the 5 MHz OCVCXO module 1A4.

Some controls for operation, testing, and adjustment of the MRC frequency lock loop are associated with the circuitry comprising the integrator. The integrator time constant may be changed from LONG to NORM (a factor of 20) by energizing relay 1A7K2. The frequency lock loop may be opened by energizing relay 1A7K1 (thereby effectively shorting integrating capacitor 1A7C40).

A second 83+ Hz signal, generated in 1A7Z1, is available at 1A7Z1-7. This signal, a TTL square wave, is coherent with the 83+ Hz signal available at 1A7Z1 pins 8 and 9 and is attenuated, filtered and adjusted by potentiometer 1A7R5 before being sent, as a modulation signal, to 1A5. The modulation may be controlled for operation, testing, and adjustment of the MRC; placing a logic low on 1A7Z1-6 will remove the 83+ Hz signal available at 1A7Z1-7 and at 1A7Z1 pins 8 and 9 by disabling a flip-flop within 1A7Z1.

A fine adjustment of the phase of the 83+ Hz reference signal at 1A7Z1-7, with respect to the 83+ Hz signal at 1A7Z1 pins 8 and 9, is accomplished at 1A7Z1-19 by potentiometer 1A7R17. A 180° phase adjustment can be made by changing the jumper from E6-E4 to E6-E9.

Alarm circuits, which establish whether the frequency lock loop is closed, or not, or, if closed, whether it has opened, even momentarily, are incorporated as part of 1A7. There are three circuits:

a. The 166+ Hz signal generated by 1A1 when the MRC is correctly frequency locked is applied via connector 1A7P2-3 to 1A7Z1-1 and its amplitude measured in 1A7Z1. Insufficient amplitude of this signal will cause a logic low to appear to 1A7Z1-38.

b. A gross phase comparison is made in the second half of phase detector 1A7U1 (phase of 83+ Hz signal at 1A7U1-4 with respect to reference 83+ Hz signal at 1A7U1 pins 1 and 2) to insure that correct frequency locking of 1A4 has occurred. The gross phase comparison will generate a dc signal at 1A7U1-5 which is sent to amplitude comparators in 1A7Z1. An improper dc signal at 1A7Z1-2 is indicative of incorrect frequency lock and will result in a logic low appearing at 1A7Z1-38.

c. Failure of the 7.368+ MHz local oscillator to achieve correct phase lock will result in a logic low appearing at 1A7Z1-16. The circuits generating this signal are contained in 1A7Z1; it is derived by monitoring the output of phase detector amplifier 1A7U7 (which is sent to 1A7Z1-15).

System faults will then generate logic lows at 1A7Z1 pins 16 and 38 and conversely, correct system operation will generate logic highs at 1A7Z1 pins 16 and 38. These signals are processed by 1A7U5 and 1A7U6 to operate the SYSTEM LOCK, OPERATE, and ALARM indicators on the front panel, and to generate the TIMING FAULT output signal obtained at J23-3. Logic highs at 1A7U5 pins 1 and 2 will result in a logic low to appear at 1A7U6-6, lighting the OPERATE indicator and will cause a logic high to appear at connector J23-3. Conversely, a logic low at 1A7U5-1, or 1A7U5-2, or at both 1A7U5-1 and 1A7U5-2 will cause the following to occur:

a. A logic high to appear at 1A7U6-6, extinguishing the OPERATE indicator

b. A logic low to appear at 1A7U5-8, lighting the ALARM indicator

c. A logic low to appear at connector J23-3.

Resetting flip-flops 1A7U5B and 1A7U5C via the SYSTEM LOCK RESET switch will extinguish the ALARM indicator. Note that a momentary fault, followed by a recovery, will light both ALARM and OPERATE indicators and that the ALARM indicator may be extinguished by depressing the RESET switch.

The 7.368+ MHz local oscillator, in 1A5, is phase locked by a phase detector in 1A7. Reference signal for the phase detector, 3660+ Hz, is derived by dividing 5 MHz by 1366 in 1A7Z1 and is obtained at 1A7Z1-21. Sample-and-hold phase detector 1A7Q2 and 1A7Q3 accepts a 7.368+ MHz signal from 1A5 and adds it to a narrow pulse from 1A7Z1-21 via amplifier 1A7Q1. The resulting dc signal has a magnitude related to the phase of the 7.368+ MHz signal present when the addition to the 3660+ Hz pulse occurred. The output, from 1A7Q3, is amplified by 1A7U7 and is the control signal for phase locking the oscillator in 1A5. Potentiometer 1A7R53 is used to set the dc level at the output of 1A7U7. Failure of the 7.368+ Hz local oscillator to achieve phase lock will result in an audio frequency appearing at 1A7U7-6. This signal, delivered to 1A7Z1-15, is used in 1A7Z1 to generate the synthesizer fail signal appearing at 1A7Z1-16.

Power for synthesizer 1A7 is provided via 1A7P1 and voltage regulators 1A7U2 (+15 V), 1A7U3 (-15 V) and 1A7U4 (+5 V).

3-6.4 Buffer Amplifier 1A8. Buffer amplifier module 1A8 (figure 5-16) consists of five identical output amplifiers that amplify the 5 MHz signal from oscillator module 1A4 for application to the front and rear panel connectors. Input 5 MHz is applied to splitter 1A6U1 where five outputs are developed. One output is amplified by output amplifier transistors 1A8Q1 and 1A8Q2 and applied to output terminal 1A8E2 and connector 1A8P1A2. Similarly, the remaining four outputs are amplified by transistors 1A8Q3 and 1A8Q4 for output amplifier 2, transistors 1A8Q5 and 1A8Q6 for output amplifier 3, transistors 1A8Q7 and 1A8Q8 for output amplifier 4 and transistors 1A8Q9 and 1A8Q10 for output amplifier 5. A sample of the output signal from amplifier 5 is rectified. The resulting dc signal is used by the CIRCUIT CHECK meter for monitoring.

Power for buffer amplifier 1A8 is provided via 1A8P1 and voltage regulator 1A8U2.

3-6.5 Real Time-of-Day Clock Module (RTC) 1A9. (See figures 5-17 and 5-18.)

NOTE

> In the following discussion, reference designations refer to 1A9A2 printed circuit board Part No. D52002-9409 (Figure 5-17) while reference designations in parentheses ( ) refer to 1A9A2 printed circuit board Part No. D52002-9409-1 (Figure 5-18).

A 5 MHz signal is received from synthesizer module 1A7 and applied to times-2 multiplier U1 in the RTC. The resultant 10 MHz output is then applied to a main counter U51, U52, U54-U56, and U63-U65 (U61-U63) where it is divided to provide outputs of 100 kHz, and 1 PPS. These signals are used as time bases for the preset advance counter, the hours, minutes, and seconds counter and the real-time data output.

The 1 PPS signal from the main counter is applied to hours, minutes, and seconds counters U7 (U8), U8 (U9), U19 (U20), U20 (U21), U31 (U34) and U32 (U35) where the pulses are counted. The counter is arranged to provide BCD time signals for driving TIME DISPLAY 1A9A1 and the real-time data output.

The preset advance counter U47 (U46), U48 (U47), U57-U59 (U57-U59), U66-U70 (U64-U68) and manual clock controls are used to set the hours, minutes, and seconds counters for TIME DISPLAY 1A9A1. These controls include HOURS S5, MINUTES S6, SECONDS S7, CLOCK OPER/TIME HOLD S2, ADD S9, and SUB S10 switches. TIME DISPLAY switch S8 is used to illuminate the TIME DISPLAY when the MRC is operated from battery power.

The real-time data output receives BCD time signals from the hours minutes seconds counters and 100 kHz from the main counter. The 100 kHz signal is divided to provide a 50 PPS timing signal to synchronize the real-time data output. The BCD time signals are applied to a shift register consisting of U33 (U36), U21 (U22), and U9 (U10) where they are converted to a serial data stream at the 50 PPS rate.

TIME DISPLAY 1A9A1 receives BCD time signals from the hours, minutes, and seconds counters. The BCD time signals are applied directly to LED displays U1-U6 to provide the TIME DISPLAY.

This module is completely field-repairable.

3-6.6 Generator Module 1A10. Generator module 1A10 (figure 5-19) receives a 5 MHz signal from synthesizer module 1A7. The 5 MHz signal from connector 1A10P1 pins 4 and 5 is multiplied to 10 MHz by diodes 1A10A1 CR9 and CR10 and transformer, T1. The resulting 10 MHz signal is applied to cascaded divide by 10 circuit U1 and divide by 10 circuit U2. The 1 MHz output of divide by 10 circuit U1 is applied to half of output driver U3 from which two 1 MHz outputs are derived. The 100 kHz output of divide by 10 circuit U2 is applied to half of output driver U3 from which two 100 kHz outputs are derived. The outputs of output driver U3 are filtered and routed to the front and rear panel connectors of the MRC via connectors 1A10P1-A1 through 1A10P1-A4.

Power for generator 1A10 is provided via 1A10P1 and voltage regulator 1A10U4.

3-6.7 Amplifier, Meter Drive, 1A16. Pushbutton switch 1A16S1 senses important points within the MRC. The selected signal is applied to meter driver 1A16A1U1 (figure 5-21) and then to front panel meter 1M1 where the status is displayed.

3-7 MAJOR POWER DISTRIBUTION BLOCKS. In this section, the field-repairable major power distribution blocks, keyed to figure 5-11, are discussed.

3-7.1 Power Supply 1A6. An input voltage of 17 to 35 Vdc power is applied from the chassis to connector 1A6P1 (figure 5-14). After filtering by capacitors 1A6C1 and 1A6C7 and inductor 1A6L1, the power is applied to switching controller 1A6U1 which controls the operation of darlington transistors 1A6Q1 and 1A6Q2 connected to the primary winding of power transformer 1A6T1. Transistors 1A6Q1 and 1A6Q2, operating in a push-pull mode, act as switches which effectively produce a square wave of voltage across the primary winding of 1A6T1.

Controller 1A6U1 controls the duty-factor (ratio of voltage "on" time to total cycle time) of the square wave voltage. By controlling the duty-factor, controller 1A6U1 maintains a constant output voltage, from the power supply, despite a variable input voltage.

The variable duty-factor square wave voltage that is generated by 1A6Q1 and 1A6Q2 also appears, by transformer action, at the several secondary windings of 1A6T1. Four separate secondary windings are used to provide the various output supply voltages.

The voltage at secondary winding terminals 1A6T1-4, 1A6T1-5 and 1A6T1-6 is rectified by diodes 1A6CR5 and 1A6CR6 and filtered by inductor 1A6L4 and capacitor 1A6C16 to provide a +18 Vdc output at connector 1A6P1-6 and 1A6P1-18. A portion of the +18 Vdc output is regulated by 1A6U5 to provide a +13.5 Vdc output at connector 1A6P1-2. The voltage at secondary winding terminals 1A6T1-4, 1A6T1-5, and 1A6T1-6 is also rectified by diodes 1A6CR3 and 1A6CR4 and filtered by inductor 1A6L3 and capacitor 1A6C14 to provide a -18 Vdc output at connector 1A6P1-3.

The voltage at secondary winding terminals 1A6T1-7, 1A6T1-8, and 1A6T1-9 is rectified by diodes 1A6CR1 and 1A6CR2 and filtered by inductor 1A6L2 and capacitor 1A6C11 to provide 7.6 Vdc. From +7.6 Vdc, three power supply outputs are generated:

a. +7.6 Vdc available at connector 1A6P1-9.

b. +5 Vdc available at connector terminals 1A6P1 pins 7 and 19 via regulator 1A6U3.

c. An adjustable output of +4.6 to +6.2 Vdc available at connector 1A6P1-13, via regulator 1A6U4 and pass transistor 1A6Q5. This output voltage can be adjusted by means of potentiometer 1A6R42.

The voltage at secondary winding terminals 1A6T1-10, 1A6T1-11 and 1A6T1-12 is rectified by diodes 1A6CR14 and 1A6CR15 and filtered by inductor 1A6L6 and capacitor 1A6C29 to provide an unregulated 1 Vdc output between connector terminals 1A6P1-8 (-) and 1A6P1-10 (+).

The voltage at secondary winding terminals 1A6T1-13, 1A6T1-14 and 1A6T1-15 is rectified by diodes 1A6CR9 and 1A6CR10 and filtered by inductor 1A6L7 and capacitor 1A6C21 to provide an isolated +7.6 Vdc output between connector terminals 1A6P1-11 (-) and 1A6P1-12 (+).

3-7.2 <u>Battery Charger/Logic 1A14</u>. Rectified and filtered +42 Vdc from the chassis subassembly is applied to Battery Charger/Logic Module 1A14 (figure 5-20). This voltage is then branched to resistor 1A14A1R26, zener diode 1A14A1CR13 and resistor 1A14A1 R36 and illuminates the AC IN USE indicator 1DS7 and provides a logic high for 1A14A1U7-2. This same voltage provides power to regulator 1A14U6 to charge battery power supply 1A17.

External dc source voltage is applied to 1A14P1-1 and is sensed by logic 1A14U7-5 after processing by resistor 1A14A1R21, zener diode 1A14CR7, and resistor 1A14R24. When external dc source is present the DC AVAILABLE indicator 1DS4 is lit and 1A14U7-5 receives a logic high.

Battery logic 1A14U8 senses the battery availability status. When the battery is in charged condition, relay 1A14K1 is energized and the battery is connected to a diode AND gate, ready to be used if the ac and dc input power fails. The BAT AVAILABLE indicator is lit via resistors 1A14R26 and 1A14R28 when relay A14K1 is energized.

The gate array 1A14U7 describes power source status via the following front panel indicators:

| | | |
|---|---|---|
| a. | ac present - logic high at 1A14U7-2<br>dc present - logic high at 1A14U7-5<br>battery charged and available | AC IN USE indicator lit<br>DC AVAILABLE indicator lit<br>BAT AVAILABLE indicator lit |
| b. | ac not used - logic low at 1A14U7-2<br>dc used - logic high at 1A14U7-5<br>battery charged and available | DC IN USE indicator lit<br>DC AVAILABLE indicator lit<br>BAT AVAILABLE indicator lit |

c. ac not used - logic high at 1A14U7-2 } AC IN USE indicator lit
dc not used - logic low at 1A14U7-5
battery charged and available } BAT AVAILABLE indicator lit

d. ac not used - logic low at 1A14U7-2 } BAT IN USE indicator lit
dc not used - logic low at 1A14U7-5
battery charged and available } BAT AVAILABLE indicator lit

(Indicators not referenced are not lit.) In addition, when the BAT IN USE indicator is lit, (logic low at 1A14U7-8), transistor 1A14Q4 is turned on, and the time-of-day clock 1A9 display relay is energized and the TIME DISPLAY is turned off.

Thermistor sensing of battery temperature is used to control battery charging rate. Normally the battery is at ambient temperature and normal fast charge and trickle charge rates are maintained by regulator 1A14U6. Any condition which would cause the battery to overheat will be sensed by the thermistor RT1 in Battery Power Supply 1A17 which, in turn, will act to reduce the charging current from 1A14U6.

Normal charging current for 1A17 ranges from about 700 mA for fast charge to about 100 mA for trickle charge. The battery can be in fast charge for a maximum of 16 hours and in trickle charge for an indefinite period.

Power required by Battery Charger/Logic module 1A14 is supplied by 1A6 via connector 1A14P1.

3-7.3 Battery Power Supply 1A17. The nickel cadmium battery is capable of powering the MRC for a maximum of one hour in the event external ac and dc sources are not used. Protection is provided by a thermistor (1A17RT1) which reduces battery charging current under abnormal operating conditions (battery overheating). Fuse 1A17F1 provides overload protection to the battery when it is removed from the MRC.

The battery can be in the high charge state (700 mA) for a maximum of 16 hours and in the trickle charge state (100 mA) for an indefinite period.

3-7.4 Power Supply (Part of Chassis Subassembly). Refer to Figure 5-22. The chassis subassembly circuitry is comprised of a conventional transformer, full wave rectifier, filter group delivering +42 V unregulated to fan 1B1, Battery Charger 1A14, and emitter follower regulator 1U1. The ac input to 1T1, 115/230 V, must be matched by selection of appropriate primary connections by switch 1S3.

The output from 1U1, normally +34 V; the output from the external dc source, nominally +22 to +30 V; and the output from the Battery Power Supply 1A17, nominally +22 V, are routed to Vac Ion High Voltage Power Supply 1A2 and Power

Supply 1A6 via diode AND gates 1U3 and 1U4. Operation of the diode gates is such that selection of a source to power the MRC is automatically accomplished on an amplitude basis under the following conditions:

a. If the ac source is used, the +34 V will operate 1A2 and 1A6.

b. If the ac source is not used, the +22 to +30 V external dc source will operate 1A2 and 1A6.

c. If both the ac and external dc sources are not used then the +22 V from 1A17 will operate 1A2 and 1A6.

A diode AND gate, 1CR1, and 1CR2, is used only to energize the Vac-Ion High Voltage Power Supply 1A2 by an external dc source during long term or high temperature storage of the MRC. An external +22 to +30 V source connected to 1J13-E (return to 1J13-C) will power 1A2 only via 1CR1.

Overload protection of the ac source is provided by fuses 1F1 and 1F2 while overload protection of the external dc source is provided by fuse 1F3. Overload protection of the battery power supply 1A17 is provided by fuse 1F4 (as shown in Figure 5-20). Toggle switch 1S4, as shown in Figures 5-20 and 5-22, simultaneously connects/disconnects all three power sources.

3-8. INTEGRATED CIRCUIT AND HYBRIDS. The following subparagraphs contain information on hybrid and standard integrated circuits used in the MRC. Hybrid integrated circuits are used in preamplifier 1A1A2, Modulator/Multiplier 1A5, and Synthesizer 1A7.

3-8.1 Preamplifier 1A1A2. The preamplifier uses one hybrid circuit 1A1A2Z1 (as shown in Figure 5-43). The preamplifier is an 83+ Hz center frequency bandpass type with circuitry to reject 166+ Hz.

The first preamplifier is broadband and generates signals for the local test point (terminal 1A1A2Z1-38), the remote test point (terminal 1A1A2Z1-5), the 166+ Hz notch filter and the second harmonic detector. The output of the second harmonic detector is routed to terminal 1A1A2Z1-9 for the 166+ Hz detector output. The output of the 166+ Hz notch filter goes to a bandpass amplifier with center frequency at 83+ Hz, which delivers its output to terminal 1A1A2Z1-18.

3-8.2 Modulator/Multiplier 1A5. This assembly uses a total of four hybrid circuits.

3-8.2.1 Hybrid 1A5A1Z1. Hybrid 1A5A1Z1 (Figure 5-23) accepts a 5 MHz carrier and 83+ Hz modulation signals and delivers a frequency modulated 2 x 5 MHz output signal. A 5 MHz carrier signal and an 83+ Hz modulation signal from synthesizer 1A7 are applied to terminals 1A5Z1-32 and 1A5Z1-25 respectively. The 5 MHz signal is routed to isolation amplifiers 1A5Z1-Q1 and 1A5Z1-Q2 and is then phase modulated with the 83+ Hz by 1A5Z1-CR1 thru CR4. The phase modulated 5 MHz signal is amplified by 1A5Z1-Q4 and doubled to 10 MHz by 1A5Z1-CR5 and 1A5Z1-CR6, and delivered to terminal 1A5Z1-15. The output from terminal 1A5Z1-15 is routed to hybrid 1A5Z2.

3-8.2.2 Hybrid 1A5Z2. Hybrid 1A5Z2 (Figure 5-24) performs a 10 x frequency multiplication of the modulated 10 MHz input signal. A 10 MHz input signal is applied to hybrid times-10 multiplier terminal 1A5Z2-2. This signal is amplified by 1A5Z2-Q1 and then frequency multiplied by a factor of 2 in 1A5Z2-Q2. The resulting 20 MHz signal is amplified by 1A5Z2-Q3 and then frequency multiplied by a factor of 5 in multiplier 1A5Z2-Q4. The 100 MHz output signal of times-5 multiplier 1A5Z2-Q4 is applied to crystal filter 1A5A2, via terminal 1A5Z2-18.

3-8.2.3 Hybrid 1A5A3Z3. Hybrid 1A5A3Z3 (Figure 5-25) performs a 2 x frequency multiplication of the modulated 100 MHz input signal. A 100 MHz signal is applied to terminal A5Z3-1 and amplified by A5Z3Q1 and frequency multiplied by a factor of 2 in A5Z3-Q2. The amplified 100 MHz signal is then applied to times-2 multiplier Q2. The resulting 200 MHz signal is applied to power amplifier A5A3Q3 via terminal A5Z3-10.

3-8.2.4 Hybrid 1A5A4Z4. Hybrid 1A5A4Z4 (Figure 5-26) contains the circuitry of the 7.368+ MHz local oscillator and derives two independent and isolated 7.368+ MHz outputs. Oscillator 1A5Z4-Q1 is a voltage controlled crystal oscillator. An external crystal is connected between terminals 1A5Z4-2 and 1A5Z4-4. A control voltage is applied to terminal 1A5Z4-17 where it is filtered by resistors 1A5Z4-R1 thru R3 and capacitor 1A5Z4C1. The control signal at terminal 1A5Z4-1 is routed, via external circuitry, to terminal 1A5Z4-5 where it is applied to varactor diodes 1A5Z4CR1 and 1A5Z4CR2. The varactor diodes are electrically in series with the crystal and changes in diode capacitance will change oscillator frequency. Nominal frequency of the oscillator, established by the external crystal, is 7.368+ MHz.

The output of the oscillator is applied to two separate output amplifiers. One amplifier 1A5Z4Q2 (1A5Z4Q3) amplifies the 7.368+ MHz signal and applies the output to terminal A5Z4-11 while the other amplifier 1A5Z4Q4 (1A5Z4Q5) amplifies the 7.368+ MHz signal and applies the output to terminal 1A5Z4-9.

3-8.3 Synthesizer 1A7. The synthesizer uses one hybrid circuit, designated 1A7A1Z1, which is shown in Figure 5-27. This is a multifunction hybrid that accepts a 5 MHz signal, and from this performs the following:

a. Generates the following signals:

(1) 5 MHz signal for use by 1A9

(2) 5 MHz signal for use by 1A10

(3) 83+ Hz modulation signal for use by 1A5

(4) 83+ Hz reference signal for use by phase detector (of frequency lock loop) in 1A7

b. Accepts the following signals:

(1) Detected 166+ Hz error signal generated by 1A1

(2) Error signal generated when phase lock of the 7.368+ MHz oscillator has not occurred

(3) DC voltage generated by the coarse phase detection accomplished by phase detector 1A7U1 - and from these, singly or in combination,

c. Generates a signal to be used by the circuitry of the front panel frequency lock loop indicators

d. Provides the reference signal required by the phase detector (that phase locks the 7.368+ MHz local oscillator).

A 5 MHz signal is applied via terminal 1A7Z1-37 to isolation amplifiers 1A7Z1Q1 and 1A7Z1Q2. After amplification and shaping by 1A7Z1U4 pins 1 and 2 the 5 MHz signal is applied to counter 1A7Z1U5, U6, and U7 and inverter 1A7Z1U4 pins 3 and 4. The 5 MHz signal from 1A7Z1U4-4 is applied to inverter 1A7Z1U4-5 to generate complementary 5 MHz outputs for the 1A10 and 1A9 modules. The output from binary counters 1A7Z1U5, U6, and U7 generates a signal, via 1A7Z1U8, 1A7Z1U9, and terminal 1A7Z1-21, which is used as a reference signal in the sample and hold phase detector (1A7Q2 and 1A7Q3 as shown in Figure 5-15).

Operation of counters 1A7Z1U5, U6, and U7 (Figure 5-27), is such that the 5 MHz input signal is divided by 1366. In addition to being used as a reference by the phase detector, the 3660+ Hz signal is divided by 2 by 1A7Z1U11 and then divided by 11 by 1A7Z1U12. The output from 1A7Z1U12-15 drives two divide-by-two stages; (1) 1A7Z1U14-5 providing 83+ Hz output at terminal 1A7Z1-7 (modulation signal for 1A5) and (2) 1A7Z1U14 pins 8 and 9 providing 83+ Hz output at terminals 1A7Z1 pins 8 and 9 (reference for phase detector 1A7U1 as shown in Figure 5-15).

Timer A7Z1U10, functioning as a monostable multivibrator, generates a logic low at terminal 1A7Z1-16 when the 7.368+ MHz local oscillator in 1A5 is not phase locked. Under normal operation, 1A7Z1U10 is periodically set by the 3660+ Hz signal used as a reference by the phase detector, and, when set, 1A7Z1U10-5 is at a logic high. An ac signal appearing at terminal 1A7Z1-15, the result of the 7.368+ MHz local oscillator not being phase locked, will reset 1A7Z1U10, causing 1A7Z1U10-5 to go to a logic low.

Comparator 1A7Z1U1 monitors, via terminal 1A7Z1-1, the level of 166+ Hz signal developed by 1A1 while comparators 1A7Z1U2 and 1A7Z1U3 monitor, via terminal 1A7Z1-2, the level of the dc voltage generated by the gross phase detection of phase detector 1A7U1 (figure 5-15). Outputs from all three comparators (figure 5-27) are combined at terminal 1A7Z1-38. Normal operation will result in a logic high appearing at terminal 1A7Z1-38; should either input voltage level fall outside its prescribed level, a logic low will appear at terminal 1A7Z1-38. Both terminals 1A7Z1-16 and 1A7Z1-38 are used by logic in 1A7 to operate the front panel SYSTEM LOCK, OPERATE and SYSTEM LOCK, ALARM indicators.

3-8.4 Standard Integrated Circuits. Table 3-1 provides a commercial nomenclature to figure number cross reference for schematics and truth tables of the standard integrated circuits used in the MRC.

Table 3-1. Standard Integrated Circuits

| Commercial Nomenclature | Function | Figure |
|---|---|---|
| 54LS02 | QUADRUPLE 2-INPUT POSITIVE-NOR GATE | 5-28 |
| 54LS08 | QUADRUPLE 2-INPUT POSITIVE-AND GATE | 5-29 |
| 54LS14 | HEX SCHMITT-TRIGGER INVERTER | 5-30 |
| 54LS20 | DUAL 4-INPUT POSITIVE-NAND GATE | 5-31 |
| 54LS30 | 8-INPUT POSITIVE-NAND GATE | 5-32 |
| 54LS74A | DUAL D-TYPE POSITIVE-EDGE-TRIGGERED FLIP-FLOPS WITH PRESET AND CLEAR | 5-33 |
| 54LS76A | DUAL J-K FLIP-FLOPS WITH PRESET AND CLEAR | 5-34 |
| 54LS165 | PARALLEL-LOAD 8-BIT SHIFT REGISTER WITH COMPLEMENTARY OUTPUTS | 5-35 |
| 54LS175 | QUAD D-TYPE FLIP-FLOPS | 5-36 |
| 54LS190 | SYNCHRONOUS UP/DOWN COUNTER | 5-37 |
| 54196 | PRESETABLE DECADE OR BINARY COUNTER LATCH | 5-38 |
| 54390 | DUAL 4-BIT DECADE AND BINARY COUNTER | 5-39 |
| MC14490 | HEX CONTACT BOUNCE ELIMINATOR | 5-40 |
| 5082-7391 | NUMERIC LED DISPLAY | 5-41 |

# CHAPTER 4

# SCHEDULED MAINTENANCE

4-1. INTRODUCTION. This chapter contains scheduled maintenance procedures to ensure that the Master Regulating Clock 0-1824/U (MRC) is operationally ready. No operator for the MRC is required. All check procedures are performed by a technician as specified. No preventive maintenance is required for this equipment. The scheduled maintenance instructions in this manual are intended to duplicate those furnished in the Planned Maintenance System (PMS). In case of conflicts, the PMS documentation takes precedence. Such conflicts should be reported immediately on the user comment sheets in accordance with the maintenance procedures for this manual.

4-2. SCHEDULED MAINTENANCE INDEX WORKSHEET. The scheduled performance test procedures contained in the Maintenance Requirement Cards for the MRC are listed in the Maintenance Index Worksheet. Preventive maintenance procedures are not required.

4-3. SCHEDULED PERFORMANCE TESTS. A copy of the Maintenance Requirement Cards is included. Follow the procedures indicated for the scheduled time periods. The scheduled performance procedures contained in the MRC Maintenance Requirement Cards are as follows:

a. Observe operational status of 0-1824/U

b. Perform 0-1824/U BITE

c. Perform primary loop alignment

d. Clean air filters

e. Conduct front panel output checks

f. Conduct rear panel output checks

g. Fabricate bench power cable (as required)

h. Fabricate 0-1824/U test cables (as required).

4-4. INACTIVE EQUIPMENT MAINTENANCE. When the MRC is inactivated for prolonged periods, specific lay-up and start-up maintenance procedures are required. These procedures are described in the Maintenance Requirement Cards and listed as follows:

4-4.1 <u>Lay-Up Maintenance</u>

a. Install protective cover

b. Removal and storage.

4-4.2 <u>Start-Up Maintenance</u>

a. Remove protective covering

b. Reinstall O-1824/U.

| SHIP SYSTEM | SUBSYSTEM | MRC CODE | |
|---|---|---|---|
| | | D-1 | |
| SYSTEM | EQUIPMENT | RATES | M/H |
| | 0-1824/U Clock, Master Regulating | RMSN | 0.1 |
| MAINTENANCE REQUIREMENT DESCRIPTION | | TOTAL M/H | |
| 1. Perform 0-1824/U operability test. | | 0.1 | |
| | | ELAPSED TIME | |
| | | 0.1 | |

SAFETY PRECAUTIONS:

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 Series.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT:

None.

PROCEDURE:

1. Perform 0-1824/U operability test.

NOTE: This MRC is applicable to equipment located in unmanned spaces only.

a. Observe ALARM light. Normal indication is off. When lit, ALARM indicates that a system-lock failure occurred since the previous check.

(1) Observe OPERATE light. Normal indication is LIT.

(a) If OPERATE light is lit, press RESET switch and observe that ALARM light goes off.

(b) If OPERATE light is off, loosen knurled screws and open right-hand access panel. Set MOD switch to OPR, LOOP switch to OPR. Press front panel RESET switch.

(2) Verify that ALARM light is off and OPERATE light is lit. If not, refer to troubleshooting procedures in the technical manual.



| LOCATION | DATE |
|---|---|
| | |

MAINTENANCE REQUIREMENT CARD (MRC)
11ND NAVSEACENPAC 4700/1 (9-75)

b. Verify the POWER SOURCE - IN USE indicators indicate the power currently being used.

c. If previously opened, close access panel and tighten knurled screws.

d. Return equipment to readiness condition.

| SHIP SYSTEM | SUBSYSTEM | MRC CODE | |
|---|---|---|---|
| | | M-1 | |
| SYSTEM | EQUIPMENT | RATES | M/H |
| | 0-1824/U<br>Clock, Master<br>Regulating | RMSN | 0.1 |
| MAINTENANCE REQUIREMENT DESCRIPTION<br>1. Perform 0-1824/U BITE operability test. | | TOTAL M/H<br>0.1<br>ELAPSED TIME | |

SAFETY PRECAUTIONS

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 Series.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

None.

PROCEDURE

Preliminary

a. Ensure that equipment has been energized for 20 minutes or more.

1. Perform 0-1824/U BITE operability test.

   a. Open both (left and right) access panels by unscrewing captive knurled screws and lowering panels.

   b. Press top spring-loaded pushbutton to successively set the CIRCUIT CHECK switch to the positions listed in Table 1 while observing CIRCUIT CHECK meter. Meter readings should be as listed. If any meter reading is out of tolerance, refer to troubleshooting procedures in the technical manual.

   c. Close both access doors and tighten captive knurled screws.

   d. Return equipment to readiness condition.

PAGE 1 OF 2

| LOCATION | DATE |
|---|---|
| | |

MAINTENANCE REQUIREMENT CARD (MRC)
11ND NAVSEACENPAC 4700/1 (9-75)

TABLE 1

| CIRCUIT CHECK SWITCH | | CIRCUIT CHECK METER INDICATION |
|---|---|---|
| POS | FUNCTION | RANGE |
| 0 | +18 V | +40 to +80 |
| 1 | Supply Voltage | +40 to +80 |
| 2 | +5 V | +40 to +80 |
| 3 | 2nd Harmonic Level | +40 to +80 |
| 4 | Battery Current (AC IN USE) | 0 to +80 |
| 5 | Cesium Oven Temp. | +40 to +80 |
| 6 | Osc. Oven Temp | +40 to +80 |
| 7 | Vac-ion Current | 0 to -20 |
| 8 | Cesium Ion Current | Set to 0 with DC-Offset adj. |
| 9 | Osc. Control Volts | 0 to ±40 |
| 10 | 5 MHz Signal Level | +40 to +80 |
| 11 | Synthesizer Lock Ind. | +40 to +80 |

PAGE 2 OF 2

MAINTENANCE REQUIREMENT CARD (MRC)
11ND NAVSEACENPAC 4700/2 (9-75)

| SHIP SYSTEM | SUBSYSTEM | MRC CODE |
|---|---|---|
| | | S-1 |

| SYSTEM | EQUIPMENT | RATES | M/H |
|---|---|---|---|
| | 0-1824/U Clock, Master Regulating | ET3<br>ETSN | 1.0<br>1.0 |

| MAINTENANCE REQUIREMENT DESCRIPTION | TOTAL M/H / ELAPSED TIME |
|---|---|
| 1. Perform Cesium beam waveform alignment<br>2. Clean air filters | TOTAL M/H 2.0<br>ELAPSED TIME 1.0 |

SAFETY PRECAUTIONS

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 Series.

2. Voltage dangerous to life exists when equipment is open and energized. Do not work alone.

3. Wear protective equipment and clear immediate area of personnel when using LP air.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

TEST EQUIPMENT

1. (0942) Oscilloscope, 200 MHz, 2 ns (SCAT 4307)

MATERIALS

1. (1346) Tag, shipping, paper, string-tied (12ea)
2. (1144) Tag, safety (2ea)

TOOLS

1. (1194) Screwdriver, flat tip, 4", ¼" tip
2. (1198) Screwdriver, flat tip, 6", general purpose
3. (2987) Screwdriver, cross tip, Phillips No. 1, 3"



| LOCATION | DATE |
|---|---|
| | |

MAINTENANCE REQUIREMENT CARD (MRC)
11ND NAVSEACENPAC 4700/1 (9-75)

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

MISCELLANEOUS

1. (0418) Faceshield, industrial
2. 0-1824/U Bench power cable. Fabricate locally using MRC U-1.
3. (2390) towel wiping
4. (1608) Brush oval 7/8" - 2-1/8"
5. MRC S-3

PRELIMINARY

NOTE: If the 0-1824/U is so installed that extending and rotating the drawer is possible, use Preliminary procedure no. 1. If extending and rotating the drawer is not possible, use Preliminary procedure no. 2.

Preliminary procedure no. 1:

a. Turn off and tag main AC POWER and main DC POWER switches.

b. Loosen captive, knurled screws and slide 0-1824/U drawer out of cabinet to limit of stops.

c. Release rotation latches and tilt drawer for access to the rear panel connectors.

d. Tag and disconnect cables from rear panel connectors J-15 through J-26.

e. Loosen captive screws and remove 0-1824/U top cover.

Preliminary procedure no. 2:

a. Turn off and tag main AC POWER and main DC POWER switches.

b. Loosen captive, knurled screws and slide 0-1824/U drawer out of cabeint to limit of stops.

c. Release rotation latches and tilt drawer for access to the rear panel connectors.

d. Tag and disconnect cables from rear panel connectors J-15 through J-26.

e. Disconnect AC power cable from J14 and DC power cable from J13.

f. Release rotation latches and return the 0-1824/U to horizontal position and lock rotation latches.

PAGE 2 OF 6

MAINTENANCE REQUIREMENT CARD (MRC)
11ND NAVSEACENPAC 4700/2 (9-75)

g. Release drawer slide catches, then remove O-1824/U from equipment cabinet and place on work surface.

h. Connect bench power cable to rear panel connector J14 and to 115 VAC power source.

i. Loosen captive screws and remove O-1824/U top cover.

PROCEDURE

1. Perform Cesium Beam Waveform Alignment.

a. Set rear panel POWER switch to ON. Remove tag and turn on main AC POWER switch.

WARNING: Voltage dangerous to life exists when equipment is open and energized. Do not work alone.

b. Open loosen knurled screws and open right-hand access door on front panel.

c. Set MOD switch to OPR.

d. Set LOOP switch to OPEN.

e. Set oscilloscope controls:

SYNC to INTERNAL

TIME/DIV to 2 MSEC

V/CM to 0.2V

f. Connect probe to test point 1A7TP1. Turn GAIN ADJ 1A1A2R1 fully CCW.

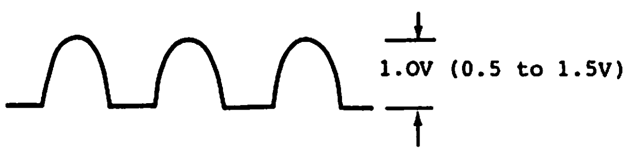
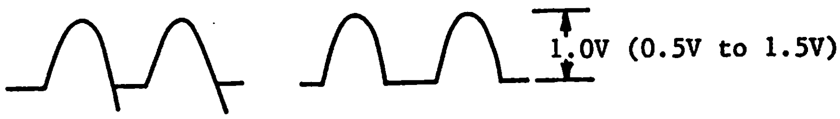



FIGURE 1

g. Adjust front panel OSCILLATOR ADJUST for a maximum positive amplitude as shown in figure 1. If waveform distortion occurs, readjust GAIN ADJ 1A1A2R1.

h. Adjust MODULATION ADJ 1A7R5 for maximum amplitude as displayed on the oscilloscope, then adjust one-half turn clockwise.

i. Adjust PHASE ADJ 1A7R17 for correctly phased waveform. Incorrect and correct waveforms are shown in figure 2.




INCORRECT CORRECT

FIGURE 2

j. Disconnect oscilloscope from 1A7TP1

k. Connect oscilloscope probe to 1A1A2TP1, preamplifier signal output. The observed waveform should be as shown in figure 3. If correct, go to step p. If not correct, set rear panel POWER switch OFF. Disconnect oscilloscope probe and go to next step.

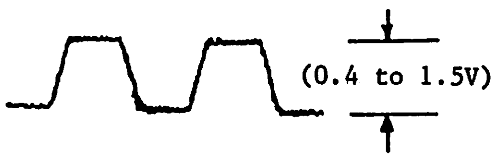



FIGURE 3

l. Rotate 0-1824/U until bottom plate is visible. Loosen 29 captive phillips head screws and remove bottom cover.

m. Set rear panel POWER switch to ON.

n. Connect oscilloscope probe to 1A1A2TP1.

o. Adjust 1A3R1 (electron multiplier adjust) for correct waveform (figure 3). If correct waveform cannot be obtained, refer to troubleshooting procedures in the technical manual. If waveform is correct, disconnect oscilloscope and go to next step p.

p. Connect oscilloscope probe to 1A7TP1. Set oscilloscope to 0.05 volts per division. Adjust front panel OSCILLATOR ADJUST control for minimum amplitude as shown in figure 4.

INCORRECT INCORRECT CORRECT

FIGURE 4

q. Set front panel LOOP OPEN/OPR switch to OPR and press front panel SYSTEM LOCK RESET button. SYSTEM LOCK OPERATE indicator should light, SYSTEM LOCK ALARM indicator should extinguish.

r. Adjust GAIN ADJ 1A1A2R1 for waveform shown in figure 5.

NOTE: Waveform will appear unstable since loop constantly corrects for precise output frequency.

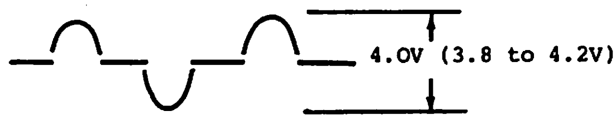



FIGURE 5

s. Disconnect oscilloscope.

t. Turn off and tag main AC POWER switch.

2. Clean Air Filters:

WARNING: Wear protective equipment and clear immediate area of personnel when using LP air.

a. Clean rear panel air filter by applying LP air in a reverse flow direction (from outside to inside).

b. Wipe accessible surfaces of inside of the 0-1824/U with a clean towel.

c. Use brush to remove dust and dirt from areas not easily accessible.

d. Clean top cover air screen by applying LP air to the inside surface of the top cover screen.

e. Replace top cover and tighten captive screws.

f. If previously removed, replace bottom cover and tighten captive screws.

g. Close front access panel and tighten captive, knurled screws.

h. Reinstall 0-1824/U into equipment rack.

NOTE: If preliminary procedure no. 1 was performed, perform step 2.h.(1). If preliminary procedure no. 2 was performed, perform step 2.h.(2).

(1) Reconnect and reposition 0-1824/U to operational position.

(a) Reconnect cables to rear panel connectors J15 through J26, as tagged. Remove tags.

(b) Release rotation latches and rotate the 0-1824/U to the horizontal position.

(c) Release slide catches and slide drawer into cabinet, and tighten captive, knurled screws at the front panel corners.

(d) Remove tags and turn on Main AC POWER and Main DC POWER switches.

(e) Push front panel RESET pushbutton.

(f) Retain equipment to readiness condition.

(2) Reinstall 0-1824/U.

(a) Disconnect bench power cable from bench AC outlet and J14.

(b) Reinsert 0-1824/U into equipment cabinet until drawer slide catches engage.

(c) Reconnect cabinet power cables to J13 and J14, as tagged.

(d) Reconnect cables to J15 through J26 as tagged. Remove tags.

(e) Release rotation latches and return the 0-1824/U to the horizontal position. Release slide catches and slide drawer into cabinet.

(f) Tighten captive knurled screws at the front panel corners.

(g) Remove tags and turn on main AC POWER and DC POWER switches.

(h) Push front panel RESET pushbutton.

(i) Return equipment to readiness condition.

| SHIP SYSTEM | SUBSYSTEM | MRC CODE | |
|---|---|---|---|
| | | S-2 | |
| SYSTEM | EQUIPMENT<br>0-1824/U<br>Clock, Master<br>Regulating | RATES<br>ET3 | M/H<br>0.2 |
| MAINTENANCE REQUIREMENT DESCRIPTION<br>1. Measure front panel output frequencies. | | TOTAL M/H<br>0.2<br>ELAPSED TIME<br>0.2 | |

SAFETY PRECAUTIONS

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 Series

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

TEST EQUIPMENT

1. (0942) Oscilloscope, 200 MHz, 2 ns (SCAT 4307)

MISCELLANEOUS

1. (2687) Connector, TEE, BNC, Type UG-274A/U
2. (2174) Termination, 50Z, feedthru (SCAT 4595)

PROCEDURE

Preliminary

a. Connect a 50 ohm termination to a coaxial cable.

b. Connect 50 ohm termination to oscilloscope CHAN A input.

1. Measure Front Panel Output Frequencies.

   a. Verify 1PPS output (A9J2)

      (1) Set oscilloscope SYNC to INTERNAL

      (2) Connect coaxial cable from oscilloscope to 0-1824/U front panel 1PPS connector.

      (3) Set oscilloscope TIME/DIV to 10 usec/DIV.

PAGE 1 OF 3

| LOCATION | DATE |
|---|---|
| | |

MAINTENANCE REQUIREMENT CARD (MRC)
11ND NAVSEACENPAC 4700/1 (9-75)

(4) Waveform on the oscilloscope should be as shown in figure 1 at one pulse per second.

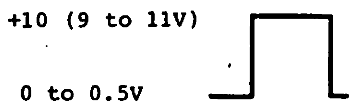



FIGURE 1

b. Verify 1 PPM Output

(1) Disconnect coaxial cable from 0-1824/U 1PPS output connector and connect to 0-1824/U front panel 1PPM connector.

(2) Observe 0-1824/U TIME DISPLAY and oscilloscope simultaneously. 1PPM pulse may appear at any horizontal position, once per minute, on the minute. Observe for three minutes to verify that the pulse, similar to that shown in figure 1, repeats on the second.

(3) Disconnect coaxial cable from 1PPM connector.

c. Verify 5 MHz output

(1) Set oscilloscope TIME/DIV to 0.1 usec/DIV.

(2) Connect coaxial cable from oscilloscope to 5 MHz output connector. The oscilloscope waveform shall appear as shown in figure 2.

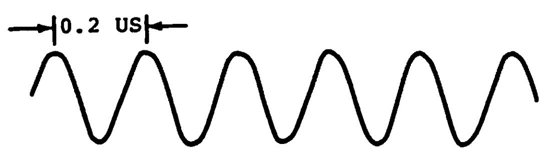



FIGURE 2

(3) Disconnect coaxial cable from 0-1824/U 5 MHz output connector.

d. Verify 1 MHz Output

(1) Set oscilloscope TIME/DIV to 0.5 usec/DIV.

(2) Connect coaxial cable from oscilloscope to 1 MHz output connector.

(3) Waveform on the oscilloscope should be as shown in figure 3.

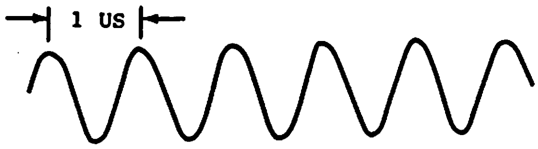



FIGURE 3

(4) Disconnect coaxial cable from 0-1824/U 1 MHz output connector.

e. Verify 100 KHz Output

(1) Set oscilloscope TIME/DIV to 5 usec/DIV.

(2) Connect coaxial cable from oscilloscope to 100 KHz output connector.

(3) Waveform on the oscilloscope should be as shown in figure 4.

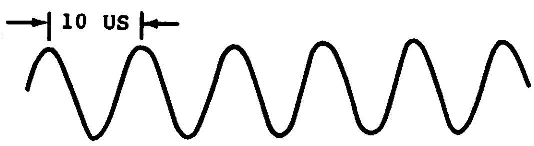



FIGURE 4

(4) Disconnect coaxial cable from 0-1824/U 100 KHz output connector.

f. Return equipment to readiness condition.

| SHIP SYSTEM | SUBSYSTEM | MRC CODE | |
|---|---|---|---|
| | | S-3 | |
| **SYSTEM** | **EQUIPMENT** | **RATES** | **M/H** |
| | 0-1824/U Clock, Master Regulating | ET3 | 0.8 |

MAINTENANCE REQUIREMENT DESCRIPTION

1. Perform rear panel output checks.

TOTAL M/H 0.8

ELAPSED TIME 0.8

SAFETY PRECAUTIONS

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 Series.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

TEST EQUIPMENT

1. (0942) Oscilloscope, 200 MHz, 2 ns (SCAT 4307)
2. (3053) Multimeter digital, Model 8600A-01, FSCM 89536 (SCAT 4212)

MATERIALS

1. (1346) Tag, shipping, paper, string-tied (12 ea.)
2. (1144) Tag, safety (2 ea.)

TOOLS

1. (1198) Screwdriver, flat tip, 6", general purpose

MISCELLANEOUS

1. 0-1824/U Bench power cable (see note 1)
2. 0-1824/U 1PPM test cable (see note 1)
3. 0-1824/U 5 MHz test cable (see note 1)
4. 0-1824/U Timing fault test cable (see note 1)
5. (2174) Termination, 50Z, feedthru (SCAT 4595)
6. MRC S-1
7. MRC U-1



| LOCATION | DATE |
|---|---|
| | |

MAINTENANCE REQUIREMENT CARD (MRC)
11ND NAVSEACENPAC 4700/1 (9-75)

PROCEDURE

NOTE 1: If your unit does not possess the bench power cable or the three test cables, fabricate them per MRC-U-1.

NOTE 2: If the O-1824/U is so installed that extending and rotating the drawer is possible, use Preliminary procedure no. 1. If extending and rotating the drawer is not possible, use Preliminary procedure no. 2.

Preliminary procedure no. 1:

a. Turn off and tag main AC POWER and main DC POWER switches.

b. Loosen captive, knurled screws and slide O-1824/U drawer out of cabinet to limit of stops.

c. Release rotation latches and tilt drawer for access to the rear panel connectors.

d. Tag and disconnect cables from rear panel connectors J15 through J26.

e. Remove tags and turn on main AC POWER and main DC POWER switches.

Preliminary procedure no. 2.:

a. Turn off and tag main AC POWER and main DC POWER switches.

b. Loosen captive, knurled screws and slide O-1824/U drawer out of cabinet to limit of stops.

c. Release rotation latches and tilt drawer for access to the rear panel connectors.

d. Tag and disconnect cables from rear panel connectors J15 through J26.

e. Disconnect AC power cable from J14 and DC power cable from J13.

f. Release rotation latches and tilt the O-1824/U to horizontal position and lock rotation latches.

g. Release drawer slide catches, then remove O-1824/U from equipment cabinets and place on work surface.

h. Connect bench power cable to rear panel connector J14 and to 115VAC power source.

1. Conduct Rear Panel Output Checks.

   a. Check 1PPM Outputs.

      (1) Connect 1PPM test cable (2-pin connector) to J15.

      (2) Connect 50-ohm termination to 1PPM test cable.

      (3) Connect 50-ohm termination to oscilloscope CHAN A input.

      (4) Set oscilloscope SYNC to INTERNAL.

      (5) Set oscilloscope TIME/DIV to 10 uSEC.

      (6) Observe 0-1824/U TIME DISPLAY and the oscilloscope, simultaneously. The 1PPM pulse should appear once per minute, on the minute. Observe for three minutes.

      (7) Disconnect 2-pin connector from J15.

      (8) Repeat procedure for J16, J17, and J18.

      (9) Disconnect 2-pin connector from J18 and proceed to substep 1.b.

   b. Check Time Code Output.

      (1) Connect 2-pin connector of 1PPM test cable to J22.

      (2) Connect BNC to BNC cable between oscilloscope EXT TRIG SYNC input and 0-1824/U front panel 1PPS output.

      (3) Set oscilloscope SYNC to EXTERNAL.

      (4) Set oscilloscope TIME/DIV to 50 MSEC.

      (5) Observe groups of one or more pulses with a peak-to-peak amplitude of 12 volts, occurring at 0.5 second intervals.

      (6) Disconnect test cable from J22 and from Oscilloscope.

      (7) Disconnect BNC to BNC coaxial cable from oscilloscope EXT TRIG SYNC and 0-1824/U 1PPS.

   c. Check 5 MHz outputs.

      (1) Connect 5 MHz test cable (3-pin connector) between 50 ohm termination on oscilloscope and rear panel J19.

      (2) Set oscilloscope TIME/DIV to .1uSEC.

PAGE 3 OF 5

(3) Observe that waveform is as shown in figure 1.

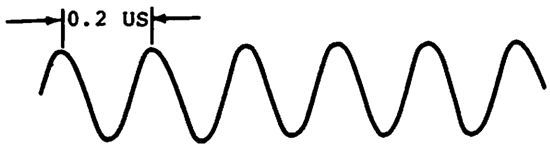



FIGURE 1

(4) Disconnect 3-pin connector from J19.

(5) Repeat steps (3) and (4) for J20 and J21.

(6) Disconnect 5 MHz test cable from J21 and from oscilloscope.

d. Check J23 outputs.

(1) Connect timing fault test cable (5-pin connector) to J23.

(2) Connect coaxial lead of test cable to 50 ohm termination on oscilloscope.

(3) Ensure that oscilloscope TIME/DIV is still set to .1 uSEC.

(4) Observe that waveform is as shown in figure 1.

(5) Disconnect test cable coaxial lead from oscilloscope.

(6) Set DVM to measure ±10VDC.

(7) Connect DVM positive lead to test cable red lead.

(8) Connect DVM common lead to test cable black lead.

(9) DVM should indicate +2.4VDC to +5.2VDC.

(10) Disconnect test cable from DVM and from J23.

e. Reinstall 0-1824/U into equipment rack.

NOTE: If preliminary procedure no. 1 was performed, perform step 1.f.(1). If alternate preliminary procedure was performed, perform step 1.f.(2).

(1) Reconnect and reposition 0-1824/U to operational position.

(a) Turn off and tag main AC POWER and main DC POWER switches.

(b) Reconnect equipment cabinet cables to rear panel connectors J15 through J26. Remove tags.

(c) Release rotation latches and tilt 0-1824/U to horizontal position.

(d) Release slide catches and slide 0-1824/U drawer into cabinet; tighten captive, knurled screws at the front panel corners.

(e) Remove tags and turn on main AC POWER and main DC POWER switches.

(f) Return equipment to readiness condition.

(2) Reinstall 0-1824/U.

(a) Set bench AC POWER OFF.

(b) Disconnect bench power cable from bench AC outlet and from 0-1824/U connector J14.

(c) Reinsert 0-1824/U into equipment cabinet until drawer slide catches engage.

(d) Reconnect AC power cable to J14 and DC power cable to J13.

(e) Reconnect cables to J15 through J26. Remove tags.

(f) Release rotation latches and return 0-1824/U to horizontal position.

(g) Release slide catches and slide 0-1824/U into cabinet.

(h) Tighten captive, knurled screws at front panel corners.

(i) Remove tags and turn on main AC POWER and main DC POWER switches.

(j) Return equipment to readiness condition.

| SHIP SYSTEM | SUBSYSTEM | MRC CODE |
|---|---|---|
| | | U-1 |

| SYSTEM | EQUIPMENT | RATES | M/H |
|---|---|---|---|
| | 0-1824/U Clock, Master Regulating | | |
| | | TOTAL M/H | |
| | | ELAPSED TIME | |

MAINTENANCE REQUIREMENT DESCRIPTION

1. Fabricate bench power cable
2. Fabricate 0-1824/U test cables

SAFETY PRECAUTIONS

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 Series.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

MATERIALS

1. Cable, power, 3-wire, MIL-C-3432 type CO-03 MGF (3/14) 0500 (5 ft.).
2. Wire, electric, PVC-insulated, copper, Part No. M5086/1-22-0 (5 ft.).
3. Wire, electric, PVC-insulated, copper, Part No. M5086/1-22-2 (5 ft.).
4. (1435) wire, electrical, bare copper, tin-plated, 22AWG (12").
5. Cable, R.F., flexible, coax, Part No. M17/028-RG058 (15 ft.).
6. Connector plug, coaxial, R.F., BNC, Part No. M39012/16-0101 (3).
7. (0287) clip, electrical, alligator style (2).
8. Connector, plug, electrical, general purpose, 2-pole, 3-wire, Part No. WC596/13-3.
9. Connector, plug, electrical, Part No. M53106F10SL-3S.
10. Connector, plug, electrical, Part No. MS3106F10SL-4S.
11. Connector, plug, electrical, Part No. MS3126F14-12S.
12. (1307) solder, tin alloy, SN60, 0.063".
13. Tubing, insulating, MIL-T-48807, Size 22 (12").
14. Connector, plug, electrical, Part No. MS81511/26EB02P1.



| LOCATION | DATE |
|---|---|
| | |

MAINTENANCE REQUIREMENT CARD (MRC)
11ND NAVSEACENPAC 4700/1 (9-75)

TOOLS

1. (1198) screwdriver, flat tip, 6", general purpose.
2. (1309) soldering iron, pencil type, w/plug-in tips, 40W.
3. (1332) stripper, wire, hand, pivot handles, No. 8-22 wire.
4. (0721) knife, pocket, electricians.

PROCEDURE

1. Fabricate Bench Power Cable.

   a. Prepare one end of the three-wire power cable as shown in figure 1. Tin the wire ends.

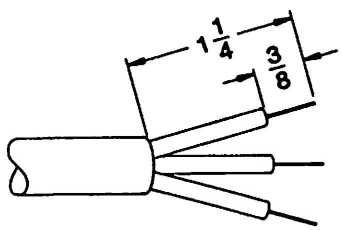



FIGURE 1

   b. Prepare the remaining end as shown in figure 2. Tin the wire ends.

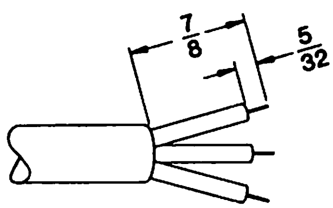



FIGURE 2

   c. Solder short (7/8") wire ends of power cable to MS126F14-12S connector as shown in figure 3.

   d. Connect remaining ends of power cable to 3-wire electrical connector WC596/13-3 as shown in figure 3.

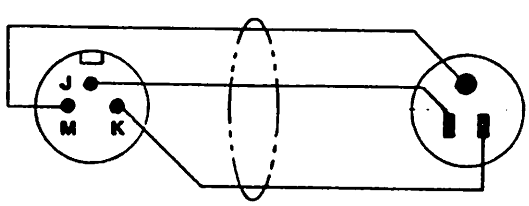



FIGURE 3

2. Fabricate 0-1824/U Test Cables.

   a. Cut coaxial cable RG058 into three equal (5') pieces.

   b. Prepare both cable ends of all pieces as shown in figure 4.

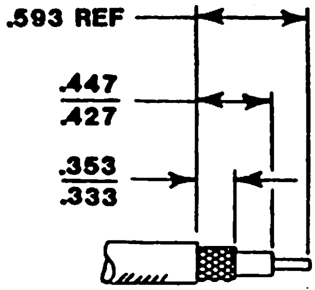



FIGURE 4

   c. Further prepare one of each cable piece as shown in figure 5.

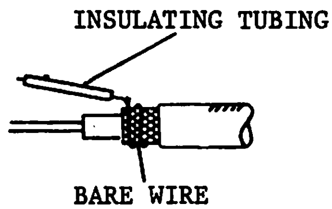



FIGURE 5

   d. Install a BNC plug connector on each piece of cable at the end shown in figure 4.

   e. Wire the remaining end of one piece of cable to the MS3106F10SL-4S (2-pin) connector as shown in figure 6.

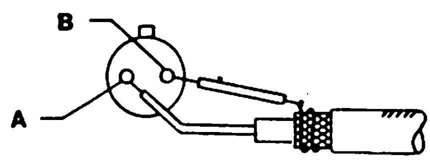



FIGURE 6

   f. Wire the remaining end of one piece of cable to the MS3106F10SL-3S (3-pin) connector as shown in figure 7.

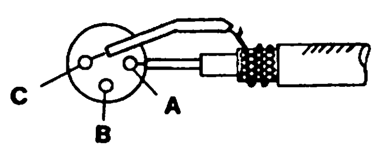



FIGURE 7

g. Strip each of both (red and black) pieces of 22AWG insulated wire 1/4". Tin each end.

h. Install an alligator clip on one end of each piece of wire.

i. Solder the red and black wires to the MS81511/2 6EB02P1 (5-pin) connector as shown in figure 8.

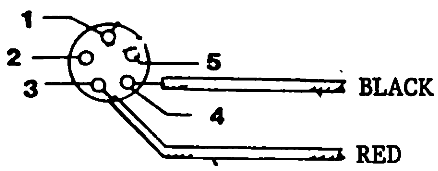



FIGURE 8

j. Wire the remaining coaxial cable to the MS81511/26EB02P1 connector as shown in figure 9.

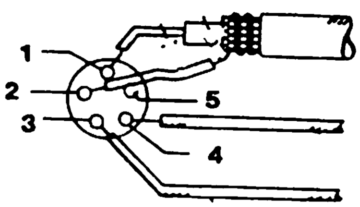



FIGURE 9

k. After checking all connections on all cable assemblies, complete assembly of connectors.

| SHIP SYSTEM | SUBSYSTEM | MRC CODE | |
|---|---|---|---|
| | | LU-1 | |
| SYSTEM | EQUIPMENT | RATES | M/H |
| | 0-1824/U Clock, Master Regulating | RMSN | 0.3 |
| MAINTENANCE REQUIREMENT DESCRIPTION | | TOTAL M/H 0.3 | ELAPSED TIME 0.3 |
| 1. Install protective covering. | | | |

SAFETY PRECAUTIONS

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 series.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

MATERIALS

1. (1144) Tag, safety
2. (0973) Paper, wrapping chemically neutral fire-resistant MIL-P-43773, Grade B
3. (1356) Tape, pressure-sensitive adhesive, masking, paper

TOOLS

1. (0721) Knife

PROCEDURE



NOTE: Accomplish if industrial work is to be performed in vicinity of equipment.

Preliminary

a. Turn off equipment power switch.

b. Turn off and tag main AC POWER and main DC POWER switches.

1. Install Protective Covering

a. Cover unit with fire-resistant wrapping paper. Ensure all seams and openings are sealed with tape.

| LOCATION | DATE |
|---|---|
| | |

| SHIP SYSTEM | SUBSYSTEM | MRC CODE | |
|---|---|---|---|
| | | LU-2 | |
| SYSTEM | EQUIPMENT | RATES | M/H |
| | 0-1824/U Clock, Master Regulating | RMSN | 0.3 |
| MAINTENANCE REQUIREMENT DESCRIPTION | | TOTAL M/H | |
| 1. Remove 0-1824/U and store connected to AC power source. | | 0.3 | |
| | | ELAPSED TIME | |
| | | 0.3 | |

SAFETY PRECAUTIONS

1. Forces afloat comply with Navy Safety Procedures for Forces Afloat, OPNAVINST 5100 Series.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

MATERIALS

1. (1346) Tag, shipping, paper, string-tied (12)
2. (1144) Tag, safety (2)

TOOLS

1. (1198) Screwdriver, flat-tip, 6"

MISCELLANEOUS

1. MRC U-1
2. 0-1824/U Bench power cable. Fabricate locally using MRC U-1

PAGE 1 OF 2

PROCEDURE

NOTE: Accomplish if power is to be unavailable to equipment for periods in excess of 30 days.

1. Remove 0-1824/U and Store Connected to AC Power Source.
   a. Turn off and tag main AC POWER and main DC POWER switches.
   b. Loosen captive, knurled screws and slide 0-1824/U drawer out of cabinet to limit of stops.
   c. Release the rotation latches and rotate drawer for access to the rear panel connectors.
   d. Tag and disconnect cables from rear panel connectors J15 through J26.

| LOCATION | DATE |
|---|---|
| | |

MAINTENANCE REQUIREMENT CARD (MRC)
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e. Disconnect AC power cable from J14 and DC power cable from J13.

f. Release rotating latches and rotate 0-1824/U to horizontal position and lock rotation latches.

g. Release drawer slide catches, and remove 0-1824/U from equipment cabinet. Transport to storage facility.

h. Connect 0-1824/U bench power cable to rear panel connector J14 and to 115VAC power source.

| SHIP SYSTEM | SUBSYSTEM | MRC CODE | |
|---|---|---|---|
| | | SU-1 | |
| **SYSTEM** | **EQUIPMENT** | **RATES** | **M/H** |
| | 0-1824/U Clock, Master Regulating | RMSN | 0.3 |
| **MAINTENANCE REQUIREMENT DESCRIPTION** | | **TOTAL M/H** | |
| 1. Remove protective covering. | | 0.3 | |
| | | **ELAPSED TIME** | |
| | | 0.3 | |

SAFETY PRECAUTIONS

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 Series.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

MATERIALS

1. Towel, wiping (2390)

TOOLS

1. Knife (0721)

PROCEDURE

PAGE 1 OF 1

NOTE: Omit requirement if equipment was not covered during lay-up.

1. Remove Protective Covering
   a. Remove wrapping paper and tape from unit.
   b. Clean dirt and wrapping residue from exterior of equipment using towels.
   c. Remove tags and turn on main AC POWER and main DC POWER switches.

| LOCATION | DATE |
|---|---|
| | |

MAINTENANCE REQUIREMENT CARD (MRC)
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| SHIP SYSTEM | SUBSYSTEM | MRC CODE | |
|---|---|---|---|
| | | SU-2 | |
| SYSTEM | EQUIPMENT | RATES | M/H |
| | 0-1824/U Clock, Master Regulating | RMSN | 0.3 |
| MAINTENANCE REQUIREMENT DESCRIPTION | | TOTAL M/H | |
| 1. Reinstall 0-1824/U. | | 0.3 | |
| | | ELAPSED TIME | |
| | | 0.3 | |

SAFETY PRECAUTIONS

1. Forces afloat comply with Navy Safety Precautions for Forces Afloat, OPNAVINST 5100 Series.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

TOOLS

1. (1198) Screwdriver, flat-tip, 6"

PROCEDURE

NOTE: Omit requirement if equipment was not covered during lay-up.

1. Reinstall 0-1824/U.
   a. Disconnect 0-1824/U bench power cable from AC outlet and from 0-1824/U connector J14.
   b. Reinsert 0-1824/U into equipment cabinet until drawer slide catches engage.
   c. Reconnect AC power cable to J14 and DC power cable to J13.
   d. Reconnect equipment cabinet cables to J15 through J26. Remove tags.
   e. Release rotation latches and return 0-1824/U to horizontal position.
   f. Release slide catches and slide 0-1824/U into cabinet.
   g. Tighten captive, knurled screws at front panel corners.
   h. Remove tags and turn on main AC POWER and main DC POWER switches.
   i. Return equipment to readiness condition.



| LOCATION | DATE |
|---|---|
| | |

MAINTENANCE REQUIREMENT CARD (MRC)
11ND NAVSEACENPAC 4700/1 (9-75)

# CHAPTER 5

# TROUBLESHOOTING

5-1. INTRODUCTION. This chapter contains troubleshooting procedures for both the organizational and intermediate/depot level activities. Organizational level troubleshooting will isolate faults to a replaceable module. Intermediate/depot level troubleshooting will isolate to a piece-part within a repairable module/assembly and/or a discrete chassis or panel mounted component. Reference should be made to the figures in Chapter 6 for the location of all modules and components. The block diagrams and schematic diagrams, figures 5-9 through 5-42, should be used as aids during testing and troubleshooting.

5-1.1 Troubleshooting Index. Table 5-1 contains an index keyed to each functional area of the Master Regulating Clock (MRC). The index references the applicable troubleshooting paragraph, table, and figure number; and the corresponding functional description. The alignment and adjustment procedures for each functional area are addressed under paragraph 6-2.

Table 5-1. Troubleshooting Index

| Functional area | Troubleshooting paragraph/ table/figure | Functional description | Alignment/ adjustment paragraph |
|---|---|---|---|
| 1 | 5-2/5-6, 5-6/N/A | 3-2 | 6-2 |
| 1A5 | 5-3.9/5-8/5-13 | 3-4.1 | |
| 1A6 | 5-3.10/5-9/5-14 | 3-4.2 | |
| 1A7 | 5-3.11/5-10/5-15 | 3-4.3 | |
| 1A8 | 5-3.12/5-12/5-16 | 3-4.4 | |
| 1A9 | 5-3.13/5-13, 5-16/5-17, 5-18 | 3-4.5 | |
| 1A10 | 5-3.14/5-18/5-19 | 3-4.6 | |
| 1A14 | 5-3.15/5-19/5-20 | 3-4.7 | |
| 1A16 | 5-3.16/5-20/5-21 | 3-4.8 | |

5-1.2 Relay and Indicator Lamp Indexes. Relays and indicator lamps used in the MRC are listed in tables 5-2 and 5-3 respectively.

5-1.3 Protective Device Index. Protective devices used in the MRC are listed in table 5-4.

5-1.4 Maintenance Turn-On Procedure. To turn on the MRC for maintenance testing refer to table 5-5. If external power sources are not indicated on POWER SOURCE IN USE indicators (27 or 28, figure 2-1) check input power source.

Table 5-2. Relay Index

| Reference designation | Schematic diagram | Functional name | Energizing voltage |
|---|---|---|---|
| 1A7A1K1 | 5-15 | Loop | 15 VDC |
| 1A7A1K2 | 5-15 | Time constant | 15 VDC |
| 1A9K1 | 5-17, 5-18 | Time display | 18 VDC |
| 1A14K1 | 5-20 | Battery relay | 18 VDC |

Table 5-3. Indicator Lamp Index

| Reference designation | Schematic diagram | Functional name | Energizing voltage |
|---|---|---|---|
| 1DS1 | 5-22 | SYSTEM LOCK ALARM | 5 VDC |
| 1DS2 | 5-20 | BAT IN USE | 5 VDC |
| 1DS3 | 5-22 | SYSTEM LOCK OPERATE | 5 VDC |
| 1DS4 | 5-20 | DC AVAILABLE | 5 VDC |
| 1DS5 | 5-20 | BAT AVAILABLE | 5 VDC |
| 1DS6 | 5-20 | DC IN USE | 5 VDC |
| 1DS7 | 5-20 | AC IN USE | 5 VDC |
| 1A9CR2 | 5-17, 5-18 | SYNC ARM | 5 VDC |
| 1A9CR1 | 5-17, 5-18 | UT SET | 5 VDC |

Table 5-4. Circuit Breaker and Fuse Index

| Reference designation | Rear panel marking | Rating | | Schematic diagram | Supply protected |
|---|---|---|---|---|---|
| | | Volts | Amps | | |
| 1F1 | 115/230 VAC | 250V | 2A | 5-22 | 115/230 VAC |
| 1F2 | 115/230 VAC | 250V | 2A | 5-22 | 115/230 VAC |
| 1F3 | EXT DC | 250V | 4A | 5-22 | EXTEND DC |
| 1F4 | INT BAT | 250V | 4A | 5-20 | INTERNAL BATTERY |
| 1F5 | SPARE FUSES | 250V | 2A | N/A | - |
| 1F6 | SPARE FUSES | 250V | 4A | N/A | - |
| 1A17F1 | - | 32V | 20A | 5-20 | BATTERY POWER SUPPLY |

Table 5-5. Maintenance Turn-On Procedure

| Step | Observe | Reference |
|---|---|---|
| 1. Ensure rear panel POWER switch (8, figure 2-2) is in OFF position. | - | - |
| 2. Connect 115 VAC or 230 VAC to connector J14 and/or +22 to 30 Vdc to connector J13. | - | - |
| 3. Ensure that the front panel LOOP OPEN/OPR switch (13, figure 2-1) is set to OPR position. | - | - |
| 4. Ensure that the front panel MOD OFF/OPR switch (14) is set to OPR position. | - | - |
| 5. Ensure that the TIME CONSTANT LONG/NORM switch (32) is set to NORM position. | - | - |
| 6. Place rear panel POWER switch (8, figure 2-2) to ON position. | - | - |
| 7. Press front panel RESET pushbutton (17, figure 2-1) to reset ALARM indicator after 20 minutes warm-up time. | - | - |

5-2. ORGANIZATIONAL LEVEL TROUBLESHOOTING. The organizational level troubleshooting for the MRC is based upon the symptoms observed during a BITE performance test using the front panel CIRCUIT CHECK switch and associated meter. It is also based upon symptoms observed during the course of normal operation or during the performance of output checks as indicated in the Maintenance Requirement Cards included in Chapter 4. If a fault is observed during the performance checks, refer to figure 5-1, Fault Logic Diagram, and perform the specified troubleshooting checks for the fault. If a bad indication or no indication appears during the front panel BITE checks, refer to table 5-6. If a bad indication or no indication appears during the output checks or during normal operation, refer to table 5-6 or paragraphs 5-2.2, 5-2.3, or 5-2.4.

NOTE

If all readings are out-of-tolerance or meter does not move, replace 1A16. If meter is still inoperative, refer problem to intermediate/depot level personnel.

5-2.1 Interconnecting Cables. Cables used for organizational and intermediate/depot level maintenance are not supplied with the MRC. They must be locally fabricated. A list of the components and cables required is given in table 1-3. Refer to the Maintenance Requirement Card U-1 in Chapter 4, which provides instructions for fabrication of all cables except the extender cables required for module testing and fault isolation. Refer to figures 5-2 through 5-6 for fabrication instructions for the module extender cables.

Table 5-6. Organizational Troubleshooting

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. | | MRC inoperative on AC power (no output, TIME DISPLAY not lit) | | | |
| | a. Observe AC IN lamp | Lamp lit | Replace 1A6 | Set MRC POWER switch and main POWER OFF. Go to step 1.b | |
| | b. Remove and check fuses F1 and F2 | Fuse blown | Replace blown fuse, set POWER ON. Go to step 1.c | Ship MRC to intermediate/depot facility for further shooting | |
| | c. Observe AC IN USE ALARM and OPERATE lamps | AC IN USE lit, OPERATE lit (see remarks), and ALARM OFF | Perform monthly check, MRC-M-1 | Set POWER OFF, check fuses F1, F2. If blown again, ship MRC to intermediate/depot facility for further troubleshooting | If ALARM is lit and OPERATE is off, push RESET |
| 2. | | MRC inoperative on DC power (no output, TIME DISPLAY not lit) | | | |
| | a. Observe DC IN USE lamp | Lamp lit | Replace 1A6 | Set MRC and main POWER OFF. Go to step 2.b | |

Table 5-6. Organizational Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 2. (cont) | b. Remove and check fuse F3 | Fuse blown | Replace blown fuse, set POWER ON. Go to step 2.c | Ship MRC to intermediate/ depot facility for further troubleshooting | |
| | c. Observe DC IN USE, ALARM, and OPERATE lamps | DC IN USE lit, OPERATE lit | Perform monthly check, MRC-M-1 | Set POWER OFF, check fuse F3. If blown again, ship MRC to intermediate/ depot facility for further troubleshooting | If ALARM lamp is lit, press RESET |
| 3. | | MRC inoperative on BAT power. (No output, TIME, DISPLAY does not light when TIME DISPLAY is pressed) | | | MRC must have been warmed up using AC or DC power source before performing step 3. Battery must have been previously charged for 16 Hrs, minimum |
| | a. Set POWER OFF. Remove and check fuse F4 | Fuse blown | Replace fuse F4, set POWER switch ON. Go to step 3.b | Replace battery pack 1A17 with a fully charged battery pack. Set POWER switch ON. Go to Step 3.c | |

Table 5-6. Organizational Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | b. Observe AVAILABLE-BAT and IN USE-BAT lamps | Both lamps lit | Perform monthly check, MRC-M-1 | Set POWER switch OFF, check fuse F4. If blown again, ship MRC to intermediate/depot facility for further troubleshooting | |
| | c. Observe AVAILABLE-BAT and IN USE-BAT lamps | Both lamps lit | Perform monthly check, MRC-M-1 | Set POWER switch OFF, replace 1A14. Set POWER switch ON, repeat observation. If MRC is still inoperative, ship MRC to intermediate/depot facility for further troubleshooting | |
| 4. | | ALARM lamp lit, OPERATE lamp off | | | |
| | a. Push front panel RESET pushbutton | ALARM lamp off, OPERATE lamp lit | MRC is operational | Go to step 4.b | |

Table 5-6. Organizational Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 4. (cont) | b. Open right-hand panel, verify that LOOP switch is set to OPR | LOOP switch is set to OPR | Go to step 4.c | Set LOOP switch to OPR, push RESET. If ALARM lamp goes out and OPERATE lights, MRC is operational. If not, go to step 4.c | |
| | c. Verify that MOD switch is set to OPR | MOD switch is set to OPR | Go to step 5 | Set MOD switch to OPR, push RESET. If ALARM lamp goes out, and OPERATE lights, MRC is operational. If not, go to step 5 | |
| 5. | The following refer to CIRCUIT CHECK switch position failure indications | | | | |
| | a. Position '0' | +40 to +80 | Go to step 5.b | Go to step 6 | +18 Vdc |
| | b. Position '1' | +40 to +80 | Go to step 5.c | Go to step 7 | System DC |
| | c. Position '2' | +40 to +80 | Go to step 5.d | Go to step 6 | +5 Vdc |
| | d. Position '3' | +40 to +80 | Go to step 5.e | Ship MRC to intermediate/depot facility for further troubleshooting | Second Harmonic Level |
| | e. Position '4' | 0 to +80 | Go to step 5.f | Go to step 8 | Battery Charge Status |

Table 5-6. Organizational Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 5. (cont) | f. Position '5' | +40 to +80 | Go to step 5.g | Ship MRC to intermediate/ depot facility for further trouble-shooting | |
| | g. Position '6' | +40 to +80 | Go to step 5.i | Go to step 5.h | Oscillator oven temperature |
| | h. Check +18 Vdc at A4P1-1 | +18 Vdc | Replace 1A4 | Ship MRC to intermediate/ depot facility for further trouble-shooting | |
| | i. Position '7' SEE REMARKS | 0 to -20 | Go to step 5.j | Go to step 9 | Warmup time of 2 minutes is required |
| | j. Position '8' | See front panel MOD switch to OFF and loop switch to OPEN. Adjust front panel DC OFFSET for midscale. Adjust front panel OSCILLATOR ADJUST for peak meter reading. Set front panel MOD switch to OPR and loop switch to OPR. Go to step 5.k | | | |

Table 5-6. Organizational Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 5. (cont) | k. Position '9' | 0 ±40 | Go to step 5.1 | Go to paragraph 5-2.4 steps m through r | |
| | 1. Position '10' | +40 to +80 | Go to step 5.m | Go to paragraph 5-2.2 | |
| | m. Position '11' | +40 to +80 | Review symptoms | Go to paragraph 5-2.4 steps d through g | |
| 6. | a. Check voltage on the following 1A6 chassis connector pins: (see remarks) | | | | Check all voltages before going to step 6.b. If all voltages low or missing, go to step 7 |
| | 1. pin 2 | +13.5 Vdc | Go to 6.a.2 | Go to 6.b | |
| | 2. pin 3 | -18 Vdc | Go to 6.a.3 | Go to 6.b | |
| | 3. pin 6 | +18 Vdc | Go to 6.a.4 | Go to 6.b | |
| | 4. pin 7 | +5 Vdc | Go to 6.a.5 | Go to 6.b | |
| | 5. pin 10 (8 return) | +1 Vdc | Go to 6.a.6 | Go to 6.b | |
| | 6. pin 9 | +7.6 Vdc | Go to 6.a.7 | Go to 6.b | |
| | 7. pin 12 (11 return) | +7.6 Vdc | Go to 6.a.8 | Go to 6.b | |
| | 8. pin 13 | 4.6-6.2 Vdc | Go to 6.a.9 | Go to 6.b | |
| | 9. pin 18 | +18 Vdc | Go to 6.a.10 | Go to 6.b | |
| | 10. pin 19 | +5 Vdc | Go to 7 | Go to 6.b | |
| | b. Set POWER switch to OFF, then proceed as follows: | | | | |
| | 1. Remove 1A6 | | | | |

Table 5-6. Organizational Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 6. (cont) | 2. At connector pin(s) noted as low, check resistance to ground | Shorted to ground | Remove/ disconnect assemblies until short is cleared. Replace shorted module<br><br>If short is not cleared by removal of assemblies, ship MRC to intermediate/ depot facility for further troubleshooting | Replace 1A6 | |
| 7. | If required, set POWER switch ON. Check voltage at 1A6P1-14 | +34 Vdc | Replace 1A6 | Ship MRC to intermediate/ depot facility for further troubleshooting | |
| 8. | a. Set POWER switch to OFF. Remove and inspect INT BATTERY fuse F4 | Fuse F4 checks good | Go to step 8.b | Replace fuse F4 | |
| | b. Reinstall fuse. Using voltmeter, check voltage across 1A17P1-2 and -4 | a. If voltage is 0 Vdc | Replace 1A17 | | |
| | | b. If voltage is greater than 17.0 Vdc | Go to step 8.c | If voltage is less than 17.0 Vdc, battery needs to be charged | |

Table 5-6. Organizational Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 8. (cont) | c. Reconnect 1A17P1. Connect AC external power sources at this time. Set POWER switch to ON. Measure voltage at chassis subassembly U4-1 | a. If voltage is +17 Vdc or higher | Go to step 8.d | | |
| | | b. If voltage is 0 Vdc | Replace 1A14 | | |
| | d. Disconnect the AC external power (connector 1J14) and check voltage at chassis subassembly U4-2 | a. If +17.0 Vdc or higher | Replace 1A6 | | |
| | | b. If 0 Vdc | Ship MRC to intermediate/depot facility for further troubleshooting | | |
| 9. | a. Check dc voltage at 1A2E4 | a. If +2 Vdc or higher | Acceptable reading | | |
| | | b. If less than +2 Vdc | Go to step 9.b | | |
| | b. Check dc voltage at 1A2E1 | +17 to +34 Vdc | Replace 1A2 | Ship MRC to intermediate/depot facility for further troubleshooting | |

5-2.2 Sinusoidal Output Missing. In the event a problem appears in one of the sinusoidal outputs, perform the following procedural steps:

a. Using oscilloscope, check front panel 5 MHz output. If present and in specification (refer to Maintenance Requirement Card S-2 figure 2, in Chapter 4), go to step b. If not present, go to step d.

b. Using oscilloscope, check front panel 1 MHz output. If present and in specification (refer to Maintenance Requirement Card S-2 figure 3), go to step c. If not present, go to step e.

c. Using oscilloscope, check front panel 100 KHz output. If present and in specification (refer to Maintenance Requirement Card S-2 figure 4), verify symptoms by performing the performance check of the Maintenance Requirement Card S-2 again. If not present, go to step f.

d. Remove buffer amplifier 1A8. Using oscilloscope, check 5 MHz signal at chassis connector, coaxial pin A1. If present, replace 1A8. If not present, reinstall 1A8 then replace 5 MHz oscillator 1A4. If 5 MHz signal is still not present, ship MRC to intermediate/depot facility for further troubleshooting.

e. Using oscilloscope, check 5MHz, square-wave at generator 1A10 pin E6. If present, replace 1A10. If not present, go to step f.

f. Disconnect 5 MHz input to synthesizer 1A7. Using oscilloscope, check 5 MHz signal at cable end. If present and at least 1 VRMS, replace 1A7. If not present, replace 5 MHz oscillator 1A4.

5-2.3 Pulse Output Missing. In the event a problem appears in one of the pulse outputs, perform the following procedural steps:

a. Using oscilloscope, check front panel 1 PPS output. If present and in specification (refer to Maintenance Requirement Card S-2 figure 1), go to step b. If not present, go to step f.

b. Using oscilloscope, check front panel 1 PPM output. If present and in specification (refer to Maintenance Requirement Card S-2 figure 1) go to step c. If not present, replace real time-of-day clock 1A9.

c. Using oscilloscope, check rear panel 1 PPS output at J26, 1 PPM outputs at J15, J16, J17, and J18. If all outputs are present and in specification (refer to Maintenance Requirement Card S-3), go to step d. If any of these outputs are missing, replace 1A9.

d. Using oscilloscope, check real time-of-day output at J22. If present and in specification (refer to Maintenance Requirement Card S-3), go to step e. If not present, replace 1A9.

e. With oscilloscope probe on J22, set front panel CLOCK OPER/TIME HOLD switch to CLOCK OPER. Observe digital pattern on oscilloscope to see that the real time-of-day output matches HRS., MIN., SEC. indication on front panel LED display. If correct, verify symptoms by performing the performance check of Maintenance Requirement Card S-3. If not a match, replace 1A9.

f. Disconnect cable from 1A9J1. Connect oscilloscope probe to cable connector, pin 1 and observe 5 MHz square wave. If present, replace 1A9. If not present, reconnect cable and go to step g.

g. Disconnect 5 MHz input cable from synthesizer 1A7. Connect oscilloscope probe to 1A9J2-1 of cable and check 5 MHz TTL squarewave. If present, replace 1A9. If not present, replace 1A7.

5-2.4 Loop-Lock Failure. In the event that the alarm lamp does not reset, perform the following procedural steps:

NOTE

Allow unit to warn up for 20 minutes, minimum, prior to starting this procedure.

a. Set front panel MOD switch to OPR and LOOP switch to OPEN.

b. Set CIRCUIT CHECK switch to position 3. If reading is +40 to +80, go to step c. If reading is out-of-tolerance, go to step g.

c. Set CIRCUIT CHECK switch to position 9. If reading is 0 $\pm 40$, go to step d. If reading is out-of-tolerance, go to step i.

d. Set CIRCUIT CHECK switch to position 11. If reading is between +40 and +80, go to step i. If reading is out-of-tolerance, go to step e.

e. Connect DC voltmeter to terminal 1A5E5, VCO VOLTS input with the return to ground. Vary front panel OSCILLATOR ADJUST control while observing voltmeter. If voltmeter reading varies as OSCILLATOR ADJUST is varied, go to step g. If voltmeter reading remains fixed, go to step f.

f. Disconnect cable at 1A5J5. Using patch cable with BNC to OSM adapter, connect frequency counter to 1A5J5 and observe frequency. If out-of-tolerance or not present, replace 1A5.

g. Set CIRCUIT CHECK switch to position 5. If reading is +40 to +80, go to step h. If reading is out-of-tolerance, ship MRC to intermediate/depot facility for further troubleshooting.

h. Set CIRCUIT CHECK switch to position 6. If reading is between +40 and +80, go to step i. If reading is out-of-tolerance, check +18 VDC at 1A14P1-1. If present, replace 1A4. If not present, ship MRC to intermediate/depot facility for further troubleshooting.

i. Connect oscilloscope to 1A7TP1. Set oscilloscope TIME/DIV to 5ms, VOLTS/DIV to 0.5.

j. Adjust front panel OSCILLATOR ADJUST for maximum positive peak. If waveform is distorted, adjust the gain 1A1A2R1 for 1.0 V p-p, then adjust OSCILLATOR ADJUST. If an increase through a peak is observed, go to step k. If a peak is not observed, go to step p.

k. Adjust gain 1A1A2R1 for 1.0 V p-p.

l. Connect oscilloscope to 1A1A2TP1. If 83.3 Hz signal is between 0.8 and 1.4 V p-p, go to step m. If less than 0.8 V p-p, go to step q.

NOTE

This value of 0.8 to 1.4 V p-p is the original factory setting. However, the MRC will operate within specifications with the peak-to-peak value of the 83.3 Hz signal as low as 0.4 V p-p.

m. Connect oscilloscope to 1A7TP1. While observing oscilloscope, vary phase adjustment 1A7R17. If signal phase varies, go to step n. If phase does not vary, replace 1A7, then repeat this check. If phase still does not vary, replace 1A5.

n. While monitoring 1A7TP1, adjust front panel OSCILLATOR ADJUST for minimum signal.

o. Set front panel LOOP switch to OPR. On 1A1A2, adjust the gain, 1A1A2R1 for $\pm$2.0 V p-p. Push front panel RESET pushbutton to reset ALARM lamp.

p. During adjustment of OSCILLATOR ADJUST in step j, if an increase in waveform amplitude was noted, replace 1A7. Repeat step j adjustment. If an increase through a peak is still not observed, replace 1A5, then continue this procedure from step k.

q. While monitoring 1A1A2TP1, adjust voltage adjustment 1A3R1 until the 83.3 Hz signal is between 0.8 and 1.4 V p-p. If this adjustment is effective, continue this procedure with step m. If this adjustment is not effective, go to step r.

NOTE

This value of 0.8 to 1.4 V p-p is the original factory setting. However, the MRC will operate within specification with a value of as low as 0.4 V p-p.

r. Using voltmeter, verify that voltage at 1A3E3, voltage monitor test point, is greater than +2.0 Vdc. If less than 2.0 Vdc, replace 1A3, then continue this procedure from step l.

5-2.5 Discrete Chassis and Panel Mounted Components. Should any of the preceding troubleshooting procedures lead to the possibility of a defective discrete component, that is a component not located within a specific module, ship the MRC to intermediate/depot facility for further troubleshooting.

5-3. INTERMEDIATE/DEPOT LEVEL TROUBLESHOOTING. These procedures are authorized for accomplishment by intermediate level and higher activities (tender/shore facility/depot). Troubleshooting at the intermediate/depot maintenance level requires the isolation of faults to a defective piece part or component. Table 5-7 contains chassis mounted power supply component troubleshooting. If MRC failure occurs during AC operation, refer to step 1; during DC operation, refer to step 2; during battery operation, refer to step 3. Modules found to be defective or inoperative at the organizational level will be repaired at this level of maintenance. Prior to performing fault isolation checks on the modules, minimize fault isolation and troubleshooting time by performing preliminary module performance checks. These checks, paragraphs 5-3.1 through 5-3.8 may expedite finding the defective component. Paragraphs 5-3.9 through 5-3.16 provide troubleshooting for each of the modules. When the proper indication is not achieved, refer to the applicable troubleshooting table or paragraph. Table 1-3 is a list of standard test equipment, special tools and accessories to be used in performing module checks as well as the fault isolation procedures. Note that a known good MRC is used as a test fixture. When a suspected bad module is to be tested or troubleshooting performed, remove the good module from the MRC test fixture and connect the bad module to the test fixture. Refer to figures 5-2 through 5-6 for fabrication of the module extender cables required for testing and fault isolating the modules. Figures 5-7 and 5-8 are 1A9 output pulse diagrams and figures 5-9 through 5-42 are block and schematic diagrams to be used as aids during testing and troubleshooting. Upon completion of troubleshooting and repair remove the module from the test fixture and reinstall the known good module.

5-3.1 Module 1A5 Performance Test Procedure.

a. Remove module 1A5 from the MRC test fixture and connect UUT module 1A5 to test fixture, using test cable assemblies for power. Use caution not to flex semi-rigid cable (P/O test fixture) unnecessarily.

b. Set MRC test fixture POWER ON.

c. Disconnect test cable end at J5. Connect counter to J5 and measure frequency. It should indicate 7.368 MHz.

d. Disconnect counter from J5. Connect power meter to J5 and measure power output. It should indicate 1.2 V peak-to-peak.

e. Disconnect counter and reconnect test cable to J5.

f. Disconnect semi-rigid cable from J4. Connect spectrum analyzer to J4. Measure frequency and power level. The frequency should indicate 9.192 GHz at a power level $\geq -5$ dBm.

g. Disconnect spectrum analyzer and reconnect semi-rigid cable to J4. Troubleshoot module 1A5 (refer to paragraph 5-3.9).

Table 5-7. Chassis Power Supply Troubleshooting

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| | **WARNING** High voltages capable of causing death are used in this equipment. Use extreme caution when handling/servicing either the power supplies or their load components | | | | |
| 1. | a. Set POWER switch OFF. Remove and inspect fuse 1F1 and 1F2 | Fuses not blown | Go to step 1.b | Replace fuse(s) | Inoperative on AC input |
| | b. Reinstall fuses. Set POWER switch ON. Check voltage at 1U1-Emitter | +34 Vdc | Go to step 1.c | Replace 1U3 | |
| | c. Check voltage at junction of chassis subassembly 1C1 and 1L2 | +35 Vdc to +44 Vdc | Record voltage and go to 1.d | Replace 1U1 | |
| | d. Measure and record voltage at junction of chassis subassembly 1L2 and 1C2 | 3.5 Vdc $\pm$.5 Vdc higher than step 1.c | Go to step 1.e | Replace 1L2 and 1C2 | |

Table 5-7. Chassis Power Supply Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | e. Set POWER switch to OFF. Using ohmmeter measure front-to-back ratios of chassis subassembly bridge rectifier 1U2 | Ratio greater than $1 \times 10^6$:1 | Go to step 1.f | Replace 1U2 | |
| | f. Disconnect AC power connector and remove fuses 1F1 and 1F2. Check chassis sub-assembly filters 1F1 and 1F2 for continuity and shorts to ground | Filters check good | Go to step 1.g | Replace filter(s) found defective | |
| | g. With AC power disconnected, check con-tinutiy through all sections of chassis sub-assembly switches 1S4 and 1S3 | Switches check good | Replace chassis subassembly transformer 1T1 | Replace switch(es) found defective | |
| 2. | a. Set POWER switch OFF. Remove and inspect fuse 1F3 | Fuse blown | Replace fuse | Go to step 2.b | Inoperative on DC input |

Table 5-7. Chassis Power Supply Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 2. (cont) | b. Connect DC source only. Set POWER switch ON. Check voltage at junction of 1U3 and 1CR2 1U3(+) | +22 to +30 Vdc | Set POWER switch OFF, check wiring through chassis connector 1J3-1 to 1A6P1-1 | Go to step 2.c | |
| | c. Check voltage at junction of capacitor 1C3 and switch 1S4 | +22 to +30 Vdc | Set POWER switch OFF, check continuity through DC section of switch 1S4. If 1S4 checks good, replace 1U3 | Set POWER OFF. Check capacitors 1C3, 1C5 for shorts, and choke 1L1 for open. If these checks are good check chassis wiring from rear panel 1J13-D through switch 1S4 | |
| 3. | a. Install a fully charged battery pack, 1A17. Connect external AC power. Set POWER switch ON, then remove external AC power. | Front panel BAT-AVAILABLE and BAT-IN USE lamps light | Perform BITE test, then allow MRC to operate for 45 minutes. Set POWER switch OFF, go to step 3.b | Set power switch OFF. Check wiring from 1A14P1-11 and -24 through chassis connector 1J11-11, and -24. If wiring checks good, check wiring between 1A6P1-7 and 1A14P1-3, 1A6P1-3, 1A14P1-25. If wiring checks good, check 1U2 | Inoperative on internal BAT power |

Table 5-7. Chassis Power Supply Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | b. Connect AC power to rear panel connector 1J14. Set front panel CIRCUIT CHECK switch to position '4'. Set POWER switch to ON | CIRCUIT CHECK meter indicates charge current being drawn | Test complete | Replace module 1A14 | |

5-3.2 <u>Module 1A6 Performance Test Procedure</u>.

a. Remove module 1A6 from the MRC test fixture and connect UUT module 1A6 with the 1A6 test cable assembly to MRC test fixture.

b. Set MRC POWER ON.

c. Measure the output voltages at the specified pins with the digital voltmeter. Requirements are as follows:

-18 Vdc to -20 Vdc at P1-3
+17.9 Vdc to +18.6 Vdc at P1-6
+17.9 Vdc to +18.6 Vdc at P1-18
+4.8 Vdc to +5.3 Vdc at P1-7
+4.8 Vdc to +5.3 Vdc at P1-19
+7.5 Vdc to +7.7 Vdc at P1-9
+7.5 Vdc to +7.7 Vdc at P1-12
+4.8 Vdc to +6.2 Vdc at P1-13
+13.5 Vdc ±1 Vdc Clock at P1-2.

5-3.3 <u>Module 1A7 Performance Test Procedure</u>.

a. Remove module 1A7 from MRC test fixture and connect UUT module 1A7 to the MRC test fixture using the 1A7 test cable assemblies.

b. Set MRC test fixture POWER ON.

c. Measure the outputs at the specified pins as follows:

5 MHz output level at P2-A2 (0.7 Vrms minimum)
5 MHz frequency at P2-A2 (5.0 MHz ±1 Hz)
5 MHz TTL level at P2-A3 (3.5 V peak-to-peak)
5 MHz TTL level at P2-1 (3.5 V peak-to-peak)
83.3 Hz output level at P1-A1 (20 mV peak-to-peak) variable with 1A7R5
Control signal level at P1-A2 (-14 Vdc to +14 Vdc)
7.358 MHz VCO level at P1-A3 (+0.7 Vdc to +12 Vdc)

5-3.4 Module 1A8 Performance Test Procedure.

a. Remove module 1A8 from the MRC test fixture and connect UUT module 1A8 to the MRC test fixture using the 1A8 test cable assembly.

b. Set test fixture POWER ON.

c. Measure the output levels at the specified terminals and observe that sinewaves are not distorted.

Output terminal A2; 1.0 Vrms to 1.5 Vrms
Output terminal A3; 1.0 Vrms to 1.5 Vrms
Output terminal A4; 1.0 Vrms to 1.5 Vrms
Output terminal A5; 1.0 Vrms to 1.5 Vrms
Output terminal A6; 1.0 Vrms to 1.5 Vrms

5-3.5 Module 1A9 Performance Test Procedure.

a. Remove module 1A9 from the MRC test fixture.

b. Remove top and bottom covers of UUT module 1A9.

c. Connect the UUT module into the MRC test fixture.

d. Set test fixture POWER ON.

e. On 1A9 assembly, observe the TIME OF DAY output at J1-5. The output shall be +6 Vdc ±1 Vdc or -6 Vdc ±1 Vdc.

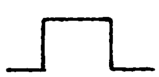
f. On 1A9 assembly, observe 1 PPM outputs into 50 ohms at the following pins:

J1-10
J1-32
J1-34
J1-35

The output at each pin shall be a low of 0 V to 0.5 V and a high of 9 V to 11 V (see figure below).

g. On front panel, observe 1 PPS output at J2 into 50 ohms and 1 PPM output at J3 into 50 ohms. The output for both connectors shall be a low of 0 V to 0.5 V and a high of 9 V to 11 V as shown below.

+10 (9 V to 11 V)
0 V to 0.5 V



5-3.6 Module 1A10 Performance Test Procedure.

a. Remove module 1A10 from the MRC test fixture and connect UUT module 1A10 to the MRC test fixture using the 1A10 test cable assembly.

b. Set test fixture POWER ON.

c. Measure the following output terminals:

A1 100 KHz at 1.0 Vrms to 1.5 Vrms
A2 100 KHz at 1.0 Vrms to 1.5 Vrms
A3 1 MHz at 1.0 Vrms to 1.5 Vrms
A4 1 MHz at 1.0 Vrms to 1.5 Vrms

5-3.7 Module 1A14 Performance Test Procedure.

a. Remove module 1A14 from the MRC test fixture and connect UUT module 1A14 to the MRC test fixture using the 1A14 test cable assembly.

b. Apply 115 Vac power at 60 Hz and +28 Vdc to the test fixture. Set test fixture POWER ON.

c. Observe that the DC AVAILABLE, BAT AVAILABLE, and AC IN USE LED are lit on the test fixture.

d. Remove AC power only and observe the AC IN USE LED extinguishes and that DC IN USE LED is lit.

e. Remove dc input (+28 Vdc) and observe that BAT IN USE LED is lit and DC available LED extinguishes.

f. Measure voltage at P1-25. It should indicate +18 (-0.1, +0.6) Vdc.

5-3.8 Module 1A16A1 Performance Test Procedure.

a. Remove meter drive amplifier 1A16A1 from test fixture and install UUT module 1A16A1 in its place, installing one screw to hold UUT in place.

b. Set test fixture POWER ON.

c. Set test fixture CIRCUIT CHECK switch successively to the positions listed in the table 5-8; CIRCUIT CHECK meter readings should be as listed.

5-3.9 Module 1A5 Troubleshooting. Connect module 1A5 as described in paragraph 5-3.1, Performance Test Procedure, then perform the steps of table 5-9.

5-3.10 Module 1A6 Troubleshooting. Connect module 1A6 as described in paragraph 5-3.2, Performance Test Procedure, then perform the steps of table 5-10.

5-3.11 Module 1A7 Troubleshooting. Remove cover plates of module 1A7 and connect as described in paragraph 5-3.3, Performance Test Procedure. Perform the procedures of table 5-11.

5-3.12 Module 1A8 Troubleshooting. Remove cover plates of module 1A8 and connect as described in paragraph 5-3.4, Performance Test Procedure. Perform the procedures of table 5-13.

5-3.13 Module 1A9 Troubleshooting. Connect module 1A9 as described in paragraph 5-3.5, Performance Test Procedures, then perform the steps of table 5-14.

Table 5-8. Module 1A16A1 Performance Test

| | Circuit check switch | Circuit check meter indication |
|---|---|---|
| Pos | Function | Range |
| 0 | +18 V | +40 to +80 |
| 1 | Supply voltage | +40 to +80 |
| 2 | +5 V | +40 to +80 |
| 3 | 2nd harmonic level | +40 to +80 |
| 4 | Battery current (AC in use) | 0 to +80 |
| 5 | Cesium oven temp. | +40 to +80 |
| 6 | Osc. oven temp. | +40 to +80 |
| 7 | Vac-ion current | 0 to -20 |
| 8 | Cesium ion current | Set to 0 DC-offset adj. |
| 9 | Osc. control volts | 0 ±40 |
| 10 | 5 MHz signal level | +40 to +80 |
| 11 | Synthesizer lock ind. | +40 to +80 |

Table 5-9. Module 1A5 Troubleshooting

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. | Check 9.192 + GHz: | | | | |
| | a. Disconnect semi-rigid coaxial cable from J4. | | | | |
| | b. Connect Spectrum Analyzer to J4 and measure frequency and power level | ≥-5.0 dBm, 9.192 GHz | Go to step 2.c | Go to step 2.a | |
| 2. | Check 7.368 MHz: | | | | |
| | a. Disconnect test cable end at J5 | | | | |
| | b. Connect RF voltmeter to J5 and measure level | Approximately 0.85 VRMS | Go to step 2.c | Go to step 3 | |
| | c. Set MRC POWER OFF. Unsolder VCO control voltage lead from 1A5A4E5. Connect variable power supply positive output to 1A5A4E5, negative to MRC chassis ground. Set power supply output to 0 Vdc | | | | |

Table 5-9. Module 1A5 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 2. (cont) | d. Connect counter to J5. Set MRC POWER ON. Measure and note output frequency. Adjust power supply to +6.2 Vdc. Measure and note new frequency | | | | |
| | e. Subtract first reading of step 2.d from second reading | Frequency shift of at least 250 Hz | Go to step 3 | Check 1A5FL6 and wiring from 1A5FL6 to 1A5A4E5. If these check good, replace 1A5Z4 | |
| 3. | Check +15 Vdc at 1A5A4E7 | +15 Vdc | Perform checks of 1A5A4L1, 1A5A4C2, 1A5A4C3, 1A5C1, 1A5C2, 1A5C3 and 1A5A4R1. If these check good, replace 1A5Z4. If fault is still present, replace 1A5A4Y1 | If low or missing, check 1A5U1, 1A5L1, 1A5C1, 1A5C3, 1A5L3, and 1A5C5 | |
| 4. | Check multipler drive chain: | | | | |
| | a. Disconnect A5CR1. Using spectrum analyzer, measure power at A5A3E5 | +23 dBm to +28 dBm | Replace A5CR1 | If less than +28 dBm, go to step 4.b | |

Table 5-9. Module 1A5 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 4. (cont) | b. Using counter check frequency at 1A5A1E1 | 100 MHz | Go to step 5 | Go to step 4.c | |
| | c. Using counter, check frequency at 1A5Z2-2 | 10 MHz | Go to step 4.f | Go to step 4.d | |
| | d. Check voltage level at 1A5Z2-29 | +15 Vdc | Replace 1A5Z2 | Go to step 4.e | |
| | e. Check voltage level at 1A5Z1-17 | +15 Vdc | Replace 1A5Z1 | Go to step 4.f | |
| | f. Check voltage level at 1A5U1-2 | +15 Vdc | Check A5L2 and A5C4 | Check 1A5U1 1A5C3, 1A5L1, and 1A5C1 | |
| 5. | Check crystal filter: | | | | |
| | a. Using RF voltmeter check frequency at 1A5A2E1 | 100 MHz, ≥-1.0 dBm | Go to step 5.b | Check coaxial wiring between 1A5A1E1 and 1A5A2E1 | |
| | b. Check frequency at 1A5A2E2 | <-6.0 dBm ≥-6.0 dBm | Go to step 6 | Replace 1A5A2 | |
| 6. | Check output multiplier: | | | | |
| | a. Using counter, frequency at 1A5Z3-10 | 200 MHz | Go to step 6.c | Go to step 6.b | |
| | b. Check voltage level at 1A5A3E4 | +15 Vdc | Replace 1A5Z3 | Check 1A5L4, 1A5C6 | |

Table 5-9. Module 1A5 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 6. (cont) | c. Using RF voltmeter check voltage at 1A5A3Q3 (collector) | If 5 VRMS | Check 1A5A3L4 through 1A5A3L6, 1A5A3C15 through 1A5A3C18 | | |
| | | If 0 VRMS or very low | Check 1A5A3Q3, 1A5A3R10 through 1A5A3R12, and 1A5A3CR1 | | |

Table 5-10. Module 1A6 Troubleshooting

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. | Check switching regulator: | | | | |
| | a. Check voltage level at 1A6P1-18 | +17.9 Vdc to 18.6 Vdc | Go to step 3 | Go to step 1.b | |
| | b. Set oscilloscope volts/DIV to 2 for both channels. Connect channel A to 1A6U1-10 and channel B to 1A6U1-9 | Complimentary squarewaves of between 10% and 45% duty cycle | Go to step 1.d | If one squarewave missing, replace 1A6U1. If both are missing, go to step 1.c | |
| | c. Check dc voltage at 1A6U1-12 | +17 Vdc to +35 Vdc | Set test fixture POWER OFF and check 1A6C25 and 1A6R12. If both check good, replace U1 | Go to step 1.e | |

Table 5-10. Module 1A6 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | d. Connect oscilloscope channel A to 1A6Q2-C and channel B to 1A6Q1-C | Pulse width modulated squarewave | Go to step 2 | If one waveform is missing, replace that transistor. If both are missing, check 1A6T1 and 1A6C20 | |
| | e. Check dc voltage at 1A6E5 | +17 Vdc to +35 Vdc | Check 1A6L1, 1A6R3 and 1A6CR20 | Check 1A6C1 and 1A6C7 | |
| 2. | Check +18 Vdc rectifier: | | | | |
| | a. Connect oscilloscope channel A to 1A6T1-4 | Pulse width modulated squarewave | Go to step 2.b | Check 1A6T1 | |
| | b. Connect oscilloscope chanel A to junction of 1A6CR5 and 1A6L4 | Rectified pulse width modulated squarewave | Go to step 2.c | Check 1A6CR5 and 1A6CR6 | |
| | c. Check 1A6L4, 1A6C16, 1A6C17, 1A6R20, and 1A6C36 | Components check good | Check wiring and PCB lands | Replace defective components | |
| 3. | Check the following voltage levels at connector P1 pins: | | | | |
| | a. P1-2 | +13.5 Vdc | Go to step 3.b | Go to step 4 | |
| | b. P1-3 | -18 Vdc | Go to step 3.c | Go to step 5 | |
| | c. P1-7 and P1-19 | +5 Vdc | Go to step 3.d | Go to step 6 | |

Table 5-10. Module 1A6 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | d. P1-9 | +7.6 Vdc | Go to step 3.e | Go to step 7 | |
| | e. P1-13 | 4.2 to 6.2 Vdc | Go to step 3.f | Go to steps 7 and 8 | |
| | f. P1-10 (P1-8 return) | +1 Vdc | Go to step 3.g | Go to step 9 | |
| | g. P1-12 (P1-11 return) | +7.6 Vdc | Test complete | Go to step 10 | |
| 4. | Check +13.5 Vdc: | | | | |
| | a. Verify that +18 Vdc is present at 1A6U5-4 | +18 Vdc (+17.9 Vdc to +18.6 Vdc) | Go to step 4.b | Return to step 1 | |
| | b. Set test fixture POWER OFF. Check 1A6R14, 1A6R17 values. Check 1A6C9, 1A6C10 for shorts | Components check good | Replace 1A6U5 | Replace defective components | |
| 5. | Check -18 Vdc: | | | | |
| | a. Check squarewave at junction of 1A6CR3, 1A6L3 | Rectified pulse width modulated squarewave | Go to step 5.b | Check 1A6CR3 and 1A6CR4 | |
| | b. Check 1A6L3 1A6C14, 1A6R19, and 1A6C37 | Components Check good | Check wiring and PCB lands | Replace defective components | |
| 6. | Check +5 Vdc: | | | | |
| | a. Check dc voltage level at 1A6U3-1 | +7.5 to +7.7 Vdc | Go to step 6.b | Go to step 7 | |

Table 5-10. Module 1A6 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 6. (cont) | b. Set test fixture POWER OFF. Check 1A6C13, 1A6C38 for shorts | Components check good | Replace 1A6U3 | Replace defective components | |
| 7. | Check +7.6 Vdc: | | | | |
| | a. Using oscilloscope, check squarewave at 1A6T1-7 | Pulse width modulated squarewave | Go to step 7.b | Check 1A6T1 | |
| | b. Check squarewave at junction of 1A6CR1 and 1A6L2 | Rectified pulse width modulated squarewave | Go to step 7.c | Check 1A6CR1, 1A6CR2 | |
| | c. Set test fixture POWER OFF. Check 1A6L2, 1A6C11, 1A6R18, and 1A6C34 | Components check good | Go to step 8 | Replace defective components | |
| 8. | Check hotwire: | | | | |
| | a. Check voltage at 1A6Q5 (collector) | +7.6 Vdc $\pm$0.1 Vdc | Go to step 8.b | Return to step 7 | |
| | b. While checking dc voltage at 1A6Q5 (base), vary 1A6R42 | Voltage varies | Go to step 8.c | If voltage is 0 Vdc or does not vary go to step 5.e | |
| | c. Check voltage at 1A6Q5 (emitter) while varying 1A6R42 | Voltage varies | Go to step 8.d | If voltage is 0 Vdc or does not vary replace 1A6Q5 | |

Table 5-10. Module 1A6 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 8. (cont) | d. Set test fixture POWER OFF. Check 1A6R44, 1A6R10 | Components check good | Go to step 8.e | Replace components found defective | |
| | e. Check 1A6R41, 1A6R42, 1A6R40, 1A6R47, 1A6R5, 1A6R10, and 1A6R43 | Components check good | Replace A6U4 | Replace defective components | |
| 9. | Check +1 Vdc: | | | | |
| | a. Using oscilloscope, check squarewave at 1A6T1-10 | Pulse width modulated squarewave | Go to step 9.b | Check 1A6T1 | |
| | b. Check squarewave at junction of 1A6CR14 and 1A6L6 | Rectified pulse width modulated squarewave | Go to step 9.c | Check 1A6CR14 and 1A6CR15 | |
| | c. Set test fixture POWER OFF. Check 1A6L6, 1A6C29, 1A6R22, 1A6C26, and 1A6C24 | Components check good | Check wiring and PCB lands | Replace components found defective | |
| 10. | Check +7.6 Vdc: | | | | |
| | a. Using oscilloscope check check squarewave at 1A6T1-13 | Pulse width modulated squarewave | Go to step 10.b | Check 1A6T1 | |

Table 5-10. Module 1A6 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 10. (cont) | b. Check squarewave at junction of 1A6CR9 and 1A6L7 | Rectified pulse width modulated square-wave | Go to step 10.c | Check 1A6CR9 and 1A6CR10 | |
| | c. Set test fixture POWER OFF. Check 1A6L7, 1A6C21, 1A6R29, 1A6C22, and 1A6C23 | Components check good | Check wiring and PCB lands | Replace components found defective | |

Table 5-11. Module 1A7 Troubleshooting

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. | Check DC supply: | | | | |
| | a. Check dc voltage level at 1A7A1U2-2 | +15 Vdc $\pm 0.3$ V | Go to step 1.b | Set test fixture POWER OFF, check 1A7A1C16 through 1A7A1C19 and 1A7A1R37. If 1A7A1R37 checks good, replace 1A7A1U2 | |
| | b. Check dc voltage level at 1A7A1U3-2 | -15 Vdc $\pm 0.3$ V | Go to step 1.c | Set test fixture POWER OFF, check 1A7A1C20 through 1A7A1C23, and 1A7A1R38. If good replace 1A7A1U3 | |

Table 5-11. Module 1A7 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | c. Check voltage level at 1A7A1U4-2 | +5 Vdc ±0.3 V | Go to step 2 | Set test fixture POWER OFF and check 1A7A1C24 through 1A7A1C27. If good, replace 1A7A1U4 | |
| 2. | Using oscilloscope, check frequency at 1A7A1E1 | 83.3 Hz at 20 mV peak-to-peak (variable with 1A7A1R5) | Go to step 3 | Go to step 9 | |
| 3. | Check 5 MHz level at 1A7A1E35 | Approximately 0.7 VRMS | Go to step 4 | Check 1A7A1DC1, 1A7A1R10, 1A7A1R11, and 1A7A1R13 | |
| 4. | Monitor dc level at 1A7A1E38 and vary test fixture OSCILLATOR ADJUST | Dc level varies | Go to step 5 | Go to step 11 | |
| 5. | Monitor dc level at 1A7A1E27 and short junction of 1A5A1C33 and 1A5A1R53 to ground | Dc level varies | Go to step 6 | Go to step 12 | |
| 6. | Using oscilloscope, ob-observe 5 MHz TTL at 1A7A1E32 | Approximately 3.5 V peak-to-peak | Go to step 7 | Replace 1A7A1Z1 | |
| 7. | Observe 5 MHz TTL at 1A7A1E33 | Approximately 3.5 V peak-to-peak | Go to step 8 | Replace 1A7A1Z1 | |

Table 5-11. Module 1A7 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 8. | Check alarm circuits: | | | | |
| | a. While observing ALARM lamp on test fixture, set MOD to OFF. | Alarm lamp lights within 15 seconds | Go to step 8.b | Go to step 8.e | |
| | b. Set MOD to OPR and push RESET | Alarm lamp should go out, OPERATE lamp should light | Go to step 8.c | Go to step 8.e | |
| | c. Set LOOP switch to OPEN | Alarm lamp lights | Go to step 8.d | Go to step 8.e | |
| | d. Set LOOP switch to OPERATE and push RESET | Alarm lamp goes out and OPERATE lamp lights | Check symptoms by repeating Performance Test | Go to step 8.e | |
| | e. Push RESET. Referring to table 5-12, set the LOOP and MOD switches to indicated settings then check TTL levels at specified points | See table 5-12 | Replace defective IC. If 1A7A1U5-1 or 1A7A1U5-2 are incorrect replace 1A7A1Z1 | | |
| 9. | Using oscilloscope, check frequency at 1A7A1Z1-37 | 5 MHz sinewave | Go to step 10 | Set test fixture POWER OFF and check 1A7A1R8, 1A7A1R9, and 1A7A1DC1 | |

Table 5-11. Module 1A7 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 10. | Using oscilloscope, check frequency at 1A7A1Z1-7 | 83.3 Hz TTL level | Set test fixture POWER OFF and check 1A7A1R1 through 1A7A1R5 and 1A7A1C1 through 1A7A1C5 | Replace 1A7A1Z1 | |
| 11. | Check detector/ integrator: | | | | |
| | a. Using oscilloscope check waveshape at 1A7A1U1-2 | 83.3 Hz, squarewave | Go to step 11.b | Replace 1A7A1Z1 | |
| | b. Connect oscilloscope EXT SYNC to 1A7A1E6 channel A to 1A7A1E15 and channel B to 1A7TP1. Set oscilloscope as follows: TRIGGER = EXT CHAN A+B = 2 V/DIV SWEEP = 2ms/DIV | Channel B waveform should be half of channel A and should be in-phase | Go to step 11.c | Replace 1A7A1U1 | |
| | c. Connect oscilloscope channel A to 1A7A1U1-4 and note relationship. Move channel B probe to 1A7A1U1-5 | In-phase portion is present | Go to step 11.d | Replace 1A7A1U1 | |

Table 5-11. Module 1A7 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 11. (cont) | d. Connect oscilloscope channel A to 1A7A1U1-8 and note relationship. Move channel B probe to 1A7A1U1-9 | In-phase portion is present | Go to step 11.e | Replace 1A7A1U1 | |
| | e. Set 1A7A1S2, Time Constant switch, to NORM and connect oscilloscope to 1A7A1TP1 | A varying waveform | Go to step 11.f | Replace R24 | |
| | f. While observing oscilloscope, turn the front panel OSC. ADJUST 1/4 turn clockwise, and note the time it takes to return to the waveform noted in step 11.e | The waveform noted in step 11.e should return | Go to step 11.g | Check 1A7A1R26, 1A7A1R27, 1A7A1R31, 1A7A1C40 and replace defective components | |
| | g. Set the 1A7S2, TIME CONSTANT SWITCH, to LONG and turn the front panel OSC. ADJUST 1/4 turn counterclockwise | The waveform should return approximately ten times longer than in step 11.f | Go to step 11.h | Check 1A7A1R28 and 1A7A1K2 and replace defective components | |

Table 5-11. Module 1A7 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 11. (cont) | h. Set LOOP switch to OPEN | DC voltage level at 1A7K1-2 matches level at 1A7K1-5 | Go to step 11.i | Replace 1A7K1 | |
| | i. Set test fixture POWER OFF. Check 1A7A1R31 through 1A7A1R36, 1A7A1C40, 1A7A1C15, 1A7A1C14, 1A7A1C13, 1A7A1C12, and 1A7A1C11 | Components check good | Replace 1A7A1U8 | Replace defective components | |
| 12. | Check 7 MHz VCO voltage: | | | | |
| | a. Using oscilloscope, check signal at 1A7A1Z1-21 | 3660 Hz, approximately 15 ns pulses | Go to step 12.b | Replace 1A7A1Z1 | |
| | b. Check signal at 1A7A1Q1 (collector) | 3660 Hz, negative going approximately 15 ns pulses | Go to step 12.c | Check 1A7A1R42, 1A7A1R51, 1A7A1C32, and 1A7A1Q1 | |
| | c. Connect channel B to 1A7A1U7-2 | Sampling envelope is present | Set test fixture POWER OFF and check 1A7A1R49, 1A7A1R44, 1A7A1R34, 1A7A1R50, and 1A7A1C36 | Check 1A7A1C31, 1A7A1C30, 1A7A1Q2. If good, replace 1A7A1U7 | |

Table 5-12. Alarm Circuit Switch Logic

| Switch position | 1A7U5 1 | 2 | 3 | 8 | 10 | 1A7U6 4 | 6 |
|---|---|---|---|---|---|---|---|
| MOD - OPR<br>LOOP - OPR | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| MOD - OFF<br>LOOP - OPR* | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| MOD - OPR<br>LOOP - OPEN | 1 | 0 | 1 | 0 | 1 | 0 | 1 |

* Must wait until ALARM indicator (DS1) is lit.

Table 5-13. Module 1A8 Troubleshooting

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. | Review checks performed in paragraph 5-3.4 | If only one amplifier channel is defective | Go to step 2 | | |
| | | If all amplifier channels are defective | Go to step 3 | | |

NOTE

Reference designations used in step 2 are for output amplifier 1. For any other channel substitute correct reference designations.

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 2. | Check amplifier channel: | | | | |
| | a. Using oscilloscope, check signal at junction of 1A8A1R3 and 1A8A1C3 | 5 MHz sinewave | Go to step 2.b | Check 1A8A1R3; if good, replace 1A8A1U1 | |
| | b. Check signal at base of 1A8A1Q1 | 5 MHz sinewave | Go to step 2.c | Replace 1A8A1C3 | |

Table 5-13. Module 1A8 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 2. (cont) | c. Using DC voltmeter, measure and note the dc voltage at collector of 1A8A1Q1 | If 1A8A1Q2-base is 1 volt greater than 1A8A1Q1-collector | Replace 1A8A1Q1 | | |
| | | If voltages are approximately equal | Replace 1A8A1Q2 | | |
| 3. | Using oscilloscope, check signal at pins 1A8A1U1-3, -4, -8, -12 and -16 | 5 MHz and same amplitude | Go to step 4 | Replace 1A8A1U1 | |
| 4. | Check +15 Vdc: | | | | |
| | a. Check +15 Vdc at 1A8A1E14 | +15 Vdc ±0.3 Vdc | Set test fixture POWER OFF, check for shorts to ground | Go to step 4.b | |
| | b. Check +18 Vdc at 1A8A1E13 | +17.9 to +18.1 Vdc | Replace 1A8U2 | Set test fixture POWER OFF and check 1A8A1L27, 1A8A1C39 and 1A8A1C40 | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409)

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|

NOTE

Module 1A9 contains a logic printed circuit board assembly 1A9A2 P/N 52002-9409. Some modules contain a functionally identical board assembly 1A9A2 P/N 52002-9409-1. Reference designations and some terminal pin numbers differ. A separate troubleshooting procedure has been included as table 5-17. Use table 5-17 if P/N 52002-9409-1 is used.

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. | Check master clock and time set: | | | | |
| | a. Using oscilloscope, signal at 1A9A2U4-4 | 10 MHz TTL squarewave | Go to step 1.b | Go to step 1.d | |
| | b. Check signal at 1A9A2U4-12 | 10 MHz TTL squarewave | Go to step 1.c | Go to step 1.d | |
| | c. Check signal at 1A9A2U52-5 | 50 ns pulse once per second (PPS) | Go to step 1.n | Go to step 1.e | |
| | d. Check signal at 1A9A2U1-11 | 10 MHz TTL squarewave | Replace 1A9A2U4 | Check 1A9A2R53, 1A9A2R58, 1A9A2R59, 1A9A2R101, 1A9A2R102, and 1A9A2C9. If these check good, replace 1A9A2U1 | |
| | e. Check signal at 1A9A2U55-7 | 0.2 sec pulse | Go to step 1.f | Go to step 1.i | |
| | f. Check signal at 1A9A2U43-6 | 0.2 sec pulse | Go to step 1.g | Replace 1A9A2U43 | |
| | g. Connect oscilloscope probe to 1A9A2U54-8. Press front panel UT SET | Change of state at 1A9A2U54-8 | Replace 1A9A2U52 | Go to step 1.h | |
| | h. Connect oscilloscope probe to 1A9A2U45-4. Press UT SET | Low-to-high transition at 1A9A2U45-4 | Replace 1A9A2U54 | Replace 1A9A2U45 | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | i. Check signal at 1A9A2U64-13 | 100 KHz squarewave | Go to step 1.k | Go to step 1.j | |
| | j. Check signal at 1A9A2U63-12 | 1 MHz squarewave | Replace 1A9A2U64 | Replace 1A9A2U63 | |
| | k. Check signal at 1A9A2U65-12 | 10 KHz squarewave | Go to step 1.1 | Replace 1A9A2U65 | |
| | 1. Check signal at 1A9A2U55-9 | 1KHz squarewave | Go to step 1.m | Replace 1A9A2U55 | |
| | m. Check signal at 1A9A2U56-9 | 200 ms pulse | Replace 1A9A2U55 | Replace 1A9A2U56 | |
| | n. Check time set switch functions by connecting oscilloscope to points indicated and perform action indicated: | | | | |
| | 1. 1A9A2U46-15, press SYNC ARM | Positive pulse (low-to high transition) | Go to step 1.n.2 | Replace 1A9A2U46 | |
| | 2. 1A9A2U44-12, press SYNC ARM | High-to-low transition | Go to step 1.n.3 | Replace 1A9A2U44 | |
| | 3. 1A9A2U46-13, press 1 PPM RESET | Positive pulse (low-to high transition) | Go to step 1.n.4 | Replace 1A9A2U46 | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | n. - Continued | | | | |
| | 4. 1A9A2U46-4, press HOURS | Positive pulse (low-to high transition) | Go to step 1.n.5 | Replace 1A9A2U46 | |
| | 5. 1A9A2U44-8, press HOURS | Negative pulse (high-to-low transition) | Go to step 1.n.6 | Replace 1A9A2U44 | |
| | 6. 1A9A2U46-11, press MINUTES | Positive pulse (low-to high transition) | Go to step 1.n.7 | Replace 1A9A2U46 | |
| | 7. 1A9A2U44-2, press MINUTES | Negative pulse (high-to-low transition) | Go to step 1.n.8 | Replace 1A9A2U44 | |
| | 8. 1A9A2U46-6 press SECONDS | Low-to-high tranistion | Go to step 1.n.9 | Replace 1A9A246 | |
| | 9. 1A9A2U45-15, switch CLOCK OP/ TIME HOLD to TIME HOLD | High-to-low transition | Go to step 1.n.10 | Replace 1A9A2U45 | |
| | 10. 1A9A2U45-2, press ADD | High-to-low transition | Go to step 1.n.11 | Replace 1A9A2U45 | |
| | 11. 1A9A2U45-13, press SUB | Low-to-high transition | Go to step 1.n.12 | Replace 1A9A2U45 | |
| | 12. 1A9A2U45-11, press SUB | High-to-low transition | Go to step 1.n.13 | Replace 1A9A2U45 | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | n. - Continued | | | | |
| | 13. 1A9A2U45-6, press SECONDS | High-to-low transition | Go to step 1.n.14 | Replace 1A9A2U45 | |
| | 14. 1A9A2U45-4, press UT SET | Low-to-high transition | Go to step 1.o | Replace 1A9A2U45 | |
| | o. Connect voltmeter to 1A9A2U30-8 | | | | |
| | 1. Set CLOCK OPERATE/TIME HOLD to TIME HOLD. Depress SECONDS and SUB | Dc voltage level goes high | Go to step 1.p | Repeat same check at 1A9A2U25-6 and go to step 1.o.2 | |
| | 2. Press SUB, MINUTES and HOURS checking for level change each time | If level change occurs for all switches | Replace 1A9A2U30 | Replace 1A9A2U25 | |
| | p. Set universal counter A→B and trigger level to approximately 1.5 volts. Connect channel A to 1A9A2U29-6 and channel B to 1A9A2U52-5. In turn, cycle each PULSE ADVANCE switch through all positions. | Counter should indicate the Pulse Advance Switch value ± 75 ns | Go to step 2 | If any one switch position change causes no shift in the pulse refer to step 1.p.1 through step 1.p.7 for corrective action | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | p. - Continued | | | | |
| | | If switch position $10^{-7}$ through $10^{-4}$ are defective | Replace 1A9A2U35 | | |
| | | If switch position $10^{-3}$ through $10^{-1}$ are defective | Replace 1A9A2U66 | | |
| | 1. Switch position $10^{-7}$ | Defective | Replace 1A9A2U47 | | |
| | 2. Switch position $10^{-6}$ | Defective | Replace 1A9A2U48 | | |
| | 3. Switch position $10^{-5}$ | Defective | Replace 1A9A2U59 | | |
| | 4. Switch position $10^{-3}$ | Defective | Replace 1A9A2U57 | | |
| | 5. Switch position $10^{-2}$ | Defective | Replace 1A9A2U69 | | |
| | 6. Switch position $10^{0}$ | Defective | Replace 1A9A2U68 | | |
| | 7. Switch position $10^{-1}$ | Defective | Replace 1A9A2U67 | | |
| 2. | For the following symptoms encountered, | | | | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 2. (cont) | go to the indicated step: | | | | |
| | a. Display in-operative/ wrong | | Go to step 3 | | |
| | b. Real time data missing/ wrong | | Go to steps 3 and 4 | | |
| | c. 1 PPS output failure | | Go to step 5 | | |
| | d. 1 PPM output failure | | Go to steps 3, 4, 5, and 6 | | |
| 3. | Check display: | | | | |
| | a. Observe TIME display | a. If display is blank | Go to step 3.b | | |
| | | b. If one character is blank, others show incorrect time or all are incorrect | Go to step 3.c | | |
| | | c. If one character is blank or partially formed, others are normal | Replace defective LED unit. (1A9A1U8 through 1A9A1U11) | | |
| | b. Press front panel TIME DISPLAY pushbutton | Display functions | Check 1A9S8. If good, replace 1A9K1 | | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | b. - Continued | If symptoms continue | Set test fixture POWER OFF, check 1A9A1R1, 1A9A1C1 through 1A9A1C3 | | |
| | c. Check clock signal at 1A9A2U29-12 | 1 PPS (pulse per second) | Go to step 3.d | Go to step 3.s | |
| | d. Connect oscilloscope probe to 1A9A2U32-13 | 10 ms negative pulse every 10 seconds | Go to step 3.e | Replace 1A9A2U32 | |
| | e. Connect oscilloscope channel A input to 1A9A2U31-3 | Change in level every 10 seconds | Go to step 3.f | Replace 1A9A2U31 | |
| | f. Connect channel A probe to 1A9A2U31-2 | Change in level every 20 seconds | Go to step 3.g | Replace 1A9A2U31 | |
| | g. Connect channel A probe to 1A9A2U31-6 | Change in level every 40 seconds | Go to step 3.h | Replace 1A9A2U31 | |
| | h. Connect channel A probe to 1A9A2U43-2 | Change in level every 60 seconds | Go to step 3.i | Go to step 3.ac | |
| | i. Disconnect oscilloscope. Set front panel CLOCK OPERATE/TIME HOLD to TIME HOLD. Measure and note levels at | See table 5-15 | Go to step 3.j | | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | i. - Continued<br><br>1A9A2U20-2, -3, -6, -7, and 1A9A2U19, -2, -3, and -6 | | | | |
| | j. Determine equivalent time indication in step 3.i | Time range of 00 to 59 | Go to step 3.k | | |
| | | If 1A9A2U20 is overrange | Replace 1A9A2U20 | | |
| | | If 1A9A2U19 is overrange | Go to step 3.ae | | |
| | k. On front panel, press and hold MINUTES switch. Press ADD switch once. Release MINUTES switch check levels at 1A9A2U20 and 1A9A2U19 | Count steps to next correct count | Go to step 3.1 | Replace 1A9A2U20 | |
| | 1. Repeat procedure of step 3.k. to bring count to 1001 at 1A9A2U20, then step count once more | a. If 1A9A2U19 steps one count higher and 1A9A2U20 steps to 0000 | Go to step 3.m | | |
| | | b. If 1A9A2U20 steps to any count other then 0000 | Replace 1A9A2U20 | | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | l. - Continued | c. If 1A9A2 1A9A2U19 steps above 101, or does not change | Go to step 3.ae | | |
| 3. (cont) | m. Repeat proc-cedure of step 3.k until count at 1A9A2U19 is at 0101 and 1001 at 1A9A2U20, then step once more | a. If count at 1A9A2U19 steps to 0000 | Go to step 3.n | | |
| | | b. If count changes to any other value | Replace 1A9A2U19 | | |
| | n. Measure and note levels at 1A9A2U8-2, -3, -6, -7, and 1A9A2U7 pins -3 and -2 | See table 5-16 to determine equivalent time indication | Go to step 3.o | | |
| | o. Determine equivalent time indication | a. Time in-dication falls in 00 to 23 range | Go to step 3.p | | |
| | | b. If count at 1A9A2U8 is over-range | Replace 1A9A2U8 | | |
| | | c. If count at 1A9A2U7 is over-range | Go to step 3.ai | | |
| | p. On front panel, press hold HOURS set switch. Press ADD switch once. Release HOURS | Count steps to next correct count | Go to step 3.q | Replace 1A9A2U8 | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | p. - Continued<br><br>switch and check levels at 1A9A2U8 and 1A9A2U7 | | | | |
| 3. (cont) | q. Repeat procedure of step 3.p to step count to 1001 at 1A9A2U8, then step once more | a. If 1A9A2U8 steps to 0000 and 1A9A2U7 steps one count higher | Go to step 3.r | | |
| | | b. If 1A9A2U8 steps to any count other than 0000 | Replace 1A9A2U8 | | |
| | | c. If 1A9A2U7-3 and -2 do not change | Check 1A9A2U18 and U30 | | |
| | r. Repeat procedure of step 3.q until the count at 1A9A2U8 is 1001 and the count at 1A9A2U7 is 10, then step once more | a. If 1A9A2U8 steps to 0000 and 1A9A2U7 steps to 00 | Go to step 3.s | | |
| | | b. If 1A9A2U8 and U7 step to any other values | Go to step 3.ai | | |
| | s. Set CLOCK OPERATE/TIME HOLD switch to CLOCK OPERATE | | | | |
| | 1. Using oscilloscope check signal at 1A9A2U17-3 | 2 PPS (pulse per second) | Go to step 3.t | Go to step 3.s.2 | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | s. - Continued | | | | |
| | 2. Check signal at 1A9A2U17-1 | Negative going 0.4 second pulse | Replace 1A9A2U17 | Replace 1A9A2U16 | |
| | t. Press SUB or ADD and check signal at 1A9A2U15-8 | 1 PPS (pulse per second) | Go to step 3.u | Using dc voltmeter check level at 1A9A2U15-9. If high replace 1A9A2U15. If low replace 1A9A2U29 | |
| | u. Press MIN and SUB or ADD and check signal at 1A9A2U29-6 | $\overline{\text{2 PPS}}$ | Go to step 3.v | Replace 1A9A2U29 | |
| | v. Press MIN and SUB or ADD and check signal at 1A9A2U42-1 | 2 PPS | Go to step 3.w | Check levels at 1A9A2U42-1 and -13. If both high replace 1A9A2U42. If 1A9A2U42-1 is low replace 1A9A2U16. If 1A9A2U4-16 is low go to step 3.ac | |
| | w. Press MIN and SUB or ADD and check signal at 1A9A2U43-4 | $\overline{\text{2 PPS}}$ | Go to step 3.x | Replace 1A9A2U43 | |
| | x. Press HRS and SUB or ADD and check signal at 1A9A2U29-11 | $\overline{\text{2 PPS}}$ | Go to step 3.y | Replace 1A9A2U29 | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | y. Press SEC and SUB or ADD and check signal at 1A9A2U17-8 | $\overline{\text{2 PPS}}$ | Go to step 3.z | Replace 1A9A2U17 | |
| | z. Check signal at 1A9A2U14-8 | 1 PPS | Go to step 3.aa | Replace 1A9A2U14 | |
| | aa. Check signal at 1A9A2U26-12 | $\overline{\text{1 PPS}}$ | Go to step 3.ab | Replace 1A9A2U26 | |
| | ab. Observe time display, malfunctioning digit indicates failed microcircuit as follows: | | | | |
| | 1. SECONDS: | UNITS | | Replace 1A9A2U32 | |
| | | TENS | | Replace 1A9A2U31 | |
| | 2. MINUTES: | UNITS | | Replace 1A9A2U20 | |
| | | TENS | | Replace 1A9A2U19 | |
| | 3. HOURS: | UNITS | | Replace 1A9A2U8 | |
| | | TENS | | Replace 1A9A2U7 | |
| | ac. Check signal at 1A9A2U29-3 | Negative going level change every 60 seconds | Go to step 3.ad | Replace 1A9A2U29 | |
| | ad. Check signal at 1A9A2U17-6 | Positive going level change every 10 seconds | Replace 1A9A2U43 | Replace 1A9A2U17 | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | ae. While holding MINUTES switch depressed, press ADD switch | Levels at 1A9A2U23-2 and -6 are high and level at 1A9A2U11-3 is low | Go to step 3.af | Replace 1A9A2U11 | |
| | af. Check level at 1A9A2U17-41 | High level | Go to step 3.ag | Replace 1A9A2U17 | |
| | ag. Set CLOCK OPERATE/ TIME HOLD to CLOCK OPERATE. Using oscilloscope, check signal at 1A9A2U6-9 | 1 MHz pulse train | Go to step 3.ah | Replace 1A9A2U13 | |
| | ah. Set CLOCK OPERATE/ TIME HOLD switch to TIME HOLD. Depress and hold MINUTES pushbutton while actuating ADD switch until the pattern at pins 1A9A2U23-7, -6, -2, and -3 is 0101. Connect oscilloscope probe to 1A9A2U6-3. Set CLOCK OPERATE/TIME HOLD to CLOCK OPERATE | Within 0 to 10 minutes, a negative going pulse appears at 1A9A2U6-3 | Replace 1A9A2U23 | Replace 1A9A2U6 | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | ai. While holding HOURS switch depressed, press ADD switch until pattern at pins 1A9A2U8-7, -6, -2, and -3 is 0011 and pattern at pins 1A9A2U7-3, -2, and -7 is 0101. Release HOURS switch and press and hold MINUTES switch. Depress ADD until pattern at 1A9A2U20 is 1001 and the pattern at 1A9A2U19 is 0101 | | Go to step 3.aj | | |
| | aj. Connect oscilloscope channel A to A2A2U6-14 and channel B to 1A9A2U5-8. Set oscilloscope for dual trace mode. Set CLOCK OPERATE/ TIME HOLD to CLOCK OPERATE | Within 2 to 4 minutes a positive pulse appears at 1A9A2U5-8 and a negative pulse at 1A9A2U6-14 | a. If both pulses appear replace 1A9A2U7<br>b. If only channel B pulse appears go to step 3.ak | | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | ak. Check signal at 1A9A2U6-9 | 1 MHz pulse train | Replace 1A9A2U6 | Replace 1A9A2U13 | |
| | al. Set CLOCK OPERATE/ TIME HOLD to TIME HOLD. Repeat HOURS portion of step 3.ai. Check levels at 1A9A2U18-2 and 1A9A2U5-8 | a. If 1A9A2U18-2 is low | Replace 1A9A2U18 | | |
| | | b. If 1A9A2U5-8 is high | Replace 1A9A2U5 | | |
| | | c. If 1A9A2U18-2 is high and 1A9A2U5-8 is low | Go to step 3.am | | |
| | am. While pressing HOURS switch, press ADD switch. Check level at 1A9A2U5-8 | a. A high level occurs every 24th count | Replace 1A9A2U6 | Replace 1A9A2U5 | |
| 4. | Check Time-of-Day output: | | | | |
| | a. Using oscilloscope, check signal at 1A9A2U53-9 | 10 KHz squarewave (20% duty cycle) | Go to step 4.b | Go to step 4.m | |
| | b. Check signal at 1A9A2U64-7 | 1 KHz squarewave (20% duty cycle) | Go to step 4.c | Go to step 4.m | |
| | c. Check signal at 1A9A2U53-7 | 100 Hz squarewave (20% duty cycle) | Go to step 4.d | Go to step 4.m | |
| | d. Check signal at 1A9A2U38-11 | 50 Hz squarewave | Go to step 4.e | Go to step 4.n | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 4. (cont) | e. Set oscilloscope mode for dual trace. Connect channel A to 1A9A2U50-1. Connect channel B to 1A9A2U40-9 | A negative-to-positive transition occurs on channel B with the 24th pulse on channel A | Go to step 4.f | Go to step 4.p | |
| | f. Repeat step 4.e with channel B probe at 1A9A2U4-8 | A positive-to-negative transition occurs on channel B on 24th pulse | Go to step 4.g | Replace 1A9A2U4 | |
| | g. Set oscilloscope for single channel, external sync. Connect channel A to U36-9 and connect sync probe to 1A9A2U33-2 | Once each second, a series of eight pulses (see figure 5-7) appears, starting at left side of CRT | Go to step 4.h | Go to step 4.s | |
| | h. Connect channel A probe to 1A9A2U21-9 | Once each second a series of 16 pulses appears beginning at left of CRT | Go to step 4.i | Replace 1A9A2U21 | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 4. (cont) | i. Connect channel A probe to 1A9A2U9-9 | Once each second a series of 24 pulses appears at left of CRT | Go to step 4.j | Replace 1A9A2U9 | |
| | j. Check signal at 1A9A2U4-6 | Pulse train | Go to step 4.k | Replace 1A9A2U4 | |
| | k. Check signal at 1A9A2U39-11 | Pulse train | Go to step 4.1 | Replace 1A9A2U39 | |
| | l. 1. Check signal at 1A9A2U36-4 | Pulse train | Check 1A9A2R20, 1A9C61 and wiring through 1A9A2J1 | Go to step 4.1.2 | |
| | 2. Check at level 1A9A2U36-14 | a. If +12.0 Vdc | Check level at 1A9A2U36-8 | | |
| | | b. If -12.0 Vdc | Replace 1A9A2U36 | | |
| | | c. If +12 Vdc low or missing | Check 1A9A2CR20, 1A9A2C8, 1A9A2R66, and 1A9A2CR27 | | |
| | m. Check dc at 1A9A2U40-9 | a. If level is low | Replace defective micro-circuit (1A9A2U53 or 1A9A2U64) | | |
| | | b. If level is high | Go to step 4.o | | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 4. (cont) | n. Check dc level at 1A9A2U40-8 | a. If level is high | Replace 1A9A2U38 | | |
| | | b. If level is low | Go to step 4.o | | |
| | o. Check signal at 1A9A2U34-2 | Negative going pulse once per second | Replace 1A9A2U40 | Replace 1A9A2U34 | |
| | p. Connect oscilloscope channel A to 1A9A2U50-1 and channel B probe to 1A9A2U39-8 | A positive pulse, with 24th pulse on channel A appears | Replace | Go to step | |
| | q. Connect channel B probe to 1A9A2U50-7 | A positive pulse, with 10th and 20th pulses on channel A | Go to step 4.r | Replace 1A9A2U50 | |
| | r. Move channel B probe to 1A9A2U50-11 | Positive pulse with 20th pulse on channel A | Replace 1A9A2U39 | Replace 1A9A2U50 | |
| | s. Check signal at 1A9A2U26-2 | 50 PPS (pulse per second) | Replace 1A9A2U33 | Replace 1A9A2U26 | |
| 5. | Check 1 PPS output: | | | | |
| | a. Using oscilloscope, check signal at 1A9A2U12-6 | $\overline{\text{1 PPS}}$ | Go to step 5.b | Go to step 5.f | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 5. (cont) | b. Check signal at 1A9A2U12-7 | 1 PPS | Go to step 5.c | Replace 1A9A2U12 | |
| | c. Check signal at 1A9A2U12-10 | 1 PPS | Go to step 5.d | Replace 1A9A2U12 | |
| | d. Check signal at 1A9A2Q7 emitter | 1 PPS | Go to step 5.e | Check 1A9A2Q7, 1A9A2R79 1A9A2R80, 1A9A2R81, 1A9A2R95, 1A9A2C57, 1A9A2C75, 1A9A2C76, and 1A9A2CR25 | |
| | e. Check signal at 1A9A2Q9 emitter | 1 PPS | Go to step 5.f | Check 1A9A2Q9, 1A9A2R96, 1A9A2R97, 1A9A2R99, 1A9A2R100, 1A9A2C56, 1A9A2C77, 1A9A2C78, and 1A9A2CR26 | |
| | f. Check signal at 1A9A2U13-13 | 100 KHz | Go to step 5.g | Replace 1A9A2U13 | |
| | g. Check wave-form at 1A9A2U24-11 | 10 ms PPS | Replace 1A9A2U38 | Replace 1A9A2U24 | |
| 6. | Check 1 PPM output: | | | | |
| | a. Using oscil-loscope, check signal at 1A9A2U12-14 | $\overline{1\ \text{PPM}}$ | Go to step 6.b | Go to step 6.m | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 6. (cont) | b. Check signal at 1A9A2U12-15 | 1 PPM | Go to step 6.c | Replace 1A9A2U12 | |
| | c. Check signal at 1A9A2Q8 emitter | 1 PPM | Go to step 6.d | Check 1A9A2Q8, 1A9A2R82, 1A9A2R83, 1A9A2R84, 1A9A2R89, 1A9A2C59, 1A9A2C58, 1A9A2C79, and 1A9A2CR27 | |
| | d. Check signal at 1A9A2U49-3 | $\overline{\text{1 PPM}}$ | Go to step 6.e | Go to step 6.m | |
| | e. Check signal at 1A9A2U49-10 | 1 PPM | Go to step 6.f | Replace 1A9A2U49 | |
| | f. Check signal at 1A9A2U49-15 | 1 PPM | Go to step 6.g | Replace 1A9A2U49 | |
| | g. Check signal at 1A9A2U49-2 | 1 PPM | Go to step 6.h | Replace 1A9A2U49 | |
| | h. Check signal at 1A9A2U49-7 | 1 PPM | Go to step 6.i | Replace 1A9A2U49 | |
| | i. Check signal at 1A9A2Q3 | 1 PPM | Go to step 6.j | Check 1A9A2Q3, 1A9A2R67, 1A9A2R68, 1A9A2R69, 1A9A2R91, 1A9A2C47, 1A9A2C48, 1A9A2C71, and 1A9A2CR21 | |

Table 5-14. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 6. (cont) | j. Check signal at 1A9A2Q4 | 1 PPM | Go to step 6.k | Check unit no. 1A9A2Q4, 1A9A2R70, 1A9A2R71, 1A9A2R72, 1A9A2R92, 1A9A2C49, 1A9A2C50, 1A9A2C72, and 1A9A2CR22 | |
| | k. Check signal at 1A9A2Q5 | 1 PPM | Go to step 6.1 | Check 1A9A2Q5, 1A9A2R73, 1A9A2R74, 1A9A2R75, 1A9A2R93, 1A9A2C51, 1A9A2C52, 1A9A2C73, and 1A9A2CR23 | |
| | 1. Check signal at 1A9A2Q6 | 1 PPM | Go to step 6.m | Check 1A9A2Q6, 1A9A2R76, 1A9A2R77, 1A9A2R78, 1A9A2R94, 1A9A2C53, 1A9A2C54, 1A9A2C74, and 1A9A2CR24 | |
| | m. Check signal at 1A9A2U41-5 | 1 PPM | Replace 1A9A2U41 | Go to step 6.n | |
| | n. Check signal at 1A9A2U40-3 | 1 PPM | Go to step 6.o | Replace 1A9A2U25 | |
| | o. Check signal at 1A9A2U40-1 | $\overline{\text{1 PPM}}$ | Replace 1A9A2U40 | Replace 1A9A2U37 | |

Table 5-15. Time Display Logic for 1A9A2U20 and 1A9A2U19 (1A9A2U21 and 1A9A2U20)*

| Minutes | | 1A9A2U20 (1A9A2U21)* | | | | 1A9A2U19 (1A9A2U20)* | | |
|---|---|---|---|---|---|---|---|---|
| Tens | Units | 3 | 2 | 6 | 7 | 3 | 2 | 6 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 5 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 6 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 7 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 8 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 9 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | (0-9) | (same as above) | | | | 1 | 0 | 0 |
| 2 | (0-9) | | | | | 0 | 1 | 0 |
| 3 | (0-9) | | | | | 1 | 1 | 0 |
| 4 | (0-9) | | | | | 0 | 0 | 1 |
| 5 | (0-9) | (same as above) | | | | 1 | 0 | 1 |
| **6 | N/A | - | - | - | - | 0 | 1 | 1 |
| **7 | N/A | - | - | - | - | 1 | 1 | 1 |
| (N/A) | (off) | 1 | 1 | 0 | 1 | - | - | - |
| (N/A) | (off) | 0 | 0 | 1 | 1 | - | - | - |
| (N/A) | ---- | 1 | 0 | 1 | 1 | - | - | - |
| (N/A) | (off) | 0 | 1 | 1 | 1 | - | - | - |
| (N/A) | (off) | 1 | 1 | 1 | 1 | - | - | - |

**011,111 indicate failure
* Applies to 1A9A2 P/N 52002-9409-1

Table 5-16. Time Display Logic for 1A9A2U8 and 1A9A2U7 (1A9A2U9 and 1A9A2U8)*

| Hours | | 1A9A2U8 (1A9A2U9)* | | | | 1A9A2U7 (1A9A2U8)* | |
|---|---|---|---|---|---|---|---|
| Tens | Units | 3 | 2 | 6 | 7 | 3 | 2 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 5 | 1 | 0 | 1 | 0 | 0 | 0 |
| 0 | 6 | 0 | 1 | 1 | 0 | 0 | 0 |
| 0 | 7 | 1 | 1 | 1 | 0 | 0 | 0 |
| 0 | 8 | 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 9 | 1 | 0 | 0 | 1 | 0 | 0 |
| 1 | (0-9) | (same as above) | | | | 1 | 0 |
| 2 | (0-9) | (same as above) | | | | 0 | 1 |
| (N/A) | | 0 | 1 | 0 | 1 | 1 | 1 |
| (N/A) | (off) | 1 | 1 | 0 | 1 | - | - |
| (N/A) | (off) | 0 | 0 | 1 | 1 | - | - |
| (N/A) | ---- | 1 | 0 | 1 | 1 | - | - |
| (N/A) | (off) | 0 | 1 | 1 | 1 | - | - |
| (N/A) | (off) | 1 | 1 | 1 | 1 | - | - |

*Applies to 1A9A2 P/N 52002-9409-1

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1)

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|

NOTE

Module 1A9 contains a logic printed circuit board assembly 1A9A2 P/N 52002-9409. Some modules contain a functionally identical board assembly 1A9A2 P/N 52002-9409-1. Reference designations and some terminal pin numbers differ. A separate troubleshooting procedure has been included as table 5-17. Use table 5-14 if P/N 52002-9409 is used.

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. | Check master clock and time set: | | | | |
| | a. Using oscilloscope, signal at 1A9A2U4-4 | 10 MHz TTL squarewave | Go to step 1.b | Go to step 1.d | |
| | b. Check signal at 1A9A2U4-12 | 10 MHz TTL squarewave | Go to step 1.c | Go to step 1.d | |
| | c. Check signal at 1A9A2U52-5 | 50 ns pulse once per second (PPS) | Go to step 1.n | Go to step 1.e | |
| | d. Check signal at 1A9A2U1-11 | 10 MHz TTL squarewave | Replace 1A9A2U4 | Check 1A9A2R53, 1A9A2R58, 1A9A2R59, 1A9A2R101, 1A9A2R102, and 1A9A2C9. If these check good, replace 1A9A2U1 | |
| | e. Check signal at 1A9A2U55-7 | 0.2 sec pulse | Go to step 1.f | Go to step 1.i | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | f. Check signal at 1A9A2U42-6 | 0.2 sec pulse | Go to step 1.g | Replace 1A9A2U42 | |
| | g. Connect oscilloscope probe to 1A9A2U54-8. Press front panel UT SET | Change of state at 1A9A2U54-8 | Replace 1A9A2U52 | Go to step 1.h | |
| | h. Connect oscilloscope probe to 1A9A2U44-4. UT SET | Low-to-high transition at 1A9A2U44-4 | Replace 1A9A2U54 | Replace 1A9A2U44 | |
| | i. Check signal at 1A9A2U62-13 | 100 KHz squarewave | Go to step 1.k | Go to step 1.j | |
| | j. Check signal at 1A9A2U61-12 | 1 MHz squarewave | Replace 1A9A2U62 | Replace 1A9A2U61 | |
| | k. Check signal at 1A9A2U63-12 | 10 KHz squarewave | Go to step 1.1 | Replace 1A9A2U63 | |
| | l. Check signal at 1A9A2U55-9 | 1 KHz squarewave | Go to step 1.m | Replace 1A9A2U55 | |
| | m. Check signal at 1A9A2U56-9 | 200 ms pulse | Replace 1A9A2U55 | Replace 1A9A2U56 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | n. Check time set switch functions by connecting oscilloscope to points indicated and perform action indicated: | | | | |
| | 1. 1A9A2U45-15, press SYNC ARM | Positive pulse (low-to-high transition) | Go to step 1.n.2 | Replace 1A9A2U45 | |
| | 2. 1A9A2U43-12, press SYNC ARM | Negative pulse (high-to-low transition) | Go to step 1.n.3 | Replace 1A9A2U43 | |
| | 3. 1A9A2U45-13, press PPM RESET | Positive pulse (low-to-high transition) | Go to step 1.n.4 | Replace 1A9A2U45 | |
| | 4. 1A9A2U45-4, press HOURS | Positive pulse (low-to-high transition) | Go to step 1.n.5 | Replace 1A9A2U45 | |
| | 5. 1A9A2U43-8, press HOURS | Negative pulse (high-to-low transition) | Go to step 1.n.6 | Replace 1A9A2U43 | |
| | 6. 1A9A2U45-11, press MINUTES | Positive pulse (low-to-high transition) | Go to step 1.n.7 | Replace 1A9A2U45 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | 7. 1A9A2U43-2, press MINUTES | Negative pulse (high-to-low transition) | Go to step 1.n.8 | Replace 1A9A2U43 | |
| | 8. 1A9A2U45-6, press SECONDS | Positive pulse (low-to-high transition) | Go to step 1.n.9 | Replace 1A9A2U45 | |
| | 9. 1A9A2U44-15, switch CLOCK OP/TIME HOLD to TIME HOLD | Negative transition (high-to-low transition) | Go to step 1.n.10 | Replace 1A9A2U44 | |
| | 10. 1A9A2U44-2, press ADD | Negative pulse (high-to-low transition) | Go to step 1.n.11 | Replace 1A9A2U44 | |
| | 11. 1A9A2U44-13, press SUB | Positive pulse (low-to-high transition) | Go to step 1.n.12 | Replace 1A9A2U44 | |
| | 12. 1A9A2U44-11, press SUB | Negative pulse (high-to-low transition) | Go to step 1.n.13 | Replace 1A9A2U44 | |
| | 13. 1A9A2U44-6, press SECONDS | Negative pulse (high-to-low transition) | Go to step 1.n.14 | Replace 1A9A2U44 | |
| | 14. 1A9A2U44-4, press UT SET | Positive pulse (low-to-high transition) | Go to step 1.o | Replace 1A9A2U44 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | o. Connect voltmeter to 1A9A2U33-8 | | | | |
| | 1. Set CLOCK OPERATE/ TIME HOLD to TIME HOLD. Depress SECONDS and SUB | Dc voltage level goes high | Go to step 1.p | Repeat same check at 1A9A2U28-6, and go to step 1.o.2 | |
| | 2. Press SUB, MINUTES and HOURS checking for level change each time | If level change occurs for all switches | Replace 1A9A2U33 | | |
| | | If any level change is missing | Replace 1A9A2U28 | | |
| | p. Set universal counter to Time A B and trigger level to approximately 1.5 volts. Connect channel A to 1A9A2U29-6 and channel B to 1A9A2U52-5. In turn, cycle each PULSE ADVANCE switch through all positions | Counter should indicate Pulse Advance Switch value $\pm 75$ ns | Go to step 2 | If any one switch position change causes no shift in the pulse refer to step 1.p.1 through 1.p.7 corrective action | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | p. - Continued | | | | |
| | | If switch position $10^{-7}$ through $10^{-4}$ are defective | Replace 1A9A2U48 | | |
| | | If switch positions $10^{-3}$ through $10^{-1}$ are defective | Replace 1A9A2U64 | | |
| | 1. Switch position $10^{-7}$ | Defective | Replace 1A9A2U46 | | |
| | 2. Switch position $10^{-6}$ | Defective | Replace 1A9A2U47 | | |
| | 3. Switch position $10^{-5}$ | Defective | Replace 1A9A2U59 | | |
| | 4. Switch position $10^{-4}$ | Defective | Replace 1A9A2U57 | | |
| | 5. Switch position $10^{-3}$ | Defective | Replace 1A9A2U67 | | |
| | 6. Switch position $10^{-2}$ | Defective | Replace 1A9A2U66 | | |
| | 7. Switch position $10^{-1}$ | Defective | Replace 1A9A2U65 | | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 2. | For the following symptoms encountered go to the indicated step: | | | | |
| | a. Display inoperative/ wrong | | Go to step 3 | | |
| | b. Real time data missing/ wrong | | Go to step 3 and 4 | | |
| | c. 1 PPS output failure | | Go to step 5 | | |
| | d. 1 PPM output failure | | Go to steps 3, 4, 5, and 6 | | |
| 3. | Check display: | | | | |
| | a. Observe TIME display | a. If display is blank | Go to step 3.b | | |
| | | b. If one character is blank, others show incorrect time or all are incorrect | Go to step 3.c | | |
| | | c. If one character is blank or partially formed, others normal | Replace defective LED unit. (1A9A1U1 through 1A9A1U6) | | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | b. Press front panel TIME DISPLAY pushbutton | Display functions | Check 1A9S8. If good, replace 1A9K1 | | |
| | | If symptoms continue | Set test fixture POWER OFF, check 1A9A1R1, 1A9A1C1 through 1A9A1C3 | | |
| | c. Check clock signal at 1A9A2U29-12 | 1 PPS (pulse per second) | Go to step 3.d | Go to step 3.s | |
| | d. Connect oscilloscope probe to 1A9A2U35-13 | 10 ms negative pulse every 10 seconds | Go to step 3.e | Replace 1A9A2U35 | |
| | e. Connect oscilloscope channel A input to 1A9A2U34-3 | Change in level every 10 seconds | Go to step 3.f | Replace 1A9A2U34 | |
| | f. Connect channel A probe to 1A9A2U34-2 | Change in level every 20 seconds | Go to step 3.g | Replace 1A9A2U34 | |
| | g. Connect channel A probe to 1A9A2U34-6 | Change in level every 40 seconds | Go to step 3.h | Replace 1A9A2U34 | |
| | h. Connect channel A probe to 1A9A2U42-2 | Change in level every 60 seconds | Go to step 3.i | Go to step 3.ac | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | i. Disconnect oscilloscope. Set front panel CLOCK OPERATE/ TIME HOLD to TIME HOLD. Measure and note levels at 1A9A2U21-2, -3, -6, -7, and 1A9A2U20, -2, -3, and -6 | See table 5-15 | Go to step 3.j | | |
| | j. Determine equivalent time indication in step 3.i | Time range of 00 to 59 | Go to step 3.k | | |
| | | If 1A9A2U21 is over-range | Replace 1A9A2U21 | | |
| | | If 1A9A2U20 is over-range | Go to step 3.ae | | |
| | k. On front panel, press and hold MINUTES switch. Press ADD switch once. Release MINUTES switch check levels at 1A9A2U21 and 1A9A2U20 | Count steps to next correct count | Go to step 3.1 | Replace 1A9A2U21 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | l. Repeat procedure of step 3.k to bring count to 1001 at 1A9A2U21, then step count once more | a. If 1A9A2U20 steps one count higher and 1A9A2U21 steps to 0000 | Go to step 3.m | | |
| | | b. If 1A9A2U21 steps to any count other then 0000 | Replace 1A9A2U21 | | |
| | | c. If 1A9A2U20 steps above 101, or does not change | Go to step 3.ae | | |
| | m. Repeat procedure of step 3.k until count at 1A9A2U20 is at 0101 and 1001 at 1A9A2U21, then step once more | a. If count at 1A9AU20 steps to 000 | Go to step 3.n | | |
| | | b. If count changes to any other value | Replace 1A9A2U20 | | |
| | n. Measure and note levels at 1A9A2U9-2, -3, -6, -7, and 1A9A2U8 pins -3 and -2 | See table 5-16 to determine equivalent time indication | Go to step 3.o | | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | o. Determine equivalent time indication | a. Time indication falls in 00 to 23 range | Go to step 3.p | | |
| | | b. If count at 1A9A2U9 is over-range | Replace 1A9A2U9 | | |
| | | c. If count at 1A9A2U8 is over-range | Go to step 3.ai | | |
| | p. On front panel, press and hold HOURS set switch. Press ADD switch once. Release HOURS switch and check levels at 1A9A2U9 and 1A9A2U8 | Count steps to next correct count | Go to step 3.q | Replace 1A9A2U9 | |
| | q. Repeat procedure of step 3.p to count to 1001 at 1A9A2U9, then step once more | a. If 1A9A2U9 steps to 0000 and 1A9A2U8 steps one count higher | Go to step 3.r | | |
| | | b. If 1A9A2U9 steps to any count other than 0000 | Replace 1A9A2U9 | | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | q. - Continued | c. If 1A9A2U8-3 and -2 do not change | Check 1A9A2U18 and U33 | | |
| | r. Repeat procedure of step 3.q until the count at 1A9A2U9 is 1001 and the count at 1A9A2U8 is 10, then step once more | a. If 1A9A2U9 steps to 0000 and 1A9A2U8 steps to 00 | Go to step 3.s | | |
| | | b. If 1A9A2U9 and U8 step to any other values | Go to step 3.ai | | |
| | s. Set CLOCK OPERATE/ TIME HOLD switch to CLOCK OPERATE | | | | |
| | 1. Using oscilloscope check signal at 1A9A2U17-3 | 2 PPS (pulse per second) | Go to step 3.t | Go to step 3.s.2 | |
| | 2. Check signal at 1A9A2U17-1 | Negative going 0.4 second pulse | Replace 1A9A2U17 | Replace 1A9A2U16 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | t. Press SUB or ADD and check signal at 1A9A2U15-8 | 2 PPS (pulse per second) | Go to step 3.u | Using dc voltmeter check level at 1A9A2U15-9. If high replace 1A9A2U15. If low replace 1A9A2U32 | |
| | u. Press MIN and SUB or ADD and check signal at 1A9A2U32-6 | $\overline{\text{2 PPS}}$ | Go to step 3.v | Replace 1A9A2U32 | |
| | v. Press MIN and SUB or ADD and check signal at 1A9A2U42-3 | 2 PPS | Go to step 3.w | Check levels at 1A9A2U41-2 and -13. If both high replace 1A9A2U41. If 1A9A2U41-2 is low replace 1A9A2U16. If 1A9A2U41-13 is low go to step 3.ac | |
| | w. Press MIN and SUB or ADD and check signal at 1A9A2U42-4 | $\overline{\text{2 PPS}}$ | Go to step 3.x | Replace 1A9A2U42 | |
| | x. Press HRS and SUB or ADD and check signal at 1A9A2U32-11 | $\overline{\text{2 PPS}}$ | Go to step 3.y | Replace 1A9A2U32 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | y. Press SEC and SUB or ADD and check signal at 1A9A2U17-8 | $\overline{\text{2 PPS}}$ | Go to step 3.z | Replace 1A9A2U17 | |
| | z. Check signal at 1A9A2U14-8 | 1 PPS | Go to step 3.aa | Replace 1A9A2U14 | |
| | aa. Check signal at 1A9A2U29-12 | $\overline{\text{1 PPS}}$ | Go to step 3.ab | Replace 1A9A2U29 | |
| | ab. Observe time display, malfunctioning digit indicates failed microcircuit as follows: | | | | |
| | 1. SECONDS: | UNITS | | Replace 1A9A2U35 | |
| | | TENS | | Replace 1A9A2U34 | |
| | 2. MINUTES: | UNITS | | Replace 1A9A2U21 | |
| | | TENS | | Replace 1A9A2U20 | |
| | 3. HOURS: | UNITS | | Replace 1A9A2U9 | |
| | | TENS | | Replace 1A9A2U8 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | ac. Check signal at 1A9A2U32-3 | Negative going level change every 60 seconds | Go to step 3.ad | Replace 1A9A2U32 | |
| | ad. Check signal at 1A9A2U17-6 | Positive going level change every 60 seconds | Replace 1A9A2U42 | Replace 1A9A2U17 | |
| | ae. While holding MINUTES switch depressed, press ADD switch | Levels at 1A9A2U20-2 and -6 are high and level at 1A9A2U19-3 is low | Go to step 3.af | Replace 1A9A2U19 | |
| | af. Check level at 1A9A2U17-11 | High level | Go to step 3.ag | Replace 1A9A2U17 | |
| | ag. Set CLOCK OPERATE/ TIME HOLD to CLOCK OPERATE. Using oscilloscope, check signal at 1A9A2U6-9 | 1 MHz pulse train | Go to step 3.ah | Replace 1A9A2U13 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | ah. Set CLOCK OPERATE/ TIME HOLD switch to TIME HOLD. Depress and hold MINUTES pushbutton while actuating ADD switch until the pattern at pins 1A9A2U20-7, -6, -2, and -3 is 0101. Connect oscilloscope probe to 1A9A2U6-3. Set CLOCK OPERATE/ TIME HOLD to CLOCK OPERATE | Within 0 to 10 minutes, a negative going pulse appears at 1A9A2U6-3 | Replace 1A9A2U20 | Replace 1A9A2U6 | |
| | ai. While holding HOURS switch depressed, press ADD switch until pattern at pins 1A9A2U9-7, -6, -2, and -3 is 0011 and pattern at pins 1A9A2U8-3, -2, and -7 is 0010. Release HOURS | | Go to step 3.aj | | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | switch and press and hold MINUTES switch. Depress ADD until pattern at 1A9A2U21 is 1001 and the pattern at 1A9A2U20 is 0101. | | | | |
| | aj. Connect oscilloscope channel A to A2A2U6-14 and channel B to 1A9A2U5-8. Set oscilloscope for dual trace mode. CLOCK OPERATE/ TIME HOLD to CLOCK OPERATE | Within 2 to 4 minutes, a positive pulse appears at 1A9A2U5-8 and a negative pulse at 1A9A2U6-14 | a. If both pulses appear replace 1A9A2U8.<br>b. If only channel B pulse appears go to step 3.ak | | |
| | ak. Check signal at 1A9A2U6-9 | 1 MHz pulse train | Replace 1A9A2U6 | Replace 1A9A2U13 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | al. Set CLOCK OPERATE/ TIME HOLD to TIME HOLD. Repeat HOURS portion of step 3.ai. Check levels at 1A9A2U18-2 and 1A9A2U5-8 | a. If 1A9A2U18-2 is low | Replace 1A9A2U18 | | |
| | | b. If 1A9A2U5-8 is high | Replace 1A9A2U5 | | |
| | | c. If 1A9A2U18-2 is high and 1A9A2U5-8 is low | Go to step 3.am | | |
| | am. While pressing HOURS switch, press ADD switch. Check level at 1A9A2U5-8 | a. A high level occurs every 24th count. | Replace 1A9A2U6 | Replace 1A9A2U5 | |
| 4. | Check Time-of-Day output: | | | | |
| | a. Using oscilloscope, check signal at 1A9A2U53-9 | 10 KHz squarewave (20% duty cycle) | Go to step 4.b | Go to step 4.m | |
| | b. Check signal at 1A9A2U62-7 | 1 KHz squarewave (20% duty cycle) | Go to step 4.c | Go to step 4.m | |
| | c. Check signal at 1A9A2U53-7 | 100 Hz squarewave (20% duty cycle) | Go to step 4.d | Go to step 4.m | |
| | d. Check signal at 1A9A2U37-11 | 50 Hz squarewave | Go to step 4.e | Go to step 4.n | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 4. (cont) | e. Set oscilloscope mode for dual trace. Connect channel A to 1A9A2U50-1. Connect channel B to 1A9A2U39-9 | A negative-to-positive transition occurs on channel B with the 24th pulse on channel A | Go to step 4.f | Go to step 4.p | |
| | f. Repeat 4.e with channel B probe at 1A9A2U4-8 | A positive-to-negative transition occurs on channel B on 24th pulse | Go to step 4.g | Replace 1A9A2U4 | |
| | g. Set oscilloscope for single channel, external sync. Connect channel A to U36-9 and connect sync probe to 1A9A2U36-2 | Once each second, a series of eight pulses (see figure 5-8) appears, starting at left side of CRT | Go to step 4.h | Go to step 4.s | |
| | h. Connect channel A probe to 1A9A2U22-9 | Once each second a series of 16 pulses appears beginning at left of CRT | Go to step 4.i | Replace 1A9A2U22 | |
| | i. Connect channel A probe to 1A9A2U10-9 | Once each second a series of 24 pulses appears at left of CRT | Go to step 4.j | Replace 1A9A2U10 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 4. (cont) | j. Check signal at 1A9A2U4-6 | Pulse train | Go to step 4.k | Replace 1A9A2U4 | |
| | k. Check signal at 1A9A2U38-11 | Pulse train | Go to step 4.1 | Replace 1A9A2U38 | |
| | l. 1. Check signal at 1A9A2U25-4 | Pulse train | Check 1A9A2R90, 1A9C61, and wiring through 1A9A2J1 | Go to 4.1.2 | |
| | 2. Check level at 1A9A2U25-14 | a. If +12.0 Vdc | Check level at 1A9A2U25-8 | | |
| | | b. If -12.0 Vdc | Replace 1A9A2U25 | | |
| | | c. If +12 Vdc low or missing | Check 1A9A2CR20, 1A9A2C8, 1A9A2C7, 1A9A2C80, 1A9A2R66, and 1A9A2CR28 | | |
| | m. Check dc level at 1A9A2U39-9 | a. If level is low | Replace defective microcircuit (1A9A2U53 or 1A9A2U62) | | |
| | | b. If level is high | Go to step 4.o | | |
| | n. Check dc level at 1A9A2U39-8 | a. If level is high | Replace 1A9A2U37 | | |
| | | b. If level is low | Go to step 4.o | | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 4. (cont) | o. Check signal at 1A9A2U24-2 | Negative going pulse once per second | Replace 1A9A2U39 | Replace 1A9A2U24 | |
| | p. Connect oscilloscope channel A to 1A9A2U50-1 and channel B probe to 1A9A2U38-8 | A positive pulse, with 24th pulse on channel A appears | Replace 1A9A2U39 | Go to step 4.q | |
| | q. Connect channel B probe to 1A9A2U50-7 | A positive pulse, with 10th and 20th pulses on channel A | Go to step 4.r | Replace 1A9A2U50 | |
| | r. Move channel B probe to 1A9A2U50-11 | Positive pulse with 20th pulse on channel A | Replace 1A9A2U38 | Replace 1A9A2U50 | |
| | s. Check signal at 1A9A2U29-2 | 50 PPS (pulse per second) | Replace 1A9A2U36 | Replace 1A9A2U29 | |
| 5. | Check 1 PPS output: | | | | |
| | a. Using oscilloscope, check signal at 1A9A2U23-6 | $\overline{\text{1 PPS}}$ | Go to step 5.b | Go to step 5.f | |
| | b. Check signal at 1A9A2U23-7 | 1 PPS | Go to step 5.c | Replace 1A9A2U23 | |
| | c. Check signal at 1A9A2U23-10 | 1 PPS | Go to step 5.d | Replace 1A9A2U23 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 5. (cont) | d. Check signal at 1A9A2Q7 emitter | 1 PPS | Go to step 5.e | Check 1A9A2Q7, 1A9A2R79, 1A9A2R80, 1A9A2R81, 1A9A2R95, 1A9A2C57, 1A9A2C75, 1A9A2C76, and 1A9A2CR25 | |
| | e. Check signal at 1A9A2Q9 emitter | 1 PPS | Go to step 5.f | Check 1A9A2Q9, 1A9A2R96, 1A9A2R97, 1A9A2R99, 1A9A2R100, 1A9A2C56, 1A9A2C77, 1A9A2C78, and 1A9A2CR26 | |
| | f. Check signal at 1A9A2U13-13 | 100 KHz | Go to step 5.g | Replace 1A9A2U13 | |
| | g. Check wave-form at 1A9A2U26-3 | 10 ms PPS | Replace 1A9A2U37 | Replace 1A9A2U27 | |
| 6. | Check 1 PPM output: | | | | |
| | a. Using oscilloscope check signal at 1A9A2U23-14 | $\overline{\text{1 PPM}}$ | Go to step 6.b | Go to step 6.m | |
| | b. Check signal at 1A9A2U23-15 | 1 PPM | Go to step 6.c | Replace 1A9A2U23 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 6. (cont) | c. Check signal at 1A9A2Q8 emitter | 1 PPM | Go to step 6.d | Check 1A9A2Q8 1A9A2R82, 1A9A2R83, 1A9A2R84, 1A9A2R89, 1A9A2C59, 1A9A2C58, 1A9A2C79, and 1A9A2CR27 | |
| | d. Check signal at 1A9A2U49-3 | 1 PPM | Go to step 6.e | Go to step 6.m | |
| | e. Check signal at 1A9A2U49-10 | 1 PPM | Go to step 6.f | Replace 1A9A2U49 | |
| | f. Check signal at 1A9A2U49-15 | 1 PPM | Go to step 6.g | Replace 1A9A2U49 | |
| | g. Check signal at 1A9A2U49-2 | 1 PPM | Go to step 6.h | Replace 1A9A2U49 | |
| | h. Check signal at 1A9A2U49-7 | 1 PPM | Go to step 6.i | Replace 1A9A2U49 | |
| | i. Check signal at 1A9A2Q3 emitter | 1 PPM | Go to step 6.j | Check 1A9A2Q3, 1A9A2R67, 1A9A2R68, 1A9A2R69, 1A9A2R91, 1A9A2C47, 1A9A2C48, 1A9A2C71, and 1A9A2CR21 | |

Table 5-17. Module 1A9 Troubleshooting (With 1A9A2 P/N 52002-9409-1) - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 6. (cont) | j. Check signal at 1A9A2Q4 emitter | 1 PPM | Go to step 6.k | Check 1A9A2Q4, 1A9A2R70, 1A9A2R71, 1A9A2R72, 1A9A2R92, 1A9A2C49, 1A9A2C50, 1A9A2C72, and 1A9A2CR22 | |
| | k. Check signal at 1A9A2Q5 emitter | 1 PPM | Go to step 6.l | Check 1A9A2Q5, 1A9A2R73, 1A9A2R74, 1A9A2R75, 1A9A2R93, 1A9A2C51, 1A9A2C52, 1A9A2C73, and 1A9A2CR23 | |
| | l. Check signal at 1A9A2Q6 emitter | 1 PPM | Go to step 6.m | Check 1A9A2Q6, 1A9A2R76, 1A9A2R77, 1A9A2R78, 1A9A2R94, 1A9A2C53, 1A9A2C54, 1A9A2C74, and 1A9A2CR24 | |
| | m. Check signal at 1A9A2U40-5 | 1 PPM | Replace 1A9A2U40 | Go to step 6.n | |
| | n. Check signal at 1A9A2U39-3 | 1 PPM | Go to step 6.o | Replace 1A9A2U28 | |
| | o. Check signal at 1A9A2U39-1 | $\overline{\text{1 PPM}}$ | Replace 1A9A2U39 | Replace 1A9A2U26 | |

5-3.14 <u>Module 1A10 Troubleshooting</u>. Connect module 1A10 as described in paragraph 5-3.6, Performance Test Procedure, then perform the steps of table 5-18.

5-3.15 <u>Module 1A14 Troubleshooting</u>. Connect module 1A14 as described in paragraph 5-3.7, Performance Test Procedure, then perform the steps of table 5-19.

5-3.16 <u>Module 1A16A1 Troubleshooting</u>.

NOTE

This UUT is unpowered during troubleshooting.

a. Refer to performance test results (paragraph 5-3.8).

b. Refer to table 5-20 and locate the symptom or symptoms found during the performance testing. Check the components listed for DC resistance or front-to-back ratio as appropriate.

Table 5-18. Module 1A10 Troubleshooting

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. | Check +5 Vdc supply: | | | | |
| | a. Check +5 Vdc at 1A10U4-2 | +5 Vdc ±0.3 Vdc | Go to step 2 | Go to step 1.b | |
| | b. Check voltage level at 1A10E8 | +7.6 Vdc ±1.0 Vdc | Set test fixture POWER OFF 1A10C34 for short. If C34 good, replace 1A10U4 | Check 1A10L17 for open and 1A10C32, 1A10C33, 1A10C39 for short | |
| 2. | Check frequency doubler: | | | | |
| | a. Using oscilloscope, check signal at 1A10A1U1-2 | 10 MHz sinewave signal | Go to step 3 | Go to step 2.b | |

Table 5-18. Module 1A10 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 2. (cont) | b. Check waveforms at 1A10A1T1-3 and -6 | a. Waveforms equal in amplitude and opposite in phase | Go to step 2.c | | |
| | | b. One phase missing | Set test fixture POWER OFF and check 1A10A1T1, 1A10A1R4, 1A10A1C8, 1A10A1CR9, and 1A10A1CR10 | | |
| | | c. Both phases low or missing | Set test fixture POWER OFF and check 1A10A1C7, 1A10A1R3, and 1A10A1T1 | | |
| | c. Set test fixture POWER OFF and check 1A10A1CR3, 1A10A1CR4, 1A10A1C3, 1A10A1C10, and 1A101L3 | | | | |
| 3. | Check 1 MHz circuitry: | | | | |
| | a. Using oscilloscope, check signal at 1A10A1U1-6 | 1 MHz square-wave | Go to step 3.b | Check +5 Vdc at 1A10A1U1-16. If present, replace 1A10A1U1; if not, go to step 5 | |

Table 5-18. Module 1A10 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 3. (cont) | b. Check signal at 1A10A1U3-5 and 1A10A1U3-18 | 1 MHz squarewave | Go to step 3.c | Check +5 Vdc at 1A10A1U3-20. If present replace 1A10A1U3; if not, go to step 5 | |
| | c. Check signal at junction of 1A10A1C25 and 1A10A1C24 | 1 MHz filtered sinewave | Check signal at junction of 1A10A1C30, 1A10A1C31. If signal is present at C30 and C31, go to step 3.d | Set test fixture POWER OFF and check 1A10A1CR7, 1A10A1R17, 1A10A1L13, 1A10A1C25, and 1A10A1C27 | |
| | | If low or missing at junction of 1A10A1C30, 1A10A1C31 | Set test fixture POWER OFF and check A10A1CR8, 1A10A1R18, 1A10A1L15, 1A10A1C30 and 1A10A1C28 | | |
| | | If low or missing at both junctions | Check 1A10A1C26, 1A10A1L12 | | |
| | d. Check 1 MHz at 1A10A4 and 1A10A3 | a. If low or missing at 1A10A4 | Check 1A10A1C24, 1A10A1L14 | | |
| | | b. If low or missing at 1A10A3 | Check 1A10A1C31, 1A10A1L16 | | |

Table 5-18. Module 1A10 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 4. | Check 100 KHz circuitry: | | | | |
| | a. Check signal at 1A10A1U2-6 | 100 KHz squarewave | Go to step 4.b | Check +5 Vdc at 1A10A1U2-16. If present replace 1A10A1U2, if not go to step 5 | |
| | b. Check signal at 1A10A1U3-14 | 100 KHz squarewave | Check at 1A10A1U3-7. If present at both points go to step 4.c | Replace 1A10A1U3 | |
| | c. Check signal at junction of 1A10A1C16 and 1A10A1C17 | 100 KHz filtered sinewave | Check also at junction 1A10A1C19, 1A10A1C20. If present at both points go to step 4.d | a. If low or missing at 1A10A1C16, 1A10A1C17 junction, set test fixture POWER OFF and check 1A10A1CR5, 1A10A1R15, 1A10A1L18, 1A10A1C16, and 1A10A1C18<br>b. If low or missing at junction 1A10A1C19, 1A10A1C20 check 1A10A1CR6, 1A10A1R16, 1A10A1L20, 1A10A1C19, and 1A10A1C21 | |

Table 5-18. Module 1A10 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 4. (cont) | | | | c. If both junctions are low or missing check 1A10A1C15 and 1A10A1L11 | |
| | d. Check 1A10A2 and 1A10A1 for 100 KHz | a. If 1A10A2 low or missing | Check 1A10A1C17 and 1A10A1L19 | | |
| | | b. If 1A10A1 low or missing | Check 1A10A1C20 and 1A10A1L21 | | |
| 5. | Check +5 Vdc distribution, set test fixture POWER OFF and check 1A10A1C38, 1A10A1L9, 1A10A1C12, 1A10A1C37, 1A10A1C3, 1A10A1L2, 1A10A1C1, 1A10A1L1, 1A10A1L10, 1A10A1C13, 1A10A1C14, and 1A10A1C22 | Components check good | | Replace components found defective | |

Table 5-19. Module 1A14 Troubleshooting

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. | Check indicator logic: | | | | |
| | a. Set test fixture POWER ON | Front panel AC IN USE lamp lights | Go to step 1.b | Check 1A14A1C28, 1A14A1R35, 1A14A1R36, 1A14A1R37, 1A14A1CR13, and 1A14A1CR16 | |
| | b. Verify DC AVAIL front panel lamp is lit | DC AVAIL lamp is lit | Go to step 1.c | Check 1A14A1R21, 1A14A1CR7, 1A14A1CR8, 1A14A1R24, and 1A14A1R23 | |
| | c. Verify BAT AVAIL front panel lamp lit | BAT AVAIL front panel lamp is lit | Go to step 1.d | Go to step 1.i | |
| | d. Disconnect AC source | AC IN USE lamp goes out and DC IN USE lamp lights | Go to step 1.e | Check dc level at 1A14A1U7-6. If TTL low replace 1A14A1R31. If TTL high replace 1A14A1U7 | |
| | e. Disconnect DC source | DC IN USE goes out and BAT IN USE lamp lights | Go to step 1.f | Replace 1A14A1U7 | |
| | f. Check dc voltage at 1A14A1CR17 cathode | DC level at 1A14A1CR17 cathode should be approx-imately 1 volt | Go to step 1.g | Go to step 1.h | |

Table 5-19. Module 1A14 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 1. (cont) | g. Reconnect AC source to test fixture | +18 Vdc | | Replace 1A14A1CR17 | |
| | h. Check level at 1A14A1U7-11 | a. If TTL high | Check A14A1CR18, A14A1Q4, A14A1R45 | | |
| | | b. If TTL low | Replace 1A14A1U7 | | |
| | i. Check dc level at 1A14P1-24 | a. If +18 Vdc or higher | Check 1A14A1R26, 1A14A1R27, 1A14A1R28, 1A14A1CR11 | | |
| | | b. If 0 Vdc | Go to step 2 | | |
| 2. | Check battery charger: | | | | |
| | a. Check dc level at 1A14P1-12 | a. If +17 Vdc or higher | Go to step 2.b | | |
| | | b. If +16.9 Vdc or lower | Go to step 2.d | | |
| | b. Check dc level at 1A14A1U8-6 | a. If level is +10 Vdc to +18 Vdc | Go to step 2.c | | |

Table 5-19. Module 1A14 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 2. (cont) | | b. If level is +2 Vdc or less | Set test fixture POWER OFF and check 1A14A1R49 through 1A14A1R53, 1A14A1R56, 1A14A1R57, 1A14A1R58, and 1A14A1C30. If these check good, replace 1A14A1U8 | | |
| | c. Check dc level at 1A14A1Q5-collector | a. If +18 Vdc | Check 1A14A1R57, 1A14A1R58, and 1A14A1Q5 | | |
| | | b. If 0 Vdc | Check 1A14A1R59. If 1A14A1R59 checks good, replace 1A14A1K1 | | |
| | d. Set test fixture POWER OFF. Disconnect text fixture battery connector 1A17P1. Set text fixture POWER ON | | Go to step 2.e | | |

Table 5-19. Module 1A14 Troubleshooting - Continued

| Step | Instruction | Indication | Yes | No | Remarks |
|---|---|---|---|---|---|
| 2. (cont) | e. Check dc level at the junction of 1A14A1CR12 and 1A14A1R30 | a. If +23 Vdc | Go to step 2.f | | |
| | | b. If 0 Vdc | Set test fixture POWER off check 1A14A1R30, 1A14A1R32, 1A14A1C27, 1A14A1R33, 1A14A1R34, and 1A14A1C28. If these check good, replace 1A14A1U6 | | |
| | f. Check dc level at 1A14P1-14 | a. If +23 Vdc | Check wiring through 1A14P1 | | |
| | | b. If 0 Vdc | Replace 1A14A1CR12 | | |

Table 5-20. Module 1A16A1 Troubleshooting

| Meter switch failed indication position | Check components |
|---|---|
| (All positions) | C6, C7, C8, C9, R28, R29, R30, R31, R32, R33, R34. If these all check good, replace U1. |
| 0 | CR1, R1, R2, R22, R24 |
| 1 | R4, R14, R24 |
| 2 | R5, R15, R24 |
| 3 | R6, R16, R35 |
| 4 | CR2, R25, R26 |
| 5 | CR1, R7 |
| 6 | R8, CR1 |
| 7 | C1, R9, R17 |
| 8 | C2, C5, R10, R18, R23, R27 |
| 9 | C3, R11, R19 |
| 10 | R12, R20 |
| 11 | C4, R13, R21 |

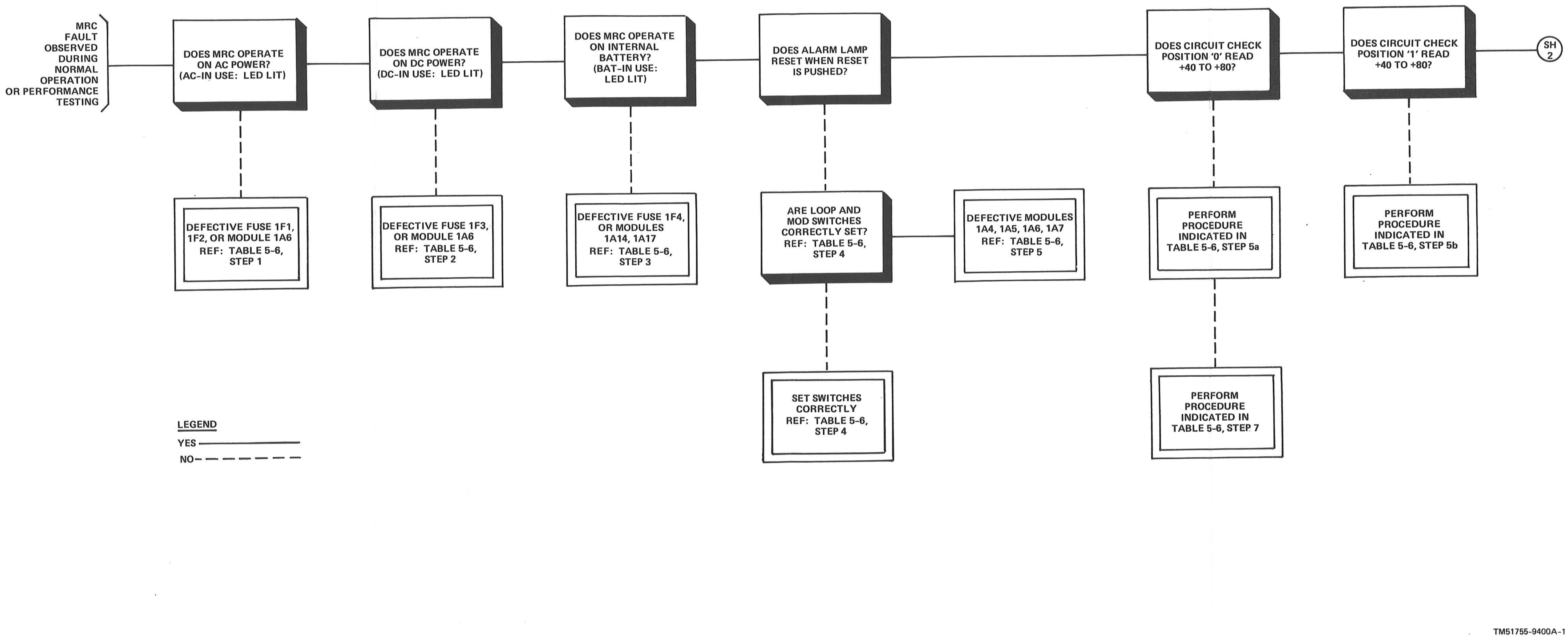



Figure 5-1. Fault Logic Diagram
(Sheet 1 of 3)

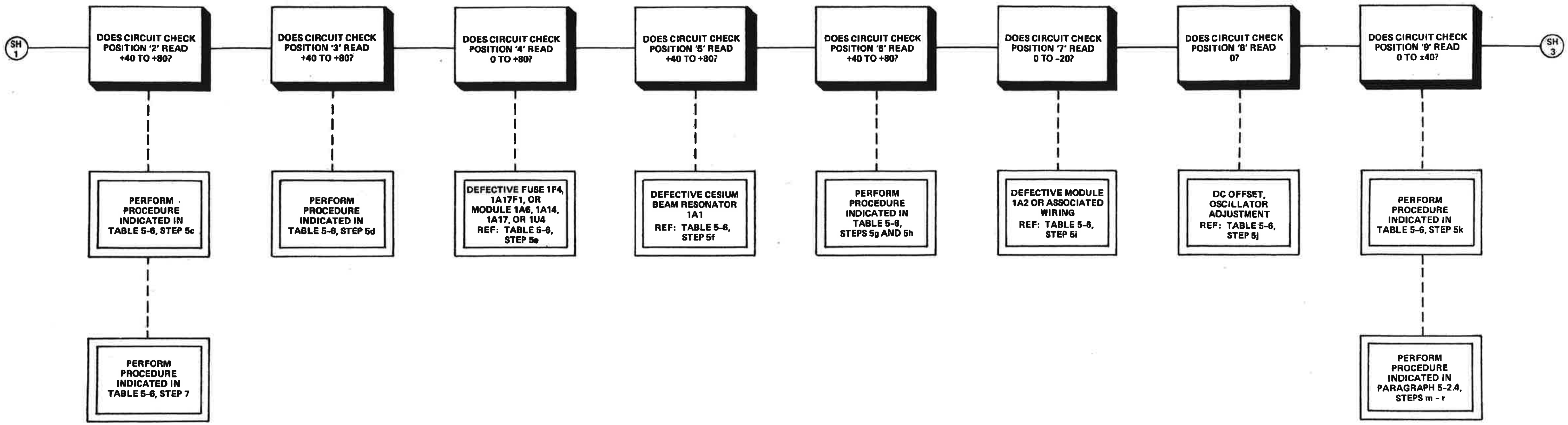
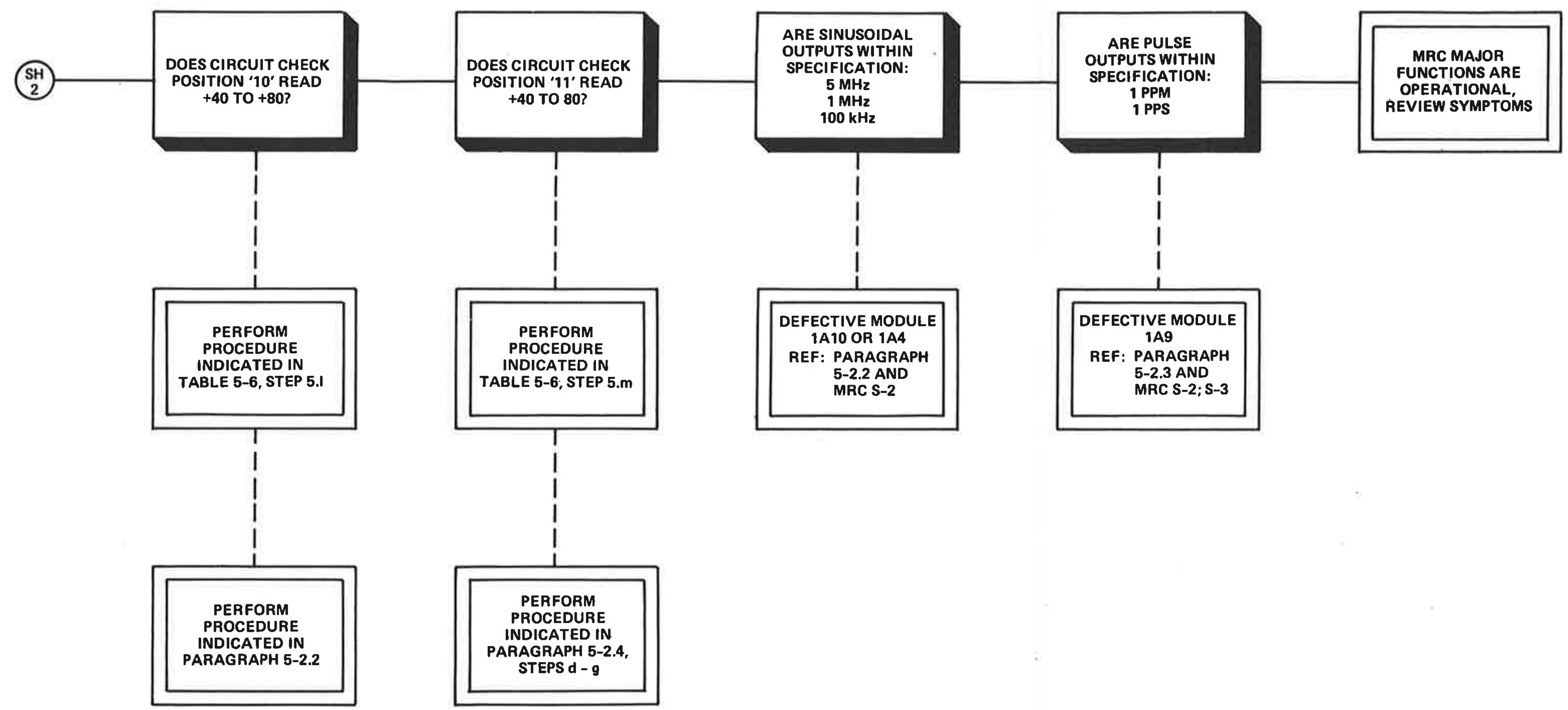
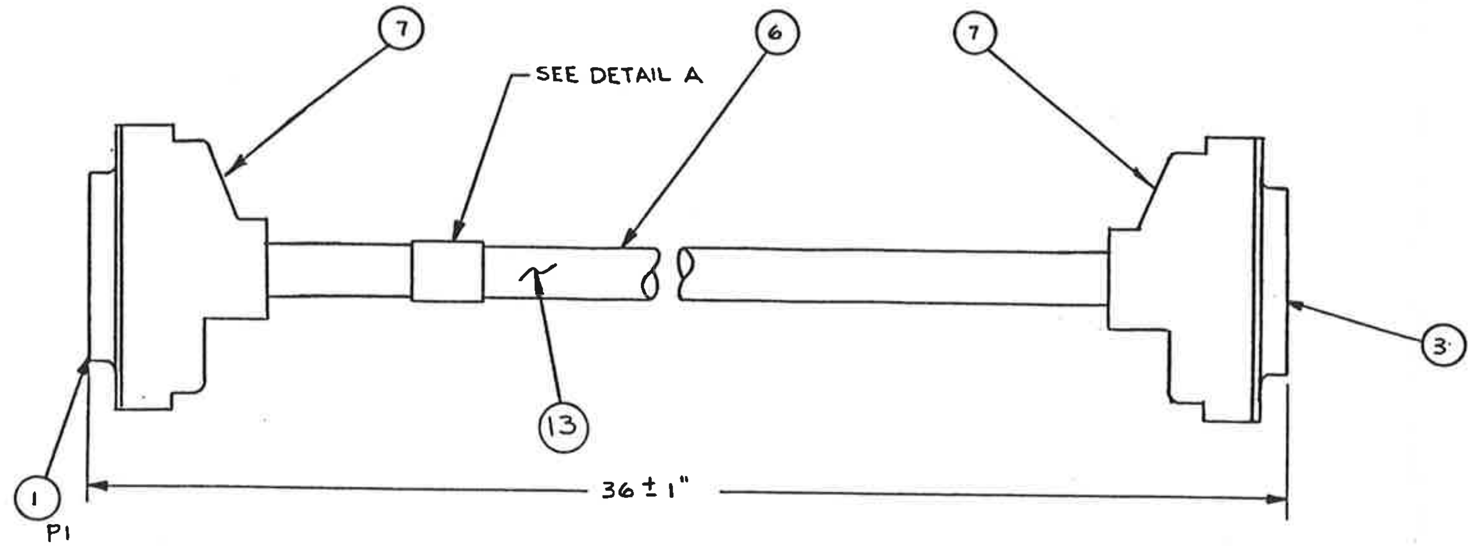



Figure 5-1. Fault Logic Diagram (Sheet 2 of 3)




TM51755-9400A-3F

Figure 5-1. Fault Logic Diagram
(Sheet 3 of 3)




8

PN C52086-9406
(POWER SUPPLY, A6)

DETAIL A

WIRE RUN LIST, P1 TO J1, CABLE A6

| PIN | FUNCTION | WIRE TYPE |
|---|---|---|
| 1 | +17-35 Vdc INPUT | NO. 22 AWG, MIL-W-16878, TYPE E |
| 2 | +13.5 Vdc (CLOCK) | |
| 3 | -18 Vdc | |
| 4 | -12 Vdc (CLOCK) | NO. 22 AWG, MIL-W-16878, TYPE E |
| 5 | NO CONNECTION | - |
| 6 | +18 Vdc | NO. 22 AWG, MIL-W-16878, TYPE E |
| 7 | +5 Vdc (CLOCK) | |
| 8 | -1 Vdc | |
| 9 | +7.6 Vdc | |
| 10 | +1 Vdc | |
| 11 | -7.6 Vdc (RTN) | |
| 12 | +7.6 Vdc | |
| 13 | HOT WIRE | |
| 14 | +17-35 Vdc INPUT | NO. 22 AWG, MIL-W-16878, TYPE E |
| 15 | NO CONNECTION | - |
| 16 | NO CONNECTION | - |
| 17 | NO CONNECTION | - |
| 18 | +18 Vdc | NO. 22 AWG, MIL-W-16878, TYPE E |
| 19 | +5 Vdc (CLOCK) | |
| 20 | +17-35 Vdc (RTN) | |
| 21 | +17-35 Vdc (RTN) | |
| 22 | RETURN | |
| 23 | RETURN | |
| 24 | RETURN | |
| 25 | RETURN | NO. 22 AWG, MIL-W-16878, TYPE E |

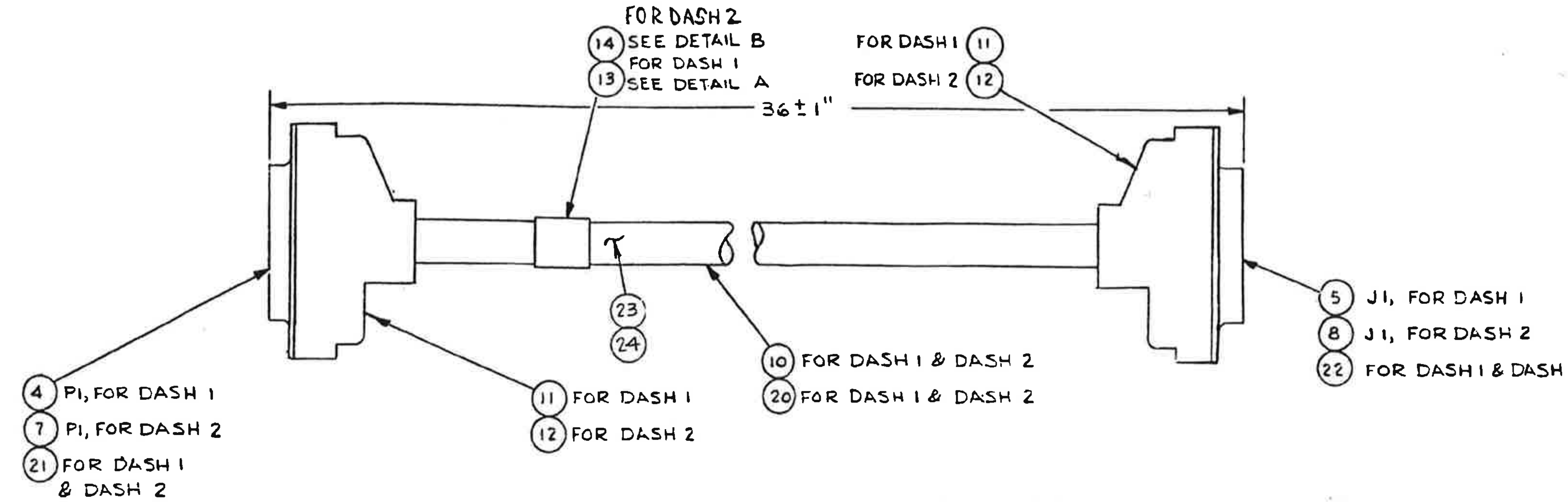
| QUANTITY -3 | QUANTITY -2 | QUANTITY — | LENGTH | FEI CODE | CODE IDENT | PART NO. | SIZE | FEI PART NO | DESCRIPTION | NOTE | ITEM NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 33.5 +.50 -.00 | A41 | 61501 | I.D. 5/16 O.D. 7/16 | | | TYGON PLASTIC TUBING | | 13 |
| | | | | | | | | | | | 12 |
| | | | | | | | | | | | 11 |
| | | | | | | | | | | | 10 |
| | | | | | | | | | | | 9 |
| | | 1 | | 568 | 25480 | SLSH-20225 | | | MARKER (BRADY SHEET) | | 8 |
| | | 2 | | 128 | 71468 | DB51212 | | | JUNCTION SHELL, STRAIGHT | | 7 |
| | | AR | | 128 | 92194 | NO. 22 AWG | | | WIRE, ELEC (INSUL HIGH TEMP. MIL-W-16878, TYPE E | | 6 |
| | | | | | | | | | | | 5 |
| | | | | | | | | | | | 4 |
| | | 1 | | 28 | 71468 | DBMM25S(M24308/F3) | | | CONNECTOR, 25 SOCKETS, J1 | | 3 |
| | | | | | | | | | | | 2 |
| | | 1 | | 28 | 71468 | DBMM25P(M24308/33) | | | CONNECTOR, 25 PINS, P1 | | 1 |

MATERIALS AND TABULATED ITEMS

REV | SHEET 1 | SHEET INDEX

TM52086-9406A

Figure 5-2. Test Cable Assembly for 1A6, Fabrication Instructions




13 REF

PN C52087-9407-1
(SYNTHESIZER A7)

DETAIL A

14 REF

PN C52087-9407-2
(SYNTHESIZER A7)

DETAIL B

WIRE RUN LIST, P1 TO J1, CABLE A7-1

| PIN | FUNCTION | WIRE TYPE |
|---|---|---|
| 1 | +18 Vdc INPUT | NO. 22 AWG, MIL-W-16878, TYPE E |
| 2 | RETURN | |
| 3 | -18 Vdc INPUT | |
| 4 | RETURN | |
| 5 | +7.6 Vdc INPUT | |
| 6 | CONTROL SIGNAL MONITOR (TO A4) | |
| 7 | TO GREEN LED | |
| 8 | TO RED LED | |
| 9 | TO RESET | |
| 10 | TO TIMING FAULT | |
| 11 | +18 Vdc RETURN | No. 22 AWG, MIL-W-16878, TYPE E |
| 12 | NO CONNECTION | - |
| 13 | NO CONNECTION | - |
| 14 | NO CONNECTION | - |
| 15 | NO CONNECTION | - |
| 16 | NO CONNECTION | - |
| 17 | NO CONNECTION | - |
| A1 | 83 Hz MODULATION | RG-178 B/U |
| A2 | CONTROL SIGNAL (TO A4) | |
| A3 | 7+ MHz VCO VOLT (TO A5) | |
| A4 | 7+ MHz INPUT (FROM A5) | RG-178 B/U |

WIRE RUN LIST, P1 TO J1, CABLE A7-2

| PIN | FUNCTION | WIRE TYPE |
|---|---|---|
| 1 | 5 MHz OUTPUT (SQ WAVE) | NO. 22 AWG, MIL-W-16878, TYPE E |
| 2 | 5 MHz OUTPUT (SQ WAVE) RETURN | |
| 3 | 167 Hz DETECTOR | |
| 4 | SYNTHESIZER LOCK INDICATOR | NO. 22 AWG, MIL-W-16878, TYPE E |
| 5 | NO CONNECTION | - |
| 6 | NO CONNECTION | - |
| 7 | NO CONNECTION | - |
| 8 | NO CONNECTION | - |
| 9 | NO CONNECTION | - |
| A1 | 5 MHz INPUT | RG-178 B/U |
| A2 | 5 MHz OUTPUT | |
| A3 | 5 MHz OUTPUT (SQ WAVE) | |
| A4 | 83 Hz INPUT | RG-178 B/U |

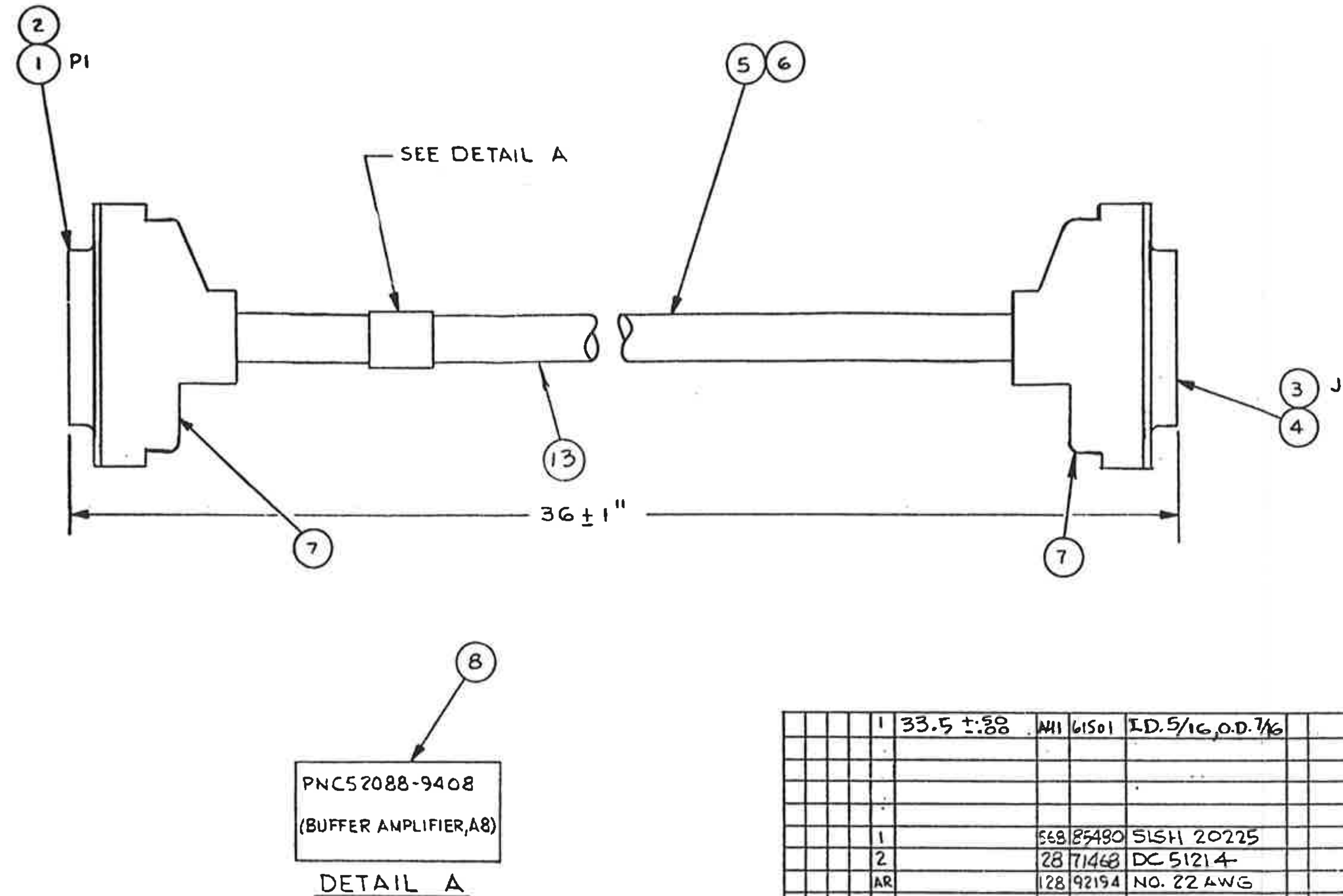
| QUANTITY -3 | QUANTITY -2 | QUANTITY -1 | LENGTH | FEI CODE | CODE IDENT | PART NO | SIZE | FEI PART NO | DESCRIPTION | NOTE | ITEM NO |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | - | 33.5 ±.50/.00 | A41 | [illegible] | I.D. 1/4, O.D 5/8 | | | TYGON PLASTIC TUBING | | 24 |
| | - | 1 | 33.5 ±.50/.00 | A41 | [illegible] | I.D 5/16 O.D 7/16 | | | TYGON PLASTIC TUBING | | 23 |
| | 4 | 4 | | 28 | 71468 | DM 53742-5092 | | | COAX CONTACT, RECEPT, STRAIGHT | | 22 |
| | 4 | 4 | | 28 | 71468 | DM53740-5105 | | | COAX CONTACT, RECEPT, STRAIGHT | | 21 |
| | AR | AR | | 128 | 92194 | RG-178 B/U | | | WIRE, COAX | | 20 |
| | | | | | | | | | | | 19 |
| | | | | | | | | | | | 18 |
| | | | | | | | | | | | 17 |
| | | | | | | | | | | | 16 |
| | | | | | | | | | | | 15 |
| | 1 | - | | 568 | 85480 | SLSH-20225 | | | MARKER (BRADY SHEET) | | 14 |
| | - | 1 | | 568 | 85480 | SLSH-20225 | | | MARKER (BRADY SHEET) | | 13 |
| | 2 | - | | 28 | 71468 | DB 51212-1 | | | JUNCTION SHELL STRAIGHT | | 12 |
| | - | 2 | | 28 | 71468 | DC 51214-1 | | | JUNCTION SHELL STRAIGHT | | 11 |
| | AR | AR | | 128 | 92194 | NO. 22 AWG | | | WIRE, ELEC (INSUL HIGH TEMP) MIL-W-16878 TYPE E | | 10 |
| | | | | | | | | | | | 9 |
| | 1 | - | | 28 | 71468 | DBMM9W4S | | | CONNECTOR, J1 | | 8 |
| | 1 | - | | 28 | 71468 | DBMM9W4P | | | CONNECTOR, P1 | | 7 |
| | | | | | | | | | | | 6 |
| | - | 1 | | 28 | 71468 | DCMM21WA4S | | | CONNECTOR, J1 | | 5 |
| | - | 1 | | 28 | 71468 | DCMM21WA4P | | | CONNECTOR, P1 | | 4 |
| | | | | | | | | | | | 3 |
| | X | | | | | | | THIS DWG -2 | CABLE ASSEMBLY | | 2 |
| | | X | | | | | | THIS DWG -1 | CABLE ASSEMBLY | | 1 |

MATERIALS AND TABULATED ITEMS

REV | SHEET 1 | SHEET INDEX

TM52087-9407A

Figure 5-3. Test Cable Assemblies 1A7-1 and 1A7-2 for 1A7, Fabrication Instructions




| Quantity | | -3 | -2 | — | LENGTH | FE: CODE | CODE IDENT | PART NO. | SIZE | FEI PART NO. | DESCRIPTION | NOTE | ITEM NO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 33.5 +.50 -.00 | A41 | 61501 | I.D. 5/16, O.D. 7/16 | | | TYGON, PLASTIC TUBING | | 13 |
| | | | | | | | | | | | | | 12 |
| | | | | | | | | | | | | | 11 |
| | | | | | | | | | | | | | 10 |
| | | | | | | | | | | | | | 9 |
| | | | | 1 | | 568 | 85480 | SLSH 20225 | | | MARKER (BRADY SHEET) | | 8 |
| | | | | 2 | | 28 | 71468 | DC 51214 | | | JUNCTION SHELL, STRAIGHT | | 7 |
| | | | | AR | | 128 | 92194 | NO. 22 AWG | | | WIRE, ELEC | | 6 |
| | | | | AR | | 128 | 92194 | RG-178 B/U | | | WIRE, COAXIAL | | 5 |
| | | | | 6 | | 28 | 71468 | DM53742-5092 | | | COAX CONTACT RECEPT STRAIGHT | | 4 |
| | | | | 1 | | 28 | 71468 | DCMM 13W6S | | | CONNECTOR, COMBINATION J1 | | 3 |
| | | | | 6 | | 28 | 71468 | DM53740-5105 | | | COAX CONTACT, PLUG STRAIGHT | | 2 |
| | | | | 1 | | 28 | 71468 | DCMM 13W6P | | | CONNECTOR, COMBINATION, P1 | | 1 |

MATERIALS AND TABULATED ITEMS

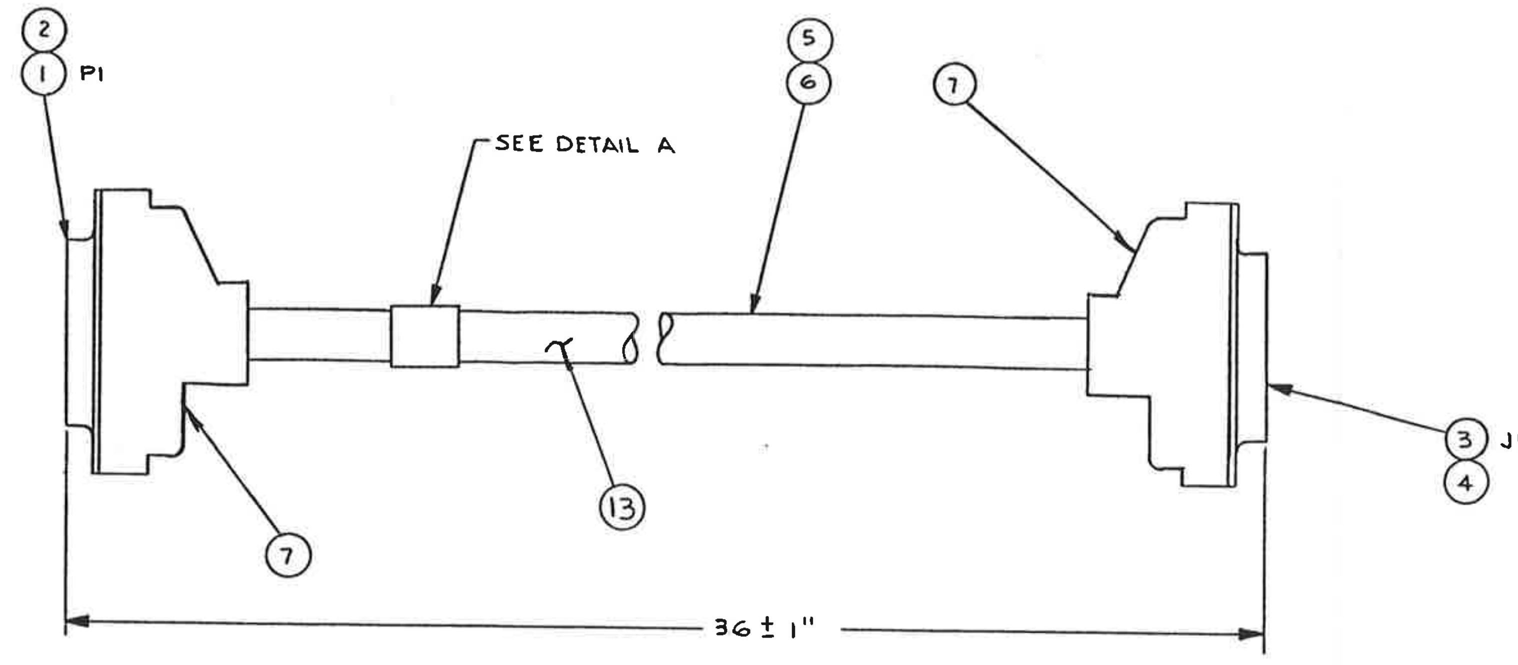
| | | |
|---|---|---|
| REV | | SHEET INDEX |
| SHEET | 1 | |

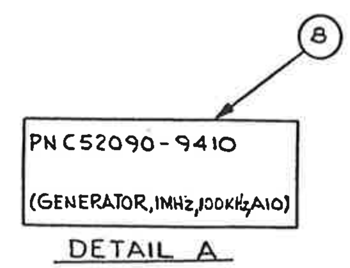
WIRE RUN LIST, P1 TO J1, CABLE A8

| PIN | FUNCTION | WIRE TYPE |
|---|---|---|
| 1 | MONITOR OUTPUT | NO. 22 AWG, MIL-W-16878, TYPE E |
| 2 | +18 Vdc RETURN | NO. 22 AWG, MIL-W-16878, TYPE E |
| 3 | NO CONNECTION | - |
| 4 | NO CONNECTION | - |
| 5 | NO CONNECTION | - |
| 6 | +18 Vdc | NO. 22 AWG, MIL-W-16878, TYPE E |
| 7 | +18 Vdc RETURN | NO. 22 AWG, MIL-W-16878, TYPE E |
| A1 | 5 MHz INPUT | RG-178 B/U |
| A2 | 5 MHz OUTPUT | |
| A3 | 5 MHz OUTPUT | |
| A4 | 5 MHz OUTPUT | |
| A5 | 5 MHz OUTPUT | |
| A6 | 5 MHz OUTPUT | RG-178 B/U |

TM52088-9408A

Figure 5-4. Test Cable Assembly for 1A8, Fabrication Instructions




| QUANTITY -3 | -2 | — | LENGTH | FEI CODE | CODE IDENT | PART NO. | SIZE | FEI PART NO. | DESCRIPTION | NOTE | ITEM NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 33.5 ±.58/.88 | A41 | 615a1 | I.D. 1/4, O.D 3/8 | | | TYGON PLASTIC TUBING | | 13 |
| | | | | | | | | | | | 12 |
| | | | | | | | | | | | 11 |
| | | | | | | | | | | | 10 |
| | | | | | | | | | | | 9 |
| | | 1 | | 568 | 35480 | SLSH 20225 | | | MARKER (BRADY SHEET) | | 8 |
| | | 2 | | 28 | 71468 | DB51212 | | | JUNCTION SHELL STRAIGHT | | 7 |
| | | AR | | 128 | 92194 | NO. 22 AWG | | | WIRE, ELEC (INSUL, HIGH TEMP, MIL-W-16878, TYPE E | | 6 |
| | | AR | | 128 | 92194 | RG-178 B/U | | | WIRE, COAXIAL | | 5 |
| | | 4 | | 28 | 71468 | DM53742-5092 | | | COAX CONTACT, RECEPT, STRAIGHT | | 4 |
| | | 1 | | 28 | 71468 | DBMM9W4S | | | CONNECTOR, COMBINATION J1 | | 3 |
| | | 4 | | 28 | 71468 | DM53740-5105 | | | COAX CONTACT, PLUG, STRAIGHT | | 2 |
| | | 1 | | 28 | 71468 | DBMM9W4P | | | CONNECTOR, COMBINATION P1 | | 1 |

MATERIALS AND TABULATED ITEMS

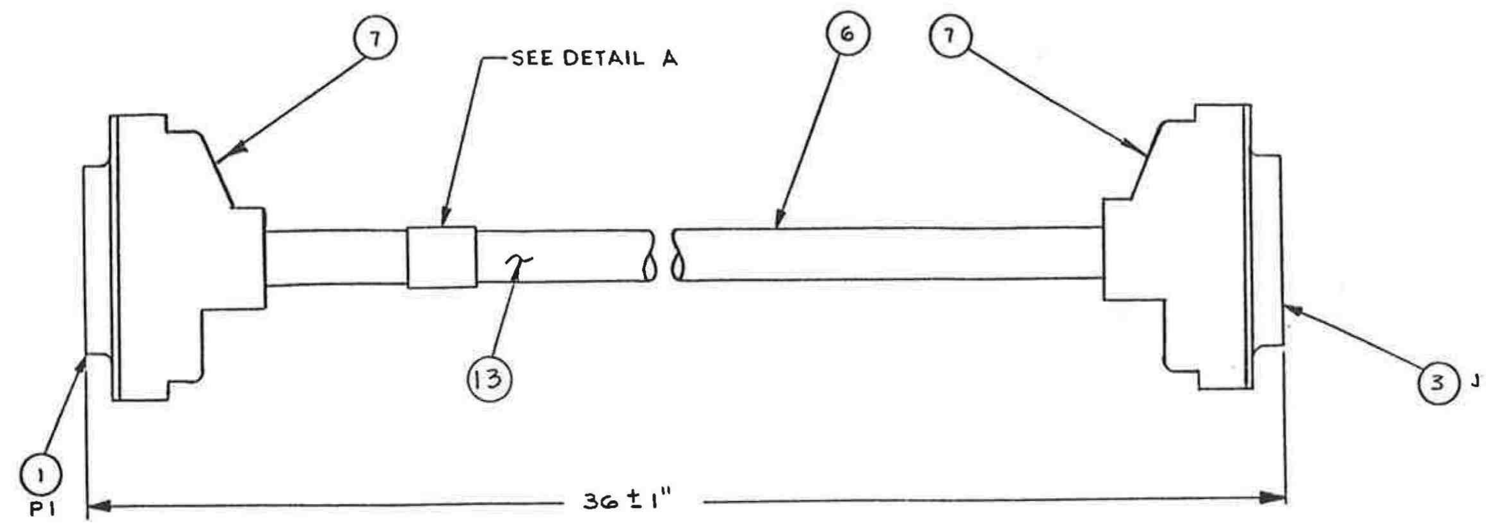
REV | 1 SHEET | SHEET INDEX

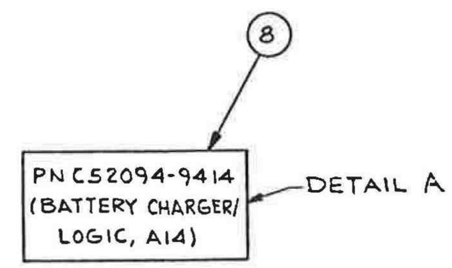
WIRE RUN LIST, P1 TO J1, CABLE A10

| PIN | FUNCTION | WIRE TYPE |
|---|---|---|
| 1 | +7.6 Vdc | NO. 22 AWG, MIL-W-16878, TYPE E |
| 2 | RETURN | NO. 22 AWG, MIL-W-16878, TYPE E |
| 3 | NO CONNECTION | - |
| 4 | 5 MHz INPUT | NO. 22 AWG, MIL-W-16878, TYPE E |
| 5 | 5 MHz RETURN | NO. 22 AWG, MIL-W-16878, TYPE E |
| A1 | 100 KHz +13 dBm | RG-178 B/U |
| A2 | 100 KHz +13 dBm | |
| A3 | 1 MHz +13 dBm | |
| A4 | 1 MHz +13 dBm | RG-178 B/U |

TM52090-9410A

Figure 5-5. Test Cable Assembly for 1A10, Fabrication Instructions




WIRE RUN LIST, P1 TO J1, CABLE A14

| PIN | FUNCTION | WIRE TYPE |
|---|---|---|
| 1 | +22 Vdc -30 Vdc INPUT | NO. 22 AWG, MIL-W-16878, TYPE E |
| 2 | TO DISPLAY RELAY A9 | |
| 3 | +5 Vdc | |
| 4 | LED (-) DC IN USE | |
| 5 | LED (+) DC AVAIL. | |
| 6 | LED (-) BAT. IN USE | NO. 22 AWG, MIL-W-16878, TYPE E |
| 7 | NO CONNECTION | - |
| 8 | LED (+) AC IN USE | NO. 22 AWG, MIL-W-16878, TYPE E |
| 9 | SENSOR (+) | |
| 10 | LED (+) BATTERY AVAIL. | |
| 11 | BATTERY | |
| 12 | BATTERY OUTPUT | |
| 13 | BATTERY OUTPUT | |
| 14 | CHARGER INPUT | NO. 22 AWG, MIL-W-16878, TYPE E |
| 15 | NO CONNECTION | - |
| 16 | SENSOR, GROUND | NO. 22 AWG, MIL-W-16878, TYPE E |
| 17 | SENSOR, GROUND | |
| 18 | SENSOR, GROUND | |
| 19 | SENSOR, GROUND | |
| 20 | SENSOR, GROUND | |
| 21 | TO METER CIRCUIT | |
| 22 | GROUND | |
| 23 | GROUND | |
| 24 | BATTERY | |
| 25 | +18 Vdc | NO. 22 AWG, MIL-W-16878, TYPE E |

| QUANTITY | | -3 | -2 | — | LENGTH | FEI CODE | CODE IDENT | PART NO. | SIZE | FEI PART NO. | DESCRIPTION | NOTE | ITEM NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 33.5 +.50 -.00 | A41 | 61501 | | | I.D. 5/16 O.D. 7/16 | TYGON TUBING | | 13 |
| | | | | | | | | | | | | | 12 |
| | | | | | | | | | | | | | 11 |
| | | | | | | | | | | | | | 10 |
| | | | | | | | | | | | | | 9 |
| | | | | 1 | | 568 | 35480 | SLSH-20225 | | | MARKER (BRADY SHEET) | | 8 |
| | | | | 2 | | 28 | 71468 | DB 51212 | | | JUNCTION SHELL STRAIGHT | | 7 |
| | | | | AR | | 128 | 92194 | NO. 22 AWG | | | WIRE ELEC (INSUL HIGH TEMP) MIL-W-16878, TYPE E | | 6 |
| | | | | | | | | | | | | | 5 |
| | | | | | | | | | | | | | 4 |
| | | | | 1 | | 28 | 71468 | DBMM25S(M24308/1-3) | | | CONNECTOR, 25 SOCKETS, J1 | | 3 |
| | | | | | | | | | | | | | 2 |
| | | | | 1 | | 28 | 71468 | DBMM25P(M24308/3-3) | | | CONNECTOR, 25 PINS, P1 | | 1 |

MATERIALS AND TABULATED ITEMS

REV 1 SHEET — SHEET INDEX

TM52094-9414A

Figure 5-6. Test Cable Assembly for 1A14, Fabrication Instructions

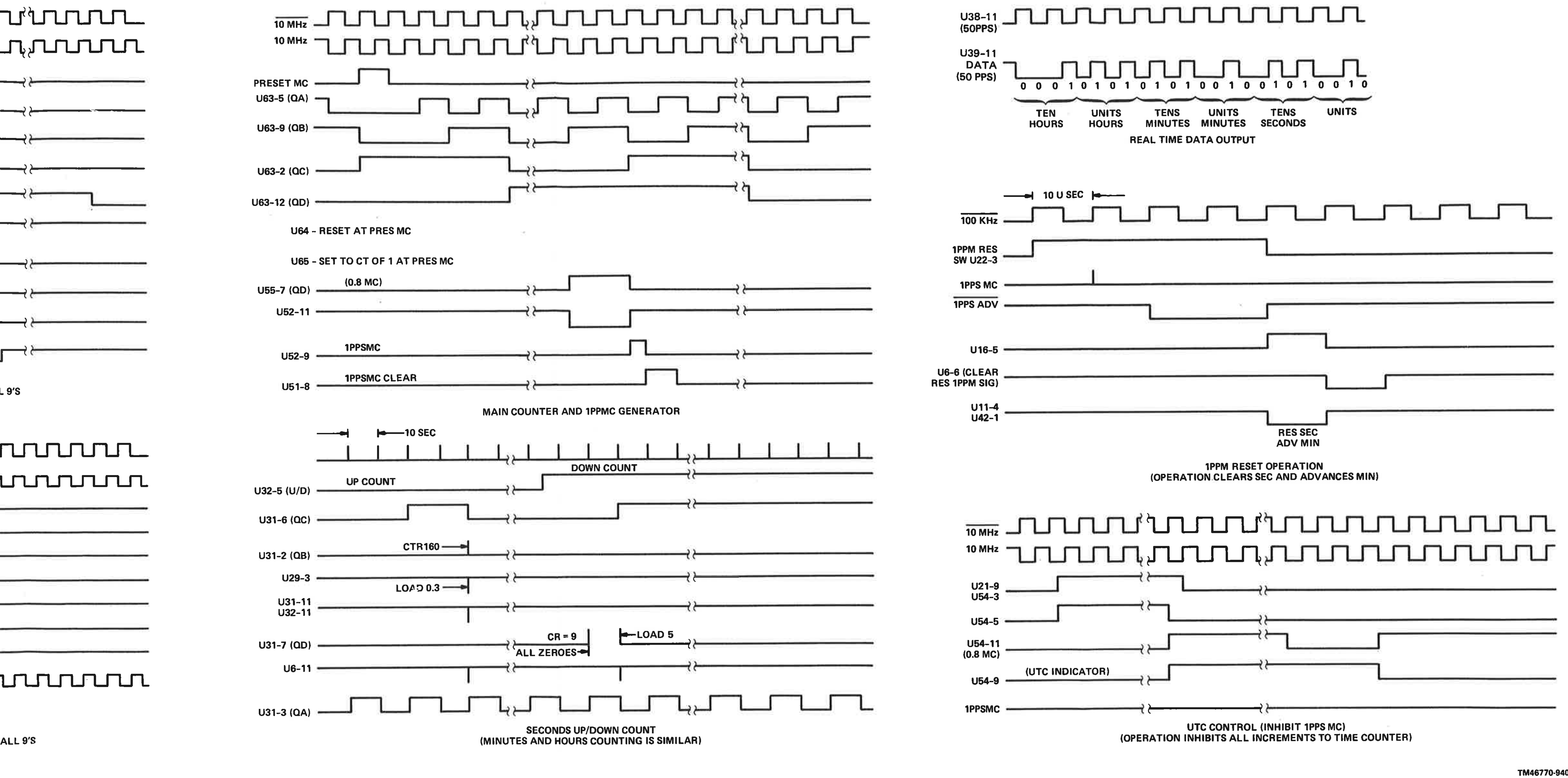
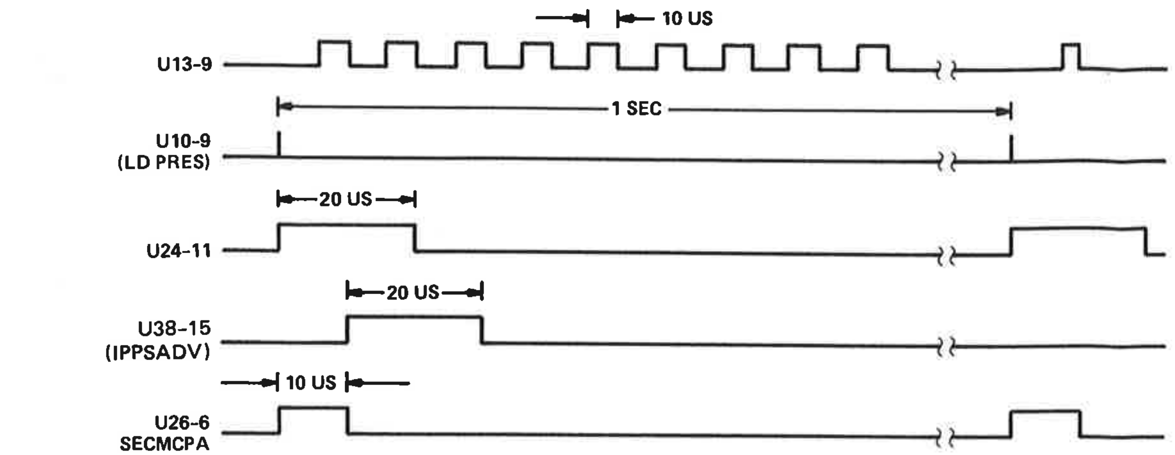
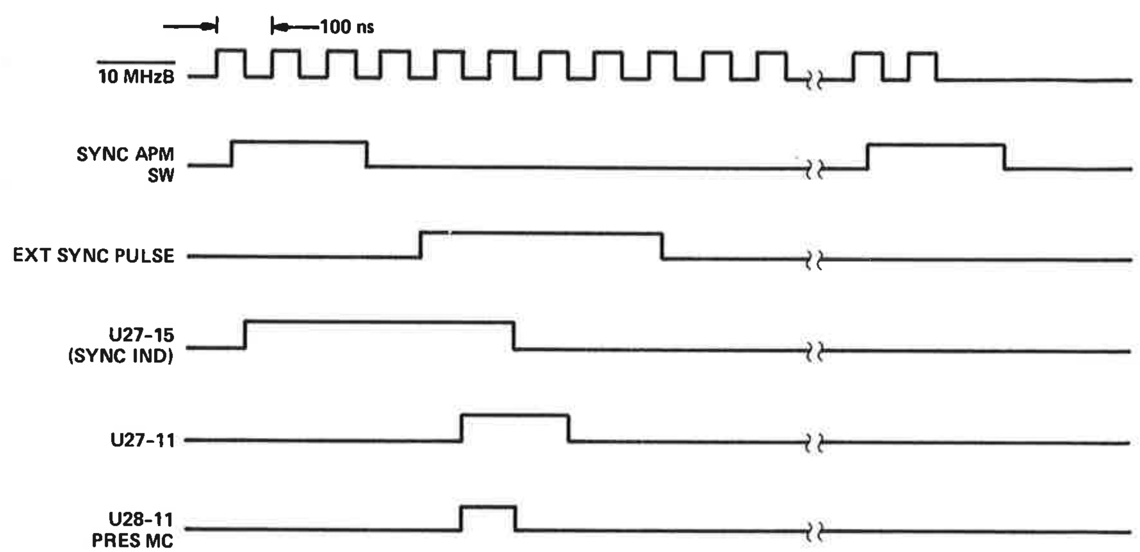


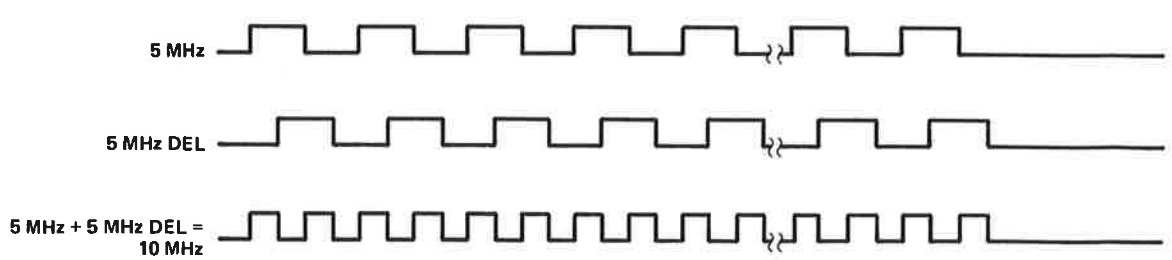

Figure 5-7. Real Time-of-Day Clock Module 1A9A2, Timing Diagram (For 1A9A2 Part No. 52002-9409)



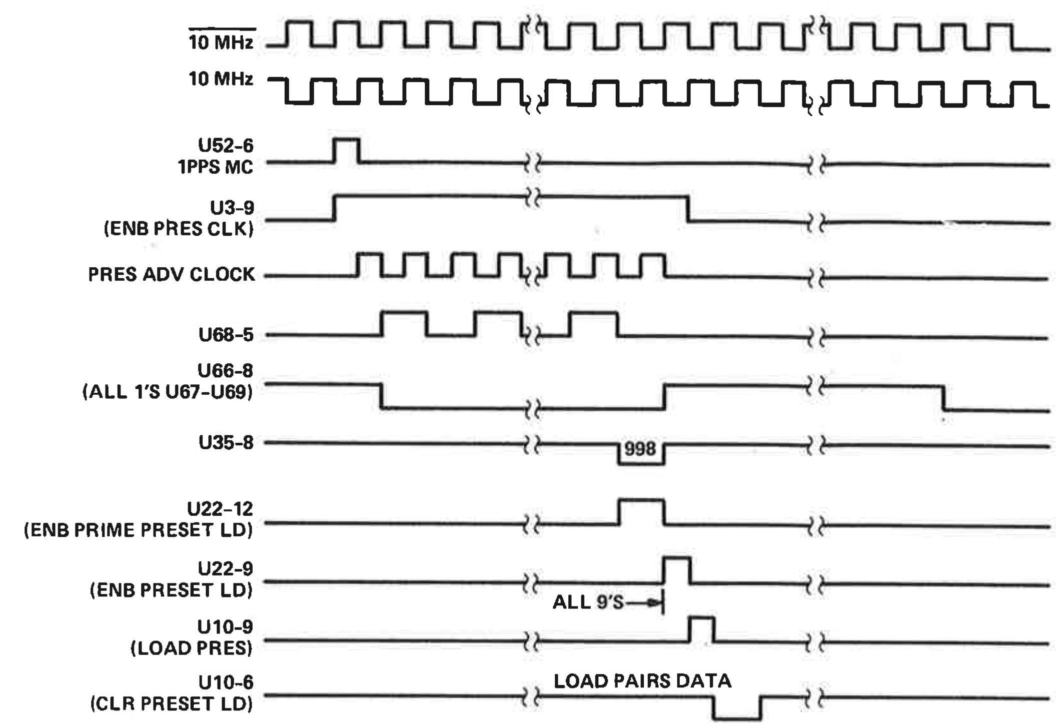

IPPS GENERATION



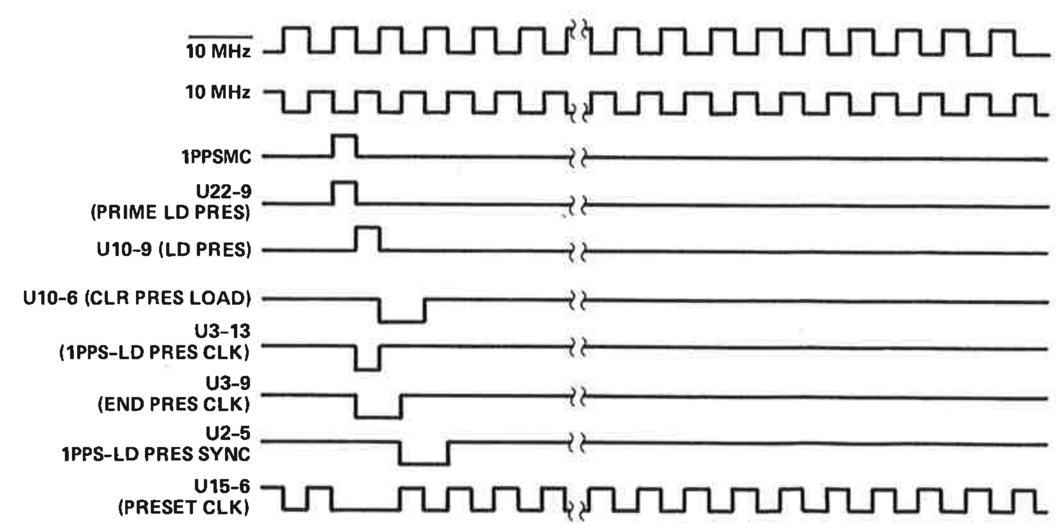

SYNC ARM - EXT SYNC
(EXTERNAL SYNCHRONIZATION OF COUNTER)



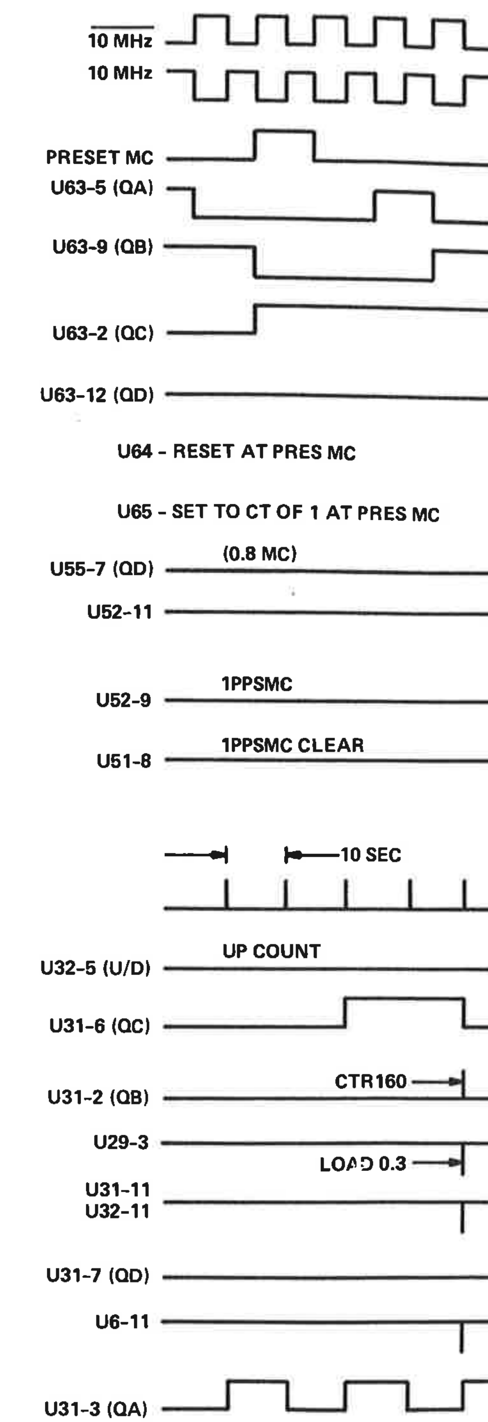

10 MHz GENERATOR
(5 MHz DOUBLER)




PRESET ADV SWITCHES NOT ALL 9'S




PRESET ADV SWITCHES SET TO ALL 9'S



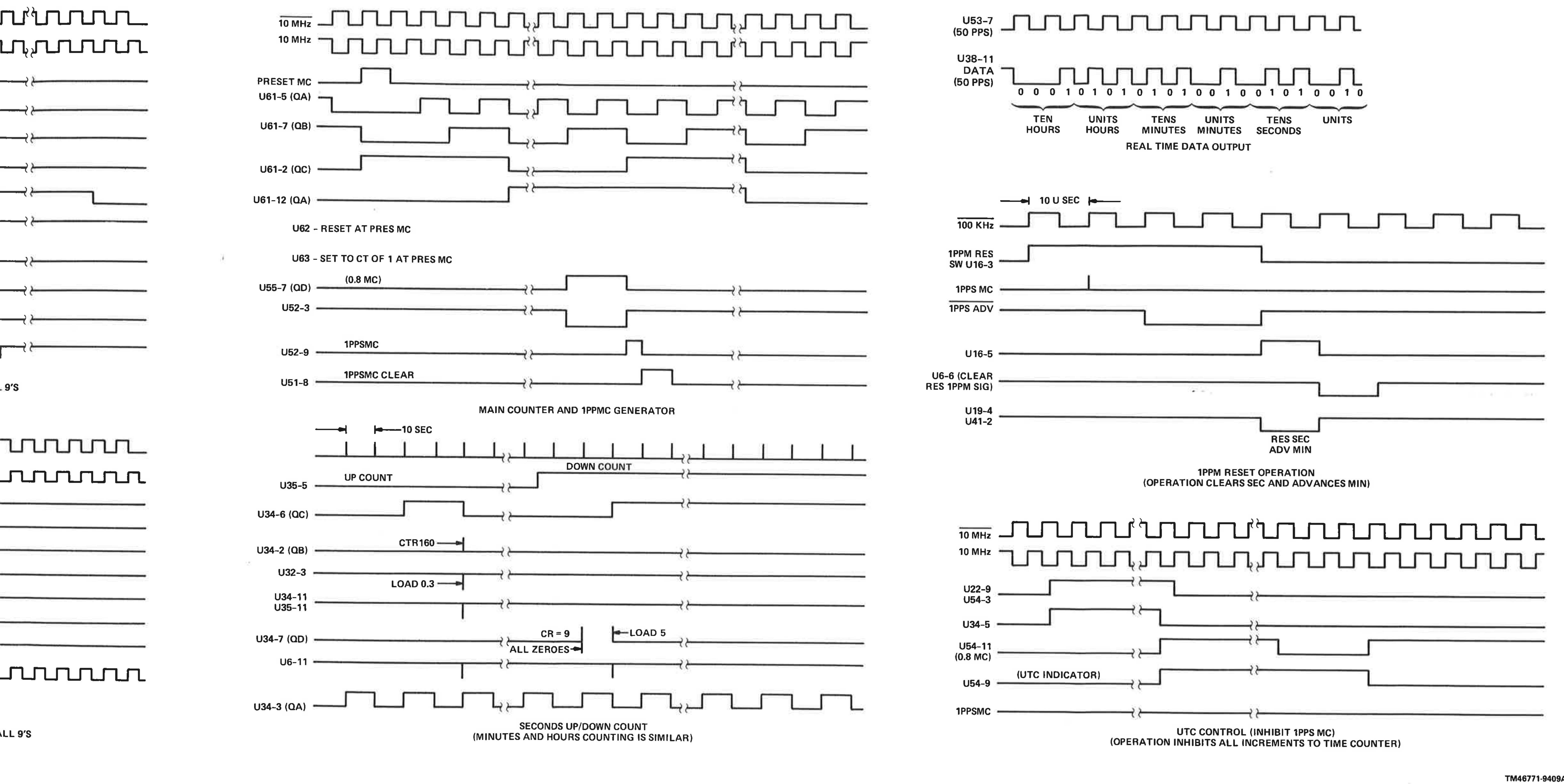
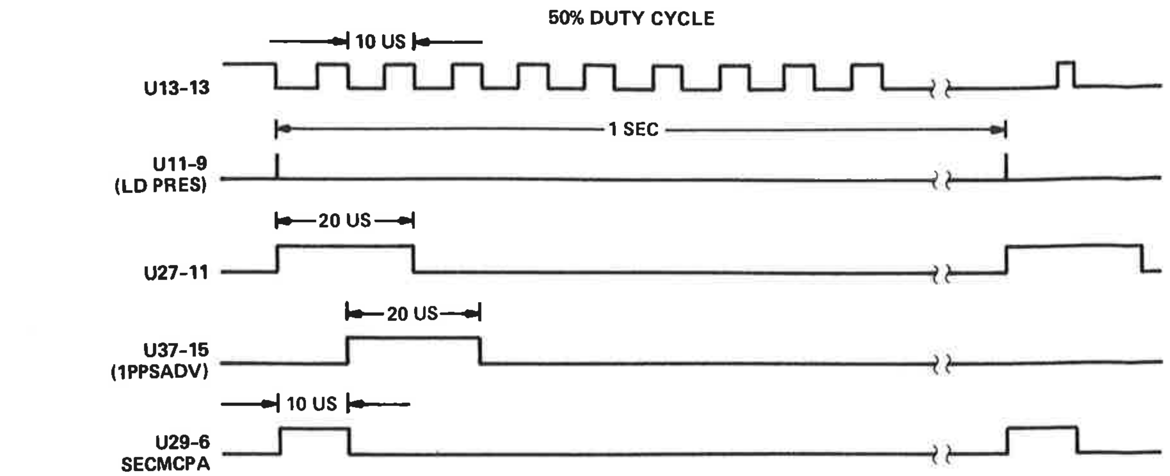
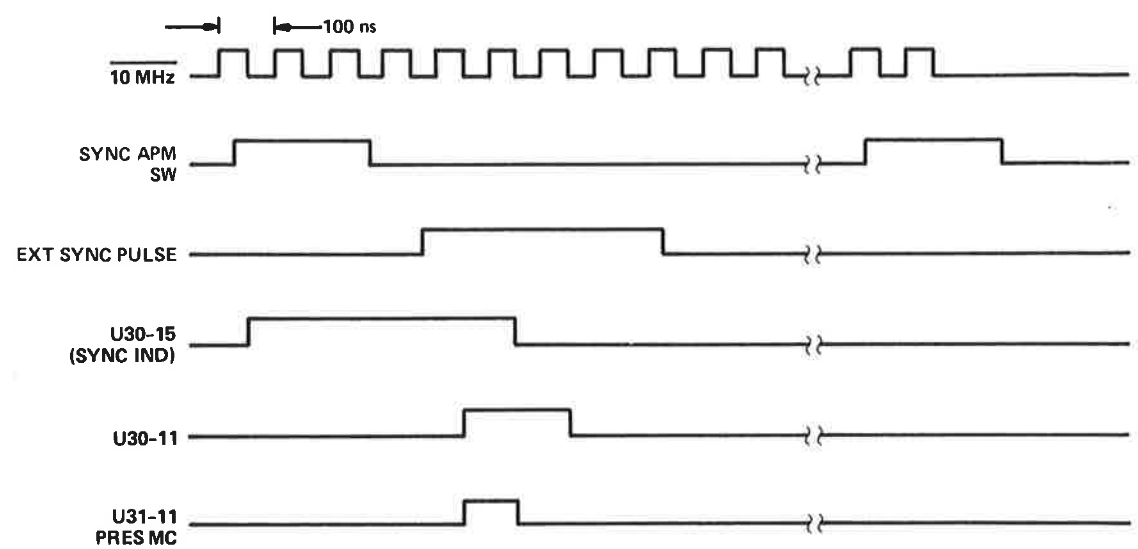


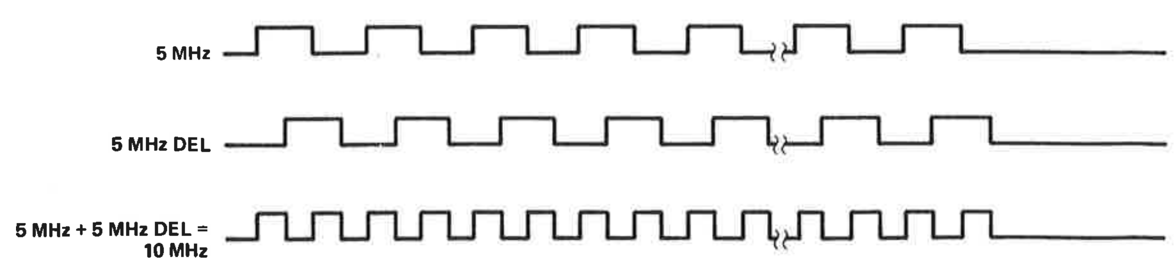

Figure 5-8. Real-Time-of-Day Clock Module 1A9A2, Timing Diagram (For 1A9A2 Part No. 52002-9409-1)



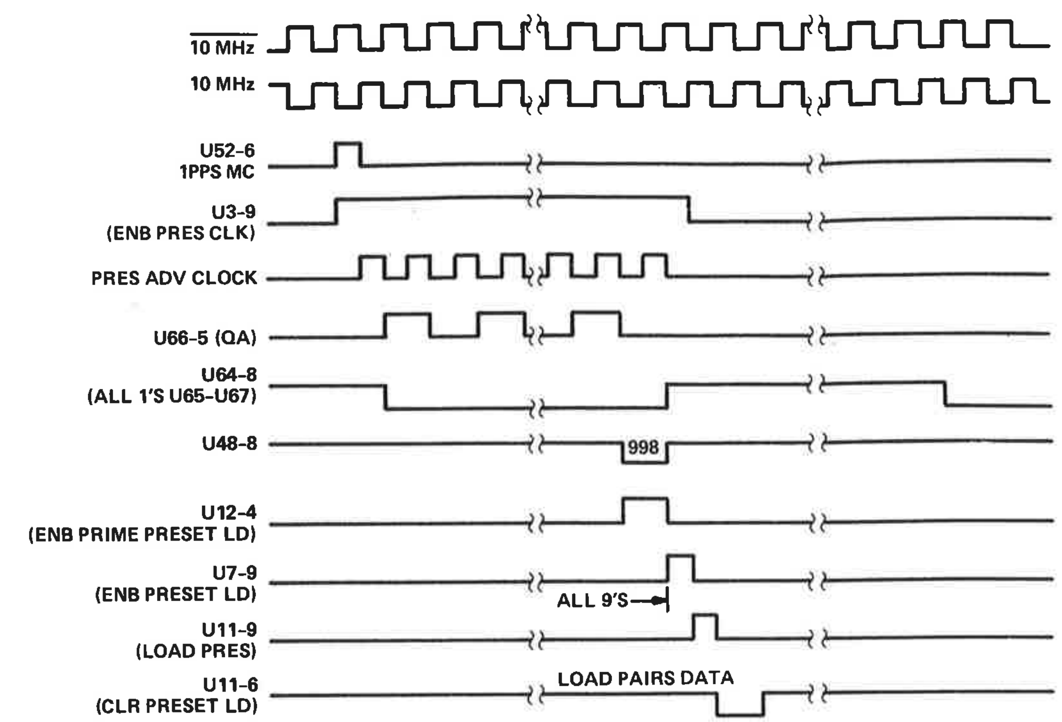
IPPS GENERATION



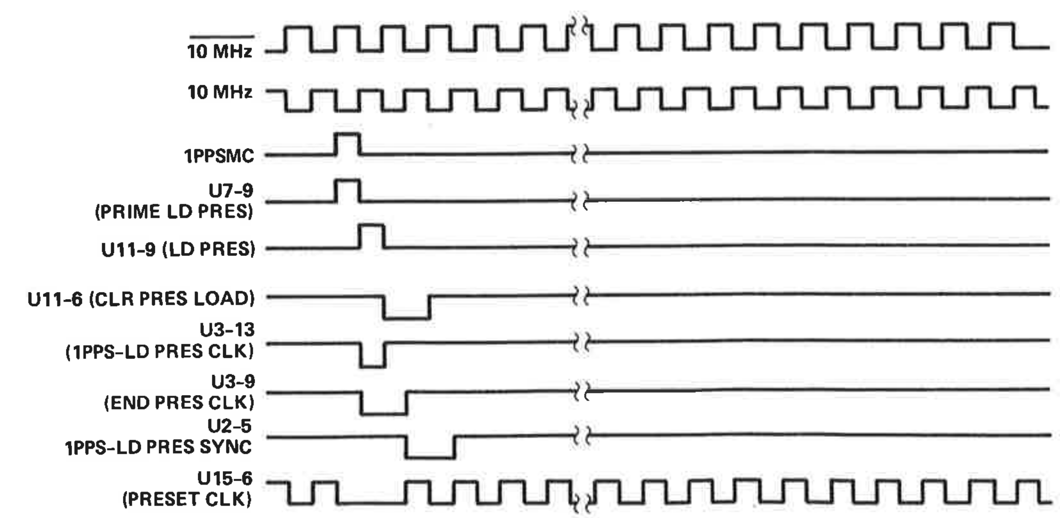
SYNC ARM - EXT SYNC
(EXTERNAL SYNCHRONIZATION OF COUNTER)



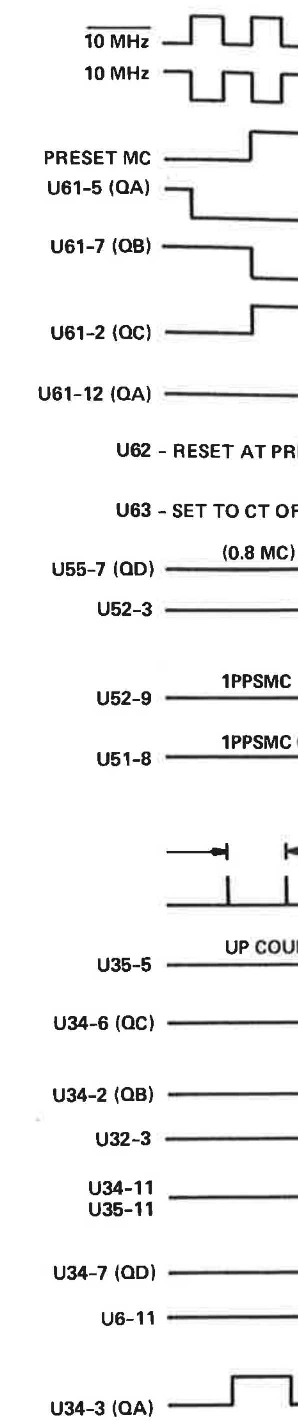
10 MHz GENERATOR
(5 MHz DOUBLER)



PRESET ADV SWITCHES NOT ALL 9'S



PRESET ADV SWITCHES SET TO ALL 9'S



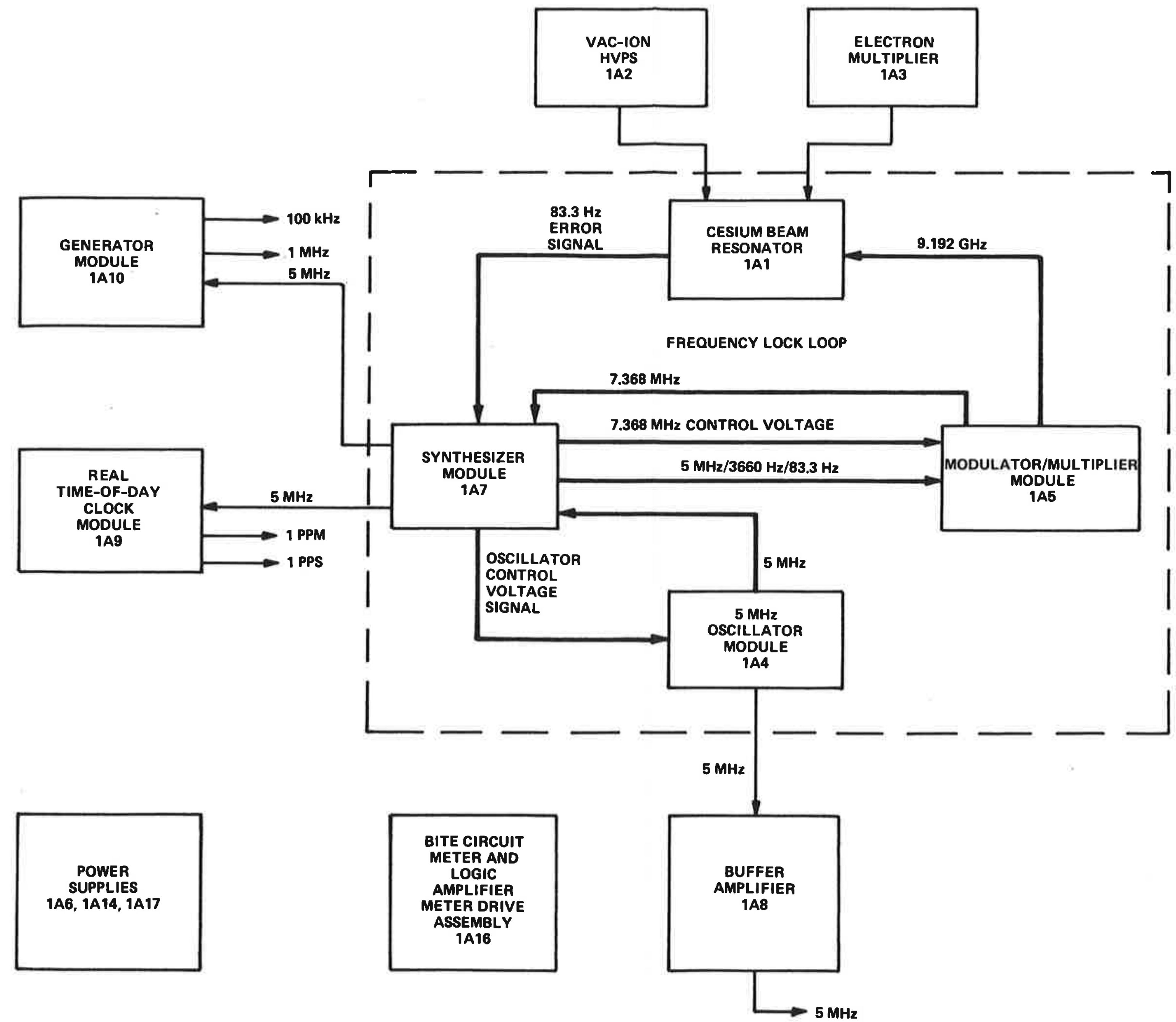



Figure 5-9. Overall Functional Block Diagram

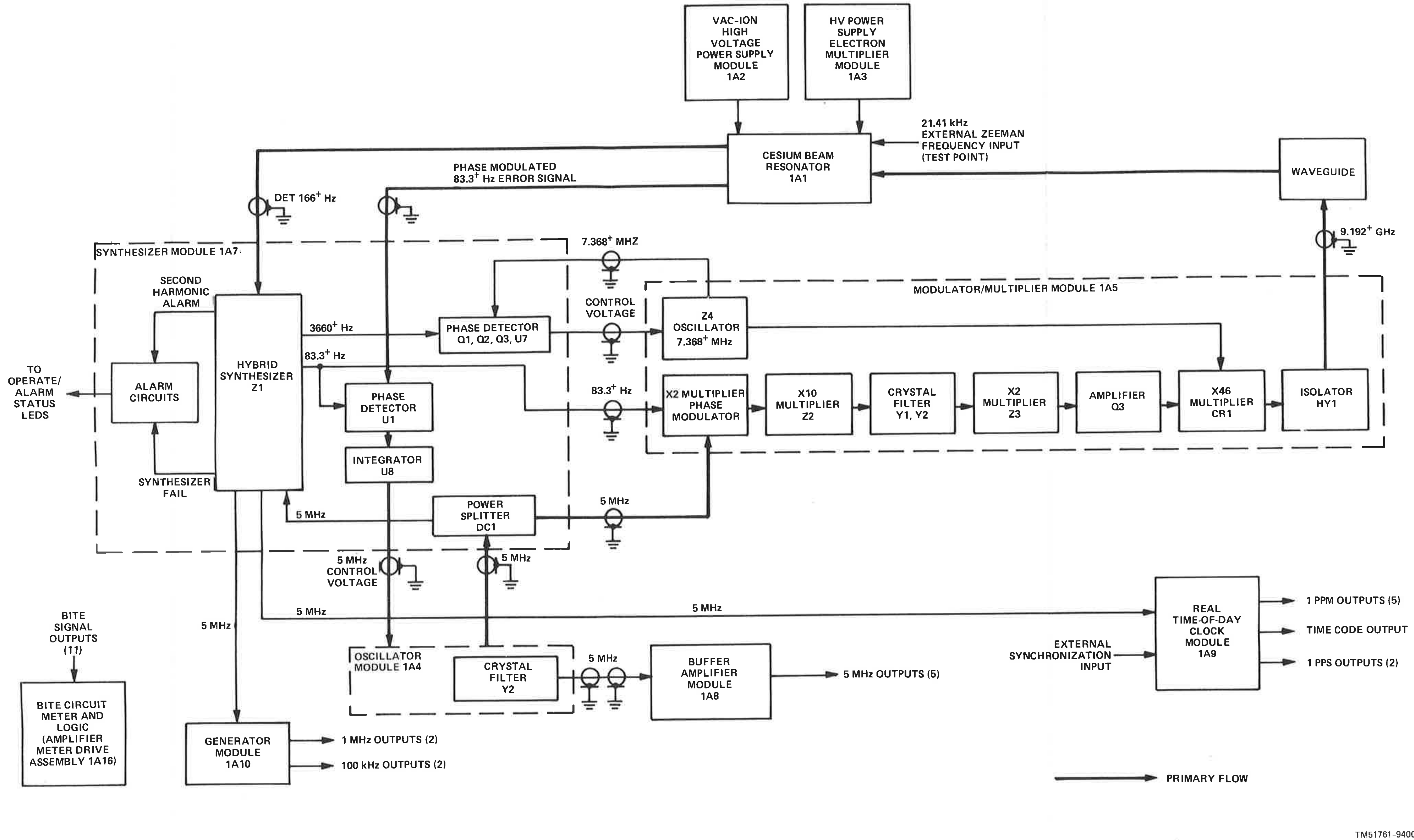



Figure 5-10. Major Signal Flow, Functional Block Diagram

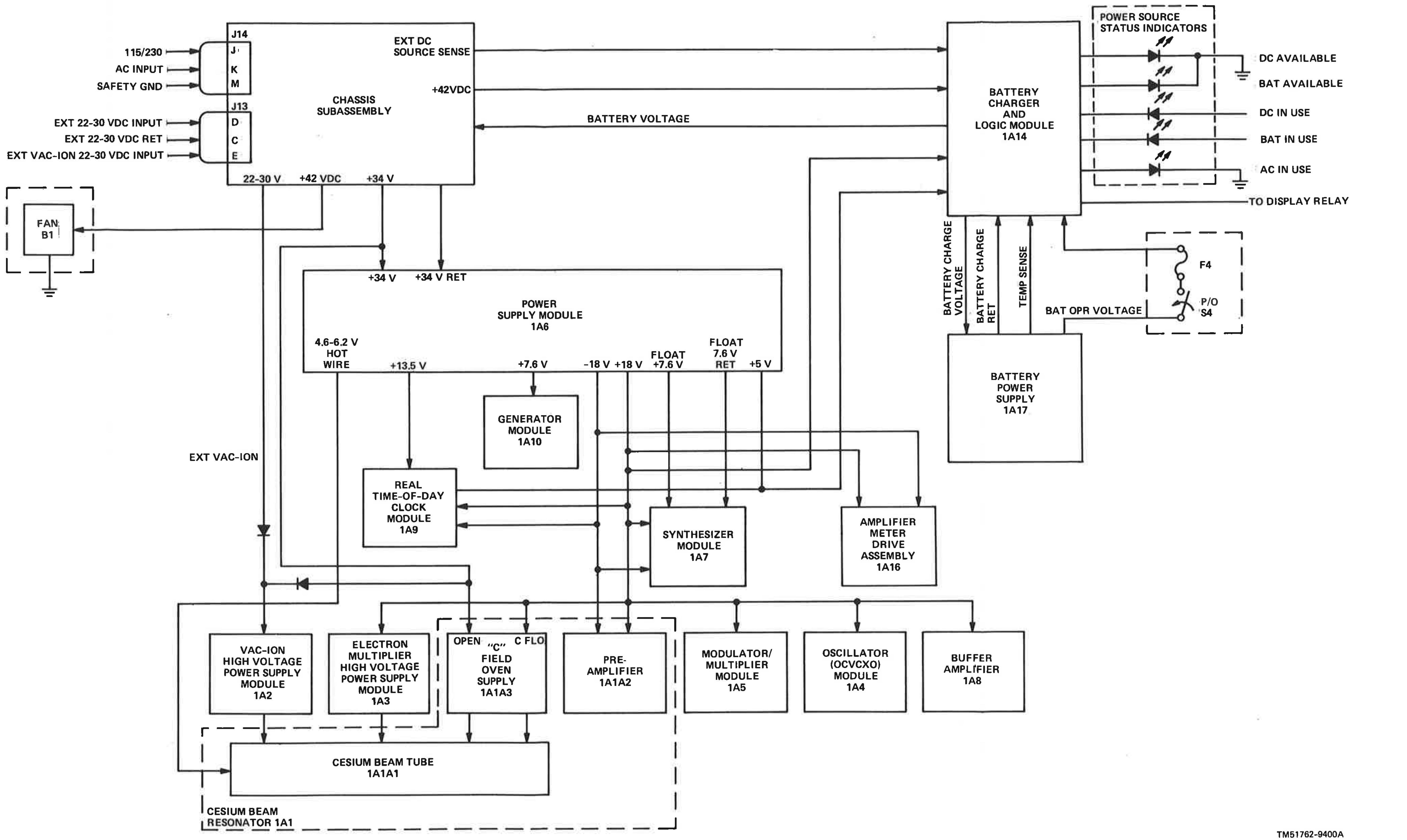



Figure 5-11. Power Distribution, Functional Block Diagram

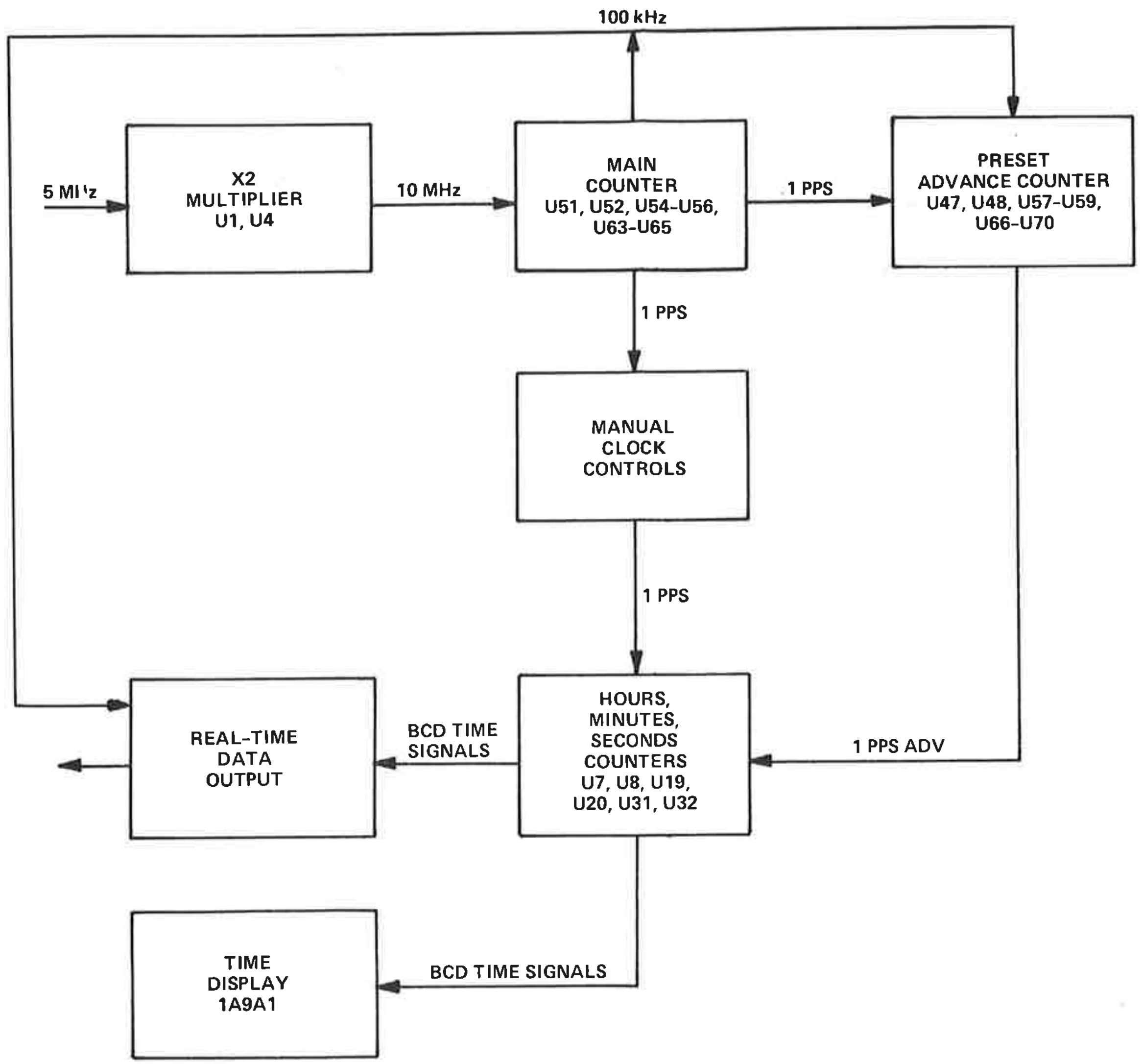



Figure 5-12. Real Time-of-Day Clock Module 1A9, Overall Block Diagram

ZONE
4C
5B
5B
5B
5B
5B
5B
5D
5D
5D
6A
6C
4B
3C
3B
4B
4B
5D
4D
4D
4C
5A
5A
5D

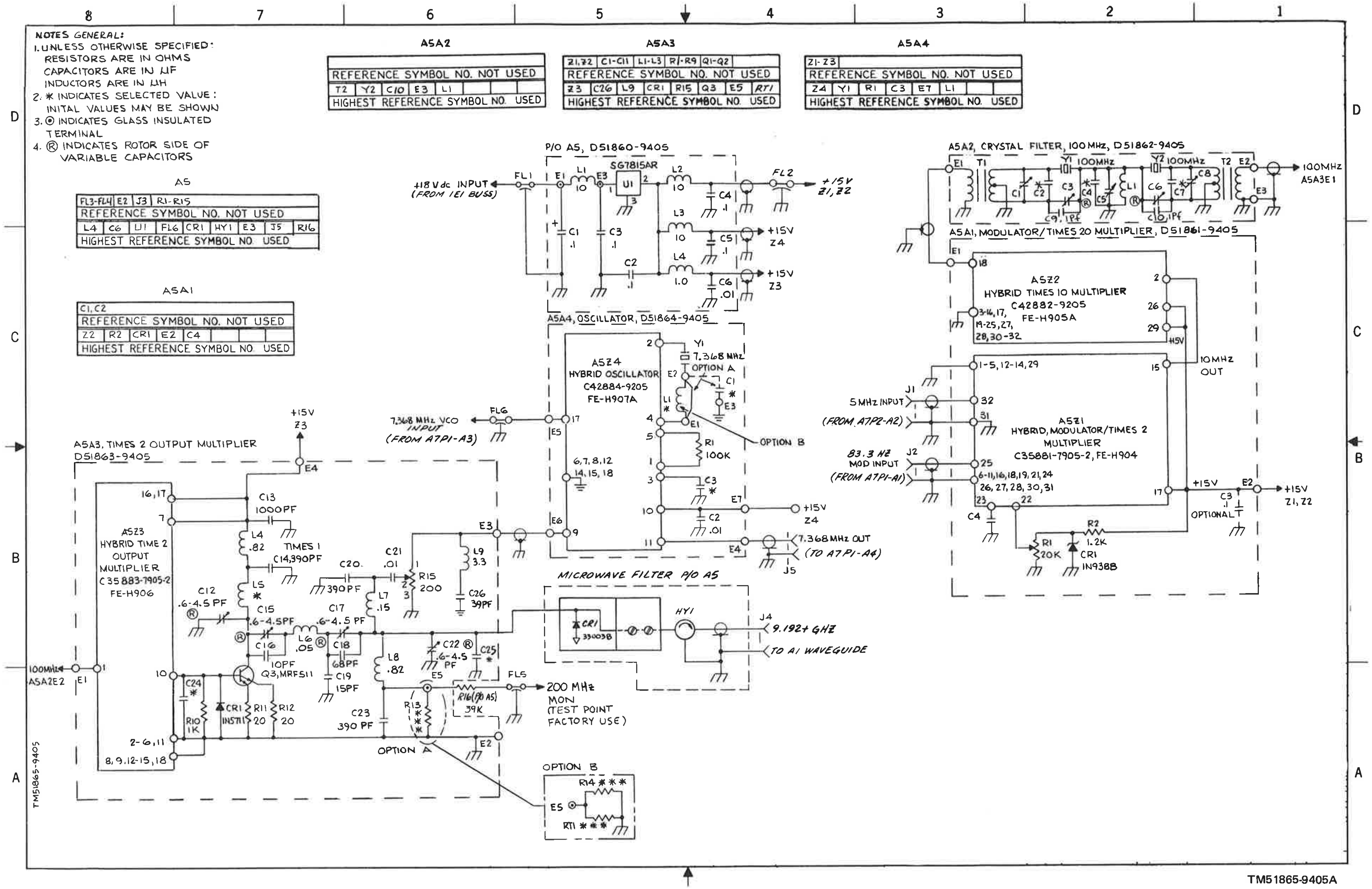
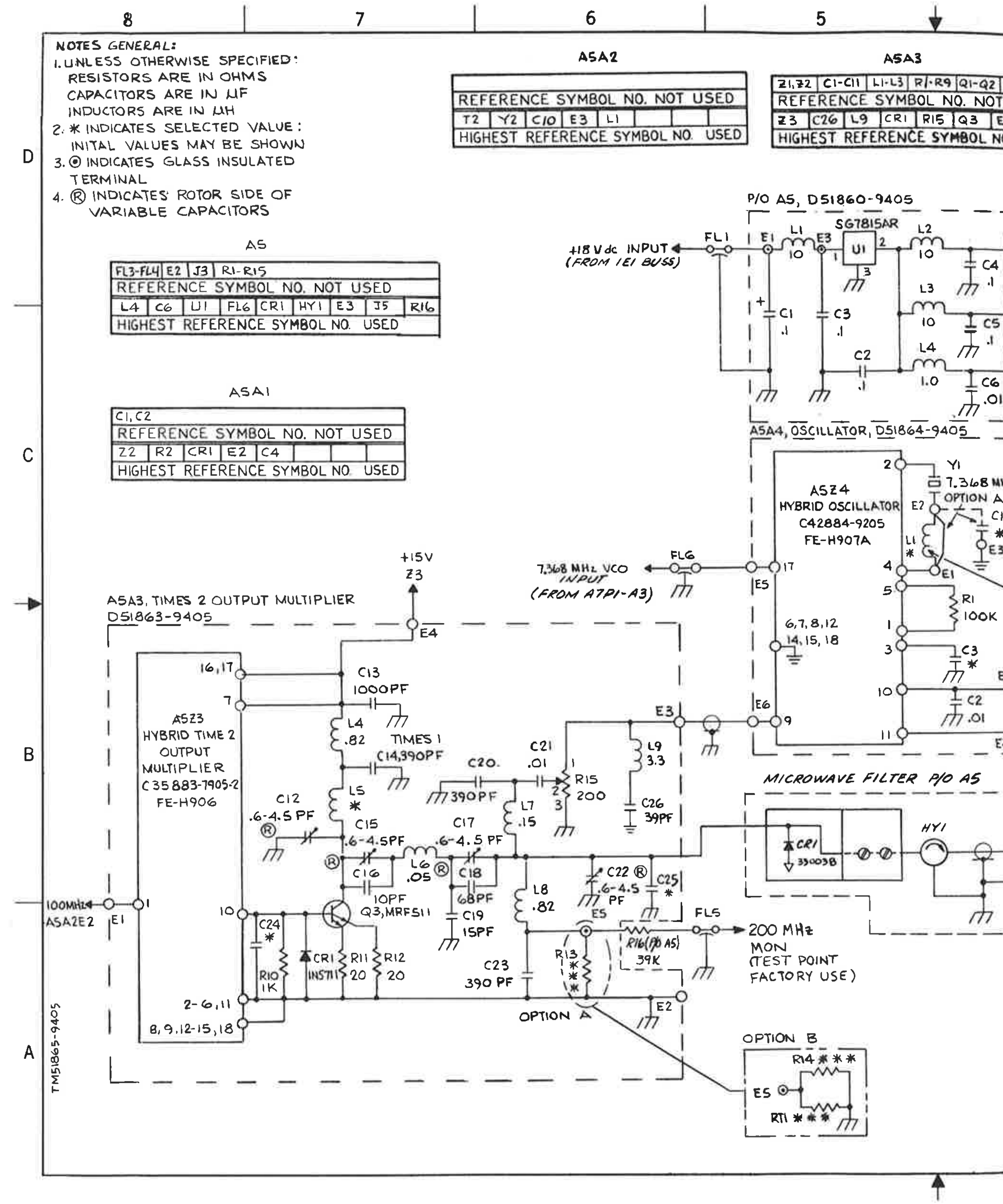


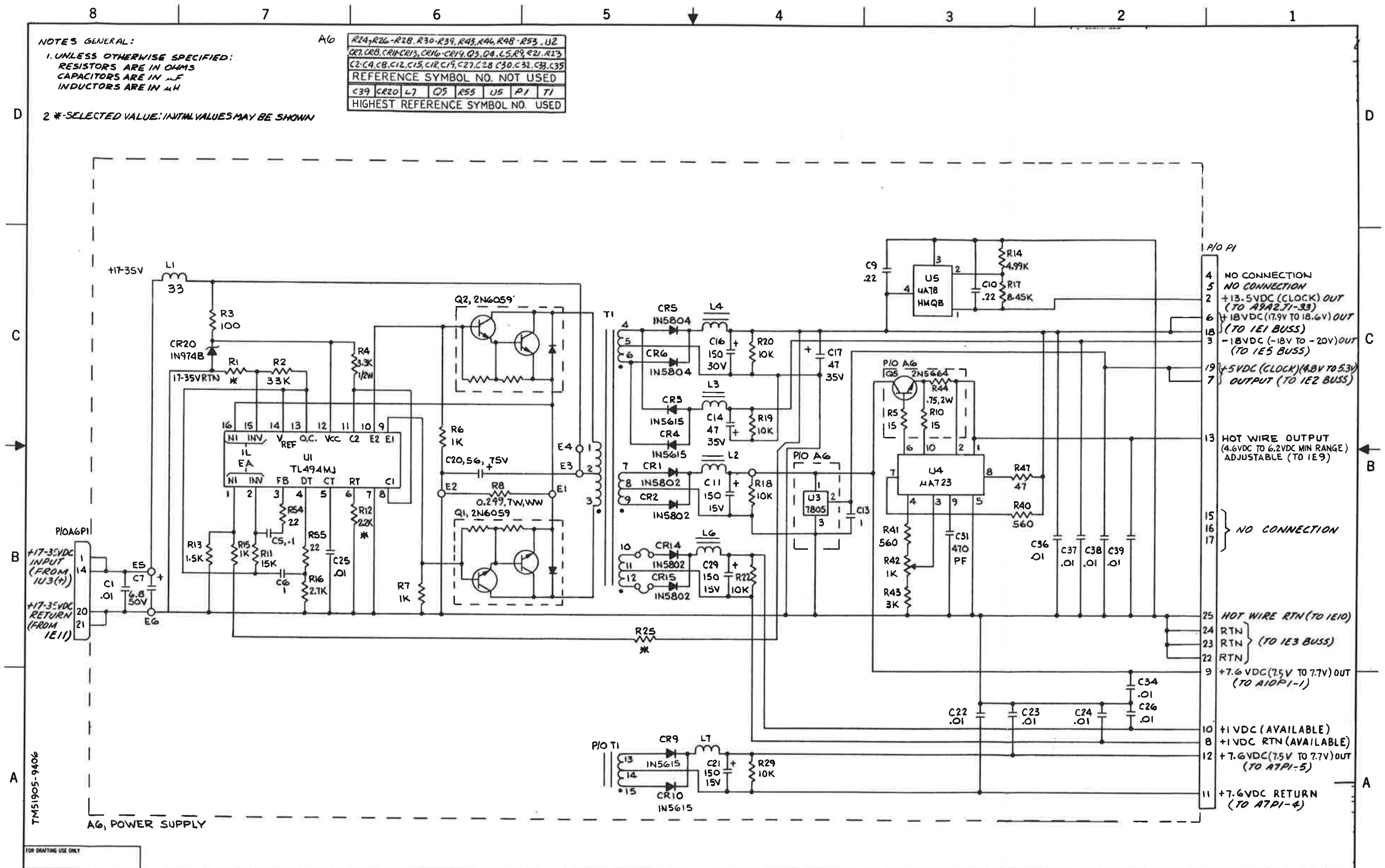

Figure 5-13. Modulator/Multiplier Module 1A5, Schematic Diagram

## PART LOCATION INDEX

(PREFIX ALL REFERENCE DESIGNATORS WITH 1A5)

| REF DES | ZONE |
|---|---|
| A1C3 | 1B |
| A1C4 | 3B |
| A1CR1 | 2B |
| A1E1 | 3C |
| A1E2 | 1B |
| A1R1 | 3B |
| A1R2 | 2B |
| A1Z1 | 3B |
| A1Z2 | 3C |
| A2C1 | 3D |
| A2C2 | 2D |
| A2C3 | 2D |
| A2C4 | 2D |
| A2C5 | 2D |
| A2C6 | 2D |
| A2C7 | 2D |
| A2C8 | 2D |
| A2E1 | 3D |
| A2E2 | 1D |
| A2E3 | 1D |
| A2L1 | 2D |
| A2T1 | 3D |
| A2T2 | 1D |
| A2Y1 | 2D |
| A2Y2 | 2D |
| A3C12 | 7B |
| A3C13 | 7B |
| A3C14 | 7B |
| A3C15 | 7B |
| A3C16 | 7A |
| A3C17 | 7B |
| A3C18 | 7A |
| A3C19 | 7A |
| A3C20 | 7B |
| A3C21 | 6B |
| A3C22 | 6A |
| A3C23 | 6A |
| A3C24 | 8A |
| A3C25 | 6A |
| A3C26 | 6B |
| A3CR1 | 7A |
| A3E1 | 8A |
| A3E2 | 6A |
| A3E3 | 6B |
| A3E4 | 7B |
| A3L4 | 7B |
| A3L5 | 7B |
| A3L6 | 7B |
| A3L7 | 6B |
| A3L8 | 6A |
| A3L9 | 6B |
| A3Q3 | 7A |
| A3R10 | 7A |
| A3R11 | 7A |
| A3R12 | 7A |
| A3R13 | 6A |
| A3R14 | 5A |
| A3R15 | 6B |
| A3R16 | 6A |
| A3RT1 | 5A |
| A3Z3 | 8B |
| A4C1 | 4C |
| A4C2 | 4B |
| A4C3 | 4B |
| A4E1 | 4C |
| A4E2 | 4C |
| A4E3 | 4C |
| A4E4 | 4B |
| A4E5 | 5C |
| A4E6 | 5B |
| A4E7 | 4B |
| A4L1 | 4C |
| A4R1 | 4C |
| A4Y1 | 4C |
| A4Z4 | 5C |
| C1 | 5D |
| C2 | 5C |
| C3 | 5D |
| C4 | 4D |
| C5 | 4D |
| C6 | 4C |
| C7 | 5B |
| C8 | 5B |
| C9 | 5B |
| C10 | 5B |
| C11 | 5B |
| CR1 | 5B |
| E1 | 5D |
| E3 | 5D |
| FL1 | 5D |
| FL5 | 6A |
| FL6 | 6C |
| HY1 | 4B |
| J1 | 3C |
| J2 | 3B |
| J4 | 4B |
| J5 | 4B |
| L1 | 5D |
| L2 | 4D |
| L3 | 4D |
| L4 | 4C |
| L5 | 5A |
| L6 | 5A |
| U1 | 5D |






TM51905-9406A

**Figure 5-14. Power Supply Module 1A6, Schematic Diagram**

| | ZONE |
|---|---|
| 31 | 4C |
| 32 | 4C |
| 33 | 4C |
| 34 | 4C |
| 35 | 4C |
| 36 | 4C |
| 37 | 4C |
| 38 | 4B |
| 41 | 5B |
| 42 | 5B |
| | 1B |
| 43 | 5B |
| 44 | 4B |
| 45 | 4B |
| 46 | 4B |
| 47 | 4B |
| 48 | 4B |
| 49 | 4B |
| 50 | 4B |
| 51 | 5B |
| 52 | 5B |
| 53 | 5B |
| 54 | 5B |
| 55 | 5B |
| 56 | 5B |
| 57 | 6B |
| | 3D |
| | 4B |
| | 7C |
| 1 | 5C |
| 2 | 4B |
| 3 | 4B |
| 4 | 4B |
| 5 | 7A, 8A |
| 6 | 7A, 7B |
| 7 | 5B |
| 8 | 4C |
| 1 | 5C |

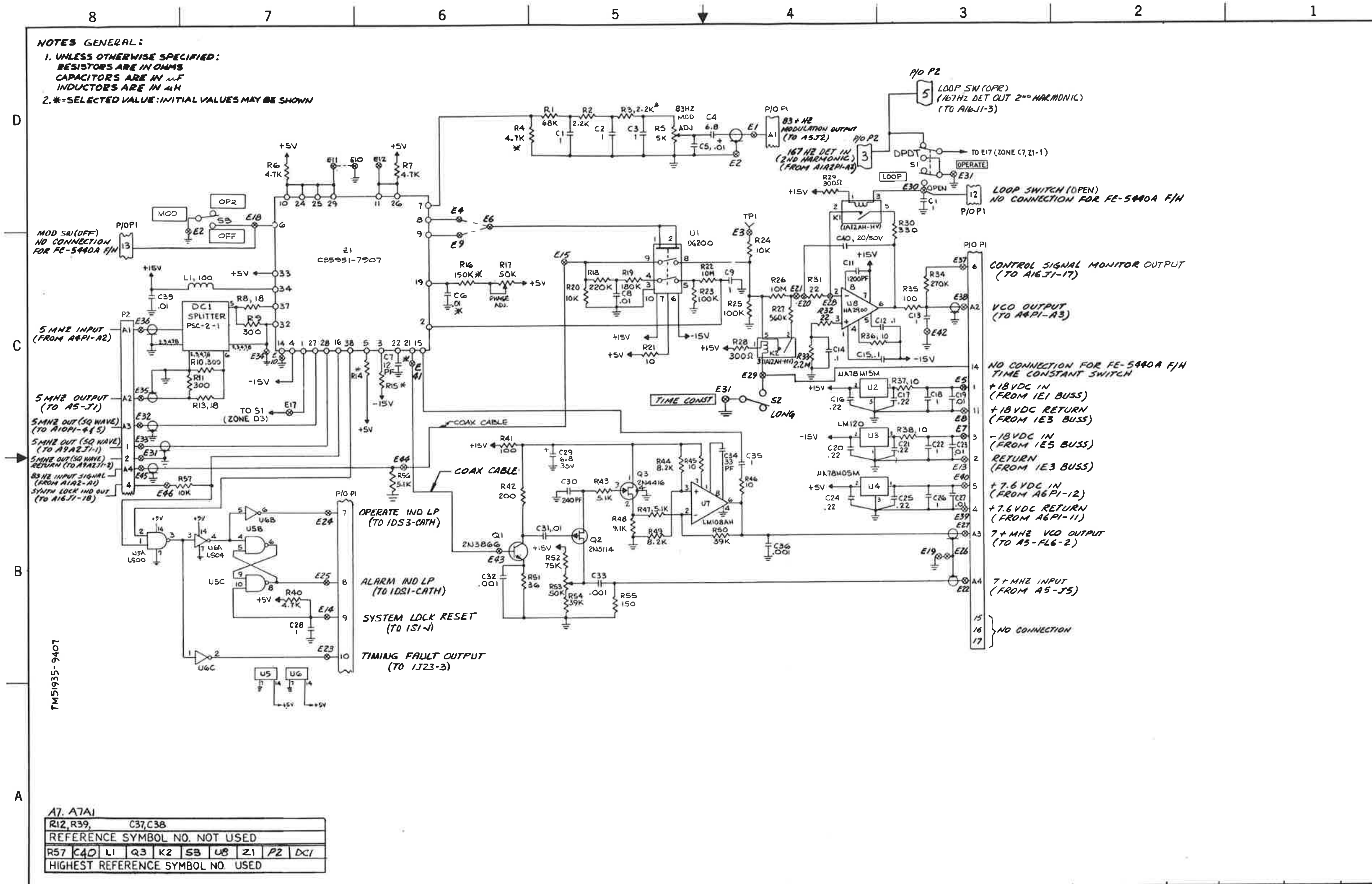



Figure 5-15. Synthesizer
Module 1A7, Schematic Diagram

PARTS LOCATION INDEX

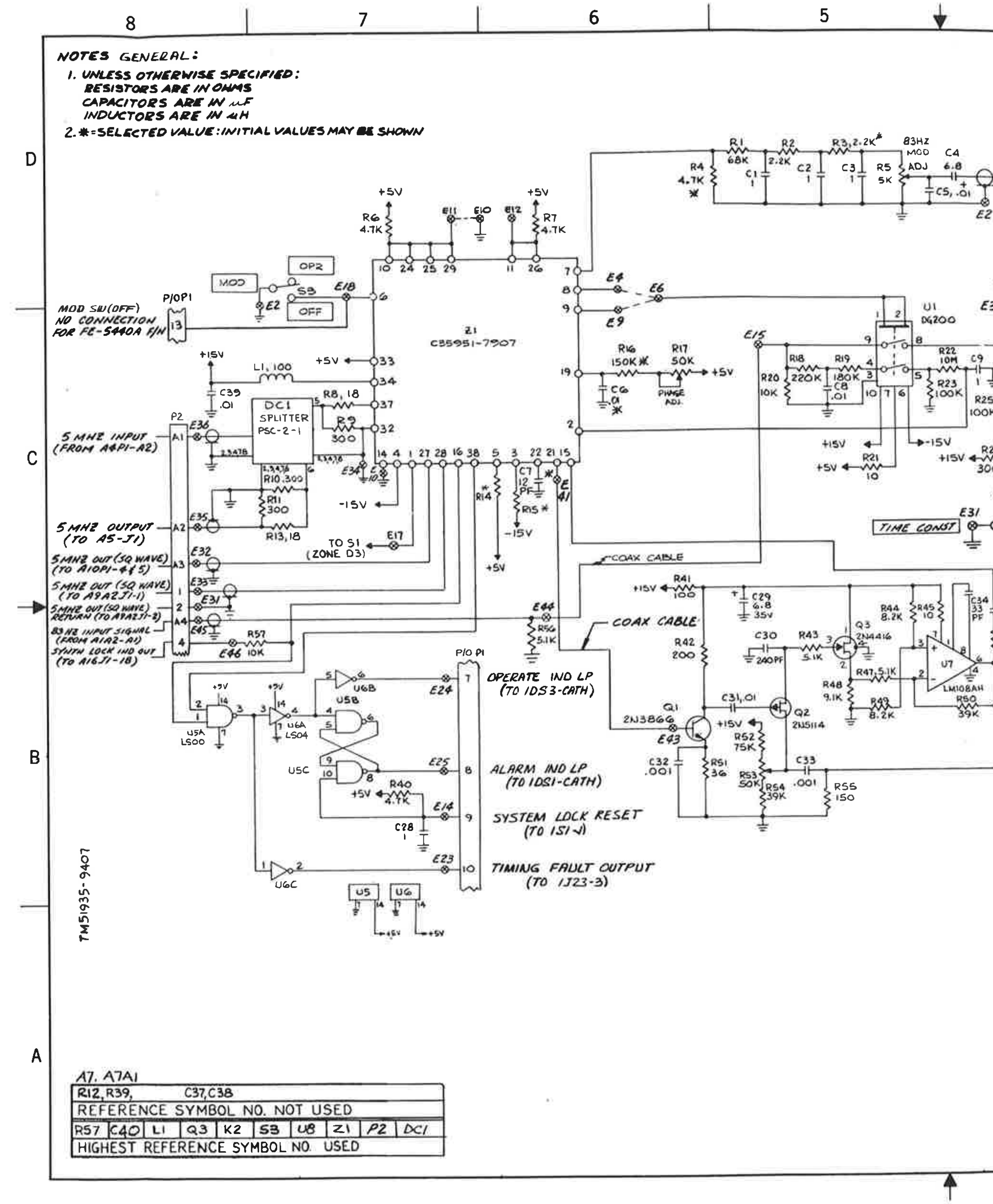
(PREFIX ALL REFERENCE DESIGNATIONS WITH 1A7)

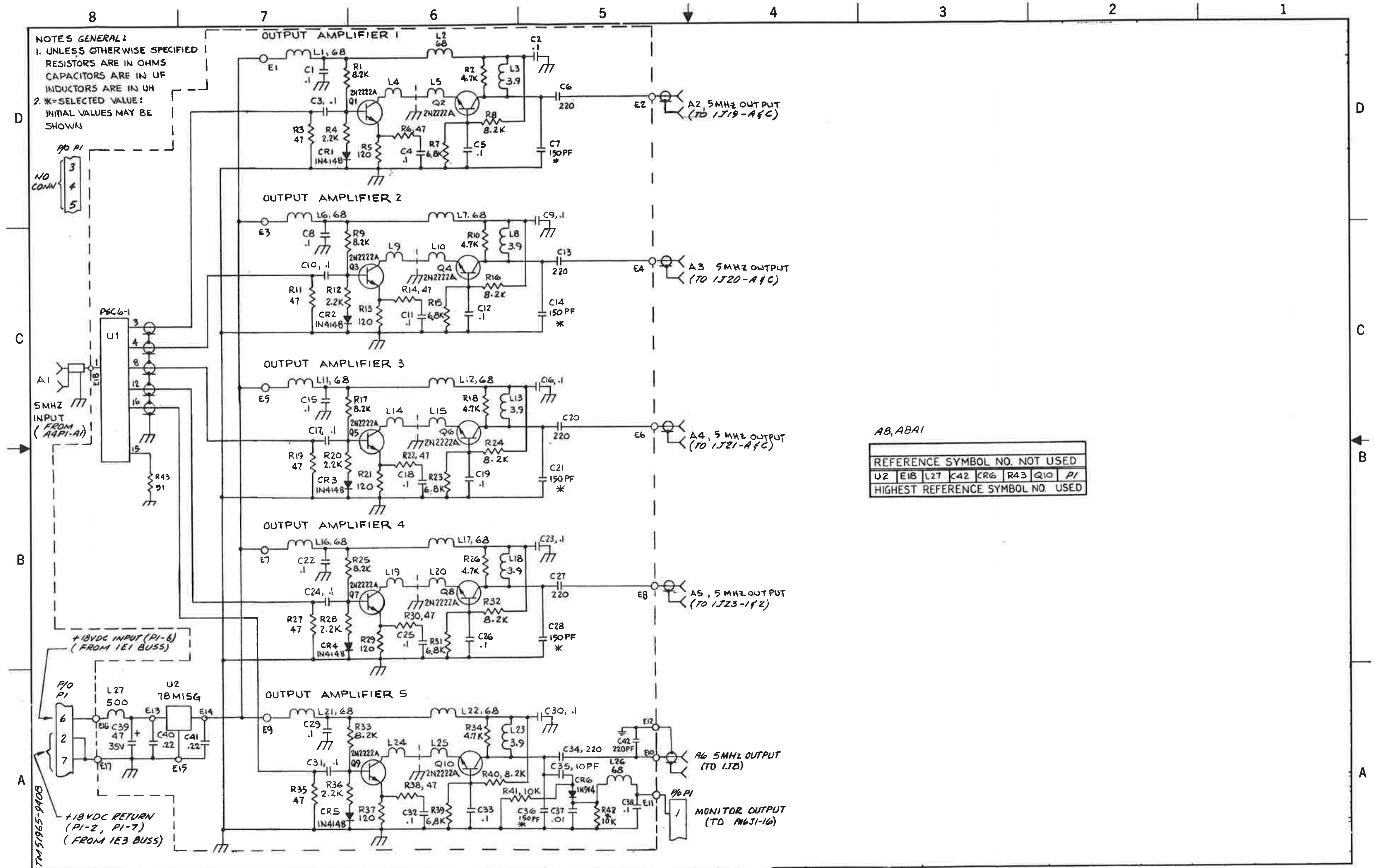
| REF DES | ZONE |
|---|---|
| A1C1 | 5D |
| A1C2 | 5D |
| A1C3 | 5D |
| A1C4 | 4D |
| A1C5 | 4D |
| A1C6 | 6C |
| A1C7 | 6C |
| A1C8 | 5C |
| A1C9 | 4C |
| A1C10 | 3D |
| A1C11 | 2C |
| A1C12 | 3C |
| A1C13 | 3C |
| A1C14 | 3C |
| A1C15 | 3C |
| A1C16 | 3B |
| A1C17 | 3B |
| A1C18 | 3B |
| A1C19 | 3B |
| A1C20 | 4B |
| A1C21 | 3B |
| A1C22 | 3B |
| A1C23 | 3B |
| A1C24 | 4B |
| A1C25 | 3B |
| A1C26 | 3B |
| A1C27 | 3B |
| A1C28 | 6B |
| A1C29 | 5B |
| A1C30 | 5B |
| A1C31 | 5B |
| A1C32 | 5B |
| A1C33 | 5B |
| A1C34 | 4B |
| A1C35 | 4B |
| A1C36 | 4B |
| A1C39 | 8C |
| A1C40 | 4C |
| A1DC1 | 7C |
| A1E1 | 4D |
| A1E2 | 4D, 7C |

| REF DES | ZONE |
|---|---|
| A1E3 | 4C |
| A1E4 | 6C |
| A1E5 | 3B |
| A1E6 | 6C |
| A1E7 | 3B |
| A1E9 | 6C |
| A1E10 | 6D, 7C |
| A1E11 | 7D |
| A1E12 | 6D |
| A1E13 | 3B |
| A1E14 | 7B |
| A1E15 | 5C |
| A1E17 | 8B |
| A1E18 | 7C |
| A1E19 | 3B |
| A1E20 | 3C |
| A1E21 | 4C |
| A1E22 | 3B |
| A1E23 | 7B |
| A1E24 | 7B |
| A1E25 | 7B |
| A1E26 | 3B |
| A1E27 | 3B |
| A1E28 | 3C |
| A1E30 | 3D |
| A1E31 | 4C, 8B, 3D |
| A1E32 | 8B |
| A1E33 | 8B |
| A1E34 | 7C |
| A1E35 | 8B |
| A1E36 | 8C |
| A1E37 | 3C |
| A1E38 | 3C |
| A1E39 | 3B |
| A1E40 | 3B |
| A1E41 | 6C |
| A1E42 | 3C |
| A1E43 | 6B |
| A1E44 | 6B |
| A1E45 | 8B |
| A1E46 | 8B |

| REF DES | ZONE |
|---|---|
| A1K1 | 3C |
| A1K2 | 4C |
| A1L1 | 7C |
| P1 | 3B, 3C, 3D, 6B, 8C |
| P2 | 3D, 8C |
| A1Q1 | 5B |
| A1Q2 | 5B |
| A1Q3 | 5B |
| A1R1 | 5D |
| A1R2 | 5D |
| A1R3 | 5D |
| A1R4 | 5D |
| A1R5 | 5D |
| A1R6 | 7D |
| A1R7 | 6D |
| A1R8 | 7C |
| A1R9 | 7C |
| A1R10 | 7C |
| A1R11 | 7B |
| A1R13 | 7B |
| A1R14 | 6C |
| A1R15 | 6B |
| A1R16 | 6C |
| A1R17 | 5C |
| A1R18 | 5C |
| A1R19 | 5C |
| A1R20 | 5C |
| A1R21 | 4C |
| A1R22 | 4C |
| A1R23 | 4C |
| A1R24 | 4C |
| A1R25 | 4C |
| A1R26 | 4C |
| A1R27 | 4C |
| A1R28 | 4C |
| A1R29 | 4D |
| A1R30 | 3C |

| REF DES | ZONE |
|---|---|
| A1R31 | 4C |
| A1R32 | 4C |
| A1R33 | 4C |
| A1R34 | 4C |
| A1R35 | 4C |
| A1R36 | 4C |
| A1R37 | 4C |
| A1R38 | 4B |
| A1R41 | 5B |
| A1R42 | 1B |
| A1R43 | 5B |
| A1R44 | 4B |
| A1R45 | 4B |
| A1R46 | 4B |
| A1R47 | 4B |
| A1R48 | 4B |
| A1R49 | 4B |
| A1R50 | 4B |
| A1R51 | 5B |
| A1R52 | 5B |
| A1R53 | 5B |
| A1R54 | 5B |
| A1R55 | 5B |
| A1R56 | 5B |
| A1R57 | 6B |
| S1 | 3D |
| S2 | 4B |
| S3 | 7C |
| A1U1 | 5C |
| A1U2 | 4B |
| A1U3 | 4B |
| A1U4 | 4B |
| A1U5 | 7A, 8A |
| A1U6 | 7A, 7B |
| A1U7 | 5B |
| A1U8 | 4C |
| A1Z1 | 5C |






| REFERENCE SYMBOL NO. NOT USED | | | | | | | |
|---|---|---|---|---|---|---|---|
| U2 | E18 | L27 | C42 | CR6 | R43 | Q10 | P1 |
| HIGHEST REFERENCE SYMBOL NO. USED | | | | | | | |

Figure 5-16. Buffer Amplifier Module 1A8, Schematic Diagram

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTORS ARE ALL 4.7K OHMS
   CAPACITORS ARE IN μf
   INDUCTORS ARE IN μH

2. * = SELECTED VALUE: INITIAL VALUES MAY BE SHOWN

3. PREFIX ALL REF. DESIGNATIONS WITH A9A2 EXCEPT WHERE PREFIX A9 OR A9A1 IS SHOWN

4. ALL IC TYPE NUMBERS SHALL BE PREFIXED WITH "54"

5. LEGENDS:

   A.) ☐ INDICATES PANEL MARKING

   B.) (—➤) REPRESENTS SHEET GRID LOCATION

   EXAMPLE: (3B7)

   SHEET — 3; VERTICAL GRID — B; HORIZONTAL GRID — 7

6 ASSOCIATED DRAWINGS:

   A9 ASSY - D52000-9409
   PL52000-9409
   D21709-6209-1 ICD(PN)

   A9A1 ASSY - D52001-9409
   PL52001-9409

   A9A2 ASSY - D52002-9409
   PL52002-9409

   A9A1 WIRING DIAGRAM - D52007-9409

   A9A2 WIRE CHART - 52006-9409

A9

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| J1, P1-P3 | | | | | | | | |
| REFERENCE SYMBOL NO. NOT USED | | | | | | | | |
| A2 | C3 | CR3 | E4 | J4 | K1 | P9 | R2 | S11 |
| HIGHEST REFERENCE SYMBOL NO. USED | | | | | | | | |

A9A1

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| REFERENCE SYMBOL NO. NOT USED | | | | | | | |
| C3 | E24 | R1 | U6 | | | | |
| HIGHEST REFERENCE SYMBOL NO. USED | | | | | | | |

A9A2

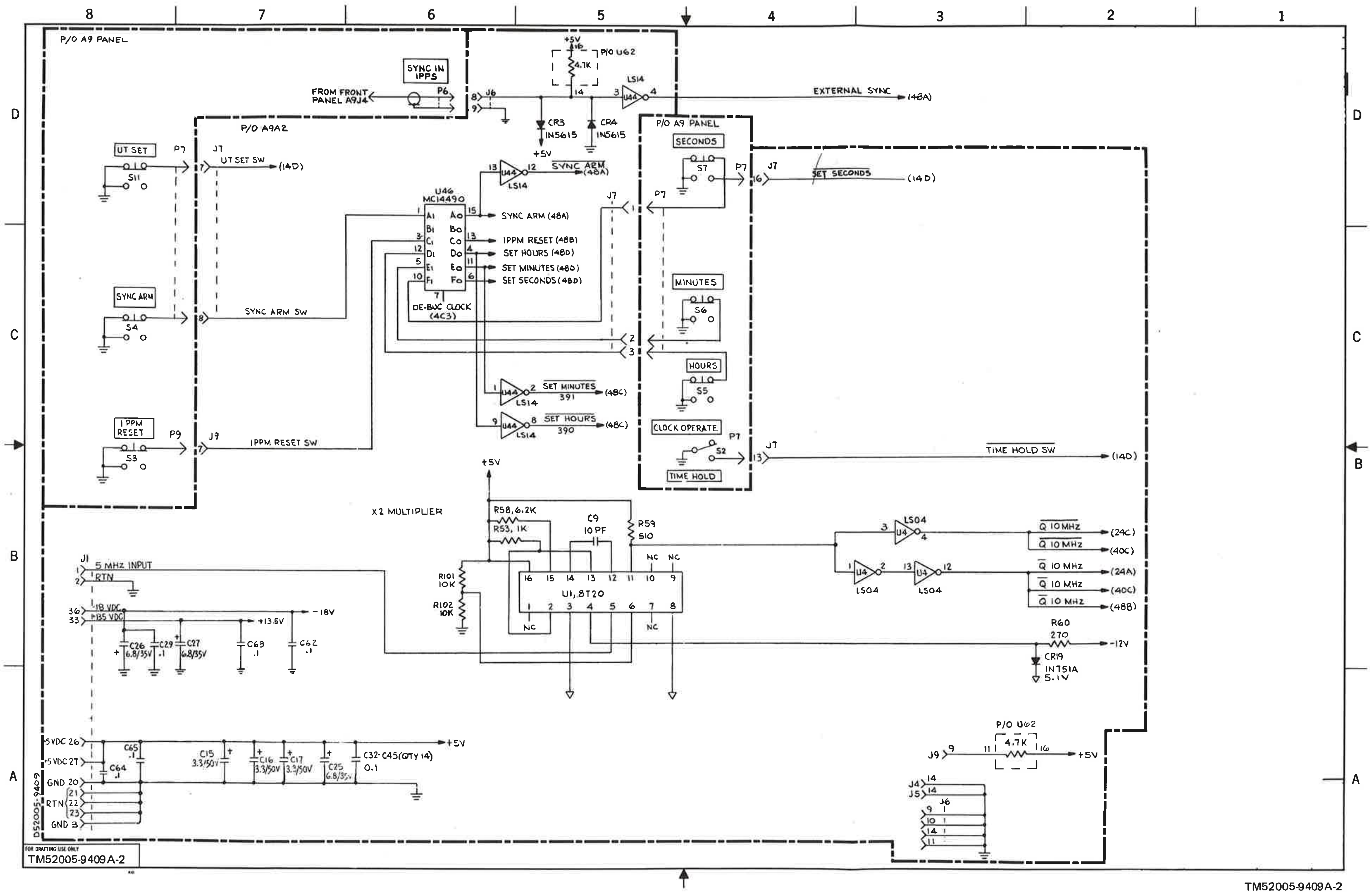
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| C3-C6, C11-C14, C18-C24, C28, ,C31, CR1, CR2, CR6-CR18 | | | | | | | |
| J2, J3, Q1, Q2, R2-R52, R54-R57, R61-R65, R88, U60, U61 | | | | | | | |
| REFERENCE SYMBOL NO. NOT USED | | | | | | | |
| C81 | CR28 | J9 | Q9 | R102 | U70 | | |
| HIGHEST REFERENCE SYMBOL NO. USED | | | | | | | |

TM52005-9409A-1

Figure 5-17. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409) (Sheet 1 of 9)

ZONE

28B, 28C,
32B, 32C,
32D
4B
8B
8C
4C
4C
4D
15C
15D
15D
8D




TM52005-9409A-2

Figure 5-17. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409) (Sheet 2 of 9)

## PARTS LOCATION INDEX

(PREFIX ALL REFERENCE DESIGNATORS WITH 1A9)

| REF DES | ZONE |
|---|---|
| A1C1 | 63D |
| A1C2 | 61D |
| A1C3 | 60D |
| A1E1 | 64D |
| A1E2 | 63B |
| A1E3 | 61B |
| A1E4 | 60B |
| A1E5 | 63B |
| A1E6 | 63B |
| A1E7 | 63B |
| A1E8 | 63B |
| A1E9 | 63B |
| A1E10 | 62B |
| A1E11 | 62B |
| A1E12 | 62B |
| A1E13 | 61B |
| A1E14 | 61B |
| A1E15 | 61B |
| A1E16 | 61B |
| A1E17 | 61B |
| A1E18 | 60B |
| A1E19 | 60B |
| A1E20 | 60B |
| A1E21 | 60B |
| A1E22 | 59B |
| A1E23 | 59B |
| A1E24 | 59B |
| A1R1 | 63D |
| A1U1 | 63C |
| A1U2 | 62C |
| A1U3 | 61C |
| A1U4 | 61C |
| A1U5 | 60C |
| A1U6 | 59C |
| A2C1 | 44B |
| A2C2 | 44B |
| A2C7 | 12D |
| A2C8 | 12D |
| A2C9 | 5B |
| A2C15 | 7A |
| A2C16 | 7A |
| A2C17 | 7A |
| A2C25 | 6A |
| A2C26 | 8B |
| A2C27 | 7B |
| A2C29 | 7B |
| A2C30 | 14C |
| A2C32 | 6A |
| A2C33 | 6A |
| A2C34 | 6A |
| A2C35 | 6A |
| A2C36 | 6A |
| A2C37 | 6A |
| A2C38 | 6A |
| A2C39 | 6A |
| A2C40 | 6A |
| A2C41 | 6A |
| A2C42 | 6A |
| A2C43 | 6A |
| A2C44 | 6A |
| A2C45 | 6A |

| REF DES | ZONE |
|---|---|
| A2C46 | 12C |
| A2C47 | 13C |
| A2C48 | 13C |
| A2C49 | 13B |
| A2C50 | 13B |
| A2C51 | 13B |
| A2C52 | 13A |
| A2C53 | 13A |
| A2C54 | 13A |
| A2C55 | 12B |
| A2C56 | 10B |
| A2C57 | 11B |
| A2C58 | 10A |
| A2C59 | 11A |
| A2C60 | 11C |
| A2C61 | 11D |
| A2C62 | 7B |
| A2C63 | 7B |
| A2C64 | 8A |
| A2C65 | 8A |
| A2C66 | 16C |
| A2C67 | 16C |
| A2C68 | 16C |
| A2C69 | 16C |
| A2C70 | 16C |
| A2C71 | 13C |
| A2C72 | 13B |
| A2C73 | 13B |
| A2C74 | 13A |
| A2C75 | 10C |
| A2C76 | 11B |
| A2C77 | 11B |
| A2C78 | 11B |
| A2C79 | 11A |
| A2C80 | 12C |
| A2C81 | 11B |
| A2CR3 | 5D |
| A2CR4 | 5D |
| A2CR5 | 44B |
| A2CR19 | 2B |
| A2CR20 | 12D |
| A2CR21 | 13B |
| A2CR22 | 13B |
| A2CR23 | 13A |
| A2CR24 | 13A |
| A2CR25 | 10B |
| A2CR26 | 10B |
| A2CR27 | 10A |
| A2CR28 | 12C |
| A2J1 | 8B, 10B, 11D, 12A, 12B, 12C, 13C, 16C |
| A2J4 | 3A, 16C, 32D, 33C |
| A2J5 | 3A, 15B, 16B, 33C |
| A2J6 | 3A, 6D, 10A, 10B, 41C |
| A2J7 | 4B, 4D, 5D, 7D, 15D |

| REF DES | ZONE |
|---|---|
| A2J8 | 31D |
| A2J9 | 3A, 7C, 28C, 32D |
| A2Q3 | 13C |
| A2Q4 | 13B |
| A2Q5 | 13B |
| A2Q6 | 13A |
| A2Q7 | 10B |
| A2Q8 | 10A |
| A2Q9 | 10B |
| A2R1 | 16B |
| A2R53 | 6B |
| A2R58 | 6B |
| A2R59 | 5B |
| A2R60 | 2B |
| A2R66 | 11D |
| A2R67 | 13C |
| A2R68 | 13C |
| A2R69 | 13B |
| A2R70 | 13B |
| A2R71 | 13B |
| A2R72 | 13B |
| A2R73 | 13B |
| A2R74 | 13B |
| A2R75 | 13A |
| A2R76 | 13A |
| A2R77 | 13A |
| A2R78 | 13A |
| A2R79 | 11B |
| A2R80 | 10C |
| A2R81 | 10B |
| A2R82 | 11A |
| A2R83 | 10A |
| A2R84 | 10A |
| A2R85 | 19D |
| A2R87 | 36B |
| A2R89 | 11A |
| A2R90 | 12D |
| A2R91 | 13B |
| A2R92 | 13B |
| A2R93 | 13A |
| A2R94 | 13A |
| A2R95 | 11B |
| A2R96 | 10B |
| A2R97 | 10B |
| A2R98 | 13C |
| A2R99 | 11B |
| A2R100 | 11A |
| A2R101 | 6B |
| A2R102 | 6B |
| A2U1 | 5B |
| A2U2 | 38D, 39C |
| A2U3 | 38C, 39D |
| A2U4 | 3B, 37D, 50B, 52C |
| A2U5 | 33A, 34A, 38D, 39C |
| A2U6 | 35C, 46C |
| A2U7 | 35A |
| A2U8 | 35B |
| A2U9 | 51B |
| A2U10 | 37A, 37B |

| REF DES | ZONE |
|---|---|
| A2U11 | 36C, 38C, 45C |
| A2U12 | 11B |
| A2U13 | 39A, 39B |
| A2U14 | 45C, 45D |
| A2U15 | 39A, 45B, 46D |
| A2U16 | 47B, 47C |
| A2U17 | 35C, 42B, 45D, 47D |
| A2U18 | 34A, 36B, 36C, 42B, 45A |
| A2U19 | 36C |
| A2U20 | 36D |
| A2U21 | 53B |
| A2U22 | 37C, 47B |
| A2U23 | 26C, 29A |
| A2U24 | 38A |
| A2U25 | 42A, 47C |
| A2U26 | 37A, 39A, 43A, 44D, 47A, 55B |
| A2U27 | 46B, 47B |
| A2U28 | 42A, 45B, 46B, 47A |
| A2U29 | 42B, 45D, 47D |
| A2U30 | 35B, 38C, 46C, 47C |
| A2U31 | 42B |
| A2U32 | 42C |
| A2U33 | 54B |
| A2U34 | 22A, 29A, 30D, 37B, 45C, 55B |
| A2U36 | 12D |
| A2U37 | 37A, 42A |
| A2U38 | 38B, 52C |
| A2U39 | 38A, 50B, 53B |
| A2U40 | 41A, 53B |
| A2U41 | 41A, 44B, 45B, 48A |
| A2U42 | 44D, 47A |
| A2U43 | 21B, 22B, 37B, 41B, 44D |
| A2U44 | 5D, 6C, 6D, 36B, 38B |
| A2U45 | 14D |
| A2U46 | 6D |
| A2U47 | 31D |
| A2U48 | 31C |
| A2U49 | 14C |
| A2U50 | 54C, 55C |
| A2U51 | 20B |
| A2U52 | 21B, 22B |
| A2U53 | 53D, 55D |
| A2U53 | 29C |

## PARTS LOCATION INDEX

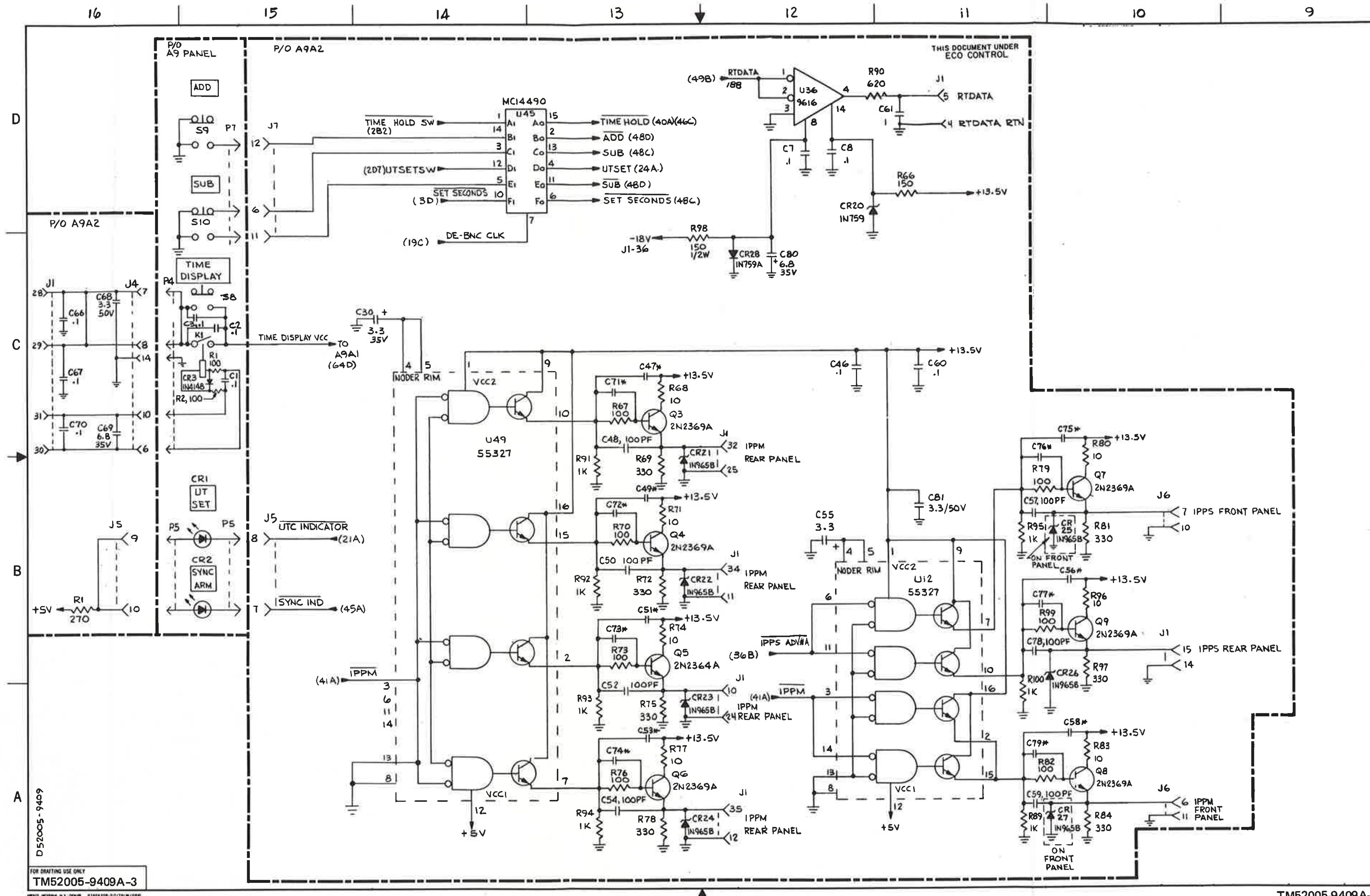
(PREFIX ALL REFERENCE DESIGNATORS WITH 1A9)

| REF DES | ZONE |
|---|---|
| A2U54 | 22B, 23B |
| A2U55 | 18C, 20C |
| A2U56 | 19C |
| A2U57 | 31B |
| A2U58 | 30A |
| A2U59 | 31B |
| A2U62 | 3A, 5D, 23B, 23D, 38D, 44B, 47C |
| A2U63 | 23C |
| A2U64 | 22C, 54D |
| A2U65 | 21C |
| A2U66 | 26B |
| A2U67 | 27B |
| A2U68 | 27B |

| REF DES | ZONE |
|---|---|
| A2U69 | 27C |
| A2U70 | 27A |
| C1 | 15C |
| C2 | 15C |
| C3 | 15C |
| CR1 | 15B |
| CR2 | 15B |
| CR3 | 15C |
| J2 | 57B |
| J3 | 57C |
| J4 | 57B |

| REF DES | ZONE |
|---|---|
| K1 | 15C |
| P4 | 15C, 32D, 63A |
| P5 | 15B, 61A |
| P6 | 6D, 59A |
| P7 | 4B, 15C |
| P8 | 31D |
| P9 | 28C, 32D |
| R1 | 15C |
| R2 | 15C |

| REF DES | ZONE |
|---|---|
| S1 | 28B, 28C, 32B, 32C, 32D |
| S2 | 4B |
| S3 | 8B |
| S4 | 8C |
| S5 | 4C |
| S6 | 4C |
| S7 | 4D |
| S8 | 15C |
| S9 | 15D |
| S10 | 15D |
| S11 | 8D |




TM52005-9409A-3

Figure 5-17. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409) (Sheet 3 of 9)

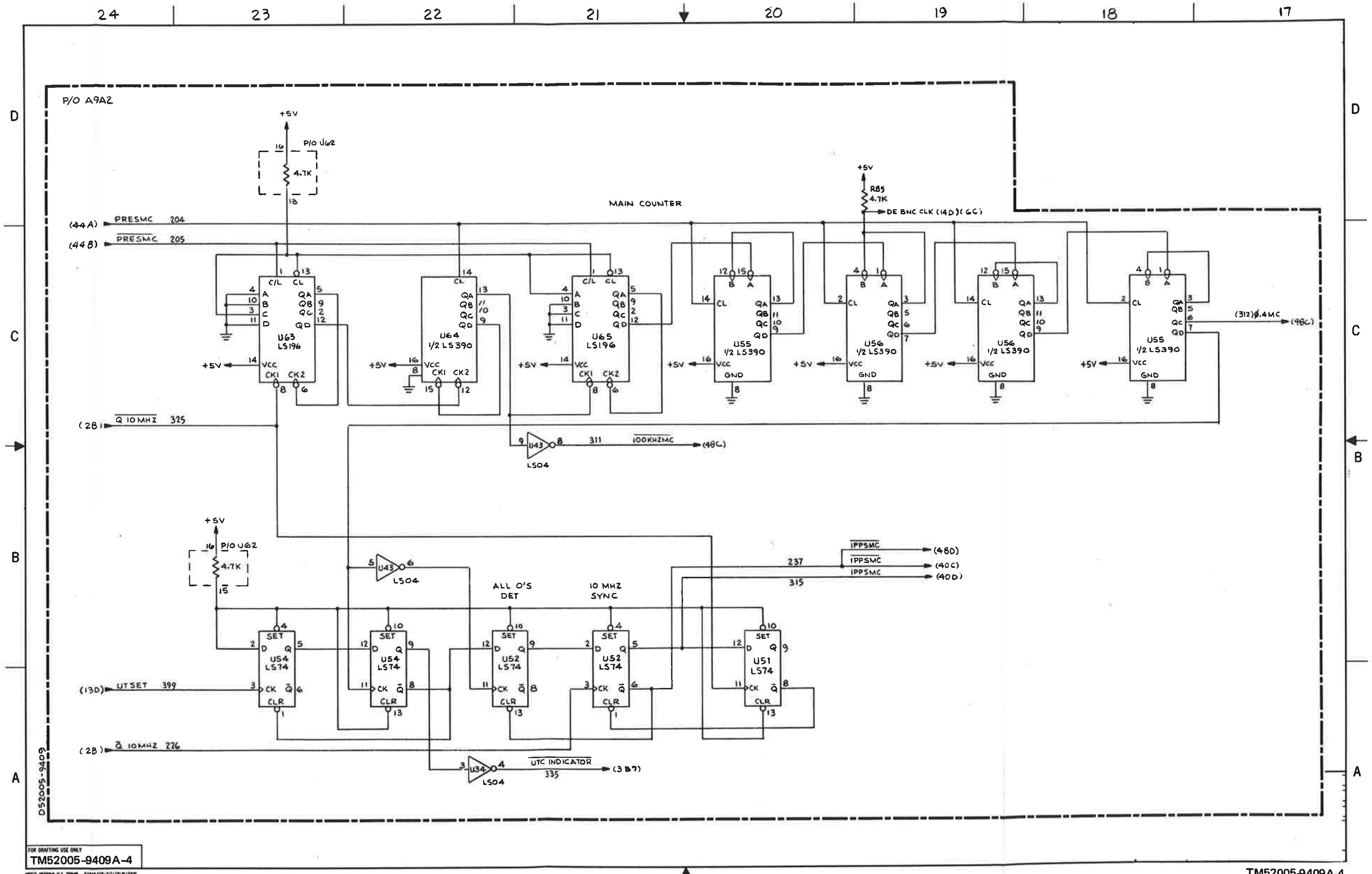
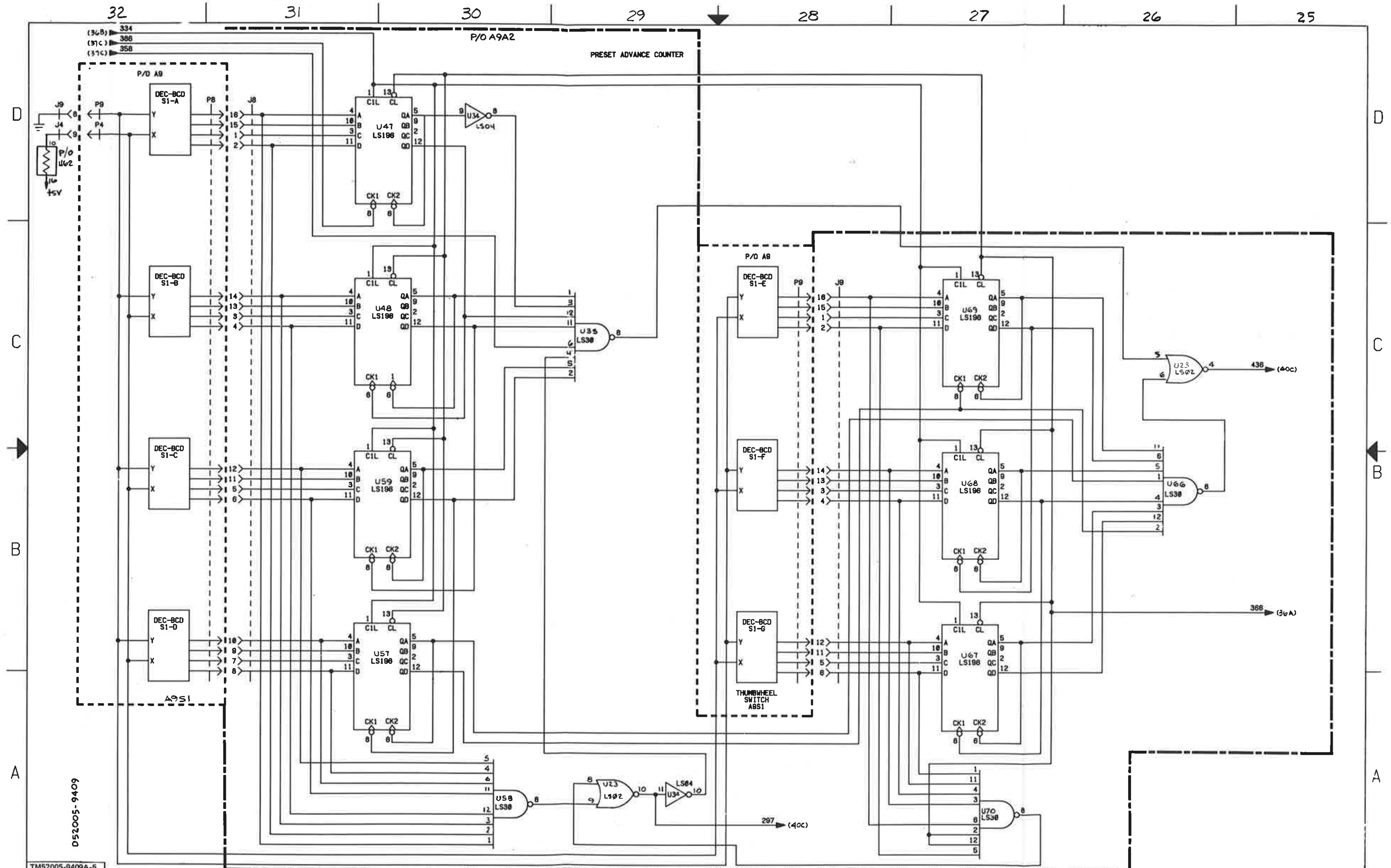



Figure 5-17. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409) (Sheet 4 of 9)



TM52005-9409A-5

Figure 5-17. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409) (Sheet 5 of 9)

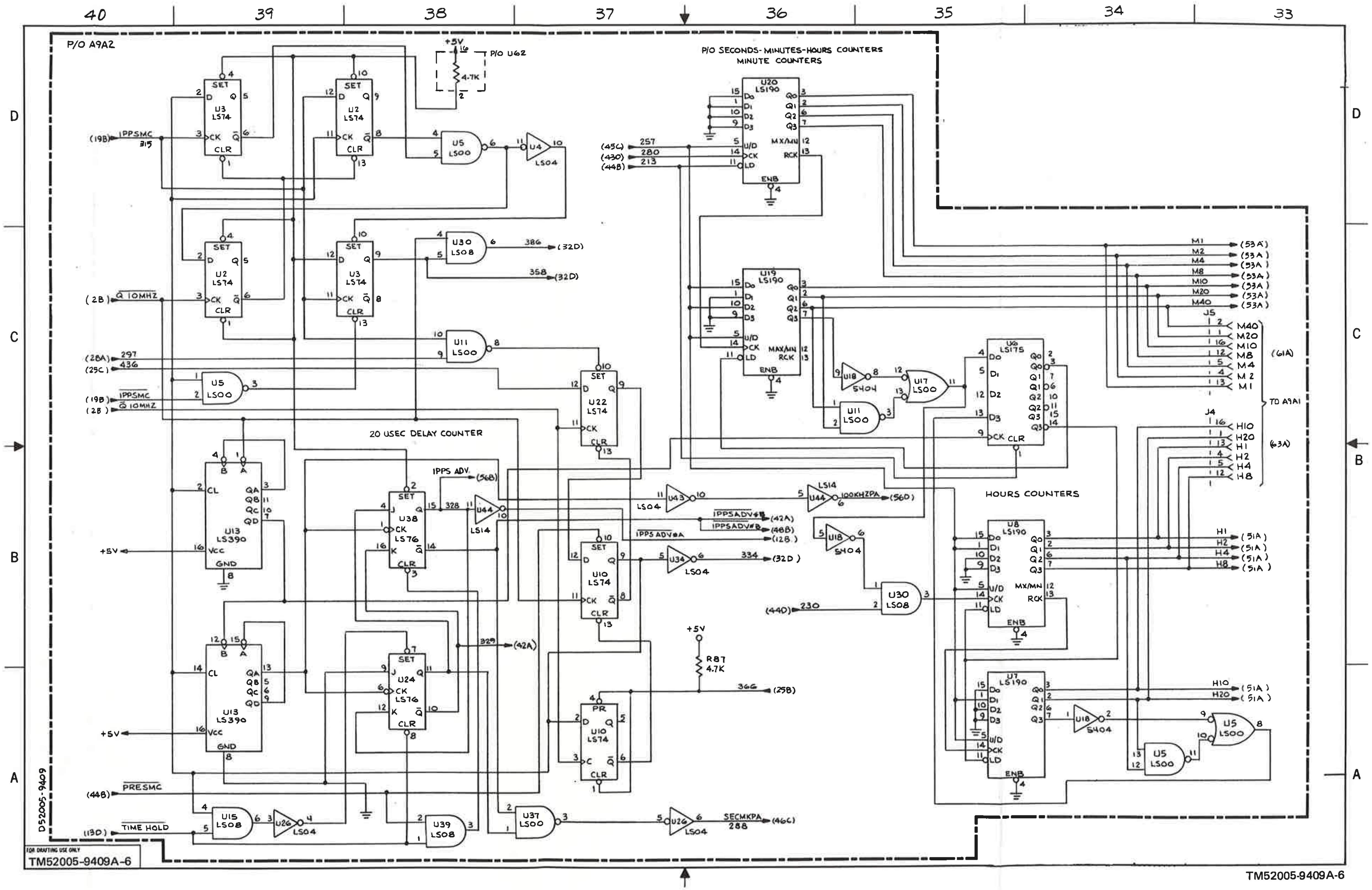



Figure 5-17. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409) (Sheet 6 of 9)

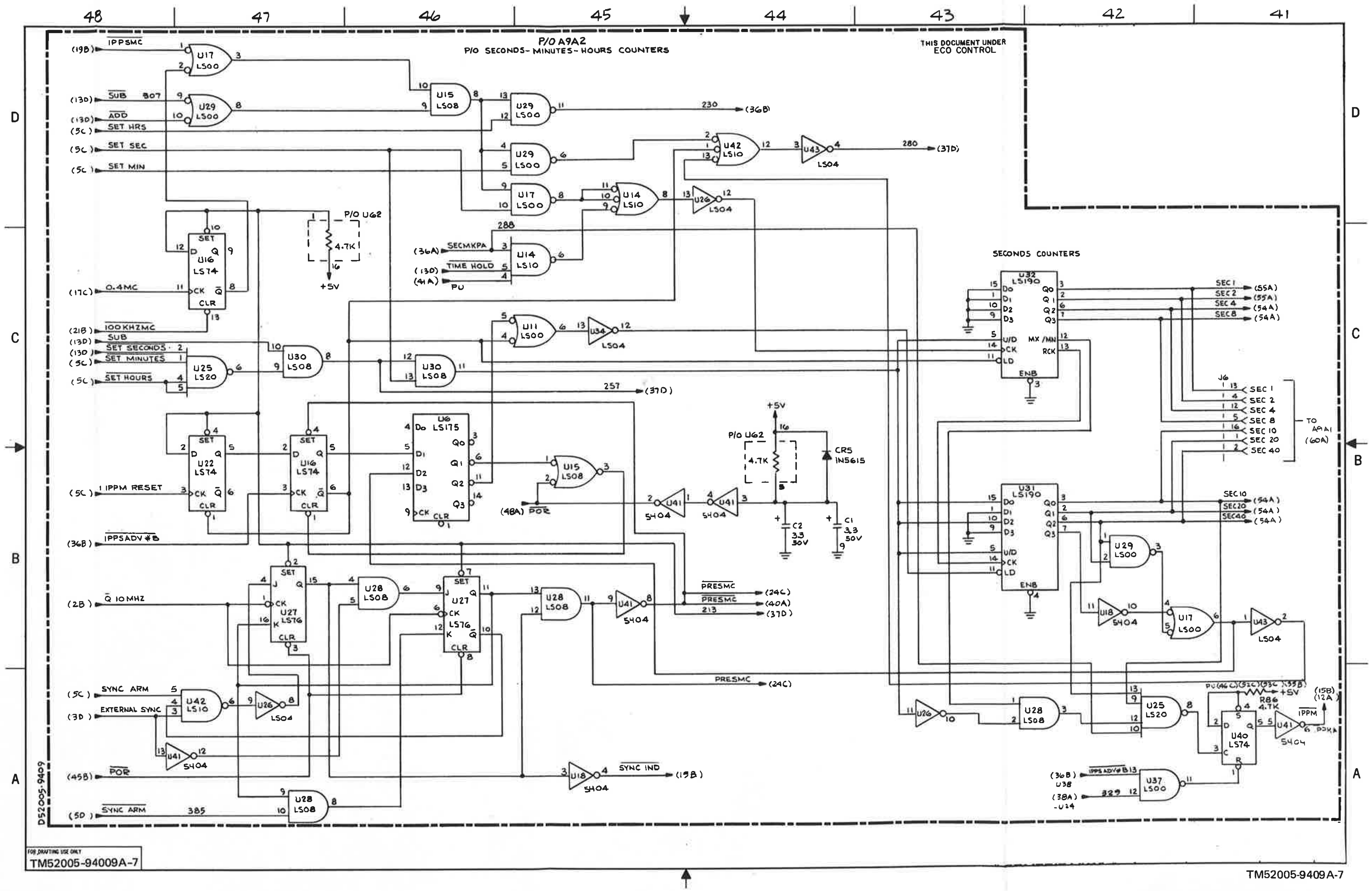
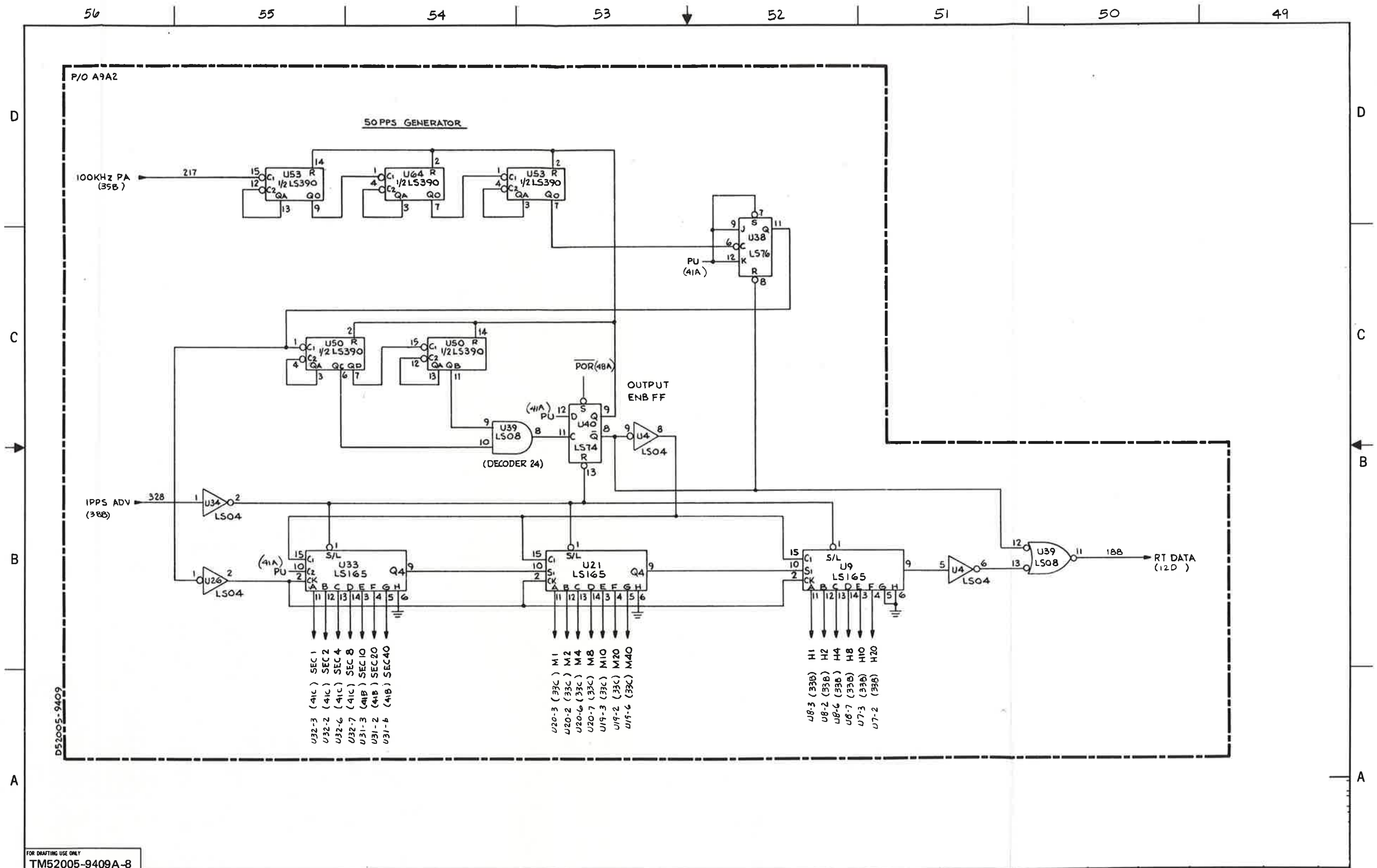
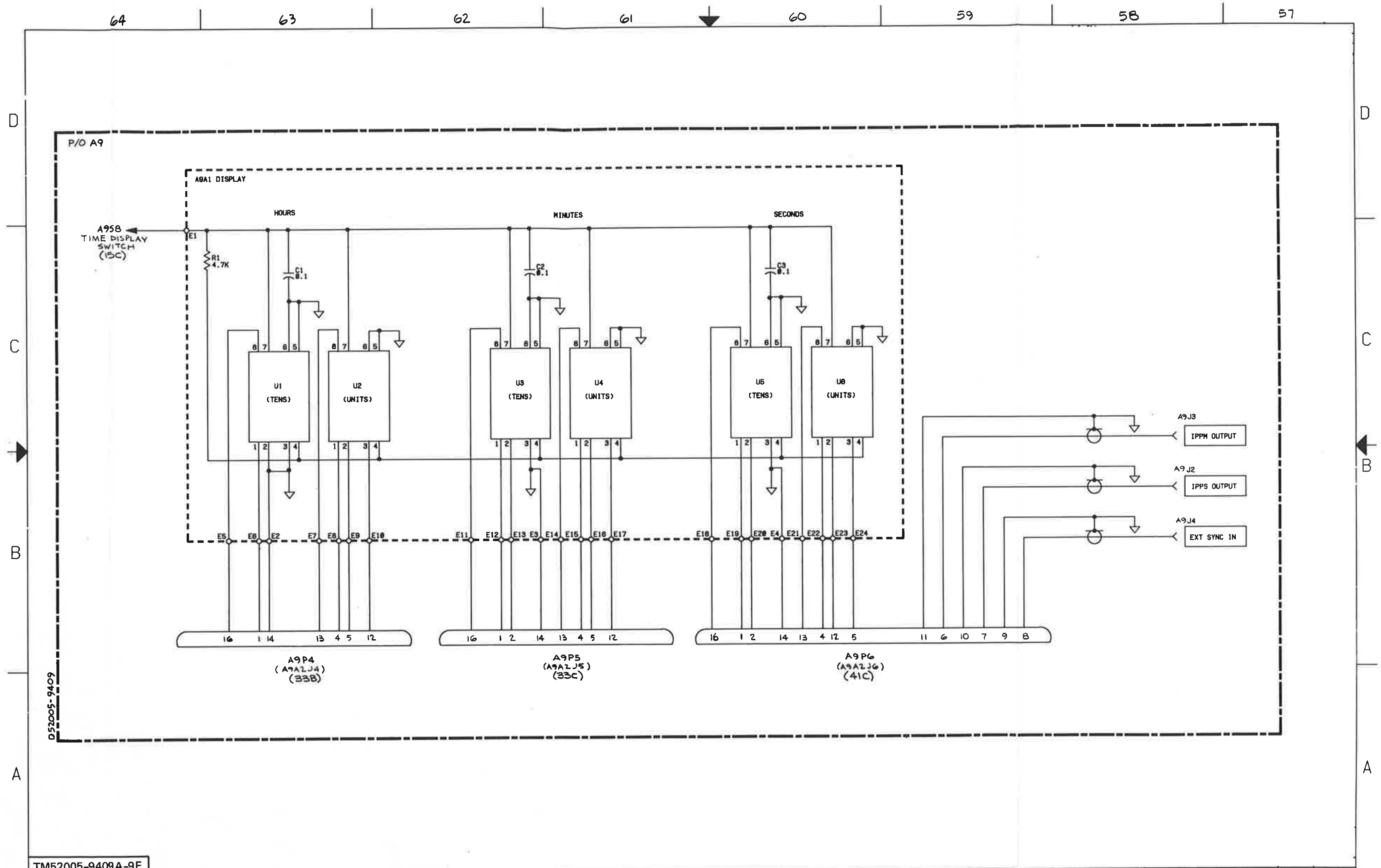


Figure 5-17. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409) (Sheet 7 of 9)




TM52005-9409A-8

**Figure 5-17. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409) (Sheet 8 of 9)**




TM52005-9409A-9F

Figure 5-17. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409) (Sheet 9 of 9)

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTORS ARE ALL 4.7K OHMS
   CAPACITORS ARE IN $\mu$f
   INDUCTORS ARE IN $\mu$H

2. * = SELECTED VALUE: INITIAL VALUES MAY BE SHOWN

3. PREFIX ALL REF. DESIGNATIONS WITH A9A2 EXCEPT WHERE PREFIX A9 OR A9A1 IS SHOWN

4. ALL IC TYPE NUMBERS SHALL BE PREFIXED WITH "54"

5. LEGENDS:

   A.) ☐ INDICATES PANEL MARKING

   B.) (⟶) REPRESENTS SHEET GRID LOCATION

   C.) GRID LOCATION

   EXAMPLE: 30 C

   HORIZONTAL GRID (30) — VERTICAL GRID (C)

   D.) HORIZONTAL GRID LOCATION

| | |
|---|---|
| SHT 1 | 1-8 |
| SHT 2 | 9-16 |
| SHT 3 | 17-24 |
| SHT 4 | 25-32 |
| SHT 5 | 33-40 |
| SHT 6 | 41-48 |
| SHT 7 | 49-56 |
| SHT 8 | 57-64 |

6. ASSOCIATED DRAWINGS:

   A9 ASSY - D52000-9409
   PL52000-9409
   D21709-6209-1 ICD (PN)

   A9A1 ASSY - D22001-6209
   PL22001-6209

   A9A2 ASSY - D52002-9409-1
   PL52002-9409-1

   A9A1 WIRING DIAGRAM - D52007-9409

   A9A2 WIRE CHART - 52006-9409

A9

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| J1, P1-P3 | | | | | | | | |
| REFERENCE SYMBOL NO. NOT USED | | | | | | | | |
| A2 | C8 | CR3 | | J4 | K1 | P9 | R2 | S11 |
| HIGHEST REFERENCE SYMBOL NO. USED | | | | | | | | |

A9A1

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| REFERENCE SYMBOL NO. NOT USED | | | | | | | |
| C3 | | R1 | U6 | | | | |
| HIGHEST REFERENCE SYMBOL NO. USED | | | | | | | |

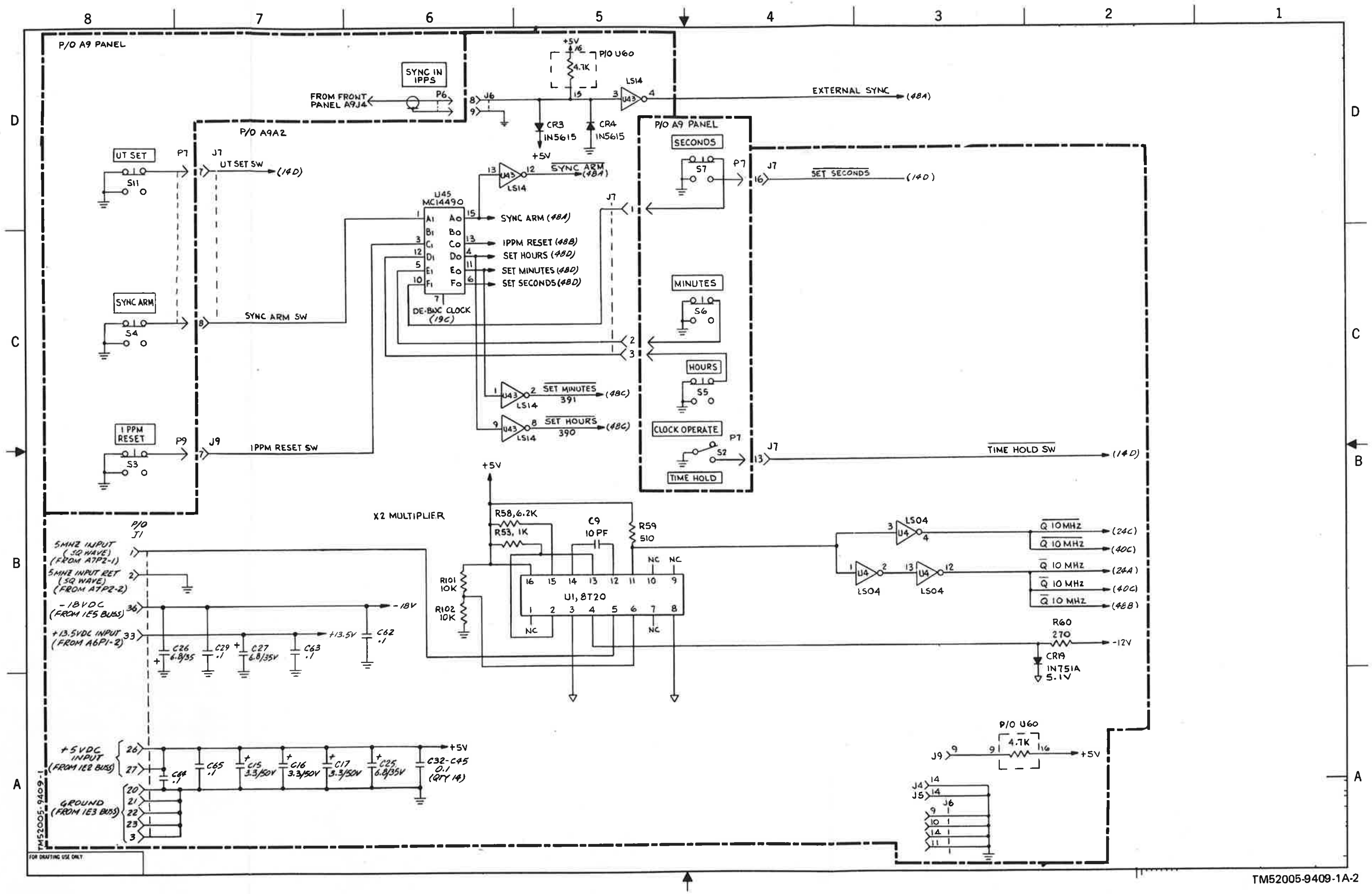
A9A2

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| C3-C6, C10-C14, C18-C24, C28, C31, CR1, CR2, CR6-CR18 | | | | | | | |
| J2, J3, Q1, Q2, R2-R52, R54-R57, R61-R65, R88 | | | | | | | |
| REFERENCE SYMBOL NO. NOT USED | | | | | | | |
| C81 | CR28 | J9 | Q9 | R102 | U68 | | |
| HIGHEST REFERENCE SYMBOL NO. USED | | | | | | | |

TM52005-9409-1A-1

Figure 5-18. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409-1) (Sheet 1 of 9)

| REF DES | ZONE |
|---|---|
| S2 | 4B |
| S3 | 8B |
| S4 | 8C |
| S5 | 4C |
| S6 | 4C |
| S7 | 4D |
| S8 | 15C |
| S9 | 15D |
| S10 | 15D |
| S11 | 8D |




TM52005-9409-1A-2

Figure 5-18. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409-1) (Sheet 2 of 9)

PARTS LOCATION INDEX

(PREFIX ALL REFERENCE DESIGNATORS WITH 1A9)

| REF DES | ZONE |
|---|---|
| A1C1 | 63C |
| A1C2 | 62C |
| A1C3 | 60C |
| A1E1 | 64C |
| A1E2 | 63B |
| A1E3 | 62B |
| A1E4 | 60B |
| A1E5 | 63B |
| A1E6 | 63B |
| A1E7 | 63B |
| A1E8 | 63B |
| A1E9 | 63B |
| A1E10 | 63B |
| A1E11 | 62B |
| A1E12 | 62B |
| A1E13 | 62B |
| A1E14 | 61B |
| A1E15 | 61B |
| A1E16 | 61B |
| A1E17 | 61B |
| A1E18 | 61B |
| A1E19 | 60B |
| A1E20 | 60B |
| A1E21 | 60B |
| A1E22 | 60B |
| A1E23 | 60B |
| A1E24 | 60B |
| A1R1 | 63C |
| A1U1 | 63C |
| A1U2 | 63C |
| A1U3 | 62C |
| A1U4 | 61C |
| A1U5 | 60C |
| A1U6 | 60C |
| A2C1 | 44B |
| A2C2 | 44B |
| A2C7 | 12D |
| A2C8 | 12D |
| A2C9 | 5B |
| A2C15 | 7A |
| A2C16 | 7A |
| A2C17 | 7A |
| A2C25 | 7A |
| A2C26 | 8B |
| A2C27 | 7B |
| A2C29 | 8B |
| A2C30 | 14C |
| A2C32 | 6A |
| A2C33 | 6A |
| A2C34 | 6A |
| A2C35 | 6A |
| A2C36 | 6A |
| A2C37 | 6A |
| A2C38 | 6A |
| A2C39 | 6A |
| A2C40 | 6A |
| A2C41 | 6A |
| A2C42 | 6A |
| A2C43 | 6A |
| A2C44 | 6A |
| A2C45 | 6A |

| REF DES | ZONE |
|---|---|
| A2C46 | 12C |
| A2C47 | 13C |
| A2C48 | 13C |
| A2C49 | 13B |
| A2C50 | 13B |
| A2C51 | 13B |
| A2C52 | 13A |
| A2C53 | 13A |
| A2C54 | 13A |
| A2C55 | 12B |
| A2C56 | 10B |
| A2C57 | 11B |
| A2C58 | 10A |
| A2C59 | 11A |
| A2C60 | 11C |
| A2C61 | 11D |
| A2C62 | 7B |
| A2C63 | 7B |
| A2C64 | 8A |
| A2C65 | 8A |
| A2C66 | 16C |
| A2C67 | 16C |
| A2C68 | 16C |
| A2C69 | 16C |
| A2C70 | 16C |
| A2C71 | 13C |
| A2C72 | 13B |
| A2C73 | 13B |
| A2C74 | 13A |
| A2C75 | 10C |
| A2C76 | 11B |
| A2C77 | 11B |
| A2C78 | 11B |
| A2C79 | 11A |
| A2C80 | 12C, |
| A2C81 | 11B |
| A2CR3 | 5D |
| A2CR4 | 5D |
| A2CR5 | 44B |
| A2CR19 | 2B |
| A2CR20 | 12B |
| A2CR21 | 13B |
| A2CR22 | 13B |
| A2CR23 | 13A |
| A2CR24 | 13A |
| A2CR25 | 10B |
| A2CR26 | 11B |
| A2CR27 | 11A |
| A2CR28 | 12C |
| A2J1 | 8B, 10B, 11D, 12A, 12B, 12C, 13C, 16C |
| A2J4 | 3A, 16C, 32D, 33C |
| A2J5 | 3A, 15B, 16B, 33C |
| A2J6 | 3A, 6D, 10A, 10B, 41C |
| A2J7 | 4B, 4D, 5D, 7D, 15D |
| A2J8 | 31D |

| REF DES | ZONE |
|---|---|
| A2J9 | 3A, 7B, 28C, 32D |
| A2Q3 | 13C |
| A2Q4 | 13B |
| A2Q5 | 13B |
| A2Q6 | 13A |
| A2Q7 | 10B |
| A2Q8 | 10A |
| A2Q9 | 10B |
| A2R1 | 16B |
| A2R53 | 6B |
| A2R58 | 6B |
| A2R60 | 2B |
| A2R66 | 11D |
| A2R67 | 13C |
| A2R68 | 13C |
| A2R69 | 13B |
| A2R70 | 13B |
| A2R71 | 13B |
| A2R72 | 13B |
| A2R73 | 13B |
| A2R74 | 13B |
| A2R75 | 13A |
| A2R76 | 13A |
| A2R77 | 13A |
| A2R78 | 13A |
| A2R79 | 11B |
| A2R80 | 10B |
| A2R81 | 10B |
| A2R82 | 11A |
| A2R83 | 10A |
| A2R84 | 10A |
| A2R85 | 19D |
| A2R86 | 41A |
| A2R87 | 36A |
| A2R89 | 11A |
| A2R90 | 12D |
| A2R91 | 13B |
| A2R92 | 13B |
| A2R93 | 13A |
| A2R94 | 13A |
| A2R95 | 11B |
| A2R96 | 10B |
| A2R97 | 10B |
| A2R98 | 13C |
| A2R99 | 11B |
| A2R100 | 11A |
| A2R101 | 6B |
| A2R102 | 6B |
| A2U1 | 5B |
| A2U2 | 38D, 39C |
| A2U3 | 38C, 39D |
| A2U4 | 3B, 37D, 51B, 53C |
| A2U5 | 33A, 34A, 38D, 39C |
| A2U6 | 35C, 46C |
| A2U7 | 37C, 47B |
| A2U8 | 35A |
| A2U9 | 35B |
| A2U10 | 52B |
| A2U11 | 37A, 37B |

| REF DES | ZONE |
|---|---|
| A2U12 | 26C, 29A |
| A2U13 | 39A, 39B |
| A2U14 | 45C, 45D |
| A2U15 | 39A, 45B, 46D |
| A2U16 | 47B, 47C |
| A2U17 | 35C, 42B, 45D, 47D |
| A2U18 | 34A, 36B, 36C, 42B, 45A |
| A2U19 | 36C, 38C, 45C |
| A2U20 | 36C |
| A2U21 | 36D |
| A2U22 | 53B |
| A2U23 | 11B, 36C |
| A2U24 | 22A, 29A, 30D, 37B, 45C, 55B |
| A2U25 | 12D |
| A2U26 | 37A, 42A |
| A2U27 | 38A |
| A2U28 | 42A, 47C |
| A2U29 | 37A, 39A, 43A, 44D, 47A, 55B |
| A2U30 | 46B, 47B |
| A2U31 | 42A, 45B, 46B, 47A |
| A2U32 | 42B, 45D, 47D |
| A2U33 | 35B, 38C, 46C, 47C |
| A2U34 | 43B |
| A2U35 | 43C |
| A2U36 | 54B |
| A2U37 | 38B, 52C |
| A2U38 | 38A, 50B, 54C |
| A2U39 | 41A, 53C |
| A2U40 | 41A, 44B, 45B, 48A |
| A2U41 | 44D, 47A |
| A2U42 | 21C, 22B, 37B, 41B, 44D |
| A2U43 | 5D, 6C, 6D, 36B, 38B |
| A2U44 | 14D |
| A2U45 | 6D |
| A2U46 | 30D |
| A2U47 | 30C |
| A2U48 | 29C |
| A2U49 | 14C |
| A2U50 | 54C, 55C |
| A2U51 | 20B |
| A2U52 | 21B, 22B |
| A2U53 | 53D, 55D |
| A2U54 | 22B, 23B |
| A2U55 | 18C, 20C |
| A2U56 | 19C |
| A2U57 | 31B |
| A2U58 | 30A |
| A2U59 | 5B, 30B |

PARTS LOCATION INDEX

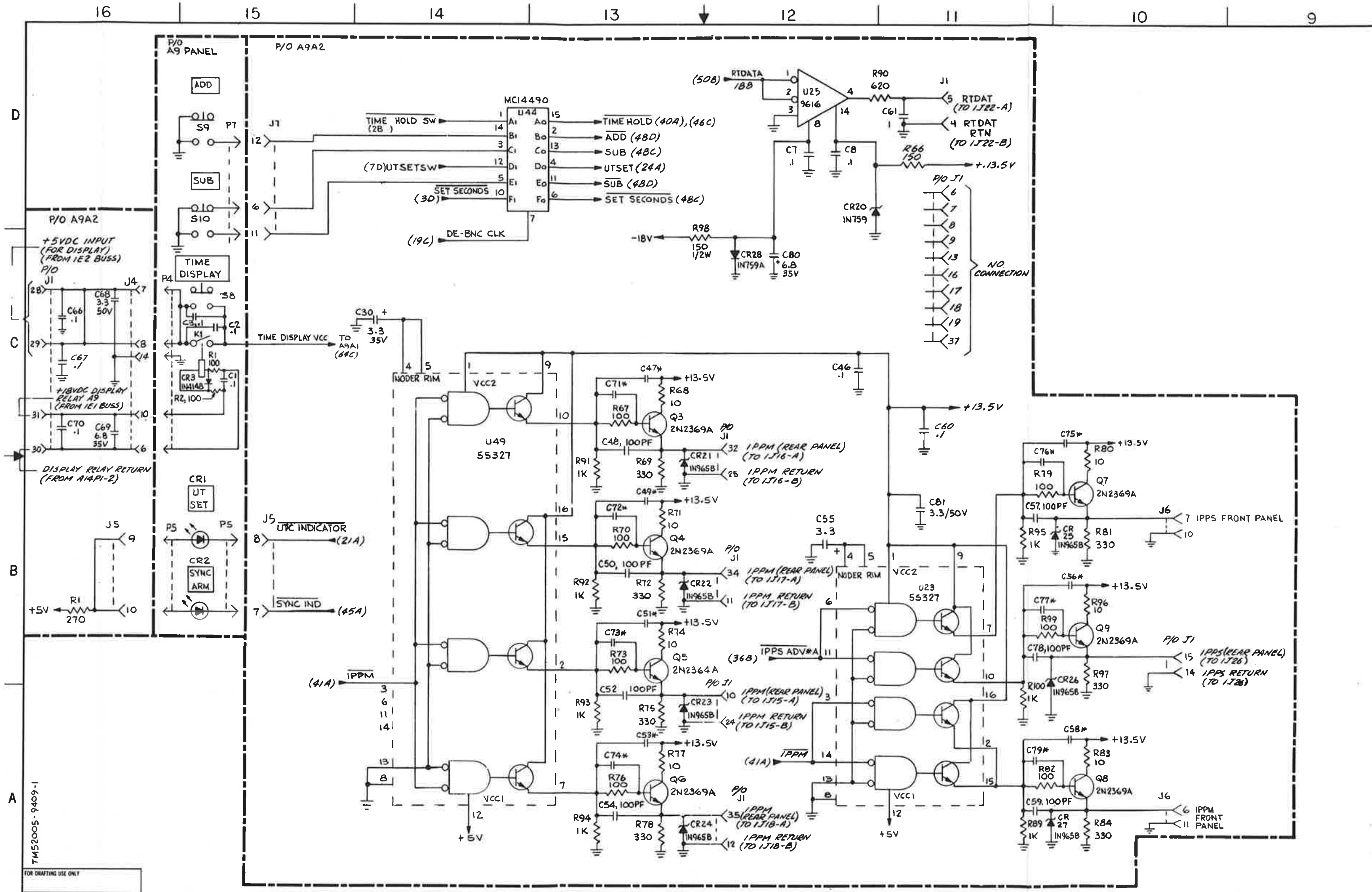
(PREFIX ALL REFERENCE DESIGNATORS WITH 1A9)

| REF DES | ZONE |
|---|---|
| A2U60 | 3A, 5D, 23B, 23D, 38D, 44B, 47C |
| A2U61 | 23C |
| A2U62 | 22C, 54D |
| A2U63 | 21C |
| A2U64 | 26B |
| A2U65 | 27B |
| A2U66 | 27B |
| A2U67 | 27C |
| A2U68 | 27A |
| C1 | 15C |
| C2 | 15C |
| C3 | 15C |

| REF DES | ZONE |
|---|---|
| CR1 | 15C |
| CR2 | 15C |
| CR3 | 15C |
| J2 | 58B |
| J3 | 58C |
| J4 | 58B |
| K1 | 15C |
| P4 | 16C, 32D, 63B |

| REF DES | ZONE |
|---|---|
| P5 | 15B, 61B |
| P6 | 6D, 60B |
| P7 | 4B, 15D |
| P8 | 31D |
| P9 | 28C, 32D |
| R1 | 15C |
| R2 | 15C |
| S1 | 28B, 28C, 32B, 32C, 32D |

| REF DES | ZONE |
|---|---|
| S2 | 4B |
| S3 | 8B |
| S4 | 8C |
| S5 | 4C |
| S6 | 4C |
| S7 | 4D |
| S8 | 15C |
| S9 | 15D |
| S10 | 15D |
| S11 | 8D |



TM52005-9409-1A-3

Figure 5-18. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409-1) (Sheet 3 of 9)

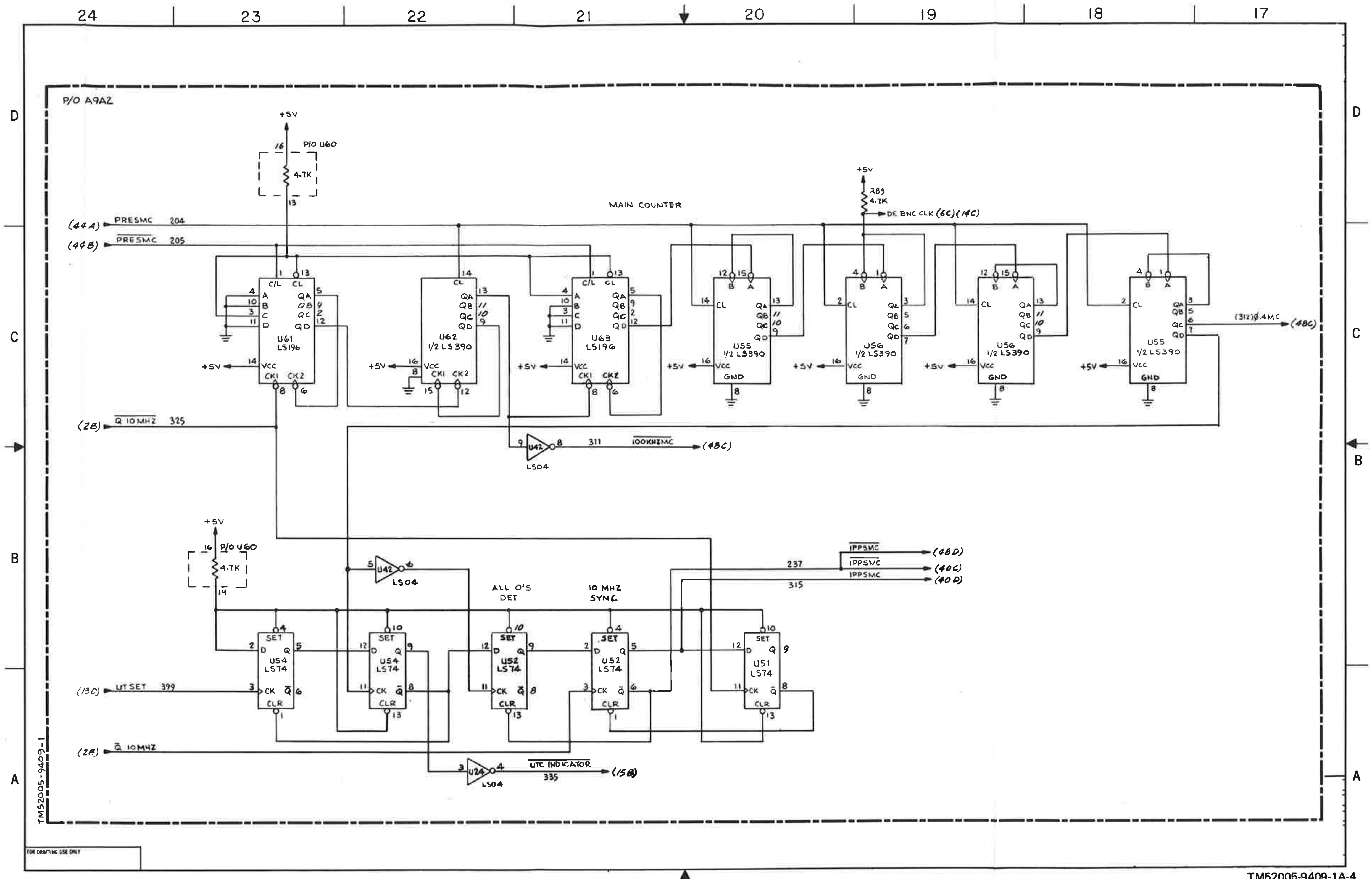
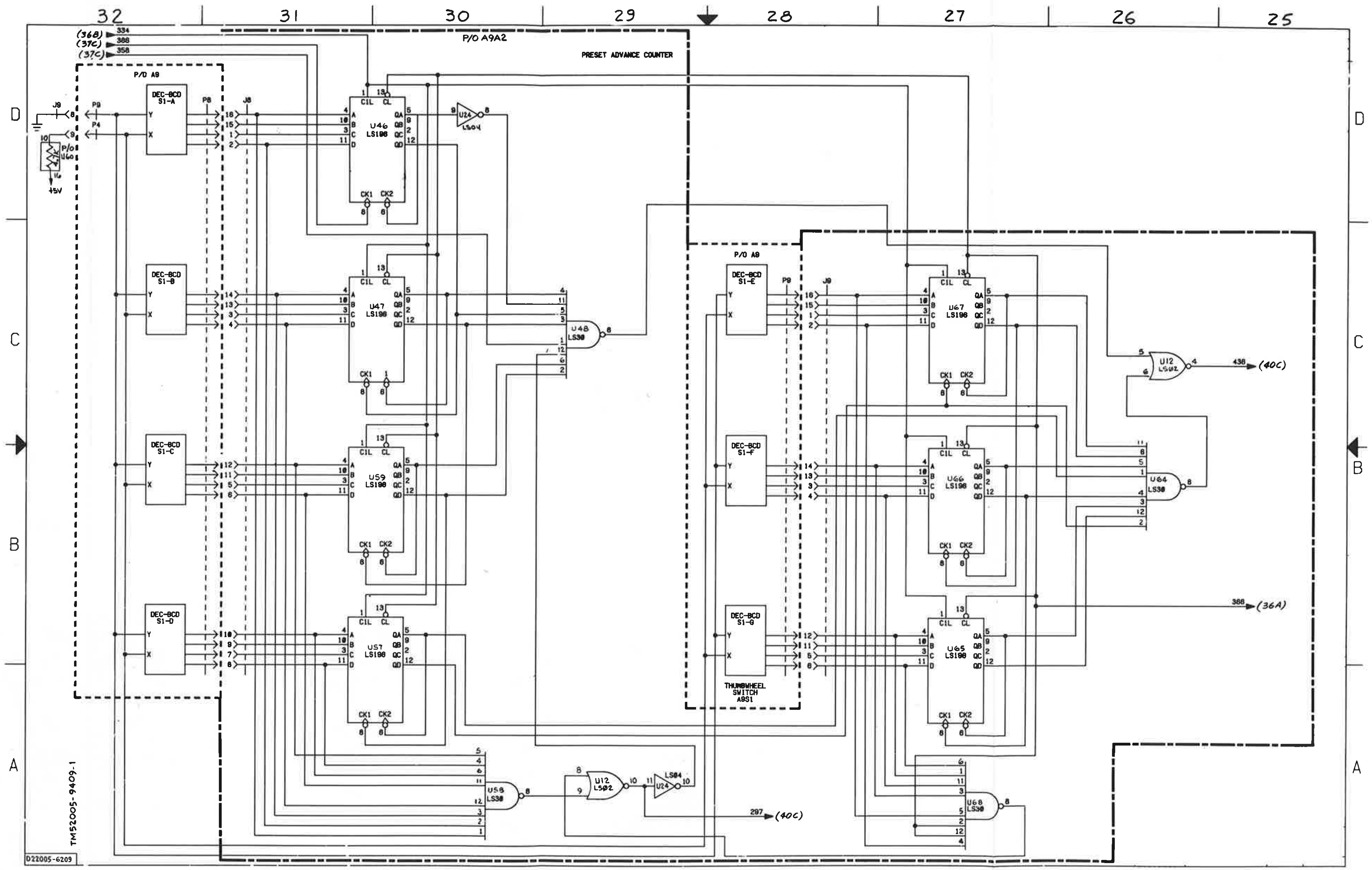
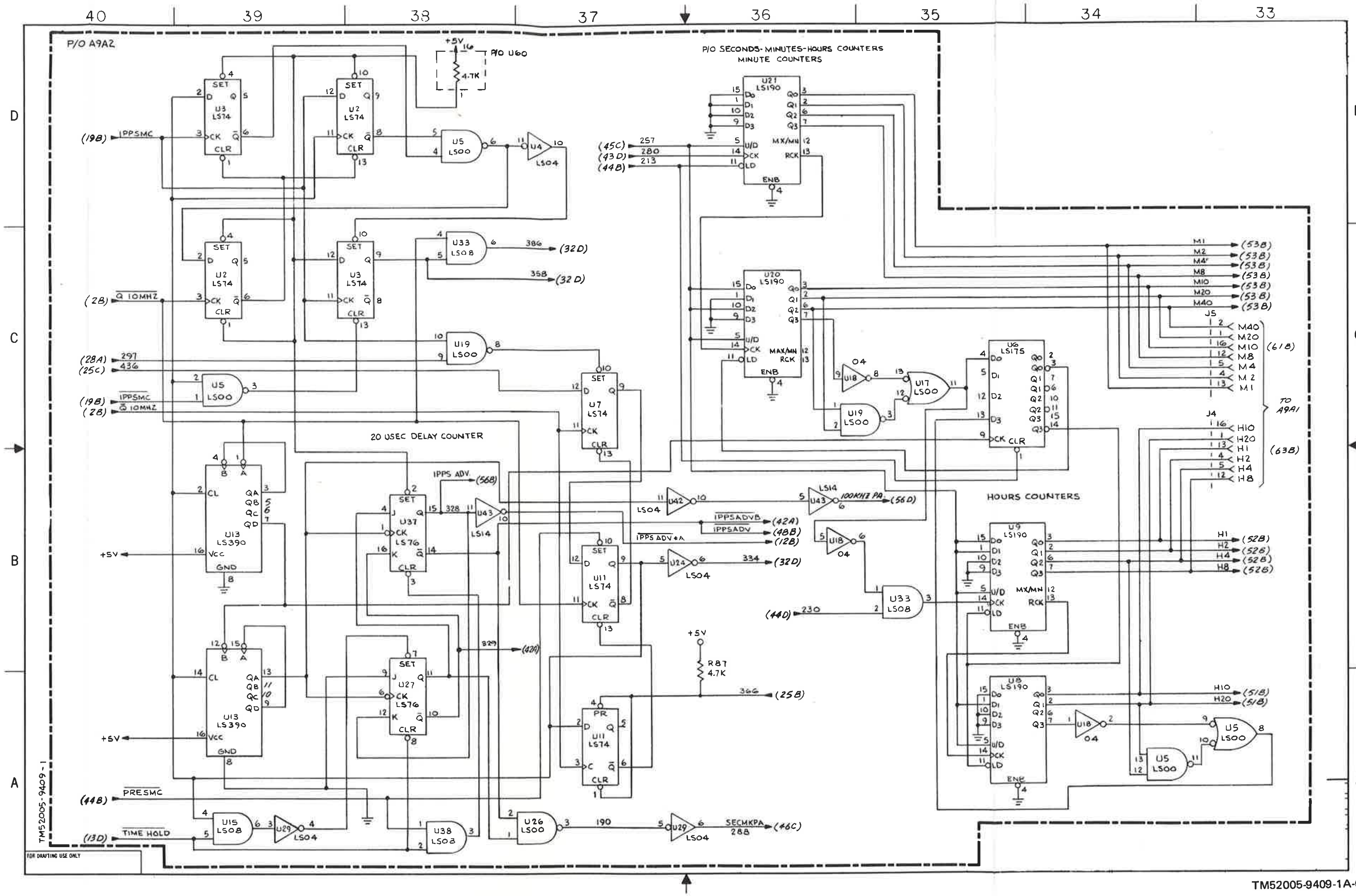


Figure 5-18. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409-1) (Sheet 4 of 9)




TM52005-9409-1A-5

Figure 5-18. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409-1) (Sheet 5 of 9)



TM52005-9409-1A-6

Figure 5-18. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409-1) (Sheet 6 of 9)

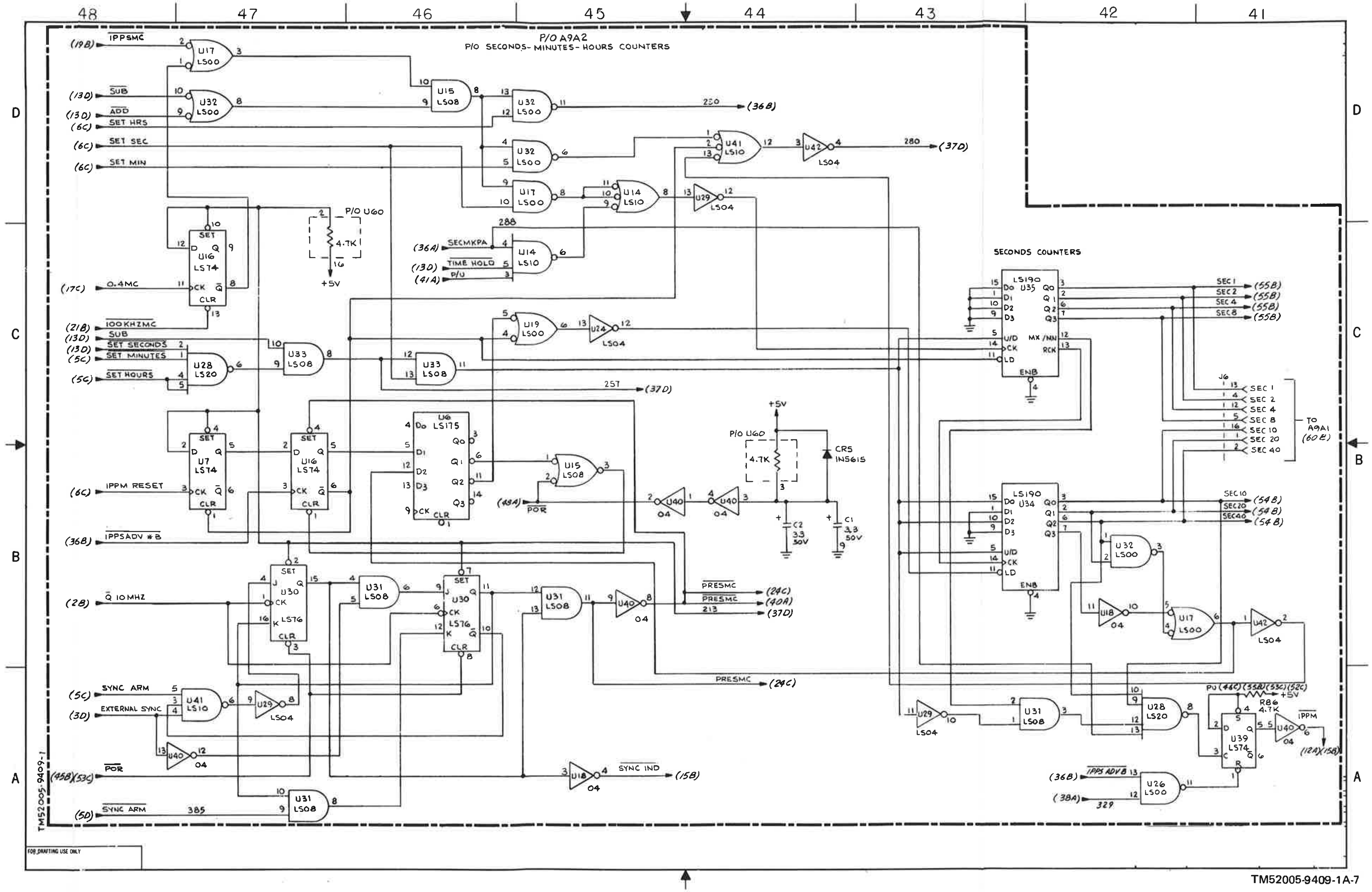



Figure 5-18. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409-1) (Sheet 7 of 9)

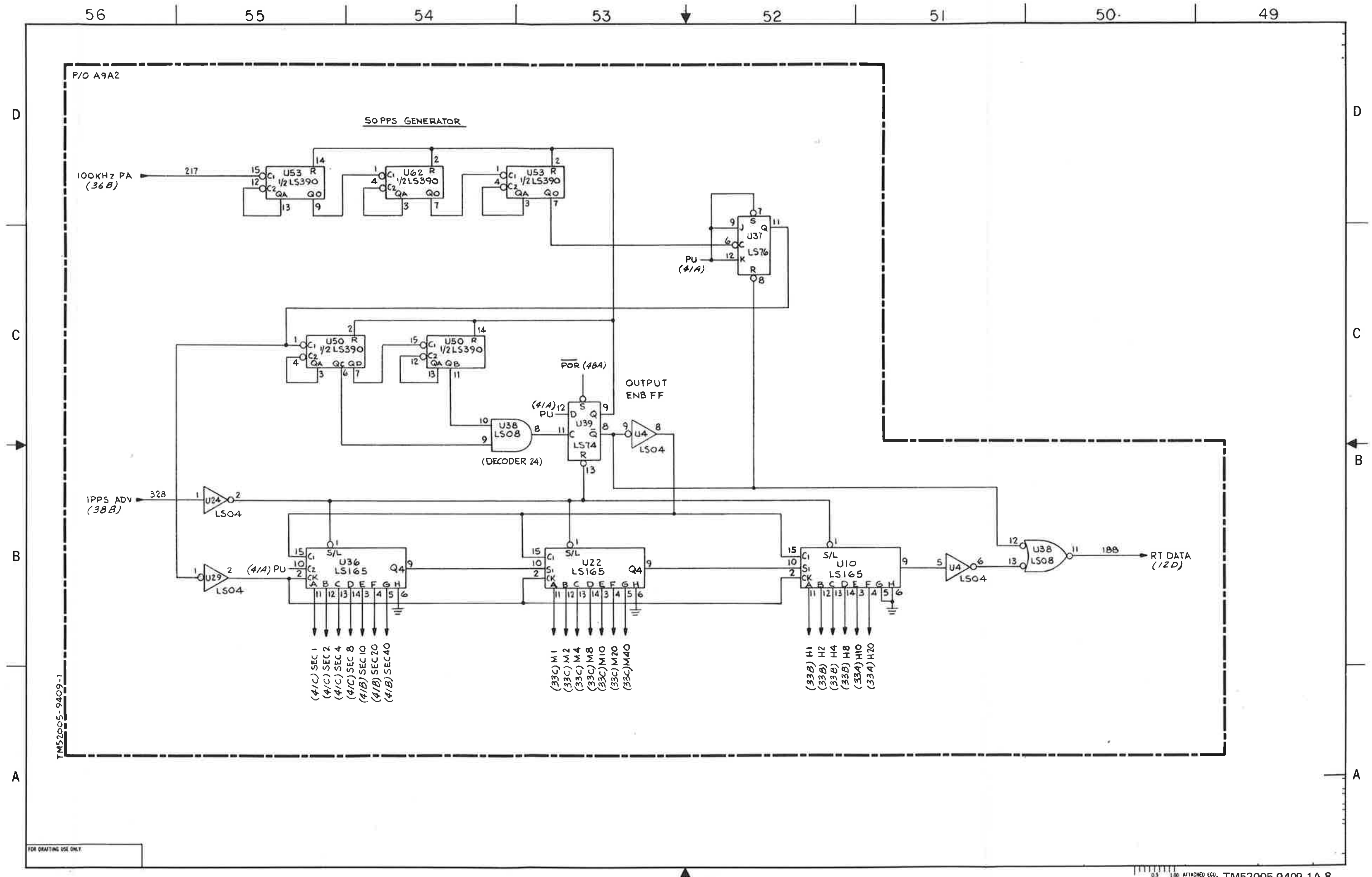
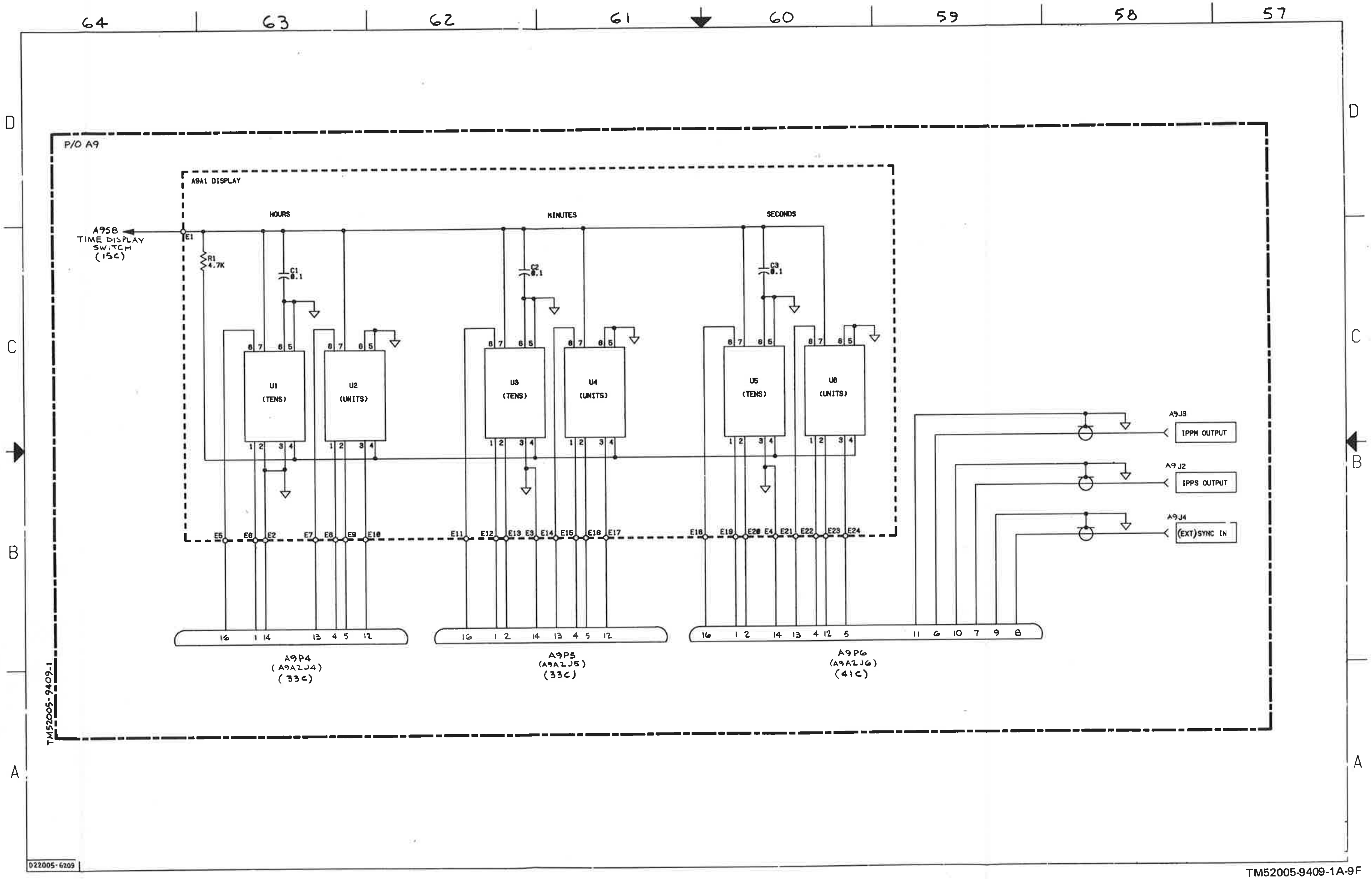



Figure 5-18. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409-1) (Sheet 8 of 9)

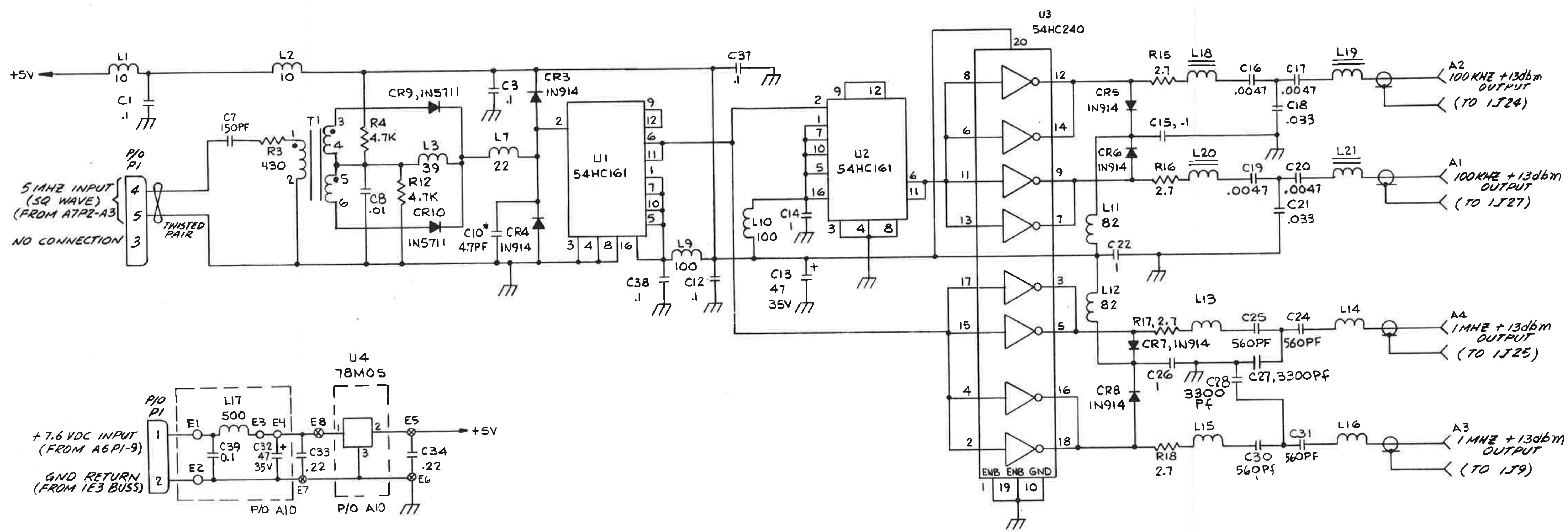



TM52005-9409-1A-9F

Figure 5-18. Real Time-of-Day Clock Module 1A9, Schematic Diagram (For 1A9A2 Part No. 52002-9409-1) (Sheet 9 of 9)

NOTES GENERAL:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTORS ARE IN OHMS
   CAPACITORS ARE IN μF
   INDUCTORS ARE IN μH
2. *=SELECTED VALUE: INITIAL VALUES MAY BE SHOWN.




A10, A10A1

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| C2, C4, C5, C6, C9, C11, C23, C29, C35, C36 | | | | | | | |
| R1, R2, R5-R11, R13, R14 | CR1, CR2 | L4, L5, L6, L8 | | | | | |
| REFERENCE SYMBOL NO. NOT USED | | | | | | | |
| R18 | C39 | U4 | P1 | CR10 | L21 | T1 | E8 |
| HIGHEST REFERENCE SYMBOL NO. USED | | | | | | | |

TM5204L-9410A

Figure 5-19. Generator Module 1A10, Schematic Diagram

NOTES GENERAL:
1. UNLESS OTHERWISE SPECIFIED:
   RESISTORS ARE IN OHMS
   CAPACITORS ARE IN µF
   INDUCTORS ARE IN µH
2. *=SELECTED VALUE: INITIAL VALUES MAY BE SHOWN.

A14, A14A1

| | | | | | | |
|---|---|---|---|---|---|---|
| C1-C26, C29, U1-U5, Q1-Q3 | | | | | | |
| R54, R55, CR1-CR6, CR9, CR10, CR14, CR15 | | | | | | |
| R1-R20, R22, R25, R29, R40-R44, R47 | | | | | | |
| REFERENCE SYMBOL NO. NOT USED | | | | | | |
| R59 | C30 | U8 | Q5 | K1 | CR18 | P1 |
| HIGHEST REFERENCE SYMBOL NO. USED | | | | | | |

A17

| | | | |
|---|---|---|---|
| | | | |
| REFERENCE SYMBOL NO. NOT USED | | | |
| F1 | RT1 | P1 | BT1 |
| HIGHEST REFERENCE SYMBOL NO. USED | | | |

P/O CHASSIS SUB-ASSY

| | | | |
|---|---|---|---|
| S1-S3 | J1-J10 | F1-F3 | |
| REFERENCE SYMBOL NO. NOT USED | | | |
| S4 | F4 | | J12 |
| HIGHEST REFERENCE SYMBOL NO. USED | | | |

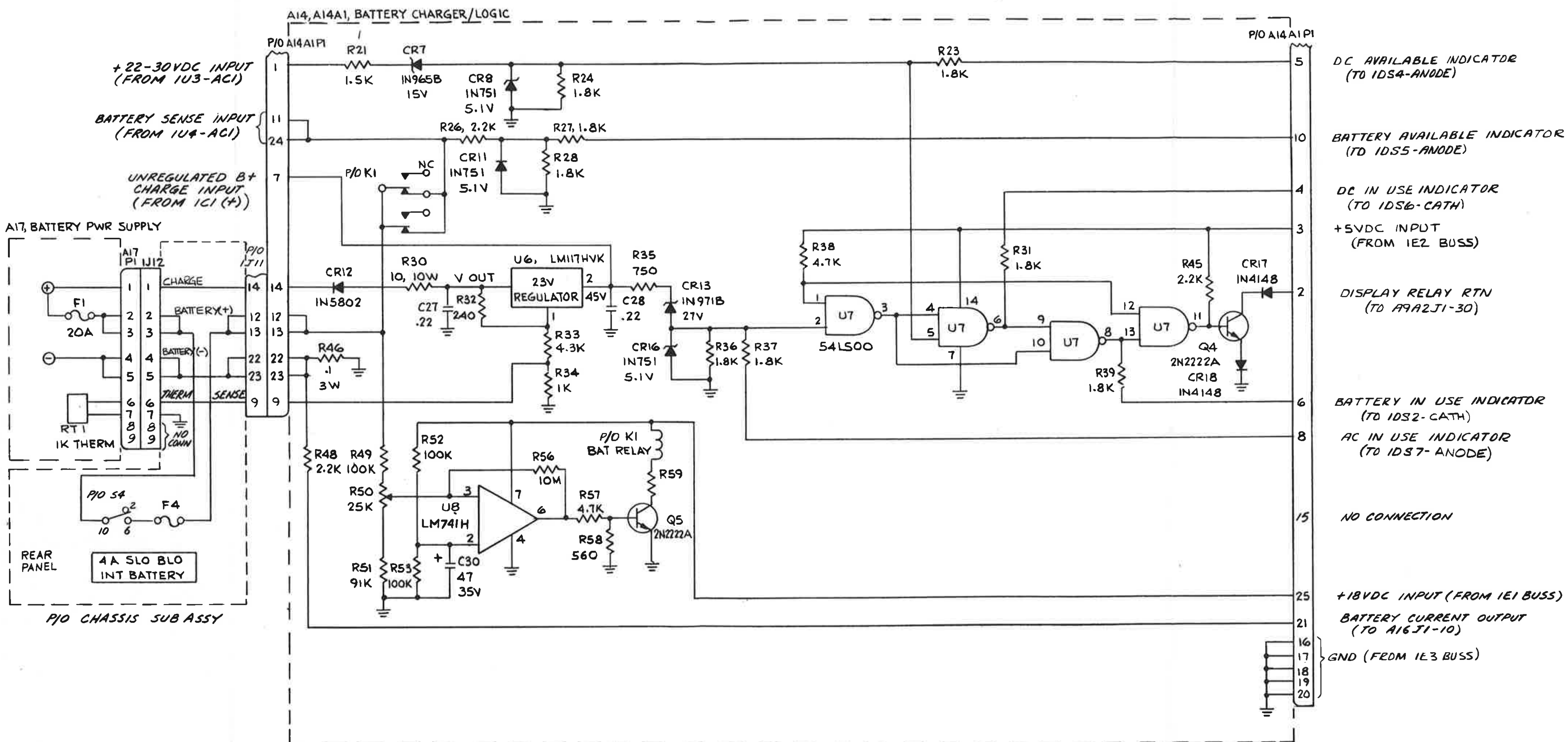
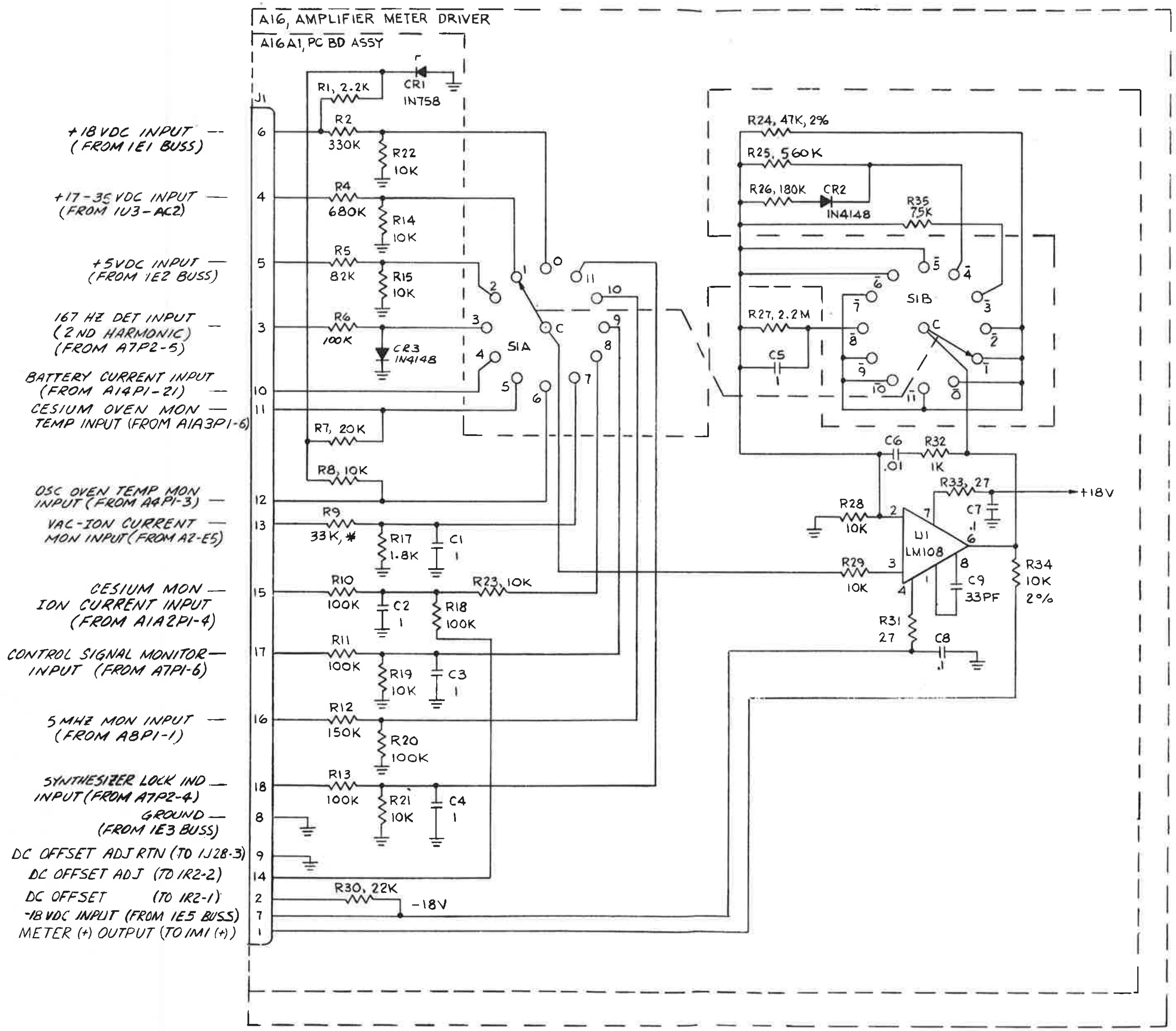



Figure 5-20. Battery Charger/Logic Module 1A14 and Battery Power Supply 1A17, Schematic Diagram




NOTES GENERAL:

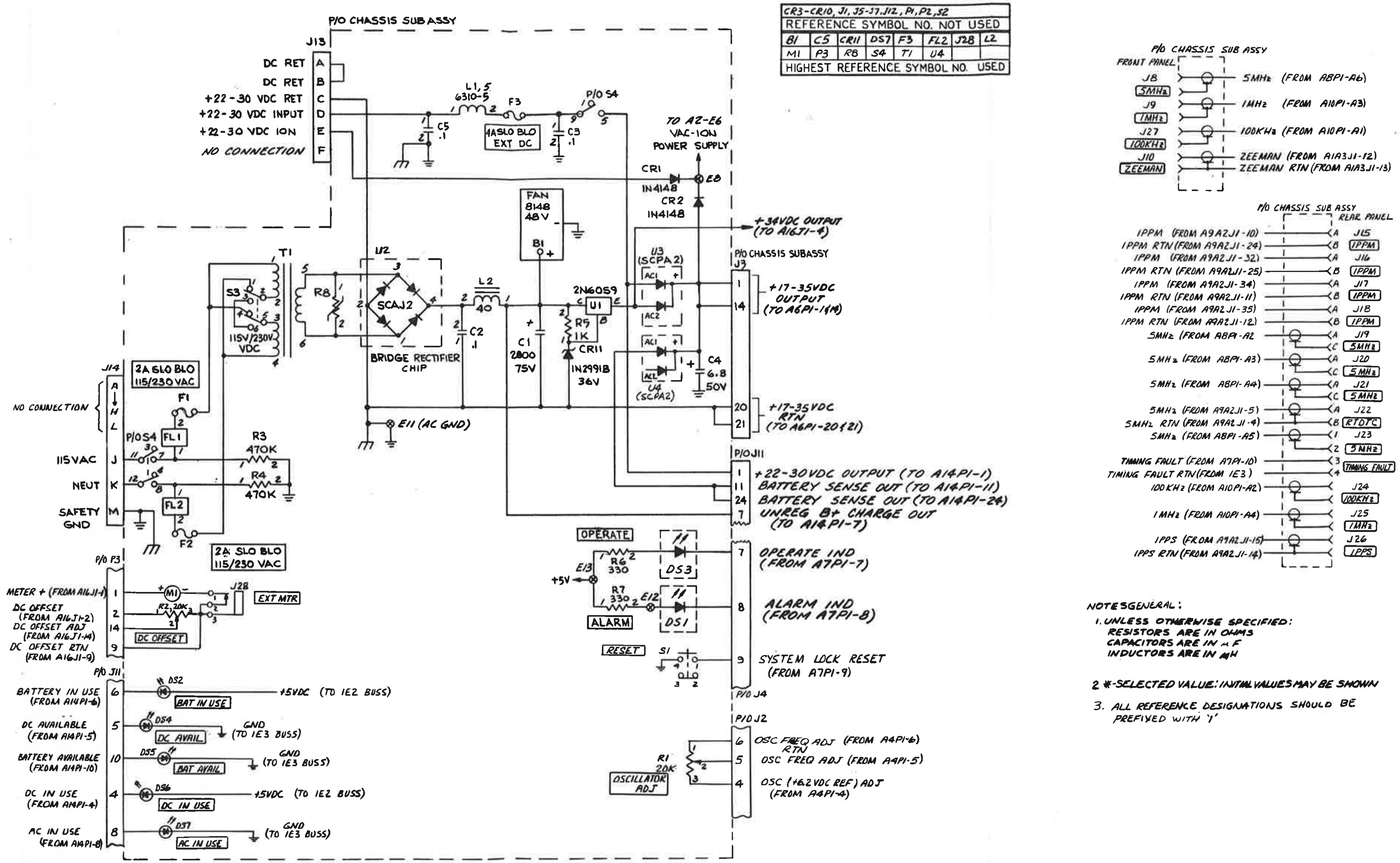
1. UNLESS OTHERWISE SPECIFIED:
   RESISTORS ARE IN OHMS
   CAPACITORS ARE IN µF
   INDUCTORS ARE IN µH
2. * = SELECTED VALUE: INITIAL VALUES MAY BE SHOWN.
3. NOTED COMPONENTS MOUNTED ON NEXT HIGHER ASSEMBLY.
4. WHEN PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, COMPLETE THE DESIGNATION WITH MODULE AND/OR ASSEMBLY PREFIX DESIGNATION.

A16, A16A1

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| R3 | R16 | | | | | | |
| REFERENCE SYMBOL NO. NOT USED | | | | | | | |
| R35 | C9 | CR3 | S1 | J1 | U1 | | |
| HIGHEST REFERENCE SYMBOL NO. USED | | | | | | | |

TM52525-9416A

Figure 5-21. Amplifier Meter Drive Assembly 1A16, Schematic Diagram



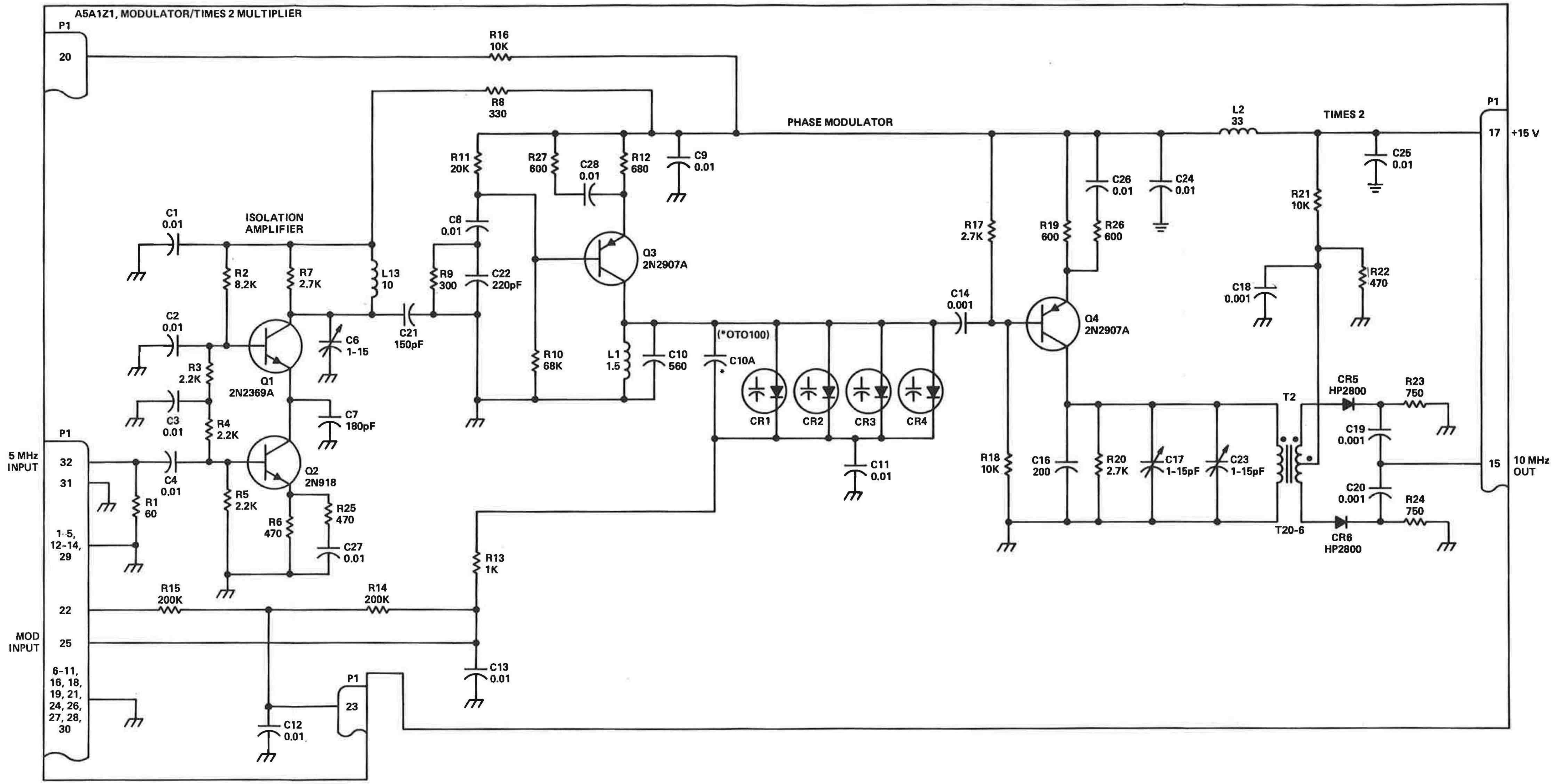

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CR3-CR10, J1, J5-J7, J12, P1, P2, S2 | | | | | | | |
| REFERENCE SYMBOL NO. NOT USED | | | | | | | |
| B1 | C5 | CR11 | DS7 | F3 | FL2 | J28 | L2 |
| M1 | P3 | R8 | S4 | T1 | U4 | | |
| HIGHEST REFERENCE SYMBOL NO. USED | | | | | | | |

NOTES GENERAL:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTORS ARE IN OHMS
   CAPACITORS ARE IN $\mu$F
   INDUCTORS ARE IN $\mu$H
2. *-SELECTED VALUE: INITIAL VALUES MAY BE SHOWN
3. ALL REFERENCE DESIGNATIONS SHOULD BE PREFIXED WITH '1'

TM51905-9418A

**Figure 5-22. Chassis Subassembly, Schematic Diagram**

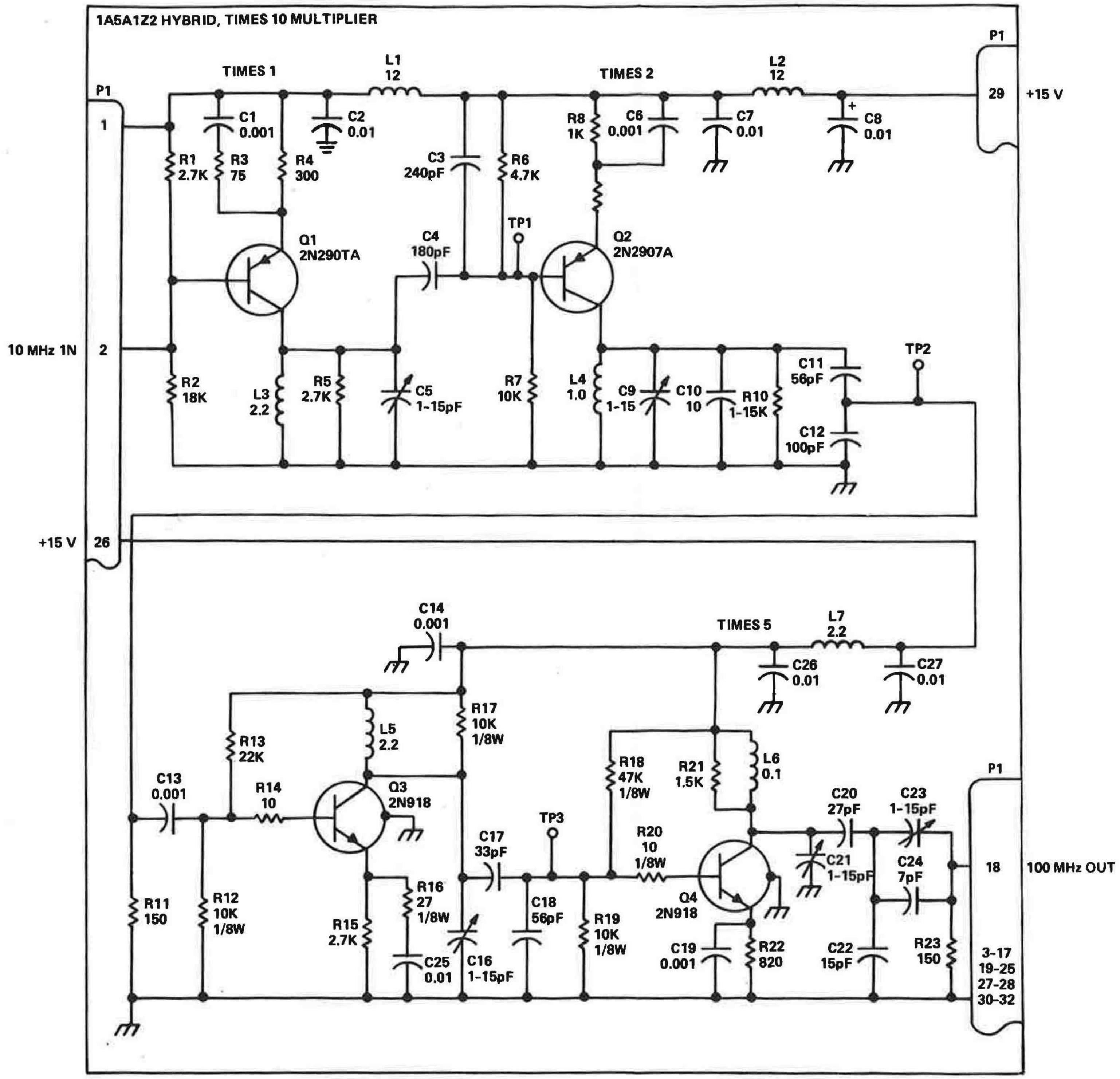



NOTES:

1. REFER TO FIGURE 5-13 FOR INTERCONNECTION DETAILS.
2. UNLESS OTHERWISE SPECIFIED: RESISTORS ARE IN OHMS, CAPACITORS ARE IN $\mu$F, AND INDUCTORS ARE IN $\mu$H.

TM51866-9405A

Figure 5-23. Hybrid Modulator/X2 Multiplier 1A5A1Z1, Schematic Diagram

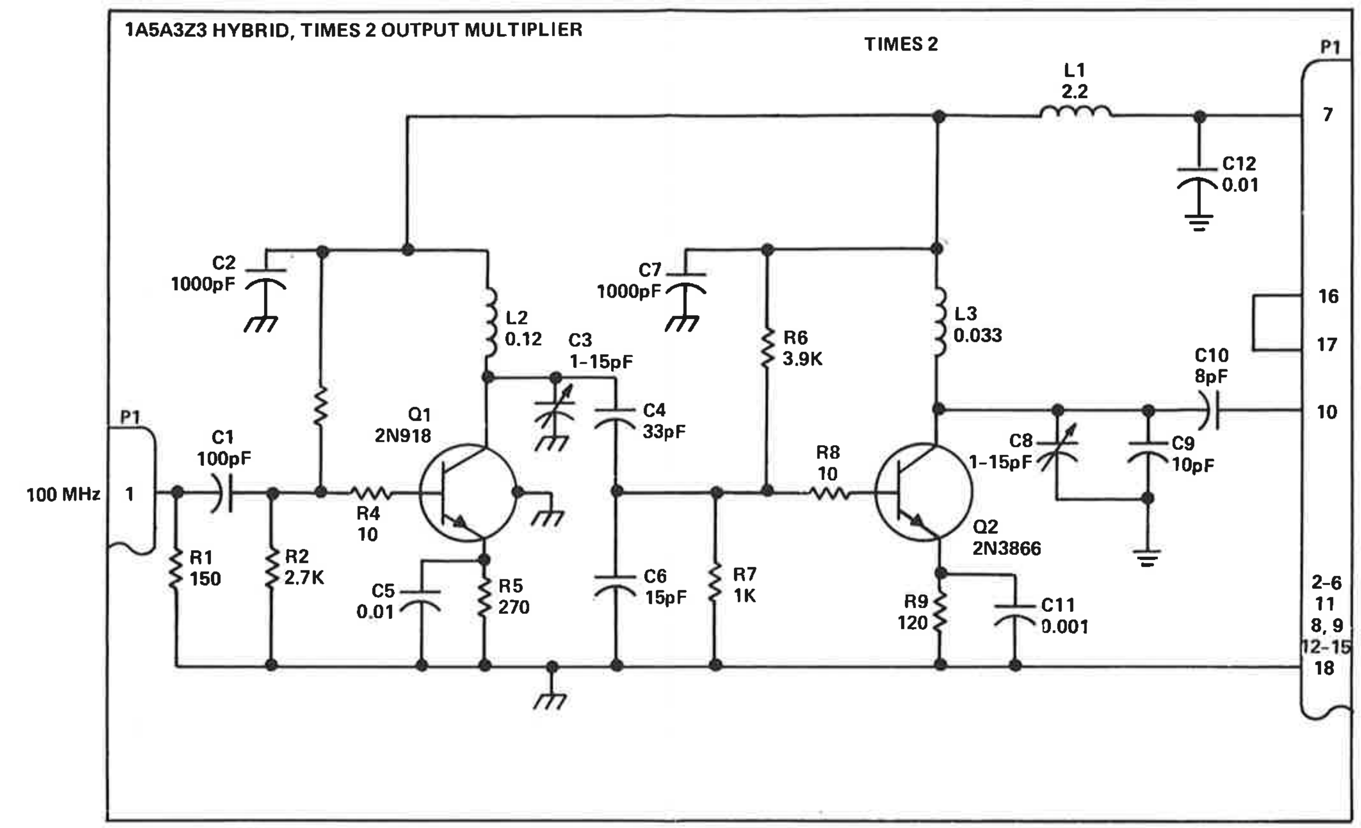



NOTES:

1. REFER TO FIGURE 5-13 FOR INTERCONNECTION DETAILS.
2. UNLESS OTHERWISE SPECIFIED: RESISTORS ARE IN OHMS, CAPACITORS ARE IN $\mu$F, AND INDUCTORS ARE IN $\mu$H.

TM51867-9405A

Figure 5-24. Hybrid X10 Multiplier 1A5A1Z2, Schematic Diagram

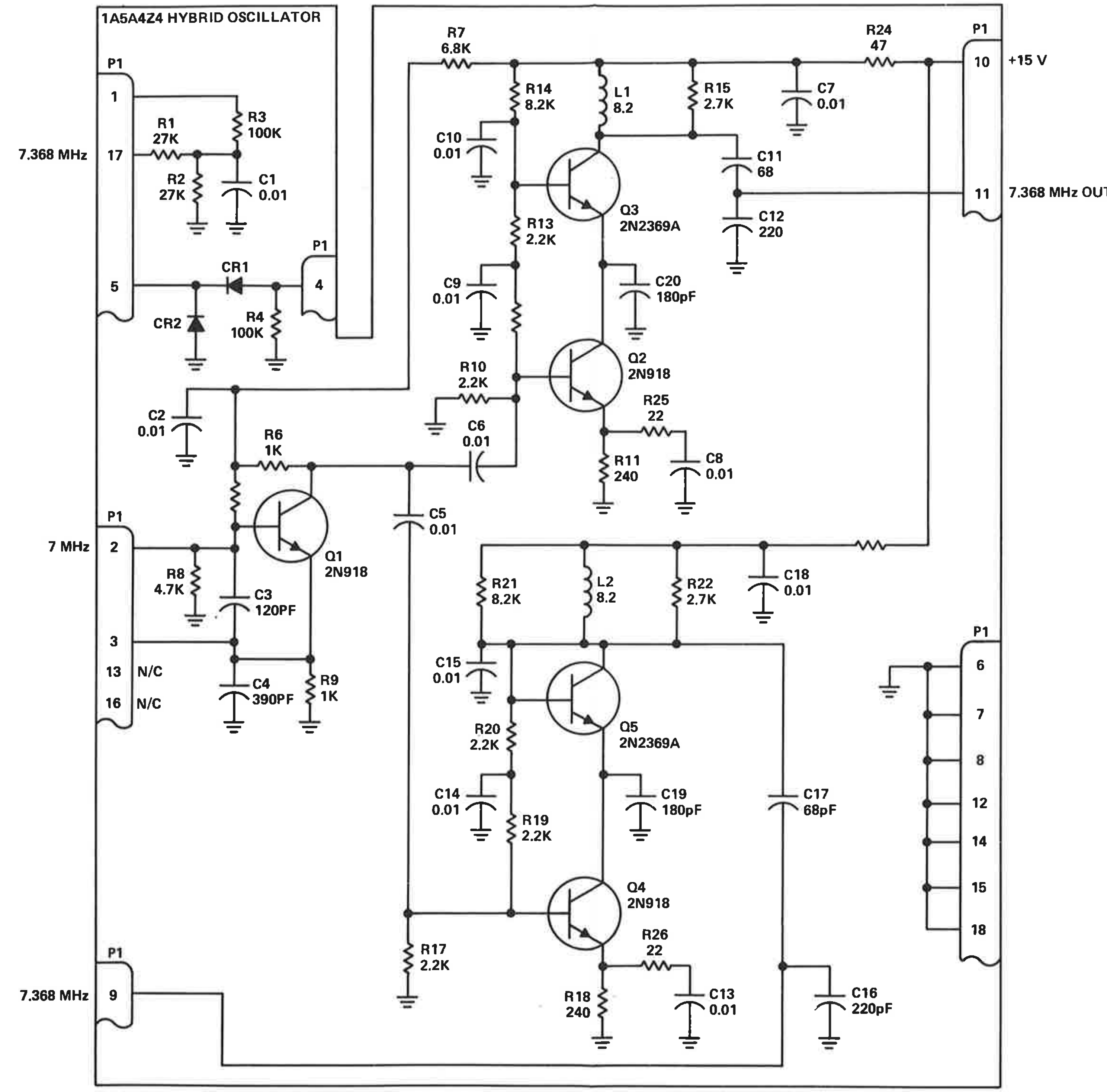



NOTES:

1. REFER TO FIGURE 5-13 FOR INTERCONNECTION DETAILS.
2. UNLESS OTHERWISE SPECIFIED: RESISTORS ARE IN OHMS, CAPACITORS ARE IN $\mu$F, AND INDUCTORS ARE IN $\mu$H.

TM51868-9405A

Figure 5-25. Hybrid X2 Multiplier 1A5A3Z3, Schematic Diagram

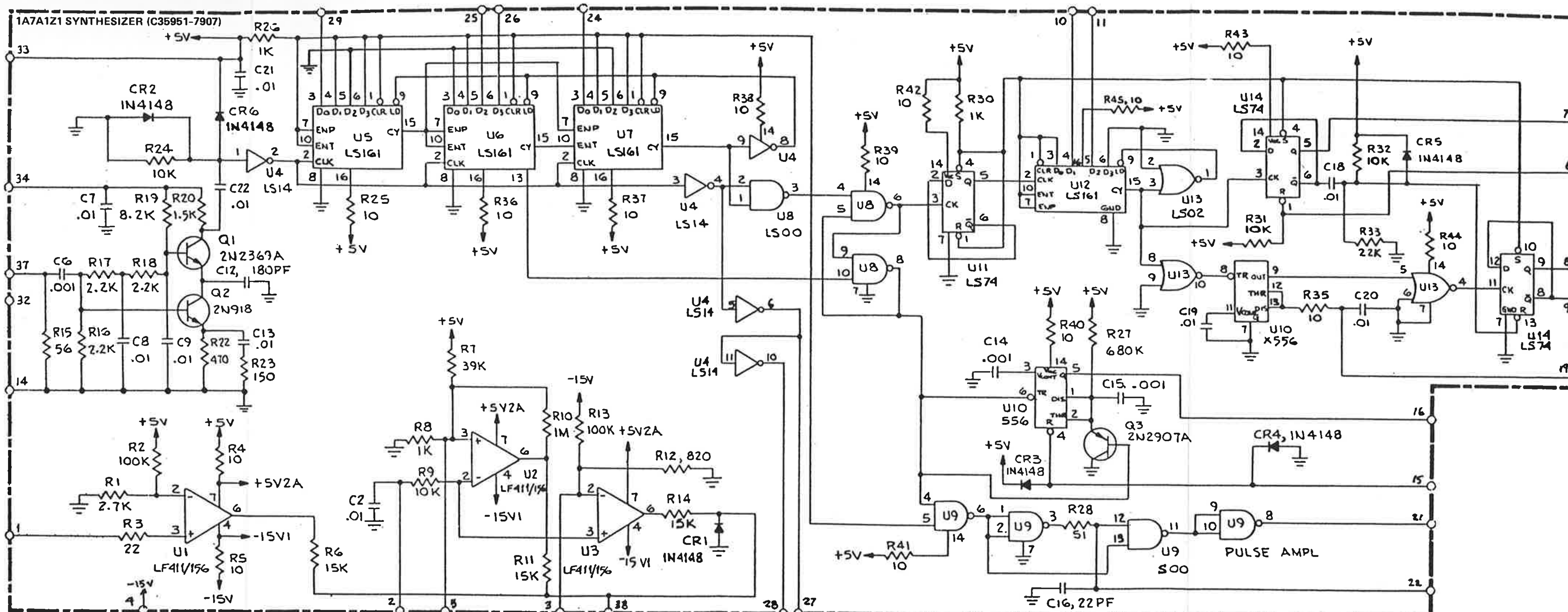



NOTES:

1. REFER TO FIGURE 5-13 FOR INTERCONNECTION DETAILS.
2. UNLESS OTHERWISE SPECIFIED: RESISTORS ARE IN OHMS, CAPACITORS ARE IN $\mu$F, AND INDUCTORS ARE IN $\mu$H.

TM51869-9405A

Figure 5-26. Hybrid Oscillator 7.368 MHz 1A5A4Z4, Schematic Diagram

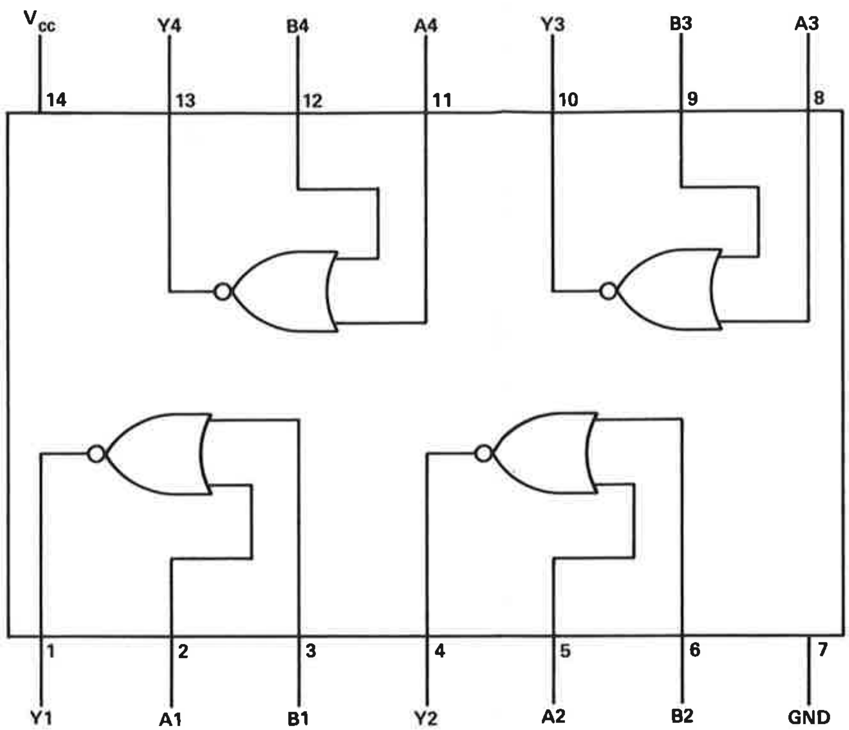



NOTES:

1. REFER TO FIGURE 5-15 FOR INTERCONNECTION DETAILS.
2. UNLESS OTHERWISE SPECIFIED: RESISTORS ARE IN OHMS, CAPACITORS ARE IN $\mu$F, AND INDUCTORS ARE IN $\mu$H.

TM51936-9407A

Figure 5-27. Hybrid Synthesizer 1A7A1Z1, Schematic Diagram



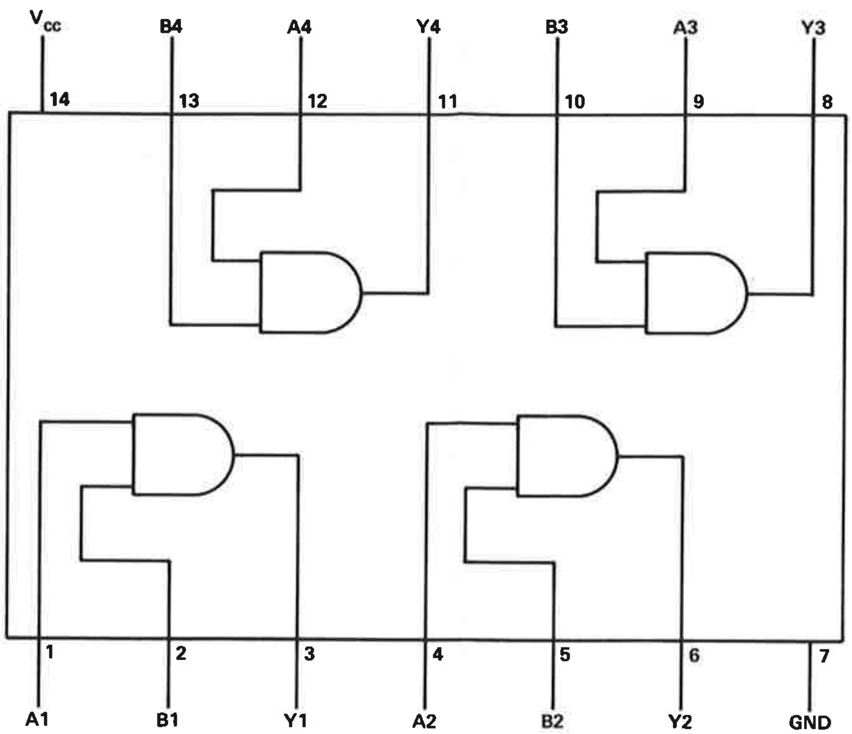

| TRUTH TABLE EACH GATE | | |
|---|---|---|
| INPUT | | OUTPUT |
| A | B | Y |
| H | X | L |
| X | H | L |
| L | L | H |

X = IRRELEVANT

POSITIVE LOGIC: $Y = \overline{A + B}$

TM52900-9400A

Figure 5-28. Quadruple 2-Input Positive NOR Gate (54LS02), Schematic Diagram

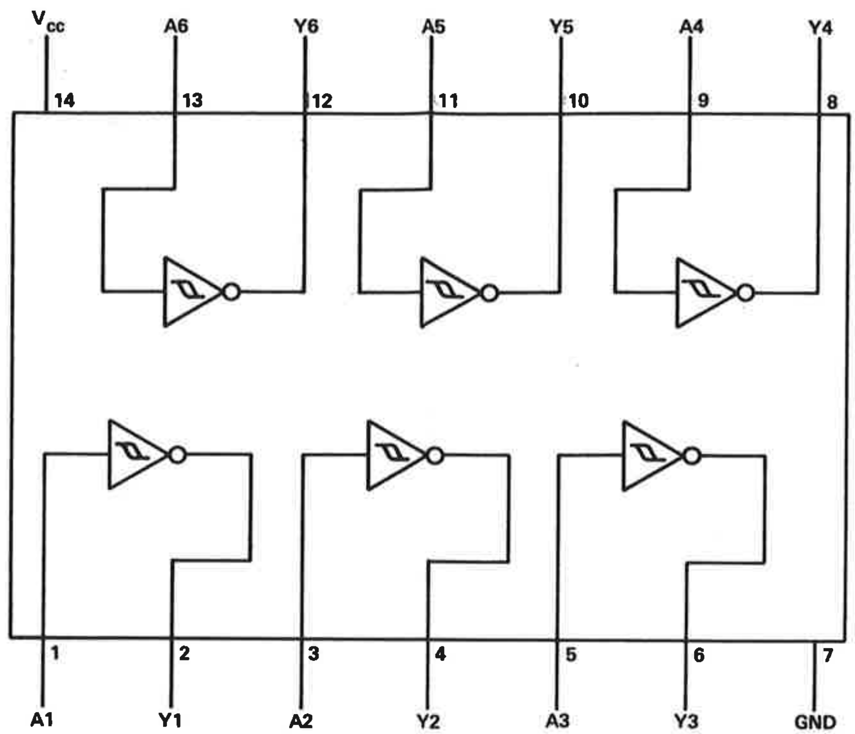



| TRUTH TABLE (EACH GATE) | | |
|---|---|---|
| INPUTS | | OUTPUT |
| A | B | Y |
| L | L | L |
| H | L | L |
| L | H | L |
| H | H | H |

POSITIVE LOGIC Y = AB

TM52901-9400A

Figure 5-29. Quadruple 2-Input Positive AND Gate (54LS08), Schematic Diagram

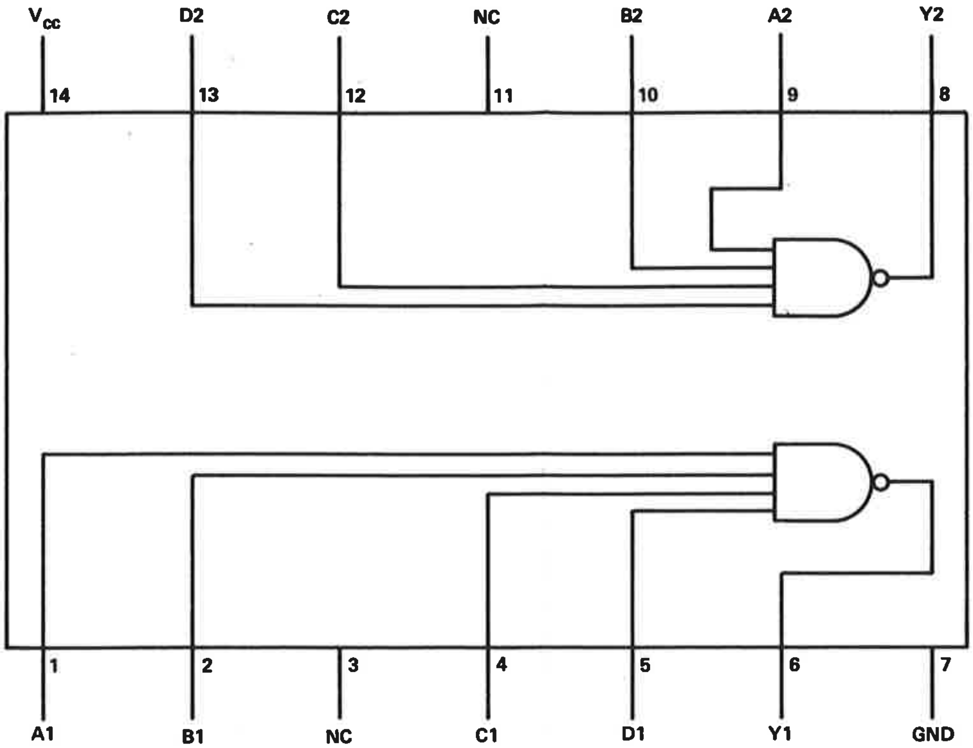



| TRUTH TABLE EACH GATE | |
|---|---|
| INPUT | OUTPUT |
| A | Y |
| L | H |
| H | L |

POSITIVE LOGIC $Y = \overline{A}$

TM52902-9400A

Figure 5-30. Hex Schmitt-Trigger Inverter (54LS14), Schematic Diagram

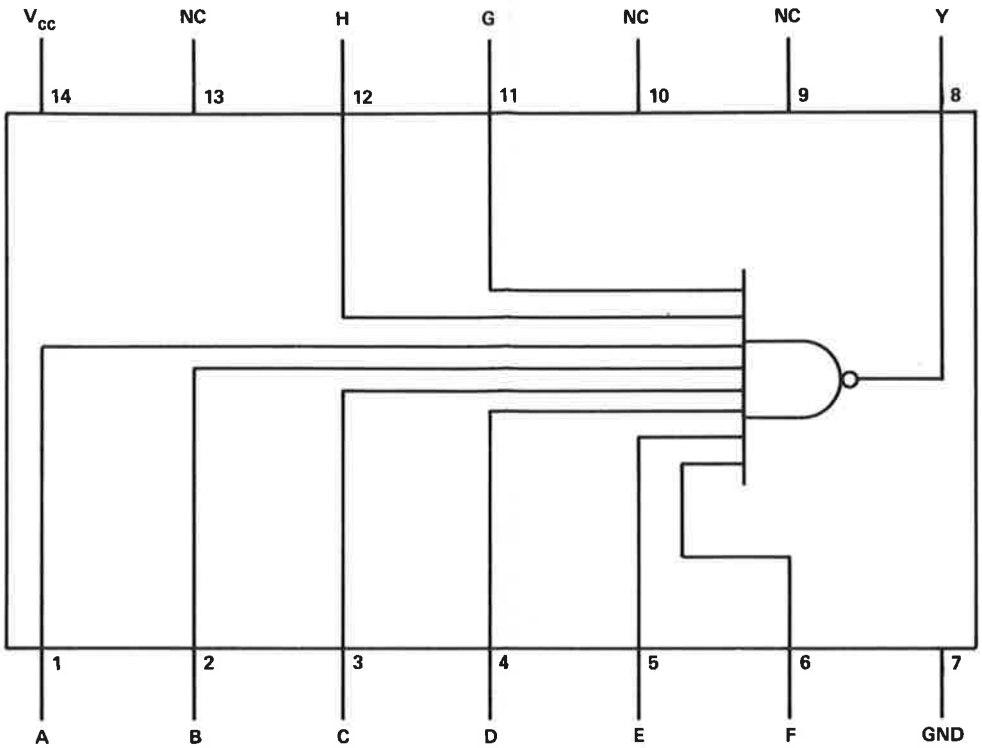



| TRUTH TABLE EACH GATE | |
|---|---|
| INPUT | OUTPUT |
| A | Y |
| L | H |
| H | L |

POSITIVE LOGIC $Y = \overline{A}$

TM52903-9400A

**Figure 5-31. Dual 4-Input Positive-NAND Gate (54LS20), Schematic Diagram**

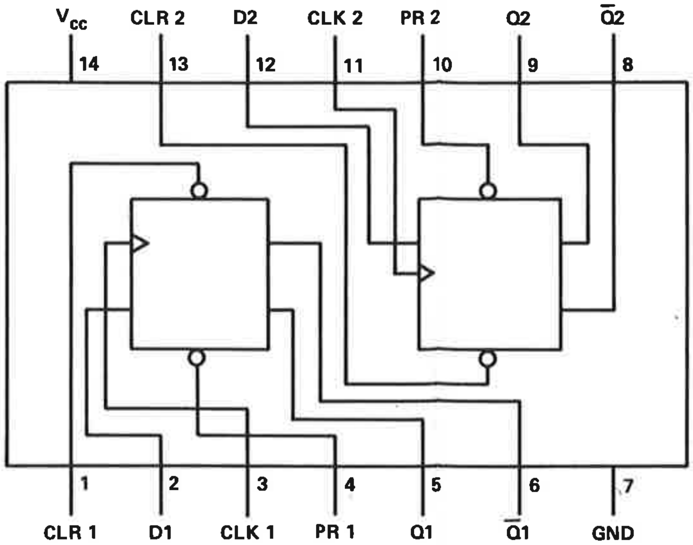



| TRUTH TABLE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| INPUTS | | | | | | | | OUTPUT |
| A | B | C | D | E | F | G | H | Y |
| H | H | H | H | H | H | H | H | L |
| ALL OTHER COMBINATIONS OF H AND L AT THE INPUTS GIVE H OUTPUT. | | | | | | | | |

POSITIVE LOGIC $Y = \overline{ABCDEFGH}$

TM 529041-9400A

Figure 5-32. 8-Input Positive-NAND Gate (54LS30), Schematic Diagram




FUNCTION TABLE

| INPUTS | | | | OUTPUTS | |
|---|---|---|---|---|---|
| $\overline{PRE}$ | $\overline{CLR}$ | CLK | D | Q | $\overline{Q}$ |
| L | H | X | X | H | L |
| H | L | X | X | L | H |
| L | L | X | X | H† | H† |
| H | H | ↑ | H | H | L |
| H | H | ↑ | L | L | H |
| H | H | L | X | $Q_0$ | $\overline{Q}_0$ |

† = THE OUTPUT LEVELS IN THIS CONFIGURATION ARE NOT GUARANTEED TO MEET THE MINIMUM LEVELS IN $V_{OH}$ IF THE LOWS AT PRESET AND CLEAR ARE NEAR $V_{IL}$ MAXIMUM. FURTHERMORE, THIS CONFIGURATION IS NONSTABLE; THAT IS, IT WILL NOT PERSIST WHEN EITHER PRESET OR CLEAR RETURNS TO ITS INACTIVE (HIGH) LEVEL.

X = IRRELEVANT.

↑ = TRANSITION FROM LOW TO HIGH LEVEL.

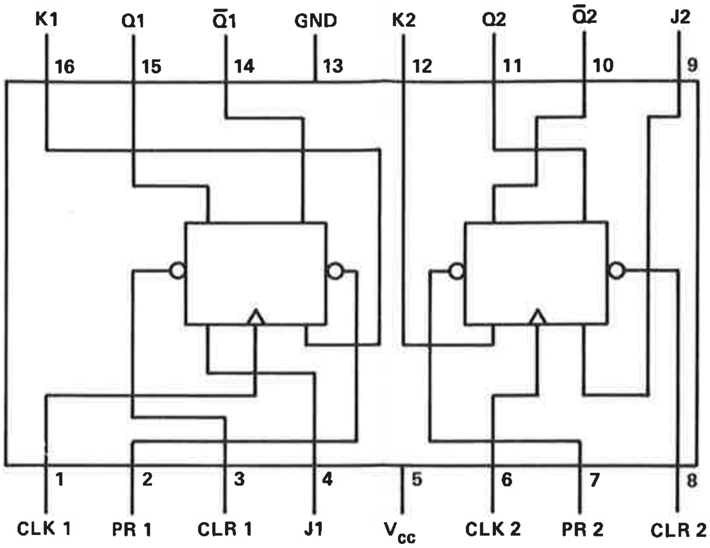
H = HIGH LEVEL (STEADY STATE).

L = LOW LEVEL (STEADY STATE).

$Q_0$ = THE LEVEL OF Q BEFORE THE INDICATED STEADY STATE INPUT CONDITIONS WERE ESTABLISHED.

TM52905-9400A

Figure 5-33. Dual D-Type Positive-Edge-Triggered Flip-Flops with Preset and Clear (54LS74A), Schematic Diagram




FUNCTION TABLE

| INPUTS | | | | | OUTPUTS | |
|---|---|---|---|---|---|---|
| PRESET | CLEAR | CLOCK | J | K | Q | $\overline{Q}$ |
| L | H | X | X | X | H | L |
| H | L | X | X | X | L | H |
| L | L | X | X | X | H† | H† |
| H | H | ↓ | L | L | $Q_0$ | $\overline{Q}_0$ |
| H | H | ↓ | H | L | H | L |
| H | H | ↓ | L | H | L | H |
| H | H | ↓ | H | H | TOGGLE | |
| H | H | H | X | X | $Q_0$ | $\overline{Q}_0$ |

X = IRRELEVANT.

† = THIS CONFIGURATION IS NONSTABLE; THAT IS, IT WILL NOT PERSIST WHEN EITHER PRESET OR CLEAR RETURNS TO ITS INACTIVE (HIGH) LEVEL.

L = LOW LEVEL (STEADY STATE).

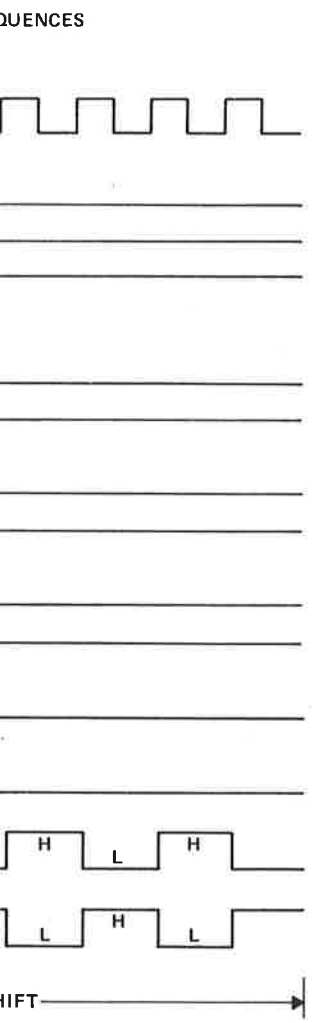
H = HIGH LEVEL (STEADY STATE).

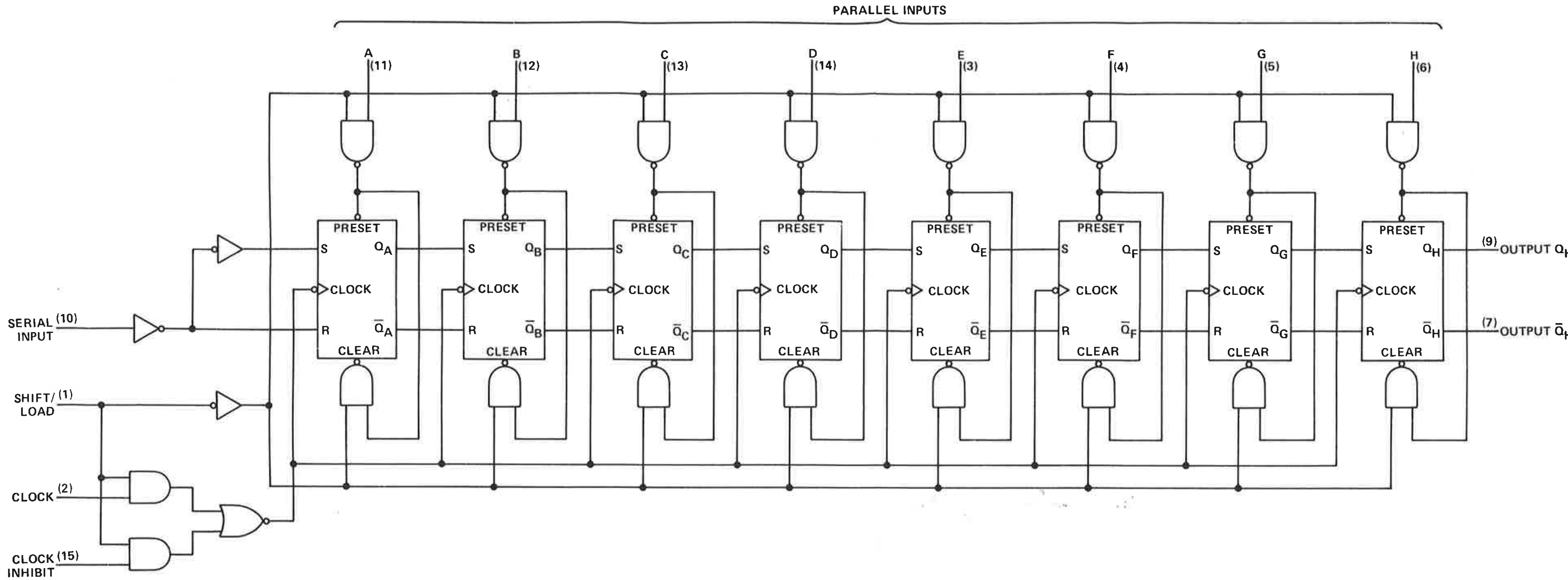
↓ = TRANSITION FROM HIGH TO LOW LEVEL.

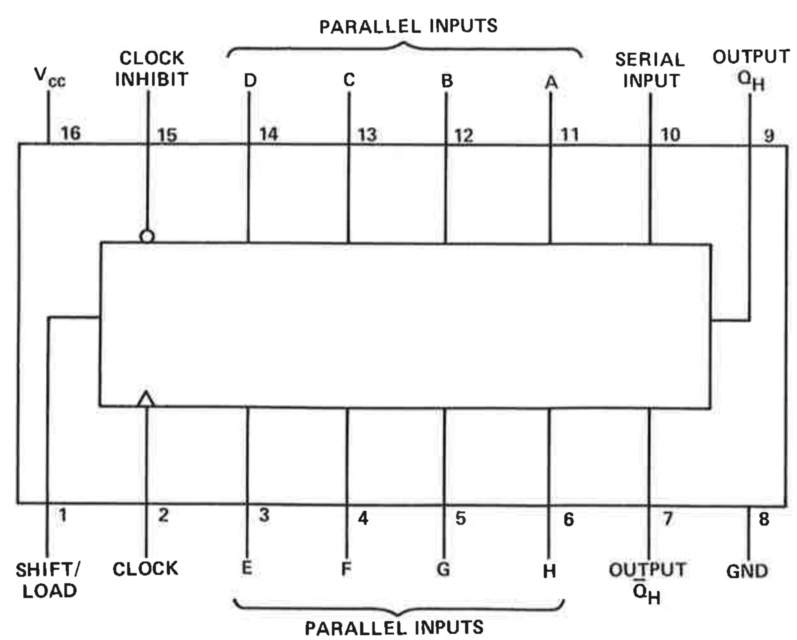
$Q_0$ = THE LEVEL OF Q BEFORE THE INDICATED STEADY STATE INPUT CONDITIONS WERE ESTABLISHED.

TM52906-9400A

Figure 5-34. Dual J-K Flip-Flops with Preset and Clear (54LS76A), Schematic Diagram




FUNCTION TABLE

| INPUTS | | | | | INTERNAL OUTPUTS | | OUTPUT |
|---|---|---|---|---|---|---|---|
| SHIFT/ LOAD | CLOCK INHIBIT | CLOCK | SERIAL | PARALLEL A . . . H | $Q_A$ | $Q_B$ | $Q_H$ |
| L | X | X | X | a . . . h | a | b | h |
| H | L | L | X | X | $Q_{A0}$ | $Q_{B0}$ | $Q_{H0}$ |
| H | L | ↑ | H | X | H | $Q_{An}$ | $Q_{Gn}$ |
| H | L | ↑ | L | X | L | $Q_{An}$ | $Q_{Gn}$ |
| H | H | X | X | X | $Q_{A0}$ | $Q_{B0}$ | $Q_{H0}$ |

X = IRRELEVANT.

L = LOW LEVEL (STEADY STATE).

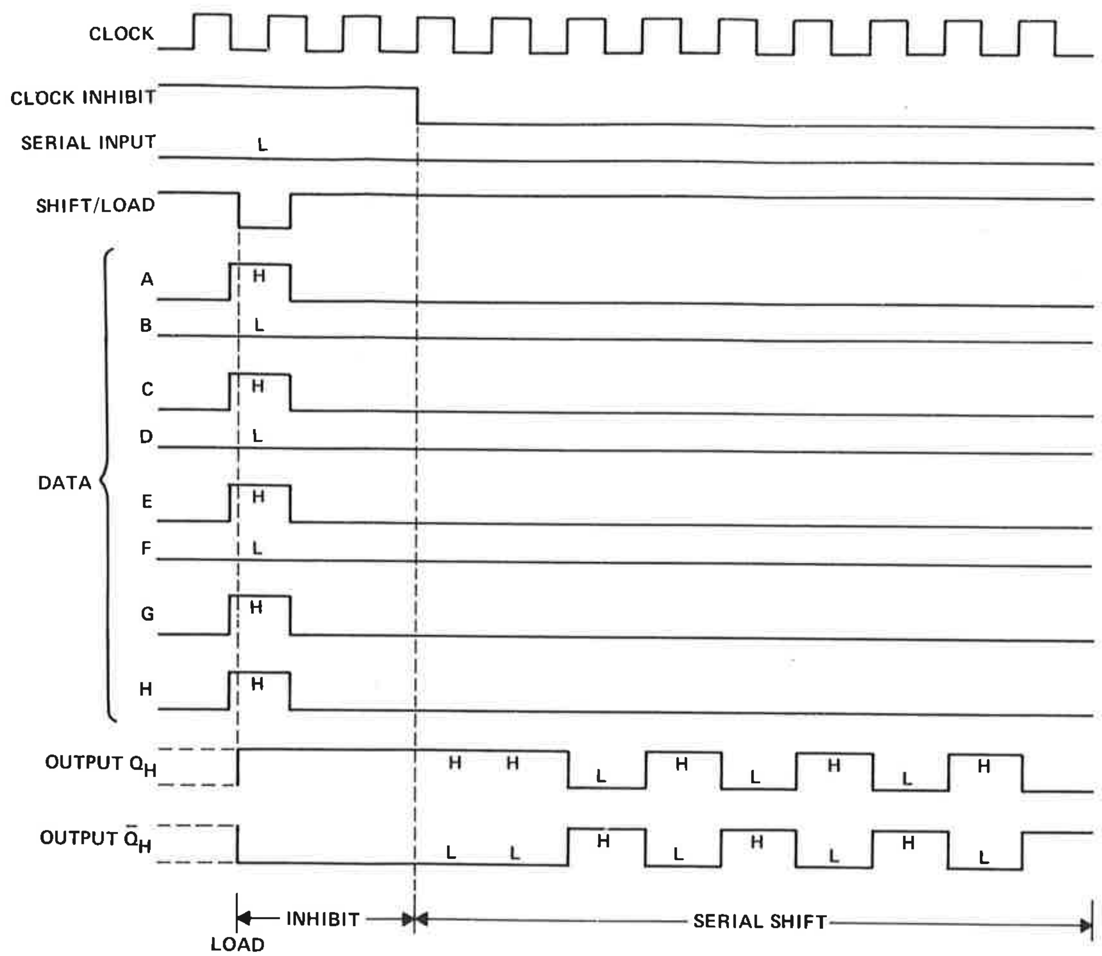
H = HIGH LEVEL (STEADY STATE).

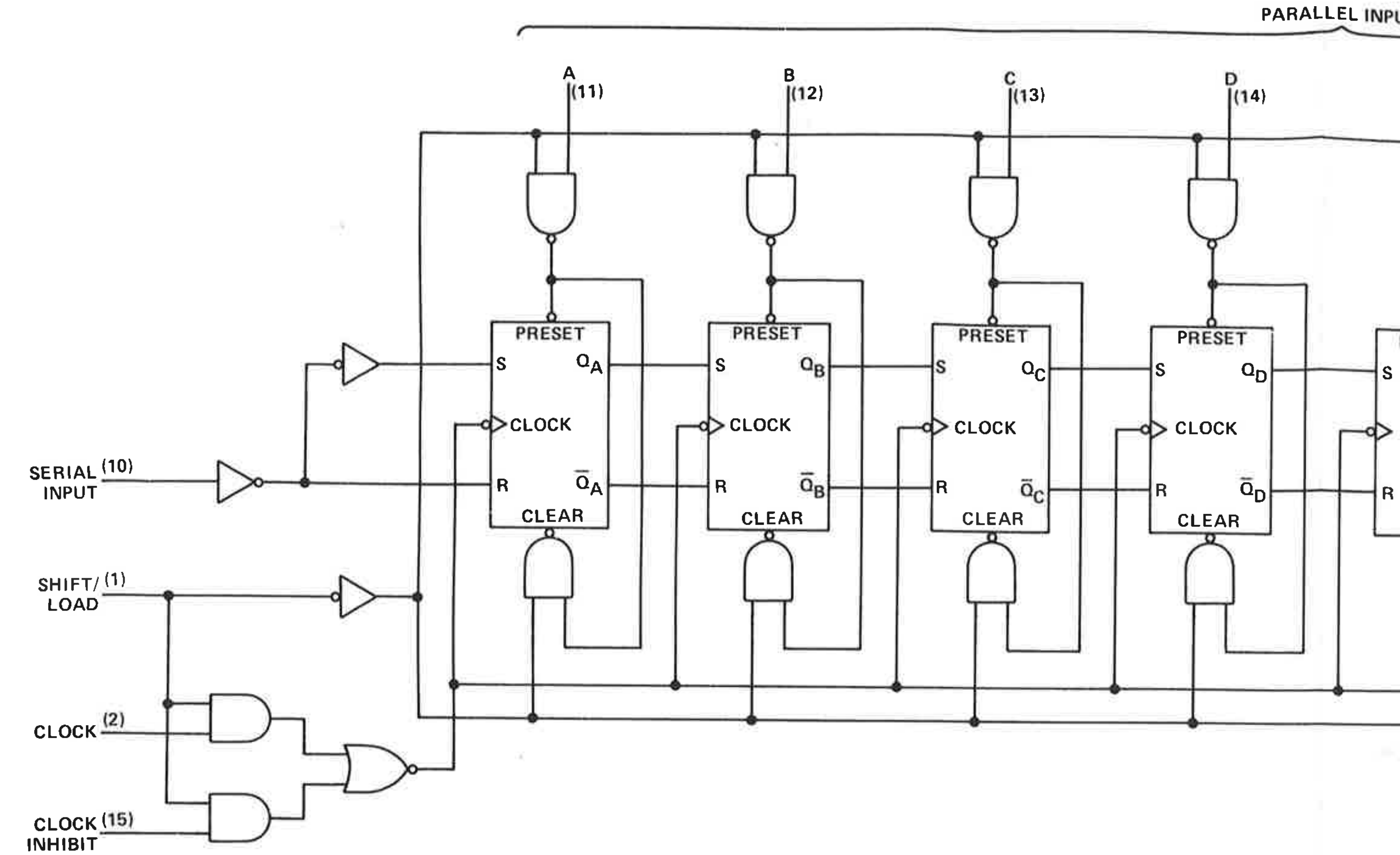
↑ = TRANSITION FROM LOW TO HIGH LEVEL.

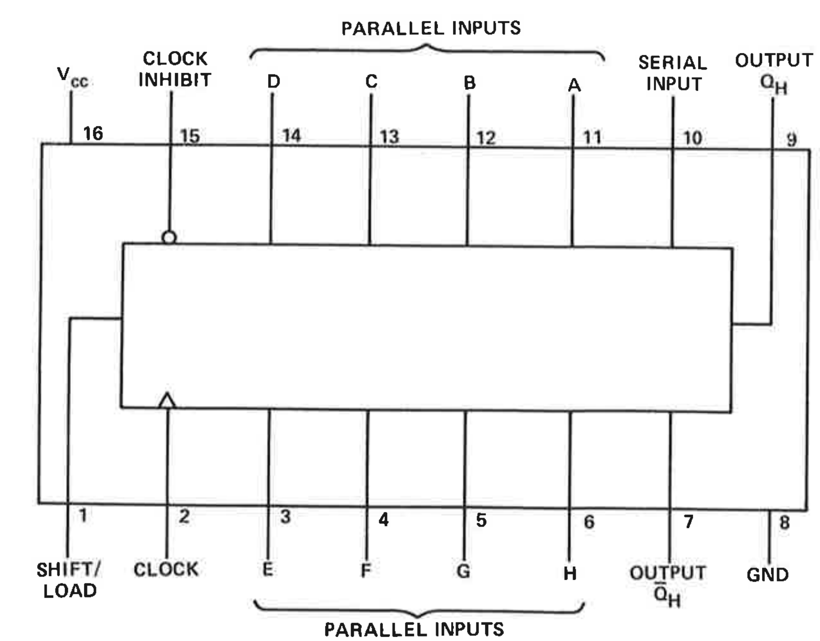
TM52907-9400A

Figure 5-35. Parallel-Load 8-Bit Shift Registers with Complementary Outputs (54LS165), Schematic Diagram

TYPICAL SHIFT, LOAD, AND INHIBIT SEQUENCES



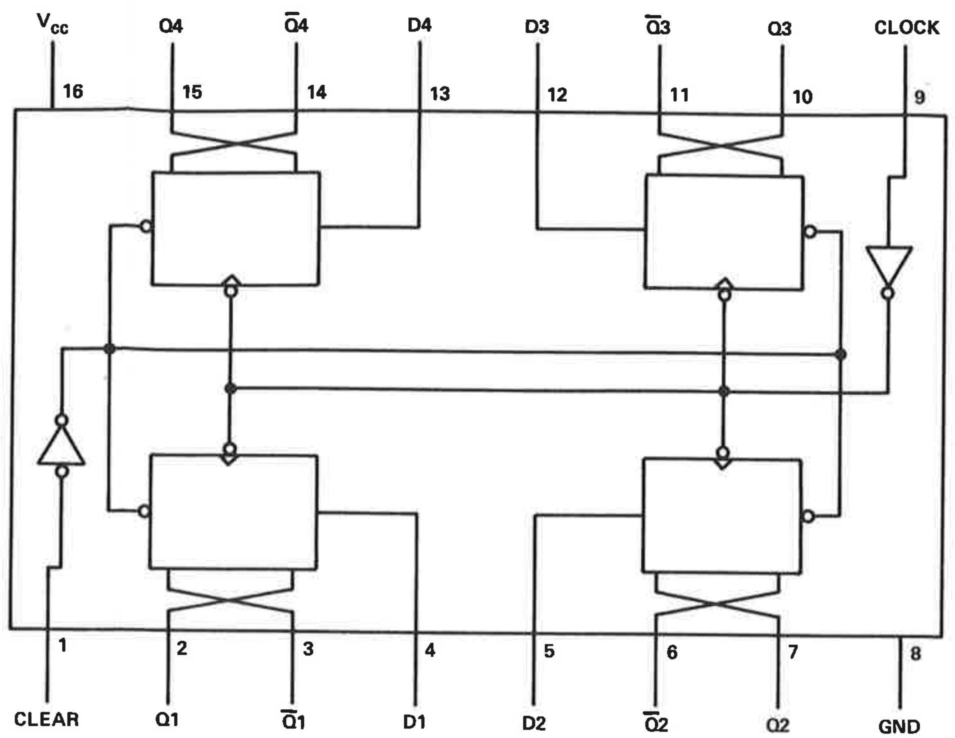

| SHIFT/ LOAD |
|---|
| L |
| H |
| H |
| H |
| H |

X = IRRELEVA

L = LOW LEVE

H = HIGH LEVE

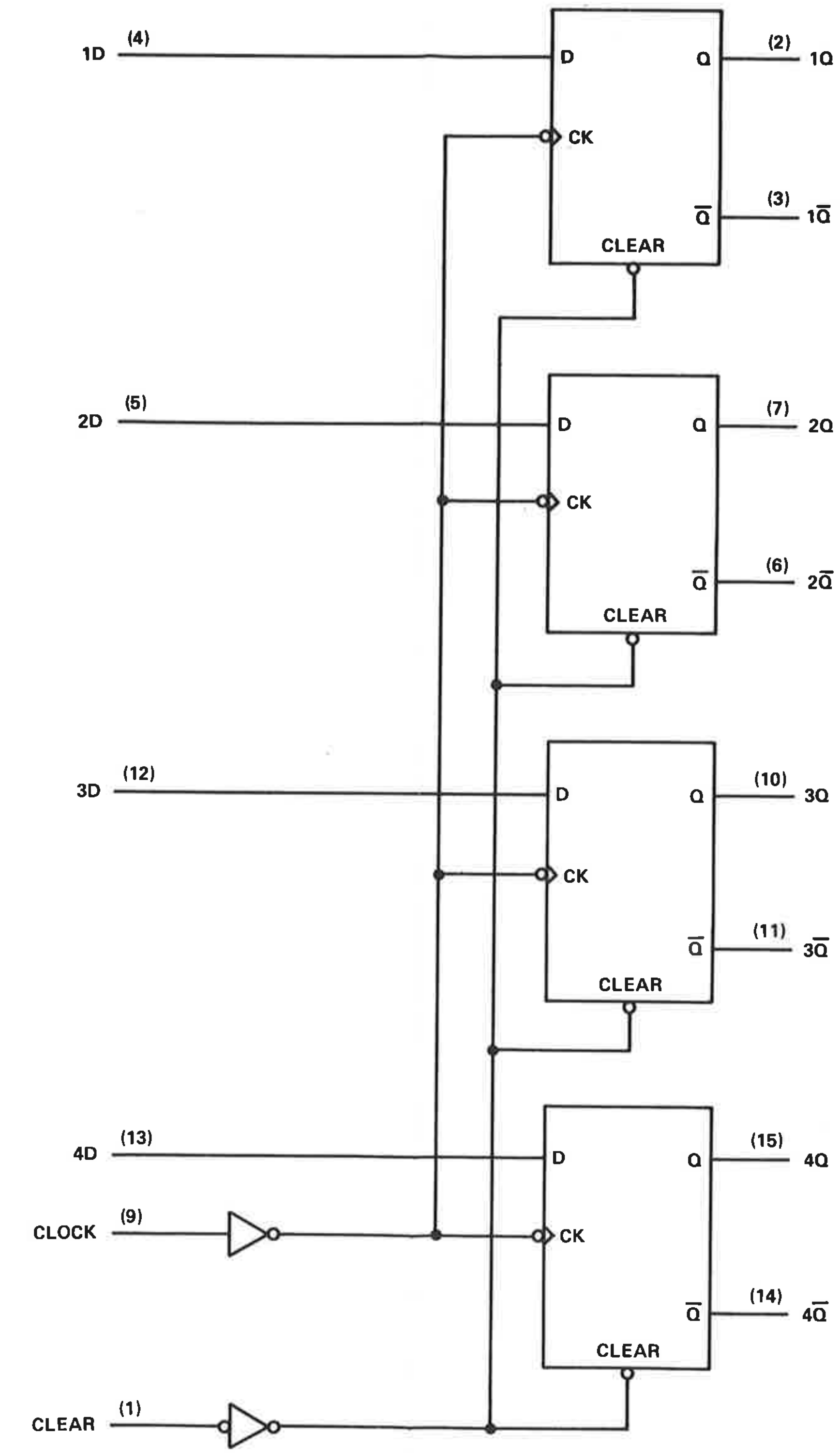
↑ = TRANSITIC




FUNCTION TABLE
(EACH FLIP-FLOP)

| INPUTS | | | OUTPUTS | |
|---|---|---|---|---|
| CLEAR | CLOCK | D | Q | $\overline{Q}$ |
| L | X | X | L | H |
| H | ↑ | H | H | L |
| H | ↑ | L | L | H |
| H | L | X | $Q_0$ | $\overline{Q}_0$ |

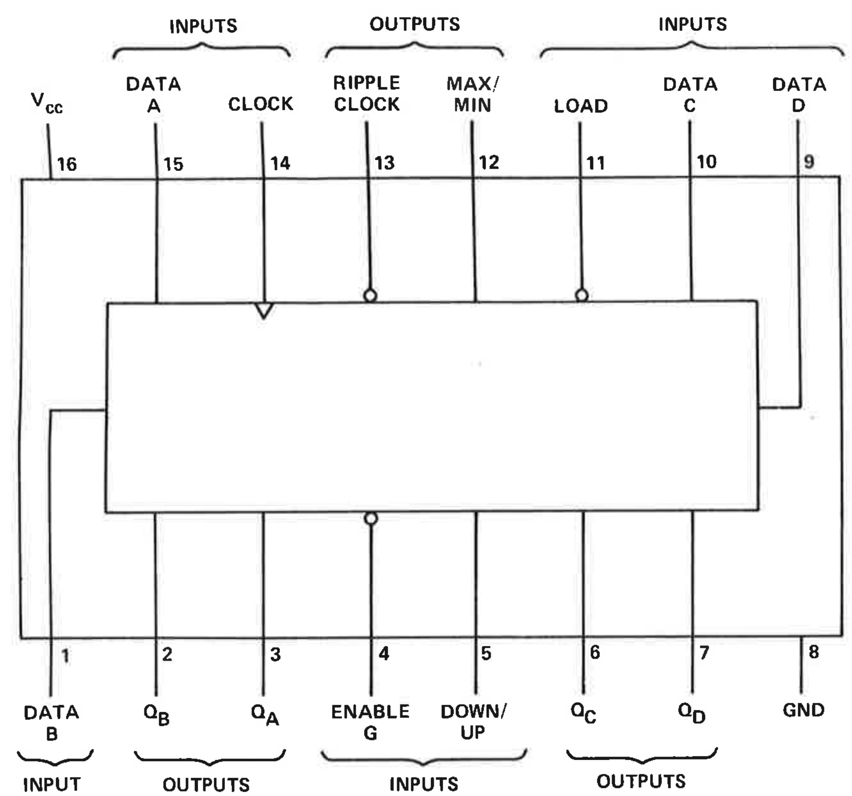
H = HIGH LEVEL (STEADY STATE)
L = LOW LEVEL (STEADY STATE)
X = IRRELEVANT
↑ = TRANSITION FROM LOW TO HIGH LEVEL
$Q_0$ = THE LEVEL OF Q BEFORE THE INDICATED STEADY STATE INPUT CONDITIONS WERE ESTABLISHED



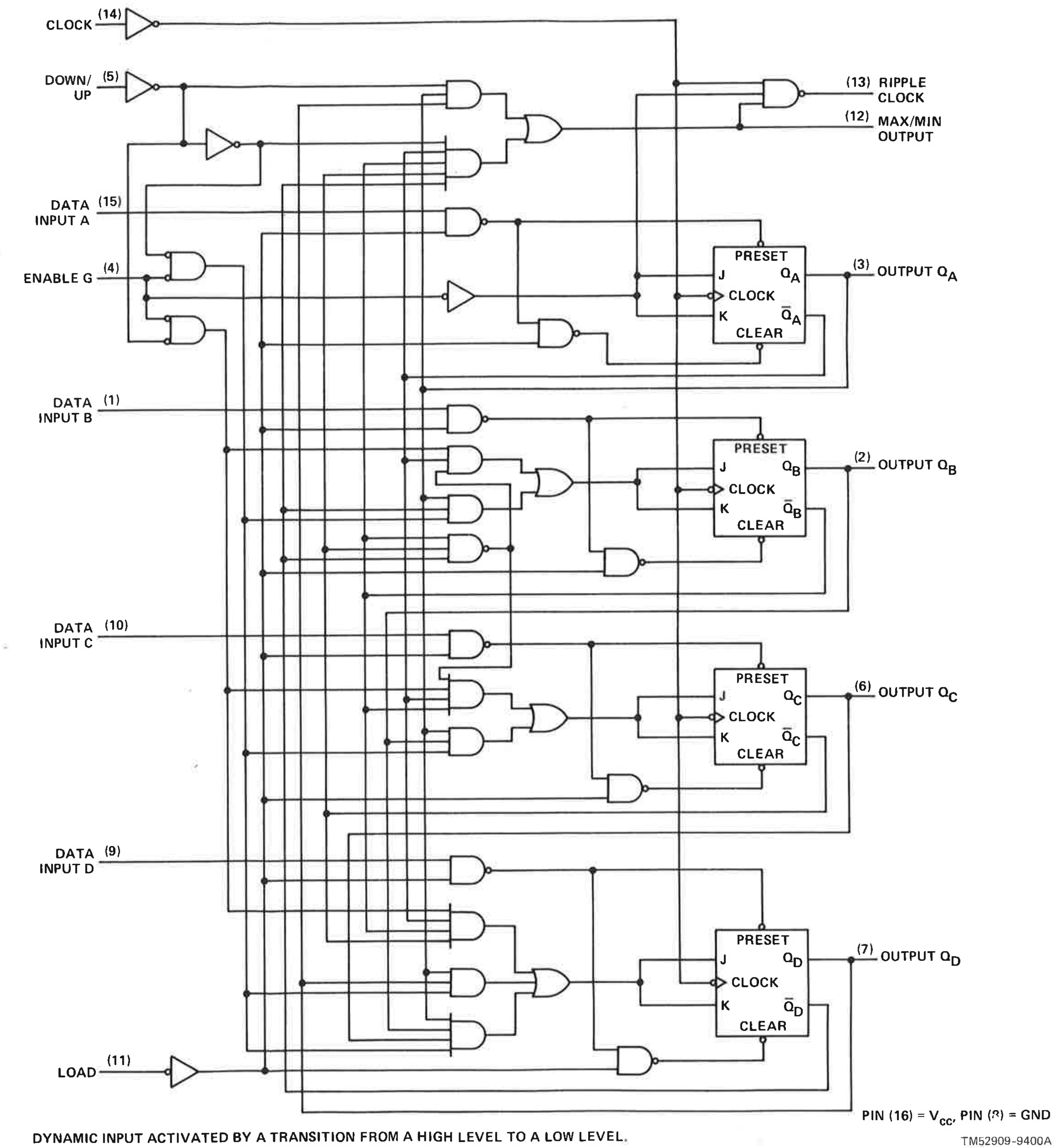

······· DYNAMIC INPUT ACTIVATED BY TRANSITION FROM A HIGH LEVEL TO A LOW LEVEL.

TM52908-9400A

Figure 5-36. Quad D-Type Flip-Flops (54LS175), Schematic Diagram




ASYNCHRONOUS INPUTS: LOW INPUT TO LOAD SETS $Q_A$ = A, $Q_B$ = B, $Q_C$ = C, and $Q_D$ = D



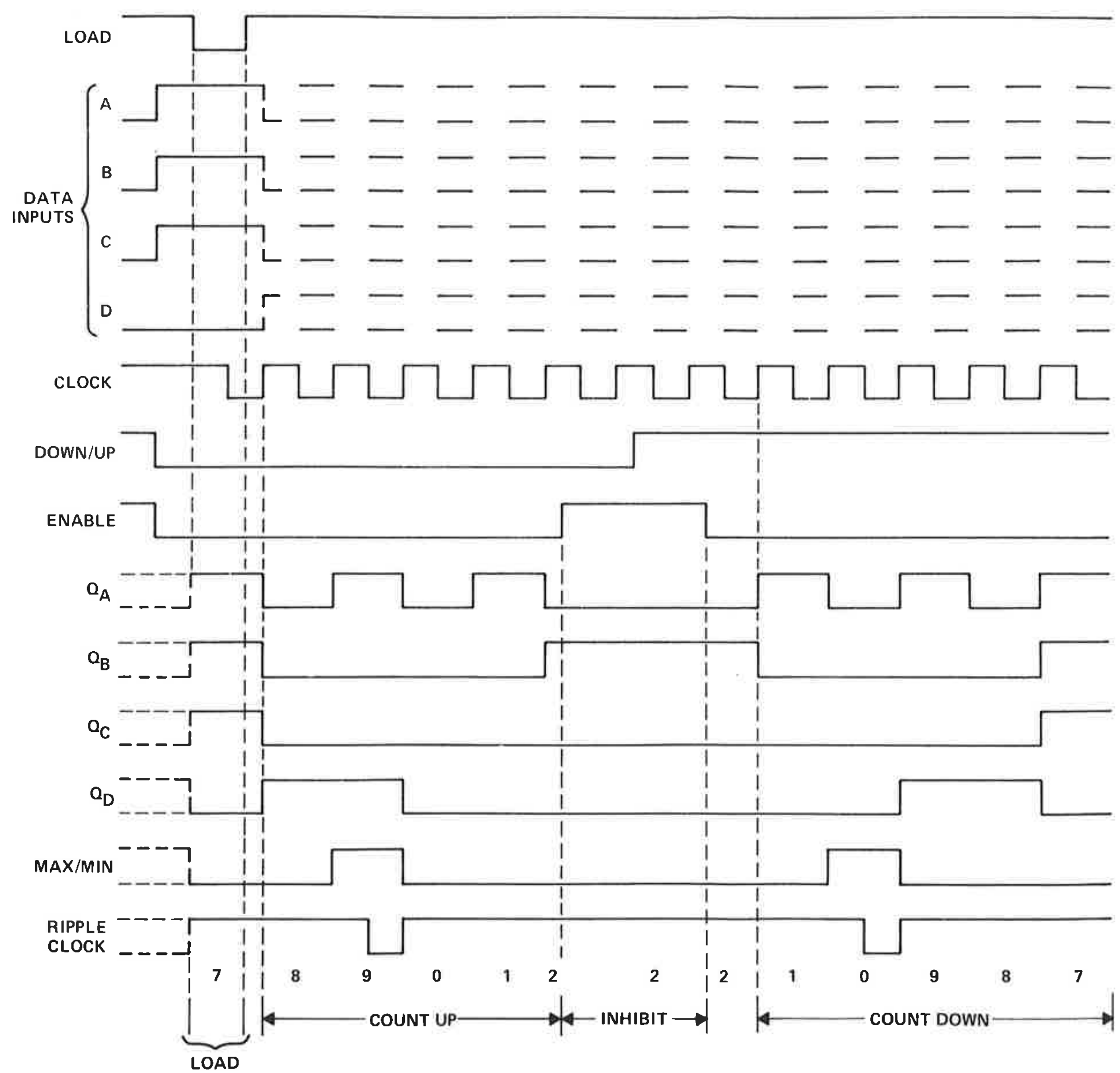

DYNAMIC INPUT ACTIVATED BY A TRANSITION FROM A HIGH LEVEL TO A LOW LEVEL.

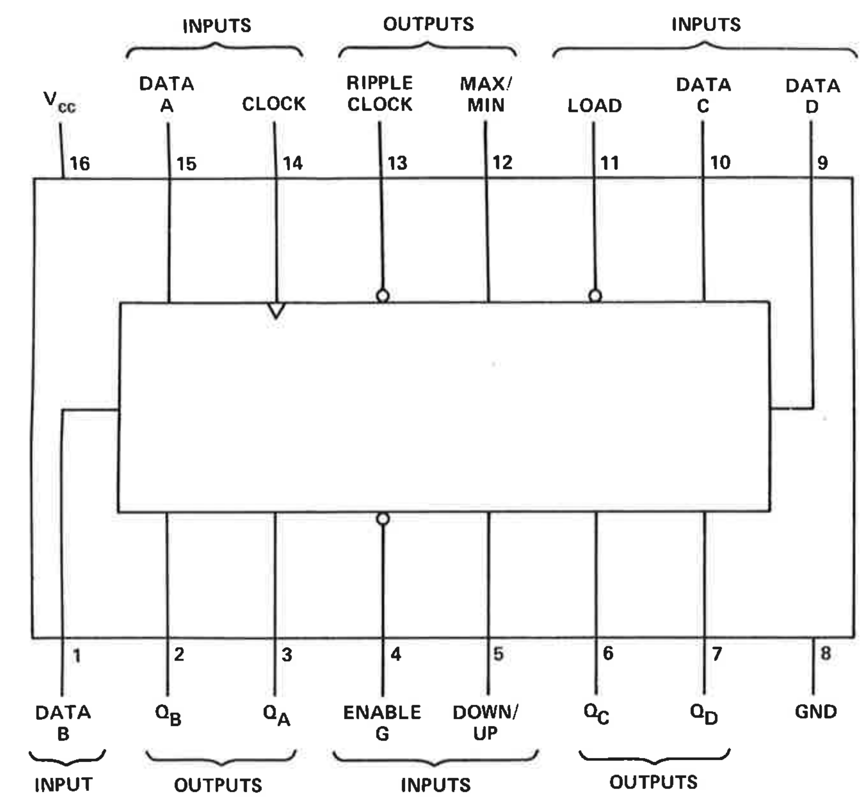
Figure 5-37. Synchronous Up/Down Counter (54LS190), Schematic Diagram

TYPICAL LOAD, COUNT, AND INHIBIT SEQUENCES

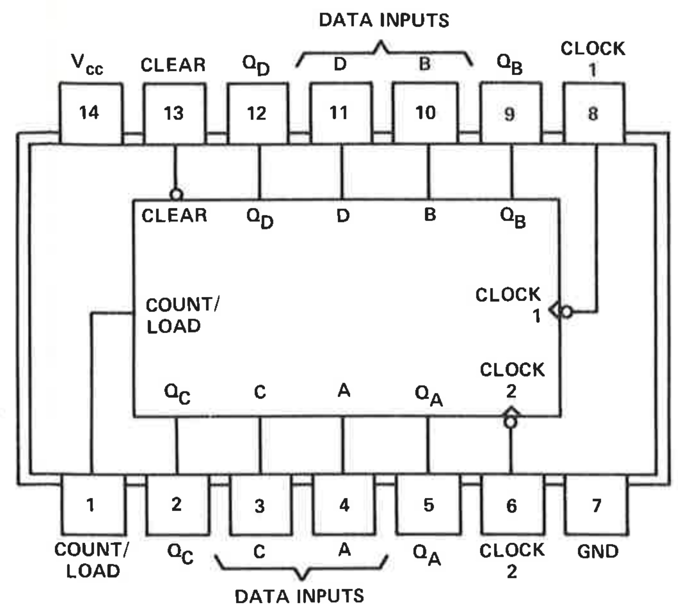
ILLUSTRATED BELOW IS THE FOLLOWING SEQUENCE:

1. LOAD (PRESET) TO BCD SEVEN.
2. COUNT UP TO EIGHT, NINE (MAXIMUM), ZERO, ONE, AND TWO.
3. INHIBIT.
4. COUNT DOWN TO ONE, ZERO (MINIMUM), NINE, EIGHT, AND SEVEN.




ASYNCHRONOUS INPUTS: LOW INPUT TO LOAD SETS $Q_A$ = A, $Q_B$ = B, $Q_C$ = C, and $Q_D$ = D




FUNCTION TABLES

DECADE (BCD)
(SEE NOTE A)

| COUNT | OUTPUT | | | |
|---|---|---|---|---|
| | $Q_D$ | $Q_C$ | $Q_B$ | $Q_A$ |
| 0 | L | L | L | L |
| 1 | L | L | L | H |
| 2 | L | L | H | L |
| 3 | L | L | H | H |
| 4 | L | H | L | L |
| 5 | L | H | L | H |
| 6 | L | H | H | L |
| 7 | L | H | H | H |
| 8 | H | L | L | L |
| 9 | H | L | L | H |

BI-QUINARY (5-2)
(SEE NOTE B)

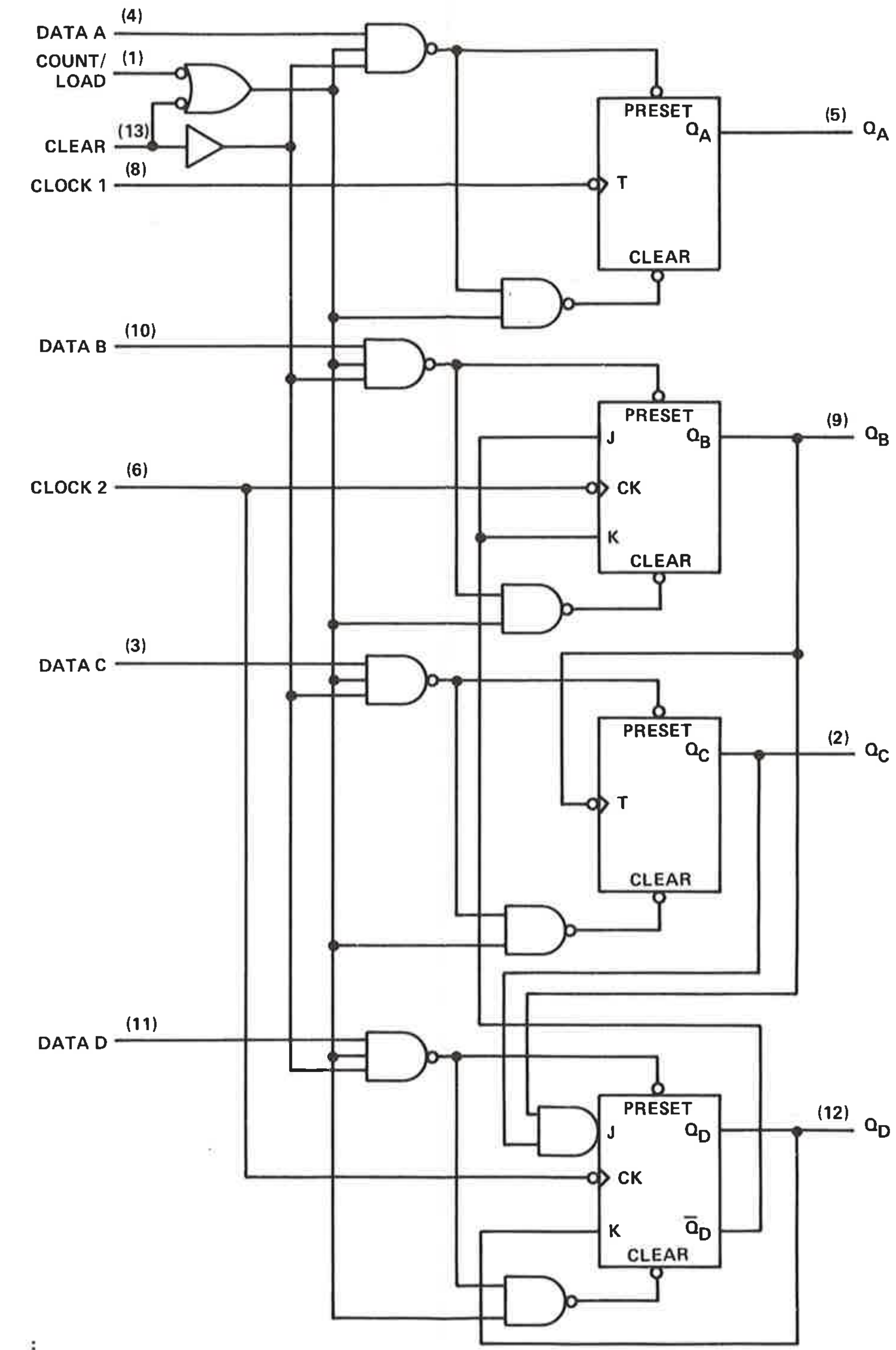
| COUNT | OUTPUT | | | |
|---|---|---|---|---|
| | $Q_A$ | $Q_D$ | $Q_C$ | $Q_B$ |
| 0 | L | L | L | L |
| 1 | L | L | L | H |
| 2 | L | L | H | L |
| 3 | L | L | H | H |
| 4 | L | H | L | L |
| 5 | H | L | L | L |
| 6 | H | L | L | H |
| 7 | H | L | H | L |
| 8 | H | L | H | H |
| 9 | H | H | L | L |

H = HIGH LEVEL, L = LOW LEVEL

NOTES:

A. OUTPUT $Q_A$ CONNECTED TO CLOCK-2 INPUT.

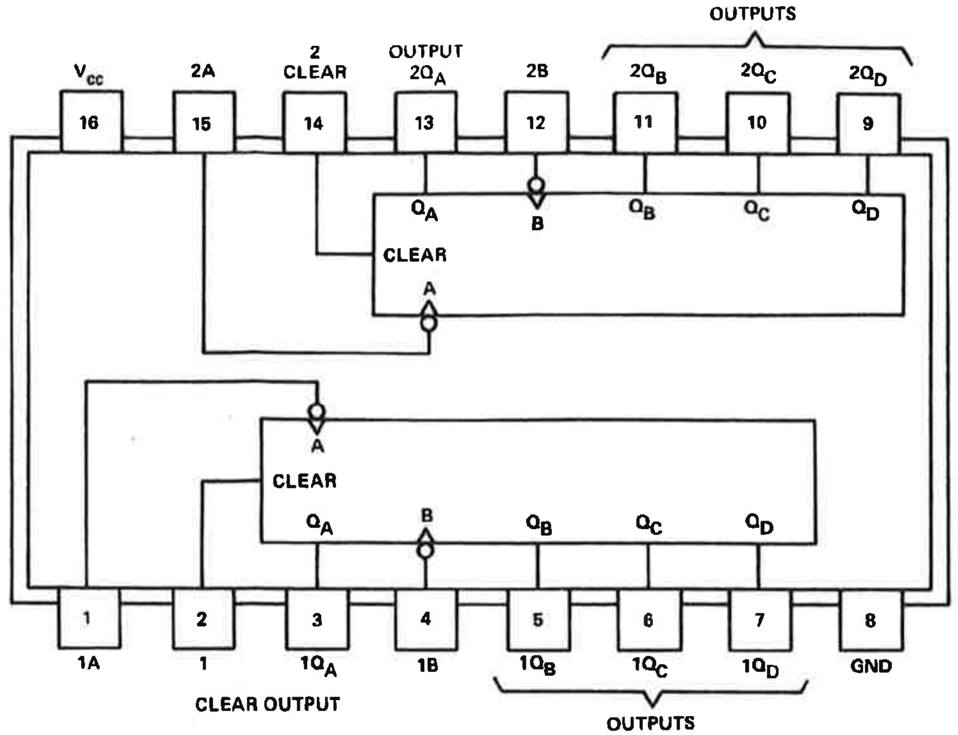
B. OUTPUT $Q_D$ CONNECTED TO CLOCK-1 INPUT.




DYNAMIC INPUT ACTIVATED BY TRANSITION FROM A HIGH LEVEL TO A LOW LEVEL.

TM52910-9400A

Figure 5-38. Presettable Decade or Binary Counter/Latch (54196), Schematic Diagram




POSITIVE LOGIC: HIGH INPUT TO CLEAR RESETS ALL FOUR OUTPUTS LOW

BCD COUNT SEQUENCE
(EACH COUNTER)
(SEE NOTE A)

| COUNT | OUTPUT | | | |
|---|---|---|---|---|
| | $Q_D$ | $Q_C$ | $Q_B$ | $Q_A$ |
| 0 | L | L | L | L |
| 1 | L | L | L | H |
| 2 | L | L | H | L |
| 3 | L | L | H | H |
| 4 | L | H | L | L |
| 5 | L | H | L | H |
| 6 | L | H | H | L |
| 7 | L | H | H | H |
| 8 | H | L | L | L |
| 9 | H | L | L | H |

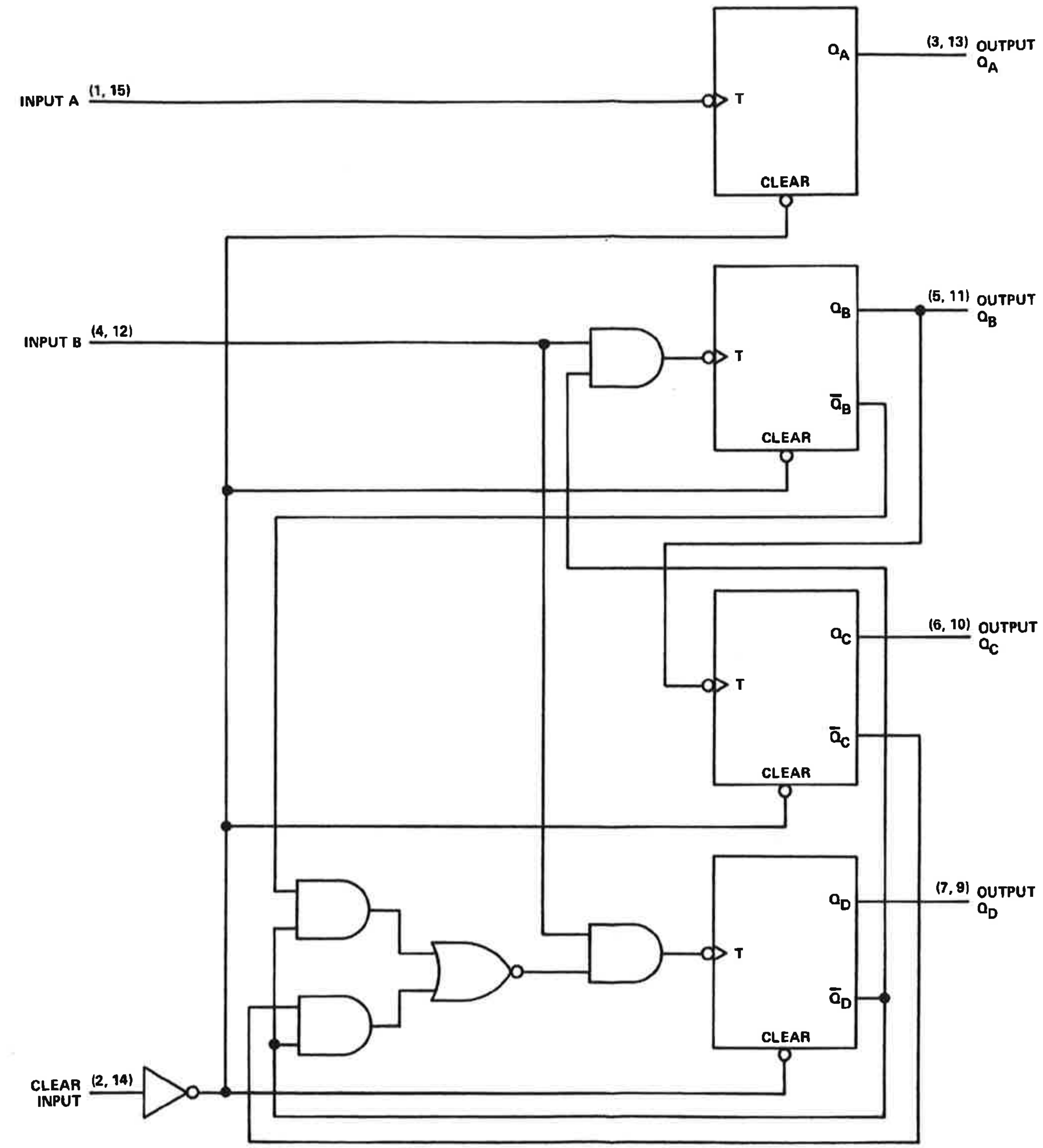
BI-QUINARY (5-2)
(EACH COUNTER)
(SEE NOTE B)

| COUNT | OUTPUT | | | |
|---|---|---|---|---|
| | $Q_A$ | $Q_D$ | $Q_C$ | $Q_B$ |
| 0 | L | L | L | L |
| 1 | L | L | L | H |
| 2 | L | L | H | L |
| 3 | L | L | H | H |
| 4 | L | H | L | L |
| 5 | H | L | L | L |
| 6 | H | L | L | H |
| 7 | H | L | H | L |
| 8 | H | L | H | H |
| 9 | H | H | L | L |

NOTES:
A. OUTPUT $Q_A$ IS CONNECTED TO INPUT B FOR BCD COUNT.

B. OUTPUT $Q_D$ IS CONNECTED TO INPUT A FOR BI-QUINARY COUNT.

C. H = HIGH LEVEL, L = LOW LEVEL.




TM52911-9400A

Figure 5-39. Dual 4-Bit Decade and Binary Counter (54390) Schematic Diagram

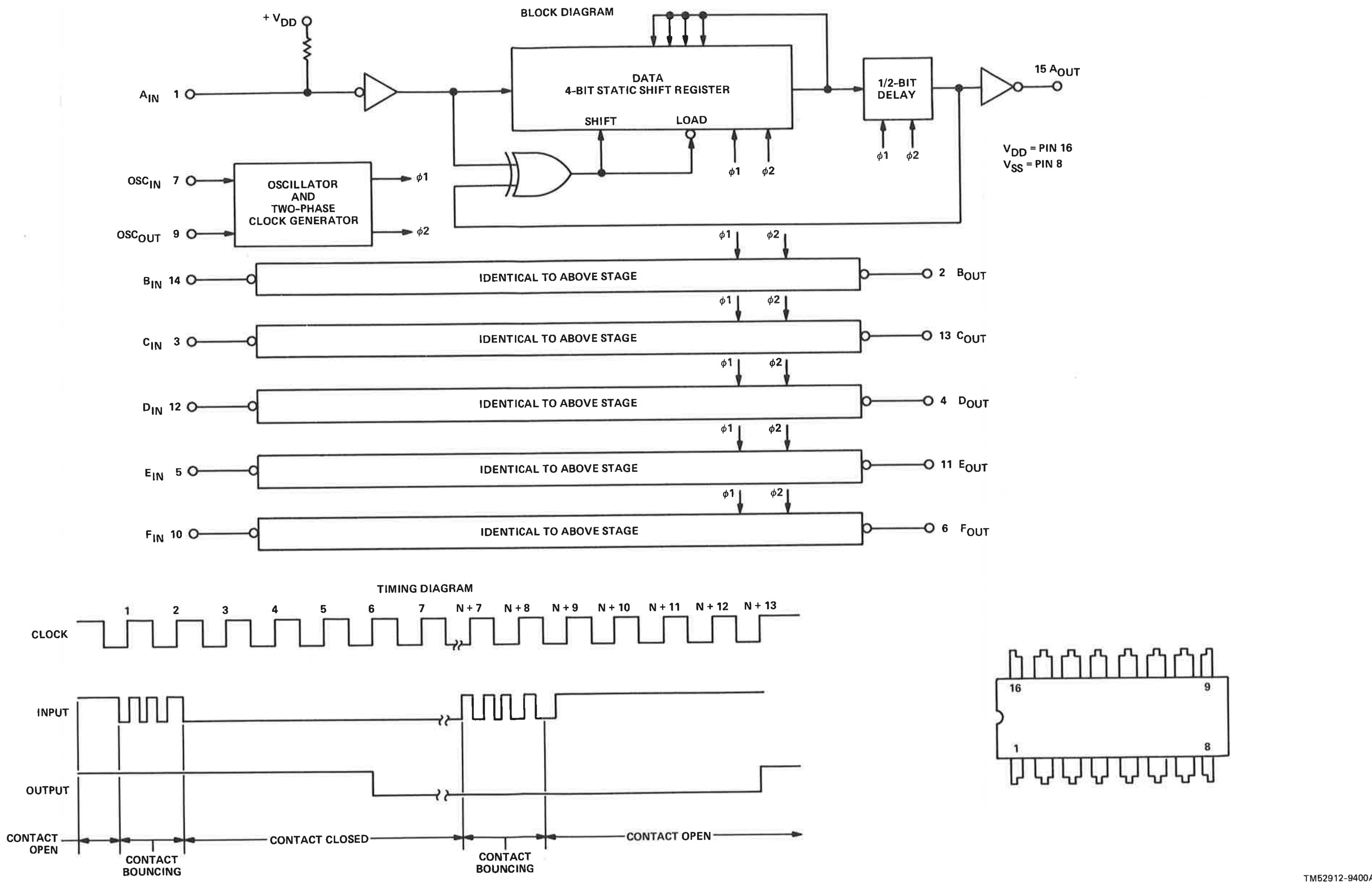
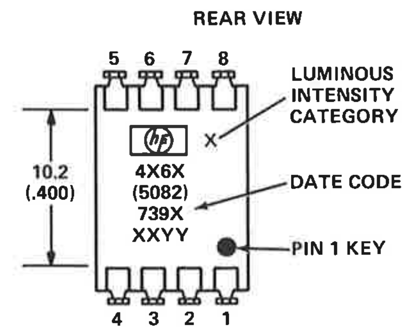
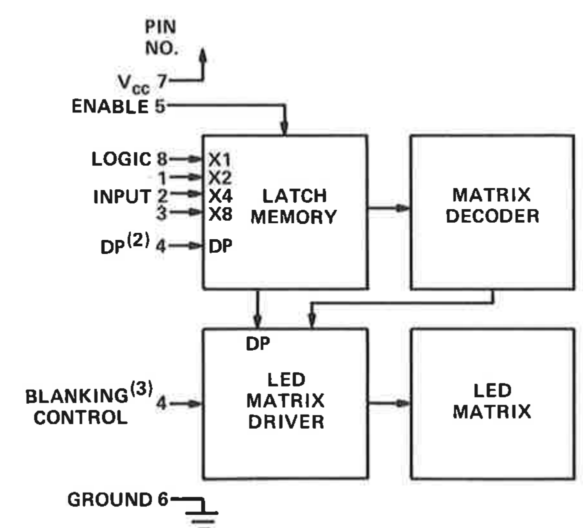



Figure 5-40. Hex Contact Bounce Eliminator (MC14490), Schematic Diagram




| TRUTH TABLE | | | | |
|---|---|---|---|---|
| BCD DATA(1) | | | | DISPLAY |
| $X_8$ | $X_4$ | $X_2$ | $X_1$ | |
| L | L | L | L | 0 |
| L | L | L | H | 1 |
| L | L | H | L | 2 |
| L | L | H | H | 3 |
| L | H | L | L | 4 |
| L | H | L | H | 5 |
| L | H | H | L | 6 |
| L | H | H | H | 7 |
| H | L | L | L | 8 |
| H | L | L | H | 9 |
| H | L | H | L | 8 |
| H | L | H | H | (BLANK) |
| H | H | L | L | (BLANK) |
| H | H | L | H | - |
| H | H | H | L | (BLANK) |
| H | H | H | H | (BLANK) |
| DECIMAL PT(2) | ON | | $V_{DP}$ = L | |
| | OFF | | $V_{DP}$ = H | |
| ENABLE(1) | LOAD DATA | | $V_E$ = L | |
| | LATCH DATA | | $V_E$ = H | |




NOTES:

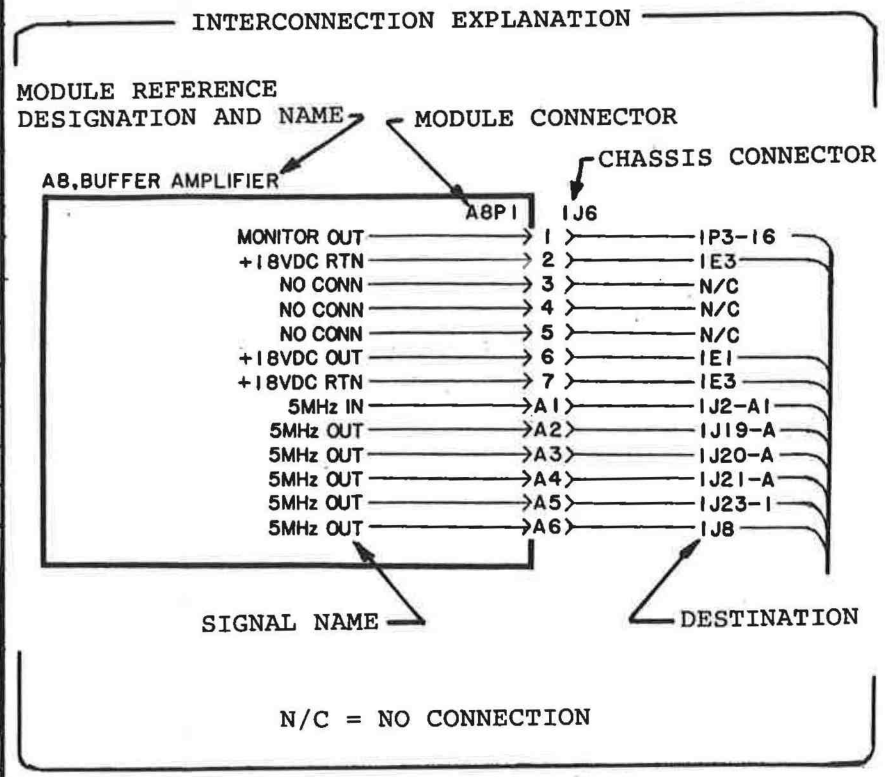
1. H = LOGIC HIGH, L = LOGIC LOW. WITH THE ENABLE INPUT AT LOGIC HIGH CHANGES IN BCD INPUT LOGIC LEVELS OR DP INPUT HAVE NO EFFECT UPON DISPLAY MEMORY, DISPLAYED CHARACTER, OR DP.

TM52913-9400A

Figure 5-41. Numeric LED Display (5082-7391), Schematic Diagram

| CHASSIS CONNECTOR LOCATION CHART | |
|---|---|
| CHASSIS CONNECTOR | LOCATED ON -OR- MATES WITH |
| 1J1 | A1A2P1 |
| 1J2 | A4P1 |
| 1J3 | A6P1 |
| 1J4 | A7P1 |
| 1J5 | A7P2 |
| 1J6 | A8P1 |
| 1J7 | A10P1 |
| 1J8 | FRONT PANEL |
| 1J9 | FRONT PANEL |
| 1J10 | FRONT PANEL |
| 1J11 | A14A1P1 |
| 1J12 | A17A1P1 |
| 1J13 | REAR PANEL |
| 1J14 | REAR PANEL |
| 1J15 | REAR PANEL |
| 1J16 | REAR PANEL |
| 1J17 | REAR PANEL |
| 1J18 | REAR PANEL |
| 1J19 | REAR PANEL |
| 1J20 | REAR PANEL |
| 1J21 | REAR PANEL |
| 1J22 | REAR PANEL |
| 1J23 | REAR PANEL |
| 1J24 | REAR PANEL |
| 1J25 | REAR PANEL |
| 1J26 | REAR PANEL |
| 1J27 | FRONT PANEL |
| 1J28 | FRONT PANEL |
| 1P1 | A1A3J1 |
| 1P2 | A9A2J1 |
| 1P3 | A16A1J1 |
| 1P4 | A5J1 |
| 1P5 | A5J2 |
| 1P6 | A5J4 |
| 1P7 | A5J5 |

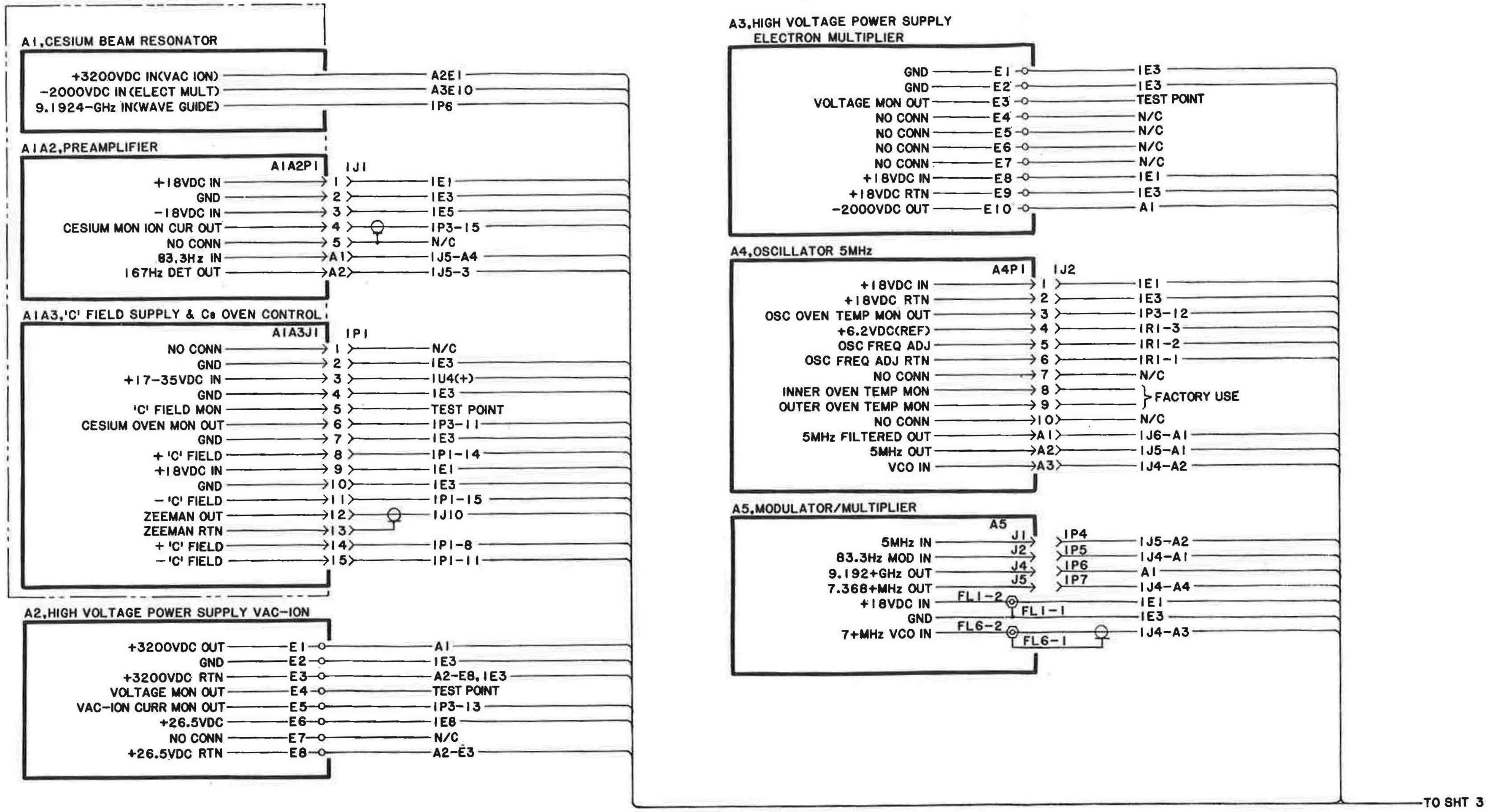
| ELECTRICAL COMPONENT LOCATION CHART | | | |
|---|---|---|---|
| COMPONENT REF DESG. | LOCATED ON | COMPONENT REF DESG. | LOCATED ON |
| 1B1 | REAR PANEL | 1E13 | FRONT PANEL |
| 1C1 | DECK | 1F1 | REAR PANEL |
| 1C2 | DECK | 1F2 | REAR PANEL |
| 1C3 | REAR PANEL | 1F3 | REAR PANEL |
| 1C4 | DECK | 1F4 | REAR PANEL |
| 1C5 | REAR PANEL | 1F5 | SPARE |
| 1CR1 | DECK | 1F6 | REAR PANEL |
| 1CR2 | DECK | 1FL1 | DECK |
| 1CR3-1CR10 | NOT USED | 1FL2 | REAR PANEL |
| 1CR11 | DECK | 1L1 | DECK |
| 1DS1 | FRONT PANEL | 1L2 | DECK |
| 1DS2 | FRONT PANEL | 1M1 | FRONT PANEL |
| 1DS3 | FRONT PANEL | 1R1 | FRONT PANEL |
| 1DS4 | FRONT PANEL | 1R2 | FRONT PANEL |
| 1DS5 | FRONT PANEL | 1R3 | DECK |
| 1DS6 | FRONT PANEL | 1R4 | REAR PANEL |
| 1DS7 | FRONT PANEL | 1R5 | DECK |
| 1E1 | DECK | 1R6 | FRONT PANEL |
| 1E2 | DECK | 1R7 | FRONT PANEL |
| 1E3 | DECK (GRD) | 1R8 | DECK |
| 1E4 | NOT USED | 1S1 | FRONT PANEL |
| 1E5 | DECK | 1S2 | NOT USED |
| 1E6 | NOT USED | 1S3 | REAR PANEL |
| 1E7 | DECK (TIE POINT) | 1S4 | REAR PANEL |
| 1E8 | DECK (TIE POINT) | 1T1 | DECK |
| 1E9 | DECK | 1U1 | DECK |
| 1E10 | DECK | 1U2 | DECK |
| 1E11 | DECK | 1U3 | DECK |
| 1E12 | FRONT PANEL | 1U4 | DECK |




CHASSIS SUB ASSY INTERCONNECTION DIAGRAM

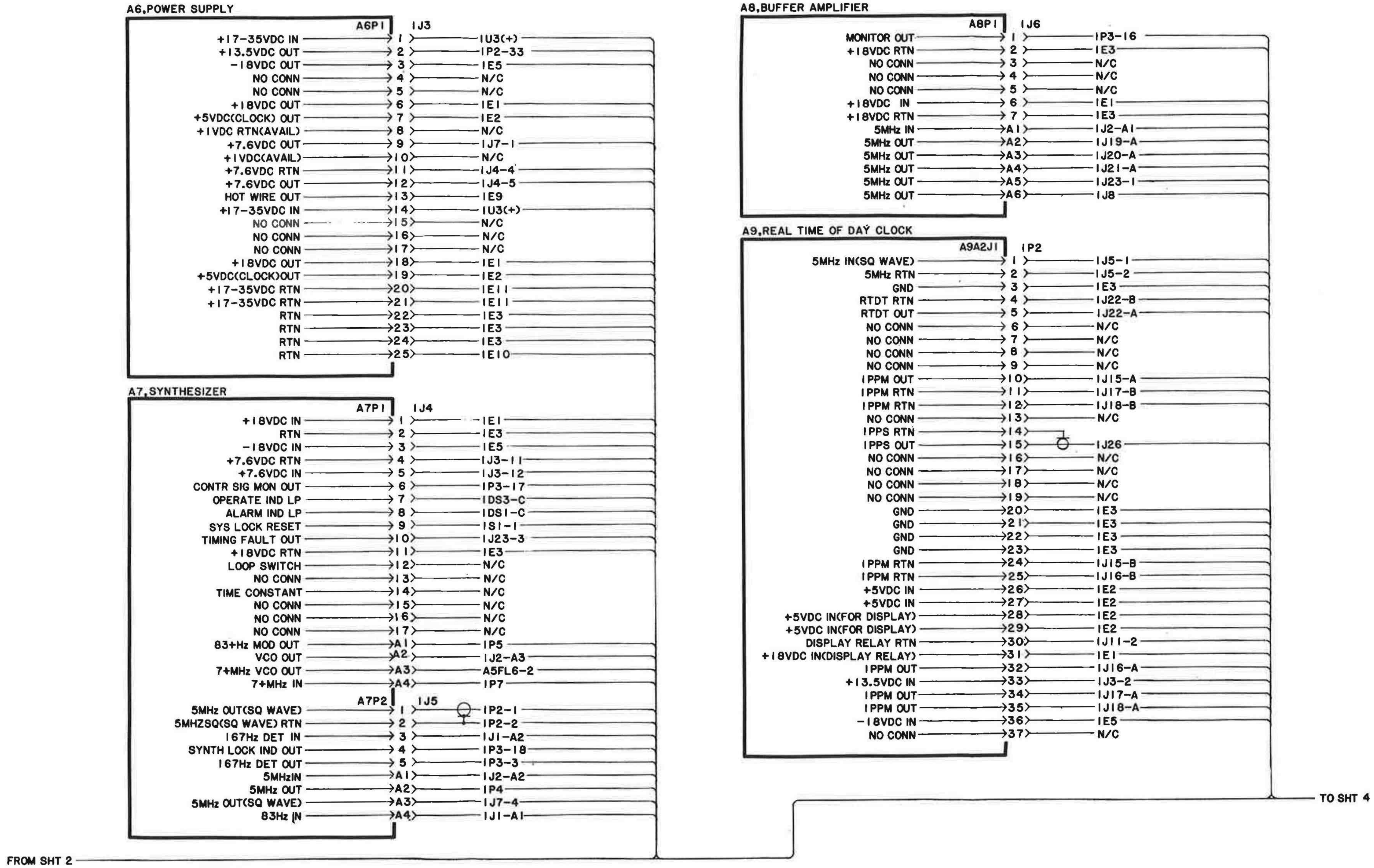
TM52495-9418-1

**Figure 5-42. Master Regulating Clock O-1824/U, Interconnection Diagram (Sheet 1 of 5)**



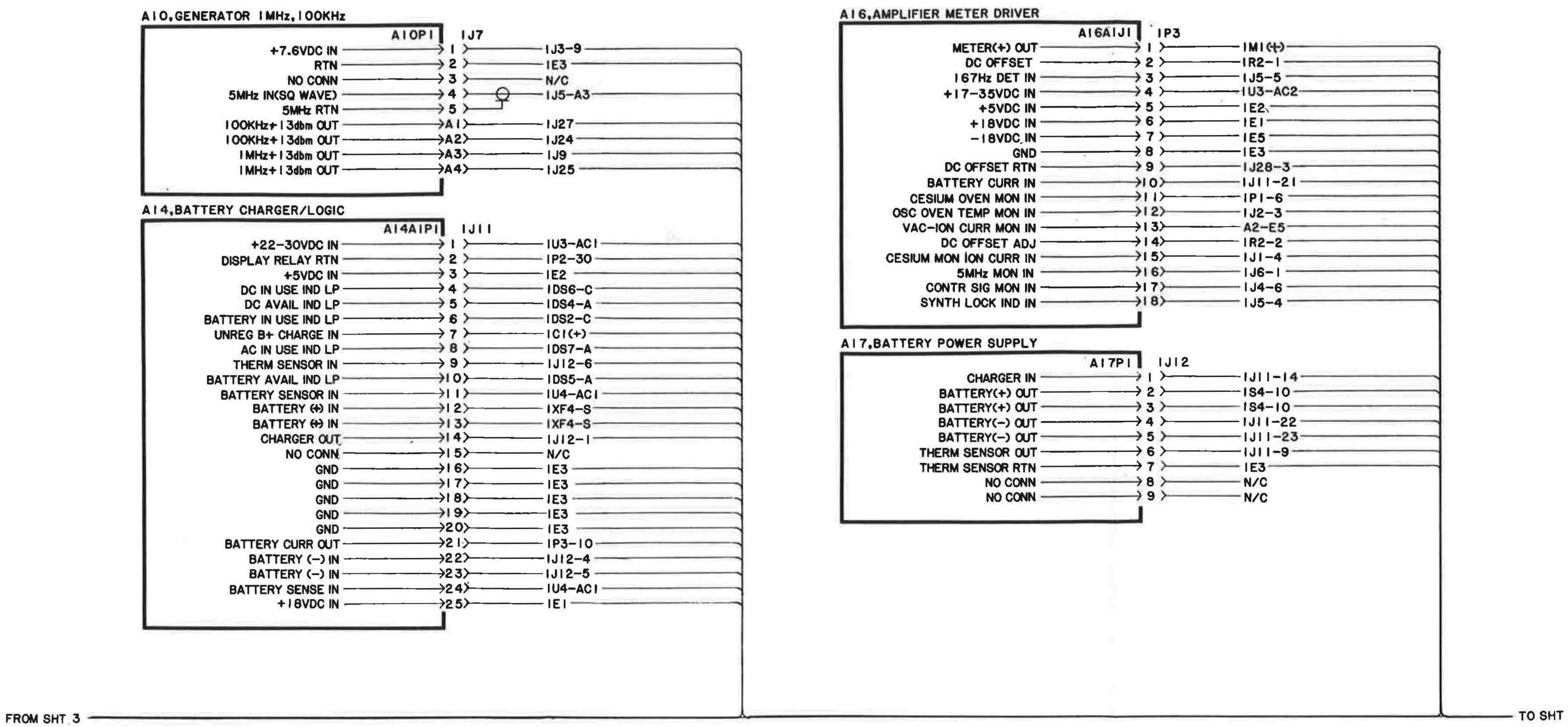

TM52495-9418-2

Figure 5-42. Master Regulating Clock 0-1824/U, Interconnection Diagram (Sheet 2 of 5)



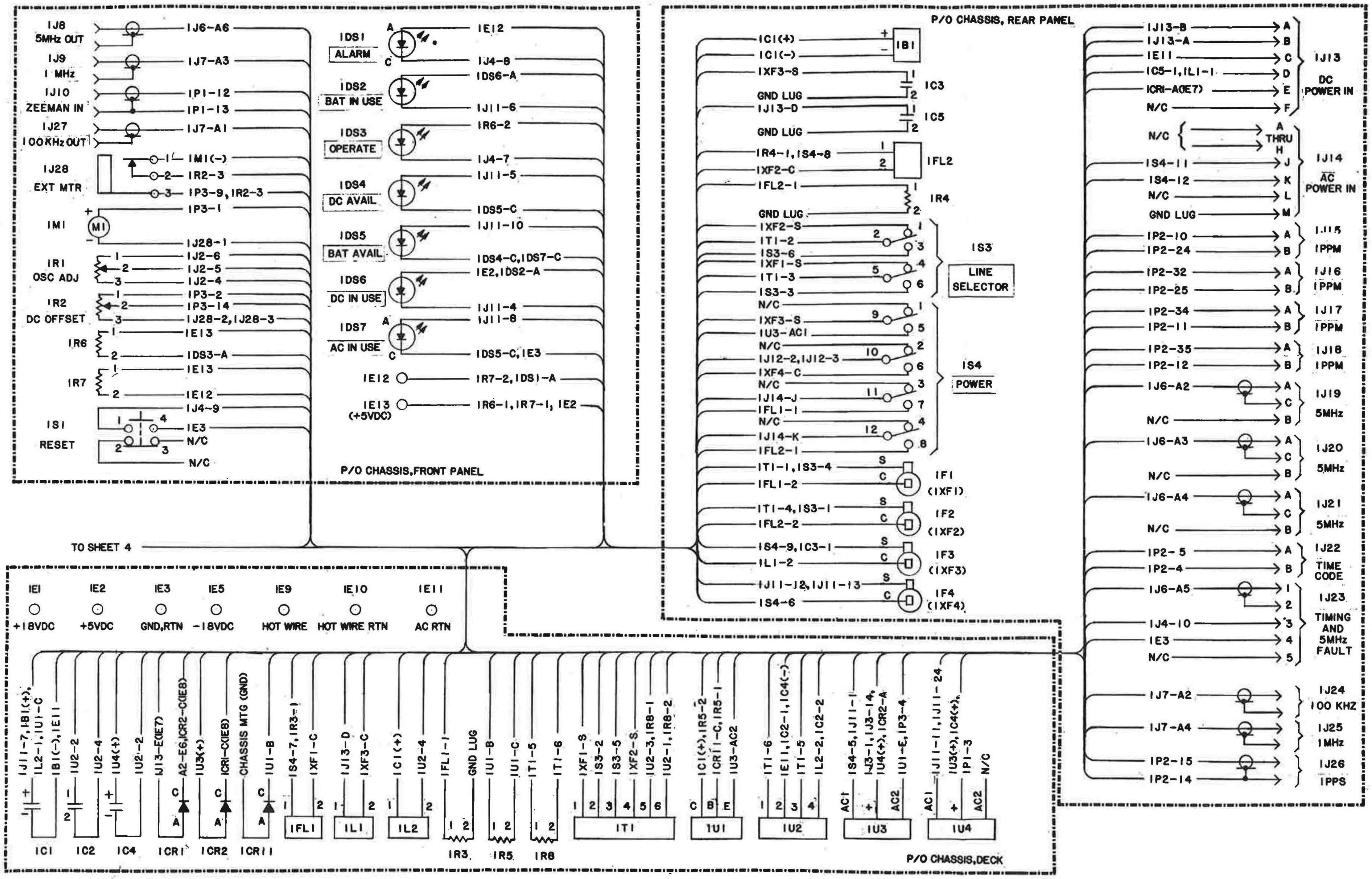

TM52495-9418-3

Figure 5-42. Master Regulating Clock 0-1824/U, Interconnection Diagram (Sheet 3 of 5)




TM52495-9418-4

Figure 5-42. Master Regulating Clock 0-1824/U, Interconnection Diagram (Sheet 4 of 5)



TM52495-9418-5F

Figure 5-42. Master Regulating Clock O-1824/U, Interconnection Diagram (Sheet 5 of 5)

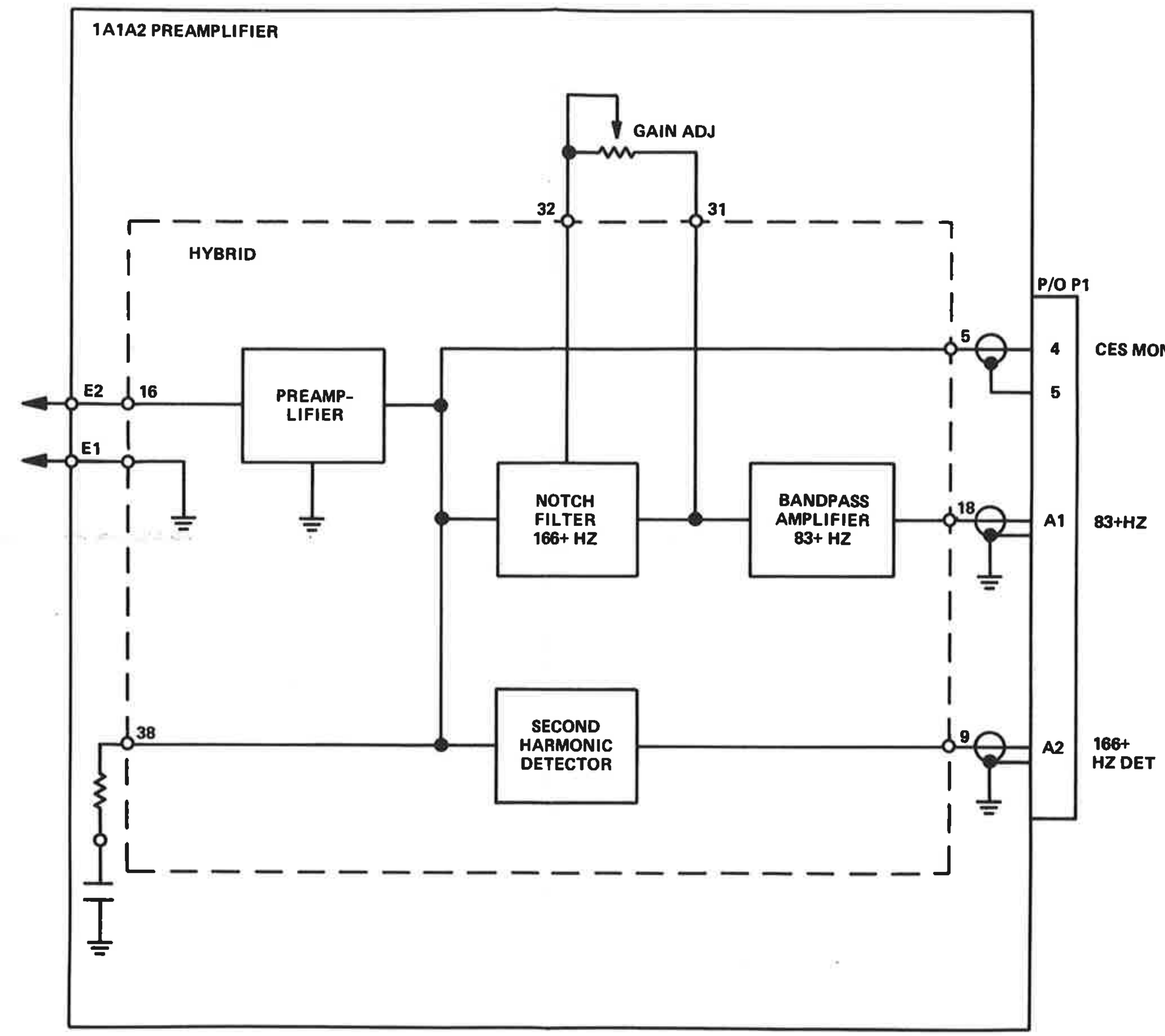



Figure 5-43. Preamplifier 1A1A2Z1,
Schematic Diagram

# CHAPTER 6

# CORRECTIVE MAINTENANCE

6-1. INTRODUCTION. This chapter contains the instructions and procedures required to remove, disassemble, replace, and adjust all replaceable modules and to replace chassis mounted piece parts of the Master Regulating Clock (MRC).

NOTE

The Cesium Beam Resonator (1A1), High Voltage Power Supply VAC-ION (1A2), High Voltage Power Supply Electron Multiplier Module (1A3), Oscillator (1A4), and Battery Power Supply (1A17) are not field repairable. These modules are field replaceable but repaired by the manufacturer.

Section 1 contains adjustment and alignment procedures. Section II contains removal, disassembly, replacement, and repair procedures for repairable assemblies and modules. This chapter contains top and bottom views of the MRC (figures 6-1 and 6-2), alignment waveforms and adjustment location (figures 6-3 and 6-4), exploded view diagrams (figures 6-5 through 6-14), and component location diagrams of printed circuit boards (figures 6-15 through 6-27) to support corrective maintenance.

## Section I. ADJUSTMENT AND ALIGNMENT

6-2. ADJUSTMENT AND ALIGNMENT PROCEDURES. There is no difference between the organizational level and intermediate/depot level adjustment and alignment procedures. A technician with knowledge of an oscilloscope can perform the necessary procedures. Refer to figures 6-1 and 6-2 for the location of modules, adjustments, and test points.

6-2.1 Preliminary Setup Procedure. Two setup procedures are possible depending upon the location of the Master Regulating Clock O-1824/U (MRC). If the MRC is installed so that the drawer can be extended and rotated, perform the procedures of paragraph 6-2.1.1. If extending and rotating the drawer is not possible, or if local operating procedures require maintenance at a different location, perform the procedures of paragraph 6-2.1.2. For reinstallation procedures, refer to paragraph 6-2.5.

6-2.1.1 Setup Procedure for In-Rack Maintenance. Perform the following procedure if the drawer can be extended and rotated:

a. Set external main ac power and dc power switches off.

b. Loosen the four captive, knurled screws at front panel corners.

c. Slide the drawer out to the fully extended position.

**CAUTION**

To prevent equipment from being dropped, ensure that MRC is supported during these procedures.

d. Release the rotation latches and rotate drawer for access to the rear panel connectors.

e. Tag and disconnect cables from rear panel connectors J15 through J26.

f. Loosen 37 captive phillips head screws on the top cover of the MRC. Remove cover and set aside.

6-2.1.2 Setup Procedure for Maintenance Outside of Rack. Perform the following procedure if the drawer cannot be extended and rotated:

a. Set external main ac power and dc power switches off.

b. Loosen the four captive, knurled screws at front panel corners.

c. Slide the drawer out to the fully extended position.

**CAUTION**

To prevent equipment from being dropped, ensure that MRC is supported during these procedures.

d. Release the rotation latches and rotate drawer for access to the rear panel connectors.

e. Tag and disconnect cables from rear panel connectors J15 through J26.

f. Safety tag and disconnect ac power cable from J14 and dc power cable from J13.

g. Return the MRC to horizontal position and lock rotation latch.

h. Release drawer slide catches, then remove the MRC from equipment cabinet and place on work surface. Go to step i at once.

i. With minimum delay, apply ac power to rear panel connector J14.

j. Loosen 37 captive phillips head screws on the top cover of the MRC. Remove the top cover and set aside.

6-2.2 Primary Loop Alignment. Perform the alignment procedure as follows using a Tektronix 475 oscilloscope or equivalent:

a. Set rear panel POWER switch to ON. Set external main ac POWER ON.

b. Loosen knurled screws and open right-hand access door on front panel.

c. Set MOD switch to OPR.

d. Set LOOP switch to OPEN.

e. Setup oscilloscope as follows:

SYNC to INTERNAL

TIME/DIV to 2 MSEC

V/CM to 0.2V

**WARNING**

High voltages capable of causing death are used in this equipment. Use extreme caution when handling/servicing either the power supplies or their load components.

f. Connect probe to test point 1A7TP1. Turn GAIN ADJ 1A1A2R1 fully CCW.

g. Adjust front panel OSCILLATOR ADJUST 1R1 for a maximum positive amplitude. Waveform should appear as shown in figure 6-3A.

h. Adjust MODULATION ADJ 1A7R5 for maximum amplitude as displayed on the oscilloscope and as shown in figure 6-3A, then adjust one-half turn clockwise.

i. Adjust PHASE ADJ 1A7R17 for correctly phased waveform. Incorrect and correct waveforms are shown in figure 6-3B.

j. Disconnect oscilloscope from 1A7TP1.

k. Connect oscilloscope probe to 1A1A2TP1, preamplifier signal output. The observed waveform should be as shown in figure 6-3C. If correct, go to step p. If not correct, set rear panel POWER switch OFF. Disconnect oscilloscope probe and go to step l.

l. Tip MRC until bottom plate is visible. Loosen 29 captive phillips head screws and remove bottom cover.

m. Set rear panel POWER switch to ON.

n. Connect oscilloscope probe to 1A1A2TP1.

o. Adjust electron multiplier adjust control 1A3R1 for correct waveform (figure 6-3C). If correct waveform cannot be obtained, refer to troubleshooting procedures in the technical manual. If waveform is now correct, disconnect oscilloscope and go to step p.

p. Connect oscilloscope probe to 1A7TP1. Set front panel OSCILLATOR ADJUST 1R1 for a minimum amplitude waveform as shown in figure 6-3D.

q. Set front panel loop switch to OPR and press front panel RESET button. OPERATE light should light, ALARM light should extinguish.

r. Adjust GAIN ADJ 1A1A2R1 for a waveform as shown in figure 6-3E.

s. Disconnect oscilloscope. Set external power off.

6-2.3 Cesium Beam Resonator/Waveguide Alignment.

a. Set MRC on its left side with the front panel facing the front of the work surface. If required, remove top and bottom covers. Connect bench power cable.

b. Preliminary adjustments.

(1) Set rear panel POWER switch to ON. Set main AC POWER ON. Allow 20 minute warmup, minimum.

(2) Loosen knurled screws and open right-hand access door on front panel.

(3) Set MOD switch to OPR.

(4) Set LOOP switch to OPEN.

(5) Set oscilloscope as follows:

SYNC TO INTERNAL

TIME/DIV to 2 MSEC

V/CM to 0.2V

(6) Connect probe to test point 1A7TP1. Adjust GAIN ADJ 1A1A2R1 fully CCW.

(7) Adjust front panel OSCILLATOR ADJUST 1R1 for maximum, positive amplitude. Waveform should appear as shown in figure 6-3A.

(8) Readjust GAIN ADJ 1A1A2R1 (if necessary) for correct waveform as shown in figure 6-3A.

(9) Adjust MODULATION ADJ 1A7R5 for maximum amplitude on oscilloscope as shown in figure 6-3A then adjust one-half turn clockwise.

c. Waveguide adjustment.

(1) Adjust stopnuts only on waveguide attenuator screws to end of screws as shown in figure 6-4.

NOTE

Do not turn attenuator screws.

(2) While observing oscilloscope, slide attenuator screws smoothly upward (toward right-hand side of MRC) through waveguide. The waveform should increase smoothly through a maximum peak, then begin decreasing before the end of travel is reached. If this sequence is not observed, go to step c(3). If this sequence is observed, go to step c(6).

CAUTION

In the following steps, one or more of the waveguide capacitive screws will be adjusted. Do not allow the screw to cross and touch the opposite end of the waveguide.

(3) Loosen the stopnut on the rightmost of the outer capacitive screws (as shown in step c(1) above) and adjust the screw fully out without removing the screw.

(4) Repeat step c(2). If the correct (increase, peak, decrease) sequence is not observed, turn screw two turns inward and repeat step c(2). Continue these actions until the correct sequence is observed, or until the screw is inserted to 3/4 depth. If this insertion depth is attained without obtaining the correct sequence, tighten the stopnut and go to step c(5). If the correct sequence is observed during this step, go to step c(6).

(5) Loosen the stopnut on the leftmost capacitive screw and repeat step c(4). When the correct sequence is obtained, tighten the stopnut and go to step c(6).

(6) Adjust attenuator for maximum positive peak waveform. Taking care not to change position, lock attenuator screws with stopnuts (fine adjustment of attenuator screws may be necessary).

d. Final adjustment.

(1) Adjust MODULATION ADJ 1A7R5 for maximum amplitude as displayed on the oscilloscope, then adjust one-half turn clockwise.

(2) Adjust PHASE ADJ 1A7R17 for correctly phased waveform. Incorrect and correct waveforms are shown in figure 6-3B.

(3) Disconnect oscilloscope from 1A7TP1.

(4) Connect oscilloscope to 1A1A2TP1, preamplifier output.

(5) Adjust 1A3R1, electron multiplier voltage, to obtain waveform shown in figure 6-3C.

(6) Connect oscilloscope probe to 1A7TP1. Set front panel OSCILLATOR ADJUST 1R1 for a zero amplitude waveform (straight line with no breaks).

(7) Set front panel LOOP switch to OPR.

(8) Set oscilloscope V/CM to 2V, adjust GAIN ADJ 1A1A2R1 for a waveform as shown in figure 6-3D.

(9) On front panel, observe that OPERATE lamp lights. Push RESET and observe that ALARM lamp goes out. If these indications are not obtained at this time, this procedure must be repeated from step c(1).

(10) Set POWER switch OFF, disconnect oscilloscope and replace covers.

6-2.4 C-Field Adjustment. The C-field is a uniform magnetic field in which the transition of the Cesium atoms takes place. The output frequency is derived from this transition. Changes in the C-field will cause a change in the output frequency. The sensitivity of the output frequency to the C-field is given by the expression:

$$\Delta f/f = 3.3\text{x}10^{-10} \quad \Delta H/H$$

Therefore a 1 percent change in the C-field would cause a $3.3\text{x}10^{-12}$ change in output frequency. This makes the C-field a useful way to offset the output frequency of the Cesium standard.

The C-field intensity is proportional to the current which flows through the C-field coils, and approximately proportional to the voltage across that coil (coil resistance can vary as a function of temperature). The 0-1824/U provides a monitor of the voltage across the C-field coil. This voltage should not be used as an absolute value to set the output frequency, but only as a reference to reset the output frequency.

All Cesium standards shipped from the factory should be within $1\text{x}10^{-11}$ ($3\text{x}10^{-11}$ is the accuracy specification). Some applications, however, may require that the standard be set to a closer tolerance (i.e., $2\text{x}10^{-12}$). Other applications may require matching the standard frequency to that of another standard. When a more accurate setting or change of the output frequency is required, the following procedure should be followed.

a. Measure the output frequency offset with regard to the reference to which it is to be set.

b. Divide the measured offset ($\Delta f/f$) by $3.3 \times 10^{-10}$.

c. Measure the C-field monitor voltage ($Vc^1$) at 1A1A3R5 test point 1A1A3J1 pin 5.

d. Multiply step b by step c.

$$\text{i.e., } (\Delta f/f \div 3.3 \times 10^{-10}) \quad (Vc^1)$$

e. Subtract the number derived in step d from step c.

$$\text{i.e., } Vc^2 - (\Delta f/f \div 3.3 \times 10^{-10}) \quad (Vc^1)$$

f. Reset the C-field monitor voltage to that derived in step e, by adjusting C-FIELD adjust 1A1A3R5 (figure 6-1).

g. Remeasure the output frequency to insure accuracy.

h. Repeat procedure if necessary.

Example: A Cesium standard is desired to be set within $3 \times 10^{-12}$ of another reference.

(1) A measurement is made and the standard is found to be offset from the reference by $+8 \times 10^{-12}$.

(2) $8 \times 10^{-12} \div 3.3 \times 10^{-10} = .024$.

(3) A measurement of the C-field monitor reads 18.0 mv.

(4) $.024 \times 18 = 0.432$.

(5) $18 - 0.432 = 17.568$.

(6) The C-field is reset to provide a monitor voltage of 17.568.

(7) A remeasurement of the output shows an offset of $1.5 \times 10^{-12}$ and the calibration is complete.

If at a later time the C-field monitor has been found to have changed from its previous value, the C-field should not be reset. This monitor is a reference only. The C-field should only be reset when the output frequency needs a correction.

6-2.5 Reinstallation. If the preliminary set-up procedure of paragraph 6-2.1.1 was used, reinstall and return the equipment to the readiness condition as described in paragraph 6-2.5.1. If the preliminary procedure of paragraph 6-2.1.2 was used, reinstall in accordance with paragraph 6-2.5.2.

6-2.5.1 Reinstallation Following In-Rack Maintenance. Reinstall the MRC and place it in readiness condition described as follows if the preliminary procedure of paragraph 6-2.1.1 was used:

a. Reconnect cables to rear panel connectors J15 through J26, as tagged. Remove tags.

b. Release rotation latches and rotate the MRC to the horizontal position.

c. Slide the drawer back into the equipment cabinet. Tighten the four captive knurled screws at the front panel corners.

d. Set external main power switches on.

e. If required, push front panel RESET pushbutton.

6-2.5.2 Reinstallation Following Maintenance Outside the Rack. Reinstall the MRC and place it in readiness condition described as follows if the preliminary procedure of paragraph 6-2.1.2 was used:

a. Disconnect bench power cable from bench ac outlet and J14.

b. Reinstall the MRC in the equipment cabinet. Ensure that drawer slides are correctly engaged.

c. Reconnect cabinet power cables to J13 and J14, as tagged.

d. Reconnect cables to J15 through J26 as tagged. Remove all tags after cables are connected and checked for correct position.

e. Release the rotation latches and rotate the MRC to the horizontal position, if necessary. Slide the drawer back into the cabinet.

f. Tighten the four captive knurled screws at the front panel corners.

g. Set external main ac power and dc power switches to on.

h. If required, push front panel RESET pushbutton.

## Section II. REPAIR PROCEDURES

6-3. INTRODUCTION. This section contains organizational (paragraph 6-4) and intermediate/depot (paragraph 6-5) repair procedures. Refer to figures 6-1 and 6-2 for location and identification of modules within the Master Regulating Clock O-1824/U, (MRC). When performing repair procedures, disassemble the MRC only to the extent necessary to perform repairs.

6-4. ORGANIZATIONAL REPAIR. Organizational repair is limited to replacement of defective MRC modules. Further disassembly and repair should not be attempted by organizational maintenance personnel. To replace a module, refer to paragraph 6-4.1 and perform the applicable removal procedure for the defective module. Module reinstallation procedures are contained in paragraph 6-4.2. Prior to removing any module perform the preliminary procedures in paragraph 6-2.1.

6-4.1 Module Removal. (See figure 6-5.) To remove any module from the MRC, loosen 37 captive screws and remove top cover (1) and/or loosen 29 captive screws and remove bottom cover (2) as necessary. Specific removal procedures for each module are contained in the following subparagraphs.

6-4.1.1 Battery Charger/Logic Module 1A14 Removal. To remove battery charger/logic module 1A14, perform the following steps.

a. Loosen two captive screws securing 1A14 module (3) to chassis.

b. Unplug 1A14 module (3) from 1J11 connector and remove module from chassis.

6-4.1.2 Generator Module 1A10 Removal. To remove generator module 1A10, perform the following steps.

a. Loosen two captive screws securing 1A10 module (4) to chassis.

b. Unplug 1A10 module (4) from 1J7 connector and remove module from chassis.

6-4.1.3 Battery Power Supply Module 1A17 Removal. To remove battery power supply module 1A17, perform the following steps.

a. Loosen four captive screws securing 1A17 module (5) to chassis.

b. Unplug 1A17 module (5) from 1J12 connector and remove module from chassis.

6-4.1.4 Buffer Amplifier Module 1A8 Removal. To remove buffer amplifier module 1A8, perform the following steps.

a. Loosen two captive screws securing 1A8 module (6) to chassis.

b. Unplug 1A8 module (6) from 1J6 connector and remove module from chassis.

6-4.1.5 5 MHz Oscillator Module 1A4 Removal. To remove 5 MHz oscillator module 1A4, perform the following steps.

a. Loosen four captive screws securing 1A4 module (7) to chassis.

b. Unplug 1A4 module (7) from 1J2 connector and remove module from chassis.

6-4.1.6 Synthesizer Module 1A7 Removal. Remove 1A7 module (8) by removing two mounting stud flat-head screws (9), and unplugging 1A7 module (8) from connectors 1J4 and 1J5.

6-4.1.7 Amplifier Meter Switch Driver Assembly 1A16 Removal. To remove amplifier meter switch driver assembly 1A16, perform the following steps.

a. Unplug 1P3 connector from 1A16 module (10).

b. Remove two pan-head screws (11), two lockwashers (12), and two flat washers (13) securing 1A16 module (10) and bracket (14) to chassis.

c. Remove two pan-head screws (15), four flat washers (16), two spacers (17), two insulating washers (18), two lockwashers (19), and two nuts (20) securing bracket (14) to 1A16 module (10).

6-4.1.8 Waveguide Assembly Removal. To remove waveguide assembly (21), perform the following steps.

a. Disconnect semi-rigid coaxial cable from waveguide assembly (21).

b. Remove waveguide assembly (21) from Cesium beam resonator module 1A1 (22) by removing two pan-head screws (23), two pan-head screws (24) four lockwashers (25), two nuts (26), and two spacers (27).

6-4.1.9 Cesium Beam Resonator Module 1A1 Removal. To remove Cesium beam resonator module 1A1, perform the following steps.

a. Refer to subparagraph 6-4.1.8 above and remove waveguide assembly.

b. Unplug connectors 1J1 and 1P1 from 1A1 module (22).

c. Remove two socket-head screws (28) and two shoulder washers (29) securing spacer (30) to chassis.

d. Remove two socket-head screws (31) and two shoulder washers (32) securing spacer (33) to chassis and remove module from chassis.

e. Remove five socket-head screws (34) securing spacers (30, 33, 35) and shield (36) to 1A1 module (22).

6-4.1.10 Modulator/Multiplier Module 1A5 Removal. To remove modulator/multiplier module 1A5, perform the following steps.

a. Tag and disconnect coaxial cables from 1A5 module (37).

b. Remove pan-head screw (38), lockwasher (39), flat washer (40), three pan-head screws (41), three lockwashers (42), and three flat washers (43) securing 1A5 module (37) to chassis and remove 1A5 module.

6-4.1.11 High Voltage Power Supply Module 1A2 Removal. To remove high voltage power supply 1A2, perform the following steps.

a. Tag and disconnect coaxial cable from 1A2 module (44).

b. Tag and disconnect individual wires from 1A2 module (44).

c. Remove four pan-head screws (45), four lockwashers (46), and four flat washers (47), securing 1A2 module (44) to chassis and remove 1A2 module.

6-4.1.12 High Voltage Power Supply Module 1A3 Removal. To remove high voltage power supply 1A3, perform the following steps.

a. Tag and disconnect coaxial cable from 1A3 module (48).

b. Tag and disconnect individual wires from 1A3 module (48).

c. Remove two pan-head screws (49) securing 1A3 module (48) to chassis.

d. Remove four pan-head screws (50), four lockwashers (51), and four flat washers (52), securing two brackets (53) to 1A3 module (48) and remove 1A3 module.

6-4.1.13 Real Time-of-Day Clock Module 1A9 Removal. To remove real time-of-day clock module 1A9, perform the following steps.

a. Disconnect connector 1P2 from rear of 1A9 module (54).

b. Unscrew three connector covers from connectors on front of 1A9 module (54).

c. Remove eight pan-head screws (55), eight lockwashers (56), and eight flat washers (57) securing 1A9 module (54) to front panel.

d. Loosen two captive screws and remove 1A9 module (54) from chassis.

6-4.1.14 Power Supply Module 1A6 Removal. To remove 1A6 module (58), remove two captive screws and unplug module from 1J3 connector.

6-4.2 Module Reinstallation. (Figure 6-5.) Specific installation procedures for each module are contained in the following subparagraphs. After all modules have been reinstalled, install bottom cover (2) and tighten 29 captive screws and/or install top cover (1) and tighten 37 captive screws, as necessary.

NOTE

After reconnecting tagged wires or cables, remove identification tags.

6-4.2.1 Power Supply Module 1A6 Reinstallation. Place 1A6 module (58) in position on chassis, and tighten two captive screws.

6-4.2.2 Real Time-of-Day Clock Module 1A9 Reinstallation. To reinstall a real time-of-day clock module 1A9, perform the following steps.

a. Place 1A9 module (54) in position on chassis and tighten two captive screws.

b. Secure 1A9 module (54) to front panel with eight pan-head screws (55), eight lockwashers (56), and eight flat washers (57).

c. Reconnect connector 1P2 to rear of 1A9 module (54).

d. Screw on three connector covers onto front connectors of 1A9 module (54).

6-4.2.3 High Voltage Power Supply Module 1A3 Reinstallation. To reinstall high voltage power supply module 1A3, perform the following steps.

a. Secure bracket (53) to 1A3 module (48) with four pan-head screws (50), four lockwashers (51), and four flat washers (52).

b. Place 1A3 module (48) in position on chassis and secure with two pan-head screws (49).

c. Reconnect wires and cables to 1A3 module (48).

6-4.2.4 High Voltage Power Supply Module 1A2 Reinstallation. To reinstall high voltage power supply module 1A2, perform the following steps.

a. Place 1A2 module (44) in position on chassis and secure with four pan-head screws (45), four lockwashers (46), and four flat washers (47).

b. Reconnect individual wires and cables to 1A2 module (44).

6-4.2.5 Modulator/Multiplier Module 1A5 Reinstallation. To reinstall modulator/ multiplier module 1A5, perform the following steps.

a. Place 1A5 module (37) in position on chassis and secure with pan-head screws (38), lockwasher (39), flat washer (40), three pan-head screws (41), three lockwashers (42), and three flat washers (43).

b. Reconnect coaxial cables to 1A5 module (37).

6-4.2.6 Cesium Beam Resonator Module 1A1 Reinstallation. To reinstall Cesium beam resonator module 1A1, perform the following steps.

a. Place spacers (30, 33, 35) and shield (36) in position on 1A1 module (22) and secure with five socket-head screws (34).

b. Place 1A1 module (22) in position on chassis and secure with four shoulder washers (29, 32) and four socket-head screws (28, 31).

c. Connect chassis harness connectors 1J1 and 1P1 into 1A1 module (22).

d. Perform Cesium Beam Resonator/Waveguide alignment (paragraph 6-2.3).

6-4.2.7 Waveguide Assembly Reinstallation. To reinstall waveguide assembly (21), perform the following steps.

a. Place waveguide assembly (21) in position on 1A1 module (22) and secure with two spacers (27), two pan-head screws (24), four lockwashers (25), two nuts (26), and two pan-head screws (23).

b. Reconnect coaxial cable to waveguide assembly (21).

c. Perform Cesium Beam Resonator/Waveguide alignment (paragraph 6-2.3).

6-4.2.8 Amplifier Meter Switch Driver Module 1A16 Assembly Reinstallation. To reinstall amplifier meter switch driver module, perform the following steps.

a. Secure bracket (14) to 1A16 module (10) using two pan-head screws (15), four flat washers (16), two spacers (17), two insulating washers (18), two lockwashers (19), and two nuts (20).

b. Place 1A16 module (10) in position on chassis and secure with two pan-head screws (11), two lockwashers (12), and two flat washers (13).

c. Connect harness assembly connector 1P3 to 1A6 module (10).

6-4.2.9 Synthesizer Module 1A7 Reinstallation. Place 1A7 module (8) in position on chassis and secure with two mounting stud flat-head screws (9).

6-4.2.10 5 MHz Oscillator Module 1A4 Reinstallation. Place 1A4 module (7) in position on chassis and tighten four captive screws.

6-4.2.11 Buffer Amplifier Module 1A8 Reinstallation. Place 1A8 module (6) in position on chassis and tighten two captive screws.

6-4.2.12 Battery Power Supply Module 1A17 Reinstallation. To reinstall battery power supply module 1A17, perform the following steps.

a. Place 1A17 module (5) in position on chassis and tighten four captive screws.

b. Connect chassis harness connector 1J12 to 1A17 module connector 1A17P1.

6-4.2.13 Generator Module 1A10 Reinstallation. Place 1A10 module (4) in position on chassis and tighten two captive screws.

6-4.2.14 Battery Charger/Logic Module 1A14 Reinstallation. Place 1A14 module (3) in position and tighten two captive screws.

6-5. INTERMEDIATE/DEPOT REPAIR. Intermediate/depot repair consists of the repair of defective MRC modules and the removal and replacement of chassis components. The following paragraphs contain MRC module repair (paragraph 6-5.1) and chassis disassembly (paragraph 6-5.2) procedures. To replace a defective chassis component refer to paragraph 6-5.2 and disassemble the chassis as required to replace the defective component. If the removal of MRC modules is necessary to gain access to a defective chassis component, refer to paragraph 6-4.1 and remove the appropriate module(s), then, proceed to paragraph 6-5.2 and continue chassis disassembly.

Chassis reassembly and module reinstallation procedures are contained in paragraphs 6-5.3 and 6-4.2, respectively. Prior to removal of any modules or components perform the preliminary procedures of paragraph 6-2.1.

6-5.1 MRC Module Repair. This paragraph covers intermediate/depot repair of the MRC modules. Module repair is limited to replacement of defective components within the modules. Due to the relative simplicity of the modules, disassembly procedures are not provided. To disassemble a module, refer to the appropriate figure for the module being repaired and disassemble the module by removing items in index number order. To reassemble a module, refer to the appropriate figure and reverse the procedure. Refer to table 6-1 below, for a listing of repairable modules and their respective exploded view illustrations. To facilitate component replacement on printed circuit board assemblies within the modules, refer to table 6-2 for a listing of the printed circuit board assemblies and their respective component location illustrations.

Table 6-1. Repairable Module Illustration List

| Module | | |
|---|---|---|
| Ref des | Common name | Figure no. |
| 1A5 | Modulator/Multiplier Module | 6-7 |
| 1A6 | Power Supply Module | 6-8 |
| 1A7 | Synthesizer Module | 6-9 |
| 1A8 | Buffer Amplifier Module | 6-10 |
| 1A9 | Real Time-Of-Day Clock Module | 6-11 |
| 1A10 | Generator Module, 1 MHz, 100 kHz | 6-12 |
| 1A14 | Battery Charger/Logic Module | 6-13 |
| 1A16 | Amplifier Meter Driver Switch Assembly | 6-14 |

Table 6-2. Printed Circuit Board Component Location Illustration List

| Printed circuit board reference designation | Figure no. |
|---|---|
| 1A5A1 | 6-15 |
| 1A5A2 | 6-16 |
| 1A5A3 | 6-17 |
| 1A5A4 | 6-18 |
| 1A6 | 6-19 |

Table 6-2. Printed Circuit Board Component Location Illustration List - Continued

| Printed circuit board reference designation | Figure no. |
|---|---|
| 1A7A1 | 6-20 |
| 1A8A1 | 6-21 |
| 1A9A1 | 6-22 |
| 1A9A2 (Part No. 52002-9409) | 6-23 |
| 1A9A2 (Part No. 52002-9409-1) | 6-24 |
| 1A10A1 | 6-25 |
| 1A14A1 | 6-26 |
| 1A16A1 | 6-27 |

6-5.2 Chassis Disassembly. Disassembly of the chassis assembly should be performed only to the extent necessary to effect repairs or to replace a defective component. To disassemble chassis assembly, refer to figures 6-5 and 6-6 and perform the procedures contained in the following subparagraphs.

NOTE

Removal of discrete electronic components (diodes, capacitors, etc.) is not included in the following procedures. To remove an electronic component, note polarity of component, then tag and disconnect leads of component using low wattage soldering iron and heat sink.

a. Remove top cover (1, figure 6-5) by loosening 37 captive screws.

b. Remove bottom cover (2, figure 6-5) by loosening 29 captive screws.

c. Tag and disconnect leads from transformer 1T1 (1, figure 6-6).

d. Remove transformer 1T1 (1) from chassis by removing two pan-head screws (2), four pan-head screws (3), eight flat washers (4), four lockwashers (5), and four hex nuts (6).

e. Remove resistor 1R8 (7) from transformer 1T1 (1).

f. Remove cover assembly (8) by removing four pan-head screws (9, 10), four lockwashers (11, 12), and four flat washers (13, 14).

g. Tag and disconnect leads from inductor 1L2 (15).

h. Remove inductor 1L2 (15) by removing two standoffs (16), four lockwashers (17), four flat washers (18), and two hex nuts (19).

i. Tag and disconnect leads to rectifier 1U4 (20).

j. Remove rectifier 1U4 (20) by removing two pan-head screws (21), two standoffs (22), and two flat washers (23).

k. Tag and disconnect leads from rectifier 1U3 (24).

l. Remove rectifier 1U3 (24) by removing two pan-head screws (25), two flat washers (26), two lockwashers (27), and two hex nuts (28).

m. Tag and disconnect leads from line filter 1FL1 (29).

n. Remove line filter 1FL1 (29) from chassis by removing two pan-head screws (30), lug (31), two flat washers (32), two lockwashers (33), and two hex nuts (34).

o. Tag and disconnect leads from integrated circuit 1U1 (36).

p. Remove integrated circuit 1U1 (36) by removing two pan-head screws (37), insulator (38), two shoulder washers (39), four flat washers (40), lug (41), lockwasher (42), and two hex nuts (43).

q. Remove insulator plate (45) by removing two pan-head screws (46), two lockwashers (47), and two flat washers (48).

r. Tag and disconnect leads to capacitor 1C1 (49).

s. Remove capacitor 1C1 (49) by removing two pan-head screws (50), two lockwashers (51), four flat washers (52), and two standoffs (53).

t. Tag and disconnect leads from blower 1B1 (59).

u. Remove blower 1B1 (59) by removing four pan-head screws (60), four flat washers (61), exhaust frame (62), exhaust screen (63), four flat washers (64), and four locknuts (65).

v. Remove switch plate (66) by removing two pan-head screws (67), two flat washers (68), and two lockwashers (69).

w. Tag and disconnect leads to slide switch 1S3 (70).

x. Remove slide switch 1S3 (70) by removing two flat-head screws (71), two flat washers (72), and two locknuts (73).

y. Tag and disconnect leads from line filter 1FL2 (74).

z. Remove line filter 1FL2 (74) by removing two pan-head screws (75), four flat washers (76), lug (77), and two locknuts (78).

NOTE

Steps aa, ab, and ac below are typical for the removal of fuses, 1F1 through 1F4, and fuse holders 1XF1 through 1XF4. Therefore, only the procedure for removing fuse 1F4 and fuse holder 1XF4 is given in the following subparagraphs.

aa. Remove fuse 1F4 (80) by unscrewing cap (81) and removing fuse from fuse holder 1XF4 (82).

ab. Tag and disconnect leads from fuse holder 1XF4 (82).

ac. Remove fuse holder 1XF4 (82) by removing hex nut (83).

ad. Tag and disconnect leads from ON-OFF switch 1S4 (88).

ae. Remove ON-OFF switch 1S4 (88) by removing hex nut (89) and washer (90).

NOTE

Steps af and ag below are typical for the removal of connectors 1J13 through 1J23. Therefore, only the procedure for removing connector 1J13 is given in the following subparagraphs.

af. Tag and disconnect leads from connector 1J13 (91).

ag. Remove connector 1J13 (91) by removing four pan-head screws (92, 93), five flat washers (94), connector cap (P/O 91) three flat washers (95), lug (96), and four locknuts (97).

NOTE

Steps ah and ai below are typical for the removal of connectors 1J24, 1J25, and 1J26. Therefore, only the procedure for removing connector 1J24 is given in the following subparagraphs.

ah. Tag and disconnect leads from connector 1J24 (127).

ai. Remove connector 1J24 (127) by removing lug (128) and terminal (129).

aj. Remove connector caps (133) by removing pan-head screw (130), lockwasher (131), and flat washer (132).

ak. Remove spare fuses 1F5 (134) and 1F6 (135) from spare fuse holder (136).

al. Remove spare fuse holder (136) by removing four pan-head screws (137), four lockwashers (138), and four flat washers (139) from rear panel (140).

am. Tag and disconnect leads from meter 1M1 (141).

an. Remove meter 1M1 (141) by removing four pan-head screws (142), four lockwashers (143), four flat washers (144), and four hex nuts (145).

ao. Tag and disconnect leads to connector 1J28 (146) and remove connector from chassis.

ap. Tag and disconnect leads to variable resistor 1R2 (147).

aq. Remove variable resistor 1R2 (147) by removing hex nut (148) and lockwasher (149).

ar. Tag and disconnect leads from variable resistor 1R1 (150).

as. Remove variable resistor 1R1 (150) from chassis by loosening dial set screw and removing dial (151) and attaching hardware.

at. Remove four pan-head screws (153), four lockwashers (154), and four flat washers (155) securing sub-panel shroud (156) to front panel. Remove grommet (152).

au. Remove sub-panel shroud (156) from sub-panel (160) by removing four pan-head screws (157), four lockwashers (158), and four flat washers (159).

av. Remove sub-panel (160) by removing four pan-head screws (161), four lockwashers (162), and four flat washers (163).

aw. Remove sub-panel base (164) by removing four flat-head screws (165).

ax. Remove bar (166) by removing five flat-head screws (167).

ay. Remove bar (168) by removing six flat-head screws (169).

NOTE

Steps az and ba below are typical for the removal of both the right and left doors and associated door stop hinges. Therefore, only the procedure for removing one is given in the following subparagraphs.

az. Remove door (174) by removing four flat-head screws (175) and door saddles (176).

ba. Remove doorstop hinge (178) by removing two flat-head screws (179).

bb. Remove four door gaskets (182, 183, 184, 185) from front panel.

bc. Tag and disconnect leads from pushbutton switch 1S1 (186).

bd. Remove pushbutton switch 1S1 (186) by removing hex nut (187).

NOTE

Steps be and bf below are typical for the removal of connectors 1J8, 1J9, 1J10, and 1J27. Therefore, only the procedures for removing connector 1J8 is given in the following subparagraphs.

be. Tag and disconnect leads from connector 1J8 (188).

bf. Remove connector 1J8 (188) by removing nut (190) and lug (189).

bg. Remove seven connector caps (211) by removing seven pan-head screws (212) and seven lockwashers (213).

bh. Remove two handles (214) by removing four flat-head screws (215).

bi. Remove center panel (216) by removing three pan-head screws (217), two flat-head screws (218), three lockwashers (219), three flat washers (220), two standoffs (221), five pan-head screws (222), five lockwashers (223), and five flat washers (224).

bj. Remove left and right side panels (225, 227) by removing 10 pan-head screws (226, 228) and 26 flat-head screws (229, 230).

bk. Remove mounting block (231) from left side panel (225) by removing four flat-head screws (232).

bl. Remove two reinforcement brackets (233) from rear panel (140) by removing four flat-head screws (234), four pan-head screws (235), eight washers (236), and four locknuts (237).

bm. Remove rear panel (140) by removing five pan-head screws (238), five lockwashers (239), and five flat washers (240).

bn. Tag and disconnect leads from bridge rectifier 1U2 (243).

bo. Remove bridge rectifier 1U2 (243) by removing pan-head screw (244), flat washer (245), lockwasher (246), and hex nut (247).

bp. Tag and disconnect leads to insulated terminals (250).

bq. Remove insulated terminals (250) by removing two pan-head screws (251), two lockwashers (252), and two flat washers (253).

br. Tag and disconnect leads from diode 1CR11 (254).

bs. Remove diode 1CR11 (254) by removing nut (255), lockwasher (256), and flat washer (257).

bt. Remove grommet (258) from mounting deck.

bu. Tag and disconnect leads to ground terminal (259) and insulated terminal (261).

bv. Remove ground terminal (259) by removing flat-head screw (260).

bw. Remove insulated terminal (261) by removing flat-head screws (262).

bx. Tag and disconnect leads to insulated terminals (263).

by. Remove insulated terminals (263) by removing flat-head screws (264).

NOTE

To remove the harness assembly from the mounting deck, remove all harness connectors and associated mounting hardware from the mounting deck. Step bz is typical for removing all harness connectors. Therefore, only the procedure for removing connector 1J3 is given in step bz.

bz. Remove connector 1J3 (265) from mounting deck (325) by removing two hex nuts (266), two lockwashers (267), two flat washers (268), and two spacers (269).

ca. Remove remaining harness leads from mounting deck (325) by removing flat-head screw (313).

cb. Remove grommets (324) from mounting deck (325).

6-5.3 Chassis Reassembly. Unless otherwise noted, installation of discrete electronic components (diodes, capacitors, etc.) is not covered in the following procedure. To install an electronic component, observe polarity of component, and, using heat sink and low wattage soldering, solder leads of component in place. After reconnecting tagged leads, remove identification tags. To reassemble the chassis assembly, refer to figure 6-6 and perform the procedure contained in the following subparagraphs.

a. Install grommets (324) into mounting deck (325).

NOTE

To install the harness assembly, install all harness connectors and leads onto mounting deck. Step b is typical for installing a harness connector. Therefore, only the procedure for installing connector 1J3 is given in step b.

b. Install connector 1J3 (265) into mounting deck (325) and secure with two spacers (269), two flat washers (268), two lockwashers (267), and two hex nuts (266).

c. Secure remaining harness leads to mounting deck (325) using flat-head screw (313).

d. Install insulated terminals (263) and secure with flat-head screws (264).

e. Reconnect leads to insulated terminals (263).

f. Install insulated terminal (261) and ground terminal (259) and secure with flat-head screws (262, 260).

g. Reconnect leads to insulated terminal (261) and ground terminal (259).

h. Install grommet (258) into mounting deck.

i. Install diode 1CR11 (254) and secure with flat washer (257), lockwasher (256), and hex nut (255).

j. Reconnect leads to diode 1CR11 (254).

k. Install insulated terminals (250) and secure with two flat washers (253), two lockwashers (252), and two pan-head screws (251).

l. Reconnect leads to insulated terminals (250).

m. Install bridge rectifier 1U2 (243) and secure with pan-head screw (244), flat washer (245), lockwasher (246), and hex nut (247).

n. Reconnect leads to bridge rectifier 1U2 (243).

o. Install rear panel (140) and secure with five flat washers (240), five lockwashers (239), and five pan-head screws (238).

p. Install two reinforcement brackets (233) onto rear panel (140) and secure with four flat-head screws (234), four pan-head screws (235), eight flat washers (236), and four locknuts (237).

q. Install mounting block (231) on left side panel (225) and secure with four flat-head screws (232).

r. Install left and right side panels (225, 227) and secure with 26 flat-head screws (229, 230) and 10 pan-head screws (226, 228).

s. Install center panel (216) and secure with two flat-head srews (218), three pan-head screws (217), three lockwashers (219), three flat washers (220), two standoffs (221), five pan-head screws (222), five lockwashers (223), and five flat washers (224).

t. Install two handles (214) and secure with four flat-head screws (215).

u. Install seven connector caps (211) and secure with seven lockwashers (213) and seven pan-head screws (212).

NOTE

Steps v and w below are typical for installing connectors 1J8, 1J9, 1J10, and 1J27. Therefore, only the procedure for installing connector 1J8 is given in steps v and w.

v. Install connector 1J8 (188) and secure with lug (189) and nut (190).

w. Reconnect leads to connector 1J8 (188).

x. Install pushbutton switch 1S1 (186) and secure with hex nut (187).

y. Reconnect leads to switch 1S1 (186).

z. Install four door gaskets (182, 183, 184, 185) into front panel.

NOTE

Steps aa and ab below are typical for the installation of both right and left doors and associated door stop hinges. Therefore, only the procedure for installing the right door and hinge is given in steps aa and ab.

aa. Install door stop hinge (178) and secure with two flat-head screws (179).

ab. Install door (174) and secure with four flat-head screws (175) and door saddles (176).

ac. Install bar (168) and secure with six flat-head screws (169).

ad. Install bar (166) and secure with five flat-head screws (167).

ae. Install sub-panel base (164) and secure with four flat-head screws (165).

af. Install sub-panel (160) and secure with four pan-head screws (161), four lockwashers (162), and four flat washers (163).

ag. Install sub-panel shroud (156) to sub-panel (160) and secure with four pan-head screws (157), four lockwashers (158), and four flat washers (159). Install sub-panel shroud (156) to front panel and secure with four pan-head screws (153), four lockwashers (154), and four flat washers (155). Install grommet (152).

ah. Install variable resistor 1R1 (150) and dial (151) and secure dial set screw.

ai. Reconnect leads to variable resistor 1R1 (150).

aj. Install variable resistor 1R2 (147) and secure with hex nut (148) and lockwasher (149).

ak. Reconnect leads to variable resistor 1R2 (147).

al. Install connector 1J28 (146) and secure to front panel. Reconnect leads.

am. Install meter 1M1 (141) and secure with four pan-head screws (142), four lockwashers (143), four flat washers (144), and four hex nuts (145).

an. Reconnect leads to meter 1M1 (141).

ao. Install spare fuses 1F5 (134) and 1F6 (135) into spare fuse holder (136).

ap. Install spare fuse holder (136) to rear panel (140) and secure with four pan-head screws (137), four lockwashers (138), and four flat washers (139).

aq. Install connector caps (133) and secure with pan-head screw (130), lockwasher (131), and flat washer (132).

NOTE

Steps ar and as below are typical for the installation of connectors 1J24, 1J25, and 1J26. Therefore, only the procedure for installing connector 1J24 is given in steps ar and as.

ar. Install connector 1J24 (127) and secure with lug (128) and terminal (129).

as. Reconnect leads to connector 1J24 (127).

NOTE

Steps at and au below are typical for the installation of connectors 1J13 through 1J23. Therefore, only the procedure for installing connector 1J13 is given in steps at and au.

at. Install connector 1J13 (91) and secure with four pan-head screws (92, 93), five flat washers (94), connector cap (P/O 91), three flat washers (95), lug (96), and four locknuts (97).

au. Reconnect leads to connector 1J13 (91).

av. Install ON-OFF switch 1S4 (88) and secure with washer (90) and hex nut (89).

aw. Reconnect leads to ON-OFF switch 1S4 (88).

NOTE

Steps ax, ay, and az below are typical for the installation of fuses 1F1 through 1F4 and fuse holders 1XF1 through 1XF4. Therefore, only the procedure for installing fuse 1F4 and fuse holder 1XF4 is given in steps ax, ay, and az.

ax. Install fuseholder 1XF4 (82) into rear panel and secure with hex nut (83).

ay. Reconnect leads to fuse holder 1XF4 (82).

az. Install fuse 1F4 (80) into fuse holder 1XF4 (82) and secure with cap (81).

ba. Install line filter 1FL2 (74) and secure with two pan-head screws (75), four flat washers (76), lug (77), and two locknuts (78).

bb. Reconnect leads to line filter 1FL2 (74).

bc. Install slide switch 1S3 (70) and secure with two flat-head screws (71), two flat washers (72), and two locknuts (73).

bd. Reconnect leads to slide switch 1S3 (70).

be. Install switch plate (66) and secure with two pan-head screws (67), two flat washers (68), and two lockwashers (69).

bf. Install blower 1B1 (59) and secure with four pan-head screws (60), four flat washers (61), exhaust frame (62), exhaust screen (63), four flat washers (64), and four locknuts (65).

bg. Reconnect leads to blower 1B1 (59).

bh. Install capacitor 1C1 (49) and secure with two pan-head screws (50), two lockwashers (51), four flat washers (52), and two standoffs (53).

bi. Reconnect leads to capacitor 1C1 (49).

bj. Install insulator plate (45) and secure with two pan-head screws (46), two lockwashers (47), and two flat washers (48).

bk. Install integrated circuit 1U1 (36) and secure with two pan-head screws (37), insulator (38), two shoulder washers (39), four flat washers (40), lug (41), lockwasher (42), and two hex nuts (43).

bl. Reconnect leads to integrated circuit 1U1 (36).

bm. Install line filter 1FL1 (29) and secure with two pan-head screws (30), lug (31), two flat washers (32), two lockwashers (33), and two hex nuts (34).

bn. Reconnect leads to line filter 1FL1 (29).

bo. Install rectifier 1U3 (24) and secure with two pan-head screws (25), two flat washers (26), two lockwashers (27), and two hex nuts (28).

bp. Reconnect leads to rectifier 1U3 (24).

bq. Install rectifier 1U4 (20) and secure with two pan-head screws (21), two standoffs (22), and two flat washers (23).

br. Reconnect leads to rectifier 1U4 (20).

bs. Install inductor 1L2 (15) and secure with two standoffs (16), four lockwashers (17), four flat washers (18), and two hex nuts (19).

bt. Reconnect leads to inductor 1L2 (15).

bu. Install cover assembly (8) and secure with four pan-head screws (9, 10), four lockwashers (11, 12), and four flat washers (13, 14).

bv. Install resistor 1R8 (7) onto transformer 1T1 (1).

bw. Install transformer 1T1 (1) and secure with two pan-head screws (2), four pan-head screws (3), eight flat washers (4), four lockwashers (5), and four hex nuts (6).

bx. Reconnect leads to transformer 1T1 (1).

by. Refer to paragraph 6-4.2 and install modules.

bz. Install bottom cover (2, figure 6-5) and secure with 29 captive screws.

ca. Install top cover (1, figure 6-5) and secure with 37 captive screws.

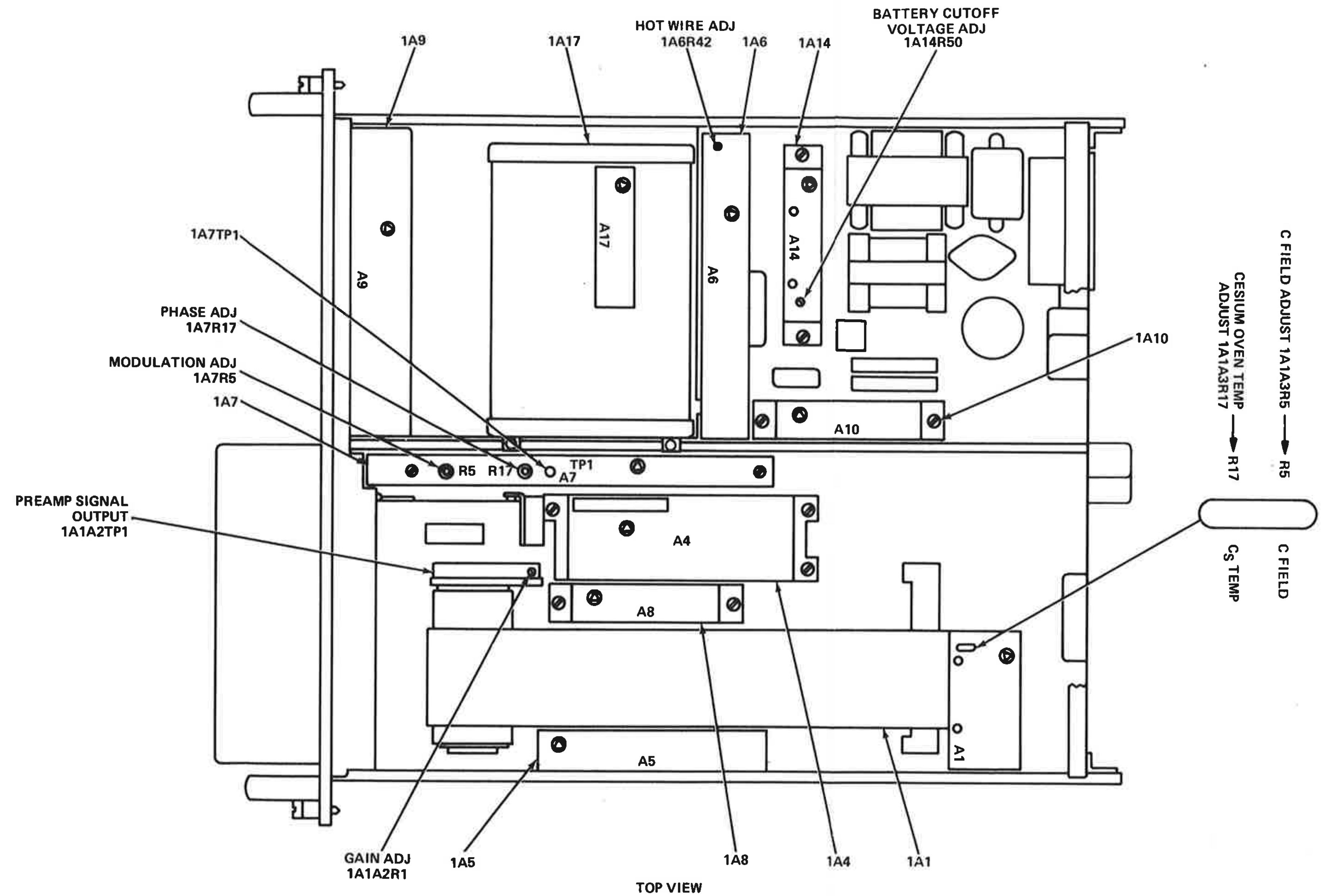



Figure 6-1. Master Regulating Clock 0-1824/U, Top View, Location of Modules, Adjustments, and Test Points

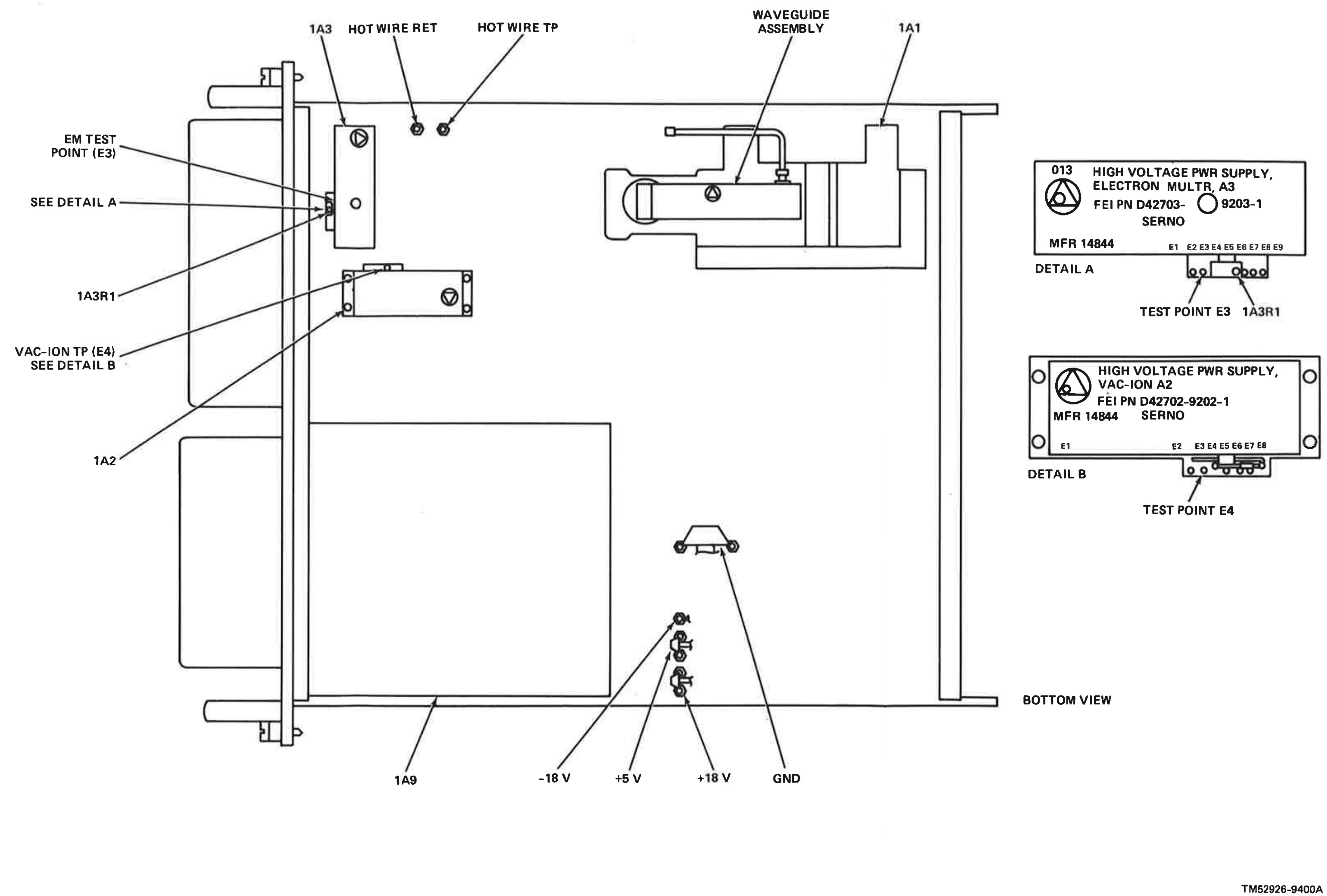



Figure 6-2. Master Regulating Clock O-1824/U, Bottom View, Location of Modules, Adjustments, and Test Points

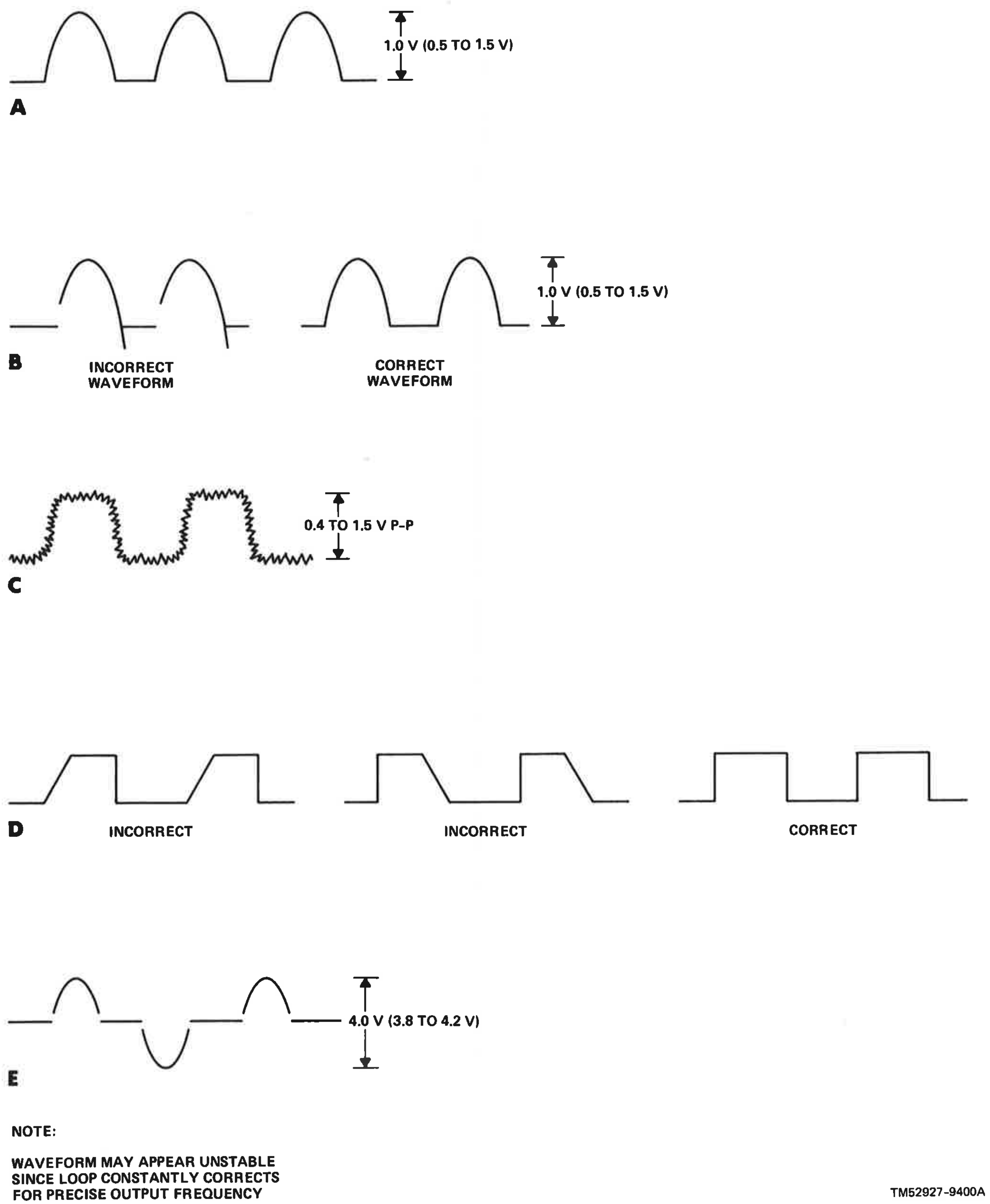



Figure 6-3. Primary Loop Alignment/ Cesuim Beam/Waveguide Alignment Waveforms

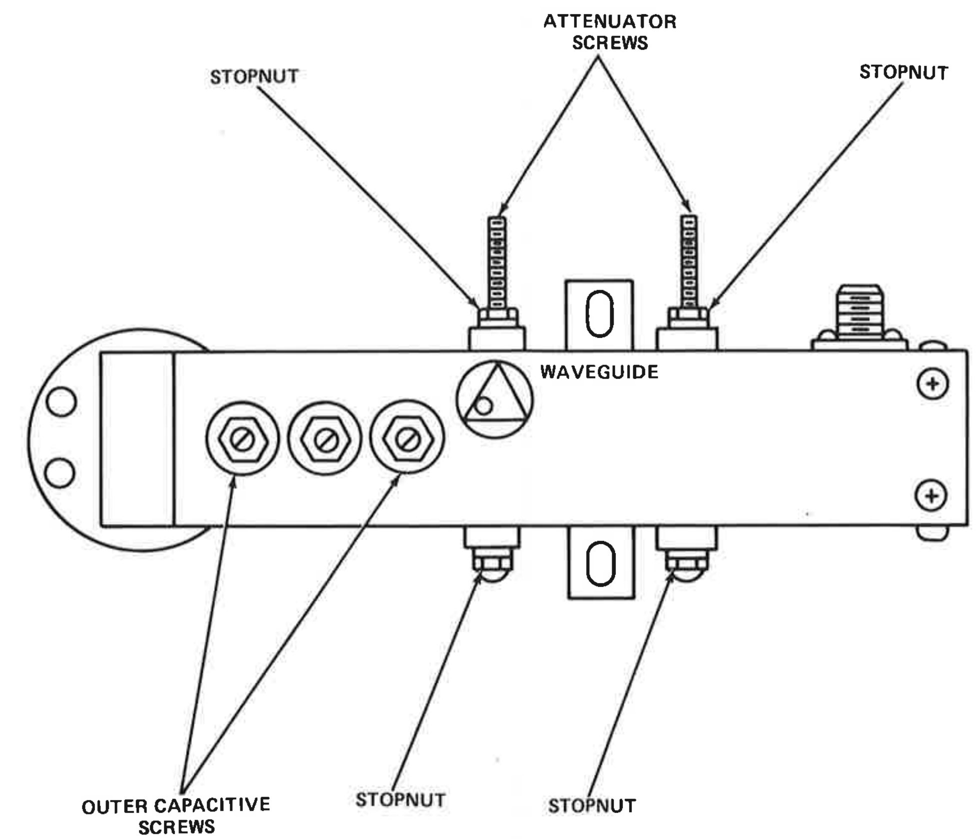



Figure 6-4. Waveguide Assembly
Adjustment Locations

LEGEND FOR FIGURE 6-5

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 1 | 1MP1 | TOP COVER | 1 | 3E |
| 2 | 1MP2 | BOTTOM COVER | 1 | 5B |
| 3 | 1A14 | BATTERY CHARGER/LOGIC MODULE | 1 | 3D |
| 4 | 1A10 | GENERATOR MODULE, 1 MHz, 100 kHz | 1 | 2C |
| 5 | 1A17 | BATTERY POWER SUPPLY MODULE | 1 | 4C |
| 6 | 1A8 | BUFFER AMPLIFIER MODULE | 1 | 2B |
| 7 | 1A4 | OSCILLATOR MODULE, 5 MHz | 1 | 5D |
| 8 | 1A7 | SYNTHESIZER MODULE | 1 | 5E |
| 9 | 1MP3 | FLAT-HEAD SCREW, MOUNTING STUD | 2 | 6E |
| 10 | 1A16 | AMPLIFIER METER DRIVER SWITCH ASSEMBLY | 1 | 4A |
| 11 | 1MP4 | PAN-HEAD SCREW | 2 | 3A |
| 12 | 1MP5 | LOCKWASHER | 2 | 3A |
| 13 | 1MP6 | FLAT WASHER | 2 | 3A |
| 14 | 1MP7 | BRACKET | 1 | 4B |
| 15 | 1MP8 | PAN-HEAD SCREW | 2 | 4B |
| 16 | 1MP9 | FLAT WASHER | 4 | 3A,4B |
| 17 | 1MP10 | SPACER | 2 | 3A |
| 18 | 1MP11 | INSULATING WASHER | 2 | 3A |
| 19 | 1MP12 | LOCKWASHER | 2 | 3A |
| 20 | 1MP13 | NUT | 2 | 3A |
| 21 | 1MP14 | WAVEGUIDE ASSEMBLY | 1 | 1C |
| 22 | 1A1 | CESIUM BEAM RESONATOR | 1 | 1E |
| 23 | 1MP15 | PAN-HEAD SCREW | 2 | 1C |
| 24 | 1MP16 | PAN-HEAD SCREW | 2 | 2C |
| 25 | 1MP138 | LOCKWASHER | 4 | 2C |
| 26 | 1MP140 | NUT | 2 | 2C |
| 27 | 1MP17 | SPACER | 2 | 1D |
| 28 | 1MP18 | SOCKET-HEAD SCREW | 2 | 1B |
| 29 | 1MP19 | SHOULDER WASHER | 2 | 1B |
| 30 | 1MP20 | SPACER | 1 | 1D |
| 31 | 1MP21 | SOCKET-HEAD SCREW | 2 | 2A |
| 32 | 1MP19 | SHOULDER WASHER | 2 | 2A |
| 33 | 1MP22 | SPACER | 1 | 2D |
| 34 | 1MP23 | SOCKET-HEAD SCREW | 5 | 1D,2C |
| 35 | 1MP24 | SPACER | 1 | 2D |
| 36 | 1MP25 | SHIELD | 1 | 1D |
| 37 | 1A5 | MODULATOR/MULTIPLIER MODULE | 1 | 1A |
| 38 | 1MP141 | PAN-HEAD SCREW | 1 | 1A |
| 39 | 1MP142 | LOCKWASHER | 1 | 1A |
| 40 | 1MP143 | FLAT WASHER | 1 | 1A |
| 41 | 1MP26 | PAN-HEAD SCREW | 3 | 1A |
| 42 | 2MP142 | LOCKWASHER | 3 | 1A |
| 43 | 1MP143 | FLAT WASHER | 3 | 1A |
| 44 | 1A2 | HIGH VOLTAGE POWER SUPPLY MODULE | 1 | 6B |
| 45 | 1MP27 | PAN-HEAD SCREW | 4 | 5B |
| 46 | 1MP12 | LOCKWASHER | 4 | 5B |
| 47 | 1MP144 | FLAT WASHER | 4 | 5B |
| 48 | 1A3 | HIGH VOLTAGE POWER SUPPLY MODULE | 1 | 7B |
| 49 | 1MP28 | PAN-HEAD SCREW | 2 | 6D |
| 50 | 1MP29 | PAN-HEAD SCREW | 4 | 6B |
| 51 | 1MP138 | LOCKWASHER | 4 | 6B |
| 52 | 1MP139 | FLAT WASHER | 4 | 6B |
| 53 | 1MP30 | BRACKET | 2 | 7B |
| 54 | 1A9 | REAL TIME-OF-DAY CLOCK MODULE | 1 | 8C |
| 55 | 1MP141 | PAN-HEAD SCREW | 8 | 4B |
| 56 | 1MP142 | LOCKWASHER | 8 | 4B |
| 57 | 1MP143 | FLAT WASHER | 8 | 4B |

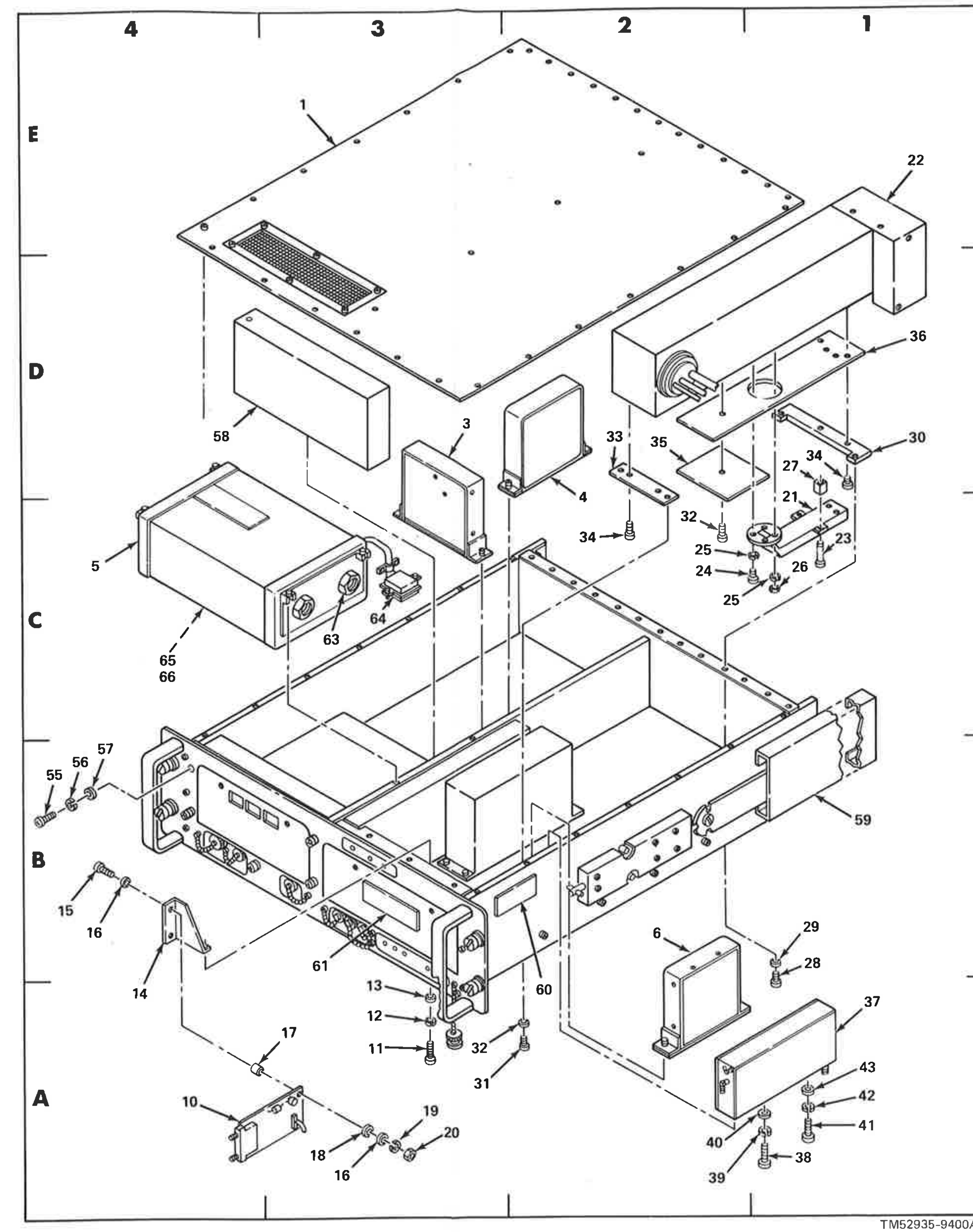



Figure 6-5. Master Regulating Clock O-1824/U, Exploded View Diagram (Sheet 1 of 2)

LEGEND FOR FIGURE 6-5 (CONTINUED)

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 58 | 1A6 | POWER SUPPLY MODULE | 1 | 4D |
| 59 | 1MP31 | RH & LH SLIDES (PAIR) | 1 | 1B |
| 60 | 1DP32 | UNIT IDENTIFICATION LABEL | 1 | 2A |
| 61 | 1MP33 | UNIT IDENTIFICATION PLATE | 1 | 3A |
| 62 | 1MP34 | CHASSIS SUBASSEMBLY | 1 | 5C |
| 63 | 1A17F1 | FUSE | 1 | 3C |
| 64 | 1A17P1 | CONNECTOR | 1 | 3C |
| 65 | 1A17BT1 | BATTERY PACK | 1 | 4C |
| 66 | 1A17RT1 | THERMISTER | 1 | 4C |

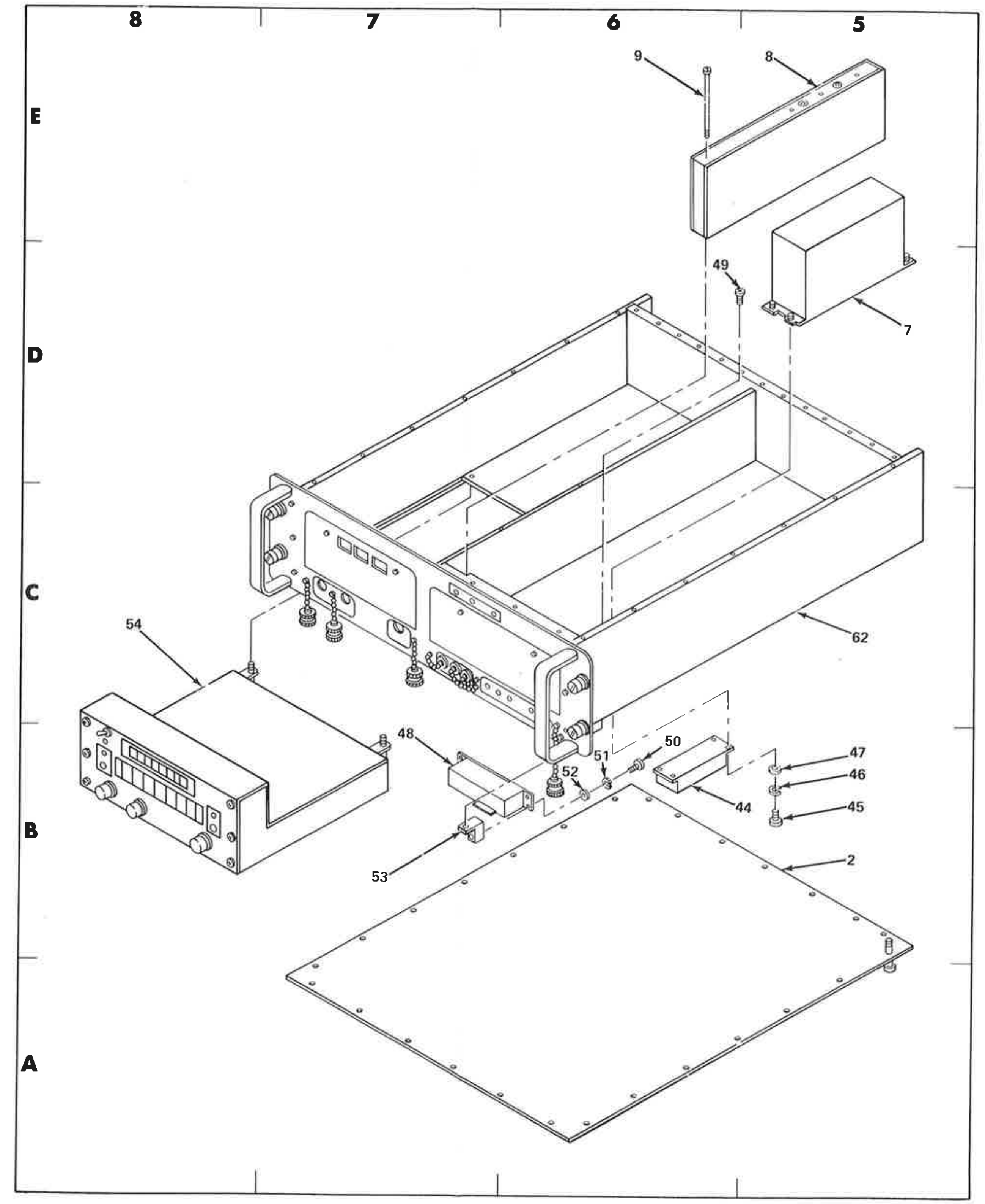



Figure 6-5. Master Regulating Clock O-1824/U, Exploded View Diagram (Sheet 2 of 2)

FIGURE 6-6

| ...CLATURE | QTY | ZONE |
|---|---|---|
| MER | 1 | 2D |
| SCREW | 2 | 3C |
| SCREW | 4 | 3D |
| HER | 8 | 3C,3D |
| IER | 4 | 3C |
| | 4 | 3C |
| | 1 | 2D |
| SEMBLY | 1 | 5E |
| SCREW | 2 | 5E |
| SCREW | 2 | 5E |
| IER | 2 | 5E |
| IER | 2 | 5E |
| HER | 2 | 5E |
| HER | 2 | 5E |
| UCTOR | 1 | 6D |
| | 2 | 5E |
| IER | 4 | 5D,5E |
| HER | 4 | 5D |
| | 2 | 5D |
| | 1 | 5D |
| SCREW | 2 | 6D |
| | 2 | 5E |
| HER | 2 | 5E |
| | 1 | 5D |
| SCREW | 2 | 5C |
| HER | 2 | 5D |
| ER | 2 | 5D |
| | 2 | 5D |
| LTER | 1 | 11E |
| SCREW | 2 | 10E,11E |
| | 1 | 10E |
| HER | 2 | 10E |
| ER | 2 | 10E |
| | 2 | 10B |
| TOR | 1 | 10E |
| ED CIRCUIT | 1 | 10D |
| SCREW | 2 | 10D |
| R | 1 | 10C |
| WASHER | 2 | 10B |
| HER | 4 | 10B,10D |
| | 1 | 10B |
| ER | 1 | 10B |
| | 2 | 10B |
| | 1 | 10B |
| R PLATE | 1 | 10B |
| SCREW | 2 | 10A |
| ER | 2 | 10A |
| IER | 2 | 10A |
| R | 1 | 10C |
| SCREW | 2 | 10D |
| ER | 2 | 10D |
| IER | 4 | 10D |
| | 2 | 10B |
| CLIP (P/O 1C1) | 1 | 10C |
| SCREW | 1 | 10C |
| | 1 | 10C |
| ER | 1 | 10C |

LEGEND FOR FIGURE 6-6

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 58 | 1MP39 | HEX NUT | 1 | 10D |
| 59 | 1B1 | BLOWER, 48V | 1 | 15E |
| 60 | 1MP61 | PAN-HEAD SCREW | 4 | 14E |
| 61 | 1MP62 | FLAT WASHER | 4 | 14E |
| 62 | 1MP63 | EXHAUST FRAME | 1 | 14E |
| 63 | 1MP64 | EXHAUST SCREEN | 1 | 14E |
| 64 | 1MP43 | FLAT WASHER | 4 | 15D |
| 65 | 1MP65 | LOCKNUT | 4 | 15D |
| 66 | 1MP66 | PLATE | 1 | 13E |
| 67 | 1MP67 | PAN-HEAD SCREW | 2 | 13E |
| 68 | 1MP68 | FLAT WASHER | 4 | 13E |
| 69 | 1MP55 | LOCKWASHER | 2 | 14D |
| 70 | 1S3 | SLIDE SWITCH | 1 | 14D |
| 71 | 1MP70 | FLAT-HEAD SCREW | 2 | 13E |
| 72 | 1MP68 | FLAT WASHER | 2 | 14D |
| 73 | 1MP69 | LOCKNUT | 2 | 14D |
| 74 | 1FL2 | LINE FILTER | 1 | 15D |
| 75 | 1MP36 | PAN-HEAD SCREW | 2 | 13D |
| 76 | 1MP37 | FLAT WASHER | 4 | 13D,15D |
| 77 | 1MP49 | LUG | 1 | 15D |
| 78 | 1MP71 | LOCKNUT | 2 | 15D |
| 79 | 1R4 | RESISTOR | 1 | 15D |
| 80 | 1F4 | FUSE, 4A | 1 | 13E |
| 81 | 1XF4MP1 | CAP (P/O 1XF4) | 1 | 13E |
| 82 | 1XF4 | FUSE HOLDER | 1 | 13E |
| 83 | 1XF4MP2 | HEX NUT (P/O 1XF4) | 1 | 14C |
| 84 | 1F2 | FUSE 2A | 1 | 12E |
| 85 | 1XF2MP1 | CAP (P/O 1XF2) | 1 | 12E |
| 86 | 1XF2 | FUSE HOLDER | 1 | 12E |
| 87 | 1XF2MP2 | HEX NUT (P/O 1XF2) | 1 | 14D |
| 88 | 1S4 | ON-OFF SWITCH | 1 | 14C |
| 89 | 1S4MP1 | HEX NUT (P/O 1S4) | 1 | 13E |
| 90 | 1S4MP2 | WASHER (P/O 1S4) | 1 | 13E |
| 91 | 1J13 | CONNECTOR | 1 | 15B |
| 92 | 1MP72 | PAN-HEAD SCREW | 1 | 13C |
| 93 | 1MP73 | PAN-HEAD SCREW | 3 | 13B |
| 94 | 1MP68 | FLAT WASHER | 5 | 13B,13C |
| 95 | 1MP53 | FLAT WASHER | 3 | 15B |
| 96 | 1MP74 | LUG | 1 | 15A |

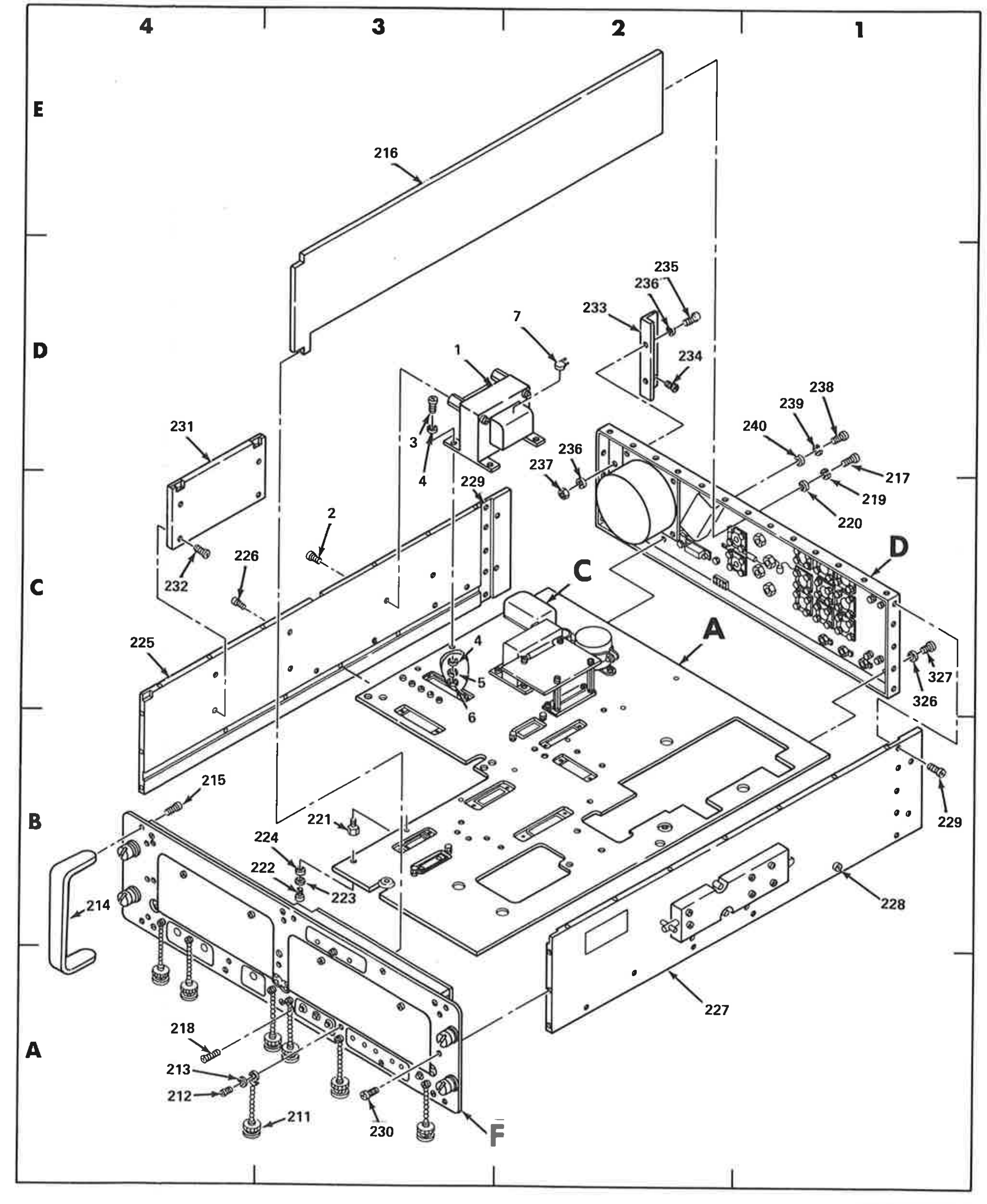


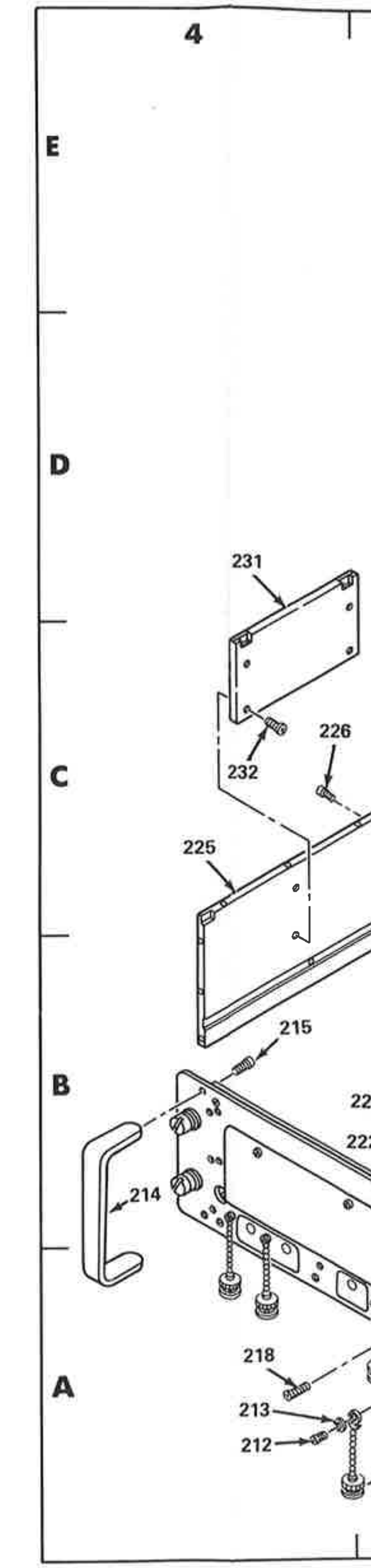

Figure 6-6. Chassis Subassembly, Exploded View Diagram (Sheet 1 of 6)

LEGEND FOR FIGURE 6-6

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 1 | 1T1 | TRANSFORMER | 1 | 2D |
| 2 | 1MP35 | PAN-HEAD SCREW | 2 | 3C |
| 3 | 1MP36 | PAN-HEAD SCREW | 4 | 3D |
| 4 | 1MP37 | FLAT WASHER | 8 | 3C,3D |
| 5 | 1MP38 | LOCKWASHER | 4 | 3C |
| 6 | 1MP39 | HEX NUT | 4 | 3C |
| 7 | 1R8 | RESISTOR | 1 | 2D |
| 8 | 1MP40 | COVER ASSEMBLY | 1 | 5E |
| 9 | 1MP35 | PAN-HEAD SCREW | 2 | 5E |
| 10 | 1MP41 | PAN-HEAD SCREW | 2 | 5E |
| 11 | 1MP42 | LOCKWASHER | 2 | 5E |
| 12 | 1MP38 | LOCKWASHER | 2 | 5E |
| 13 | 1MP43 | FLAT WASHER | 2 | 5E |
| 14 | 1MP37 | FLAT WASHER | 2 | 5E |
| 15 | 1L2 | 40 MH INDUCTOR | 1 | 6D |
| 16 | 1MP44 | STANDOFF | 2 | 5E |
| 17 | 1MP42 | LOCKWASHER | 4 | 5D,5E |
| 18 | 1MP43 | FLAT WASHER | 4 | 5D |
| 19 | 1MP45 | HEX NUT | 2 | 5D |
| 20 | 1U4 | RECTIFIER | 1 | 5D |
| 21 | 1MP46 | PAN-HEAD SCREW | 2 | 6D |
| 22 | 1MP47 | STANDOFF | 2 | 5E |
| 23 | 1MP37 | FLAT WASHER | 2 | 5E |
| 24 | 1U3 | RECTIFIER | 1 | 5D |
| 25 | 1MP46 | PAN-HEAD SCREW | 2 | 5C |
| 26 | 1MP43 | FLAT WASHER | 2 | 5D |
| 27 | 1MP42 | LOCKWASHER | 2 | 5D |
| 28 | 1MP39 | HEX NUT | 2 | 5D |
| 29 | 1FL1 | RF LINE FILTER | 1 | 11E |
| 30 | 1MP48 | PAN-HEAD SCREW | 2 | 10E,11E |
| 31 | 1MP49 | LUG | 1 | 10E |
| 32 | 1MP37 | FLAT WASHER | 2 | 10E |
| 33 | 1MP38 | LOCKWASHER | 2 | 10E |
| 34 | 1MP39 | HEX NUT | 2 | 10B |
| 35 | 1R3 | FILM RESISTOR | 1 | 10E |
| 36 | 1U1 | INTEGRATED CIRCUIT | 1 | 10D |
| 37 | 1MP50 | PAN-HEAD SCREW | 2 | 10D |
| 38 | 1MP51 | INSULATOR | 1 | 10C |
| 39 | 1MP52 | SHOULDER WASHER | 2 | 10B |
| 40 | 1MP53 | FLAT WASHER | 4 | 10B,10D |
| 41 | 1MP54 | LUG | 1 | 10B |
| 42 | 1MP55 | LOCKWASHER | 1 | 10B |
| 43 | 1MP56 | HEX NUT | 2 | 10B |
| 44 | 1R5 | RESISTOR | 1 | 10B |
| 45 | 1MP57 | INSULATOR PLATE | 1 | 10B |
| 46 | 1MP58 | PAN-HEAD SCREW | 2 | 10A |
| 47 | 1MP38 | LOCKWASHER | 2 | 10A |
| 48 | 1MP59 | FLAT WASHER | 2 | 10A |
| 49 | 1C1 | CAPACITOR | 1 | 10C |
| 50 | 1MP41 | PAN-HEAD SCREW | 2 | 10D |
| 51 | 1MP38 | LOCKWASHER | 2 | 10D |
| 52 | 1MP37 | FLAT WASHER | 4 | 10D |
| 53 | 1MP60 | STANDOFF | 2 | 10B |
| 54 | 1C1MP1 | MOUNTING CLIP (P/O 1C1) | 1 | 10C |
| 55 | 1MP48 | PAN-HEAD SCREW | 1 | 10C |
| 56 | 1MP59 | WASHER | 1 | 10C |
| 57 | 1MP38 | LOCKWASHER | 1 | 10C |

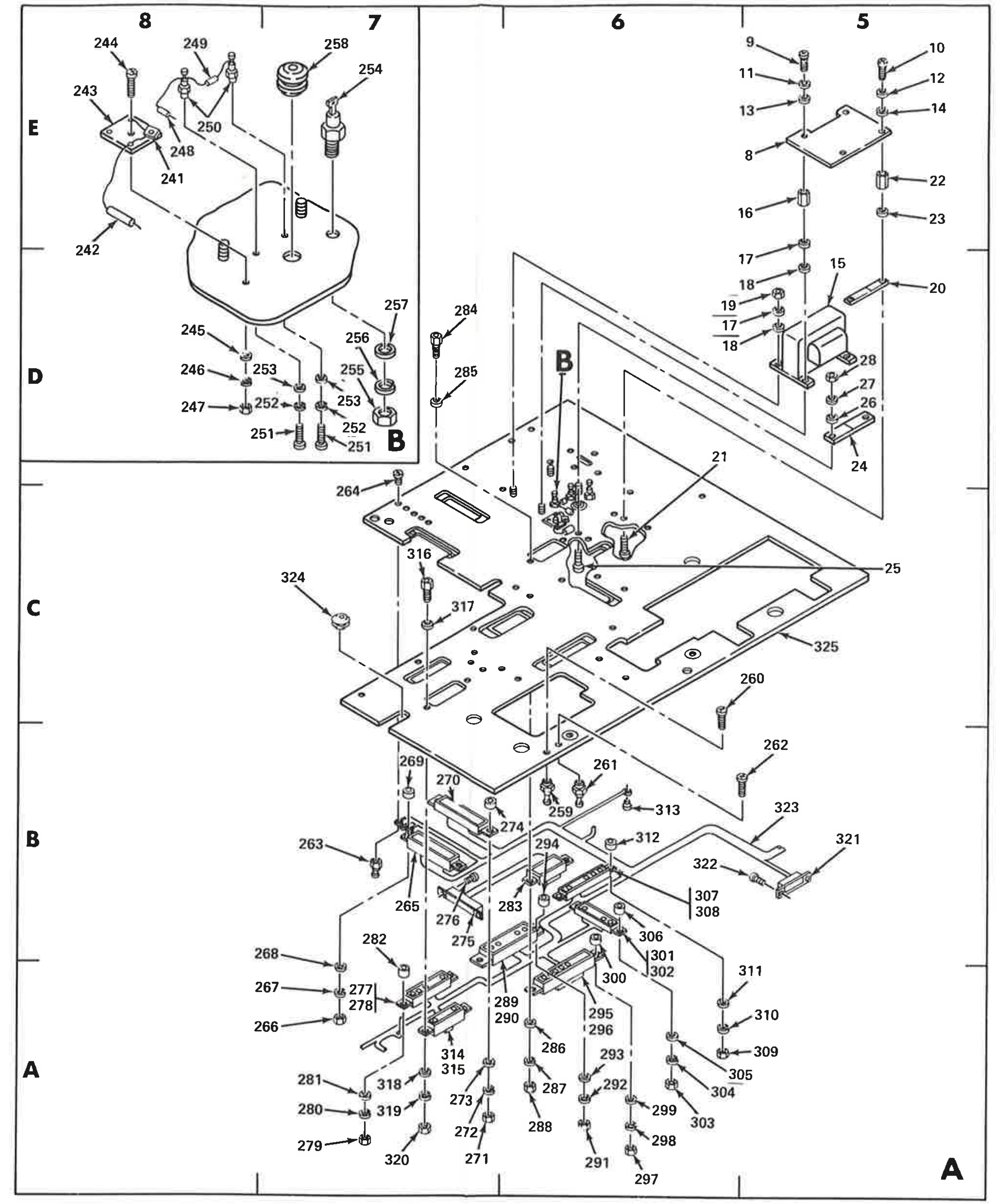
LEGEND FOR FIGURE 6-6

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 58 | 1MP39 | HEX NUT | 1 | 10D |
| 59 | 1B1 | BLOWER, 48V | 1 | 15E |
| 60 | 1MP61 | PAN-HEAD SCREW | 4 | 14E |
| 61 | 1MP62 | FLAT WASHER | 4 | 14E |
| 62 | 1MP63 | EXHAUST FRAME | 1 | 14E |
| 63 | 1MP64 | EXHAUST SCREEN | 1 | 14E |
| 64 | 1MP43 | FLAT WASHER | 4 | 15D |
| 65 | 1MP65 | LOCKNUT | 4 | 15D |
| 66 | 1MP66 | PLATE | 1 | 13E |
| 67 | 1MP67 | PAN-HEAD SCREW | 2 | 13E |
| 68 | 1MP68 | FLAT WASHER | 4 | 13E |
| 69 | 1MP55 | LOCKWASHER | 2 | 14D |
| 70 | 1S3 | SLIDE SWITCH | 1 | 14D |
| 71 | 1MP70 | FLAT-HEAD SCREW | 2 | 13E |
| 72 | 1MP68 | FLAT WASHER | 2 | 14D |
| 73 | 1MP69 | LOCKNUT | 2 | 14D |
| 74 | 1FL2 | LINE FILTER | 1 | 15D |
| 75 | 1MP36 | PAN-HEAD SCREW | 2 | 13D |
| 76 | 1MP37 | FLAT WASHER | 4 | 13D,15D |
| 77 | 1MP49 | LUG | 1 | 15D |
| 78 | 1MP71 | LOCKNUT | 2 | 15D |
| 79 | 1R4 | RESISTOR | 1 | 15D |
| 80 | 1F4 | FUSE, 4A | 1 | 13E |
| 81 | 1XF4MP1 | CAP (P/O 1XF4) | 1 | 13E |
| 82 | 1XF4 | FUSE HOLDER | 1 | 13E |
| 83 | 1XF4MP2 | HEX NUT (P/O 1XF4) | 1 | 14C |
| 84 | 1F2 | FUSE 2A | 1 | 12E |
| 85 | 1XF2MP1 | CAP (P/O 1XF2) | 1 | 12E |
| 86 | 1XF2 | FUSE HOLDER | 1 | 12E |
| 87 | 1XF2MP2 | HEX NUT (P/O 1XF2) | 1 | 14D |
| 88 | 1S4 | ON-OFF SWITCH | 1 | 14C |
| 89 | 1S4MP1 | HEX NUT (P/O 1S4) | 1 | 13E |
| 90 | 1S4MP2 | WASHER (P/O 1S4) | 1 | 13E |
| 91 | 1J13 | CONNECTOR | 1 | 15B |
| 92 | 1MP72 | PAN-HEAD SCREW | 1 | 13C |
| 93 | 1MP73 | PAN-HEAD SCREW | 3 | 13B |
| 94 | 1MP68 | FLAT WASHER | 5 | 13B,13C |
| 95 | 1MP53 | FLAT WASHER | 3 | 15B |
| 96 | 1MP74 | LUG | 1 | 15A |



LEGEND FOR FIGURE 6-6

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 97 | 1MP69 | LOCKNUT | 4 | 15A,15B |
| 98 | 1C5 | CAPACITOR | 1 | 15B |
| 99 | 1L1 | 5MH INDUCTOR | 1 | 14B |
| 100 | 1J14 | CONNECTOR | 1 | 14B |
| 101 | 1MP75 | FLAT-HEAD SCREW | 4 | 13B |
| 102 | 1MP53 | FLAT WASHER | 4 | 14B |
| 103 | 1MP69 | LOCKNUT | 4 | 15B |
| 104 | 1MP76 | PAN-HEAD SCREW | 1 | 12C |
| 105 | 1MP38 | LOCKWASHER | 1 | 12C |
| 106 | 1MP37 | FLAT WASHER | 2 | 12C |
| 107 | 1J17 | CONNECTOR | 1 | 14B |
| 108 | 1MP72 | PAN-HEAD SCREW | 3 | 13B |
| 109 | 1MP50 | PAN-HEAD SCREW | 1 | 12C |
| 110 | 1MP68 | FLAT WASHER | 5 | 12C,13B |
| 111 | 1MP53 | FLAT WASHER | 4 | 14B |
| 112 | 1MP69 | LOCKNUT | 4 | 14A,14B |
| 113 | 1J20 | CONNECTOR | 1 | 14A |
| 114 | 1MP72 | PAN-HEAD SCREW | 3 | 13B |
| 115 | 1MP50 | PAN-HEAD SCREW | 1 | 12C |
| 116 | 1MP68 | FLAT WASHER | 5 | 12B,12C |
| 117 | 1MP53 | FLAT WASHER | 4 | 14A |
| 118 | 1MP77 | LUG | 1 | 14A |
| 119 | 1MP69 | LOCKNUT | 4 | 15A |
| 120 | 1C3 | CAPACITOR | 1 | 15A |
| 121 | 1J23 | CONNECTOR | 1 | 15A |
| 122 | 1MP72 | PAN-HEAD SCREW | 3 | 12B |
| 123 | 1MP50 | PAN-HEAD SCREW | 1 | 12B |
| 124 | 1MP68 | FLAT WASHER | 5 | 12B,13B |
| 125 | 1MP53 | FLAT WASHER | 4 | 15A |
| 126 | 1MP69 | LOCKNUT | 4 | 15A |
| 127 | 1J24 | CONNECTOR | 1 | 13B |
| 128 | 1MP78 | LUG | 1 | 13A |
| 129 | 1MP79 | TERMINAL | 1 | 13A |
| 130 | 1MP80 | PAN-HEAD SCREW | 1 | 12B |
| 131 | 1MP38 | LOCKWASHER | 1 | 12B |
| 132 | 1MP59 | FLAT WASHER | 1 | 12B |
| 133 | 1MP81 | CAP & CHAIN | 2 | 12B |
| 134 | 1F5 | FUSE | 1 | 12B |
| 135 | 1F6 | FUSE | 1 | 12B |
| 136 | 1MP82 | SPARE FUSE HOLDER | 1 | 12B |
| 137 | 1MP67 | PAN-HEAD SCREW | 4 | 12A |
| 138 | 1MP55 | LOCKWASHER | 4 | 12A |
| 139 | 1MP68 | FLAT WASHER | 4 | 12A |
| 140 | 1MP83 | REAR PANEL | 1 | 13A |
| 141 | 1M1 | METER | 1 | 17C |
| 142 | 1MP84 | PAN-HEAD SCREW (P/O 1M1) | 4 | 17C |
| 143 | 1MP55 | LOCKWASHER (P/O 1M1) | 4 | 16D |
| 144 | 1MP53 | FLAT WASHER (P/O 1M1) | 4 | 16D |



TM52936-9400A-2

Figure 6-6. Chassis Subassembly, Exploded View Diagram (Sheet 2 of 6)

LEGEND FOR FIGURE 6-6

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 145 | 1MP56 | HEX NUT (P/O 1M1) | 4 | 16D |
| 146 | 1J28 | CONNECTOR | 1 | 17C |
| 147 | 1R2 | RESISTOR | 1 | 16D |
| 148 | 1R2MP1 | HEX NUT (P/O 1R2) | 1 | 17C |
| 149 | 1R2MP2 | LOCKWASHER (P/O 1R2) | 1 | 17C |
| 150 | 1R1 | RESISTOR | 1 | 17C |
| 151 | 1MP85 | DIAL | 1 | 17C |
| 152 | 1MP86 | GROMMET | 1 | 16E |
| 153 | 1MP87 | PAN-HEAD SCREW | 4 | 16E |
| 154 | 1MP88 | LOCKWASHER | 4 | 16E |
| 155 | 1MP89 | FLAT WASHER | 4 | 16E |
| 156 | 1MP90 | SUB-PANEL SHROUD | 1 | 16D |
| 157 | 1MP92 | PAN-HEAD SCREW | 4 | 16E |
| 158 | 1MP88 | LOCKWASHER | 4 | 16D |
| 159 | 1MP89 | FLAT WASHER | 4 | 16D |
| 160 | 1MP91 | SUB-PANEL | 1 | 17D |
| 161 | 1MP92 | PAN-HEAD SCREW | 4 | 16C |
| 162 | 1MP88 | LOCKWASHER | 4 | 16C |
| 163 | 1MP89 | FLAT WASHER | 4 | 16C |
| 164 | 1MP93 | SUB-PANEL BASE | 1 | 16C |
| 165 | 1MP94 | FLAT-HEAD SCREW | 4 | 18B |
| 166 | 1MP95 | BAR, TOP | 1 | 19D |
| 167 | 1MP96 | FLAT-HEAD SCREW | 4 | 19C |
| 168 | 1MP97 | BAR | 1 | 18C |
| 169 | 1MP96 | FLAT-HEAD SCREW | 5 | 18B |
| 170 | 1MP98 | FRONT PANEL DOOR, LH | 1 | 19B |
| 171 | 1MP99 | FLAT-HEAD SCREW | 4 | 18B,19C |
| 172 | 1MP140 | DOOR SADDLE | 2 | 18B,19C |
| 173 | 1MP100 | WINDOW | 1 | 19B |
| 174 | 1MP101 | FRONT PANEL DOOR, RH | 1 | 18A |
| 175 | 1MP99 | FLAT-HEAD SCREW | 4 | 17A,18B |
| 176 | 1MP140 | DOOR SADDLE | 2 | 17B,18B |
| 177 | 1MP102 | LABEL | 1 | 18B |
| 178 | 1MP103 | DOOR STOP HINGE, RH | 1 | 17B |
| 179 | 1MP99 | FLAT-HEAD SCREW | 2 | 18A |
| 180 | 1MP104 | DOOR STOP HINGE, LH | 1 | 19C |
| 181 | 1MP99 | FLAT-HEAD SCREW | 2 | 19B |
| 182 | 1MP105 | DOOR GASKET, LH | 1 | 23C |
| 183 | 1MP106 | DOOR GASKET, LH | 1 | 23D |
| 184 | 1MP107 | DOOR GASKET, RH | 1 | 22B |
| 185 | 1MP108 | DOOR GASKET, RH | 1 | 22B |
| 186 | 1S1 | PUSHBUTTON SWITCH | 1 | 21D |
| 187 | 1S1MP1 | HEX NUT (P/O 1S1) | 1 | 22C |
| 188 | 1J8 | CONNECTOR | 1 | 22C |
| 189 | 1MP78 | LUG | 1 | 21D |
| 190 | 1J8MP1 | NUT (P/O 1J8) | 1 | 20D |
| 191 | 1J9 | CONNECTOR | 1 | 22C |
| 192 | 1MP78 | LUG | 1 | 21C |

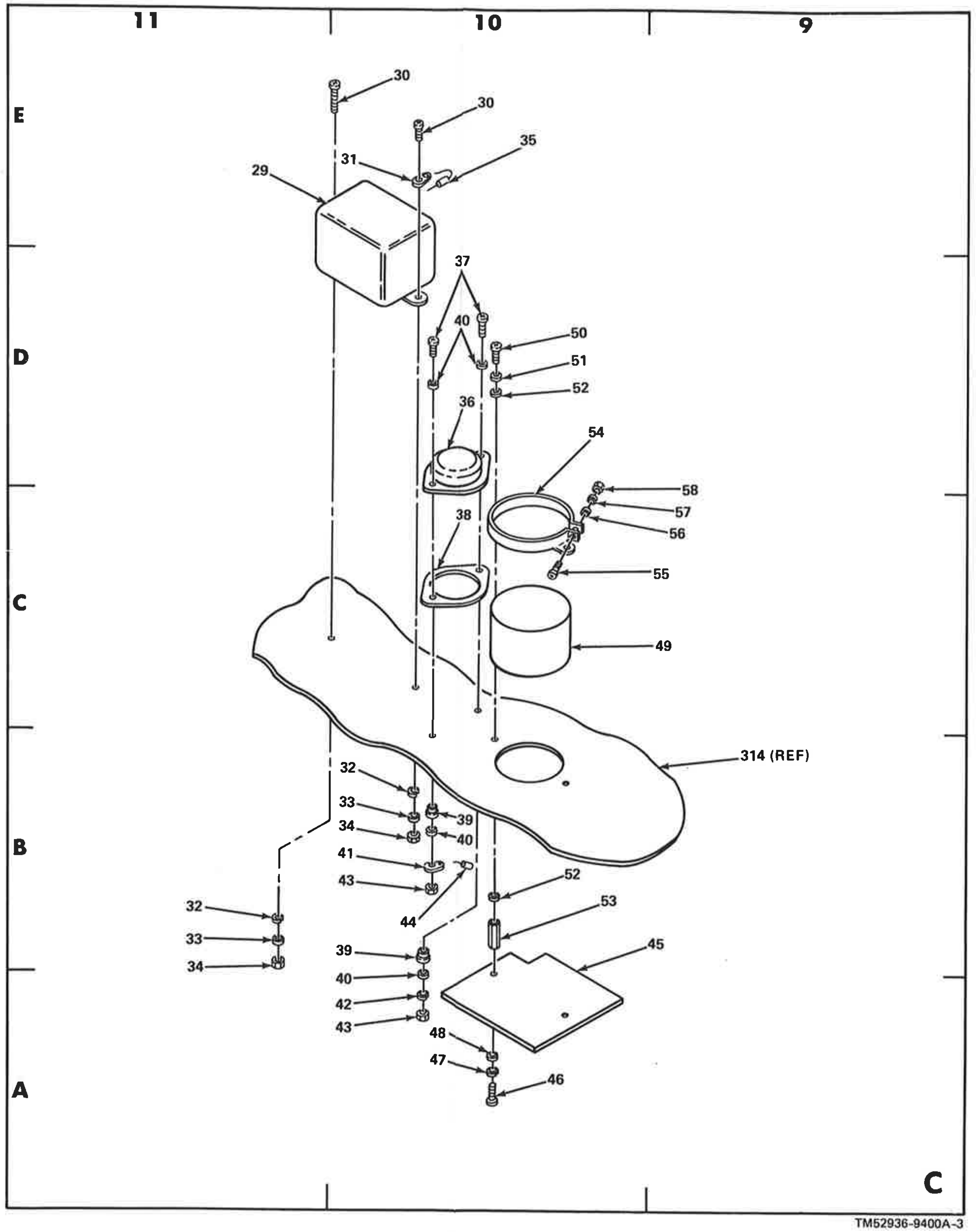



Figure 6-6. Chassis Subassembly, Exploded View Diagram (Sheet 3 of 6)

LEGEND FOR FIGURE 6-6

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 193 | 1J9MP1 | NUT (P/O 1J9) | 1 | 20D |
| 194 | 1J27 | CONNECTOR | 1 | 22C |
| 195 | 1MP78 | LUG | 1 | 20C |
| 196 | 1J27MP1 | NUT (P/O 1J27) | 1 | 20D |
| 197 | 1J10 | CONNECTOR | 1 | 21B |
| 198 | 1MP78 | LUG | 1 | 20C |
| 199 | 1J10MP1 | NUT (P/O 1J10) | 1 | 20C |
| 200 | 1DS3 | LIGHT EMITTING DIODE (LED), GREEN | 1 | 21D |
| 201 | 1R6 | RESISTOR | 1 | 21D |
| 202 | 1DS1 | LIGHT EMITTING DIODE (LED), RED | 1 | 21D |
| 203 | 1R7 | RESISTOR | 1 | 21C |
| 204 | 1DS7 | LIGHT EMITTING DIODE (LED), GREEN | 1 | 21C |
| 205 | 1DS6 | LIGHT EMITTING DIODE (LED), GREEN | 1 | 21C |
| 206 | 1DS2 | LIGHT EMITTING DIODE (LED), AMBER | 1 | 20C |
| 207 | 1DS4 | LIGHT EMITTING DIODE (LED), GREEN | 1 | 21C |
| 208 | 1DS5 | LIGHT EMITTING DIODE (LED), GREEN | 1 | 21C |
| 209 | 1MP109 | INSULATED TERMINAL | 17 | 20C |
| 210 | 1MP110 | FRONT PANEL | 1 | 20B |
| 211 | 1MP81 | CAP & CHAIN | 7 | 3A |
| 212 | 1MP58 | PAN-HEAD SCREW | 4 | 4A |
| 213 | 1MP38 | LOCKWASHER | 7 | 4A |
| 214 | 1MP111 | HANDLE | 2 | 4B |
| 215 | 1MP112 | FLAT-HEAD SCREW | 4 | 4B |
| 216 | 1MP113 | CENTER PANEL | 1 | 3E |
| 217 | 1MP114 | PAN-HEAD SCREW | 3 | 1D |
| 218 | 1MP115 | FLAT-HEAD SCREW | 2 | 4A |
| 219 | 1MP116 | LOCKWASHER | 3 | 1D |
| 220 | 1MP117 | FLAT WASHER | 3 | 1C |
| 221 | 1MP118 | STANDOFF | 2 | 3B |
| 222 | 1MP36 | PAN-HEAD SCREW | 5 | 3B |
| 223 | 1MP38 | LOCKWASHER | 5 | 3B |
| 224 | 1MP37 | FLAT WASHER | 5 | 3B |
| 225 | 1MP119 | SIDE PANEL, LH | 1 | 4C |
| 226 | 1MP138 | PAN-HEAD SCEW | 4 | 3C |
| 227 | 1MP120 | SIDE PANEL, RH | 1 | 2A |
| 228 | 1MP145 | FLAT-HEAD SCREW | 4 | 2D |
| 229 | 1MP121 | FLAT-HEAD SCREW | 10 | 1B,3C |
| 230 | 1MP122 | FLAT-HEAD SCREW | 6 | 3A |
| 231 | 1MP123 | MOUNTING BLOCK | 1 | 4D |
| 232 | 1MP114 | FLAT-HEAD SCREW | 4 | 4C |
| 233 | 1MP124 | REINFORCEMENT BRACKET, RH/LH | 2 | 2D |
| 234 | 1MP145 | FLAT-HEAD SCREW | 4 | 2D |
| 235 | 1MP125 | PAN-HEAD SCREW | 4 | 2D |
| 236 | 1MP62 | WASHER | 8 | 2C,2D |
| 237 | 1MP65 | LOCKNUT | 4 | 2C |
| 238 | 1MP126 | PAN-HEAD SCREW | 5 | 1D |
| 239 | 1MP38 | LOCKWASHER | 5 | 1D |
| 240 | 1MP59 | FLAT WASHER | 5 | 1D |

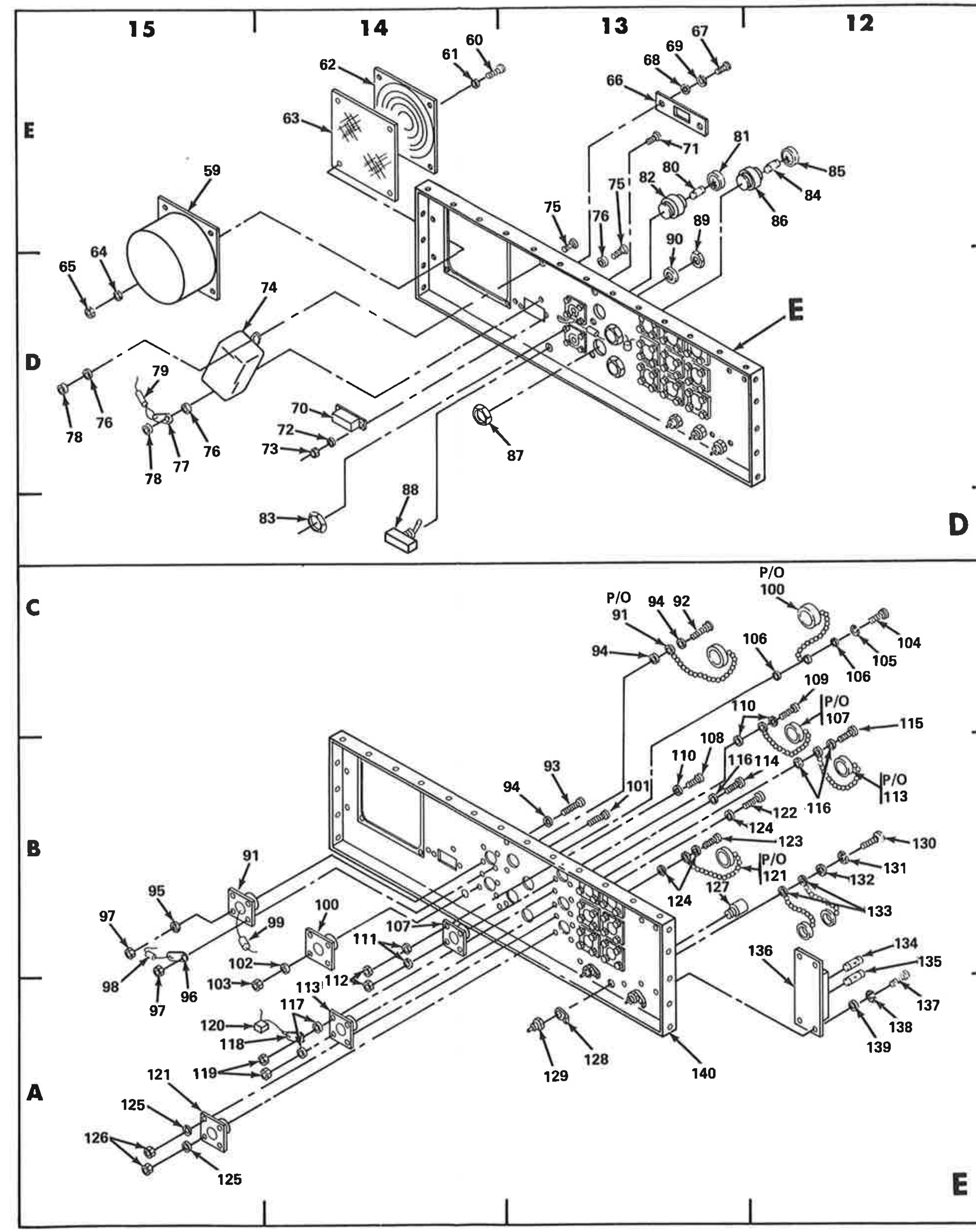



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Figure 6-6. Chassis Subassembly, Exploded View Diagram (Sheet 4 of 6)

LEGEND FOR FIGURE 6-6

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 241 | 1C2 | CAPACITOR | 1 | 8E |
| 242 | 1C4 | CAPACITOR | 1 | 8E |
| 243 | 1U2 | BRIDGE RECTIFIER | 1 | 8E |
| 244 | 1MP50 | PAN-HEAD SCREW | 1 | 8E |
| 245 | 1MP53 | FLAT WASHER | 1 | 8D |
| 246 | 1MP55 | LOCKWASHER | 1 | 8D |
| 247 | 1MP56 | HEX NUT | 1 | 8D |
| 248 | 1CR2 | DIODE | 1 | 8E |
| 249 | 1CR1 | DIODE | 1 | 8E |
| 250 | 1MP127 | INSULATED TERMINAL | 2 | 8E |
| 251 | 1MP73 | PAN-HEAD SCREW | 2 | 7D |
| 252 | 1MP55 | LOCKWASHER | 2 | 7D |
| 253 | 1MP53 | FLAT WASHER | 2 | 7D |
| 254 | 1CR11 | DIODE | 1 | 7E |
| 255 | 1MP39 | HEX NUT | 1 | 7D |
| 256 | 1MP128 | LOCKWASHER | 1 | 7D |
| 257 | 1MP43 | FLAT WASHER | 1 | 7D |
| 258 | 1MP129 | GROMMET | 2 | 7E |
| 259 | 1MP130 | GROUND TERMINAL | 1 | 5C |
| 260 | 1MP75 | FLAT-HEAD SCREW | 1 | 6B |
| 261 | 1MP127 | INSULATED TERMINAL | 1 | 5B |
| 262 | 1MP75 | FLAT-HEAD SCREW | 1 | 6B |
| 263 | 1MP127 | INSULATED TERMINAL | 5 | 7B |
| 264 | 1MP75 | FLAT-HEAD SCREW | 5 | 7C |
| 265 | 1J3 | CONNECTOR | 1 | 7B |
| 266 | 1MP131 | HEX NUT | 2 | 7A |
| 267 | 1MP88 | LOCKWASHER | 2 | 7A |
| 268 | 1MP89 | FLAT WASHER | 2 | 7B |
| 269 | 1MP132 | SPACER | 2 | 7B |
| 270 | 1J11 | CONNECTOR | 1 | 7B |
| 271 | 1MP131 | HEX NUT | 2 | 7A |
| 272 | 1MP88 | LOCKWASHER | 2 | 7A |
| 273 | 1MP89 | FLAT WASHER | 2 | 7A |
| 274 | 1MP132 | SPACER | 2 | 7B |
| 275 | 1P2 | CONNECTOR | 1 | 7B |
| 276 | 1MP133 | SCREW LOCK ASSEMBLY | 2 | 7B |
| 277 | 1J5 | CONNECTOR | 1 | 7A |
| 278 | 1MP134 | COAX CONTACT | 4 | 7A |
| 279 | 1MP131 | HEX NUT | 2 | 7A |
| 280 | 1MP88 | LOCKWASHER | 2 | 7A |
| 281 | 1MP89 | FLAT WASHER | 2 | 7A |
| 282 | 1MP132 | SPACER | 2 | 7B |
| 283 | 1J12 | CONNECTOR | 1 | 6B |
| 284 | 1MP135 | SCREW LOCK ASSEMBLY | 2 | 7D |
| 285 | - | LOCKWASHER (P/O 1MP135) | 2 | 7D |
| 286 | - | FLAT WASHER (P/O 1MP135) | 2 | 6A |
| 287 | - | LOCKWASHER (P/O 1MP135) | 2 | 6A |
| 288 | - | HEX NUT (P/O 1MP135) | 2 | 6A |

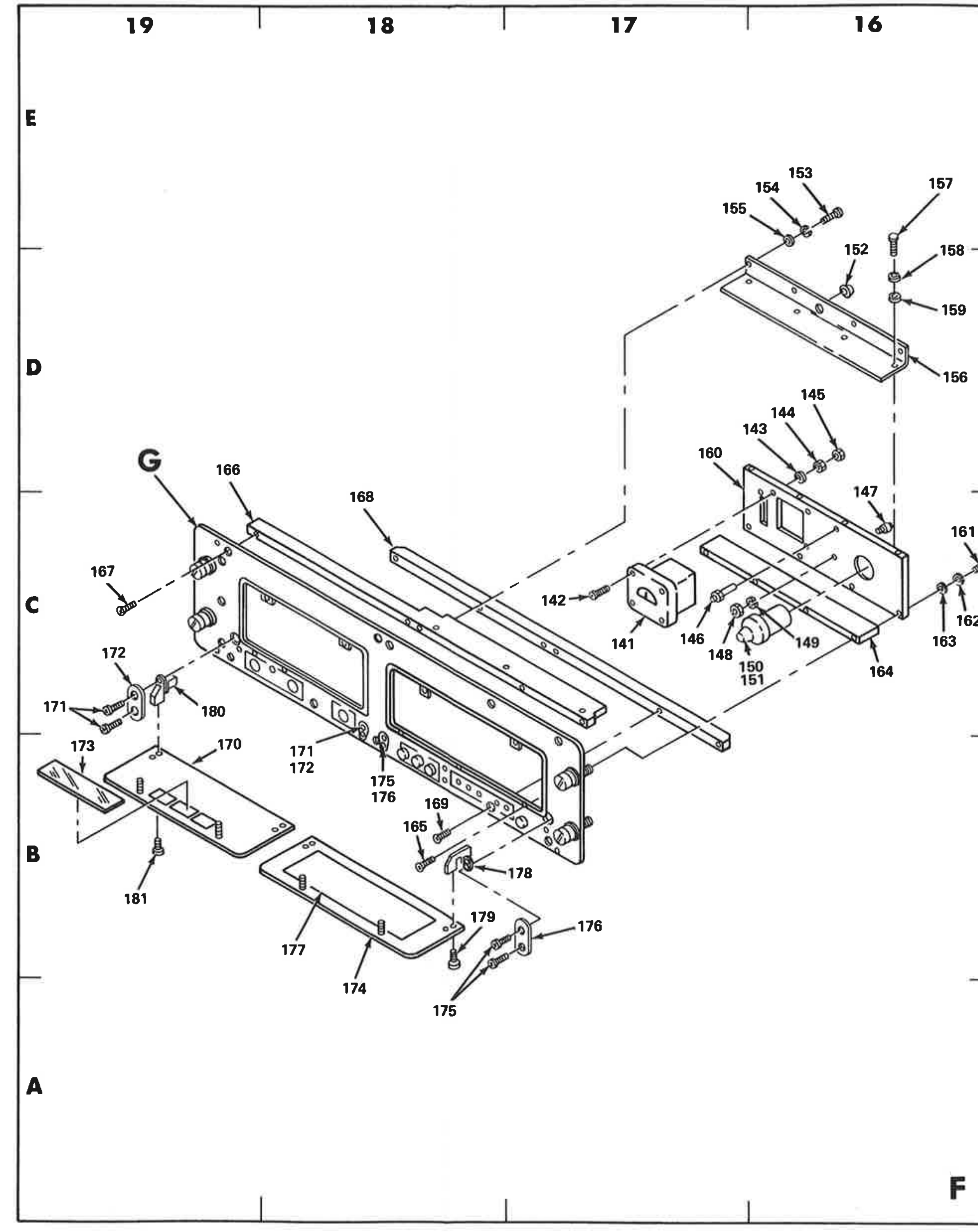


Figure 6-6. Chassis Subassembly, Exploded View Diagram (Sheet 5 of 6)

LEGEND FOR FIGURE 6-6

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 289 | 1J4 | CONNECTOR | 1 | 7A |
| 290 | 1MP134 | COAX CONTACT | 4 | 7A |
| 291 | 1MP131 | HEX NUT | 2 | 6A |
| 292 | 1MP88 | LOCKWASHER | 2 | 6A |
| 293 | 1MP89 | FLAT WASHER | 2 | 6A |
| 294 | 1MP132 | SPACER | 2 | 6B |
| 295 | 1J6 | CONNECTOR | 1 | 6A |
| 296 | 1MP134 | COAX CONTACT | 4 | 6A |
| 297 | 1MP131 | HEX NUT | 2 | 6A |
| 298 | 1MP88 | LOCKWASHER | 2 | 6A |
| 299 | 1MP89 | FLAT WASHER | 2 | 6A |
| 300 | 1MP132 | SPACER | 2 | 6A |
| 301 | 1J2 | CONNECTOR | 1 | 6A |
| 302 | 1MP134 | COAX CONTACT | 3 | 6A |
| 303 | 1MP131 | HEX NUT | 2 | 6A |
| 304 | 1MP88 | LOCKWASHER | 2 | 6A |
| 305 | 1MP89 | FLAT WASHER | 2 | 6A |
| 306 | 1MP132 | SPACER | 2 | 6B |
| 307 | 1J7 | CONNECTOR | 1 | 6B |
| 308 | 1MP134 | COAX CONTACT | 4 | 6B |
| 309 | 1MP131 | HEX NUT | 2 | 5A |
| 310 | 1MP88 | LOCKWASHER | 2 | 5A |
| 311 | 1MP89 | FLAT WASHER | 2 | 5A |
| 312 | 1MP132 | SPACER | 2 | 6B |
| 313 | 1MP75 | FLAT-HEAD SCREW | 1 | 6B |
| 314 | 1J1 | CONNECTOR | 1 | 7A |
| 315 | 1MP134 | COAX CONTACT | 2 | 7A |
| 316 | 1MP135 | SCREW LOCK ASSEMBLY | 2 | 7C |
| 317 | - | LOCKWASHER (P/O 1MP135) | 2 | 7C |
| 318 | - | FLAT WASHER (P/O 1MP135) | 2 | 7A |
| 319 | - | LOCKWASHER (P/O 1MP135) | 2 | 7A |
| 320 | - | HEX NUT (P/O 1MP135) | 2 | 7A |
| 321 | 1P1 | CONNECTOR | 1 | 5B |
| 322 | 1MP133 | SCREW LOCK ASSEMBLY | 2 | 6B |
| 323 | 1MP136 | HARNESS ASSEMBLY | 1 | 5B |
| 324 | 1MP129 | GROMMET | 2 | 7C |
| 325 | 1MP137 | MOUNTING DECK | 1 | 5C |
| 326 | 1MP38 | LOCKWASHER | 2 | 1C |
| 327 | 1MP126 | PAN-HEAD SCREW | 2 | 1C |

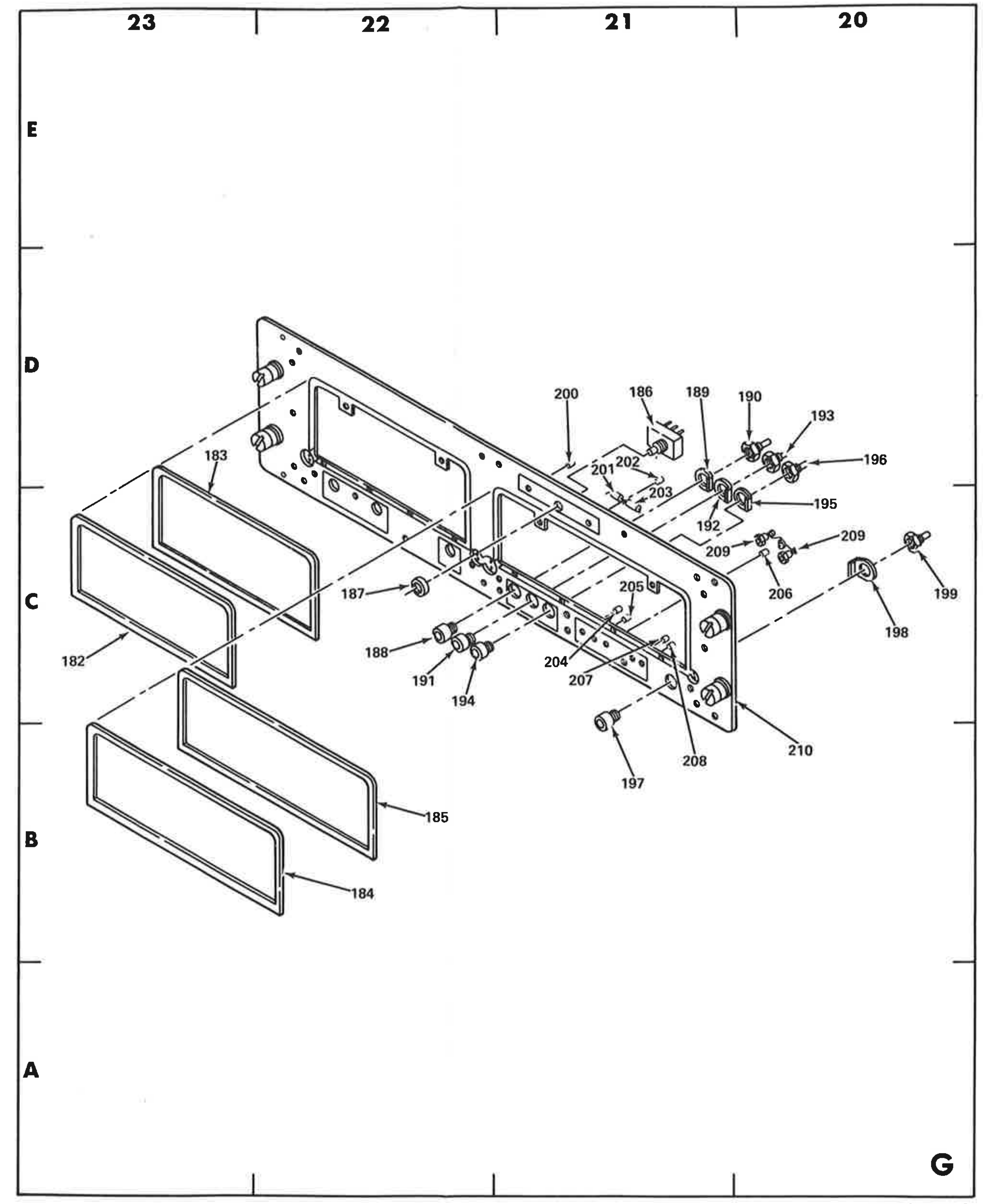


Figure 6-6. Chassis Subassembly, Exploded View Diagram (Sheet 6 of 6)

| | QTY | ZONE |
|---|---|---|
| | 1 | 1E |
| | 6 | 1E |
| | 1 | 3A |
| | 9 | 2A |
| TOR | 1 | 4B |
| | 6 | 4B |
| | 6 | 4B |
| | 6 | 4B |
| . FILTER | 1 | 4C |
| | 4 | 4C |
| | 4 | 4C |
| | 2 | 4C |
| | 2 | 4C |
| | 1 | 3C |
| | 1 | 3C |
| | 1 | 3C |
| | 4 | 4C |
| | 4 | 4C |
| | 4 | 3C |
| | 1 | 3C |
| | 1 | 3C |
| | 1 | 3C |
| | 6 | 3C |
| | 2 | 2C |
| C | 1 | 3B |
| | 1 | 3B |
| | 1 | 2C |
| C | 1 | 3B |
| | 1 | 3B |
| | 1 | 2C |
| | 1 | 3A |
| | 2 | 3A,3B |
| | 2 | 1C,2C |
| | 2 | 1B,2C |
| | 2 | 1C,2C |
| | 1 | 1C |
| | 3 | 1C |
| | 3 | 1C |
| | 1 | 2D |
| | 1 | 2D |
| | 1 | 1B |
| | 1 | 2B |
| | 1 | 2B |
| | 1 | 2B |
| | 6 | 1A |
| | 2 | 1B |
| | 10 | 1B,2B |
| | 8 | 1B |
| | 2 | 2B |
| | 2 | 2B |
| UTPUT | 1 | 3D |
| | 3 | 3D |
| | 3 | 3D |
| | 1 | 3D |
| | 2 | 3D |
| | 1 | 3C |
| | 1 | 3D |

LEGEND FOR FIGURE 6-7

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 58 | 1A5A4 | PC BOARD ASSY, OSCILLATOR | 1 | 2C |
| 59 | 1A5MP4 | PAN-HEAD SCREW | 4 | 2C |
| 60 | 1A5MP5 | LOCKWASHER | 4 | 2C |
| 61 | 1A5MP6 | FLAT WASHER | 2 | 2C |
| 62 | 1A5MP7 | GROUND LUG | 2 | 2C |
| 63 | 1A5L1 | INDUCTOR | 1 | 4E |
| 64 | 1A5C1 | CAPACITOR | 1 | 4E |
| 65 | 1A5E1 | TERMINAL | 1 | 4E |
| 66 | 1A5C3 | CAPACITOR | 1 | 4E |
| 67 | 1A5C2 | CAPACITOR | 1 | 4E |
| 68 | 1A5L2 | INDUCTOR | 1 | 4E |
| 69 | 1A5C4 | CAPACITOR | 1 | 3E |
| 70 | 1A5C5 | CAPACITOR | 1 | 3E |
| 71 | 1A5C6 | CAPACITOR | 1 | 3D |
| 72 | 1A5E3 | TERMINAL | 2 | 3D |
| 73 | 1A5MP7 | GROUND LUG | 1 | 3D |
| 74 | 1A5L3 | INDUCTOR | 1 | 4E |
| 75 | 1A5L4 | INDUCTOR | 1 | 4E |
| 76 | 1A5CR1 | DIODE | 1 | 3B |
| 77 | 1A5MP23 | HOUSING | 1 | 2E |
| 78 | 1A5MP24 | FLAT-HEAD SCREW | 2 | 2C |
| 79 | 1A5FL2 | CAPACITOR, FEED-THRU | 1 | 3B |
| 80 | 1A5R16 | RESISTOR | 1 | 3E |

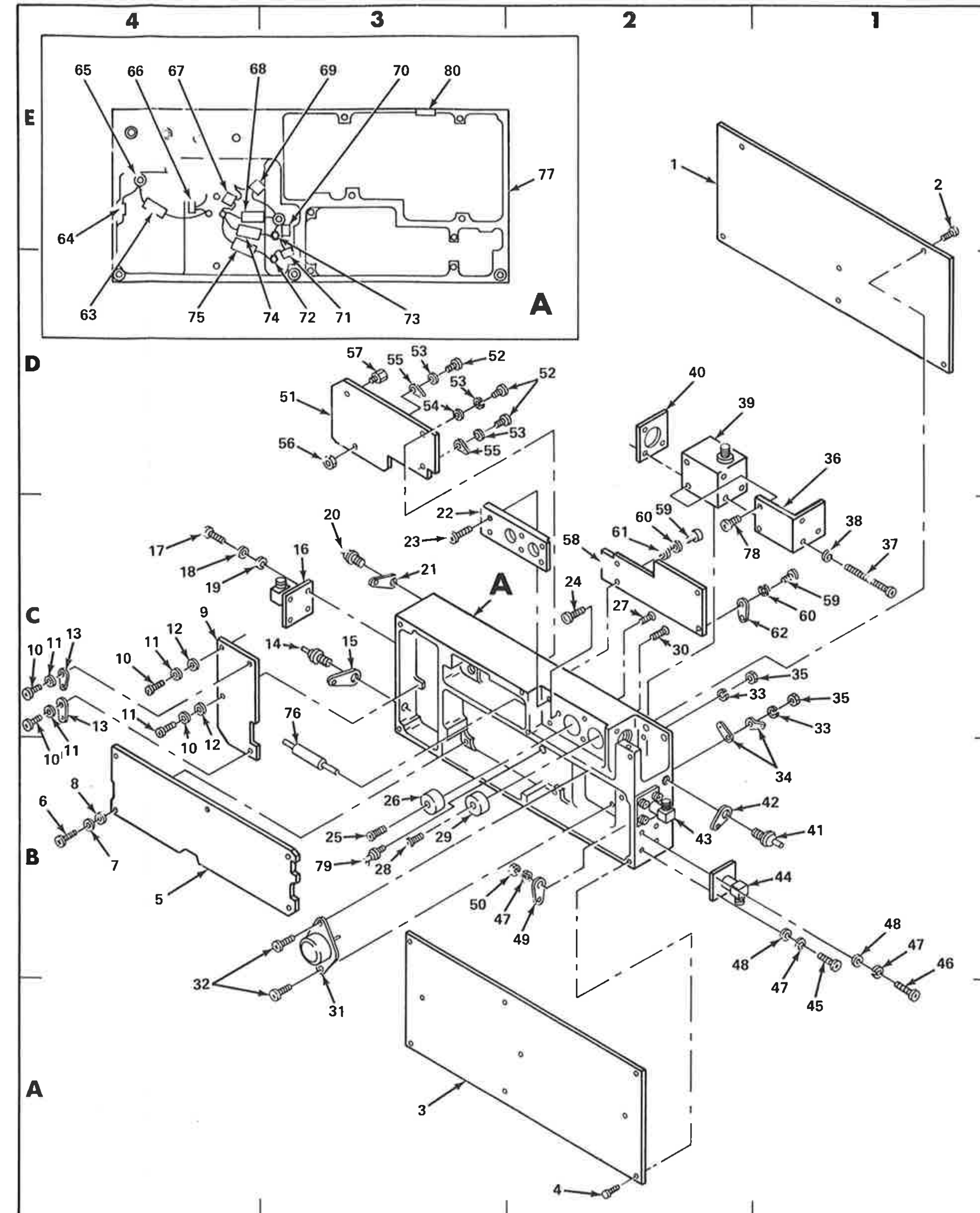


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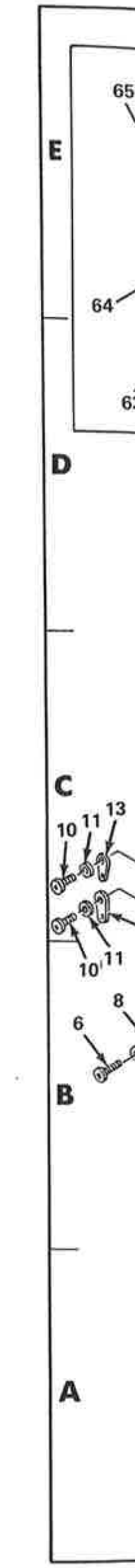
Figure 6-7. Module 1A5, Exploded View Diagram

LEGEND FOR FIGURE 6-7

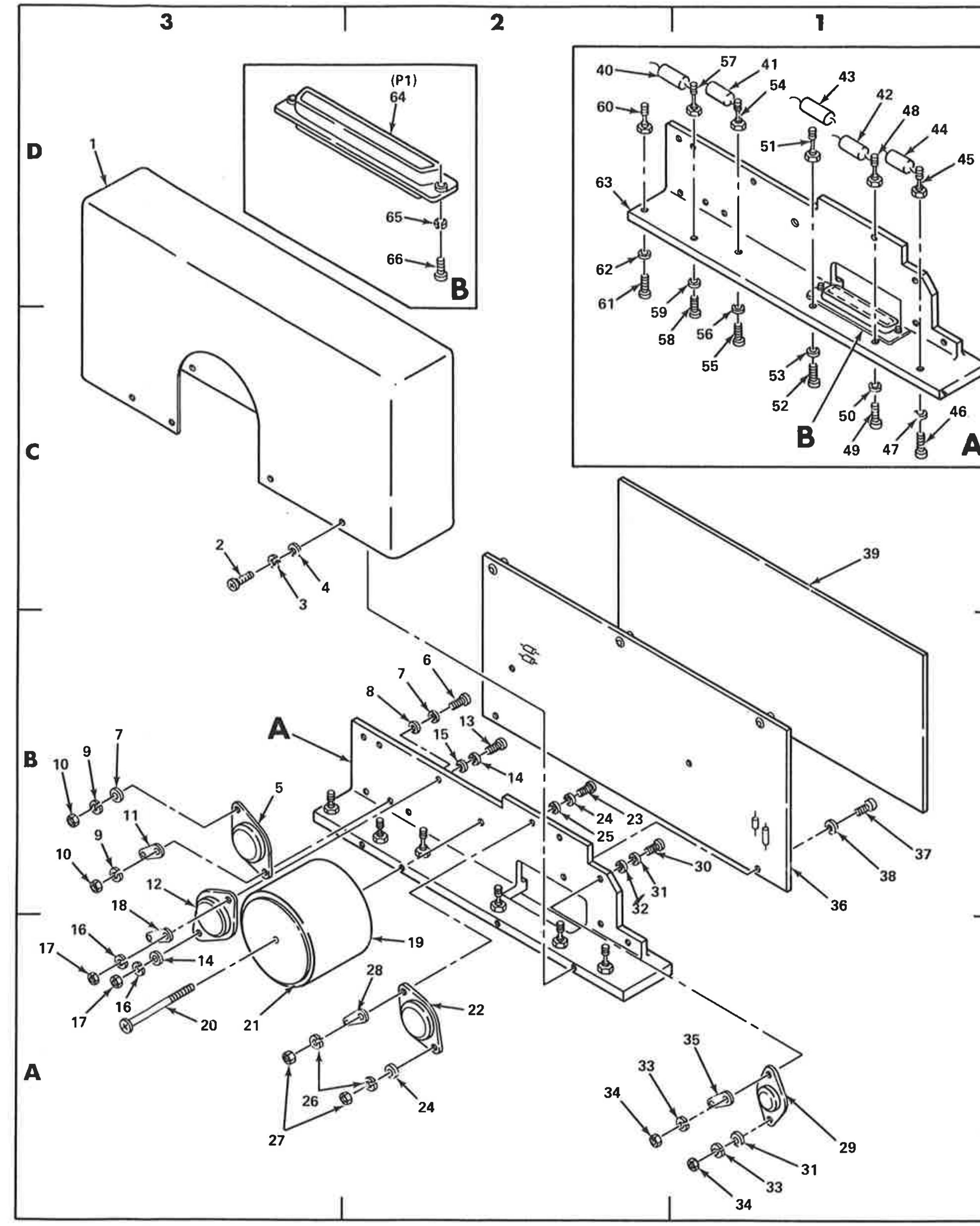
| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 1 | 1A5MP1 | TOP COVER | 1 | 1E |
| 2 | 1A5MP2 | FLAT-HEAD SCREW | 6 | 1E |
| 3 | 1A5MP3 | BOTTOM COVER | 1 | 3A |
| 4 | 1A5MP2 | FLAT-HEAD SCREW | 9 | 2A |
| 5 | 1A5A1 | PC BOARD ASSY, MODULATOR | 1 | 4B |
| 6 | 1A5MP4 | PAN-HEAD SCREW | 6 | 4B |
| 7 | 1A5MP5 | LOCKWASHER | 6 | 4B |
| 8 | 1A5MP6 | FLAT WASHER | 6 | 4B |
| 9 | 1A5A2 | PC BOARD ASSY, CRYSTAL FILTER | 1 | 4C |
| 10 | 1A5MP4 | PAN-HEAD SCREW | 4 | 4C |
| 11 | 1A5MP5 | LOCKWASHER | 4 | 4C |
| 12 | 1A5MP6 | FLAT WASHER | 2 | 4C |
| 13 | 1A5MP7 | GROUND LUG | 2 | 4C |
| 14 | 1A5FL6 | CAPACITOR, FEED-THRU | 1 | 3C |
| 15 | 1A5MP8 | SOLDER LUG | 1 | 3C |
| 16 | 1A5J5 | CONNECTOR | 1 | 3C |
| 17 | 1A5MP4 | PAN-HEAD SCREW | 4 | 4C |
| 18 | 1A5MP5 | LOCKWASHER | 4 | 4C |
| 19 | 1A5MP6 | FLAT WASHER | 4 | 3C |
| 20 | 1A5FL5 | CAPACITOR, FEED-THRU | 1 | 3C |
| 21 | 1A5MP8 | SOLDER LUG | 1 | 3C |
| 22 | 1A5MP9 | TUNING COVER | 1 | 3C |
| 23 | 1A5MP10 | PAN-HEAD SCREW | 6 | 3C |
| 24 | 1A5MP11 | SETSCREW | 2 | 2C |
| 25 | 1A5C7 | TUNING SCREW, METALLIC | 1 | 3B |
| 26 | 1A5MP12 | KOVAR POST | 1 | 3B |
| 27 | 1A5MP13 | FLAT-HEAD SCREW | 1 | 2C |
| 28 | 1A5C8 | TUNING SCREW, METALLIC | 1 | 3B |
| 29 | 1A5MP12 | KOVAR POST | 1 | 3B |
| 30 | 1A5MP13 | FLAT-HEAD SCREW | 1 | 2C |
| 31 | 1A5U1 | INTEGRATED CIRCUIT | 1 | 3A |
| 32 | 1A5MP14 | PAN-HEAD SCREW | 2 | 3A,3B |
| 33 | 1A5MP15 | LOCKWASHER | 2 | 1C,2C |
| 34 | 1A5MP7 | GROUND LUG | 2 | 1B,2C |
| 35 | 1A5MP16 | HEX NUT | 2 | 1C,2C |
| 36 | 1A5MP17 | BRACKET | 1 | 1C |
| 37 | 1A5MP18 | PAN-HEAD SCREW | 3 | 1C |
| 38 | 1A5MP5 | LOCKWASHER | 3 | 1C |
| 39 | 1A5HY1 | CIRCULATOR | 1 | 2D |
| 40 | 1A4MP19 | GASKET | 1 | 2D |
| 41 | 1A5FL1 | CAPACITOR, FEED-THRU | 1 | 1B |
| 42 | 1A5MP8 | SOLDER LUG | 1 | 2B |
| 43 | 1A5J1 | CONNECTOR | 1 | 2B |
| 44 | 1A5J2 | CONNECTOR | 1 | 2B |
| 45 | 1A5MP4 | PAN-HEAD SCREW | 6 | 1A |
| 46 | 1A5MP10 | PAN-HEAD SCREW | 2 | 1B |
| 47 | 1A5MP5 | LOCKWASHER | 10 | 1B,2B |
| 48 | 1A5MP6 | FLAT WASHER | 8 | 1B |
| 49 | 1A5MP7 | GROUND LUG | 2 | 2B |
| 50 | 1A5MP20 | HEX NUT | 2 | 2B |
| 51 | 1A5A3 | PC BOARD ASSY, TIMES 2 OUTPUT | 1 | 3D |
| 52 | 1A5MP4 | PAN-HEAD SCREW | 3 | 3D |
| 53 | 1A5MP5 | LOCKWASHER | 3 | 3D |
| 54 | 1A5MP6 | FLAT WASHER | 1 | 3D |
| 55 | 1A5MP7 | GROUND LUG | 2 | 3D |
| 56 | 1A5MP21 | NUT | 1 | 3C |
| 57 | 1A5MP22 | STANDOFF | 1 | 3D |
| 58 | 1A5A4 | PC BOARD ASSY, OSCILLATOR | 1 | 2C |
| 59 | 1A5MP4 | PAN-HEAD SCREW | 4 | 2C |
| 60 | 1A5MP5 | LOCKWASHER | 4 | 2C |
| 61 | 1A5MP6 | FLAT WASHER | 2 | 2C |
| 62 | 1A5MP7 | GROUND LUG | 2 | 2C |
| 63 | 1A5L1 | INDUCTOR | 1 | 4E |
| 64 | 1A5C1 | CAPACITOR | 1 | 4E |
| 65 | 1A5E1 | TERMINAL | 1 | 4E |
| 66 | 1A5C3 | CAPACITOR | 1 | 4E |
| 67 | 1A5C2 | CAPACITOR | 1 | 4E |
| 68 | 1A5L2 | INDUCTOR | 1 | 4E |
| 69 | 1A5C4 | CAPACITOR | 1 | 3E |
| 70 | 1A5C5 | CAPACITOR | 1 | 3E |
| 71 | 1A5C6 | CAPACITOR | 1 | 3D |
| 72 | 1A5E3 | TERMINAL | 2 | 3D |
| 73 | 1A5MP7 | GROUND LUG | 1 | 3D |
| 74 | 1A5L3 | INDUCTOR | 1 | 4E |
| 75 | 1A5L4 | INDUCTOR | 1 | 4E |
| 76 | 1A5CR1 | DIODE | 1 | 3B |
| 77 | 1A5MP23 | HOUSING | 1 | 2E |
| 78 | 1A5MP24 | FLAT-HEAD SCREW | 2 | 2C |
| 79 | 1A5FL2 | CAPACITOR, FEED-THRU | 1 | 3B |
| 80 | 1A5R16 | RESISTOR | 1 | 3E |



| QTY | ZONE |
|---|---|
| 1 | 3D |
| 10 | 3C |
| 10 | 3C |
| 10 | 3C |
| 1 | 3B |
| 2 | 2B |
| 3 | 2B |
| 2 | 2B |
| 2 | 3B |
| 2 | 3B |
| 1 | 3B |
| 1 | 3B |
| 2 | 2B |
| 3 | 2B,3A |
| 2 | 2B |
| 2 | 3A |
| 2 | 3A |
| 1 | 3A |
| 1 | 2A |
| 1 | 3A |
| 1 | 3A |
| 1 | 2A |
| 2 | 2B |
| 3 | 2A,2B |
| 2 | 2B |
| 2 | 3A |
| 2 | 3A |
| 1 | 2A |
| 1 | 1A |
| 2 | 2B |
| 3 | 1A,2B |
| 2 | 2B |
| 2 | 1A |
| 2 | 1A |
| 1 | 1A |
| 1 | 1B |
| 4 | 1B |
| 4 | 1B |
| 1 | 1C |
| 1 | 2D |
| 1 | 1D |
| 1 | 1D |
| 1 | 1D |
| 1 | 1D |
| 1 | 1D |
| 1 | 1C |
| 1 | 1C |
| 1 | 1D |
| 1 | 1C |
| 1 | 1C |
| 1 | 1D |
| 1 | 1C |
| 1 | 1C |
| 1 | 1D |
| 1 | 1C |
| 1 | 1C |
| 1 | 1D |

LEGEND FOR FIGURE 6-8

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 58 | 1A6MP16 | PAN-HEAD SCREW | 1 | 1D |
| 59 | 1A6MP9 | LOCKWASHER | 1 | 1D |
| 60 | 1A6E1 | TERMINAL | 1 | 2D |
| 61 | 1A6MP16 | PAN-HEAD SCREW | 1 | 2D |
| 62 | 1A6MP9 | LOCKWASHER | 1 | 2D |
| 63 | 1A6MP17 | HEAT SINK | 1 | 2D |
| 64 | 1A6P1 | CONNECTOR | 1 | 3D |
| 65 | 1A6MP7 | FLAT WASHER (BETWEEN HEAT SINK AND CONNECTOR) | 2 | 2D |
| 66 | 1A6MP18 | FLAT-HEAD SCREW | 2 | 2D |
| 67 | 1A6MP4 | FLAT WASHER | 4 | 2D |




TM52938-9406A

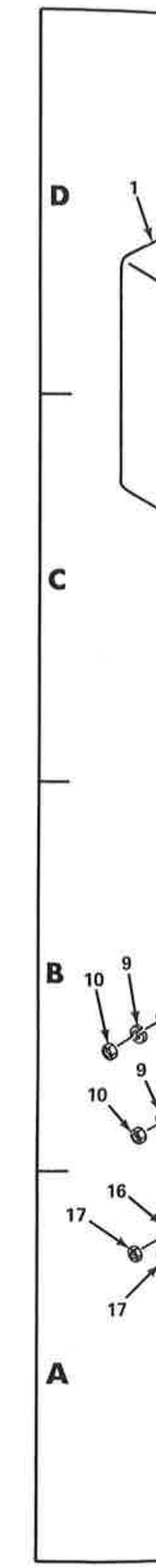
Figure 6-8. Module 1A6, Exploded View Diagram

LEGEND FOR FIGURE 6-8

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 1 | 1A6MP1 | COVER | 1 | 3D |
| 2 | 1A6MP2 | PAN-HEAD SCREW | 10 | 3C |
| 3 | 1A6MP3 | LOCKWASHER | 10 | 3C |
| 4 | 1A6MP4 | FLAT WASHER | 10 | 3C |
| 5 | 1A6Q2 | TRANSISTOR | 1 | 3B |
| 6 | 1A6MP6 | PAN-HEAD SCREW | 2 | 2B |
| 7 | 1A6MP7 | FLAT WASHER | 3 | 2B |
| 8 | 1A6MP8 | SHOULDER WASHER | 2 | 2B |
| 9 | 1A6MP9 | LOCKWASHER | 2 | 3B |
| 10 | 1A6MP10 | HEX NUT | 2 | 3B |
| 11 | 1A6MP11 | LUG | 1 | 3B |
| 12 | 1A6Q1 | TRANSISTOR | 1 | 3B |
| 13 | 1A6MP6 | PAN-HEAD SCREW | 2 | 2B |
| 14 | 1A6MP7 | FLAT WASHER | 3 | 2B,3A |
| 15 | 1A6MP8 | SHOULDER WASHER | 2 | 2B |
| 16 | 1A6MP9 | LOCKWASHER | 2 | 3A |
| 17 | 1A6MP10 | HEX NUT | 2 | 3A |
| 18 | 1A6MP11 | LUG | 1 | 3A |
| 19 | 1A6T1 | TRANSFORMER | 1 | 2A |
| 20 | 1A6MP12 | PAN-HEAD SCREW | 1 | 3A |
| 21 | 1A6MP13 | WASHER | 1 | 3A |
| 22 | 1A6U3 | VOLTAGE REGULATOR | 1 | 2A |
| 23 | 1A6MP6 | PAN-HEAD SCREW | 2 | 2B |
| 24 | 1A6MP7 | FLAT WASHER | 3 | 2A,2B |
| 25 | 1A6MP8 | SHOULDER WASHER | 2 | 2B |
| 26 | 1A6MP9 | LOCKWASHER | 2 | 3A |
| 27 | 1A6MP10 | HEX NUT | 2 | 3A |
| 28 | 1A6MP11 | LUG | 1 | 2A |
| 29 | 1A6Q5 | TRANSISTOR | 1 | 1A |
| 30 | 1A6MP6 | PAN-HEAD SCREW | 2 | 2B |
| 31 | 1A6MP7 | FLAT WASHER | 3 | 1A,2B |
| 32 | 1A6MP8 | SHOULDER WASHER | 2 | 2B |
| 33 | 1A6MP9 | LOCKWASHER | 2 | 1A |
| 34 | 1A6MP10 | HEX NUT | 2 | 1A |
| 35 | 1A6MP11 | LUG | 1 | 1A |
| 36 | 1A6MP14 | PC BOARD | 1 | 1B |
| 37 | 1A6MP3 | PAN-HEAD SCREW | 4 | 1B |
| 38 | 1A6MP4 | FLAT WASHER | 4 | 1B |
| 39 | 1A6MP15 | INSULATOR | 1 | 1C |
| 40 | 1A6R8 | RESISTOR | 1 | 2D |
| 41 | 1A6C20 | CAPACITOR | 1 | 1D |
| 42 | 1A6L1 | INDUCTOR | 1 | 1D |
| 43 | 1A6C17 | CAPACITOR | 1 | 1D |
| 44 | 1A6C7 | CAPACITOR | 1 | 1D |
| 45 | 1A6E6 | TERMINAL | 1 | 1D |
| 46 | 1A6MP16 | PAN-HEAD SCREW | 1 | 1C |
| 47 | 1A6MP9 | LOCKWASHER | 1 | 1C |
| 48 | 1A6E5 | TERMINAL | 1 | 1D |
| 49 | 1A6MP16 | PAN-HEAD SCREW | 1 | 1C |
| 50 | 1A6MP9 | LOCKWASHER | 1 | 1C |
| 51 | 1A6E4 | TERMINAL | 1 | 1D |
| 52 | 1A6MP16 | PAN-HEAD SCREW | 1 | 1C |
| 53 | 1A6MP9 | LOCKWASHER | 1 | 1C |
| 54 | 1A6E3 | TERMINAL | 1 | 1D |
| 55 | 1A6MP16 | PAN-HEAD SCREW | 1 | 1C |
| 56 | 1A6MP9 | LOCKWASHER | 1 | 1C |
| 57 | 1A6E2 | TERMINAL | 1 | 1D |

LEGEND FOR FIGURE 6-8

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 58 | 1A6MP16 | PAN-HEAD SCREW | 1 | 1D |
| 59 | 1A6MP9 | LOCKWASHER | 1 | 1D |
| 60 | 1A6E1 | TERMINAL | 1 | 2D |
| 61 | 1A6MP16 | PAN-HEAD SCREW | 1 | 2D |
| 62 | 1A6MP9 | LOCKWASHER | 1 | 2D |
| 63 | 1A6MP17 | HEAT SINK | 1 | 2D |
| 64 | 1A6P1 | CONNECTOR | 1 | 3D |
| 65 | 1A6MP7 | FLAT WASHER (BETWEEN HEAT SINK AND CONNECTOR) | 2 | 2D |
| 66 | 1A6MP18 | FLAT-HEAD SCREW | 2 | 2D |
| 67 | 1A6MP4 | FLAT WASHER | 4 | 2D |



LEGEND FOR FIGURE 6-9

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 1 | 1A7MP1 | RH COVER | 1 | 1E |
| 2 | 1A7MP2 | FLAT-HEAD SCREW | 9 | 2E |
| 3 | 1A7MP3 | LH COVER | 1 | 4A |
| 4 | 1A7MP2 | FLAT-HEAD SCREW | 9 | 4B |
| 5 | 1A7A1 | PC BOARD ASSEMBLY | 1 | 2B |
| 6 | 1A7MP4 | PAN-HEAD SCREW | 6 | 4C |
| 7 | 1A7MP5 | LOCKWASHER | 6 | 4C |
| 8 | 1A7MP6 | FLAT WASHER | 6 | 4C |
| 9 | 1A7P1 | CONNECTOR | 1 | 3C |
| 10 | 1A7MP7 | FLAT-HEAD SCREW | 2 | 3C |
| 11 | 1A7MP8 | FLAT WASHER | 2 | 3D |
| 12 | 1A7P2 | CONNECTOR | 1 | 2C |
| 13 | 1A7MP7 | FLAT-HEAD SCREW | 2 | 2B |
| 14 | 1A7MP8 | FLAT WASHER | 2 | 2C |
| 15 | 1A7S3 | SWITCH, SPDT, WITH NUT | 1 | 1C,2D |
| 16 | 1A7S1 | SWITCH, DPDT, WITH NUT | 1 | 1C,2D |
| 17 | 1A7S2 | SAME AS 1A7S3 | 1 | 1C,2D |
| 18 | 1A7MP9 | FRONT PANEL | 1 | 1C |
| 19 | 1A7MP10 | FLAT-HEAD SCREW | 4 | 1C |
| 20 | 1A7TP1 | TEST POINT | 1 | 2D |
| 21 | 1A7MP11 | HOUSING | 1 | 3E |

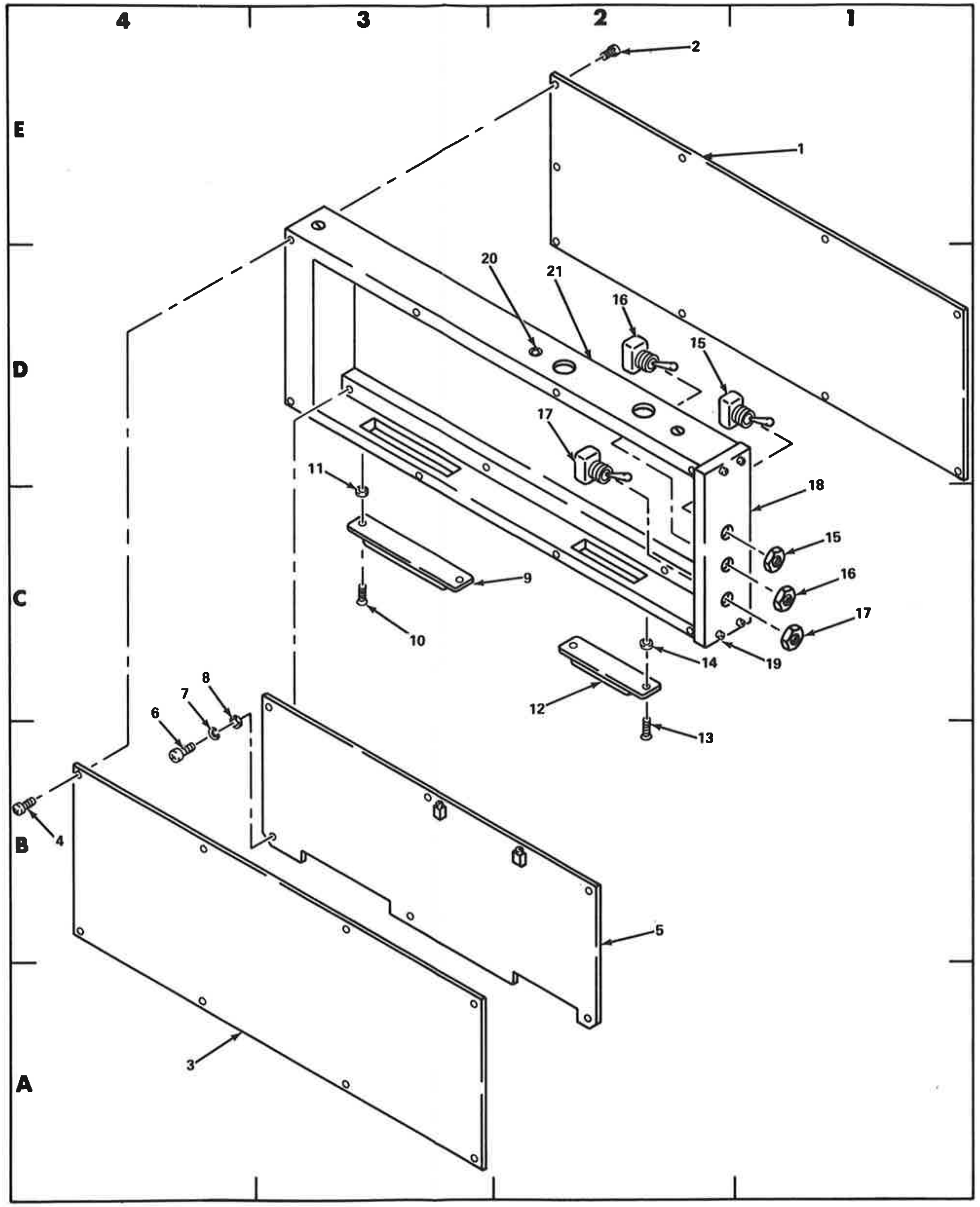



Figure 6-9. Module 1A7, Exploded View Diagram

LEGEND FOR FIGURE 6-10

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 1 | 1A8MP1 | COVER | 1 | 4B |
| 2 | 1A8MP2 | FLAT-HEAD SCREW | 2 | 1D |
| 3 | 1A8MP3 | PAN-HEAD SCREW | 4 | 1D |
| 4 | 1A8MP4 | LOCKWASHER | 4 | 1D |
| 5 | 1A8MP5 | FLAT WASHER | 4 | 1D |
| 6 | 1A8P1 | CONNECTOR | 1 | 1C |
| 7 | 1A8MP6 | FLAT-HEAD SCREW | 2 | 2C |
| 8 | 1A8MP5 | FLAT WASHER | 2 | 2C |
| 9 | 1A8MP4 | LOCKWASHER | 2 | 2C |
| 10 | 1A8MP7 | HEX NUT | 2 | 2C |
| 11 | 1A8A1 | PC BOARD ASSEMBLY | 1 | 2C |
| 12 | 1A8MP3 | PAN-HEAD SCREW | 4 | 3C |
| 13 | 1A8MP4 | LOCKWASHER | 4 | 3C |
| 14 | 1A8MP5 | FLAT WASHER | 4 | 3C |
| 15 | 1A8MP8 | PAN-HEAD SCREW | 4 | 3C |
| 16 | 1A8MP9 | LOCKWASHER | 4 | 3C |
| 17 | 1A8MP10 | FLAT WASHER | 4 | 3C |
| 18 | 1A8U2 | VOLTAGE REGULATOR | 1 | 3D |
| 19 | 1A8MP11 | HEAT SINK | 1 | 3D |
| 20 | 1A8MP3 | PAN-HEAD SCREW | 1 | 2D |
| 21 | 1A8MP5 | FLAT WASHER | 1 | 2D |
| 22 | 1A8MP4 | LOCKWASHER | 1 | 3D |
| 23 | 1A8MP12 | HOUSING | 1 | 1D |

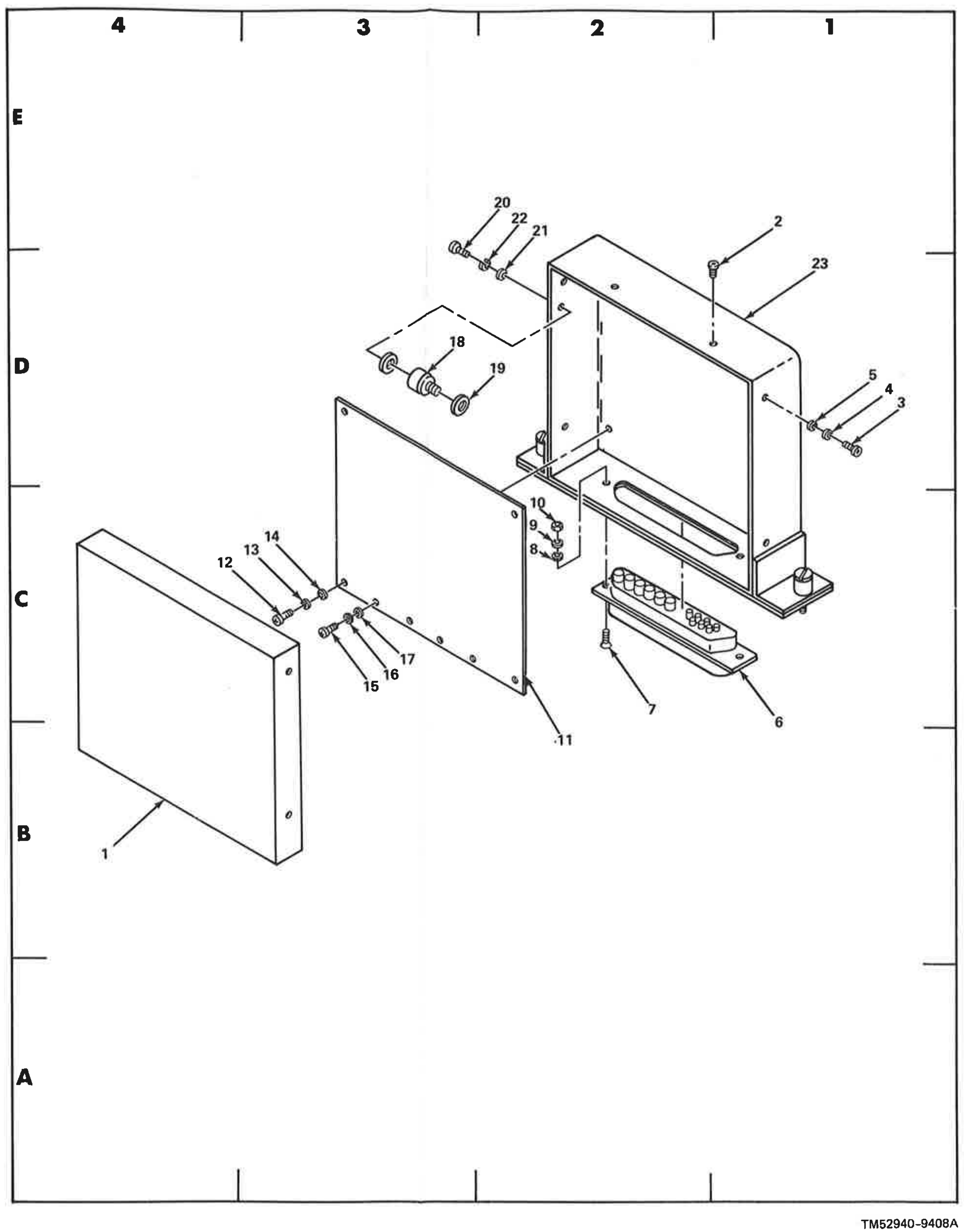
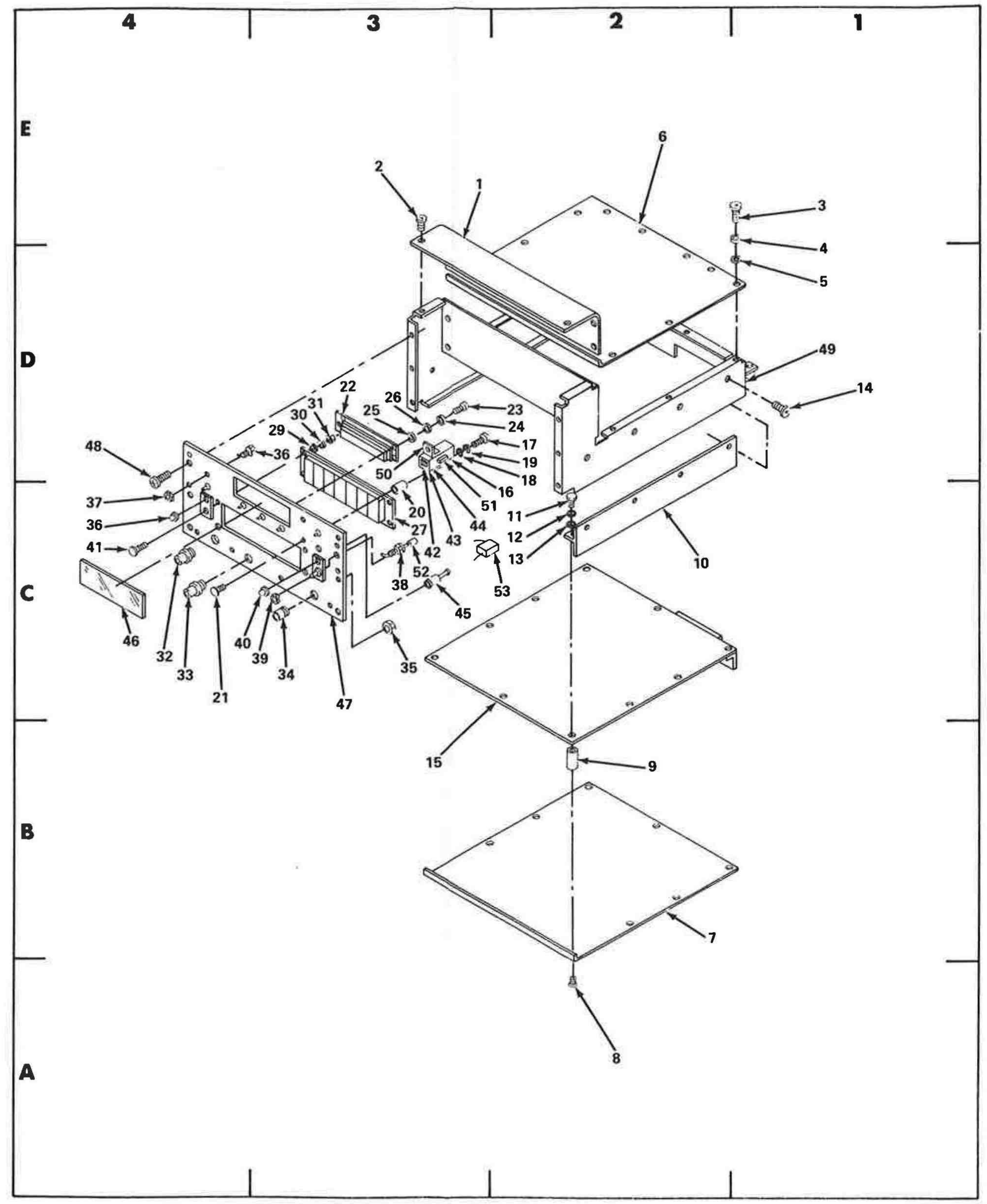



Figure 6-10. Module 1A8, Exploded View Diagram

LEGEND FOR FIGURE 6-11

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 1 | 1A9MP1 | TOP COVER | 1 | 3E |
| 2 | 1A9MP2 | FLAT-HEAD SCREW | 2 | 3E |
| 3 | 1A9MP3 | PAN-HEAD SCREW | 14 | 1E |
| 4 | 1A9MP4 | LOCKWASHER | 14 | 1D |
| 5 | 1A9MP22 | FLAT WASHER | 14 | 1D |
| 6 | 1A9MP5 | TOP COVER | 1 | 2E |
| 7 | 1A9MP6 | BOTTOM COVER | 1 | 2B |
| 8 | 1A9MP7 | FLAT-HEAD SCREW | 10 | 2A |
| 9 | 1A9MP8 | STANDOFF | 10 | 2B |
| 10 | 1A9MP9 | BRACKET | 2 | 2C |
| 11 | 1A9MP3 | PAN-HEAD SCREW | 8 | 2C |
| 12 | 1A9MP4 | LOCKWASHER | 8 | 2C |
| 13 | 1A9MP22 | FLAT WASHER | 8 | 2C |
| 14 | 1A9MP7 | FLAT-HEAD SCREW | 8 | 1D |
| 15 | 1A9A2 | PC BOARD ASSEMBLY, LOGIC | 1 | 3B |
| 16 | 1A9K1 | RELAY | 1 | 3D |
| 17 | 1A9MP10 | PAN-HEAD SCREW | 2 | 3D |
| 18 | 1A9MP15 | FLAT WASHER | 2 | 2C |
| 19 | 1A9MP13 | LOCKWASHER | 2 | 3D |
| 20 | 1A9MP11 | STANDOFF | 2 | 3C |
| 21 | 1A9MP12 | FLAT-HEAD SCREW | 2 | 4C |
| 22 | 1A9A1 | PC BOARD ASSEMBLY, DISPLAY | 1 | 3D |
| 23 | 1A9MP10 | PAN-HEAD SCREW | 5 | 3D |
| 24 | 1A9MP13 | LOCKWASHER | 5 | 3D |
| 25 | 1A9MP15 | FLAT WASHER | 5 | 3D |
| 26 | 1A9MP24 | WASHER, SHOULDER, INSULATED | 5 | 3D |
| 27 | 1A9S1 | THUMBWHEEL SWITCH | 1 | 3C |
| 28 | 1A9MP14 | FLAT-HEAD SCREW | 4 | 4C |
| 29 | 1A9MP15 | FLAT WASHER | 4 | 3D |
| 30 | 1A9MP13 | LOCKWASHER | 4 | 3D |
| 31 | 1A9MP16 | HEX NUT | 4 | 3D |
| 32 | 1A9J2 | CONNECTOR | 1 | 4C |
| 33 | 1A9J3 | SAME AS 1A9J2 | 1 | 4C |
| 34 | 1A9J4 | SAME AS 1A9J2 | 1 | 3C |
| 35 | 1A9MP25 | NUT (P/O OF CONNECTOR) | 3 | 3C |
| 36 | 1A9S2 | SWITCH, SPDT | 1 | 4D |
| 37 | 1A9MP23 | NUT (P/O 1A9S2) | 1 | 4D |
| 38 | 1A9S3 THRU 1A9S11 | SWITCH, PUSH | 9 | 3C,3D |
| 39 | 1A9MP17 | KNURLED NUT | 9 | 4C |
| 40 | 1A9CR1 | DIODE | 1 | 3C |
| 41 | 1A9CR2 | SAME AS 1A9CR1 | 1 | 4C |
| 42 | 1A9CR3 | DIODE (ON BOTTOM OF 1A9K1) | 1 | 3C |
| 43 | 1A9R1 | RESISTOR (ON BOTTOM OF 1A9K1) | 1 | 3C |
| 44 | 1A9R2 | RESISTOR (ON BOTTOM OF 1A9K1) | 1 | 3C |
| 45 | 1A9E1 THRU 1A9E4 | TERMINAL | 4 | 3C |
| 46 | 1A9MP18 | WINDOW | 1 | 4C |
| 47 | 1A9MP19 | FRONT PANEL | 1 | 3C |
| 48 | 1A9MP20 | FLAT-HEAD SCREW | 6 | 4D |
| 49 | 1A9MP21 | CHASSIS | 1 | 1D |
| 50 | 1A9C1 | CAPACITOR (ON SIDE OF 1A9K1) | 1 | 3D |
| 51 | 1A9C2 | CAPACITOR (ON SIDE OF 1A9K1) | 1 | 3C |
| 52 | 1A9C3 | CAPACITOR (ON BACK OF 1A9S8) | 1 | 3C |
| 53 | 1A9P4 THRU 1A9P9 | PLUG | 6 | 2C |




TM52941-9409A

Figure 6-11. Module 1A9, Exploded View Diagram

LEGEND FOR FIGURE 6-12

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 1 | 1A10MP1 | COVER | 1 | 3A |
| 2 | 1A10MP2 | FLAT-HEAD SCREW | 2 | 1D |
| 3 | 1A10MP3 | PAN-HEAD SCREW | 4 | 1C |
| 4 | 1A10MP4 | LOCKWASHER | 4 | 1C |
| 5 | 1A10MP5 | FLAT WASHER | 4 | 1C |
| 6 | 1A10A1 | PC BOARD ASSEMBLY | 1 | 2B |
| 7 | 1A10MP3 | PAN-HEAD SCREW | 4 | 2B |
| 8 | 1A10MP4 | LOCKWASHER | 4 | 2B |
| 9 | 1A10MP5 | FLAT WASHER | 4 | 2B |
| 10 | 1A10E1 THRU 1A10E4 | TERMINAL | 4 | 1B,1C |
| 11 | 1A10MP6 | PAN-HEAD SCREW | 4 | 2D |
| 12 | 1A10MP7 | LOCKWASHER | 4 | 2C |
| 13 | 1A10MP8 | FLAT WASHER | 4 | 2C |
| 14 | 1A10C39 | CAPACITOR | 1 | 1C |
| 15 | 1A10L17 | INDUCTOR | 1 | 1C |
| 16 | 1A10C32 | CAPACITOR | 1 | 1B |
| 17 | 1A10U4 | VOLTAGE REGULATOR | 1 | 2C |
| 18 | 1A10XU4 | HEAT SINK | 1 | 2B |
| 19 | 1A10MP9 | PAN-HEAD SCREW | 1 | 2C |
| 20 | 1A10MP4 | LOCKWASHER | 1 | 2C |
| 21 | 1A10MP5 | FLAT WASHER | 1 | 2C |
| 22 | 1A10P1 | CONNECTOR | 1 | 1B |
| 23 | 1A10MP10 | FLAT-HEAD SCREW | 2 | 2B |
| 24 | 1A10MP11 | FLAT WASHER | 2 | 1C |
| 25 | 1A10MP5 | FLAT WASHER | 2 | 2C |
| 26 | 1A10MP4 | LOCKWASHER | 2 | 2C |
| 27 | 1A10MP12 | HEX NUT | 2 | 2C |
| 28 | 1A10MP13 | HOUSING | 1 | 1C |

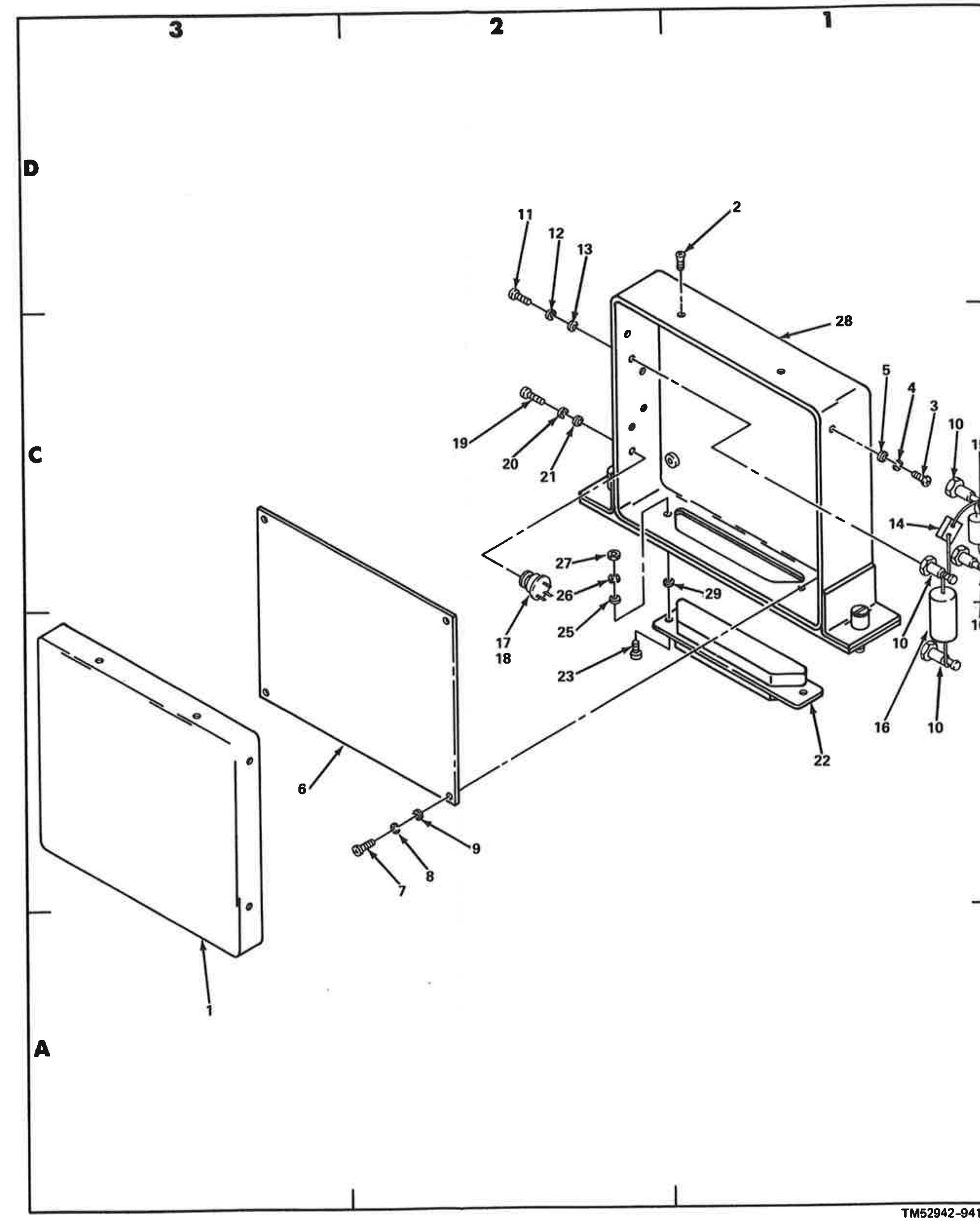



Figure 6-12. Module 1A10, Exploded View Diagram

LEGEND FOR FIGURE 6-13

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 1 | 1A14MP1 | COVER | 1 | 3A |
| 2 | 1A14MP2 | FLAT-HEAD SCREW | 2 | 1D |
| 3 | 1A14MP3 | PAN-HEAD SCREW | 4 | 1C |
| 4 | 1A14MP4' | FLAT WASHER | 4 | 1C |
| 5 | 1A14MP5 | LOCKWASHER | 4 | 1C |
| 6 | 1A14R30 | RESISTOR | 1 | 3B |
| 7 | 1A14MP6 | PAN-HEAD SCREW | 2 | 3A |
| 8 | 1A14MP7 | FLAT WASHER | 4 | 3B |
| 9 | 1A14MP8 | LOCKWASHER | 2 | 3B |
| 10 | 1A14MP9 | HEX NUT | 2 | 2B |
| 11 | 1A14A1 | PC BOARD ASSEMBLY | 1 | 2B |
| 12 | 1A14MP3 | PAN-HEAD SCREW | 4 | 2B |
| 13 | 1A14MP5 | LOCKWASHER | 4 | 2B |
| 14 | 1A14MP10 | FLAT WASHER | 4 | 2B |
| 15 | 1A14MP11 | FLAT-HEAD SCREW | 2 | 2B |
| 16 | 1A14MP10 | FLAT WASHER | 2 | 3C |
| 17 | 1A14MP5 | LOCKWASHER | 2 | 3C |
| 18 | 1A14MP12 | HEX NUT | 2 | 3C |
| 19 | 1A14U6 | INTEGRATED CIRCUIT | 1 | 2C |
| 20 | 1A14MP13 | PAN-HEAD SCREW | 2 | 2D |
| 21 | 1A14MP10 | FLAT WASHER | 3 | 2C,2D |
| 22 | 1A14MP14 | SHOULDER WASHER | 2 | 2C |
| 23 | 1A14MP4 | FLAT WASHER | 1 | 1C |
| 24 | 1A14MP5 | LOCKWASHER | 1 | 2C |
| 25 | 1A14MP12 | HEX NUT | 2 | 1C,2C |
| 26 | 1A14MP15 | INSULATOR | 1 | 2D |
| 27 | 1A14MP16 | SOLDER LUG | 1 | 1C |
| 28 | 1A14MP17 | HOUSING | 1 | 1C |

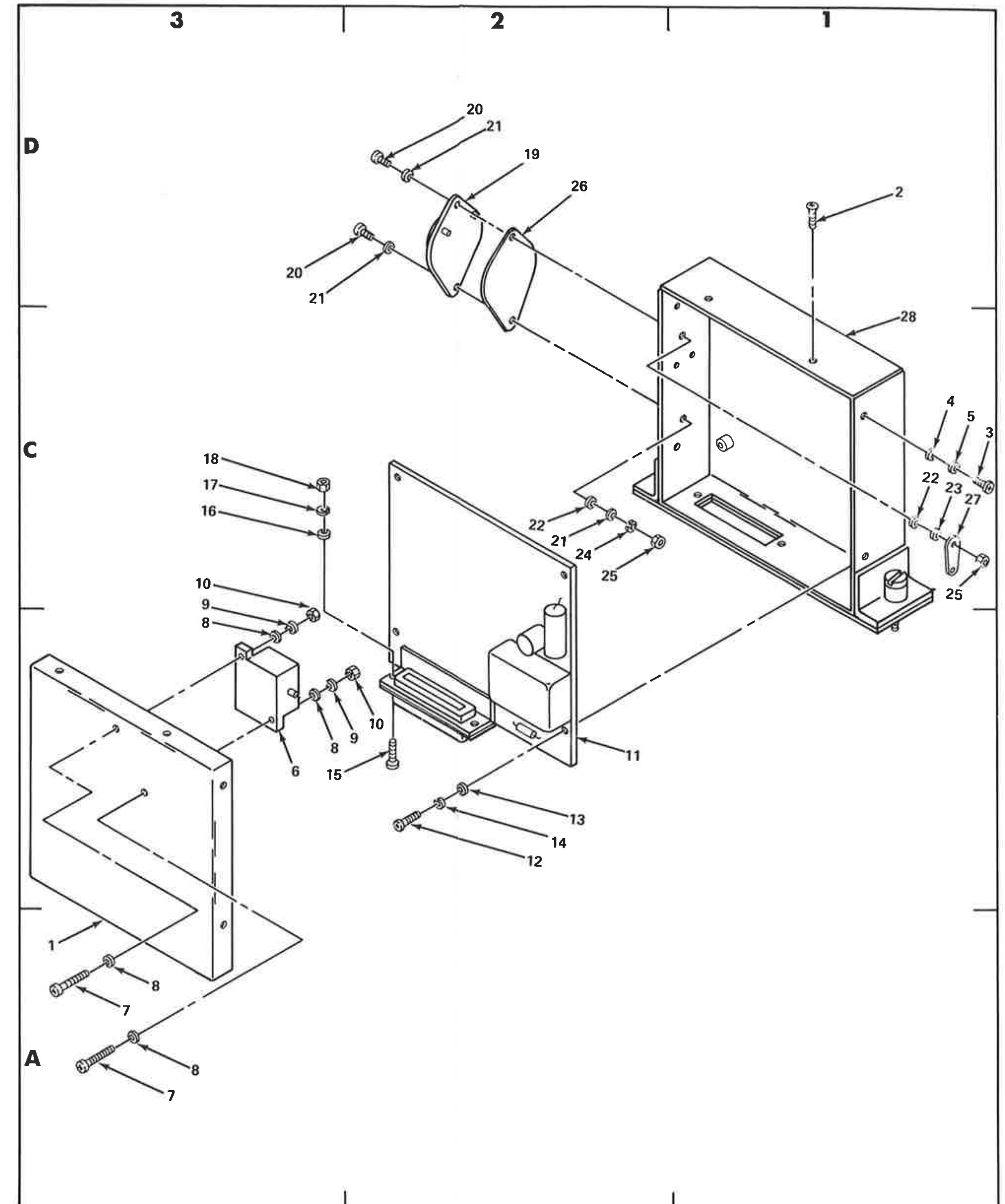



Figure 6-13. Module 1A14, Exploded View Diagram

LEGEND FOR FIGURE 6-14

| INDEX NO. | REFERENCE DESIGNATION | NOMENCLATURE | QTY | ZONE |
|---|---|---|---|---|
| 1 | 1A16S1 | SWITCH | 1 | 1C |
| 2 | 1A16A1 | PC BOARD ASSY | 1 | 2B |

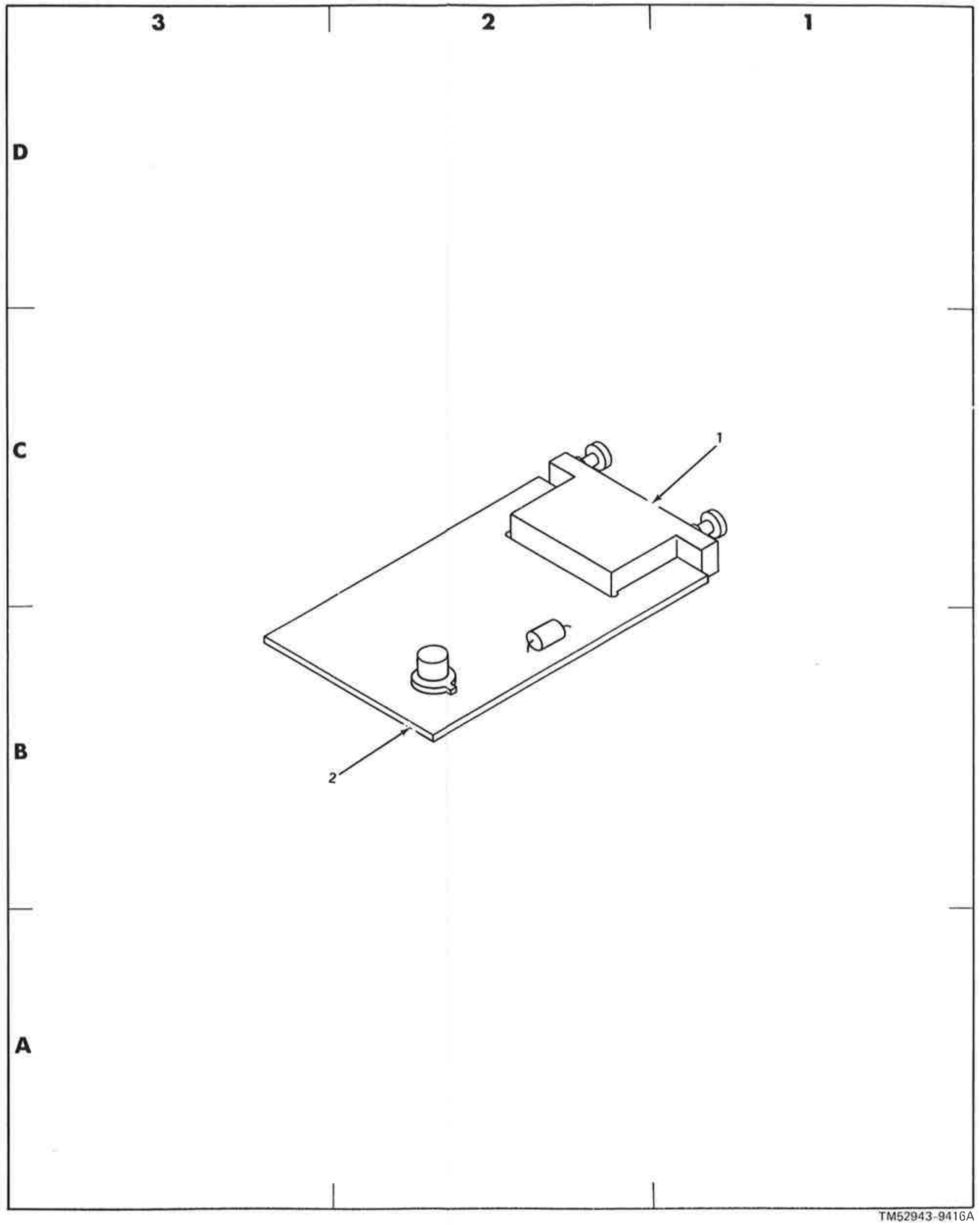
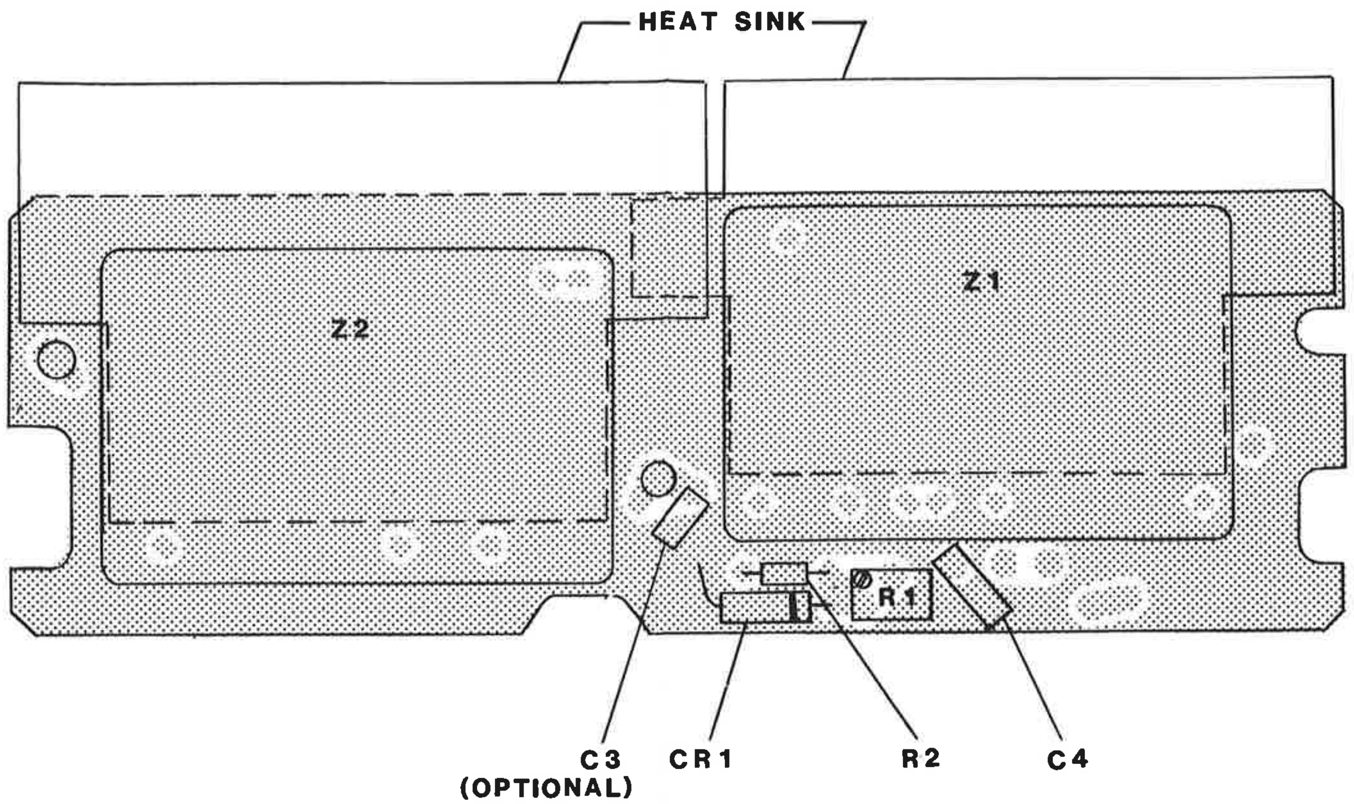
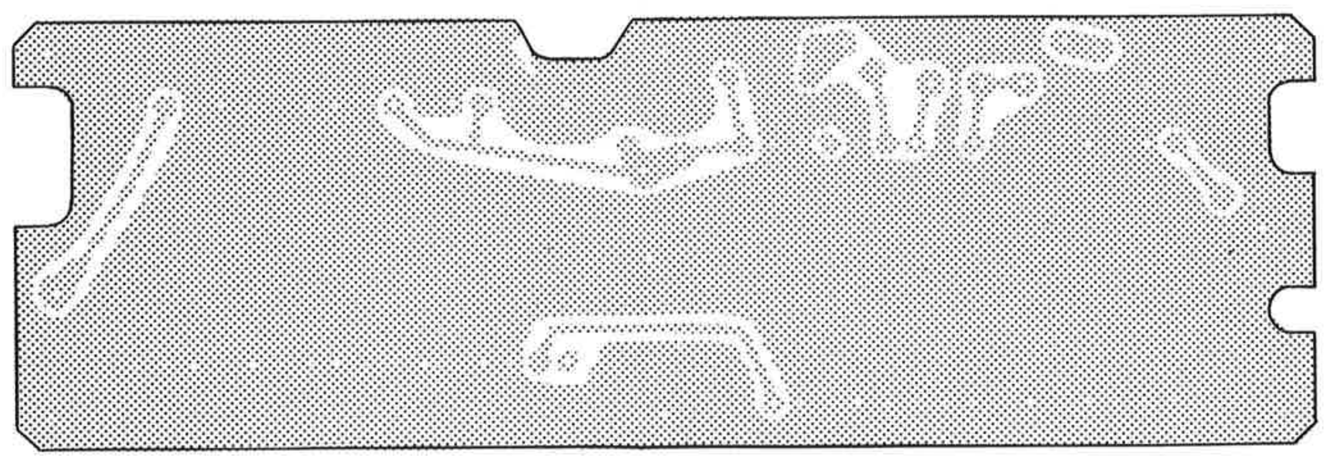



Figure 6-14. Module 1A16, Exploded View Diagram



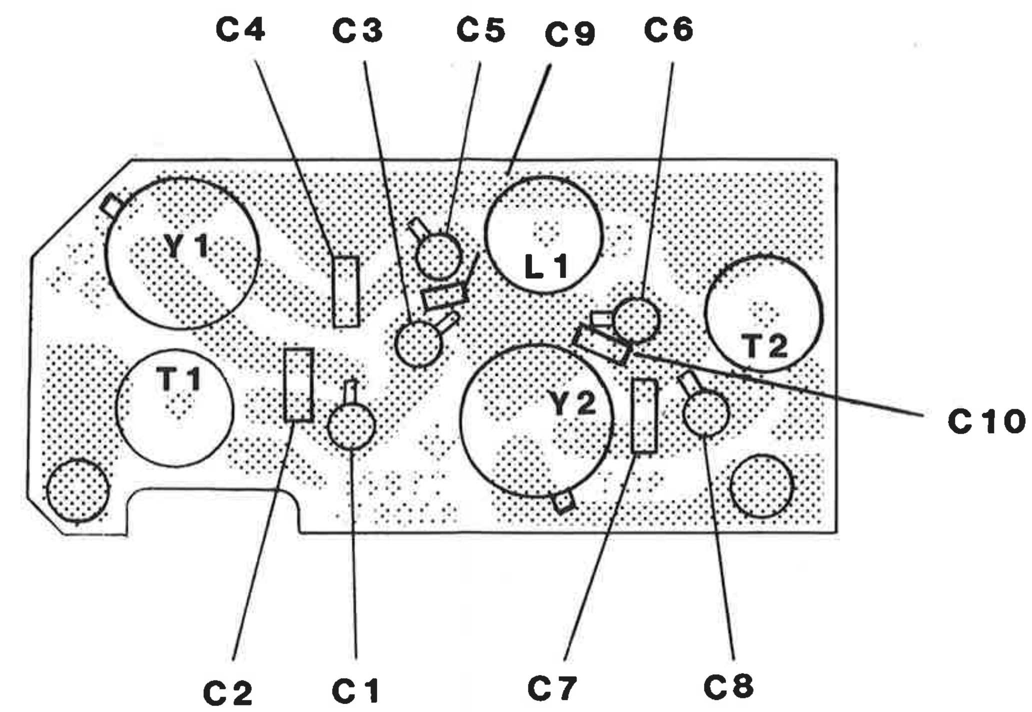

TOP SIDE PC BOARD 35871-7905



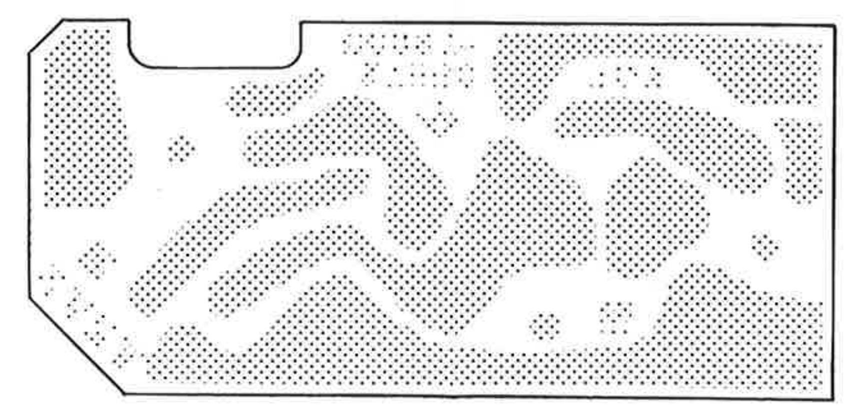
BOTTOM SIDE PC BOARD 35871-7905

TM51861-9405A

Figure 6-15. Printed Circuit Board 1A5A1, Component Location Diagram



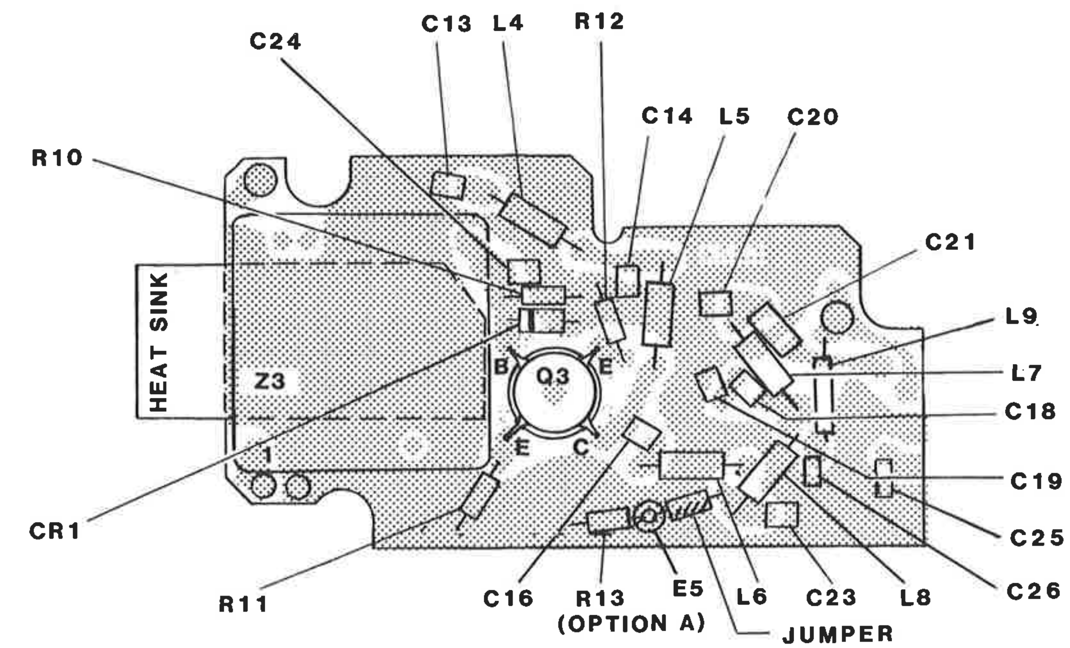

TOP SIDE PC BOARD 35872-7905



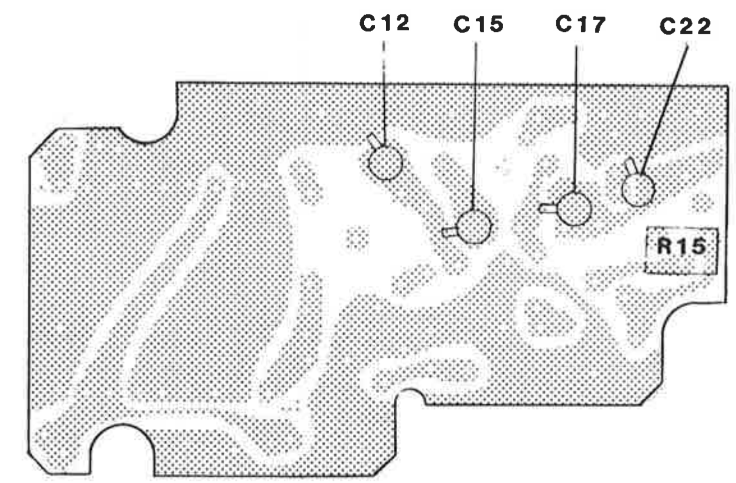
BOTTOM SIDE PC BOARD 35872-7905

TM51862-9405A

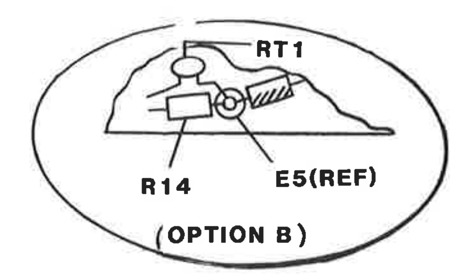
Figure 6-16. Printed Circuit Board 1A5A2, Component Location Diagram




TOP SIDE PC BOARD 35873-7905

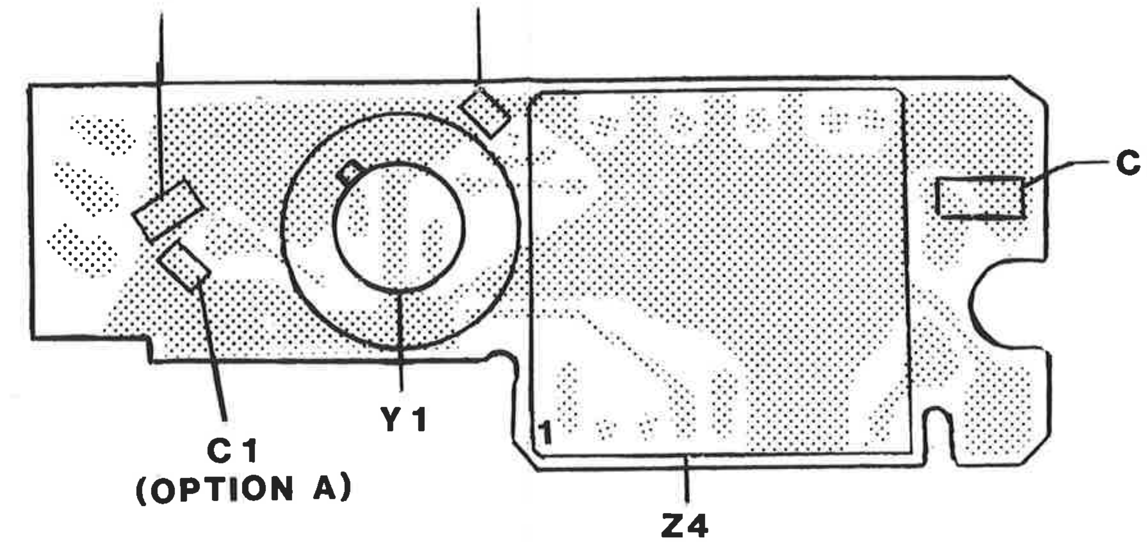



BOTTOM SIDE PC BOARD 35873-7905

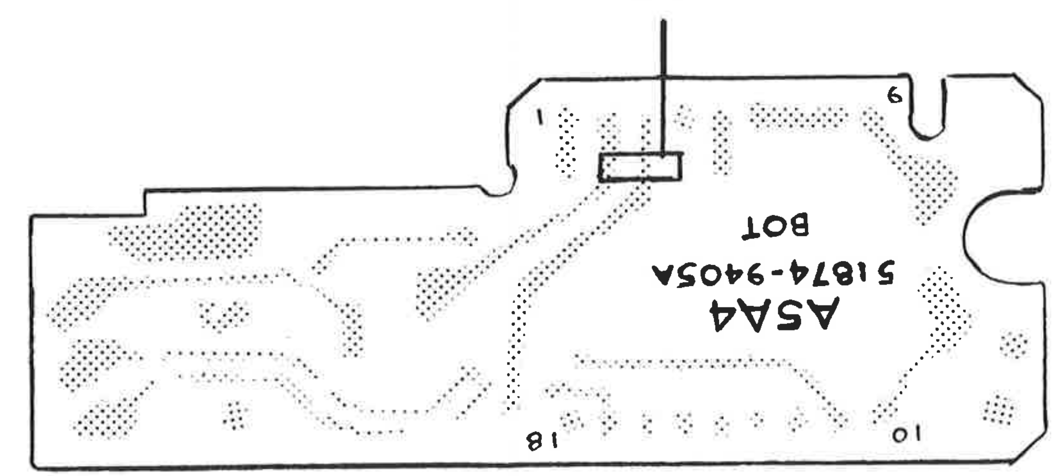



TM51863-9405A

Figure 6-17. Printed Circuit Board 1A5A3, Component Location Diagram



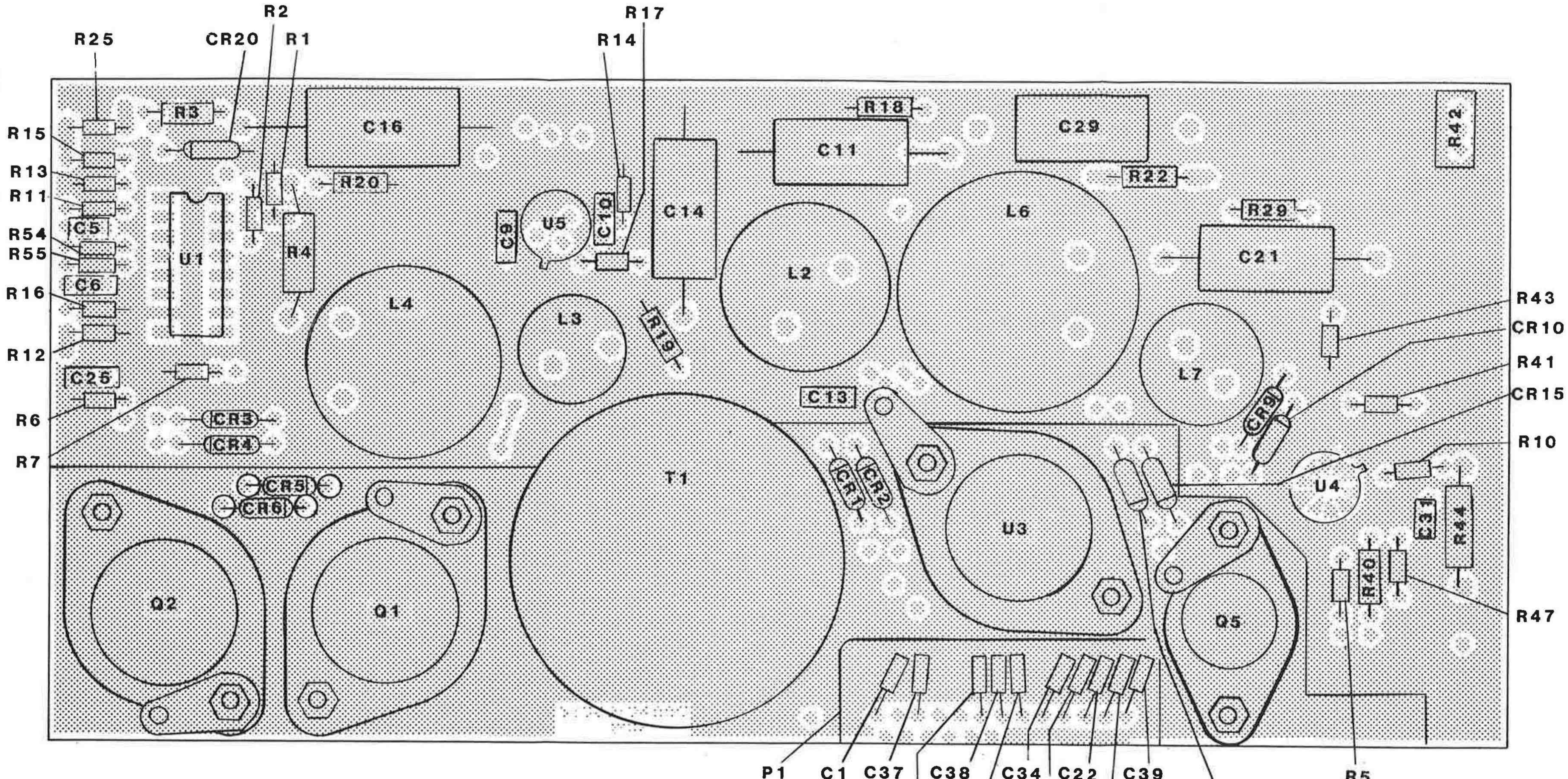

TOP SIDE PC BOARD 51874-9405




BOTTOM SIDE PC BOARD 51874-9405

TM51864-9405A

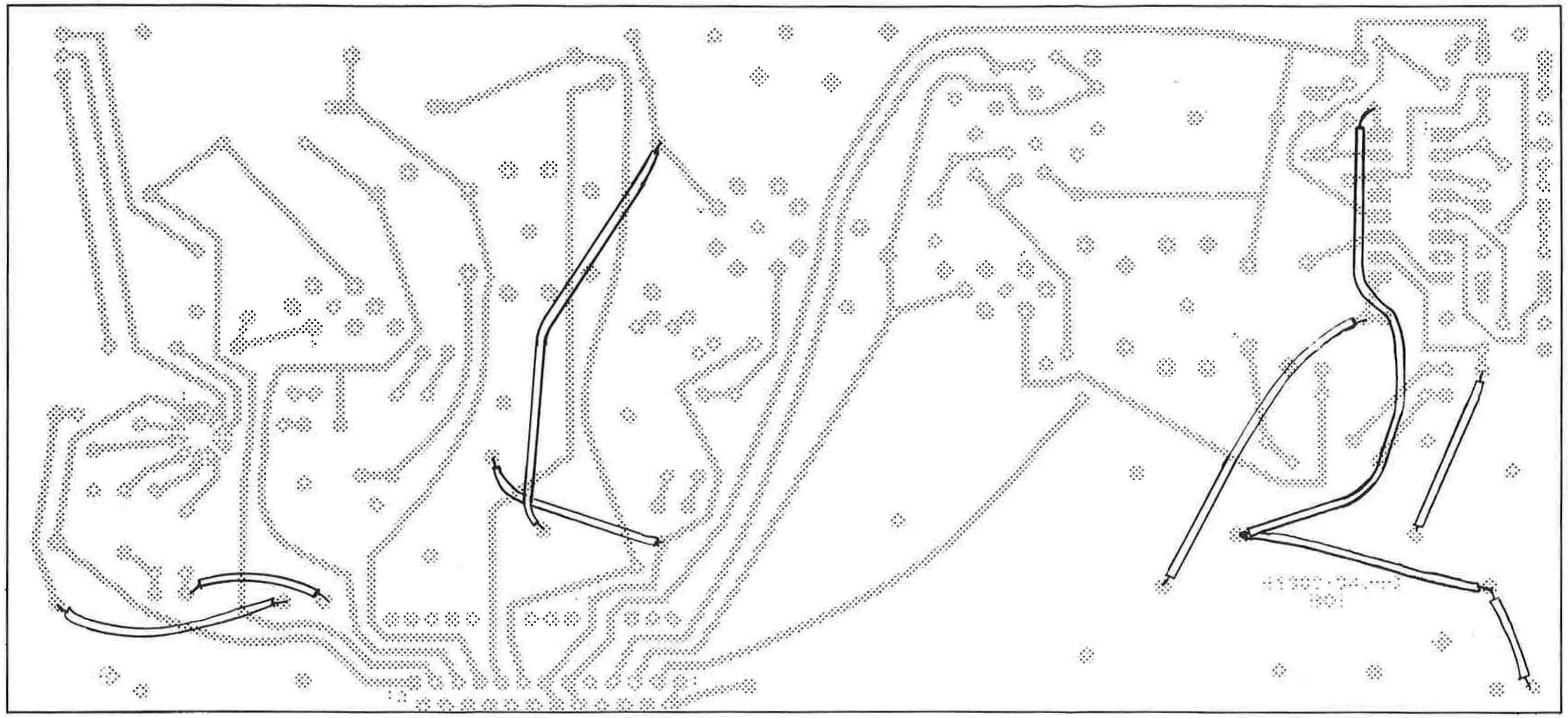
Figure 6-18. Printed Circuit Board 1A5A4, Component Location Diagram




TOP SIDE PC BOARD 51902-9406

TM51900-9406A-1

Figure 6-19. Printed Circuit Board 1A6, Component Location Diagram (Sheet 1 of 2)



**BOTTOM SIDE PC BOARD 51902-9406**

TM51900-9406A-2F

Figure 6-19. Printed Circuit Board 1A6, Component Location Diagram (Sheet 2 of 2)

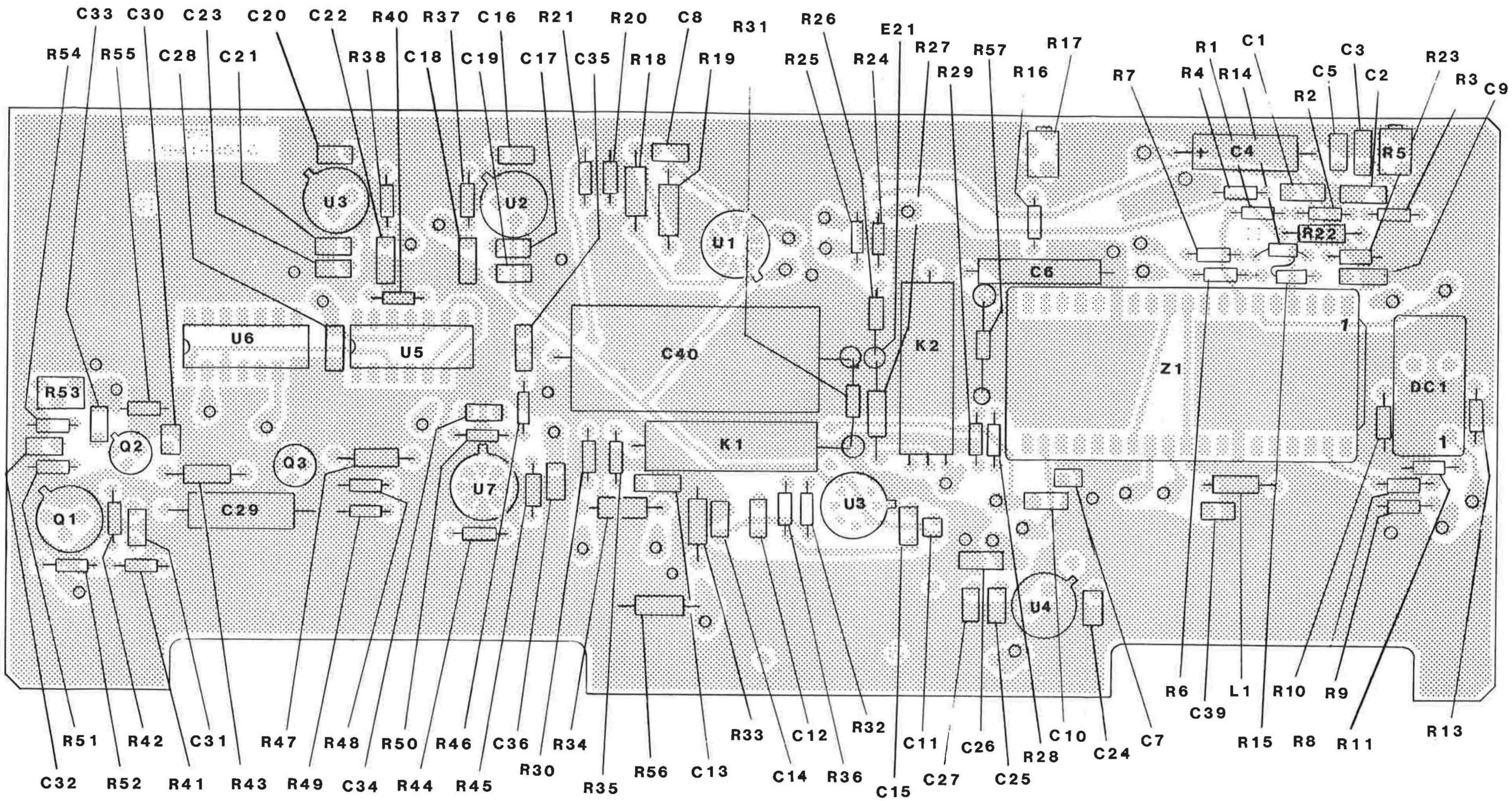
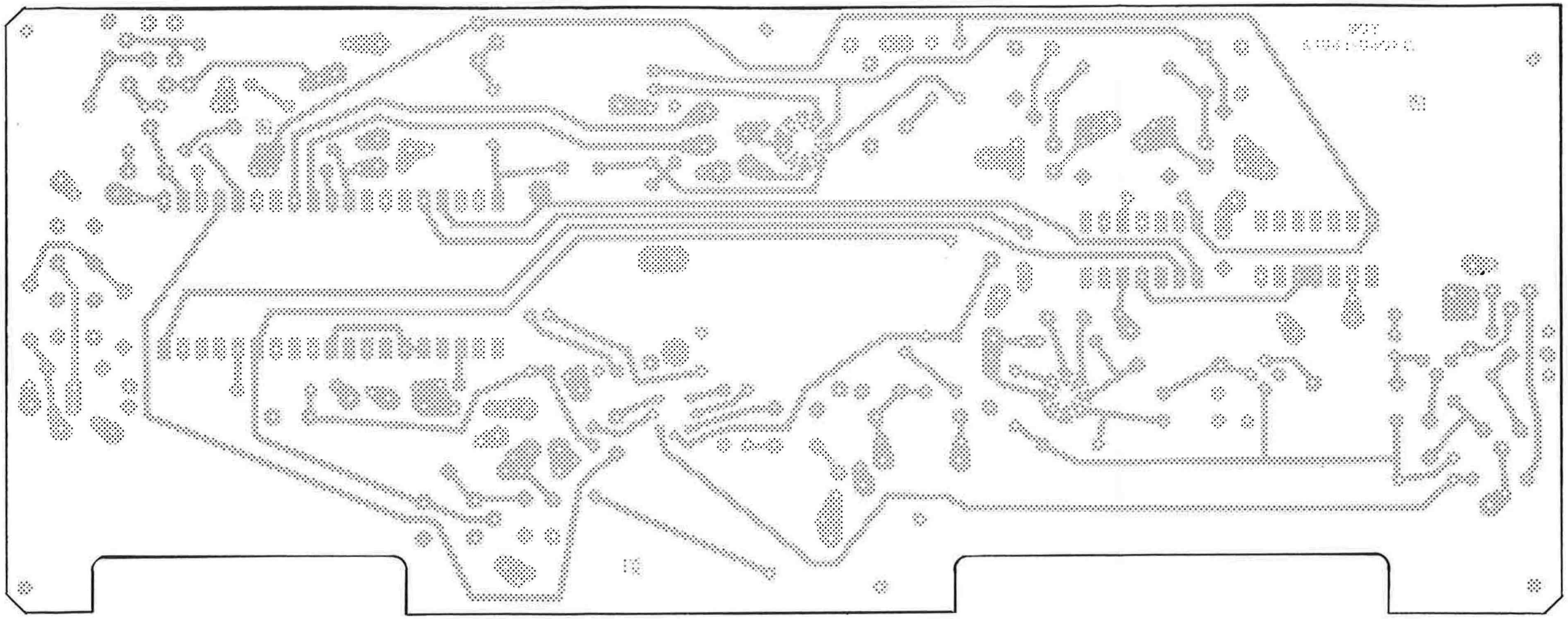


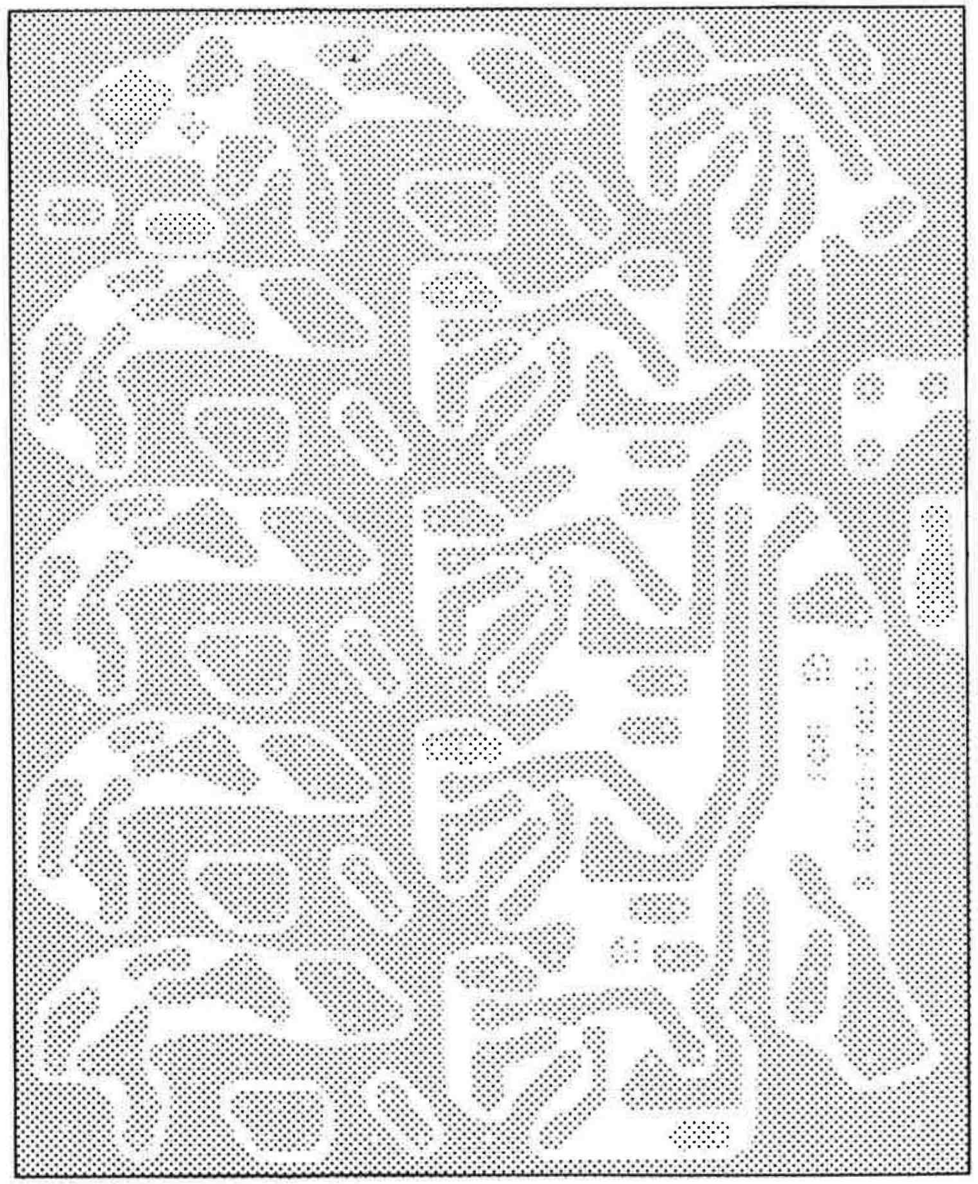

Figure 6-20. Printed Circuit Board 1A7A1, Component Location Diagram (Sheet 1 of 2)



BOTTOM SIDE PC BOARD 51941-9407

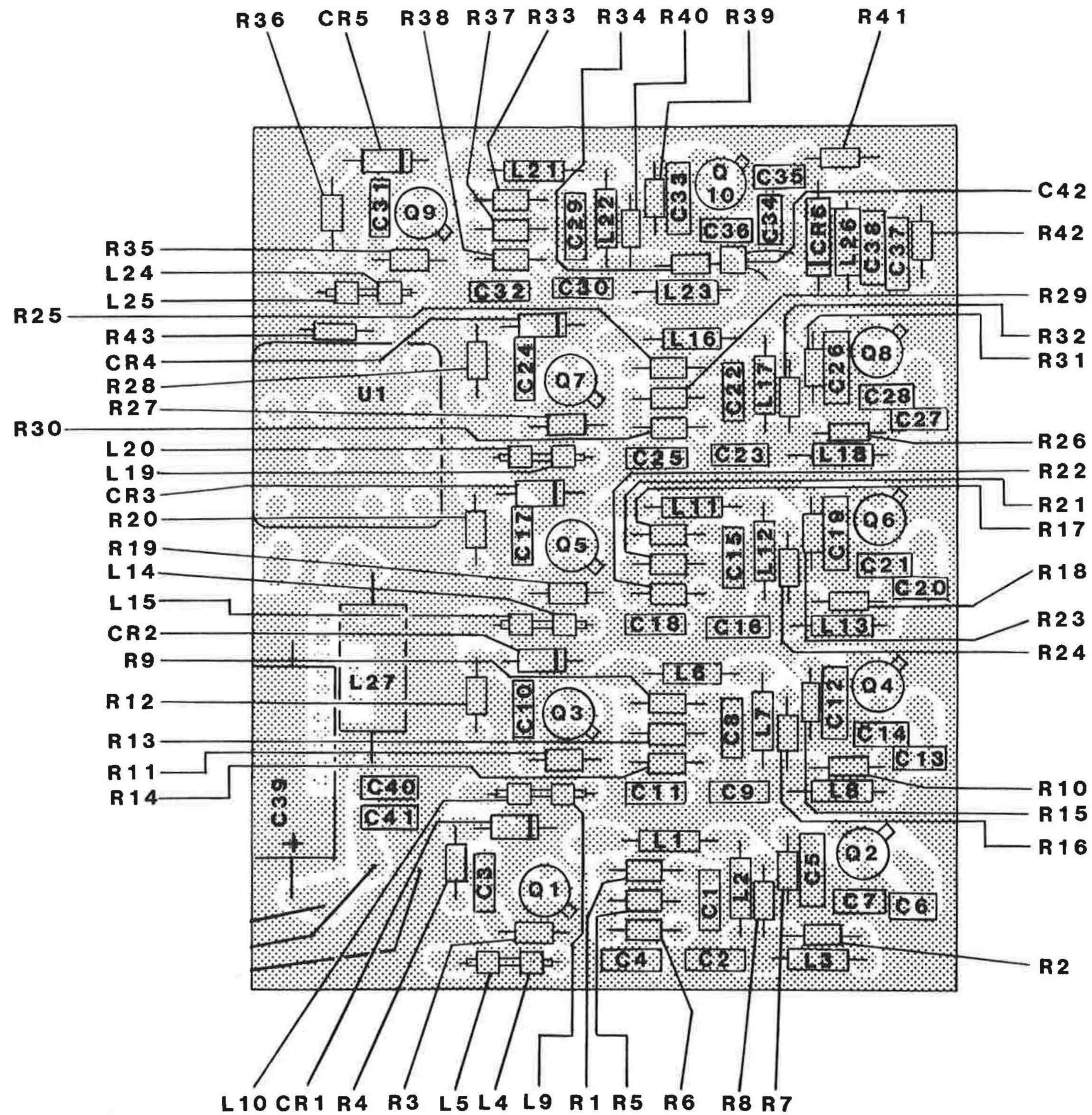
TM51931-9407A-2F

Figure 6-20. Printed Circuit Board 1A7A1, Component Location Diagram (Sheet 2 of 2)



BOTTOM SIDE PC BOARD 51962-9408

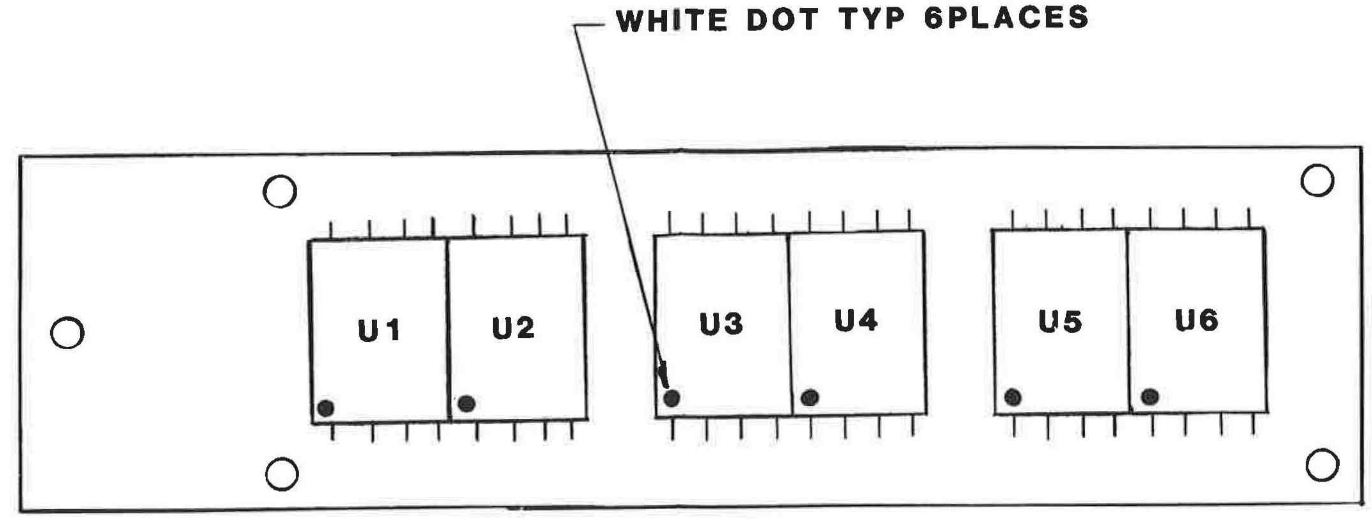
TM51961-9408A-1B



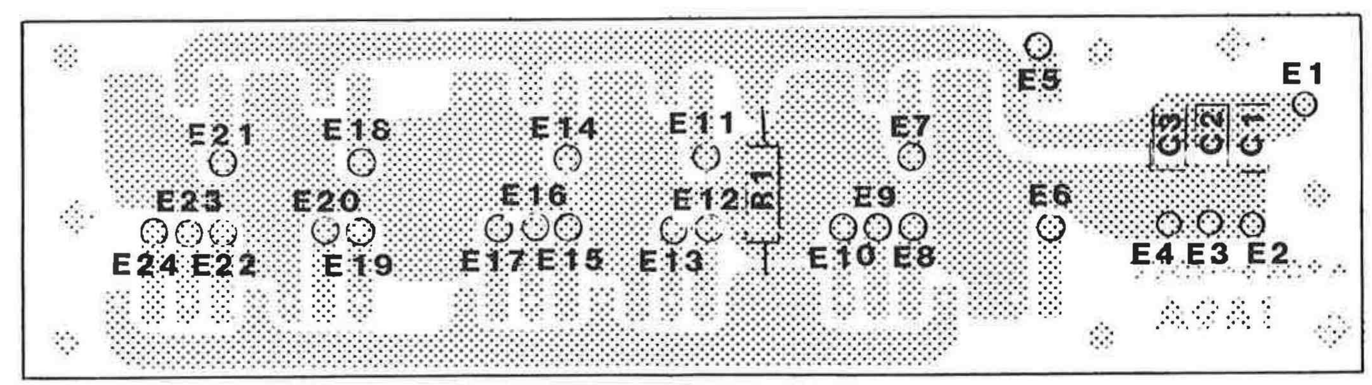

TOP SIDE PC BOARD 51962-9408

TM51961-9408A-1A

Figure 6-21. Printed Circuit Board 1A8A1, Component Location Diagram




TOP SIDE PC BOARD 22011-6209




BOTTOM SIDE PC BOARD 22011-6209

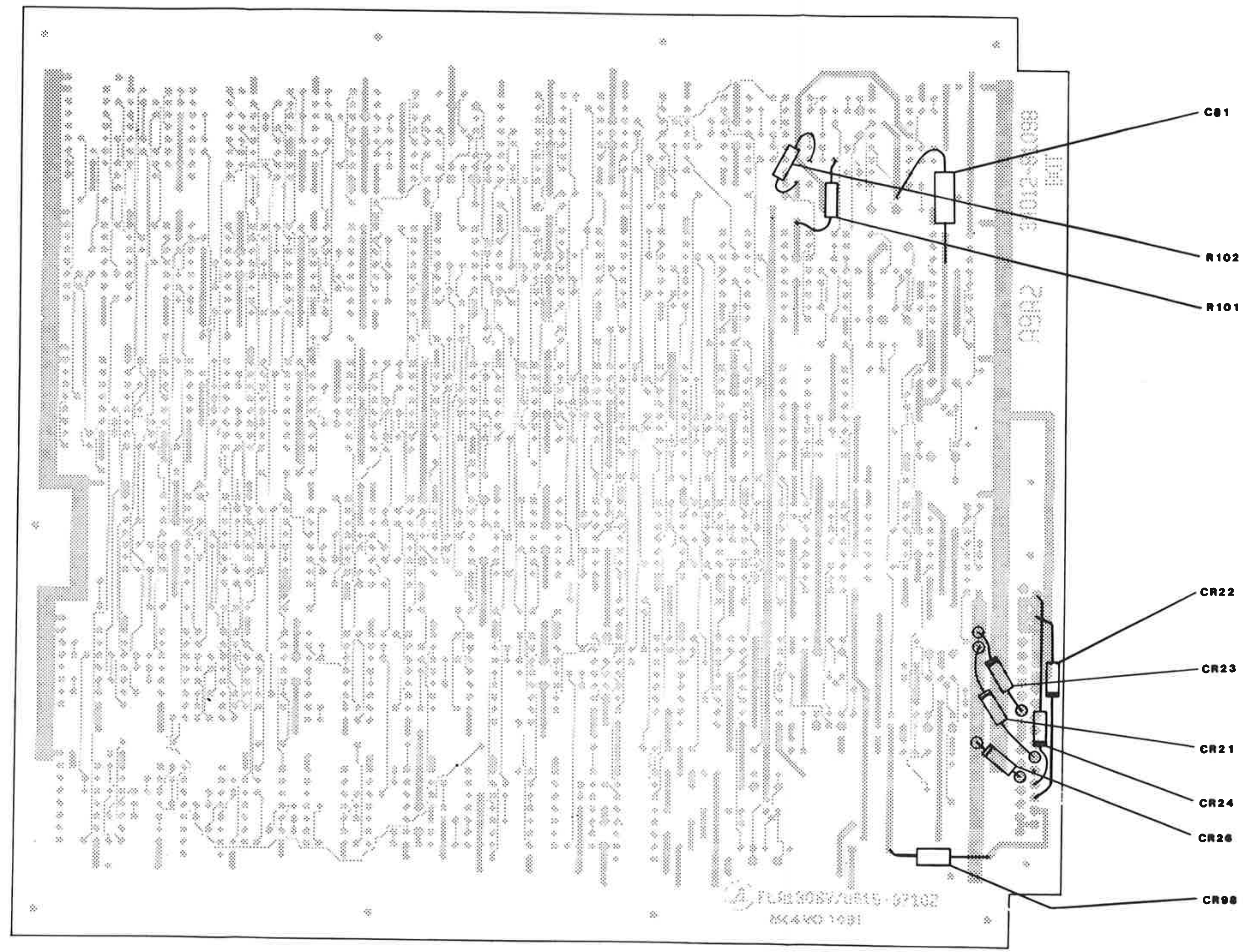
TM22001-9409A

Figure 6-22. Printed Circuit Board 1A9A1, Component Location Diagram


TOP SIDE PC BOARD 34012-8109

TM22002-9409A-1

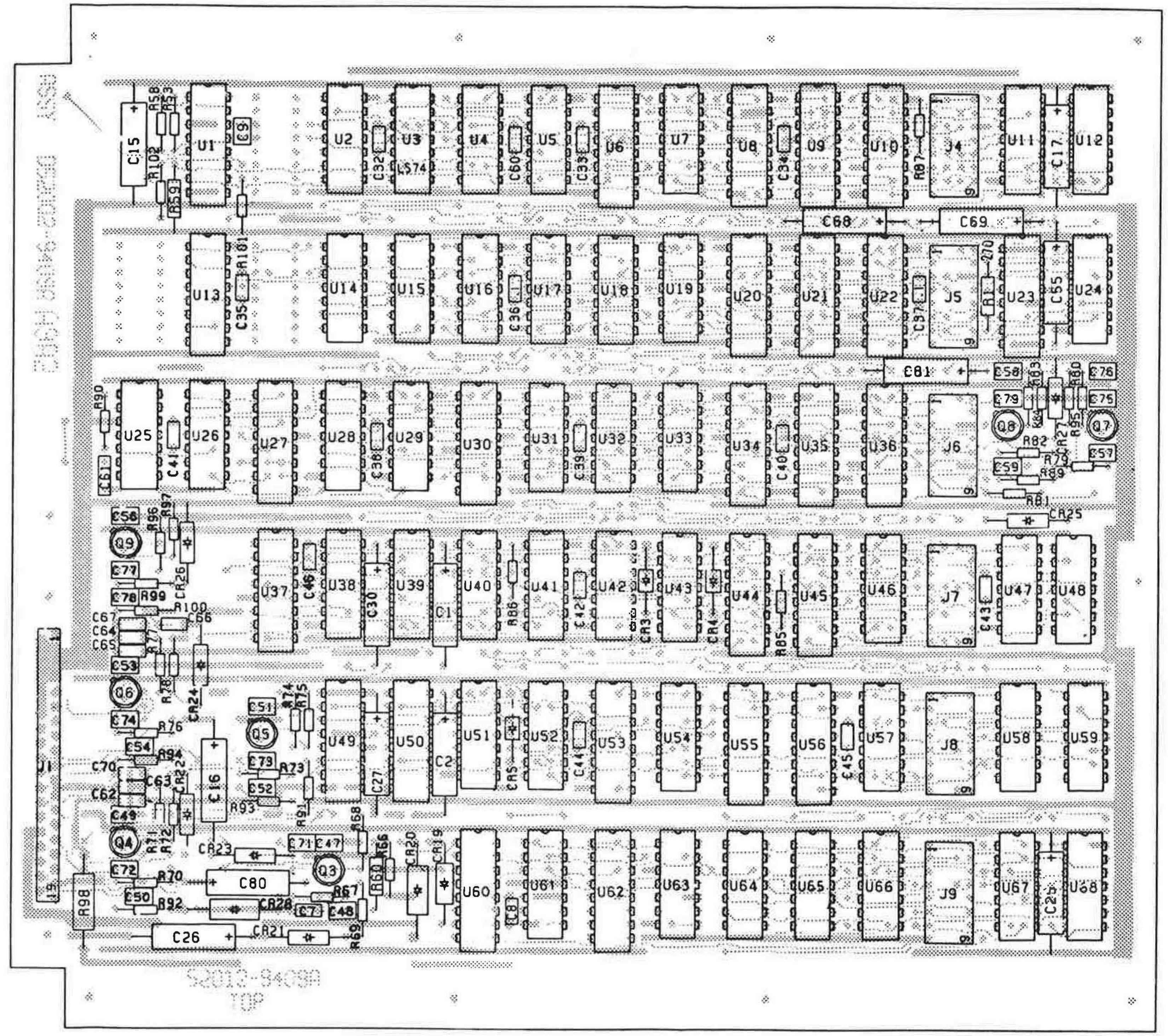
Figure 6-23. Printed Circuit Board 1A9A2, (P/N 52002-9409), Component Location Diagram (Sheet 1 of 2)




BOTTOM SIDE PC BOARD 34012-8109

TM22002-9409A-2F

Figure 6-23. Printed Circuit Board 1A9A2, (P/N 52002-9409), Component Location Diagram (Sheet 2 of 2)




TOP SIDE PC BOARD 52012-9409

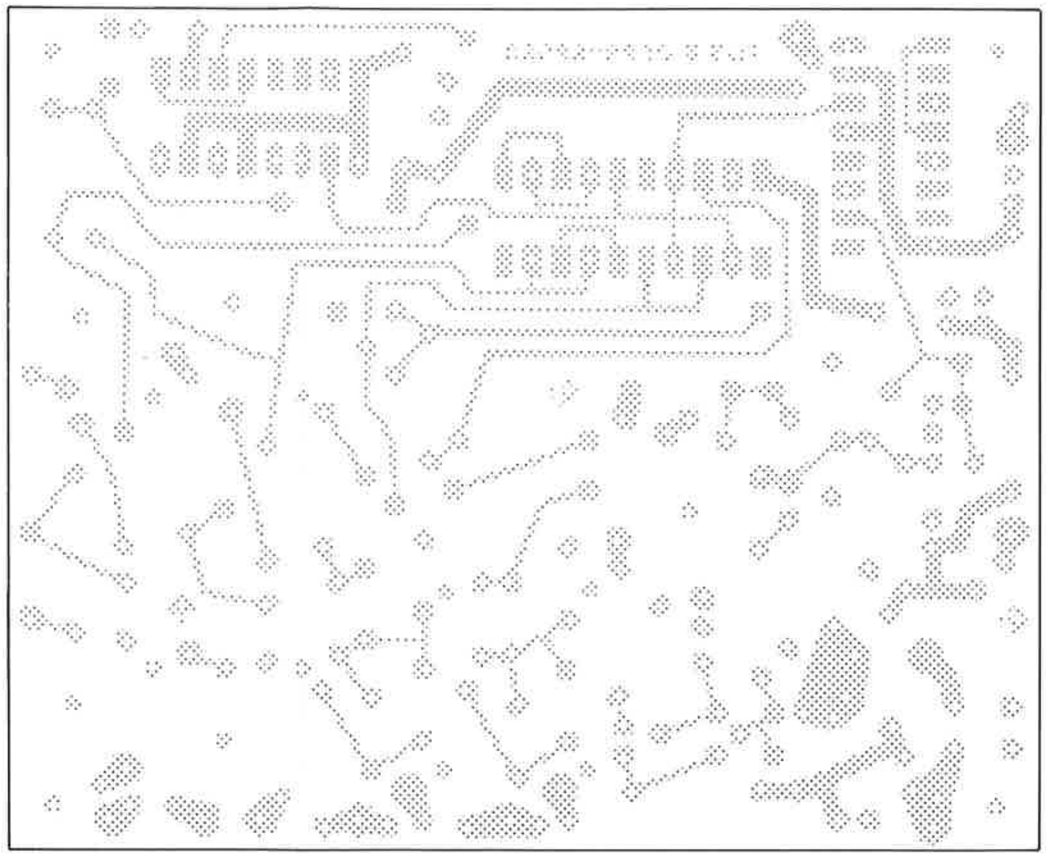
TM22002-9409-1A-1

Figure 6-24. Printed Circuit Board 1A9A2, (P/N 52002-9409-1), Component Location Diagram (Sheet 1 of 2)

BOTTOM SIDE PC BOARD 52012-9409

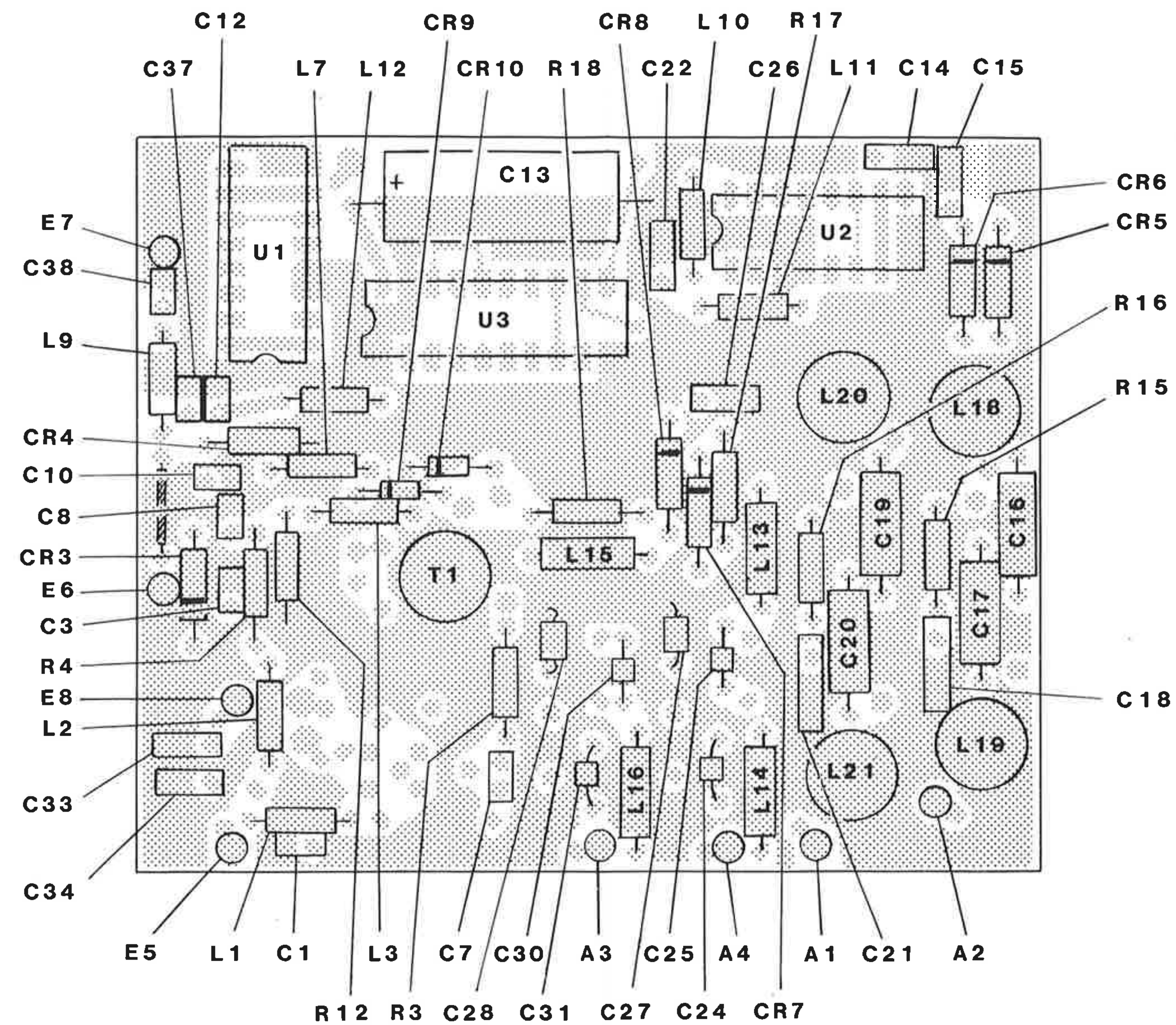
TM22002-9409-1A-2F

Figure 6-24. Printed Circuit Board 1A9A2, (P/N 52002-9409-1), Component Location Diagram (Sheet 2 of 2)



BOTTOM SIDE PC BOARD 52042-9410

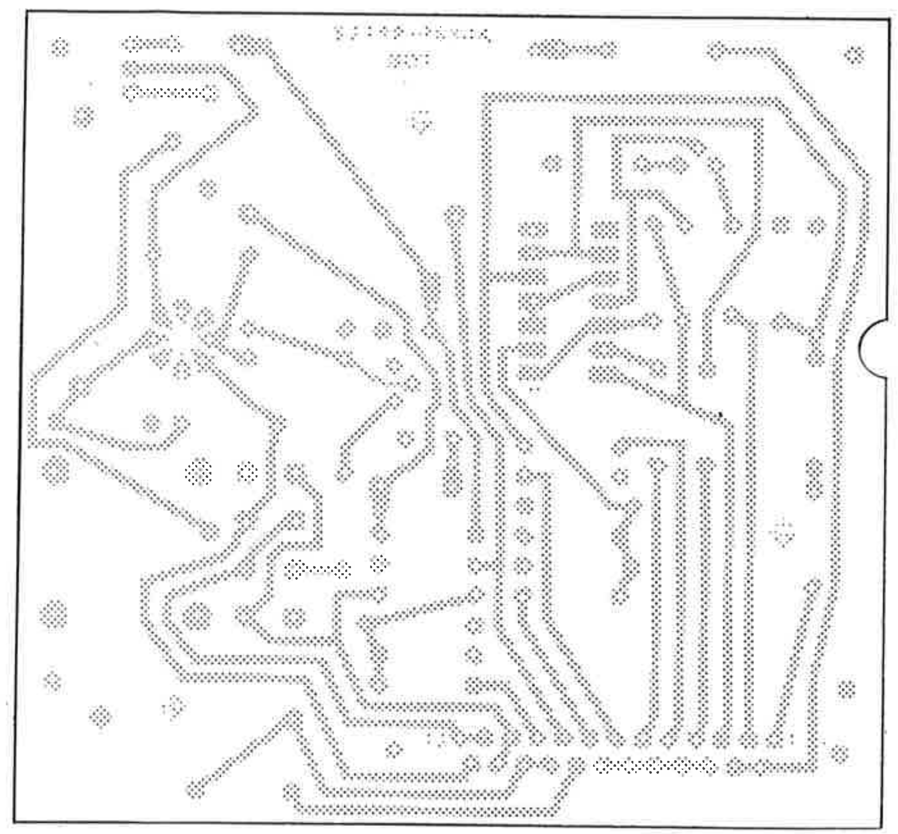
TM52041-9410A-1B




TOP SIDE PC BOARD 52042-9410

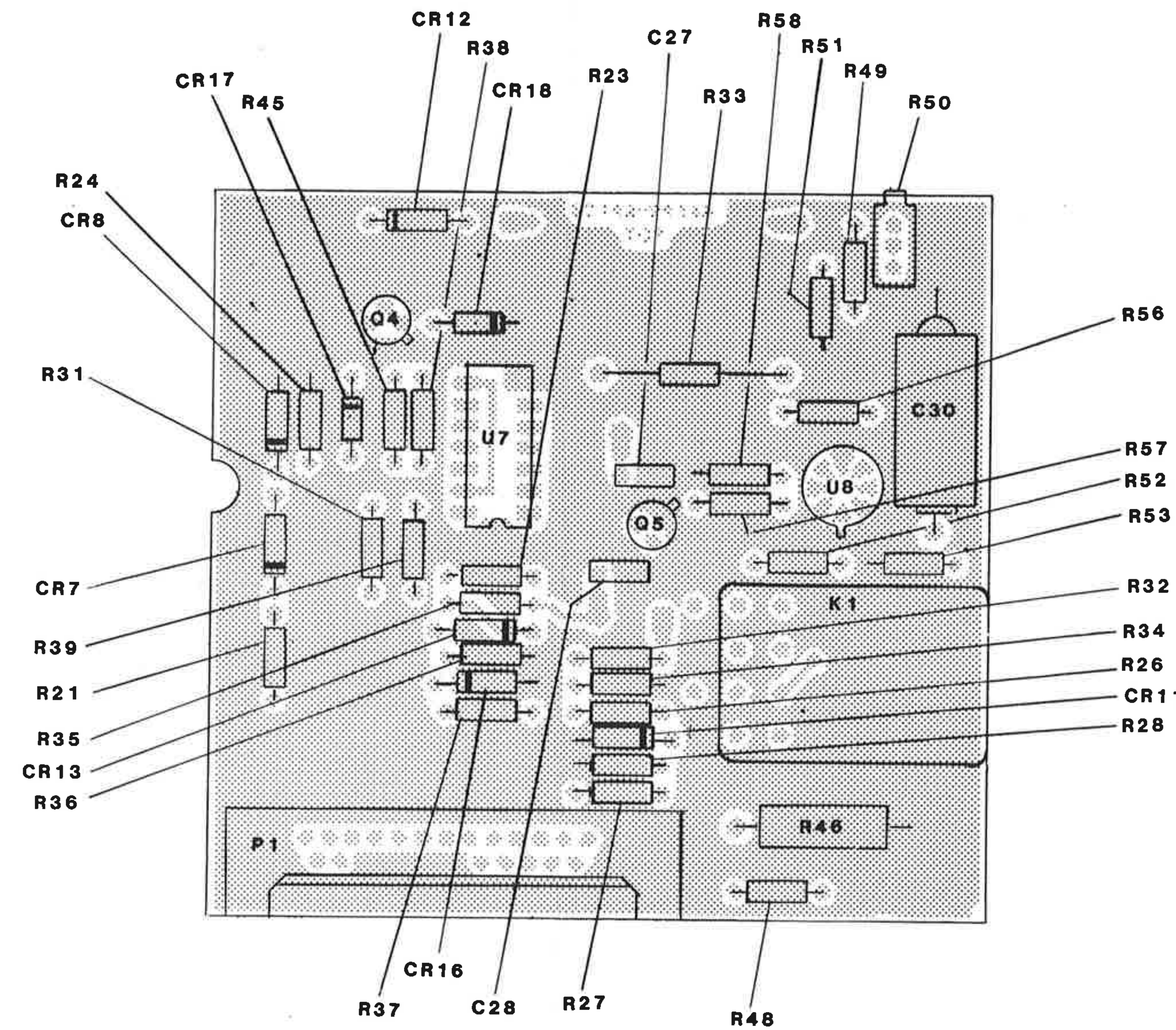
TM52041-9410A-1A

Figure 6-25. Printed Circuit Board 1A10A1, Component Location Diagram



BOTTOM SIDE PC BOARD 52142-9414

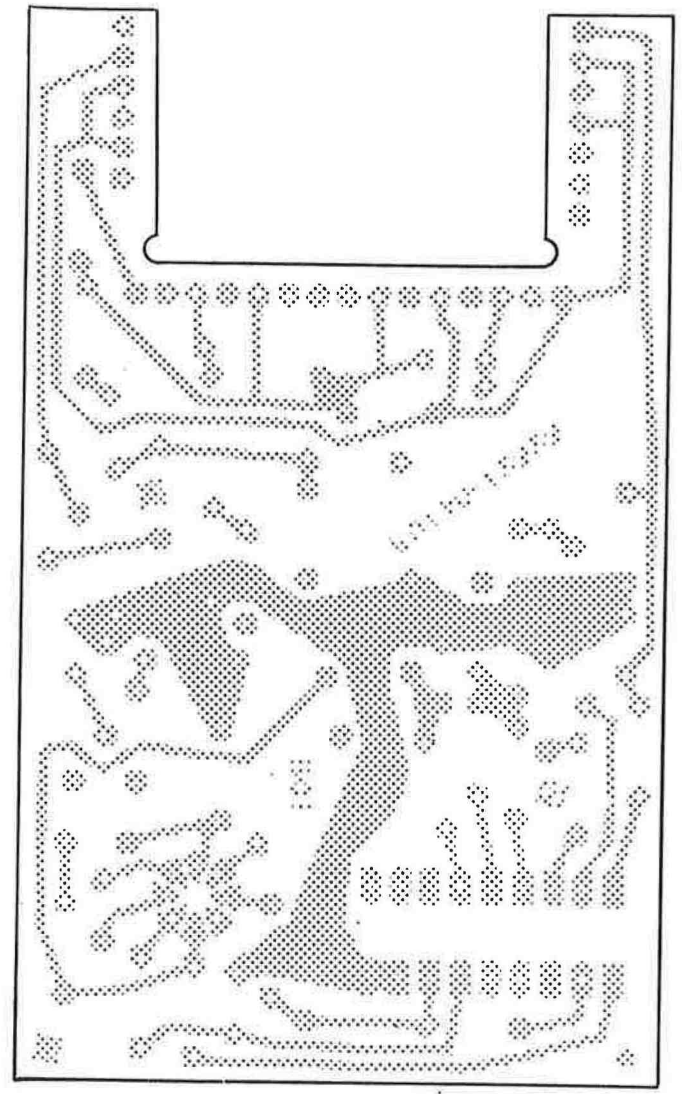
TM52141-9414A-1B




TOP SIDE PC BOARD 52142-9414

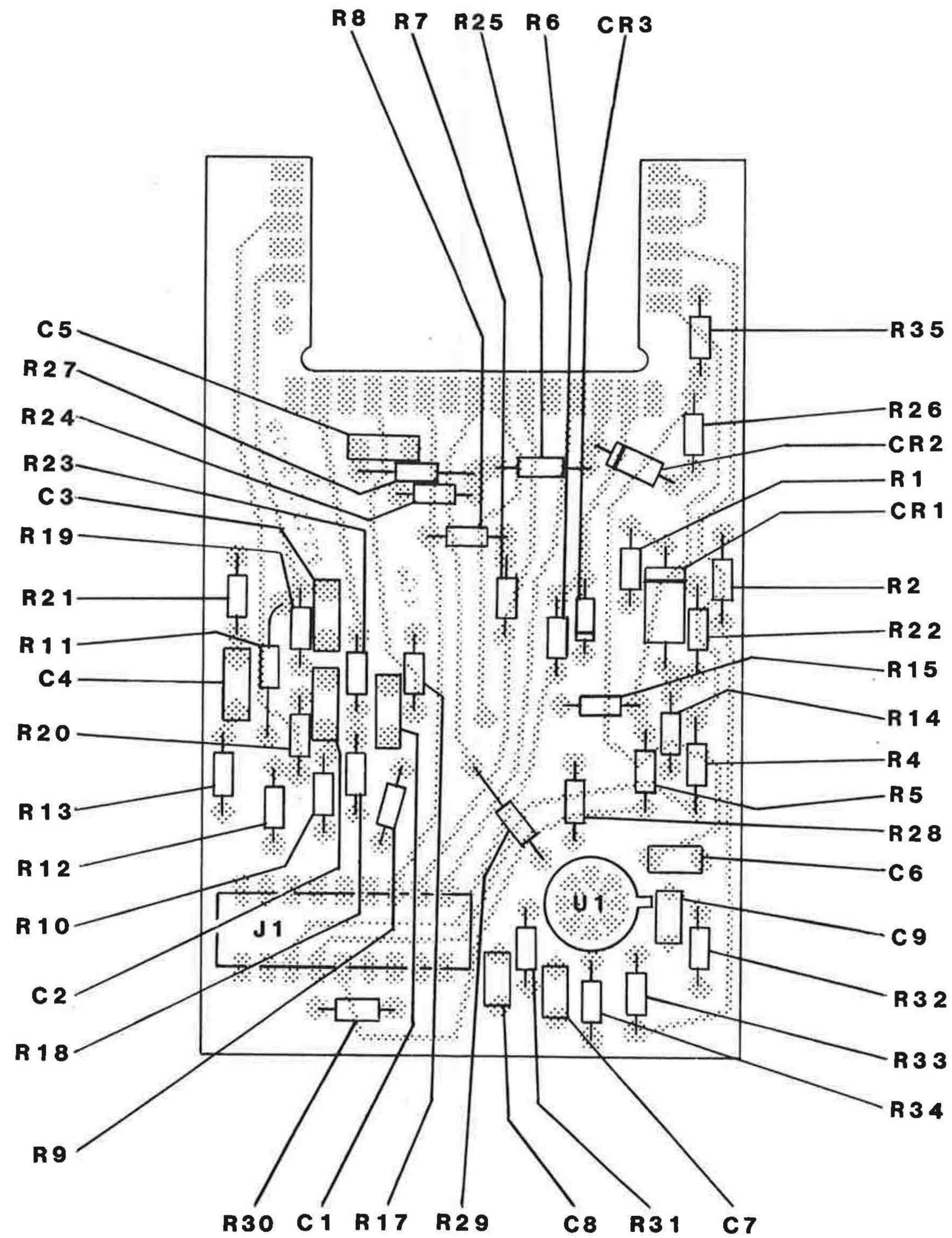
TM52141-9414A-1A

Figure 6-26. Printed Circuit Board 1A14A1, Component Location Diagram



**BOTTOM SIDE PC BOARD 52521-9418**

TM52531-9416A-1B




**TOP SIDE PC BOARD 52521-9418**

TM52531-9416A-1A

Figure 6-27. Printed Circuit Board 1A16A1, Component Location Diagram

# CHAPTER 7

# PARTS LIST

7-1. INTRODUCTION. This chapter contains information necessary to identify and obtain replacement parts required to maintain MRC 0-1824/U at the organizational and intermediate/depot levels.

7-2. PARTS LIST. The Parts List (table 7-1) is divided and arranged by major assemblies including their subassemblies and parts in alpha-numeric sequence (e.g., 1A1 with its parts, precedes 1A2 with its parts). All parts attached to a major assembly are listed first, then each of its subassemblies would be listed, each followed by their respective parts, for example: Major assembly 1A5 with its parts 1A5C1, 1A5J1, etc. would be listed before subassembly 1A5A1 with its parts such as 1A5A1CR1 or 1A5A1R1. Table 7-1 provides information in columns headed as follows:

7-2.1 Reference Designation Column. This column contains the reference designations listed in sequential order. The Unit numbering method of assigning reference designations has been used to identify units, assemblies, subassemblies, and parts. This method has been expanded as much as necessary to adequately cover the various degrees of subdivision of the equipment. Examples of this unit numbering method and typical expansions of the same are illustrated by the following:

Example 1: 1A5L1

| 1A5 | L | 1 |
|---|---|---|
| Assy. No. | Class of Item | Item No. within class |

Read as: Inductor (L) number one (1) of assembly 1A5

Example 2: 1A7A1K1

| 1A7 | A1 | K | 1 |
|---|---|---|---|
| Assy. No. | Subassembly Designation | Class of Item | Item No. within class |

Read as: Relay (K) number one (1) of subassembly number (A1) of assembly 1A7.

7-2.2 Notes Column. This column is reserved to identify equipment reference information such as serial number, model number, configuration data, etc. (See notes in paragraph 7-8.) An asterisk (*) indicates that this is a selected value part, with initial value shown.

7-2.3 Name and Description Column. This column provides descriptive data, including military type or manufacturer's part number and manufacturer's code to identify the parts of the equipment.

7-2.4 Figure Number Column. This column references the illustration which pictorially locates the part.

7-3. LIST OF COMMON ITEM DESCRIPTIONS. Table 7-2 provides a listing of items with more than five applications.

7-4. LIST OF COMMON BULK ITEMS. Table 7-3 contains a description of common bulk items used in the MRC. Numbr codes are assigned in consecutive order for identification purposes.

7-5. LIST OF ATTACHING HARDWARE. Table 7-4 provides a listing of hardware used in the MRC with a quantity of more than five, in part number order.

7-6. LIST OF MANUFACTURERS. Table 7-5 lists the manufacturers of parts used in the MRC. This table includes the manufaturers' five digit code number used in table 7-1 to identify the manufacturers.

7-7. PARTS LOCATION ILLUSTRATIONS. Figures 6-6 through 6-28 are provided showing the location of parts. Mechanical Parts (MP) listed in legend under Reference Designation are listed in index number order. Partial reference designations are used on the illustrations as well as on the equipment. The partial reference designations consist of the class letter(s) and the identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. The appropriate prefix for each unit, assembly, and subassembly is given in the title of the corresponding illustrations.

7-8. NOTES. The following notes are referenced in the notes column of table 7-1:

Note 1. Applicable to 1A9A2, Part Number D52002-9409

Note 2. Applicable to 1A9A2, Part Number D52002-9409-1

7-9. HOW TO LOCATE PART IN PARTS LIST.

7-9.1 <u>When the Reference Designation is Known</u>.

a. Locate part in reference designation column of parts list (table 7-1).

b. If physical location is desired, refer to figure number column of parts list (table 7-1).

7-9.2 <u>When the Reference Designation is Not Known</u>.

a. Search illustrations at end of Chapter 6 until part is located.

b. Note its partial reference designation and add the prefix that is part of the figure title.

c. Locate part in reference designation column of parts list (table 7-1). If part is a hardware item (mechanical part (MP)), refer to table 7-4.

Table 7-1. Parts List

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| | | MASTER REGULATING CLOCK (MRC): mfr 14844, part no. D21700-6200-3 | 6-5 |
| 1 | | CHASSIS SUBASSEMBLY: mfr 14844, part no. D52490-9418 | 6-6 |
| 1B1 | | BLOWER: 48V, mfr 23936, part no. 8148 | 6-6 |
| 1C1 | | CAPACITOR, POLYCARB: 2800 uf, 75 WVDC, mfr 14844, part no. 22742-6200-1 | 6-6 |
| 1C2 and 1C3 | | CAPACITOR, CERAMIC: 0.1 uf, $\pm$10%, 100 WVDC, mfr 81349, MIL type CKR06BX104KR | 6-6 |
| 1C4 | | CAPACITOR, TANTALUM: 6.8 uf, $\pm$10%, 35 WVDC, mfr 56289, part no. CSR13F685KR | 6-6 |
| 1C5 | | CAPACITOR, CERAMIC: same as 1C2 | 6-6 |
| 1CR1 and 1CR2 | | DIODE: mfr 81349, MIL type JANTX1N4148 | 6-6 |
| 1CR3 thru 1CR10 | | NOT USED | |
| 1CR11 | | DIODE: 36V, mfr 81349, MIL type JANTX1N2991B | 6-6 |
| 1DS1 | | DIODE: LED (red), mfr 50434, part no. HLMP4700 | 6-6 |
| 1DS2 | | DIODE: LED (amber), mfr 50434, part no. HLMP4719 | 6-6 |
| 1DS3 thru 1DS7 | | DIODE: LED (green), mfr 50434, part no. HLMP3507 | 6-6 |
| 1F1 and 1F2 | | FUSE, SLO BLO: 2A, 250V, mfr 81349, MIL type F02B250V2A | 2-2 |
| 1F3 and 1F4 | | FUSE, SLO BLO: 4A, 250V, mfr 81349, MIL type F02B250V4A | 2-2 |
| 1F5 | | FUSE, SLO BLO: same as 1F1 | 6-6 |
| 1F6 | | FUSE, SLO BLO: same as 1F3 | 6-6 |
| 1FL1 and 1FL2 | | FILTER, LINE, RF: mfr 81349, MIL type M15733/05-001 | 6-6 |
| 1J1 | | CONNECTOR: mfr 71468, part no. DAMM7W2S | 6-6 |
| 1J2 | | CONNECTOR: mfr 71468, part no. DBMMF13W3S | 6-6 |
| 1J3 | | CONNECTOR: mfr 71468, part no. DBMMF25S | 6-6 |
| 1J4 | | CONNECTOR: mfr 74168, part no. DCMMF21WA4S | 6-6 |
| 1J5 | | CONNECTOR: mfr 71468, part no. DBMMF9WF4S | 6-6 |
| 1J6 | | CONNECTOR: mfr 71468, part no. DCMMF13W6S | 6-6 |
| 1J7 | | CONNECTOR: same as J5 | 6-6 |
| 1J8 thru 1J10 | | CONNECTOR, BNC, RF TYPE: mfr 81349, MIL type M39012/21-0001 | |
| 1J11 | | CONNECTOR: same as 1J3 | 6-6 |
| 1J12 | | CONNECTOR: mfr 71468, part no. M24308/3-1 | 6-6 |
| 1J13 | | CONNECTOR: mfr 96906, MIL type MS3102R14S-6P | 6-6 |
| 1J14 | | CONNECTOR: mfr 96906, MIL type MS3122E14-12P | 6-6 |
| 1J15 thru 1J18 | | CONNECTOR: mfr 96906, MIL type MS3102R10SL-4P | 2-2 |
| 1J19 thru 1J21 | | CONNECTOR: mfr 96906, MIL type MS3102R10SL-3P | 2-2 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1J22 | | CONNECTOR: same as 1J15 | 2-2 |
| 1J23 | | CONNECTOR: mfr 96906, MIL type MS1511/ 21EB02S1 | 6-6 |
| 1J24 thru 1J27 | | CONNECTOR BNC: same as 1J8 | 2-2 |
| 1J28 | | PHONO JACK, MICRO JAX: mfr 82389, part no. TR-2A | 6-6 |
| 1L1 | | INDUCTOR, 5MH: mfr 04213, part no. 6310-13 | 6-6 |
| 1L2 | | INDUCTOR, 40MH: mfr 27675, part no. 3148 | 6-6 |
| 1M1 | | METER: mfr 11707, part no. 1610-63-1 | 6-6 |
| 1P1 | | CONNECTOR: mfr 71468, part no. DAMM15S | 6-6 |
| 1P2 | | CONNECTOR: mfr 71468, part no. DCMM37S | 6-6 |
| 1P3 | | CONNECTOR: 18 pin plug carrier, mfr 91506, part no. 618-AG16 | 6-6 |
| 1P4 and 1P5 | | CONNECTOR, RIGHT ANGLE: mfr 98291, part no. 55-628-9196-31 | 6-6 |
| 1P6 | | CONNECTOR, P/O SEMI RIGID CABLE ASSY: mfr 14844, part no. 51768-9400 | 6-6 |
| 1P7 | | CONNECTOR: same as 1P4 | 6-6 |
| 1R1 | | RESISTOR, MULTITURN: 20K, ±10%, 2W, mfr 80294, part no. 3501S-203 | 6-6 |
| 1R2 | | RESISTOR, VARIABLE: 20K, 1/2W, mfr 81349 MIL type RJR24FW203P | 6-6 |
| 1R3 and 1R4 | | RESISTOR, FILM: 470K, ±2%, 1/4W, mfr 81349, MIL type RLR07C474GP | 6-6 |
| 1R5 | | RESISTOR, FILM: 1K, ±2%, 1/4W, mfr 81349, MIL type RLR07C1001GR | 6-6 |
| 1R6 and 1R7 | | RESISTOR, FILM: 330 ohms, ±2%, 1/4W, mfr 81349, MIL type RLR07C3300GR | 6-6 |
| 1R8 | | VARISTOR: mfr 14844, part no. 22786-6200 | 6-6 |
| 1S1 | | SWITCH PUSHBUTTON: mfr 21649, part no. M8805/110-5161 | 6-6 |
| 1S2 | | NOT USED | |
| 1S3 | | SWITCH SLIDE, 2 POSITION: mfr 29604, part no. S5022CD03-0 | 6-6 |
| 1S4 | | SWITCH, ON-OFF, 4PDT, LOCKING BAT: mfr 95146, part no. MTL-406N | 6-6 |
| 1T1 | | TRANSFORMER: mfr 27675, part no. DT-3741 | 6-6 |
| 1U1 | | MICROCIRCUIT: mfr 81349, MIL type JANTX2N6059 | 6-6 |
| 1U2 | | MICROCIRCUIT: mfr 14099, part no. SCAJ2 | 6-6 |
| 1U3 and 1U4 | | MICROCIRCUIT: mfr 14099, part no. SCPA2 | 6-6 |
| 1A1 | | CESIUM BEAM RESONATOR ASSEMBLY: mfr 14844, part no. 42701-9201-1 | 6-5 |
| 1A2 | | HIGH VOLTAGE POWER SUPPLY MODULE: mfr 14844, part no. 42702-9202-1 | 6-5 |
| 1A3 | | HIGH VOLTAGE POWER SUPPLY MODULE: mfr 14844, part no. 42703-9203-1 | 6-5 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A4 | | OSCILLATOR MODULE (OCVCXO) 5 MHZ: mfr 14844, part no. 21708-6208-1 | 6-5 |
| 1A5 | | MODULATOR/MULTIPLIER MODULE: mfr 14844, part no. 42705-9205-1 | 6-5 |
| 1A5C1 thru 1A5C5 | | CAPACITOR, CERAMIC: 0.1 uf, ±10%, 50V, mfr 81349, MIL type CKR05BX104KR | 6-7 |
| 1A5C6 | | CAPACITOR, CERAMIC: 0.01 uf, ±10%, 100V, mfr 81349, MIL type CKR05BX103KR | 6-7 |
| 1A5C7 and 1A5C8 | | TUNING SCREW: mfr 91293, part no. 6926-0 | 6-7 |
| 1A5CR1 | | DIODE, STEP RECOVERY: mfr 28480, part no. 33003/B | 6-7 |
| 1A5FL1 and 1A5FL2 | | CAPACITOR FEED-THRU: 1500 pf, mfr 12294, part no. 1250-700 | 6-7 |
| 1A5FL3 and 1A5FL4 | | NOT USED | |
| 1A5FL5 and 1A5FL6 | | CAPACITOR FEED-THRU: same as 1A5FL1 | 6-7 |
| 1A5HY1 | | CIRCULATOR, X-BAND: mfr 14844, part no. 21874-6205-1 | 6-7 |
| 1A5J1 and 1A5J2 | | CONNECTOR, RF, TYPE SMA: mfr 18758, part no. 10-2060-2624 | 6-7 |
| 1A5J3 | | NOT USED | |
| 1A5J4 | | P/O 1A5HY1 | |
| 1A5J5 | | CONNECTOR, RF, TYPE SMA: same as 1A5J1 | 6-7 |
| 1A5L1 thru 1A5L3 | | INDUCTOR: 10 uH, mfr 96906, MIL type MS14046-4 | 6-7 |
| 1A5L4 | | INDUCTOR: 1.0 uH, mfr 96906, MIL type MS18130-8 | 6-7 |
| 1A5R1 thru 1A5R15 | | NOT USED | |
| 1A5R16 | | RESISTOR, FILM: 39K, ±2%, 1/8W, mfr 81349, MIL type RLR05C3902GR | 6-7 |
| 1A5U1 | | MICROCIRCUIT, REGULATOR, ISV: mfr 34333, part no. SG7815AR/883B | 6-7 |
| 1A5A1 | | MODULATOR/TIMES 20 MULTIPLIER PC ASSEMBLY: mfr 14844, part no. 51861-9405 | 6-15 |
| 1A5A1C1 and 1A5A1C2 | | NOT USED | |
| 1A5A1C3 | | CAPACITOR, CERAMIC: same as 1A5C1 | 6-15 |
| 1A5A1C4 | | CAPACITOR, CERAMIC: 1 uf, ±10%, 50V, mfr 81349, MIL type CKR06BX105KR | 6-15 |
| 1A5A1CR1 | | DIODE, ZENER: 9.0V, ±5%, 500MV, mfr 81349, MIL type JANTX1N938B | 6-15 |
| 1A5A1R1 | | RESISTOR, VARIABLE: 20K, mfr 81349, MIL type RJR26FW203PR | 6-15 |
| 1A5A1R2 | | RESISTOR, FILM: 1.2K, ±2%, 1/8W, mfr 81349, MIL type RLR05C1201GR | 6-15 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A5A1Z1 | | MICROCIRCUIT, HYBRID: mfr 14844, part no. C35881-7905-2 | 6-15 |
| 1A5A1Z2 | | MICROCIRCUIT, HYBRID: mfr 14844, part no. C42882-9205 | 6-15 |
| 1A5A2 | | CRYSTAL FILTER, 100 MHZ, ASSEMBLY: mfr 14844, part no. 51862-9405 | 6-16 |
| 1A5A2C1 | | CAPACITOR, VARIABLE: 0.6 - 4.5 pf, mfr 91293, part no. R7273 | 6-16 |
| 1A5A2C2 | * | CAPACITOR, CERAMIC: mfr 93958, part no. 1U5RK | 6-16 |
| 1A5A2C3 | | CAPACITOR, VARIABLE: same as 1A5A2C1 | 6-16 |
| 1A5A2C4 | * | CAPACITOR, CERAMIC: same as 1A5A2C2 | 6-16 |
| 1A5A2C5 and 1A5A2C6 | | CAPACITOR, VARIABLE: same as 1A5A2C1 | 6-16 |
| 1A5A2C7 | * | CAPACITOR, CERAMIC: same as 1A5A2C2 | 6-16 |
| 1A5A2C8 | | CAPACITOR, VARIABLE: same as 1A5A2C1 | 6-16 |
| 1A5A2C9 | | CAPACITOR, CERAMIC: 1pf, ±0.5%, 50V, mfr 14844, part no. A40154-SCD-7502 | 6-16 |
| 1A5A2C10 | | Same as 1A5A2C9 | |
| 1A5A2L1 | * | INDUCTOR: mfr 14844, part no. 35888-7905 | 6-16 |
| 1A5A2T1 and 1A5A2T2 | | TRANSFORMER: mfr 14844, part no. 35889-7905-1 | 6-16 |
| 1A5A2Y1 | | CRYSTAL: 100 MHz, mfr 14844, part no. 42887-9205-1 | 6-16 |
| 1A5A2Y2 | | CRYSTAL: 100 MHz, mfr 14844, part no. 42887-9205-2 | 6-16 |
| 1A5A3 | | TIMES 2 OUTPUT MULTIPLIER PC ASSEMBLY: mfr 14844, part no. 51863-9405 | 6-17 |
| 1A5A3C1 thru 1A5A3C11 | | NOT USED | |
| 1A5A3C12 | | CAPACITOR, VARIABLE: same as 1A5A2C1 | 6-17 |
| 1A5A3C13 | | CAPACITOR, CERAMIC: 0.001 uf, ±5%, 50V, mfr 51642, part no. 150-100-NPO-102J | 6-17 |
| 1A5A3C14 | | CAPACITOR, CERAMIC: 390 pf, ±5%, 100V, mfr 51642, part no. 150-100-NPO-391J | 6-17 |
| 1A5A3C15 | | CAPACITOR, VARIABLE: same as 1A5A2C1 | 6-17 |
| 1A5A3C16 | | CAPACITOR, CERAMIC: 10 pf, ±5%, 100V, mfr 51642, part no. 100-100-NPO-100J | 6-17 |
| 1A5A3C17 | | CAPACITOR, VARIABLE: same as 1A5A2C1 | 6-17 |
| 1A5A3C18 | | CAPACITOR, CERAMIC: 68 pf, ±5%, 100V, mfr 51642, part no. 200-100-NPO-680J | 6-17 |
| 1A5A3C19 | | CAPACITOR, CERAMIC: 15 pf, ±5%, 100V, mfr 51642, part no. 100-100-NPO-150J | 6-17 |
| 1A5A3C20 | | CAPACITOR, CERAMIC: same as 1A5A3C14 | 6-17 |
| 1A5A3C21 | | CAPACITOR, CERAMIC: 0.01 uf, ±10%, 100V, mfr 81349, MIL type MIL-C-39014/1 | 6-17 |
| 1A5A3C22 | | CAPACITOR, VARIABLE: same as 1A5A2C1 | 6-17 |
| 1A5A3C23 | | CAPACITOR, CERAMIC: same as 1A5A3C14 | 6-17 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A5A3C24 and 1A5A3C25 | * | CAPACITOR, CERAMIC: 39 pf, ±5%, 200V, (1-100 pf) mfr 51642, part no. 100-100-NPO-xxxJ | 6-17 |
| 1A5A3C26 | | CAPACITOR, CERAMIC: 39 pf, ±5%, 100V, mfr 51642, part no. 150-100-NPO-390J | 6-17 |
| 1A5A3CR1 | | DIODE, IN5711: mfr 81349, MIL type JANTX1N5711 | 6-17 |
| 1A5A3L1 thru 1A5A3L3 | | NOT USED | |
| 1A5A3L4 | | INDUCTOR: 0.82 uH, ±10%, 0.38A, mfr 96906 MIL type MS75083-12 | 6-17 |
| 1A5A3L5 | * | INDUCTOR: mfr 14844, part no. 35891-7905-1 | 6-17 |
| 1A5A3L6 | | INDUCTOR: 0.05 uH, mfr 14844, part no. 35891-7905-2 | 6-17 |
| 1A5A3L7 | | INDUCTOR: 0.15 uH, ±10%, 1.1A, mfr 99800, part no. 1025-00 | 6-17 |
| 1A5A3L8 | | INDUCTOR: same as 1A5A3L4 | 6-17 |
| 1A5A3L9 | | INDUCTOR: 3.3 uH, mfr 96906, MIL type MS75084-06 | 6-17 |
| 1A5A3Q1 and 1A5A3Q2 | | NOT USED | |
| 1A5A3Q3 | | TRANSISTOR, SI, NPN: mfr 04713, part no. MRF511 | 6-17 |
| 1A5A3R1 thru 1A5A3R9 | | NOT USED | |
| 1A5A3R10 | | RESISTOR, FILM: 1K, ±2%, 1/8W, mfr 81349, MIL no. RLR05C1001GR | 6-17 |
| 1A5A3R11 and 1A5A3R12 | | RESISTOR, FILM: 20, ±2%, 1/4W, mfr 81349, MIL type RLR07C2000GR | 6-17 |
| 1A5A3R13 and 1A5A3R14 | * | RESISTOR, FILM: mfr 81349, MIL type RLR05C2701GR | 6-17 |
| 1A5A3R15 | | RESISTOR, VARIABLE: 0-200, mfr 81349, MIL type RJR26FW201P | 6-17 |
| 1A5A3RT1 | * | THERMISTER: mfr 14844, part no. A40510-SCD-XXX | |
| 1A5A3Z1 and 1A5A3Z2 | | NOT USED | |
| 1A5A3Z3 | | MICROCIRCUIT, HYBRID: mfr 14844, part no. C35883-7905-2 | 6-17 |
| 1A5A4 | | OSCILLATOR, PC ASSY: mfr 14844, part no. 51864-9405 | 6-18 |
| 1A5A4C1 | * | CAPACITOR, CERAMIC: mfr 51642, part no. 100-100-NP0391J | 6-18 |
| 1A5A4C2 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-18 |
| 1A5A4C3 | * | CAPACITOR, CERAMIC: same as 1A5A4C1 | |
| 1A5A4L1 | * | INDUCTOR: mfr 96906, MIL type MS18310-8 | 6-18 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A5A4R1 | | RESISTOR, FILM: 100K, ±2%, 1/8W, mfr 81349, MIL type RLR05C1003GR | 6-18 |
| 1A5A4Y1 | | CRYSTAL, QUARTZ: 7.368 MHz, mfr 14844, part no. 42873-9205 | 6-18 |
| 1A5A4Z1 thru 1A5A4Z3 | | NOT USED | |
| 1A5A4Z4 | | MICROCIRCUIT, HYBRID: mfr 14844, part no. 42884-9205 | 6-18 |
| 1A6 | | POWER SUPPLY MODULE: mfr 14844, part no. 51706-9406 | 6-5 |
| 1A6C1 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-19 |
| 1A6C2 thru 1A6C4 | | NOT USED | |
| 1A6C5 | | CAPACITOR, CERAMIC: same as 1A5C1 | 6-19 |
| 1A6C6 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-19 |
| 1A6C7 | | CAPACITOR, TANTALUM: 6.8 uf, ±10%, 50V, mfr 81349, MIL type CSR13G685KR | 6-8 |
| 1A6C8 | | NOT USED | |
| 1A6C9 1A6C10 | | CAPACITOR, CERAMIC: 0.22 uf, ±10%, 50V, mfr 81349, MIL type CKR06BX224KR | 6-19 |
| 1A6C11 | | CAPACITOR, TANTALUM: 150 uf, ±10%, 15V, mfr 81349, MIL type CSR13D157KR | 6-19 |
| 1A6C12 | | NOT USED | |
| 1A6C13 | | CAPACITOR, CERAMIC: 1 uf, ±10%, 50V, mfr 81349, MIL type CKR06BX105KR | 6-19 |
| 1A6C14 | | CAPACITOR, TANTALUM: 47 uf, ±10%, 35V, mfr 81349, MIL type CSR13F476KR | 6-19 |
| 1A6C15 | | NOT USED | |
| 1A6C16 | | CAPACITOR, TANTALUM: 150 uf, ±10%, 30V, mfr 81349, MIL type M39006/22-0557 | 6-19 |
| 1A6C17 | | CAPACITOR, TANTALUM: same as 1A6C14 | 6-8 |
| 1A6C18 and 1A6C19 | | NOT USED | |
| 1A6C20 | | CAPACITOR, TANTALUM: 56 uf, ±10%, 75V, mfr 81349, MIL type M39006/22-0617 | 6-8 |
| 1A6C21 | | CAPACITOR, TANTALUM: same as 1A6C11 | 6-19 |
| 1A6C22 thru 1A6C24 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-19 |
| 1A6C25 | | CAPACITOR, POLYCARB: 0.01 uf, ±10%, 50V, mfr 81349, MIL type M83421/01-2174R | 6-19 |
| 1A6C26 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-19 |
| 1A6C27 and 1A6C28 | | NOT USED | |
| 1A6C29 | | CAPACITOR, TANTALUM: same as 1A6C11 | 6-19 |
| 1A6C30 | | NOT USED | |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A6C31 | | CAPACITOR, CERAMIC: 470 uf, ±10%, 200V, mfr 81349, MIL type CKR05BX471KR | 6-19 |
| 1A6C32 and 1A6C33 | | NOT USED | |
| 1A6C34 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-19 |
| 1A6C35 | | NOT USED | |
| 1A6C36 thru 1A6C39 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-19 |
| 1A6CR1 and 1A6CR2 | | DIODE, SWITCHING: mfr 81349, MIL type JANTX1N5802 | 6-19 |
| 1A6CR3 and 1A6CR4 | | DIODE, SWITCHING: mfr 81349, MIL type JANTX1N5615 | 6-19 |
| 1A6CR5 and 1A6CR6 | | DIODE, SWITCHING: mfr 81349, MIL type JANTX1N5804 | 6-19 |
| 1A6CR7 and 1A6CR8 | | NOT USED | |
| 1A6CR9 and 1A6CR10 | | DIODE, SWITCHING: mfr 81349, MIL type JANTX1N5615 | 6-19 |
| 1A6CR11 thru 1A6CR13 | | NOT USED | |
| 1A6CR14 and 1A6CR15 | | DIODE, SWITCHING: same as 1A6CR1 | 6-19 |
| 1A6CR16 thru 1A6CR19 | | NOT USED | |
| 1A6CR20 | | DIODE, ZENER: 36V, ±5%, 0.40W, mfr 81349, MIL type JANTX1N974B | 6-19 |
| 1A6L1 | | INDUCTOR: 33 uH, mfr 04213, part no. 6310-5 | 6-8 |
| 1A6L2 | | INDUCTOR: 0.3 uH, ±10%, mfr 14844, part no. 51912-9406-1 | 6-19 |
| 1A6L3 | | INDUCTOR: 9 uh, ±10%, mfr 14844, part no. 51912-9406-2 | 6-19 |
| 1A6L4 | | INDUCTOR: 1.2 uH, ±10%, mfr 14844, part no. 51912-9406-3 | 6-19 |
| 1A6L5 | | NOT USED | |
| 1A6L6 | | INDUCTOR: 0.8 uH, ±10%, mfr 14844, part no. 51912-9406-04 | 6-19 |
| 1A6L7 | | INDUCTOR: 2.5 uH, ±10%, mfr 14844, part no. 51912-9406-5 | 6-19 |
| 1A6P1 | | CONNECTOR: mfr 71468, part no. DBMM25PS | 6-8 |
| 1A6Q1 and 1A6Q2 | | TRANSISTOR, SI, NPN: mfr 81349, MIL type JANTX2N6059 | 6-8 |
| 1A6Q3 and 1A6Q4 | | NOT USED | |
| 1A6Q5 | | TRANSISTOR, SI, NPN: mfr 81349, MIL type JANTX2N5664 | 6-8 |
| 1A6R1 | * | RESISTOR, FILM: mfr 81349, MIL type RLR07C1002GR | 6-19 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A6R2 | | RESISTOR, FILM: 33K, ±2%, 1/4W, mfr 81349, MIL type RLR07C3302GR | 6-19 |
| 1A6R3 | | RESISTOR, FILM: 100, ±2%, 1/4W, mfr 81349, MIL type RLR07C1000GR | 6-19 |
| 1A6R4 | | RESISTOR, COMP: 3.3K, ±5%, 1/2W, mfr 81349 MIL type RCR20C332JR | 6-19 |
| 1A6R5 | | RESISTOR, FILM: 15, ±2%, 1/4W, mfr 81349, MIL type RLR07C15R0GR | 6-19 |
| 1A6R6 and 1A6R7 | | RESISTOR, FILM: same as 1R5 | 6-19 |
| 1A6R8 | | RESISTOR, WIRE-WOUND: 0.249, ±1, 7W, mfr 81349, MIL type RWR84SR249FR | 6-8 |
| 1A6R9 | | NOT USED | |
| 1A6R10 | | RESISTOR, FILM: same as 1A6R5 | |
| 1A6R11 | | RESISTOR, FILM: 15K, ±2%, 1/4W, mfr 81349, MIL type RLR07C1502GR | 6-19 |
| 1A6R12 | * | RESISTOR, FILM: 2.2K, ±2%, 1/4W, mfr 81349, MIL type RLR07C2201GR | 6-19 |
| 1A6R13 | | RESISTOR, FILM: 1.5K, ±2%, 1/4W, mfr 81349, MIL type RLR07C1501GR | 6-19 |
| 1A6R14 | | RESISTOR, FILM: 4.99K, ±1%. 1/10W, mfr 81349, MIL type RNC55H4991FR | 6-19 |
| 1A6R15 | | RESISTOR, FILM: same as 1R5 | 6-19 |
| 1A6R16 | | RESISTOR, FILM: 2.7K, ±2%, 1/4W, mfr 81349, MIL type RLR07C2701GR | 6-19 |
| 1A6R17 | | RESISTOR, FILM: 8.45K, ±1%, 1/10W, mfr 81349, MIL type RNC55H8451FR | 6-19 |
| 1A6R18 thru 1A6R20 | | RESISTOR, FILM: same as 1A6R1 | 6-19 |
| 1A6R21 | | NOT USED | |
| 1A6R22 | | RESISTOR, FILM: same as 1A6R1 | 6-19 |
| 1A6R23 and 1A6R24 | | NOT USED | |
| 1A6R25 | * | RESISTOR, FILM: mfr 81349, MIL type RLR07CXXXXGR | 6-19 |
| 1A6R26 thru 1A6R28 | | NOT USED | |
| 1A6R29 | | RESISTOR, FILM: 510, ±2%, 1/4W, mfr 81349, MIL type RLR07C5100GR | 6-19 |
| 1A6R30 thru 1A6R39 | | NOT USED | |
| 1A6R40 and 1A6R41 | | RESISTOR, FILM: 560, ±2%, 1/4W, mfr 81349, MIL type RLR07C5600GR | 6-19 |
| 1A6R42 | | RESISTOR, VARIABLE: 1K, mfr 81349, MIL type RJR24FX102P | 6-19 |
| 1A6R43 | | RESISTOR, FILM: 3K, ±2%, 1/4W, mfr 81349, MIL type RLR07C3001GR | 6-19 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A6R44 | | RESISTOR, WIRE-WOUND: 0.75 ohms, ±1%, 2W, mfr 81349, MIL type RWR80SR750FR | 6-19 |
| 1A6R45 and 1A6R46 | | NOT USED | |
| 1A6R47 | | RESISTOR, FILM: 47, ±2%, 1/4W, mfr 81349, MIL type RLR07C47R0GR | 6-19 |
| 1A6R48 thru 1A6R53 | | NOT USED | |
| 1A6R54 and 1A6R55 | | RESISTOR, FILM: 22, ±2%, 1/4W, mfr 81349, MIL type RLR07C22R0GR | 6-19 |
| 1A6T1 | | TRANSFORMER: mfr 14844, part no. 51913-9406 | 6-8 |
| 1A6U1 | | MICROCIRCUIT: mfr 04713, part no. TL494MJ/883B | 6-19 |
| 1A6U2 | | NOT USED | |
| 1A6U3 | | MICROCIRCUIT, LINEAR: mfr 01295, part no. UA7805/883B | 6-8 |
| 1A6U4 | | MICROCIRCUIT, LINEAR: mfr 18324, part no. UA723/883B | 6-19 |
| 1A6U5 | | MICROCIRCUIT, LINEAR: mfr 07263, part no. UA78MGHMOB/883B | 6-19 |
| 1A7 | | SYNTHESIZER UNIT ASSEMBLY: mfr 14844, part no. D51707-9407 | 6-5 |
| 1A7P1 | | CONNECTOR: mfr 71468, part no. DCMM21WA4P | 6-9 |
| 1A7P2 | | CONNECTOR: mfr 71468, part no. DBMM9W4P | 6-9 |
| 1A7S1 | | SWITCH, DPDT: mfr 95146, part no. MTL-206N | 6-9 |
| 1A7S2 and 1A7S3 | | SWITCH, SPDT: mfr 95146, part no. MTL-106D | 6-9 |
| 1A7A1 | | PC BOARD ASSEMBLY: mfr 14844, part no. D51931-9407 | 6-20 |
| 1A7A1C1 thru 1A7A1C3 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-20 |
| 1A7A1C4 | | CAPACITOR, TANT: same as 1C4 | 6-20 |
| 1A7A1C5 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-20 |
| 1A7A1C6 | | CAPACITOR: mfr 81349, MIL type M83421/01-10895 | 6-20 |
| 1A7A1C7 | | CAPACITOR, CERAMIC: 12 pf, ±5%, 100 VDC, mfr 51642, part no. 100-100-NPO-120J | 6-20 |
| 1A7A1C8 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-20 |
| 1A7A1C9 and 1A7A1C10 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-20 |
| 1A7A1C11 | | CAPACITOR, CERAMIC: 1200 pf, ±5%, 100 VDC, mfr 51642, part no. 150-100-NPO-122J | 6-20 |
| 1A7A1C12 | | CAPACITOR, CERAMIC: same as 1A5C1 | 6-20 |
| 1A7A1C13 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-20 |
| 1A7A1C14 and 1A7A1C15 | | CAPACITOR, CERAMIC: same as 1A5C1 | 6-20 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A7A1C16 and 1A7A1C17 | | CAPACITOR, CERAMIC: same as 1A6C9 | 6-20 |
| 1A7A1C18 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-20 |
| 1A7A1C19 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-20 |
| 1A7A1C20 and 1A7A1C21 | | CAPACITOR, CERAMIC: same as 1A6C9 | 6-20 |
| 1A7A1C22 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-20 |
| 1A7A1C23 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-20 |
| 1A7A1C24 and 1A7A1C25 | | CAPACITOR, CERAMIC: same as 1A6C9 | 6-20 |
| 1A7A1C26 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-20 |
| 1A7A1C27 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-20 |
| 1A7A1C28 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-20 |
| 1A7A1C29 | | CAPACITOR, TANT: same as 1C4 | 6-20 |
| 1A7A1C30 | | CAPACITOR, CERAMIC: 240 pf, ±5%, 200 VDC, mfr 81349, MIL type CDR23BG241CJSM | 6-20 |
| 1A7A1C31 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-20 |
| 1A7A1C32 and 1A7A1C33 | | CAPACITOR, CERAMIC: 0.001 uf, ±10%, 200 VDC, mfr 81349, MIL type CKR05BX102KR | 6-20 |
| 1A7A1C34 | | CAPACITOR, CERAMIC: 33 pf, ±10%, 200V, mfr 81349, MIL type CKR05BX330KR | 6-20 |
| 1A7A1C35 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-20 |
| 1A7A1C36 | | CAPACITOR, CERAMIC: same as 1A7A1C32 | 6-20 |
| 1A7A1C37 and 1A7A1C38 | | NOT USED | |
| 1A7A1C39 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-20 |
| 1A7A1C40 | | CAPACITOR: 20 uf, ±10%, 50V, mfr 14752, part no. 650B1A206K | 6-20 |
| 1A7A1DC1 | | POWER SPLITTER: mfr 15542, part no. PSC-2-1 | 6-20 |
| 1A7A1K1 and 1A7A1K2 | | RELAY: mfr 21317, part no. 56-1121-10 | 6-20 |
| 1A7A1L1 | | COIL RADIO FREQ: 100 uH, mfr 96906, MIL type MS75085-7 | 6-20 |
| 1A7A1Q1 | | TRANSISTOR: mfr 81349, MIL type JANTX2N3666 | 6-20 |
| 1A7A1Q2 | | TRANSISTOR: mfr 81349, MIL type JANTX2N5114 | 6-20 |
| 1A7A1Q3 | | TRANSISTOR: mfr 81349, MIL type JANTX2N4416 | 6-20 |
| 1A7A1R1 | | RESISTOR, FILM: 68K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C6802GR | 6-20 |
| 1A7A1R2 and 1A7A1R3 | * | RESISTOR, FILM: 2.2K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C2201GR | 6-20 |
| 1A7A1R4 | * | RESISTOR, FILM: 4.7K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C4701GR | 6-20 |
| 1A7A1R5 | | RESISOTR, VARIABLE: 5K ohm, 1/4W, mfr 81349, MIL type RJR26FX502P | 6-20 |
| 1A7A1R6 and 1A7A1R7 | | RESISTOR, FILM: same as 1A7A1R4 | 6-20 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A7A1R8 | | RESISTOR, FILM: 18 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C18R0GR | 6-20 |
| 1A7A1R9 thru 1A7A1R11 | | RESISTOR, FILM: 300 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C3000GR | 6-20 |
| 1A7A1R12 | | NOT USED | |
| 1A7A1R13 | | RESISTOR, FILM: same as 1A7A1R8 | 6-20 |
| 1A7A1R14 | * | RESISTOR, FILM: 62K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C6201GR | 6-20 |
| 1A7A1R15 | * | RESISTOR, FILM: 270K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C2703GR | 6-20 |
| 1A7A1R16 | * | RESISTOR, FILM: 150K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C1503GR | 6-20 |
| 1A7A1R17 | | RESISTOR, VARIABLE: 50K ohm, ±2%, 1/4W, mfr 81349, MIL type RJR26FX503P | 6-20 |
| 1A7A1R18 | | RESISTOR, FILM: 220K ohm, ±0.1%, 1/8W, mfr 81349, MIL type RNC55J12203BR | 6-20 |
| 1A7A1R19 | | RESISTOR, FILM: 180K ohm, ±0.1%, 1/8W, mfr 81349, MIL type RNC55J1803BR | 6-20 |
| 1A7A1R20 | | RESISTOR, FILM: 10K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C1002GR | 6-20 |
| 1A7A1R21 | | RESISTOR, FILM: 10 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C10R0GR | 6-20 |
| 1A7A1R22 | | RESISTOR, COMP: 10 ohm, ±5%, 1/4W, mfr 81349, MIL type RCR07G106JR | 6-20 |
| 1A7A1R23 | | RESISTOR, FILM: same as 1A5A4R1 | 6-20 |
| 1A7A1R24 | | RESISTOR, FILM: same as 1A7A1R20 | 6-20 |
| 1A7A1R25 | | RESISTOR, FILM: same as 1A5A4R1 | 6-20 |
| 1A7A1R26 | | RESISTOR, COMP: 10M ohm, ±5%, 1/8W, mfr 81349, MIL type RCR05C106JR | 6-20 |
| 1A7A1R27 | | RESISTOR, COMP: 560K ohm, ±5%, 1/4W, mfr 81349, MIL type RCR07G564JR | 6-20 |
| 1A7A1R28 and 1A7A1R29 | | RESISTOR, FILM: 1.2K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05G1201GR | 6-20 |
| 1A7A1R30 | | RESISTOR, FILM: 330 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C3300GR | 6-20 |
| 1A7A1R31 and 1A7A1R32 | | RESISTOR, FILM: 22 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C22R0GR | 6-20 |
| 1A7A1R33 | | RESISTOR, COMP: 2.2M ohm, ±2%, 1/4W, mfr 81349, MIL type RCR07G225JR | 6-20 |
| 1A7A1R34 | | RESISTOR, FILM: 270K ohm, ±1%, 1/8W, mfr 81349, MIL type RNC55J2703FR | 6-20 |
| 1A7A1R35 | | RESISTOR, FILM: 100 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C1000GR | 6-20 |
| 1A7A1R36 and 1A7A1R38 | | RESISTOR, FILM: same as 1A7A1R21 | 6-20 |
| 1A7A1R39 | | NOT USED | |
| 1A7A1R40 | | RESISTOR, FILM: same as 1A7A1R4 | 6-20 |
| 1A7A1R41 | | RESISTOR, FILM: same as 1A7A1R35 | 6-20 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A7A1R42 | | RESISTOR, FILM: 200 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C2000GR | 6-20 |
| 1A7A1R43 | | RESISTOR, FILM: 5.1K ohm, ±2%, 1/4W, mfr 81349, MIL type RLR07C5101GR | 6-20 |
| 1A7A1R44 | | RESISTOR, FILM: 8.2K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C820KR | 6-20 |
| 1A7A1R45 and 1A7A1R46 | | RESISTOR, FILM: same as 1A7A1R21 | 6-20 |
| 1A7A1R47 | | RESISTOR, FILM: same as 1A7A1R43 | 6-20 |
| 1A7A1R48 | | RESISTOR, FILM: 9.1K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C9101GR | 6-20 |
| 1A7A1R49 | | RESISTOR, FILM: same as 1A7A1R44 | 6-20 |
| 1A7A1R50 | | RESISTOR, FILM: 39K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C3902GR | 6-20 |
| 1A7A1R51 | | RESISTOR, FILM: 36 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C36R0GR | 6-20 |
| 1A7A1R52 | | RESISTOR, FILM: 75K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C7502GR | 6-20 |
| 1A7A1R53 | | RESISTOR, VARIABLE: 50K ohm, 1/4W, mfr 81349, MIL type RJR26FW503P | 6-20 |
| 1A7A1R54 | | RESISTOR, FILM: same as 1A7A150 | 6-20 |
| 1A7A1R55 | | RESISTOR, FILM: 150 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C1500GR | 6-20 |
| 1A7A1R56 | * | RESISTOR, FILM: same as 1A7A1R43 | 6-20 |
| 1A7A1R57 | | RESISTOR, FILM: same as 1A7A1R20 | 6-20 |
| 1A7A1U1 | | MICROCIRCUIT: mfr 32293, part no. 1H200 | 6-20 |
| 1A7A1U2 | | MICROCIRCUIT: mfr 07263, part no. UA78M15HM/883B | 6-20 |
| 1A7A1U3 | | MICROCIRCUIT: mfr 27014, part no. LM120H-15/883B | 6-20 |
| 1A7A1U4 | | MICROCIRCUIT: mfr 07263, part no. UA78M05HM/883B | 6-20 |
| 1A7A1U5 | | MICROCIRCUIT: mfr 18324, part no. 54LS00/883B | 6-20 |
| 1A7A1U6 | | MICROCIRCUIT: mfr 18324, part no. 54LS04/883B | 6-20 |
| 1A7A1U7 | | MICROCIRCUIT: mfr 27014, part no. LM108AH/833B | 6-20 |
| 1A7A1U8 | | MICROCIRCUIT: mfr 34371, part no. HA2-2900-8 | 6-20 |
| 1A7A1Z1 | | HYBRID SYNTHESIZER: mfr 14844, part no. C35951-7907 | 6-20 |
| 1A8 | | BUFFER AMPLIFIER: mfr 14844, part no. 51708-9408 | 6-5 |
| 1A8P1 | | CONNECTOR, SUBMINIATURE: mfr 71468, part no. DCMM13W6P | 6-10 |
| 1A8U2 | | VOLTAGE REGULATOR: mfr 27014, part no. 78M15G/883B | 6-10 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A8A1 | | PC BOARD ASSEMBLY: mfr 14844, part no. D51961-9408 | 6-21 |
| 1A8A1C1 thru 1A8A1C5 | | CAPACITOR, CERAMIC: same as 1C2 | 6-21 |
| 1A8A1C6 | | CAPACITOR, CERAMIC: 220 pf, ±5%, 100 VDC, mfr 51642, part no. 150-100-NPO-221J | 6-21 |
| 1A8A1C7 | * | CAPACITOR, CERAMIC: 150 pf, ±5%, 100 VDC, mfr 51642, part no. 150-100-NPO-151J | 6-21 |
| 1A8A1C8 thru 1A8A1C12 | | CAPACITOR, CERAMIC: same as 1C2 | 6-21 |
| 1A8A1C13 | | CAPACITOR, CERAMIC: same as 1A8A1C6 | 6-21 |
| 1A8A1C14 | | CAPACITOR, CERAMIC: same as 1A8A1C7 | 6-21 |
| 1A8A1C15 thru 1A8A1C19 | | CAPACITOR, CERAMIC: same as 1C2 | 6-21 |
| 1A8A1C20 | | CAPACITOR, CERAMIC: same as 1A8A1C6 | 6-21 |
| 1A8A1C21 | | CAPACITOR, CERAMIC: same as 1A8A1C7 | 6-21 |
| 1A8A1C22 thru 1A8A1C26 | | CAPACITOR, CERAMIC: same as 1C2 | 6-21 |
| 1A8A1C27 | | CAPACITOR, CERAMIC: same as 1A8A1C6 | 6-21 |
| 1A8A1C28 | | CAPACITOR, CERAMIC: same as 1A8A1C7 | 6-21 |
| 1A8A1C29 thru 1A8A1C33 | | CAPACITOR, CERAMIC: same as 1C2 | 6-21 |
| 1A8A1C34 | | CAPACITOR, CERAMIC: same as 1C6 | 6-21 |
| 1A8A1C35 | | CAPACITOR, CERAMIC: 10 pf, ±5%, 100 VDC, mfr 51642, part no. 100-100-NPO-100J | 6-21 |
| 1A8A1C36 | | CAPACITOR, CERAMIC: same as 1A8A1C7 | 6-21 |
| 1A8A1C37 | | CAPACITOR, CERAMIC: 0.01 uf, ±10%, 100 VDC, mfr 81349, MIL type CKR06BX103KR | 6-21 |
| 1A8A1C38 | | CAPACITOR, CERAMIC: same as 1C2 | 6-21 |
| 1A8A1C39 | | CAPACITOR, TANT: same as 1A6C14 | 6-21 |
| 1A8A1C40 and 1A8A1C41 | | CAPACITOR, CERAMIC: same as 1A6C9 | 6-21 |
| 1A8A1C42 | | CAPACITOR, CERAMIC: same as 1A8A1C6 | 6-21 |
| 1A8A1CR1 thru 1A8A1CR5 | | DIODE: same as 1CR1 | 6-21 |
| 1A8A1CR6 | | DIODE: mfr 81349, MIL type JANTX1N914 | 6-21 |
| 1A8A1L1 and 1A8A1L2 | | INDUCTOR, RF, MOLDED: 69 uH, ±10%, mfr 96906, MIL type MS75085-5 | 6-21 |
| 1A8A1L3 | | INDUCTOR, RF, MOLDED: 3.9 uH, ±10%, mfr 96906, MIL type MS75084-07 | 6-21 |
| 1A8A1L4 and 1A8A1L5 | | INDUCTOR, BEAD: mfr 02114, part no. 5659065/446 | 6-21 |
| 1A8A1L6 and 1A8A1L7 | | INDUCTOR, RF, MOLDED: same as 1A8A1L1 | 6-21 |
| 1A8A1L8 | | INDUCTOR, RF, MOLDED: same as 1A8A1L3 | 6-21 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A8A1L9 and 1A8A1L10 | | INDUCTOR, BEAD: same as 1A8A1L4 | 6-21 |
| 1A8A1L11 and 1A8A1L12 | | INDUCTOR, RF, MOLDED: same as 1A8A1L1 | 6-21 |
| 1A8A1L13 | | INDUCTOR, RF, MOLDED: same as 1A8A1L3 | 6-21 |
| 1A8A1L14 and 1A8A1L15 | | INDUCTOR, BEAD: same as 1A8A1L4 | 6-21 |
| 1A8A1L16 and 1A8A1L17 | | INDUCTOR, RF, MOLDED: same as 1A8A1L1 | 6-21 |
| 1A8A1L18 | | INDUCTOR, RF, MOLDED: same as 1A8A1L3 | 6-21 |
| 1A8A1L19 and 1A8A1L20 | | INDUCTOR, BEAD: same as 1A8A1L4 | 6-21 |
| 1A8A1L21 and 1A8A1L22 | | INDUCTOR, RF, MOLDED: same as 1A8A1L1 | 6-21 |
| 1A8A1L23 | | INDUCTOR, RF, MOLDED: same as 1A8A1L3 | 6-21 |
| 1A8A1L24 and 1A8A1L25 | | INDUCTOR, BEAD: same as 1A8A1L4 | 6-21 |
| 1A8A1L26 | | INDUCTOR, RF, MOLDED: same as 1A8A1L1 | 6-21 |
| 1A8A1L27 | | INDUCTOR, RF, MOLDED: 50 to 500 uH, $\pm$10% mfr 04213, part no. 1670-2 | 6-21 |
| 1A8A1Q1 thru 1A8A1Q10 | | TRANSISTOR: mfr 81349, MIL type JANTX2N2222A | 6-21 |
| 1A8A1R1 | | RESISTOR, COMP: 8.2K ohm, $\pm$2%, 1/8W, mfr 81349, MIL type RLR05C8201GR | 6-21 |
| 1A8A1R2 | | RESISTOR, FILM: same as 1A7A1R4 | 6-21 |
| 1A8A1R3 | | RESISTOR, COMP: 47 ohm, $\pm$2%, 1/8W, mfr 81349, MIL type RLR05C47R0GR | 6-21 |
| 1A8A1R4 | | RESISTOR, COMP: same as 1A7A1R2 | 6-21 |
| 1A8A1R5 | | RESISTOR, COMP: 120 ohm, $\pm$2%, 1/8W, mfr 81349, MIL to type RLR05C1200GR | 6-21 |
| 1A8A1R6 | | RESISTOR, COMP: same as 1A8A1R3 | 6-21 |
| 1A8A1R7 | | RESISTOR, COMP: 6.8K ohm, $\pm$2%, 1/8W, mfr 81349, MIL type RLR05C6801GR | 6-21 |
| 1A8A1R8 and 1A8A1R9 | | RESISTOR, COMP: same as 1A8A1R1 | 6-21 |
| 1A8A1R10 | | RESISTOR, FILM: same as 1A7A1R4 | 6-21 |
| 1A8A1R11 | | RESISTOR, COMP: same as 1A8A1R3 | |
| 1A8A1R12 | | RESISTOR, FILM: same as 1A7A1R2 | 6-21 |
| 1A8A1R13 | | RESISTOR, COMP: same as 1A8A1R5 | 6-21 |
| 1A8A1R14 | | RESISTOR, COMP: same as 1A8A1R3 | 6-21 |
| 1A8A1R15 | | RESISTOR, COMP: same as 1A8A1R7 | 6-21 |
| 1A8A1R16 and 1A8A1R17 | | RESISTOR, COMP: same as 1A8A1R1 | 6-21 |
| 1A8A1R18 | | RESISTOR, FILM: same as 1A7A1R4 | 6-21 |
| 1A8A1R19 | | RESISTOR, COMP: same as 1A8A1R3 | 6-21 |
| 1A8A1R20 | | RESISTOR, FILM: same as 1A7A1R2 | 6-21 |
| 1A8A1R21 | | RESISTOR, COMP: same as 1A8A1R5 | 6-21 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A8A1R22 | | RESISTOR, COMP: same as 1A8A1R3 | 6-21 |
| 1A8A1R23 | | RESISTOR, COMP: same as 1A8A1R7 | 6-21 |
| 1A8A1R24 and 1A8A1R25 | | RESISTOR, COMP: same as 1A8A1R1 | 6-21 |
| 1A8A1R26 | | RESISTOR, FILM: same as 1A7A1R4 | 6-21 |
| 1A8A1R27 | | RESISTOR, COMP: same as 1A8A1R3 | 6-21 |
| 1A8A1R28 | | RESISTOR, FILM: same as 1A7A1R2 | 6-21 |
| 1A8A1R29 | | RESISTOR, COMP: same as 1A8A1R5 | 6-21 |
| 1A8A1R30 | | RESISTOR, COMP: same as 1A8A1R3 | 6-21 |
| 1A8A1R31 | | RESISTOR, COMP: same as 1A8A1R7 | 6-21 |
| 1A8A1R32 and 1A8A1R33 | | RESISTOR, COMP: same as 1A8A1R1 | 6-21 |
| 1A8A1R34 | | RESISTOR, FILM: same as 1A7A1R4 | 6-21 |
| 1A8A1R35 | | RESISTOR, COMP: same as 1A8A1R3 | 6-21 |
| 1A8A1R36 | | RESISTOR, FILM: same as 1A7A1R2 | 6-21 |
| 1A8A1R37 | | RESISTOR, COMP: same as 1A8A1R5 | 6-21 |
| 1A8A1R38 | | RESISTOR, COMP: same as 1A8A1R3 | 6-21 |
| 1A8A1R39 | | RESISTOR, COMP: same as 1A8A1R7 | 6-21 |
| 1A8A1R40 | | RESISTOR, COMP: same as 1A8A1R1 | 6-21 |
| 1A8A1R41 | | RESISTOR, FILM: same as 1A7A1R20 | 6-21 |
| 1A8A1R42 | * | RESISTOR, FILM: same as 1A7A1R20 | 6-21 |
| 1A8A1R43 | | RESISTOR, COMP: 51 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C51ROGR | 6-21 |
| 1A8A1U1 | | POWER SPLITTER: mfr 15542, part no. PSC6-1 | 6-21 |
| 1A9 | | REAL TIME-OF-DAY CLOCK: mfr 14844, part no. D21709-6209-1 | 6-5 |
| 1A9C1 thru 1A9C3 | | CAPACITOR, CERAMIC: same as 1A5C1 | 6-11 |
| 1ASCR1 and 1A9CR2 | | DIODE, LIGHT EMITTING: mfr 81349, MIL type JANTX1N6094 | 6-11 |
| 1A9CR3 | | DIODE: same as 1CR1 | 6-11 |
| 1A9J1 | | NOT USED | |
| 1A9J2 thru 1A9J4 | | CONNECTOR, BNC: mfr 81349, MIL type M39012/21-001 | 6-11 |
| 1A9K1 | | RELAY: mfr 81349, MIL type M5757/13-506 | 6-11 |
| 1A9P1 thru 1A9P3 | | NOT USED | |
| 1A9P4 thru 1A9P9 | | PLUG: mfr 91506, MIL type 616AG1 | 6-11 |
| 1A9R1 and 1A9R2 | | RESISTOR, FILM: 100 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05G1000GR | 6-11 |
| 1A9S1 | | SWITCH, THUMB WHEEL: mfr 07126, part no. 711/107/600/7 | 6-11 |
| 1A9S2 | | SWITCH, TOGGLE: mfr 09353, part no. 7101MGE | 6-11 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A9S3 thru 1A9S11 | | SWITCH, PUSHBUTTON: same as 1S1 | 6-11 |
| 1A9A1 | | PC ASSY DISPLAY: mfr 14844, part no. D22001-6209 | 6-22 |
| 1A9A1C1 thru 1A9A1C3 | | CAPACITOR, CERAMIC: same as 1A5C1 | 6-22 |
| 1A9A1R1 | | RESISTOR, FILM: same as 1A7A1R4 | 6-22 |
| 1A9A1U1 thru 1A9A1U6 | | MICROCIRCUIT: mfr 28480, part no. 5082-7391 | 6-22 |
| 1A9A2 | 1 | PC ASSY LOGIC: mfr 14844, part no. D52002-9409 | 6-23 |
| 1A9A2C1 and 1A9A2C2 | 1 | CAPACITOR, TANT: 3.3 uf, ±10%, 50WVDC, mfr 81349, MIL type CSR13F335KR | 6-23 |
| 1A9A2C3 thru 1A9A2C26 | | NOT USED | |
| 1A9A2C7 and 1A9A2C8 | 1 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-23 |
| 1A9A2C9 | 1 | CAPACITOR, CERAMIC: 10 pf, ±5%, 100VDC, mfr 51642, part no. 150-100-NPO-100J | 6-23 |
| 1A9A2C10 thru 1A9A2C14 | | NOT USED | |
| 1A9A2C15 thru 1A9A2C17 | 1 | CAPACITOR, TANT: same as 1A9A2C1 | 6-23 |
| 1A9A2C18 thru 1A9A2C24 | | NOT USED | |
| 1A9A2C25 thru 1A9A2C27 | 1 | CAPACITOR, TANT: same as 1C4 | 6-23 |
| 1A9A2C28 | | NOT USED | |
| 1A9A2C29 | 1 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-23 |
| 1A9A2C30 | 1 | CAPACITOR, TANT: same as 1A9A2C1 | 6-23 |
| 1A9A2C31 | | NOT USED | |
| 1A9A2C32 thru 1A9A2C46 | 1 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-23 |
| 1A9A2C47 thru 1A9A2C54 | 1 * | CAPACITOR, CERAMIC: 100 pf, ±5%, 100VDC, mfr 51642, part no. 150-100-NPO-101J | 6-23 |
| 1A9A2C55 | 1 | CAPACITOR, TANT: same as 1A9A2C1 | 6-23 |
| 1A9A2C56 thru 1A9A2C58 | 1 * | CAPACITOR, CERAMIC: same as 1A9A2C47 | 6-23 |
| 1A9A2C59 | 1 | CAPACITOR, CERAMIC: same as 1A9A2C48 | 6-23 |
| 1A9A2C60 | 1 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-23 |
| 1A9A2C61 | 1 | CAPACITOR, CERAMIC: 1 uf, ±10%, 50 WVDC, mfr 81349, type CKR06BX105KS | 6-23 |
| 1A9A2C62 thru 1A9A2C67 | 1 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-23 |
| 1A9A2C68 | 1 | CAPACITOR, TANT: same as 1A9A2C2 | 6-23 |
| 1A9A2C69 | 1 | CAPACITOR, TANT: same as 1C4 | 6-23 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A9A2C70 | 1 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-23 |
| 1A9A2C71 thru 1A9A2C79 | 1 * | CAPACITOR, CERAMIC: same as 1A9A2C47 | 6-23 |
| 1A9A2C80 | 1 | CAPACITOR, TANT: same as 1C4 | 6-23 |
| 1A9A2C181 | 1 | CAPACITOR, TANT: same as 1A9A2C2 | 6-23 |
| 1A9A2CR1 and 1A9A2CR2 | | NOT USED | |
| 1A9A2CR3 thru 1A9A2CR5 | 1 | DIODE, RECTIFIER: same as 1A6CR3 | 6-23 |
| 1A9A2CR6 thru 1A9A2CR18 | | NOT USED | |
| 1A9A2CR19 | 1 | DIODE, ZENER: mfr 81349, MIL type JANTX1N751A | 6-23 |
| 1A9A2CR20 | 1 | DIODE: mfr 81349, MIL type JANTX1N759A | 6-23 |
| 1A9A2CR21 thru 1A9A2CR27 | 1 | DIODE: mfr 81349, MIL type JANTX1N965B | 6-23 |
| 1A9A2CR28 | 1 | DIODE: same as 1A9A2CR20 | 6-23 |
| 1A9A2J1 | 1 | CONNECTOR: mfr 81349, MIL type M24308/24-58 | 6-23 |
| 1A9A2J2 and 1A9A2J3 | | NOT USED | |
| 1A9A2J4 thru 1A9A2J9 | 1 | SOCKET, DIP 16P: mfr 91506, part no. 516-AG10D | 6-23 |
| 1A9A2Q1 and 1A9A2Q2 | | NOT USED | |
| 1A9A2Q3 thru 1A9A2Q9 | 1 | TRANSISTOR: mfr 81349, MIL type JANTX2N2369A | 6-23 |
| 1A9A2R1 | 1 | RESISTOR, FILM: 270 ohm, ±2%, 1/4W, mfr 81349, MIL type RLR07G2700GR | 6-23 |
| 1A9A2R2 thru 1A9A2R52 | | NOT USED | |
| 1A9A2R53 | 1 | RESISTOR, FILM: 1.0K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05G1001GR | 6-23 |
| 1A9A2R54 thru 1A9A2R57 | | NOT USED | |
| 1A9A2R58 | 1 | RESISTOR, FILM: 6.2K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05G6201GR | 6-23 |
| 1A9A2R59 | 1 | RESISTOR, FILM: 510 ohm, ±2%, 1/4W, mfr 81349, MIL type RLR07G5100GR | 6-23 |
| 1A9A2R60 | 1 | RESISTOR, FILM: same as 1A9A2R1 | 6-23 |
| 1A9A2R61 thru 1A9A2R65 | | NOT USED | |
| 1A9A2R66 | 1 | RESISTOR, FILM: 150 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05G1500GR | 6-23 |
| 1A9A2R67 | 1 | RESISTOR, FILM: same as 1A9R1 | 6-23 |
| 1A9A2R68 | 1 | RESISTOR, FILM: 10 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05G10R0GR | 6-23 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A9A2R69 | 1 | RESISTOR, FILM: same as 1A7A1R30 | 6-23 |
| 1A9A2R70 | 1 | RESISTOR, FILM: same as 1A9R1 | 6-23 |
| 1A9A2R71 | 1 | RESISTOR, FILM: same as 1A9A2R68 | 6-23 |
| 1A9A2R72 | 1 | RESISTOR, FILM: same as 1A7A1R30 | 6-23 |
| 1A9A2R73 | 1 | RESISTOR, FILM: same as 1A9R1 | 6-23 |
| 1A9A2R74 | 1 | RESISTOR, FILM: same as 1A9A2R68 | 6-23 |
| 1A9A2R75 | 1 | RESISTOR, FILM: same as 1A7A1R30 | 6-23 |
| 1A9A2R76 | 1 | RESISTOR, FILM: same as 1A9R1 | 6-23 |
| 1A9A2R77 | 1 | RESISTOR, FILM: same as 1A9A2R68 | 6-23 |
| 1A9A2R78 | 1 | RESISTOR, FILM: same as 1A7A1R30 | 6-23 |
| 1A9A2R79 | 1 | RESISTOR, FILM: same as 1A9R1 | 6-23 |
| 1A9A2R80 | 1 | RESISTOR, FILM: same as 1A9A2R68 | 6-23 |
| 1A9A2R81 | 1 | RESISTOR, FILM: same as 1A7A1R30 | 6-23 |
| 1A9A2R82 | 1 | RESISTOR, FILM: same as 1A9R1 | 6-23 |
| 1A9A2R83 | 1 | RESISTOR, FILM: same as 1A9A2R68 | 6-23 |
| 1A9A2R84 | 1 | RESISTOR, FILM: same as 1A7A1R30 | 6-23 |
| 1A9A2R85 thru 1A9A2R87 | 1 | RESISTOR, FILM: 4.7K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05G4701GR | 6-23 |
| 1A9A2R88 | | NOT USED | |
| 1A9A2R89 | 1 | RESISTOR, FILM: same as 1A9A2R53 | 6-23 |
| 1A9A2R90 | 1 | RESISTOR, FILM: same as 1A9A2R58 | 6-23 |
| 1A9A2R91 thru 1A9A2R95 | 1 | RESISTOR, FILM: same as 1A9A2R53 | 6-23 |
| 1A9A2R96 | 1 | RESISTOR, FILM: same as 1A9A2R68 | 6-23 |
| 1A9A2R97 | 1 | RESISTOR, FILM: same as 1A7A1R30 | 6-23 |
| 1A9A2R98 | 1 | RESISTOR, FILM: 150 ohm, ±2%, 1/2W, mfr 81349, MIL type RCR20G1500GR | 6-23 |
| 1A9A2R99 | 1 | RESISTOR, FILM: same as 1A9R1 | 6-23 |
| 1A9A2R100 | 1 | RESISTOR, FILM: same as 1A9A2R53 | 6-23 |
| 1A9A2R101 | 1 | RESISTOR, FILM: 10K ohm ±2%, 1/8W, mfr 81349, MIL type RLR05G1002GR | 6-23 |
| 1A9A2R102 | 1 | RESISTOR, FILM: mfr 81349, MIL type RLR05G4301GR | 6-23 |
| 1A9A2U1 | 1 | MICROCIRCUIT: mfr 18324, part no. 8T20 | 6-23 |
| 1A9A2U2 and 1A9A2U3 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS74/883B | 6-23 |
| 1A9A2U4 | 1 | MICROCIRCUIT: same as 1A7A1U6 | 6-23 |
| 1A9A2U5 | 1 | MICROCIRCUIT: same as 1A7A1U5 | 6-23 |
| 1A9A2U6 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS175/883B | 6-23 |
| 1A9A2U7 and 1A9A2U8 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS190/883B | 6-23 |
| 1A9A2U9 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS165/883B | 6-23 |
| 1A9A2U10 | 1 | MICROCIRCUIT: same as 1A9A2U2 | |
| 1A9A2U11 | 1 | MICROCIRCUIT: same as 1A7A1U5 | 6-23 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A9A2U12 | 1 | MICROCIRCUIT: mfr 01295, part no. 55327/883B | 6-23 |
| 1A9A2U13 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS390/883B | 6-23 |
| 1A9A2U14 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS10/883B | 6-23 |
| 1A9A2U15 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS08/883B | 6-23 |
| 1A9A2U16 | 1 | MICROCIRCUIT: same as 1A9A2U2 | 6-23 |
| 1A9A2U17 | 1 | MICROCIRCUIT: same as 1A7A1U5 | 6-23 |
| 1A9A2U18 | 1 | MICROCIRCUIT: mfr 01295, part no. 5404/883B | 6-23 |
| 1A9A2U19 and 1A9A2U20 | 1 | MICROCIRCUIT: same as 1A9A2U7 | 6-23 |
| 1A9A2U21 | 1 | MICROCIRCUIT: same as 1A9A2U9 | 6-23 |
| 1A9A2U22 | 1 | MICROCIRCUIT: same as 1A9A2U2 | 6-23 |
| 1A9A2U23 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS02/883B | 6-23 |
| 1A9A2U24 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS76/883B | 6-23 |
| 1A9A2U25 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS20/883B | 6-23 |
| 1A9A2U26 | 1 | MICROCIRCUIT: same as 1A7A1U6 | 6-23 |
| 1A9A2U27 | 1 | MICROCIRCUIT: same as 1A9A2U24 | 6-23 |
| 1A9A2U28 | 1 | MICROCIRCUIT: same as 1A9A2U15 | 6-23 |
| 1A9A2U29 | 1 | MICROCIRCUIT: same as 1A7A1U5 | 6-23 |
| 1A9A2U30 | 1 | MICROCIRCUIT: same as 1A9A2U15 | 6-23 |
| 1A9A2U31 and 1A9A2U32 | 1 | MICROCIRCUIT: same as 1A9A2U7 | 6-23 |
| 1A9A2U33 | 1 | MICROCIRCUIT: same as 1A9A2U9 | 6-23 |
| 1A9A2U34 | 1 | MICROCIRCUIT: same as 1A7A1U6 | 6-23 |
| 1A9A2U35 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS30/883B | 6-23 |
| 1A9A2U36 | 1 | MICROCIRCUIT: mfr 07263, part no. 9616 | 6-23 |
| 1A9A2U37 | 1 | MICROCIRCUIT: same as 1A7A1U5 | 6-23 |
| 1A9A2U38 | 1 | MICROCIRCUIT: same as 1A9A2U24 | 6-23 |
| 1A9A2U39 | 1 | MICROCIRCUIT: same as 1A9A2U15 | 6-23 |
| 1A9A2U40 | 1 | MICROCIRCUIT: same as 1A9A2U2 | 6-23 |
| 1A9A2U41 | 1 | MICROCIRCUIT: same as 1A9A2U18 | 6-23 |
| 1A9A2U42 | 1 | MICROCIRCUIT: same as 1A9A2U14 | 6-23 |
| 1A9A2U43 | 1 | MICROCIRCUIT: same as 1A7A1U6 | 6-23 |
| 1A9A2U44 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS14/883B | 6-23 |
| 1A9A2U45 and 1A9A2U46 | 1 | MICROCIRCUIT: mfr 04713, part no. MC14490 | 6-23 |
| 1A9A2U47 and 1A9A2U48 | 1 | MICROCIRCUIT: mfr 18324, part no. 54LS196/883B | 6-23 |
| 1A9A2U49 | 1 | MICROCIRCUIT: same as 1A9A2U12 | 6-23 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A9A2U50 | 1 | MICROCIRCUIT: same as 1A9A2U13 | 6-23 |
| 1A9A2U51 and 1A9A2U52 | 1 | MICROCIRCUIT: same as 1A9A2U2 | 6-23 |
| 1A9A2U53 | 1 | MICROCIRCUIT: same as 1A9A2U13 | 6-23 |
| 1A9A2U54 | 1 | MICROCIRCUIT: same as 1A9A2U2 | 6-23 |
| 1A9A2U55 and 1A9A2U56 | 1 | MICROCIRCUIT: same as 1A9A2U13 | 6-23 |
| 1A9A2U57 | 1 | MICROCIRCUIT: same as 1A9A2U47 | 6-23 |
| 1A9A2U58 | 1 | MICROCIRCUIT: same as 1A9A2U35 | 6-23 |
| 1A9A2U59 | 1 | MICROCIRCUIT: same as 1A9A2U47 | 6-23 |
| 1A9A2U60 and 1A9A2U61 | | NOT USED | |
| 1A9A2U62 | 1 | RESISTOR, NETWORK: mfr 81349, MIL type M83410102M | 6-23 |
| 1A9A2U63 | 1 | MICROCIRCUIT: same as 1A9A2U47 | 6-23 |
| 1A9A2U64 | 1 | MICROCIRCUIT: same as 1A9A2U13 | 6-23 |
| 1A9A2U65 | 1 | MICROCIRCUIT: same as 1A9A2U47 | 6-23 |
| 1A9A2U66 | 1 | MICROCIRCUIT: same as 1A9A2U35 | 6-23 |
| 1A9A2U67 thru 1A9A2U69 | 1 | MICROCIRCUIT: same as 1A9A2U47 | 6-23 |
| 1A9A2U70 | 1 | MICROCIRCUIT: same as 1A9A2U35 | 6-23 |
| 1A9A2 | 2 | PC ASSY LOGIC: mfr 14844, part no. D52002-9409-1 (Alternate part for 1A9A2 part no. D52002-9409, figure 6-22) | 6-24 |
| 1A9A2C1 and 1A9A2C2 | 2 | CAPACITOR, TANT: 3.3 uf, ±10%, 50WVDC, mfr 81349, MIL type CSR13F335KR | 6-24 |
| 1A9A2C3 thru 1A9A2C6 | 2 | NOT USED | |
| 1A9A2C7 and 1A9A2C8 | 2 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-24 |
| 1A9A2C9 | 2 | CAPACITOR, CERAMIC: 10 pf, ±5%, 100V, mfr 51642, part no. 150-100-NPO-100J | 6-24 |
| 1A9A2C10 thru 1A9A2C14 | | NOT USED | |
| 1A9A2C15 thru 1A9A2C17 | 2 | CAPACITOR, TANT: same as 1A9A2C1 | 6-24 |
| 1A9A2C18 thru 1A9A2C24 | | NOT USED | |
| 1A9A2C25 thru 1A9A2C27 | 2 | CAPACITOR, TANT: same as 1C4 | 6-24 |
| 1A9A2C28 | | NOT USED | |
| 1A9A2C29 | 2 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-24 |
| 1A9A2C30 | 2 | CAPACITOR, TANT: same as 1A9A2C1 | 6-24 |
| 1A9A2C31 | | NOT USED | |
| 1A9A2C32 thru 1A9A2C46 | 2 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-24 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A9A2C47 thru 1A9A2C54 | 2 * | CAPACITOR, MICA: mfr 51642, part no. 150-100-NPO-101J | 6-24 |
| 1A9A2C55 | 2 | CAPACITOR, TANT: same as 1A9A2C1 | 6-24 |
| 1A9A2C56 thru 1A9A2C59 | 2 * | CAPACITOR, MICA: same as 1A9A2C47 | 6-24 |
| 1A9A2C60 | 2 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-24 |
| 1A9A2C61 | 2 | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-24 |
| 1A9A2C62 thru 1A9A2C67 | 2 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-24 |
| 1A9A2C68 | 2 | CAPACITOR, TANT: same as 1A9A2C1 | 6-24 |
| 1A9A2C69 | 2 | CAPACITOR, TANT: same as 1C4 | 6-24 |
| 1A9A2C70 | 2 | CAPACITOR, CERAMIC: same as 1A5C1 | 6-24 |
| 1A9A2C71 thru 1A9A2C79 | 2 * | CAPACITOR, CERAMIC: same as 1A9A2C47 | 6-24 |
| 1A9A2C80 | 2 | CAPACITOR, TANT: same as 1C4 | 6-24 |
| 1A9A2C81 | 2 | CAPACITOR, TANT: same as 1A9A2C1 | 6-24 |
| 1A9A2CR1 and 1A9A2CR2 | | NOT USED | |
| 1A9A2CR3 thru 1A9A2CR19 | 2 | DIODE, SWITCHING: same as 1A6CR3 | 6-24 |
| 1A9A2CR20 | 2 | DIODE: mfr 81349, MIL type JANTX1N759A | 6-24 |
| 1A9A2CR21 thru 1A9A2CR27 | 2 | DIODE: mfr 81349, MIL type, JANTX1N965B | 6-24 |
| 1A9A2CR28 | 2 | DIODE: same as 1A9A2CR20 | 6-24 |
| 1A9A2J1 | 2 | CONNECTOR: mfr 71468, part no. DCMM37PW | 6-24 |
| 1A9A2J2 and 1A9A2J3 | | NOT USED | |
| 1A9A2J4 thru 1A9A2J9 | 2 | SOCKET, DIP 16P: mfr 91506, part no. 516-AG10D | 6-24 |
| 1A9A2Q1 and 1A9A2Q2 | | NOT USED | |
| 1A9A2Q3 thru 1A9A2Q9 | 2 | TRANSISTOR: mfr 81349, MIL type JANTX2N2369A | 6-24 |
| 1A9A2R1 | 2 | RESISTOR, FILM: 370 ohm, 1/4W, mfr 81349, MIL type RLR0G2700GR | 6-24 |
| 1A9A2R2 thru 1A9A2R52 | | NOT USED | |
| 1A9A2R53 | 2 | RESISTOR, FILM: 1.0K ohm, 1/8W, mfr 81349, MIL type RLR05G1001GR | 6-24 |
| 1A9A2R54 thru 1A9A2R57 | | NOT USED | |
| 1A9A2R58 | 2 | RESISTOR, FILM: 6.2K ohm, 1/8W, mfr 81349, MIL type RLR05G6201GR | 6-24 |
| 1A9A2R59 | 2 | RESISTOR, FILM: 510 ohm, 1/4W, mfr 81349, MIL type RLR07G5100GR | 6-24 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A9A2R60 | 2 | RESISTOR, FILM: same as 1A9A2R1 | 6-24 |
| 1A9A2R61 thru 1A9A2R65 | | NOT USED | |
| 1A9A2R66 | 2 | RESISTOR, FILM: 150 ohm, 1/8W, mfr 81349, MIL type RLR05G1500GR | 6-24 |
| 1A9A2R67 | 2 | RESISTOR, FILM: same as 1A9R1 | 6-24 |
| 1A9A2R68 | 2 | RESISTOR, FILM: 10 ohm, 1/8W, mfr 81349, MIL type RLR05G10R0GR | 6-24 |
| 1A9A2R69 | 2 | RESISTOR, FILM: same as 1A7A1R30 | 6-24 |
| 1A9A2R70 | 2 | RESISTOR, FILM: same as 1A9R1 | 6-24 |
| 1A9A2R71 | 2 | RESISTOR, FILM: same as 1A9A2R68 | 6-24 |
| 1A9A2R72 | 2 | RESISTOR, FILM: same as 1A7A1R30 | 6-24 |
| 1A9A2R73 | 2 | RESISTOR, FILM: same as 1A9R1 | 6-24 |
| 1A9A2R74 | 2 | RESISTOR, FILM: same as 1A9A2R68 | 6-24 |
| 1A9A2R75 | 2 | RESISTOR, FILM: same as 1A7A1R30 | 6-24 |
| 1A9A2R76 | 2 | RESISTOR, FILM: same as 1A9R1 | 6-24 |
| 1A9A2R77 | 2 | RESISTOR, FILM: same as 1A9A2R68 | 6-24 |
| 1A9A2R78 | 2 | RESISTOR, FILM: same as 1A7A1R30 | 6-24 |
| 1A9A2R79 | 2 | RESISTOR, FILM: same as 1A9R1 | 6-24 |
| 1A9A2R80 | 2 | RESISTOR, FILM: same as 1A9A2R68 | 6-24 |
| 1A9A2R81 | 2 | RESISTOR, FILM: same as 1A7A1R30 | 6-24 |
| 1A9A2R82 | 2 | RESISTOR, FILM: same as 1A9R1 | 6-24 |
| 1A9A2R83 | 2 | RESISTOR, FILM: same as 1A9A2R68 | 6-24 |
| 1A9A2R84 | 2 | RESISTOR, FILM: same as 1A7A1R30 | 6-24 |
| 1A9A2R85 thru 1A9A2R87 | 2 | RESISTOR, FILM: 4.7K ohm, 1/8W, mfr 81349, MIL type RLR05G4701GR | 6-24 |
| 1A9A2R88 | 2 | NOT USED | 6-24 |
| 1A9A2R89 | 2 | RESISTOR, FILM: same as 1A9A2R53 | 6-24 |
| 1A9A2R90 | 2 | RESISTOR, FILM: same as 1A9A2R58 | 6-24 |
| 1A9A2R91 thru 1A9A2R95 | 2 | RESISTOR, FILM: same as 1A9A2R53 | 6-24 |
| 1A9A2R96 | 2 | RESISTOR, FILM: same as 1A9A2R68 | 6-24 |
| 1A9A2R97 | 2 | RESISTOR, FILM: same as 1A7A1R30 | 6-24 |
| 1A9A2R98 | 2 | RESISTOR, FILM: 150 ohm, 1/2W, mfr 81349, MIL type RCR20G1500GR | 6-24 |
| 1A9A2R99 | 2 | RESISTOR, FILM: same as 1A9R1 | 6-24 |
| 1A9A2R100 | 2 | RESISTOR, FILM: same as 1A9A2R53 | 6-24 |
| 1A9A2R101 | 2 | RESISTOR, FILM: 150 ohm, 1/2W, mfr 81349, MIL type RLR05G1002GR | 6-24 |
| 1A9A2R102 | 2 | RESISTOR, FILM: mfr 81349, MIL type RLR05G4301GR | 6-24 |
| 1A9A2U1 | 2 | MICROCIRCUIT: mfr 18324, part no. 8T20 | 6-24 |
| 1A9A2U2 and 1A9A2U3 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS74/883B | 6-24 |
| 1A9A2U4 | 2 | MICROCIRCUIT: same as 1A7A1U6 | 6-24 |
| 1A9A2U5 | 2 | MICROCIRCUIT: same as 1A7A1U5 | 6-24 |
| 1A9A2U6 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS175/883B | 6-24 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A9A2U7 | 2 | MICROCIRCUIT: same as 1A9A2U2 | 6-24 |
| 1A9A2U8 and 1A9A2U9 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS190/883B | 6-24 |
| 1A9A2U10 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS165/883B | 6-24 |
| 1A9A2U11 | 2 | MICROCIRCUIT: same as 1A9A2U2 | 6-24 |
| 1A9A2U12 | 2 | MICROCIRCUIT: same as 1A2A1U5 | 6-24 |
| 1A9A2U13 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS390/883B | 6-24 |
| 1A9A2U14 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS10/883B | 6-24 |
| 1A9A2U15 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS08/883B | 6-24 |
| 1A9A2U16 | 2 | MICROCIRCUIT: same as 1A9A2U2 | 6-24 |
| 1A9A2U17 | 2 | MICROCIRCUIT: same as 1A9A1U5 | 6-24 |
| 1A9A2U18 | 2 | MICROCIRCUIT: mfr 01295, part no. 5404/883B | 6-24 |
| 1A9A2U19 | 2 | MICROCIRCUIT: same as 1A7A1U5 | 6-24 |
| 1A9A2U20 and 1A9A2U21 | 2 | MICROCIRCUIT: same as 1A9A2U2 | 6-24 |
| 1A9A2U22 | 2 | MICROCIRCUIT: same as 1A9A2U10 | 6-24 |
| 1A9A2U23 | 2 | MICROCIRCUIT: mfr 01295, part no. 55327/883B | 6-24 |
| 1A9A2U24 | 2 | MICROCIRCUIT: same as 1A7A1U6 | 6-24 |
| 1A9A2U25 | 2 | MICROCIRCUIT: mfr 07263, part no. 9616/883B | 6-24 |
| 1A9A2U26 | 2 | MICROCIRCUIT: same as 1A7A1U5 | 6-24 |
| 1A9A2U27 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS76/883B | 6-24 |
| 1A9A2U28 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS20/883B | 6-24 |
| 1A9A2U29 | 2 | MICROCIRCUIT: same as 1A7A1U6 | 6-24 |
| 1A9A2U30 | 2 | MICROCIRCUIT: same as 1A9A2U27 | 6-24 |
| 1A9A2U31 | 2 | MICROCIRCUIT: same as 1A9A2U15 | 6-24 |
| 1A9A2U32 | 2 | MICROCIRCUIT: same as 1A7A1U5 | 6-24 |
| 1A9A2U33 | 2 | MICROCIRCUIT: same as 1A9A2U15 | 6-24 |
| 1A9A2U34 and 1A9A2U35 | 2 | MICROCIRCUIT: same as 1A9A2U8 | 6-24 |
| 1A9A2U36 | 2 | MICROCIRCUIT: same as 1A9A2U10 | 6-24 |
| 1A9A2U37 | 2 | MICROCIRCUIT: same as 1A9A2U27 | 6-24 |
| 1A9A2U38 | 2 | MICROCIRCUIT: same as 1A9A2U15 | 6-24 |
| 1A9A2U39 | 2 | MICROCIRCUIT: same as 1A9A2U2 | 6-24 |
| 1A9A2U40 | 2 | MICROCIRCUIT: same as 1A9A2U18 | 6-24 |
| 1A9A2U41 | 2 | MICROCIRCUIT: same as 1A9A2U14 | 6-24 |
| 1A9A2U42 | 2 | MICROCIRCUIT: same as 1A7A1U6 | 6-24 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A9A2U43 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS14/883B | 6-24 |
| 1A9A2U44 and 1A9A2U45 | 2 | MICROCIRCUIT: mfr 04713, part no. MC14490 | 6-24 |
| 1A9A2U46 and 1A9A2U47 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS196/883B | 6-24 |
| 1A9A2U48 | 2 | MICROCIRCUIT: mfr 18324, part no. 54LS30/883B | 6-24 |
| 1A9A2U49 | 2 | MICROCIRCUIT: same as 1A9A2U23 | 6-24 |
| 1A9A2U50 | 2 | MICROCIRCUIT: same as 1A9A2U13 | 6-24 |
| 1A9A2U51 and 1A9A2U52 | 2 | MICROCIRCUIT: same as 1A9A2U2 | 6-24 |
| 1A9A2U53 | 2 | MICROCIRCUIT: same as 1A9A2U13 | 6-24 |
| 1A9A2U54 | 2 | MICROCIRCUIT: same as 1A9A2U2 | 6-24 |
| 1A9A2U55 and 1A9A2U56 | 2 | MICROCIRCUIT: same as 1A9A2U13 | 6-24 |
| 1A9A2U57 | 2 | MICROCIRCUIT: same as 1A9A2U46 | 6-24 |
| 1A9A2U58 | 2 | MICROCIRCUIT: same as 1A9A2U48 | 6-24 |
| 1A9A2U59 | 2 | MICROCIRCUIT: same as 1A9A2U46 | 6-24 |
| 1A9A2U60 | 2 | RESISTOR, NETWORK: mfr 81349, MIL type M83410102M | 6-24 |
| 1A9A2U61 | 2 | MICROCIRCUIT: same as 1A9A2U46 | 6-24 |
| 1A9A2U62 | 2 | MICROCIRCUIT: same as 1A9A2U13 | 6-24 |
| 1A9A2U63 | 2 | MICROCIRCUIT: same as 1A9A2U46 | 6-24 |
| 1A9A2U64 | 2 | MICROCIRCUIT: same as 1A9A2U48 | 6-24 |
| 1A9A2U65 thru | 2 | MICROCIRCUIT: same as 1A9A2U46 | 6-24 |
| 1A9A2U67 | 2 | MICROCIRCUIT: same as 1A9A2U46 | 6-24 |
| 1A9A2U68 | 2 | MICROCIRCUIT: same as 1A9A2U48 | 6-24 |
| 1A10 | | GENERATOR, 1 MHZ: mfr 14844, part no. D21710-6210-1 | 6-5 |
| 1A10C32 | | CAPACITOR, TANTULUM: same as 1A6C14 | 6-12 |
| 1A10C39 | | CAPACITOR, CERAMIC: 47 uf, 100V, mfr 51642, part no. 200-100-X7R-103J | 6-12 |
| 1A10L17 | | INDUCTOR, RF, MOLDED: same as 1A8A1L27 | 6-12 |
| 1A10P1 | | CONNECTOR: mfr 71468, part no. DBM9W4P | 6-12 |
| 1A10U4 | | MICROCIRCUIT: same as 1A7A1U4 | 6-12 |
| 1A10A1 | | PC BOARD ASSY: mfr 14844, part no. D52041-9410 | 6-25 |
| 1A10A1C1 | | CAPACITOR, CERAMIC: 0.1 uf, 100V, mfr 51642, part no. 200-200-X7R-104J | 6-25 |
| 1A10A1C2 | | NOT USED | |
| 1A10A1C3 | | CAPACITOR, CERAMIC: same as 1A10A1C1 | |
| 1A10A1C4 thru 1A10A1C6 | | NOT USED | |
| 1A10A1C7 | * | CAPACITOR, CERAMIC: same as 1A8A1C7 | 6-25 |
| 1A10A1C8 | | CAPACITOR, CERAMIC: same as 1A10C39 | 6-25 |
| 1A10A1C9 | | NOT USED | |
| 1A10A1C10 | * | CAPACITOR, CERAMIC: mfr 51642, part no. 100-100-NPO-4R7J | 6-25 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A10A1C11 | | NOT USED | |
| 1A10A1C12 | | CAPACITOR, CERAMIC: same as 1A10A1C1 | 6-25 |
| 1A10A1C13 | | CAPACITOR, TANT: same as 1A6C14 | 6-25 |
| 1A10A1C14 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-25 |
| 1A10A1C15 | | CAPACITOR, CERAMIC: 1 uf, 50 WVDC, mfr 81349, MIL type CKR05BK104KR | 6-25 |
| 1A10A1C16 and 1A10A1C17 | | CAPACITOR: 0.0047 uf, 100 VDC, mfr 27735, part no. PP11-0047-100-1 | 6-25 |
| 1A10A1C18 | | CAPACITOR, CERAMIC: 0.033 uf, 100 WVDC, mfr 51642, part no. 400-100-NPO-333J | 6-25 |
| 1A10A1C19 and 1A10A1C20 | | CAPACITOR: same as 1A10A1C16 | 6-25 |
| 1A10A1C21 | | CAPACITOR, CERAMIC: same as 1A10A1C18 | 6-25 |
| 1A10A1C22 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-25 |
| 1A10A1C23 | | NOT USED | |
| 1A10A1C24 and 1A10A1C25 | | CAPACITOR, CERAMIC: 560 pf, 100 WVDC, mfr 51642, part no. 150-100-NPO-561J | 6-25 |
| 1A10A1C26 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-25 |
| 1A10A1C27 and 1A10A1C28 | | CAPACITOR, CERAMIC: 3300 pf, 100 WVDC, mfr 51642, part no. 200-100-NPO-332J | 6-25 |
| 1A10A1C29 | | NOT USED | |
| 1A10A1C30 and 1A10A1C31 | | CAPACITOR, CERAMIC: same as 1A10A1C24 | 6-25 |
| 1A10A1C32 | | NOT USED | |
| 1A10A1C33 and 1A10A1C34 | | CAPACITOR, CERAMIC: same as 1A6C9 | 6-25 |
| 1A10A1C35 and 1A10A1C36 | | NOT USED | |
| 1A10A1C37 and 1A10A1C38 | | CAPACITOR, CERAMIC: same as 1A10A1C1 | 6-25 |
| 1A10A1CR1 and 1A10A1CR2 | | NOT USED | |
| 1A10A1CR3 thru 1A10A1CR8 | | DIODE: same as 1A8A1CR6 | 6-25 |
| 1A10A1CR9 and 1A10A1CR10 | | DIODE: same as 1A5A3CR1 | 6-25 |
| 1A10A1L1 and 1A10A1L2 | | INDUCTOR: 10 uH, mfr 96906, MIL type MS14046-4 | 6-25 |
| 1A10A1L3 | | INDUCTOR: 39 uH, mfr 96906, MIL type MS75085-2 | 6-25 |
| 1A10A1L4 thru 1A10A1L6 | | NOT USED | |
| 1A10A1L7 | | INDUCTOR: 22 uH, mfr 96906, MIL type MS75084-16 | 6-25 |
| 1A10A1L8 | | NOT USED | |
| 1A10A1L9 and 1A10A1L10 | | INDUCTOR: 100 uH, mfr 96906, MIL type MS75085-7 | 6-25 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A10A1L11 and 1A10A1L12 | | INDUCTOR: 82uH, mfr 96906, MIL type MS75085-6 | 6-25 |
| 1A10A1L13 thru 1A10A1L16 | | INDUCTOR: mfr 14844, part no. A52053-9410 | 6-25 |
| 1A10A1L17 | | NOT USED | |
| 1A10A1L18 thru 1A10A1L21 | | INDUCTOR: mfr 14844, part no. A52051-9410 | 6-25 |
| 1A10A1R1 and 1A10A1R2 | | NOT USED | |
| 1A10A1R3 | | RESISTOR, COMP: 430 ohm, 1/4W, mfr 81349, MIL type RCR07G431JR | 5-25 |
| 1A10A1R4 | | RESISTOR, COMP: 4.7K ohm, 1/4W, mfr 81349, MIL type RCR07G472JR | 6-25 |
| 1A10A1R5 thru 1A10A1R11 | | NOT USED | |
| 1A10A1R12 | | RESISTOR, COMP: same as 1A10A1R4 | |
| 1A10A1R13 and 1A10A1R14 | | NOT USED | |
| 1A10A1R15 thru 1A10A1R18 | | RESISTOR, COMP: 2.7 ohm, 1/4W, mfr 81349, MIL type RCR07G2R7JR | 6-25 |
| 1A10A1T1 | | TRANSFORMER: mfr 14844, part no. A52052-9410 | 6-25 |
| 1A10A1U1 and 1A10AU2 | | MICROCIRCUIT: mfr 02195, part no. 54HC161/883B | 6-25 |
| 1A10A1U3 | | MICROCIRCUIT: mfr 02195, part no. 54HC240/883B | 6-25 |
| 1A14 | | BTRY CHGR, LOGIC: mfr 14844, part no. D51714-9414 | 6-5 |
| 1A14R1 thru 1A14R29 | | NOT USED | |
| 1A14R30 | | RESISTOR, WIRE-WOUND: 10 ohm, $\pm$1%, 10W, mfr 81349, MIL type RER65F10R0R | 6-26 |
| 1A14U1 thru 1A14U5 | | NOT USED | |
| 1A14U6 | | MICROCIRCUIT, LINEAR: mfr 27014, part no. LM117HVK/883B | 6-26 |
| 1A14A1 | | PC ASSY: mfr 14844, part no. D52141-9414 | 6-26 |
| 1A14A1C1 thru 1A14A1C26 | | NOT USED | |
| 1A14A1C27 and 1A14A1C28 | | CAPACITOR, CERAMIC: 0.22 uf, $\pm$10%, 100V, mfr 81349, MIL type CKR06CW224KR | 6-26 |
| 1A14A1C29 | | NOT USED | |
| 1A14A1C30 | | CAPACITOR, TANTALUM: same as 1A6C14 | 6-26 |
| 1A14A1CR1 thru 1A14A1CR6 | | NOT USED | |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A14A1CR7 | | DIODE: same as 1A9A2CR21 | 6-26 |
| 1A14A1CR8 | | DIODE: ZENER: mfr 81349, MIL type JANTX1N751 | 6-26 |
| 1A14A1CR9 and 1A14A1CR10 | | NOT USED | |
| 1A14A1CR11 | | DIODE, SWITCHING: same as 1A14A1CR8 | 6-26 |
| 1A14A1CR12 | | DIODE, SWITCHING: mfr 81349, MIL type JANTX1N5802 | 6-26 |
| 1A14A1CR13 | | DIODE, ZENER: mfr 81349, MIL type JANTX1N971B | 6-26 |
| 1A14A1CR14 and 1A14A1CR15 | | NOT USED | |
| 1A14A1CR16 | | DIODE, ZENER: same as 1A14A1CR8 | 6-26 |
| 1A14A1CR17 and 1A14A1CR18 | | DIODE: same as 1CR1 | 6-26 |
| 1A14A1K1 | | RELAY: mfr 02289, part no. 28PK-B-118 | 6-26 |
| 1A14A1P1 | | CONNECTOR: mfr 81349, MIL type M24308/24-27 | 6-26 |
| 1A14A1Q1 and 1A14A1Q3 | | NOT USED | |
| 1A14A1Q4 and 1A14A1Q5 | | TRANSISTOR: same as 1A8A1Q1 | 6-26 |
| 1A14A1R1 thru 1A14A1R20 | | NOT USED | |
| 1A14A1R21 | | RESISTOR, FILM: same as 1A6R13 | 6-26 |
| 1A14A1R22 | | NOT USED | |
| 1A14A1R23 and 1A14A1R24 | | RESISTOR, FILM: 1.8K ohm, ±2%, 1/4W, mfr 81349, MIL type RLR07C1801GR | 6-26 |
| 1A14A1R25 | | NOT USED | |
| 1A14A1R26 | | RESISTOR, FILM: same as 1A6R12 | 6-26 |
| 1A14A1R27 and 1A14A1R28 | | RESISTOR, FILM: same as 1A14A1R23 | 6-26 |
| 1A14A1R29 and 1A14A1R30 | | NOT USED | |
| 1A14A1R31 | | RESISTOR, FILM: same as 1A14A1R23 | 6-26 |
| 1A14A1R32 | | RESISTOR, FILM: 240 ohm, ±2%, 1/4W, mfr 81349, MIL type RLR07C2400GR | 6-26 |
| 1A14A1R33 | | RESISTOR, FILM: 4.3K ohm, ±2%, 1/4W, mfr 81349, MIL type RLR07C4301GR | 6-26 |
| 1A14A1R34 | | RESISTOR, FILM: same as 1R5 | 6-26 |
| 1A14A1R35 | | RESISTOR, FILM: 750 ohm, ±2%, 1/4W, mfr 81349, MIL type RLR07C7500GR | 6-26 |
| 1A14A1R36 and 1A14A1R37 | | RESISTOR, FILM: same as 1A14A1R23 | 6-26 |
| 1A14A1R38 | | RESISTOR, FILM: 4.7K ohm, ±2%, 1/4W, mfr 81349, MIL type RLR07C4701GR | 6-26 |
| 1A14A1R39 | | RESISTOR, FILM: same as 1A14A1R23 | 6-26 |
| 1A14A1R40 thru 1A14A1R44 | | NOT USED | |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A14A1R45 | | RESISTOR, FILM: same as 1A6R12 | 6-26 |
| 1A14A1R46 | | RESISTOR, WIRE-WOUND: 0.1 ohm, ±1%, 3W, mfr 81349, MIL type RWR89SR100FR | 6-26 |
| 1A14A1R47 | | NOT USED | |
| 1A14A1R48 | | RESISTOR, FILM: same as 1A6R12 | 6-26 |
| 1A14A1R49 | | RESISTOR, FILM: 100K ohm, ±2%, 1/4W, mfr 81349, MIL type RLR07C1003GR | 6-26 |
| 1A14A1R50 | | RESISTOR, VARIABLE: 25K ohm, ±10%, 5W, mfr 81349, MIL type RJR24FX253M | 6-26 |
| 1A14A1R51 | | RESISTOR, FILM: 91K ohm, ±2%, 1/4W, mfr 81349, MIL type RLR07C9102GR | 6-26 |
| 1A14A1R52 and 1A14A1R53 | | RESISTOR, FILM: same as 1A14A1R49 | 6-26 |
| 1A14A1R54 and 1A14A1R55 | | NOT USED | |
| 1A14A1R56 | | RESISTOR, FILM: 10M ohm, ±2%, 1/4W, mfr 81349, MIL type RLR07C1005GR | 6-26 |
| 1A14A1R57 | | RESISTOR, FILM: same as 1A14A1R38 | 6-26 |
| 1A14A1R58 | | RESISTOR, FILM: same as 1A6R40 | 6-26 |
| 1A14A1R59 | | RESISTOR, FILM: same as 1A6R13 | 6-26 |
| 1A14A1U1 thru 1A14A1U6 | | NOT USED | |
| 1A14A1U7 | | MICROCIRCUIT: same as 1A7A1U5 | 6-26 |
| 1A14A1U8 | | MICROCIRCUIT, LINEAR: mfr 27014, part no. LM741H/883B | 6-26 |
| 1A16 | | SW ASSY/AMPL MTR DR: mfr 14844, part no. D52520-9418 | 6-5 |
| 1A16S1 | | SWITCH: mfr 91812, part no. 2812BA-2E | 6-14 |
| 1A16A1 | | AMPL MTR DRVR ASSY: mfr 14844, part no. D52531-9418 | 6-27 |
| 1A16A1C1 thru 1A16A1C5 | | CAPACITOR, CERAMIC: same as 1A5A1C4 | 6-27 |
| 1A16A1C6 | | CAPACITOR, CERAMIC: same as 1A5C6 | 6-27 |
| 1A16A1C7 and 1A16A1C8 | | CAPACITOR, CERAMIC: same as 1A5C1 | 6-27 |
| 1A16A1C9 | | CAPACITOR, CERAMIC: same as 1A7A1C34 | 6-27 |
| 1A16A1CR1 | | DIODE: mfr 81349, MIL type JANTX1N758 | |
| 1A16A1CR2 and 1A16A1CR3 | | DIODE: same as 1CR1 | 6-27 |
| 1A16A1J1 | | CONNECTOR, IC SOCKET, 18 PIN: mfr 71279 part no. 703-4318-01-03-10 | 6-27 |
| 1A16A1R1 | | RESISTOR, FILM: same as 1A7A1R2 | 6-27 |
| 1A16A1R2 | | RESISTOR, COMP: 330K ohm, ±5%, 1/8W, mfr 81349, MIL type RCR05G334JR | 6-27 |
| 1A16A1R3 | | NOT USED | |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A16A1R4 | | RESISTOR, COMP: 680K ohm, ±5%, 1/8W, mfr 81349, MIL type RCR05G684JR | 6-27 |
| 1A16A1R5 | | RESISTOR, FILM: 82K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C8202GR | 6-27 |
| 1A16A1R6 | | RESISTOR, FILM: 100K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C1003GR | 6-27 |
| 1A16A1R7 | | RESISTOR, FILM: 20K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C2002GR | 6-27 |
| 1A16A1R8 | | RESISTOR, FILM: same as 1A7A1R20 | 6-27 |
| 1A16A1R9 | * | RESISTOR, FILM: 33K ohm, 1/8W, mfr 81349, MIL type RLR05C3302GR | 6-27 |
| 1A16A1R10 and 1A16A1R11 | | RESISTOR, FILM: same as 1A5A4R1 | 6-27 |
| 1A16A1R12 | | RESISTOR, FILM: same as 1A7A1R16 | 6-27 |
| 1A16A1R13 | | RESISTOR, FILM: same as 1A5A4R1 | 6-27 |
| 1A16A1R14 and 1A16A1R15 | | RESISTOR, FILM: same as 1A7A1R20 | 6-27 |
| 1A16A1R16 | | NOT USED | |
| 1A16A1R17 | | RESISTOR, FILM: 1.8K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C1801GR | 6-27 |
| 1A16A1R18 | | RESISTOR, FILM: same as 1A5A4R1 | 6-27 |
| 1A16A1R19 | | RESISTOR, FILM: same as 1A7A1R20 | 6-27 |
| 1A16A1R20 | | RESISTOR, FILM: same as 1A5A4R1 | 6-27 |
| 1A16A1R21 thru 1A16A1R23 | | RESISTOR, FILM: same as 1A7A1R20 | 6-27 |
| 1A16A1R24 | | RESISTOR, FILM: 47K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C4702GR | 6-27 |
| 1A16A1R25 | | RESISTOR, COMP: 560K ohm, ±5%, 1/8W, mfr 81349, MIL type RCR05G564JR | 6-27 |
| 1A16A1R26 | | RESISTOR, FILM: 180K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C1803GR | 6-27 |
| 1A16A1R27 | | RESISTOR, COMP: 2.2M ohm, ±5%, 1/8W, mfr 81349, MIL type RCR05G225JR | 6-27 |
| 1A16A1R28 and 1A16A1R29 | | RESISTOR, FILM: same as 1A7A1R20 | 6-27 |
| 1A16A1R30 | | RESISTOR, FILM: 22K ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C220GR | 6-27 |
| 1A16A1R31 | | RESISTOR, FILM: 27 ohm, ±2%, 1/8W, mfr 81349, MIL type RLR05C27R0GR | 6-27 |
| 1A16A1R32 | | RESISTOR, FILM: same as 1A5A3R10 | 6-27 |
| 1A16A1R33 | | RESISTOR, FILM: same as 1A16A1R31 | 6-27 |
| 1A16A1R34 | | RESISTOR, FILM: same as 1A7A1R20 | 6-27 |
| 1A16A1R35 | | RESISTOR, COMP: 75K ohm, ±5%, 1/8W, mfr 81349, MIL type RCR05G753JR | 6-27 |
| 1A16A1U1 | | MICROCIRCUIT: mfr 27014, part no. LM108AH/883B | 6-27 |

Table 7-1. Parts List - Continued

| Reference designation | Notes | Name and description | Figure no. |
|---|---|---|---|
| 1A17 | | BATTERY PWR SUPPLY: mfr 14844, part no. D51717-9417 | 6-5 |
| 1A17BT1 | | BATTERY PACK: mfr 14844, part no. A40595-SCD-108 | 6-5 |
| 1A17F1 | | FUSE, 20 AMP, 32 VOLTS: mfr 75915, part no. 275020 | 6-5 |
| 1A17P1 | | CONNECTOR: mfr 71468, part no. DEMM9P | 6-5 |
| 1A17RT1 | | THERMISTOR: 1K ohm, mfr 90634, part no. 31TD2 | 6-5 |

Table 7-2. Common Item Descriptions

| Item number | Name and description |
|---|---|
| 1 | Capacitor, Ceramic, 150 pf, 100 Vdc: mfr 51642, P/N 150-100-NPO-151J |
| 2 | Capacitor, Ceramic, 220 pf, 100 Vdc: mfr 51642, P/N 150-100-NPO-221J |
| 3 | Capacitor, Ceramic, 0.01 uf, 100V: mfr 81349, MIL type CKR05BX103KR |
| 4 | Capacitor, Ceramic, 0.1 uf, 50V: mfr 81349, MIL type CKR05BX104KR |
| 5 | Capacitor, Ceramic, 0.1 uf, 100 WVDC: mfr 81349, MIL type CKR06BX104KR |
| 6 | Capacitor, Ceramic, 1 uf, 50V: mfr 96906, MIL type M39014/02-1419 |
| 7 | Capacitor, Mica: mfr 51642, P/N 150-100-NPO-101J |
| 8 | Capacitor, Tantalum, 6.8 uf, 50 WVDC: mfr 56289, CSR13F685KR |
| 9 | Capacitor, Variable, 0.6-4.5 pf: mfr 91293, P/N R7273 |
| 10 | Connector, BNC, RF TYPE: mfr 81349, MIL type M39012/21-0001 |
| 11 | Diode: mfr 81349, MIL type JANTX1N914 |
| 12 | Diode: mfr 81349, MIL type JANTX1N965B |
| 13 | Diode: mfr 81349, MIL type JANTX1N4148 |
| 14 | Diode, Switching: mfr 81349, MIL type JANTX1N5615 |
| 15 | Inductor, Bead: mfr 02114, P/N 5659065/446 |

Table 7-2. Common Item Descriptions - Continued

| Item number | Name and description |
|---|---|
| 16 | Inductor, RF, Molded, 68 UH: mfr 96906, MIL type MS75085-5 |
| 17 | Microcircuit: mfr 18324, P/N 54LS00/883B |
| 18 | Microcircuit: mfr 18324, P/N 54LS74/883B |
| 19 | Microcircuit: mfr 18324, P/N 54LS196/883B |
| 20 | Microcircuit: mfr 18324, P/N 54LS190/883B |
| 21 | Microcircuit: mfr 18324, P/N 54LS390/883B |
| 22 | Microcircuit: mfr 28480, P/N 5082-7391 |
| 23 | Plug: mfr 91506, MIL type 616AG1 |
| 24 | Resistor, Film, 10 Ohm, 1/8W: mfr 81349, MIL type RLR05C10R0GR |
| 25 | Resistor, Comp., 47 Ohm, 1/8W: mfr 81340, MIL type RLR0547R0GR |
| 26 | Resistor, Film, 4.7K Ohm, 1/8W: mfr 81349, MIL type RLR05C4701GR |
| 27 | Resistor, Film, 2.2K Ohm, 1/8W: mfr 81349, MIL type RLR05C2201GR |
| 28 | Resistor, Comp., 8.2K Ohm, 1/8W: mfr 81349, MIL type RLR05C8201GR |
| 29 | Resistor, Film, 10K Ohm, 1/8W: mfr 81349, MIL type RLR05C1002GR |
| 30 | Resistor, Film, 10 Ohm, 1/8W: mfr 81349, MIL type RLR05G10R0GR |
| 31 | Resistor, Film, 100 Ohm, 1/8W: mfr 81349, MIL type RLR05G1000GR |
| 32 | Resistor, Film, 330 Ohm, 1/8W: mfr 81349, MIL type RLR05G3300GR |
| 33 | Resistor, Film, 1.0K Ohm, 1/8W: mfr 81349, MIL type RLR05G1001GR |
| 34 | Resistor, Film: mfr 81349, 1.8K, MIL type RLR07C1801GR |
| 35 | Socket, DIP, 16P: mfr 91506, P/N 516-AG10D |
| 36 | Switch, Pushbutton: mfr 04426, P/N 76-2222-404 |
| 37 | Transistor: mfr 81349, MIL type JANTX2N2222A |
| 38 | Transistor: mfr 81349, MIL type JANTX2N2369A |

Table 7-3. List of Common Bulk Items

| Item no. | Ref des | Description | Qty |
|---|---|---|---|
| 1 | 1A14MP15 | INSULATOR: mfr 18565; part no. 60-11-6875-1671 | 1 |
| 2 | 1A14MP14 | WASHER, TEFLON: mfr 06540; part no. 2630-18527-T116-00 | 2 |
| 3 | 1A14MP16 | LUG, SOLDER: mfr 83330; part no. 1416-4 | 1 |
| 4 | 1A5A1MP1 | INSULATOR, HYBRID: mfr 14844; part no. 851868-9405 | 2 |
| 5 | 1A5MP8 | LUG, SOLDER: mfr 83330; part no. 1488-8 | 3 |
| 6 | 1A5MP7 | LUG, GROUND: mfr 71002; part no. 575 | 9 |
| 7 | 1A5E1 | TERMINAL, GLASS INSULATED: mfr 20092, part no. 4AS-30W-SS | 1 |
| 8 | 1A5E3 | TERMINAL, INSULATED: mfr 71279; part no. 570-2255-02-05-00 | 3 |
| 9 | 1A5A2MP2 | TERMINAL, GLASS INSULATED: mfr 20093, part no. 5AS-30W-SS-MOD A | 2 |
| 10 | 1A6MP11 | LUG: mfr 83330; part no. 1412-4 | 4 |
| 11 | 1A6MP18 | INSERT, STANDOFF: mfr 14844; part no. A13207-STD-8 | 3 |
| 12 | 1A6MP8 | WASHER, SHOULDER: mfr 06540; part no. 2630-14020-T093 | 8 |
| 13 | 1A6MP19 | INSULATOR, TO-3: mfr 18565; part no. 60-11-6875-1671 | 2 |
| 14 | 1A6MP20 | INSULATOR, TO-66: mfr 18565; part no. 60-11-4997-1671 | 1 |
| 15 | 1A7TP1 | TERMINAL, TEST POINT: mfr 17117; part no. M39024/5-11 | 1 |
| 16 | 1A7A1MP1 | TERMINAL, GLASS: mfr 14844; part no. C23013-SCD-3 | 3 |
| 17 | 1A5A3MP1 | TERMINAL, GLASS: mfr 14844; part no. C7830-TSD-2 | 2 |
| | 1A7A1MP2 | TERMINAL, GLASS: mfr 14844; part no. C7830-TSD-2 | 42 |
| 18 | 1A9MP8 | STANDOFF: mfr 06540; part no. 8216-SS-0440 | 10 |
| 19 | 1A9MP11 | STANDOFF: mfr 06540; part no. 8106-A-0256 | 2 |
| 20 | 1A9MP17 | NUT, KNURLED: mfr 09353; part no. 7969 | 9 |
| 21 | 1A10E1 thru 1A10E4 | TERMINAL, INSULATED: mfr 71279; part no. 572-4872-01-05-16 | 4 |
| 22 | 1A8MP11 | HOLDER, HEATSINK: mfr 05820; part no. 260-4T5 | 1 |
| | 1A10XU4 | HOLDER, HEATSINK: mfr 05820; part no. 240-4T5 | 1 |
| 23 | 1MP135 | SCREW LOCK ASSEMBLY: mfr 71468; part no. D20418-2 | 4 |
| | 1A9A2MP1 | SCREW LOCK ASSEMBLY: mfr 71468; part no. D20418-2 | 2 |
| 24 | 1A17MP1 | TIE ROD: mfr 14844; part no. B52481-9417 | 2 |
| 25 | 1A17MP2 | NUT, PILOT BEARING NO. 10-32: mfr 14844; part no. B52482-9417 | 4 |
| 26 | 1A17MP3 | SCREW, CAPTIVE NO. 10-32, PATCH LOK: mfr 14844; part no. B52483-9417 | 4 |
| 27 | 1A17MP4 | PLATE, BEARING: mfr 14844; part no. C52484-9417 | 1 |
| 28 | 1A17MP5 | PLATE, BEARING: mfr 14844; part no. C52485-9417 | 1 |
| 29 | 1MP85 | DIAL: mfr 80294; part no. H-492-3 | 1 |
| 30 | 1MP82 | HOLDER, SPARE FUSE: mfr 14844; part no. D52494-9418 | 1 |

Table 7-3. List of Common Bulk Items - Continued

| Item no. | Ref des | Description | Qty |
|---|---|---|---|
| 31 | 1XF1 thru 1XF4 | FUSEHOLDER, SHIELDED: mfr 14844; part no. A2279-6200 | 4 |
| 32 | 1MP109 | TERMINAL, INSULATED TURRET: mfr 71279; part no. 572-4870-01-05-16 | 17 |
| 33 | 1MP64 | SCREEN, EXHAUST: mfr 14844; part no. D52493-9418-2 | 1 |
| 34 | 1A10A1MP1 | TERMINAL: mfr 14844; part no. C5130-SCD-TSD-2 | 15 |
| | 1A8A1MP1 | TERMINAL: mfr 14844; part no. C5130-SCD-TSD-2 | 18 |
| | 1A9A1MP1 | TERMINAL: mfr 14844; part no. C5130-SCD-TSD-2 | 24 |
| 35 | 1A17MP6 | SCREW LOCK ASSEMBLY: mfr 71468; part no. D20419-16 | 2 |
| 36 | 1A6E1, 1A6E3 thru 1A6E5 | TERMINAL: mfr 71279; part no. 572-4826-01 | 4 |
| 37 | 1A5A3MP3 | INSULATOR, HYBRID: mfr 14844; part no. B51869-9405 | 1 |
| 38 | 1A5A4MP1 | INSULATOR, HYBRID: mfr 14844; part no. B51870-9405 | 1 |
| 39 | 1A9E1 thru 1A9E4 | TERMINAL, INSULATED: mfr 71279; part no. 4826-1-0516 | 4 |

Table 7-4. List of Attaching Hardware

| Item no. | Part number | Description | Qty | Ref des |
|---|---|---|---|---|
| 1 | 1488-8 | LUG, SOLDER | 5 | 1A5MP8 |
| 2 | 1497 | LUG, SOLDER (BNC) | 7 | 1MP78 |
| 3 | 2630-14020 T093 | WASHER, SHOULDER, INSULATED #2 | 13 | 1A6MP8, 1A9MP24 |
| 4 | 29466-STD-5 | SPACER, 0.062 THK | 12 | 1MP132 |
| 5 | 575 | LUG, GROUND | 9 | 1A5MP7 |
| 6 | 7969 | NUT, KNURLED, 1/4-40 THD (3/8 O.D.) | 9 | 1A9MP17 |
| 7 | 8216-SS-0440 | STANDOFF, 1/4 HEX #4-40 | 10 | 1A9MP8 |
| 8 | 9207-PH-091 | SPACER, 3/16 DIA x 1/8 LG | 6 | 1MP10 |
| 9 | A1-KA-02-XKZZ | NUT, NYLON, HEX #2-56 | 5 | 1A10A1 |
| 10 | D20418-2 | SCREW, LOCK ASSY, FEMALE | 6 | 1MP135, 1A9A2 |

Table 7-4. List of Attaching Hardware - Continued

| Item no. | Part number | Description | Qty | Ref des |
|---|---|---|---|---|
| 11 | MS15795-802 | WASHER, FLAT #2 | 16 | 1MP9, 1A14A1 |
| 12 | MS15795-803 | WASHER, FLAT #4 | 66 | 1MP6, 1MP53, 1A7MP8, 1A10MP11, 1A14MP4 |
| 13 | MS15795-805 | WASHER, FLAT #6 | 30 | 1MP37 |
| 14 | MS15795-807 | WASHER, FLAT #8 | 13 | 1MP43 |
| 15 | MS21045-04 | NUT, HEX, SELF LOCK #4-40 | 48 | 1MP69 |
| 16 | MS21045-08 | NUT, HEX, SELF LOCK #8-32 | 8 | 1MP65 |
| 17 | MS24693-C4 | SCREW FHMS #4-40 100DEG x 3/8LG | 12 | 1A7MP7, 1A8MP6, 1A10MP10 |
| 18 | MS35338-134 | WASHER, SPLIT LOCK #2 | 116 | 1MP12, 1MP88, 1A5MP5, 1A6MP3, 1A7MP5, 1A8MP9, 1A9MP13, 1A10MP7, 1A14MP8, 1A14A1 |
| 19 | MS35338-135 | WASHER, SPLIT LOCK #4 | 95 | 1MP5, 1MP138, 1MP55, 1A5MP15, 1A6MP9, 1A8MP4, 1A9MP4, 1A9A2, 1A10MP4, 1A14MP5 |
| 20 | MS35338-136 | WASHER, SPLIT LOCK #6 | 46 | 1MP38, 1MP142 |
| 21 | MS35338-137 | WASHER, SPLIT LOCK #8 | 8 | 1MP42 |
| 22 | MS35649-224 | NUT, HEX #2-56 | 26 | 1MP13, 1MP131, 1A5MP16, 1A9MP16, 1A14MP9, 1A14A1 |

Table 7-4. List of Attaching Hardware - Continued

| Item no. | Part number | Description | Qty | Ref des |
|---|---|---|---|---|
| 23 | MS35649-244 | NUT, HEX #4-40 | 27 | 1MP140, 1MP56, 1A5MP20, 1A6MP10, 1A8MP7, 1A9A2, 1A10MP12, 1A14MP12 |
| 24 | MS35649-264 | NUT, HEX #6-32 | 12 | 1MP39, 1MP45 |
| 25 | MS51957-1 | SCREW, PHMS #2-56 1/8 LG | 8 | 1A7MP4 |
| 26 | MS51957-12 | SCREW, PHMS #4-40 3/16 LG | 25 | 1A8MP3, 1A10MP3, 1A14MP3 |
| 27 | MS51957-123 | SCREW, PHMS #6-32 9/16 LG | 13 | 1MP141, 1MP46 |
| 28 | MS51957-13 | SCREW, PHMS #4-40 1/4 LG | 19 | 1MP29, 1A6MP16, 1A10MP9 |
| 29 | MS51957-14 | SCREW, PHMS #4-40 5/16 LG | 34 | 1MP67, 1A5MP14, 1A9MP3, 1A9A2 |
| 30 | MS51957-15 | SCREW, PHMS, #4-40 3/8 LG | 9 | 1MP16, 1MP73 |
| 31 | MS51957-16 | SCREW, PHMS #4-40 7/16 LG | 48 | 1MP4, 1MP72, 1A6MP6, 1A14MP13 |
| 32 | MS51957-17 | SCREW, PHMS #4-40 1/2 LG | 12 | IMP50 |
| 33 | MS51957-2 | SCREW, PHMS #2-56 3/16 LG | 70 | 1MP27, 1MP87, 1A5MP4, 1A6MP2, 1A8MP8, 1A9MP10, 1A10MP6 |
| 34 | MS51957-26 | SCREW, PHMS #6-32 1/4 LG | 6 | 1MP58 |
| 35 | MS51957-27 | SCREW, PHMS #6-32 5/16 LG | 7 | 1MP126 |
| 36 | MS51957-28 | SCREW, PHMS #6-32 3/8 LG | 14 | 1MP41, 1MP138 |
| 37 | MS51957-29 | SCREW, PHMS #6-32 7/16 LG | 12 | 1MP36 |
| 38 | MS51957-3 | SCREW, PHMS #2-56 1/4 LG | 10 | 1MP92 |

Table 7-4. List of Attaching Hardware - Continued

| Item no. | Part number | Description | Qty | Ref des |
|---|---|---|---|---|
| 39 | MS51957-30 | SCREW, PHMS #6-32 1/2 LG | 6 | 1MP26, 1MP48 |
| 40 | MS51957-4 | SCREW, PHMS #2-56 5/16 LG | 8 | 1A5MP10, 1A14MP6 |
| 41 | MS51957-5 | SCREW, PHMS #2-56 3/8 LG | 6 | 1A14A1 |
| 42 | MS51958-62 | SCREW, PHMS #10-32 7/16 LG | 7 | 1MP114 |
| 43 | MS51959-12 | SCREW, FHMS #4-40 3/16 LG | 6 | 1A8MP2, 1A10MP2, 1A14MP2 |
| 44 | MS51959-13 | SCREW, FHMS #4-40 1/4 LG | 30 | 1MP99, 1A9MP7 |
| 45 | MS51959-15 | SCREW, FHMS #4-40 3/8 LG | 14 | 1MP75 |
| 46 | MS51959-2 | SCREW, FHMS #2-56 3/16 LG | 33 | 1A5MP2, 1A7MP2 |
| 47 | MS51959-28 | SCREW, FHMS #6-32 3/8 LG | 8 | 1MP28, 1A9MP20 |
| 48 | MS51959-3 | SCREW, FHMS #2-56 1/4 LG | 8 | 1MP94, 1A5MP13, 1A9MP12 |
| 49 | MS51959-4 | SCREW, FHMS #2-56 5/16 LG | 8 | 1A7MP10, 1A9MP14 |
| 50 | MS51960-63 | SCREW, FHMS #10-32 3/8 LG | 10 | 1MP121 |
| 51 | MS51960-65 | SCREW, FHMS #10-32 1/2 LG | 15 | 1MP96, 1MP122 |
| 52 | NAS620-2 | WASHER, FLAT #2 | 91 | 1MP89, 1A5MP6, 1A6MP4, 1A7MP6, 1A8MP10, 1A9MP15, 1A14MP7 |
| 53 | NAS620-4 | WASHER, FLAT #4 | 18 | 1A6MP7 |
| 54 | NAS620-4L | WASHER, FLAT #4 | 118 | 1MP68, 1A8MP5, 1A9MP22, 1A9A2, 1A10MP5, 1A14MP10 |
| 55 | NAS620-6L | WASHER, FLAT #6 | 7 | 1MP59 |
| 56 | NAS620-8L | WASHER, FLAT #8 | 12 | 1MP62 |
| 57 | NAS620C-4L | WASHER, FLAT #4 | 8 | 1MP139 |

Table 7-4. List of Attaching Hardware - Continued

| Item no. | Part number | Description | Qty | Ref des |
|---|---|---|---|---|
| 58 | NAS620C-6L | WASHER, FLAT #6 | 12 | 1MP143 |
| 59 | NAS6620-2 | WASHER, #2 | 14 | 1MP144 |
| 60 | MS51959-42 | SCREW, FHMS #8-32 5/16 LG | 8 | 1MP145 |

Table 7-5. List of Manufacturers

| Code number | Manufacturer and address |
|---|---|
| 01195 | Texas Instruments, Inc.<br>Semiconductor Group<br>P.O. Box 225012 M/S 49<br>Dallas, TX 75265 |
| 02214 | Amperex Electronics Corp<br>Ferroxcube Division<br>5083 Kings Hwy<br>Saugerties, NY 12477 |
| 04213 | Caddell-Burns Mfg Co. Inc.<br>40 E. Second Street<br>Mineola, NY 11501 3679 |
| 04426 | Illinois Tool Works Inc.<br>Licon Div.<br>6615 W. Irving Park Rd<br>Chicago, Il 60634 |
| 04713 | Motorola Semiconductor Prod. Sales<br>Sub. of Motorola Inc.<br>4828 E. McDowell Road<br>Phoenix, AZ 85008 |
| 04752 | American Electronics Inc.<br>1600 E. Valencia Drive<br>Fullerton, CA 92631 |
| 07126 | Digitran Co.<br>Div. Beckton Dickenson and Co.<br>855 S. Arroyd Pky<br>Pasadena, CA 91105 |
| 07263 | Fairchild Camera and Instrument Corp.<br>Semiconductor Div.<br>401 Ellis Street<br>Mountain View, CA 94042 |

Table 7-5. List of Manufacturers - Continued

| Code number | Manufacturer and address |
|---|---|
| 09353 | Translite Engineering Co.<br>Reseda, CA 91335 |
| 11707 | Ideal Precision Meter Co.<br>214 Franklin Street<br>Brooklyn, NY 11222 |
| 12294 | Erie Technical Products Ltd.<br>5 Fraser Avenue<br>Trenton, Ontario, Canada K8V 5S1 |
| 14099 | Steconne Products Co.<br>8479 Pardee Drive<br>Oakland, CA 94621 3999 |
| 14752 | Electro Cube, Inc.<br>710 S. Del Mar Avenue<br>San Gabriel, CA 91776 |
| 14844 | Frequency Electronics Inc.<br>55 Charles Lindberg Blvd.<br>Mitchell Field, NY 11553 |
| 15542 | Mini-Circuits Laboratory<br>Div. Scientific Component Corp.<br>2625 E. 14th Street<br>Brooklyn, NY 11235 3679 |
| 18324 | Signetics Corp.<br>4130 S. Market Ct.<br>Sacramento, CA 95834 |
| 18758 | Tek Wave Inc.<br>3 Delaware Drive<br>New Hyde Park, NY 11040 A3825 |
| 21317 | Electronic Applications Co.<br>4918 Santa Anita Avenue<br>El Monte, CA 91734 |
| 21649 | Otto Controls<br>Division of Otto Eng Inc.<br>36 Main Street<br>Carpentersville, IL 60110 |
| 23936 | Pamotor Div.<br>William J. Purdy Co.<br>770 Airport Blvd.<br>Burlingame, CA 94010 |

Table 7-5. List of Manufacturers - Continued

| Code number | Manufacturer and address |
|---|---|
| 27014 | National Semiconductor Corp.<br>2900 Semiconductor Drive<br>Santa Clara, CA 95051 3674 |
| 27675 | Design Transformer Corp.<br>29-16 40th Avenue<br>Long Island City, NY 11101 A3612 |
| 28480 | Hewlett-Packard Co.<br>Corporate HQ.<br>3000 Hanover Street<br>Palo Alto, CA 94304 |
| 32293 | Intersel Inc.<br>Sub. of General Electric Co.<br>10900 N. Tantau Avenue<br>Cupertino, CA 95014 |
| 34333 | Silicon General Inc.<br>11651 Monarch Street<br>Garden Grove, CA 92641 |
| 34371 | Harris Corp.<br>Harris Semiconductor Div.<br>200 Palm Bay Blvd.<br>P.O. Box 882<br>Melbourne, FL 32901 |
| 50056 | Pizo Electric Products Inc.<br>212 Druham Avenue<br>Mitchen, NY 08840 |
| 50434 | Hewlett Packard Co.<br>Optoelectronics Div.<br>640 Page Mill Road<br>Palo Alto, CA 94304 |
| 51642 | Centre Engineering Inc.<br>2820 E. College Avenue<br>State College, PA 16801 |
| 56289 | Sprague Electric Co.<br>87 Marshall Street<br>North Adams, MA 01247 3675 |
| 71400 | Bussman Div. of McGraw Edison Co.<br>Old State Road<br>P.O. Box 14460<br>St. Louis, MO 63178 |

Table 7-5. List of Manufacturers - Continued

| Code number | Manufacturer and address |
|---|---|
| 71468 | ITT Cannon Electric Division of International Telephone and Telegraph Corp.<br>10550 Talbert Avenue<br>P.O. Box 8040<br>Fountain Valley, CA 93643 |
| 75915 | Littelfuse Inc.<br>800 E. Northwest Hwy.<br>Des Plaines, IL 60016 |
| 80294 | Bourns Instruments Inc.<br>1200 Columbia Avenue<br>Riverside, CA 92506 |
| 81349 | Military Specifications Promulgated by Military Departments/Agencies Under Authority of Defense Standardization Manual 4120 3-M |
| 91293 | Johanson Mfg. Co.<br>Rockway Valley Road<br>Boonton, NJ 07005 |
| 91506 | Augat Inc.<br>33 Perry Avenue<br>P.O. Box 7790<br>Attleboro, MA 02703 |
| 91812 | Jamco Corp.<br>3111 Winona Avenue<br>P.O. Box 3038<br>Burbank, CA 91504 A3679 |
| 93958 | Republic Electronics Corp.<br>176E Seventh Street<br>Peterson, NJ 07524 |
| 95146 | Alco Electronic Products Inc.<br>1551 Osgood Street<br>North Andover, MA 01845 |

Table 7-5. List of Manufacturers - Continued

| Code number | Manufacturer and address |
|---|---|
| 96906 | Military Standards Promulgated by Military Departments Under Authority of Defense Standardization Manual 4120 3-M |
| 99800 | American Precision Industries Inc.<br>Delevan Div.<br>270 Quaker Road<br>East Aurora, NY 14052 |

# CHAPTER 8

# INSTALLATION

8-1. INTRODUCTION. This chapter contains instructions for unpacking, inspecting, installing, and initial operation of the Master Regulating Clock.

8-2. UNPACKING. There are no special instructions required to unpack the Master Regulating Clock.

8-3. INSPECTION. Prior to installing the Master Regulating Clock perform the following visual inspection.

a. Inspect all equipment for obvious signs of physical damage.

b. Inspect all front end rear panel controls and indicators for cracks, breaks, or other physical damage.

8-4. INSTALLATION. The preferred installation of the Master Regulating Clock is on a slide chassis rack mount. As an alternative, the Master Regulating Clock may be bench mounted. Refer to figures 2-1 and 2-2 and tables 2-1 and 2-2 for front and rear panel connector locations and functions. Refer to figure 8-1 for installation connections. Refer to the MRC cards contained in Chapter 4 for external cable fabrication data.

8-5. INSTALLATION SITE SELECTION. The following conditions should be considered in selection of the installation site.

a. Selected mounting area should be an area within the normal operating temperature (-28°C to +65°C) and humidity (up to 95 percent).

b. Selected mounting area should be free from strong surrounding magnetic fields.

8-6. PRE-ENERGIZING PROCEDURE. Prior to initial turn-on and preliminary check, the following checklist should be completed.

a. Check that test equipment and accessories listed in Chapter 1, table 1-3 are available, operating satisfactorily, and have been calibrated in accordance with applicable regulations.

b. Check that all field changes, if any, have been accomplished.

c. Check that all installation and reference standards are entered on the Installation Standards Summary Sheet, figure 8-2.

d. Check that there is access to the Master Regulating Clock for maintenance.

e. Check that it is safe to turn on the Master Regulating Clock.

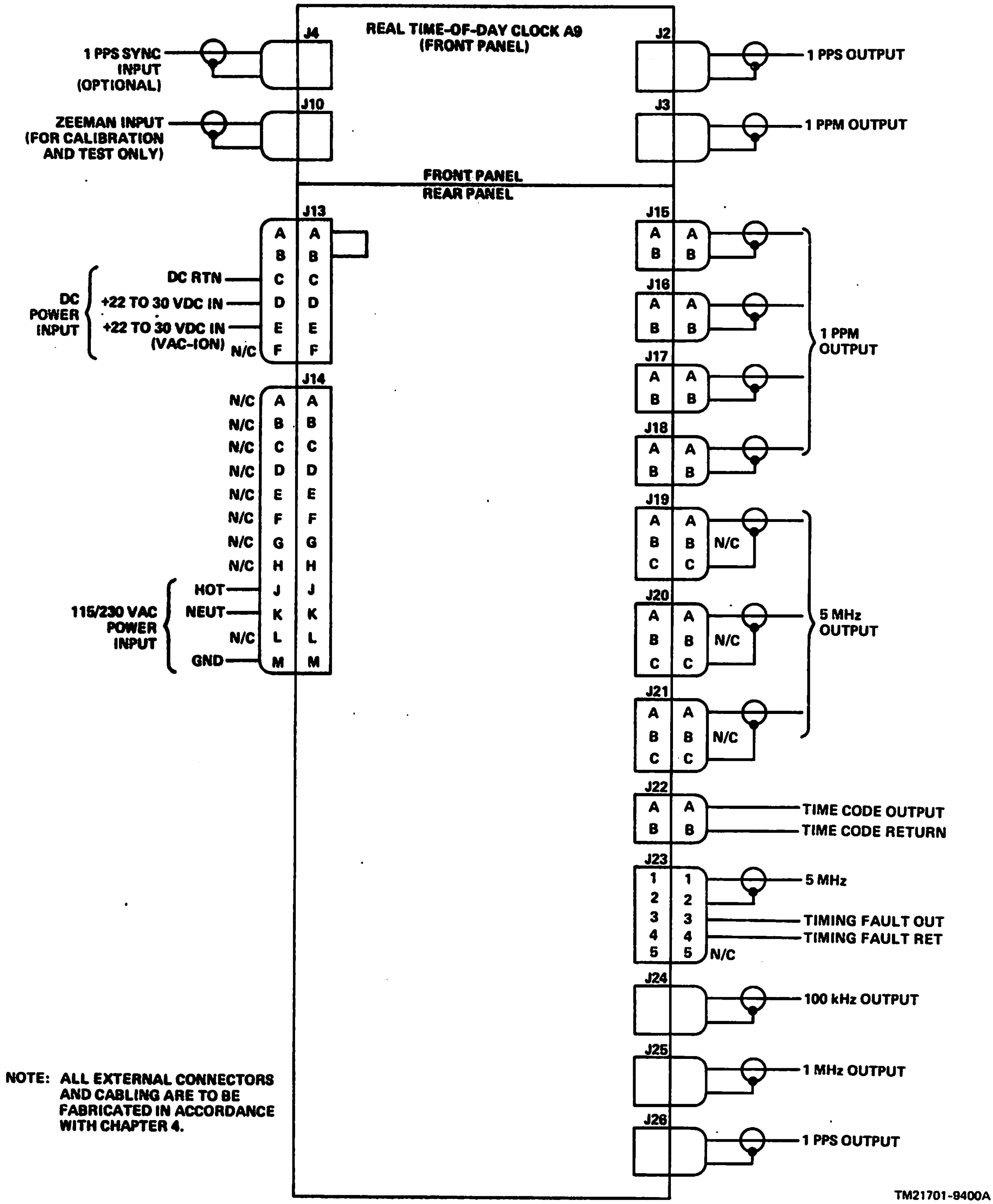



**Figure 8-1. Input/Output Connection Diagram**

MASTER REGULATING CLOCK O-1824/U

NAVELEX

INSTALLATION STANDARDS SUMMARY

Input Voltage ____________Vac

Input Frequency __________Hz

(When reference standards tests are made)

Date ______________________________

Serial Number ____________________

of Model _________________________

Installed in (ship or station)

__________________________________

Record on this summary sheet the test indications which have been obtained during the installation verification test.

| Maintenance Requirement Card | Reference Standard | |
|---|---|---|
| M-1 | CIRCUIT CHECK Switch Position | Meter Indication |
| | 0 | __________ |
| | 1 | __________ |
| | 2 | __________ |
| | 3 | __________ |
| | 4 | __________ |
| | 5 | __________ |
| | 6 | __________ |
| | 7 | __________ |
| | 8 | __________ |
| | 9 | __________ |
| | 10 | __________ |
| | 11 | __________ |
| S-2 | Step | Observe |
| | 1. a | __________ |
| | 1. b | __________ |
| | 1. c | __________ |
| | 1. d | __________ |
| | 1. e | __________ |
| S-3 | Step | |
| | 1. b | __________ |
| | 1. c | __________ |
| | 1. d | __________ |
| | 1. e | __________ |

TM21700-9400A

Figure 8-2. Installation Standards Summary Sheet

8-7. PREOPERATION. Prior to initial turn-on perform the preoperational procedure in Chapter 2, paragraph 2-4.

8-8. INITIAL TURN-ON. Turn on the Master Regulating Clock by performing the turn-on procedure in Chapter 2, paragraph 2-5.

8-9. PRELIMINARY CHECK. To perform the preliminary check, refer to paragraph 2-10.1 and perform the Master Regulating Clock daily check.

8-10. INSTALLATION VERIFICATION TEST. Installation verification test of the Master Regulating Clock is accomplished by performing the daily and monthly checks contained in paragraph 2-11. In addition, perform the checks contained in the front panel and rear panel output checks contained in the Maintenance Requirement Cards S-2 and S-3 in Chapter 4. Results of the verification test should be recorded in the appropriate spaces on the Installation Standards Summary Sheet, figure 8-2.

# INDEX

INDEX - Continued

INDEX - Continued

| Subject | Paragraph, Figure, Table, Number |
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E - Continued

INDEX - Continued

INDEX - Continued

| Subject | Paragraph, Figure, Table, Number |
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I - Continued

INDEX - Continued

INDEX - Continued

INDEX - Continued

Subject | Paragraph, Figure, Table, Number

O - Continued

INDEX - Continued

| Subject | Paragraph, Figure, Table, Number |
|---|---|

P - Continued



Q



R



S

INDEX - Continued

| Subject | Paragraph, Figure, Table, Number |
|---|---|

S - Continued

INDEX - Continued

| Subject | Paragraph, Figure, Table, Number |
|---|---|

T



U



W

SPAWAR 4160/1A (10-85)

# USER ACTIVITY TECHNICAL MANUAL COMMENT SHEET (UATMCS)

1. UATMCS SEQUENCE NUMBER (SITE)

2. DATE

3. PUBLICATION NUMBER

4. VOLUME NO.

5. TITLE/NOMENCLATURE

6. ORIGINAL PUBLICATION DATE

7. CHANGES

8. CLASSIFICATION OF UATMCS: ☐ UNCLASSIFIED ☐ CLASSIFIED ______

9. THIS COMMENT IMPACTS: ☐ SAFETY ☐ EQUIPMENT OPERATION ☐ PREVENT MAINT ☐ CORRECT MAINT ☐ TRAINING ☐ PARTS LIST ☐ OTHER

10. UATMCS TYPE: ☐ PROBLEM ☐ QUESTION ☐ SUGGESTION ☐ COMMENT

11. RECOMMENDED CHANGE TO PUBLICATION

| PAGE NO. | PARA-GRAPH | LINE NO. | FIGURE NO. | TABLE NO. | RECOMMENDED CHANGES AND REASON |
|---|---|---|---|---|---|
| | | | | | |

12. ORIGINATOR NAME

13. RANK/RATE/GRADE AND TITLE

14. WORK CENTER

15. TELEPHONE (AUTOVON/COM'L)

16. SHIP HULL NO. AND/OR DUTY STATION ( DO NOT ABBREVIATE)

17. FOR SPAWAR USE ONLY

| a. CONTROL NO. | b. COG ISEA | c. DATES | | | d. PRIORITY | e. TRANSMITTED TO |
|---|---|---|---|---|---|---|
| | | REC | FWD | DUE | | |
| | | | | | | |

INSTRUCTIONS:

1. USE PLAIN WHITE PAPER FOR CONTINUATION SHEETS
2. FOR UNCLASSIFIED UATMCS FOLD ON DOTTED LINE ON REVERSE SIDE. STAPLE/SEAL AND MAIL TO COMMANDING OFFICER, NAVELEXCEN PORTSMOUTH, P.O. BOX 55, PORTSMOUTH, VIRGINIA 23705-0055. ATTENTION: SPAWAR TECH DATA CENTER. MARK AND MAIL CLASSIFIED UATMCS IN ACCORDANCE WITH OPNAVINST 5510.1 (CURRENT VERSION)
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10. UATMCS TYPE: ☐ PROBLEM ☐ QUESTION ☐ SUGGESTION ☐ COMMENT

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|---|---|
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|---|---|---|---|---|---|---|
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|---|---|
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16. SHIP HULL NO. AND/OR DUTY STATION ( DO NOT ABBREVIATE)

17. FOR SPAWAR USE ONLY

| a. CONTROL NO. | b. COG ISEA | c. DATES | | | d. PRIORITY | e. TRANSMITTED TO |
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Table 2-2. Installation Data-Continued

| | |
|---|---|
| Magnetic field environment . . | MRC should be installed in an area that is relatively free of strong magnetic fields. Tolerable ambient steady-state magnetic field intensity: 0 to 25 oersteds; tolerable sinusoidal variation of 0 to 25 oersted field: 1 Hz |
| Explosive atmosphere . . . . . | MRC can operate in explosive atmosphere as defined by MIL-STD-810C, Method 511.1, Procedure I |
| Altitude . . . . . . . . . . . . . . | Accurate within design specifications for all altitudes up to 50,000 feet |
| Inclination . . . . . . . . . . . . | Meets requirements of MIL-E-16400 |
| Shock . . . . . . . . . . . . . . . | Meets requirements of MIL-E-5400 |
| Vibration . . . . . . . . . . . . . | Meets requirements of MIL-STD-810 |
| Crash safety . . . . . . . . . . . | Meets requirements of MIL-E-5400 Paragraph 3.4.24.6.2 |
| Air conditioning and heat dissipation . . . . . . . . . . . | Not applicable |

## Section II. INSTALLATION PROCEDURES

2-8. SCOPE. This section provides instructions for assembly, installation, and interconnection required at time of installation to ensure normal operational performance.

2-9. INSTALLATION SEQUENCE. Install the MRC in accordance with the following guidelines and procedures.

a. Site Selection. The MRC is a portable unit that may be set up on a bench or that may be permanently installed in a cabinet as part of Radio Receiver Transmitter Set, AN/FRC-117; aboard an aircraft as part of Airborne Communications System AN/ARC-96, or in the Electronic Systems Test Set AN/URM-202.

b. Installation. The MRC is installed in its designated cabinet assembly as determined by the facility cabinet configurations. The cabinet assembly recess contains two stationary slides on which two nylon buttons located on the bottom of the drawer are placed. The unit is installed in the cabinet using the following procedure.

(1) Place drawer on cabinet slides and carefully push drawer part way into cabinet assembly recess.

(2) Carefully continue to push drawer until connectors on rear of drawer are firmly seated with mating connectors of cabinet.

(3) Insert four screws in front panel and tighten with a screw-driver until drawer is firmly secured in cabinet.

c. Primary Power Connections. The MRC is operated from 115 Vac or 230 Vac (47 to 63 Hz or 360 to 460 Hz), or 22 to 30 Vdc power. The MRC requires 185 watts of primary power at 115 Vac or 63 watts of primary power at 26 Vdc for normal operation. Connect the MRC to power as follows:

NOTE

For 115 Vac operation, P1-4 and P1-5 are jumpered and P1-6 and P1-7 are jumpered. To operate the MRC from 230 Vac, the connector P1 jumpers used for 115 Vac should be removed and a new jumper should be installed between P1-5 and P1-6. Refer to tables 2-3 through 2-5 for details of the following connections.

(1) Connect primary power to MRC through power cables to connector P1 on rear panel.

(2) Connect signal cables to connector P2 on rear panel and signal connections on front panel.

d. Internal Battery Operation. An internal battery provides power to operate the MRC for 2 hours at +25°C (77°F) at fully-charged capacity; and 1 hour at +55°C and -28°C (+131°F and -18.4°F).

NOTE

If both ac and external dc primary voltages are connected, the MRC will normally operate on the ac voltage and will use the optional dc source for emergency standby power in the event of an ac power loss. Switchover to dc operation is automatic. During the absence of ac and dc power, the MRC will automatically switch over to internal battery pack operation.

Table 2-3. Connector P1 Power Connections on MRC Rear Panel

| Pin | Function |
|---|---|
| 1 | AC (115V or 230V) |
| 2 | Neutral |
| 3 | Safety ground |
| 4, 5 | 115V external jumper |
| 6, 7<br>(5, 6) | 115V external jumper<br>(230V external jumper) |
| 8, 9, 10 | Unused |
| 11 | +22 to +30 Vdc |
| 12 | Return for pin 11 |

Table 2-4. Connector P2 Signal Connections on MRC Rear Panel

| Pin | Function |
|---|---|
| 1 | 3 MHz square wave |
| 2 | Unused |
| 3 | 3 MHz square wave |
| 4 | Unused |
| 5 | Real-time data |
| 6 | Real-time data transfer clock |
| 7 | Real-time data transfer gate |
| 8 | Second mark |
| 9 | Minute mark (1 PPM) |
| 10 | Signal ground |

Table 2-4. Connector P2 Signal Connections on MRC Rear Panel-Continued

| Pin | Function |
|---|---|
| 11 | Timing fault output |
| 12 | Return for pins 5 through 9 |
| 13 | Real-time data |
| 14 | Real-time data transfer clock |
| 15 | Real-time data transfer gate |
| 16 | Second mark |
| 17 | Minute mark (1 PPM) |
| 18 | Return for pin 11 (chassis ground) |
| 19 | Unused |
| 20 | Return for pins 13 through 17 |

Table 2-5. Connectors on MRC Front Panel

| Quantity | Function | Connector Type (or Equivalents) | Mating Connectors |
|---|---|---|---|
| 1 | 5 MHz output | UG-625B/U | CW-123A/U |
| 1 | 1 MHz output | UG-625B/U | CW-123A/U |
| 1 | 1 PPS output | Bendix Microwave 33062-1 | CW-123A/U |
| 1 | Sync in | Bendix Microwave 33062-1 | CW-123A/U |
| 1 | 1 PPM output | Bendix Microwave 33062-1 | CW-123A/U |
| 1 | Zeeman input | UG-625B/U | CW-123A/U |

# CHAPTER 3

## PREPARATION FOR USE AND RESHIPMENT

3-1. INTRODUCTION. This chapter consists of two sections; Section I covers preparation for use, and Section II covers preparation for reshipment.

## Section I. PREPARATION FOR USE

3-2. PREPARATION FOR USE. To prepare the MRC for use, proceed as follows:

NOTE

> Before performing any checks, be sure to open the front panel hinged doors so that all controls, indicators, and connectors are available for observation and use.

a. Remove top cover. Ensure that STORAGE/OPERATE switch is set at OPERATE.

NOTE

> Battery power supply A17 should be removed and replaced before proceeding. Refer to paragraph 6-10c for instructions in lieu of step b below. While removed from MRC, perform test procedures of paragraph 6-10d.

b. At rear top side of battery pack, set internal battery ON/OFF switch S1 to ON. Reinstall top cover.

c. On rear panel, check that fuses F1 through F4 are present and in position. Apply ac power. (Spare fuses have been provided and are located in fuseholders marked SPARE FUSES.)

NOTE

> Allow 20 minutes warmup time for Cesium beam resonator signal level and crystal oscillator frequency to stabilize.

d. Check that the following indicators are lit.

(1) <u>POWER SOURCE/IN USE</u>

| | |
|---|---|
| AC<br>DC<br>BAT | Only one lights. |

(2) POWER SOURCE/AVAILABLE

| | |
|---|---|
| DC<br>BAT | If external dc is applied, and internal batteries are suitable for operation, these indicators light. |

(3) PRIMARY LOOP and SECONDARY LOOP

| | |
|---|---|
| OPERATE<br>ALARM | Both OPERATE lamps light. If one of the alarms is lit, it is an indication that a fault exists or existed. Push RESET switch. If ALARM lamp does not go out, further checking is required. |

(4) BATTERY CHARGING SYSTEM

| | |
|---|---|
| TRICKLE<br>HIGH | LED indicators illuminate when battery charging circuits are on constant trickle charge and when BAT CHG is set to HIGH to apply a high charging rate to the battery. |

e. Assuming that all ac and dc input voltages are correctly applied, check for proper indications using CIRCUIT CHECK meter and switch positions of table 3-1. Proceed through all 12 steps of switch, and note that CIRCUIT CHECK meter indications fall within range of readings indicated.

f. With CIRCUIT CHECK switch set at position 4, 5, or 6, MRC must be warmed up for CIRCUIT CHECK meter to read within indicated range. At turn-on, or if MRC is not fully warmed up, meter may read above required ranges. Oven temperatures may be above or below normal readings depending on ambient temperature.

g. Set CIRCUIT CHECK switch at position 8 (Cesium ion current). Observe PRIMARY LOOP OPERATE and ALARM indicators. If PRIMARY LOOP OPERATE lamp is not lit, set PRIMARY LOOP MOD OFF/OPR switch to OFF.

h. Momentarily actuate PRIMARY LOOP SLEW INCR/DECR switch toward INCR or DECR position until indication of ion current appears on meter. Meter indication will trace out dc resonance characteristics of Cesium beam tube (A1) frequency (Ramsey curve) as 14.50 + MHz oscillator frequency is varied by SLEW control. Characteristics of Ramsey curve are shown in figure 3-1.

i. Continue operating PRIMARY LOOP SLEW INCR/DECR switch until minima, maximum, and minima indications have been traced out on meter.

Table 3-1. Circuit Check Functions

| Switch Position | Function | | CIRCUIT CHECK Meter Reading Range |
|---|---|---|---|
| 1 | DC supply voltage | | +40 to +80 |
| 2 | Battery voltage | | +40 to +80 |
| 3 | Battery current | High charge | +40 to +80 |
| | | Trickle charge | 0 to +40 |
| | | Discharge | -40 to -80 |
| 4 | Cesium oven temperature | | +40 to +80 |
| 5 | Primary oscillator oven temperature | | +40 to +80 |
| 6 | Secondary oscillator oven temperature | | +40 to +80 |
| 7 | VAC-ION current | | 0 to +20 |
| 8 | Cesium ion current | | Set to 0 with OFFSET |
| 9 | Primary oscillator control voltage | | 0 +/-40 |
| 10 | Secondary oscillator control voltage | | 0 +/-40 |
| 11 | Secondary phase detector voltage | | 0 to +20 |
| 12 | 3 MHz signal level | | +40 to +80 |

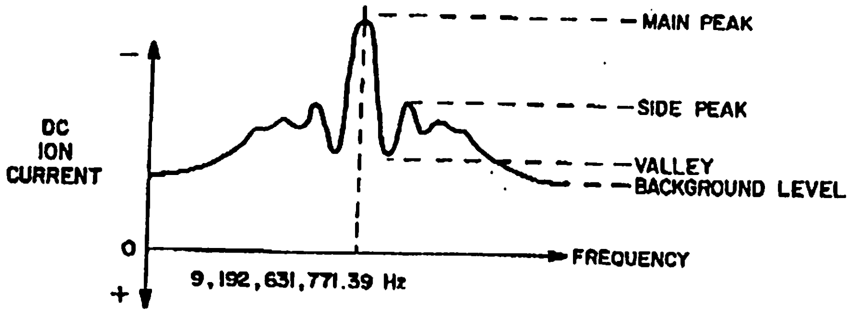


Figure 3-1. Cesium Beam Tube DC Response Characteristic (Ramsey Curve)

j. Actuate PRIMARY LOOP SLEW INCR/DECR switch in direction required to obtain maximum indication of trace centered on meter. If Ramsey curve trace is off meter, adjust DC OFFSET to bring it back within meter range.

NOTE

> If Ramsey curve does not trace out on meter, reset CIRCUIT CHECK switch at position 9 (primary oscillator control voltage) and activate PRIMARY LOOP SLEW switch to INCR or DECR position until meter nulls at zero. This sets 14.59 + MHz oscillator of primary loop to approximate frequency for achieving 9.19 + GHz transition frequency necessary to lock primary loop and achieve Ramsey curve. Then repeat steps g through i.

k. Release PRIMARY LOOP SLEW switch where main peak of Ramsey curve is achieved.

l. Reset PRIMARY LOOP MOD OFF/OPR switch to OPR; primary loop will automatically be locked. This condition will be indicated by green PRIMARY LOOP OPERATE lamp. It is advisable to sweep through curve once so that main peak is selected and unit does not lock on side peak. Depressing RESET pushbutton will extinguish ALARM lamp.

m. All MRC signal inputs and outputs are connected via front panel coaxial connectors and rear panel connector P2.

n. Refer to paragraph 4-7 for instructions on setting 24-hour real time-of-day clock to internal time base and/or to external sync pulse.

NOTE

When the MRC is operated with power supplied by its internal battery, the approximate recharge time is 16 hours. The BAT CHG switch must be in the HIGH position during the recharge cycle. If the MRC is to be without primary ac or dc power for more than 1 hour and it is desired to maintain real time within the MRC, an ancillary battery will be required to power the MRC.

Looking From Back

P1


1 & 2 Power in

4,5 JUMP

6,7 JUMP