TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS FOR

PORTABLE REAL TIME CLOCK

(PRTC)

MODEL FE-5450A

FREQUENCY ELECTRONICS INC.

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FOR

PORTABLE REAL TIME CLOCK (PRTC)

FEI MODEL FE-5450A

AND

DIFFERENCE DATA SHEETS

FOR

FEI MODELS

FE-5450A/J, FE-5450A/J-EC, AND FE-5450A/J-ESM

30 November 1986

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 personnel 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 still exist when the power is in the off position, due to charges retained by capacitors. To avoid casualties, always disconnect 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 are applicable to this equipment:

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.
2. Voltage dangerous to life exists when equipment is open and energized. Do not work alone.
3. Use two people when lifting PRTC.

The following cautions are applicable to this equipment:

CAUTION

1. When stored at temperatures above 35°C (95°F) the VAC-ION pump of the Cesium beam tube must be operated.
2. To prevent equipment from being dropped, ensure that MRC is supported during these procedures.
3. In the following steps, one or more of the waveguide capacitive screws will be adjusted. Do not allow the screw to "bottom out."

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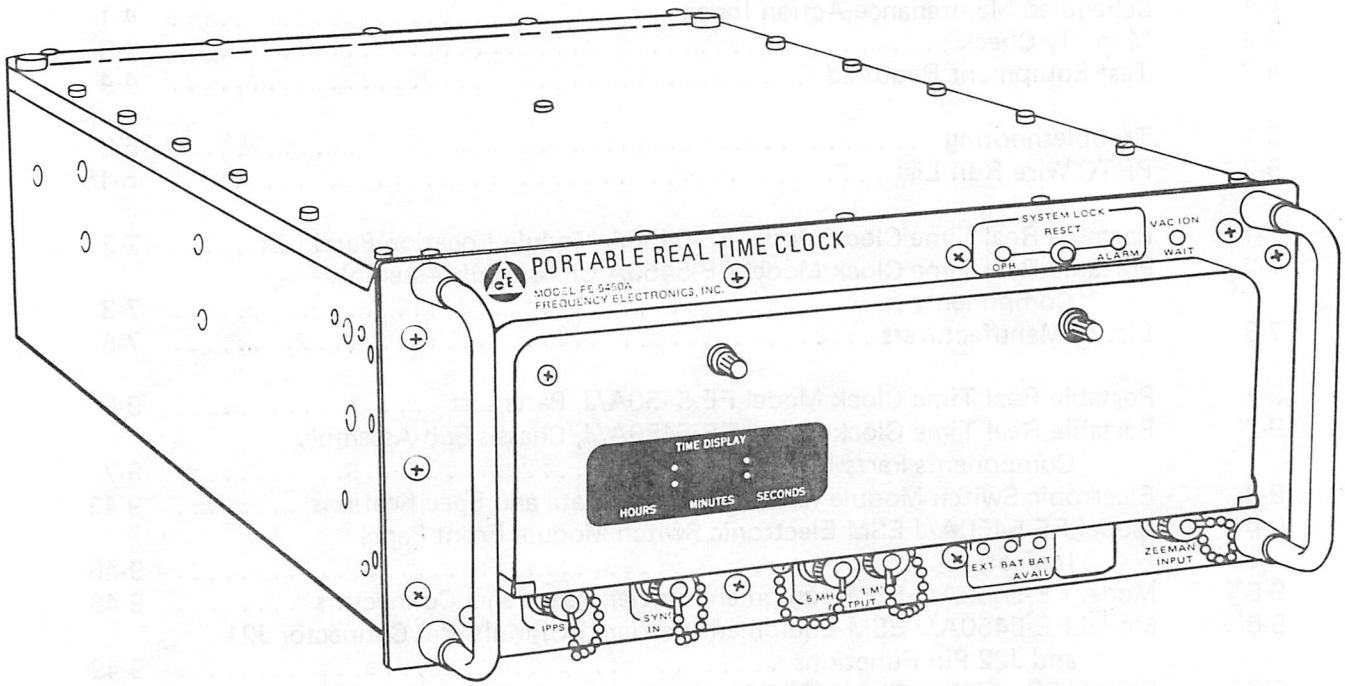

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Figure 1-1. Portable Real Time Clock, Model FE-5450A

CHAPTER 1

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual contains operation and maintenance instructions for Portable Real Time Clock (PRTC) Model FE-5450A. The PRTC is manufactured by Frequency Electronics Incorporated (FEI) located at Mitchel Field, N.Y.

1-3. EQUIPMENT DESCRIPTION.

1-4. The PRTC (figure 1-1) is a self contained, bench mounted, solid state, precision instrument, designed for frequency and time measurment functions. The PRTC can be modified for installation in a standard 19 inch electrical equipment rack. A Cesium beam resonator within the PRTC serves as an atomic frequency standard to stabilize the output of a quartz crystal oscillator through feedback control circuitry. The PRTC provides 100 KHz, 1 MHz, and 5 MHz standard output frequencies. The 100 KHz outputs are provided through rear panel connectors while the 1 MHz and 5 MHz outputs are available through connectors on both front and rear panels. A real time-of-day (TOD) clock digital display, located on the front panel, indicates time in hours, minutes, and seconds. The PRTC timing information is provided in the form of 1 pulse-per-second (PPS) and TOD outputs. The 1 PPS outputs are available on both the front and rear panels. The TOD outputs are available through connectors on the rear panel only. All outputs are referenced to an atomic clock frequency standard built into the PRTC. The atomic clock is based on the the natural resonant frequency of 9192631771.59 Hz for one isotope of the Cesium atom (Cesium 133).

1-5. TECHNICAL DATA AND SPECIFICATIONS.

1-6. The PRTC technical parameters, performance and environmental specifications, and overall dimensions, are referenced in table 1-1.

1-7. EQUIPMENT AND DOCUMENT SUPPLIED.

1-8. The documents and subassemblies supplied with the PRTC, including quantity, and approximate weight and overall dimensions for each item, are listed in table 1-2.

TABLE 1-1. TECHNICAL DATA AND SPECIFICATIONS

PARAMETERS	SPECIFICATIONS
Warm-up time:	20 minutes at -28°C (-18°F) to +65°C (+149°F) ambient
Accuracy (Δf/f):	$\pm 3 \times 10^{-11}$
Reproducibility (Δf/f):	$\pm 1 \times 10^{-11}$
Settability (Δf/f):	$\pm 2 \times 10^{-12}$
Range (Δf/f:	6×10^{-11}
Stability:	
Long term (Δf/f):	$\pm 1 \times 10^{-11}$ for life of Cesium beam tube
Short term (Δf/f):	$7 \times 10^{-11} / \sqrt{t}$
Stability vs. operating temperatures (-28°C (-18°F) to +65°C (+149°F) ambient), Δf/f:	$< \pm 2 \times 10^{-11}$
Stability vs. humidity (50% to 90% relative humidity) Δf/f:	$< \pm 1 \times 10^{-11}$
Stability vs. magnetic field (Δf/f):	$< \pm 2 \times 10^{-12}$/2 gauss dc
Output signals (sinusoidal):	
Frequencies:	5 MHz, 1 MHz, 100 kHz
Amplitude:	1 to 1.5 V rms into 50 ohms termination
Clock outputs both 1 PPS, 1PPM	+10 V ± 1 V into 50 ohms termination 20 μsec wide, rise time 50 nanosec, fall time 1 μsec
Time code output, 1 word/sec	24 bit serial BCD word "1" = +6 ±1 V "0" = -6 ±1 V
Harmonic distortion	< -40 dB
Nonharmonic distortion	< -80 dB
Signal-to-phase noise ratio (1 MHz and 5 MHz only, in frequency bands fc ± 1 Hz to fc ± 15 kHz	< -80 dB
Environmental	
Operating temperature	Over -28°C (-18°F) to +65°C (+149°F)
CAUTION When stored at temperatures above 35°C (95°F) the VAC-ION pump of the Cesium beam tube must be operated.	

TABLE 1-1. TECHNICAL DATA AND SPECIFICATIONS (CONT)

PARAMETERS	SPECIFICATIONS
Nonoperating temperature:	-62°C (-80°F) to +75°C (+167°F)
Storage temperature:	-62°C (-80°F) to +75°C (+167°F) (without batteries) -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 charge a completely discharged battery	16 hours
Battery switchover:	Automatic
Power required to trickle charge standby battery only:	6W
Power required to charge completed discharged standby battery only:	50W 22-30 Vdc
Power:	22- to 30 Vdc, 63 watts maximum
Power consumption	
Warm-up (24 Vdc)	75W
Frequency time standard only (24 Vdc):	45W
Dimensions:	
Width:	13.25 inches
Height	5.22 inches
Depth:	22.30 inches
Weight:	40 pounds
Volume:	1521.6 cubic inches

TABLE 1-2. EQUIPMENT AND DOCUMENTS SUPPLIED

QUANTITY	NOMENCLATURE	DIMENSIONS IN INCHES	WEIGHT AND VOLUME
1	Cesium Beam Resonator, Assembly A1	W = 2.29 H = 3.06 D = 15.19	12.5 pounds 106.4 cubic inches
1	High Voltage Power Supply VAC-ION Module A2	W = 1.34 H = 0.73 D = 3.65	0.2 pounds 3.6 cubic inches
1	High Voltage Power Supply Electron Multiplier Module 5 MHz, A3	W = 1.47 H = 0.76 D = 3.88	0.2 pounds 4.3 cubic inches
1	5 MHz Oven Controlled, Voltage Controlled, Crystal Oscillator (OCVCXO) Module A4	W = 2.19 H = 5.83 D = 3.75	1.1 pounds 47.9 cubic inches
1	Modulator/Multiplier Module A5	W = 1.05 H = 2.75 D = 6.90	0.8 pounds 19.9 cubic inches
1	Power Supply Module, A6	W = 1.84 H = 4.15 D = 7.69	2 pounds 58.7 cubic inches
1	Synthesizer Module, A7	W = 0.85 H = 3.70 D = 10.48	1.3 pounds 33 cubic inches
1	Buffer Amplifier Module A8	W = 5.0 H = 4.36 D = 1.0	0.5 pounds 21.8 cubic inches
1	Real Time-of-Day Clock PC Assembly A9	W = 7.75 H = 4.31 D = 9.87	3.4 pounds 329 cubic inches
1	Generator Module A10	W = 5 H = 4 D = 1	0.5 pounds 20 cubic inches

TABLE 1-2. EQUIPMENT AND DOCUMENTS SUPPLIED (CONT)

QUANTITY	NOMENCLATURE	DIMENSIONS IN INCHES	WEIGHT AND VOLUME
1	Battery Charger/Logic Module A14	W = 5 H = 3.9 D = 1	0.5 pounds 19.3 cubic inches
1	Battery Power Supply Module A17	W = 5.3 H = 2.7 D = 7.4	9 pounds 106.9 cubic inches
1	Time-Of-Day Display PC Assembly A19	W = 4.2 H = 1.1 D = 0.9	0.1 pounds 4.2 cubic inches
1	Amplifier Meter Driver Assembly A25	W = 2.1 H = 4.1 D = 0.5	0.1 pounds 4.3 cubic inches
2	Technical Manual Operation and Maintenance Instructions For Portable Real Time Clock (PRTC) Model FE-5450A And Difference Data Sheets For Models FE-5450A/J, FE-5450A/J-EC, and FE-5450A/J-ESM		

CHAPTER 2

OPERATING INSTRUCTIONS

2-1. INTRODUCTION.

2-2. This chapter contains operating instructions for the PRTC, including the functional description and location of all operating controls and indicators and input and output connectors. The PRTC 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 warm-up time necessary for PRTC stabilization. The PRTC is turned on at time of installation and not turned off unless taken out of service. The power ON/OFF switch is located inside the unit and is therefore not accessible to the operator. Turn-on and turn-off procedures are provided in Chapter 8 — Installation.

2-3. CONTROLS AND INDICATORS.

2-4. The PRTC contains internal and external controls and indicators. The external controls and indicators are located on the front panel. The internal controls and indicators are located within the unit and are accessible by removing the top cover. The location and function of the controls and indicators are provided in the following figures and tables.

CONTROLS/INDICATORS FOR	FIGURE NO.	TABLE NO.
Front Panel	2-1	2-1
Internal	2-2	2-2

2-5. INPUT AND OUTPUT CONNECTORS.

2-6. The PRTC input and output connectors are located on the front and rear panels. Their location and function are provided in the following figures and tables.

INPUT/OUTPUT CONNECTORS FOR	FIGURE NO.	TABLE NO.
Front Panel	2-3	2-3
Rear Panel	2-4	2-4

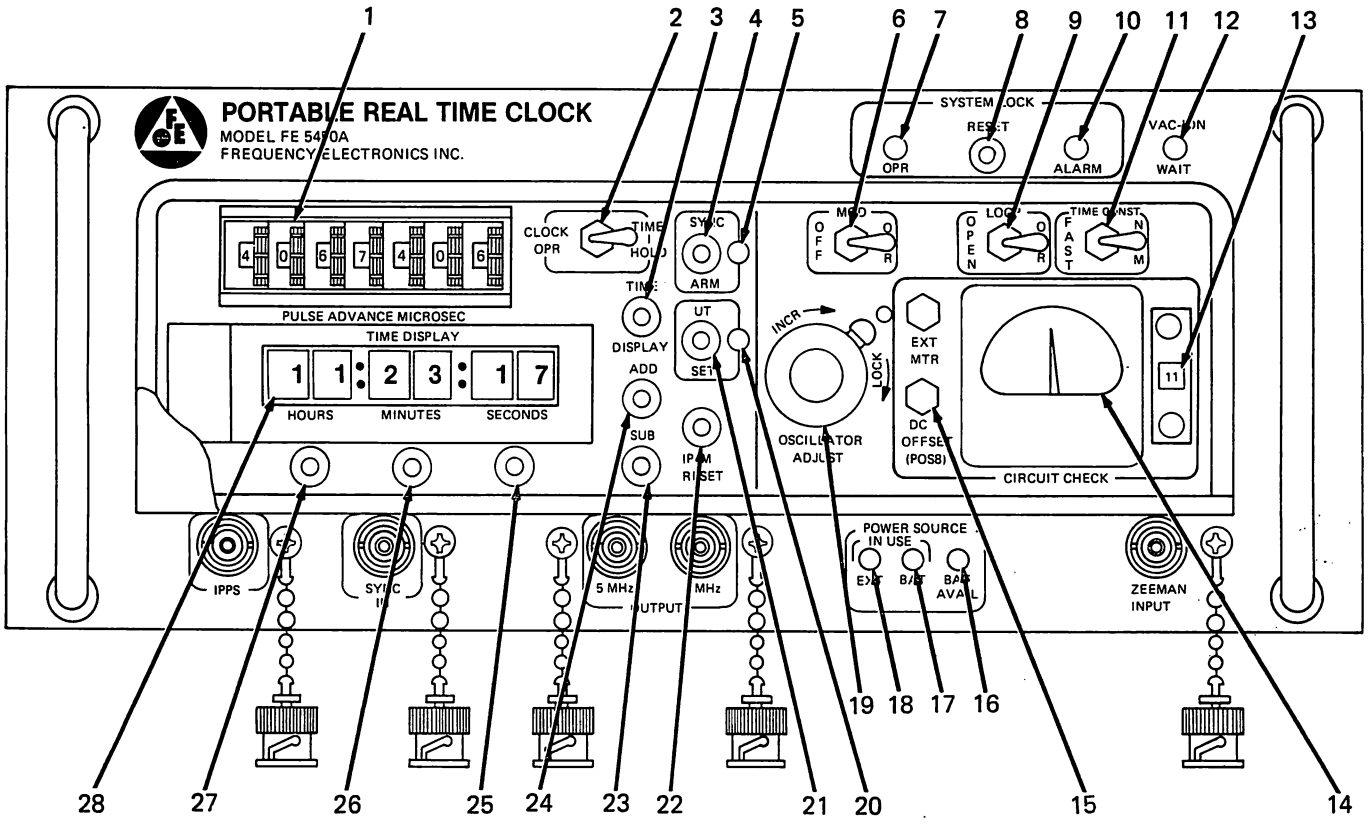

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Figure 2-1. Front Panel Controls and Indicators

NOTE

Index numbers referenced in tables, including those in parenthesis, are keyed to index numbers in corresponding figure.

TABLE 2-1. FRONT PANEL CONTROLS AND INDICATORS

INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	PULSE ADVANCE MICROSEC thumb-wheel switch (S12)	Advances the 1 PPS output over a range between 0.1 microsecond and 1 second in 0.1 microsecond steps
2	CLOCK OPR/TIME HOLD switch (S2)	When set to CLOCK OPR position, TIME DISPLAY (28) clock operates normally. When set to TIME HOLD position, TIME DISPLAY is stopped to allow clock setting.
3	TIME DISPLAY switch (S8)	When depressed, lights TIME DISPLAY indicator (28) when operating with internal battery.
4	SYNC ARM switch (S4)	When depressed, synchronizes PRTC to an external standard.
5	SYNC ARM indicator (DS9)	Lights when external synchronization (TTL level or 1 PPS) is applied via SYNC IN connector and SYNC ARM switch (4) is momentarily depressed. Indicator will remain lit until synchronization has occurred.
6	MOD OFF/OPR	When set to OFF position, the 83 + Hz modulation input signal is removed from modulator/multiplier module (A5) for testing and adjustment. When set to OPR position the 83 + Hz modulation input signal is applied to modulator/multiplier module (A5) for normal operation.
7	SYSTEM LOCK OPR indicator (DS3)	When lit, indicates system is operating normally and maintaining frequency lock.
8	SYSTEM LOCK RESET switch (S1)	When depressed, resets alarm circuits after they have been activated and after frequency lock has reoccurred.
9	LOOP OPEN/OPER switch (S14)	When set to OPEN position, frequency lock loop is open for maintenance and/or adjustment. When set to OPER position, frequency lock loop is closed for normal operation.

TABLE 2-1. FRONT PANEL CONTROLS AND INDICATORS (CONT)

INDEX NO.	CONTROL OR INDICATOR	FUNCTION
10	SYSTEM LOCK ALARM indicator (DS1)	When lit, indicates that the frequency lock loop has been momentarily or permanently opened.
11	TC/FAST/NORM switch (S15)	In NORM position, time constant of frequency lock loop is set to approximately 1 second. In FAST position, time constant of frequency lock loop is set to approximately 10 seconds.
12	VAC-ION WAIT indicator (DS10)	Not used.
13	CIRCUIT CHECK push-button switch (A25S1)	Selects function to be displayed on CIRCUIT CHECK meter (14) as follows:
	0 — System +18 Vdc	Indicates level of +18 Vdc regulated power supply voltage
	1 — System -18 Vdc	Indicates level of -18 Vdc raw (unregulated) power supply voltage.
	2 — System +5 Vdc	Indicates level of +5 Vdc regulated power supply voltage.
	3 — Battery Voltage	Indicates level of battery voltage.
	4 — Battery Current	Indicates level of battery charging/discharging current.
	5 — Cesium beam resonator assembly (A1) oven temp.	Indicates temperature of Cesium beam resonator assembly A1 oven.
	6 — 5 MHz Oscillator Oven Temp.	Indicates level of OCVCXO module A4 oven temperature.
	7 — Vac-Ion Current	Indicates Vac-iron current level from Vac-ion high voltage power supply module A2.
	8 — Cesium Ion Current	Indicates level of Cesium beam ion current from Cesium beam resonator assembly A1.
	9 — Osc. Control Voltage	Indicates frequency control voltage from synthesizer module A7.
	10 — 5 MHz Signal Level	Indicates signal level from buffer amplifier module A8.
	11 — Synthesizer Lock Indicator	Indicates lock indicator control voltage from syntehsizer module A7.
14	CIRCUIT CHECK meter (M1)	Indicates the value of function selected by the CIRCUIT CHECK push-button switch (13).

TABLE 2-1. FRONT PANEL CONTROLS AND INDICATORS (CONT)

INDEX NO.	CONTROL OR INDICATOR	FUNCTION
15	DC OFFSET (POS 8) control (R2)	Used to adjust meter indication for ion current measurement of Cesium beam resonator assembly A1.
16	POWER SOURCE BAT AVAIL indicator (DS5)	When lit, indicates that internal batteries are available for powering the PRTC.
17	POWER SOURCE IN USE BAT indicator (DS2)	When lit, indicates that PRTC is being powered by internal batteries.
18	POWER SOURCE IN USE EXT indicator (DS4)	When lit, indicates that PRTC is being powered by external dc power sources.
19	OSCILLATOR ADJUST INCR/LOCK control (R1)	Used to control OCVCXO module (A4) output frequency when frequency lock loop is open.
20	UT SET indicator (DS8)	Lights when UT SET switch (21) is depressed.
21	UT SET switch (S11)	When depressed, retards TIME DISPLAY indicator (28), 1 PPM and 1 PPS clock outputs, and time code output by one second. Also lights UT SET indicator (20).
22	1 PPM RESET switch (S3)	When depressed, TIME DISPLAY (28) seconds display returns to 00 and minutes display advances to the next minute. Also time code and 1 PPM outputs are changed similarly.
23	SUB switch (S10)	When depressed, subtracts from TIME DISPLAY indicator (28) when used in conjunction, with the HOURS, MINUTES, and SECONDS switches (27, 26 and 25).
24	ADD switch (S9)	When depressed, adds to TIME DISPLAY indicator (28) when used in conjunction with the HOURS, MINUTES, and SECONDS switches (27, 26 and 25).
25	TIME DISPLAY SECONDS switch (S7)	When depressed, allows SECONDS portion of TIME DISPLAY indicator (28) to be set using SUB and ADD switches (23 and 24).
26	TIME DISPLAY MINUTES switch (S6)	When depressed, allows MINUTES portion of TIME DISPLAY indicator (28) to be set using SUB and ADD switches (23 and 24).

TABLE 2-1. FRONT PANEL CONTROLS AND INDICATORS (CONT)

INDEX NO.	CONTROL OR INDICATOR	FUNCTION
27	TIME DISPLAY HOURS switch (S5)	When depressed, allows HOURS portion of TIME DISPLAY indicator (28) to be set using SUB and ADD switches (23 and 24).
28	TIME DISPLAY indicator (A19)	Provides LED numerical display of time.

TABLE 2-2. INTERNAL OPERATOR CONTROLS AND INDICATORS

INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	Fuse (F3)	Provides overload protection for internal batteries.
2	ON/OFF switch (S17)	Controls operating power to PRTC.
3	Fuse (F2)	Provides overload protection for +22 Vdc to +30 Vdc power source connected to POWER IN 2 connector (6, Figure 2-4).
4	Fuse (F1)	Provides overload protection for +22 Vdc to +30 Vdc power source connected to POWER IN 1 connector (5, Figure 2-4).

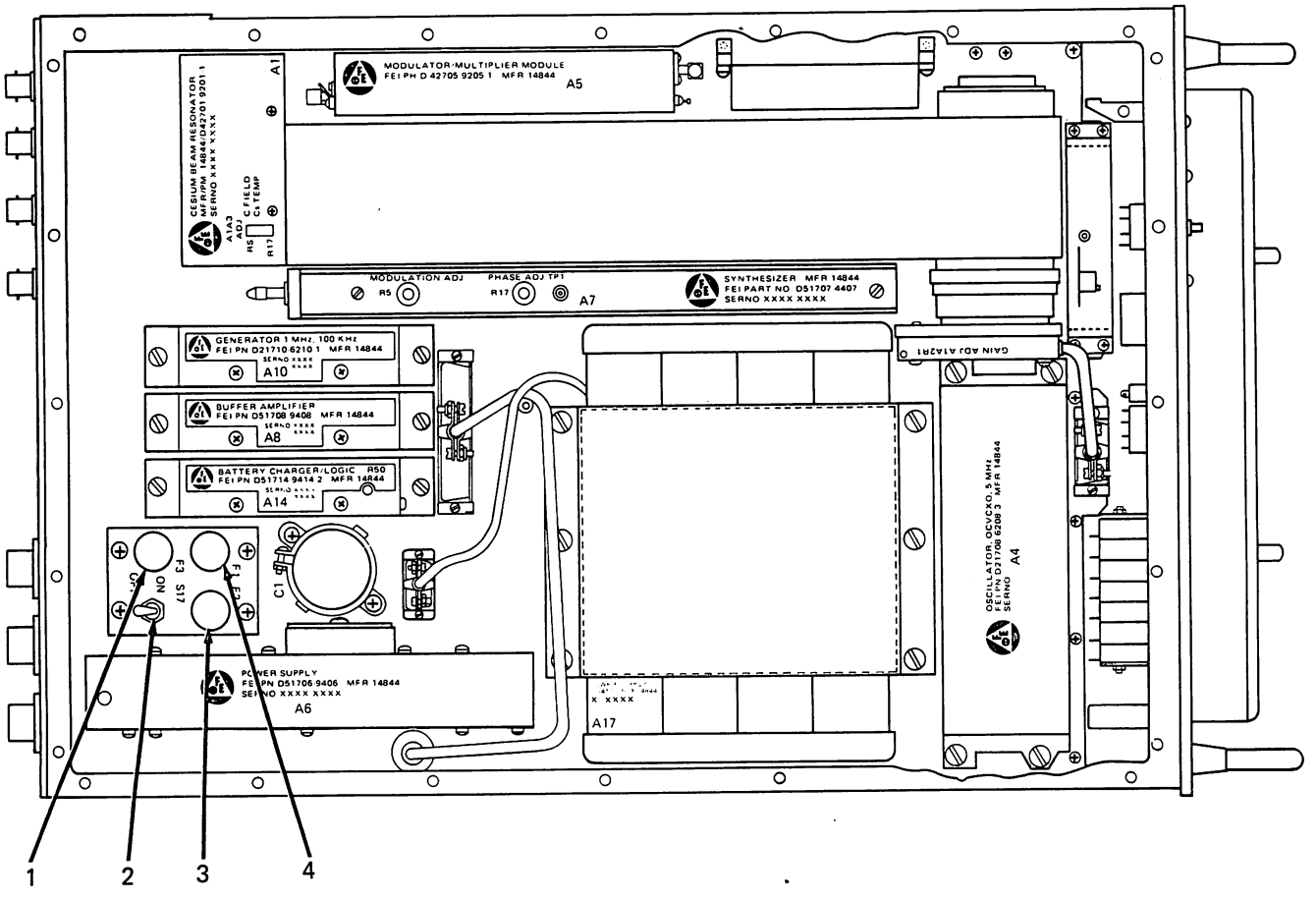

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Figure 2-2. Internal Operator Controls and Indicators (Top Cover Removed)

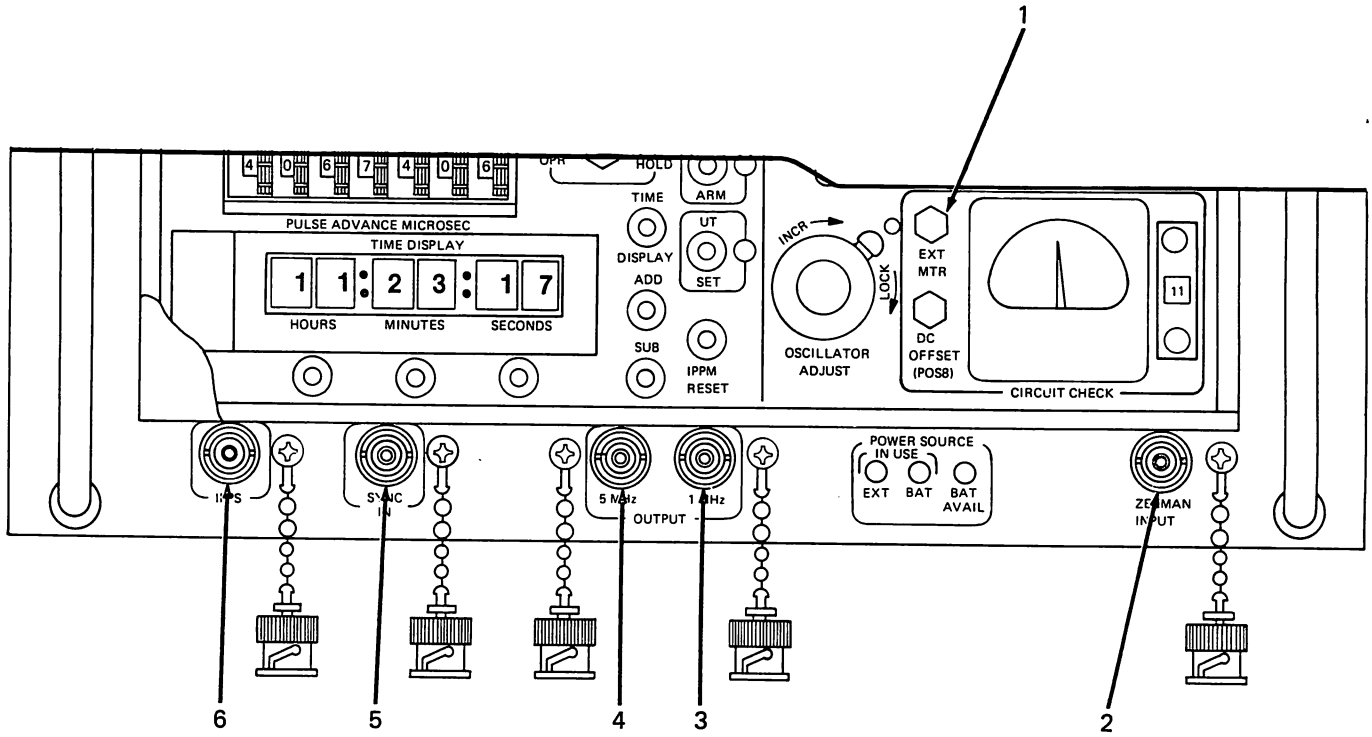

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Figure 2-3. Front Panel Connectors

TABLE 2-3. FRONT PANEL CONNECTORS

INDEX NO.	CONNECTORS	FUNCTION
1	EXT MTR J28	Provides capability to substitute a more sensitive external meter for CIRCUIT CHECK METER (14).
2	ZEEMAN INPUT coaxial J27	Used to connect Zeeman input frequency signal during maintenance and troubleshooting of PRTC.
3	1 MHz OUTPUT coaxial J26	Provides 1 MHz output signal.
4	5 MHz OUTPUT coaxial J25	Provides 5 MHz output signal.
5	SYNC IN coaxial J24	Provides connection for PRTC synchronization from external signal (TTL level pulse, 1 PPM, or 1 PPS).
6	1 PPS coaxial J23	Provides one pulse-per-second (1 PPS) output signal.

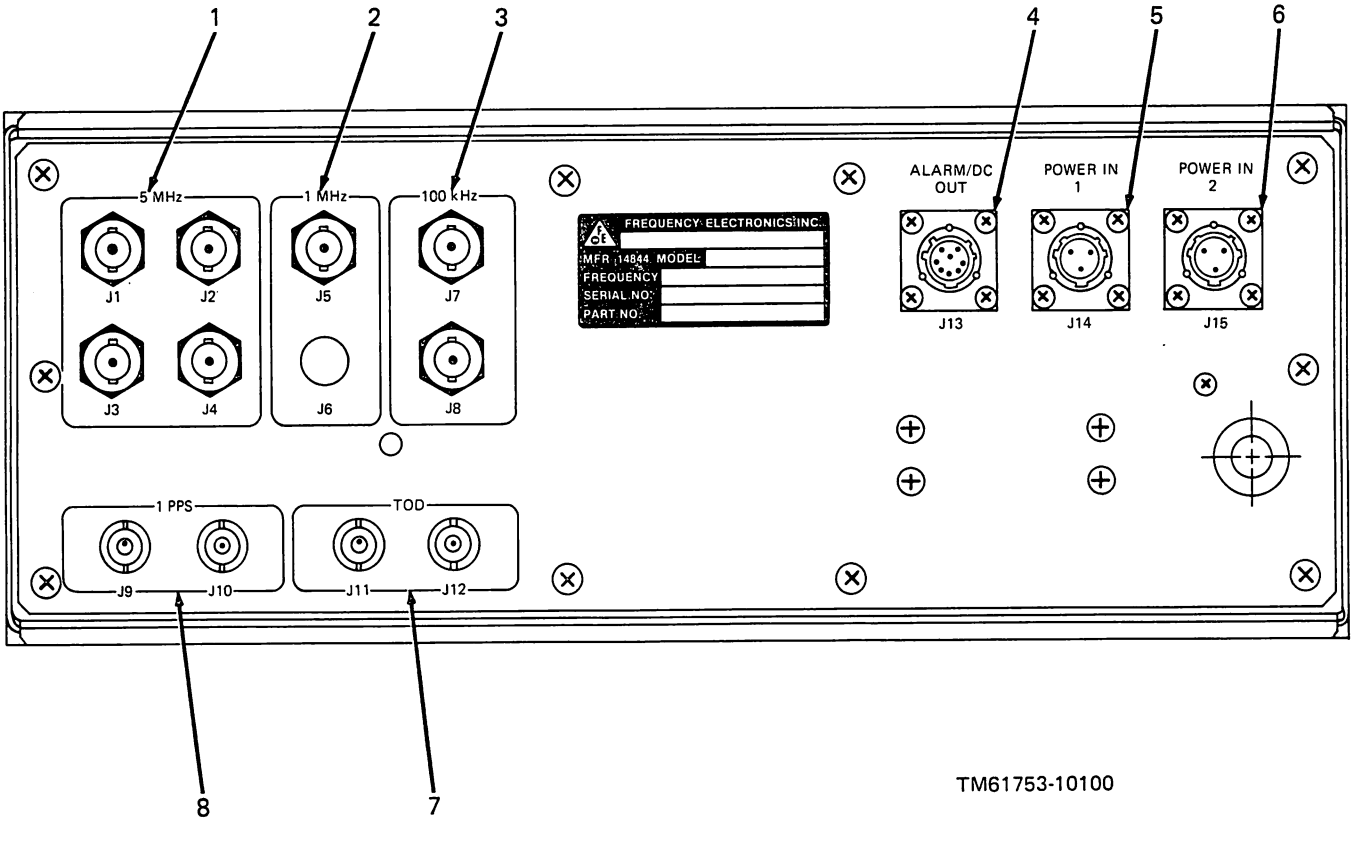

Figure 2-4. Rear Panel Connectors

TABLE 2-4. REAR PANEL CONNECTORS

INDEX NO.	CONNECTORS	FUNCTION
1	5 MHz coaxial J1 through J4	Provides 5 MHz output signals.
2	1 MHz coaxial J5	Provides 1 MHz output signals.
3	100 KHz coaxial J7 and J8	Provides 100 KHz output signals
4	ALARM/DC OUT multi-pin J13	Used to connect timing fault output (alarm) and dc power (22 to 30 Vdc) to external equipment.
5	POWER IN 1 multi-pin J14	Used to connect dc power (22 to 30 Vdc, primary or backup) to PRTC.
6	POWER IN 2 multi-pin J15	Used to connect dc power (22 to 30 Vdc), primary or backup to PRTC.
7	TOD coaxial J11 and J12	Used to connect real time-of-day output to external equipment.
8	1 PPS coaxial J9 and J10	Provides for 1 PPS output signal.

2-7. SETTING REAL TIME OF DAY (TOD) CLOCK.

2-8. The real time-of-day (TOD) clock displays a digital readout of real time in hours, minutes, and seconds (28, figure 2-1). It also provides two TOD outputs from rear panel connectors J11 and J12 (7, figure 2-4) and three one pulse per second (1 PPS) outputs; two 1 PPS outputs are available at rear panel connectors J9 and J10 (8) and one 1 PPS output is available at the front panel (6, figure 2-3). Procedures to set the clock for specific applications are as follows:

2-9. UNSYNCHRONIZED TOD. To set the TOD to a known reference, perform the following steps:

a. On PRTC front panel, turn two DZUS fasteners counter clockwise and allow cover to swing down.

b. Set CLOCK OPR/TIME HOLD switch (2, figure 2-1) to TIME HOLD position.

c. Set the HOURS readout on front panel TIME DISPLAY (28) by depressing the HOURS pushbutton switch (27) while simultaneously depressing the SUB (23) or ADD (24) pushbutton switches until the correct hour is displayed. Release the HOURS pushbutton switch (27).

d. Set the MINUTES readout on TIME DISPLAY (28) by depressing the MINUTES pushbutton switch (26) while simultaneously depressing the SUB (23) or ADD (24) pushbutton switches until the minutes displayed is at least one minute ahead of the true reference time. Release the MINUTES pushbutton switch (26).

e. Set the SECONDS readout on TIME DISPLAY (28) by depressing the SECONDS pushbutton switch (25) while simultaneously depressing the ADD (24) or SUB (23) pushbutton switches until the TIME DISPLAY (28) indicates 00 seconds.

f. When the reference time corresponds to the time set on the TIME DISPLAY (28), set the CLOCK OPR/TIME HOLD switch (2) to the CLOCK OPR position.

2-10. CLOCK SYNCRONIZATION. The PRTC can be synchronized to an external reference signal. To synchronize the PRTC TOD to an external reference, perform the following steps:

a. Connect external reference 1 PPS synchronizing pulse to PRTC SYNC IN connector (5, figure 2-3).

b. If TOD has not been set, perform the procedures specified in paragraph 2-9.

c. Depress SYNC ARM pushbutton switch (4, figure 2-1). Observe that the SYNC ARM indicator (5) lights.

d. When the SYNC ARM indicator (5) goes out the PRTC is synchronized with the external reference.

e. Set the HOURS, MINUTES and SECONDS to correspond to the reference time-of-day by depressing the respective switch and SUB (23) or ADD (24) pushbutton switches.

2-11. UNIVERSAL TIME (UT). The National Bureau of Standards (NBS) periodically announces that corrections to universal time will be made. These corrections are a result of a slowing earth rotation. The correction, known as leap seconds, are made at specific times and are a subtraction or loss of a second of time. When a universal time correction is announced, perform the following steps.

a. Synchronize the PRTC TOD to NBS or Naval Observatory time or to an external reference that is set to universal time (see paragraph 2-10).

b. At the time designated by NBS, depress UT SET pushbutton switch (21, figure 2-1). Each depression subtracts one second from the TOD clock. The UT SET indicator (20) will light when the UT SET switch command has been received.

2-12. 1 PPM RESET FUNCTION. The 1 PPM RESET pushbutton switch (22, figure 2-1) used to set the minute so that the transition is synchronized to the leading edge of a 1 PPS pulse. When the 1 PPM RESET pushbutton switch (22) is depressed, the TIME DISPLAY (28) SECONDS readout (count) goes to zero and the MINUTES readout advances to the next minute.

2-13. FREQUENCY STANDARD.

2-14. As a frequency standard, the PRTC provides 1 MHz, 5 MHz, and 100 KHz outputs. The 1 MHz and 5 MHz sinusoidal outputs are available at the front panel (3 and 4, figure 2-3) and at the rear panel (2 and 1, figure 2-4). The 100 KHz sinusoidal output is available at the rear panel only (3).

2-15. BATTERY OPERATION.

2-16. In the event of a primary DC power loss, the PRTC is automatically powered by battery power supply A17. This switchover is indicated on the front panel by the illumination of the POWER SOURCE IN USE BAT indicator (17, figure 2-1) and the extinguishing of the POWER SOURCE IN USE EXT indicator (18). To conserve battery power, the TIME DISPLAY (28) does not stay on during battery operation but can be displayed by depressing the TIME DISPLAY switch (3). The PRTC will operate from a fully charged battery for a period not exceeding one hour.

CHAPTER 3

FUNCTIONAL DESCRIPTION

3-1. INTRODUCTION.

3-2. This chapter 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 Real Time-of-Day (TOD) 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 PRTC power distribution circuits are provided.

3-3. Refer to table 1-2 for a listing of sub-assemblies that comprise the PRTC.

3-4. OVERVIEW OF SIGNAL CIRCUITS OPERATION.

3-5. The following paragraphs provide an operational overview of the various PRTC signal circuits (figure 3-1).

3-6. FREQUENCY LOCK OPERATION. The PRTC uses the property of atomic resonance in the Cesium beam resonator module A1 to control, via a frequency lock loop, the frequency of a 5 MHz oven controlled, voltage controlled, crystal oscillator (OCVCXO) module A4. Frequency locking of the OCVCXO module A4 is accomplished by operating the Cesium beam resonator and associated electronics as a frequency discriminator (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.

3-7. The defined center frequency of the PRTC Cesium beam resonator is 9192631771.59 Hz (figure 3-2), and departure from this center frequency will yield signal output currents less than maximum obtainable from the Cesium beam resonator. This characteristic of the Cesium beam resonator is made to behave as a frequency discriminator by use of a modulation/demodulation technique.

3-8. If the 9.192+ GHz resonator input signal is frequency modulated, the resonator beam current will contain the modulation frequency signal at 0° or 180° phase depending upon whether the modulated microwave resonator signal is above or below the center frequency as shown in D and B of figure 3-3. At the center frequency, resonator beam current will contain a component of twice modulation frequency as shown in C of figure 3-3. Components of twice modulation frequency also occur at other microwave frequencies, such as A and E of figure 3-3.

3-9. 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 3-3 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 3-4.

3-10. Implementation of the PRTC frequency lock loop is shown in figure 3-5. Output from OCVCXO module A4 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 module A5. The 83+ Hz

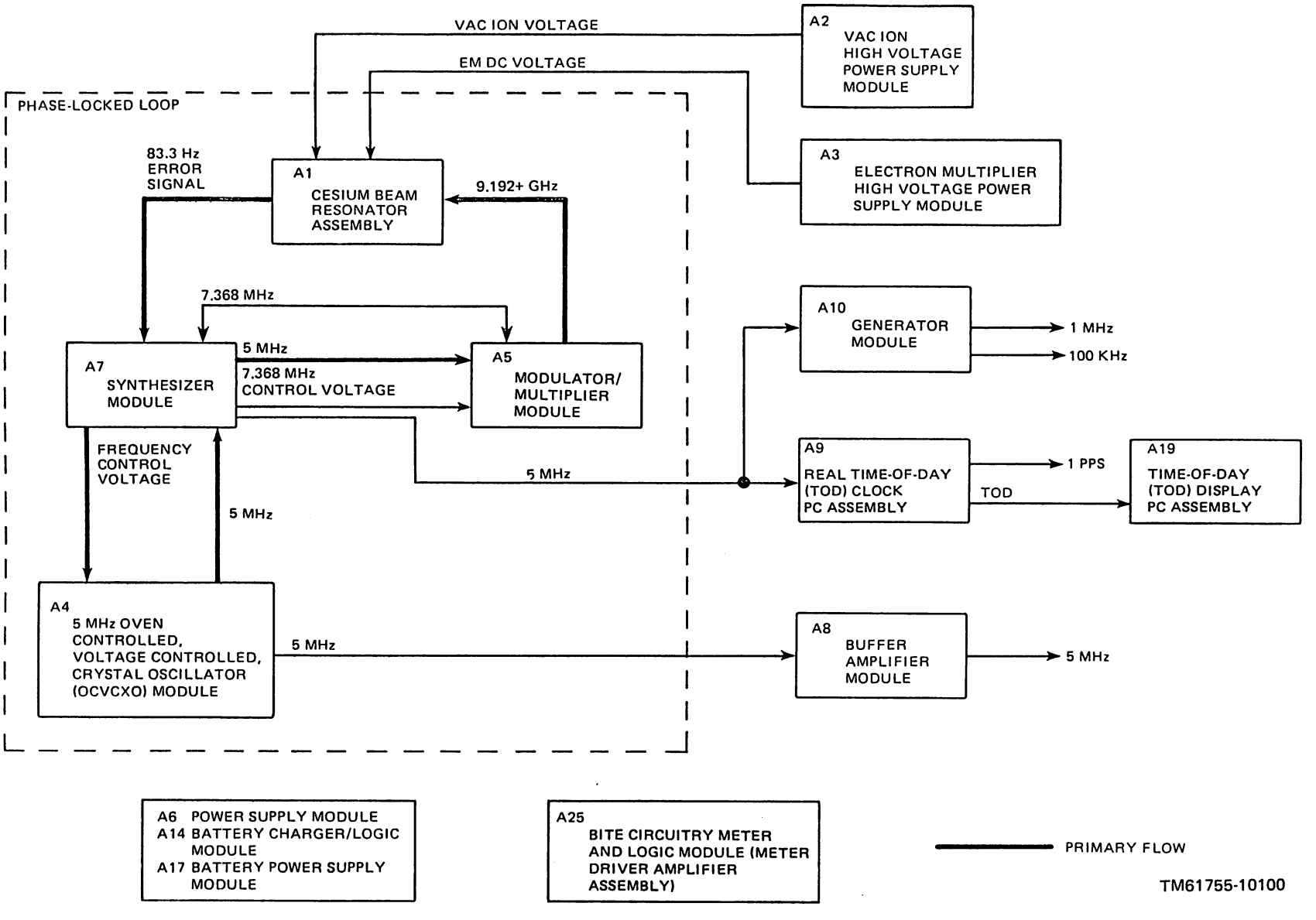

Figure 3-1. PRTC Overall Functional Block Diagram

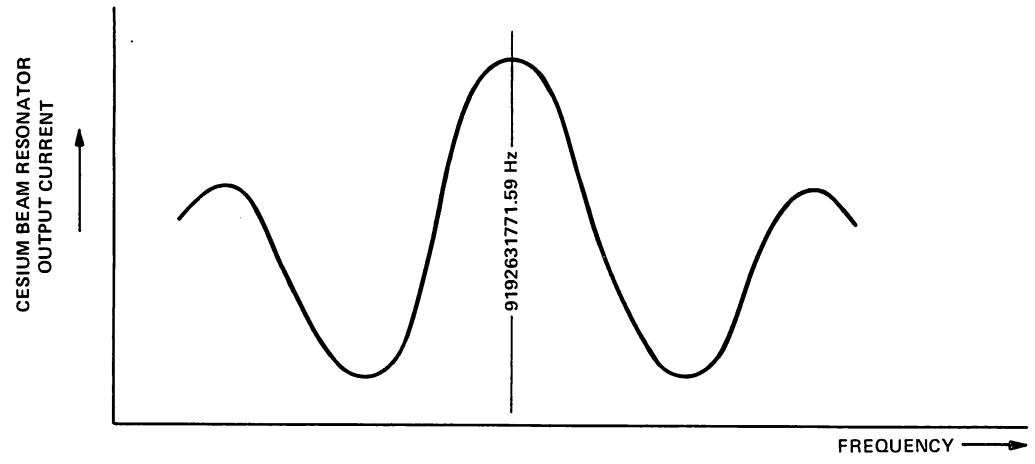

Figure 3-2. Cesium Beam Resonator Transfer Characteristic

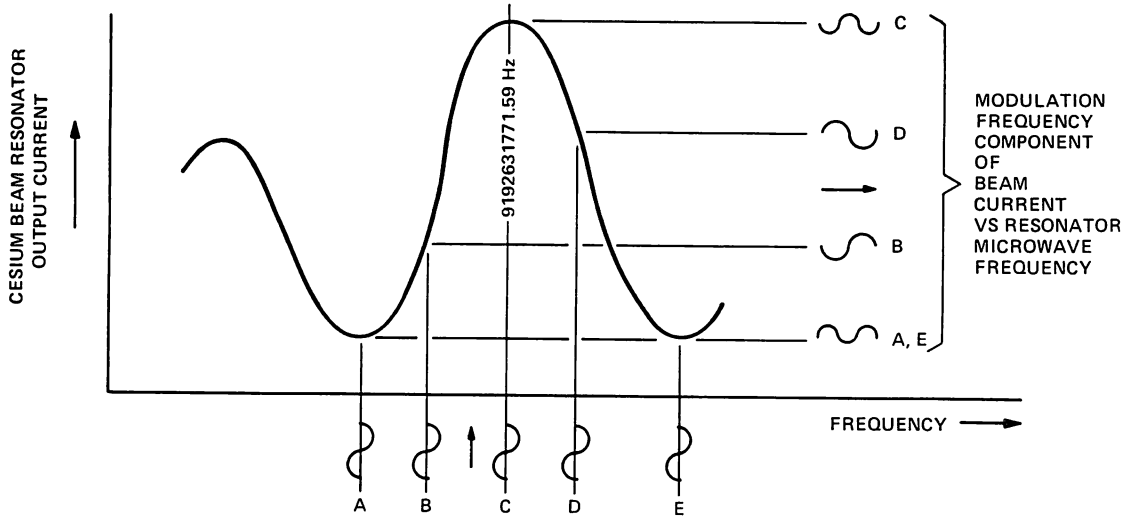

Figure 3-3. Frequency Modulation of Resonator Microwave Input Signal

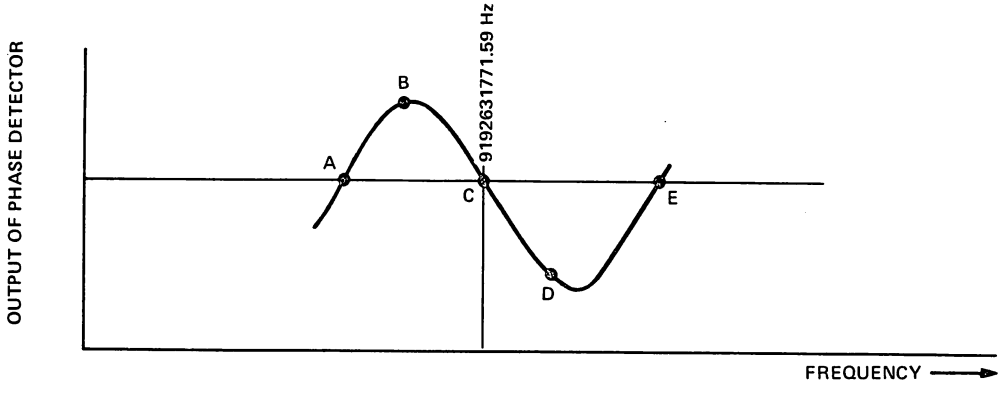

Figure 3-4. Derived Discriminator Characteristic

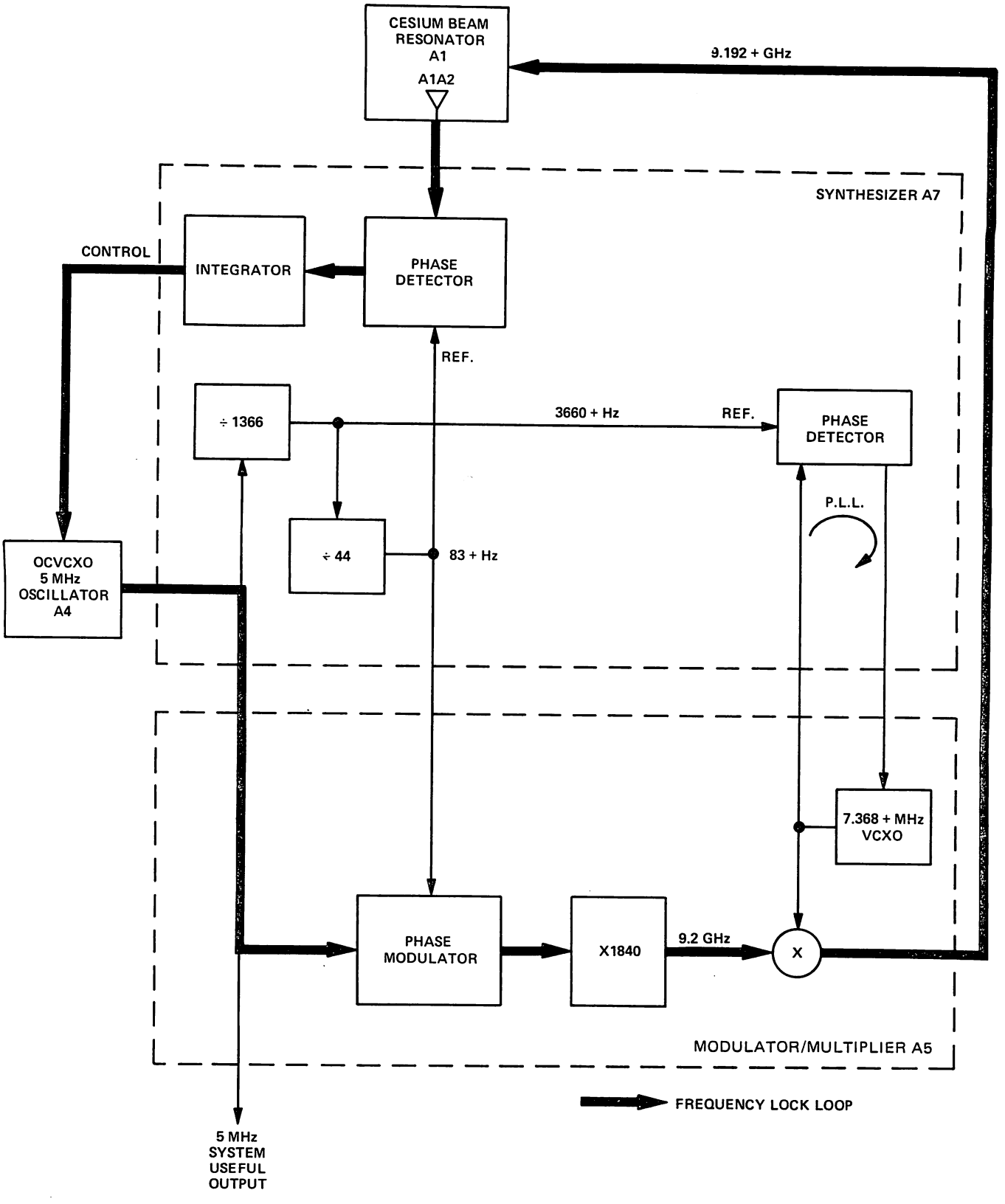

Figure 3-5. PRTC Frequency Lock Loop

frequency modulated microwave signal is detected by the Cesium beam resonator resulting in, at the output of preamplifier A1A2, an 83+ Hz signal whose behavior with regard to amplitude and phase is like that depicted in figure 3-3. Phase detection (figure 3-5) of the 83+ Hz signal from preamplifier A1A2, with respect to the 83+ Hz modulation signal and filtering, will yield a dc signal to keep OCVCXO module A4 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 A5 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 non-integer multiple $\left(\frac{2013}{1366}\right)$ of 5 MHz. This is accomplished in synthesizer module A7 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 A5) is derived from a phase comparison of every 2013th cycle of 7.368+ MHz against the 3660+ Hz reference.

3-11. The signals (83+ Hz) used by the phase modulator in modulator/multiplier module A5 as well as a reference for the phase detector in synthesizer module A7 are derived, in synthesizer module A7, by division of the 3660+ Hz signal by 44.

3-12. In the above described system, all signals are coherent with the 5 MHz oscillator signal.

3-13. REAL TIME-OF-DAY (TOD) CLOCK A9 OPERATION. The TOD clock PC assembly A9 is an assembly of transistor-transistor logic (TTL) circuits whose function is to generate 1 PPS and TOD signals available on front and rear panels of the PRTC, as well as a TOD signal to TOD display PC assembly A19. Signals are derived from the stabilized 5 MHz OCVCXO module A4 (via synthesizer module A7) and consequently have the accuracy and stability of the Cesium beam resonator.

3-14. DETAILED THEORY OF SIGNAL CIRCUITS OPERATION.

3-15. Figure 3-6 illustrates major signal blocks of the PRTC and is an expansion of figure 3-5 used in describing the operation of the frequency lock loop. The method of generation of various PRTC output signals, error and alarm blocks (to establish whether frequency lock has occurred and has not been broken) and the circuit check block for PRTC performance evaluation and testing are illustrated in figure 3-6.

3-16. All PRTC outputs are derived from OCVCXO module A4. Functional requirements of each block comprising the signal portion of the PRTC are described in the following paragraphs.

3-17. CESIUM BEAM RESONATOR ASSEMBLY A1. The major component of Cesium beam resonator assembly A1 is the Cesium beam tube A1A1 consisting of a Cesium oven, input selector magnet, atom-microwave interaction region, output selector magnet, current preamplifier, hot wire ionizer, and 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 vac-ion high voltage power supply module A2, while the electron multiplier is powered by (adjustable) kilovolts dc from electron multiplier high voltage power supply module A3.

3-18. Another component of the Cesium beam resonator assembly A1 is the C-field and Cesium oven control A1A3. The C-field portion of A1A3 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 A1A3 maintains a constant temperature in the Cesium oven.

3-19. 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 A1A1.

3-20. If the microwave input to the Cesium beam resonator assembly A1 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 assembly A1, amplifies the 83+ Hz signal output of the Cesium beam tube and applies the resulting signal to the phase detector in synthesizer module A7. A second output from preamplifier A1A2 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 module A7 to indicate that frequency lock of the PRTC has occurred. The Cesium beam resonator is not field-repairable.

3-21. 5 MHz OVEN CONTROLLED, VOLTAGE CONTROLLED, CRYSTAL OSCILLATOR (OCVCXO) MODULE A4. OCVCXO module A4 is an oven controlled, voltage controlled crystal oscillator 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.

3-22. OCVCXO module A4 has two isolated outputs; one output provides a signal for synthesizer module A7, the second output provides a signal for buffer amplifier module A8.

3-23. The oscillator is a sealed unit and is subject to factory repair only.

3-24. MODULATOR/MULTIPLIER MODULE A5. Modulator/multiplier module A5 generates the modulated microwave signal required by Cesium beam resonator assembly A1. This is accomplished by multiplying a 5 MHz signal from OCVCXO module A4 obtained via synthesizer module A7, 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 Cesium beam resonator assembly A1.

3-25. The local oscillator in modulator/multiplier module A5 is a voltage controlled crystal oscillator that is phase locked, via a phase detector and digital frequency dividers in synthesizer module A7, to a non-integer multiple of 5 MHz.

3-26. Frequency modulation of the 83+ Hz microwave signal is accomplished by generating the modulation signal by digital frequency division in synthesizer module A7 and applying the 83+ Hz modulation signal to the phase modulator in modulator/multiplier module A5. Phase modulation is performed on a 5 MHz carrier.

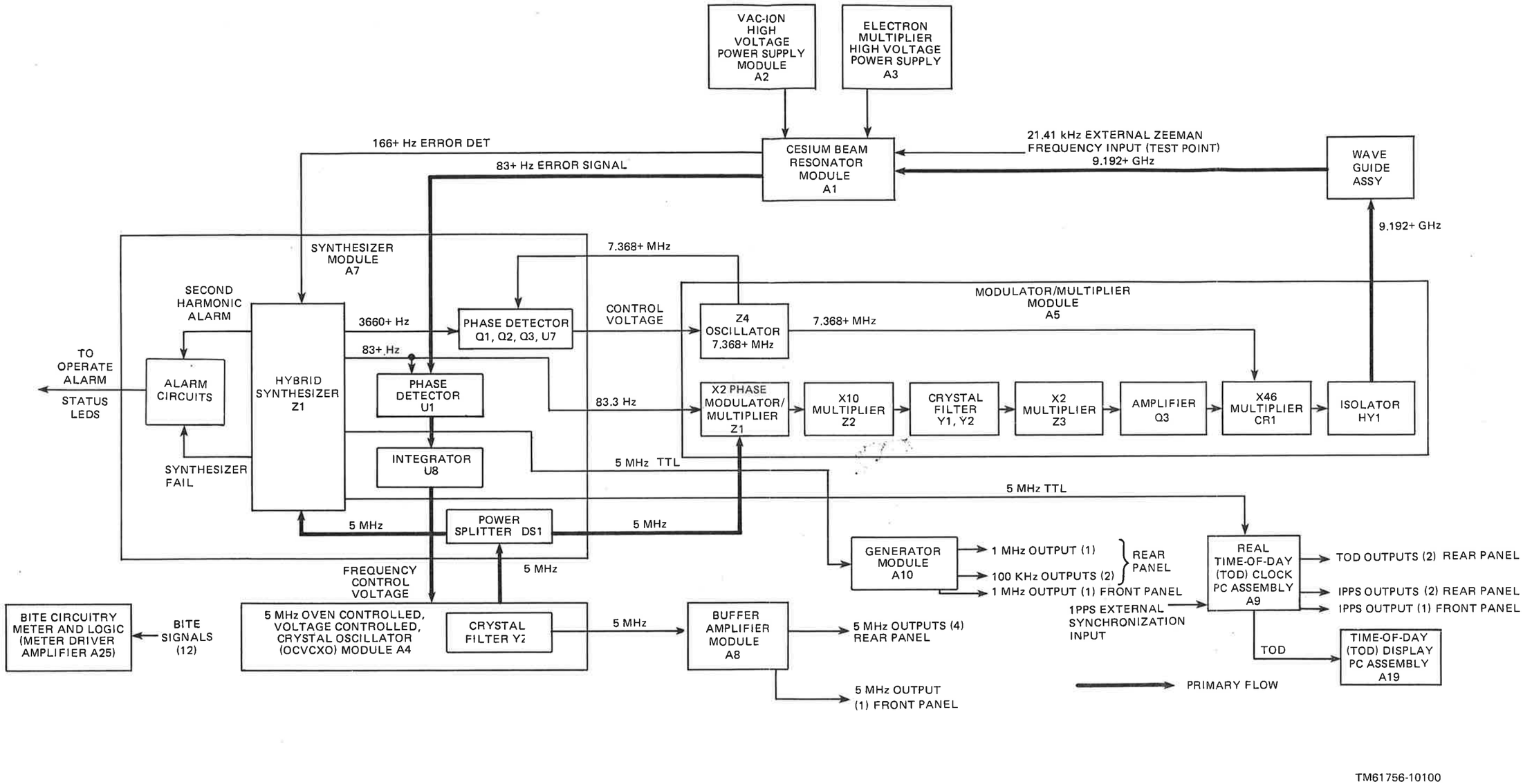

Figure 3-6. Detailed Functional Block Diagram

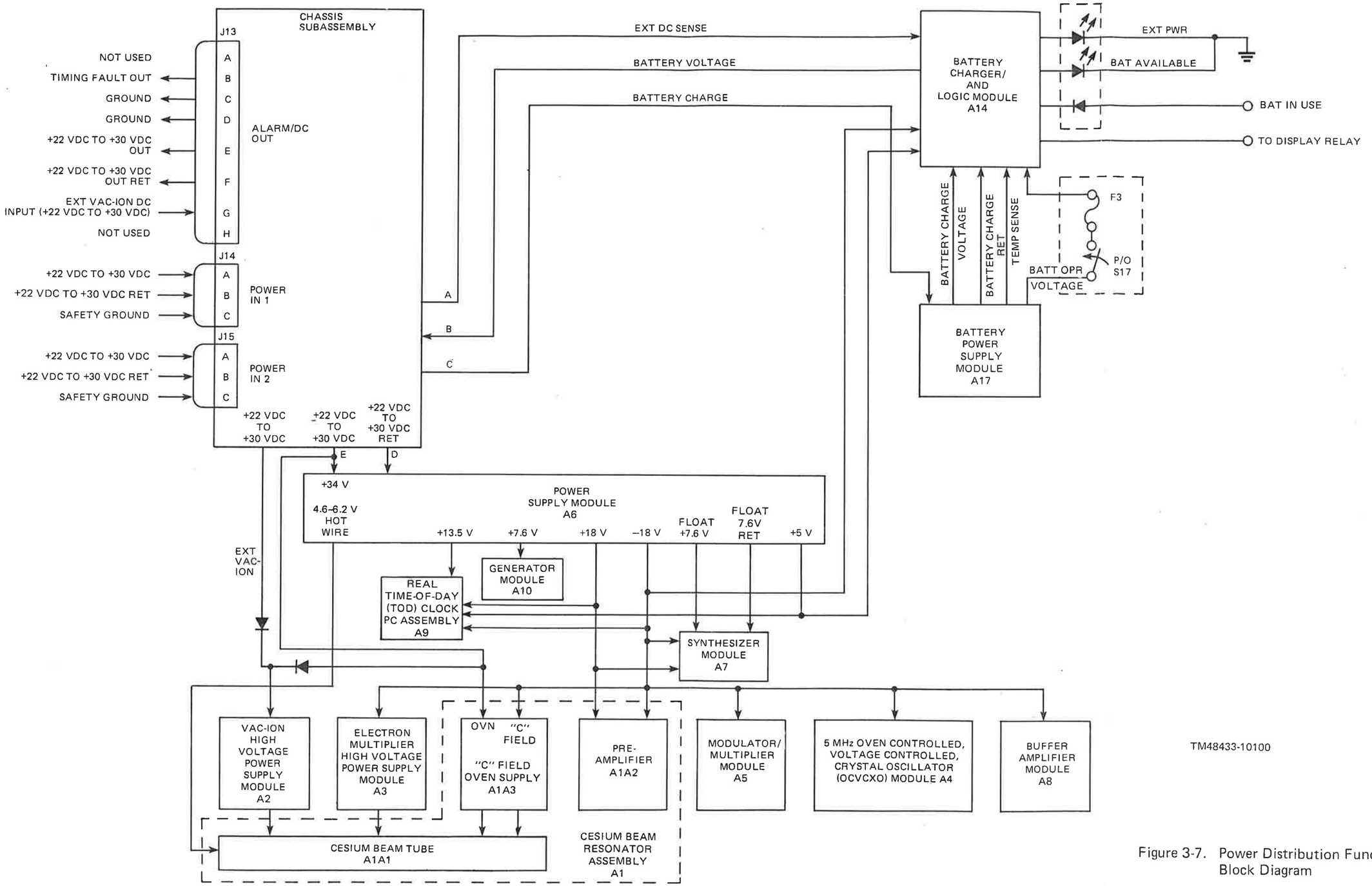

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Figure 3-7. Power Distribution Functional Block Diagram

3-27. The modulator/multiplier module A5 is primarily comprised of hybrid integrated circuits and, depending upon facilities available, repair by replacement of a hybrid integrated circuit may be possible.

3-28. SYNTHESIZER MODULE A7. Synthesizer module A7 performs the following functions:

a. Accepts a 5 MHz signal from OCVCXO module A4 and, from which three 5 MHz signals are generated for input to modulator/multiplier module A5, TOD clock PC assembly A9, and generator module A10.

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

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

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 A5 and (2) generating a control voltage for delivery to modulator/multiplier module A5.

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

3-29. A 5 MHz signal from OCVCXO module A4 is split two ways in a passive 50 ohm power splitter A7DS1. One output from power splitter A7DS1 is the 5 MHz signal delivered to modulator/multiplier module A5; the second output from power splitter A7DS1 is the 5 MHz signal input to synthesizer A7Z1. Two 5 MHz square wave signals are obtained from synthesizer A7Z1. One 5 MHz square wave signal is delivered to the TOD clock PC assembly A9; the second wave signal goes to generator module A10.

3-30. The 83+ Hz error signal from Cesium beam resonator assembly A1 is compared in the phase detector A7U1 with respect to an 83+ Hz reference signal which is obtained by division of 5 MHz by 60104 in synthesizer A7Z1. The output from the phase detector after filtering (integration) becomes the control voltage output from synthesizer module A7 applied to OCVCXO module A4.

3-31. This same 83+ Hz signal, obtained from synthesizer A7Z1 by dividing 5 MHz by 60104 in Z1, is also applied to the phase modulator in modulator/multiplier module A5.

3-32. 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 synthesizer A7Z1 monitors the level of this signal (as well as the level of another signal whose derivation is not shown in synthesizer module A7) and derives, as an output from synthesizer A7Z1, 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 OPR and ALARM front panel indicators. The SYNTHESIZER FAIL signal indicates when the 7.368+ MHz local oscillator is improperly phase locked.

3-33. The 7.368+ MHz local oscillator in modulator/multiplier module A5 is phase locked by a phase detector in synthesizer module A7. The reference signal for the phase detector, 3660+ Hz,

is obtained by dividing 5 MHz by 1366 in synthesizer A7Z1. 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 synthesizer A7Z1 is used by the alarm circuits previously discussed.

3-34. With the exception of synthesizer A7Z1, synthesizer module A7 is field-repairable. Depending upon facilities available, repair by replacement of synthesizer A7Z1 may be possible.

3-35. BUFFER AMPLIFIER MODULE A8. Buffer amplifier module A8 generates the multiple, isolated, 5 MHz outputs required by the PRTC. The buffer amplifier module A8 consists of five identical output amplifiers that amplify the 5 MHz signal from OCVCXO module A4 for application to the front and rear panel connectors.

3-36. This module is completely field repairable.

3-37. TOD CLOCK PC ASSEMBLY A9. The TOD clock PC assembly A9 provides the following outputs from a 5 MHz input signal.

a. Two TOD outputs to rear panel

b. One TOD output to TOD display A19

c. Two PPS outputs to rear panel

d. One PPS output to front panel

3-38. 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 TOD output.

3-39. 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 TOD display PC assembly A19 and the TOD output.

3-40. The preset advance counter and manual clock controls are used to set the hours, minutes, and seconds counters for the TOD display PC assembly A19. These controls include HOURS, MINUTES, SECONDS, CLOCK OPR/TIME HOLD, ADD and SUB switches. The TIME DISPLAY switch is used to illuminate the TOD display when the PRTC is operated from battery power.

3-41. The TOD 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 TOD 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.

3-42. TOD DISPLAY PC ASSEMBLY A19. The TOD display PC assembly A19 receives BCD time signals from the hours, minutes, seconds counters in TOD clock PC assembly A9. The BCD time signals are applied directly to LED displays to provide the visual readout.

3-43. GENERATOR MODULE A10. Generator module A10 generates two isolated 1 MHz outputs and two isolated 100 kHz outputs. Excitation for generator module A10 is obtained from synthesizer module A7.

3-44. This module is completely field-repairable.

3-45. METER DRIVER AMPLIFIER ASSEMBLY A25. Meter driver amplifier assembly A25 monitors the internal functions of the PRTC. The CIRCUIT CHECK meter displays indication of +18 Vdc, -18 Vdc, and +5 Vdc output voltages from power supply A6, battery voltage, battery current, Cesium ion current, vac-ion current, and Cesium oven temperature (all relating to performance of the Cesium beam resonator module A1), oscillator oven temperature, oscillator control voltage, 5 MHz signal level from buffer amplifier module A8 and the synthesizer fail signal from synthesizer module A7. The function to be displayed is selected by setting the Circuit Check thumbwheel switch on the front panel. An external meter may be connected to the EXT MTR connector on the front panel.

3-46. This module is completely field-repairable.

3-47. POWER DISTRIBUTION OVERVIEW OF OPERATION.

3-48. The PRTC operates on +22 to +30 Vdc external power or internal battery power. The external +22 to +30 Vdc is fed to the PRTC via two rear panel connectors. Internal battery power is available to operate the PRTC for a maximum of one hour in the event of loss of both external dc power sources. Status lamps on the front panel indicate primary power usage and availability in the PRTC. Full recharging of, or maintaining a trickle charging current in, the internal battery requires use of the external dc supply.

3-49. POWER DISTRIBUTION DETAILS OF OPERATION.

3-50. Power distribution (figure 3-7) within the PRTC will be briefly discussed, followed by a detailed discussion of the functional operation of each subassembly relating to power supply.

3-51. The PRTC can be operated from either one of two redundant externally supplied +22 to +30 Vdc voltages or by internal batteries. If either one of the external dc power sources fail, the PRTC will continue to operate on the remaining external dc power source. If both external dc power sources fail, the PRTC will operate on internal batteries.

3-52. Upon application of external dc power source, +22 to +30 Vdc BATTERY CHARGE voltage is applied through the chassis subassembly to battery power supply module A17. Battery power supply, in turn, outputs a BAT(+) out signal to battery charger/logic module A14 indicating battery power supply voltage.

3-53. External +22 and +30 Vdc power is also applied to power supply module A6, Cesium beam resonator "C" field oven supply A1A3, and to VAC-ION high voltage power supply module A2, via diode CR13.

3-54. Power supply module A6 is a dc to dc converter that outputs the following dc voltages to the PRTC subassemblies referenced below:

Voltage	Subassembly
+13.5 Vdc	TOD Clock PC Assembly A9
+ 5 Vdc	Real TOD Clock PC Assembly A9
	Battery Charger/Logic Module A14
+18 Vdc	TOD Clock PC Assembly A9
	Battery Charger/Logic Module A14
	Synthesizer Module A7
	Electron Multiplier High Voltage Power Supply Module A3
	Modulator/Multiplier Module A5
	OCVCXO Module A4
	Buffer Amplifier Module A8
	"C" Field Oven Supply A1A3
	Preamplifies A1A2
	Meter Driver Amplifier Module A5
-18 Vdc	TOD Clock PC Assembly A9
	Synthesizer Module A7
	Preamplifier A1A2
	Meter Driver Amplifier Module A5
+ 7.6 Vdc	Generator A10
+ 7.6 Vdc (isolated)	Synthesizer Module A7
+ 4.6 Vdc to + 6.2 Vdc	Cesium Beam Tube A1A1

3-55. Vac-ion high voltage power supply module A2 generates approximately +3 Kv to support the vac-ion pump affixed to the Cesium beam tube. Also, electron multiplier high voltage power supply module A3 generates an adjustable (approximately -1000 to -2500 V) voltage for use by the electron multiplier in the Cesium beam tube.

3-56. VAC-ION HIGH VOLTAGE POWER SUPPLY MODULE A2. Vac-ion high voltage power supply module A2 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 +22 to +30 Vdc from the external dc supply. The input to this supply is AND-gated so that an external dc supply may be used to energize Vac-ion high voltage power supply module A2 without energizing the remainder of the PRTC (for long term storage of the PRTC).

3-57. This unit is sealed and is not repairable.

3-58. ELECTRON MULTIPLIER HIGH VOLTAGE POWER SUPPLY MODULE A3. Electron Multiplier High Voltage Power Supply module A3, 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 module A6.

3-59. This unit is sealed and is not repairable.

3-60. POWER SUPPLY MODULE A6. Power supply module A6 is a pulse-width modulated switching regulator supply whose input voltages are as follows:

a. +22 to +30 Vdc from external supply via chassis subassembly

b. 17 V minimum from battery power supply module A17

3-61. Output voltages from power supply module A6 are shown in figure 3-7. These voltages are maintained by the switching regulator over the input voltage range of +17 to +30 V.

3-62. This module is completely field-repairable.

3-63. BATTERY POWER SUPPLY MODULE A17. Battery power supply module A17, 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.

3-64. The battery is sealed and is not repairable.

3-65. BATTERY CHARGER/LOGIC MODULE A14. The functions of the battery charger/ logic module A14, are as follows:

a. External dc is used to charge the battery via current limiting devices.

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

c. Delivers battery voltage via chassis subassembly to operate the PRTC upon loss of both external dc power supplies.

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

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.

3-66. When the PRTC is operating from battery power supply module A17, the battery voltage is monitored in battery charged/logic module A14. When the voltage drops to approximately 17 volts, the relay in battery charger/logic module A14 disconnects the battery. When the PRTC is operating from battery power supply module A17, logic is used to turn off the TOD DISPLAY in module A19 to conserve battery power.

3-67. 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. EXT IN USE monitors external dc supply voltage.

b. BAT AVAL monitors battery voltage (from A17).

c. BAT IN USE indicates the battery is the primary power source.

3-68. This module is completely field-repairable.

3-69. CHASSIS POWER SUPPLY (PART OF CHASSIS SUBASSEMBLY). Functions of the power supply which is part of chassis subassembly are as follows:

a. Accepts a +22 to +30 Vdc external dc power source for use by the following:
   (1) Cesium oven of A1A1.
   (2) Vac-Ion High Voltage Power Supply Module A2.
   (3) Power Supply Module A6.

b. Generates external dc power source sense voltage for battery charger/logic module A14.

c. Accepts voltage from battery power supply module A17 (via battery charger/logic module A14) to operate the PRTC when both external +22 to +30 Vdc sources are not available.

3-70. A diode AND-gate connects the external dc sources and the battery power supply module A17, to power supply module A6, vac-ion high voltage power supply module A2, and the Cesium oven of A1A1.

3-71. This module is completely field-repairable.

3-72. DETAILED CIRCUIT DESCRIPTIONS.

3-73. The following paragraphs contain detailed circuit level descriptions for each repairable module in the PRTC. In this section, the major signal blocks in figure 3-6 (that are field-repairable) are discussed.

3-74. PREAMPLIFIER A1A2. Preamplifier A1A2 is a part of Cesium beam resonator module A1. It is mounted on the Cesium beam tube A1A1 at the electron multiplier end of the tube. The preamplifier (figure 3-8) 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 synthesizer module A7 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 A16 via A1P1 pins 4 and 5. Power for hybrid A1A2Z1 is provided via connector A1P1 and regulators A1A2U1 and A1A2U2. Potentiometer A1A2R1 sets the gain obtained from hyrid circuit A1A2Z1.

3-75. MODULATOR/MULTIPLIER MODULE A5. The 5 MHz and 83+ Hz signals from synthesizer module A7 (figure 5-6) are applied via connectors J1 and J2 of 1A5 to modulator/times 20 multiplier A5A1. Hybrid A5A1Z1 is a hybrid phase modulator and times 2 multiplier. The modulated 10 MHz signal from A5A1Z1 is multiplied by 10 in hybrid multiplier A5A1Z2 and the resulting modulated 100 MHz signal is applied to crystal filter A5A2. After filtering, the modulated

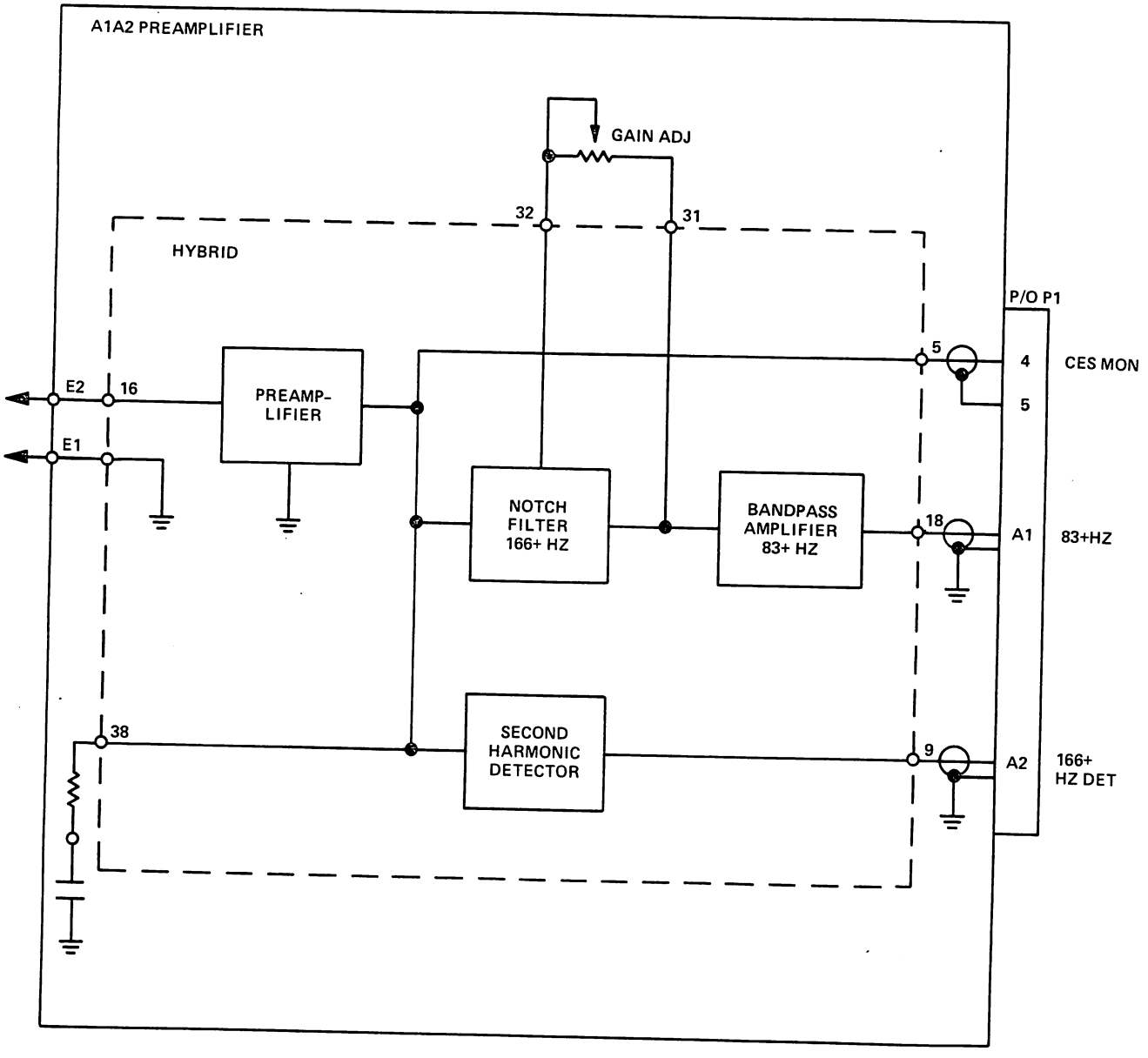


Figure 3-8. Preamplifier A1A2 Block Diagram.

100 MHz signal is multiplied by 2 in hybrid multiplier A5A3Z3 and the resulting modulated 200 MHz signal is amplified by amplifier A5A3Q3. The output of amplifier A5A3Q3 is then fed to a times 46 multiplier A5CR1, a step recovery diode, to generate a modulated 9200 MHz signal.

3-76. In addition, diode A5CR1 is fed a 7.368+ MHz signal obtained from oscillator hybrid A5A4Z4. Mixing occurs in diode A5CR1; the resulting modulated 9.192+ GHz signal is filtered by a coupled pair of microwave coaxial cavities (part of A5 housing) and is then routed to Cesium beam resonator module A1 via a coaxial-to-waveguide transition.

3-77. 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 module A7.

3-78. Oscillator A5Z4 generates the 7.368+ MHz signal that is routed to synthesizer module A7. A control signal is developed by synthesizer module A7 and returned to hybrid A5Z4 to accomplish phase locking of the oscillator.

3-79. Potentiometer A5A3R15 adjusts the level of 7.368+ MHz signal injected into diode (mixer) A5CR1. Potentiometer A5A1R1 optimizes the operation of the phase modulator in hybrid A5Z1. Power for the modulator/multiplier is provided via A5FL1 and regulator A5U1.

3-80. SYNTHESIZER MODULE A7. A 5 MHz signal from OCVCXO module A4 is applied to connector A7P2-A1 (figure 5-6) and is split 2 ways in passive power splitter DC1. One output becomes the 5 MHz signal fed to modulator/multiplier module A5 via connector A7P2-A2; the other output is the 5 MHz input to hybrid A7Z1. Hybrid A7Z1 generates two 5 MHz square wave signals from the 5 MHz input. These signals, obtained at A7Z1 pins 27 and 28, are the 5 MHz signals fed to generator module A10 (100 kHz, 1 MHz generator) and TOD clock PC assembly, respectively.

3-81. The 83+ Hz error signal from Cesium beam resonator module A1 is applied to A7P2-A4 and then fed to phase detector A7U1 where it is compared in phase to an 83+ Hz reference signal generated in A7Z1 (available at A7Z1 pins 8 and 9). The output from A7U1, ac with a dc component, is integrated by integrator A7U8. The output from integrator A7U8, available at A7P1-A2, is the control voltage for frequency locking the 5 MHz OCVCXO module A4.

3-82. Some controls for operation, testing, and adjustment of the PRTC frequency lock loop are associated with the circuitry comprising the integrator. The integrator time constant may be changed from NORM to FAST (a factor of 20) by energizing relay A7K2. The frequency lock loop may be opened by energizing relay A7K1 (thereby effectively shorting integrating capacitor A7C40).

3-83. A second 83+ Hz signal, generated in synthesizer A7Z1, is available at A7Z1-7. This signal, a TTL square wave, is coherent with the 83+ Hz signal available at synthesizer A7Z1 pins 8 and 9 and is attenuated, filtered and adjusted by potentiometer A7R5 before being sent, as a modulation signal, to modulator/multiplier module A5. The modulation may be controlled for operation, testing, and adjustment of the PRTC; placing a logic low on A7Z1-6 will remove a 83+ Hz signal available at A7Z1-7 and at A7Z1 pins 8 and 9 by disabling a flip-flop within synthesizer A7Z1.

3-84. A fine adjustment of the phase of the 83+ Hz reference signal at A7Z1-7, with respect to the 83+ Hz signal at A7Z1 pins 8 and 9, is accomplished at A7Z1-19 by potentiometer A7R17. A 180° phase adjustment can be made by changing the jumper from E6-E4 to E6-E9.

3-85. 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 synthesizer module A7. There are three circuits:

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

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

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

3-86. System faults will then generate logic lows at A7Z1 pins 16 and 38, and conversely, correct system operation will generate logic highs at A7Z1 pins 16 and 38. These signals are processed by A7U5 and A7U6 to operate the SYSTEM LOCK OPR, and SYSTEM LOCK ALARM indicators on the front panel, and to generate the TIMING FAULT output signal obtained at J23-3. Logic highs at A7U5 pins 1 and 2 will result in a logic low to appear at A7U6-6, lighting the OPR indicator and will cause a logic high to appear at J23-3. Conversely, a logic low at A7U5-1 or A7U5-2, or at both A7U5-1 and A7U5-2 will cause the following to occur:

a. A logic high to appear at A7U6-6 extinguishing the OPR indicator

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

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

3-87. Resetting flip-flops A7U5B and A7U5C 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 OPR indicators and that the ALARM indicator may be extinguished by depressing the RESET switch.

3-88. The 7.368+ MHz local oscillator in modulator/multiplier module A5 is phase locked by a phase detector in synthesizer module A7. Reference signal for the phase detector, 3660+ Hz, is derived by dividing 5 MHz by 1366 in synthesizer A7Z1 and is obtained at A7Z1-21. Sample-and-hold phase detector A7Q2 and A7Q3 accepts a 7.368+ MHz signal from modulator/multiplier module A5 and adds it to a narrow pulse from A7Z1-21 via amplifier A7Q1. 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 A7Q3 is amplified by A7U7 and is the control signal for phase locking the oscillator in modulator/multiplier module A5. Potentiometer A7R53 is used to set the dc level at the output of A7U7. Failure of the 7.368+ Hz local oscillator to achieve phase lock will result in an audio frequency appearing at A7U7-6. This signal, delivered to A7Z1-15, is used in synthesizer A7Z1 to generate the synthesizer fail signal appearing at A7Z1-16.

3-89. Power for synthesizer module A7 is provided via A7P1 and voltage regulators A7U2 (+15 V), A7U3 (-15V) and A7U4 (+5 V).

3-90. BUFFER AMPLIFIER MODULE A8. Buffer amplifier module A8 (figure 5-6) consists of five identical output amplifiers that amplify the 5 MHz signal from OCVCXO module A4 for application to the front and rear panel connectors. Input 5 MHz is applied to splitter A6U1 where five outputs are developed. One output is amplified by output amplifier transistors A8Q1 and A8Q2 and applied to output terminal A8E2 and connector A8P1A2. Similarly, the remaining four outputs are amplified by transistors A8Q3 and A8Q4 for output amplifier 2, transistors A8Q5 and A8Q6 for output amplifier 3, transistors A8Q7 and A8Q8 for output amplifier 4 and transistors A8Q9 and A8Q10 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.

3-91. Power for buffer amplifier module A8 is provided via A8P1 and voltage regulator A8U2.

3-92. TOD CLOCK PC ASSEMBLY A9 (figure 5-17). A 5 MHz signal is received from synthesizer module A7 and applied to times 2 multiplier U1 in the TOD clock PC assembly A9. The resultant 10 MHz output is then applied to a main counter U51, U52, U54-U56, and 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, seconds counter and the TOD output.

3-93. The 1 PPS signal from the main counter is applied to hours, minutes, seconds counters U8, U9, U20, U21, U34 and U35 where the pulses are counted. The counter is arranged to provide BCD time signals for driving TOD display PC assembly A19 and the TOD output.

3-94. The preset advance counter U46, U47, U57-U59, U64-U68 and manual clock controls are used to set the hours, minutes, and seconds counters for TOD display PC assembly A19. 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 TOD display when the PRTC is operated from battery power.

3-95. The TOD 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 TOD output. The BCD time signals are applied to a shift register consisting of U36, U22, and U10 where they are converted to a serial data stream at the 50 PPS rate.

3-96. TOD DISPLAY PC ASSEMBLY A19. TOD display PC assembly A19 receives BCD time signals from the hours, minutes, seconds counters in TOD clock PC assembly A19. The BCD time signals are applied directly to LED displays U1-U6 to provide the TOD display.

3-97. This module is completely field-repairable.

3-98. GENERATOR MODULE A10. Generator module A10 (figure 5-8) receives a 5 MHz signal from synthesizer module A7. The 5 MHz signal from connector A10P1 pins 4 and 5 is multiplied to 10 MHz by diodes A10A1 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 PRTC via connectors A10P1-A1 through A10P1-A4.

3-99. Power for generator module A10 is provided via A10P1 and voltage regulator A10U4.

3-100. METER DRIVER AMPLIFIER MODULE A25. Pushbutton switch A25S1 senses important points within the PRTC. The selected signal is applied to meter driver A25A1U1 (figure 5-10) and then to front panel meter M1 where the status is displayed.

3-101. MAJOR POWER DISTRIBUTION BLOCKS.

3-102. In this section, the field-repairable major power distribution blocks, keyed to figure 3-7, are discussed.

3-103. POWER SUPPLY MODULE A6. An input voltage of 17 to 35 Vdc power is applied from the chassis to connector A6P1 (figure 5-4). After filtering by capacitors A6C1 and A6C7 and inductor A6L1, the power is applied to switching controller A6U1 which controls the operation of darlington transistors A6Q1 and A6Q2 connected to the primary winding of power transformer A6T1. Transistors A6Q1 and A6Q2, operating in a push-pull mode, act as switches which effectively produce a square wave of voltage across the primary winding of A6T1.

3-104. Controller A6U1 controls the duty-factor (ratio of voltage "on" time to total cycle time) of the square wave voltage. By controlling the duty-factor, controller A6U1 maintains a constant output voltage, from the power supply, despite a variable input voltage.

3-105. The variable duty-factor square wave voltage that is generated by A6Q1 and A6Q2 also appears, by transformer action, at the several secondary windings of A6T1. Four separate secondary windings are used to provide the various output supply voltages.

3-106. The voltage at secondary winding terminals A6T1-4, A6T1-5 and A6T1-6 is rectified by diodes A6CR5 and A6CR6 and filtered by inductor A6L4 and capacitor A6C16 to provide a +18 Vdc output at connector A6P1-6 and A6P1-18. A portion of the +18 Vdc output is regulated by A6U5 to provide a +13.5 Vdc output at connector A6P1-2. The voltage at secondary winding terminals A6T1-4, A6T1-5 and A6T1-6 is also rectified by diodes A6CR3 and A6CR4 and filtered by inductor A6L3 and capacitor A6C14 to provide a -18 Vdc output at connector A6P1-3.

3-107. The voltage at secondary winding terminals A6T1-7, A6T1-8 and A6T1-9 is rectified by diodes A6CR1 and A6CR2 and filtered by inductor A6L2 and capacitor A6C11 to provide 7.6 Vdc. From +7.6 Vdc, three power supply outputs are generated:

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

b. +5 Vdc available at connector terminals A6P1-7, 19, via regulator A6U3.

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

3-108. The voltage at secondary winding terminals A6T1-10, A6T1-11 and A6T1-12 is rectified by diodes A6CR14 and A6CR15 and filtered by inductor A6L6 and capacitor A6C29 to provide an unregulated 1 Vdc output between connector terminals A6P1-8 (—) and A6P1-10 (+).

3-109. The voltage at secondary winding terminals A6T1-13, A6T1-14 and A6T1-15 is rectified by diodes A6CR9 and A6CR10 and filtered by inductor A6L7 and capacitor A6C21 to provide an isolated +7.6 Vdc output between connector terminals A6P1-11 (—) and A6P1-12 (+).

3-110. BATTERY CHARGER/LOGIC MODULE A14. External dc source voltage is applied to A14P1-1 and is sensed by logic A14U7-5 after processing by resistor A14A1R21, zener diode A14CR7, and resistor A14R24. When external dc source is present the EXT IN USE indicator lights and A14U7-5 receives a logic high.

3-111. Battery logic A14U8 senses the battery availability status. When the battery is in a charged condition, relay A14K1 is energized and the battery is connected to a diode AND gate ready to be used if the dc input power fails. The BAT AVAL indicator lights via resistors A14R26 and A14R28 when relay A14K1 is energized.

3-112. The gate array A14U7 describes power sources via front panel indicators:

a. dc present — logic high at A14U7-5 battery charged and available	EXT IN USE indicator lights BAT AVAL indicator lights
b. dc present — logic high at A14U7-5 battery charged and available	EXT IN USE indicator lights BAT AVAL indicator lights
c. dc absent — logic low at A14U7-5 battery charged and available	BAT IN USE indicator lights BAT AVAL indicator lights

3-113. Unmentioned indicators are unlit. In addition, when the BAT AVAL indicator is lit, (logic low at A14U7-8), transistor A14Q4 is turned on, and the time-of-day clock A9 display relay is energized and the TOD display PC assembly A19 is turned off.

3-114. Power required by battery charger/logic module A14 is supplied by power supply module A6 via connector A14P1.

3-115. BATTERY POWER SUPPLY MODULE A17. The nickel cadmium battery is capable of powering the PRTC for a maximum of one hour in the event external dc power sources are not available. Protection is provided by a thermistor (A17RT1) which reduces charging current of the battery under abnormal conditions of operation (overheating). Fuse A17F1 protects the battery when it is removed from the PRTC.

3-116. 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.

3-117. External power of +22 to +30 Vdc is applied to either or both chassis subassembly connectors, POWER IN 1 (J14) and POWER IN 2 (J15) and goes through fuses F1 and F2 to switch S17. Fuses F1 and F2 provide circuit overload protection of the dc source. When S17 is closed, the +22 to +30 Vdc is routed to doubler pack U1 and, via diodes CR15 and CR16, to connector P1-1 in battery charger/logic module A14. Diodes CR15 and CR16 act as an OR gate, providing isolation between the two input voltage sources and between the output from the switch and the input to A14. From A14P1, the +22 to +30 Vdc is routed through A14 circuit components R21, CR7, CR8, R24, and R23 to EXT PWR LED DS4. The A14 circuit components control and maintain the necessary voltage level for DS4 illumination. The +22 to +30 Vdc from U1 is routed to battery power supply module A17, power supply module A6, high voltage power supply VAC-ION module A2, and ALARM/DC OUT connector J13-E. Chassis subassembly components capacitors C1 and C2, resistor R8, and diode CR12, regulate and control the battery charger output voltage to A17.

3-118. A +22 to +30 Vdc supply can be applied to module A2 via ALARM/DC OUT connector J13-E for externally energizing the vac-ion pump. Diodes CR13 and CR14 act as an OR gate, providing isolation between the external input from J13-E and the internal input from U1.

3-119. The battery power supply module A17 serves as a redundant source for dc power in the event that an external power loss is detected. If this occurs, +22 to +30 Vdc battery voltage is routed from battery power supply module A17 to chassis subassembly component, doubler pack U2, via battery charger logic module A14. From U2, the required voltages are distributed to A17, A6, A2, and J13-E.

3-120. INTEGRATED CIRCUIT AND HYBRIDS.

3-121. The following subparagraphs contain information on hybrid and standard integrated circuits used in the PRTC. Hybrid integrated circuits are used in preamplifier A1A2, modulator/multiplier module A5, and synthesizer module A7.

3-122. Preamplifier A1A2. The preamplifier uses one hybrid circuit A1A2Z1 (shown in figure 3-8). Overall the preamplifier is an 83+ Hz center frequency bandpass amplifier with circuitry to reject 166+ Hz.

3-123. The first preamplifier is broadband and generates signals for the local test point (terminal A1A2Z1-38), the remote test point (terminal A1A2Z1-5), the 166+ Hz notch filter and the second harmonic detector. The output of the second harmonic detector is routed to terminal A1A2Z1-9 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 A1A2Z1-18.

3-124. MODULATOR/MULTIPLIER MODULE A5. This assembly uses a total of four hybrid circuits.

3-125. HYBRID A5A1Z1. This hybrid (figure 3-9) 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 module A7 are applied to A5Z1 terminal A5Z1-32 and A5Z1-25, respectively. The 5 MHz signal is routed to isolation amplifier A5Z1-Q1 and A5Z1-Q2 and is then phase modulated with the 83+ Hz by A5Z1-CR1 thru CR4. The phase

modulated 5 MHz is amplified by A5Z1-Q4, doubled to 10 MHz by A5Z1-CR5 and A5Z1-CR6, and delivered to terminal A5Z1-15. Output from terminal A5Z1-15 is routed to hybrid A5Z2.

3-126. Hybrid A1A5Z2. This hybrid (figure 3-10) 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 A5Z2-2. This signal is amplified by A5Z2-Q1 and then frequency multiplied by a factor of 2 in A5Z2-Q2. The resulting 20 MHz signal is amplified by A5Z2-Q3 and then frequency multiplied by a factor of 5 in multiplier A5Z2-Q4. The 100 MHz output signal of times 5 multiplier A5Z2-Q4 is applied to crystal filter A5A2, via terminal A5Z2-18.

3-127. Hybrid A5A3Z3. This hybrid (figure 3-11) 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 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.

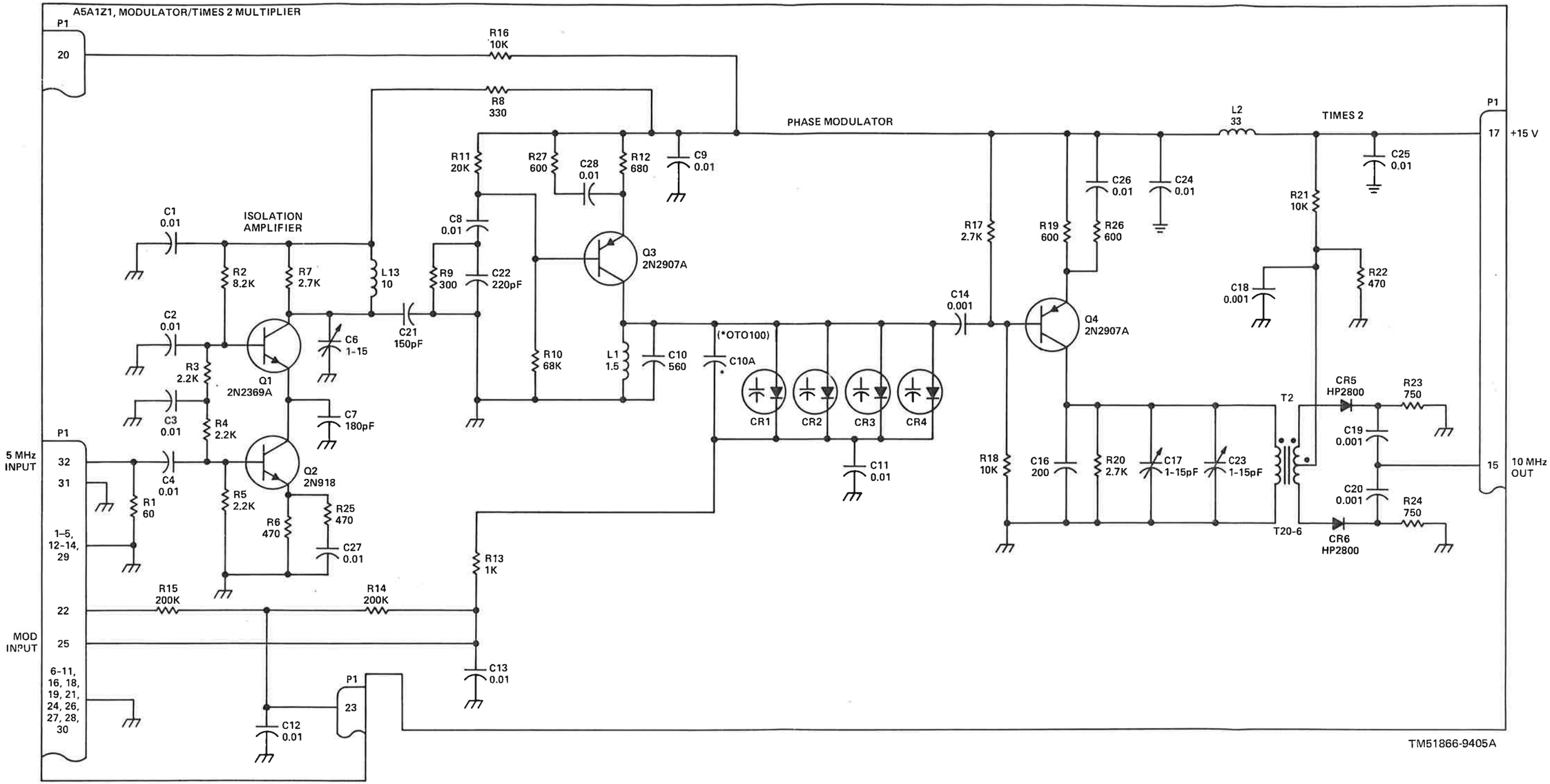
3-128. Hybrid A5A4Z4. This hybrid (figure 3-12) contains the circuitry of the 7.368+ MHz local oscillator and derives two independent and isolated 7.368+ MHz outputs. Oscillator A5Z4-Q1 is a voltage controlled crystal oscillator. An external crystal is connected between terminals A5Z4-2 and A5Z4-4. A control voltage is applied to terminal A5Z4-17 where it is filtered by resistors A5Z4-R1-R3 and capacitor A5Z4C1. The control signal at terminal A5Z4-1 is routed, via external circuitry, to terminal A5Z4-5 where it is applied to varactor diodes A5Z4CR1 and A5Z4CR2. 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.

3-129. The output of oscillator is applied to two separate output amplifiers. One amplifier A5Z4Q2, Q3 amplifies the 7.368+ MHz signal and applies the output to terminal A5Z4-11 while the other amplifier A5Z4Q4, Q5 amplifies the 7.368+ MHz signal and applies the output to terminal A5Z4-9.

3-130. SYNTHESIZER MODULE A7. The synthesizer uses one hybrid circuit, designated A7A1Z1 (figure 3-13). This is a multifunction hybrid that accepts a 5 MHz signal, and from this, does the following:

a. Generates the following signals:
   (1) 5 MHz signal for use by TOD clock PC assembly A9.
   (2) 5 MHz signal for use by generator module A10.
   (3) 83+ Hz modulation signal for use by modulator/multiplier module A5.
   (4) 83+ Hz reference signal for use by phase detector (of frequency lock loop) in synthesizer module A7.

b. Accepts the following signals:
   (1) The detected 166+ Hz error signal generated by Cesium beam resonator module A1.
   (2) The error signal generated when phase lock of the 7.368+ MHz oscillator has not occurred.



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NOTES:

1. REFER TO FIGURE 5-3 FOR INTERCONNECTION DETAILS.
2. UNLESS OTHERWISE SPECIFIED: RESISTORS ARE IN OHMS, CAPACITORS ARE IN μF, AND INDUCTORS ARE IN μH.

Figure 3-9. Hybrid Modulator/X2 Multiplier A5A1Z1, Schematic Diagram

(3) The dc voltage generated by the coarse phase detection accomplished by phase detector A7U1 – 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.

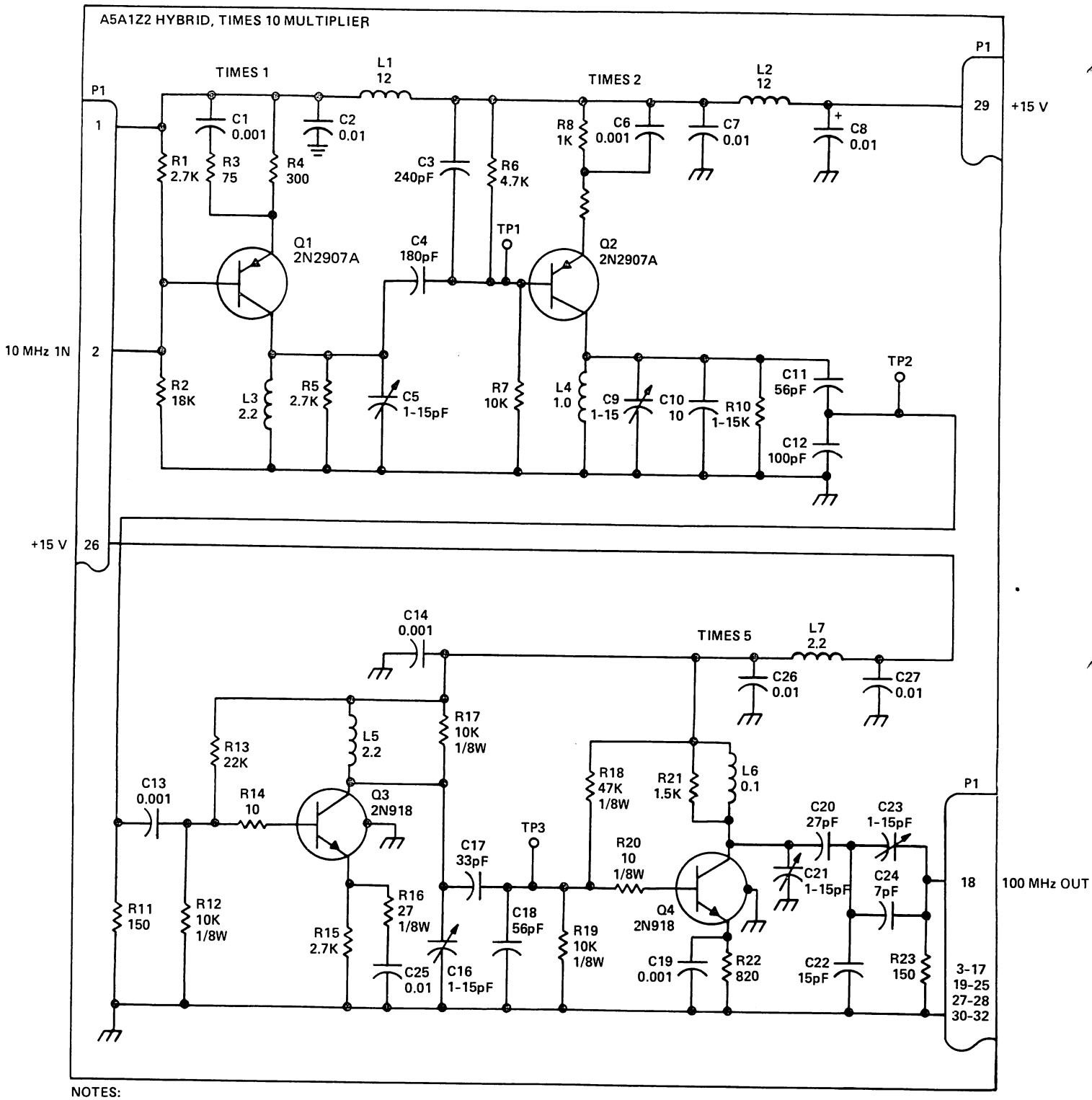
d. Provides the reference signal required by the phase detector (that phase locks the 7.368+ MHz local oscillator).

3-131. A 5 MHz signal is applied via terminal A7Z1-37 to isolation amplifier A7Z1Q1, A7Z1Q2. After amplification and shaping by A7Z1U4 (1, 2) the 5 MHz signal is applied to counter A7Z1U5, U6, U7 and inverter A7Z1U4 (3, 4). The 5 MHz signal from A7Z1U4-4 is applied to inverter A7Z1U4-5 to generate complementary 5 MHz outputs for the generator module A10 and TOD clock PC assembly A9. Output from binary counters A7Z1U5, U6, U7 generates a signal, via A7Z1U8, A7Z1U9 and terminal A7Z1-21, which is used as a reference signal in the sample and hold phase detector A7Q2 and A7Q3 (figure 5-5).

3-132. Operation of counter A7Z1U5, U6, U7 (figure 3-13) is such that the input signal (5 MHz) is divided by 1366. In addition to being used as a reference by the phase detector, this 3660+ Hz signal is divided by 2 by A7Z1U11 and then divided by 11 by A7Z1U12. Output from A7Z1U12-15 is used to drive two divide-by-two stages; (1) A7Z1U14-5 providing 83+ Hz output at terminal A7Z1-7 (modulation signal for A5) and (2) A7Z1U14-8, 9 providing 83+ Hz output at terminals A7Z1-9, 8 (reference for phase detector A7U1 (figure 5-5).

3-133. Timer A7Z1U10, functioning as a monostable multivibrator, generates a logic low at terminal A7Z1-16 when the 7.368+ MHz local oscillator (in modulator/multiplier module A5) is not phase locked. Under normal operation A7Z1U10 is periodically set by the 3660+ Hz signal used as a reference by the phase detector, and, when set, A7Z1U10-5 is at a logic high. An ac signal appearing at terminal A7Z1-15, the result of the 7.368+ MHz local oscillator not being phase locked, will reset A7Z1U10, causing A7Z1U10-5 to go to a logic low.

3-134. Comparator A7Z1U1 monitors, via terminal A7Z1-1, the level of 166+ Hz signal developed by Cesium beam resonator assembly A1 while comparators A7Z1U2 and A7Z1U3 monitor, via terminal A7Z1-2, the level of the dc voltage generated by the gross phase detection of phase detector A7U1 (figure 5-5). Outputs from all three comparators (figure 3-13) are combined at terminal A7Z1-38. Normal operation will result in a logic high appearing at terminal A7Z1-38; should either input voltage level fall outside its prescribed level a logic low will appear at terminal A7Z1-38. Both terminals A7Z1-16 and A7Z1-38 are used by logic in synthesizer module A7 to operate the front panel SYSTEM LOCK OPR and SYSTEM LOCK ALARM indicators.



NOTES:

1. REFER TO FIGURE 5-3 FOR INTERCONNECTION DETAILS.
2. UNLESS OTHERWISE SPECIFIED: RESISTORS ARE IN OHMS, CAPACITORS ARE IN μF, AND INDUCTORS ARE IN μH.

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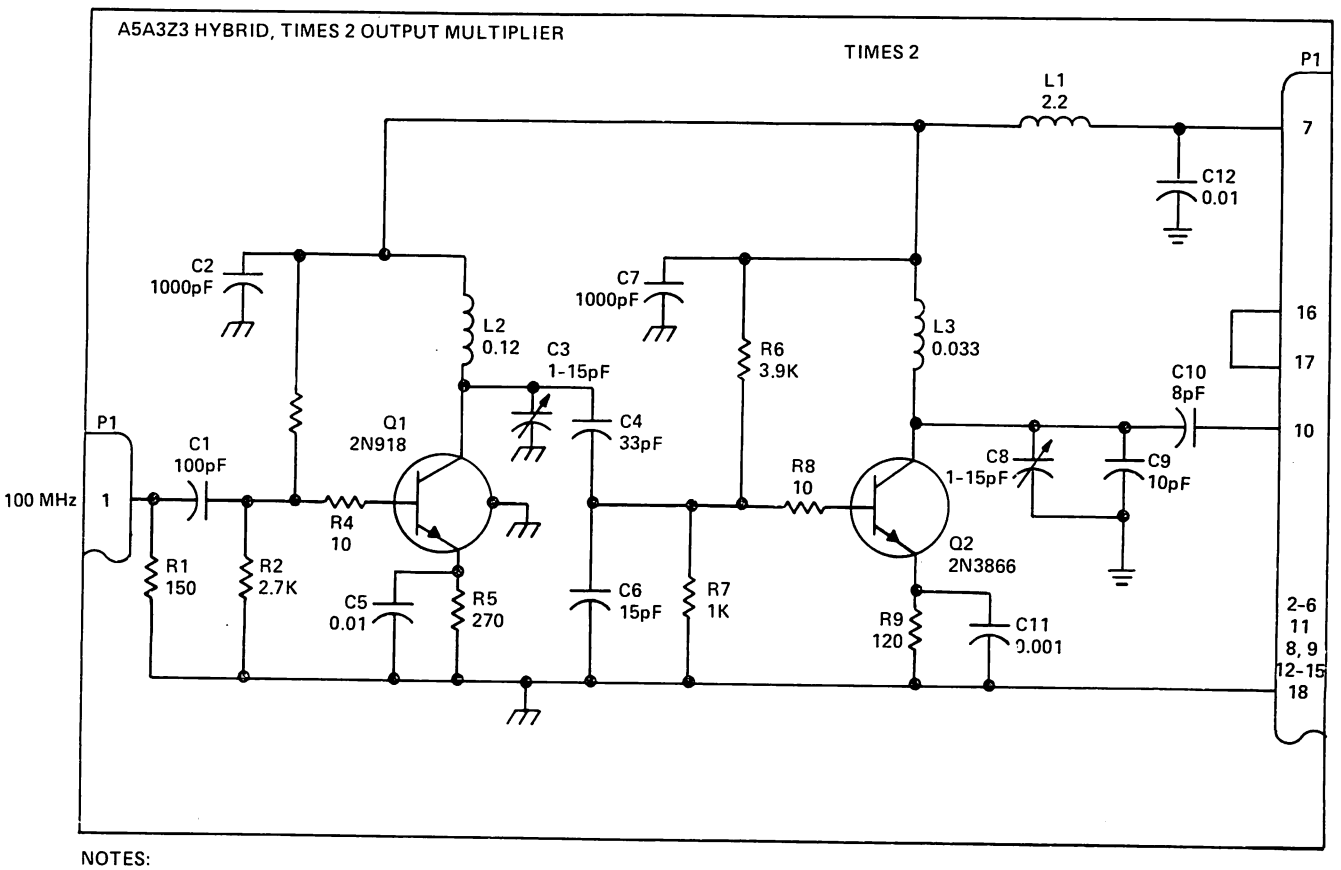
Figure 3-10. Hybrid X10 Multiplier A5A1Z2, Schematic Diagram



NOTES:

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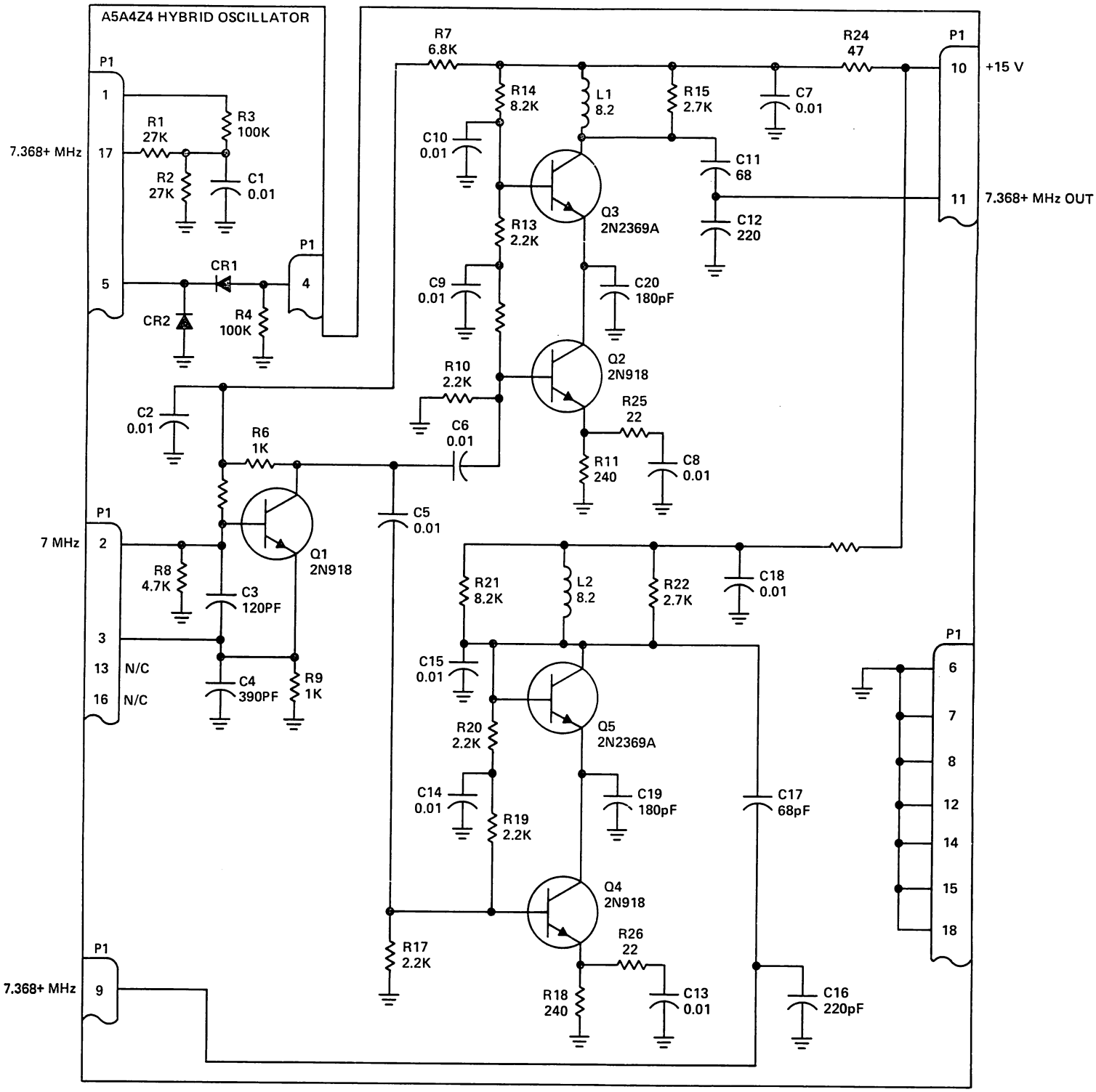
1. REFER TO FIGURE 5-3 FOR INTERCONNECTION DETAILS.
2. UNLESS OTHERWISE SPECIFIED: RESISTORS ARE IN OHMS, CAPACITORS ARE IN μF, AND INDUCTORS ARE IN μH.

Figure 3-11. Hybrid X2 Multiplier A5A3Z3, Schematic Diagram



NOTES:

1. REFER TO FIGURE 5-3 FOR INTERCONNECTION DETAILS.
2. UNLESS OTHERWISE SPECIFIED: RESISTORS ARE IN OHMS, CAPACITORS ARE IN μF, AND INDUCTORS ARE IN μH.

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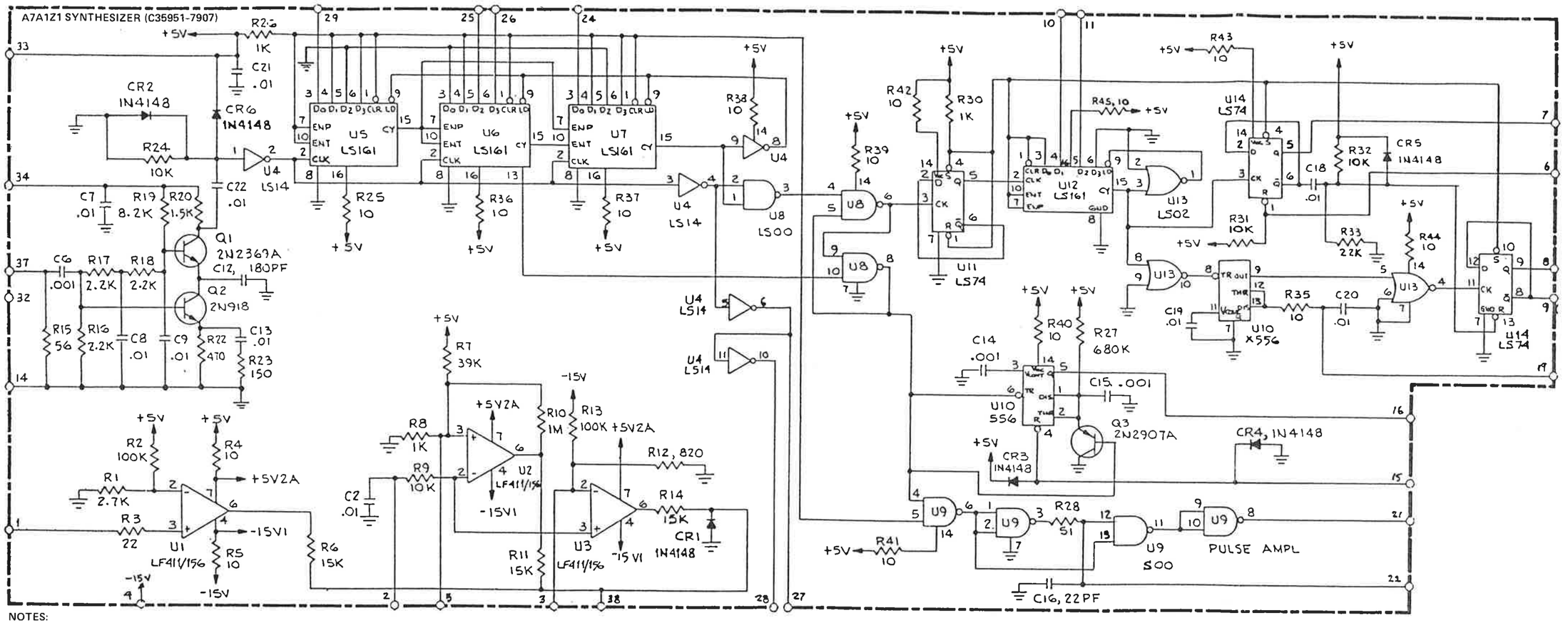
Figure 3-12. Hybrid Oscillator 7.368+ MHz A5A4Z4, Schematic Diagram



NOTES:

1. REFER TO FIGURE 5-5 FOR INTERCONNECTION DETAILS.
2. UNLESS OTHERWISE SPECIFIED: RESISTORS ARE IN OHMS, CAPACITORS ARE IN μF, AND INDUCTORS ARE IN μH.

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Figure 3-13. Hybrid Synthesizer A7A1Z1, Schematic Diagram

CHAPTER 4

SCHEDULED MAINTENANCE

4-1. INTRODUCTION.

4-2. This chapter contains the scheduled maintenance instructions consisting of the scheduled maintenance action index, preventive maintenance procedures, scheduled operational checks, and a scheduled performance test.

4-3. SCHEDULED MAINTENANCE ACTION INDEX.

4-4. Table 4-1 is the scheduled maintenance action index which lists the scheduled maintenance task and the frequency of task performance.

TABLE 4-1. SCHEDULED MAINTENANCE ACTION INDEX

PERIODICITY	MAINTENANCE TASK	REFERENCE
W	Visual Inspection	Para. 4-7
W	Cleaning	Para. 4-8
D	Scheduled Operational Check	Para. 4-11
M	Scheduled Operational Check	Para. 4-12
S	Scheduled Performance Test	Para. 4-13
W = Weekly	M = Monthly	
D = Daily	S = Semi-annually	

4-5. PREVENTIVE MAINTENANCE PROCEDURES.

4-6. The preventive maintenance procedures consist of the visual inspection and cleaning procedures.

4-7. VISUAL INSPECTION. Visually inspect the PRTC as follows:

a. Inspect all threaded parts for broken, stripped, or otherwise damaged threads.

b. Inspect all connectors for cleanliness, rust, corrosion, and broken, damaged or missing pins.

c. Check all controls and switches for proper mechanical operation.

d. Inspect all LED's for broken, cracked, missing, or damaged lenses.

e. Inspect chassis mounted components for damage and secure mounting.

4-8. CLEANING. Clean the PRTC as follows:

WARNING

Dry-cleaning solvent, P-D-680, Type II, is toxic. Protection: Chemical goggles, gloves, and forced ventilation or respirator. Keep solvent off skin, eyes, and clothes.

WARNING

Cleaning with compressed air can create airborne particles that may enter eyes. Pressure shall not exceed 30 psig. Wear goggles. Do not direct compressed air against skin.

a. Clean exterior surfaces of the PRTC chassis and internal modules with a clean, lint-free cloth dampened with dry-cleaning solvent, P-D-680, Type II. Use soft-bristled brush to remove any stubborn foreign matter. Dry all surfaces thoroughly with a clean, lint-free cloth or blow dry with low pressure, clean, dry compressed air.

b. If necessary, clean interior of chassis assembly and modules with low pressure, clean, dry compressed air and a hand-held vacuum cleaner with a small non-metallic nozzle attachment. Exercise care not to damage components during cleaning.

4-9. SCHEDULED OPERATION CHECKS.

4-10. Scheduled operation checks consist of daily and monthly checks on the PRTC which shall be performed as follows:

4-11. DAILY CHECK. Check the PRTC daily as follows:

a. For normal indication, observe that SYSTEM LOCK OPR indicator lamp (7, figure 2-1) and POWER SOURCE IN USE EXT indicator lamp (18) are on, and SYSTEM LOCK ALARM indicator lamp (10) is off.

b. If SYSTEM LOCK OPR indicator lamp (7) is on, SYSTEM LOCK ALARM indicator lamp (10) is off, and POWER SOURCE IN USE EXT indicator lamp (18) is off, check that external power source is on and cables are properly secured to POWER IN 1 J14 and POWER IN 2 J15 connectors (5 and 6, figure 2-4). If condition still exists, refer to chapter 5, troubleshooting.

c. If external power is applied and SYSTEM LOCK OPR indicator (7, figure 2-1), SYSTEM LOCK ALARM indicator (10) and POWER SOURCE IN USE EXT indicator (18) lamps are off, check that S17 ON/OFF switch (2, figure 2-2) is in the ON position. If condition still exists, refer to chapter 5, troubleshooting.

d. If both SYSTEM LOCK OPR indicator (7, figure 2-1) and SYSTEM LOCK ALARM indicator (10) are lit, indicating a system-lock failure since the last check, depress SYSTEM LOCK RESET switch (8). Observe that SYSTEM LOCK ALARM indicator (10) goes off. If indicator remains on, refer to chapter 5, troubleshooting.

e. If SYSTEM LOCK OPR indicator (7) is off and SYSTEM LOCK ALARM indicator (10) is on, check that MOD OFF/OPR switch (6) is set to OPR, LOOP OPEN/OPER switch (9) is set to OPER, and depress SYSTEM LOCK RESET switch (8). Observe that SYSTEM LOCK OPR indicator (7) goes on and SYSTEM LOCK ALARM indicator (10) goes off. If SYSTEM LOCK ALARM indicator (10) stays on, refer to chapter 5, troubleshooting.

4-12. MONTHLY CHECK. Check the PRTC monthly as follows:

a. Set CIRCUIT CHECK push-button switch (13, figure 2-1) successively to the positions listed in table 4-2. Observe that CIRCUIT CHECK meter (14) indications are as listed in table 4-2. If any readings are out of range, refer to chapter 5, troubleshooting.

b. Observe that TIME DISPLAY (28) readout indicates correct time, and that SECONDS and MINUTES readouts are being incremented. If TIME DISPLAY (28) readout does not indicate the correct time, set correct time as described in paragraph 2-7. If TIME DISPLAY (28) SECONDS and MINUTES readouts are not incrementing, check that CLOCK OPR/TIME HOLD switch (2) is set to CLOCK OPR, refer to chapter 5, troubleshooting.

TABLE 4-2. MONTHLY CHECK

CIRCUIT CHECK SWITCH		CIRCUIT CHECK METER INDICATION RANGE
POS	FUNCTION	
0	System +18 Vdc	+40 to +80
1	System -18 Vdc	+40 to +80
2	System +5 Vdc	+40 to +80
3	Battery Voltage	+40 to +80
4	Battery Current	CHG: 0 to +80 DISCH: -40 to -80
5	Cesium Beam Resonator Oven Temp.	+40 to +80
6	5 MHz Oscillator Oven Temp.	+40 to +80
7	Vac-Ion Current	0 to -20
8	Cesium Ion Current	Set to 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

4-13. SCHEDULED PERFORMANCE TEST.

4-14. The scheduled performance test consists of detailed test procedures used for evaluating PRTC performance. These procedures should be performed in their entirety in the sequence listed below. If during the test, an incorrect indication is observed, refer to the troubleshooting section in Chapter 5. Table 4-3 lists the required test equipment for test performance.

a. Perform the daily PRTC check as specified in paragraph 4-11.

TABLE 4-3. TEST EQUIPMENT REQUIRED

TYPE	MANUFACTURE AND MODEL NUMBER	EQUIPMENT PARAMETERS
Oscilloscope	Tektronix 475	Frequency range: 50 Hz to 7.4 MHz Amplitude range: 20 mV to 12 V Rise Times: 20 nanoseconds
RF Voltmeter	Boonton 92B-S5	Frequency range: 100 kHz to 100 MHz Amplitude range: 50 V p-p ±0.1V Power: -4 to +16 dBm
Counter	Hewlett-Packard 5328A	Frequency range: 100 kHz to 200 MHz
Spectrum Analyzer	Tektronix 492-02	Frequency range: 9.2 GHz ±1 Hz Power level range: -5.0 to +1.0 dBm
Digital Voltmeter	Fluke 8600A-01	Voltage range: -18 Vdc to +45 Vdc Resistance range: 0 to 8 kohms
RF Cable	M17/028-RG058	Flexible coaxial (15 feet)
Connector, TEE, BNC Termination	Type UG-274A/u	5o Ω, feedthru

b. Perform the monthly PRTC check as specified in paragraph 4-12.

c. Set oscilloscope to internal sync.

d. Connect two BNC-TEE connectors, 50-ohm termination, oscilloscope channel A input and counter as shown in figure 4-1A to rear panel 5 MHz connector J1 (1, figure 2-4). Observe that oscilloscope displays waveform as shown in figure 4-2A and counter indicates 5.000000 MHz ± 1 Hz.

e. Disconnect test equipment from rear panel 5 MHz connector J1 (1, figure 2-4).

f. Repeat steps d. and e. at rear panel for 5 MHz connectors J2, J3, and J4.

g. Repeat step d. at front panel for 5 MHz OUTPUT connector J25 (4, figure 2-3).

h. Disconnect test equipment from 5 MHz OUTPUT connector J25 (4).

i. Connect test equipment as shown in figure 4-1A to rear panel 1 MHz connector J5 (2, figure 2-4). Observe that oscilloscope displays waveform as shown in figure 4-2B and counter indicates 1.000000 MHz ±1 Hz.

j. Disconnect test equipment from rear panel 1 MHz connector J5 (2, figure 2-4).

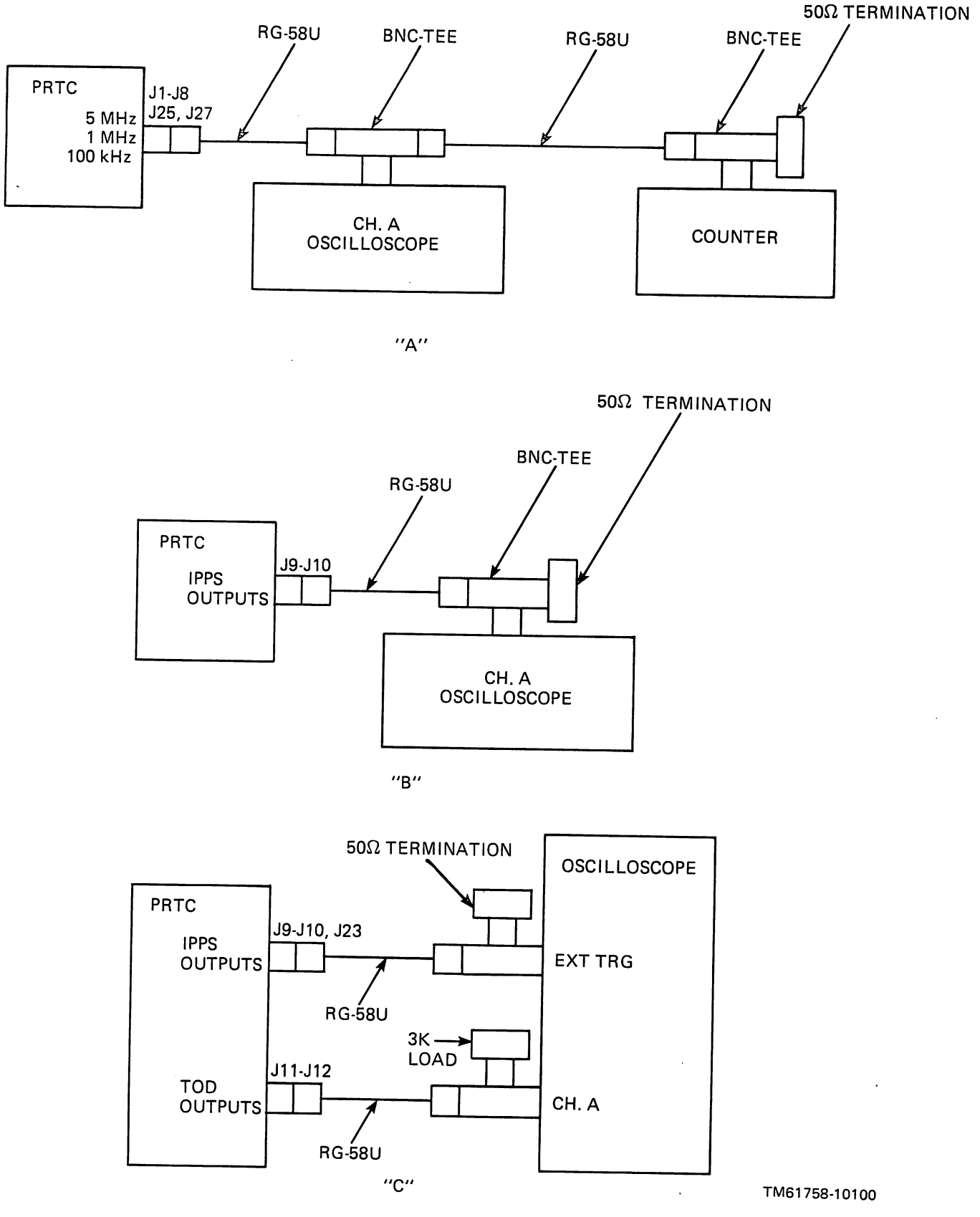
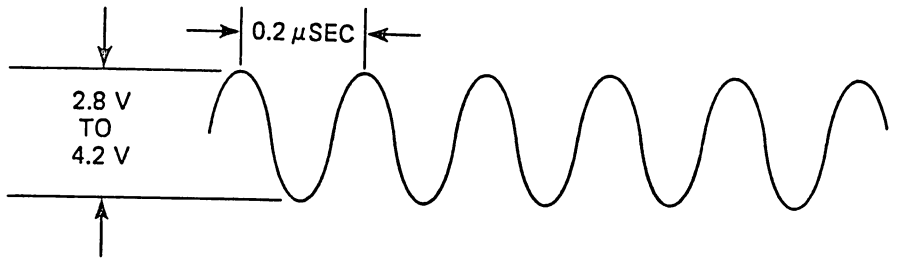
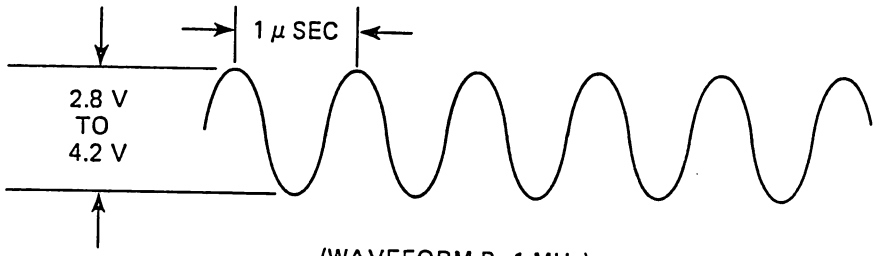


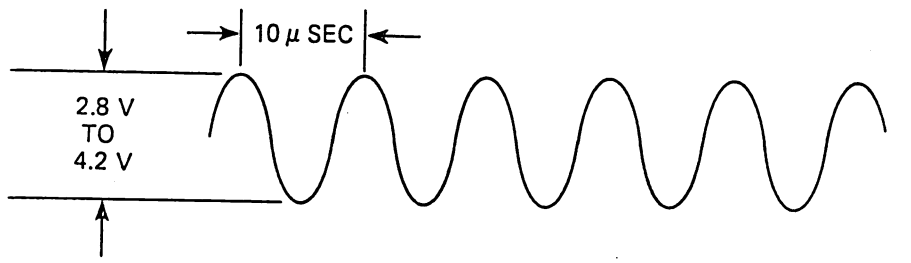
Figure 4-1. PRTC Typical Test Configurations



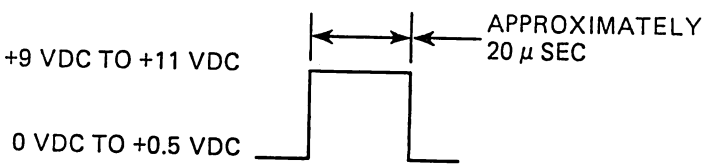
(WAVEFORM A- 5 MHz)



(WAVEFORM B- 1 MHz)



(WAVEFORM C- 100 kHz)



RISETIME LESS THAN 50 n SEC
FALL TIME LESS THAN 1 μ SEC

(WAVEFORM D- IPPS)

TM61759-10100

Figure 4-2. Performance Test Waveforms

k. Repeat step i. at front panel for MHz OUTPUT connector J26 (3, figure 2-3).

l. Disconnect test equipment from 1 MHz OUTPUT connector J26 (3).

m. Connect test equipment as shown in figure 4-1A to rear panel 100 kHz connector J7 (3, figure 2-4). Observe that oscilloscope displays waveform as shown in figure 4-2C and counter indicates 100.000 kHz ±1 Hz.

n. Disconnect test equipment from rear panel 100 kHz connector J7 (3, figure 2-4).

o. Repeat steps m. and n. for 100 kHz rear panel connector J8 (3).

p. Connect one BNC-TEE connector, 50-ohm termination, and oscilloscope as shown in figure 4-1B to rear panel 1 PPS connector J9 (8, figure 2-4). Observe that oscilloscope displays waveform as shown in figure 4-2D.

q. Disconnect test equipment from rear panel 1 PPS connector J9 (8, figure 2-4).

r. Repeat step p. at rear panel for 1 PPS connector J10 (8).

s. Disconnect test equipment from rear panel 1 PPS connector J10 (8).

t. Repeat step p. for front panel 1 PPS connector J23 (6, figure 2-3).

u. Disconnect test equipment from front panel 1 PPS connector J23 (6).

v. Check time of day (TOD) outputs as follows:

(1) Set oscilloscope to external sync and time/division to 50 msec.

(2) Connect BNC-TEE connector, 50-ohm termination, and oscilloscope external trigger input as shown in figure 4-1C to rear panel 1 PPS connector J9 or J10 (8, figure 2-4).

(3) Connect BNC-TEE connector, 3K-ohm termination and oscilloscope channel A input as shown in figure 4-1C to rear panel TOD connector J11 (7, figure 2-4). Observe that oscilloscope displays groups of one or more pulses occurring at 0.5 second intervals, the positive peak amplitude is between +5 Vdc and +7 Vdc, and the negative peak amplitude is between -5 Vdc and -7 Vdc.

(4) Repeat step (3) at rear panel TOD connector J12 (7).

(5) Disconnect test equipment from PRTC.

w. Check alarm and dc outputs as follows:

(1) Set digital voltmeter (DVM) to measure dc volts.

(2) Connect DVM negative lead to ALARM/DC OUT connector J13 pin F (4, figure 2-4). Connect DVM positive lead to pin E of connector J13. Observe that DVM indicates level of external power source being used or level of internal PRTC batteries, as applicable.

(3) Disconnect DVM leads from rear panel ALARM/OUT connector J13 (4).

(4) Connect DVM negative lead to pin C of ALARM/DC OUT connector J13 (4) and positive lead to pin B. Observe that DVM indicates between +2.4 Vdc and +5.2 Vdc.

(5) Set front panel LOOP OPEN/OPER switch (9, figure 2-1) to OPEN. Observe that front panel SYSTEM LOCK ALARM indicator (10) lights and DVM indicates between 0.0 Vdc and +0.5 Vdc.

(6) Set front panel LOOP OPEN/OPER switch (9) to OPER and depress SYSTEM LOCK RESET pushbutton switch (8). Observe that SYSTEM LOCK ALARM indicator (10) goes out and DVM indicates between +2.4 Vdc and +5.2 Vdc.

(7) Disconnect DVM from ALARM/DC OUT connector J13 (4, figure 2-4).

CHAPTER 5

TROUBLESHOOTING

5-1. INTRODUCTION.

5-2. This chapter contains troubleshooting procedures, and reference diagrams applicable to the PRTC.

5-3. FAULT ISOLATION.

5-4. PRTC troubleshooting is limited to fault isolation to a defective module or chassis mounted component. Table 5-1 contains bench type troubleshooting procedures used to facilitate PRTC fault isolation. Figure 5-1, used in conjunction with this procedure, shows the adjustment location for module A3. All procedures are based on indications observed during the daily and monthly tests, and during the performance test. If a fault is still present after performing the indicated repair action referenced in the troubleshooting table, inspect the PRTC chassis subassembly wiring. If the fault is still present, return the PRTC to the manufacturer.

5-5. TROUBLESHOOTING AIDS.

5-6. Troubleshooting aids consist of PRTC wiring data and applicable schematic diagrams. The wiring data is comprised of a point-to-point wire run list (table 5-2) and an associated wire run diagram (figure 5-2). The wire run diagram shows wiring locations for selected chassis mounted components. The wiring data and schematic diagrams (figures 5-3 through 5-10) are provided for reference purposes only to facilitate troubleshooting.

5-7. Table 5-2 is arranged in six columns. The electrical terminations are listed in the first column (FROM) in alphanumeric order by reference designation. Destinations of wires from the terminations are listed in the second column (TO). Wire size and color are listed in the third (AWG) and fourth (COLOR) columns respectively. The entries in the color column are abbreviated as follows:

ABBREVIATION	COLOR
BLK	Black
BLU	Blue
BRN	Brown
GRN	Green
GRY	Grey
ORN	Orange
RED	Red
VIO	Violate
WHT	White
YEL	Yellow
WHT/BLK	White/Black
WHT/BLUE	White/Blue
WHT/BRN	White/Brown
WHT/GRN	White/Green
WHT/GRY	White/Grey
WHT/ORG	White/Orange
WHT/RED	White/Red
WHT/YEL	White/Yellow

Column five (FUNCTION) lists the function associated with the corresponding wire. Column six (REMARKS) contains additional pertinent information. Typical entries in this column are as follows:

ENTRY	EXPLANATION
(SH1), (SH2), (SH3)	Identifies sheet 1, 2, or 3 of figure 5-2 on which wire location is shown.
A	Applicable to Model FE-5450A only
B	Applicable to Model FE-5450A/J only
C	Applicable to Model FE-5450A/J-ESM only

TABLE 5-1. TROUBLESHOOTING

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
1	Observe that POWER SOURCE IN USE EXT indicator (18, figure 2-1) is lit.	Proceed to step 2.	Check that external power sources are connected and/or that internal batteries are installed and that ON/OFF switch S17 (2, figure 2-2) is set to ON. Check fuses F1(4), F2(3), and F3(1), ON/OFF switch S17(2), diodes in U1 and U2, capacitors C1 and C2, and indicator DS4 (18, figure 2-1). If all components are good, replace battery charger/logic module A14.
2	Observe that SYSTEM LOCK OPR indicator (7) is lit and ALARM indicator (10) is not lit.	Proceed to step 15.	Proceed to step 2a.
	a. If both SYSTEM LOCK OPR and ALARM indicators (7 and 10) are lit, depress SYSTEM LOCK RESET pushbutton switch (8). Observe that SYSTEM LOCK ALARM indicator (10) goes out.	Proceed to step 15.	Proceed to step 2b.
	b. If SYSTEM LOCK OPR indicator (7) is not lit, check that MOD switch (6) is set to OPR, LOOP switch (9) is set to OPER, and then depress SYSTEM LOCK RESET	Proceed to step 15.	Proceed to step 3.

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
2	pushbutton switch (8). Observe that SYSTEM LOCK OPR indicator (7) is lit and ALARM indicator (10) is not lit.		
3	NOTE For steps 3 through 14 and 26, if all CIRCUIT CHECK meter (14) indications are incorrect, replace meter drive amplifier assembly A25. If replacing suspected defective module, or chassis mounted component does not return PRTC to operation proceed to step 27.		
	Set CIRCUIT CHECK pushbutton switch (13) to 0. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 4.	Proceed to step 27.
4	Set CIRCUIT CHECK pushbutton switch (13) to 1. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 5.	Proceed to step 27.
5	Set CIRCUIT CHECK pushbutton switch (13) to 2. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 6.	Proceed to step 27.
6	Set CIRCUIT CHECK pushbutton switch (13) to 3. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 7.	Replace battery pack.

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
7	Set CIRCUIT CHECK pushbutton switch (13) to 4. Observe that CIRCUIT CHECK meter (14) indicates between 0 and +80 if PRTC is being powered by external power or between -40 and -80 when PRTC is being powered by internal batteries.	Proceed to step 8.	If CIRCUIT CHECK meter does not indicate between 0 and +80 when PRTC is being powered by external power, replace battery charger/logic module A14 and/or chassis mounted component(s) F3, CR12, and R8. If CIRCUIT CHECK meter does not indicate between -40 and -80 when PRTC is being powered by internal batteries, allow batteries to recharge or replace battery power supply module A17.
8	Set CIRCUIT CHECK pushbutton switch (13) to 5. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 9.	Replace Cesium beam resonator assembly A1.
9	Set CIRCUIT CHECK pushbutton switch (13) to 6. Ensure that PRTC has been turned on for at least 20 minutes. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 10.	Replace 5 MHz OCVCXO module A4.
10	Set CIRCUIT CHECK pushbutton switch (13) to 7. Ensure that PRTC has been turned on for at least 20 minutes. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 11.	Replace VAC-ION high voltage power supply module A2.

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
11	Set CIRCUIT CHECK pushbutton switch (13) to 8 and proceed as follows:		
	a. Set MOD switch (6) to OFF.		
	b. Adjust DC OFFSET (POS 8) potentiometer (15) for a CIRCUIT CHECK meter (14) indication of 0.	Proceed to step 11c.	Replace DC OFFSET (POS 8) potentiometer R2.
	c. Adjust OSCILLATOR. ADJUST potentiometer (19) for peak CIRCUIT CHECK meter (14) indication.	Proceed to step 11d.	Replace 5 MHz OCVCXO module A4 and/or OSCILLATOR ADJUST potentiometer R1.
	d. Repeat steps 11b and 11c until no further adjustment is required.	Proceed to step 12.	——
12	a. Set MOD OFF/OPR switch (6) to OPR.		
	b. Set CIRCUIT CHECK pushbutton switch (13) to 9. Observe that CIRCUIT CHECK meter (14) indicates between -40 and +40.	Proceed to step 13.	Replace synthesizer module A7.
13	Set CIRCUIT CHECK pushbutton switch (13) to 10. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 14.	Replace 5 MHz OCVCXO module A4 or buffer amplifier module A8.
14	Set CIRCUIT CHECK pushbutton switch (13) to 11. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 15.	Proceed to step 26.

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
15	Set oscilloscope to internal sync. Using two BNC-TEE connectors, connect 50-ohm termination oscilloscope channel A input, and counter input to rear panel 5 MHz connector J1 (1, figure 2-4). Observe that oscilloscope displays waveform as shown in figure 4-2A and counter indicates 5.000000 MHz ± 1 Hz. Disconnect 50-ohm termination, oscilloscope, and counter from rear panel 5 MHz connector J1 (1, figure 2-4).	Proceed to step 16.	Proceed to step 16.
16	Repeat step 15 at rear panel 5 MHz connectors J2, J3, and J4 and at 5 MHz front panel connector J25 (4, figure 2-3).	Proceed to step 17.	If all 5 MHz outputs are incorrect replace 5 MHz OCVCXO module A4 or buffer amplifier module A8. If more than one but not all of the 5 MHz outputs are incorrect, replace buffer amplifier module A8.
17	Using two BNC-TEE connectors, connect 50-ohm termination, oscilloscope channel A input, and counter input to rear panel 1 MHz connector J5 (2, figure 2-4). Observe that oscilloscope displays waveform as shown in figure 4-2B counter indicates 1.000000 MHz ± 1 Hz. Disconnect 50-ohm termination, oscilloscope, and counter from rear panel 1 MHz connector J5 (2, figure 2-4).	Proceed to step 18.	Proceed to step 18.

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
18	Repeat step 17 at front panel 1 MHz connector J26 (3, figure 2-3).	Proceed to step 19.	If both 1 MHz outputs are incorrect, replace generator module A10, synthesizer module A7, or 5 MHz OCVCXO module A4. If only one 1 MHz output is incorrect, replace generator module A10.
19	Using two BNC-TEE connectors, connect 50-ohm termination, oscilloscope channel A input, and counter input to rear panel 100 kHz connector J7 (3, figure 2-4). Observe that oscilloscope displays waveform as shown in figure 4-2C and counter indicates 100.000 kHz ± 1 Hz.	Proceed to step 20.	Proceed to step 20.
20	Repeat step 19 at rear panel 100 kHz connector J8 (3, figure 2-4).	Proceed to step 21.	If both 100 kHz outputs are incorrect, replace generator module A10, synthesizer module A7, or 5 MHz OCVCXO oscillator module A4. If one but not both 100 kHz output are incorrect, replace generator module A10.
21	Using BNC-TEE connector, connect 50-ohm termination and oscilloscope channel A input to rear panel 1 PPS connector J9 (8, figure 2-4). Observe that oscilloscope displays waveform as shown in figure 4-2D. Disconnect 50--ohm termination and oscilloscope from rear panel 1 PPS connector J9 (8, figure 2-4).	Proceed to step 22.	Proceed to step 22.

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
22	Observe that TIME DISPLAY (28) indicates correct time and that SECONDS and MINUTES readouts are being incremented.	Proceed to step 23.	If TIME DISPLAY does not indicate correct time, set PRTC to correct time. If TIME DISPLAY readout SECONDS and MINUTES readouts are not incrementing, ensure that CLOCK OPR/TIME HOLD switch (2) is set to CLOCK OPR, position. If SECONDS and MINUTES readouts are still not incrementing, replace TOD clock PC assembly A9, synthesizer module A7, or 5 MHz OCVCXO module A4. If replacement of these modules do not provide correct indication, replace TOD display PC assembly A19.
23	Repeat step 21 at rear panel 1 PPS connector J10 (8) and at front panel 1 PPS connector J23 (6, figure 2-3).	Proceed to step 24.	If all 1 PPS outputs are incorrect replace TOD clock PC assembly A9 or synthesizer module A7. If one or more of the 1 PPS outputs are incorrect, replace TOD clock PC assembly A9.
24	Check the TOD outputs as follows: a. Set oscilloscope to external sync. b. Connect oscilloscope external trigger input to rear panel 1 PPS connector J9 or J10 (8, figure 2-4). c. Connect oscilloscope channel A input to rear panel TOD connector J11 (7). d. Set CLOCK OPR/TIME HOLD switch (2, figure 2-1) to TIME HOLD position.		

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
24	e. Observe that oscilloscope displays digital pattern that matches TIME DISPLAY readout (28) HOURS, MINUTES, and SECONDS indication, and whose positive peak amplitude is between +5 Vdc and +7 Vdc and negative peak amplitude is between -5 Vdc and -7 Vdc.	Proceed to step 24f.	Proceed to step 24.
	f. Disconnect 50-ohm termination and oscilloscope from rear panel TOD connector J11 (7, figure 2-4).		
	g. Using BNC-TEE connector, connect 50-ohm termination and oscilloscope channel A input to rear panel TOD connector J12 (7).		
	h. Repeat step 24e.	Proceed to step 24i.	Replace TOD clock PC assembly A9.
	i. Disconnect oscilloscope from PRTC.		
25	Check alarm and dc output as follows:		
	a. Set DVM to measure dc volts.		
	b. Connect DVM negative lead to ALARM/DC OUT connector J13 (4, figure 2-4) pin F and positive lead to pin E. Observe that DVM indicates level of external power source being used or level of internal batteries if PRTC is being powered by internal batteries.	Proceed to step 25c.	Replace diode CR11.

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
25	c. Disconnect DVM from PRTC.		
	d. Connect DVM negative lead to ALARM/DC OUT connector J13 (4) pin C and positive lead to pin B. Observe that DVM indicates between +2.4 Vdc and +5.2 Vdc.	Proceed to step 25e.	Replace synthesizer module A7.
	e. Set front panel LOOP OPEN/OPR switch (9, figure 2-1) to OPEN position. Observe that front panel SYSTEM LOCK ALARM indicator (10) lights and DVM indicates between 0.0 Vdc and +0.5 Vdc.	Proceed to step 25f.	Replace synthesizer module A7 or or SYSTEM LOCK ALARM indicator DS1.
	f. Set front panel LOOP OPEN/OPER switch (9) to OPER position and depress SYSTEM LOCK RESET switch (8). Observe that SYSTEM LOCK ALARM indicator (10) goes out, SYSTEM LOCK OPR indicator (7) lights, and DVM indicates between +2.4 Vdc and +5.2 Vdc.	Proceed to step 25g.	If incorrect voltages are observed, replace synthesizer module A7. If PRTC does not reset upon depression of SYSTEM LOCK RESET switch (8, figure 2-1), do steps 26 and 27.
	g. Disconnect DVM from ALARM/DC OUT connector J13 (4, figure 2-4).	This completes the PRTC troubleshooting procedure. Upon completion, do the performance test referenced in paragraph 4-13.	

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
26	If PRTC does not reset when SYSTEM LOCK RESET switch (8, figure 2-1) is depressed, proceed as follows: **NOTE** Allow PRTC to warm-up for at least 20 minutes before proceeding. a. Set MOD OFF/OPR switch (6) to OPR position and LOOP OPEN/OPER switch (9) to OPEN position.		
	b. Set CIRCUIT CHECK pushbutton switch (13) to 9. Observe that CIRCUIT CHECK meter (14) indicates between -40 and +40.	Proceed to step 26c.	Proceed to step 26h.
	c. Set CIRCUIT CHECK pushbutton switch (13) to 11. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 26h.	Proceed to step 26d.
	d. Connect DVM positive lead to A5A4E5 (7.368 MHz VCO input) and negative lead to ground. While varying OSCILLATOR ADJUST control (19) observe that DVM indication varies.	Proceed to step 26f.	Proceed to step 26e.

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
26	e. Disconnect cable from modulator/multiplier module A5 connector J4. Using patch cable with OSM adapter, connect frequency counter input to A5J5. Observe that frequency counter indicates 7.368 MHz. Disconnect frequency counter from A5J5 and reconnect cable to A5J4.	Proceed to step 26f.	Replace modulator/multiplier module A5.
	f. Set CIRCUIT CHECK pushbutton switch (13) to 5. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 26g.	Check wiring to Cesium beam resonator assembly A1. If wiring appears OK, replace assembly.
	g. Set CIRCUIT CHECK pushbutton switch (13) to 6. Observe that CIRCUIT CHECK meter (14) indicates between +40 and +80.	Proceed to step 26h.	Check wiring to 5 MHz OCVCXO module A4. If wiring appears OK, replace module.
	h. Set oscilloscope as listed below: Sync to internal Time/ division 2 μSEC Volts/ division 0.2 V.		
	i. Connect oscilloscope probe to synthesizer module test point A7TP1.		
	j. Set LOOP OPEN/ OPER switch to OPEN, turn GAIN ADJ A1A2R1 fully CCW, vary OSCILLATOR ADJUST control (19) for maximum positive peak of waveform displayed on oscilloscope as shown in figure 4-2B.	Proceed to step 26k.	Replace synthesizer module A7 or modulator/multiplier module A5.

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
26	k. Adjust Cesium beam resonator GAIN ADJ A1A2R1 for 1.0 V peak-to-peak signal.		
	l. Connect oscilloscope probe to Cesium beam resonator test point A1A2TP1. Observe that waveform as shown in figure 4-2D appears on oscilloscope.	Proceed to step 26m.	Adjust electron multiplier high voltage power supply module at A3R1 (figure 5-1) for peak-to-peak amplitude ranging between 0.4 V and 1.5 V. If adjustment cannot be made, replace module.
	m. Disconnect oscilloscope probe from Cesium beam resonator test point A1A2TP1.		
	n. Connect oscilloscope probe to synthesizer module test point A7TP1.		
	o. Adjust synthesizer module PHASE ADJ A7R17 for correctly phased waveform as shown in figure 4-2C.	Proceed to step 26p.	Replace synthesizer module A7 or modulator/multiplier module A5.
	p. Vary OSCILLATOR ADJUST control (19, figure 2-1) for a zero amplitude waveform (straight line with no breaks).		
	q. Set LOOP OPEN/ OPER switch (9) to OPER position.		
	r. Adjust Cesium beam resonator GAIN ADJ A1A2R1 for waveform as shown in figure 4-2E.		
	s. Depress SYSTEM LOCK RESET switch (8, figure 2-1) to extinguish SYSTEM LOCK ALARM indicator (10).		

TABLE 5-1. TROUBLESHOOTING (CONT'D)

STEP	PROCEDURE	CORRECT INDICATION	INCORRECT INDICATION
27	Using DVM, check voltages on the following A6P1 chassis connector pins: pin 2 – +13.5 Vdc ±1.0 Vdc pin 3 – -18.0 Vdc -0.0 +2.0 Vdc pin 6 – +18.0 Vdc -0.1 +0.6 Vdc pin 7 – +5.0 Vdc -0.2 +0.3 Vdc pin 9 – +7.6 Vdc ±0.1 Vdc pin 12 – +7.6 Vdc ±0.1 Vdc pin 13 – +5.5 Vdc -0.9 +0.7 Vdc pin 18 – +18.0 Vdc -0.1 +0.6 Vdc pin 19 – +5.0 Vdc -0.2 +0.3 Vdc		Remove power supply module A6 and check for shorts to ground at pin or pins where voltages were not present. Replace module if proper voltages are not ultimately obtained at designated pin locations.

TABLE 5-2. PRTC WIRE RUN LIST

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
A1A1-1	A2-E1	HV CABLE		+3200 VDC	
A1A1-2	A3-E10	HV CABLE		–HV (–2000 VDC)	
A2-E1	A1A1-1	HV CABLE		+3200 VDC	
A2-E2	E3	24	BLK	GROUND	
A2-E3	A2-E8	24	–	JUMPER	
A2-E4	A25-E7	24	WHT/ORN	VOLT MON TEST	
A2-E5	NO CONN	–	–	VAC ION CURR	
A2-E6	E7	24	BRN	+26.5 VDC	
A2-E7	NO CONN	–	–	–	
A2-E8	A2-E3	24	–	+26.5 VDC RTN	
A2-E8	E3	24	BLK		
A3-E1	E3	24	BLK	GROUND	
A3-E2	E3	24	BLK		
A3-E3	NO CONN	–	–	NO CONNECTION	
A3-E4	NO CONN	–	–		
A3-E5	NO CONN	–	–		
A3-E6	NO CONN	–	–		
A3-E7	NO CONN	–	–		
A3-E8	E1	24	RED	+18 VDC	
A3-E9	E3	24	BLK	+18 VDC RTN	
A3-E10	A1A1-2	HV CABLE		–HV (–2000 VDC)	
A5-FL1-1	E3	24	BLK	GROUND	
A5-FL1-2	E1	24	RED	+18 VDC	
A5-FL6-1		RG178 SHIELD		GROUND	
A5-FL6-2	XA7P1-A3	RG178 COND		7.368 MHz VCO	
A19-E1	S8-4	24	WHT/RED	TIME DISPLAY	(SH 1)
A19-E2	XA9P4-14	24	WHT/YEL		(SH 1)
A19-E3	XA9P5-14	24	WHT/YEL		(SH 1)
A19-E4	XA9P6-14	24	WHT/YEL		(SH 1)
A19-E5	XA9P4-16	24	WHT/BLU		(SH 1)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
A19-E6	XA9P4-1	24	BRN		(SH 1)
A19-E7	XA9P4-13	24	WHT/ORN		(SH 1)
A19-E8	XA9P4-4	24	WHT/BLK		(SH 1)
A19-E9	XA9P4-5	24	GRN		(SH 1)
A19-E10	XA9P4-12	24	WHT/RED		(SH 1)
A19-E11	XA9P5-16	24	WHT/BLU		(SH 1)
A19-E12	XA9P5-1	24	BRN		(SH 1)
A19-E13	XA9P5-2	24	WHT/BRN		(SH 1)
A19-E14	XA9P5-13	24	WHT/ORN		(SH 1)
A19-E15	XA9P5-4	24	WHT/BLK		(SH 1)
A19-E16	XA9P5-5	24	GRN	TIME DISPLAY	(SH 1)
A19-E17	XA9P5-12	24	WHT/RED		(SH 1)
A19-E18	XA9P6-16	24	WHT/BLU		(SH 1)
A19-E19	XA9P6-1	24	BRN		(SH 1)
A19-E20	XA9P6-2	24	WHT/BRN		(SH 1)
A19-E21	XA9P6-13	24	WHT/ORN		(SH 1)
A19-E22	XA9P6-4	24	WHT/BLK		(SH 1)
A19-E23	XA9P6-12	24	WHT/RED		(SH 1)
A19-E24	XA9P6-5	24	GRN		(SH 1)
A25-A	A25S1A-C	24	WHT/BLUE		(SH 2)
A25-B	A25S1A-0	24	GRN		(SH 2)
A25-C	A25S1A-1	24	WHT/BLK		(SH 2)
A25-D	A25S1A-2	24	WHT/GRY		(SH 2)
A25-F	A25S1A-3	24	WHT/GRN	CONNECTIONS BETWEEN METER BD AND SELECT SWITCH	(SH 2)
A25-G	A25S1A-7	24	WHT/BRN		(SH 2)
A25-H	A25S1A-8	24	WHT/VIO		(SH 2)
A25-I	A25S1A-9	24	WHT/ORN		(SH 2)
A25-J	A25S1A-10	24	WHT/BRN		(SH 2)
A25-K	A25S1A-11	24	VIO		(SH 2)
A25-L	A25S1B-$\overline{C}$	24	ORN		(SH 2)
A25-M	A25S1B-$\overline{O}$	24	WHT		(SH 2)
A25-N	A25S1B-$\overline{4}$	24	VIO		(SH 2)
A25-P	A25S1B-$\overline{8}$	24	GRY		(SH 2)
A25-R	A25S1B-$\overline{3}$	24	GRN		

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
A25-E1	E5	24	BLU	−18 VDC	(SH 2)
A25-E2	E2	24	YEL	+5 VDC	(SH 2)
A25-E3	U2-3	24	BRN	BATT VOLTAGE	(SH 2)
A25-E4	A25S1A-4	24	WHT/RED	BATT CURRENT	(SH 2)
A25-E4	XA14P1-21	24	WHT/BLK	BATT CURRENT	A (SH 2)
A25-E4	XA14P1-21	24	WHT/BLK	GROUND	B (SH 2)
A25-E5	A25S1A-5	24	WHT/BLK	CS OVEN TEMP	(SH 2)
A25-E5	XA1J1-6	24	WHT/BRN		(SH 2)
A25-E6	A25S1A-6	24	WHT/YEL	OSC OVEN TEMP	(SH 2)
A25-E6	XA4P1-3	24	WHT/RED		(SH 2)
A25-E7	A2-E4	24	WHT/ORN	VAC-ION CUR MON	(SH 2)
A25-E8	XA1P1-4	RG178 COND		CS-ION CURR	(SH 2)
A25-E9	XA7P1-6	24	WHT/VIO	CONTR SIG MON	(SH 2)
A25-E10	XA8P1-1	24	WHT/BLU	5 MHz MONITOR	(SH 2)
A25-E11	XA7P2-4	24	WHT/GRY	SYN CONT VOLT	(SH 2)
A25-E12	J28-3	24	BLK	GROUND	(SH 2)
A25-E13	R2-2	24	WHT/YEL	DC OFFSET ADJ	(SH 2)
A25-E14	R2-1	24	GRN	DC OFFSET ADJ	(SH 2)
A25-E15	M1−(+)	24	BRN	METER (+)	(SH 2)
A25-E16	E3	24	BLK	DC RETURN	(SH 2)
A25-E17	E3	24	BLK	DC RETURN	(SH 2)
A25-E18	E1	24	RED	+18 VDC	(SH 2)
A25S1A-C	A25-A	24	WHT/BLU	METER SELECT SWITCH	(SH 2)
A25S1A-0	A25-B	24	GRN		(SH 2)
A25S1A-1	A25-C	24	WHT/BLK		(SH 2)
A25S1A-2	A25-D	24	WHT/GRY		(SH 2)
A25S1A-3	A25-F	24	WHT/GRN		(SH 2)
A25S1A-4	A25-E4	24	WHT/RED		(SH 2)
A25S1A-5	A25-E5	24	WHT/BLK		(SH 2)
A25S1A-6	A25-E6	24	WHT/YEL		(SH 2)
A25S1A-7	A25-G	24	WHT/BRN		(SH 2)
A25S1A-8	A25-H	24	WHT/VIO		(SH 2)
A25S1A-9	A25-I	24	WHT/ORN		(SH 2)
A25S1A-10	A25-J	24	WHT/BRN		(SH 2)
A25S1A-11	A25-K	24	VIO		(SH 2)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
A25S1B-$\overline{C}$	A25-L	24	ORN		(SH 2)
A25S1B-$\overline{0}$	A25-M	24	WHT		(SH 2)
A25S1B-$\overline{0}$	A25S1B-$\overline{1}$	26	–		(SH 2)
A25S1B-$\overline{1}$	A25S1B-$\overline{0}$	26	–		(SH 2)
A25S1B-$\overline{1}$	A25S1B-$\overline{2}$	26	–		(SH 2)
A25S1B-$\overline{2}$	A25S1B-$\overline{7}$	26	–		(SH 2)
A25S1B-$\overline{3}$	A25-R	24	GRN		(SH 2)
A25S1B-$\overline{3}$	A25S1B-$\overline{5}$	26	–		(SH 2)
A25S1B-$\overline{4}$	A25-N	24	VIO	METER SELECT SWITCH	(SH 2)
A25S1B-$\overline{5}$	A25S1B-$\overline{3}$	26	–		(SH 2)
A25S1B-$\overline{5}$	A25S1B-$\overline{6}$	26	–		(SH 2)
A25S1B-$\overline{6}$	A25S1B-$\overline{5}$	26	–		(SH 2)
A25S1B-$\overline{7}$	A25S1B-$\overline{2}$	26	–		(SH 2)
A25S1B-$\overline{7}$	A25S1B-$\overline{9}$	26	–		(SH 2)
A25S1B-$\overline{8}$	A25-P	24	GRY		(SH 2)
A25S1B-$\overline{9}$	A25S1B-$\overline{7}$	26	–		(SH 2)
A25S1B-$\overline{9}$	A25S1B-$\overline{10}$	26	–		(SH 2)
A25S1B-$\overline{10}$	A25S1B-$\overline{9}$	26	–		(SH 2)
A25S1B-$\overline{10}$	A25S1B-$\overline{11}$	26	–		(SH 2)
A25S1B-$\overline{11}$	A25S1B-$\overline{10}$	26	–		(SH 2)
C1-(+)	E8	20	ORN		
C1-(+)	E19	20	ORN		
C1-(+)	R8-1				A
C1-(+)	U1-2	20	ORN		
C1-(+)	XA1J1-3	24	ORN		
C1-(+)	XA6P1-1	20	ORN		
C1-(+)	XA6P1-14	20	ORN	+17–35 VDC	
C1-(–)	E3	20	BLK	RETURN	
C1-(–)	J13-F	20	BLK		
C1-(–)	J14-B	20	BLK		
C1-(–)	J15-B	20	BLK		
C1-(–)	XA6P1-20	20	BLK		
C1-(–)	XA6P1-21	20	BLK		

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
C2-(+)	U1-2			+17–35 VDC	(SH 3)
C2-(–)	E11			+28 VDC RTN	(SH 3)
C3-(+)	XA9P4-9			+5 VDC	B
C3-(–)	XA9P4-14			+5 VDC RTN	B
C4-(+)	XA9P4-10			HOURS DISPLAY	B
C4-(–)	XA9P4-14			HOURS DISPLAY	B
C5-1	S14-1			LOOP SW	(SH 1)
C5-2	S14-2				(SH 1)
C6-1	S15-1			TIME CONSTANT	(SH 1)
C6-2	S15-2				(SH 1)
C7-1	K1-A3			DISPLAY RELAY	(SH 2)
C7-2	K1-A1				(SH 2)
C8-1	K1-B3				(SH 2)
C8-2	K1-B2				(SH 2)
C9-1	S8-1			TIME DISPLAY	(SH 1)
C9-2	S8-4				(SH 1)
CR11-A	E9			+17–35 VDC	(SH 3)
CR11-C	J13-E			+28 VDC	(SH 3)
CR12-A	R8-2			BATTERY CHARGER	A
CR12-C	E19				A
CR13-A	E8			+17–35 VDC	(SH 3)
CR13-C	E7			+26.5 VDC	(SH 3)
CR14-A	E6			VAC-ION IN	(SH 3)
CR14-C	E7			+26.5 VDC	(SH 3)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
CR15-A	S17-3				(SH 2)
CR15-C	S17-11				(SH 2)
				(+) DC VOLTAGE	
CR16-A	S17-6				(SH 2)
CR16-C	S17-11				(SH 2)
CR17-A	K1-X1			DISPLAY RELAY	(SH 2)
CR17-C	K1-X2				(SH 2)
DS1-A	R7-2			ALARM LED	(SH 1)
DS1-C	XA7P1-8	24	GRY		(SH 1)
DS2-A	E13	24	YEL	BAT IN USE LED	A (SH 1)
DS2-C	XA14P1-6	24	WHT/ORN		A (SH 1)
DS3-A	E12	24	WHT/YEL	OPERATE LED	(SH 1)
DS3-C	XA7P1-7	24	WHT/BLU		(SH 1)
DS4-A	XA14P1-5	24	WHT/GRN	EXT POWER LED	(SH 1)
DS4-C	DS5-C	24	BLK		(SH 1)
DS5-A	XA14P1-10	24	WHT/BLU	BAT AVAIL LED	A (SH 1)
DS5-C	DS4-C	24	BLK		A (SH 1)
DS5-C	DS6-C TERMINAL POST	24	BLK		
DS6-A TERMINAL POST	NO CONN	–	–		
DS6-C	DS5-C	24	BLK		
DS6-C	DS7-C TERMINAL POST	24	BLK	SPARE	
DS7-A	NO CONN	–	–		
DS7-C	DS6-C TERMINAL POST	24	BLK		
DS7-C TERMINAL POST	E10	24	BLK		

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
DS8-A	XA9P5-9	24	WHT	UT SET LED	(SH 1)
DS8-C	XA9P5-8	24	GRY		(SH 1)
DS9-A	XA9P5-10	24	WHT/BRN	SYNC ARM LED	(SH 1)
DS9-C	XA9P5-7	24	VIO		(SH1)
DS10-A	NO CONN	–	–	VAC-ION LED	(SH 1)
DS 10-C	S1-4	24	BLK		(SH 1)
DS 10-C	S15-2	24	BLK		(SH 1)
E1	A3-E8	24	RED	+18 VDC	
E1	A5FL1-2	24	RED		
E1	A25-E18	24	RED		
E1	XA1J1-9	24	RED		
E1	XA1P1-1	24	RED		
E1	XA4P1-1	24	RED		
E1	XA6P1-6	20	RED		
E1	XA6P1-18	20	RED		
E1	XA7P1-1	24	RED		
E1	XA8P1-6	24	RED		
E1	XA9J1-26	24	RED		
E1	XA14P1-25	24	RED		
E2	A25-E2	24	YEL	+5 VDC	
E2	E13	24	YEL		
E2	XA6P1-7	20	YEL		
E2	XA6P1-19	20	YEL		
E2	XA9J1-28	24	YEL		
E2	XA9J1-29	24	YEL		
E2	XA9J1-30	24	YEL		
E2	XA9J1-31	24	YEL		
E2	XA14P1-3	24	YEL		
E3	A2-E2	24	BLK	GROUND RETURNS	
E3	A2-E8	24	BLK		

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
E3	A3-E1	24	BLK		
E3	A3-E2	24	BLK		
E3	A3-E9	24	BLK		
E3	A5FL1-1	24	BLK		
E3	A25-E17	24	BLK		
E3	C1-(–)	20	BLK		
E3	E10	20	BLK		
E3	E11	20	BLK		
E3	J13-C	20	BLK		
E3	XA1J1-1	24	BLK		
E3	AX1J1-4	24	BLK		
E3	XA1J1-7	24	BLK		
E3	XA1J1-10	24	BLK		
E3	XA1P1-2	24	BLK		
E3	XA4P1-2	24	BLK		
E3	XA6P1-22	22	BLK	GROUND RETURNS	
E3	XA6P1-23	22	BLK		
E3	XA6P1-24	22	BLK		
E3	XA7P1-2	24	BLK		
E3	XA7P1-11	24	BLK		
E3	XA8P1-2	24	BLK		
E3	XA8P1-7	24	BLK		
E3	XA9J1-33	24	BLK		
E3	XA9J1-36	24	BLK		
E3	XA10P1-2	24	BLK		
E3	XA14P1-16	24	BLK		
E3	XA14P1-17	24	BLK		
E3	XA14P1-18	24	BLK		
E3	XA14P1-19	24	BLK		
E3	XA14P1-20	24	BLK		
E5	A25-E1	24	BLU		
E5	XA1P1-3	24	BLU	–18 VDC	
E5	XA6P1-3	20	BLU		

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
E5	XA7P1-3	24	BLU	−18 VDC	
E5	XA9J1-2	24	BLU		
E6	CR14-A			VAC-ION IN	(SH 3)
E6	J13-G	20	BRN		(SH 3)
E7	A2-E6	24	BRN	+26.5 VDC	(SH 3)
E7	CR13-C				(SH 3)
E7	CR14-C				(SH 3)
E8	C1-(+)	20	ORN	+17−35 VDC	(SH 3)
E8	CR13-A				(SH 3)
E9	CR11-A				(SH 3)
E9	U1-2	20	ORN		(SH 3)
E10	DS7-C TERMINAL POST	24	BLK	GROUND	(SH 1)
E10	E3	20	BLK		(SH 1)
E10	S14-5	24	BLK		(SH 1)
E11	C2-(−)				(SH 3)
E11	E3	20	BLK		(SH 3)
E12	DS3-A	24	WHT/YEL	TIE POINT	(SH 1)
E12	R6-2				(SH 1)
E13	DS2-A	24	YEL	+5 VDC	A (SH 1)
E13	E2	24	YEL		(SH 1)
E13	R6-1				(SH 1)
E13	R7-1				(SH 1)
E14	J14-C	20	BLK	CHASSIS GROUND	(SH 3)
E15	J15-C	20	BLK		(SH 3)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
E16	J13-D	20	BLK	CHASSIS GROUND	(SH 3)
E17	XA6P1-13	20	BRN	HOT WIRE	
E18	XA6P1-25	20	BLK	HOT WIRE RTN	
E19	C1-(+)	20	ORN	+17–35 VDC	B
E19	CR12-C			BATTERY CHARGER	A
E19	XA17P1-1	20	ORN		A
F1-TOP	J14-A	20	ORN	+28 VDC	
F1-SIDE	S17-2	20	ORN	+28 VDC FUSED	
F2-TOP	J15-A	20	ORN	+28 VDC	
F2-SIDE	S17-5	20	ORN	+28 VDC FUSED	
F3-TOP	XA17P1-2	20	RED	BATT VOLTAGE	
F3-TOP	XA17P1-3	20	RED		
F3-SIDE	S17-8	20	RED	BATT VOLT FUSED	
J1	XA8P1-A3	RG178 COAX		5 MHz	(SH 3)
J2	XA8P1-A4	RG178 COAX			(SH 3)
J3	XA8P1-A5	RG178 COAX			(SH 3)
J4	XA8P1-A6	RG178 COAX			(SH 3)
J5	XA10P1-A3	RG178 COAX		1 MHz	(SH 3)
J6	XA10P1-A4	RG178 COAX			B (SH 3)
J7	XA10P1-A1	RG178 COAX		100 MHz	A (SH 3)
J8	XA10P1-A2	RG178 COAX			A (SH 3)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
J9 CENT	XA9J1-11	RG178 COND		1 PPS	(SH 3)
J9 GND	XA9J1-8	RG178 SHIELD			(SH 3)
J10 CENT	XA9J1-3	RG178 COND			(SH 3)
J10 GND	XA9J1-37	RG178 SHIELD			(SH 3)
J11 CENT	XA9J1-15	RG178 COND		TOD	(SH 3)
J11 GND	XA9J1-34	RG178 SHIELD			(SH 3)
J12 CENT	XA9J1-7	RG178 COND			(SH 3)
J12 GND	XA9J1-35	RG178 SHIELD			(SH 3)
J13-B	XA7P1-10	24	WHT/ORN	ALARM/DC OUT	(SH 3)
J13-C	E3	20	BLK		(SH 3)
J13-D	E16	20	BLK		(SH 3)
J13-E	CR11-C				(SH 3)
J13-F	C1-(–)	20	BLK		(SH 3)
J13-G	E6	20	BRN		(SH 3)
J14-A	F1-TOP	20	ORN	POWER IN #1	(SH 3)
J14-B	C1-(–)	20	BLK		(SH 3)
J14-C	E14	20	BLK		(SH 3)
J15-A	F2-TOP	20	ORN	POWER IN #2	(SH 3)
J15-B	C1-(–)	20	BLK		(SH 3)
J15-C	E15	20	BLK		(SH 3)
J16-J22		–	–	PART OF EQUIP. CARRIER	C
		–	–		C
J23-CENT	XA9P6-6	24	VIO	1 PPS	(SH 1)
J23-GND	XA9P6-10	24	BLK		(SH 1)
J24-CENT	XA9P6-8	24	GRY	SYNC IN	(SH 1)
J24-GND	XA9P6-9	24	BLK		(SH 1)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
J25-CENT	XA8P1-A2	RG178 COND		5 MHz	A (SH 1)
J25-GND		RG178 SHIELD			A (SH 1)
J26-CENT	XA10P1-A4	RG178 COND		1 MHz	A (SH 1)
J26-GND		RG178 SHIELD			A (SH 1)
J27-CENT	XA1J1-12	RG178 COND		ZEEMAN IN	(SH 1)
J27-GND	XA1J1-13	RG178 SHIELD			(SH 1)
J28-1	M1-(–)	24	WHT/BLK	EXT METER	(SH 1)
J28-2	J28-3	24	–		(SH 1)
J28-2	R2-3	24	WHT		(SH 1)
J28-3	A25-E12	24	BLK		(SH 1)
J28-3	J28-2	24	–		(SH 1)
K1-X1	CR17-A			DISPLAY RELAY	(SH 2)
K1-X1	R3-1				(SH 2)
K1-X2	CR17-C				(SH 2)
K1-X2	R4-1				(SH 2)
K1-A1	C7-2				(SH 2)
K1-A1	R4-2				(SH 2)
K1-A1	XA9P4-10	24	WHT/BRN		(SH 2)
K1-A3	C7-1				(SH 2)
K1-A3	R3-2				(SH 2)
K1-A3	XA9P4-6	24	WHT/BLU		(SH 2)
K1-B2	C8-2				(SH 2)
K1-B2	S8-1	24	VIO		(SH 2)
K1-B3	C8-1				(SH 2)
K1-B3	S8-4	24	WHT/RED	DISPLAY RELAY	(SH 2)
M1-(+)	A25-E15	24	BRN	METER	(SH 1)
M1-(–)	J28-1	24	WHT/BLK		(SH 1)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
R1-1	XA4P1-6		SHIELD	OSC ADJUST 2-WIRE TWISTED W/SHIELD	(SH 1)
R1-2	XA4P1-5	24	BLK		(SH 1)
R1-3	XR4P1-4	24	WHT		(SH 1)
R2-1	A25-E14	24	GRN	DC OFFSET	(SH 1)
R2-2	A25-E13	24	WHT/YEL		(SH 1)
R2-3	J28-2	24	WHT		(SH 1)
R3-1	K1-X1			DISPLAY RELAY	(SH 2)
R3-2	K1-A3				(SH 2)
R4-1	K1-X2				(SH 2)
R4-2	K1-A1				(SH 2)
R6-1	E13			OPERATE LED	(SH 1)
R6-2	E12				(SH 1)
R7-1	E13			ALARM LED	(SH 1)
R7-2	DS1-A				(SH 1)
R8-1	C1-(+)			+17–35 VDC	A
R8-2	CR12-A			BATTERY CHARGER	A
S1-1	XA7P1-9	24	WHT/BLK	RESET	(SH 1)
S1-4	DS10-C	24	BLK		(SH 1)
S1-4	S14-2	24	BLK		(SH 1)
S2-1	XA9P7-4	24	ORN	TIME HOLD	(SH 1)
S2-2	S4-3	24	BLK		(SH 1)
S2-2	S12, A-$\overline{C}$	24	BLK		(SH 1)
S2-3	XA9P7-13	24	WHT/ORN		(SH 1)
S3-1	XA9P9-10	24	WHT/BLK		(SH 1)
S3-2	XA9P9-7	24	VIO		(SH 1)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
S3-3	S3-4	24	–	1PPM RESET	(SH 1)
S3-3	S11-4	24	BLK		(SH 1)
S3-4	S3-3	24	–		(SH 1)
S3-4	S10-3	24	BLK		(SH 1)
S4-1	XA9P7-9	24	WHT	SYNC ARM	(SH 1)
S4-2	XA9P7-8	24	GRY		(SH 1)
S4-3	S2-2	24	BLK		(SH 1)
S4-3	S4-4	24	–		(SH 1)
S4-3	S13-2	24	BLK		(SH 1)
S4-4	S4-3	24	–		(SH 1)
S4-4	S11-3	24	BLK		(SH 1)
S4-4	XA9P9-8	24	BLK		(SH 1)
S5-1	XA9P7-14	24	WHT/YEL	HOURS	(SH 1)
S5-2	XA9P7-3	24	ORN		(SH 1)
S5-3	S5-4	24	–		(SH 1)
S5-3	S6-4	24	BLK		(SH 1)
S5-4	S5-3	24	–		(SH 1)
S6-1	XA9P7-15	24	WHT/GRN	MINUTES	(SH 1)
S6-2	XA9P7-2	24	WHT/GRY		(SH 1)
S6-3	S6-4	24	–		(SH 1)
S6-3	S7-4	24	BLK		(SH 1)
S6-4	S5-3	24	BLK		(SH 1)
S6-4	S6-3	24	–		(SH 1)
S7-1	XA9P7-16	24	WHT/BLU	SECONDS	(SH 1)
S7-2	XA9P7-1	24	BRN		(SH 1)
S7-3	S7-4	24	–		(SH 1)
S7-3	S10-4	24	BLK		(SH 1)
S7-4	S6-3	24	BLK		(SH 1)
S7-4	S7-3	24	–		(SH 1)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
S8-1	XA9P4-7	24	VIO		(SH 1)
S8-1	XA9P4-8	24	VIO		(SH 1)
S8-1	XA9P4-9	24	VIO		(SH 1)
S8-1	C9-1			TIME DISPLAY	(SH 1)
S8-1	K1-B2	24	VIO		(SH 1)
S8-4	A19E1	24	WHT/RED		(SH 1)
S8-4	C9-2				(SH 1)
S8-4	K1-B3	24	WHT/RED		(SH 1)
S9-1	XA9P7-12	24	WHT/RED		(SH 1)
S9-2	XA9P7-5	24	GRN		(SH 1)
S9-3	S9-4	24	–	ADD	(SH 1)
S9-3	S11-4	24	BLK		(SH 1)
S9-4	S9-3	24	–		(SH 1)
S10-1	XA9P7-11	24	WHT/BRN		(SH 1)
S10-2	XA9P7-6	24	WHT/VIO		(SH 1)
S10-3	S3-4	24	BLK		(SH 1)
S10-3	S10-4	24	–	SUB	(SH 1)
S10-4	S7-3	24	BLK		(SH 1)
S10-4	S10-3	24	–		(SH 1)
S11-1	XA9P7-10	24	WHT/BLK		(SH 1)
S11-2	XA9P7-7	24	VIO		(SH 1)
S11-3	S4-4	24	BLK		(SH 1)
S11-3	S11-4	24	–	UT SET	(SH 1)
S11-4	S3-3	24	BLK		(SH 1)
S11-4	S9-3	24	BLK		(SH 1)
S11-4	S11-3	24	–		(SH 1)
S12, A-1	XA9P8-16	24	WHT/BLU		(SH 1)
S12, A-4	XA9P8-1	24	BRN		(SH 1)
S12, A-$\overline{C}$	S2-2	24	BLK	PRESET ADVANCE COUNTER	(SH 1)
S12, A-$\overline{C}$	S12, B-$\overline{C}$	24	–		(SH 1)
S12, A-8	XA9P8-2	24	WHT/GRY		(SH 1)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
S12-A-2	XA9P8-15	24	WHT/GRN		(SH 1)
S12-A-C	S12, B-C	24	–		(SH 1)
S12, B-1	XA9P8-14	24	WHT/YEL		(SH 1)
S12, B-4	XA9P8-3	24	ORN		(SH 1)
S12, B-$\overline{C}$	S12, A-$\overline{C}$	24	–		(SH 1)
S12, B-$\overline{C}$	S12, C-$\overline{C}$	24	–		(SH 1)
S12, B-8	XA9P8-4	24	ORN		(SH 1)
S12, B-2	XA9P8-13	24	WHT/ORN		(SH 1)
S12, B-C	S12, A-C	24	–		(SH 1)
S12, B-C	S12, C-C	24	–		(SH 1)
S12, C-1	XA9P8-12	24	WHT/RED		(SH 1)
S12, C-4	XA9P8-5	24	GRN		(SH 1)
S12, C-$\overline{C}$	S12, B-$\overline{C}$	24	–		(SH 1)
S12, C-$\overline{C}$	S12, D-$\overline{C}$	24	–		(SH 1)
S12, C-8	XA9P8-6	24	WHT/VIO		(SH 1)
S12, C-2	XA9P8-11	24	WHT/BRN		(SH 1)
S12, C-C	S12, B-C	24	–	PRESET ADVANCED COUNTER	(SH 1)
S12, C-C	S12, D-C	24	–		(SH 1)
S12, D-1	XA9P8-10	24	WHT/BLK		(SH 1)
S12, D-4	XA9P8-7	24	VIO		(SH 1)
S12, D-$\overline{C}$	S12, C-$\overline{C}$	24	–		(SH 1)
S12, D-$\overline{C}$	S12, E-$\overline{C}$	24	–		(SH 1)
S12, D-8	XA9P8-8	24	GRY		(SH 1)
S12, D-2	XA9P8-9	24	WHT		(SH 1)
S12, D-C	S12, C-C	24	–		(SH 1)
S12, D-C	S12, E-C	24	–		(SH 1)
S12, E-1	XA9P9-16	24	WHT/BLU		(SH 1)
S12, E-4	XA9P9-1	24	BRN		(SH 1)
S12, E-$\overline{C}$	S12, D-$\overline{C}$	24	–		(SH 1)
S12, E-$\overline{C}$	S12, F-$\overline{C}$	24	–		(SH 1)
S12, E-8	XA9P9-2	24	WHT/GRY		(SH 1)
S12, E-2	XA9P9-15	24	WHT/GRN		(SH 1)
S12, E-C	S12, D-C	24	–		(SH 1)
S12, E-C	S12, F-C	24	–		(SH 1)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
S12, F-1	XA9P9-14	24	WHT/YEL		(SH 1)
S12, F-4	XA9P9-3	24	ORN		(SH 1)
S12, F-$\overline{C}$	S12, E-$\overline{C}$	24	–		(SH 1)
S12, F-$\overline{C}$	S12, G-$\overline{C}$	24	–		(SH 1)
S12, F-8	XA9P9-4	24	ORN		(SH 1)
S12, F-2	XA9P9-13	24	WHT/ORN		(SH 1)
S12, F-C	S12, E-C	24	–		(SH 1)
S12, F-C	S12, G-C	24	–		(SH 1)
S12, G-1	XA9P9-12	24	WHT/RED	PRESET ADVANCED COUNTER	(SH 1)
S12, G-4	SA9P9-5	24	GRN		(SH 1)
S12, G-$\overline{C}$	S12, F-$\overline{C}$	24	–		(SH 1)
S12, G-8	XA9P9-6	24	WHT/VIO		(SH 1)
S12, G-2	X19P9-11	24	WHT/ORN		(SH 1)
S12, G-C	S12, F-C	24	–		(SH 1)
S12, G-C	XA9P9-9	24	YEL		(SH 1)
S13-1	XA7P1-13	24	GRN		(SH 1)
S13-2	S4-3	24	BLK	MOD SW(OFF)	(SH 1)
S13-2	S14-2	24	BLK		(SH 1)
S14-1	C5-1				(SH 1)
S14-1	XA7P1-12	24	BRN		(SH 1)
S14-2	C5-2				(SH 1)
S14-2	S1-4	24	BLK	LOOP SW (OPEN)	(SH 1)
S14-2	S13-2	24	BLK		(SH 1)
S14-2	S14-5	24	–		(SH 1)
S14-4	XA7P2-5	24	WHT/VIO		(SH 1)
S14-5	E10	24	BLK	LOOP SW (OPR)	(SH 1)
S14-5	S14-2	24	–		(SH 1)
S15-1	C6-1				(SH 1)
S15-1	XA7P1-14	24	VIO	TIME CONSTANT SW (NORM)	(SH 1)
S15-2	C6-2				(SH 1)
S15-2	DS10-C	24	BLK		(SH 1)

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
S17-2	F1-SIDE	20	ORN	POWER ON/OFF	(SH 2)
S17-3	CR15-A				(SH 2)
S17-3	U1-1	20	ORN		(SH 2)
S17-5	F2-SIDE	20	ORN		(SH 2)
S17-6	CR16-A				(SH 2)
S17-6	U1-3	20	ORN		(SH 2)
S17-8	F3-SIDE	20	RED		(SH 2)
S17-9	XA14P1-12	24	RED		(SH 2)
S17-9	XA14P1-13	24	RED		(SH 2)
S17-11	CR15-C				(SH 2)
S17-11	CR16-C				(SH 2)
S17-11	XA14P1-1	24	ORN		(SH 2)
U1-1	S17-3	20	ORN	+28 VDC	(SH 3)
U1-2	C1-(+)	20	ORN	+17–35 VDC	(SH 3)
U1-2	C2-(+)				(SH 3)
U1-2	E9	20	ORN		(SH 3)
U1-2	U2-2	16	–		(SH 3)
U1-3	S17-6	20	ORN	+28 VDC	(SH 3)
U2-2	U1-2	16	–	+17–35 VDC	(SH 3)
U2-3	A25-E3	24	BRN	BATTERY VOLTAGE	(SH 3)
U2-3	XA14P1-11	24	BRN		(SH 3)
U2-3	XA14P1-24	24	BRN		(SH 3)
WAVE GUIDE	XA5J4	SEMI-RIGID CABLE		9.192+ GHz	
XA1J1-1	NO CONN	–	–	–	
XA1J1-2	E3	24	BLK	GROUND	
XA1J1-3	C1-(+)	24	ORN	+17–35 VDC	
XA1J1-4	E3	24	BLK	GROUND	
XA1J1-5	NO CONN	–	–	CS FIELD TEST	
XA1J1-6	A25-E5	24	WHT/BRN	CS OVEN TEMP	
XA1J1-7	E3	24	BLK	GROUND	
XA1J1-8	XA1J1-14	24	–	+'C' FIELD	

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
XA1J1-9	E1	24	RED	+ 18 VDC	
XA1J1-10	E3	24	BLK	+ 18 VDC RTN	
XA1J1-11	XA1J1-15	24	–	– 'C' FIELD	
XA1J1-12	J27-CENT	RG178 COND		ZEEMAN	
XA1J1-13	J27-GND	RG178 SHIELD		ZEEMAN RTN	
XA1J1-14	XA1J1-8	24	–	+ 'C' FIELD	
XA1J1-15	XA1J1-11	24	–	– 'C' FIELD	
XA1P1-1	E1	24	RED	+ 18 VDC	
XA1P1-2	E3	24	BLK	GROUND	
XA1P1-3	E5	24	BLU	– 18 VDC	
XA1P1-4	A25-E8	RG178 COND		CS MON ION CURR	
XA1P1-5	SHIELD	RG178 SHIELD		N/C	
XA1P1-A1	XA7P2-A4	RG178 COAX		5 MHz	
XA1P1-A2	XA7P2-3	RG178 COAX		167 Hz DET	
XA4P1-1	E1	24	RED	+ 18 VDC	
XA4P1-2	E3	24	BLK	+ 18 VDC RTN	
XA4P1-3	A25-E6	24	WHT/RED	OSC OVEN TEMP	
XA4P1-4	R1-3		WHT	OSC ADJUST 2 WIRE TWISTED W/SHIELD	
XA4P1-5	R1-2		BLK		
XA4P1-6	R1-1		SHIELD		
XA4P1-7	NO CONN	–	–	–	
XA4P1-8	NO CONN	–	–	INNER OVEN TEMP	
XA4P1-9	NO CONN	–	–	OUTER OVEN TEMP	
XA4P1-10	NO CONN	–	–	–	
XA4P1-A1	XA8P1-A1	RG178 COAX		5 MHz	
XA4P1-A2	XA7P2-A1	RG178 COAX		5 MHz	
XA4P1-A3	XA7P1-A2	RG178 COAX		VCO INPUT	
XA5-J1	XA7P2-A2	RG178 COAX		5 MHz	
XA5-J2	XA7P1-A1	RG178 COAX		83.8 Hz MOD	
XA5-J4	WAVE GUIDE	SEMI-RIGID CABLE		9.192 + GHz	
XA5-J5	XA7P1-A4	RG178 COAX		7.368 MHz	

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
XA6P1-1	C1-(+)	20	ORN	+ 17–35 VDC	
XA6P1-2	XA9J1-24	24	WHT/ORN	+ 13.5 VDC	
XA6P1-3	E5	20	BLU	– 18 VDC	
XA6P1-4	NO CONN	–	–	–	
XA6P1-5	NO CONN	–	–	–	
XA6P1-6	E1	20	RED	+ 18 VDC	
XA6P1-7	E2	20	YEL	+ 5 VDC (CLOCK)	
XA6P1-8	NOT USED	–	–	+ 1 VDC RTN	
XA6P1-9	XA10P1-1	24	ORN	+ 7.6 VDC	
XA6P1-10	NOT USED	–	–	+ 1 VDC	
XA6P1-11	XA7P1-4	24	WHT/ORN	+ 7.6 VDC RTN	
XA6P1-12	XA7P1-5	24	ORN	+ 7.6 VDC	
XA6P1-13	E17	20	BRN	HOT WIRE	
XA6P1-14	C1-(+)	20	ORN	+ 17–35 VDC	
XA6P1-15	NO CONN	–	–	–	
XA6P1-16	NO CONN	–	–	–	
XA6P1-17	NO CONN	–	–	–	
XA6P1-18	E1	20	RED	+ 18 VDC	
XA6P1-19	E2	20	YEL	+ 5 VDC (CLOCK)	
XA6P1-20	C1-(–)	20	BLK	+ 17–35 VDC RETURN	
XA6P1-21	C1-(–)	20	BLK		
XA6P1-22	E3	22	BLK	RETURN	
XA6P1-23	E3	22	BLK	RETURN	
XA6P1-24	E3	22	BLK	RETURN	
XA6P1-25	E18	20	BLK	HOT WIRE RTN	
XA7P1-1	E1	24	RED	+ 18 VDC	
XA7P1-2	E3	24	BLK	RETURN	
XA7P1-3	E5	24	BLU	– 18 VDC	
XA7P1-4	XA6P1-11	24	WHT/ORN	+ 7.6 VDC RTN	
XA7P1-5	XA6P1-12	24	ORN	+ 7.6 VDC	
XA7P1-6	A25-E9	24	WHT/VIO	CONTR SIG MON	
XA7P1-7	DS3-C	24	WHT/BLU	OPER LED	
XA7P1-8	DS1-C	24	GRY	ALARM LED	
XA7P1-9	S1-1	24	WHT/BLK	RESET	

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
XA7P1-10	J13-B	24	WHT/ORN	FAULT OUT	
XA7P1-11	E3	24	BLK	+ 18 VDC RTN	
XA7P1-12	S14-1	24	BRN	LOOP SW OPEN	
XA7P1-13	S13-1	24	GRN	MOD SW OFF	
XA7P1-14	S15-1	24	VIO	TCSW NORM	
XA7P1-15	NO CONN	–	–	–	
XA7P1-16	NO CONN	–	–	–	
XA7P1-17	NO CONN	–	–	–	
XA7P1-A1	XA5-J2	RG178 COAX		83.3 Hz MOD	
XA7P1-A2	XA4P1-A3	RG178 COAX		VCO OUT	
XA7P1-A3	A5-FL6-2	RG178 COAX		7.368 MHz VCO	
XA7P1-A4	XA5-J5	RG178 COAX		7.368 MHz	
XA7P2-1	XA9J1-19	RG178 COND		5 MHz (SQ WAVE)	
XA7P2-2	XA9J1-18	RG178 SHIELD		5 MHz RTN	
XA7P2-3	XA1P1-A2	RG178 COND		167 Hz DET	
XA7P2-4	A25-E11	24	WHT/GRY	SYN CONT VOLT	
XA7P2-5	S14-4	24	WHT/VIO	LOOP SW OPER	
XA7P2-A1	XA4P1-A2	RG178 COAX		5 MHz	
XA7P2-A2	XA5-J1	RG178 COAX		5 MHz	
XA7P2-A3	XA10P1-4	RG178 COND		5 MHz (SQ WAVE)	
XA7P2-A3	XA10P1-5	RG178 SHIELD		5 MHz RTN	
XA7P2-A4	XA1P1-A1	RG178 COAX		83 Hz	
XA8P1-1	A25-E10	24	WHT/BLU	MONITOR OUT	
XA8P1-2	E3	24	BLK	+ 18 VDC RTN	
XA8P1-3	NO CONN	–	–	–	
XA8P1-4	NO CONN	–	–	–	
XA8P1-5	NO CONN	–	–	–	
XA8P1-6	E1	24	RED	+ 18 VDC	
XA8P1-7	E3	24	BLK	+ 18 VDC RTN	
XA8P1-A1	XA4P1-A1	RG178 COAX		5 MHz	
XA8P1-A2	J25	RG178 COAX		5 MHz	A
XA8P1-A3	J1	RG178 COAX		5 MHz	

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
XA8P1-A4	J2	RG178 COAX		5 MHz	
XA8P1-A5	J3	RG178 COAX		5 MHz	
XA8P1-A6	J4	RG178 COAX		5 MHz	
XA9J1-1	NO CONN	–	–	–	
XA9J1-2	NO CONN	–	–	–	
XA9J1-3	J10	RG178 COND		1 PPS	
XA9J1-4	NO CONN	–	–	–	
XA9J1-5	NO CONN	–	–	–	
XA9J1-6	NO CONN	–	–	–	
XA9J1-7	J12	RG178 COND		RTDA (TOD)	
XA9J1-8	J9 SHIELD	RG178 SHIELD		1 PPS RTN	
XA9J1-9	NO CONN	–	–	–	
XA9J1-10	NO CONN	–	–	–	
XA9J1-11	J9	RG178 COND		1 PPS	
XA9J1-12	NO CONN	–	–	–	
XA9J1-13	NO CONN	–	–	–	
XA9J1-14	NO CONN	–	–	–	
XA9J1-15	J11	RG178 COND		RTDA (TOD)	
XA9J1-16	NO CONN	–	–	–	
XA9J1-17	NO CONN	–	–	–	
XA9J1-18	XA7P2-2	RG178 SHIELD		5 MHz RTN	
XA9J1-19	XA7P2-1	RG178 COND		5 MHz (SQ WAVE)	
XA9J1-20	NO CONN	–	–	–	
XA9J1-21	E5	24	BLU	–18 VDC	
XA9J1-22	NO CONN	–	–	–	
XA9J1-23	NO CONN	–	–	–	
XA9J1-24	XA6P1-2	24	WHT/ORN	+13.5 VDC	
XA9J1-25	NO CONN	–	–	–	
XA9J1-26	E1	24	RED	+18 VDC	
XA9J1-27	XA14P1-2	24	GRN	DISPLAY RELAY	
XA9J1-28	E2	24	YEL	+5 VDC	
XA9J1-29	E2	24	YEL	+5 VDC	
XA9J1-30	E2	24	YEL	+5 VDC	
XA9J1-31	E2	24	YEL	+5 VDC	

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
XA9J1-32	NO COMM	–	–	–	
XA9J1-33	E3	24	BLK	GROUND	
XA9J1-34	J11 SHIELD	RG178 SHIELD		RTDA RTN (TOD)	
XA9J1-35	J12 SHIELD	RG178 SHIELD		RTDA RTN (TOD)	
XA9J1-36	E3	24	BLK	GROUND	
XA9J1-37	J10 SHIELD	RG178 SHIELD		1PPS RTN	
XA9P4-1	A19-E6	24	BRN	HOURS DISPLAY	
XA9P4-2	NO CONN	–	–	–	
XA9P4-3	NO CONN	–	–	–	
XA9P4-4	A19-E8	24	WHT/BLK	HOURS DISPLAY	
XA9P4-5	A19-E9	24	GRN		
XA9P4-6	K1-A3	24	WHT/BLUE	DISPLAY RELAY	
XA9P4-7	S8-1	24	VIO	+5 VDC	
XA9P4-8	S8-1	24	VIO		
XA9P4-9	C3-(+)			+5 VDC	
XA9P4-9	S8-1	24	VIO		
XA9P4-10	C4-(+)			DISPLAY RELAY	
XA9P4-10	K1-A1	24	WHT/BRN		
XA9P4-11	NO CONN	–	–	–	
XA9P4-12	A19-E7	24	WHT/RED	HOURS DISPLAY	
XA9P4-13	A19-E10	24	WHT/ORN		
XA9P4-14	A19-E2	24	WHT/YEL		
XA9P4-14	C3-(–)				
XA9P4-14	C4-(–)				
XA9P4-15	NO CONN	–	–	–	
XA9P4-16	A19-E5	24	WHT/BLUE	HOURS DISPLAY	
XA9P5-1	A19-E12	24	BRN	MINUTES DISPLAY	
XA9P5-2	A19-E13	24	WHT/BRN		
XA9P5-3	NO CONN	–	–	–	
XA9P5-4	A19-E15	24	WHT/BLK	MINUTES DISPLAY	
XA9P5-5	A19-E16	24	GRN		
XA9P5-6	NO CONN	–	–	–	
XA9P5-7	DS9-C	24	VIO	SYNC ARM LED	
XA9P5-8	DS8-C	24	GRY	UT SET LED	

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
XA9P5-9	DS8-A	24	WHT	UT SET LED	
XA9P5-10	DS9-A	24	WHT/BRN	SYNC ARM LED	
XA9P5-11	NO CONN	–	–	–	
XA9P5-12	A19-E17	24	WHT/RED	MINUTES DISPLAY	
XA9P5-13	A19-E14	24	WHT/ORN		
XA9P5-14	A19-E3	24	WHT/YEL		
XA9P5-15	NO CONN	–	–	–	
XA9P5-16	A19-E11	24	WHT/BLU	MINUTES DISPLAY	
XA9P6-1	A19-E19	24	BRN	SECOND DISPLAY	
XA9P6-2	A19-E20	24	WHT/BRN		
XA9P6-3	NO CONN	–	–	–	
XA9P6-4	A19-E22	24	WHT/BLK	SECONDS DISPLAY	
XA9P6-5	A19-E24	24	GRN		
XA9P6-6	J23-CENT	24	VIO		
XA9P6-7	NO CONN	–	–	–	
XA9P6-8	J24-CENT	24	GRY	EXT SYNC	
XA9P6-9	J24-GND	24	BLK	ENT SYNC RTN	
XA9P6-10	NO CONN	–	–	–	
XA9P6-11	J23-GND	24	BLK	GROUND	
XA9P6-12	A19-E23	24	WHT/RED	SECONDS DISPLAY	
XA9P6-13	A19-E21	24	WHT/ORN		
XA9P6-14	A19-E4	24	WHT/YEL		
XA9P6-15	NO CONN	–	–	–	
XA9P6-16	A19-E18	24	WHT/BLU	SECONDS DISPLAY	
XA9P7-1	S7-2	24	BRN	SECONDS SW	
XA9P7-2	S6-2	24	WHT/GRY	MINUTES SW	
XA9P7-3	S5-2	24	ORN	HOURS SW	
XA9P7-4	S2-1	24	ORN	TIME HOLD SW	
XA9P7-5	S9-2	24	GRN	ADD SW	
XA9P7-6	S10-2	24	WHT/VIO	SUB SW	
XA9P7-7	S11-2	24	VIO	UT SET SW	
XA9P7-8	S4-2	24	GRY	SYNC ARM SWITCH	
XA9P7-9	S4-1	24	WHT	SYNC ARM SWITCH	
XA9P7-10	S11-1	24	WHT/BLK	UT SET SW	

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

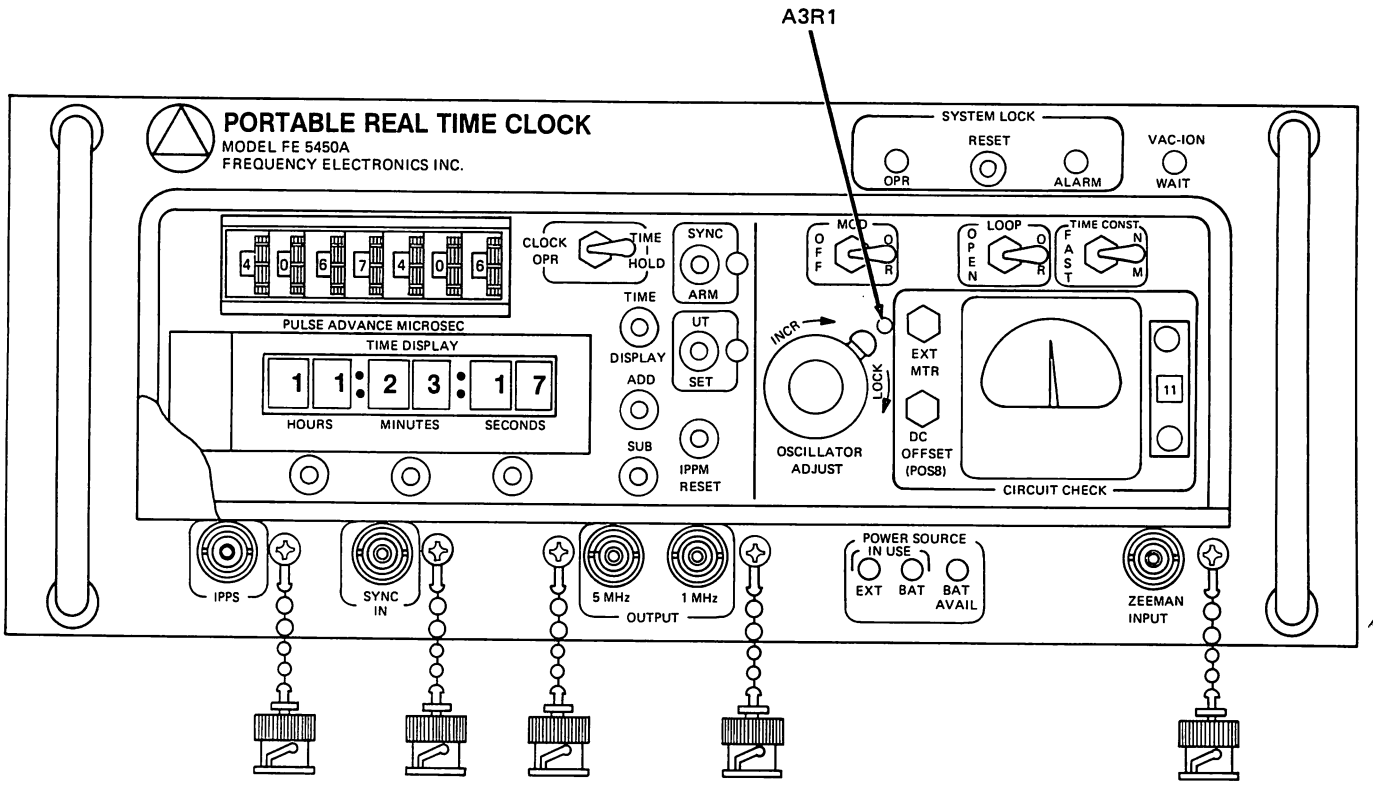
FROM	TO	AWG	COLOR	FUNCTION	REMARKS
XA9P7-11	S10-1	24	WHT/BRN	SUB SW	
XA9P7-12	S9-1	24	WHT/RED	ADD SW	
XA9P7-13	S2-3	24	WHT/ORN	TIME HOLD SW	
XA9P7-14	S5-1	24	WHT/YEL	HOURS SW	
XA9P7-15	S6-1	24	WHT/GRN	MINUTES SW	
XA9P7-16	S7-1	24	WHT/BLU	SECONDS SW	
XA9P8-1	S12, A-4	24	BRN		
XA9P8-2	S12, A-8	24	ORN		
XA9P8-3	S12, B-4	24	ORN		
XA9P8-4	S12, B-8	24	GRN		
XA9P8-5	S12, C-4	24	GRN		
XA9P8-6	S12, C-8	24	WHT/VIO		
XA9P8-7	S12, D-4	24	VIO		
XA9P8-8	S12, D-8	24	GRY		
XA9P8-9	S12, D-2	24	WHT		
XA9P8-10	S12, D-1	24	WHT/BLK		
XA9P8-11	S12, C-2	24	WHT/BRN	THUMBWHEEL SWITCH	
XA9P8-12	S12, C-1	24	WHT/RED		
XA9P8-13	S12, B-2	24	WHT/ORN		
XA9P8-14	S12, B-1	24	WHT/YEL		
XA9P8-15	S12, A-2	24	WHT/GRN		
XA9P8-16	S12, A-1	24	WHT/BLU		
XA9P9-1	S12, E-4	24	BRN		
XA9P9-2	S12, E-8	24	WHT/GRY		
XA9P9-3	S12, F-4	24	ORN		
XA9P9-4	S12, F-8	24	ORN		
XA9P9-5	S12, G-4	24	GRN		
XA9P9-6	S12, G-8	24	WHT/VIO		
XA9P9-7	S3-2	24	VIO	1PPM RESET	
XA9P9-8	S4-4	24	BLK	SYNC ARM	
XA9P9-9	S12, G-C	24	YEL	THUMBWHEEL	
XA9P9-10	S3-1	24	WHT/BLK	1PPM RESET	
XA9P9-11	S12, G-2	24	WHT/ORN		
XA9P9-12	S12, G-1	24	WHT/RED		

TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
XA9P9-13	S12, F-2	24	WHT/ORN	THUMBWHEEL SWITCH	
XA9P9-14	S12, F-1	24	WHT/YEL		
XA9P9-15	S12, E-2	24	WHT/GRN		
XA9P9-16	S12, E-1	24	WHT/BLU		
XA10P1-1	XA6P1-9	24	ORN	+ 7.6 VDC	
XA10P1-2	E3	24	BLK	RETURN	
XA10P1-3	NO CONN	–	–	–	
XA10P1-4	XA7P2-A3	RG178 COND		5 MHz (SQ WAVE)	
XA10P1-5	XA7P2-A3	RG178 SHIELD		5 MHz RTN	
XA10P1-A1	J7	RG178 COAX		100 kHz	A
XA10P1-A2	J8	RG178 COAX			A
XA10P1-A3	J5	RG178 COAX		1 MHz	
XA10P1-A4	J6	RG178 COAX		1 MHz	B
XA10P1-A4	J26	RG178 COAX		1 MHz	A
XA14P1-1	S17-11	24	ORN	+22–30 VDC	
XA14P1-2	XA9J1-27	24	GRN	DISPLAY RELAY	
XA14P1-3	E2	24	YEL	+ 5 VDC	
XA14P1-4	NO CONN	–	–	–	
XA14P1-5	DS4-A	24	WHT/GRN	EXT PWR LED	
XA14P1-6	DS2-C	24	WHT/ORN	BAT IN USE LED	
XA14P1-7	NO CONN	–	–	–	
XA14P1-8	NO CONN	–	–	–	
XA14P1-9	NO CONN	24	GRY	–	
XA14P1-10	DS5-A	24	WHT/BLU	BAT AVAIL LED	
XA14P1-11	U2-3	24	BRN	BATTERY SENSE	
XA14P1-12	S17-9	24	RED	POWER ON/OFF	
XA14P1-13	S17-9	24	RED		
XA14P1-14	NO CONN	–	–	–	
XA14P1-15	NO CONN	–	–	–	
XA14P1-16	E3	24	BLK	GROUND	
XA14P1-17	E3	24	BLK	GROUND	
XA14P1-18	E3	24	BLK	GROUND	
XA14P1-19	E3	24	BLK	GROUND	
XA14P1-20	E3	24	BLK	GROUND	

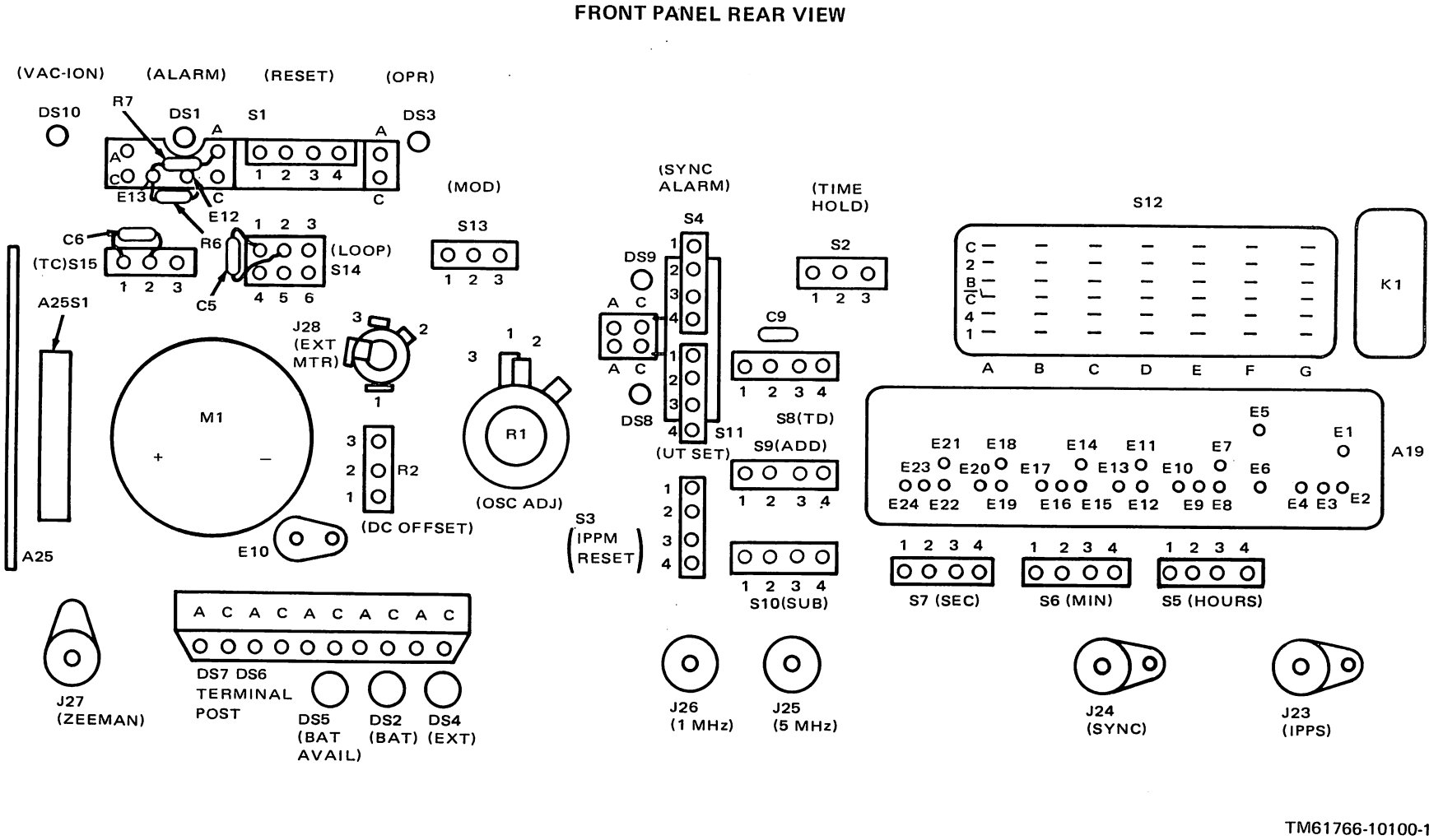
TABLE 5-2. PRTC WIRE RUN LIST (CONT'D)

FROM	TO	AWG	COLOR	FUNCTION	REMARKS
XA14P1-21	A25-E4	24	WHT/BLK	BATTERY CURRENT	A
XA14P1-21	A25-E4	24	WHT/BLK	GROUND	B
XA14P1-22	XA17P1-4	24	VIO	BATTERY (–) CHARGER	
XA14P1-23	XA17P1-5	24	VIO		
XA14P1-24	U2-3	24	BRN	BATTERY SENSE	
XA14P1-25	E1	24	RED	+18 VDC	
XA17P1-1	E19	20	ORN	BATTERY CHARGER	A
XA17P1-2	F3-TOP	20	RED	BATTERY (+) CHARGER	A
XA17P1-3	F3-TOP	20	RED	BATTERY (+) CHARGER	A
XA17P1-4	XA14P1-22	24	VIO	BATTERY (–) CHARGER	A
XA17P1-5	XA14P1-23	24	VIO	BATTERY (–) CHARGER	A
XA17P1-6	NO CONN	24	GRY	THERMISTOR	A
XA17P1-7	NO CONN	24	BLK		A



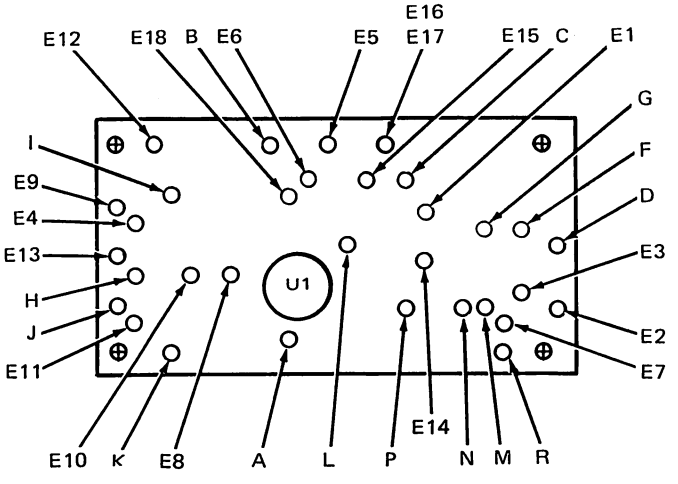
TM61754-10100

Figure 5-1. Electron Multiplier High Voltage Power Supply Module A3
Adjustment Location

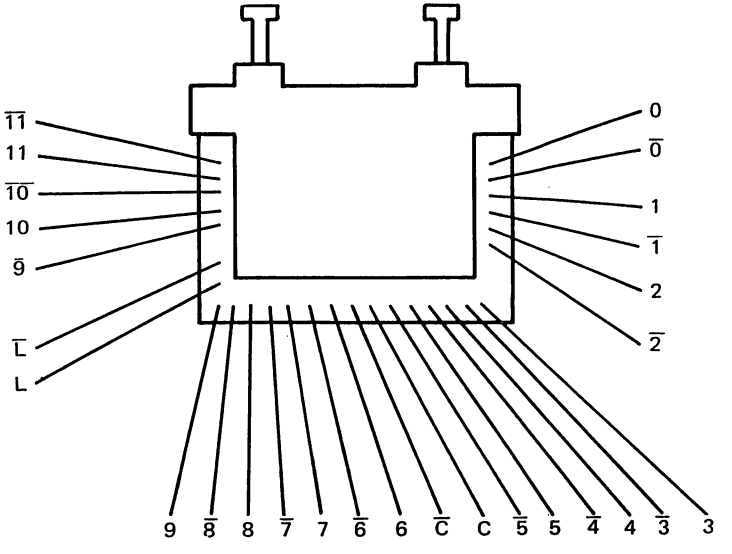


TM61766-10100-1

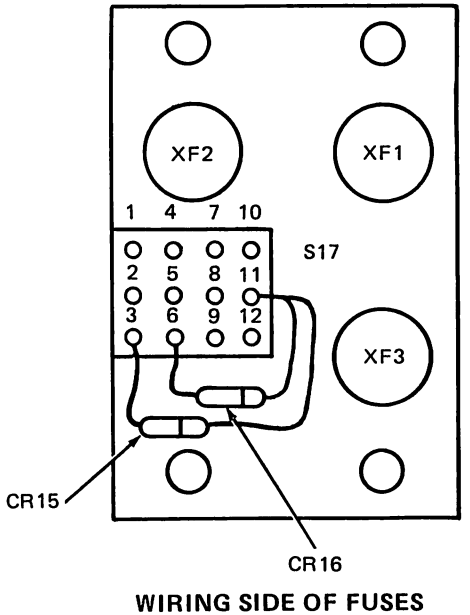
Figure 5-2. PRTC Chassis Subassembly Components Location Wiring Diagram (Sheet 1 of 3)



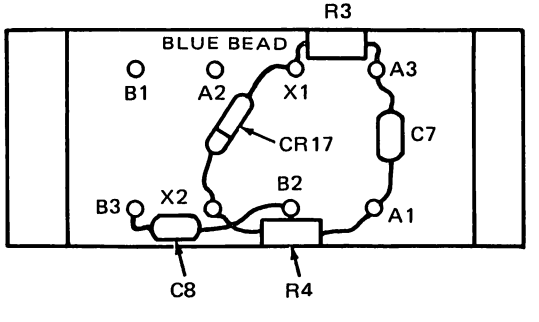
A25 VIEW COMPONENT SIDE



A25S1



WIRING SIDE OF FUSES



WIRING SIDE OF (K1) RELAY

TM61766-10100-2

Figure 5-2. PRTC Chassis Subassembly Components Location Wiring Diagram (Sheet 2 of 3)

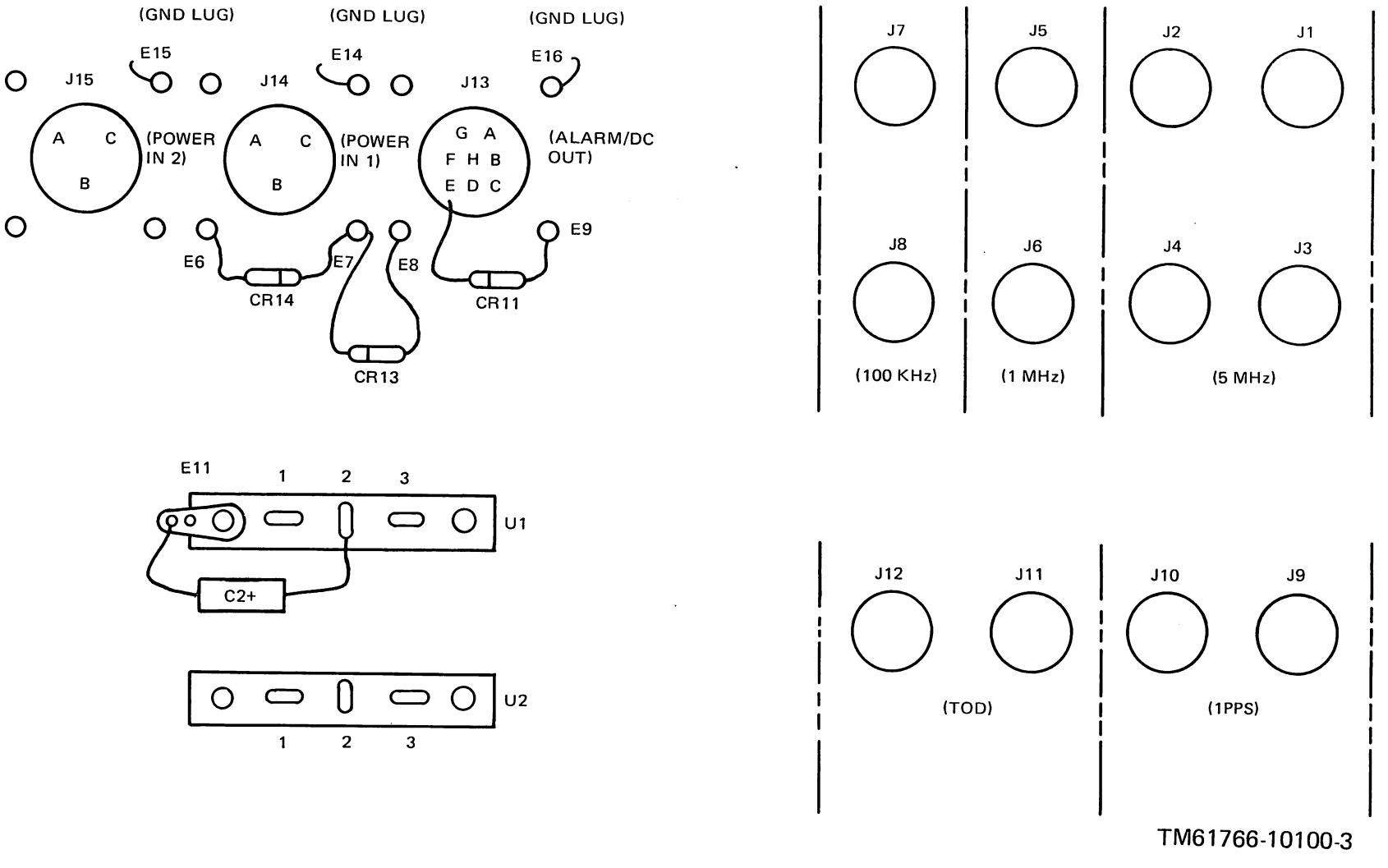


Figure 5-2. PRTC Chassis Subassembly Components Location Wiring Diagram (Sheet 3 of 3)

NOTES GENERAL:
1. UNLESS OTHERWISE SPECIFIED:
   RESISTORS ARE IN OHMS
   CAPACITORS ARE IN µF
   INDUCTORS ARE IN µH
2. * INDICATES SELECTED VALUE:
   INITAL VALUES MAY BE SHOWN
3. ⊙ INDICATES GLASS INSULATED TERMINAL
4. Ⓡ INDICATES ROTOR SIDE OF VARIABLE CAPACITORS

A5

FL3-FL4	E2	J3	R1-R15					
REFERENCE SYMBOL NO. NOT USED								
L4	C6	U1	FL6	CR1	HY1	E3	J5	R16
HIGHEST REFERENCE SYMBOL NO. USED								

A5A1

C1, C2							
REFERENCE SYMBOL NO. NOT USED							
Z2	R2	CR1	E2	C4			
HIGHEST REFERENCE SYMBOL NO. USED							

A5A2

REFERENCE SYMBOL NO. NOT USED							
T2	Y2	C10	E3	L1			
HIGHEST REFERENCE SYMBOL NO. USED							

A5A3

Z1, Z2	C1-C11	L1-L3	R1-R9	Q1-Q2			
REFERENCE SYMBOL NO. NOT USED							
Z3	C26	L9	CR1	R15	Q3	E5	RT1
HIGHEST REFERENCE SYMBOL NO. USED							

A5A4

Z1-Z3							
REFERENCE SYMBOL NO. NOT USED							
Z4	Y1	R1	C3	E7	L1		
HIGHEST REFERENCE SYMBOL NO. USED							

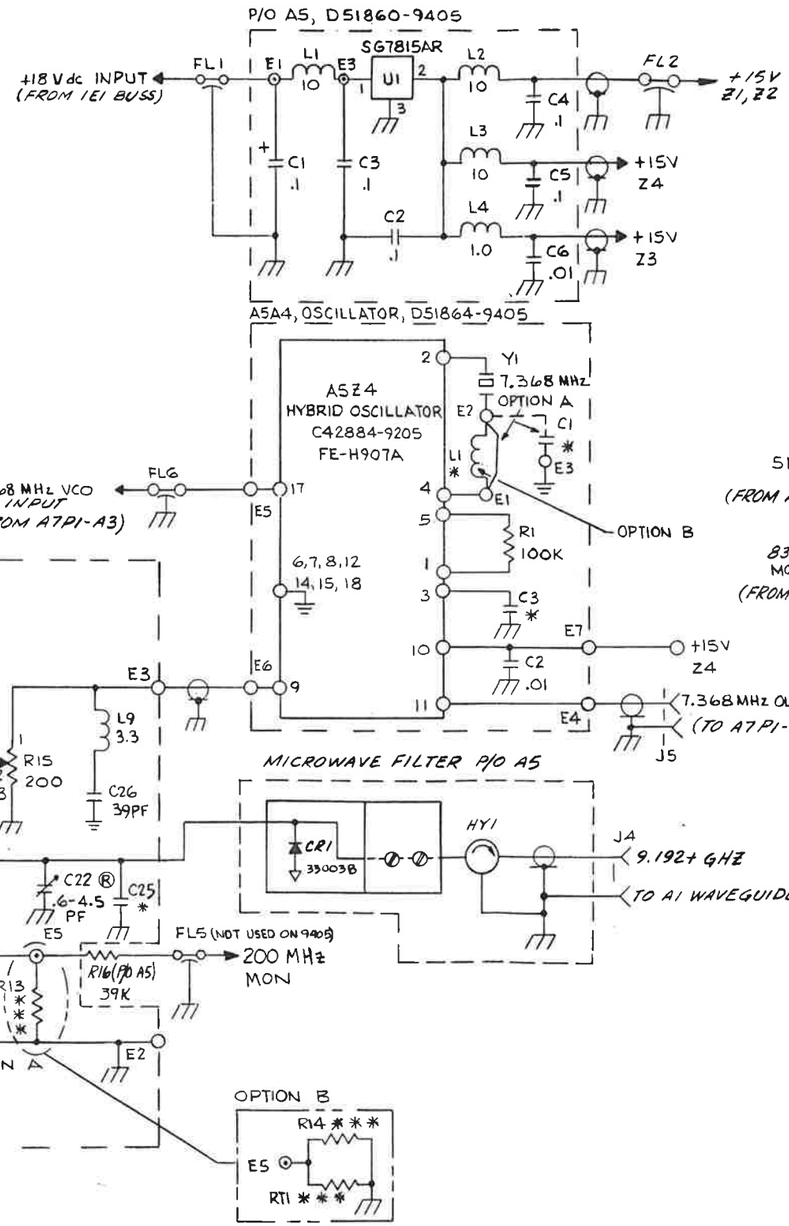
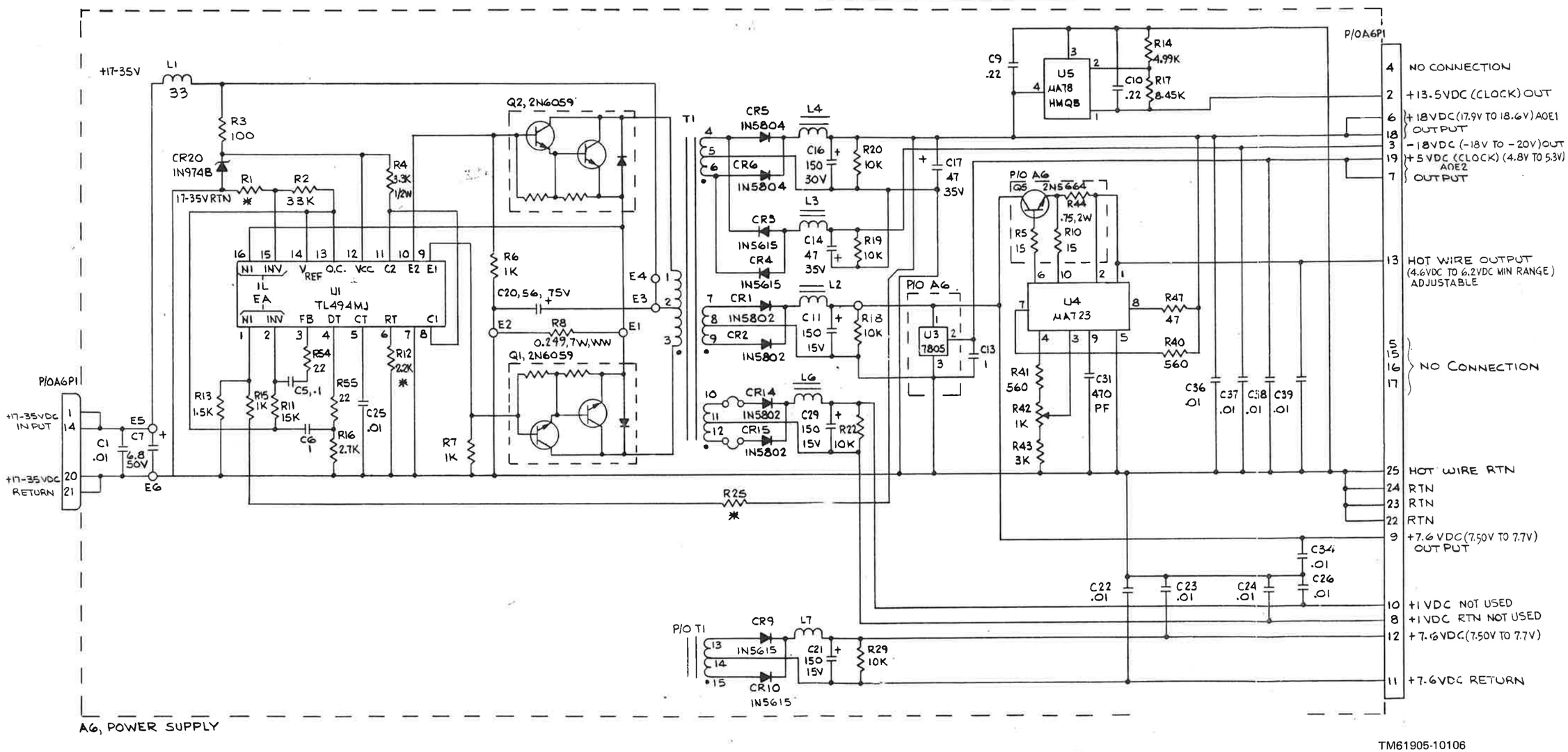


Figure 5-3. PRTC Modulator/Multiplier Module A5, Schematic Diagram

A6, A6A1							
Q3, Q4							
C35, CR7, CR8, CR11-CR13, CR16-CR19, L5, U2							
C2-C4, C8, C12, C15, C18, C19, C27, C28, C30, C32, C33							
R9, R21, R23, R24, R26-R28, R30-R39, R45, R46, R48-R53							
REFERENCE SYMBOL NO. NOT USED*							
C39	CR20	R55	C7	Q5	T1	U5	P1
HIGHEST REFERENCE SYMBOL NO. USED							

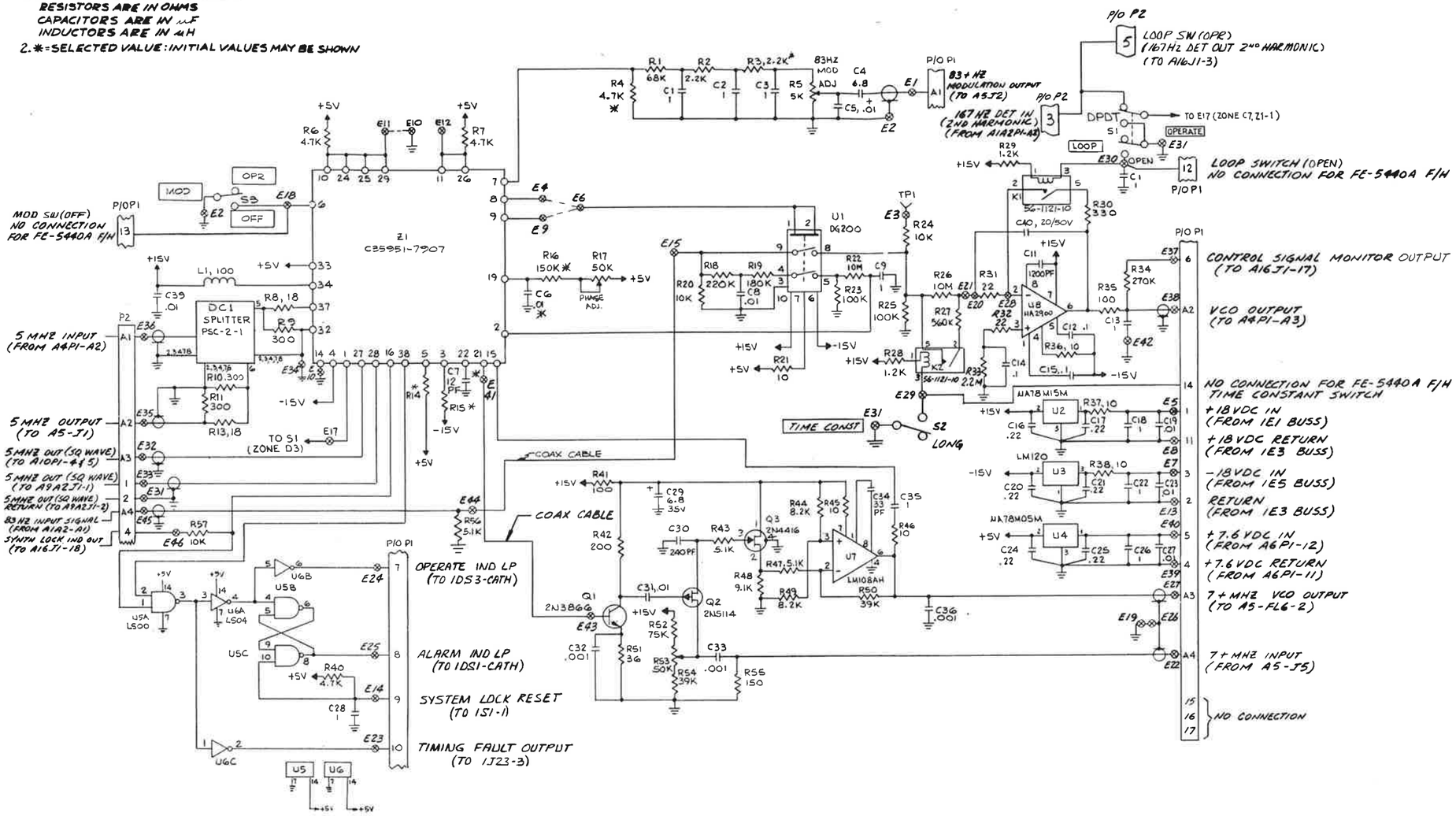


TM61905-10106

Figure 5-4. PRTC Power Supply Module A6, 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

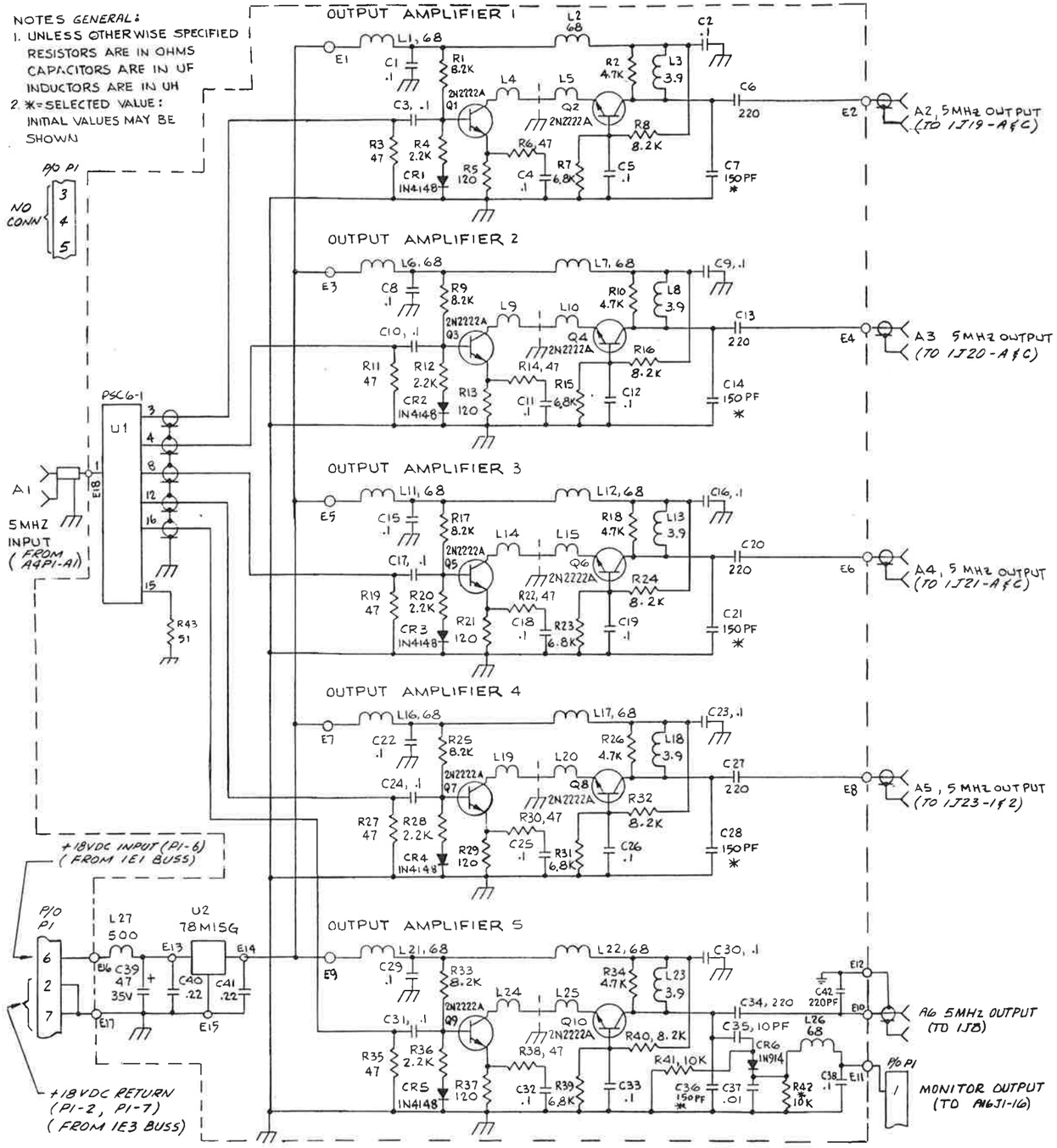


TM51935-9407

A7, A7A1

R12, R39, C37, C38								
REFERENCE SYMBOL NO. NOT USED								
R57	C40	L1	Q3	K2	S3	U8	Z1	P2	DC1
HIGHEST REFERENCE SYMBOL NO. USED								

Figure 5-5. PRTC Synthesizer Module A7, Schematic Diagram



A8, A8A1

REFERENCE SYMBOL NO. NOT USED							
U2	E18	L27	C42	CR6	R43	Q10	P1
HIGHEST REFERENCE SYMBOL NO. USED							

TM51936-9408

Figure 5-6. PRTC Buffer Amplifier Module A8, 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 A9 EXCEPT WHERE PREFIX A19 OR P/O CHASSIS SUBASSY 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 — VERTICAL GRID

   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

   A9 ASSY D62002-10109
   PL62002-10109

   A9A1 WIRING DIAGRAM - D52007-9409

   A9A2 WIRE CHART - 52006-9409

P/O CHASSIS SUBASSY

J1-J22, P1-P3, R1, R2, CR1-CR16, C1-C6, S1, DS1-DS7							
REFERENCE SYMBOL NO. NOT USED							
J24	P9	R4	CR17	C9	S12	DS9	K1
HIGHEST REFERENCE SYMBOL NO. USED							

A19

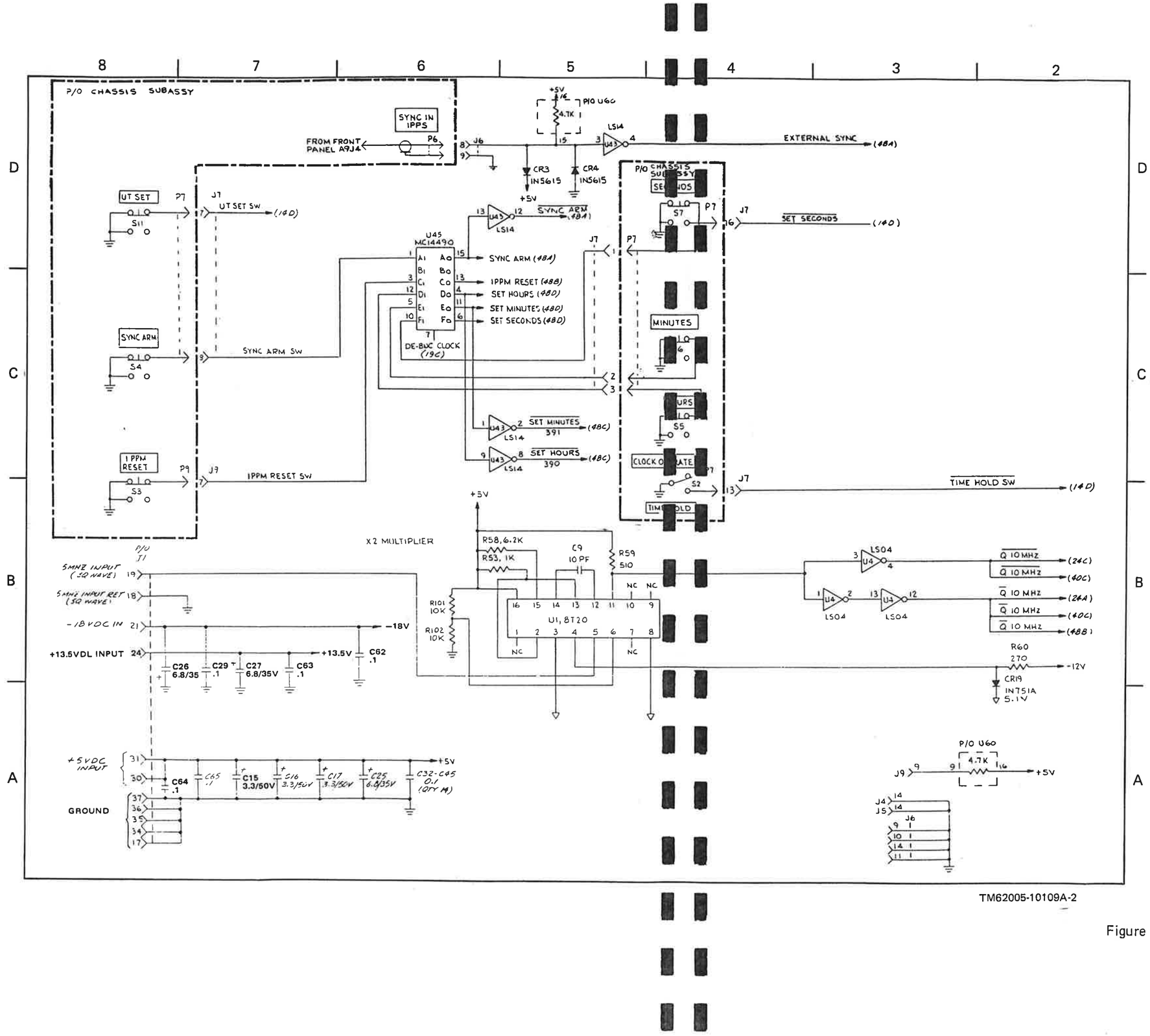
REFERENCE SYMBOL NO. NOT USED							
C3		R1	U6				
HIGHEST REFERENCE SYMBOL NO. USED							

A9

C3-C6, C10-C14, C18-C24, C28, C31, CR1, CR2, CR6-CR8							
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							

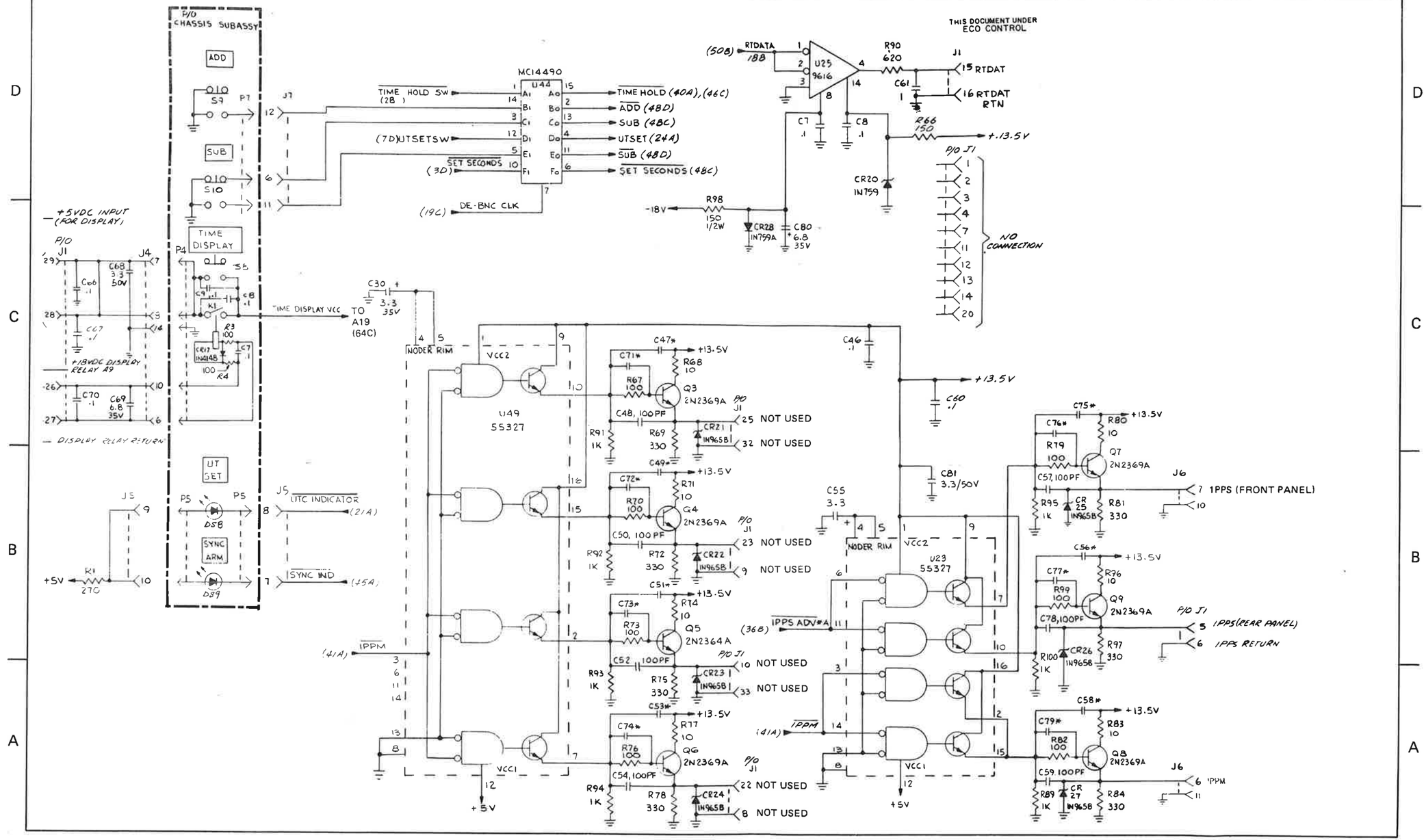
TM62005-10109A-1

Figure 5-7. PRTC Real Time-Of-Day Clock PC Assembly A9, Display PC Assembly A19, and P/O Chassis Subassy Schematic Diagram (Sheet 1 of 9)



TM62005-10109A-2

Figure 5-7. PRTC Real Time-Of-Day Clock PC Assembly A9, Display PC Assembly A19, and P/O Chassis Subassy Schematic Diagram (Sheet 2 of 9)



TM62005-10109A-3

Figure 5-7. PRTC Real Time-Of-Day Clock PC Assembly A9, Display PC Assembly A19, and P/O Chassis Subassy Schematic Diagram (Sheet 3 of 9)

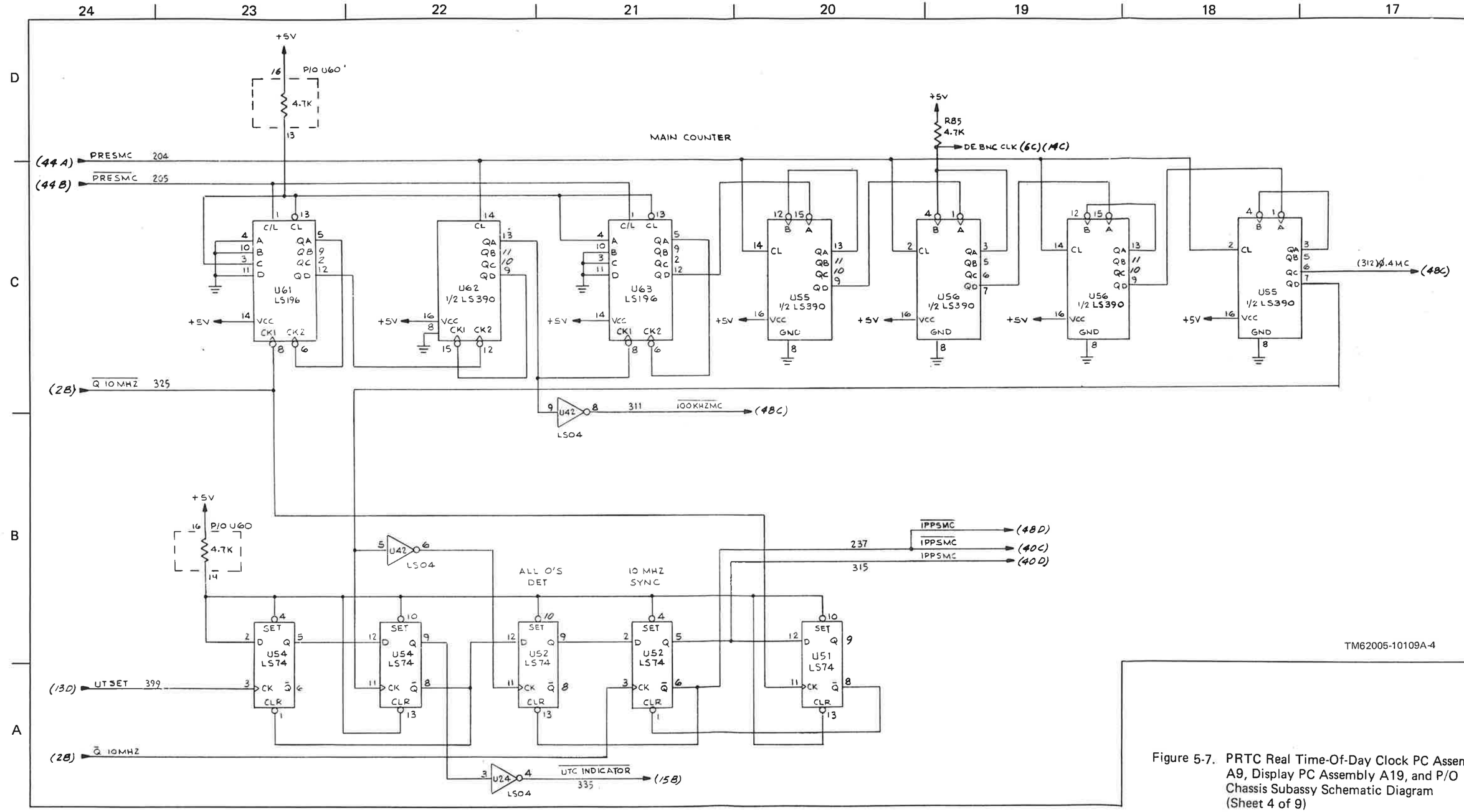


Figure 5-7. PRTC Real Time-Of-Day Clock PC Assembly A9, Display PC Assembly A19, and P/O Chassis Subassy Schematic Diagram (Sheet 4 of 9)

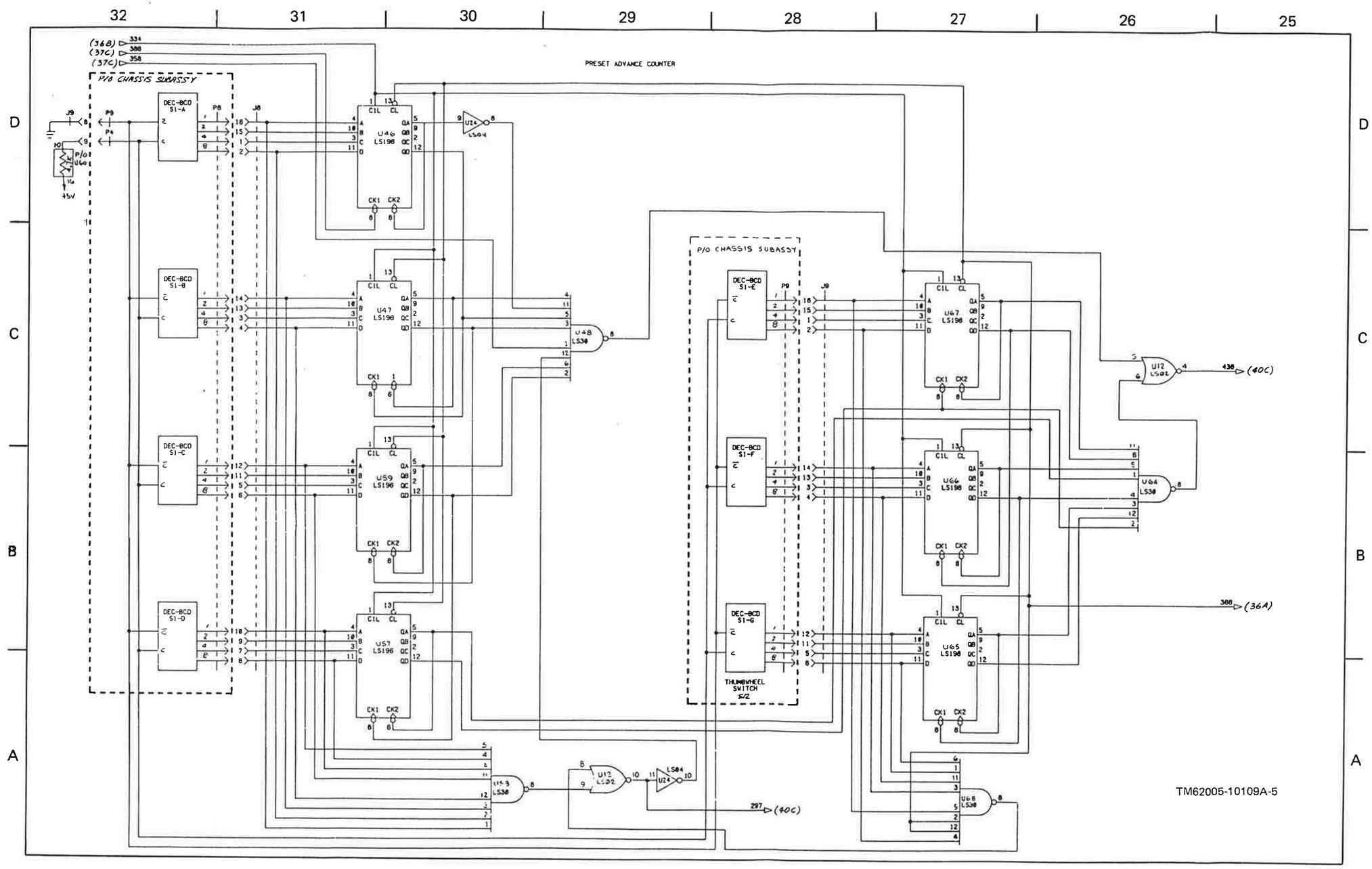


Figure 5-7. PRTC Real Time-Of-Day Clock PC Assembly A9, Display PC Assembly A19, and P/O Chassis Subassy Schematic Diagram (Sheet 5 of 9)

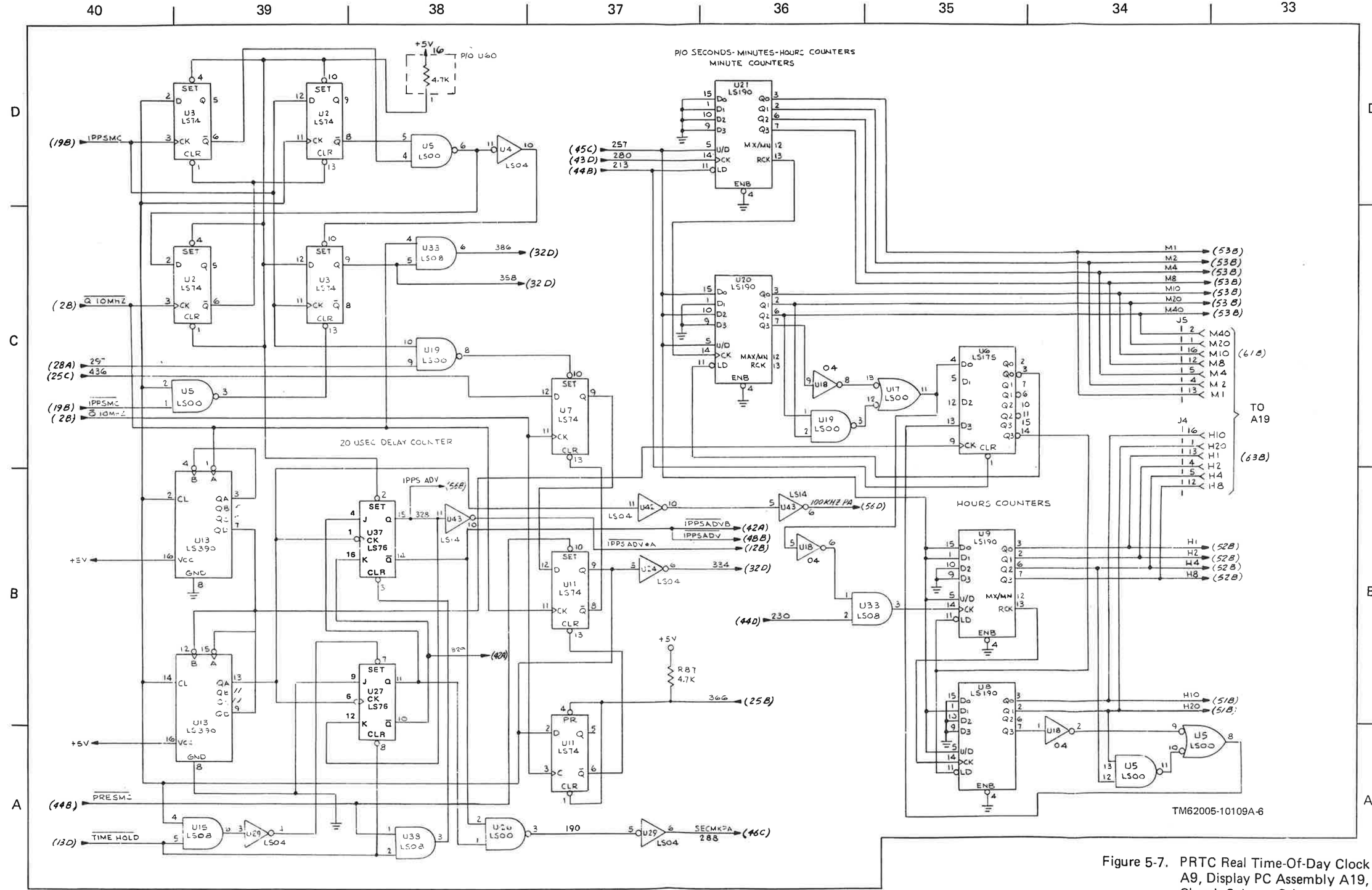


Figure 5-7. PRTC Real Time-Of-Day Clock PC Assembly A9, Display PC Assembly A19, and P/O Chassis Subassy Schematic Diagram (Sheet 6 of 9)

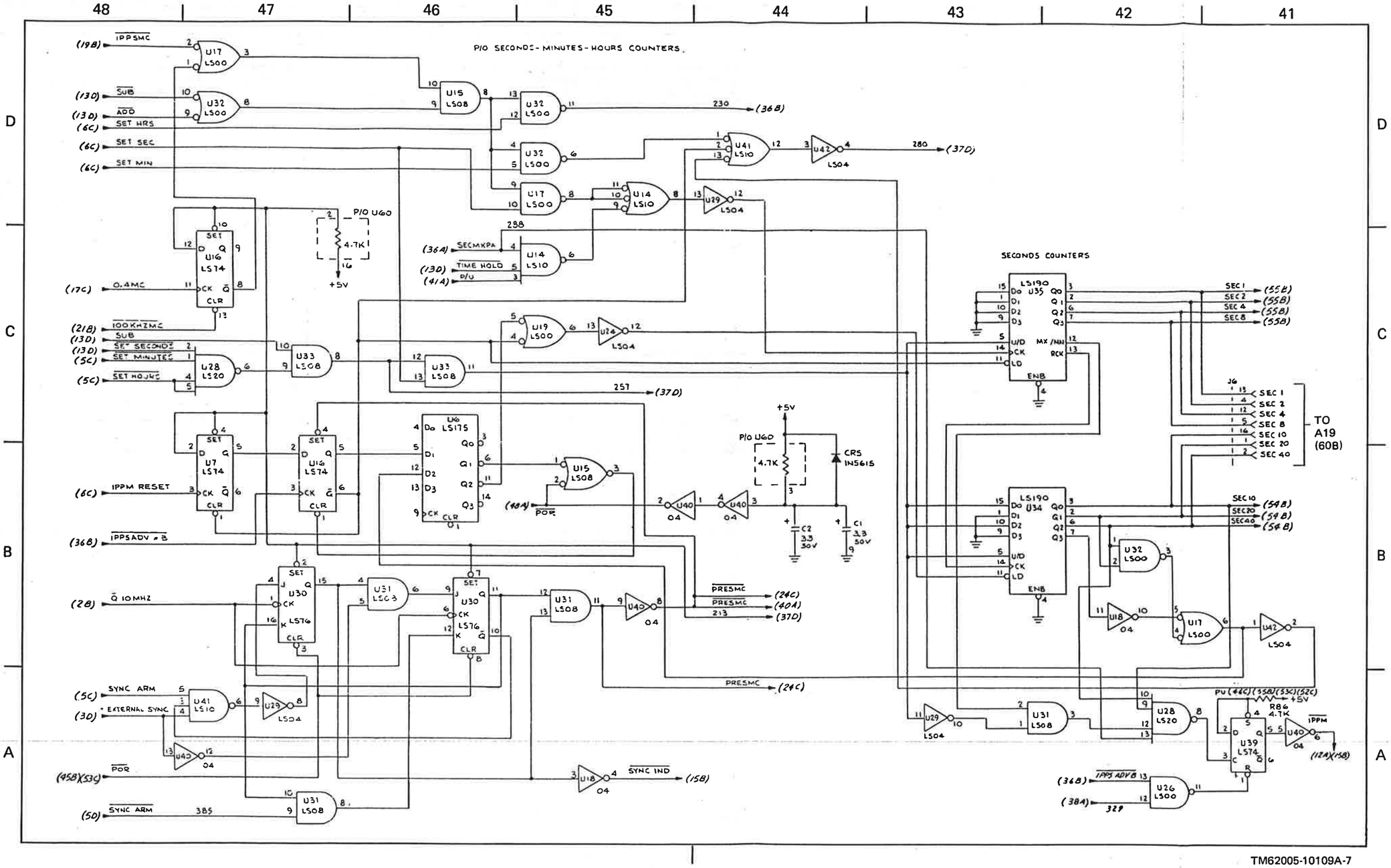


Figure 5-7. PRTC Real Time-Of-Day Clock PC Assembly A9, Display PC Assembly A19, and P/O Chassis Subassy Schematic Diagram (Sheet 7 of 9)

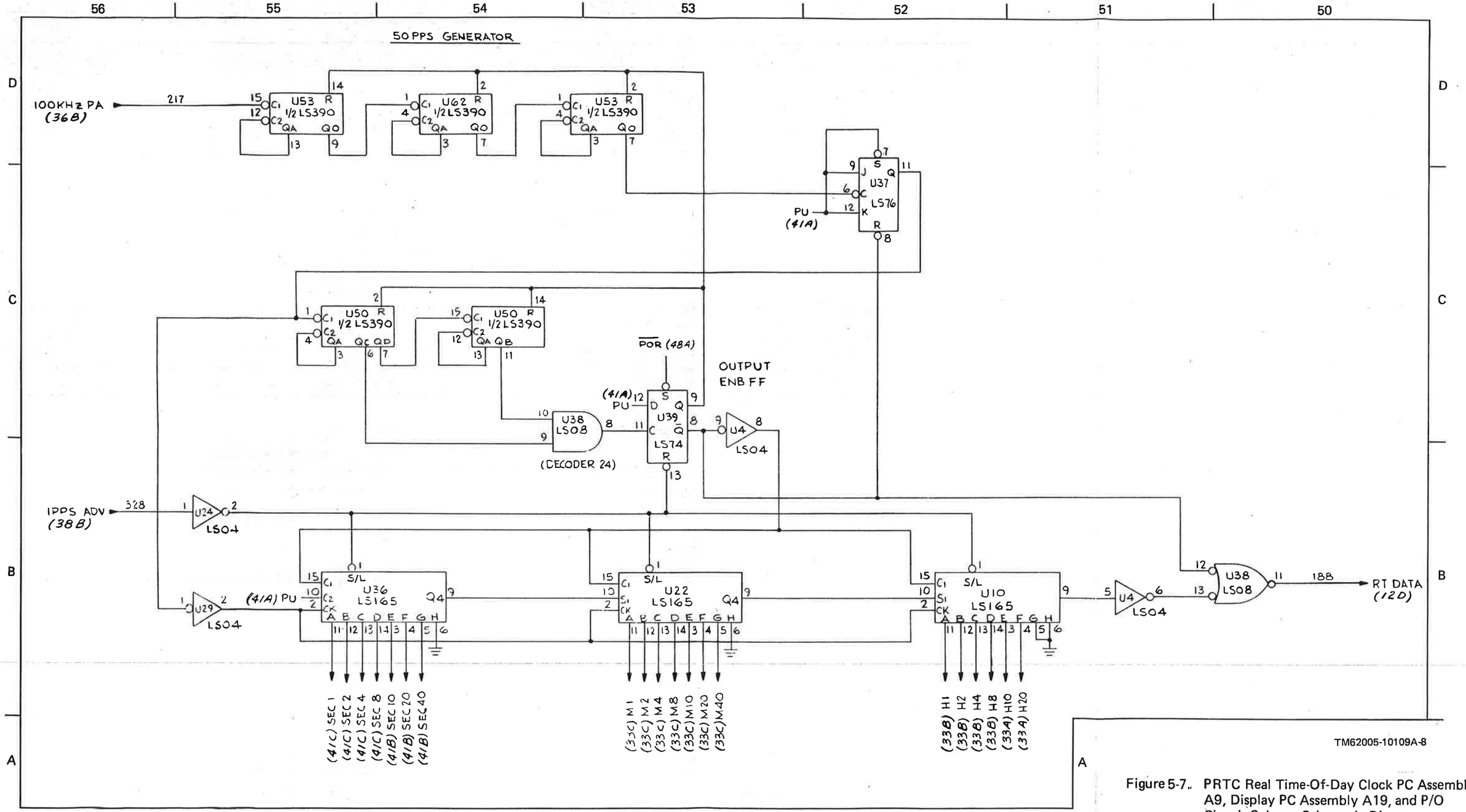
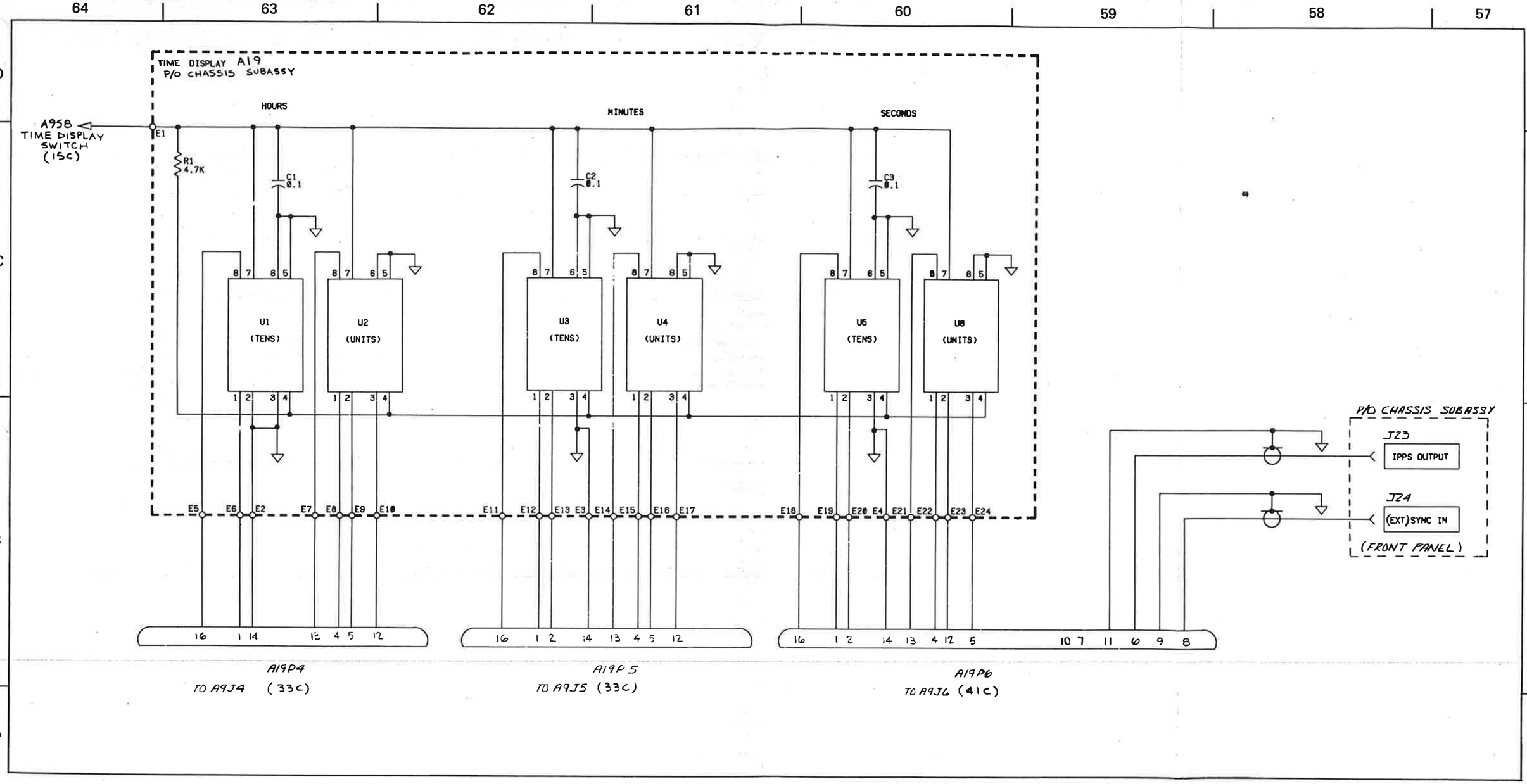


Figure 5-7. PRTC Real Time-Of-Day Clock PC Assembly A9, Display PC Assembly A19, and P/O Chassis Subassy Schematic Diagram (Sheet 8 of 9)

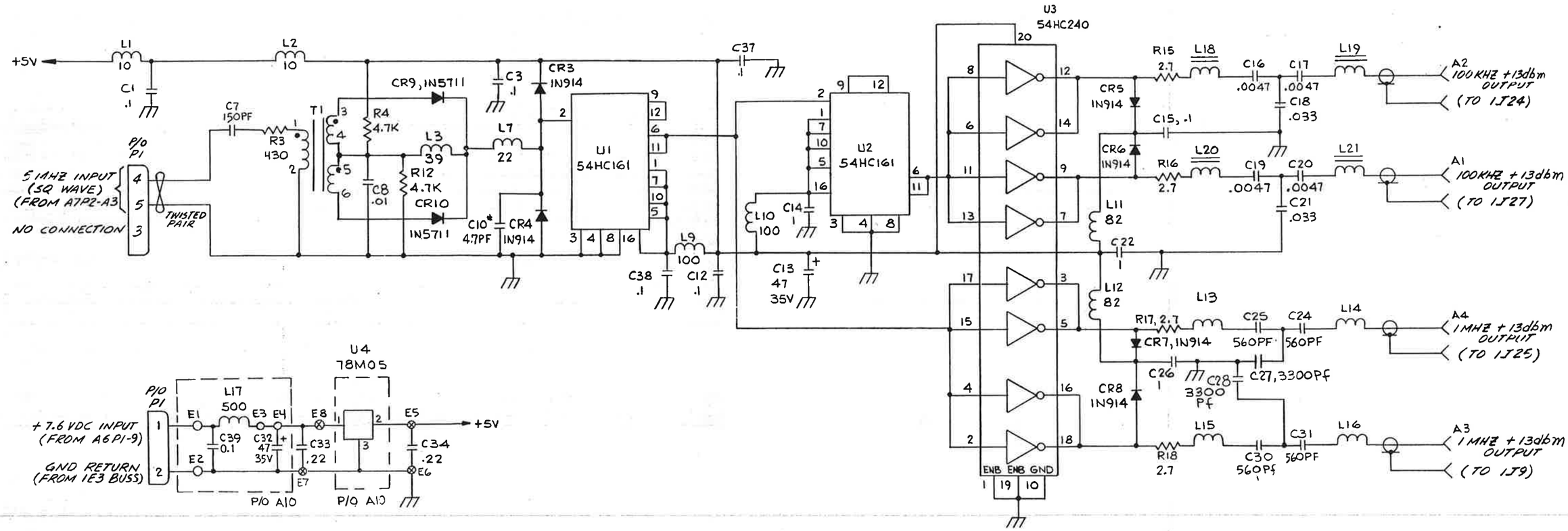


TM62005-10109A-A-9F

Figure 5-7. PRTC Real Time-Of-Day Clock PC Assembly A9, Display PC Assembly A19, and P/O Chassis Subassy Schematic Diagram (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.



TM52045-9410

A10, A10A1

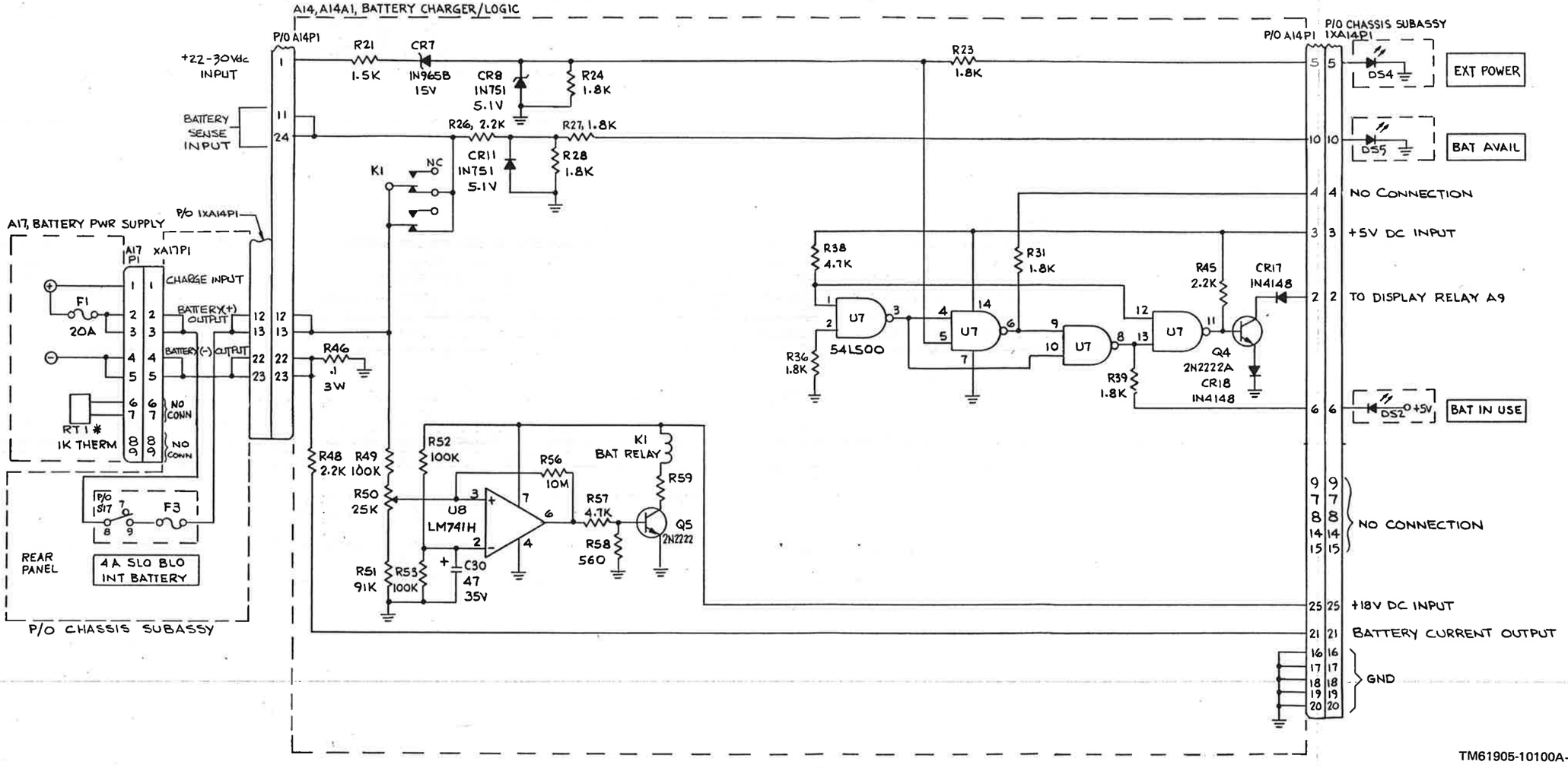
C2,C4, C5, C6,C9,C11,C23,C29,C35, C36							
R1,R2,R5-R11,R13,R14				CR1,CR2	L4,L5,L6,L8		
REFERENCE SYMBOL NO. NOT USED							
R18	C39	U4	P1	CR10, L21		T1	E8
HIGHEST REFERENCE SYMBOL NO. USED							

Figure 5-8. PRTC Generator Module A10, Schematic Diagram

A14.A14A1
R47, R54. R55, Q1-Q3
R1-R20, R22, R25, R29, R30, R32-R35, R37, R40-R44,
C1-C29. CR1-CR6, CR9 CR10, CR12-CR16, U1-U6
REFERENCE SYMBOL NO. NOT USED
C30 | CR18 | R59 | K1 | U8 | Q5 | P1 |
HIGHEST REFERENCE SYMBOL NO. USED

A17
REFERENCE SYMBOL NO. NOT USED
RT1 | F1 | P1 |				
HIGHEST REFERENCE SYMBOL NO. USED

P/O CHASSIS SUBASSY
DS1, DS3, F1-F3, S1-S14, XA1P-XA13P, XA15P, XA16P
REFERENCE SYMBOL NO. NOT USED
DS5 | F4 | S17 | XA17P				
HIGHEST REFERENCE SYMBOL NO. USED



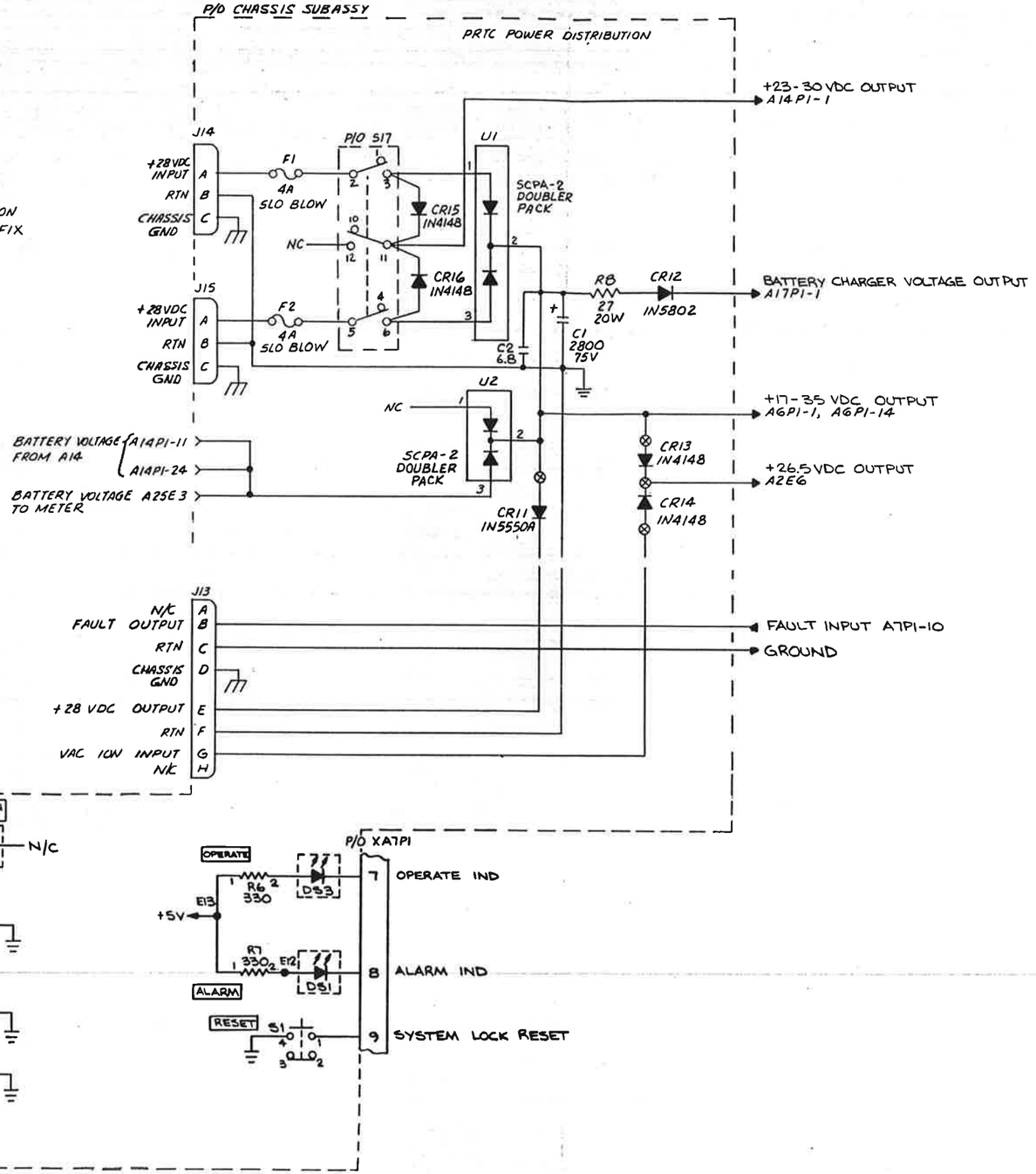
TM61905-10100A-1

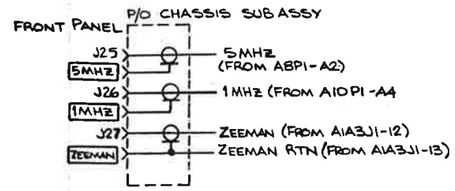
Figure 5-9. PRTC Battery Charger/Logic Module A14, Battery Power Supply Module A17, and P/O Chassis Subassy Schematic Diagram (Sheet 1 of 2)

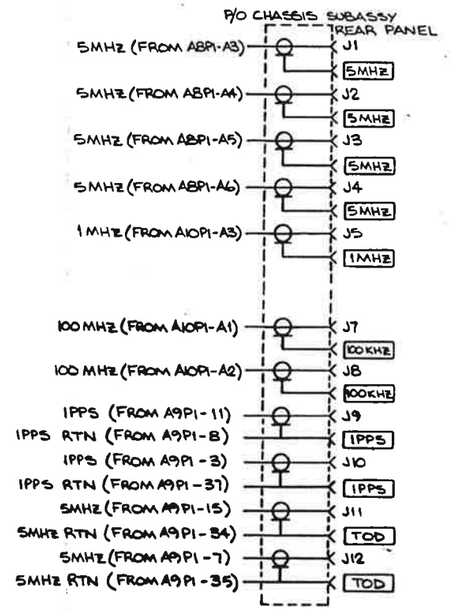
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   RESISTOR ARE IN OHMS
   CAPACITOR ARE IN UF
2. * = SELECTED VALUE: INITAL VALUES MAY BE SHOWN.
3. NOTED COMPONENTS MOUNTED ON NEXT HIGHER ASSEMBLY.
4. WHEN PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, COMPLETE THE DESIGNATION WITH MODULE AND/OR ASSEMBLY PREFIX DESIGNATION.
5. ASSOCIATED DRAWINGS:
   A6: D51900-9406
   PL51900-9406
   D51706-9406 ICD (PN)
   A14: D61900-10114 (ASSY)
   PL61900-10114
   D51714-9414-2 ICD (PN)
   A14A1: D61901-10114 (ASSY)
   PL61901-10114
   A17: D62470-10117
   PL62470-10117
   D51717-9417-1 ICD (PN)
   A0: D62490-10118
   PL62490-10118

P/O CHASSIS SUBASSY

CR1-CR10							
C3, C4, DS2, DS4, DS5-DS9, S2-S12, S16							
XA1P-XA6P, XA8P-XA13P, J16-J24 R1-R5							
REFERENCE SYMBOL NO. NOT USED							
C6	CR14	DS10	F3	J27	R8	S17	U2
HIGHEST REFERENCE SYMBOL NO. USED							



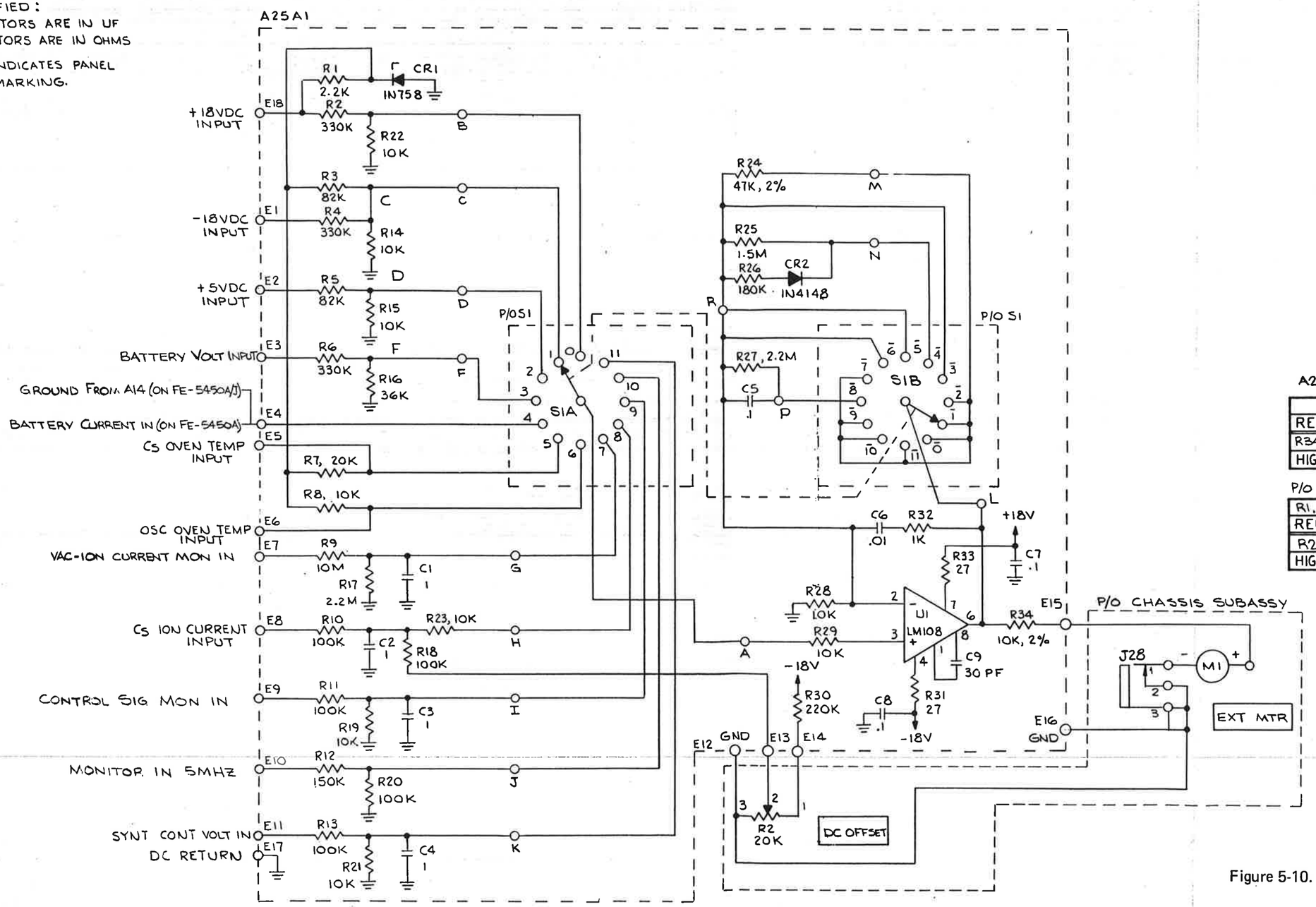




TM61905-10100A-2

Figure 5-9. PRTC Battery Charger/Logic Module A14, Battery Power Supply Module A17, and P/O Chassis Subassy Schematic Diagram (Sheet 2 of 2)

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   CAPACITORS ARE IN UF
   RESISTORS ARE IN OHMS
2. ▭ INDICATES PANEL MARKING.



A25, A25A1

REFERENCE SYMBOL NO. NOT USED								
R34	C9	CR2	U1	S1				
HIGHEST REFERENCE SYMBOL NO. USED								

P/O CHASSIS SUBASSY

R1, J1 - J27								
REFERENCE SYMBOL NO. NOT USED								
R2	J28	M1						
HIGHEST REFERENCE SYMBOL NO. USED								

TM62205-10125

Figure 5-10. PRTC Amplifier, Meter Driver Module A25, and P/O Chassis Subassy Schematic Diagram

CHAPTER 6

CORRECTIVE MAINTENANCE

6-1. INTRODUCTION.

6-2. This chapter contains the corrective maintenance procedures required to repair the PRTC. Corrective maintenance is limited to the removal and replacement of defective sub-assemblies and chassis mounted components (see paragraph 6-13). Additionally, alignment and adjustment procedures which must be performed when certain sub-assemblies are replaced, are included as a part of this chapter.

6-3. ALIGNMENT AND ADJUSTMENT.

6-4. The following procedures shall be performed upon removal and replacement of selected sub-assemblies as referenced in the respective procedure.

6-5. HOT-WIRE LEVEL ADJUSTMENT. Perform the hot-wire level adjustment upon replacement of power supply module A6 or Cesium beam resonator assembly A1 as follows:

a. Connect vacuum tube volt meter (VTVM) between E17 (figure 6-1) and ground.

b. While observing VTVM, adjust A6R42 (figure 6-2) for the hot wire voltage labeled on the Cesium beam resonator assembly A1.

6-6. WAVEGUIDE ATTENUATOR ADJUSTMENT. Perform the waveguide attenuator adjustment on new waveguide assembly prior to waveguide assembly alignment (see paragraph 6-7) as follows:

a. Remove six screws and lock washers from the waveguide cover as shown in figure 6-3.

b. Remove waveguide cover.

c. Check that attenuator's metalized side is flush against the bottom of the waveguide.

d. If attenuator is not flush, loosen stopnut on each attenuator screw and tighten screws.

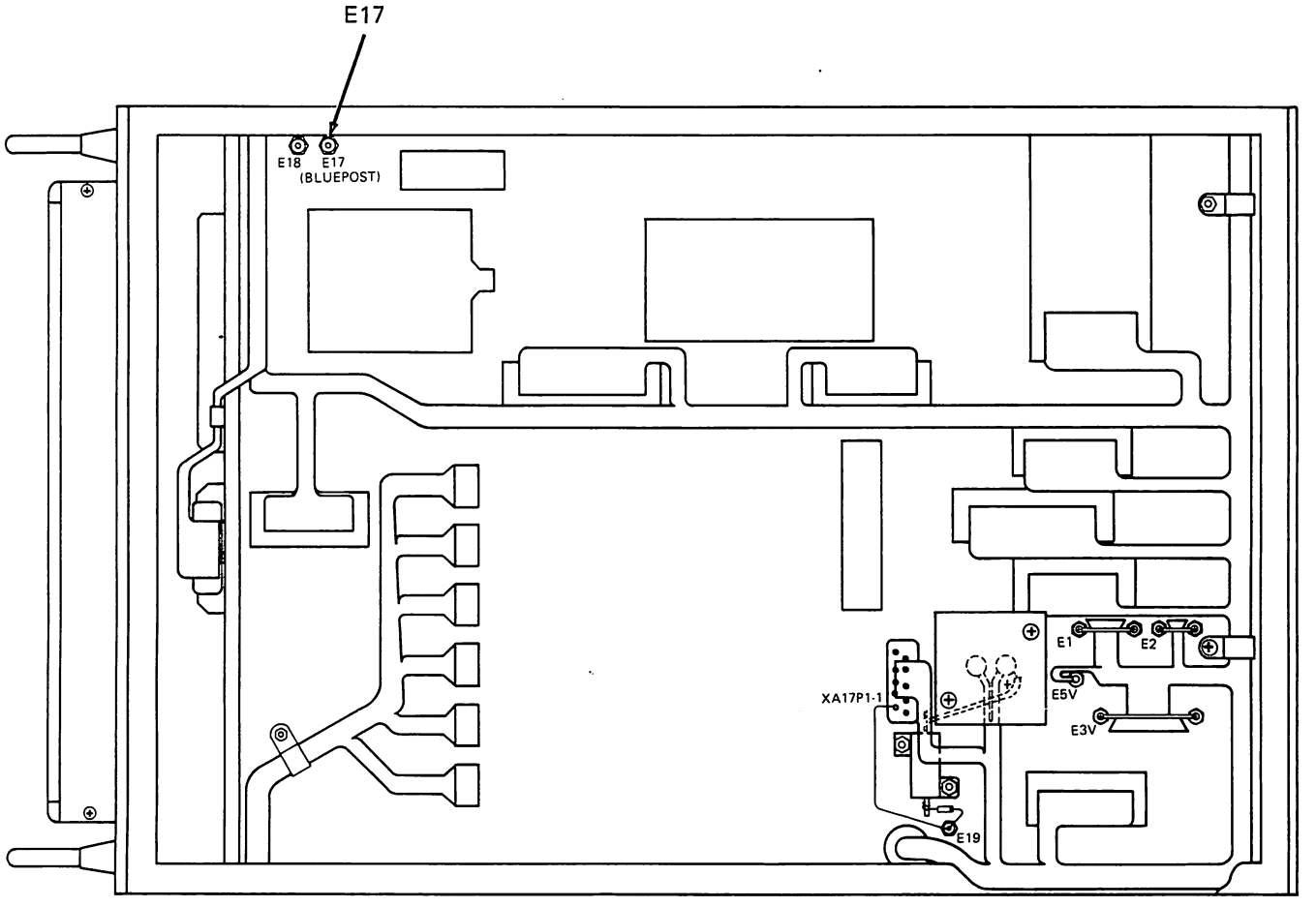
e. Retighten stopnuts.

f. Replace waveguide cover, and secure cover with six screws and lock washers.

g. Install waveguide assembly as described in paragraph 6-16.

6-7. WAVEGUIDE ALIGNMENT. Perform the waveguide alignment on new waveguide assembly following waveguide attenuator adjustment (see paragraph 6-6) and prior to waveguide installation (see paragraph 6-16) as follows:

a. Set PRTC on its left side with the front panel facing the front of the work surface. Remove top and bottom covers and connect power cable to either POWER IN 1 (5, figure 2-4) or POWER IN 2 (6) connectors on rear panel.



TM61757-10100

Figure 6-1. VTVM Connection For Hot Wire Level Adjustment
(Bottom Cover Removed)

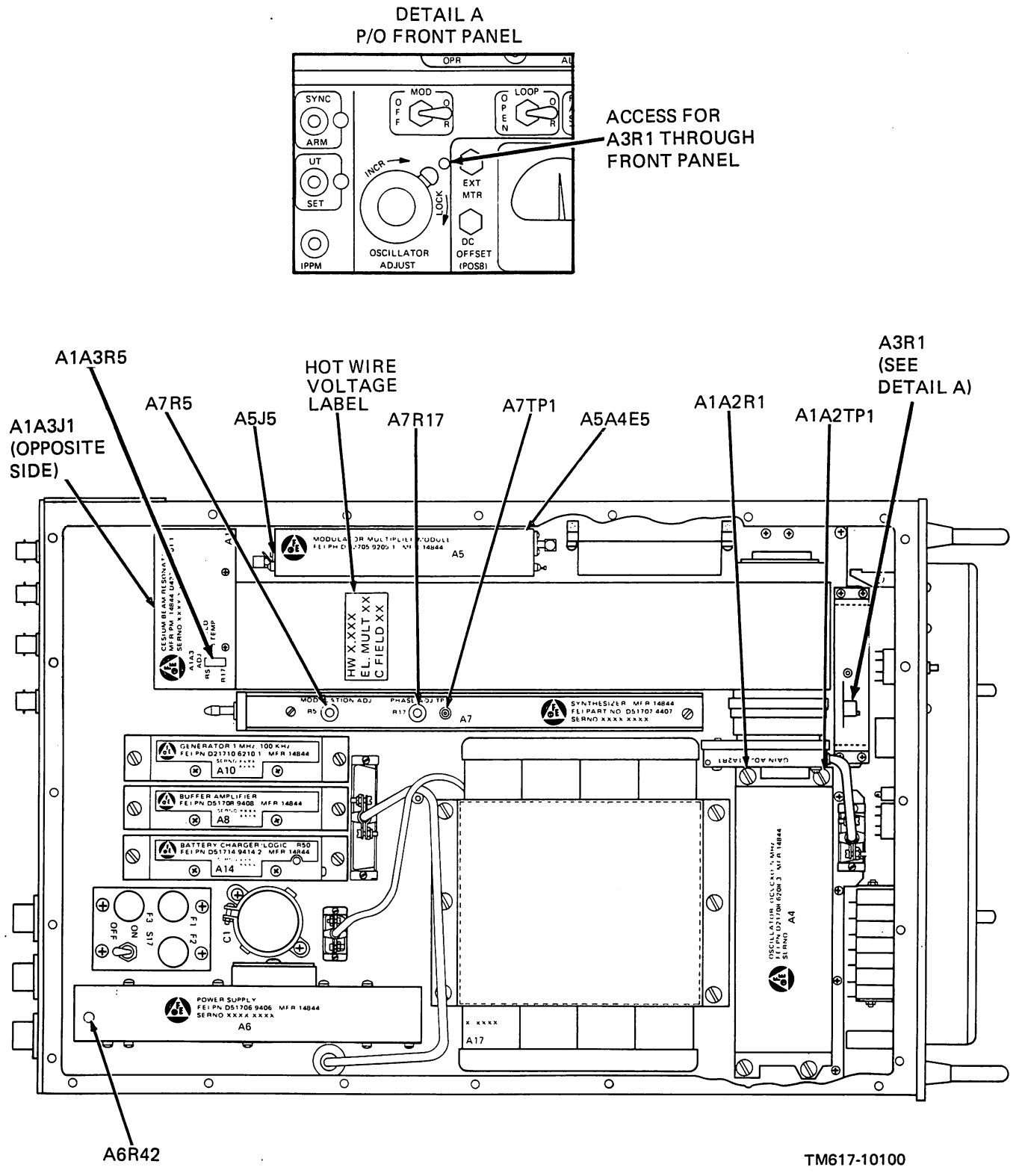


Figure 6-2. PRTC Alignment and Adjustment Locations
(Top Cover Removed)

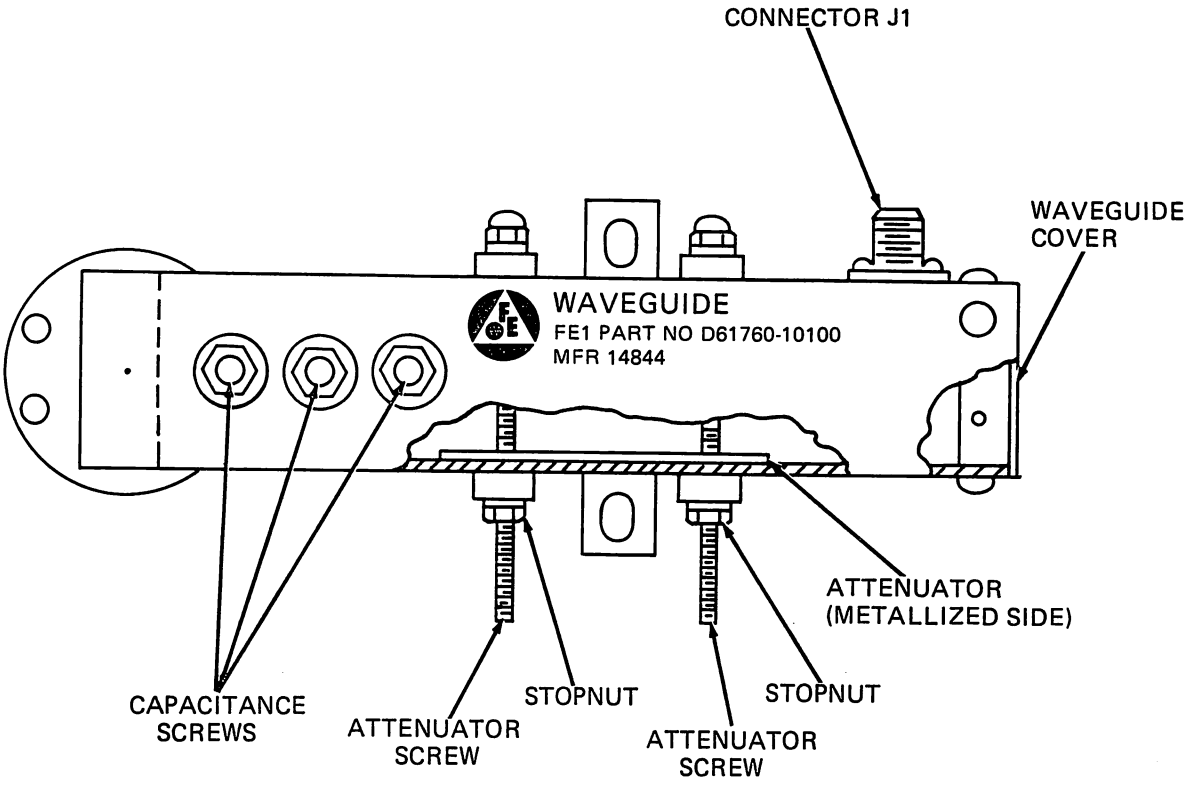


Figure 6-3. Waveguide Alignment/Adjustment Locations

b. Ensure ON/OFF power switch (2, figure 2-2) is set to ON position and allow unit to warm up for a minimum of 20 minutes.

c. Loosen knurled screws and lower access door on front panel.

d. Set MOD OFF/OPR switch (6, figure 2-1) to OPR position.

e. Set LOOP OPEN/OPER switch (9) to OPEN position.

f. Set oscilloscope as follows:
SYNC TO INTERNAL
TIME/DIV to 2 MSEC
V/CM to 0.2V

g. Connect oscilloscope probe to A7TP1 (figure 6-2) and observe that waveform as shown in figure 6-4A, is displayed on oscilloscope.

NOTE

Waveform may be inverted if incorrect frequency or no actual signal exists.

h. Reduce gain by varying A1A2R1 (figure 6-2) until waveform as shown in figure 6-4B is observed.

i. On front panel, vary OSCILLATOR ADJUST R1 (19, figure 2-1) for maximum positive amplitude. If necessary, reduce gain by varying A1A2R1 (figure 6-2).

j. Remove the three capacitance screws shown in figure 6-3 from waveguide.

k. While observing oscilloscope, move attenuator screws shown in figure 6-3 smoothly upward. The waveform should increase through a maximum peak then begin decreasing before the end of attenuator screw travel is reached. If this sequence is not observed, perform steps l, m, and n. If this sequence is observed, go to step o.

l. Move attenuator screws until one-half of the maximum peak is observed.

m. Install capacitance screws as required to achieve the maximum peak. Capacitance screws must not hit bottom of waveguide.

n. Tighten the capacitance screw stopnuts to secure capacitance screws, and repeat step k.

o. Secure attenuator screws to achieve the maximum peak by tightening attenuator screw stopnuts.

p. Replace capacitance screws, ensuring that the signal level remains at maximum.

q. On front panel, set LOOP OPEN/OPER switch (9, figure 2-1) to OPER position. Observe that SYSTEM LOCK OPR lamp (7) lights.

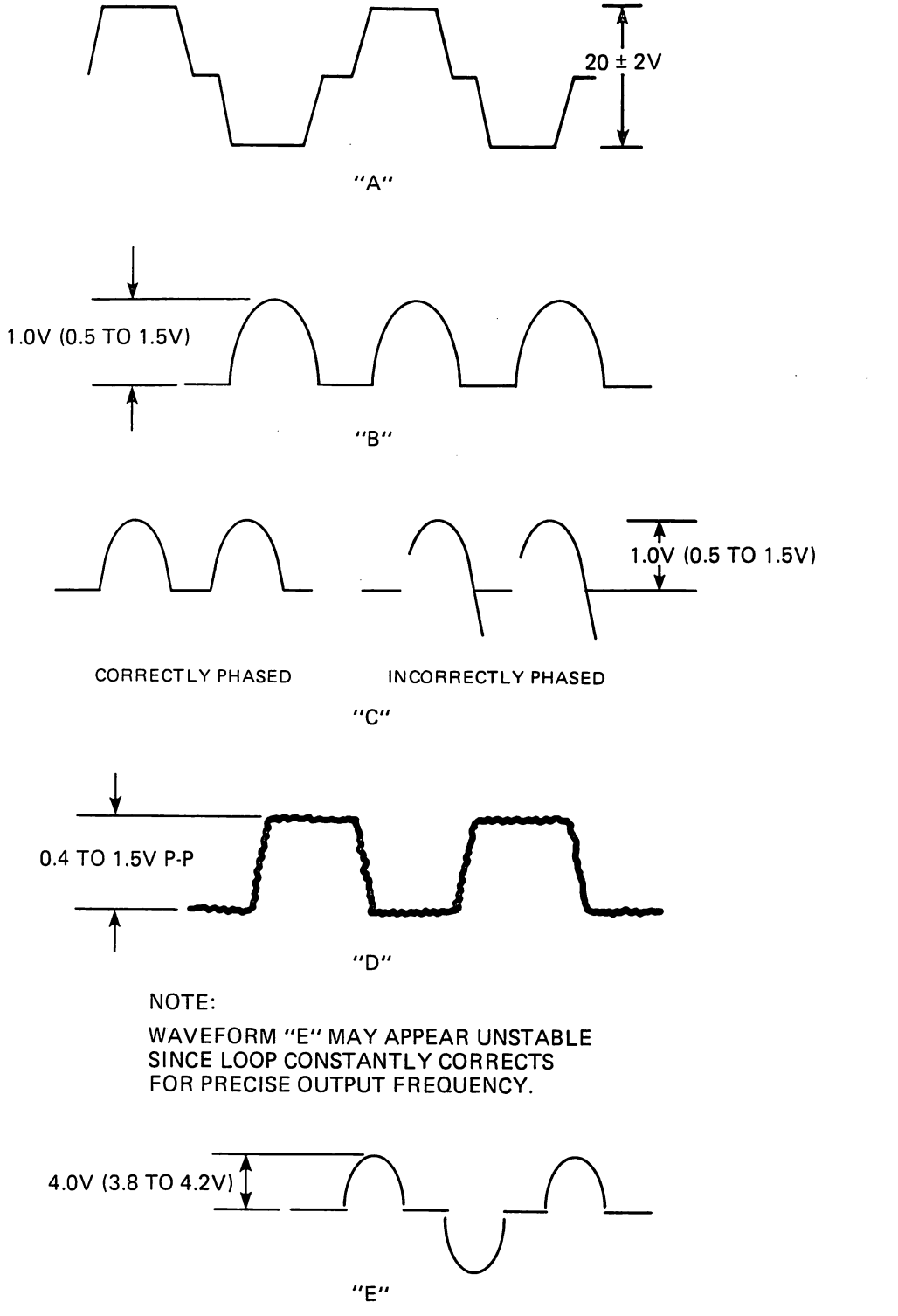


Figure 6-4. PRTC LOOP and Waveguide Alignment/Adjustment Waveforms

r. Depress SYSTEM LOCK RESET switch (8). Observe that SYSTEM LOCK ALARM lamp (10) goes out.

s. Disconnect oscilloscope probe from A7TP1 (figure 6-2). Set ON/OFF power switch (2, figure 2-3) to OFF position.

t. On rear panel, disconnect power cable from POWER IN 1 J14 or POWER IN 2 J15 connector (5 and 6, figure 2-4).

6-8. LOOP ALIGNMENT. Perform the loop alignment upon replacement of the waveguide assembly (see paragraph 6-16) or Cesium beam resonator assembly A1 (see paragraph 6-17) as follows:

NOTE

Refer to figure 6-2 for location of loop alignment adjustments and test points.

a. Remove top cover.

b. If necessary, perform turn-on procedure (paragraph 8-15).

c. Loosen two captive screws and lower front panel access panel.

d. Ensure that MOD OFF/OPR switch (6, figure 2-1) is set to OPR position.

e. Set LOOP OPEN/OPER switch (9) to OPEN position.

f. Set oscilloscope as indicated below:
   (1) Sync to internal
   (2) Time/division to 2 μSEC
   (3) Volts/division to 0.2 V

g. Connect oscilloscope probe to synthesizer module test point A7TP1. Observe waveform as shown in figure 6-4B. If waveform is incorrect, adjust Cesium beam resonator GAIN ADJ A1A2R1 for correct waveform.

h. Adjust front panel OSCILLATOR ADJUST (19, figure 2-1) for maximum positive amplitude of waveform displayed on oscilloscope. If distortion of waveform occurs readjust Cesium beam resonator GAIN ADJ A1A2R1.

i. Adjust synthesizer module MODULATION ADJ A7R5 for maximum amplitude of waveform displayed on oscilloscope, then turn MODULATION ADJ A7R5 one-half turn counterclockwise.

j. Adjust synthesizer module PHASE ADJ A7R17 for correctly phased waveform as shown. Correct and incorrect phased waveforms are shown in figure 6-4C.

k. Disconnect oscillosocpe probe from synthesizer module test point A7P1.

l. Connect oscilloscope probe to Cesium beam resonator test point A1A2TP1, preamplifier output signal. Observe waveform as shown in figure 6-4D. If waveform is correct, proceed to step s. If waveform is incorrect, proceed to step m.

m. Disconnect oscilloscope probe from Cesium beam resonator test point A1A2TP1.

n. Adjust electron multiplier high voltage power supply module adjustment A3R1 for waveform as shown in figure 6-4D.

o. Disconnect oscilloscope probe from Cesium beam resonator test point A1A2TP1.

p. Connect oscilloscope probe synthesizer module test point A7TP1.

q. Adjust front panel OSCILLATOR ADJUST (20, figure 2-1) for a zero amplitude waveform (straight line with no breaks).

r. Set front panel LOOP OPEN/OPER switch (9) to OPER.

s. Adjust Cesium beam resonator GAIN ADJ A1A2R1 for waveform as shown in figure 6-4E.

t. Disconnect oscilloscope probe from synthesizer module test point A7TP1.

u. Reinstall top and bottom covers.

6-9. 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: $\Delta f/f = 3.3 \times 10^{-10}\ \Delta H/H$. Thus, a 1% change in the C-field would cause a 3.3×10^{-12} change in output frequency. This makes the C-field a useful way to offset the output frequency of the Cesium standard.

6-10. 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 voltage across the C-field coil is monitored at A1A3J1 pin 3 (figure 6-2). 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.

6-11. The Cesium standard of the PRTC is set at the factory to be within 1×10^{-11} (3×10^{-11} is the accuracy specification). Some applications, however, may require that the standard be set to a closer tolerance, i.e., 2×10^{-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 3.3×10^{-10}.

c. Measure the C-field monitor voltage (Vc^1) at test point A1A3J1 pin 5.

d. Multiply step (b), by step (c).

i.e., $(\Delta f/f \div 3.3 \times 10^{-10}).\ Vc^1$

e. Subtract the number derived in step (d) from step (c).

i.e., $Vc^2 - (\Delta f/f \div 3.3 \times 10^{-10}).\ Vc^1$

f. Reset the C-field monitor voltage to that derived in step (e), by adjusting C–FIELD adjust A1A3R5.

g. Remeasure the output frequency to insure accuracy.

h. Repeat procedure if necessary.

6-12. Examples of applications that would require correcting the Cesium standard, including methods for calculation, are as follows:

a. A cesium standard is desired to be set within 3×10^{-12} of another reference. A measurement is made and the standard is found to be offset from the reference by $+8 \times 10^{-12}$.

Calculate: $8 \times 10^{-12} \div 3.3 \times 10^{-10} = .024$

b. A measurement of the C-field monitor reads 18.0 mv.

Calculate: $.024 \times 18 = 0.432.$

$18 - 0.432 = 17.568.$

c. The C-field is reset to provide a monitor voltage of 17.568. A remeasurement of the output shows an offset of 1.5×10^{-12} and the calibration is complete.

NOTE

If at a later time the C-field monitor voltage has been found to have changed from its previous value, the C-field **should not** be reset. This monitor voltage is a reference only. The C-field should only be reset when the output frequency needs a correction.

6-13. REMOVAL AND REPLACEMENT.

6-14. The following paragraphs contain removal and replacement procedures for the waveguide assembly, defective sub-assemblies, and chassis mounted connectors. For other chassis components, removal and replacement is obvious and therefore procedures are not necessary. During removal and replacement, refer to paragraphs 4-7 and 4-8 respectively for inspection and cleaning procedures.

6-15. PRTC COVERS. Prior to replacing waveguide assembly, defective sub-assemblies, or chassis mounted components, remove as required, the top or bottom cover (figure 8-4) as follows:

a. Disconnect external power source from rear panel POWER IN 1 and POWER IN 2 connectors (5 and 6, figure 2-4).

b. Remove 25 screws that secure top cover to chassis assembly and remove top cover.

c. Remove 25 screws that secure bottom cover to chassis assembly and remove bottom cover.

d. To reinstall, position top or bottom cover on chassis assembly, and replace screws.

e. Reconnect external power to PRTC as required.

6-16. WAVEGUIDE ASSEMBLY. Remove and replace the waveguide assembly as follows:

a. Disconnect semi-rigid coaxial cable from waveguide assembly.

b. Remove four screws and lockwashers, two nuts, and two spacers that secure waveguide assembly to Cesium beam resonator assembly A1.

c. Remove waveguide assembly.

d. Perform waveguide attenuator adjustment in accordance with paragraph 6-6 on replacement waveguide.

e. Secure replacement waveguide assembly to Cesium beam resonator assembly A1 with two spacers, nuts, four lockwashers, and screws.

f. Reconnect coaxial cable to waveguide assembly.

g. Perform PRTC waveguide alignment and loop alignment in accordance with paragraph 6-7 and 6-8 respectively.

6-17. CESIUM BEAM RESONATOR ASSEMBLY A1. Remove and replace the Cesium beam resonator assembly A1 as follows:

a. Refer to paragraph 6-16 a., b., and c. above and remove waveguide assembly.

b. Unplug connectors J1 and P1 from Cesium beam resonator assembly A1.

c. Remove four screws and washers securing spacers to chassis and remove Cesium beam resonator assembly A1.

d. Remove five screws securing spacers and shield to Cesium beam resonator assembly A1.

e. Secure spacers and shield to replacement Cesium beam resonator assembly A1 with five screws.

f. Secure spacers to chassis with four screws and washers.

g. Connect chassis harness connectors J1 and P1 to Cesium beam resonator assembly A1.

h. Perform hot-wire level adjustment and loop alignment in accordance with paragraphs 6-5 and 6-8 respectively.

6-18. VAC-ION HIGH VOLTAGE POWER SUPPLY MODULE A2. Remove and replace VAC-ION high voltage power supply module A2 as follows:

a. Tag and disconnect voltage cable from VAC-ION high voltage power supply module A2.

b. Tag and unsolder wires from VAC-ION high voltage power supply module A2.

c. Remove four screws, lockwashers, and flat washers that secure VAC-ION high voltage power supply module A2 to chassis and remove VAC-ION high voltage power supply module A2.

d. Secure replacement VAC-ION high voltage power supply module A2 to chassis with four screws, lockwashers, and flat washers.

e. Resolder wires to VAC-ION high voltage power supply module A2. Remove tags.

f. Connect coaxial cable VAC-ION high voltage power supply module A2. Remove tag.

6-19. ELECTRON MULTIPLIER HIGH VOLTAGE POWER SUPPLY MODULE A3. Remove and replace electron multiplier high voltage power supply module A3 as follows:

a. Tag and disconnect high voltage cable from electron multiplier high voltage power supply module A3.

b. Tag and unsolder wires from electron multiplier high voltage power supply module A3.

c. Remove two screws that secure electron multiplier high voltage power supply module A3 to chassis.

d. Remove four screws lockwashers, and flat washers that secure bracket and electron multiplier high voltage power supply module A3 to chassis and remove bracket and electron multiplier high voltage power supply module A3.

e. Secure bracket and replacement electron multiplier high voltage power supply module A3 to chassis with four screws, lockwashers, and flat washers.

f. Secure electron multiplier high voltage power supply module A3 to chassis with two screws.

g. Resolder wires to electron multiplier high voltage power supply module A3. Remove tags.

h. Connect coaxial cable to electron multiplier high voltage power supply module A3. Remove tag.

6-20. 5 MHz OCVCXO MODULE A4. Remove and replace 5 MHz OCVCXO module A4 as follows:

a. Loosen four captive screws that secure 5 MHz OCVCXO module A4 to chassis.

b. Unplug module A4 from connector J2 and remove OCVCXO module A4.

c. Plug replacement 5 MHz OCVCXO module A4 into connector J2.

d. Tighten two captive screws that secure OCVCXO module A4 to chassis.

6-21. MODULATOR/MULTIPLIER MODULE A5. Remove and replace modulator/multiplier module A5, as follows:

a. Tag and disconnect six cables from modulator/multiplier module A5.

b. Remove four screws, lockwashers, and flat washers that secure modulator/multiplier module A5 to chassis and remove modulator/multiplier module A5.

c. Secure replacement modulator/multiplier module A5 to chassis with four screws, lockwashers, and flat washers.

d. Connect six cables to modulator/multiplier module A5. Remove tags.

6-22. POWER SUPPLY MODULE A6. Remove and replace power supply module A6 as follows:

a. Loosen two captive screws that secure power supply module A6 to chassis.

b. Unplug power supply module A6 from connector J3 and remove power supply module A6.

c. Plug replacement power supply module A6 into connector J3.

d. Tighten two captive screws to power supply module A6 to chassis.

e. Perform hot-wire level adjustment in accordance with paragraph 6-5.

6-23. SYNTHESIZER MODULE A7. Remove and replace synthesizer module A7 as follows:

a. Remove two screws that secure synthesizer module A7 to chassis.

b. Unplug synthesizer module A7 from connectors J4 and J5 and remove synthesizer module A7.

c. Plug replacement synthesizer module A7 into connectors J4 and J5.

d. Secure synthesizer module A7 to chassis with two screws.

6-24. BUFFER AMPLIFIER MODULE A8. Remove and replace buffer amplifier module A8 as follows:

a. Loosen two captive screws that secure buffer amplifier module A8 to chassis.

b. Unplug buffer amplifier module A8 from connector J6 and remove buffer amplifier module A8.

c. Plug replacement buffer amplifier module A8 into connector J6.

d. Tighten two captive screws to secure buffer amplifier module A8 to chassis.

6-25. TOD CLOCK PC ASSEMBLY A9. Remove and replace TOD clock PC assembly A9 as follows:

a. Tag and disconnect connector P2 from rear of real TOD clock PC assembly A9 connector J1.

b. Remove two connector covers from coaxial connectors on front of TOD clock PC assembly A9.

c. Loosen two captive screws that secure TOD clock PC assembly A9 to chassis and remove TOD clock PC assembly A9.

d. Tighten two captive screws to secure replacement of TOD clock PC assembly A9 to chassis.

e. Replace two connector covers on coasial connectors on front of TOD clock PC assembly A9.

f. Connect connector P2 to rear of TOD clock PC assembly A9 connector J1. Remove tag.

6-26. GENERATOR MODULE A10. Remove and replace generator module A10 as follows:

a. Loosen two captive screws that secure generator module A10 to chassis.

b. Unplug generator module A10 from connector J7 and remove generator module A10.

c. Plug replacement generator module A10 into connector J7.

d. Tighten two captive screws to generator module A10 to chassis.

6-27. BATTERY CHARGER/LOGIC MODULE A14. Remove and replace battery charger/logic module A14 as follows:

a. Loosen two captive screws that secure battery charger/logic module A14 to chassis.

b. Unplug battery charger/logic module A14 from connector J11 and remove battery charger/logic module A14.

c. Plug replacement battery charger/logic module A14 into connector J11.

d. Tighten two captive screws to secure battery charger/logic module A14 to chassis.

6-28. BATTERY POWER SUPPLY MODULE A17. Remove and replace battery power supply A17 as follows:

a. Loosen four captive screws that secure battery power supply A17 to chassis.

b. Unplug battery power supply module A17 from connector J12 and remove battery power supply module A17.

c. Plug replacement battery power supply module A17 into connector J12.

d. Tighten four captive screws to secure battery power supply module A17 to chassis.

6-29. TOD DISPLAY PC ASSEMBLY A19. Remove and replace TOD display PC assembly A19 as follows:

a. Remove four screws, flat washers, and lockwashers securing TOD display PC assembly A19 to front panel.

b. Tag and disconnect wires from TOD display PC assembly A19.

c. Connect wires to replacement TOD display PC assembly A19 and remove tags from wires.

d. Secure TOD display PC assembly A19 to front panel with four screws, flat washers, and lockwashers.

6-30. METER DRIVER AMPLIFIER ASSEMBLY A25. Remove and replace meter driver amplifier assembly A25 as follows:

a. Unplug connector J28 from meter driver amplifier assembly A25.

b. Remove two screws, lockwashers, and flat washers that secure bracket and meter drive amplifier assembly A25 and remove bracket and meter drive amplifier assembly A25.

c. Remove two screws, four washers, two spacers, two insulating washers, two lockwashers, and two nuts that secure bracket meter driver amplifier assembly A25.

d. Secure bracket to replacement meter driver amplifier assembly A25 with two screws, four washers, two spacers, two insulating washers, two lockwashers, and two nuts.

e. Secure bracket and meter driver amplifier assembly A25 to chassis with two screws, lockwashers, and flat washers.

f. Connect connector J28 to meter driver amplifier assembly A25.

6-31. CONNECTORS J1 THROUGH J8. Remove and replace connectors J1 through J8 as follows:

a. Remove large nut that secures connector to be replaced to rear panel.

b. Remove small nut and wire from rear of chassis. Tag and disconnect lead.

c. Insert lead into replacement connector and secure to rear of chassis.

d. Secure replacement connector to rear panel with large nut that is supplied with replacement connector. Remove tag.

6-32. CONNECTORS J9 THROUGH J12 AND J23 THROUGH J27. Remove and replace connectors J9 through J12 and J23 through J27 as follows:

a. Remove nut, flat washer, and lug with wire that secures connector to be replaced to panel.

b. Tag and unsolder wire from lug (it defective).

c. Resolder wire to lug if required and remove tag.

d. Secure replacement connector to panel with nut and flat washer.

6-33. CONNECTORS J13 THROUGH J15. Remove and replace connectors J13 through J15 as follows:

a. Remove four mounting screws, flat washers, lockwashers and nuts that secure connector to be replaced to rear panel. Tag and unsolder wires from connector pins.

b. Insert wires into replacement connector and resolder wires to pins. Remove tags.

c. Secure replacement connector to rear panel with four screws, flat washers, lockwashers, and nuts.

6-34. CONNECTOR J28. Replace connector J28 as follows:

a. Remove nut securing phono jack connector from chassis front panel.

b. Tag and unsolder connector leads.

c. Solder lead into replacement phono jack connector and remove tag.

d. Secure replacement connector to front panel with nut.

6-35. CONNECTOR XA1J1. Remove and replace connector XA1J1 as follows:

a. Tag and unsolder leads from connector pins.

b. Remove two screws that secure connector and shell to chassis.

c. Secure replacement connector and shell to chassis with two screws.

d. Resolder leads to connector pins and remove tags.

6-36. CONNECTOR XA1P1 OR XA17P1. Remove and replace connector XA1P1 or XA17P1 as follows:

a. Remove two lock nut assemblies and associated hardware, securing connector to chassis.

b. Tag and unsolder leads from connector pins.

c. Resolder wires to replacement connector pins and remove tags.

d. Secure replacement connector to chassis with associated hardware.

6-37. CONNECTORS XA5J1, XA5J2, XA5J5, AND XA9P4 THROUGH XA9P9. Remove and replace connectors XA5J1, XA5J2, XA5J5, and XA9P4 through XA9P9 as follows:

a. Tag and unsolder leads from connector.

b. Solder wire to replacement connector and remove tag.

6-38. CONNECTORS XA4P1, XA6P1, XA7P1, XA7P2, XA8P1, XA10P1, AND XA14P1. Remove and replace connectors XA4P1, XA6P1, XA7P1, XA7P2, XA8P1, XA10P1 and XA14P1 as follows:

a. Remove two nuts and associated hardware securing connector to chassis.

b. Tag and unsolder leads from connector pins.

c. Resolder leads to replacement connector pins and remove tags.

d. Secure replacement connector to chassis with two nuts and associated hardware.

6-39. CONNECTOR XA9J1. Remove and replace connector XA9J1 as follows:

a. Remove two screws securing connector assembly to chassis.

b. Remove two screws and nuts securing clamp around electrical wire bundle.

c. Unsolder wires from connector and tag leads.

d. Insert wires into replacement connector and solder wires to pins. Remove tags.

e. Secure clamp around electrical wire bundle with two screws and nuts.

f. Secure replacement connector assembly to chassis with two screws.

6-40. PRTC CHECKOUT.

6-41. Upon completion of any corrective maintenance, conduct the performance test referenced in paragraph 4-13 to ensure satisfactory PRTC operation.

CHAPTER 7

ILLUSTRATED PARTS LIST

7-1. INTRODUCTION.

7-2. This chapter contains illustration and parts list for the PRTC, Model FE-5450A, part number D61700-10100, manufactured by Frequency Electronics, Incorporated.

7-3. PARTS IDENTIFICATION.

7-4. Table 7-1 and 7-2 lists the PRTC subassemblies and chassis mounted components respectively in reference designation order. The subassemblies and chassis components are keyed by reference designator to figures 7-1 and 7-2 respectively. The parts list is divided into four columns as described on the following pages.

7-5. REFERENCE DESIGNATION. This column contains the reference designation of the listed subassembly or chassis component in alpha-numeric sequence.

7-6. DESCRIPTION COLUMN. This column contains the nomenclature of the listed subassembly or chassis component.

7-7. MANUFACTURER'S CODE IDENTIFICATION COLUMN. This column lists the manufacturer's five-digit federal supply code. This code is also listed and keyed to the manufacturer's name and address in table 7-3.

7-8. PART NUMBER COLUMN. This column contains the vendor's part number for the listed subassembly or component.

TABLE 7-1. PORTABLE REAL TIME CLOCK MODEL FE-5450A
SUB ASSEMBLY PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MFG CODE IDENT	PART NUMBER
–	Portable Real Time Clock Model FE-5450A	14844	D61700-10100
A1	Cesium Beam Resonator Assembly	14844	D42701-9201-1
A2	High Voltage Power Supply, Vac-Ion	14844	D42702-9202-1
A3	High Voltage Power Supply, Electron Multiplier	14844	D42703-9203-1
A4	Oscillator, OCVCXO, 5 MHz Module	14844	D21708-6208-3
A5	Modulator/Multiplier Module	14844	D42705-9205-1
A6	Power Supply Module	14844	D51706-9406
A7	Synthesizer Module	14844	D51707-9407
A8	Buffer Amplifier Module	14844	D51708-9408
A9	Real Time-Of-Day Clock PC Assembly	14844	D62000-10109
A10	Generator Module, 1 MHz, 100 kHz	14844	D21710-6210-1
A11 thru A13	Not Used		
A14	Battery Charger/Logic Module	14844	D51714-9414-2
A15 and A16	Not Used		
A17	Battery Power Supply Module	14844	D51717-9417-1
A18	Not used		
A19	Time-Of-Day Display PC Assembly	14844	D22001-6209
A20 thru A24	Not Used		
A25	Meter Driver Amplifier Assembly	14844	D62200-10125
–	Waveguide Assembly	14844	D61760-10100
–	Cable, Semi-Rigid Assembly	14844	C51786-9400-2
–	Harness Assembly	14844	D45874-9171

TABLE 7-2. PORTABLE REAL TIME CLOCK MODEL FE-5450A CHASSIS SUB-ASSEMBLY COMPONENTS PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MFG CODE IDENT	PART NUMBER
C1	Capacitor, polycarb, 2800 μF -10 +75%, 75 Vdc	14844	A22742-6200-1
C2	Capacitor, tantalum, 6.8 μF ±10%, 50 Vdc	81349	CSR13G685KR
C3 and C4	Not Used		
C5 thru C9	Capacitor, ceramic, 0.1 μF ±10%, 50 Vdc	81349	CKR05BX104KR
CR1 thru CR10	Not Used		
CR11	Diode	04713	1N5550A
CR12	Diode, switching	81349	JANTX1N5802
CR13 thru CR17	Diode, switching	81349	JANTX1N4148
DS1	Diode, light emitting, red	14844	A40324-SCD-4700
DS2	Diode, light emitting, amber	14844	A40324-SCD-4719
DS3 thru DS5	Diode, light emitting, green	14844	A40324-SCD-3507
DS6 and DS7	Not Used		
DS8 and DS9	Same as DS3		
DS10	Same as DS2		
F1 thru F3	Fuse, 4A	75915	312004
J1 thru J5	Connector, BNC	91836	KC-19-110
J6	Not Used		
J7 and J8	Same as J1		
J9 thru J12	Connector, BNC	02660	UG-625B/U
J13	Connector	71468	MS3112E-12-8S
J14 and J15	Connector	71468	MS3112E-12-3PY
J16 thru J22	Not Used		
J23 thru J27	Connector, RF type BNC, type UG-625 B/U	81349	M39012/21-001
J28	Connector, phono jack, micro jax	82389	TR-2A
K1	Relay	81349	M5757/13-056
M1	Meter	14844	D22799-6200
R1	Resistor, multi-turn, 20K ohms ±10%, 2W	14844	A22785-6200
R2	Resistor, variable, 20K ohms ±10%, 1/2 W	80294	3292L-1-203M

TABLE 7-2. PORTABLE REAL TIME CLOCK MODEL FE-5450A CHASSIS SUB-ASSEMBLY COMPONENTS PARTS LIST (CONT'D)

REFERENCE DESIGNATION	DESCRIPTION	MFG CODE IDENT	PART NUMBER
R3 and R4	Resistor, composition, 100 ohms ±5%, 1/8 W	81349	RLR05G1000KS
R5	Not Used		
R6 and R7	Resistor, composition, 330 ohms ±5%, 1/8 W	81349	RLR05G3300KS
R8	Resistor, Wirewound, Power 20 ohms, 20 W	91637	ERH-25
S1	Switch, pushbutton	04426	76-2222-404
S2	Switch, spdt	09353	7101-MYZ-GE
S3 thru S11	Same as S1		
S12	Switch, 7 section thumbwheel	14844	7R1Q7656G
S13 and S14	Switch, dpdt	95146	MTL-206N
S15	Switch, spdt	95146	MTL-1060
S16	Not Used		
S17	Switch, spdt	95146	MTL-406N
U1 and U2	Integrated circuit, rectifier	14099	SCPA-2
XA1J1	Connector	81349	M24308/1-2
XA1P1	Connector	71468	DAMM7W2S
XA2P1 and XA3P1	Not Used		
XA4P1	Connector	71468	DBMMF13W3S
XA5J1 and XA5J2	Connector, coaxial, RT angle SMA	14844	55-628-9196-31
XA5J3 and SA5J4	Not Used		
XA5J5	Same as XA5J1		
XA6P1	Connector	71468	DBMMF25S
XA7P1	Connector	71468	DCMMF21WA4S
XA7P2	Connector	71468	DBMMF9W4S
XA8P1	Connector	71468	DCMMF13W6S
XA9J1	Connector	81349	M24308/1-4
XA9P1 thru XA9P3	Not Used		
XA9P4 thru XA9P9	Connector, 16 Pin Plug Carrier	14844	A40525-SCD-AG16

TABLE 7-2. PORTABLE REAL TIME CLOCK MODEL FE-5450A CHASSIS SUB-ASSEMBLY COMPONENTS PARTS LIST (CONT'D)

REFERENCE DESIGNATION	DESCRIPTION	MFG CODE IDENT	PART NUMBER
XA10P1	Same as XA7P2		
XA11P1 thru XA13P1	Not Used		
XA14P1	Same as XA6P1		
XA15P1 and XA16P1	Not Used		
XA17P1	Connector	81349	M24308/1-1
XF1 thru XF3	Fuseholder	75915	342-004

TABLE 7-3. LIST OF MANUFACTURERS

CODE NUMBER	MANUFACTURER AND ADDRESS
02660	Bunkerramo Corp. Amphenol Connector Div. 2801 S. 25th Avenue Broadview, IL 60153
04426	Illinois Tool Works Inc. Licon Div. 6615 W. Irving Park Rd. Chicago, IL 60634
04713	Motorola Semiconductor Prod. Sales Sub. of Motorola Inc. 4828 E. McDowell Road Phoenix, AZ 85008
09353	Translite Engineering Co. Reseda, CA 91335
14099	Steconne Products Co. 8479 Pardee Drive Oakland, CA 94621 3999
14844	Frequency Electronics Inc. 55 Charles Lindberg Blvd. Mitchel Field, NY 11553

TABLE 7-3. LIST OF MANUFACTURERS (CONT'D)

CODE NUMBER	MANUFACTURER AND ADDRESS
71468	ITT Cannon Electric Division of International Telephone and Telegraph Corp. 10550 Talbert Avenue P.O. Box 8040 Fountain Valley, CA 93643
75915	Littlefuse Inc. 800 E. Northwest Hwy. Des Plaines, IL 60016
80294	Bourns Instruments Inc. 1200 Columbia Avenue Riverside, CA 92506
81349	Military Specifications Promulgated by Military Departments/Agencies Under Authority of Defense Standardization Manual 4120 3-M
82389	Switchcraft Inc. 5555 N. Elston Avenue Chicago, IL 60630
91637	Dale Electronics Inc. P.O. Box 609 Columbus, NE 68601
91836	Kings Electronics Co. Inc. 40 Marbledale Road Tuckahoe, NY 10707
95146	Alco Electronic Products Inc. 1551 Osgood Street North Andover, MA 01845

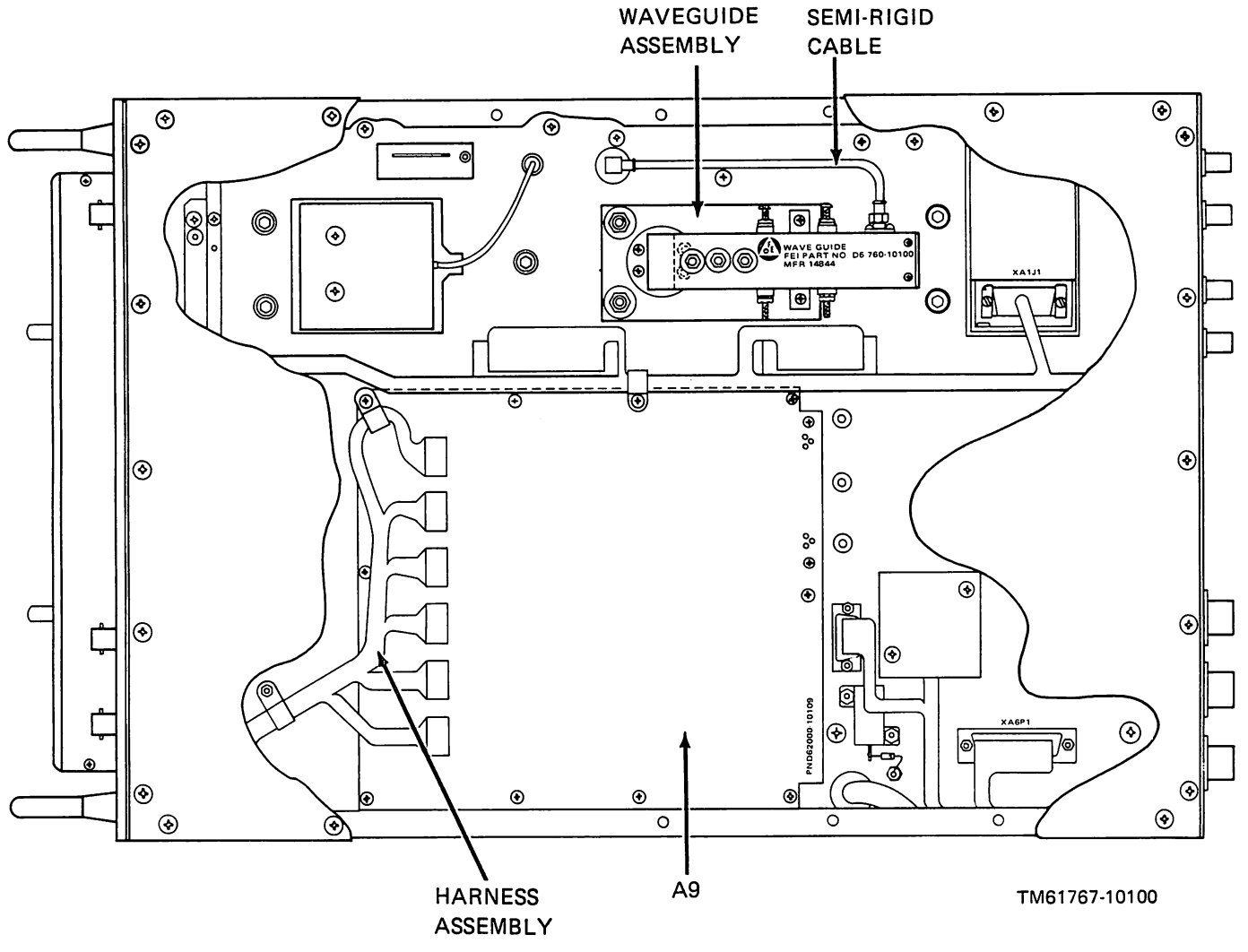


Figure 7-1. PRTC Subassemblies Location Diagram (Sheet 1 of 3)

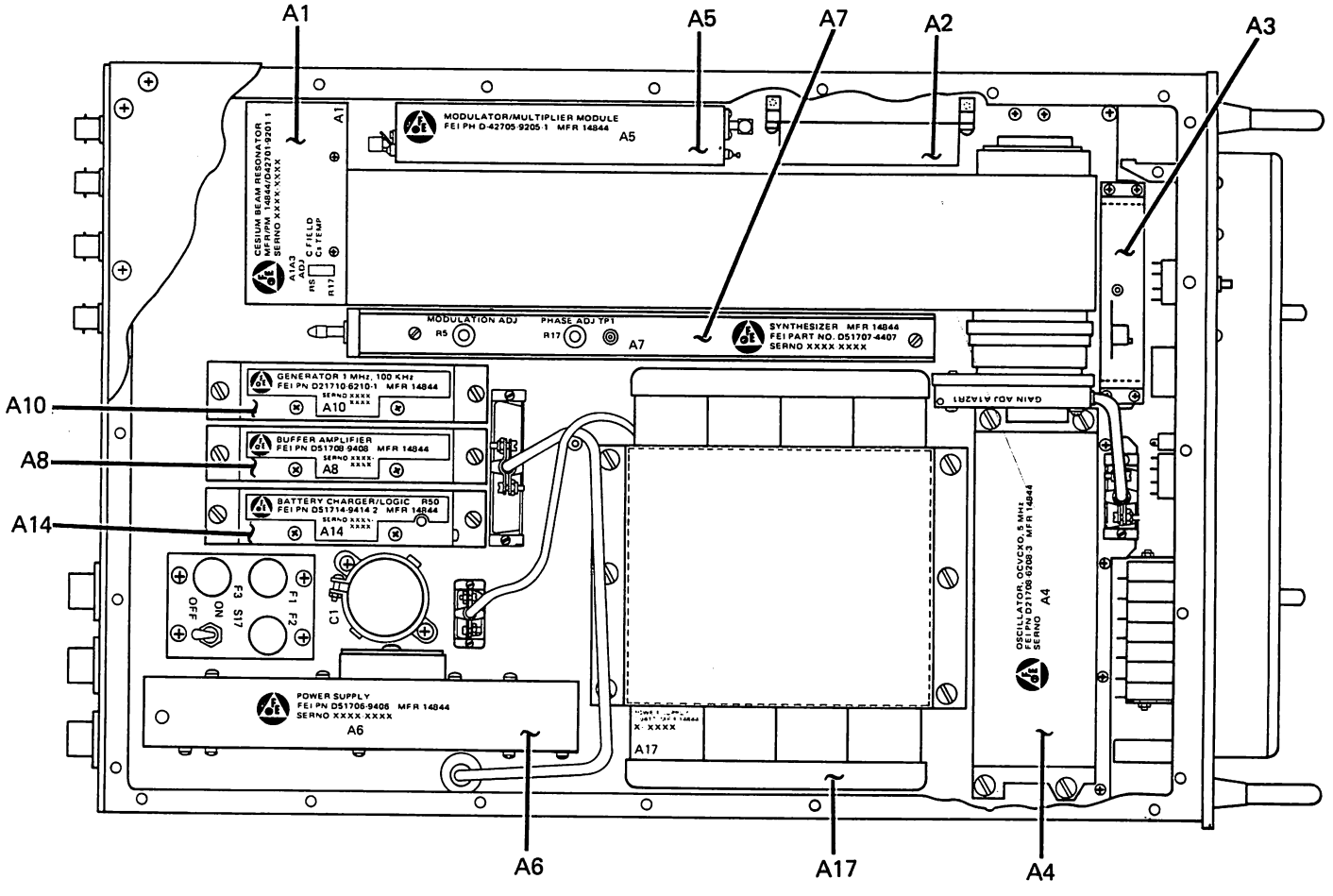


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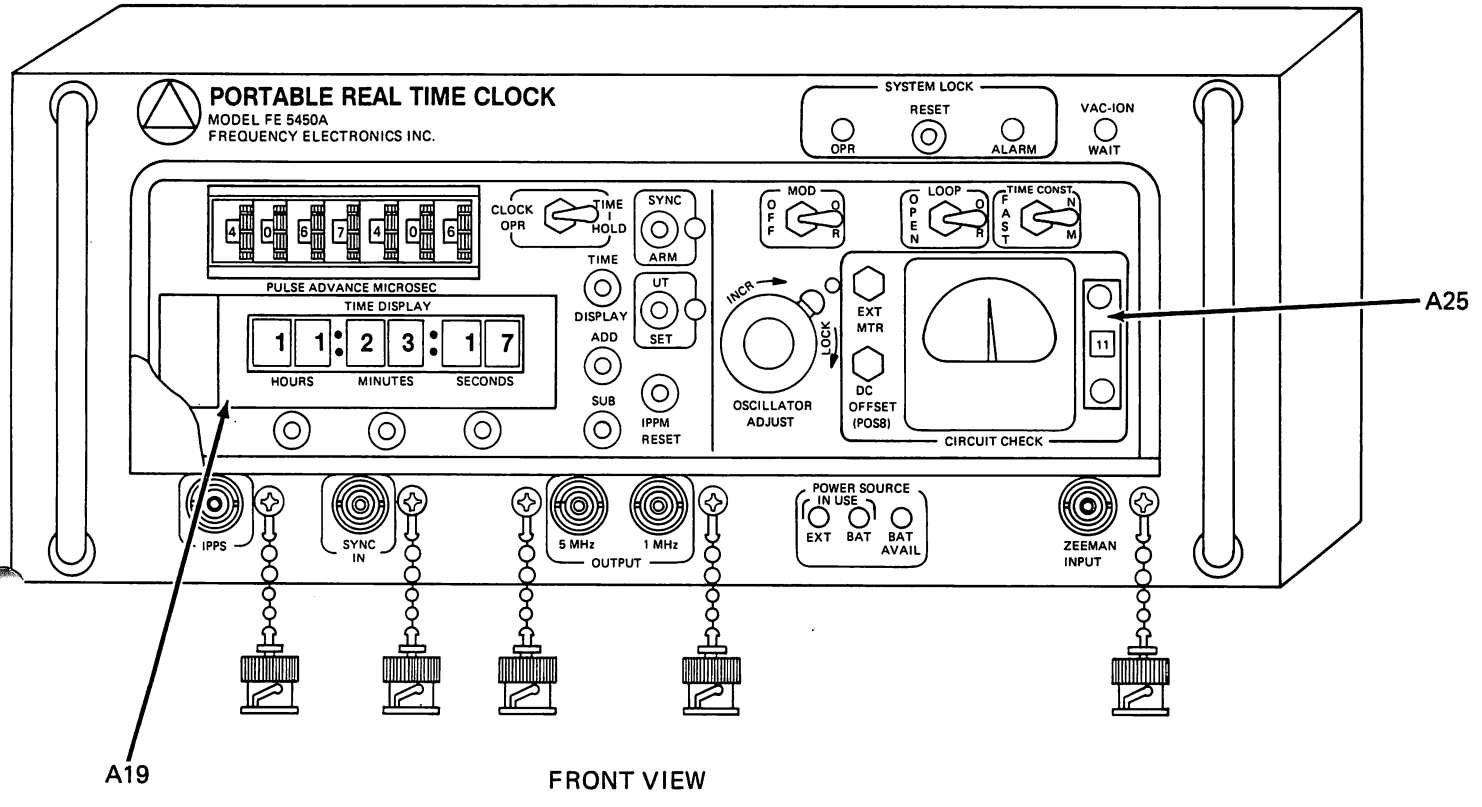
Figure 7-1. PRTC Subassemblies Location Diagram (Sheet 2 of 3)



FRONT VIEW

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Figure 7-1. PRTC Subassemblies Location Diagram (Sheet 3 of 3)

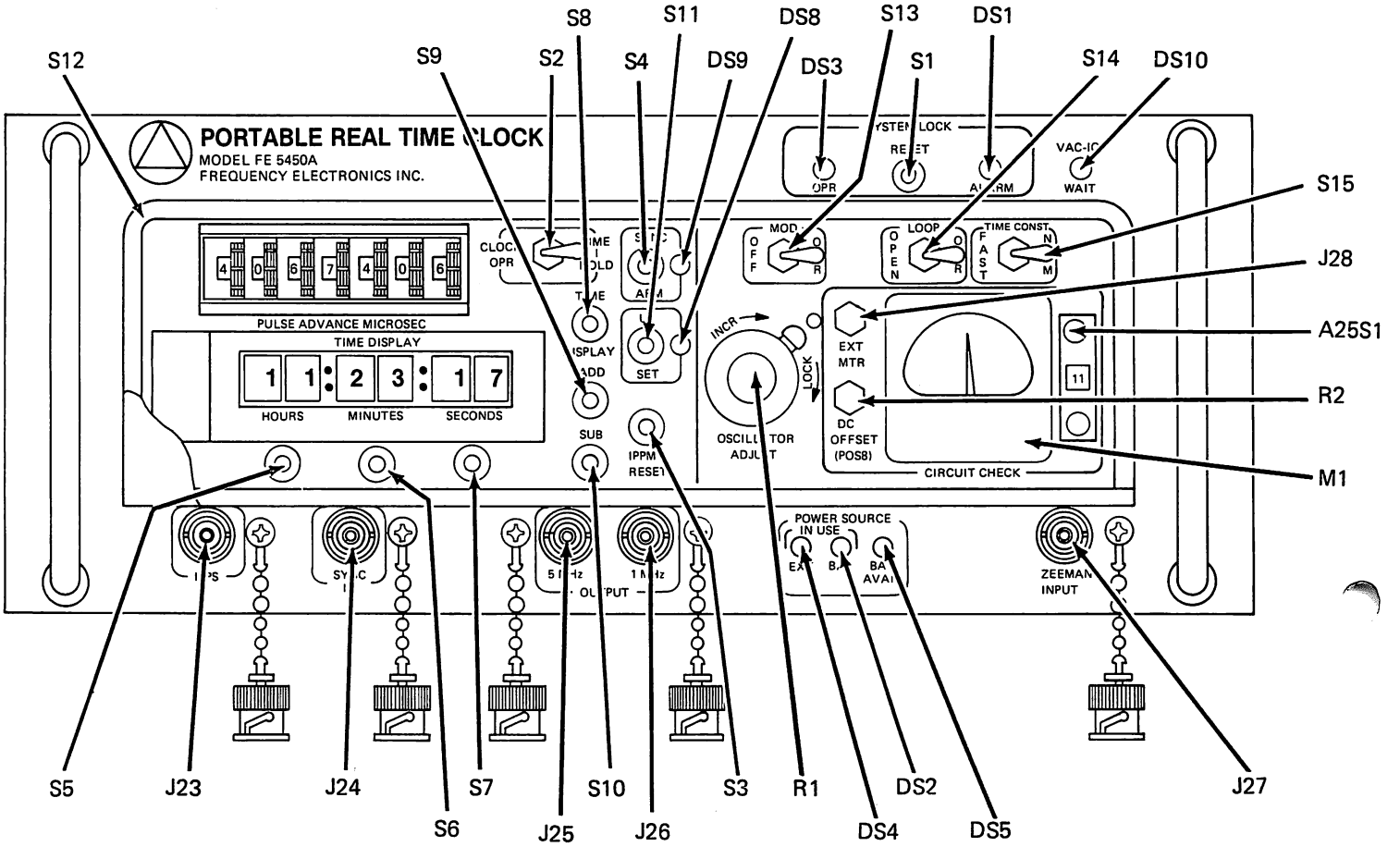

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Figure 7-2. Chassis Subassembly Component Location Diagram (Sheet 1 of 6)

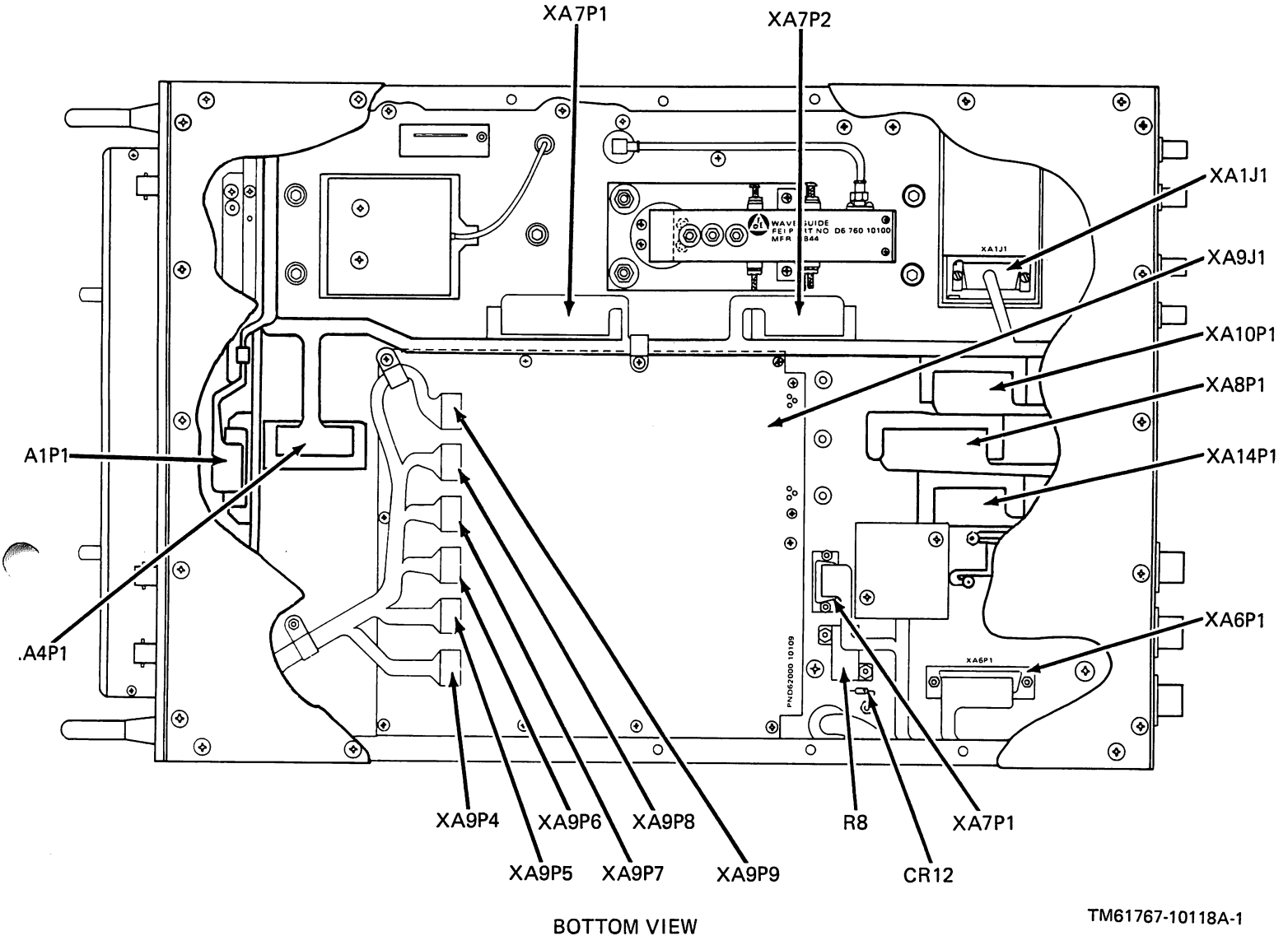

Figure 7-2. Chassis Subassembly Component Location Diagram (Sheet 2 of 6)

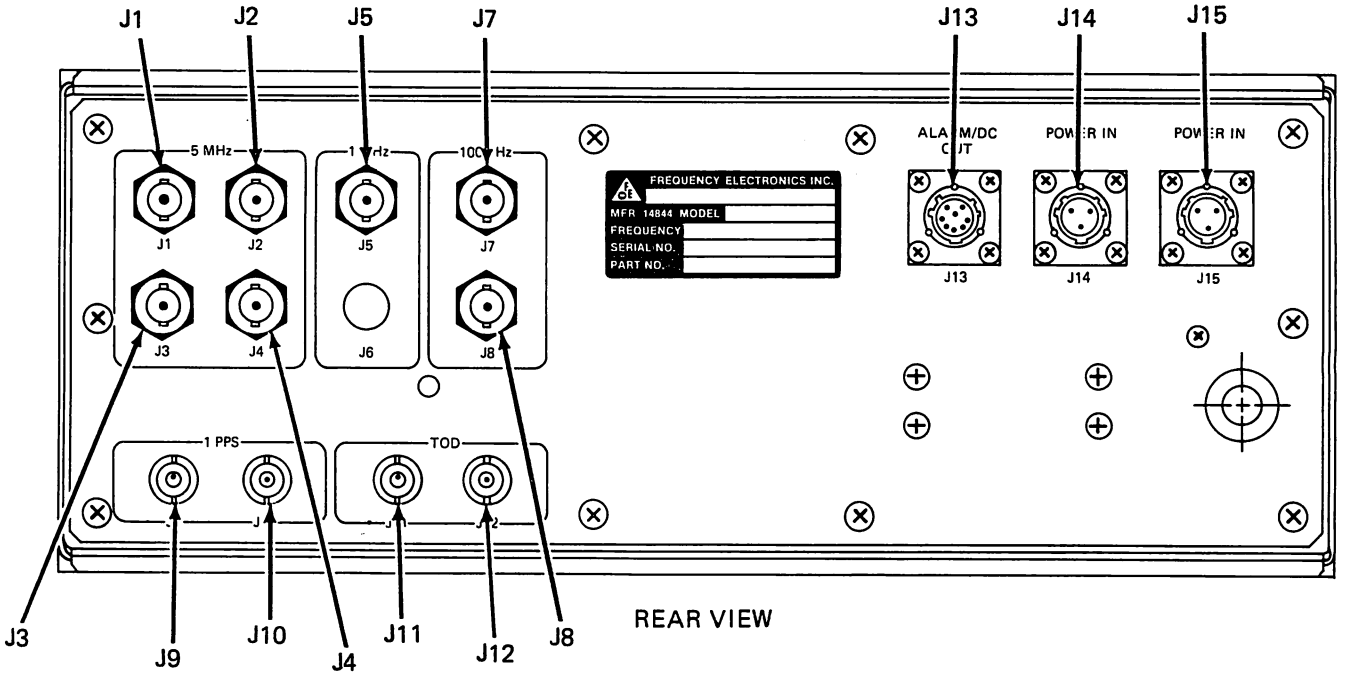

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Figure 7-2. Chassis Subassembly Component Location Diagram (Sheet 3 of 6)

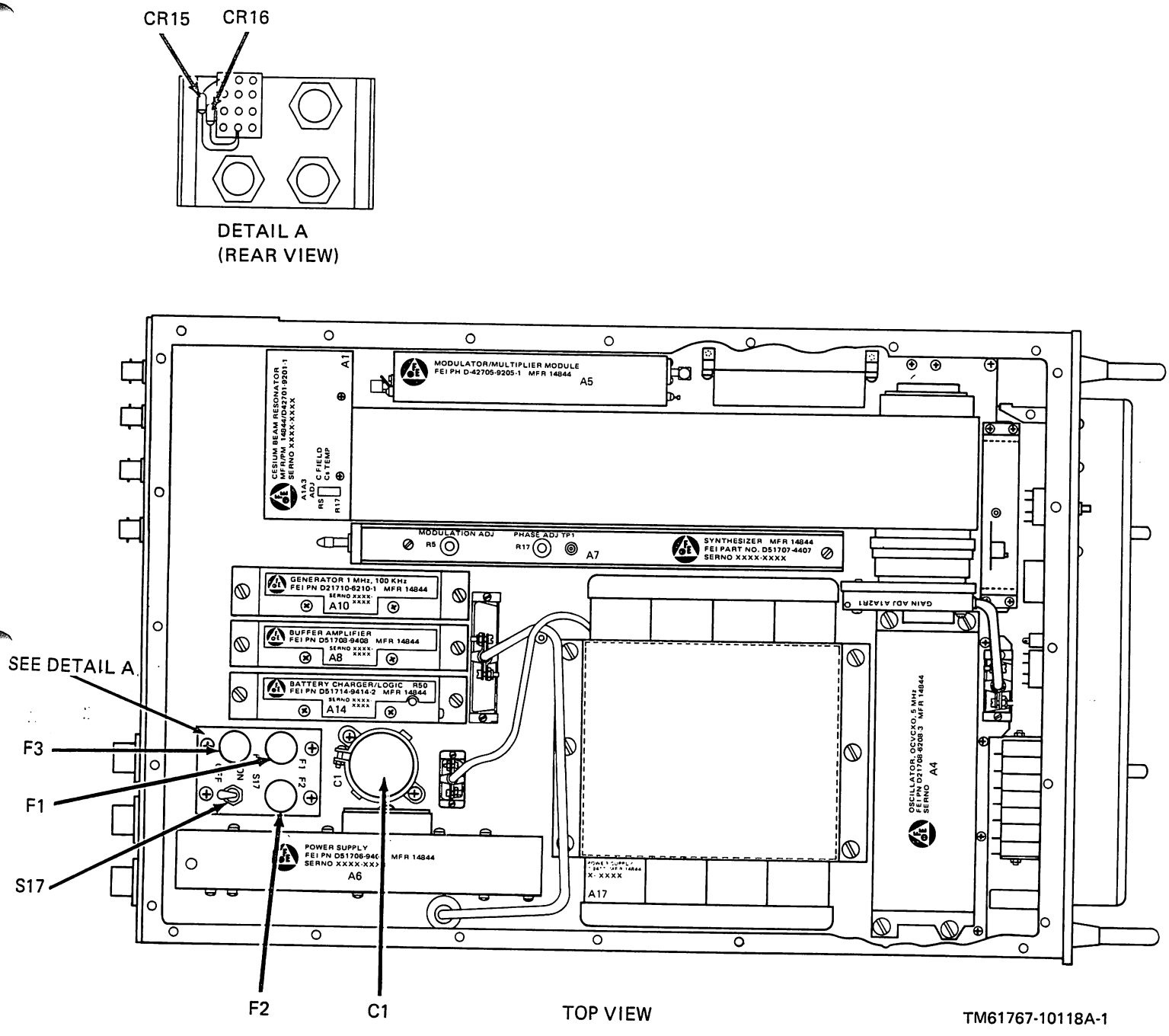

Figure 7-2. Chassis Subassembly Component Location Diagram (Sheet 4 of 6)

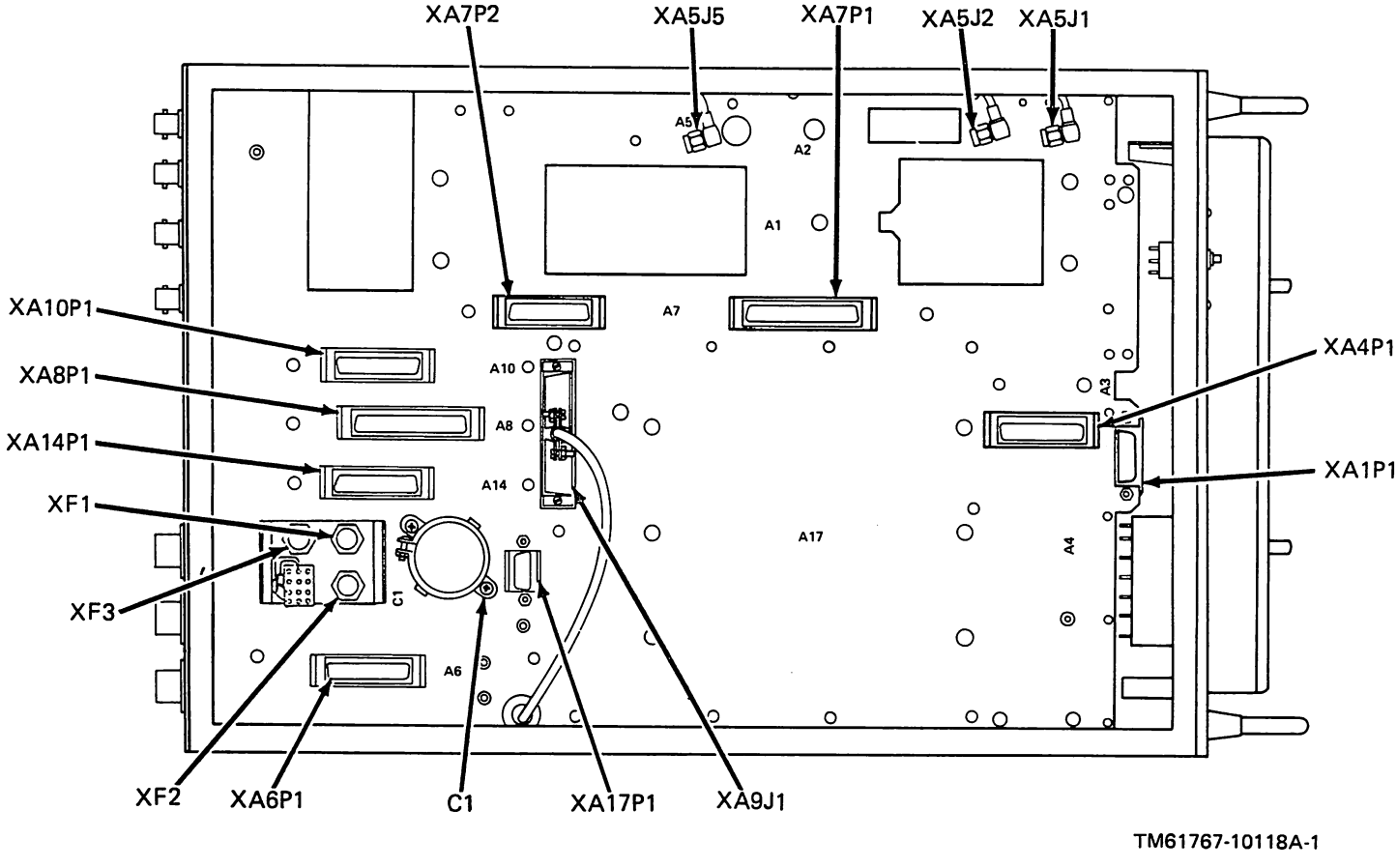

Figure 7-2. Chassis Subassembly Component Location Diagram (Sheet 5 of 6)

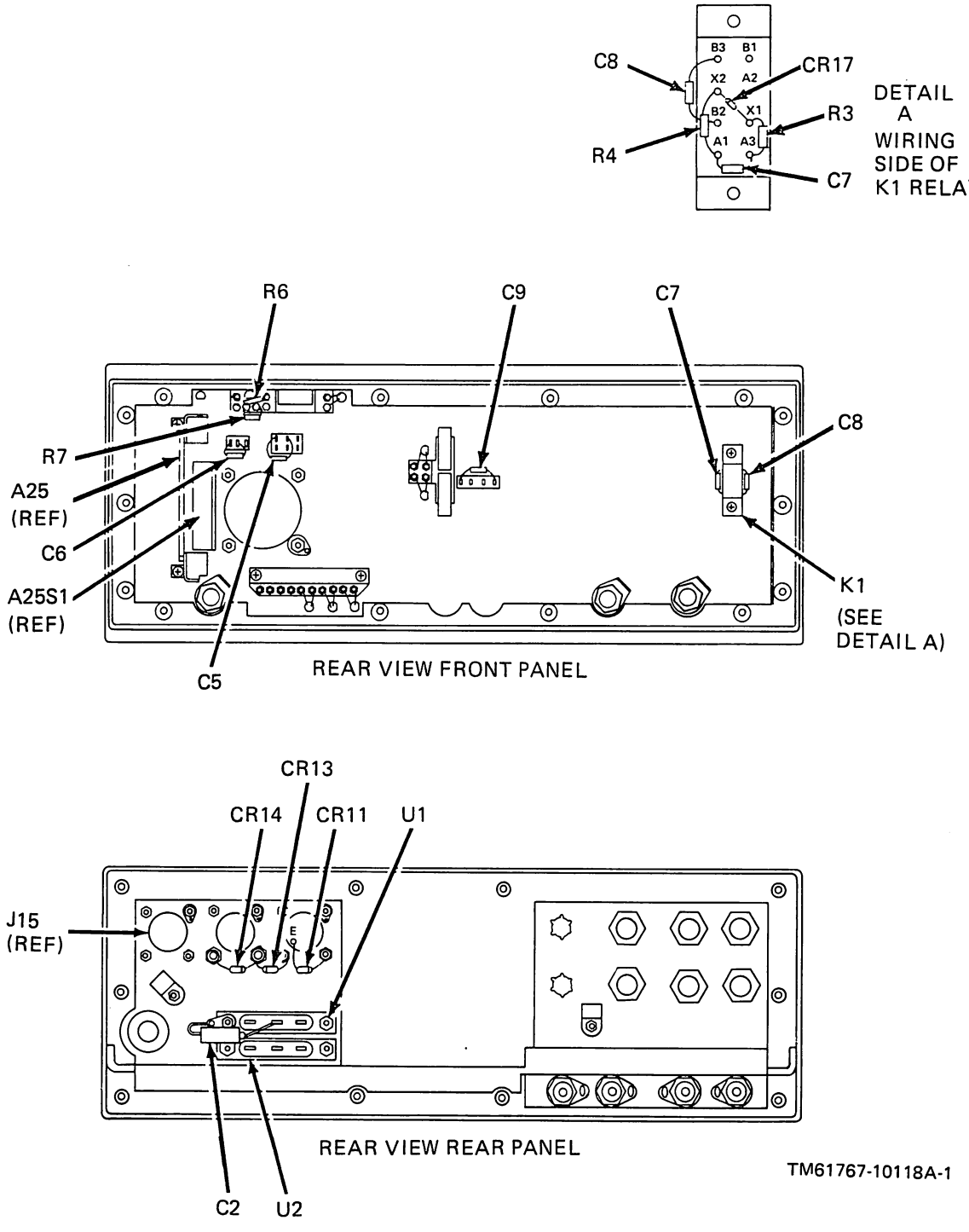

Figure 7-2. Chassis Subassembly Component Location Diagram (Sheet 6 of 6)

CHAPTER 8

INSTALLATION

8-1. INTRODUCTION.

8-2. This chapter contains instructions for unpacking, inspecting, installing, and initial operation of PRTC Model FE-5450A.

8-3. SITE INFORMATION.

8-4. The PRTC, Model FE-5450A is a bench mounted instrument. If required, it can be modified for installation in a standard 19-inch electrical equipment rack or cabinet. Figure 8-1 illustrates the PRTC's overall dimensions as a bench mounted unit.

8-5. UNPACKING AND REPACKING.

8-6. The following paragraphs contain the information necessary for unpacking and repacking the PRTC.

8-7. UNPACKING. To unpack the PRTC, proceed as follows:

CAUTION

Do not use sharp instrument to open shipping container.

a. Carefully open shipping container and remove packing material.

b. Remove PRTC from shipping container.

c. Save shipping container and packing material for repacking.

8-8. REPACKING. To repack the PRTC for shipment, proceed as follows:

a. Carefully place PRTC in shipping container.

b. Place packing material secured around PRTC to ensure adequate protection while in transit.

c. Secure shipping container.

8-9. INSPECTION.

8-10. Upon removal of PRTC from shipping container, visually inspect unit for possible damage caused in transit as follows:

a. Inspect all equipment for obvious signs of physical damage.

b. Inspect all front end rear panel controls, indicators and connectors for cracks, breaks, or other physical damage.

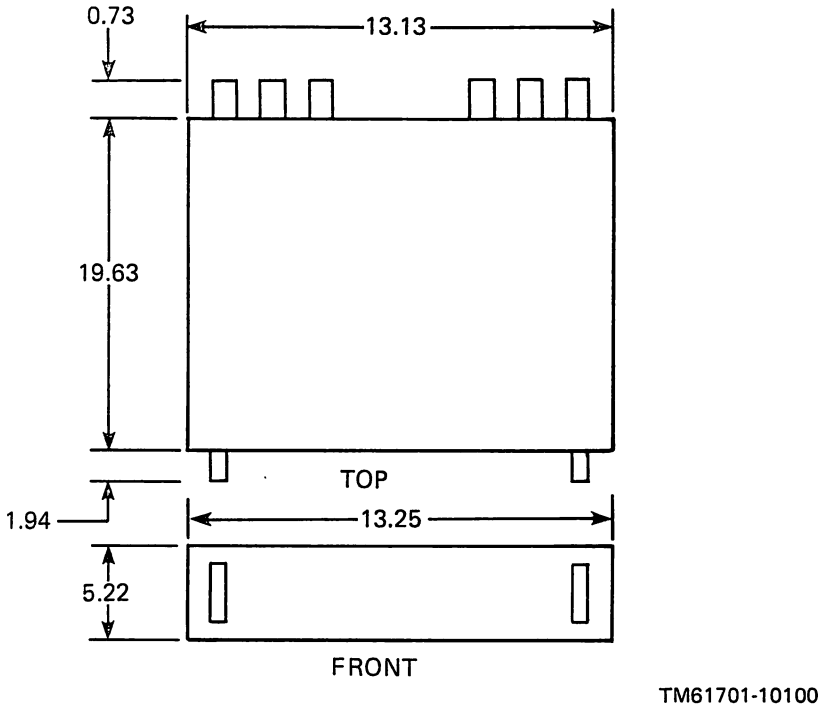

Figure 8-1. PRTC Outline Dimensional Drawing

8-11. INPUT POWER REQUIREMENTS.

8-12. The input power requirements for the PRTC is +22 Vdc to +30 Vdc. The PRTC contains provisions for two independent sources of external dc power. One source serves as a primary source while the second serves as a backup. Should both external dc power sources fail, the battery power supply module A17 provides for PRTC operating power not to exceed one hour.

8-13. PRTC CABLE FABRICATION.

8-14. Fabricate cables for PRTC as follows:

a. Refer to figure 8-2 and fabricate one end of POWER IN 1 and POWER IN 2 cables for rear panel connectors J14 and J15 (5 and 6, figure 2-4). Fabricate opposite end for connection to external power source.

b. Refer to figure 8-3 and fabricate one end of ALARM/DC OUT cable for rear panel connector J13 (4, figure 2-4). Fabricate opposite end for connection to external alarm.

c. Connect POWER IN 1 and POWER IN 2 cables to connectors J14(5) and J15(6) respectively. Connect opposite end of cables to external power source.

d. Connect ALARM/DC OUT cable to connector J13(4). Connect opposite end to external alarm.

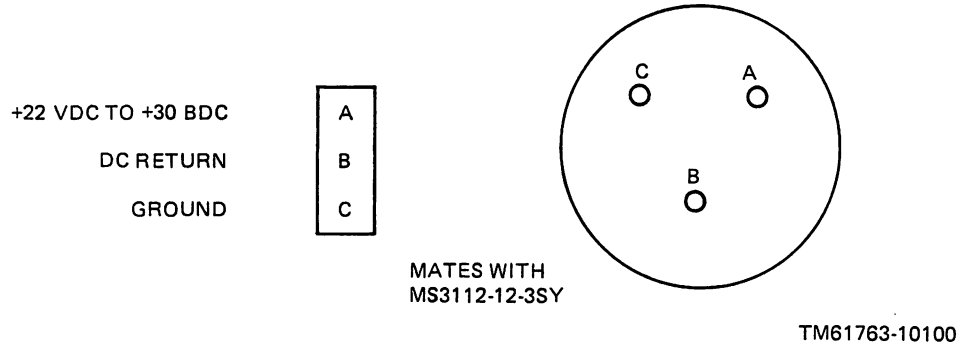

Figure 8-2. Pin Connections for POWER IN 1 Connector J14 and POWER IN 2 Connector J15.

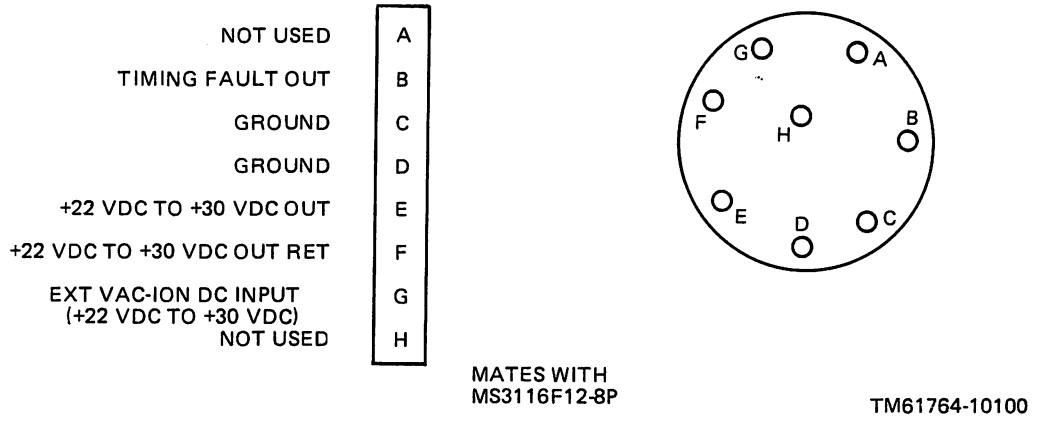

Figure 8-3. Pin Connections for ALARM/DC OUT Connector J13.

8-15. INITIAL TURN-ON PROCEDURE.

8-16. To turn on the PRTC perform the following procedure:

NOTE

The PRTC internal battery is discharged when shipped from the factory. Unit must therefore be operated a minimum of 16 hours for battery to be fully charged.

a. On PRTC front panel (3, figure 8-4), turn two Dzus fasteners (4) counterclockwise and allow cover to swing down.

b. On front panel, set LOOP OPEN/OPER switch (9, figure 2-1) to OPEN position.

c. Set TIME CONST FAST/NORM switch (11) to NORM position.

d. Set MOD OFF/OPR switch (6) to OPR position.

e. Remove 25 screws (1, figure 8-4) securing top cover (2) to PRTC chassis. Remove top cover (2).

f. Set ON/OFF switch S17 (2, figure 2-2) to ON position.

g. Replace top cover (2, figure 8-4) on PRTC chassis and secure with 25 screws (1).

h. Allow a minimum of 30 minutes for PRTC to stabilize.

i. Depress SYSTEM LOCK RESET pushbutton switch (8, figure 2-1) to reset (extinguish) SYSTEM LOCK ALARM indicator (10).

j. Set time of day (TOD) as specified in paragraph 2-7.

8-17. INSTALLATION VERIFICATION TEST.

8-18. Installation verification test of the PRTC is accomplished by performing the scheduled operational checks referenced in paragraph 4-9.

8-19. PREPARATION FOR STORAGE.

8-20. Perform the following procedure when the PRTC is to be taken out of service.

a. Remove 25 screws (1, figure 8-4) securing top cover (2) to PRTC chassis. Remove top cover (2).

b. Set ON/OFF switch S17 (2, figure 2-2) to OFF position.

NOTE

Disconnecting external dc power prior to turning off switch S17 will cause the PRTC to switch to internal battery.

c. Replace top cover (2, figure 8-4) on chassis and secure with 25 screws.

d. Disconnect all input and output cables from PRTC.

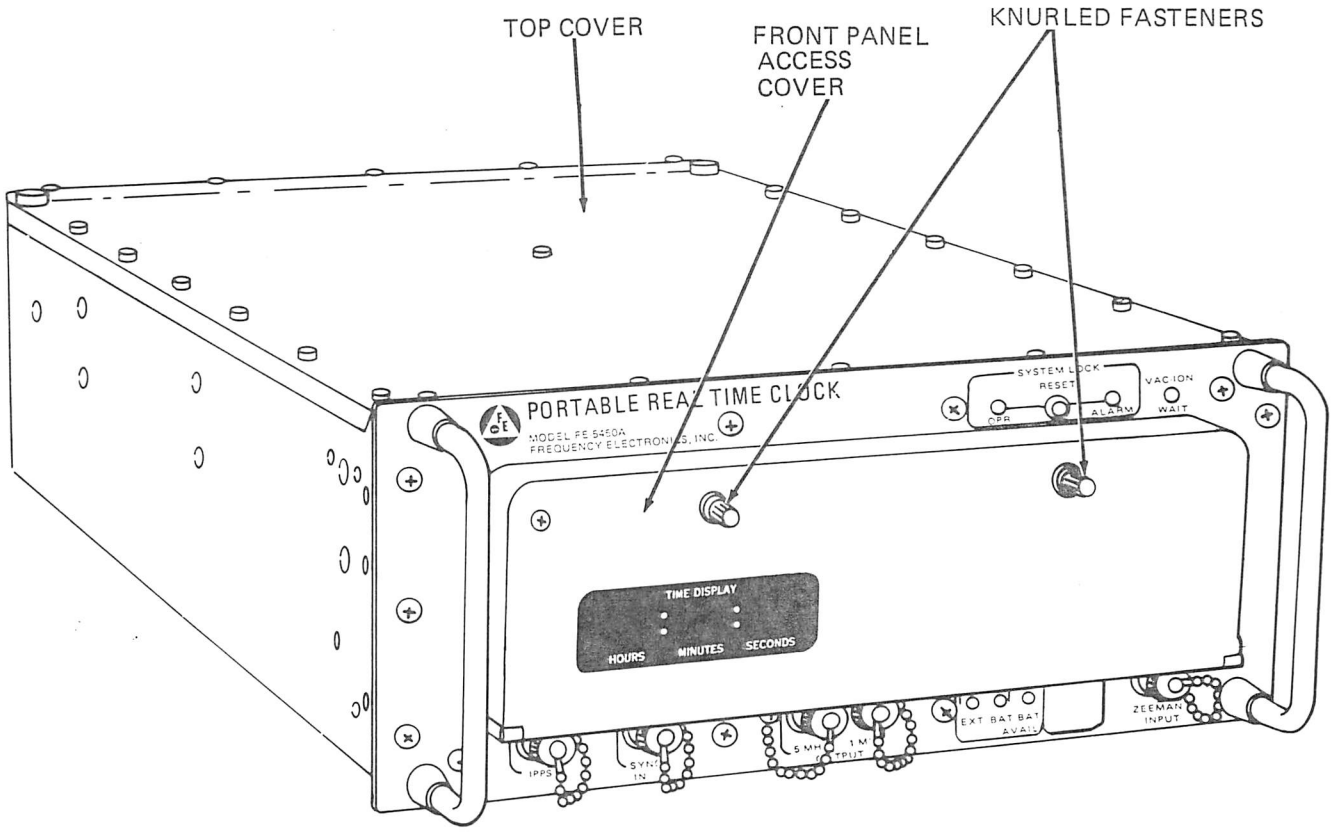

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Figure 8-4. PRTC Front and Top Cover Removal

CHAPTER 9

DIFFERENCE DATA SHEETS

9-1. INTRODUCTION.

9-2. Operation and maintenance instructions for the models included in this chapter are the same as the instructions for the Portable Real Time Clock (PRTC), Model No. FE-5450A except for the specific differences noted by the applicable Difference Data Sheet. Chapters 1 through 8 contain complete operation and maintenance information on the Portable Real Time Clock (PRTC), Model No. FE-5450A, Part No. ICD-D61700-10100.

9-3. INDEX OF DIFFERENCE DATA SHEETS.

DIFFERENCE DATA SHEET NO. 1

Portable Real Time Clock (PRTC) **Model No. FE-5450A/J**

The instructions contained in the preceding chapters of this technical manual are applicable to this model except for the differences cited in this difference data sheet.

1. GENERAL INFORMATION

a. Model FE-5450A/J (see figure 9-1) does not have a 100 kHz output. Additonally the 1 MHz and 5 MHz outputs are available on the rear panel only.

b. Model FE-5450A/J does not have a battery power supply module A17 or a battery charger/logic module A14. This model uses a display dropout module A14 that is physically located in place of the battery charger/logic module A14.

c. The approximate overall dimensions in inches for Model FE-5450A/J are: W = 13.25, H = 5.22, and D = 22.30. The approximate weight and volume are 33 pounds and 1521.6 cubic inches respectively.

2. OPERATING INSTRUCTIONS

a. All front panel controls and indicators referenced in figure 2-1, are applicable to Model FE-5450A/J except for positions 3 and 4 of CIRCUIT CHECK pushbutton switch (index no. 13). Additionally, DS5 POWER SOURCE BAT AVAIL indicator (index no. 16) and DS2 POWER SOURCE IN USE BAT indicator (index no. 17) are not used in this model.

b. All internal operator controls and indicators referenced in figure 2-2 are used in Model FE-5450A/J except for fuse F3 (index no. 1).

c. All front panel connectors referenced in figure 2-3 are used in Model FE-5450A/J except for the 1 MHz OUTPUT connector J26 (index no. 3) and the 5 MHz OUTPUT connector J25 (index no. 4).

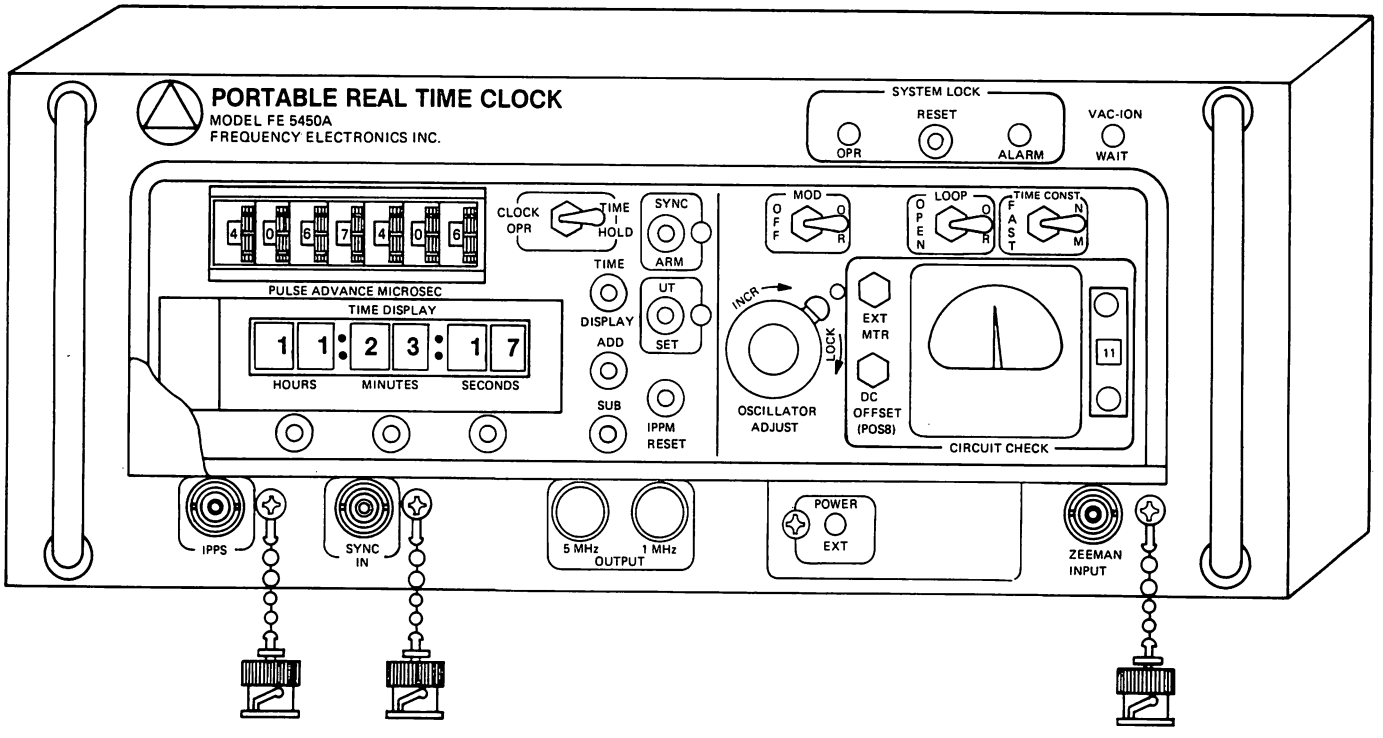
d. The 100 kHz rear panel connectors, J7 and J8 (see figure 2-4, index no. 3) are not used in Model FE-5450A/J. Both 1 MHz rear panel connectors J5 and J6 (index no. 2) are used in this model.

3. FUNCTIONAL DESCRIPTION

The functional description for Model FE-5450A/J is the same as that described for Model FE-5450A except for the following differences:

a. Model FE-5450A/J does not have a battery power supply module A17 or a battery charger/logic module A14.

b. Model FE-5450A/J uses a display dropout module A14. Module A14 generates two signals: one signal goes to the TOD display PC assembly A19 power relay to illuminate the display. The second signal illuminates the POWER SOURCE IN USE EXT indicator DS4 (18, figure 2-1) when 22 Vdc to 30 Vdc is applied to the PRTC.



TM45790-9171

Figure 9-1. Portable Real Time Clock, Model FE-5450A/J

c. In Model FE-5450A/J, buffer amplifier module A8 has been modified to provide four (4) 5 MHz outputs to the rear panel only.

d. In Model FE-5450A/J, TOD clock PC assembly A9, including portions of the chassis subassembly, have been modified internally for design purposes. However, both are still functionally the same as that which is used in Model FE-5450A.

e. In Model FE-5450A/J, generator module A10 has been modified to provide two (2) 1 MHz outputs to the rear panel.

4. SCHEDULED MAINTENANCE

For Model FE-5450A/J, scheduled maintenance tasks are not applicable to the 100 kHz outputs.

5. TROUBLESHOOTING

a. All troubleshooting steps specified in table 5-1 are applicable to Model FE-5450A/J except as follows:

(1) For step 1., in INCORRECT INDICATION column, substitute the following:

INCORRECT INDICATION
Check that external power sources are connected and ON/OFF switch S17 (2, figure 2-2) is set to ON. Check fuses F1(4) and F2(3), ON/OFF switch S17(2), diodes in U1 and U2, capacitors C1 and C2 and indicator DS4 (18, figure 2-1). If all components are good replace display dropout module A14.

(2) Steps 6 and 7 do not apply.

(3) In step 16, connector J25 is not applicable.

(4) In step 18, PROCEDURE column, substitute the following: "repeat step 17 at rear panel 1 MHz connector J6".

(5) Steps 19 and 20 do not apply.

b. Schematic diagrams for Model FE-5450A/J modules A8, A9, A10, A14, and part of the chassis subassembly, appear in figures 9-2 through 9-6 respectively. Schematic diagrams for remaining modules are the same as those included in chapter 5.

6. CORRECTIVE MAINTENANCE

a. For Model FE-5450A/J, paragraph 6-27, substitute paragraph title with DISPLAY DROPOUT MODULE A14. Procedures for removal and replacement remain as is.

b. Paragraph 6-28 does not apply.

7. ILLUSTRATED PARTS LIST

a. For Model FE-5450A/J, tables 9-1 and 9-2 are substituted for tables 7-1 and 7-2 respectively.

b. For Model FE-5450A/J, battery power supply module A17 (see figure 7-1) is not included and module A14 is designated as display dropout module part number D51714-9414-1.

c. For Model FE-5450A/J, figure 7-2 is applicable except for diode CR12, resistor R8, LEDs DS2 and DS5, and connectors J7, J8, J25, and J26.

d. In Model FE-5450A/J, connector J6 (see figure 9-7) and capacitor C3 and C4 (see figure 9-8) have been added.

8. INSTALLATION

For Model FE-5450A/J, paragraph 8-12 INPUT POWER REQUIREMENTS, reference to battery power supply A17 does not apply.

TABLE 9-1. PORTABLE REAL TIME CLOCK MODEL FE-5450A/J, PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MFG CODE IDENT	PART NUMBER
–	Portable Real Time Clock Model FE-5450A/J	14844	B45770-9171
A1	Cesium Beam Resonator Assy	14844	D42701-9201-1
A2	High Voltage Power Supply, VAC-ION	14844	D42702-9202-1
A3	High Voltage Power Supply, Electron Multiplier	14844	D42703-9203-1
A4	Oscillator, OCVCXO, 5 MHz	14844	D21708-6208-3
A5	Modulator/Multiplier Module	14844	D42705-9205-1
A6	Power Supply Module	14844	D51706-9406
A7	Synthesizer Module	14844	D51707-9407
A8	Buffer Amplifier Module	14844	D51708-9408-2
A9	Real Time-Of-Day Clock PC Assy	14844	D62000-10109-1
A10	Generator Module, 1 MHz	14844	D21710-6210-4
A11 thru A13	Not Used		
A14	Display Dropout Module	14844	D51714-9414-1
A15 thru A18	Not Used		
A19	Time-Of-Day Display PC Assy	14844	D22001-6209
A20 thru A24	Not Used		
A25	Meter Driver Amplifier Assy	14844	D62200-10125
–	Waveguide Assembly	14844	D61760-10100
–	Cable, Semi-Rigid	14844	C51768-9400-2
–	Harness Assembly	14844	D45874-9171

TABLE 9-2. PORTABLE REAL TIME CLOCK MODEL FE-5450A/J, CHASSIS SUB-ASSEMBLY COMPONENTS PARTS LIST

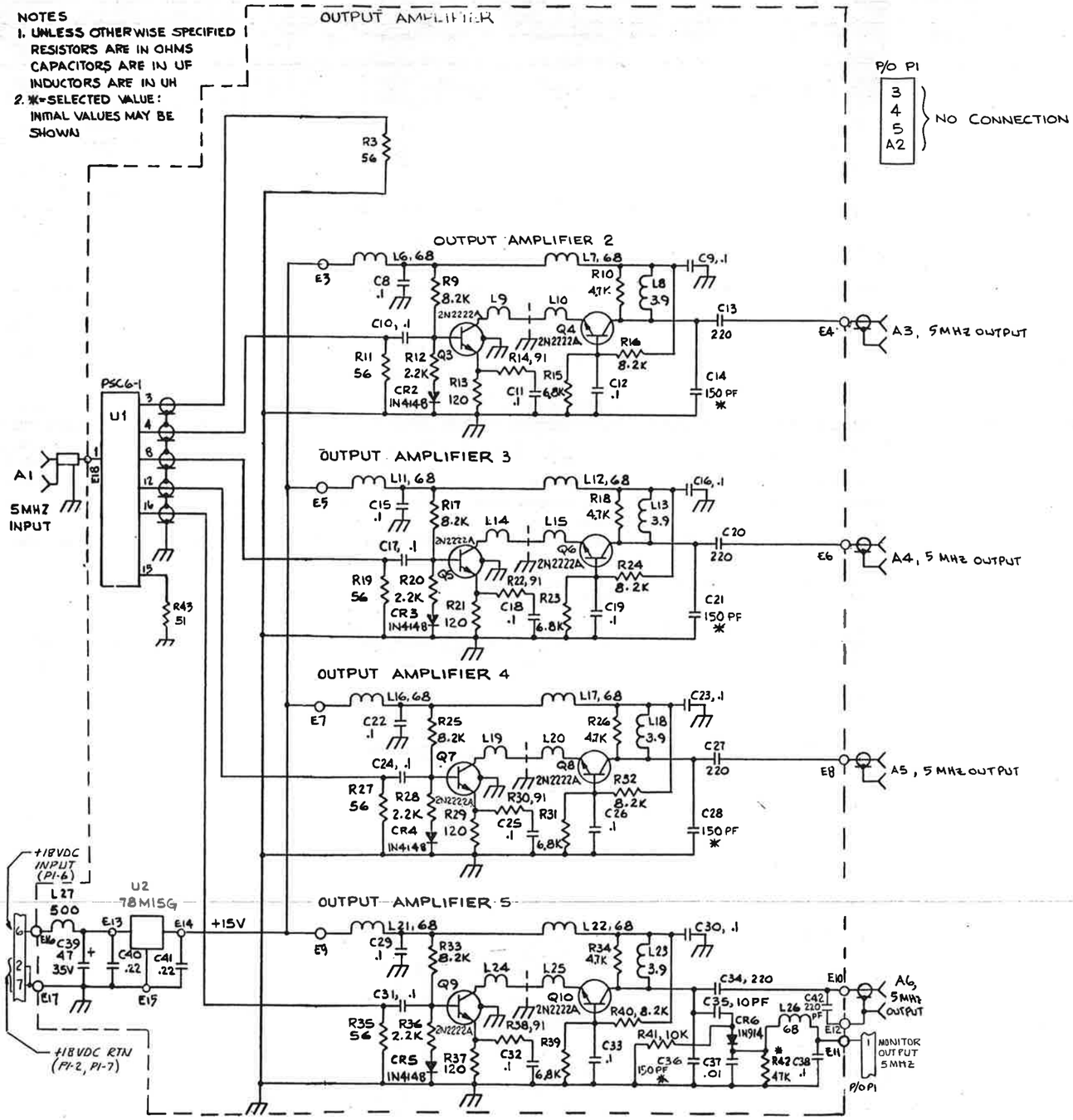
REFERENCE DESIGNATION	DESCRIPTION	MFG CODE IDENT	PART NUMBER
C1	Capacitor, polycarb, 2800 μF -10 +75% Vdc	14844	A22742-6200-1
C2	Capacitor, tantalum 6.8 μF ±10%, 50 Vdc	81349	CSR13G685KR
C3, C4	Capacitor, tantalum, 6.8 μF ±10%, 35 Vdc	81349	CSR13F685KR
C5 thru C9	Capacitor, ceramic, 0.1 μF 100%, 5V	81349	CKR05BX104KR
CR1 thru CR10	Not Used		
CR11	Diode	04713	1N5550A
CR12	Not Used		
CR13 thru CR17	Diode	04713	1N4148
DS1	Diode, light emitting, red	14844	A40324-SCD-4700
DS2	Not Used		
DS3 and DS4	Diode, light emitting, green	14844	A40324-SCD-3507
DS5 thru DS7	Not Used		
DS8, DS9	Same as DS3		
DS10	Diode, light emitting, amber	14844	A40324-SCD-4719
F1 thru F3	Fuse, 4A	75915	312004
J1 thru J6	Connector, BNC	91836	KC-19-110
J7, J8	Not Used		
J9 thru J12	Connector, BNC	02660	UG-625B/U

TABLE 9-2. PORTABLE REAL TIME CLOCK MODEL FE-5450A/J, CHASSIS SUB-ASSEMBLY COMPONENTS PARTS LIST (CONT'D)

REFERENCE DESIGNATION	DESCRIPTION	MFG CODE IDENT	PART NUMBER
J13	Connector	71468	MS3112E-12-8S
J14 and J15	Connector	71468	MS3112E-12-3PY
J16 thru J22	Not Used		
J23 and J24	Connector, RF type BNC	81349	M39012/21-001
J25 and J26	Not Used		
J27	Same as J23		
J28	Connector, phono jack, micro jax	82389	TR-2A
K1	Relay	81349	M5757/13-056
M1	Meter	14844	D22799-6200
R1	Resistor, multi-turn, 20K ohms ±10%, 2W	14844	A22785-6200
R2	Resistor, variable, 20K ohms ±10%, 1/2 W	80294	3292L-1-203M
R3 and R4	Resistor, composition, 100 ohms ±5%, 1/8 W	81349	RLR05G1000KS
R5	Not Used		
R6 and R7	Resistor, composition, 330 ohms ±5%, 1/8 W	81349	RLR05G3300KS
S1	Switch, pushbutton	04426	76-2222-404
S2	Switch, spdt	09353	7101-MYZ-GE
S3 thru S11	Same as S1		
S12	Switch, 7 section thumbwheel	14844	7R1Q7656G
S13 and S14	Switch, dpdt	95146	MTL-206N

TABLE 9-2. PORTABLE REAL TIME CLOCK MODEL FE-5450A/J, CHASSIS SUB-ASSEMBLY COMPONENTS PARTS LIST (CONT'D)

REFERENCE DESIGNATION	DESCRIPTION	MFG CODE IDENT	PART NUMBER
S15	Switch, spdt	95146	MTL-1060
S16	Not Used		
S17	Switch, 4pdt	95146	MTL-406N
U1 and U2	Integrated circuit, rectifier	14099	SCPA-2
XA1J1	Connector	81349	M24308/1-2
XA1P1	Connector	71468	DAMM7W2S
XA2P1 and XA3P1	Not Used		
XA4P1	Connector	71468	DBMMF13W3S
XA5J1 and XA5J2	Connector, coaxial, RT angle SMA	14844	55-628-9196-31
XA5J3 and XA5J4	Not Used		
XA6P1	Connector	71468	DBMMF25S
XA7P1	Connector	71468	DCMMF21WA4S
XA7P2	Connector	71469	DBMMF9W4S
XA8P1	Connector	71468	DCMMF13W6S
XA9J1	Connector	81349	M24308/1-4
XA9P1 thru XA9P3	Not Used		
XA9P4 thru XA9P9	Connector, 16 Pin Plug Carrier	14844	A40525-SCD-AG16
XA10P1	Same as XA7P2		
XA11P1 thru XA13P1	Not Used		
XA14P1	Same as XA6P1		
XA15P1 and XA16P1	Not Used		
XF1 thru XF3	Fuseholder	75915	342-004



A8, A8A1
C1-C7, R1, R2, R4-R8, L1-L5, G1,
Q2, CR1, E1, E2
REFERENCE SYMBOL NO. NOT USED
U2 | E18 | L27 | C42 | CR6 | R43 | Q10 | P1
HIGHEST REFERENCE SYMBOL NO. USED

TM45875-9171

Figure 9-2. PRTC Model FE-5450A/J Buffer Amplifier Module A8, Schematic Diagram

NOTES:

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. PREFIX ALL REF DESIG WITH A9 EXCEPT WHERE PREFIX A19 OR P/O CHASSIS SUBASSY
4. ALL IC TYPE NUMBERS SHALL BE PREFIXED WITH "54" AS SHOWN IN TABLE I
5. LEGENDS:
   A.) [ ] INDICATES PANEL MARKING
   B.) (—▷) REPRESENTS SHEET GRID LOCATION
   EXAMPLE: (3B7)
   SHEET — 3 | B — HORIZONTAL GRID
   | — VERTICAL GRID
6. ASSOCIATED DRAWINGS:
   A9 ASSY - D45892-9171
   PL45892-9171
   A19 ASSY - D22001-6209
   PL22001-6209
   CHASSIS SUBASSY - D45790-9171
   PL45790-9171
7. UNLESS OTHERWISE SPECIFIED ALL COMPONENTS ARE PART OF A9 ASSY

TABLE I

TYPE	QTY	PIN		
		Vcc	GND	Vee
54LS90	7	5	10	-
5404	2	14	7	-
54LS00	5	14	7	-
54LS02	1	14	7	-
54LS04	4	14	7	-
54LS05	3	14	7	-
54LS08	4	14	7	-
54LS10	2	14	7	-
54LS14	1	14	7	-
54LS20	1	14	7	-
54LS30	4	14	7	-
54LS74	8	14	7	-
54LS95	5	14	7	-
54LS196	10	14	7	-
9616	3	14	7	8
54LS76	4	5	13	-
54LS175	2	16	8	-
54LS190	6	16	8	-
8T20	1	16	8	-
		Vcc_1	Vcc_2	GND	
55327	1	12	1	8	-
TOTAL	74				

P/O CHASSIS SUBASSY

J1-J22, S1, CR1-CR16, C1-C6							
DS1-DS7, R1, R2							
REFERENCE SYMBOL NO. NOT USED							
CR17	R4	J24	K1	P9	S12	DS9	C9
HIGHEST REFERENCE SYMBOL NO. USED							

A19

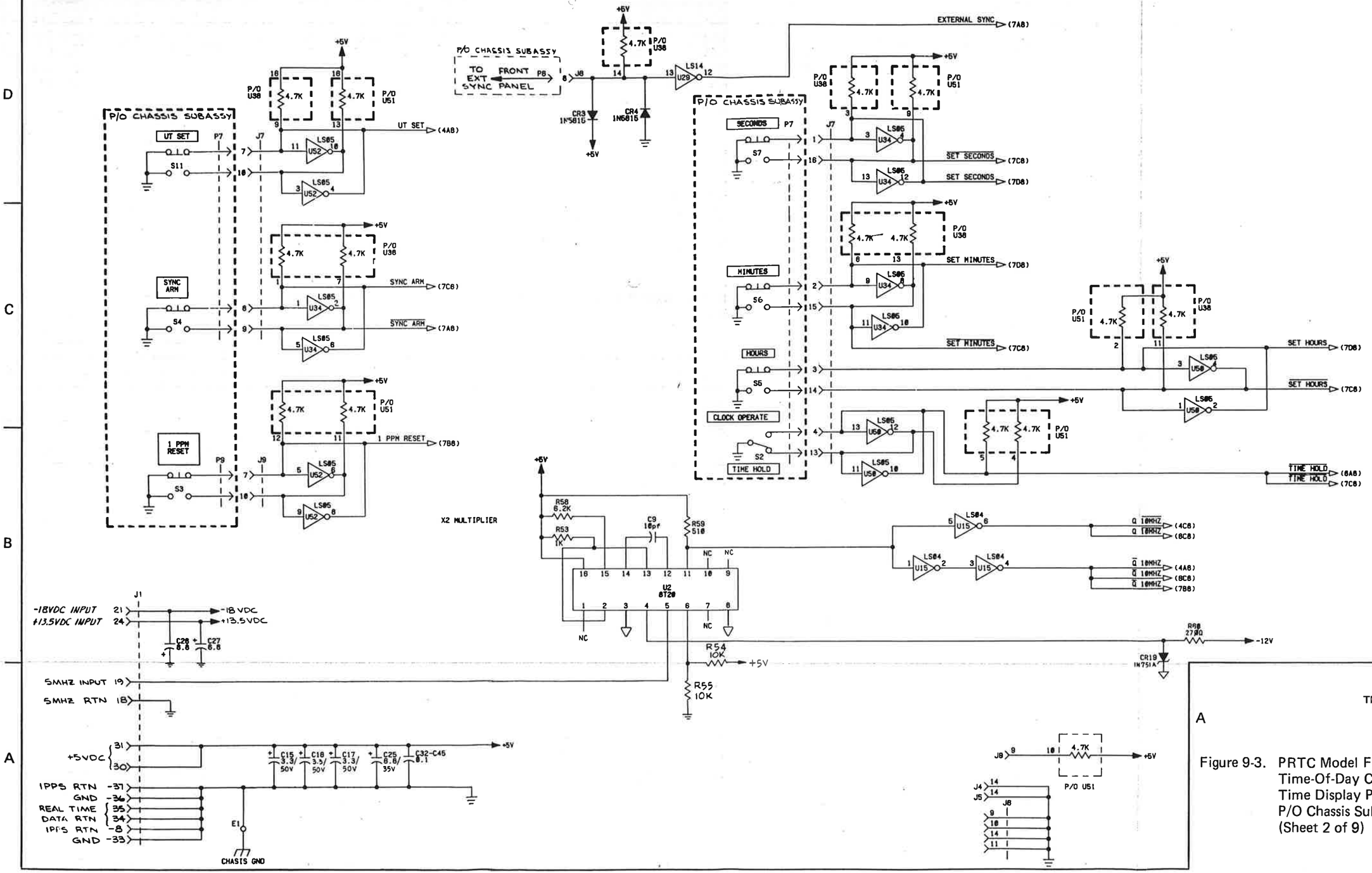
REFERENCE SYMBOL NO. NOT USED							
C3	R1	U6	E24				
HIGHEST REFERENCE SYMBOL NO. USED							

A9

C11-C14, C18-C24, C28, J2, J3, R2, R3, R5-R44							
CR1, CR2, CR6, CR7, CR11-CR17							
REFERENCE SYMBOL NO. NOT USED							
C45	E1	J9	L1	Q2	R65	U76	CR19
HIGHEST REFERENCE SYMBOL NO. USED							

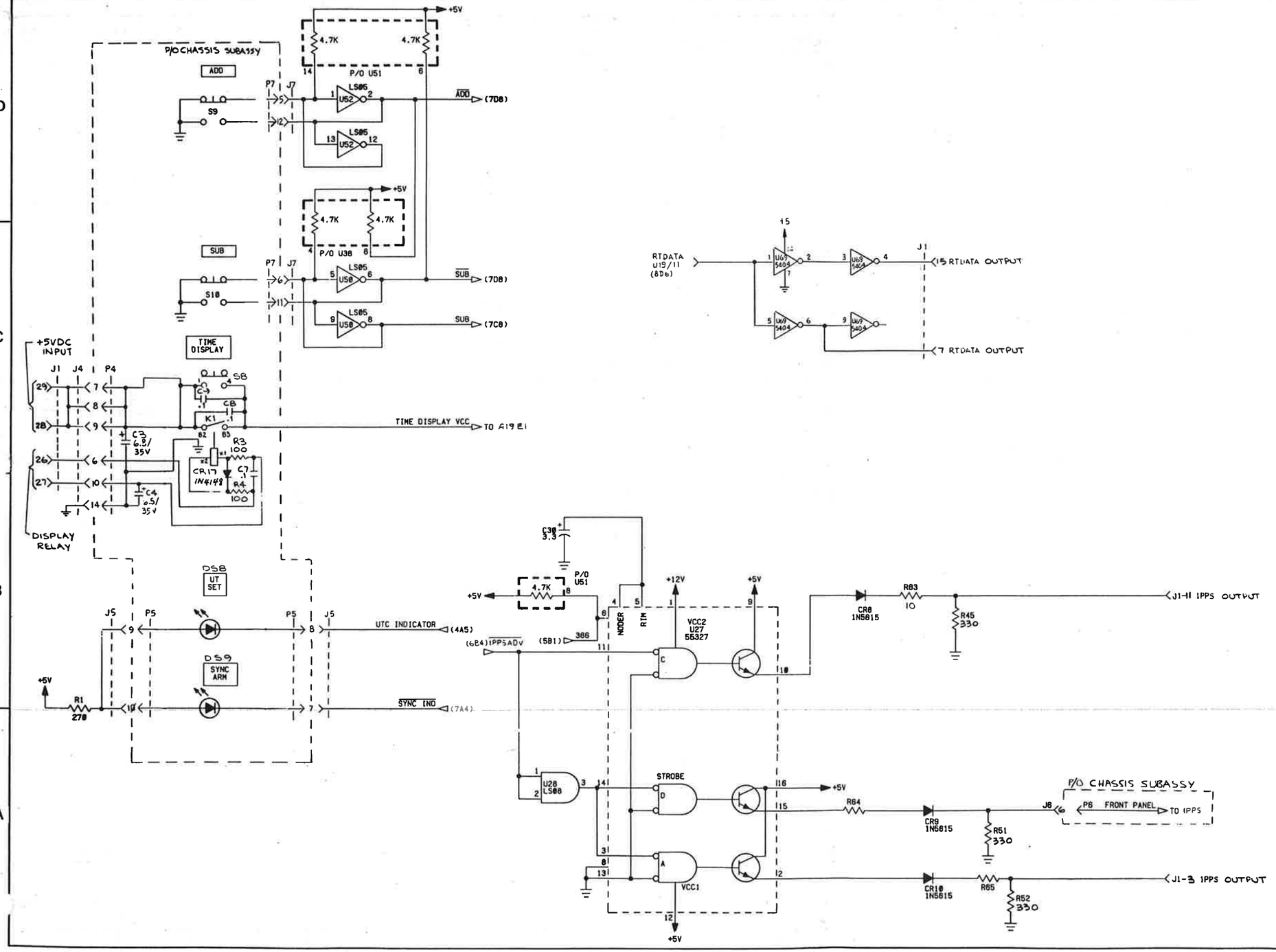
TM45895-9171A-1

Figure 9-3. PRTC Model FE-5450A/J Real Time-Of-Day Clock PC Assembly A9, Time Display PC Assembly A19, and P/O Chassis Subassy, Schematic Diagram (Sheet 1 of 9)



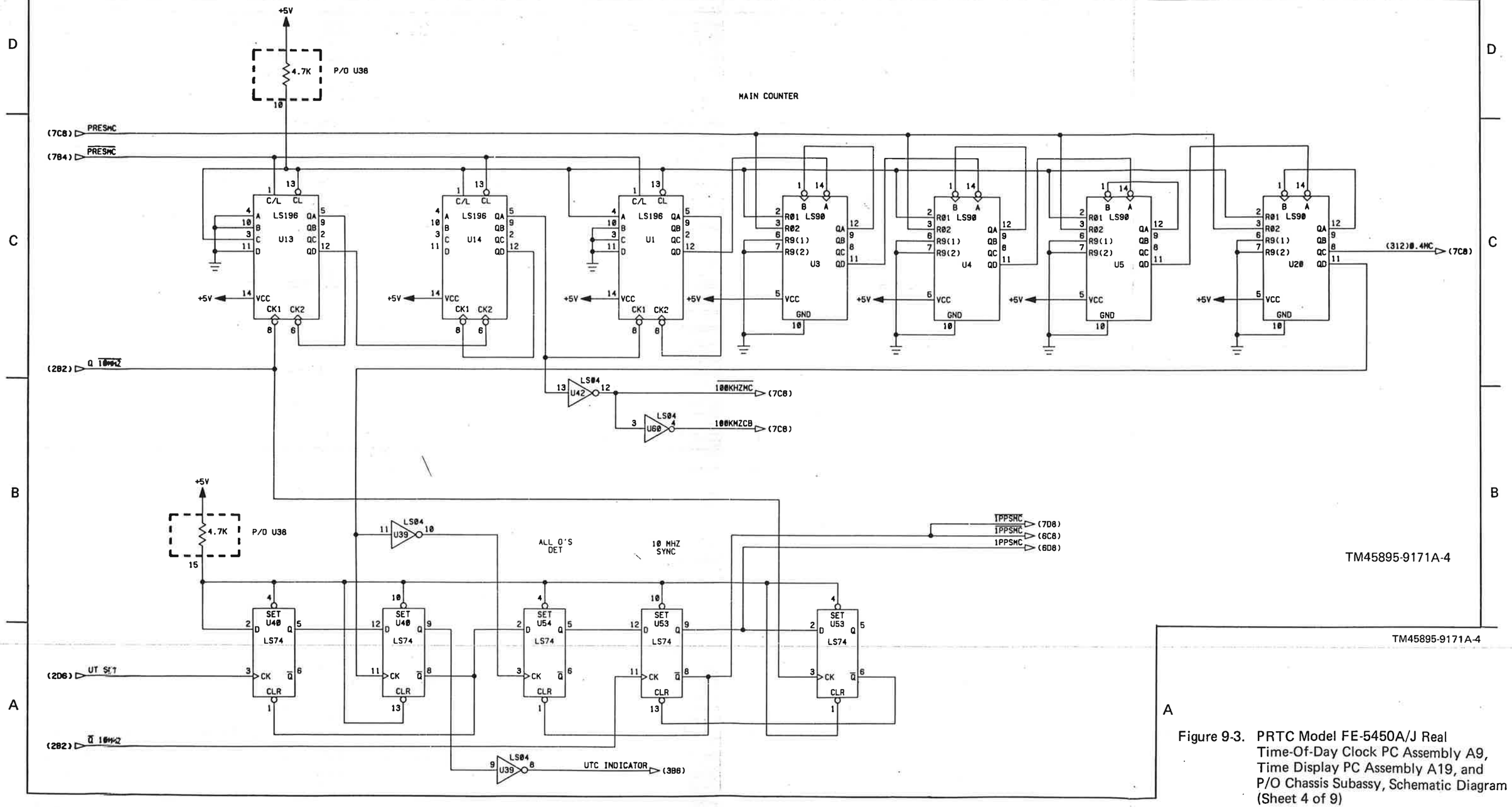
TM45895-9171A-2

Figure 9-3. PRTC Model FE-5450A/J Real Time-Of-Day Clock PC Assembly A9, Time Display PC Assembly A19, and P/O Chassis Subassy, Schematic Diagram (Sheet 2 of 9)



TM45895-9171A-3

Figure 9-3. PRTC Model FE-5450A/J Real Time-Of-Day Clock PC Assembly A9, Time Display PC Assembly A19, and P/O Chassis Subassy, Schematic Diagram (Sheet 3 of 9)



TM45895-9171A-4

TM45895-9171A-4

Figure 9-3. PRTC Model FE-5450A/J Real Time-Of-Day Clock PC Assembly A9, Time Display PC Assembly A19, and P/O Chassis Subassy, Schematic Diagram (Sheet 4 of 9)

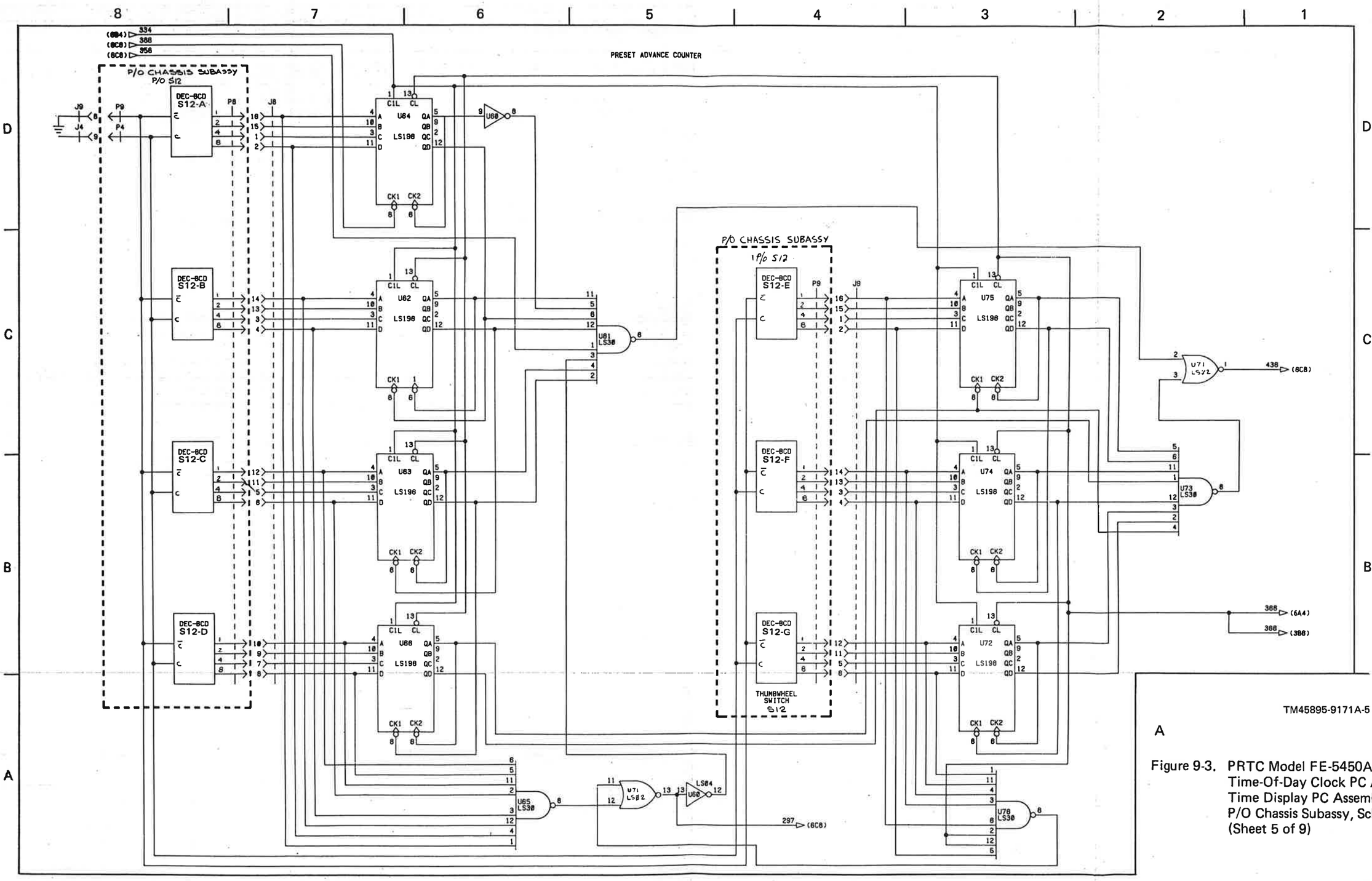


Figure 9-3. PRTC Model FE-5450A/J Real Time-Of-Day Clock PC Assembly A9, Time Display PC Assembly A19, and P/O Chassis Subassy, Schematic Diagram (Sheet 5 of 9)

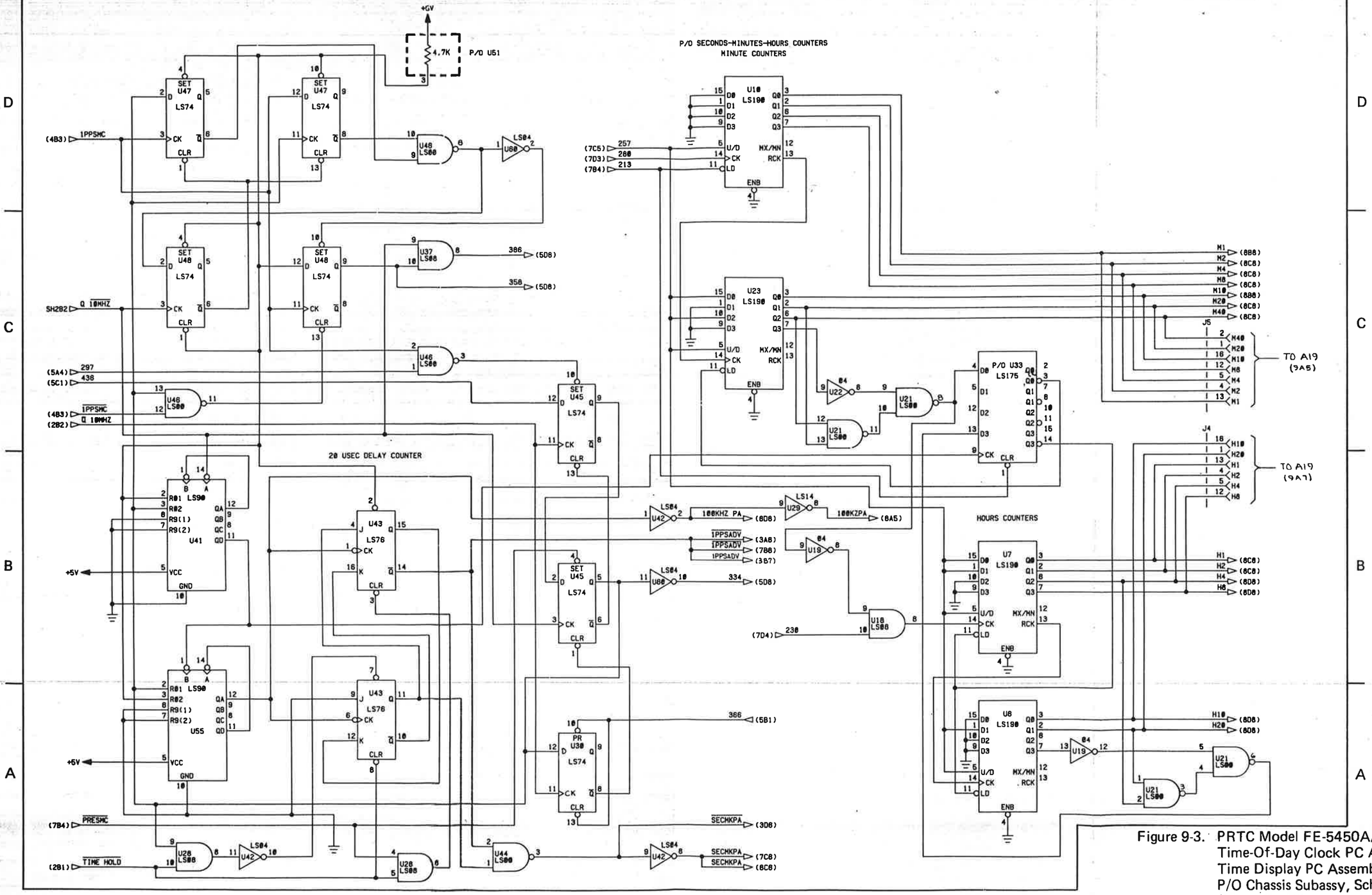


Figure 9-3. PRTC Model FE-5450A/J Real Time-Of-Day Clock PC Assembly A9, Time Display PC Assembly A19, and P/O Chassis Subassy, Schematic Diagram (Sheet 6 of 9)

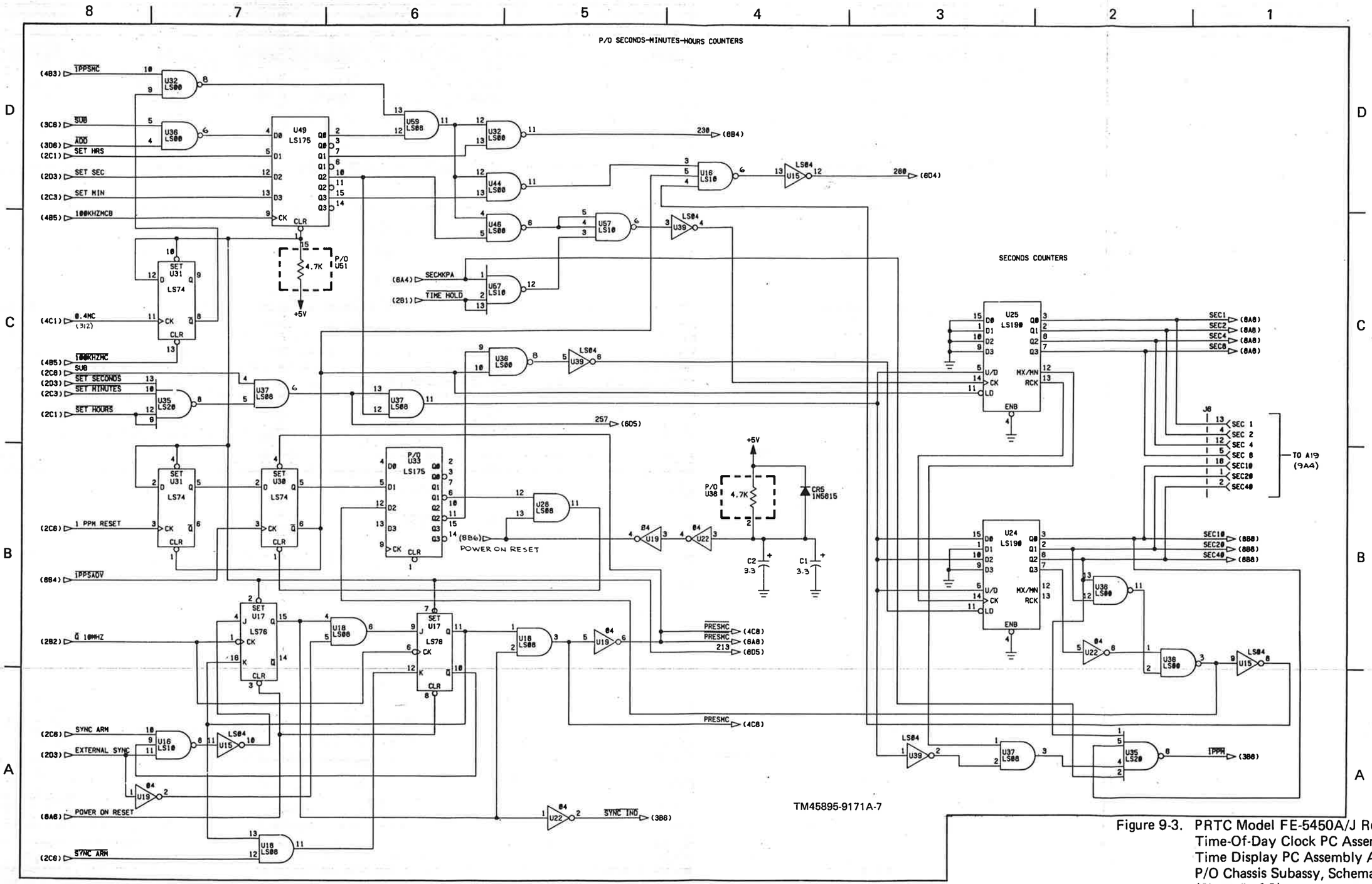


Figure 9-3. PRTC Model FE-5450A/J Real Time-Of-Day Clock PC Assembly A9, Time Display PC Assembly A19, and P/O Chassis Subassy, Schematic Diagram (Sheet 7 of 9)

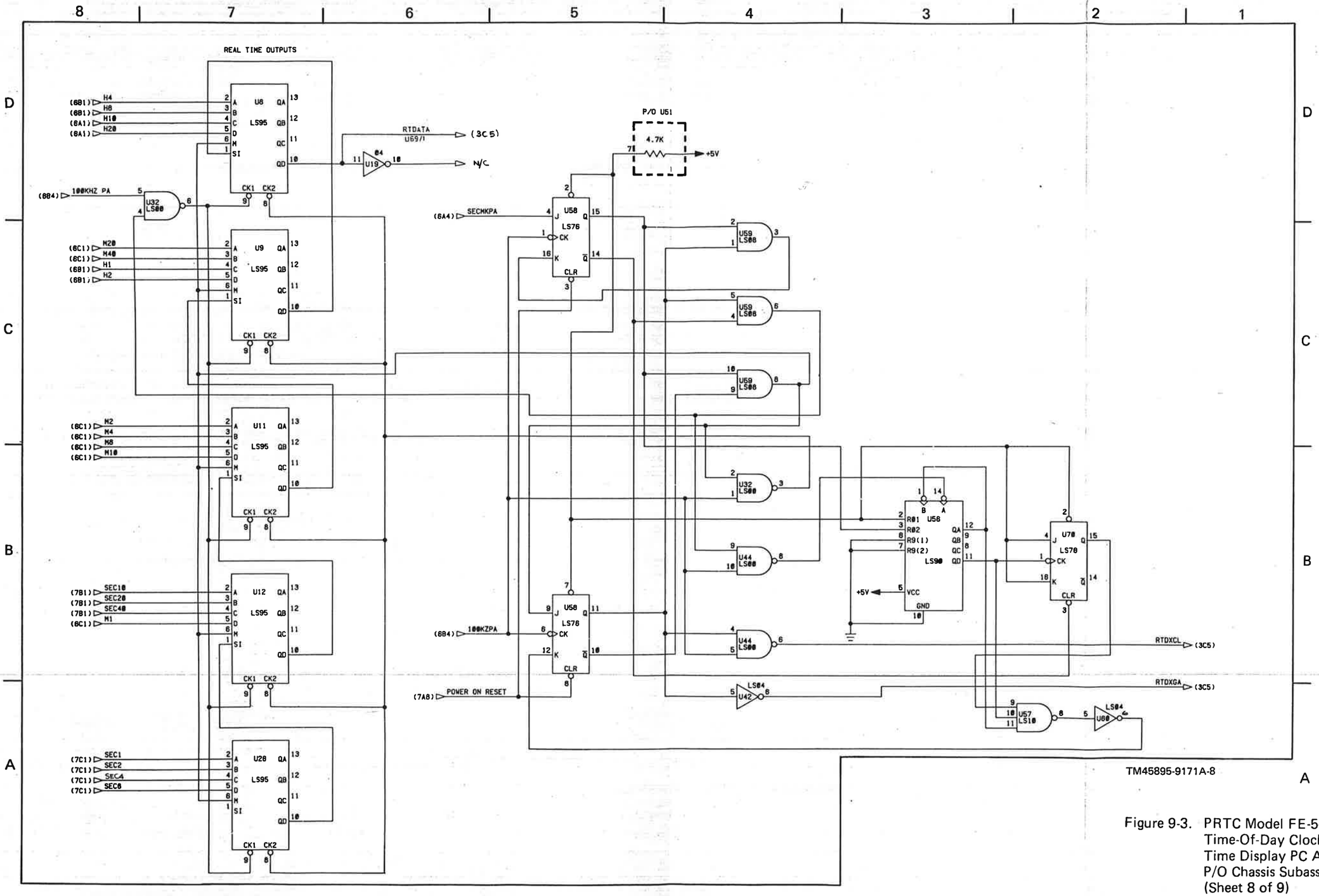


Figure 9-3. PRTC Model FE-5450A/J Real Time-Of-Day Clock PC Assembly A9, Time Display PC Assembly A19, and P/O Chassis Subassy, Schematic Diagram (Sheet 8 of 9)

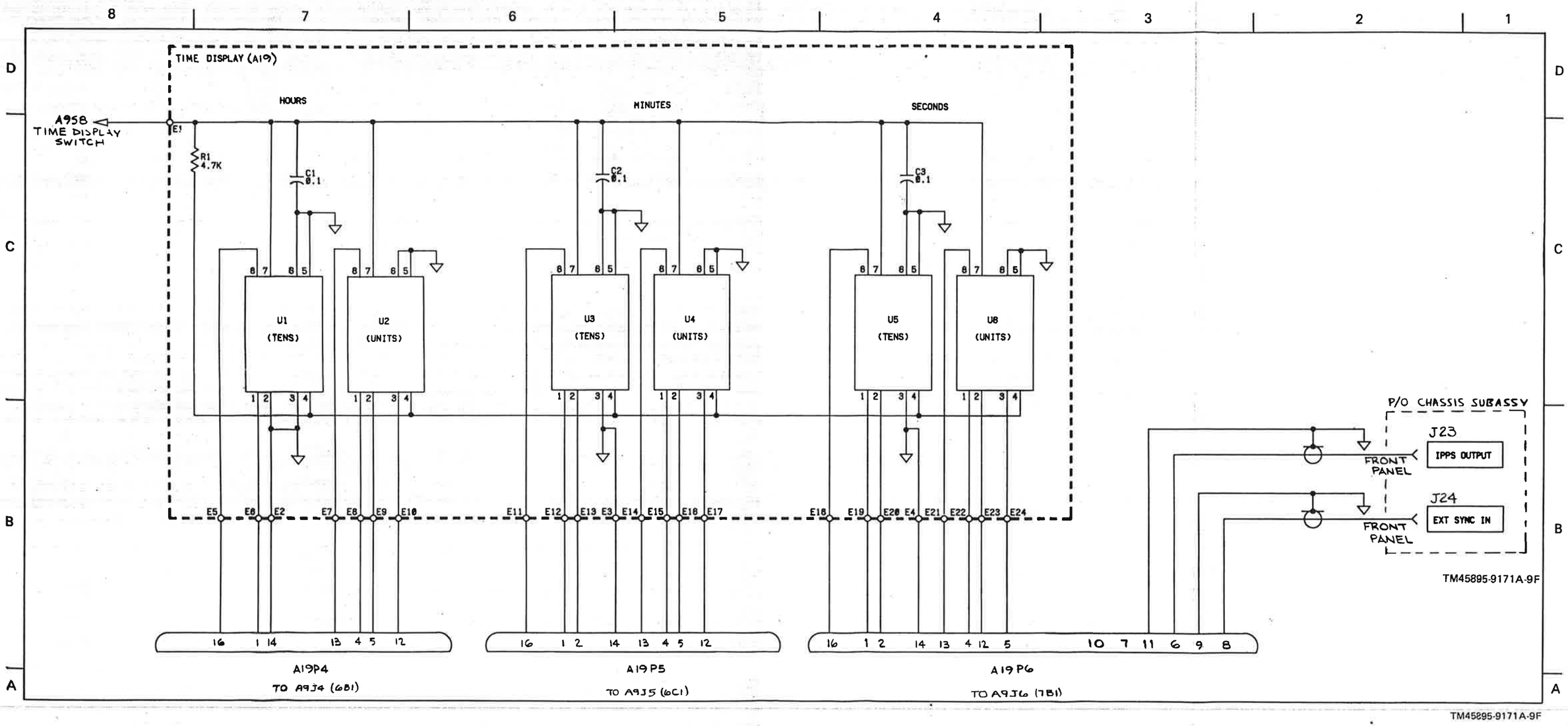
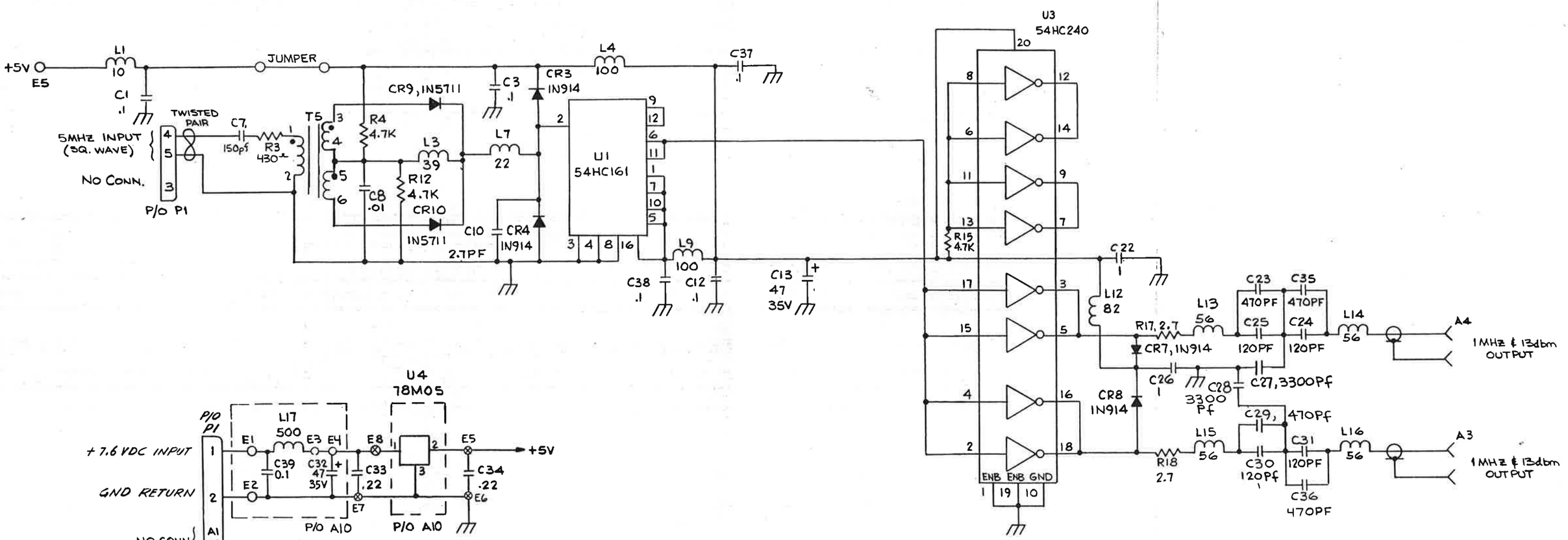


Figure 9-3. PRTC Model FE-5450A/J Real Time-Of-Day Clock PC Assembly A9, Time Display PC Assembly A19, and P/O Chassis Subassy, Schematic Diagram (Sheet 9 of 9)

NOTES:

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, C14 THRU C21, CR1, CR2, T1 THRU T4, CR5, CR6, U2							
R1, R2, R5-R11, R13, R14, R16, L2, L5, L6, L8, L10, L11							
REFERENCE SYMBOL NO. NOT USED							
R18	C39	U4	P1	CR10	L17	T5	E8
HIGHEST REFERENCE SYMBOL NO. USED							

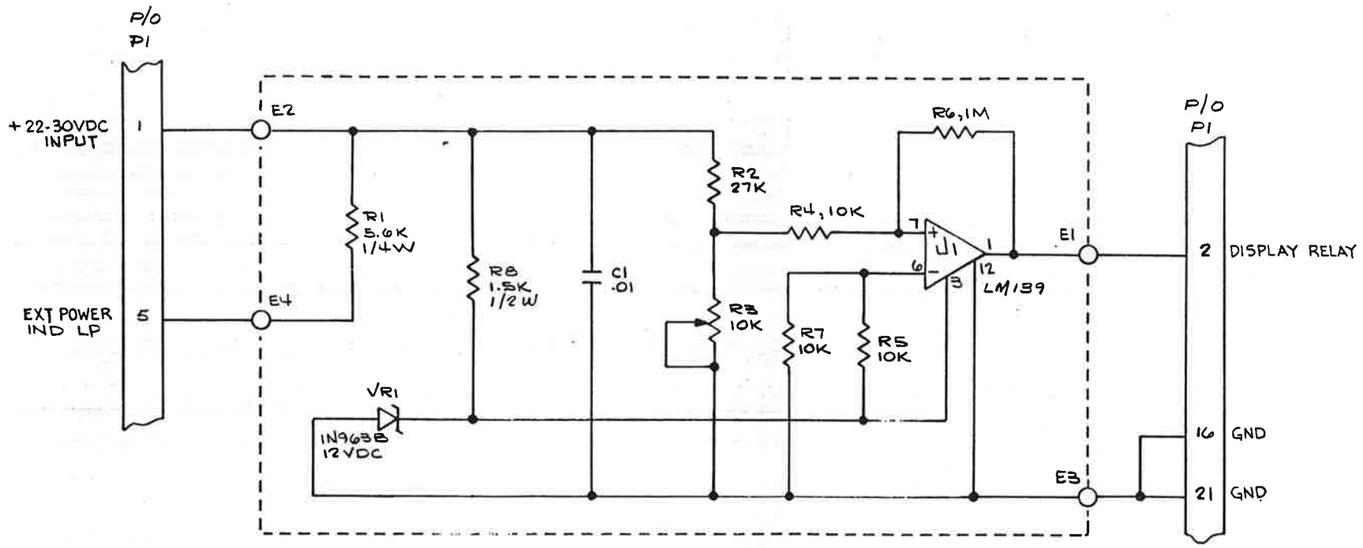
TM45835-9171

Figure 9-4. PRTC Model FE-5450A/J Generator Module A10, Schematic Diagram

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   RESISTORS ARE IN OHMS
   CAPACITORS ARE IN μF
   INDUCTORS ARE IN μH

2. *=SELECTED VALUE: INITIAL VALUES MAY BE SHOWN



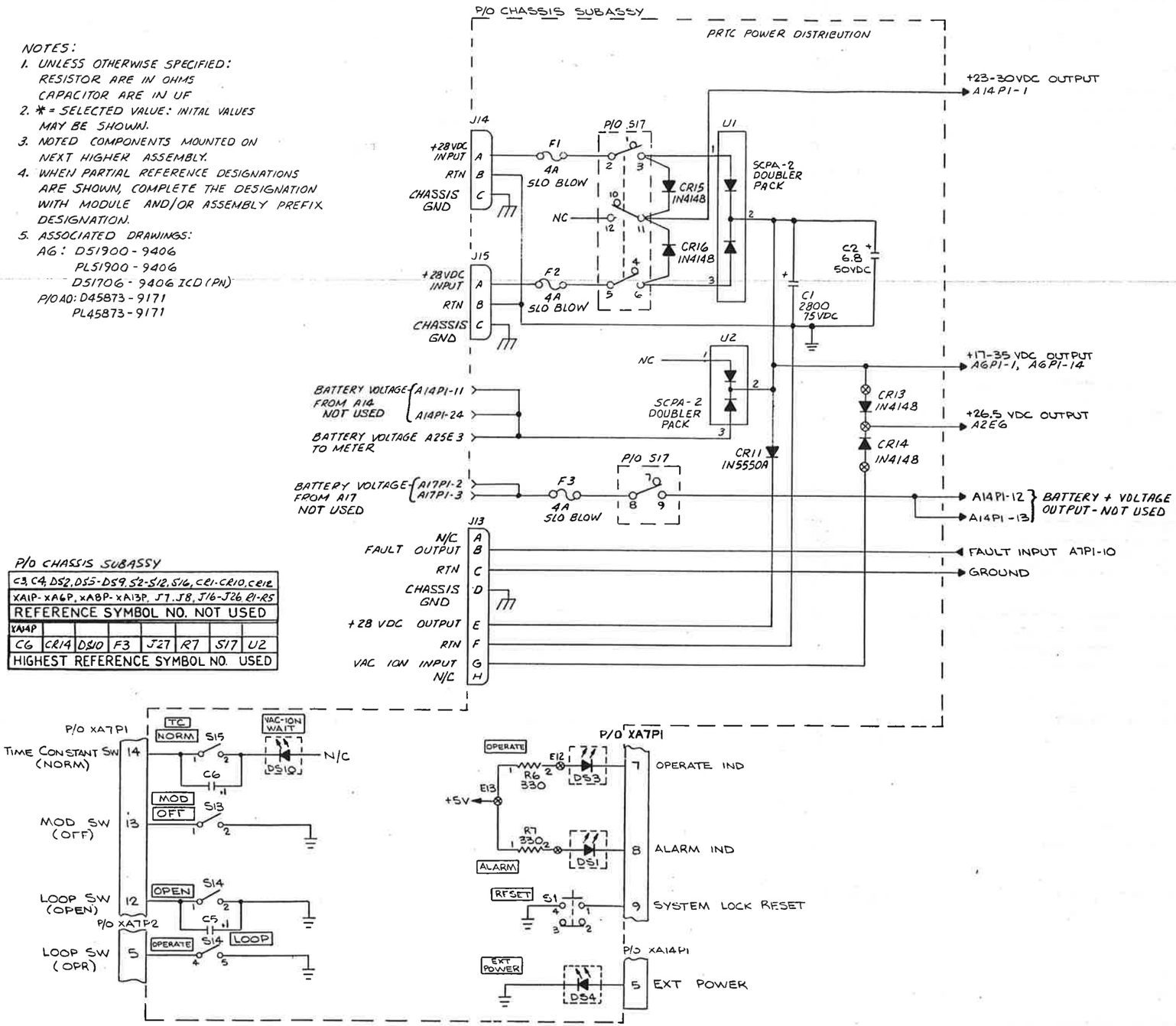
A14

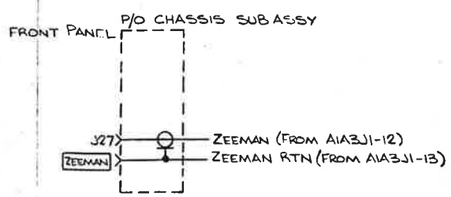
REFERENCE SYM NO. NOT USED								
C1	R8	VR1	U1	E4	P1			
HIGHEST REFERENCE SYM USED								

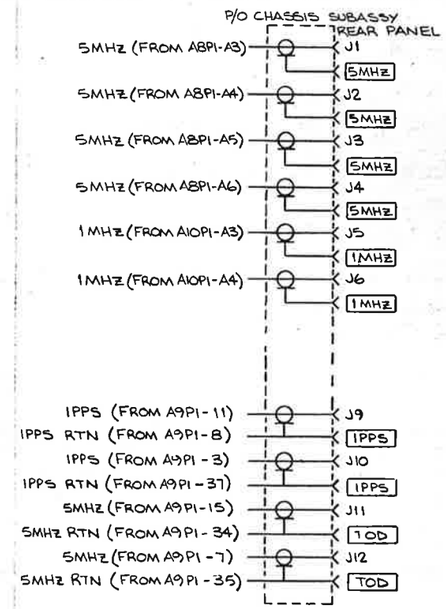
TM45765-9171

Figure 9-5. PRTC Model FE-5450A/J Display Dropout Module A14, Schematic Diagram

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   RESISTOR ARE IN OHMS
   CAPACITOR ARE IN UF
2. * = SELECTED VALUE: INITAL 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.
5. ASSOCIATED DRAWINGS:
   AG: D51900-9406
   PL51900-9406
   D51706-9406 ICD (PN)
   P/O A0: D45873-9171
   PL45873-9171







TM45725-9171

Figure 9-6. PRTC Model FE-5450A/J P/O Chassis Subassembly Schematic Diagram

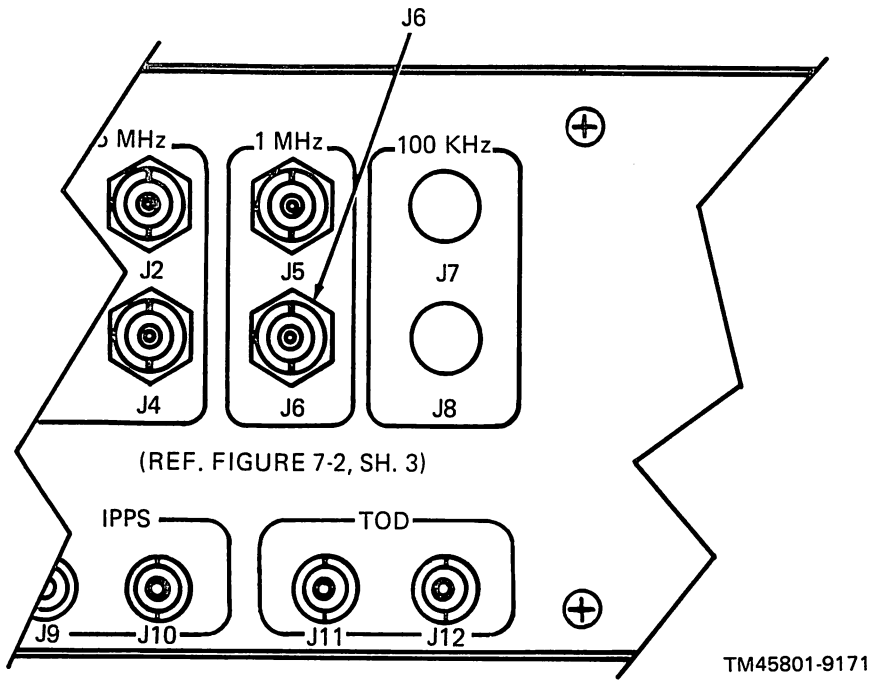


Figure 9-7. Model FE-5450A/J Chassis Subassembly Component Location Diagram for Connector J6

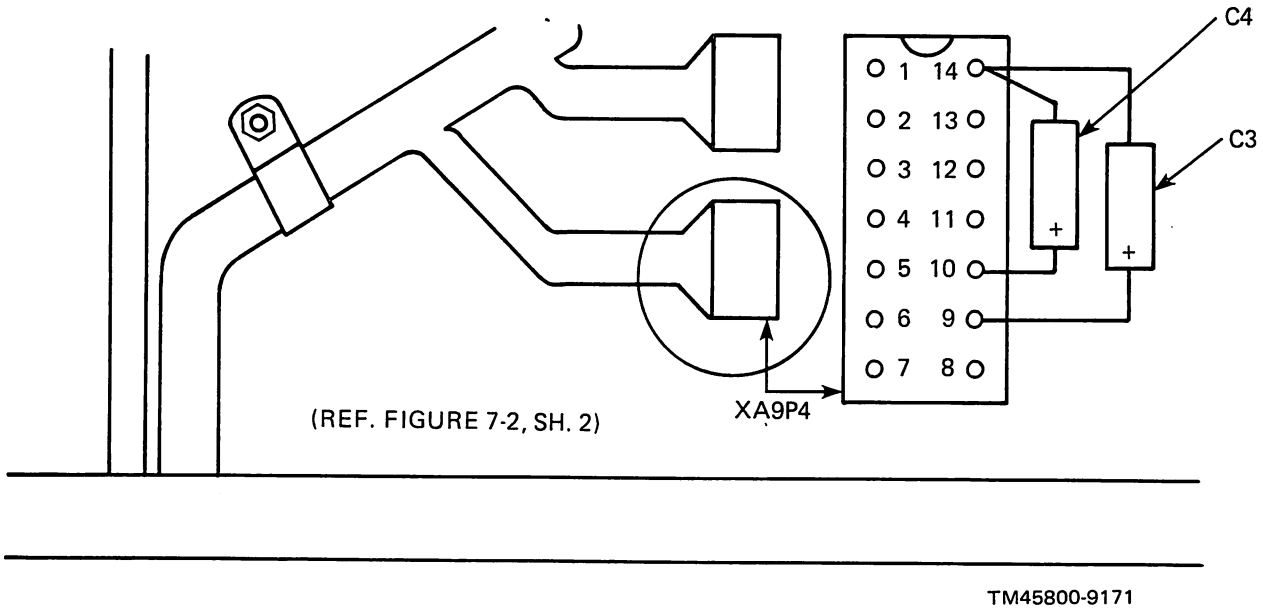


Figure 9-8. Model FE-5450A/J Chassis Subassembly Component Location Diagram for Capacitors C3 and C4

DIFFERENCE DATA SHEET NO. 2

Portable Real Time Clock (PRTC)
With Equipment Carrier (EC)

Model No. FE-5450A/J-EC

The instructions contained in difference data sheet no. 1, and in the preceding chapters of this technical manual, are applicable to this model except for the differences cited in this difference data sheet.

1. GENERAL INFORMATION

a. Model FE-5450A/J-EC is a rack mounted unit, (see figure 9-9) secured to an aluminum equipment carrier. The equipment carrier provides for installation of this model in a standard 19-inch electrical equipment rack. The right side of the equipment carrier contains an enclosure which is not used in this model. The opening to the enclosure is covered with an aluminum plate. Holes in the rear of the equipment carrier, also not used in this model, are plugged.

b. The approximate overall dimensions in inches for Model FE-5450A/J-EC are: W = 19.00, H = 5.22, and D = 22.30. The approximate weight and volume are 43 pounds and 2211.7 cubic inches respectively.

c. Model FE-5450A/J-EC is electrically and functionally identical to Model FE-5450A/J referenced in Difference Data Sheet No. 1.

2. INSTALLATION

Model FE-5450A/J-EC is a rack mounted unit, designed for installation in a standard 19-inch electrical equipment rack or cabinet. The overall dimensions for this model is illustrated in figure 9-10.

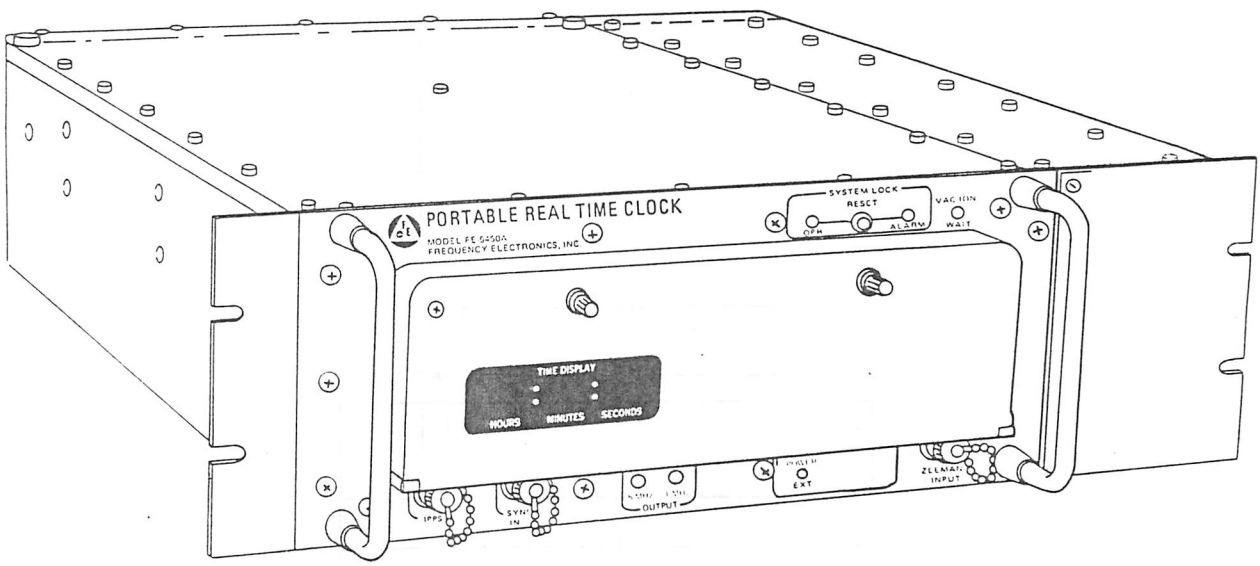
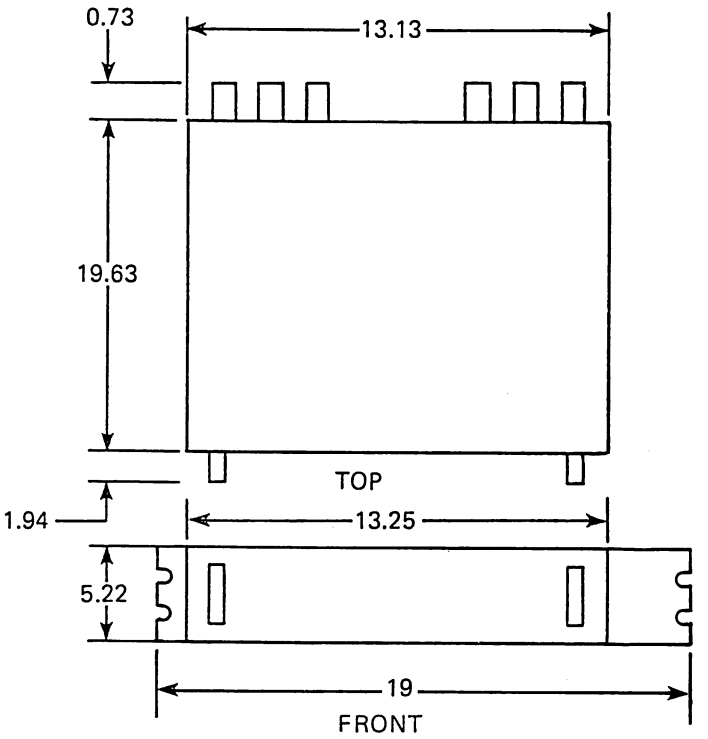


Figure 9-9. Portable Real Time Clock, Model FE-5450A/J-EC



TM45702-9171

Figure 9-10. Model FE-5450A/J-EC Outline Dimensional Drawing

DIFFERENCE DATA SHEET NO. 3

Portable Real Time Clock and Equipment Carrier with Electronic Switch Module (PRTC/ESM)

Model No. FE-5450A/J-ESM

The instructions contained in difference data sheet no. 1 and 2, and in the preceeding chapters of this technical manual, are applicable to this model except for the differences cited in this difference data sheet.

1. GENERAL INFORMATION

a. Model FE-5450A/J-ESM (see figure 9-11) consists of a PRTC, and a plug in electronic switch module (ESM) enclosed in an aluminum equipment carrier (EC). The ESM contains fault detection circuitry for monitoring selected PRTC inputs, in addition to other circuitry, for internal self-test monitoring. In the event the ESM detects a fault, either from within itself or from any one of the PRTC outputs, the ESM switches over operation to another operating PRTC.

b. Model FE-5450A/J-ESM is a rack mounted unit. It is secured to an EC identical to that described for Model FE-5450A/J-EC in difference data sheet no. 2. In this model however, the enclosure located on the right side of the carrier is used for housing the ESM. Connectors, located on the rear of the EC, are used for the receipt and distribution of ESM signals.

c. The technical data and specifications for the ESM are listed in table 9-3.

d. The approximate overall dimensions in inches for Model FE-5450A/J-ESM are: W = 19.00, H = 5.22, and D = 22.30. The approximate weight and volume are 60 pounds and 2211.7 cubic inches respectively.

e. With the exception of the ESM, Model FE-5450A/J-ESM is electrically and functionally identical to Models FE-5450A/J and FE-5450A/J-EC referenced in difference data sheets 1 and 2 respectively.

2. OPERATING INSTRUCTIONS

a. With the exception of the ESM, all controls and indicators on Model FE-5450A/J-ESM are the same as that described for Model FE-5450A/J in difference data sheet no. 1.

b. There are no controls for the ESM. The ESM is a self-contained module with three indicators located on the front panel. The location and function of these indicators are referenced in figure 9-12 and table 9-4 respectively.

c. With the exception of the EC, all input and output connectors on Model FE-5450A/J-ESM are the same as that described for Model FE-5450A/J in difference data sheet no. 1. Additional output connectors, located on the rear of the EC, are illustrated and described in figure 9-13 and table 9-5 respectively.

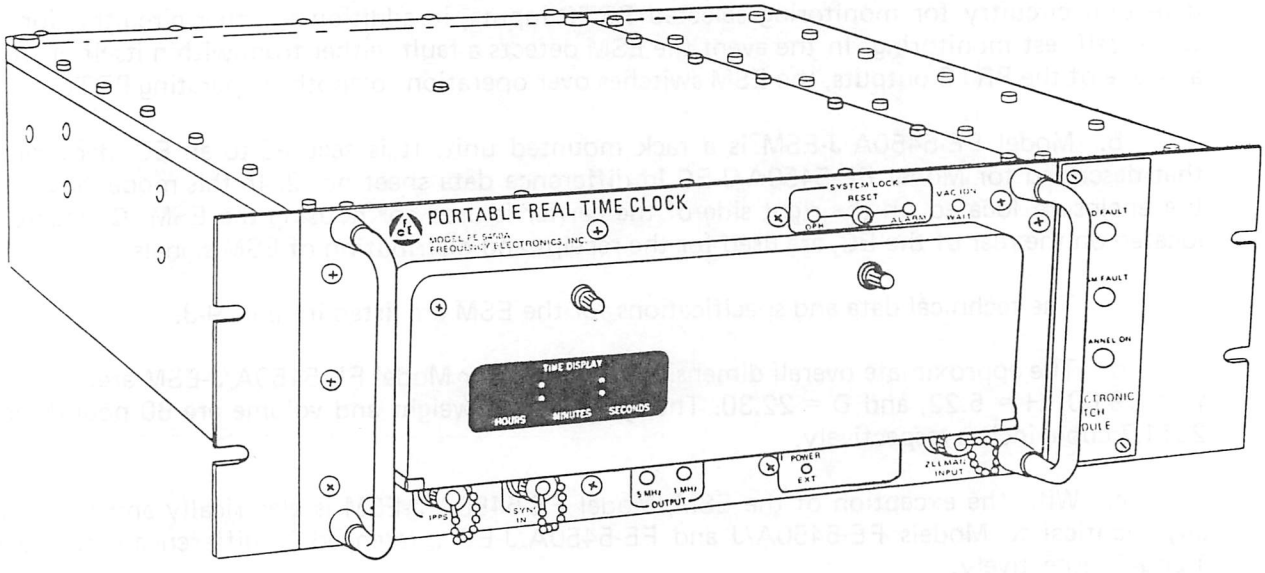


Figure 9-11. Portable Real Time Clock, Model FE-5450A/J-ESM

TABLE 9-3. ELECTRONIC SWITCH MODULE (ESM) TECHNICAL DATA AND SPECIFICATIONS

PARAMETER		SPECIFICATION
TYPE	ELECTRICAL CHARACTERISTIC	
5 MHz, 1 MHz Input	Level Harmonics VSWR	+13 dBm ± 1 dB -40 dB maximum 1.5:1 maximum
1 PPS Input	Level High Level Low Pulsewidth Rise Time Fall Time Jitter, pulse-to-pulse Load Impedance	+2.5 minimum 0.5 V maximum 20 μs minimum 50 ns maximum 2 μs maximum 5 ns rms maximum 50 ohms
TOD Input	Level	A binary "one" shall be +2.5 V minimum and a binary "zero" shall be +0.5 V maximum
Command Input (STD SEL CMD)	Levels	Alarm=High=2.5 V Min. @ 200 μA No Alarm=Low=0.5 V Max. @ 4 mA
5 MHz, 1 MHz	Level Harmonics Non-Harmonic Distortion VSWR Isolation (5 MHz only)	+16 dBm ± 1.5 dB -40 dB maximum -100 dB maximum 1.5:1 maximum -100 dB maximum
1 PPS Output	Levels High (True) Low (False) Pulsewidth Rise Time Fall Time Jitter, Pulse-To-Pulse Load Impedance	+2.5 minimum 0.5 V maximum 20 μs minimum 50 ns maximum 2 μs maximum 5 ns rms maximum 50 ohms
TOD Output	Level	A binary "one" shall be +2.5 V minimum and a binary "zero" shall be +0.5 V maximum at 4 mA
Alarm Outputs (STD Fault, ESM Fault)	Levels	Alarm=High=2.5 V Min. @ 200 μA No Alarm=Low=0.5 V Max. @ 4 mA
Status Output (STD SEL CMD Status)	Level	No Select=High=2.5 V Min. @ 200 μA Select=Low=0.5 V Max. @ 4 mA
DC Power Requirements	Voltage Current Noise and ripple	22-28 V 150 mA maximum 5 mV P-P maximum
PRTC Switchover	Switching Speed	10 μsecond maximum

3. FUNCTIONAL DESCRIPTION

a. Reference designators, assigned to Model FE-5450A/J-ESM configuration, are as follows:

Ref Design.	Item
A1	PRTC and Equipment Carrier
A1A1	PRTC
A2	ESM

b. The PRTC unit is functionally the same as that described for Model FE-5450A/J (see difference data sheet no. 1).

c. The ESM monitors the operating PRTC 5 MHz, 1 MHz, 1 PPS, TOD, and ALARM/DC OUT inputs. In the event an incorrect input or open loop condition is detected, the ESM automatically switches PRTC operation to a standby operational PRTC.

d. Connector A2P1, located on the rear of the ESM, plugs into equipment carrier mating connector XA2P1. The monitored outputs go directly from the PRTC rear panel, through the mating connector, to A2P1 for ESM monitoring. During normal system operation, the green CHANNEL ON lamp DS3 (3, figure 9-12) is illuminated. When a PRTC fault is detected the CHANNEL ON lamp extinguishes and the red STD FAULT lamp (DS1) (1, figure 9-12) illuminates. Concurrently, the ESM generates a SWITCH OVERRIDE signal which goes to the standby operational PRTC via connectors A2P1, XA1J1, and A1J22 respectively.

e. The ESM contains built-in-test (BIT) circuitry for internal self monitoring of the 5 MHz and 1 MHz SWITCHED OUTPUTS. In the event an ESM fault is detected, the CHANNEL ON lamp extinguishes and the red ESM FAULT lamp DS2 (2, figure 9-12) illuminates. Concurrently, the SWITCH OVERRIDE signal is generated and routed to the standby PRTC as described for PRTC fault detection in paragraph d. above.

4. SCHEDULED MAINTENANCE

a. With the exception of the ESM, scheduled maintenance for Model FE-5450A/J-ESM is the same as that described for Model FE-5450A/J in difference data sheet no. 1.

b. ESM LEDs DS1, DS2, and DS3 (see figure 9-12) should be inspected weekly for damaged lenses.

c. Model FE-5450A/J-ESM operating unit should be inspected daily for illumination of ESM CHANNEL ON indicator DS3 (3, figure 9-12). If the CHANNEL ON indicator is extinguished and the STD FAULT lamp (1) is illuminated, check that the PRTC LOOP OPEN/OPER switch (9, figure 2-1) is set to the OPER position. If the switch is properly set, and the STD FAULT lamp continues to illuminate, a fault has been detected in the PRTC. Refer to the troubleshooting section for Model FE-5450A/J in difference data sheet no. 1 and in Chapter 5 of this manual for corrective action.

d. If the CHANNEL ON indicator (3) is extinguished and the ESM FAULT lamp (2) is illuminated, a fault has been detected within the ESM itself. Refer to paragraph 5 of this difference data sheet for corrective action.

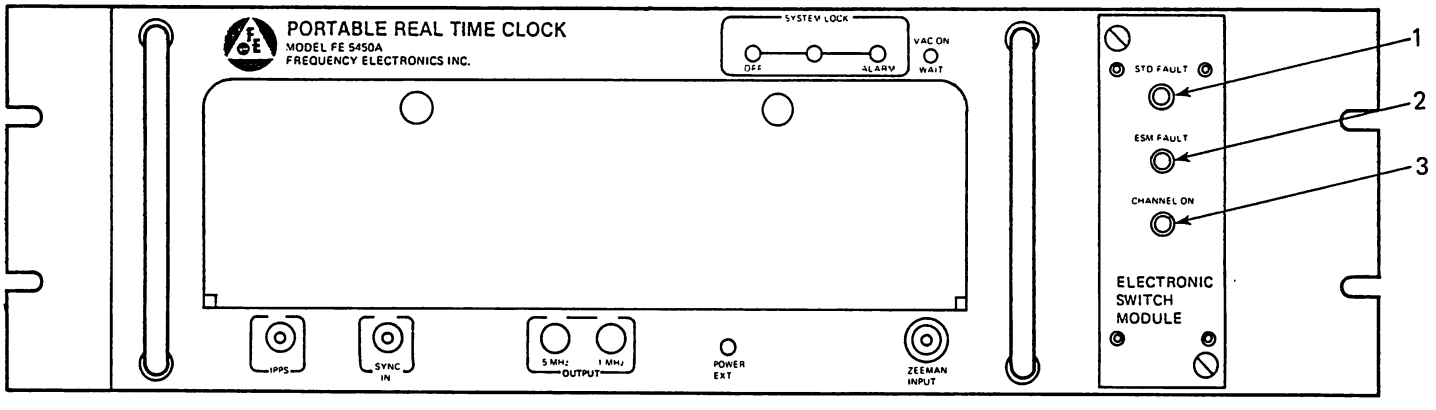


Figure 9-12. Model FE-5450A/J-ESM Electronic Switch Module Front Panel Indicators

5. TROUBLESHOOTING

a. With the exception of the ESM, troubleshooting procedures for Model FE-5450A/J-ESM is the same as that described for Model FE-5450A/J in difference data sheet no. 1.

b. The ESM contains BIT circuitry for monitoring internal circuit operations. A defective ESM is indicated by the illumination of the red ESM FAULT lamp (2, figure 9-12). If this condition is detected, remove the defective ESM and replace it with another ESM known to be in satisfactory operating condition.

c. With the exception of the ESM and the EC schematic diagram applicable to Model FE-5450-A/J (see difference data sheet no. 1) are also applicable to Model FE-5450A/J-ESM. The wire-run list applicable to Model FE-5450A (see table 5-2) is also applicable to Model FE-5450A/J-ESM except for the differences noted therein.

d. An EC pin function table for MS connectors J21 and J22 (table 9-6) and an overall wiring diagram for the PRTC and EC (figure 9-14) are provided for reference purposes only.

6. CORRECTIVE MAINTENANCE

a. With the exception of the ESM, corrective maintenance for Model FE-5450A/J-ESM is the same as that described for Model FE-5450A/J in difference data sheet no. 1.

b. Removal and replacement procedures for the ESM are as follows:

(1) Remove two screws securing ESM to EC.

(2) Pull out ESM from carrier housing.

(3) Install replacement ESM in carrier housing. Ensure that ESM connector A2P1 is aligned properly with EC receptacle connector XA1J1 (figure 9-15).

(4) Secure ESM from carrier housing.

TABLE 9-4. MODEL FE-5450A/J-ESM ELECTRONIC SWITCH MODULE FRONT PANEL INDICATORS

INDEX NO.	INDICATOR	FUNCTION
1	STD FAULT (DS1)	Illuminates red when ESM detects fault in PRTC.
2	ESM FAULT (DS2)	Illuminates red when fault is detected in ESM.
3	CHANNEL ON (DS3)	Illuminates green when operating on-line PRTC is functioning normally.

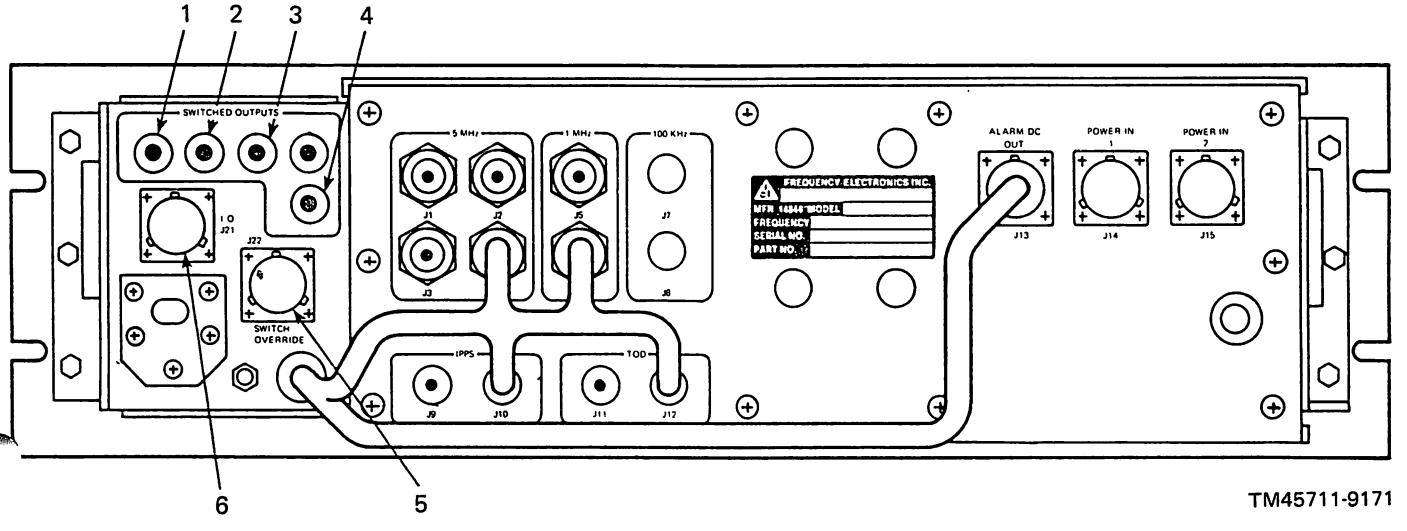


Figure 9-13. Model FE-5450A/J-ESM Equipment Carrier Rear Panel Connectors

TABLE 9-5. MODEL FE-5450A/J-ESM EQUIPMENT CARRIER REAR PANEL CONNECTORS

INDEX NO.	CONNECTOR	FUNCTION
1	5 MHz/J16 (Coaxial Type)	Provides standard 5 MHz output signal to external equipment.
2	1 MHz/J17 (Coaxial Type)	Provides standard 1 MHz output signal to external equipment.
3	1PPS/J18	Provides standard 1PPS output signal to external equipment.
4	TOD/J19, J20 (Coaxial Type)	Provides real time-of-day (TOD) output signal to external equipment.
5	SWITCH OVERRIDE/J22 (MS Type)	Provides switchover signal to other operational PRTC.
6	I/O/J21 (MS Type)	Provides PRTC and ESM status signals to, and receives PRTC operating commands from, external equipment.

c. Removal and replacement procedures for EC connectors J16 through J20 are the same as those described for connectors in paragraph 6-32.

d. Removal and replacement procedures for EC connectors J21 and J22 are the same as those described for connectors in paragraph 6-33.

e. Removal and replacement procedures for the EC receptacle connector XA1P1 are as follows:

(1) Remove three (3) panhead screws, nuts, and bolts from RH side of equipment carrier (EC) faceplate.

(2) Remove 14 panhead screws securing EC side panel to top and bottom covers.

(3) Remove three (3) countersunk screws from rear of side panel.

(4) Remove one (1) panhead and one (1) countersunk screw from center of side panel.

(5) Remove side panel.

(6) Tag and disconnect wires from connectors.

(7) Remove two (2) panhead screws securing connector to mounting bracket.

(8) Remove connector.

(9) Install replacement connector in mounting bracket and secure with two (2) screws.

TABLE 9-6. MODEL FE-5450A/J-ESM EQUIPMENT CARRIER (EC) MULTI-PIN CONNECTOR J21 AND J22 PIN FUNCTIONS

CONNECTOR	CONNECTOR TYPE	PIN	FUNCTION	NOTES
J21 I/O	MS3112E 14-19P	B	Std Sel Cmd	Select = 0
		C	Return	
		D	Std Sel Status	Select = 0
		E	Return	
		F	Auto/Manual Cmd	Manual = 0
		G	Return	
		H	Auto/Manual Status	Manual = 0
		J	Return	
		P	Std Alarm	Alarm = 1
		R	Return	
		S	ESM Alarm	Alarm = 1
		T	Return	
		U	Ground	Conn. Status
		V	Shield	
		A,M,N K,L	Spare	
All J21 I/O Command/Status signals are discrete levels with exception of STD SEL Cmd, which is a TTL low level pulse of 1 msec minimum duration. For maintenance function, Pins B and F are held low for duration of maintenance operation.				
J22 Switch Override	MS3112E 14-5S	B	Override In	Override = 0
		C	Return	
		D	Override Out	
		E	Return	
		A	Shield	

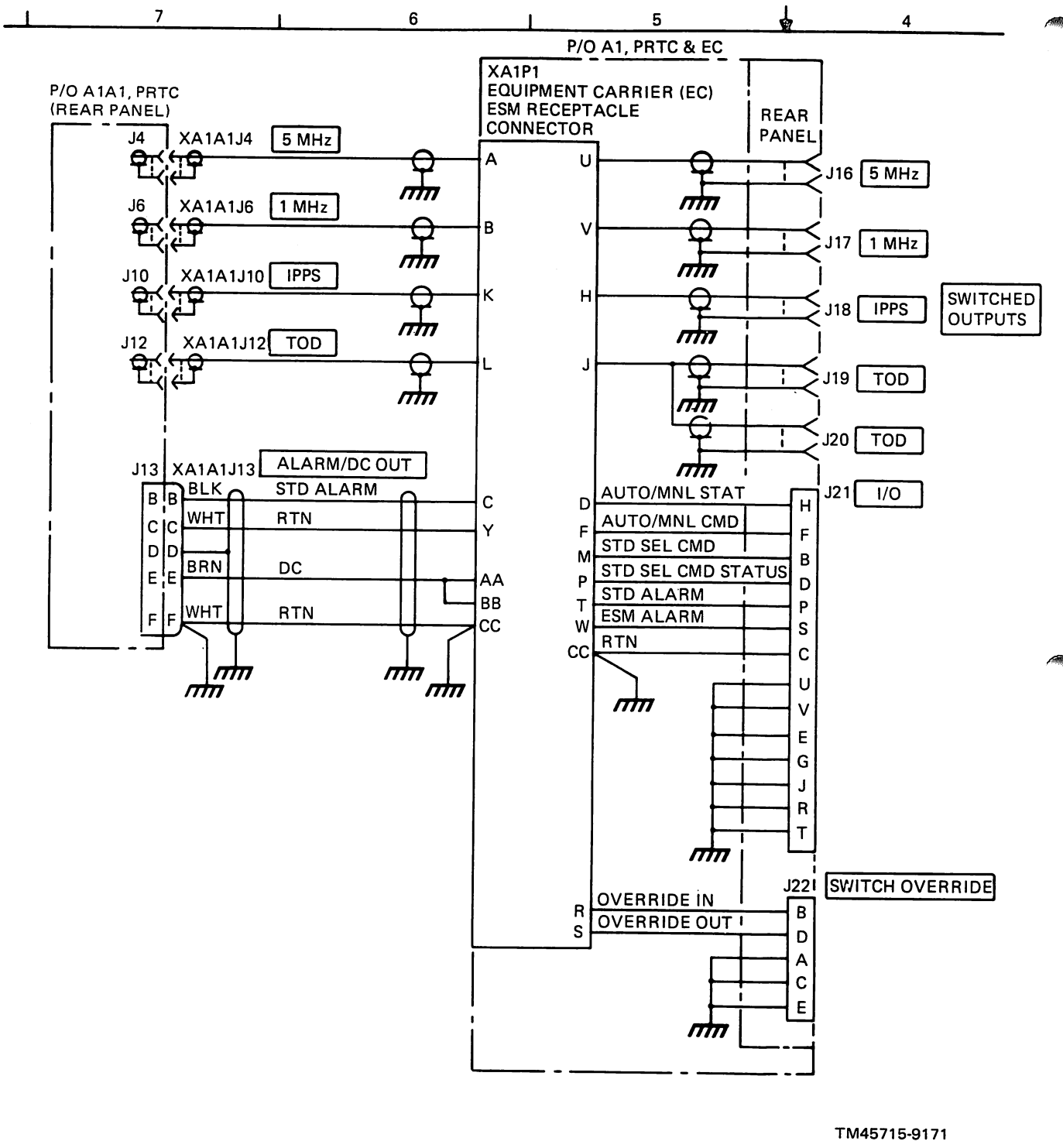


Figure 9-14. Model FE-5450A/J-ESM Portable Real Time Clock (PRTC) and Equipment Carrier (EC) Wiring Diagram

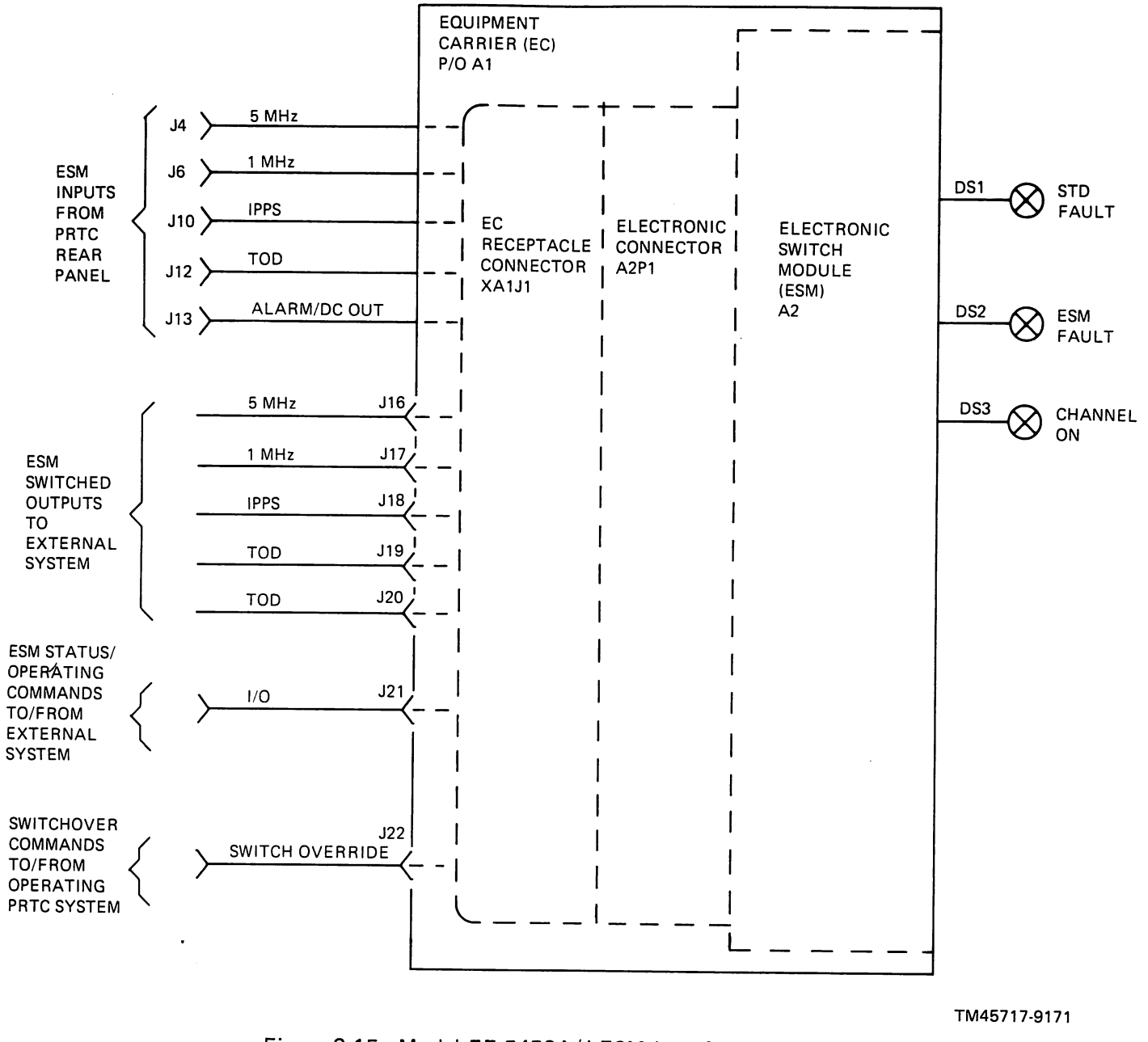


Figure 9-15. Model FE-5450A/J-ESM Interface Block Diagram

TABLE 9-7. PORTABLE REAL TIME CLOCK (PRTC) WITH EQUIPMENT CARRIER AND ELECTRONIC SWITCH MODULE (ESM), MODEL FE-5450A/J-ESM, PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MFR CODE IDENT	PART NUMBER
–	Portable Real Time Clock (PRTC) with Equipment Carrier and Electronic Switch Module (ESM) Model FE-5450A/J-ESM	14844	B45700-9171
A1	Portable Real Time Clock (PRTC) Model FE-5450A/J with Equipment Carrier (EC) (see table 9-8 for breakdown)	14844	B45720-9171
A1A1	Portable Real Time Clock (PRTC) (ESM) Model FE-7790A (see table 9-9 for breakdown)	14844	B45770-9171
A2	Electronic Switch Module (ESM) Model FE-7790A (see table 9-9 for breakdown)	14844	B45840-9171

TABLE 9-8. PORTABLE REAL TIME CLOCK (PRTC) MODEL FE-5450A/J WITH EQUIPMENT CARRIER (EC) PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MFR CODE IDENT	PART NUMBER
A1	Portable Real Time Clock (PRTC) Model FE-5450A/J with Equipment Carrier (EC)	14844	B45720-9171
J16	Connector, BNC	02660	UG-625B/N
J17	Connector, BNC	02660	UG-625B/N
J18	Connector, BNC	02660	UG-625B/N
J19	Connector, BNC	02660	UG-625B/N
J20	Connector, BNC	02660	UG-625B/N
J21	Connector	71468	MS3112E-14-19P
J22	Connector	71468	MS3112E-14-5S
XA2P1	Connector	09922	MS26RM-1

(10) Reconnect wires to appropriate connector pins and remove tags.

(11) Install side panel and replace one (1) panhead and one (1) countersunk screw in center of panel.

(12) Replace three (3) countersunk screws in rear of side panel.

(13) Replace 14 panhead screws to secure side panel to top and bottom covers.

(14) Replace three (3) panhead screws, nuts, and bolts to RH side of EC faceplate.

7. ILLUSTRATED PARTS LIST

a. With the exception of the ESM and EC, the illustrated parts list for Model FE-5450A/J-ESM is the same as that described for Model FE-5450A/J in difference data sheet no. 1.

b. The overall parts breakdown for Model FE-5450A/J-ESM is referenced in table 9-7. The parts breakdown for the EC and ESM are referenced in tables 9-8 and 9-9 respectively. Refer to figure 9-16 for parts location.

8. INSTALLATION

Installation data for Model FE-5450A/J-ESM is identical to that described for Model FE-5450A/J-EC in difference data sheet no. 2.

TABLE 9-9. ELECTRONIC SWITCH MODULE (ESM) MODEL FE-7790A, PARTS LIST

REFERENCE DESIGNATION	DESCRIPTION	MFR CODE IDENT	PART NUMBER
A2	Electronic Switch Module (ESM) Model FE-7790A	14844	B45840-9171
DS1	LED (Red)	50434	HLMP-4700
DS2	LED (Red)	50434	HLMP-4700
DS3	LED (Green)	50434	HLMP-3507
P1	Connector	09922	MSD26PM-1S9

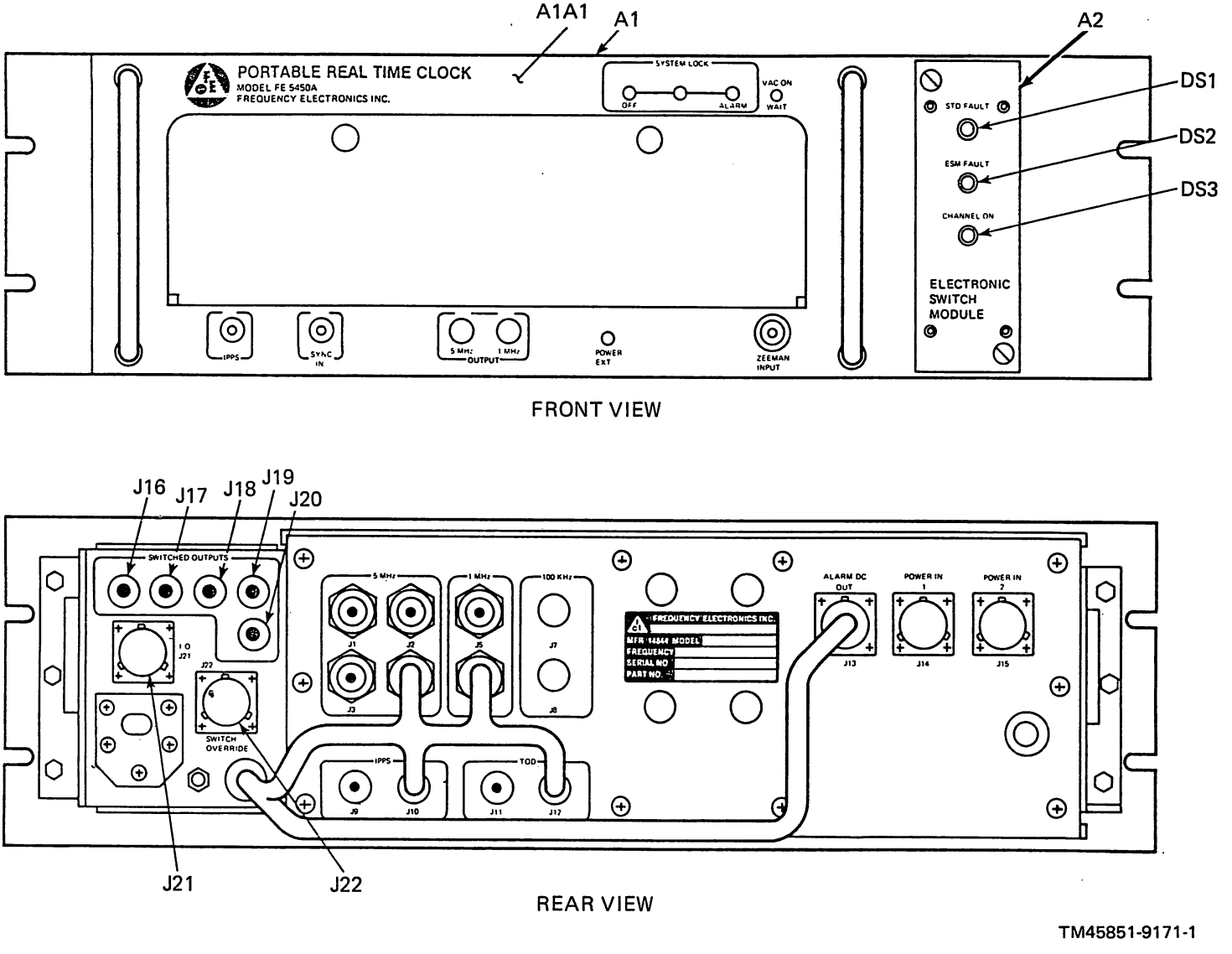


Figure 9-16. Model FE-5450A/J-ESM Parts Location Drawing (Sheet 1 of 2)

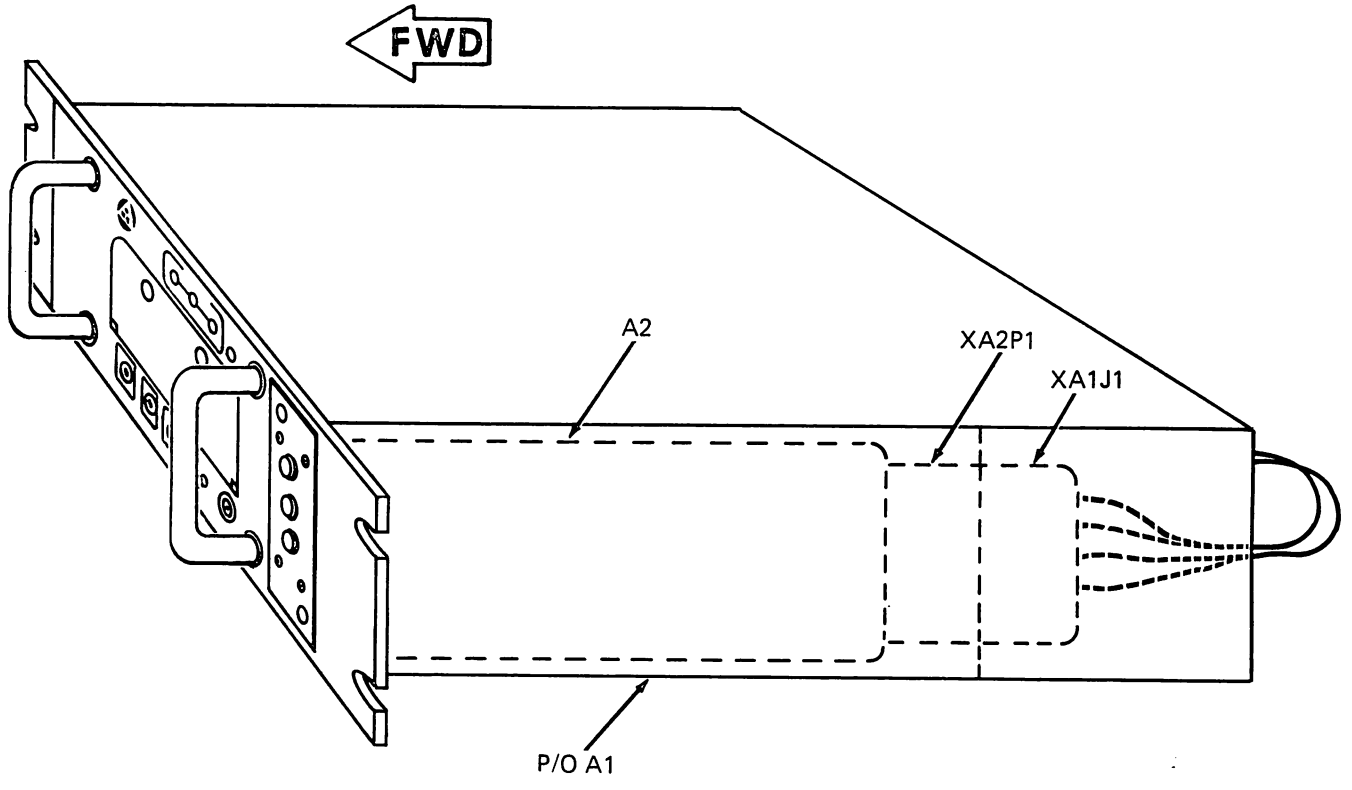
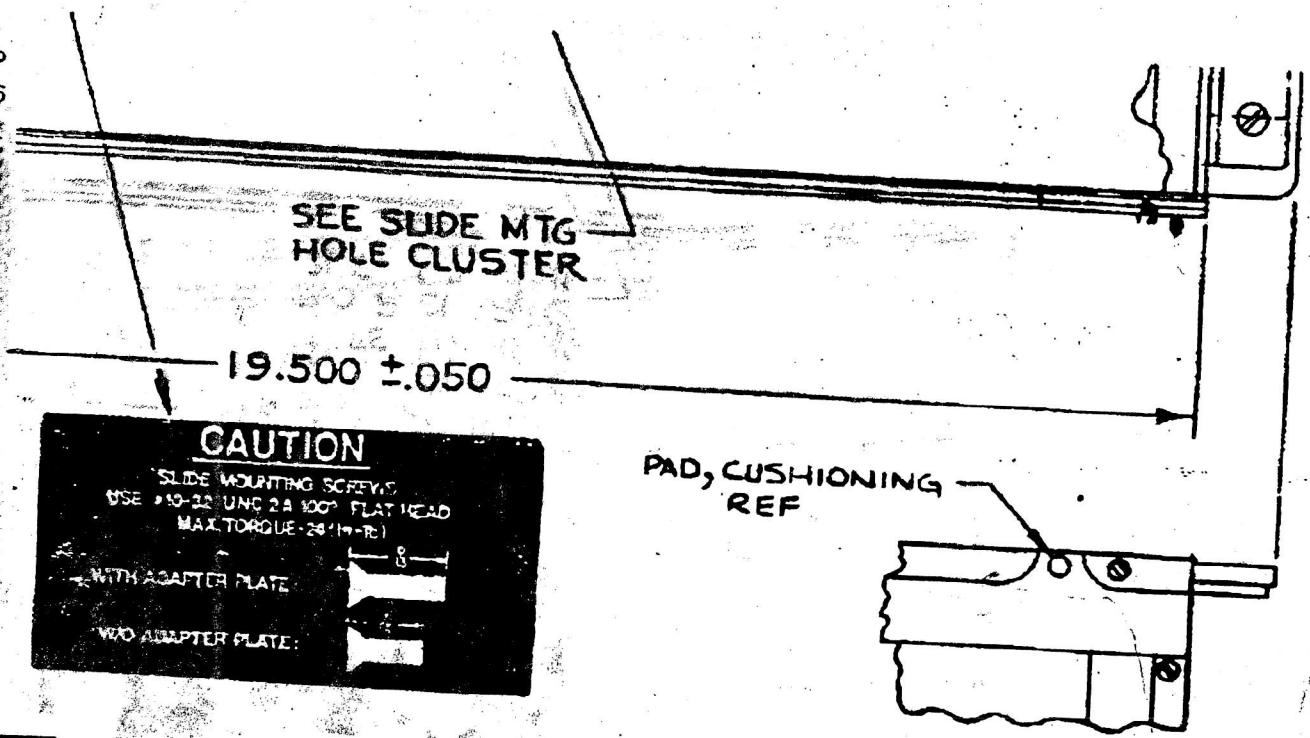
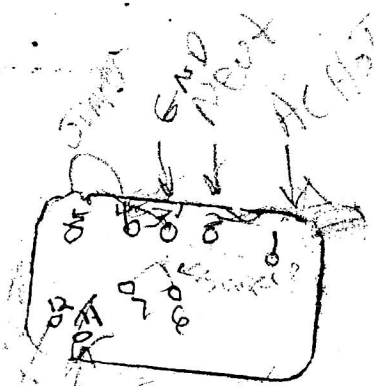


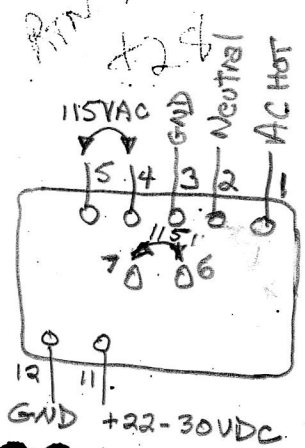
Figure 9-16. Model FE-5450A/J-ESM Parts Location Drawing (Sheet 2 of 2)





5. Connector P1 (Power) shall be wired as follows:

PIN	FUNCTION
1	Ac Hot*
2	Neutral
3	Safety Ground
11	+22 to +30 VDC
12	Return for Pin 11



* For 115 Vac, connect Pin 4 to Pin 5, and Pin 6 to Pin 7.

* For 230 Vac, connect Pin 5 to Pin 6

PN:D21700-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