MODELS
6747A AND 6747A-20
SWEPT FREQUENCY SYNTHESIZER

MAINTENANCE MANUAL

WILTRON

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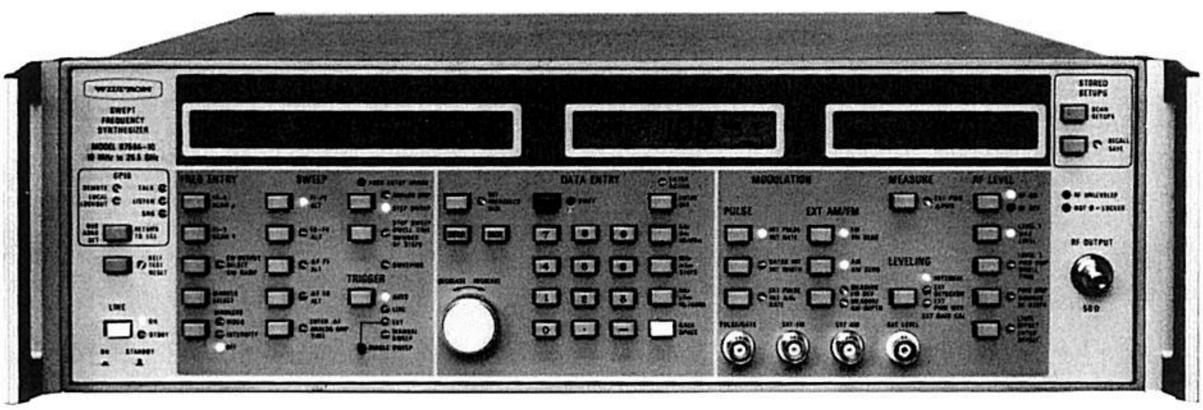

Figure 1-1. Typical Series 67XXA Swept Frequency Synthesizer

SECTION I
GENERAL INFORMATION

CONTENTS

SECTION I
GENERAL INFORMATION

1-1 SCOPE OF THE MANUAL

This manual provides general information, performance verification, calibration, parts, and service information for the model number indicated on the title page. Most of the information in this manual applies to all models in the 67XXA series; these pages are indicated by "67XXA" notation at the base of the page and in text. Specific model number references are made where the information presented is unique to that model only.

1-2 INTRODUCTION

Section I provides a general description of the equipment, its identification number, manuals, performance specifications, and options. A list of recommended test equipment is also given.

1-3 IDENTIFICATION NUMBER

All WILTRON instruments are assigned a unique six-digit ID number, such as "405001." Each 67XXA has two ID numbers assigned – one for the basic frame and one for the RF deck. The ID number for the RF deck is affixed to the outside of the rear panel, while that for the basic frame is affixed to chassis floor, below the swing-out RF deck. The RF deck ID number, on the outside, is the primary number. Please use it when ordering parts or corresponding with WILTRON's Customer Service department.

1-4 RELATED MANUALS

This is one of a two manual set that consists of an Operating Manual (OM) and a Maintenance Manual (MM). The OM provides coverage for all models in the 67XXA series. Conversely, the MMs contains model-dependent information. Because of this model dependency there are seventeen different MMs—one for each frequency model. The MMs provide performance verification, calibration, parts, and service (schematics, block diagrams, circuit description) information for the model being covered. Each frequency model may also be covered by a preliminary MM. If preliminary MMs exist, they will be discontinued when the final MM becomes available. The WILTRON part number for this manual is listed on the title page; the part numbers for all MMs and preliminary MMs are listed in Table 1-1 above.

Table 1-1. Maintenance Manual Part Numbers

67XX Model Number(s)	Final Manual Part Number	Preliminary Manual Part Number
6709A/–40	10370-00010	10370-00008
6717A/–20	10370-00014	10370-00012
6719A	10370-00018	10370-00016
6721A/–20	10370-00022	10370-00020
6722A/–20	10370-00082	10370-00080
6728A/–40	10370-00026	10370-00024
6729A/–20	10370-00034	10370-00032
6730A/–40	10370-00038	10370-00036
6736A	10370-00042	10370-00040
6737A/–20	10370-00046	10370-00044
6740A	10370-00076	10370-00078
6742A	10370-00050	10370-00048
6747A/–20	10370-00054	10370-00052
6753A/–10	10370-00058	10370-00056
6759A/–10	10370-00062	10370-00060
6763A	10370-00066	10370-00064
6769A	10370-00070	10370-00068

1-5 DESCRIPTION

The Series 67XXA Swept Frequency Synthesizers are microprocessor-based, GPIB, synthesized signal sources that generate swept and CW frequencies in one or more frequency bands between 10 MHz and 40 GHz. The series, which will expand as additional frequency ranges are added, presently consists of 28 models covering a variety of frequency and power ranges. Table 1-2 lists all models presently available, their frequency range, and their output power level.

1-6 OPTIONS

The following standard instrument options are available.

Option 1, Rack Mount. A kit is available containing mounting brackets and chassis track slides.

Table 1-2. 67XXA Series Swept Frequency Synthesizers

67XX Model	Frequency (GHz)	Output Power
6709A 6709A–40	.01-2	+10 dBm +16 dBm
6717A 6717A–20	.01-8.4	+10 dBm +13 dBm
6719A	2-8.4	+13 dBm
6721A 6721A–20	2-12.4	+10 dBm +13 dBm
6722A 6722A–20	.01-12.4	+10 dBm +13 dBm
6728A 6728A–40	8-12.4	+13 dBm +16 dBm
6729A 6729A–20	2-20	+10 dBm +13 dBm
6730A 6730A–40	12.4-20	+13 dBm +16 dBm
6736A	18-26.5	+7 dBm
6737A 6737A–20	2-26.5	+10 dBm +13 dBm
6740A	26.5-40	+10 dBm
6742A**	18-40	+5 dBm, ≤26.5 GHz 0 dBm, >26.5 GHz
6747A 6747A–20	.01-20	+10 dBm +13 dBm
6753A 6753A–10	2-26.5	+10 dBm, ≤20 GHz +5 dBm, >20 GHz +10 dBm
6759A 6759A–10	.01-26.5	+10 dBm, ≤20 GHz +5 dBm, >20 GHz +10 dBm
6763A**	2-40	+10 dBm, ≤20 GHz +5 dBm, ≤26.5 GHz 0 dBm, ≤40 GHz
6769A**	.01-40	+10 dBm, ≤20 GHz +5 dBm, ≤26.5 GHz 0 dBm, ≤40 GHz

* Optional attenuator reduces rated power by 3 dB.
** Scheduled for later introduction.

Option 2A, 110 dB Step Attenuator. Each synthesizer comes supplied with a 110 dB Step Attenuator installed. Rated output power is reduced by 3 dB. This option is available only for the following models:

6709A/6709A-40
6717A/6717A-20
6719A
6721A/6721A-20
6728A/6728A-40

Option 2B, 90 dB Step Attenuator. Each synthesizer comes supplied with a 90 dB Step Attenuator installed. Rated output power is reduced by 3 dB. This option is available for all models having an upper frequency limit above 18 GHz.

Option 2C, 110 dB Step Attenuator. Each synthesizer comes supplied with a 110 dB Step Attenuator installed. Rated output power is reduced by 3 dB. This option is available for all models having an upper frequency limit above 18 GHz.

Option 9K, K Connector. Each synthesizer comes supplied with a rear panel K Connector™ RF Output instead of the type of connector that would normally be installed on the front panel. The front panel connector is deleted. Rated output power, flatness, and SWR are slightly degraded.

1-7 PERFORMANCE SPECIFICATIONS

Performance specifications for all 67XXA series synthesizers are listed in Section 1 of the Operating Manual.

1-8 RECOMMENDED TEST EQUIPMENT

Table 1-3 provides a lists of recommended test equipment needed to check and service the 67XXA Series Swept Frequency Synthesizers. The entries are coded to show for which types of testing the equipment is used. These codes are described below.

Code	Type of Testing
C	Calibration (MM-Section 3)
P	Performance Verification (MM-Section 4)
T	Troubleshooting (MM-Section 6)

Table 2-1. Recommended Test Equipment Used for Performance Tests, Calibration/Adjustments and Troubleshooting

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	USED IN SECTION(S)
Spectrum Analyzer	*Frequency:* 0.01 to 20 GHz *Resolution:* 30 Hz	Tektronix, Model 494P	P, C, T
Frequency Counter	*Frequency:* 0.01 to 20 GHz *Input Impedance:* 50Ω *Resolution:* 1 Hz *Other:* Ext Time Base Input	EIP Microwave, Inc. Model 578A, Option 91	P, C, T
Power Meter	*Power Range:* –30 to +20 dBm	Hewlett-Packard, Model 436	P, C, T
Power Sensor	*Frequency Range:* 0.01 to 20 GHz *Power Range:* –30 to +20 dBm	Hewlett-Packard, Model 8485A	P, C, T
Digital Voltmeter	*Resolution:* 4-1/2 digits (to 20V) *DC Accuracy:* 0.002% + 2 counts *DC Input Impedance:* 10 MΩ *AC Accuracy:* 0.07% + 100 counts (to 20 kHz) *AC Input Impedance:* 1 MΩ	John Fluke, Inc. Model 8840A With Option 8840A-09 (True RMS AC)	P, C, T
Frequency Standard	*Frequency:* 10 MHz *Accuracy:* 1 x 10^{-10} parts/day	Spectracom Corp. Model 8161	P, C
Function Generator	*Output Voltage:* 300 mV to 10V *Functions:* 200 kHz sine wave, 100 Hz square wave	Model 8116A	P, C
Oscilloscope	*Bandwidth:* dc to 150 MHz *Sensitivity:* 2 mV *Horiz. Sensitivity:* 50 ns/division	Tektronix, Inc. Model 2445	P, C, T
Feedthrough Termination	*Impedance:* 50Ω *Connectors:* BNC *Frequency Range:* dc to 20 GHz	Tektronix, Inc. Part Number 011-0049-01	P
Pulse Detector	*Output Polarity:* Negative *Frequency Range:* dc to 20 GHz	Wiltron Company Model 75KA50	P
Modulation Analyzer	*Frequency Input:* 10 MHz (or the IF of the spectrum analyzer) *FM Max. Deviation:* 500 kHz *FM Accuracy:* ±1% to 100 kHz rate *AM Depth:* 0% to 90% *AM Mod. Rates:* dc to 100 kHz *AM Accuracy:* ± 3% *Filters:* 50 Hz lowpass, 15 kHz highpass	Hewlett-Packard Model 8901A	P, C
Scalar Network Analyzer	*Frequency Range:* 0.01 to 40 GHz	WILTRON Model 560A, with 560-7K50 Option 2 RF Detector	C
High Pass Filter	150 MHz High-Pass Filter (DC Block)	Narda, Model 4564	P
Low Pass Filter	450 MHz Low Pass Filter	Mini-Circuits, Model LP-450	P
Short Circuit	*Connectors:* 50Ω BNC	Use Feedthrough Termination	P
Tee	*Connectors:* 50Ω BNC	Any common source	P
Cables	*Connectors:* 50Ω BNC	Any common source	P

NOTES: 1) P = Performance Tests (Section 2); C = Calibration/Adjustments (Section 3); T = Troubleshooting (Section 6)
2) This table contains the support equipment for Models 6747A and 6747A-20 instruments with an upper frequency limit of 20 GHz.
3) This table does not include the recommended test equipment that is necessary to perform the automated RF Level Calibration Test; refer to section 3, Calibration/Adjustments.
4) Please contact WILTRON Customer Service at (408) 778-2000 for help regarding test equipment compatibility.

SECTION II
PERFORMANCE VERIFICATION

CONTENTS

SECTION II
PERFORMANCE VERIFICATION

2-1 INTRODUCTION

This section contains procedures used to verify the performance specifications of 6747A and 6747A-20 Swept Frequency Synthesizers. This procedure covers all units having any version of firmware. Instruments with an Option 2A (110 dB) or Option 2B (90 dB) step attenuator are also supported.

NOTE

For brevity, the term "6747A/-20" is used as a reference to either the 6747A (+10 dBm RF output) or the 6747A-20 (+13 dBm RF output). A specific reference is made to only one of the instrument models when the procedure for that model type requires special instructions.

The generic "67XXA" reference refers to any synthesizer model; model number is not critical in such a case.

2-2 RECOMMENDED TEST EQUIPMENT

Table 2-1 on the following page lists the test equipment required for the Performance Tests.

The procedures refer to specific test equipment front panel control labels when the setup parameters of the test are critical to making an accurate measurement. In some cases, substitute equipment having the same Critical Specifications as those of the equipment listed in the Recommended Test Equipment list in Table 1-2 may not have exactly the same labels yet may provide similar functions.

Contact the WILTRON Customer Service department at (408) 778-2000 if you need clarification of any equipment or procedural reference.

2-3 PERFORMANCE TEST RECORD

A blank copy of a sample performance test record is provided in Section 4, Test Record. The test record provides the means for maintaining an accurate and complete record of instrument performance. We recommend that you copy these pages and record the results on the copy rather than the original pages supplied in Section 4. Record your initial testing of the instrument; this data can later be used as benchmark values for future tests of the same instrument (referenced by its serial number).

2-4 CONNECTOR AND KEY LABEL NOTATION

The test instructions include many references to equipment interconnections and control settings. For all 6747A or 6747A-20 references, specific labels are used to denote the appropriate connector or key depression (such as CW OUTPUT SELECT or RF OUTPUT). Most other references to support test equipment use general labels for commonly used connector and features (such as Span or RF Input). In some cases, a specific label is used that is a particular feature of the test equipment listed in Table 2-1.

Upon pressing many 6747A or 6747A-20 front panel keys, an LED indicator next to the key lights to verify the selection. Be aware of their presence to ensure that the desired function is enabled.

Three additional LED indicators that should be periodically viewed are the ENTRY ACTIVE, RF UNLEVELED, and NOT Θ-LOCKED indicators. Be aware of their presence during the test sequence. These three indicators may signal a situation that is the result of an instrument failure which may cause errant test results.

Table 2-1. Recommended Test Equipment Used in the Performance Tests

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	REQUIRED FOR TEST(S)
Spectrum Analyzer	*Frequency:* 0.01 to 20 GHz *Resolution:* 30 Hz	Tektronix, Model 494P	2-8, 2-9, 2-10, 2-12, 2-13, 2-14, 2-17
Frequency Counter	*Frequency:* 0.01 to 20 GHz *Input Impedance:* 50Ω *Resolution:* 1 Hz *Other:* Ext Time Base Input	EIP Microwave, Inc. Model 578A, Option 91	2-6
Power Meter	*Power Range:* –30 to +20 dBm	Hewlett-Packard, Model 436	2-11, 2-15
Power Sensor	*Frequency Range:* 0.01 to 20 GHz *Power Range:* –30 to +20 dBm	Hewlett-Packard, Model 8485A	2-11, 2-15
Digital Voltmeter	*Resolution:* 4-1/2 digits (to 20V) *DC Accuracy:* 0.002% + 2 counts *DC Input Impedance:* 10 MΩ *AC Accuracy:* 0.07% + 100 counts (to 20 kHz) *AC Input Impedance:* 1 MΩ	John Fluke, Inc. Model 8840A With Option 8840A-09 (True RMS AC)	2-13, 2-14
Frequency Standard	*Frequency:* 10 MHz *Accuracy:* 1 x 10^{-10} parts/day	Spectracom Corp. Model 8161	2-5
Function Generator	*Output Voltage:* 300 mV to 10V *Functions:* 200 kHz sine wave, 100 Hz square wave	Model 8116A	2-13, 2-14
Oscilloscope	*Bandwidth:* dc to 150 MHz *Sensitivity:* 2 mV *Horiz. Sensitivity:* 50 ns/division	Tektronix, Inc. Model 2445	2-5, 2-7, 2-15, 2-16
Feedthrough Termination	*Impedance:* 50Ω *Connectors:* BNC *Frequency Range:* dc to 20 GHz	Tektronix, Inc. Part Number 011-0049-01	2-15, 2-16
Pulse Detector	*Output Polarity:* Negative *Frequency Range:* dc to 20 GHz	Wiltron Company Model 75KA50	2-15
Modulation Analyzer	*Frequency Input:* 10 MHz (or the IF of the spectrum analyzer) *FM Max. Deviation:* 500 kHz *FM Accuracy:* ±1% to 100 kHz rate *AM Depth:* 0% to 90% *AM Mod. Rates:* dc to 100 kHz *AM Accuracy:* ± 3% *Filters:* 50 Hz lowpass, 15 kHz highpass	Hewlett-Packard Model 8901A	2-14
High Pass Filter	150 MHz High-Pass Filter	Narda, Model 4564	2-13
Low Pass Filter	450 MHz Low Pass Filter	Mini-Circuits, Model LP-450	2-14
Short Circuit	*Connectors:* 50Ω BNC	Use Feedthrough Termination	2-17
Tee	*Connectors:* 50Ω BNC	Any common source	2-13, 2-14
Cables	*Connectors:* 50Ω BNC	Any common source	All tests

NOTE: This table contains a subset of the total support equipment needs for 6747A or 6747A-20 instruments with an upper frequency limit of 20 GHz. It includes only the equipment required for the Performance Tests provided in this section. Refer to Table 1-3 in Section 1, General Information, for a complete list. Please contact WILTRON Customer Service at (408) 778-2000 for help regarding test equipment compatibility.

2-5 INTERNAL TIME BASE AGING RATE TEST

a. Test Description

The following procedure verifies that the 6747A/-20 10 MHz time base is within its aging specification. The 6747A/-20 derives its frequency accuracy from an internal 10 MHz crystal oscillator standard. An inherent characteristic of crystal oscillators is the effect of crystal "aging" within the first few days to weeks of operation. Typically, a crystal oscillator's frequency increases slightly at first, then settles to a relatively constant value for the rest of its life. The 6747A/-20 reference oscillator aging is specified as 1×10^{-9} parts per day (24 hour period).

NOTE

Do not confuse crystal aging with other short-term frequency instabilities like noise and temperature.

For greatest absolute frequency accuracy, allow the 6747A/-20 to warm up until its RF output frequency has stabilized (usually 7 to 30 days) before adjustment (calibration). After calibration, the change in reference oscillator frequency should remain within the aging rate if: (1) the time base oven is not allowed to cool, (2) the instrument orientation with respect to the earth's magnetic field is maintained, and (3) the instrument does not sustain any mechanical shock. This test should be done upon receipt of the instrument and again after a period of several days to weeks to fully qualify the aging rate.

The time (in seconds) required for a specific phase change of 1 cycle (360°) is measured at the start and finish of the test time period (at least 3 but preferably 24 hours or more). Aging rate is calculated with a formula that (inversely) relates time and frequency.

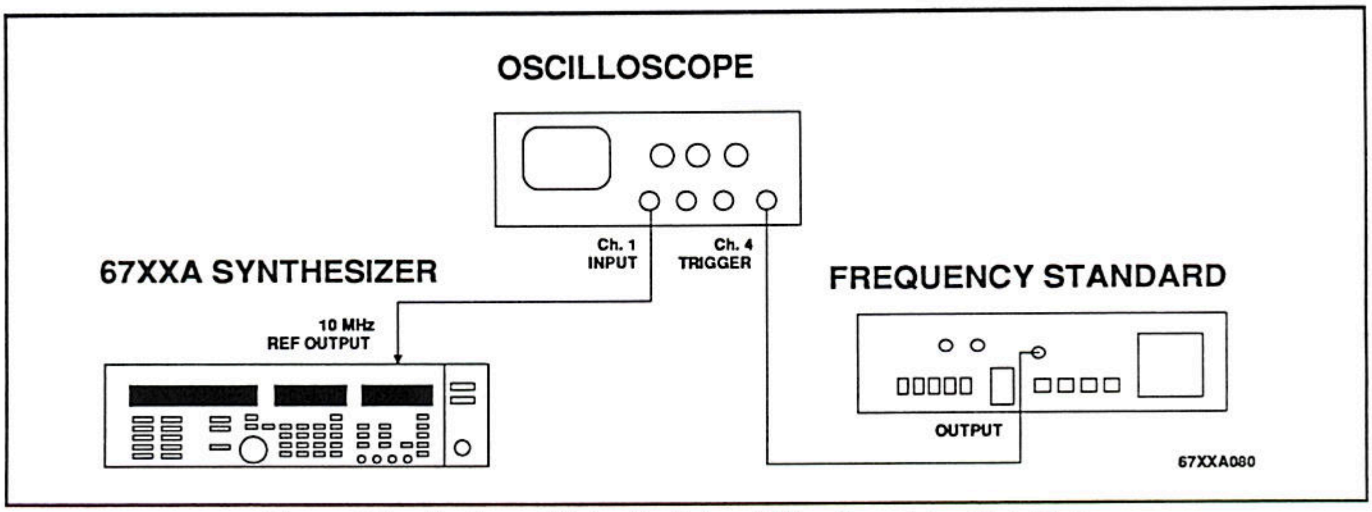

Figure 2-1. Equipment Setup for Internal Time Base Aging Rate Test

b. Test Setup

1. Connect the equipment as shown in Figure 2-1.
   - (a) Connect the 6747A/-20 rear panel 10 MHZ REF OUTPUT to the Oscilloscope vertical input.
   - (b) Connect the Frequency Standard (having long term stability $\leq 1 \times 10^{-10}$) to the Oscilloscope external trigger input.
   - (c) Set the Oscilloscope controls as follows:
     - (1) External Triggering
     - (2) TIME/DIV: 50 ns
     - (3) VOLT/DIV: 0.5

c. Test Procedure

1. Adjust the Oscilloscope external triggering controls for a stable display of the 6747A/-20 10 MHz REF OUTPUT signal.
2. Record the start time of the test period as T_S in the Test Record.
3. Immediately, measure the time (in seconds) required for a 360 degree phase change on the Oscilloscope display. Record this as T_1 in the Test Record.
4. Wait for a period of time (at least 3 but preferably 24 hours) and remeasure the time required for a 360 degree phase change. Record this as T_2 in the Test Record.

5. Immediately, record the finish time of the test period as T_F in the Test Record.

6. Calculate the aging rate as follows:

$$\text{Aging Rate} = \left(\frac{1\ \text{cycle}}{F_{STD}}\right) \times \left(\left|\frac{1}{T_1} - \frac{1}{T_2}\right|\right) \times \left(\frac{T_{SPEC}}{T_F - T_S}\right)$$

Where:
$F_{STD}=10 \times 10^6$ Hertz
(6747A/-20 ref. oscillator frequency)
T_F=Test period end time (hours)
T_S=Test period start time (hours)
T_1=Initial 360° phase change time (seconds)
T_2=Final 360° phase change time (seconds)
T_{SPEC}=Spec. reference period (i.e., per day)
1 cycle=Portion of F_{STD} applied to test

7. Record the computed result in the Test Record. To meet the specification, the calculated aging rate must be $<1 \times 10^{-9}$ per day.

2-6 FREQUENCY SYNTHESIS TESTS

a. Test Description

The frequency synthesis tests are divided into two main parts, fine loop tests and coarse loop/YIG loop tests. The coarse loop/YIG loop test steps the unit through its full frequency range in 1 GHz steps. The fine loop tests steps the unit through 1 kHz steps. Ten 1 kHz steps are needed to verify the fine loop.

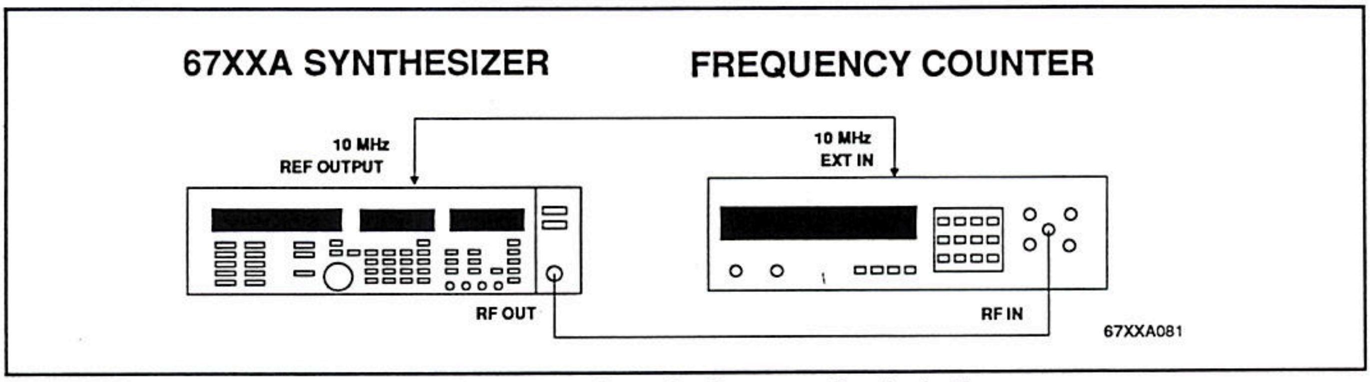

Figure 2-2. Equipment Setup for Frequency Synthesis Tests

b. Test Setup

1. Connect the equipment as shown in Figure 2-2.
   (a) Connect the 6747A/-20 rear panel 10 MHZ REF OUTPUT to the Frequency Counter 10 Mhz External Reference input.
   (b) Connect the 6747A/-20 RF OUTPUT to the Frequency Counter RF Input.

c. Coarse Loop/YIG Loop Test Procedure

1. Initialize the 6747A/-20 for 1 GHz steps as follows:
   (a) Press <Shift> RESET.
   (b) Press CW OUTPUT SELECT.
   (c) Enter 1 GHz.
   (d) Press SET INCR/DECR SIZE.
   (e) Enter 1 GHz.

2. Record the Frequency Counter reading in the Test Record. The Frequency Counter reading must be within ±100 Hz of the displayed 6747A/-20 frequency to accurately complete this test.

NOTE

The counter is typically within ±1 Hz since the instruments use a common time base. Differences of a few Hertz can be caused by noise and counter limitations. Differences of ≥±100 Hz indicate a frequency synthesis problem.

3. On the 6747A/-20, press INCR. Record the Frequency Counter reading in the Test Record.

4. Repeat step c.3 until all frequencies listed in the Test Record have been recorded.

d. Fine Loop Test Procedure

1. Set the 6747A/-20 for 1 kHz steps as follows:
   (a) Press <Shift> RESET.
   (b) Press F1-F9 SCAN ▲ to display the F3 frequency noted on the Test Record.
   (c) Press CW OUTPUT SELECT.
   (d) Press SET INCR/DECR SIZE.
   (e) Enter 1 kHz.

2. Record the Frequency Counter reading in the Test Record. It must be within ±100 Hz of the 6747A/-20 displayed frequency to meet specification.

3. On the 6747A/-20, press INCR. Record the Frequency Counter reading in the Test Record.

4. Repeat step d.3 until all frequencies listed in the Test Record have been recorded.

2-7 MARKER AND BLANKING VERIFICATION

a. Test Description

This test verifies correct operation of the markers and blanking signals. Operation and programmability are both tested.

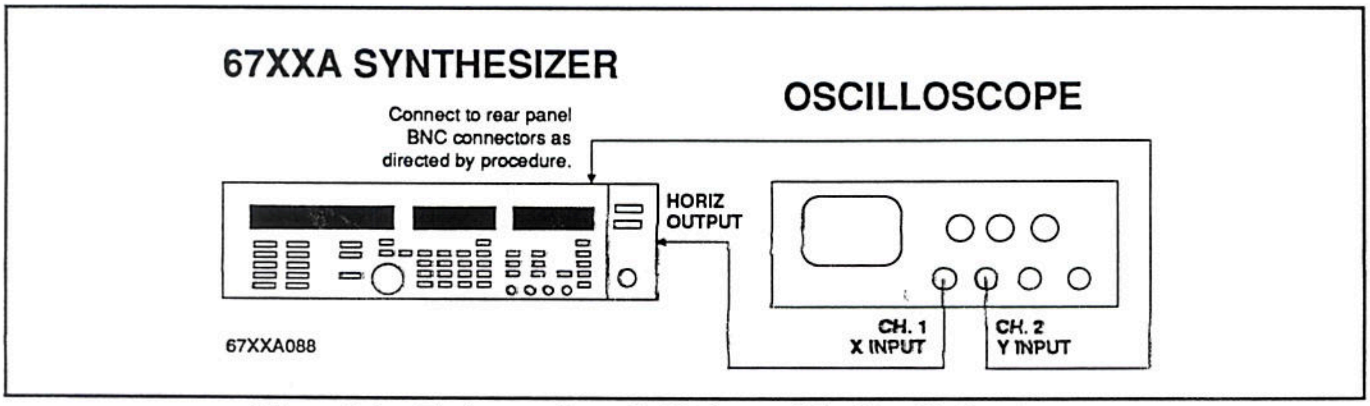

Figure 2-3. Equipment Setup for Marker and Blanking Verification

b. Test Setup

1. Connect the equipment as shown in Figure 2-3.
   (a) Connect the 6747A/-20 rear panel MARKER OUTPUT to the Oscilloscope Ch. 2 input (Y-axis input).
   (b) Connect the 6747A/-20 rear panel HORIZ OUTPUT to the oscilloscope X-axis input.

c. Marker Selection Procedure

1. Set up the 6747A/-20 for a full-range sweep:
   (a) Press <Shift> RESET.
   (b) Press F1-F2.
   (c) Press <Shift> TRIGGER 0 8 0 to unlock the 6747A/-20; this permits easier viewing of the markers on the Oscilloscope display.

2. Press F1-F9 SCAN ▲ to display the F1 frequency noted on the Test Record. Press the 6747A/-20 MARKER SELECT button, then press MARKERS VIDEO. Verify that a marker appears on the Oscilloscope. Note its presence on the Test Record.

3. Check the other eight markers as follows:
   (a) Press F1-F9 SCAN ▲ to display the F2 frequency noted on the Test Record.
   (b) Press MARKER SELECT to select the next marker. Verify that a marker appears on the Oscilloscope. Note its presence on the Test Record.

4. Repeat step 3 until all nine markers have been selected and verified. Note their presence on the Test Record.

d. Marker Output Verification Procedure

1. Observe the oscilloscope display and verify that +5V (TTL high) markers appear at nine points along the horizontal axis. (All markers have already been selected in the previous Marker Selection procedure.) Note their presence on the Test Record.

2. On the 6747A/-20, select MARKERS INTENSITY.

3. Verify that each marker changes from a +5V (TTL high) signal to to an intensified spot. Note the presence of each on the Test Record.

4. Move the Oscilloscope Y-axis input from the 6747A/-20 rear panel MARKER OUTPUT to the 6747A/-20 rear panel SEQ SYNC OUTPUT.

5. Verify that the waveform changes:
   (a) To a +5V signal (TTL high) during the following times: at retrace, at each bandswitch point, and at each switched-filter switch point (2-8 GHz band only);
   (b) To –10V at the selected (active) video marker frequency;
   (c) To –5V at all other marker frequencies.
   (d) Note the result of steps d.5(a), d.5(b), and d.5(c) on the Test Record.

6. Press the F1-F9 SCAN ▲ key to select another marker. Verify that the newly selected marker changes from –5V to –10V, and that the previously selected marker changes to –5V. Note the result on the Test Record.

7. Move the Oscilloscope Y-axis input from the 6747A/-20 rear panel SEQ SYNC OUTPUT to the 6747A/-20 rear panel BANDSWITCH BLANK OUTPUT connector.

8. With the rear panel FUNCTION SELECT set for +BLANK, verify that the signal only changes to +5V during the bandswitch dwell points listed in the Test Record. Note the result on the Test Record.

9. With the rear panel FUNCTION SELECT set to –BLANK, verify that the signal only changes to –5V during the bandswitch dwell points listed in the Test Record. Note the result on the Test Record.

10. Move the Oscilloscope Y-axis input from the 6747A/-20 rear panel BANDSWITCH BLANK OUTPUT to the 6747A/-20 rear panel RETRACE BLANK OUTPUT connector.

11. With the FUNCTION SELECT set to –BLANK, verify that the signal changes to –5V during retrace. Note the result on the Test Record.

12. With the FUNCTION SELECT set to +BLANK, verify that the signal changes to +5V during retrace. Note the result on the Test Record.

13. Press <SHIFT> TRIGGER 0 8 1 to relock the 6747A/-20.

2-8 NARROW BAND SPURIOUS TESTS

a. Test Description

This test verifies that the fine and coarse loop fractional division filters are functioning properly.

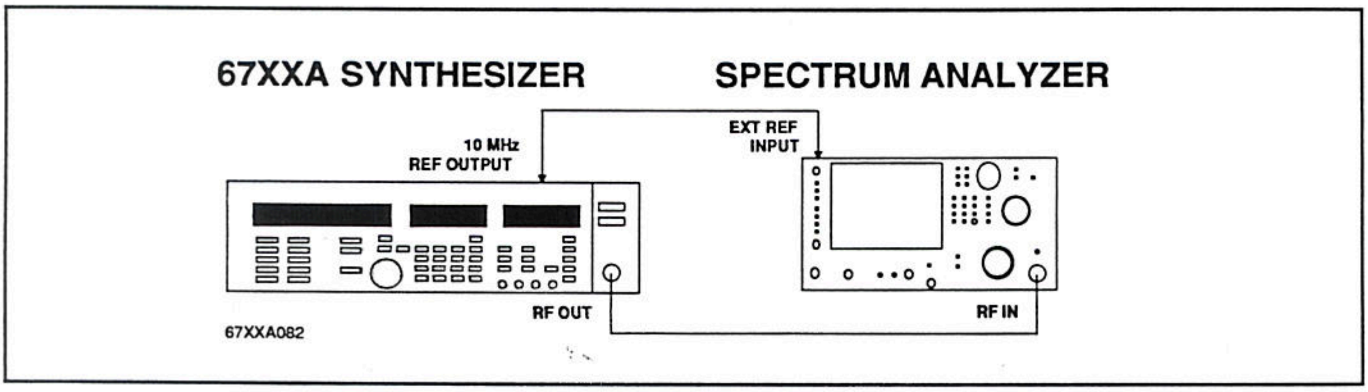

Figure 2-4. Equipment Setup for Narrow Band Spurious Tests

b. Test Setup

1. Connect the equipment as shown in Figure 2-4.
   - (a) Connect the 6747A/-20 rear panel 10 MHZ REF OUTPUT to the Spectrum Analyzer External Reference Input.
   - (b) Connect the 6747A/-20 RF OUTPUT to the Spectrum Analyzer RF Input.

c. Fine Loop Test Procedure

1. Set up the 6747A/-20 for fractional division on the fine loop as follows:
   - (a) Press <Shift> RESET.
   - (b) Press CW OUTPUT SELECT and enter the frequency indicated on the Test Record.
   - (c) Press SET INCR/DECR SIZE.
   - (d) Enter 1 kHz.
   - (e) Press INCR.

2. Set up the Spectrum Analyzer as follows:
   - (a) CF: Set to 10 kHz higher than 6747A/-20 F1 frequency value.
   - (b) RF Level: Set signal peak to top graticule.
   - (c) Span: Set to 100 Hz
   - (d) RBW: 30 Hz
   - (e) Video Filter: On (if necessary)

NOTE

In order to make an accurate measurement of the 6747A/-20 spurious responses, the noise floor of the Spectrum Analyzer must be clearly below –65 dBc, preferably below –75 dBc.

3. Measure and record on the Test Record, all spurious signals at 10, 20, 30, 40, and 50 kHz away from the carrier. (On the Spectrum Analyzer, increase the center frequency by 10 kHz for each measurement to keep the measured peak at center screen.) All spurious signals must be <–60 dBc to meet specification.

d. Coarse Loop Test Procedure

1. Set up the 6747A/-20 for fractional division on the coarse loop as follows:
   - (a) Press <Shift> RESET.
   - (b) Press CW OUTPUT SELECT.
   - (c) Using the keypad and terminator keys, enter a new frequency value for F1 from the Test Record.
   - (d) Press SET INCR/DECR SIZE.
   - (e) Enter 2 MHz.
   - (f) Press INCR.

2. Set up the Spectrum Analzer as follows:
   - (a) Span: 100 kHz/div
   - (b) CF: Set to 200 kHz higher than the 6747A-20 F1 frequency value.
   - (c) RBW: 1 kHz
   - (d) Video Filter: Wide

3. Measure and record on the Test Record, all spurious signals at 200 and 400 kHz away from the carrier. (On the spectrum analyzer, increase the center frequency by 200 kHz for each measurement to keep the measured peak at center screen.) All spurious signals must be <–60 dBc to meet specification.

2-9 SPURIOUS AND HARMONIC TESTS: RF OUTPUT SIGNALS ≤2 GHz

a. Test Description

This test applies only to 6747A/-20 models with a 0.01-2 GHz frequency band and verifies that the 6747A/-20 meets its 0.01-2 GHz harmonic specifications.

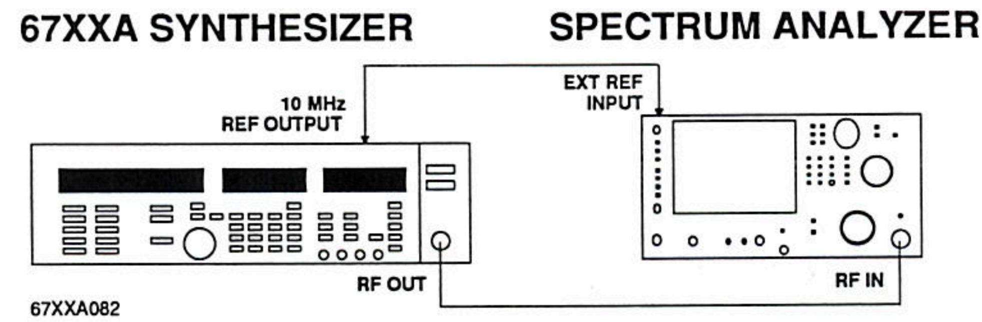

Figure 2-5. Equipment Setup for Spurious and Harmonic Tests: RF Output Signals ≤2 GHz

b. Test Setup

1. Connect the equipment as shown in Figure 2-5.
   (a) Connect the 6747A/-20 rear panel 10 MHZ REF OUTPUT to the Spectrum Analyzer External Reference Input.
   (b) Connect the 6747A/-20 RF OUTPUT to the Spectrum Analyzer RF Input.

c. Test Procedure

1. Set up the Spectrum Analyzer as follows:
   (a) Span: 10 MHz/div
   (b) CF: 50 MHz
   (c) RBW: 1 MHz
   (d) Sweep Speed: Auto (to resolve signal peaks clearly)

2. Set the the 6747A/-20 as follows:
   (a) Press <Shift> RESET
   (b) Press CW OUTPUT SELECT
   (c) Enter 10 MHz.

3. On the Spectrum Analyzer, measure and record on the Test Record the presence of any harmonics of the 10 MHz carrier that are ≤–20 dBc and any spurious responses that are ≤–40 dBc.

NOTE

Harmonics appear at multiples of the CW frequency and diminish quickly as the CW frequency goes greater than 1 GHz.

4. Repeat steps c.2 and c.3 for 6747A/-20 CW frequencies of 20 and 30 MHz. Measure and record the presence of harmonics and spurious responses.

5. Change the Spectrum Analyzer as follows:
   (a) Span: 100 MHz/div
   (b) CF: 500 MHz

6. Repeat steps c.2 and c.3 for 6747A/-20 CW frequencies of 40 MHz. Measure and record the presence of harmonics and spurious responses.

7. Change the Spectrum Analyzer as follows:
   (a) Span: 200 MHz/div (or maximum span width)
   (b) CF: 1 GHz

8. Repeat steps c.2 and c.3 for a 6747A/-20 CW frequency of 350 MHz. Measure and record the presence of harmonics and spurious responses.

9. Change the Spectrum Analyzer as follows:
   (a) Span: 10 MHz/div
   (b) CF: To match desired 6747A/-20 harmonic

10. Repeat steps c.2 and c.3 for a 6747A/-20 CW frequencies of 1.6 GHz. Measure and record the presence of harmonics and spurious responses.

2-10 HARMONIC TEST: RF OUTPUT SIGNALS FROM 2 TO 10 GHz

a. Test Description

This test verifies that the 6747A/-20 meets its harmonic specifications for RF Output signals from 2-10 GHz. Test Record entries are supplied for harmonics up to a frequency limit of 20 GHz (the upper limit of the 6747A and 6747A-20). Additional harmonic checks may be made at any freuqency of interest through the use of a Spectrum Analyzer with a higher frequency range.

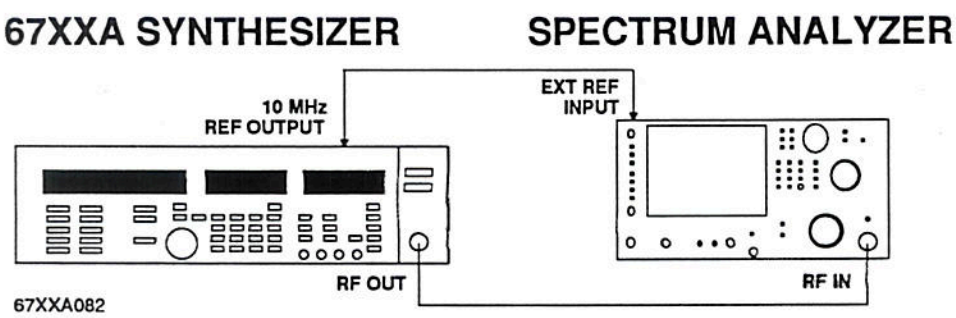

Figure 2-6. Equipment Setup for Harmonic Test: RF Output Signals From 2 to 10 GHz

b. Test Setup

1. Connect equipment as shown in Figure 2-6.
   (a) Connect the 6747A/-20 rear panel 10 MHZ REF OUTPUT to the Spectrum Analyzer External Reference Input.
   (b) Connect the 6747A/-20 RF OUTPUT to the Spectrum Analyzer RF Input.

c. Test Procedure

1. Set up the Spectrum Analyzer as follows:
   (a) Span: 5 kHz/div
   (b) CF: 2.1 GHz
   (c) RBW: 1 kHz
   (d) Wide Video Filter: On

2. Set the 6747A/-20 CW frequency as follows:
   (a) Press <Shift> RESET
   (b) Press CW OUTPUT SELECT
   (c) Enter 2.1 GHz

3. On the Spectrum Analyzer, measure and record the harmonics on the Test Record. To meet specification, all harmonics must be ≥60 dBc.

NOTE

It may be necessary to adjust the Peaking control for maximum signal level, then adjust the Reference Level control to place the signal at the top screen graticule.

4. Repeat steps 1 through 3 at CW frequencies of 3.6, 6.1, 7, and 10 GHz. Record the results on the Test Record.

2-11 POWER LEVEL ACCURACY AND FLATNESS VERIFICATION

a. Test Description

Power level verification is divided into two sections, power level accuracy and power flatness. Power level flatness is initially checked by observing a full band sweep, first in step sweep, then in analog sweep. Power level accuracy is then checked by stepping the power down in twelve 1 dB increments from its maximum rated power level. Individual Test Record entries are available for all model configurations; use only the one for your particular model. Note that the Power Level Flatness in Analog Sweep is a typical value, not a specification.

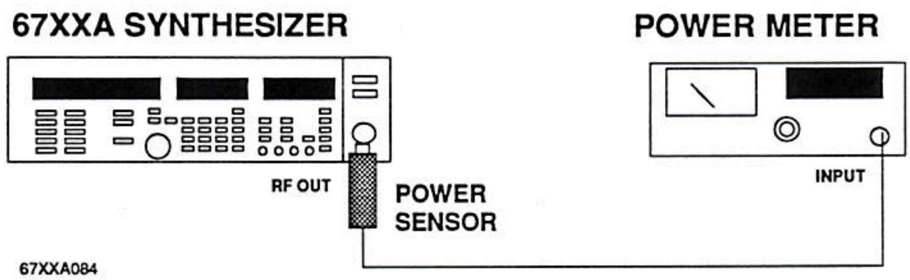

Figure 2-7. Equipment Setup for Power Level Accuracy and Flatness Verification

b. Test Setup

1. Connect the equipment as shown in Figure 2-7.
   - (a) Calibrate the Power Meter with the Power Sensor.
   - (b) Connect the Power Meter's Power Sensor to the RF OUTPUT of the 6747A/-20.

c. Power Level Flatness Procedure

1. Set up the 6747A/-20 for full band sweep at maximum rated power as follows:
   - (a) Press <Shift> RESET.
   - (b) Press F1-F2.
   - (c) Press STEP SWEEP DWELL TIME.
   - (d) Enter 1 sec.
   - (e) Select STEP SWEEP.

2. As the 6747A/-20 steps through the full frequency range, measure and record the maximum and minimum Power Meter reading values on the Test Record.

3. Use the following 6747A/-20 keystrokes to verify the accuracy and flatness of the analog sweep.
   - (a) Set the rear panel RETRACE RF switch to ON.
   - (b) Press TRIGGER twice to light the EXT indicator.
   - (c) Press ANALOG SWEEP.
   - (d) Press <Shift> ANALOG SWP TIME.
   - (e) Enter 99 Sec.
   - (f) Press SINGLE SWEEP to initiate a sweep.

4. During the long analog sweep, measure and record the maximum and minimum Power Meter reading values on the Test Record.

d. Power Level Accuracy Procedure

1. To set up the 6747A/-20 for the power level accuracy procedure:
   - (a) Press <Shift> RESET.
   - (b) Press CW OUTPUT SELECT.
   - (c) Enter 50 MHz.
   - (d) Press LEVEL 1.
   - (e) Press SET INCR/DECR SIZE.
   - (f) Enter 1 dB.

2. Measure and record the Power Meter reading on the Test Record.

3. On the 6747A/-20, press DECR. Measure and record the Power Meter reading on the Test Record.

4. Repeat step d.3 with the other levels listed in the Test Record.

2-12 STEP ATTENUATOR VERIFICATION

a. Test Description

This procedure verifies operation of the optional 90 or 110 dB step attenuator. It is not required for instruments with no step attenuator installed. The internal step attenuator is tested by stepping it throughout its range while looking at the resulting power drop steps with a spectrum analyzer. The 110 dB step attenuator is constructed of four segments: one 10 dB, one 20 dB, and two 40 dB segments. The 90 dB step attenuator is also constructed of four segments: one 10 dB, one 20 dB, and two 30 dB segments. The power levels used in the procedures ensure that each of the attenuator's segments are tested. Use the appropriate section steps for Option 2A (110 dB) instruments or Option 2B (90 dB) instruments; individual Test Record entries are supplied for each.

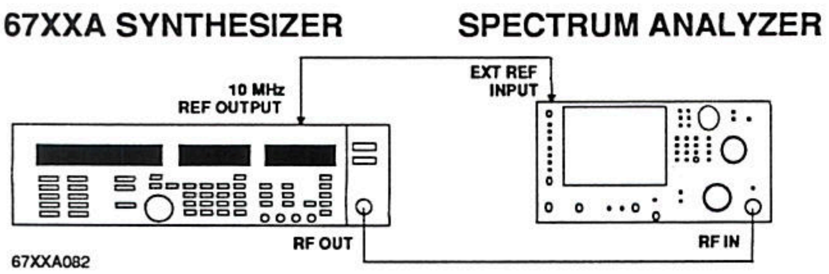

Figure 2-8. Equipment Setup for Step Attenuator Verification

b. Test Setup

1. Connect the equipment as shown in Figure 2-8.
   (a) Connect the 6747A/-20 rear panel 10 MHZ REF OUTPUT to the Spectrum Analyzer External Reference Input.
   (b) Connect the 6747A/-20 RF OUTPUT to the Spectrum Analyzer RF Input.

c. Power Level Flatness and Rated Power Accuracy Procedure (for Option 2A instruments with 90 dB Step Attenuator)

1. Set up the 6747A/-20 for a CW sweep at the low end of its high power range (no attenuation used) as follows:
   (a) Press <Shift> RESET.
   (b) Press CW OUTPUT SELECT.
   (c) Enter 5 GHz.
   (d) Press LEVEL 1.
   (e) Enter 4 dB.
   (f) Press SET INCR/DECR SIZE.
   (g) Enter 10 dB.
2. Set up the Spectrum Analyzer as follows:
   (a) CF: 5 GHz
   (b) Span: 2 kHz/division
   (c) RBW: 10 kHz
   (d) Filter: Narrow
   (e) Reference Level: Place peak of signal exactly on the center horizontal graticule
3. On the 6747A/-20, press DECR to decrease the RF OUTPUT power by 10 dB (to an RF OUTPUT level of –6 dBm). This switches in the first 10 dB step attenuator section.
4. On the Spectrum Analyzer, decrease the Reference Level by 10 dB to bring the peak of the signal back to the center graticule. Measure and record in the Test Record the peak signal power level.
5. On the 6747A/-20, press DECR to decrease the RF OUTPUT power by another 10 dB (to an RF OUTPUT level of –16 dBm). This switches in the first 20 dB step attenuator section.

6. On the Spectrum Analyzer, decrease the Reference Level by 10 dB to bring the peak of the signal back to the center graticule. Measure and record in the Test Record the peak signal power level.

7. On the 6747A/-20, press DECR to decrease the RF OUTPUT power by another 10 dB (to an RF OUTPUT level of –26 dBm). This switches in the first 30 dB step attenuator section.

8. On the Spectrum Analyzer, decrease the Reference Level by 10 dB to bring the peak of the signal back to the center graticule. Measure and record in the Test Record the peak signal power level.

9. On the 6747A/-20, press DECR three times to decrease the RF OUTPUT power by another 40 dB (to an RF OUTPUT level of –56 dBm). This switches in the last 30 dB step attenuator section.

10. On the Spectrum Analyzer, decrease the Reference Level by 30 dB to bring the peak of the signal back to the center graticule. Measure and record in the Test Record the peak signal power level.

d. *Power Level Flatness and Rated Power Accuracy Procedure (for Option 2A instruments with 110 dB Step Attenuator)*

1. Set up the 6747A/-20 for a CW sweep at the low end of its high power range (no attenuation used) as follows:
   (a) Press <Shift> RESET.
   (b) Press CW OUTPUT SELECT.
   (c) Enter 5 GHz.
   (d) Press LEVEL 1.
   (e) Enter 4 dB.
   (f) Press SET INCR/DECR SIZE.
   (g) Enter 10 dB.

2. Set up the Spectrum Analyzer as follows:
   (a) CF: 5 GHz
   (b) Span: 2 kHz/division
   (c) RBW: 10 kHz
   (d) Filter: Narrow
   (e) Reference Level: Place peak of signal exactly on the center horizontal graticule

3. On the 6747A/-20, press DECR to decrease the RF OUTPUT power by 10 dB (to an RF OUTPUT level of –6 dBm). This switches in the first 10 dB step attenuator section.

4. On the Spectrum Analyzer, decrease the Reference Level by 10 dB to bring the peak of the signal back to the center graticule. Measure and record in the Test Record the peak signal power level.

5. On the 6747A/-20, press DECR to decrease the RF OUTPUT power by another 10 dB (to an RF OUTPUT level of –16 dBm). This switches in the first 20 dB step attenuator section.

6. On the Spectrum Analyzer, decrease the Reference Level by 10 dB to bring the peak of the signal back to the center graticule. Measure and record in the Test Record the peak signal power level.

7. On the 6747A/-20, press DECR twice to decrease the RF OUTPUT power by another 20 dB (to an RF OUTPUT level of –36 dBm). This switches in the first 40 dB step attenuator section.

8. On the Spectrum Analyzer, decrease the Reference Level by 20 dB to bring the peak of the signal back to the center graticule. Measure and record in the Test Record the peak signal power level.

9. On the 6747A/-20, press DECR four times to decrease the RF OUTPUT power by another 40 dB (to an RF OUTPUT level of –76 dBm). This switches in the last 40 dB step attenuator section.

10. On the Spectrum Analyzer, decrease the Reference Level by 40 dB to bring the peak of the signal back to the center graticule. Measure and record in the Test Record the peak signal power level.

2-13 FM MODULATION TESTS

a. Test Description

This procedure verifies the operation of the 6747A/-20 frequency modulation input sensitivity circuit and accuracy of the front panel MODULATION display.

After calibrating a Function Generator's sine wave output (1 Vpeak; 0.707 Vrms) with a Digital Voltmeter, the signal is connected to the 6747A/-20's (front panel) FM input. The RF OUTPUT of the 6747A/-20 is monitored on a Spectrum Analyzer display. The magnitude of power carried in the FM sidebands is determined by the amount of signal decrease in the carrier level on the Spectrum Analyzer display. This qualifies how the FM input signal affects the synthesizer's RF OUPUT.

Once the FM circuit's proper operation is verified, the accuracy of the front panel MODULATION display is checked. The displayed FM deviation value (resulting from the previous FM sensitivity test) is noted. Then an FM sensitivity parameter (determined by computation from the displayed value) is entered to generate a carrier level decrease. The value of the decrease verifies the proper operation of the meter circuits.

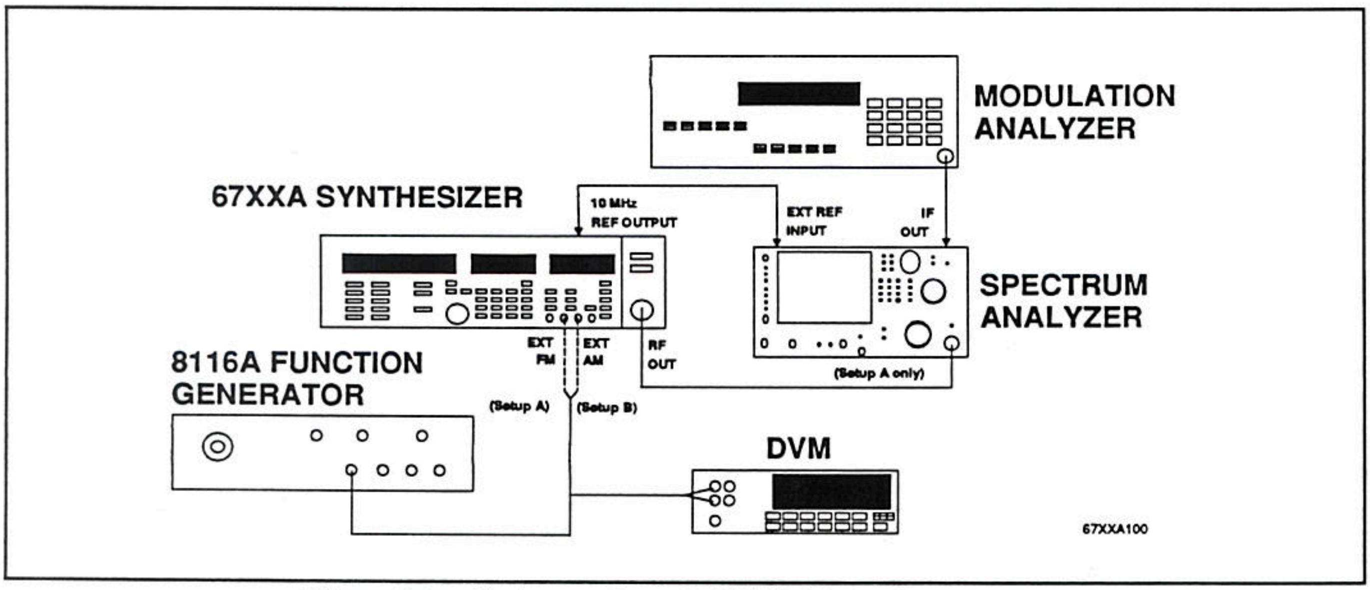

Figure 2-9. Equipment Setup for FM Modulation Tests

b. Test Setup

1. Connect the equipment as shown in Figure 2-9.
   (a) Connect the 6747A/-20 rear panel 10 MHZ REF OUTPUT to the Spectrum Analyzer External Reference Input.
   (b) Connect the Function Generator Output to the BNC tee. Connect one leg of the tee to the 6747A/-20 front panel EXT FM input. Connect the other leg of the tee to the Digital Voltmeter input.

c. FM Input Sensitivity Procedure

1. Adjust the Function Generator for a 40 kHz ±200 Hz sine wave, 0.707 Vrms ±0.5%, with no dc offset. The generator voltage must be set while connected to the 6747A/-20 EXT FM input through the BNC tee.

2. Set up the 6747A/-20 as follows:
   (a) Press <Shift> RESET.
   (b) Press CW OUTPUT SELECT.
   (c) Enter 1.1 GHz.
   (d) Press <Shift> FM SENS.
   (e) Enter 96 kHz.

3. Set up the spectrum analyzer as follows:
   (a) CF: 1.1 GHz
   (b) Span/Div: 10 kHz
   (c) RBW: 1 kHz.
   (d) Reference Level: Adjust to place the signal at the top graticule of the display.

4. On the 6747A/-20, press FM.

5. Observe the first Bessel null (Figure 2-10) at the carrier frequency (modulation index = 2.4). Measure the drop in carrier level and record it on the Test Record. The carrier level must have decreased by ≥26 dB to meet specification.

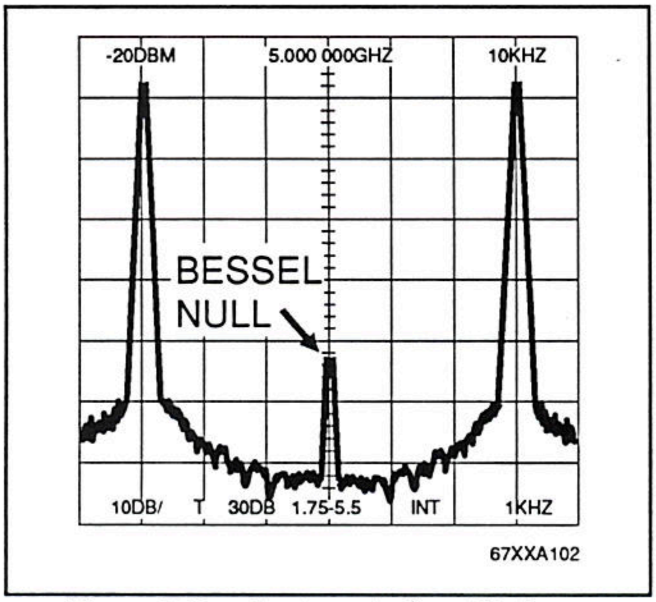

Figure 2-10. Spectrum Analyzer Display of Bessel Null on FM Modulation Waveform

d. FM Meter Accuracy Procedure

1. Press the MEASURE FM DEV key once (the key directly below the AM key). The MEASURE FM DEV indicator next to the key will light. Record the number shown in the MODULATION display in the Test Record.

2. Divide 9216 by the number in recorded previously in step d.1. (Calculate the result to a three-digit accuracy.) Record the result in the Test Record.

3. On the 6747A/-20, press <Shift> FM SENS.

4. Enter the calculated value from step d.2 above using the keypad. Then press the kHz key as the data terminator.

5. Measure the drop in carrier level and record it on the Test Record. The carrier level must have decreased by ≥26 dB to meet specification.

6. Repeat steps c.2 thru d.5 for frequencies of 5, 10, and 16 GHz and record the results on the Test Record.

7. On the 6747A/-20, press <Shift> RESET.

2-14 AM MODULATION TESTS

a. Test Description

This procedure verifies the operation of the 6747A/-20 amplitude modulation input sensitivity circuit and accuracy of the front panel MODULATION display.

After calibrating a Function Generator's sine wave output (1 Vpeak; 0.707 Vrms) with a Digital Voltmeter, the signal is connected to the 6747A/-20's (front panel) AM input. The RF OUTPUT of the 6747A/-20 is monitored on a Spectrum Analyzer display. The (modulated) IF Output of the Spectrum Analyzer is monitored with a Modulation Analyzer. A 30% AM modulation (default value) signal is set to a reference point on the Spectrum Analyzer. The actual modulation value is then computed from the indicated Modulation Meter values. (The absolute values of the AM PK+ and AM PK– readings are used in the given formula to compensate for non-linearity errors in the test equipment.)

Once the AM circuit's proper operation is verified, the accuracy of the front panel MODULATION display is checked. The displayed AM deviation value (resulting from the previous AM sensitivity test) is noted. Then acorresponding AM sensitivity parameter is determined by manual calculation. The comparison of the calculated value to the displayed value indicates the accuracy of the meter circuits.

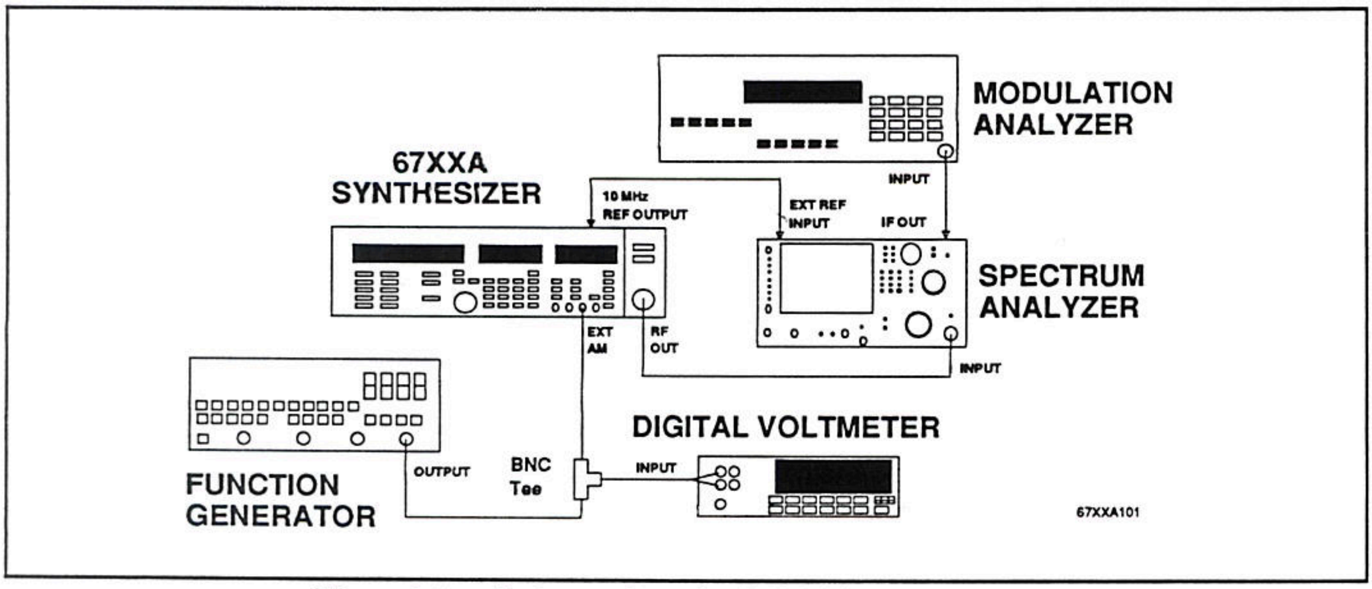

Figure 2-11. Equipment Setup for AM Modulation Tests

b. Test Setup

1. Connect the equipment as shown in Figure 2-11.
   (a) Connect the 6747A/-20 rear panel 10 MHZ REF OUTPUT to the Spectrum Analyzer External Reference Input.
   (b) Connect the Function Generator Output to the BNC tee. Connect one leg of the tee to the 6747A/-20 front panel EXT FM input. Connect the other leg of the tee to the Digital Voltmeter input.
   (c) Connect the IF Output of the Spectrum Analyzer to the Input of the Modulation Analyzer.

c. AM Input Sensitivity Procedure

1. Connect the Digital Voltmeter to the Function Generator and adjust the output voltage for a 1 kHz sine wave, 0.707 Vrms ±0.5%, while the generator is connected to the EXT AM connector.

2. Set up the 6747A-20 as follows:
   (a) Press <Shift> RESET.
   (b) Press LEVEL 1.
   (c) Enter a power level that is 4 dB below maximum rated power.
   (d) Press CW OUTPUT SELECT.
   (e) Enter 1.1 GHz.
   (f) Press AM.

3. Set up the Spectrum Analyzer as follows:
   (a) CF: 1.1 GHz
   (b) Span/Div: 0 Hz (labeled as 10 mSec setting on Tektronix Model 494)
   (c) RBW: 100 kHz
   (d) MIN Noise: Activate

4. On the Spectrum Analyzer, adjust the reference level to place the trace 6 to 8 dB below the top graticule of the display.

5. Set up the Modulation Analyzer for:
   (a) AM PK (+)
   (b) 300 Hz High-Pass Filter
   (c) 3 kHz Low-Pass Filter

6. Measure the peak AM on the Modulation Analyzer. Note the AM PK(+) reading on the Test Record.

7. Press PK(–) on the Modulation Analyzer.

8. Measure the peak AM on the Modulation Analyzer. Note the AM PK(–) reading on the Test Record.

9. Compute the actual AM input sensitivity with the following formula:

$$\%AM = 100 \times \left(\frac{|AM\ PK+| + |AM\ PK-|}{200 + |AM\ PK+| - |AM\ PK-|} \right)$$

10. The calculated result should be between 26 and 34% AM. Note this result in the Test Record; it will be used in the AM Meter Accuracy check that follows.

d. AM Meter Accuracy Procedure

1. Complete steps c.1 through c.10 in the previous AM Input Sensitivity Procedure.

2. Press the MEASURE AM DEPTH key twice to light the indicator next to the MEASURE AM DEPTH key label.

3. Record on the Test Record the number shown in the MODULATION display.

4. Divide 30 by the number recorded in the previous step. Calculate the result to a three-digit accuracy and record it on the Test Record.

5. Multiply the result of step 3 above by the result obtained in step 10 of the AM Input Sensitivity Procedure. Record this result on the Test Record. The product of the calculation must be between 26% to 34% AM.

6. Repeat steps c.2 through d.5 for test frequencies of 5, 10, and 16 GHz. Record the results in the Test Record.

7. On the 6747A/-20, press <Shift> RESET.

2-15 PULSE MODULATION TESTS: RISE TIME, FALL TIME, OVERSHOOT, AND LEVEL

a. Test Description

Pulse modulation tests verify correct operation as well as rise time, fall time, overshoot, and leveling.

The Pulse Leveling Accuracy test compares the pulsed RF output level to the CW output level to verify the performance of the level detector(s), detector/preamplifier(s), and ALC sample/hold circuits. The 6747A/-20 LEVEL display power meter reading is calibrated with an external power meter. Any minor displayed power difference is offset before the test is performed.

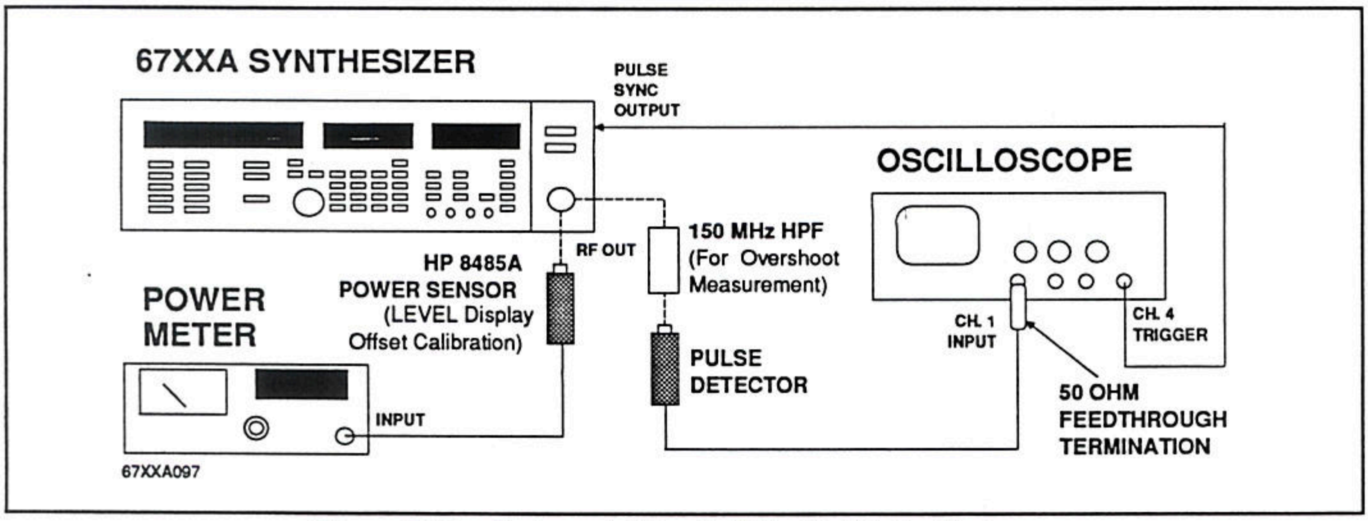

Figure 2-12. Equipment Setup for Pulse Modulation Tests (Rise Time, Fall Time, Overshoot, and Level)

b. Test Setup

1. For all models, connect the equipment as shown in Figure 2-12.
   (a) Connect the 6747A/-20 rear panel PULSE SYNC OUTPUT to the Oscilloscope Trigger input.
   (b) Connect a 50Ω Feedthrough Termination to the Vertical Input of the Oscilloscope.
   (c) Connect the Pulse Detector Output to the 50Ω Feedthrough Termination.
   (d) Connect the Pulse Detector Input through a 150 MHz Low Pass Filter to the 6747A/-20 RF OUTPUT.

c. Rise Time, Fall Time, Overshoot, and Level Test Procedure

1. Set up the 6747A/-20 as follows:
   (a) Press <Shift> RESET.
   (b) Press CW OUTPUT SELECT.
   (c) Enter 5 GHz.
   (d) Press INT PULSE.
   (e) Press <Shift> INT WIDTH.
   (f) Enter 5 μs.
   (g) Press <Shift> INT RATE.
   (h) Enter 50 kHz.

2. Observe the output of the Pulse Detector on the Oscilloscope. Refer to Figure 2-13 to interpret the detector waveform. Adjust the Oscilloscope controls to measure and record in the Test Record the following:
   (a) Rise Time: <10 ns
   (b) Pulse Width: 5 μs (±10 ns, typical)
   (c) Pulse Rate: 50 kHz
   (d) Overshoot: <10% (typical)

3. Repeat step c.2 for frequencies of 10 and 16 GHz. Record the results in the Test Record.

d. *Pulse Leveling Accuracy Check Preliminary Test Setup*

1. Set up the test equipment as described in step b.1. In addition, do the following:
   (a) Properly calibrate the Power Meter and Power Meter Sensor.
   (b) Disconnect the Pulse Detector from the 6747A/-20 RF OUTPUT and connect the Power Meter's Power Sensor in its place.

2. On the 6747A/-20:
   (a) Press LEVEL 1.
   (b) Press SET INCR/DECR.
   (c) Enter .01 dBm.

3. On the 6747A/-20, press INT PULSE to turn pulse modulation off (turned on in step c.1(d); the INT PULSE indicator should go out. The 6747A/-20 is now generating a CW output frequency.

4. On the 6747A/-20 change the CW output frequency as follows:
   (a) Press CW OUTPUT SELECT.
   (b) Enter 1.1 GHz.

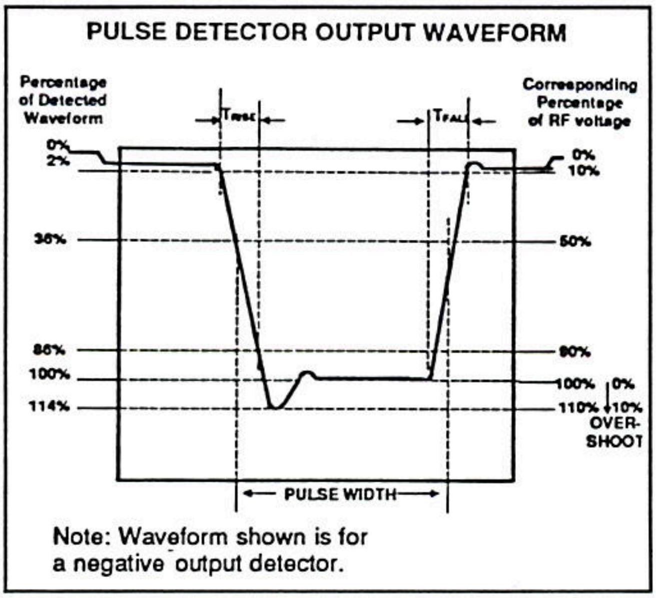

Figure 2-13. Measurement Parameters for Pulse Modulation Waveform

e. *6747A/-20 LEVEL Display Calibration*

1. Note the value displayed in the 6747A/-20 LEVEL display on the Test Record.

2. Using the 6747A/-20 INCR and DECR keys, adjust the synthesizer's power output in 0.01 dB increments until the value in the the Power Meter's display matches the value previously noted in step e.1. Note this level in the Test Record.

3. In the Test Record, compute the difference of the readings noted in steps e.1 and e.2.

4. On the 6747A/-20:
   (a) Press <Shift> ENTER OFFSET.
   (b) Enter the value recorded in step e.3.
   (c) Press LEVEL OFFSET.
   (d) Press LEVEL 1.
   (e) Press SET INCR/DECR.
   (f) Enter .1 dBm.
   (g) Press LEVEL OFFSET twice.

5. The 6747A/-20 LEVEL display reading should now indicate and track the power meter display reading to within 0.1 dB as the test procedure is performed.

f. ***Pulse Leveling Accuracy Test Procedure***

1. Disconnect the Power Sensor and reconnect the Pulse Detector to the 6747A/-20 RF OUTPUT.

2. On the 6747A/-20 change the CW output frequency as follows:
   (a) Press CW OUTPUT SELECT.
   (b) Enter 5 GHz.

3. On the Oscilloscope:
   (a) Adjust the vertical offset to place the trace exactly on the center graticle; this is used as the CW-level reference line.
   (b) Use the Auto Triggering mode to continue sweeping the display when the pulse is off.
   (c) Adjust the vertical sensitivity to the most sensitive setting (mv/Div) possible while keeping the trace at the center graticule reference line.

4. On the 6747A/-20, press INT PULSE to turn on the RF pulse. The INT PULSE indicator will light and the MODULATION display will indicate a 1 kHz rate (default value pulse rate). On the Oscilloscope, observe that the nominal level of the displayed pulse peak has shifted vertically, slightly off of the centerline.

5. Record the value indicated on the 6747A/-20 LEVEL display in the Test Record.

6. On the 6747A/-20:
   (a) Press LEVEL 1.
   (b) Press SET INCR/DECR SIZE.
   (c) Enter 0.1 dB.
   (d) Press INCR or DECR key a few times until the nominal peak level is evenly centered on the display centerline reference.

7. Record the value indicated on the 6747A/-20 LEVEL display in the Test Record.

8. Subtract the LEVEL display reading recorded in step f.7 from the reading recorded in step f.5. This is the pulse level error. Record it in the Test Record.

9. On the 6747A/-20 change the pulse width as follows:
   (a) Press <Shift> INT WIDTH.
   (b) Enter 2 µs.

10. Repeat steps f.2 through f.9 with the new pulse width value entered in step f.9(b).

11. Repeat step f.10 using the following pulse width values each time for step f.9(b): 1 µs, 0.5 µs, 0.2 µs, and 0.1 µs. Record the results of each on the Test Record.

12. On the 6747A/-20 change the CW output frequency and internal pulse width as follows:
    (a) Press CW OUTPUT SELECT.
    (b) Enter 1.1 GHz.
    (c) Press <Shift> INT WIDTH.
    (d) Enter 5 µs.

13. Repeat steps f.2 through f.9 with the new CW frequency and pulse width value entered in steps f.12 (b) and (d).

14. Repeat step f.13 using the following pulse width values each time for step f.9(b): 2 µs, 1 µs, and 0.5 µs. Record the results of each on the Test Record.

2-16 PULSE MODULATION TEST: VIDEO FEEDTHROUGH

a. Test Description

This pulse modulation tests verifies that the video feedthrough is within specification.

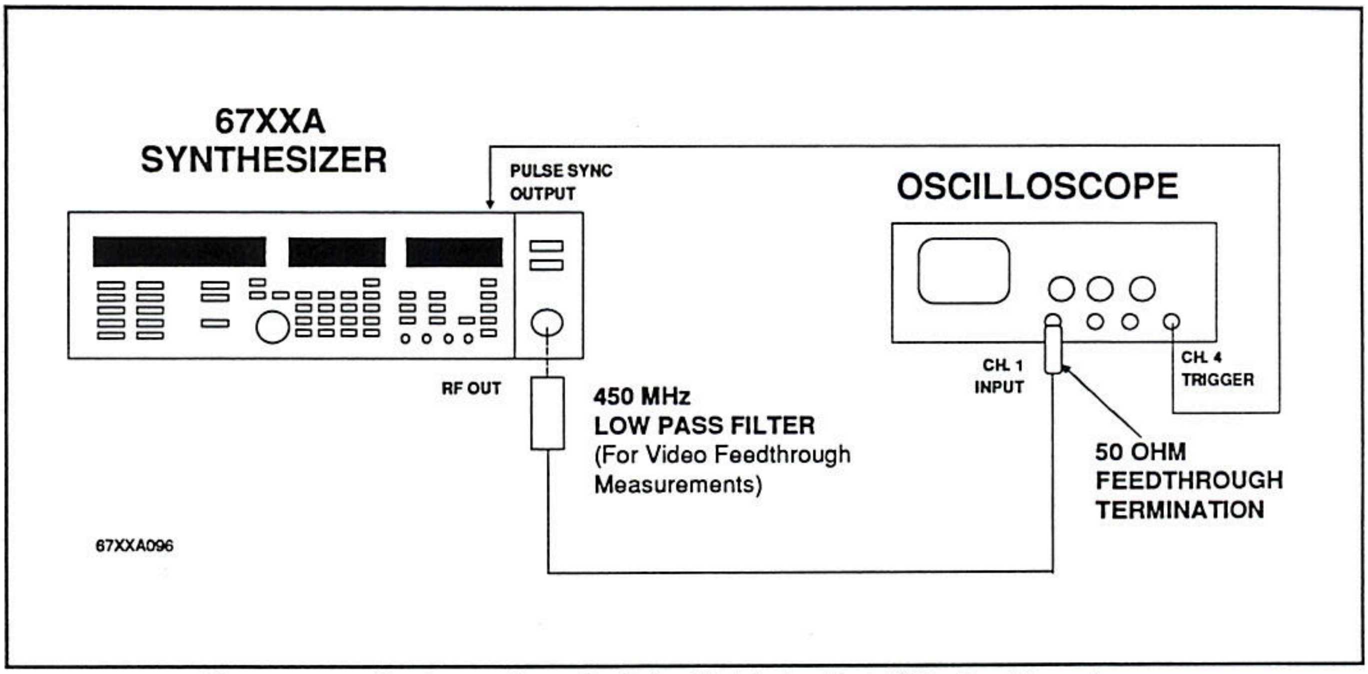

Figure 2-14. Equipment Setup for Pulse Modulation Test: Video Feedthrough

b. Test Setup

1. Connect the equipment as shown in Figure 2-14.
   - (a) Connect the 6747A/-20 rear panel PULSE SYNC OUTPUT to the Oscilloscope Trigger Input.
   - (b) Connect a 50Ω Feedthrough Termination to the Vertical Input of the Oscilloscope.
   - (c) Connect the Pulse Detector Output to the 50Ω Feedthrough Termination.
   - (d) Connect the Pulse Detector Input through a 450 MHz High Pass Filter to the 6747A/-20 RF OUTPUT.

c. Test Procedure

1. Set up the 6747A/-20 as follows:
   - (a) Press <Shift> RESET.
   - (b) Press CW OUTPUT SELECT.
   - (c) Enter 1.1 GHz.
   - (d) Press INT PULSE.
   - (e) Press <Shift> INT WIDTH.
   - (f) Enter 5 μs.
   - (g) Press <Shift> INT RATE.
   - (h) Enter 100 kHz.
2. Set the Oscilloscope controls as follows:
   - (a) Vertical Sensitivity: 5 mV/division
   - (b) External Trigger: On the positive slope of the Channel 1 signal input
   - (c) Horiz. Time Base: 1 μSec/division

NOTE

Use the Oscilloscope's 20 MHz bandwidth limit to aid in viewing the voltage spikes.

3. Measure and record the voltage spikes (video feedthrough) on the Test Record. They must be <±5 mVpeak to meet specification.
4. Repeat steps c.1 through c.3 using a CW output frequency of 5, 10, and 16 GHz for step c.1(c). Record the results of each on the Test Record.

2-17 PULSE MODULATION TEST: RF ON/OFF RATIO

a. Test Description

This pulse modulation test verifies the ratio of RF on power to RF off power.

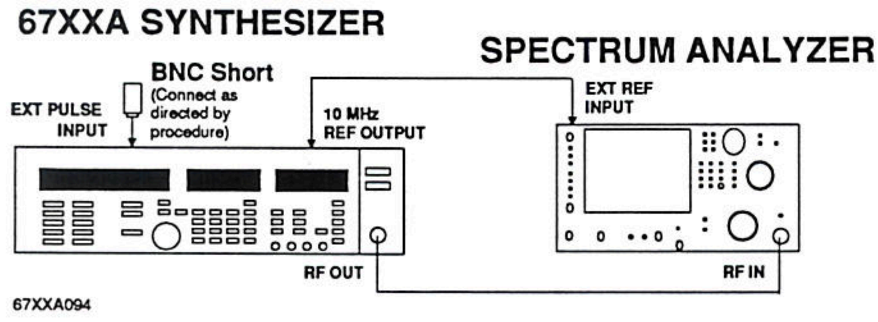

Figure 2-15. Equipment Setup for Pulse Modulation Test: RF ON/OFF Ratio

b. Test Setup

1. Connect the equipment as shown in Figure 2-15.
   (a) Connect the 6747A/-20 rear panel 10 MHZ REF OUTPUT to the Spectrum Analyzer External Reference Input.
   (b) Connect the 6747A/-20 RF OUTPUT to the Spectrum Analyzer RF Input.

c. Test Procedure

1. Set up the 6747A/-20 as follows:
   (a) Set the rear panel ±PULSE switch to +PULSE.
   (b) Press <Shift> RESET.
   (c) Press CW OUTPUT SELECT.
   (d) Enter 1.1 GHz.
   (e) Press EXT PULSE.

2. Set up the spectrum analyzer as follows:
   (a) CF: 1.1 GHz
   (b) Span/Div: 10 kHz
   (c) RBW: 1 kHz
   (d) Video Filter: Wide
   (e) MIN Noise: Activated
   (f) Reference Level: Adjust to place the signal at the top graticule of the screen.

3. Connect a Short between the 6747A/-20 rear panel EXT PULSE INPUT center and outer conductors.

4. On the Spectrum Analyzer, decrease the Reference Level by 20 dB, then measure the signal amplitude and record it on the Test Record. The measured signal must be ≥60 dB from the top graticule.

NOTE

A 60 dB level change plus a 20 dB decrease in the reference level equals an 80 dB on/off ratio (specification).

5. If the signal level drifts slowly after connecting the Short, remove the Short momentarily and apply it again. (Make the measurement as soon as possible after applying the Short.) This drift is due to the Sample/Hold circuit not holding the level because of the pulse duty factor (ratio of RF ON to RF OFF). This drift will not be present in normal pulse operation as the minimum pulse repetition rate is 10 Hz.

6. Remove the Short.

7. On the 6747A/-20, enter 5 GHz.

8. Adjust the Spectrum Analyzer Reference Level control to place the signal at the top of the display.

9. Reconnect the Short and repeat steps 4 and 5.

10. Repeat steps 6 thru 9 for 6747A/-20 CW frequencies of 10 and 16 GHz. Record the results in the Test Record.

SECTION III
CALIBRATION / ADJUSTMENMTS

CONTENTS

SECTION III
CALIBRATION/ADJUSTMENTS

3-1 INTRODUCTION

This section contains calibration and/or adjustment procedures for 67XXA instruments with frequency ranges between 10 MHz and 26.5 GHz. These procedures are typically accomplished due to out-of-specification conditions having been noted in the Section II, Performance Verification tests or as a result of subassembly/component repair or replacement.

NOTE

It is recommended that you upgrade your instrument's operating firmware to the latest available version prior to calibration. Although the SHIFT TRIGGER XXX codes used in these calibration procedures are implemented in earlier versions of firmware, newer firmware versions contain upgraded calibration techniques that will maximize the performance of your instrument. Contact Wiltron Customer Service at (408) 778-2000 for further details.

3-2 RECOMMENDED TEST EQUIPMENT

A listing of the test equipment required for these calibration and adjustment procedures is supplied in Table 1-3 of Section I of this manual. This equipment is identified by the letter "C" in the "USE" column.

Due to the complexity of the adjustment parameters in the RF Level Calibration Test in paragraph 3-20, an automated test is required. A computer with a GPIB interface and a GPIB-controllable power meter are required for this test. A calibration test program is supplied with this manual. A specific list of test equipment required is supplied in paragraph 3-20.

3-3 PERFORMANCE TEST RECORD

A blank copy of a sample performance test record is provided in Section 4, Test Records. This test record provides the model-specific frequency and power levels called for by the procedures in this section. It also provides the means for maintaining an accurate and complete record of instrument performance. We recommend that you copy these pages and record on them the results from: (1) your initial calibration of out-of-specification 67XXA circuits, or (2) your initial adjustment of replaced subassemblies. These initial readings can later be used as benchmark values for future tests of the same serial-numbered instrument.

3-4 STATIC HANDLING PROCEDURES

The 67XXA contains components that are subject to damage by static electricity. Table 6A-2 in Section 6A provides a list of precautions that, when followed, will minimize the possibilities of static-shock damage.

3-5 ADJUSTMENTS FOLLOWING SUBASSEMBLY OR MICROWAVE COMPONENT REPAIR OR REPLACEMENT

Table 3-1 lists the adjustments that should be performed following the repair or replacement of subassemblies or microwave components.

Table 3-1. Adjustments Following Repair or Replacement of Subassemblies and Microwave Components

If a Repair or Replacement Action Was Made To:	Perform the Following Adjustment(s) In Paragraph(s):
A1 Front Panel PCB	None
A2 Front Panel Control PCB	3-9
A3 Coarse Loop Mixer PCB	None
A4 Coarse Loop Oscillator PCB	See troubleshooting in section 6H.
A5 Reference Oscillator PCB	See troubleshooting in section 6G.
A6 Coarse Loop Divider PCB	None
A7 Reference Divider PCB	None
A8 Serial I/O PCB	None
A9 Fine Loop Oscillator PCB	None
A10 Reference Buffer PCB	None
A11 Fine Loop Divider PCB	None
A12 YIG Phase Detector PCB	3-15
A13 Pulse Generator PCB	None
A15 ALC PCB	3-6, 3-7, 3-10, 3-11, 3-20
A16 FM PCB	3-14, 3-15, 3-16, 3-18
A17 Analog Instruction PCB	3-17, 3-18
A18 YIG Driver PCB (C/S Band)	3-13, 3-14, 3-15, 3-17
A19 YIG Driver PCB (X Band)	3-13, 3-14, 3-15, 3-17
A20 YIG Driver PCB (Ku Band)	3-13, 3-14, 3-15, 3-17
A21 YIG Driver PCB (K Band)	3-13, 3-14, 3-15, 3-17
A22 Regulator Interface PCB	None
A23 Microprocessor PCB	3-6 thru 3-20. None, if U27 and U28 firmware EPROMs are reused.
A24 GPIB PCB	None
A25 Switching Power Supply PCB	3-19
A27 Aux I/O PCB	None
A28 Motherboard PCB	None
A29 Rear Panel Interface PCB	3-7
A30 Sampler/IF Amplifier PCB	None
A31 Power Amplifier PCB	None
Any YIG Oscillator	3-13, 3-14, 3-15, 3-17
0.01-to-2 GHz Downconverter	3-7, 3-8, 3-10, 3-20
2-to-26.5 GHz Leveling Coupler/Det.	3-7, 3-8, 3-10, 3-20
26.5-to-40 GHz Leveling Coupler/Det.	3-7, 3-8, 3-10, 3-20
2-to-8 GHz Modulator	3-7
8-to-12.4 GHz Modulator	3-7
12.4-to-20 GHz Modulator	3-7
20-to-26.5 GHz Modulator	3-7

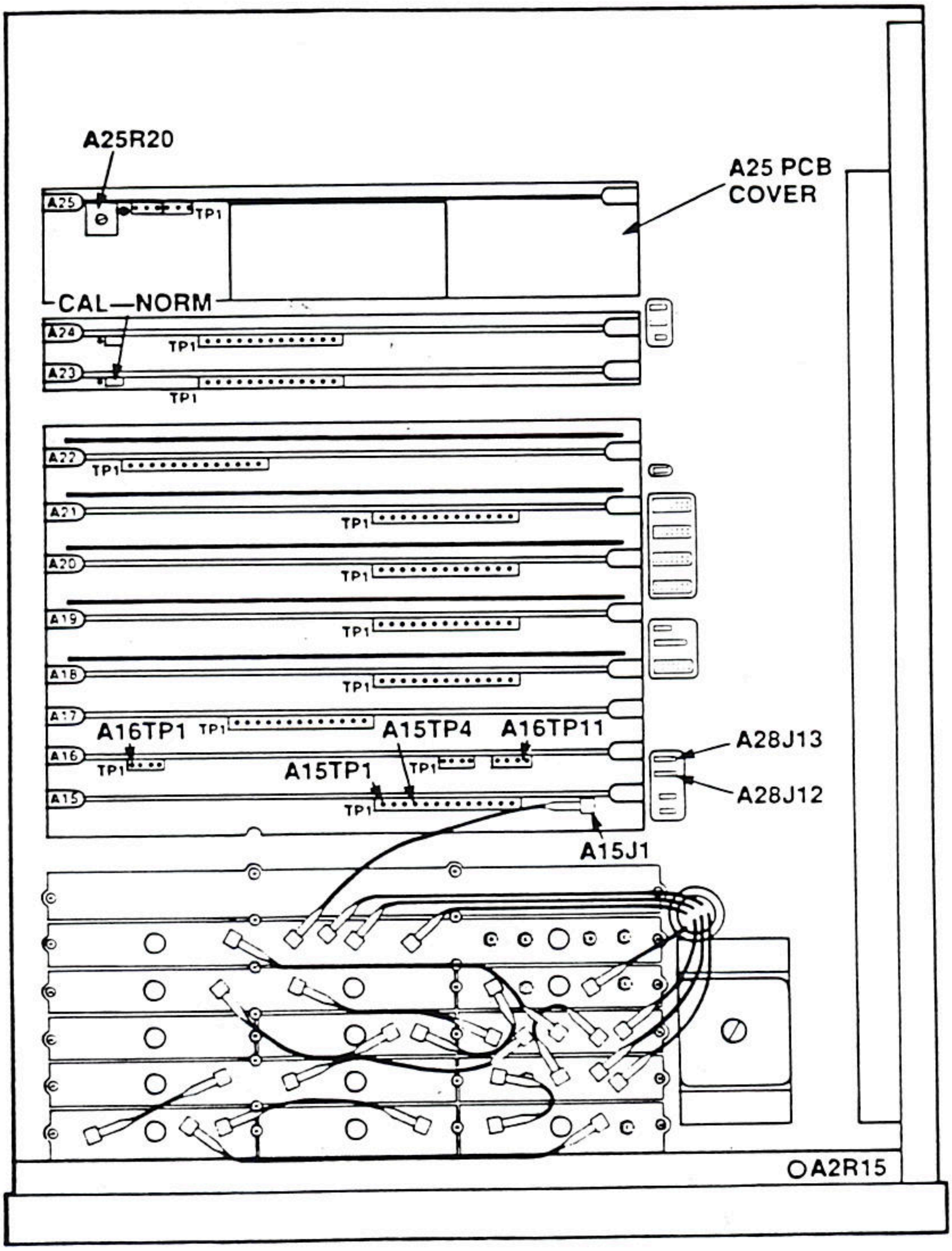

Figure 3-1. Top View of 67XXA showing RF Casting Connectors, Motherboard Connectors, and PCB Test Points

3-6 ALC LEVEL OFFSET ADJUSTMENTS

This paragraph provides ALC Level Offset adjustment procedures. These procedures are required following replacement of the A15 PCB.

a. ***Test Setup***. Connect the equipment as shown in Figure 3-2 and turn the equipment on.

b. ***Primary Leveling Circuit***

1. For models that have only one leveling circuit (see Test Record), remove the cable from A28J12 and temporarily connect it to A28J13 (see Figure 3-1).

2. Press SHIFT then RESET.

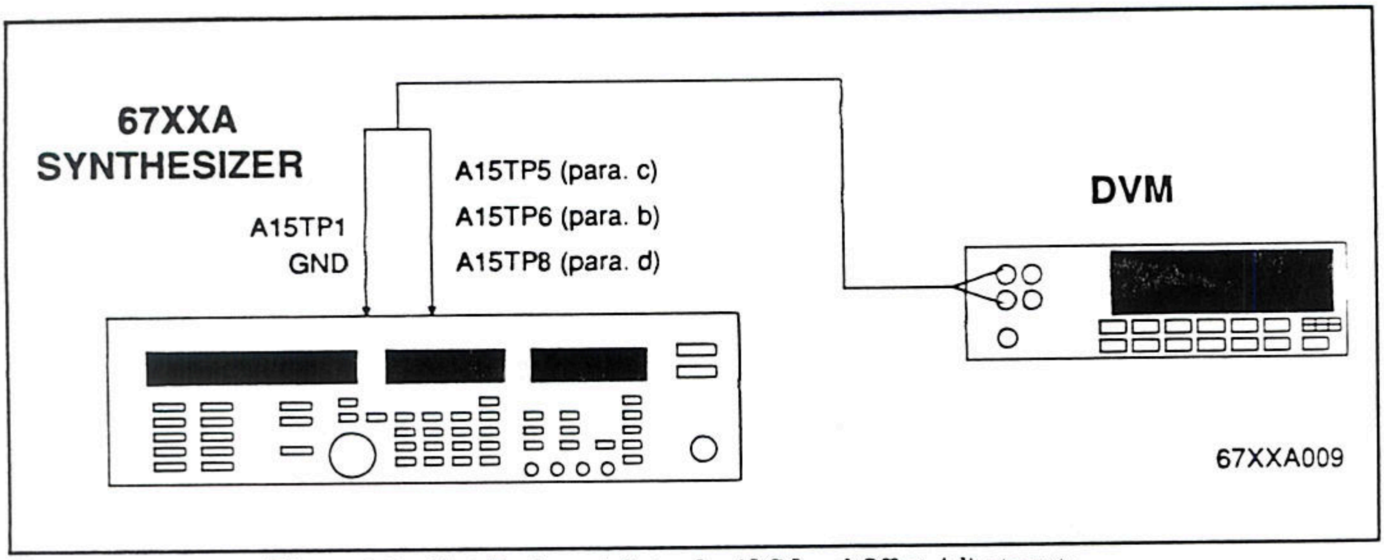

Figure 3-2. Test Equipment Setup for ALC Level Offset Adjustments

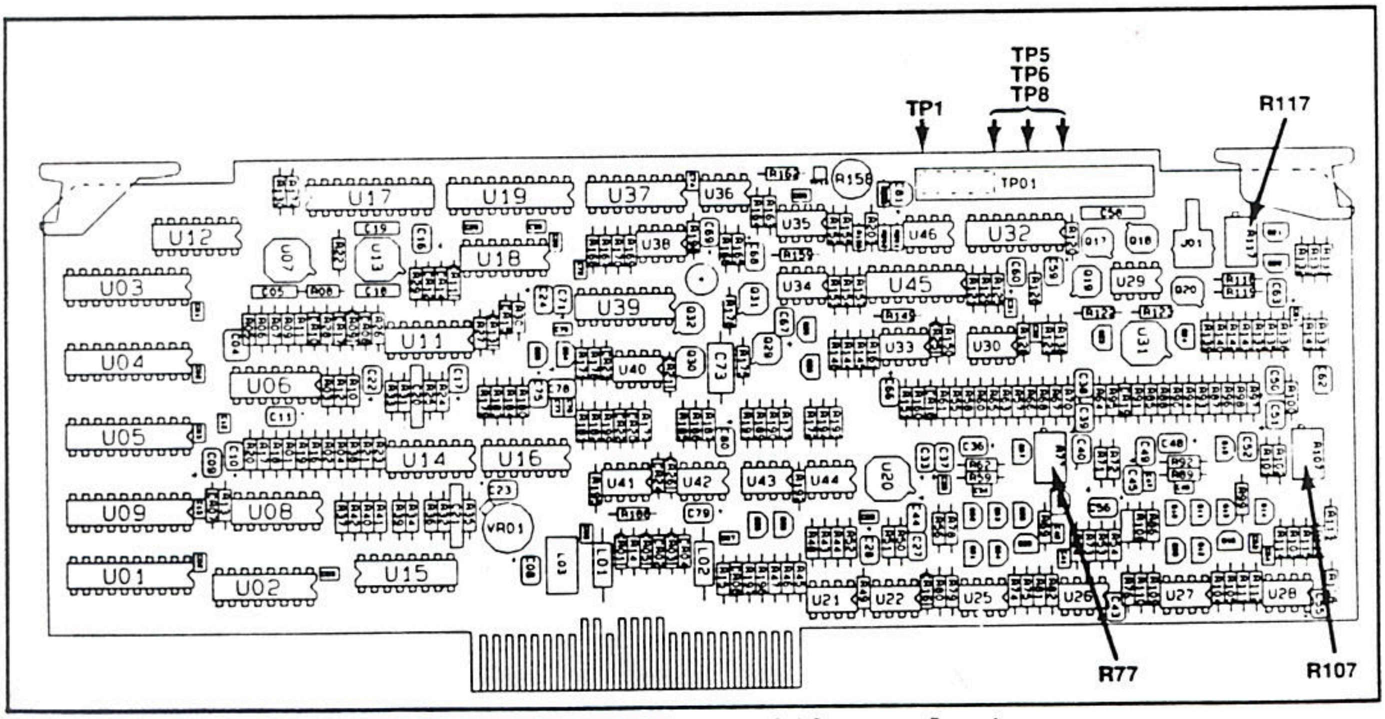

Figure 3-3. A15 ALC PCB Test Point and Adjustment Locations

3. Press CW OUTPUT SELECT.

4. Enter a new frequency for F1 from the Test Record, using the keypad and terminator keys.

5. Turn the RF off; press RF ON/OFF to light the RF OFF indicator.

6. Connect a digital voltmeter (DVM) between A15TP7 (+) and A15TP1 (–) (see Figure 3-2).

7. Adjust A15R77 for 0V ±50 μV.

8. If the cable to A28J12 was connected to A28J13 in step b.1., restore it to A28J12.

c. ***Secondary Leveling Circuit***

1. Press CW and enter a new frequency for F1 from the Test Record, using the keypad and terminator keys.

2. Move the DVM (+) lead to A15TP7.

3. Adjust A15R107 for 0V ±50 μV.

d. ***Pulse Circuit***

1. Press CW and enter a new frequency for F1 from the Test Record, using the keypad and terminator keys.

2. Press SHIFT, then DINT 1 kHz RATE to turn on the internal 1 kHz modulation.

3. Disconnect the cable from A15J1 (see Figure 3-1)

4. Move the DVM (+) lead to A15TP8.

5. Adjust A15R117 for 0V ±5 μV

6. Reconnect the cable to A15J1.

7. Press INT PULSE to turn the internal modulation off.

3-7 ALC BANDWIDTH ADJUSTMENTS

This paragraph provides ALC Bandwidth adjustment procedures. These adjustments may be required following replacement of the A15 PCB, the pulse/level modulator(s), level detector(s), YIG oscillator(s), or A23U27 IC.

a. ***Test Setup***. Connect the equipment as shown in Figure 3-4.

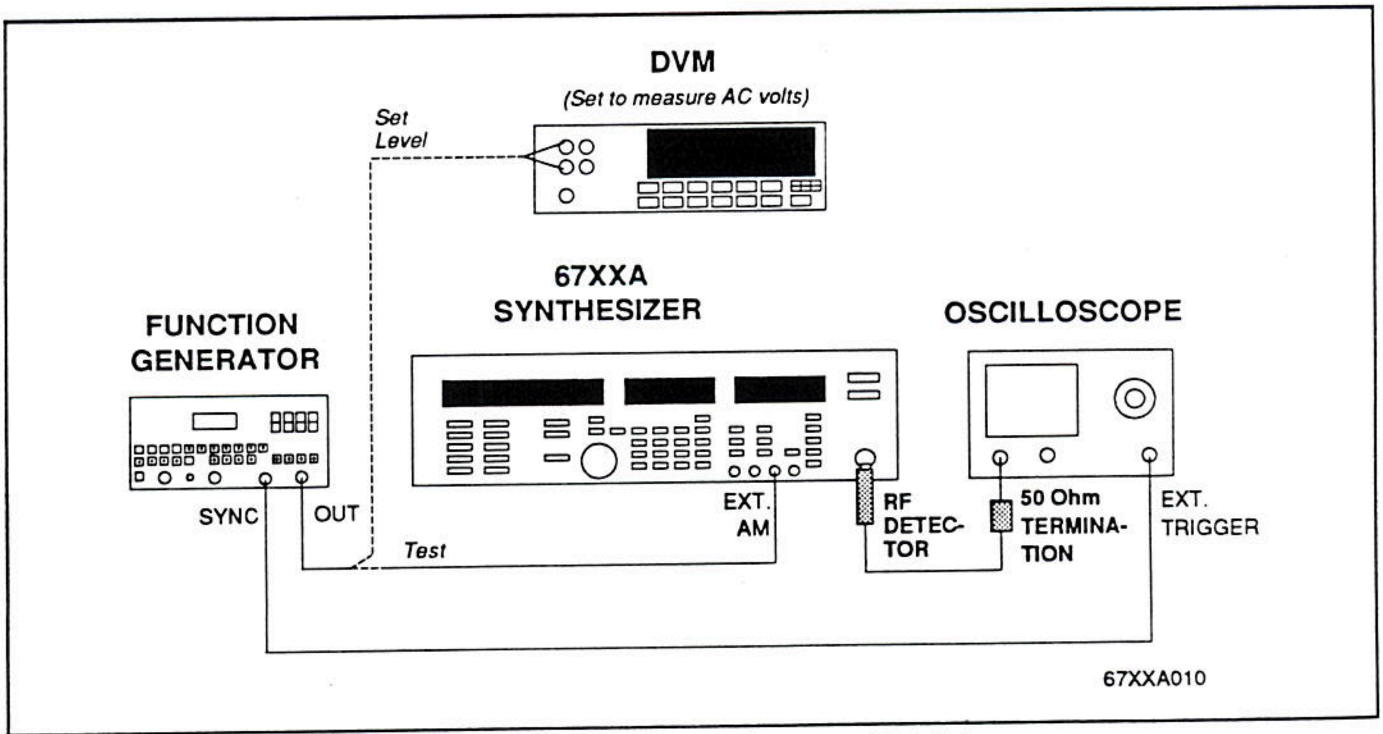

Figure 3-4. ALC Bandwidth Adjustments Test Setup

1. Adjust the function generator for a 1 kHz sinewave output with an output amplitude of 1 volt peak (0.707 VRMS) and an offset of 0V.

2. On the 67XXA, press SHIFT, then RESET.

3. Set the 67XXA power output to +4 dBm.

4. Move the A23 CAL/NORM jumper on the A23 PCB to the CAL position.

5. Press AM, SHIFT, TRIGGER, 042 on the 67XXA. The calibration frequency will be shown in the FREQUENCY display and the ALC gain adjust DAC setting will be shown in the MODULATION/TIME display.

6. Adjust the oscilloscope vertical gain control for a vertical deflection of 6 major divisions. Adjust the output frequency of the function generator to 120 kHz. The vertical deflection should not be less than 4.2 divisions. Press SET INCR/DECR 10 kHz. Then press the INCR or DECR button to readjust the DAC for a vertical deflection of 6 major divisions.

7. After the adjustment, press RECALL. The FREQUENCY display indication will advance to the next calibration frequency.

8. Repeat the above steps until the indication in the FREQUENCY display returns to the bottom frequency of the band.

9. Press SHIFT to return from the calibration mode.

10. Press the SCAN button until F2 is shown in the FREQUENCY display. Then press CW OUTPUT SELECT.

11. Press SHIFT, TRIGGER, 042 to put the 67XXA back in the calibration mode for adjustment of the next band (of multiband units) and repeat steps 1 thru 12 to calibrate each remaining band.

12. When all bands have been calibrated, press SHIFT to exit the calibration mode and restore the A23 PCB CAL/NORM jumper to the NORM position. This completes the calibration of the AM bandwidth.

3-8 ALC SLOPE ADJUSTMENT

This paragraph provides a procedure for adjusting the level-vs-frequency slope of the internal Level Detector. This adjustment is required following replacement of the level detector, 0.01-2 GHz downconverter, or the A23U27 IC.

a. ***Test Setup***. Connect the equipment as shown in Figure 3-5 and turn the equipment on.

1. Place the A23 PCB CAL/NORM jumper (see Figure 3-1) to the CAL position.

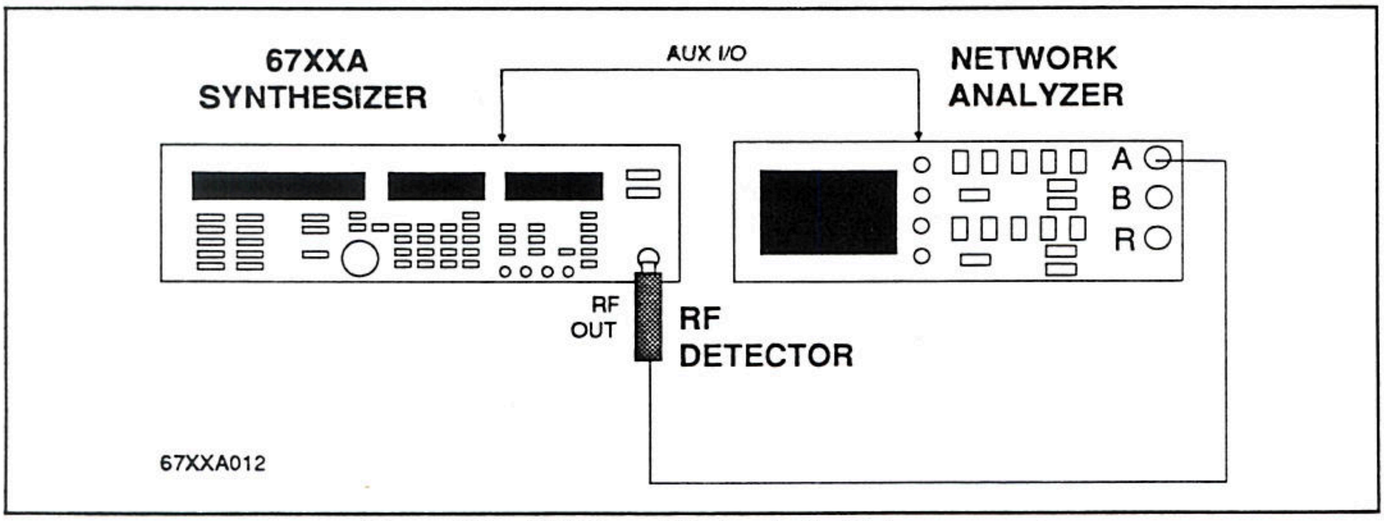

Figure 3-5. ALC Slope Adjustments Test Setup

b. Slope Adjustment

1. Press SHIFT, then RESET. Then place the A23 PCB CAL/NORM jumper to the CAL position.

2. Press F1-F9 SCAN Δ to light the F1 annunciator.

3. Enter a frequency from the Test Record for F1, using the keypad and terminator keys.

4. Press F1-F9 SCAN Δ to light the F2 annunciator.

5. Enter a frequency from the Test Record for F2, using the keypad and terminator keys.

6. Press F1–F2 to start an analog sweep.

7. Press SHIFT, then TRIGGER.

NOTE

The SHIFT, then TRIGGER key sequence actuates the 67XXA's "hidden-key routines" that are used in calibration and troubleshooting. Descriptions of these routines are contained in the Service section of this manual. When a hidden-key routine has been actuated, the keys used (except for the keypad) have different functions than are indicated from the respective key's front panel markings.

8. On the keypad, enter the three-digit code from the Test Record.

9. Press INT PULSE.

10. Enter 9 on the keypad and press the kHz terminator key.

11. Press CW OUTPUT SELECT, then enter 1 2 8 on the keypad, and press the MHz terminator key.

12. Press SET INCR/DECR SIZE, enter 1 0 on the keypad, and press the MHz terminator key.

13. Observe that the 560A displays a waveform similar to that shown in Figure 3-6.

14. Using the DECR and INCR keys, adjust the displayed waveform for best flatness.

15. Repeat steps 1 thru 14 for the other applicable Test Record frequencies.

NOTE

For some models, such as those having a heterodyne band (0.01-2 GHz), the slope adjustment is performed twice — once for the <2GHz level detector and again for the >2 GHz level detector.

16. Return the A23 PCB CAL/NORM jumper to the NORM position.

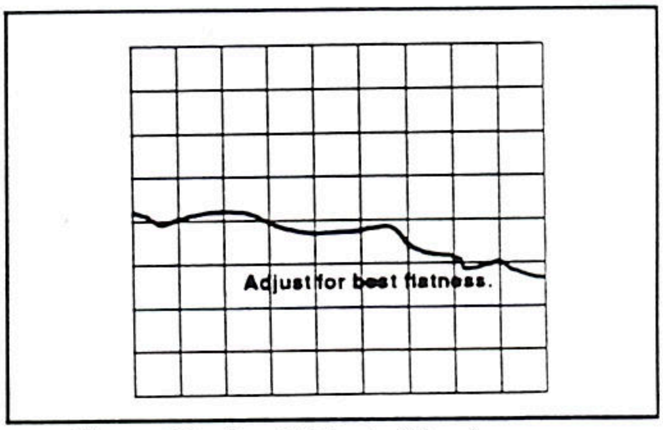

Figure 3-6. Level Detector Waveform

3-9 EXTERNAL LEVELING OFFSET ADJUSTMENT

This paragraph provides a procedure for adjusting the voltage offset of the external detector input circuits. This adjustment is required following replacement of the A2 PCB.

a. ***Test Setup***. Connect the equipment as shown in Figure 3-7, and turn tthe euqipment on.

b. ***Leveling Offset Adjustment***

1. Press SHIFT, then RESET.
2. Press the LEVELING key to light the EXT DETECTOR indicator.
3. Connect the digital voltmeter leads between A15TP4 (+) and A15TP1 (–) (see Figure 3-2).
4. Adjust A2R15 for 0V ±1 mV.

3-10 AM SENSITIVITY CALIBRATION

This paragraph provides a procedure for calibrating the percent-AM-per-volt sensitivity of the external AM input. This adjustment is required following replacement of the A15 PCB or the A23U27 IC.

a. ***Test Setup***. Connect the equipment as shown in Figure 3-8 and turn the equipment on.

1. Press SHIFT, then RESET.
2. On the 67XXA rear panel, place the AC AM — DC AM switch to AC AM.
3. Place the A23 PCB CAL/NORM jumper to the CAL position (see Figure 3-1).
4. Set the function generator to produce a 1 kHz sinewave, at 0V offset, 0.707 ±0.003 Vrms at the EXT AM input connector.

b. ***AM Sensitivity Adjustment***

1. Set up the spectrum analyzer as follows:
   (1) Center Frequency: As shown in Test Record for band being calibrated.
   (2) Resolution BW: 10 kHz
   (3) MIN Noise: Activated
   (4) Ref Level: Adjust to place the displayed trace 8 dB below the top of the screen.
2. On the spectrum analyzer, locate the fundamental frequency and reduce the frequency apan to 2 kHz/division. *Exactly* center the funcamental signal and adjust the reference level to place the peak of the fundamental at the topmost graticule line.
3. On 67XXA, press AM.
4. Press SHIFT, then AM SENS.
5. Enter 50% from the keypad.
6. Press SHIFT, then TRIGGER.
7. Enter the three digit code from the test record.
8. Press INT PULSE.
9. Enter 6 on the keypad, and press the kHz terminator key.

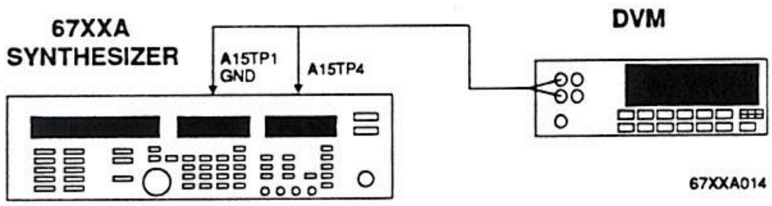

Figure 3-7. External Leveling Offset Adjusmtent Test Setup

10. Press CW OUTPUT SELECT and enter 1 0 0 on the keypad, then press the MHz terminator key.

11. Press SET INCR/DECR SIZE and enter 1 on the keypad, then press the MHz terminator key.

12. On the modulation meter, select the AM PK+ function, the 50 Hz high-pass filter, and 15 kHz low-pass filter.

13. Using the DECR and INCR keys, adjust the 67XXA for a 50% AM reading on the modulation meter.

14. Alternate between PK+ and PK– meter modes and adjust the 67XXA so that the average of the two readings is 50% AM.

15. Press RECALL to save the calibration results.

16. Repeat steps 5 thru 14 for the remaining Test Record values.

17. Return the A23 PCB CAL-NORM jumper to the NORM position.

3-11 AM METER CALIBRATION

This paragraph provides a procedure for calibrating the metering function of the amplitude modulation circuitry (% AM readout on the MODULATION display). This adjustment is required following replacement of the A15 PCB or the A23U27 IC.

a. ***Test Setup***. Connect the equipment as was shown in Figure 3-8 and turn the equipment on.

1. Place the A23 CAL/NORM jumper to the CAL position (see Figure 3-1).

b. ***Meter Calibration***

1. Adjust the Function Generator for a 1 kHz sinewave at 0.707 ±0.003 Vrms, 0V offset, as measured on the DVM (with the generator connected to the EXT AM input).

2. On the 67XXA, SHIFT, then RESET, then press CW OUTPUT SELECT and set to mid-band of the lowest frequency band in the instrument.

3. Press EXT AM to light the AM indicator.

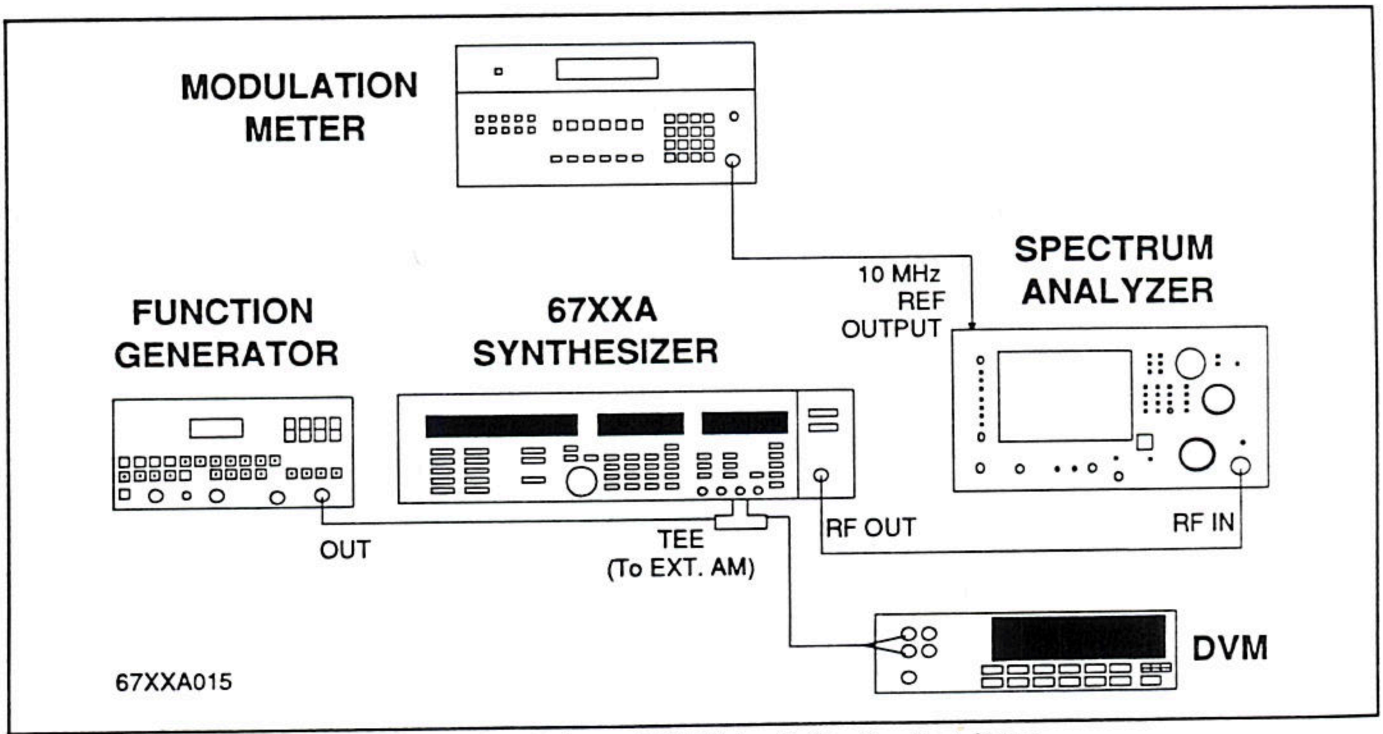

Figure 3-8. AM Sensitivity and AM Meter Calibration Test Setup

4. Disconnect the function generator from the EXT AM connector on the 67XXA.

5. Enter 3 4 2 from the keypad.

6. Press SHIFT, then TRIGGER and enter 3 9 8 from the keypad.

7. Reconnect the function generator to the 67XXA EXT AM connector.

8. Press SHIFT, then TRIGGER.

9. Enter 3 4 3 from the keypad. The metering circuitry is now calibrated.

10. Return the A23 PCB CAL/NORM jumper to the NORM position.

c. AM Meter Calibration Verification

1. To verify the previous adjustment, press SHIFT, then RESET.

2. Set a CW frequency equal to a mid-band point on the 67XXA's lowest band.

3. Press SHIFT, AM SENSE and set to 50%, then press the AM button.

4. Press MEASURE AM DEPTH. The display should indicate 47.5% and 4.5%.

3-12 10 MHz REFERENCE OSCILLATOR CALIBRATION

This paragraph provides a procedure for calibrating the 10 MHz Reference Oscillator. This adjustment may be required during periodic calibration intervals and following replacement of the reference oscillator.

a. ***Test Setup.*** Connect the equipment as shown in Figure 3-9.

1. Place the 67XXA in the STDBY (standby) mode and let it run for 48 continuous hours.

2. Press the LINE key to ON two hours prior to making the adjustment.

b. ***Reference Oscillator Adjustment***

1. Press SHIFT, then RESET.

2. Press F1-F9 SCAN Δ to light the F1 annunciator.

3. Enter a frequency from the Test Record for F1, using the keypad and terminator keys.

4. Press CW OUTPUT SELECT.

5. Remove the adjustment-access screw from the top of the 10 MHz Reference Oscillator oven (see Figure 3-10).

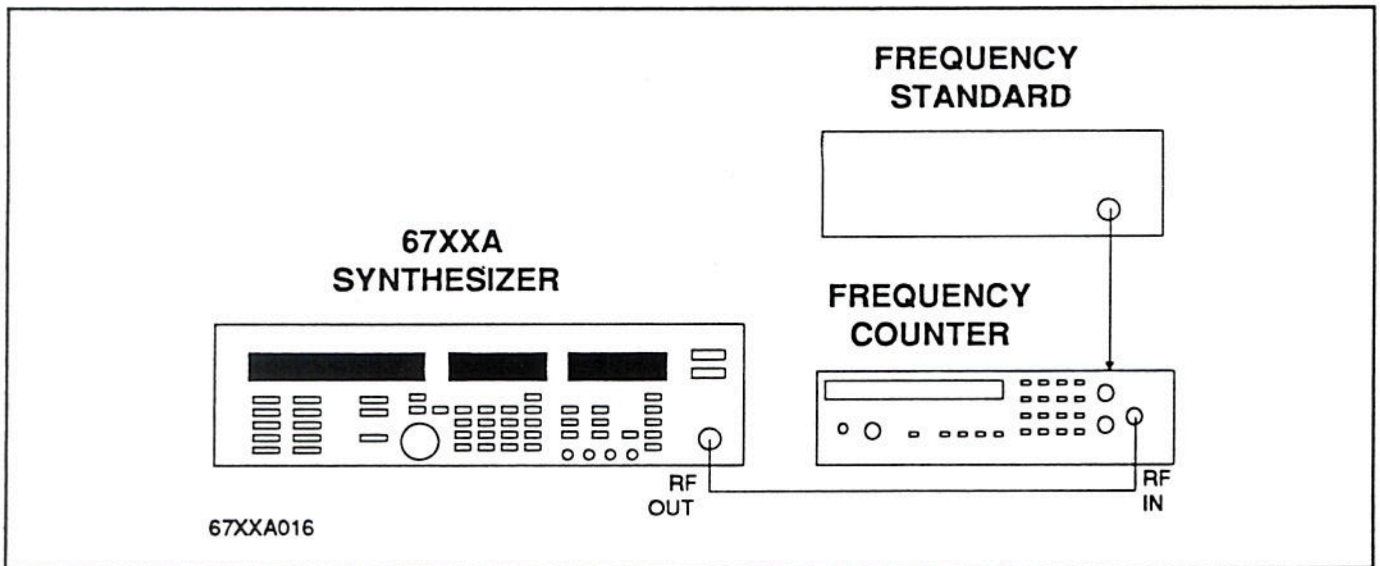

Figure 3-9. 10 z Reference Oscillator Adjustment Test Setup

6. Using a non-magnetic screwdriver, adjust the potentiometer located inside the oven to set the frequency shown in the Test Record (within +/- 100 Hz).

7. Using the handle of a screwdriver or similar device, tap the oscillator oven housing sharply while watching the frequency counter disply for any variance. Then, readjust the frequency if necessary. Repeat this step to ensure frequency stability of the oscillator.

8. Replace the adjustment-access screw.

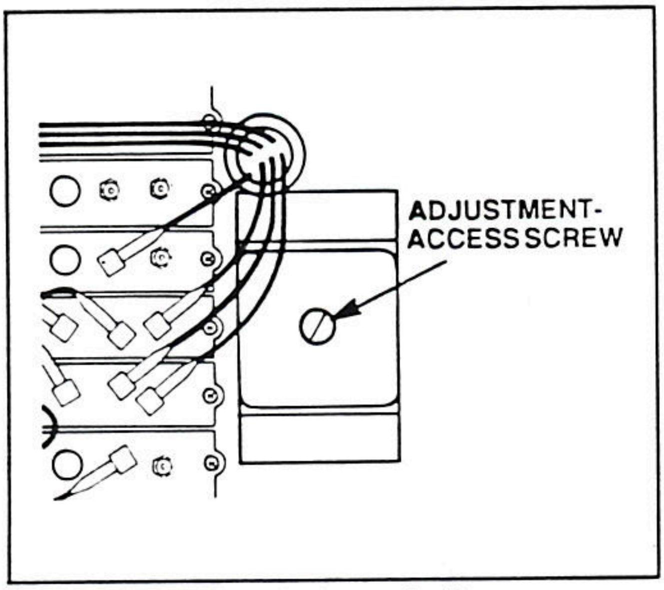

Figure 3-10. Reference Oscillator Ove n Tuning Screw Location

3-13 FM DRIVER CALIBRATION

This paragraph provides a procedure for calibrating the frequency modulation (FM) driver circuit on the A16 PCB. This adjustment is required following replacement of either a YIG oscillator or the A23U27 IC.

a. ***Test Setup***. Connect the equipment as shown in Figure 3-11 and turn the equipment on.

1. Press SHIFT, then RESET.

2. Place the A23 PCB CAL/NORM jumper in the CAL position (see Figure 3-1).

b. ***FM Driver Adjustment***

1. Press CW OUTPUT SELECT.

2. Enter a frequency from the Test Record for F1, using the keypad and terminator keys.

3. Press SHIFT, TRIGGER, 4 0 4, then wait about 15 seconds.

4. Return the A23 PCB CAL/NORM jumper to the NORM position.

NOTE

The SHIFT, then TRIGGER key sequence actuates the 67XXA's "hidden-key routines" that are used in calibration and troubleshooting. Descriptions of these routines are contained in the Service section of this manual. When a hidden-key routine has been implemented, the keys used (except the numeric keypad keys) have different functions than are indicated by the respective key's front panel markings.

3-14 FM SENSITIVITY CALIBRATION

This paragraph provides a procedure for calibrating the sensitivity of the EXT FM input. This adjustment is required following replacement of the A16 PCB, A18-A21 PCBs, a YIG oscillator, or the A23U27 IC.

a. ***Test Setup***. Connect the equipment as shown in Figure 3-11 and turn the equipment on.

1. Press SHIFT, then RESET.

2. Place the A23 PCB CAL/NORM jumper in the CAL position (see Figure 3-1).

b. ***FM Sensitivity Adjustment***

1. Set the function generator for a 40 kHz ±200 Hz sinewave with an offset of 0V and an amplitude of 1V peak.

2. Fine tune the function generator amplitude for a DVM reading of 0.707 Vrms (as measured with the generator connected to the EXT FM input connector).

3. Press SHIFT, then RESET.

4. Press CW OUTPUT SELECT.

5. From the Test Record, enter an F1 frequency value for the band being calibrated, using the keypad and terminator keys.

6. Set the spectrum analyzer controls as follows:

   (1) Center Frequency: Same as F1 value (set in step 5)
   (2) Freq. Span/Div: 20 kHz
   (3) Resolution BW: 10 kHz
   (4) Ref Level: To place the signal peak at the top of the screen (with 67XXA FM off)

7. On the 67XXA, press SHIFT, then FM SENS.

8. Enter 96 kHz using the keypad and terminator keys.

9. Press FM.

10. Press SHIFT, then TRIGGER and enter 3 0 8.

11. Press CW OUTPUT SELECT, enter 2 3 0 0 from the keypad, and press the MHz terminator key. (Enter 1 2 0 0 if calibrating a frequency doubler band of 26.5 to 40 GHz.)

12. Press SET INCR/DECR SIZE, enter 1 0 on the keypad, and press the MHz terminator key.

13. Using the DECR and INCR keys, adjust the waveform displayed on the spectrum analyzer so that the center portion is at minimum amplitude.

14. Press SET INCR/DECR SIZE, enter 1 on the keypad, and press the MHz terminator key.

15. Use the DECR and INCR keys to fine-adjust the waveform null, such that the center of the waveform is at least 40 dB below the top of the screen.

16. Press RECALL to store the calibration data.

17. Press SHIFT to exit the calibration mode.

18. Repeat steps 3 thru 20 for the remaining band(s) to be calibrated.

19. Return the A23 PCB CAL/NORM jumper to the NORM position.

3-15 FM FLATNESS CALIBRATION

This paragraph provides a procedure for calibrating the flatness of the FM circuit response. This adjustment is required following replacement of the A16 PCB, a YIG Oscillator, or the A23U27 IC.

a. ***Test Setup.*** Connect the equipment as was shown in Figure 3-11 and turn the equipment on.

1. Place the A23 PCB CAL/NORM jumper in the CAL position (see Figure 3-1).

b. ***FM Flatness Adjustment***

1. Set the function generator for a sinewave output at 2 kHz ±10 Hz, with an offset of 0V and an amplitude of 0.339 ±0.003 Vrms.

2. Press SHIFT, then RESET.

3. Press CW OUTPUT SELECT.

4. From the Test Record, enter a frequency for F1 for the band being calibrated using the keypad and terminator keys.

5. Set the spectrum analyzer controls as follows:

   (1) Center Frequency: Set to Test Record frequency
   (2) Freq. Span/Div: 0 Hz
   (3) Resolution BW: 100 Hz
   (4) Ref Level: To place the signal peak at the top of the screen (with 67XXA FM off)

6. On the 67XXA, press SHIFT, then FM SENS.

7. Enter 10 kHz, using the keypad and terminator keys.

8. Press FM. On the analyzer, notice that the fundamental has dropped in amplitude and has 1 kHz sidebands.

9. Press SHIFT, then TRIGGER and enter 3 1 7.

10. Press CW and set to 80 MHz.

11. Press SET INCR/DECR SIZE, enter 1 0 on the keypad, and press the MHz terminator key.

12. Using the DECR and INCR keys, adjust the fundamental as far as possible down from the reference established in step 5d.

13. Press SET INCR/DECR SIZE, enter 1 on the keypad, and press the MHz terminator key.

14. Use the DECR and INCR keys to further reduce the trace level to at least 10 dB below the top of the display.

15. Press RECALL to store the calibration data.

16. Repeat steps 3 thru 17 for the remaining band to be calibrated.

17. Return the A23 PCB CAL/NORM jumper to the NORM position.

3-16 FM METER CALIBRATION

This paragraph provides a procedure for calibrating the metering function of the FM circuitry (FM MHz/V readout on the MODULATION display). This adjustment is required following replacement of the A16 PCB or the A23U27 IC.

a. ***Test Setup***. Connect the equipment as was shown in Figure 3-11 and turn the equipment on.

1. Place the A23 PCB CAL/NORM jumper in the CAL position (see Figure 3-1).

b. ***Meter Calibration***

1. Set the function generator for a 40 kHz sinewave output with an offset of and an amplitude of 0.707 ±0.003 Vrms, measured with the generator connected to the EX FM input.

2. Press SHIFT, then RESET.

3. Disconnect the generator from the EXT FM input connector.

4. Press SHIFT, then TRIGGER.

5. On the keypad, enter 3 4 0.

6. Connect the generator to the EXT FM input connector.

7. Press SHIFT, then TRIGGER.

8. On the keypad, enter 3 4 1. The meter is now calibrated and the calibration data has been saved.

9. Press FM.

10. Press MEASURE FM DEV.

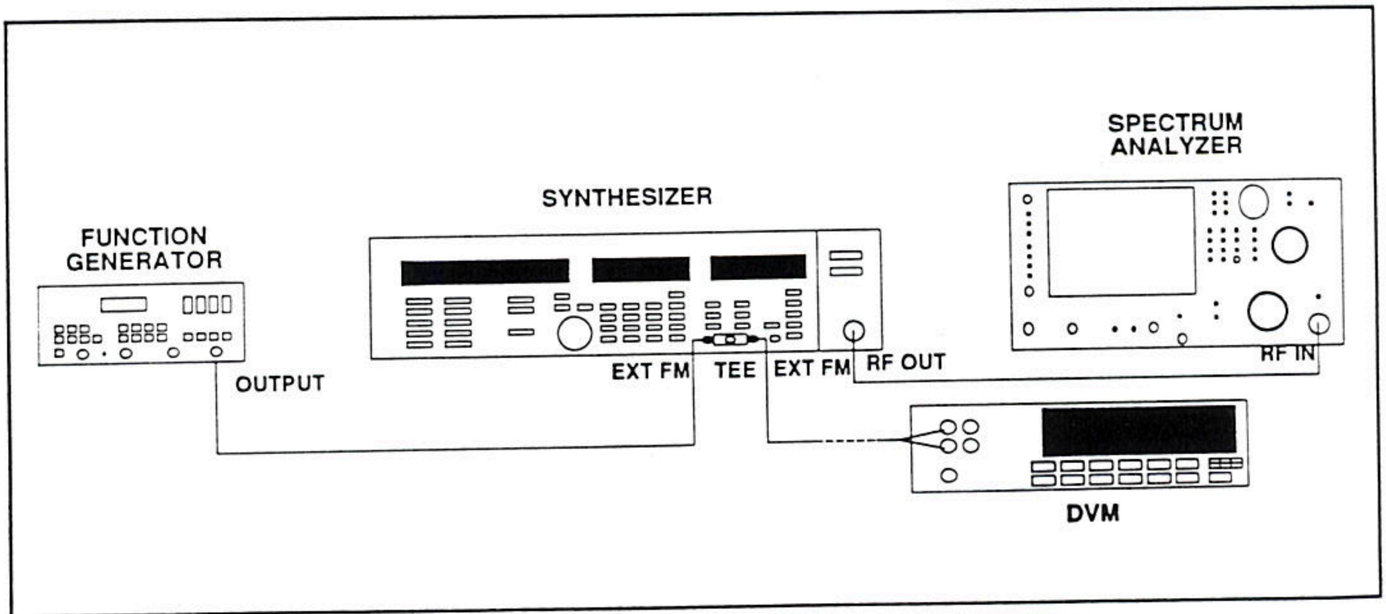

Figure 3-11. FM Sensitivity, Meter, and Flatness Calibration Test Setup

11. Verify that the MODULATION display reads 300 ±3 kHz.

12. Return the A23 PCB CAL/NORM jumper to the NORM position.

3-17 YIG FREQUENCY CALIBRATION

This paragraph provides a procedure for calibrating the output frequency of the YIG oscillators. These adjustments are required following the replacement of any YIG oscillator or the A17 thru A21 PCBs

a. ***Test Setup***. Connect the equipment as shown in Figure 3-12 and turn the equipment on.

   1. Place the A23 PCB CAL/NORM jumper in the CAL position (see Figure 3-1).

b. ***Bands 0 thru 4 (as Appropriate) YIG Oscillator Adjustments.*** Refer to the Test Record for the bands employed in your model; adjust each band as described below.

   1. Press SHIFT, then RESET.

   2. If A23U27 was replaced, press SHIFT, then TRIGGER, then enter 0 9 0 from the keypad to erase any previous calibration data.

   3. Press CW OUTPUT SELECT to light the F1 annunciator.

   4. From the Test Record, enter a frequency for F1 for the band being calibrated using the keypad and terminator keys.

   5. Press SHIFT, then TRIGGER.

   6. From the Test Record, enter the three-digit code for the band being calibrated.

   7. Verify that the FREQUENCY display indicates the Test Record value. Press the SET INCR/DECR SIZE key and enter 1 MHz.

   8. Using the DECR and INCR keys, adjust the counter frequency to agree with the 67XXA FREQUENCY display ±2 MHz.

NOTE

If the counter frequency differs greatly from the 67XXA frequency (or if you have difficulty in making the two frequencies match), you may want to select a larger or smaller incremental value for the SET INCR/DECR SIZE key. The default value is 1 MHz. To select a different value, press SET INCR/DECR SIZE, enter the desired value (5, 10, 20, etc.) from the keypad, and press the MHz terminator key.

   9. Press RECALL to save the calibration test data. A mid-band frequency will appear on the 67XXA and counter displays.

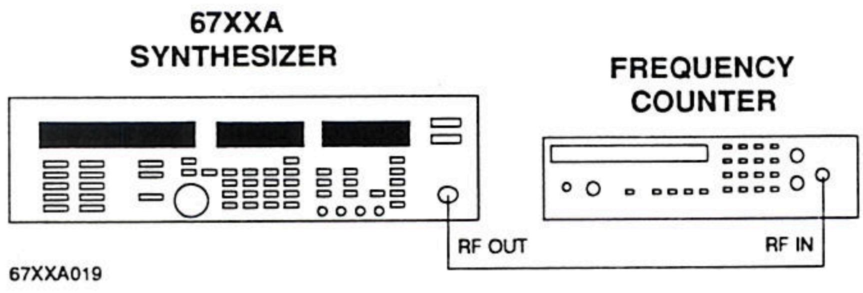

Figure 3-12. YIG Oscillator Frequency Calibration Test Setup

10. Repeat step 8 for the mid-band test frequency.

11. Press RECALL to save the calibration test data. A top-of-the-band frequency will appear on the 67XXA and counter displays.

12. Repeat step 8 for this test frequency. Press RECALL to save the calibration data; the band start frequency will be displayed. Repeat steps 8 through 12 to fine tune the adjustment, then press the SHIFT button.

13. Repeat steps 3 thru 12 for the remaining bands appearing in the Test Record.

14. Press SHIFT twice, then RESET to exit the calibration mode.

15. Return the A23CAL/NORM jumper to the NORM position.

3-18 ANALOG SWEEP CALIBRATION

This paragraph provides a procedure for calibrating the analog sweep. This adjustment is required following replacement of the A16 or A17 PCB.

a. Test Setup.

1. No test equipment is required. Turn the 67XXA on.

2. Place the A23 PCB CAL/NORM jumper to the CAL position (see Figure 3-1).

b. Sweep Calibration

1. Press RESET.

2. Press F1-F9 SCAN Δ to light the F4 annunciator.

3. Press CW OUTPUT SELECT.

4. Press SHIFT, then TRIGGER.

5. Enter 0 0 5 from the keypad.

6. Press SHIFT, then TRIGGER.

7. Enter 0 0 6 from the keypad; the analog sweep is now calibrated. The calibration values are automatically saved.

8. Return the A23 PCB CAL/NORM jumper to the NORM position.

3-19 POWER SUPPLY INJECTION-LOCK ADJUST

This procedure synchronizes the power supply 50 kHz switching rate to the 10 MHz crystal reference to eliminate intermodulation products. This adjustment is required following replacement of the A25 PCB.

a. Test Setup.

1. Disconnect the line cord.

2. Remove the cover from the A25 PCB housing (see Figure 3-1).

3. Connect the equipment as shown in Figure 3-13.

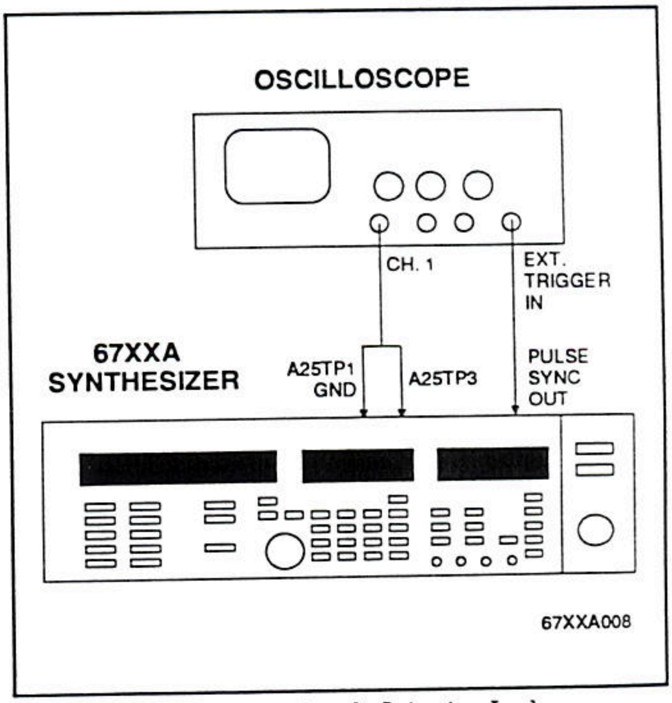

Figure 3-13. Power Supply Injection-Lock Calibration Test Setup

WARNING

Voltages hazardous to life are present when the cover is removed from the A25 housing. High-voltage connections on both the A25 PCB and the A25 heat sink are exposed.

4. Reconnect the line cord, and press the LINE key to ON.

b. Injection-Lock Adjustment

1. Set up the oscilloscope as follows:

   (1) Vertical: 5V/div
   (2) Horizontal: 5 µs/div
   (3) Trigger: Ext

2. On the 67XXA, press INT PULSE.

3. Press SHIFT, then INT WIDTH.

4. Enter 10 µs using the keypad and terminator keys.

5. Press SHIFT, then INT RATE.

6. Enter 50 kHz using the keypad and terminator keys.

7. Adjust A25R20 (see Figure 3-2) to provide a stable squarewave display on the oscilloscope.

8. Rotate A25R20 slightly to each side of the setting that provides the stable display, carefully noting the adjustment positions at which the display becomes unstable.

9. Reset A25R20 exactly half-way between the positions at which the display becomes unstable.

10. Inscribe a mark on the potentiometer to show the position of this optimum setting.

11. Press the LINE key to STDBY.

12. Disconnect the line cord.

13. Replace the cover on the A25 PCB housing.

3-20 RF LEVEL CALIBRATION

The RF level is calibrated by an automated test system. A computer-controlled power meter measures power at many frequencies and power levels. Correction factors are then calculated and stored in the 67XXA's non-volatile memory.

This adjustment is required following replacement of the A15 PCB, the level detector(s), or the A23U27 or A23U28 ICs. The automated program can be ordered through WILTRON Customer Service.

SECTION IV
TEST RECORD

CONTENTS

SECTION IV
TEST RECORDS

4-1 INTRODUCTION

This section provides two Test Record tables for recording the results of the Performance Verification Tests (in Section 2) and the Calibration/Adjustments Tests (in Section 3). They jointly provide the means for maintaining an accurate and complete record of instrument performance.

This test record provided here has been customized for the 6747A and 6747A-20 models. It should only be used with matching procedures in Section 2 and 3 that cover the 6747A or 6747A-20 models. Specific references to frequency parameters, power levels, and non-applicable procedures make each Test Record easy to follow.

We recommend that you make a copy of these pages each time the test procedures are performed. By dating each Test Record copy, a detailed history of instrument perfomance can be accumulated.

4-2 PERFORMANCE VERIFICATION TEST RECORD

The Test Record for the Performance Verification procedures supplied in Section 2 is located immediately following this page.

4-3 CALIBRATION/ADJUSTMENTS TEST RECORD

The Test Record for the Calibration/Adjustment procedures supplied in Section 3 follows the Performance Verification Test Record.

NOTE

Results of the automated RF Level Calibration procedure in Section 3 are not included in this Test Record. Calibration data is stored in instrument memory. Contact Customer Service at (408) 778-2000 for more details.

WILTRON Model 6747A and 6747A-20 **Date:** ____________

Serial Number ____________ **Tested By:** ____________

2-5. Internal Time Base Aging Rate Test

Step	*Procedure Comments*	*Lower Limit*	*Measured Value*	*Upper Limit*
c. Test Procedure				
2	Record T_S value		______hours	
3	Record T_1 value		______sec	
4	Record T_2 value		______sec	
5	Record T_F value		______hours	
7	Record the calculated aging rate		______per day	1×10^{-9} per day

2-6. Frequency Synthesis Tests

Step	*Procedure Comments*	*Lower Limit*	*Measured Value*	*Upper Limit*
c. Coarse Loop/YIG Loop Test Procedure				
2	Record the Frequency Counter Reading	0.999 999 900 GHz	__________ GHz	1.000 000 100 GHz
3	Record the Frequency Counter Reading	1.999 999 900 GHz	__________ GHz	2.000 000 100 GHz
4	Record the Frequency Counter Readings . . .	2.999 999 900 GHz	__________ GHz	3.000 000 100 GHz
		3.999 999 900 GHz	__________ GHz	4.000 000 100 GHz
		4.999 999 900 GHz	__________ GHz	5.000 000 100 GHz
		5.999 999 900 GHz	__________ GHz	6.000 000 100 GHz
		6.999 999 900 GHz	__________ GHz	7.000 000 100 GHz
		7.999 999 900 GHz	__________ GHz	8.000 000 100 GHz
		8.999 999 900 GHz	__________ GHz	9.000 000 100 GHz
		9.999 999 900 GHz	__________ GHz	10.000 000 100 GHz
		10.999 999 900 GHz	__________ GHz	11.000 000 100 GHz
		11.999 999 900 GHz	__________ GHz	12.000 000 100 GHz
		12.999 999 900 GHz	__________ GHz	13.000 000 100 GHz
		13.999 999 900 GHz	__________ GHz	14.000 000 100 GHz
		14.999 999 900 GHz	__________ GHz	15.000 000 100 GHz
		15.999 999 900 GHz	__________ GHz	16.000 000 100 GHz
		16.999 999 900 GHz	__________ GHz	17.000 000 100 GHz
		17.999 999 900 GHz	__________ GHz	18.000 000 100 GHz
		18.999 999 900 GHz	__________ GHz	19.000 000 100 GHz
		19.999 999 900 GHz	__________ GHz	20.000 000 100 GHz
d. Fine Loop Test Procedure				
2	Record the Frequency Counter Reading	0.999 999 900 GHz	__________ GHz	1.000 000 100 GHz
3	Record the Frequency Counter Reading	0.999 998 900 GHz	__________ GHz	1.000 001 100 GHz
4	Record the Frequency Counter Readings . . .	0.999 997 900 GHz	__________ GHz	1.000 002 100 GHz
		0.999 996 900 GHz	__________ GHz	1.000 003 100 GHz
		0.999 995 900 GHz	__________ GHz	1.000 004 100 GHz
		0.999 994 900 GHz	__________ GHz	1.000 005 100 GHz
		0.999 993 900 GHz	__________ GHz	1.000 006 100 GHz
		0.999 992 900 GHz	__________ GHz	1.000 007 100 GHz
		0.999 991 900 GHz	__________ GHz	1.000 008 100 GHz
		0.999 990 900 GHz	__________ GHz	1.000 009 100 GHz
		0.999 989 900 GHz	__________ GHz	1.000 010 100 GHz

2-7. Marker and Blanking Verification

Step	Procedure Comments	Marker/Signal Presence
	c. Marker Selection Procedure	
2	6747A-20 F1 Frequency Marker = .01 GHz	
2	Verify that a marker appears on the left side of the scope at the start of trace	______
3(a)	6747A-20 F2 Frequency Marker = 20 GHz	
3(b)	Verify that a marker appears on the right side of the scope at the end of trace	______
4	6747A-20 F3 Frequency Marker = 1 GHz	
4	Verify that a marker appears on the scope	______
4	6747A-20 F4 Frequency Marker = 4 GHz	
4	Verify that a marker appears on the scope	______
4	6747A-20 F5 Frequency Marker = 8 GHz	
4	Verify that a marker appears on the scope	______
4	6747A-20 F6 Frequency Marker = 10 GHz	
4	Verify that a marker appears on the scope	______
4	6747A-20 F7 Frequency Marker = 12 GHz	
4	Verify that a marker appears on the scope	______
4	6747A-20 F8 Frequency Marker = 15 GHz	
4	Verify that a marker appears on the scope	______
4	6747A-20 F9 Frequency Marker = 18 GHz	
4	Verify that a marker appears on the scope	______
	d. Marker Output Verification Procedure	
1	Verify +5V (TTL high) markers at nine points on scope display	______
3	Verify that all markers change to intensified spots	______
5(a)	Verify +5V (TTL high) signal at retrace	______
	Verify +5V signal at bandswitch point	______
	Verify +5V signal at each switched filter point:	
	3.5 GHz switch point	______
	6.0 GHz switch point	______
5(b)	Verify –10V signal at selected marker frequency	______
5(c)	Verify –5V signal at all other marker frequencies	______
6	Verify that new marker changes from –5V to –10V	______
	Verify that previous marker changes from –10V to –5V	______
8	Verify +5V signal during the following bandswitch dwell points:	
	2.0 GHz bandswitch dwell point	______
	8.0 GHz bandswitch dwell point	______
	12.4 GHz bandswitch dwell point	______
9	Verify –5V signal during the following bandswitch dwell points:	
	2.0 GHz bandswitch dwell point	______
	8.0 GHz bandswitch dwell point	______
	12.4 GHz bandswitch dwell point	______
11	Verify –5V signal during retrace	______
2	Verify +5V signal during retrace	______

2-8. Narrowband Spurious Tests

Step	Procedure Comments	Lower Limit	Measured Value	Upper Limit
c. Fine Loop Test Procedure				
1(b)	Enter 2.1 GHz.			
3	Record the presence of all spurious signals at a carrier offset of:			
	10 kHz		_______dBc	–60 dBc
	20 khz		_______dBc	–60 dBc
	30 kHz		_______dBc	–60 dBc
	40 kHz		_______dBc	–60 dBc
	50 kHz		_______dBc	–60 dBc
d. Coarse Loop Test Procedure				
1(c)	Enter 2.1 GHz.			
3	Record the presence of all spurious signals at a carrier offset of:			
	200 kHz		_______dBc	–60 dBc
	400 khz		_______dBc	–60 dBc

2-9. Spurious and Harmonic Tests: RF Output Signals ≤2 GHz

Step	Procedure Comments	Lower Limit	Measured Value	Upper Limit
c. Test Procedure				
3	Record the presence of all harmonics of the 10 MHz carrier		_______dBc	–20 dBc
3	Record the presence of all spurious responses on the Spectrum Analyzer display		_______dBc	–40 dBc
4	Record the presence of all harmonics of the 20 MHz carrier		_______dBc	–20 dBc
4	Record the presence of all spurious responses on the Spectrum Analyzer display		_______dBc	–40 dBc
4	Record the presence of all harmonics of the 30 MHz carrier		_______dBc	–20 dBc
4	Record the presence of all spurious responses on the Spectrum Analyzer display		_______dBc	–40 dBc
6	Record the presence of all harmonics of the 40 MHz carrier		_______dBc	–20 dBc
6	Record the presence of all spurious responses on the Spectrum Analyzer display		_______dBc	–40 dBc
8	Record the presence of all harmonics of the 350 MHz carrier		_______dBc	–20 dBc
8	Record the presence of all spurious responses on the Spectrum Analyzer display		_______dBc	–40 dBc
10	Record the presence of all harmonics of the 1.6 GHz carrier		_______dBc	–60 dBc
10	Record the presence of all spurious responses on the Spectrum Analyzer display		_______dBc	–60 dBc
10	Record the presence of all harmonics of the 3.2 GHz carrier		_______dBc	–60 dBc
10	Record the presence of all spurious responses on the Spectrum Analyzer display		_______dBc	–60 dBc
10	Record the presence of all harmonics of the 4.8 GHz carrier		_______dBc	–60 dBc
10	Record the presence of all spurious responses on the Spectrum Analyzer display		_______dBc	–60 dBc

2-10. Harmonic Tests: RF Output Signals From 2 to 10 GHz

Step	Procedure Comments	Lower Limit	Measured Value	Upper Limit
c. Test Procedure				
3	Record the level of all harmonics of the 2.1 GHz carrier:			
	4.2 GHz (2nd harmonic)		_______dBc	–60 dBc
	6.3 GHz (3rd harmonic)		_______dBc	–60 dBc
	8.4 GHz (4th harmonic)		_______dBc	–60 dBc
	10.5 GHz (5th harmonic)		_______dBc	–60 dBc
	12.6 GHz (6th harmonic)		_______dBc	–60 dBc
	14.8 GHz (7th harmonic)		_______dBc	–60 dBc
	16.9 GHz (8th harmonic)		_______dBc	–60 dBc
	19 GHz (9th harmonic)		_______dBc	–60 dBc
4	Record the level of all harmonics of the 3.6 GHz carrier:			
	7.2 GHz (2nd harmonic)		_______dBc	–60 dBc
	10.8 GHz (3rd harmonic)		_______dBc	–60 dBc
	14.4 GHz (4th harmonic)		_______dBc	–60 dBc
	18 GHz (5th harmonic)		_______dBc	–60 dBc
4	Record the level of all harmonics of the 7 GHz carrier:			
	14 GHz (2nd harmonic)		_______dBc	–60 dBc
4	Record the level of all harmonics of the 10 GHz carrier:			
	20 GHz (2nd harmonic)		_______dBc	–60 dBc

2-11. Power Level Accuracy and Flatness Verification (6747A Models without Optional Attenuator)

Step	Procedure Comments	Lower Limit	Measured Value	Upper Limit
c. Power Level Flatness Procedure				
2	Measure and record the maximum power level reading (step sweep)		________ dBm	+10.4 dBm
2	Measure and record the minimum power level reading (step sweep)	+9.6 dBm	________ dBm	
4	Measure and record the maximum power level reading (analog sweep; typical, not a spec) . .		________ dBm	+11.0 dBm
4	Measure and record the minimum power level reading (analog sweep; typical, not a spec) . .	+9.0 dBm	________ dBm	
d. Power Level Accuracy Procedure				
2	Measure and record the Power Meter reading at maximum leveled power (LEVEL 1)	+9.4 dBm	________ dBm	+10.6 dBm
3	Measure and record the Power Meter reading	+8.4 dBm	________ dBm	+9.6 dBm
4	Measure and record the Power Meter readings	+7.4 dBm	________ dBm	+8.6 dBm
		+6.4 dBm	________ dBm	+7.6 dBm
		+5.4 dBm	________ dBm	+6.6 dBm
		+4.4 dBm	________ dBm	+5.6 dBm
		+3.4 dBm	________ dBm	+4.6 dBm
		+2.4 dBm	________ dBm	+3.6 dBm
		+1.4 dBm	________ dBm	+2.6 dBm
		+0.4 dBm	________ dBm	+1.6 dBm
		–0.6 dBm	________ dBm	+0.6 dBm
		–1.6 dBm	________ dBm	–0.4 dBm
		–2.6 dBm	________ dBm	–1.4 dBm

2-11. Power Level Accuracy and Flatness Verification (6747A Models with 90 dB or 110 dB Optional Attenuator)

Step	Procedure Comments	Lower Limit	Measured Value	Upper Limit
c. Power Level Flatness Procedure				
2	Measure and record the maximum power level reading (step sweep)		________ dBm	+7.8 dBm
2	Measure and record the minimum power level reading (step sweep)	+6.2 dBm	________ dBm	
4	Measure and record the maximum power level reading (analog sweep; typical, not a spec) . .		________ dBm	+10.0 dBm
4	Measure and record the minimum power level reading (analog sweep; typical, not a spec) . .	+4.0 dBm	________ dBm	
d. Power Level Accuracy Procedure				
2	Measure and record the Power Meter reading at maximum leveled power (LEVEL 1)	+5.6 dBm	________ dBm	+8.4 dBm
3	Measure and record the Power Meter reading	+4.6 dBm	________ dBm	+7.4 dBm
4	Measure and record the Power Meter readings	+3.6 dBm	________ dBm	+6.4 dBm
		+2.6 dBm	________ dBm	+5.4 dBm
		+1.6 dBm	________ dBm	+4.4 dBm
		+0.6 dBm	________ dBm	+3.4 dBm
		–0.4 dBm	________ dBm	+2.4 dBm
		–1.4 dBm	________ dBm	+1.4 dBm
		–2.4 dBm	________ dBm	+0.4 dBm
		–3.4 dBm	________ dBm	–0.6 dBm
		–4.4 dBm	________ dBm	–1.6 dBm
		–5.4 dBm	________ dBm	–2.6 dBm
		–6.4 dBm	________ dBm	–3.6 dBm

2-11. Power Level Accuracy and Flatness Verification (6747A-20 Models without Optional Attenuator)

Step	Procedure Comments	Lower Limit	Measured Value	Upper Limit
c. Power Level Flatness Procedure				
2	Measure and record the maximum power level reading (step sweep)		________ dBm	+13.4 dBm
2	Measure and record the minimum power level reading (step sweep)	+12.6 dBm	________ dBm	
4	Measure and record the maximum power level reading (analog sweep; typical, not a spec) . .		________ dBm	+14.0 dBm
4	Measure and record the minimum power level reading (analog sweep; typical, not a spec) . .	+12.0 dBm	________ dBm	
d. Power Level Accuracy Procedure				
2	Measure and record the Power Meter reading at maximum leveled power (LEVEL 1)	+12.4 dBm	________ dBm	+13.6 dBm
3	Measure and record the Power Meter reading	+11.4 dBm	________ dBm	+12.6 dBm
4	Measure and record the Power Meter readings	+10.4 dBm	________ dBm	+11.6 dBm
		+9.4 dBm	________ dBm	+10.6 dBm
		+8.4 dBm	________ dBm	+9.6 dBm
		+7.4 dBm	________ dBm	+8.6 dBm
		+6.4 dBm	________ dBm	+7.6 dBm
		+5.4 dBm	________ dBm	+6.6 dBm
		+4.4 dBm	________ dBm	+5.6 dBm
		+3.4 dBm	________ dBm	+4.6 dBm
		+2.4 dBm	________ dBm	+3.6 dBm
		+1.4 dBm	________ dBm	+2.6 dBm
		+0.4 dBm	________ dBm	+1.6 dBm

2-11. Power Level Accuracy and Flatness Verification (6747A-20 Models with 90 dB or 110 dB Optional Attenuator)

Step	Procedure Comments	Lower Limit	Measured Value	Upper Limit
	c. Power Level Flatness Procedure			
2	Measure and record the maximum power level reading (step sweep)		_______ dBm	+10.8 dBm
2	Measure and record the minimum power level reading (step sweep)	+9.2 dBm	_______ dBm	
4	Measure and record the maximum power level reading (analog sweep; typical, not a spec) . .		_______ dBm	+13.0 dBm
4	Measure and record the minimum power level reading (analog sweep; typical, not a spec) . .	+7.0 dBm	_______ dBm	
	d. Power Level Accuracy Procedure			
2	Measure and record the Power Meter reading at maximum leveled power (LEVEL 1)	+8.6 dBm	_______ dBm	+11.4 dBm
3	Measure and record the Power Meter reading	+7.6 dBm	_______ dBm	+10.4 dBm
4	Measure and record the Power Meter readings	+6.6 dBm	_______ dBm	+9.4 dBm
		+5.6 dBm	_______ dBm	+8.4 dBm
		+4.6 dBm	_______ dBm	+7.4 dBm
		+3.6 dBm	_______ dBm	+6.4 dBm
		+2.6 dBm	_______ dBm	+5.4 dBm
		+1.6 dBm	_______ dBm	+4.4 dBm
		+0.6 dBm	_______ dBm	+3.4 dBm
		–0.4 dBm	_______ dBm	+2.4 dBm
		–1.4 dBm	_______ dBm	+1.4 dBm
		–2.4 dBm	_______ dBm	+0.4 dBm
		–3.4 dBm	_______ dBm	–1.6 dBm

2-12. Step Attenuator Verification (6747A or 6720A-20 Models without Optional Attenuator)

Step	Procedure Comments	Lower Limit	Measured Value	Upper Limit
	This test is not required as the synthesizer has no optional attenuator installed.			

2-12. Step Attenuator Verification (6747A or 6720A-20 Models with Option 2B — 90 dB Attenuator)

Step	Procedure Comments	Lower Limit	Measured Value	Upper Limit
	c. Power Level Accuracy Procedure			
4	Measure and record the peak signal level displayed on the Spectrum Analyzer (10 dB Attenuation; peak = –6 dBm ±1.4 dB) .	–7.4 dBm	_________ dBm	–4.6 dBm
6	Measure and record the peak signal level displayed on the Spectrum Analyzer (20 dB Attenuation; peak = –16 dBm ±1.4 dB) .	–17.4 dBm	_________ dBm	–14.6 dBm
8	Measure and record the peak signal level displayed on the Spectrum Analyzer (30 dB Attenuation; peak = –26 dBm ±2.6 dB) .	–28.6 dBm	_________ dBm	–23.4 dBm
10	Measure and record the peak signal level displayed on the Spectrum Analyzer (60 dB Attenuation; peak = –56 dBm ±3.1 dB) .	–58.1 dBm	_________ dBm	–52.9 dBm

2-12. Step Attenuator Verification (6747A or 6720A-20 Models with Option 2B — 110 dB Attenuator)

Step	*Procedure Comments*	*Lower Limit*	*Measured Value*	*Upper Limit*
d. Power Level Accuracy Procedure				
4	Measure and record the peak signal level displayed on the Spectrum Analyzer (10 dB Attenuation; peak = −6 dBm ±1.4 dB)	−7.4 dBm	________ dBm	−4.6 dBm
6	Measure and record the peak signal level displayed on the Spectrum Analyzer (20 dB Attenuation; peak = −16 dBm ±1.4 dB)	−17.4 dBm	________ dBm	−14.6 dBm
8	Measure and record the peak signal level displayed on the Spectrum Analyzer (40 dB Attenuation; peak = −36 dBm ±2.6 dB)	−38.6 dBm	________ dBm	−33.4 dBm
10	Measure and record the peak signal level displayed on the Spectrum Analyzer (80 dB Attenuation; peak = −76 dBm ±3.1 dB)	−79.1 dBm	________ dBm	−72.9 dBm

2-13. FM Modulation Tests

Step	*Procedure Comments*	*Lower Limit*	*Measured Value*	*Upper Limit*
c. FM Input Sensitivity Procedure				
5	Measure and record the signal level of the Bessel null displayed on the Spectrum Analyzer (CF = 1.1 GHz)	26 dB decrease	______ dB decrease	
d. FM Meter Accuracy Procedure				
1	Record the number in the MODULATION display			_______
2	Divide 9216 by the number noted in the previous line			_______
5	Measure and record the decrease in carrier level	26 dB decrease	______ dB decrease	
6	Measure and record the signal level of the Bessel null displayed on the Spectrum Analyzer (CF = 5 GHz)	26 dB decrease	______ dB decrease	
	Record the number in the MODULATION display			_______
	Divide 9216 by the number noted in the previous line			_______
	Measure and record the decrease in carrier level	26 dB decrease	______ dB decrease	
6	Measure and record the signal level of the Bessel null displayed on the Spectrum Analyzer (CF = 10 GHz)	26 dB decrease	______ dB decrease	
	Record the number in the MODULATION display			_______
	Divide 9216 by the number noted in the previous line			_______
	Measure and record the decrease in carrier level	26 dB decrease	______ dB decrease	
6	Measure and record the signal level of the Bessel null displayed on the Spectrum Analyzer (CF = 16 GHz)	26 dB decrease	______ dB decrease	
	Record the number in the MODULATION display			_______
	Divide 9216 by the number noted in the previous line			_______
	Measure and record the decrease in carrier level	26 dB decrease	______ dB decrease	

2-14. AM Modulation Tests

Step	Procedure Comments	Lower Limit	Measured Value	Upper Limit
c. AM Input Sensitivity and Meter Accuracy (at 1.1 GHz)				
6	Measure and note the Modulation Analyzer AM PK (+) reading			______
8	Measure and note the Modulation Analyzer AM PK (–) reading			______
10	Calculate and note the actual AM sensitivity . .	26%	____%	34%
d. AM Meter Accuracy Procedure (at 1.1 GHz)				
3	Record the number in the MODULATION display			______
4	Divide 30 by the number noted in the previous line. Note the result			______
5	Multiply the result of the previous step by the result of the calculation in step f.10. Verify that the product of the calculation is between 26% and 34% AM	26%	______%	34%
6	Repeat steps c.2 through d.5 for CW frequencies of 5, 10, and 16 GHz.			
c. AM Input Sensitivity and Meter Accuracy (at 5 GHz)				
6	Measure and note the Modulation Analyzer AM PK (+) reading			______
8	Measure and note the Modulation Analyzer AM PK (–) reading			______
10	Calculate and note the actual AM sensitivity . .	26%	____%	34%
d. AM Meter Accuracy Procedure (at 5 GHz)				
3	Record the number in the MODULATION display			______
4	Divide 30 by the number noted in the previous line. Note the result			______
5	Multiply the result of the previous step by the result of the calculation in step f.10. Verify that the product of the calculation is between 26% and 34% AM	26%	______%	34%
c. AM Input Sensitivity and Meter Accuracy (at 10 GHz)				
6	Measure and note the Modulation Analyzer AM PK (+) reading			______
8	Measure and note the Modulation Analyzer AM PK (–) reading			______
10	Calculate and note the actual AM sensitivity . .	26%	____%	34%
d. AM Meter Accuracy Procedure (at 10 GHz)				
3	Record the number in the MODULATION display			______
4	Divide 30 by the number noted in the previous line. Note the result			______
5	Multiply the result of the previous step by the result of the calculation in step f.10. Verify that the product of the calculation is between 26% and 34% AM	26%	______%	34%
c. AM Input Sensitivity and Meter Accuracy (at 16 GHz)				
6	Measure and note the Modulation Analyzer AM PK (+) reading			______
8	Measure and note the Modulation Analyzer AM PK (–) reading			______
10	Calculate and note the actual AM sensitivity . .	26%	____%	34%
d. AM Meter Accuracy Procedure (at 16 GHz)				
3	Record the number in the MODULATION display			______
4	Divide 30 by the number noted in the previous line. Note the result			______
5	Multiply the result of the previous step by the result of the calculation in step f.10. Verify that the product of the calculation is between 26% and 34% AM	26%	______%	34%

2-15. Pulse Modulation Tests: Rise Time, Fall Time, Overshoot, and Level

Step	*Procedure Comments*	*Lower Limit*	*Measured Value*	*Upper Limit*
c. Rise Time, Fall Time, Overshoot, and Level				
1(c)	F1 frequency set to 5 GHz; measure and record the following:			
2(a)	Rise Time		______ns	10 ns
2(b)	Pulse Width (typical; not a specification)		______µs	
2(c)	Pulse Rate is 50 kHz		______kHz	
2(d)	Overshoot (typical; not a specification)		______%	10%
	Repeat steps c.1 and c.2 for a 10 GHz CW frequency.			
1(c)	F1 frequency set to 10 GHz; measure and record the following:			
2(a)	Rise Time		______ns	10 ns
2(b)	Pulse Width (typical; not a specification)		______µs	
2(c)	Pulse Rate is 50 kHz		______kHz	
2(d)	Overshoot (typical; not a specification)		______%	10%
	Repeat steps c.1 and c.2 for a 16 GHz CW frequency.			
1(c)	F1 frequency set to 16 GHz; measure and record the following:			
2(a)	Rise Time		______ns	10 ns
2(b)	Pulse Width (typical; not a specification)		______µs	
2(c)	Pulse Rate is 50 kHz		______kHz	
2(d)	Overshoot (typical; not a specification)		______%	10%
e. 6747A-20 LEVEL Display Calibration				
1	Note the 6747A-20 LEVEL display value			______dBm
2	Note the 6747A-20 LEVEL display value			______dBm
3	Calculate the difference between steps c.1 and c.2. Note this value			______dB
f. Pulse Level Accuracy Test Procedure (Pulse Width = 5 µs; CW frequency = 5 GHz)				
5	Record the 6747A-20 LEVEL display value			______dBm
7	Record the 6747A-20 LEVEL display value			______dBm
8	Calculate and record the Pulse Level Error as the value noted in step f.5 minus that recorded in step f.7. (Specification is ≤±0.3 dB.)	–0.3 dB	______dB	+0.3 dB
10	Repeat steps f.2 through f.9 with a pulse width of 2 µs entered in step f.9(b)			
f. Pulse Level Accuracy Test Procedure (Pulse Width = 2 µs; CW frequency = 5 GHz)				
5	Record the 6747A-20 LEVEL display value			______dBm
7	Record the 6747A-20 LEVEL display value			______dBm
8	Calculate and record the Pulse Level Error as the value noted in step f.5 minus that recorded in step f.7. (Specification is ≤±0.3 dB.)	–0.3 dB	______dB	+0.3 dB

2-15. Pulse Modulation Tests: Rise Time, Fall Time, Overshoot, and Level (Continued)

Step	*Procedure Comments*	*Lower Limit*	*Measured Value*	*Upper Limit*
11	Repeat steps f.2 through f.9 with a pulse width of 1 µs entered in step f.9(b)			
f. Pulse Level Accuracy Test Procedure (Pulse Width = 1 µs; CW frequency = 5 GHz)				
5	Record the 6747A-20 LEVEL display value			______dBm
7	Record the 6747A-20 LEVEL display value			______dBm
8	Calculate and record the Pulse Level Error as the value noted in step f.5 minus that recorded in step f.7. (Specification is ≤±0.5 dB.)	–0.5 dB	______dB	+0.5 dB
11	Repeat steps f.2 through f.9 with a pulse width of 0.5 µs entered in step f.9(b)			
f. Pulse Level Accuracy Test Procedure (Pulse Width = 0.5 µs; CW frequency = 5 GHz)				
5	Record the 6747A-20 LEVEL display value			______dBm
7	Record the 6747A-20 LEVEL display value			______dBm
8	Calculate and record the Pulse Level Error as the value noted in step f.5 minus that recorded in step f.7. (Specification is ≤±0.8 dB.)	–0.8 dB	______dB	+0.8 dB
11	Repeat steps f.2 through f.9 with a pulse width of 0.2 µs entered in step f.9(b)			
f. Pulse Level Accuracy Test Procedure (Pulse Width = 0.2 µs; CW frequency = 5 GHz)				
5	Record the 6747A-20 LEVEL display value			______dBm
7	Record the 6747A-20 LEVEL display value			______dBm
8	Calculate and record the Pulse Level Error as the value noted in step f.5 minus that recorded in step f.7. (Specification is ≤±1.5 dB.)	–1.5 dB	______dB	+1.5 dB
11	Repeat steps f.2 through f.9 with a pulse width of 0.1 µs entered in step f.9(b)			
f. Pulse Level Accuracy Test Procedure (Pulse Width = 0.1 µs; CW frequency = 5 GHz)				
5	Record the 6747A-20 LEVEL display value			______dBm
7	Record the 6747A-20 LEVEL display value			______dBm
8	Calculate and record the Pulse Level Error as the value noted in step f.5 minus that recorded in step f.7. (Specification is ≤±1.5 dB.)	–1.5 dB	______dB	+1.5 dB

2-15. Pulse Modulation Tests: Rise Time, Fall Time, Overshoot, and Level (Continued)

Step	*Procedure Comments*	*Lower Limit*	*Measured Value*	*Upper Limit*
13	Repeat steps f.2 through f.9 with a pulse width of 5 µs entered in step f.9(b)			
f. Pulse Level Accuracy Test Procedure (Pulse Width = 5 µs; CW frequency = 1.1 GHz)				
5	Record the 6747A-20 LEVEL display value			______dBm
7	Record the 6747A-20 LEVEL display value			______dBm
8	Calculate and record the Pulse Level Error as the value noted in step f.5 minus that recorded in step f.7. (Specification is ≤±0.3 dB.)	–0.3 dB	______dB	+0.3 dB
14	Repeat steps f.2 through f.9 with a pulse width of 2 µs entered in step f.9(b)			
f. Pulse Level Accuracy Test Procedure (Pulse Width = 2 µs; CW frequency = 1.1 GHz)				
5	Record the 6747A-20 LEVEL display value			______dBm
7	Record the 6747A-20 LEVEL display value			______dBm
8	Calculate and record the Pulse Level Error as the value noted in step f.5 minus that recorded in step f.7. (Specification is ≤±0.6 dB.)	–0.6 dB	______dB	+0.6 dB
14	Repeat steps f.2 through f.9 with a pulse width of 1 µs entered in step f.9(b)			
f. Pulse Level Accuracy Test Procedure (Pulse Width = 1 µs; CW frequency = 1.1 GHz)				
5	Record the 6747A-20 LEVEL display value			______dBm
7	Record the 6747A-20 LEVEL display value			______dBm
8	Calculate and record the Pulse Level Error as the value noted in step f.5 minus that recorded in step f.7. (Specification is ≤±0.9 dB.)	–0.9 dB	______dB	+0.9 dB
14	Repeat steps f.2 through f.9 with a pulse width of 0.5 µs entered in step f.9(b)			
f. Pulse Level Accuracy Test Procedure (Pulse Width = 0.5 µs; CW frequency = 1.1 GHz)				
5	Record the 6747A-20 LEVEL display value			______dBm
7	Record the 6747A-20 LEVEL display value			______dBm
8	Calculate and record the Pulse Level Error as the value noted in step f.5 minus that recorded in step f.7. (Specification is ≤±1.2 dB.)	–1.2 dB	______dB	+1.2 dB

2-16. Pulse Modulation Test: Video Feedthrough

Step	*Procedure Comments*	*Lower Limit*	*Measured Value*	*Upper Limit*
c. Test Procedure				
1(c)	F1 frequency set to 1.1 GHz			
3	Measure and record the Video Fedthrough voltage spikes (specification = <+5 mV peak).		______mV peak	+5 mV peak
1(c)	F1 frequency set to 5 GHz			
4	Measure and record the Video Fedthrough voltage spikes (specification = <+5 mV peak).		______mV peak	+5 mV peak
1(c)	F1 frequency set to 10 GHz			
4	Measure and record the Video Fedthrough voltage spikes (specification = <+5 mV peak).		______mV peak	+5 mV peak
1(c)	F1 frequency set to 16 GHz			
4	Measure and record the Video Fedthrough voltage spikes (specification = <+5 mV peak).		______mV peak	+5 mV peak

2-17. Pulse Modulation Test: RF On/Off Ratio

Step	Procedure Comments	Lower Limit	Measured Value	Upper Limit
c. Test Procedure				
1(d)	F1 frequency set to 1.1 GHz			
4	Measure and record the peak of the signal on the Spectrum Analyzer. (Measured signal must be >60 dB below top graticule to meet specification; this represents an On/Off Ratio of >80 dB.)		______dB	60 dB
7	Repeat steps c.6 through c.9 for a CW frequency of 5 GHz.			
1(d)	F1 frequency set to 5 GHz			
4	Measure and record the peak of the signal on the Spectrum Analyzer. (Measured signal must be >60 dB below top graticule to meet specification; this represents an On/Off Ratio of >80 dB.)		______dB	60 dB
10	Repeat steps c.6 through c.9 for a CW frequency of 10 GHz.			
1(d)	F1 frequency set to 10 GHz			
4	Measure and record the peak of the signal on the Spectrum Analyzer. (Measured signal must be >60 dB below top graticule to meet specification; this represents an On/Off Ratio of >80 dB.)		______dB	60 dB
10	Repeat steps c.6 through c.9 for a CW frequency of 16 GHz.			
1(d)	F1 frequency set to 16 GHz			
4	Measure and record the peak of the signal on the Spectrum Analyzer. (Measured signal must be >60 dB below top graticule to meet specification; this represents an On/Off Ratio of >80 dB.)		______dB	60 dB

WILTRON Model 6747A and 6747A-20 **Date:** ____________________

Serial Number ____________________ **Tested By:** ____________________

PERFORMANCE TEST/STEP	VERIFICATION CONDITIONS	MEASURED VALUE
3-6 ALC Level Offset Adjustments This instrument uses two leveling circuits – the Primary Leveling Circuit supports Band 0 (0.01-2.0 GHz); the Secondary Leveling Circuit supports Bands 1 through 3 (2.0-20 GHz).		
b. Primary Leveling Circuit		
4.	F1 = 1 GHz	
7.	A15TP7 = 0V ±50 µV	____________volts
c. Secondary Leveling Circuit		
1.	F1 = 2 GHz	
3.	A15TP7 = 0V ±50 µV	____________volts
d. Pulse Circuit		
1.	F1 = 2 GHz	
5.	A15TP8 = 0V ±5 µV	____________volts
3-7 ALC Bandwidth Adjustments This adjustment is required for each band:		
0.01-2 GHz	Follow steps 1 through 11.	
2-8 GHz	Follow steps 1 through 11.	
8-12.4 GHz	Repeat steps 1 through 11.	
12.4-20 GHz	Repeat steps 1 through 11; then step 12.	

PERFORMANCE TEST/STEP	VERIFICATION CONDITIONS	MEASURED VALUE
3-8 ALC Slope Adjustment This adjustment is required for each band: 0.01-2 GHz 2-8 GHz 8-12.4 GHz 12.4-20 GHz		
b.3 0.01-2 GHz Band 3. 5. 8. 14.	F1 = 0.01 GHz F2 = 2 GHz <Shift> TRIGGER Code = 051 Draw resulting waveform flatness	Draw Waveform Flatness for 0.01-2 GHz Band
b.3 2-8 GHz Band 3. 5. 8. 14.	F1 = 2 GHz F2 = 8 GHz <Shift> TRIGGER Code = 051 Draw resulting waveform flatness	Draw Waveform Flatness for 2-8 GHz Band
b.3 8-12.4 GHz Band 3. 5. 8. 14.	F1 = 8 GHz F2 = 12.4 GHz <Shift> TRIGGER Code = 051 Draw resulting waveform flatness	Draw Waveform Flatness for 8-12.4 GHz Band
b.3 12.4-20 GHz Band 3. 5. 8. 14.	F1 = 12.4 GHz F2 = 20 GHz <Shift> TRIGGER Code = 051 Draw resulting waveform flatness	Draw Waveform Flatness for 12.4-20 GHz Band
3-9 External Leveling Offset Adjustment 4.	A15TP4 = 0V ±1 mV	____________volts

PERFORMANCE TEST/STEP	VERIFICATION CONDITIONS	MEASURED VALUE
3-10 AM Sensitivity Calibration This calibration is required for each of the installed bands.		
b. 0.01-2 GHz Band		
1.	Spectrum Analyzer CF = 1.1 GHz	
7.	<Shift> TRIGGER Code = 054	
14.	Averaged Readings = 50%	
b. 2-8 GHz Band		
1.	Spectrum Analyzer CF = 5 GHz	
7.	<Shift> TRIGGER Code = 054	
14.	Averaged Readings = 50%	
b. 8-12.4 GHz Band		
1.	Spectrum Analyzer CF = 10 GHz	
7.	<Shift> TRIGGER Code = 054	
14.	Averaged Readings = 50%	
b. 12.4-20 GHz Band		
1.	Spectrum Analyzer CF = 15 GHz	
7.	<Shift> TRIGGER Code = 054	
14.	Averaged Readings = 50%	
15.	Press RECALL to save calibration results.	
3-11 AM Meter Calibration		
b.2	Set to 5 GHz.	
c.2	Set to 5 GHz.	
3-12 10 MHz Reference Oscillator Calibration		
b.3	F1 = 2 GHz	
6.	Adjust for Counter Reading = 2 GHz ±100 Hz	__________GHz
3-13 FM Driver Calibration This calibration is automatically competed for each of the installed bands.		
b.2	F1 = 2 GHz	
b.3	<Shift> TRIGGER Code = 404	

PERFORMANCE TEST/STEP	VERIFICATION CONDITIONS	MEASURED VALUE
3-14 FM Sensitivity Calibration This calibration is required for each of the installed bands.		
b. 0.01-2 GHz Band 5. 15.	F1 = 1.1 GHz Draw Waveform Null	Draw Waveform Null
b. 2-8 GHz Band 5. 15.	F1 = 2 GHz Draw Waveform Null	Draw Waveform Null
b. 8-12.4 GHz Band 5. 15.	F1 = 8 GHz Draw Waveform Null	Draw Waveform Null
b. 12.4-20 GHz Band 5. 15.	F1 = 12.4 GHz Draw Waveform Null	Draw Waveform Null

PERFORMANCE TEST/STEP	VERIFICATION CONDITIONS	MEASURED VALUE
3-15. FM Flatness Calibration This calibration is required for each of the installed bands.		
b. 0.01-2 GHz Band 4. 5. 14.	F1 = 1.1 GHz Spectrum Analyzer CF = 1.1 GHz Draw Waveform	Draw Waveform
b. 2-8 GHz Band 4. 5. 14.	F1 = 2 GHz Spectrum Analyzer CF = 2 GHz Draw Waveform	Draw Waveform
b. 8-12.4 GHz Band 4. 5. 14.	F1 = 8 GHz Spectrum Analyzer CF = 8 GHz Draw Waveform	Draw Waveform Null
b. 12.4-20 GHz Band 4. 5. 14.	F1 = 12.4 GHz Spectrum Analyzer CF = 12.4 GHz Waveform	Draw Waveform Null

PERFORMANCE TEST/STEP	VERIFICATION CONDITIONS	MEASURED VALUE
3-16 FM Meter Calibration Follow Test Procedure Steps.		
3-17 YIG Frequency Calibration This calibration is required for each of the installed bands.		
b. 0.01-2 GHz Band 4. 6. 8.	F1 = 1.1 GHz <Shift> TRIGGER Code = 064 Counter and 6737A agree within ±2 MHz	________ MHz
b. 2-8 GHz Band 4. 6. 8.	F1 = 2 GHz <Shift> TRIGGER Code = 064 Counter and 6737A agree within ±2 MHz	________ MHz
b. 8-12.4 GHz Band 4. 6. 8.	F1 = 12.4 GHz <Shift> TRIGGER Code = 064 Counter and 6737A agree within ±2 MHz	________ MHz
b. 12.4-20 GHz Band 4. 6. 8.	F1 = 20 GHz <Shift> TRIGGER Code = 064 Counter and 6737A agree within ±2 MHz	________ MHz
3-18 Analog Sweep Calibration Follow Test Procedure Steps.		
3-19 Power Supply Injection-Lock Adjustment Follow Test Procedure Steps.		
3-20 RF Level Calibration This test is performed with an automated test procedure. Contact the factory at (408) 778-2000 for further information.		

SECTION V
PARTS LISTS

CONTENTS

Table 5-1. Vendor and Vendor FSCM Number Cross-Reference List

VENDOR	FSCM NO.	VENDOR	FSCM NO.
Airco	N/L	Intersil	32293
Allen-Bradley	01121	Kemet	N/L
Alpha	23365	Lenox-Fugel	24759
Amp	00779	Linear Technology	N/L
Analog Devices	24355	Lumex	N/L
Arco	N/L	MEPCO	19701
Aromat	61529	Micropower	N/L
Augat	91506	Mini Circuits	N/L
Beckman	60771	Monsanto	N/L
Belden	70903	MOT	N/L
Bell	N/L	Motorola	50012
Berg	N/L	Murata/Erie	72982
Berg-Du Pont	N/L	Nichicon	N/L
Bourns	08116	NSC	N/L
Burr-Brown	13919	Omron	N/L
Cal-R	92114	Panasonic	N/L
Cambion	N/L	Plessy	N/L
Central Labs	N/L	Precision Monolithic	N/L
Centre Engineering	51642	RCA	N/L
CDI	57518	RF Monolithic, Inc.	N/L
Chicago Switch	N/L	RMC	N/L
Circuit Assembly	52072	Samtec	55322
Corcom	N/L	Semtech	14099
Cornell-Dubilier	N/L	Signetics	N/L
Corning	N/L	Siliconix	17865
Crystek Crystal	N/L	Solid State Devices	N/L
Dallas Semiconductor	N/L	Sprague	N/L
Delevan	N/L	Squires	60386
Electrocube	14752	Supertex, Inc.	N/L
Electromotive	72915	Sussco (ARCO)	N/L
Elmenco	N/L	Teka Products	N/L
Erie	72982	Texas Instruments	01295
Ferroxcube	N/L	TRW	N/L
FSC	N/L	Ultex	N/L
Fujitsu	61271	Vermont Precision	55710
G.E.	N/L	Verospeed	N/L
Hamlin Inc.	27011	West Coast Magnetics	12042
Hitachi	N/L	Western Thermistor	N/L
IMB	27556	Winchester	81312
Intel	34649	Xicor	N/L
		3M	N/L

SECTION V
PARTS LISTS

5-1 INTRODUCTION

This section provides parts lists for the 67XXA Series Swept Frequency Synthesizers. The parts lists are divided into four groups:

- Printed circuit board (PCB) parts (Tables 5-4 thru 5-34)
- Options and accessories (Tables 5-35 thru 5-39)
- Major assembly parts (Figures 5-1 through 5-9)
- Microwave deck parts (Figure 5-10)

5-2 PARTS-ORDERING INFORMATION

Parts may be odered from your local WILTRON representative or directly from the factory.

WILTRON Company
490 Jarvis Drive
Morgan Hill, CA 95037-2809

Telephone: 408-778-2000
TWX: 285227 WILTRON MH
FAX: 408-778-0239

When ordering, give complete information including the model and serial number of the instrument, the full part description, the WILTRON part number, and the quantity required.

5-3 VENDOR INFORMATION

Table 4-1 on the facing page provides a cross-reference list of vendors and their associated FSCM number. Vendors without FSCM numbers are marked with an "N/L" (No Listing).

5-4 ABBREVIATIONS

Common abbreviations used in the parts list descriptions are defined in Table 5-2.

5-5 ORGANIZATION OF PARTS LISTS

Table 5-3 lists the location of all major assembly groups, PCBs, options/accessories, and microwave deck component lists.

Table 5-2. Common Abbreviations Used in the Parts List

Abbreviation	Description	Abbreviation	Description
A	Ampere, Assembly	N	Not Assigned
B	Fan	P	Pin, Plug
C	Capacitor	PCB	Printed Circuit Board
CC	Carbon Composition	Q	Transistor
CER	Ceramic	R	Resistor
CR	Diode	RN	Resistor Network
DS	Display Indicator	S	Switch
E	Miscellaneous Electrical Part	SI	Silicon
F	Female	SW	Switch
FF	Flip Flop	T	Transformer
FXD	Fixed	TANT	Tantalum
HDR	Header	TP	Test Point
J	Jack	U	Integrated Circuit, Micro- (10^{-6})
K	Kilo (10^3), Relay	UF	Micro Farad (μF)
L	Inductor	UH	Micro Henry (μH)
LCD	Liquid Crystal Display	V	Volt
LED	Light Emitting Diode	VR	Voltage Regulator
M	Male, Meg- (10^6)	W	Watt, Wire Jumper
MF	Metal Film	Y	Crystal
MH	Milli Henry (mH)		

Table 5-3. Organization of Parts Lists

Table 5-4. A1 Front Panel PCB (6700-D-31701-3; Rev. C) Parts List (Page 1 of 3)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	230-37	12	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C2	250-41	1	CAPACITOR,FXD,TANT,6.8UF,10%,3V	196D685X9035KE3	SPRAGUE
C3	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C4	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C5	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C6	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C7	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C8	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C9	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C10	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C11	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C12	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C13	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
CR1	10-4	2	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR2	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
DS1	15-32	44	INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS2	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS3	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS4	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS5	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS6	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS7	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS8	15-31	4	INDICATOR,LED,RED	SSL-LX20465RD	LUMEX
DS9	15-31		INDICATOR,LED,RED	SSL-LX20465RD	LUMEX
DS10	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS11	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS12	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS13	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS14	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS15	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS16	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS17	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS18	15-31		INDICATOR,LED,RED	SSL-LX20465RD	LUMEX
DS19	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS20	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS21	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS22	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS23	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS24	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS25	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS26	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS27	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS28	15-33	1	INDICATOR,LED,GREEN	SSL-LX20465GD	LUMEX
DS29	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS30	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS31	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS32	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS33	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS34	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS35	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS36	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS37	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS38	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS39	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS40			NOT ASSIGNED		
DS41			NOT ASSIGNED		
DS42	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS43	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS44	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS45	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX

Table 5-4. A1 Front Panel PCB (6700-D-31701-3; Rev. C) Parts List (Page 2 of 3)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
DS46	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS47	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS48	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS49	15-32		INDICATOR,LED,YELLOW	SSL-LX20465YD	LUMEX
DS50	15-31		INDICATOR,LED,RED	SSL-LX20465RD	LUMEX
DS51	B30539-1	1	DISPLAY,LCD,7 SEGMENT	7128-313-465	HAMLIN INC.
DS52	B30537-1	1	DISPLAY,LCD,7 SEGMENT	7126-313-465	HAMLIN INC.
DS53	B30538-1	1	DISPLAY,LCD,7 SEGMENT	7127-313-465	HAMLIN INC.
L1	310-53	1	INDUCTOR,FXD,47UH,5%	1537-60	DELEVAN
P1	803-30	4	RIBBON CABLE ASSY	IDMD-13-D-4-R	SAMTEC
P2	803-30		RIBBON CABLE ASSY	IDMD-13-D-4-R	SAMTEC
P3	803-30		RIBBON CABLE ASSY	IDMD-13-D-4-R	SAMTEC
P4	803-30		RIBBON CABLE ASSY	IDMD-13-D-4-R	SAMTEC
P5	551-420	1	CONNECTOR,HEADER,PCB MNT RT	65521-102	BERG
Q1	20-2N3906	1	TRANSISTOR,PNP,2N3906,SI	2N3906	MOTOROLA
R1	110-2.32K-1	2	RESISTOR,FXD,MF,2.32K,1%,0.25W	SMA-4-2.32K	CORNING
R2	110-2.32K-1		RESISTOR,FXD,MF,2.32K,1%,0.25W	SMA-4-2.32K	CORNING
R3	110-221-1	5	RESISTOR,FXD,MF,221,1%,0.25W	SMA-4-221	CORNING
R4	110-221-1		RESISTOR,FXD,MF,221,1%,0.25W	SMA-4-221	CORNING
R5	110-221-1		RESISTOR,FXD,MF,221,1%,0.25W	SMA-4-221	CORNING
R6	110-221-1		RESISTOR,FXD,MF,221,1%,0.25W	SMA-4-221	CORNING
R7	110-221-1		RESISTOR,FXD,MF,221,1%,0.25W	SMA-4-221	CORNING
R8	110-1K-1	1	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R9	110-3.83K-1	1	RESISTOR,FXD,MF,3.83K,1%,0.25W	SMA-4-3.83K	CORNING
R10	110-215-1	1	RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
RN1	123-14	6	RESISTOR,NETWORK,MF,7X220,2%	408A221	AB
RN2	123-14		RESISTOR,NETWORK,MF,7X220,2%	408A221	AB
RN3	123-14		RESISTOR,NETWORK,MF,7X220,2%	408A221	AB
RN4	123-14		RESISTOR,NETWORK,MF,7X220,2%	408A221	AB
RN5	123-14		RESISTOR,NETWORK,MF,7X220,2%	408A221	AB
RN6	123-14		RESISTOR,NETWORK,MF,7X220,2%	408A221	AB
SW1	430-131	51	SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW2	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW3	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW4	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW5	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW6	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW7	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW8	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW9	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW10	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW11	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW12	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW13	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW14	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW15	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW16	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW17	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW18			NOT ASSIGNED		
SW19	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW20	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW21	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW22	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW23			NOT ASSIGNED		
SW24	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW25	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW26	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW27	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW28	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW29	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS

Table 5-4. A1 Front Panel PCB (6700-D-31701-3; Rev. C) Parts List (Page 3 of 3)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
SW30	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW31	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW32	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW33	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW34	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW35	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW36	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW37	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW38	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW39	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW40	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW41	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW42	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW43	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW44	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW45	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW46	430-159	1	SWITCH,PUSH-PUSH,PC VERT	K40351AA	CENTRALABS
SW47	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW48	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW49	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW50	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW51	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW52	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
SW53	430-131		SWITCH,PUSH BUTTON	K40141AA	CENTRALABS
U1	54-41	6	IC,TTL,74LS374,OCTAL,D FF	DM74LS374N	NSC
U2	54-41		IC,TTL,74LS374,OCTAL,D FF	DM74LS374N	NSC
U3	54-41		IC,TTL,74LS374,OCTAL,D FF	DM74LS374N	NSC
U4	54-41		IC,TTL,74LS374,OCTAL,D FF	DM74LS374N	NSC
U5	54-41		IC,TTL,74LS374,OCTAL,D FF	DM74LS374N	NSC
U6	54-41		IC,TTL,74LS374,OCTAL,D FF	DM74LS374N	NSC
U7	54-341	5	IC,CMOS,FOUR DIGIT DISPLAY	ICM7211AMIPL	INTERSIL
U8	54-341		IC,CMOS,FOUR DIGIT DISPLAY	ICM7211AMIPL	INTERSIL
U9	54-341		IC,CMOS,FOUR DIGIT DISPLAY	ICM7211AMIPL	INTERSIL
U10	54-341		IC,CMOS,FOUR DIGIT DISPLAY	ICM7211AMIPL	INTERSIL
U11	54-340	1	IC,CMOS,4049,HEX BUFFER/CONV	CD4049AE	RCA
U12	54-341		IC,CMOS,FOUR DIGIT DISPLAY	ICM7211AMIPL	INTERSIL

Table 5-5. A2 Front Panel Control PCB (6700-D-31702-3; Rev. H) Parts List (Page 1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	250-42	4	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C2	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C3	230-37	29	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C4	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C5	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C6	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C7	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C8	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C9	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C10	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C11	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C12	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C13	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C14	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C15	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C16	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C17	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C18	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C19	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C20	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C21	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C22	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C23	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C24	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C25	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C26	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C27	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C28	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C29	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C30	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C31	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C32	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C33	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
CR1	10-1N758A	2	DIODE,ZENER,1N758A,10V,5%	1N758A	MOTOROLA
CR2	10-1N758A		DIODE,ZENER,1N758A,10V,5%	1N758A	MOTOROLA
CR3	10-1N751A	2	DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR4	10-FD300	4	DIODE RECTIFIER,IN3595,125V,4A	IN3595	SOLID STATE DEVICES
CR5	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	IN3595	SOLID STATE DEVICES
CR6	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	IN3595	SOLID STATE DEVICES
CR7	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	IN3595	SOLID STATE DEVICES
CR8	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR9	10-1N755A	2	DIODE,ZENER,1N755A,7.5V,5%	1N755A	MOTOROLA
CR10	10-1N755A		DIODE,ZENER,1N755A,7.5V,5%	1N755A	MOTOROLA
J1	553-216	4	SOCKET,RIBBON CABLE HEADER	SD-113-T-2	SAMTEC
J2	553-216		SOCKET,RIBBON CABLE HEADER	SD-113-T-2	SAMTEC
J3	553-216		SOCKET,RIBBON CABLE HEADER	SD-113-T-2	SAMTEC
J4	553-216		SOCKET,RIBBON CABLE HEADER	SD-113-T-2	SAMTEC
J5	551-206	2	CONNECTOR,HDR,PC MNT RT ANGL	65521-103	BERG
J6	551-206		CONNECTOR,HDR,PC MNT RT ANGL	65521-103	BERG
L1	310-89	2	INDUCTOR,FIXED,1.9uH @ 50mHz	VK200 10/3B	FERROXCUBE
L2	310-89		INDUCTOR,FIXED,1.9uH @ 50mHz	VK200 10/3B	FERROXCUBE
L3	310-98	1	INDUCTOR,FXD,1mH,10%	1537-744	DELEVAN
P1	551-645	1	CONNECTOR,HEADER,1 ROW-0.10"	68015-112	BERG
P2	551-552	2	CONNECTOR HEADER,1 ROW-0.10"	68016-104	BERG
R1	110-10K-1	3	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R2	110-100K-1	1	RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4-100K	CORNING
R3	110-100-1	8	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R4	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R5	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R6	110-5.11K-1	2	RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-5.11K	CORNING

Table 5-5. A2 Front Panel Control PCB (6700-D-31702-3; Rev. H) Parts List (Page 2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R7	110-5.11K-1		RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-5.11K	CORNING
R8	110-5.49K-1	1	RESISTOR,FXD,MF,5.49K,1%,0.25W	SMA-4-5.49K	CORNING
R9	110-2.55K-1	1	RESISTOR,FXD,MF,2.55K,1%,0.25W	SMA-4-2.55K	CORNING
R10	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R11	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R12	110-1.96K-1	2	RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R13	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R14	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R15	157-1K	1	RESISTOR,TRIM,CER,1K,10%,20T	89PR1K	BECKMAN
R16	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R17	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R18	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R19	110-100-1	1	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R20	110-4.75K-1	1	RESISTOR,FXD,MF,4.75K,1%,0.25W	SMA-4-4.75K	CORNING
R21	110-499-1	1	RESISTOR,FXD,MF,499,1%,0.25W	SMA-4-499	CORNING
R22	110-4.64K-1	2	RESISTOR,FXD,MF,4.64K,1%,0.25W	SMA-4-4.64K	CORNING
R23	110-4.64K-1		RESISTOR,FXD,MF,4.64K,1%,0.25W	SMA-4-4.64K	CORNING
RN1	123-9	3	RESISTOR,NETWORK,MF,9X10K,2%	410A103	AB
RN2	123-9		RESISTOR,NETWORK,MF,9X10K,2%	410A103	AB
RN3	123-9		RESISTOR,NETWORK,MF,9X10K,2%	410A103	AB
U1	54-518	2	IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INST.
U2	54-518		IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INST.
U3	54-528	3	IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INST.
U4	54-510	1	IC,CMOS,74HC04,HEX	SN74HC04N	TEXAS INST.
U5	54-508	1	IC,CMOS,74HC02,QUAD 2-INPUT	SN74HC02N	TEXAS INST.
U6	54-515	2	IC,CMOS,74HC148,SINGLE	SN74HC148N	TEXAS INST.
U7	54-528		IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INST.
U8	54-528		IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INST.
U9	54-515		IC,CMOS,74HC148,SINGLE	SN74HC148N	TEXAS INST.
U10	54-519	1	IC,CMOS,74HC165,8 BIT SERIAL	SN74HC165N	TEXAS INST.
U11	54-513	1	IC,CMOS,74HC74,DUAL D-TYPE	SN74HC74N	TEXAS INST.
U12	54-339	14	IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U13	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U14	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U15	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U16	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U17	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U18	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U19	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U20	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U21	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U22	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U23	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U24	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U25	54-339		IC,CMOS,4054,INDIVIDUAL LCD	CD4054BE	RCA
U26	50-DG200BA	1	IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U27	50-9	1	IC,OP AMP,LF356,SINGLE	LF356N	NSC
U28	54-376	2	IC,OP-AMP,OP27EJ,SINGLE,25uV	OP27EJ	PRECISION MONOLITHIC
U29	54-376		IC,OP-AMP,OP27EJ,SINGLE,25uV	OP27EJ	PRECISION MONOLITHIC

Table 5-6. A3 Coarse Loop Mixer PCB (6700-D-31703-3; Rev. C) Parts List (Page 1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1			NOT ASSIGNED		
C2	220-100	2	CAPACITOR,FXD,MICA,100PF,5%,50V	CD15FD101J03	CORNELL DUBILIER
C3	250-42	3	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C4	230-37	6	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C5	220-100		CAPACITOR,FXD,MICA,100PF,5%,50V	CD15FD101J03	CORNELL DUBILIER
C6	220-330	2	CAPACITOR,FXD,MICA,330PF,5%,50V	CD15FD331JO3	CORNELL DUBILIER
C7	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C8	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C9	220-330		CAPACITOR,FXD,MICA,330PF,5%,50V	CD15FD331JO3	CORNELL DUBILIER
C10	220-30	1	CAPACITOR,FXD,MICA,30PF,5%,500V	CD15ED300JO3	CORNELL DUBILIER
C11	220-51	1	CAPACITOR,FXD,MICA,51PF,5%,500V	CD15ED510J03	CORNELL DUBILIER
C12	220-15	1	CAPACITOR,FXD,MICA,15PF,5%,500V	CMO5D150J03	ARCO/SOSHIN
C13	230-30	3	CAPACITOR,FXD,CER,1000PF,+80/-20V	BGP.001,500V,+80-20	RMC
C14	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C15	230-30		CAPACITOR,FXD,CER,1000PF,+80/-20V	BGP.001,500V,+80-20	RMC
C16	220-130	1	CAPACITOR,FXD,MICA,130PF,5%,50V	CD15FD131JO3	CORNELL DUBILIER
C17	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C18	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C19	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C20	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C21	230-30		CAPACITOR,FXD,CER,1000PF,+80/-20V	BGP.001,500V,+80-20	RMC
L1	310-57	2	INDUCTOR,FXD,0.15UH,10%	1025-00	DELEVAN
L2	310-82	2	INDUCTOR,FIXED,0.10UH,10%	551-5172-09	CAMBION
L3	310-82		INDUCTOR,FIXED,0.10UH,10%	551-5172-09	CAMBION
L4	310-57		INDUCTOR,FXD,0.15UH,10%	1025-00	DELEVAN
P1	551-539	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-004	BERG
Q1	20-2N5179	6	TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q2	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q3	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q4	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q5	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q6	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
R1	110-61.9-1	2	RESISTOR,FXD,MF,61.9,1%,0.25W	SMA-4 OR C4	CORNING
R2	110-249-1	1	RESISTOR,FXD,MF,249,1%,0.25W	SMA-4	CORNING
R3	110-68.1-1	1	RESISTOR,FXD,MF,68.1,1%,0.25W	SMA-4 OR C4	CORNING
R4	110-6.19K-1	1	RESISTOR,FXD,MF,6.19K,1%,0.25W	SMA-4	CORNING
R5	110-681-1	2	RESISTOR,FXD,MF,681,1%,0.25W	SMA-4	CORNING
R6	110-619-1	2	RESISTOR,FXD,MF,619,1%,0.25W	SMA-4	CORNING
R7	110-619-1		RESISTOR,FXD,MF,619,1%,0.25W	SMA-4	CORNING
R8	110-147-1	2	RESISTOR,FXD,MF,147,1%,0.25W	SMA-4 OR C4	CORNING
R9	110-36.5-1	1	RESISTOR,FXD,MF	SMA-4	CORNING
R10	110-147-1		RESISTOR,FXD,MF,147,1%,0.25W	SMA-4 OR C4	CORNING
R11	110-178-1	2	RESISTOR,FXD,MF,178,1%,0.25W	SMA- 4 OR C4	CORNING
R12	110-48.7-1	1	RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4 OR C4	CORNING
R13	110-61.9-1		RESISTOR,FXD,MF,61.9,1%,0.25W	SMA-4 OR C4	CORNING
R14	110-2.15K-1	1	RESISTOR,FXD,MF,2.15K,1%,0.25W	SMA-4	CORNING
R15	110-332-1	3	RESISTOR,FXD,MF,332,1%,0.25W	SMA-4	CORNING
R16	110-332-1		RESISTOR,FXD,MF,332,1%,0.25W	SMA-4	CORNING
R17	110-332-1		RESISTOR,FXD,MF,332,1%,0.25W	SMA-4	CORNING
R18	110-71.5-1	1	RESISTOR,FXD,MF,71.5,1%,0.25W	SMA-4 OR C4	CORNING
R19	110-4.87K-1	1	RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4	CORNING
R20	110-715-1	1	RESISTOR,FXD,MF,715,1%,0.25W	SMA-4	CORNING
R21	110-1K-1	1	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R22	110-82.5-1	1	RESISTOR,FXD,MF,82.5,1%,0.25W	SMA-4 OR C4	CORNING
R23	110-4.22K-1	2	RESISTOR,FXD,MF,4.22K,1%,0.25W	SMA-4	CORNING
R24	110-3.83K-1		RESISTOR,FXD,MF,3.83K,1%,0.25W	SMA-4	CORNING
R25	110-562-1	3	RESISTOR,FXD,MF,562,1%,0.25W	SMA-4	CORNING
R26	110-562-1		RESISTOR,FXD,MF,562,1%,0.25W	SMA-4	CORNING
R27	110-178-1		RESISTOR,FXD,MF,178,1%,0.25W	SMA4 OR C4	CORNING
R28	110-681-1		RESISTOR,FXD,MF,681,1%,0.25W	SMA-4	CORNING

Table 5-6. A3 Coarse Loop Mixer PCB (6700-D-31703-3; Rev. C) Parts List (Page 2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R29	110-4.22K-1		RESISTOR,FXD,MF,4.22K,1%,0.25W	SMA-4	CORNING
R30	110-3.83K-1		RESISTOR,FXD,MF,3.83K,1%,0.25W	SMA-4	CORNING
R31	110-121-1	1	RESISTOR,FXD,MF,121,1%,0.25W	SMA-4 OR C4	CORNING
R32	110-383-1	1	RESISTOR,FXD,MF,383,1%,0.25W	SMA-4	CORNING
R33	110-562-1		RESISTOR,FXD,MF,562,1%,0.25W	SMA-4	CORNING
R34	110-44.2-1	1	RESISTOR,MF,1/4W,1%	SMA-4	CORNING
U1	60-26	1	MIXER,DOUBLE BALANCE,0.5-500MH	SRA-1	MINI CIRCUIT

Table 5-7. A4 Coarse Loop Oscillator PCB (6700-D-31704-3; Rev. D) Parts List (Page 1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	223-15	1	CAPACITOR,FXD,MICA,15PF,5%,500V	M04CD150JO3	ARCO/SOSHIN
C2	230-37	4	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C3	223-91	2	CAPACITOR,FXD,MICA,91PF,5%,500V	DM10D910J0100WV4CR	ELECTROMOTIVE
C4	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C5	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C6	223-91		CAPACITOR,FXD,MICA,91PF,5%,500V	DM10D910J0100WV4CR	ELECTROMOTIVE
C7	223-10	1	CAPACITOR,FXD,MICA,10PF,5%,500V	CD10CD100JO3M	CORNELL DUBILIER
C8	223-100	5	CAPACITOR,FXD,MICA,100PF,5%,50V	CD10FD101J03	CORNELL DUBILIER
C9	223-100		CAPACITOR,FXD,MICA,100PF,5%,50V	CD10FD101J03	CORNELL DUBILIER
C10	223-100		CAPACITOR,FXD,MICA,100PF,5%,50V	CD10FD101J03	CORNELL DUBILIER
C11	250-42	9	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C12			NOT ASSIGNED		
C13	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C14	223-100		CAPACITOR,FXD,MICA,100PF,5%,50V	CD10FD101J03	CORNELL DUBILIER
C15	223-50	1	CAPACITOR,FXD,MICA,50PF,5%,500V	DM 10E500J	ELMENCO
C16	223-100		CAPACITOR,FXD,MICA,100PF,5%,50V	CD10FD101J03	CORNELL DUBILIER
C17	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C18	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C19	240-38	1	CAPACITOR,VAR,0.8-8PF,500V	27295	CDI
C20	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C21	230-49	2	CAPACITOR,FXD,.022uF,100V	200-100-X7R-223K	CENTRE ENG
C22	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C23	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C24	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C25	230-61	1	CAPACITOR,FXD,560pF,+/-5%	200-100-NPO-561J	CENTRE ENG
C26	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C27	230-58	1	CAPACITOR,FXD,270pF,+/-5%	200-100-NPO-271J	CENTRE ENG
C28	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C29	230-49		CAPACITOR,FXD,.022uF,100V	200-100-X7R-223K	CENTRE ENG
CR1	10-47	2	DIODE,VARACTOR	DVH6730-13	ALPHA
CR2	10-47		DIODE,VARACTOR	DVH6730-13	ALPHA
CR3	10-1N4446	2	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR4	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR5	10-FD300	3	DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR6	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR7	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
L1	310-34	6	INDUCTOR,FXD,0.33UH,20%	1537-04	DELEVAN
L2	310-34		INDUCTOR,FXD,0.33UH,20%	1537-04	DELEVAN
L3	310-34		INDUCTOR,FXD,0.33UH,20%	1537-04	DELEVAN
L4	310-34		INDUCTOR,FXD,0.33UH,20%	1537-04	DELEVAN
L5	310-34		INDUCTOR,FXD,0.33UH,20%	1537-04	DELEVAN
L6			NOT ASSIGNED		
L7	310-34		INDUCTOR,FXD,0.33UH,20%	1537-04	DELEVAN
L8	310-53	2	INDUCTOR,FXD,47.0UH,5%	1537-60	DELEVAN
L9	310-53		INDUCTOR,FXD,47.0UH,5%	1537-60	DELEVAN
L10	310-109	1	INDUCTOR,FXD,470uH,10%	1025-84	DELEVAN
L11	310-110	1	INDUCTOR,FXD,560uH,10%	1025-86	DELEVAN
P1	551-538	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-011	BERG
Q1	20-2N5179	2	TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q2	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q3	20-44	1	TRANSISTOR,NPN,SINGLE	NE41635	NEC
R1	110-2.05K-1	1	RESISTOR,FXD,MF,2.05K,1%,0.25W	SMA-4	CORNING
R2	110-15.4K-1	2	RESISTOR,FXD,MF,15.4K,1%,0.25W	SMA-4	CORNING
R3	110-1.40K-1	2	RESISTOR,FXD,MF,1.40K,1%,0.25W	SMA-4	CORNING
R4	110-1.54K-1	2	RESISTOR,FXD,MF,1.54K,1%,0.25W	SMA-4	CORNING
R5	110-15.4K-1		RESISTOR,FXD,MF,15.4K,1%,0.25W	SMA-4	CORNING
R6	110-1.40K-1		RESISTOR,FXD,MF,1.40K,1%,0.25W	SMA-4	CORNING
R7	110-511-1	1	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4	CORNING
R8	110-365-1	1	RESISTOR,FXD,MF,365,1%,0.25W	SMA-4	CORNING
R9	110-100K-1	2	RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4	CORNING

Table 5-7. A4 Coarse Loop Oscillator PCB (6700-D-31704-3; Rev. D) Parts List (Page 2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R10	110-316-1	1	RESISTOR,FXD,MF,316,1%,0.25W	SMA-4	CORNING
R11	110-3.01K-1	1	RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4	CORNING
R12	110-442-1		RESISTOR,FXD,MF,442,1%,0.25W	SMA-4	CORNING
R13	110-10-1	1	RESISTOR,FXD,MF,10,1%,0.25W	SMA-4 OR C4	CORNING
R14	110-442-1	2	RESISTOR,FXD,MF,442,1%,0.25W	SMA-4	CORNING
R15	110-215-1	1	RESISTOR,FXD,MF,215,1%,0.25W	SMA-4	CORNING
R16	110-3.16K-1	4	RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4	CORNING
R17	110-3.16K-1		RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4	CORNING
R18	110-51.1-1	2	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R19	110-3.16K-1		RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4	CORNING
R20	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R21	110-3.16K-1		RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4	CORNING
R22	110-1K-1	2	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R23	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R24	110-1.96K-1	1	RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4	CORNING
R25	110-1.54K-1		RESISTOR,FXD,MF,1.54K,1%,0.25W	SMA-4	CORNING
R26	110-1.47K-1	2	RESISTOR,FXD,MF,1.47K,1%,0.25W	SMA-4	CORNING
R27	110-1.47K-1		RESISTOR,FXD,MF,1.47K,1%,0.25W	SMA-4	CORNING
R28	110-100K-1		RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4	CORNING
R29	110-6.19K-1	1	RESISTOR,FXD,MF,6.19K,1%,0.25W	SMA-4	CORNING
TP1	702-17	2	TERMINAL,EYELET	20-2137D	VEROSPEED
TP2	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
U1	50-30	1	IC,OP AMP,5532A,DUAL,300K OHM	NE5532N	SIGNETICS
W1	800-13	0	WIRE,BUSS,22AWG	8021	BELDEN
W2	800-13		WIRE,BUSS,22AWG	8021	BELDEN

Table 5-8. A5 Reference Oscillator PCB (6700-D-31705-3; Rev. F) Parts List (Page 1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1			NOT ASSIGNED		
C2			NOT ASSIGNED		
C3	250-41	6	CAPACITOR,FXD,TANT,6.8UF,10%,3V	196D685X9035KE3	SPRAGUE
C4	230-65	2	CAPACITOR,FXD,1500pF,+/-5%	200-100-NPO-152J	CENTRE ENG
C5	230-65		CAPACITOR,FXD,1500pF,+/-5%	200-100-NPO-152J	CENTRE ENG
C6	250-41		CAPACITOR,FXD,TANT,6.8UF,10%,3V	196D685X9035KE3	SPRAGUE
C7	250-41		CAPACITOR,FXD,TANT,6.8UF,10%,3V	196D685X9035KE3	SPRAGUE
C8	230-37	3	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C9	240-37	1	CAPACITOR,VAR,0.6-4.5PF,500V	27275	CDI
C10			NOT ASSIGNED		
C11	223-3	3	CAPACITOR,FXD,MICA,3PF,0.5PF,5V	CD10CD030D03	CORNELL DUBILIER
C12	223-3		CAPACITOR,FXD,MICA,3PF,0.5PF,5V	CD10CD030D03	CORNELL DUBILIER
C13			NOT ASSIGNED		
C14	223-27	1	CAPACITOR,FXD,MICA,27PF,5%,500V	CD10ED270JO3	CORNELL DUBILIER
C15	223-3		CAPACITOR,FXD,MICA,3PF,0.5PF,5V	CD10CD030D03	CORNELL DUBILIER
C16	230-30	2	CAPACITOR,FXD,CER,1000PF,+80/-20	BGP.001,500V,+80-20	RMC
C17	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C18			NOT ASSIGNED		
C19			NOT ASSIGNED		
C20			NOT ASSIGNED		
C21	230-30		CAPACITOR,FXD,CER,1000PF,+80/-20	BGP.001,500V,+80-20	RMC
C22	223-100	2	CAPACITOR,FXD,MICA,100PF,5%,50V	CD10FD101J03	CORNELL DUBILIER
C23	223-10	3	CAPACITOR,FXD,MICA,10PF,5%,500V	CD10CD100JO3M	CORNELL DUBILIER
C24	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C25	223-100		CAPACITOR,FXD,MICA,100PF,5%,50V	CD10FD101J03	CORNELL DUBILIER
C26	230-11	1	CAPACITOR,FXD,CER,0.01UF,+80/-20	TCP-R01	ARCO/SOSHIN
C27	223-91	1	CAPACITOR,FXD,MICA,91PF,5%,500V	DM10D910J0100WV4CR	ELECTROMOTIVE
C28	230-55	4	CAPACITOR,FXD,100pF,+/-5%	150-100-NPO-101J	CENTRE ENG
C29	230-39	4	CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C30	230-55		CAPACITOR,FXD,100pF,+/-5%	150-100-NPO-101J	CENTRE ENG
C31	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C32	230-55		CAPACITOR,FXD,100pF,+/-5%	150-100-NPO-101J	CENTRE ENG
C33	230-52	1	CAPACITOR,FDX,15pF,+/-5%	150-100-NPO-150J	CENTRE ENG
C34	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C35	230-55		CAPACITOR,FXD,100pF,+/-5%	150-100-NPO-101J	CENTRE ENG
C36			NOT ASSIGNED		
C37			NOT ASSIGNED		
C38			NOT ASSIGNED		
C39			NOT ASSIGNED		
C40			NOT ASSIGNED		
C41	250-41		CAPACITOR,FXD,TANT,6.8UF,10%,3V	196D685X9035KE3	SPRAGUE
C42	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C43	250-42	2	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C44	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C45	223-10		CAPACITOR,FXD,MICA,10PF,5%,500V	CD10CD100JO3M	CORNELL DUBILIER
C46	223-10		CAPACITOR,FXD,MICA,10PF,5%,500V	CD10CD100JO3M	CORNELL DUBILIER
C47	250-41		CAPACITOR,FXD,TANT,6.8UF,10%,3V	196D685X9035KE3	SPRAGUE
C48	250-41		CAPACITOR,FXD,TANT,6.8UF,10%,3V	196D685X9035KE3	SPRAGUE
C49	230-51	1	CAPACITOR,FDX,3.3pF,+/-.025	150-100-NPO-339C	CENTRE ENG
CR1	10-1N4446	5	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR2	10-1N752A	1	DIODE,ZENER,1N752A,5.6V,5%	1N752A	MOTOROLA
CR3	10-47	1	DIODE,VARACTOR	DVH6730-13	ALPHA
CR4	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR5	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR6	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR7	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
L1	310-53	1	INDUCTOR,FXD,47.0UH,5%	1537-60	DELEVAN
L2	310-45	2	INDUCTOR,FXD,100.0UH,5%	1315-12J	AIRCO
L3	310-45		INDUCTOR,FXD,100.0UH,5%	1315-12J	AIRCO

Table 5-8. A5 Reference Oscillator PCB (6700-D-31705-3; Rev. F) Parts List (Page 2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
P1	551-538	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-011	BERG
Q1	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q2	20-44	1	TRANSISTOR,NPN,SINGLE	NE41635	NEC
Q3	20-2N5179	4	TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q4	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q5	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q6	20-2N3694	1	TRANSISTOR,NPN,2N3694,SI,GEN P	MPS3694-18	MOTOROLA
Q7	20-2N4249	1	TRANSISTOR,PNP,2N4249,SI,LOW N	MPS4249-18	MOTOROLA
R1	110-10K-1	1	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R2	110-3.16K-1	2	RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4	CORNING
R3	110-1K-1	2	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R4	110-3.16K-1		RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4	CORNING
R5	110-110K-1	2	RESISTOR,FXD,MF,110K,1%,0.25W	SMA-4	CORNING
R6	110-110K-1		RESISTOR,FXD,MF,110K,1%,0.25W	SMA-4	CORNING
R7	110-100-1	2	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R8	110-2.05K-1	2	RESISTOR,FXD,MF,2.05K,1%,0.25W	SMA-4	CORNING
R9	110-3.83K-1	1	RESISTOR,FXD,MF,3.83K,1%,0.25W	SMA-4	CORNING
R10			NOT ASSIGNED		
R11	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R12	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R13	110-13.3K-1	1	RESISTOR,FXD,MF,13.3K,1%,0.25W	SMA-4	CORNING
R14	110-7.5K-1	1	RESISTOR,FXD,MF,7.5K,1%,0.25W	SMA-4	CORNING
R15	110-5.11-1	1	RESISTOR,FXD,MF,5.11,1%,0.25W	SMA-4	CORNING
R16	110-511-1	1	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4	CORNING
R17	110-1.69K-1	1	RESISTOR,FXD,MF,1.69K,1%,0.25W	SMA-4	CORNING
R18	110-1.07K-1	1	RESISTOR,FXD,MF,1.07K,1%,0.25W	SMA-4	CORNING
R19	110-2.05K-1		RESISTOR,FXD,MF,2.05K,1%,0.25W	SMA-4	CORNING
R20	110-15.4K-1	1	RESISTOR,FXD,MF,15.4K,1%,0.25W	SMA-4	CORNING
R21	110-1.54K-1	1	RESISTOR,FXD,MF,1.54K,1%,0.25W	SMA-4	CORNING
R22	109-180-5	1	RESISTOR,FXD,MF,180,5%,0.12W	C3 180OHM 5%	CORNING
R23	109-2K-5	2	RESISTOR,FXD,MF,2K,5%,0.12W	C3 2K 5%	CORNING
R24	109-510-5	2	RESISTOR,FXD,MF,510,5%,0.12W	C3 470 5%	CORNING
R25	109-1K-5	2	RESISTOR,FXD,MF,1K,5%,0.12W	C3 1K 5%	CORNING
R26	109-16K-5	2	RESISTOR,FXD,MF,16K,5%,0.12W	C3 16K 5%	CORNING
R27	109-24-5	1	RESISTOR,FXD,MF,24,5%,0.125W	CMF-50	DALE RESISTOR
R28	109-330-5	1	RESISTOR,FXD,MF,330,5%,0.125W	C3 330 OHM 5%	CORNING
R29	109-100-5	1	RESISTOR,FXD,MF,100,1%,0.12W	C3 100 OHM 5%	CORNING
R30	109-750-5	1	RESISTOR,FXD,MF,750,5%,0.12W	C3 750OHM 5%	CORNING
R31	109-2.2K-5	1	RESISTOR,FXD,MF,2.2K,5%,0.12W	C3 2.2K 5%	CORNING
R32	110-51.1-1	1	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R33	109-2K-5		RESISTOR,FXD,MF,2K,5%,0.12W	C3 2K 5%	CORNING
R34	109-510-5		RESISTOR,FXD,MF,510,5%,0.12W	C3 470 5%	CORNING
R35	109-1K-5		RESISTOR,FXD,MF,1K,5%,0.12W	C3 1K 5%	CORNING
R36	109-16K-5		RESISTOR,FXD,MF,16K,5%,0.12W	C3 16K 5%	CORNING
R37	157-100-A	1	RESISTOR,TRIM,CER,100OHM,10%	68WR100	BECKMAN
R38	110-750-1	2	RESISTOR,FXD,MF,750,1%,0.25W	SMA-4	CORNING
R39	110-750-1		RESISTOR,FXD,MF,750,1%,0.25W	SMA-4	CORNING
U1	54-376	1	IC,OP-AMP,OP27EJ,SINGLE,25uV	OP27EJ	PRECISION MONOLITHIC
Y1	A9855	1	SAW RESONATOR ELEMENT,500MHZ	RS1003P	RF MONOLITHIC

Table 5-9. A6 Coarse Loop Divider PCB (6700-D-31706-3; Rev. F) Parts List (Page 1 of 3)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	230-39	17	CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C2	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C3	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C4	250-105	1	CAPACITOR,FXD,ALUM,10UF,-10/+7	513D106M050JA4	SPRAGUE
C5	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C6	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C7	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C8	250-42A	10	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C9	250-19A	1	CAPACITOR,FXD,TANT,1UF,10%,35V	196D-105X9035HA1	SPRAGUE
C10	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C11	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C12	230-64	2	CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C13	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C14	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C15	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C16	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C17			NOT ASSIGNED		
C18	230-47	1	CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C19	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C20	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C21	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C22	250-107	1	CAPACITOR,FXD,ALUM,47UF,-10/+7	476RAR035A	ILLINOIS CAP
C23	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C24	230-59	2	CAPACITOR,FXD,390pF,+/-5%	200-100-NPO-391J	CENTRE ENG
C25	230-59		CAPACITOR,FXD,390pF,+/-5%	200-100-NPO-391J	CENTRE ENG
C26	230-56	2	CAPACITOR,FXD,120pF,+/-5%	150-100-NPO-121J	CENTRE ENG
C27	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C28	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C29	230-56		CAPACITOR,FXD,120pF,+/-5%	150-100-NPO-121J	CENTRE ENG
C30			NOT ASSIGNED		
C31			NOT ASSIGNED		
C32			NOT ASSIGNED		
C33			NOT ASSIGNED		
C34			NOT ASSIGNED		
C35			NOT ASSIGNED		
C36	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C37			NOT ASSIGNED		
C38	230-76	12	CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C39	230-76		CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C40	230-76		CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C41	230-76		CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C42	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C43	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C44	230-76		CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C45	230-76		CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C46	230-76		CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C47	230-76		CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C48	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C49	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C50	230-76		CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C51	230-76		CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C52	230-76		CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C53	230-76		CAPACITOR,FXD,CER,1200PF,1%NPO	200-100-NPO-122F	CENTRE ENG
C54	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C55	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C56	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C57	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
CR1	10-1N4446	1	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR2	10-4	5	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR3	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA

Table 5-9. A6 Coarse Loop Divider PCB (6700-D-31706-3; Rev. F) Parts List (Page 2 of 3)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
CR4	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR5	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
L1	310-53	3	INDUCTOR,FXD,47.0UH,5%	1537-60	DELEVAN
L2	310-43	2	INDUCTOR,FXD,10.0UH,10%	1537-36	DELEVAN
L3	310-43		INDUCTOR,FXD,10.0UH,10%	1537-36	DELEVAN
L4			NOT ASSIGNED		
L5	310-53		INDUCTOR,FXD,47.0UH,5%	1537-60	DELEVAN
L6	310-53		INDUCTOR,FXD,47.0UH,5%	1537-60	DELEVAN
P1	551-538	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-011	BERG
P2	551-539	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-004	BERG
Q1	20-2N5179	1	TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q2	20-2N3904	2	TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q3	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
R1	110-6.19-1	1	RESISTOR,FXD,MF,6.19,1%,0.25	RN55D 6.19 OHM 1%	VERMONT PRECISION
R2	110-51.1-1	2	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R3	110-3.32K-1	1	RESISTOR,FXD,MF,3.32K,1%,0.25W	SMA-4	CORNING
R4	110-1.21K-1	1	RESISTOR,FXD,MF,1.21K,1%,0.25W	SMA-4	CORNING
R5	110-10-1	1	RESISTOR,FXD,MF,10,1%,0.25W	SMA-4 OR C4	CORNING
R6	110-82.5-1	1	RESISTOR,FXD,MF,82.5,1%,0.25W	SMA-4 OR C4	CORNING
R7	110-42.2-1	1	RESISTOR,FXD,MF,42.2,1%,0.25W	SMA-4	CORNING
R8	110-1K-1	6	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R9	110-2.37K-1	1	RESISTOR,FXD,MF,2.37K,1%,0.25W	SMA-4	CORNING
R10	110-511-1	1	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4	CORNING
R11	110-487-1	2	RESISTOR,FXD,MF,487,1%,0.25W	SMA-4	CORNING
R12	110-487-1		RESISTOR,FXD,MF,487,1%,0.25W	SMA-4	CORNING
R13	110-4.42K-1	2	RESISTOR,FXD,MF,4.42K,1%,0.25W	SMA-4	CORNING
R14	110-4.42K-1		RESISTOR,FXD,MF,4.42K,1%,0.25W	SMA-4	CORNING
R15	110-178-1	1	RESISTOR,FXD,MF,178,1%,0.25W	SMA4 OR C4	CORNING
R16	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R17	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R18	110-20.5K-1	1	RESISTOR,FXD,MF,20.5K,1%,0.25W	SMA-4	CORNING
R19	110-24.9K-1	1	RESISTOR,FXD,MF,24.9K,1%,0.25W	SMA-4	CORNING
R20	110-3.01K-1	2	RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4	CORNING
R21	110-100-1	8	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R22	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R23	110-2.94K-1	1	RESISTOR,FXD,MF,2.94K,1%,0.25W	SMA-4	CORNING
R24-R42			NOT ASSIGNED		
R43	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R44	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R45	113-665-0.5	4	RESISTOR,FXD,MF,665,0.5%,0.125W	RN55C	VERMONT PRECISION
R46	113-665-0.5		RESISTOR,FXD,MF,665,0.5%,0.125W	RN55C	VERMONT PRECISION
R47	113-332-0.5	4	RESISTOR,FXD,MF,332,0.5%,0.125W	RN55C	VERMONT PRECISION
R48	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R49	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R50	110-205-1	2	RESISTOR,FXD,MF,205,1%,0.25W	SMA-4	CORNING
R51	110-3.83K-1	2	RESISTOR,FXD,MF,3.83K,1%,0.25W	SMA-4	CORNING
R52	113-332-0.5		RESISTOR,FXD,MF,332,0.5%,0.125W	RN55C 332 OHM .5%	VERMONT PRECISION
R53	113-332-0.5		RESISTOR,FXD,MF,332,0.5%,0.125W	RN55C 332 OHM .5%	VERMONT PRECISION
R54	113-165-0.5	1	RESISTOR,FXD,MF,165,0.5%,0.125W	RN55C 165 OHM .5%	VERMONT PRECISION
R55	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R56	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R57	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R58	110-3.01K-1		RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4	CORNING
R59	113-665-0.5		RESISTOR,FXD,MF,665,0.5%,0.125W	RN55C 665 OHM .5%	VERMONT PRECISION
R60	113-665-0.5		RESISTOR,FXD,MF,665,0.5%,0.125W	RN55C 665 OHM .5%	VERMONT PRECISION
R61	113-332-0.5		RESISTOR,FXD,MF,332,0.5%,0.125W	RN55C 332 OHM .5%	VERMONT PRECISION
R62	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R63	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R64	110-205-1		RESISTOR,FXD,MF,205,1%,0.25W	SMA-4	CORNING
R65	110-3.83K-1		RESISTOR,FXD,MF,3.83K,1%,0.25W	SMA-4	CORNING

Table 5-9. A6 Coarse Loop Divider PCB (6700-D-31706-3; Rev. F) Parts List (Page 3 of 3)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R66	110-68.1-1	2	RESISTOR,FXD,MF,68.1,1%,0.25W	SMA-4 OR C4	CORNING
R67	110-68.1-1		RESISTOR,FXD,MF,68.1,1%,0.25W	SMA-4 OR C4	CORNING
R68	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
TP1	702-17	5	TERMINAL,EYELET	20-2137D	VEROSPEED
TP2	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP3	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP4	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP5	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
U1	54-512	1	IC,CMOS,74HC14,HEX	SN74HC14N	TEXAS INSTRUMENTS
U2	54-518	2	IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INSTRUMENTS
U3	54-558	2	IC,TTL,74S169,4 BIT UP/DOWN	SN74169N	TEXAS INSTRUMENTS
U4	54-557	1	IC,TTL,74S20,DUAL,4 INPUT NAND	SN74S20N	TEXAS INSTRUMENTS
U5	54-353	1	IC,TTL,74S74,DUAL,D-TYPE POSITIVE	SN74S74N	TEXAS INSTRUMENTS
U6	54-518		IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INSTRUMENTS
U7	54-74167	1	IC,TTL,74167,DECADE RATE MULTIPLIER	DM74167N	NSC
U8	54-558		IC,TTL,74S169,4 BIT UP/DOWN	SN74169N	TEXAS INSTRUMENTS
U9	54-349	1	IC,TTL,74LS283,SINGLE,4 BIT	SN74LS283N	TEXAS INSTRUMENTS
U10	54-198	1	IC,ECL,MC12009,DUAL MOD PRESCALER	MC12009P	MOTOROLA
U16	54-74LS196	1	IC,TTL,74LS196,DECADE COUNTER	74LS196PC	FSC
U17	54-74LS112	1	IC,TTL,74LS112,DUAL,JK FLIP FLOP	74LS112PC	FSC
U18	54-74LS00	1	IC,TTL,74LS00,QUAD,2 INPUT NAND	SN74LS00P	MOTOROLA
U19	54-503	1	IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
VR1	54-MC7805CP	1	IC,VOLTAGE REGULATOR,7805,5V	340T-5	NSC

Table 5-10. A7 Reference Divider PCB (6700-D-31707-3; Rev. F) Parts List (Page 1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	230-67	2	CAPACITOR,FXD,CER,33pf,5%,100V	150-100-NPO-330J	CENTRE ENG
C2	230-39	1	CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C3	230-67		CAPACITOR,FXD,CER,33pf,5%,100V	150-100-NPO-330J	CENTRE ENG
C4	230-37	11	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C5			NOT ASSIGNED		
C6			NOT ASSIGNED		
C7			NOT ASSIGNED		
C8			NOT ASSIGNED		
C9	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C10	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C11	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C12	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C13	230-49	2	CAPACITOR,FXD,.022uF,100V	200-100-X7R-223K	CENTRE ENG
C14	230-64	2	CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C15	230-49		CAPACITOR,FXD,.022uF,100V	200-100-X7R-223K	CENTRE ENG
C16	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10	RPE122104M100V	MURATA/ERIE
C17	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C18	230-60	1	CAPACITOR,FXD,470pF,+/-5%	200-100-NPO-471J	CENTRE ENG
C19	230-58	2	CAPACITOR,FXD,270pF,+/-5%	200-100-NPO-271J	CENTRE ENG
C20	230-58		CAPACITOR,FXD,270pF,+/-5%	200-100-NPO-271J	CENTRE ENG
C21	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C22	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C23	250-42	3	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C24	250-41	1	CAPACITOR,FXD,TANT,6.8UF,10%,3V	196D685X9035KE3	SPRAGUE
C25	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C26	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C27	230-47	1	CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C28	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C30	230-52	1	CAPACITOR,FDX,15pF,+/-5%	150-100-NPO-150J	CENTRE ENG
C31	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C32	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
CR1			NOT ASSIGNED		
CR2			NOT ASSIGNED		
CR3			NOT ASSIGNED		
CR4	10-1N4446	3	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR5	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR6	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR7	10-4	2	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR8	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
P1	551-538	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-011	BERG
Q1	20-2N5179	1	TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q2			NOT ASSIGNED		
Q3	20-2N3906	1	TRANSISTOR,PNP,2N3906,SI,GEN P	2N3906	MOTOROLA
Q4	20-2N2222A	2	TRANSISTOR,NPN,2N2222A,SI,MED-	2N2222A	MOTOROLA
Q5	20-2N2222A		TRANSISTOR,NPN,2N2222A,SI,MED-	2N2222A	MOTOROLA
Q6	20-2N3694	1	TRANSISTOR,NPN,2N3694,SI,GEN P	MPS3694-18	MOTOROLA
Q7	20-2N2907A	1	TRANSISTOR,PNP,2N2907A,SI,MED-	2N2907A	MOTOROLA
Q8	20-2N3904	1	TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
R1	109-43-5	2	RESISTOR,FXD,MF,43,5%,0.12W	CMF-50	DALE RESISTOR
R2	109-43-5		RESISTOR,FXD,MF,43,5%,0.12W	CMF-50	DALE RESISTOR
R3	109-75-5	1	RESISTOR,FXD,MF,75,1%,0.12W	CMF-50	DALE RESISTOR
R4	110-2K-1	1	RESISTOR,FXD,MF,2K,1%,0.25W	SMA-4	CORNING
R5	110-787-1	1	RESISTOR,FXD,MF,787,1%,0.25W	SMA-4	CORNING
R6	110-147-1	1	RESISTOR,FXD,MF,147,1%,0.25W	SMA-4 OR C4	CORNING
R7	109-120-5	1	RESISTOR,FXD,MF,120,5%,0.12W	C3 120 OHM 5%	CORNING
R8			NOT ASSIGNED		
R9	110-316-1	1	RESISTOR,FXD,MF,316,1%,0.25W	SMA-4	CORNING
R10	110-100-1	5	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R11	109-51-5	1	RESISTOR,FXD,MF,51,5%,0.12W	CMF-50	DALE RESISTOR
R12	110-51.1-1	5	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING

Table 5-10. A7 Reference Divider PCB (6700-D-31707-3; Rev. F) Parts List (Page 2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R13	110-2.74K-1	1	RESISTOR,FXD,MF,2.74K,1%,0.25W	SMA-4	CORNING
R14	110-511-1	2	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4	CORNING
R15	109-5.1K-5	2	RESISTOR,FXD,MF,5.1K,5%,0.12W	C3 5.1K 5%	CORNING
R16	109-5.1K-5		RESISTOR,FXD,MF,5.1K,5%,0.12W	C3 5.1K 5%	CORNING
R17	109-300-5	1	RESISTOR,FXD,MF,300,5%,0.12W	C3 300 OHM 5%	CORNING
R18	110-10K-1	3	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R19	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R20	110-1K-1	4	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R21	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R22	110-681-1	1	RESISTOR,FXD,MF,681,1%,0.25W	SMA-4	CORNING
R23	110-5.11K-1	4	RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4	CORNING
R24	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R25	110-5.11K-1		RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4	CORNING
R26	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R27	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R28	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R29	110-511-1		RESISTOR,FXD,MF,511,1%,0.25W	SMA-4	CORNING
R30	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R31	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R32	110-16.2-1	1	RESISTOR,FXD,MF,16.2,1%,0.25W	SMA-4 OR C4	CORNING
R33	110-5.11K-1		RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4	CORNING
R34	110-5.11K-1		RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4	CORNING
R35	110-17.8K-1	2	RESISTOR,FXD,MF,17.8K,1%,0.25W	SMA-4	CORNING
R36	110-17.8K-1		RESISTOR,FXD,MF,17.8K,1%,0.25W	SMA-4	CORNING
R37	110-4.02K-1	2	RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4	CORNING
R38	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R39	110-4.02K-1		RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4	CORNING
R40	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R41	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R42	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R43	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
TP1	702-17	3	TERMINAL,EYELET	20-2137D	VEROSPEED
TP2	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP3	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
U1	54-547	1	IC,ECL,SP8680B,SINGLE,10/11	SP8680B	PLESSY
U2	54-328	1	IC,TTL.74S02,QUAD,2 INPUT NOR	74S02	FSC
U3	54-329	3	IC,TTL,74S112,DUAL,JK EDGE-TRIG	SN74S112N	TEXAS INSTRUMENTS
U4	54-329		IC,TTL,74S112,DUAL,JK EDGE-TRIG	SN74S112N	TEXAS INSTRUMENTS
U5	54-74132	1	IC,TTL,74132,QUAD,NAND SCHMITT	DM74132N	NSC
U6	54-329		IC,TTL,74S112,DUAL,JK EDGE-TRIG	SN74S112N	TEXAS INSTRUMENTS
U7	54-376	1	IC,OP-AMP,OP27EJ,SINGLE,25uV	OP27EJ	PRECISION MONOLITHIC
VR1	54-MC7805CP	1	IC,VOLTAGE REGULATOR,7805,5V	340T-5	NSC

Table 5-11. A8 Serial I/O PCB (6700-D-31708-3; Rev. D) Parts List (Page 1 of 1)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1			NOT ASSIGNED		
C2			NOT ASSIGNED		
C3			NOT ASSIGNED		
C4			NOT ASSIGNED		
C5			NOT ASSIGNED		
C6			NOT ASSIGNED		
C7			NOT ASSIGNED		
C8			NOT ASSIGNED		
C9	230-61	1	CAPACITOR,FXD,560pF,+/-5%	200-100-NPO-561J	CENTRE ENG
C10	230-37	13	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C11	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C12	230-71	1	CAPACITOR,FIXED,CER,68pf,5%	150-100-NPO-680J	CENTR ENG
C13	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C14	250-105	1	CAPACITOR,FXD,ALUM,10UF,-10/+7	513D106M050JA4	SPRAGUE
C15	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C16	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
L1	310-53	1	INDUCTOR,FXD,47.0UH,5%	1537-60	DELEVAN
R1	110-1K-1	2	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R2	110-499-1	1	RESISTOR,FXD,MF,499,1%,0.25W	SMA-4	CORNING
R3	110-4.75K-1	1	RESISTOR,FXD,MF,4.75K,1%,0.25W	SMA-4	CORNING
R4	110-24.9-1	1	RESISTOR,MF,1/4W,1%	SMA-4	CORNING
R5	110-200-1	3	RESISTOR,FXD,MF,200,1%,0.25W	SMA-4	CORNING
R6	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R7	110-511-1	2	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4	CORNING
R8	110-200-1		RESISTOR,FXD,MF,200,1%,0.25W	SMA-4	CORNING
R9	110-200-1		RESISTOR,FXD,MF,200,1%,0.25W	SMA-4	CORNING
R10	110-51.1-1	2	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R11	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R4			NOT ASSIGNED		
R5			NOT ASSIGNED		
R6			NOT ASSIGNED		
R7			NOT ASSIGNED		
R8			NOT ASSIGNED		
R9			NOT ASSIGNED		
R10			NOT ASSIGNED		
R11			NOT ASSIGNED		
R12	110-511-1		RESISTOR,FXD,MF,511,1%,0.25W	SMA-4	CORNING
RN1	123-34	1	RESISTOR,NETWORK,MF,5X470,2%	MSP10A03-471G	DALE
RN2	123-15	2	RESISTOR,NETWORK,MF,7X4.7K,2%	4308R-101-472	BOURNS
RN3	123-15		RESISTOR,NETWORK,MF,7X4.7K,2%	4308R-101-472	BOURNS
T1	320-88	4	TRANSFORMER,RF,FIX,200-500KHZ		WEST COAST MAGNETICS
T2	320-88		TRANSFORMER,RF,FIX,200-500KHZ		WEST COAST MAGNETICS
T3	320-88		TRANSFORMER,RF,FIX,200-500KHZ		WEST COAST MAGNETICS
T4	320-88		TRANSFORMER,RF,FIX,200-500KHZ		WEST COAST MAGNETICS
U1	54-528	1	IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INSTRUMENTS
U2	54-512	1	IC,CMOS,74HC14,HEX	SN74HC14N	TEXAS INSTRUMENTS
U3	54-514	1	IC,CMOS,74HC125,QUAD	SN74HC125N	TEXAS INSTRUMENTS
U4	54-513	1	IC,CMOS,74HC74,DUAL D-TYPE	SN74HC74N	TEXAS INSTRUMENTS
U5	54-523	1	IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U6	54-458	2	IC,ANALOG SWITCH,DG 508,8	DG508CJ	SILICONIX
U7	54-365	1	IC,CMOS,7555,TIMER	ICM7555IPA	INTERSIL
U8	54-535	1	IC,CMOS,74HC393,DUAL,4BIT	SN74HC393N	TEXAS INSTRUMENTS
U9	54-532	1	IC,CMOS,74HC299, 8 BIT	CD74HC299F	RCA
U10	54-336	1	IC,CMOS,509,4 CHANNEL DIFFER	DG509 ACJ	SILICONIX
U11	54-519	1	IC,CMOS,74HC165,8 BIT SERIAL	SN74HC165N	TEXAS INSTRUMENTS
U12	54-458		IC,ANALOG SWITCH,DG 508,8	DG508CJ	SILICONIX

Table 5-12. A9 Fine Loop Oscillator PCB (6700-D-31709-3; Rev. E) Parts List (Page 1 of 3)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1			NOT ASSIGNED		
C2			NOT ASSIGNED		
C3			NOT ASSIGNED		
C4			NOT ASSIGNED		
C5			NOT ASSIGNED		
C6			NOT ASSIGNED		
C7	230-66	1	CAPACITOR,FXD,CER,0.22UF,10%	CW30C224K	CENTRALAB
C8	250-42A	11	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C9	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C10	230-37	7	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C11	250-143	7	CAPACITOR,FXD,CER,180pF,5%,100V	150-100-NPO-181J	CENTRE ENG
C12	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C13	250-143		CAPACITOR,FXD,CER,180pF,5%,100V	150-100-NPO-181J	CENTRE ENG
C14	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C15	250-143		CAPACITOR,FXD,CER,180pF,5%,100V	150-100-NPO-181J	CENTRE ENG
C16			NOT ASSIGNED		
C17	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C18	250-143		CAPACITOR,FXD,CER,180pF,5%,100V	150-100-NPO-181J	CENTRE ENG
C19	230-60	2	CAPACITOR,FXD,470pF,+/-5%	200-100-NPO-471J	CENTRE ENG
C20	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C21	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C22	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C23	230-70	2	CAPACITOR,FIXED,CER,27pf,5%	150-100-NPO-270J	CENTRE ENG
C24	230-60		CAPACITOR,FXD,470pF,+/-5%	200-100-NPO-471J	CENTRE ENG
C25	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C26	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C27	230-70		CAPACITOR,FIXED,CER,27pf,5%	150-100-NPO-270J	CENTRE ENG
C28	250-143		CAPACITOR,FXD,CER,180pF,5%,100V	150-100-NPO-181J	CENTRE ENG
C29	250-143		CAPACITOR,FXD,CER,180pF,5%,100V	150-100-NPO-181J	CENTRE ENG
C30	250-143		CAPACITOR,FXD,CER,180pF,5%,100V	150-100-NPO-181J	CENTRE ENG
C31	230-77	1	CAPACITOR,FXD,CER,3300pF,5%	300-100-NPO-332J	CENTRE ENGIN
C32	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
CR1	10-FD300	8	DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR2			NOT ASSIGNED		
CR3	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR4	10-1N823	1	DIODE,ZENER,1N823,6.2V,5%	1N823	MOTOROLA
CR5			NOT ASSIGNED		
CR6			NOT ASSIGNED		
CR7			NOT ASSIGNED		
CR8			NOT ASSIGNED		
CR9			NOT ASSIGNED		
CR10			NOT ASSIGNED		
CR11	10-72	2	DIODE,VARACTOR,ZC804B	ZC804B	MSI ELECTORN
CR12	10-72		DIODE,VARACTOR,ZC804B	ZC804B	MSI ELECTORN
CR13			NOT ASSIGNED		
CR14	10-4	2	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR15	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
J1			NOT ASSIGNED		
J2			NOT ASSIGNED		
J3	551-547	1	CONNECTOR HEADER,1 ROW-0.10"	68001-103	BERG
L1	310-36	2	INDUCTOR,FXD,0.33UH,20%	1025-8	DELEVAN
L2	310-36		INDUCTOR,FXD,0.33UH,20%	1025-8	DELEVAN
L3	310-72	2	INDUCTOR,FXD,0.047UH,+-10%	551-5172-05-02-00	CAMBION
L4	310-72		INDUCTOR,FXD,0.047UH,+-10%	551-5172-05-02-00	CAMBION
P1	551-538	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-011	BERG
Q1	20-56	1	TRANSISTOR,JFET,J310	J310	SILICONIX
Q2	20-2N5179	5	TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q3	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q4	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q5	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA

Table 5-12. A9 Fine Loop Oscillator PCB (6700-D-31709-3; Rev. E) Parts List (Page 2 of 3)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
Q6	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
R1	109-33-5	6	RESISTOR,FXD,MF,33,5%,0.12W	C3 33OHM 5%	CORNING
R2	109-33-5		RESISTOR,FXD,MF,33,5%,0.12W	C3 33OHM 5%	CORNING
R3	109-33-5		RESISTOR,FXD,MF,33,5%,0.12W	C3 33OHM 5%	CORNING
R4	109-33-5		RESISTOR,FXD,MF,33,5%,0.12W	C3 33OHM 5%	CORNING
R5	109-33-5		RESISTOR,FXD,MF,33,5%,0.12W	C3 33OHM 5%	CORNING
R6	109-33-5		RESISTOR,FXD,MF,33,5%,0.12W	C3 33OHM 5%	CORNING
R7	110-3.01K-1	6	RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4-3.01K	CORNING
R8	110-3.01K-1		RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4-3.01K	CORNING
R9	110-3.01K-1		RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4-3.01K	CORNING
R10	110-3.01K-1		RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4-3.01K	CORNING
R11	110-13.7K-1	2	RESISTOR,FXD,MF,13.7K,1%,0.25W	SMA-4-13.7K	CORNING
R12	110-1.78K-1	1	RESISTOR,FXD,MF,1.78K,1%,0.25W	SMA-4-1.78K	CORNING
R13	109-1K-5	6	RESISTOR,FXD,MF,1K,5%,0.12W	C3 1K 5%	CORNING
R14	109-1K-5		RESISTOR,FXD,MF,1K,5%,0.12W	C3 1K 5%	CORNING
R15	110-11.8K-1	2	RESISTOR,FXD,MF,11.8K,1%,0.25W	SMA-4-11.8K	CORNING
R16	110-1.96K-1	1	RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R17	110-1.47K-1	1	RESISTOR,FXD,MF,1.47K,1%,0.25W	SMA-4-1.47K	CORNING
R18	110-2.37K-1	1	RESISTOR,FXD,MF,2.37K,1%,0.25W	SMA-4-2.37K	CORNING
R19	110-10K-1	1	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R20	110-5.11K-1	2	RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-5.11K	CORNING
R21	110-1.27K-1	1	RESISTOR,FXD,MF,1.27K,1%,0.25W	SMA-4-1.27K	CORNING
R22	110-4.02K-1	2	RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4-4.02K	CORNING
R23	110-90.9K-1	1	RESISTOR,FXD,MF,90.9K,1%,0.25W	SMA-4-90.9K	CORNING
R24	110-6.04K-1	1	RESISTOR,FXD,MF,6.04K,1%,0.25W	SMA-4-6.04K	CORNING
R25	110-30.1K-1	1	RESISTOR,FXD,MF,30.1K,1%,0.25W	SMA-4-30.1K	CORNING
R26	110-13.7K-1		RESISTOR,FXD,MF,13.7K,1%,0.25W	SMA-4-13.7K	CORNING
R27	110-11.8K-1		RESISTOR,FXD,MF,11.8K,1%,0.25W	SMA-4-11.8K	CORNING
R28	110-41.2K-1	1	RESISTOR,FXD,MF,41.2K,1%,0.25W	SMA-4-41.2K	CORNING
R29	110-10.2K-1	1	RESISTOR,FXD,MF,10.2K,1%,0.25W	SMA-4-10.2K	CORNING
R30	110-3.01K-1		RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4-3.01K	CORNING
R31	110-10.5K-1	1	RESISTOR,FXD,MF,10.5K,1%,0.25W	SMA-4-10.5K	CORNING
R32	110-3.01K-1		RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4-3.01K	CORNING
R33	109-51-5	1	RESISTOR,FXD,MF,51,5%,0.12W	CMF-50	DALE RESISTOR
R34	110-316-1	1	RESISTOR,FXD,MF,316,1%,0.25W	SMA-4-316	CORNING
R35	109-750-5	3	RESISTOR,FXD,MF,750,5%,0.12W	C3 750OHM 5%	CORNING
R36	109-16-5	1	RESISTOR,FXD,MF,16,5%,0.12W	C3 16OHM 5%	CORNING
R37	109-5.1K-5	3	RESISTOR,FXD,MF,5.1K,5%,0.12W	C3 5.1K 5%	CORNING
R38	109-3K-5	1	RESISTOR,FXD,MF,3K,5%,0.12W	C3 3K 5%	CORNING
R39	109-330-5	2	RESISTOR,FXD,MF,330,5%,0.125W	C3 330 OHM 5%	CORNING
R40	109-330-5		RESISTOR,FXD,MF,330,5%,0.125W	C3 330 OHM 5%	CORNING
R41	109-110-5	2	RESISTOR,FXD,MF,110,5%,0.12W	C3 110OHM 5%	CORNING
R42	109-91-5	2	RESISTOR,FXD,MF,91,5%,0.12W	C3 91OHM 5%	CORNING
R43	109-5.1K-5		RESISTOR,FXD,MF,5.1K,5%,0.12W	C3 5.1K 5%	CORNING
R44	109-750-5		RESISTOR,FXD,MF,750,5%,0.12W	C3 750OHM 5%	CORNING
R45	109-36-5	1	RESISTOR,FXD,MF,36,5%,0.12W	C3 36OHM 5%	CORNING
R46	109-150-5	2	RESISTOR,FXD,MF,150,5%,0.12W	C3 150OHM 5%	CORNING
R47	109-1K-5		RESISTOR,FXD,MF,1K,5%,0.12W	C3 1K 5%	CORNING
R48	109-43-5	4	RESISTOR,FXD,MF,43,5%,0.12W	CMF-50	DALE RESISTOR
R49	109-1K-5		RESISTOR,FXD,MF,1K,5%,0.12W	C3 1K 5%	CORNING
R50	109-43-5		RESISTOR,FXD,MF,43,5%,0.12W	CMF-50	DALE RESISTOR
R51	109-110-5		RESISTOR,FXD,MF,110,5%,0.12W	C3 110OHM 5%	CORNING
R52	109-91-5		RESISTOR,FXD,MF,91,5%,0.12W	C3 91OHM 5%	CORNING
R53	109-5.1K-5		RESISTOR,FXD,MF,5.1K,5%,0.12W	C3 5.1K 5%	CORNING
R54	109-750-5		RESISTOR,FXD,MF,750,5%,0.12W	C3 750OHM 5%	CORNING
R55	109-150-5		RESISTOR,FXD,MF,150,5%,0.12W	C3 150OHM 5%	CORNING
R56	109-1K-5		RESISTOR,FXD,MF,1K,5%,0.12W	C3 1K 5%	CORNING
R57	109-43-5		RESISTOR,FXD,MF,43,5%,0.12W	CMF-50	DALE RESISTOR
R58	109-1K-5		RESISTOR,FXD,MF,1K,5%,0.12W	C3 1K 5%	CORNING
R59	109-43-5		RESISTOR,FXD,MF,43,5%,0.12W	CMF-50	DALE RESISTOR

Table 5-12. A9 Fine Loop Oscillataor PCB (6700-D-31709-3; Rev. E) Parts List (Page 3 of 3)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R60	109-1.8K-5	1	RESISTOR,FXD,MF,1.8K,5%,0.12W	C3 1.8K 5%	CORNING
R61	110-71.5K-1	1	RESISTOR,FXD,MF,71.5K,1%,0.25W	SMA-4-71.5K	CORNING
R62	110-147K-1	1	RESISTOR,FXD,MF,147K,1%,0.25W	SMA-4-147K	CORNING
R63	110-511-1	1	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R64	110-5.11K-1		RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-5.11K	CORNING
R65	110-19.6K-1	1	RESISTOR,FXD,MF,19.6K,1%,0.25W	SMA-4-19.6K	CORNING
R66	110-4.02K-1		RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4-4.02K	CORNING
R67	110-33.2K-1	1	RESISTOR,FXD,MF,33.2K,1%,0.25W	SMA-4-33.2K	CORNING
TP1	702-17	7	TERMINAL,EYELET	20-2137D	VEROSPEED
TP2	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP3			NOT ASSIGNED		
TP4	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP5	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP6	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP7			NOT ASSIGNED		
TP8	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP9	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
U1	50-30	2	IC,OP AMP,5532A,DUAL,300K OHM	NE5532N	SIGNETICS
U2	50-30		IC,OP AMP,5532A,DUAL,300K OHM	NE5532N	SIGNETICS
U3	54-376	1	IC,OP-AMP,OP27EJ,SINGLE,25uV	OP27EJ	PRECISION MONOLITHIC
U4	50-9	1	IC,OP AMP,LF356,SINGLE	LF356N	NSC

Table 5-13. A10 Reference Buffer PCB (6700-D-31710-3; Rev. E) Parts List (Page 1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	250-19	1	CAPACITOR,FXD,TANT,1UF,10%,35V	196D105X9035HE3	SPRAGUE
C2	230-66	1	CAPACITOR,FXD,CER,0.22uf,10%	CW30C224K	CENTRALAB
C3	250-42	2	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C4	230-47	10	CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C5	230-39	8	CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C6	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C7	230-47		CAPACITOR,FXD,?,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C8	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C9	230-47		CAPACITOR,FXD,?,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C10	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C11	230-47		CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C12	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C13	230-47		CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C14	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C15	230-47		CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C16	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C17	230-47		CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C18	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C19	230-47		CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C20	230-47		CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C21	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C22	230-47		CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
CR1	10-4	2	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR2	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR3	10-FD300	2	DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR4	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
L1	310-43	1	INDUCTOR,FXD,10.0UH,10%	1537-36	DELEVAN
L2	310-61	3	INDUCTOR,FXD,10UH,10%	1025-44	DELEVAN
L3	310-61		INDUCTOR,FXD,10UH,10%	1025-44	DELEVAN
L4	310-61		INDUCTOR,FXD,10UH,10%	1025-44	DELEVAN
P1	551-539	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-004	BERG
Q1	20-2N3563	5	TRANSISTOR,NPN,2N3563,SI,RF-IF	PN3563	FSC
Q2	20-2N3563		TRANSISTOR,NPN,2N3563,SI,RF-IF	PN3563	FSC
Q3	20-2N3563		TRANSISTOR,NPN,2N3563,SI,RF-IF	PN3563	FSC
Q4	20-2N3563		TRANSISTOR,NPN,2N3563,SI,RF-IF	PN3563	FSC
Q5	20-2N3563		TRANSISTOR,NPN,2N3563,SI,RF-IF	PN3563	FSC
Q6	20-2N5179	3	TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q7	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q8	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q9	20-2N3906	2	TRANSISTOR,PNP,2N3906,SI,GEN P	2N3906	MOTOROLA
Q10	20-2N3906		TRANSISTOR,PNP,2N3906,SI,GEN P	2N3906	MOTOROLA
Q11	20-2N3904	2	TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q12	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
R1	110-5.11-1	1	RESISTOR,FXD,MF,5.11,1%,0.25W	RN55D 5.11 OHM 1%	VERMONT PRECISION
R2	109-51-5	9	RESISTOR,FXD,MF,51,5%,0.12W	CMF-50	DALE RESISTOR
R3	109-1.8K-5	1	RESISTOR,FXD,MF,1.8K,5%,0.12W	C3 1.8K 5%	CORNING
R4	109-2.2K-5	1	RESISTOR,FXD,MF,2.2K,5%,0.12W	C3 2.2K 5%	CORNING
R5	109-36-5	1	RESISTOR,FXD,MF,36,5%,0.12W	C3 36OHM 5%	CORNING
R6	109-330-5	8	RESISTOR,FXD,MF,330,5%,0.125W	C3 330 OHM 5%	CORNING
R7	109-51-5		RESISTOR,FXD,MF,51,5%,0.12W	CMF-50	DALE RESISTOR
R8	109-51-5		RESISTOR,FXD,MF,51,5%,0.12W	CMF-50	DALE RESISTOR
R9	109-51-5		RESISTOR,FXD,MF,51,5%,0.12W	CMF-50	DALE RESISTOR
R10	109-51-5		RESISTOR,FXD,MF,51,5%,0.12W	CMF-50	DALE RESISTOR
R11	109-20-5	3	RESISTOR,FXD,MF,20,5%,0.12W	C3 20OHM 5%	CORNING
R12	109-82-5		RESISTOR,FXD,MF,82,5%,0.12W	C3,82OHM,5%	CORNING
R13	109-330-5		RESISTOR,FXD,MF,330,5%,0.125W	C3 330 OHM 5%	CORNING
R14	109-750-5	3	RESISTOR,FXD,MF,750,5%,0.12W	C3 750OHM 5%	CORNING
R15	109-330-5		RESISTOR,FXD,MF,330,5%,0.125W	C3 330 OHM 5%	CORNING
R16	109-30-5	5	RESISTOR,FXD,MF,30,5%,0.12W	C3 30OHM 5%	CORNING
R17	109-51-5		RESISTOR,FXD,MF,51,5%,0.12W	CMF-50	DALE RESISTOR

Table 5-13. A10 Reference Buffer PCB (6700-D-31710-3; Rev. E) Parts List (Page 2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R18	109-16-5	3	RESISTOR,FXD,MF,16,5%,0.12W	C3 16 OHM 5%	CORNING
R19	109-20-5		RESISTOR,FXD,MF,20,5%,0.12W	C3 20OHM 5%	CORNING
R20	109-82-5		RESISTOR,FXD,MF,82,5%,0.12W	CMF-50	DALE RESISTOR
R21	109-330-5		RESISTOR,FXD,MF,330,5%,0.125W	C3 330 OHM 5%	CORNING
R22	109-750-5		RESISTOR,FXD,MF,750,5%,0.12W	C3 750OHM 5%	CORNING
R23	109-330-5		RESISTOR,FXD,MF,330,5%,0.125W	C3 330 OHM 5%	CORNING
R24	109-30-5		RESISTOR,FXD,MF,30,5%,0.12W	C3 30OHM 5%	CORNING
R25	109-51-5		RESISTOR,FXD,MF,51,5%,0.12W	CMF-50	DALE RESISTOR
R26	109-16-5		RESISTOR,FXD,MF,16,5%,0.12W	C3 16 OHM 5%	CORNING
R27	109-20-5		RESISTOR,FXD,MF,20,5%,0.12W	C3 20OHM 5%	CORNING
R28	109-82-5		RESISTOR,FXD,MF,82,5%,0.12W	CMF-50	DALE RESISTOR
R29	109-330-5		RESISTOR,FXD,MF,330,5%,0.125W	C3 330 OHM 5%	CORNING
R30	109-750-5		RESISTOR,FXD,MF,750,5%,0.12W	C3 750OHM 5%	CORNING
R31	109-330-5		RESISTOR,FXD,MF,330,5%,0.125W	C3 330 OHM 5%	CORNING
R32	109-30-5		RESISTOR,FXD,MF,30,5%,0.12W	C3 30OHM 5%	CORNING
R33	109-51-5		RESISTOR,FXD,MF,51,5%,0.12W	CMF-50	DALE RESISTOR
R34	109-16-5		RESISTOR,FXD,MF,16,5%,0.12W	C3 16 OHM 5%	CORNING
R35	109-330-5		RESISTOR,FXD,MF,330,5%,0.125W	C3 330 OHM 5%	CORNING
R36	109-30-5		RESISTOR,FXD,MF,30,5%,0.12W	C3 30OHM 5%	CORNING
R37	109-30-5		RESISTOR,FXD,MF,30,5%,0.12W	C3 30OHM 5%	CORNING
R38	109-2K-5	1	RESISTOR,FXD,MF,2K,5%,0.12W	C3 2K 5%	CORNING
R39	109-51-5		RESISTOR,FXD,MF,51,5%,0.12W	CMF-50	DALE RESISTOR
TP1	702-17	1	TERMINAL,EYELET	20-2137D	VEROSPEED
VR1	54-MC7805CP	1	IC,VOLTAGE REGULATOR,7805,5V	340T-5	NSC

Table 5-14. A11 Fine Loop Divider PCB (6700-D-31711-3; Rev. G) Parts List (Page 1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	230-37	19	CAPACITOR,FXD,CER,0.1UF,20%,10V	PE122104M100V	MURATA/ERIE
C2	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C3	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C4	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C5	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C6	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C7	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C8	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C9	250-42	5	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C10	230-66	1	CAPACITOR,FXD,CER,0.22uf,10%	CW30C224K	CENTRALAB
C11	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C12	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C13	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C14	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C15	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C16	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C17	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C18	230-64	4	CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C19	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C20	230-52	1	CAPACITOR,FDX,15pF,+/-5%	150-100-NPO-150J	CENTRE ENG
C21	250-58	2	CAPACITOR,FXD,TANT,68UF,10%,6V	196D686X9006KE3	SPRAGUE
C22	250-58		CAPACITOR,FXD,TANT,68UF,10%,6V	196D686X9006KE3	SPRAGUE
C23	230-47	1	CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C24	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C25	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C26	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C27	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C28-C47			NOT ASSIGNED		
C48	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C49-C52			NOT ASSIGNED		
C53	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
CR1	10-4	1	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
L1	310-53	1	INDUCTOR,FXD,47.0UH,5%	1537-60	DELEVAN
L2	310-43	3	INDUCTOR,FXD,10.0UH,10%	1537-36	DELEVAN
L3	310-43		INDUCTOR,FXD,10.0UH,10%	1537-36	DELEVAN
L4	310-43		INDUCTOR,FXD,10.0UH,10%	1537-36	DELEVAN
P1	551-538	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-011	BERG
P2	551-539	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-004	BERG
Q1	20-2N5179	1	TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q2	20-2N3904	2	TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q3	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
R1	110-16.2-1	1	RESISTOR,FXD,MF,16.2,1%,0.25W	SMA-4-16.2	CORNING
R2	110-54.9-1	1	RESISTOR,FXD,MF,54.9,1%,0.25W	SMA-4-54.9	CORNING
R3	110-1K-1	6	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R4	110-3.48K-1	1	RESISTOR,FXD,MF,3.48K,1%,0.25W	SMA-4-3.48K	CORNING
R5	110-100-1	1	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R6	110-26.1-1	1	RESISTOR,FXD,MF,26.1,1%,0.25W	SMA-4-26.1	CORNING
R7	110-464-1	2	RESISTOR,FXD,MF,464,1%,0.25W	SMA-4-464	CORNING
R8	110-464-1		RESISTOR,FXD,MF,464,1%,0.25W	SMA-4-464	CORNING
R9			NOT ASSIGNED		
R10			NOT ASSIGNED		
R11			NOT ASSIGNED		
R12			NOT ASSIGNED		
R13	110-5.36K-1	2	RESISTOR,FXD,MF,5.36K,1%,0.25W	SMA-4-5.36K	CORNING
R14	110-5.36K-1		RESISTOR,FXD,MF,5.36K,1%,0.25W	SMA-4-5.36K	CORNING
R15			NOT ASSIGNED		
R16			NOT ASSIGNED		
R17			NOT ASSIGNED		
R18			NOT ASSIGNED		
R19			NOT ASSIGNED		

Table 5-14. A11 Fine Loop Divider PCB (6700-D-31711-3; Rev. G) Parts List (Page 2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R20	110-604K-1	1	RESISTOR,FXD,MF,604K,1%,0.25W	SMA-4-604K	CORNING
R21	113-7.23K-0.5	4	RESISTOR,FXD,MF,7.23K,0.5%	RN55C 7.23K .5%	VERMONT PRECISION
R22	113-7.23K-0.5		RESISTOR,FXD,MF,7.23K,0.5%	RN55C 7.23K .5%	VERMONT PRECISION
R23	113-3.61K-0.5	4	RESISTOR,FXD,MF,3.61K,0.5%	RN55C 3.61K .5%	VERMONT PRECISION
R24	110-511-1		RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R25	110-9.53K-1	3	RESISTOR,FXD,MF,9.53K,1%,0.25W	SMA-4-9.53K	CORNING
R26	113-3.61K-0.5		RESISTOR,FXD,MF,3.61K,0.5%	RN55C 3.16K .5%	VERMONT PRECISION
R27	113-3.61K-0.5		RESISTOR,FXD,MF,3.61K,0.5%	RN55C 3.16K .5%	VERMONT PRECISION
R28	113-1.8K-0.5	3	RESISTOR,FXD,MF,1.8K,0.5%	RN55C 1.8K .5%	VERMONT PRECISION
R29	110-1.96K-1	1	RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R30	110-7.87K-1	1	RESISTOR,FXD,MF,7.87K,1%,0.25W	SMA-4-7.87K	CORNING
R31	113-2.4K-0.5	2	RESISTOR,FXD,MF,2.4K,0.5%,0.12W	RN55C,2.4K,.5%	VERMONT PRECISION
R32	113-2.4K-0.5		RESISTOR,FXD,MF,2.4K,0.5%,0.12W	RN55C,2.4K,.5%	VERMONT PRECISION
R33	113-1.21K-0.5	1	RESISTOR,FXD,MF,1.21K,0.5%	RN55C,1.21K,.5%	VERMONT PRECISION
R34	110-511-1		RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R35	110-9.53K-1		RESISTOR,FXD,MF,9.53K,1%,0.25W	SMA-4-9.53K	CORNING
R36	113-1.8K-0.5		RESISTOR,FXD,MF,1.8K,0.5%	RN55C,1.8K,.5%	VERMONT PRECISION
R37	113-1.8K-0.5		RESISTOR,FXD,MF,1.8K,0.5%	RN5C,1.8K,.5%	VERMONT PRECISION
R38	113-909-0.5	1	RESISTOR,FXD,MF,909,0.5%	RN55C,909,.5%	VERMONT PRECISION
R39	110-511-1		RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R40	110-19.6K-1	1	RESISTOR,FXD,MF,19.6K,1%,0.25W	SMA-4-19.6K	CORNING
R41	113-7.23K-0.5		RESISTOR,FXD,MF,7.23K,0.5%	RN55C,7.23K,.5%	VERMONT PRECISION
R42	113-7.23K-0.5		RESISTOR,FXD,MF,7.23K,0.5%	RN55C,7.23K,.5%	VERMONT PRECISION
R43	113-3.61K-0.5		RESISTOR,FXD,MF,3.61K,0.5%	RN55C,3.61K,.5%	VERMONT PRECISION
R44	110-511-1		RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R45	110-9.53K-1		RESISTOR,FXD,MF,9.53K,1%,0.25W	SMA-4-9.53K	CORNING
R46	110-4.02K-1	1	RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4-4.02K	CORNING
R47	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R48	110-169-1	2	RESISTOR,FXD,MF,169,1%,0.25W	SMA-4-169	CORNING
R49	110-169-1		RESISTOR,FXD,MF,169,1%,0.25W	SMA-4-169	CORNING
R50			NOT ASSIGNED		
R51			NOT ASSIGNED		
R52			NOT ASSIGNED		
R53			NOT ASSIGNED		
R54	110-274-1	2	RESISTOR,FXD,MF,274,1%,0.25W	SMA-4-274	CORNING
R55	110-274-1		RESISTOR,FXD,MF,274,1%,0.25W	SMA-4-274	CORNING
R56	110-511-1		RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R57	110-2.37K-1	1	RESISTOR,FXD,MF,2.37K,1%,0.25W	SMA-4-2.37K	CORNING
R58	110-511-1		RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R59	110-51.1-1	1	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
U1	54-512	1	IC,CMOS,74HC14,HEX	SN74HC14N	TEXAS INSTRUMENTS
U2	54-518	2	IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INSTRUMENTS
U3	54-74LS196	2	IC,TTL,74LS196,DECADE COUNTER	74LS196PC	FSC
U4	54-545	1	IC,AS TTL,74AS11,TRIPLE	SN74AS11N	TEXAS INSTRUMENTS
U5	54-74LS196		IC,TTL,74LS196,DECADE COUNTER	74LS196PC	FSC
U6	54-518		IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INSTRUMENTS
U7	54-74167	1	IC,TTL,74167,DECADE RATE MUL	DM74167N	NSC
U8	54-361	1	IC,TTL,74S196,PRESETTABLE	SN74S196N	TEXAS INSTRUMENTS
U9	54-329	2	IC,TTL,74S112,DUAL,JK EDGE-TRIGGER	SN74S112N	TEXAS INSTRUMENTS
U10	54-74LS132	1	IC,TTL,74LS132,QUAD,NAND SCHMIDT	DM74LS132N	NSC
U11	54-349	1	IC,TTL,74LS283,SINGLE,4 BIT	SN74LS283N	TEXAS INSTRUMENTS
U12	54-406	1	IC,TTL,74S197,BINARY COUNTER	SN74S197N	TEXAS INSTRUMENTS
U13	54-329		IC,TTL,74S112,DUAL,JK EDGE-TRIGGER	SN74S112N	TEXAS INSTRUMENTS
U14	54-547	1	IC,ECL,SP8680B,SINGLE,10/11	SP8680B	PLESSY
U15	54-544	1	IC,AS TTL,74AS02,QUAD	SN74AS02N	TEXAS INSTRUMENTS
U16-U18			NOT ASSIGNED		
U19	54-172	1	IC,TTL,74LS390,DUAL,DECADE COUNTER	DM74LS390N	NSC
U20	54-540	1	IC,ALS TTL,74ALS112,DUAL	74ALS112N	TEXAS INSTRUMENTS
VR1	54-MC7805CP	1	IC,VOLTAGE REGULATOR,7805,5V	340T-5	NSC

Table 5-15. A12 YIG Phase Detector PCB (6700-D-31712-3; Rev. E) Parts List (Page 1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	230-66	1	CAPACITOR,FXD,CER,0.22uf,10%	W30C224K	CENTRE LAB
C2	250-41	1	CAPACITOR,FXD,TANT,6.8UF,10%,3V	196D685X9035KE3	SPRAGUE
C3	230-64	6	CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C4	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C5	230-37	7	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C6	250-77	1	CAPACITOR,FXD,CER,0.01UF,10%,1V	CK05BX103K	SPRAGUE
C7	230-52	1	CAPACITOR,FDX,15pF,+/-5%	150-100-NPO-150J	CENTRE ENG
C8			NOT ASSIGNED		
C9			NOT ASSIGNED		
C10	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C11	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C12	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C13	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C14	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C15	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C16	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C17			NOT ASSIGNED		
C18			NOT ASSIGNED		
C19			NOT ASSIGNED		
C20	223-330	4	CAPACITOR,FXD,MICA,330PF,5%,10V	CMO4FA331JO3	ARCO/SOSHIN
C21	223-330		CAPACITOR,FXD,MICA,330PF,5%,10V	CMO4FA331JO3	ARCO/SOSHIN
C22	223-43	2	CAPACITOR,FXD,MICA,43PF,5%,500V	DM 10E 430J05%300V	ELMENCO
C23	223-43		CAPACITOR,FXD,MICA,43PF,5%,500V	DM 10E 430J05%300V	ELMENCO
C24	250-42	2	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C25	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C26	223-330		CAPACITOR,FXD,MICA,330PF,5%,10V	CMO4FA331JO3	ARCO/SOSHIN
C27	223-330		CAPACITOR,FXD,MICA,330PF,5%,10V	CMO4FA331JO3	ARCO/SOSHIN
CR1	10-1N4446	1	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
L1	310-53	2	INDUCTOR,FXD,47.0UH,5%	1537-60	DELEVAN
L2	310-53		INDUCTOR,FXD,47.0UH,5%	1537-60	DELEVAN
P1	551-538	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-011	BERG
Q1	20-2N5179	1	TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q2			NOT ASSIGNED		
Q3			NOT ASSIGNED		
Q4	20-2N2222A	2	TRANSISTOR,NPN,2N2222A,SI,MED	2N2222A	MOTOROLA
Q5	20-2N2222A		TRANSISTOR,NPN,2N2222A,SI,MED	2N2222A	MOTOROLA
Q6	20-45	1	TRANSISTOR,FET,N CHANNEL ENH	VN10KM	SILICONIX
Q7	20-2N3563	2	TRANSISTOR,NPN,2N3563,SI,RF-IF	PN3563	FSC
Q8	20-2N3563		TRANSISTOR,NPN,2N3563,SI,RF-IF	PN3563	FSC
R1	109-56-5	1	RESISTOR,FXD,MF,56,5%,0.12W	C3 56OHM 5%	CORNING
R2	110-1K-1	5	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R3	110-3.48K-1	1	RESISTOR,FXD,MF,3.48K,1%,0.25W	SMA-4	CORNING
R4	109-100-5	1	RESISTOR,FXD,MF,100,1%,0.12W	CMF-50	DALE RESISTOR
R5	109-27-5	1	RESISTOR,FXD,MF,27,5%,0.12W	CMF-50	DALE RESISTOR
R6	110-200-1	1	RESISTOR,FXD,MF,200,1%,0.25W	SMA-4	CORNING
R7	110-56.2-1	1	RESISTOR,FXD,MF,56.2,1%,0.25W	SMA-4 OR C4	CORNING
R8			NOT ASSIGNED		
R9			NOT ASSIGNED		
R10			NOT ASSIGNED		
R11	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R12	110-750-1	2	RESISTOR,FXD,MF,750,1%,0.25W	SMA-4	CORNING
R13	110-348-1	1	RESISTOR,FXD,MF,348,1%,0.25W	SMA-4	CORNING
R14	110-1.07K-1	1	RESISTOR,FXD,MF,1.07K,1%,0.25W	SMA-4	CORNING
R15	110-887-1	2	RESISTOR,FXD,MF,887,1%,0.25W	SMA-4	CORNING
R16	110-301-1	2	RESISTOR,FXD,MF,301,1%,0.25W	SMA-4	CORNING
R17	110-2.43K-1	1	RESISTOR,FXD,MF,2.43K,1%,0.25W	SMA-4	CORNING
R18	110-301-1		RESISTOR,FXD,MF,301,1%,0.25W	SMA-4	CORNING
R19	110-887-1		RESISTOR,FXD,MF,887,1%,0.25W	SMA-4	CORNING
R20	110-383-1	1	RESISTOR,FXD,MF,383,1%,0.25W	SMA-4	CORNING
R21	110-681-1	1	RESISTOR,FXD,MF,681,1%,0.25W	SMA-4	CORNING

Table 5-15. A12 YIG Phase Detector PCB (6700-D-31712-3; Rev. E) Parts List (Page 2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R22	110-750-1		RESISTOR,FXD,MF,750,1%,0.25W	SMA-4	CORNING
R23	110-5.11K-1	1	RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4	CORNING
R24	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R25	110-4.87K-1		RESISTRO,FXD,MF,4.87K,1%,0.25W	SMA-4	CORNING
R26	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R27	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4	CORNING
R28	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4	CORNING
R29	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4	CORNING
R30	110-90.9K-1	2	RESISTOR,FXD,MF,90.9K,1%,0.25W	SMA-4	CORNING
R31	110-19.6K-1	2	RESISTOR,FXD,MF,19.6K,1%,0.25W	SMA-4	CORNING
R32	110-100-1	2	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R33	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R34	110-90.9K-1		RESISTOR,FXD,MF,90.9K,1%,0.25W	SMA-4	CORNING
R35	110-19.6K-1		RESISTOR,FXD,MF,19.6K,1%,0.25W	SMA-4	CORNING
R36	110-68.1-1	2	RESISTOR,FXD,MF,68.1,1%,0.25W	SMA-4 OR C4	CORNING
R37	110-16.2-1	1	RESISTOR,FXD,MF,16.2,1%,0.25W	SMA-4 OR C4	CORNING
R38	110-2.74K-1	2	RESISTOR,FXD,MF,2.74K,1%,0.25W	SMA-4	CORNING
R39	110-2.74K-1		RESISTOR,FXD,MF,2.74K,1%,0.25W	SMA-4	CORNING
R40	110-22.6K-1	2	RESISTOR,FXD,MF,22.6K,1%,0.25W	SMA-4	CORNING
R41	110-22.6K-1		RESISTOR,FXD,MF,22.6K,1%,0.25W	SMA-4	CORNING
R42	110-169-1	1	RESISTOR,FXD,MF,169,1%,0.25W	SMA-4 OR C4	CORNING
R43	110-51.1-1	1	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R44	110-68.1-1		RESISTOR,FXD,MF,68.1,1%,0.25W	SMA-4 OR C4	CORNING
R45	110-4.02K-1	1	RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4	CORNING
R46	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
U1	54-547	1	IC,ECL,SP8680B,SINGLE,10/11	SP8680B	PLESSY
U2	54-361	2	IC,TTL,74S196,PRESETTABLE	SN74S196N	TEXAS INSTRUMENTS
U3	54-361		IC,TTL,74S196,PRESETTABLE	SN74S196N	TEXAS INSTRUMENTS
U4	54-540	1	IC,ALS TTL,74ALS112,DUAL	74ALS112N	TEXAS INSTRUMENTS
U5	54-390	1	IC,TTL,74ALS00A,QUAD,2 INPUT	SN74ALS00AN	TEXAS INSTRUMENTS
U6	50-9	1	IC,OP AMP,LF356,SINGLE	LF356N	NSC
VR1	54-MC7805CP	1	IC,VOLTAGE REGULATOR,7805,5V	340T-5	NSC

Table 5-16. A13 Pulse Generator PCB (6700-D-31713-3; Rev. K) Parts List (Page 1 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	230-37	40	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C2	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C3	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C4	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C5	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C6	250-58	1	CAPACITOR,FXD,TANT,68UF,10%,6V	196D686X9006KE3	SPRAGUE
C7	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C8	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C9	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C10	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C11	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C12	230-55	2	CAPACITOR,FXD,100pF,+/-5%	150-100-NPO-101J	CENTRE ENG
C13	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C14	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C15	230-55		CAPACITOR,FXD,100pF,+/-5%	150-100-NPO-101J	CENTRE ENG
C16	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C17	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C18			NOT ASSIGNED		
C19	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C20	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C21	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C22	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C23	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C24	230-70	2	CAPACITOR,FIXED,CER,27pf,5%	150-100-NPO-270J	CENTRE ENG.
C25	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C26	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C27	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C28	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C29	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C30	230-64	8	CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C31	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C32	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C33	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C34	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C35	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C36	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C37	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C38	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C39	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C40	250-40	1	CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X002HE3	SPRAGUE
C41	250-42	2	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C42	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C43	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C44	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C45	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C46	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C47	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C48	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C49	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C50	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C51	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C52	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C53	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C54	230-64		CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C56	230-70		CAPACITOR,FIXED,CER,27pf,5%	150-100-NPO-270J	CENTRE ENG
C57	230-47	1	CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C58	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
CR1	10-1N4446	9	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR2	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR3	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL

Table 5-16. A13 Pulse Generator PCB (6700-D-31713-3; Rev. K) Parts List (Page 2 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
CR5	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR6	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR7	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR8	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR9	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR10	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR11	10-1N746A	1	DIODE,ZENER,1N746,3.3V,10%	1N746	MOTOROLA
CR12	10-4	9	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR13	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR14	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR15	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR16	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR17	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR18	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR19	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
DS1	15-5	2	INDICATOR,LED,RED	MV5774C	MONSANTO
DS2	15-5		INDICATOR,LED,RED	MV5774C	MONSANTO
L1	310-89	1	INDUCTOR,FIXED,1.9uH @ 50mHz	VK200 10/3B	FERROXCUBE
L2	310-45	1	INDUCTOR,FXD,100.0UH,5%	1315-12J	AIRCO
L3	310-57	4	INDUCTOR,FXD,0.15UH,10%	1025-00	DELEVAN
L4	310-57		INDUCTOR,FXD,0.15UH,10%	1025-00	DELEVAN
L5	310-57		INDUCTOR,FXD,0.15UH,10%	1025-00	DELEVAN
L6	310-57		INDUCTOR,FXD,0.15UH,10%	1025-00	DELEVAN
P1	551-538	1	CONNECTOR,SOCKET,1 ROW-0.150"	66947-011	BERG
Q1	20-2N4249	2	TRANSISTOR,PNP,2N4249,SI,LOW N	MPS4249-18	MOTOROLA
Q2	20-2N4249		TRANSISTOR,PNP,2N4249,SI,LOW N	MPS4249-18	MOTOROLA
Q3	20-2N4122	16	TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q4	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q5	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q6	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q7	20-2N5179	4	TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q8	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q9	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q10	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q11	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q12	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q13	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q14	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q15	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q16	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q17	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA
Q18	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q19	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q20	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q21	20-2N4122		TRANSISTOR,PNP,2N4122,SI,GEN P	PN4122	NATIONAL
Q22	20-2N5179		TRANSISTOR,NPN,2N5179,SI,HIGH	2N5179	RCA 109
Q23			NOT ASSIGNED		
Q24	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q25	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
R1	110-2.05K-1	2	RESISTOR,FXD,MF, 2.05K,1%,0.25W	SMA-4-2.05K	CORNING
R2	110-4.02K-1	2	RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4-4.02K	CORNING
R3	110-2.05K-1		RESISTOR,FXD,MF,2.05K,1%,0.25W	SMA-4-2.05K	CORNING
R4	110-4.02K-1		RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4-4.02K	CORNING
R5	110-200-1	1	RESISTOR,FXD,MF,200,1%,0.25W	SMA-4-200	CORNING
R6	110-1K-1	2	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R7	110-100-1	4	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R8			NOT ASSIGNED		
R9	110-511-1	2	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R10	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R11	110-10.5K-1	1	RESISTOR,FXD,MF,10.5K,1%,0.25W	SMA-4-10.5K	CORNING

Table 5-16. A13 Pulse Generator PCB (6700-D-31713-3; Rev. K) Parts List (Page 3 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R12	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R13	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R14	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R15	110-383-1	2	RESISTOR,FXD,MF,383,1%,0.25W	SMA-4-383	CORNING
R16	110-383-1		RESISTOR,FXD,MF,383,1%,0.25W	SMA-4-383	CORNING
R17	110-51.1-1	17	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R18	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R19	110-1.78K-1	4	RESISTOR,FXD,MF,1.78K,1%,0.25W	SMA-4-1.78K	CORNING
R20	110-261-1	4	RESISTOR,FXD,MF,261,1%,0.25W	SMA-4-261	CORNING
R21	110-536-1	4	RESISTOR,FXD,MF,536,1%,0.25W	SMA-4-536	CORNING
R22	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R23	110-56.2-1	8	RESISTOR,FXD,MF,56.2,1%,0.25W	SMA-4-56.2	CORNING
R24	110-56.2-1		RESISTOR,FXD,MF,56.2,1%,0.25W	SMA-4-56.2	CORNING
R25	110-332-1	4	RESISTOR,FXD,MF,332,1%,0.25W	SMA-4-332	CORNING
R26	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R27	110-26.1-1	4	RESISTOR,FXD,MF,26.1,1%,0.25W	SMA-4-26.1	CORNING
R28	110-536-1		RESISTOR,FXD,MF,536,1%,0.25W	SMA-4-536	CORNING
R29	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R30	110-261-1		RESISTOR,FXD,MF,261,1%,0.25W	SMA-4-261	CORNING
R31	110-56.2-1		RESISTOR,FXD,MF,56.2,1%,0.25W	SMA-4-56.2	CORNING
R32	110-332-1		RESISTOR,FXD,MF,332,1%,0.25W	SMA-4-332	CORNING
R33	110-56.2-1		RESISTOR,FXD,MF,56.2,1%,0.25W	SMA-4-56.2	CORNING
R34	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R35	110-26.1-1		RESISTOR,FXD,MF,26.1,1%,0.25W	SMA-4-26.1	CORNING
R36	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R37	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R38	110-1.78K-1		RESISTOR,FXD,MF,1.78K,1%,0.25W	SMA-4-1.78K	CORNING
R39	110-169-1	1	RESISTOR,FXD,MF,169,1%,0.25W	SMA-4-169	CORNING
R40	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R41	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R42	110-1.78K-1		RESISTOR,FXD,MF,1.78K,1%,0.25W	SMA-4-1.78K	CORNING
R43	110-536-1		RESISTOR,FXD,MF,536,1%,0.25W	SMA-4-536	CORNING
R44	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R45	110-261-1		RESISTOR,FXD,MF,261,1%,0.25W	SMA-4-261	CORNING
R46	110-56.2-1		RESISTOR,FXD,MF,56.2,1%,0.25W	SMA-4-56.2	CORNING
R47	110-56.2-1		RESISTOR,FXD,MF,56.2,1%,0.25W	SMA-4-56.2	CORNING
R48	110-332-1		RESISTOR,FXD,MF,332,1%,0.25W	SMA-4-332	CORNING
R49	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R50	110-26.1-1		RESISTOR,FXD,MF,26.1,1%,0.25W	SMA-4-26.1	CORNING
R51	110-56.2-1		RESISTOR,FXD,MF,56.2,1%,0.25W	SMA-4-56.2	CORNING
R52	110-536-1		RESISTOR,FXD,MF,536,1%,0.25W	SMA-4-536	CORNING
R53	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R54	110-261-1		RESISTOR,FXD,MF,261,1%,0.25W	SMA-4-261	CORNING
R55	110-332-1		RESISTOR,FXD,MF,332,1%,0.25W	SMA-4-332	CORNING
R56	110-56.2-1		RESISTOR,FXD,MF,56.2,1%,0.25W	SMA-4-56.2	CORNING
R57	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R58	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R59	110-1.78K-1		RESISTOR,FXD,MF,1.78K,1%,0.25W	SMA-4-1.78K	CORNING
R60	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R61	110-26.1-1		RESISTOR,FXD,MF,26.1,1%,0.25W	SMA-4-26.1	CORNING
R62	110-2.37K-1	1	RESISTOR,FXD,MF,2.37K,1%,0.25W	SMA-4-2.37K	CORNING
R63	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R64	110-511-1		RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R65	110-6.49-1	1	RESISTOR,FXD,MF,6.49,1%,0.25W	RN55D,6.49, 1%	VPR
R66	110-90.9-1	2	RESISTOR,FXD,MF,402,1%,0.25W	SMA-4-90.9	CORNING
R67	110-402-1	1	RESISTOR,FXD,MF,402,1%,0.25W	SMA-4-402	CORNING
R68	110-90.9-1		RESISTOR,FXD,MF,402,1%,0.25W	SMA-4-90.9	CORNING
TP1	702-17	9	TERMINAL,EYELET	20-2137D	VEROSPEED
TP2	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP3	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED

Table 5-16. A13 Pulse Generator PCB (6700-D-31713-3; Rev. K) Parts List (Page 4 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
TP4	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP5	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP6	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP7	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP8	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
TP9	702-17		TERMINAL,EYELET	20-2137D	VEROSPEED
U1			NOT ASSIGNED		
U2	54-539	1	IC,ALS TTL,74ALS86,QUADRUPLE	SN74ALS86N	TEXAS INSTRUMENTS
U3	54-387	2	IC,TTL,74ALS08,QUAD,2 INPUT	SN74ALS08N	TEXAS INSTRUMENTS
U4	54-542	9	IC,ALS TTL,74ALS160,BCD	SN74ALS160N	TEXAS INSTRUMENTS
U5	54-542		IC,ALS TTL,74ALS160,BCD	SN74ALS160N	TEXAS INSTRUMENTS
U6	54-542		IC,ALS TTL,74ALS160,BCD	SN74ALS160N	TEXAS INSTRUMENTS
U8	54-541	2	IC,ALS TTL,74ASL151,8 INPUT	SN74ALS151N	TEXAS INSTRUMENTS
U9	54-512	1	IC,CMOS,74HC14,HEX	SN74HC14N	TEXAS INSTRUMENTS
U10	54-518	7	IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INSTRUMENTS
U11	54-542		IC,ALS TTL,74ALS160,BCD	SN74ALS160N	TEXAS INSTRUMENTS
U12	54-542		IC,ALS TTL,74ALS160,BCD	SN74ALS160N	TEXAS INSTRUMENTS
U13	54-542		IC,ALS TTL,74ALS160,BCD	SN74ALS160N	TEXAS INSTRUMENTS
U14	54-387		IC,TTL,74ALS08,QUAD,2 INPUT	SN74ALS08N	TEXAS INSTRUMENTS
U15	54-541		IC,ALS TTL,74ASL151, 8 INPUT	SN74ALS151N	TEXAS INSTRUMENTS
U16	54-518		IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INSTRUMENTS
U17	54-518		IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INSTRUMENTS
U18	54-542		IC,ALS TTL,74ALS160,BCD	SN74ALS160N	TEXAS INSTRUMENTS
U19	54-542		IC,ALS TTL,74ALS160,BCD	SN74ALS160N	TEXAS INSTRUMENTS
U20	54-542		IC,ALS TTL,74ALS160,BCD	SN74ALS160N	TEXAS INSTRUMENTS
U21	54-518		IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INSTRUMENTS
U22	54-518		IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INSTRUMENTS
U24	54-552	3	IC,ALS-TTL,74ALS153,DUAL,4 LINE	SN74ALS153N	TEXAS INSTRUMENTS
U23			NOT ASSIGNED		
U25	54-538	3	IC,ALS TTL,74ALS74,DUAL	SN74ALS74N	TEXAS INSTRUMENTS
U26	54-537	1	IC,ALS TTL,74ALS38,QUADRUPLE	SN74ALS38N	TEXAS INSTRUMENTS
U27	54-538		IC,ALS TTL,74ALS74,DUAL	SN74ALS74N	TEXAS INSTRUMENTS
U28	54-538		IC,ALS TTL,74ALS74,DUAL	SN74ALS74N	TEXAS INSTRUMENTS
U29	54-324	1	IC,TTL,DUAL,DIGITAL DELAY	DDU-4-5125	DATA DELAY
U30	54-552		IC,ALS-TTL,74ALS153,DUAL,4 LINE	SN74ALS153N	TEXAS INSTRUMENTS
U31	54-552		IC,ALS-TTL,74ALS153,DUAL,4 LINE	SN74ALS153N	TEXAS INSTRUMENTS
U32	54-391	2	IC,TTL,74ALS02,QUAD,2INPUT NOR	SN74ALS02N	TEXAS INSTRUMENTS
U33			NOT ASSIGNED		
U34	54-518		IC,CMOS,74HC164,8 BIT SERIAL	SN74HC164N	TEXAS INSTRUMENTS
U35	54-391		IC,TTL,74ALS02,QUAD,2 INPUT NOR	SN74ALS02N	TEXAS INSTRUMENTS
U36	54-233	2	IC,OP AMP,CA3054	CA3054	RCA
U37	54-233		IC,OP AMP,CA3054	CA3054	RCA
VR1	54-184	1	IC,VOLTAGE REGULATOR,7905,-5V	UA7905UC	FSC

Table 5-17. A15 ALC PCB (6700-D-31715-3; Rev. M) Parts List (Page 1 of 8)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	230-39	11	CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C2	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C3	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C4	223-56	1	CAPACITOR,FXD,MICA,56PF,5%,500V	DM10E 560J0 500V	CORNELL DUBILIER
C5	230-85	1	CAPACITOR,FXD,CER,0.33uF,10%	300-100-X7R-334K	CENTRE ENG
C6	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C7	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C8	250-58A	1	CAPACITOR,FXD,TANT,68UF,10%,6V	196D686X9006KA1	SPRAGUE
C9	250-40A	1	CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C10	250-42A	33	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C11	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C12	230-53	4	CAPACITOR,FXD,39pF,+/-5%	150-100-NPO-390J	CENTRE ENG
C13	230-53		CAPACITOR,FXD,39pF,+/-5%	150-100-NPO-390J	CENTRE ENG
C14	230-57	2	CAPACITOR,FXD,220pF	200-100-NPO-221J	CENTRE ENG
C15	230-59	1	CAPACITOR,FXD,390pF,+/-5%	200-100-NPO-391J	CENTRE ENG
C16	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C17	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C18	230-66	2	CAPACITOR,FXD,CER,0.22uf,10%	CW30C224K	CENTRALAB
C19	230-66		CAPACITOR,FXD,CER,0.22uf,10%	CW30C224K	CENTRALAB
C20	210-30	3	CAPACITOR,FXD,PEST,0.10UF,10%	ECQ-E2104KZS	PANASONIC
C21	210-30		CAPACITOR,FXD,PEST,0.10UF,10%	ECQ-E2104KZS	PANASONIC
C22	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C23	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C24	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C25	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C26	230-53		CAPACITOR,FXD,39pF,+/-5%	150-100-NPO-390J	CENTRE ENG
C27	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C28	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C29	230-53		CAPACITOR,FXD,39pF,+/-5%	150-100-NPO-390J	CENTRE ENG
C30	230-52	3	CAPACITOR,FDX,15pF,+/-5%	150-100-NPO-150J	CENTRE ENG
C31	230-52		CAPACITOR,FDX,15pF,+/-5%	150-100-NPO-150J	CENTRE ENG
C32	230-51	1	CAPACITOR,FDX,3.3pF,+/-.025	150-100-NPO-339C	CENTRE ENG
C33	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C34	230-55	2	CAPACITOR,FXD,100pF,+/-5%	150-100-NPO-101J	CENTRE ENG
C35	230-58	2	CAPACITOR,FXD,270pF,+/-5%	200-100-NPO-271J	CENTRE ENG
C36	250-39A	4	CAPACITOR,FXD,TANT,4.7UF,20%,3V	196D475X0035JA1	SPRAGUE
C37	250-39A		CAPACITOR,FXD,TANT,4.7UF,20%,3V	196D475X0035JA1	SPRAGUE
C38	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C39	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C40	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C41	230-47	4	CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C42	230-47		CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C43	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C44	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C45	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C46	230-55		CAPACITOR,FXD,100pF,+/-5%	150-100-NPO-101J	CENTRE ENG
C47	230-58		CAPACITOR,FXD,270pF,+/-5%	200-100-NPO-271J	CENTRE ENG
C48	250-39A		CAPACITOR,FXD,TANT,4.7UF,20%,3V	196D475X0035JA1	SPRAGUE
C49	250-39A		CAPACITOR,FXD,TANT,4.7UF,20%,3V	196D475X0035JA1	SPRAGUE
C50	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C51	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C52	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C53	230-47		CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C54	230-47		CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C55	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C56	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C57	230-62	1	CAPACITOR,FXD,680pF,+/-5%	200-100-NPO-681J	CENTRE ENG
C58	210-30		CAPACITOR,FXD,PEST,0.10UF,10%	ECQ-E2104KZS	SPRAGUE
C59	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C60	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE

Table 5-17. A15 ALC PCB (6700-D-31715-3; Rev. M) Parts List (Page 2 of 8)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C61	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C62	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C63	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C64	230-57		CAPACITOR,FXD,220pF	200-100-NPO-221J	CENTRE ENG
C65	230-74	1	CAPACITOR,FIXED,CER,5PF,5%	200-100-NPO-5R0J	CENTRE ENG
C66	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C67	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C68	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C69	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C70	230-68	1	CAPACITOR,TXD,CER,22pf,5%,100V	150-100-NPO-220J	CENTRE ENG
C71	250-41A	1	CAPACITOR,FXD,TANT,6.8pF,10%,3V	196D685X9035KA1	SPRAGUE
C72	230-60	1	CAPACITOR,FXD,470pF,+/-5%	200-100-NPO-471J	CENTRE ENG
C73	250-102	1	CAPACITOR,FXD,PCAR,0.01UF,1%,5V	RV2A103F	IMB
C74	230-52		CAPACITOR,FDX,15pF,+/-5%	150-100-NPO-150J	CENTRE ENG
C75	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C76	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C77	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C78	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C79	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C80	250-42A		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KA1	SPRAGUE
C81	250-40	1	CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X002HE3	SPRAGUE
C82	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C83	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C84	230-67	2	CAPACITOR,FXD,CER,33pF,5%,100V	150-100-NPO-330J	CENTRE
C85	230-67		CAPACITOR,FXD,CER,33pF,5%,100V	200-100-NPO-330J	CENTRE
CR1	10-FD300	9	DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR2	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR3	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR4	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR5	10-11	2	DIODE,ZENER,1N750A,4.7V,5%	IN750A	FSC
CR6	10-11		DIODE,ZENER,1N750A,4.7V,5%	IN750A	FSC
CR7	10-1N751A	2	DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR8	10-1N4446	12	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR9	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR10	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR11	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR12	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR13	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR14	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR15	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR16	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR17	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR18	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR19	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR20	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR21	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR22	10-1N755A	1	DIODE,ZENER,1N755A,7.5V,5%	1N755A	MOTOROLA
CR23	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR24	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR25	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR26	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
J1	516-57	1	CONNECTOR,RF CABLE,SMB RECP	32JR111-1	SPECIALTY CO
L1	310-43	2	INDUCTOR,FXD,10.0UH,10%	1537-36	DELEVAN
L2	310-43		INDUCTOR,FXD,10.0UH,10%	1537-36	DELEVAN 109
Q1	20-56	4	TRANSISTOR,JFET,J310	J310	SILICONIX
Q2	20-2N3904	15	TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q3	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q4	20-56		TRANSISTOR,JFET,J310	J310	SILICONIX
Q5	20-2N3906	7	TRANSISTOR,PNP,2N3906,SI,GEN P	2N3906	MOTOROLA
Q6	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA

Table 5-17. A15 ALC PCB (6700-D-31715-3; Rev. M) Parts List (Page 3 of 8)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
Q7	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q8	20-2N3906		TRANSISTOR,PNP,2N3906,SI,GEN P	2N3906	MOTOROLA
Q9	20-56		TRANSISTOR,JFET,J310	J310	SILICONIX
Q10	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q11	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q12	20-56		TRANSISTOR,JFET,J310	J310	SILICONIX
Q13	20-2N3906		TRANSISTOR,PNP,2N3906,SI,GEN P	2N3906	MOTOROLA
Q14	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q15	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q16	20-2N3906		TRANSISTOR,PNP,2N3906,SI,GEN P	2N3906	MOTOROLA
Q17	20-66	8	TRANSISTOR,JFET,2N4392,SI	2N4392	SILICONIX
Q18	20-66		TRANSISTOR,JFET,2N4392,SI	2N4392	SILICONIX
Q19	20-66		TRANSISTOR,JFET,2N4392,SI	2N4392	SILICONIX
Q20	20-66		TRANSISTOR,JFET,2N4392,SI	2N4392	SILICONIX
Q21	20-2N3906		TRANSISTOR,PNP,2N3906,SI,GEN P	2N3906	MOTOROLA
Q22	20-2N3906		TRANSISTOR,PNP,2N3906,SI,GEN P	2N3906	MOTOROLA
Q23	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q24	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q25	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q26	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q27			NOT ASSIGNED		
Q28			NOT ASSIGNED		
Q29	20-66		TRANSISTOR,JFET,2N4392,SI	2N4392	SILICONIX
Q30	20-66		TRANSISTOR,JFET,2N4392,SI	2N4392	SILICONIX
Q31	20-66		TRANSISTOR,JFET,2N4392,SI	2N4392	SILICONIX
Q32	20-66		TRANSISTOR,JFET,2N4392,SI	2N4392	SILICONIX
Q33	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q34	20-2N3906		TRANSISTOR,PNP,2N3906,SI,GEN P	2N3906	MOTOROLA
Q35	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
Q36	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN P	2N3904	MOTOROLA
R1	110-1K-1	25	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R2	110-604-1	2	RESISTOR,FXD,MF,604,1%,0.25W	SMA-4-604	CORNING
R3	110-2K-1	4	RESISTOR,FXD,MF,2K,1%,0.25W	SMA-4-2K	CORNING
R4	110-2K-1		RESISTOR,FXD,MF,2K,1%,0.25W	SMA-4-2K	CORNING
R5	110-10K-1	13	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R6	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R7	110-100-1	10	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R8	110-100K-1	6	RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4-100K	CORNING
R9	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R10	110-604-1		RESISTOR,FXD,MF,604,1%,0.25W	SMA-4-604	CORNING
R11	110-2K-1		RESISTOR,FXD,MF,2K,1%,0.25W	SMA-4-2K	CORNING
R12	110-2K-1		RESISTOR,FXD,MF,2K,1%,0.25W	SMA-4-2K	CORNING
R13	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R14	110-3.16K-1	3	RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4-3.16K	CORNING
R15	110-3.16K-1		RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4-3.16K	CORNING
R16	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R17	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R18	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R19	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R20	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R21	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R22	110-196K-1	1	RESISTOR,FXD,MF,196K,1%,0.25W	SMA-4-196K	CORNING
R23	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R24	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R25	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R26	110-20K-1	2	RESISTOR,FXD,MF,20K,1%,0.25W	SMA-4-20K	CORNING
R27	110-20K-1		RESISTOR,FXD,MF,20K,1%,0.25W	SMA-4-20K	CORNING
R28	110-14K-1	2	RESISTOR,FXD,MF,14K,1%,0.25W	SMA-4-14K	CORNING
R29	110-14K-1		RESISTOR,FXD,MF,14K,1%,0.25W	SMA-4-14K	CORNING
R30	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING

Table 5-17. A15 ALC PCB (6700-D-31715-3; Rev. M) Parts List (Page 4 of 8)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R31	110-1M-1	4	RESISTOR,FXD,MF,1M,1%,0.25W	SMA-4-1M	CORNING
R32	110-1M-1		RESISTOR,FXD,MF,1M,1%,0.25W	SMA-4-1M	CORNING
R33	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R34	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R35	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R36	110-953-1	2	RESISTOR,FXD,MF,953,1%,0.25W	SMA-4-953	CORNING
R37	110-3.01K-1	3	RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4-3.01K	CORNING
R38	110-6.04K-1	1	RESISTOR,FXD,MF,6.04K,1%,0.25W	SMA-4-6.04K	CORNING
R39	110-4.99K-1	5	RESISTOR,FXD,MF,4.99K,1%,0.25W	SMA-4-4.99K	CORNING
R40	110-4.02K-1	4	RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4-4.02K	CORNING
R41	110-4.99K-1		RESISTOR,FXD,MF,4.99K,1%,0.25W	SMA-4-4.99K	CORNING
R42	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R43	110-511-1	1	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R44	110-4.87K-1	9	RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R45	110-46.4K-1	2	RESISTOR,FXD,MF,46.4K,1%,0.25W	SMA-4-46.4K	CORNING
R46	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R47	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R48	110-46.4K-1		RESISTOR,FXD,MF,46.4K,1%,0.25W	SMA-4-46.4K	CORNING
R49	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R50	110-825-1	1	RESISTOR,FXD,MF,825,1%,0.25W	SMA-4-825	CORNING

Table 5-17. A15 ALC PCB (6700-D-31715-3; Rev. K) Parts List (Page 5 of 8)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R51	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R52	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R53	110-4.75K-1	4	RESISTOR,FXD,MF,4.75K,1%,0.25W	SMA-4-4.75K	CORNING
R54	110-4.75K-1		RESISTOR,FXD,MF,4.75K,1%,0.25W	SMA-4-4.75K	CORNING
R55	110-215-1	4	RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
R56	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R57	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R58	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R59	110-40.2-1	2	RESISTOR,FXD,MF,40.2,1%,0.25W	SMA-4-40.2	CORNING
R60	110-7.15K-1	4	RESISTOR,FXD,MF,7.15K,1%,0.25W	SMA-4-7.15K	CORNING
R61	110-1M-1		RESISTOR,FXD,MF,1M,1%,0.25W	SMA-4-1M	CORNING
R62	110-316-1	1	RESISTOR,FXD,MF,316,1%,0.25W	SMA-4-316	CORNING
R63	110-7.15K-1		RESISTOR,FXD,MF,7.15K,1%,0.25W	SMA-4-7.15K	CORNING
R64	110-215-1		RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
R65	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R66	110-7.87K-1	3	RESISTOR,FXD,MF,7.87K,1%,0.25W	SMA-4-7.87K	CORNING
R67	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R68	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R69	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R70	110-750-1	6	RESISTOR,FXD,MF,750,1%,0.25W	SMA-4-750	CORNING
R71	110-681-1	2	RESISTOR,FXD,MF,681,1%,0.25W	SMA-4-681	CORNING
R72	110-750-1		RESISTOR,FXD,MF,750,1%,0.25W	SMA-4-750	CORNING
R73	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R74	110-1.69K-1		RESISTOR,FXD,MF,1.69K,1%,0.25W	SMA-4-1.69K	CORNING
R75	110-6.81K-1	2	RESISTOR,FXD,MF,6.81K,1%,0.25W	SMA-4-6.81K	CORNING
R76	110-48.7-1	10	RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R77	157-1K-B	2	RESISTOR,TRIM,CER,1K,10%,18T	89PR1K	BECKMAN
R78	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R79	110-3.01K-1		RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4-3.01K	CORNING
R80	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R81	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R82	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R83	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R84	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R85	110-215-1		RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
R86	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R87	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R88	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R89	110-40.2-1		RESISTOR,MF,1/4W,1%	SMA-4-40.2	CORNING
R90	110-7.15K-1		RESISTOR,FXD,MF,7.15K,1%,0.25W	SMA-4-7.15K	CORNING
R91	110-1M-1		RESISTOR,FXD,MF,1M,1%,0.25W	SMA-4-1M	CORNING
R92	110-348-1	1	RESISTOR,FXD,MF,348,1%,0.25W	SMA-4-348	CORNING
R93	110-7.15K-1		RESISTOR,FXD,MF,7.15K,1%,0.25W	SMA-4-7.15K	CORNING
R94	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R95	110-215-1		RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
R96	110-7.87K-1		RESISTOR,FXD,MF,7.87K,1%,0.25W	SMA-4-7.87K	CORNING
R97	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R98	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R99	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R100	110-750-1		RESISTOR,FXD,MF,750,1%,0.25W	SMA-4-750	CORNING
R101	110-681-1		RESISTOR,FXD,MF,681,1%,0.25W	SMA-4-681	CORNING
R102	110-750-1		RESISTOR,FXD,MF,750,1%,0.25W	SMA-4-750	CORNING
R103	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R104	110-1.69K-1		RESISTOR,FXD,MF,1.69K,1%,0.25W	SMA-4-1.69K	CORNING
R105	110-6.81K-1		RESISTOR,FXD,MF,6.81K,1%,0.25W	SMA-4-6.81K	CORNING
R106	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R107	157-1K-B		RESISTOR,TRIM,CER,1K,10%,18T	89PR1K	BECKMAN
R108	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R109	110-3.01K-1		RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4-3.01K	CORNING
R110	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING

Table 5-17. A15 ALC PCB (6700-D-31715-3; Rev. K) Parts List (Page 6 of 8)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R111	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R112	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R113	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R114	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R115	110-4.75K-1		RESISTOR,FXD,MF,4.75K,1%,0.25W	SMA-4-4.75K	CORNING
R116	110-4.75K-1		RESISTOR,FXD,MF,4.75K,1%,0.25W	SMA-4-4.75K	CORNING
R117	157-20K-B	1	RESISTOR,TRIM,CER,20K,10%,18T	68XR-20K	BECKMAN
R118	110-40.2K-1	2	RESISTOR,FXD,MF,40.2K,1%,0.25W	SMA-4-40.2K	CORNING
R119	110-40.2K-1		RESISTOR,FXD,MF,40.2K,1%,0.25W	SMA-4-40.2K	CORNING
R120	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R121	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R122	110-100K-1		RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4-100K	CORNING
R123	110-100K-1		RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4-100K	CORNING
R124			NOT ASSIGNED		
R125	113-4.87K-0.1	1	RESISTOR,FXD,MF,4.87K,0.1%	RN55C,4.87K,.1%	VERMONT PRECISION
R126	113-2K-0.1	1	RESISTOR,FXD,MF,2K,0.1%	RN55C,2K,.1%	VERMONT PRECISION
R127	113-10K-0.1	1	RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R128	113-24.9K-0.1		RESISTOR,FXD,MF,24.9K,0.1%,0.1W	RN55C,24.9K,.1%	VERMONT PRECISION
R129	110-4.22K-1	1	RESISTOR,FXD,MF,4.22K,1%,0.25W	SMA-4-4.22K	CORNING
R130	110-4.02K-1		RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4-4.02K	CORNING
R131	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R132	110-2.74K-1	1	RESISTOR,FXD,MF,2.74K,1%,0.25W	SMA-4-2.74K	CORNING
R133	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R134	110-1.47K-1	1	RESISTOR,FXD,MF,1.47K,1%,0.25W	SMA-4-1.47K	CORNING
R135	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R136	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R137	110-787-1	1	RESISTOR,FXD,MF,787,1%,0.25W	SMA-4-787	CORNING
R138	110-1.62K-1	4	RESISTOR,FXD,MF,1.62K,1%,0.25W	SMA-4-1.62K	CORNING
R139	110-1.62K-1		RESISTOR,FXD,MF,1.62K,1%,0.25W	SMA-4-1.62K	CORNING
R140	110-332-1	2	RESISTOR,FXD,MF,332,1%,0.25W	SMA-4-332	CORNING
R141	110-33.2-1	1	RESISTOR,FXD,MF,33.2,1%,0.25W	SMA-4-33.2	CORNING
R142	110-562-1	2	RESISTOR,FXD,MF,562,1%,0.25W	SMA-4-562	CORNING
R143	110-562-1		RESISTOR,FXD,MF,562,1%,0.25W	SMA-4-562	CORNING
R144	110-1.62K-1		RESISTOR,FXD,MF,1.62K,1%,0.25W	SMA-4-1.62K	CORNING
R145	110-1.62K-1		RESISTOR,FXD,MF,1.62K,1%,0.25W	SMA-4-1.62K	CORNING
R146	110-332-1		RESISTOR,FXD,MF,332,1%,0.25W	SMA-4-332	CORNING
R147			NOT ASSIGNED		
R148			NOT ASSIGNED		
R149	110-5.11-1	1	RESISTOR,FXD,MF,5.11,1%,0.25W	RN55D,5.11,1%	VERMONT PRECISION
R150	110-2.49K-1	4	RESISTOR,FXD,MF,2.49K,1%,0.25W	SMA-4-2.49K	CORNING
R151	110-2.49K-1		RESISTOR,FXD,MF,2.49K,1%,0.25W	SMA-4-2.49K	CORNING
R152	113-6.19K-0.1	2	RESISTOR,FIX,MF,6.19K,0.1%	RN55C,6.19K,.1%	VERMONT PRECISION
R153	110-4.87K-0.1		RESISTOR,FXD,MF,4.87K,1%,0.25W	RN55C,4.87K,.1%	VERMONT PRECISION
R154	113-6.19K-0.1		RESISTOR,FIX,MF,6.19K,0.1%	RN55C,6.19,.1%	VERMONT PRECISION
R155	113-4.87K-0.1		RESISTOR,FXD,MF,4.87K,0.1%	RN55C,4.87,.1%	VERMONT PRECISION
R156	109-22K-5	1	RESISTOR,FXD,MF,22K,5%,0.125W	SMA-4-22K	CORNING
R157	110-9.53K-1	1	RESISTOR,FXD,MF,9.53K,1%,0.25W	SMA-4-9.53K	CORNING
R158	158-2	1	RESISTOR,TRIM,CER,1K,10%,1T	A2B102	ALLEN BRADLEY
R159	110-2.49K-1		RESISTOR,FXD,MF,2.49K,1%,0.25W	SMA-4-2.49K	CORNING
R160	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R161	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R162	110-4.99K-1		RESISTOR,FXD,MF,4.99K,1%,0.25W	SMA-4-4.99K	CORNING
R163	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R164	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R165	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R166	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R167	110-4.02K-1		RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4-4.02K	CORNING
R168	110-16.2K-1	1	RESISTOR,FXD,MF,16.2K,1%,0.25W	SMA-4-16.2K	CORNING
R169	110-3.32K-1	1	RESISTOR,FXD,MF,3.32K,1%,0.25W	SMA-4-3.32K	CORNING
R170	110-8.06K-1	1	RESISTOR,FXD,MF,8.06K,1%,0.25W	SMA-4-8.06K	CORNING

Table 5-17. A15 ALC PCB (6700-D-31715-3; Rev. K) Parts List (Page 7 of 8)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R171	110-4.02K-1		RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4-4.02K	CORNING
R172	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R173	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R174	110-5.11K-1	2	RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-5.11K	CORNING
R175	110-100K-1		RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4-100K	CORNING
R176	110-100K-1		RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4-100K	CORNING
R177	110-31.6K-1	1	RESISTOR,FXD,MF,31.6K,1%,0.25W	SMA-4-31.6K	CORNING
R178	110-14.7K-1		RESISTOR,FXD,MF,14.7K,1%,0.25W	SMA-4-14.7K	CORNING
R179	110-274-1	1	RESISTOR,FXD,MF,274,1%,0.25W	SMA-4-274	CORNING
R180	110-9.09K-1	2	RESISTOR,FXD,MF,9.09K,1%,0.25W	SMA-4-9.09K	CORNING
R181	110-750-1		RESISTOR,FXD,MF,750,1%,0.25W	SMA-4-750	CORNING
R182	110-750-1		RESISTOR,FXD,MF,750,1%,0.25W	SMA-4-750	CORNING
R183	110-9.09K-1		RESISTOR,FXD,MF,9.09K,1%,0.25W	SMA-4-9.09K	CORNING
R184	110-536-1	1	RESISTOR,FXD,MF,536,1%,0.25W	SMA-4-536	CORNING
R185	110-1.69K-1		RESISTOR,FXD,MF,1.69K,1%,0.25W	SMA-4-1.69K	CORNING
R186	110-7.50-1	1	RESISTOR,FXD,MF,7.50,1%,0.25W	SMA-4-7.50	CORNING
R187	110-100K-1		RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4-100K	CORNING
R188	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R189	110-18.7K-1	1	RESISTOR,FXD,MF,18.7K,1%,0.25W	SMA-4-18.7K	CORNING
R190	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R191	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R192	110-3.16K-1		RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4-3.16K	CORNING
R193	110-7.87K-1		RESISTOR,FXD,MF,7.87K,1%,0.25W	SMA-4-7.87K	CORNING
R194	110-12.1K-1	1	RESISTOR,FXD,MF,12.1K,1%,0.25W	SMA-4-12.1K	CORNING
R195	110-5.11K-1		RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-11K	CORNING
R196	110-13.3K-1	1	RESISTOR,FXD,MF,13.3K,1%,0.25W	SMA-4-13.3K	CORNING
R197	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R198	110-953-1		RESISTOR,FXD,MF,953,1%,0.25W	SMA-4-953	CORNING
R199	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R200	109-910-5	1	RESISTOR,FXD,MF,910,5%,0.125W	SMA-4-910	CORNING
R201	109-1.8K-5	1	RESISTOR,FXD,MF,1.8K,5%,0.12W	C3 1.8K 5%	CORNING
R202	109-750-5	1	RESISTOR,FXD,MF,750,5%,0.12W	C3 750OHM 5%	CORNING
R203	110-61.9-1	1	RESISTOR,FXD,MF,61.9,1%,0.25W	SMA-4-61.9	CORNING
TP1-TP13	551-608	1	CONNECTOR SOCKET,1 ROW, 0.150"	66947-013	BERG
TP14	702-17	1	TERMINAL,EYELET	20-2137D	VEROSPEED
U1	54-530	1	IC,CMOS,74HCT244,OCTAL	SN74HC244N	TEXAS INSTRUMENTS
U2	54-528	1	IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INSTRUMENTS
U3	54-523	3	IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U4	54-523		IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U5	54-523		IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U6	54-132	4	IC,OP AMP,TL074CN3,QUAD	TL074CN3	TEXAS INSTRUMENTS
U7	50-DG200BA	4	IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U8	54-132		IC,OP AMP,TL074CN3,QUAD	TL074CN3	TEXAS INSTRUMENTS
U9	54-505	2	IC,D/A,7528,8BIT,BIN.,400nSEC	AD7528JN	ANALOG DEVICES
U10			NOT ASSIGNED		
U11	54-132		IC,OP AMP,TL074CN3,QUAD	TL074CN3	TEXAS INSTRUMENTS
U12	54-537	1	IC,ALS TTL,74ALS38,QUADRUPLE	SN74ALS38N	TEXAS INSTRUMENTS
U13	50-DG200BA		IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U14	54-132		IC,OP AMP,TL074CN3,QUAD	TL074CN3	TEXAS INSTRUMENTS
U15	54-336	1	IC,CMOS,509,*,4 CHANNEL DIFF	DG509 ACJ	SILICONIX
U16	54-560	1	IC,ANALOG MULT,MPY634KP,10 MHZ	MPY634KP	BURR-BROWN
U17	54-501	1	IC,D/A,MP1232,12 BIT	MP1232HN	MICROPOWER
U18	54-53	1	IC,OP AMP,TL072,DUAL	TL072CP3	TEXAS INSTRUMENTS
U19	54-505		IC,D/A,7528,8BIT,BIN.,400nSEC	AD7528JN	ANALOG DEVICES
U20	50-DG200BA		IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U21	54-503	11	IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U22	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U24	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U25	50-27	3	IC,OP AMP,OP37,SINGLE,6M,50V	OP-37EP	PRECISION MONOLITHIC
U26	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY

Table 5-17. A15 ALC PCB (6700-D-31715-3; Rev. K) Parts List (Page 8 of 8)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
U27	50-27		IC,OP AMP,OP37,SINGLE,6M,50V	OP-37EP	PRECISION MONOLITHIC
U28	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U29	50-34	1	IC,OP AMP,LT1056ACH,SINGLE	LT1056ACH	LINEAR TECHNOLOGY
U30			NOT ASSIGNED		
U31	50-DG200BA		IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U32	54-24	2	IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U33	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U34	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U35	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U36	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U37	54-129	1	IC,D/A,AD7524,8 BITS	AD7524JN	ANALOG DEVICES
U38	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U39	54-24		IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U40	50-33		IC,OP AMP,LT1056,SINGLE	LT1056CN8	LINEAR TECHNOLOGY
U41	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U42	54-30	3	IC,COMPARATOR,LM311,SINGLE	LM311N	RCA
U43	54-30		IC,COMPARATOR,LM311,SINGLE	LM311N	RCA
U44	54-30		IC,COMPARATOR,LM311,SINGLE	LM311N	RCA
U45	20-46	1	TRANSISTOR,NPN,5 HIGH CURRENT	CA3183E	RCA
U46	50-9	1	IC,OP AMP,LF356,SINGLE	LF356N	NSC
VR1	54-502	1	IC,VOLTAGE REG,LT1031,10V	LT1031CCH	LINEAR TECHNOLOGY
W1	551-577	2	CONNECTOR SOCKET, GOLD	65474-001	BERG
W2	551-577		CONNECTOR SOCKET, GOLD	65474-001	BERG

Table 5-18. A16 FM PCB (6700-D-31716-3; Rev. G) Parts List (Page 1 of 5)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	250-42	22	CAPACITOR,FXD,TANT,10UF,10%,25V	96D106X9025KE3	SPRAGUE
C2	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C3	220-51	1	CAPACITOR,FXD,MICA,51PF,5%,500V	CD15ED510J03	CORNELL DUBILIER
C4	230-39	4	CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C5	230-49	1	CAPACITOR,FXD,0.022UF,100V	200-100-X7R-223K	CENTRE
C6	230-41	1	CAPACITOR,FXD,CER,1.0UF,20%,10V	400-100-601-105M	CENTRE
C7	230-37	3	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C8	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C9	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C10	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C11	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C12	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C13	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C14	250-102	2	CAPACITOR,FXD,PCAR,0.01UF,1%,5V	RV2A103F	IMB
C15	250-102		CAPACITOR,FXD,PCAR,0.01UF,1%,5V	RV2A103F	IMB
C16	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C17	227-12	1	CAPACITOR,FXD,PEST,0.1055UF,2%	ZV2B10052G	IMB
C18	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C19	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C20	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C21	220-820	1	CAPACITOR,FXD,MICA,820PF,5%,30V	CD15FC821J03	CORNELL DUBILIER
C22	223-10	2	CAPACITOR,FXD,MICA,10PF,5%,500V	CD10CD100JO3M	CORNELL DUBILIER
C23	223-10		CAPACITOR,FXD,MICA,10PF,5%,500V	CD10CD100JO3M	CORNELL DUBILIER
C24	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C25	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C26	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C27	230-39		CAPACITOR,FXD,CER,0.1UF,10%,50V	8121-050-X7RO-104K	ERIE
C28	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C29	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C30			NOT ASSIGNED		
C31			NOT ASSIGNED		
C32	220-150	1	CAPACITOR,FXD,MICA,150PF,5%,50V	DM15F151J	ARCO/SOSHIN
C33	250-77	1	CAPACITOR,FXD,CER,0.01UF,10%,1V	CK05BX103K	SPRAGUE
C34	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C35	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C36	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C37	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C38	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C39	250-39	1	CAPACITOR,FXD,TANT,4.7UF,20%,3V	196D475X0035JE3	SPRAGUE
C40	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C41	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C42	220-24	1	CAPACITOR,FXD,MICA,24PF,5%,500V	CD15ED240JO3	CORNELL DUBILIER
C43	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C44	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C45-C57			NOT ASSIGNED		
C58	223-600	1	CAPACITOR,FXD,CER,1500PF,10%	200-100-X7R-152K	CENTRE ENG
CR1	10-FD300	13	DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR2	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR3	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR4	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR5	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR6	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR7	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR8	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR9	10-11	3	DIODE,ZENER,1N750A,4.7V,5%	IN750A	FSC
CR10	10-11		DIODE,ZENER,1N750A,4.7V,5%	IN750A	FSC
CR11			NOT ASSIGNED		
CR12	10-4	1	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR13	10-1N4446	20	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR14	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL

Table 5-16. A16 FM PCB (6700-D-31716-3; Rev. G) Parts List (Page 2 of 5)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
CR15	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR16	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR17	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR18	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR19	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR20	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR21	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR22	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR23	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR24	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR25	10-1N754A	1	DIODE,ZENER,1N754A,6.8V,5%	1N754A	FSC
CR26	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR27	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR28	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR29	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR30	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR31	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR32	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR33	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR34	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR35	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR36	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR37	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR38	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR39	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR40	10-11		DIODE,ZENER,1N750A,4.7V,5%	IN750A	FSC
R1	110-604-1	2	RESISTOR,FXD,MF,604,1%,0.25	SMA-4-604	CORNING
R2	110-1K-1	11	RESISTOR,FXD,MF,1K,1%,0.25	SMA-4-1K	CORNING
R3	110-1.96K-1	7	RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R4	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R5	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R6	110-604-1		RESISTOR,FXD,MF,604,1%,0.25W	SMA-4-604	CORNING
R7	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R8	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R9	110-10K-1	21	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R10	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R11	110-5.36K-1	1	RESISTOR,FXD,MF,5.36K,1%,0.25W	SMA-4-5.36K	CORNING
R12	110-100-1	3	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R13	110-51.1-1	18	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R14	110-11K-1	2	RESISTOR,FXD,MF,11K,1%,0.25W	SMA-4-11K	CORNING
R15	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R16	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R17	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R18	110-3.16K-1	2	RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4-3.16K	CORNING
R19	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R20	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R21	110-3.16K-1		RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4-3.16K	CORNING
R22	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R23	110-1.87K-1	2	RESISTOR,FXD,MF,1.87K,1%,0.25W	SMA-4-1.87K	CORNING
R24	110-12.1K-1	1	RESISTOR,FXD,MF,12.1K,1%,0.25W	SMA-4-12.1K	CORNING
R25	110-1K-1		RESISTRO,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R26	110-13K-1	1	RESISTOR,FXD,MF,13K,1%,0.25W	SMA-4-13K	CORNING
R27	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R28	110-80.6K-1	1	RESISTOR,FXD,MF,80.6K,1%,0.25W	SMA-4-80.6K	CORNING
R29	110-7.5K-1	1	RESISTOR,FXD,MF,7.5K,1%,0.25W	SMA-4-7.5K	CORNING
R30	110-316-1	1	RESISTOR,FXD,MF,316,1%,0.25W	SMA-4-316	CORNING
R31	110-2.21K-1	1	RESISTOR,FXD,MF,2.21K,1%,0.25W	SMA-4-2.21K	CORNING
R32	110-100K-1	2	RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4-100K	CORNING
R33	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R34	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING

Table 5-18. A16 FM PCB (6700-D-31716-3; Rev. G) Parts List (Page 3 of 5)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R35	110-5.9K-1	2	RESISTOR,FXD,MF,5.9K,1%,0.25W	SMA-4-5.9K	CORNING
R36			NOT ASSIGNED		
R37	110-2.26K-1	1	RESISTOR,FXD,MF,2.26K,1%,0.25W	SMA-4-2.26K	CORNING
R38	110-95.3K-1	1	RESISTOR,FXD,MF,95.3K,1%,0.25W	SMA-4-95.3K	CORNING
R39	110-3.83K-1	3	RESISTOR,FXD,MF,3.83K,1%,0.25W	SMA-4-3.83K	CORNING
R40	110-100K-1		RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4-100K	CORNING
R41	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R42	110-28.7K-1	2	RESISTOR,FXD,MF,28.7K,1%,0.25W	SMA-4-28.7K	CORNING
R43	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R44	110-5.9K-1		RESISTOR,FXD,MF,5.9K,1%,0.25W	SMA-4-5.9K	CORNING
R45	110-28.7K-1		RESISTOR,FXD,MF,28.7K,1%,0.25W	SMA-4-28.7K	CORNING
R46	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R47	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R48	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R49	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R50	110-8.06K-1	1	RESISTOR,FXD,MF,8.06K,1%,0.25W	SMA-4-8.06K	CORNING
R51	110-1.87K-1		RESISTOR,FXD,MF,1.87K,1%,0.25W	SMA-4-1.87K	CORNING
R52	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R53	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R54	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R55	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R56	110-18.2K-1	2	RESISTOR,FXD,MF,18.2K,1%,0.25W	SMA-4-18.2K	CORNING
R57	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R58	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R59	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R60	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R61	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R62	110-31.6-1	2	RESISTOR,FXD,MF,31.6,1%,0.25W	SMA-4-31.6	CORNING
R63	110-31.6-1		RESISTOR,FXD,MF,31.6,1%,0.25W	SMA-4-31.6	CORNING
R64	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R65	110-12.4K-1	1	RESISTOR,FXD,MF,12.4K,1%,0.25W	SMA-4-12.4K	CORNING
R66	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R67	110-3.83K-1		RESISTOR,FXD,MF,3.83K,1%,0.25W	SMA-4-3.83K	CORNING
R68	110-30.1K-1	1	RESISTOR,FXD,MF,30.1K,1%,0.25W	SMA-4-30.1K	CORNING
R69	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R70	110-8.45K-1	1	RESISTOR,FXD,MF,8.45K,1%,0.25W	SMA-4-8.45K	CORNING
R71	110-3.83K-1		RESISTOR,FXD,MF,3.83K,1%,0.25W	SMA-4-3.83K	CORNING
R72	110-4.02K-1	1	RESISTOR,FXD,MF,4.02K,1%,0.25W	SMA-4-4.02K	CORNING
R73	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R74	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R75	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING

Table 5-16. A16 FM PCB (6700-D-31716-3; Rev. G) Parts List (Page 4 of 5)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R76	110-44.2K-1	1	RESISTOR,FXD,MF,44.2K,1%,0.25W	SMA-4-44.2K	CORNING
R77	110-12.7K-1	1	RESISTOR,FXD,MF,12.7K,1%,0.25W	SMA-4-12.7K	CORNING
R78	110-40.2K-1	1	RESISTOR,FXD,MF,40.2K,1%,0.25W	SMA-4-40.2K	CORNING
R79	110-21.5K-1	1	RESISTOR,FXD,MF,21.5K,1%,0.25W	SMA-4-21.5K	CORNING
R80	110-2.15K-1		RESITOR,FXD,MF,2.15K,1%,0.25W	SMA-4-2.15K	CORNING
R81	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R82	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R83	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R84	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R85	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R86	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R87	110-196K-1	4	RESISTOR,FXD,MF,196K,1%,0.25W	SMA-4-196K	CORNING
R88	110-196K-1		RESISTOR,FXD,MF,196K,1%,0.25W	SMA-4-196K	CORNING
R89	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R90	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R91	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R92	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R93	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R94	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R95	110-196K-1		RESISTOR,FXD,MF,196K,1%,0.25W	SMA-4-196K	CORNING
R96	110-196K-1		RESISTOR,FXD,MF,196K,1%,0.25W	SMA-4-196K	CORNING
R97	110-4.64K-1	1	RESISTOR,FXD,MF,4.64K,1%,0.25W	SMA-4-4.64K	CORNING
R98	110-178K-1	1	RESISTOR,FXD,MF,178K,1%,0.25W	SMA-4-178K	CORNING
R99	110-14.7K-1	1	RESISTOR,FXD,MF,14.7K,1%,0.25W	SMA-4-14.7K	CORNING
R100	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R101	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R102	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R103	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R104	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R105	110-11K-1		RESISTOR,FXD,MF,11K,1%,0.25W	SMA-4-11K	CORNING
R106	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R107	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R108	113-665-0.5	3	RESISTOR,FXD,MF,665,0.5%,0.125W	RN55C,665,.5%	VERMONT PRECISION
R109	113-665-0.5		RESISTOR,FXD,MF,665,0.5%,0.125W	RN55C,665,.5%	VERMONT PRECISION
R110	110-825-1	1	RESISTOR,FXD,MF,825,1%,0.25W	SMA-4-825	CORNING
R111	113-332-0.5	1	RESISTOR,FXD,MF,332,0.5%,0.125W	RN55C,1.33K,.5%	VERMONT PRECISION
R112	110-4.22K-1	1	RESISTOR,FXD,MF,4.22K,1%,0.25W	SMA-4-4.22K	CORNING
R113	113-1.33K-0.5	3	RESISTOR,FXD,MF,1.33K,0.5%	RN55C,1.33K,.5%	VERMONT PRECISION
R114	113-1.33K-0.5		RESISTOR,FXD,MF,1.33K,0.5%	RN55C,1.33K,.5%	VERMONT PRECISION
R115	110-511-1	3	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R116	113-665-0.5		RESISTOR,FXD,MF,665,0.5%,0.125W	RN55C,665,.5%	VERMONT PRECISION
R117	110-9.53K-1	1	RESISTOR,FXD,MF,9.53K,1%,0.25W	SMA-4-9.53	CORNING
R118	110-511-1		RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R119	110-41.2K-1	1	RESISTOR,FXD,MF,41.2K,1%,0.25W	SMA-4-41.2K	CORNING
R120	113-2.64K-0.5	2	RESISTOR,FXD,MF,2.64K,0.5%	RN55C,2.64K,.5%	VERMONT PRECISION
R121	113-2.64K-0.5		RESISTOR,FXD,MF,2.64K,0.5%	RN55C,2.64K,.5%	VERMONT PRECISION
R122	110-511-1		RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R123	113-1.33K-0.5		RESISTOR,FXD,MF,1.33K,0.5%	RN55C,1.33K,.5%	VERMONT PRECISION
R124	110-19.6K-1	1	RESISTOR,FXD,MF,19.6K,1%,0.25W	SMA-4-19.6K	CORNING
TP1-TP4	551-539	3	CONNECTOR,SOCKET,1 ROW-0.150"	66947-004	BERG
TP5-TP8	551-539		CONNECTOR,SOCKET,1 ROW-0.150"	66947-004	BERG
TP9-TP12	551-539		CONNECTOR,SOCKET,1 ROW-0.150"	66947-004	BERG
U1	50-30	5	IC,OP AMP,5532A,DUAL,300K OHM	NE5532N	SIGNETICS
U2	50-22	1	IC,OP AMP,NE5534,SINGLE	NE5534FE	SIGNETICS
U3	50-DG200BA	4	IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U4	50-9	8	IC,OP AMP,LF356,SINGLE	LF356N	NSC
U5	54-528	1	IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INSTRUMENTS
U6	54-523	3	IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U7			NOT ASSIGNED		
U8	54-510	1	IC,CMOS,74HC04,HEX	SN74HC04N	TEXAS INSTRUMENTS

Table 5-18. A16 FM PCB (6700-D-31716-3; Rev. G) Parts List (Page 5 of 5)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
U9	54-523		IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U10	54-334	1	IC,D/A,12 BIT	DAC 1208 LCD	NATIONAL
U11	50-9		IC,OP AMP,LF356,SINGLE	LF356N	NSC
U12	54-24	2	IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U13	50-30		IC,OP AMP,5532A,DUAL,300K OHM	NE5532N	SIGNETICS
U14	50-DG200BA		IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U15	50-7	2	IC,OP AMP,LF357,SINGLE	LF357N	NSC
U16	50-9		IC,OP AMP,LF356,SINGLE	LF356N	NSC
U17	50-7		IC,OP AMP,LF357,SINGLE	LF357N	NSC
U18	54-24		IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U19	54-53	2	IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS
U20	54-505	1	IC,D/A,7528,8BIT,BIN.,400nSEC	AD7528JN	ANALOG DEVICES
U21	50-9		IC,OP AMP,LF356,SINGLE	LF356N	NSC
U22	50-DG200BA		IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U23	50-9		IC,OP AMP,LF356,SINGLE	LF356N	NSC
U24	50-9		IC,OP AMP,LF356,SINGLE	LF356N	NSC
U25	50-9		IC,OP AMP,LF356,SINGLE	LF356N	NSC
U26	50-9		IC,OP AMP,LF356,SINGLE	LF356N	NSC
U27	54-53		IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS
U28	54-132	2	IC,OP AMP,TL074CN3,QUAD	TL074CN3	TEXAS INSTRUMENTS
U29	50-DG200BA		IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U30	54-132		IC,OP AMP,TL074CN3,QUAD	TL074CN3	TEXAS INSTRUMENTS
W1	800-176	4	WIRE,JUMPER,0.500X0.175	.500 X .175 TEFLON	SQUIRES
W2	800-176		WIRE,JUMPER,0.500X0.175	.500 X .175 TEFLON	SQUIRES
W3	800-176		WIRE,JUMPER,0.500X0.175	.500 X .175 TEFLON	SQUIRES
W4	800-176		WIRE,JUMPER,0.500X0.175	.500 X .175 TEFLON	SQUIRES
W5	800-140	2	WIRE,JUMPER,0.400X0.125	J0.400 X 0.125 T22	SQUIRES
W6	800-140		WIRE,JUMPER,0.400X0.125	J0.400 X 0.125 T22	SQUIRES

Table 5-19. A17 Analog Instruction PCB (6700-D-31717-3; Rev. H) Parts List (Page 1 of 5)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	230-37	13	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C2	250-42	36	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C3	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C4	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C5	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C6	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C7	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C8	227-51	1	CAPACITOR,FXD,PEST,0.0022UF,10V	ZA2B222K	IMB
C9	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C10	250-19	1	CAPACITOR,FXD,TANT,1UF,10%,35V	196D105X9035HE3	SPRAGUE
C11	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C12	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C13	220-200	4	CAPACITOR,FXD,MICA,200PF,5%,50V	CD15FD201J03	CORNELL DUBILIER
C14	250-123	1	CAPACITOR,FXD,PPRO,1.0uF,10%	X363uw 1.0/10/100	TRW
C15	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C16	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C17	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C18	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C19	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C20	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C21	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C22	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C23	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C24	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C25	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C26	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C27	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C28	220-200		CAPACITOR,FXD,MICA,200PF,5%,50V	CD15FD021J03	CORNELL DUBILIER
C29	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C30	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C31	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C32	220-200		CAPACITOR,FXD,MICA,200PF,5%,50V	CD15FD201J03	CORNELL DUBILIER
C33	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C34	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C35	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C36	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C37	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C38	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C39	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C40	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C41	227-50	4	CAPACITOR,FXD,PEST,0.01UF,2%,2V	ZA2C103G	IMB
C42	227-50		CAPACITOR,FXD,PEST,0.01UF,2%,2V	ZA2C103G	IMB
C43	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C44	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C45	227-50		CAPACITOR,FXD,PEST,0.01UF,2%,2V	ZA2C103G	IMB
C46	227-50		CAPACITOR,FXD,PEST,0.01UF,2%,2V	ZA2C103G	IMB
C47	230-41	2	CAPACITOR,FXD,CER,1.0UF,20%,10V	400-100-601-105M	CENTRE
C48	220-200		CAPACITOR,FXD,MICA,200PF,5%,50V	CD15FD201J03	CORNELL DUBILIER
C49	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C50	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C51	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C52	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C53			NOT ASSIGNED		
C54	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C55	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C56	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C57	230-41		CAPACITOR,FXD,CER,1.0UF,20%,10V	400-100-601-105M	CENTRE
C58	250-39	2	CAPACITOR,FXD,TANT,4.7UF,20%,3V	196D475X0035JE3	SPRAGUE
C59	250-39		CAPACITOR,FXD,TANT,4.7UF,20%,3V	196D475X0035JE3	SPRAGUE
C60	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE

Table 5-19. A17 Analog Instruction PCB (6700-D-31717-3; Rev. H) Parts List (Page 2 of 5)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C61	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C62	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C63	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C64	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
CR1	10-FD300	11	DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR2	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR3	10-4	2	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR4	10-1N4446	2	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR5	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR6	10-1N751A	2	DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR7	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR8			NOT ASSIGNED		
CR9			NOT ASSIGNED		
CR10	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR11	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR12	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR13	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR14	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR15	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR16	10-1N757A		DIODE,ZENER,1N757A,9.1V,5%	1N757A	MOTOROLA
CR17	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR18	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR19	10-1N757A	2	DIODE,ZENER,1N757A,9.1V,5%	1N757A	MOTOROLA
L1	310-45	1	INDUCTOR,FXD,100.0UH,5%	1315-12J	AIRCO
L2	310-43	1	INDUCTOR,FXD,10.0UH,10%	1537-36	DELEVAN
Q1	20-2N3694	1	TRANSISTOR,NPN,2N3694,SI,GEN P	MPS3694-18	MOTOROLA
R1	113-10K-0.1	15	RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R2	110-100-1	20	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R3	110-49.9-1	2	RESISTOR,FXD,MF,49.9,1%,0.25W	SMA-4	CORNING
R4	110-49.9-1		RESISTOR,FXD,MF,49.9,1%,0.25W	SMA-4	CORNING
R5	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R6	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R7	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R8	110-51.1-1	9	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R9	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R10	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R11	110-90.9K-1	1	RESISTOR,FXD,MF,90.9K,1%,0.25W	SMA-4	CORNING
R12	113-10.18K-0.1	1	RESISTOR,FXD,MF,10.18K,0.1%	RN55C,10.18K,.1%	VERMONT PRECISION
R13	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R14	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R15	110-80.6K-1	1	RESISTOR,FXD,MF,80.6K,1%,0.25W	SMA-4	CORNING
R16	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R17	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R18	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R19	110-10K-1	9	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R20	110-17.8K-1	1	RESISTOR,FXD,MF,17.8K,1%,0.25W	SMA-4	CORNING
R21	110-825K-1	1	RESISTOR,FXD,MF,825K,1%,0.25W	SMA-4	CORNING
R22	110-1K-1	3	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R23	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C3	CORNING
R24	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R25	113-10K-0.1A	4	RESISTOR,FXD,MF,10K,0.1%	RN55E,10K,.1%	VERMONT PRECISION
R26	113-10K-0.1A		RESISTOR,FXD,MF,10K,0.1%	RN55E,10K,.1%	VERMONT PRECISION
R28	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R29	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R30	110-2K-1	2	RESISTOR,FXD,MF,2K,1%,0.25W	SMA-4	CORNING
R31	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R32	110-24.9-1	1	RESISTOR,MF,1/4W,1%	SMA-4	CORNING
R33	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R34	110-2K-1		RESISTOR,FXD,MF,2K,1%,0.25W	SMA-4	CORNING
R35	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING

Table 5-19. A17 Analog Instruction PCB (6700-D-31717-3; Rev. H) Parts List (Page 3 of 5)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R36	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R37	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R38	110-953-1	2	RESISTOR,FXD,MF,953,1%,0.25W	SMA-4	CORNING
R39	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R40	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R41	110-953-1		RESISTOR,FXD,MF,953,1%,0.25W	SMA-4	CORNING
R42	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R43	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R44	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R45	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R46	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R47	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R48	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R49			NOT ASSIGNED		
R50	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R51	113-30.1K-0.1	3	RESISTOR,FIXED,MF,30.1K,0.1%	CEA-T2-30.1K-0.1%	TRW
R52	113-10K-0.1A		RESISTOR,FXD,MF,10K,0.1%	RN55E,10K,.1%	VERMONT PRECISION
R53	113-30.1K-0.1		RESISTOR,FIXED,MF,30.1K,0.1%	CEA-T2-30.1K-0.1%	TRW
R54	113-10K-0.1A		RESISTOR,FXD,MF,10K,0.1%	RN55E,10K,.1%	VERMONT PRECISION
R55	113-30.1K-0.1		RESISTOR,FIXED,MF,30.1K,0.1%	CEA-T2-30.1K-0.1%	TRW
R56	110-215K-1	1	RESISTOR,FXD,MF,215K,1%,0.25W	SMA-4	CORNING
R57	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R58	110-5.11K-1	1	RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4	CORNING
R59	110-9.53K-1	1	RESISTOR,FXD,MF,9.53K,1%,0.25W	SMA-4	CORNING
R60			NOT ASSIGNED		
R61	110-20K-1	1	RESISTOR,FXD,MF,20K,1%,0.25W	SMA-4 OR C4	CORNING
R62	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R63	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R64	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING

Table 5-19. A17 Analog Instruction PCB (6700-D-31717-3; Rev. H) Parts List (Page 4 of 5)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R65	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R66	110-2.87K-1	1	RESISTOR,FXD,MF,2.87K,1%,0.25W	SMA-4	CORNING
R67	110-1M-1	4	RESISTOR,FXD,MF,1M,1%,0.25W	SMA-4	CORNING
R68	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R69	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R70			NOT ASSIGNED		
R71			NOT ASSIGNED		
R72			NOT ASSIGNED		
R73	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R74	113-1.8K-0.1	4	RESISTOR,FXD,MF,1.8K,0.1%,0.12W	RN55C,1.8K,.1%	VERMONT PRECISION
R75	113-1.8K-0.1		RESISTOR,FXD,MF,1.8K,0.1%,0.12W	RN55C,1.8K,.1%	VERMONT PRECISION
R76	113-1.8K-0.1		RESISTOR,FXD,MF,1.8K,0.1%,0.12W	RN55C,1.8K,.1%	VERMONT PRECISION
R77	113-1.8K-0.1		RESISTOR,FXD,MF,1.8K,0.1%,0.12W	RN55C,1.8K,.1%	VERMONT PRECISION
R78			NOT ASSIGNED		
R79	110-1M-1		RESISTOR,FXD,MF,1M,1%,0.25W	SMA-4	CORNING
R80	113-1K-0.1	2	RESISTOR,FXD,MF,1K,0.1%,0.125W	RN55C,1K,.1%	VERMONT PRECISION
R81	110-110-1	2	RESISTOR,FXD,MF,110,1%,0.25W	SMA-4 OR C4	CORNING
R82	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R83	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R84	110-1M-1		RESISTOR,FXD,MF,1M,1%,0.25W	SMA-4	CORNING
R85	113-1K-0.1		RESISTOR,FXD,MF,1K,0.1%,0.125W	RN55C,1K,.1%	VERMONT PRECISION
R86	110-110-1		RESISTOR,FXD,MF,110,1%,0.25W	SMA-4 OR C4	CORNING
R87	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R88	110-33.2K-1	1	RESISTOR,FXD,MF,33.2K,1%,0.25W	SMA-4	CORNING
R89	110-1.69K-1	2	RESISTOR,FXD,MF,1.69K,1%,0.25W	SMA-4	CORNING
R90	110-1.69K-1		RESISTOR,FXD,MF,1.69K,1%,0.25W	SMA-4	CORNING
R91	110-1M-1		RESISTOR,FXD,MF,1M,1%,0.25W	SMA-4	CORNING
R92	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R93	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4 OR C4	CORNING
R94	113-1M-0.1	6	RESISTOR,FXD,MF,1M,0.1%,0.25W	RN55C,1M,.1%	VERMONT PRECISION
R95	113-1M-0.1		RESISTOR,FXD,MF,1M,0.1%,0.25W	RN55C,1M,.1%	VERMONT PRECISION
R96	113-1M-0.1		RESISTOR,FXD,MF,1M,0.1%,0.25W	RN55C,1M,.1%	VERMONT PRECISION
R97	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R98	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R99	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4 OR C4	CORNING
R100	113-1M-0.1		RESISTOR,FXD,MF,1M,0.1%,0.25W	RN55C,1M,.1%	VERMONT PRECISION
R101	113-1M-0.1		RESISTOR,FXD,MF,1M,0.1%,0.25W	RN55C,1M,.1%	VERMONT PRECISION
R102	113-1M-0.1		RESISTOR,FXD,MF,1M,0.1%,0.25W	RN55C,1M,.1%	VERMONT PRECISION
R103	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R104			NOT ASSIGNED		
R105			NOT ASSIGNED		
R106			NOT ASSIGNED		
R107			NOT ASSIGNED		
R108	113-19.6K-0.1	2	RESISTOR,FXD,MF,19.6K,0.1%,0.2W	RN55C,19.6K,.1%	VERMONT PRECISION
R109	113-19.6K-0.1		RESISTOR,FXD,MF,19.6K,0.1%,0.2W	RN55C,19.6K,.1%	VERMONT PRECISION
R110	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
R111	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125W	RN55C,10K,.1%	VERMONT PRECISION
RN1	123-6	1	RESISTOR,NETWORK,MF,7X10K,2%	4308R-101-103	BOURNS
TP1-TP13	551-608	1	CONNECTOR SOCKET,1 ROW, 0.150"	66947-013	BERG
U1	54-520	2	IC,CMOS,74HC273,OCTAL D-TYPE	SN74HC273N	TEXAS INSTRUMENTS
U2	54-522	1	IC,CMOS,74HC373,OCTAL 3-STATE	SN74HC373N	TEXAS INSTRUMENTS
U3	54-459	1	IC,A/D,574,12 BIT,BINARY,24uSEC	AD574AJD	ANALOG DEVICES
U4	54-526	2	IC,74HCT04,HEX INVERTERS	CE74HCT04E	RCA
U5	54-524	2	IC,CMOS,74HCT00,QUAD 2-INPUT	MC74HCT00N	MOTOROLA
U6	54-356	1	IC,TTL,74LS136,QUAD,2 INPUT	SN74LS136N	TEXAS INSTRUMENTS
U7	54-458	3	IC,ANALOG SWITCH,DG 508,8	DG508CJ	SILICONIX
U8	54-523	3	IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U9	54-458		IC,ANALOG SWITCH,DG 508,8	DG508CJ	SILICONIX
U10	54-204	1	IC,OP AMP,LF398,SINGLE	LF395N	NSC
U11	54-523		IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS

Table 5-19. A17 Analog Instruction PCB (6700-D-31717-3; Rev. H) Parts List (Page 5 of 5)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
U12	54-526		IC,74HCT04,HEX INVERTERS	CE74HCT04E	RCA
U13	54-458		IC,ANALOG SWITCH,DG 508,8	DG508CJ	SILICONIX
U14	54-528	2	IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INSTRUMENTS
U15	50-DG200BA	3	IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U16	54-520		IC,CMOS,74HC273,OCTAL D-TYPE	SN74HC273N	TEXAS INSTRUMENTS
U17	54-528		IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INSTRUMENTS
U18	54-334	2	IC,D/A,12 BIT	DAC 1208 LCD	NATIONAL
U19	54-53	8	IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS
U20	54-24	5	IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U21	54-503	7	IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U22	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U23	54-524		IC,CMOS,74HCT00,QUAD 2-INPUT	MC74HCT00N	MOTOROLA
U24	54-334		IC,D/A,12 BIT	DAC 1208 LCD	NATIONAL
U25	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U26	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U27	54-30	1	IC,COMPARATOR,LM311,SINGLE	LM311N	RCA
U28	54-502	2	IC,VOLTAGE REG,LT1031,10V	LT1031CCH	LINEAR TECHNOLOGY
U30	54-502		IC,VOLTAGE REG,LT1031,10V	LT1031CCH	LINEAR TECHNOLOGY
U31	54-53		IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS
U32	54-132	1	IC,OP AMP,TL074CN3,QUAD	TL074CN3	TEXAS INSTRUMENTS
U33	54-24		IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U34	54-460	2	IC,D/A,9331,16 BIT,+11,5V	MP9331-16-4	MICRO POWER
U35	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U36	50-DG200BA		IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U37	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U38	54-460		IC,D/A,9331,16 BIT,+11,5V	MP9331-16-4	MICRO POWER
U39	54-503		IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U40	54-523		IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTSTRUMENTS
U41	50-DG200BA		IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U42	54-505	1	IC,D/A,7528,8BIT,BIN.,400nSEC	AD7528JN	ANALOG DEV
U45	54-53		IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS
U46	54-24		IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U47	54-53		IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS
U48	54-53		IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS
U49	54-24		IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U50	54-24		IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U51	54-53		IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS
U52	54-53		IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS

Table 5-20. A18 YIG Driver PCB (2-8 GHz; 6700-D-31718-4; Rev. B) Parts List

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
			NOTE: THE A18 (2-8 GHz) YIG DRIVER PCB (P/N 6700-D-31718-4) INCLUDES ALL COMMON PARTS LISTED IN TABLE 5-26 PLUS THOSE LISTED BELOW:		
C2*	230-3	1	CAPACITOR,FXD,CER,1000PF,10%	DD-102	CENTRALAB
C3*	223-10	1	CAPACITOR,FXD,MICA,10PF,5%	CD10CD100JO3M	CORNELL DUBILIER
C17*	220-200	1	CAPACITOR,FXD,MICA,200PF,5%		
C24*	230-53	1	CAPACITOR,FXD,39pF,+/-5%	150-100-NPO-390J	CENTRE ENG
C27*	230-48	1	CAPACITOR,FXD,.018uF,+/-10%	200-100-X7R-183K	CENTRE ENG
C36	250-77	6	CAPACITOR,FXD,CER,0.01UF,10%	CK05BX103K	SPRAGUE
C37	220-10	1	CAPACITOR,FXD,MICA,10PF,5%		
C38	250-19	1	CAPACITOR,FXD,TANT,1UF,10%,35V	196D105X9035HE3	SPRAGUE
C41			NOT ASSIGNED		
CR28	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR30	10-STB568		DIODE,RECTIFIER,STB568,GOV,?	STB568	GENERAL ELECTRIC
CR31	10-1N755A	1	DIODE,ZENER,1N755A,7.5V,5%	1N755A	MOTOROLA
CR33	10-STB568		DIODE,RECTIFIER,STB568,GOV	STB568	GENERAL ELECTRIC
R6*	110-12.7K-1	1	RESISTOR,FXD,MF,12.7K,1%,0.25		
R8*	110-1.87K-1	1	RESISTOR,FXD,MF,1.87K,1%,0.25		
R9*	110-12.4K-1	1	RESISTOR,FXD,MF,12.4K,1%,0.25		
R40	113-10K-1	8	RESISTOR,FIXED,METAL FILM,10K		
R41	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R42	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R43	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R45*	113-105K-1	1	RESISTOR,FXD,MF,105K,1%,		
R46*	110-464K-1	1	RESISTOR,FXD,MF,464K,1%,0.25		
R52	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R53	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R54	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R55	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R56*	113-27.4K-1	1	RESISTOR,FIXED,METEL FILM,27.4K		
R73	110-15K-1	1	RESISTOR,FXD,MF,15K,1%,0.25		
R74	110-4.99K-1		RESISTOR,FXD,MF,4.99K,1%,0.25	SMA-4 OR C4	CORNING
R75	103-6.8-5	1	RESISTOR,FXD,CC,6.8,5%,1W	RC32GF6.8J	ALLEN BRADLEY
R76	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R80*	110-4.99K-1		RESISTOR,FXD,MF,4.99K,1%,0.25	SMA-4 OR C4	CORNING
R82	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R83	110-100K-1		RESISTOR,FXD,MF,100K,1%,0.25		
R84	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125		
R85*	113-4.99K-0.1	1	RESISTOR,FXD,MF,4.99K,0.1%,0.1		
R86	130-1-3		RESISTOR,FXD,WW,1,5%,3.25W	UT-2C-20	ULTEX
R89	110-4.99K-1		RESISTOR,FXD,MF,4.99K,1%,0.25	SMA-4 OR C4	CORNING
R91*			NOT ASSIGNED		
U9	50-9		IC,OP AMP,LF356,SINGLE	LF356N	NSC
U10	50-6	2	IC OP AMP,LM358,DUAL	MLM358	MOTOROLA

Table 5-21. A18 YIG Driver PCB (2-8 GHz; 6700-D-31718-9; Rev. B) Parts List

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
			NOTE: THE A18 (2-8 GHz) YIG DRIVER PCB (P/N 6700-D-31718-9) INCLUDES ALL COMMON PARTS LISTED IN TABLE 5-26 PLUS THOSE LISTED BELOW:		
C2*	230-3	1	CAPACITOR,FXD,CER,1000PF,10%	DD-102	CENTRALAB
C3*	223-10	1	CAPACITOR,FXD,MICA,10PF,5%	CD10CD100JO3M	CORNELL DUBILIER
C17*	220-200	1	CAPACITOR,FXD,MICA,200PF,5%		
C24*	230-53	1	CAPACITOR,FXD,39pF,+/-5%	150-100-NPO-390J	CENTRE ENG
C27*	230-48	1	CAPACITOR,FXD,.018uF,+/-10%	200-100-X7R-183K	CENTRE ENG
C36	250-77	6	CAPACITOR,FXD,CER,0.01UF,10%	CK05BX103K	SPRAGUE
C37	220-10	1	CAPACITOR,FXD,MICA,10PF,5%		
C38	250-19	1	CAPACITOR,FXD,TANT,1UF,10%,35V	196D105X9035HE3	SPRAGUE
C41	250-77		CAPACITOR,FXD,CER,0.01UF,10%	CK05BX103K	SPRAGUE
CR28	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR30	10-STB568		DIODE,RECTIFIER,STB568,GOV	STB568	GENERAL ELECTRIC
CR31	10-1N755A	1	DIODE,ZENER,1N755A,7.5V,5%	1N755A	MOTOROLA
CR33	10-STB568		DIODE,RECTIFIER,STB568	STB568	GENERAL ELECTRIC
R6*	110-12.7K-1	1	RESISTOR,FXD,MF, 12.7K,1%,0.25		
R8*	110-1.87K-1	1	RESISTOR,FXD,MF, 1.87K,1%,0.25		
R9*	110-12.4K-1	1	RESISTOR,FXD,MF, 12.4K,1%,0.25		
R40	113-10K-1	8	RESISTOR,FIXED,METAL FILM,10K		
R41	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R42	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R43	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R45*	113-105K-1	1	RESISTOR,FXD,MF,105K,1%,		
R46*	110-464K-1	1	RESISTOR,FXD,MF,464K,1%,0.25		
R52	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R53	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R54	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R55	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R56*	113-27.4K-1	1	RESISTOR,FIKED,METEL FILM,27.4K		
R73	110-15K-1	1	RESISTOR,FXD,MF,15K,1%,0.25		
R74	110-4.99K-1		RESISTOR,FXD,MF,4.99K,1%,0.25	SMA-4 OR C4	CORNING
R75	103-6.8-5	1	RESISTOR,FXD,CC,6.8,5%,1W	RC32GF6.8J	ALLEN BRADLEY
R76	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R80*	110-4.99K-1		RESISTOR,FXD,MF,4.99K,1%,0.25	SMA-4 OR C4	CORNING
R82	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R83	110-100K-1		RESISTOR,FXD,MF,100K,1%,0.25		
R84	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125		
R85*	113-4.99K-0.1	1	RESISTOR,FXD,MF,4.99K,0.1%,0.1		
R86	130-1-3		RESISTOR,FXD,WW,1,5%,3.25W	UT-2C-20	ULTEX
R89	110-4.99K-1		RESISTOR,FXD,MF,4.99K,1%,0.25	SMA-4 OR C4	CORNING
R91*	110-105K-1	1	RESISTOR,FXD,MF,105K,1%,0.25W		
U9	50-9		IC,OP AMP,LF356,SINGLE	LF356N	NSC
U10	50-6	2	IC,OP AMP,LM358,DUAL	MLM358	MOTOROLA

Table 5-22. A19 YIG Driver PCB (8-12.4 GHz; 6700-D-31718-5; Rev. B) Parts List

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
			NOTE: THE A19 (8-12.4 GHz) YIG DRIVER PCB (P/N 6700-D-31718-5) INCLUDES ALL COMMON PARTS LISTED IN TABLE 5-26 PLUS THOSE LISTED BELOW:		
C2*	220-680	1	CAPACITOR,FXD,MICA,680PF,5%	DM15-681J	ADI,ARCO/SOSHIN
C3*	223-10	1	CAPACITOR,FXD,MICA,10PF,5%	CD10CD100JO3M	CORNELL DUBILIER
C17*	220-390	1	CAPACITOR,FXD,MICA,390PF,5%	DM15-391T	ELMENCO
C24*	230-53	1	CAPACITOR,FXD,39pF,+/-5%	150-100-NPO-390J	CENTRE ENG
C27*	230-47	1	CAPACITOR,FXD,.01uF,+/-10%	200-100-X7R-103K	CENTRE ENG
C36			NOT ASSIGNED		
C37			NOT ASSIGNED		
C38			NOT ASSIGNED		
C41			NOT ASSIGNED		
CR28			NOT ASSIGNED		
CR30			NOT ASSIGNED		
CR31			NOT ASSIGNED		
CR33			NOT ASSIGNED		
R6*	110-12.1K-1	1	RESISTOR,FXD,MF,12.1K,1%,0.25		
R8*	110-2.74K-1	1	RESISTOR,FXD,MF,2.74K,1%,0.25		
R9*	110-12.4K-1	1	RESISTOR,FXD,MF,12.4K,1%,0.25		
R40	113-10K-1	8	RESISTOR,FIXED,METAL FILM,10K		
R41	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R42	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R43	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R45*	113-26.1K-1	1	RESISTOR,FIXED,METAL FILM,26.1K		
R46*	110-499K-1	1	RESISTOR,FXD,MF,499K,1%,0.25		
R52	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R53	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R54	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R55	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R56*	113-34.8K-1	1	RESISTOR,FIXED,METAL FILM,34.8K		
R73			NOT ASSIGNED		
R74			NOT ASSIGNED		
R75			NOT ASSIGNED		
R76			NOT ASSIGNED		
R80*	110-4.99K-1		RESISTOR,FXD,MF,4.99K,1%,0.25	SMA-4 OR C4	CORNING
R82			NOT ASSIGNED		
R83			NOT ASSIGNED		
R84			NOT ASSIGNED		
R85*			NOT ASSIGNED		
R86			NOT ASSIGNED		
R89			NOT ASSIGNED		
R91*			NOT ASSIGNED		
U9			NOT ASSIGNED		
U10			NOT ASSIGNED		

Table 5-23. A20 YIG Driver PCB (12.4-20 GHz; 6700-D-31718-6; Rev. B) Parts List

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
			NOTE: THE A20 (12.4-20 GHz) YIG DRIVER PCB (P/N 6700-D-31718-6) INCLUDES ALL COMMON PARTS LISTED IN TABLE 5-26 PLUS THOSE LISTED BELOW:		
C2*	230-3	1	CAPACITOR,FXD,CER,1000PF,10%	DD-102	CENTRALAB
C3*	223-15	1	CAPACITOR,FXD,MICA,15PF,5%,	CM04CD150JO3	ARCO/SOSHIN
C17*	220-270	1	CAPACITOR,FXD,MICA,270PF,5%	CD15FD271J03M	CORNELL DUBILIER
C24*	230-53	1	CAPACITOR,FXD,39pF,+/-5%	150-100-NPO-390J	CENTRE ENG
C27*	230-91	1	CAPACITOR,FXD,CER,4700pF	150-100-472K	CENTRE ENG
C36			NOT ASSIGNED		
C37			NOT ASSIGNED		
C38			NOT ASSIGNED		
C41	250-77		CAPACITOR,FXD,CER,0.01UF,10%	CK05BX103K	SPRAGUE
CR28	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR30			NOT ASSIGNED		
CR31			NOT ASSIGNED		
CR33	10-STB568		DIODE,RECTIFIER,STB568,GOV	STB568	GENERAL ELECTRIC
R6*	110-12.7K-1	1	RESISTOR,FXD,MF,12.7K,1%,0.25		
R8*	110-1.87K-1	1	RESISTOR,FXD,MF,1.87K,1%,0.25		
R9*	110-8.25K-1	1	RESISTOR,FXD,MF,8.25K,1%,0.25		
R40			NOT ASSIGNED		
R41			NOT ASSIGNED		
R42			NOT ASSIGNED		
R43			NOT ASSIGNED		
R45*	113-14.3K-1	1	RESISTOR,FIXED,METAL FILM,14.3K		
R46*	110-422K-1	1	RESISTOR,FXD,MF,422K,1%,0.25		
R52			NOT ASSIGNED		
R53			NOT ASSIGNED		
R54			NOT ASSIGNED		
R55			NOT ASSIGNED		
R56*	113-17.8K-1	1	RESISTOR,FIXED,METAL FILM,17.8K		
R73			NOT ASSIGNED		
R74			NOT ASSIGNED		
R75			NOT ASSIGNED		
R76			NOT ASSIGNED		
R80*	110-2K-1	2	RESISTOR,FXD,MF,2K,1%,0.25		
R82	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R83	110-100K-1		RESISTOR,FXD,MF,100K,1%,0.25		
R84	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25		
R85*	110-2K-1		RESISTOR,FXD,MF,2K,1%,0.25		
R86	130-1-3		RESISTOR,FXD,WW,1,5%,3.25W	UT-2C-20	ULTEX
R89			NOT ASSIGNED		
R91*			NOT ASSIGNED		
U9			NOT ASSIGNED		
U10	50-6	2	IC OP AMP,LM358,DUAL	MLM358	MOTOROLA

Table 5-24. A21 YIG Driver PCB (20-26.5 GHz; 6700-D-31718-7; Rev. B) Parts List

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
			NOTE: THE A21 (20-26.5 GHz) YIG DRIVER PCB (P/N 6700-D-31718-7) INCLUDES ALL COMMON PARTS LISTED IN TABLE 5-26 PLUS THOSE LISTED BELOW:		
C2*	230-3	1	CAPACITOR,FXD,CER,1000PF,10%	DD-102	CENTRALAB
C3*	223-15	1	CAPACITOR,FXD,MICA,15PF,5%	CM04CD150JO3	ARCO/SOSHIN
C17*	220-470	1	CAPACITOR,FXD,MICA,470PF,5%		
C24*	230-71	1	CAPACITOR,FIXED,CER,68pf,5%	150-100-NPO-680J	CENTRE ENG
C27*	230-91	1	CAPACITOR,FXD,CER,4700pF	150-100-472K	CENTRE ENG
C36			NOT ASSIGNED		
C37			NOT ASSIGNED		
C38			NOT ASSIGNED		
C41			NOT ASSIGNED		
CR28			NOT ASSIGNED		
CR30			NOT ASSIGNED		
CR31			NOT ASSIGNED		
CR33			NOT ASSIGNED		
R6*	110-12.7K-1	1	RESISTOR,FXD,MF,12.7K,1%,0.25		
R8*	110-1.87K-1	1	RESISTOR,FXD,MF,1.87K,1%,0.25		
R9*	110-10.2K-1	1	RESISTOR,FXD,MF,10.2K,1%,0.25		
R40	113-10K-1	8	RESISTOR,FIXED,METAL FILM,10K		
R41	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R42	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R43	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R45*	113-15K-1	1	RESISTOR,FIXED,METAL FILM15K		
R46*	110-499K-1	1	RESISTOR,FXD,MF,499K,1%,0.25		
R52	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R53	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R54	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R55	113-10K-1		RESISTOR,FIXED,METAL FILM,10K		
R56*	113-30.9K-1	1	RESISTOR,FIXED,METAL FILM,30.9K		
R73			NOT ASSIGNED		
R74			NOT ASSIGNED		
R75			NOT ASSIGNED		
R76			NOT ASSIGNED		
R80*	110-2K-1	1	RESISTOR,FXD,MF,2K,1%,0.25		
R82			NOT ASSIGNED		
R83			NOT ASSIGNED		
R84			NOT ASSIGNED		
R85*			NOT ASSIGNED		
R86			NOT ASSIGNED		
R89			NOT ASSIGNED		
R91*			NOT ASSIGNED		
U9			NOT ASSIGNED		
U10			NOT ASSIGNED		

Table 5-25. A21 YIG Driver PCB (18-26.5 GHz; 6700-D-31718-8; Rev. B) Parts List

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
			NOTE: THE A21 (18-26.5 GHz) YIG DRIVER PCB (P/N 6700-D-31718-8) INCLUDES ALL COMMON PARTS LISTED IN TABLE 5-26 PLUS THOSE LISTED BELOW:		
C2*	230-3	1	CAPACITOR,FXD,CER,1000PF,10%	DD-102	CENTRALAB
C3*	223-15	1	CAPACITOR,FXD,MICA,15PF,5%	CM04CD150JO3	ARCO/SOSHIN
C17*	220-470	1	CAPACITOR,FXD,MICA,470PF,5%		
C24*	230-71	1	CAPACITOR,FIXED,CER,68pf,5%	150-100-NPO-680J	CENTRE ENG
C27*	230-91	1	CAPACITOR,FXD,CER,4700pF	150-100-472K	CENTRE ENG
C36					
C37					
C38					
C41					
CR28					
CR30					
CR31					
CR33					
R6*	110-12.7K-1	1	RESISTOR,FXD,MF,12.7K,1%,0.25		
R8*	110-1.87K-1	1	RESISTOR,FXD,MF,1.87K,1%,0.25		
R9*	110-10.2K-1	1	RESISTOR,FXD,MF,10.2K,1%,0.25		
R40			NOT ASSIGNED		
R41			NOT ASSIGNED		
R42			NOT ASSIGNED		
R43			NOT ASSIGNED		
R45*	113-16.2K-1	1	RESISTOR,FIXED,METAL FILM,16.2K		
R46*	110-499K-1	1	RESISTOR,FXD,MF,499K,1%,0.25		
R52			NOT ASSIGNED		
R53			NOT ASSIGNED		
R54			NOT ASSIGNED		
R55			NOT ASSIGNED		
R56*	113-33.2K-1	1	RESISTOR,FIXED,METAL FILM,33.2K		
R73					
R74					
R75					
R76					
R80*	110-2K-1	1	RESISTOR,FXD,MF,2K,1%,0.25		
R82					
R83					
R84					
R85*					
R86					
R89					
R91*					
U9					
U10					

Table 5-26. YIG Driver PCB Common Parts List (Page 1 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	227-45	2	CAPACITOR,FXD,MYLR,0.1UF,20%	230B1B104M	ELECTROCUBE
C2*			REFER TO TABLES 5-20 THRU 5-25		
C3*			REFER TO TABLES 5-20 THRU 5-25		
C4	250-42		CAPACITOR,FXD,TANT,10UF,10%	196D106X9025KE3	SPRAGUE
C5	250-42		CAPACITOR,FXD,TANT,10UF,10%	196D106X9025KE3	SPRAGUE
C6	250-42		CAPACITOR,FXD,TANT,10UF,10%	196D106X9025KE3	SPRAGUE
C7	250-42		CAPACITOR,FXD,TANT,10UF,10%	196D106X9025KE3	SPRAGUE
C8	250-42		CAPACITOR,FXD,TANT,10UF,10%	196D106X9025KE3	SPRAGUE
C9	250-42		CAPACITOR,FXD,TANT,10UF,10%	196D106X9025KE3	SPRAGUE
C10			NOT ASSIGNED		
C11			NOT ASSIGNED		
C12			NOT ASSIGNED		
C13			NOT ASSIGNED		
C14			NOT ASSIGNED		
C15	250-77		CAPACITOR,FXD,CER,0.01UF,10%	CK05BX103K	SPRAGUE
C16	250-77		CAPACITOR,FXD,CER,0.01UF,10%	CK05BX103K	SPRAGUE
C17*			REFER TO TABLES 5-20 THRU 5-25		
C18	250-41	1	CAPACITOR,FXD,TANT,6.8UF,10%	196D685X9035KE3	SPRAGUE
C19	230-37		CAPACITOR,FXD,CER,0.1UF,20%	RPE122104M100V	MURATA/ERIE
C20	250-42	9	CAPACITOR,FXD,TANT,10UF,10%	196D106X9025KE3	SPRAGUE
C21	250-42		CAPACITOR,FXD,TANT,10UF,10%	196D106X9025KE3	SPRAGUE
C22	227-45		CAPACITOR,FXD,MYLR,0.1UF,20%	230B1B104M	ELECTROCUBE
C23	220-560	1	CAPACITOR,FXD,MICA,560PF,5%	DM15F561J300	ARCO
C24*			REFER TO TABLES 5-20 THRU 5-25		
C25	220-130	1	CAPACITOR,FXD,MICA,130PF,5%	CD15FD131JO3	CORNELL DUBILIER
C26	250-42		CAPACITOR,FXD,TANT,10UF,10%	196D106X9025KE3	SPRAGUE
C27*			REFER TO TABLES 5-20 THRU 5-25		
C28	230-37		CAPACITOR,FXD,CER,0.1UF,20%	RPE122104M100V	MURATA/ERIE
C29	250-51	2	CAPACITOR,FXD,ALUM,47UF,-10/+5%	T3073FE470T063JPT	MEPCO
C30	223-100	1	CAPACITOR,FXD,MICA,100PF,5%,50	CD10FD101J03	CORNELL DUBILIER
C31	250-51		CAPACITOR,FXD,ALUM,47UF,-10/+5%	T3073FE470T063JPT	MEPCO
C32			NOT ASSIGNED		
C33	230-37	6	CAPACITOR,FXD,CER,0.1UF,20%	RPE122104M100V	MURATA/ERIE
C34	250-77		CAPACITOR,FXD,CER,0.01UF,10%	CK05BX103K	SPRAGUE
C35			NOT ASSIGNED		
C36			REFER TO TABLES 5-20 THRU 5-25		
C37			REFER TO TABLES 5-20 THRU 5-25		
C38			REFER TO TABLES 5-20 THRU 5-25		
C39	250-77		CAPACITOR,FXD,CER,0.01UF,10%	CK05BX103K	SPRAGUE
C40			NOT ASSIGNED		
C41			REFER TO TABLES 5-20 THRU 5-25	CK05BX103K	SPRAGUE
C42			NOT ASSIGNED		
C43	230-37		CAPACITOR,FXD,CER,0.1UF,20%	RPE122104M100V	MURATA/ERIE
C44	230-37		CAPACITOR,FXD,CER,0.1UF,20%	RPE122104M100V	MURATA/ERIE
C45	230-37		CAPACITOR,FXD,CER,0.1UF,20%	RPE122104M100V	MURATA/ERIE
CR1	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR2	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR3	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR4	10-1N746A	2	DIODE,ZENER,1N746,3.3V,10%	1N746	MOTOROLA
CR5	10-1N4446	8	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR6	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR7	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR8	10-1N746A		DIODE,ZENER,1N746,3.3V,10%	1N746	MOTOROLA
CR9			NOT ASSIGNED		
CR10			NOT ASSIGNED		
CR11	10-SI2	3	DIODE,RECTIFIER,IN4003,200V	SS6253	SEMTECH
CR12	10-1N5359A	1	DIODE,ZENER,1N5359,24V,20%	1N5359A	MOTOROLA
CR13	10-FD300	3	DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE DEVICES
CR14	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR15	10-FD300		DIODE,RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE DEVICES

Table 5-26. YIG Driver PCB Common Parts List (Page 2 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
CR16	10-FD300		DIODE,RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE DEVICES
CR17	10-1N962B	1	DIODE,ZENER,1N962,11V,5%	1N962B	MOTOROLA
CR18	10-11	1	DIODE,ZENER,1N750A,4.7V,5%	IN750A	FSC
CR19	10-25	2	DIODE,RECTIFIER,MR854,400V,100	MR854	MOTOROLA
CR20	10-25		DIODE,RECTIFIER,MR854,400V,100	MR854	MOTOROLA
CR21	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR22	15-5	1	INDICATOR,LED,RED	MV5774C	MONSANTO
CR23			NOT ASSIGNED		
CR24			NOT ASSIGNED		
CR25			NOT ASSIGNED		
CR26	10-4	3	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR27	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR28			REFER TO TABLES 5-20 THRU 5-25		
CR29	10-STB568	4	DIODE,RECTIFIER,STB568,GOV	STB568	GENERAL ELECTRIC
CR30			REFER TO TABLES 5-20 THRU 5-25		
CR31		1	REFER TO TABLES 5-20 THRU 5-25		
CR32	10-STB568		DIODE,RECTIFIER,STB568,GOV	STB568	GENERAL ELECTRIC
CR33			REFER TO TABLES 5-20 THRU 5-25		
CR34	10-SI2		DIODE,RECTIFIER,IN4003,200V	SS6253	SEMTECH
CR35	10-SI2		DIODE,RECTIFIER,IN4003,200V	SS6253	SEMTECH
CR36	10-1N751A	1	DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
P1	551-517	1	CONNECTOR,SOCKET,1ROW-.1"X.1"	100-083-30218-190	TEKA PRODUCTS
Q1			NOT ASSIGNED		
Q2			NOT ASSIGNED		
Q3	20-45	1	TRANSISTOR,FET,N CHANNEL ENH	VN10KM	SILICONIX
Q4	20-MPSA92	1	TRANSISTOR,PNP,MPSA92,SI,HIGH	MPSA92	MOTOROLA
Q5			NOT ASSIGNED		
Q6	20-MPSA42	3	TRANSISTOR,NPN,MPSA42,SI,HIGH	MPSA42	MOTOROLA
Q7	20-MPSA42		TRANSISTOR,NPN,MPSA42,SI,HIGH	MPSA42	MOTOROLA
Q8			NOT ASSIGNED		
Q9	20-MPSA42		TRANSISTOR,NPN,MPSA42,SI,HIGH	MPSA42	MOTOROLA
R1	110-10K-1	7	RESISTOR,FXD,MF,10K,1%,0.25		
R2	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25		
R3	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25		
R4	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25		
R5	110-1.78K-1	1	RESISTOR,FXD,MF,1.78K,1%,0.25		
R6*			REFER TO TABLES 5-20 THRU 5-25		
R7	130-47-3	1	RESISTOR,FXD,WW,47,5%,3.25W		
R8*			REFER TO TABLES 5-20 THRU 5-25		
R9*			REFER TO TABLES 5-20 THRU 5-25		
R10	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R11	110-196-1	2	RESISTOR,FXD,MF,196,1%,0.25		
R12	130-15-3		RESISTOR,FXD,WW,15,5%,3.25W		
R13	110-4.42K-1	2	RESISTOR,FXD,MF,4.42K,1%,0.25		
R14	130-15-3		RESISTOR,FXD,WW,15,5%,3.25W		
R15	130-15-3	4	RESISTOR,FXD,WW,15,5%,3.25W		
R16	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R17	110-4.42K-1		RESISTOR,FXD,MF,4.42K,1%,0.25		
R18	110-196-1		RESISTOR,FXD,MF,196,1%,0.25		
R19	130-15-3		RESISTOR,FXD,WW,15,5%,3.25W		
R20			NOT ASSIGNED		
R21			NOT ASSIGNED		
R22	110-8.06K-1	2	RESISTOR,FXD,MF,8.06K,1%,0.25		
R23	110-16.2K-1	2	RESISTOR,FXD,MF,16.2K,1%,0.25		
R24	110-8.06K-1		RESISTOR,FXD,MF,8.06K,1%,0.25		
R25	110-16.2K-1		RESISTOR,FXD,MF,16.2K,1%,0.25		
R26	110-51.1K-1	1	RESISTOR,FXD,MF,51.1K,1%,0.25		
R27	110-30.1K-1	1	RESISTOR,FXD,MF,30.1K,1%,0.25		
R28	113-3.01K-0.1	1	RESISTOR,FXD,MF,3.01K,0.1%,0.1		
R29	131-35	1	RESISTOR,FXD,WW,3,3%,5W,3PPM		

Table 5-26. YIG Driver PCB Common Parts List (Page 3 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R30	110-30.1-1	1	RESISTOR,FXD,MF,30.1,1%,0.25	SMA-4 OR C4	CORNING
R31	110-511-1	4	RESISTOR,FXD,MF,511,1%,0.25		
R32	110-31.6K-1	1	RESISTOR,FXD,MF,31.6K,1%,0.25		
R33	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R34	110-100-1	11	RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R35	110-5.11K-1	2	RESISTOR,FXD,MF,5.11K,1%,0.25		
R36	110-5.11K-1		RESISTOR,FXD,MF,5.11K,1%,0.25		
R37	110-825-1	1	RESISTOR,FXD,MF,825,1%,0.25		
R38	110-8.66K-1	1	RESISTOR,FXD,MF,8.66K,1%,0.25		
R39	110-59K-1	1	RESISTOR,FXD,MF,59K,1%,0.25		
R40			REFER TO TABLES 5-20 THRU 5-25		
R41			REFER TO TABLES 5-20 THRU 5-25		
R42			REFER TO TABLES 5-20 THRU 5-25		
R43			REFER TO TABLES 5-20 THRU 5-25		
R44	110-1K-1	3	RESISTOR,FXD,MF,1K,1%,0.25		
R45*			REFER TO TABLES 5-20 THRU 5-25		
R46*			REFER TO TABLES 5-20 THRU 5-25		
R47	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25		
R48	110-511-1		RESISTOR,FXD,MF,511,1%,0.25		
R49	110-51.1-1	1	RESISTOR,FXD,MF,51.1,1%,0.25	SMA-4 OR C4	CORNING
R50	110-348-1	1	RESISTOR,FXD,MF,348,1%,0.25		
R51	102-.5-5	1	RESISTOR,FXD,CC,0.5,5%,0.5W	UT-1/2 5% 0.5ohm	
R52			REFER TO TABLES 5-20 THRU 5-25		
R53			REFER TO TABLES 5-20 THRU 5-25		
R54			REFER TO TABLES 5-20 THRU 5-25		
R55			REFER TO TABLES 5-20 THRU 5-25		
R56*			REFER TO TABLES 5-20 THRU 5-25		
R57	110-511-1		RESISTOR,FXD,MF,511,1%,0.25		
R58	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25		
R59	110-1.54K-1	1	RESISTOR,FXD,MF,1.54K,1%,0.25		
R60	110-38.3K-1	1	RESISTOR,FXD,MF,38.3K,1%,0.25		
R61	110-332-1	1	RESISTOR,FXD,MF,332,1%,0.25		
R62	113-10K-0.1	5	RESISTOR,FXD,MF,10K,0.1%,0.125		
R63	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125		
R64	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125		
R65	113-10K-0.1		RESISTOR,FXD,MF,10K,0.1%,0.125		
R66	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R67	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25		
R68	110-100K-1	3	RESISTOR,FXD,MF,100K,1%,0.25		
R69	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R70	130-1-3	3	RESISTOR,FXD,WW,1,5%,3.25W	UT-2C-20	ULTEX
R71	110-4.99K-1	4	RESISTOR,FXD,MF,4.99K,1%,0.25	SMA-4 OR C4	CORNING
R72	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25		
R73			REFER TO TABLES 5-20 THRU 5-25		
R74			REFER TO TABLES 5-20 THRU 5-25		
R75			REFER TO TABLES 5-20 THRU 5-25		
R76			REFER TO TABLES 5-20 THRU 5-25		
R77	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R78	110-100K-1		RESISTOR,FXD,MF,100K,1%,0.25		
R79	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25		
R80*			REFER TO TABLES 5-20 THRU 5-25		
R81	130-1-3		RESISTOR,FXD,WW,1,5%,3.25W	UT-2C-20	ULTEX
R82			REFER TO TABLES 5-20 THRU 5-25		
R83			REFER TO TABLES 5-20 THRU 5-25		
R84			REFER TO TABLES 5-20 THRU 5-25		
R85*			REFER TO TABLES 5-20 THRU 5-25		
R86			REFER TO TABLES 5-20 THRU 5-25		
R87	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R88	110-100-1		RESISTOR,FXD,MF,100,1%,0.25	SMA-4 OR C4	CORNING
R89			REFER TO TABLES 5-20 THRU 5-25		

Table 5-26. YIG Driver PCB Common Parts List (Page 4 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R90	110-511-1		RESISTOR,FXD,MF,511,1%,0.25		
R91*			REFER TO TABLES 5-20 THRU 5-25		
TP1-TP13	551-608	1	CONNECTOR SOCKET,1 ROW, 0.150"	66947-013	BERG
U1	50-9	3	IC,OP AMP,LF356,SINGLE	LF356N	NSC
U2	50-DG200BA	1	IC,ANALOG SWITCH,DG200,DUAL	DG200ABA	SILICONIX
U3	50-9		IC,OP AMP,LF356,SINGLE	LF356N	NSC
U4	54-132	1	IC,OP AMP,TL074CN3,QUAD	TL074CN3	TEXAS INSTRUMENTS
U5	54-24	1	IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U6	54-376	1	IC,OP-AMP,OP27EJ,SINGLE,25uV	OP27EJ	PRECISION MONOLITHIC
U7	54-336	1	IC,CMOS,509,4 CHANNEL DIFFER	DG509 ACJ	SILICONIX
U8	50-6		IC, OP AMP,LM358,DUAL	MLM358	MOTOROLA
U9	50-9		IC,OP AMP,LF356,SINGLE	LF356N	NSC
U10			REFER TO TABLES 5-20 THRU 5-25		
W1	800-260	3	WIRE,JUMPER,1.000X0.125,	J1.000X0.125T22	SQUIRES
W2	800-260		WIRE,JUMPER,1.000X0.125,	J1.000X0.125T22	SQUIRES
W3	800-260		WIRE,JUMPER,1.000X0.125,	J1.000X0.125T22	SQUIRES
W4		4	REFER TO TABLES 5-20 THROUGH 5-25		
W5	800-140	1	WIRE,JUMPER,0.400X0.125	J0.400 X 0.125 T22	SQUIRES

Table 5-27. A22 Regulator Interface PCB (6700-D-31722-3; Rev. F) Parts List (Page 1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	230-41	2	CAPACITOR,FXD,CER,1.0UF,20%,10V	400-100-601-105M	CENTRE
C2	250-42	2	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C3	230-41		CAPACITOR,FXD,CER,1.0UF,20%,10V	400-100-601-105M	CENTRE
C4	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C5	250-39	1	CAPACITOR,FXD,TANT,4.7UF,20%,3V	196D475X0035JE3	SPRAGUE
C6	230-30	2	CAPACITOR,FXD,CER,1000PF,+80/-20	BGP.001,500V,+80-20	RMC
C7	227-45	1	CAPACITOR,FXD,MYLR,0.1UF,20%,1V	230B1B104M	ELECTROCUBE
C8	227-50	1	CAPACITOR,FXD,PEST,0.01UF,2%,2V	ZA2C103G	IMB
C9	230-30		CAPACITOR,FXD,CER,1000PF,+80/-20	BGP.001,500V,+80-20	RMC
C10	250-34	2	CAPACITOR,FXD,ALUM,10UF,-10/+5	3070-CD100T063SF	MEPCO
C11	250-34		CAPACITOR,FXD,ALUM,10UF,-10/+5	3070-CD100T063SF	MEPCO
C12	250-136	16	CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C13	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C14	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C15	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C16	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C17	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C18	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C19	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C20	230-37	2	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C21	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C22	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C23	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C24	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C25	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C26	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C27	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C28	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C29	250-136		CAPACITOR,FXD,TANT,2.2uf	T354E225M050AS	KEMET
C30	250-19	1	CAPACITOR,FXD,TANT,1UF,10%,35V	196D105X9035HE3	SPRAGUE
CR1	10-1N752A	1	DIODE,ZENER,1N752A,5.6V,5%	1N752A	MOTOROLA
CR2	10-1N4743A	1	DIODE,ZENER,1N4743,13V,10%	1N4743A	MOTOROLA
CR3	10-4	1	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR4	10-1N4446	2	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR5	10-1N4751	1	DIODE,ZENER,1N4751A,30V,5%	1N4751A	MOTOROLA
CR6	10-SI4	8	DIODE,RECTIFIER,1N4004,400V,30	SS6253	SEMTECH
CR7	10-SI4		DIODE,RECTIFIER,1N4004,400V,30	SS6253	SEMTECH
CR8	10-SI4		DIODE,RECTIFIER,1N4004,400V,30	SS6253	SEMTECH
CR9	10-SI4		DIODE,RECTIFIER,1N4004,400V,30	SS6253	SEMTECH
CR10	10-SI4		DIODE,RECTIFIER,1N4004,400V,30	SS6253	SEMTECH
CR11	10-SI4		DIODE,RECTIFIER,1N4004,400V,30	SS6253	SEMTECH
CR12	10-SI4		DIODE,RECTIFIER,1N4004,400V,30	SS6253	SEMTECH
CR13	10-SI4		DIODE,RECTIFIER,1N4004,400V,30	SS6253	SEMTECH
CR14	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
P1	551-517	2	CONNECTOR,SOCKET,1ROW-.1"X.1"	100-083-30218-190	TEKA PRODUCTS
P2			NOT ASSIGNED		
P3	551-517		CONNECTOR,SOCKET,1ROW-.1"X.1"	100-083-30218-190	TEKA PRODUCTS
Q1			NOT ASSIGNED		
Q2	20-MPSA42	1	TRANSISTOR,NPN,MPSA42,SI,HIGH	MPSA42	MOTOROLA
Q3	20-MPSA92	4	TRANSISTOR,PNP,MPSA92,SI,HIGH	MPSA92	MOTOROLA
Q4	20-MPSU04	1	TRANSISTOR,NPN,MPSU04,SI,MEDIU	MPSU04	MOTOROLA
Q5			NOT ASSIGNED		
Q6	20-MPSA92		TRANSISTOR,PNP,MPSA92,SI,HIGH	MPSA92	MOTOROLA
Q7	20-MPSA92		TRANSISTOR,PNP,MPSA92,SI,HIGH	MPSA92	MOTOROLA
Q8	20-MPSA92		TRANSISTOR,PNP,MPSA92,SI,HIGH	MPSA92	MOTOROLA
R1	110-316-1	1	RESISTOR,FXD,MF,316,1%,0.25W	SMA-4-316	CORNING
R2	110-5.62K-1		RESISTOR,FXD,MF,5.62K,1%,0.25W	SMA-4-5.62K	CORNING
R3	110-3.83K-1	1	RESISTOR,FXD,MF,3.83K,1%,0.25W	SMA-4-3.83K	CORNING
R4	110-1.69K-1	2	RESISTOR,FXD,MF,1.69K,1%,0.25W	SMA-4-1.69K	CORNING
R5	110-3.32K-1	2	RESISTOR,FXD,MF,3.32K,1%,0.25W	SMA-4-3.32K	CORNING

Table 5-27. A22 Regulator Interface PCB (6700-D-31722-3; Rev. F) Parts List (Page 2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R6	102-.5-5	3	RESISTOR,FXD,CC,0.5,5%,0.5W	UT-1/2 5% 0.5OHM	
R7	102-.5-5		RESISTOR,FXD,CC,0.5,5%,0.5W	UT-1/2 5% 0.5OHM	
R8	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R9	110-2.21K-1	1	RESISTOR,FXD,MF,2.21K,1%,0.25W	SMA-4-2.21K	CORNING
R10	110-2.15K-1	3	RESISTOR,FXD,MF,2.15K,1%,0.25W	SMA-4-2.15K	CORNING
R11	110-511-1	1	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R12	110-5.11K-1	2	RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-5.11K	CORNING
R13	110-4.12K-1	1	RESISTOR,FXD,MF,4.12K,1%,0.25W	SMA-4-4.12K	CORNING
R14	110-2.15K-1		RESISTOR,FXD,MF,2.15K,1%,0.25W	SMA-4-2.15K	CORNING
R15	110-1.69K-1		RESISTOR,FXD,MF,1.69K,1%,0.25W	SMA-4-1.69K	CORNING
R16			NOT ASSIGNED		
R17	102-.5-5		RESISTOR,FXD,CC,0.5,5%,0.5W	UT-1/2 5% 0.5ohm	
R18	110-3.32K-1		RESISTOR,FXD,MF,3.32K,1%,0.25W	SMA-4-3.32K	CORNING
R19	110-1.47K-1	1	RESISTOR,FXD,MF,1.47K,1%,0.25W	SMA-4-1.47K	CORNING
R20	110-7.87K-1	1	RESISTOR,FXD,MF,7.87K,1%,0.25W	SMA-4-7.87K	CORNING
R21	110-2.15K-1		RESISTOR,FXD,MF,2.15K,1%,0.25W	SMA-4-2.15K	CORNING
R22	110-1K-1	2	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R23	110-5.11K-1		RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-11K	CORNING
R24	110-16.9K-1	1	RESISTOR,FXD,MF,16.9K,1%,0.25W	SMA-4-16.9K	CORNING
R25	110-90.9K-1	1	RESISTOR,FXD,MF,90.9K,1%,0.25W	SMA-4-90.9K	CORNING
R26	110-49.9K-1	2	RESISTOR,FXD,MF,49.9K,1%,0.25W	SMA-4-49.9K	CORNING
R27	110-49.9K-1		RESISTOR,FXD,MF,49.9K,1%,0.25W	SMA-4-49.9K	CORNING
R28	110-215K-1	1	RESISTOR,FXD,MF,215K,1%,0.25W	SMA-4-215K	CORNING
R29	110-162K-1	1	RESISTOR,FXD,MF,162K,1%,0.25W	SMA-4-162K	CORNING
R30	110-115K-1	1	RESISTOR,FXD,MF,115K,1%,0.25W	SMA-4-115K	CORNING
R31	110-10K-1	2	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R32	110-64.9K-1	2	RESISTOR,FXD,MF,64.9K,1%,0.25W	SMA-4-64.9K	CORNING
R33	110-64.9K-1		RESISTOR,FXD,MF,64.9K,1%,0.25W	SMA-4-64.9K	CORNING
R34	110-45.3K-1	2	RESISTOR,FXD,MF,45.3K,1%,0.25W	SMA-4-45.3K	CORNING
R35	110-45.3K-1		RESISTOR,FXD,MF,45.3K,1%,0.25W	SMA-4-45.3K	CORNING
R36	110-127K-1	2	RESISTOR,FXD,MF,127K,1%,0.25W	SMA-4-127K	CORNING
R37	110-127K-1		RESISTOR,FXD,MF,127K,1%,0.25W	SMA-4-127K	CORNING
R38	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R39	110-147K-1	1	RESISTOR,FXD,MF,147K,1%,0.25W	SMA-4-147K	CORNING
R40	110-75K-1	1	RESISTOR,FXD,MF,75K,1%,0.25W	SMA-4-75K	CORNING
TP1	551-608	1	CONNECTOR SOCKET,1 ROW, 0.150"	66947-013	BERG
U1	54-53	2	IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS
U2	54-53		IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS
VR1			NOT ASSIGNED		
VR2	54-335	1	IC,VOLTAGE REFERENCE,10V	AD581LH	ANALOG DEVICES

Table 5-28. A23 Microprocessor PCB (6700-D-31723-3; Rev. H) Parts List (Page 1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	250-57	1	CAPACITOR,FXD,TANT,150UF,10%,6V	196D157X9006PE3	SPRAGUE
C2	230-37	33	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C3	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C4	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C5	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C6	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C7	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C8	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C9	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C10	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C11	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C12	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C13	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C14	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C15			NOT ASSIGNED		
C16	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C17	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C18	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C19	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C20	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C21	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C22	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C23	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C24	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C25	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C26	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C27	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C28	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C29	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C30	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C31	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C32	230-70	1	CAPACITOR,FXD,CER,27PF,5%	150-100-NPO-270J	CENTRE
C33	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C34	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C35	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
CR1			NOT ASSIGNED		
CR2	10-1N751A	1	DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
J1	551-148	1	CONNECTOR,DIP SCKT,PCB MNT,18	CA-18S-10SD	CIRCUIT ASSE
L1	310-89	1	INDUCTOR,FIXED,1.9uH @ 50MHz	VK200 10/3B	FERROXCUBE
P1			NOT ASSIGNED		
P2	551-206	1	CONNECTOR,HDR,PC MNT RT ANGL,3	65521-103	BERG
P3	551-236	1	CONNECTOR,DIP SCKT,PC MNT,18	8136-475G9	AUGAT
R1	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R2	110-10K-1	7	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R3	110-100-1	1	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R4	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R5	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R6	110-5.11K-1	2	RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-5.11K	CORNING
R7	110-5.11K-1		RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-5.11K	CORNING
R8	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R9	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R10	110-1K-1	1	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R11	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
RN1	123-9	2	RESISTOR,NETWORK,MF,9X10K,2%	410A103	AB
RN2	123-9		RESISTOR,NETWORK,MF,9X10K,2%	410A103	AB
SW1	420-14	1	SWITCH,SLIDE,2PDT,PC MT VERT	124-441-020	CHICAGO SWITCH
U1	54-317	1	IC,MICROPROCESSOR,8284A	8284A	INTEL
U2	54-74LS73	1	IC,TTL,74LS73,DUAL,JK FLIP FLOP	DM74LS73AN	NSC
U3			NOT ASSIGNED		
U4	54-44	1	IC,TTL,74LS74,DUAL,D FLIP FLOP	DM74LS74AN	NSC

Table 5-28. A23 Microprocessor PCB (6700-D-31723-3; Rev. H) Parts List (Page 2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
U5	54-74LS04	1	IC,TTL,74LS04,HEX,INVERTERS	74LS04PC	FSC
U6	54-113	1	IC,TTL,74LS393,DUAL,4 BIT BINARY	DM74LS393N	NSC
U7	54-212	1	IC,MICROPROCESSOR,8253-5	P8253-5	INTEL
U8	54-316	1	IC,MICROPROCESSOR,8259A	8259A	INTEL
U9	54-315	1	IC,MICROPROCESSOR,8088	8088	INTEL
U10	54-103	2	IC,TTL,74LS373,OCTAL,TRANSPARE	DM74LS373N	NSC
U11	54-103		IC,TTL,74LS373,OCTAL,TRANSPARE	DM74LS373N	NSC
U12	54-74LS01	1	IC,TTL,74LS01,QUAD,2 INPUT NAND	N74LS01N	SIGNETICS
U13	54-57	1	IC,TTL,74LS02,QUAD,2 INPUT NOR	DM74LS02N	NSC
U14	54-534	1	IC,CMOS,74HCT374,OCTAL 3-STATE	MC74HCT374N	MOTOROLA
U15	54-530	2	IC,CMOS,74HCT244,OCTAL	SN74HC244N	TEXAS INSTRUMENTS
U16	54-533	1	IC,CMOS,74HCT373,OCTAL 3-STATE	MC74HCT373N	MOTOROLA
U17	54-530		IC,CMOS,74HCT244,OCTAL	SN74HC244N	TEXAS INSTRUMENTS
U18	54-528	2	IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INSTRUMENTS
U19	54-528		IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INSTRUMENTS
U20	54-74LS139	2	IC,TTL,74LS139,DUAL,2 TO 4 DEC	DM74LS139N	NSC
U21	54-74LS139		IC,TTL,74LS139,DUAL,2 TO 4 DEC	DM74LS139N	NSC
	NOTE: U22 and U23 EPROMS are blank (unprogrammed) memory chips. Please contact a WILTRON Service Representative to aquire the correct replacement firmware revision for your instrument.				
U22	56-20	2	IC,MEMORY,27256,EPROM,32K X 8	HN27256G-25	HITACHI
U23	56-20		IC,MEMORY,27256,EPROM,32K X 8	HN27256G-25	HITACHI
U24	56-7	1	IC,MEMORY,2764-4,EPROM	HN482764G-3	HIT
U25	54-402	1	IC,MEMORY,DS1225/MK48Z08,220NSEC	DS1225Y	DALLAS SEMICONDUCTOR
U26	54-409	2	IC,MEMORY,HM6264LP-15,RAM	HM6264LP-15	HITACHI
U27	54-347	2	IC,MEMORY,EEPROM	2864A	XICOR
U28	54-347		IC,MEMORY,EEPROM	2864A	XICOR
U29	54-409		IC,MEMORY,HM6264LP-15,RAM	HM6264LP-15	HITACHI
U30	54-74LS138	1	IC,TTL,74LS138,3 TO 8 DECODER	SN74LS138N	TEXAS INSTRUMENTS
U31			NOT ASSIGNED		
U32	54-493	1	IC,VOLTAGE COMPARATOR,TL7705A	TL7705ACP	TEXAS INSTRUMENTS
W1			NOT ASSIGNED		
W2	800-140	7	WIRE,JUMPER,0.400X0.125	J0.400 X 0.125 T22	SQUIRES
W3	800-140		WIRE,JUMPER,0.400X0.125	J0.400 X 0.125 T22	SQUIRES
W4			NOT ASSIGNED		
W5	800-140		WIRE,JUMPER,0.400X0.125	J0.400 X 0.125 T22	SQUIRES
W6			NOT ASSIGNED		
W7	800-140		WIRE,JUMPER,0.400X0.125	J0.400 X 0.125 T22	SQUIRES
W8			NOT ASSIGNED		
W9	800-140		WIRE,JUMPER,0.400X0.125	J0.400 X 0.125 T22	SQUIRES
W10			NOT ASSIGNED		
W11			NOT ASSIGNED		
W12	800-140		WIRE,JUMPER,0.400X0.125	J0.400 X 0.125 T22	SQUIRES
W13	800-140		WIRE,JUMPER,0.400X0.125	J0.400 X 0.125 T22	SQUIRES
Y1	630-27	1	CRYSTAL,15MHZ,0.005%	CY15A	CRYSTEK CRYSTAL

Table 5-29. A24 GPIB PCB (6700-D-31724-3; Rev. C) Parts List (Page 1 of 1)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	250-41	1	CAPACITOR,FXD,TANT,6.8UF,10%,3V	196D685X9035KE3	SPRAGUE
C2	230-37	17	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C3	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C4	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C5	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C6	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C7	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C8	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C9	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C10	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C11	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C12	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C13	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C14	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C15	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C16	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C17	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C18	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
CR1	10-1N4446	1	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
J1	551-236	1	CONNECTOR,DIP SCKT,PC MNT,18	8136-475G9	AUGAT
L1	310-89	1	INDUCTOR,FIXED,1.9uH @ 50mHz	VK200 10/3B	FERROXCUBE
P1			NOT ASSIGNED		
P2	551-102	1	CONNECTOR,HDR,PC MNT,26 PIN DU	CA-D265P100-230-430	CIRCUIT ASSY
P3	551-206	1	CONNECTOR,HDR,PC MNT RT ANGL,3	65521-103	BERG
R1	110-1K-1	4	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R2	110-75K-1	1	RESISTOR,FXD,MF,75K,1%,0.25W	SMA-4	CORNING
R3	110-10K-1	5	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R4	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R5	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R6	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R7	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R8	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R9	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R10	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
RN1	123-9	1	RESISTOR,NETWORK,MF,9X10K,2%	410A103	AB
S1	420-14	1	SWITCH,SLIDE,2PDT,PC MT VERT	124-441-020	CHICAGO SWITCH
U1	54-93	1	IC,MICROPROCESSOR,8085A	P8085A	INTEL
U2	54-526	1	IC,74HCT04,HEX INVERTERS	CE74HCT04E	RCA
U3	54-74LS01	1	IC,TTL,74LS01,QUAD,2 INPUT NAN	N74LS01N	SIGNETICS
U4	54-529	1	IC,CMOS,74HCT139,DUAL,1OF4	74HCT139N	SUPERTEX INC
U5	54-332	1	IC,TTL,75161A,8 CHANNELS,GPIB	DN75161AN	NSC
U6	54-331	1	IC,TTL,75160A,8 CHANNELS,GPIB	DN75160AN	NSC
U7	54-330	1	IC,TTL,7210,?,GPIB TALKER/LIST	UPD7210C	NEC
U8	54-533	1	IC,CMOS,74HCT373,OCTAL 3-STATE	MC74HCT373N	MOTOROLA
U9	54-527	1	IC,CMOS,74HCT74,DUAL D-TYPE	CD74HCT74E	RCA
U10	54-346	1	IC,MEMORY,27128-3,EPROM	27128-3	INTEL
U11	54-409	1	IC,MEMORY,HM6264LP-15,RAM	HM6264LP-15	HITACHI
U12	54-314	1	IC,MICROPROCESSOR,8255A-5	8255A-5	INTEL
U13	54-528	1	IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INSTRUMENTS
U14			NOT ASSIGNED		
U15	54-530	1	IC,CMOS,74HCT244,OCTAL	SN74HC244N	TEXAS INSTRUMENTS
U16	54-531	1	IC,CMOS,74HCT245,OCTAL	MC74HCT245N	MOTOROLA
U17	54-74LS00	1	IC,TTL,74LS00,QUAD,2 INPUT NAND	SN74LS00P	MOT
Y1	630-17	1	CRYSTAL,6.000MHZ,+/-0.005%	6.000MHZ	CRYSTEK

Table 5-30. A25 Switching Power Supply PCB (6700-D-31725-3; Rev. J) Parts List (Page 1 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	223-130	1	CAPACITOR,FXD,MICA,130PF,5%,50V	CM04ED131J03	ARCO
C2	230-33	1	CAPACITOR,FXD,CER,2000PF,20%,5V	BGP.002+-20%500VY5U	RMC
C3			NOT ASSIGNED		
C4			NOT ASSIGNED		
C5	250-121	2	CAPACITOR,FIXED,CER,0.01uF	30GAS10	SPRAGUE
C6	250-121		CAPACITOR,FIXED,CER,0.01uF	30GAS10	SPRAGUE
C7			NOT ASSIGNED		
C8	250-85	2	CAPACITOR,FXD,ALUM,12UF,350V	TVA-1605	SPRAGUE
C9	227-50	1	CAPACITOR,FXD,PEST,0.01UF,2%,2V	ZA2C103G	IMB
C10	250-85		CAPACITOR,FXD,ALUM,12UF,350V	TVA-1605	SPRAGUE
C11	220-240	3	CAPACITOR,FXD,MICA,240PF,5%,50V	DM15FD241J03	SUSSCO (ARCO)
C12	230-37	11	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C13			NOT ASSIGNED		
C14	220-27	1	CAPACITOR,FXD,MICA,27PF,5%,500V	CD15ED270J03	CORNELL DUBILIER
C15	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C16	227-13	1	CAPACITOR,FXD,MICA,1000PF,2%,1V	CD19FD102G03	CORNELL DUBILIER
C17	250-39	2	CAPACITOR,FXD,TANT,4.7UF,20%,3V	196D475X0035JE3	SPRAGUE
C18	250-42	3	CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C19	220-470	1	CAPACITOR,FXD,MICA,470PF,5%,50V	DM15FD471J03	SUSSCO (ARCO)
C20	230-3	6	CAPACITOR,FXD,CER,1000PF,10%,1V	DD-102	CENTRALAB
C21	250-77	2	CAPACITOR,FXD,CER,0.01UF,10%,1V	CK05BX103K	SPRAGUE
C22	250-77		CAPACITOR,FXD,CER,0.01UF,10%,1V	CK05BX103K	SPRAGUE
C23	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C24	250-40	2	CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X002HE3	SPRAGUE
C25	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C26	250-39		CAPACITOR,FXD,TANT,4.7UF,20%,3V	196D475X0035JE3	SPRAGUE
C27	250-40		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X002HE3	SPRAGUE
C28	250-42		CAPACITOR,FXD,TANT,10UF,10%,25V	196D106X9025KE3	SPRAGUE
C29	230-34	2	CAPACITOR,FXD,CER,2700PF,10%,1V	805-024-Z5F-272K	ERIE
C30	230-34		CAPACITOR,FXD,CER,2700PF,10%,1V	805-024-Z5F-272K	ERIE
C31	210-30	2	CAPACITOR,FXD,PEST,0.10UF,10%	ECQ-E2104KZS	PANASONIC
C32	250-133	2	CAPACITOR,FXD,ALUM,220UF	UPA-1E221M	NICHICON
C33	250-133		CAPACITOR,FXD,ALUM,220UF	UPA-1E221M	NICHICON
C34	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C35	230-3		CAPACITOR,FXD,CER,1000PF,10%,1V	DD-102	CENTRALAB
C36	220-240		CAPACITOR,FXD,MICA,240PF,5%,50V	DM15FD241J03	SUSSCO (ARCO)
C37	230-3		CAPACITOR,FXD,CER,1000PF,10%,1V	DD-102	CENTRALAB
C38	250-134	6	CAPACITOR,FXD,ALUM,47UF	UPAIH470MRH	NICHICON
C39	250-134		CAPACITOR,FXD,ALUM,47UF	UPAIH470MRH	NICHICON
C40	250-135	3	CAPACITOR,FXD,ALUM,10UF	UPA1J100MAH	NICHICON
C41	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C42	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C43	230-3		CAPACITOR,FXD,CER,1000PF,10%,1V	DD-102	CENTRALAB
C44	230-3		CAPACITOR,FXD,CER,1000PF,10%,1V	DD-102	CENTRALAB
C45	250-162		CAPACITOR,FXD,ALUM,22UF,20%	UPA2C220M	NICHICON
C46	250-162		CAPACITOR,FXD,ALUM,22UF,20%	UPA2C220M	NICHICON
C47	250-134		CAPACITOR,FXD,ALUM,47UF	UPAIH470MRH	NICHICON
C48	250-134		CAPACITOR,FXD,ALUM,47UF	UPAIH470MRH	NICHICON
C49	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C50			NOT ASSIGNED		
C51			NOT ASSIGNED		
C52	210-30		CAPACITOR,FXD,PEST,0.10UF,10%	ECQ-E2104KZS	PANASONIC
C53	230-3		CAPACITOR,FXD,CER,1000PF,10%,1V	DD-102	CENTRALAB
C54	250-134		CAPACITOR,FXD,ALUM,47UF	UPAIH470MRH	NICHICON
C55	250-134		CAPACITOR,FXD,ALUM,47UF	UPAIH470MRH	NICHICON
C56	250-135		CAPACITOR,FXD,ALUM,10UF	UPA1J100MAH	NICHICON
C57	250-135		CAPACITOR,FXD,ALUM,10UF	UPA1J100MAH	NICHICON
C58	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C59	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C60	230-8	2	CAPACITOR,FXD,CER,0.02UF,20%,5V	B-GP.02+/-20% 500V	RMC

Table 5-30. A25 Switching Power Supply PCB (6700-D-31725-3; Rev. J) Parts List (Page 2 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C61	230-8		CAPACITOR,FXD,CER,0.02UF,20%,5V	B-GP.02+/-20% 500V	RMC
C62	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C63	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C64	250-19A	1	CAPACITOR,FXD,TANT,1UF,10%,35V	196D-105X9035HA1	SPRAGUE
C65	220-240		CAPACITOR,FXD,MICA,240PF,5%,50V	DMJ15FD241J03	SUSSCO (ARCO)
CR1	10-1N4446	8	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR2	10-78	2	DIODE,ZENER,1N5351B,14V,5%	1N5351B	MOTOROLA
CR3	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR4	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR5	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR6	10-23	2	DIODE,RECTIFIER,IN493G,400V	1N4936	MOTOROLA
CR7	10-23		DIODE,RECTIFIER,IN493G,400V	1N4936	MOTOROLA
CR8	10-1N751A	1	DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR9	10-1N752A	1	DIODE,ZENER,1N752A,5.6V,5%	1N752A	MOTOROLA
CR10	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR11	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR12	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR13	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR14	10-31	2	DIODE,RECTIFIER,1N4934,100V	1N5416	SEMTECH
CR15	10-31		DIODE,RECTIFIER,1N4934,100V	1N5416	SEMTECH
CR16	10-24	1	DIODE ZENER,IN5360A,25V,10%	1N5360A	MOTOROLA
CR17			NOT ASSIGNED		
CR18			NOT ASSIGNED		
CR19	10-78		DIODE,ZENER,1N5351B,14V,5%	1N5351B	MOTOROLA
CR20			NOT ASSIGNED		
CR21			NOT ASSIGNED		
CR22	10-26	4	DIODE,RECTIFIER,MR852,200V	MR852	MOTOROLA
CR23	10-26		DIODE,RECTIFIER,MR852,200V	MR852	MOTOROLA
CR24	10-25	2	DIODE,RECTIFIER,MR854,400V	MR854	MOTOROLA
CR25	10-40	4	DIODE,RECTIFIER,MR822,200V	MR822	MOTOROLA
CR26	10-40		DIODE,RECTIFIER,MR822,200V	MR822	MOTOROLA
CR27	10-25		DIODE,RECTIFIER,MR854,400V	MR854	MOTOROLA
CR28	10-26		DIODE,RECTIFIER,MR852,200V	MR852	MOTOROLA
CR29	10-26		DIODE,RECTIFIER,MR852,200V	MR852	MOTOROLA
CR30	10-40		DIODE,RECTIFIER,MR822,200V	MR822	MOTOROLA
CR31	10-40		DIODE,RECTIFIER,MR822,200V	MR822	MOTOROLA
CR32	15-18	1	INDICATOR,LED,RED	550-0406	DIALIGHT
L1	A30511	1	INDUCTOR,FXD,17.6uh/7.3A		WEST COAST MAGNETICS
L2-L12			NOT ASSIGNED		
L13	A32372	2	INDUCTOR FILTER,SWITCHER		WEST COAST MAGNETICS
L14	A32372		INDUCTOR FILTER,SWITCHER		WEST COAST MAGNETICS
L15	310-53	1	INDUCTOR,FXD,47.0UH,5%	1537-60	DELEVAN
L16	310-98	1	INDUCTOR,FXD,1mH,10%	1537-744	DELEVAN
L17	310-35	1	INDUCTOR,FXD,10mH,10%	MR10000	LENOX-FUGEL
Q1	20-9	1	TRANSISTOR,PNP,2N4249,SI	2N4249	CDI
Q2	20-2N3694	3	TRANSISTOR,NPN,2N3694,SI,GEN PURP	MPS3694-18	MOTOROLA
Q3	20-2N2222A	2	TRANSISTOR,NPN,2N2222A,SI	2N2222A	MOTOROLA
Q4	20-2N2905	2	TRANSISTOR,PNP,2N2905,SI	2N2905	MOTOROLA
Q5	20-2N2905		TRANSISTOR,PNP,2N2905,SI	2N2905	MOTOROLA
Q6			NOT ASSIGNED		
Q7			NOT ASSIGNED		
Q8	20-2N2907A	1	TRANSISTOR,PNP,2N2907A,SI	2N2907A	MOTOROLA
Q9	20-2N2222A		TRANSISTOR,NPN,2N2222A,SI	2N2222A	MOTOROLA
Q10	20-2N3694		TRANSISTOR,NPN,2N3694,SI,GEN PURP	MPS3694-18	MOTOROLA
Q11	20-2N3694		TRANSISTOR,NPN,2N3694,SI,GEN PURP	MPS3694-18	MOTOROLA
Q12	20-2N3904		TRANSISTOR,NPN,2N3904,SI,GEN PURP	2N3905	MOTOROLA
R1	110-6.19K-1	2	RESISTOR,FXD,MF,6.19K,1%,0.25W	SMA-4-6.19K	CORNING
R2	110-6.19K-1		RESISTOR,FXD,MF,6.19K,1%,0.25W	SMA-4-6.19K	CORNING
R3	102-.5-5	2	RESISTOR,FXD,CC,0.5,5%,0.5W	UT-1/2 5% 0.5ohm	VERMONT PRECISION
R4	110-365-1	2	RESISTOR,FXD,MF,365,1%,0.25W	SMA-4-365	CORNING

Table 5-30. A25 Switching Power Supply PCB (6700-D-31725-3; Rev. J) Parts List (Page 3 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R5	102-100K-5	2	RESISTOR,FXD,CC,100K,5%,0.5W	RC20GF104J	ALLEN BRADLEY
R6			NOT ASSIGNED		
R7	110-365-1		RESISTOR,FXD,MF,365,1%,0.25W	SMA-4-365	CORNING
R8	102-.5-5		RESISTOR,FXD,CC,0.5,5%,0.5W	UT-1/2 5% 0.5ohm	VERMONT PRECISION
R9	113-4.84K-0.1	1	RESISTOR,FXD,MF,4.84K,0.1%,0.1W	RN55C,4.8K,.1%	VERMONT PRECISION
R10	110-1K-1	7	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R11	113-4.99K-0.1	1	RESISTOR,FXD,MF,4.99K,0.1%,0.1W	RN55C,4.8K,.1%	VERMONT PRECISION
R12	110-22.1K-1	2	RESISTOR,FXD,MF,22.1K,1%,0.25W	SMA-4-22.1K	CORNING
R13	110-42.2K-1	1	RESISTOR,FXD,MF,42.2K,1%,0.25W	SMA-4-42.2K	CORNING
R14			NOT ASSIGNED		
R15	110-100-1	2	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R16	110-22.1K-1		RESISTOR,FXD,MF,22.1K,1%,0.25W	SMA-4-22.1K	CORNING
R17	110-1.87K-1	1	RESISTOR,FXD,MF,1.87K,1%,0.25W	SMA-4-1.87K	CORNING
R18	110-3.16K-1	1	RESISTOR,FXD,MF,3.16K,1%,0.25W	SMA-4-3.16K	CORNING
R19	110-24.9K-1	1	RESISTOR,FXD,MF,24.9K,1%,0.25W	SMA-4-24.9K	CORNING
R20	156-5K	1	RESISTOR,TRIM,CER,5K,10%,1T	72XWR-5K	BECKMAN
R21	110-8.45K-1	1	RESISTOR,FXD,MF,8.45K,1%,0.25W	SMA-4-8.45K	CORNING
R22	110-13.3K-1	1	RESISTOR,FXD,MF,13.3K,1%,0.25W	SMA-4-13.3K	CORNING
R23	110-6.81K-1	1	RESISTOR,FXD,MF,6.81K,1%,0.25W	SMA-4-6.81K	CORNING
R24	110-10K-1	8	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R25	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R26	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R27	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R28	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R29	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R30	110-28.7-1	2	RESISTOR,FXD,MF,28.7,1%,0.25W	SMA-4-28.7	CORNING
R31	110-261-1	2	RESISTOR,FXD,MF,261,1%,0.25W	SMA-4-261	CORNING
R32	110-28.7-1		RESISTOR,FXD,MF,28.7,1%,0.25W	SMA-4-28.7	CORNING
R33	110-261-1		RESISTOR,FXD,MF,261,1%,0.25W	SMA-4-261	CORNING
R34	104-750-5	2	RESISTOR,FXD,CC,750,5%,2W	RC42GF751J	ALLEN BRADLEY
R35	104-750-5		RESISTOR,FXD,CC,750,5%,2W	RC42GF751J	ALLEN BRADLEY
R36	110-68.1-1	1	RESISTOR,FXD,MF,68.1,1%,0.25W	SMA-4-68.1	CORNING
R37	110-19.6-1	1	RESISTOR,FXD,MF,19.6,1%,0.25W	SMA-4-19.6	CORNING
R38	110-249-1	1	RESISTOR,FXD,MF,249,1%,0.25W	SMA-4-249	CORNING
R39	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R40	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R41	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R42	101-2.2M-5	1	RESISTOR,FXD,CC,2.2M,5%,0.25W	RC07GF225J	ALLEN BRADLEY
R43	110-48.7K-1	1	RESISTOR,FXD,MF,48.7K,1%,0.25W	SMA-4-48.7K	CORNING
R44	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R45	110-1.47K-1	1	RESISTOR,FXD,MF,1.47K,1%,0.25W	SMA-4-1.47K	CORNING
R46	110-14.7K-1	1	RESISTOR,FXD,MF,14.7K,1%,0.25W	SMA-4-14.7K	CORNING
R47	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R48	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R49	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R50	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R51	110-147-1	1	RESISTOR,FXD,MF,147,1%,0.25W	SMA-4-147	CORNING
R52	110-750K-1	1	RESISTOR,FXD,MF,750K,1%,0.25W	SMA-4-750K	CORNING
R53	110-499-1	2	RESISTOR,FXD,MF,499,1%,0.25W	SMA-4-499	CORNING
R54	110-100K-1	1	RESISTOR,FXD,MF,100K,1%,0.25W	SMA-4-100K	CORNING
R55	110-499-1		RESISTOR,FXD,MF,499,1%,0.25W	SMA-4-499	CORNING
R56	110-10-1	4	RESISTOR,FXD,MF,10,1%,0.25W	SMA-4-10	CORNING
R57	110-10-1		RESISTOR,FXD,MF,10,1%,0.25W	SMA-4-10	CORNING
R58	110-402-1	1	RESISTOR,FXD,MF,402,1%,0.25W	SMA-4-402	CORNING
R59	110-24.9-1	1	RESISTOR,MF,1/4W,1%	SMA-4-24.9	CORNING
R60	110-10-1		RESISTOR,FXD,MF,10,1%,0.25W	SMA-4-10	CORNING
R61	110-3.24-1		RESISTOR,FXD,MF,3.24,1%,0.25W	SMA-4-3.24	CORNING
R62	110-51.1-1	1	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R63			NOT ASSIGNED		
R64	110-61.9-1	2	RESISTOR,FXD,MF,61.9,1%,0.25W	SMA-4-61.9	CORNING

Table 5-30. A25 Switching Power Supply PCB (6700-D-31725-3; Rev. J) Parts List (Page 4 of 4)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R65	110-121-1	1	RESISTOR,FXD,MF,121,1%,0.25W	SMA-4-121	CORNING
R66			NOT ASSIGNED		
R67			NOT ASSIGNED		
R68			NOT ASSIGNED		
R69			NOT ASSIGNED		
R70	110-5.11K-1	1	RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-5.11K	CORNING
R71	110-61.9-1		RESISTOR,FXD,MF,61.9,1%,0.25W	SMA-4-61.9	CORNING
R72	110-31.6K-1	1	RESISTOR,FXD,MF,31.6K,1%,0.25W	SMA-4-31.6K	CORNING
R73	110-10-1	1	RESISTOR,FXD,MF,10,1%,0.25W	SMA-4-10	CORNING
R74	110-15-1	1	RESISTOR,FXD,MF,15,1%,0.25W	SMA-4-15	CORNING
R75	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R76	110-511-1	1	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R77	110-26.1-1	1	RESISTOR,FXD,MF,26.1,1%,0.25W	SMA-4-26.1	CORNING
R78	110-1.96K-1	1	RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R79	110-332-1	1	RESISTOR,FXD,MF,332,1%,0.25W	SMA-4-332	CORNING
RT1	35-1	1	THERMISTOR,NTC,1.0M,05%,0.1W	12C1004-5	WESTERN THERMISTOR
T1			NOT ASSIGNED		
T2			NOT ASSIGNED		
T3	320-96	1	TRANSFORMER,POWER,50kHZ	B34052	WEST COAST MAGNETICS
TP1	551-674	2	CONNECTOR SOCKET	66947-003	BERG
TP2	551-674		CONNECTOR SOCKET	66947-003	BERG
TP3	551-674		CONNECTOR SOCKET	66947-003	BERG
TP4	551-674		CONNECTOR SOCKET	66947-003	BERG
TP5	551-674		CONNECTOR SOCKET	66947-003	BERG
TP6	551-674		CONNECTOR SOCKET	66947-003	BERG
U1	20-820	2	OPTOCOUPLER,GEN PURPOSE,NPN,MC	MCT-2E	MONSANTO
U2	20-820		OPTOCOUPLER,GEN PURPOSE,NPN,MC	MCT-2E	MONSANTO
U3	50-33	1	IC,OP AMP,LT1056,SINGLE	LT1056CN8	LINEAR TECHNOLOGY
U4	54-140	1	IC,OP AMP,MC3420,SINGLE	MC3420P	MOTOROLA
U5	54-555	1	IC,OP AMP,NE555,SINGLE	LM555CN	RCA
VR1	54-LM340T	1	IC,VOLTAGE REGULATOR,LM340	LM340T-12	NSC
VR2	54-335	1	IC,VOLTAGE REFERENCE,10V	AD581LH	ANALOG DEVICES

Table 5-31. A26 Line Filter PCB (6700-D-31726-3; Rev. B) Parts List (Page 1 of 1)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1		2	CAPACITOR,FXD,1.0UF,400V		
C2			CAPACITOR,FXD,1.0UF,400V		
RT1	35-7	2	THERMISTOR,NTC,5.00,10%,2.0W	50B5R00K	CAL-R
RT2	35-7		THERMISTOR,NTC,5.00,10%,2.0W	50B5R00K	CAL-R
RV1	35-14	2	VARISTOR,150VRMS,0.6W	V150LA10A	G.E.
RV2	35-14		VARISTOR,150VRMS,0.6W	V150LA10A	G.E.

Table 5-32. A27 Aux I/O PCB (6700-D-31727-3; Rev. C) Parts List (Page 1 of 1)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
CR1	10-1N4446	2	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR2	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
J1	551-579	1	CONNECTOR,RACK & PNL,SUB MIN	745114-1	AMP
J2	551-556	1	CONNECTOR,HEADER,2 ROW-0.10"X	67997-114	BERG
K1	690-38	2	RELAY,LATCHING,2C,5VDC	DS2ES-DC5V	AROMAT
K2	690-38		RELAY,LATCHING,2C,5VDC	DS2ES-DC5V	AROMAT
Q1	20-2N4249	2	TRANSISTOR,PNP,2N4249,SI,LOW N	MPS4249-18	MOTOROLA
Q2	20-2N4249		TRANSISTOR,PNP,2N4249,SI,LOW N	MPS4249-18	MOTOROLA
R1	110-1K-1	2	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R2	110-10K-1	2	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
R3	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4	CORNING
R4	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4	CORNING
S1	430-229	1	SWITCH,DIP,16 PIN,ROCKER,9	1-435802-9	AMP

Table 5-33. A28 Motherboard PCB (6700-D-31828-3; Rev. A) Parts List (Page 1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	230-40	2	CAPACITOR,FXD,CER,0.01UF,20%,1V	5GA-S10	SPRAGUE
C2	230-40		CAPACITOR,FXD,CER,0.01UF,20%,1V	5GA-S10	SPRAGUE
C3			NOT ASSIGNED		
C4			NOT ASSIGNED		
C5	250-144	1	CAPACITOR,FXD,ALUM,1500UF,20%	ULB1H152M	NICHICON
C6	250-19A	2	CAPACITOR,FXD,TANT,1UF,10%,35V	196D-105X9035HA1	SPRAGUE
C7	230-37	1	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C8	250-19A		CAPACITOR,FXD,TANT,1UF,10%,35V	196D-105X9035HA1	SPRAGUE
CR1			NOT ASSIGNED		
CR2			NOT ASSIGNED		
CR3			NOT ASSIGNED		
CR4			NOT ASSIGNED		
CR5	10-SI2	1	DIODE,RECTIFIER,IN4003,200V	SS6253	SEMTECH
CR6			NOT ASSIGNED		
CR7			NOT ASSIGNED		
CR8			NOT ASSIGNED		
CR9			NOT ASSIGNED		
CR10	10-1N4743A	2	DIODE,ZENER,1N4743,13V,10%	1N4743A	MOTOROLA
CR11	10-1N4743A		DIODE,ZENER,1N4743,13V,10%	1N4743A	MOTOROLA
CR12	10-1N4446	1	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
FL1	260-7	1	EMI FILTER,BALANCED,SOLDER	3EZP	CORCOM
J1	551-561	1	CONNECTOR HEADER,1ROW-0.10"	65595-111	BERG
J2	551-560	1	CONNECTOR,HEADER,1 ROW-0.10"	65595-104	BERG
J3	551-552	2	CONNECTOR HEADER,1 ROW-0.10"	68016-104	BERG
J4	551-552		CONNECTOR HEADER,1 ROW-0.10"	68016-104	BERG
J5	551-551	5	CONNECTOR HEADER,1 ROW-0.10"	68016-103	BERG
J6	551-551		CONNECTOR HEADER,1 ROW-0.10"	68016-103	BERG
J7	551-551		CONNECTOR HEADER,1 ROW-0.10"	68016-103	BERG
J8	551-551		CONNECTOR HEADER,1 ROW-0.10"	68016-103	BERG
J9	551-553	1	CONNECTOR HEADER,1 ROW-0.10"	68492-106	BERG
J10	551-707	5	CONNECTOR,HDR,1 ROW-0.10",PC	69167-103	BERG
J11	551-707		CONNECTOR,HDR,1 ROW-0.10",PC	69167-103	BERG
J12	551-605	2	CONNECTOR,HDR,1 ROW-0.10"	68002-104	BERG
J13	551-605		CONNECTOR,HDR,1 ROW-0.10"	68002-104	BERG
J14	551-554	1	CONNECTOR HEADER,2 ROW-0.10"	68492-114	BERG
J15			NOT ASSIGNED		
J16			NOT ASSIGNED		
J17			NOT ASSIGNED		
J18			NOT ASSIGNED		
J19	551-603	2	CONNECTOR,HDR,2 ROW-0.10"X0.10	68492-126	BERG
J20	551-707		CONNECTOR HEADER,1 ROW-,0.10",PC	69167-103	BERG
J21	551-707		CONNECTOR,HDR,1 ROW-0.10",PC	69167-103	BERG
J22	551-707		CONNECTOR,HDR,1 ROW-0.10",PC	69167-103	BERG
J23	551-603		CONNECTOR,HDR,2 ROW-0.10"X0.10	68492-126	BERG
J24	551-551		CONNECTOR HEADER,1 ROW-0.10"	68016-103	BERG
J25	551-586	1	CONNECTOR,HEADER,2 ROW-0.1"X	68492-124	BERG
J26	551-600	1	CONNECTOR HEADER,1 ROW-.20"	10-63-1063	MOLEX
J27	551-607	1	CONNECTOR,HEADER,2 ROW-.1"X.1"	68492-130	BERG
K1	690-47	1	RELAY,CRADLE,3C,24VDC,650,SING	LY30-US-DC24	OMRON
Q1	20-45	1	TRANSISTOR,FET,N CHANNEL ENH	VN10KM	SILICONIX
Q2	20-2N2222A	1	TRANSISTOR,NPN,2N2222A,SI,MED	2N2222A	MOTOROLA
Q3	20-2N3694	1	TRANSISTOR,NPN,2N3694,SI,GEN P	MPS3694-18	MOTOROLA
Q4	20-2N6041	1	TRANSISTOR,PNP,2N6041,SI,DARLI	2N6041	MOTOROLA
R1	102-100K-5	2	RESISTOR,FXD,CC,100K,5%,0.5W	RC20GF104J	ALLEN BRADLEY
R2	102-100K-5		RESISTOR,FXD,CC,100K,5%,0.5W	RC20GF104J	ALLEN BRADLEY
R3	110-3.83K-1	1	RESISTOR,FXD,MF,3.83K,1%,0.25W	SMA-4-3.83K	CORNING
R4	110-53.6K-1	1	RESISTOR,FXD,MF,53.6K,1%,0.25W	SMA-4-53.6K	CORNING
R5	110-4.99K-1	1	RESISTOR,FXD,MF,4.99K,1%,0.25W	SMA-4-4.99K	CORNING
R6	110-1K-1	2	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R7	110-15K-1	1	RESISTOR,FXD,MF,15K,1%,0.25W	SMA-4-15K	CORNING

Table 5-33. A28 Motherboard PCB (6700-D-31828-3; Rev. A) Parts List (Page 2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R8	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R9			NOT ASSIGNED		
R10			NOT ASSIGNED		
R11	110-316-1	1	RESISTOR,FXD,MF,316,1%,0.25W	SMA-4-316	CORNING
R12	110-5.62K-1	1	RESISTOR,FXD,MF,5.62K,1%,0.25W	SMA-45.62K	CORNING
XA1			NOT ASSIGNED		
XA2			NOT ASSIGNED		
XA3			NOT ASSIGNED		
XA4			NOT ASSIGNED		
XA5			NOT ASSIGNED		
XA6P1			NOT ASSIGNED		
XA6P2			NOT ASSIGNED		
XA7			NOT ASSIGNED		
XA8	551-503	5	CONNECTOR,CARD EDGE,PRESS FIT	NK20A-1-1-192	WINCHESTER
XA9			NOT ASSIGNED		
XA10			NOT ASSIGNED		
XA11P1			NOT ASSIGNED		
XA11P2			NOT ASSIGNED		
XA12			NOT ASSIGNED		
XA13			NOT ASSIGNED		
XA14			NOT ASSIGNED		
XA15	551-501	5	CONNECTOR,CARD EDGE,PRESS FIT	NK25A-1-1-192	WINCHESTER
XA16	551-501		CONNECTOR,CARD EDGE,PRESS FIT	NK25A-1-1-192	WINCHESTER
XA17	551-502	1	CONNECTOR,CARD EDGE,PRESS FIT	NK35A-1-1-192	WINCHESTER
XA18			NOT ASSIGNED		
XA19			NOT ASSIGNED		
XA20			NOT ASSIGNED		
XA21			NOT ASSIGNED		
XA22			NOT ASSIGNED		
XA23			NOT ASSIGNED		
XA24			NOT ASSIGNED		
XA25P1			NOT ASSIGNED		
XA25P2			NOT ASSIGNED		
XA27			NOT ASSIGNED		
XA14			NOT ASSIGNED		

Table 5-34. A29 Rear Panel Interface PCB (6700-D-31729-3; Rev. H) Parts List (Page 1 of 6)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
C1	250-40A	19	CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C2	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C3	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C4	230-37	19	CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C5	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C6			NOT ASSIGNED		
C7	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C8	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C9	230-11	1	CAPACITOR,FXD,CER,0.01UF,+80/-20	TCP-R01	ARCO/SOSHIN
C10	250-143	2	CAPACITOR,FXD,CER,180pF,5%,100V	150-100-NPO-181J	CENTRE ENG
C11	230-64	1	CAPACITOR,FXD,1000pF,+/-5%	200-100-NPO-102J	CENTRE ENG
C12	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C13	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C14	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C15	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C16	250-143		CAPACITOR,FXD,CER,180pF,5%,100V	150-100-NPO-181J	CENTRE ENG
C17	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C18	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C19	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C20	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C21	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C22	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C23	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C24	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C25	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C26	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C27	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C28	230-70	1	CAPACITOR,FIXED,CER,27pf,5%	150-100-NPO-270J	CENTRE ENG
C29	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C30	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C31	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C32	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C33	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C34	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C35	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C36	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C37	250-40A		CAPACITOR,FXD,TANT,2.2UF,20%,2V	196D225X0025HA1	SPRAGUE
C38			NOT ASSIGNED		
C39			NOT ASSIGNED		
C40			NOT ASSIGNED		
C41			NOT ASSIGNED		
C42			NOT ASSIGNED		
C43			NOT ASSIGNED		
C44			NOT ASSIGNED		
C45	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C46	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C47			NOT ASSIGNED		
C48	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C49	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C50	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C51	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C52	230-37		CAPACITOR,FXD,CER,0.1UF,20%,10V	RPE122104M100V	MURATA/ERIE
C53	230-74	4	CAPACITOR,FXD,CER,5PF,5%	200-100-NPO-5R0J	CENTRE ENG
C54	230-74		CAPACITOR,FXD,CER,5PF,5%	200-100-NPO-5R0J	CENTRE ENG
C55	230-74		CAPACITOR,FXD,CER,5PF,5%	200-100-NPO-5R0J	CENTRE ENG
C56	230-74		CAPACITOR,FXD,CER,5PF,5%	200-100-NPO-5R0J	CENTRE ENG
CR1	10-1N751A	9	DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR2	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR3	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR4	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA

Table 5-34. A29 Rear Panel Interface PCB (6700-D-31729-3; Rev. H) Parts List (Page 2 of 6)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
CR5	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR6	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR7			NOT ASSIGNED		
CR8	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR9			NOT ASSIGNED		
CR10			NOT ASSIGNED		
CR11	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
CR12	10-4	3	DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR13	10-1N759A	1	DIODE,ZENER,1N759A,12V,5%	1N759A	FSC
CR14	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR15			NOT ASSIGNED		
CR16	10-4		DIODE,SCHOTTKY MIXER,MBD501	MBD501	MOTOROLA
CR17			NOT ASSIGNED		
CR18			NOT ASSIGNED		
CR19			NOT ASSIGNED		
CR20			NOT ASSIGNED		
CR21			NOT ASSIGNED		
CR22	10-1N4446	20	DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR23	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR24	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR25	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR26	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR27	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR28	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR29	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR30	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR31	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR32	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR33	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR34	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR35	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR36	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR37	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR38	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR39	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR40	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR41	10-1N4446		DIODE,SWITCHING,1N4446,75V,4NS	1N4446 T+R	BELL
CR42	10-FD300	7	DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR43	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR44	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR45	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR46	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR47	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR48	10-FD300		DIODE RECTIFIER,IN3595,125V,4A	1N3595	SOLID STATE
CR49	10-1N751A		DIODE,ZENER,1N751A,5.1V,5%	1N751A	MOTOROLA
J1	551-707	4	CONN,HEADER,1 ROW,.100",PC	69167-103	BERG-DU PONT
J2	551-707		CONN,HEADER,1 ROW,.100",PC	69167-103	BERG-DU PONT
J3	551-707		CONN,HEADER,1 ROW,.100",PC	69167-103	BERG-DU PONT
J4	551-707		CONN,HEADER,1 ROW,.100",PC	69167-103	BERG-DU PONT
J5			NOT ASSIGNED		
J6	551-548	4	CONNECTOR HEADER,1 ROW-0.10"	68001-106	BERG
J7	551-548		CONNECTOR HEADER,1 ROW-0.10"	68001-106	BERG
J8	551-548		CONNECTOR HEADER,1 ROW-0.10"	68001-106	BERG
J9	551-548		CONNECTOR HEADER,1 ROW-0.10"	68001-106	BERG
J10	551-706	1	CONNECTOR,HEADER,PCB MNT	CA-D10SP100-180-400	CIRCUIT ASSY
J11	551-557	2	CONNECTOR,HEADER,1 ROW-0.10"	68001-104	BERG
J12	551-557		CONNECTOR,HEADER,1 ROW-0.10"	68001-104	BERG
L1	310-89	2	INDUCTOR,FIXED,1.9uH @ 50mHz	VK200 10/3B	FERROXCUBE
L2	310-89		INDUCTOR,FIXED,1.9uH @ 50mHz	VK200 10/3B	FERROXCUBE
L3	310-45	1	INDUCTOR,FXD,100.0UH,5%	1315-12J	AIRCO

Table 5-34. A29 Rear Panel Interface PCB (6700-D-31729-3; Rev. H) Parts List (Page 3 of 6)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
L6	310-53	1	INDUCTOR,FXD,47.0UH,+-5%	1537-60	DELEVAN
P1	551-542	1	CONNECTOR,PCB TRANSISTOR TYPE	FCN-754PO14-AU/O	FUJITSU
P2	551-362	2	CONNECTOR,INSULATION DIS	3926-000T	3M
P3	551-362		CONNECTOR,INSULATION DIS	3926-000T	3M
Q1	20-2N2907A	2	TRANSISTOR,PNP,2N2907A,SI,MED	2N2907A	MOTOROLA
Q2	20-2N2907A		TRANSISTOR,PNP,2N2907A,SI,MED	2N2907A	MOTOROLA
Q3	20-2N2222A	10	TRANSISTOR,NPN,2N2222A,SI,MED	2N2222A	MOTOROLA
Q4	20-2N2222A		TRANSISTOR,NPN,2N2222A,SI,MED	2N2222A	MOTOROLA
Q5	20-2N2222A		TRANSISTOR,NPN,2N2222A,SI,MED	2N2222A	MOTOROLA
Q6	20-2N2222A		TRANSISTOR,NPN,2N2222A,SI,MED	2N2222A	MOTOROLA
Q7	20-2N2222A		TRANSISTOR,NPN,2N2222A,SI,MED	2N2222A	MOTOROLA
Q8	20-2N2222A		TRANSISTOR,NPN,2N2222A,SI,MED	2N2222A	MOTOROLA
Q9	20-2N2222A		TRANSISTOR,NPN,2N2222A,SI,MED	2N2222A	MOTOROLA
Q10	20-2N2222A		TRANSISTOR,NPN,2N2222A,SI,MED	2N2222A	MOTOROLA
R1	110-100-1	31	RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R2	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R3	110-34.8K-1	3	RESISTOR,FXD,MF,34.8K,1%,0.25W	SMA-4-34.8K	CORNING
R4	110-30.1K-1		RESISTOR,FXD,MF,30.1K,1%,0.25W	SMA-4-30.1K	CORNING
R5	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R6	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R7	110-34.8K-1		RESISTOR,FXD,MF,34.8K,1%,0.25W	SMA-4-34.8K	CORNING
R8	110-30.1K-1		RESISTOR,FXD,MF,30.1K,1%,0.25W	SMA-4-30.1K	CORNING
R9	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R10	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R11	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R12	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R13	110-34.8K-1		RESISTOR,FXD,MF,34.8K,1%,0.25W	SMA-4-100	CORNING
R14	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R15	110-30.1K-1		RESISTOR,FXD,MF,30.1K,1%,0.25W	SMA-4-30.1K	CORNING
R16	110-30.1K-1		RESISTOR,FXD,MF,30.1K,1%,0.25W	SMA-4-30.1K	CORNING
R17	110-30.1K-1		RESISTOR,FXD,MF,30.1K,1%,0.25W	SMA-4-30.1K	CORNING
R18	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R19	110-12.7K-1	1	RESISTOR,FXD,MF,12.7K,1%,0.25W	SMA-4-12.7K	CORNING
R20	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R21	110-16.2-1	1	RESISTOR,FXD,MF,16.2,1%,0.25W	SMA-4-16.2	CORNING
R22	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R23	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R24	110-5.11K-1	2	RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-5.11K	CORNING
R25	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R26	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R27	110-10K-1	21	RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R28	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R29	110-20.5K-1	1	RESISTOR,FXD,MF,20.5K,1%,0.25W	SMA-4-20.5K	CORNING
R30	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R31	110-20K-1	2	RESISTOR,FXD,MF,20K,1%,0.25W	SMA-4-20K	CORNING
R32	110-20K-1		RESISTOR,FXD,MF,20K,1%,0.25W	SMA-4-20K	CORNING
R33	110-102K-1	1	RESISTOR,FXD,MF,102K,1%,0.25W	SMA-4-102K	CORNING
R34	110-205K-1	1	RESISTOR,FXD,MF,205K,1%,0.25W	SMA-4-205K	CORNING
R35	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R36	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R37	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R38	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R39	110-48.7-1	8	RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R40	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R41	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R42	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R43	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R44	110-33.2-1	2	RESISTOR,FXD,MF,33.2,1%,0.25W	SMA-4-33.2	CORNING
R45	110-33.2-1		RESISTOR,FXD,MF,33.2,1%,0.25W	SMA-4-33.2	CORNING
R46	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING

Table 5-34. A29 Rear Panel Interface PCB (6700-D-31729-3; Rev. H) Parts List (Page 4 of 6)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R47	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R48	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R49	110-215-1	8	RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
R50	110-215-1		RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
R51	110-215-1		RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
R52	110-215-1		RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
R53	110-133-1	4	RESISTOR,FXD,MF,133,1%,0.25W	SMA-4-133	CORNING
R54	110-133-1		RESISTOR,FXD,MF,133,1%,0.25W	SMA-4-133	CORNING
R55	110-61.9-1	3	RESISTOR,FXD,MF,61.9,1%,0.25W	SMA-4-61.9	CORNING
R56	110-61.9-1		RESISTOR,FXD,MF,61.9,1%,0.25W	SMA-4-61.9	CORNING
R57	110-215-1		RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
R58	110-215-1		RESISTOR,FXD,FM,215,1%,0.25W	SMA-4-215	CORNING
R59	110-215-1		RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
R60	110-215-1		RESISTOR,FXD,MF,215,1%,0.25W	SMA-4-215	CORNING
R61	110-133-1		RESISTOR,FXD,MF,133,1%,0.25W	SMA-4-133	CORNING
R62	110-133-1		RESISTOR,FXD,MF,133,1%,0.25W	SMA-4-133	CORNING
R63	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R64	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R65	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R66	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R67	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R68	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R69	110-51.1-1	3	RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R70	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R71	110-51.1-1		RESISTOR,FXD,MF,51.1,1%,0.25W	SMA-4-51.1	CORNING
R72	110-61.9-1		RESISTOR,FXD,MF,61.9,1%,0.25W	SMA-4-61.9	CORNING
R73			NOT ASSIGNED		
R74			NOT ASSIGNED		
R75			NOT ASSIGNED		
R76			NOT ASSIGNED		
R77			NOT ASSIGNED		
R78			NOT ASSIGNED		
R79			NOT ASSIGNED		
R80			NOT ASSIGNED		
R81	110-4.87K-1	4	RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R82	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R83	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R84	110-4.87K-1		RESISTOR,FXD,MF,4.87K,1%,0.25W	SMA-4-4.87K	CORNING
R85	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R86	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R87	110-3.01K-1	2	RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4-3.01K	CORNING
R88	110-1.96K-1	5	RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R89	110-1.47K-1	2	RESISTOR,FXD,MF,1.47K,1%,0.25W	SMA-4-1.47K	CORNING
R90	110-1.47K-1		RESISTOR,FXD,MF,1.47K,1%,0.25W	SMA-4-1.47K	CORNING
R91	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R92	110-48.7-1		RESISTOR,FXD,MF,48.7,1%,0.25W	SMA-4-48.7	CORNING
R93	110-511-1	1	RESISTOR,FXD,MF,511,1%,0.25W	SMA-4-511	CORNING
R94	110-66.5K-1	1	RESISTOR,FXD,MF,66.5K,1%,0.25W	SMA-4-66.5K	CORNING
R95	110-95.3K-1	1	RESISTOR,FXD,MF,95.3K,1%,0.25W	SMA-4-95.3K	CORNING
R96	110-14.7K-1	1	RESISTOR,FXD,MF,14.7K,1%,0.25W	SMA-4-14.7K	CORNING

Table 5-34. A29 Rear Panel Interface PCB (6700-D-31729-3; Rev. H) Parts List (Page 5 of 6)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
R97	110-301K-1	1	RESISTOR,FXD,MF,301K,1%,0.25W	SMA-4-301	CORNING
R98	110-909-1	1	RESISTOR,FXD,MF,909,1%,0.25W	SMA-4-909	CORNING
R99	110-1K-1	2	RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R100	110-3.01K-1		RESISTOR,FXD,MF,3.01K,1%,0.25W	SMA-4-3.01K	CORNING
R101	110-1.87K-1	4	RESISTOR,FXD,MF,1.87K,1%,0.25W	SMA-4-1.87K	CORNING
R102	110-1.87K-1		RESISTOR,FXD,MF,1.87K,1%,0.25W	SMA-4-1.87K	CORNING
R103	110-1.87K-1		RESISTOR,FXD,MF,1.87K,1%,0.25W	SMA-4-1.87K	CORNING
R104	110-1.87K-1		RESISTOR,FXD,MF,1.87K,1%,0.25W	SMA-4-1.87K	CORNING
R105	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R106	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R107	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R108	110-1.96K-1		RESISTOR,FXD,MF,1.96K,1%,0.25W	SMA-4-1.96K	CORNING
R109	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R110	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R111	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R112	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R113	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R114	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R115	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R116	110-100-1		RESISTOR,FXD,MF,100,1%,0.25W	SMA-4-100	CORNING
R117	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R118	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R119	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R120	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R121	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R122	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R123	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R124	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R125	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R126	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R127	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R128	110-10K-1		RESISTOR,FXD,MF,10K,1%,0.25W	SMA-4-10K	CORNING
R129	103-240-5	4	RESISTOR,FXD,CC,240,5%,1W	RC32GF241J	ALLEN BRADLEY
R130	103-240-5		RESISTOR,FXD,CC,240,5%,1W	RC32GF241J	ALLEN BRADLEY
R131	103-240-5		RESISTOR,FXD,CC,240,5%,1W	RC32GF241J	ALLEN BRADLEY
R132	103-240-5		RESISTOR,FXD,CC,240,5%,1W	RC32GF241J	ALLEN BRADLEY
R133	110-22.1-1	4	RESISTOR,FXD,MF,22.1,1%,0.25W	SMA-4-22.1	CORNING
R134	110-22.1-1		RESISTOR,FXD,MF,22.1,1%,0.25W	SMA-4-22.1	CORNING
R135	110-22.1-1		RESISTOR,FXD,MF,22.1,1%,0.25W	SMA-4-22.1	CORNING
R136	110-22.1-1		RESISTOR,FXD,MF,22.1,1%,0.25W	SMA-4-22.1	CORNING
R137	110-1K-1		RESISTOR,FXD,MF,1K,1%,0.25W	SMA-4-1K	CORNING
R138	110-5.11K-1		RESISTOR,FXD,MF,5.11K,1%,0.25W	SMA-4-5.11K	CORNING
RN1	123-6	4	RESISTOR,NETWORK,MF,7X10K,2%	4308R-101-103	BOURNS
RN2	123-6		RESISTOR,NETWORK,MF,7X10K,2%	4308R-101-103	BOURNS
RN3	123-15	2	RESISTOR,NETWORK,MF,7X4.7K,2%	4308R-101-472	BOURNS
RN4	123-15		RESISTOR,NETWORK,MF,7X4.7K,2%	4308R-101-472	BOURNS
RN5	123-6		RESISTOR,NETWORK,MF,7X10K,2%	4308R-101-103	BOURNS
RN6	123-6		RESISTOR,NETWORK,MF,7X10K,2%	4308R-101-103	BOURNS
U1	54-530	2	IC,CMOS,74HCT244,OCTAL	SN74HC244N	TEXAS INSTRUMENTS
U2	54-524	1	IC,CMOS,74HCT00,QUAD 2-INPUT	MC74HCT00N	MOTOROLA
U3	54-530		IC,CMOS,74HCT244,OCTAL	SN74HC244N	TEXAS INSTRUMENTS
U4	54-523	6	IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U5	54-132	2	IC,OP AMP,TL074CN3,QUAD	TL074CN3	TEXAS INSTRUMENTS
U6	54-528	2	IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INSTRUMENTS
U7	54-528		IC,CMOS,74HCT138,1 OF 8	SN74HCT138N	TEXAS INSTRUMENTS
U8	54-523		IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U9	54-523		IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U10	54-334	3	IC,D/A,12 BIT	DAC 1208 LCD	NATIONAL
U11	54-132		IC,OP AMP,TL074CN3,QUAD	TL074CN3	TEXAS INSTRUMENTS
U12	54-24	6	IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX

Table 5-34. A29 Rear Panel Interface PCB (6700-D-31729-3; Rev. H) Parts List (Page 6 of 6)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
U13	54-334		IC,D/A,12 BIT	DAC 1208 LCD	NATIONAL
U14	50-9	1	IC,OP AMP,LF356,SINGLE	LF356N	NSC
U15	54-334		IC,D/A,12 BIT	DAC 1208 LCD	NATIONAL
U16	54-53	1	IC,OP AMP,TLO72,DUAL	TL072CP3	TEXAS INSTRUMENTS
U17	54-510	1	IC,CMOS,74HC04,HEX	SN74HC04N	TEXAS INSTRUMENTS
U18	54-523		IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U19	54-144	5	IC,TTL,75451,DUAL,PERIPHERAL D	SN75451BP	TEXAS INSTRUMENTS
U20	54-144		IC,TTL,75451,DUAL,PERIPHERAL D	SN75451BP	TEXAS INSTRUMENTS
U21	54-144		IC,TTL,75451,DUAL,PERIPHERAL D	SN75451BP	TEXAS INSTRUMENTS
U22			NOT ASSIGNED		
U23	54-144		IC,TTL,75451,DUAL,PERIPHERAL D	SN75451BP	TEXAS INSTRUMENTS
U24	54-523		IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U25	54-24		IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U26	54-24		IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U27	54-24		IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U28			NOT ASSIGNED		
U29	20-46	5	TRANSISTOR,NPN,5 HIGH CURRENT	CA3183E	RCA
U30	20-46		TRANSISTOR,NPN,5 HIGH CURRENT	CA3183E	RCA
U31			NOT ASSIGNED		
U32			NOT ASSIGNED		
U33	20-46		TRANSISTOR,NPN,5 HIGH CURRENT	CA3183E	RCA
U34			NOT ASSIGNED		
U35			NOT ASSIGNED		
U36	50-33	7	IC,OP AMP,LT1056,SINGLE	LT1056CN8	LINEAR TECHNOLOGY
U37	50-33		IC,OP AMP,LT1056,SINGLE	LT1056CN8	LINEAR TECHNOLOGY
U38	50-33		IC,OP AMP,LT1056,SINGLE	LT1056CN8	LINEAR TECHNOLOGY
U39	54-503	1	IC,OP-AMP,LT1007,SINGLE	LT1007CN8	LINEAR TECHNOLOGY
U40	20-46		TRANSISTOR,NPN,5 HIGH CURRENT	CA3183E	RCA
U41	54-24		IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
U42	50-33		IC,OP AMP,LT1056,SINGLE	LT1056CN8	LINEAR TECHNOLOGY
U43	50-33		IC,OP AMP,LT1056,SINGLE	LT1056CN8	LINEAR TECHNOLOGY
U44	50-33		IC,OP AMP,LT1056,SINGLE	LT1056CN8	LINEAR TECHNOLOGY
U45	50-33		IC,OP AMP,LT1056,SINGLE	LT1056CN8	LINEAR TECHNOLOGY
U46	20-46		TRANSISTOR,NPN,5 HIGH CURRENT	CA3183E	RCA
U47	54-523		IC,CMOS,74HC374,OCTAL 3-STATE	SN74HC374N	TEXAS INSTRUMENTS
U48	54-24		IC,ANALOG SWITCH,DG201,QUAD	DG201ACJ	SILICONIX
VR1	54-184	1	IC,VOLTAGE REGULATOR,7905,-5V	UA7905UC	FSC
W1	800-140	1	WIRE,JUMPER,0.400X0.125	J0.400 X 0.125 T22	SQUIRES

Table 5-35. 67XXA Rack Mount Kit With Slides

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
-	790-106	2	Hardware, Extension Bracket		Wiltron Co.
-	790-292	2	Slide Kit, Rack		Wiltron Co.
-	900-89	6	Screw, Flat Head, 8-32, 0.375, Philips		Wiltron Co.
-	900-95	8	Screw, Flat Head, 10-32, 0.250, Philips		Wiltron Co.
-	A31689	2	Trim Strip, Option Handle		Wiltron Co.
-	C31667	2	Option Handle, Mach		Wiltron Co.
-	D31678-1	1	Left Adapter Plate, Rack Mount		Wiltron Co.
-	D31678-2	1	Right Adapter Plate, Rack Mount		Wiltron Co.

Table 5-36. 67XXA Option 2A – 110 dB Step Attenuator

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
		Option 2A is available only for the following models: 6709A/6709A-40, 6717A/6717A-20, 6719A, 6721A/6721A-20, 6728A/6728A-40			
		The following attenuators have been installed in 67XXAs shipped prior to Summer 1988; contact Wiltron Customer Service at (408) 778-2000 for specific information on a particular model (relative to its serial number).			
-	4422K	1	110 dB, DC-20 GHz		Wiltron Co.
-	1010-39	1	110 dB, DC-18 GHz		Wiltron Co.

Table 5-37. 67XXA Option 2B – 90 dB Step Attenuator

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
		Option 2B is available for all models having an upper frequency limit above 18 GHz.			
		The following attenuators have been installed in 67XXAs shipped prior to Summer 1988; contact Wiltron Customer Service at (408) 778-2000 for specific information on a particular model (relative to its serial number).			
-	4522K	1	110 dB, DC-26.5 GHz		Wiltron Co.
-	1010-37	1	90 dB, DC-26.5 GHz		Wiltron Co.

Table 5-38. 67XXA Option 2C – 110 dB Step Attenuator

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
		Option 2C is available for all models having an upper frequency limit above 18 GHz.			
-	4622K	1	110 dB, DC-40 GHz		Wiltron Co.

Table 5-39. 67XXA Option 9K – Rear Panel K Connector (6700-D-31862)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
		Each synthesizer comes supplied with a rear panel K Connector™ RF Output instead of the type of connector that would normally be installed on the front panel. The front panel connector is deleted.			
-	513-31	1	Connector, RF Bulkhead, K		Wiltron Co.
-	680-645	1	Label, Rear Panel		Wiltron Co.
-	720-1/8	2	Cable Fastener, Clamp, 0.12, Wht		Wiltron Co.
-	900-148	4	Screw, Pan Hd, 4-40, 0.375, Philips		Wiltron Co.
-	900-348	4	Washer, #6, Flt, SST, 0.375		Wiltron Co.
-	900-392	4	Washer, #6, Split Lk, SST		Wiltron Co.
-	900-81	2	Screw, Flt Hd, 6-32, 0.500, Philips		Wiltron Co.
-	A13393	1	Plug Button, Painted, 0.625 Inch		Wiltron Co.
-	A31506	1	Spacer Plate, Coupler, 26.5 GHz		Wiltron Co.
-	A31886	2	Bracket, Cable Support		Wiltron Co.
-	A31887	1	Plug, RF Output, 67XXA		Wiltron Co.
-	A9201-157	1	Cable Assy, UT-141, SM-SM, 3 In		Wiltron Co.
-	A9201-158	1	Cable Assy, SMA M-M, UT-141		Wiltron Co.
-	A9201-170	1	Cable Assy, UT-141, SM-SM, Atten		Wiltron Co.

INDEX NO.	NAME	WILTRON PART NO.	QTY
1	ON/STANDBY Pushbutton	C8187-1	1
2	DECR Pushbutton	B32154-20	1
3	INCR Pushbutton	B32154-19	1
4	INCR/DECR Knob	A12070	1
5	"." Pushbutton	B32154-7	1
6	"1" Pushbutton	B32154-8	1
7	"2" Pushbutton	B32154-9	1
8	"3" Pushbutton	B32154-10	1
9	"4" Pushbutton	B32154-11	1
10	"5" Pushbutton	B32154-12	1
11	"6" Pushbutton	B32154-13	1
12	"7" Pushbutton	B32154-14	1
13	"8" Pushbutton	B32154-15	1
14	"9" Pushbutton	B32154-16	1
15	"0" Pushbutton	B32154-17	1
16	"-" Pushbutton	B32154-18	1
17	All other pushbuttons that are not otherwise called out.	C8187-1	36
18	Handle, Front	C31648	2
19	Overlay, Front Panel	D31580	1
20	Shift Key Pushbutton	C8187-4	1
21	Instrument Case	D31615-2	1
22	Foot, Rear	D13656	4
23	Handle, End Cap	B31636	4
24	Foot, Bottom	D13655	4
25	Handle Strap, Plastic	B31651	2
26	Insert, Handle Strap	B31634	2

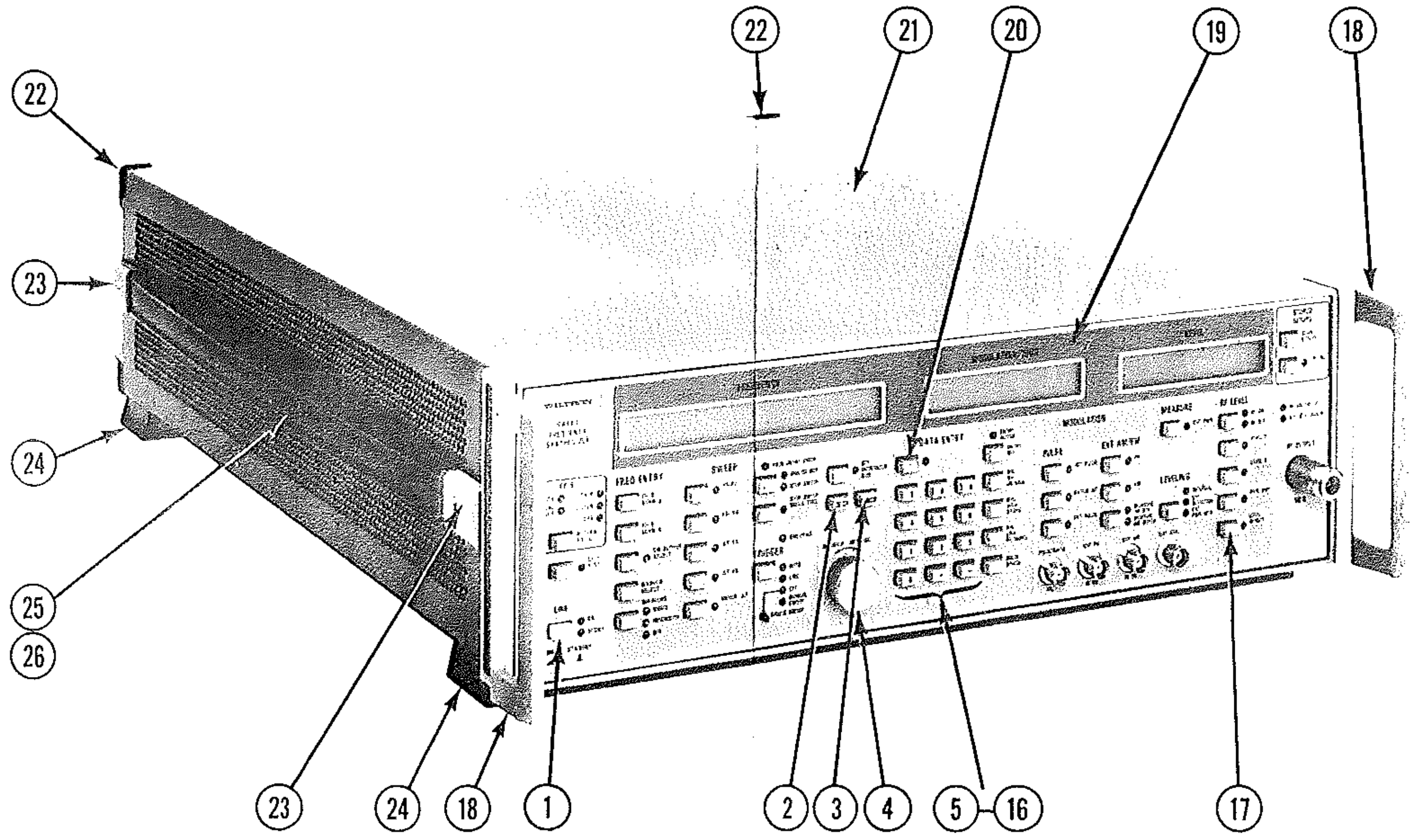

Figure 5-1. Top Assembly

INDEX NO	NAME	WILTRON PART NO.	QTY
1	Standoff, Male/Female	790-265	9
2	Mounting Bracket	A31594	5
3	DC Motor	60-25	1
4	A2 PCB, Front Panel Control	D31702-3	1
5	A1 PCB, Front Panel	D31701-3	1
6	Subpanel Plate Assembly	C31949	1
7	Ribbon Cable	803-30	4

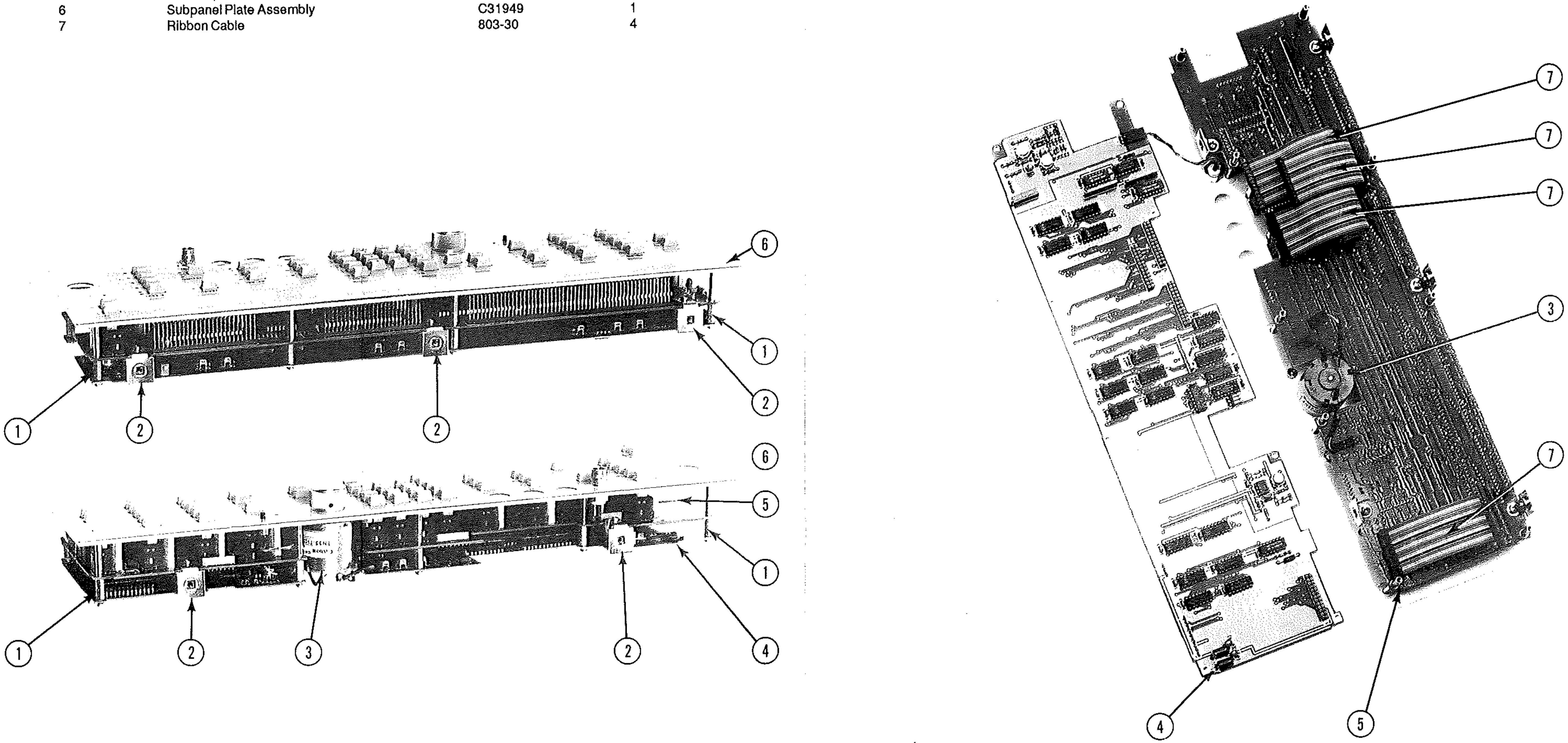

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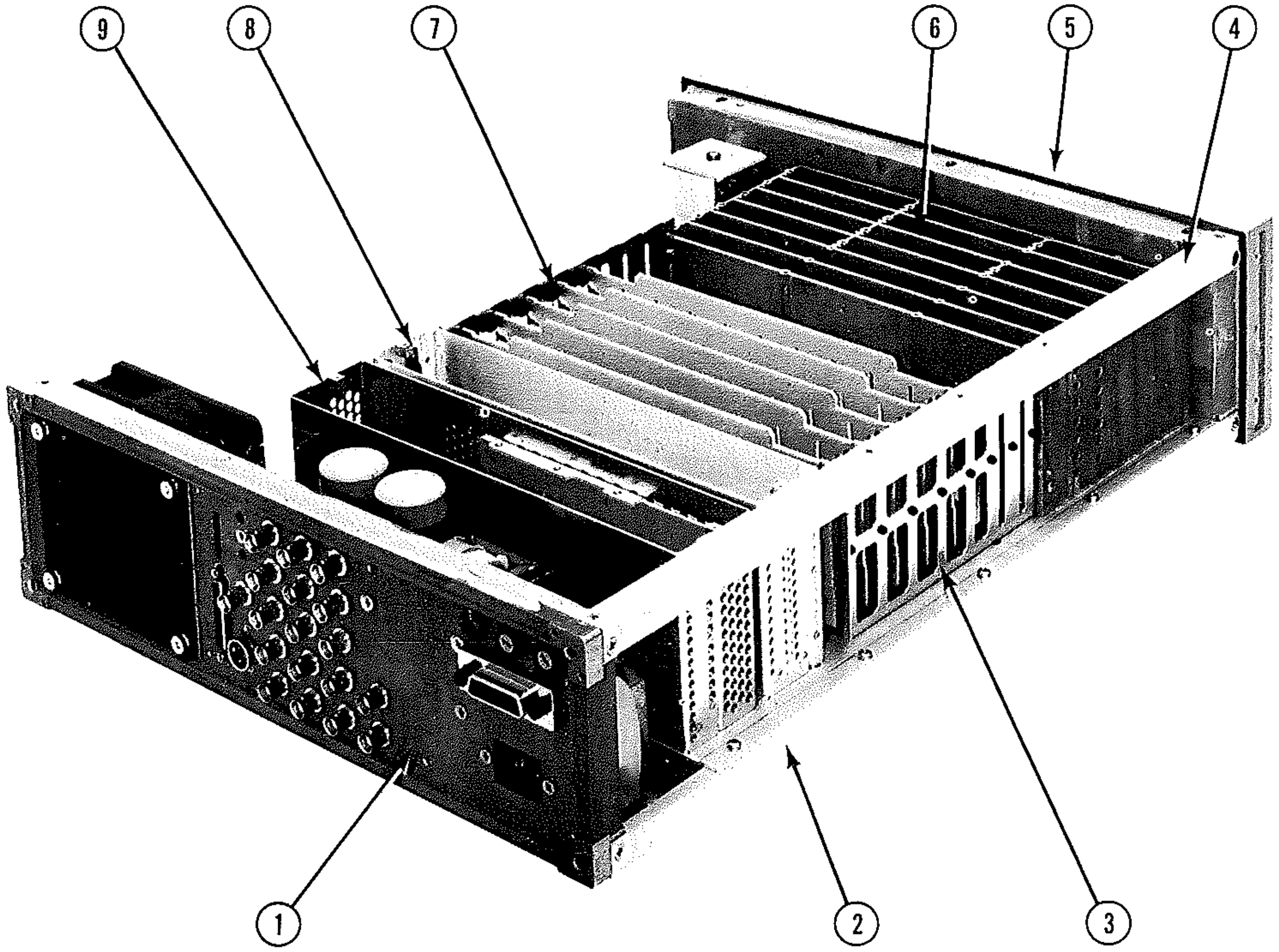
Figure 5-2. Front Panel Assembly

INDEX NO	NAME	WILTRON PART NO.	QTY.
1	Rear Casting	D31610	1
2	Extrusion, Lower Left	B31600	1
3	Card Cage Bracket, Left	C31838	1
4	Extrusion, Upper Left	B31598	1
5	Front Casting	D31938	1
6	RF Housing	D31512	1
7	Card Cage Bracket, Right	C31837	1
8	Digital Housing	C31836	1
-	Digital Housing Cover	C31547	1
9	Power Supply Housing	C31835	1
-	Power Supply Housing Cover	C31633	1
10	10 MHz Crystal Oscillator Assembly	C31924	1
11	Chassis Mount	B31641	1
12	6700 Chassis	D31549	1
13	Pillow Block Assembly	A31834	1



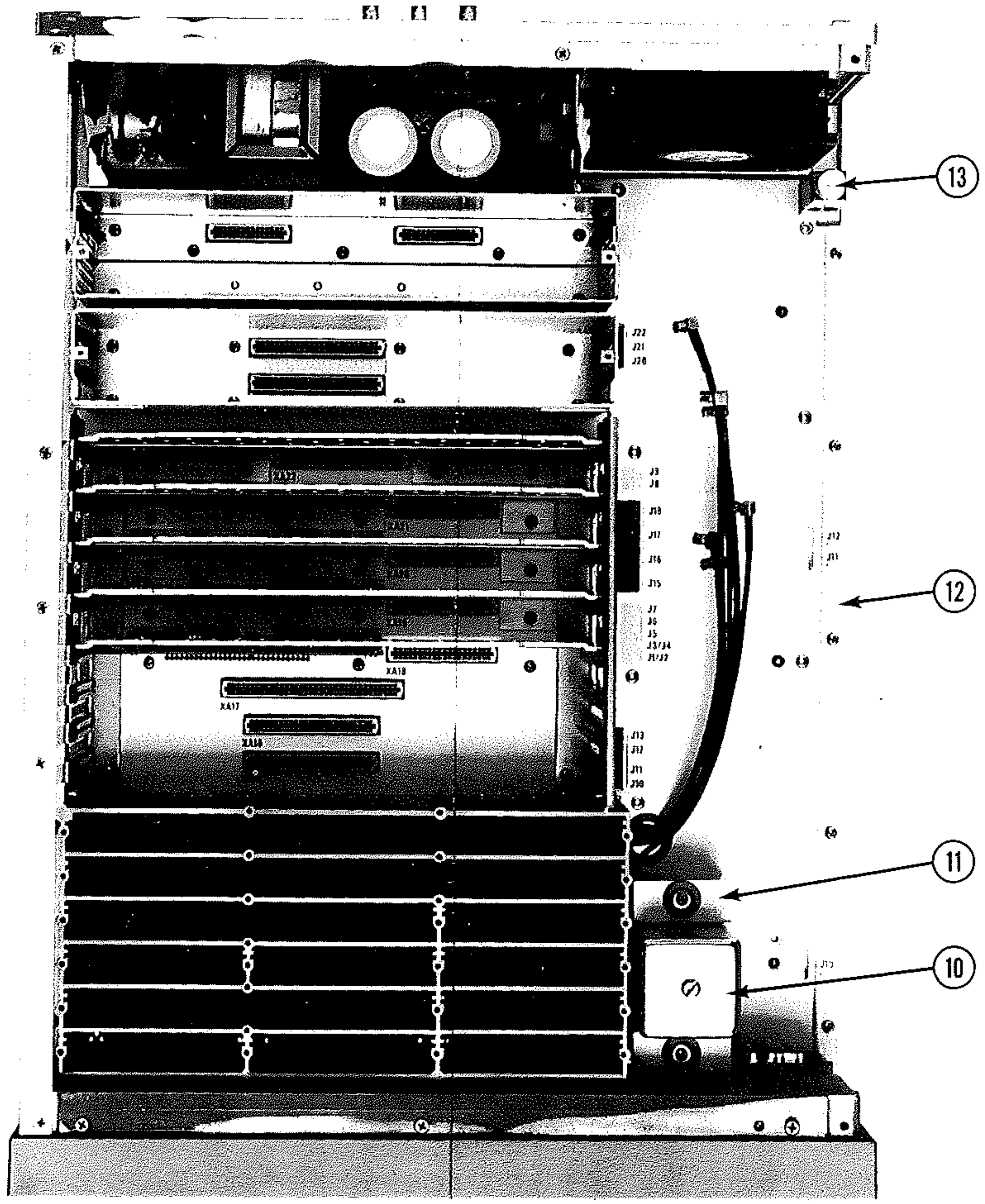


Figure 5-3. Basic Frame Assembly

INDEX NO.	NAME	WILTRON PART NO.	QTY.
1	A3 PCB, Coarse Loop Mixer	D31703-3	1
2	A6 PCB, Coarse Loop Divider	D31706-3	1
3	A4 PCB, Coarse Loop Oscillator	D31704-3	1
4	A9 PCB, Fine Loop Oscillator	D31709-3	1
5	A5 PCB, 500 MHz Reference Oscillator	D31705-3	1
6	A7 PCB, Reference Divider	D31707-3	1
7	A12 PCB, YIG Phase Detector	D31712-3	1
8	A25 PCB, Power Supply	D31725-3	1
9	A24 PCB, GPIB	D31724-3	1
10	A23 PCB, Microprocessor	D31724-3	1
11	A22 PCB, Regulator	D31722-3	1
12	A21 PCB, YIG Driver, 18-26.5 GHz	D31718-7	1
13	A20 PCB, YIG Driver, 13.25-20 GHz	D31718-6	1
14	A19 PCB, YIG Driver, 8-12.4 GHz	D31718-5	1
15	A18 PCB, YIG Driver, 2-8.4 GHz	D31718-4	1
16	A17 PCB, Analog Instruction	D31717-3	1
17	A16 PCB, FM Amplifier	D31716-3	1
18	A15 PCB, ALC	D31714-3	1
19	Cover Plate, A14, Blank	B31585	1
20	A13 PCB, Pulse Generator	D31713-3	1
21	A11 PCB, Fine Loop Divider	D31711-3	1
22	A8 PCB, Serial I/O	D31708-3	1

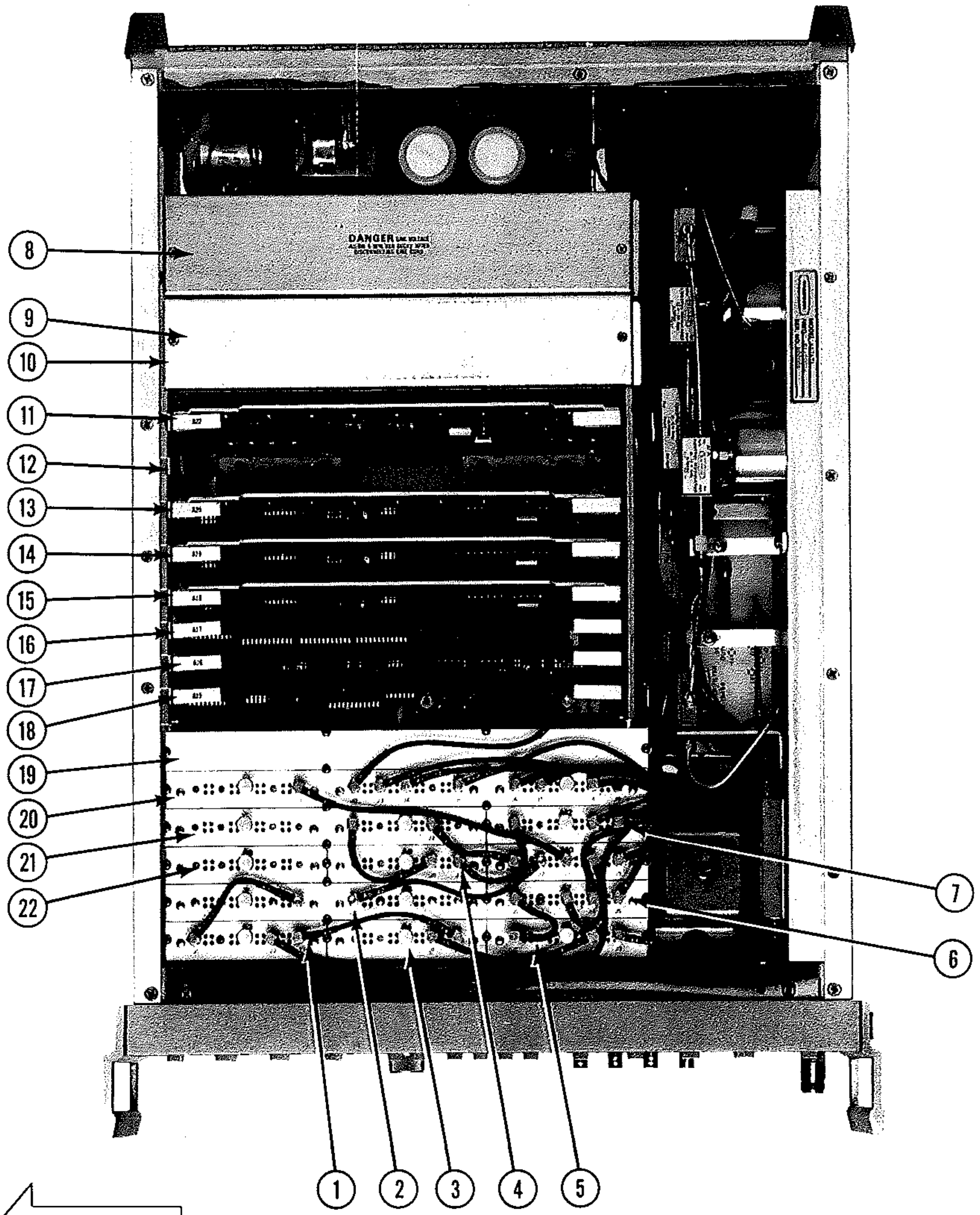


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Figure 5-4. PCB Mechanical Assembly

NOTE: The A3 thru A13 PCBs are pull out assemblies with permanently attached cover plates and handles, as shown below. These PCBs all reside in the RF Housing.

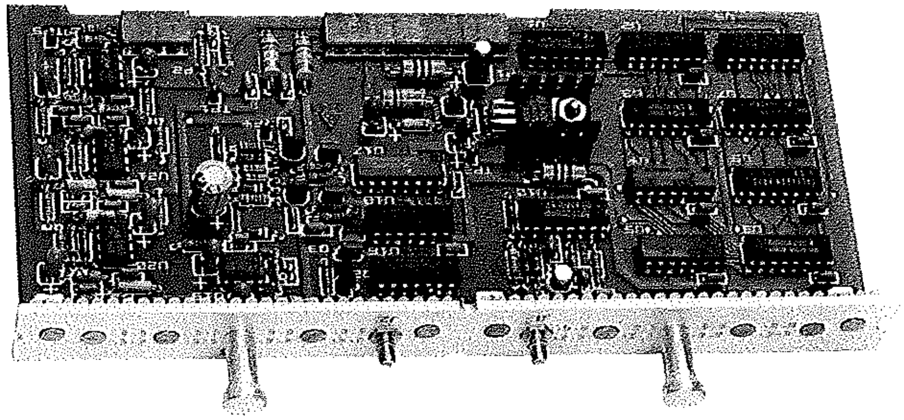

Figure 5-5. Pull Out PCBs

INDEX NO.	NAME	WILTRON PART NO.	QTY.
1	Cable Assy, SMC, F/F, RG174U, Double Shielded	A30651	17
-	A3J1 to A6J1	A30651-1	
-	A3J2 to A5J2	A30651-2	
-	A3J3 to A4J2	A30651-3	
-	A4J1 to Power Amp IN	A30651-4	
-	A5J1 to A7J1	A30651-5	
-	A6J2 to A10J2	A30651-7	
-	A7J3 to A10J4	A30651-8	
-	A7J5 to Crystal Oscillator	A30651-10	
-	A9J1 to A11J1	A30651-11	
-	A9J2 to A12J1	A30651-12	
-	A10J1 to A11J2	A30651-13	
-	A10J3 to A13J1	A30651-14	
-	A12J4 to Sample I/F OUT	A30651-17	
-	A13J6 to 2-8 Pulse Mod	A30651-22	
-	A13J7 to 8-12 Pulse Mod	A30651-23	
-	A13J8 to 12-20 Pulse Mod	A30651-24	
-	A13J9 to 20-26 Pulse Mod	A30651-25	
2	Cable Assy, BNC to SMC, RF174U, Double Shielded	A32067	6
-	Rear Panel 10 MHz IN to A7J4	A32067-1	
-	Rear Panel Pulse SYNC to A13J5	A32067-2	
-	Rear Panel 10 MHz OUT to A10J5	A32067-3	
-	Rear Panel Pulse IN to A13J4	A32067-4	
-	Rear Panel HIGH RES IN to A12J3	A32067-5	
-	Front Panel Pulse IN to A13J3	A32067-6	
3	Cable Assembly, SMA to SMC, RG174, A5J3 to Down Converter IN	A32078-1	1
4	Cable Assy, SMC-F to SMB-F, Double Shielded Coax, A13J2 to A15J1	A32079-1	1

Figure 5-6. Cabling to Digital Housing (1 of 2)

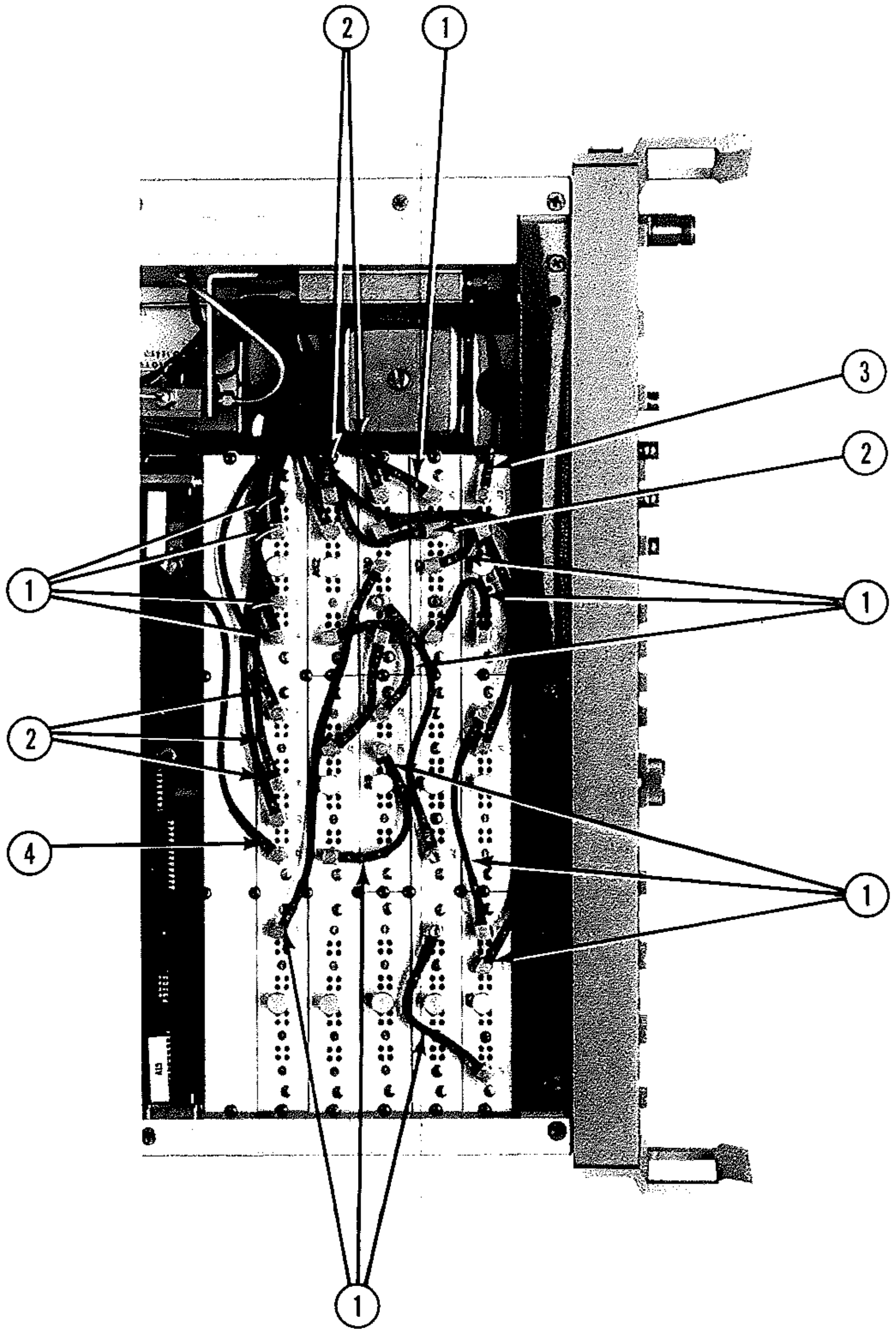

Figure 5-6. Cabling to Digital Housing (2 of 2)

INDEX NO.	NAME	WILTRON PART NO.	QTY.
1	A28 PCB, Motherboard	D31728-3	1
2	Extrusion, Lower Left	B31600	1
3	Shield, High Voltage	B31585	1
4	Label, Danger Line Voltage	A8138	2
5	Shield, Cable	B31646	1
6	A29 PCB, Rear Panel Interface	D31729-3	1
7	Extrusion, Lower Right	B31601	1
8	Cable Assembly, 2-Conductor, 26 AWG	A32075-1	1

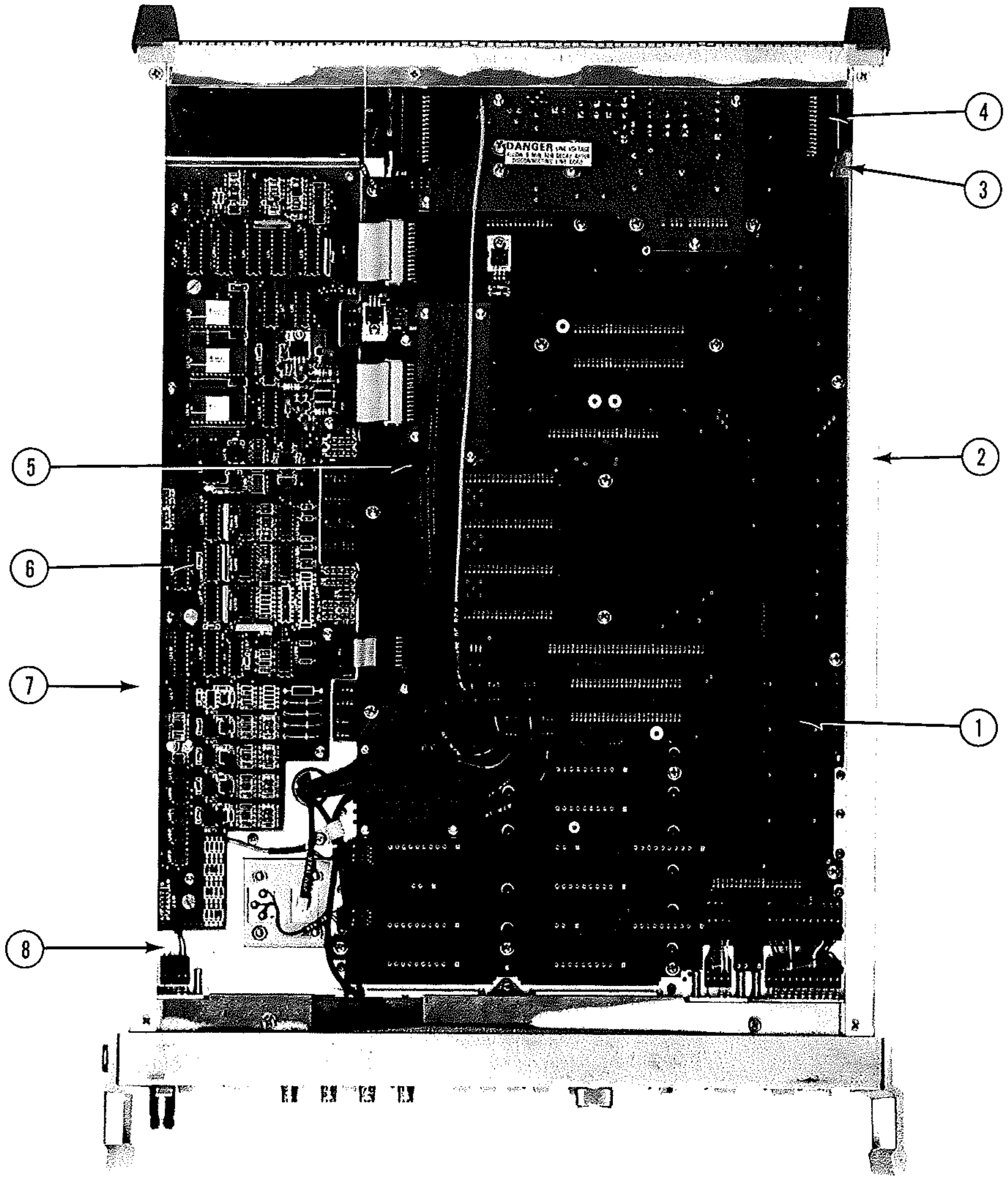

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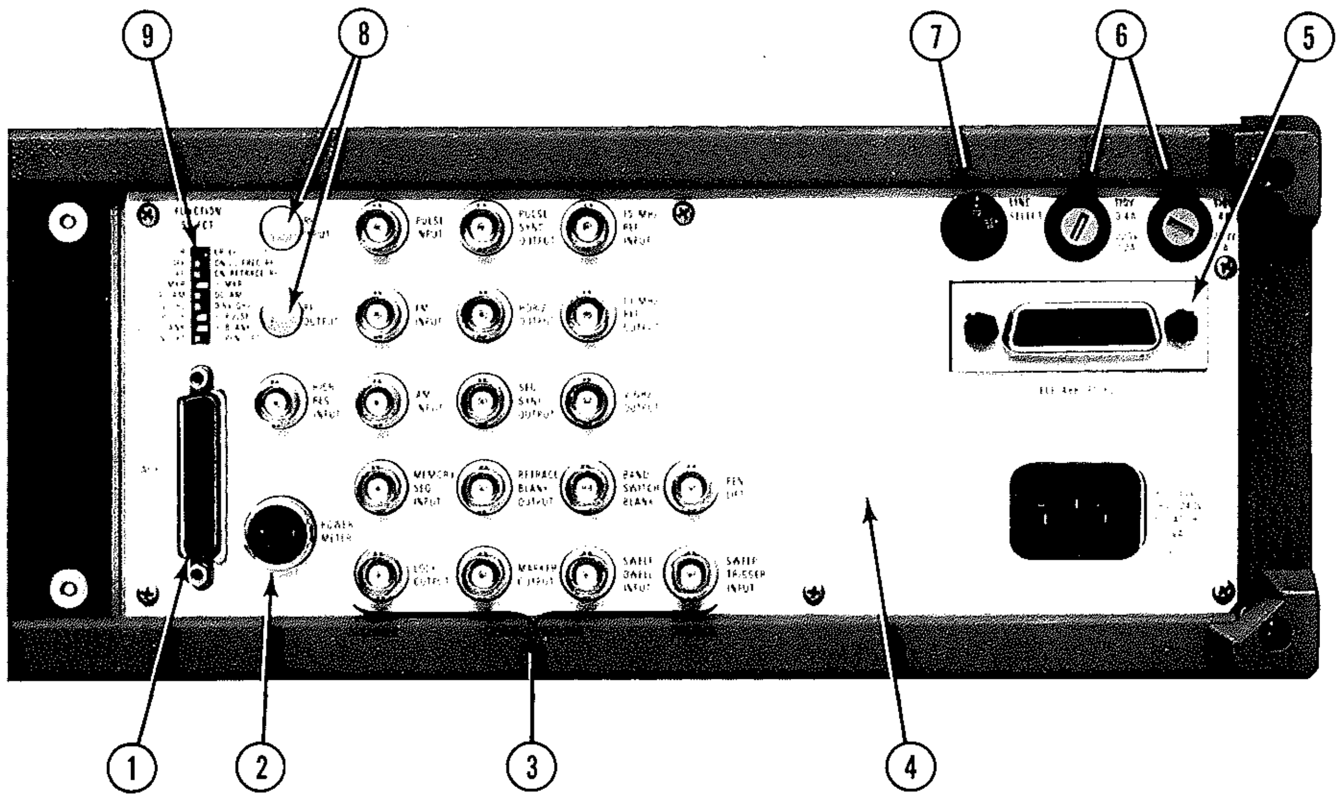
Figure 5-7. Basic Frame Assembly, Bottom View

INDEX NO.	NAME	WILTRON PART NO.	QTY.
1	Connector, AUX I/O	551-579	1
2	Cable Assembly, Power Meter	B31926	1
3	Connector, BNC Female	510-5	18
4	Overlay, Rear Panel	C31612	1
5	Cable Assembly, GPIB	A31928	1
6	Fuse Holder, 3 AG	553-176	2
7	Switch, Rotery, Line Select	410-85	1
8	Plugs, Button, 5/8	790-42	2
9	Switch, Function Select	430-229	1
10	Power Supply Regulator Capacitor	250-86	2
11	Capacitor, P/O A28 PCB	250-144	1
12	A28 PCB, Motherboard	D31728-3	1
13	Line Transformer	B31929	1
14	EMI Filter	260-11	1
-	Shield , Cap	B31670	1
15	Power Supply Housing	C31835	1
16	Mounting Clips	553-233	2
17	A27 PCB, AUX I/O	D31727-3	1
18	Fan	650-8	1



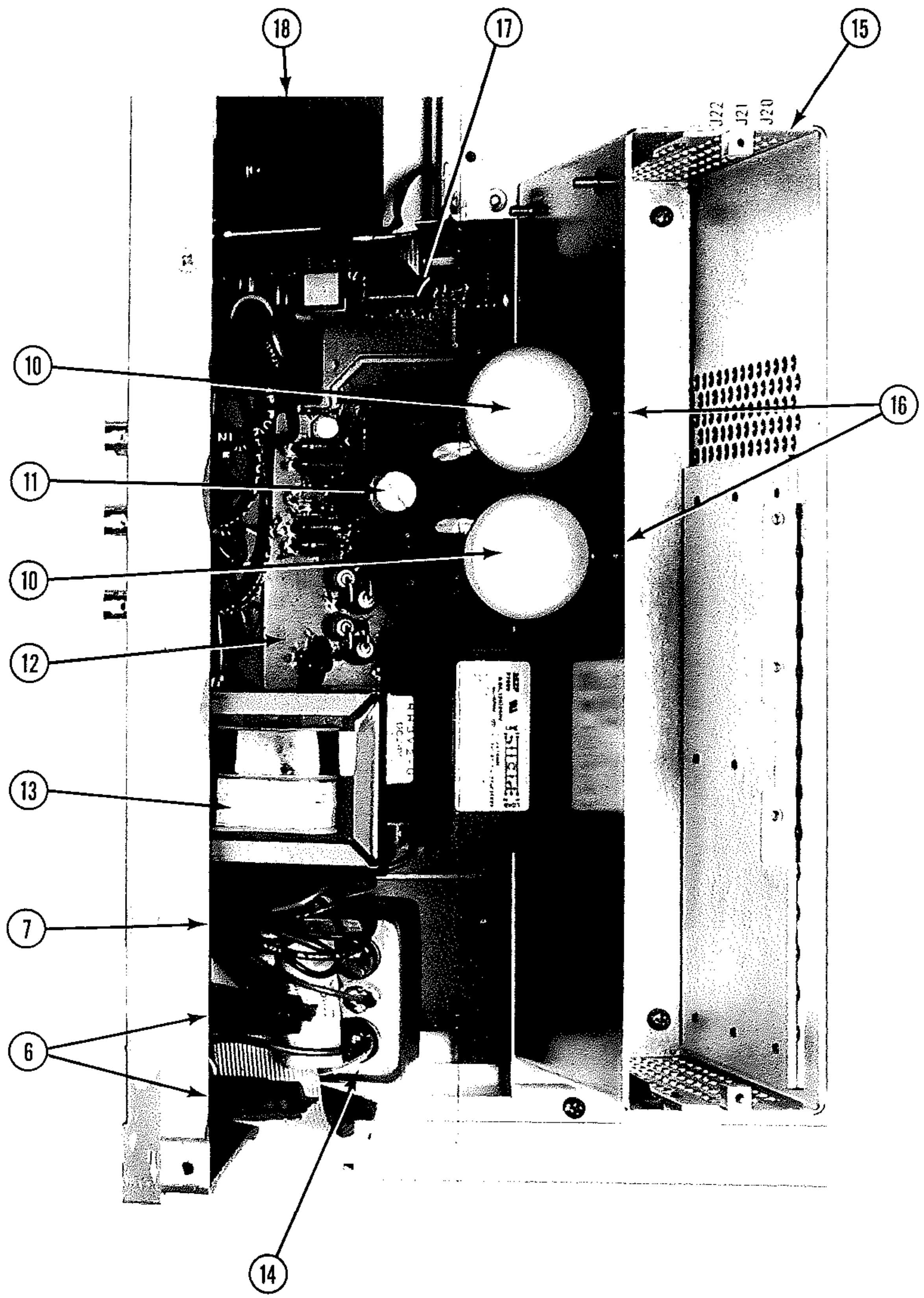
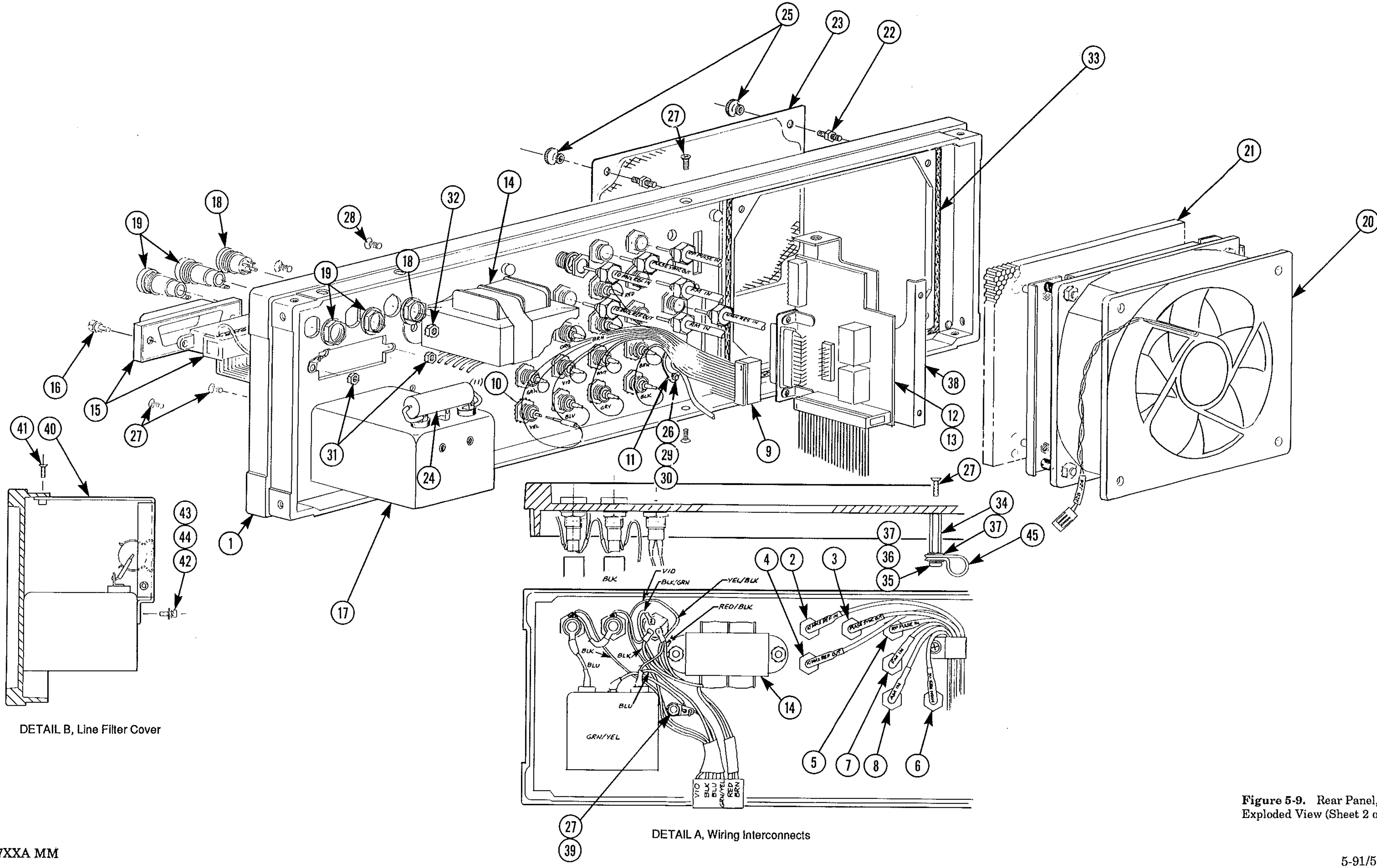


Figure 5-8. Rear Panel Assembly

INDEX NO.	NAME	WILTRON PART NO.	QTY.
1	Rear Casting	D31610	1
2	Cable Assembly, BNC to SMC	A32067-1	1
3	Cable Assembly, BNC to SMC	A32067-2	1
4	Cable Assembly, BNC to SMC	A32067-3	1
5	Cable Assembly, BNC to SMC	A32067-4	1
6	Cable Assembly, BNC to SMC	A32067-5	1
7	Cable Assembly, BNC to 3 Pin	A32068-1	1
8	Cable Assembly, BNC to 3 Pin	A32068-2	1
9	Cable Assembly, Ribbon, 14 Conductor	A31931	1
10	Connector , BNC, Female	510-5	11
11	Cable Assembly, Power Meter	B31926	1
12	PC Assembly, AUX I/O, A27	C31727-3	1
13	Connector , Mounting Hardware	525-24	2
14	Wiring Assembly, Transformer	B31929	1
15	Cable Assembly, GPIB	A31928	1
16	Connector Accessory, Mounting Hardware	551-588	1
17	EMI Filter, Balanced Box	260-11	1
18	Switch, Rotary	410-85	1
19	Fuse Holder, 3 AG	553-176	2
20	Sub-Assembly, Fan	B31927	1
21	Honeycomb, Fan	B31591	1
22	Standoff, M/F, 6/32	785-882	4
23	Filter, Fan	783-403	1
24	Capacitor, Fixed	250-149	1
25	Nut, Thumb, 6/32	790-193	4
26	Screw, Flat Head, 2/56	900-27	2
27	Screw, Flat Head, 6/32	900-69	6
28	Screw, Flat Head, 8/32	900-89	2
29	Washer, #2, Split, SST	900-389	2
30	Nut, Hex, 2/56	900-317	2
31	Nut, Kep, 4/40	900-326	2
32	Nut, Kep, 8/32	900-336	2
33	Gasket, RF1, .125"L, .125"W	790-269	1.5
34	Standoff, plain, 6/32	785-610	1
35	Screw, Pan Head, 6/32	900-174	1
37	Washer, #6, Flat, SST	900-348	2
38	Bracket, Chassis Support	B31597	1
39	Nut , Kep, 6/32	900-332	1
40	Assembly, Cap Support, Line Filter	B31970	1
41	Screw, Flat head, 4/40	900-45	2
42	Screw, Pan head, 4/40	900-142	2
43	Washer, Flat, #4, SST	900-346	2
44	Washer, #4, Split, SST	900-391	2
45	Cable Fastener,Clamp	720-3/8	1

Figure 5-9. Rear Panel Assembly, Exploded View (1 of 2)



DETAIL B, Line Filter Cover

DETAIL A, Wiring Interconnects

Figure 5-9. Rear Panel, Exploded View (Sheet 2 of 2)

Table 5-40. Typical 67XXA Microwave Deck Parts List (1 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
			MICROWAVE DECK ELECTRICAL COMPONENTS		
	C31921	1	A30 SAMPLER/IF AMP ASSY		WILTRON CO.
	B31867	1	A31 POWER AMP ASSY, CABLED		WILTRON CO.
	C31755-3	1	SWITCHED FILTER INTERACE PCB		WILTRON CO.
	43KA-3	2	ATTENUATOR, 3 DB		WILTRON CO.
	43KA-20	1	ATTENUATOR, 20 DB		WILTRON CO.
	A31960	1	CONTROL MOD ASSY, 2-8 GHZ, CABLED		WILTRON CO.
	A31961	1	CONTROL MOD ASSY, 8-12 GHZ, CABLED		WILTRON CO.
	A31962	1	CONTROL MOD ASSY, 12-20 GHZ, CABLED		WILTRON CO.
	A31963	1	CONTROL MOD ASSY, 18-26.5 GHZ, CABLED		WILTRON CO.
	C15360	1	DIRECTIONAL COUPLER, 2-26 GHZ		WILTRON CO.
	A31959	1	DOWN CONVERTER ASSY, CABLED		WILTRON CO.
	1000-41	1	ISOLATOR, 18-26.5 GHZ	DF1133	DITOM MICROWAVE
	1000-39	1	ISOLATOR,DUAL, 8-12.4 GHZ	31831	NARDA
	1000-40	1	ISOLATOR,DUAL, 12.4-20 GHZ	31832	NARDA
	C31900-2	1	OSCILLATOR ASSY, SC, 2-8 GHZ, HI PWR		WILTRON CO.
	C31901-1	1	OSCILLATOR ASSY, X, 8-12 GHZ		WILTRON CO.
	C31902-1	1	OSCILLATOR ASSY, KU, 12-20 GHZ		WILTRON CO.
	C31903	1	OSCILLATOR ASSY, K, 20-26.5 GHZ		WILTRON CO.
	A31956	1	PIN SWITCH, RF OUTPUT, CABLED		WILTRON CO.
	A31957	1	PIN SWITCH, SAMPLER, CABLED		WILTRON CO.
	ND19383	1	67XXA RF TAKE OFF		WILTRON CO.
			MICROWAVE DECK CABLE ASSEMBLIES		
	551-474	1	CONNECTOR, RF CABLE, SMA	705979-001	CABLE WAVE
	A30645-1	1	CABLE ASSY, (4-PIN CONN)		WILTRON CO.
	A12364	1	CABLE ASSY, THERMOSTAT, 67XXA		WILTRON CO.
	A32078-1	1	CABLE ASSY, SMA-SMC, RG-174		WILTRON CO.
	A30651-4	1	CABLE ASSY, SMC F/F, DBL-SHLD, COAX		WILTRON CO.
	A30651-17	1	CABLE ASSY, SMC F/F, DBL-SHLD, COAX		WILTRON CO.
	A30651-22	1	CABLE ASSY, SMC F/F, DBL-SHLD, COAX		WILTRON CO.
	A30651-23	1	CABLE ASSY, SMC F/F, DBL-SHLD, COAX		WILTRON CO.
	A30651-24	1	CABLE ASSY, SMC F/F, DBL-SHLD, COAX		WILTRON CO.
	A30651-25	1	CABLE ASSY, SMC F/F, DBL-SHLD, COAX		WILTRON CO.
	A9202-95	1	ASSY,CABLE, UT85, SM-SM, 2.0		WILTRON CO.
	A9202-100	1	ASSY,CABLE, UT85, SM-SM, 2.0IN		WILTRON CO.
	A9202-88	1	ASSY,CABLE, UT85, SM-SM, 7.0IN		WILTRON CO.
	A9202-89	1	ASSY,CABLE, UT85, SM-SM,		WILTRON CO.
	A9202-90	1	ASSY,CABLE, UT85, SM-SM, 3.5IN		WILTRON CO.
	A9202-116	1	ASSY,CABLE, UT85, SM-SM		WILTRON CO.
	A9202-93	1	ASSY,CABLE, UT85, SM-SM, 4.0IN		WILTRON CO.
	A9202-94	1	ASSY,CABLE, UT85, SM-SM		WILTRON CO.
	A9202-103	1	ASSY,CABLE, UT85, SM-SM, 4.5IN		WILTRON CO.
	A9202-97	1	ASSY,CABLE, UT85, SM-SM, 5.0		WILTRON CO.
	A9202-98	1	ASSY,CABLE, UT85, SM-SM		WILTRON CO.
	A9202-99	1	ASSY,CABLE, UT85, SM-SM, 6.0IN		WILTRON CO.
	A9201-153	1	ASSY,CABLE, UT141, SM-SM		WILTRON CO.
	A9201-147	1	ASSY,CABLE, UT141, SM-SM, 2.0IN		WILTRON CO.
	A9201-148	1	ASSY,CABLE, UT141, SM-SM, 1.4"		WILTRON CO.
	A9201-149	1	ASSY,CABLE, UT141, SM-SM, 6.7IN		WILTRON CO.
	A9201-151	1	ASSY,CABLE, UT141, SM-SM, 3.0"		WILTRON CO.
	A9201-183	1	ASSY,CABLE, UT141, SM-SM		WILTRON CO.
	A9201-154	1	ASSY,CABLE, UT141, SM-SM, 5.5IN		WILTRON CO.

Table 5-40. Typical 67XXA Microwave Deck Parts List (2 of 2)

REF DES	WILTRON PART NO.	QTY	DESCRIPTION	VENDOR PART NO.	VENDOR NAME
			MICROWAVE DECK MECHANICAL COMPONENTS		
	A8133	1	ASSY, LABEL, RF DECK	660-A-8133	CELLOTAPE
	A31691	1	BRACKET, DUAL ISOLATOR (KU BAND)		WILTRON CO.
	A31877	1	BRACKET, HEAT SINK (SC BAND)		WILTRON CO.
	A31692	1	BRACKET, DUAL ISOLATOR (X-BAND)		WILTRON CO.
	721-2	5	CABLE FASTENER, TIE, 0.75, WHT	T18R	TYTON
	720-1/2	1	CABLE FASTENER, CLAMP, 0.50, WHT	CLN1/2	ICO RALLY
	720-7/16	1	CABLE FASTENER, CLAMP, 0.44, WHT	CLN7/16	ICO RALLY
	720-3/16	1	CABLE FASTENER, CLAMP, 0.19, WHT	CLN3/16	ICO RALLY
	720-1/4	1	CABLE FASTENER, CLAMP, 0.25, WHT	CLN1/4	ICO RALLY
	A31955-1	1	COUPLER MNT PLATE ASSY, K-KF		WILTRON CO.
	D31501	1	HEAT SINK, RF DECK (MACH)		WILTRON CO.
	A31697	1	HEAT SINK PLATE, AMPLIFIER (K)		WILTRON CO.
	900-332	1	NUT, KEP, 6-32, 0.312		WILTRON CO.
	900-41	2	SCREW, FLT HD, 4-40, 0.312, PHIL		WILTRON CO.
	900-547	2	SCREW, PAN, 2-56, 0.750, PHIL		WILTRON CO.
	900-148	16	SCREW, PAN HD, 4-40, 0.375, PHIL		WILTRON CO.
	900-124	5	SCREW, PAN HD, 2-56, 0.250, PHIL		WILTRON CO.
	900-166	2	SCREW, PAN HD, 6-32, 0.250, PHIL		WILTRON CO.
	900-168	17	SCREW, PAN HD, 6-32, 0.312, PHIL		WILTRON CO.
	900-178	3	SCREW, PAN HD, 6-32, 0.437, PHIL		WILTRON CO.
	900-56	4	SCREW, FLT HD, 4-40, 0.750, PHIL		WILTRON CO.
	900-81	6	SCREW, FLT HD, 6-32, 0.500, PHIL		WILTRON CO.
	900-127	3	SCREW, PAN HD, 2-56, 0.375, PHIL		WILTRON CO.
	900-151	3	SCREW, PAN HD, 4-40, 0.500, PHIL		WILTRON CO.
	900-345	6	WASHER, #4, FLT, SST		WILTRON CO.
	900-389	7	WASHER, #2, SPLIT LK, SST		WILTRON CO.
	900-391	16	WASHER, #4, SPLIT LK, SST		WILTRON CO.
	900-392	24	WASHER, #6, SPLIT LK, SST		WILTRON CO.
	900-346	6	WASHER, #4, FLT SMALL, SST	NAS620C-4L	AFCOM
	900-348	18	WASHER, #6, FLT, SST		WILTRON CO.
	900-349	4	WASHER, #6, FLT SMALL, SST, 0.27	NAS620C6L	AFCOM

SECTION VI
SERVICE

6A-1 INTRODUCTION

This section contains general service information, description, schematics, and troubleshooting information for all 6700A circuits. The 6700A circuits are divided into subsystems. Each subsystem is then described in a separate subsection. All service data (schematics, description, block diagrams, etc.) that affect a subsystem are contained within that subsection. For example, all schematics and other service data bearing on the power supply subsystem are contained within paragraphs 6C. This includes the one page of the A28 Motherboard schematic that contains power supply circuitry.

6A-2 GENERAL INFORMATION

6A-2.1 Module Exchange Program

WILTRON maintains a module exchange program for selected synthesizer modules (Table 6A-1). If a malfunction occurs in one of these modules, the module can be exchanged. Upon request and typically within 24 hours, WILTRON will ship an exchange module. The customer then has 30 days in which to return the defective item. All exchange parts are warranted for 90 days from the date of shipment or for the balance of the original-part warranty—whichever is longer.

For more information on this program, contact your local representative or call WILTRON Customer Service direct at 408-778-2000.

6A-2.2 Preventive Maintenance

The two air filters on the synthesizer rear panel should be periodically checked, and cleaned as necessary.

6A-2.3 Recommend Test Equipment

A list of recommended test equipment is provided in Section 1, Table 1-2.

Table 6A-1. Replaceable Subassemblies

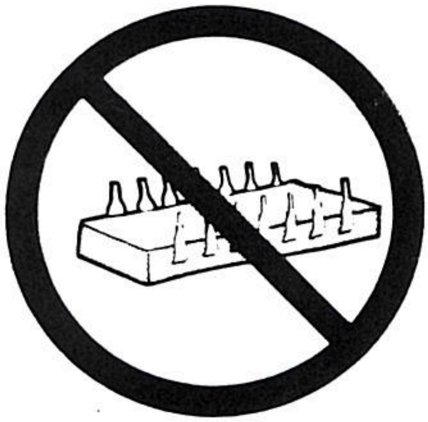
ASSY NO.	NOUN	WILTRON PART NO.
A1	Front Panel PCB	D31701-3
A2	Front Panel Interface PCB	D31702-3
A3	Coarse Loop Mixer PCB	D31703-3
A4	Coarse Loop Oscillator PCB	D31704-3
A5	Reference Oscillator PCB	D31705-3
A6	Coarse Loop Divider PCB	D31706-3
A7	Reference Divider PCB	D31707-3
A8	Serial I/O PCB	D31708-3
A9	Fine Loop Oscillator PCB	D31709-3
A10	Reference Buffer PCB	D31710-3
A11	Fine Loop Divider PCB	D31711-3
A12	YIG Phase Detector PCB	D31712-3
A13	Pulse Generator PCB	D31713-3
A15	ALC PCB	D31715-3
A16	FM PCB	D31716-3
A17	Analog Instruction PCB	D31717-3
A18	YIG Driver PCB	D31718-104
A19	YIG Driver PCB	D31718-105
A20	YIG Driver PCB	D31718-106
A21	YIG Driver PCB	D31718-107
A22	Regulator Interface PCB	D31722-3
A23	Microprocessor PCB	D31723-3
A24	GPIB PCB	D31724-3
A25	Power Supply PCB	D31725-3
A27	Auxilliary I/O PCB	D31727-3
A29	Rear Panel Interface PCB	D31729-3

6A-2.4 Static Handling Procedures

This instrument contains components that are subject to being damagd by static electricity. Table 6A-2 provides a list of precautions that, if followed, will minimize the possibilities of static-shock damage.

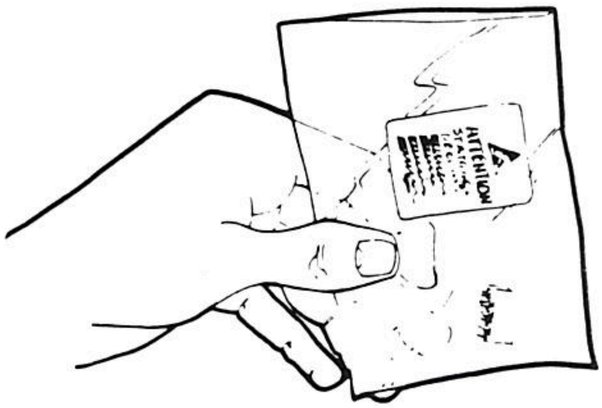
Table 6A-2. Static Warning Precautions (Sheet 1 of 2)

1. Do not touch exposed contacts on any static sensitive component.



2. Do not slide static sensitive components across any surface.

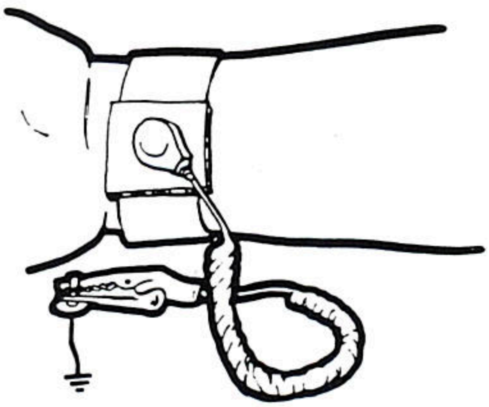
3. Do not handle static sensitive components in areas where the floor or work surface covering is capable of generating a static charge.



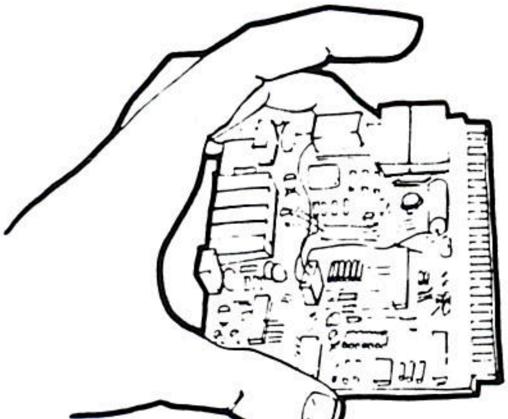
4. Transport and store PCBs and other static sensitive devices in static-shielded containers.

Table 6A-2. Static Warning Precautions (Sheet 2 of 2)

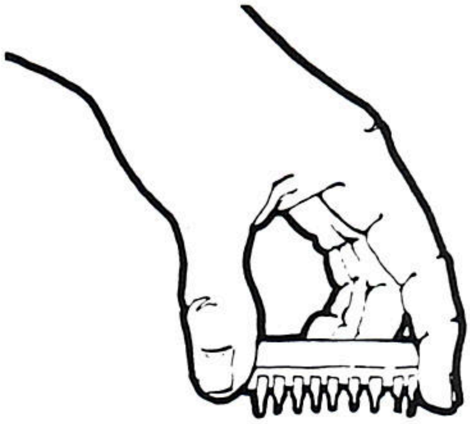
5. Label all static sensitive devices.



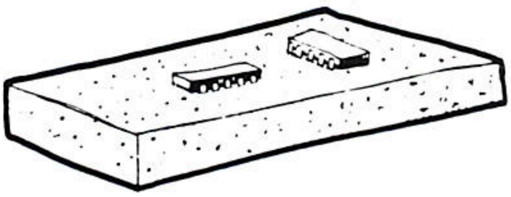
6. Wear a static-discharge wristband when working around static sensitive components.



7. Handle PCBs only by their edges.



8. Pick up solid state devices by their bodies and never by their leads.



9. Keep component leads shorted together whenever possible.

10. Additional Guidelines:
    - Keep workspaces clean and free of any objects capable of holding or storing an electric charge.
    - Connect soldering tools to an earth ground.
    - Use only special anti-static suction or wick-type desoldering tools.

6A-2.5 Schematic Conventions

The schematic conventions used in this manual are described below.

1. Signal flow is from left to right. That is, all signals entering the PCB do so on the left of the page and those exiting the PCB do so on the right of the page.
2. The arrow points of the ignal flags indicate the direction of signal flow.
3. The lettering in the signal flags indicate the sheet and grid coordinates where the signals either go to or come from.
4. The arrow points on connector lines indicate plugs; the arrow tails indicate jacks.
5. Signal lines are identified by a distinctive name, mnemonic symbol, or voltage value. The letters "H" and "L" in front of digital signal lines indicate the line's active state—H for TTL high and L for TTL low. The "(-)" symbol that follows certain analog signal lines indicates a negative value.

6A-3 OVERALL CIRCUIT DESCRIPTION AND BLOCK DIAGRAM

The Series 6700A Swept Frequency Synthesizer is comprised of 28 printed circuit boards (PCBs) and is organized into universal and model-dependent circuits. The block diagram of the typical four-band 6700A in Figure 6A-1 shows this organization.

The shaded circuits in the figure are those related to the generation of the microwave frequencies. These circuits are the YIG-tuned oscillators, the 10 MHz to 2 GHz Heterodyne Down Converter Module, the Level Coupler, the Step Attenuator, and the Control Modulators. These PCBs and components are described in Section 6R, Microwave Deck. The types of components used and the circuit configuration varies according to model number.

The unshaded universal circuits are those common to each model and are grouped into the following ten subsystems:

1. Power Supply
2. Digital Control
3. Operator I/O
4. Instrument I/O
5. Frequency Synthesis
6. Analog Instruction
7. RF Power and Control
8. Frequency Modulation
9. Yig Driver
10. Interconnect

These subsystems are briefly described below.

a. ***Power Supply Subsystem.*** This subsystem supplies regulated voltages to the synthesizer circuits. The subsystem consists of the A25 Switching Power Supply PCB, A22 Regulator PCB, and part of the A28 Motherboard PCB. It is described in paragraphs 6C.

b. ***Digital Control Subsystem.*** This subsystem provides microprocessor control for the synthesizer circuits. The subsystem consists of the A23 Microprocessor, A8 Serial I/O and A24 GPIB PCBs. It is described in paragraphs 6D.

c. ***Operator Input/Output Subsystem.*** This subsystem interfaces the front panel to the A23 Microprocesssor PCB. It consists of the A1 Front Panel PCB and the A2 Front Panel Control PCB. It is described in paragraphs 6E.

d. ***Instrument Input/Output Subsystem.*** This subsystem contains the necessary circuitry for operation of the 6700A with other instruments such as a network analizer. It consists of the A27 Auxiliary I/O and the A29 Rear Panel Interface PCBs. It is described in paragraphs 6F.

e. ***Frequency Sysnthesis Subsystem.*** This subsystem provides the reference frequencies and phase lock circuits for precise control of the YIG oscillator frequency. This subsystem is further divided into following four subsystems. It is described in paragraphs 6G through 6K.

1. *Reference Loop.* This subsystem provides the overall reference for the frequency systhesis subsystem. It consists of the 10 MHz Crystal Oscillator, the A5 Reference Oscillator, the A7 Reference Divider, and the A10 Reference Buffer PCBs.
2. *Coarse Loop.* This subsystem provides the coarse frequency tuning frequencies for the YIG Loop. It consists of the A3 Coarse Loop Mixer, A4 Coarse Loop Oscillator, and A6 Coarse Loop Divider PCBs.
3. *Fine Loop.* This subsystem provides the fine frequency tuning frequencies for the YIG Loop. It consists of the A9 Fine Loop Oscillator and the A11 Fine Loop Divider PCBs.

4. *YIG Loop*. This subsystem provides the phase detector and correction voltages for phase locking the YIG oscillators to the Coarse and Fine Loop frequencies. It consists of the A12 YIG phae Detector, A30 Sampler/IF, A31 Power Amplifier, and part of the A16 FM PCBs.

f. ***Analog Instruction Subsystem.*** This subsystem provides the analog voltages and ramp for control of the YIG oscillators. It also provides the power meter and digital voltmeter interface to the microprocessor. It consists of the A17 Analog Instruction PCB. It is described in paragraphs 6L.

g. ***RF Power and Control Subsystem.*** This subsystem provides control of the RF output power for leveling, AM modulation, pulse modulation, and multiplexing of the Yig oscillator outputs. It consists of the A15 ALC, the A13 Pulse Generator, and part of the A29 Rear Panel Interface PCBs. It is described in paragraphs 6M.

h. ***FM Subsystem:*** This subsystem processes the YIG oscillator phase-lock error voltage and the external FM input signal. The subsystem consists of the A16 FM PCB and parts of the A18 thru A21 YIG Driver PCBs. It is described in paragraph 6N.

i. ***YIG Driver Subsystem.*** This subsystem provides the tuning currents and bias voltages for control of lthe Yig oscillators. It is described in paragraph 6P.

j. ***Interconnect Subsystem.*** This subsystem provides interconnection between internal components and assemblies. The subsystem consists of the A28 Motherboard PCB and associated cables. The subsystem is described and an interconnection diagram provided in paragraph 6Q.

6A-4 OVERALL TROUBLESHOOTING

The 6700 provides software-generated error codes and hidden-key routines to aid in troubleshooting to the replaceable subassembly level. The error codes are listed in Table 6B-3. This table gives directions to flowcharts or procedures located in the various subsystem sections. These flowcharts or procedures provide detailed trouble isolation using hidden (unmarked) front- panel- key routines.

Tables 6B-4 and 6B-5 provide troubleshooting procedures for faults that do not produce error codes.

6B-1 OVERALL CIRCUIT DESCRIPTION AND BLOCK DIAGRAM

The Series 6700A Swept Frequency Synthesizer is comprised of 29 printed circuit boards (PCBs) and is organized into universal and model-dependent circuits. The block diagram of the typical four-band 6700A in Figure 6B-1 shows this organization.

The shaded circuits in the figure are those related to the generation of the microwave frequencies. These circuits are the YIG-tuned oscillators, the 10 MHz to 2 GHz Heterodyne Down Converter Module, the Level Coupler, the Step Attenuator, and the Control Modulators. These PCBs and components are described in Section 6Q, Microwave Deck. The types of components used and the circuit configuration varies according to model number.

The unshaded universal circuits are those common to each model and are grouped into the following ten subsystems:

1. Power Supply
2. Digital Control
3. Front Panel Subsystem
4. Instrument I/O
5. Frequency Synthesis
6. Analog Instruction
7. ALC/Pulse Modulation
8. Yig Driver
9. Interconnect

These subsystems are briefly described below.

a. ***Power Supply Subsystem.*** This subsystem supplies regulated voltages to the synthesizer circuits. The subsystem consists of the A25 Switching Power Supply PCB, A22 Regulator PCB, and part of the A28 Motherboard PCB. It is described in paragraphs 6N.

b. ***Digital Control Subsystem.*** This subsystem provides microprocessor control for the synthesizer circuits. The subsystem consists of the A23 Microprocessor, A8 Serial I/O and A24 GPIB PCBs. It is described in paragraphs 6E.

c. ***Front Panel Subsystem.*** This subsystem interfaces the front panel to the A23 Microprocesssor PCB. It consists of the A1 Front Panel PCB and the A2 Front Panel Control PCB. It is described in paragraphs 6D.

d. ***Instrument Input/Output Subsystem.*** This subsystem contains the necessary circuitry for operation of the 6700A with other instruments such as a network analizer. It consists of the A27 Auxiliary I/O and the A29 Rear Panel Interface PCBs. It is described in paragraphs 6F.

e. ***Frequency Sysnthesis Subsystem.*** This subsystem provides the reference frequencies and phase lock circuits for precise control of the YIG oscillator frequency. This subsystem is further divided into following four subsystems. It is described in paragraphs 6G through 6J.

1. *Reference Loop.* This subsystem provides the overall reference for the frequency systhesis subsystem. It consists of the 10 MHz Crystal Oscillator, the A5 Reference Oscillator, the A7 Reference Divider, and the A10 Reference Buffer PCBs.
2. *Coarse Loop.* This subsystem provides the coarse frequency tuning frequencies for the YIG Loop. It consists of the A3 Coarse Loop Mixer, A4 Coarse Loop Oscillator, and A6 Coarse Loop Divider PCBs.
3. *Fine Loop.* This subsystem provides the fine frequency tuning frequencies for the YIG Loop. It consists of the A9 Fine Loop Oscillator and the A11 Fine Loop Divider PCBs.
4. *YIG Loop/FM.* This subsystem provides the phase detector and correction voltages for phase locking the YIG oscillators to the Coarse and Fine Loop frequencies. It consists of the A12 YIG phac Detector, A30 Sampler/IF, A31 Power Amplifier, and part of the A16 FM PCBs. The FM portion of the subsystem processes the YIG oscillator phase-lock error voltage and the external FM input signal.

f. ***Analog Instruction Subsystem.*** This subsystem provides the analog voltages and ramp for control of the YIG oscillators. It also provides the power meter and digital voltmeter interface to the microprocessor. It consists of the A17 Analog Instruction PCB. It is described in paragraphs 6K.

g. ***ALC/Pulse Modulation Subsystem.*** This subsystem provides control of the RF output power for leveling, AM modulation, pulse modulation, and multiplexing of the Yig oscillator outputs. It consists of the A15 ALC, the A13 Pulse Generator, and part of the A29 Rear Panel Interface PCBs. It is described in paragraphs 6M.

h. ***YIG Driver Subsystem.*** This subsystem provides the tuning currents and bias voltages for control of lthe Yig oscillators. It is described in paragraph 6L.

i. ***Interconnect Subsystem.*** This subsystem provides interconnection between internal components and assemblies. The subsystem consists of the A28 Motherboard PCB and associated cables. The subsystem is described and an interconnection diagram provided in paragraph 6P.

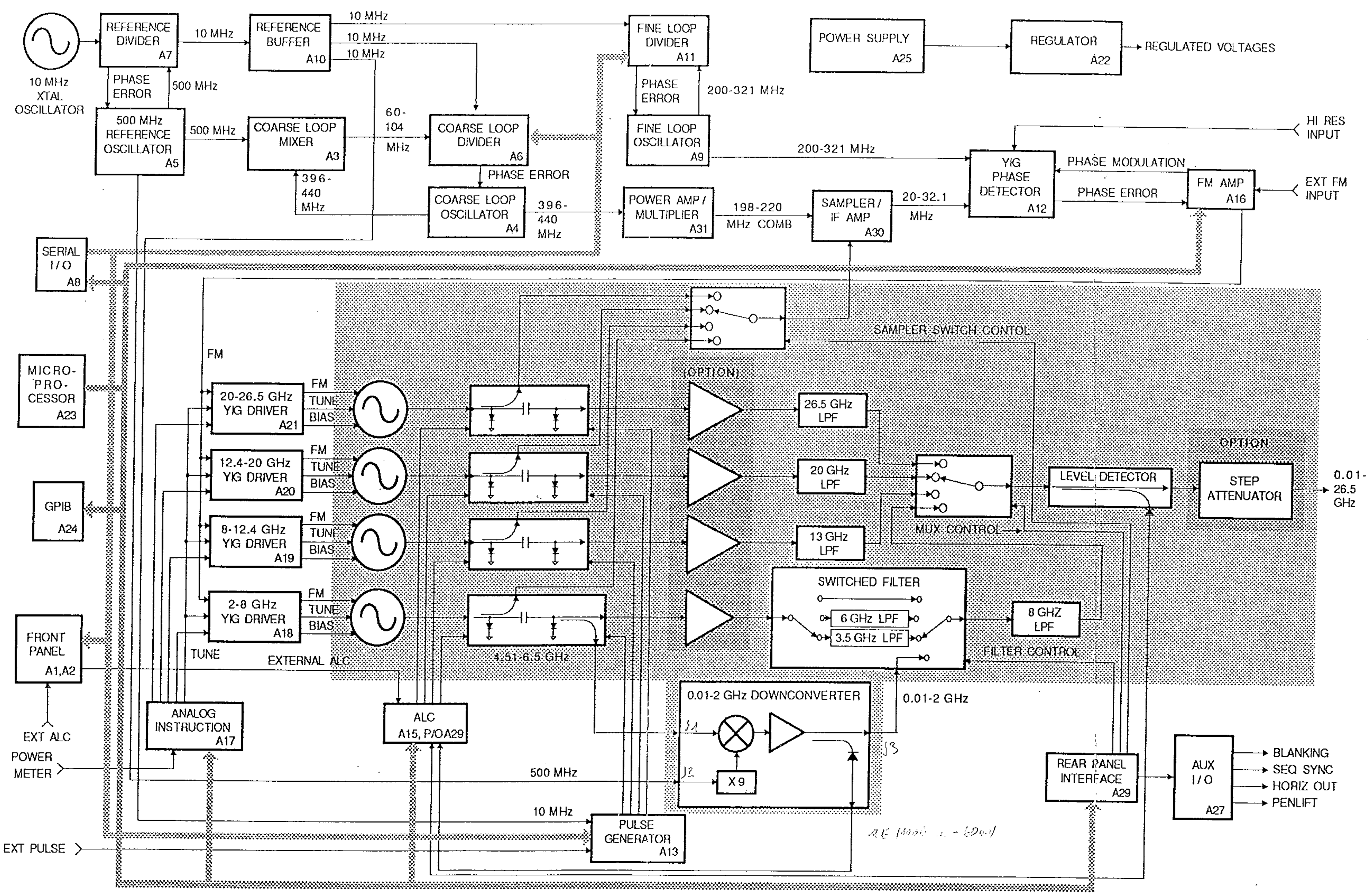


Figure 6B-1. Typical 67XXA Swept Frequency Synthesizer, Block Diagram Showing Bands 0 Through 4

6C-1 OVERALL TROUBLESHOOTING

The 6700 provides software-generated error codes and hidden-key routines to aid in troubleshooting to the replaceable subassembly level. The error codes are listed in Section 6C. This table gives directions to flowcharts or procedures located in the various subsystem sections. These flowcharts or procedures provide detailed trouble isolation using hidden (unmarked) front- panel- key routines.

Section 6C also provides troubleshooting procedures for faults that do not produce error codes.

Table 6C-1. Error Codes, Troubleshooting Table (1 of 10)

Error Code	Description	Remarks/Possible Problem Area
E00	The microprocessor is unable to perform a self-test. This can be caused by either the DVM or the ±15V(G) supplies. This is a fatal error, which means that normal operation is curtailed until the error is corrected.	Refer to paragraph 6C-3 for Power Supply Subsystem troubleshooting procedures.
E0-1	A17 Board is missing, or +10V Reference in A17 or A15 failed.	
	Coarse Loop Tests ***NOTE:*** The Reference Loop must be operating.	Refer to paragraph 6G-7 for detailed troubleshooting tables, flowcharts, and/or procedures.
E4-10	Phase-Lock Error. This test checks the A6 PCB for phase detector output. If this test passes, then the E4-13 test is run. If this test fails, then the E4-11 and E4-12 tests are used to narrow the problem area.	A3, A4, or A6 PCBs.
E4-11	Phase-Lock Negative Error. The 10 MHz reference for the Coarse Loop Subsystem is missing.	A6 PCB Input Buffer or A10 PCB Reference Buffer.
E4-12	Phase-Lock Positive Error. The A6 Coarse Loop Divider PCB is not receiving a signal from the A3 Coarse Loop Mixer PCB.	A3 and A4 PCBs.
E4-13	VCO Tuning Voltage Error. The VCO tuning voltage is out of range. The instrument may operate normally; however, it needs to be recalibrated.	If the voltage value reveals that the sweep is at the end of its range opposite from where it should be, the probable cause is the A4 PCB Tuning Amplifier.
	Reference Loop Tests. ***NOTE:*** The E5-series tests take precedence over the E4-, E9-, and E12-series tests. If there is no output from the A5 PCB—via the A10 PCB—the E4-, E9-, and E12-series tests are bypassed until the A5 PCB error is corrected.	Refer to paragraph 6H-7 for detailed troubleshooting tables, flowcharts, and/or procedures.

Table 6C-1. Error Codes, Troubleshooting

Error Code	Description	Remarks/Possible Problem Area
E5-10	Phase-Lock Error. Test checks whether the A5 Reference Oscillator is locked. If unlocked, the E5-11 and E5-12 tests are run. If locked, they are bypassed.	
E5-11	Phase-Lock Negative Error.	The A7 Reference Divider PCB.
E5-12	Phase-Lock Positive Error.	The A7 Reference Divider PCB is not receiving the 500 MHz signal from the A5 PCB.
E5-13	VCO Tuning Voltage Error.	The alignment of the VCO tuning voltage is marginal and requires recalibration.
	A8 Serial I/O Test.	
E8-10	Serial I/O Not Responding. Failure indicates that the A8 Serial I/O PCB is not receiving information from the front panel.	Refer to paragraph 6D-6 for detailed troublele shooting tables, flow-charts, and/or procedures.
	Fine Loop Tests ***NOTE:*** The Reference Loop must be operating but not locked for the following tests. If there is an E5 error code, then the E9-series tests are run. If the E9-series tests fail, only the E5 error code will be displayed.	Refer to paragraph 6J-7 for detailed troubleshooting tables, flowcharts, and/or procedures.
E9-10	Phase-Lock Error. Tests whether the A9 Fine Loop Oscillator is locked. If unlocked, the E9-11 and E9-12 tests are run. If locked, they are bypassed.	
E9-11	Phase-Lock Negative Error.	The A11 Reference Divider PCB is not receiving the Fine Loop signal from the A9 PCB.
E9-12	Phase-Lock Positive Error.	The 10 MHz reference signal is not being received by the A11 Reference Divider PCB.

Table 6C-1. Error Codes, Troubleshooting Table (3 of 10)

Error Code	Description	Remarks/Possible Problem Area
E9-13	VCO Tuning Voltage Error. The VCO tuning voltage is out of range. The instrument may operate properly; however, it should be calibrated.	If the voltage value reveals that the sweep is at the end of its range opposite from where it should be, the probable cause is the A9 PCB Tuning Amplifier.
	A12 Yig Loop Tests. ***NOTE:*** The E4-, E5-, and E9-series tests must have been successfully completed before these tests will be run. If any of the E4-, E5-, or E9-series tests fail, the E12-series tests are bypassed.	Refer to paragraph 6K-7 for detailed troubleshooting tables, flowcharts, and/or procedures.
E12-10	Phase Lock Error. The YIG Loop will not phase lock in any band. If completed successfully, the E12-11 and E12-12 tests are bypassed. If only one oscillator is not locking, the FM-path error code for that oscillator is displayed.	A12, A16, A30 and/or A31 PCBs
E12-11	Phase-Lock Negative Error.	The reference signal from the A9 PCB is not being received.
E12-12	Phase-Lock Positive Error.	No RF is being received from the A30 Sampler/IF PCB.
	A13 Pulse Generator test.	
E13-10	Pulse Generator Error.	A13 Pulse Generator PCB.
	A15 ALC tests	
E15-10	UNLEVELED-Indicator-On Error. The front panel UNLEVELED indicator is always on.	A15U42-44
E15-11	UNLEVELED-Indicator-Off Error. The front panel UNLEVELED indicator will not come on.	A15U12, U40, U42-44
E15-13	Phase Error, AM Peak Detector. The AM Peak Detector is inoperative.	A15U11, U13, U15

Table 6C-1. Error Codes, Troubleshooting

Error Code	Description	Remarks/Possible Problem Area
E15-14	Phase Error,AM Trough Detector. Failure indicates that the AM Trough Detector is inoperative.	A15U11, U13, U15
E15-15	–10V Ref Error.	The A15 PCB -10V reference supply is inoperative: A15VR1, A15U14
E15-16	+10V Ref Error.	The A15 PCB +10V reference supply is inoperative: A15VR1, A15U14
E15-20	Unleveled Error, Full Band . The RF output is unleveled (maximum output) across the entire frequency range. (If only one band were unleveled, one of the E18- thru E21-series error codes would be shown.)	
E15-21	No RF Error, Full band . No RF output is present across the entire frequency range. (If only one band were unleveled, one of the E18- thru E21-series error codes would be shown.)	
E15-22	Slope DAC Error.	Slope DAC is inoperative: A15U8, A15U9
E15-23	Detector Path Error, Band 0 CW .	Either the Downconverter or the band 0 Preamplifier on the A15 PCB is defective.
E15-24	Detector Path Error, Band 1-4 CW .	Either the Band 1-4 Level Detector or Band 1-4 Preamplifier on the A15 PCB is defective.
E15-25	Detector Path Error, Band 0 Sample/Hold . This test is bypassed if the E15-23 test passes.	This detector path, which is used during pulse operations, is defective.
E15-26	Detector Path Error, Band 1-4 Sample/Hold . This test is bypassed if the E15-24 test passes.	This detector path, which is used during pulse operations, is defective.
E15-30	Band 0 Pulse Error. This test is bypassed if the E13-10 test passes.	Indicates that the A13 PCB pulse driver for Band 1, Band 1 Control Modulator, or A15 Sample/Hold circuit is defective.

Table 6C-1. Error Codes, Troubleshooting Table (5 of 10)

Error Code	Description	Remarks/Possible Problem Area
E15-31	Band 1-4 Pulse Error. This test is bypassed if the E13-10 test passes.	The A13 PCB pulse drivers, or the A15 PCB Sample/Hold circuit is defective.
E15-40	Voltage Level reference error.	
	A16 FM tests.	
E16-10	FM Ø Error. .	The FM peak detector on A16 is inoperative: A16U28
E16-11	Phase Mod Ø Error.	The Phase Modulation Peak Detector on the A16 PCB is inoperative.: A16U30
E16-12	YIG Loop Ø Error.	The loop amplifier for the YIG loop is inoperative.
E16-13	Sweep Path Error, Yig FM .	The 50 MHz sweep path is inoperative.
	A17 Analog Instruction	
E17-10	DVM Measurement Error, 0 Volts. The DVM is inoperative. All other tests are bypassed. This is a fatal error: the 6700A is inoperative.	
E17-11	DVM Measurement Error, +10 Volts.	The 10V reference for the A17 PCB is defective.
E17-12	DVM Measurement Error, +20 Volt Range.	The 20v range of the DVM is inoperative.
E17-13	DVM Measurement Error, 100 Volt Range.	The 100V range of the DVM is inoperative.
E17-20	Tune DAC 0V.	The Tune DAC is not operating properly .
E17-21	Tune DAC +10V.	The Tune DAC −10V reference supply or the Tune DAC itself is defective.

Table 6C-1. Error Codes, Troubleshooting

Error Code	Description	Remarks/Possible Problem Area
E17-22	DVM Error, Tune DAC –10V.	The Tune DAC +10V reference supply or the Tune DAC itself is defective.
E17-23	DVM Error, Tune DAC Sweep.	Linearity problem in the Tune DAC.
E17-24	DVM Error, Tune DAC Gain= 4.	The switch for gain=4 is defective: A17U41A.
E17-30	Ramp Generator Error.	The integrator for the ramp generator and its associated circuitry is not operating properly.
E17-31	Sweep Time Error, Sweep Time DAC	The DAC that controls the sweep time is out of its specified limits.
E17-32	Retrace Time Error, Sweep Time DAC	Error in the retrace timing of the ramp.
E17-33	Range Error, Sweep Time Circuit.	Error in the >1 second sweep-time circuitry.
E17-40	Sweep Width DAC Error, 0V.	Sweep Width DAC error at maximum attenuation.
E17-41	Sweep Width DAC Error, Full-Scale. +10V	Sweep Width DAC error at full scale.
E17-42	Sweep Width DAC Error. –10V	
E17-43	Sweep Width DAC Error, 1% Steps.	Sweep Width DAC linearity error.
E17-44	Sweep Width DAC Error, Gain 4.	The Gain=4 switch is defective: A17U36.
E17-50	Linearizer Slope DAC Ø Error.	Linearizer DAC is defective.
E17-51	Linearizer Slope DAC 100 % Error.	Linearizer DAC is defective.
E17-52	Linearizer Slope DAC 0 % Error.	Linearizer DAC is defective.

Table 6C-1. Error Codes, Troubleshooting Table (7 of 10)

Error Code	Description	Remarks/Possible Problem Area
E17-53	Linearizer Breakpoint DAC 50% Error.	Breakpoint DAC is defective.
E17-60	Power Meter Error.	The power meter circuit is defective.
	RF tests ***NOTE:*** Paragraph 6L-????1 contains a table that shows the band-vs-oscillator frequency range for all 6700A models. The following error codes indicate a problem on the RF Deck. Not all error codes are used on every model. The first two digits of the code are the number of the YIG Driver PCB (A18–A21) associated with the band. The third digit is the band number. The fourth digit is the type of test.	
E18-01	Unleveled Error, Band 0.	The downconverter output is unleveled. The Band 1 Control Modulator or modulator drive is the most probable cause.
E18-02	No RF Error, Band 0.	Either the Downconverter is defective or there is no output from the A5 Reference Oscillator PCB to the Downconverter.
E18-03	FM Path Error, Band 0.	
E18-11	Unleveled Error, Band 1.	The Band 1 Control Modulator or driver is defective.
E18-12	No RF Error, Band 1.	The Band 1 Control Modulator or oscillator is defective.
E18-13	FM Path Error, Band 1.	The FM driver on A18 is defective.
E19-21	Unleveled Error, Band 2.	The Band 2 Control Modulator or driver is defective.
E19-22	No RF Error, Band 2.	The Band 2 Control Modulator or oscillator is defective.

Table 6C-1. Error Codes, Troubleshooting

Error Code	Description	Remarks/Possible Problem Area
E19-23	FM Path Error, Band 2 .	The FM driver on A19 is defective.
E20-31	Unleveled Error, Band 3.	The Band 3 Control Modulator or driver is defective.
E20-32	No RF Error, Band 3.	The Band 3 Control Modulator or oscillator is defective._
E20-33	FM Path Error, Band 3.	The FM driver on A20 is defective.
E21-41	Unleveled Error, Band 4.	The Band 4 Control Modulator or driver is defective.
E21-42	No RF Error, Band 4.	The Band 4 Control Modulator or oscillator is defective.
E21-43	FM Path Error, Band 4 .	The FM driver on the A21 PCB is defective.
E21-51	Unleveled Error, Band 5.	The Band 4 Control Modulator or driver is defective.
E21-52	No RF Error, Band 5.	The Band 4 Control Modulator, oscillator or Band 5 multiplier is defective.
E21-53	FM Path Error, Band 5.	The FM driver on A21 is defective.
	Power Supply/Regulator Tests.	
E22-10	PS1 Error.	A PS1 monitor problem which cannot be determined from the E22-21 through -29 tests below.
E22-11	PS2 Error.	A PS2 monitor problem which cannot be determined from the E22-21 through -29 tests below.
E22-20	+9V LP Error.	The 9V supply has no output to the 5V regulators in the phase lock circuitry.

Table 6C-1. Error Codes, Troubleshooting Table (9 of 10)

Error Code	Description	Remarks/Possible Problem Area
E22-21	+24V Error.	The supply is unregulated. If there is no output from this supply, the STANDBY lite will not illuminate and the instrument will not power up.
E22-22	+15V LP Error.	There is no output from this supply located on the A22 PCB.
E22-23	−18V Tuning Error.	There is no output from this supply located on the A22 PCB.
E22-24	−43V Tuning Error.	There is no output from this supply located on the A22 PCB.
E22-25	−15V LP Error.	There is no output from this supply located on the A22 PCB.
E22-26	+15V LP Error.	There is no output from this supply located on the A22 PCB.
E22-27	+15V FM Error.	There is no output from this supply located on the A22 PCB.
E22-28	+15V (A) Error.	There is no output from this supply located on the A22 PCB.
E22-29	−15V FM Error.	There is no output from this supply located on the A22 PCB.
E22-30	−15V (A) Error.	There is no output from this supply located on the A22 PCB.
E22-31	−15V Error.	
	Microprocessor Tests	
E23-10	Non-volatile RAM for storing front panel setups has failed read-write testing.	Replace A23U25.
E23-11	Volatile RAM #1 has failed read-write test.	Replace A23U26.

Table 6C-1. Error Codes, Troubleshooting

Error Code	Description	Remarks/Possible Problem Area
E23-12	Volatile RAM #2 has failed read-write test.	Replace A23U29.
E23-14	Personality PROM Check-Sum Error.	Replace A23U24.
E23-15	PROM Check-Sum Error.	Replace A23U22 and A23U23
E23-17	EEPROM Check-Sum Error.	Error in the Band 0 level detector calibration table.
E23-18	EEPROM Check-Sum Error.	Error in the Band 1-4 level detector calibration table.
E23-19	EEPROM Check-Sum Error.	Error in the attenuator insertion loss table.
E23-20	Stored Setups Check-Sum Error.	
E23-21	I/O Error. Indicates the I/O interrupt is inoperative.	Replace A23U8.
	A24 GPIB Tests	
E24-0	GPIB no response or A24 not installed.	
E24-10	Check-Sum Error in the GPIB RAM.	Replace A24U11.
E24-11	Check-Sum error in the PROM.	Replace A24U10.
E24-12	GPIB Interface Error.	The interface processor is inoperative. Replace A24U7.
E29-10	V/GHz Offset Dac Error.	
E29-11	V/GHz Slope Error.	

Table 6C-2. 6700A Does Not Power Up

Trouble Indication	Troubleshooting Procedure
STANDBY lite OFF	Check both line fuses on rear panel. • If the line fuses are good, check A22TP11 for +24V. • If the +24V is present, check the A28J1 connection to the front panel casting. If this connection is good, then there is an open in the cabling between the front panel casting and the A1 and A2 PCBs. • If there is no +24V at A22TP11, disconnect A28J3 and A28J1. If the +24V appears, there is a short circuit in either the front panel casting PCBs or the 10 MHz crystal oscillator. • If the +24V does not appear, the problem is with A22VR1, A52T1, or A28CR6-9.
STANDBY lite ON.	When the **LINE** key is pressed, the **STANDBY** lite should go off and the **ON** lite should illuminate. • If **STANDBY** goes off and the **ON** lite remains off, it indicates either that the **LINE** switch is defective or that there is a short circuit on the +24V line following the **LINE** switch. • If the **STANDBY** lite goes off and the **ON** lite illuminates as normal, you should hear a click. This click means the A28K1 relay has energized. If A28K1 does not energize, but the fan operates, then A28K1 is defective. If the fan does not operate, the cabling from the front panel casting via A28J2 is most likely open.
Front panel LCDs and LEDs flash on and off when **LINE** is switched to **ON**.	Indicates one of the A25 outputs is shorted to ground.

6D – FRONT PANEL A1 and A2 PCBs

6D-1 FRONT PANEL ASSEMBLIES: A1 and A2 PCBS

This section contains service information for the front panel assemblies listed in Table 6D-1 below. Refer also to the general reference information in sections 6A, 6B, and 6C. It is also helpful to have an understanding of the Digital Control circuitry (section 6E), the A17 Analog Instruction DVM circuitry (section 6K), and the ALC circuits (section 6M).

Table 6D-1. Front Panel Service Information

Documentation	Reference	Page
OVERALL ASSEMBLY LEVEL		
Overall Description	Para. 6D-2	6D-2
Block Diagram	Fig. 6D-1	6D-9
Troubleshooting	Tbl. 6D-2	6D-6
PCB LEVEL		
A1 Front Panel PCB		
General Circuit Description	Para. 6D-3	6D-2
Detailed Circuit Description	Para. 6D-5	6D-3
Block Diagram	Fig. 6D-1	6D-9
Troubleshooting	Tbl. 6D-2	6D-6
Schematic (Sheet 1 of 4)	Fig. 6D-3	6D-11
(Sheet 2 of 4)	"	6D-13
(Sheet 3 of 4)	"	6D-15
(Sheet 4 of 4)	"	6D-17
Parts Locater Diagram	Fig. 6D-4	6D-10, 12,14,16
A2 Front Panel PCB		
General Circuit Description	Para. 6D-4	6D-2
Detailed Circuit Description	Para. 6D-6	6D-4
Block Diagram	Fig. 6D-1	6D-9
Troubleshooting	Tbl. 6D-2	6D-6
Schematic (Sheet 1 of 3)	Fig. 6D-5	6D-19
(Sheet 2 of 3)	"	6D-21
(Sheet 3 of 3)	"	6D-23
Parts Locater Diagram	Fig. 6D-6	6D-18, 20,21

6D-2 FRONT PANEL ASSEMBLIES, OVERALL DESCRIPTION

The front panel assemblies consists of the A1 Front Panel PCB and the A2 Front Panel Control PCB. Both are shown clearly in the Parts Lists assembly photographs section V.

The front panel group provides the interface between the operator and the microprocessor (which controls the operating functions of the instrument). Also included in this group is a preamplifier for the External ALC function of the Leveling Loop.

A block diagram of the Front Panel Subsystem is shown in the first foldout, Figure 6D-1. Please refer to this figure for the following general description of the A1 and A2 PCBs.

The interface between the front panel PCBs and the rest of the instrument is via wire harnesses between the A28 Motherboard and three A2 PCB connectors: A2P1, A2P2, and A2P4. These connectors provide the following functions:

- A2P1 provides:
  (1) The serial I/O to the A8 Serial I/O PCB for communication to the microprocessor,
  (2) Front panel power supply connections, and
  (3) Keyboard data and microprocessor interrupt signals.
- A2P2 provides:
  (1) +24VG from the power switch to enable the instrument power on circuits, and
  (2) The DECREASE/INCREASE knob DC voltage output. This voltage is monitored by the DVM on the A17 Analog Instruction PCB.
- A2P4 supplies:
  The external leveling signal that goes to the A15 ALC PCB; it is preamplified on the A2 PCB.

The A1 and A2 PCBs are mounted in the front panel casting to prevent the internal RF sources and microprocessor bus signals from interfering with sensitive external equipment. The A1 PCB displays are liquid crystal displays (LCD's) with a 150 Hz (approximate) backplane signal. Other than the constantly active LCD backplane signal, the front panel is in a completely static state. It only becomes active when the instrument microprocessor writes to an LCD display or LED latch or when a key is pressed.

6D-3 A1 FRONT PANEL PCB, GENERAL DESCRIPTION

Refer primarily to the front panel block diagram, Figure 6D-1, for the following descriptions.

6D-3.1 Alpha-Numeric Displays (LCDs) and Display Digit Drivers

The 67XXA has three, 7-segment, numeric liquid crystal displays (LCDs).

- FREQUENCY
- MODULATION/TIME
- LEVEL

These LCDs show characters and numerals that inform you of the status of instrument operations and function parameters. Each digit of the LCD is arranged in a 7-segment configuration. The driver for each full-size digit on the LCDs receives 8-bit parallel data from the A2 Front Panel Control PCB data bus. Each 40-pin display digit driver package is capable of latching data and providing drive for as many as four LCD digits. The FREQUENCY display requires three driver packages while the MODULATION/TIME and LEVEL displays require only one driver each.

The MODULATION/TIME digit driver provides the backplane voltage for the other digit drivers.

In addition to the digit drivers controlling the LCD characters and numerals, there are distinct latches on the A2 PCB that control the messages displayed on the A1 PCB's LCDs (for example, the CW, MARKER, EXT REF, and LEVEL 1 messages) These latches also receive their control from the 8-bit data bus on the A2 PCB.

6D-3.2 Indicator LED's and Latch Drivers

Fourty-seven of the fifty LED's on A1 Front Panel PCB receive their drive signals from the TTL data latches indicated on the A1 shematic (Figure 6D-3, sheet 2). These latches receive their control from the A2 PCB 8-bit data bus (signals **D0-D7**). They are controlled entirely by the A23 PCB Microprocessor via the A8 Serial I/O and A2 Front Panel Control PCBs. The RF UNLEVELED LED is the only one not directly under microprocessor control. It receives its control directly from the L RF UNLVLD line that originates on the A15 ALC PCB (section 6M, A15 schematic, sheet 5) and is routed via the A2 Front Panel Control PCB (A2 PCB schematic, sheet 1).

6D-3.3 Keyboard Matrix

All of the keyboard matrix keys are of a double-pole-single-throw (DPST) configuration (illustrated in the A1 PCB schematic notes, sheet 1). One pole supplies an X-axis signal and the other a Y-axis signal. The coordinate signals of these X and Y axes go to the A2 PCB where the appropriate X/Y coordinate button location is encoded and sent as an 8-bit serial data word to the A23 Microprocessor PCB (via the A8 Serial I/O PCB).

When the front panel STANDBY/LINE key is depressed (power on), it sends +24 volts to the A28K1 relay (on the A28 Motherboard PCB) to actuate the power supply circuits. This power-on circuitry is detailed on sheet 1 of the A28 schematic in section 6P)

6D-4 A2 FRONT PANEL CONTROL PCB, GENERAL DESCRIPTION

Refer primarily to the front panel block diagram, Figure 6D-1, for the following description.

6D-4.1 Serial Input/Parallel Output

Data comes from the A8 Serial I/O PCB in a serial format. The front panel clock signal clocks a shift register that loads this serial data into a 16-bit latch. Eight bits are for the front panel 8-bit parallel data bus and eight bits are for addressing of the appropriate data latch on the A2 PCB or the LCD drivers on the A1 PCB. When the data has been loaded, the A8 PCB applies a strobe that loads the data into the latches.

When pressing a key, the Keyboard Decode logic determines the X and Y coordinates of the depressed key and sends an interrupt to the A23 Microprocessor PCB. The microprocessor then configures the A8 PCB to receive data from the front panel. The A8 PCB sends a clock signal to a shift register on the A2 PCB where the data is stored. The clock signal shifts the data out from the A2 PCB latches in serial format into another shift register on the A8 PCB. After completion of the serial I/O data transfer, the microprocessor reads the keycode from the shift register on the A8 PCB and takes appropriate action.

6D-4.2 DECREASE/INCREASE Knob Motor

The front panel DECREASE/INCREASE knob drives a dc motor that produces a dc voltage that has a polarity set by the direction of rotation and is proportional in magnitude to the speed of rotation. This dc voltage goes to an amplifier on the A2 PCB having a gain of 10. The output of the amplifier goes as an analog voltage (**KNOB MON**) to the DVM multiplexer on the A17 Analog Instruction PCB. TheA23 PCB Microprocessor reads this voltage via the DVM, then determines the necessary amount and direction to change the currently open parameter.

Since the amplifier is dc coupled and of relatively high gain, the 67XXA has provision for zeroing the amplifier input voltage (via **KNOB AMP ZERO**). When in the zero mode, the A23 Microprocessor PCB reads the residual voltage at the DVM on the A17 PCB and stores this data. When the microprocessor reads a voltage resulting from movement of the knob, it subtracts this residual voltage data to determine the actual measurement value. This is especially important when the knob is turned very slowly, as it then produces extremely small voltages for the knob circuitry to work with. The ability of the knob circuitry to respond to such a wide range of operator control variances makes it very convenient to use the knob often for all function parameters with predictable control.

6D-4.3 External Detector Amplifier (EXT LEVEL BNC Input)

A differential receiver amplifier having a gain of 5 receives the analog input voltage from an external detector connected to the front panel EXT LEVEL BNC connector. (An external detector or power meter is often used instead of the 67XXA's internal detector to eliminate uncertainties caused by long cables or the insertion of an additional amplifier in the 67XXA's RF OUTPUT path.) The amplified signal goes to the A15 ALC PCB for further processing of output power level control. Since the external detector or power meter output voltage can be very low, provisions have been made for adjusting the offset balance of the amplifier (via potentiometer A2R15). Adjustment is made through a small hole in top of the front panel casting during calibration of the ALC circuits (see the procedures in section 3, Claibration and Adjustments). This adjustment access hole is covered by the instrument cover during normal operation.

6D-5 A1 FRONT PANEL PCB, DETAILED CIRCUIT DESCRIPTION

Refer primarily to the A1 PCB schematic set (Figure 6D-3, sheets 1 through 4) for the following descriptions.

6D-5.1 Line Switch and Power on Circuits

Refer to Figure 6D-3, sheet 1 and sheet 1 of the A28 schematic in section 6P. Whenever the 67XXA is physically connected to line voltage (ac mains), **+24V1** is present at A1P1-6. This voltage comes from the A22 Regulator Interface PCB.

- With the LINE switch in the STANDBY position, the **+24V1** goes only to the A2DS2 STANDBY LED.
- With the LINE switch in the ON position, **+24V1** becomes **+24VG** and goes to the ON LED and to A2P1-5. This voltage at P1-5 energizes relay A28K1 (on the A28 Motherboard) which applies line voltage to the rectifiers located on the A28 Motherboard. This **+24VG** also supplies the **+24V1** required for the A5 Reference Oscillator, the +12V regulator (A25VR1) on the A25 Switching Power Supply PCB, and the V/GHz amplifier (A29U14) on the A29 Rear Panel Interface PCB.

6D-5.2 Front Panel Keys

Each key in the front panel keyboard matrix, with the exception of the SINGLE SWEEP key, is a DPST type switch (shown schematically in the Notes area of the A1 PCB schematic, sheet 1). Each time a key is pressed, **GND D** is sensed as an X and Y coordinate (**X0-X7** and **Y0-Y7**) by encoders A2U6 and U9 on the A2 Front Panel Control PCB (see sheet 1 of the A2 schematic). The parallel data output of the encoders is converted by A2U10 into a serial 8-bit byte format. Then, A2U11 sends an interrupt request (**KBD INT**, A2P1-7) to the A23 Microprocessor PCB. The microprocessor instructs the A8 Serial I/O PCB to obtain the available encoded data (known as the "keycode") from A2U10 which serially transmits the data word to the A23 Microprocessor PCB (**FRONT PANEL OUT**, A2P1-5).

The SINGLE SWEEP key uses two diodes, A2CR1 and CR2, rather than a pushbutton, to simulate a DPST switch with lines **X6** (a1P4-4) and **Y1**. The X and Y coordinates are then processed as previously described.

6D-5.3 LED Drivers

The 8-bit latches (A1U1-U6), shown on Sheet 2 of the A1 schematic, drive the LED indicators on the A1 Front Panel PCB. The latches receive their data via the 8-bit bus (**D0-7**) that comes from the serial/parallel conversion circuits on the A2 PCB. These latched LEDs, with the exception of the L RF UNLVLD LED, are entirely under software control. Q1 is the driver for the L RF UNLVLD LED and is controlled by the **L RF UNLVLD** signal from the A15 ALC board.

Note that U1 pin 19 (**KNOB AMP ZERO**, A1P1-4) does not drive an LED but supplies a logic signal for zeroing the DECREASE/INCREASE knob amplifier (A2U27) on the A2 Board.

6D-5.4 LCD Digit Drivers

The 4-digit LCD display drivers (A1U7-U12) are shown on sheets 2 and 4 of the A1 PCB schematic. The data inputs to each of these drivers are connected to the 8-bit bus (**D0-7**) that comes from the A2 Front Panel Control PCB. The **OSC** inputs (pin 36) of all drivers, except the U10 driver, are grounded. This disables the internal 19 kHz oscillator that provides the backplane signal (**BP**) required by the LCD's. U10's **OSC** pin is left floating; this enables its oscillator. This 19 kHz oscillator signal is internally divided by 128; the result is a 0 to 5 V square wave backplane signal at approximately 150 Hz (U10 pin 5). This signal goes directly to the backplane of the MODULATION/TIME display and to the inverting amplifier package U11. U11 buffers this backplane signal, reinverting its own output at pin 2 to obtain the proper polarity as inputs for its other five amplifiers, thereby providing the additional backplance signal drive capability for the other LCD digit drivers. The backplane signal, **BP**, also goes to the A2 Front Panel Control PCB via A1P3-6 to supply the backplane to the LCD message drivers located on the A2 Board.

6D-5.5 Digit Driver Strobe Signals

Each data latch requires a strobe signal. These strobe signals are decoded by A2U3, U7, and U8 (shown on sheet 1 of the A2 schematic). The **FP STRB** signal (A1P1-13) from the A8 Serial I/O board enables the appropriate strobe to latch data into their respective latches and display drivers.

6D-6 A2 FRONT PANEL CONTROL PCB, DETAILED CIRCUIT DESCRIPTION

Refer to the A2 PCB schematic set (Figure 6D-5, sheets 1 through 3) for the following descriptions.

6D-6.1 Serial Input

Refer to sheet 1 of the A2 schematic. The serial data signal (**FP DATA**, A2P1-1) and clock signal (**FP CLK**, A2P1-5) go to U30, a Schmitt-trigger inverter that improves each signal's rise time. The rise time of these signals is severely degraded by the filtercons (filter connectors) mounted in the front panel casting. The clock signal goes to shift registers A2U1 and U2 to clock the serial input bits of each 16-bit word into the registers. U1 receives 8 bits of data for the data latches and LCD digit drivers; U2 receives 5 bits of address data for the latches.

Once the serial data has been shifted into the two registers, the **FP STRB** signal (A2P1-13) goes low to enable a low output from one of the three 3-to-8 decoders (A2U3, U7, or U8). The destination latch of the strobe elsewhere on the A1 or A2 PCB will then latch the available data on the internal 8-bit bus (**D0-7**) into its registers. After the strobe signal, further data bus changes will not affect data that has already been latched into the A1 or A2 latches.

Six inverting buffers in U4 and U5B invert the strobe signals going to latches that drive the LCD display messages.

6D-6.2 Keyboard Encoding

Each front panel key depression causes an interrupt on the A23 Microprocessor PCB. The keyboard matrix X and Y coordinate signals go to A2U6 and U9 encoders (on sheet 1 of the A2 schematic). These encoders perform the opposite function of the 3-to-8 decoders used for address decoding. When any of the inputs to the encoder goes low (to **GND D** when a key is depressed), it sets the Group Select (**GS**) output on U6 or U9 pin 14 low. This indicates that the pin 6, 7 and 9 outputs of U6 or U9 will be in a binary format. The **GS** output goes to U5A pin 2, which forces its pin 1 output to go high, and thereby causes U11A pin 5 output to go high. This sends a keyboard interrupt signal (**KBD INT**) to the A23 PCB.

Upon receiving the interrupt, the microprocessor completes its present task, then sends the address **FP DATA** to enable A2U10 (via the A8 Serial I/O

PCB). The response time from the time the interrupt is sent until the microprocessor services the interrupt depends on the particular task that is being performed at the time the interrupt request is received. In CW mode, this time is about 4 ms. In step sweep or analog sweep modes, response time can be from about 4 ms to about 20 ms.

At the same time A2U10 pin 1 goes low to load data into its registers, U11A pin 1 clears the flipflop and U11A pin 5 goes low to clear the interrupt request. Then, the microprocessor instructs the A8 PCB to send a clock pulse train to the A2 PCB where it shifts data out of A2U10 and shifts it into the A8 PCB shift register for reading by the A23 Microprocessor PCB.

The keycode is again verified under software control to validify an actual key depression. Approximately 7 ms later, the A23 Microprocessor again loads the A2U10 shift register and reads the data a second time. If the keycode is a valid code, and if it is the same as was read during the first conversion, the processor executes the routines for this keycode.

A valid key depression is also ensured through hardware constraints. The 6-bit keycode (A2U10 inputs **B-G**) is bracketed by the two **GS** bits from A2U6 and U9 pins 14 (A2U10 inputs **A** and **H**). Also, both the X and Y coordinates must be activated by the DPST switch configuration in order for an interrupt to be sent. If only one pole of the DPST key switch is grounded to **GND D**, it will not send an interrupt to the processor.

6D-6.3 Display Message Data Latches

A2U12 thru U25, shown on sheets 2 and 3 of the A2 schematic, are 4-bit latches/drivers for the LCDs. They operate in the same manner as a 74LS374 data latch except that their outputs always have a 50 Hz square wave imposed on them. This is due to the backplane signal, **BP**, on pin 2, the **DF** input to each of these latches. A high on the **DF** input will cause the output to be *180 degrees out of phase* with the backplance signal; a low on the input will cause the output to be *in phase* with the backplane signal.

Note that pairs of these latches are tied to a common strobe line. One latch receives the upper 4 bits and the other the lower 4 bits of each 8-bit parallel word on data bus lines **D0-D7**. Transition of the strobe line signals from low to high latches the data into the latches.

6D-6.4 Knob Amplifier

The front panel DECREASE/INCREASE knob motor, mounted on the front panel subplate is a DC motor. It's output varies in amplitude with the speed of the motor; the polarity of its output is determined by the direction of rotation. Its output voltage, across **KNOB MOTOR INPUT** and **REF**, goes via A2U26 analog switch to A2U27. A2CR1 and CR2 clamp the output of the motor to approximately 10.7 volts to prevent damage to U26 analog switch.

During the knob zero software routine, **KNOB AMP ZERO** is sent low, U26B opens and U26A closes; this disconnects the motor signal inputs to U27 and connects the inputs to ground (**GND G**). The A23 Microprocessor reads the output voltage of U27 via the DVM on the A17 Analog Instruction PCB and stores this reading. It then returns **KNOB AMP ZERO** to high, this opens U26A and closes U26B. The measurement of the U27 output voltage is then made. At very slow speeds this voltage will be very low, so the zero voltage of U27 will be subtracted from the motor voltage to give a more accurate reading of the voltage.

Without this zeroing of U27, the speed at which a parameter change is made would vary, depending on both the direction and speed of the motor. Also, without the zeroing, the offset voltages of U27 could cause a high enough output of U27 that would indicate apparent motor rotation when there was no actual motor rotation. U27 amplifies the motor voltage by five. Its output is clamped to about 8.2 volts by CR9 and CR10 to improve recovery time from an overdrive condition and to protect the analog multiplexer input on the A17 PCB. R5 isolates the output of U27 from the (front panel casting) filtercon shunt capacitance by effectively increasing the RC time constant.

6D-6.5 External Level Detector Preamplifier

The external level detector input (EXT LEVEL) from the front panel BNC connector goes to J6 pin 2 (**EXT LVL DET INPUT**). J6 pins 1 and 3 is the reference or ground side of the detector (**EXT LVL DET REF**). CR4 and CR5 clamp any signal on the two inputs to about +5.7 volts and CR6 and CR7 clamp the inputs to about −5.7 volts. R8 supplies the optimum load for the external detector to maintain optimum linearity with the leveling loop circuitry.

U28 is a unity gain, non-inverting amplifier that buffers the detector voltage. U29 is differential receiver with a gain of 5 that amplifies the external signal to the proper level for use by the A15 ALC PCB. Potentiometer R15 adjusts U29 input offset to optimize leveling at low power levels. Since most operational amplifiers do not work well with a capacitive load, R17 isolates the output of U29 from the capacitance of the front panel casting filtercon.

6D-7 FRONT PANEL ASSEMBLIES, TROUBLESHOOTING

Front panel assembly troubleshooting is covered entirely in Table 6D-2. Front panel disassembly procedures are covered in section 7.

6D-8 FRONT PANEL ASSEMBLIES, SERVICE SHEETS

Table 6D-1 on the first page of this section presents the arrangement of the block diagram, schematics, and parts locater diagrams for the A1 and A2 Front Panel Assembly PCBs.

Table 6D-2. Front Panel Troubleshooting (1 of 3)

Trouble Category	Troubleshooting Procedure
	General Front Panel Troubleshooting
Preliminary Checks at Power On	In normal operation, the following occurs when instrument power is turned on: 1) The front panel LCDs and LEDs light in a random pattern for a few seconds, then blank while the instrument self test routine runs; 2) After self test finishes, the front panel displays the setup that was present when instrument power was last turned off. If the LCDs and LEDs don't change from their initial random pattern and front panel controls are inoperative, the problem lies in either the Digital Control assemblies (section 6E) or the Front Panel assemblies (section 6D). If the Digital Control assembly troubleshooting has not yet been done, complete the troubleshooting procedures in section 6E before continuing with the following Front Panel assembly troubleshooting tests. The following procedures assume that the Digital Control assemblies have been eliminated as the cause of the problem. To disassemble the front panel assembly for troubleshooting, see section 7, Disassembly and Repair Procedures.
Serial I/O Interface Problems	You should normally be able to determine if the serial I/O portion of the front panel is operating by observing the signals at the front panel interface on the front casting without even removing the front panel assembly from its casting. This should be done first to determine if the problem exists in the A8 Serial I/O or the front panel assembly. Synchronize the oscilloscope on the **FP STRB** signal at A28J1-6. You can then observe the **FP DATA** at A28J1-3 and the **FP CLOCK** at A28J1-4.
Serial I/O Key Response	To see if the serial I/O is responding to a key, syncronize the scope with the **KBD INT** signal on A28J1-7 and observe the **FP CLOCK** at A28J1-4 and the **FP DATA** at A28J1-5

Table 6D-2. Front Panel Troubleshooting (2 of 3)

Trouble Category	Troubleshooting Procedure
	General Front Panel Troubleshooting (Continued)
Serial-to-Parallel Conversion Circuitry	If the front panel displays don't change from the initial random pattern (following power on self test), the problem may lie in the A2 PCB's serial-to-parallel conversion circuits. **NOTE** There is a built-in service routine in the 67XXA to aid troubleshooting of the front panel circuits. It is implimented in one of two ways: 1) If there is front panel control via the keyboard, press SHIFT, TRIGGER, 019. 2) If there is no front panel control via the keyboard, send the following over the GPIB (the example shown is for the Wiltron 85). OUTPUT 705;"WH1 019" This service routine turns on all LCDs and LEDs (except the RF UNLEVELED LED) for a short period then blanks the displays; this sequence is repeated in a continuous loop.
LCD Problems	The backplane signal on each LCD is a +5 V square wave at about 150Hz. The segment being driven also has a +5 V square wave at approximately 150 Hz in the on or off condition, however, in the *off* condition, the segment signal will be in phase with the backplane signal and in the *on* condition, it will be 180 degrees out of phase. If there is a segment not turning on, and you observe a differentiated square wave at its drive pin, it indicates that the drive from the driver IC is open. The differentiated square wave is due to the capacitive coupling of the backplane signal to the high impedance open circuit. This will also be affected by whether a X1 (1 meg) or X10 (10 meg) oscilloscope probe is used. (Make sure that the oscilloscope probe is also properly compensated before making these measurements.)
Front Panel Data, Clock, and Strobe Signals	Check the **FP DATA**, **FP CLOCK**, and **FP STRB** signals at A2U30 pins 4, 8, and 10 respectively. If the signals are present, the most likely suspect is the A2U1 data latch. If one or more of the signals is not present, the A2U30 buffer is probably defective. If some of the LCDs or LEDs remain on after the initial power on self test routine, a data latch or strobe latch is probably defective. Check the A2U7 and A2U8 strobe outputs with an oscilloscope during power on. Replace the IC that yields defective outputs.
Digit / Message Driver Cirtcuits	If the strobe lines appear to be in order, the most likely problem is a data latch. The message latches U12-U25 are located on the A2 PCB; the digit drivers for the LCDs and the LED drivers are located on the A1 PCB. By observing which message or group of messages is improper, the message-activate line can be traced to a specific latch. Sheets 2 and 3 of the A2 PCB schematic show the data latches and the message lines under their control. Sheets 3 and 4 of the A1 PCB schematics show the LCDs themselves with the message signals from the A2 PCB. From the latch, the signal can be traced through the A1/A2 interconnect cabling to the LCD socket. If one of the LCDs is missing a digit, or if one or a group of digits is improper, an LCD digit driver is probably defective. Sheets 3 and 4 of the A1 PCB schematic show the LCDs with the interconnects to their associated digit-driver ICs. Each of these digit drivers drive up to four of the digits on one LCD. If one segment of all digits is improper, a defective 8-bit data bus (**D0-D7**) is likely. This bus is driven by shift register A2U1.

Table 6D-2. Front Panel Troubleshooting (3 of 3)

Trouble Category	Troubleshooting Procedure
	General Front Panel Troubleshooting (Continued)
Loss of Front Panel Control	If the front panel displays operate normally but you have lost front panel control, A2U10, A2U5A, or A2U11A circuitry is most likely defective. Check the **KBD OUT** signal at A2P1-7; it should go to TTL high when a key is depressed. If this signal response is proper, suspect the key matrix lines (**X0-X7** or **Y0-Y7**), decoders A2U6 or A2U9, or the A2U10 shift register circuit. Press a key and monitor the outputs of A2U6 and A2U9; they should change to a new 8-bit code for each different key. If this is proper, check to see that the data is being shifted out of A2U10 in a serial format. The keys can easily be checked by monitoring the X and Y coordinate lines and pressing a key. When the key is pressed, the X and Y coordinate lines for that key will go from a TTL high to ground. An indication of a bad key switch would be that there is no response from the instrument for that key (the microprocessor will ignore improper keycodes).
DECREASE/INCREASE Knob Inoperative	Monitor **KNOB MOTOR INPUT** between A2J5-2 and A2J5-1,3 with a DVM or oscilloscope. Turning the knob should produce a voltage. The magnitude of this voltage will increase with the speed that the knob is turned; the polarity will change with the direction of rotation. If no voltage is measured, remove the plug from A2J5 and measure the output at the plug contacts. If the voltage is proper, suspect either A2U5D, A2U26A or B, or the signal from the latch controlling these two circuits. If no voltage is measured on the plug, the motor assembly should be checked by disconnecting it from its connector on the A2 board and connecting an external 5 volt supply to it. It should turn in one direction with one polarity and in the other with the other polarity. Replace it if it does not respond. If the voltage at A2J5 is proper, measure the knob amp output voltage at A2U27-6 (**KNOB MON**). This voltage should be the opposite polarity and be 10 times the magnitude of the input voltage at A2J5. The U27 knob amplifier can be checked by applying a 0.5 volt DC voltage between J5-2 an J5-1,3. The **KNOB MON** output signal should be amplified by a factor of 10 and be of opposite polarity. If this voltage is improper, A2U27 or its associated circuitry is defective. If the voltage is proper, troubleshoot theo 67XXA A17 Analog Instruction PCB DVM circuit in section 6K.
No Output From the External ALC Preamplifier	Connect a DC voltage source set to +1 Vp-p square wave to the 67XXA front panel EXT LEVEL BNC input. Measure the **FP ALC INPUT** voltage at A2P4-3; it have an amplitude gain of 5 and have the opposite polarity of the input signal. If this voltage is improper, A2U28 or A2U29 circuitry is defective. If this voltage is proper, go to the ALC troubleshooting in section 6M. With a detector connected to the EXT LEVEL input and no RF applied to the detector, A2R15 is adjusted for 0V ±10μV.

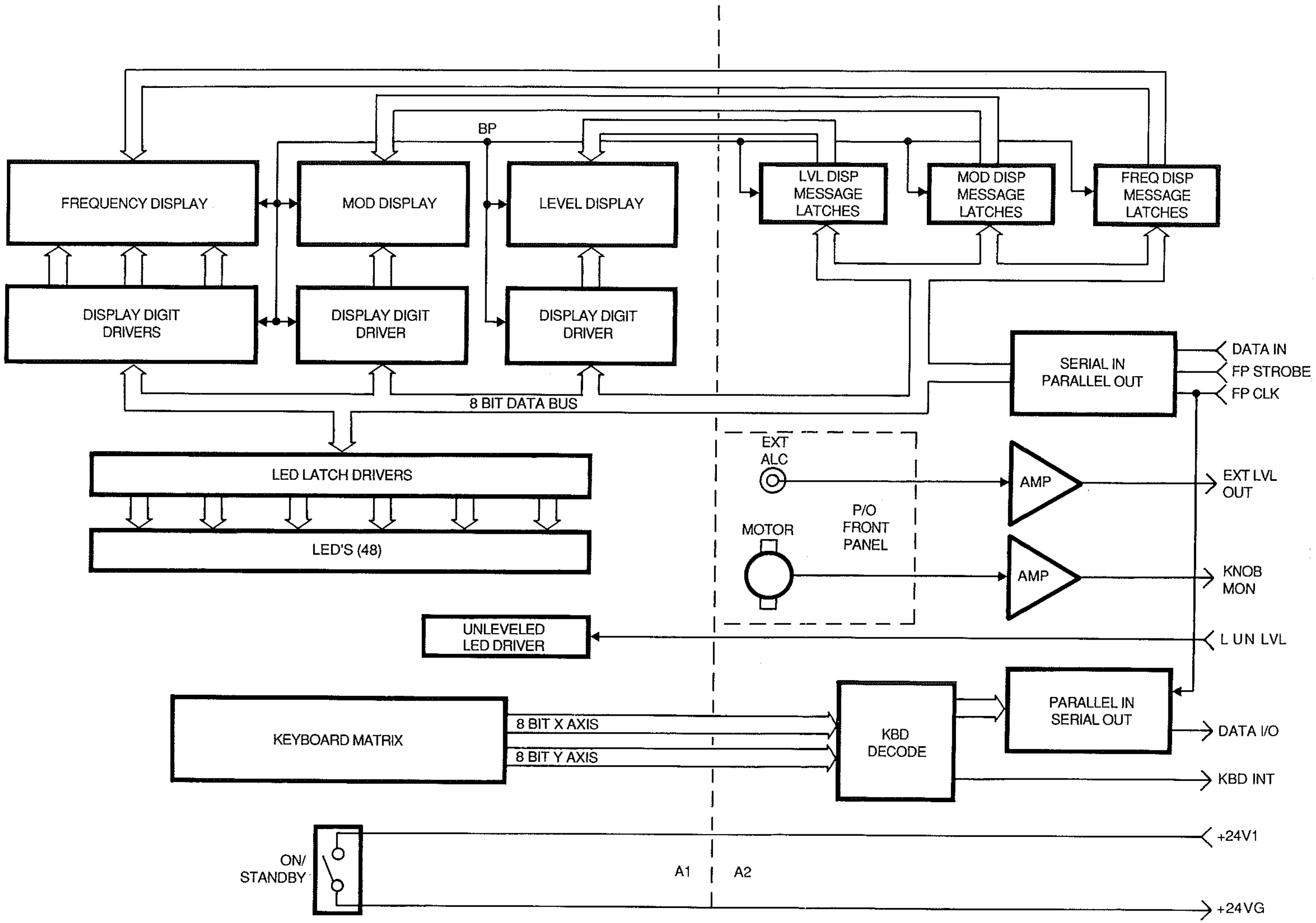
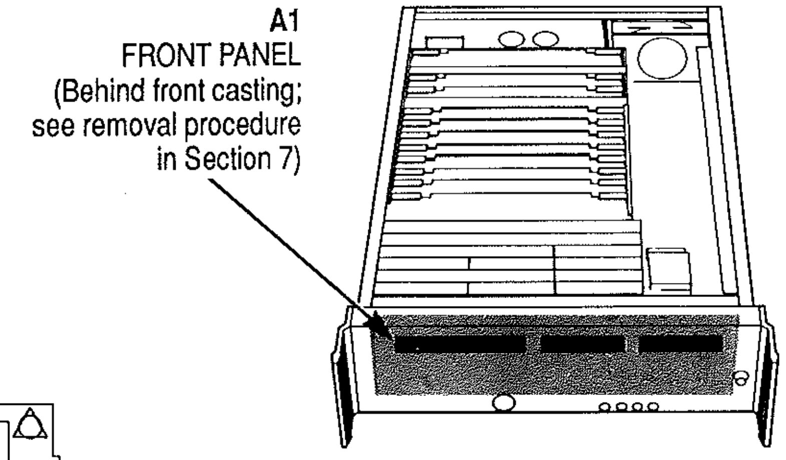
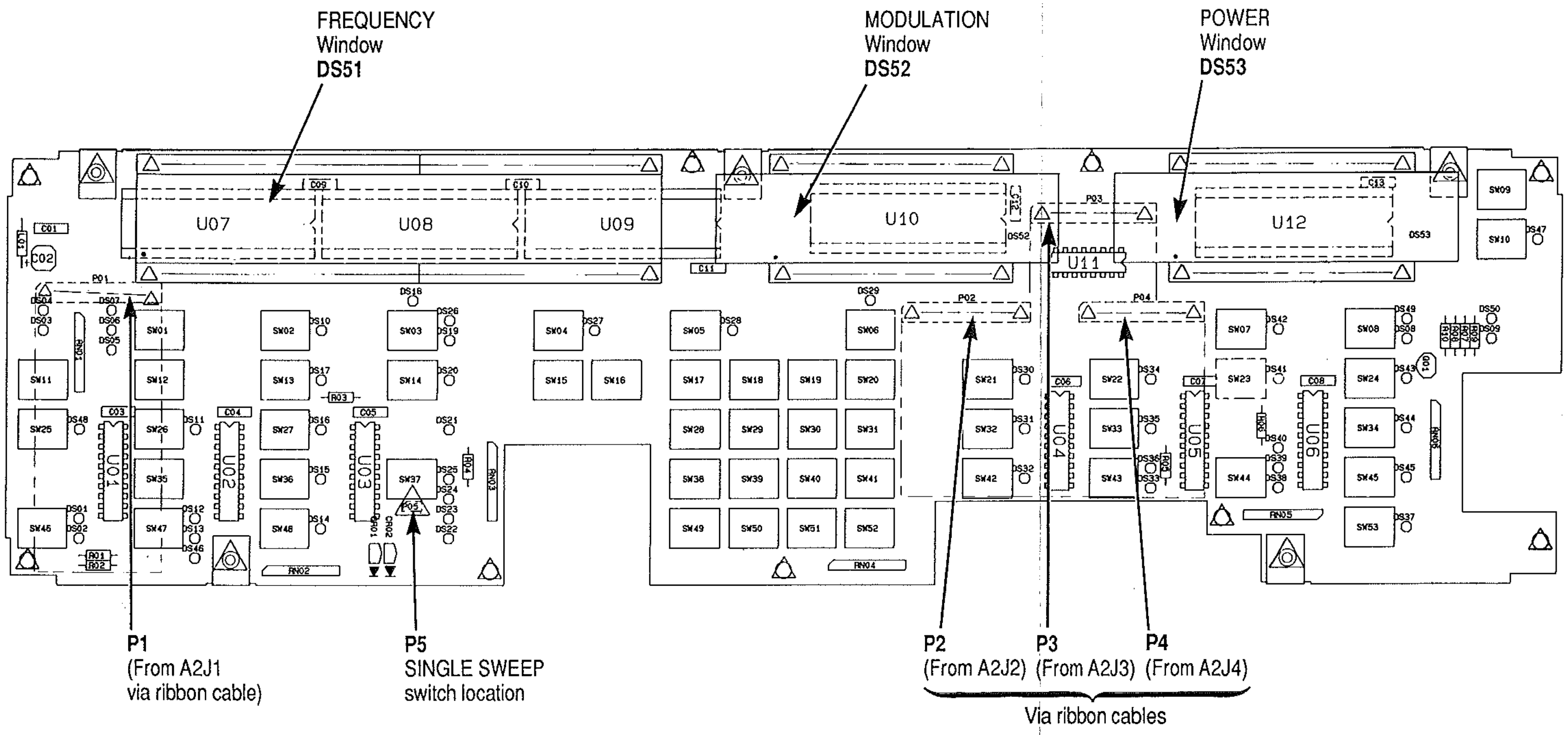


Figure 6D-1. Front Panel Block Diagram

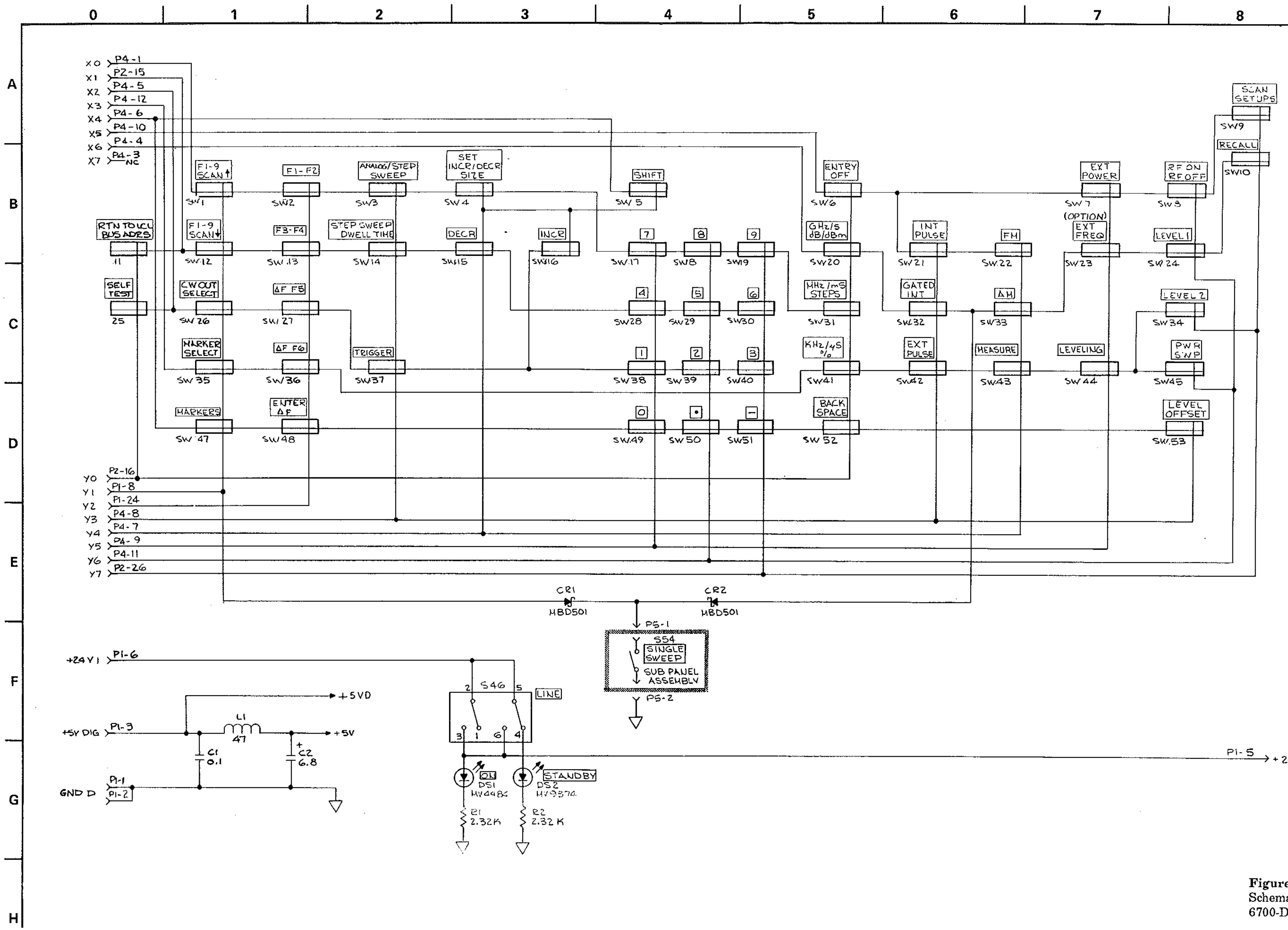
NOTE:
U7, U8, U10, U12,
P1, P2, P3, and P4 are
mounted on back side.





NOTE:
Leading zeros on
component number
references may be
disregarded.

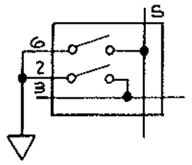
Figure 6D-2. A1 Front Panel PCB
Parts Locater Diagram
6700-D-31701-3 (Rev. C)



A1 FRONT PANEL SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:

   ISOLATED GROUNDS: ▽
4. SUBASSEMBLY BORDERS ARE DENOTED AS:
5. SW1-SW53 FRONT PANEL SWITCH LABELS ARE BOXED FOR CLARITY. ELECTRICAL SWITCH DETAIL IS REPRESENTED AS:



6. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:

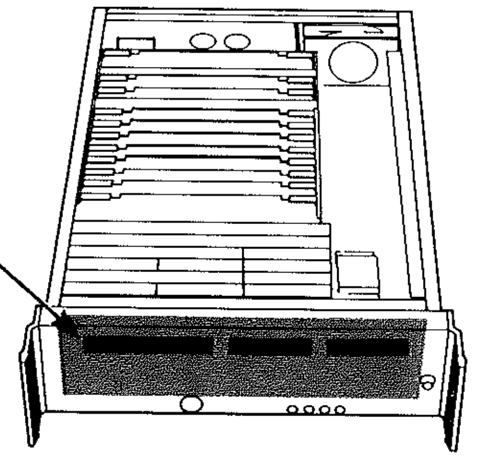
   CR1, CR2, U1-U12
7. LAST USED/NOT USED COMPONENTS ARE:

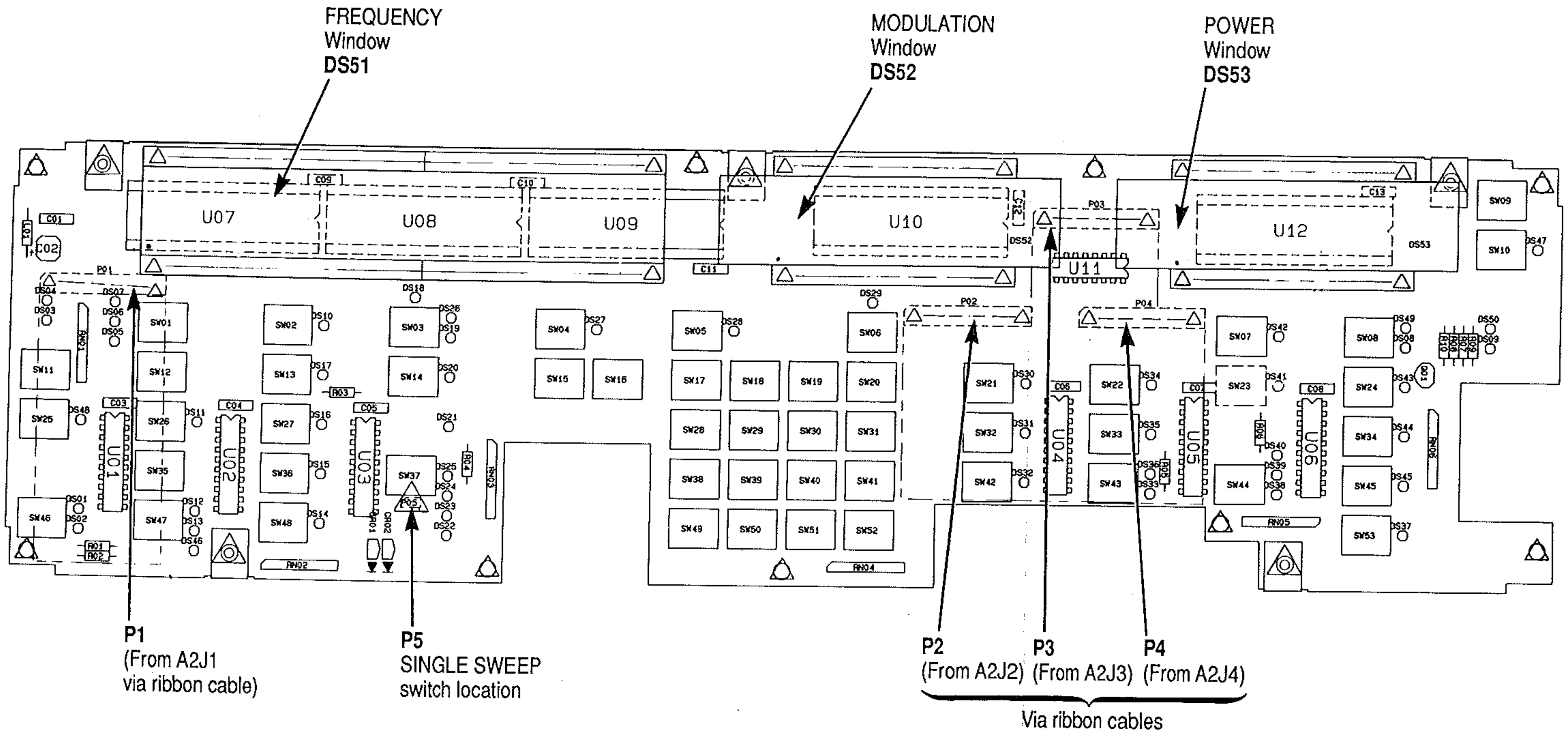
REFERENCE DESIGNATORS	
LAST USED	NOT USED
C13	DS41
CR2	SW23
DS53	
L1	
P5	
Q1	
R10	
RN6	
S53	
U12	

Figure 6D-3. A1 Front Panel PCB Schematic Diagram (Sheet 1 of 4) 6700-D-31701-3 (Rev. C)

NOTE:
U7, U8, U10, U12,
P1, P2, P3, and P4 are
mounted on back side.

A1
FRONT PANEL
(Behind front casting;
see removal procedure
in Section 7)





NOTE:
Leading zeros on
component number
references may be
disregarded.

Copy of Figure 6D-2. A1 Front Panel PCB
Parts Locater Diagram
6700-D-31701-3 (Rev. C)

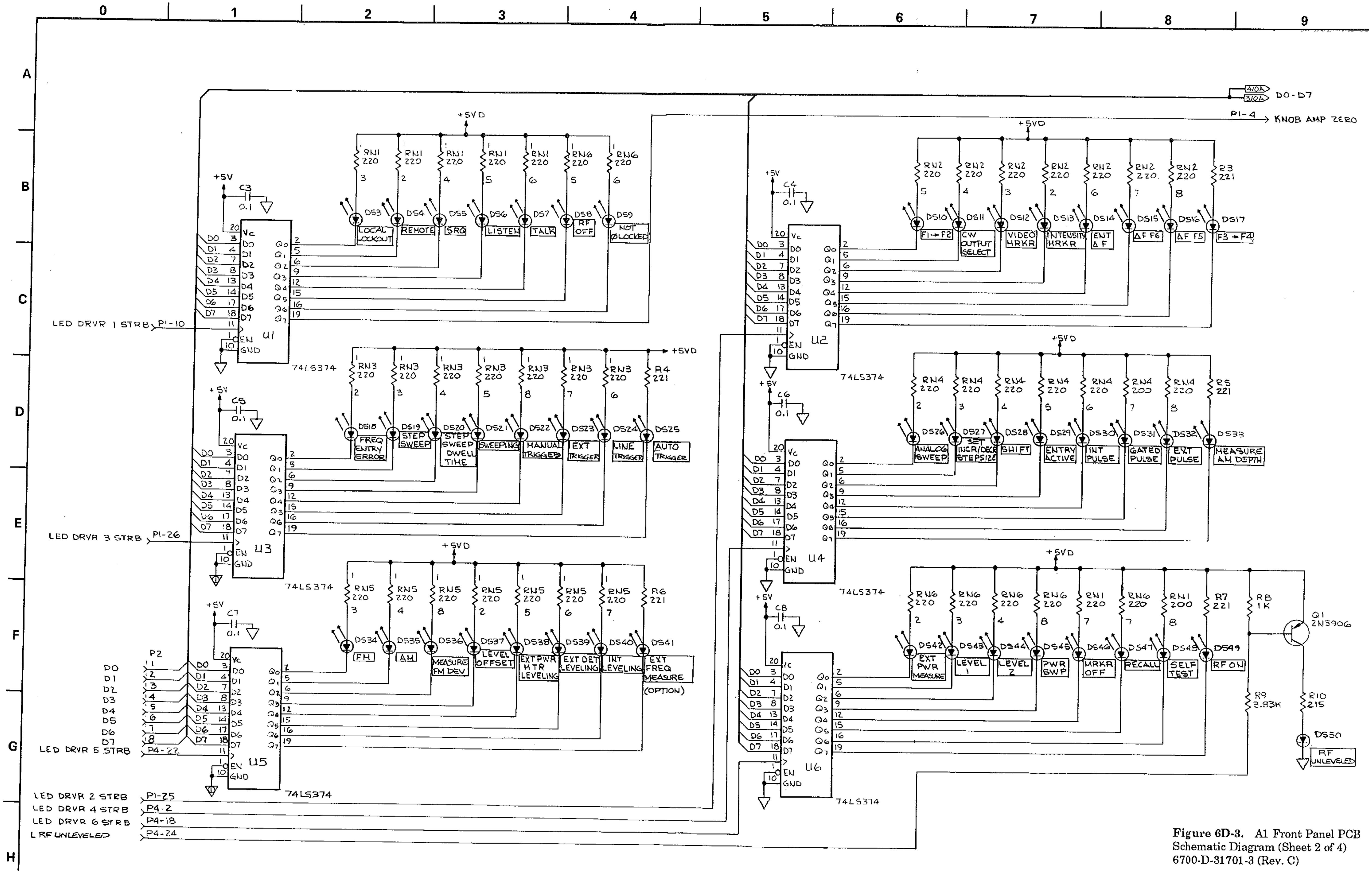
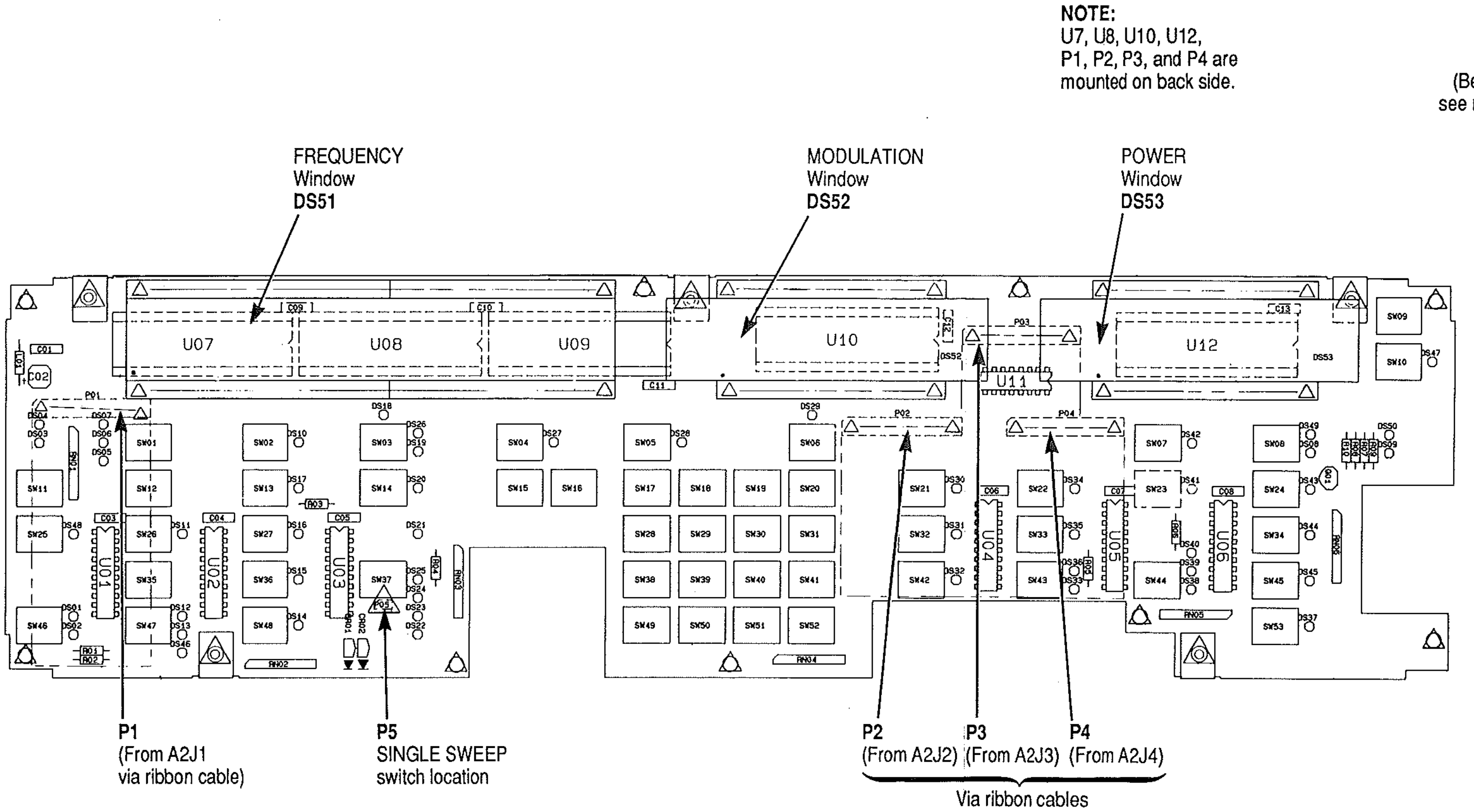
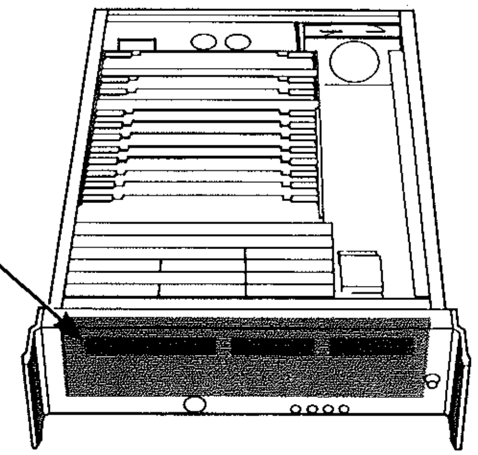


Figure 6D-3. A1 Front Panel PCB Schematic Diagram (Sheet 2 of 4) 6700-D-31701-3 (Rev. C)





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6D-2. A1 Front Panel PCB Parts Locater Diagram
6700-D-31701-3 (Rev. C)

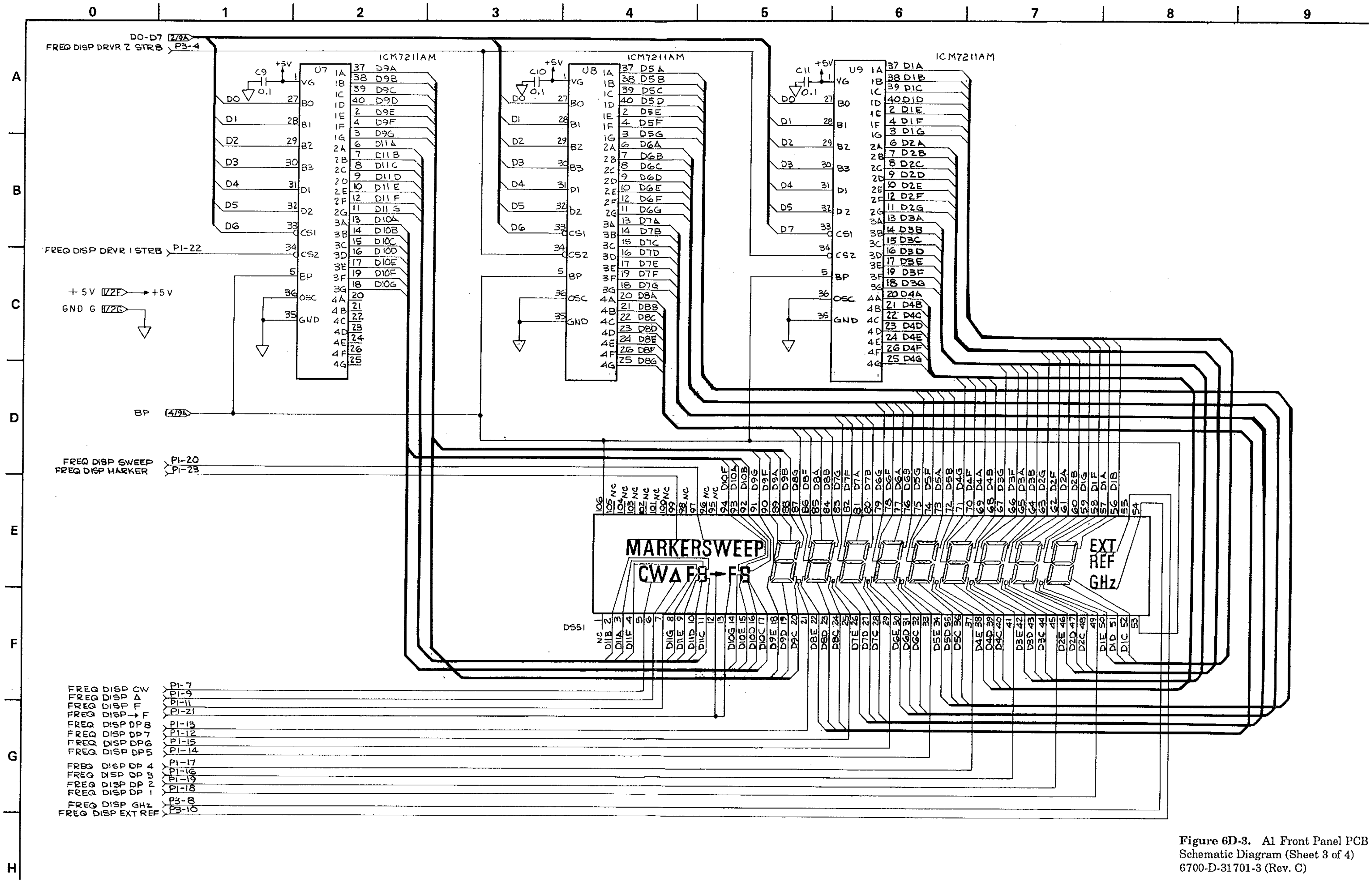
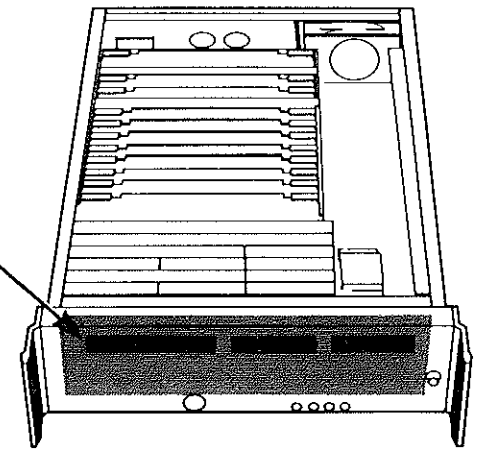
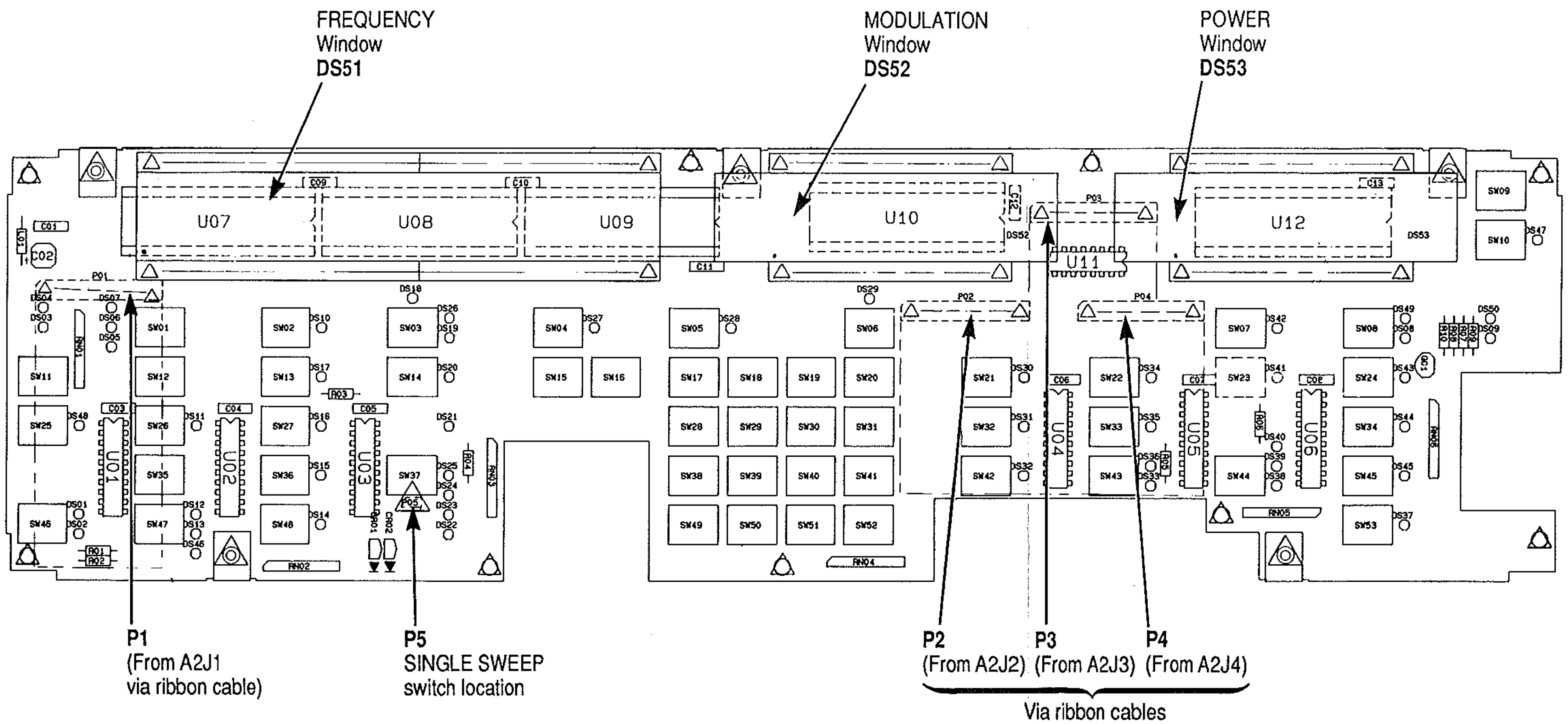


Figure 6D-3. A1 Front Panel PCB Schematic Diagram (Sheet 3 of 4) 6700-D-31701-3 (Rev. C)

NOTE:
U7, U8, U10, U12,
P1, P2, P3, and P4 are
mounted on back side.





NOTE:
Leading zeros on
component number
references may be
disregarded.

Copy of Figure 6D-2. A1 Front Panel PCB Parts Locater Diagram
6700-D-31701-3 (Rev. C)

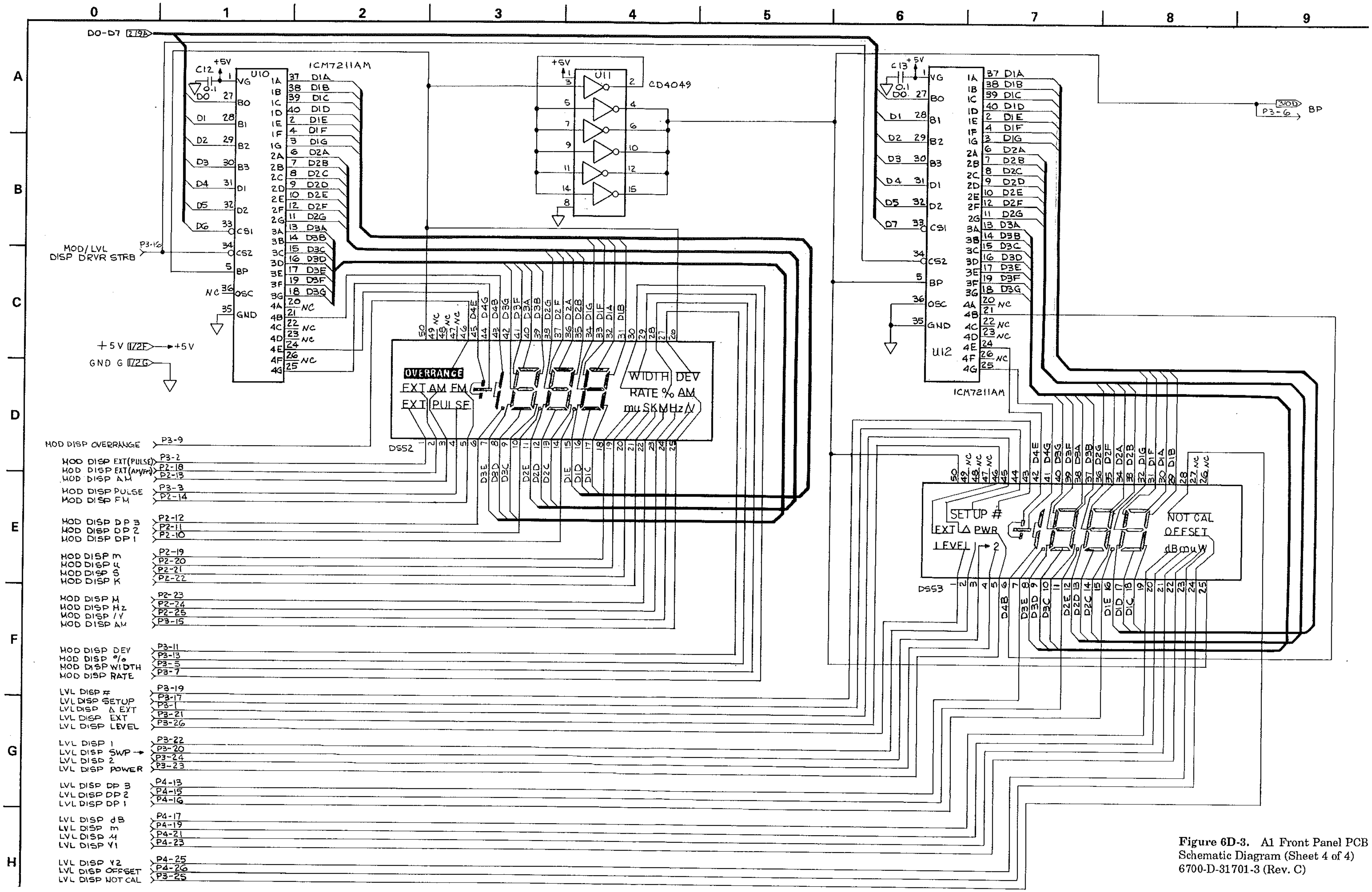
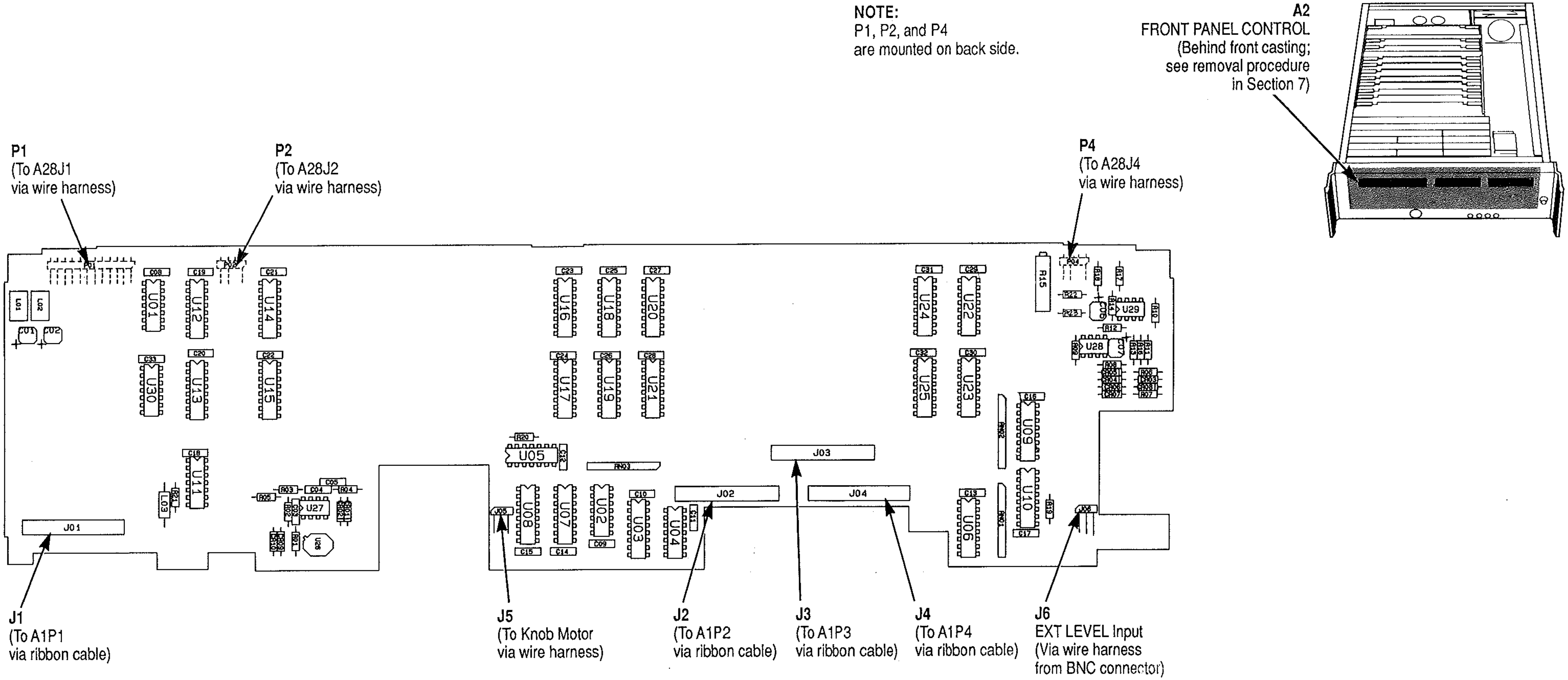


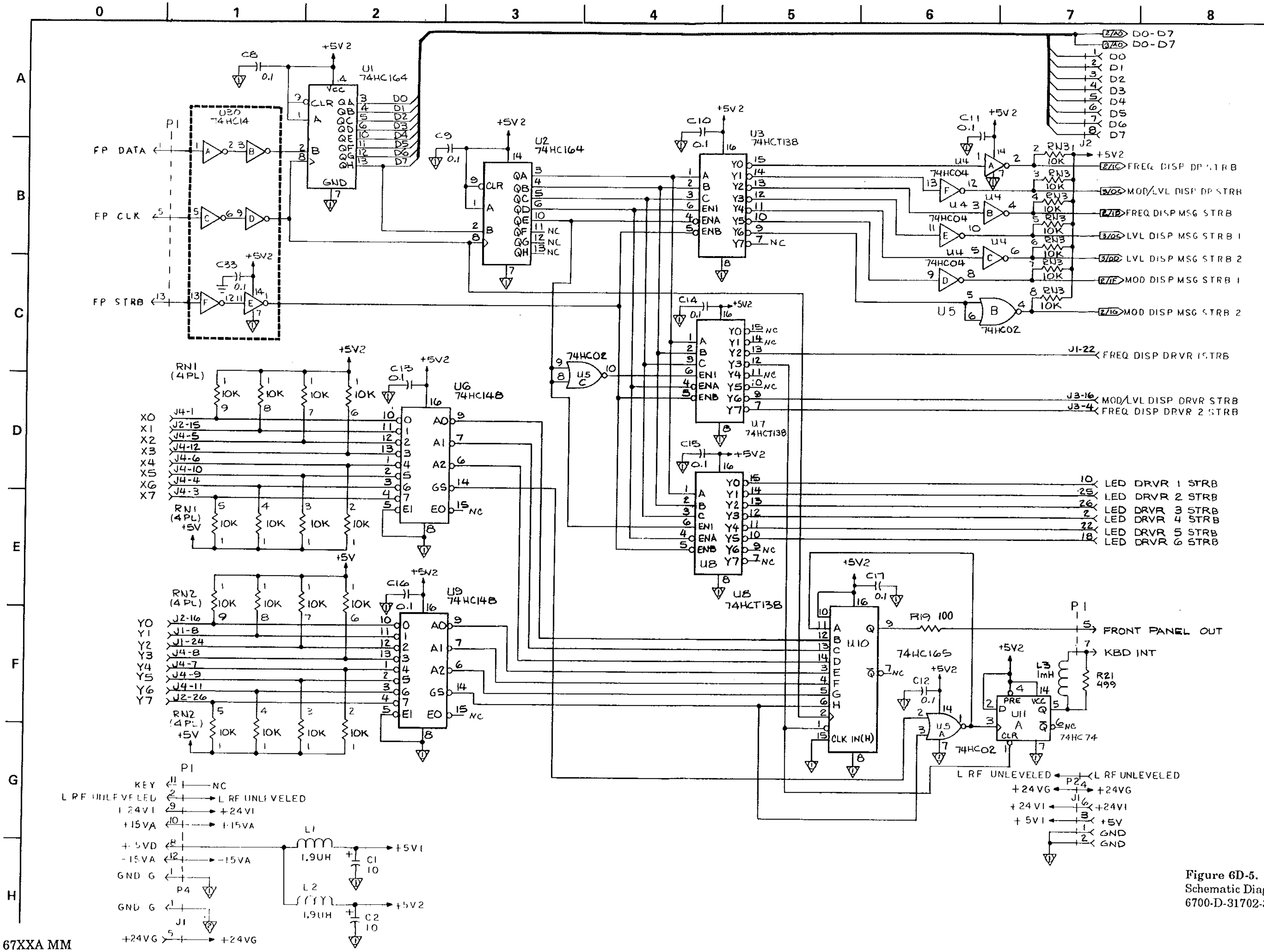
Figure 6D-3. A1 Front Panel PCB Schematic Diagram (Sheet 4 of 4) 6700-D-31701-3 (Rev. C)

NOTE:
P1, P2, and P4
are mounted on back side.



NOTE:
Leading zeros on
component number
references may be
disregarded.

Figure 6D-4. A2 Front Panel Control PCB
Parts Locater Diagram
6700-D-31702-3 (Rev. G)



A2 FRONT PANEL CONTROL SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   ISOLATED GROUNDS: (1) (2)
4. ADJUSTABLE COMPONENTS ARE DENOTED AS:
   R15
5. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   U12-U29
6. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C33 CR10 J6 L3 P4 R23 RN3 U30	P3 U11B

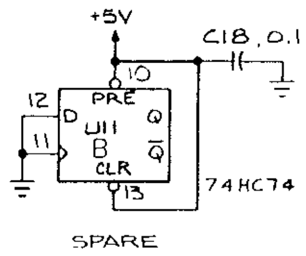
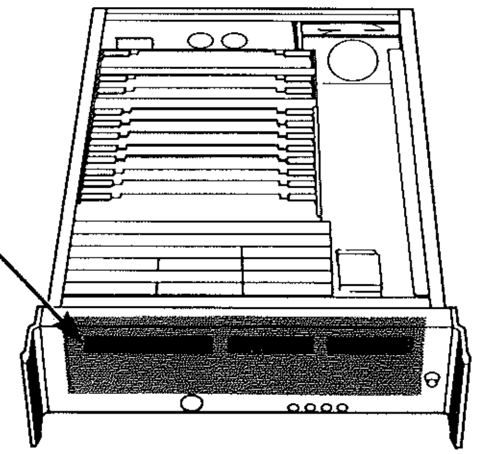
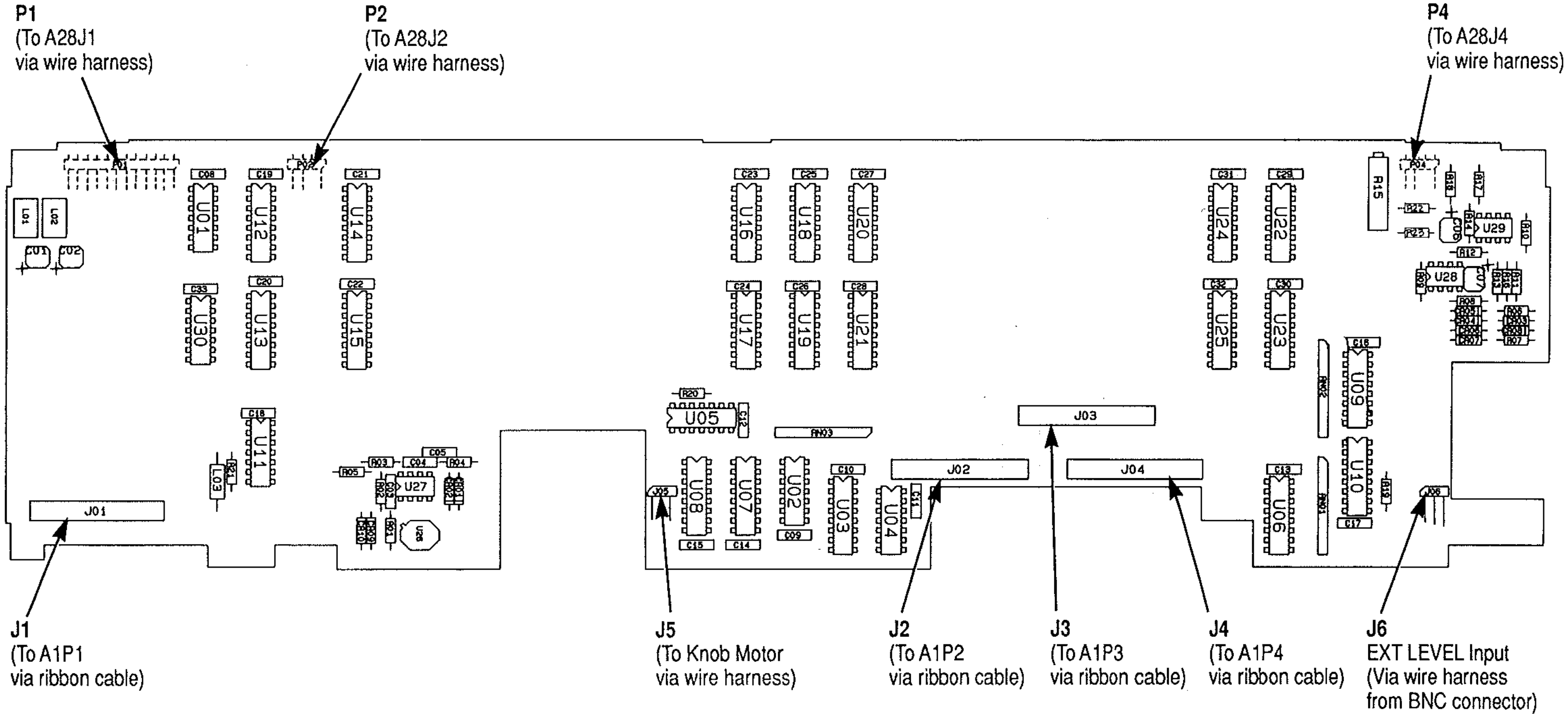


Figure 6D-5. A2 Front Panel Control PCB Schematic Diagram (Sheet 1 of 3)
6700-D-31702-3 (Rev. G)

NOTE:
P1, P2, and P4
are mounted on back side.





NOTE:
Leading zeros on
component number
references may be
disregarded.

Copy of Figure 6D-4. A2 Front Panel Control PCB
Parts Locater Diagram
6700-D-31702-3 (Rev. G)

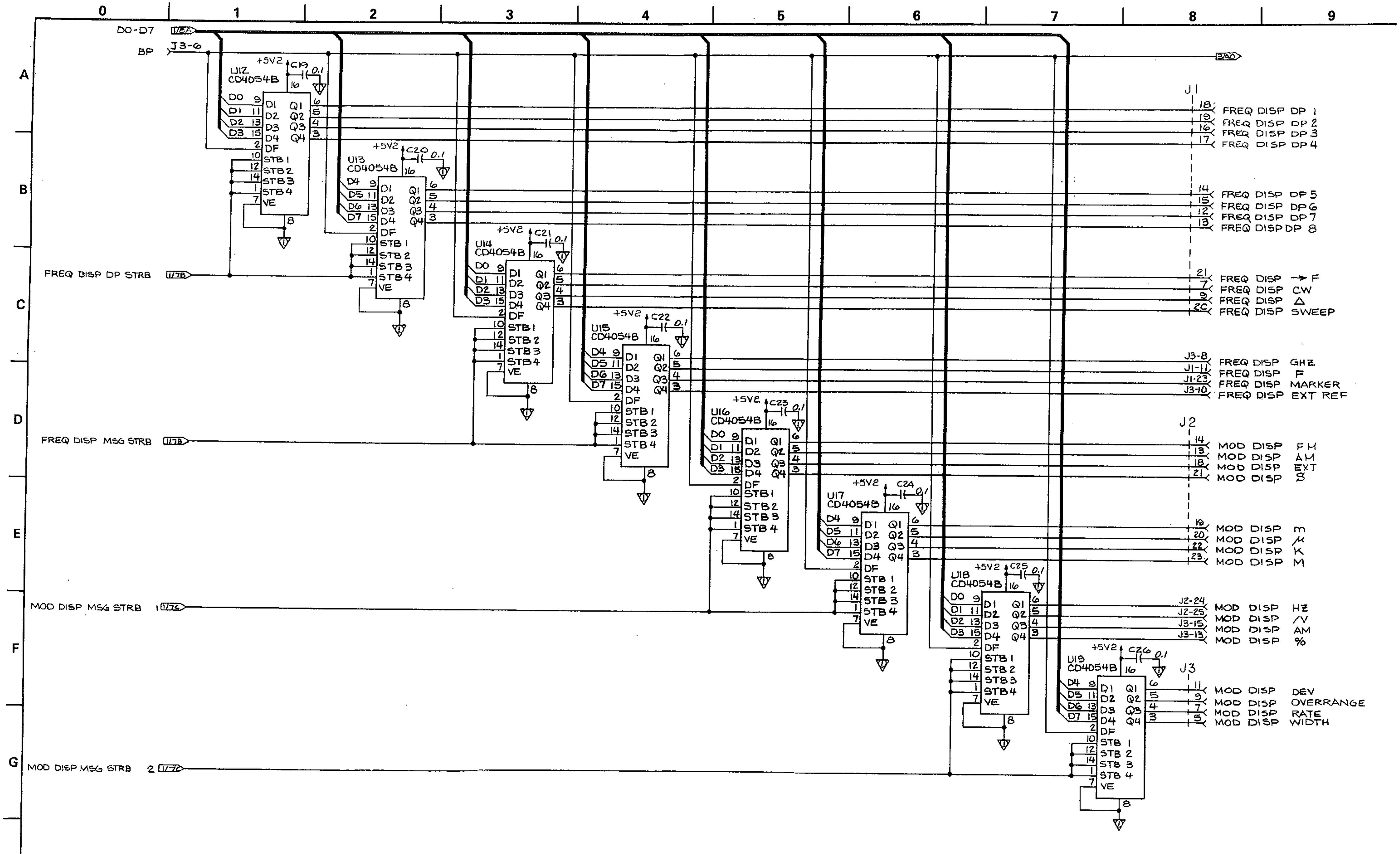
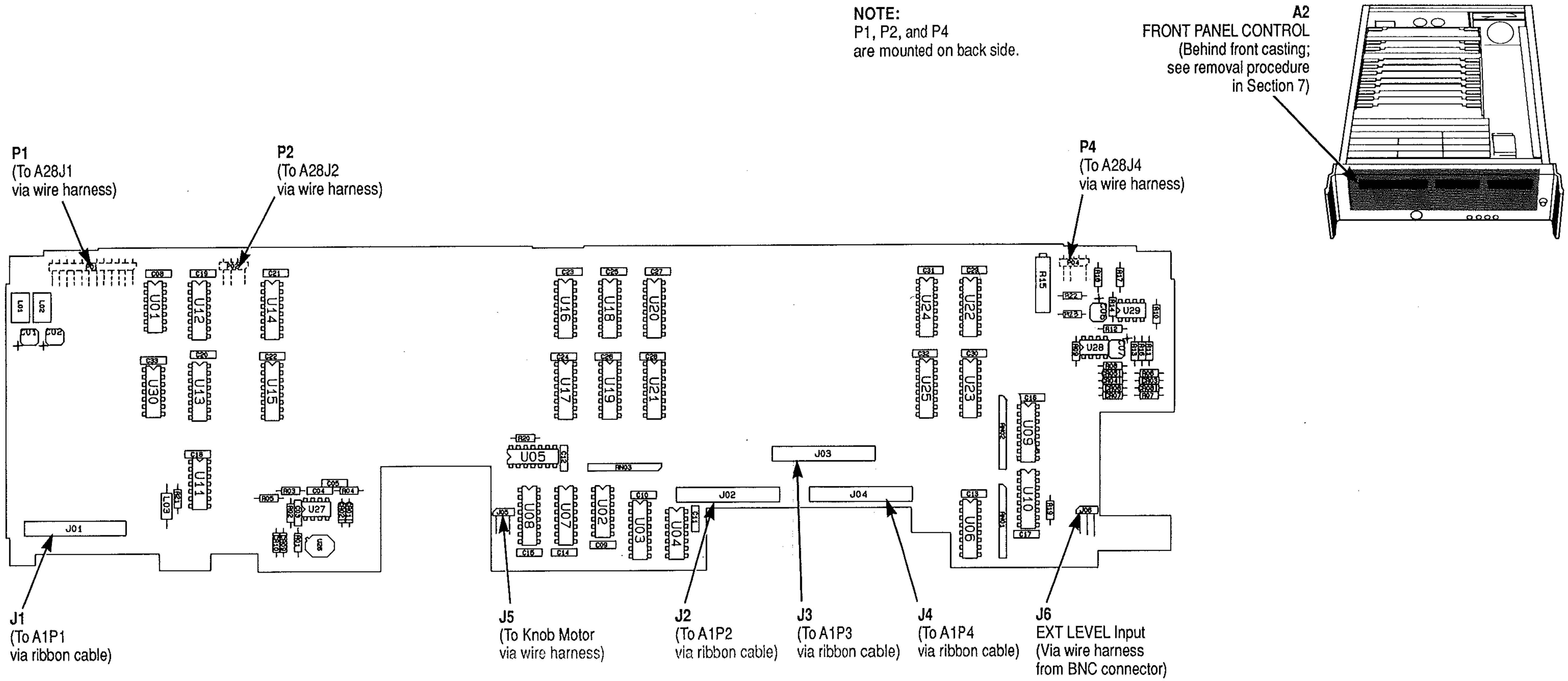


Figure 6D-5. A2 Front Panel Control PCB Schematic Diagram (Sheet 2 of 3)
6700-D-31702-3 (Rev. G)



NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6D-4. A2 Front Panel Control PCB Parts Locater Diagram
6700-D-31702-3 (Rev. G)

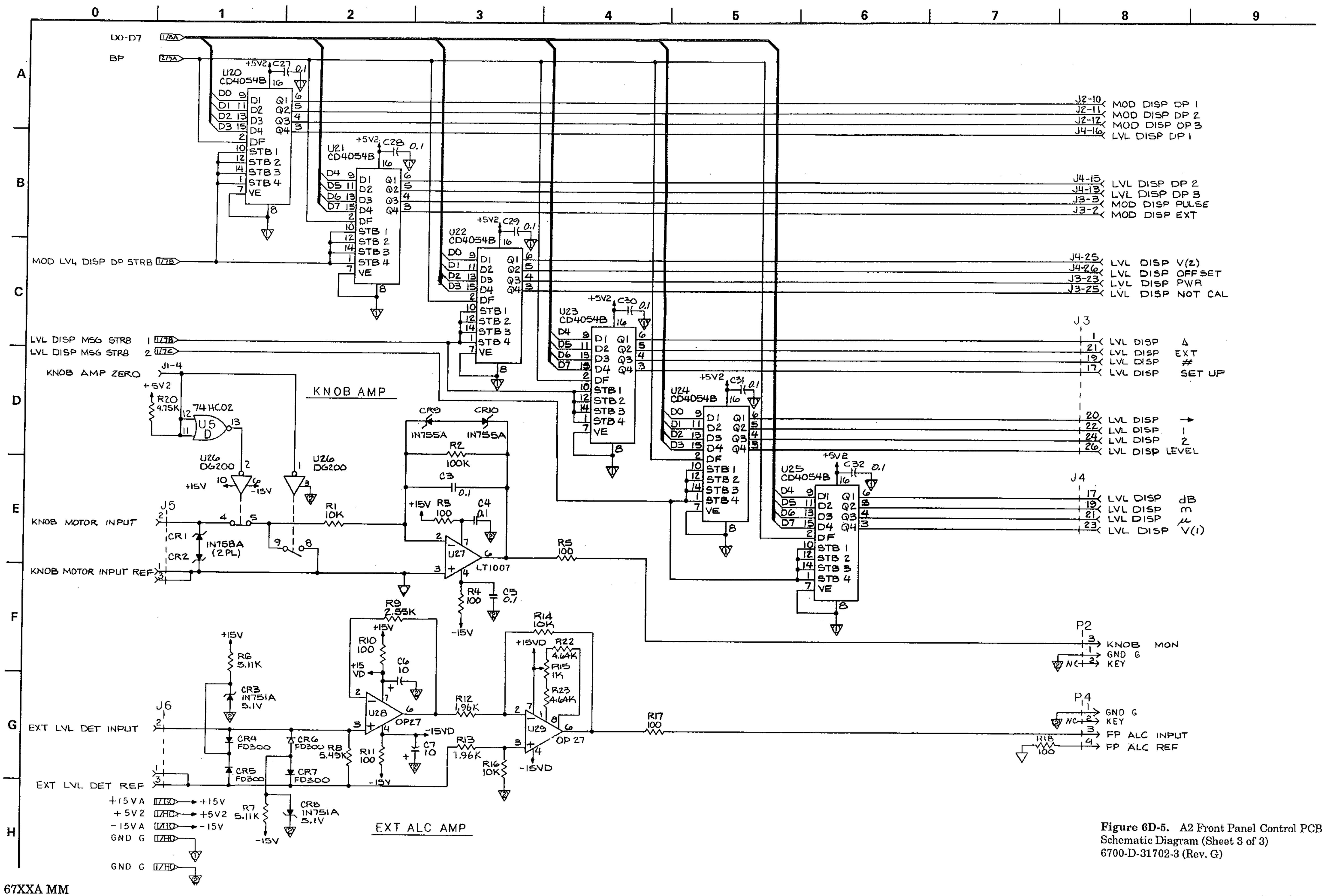


Figure 6D-5. A2 Front Panel Control PCB Schematic Diagram (Sheet 3 of 3)
6700-D-31702-3 (Rev. G)

6E – DIGITAL CONTROL A8, A23, and A24 PCBs

6E-1 DIGITAL CONTROL ASSEMBLIES: A23, A24, and A8 PCBs

This section contains service information for the digital control assemblies listed in Table 6E-1 below. Refer also to the general reference information in sections 6A, 6B, and 6C.

Table 6E-1. Digital Control Service Information

Documentation	Reference	Page
OVERALL ASSEMBLY LEVEL		
Overall Description	Para. 6E-2	6E-1
Block Diagram	Fig. 6E-2	6E-13
Troubleshooting	Tbl. 6E-2	6E-6
PCB LEVEL		
A8 Digital Control PCB		
General Circuit Description	Para. 6E-5	6E-3
Detailed Circuit Description	Para. 6E-6	6E-4
Block Diagram	Fig. 6E-3	6E-13
Troubleshooting	Tbl. 6E-2	6E-6
Schematic (Sheet 1 of 1)	Fig. 6E-11	6E-23
Parts Locater Diagram	Fig. 6E-10	6E-10
A23 Microprocessor PCB		
General Circuit Description	Para. 6E-3	6E-1
Block Diagram	Fig. 6E-4	6E-14
Troubleshooting	Tbl. 6E-2	6E-6
Schematic (Sheet 1 of 2)	Fig. 6E-7	6E-17
(Sheet 2 of 2)	"	6E-19
Parts Locater Diagram	Fig. 6E-6	6E-16,18
A24 GPIB PCB		
General Circuit Description	Para. 6E-4	6E-2
Block Diagram	Fig. 6E-5	6E-15
Troubleshooting	Tbl. 6E-2	6E-6
Schematic (Sheet 1 of 1)	Fig. 6E-9	6E-21
Parts Locater Diagram	Fig. 6E-8	6E-20

6E-2 DIGITAL CONTROL ASSEMBLIES, OVERALL DESCRIPTION

The digital control assemblies consist of the A23 Microprocessor PCB, A24 GPIB PCB, and A8 Serial I/O PCB. These assemblies control the synthesizer either locally via the front panel or remotely over the IEEE-488 General Purpose Interface Bus (GPIB).

The A23 Microprocessor PCB has the leading role in this group. It controls the A23, A8, A15, A16, A17, and A29 PCBs using two buses, each having 8-bit data and 3-bit address lines. In addition, each PCB has its own control line from the A23 board.

The A24 GPIB PCB interfaces with the A23 Microprocessor PCB using interrupts. When an (external) GPIB controller sends a command to the synthesizer, the A24 PCB decodes the command and sends an interrupt to the main microprocessor on the A23 PCB. This interrupt has the highest priority of any other interrupts that may be present. Upon being interrupted, the main microprocessor processes the command from the GPIB and performs the required task.

The A2 Front Panel Control, A6 Coarse Loop Divider, A11 Fine Loop Divider, and A13 Pulse Generator PCBs receive commands from the A23 Microprocessor PCB via the A8 Serial I/O PCB. Since these boards are sensitive to the high-frequency components of the 8-bit microprocessor bus signals, they are controlled through a serial bus. The main microprocessor sends information in parallel to the A8 board which then converts the information to a serial format. This serial bus signal is much slower. It transits the filter networks for each of the PCBs on the serial bus with much less interference than could the high-speed parallel-bus signals.

6E-3 A23 MICROPROCESSOR PCB, GENERAL DESCRIPTION

Refer to the block diagram in Figure 6E-4 for the following discussion. The A23 PCB central processing unit (CPU) is an 8088, 16-bit microprocessor operating at a 5 MHz clock rate. Integrated circuit U1 provides the 5 MHz clock (derived from a 15 MHz crystal). U1 also provides 2 wait states (total of 400 ns) when the microprocessor is addressing hardware outside of the A23 PCB. The address and data buses of the 8088 are multiplexed. U10 and U11 separate the address bus from the multiplexed data-address.

The on-board memory has the following capabilities.

- 64 K of EPROM (expandable to 128 K) for storing the main operating program of the synthesizer. This is also called firmware.
- 16 K of EEPROM (expandable to 64 K) for storing calibration data. This EEPROM is electrically erasable and is programmed by the main microprocessor during calibration. The reprogramming is enabled by a jumper (P2, CAL/NORMAL).
- 8 K of non-volatile RAM for storing front panel setups in the power-off condition. The battery for this RAM is part of the memory's integrated circuit structure and requires no external charging circuitry.
- 16 K of general purpose scratch-pad RAM.

As shown in Figure 6E-4, the address bus goes to the U14 port latch where it is decoded to the PCB address bus lines (**PA0–PA2**) and to latches U18 and U19. These latches provide additional decoding that enables the individual board address lines—used in combination with the board address bus—to send and receive information to the other PCBs.

The microprocessor data bus also goes to the U16 buffer-latch and then to the other PCBs on the data bus. U17 receives data from the data bus sent by either the A24 GPIB PCB, the A8 Serial I/O PCB, or the DVM circuit on the A17 PCB. U15 provides a start up instruction to the microprocessor at instrument turn on.

A second circuit in latch U18 provides the interrupt control for the microprocessor. These interrupts are handled on a priority basis. The GPIB has top priority; the front panel has the lowest priority.

Of the lines entering Interrupt Control(ler) U8, the **LFF INT** (Low Fast Frequency) signal comes from the A24 GPIB PCB and is used when fast frequency stepping is desired over the GPIB. For fast frequency stepping, up to 512 frequencies are stored in RAM in either sequential or non-sequential order. Then, each time the A24 PCB receives a group execute trigger (GET) command from the GPIB, it sends an LFF interrupt. The microprocessor then commands the synthesizer to go to the next frequency stored in the frequency look-up table. This reduces the time required for the GPIB microprocessor to process the frequency commands and request service from the main microprocessor.

The **DWELL INT** line comes from the A17 Analog Instruction PCB during analog sweep operations. This interrupt tells the microprocessor that a dwell has occurred and that it must now process either a bandswitch, retrace, or beginning of a new sweep.

The interrupts from the U6 counter and U7 timer provide timing signals for waits. Waits include time allowance for the phase-lock loops to achieve lock. During these waits, the microprocessor does other tasks. Then, upon timing out, the timer sends the interrupt, and the microprocessor services the next required task. There is also a housekeeping routine that uses these timers; it occurs every 50 ms. In the housekeeping routine, the microprocessor checks for phase lock on each of the loops and monitors such items as the power meter, AM, FM, and rear panel DIP switches located on the A27 Auxiliary I/O PCB.

The remaining two inputs to the PCB, **LINE TRIG** and **EXT TRIG**, are multiplexed to one signal that interrupts when the sweep mode is set for line or external trigger operations.

6E-4 A24 GPIB PCB, GENERAL DESCRIPTION

The A24 GPIB PCB has its own microprocessor for interfacing the IEEE-488 instrument bus with the A24 PCB main microprocessor. It also contains a GPIB microprocessor and the necessary ROM and RAM for its operation.

GPIB Processor U7 controls the U5 and U6 bus transceivers. U7 is in turn controlled by U1, an 8085 8-bit microprocessor. U1 implements GPIB subset functions SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, and C5. The interface between U1 and U7 is via interrupts. The bus transfer rate is approximately 15 Kbytes/second. U7 receives commands from the IEEE-488 bus and sends them to a part of RAM used as a buffer. U1 then decodes these commands and sends the information to another part of RAM used as an output buffer. From here they go through U12 and U16 to the A23 PCB main microprocessor.

Microprocessor U1 has its own clock generator controlled by a 6 MHz crystal. Its program is located in EPROM U10. U11, an 8K RAM, acts as an input/output buffer and general scratch-pad RAM. U8 separates the address information from the multiplexed data-address bus of the 8085.

U4 and the GPIB interrupt from U12 control the transfer of data between the 8085 and the A23 (main) Microprocessor PCB.

For fast frequency stepping, an LFF interrupt is provided by the FF Int(terrupt) Logic circuit comprised of U9, U3, U13, and U17. First during its operation, up to 512 frequencies are loaded into the main microprocessor RAM (look-up table) from the GPIB. Then, each time a GET command is received from the GPIB, a LFF interrupt goes to the A23 Microprocessor PCB. When the main microprocessor receives this interrupt, it knows to go to a new frequency (which is stored in the look-up table) and executes the commands to perform the operation.

At turn-on, the main microprocessor tells the GPIB microprocessor to perform a self test. The GPIB then performs this self test on the circuits located on the A24 PCB and provides the results in a buffer in RAM. When the main microprocessor has completed its self test routines, it comes back and gets the results of the GPIB self test.

U14 is a parallel peripheral driver/receiver intended for future use.

The front panel GPIB status LEDs (remote, SRQ, listen, talk, etc.) are controlled by the main microprocessor from information supplied by the GPIB processor.

6E-5 A8 SERIAL I/O PCB, GENERAL DESCRIPTION

The A8 PCB, shown in the Figure 6E-3 block diagram, converts the 8-bit parallel data from the microprocessor data bus to a 16-bit serial format. It transmits this data to the A2, A6, A11, and A13 PCBs. It receives information from the A2, A14, and A7 PCBs. The A8 PCB is addressed through Port Decoder (processor address decoder) U1.

6E-5.1 Transmitting data

The microprocessor first loads data to the U5 multiplex (mux) latch. This latch selects which PCB will receive the data. The microprocessor then loads two 8-bit words into shift registers U9 and U11. When U11 finishes loading, it sets the U7 clock timer to start clocking data out at a rate of approximately 400 kHz. The parallel data in shift registers U9 and U11 is routed to the appropriate PCB via the U6 data mux. The clock is routed to that same PCB through clock mux U12. The clock synchronizes the receiving PCB circuits with the data transfer rate.

After 32 clock cycles, 16 bits of data have been transmitted and the timer disables the clock generator. In the case of the A2 Front Panel Control PCB, the timer also sends a strobe to latch data into the A2 PCB latches.

6E-5.2 Receiving data

When any key is pressed on the front panel, the A2 PCB sends an interrupt to the A23 Microprocessor PCB. Upon servicing the interrupt, the microprocessor sets the U10 serial input mux to switch the front panel data into U11 and clock mux U12 to route the clock to the front panel. It then triggers clock timer U7/U8 to shift the data first into U11 and then from U11 to U9. After the data has been shifted into U9, the microprocessor interprets and processes the keystroke.

In the case of the external reference detector signal input (**EXT REF DET**), the state of the line is read by the microprocessor (about every 50 ms) during housekeeping. In this case, the clock signal is used only on the A8 PCB to shift the data into the shift registers, it does not go through the clock mutiplexer.

6E-5.3 Ground Return Mux

The transformers following shift register U9 and clock timer U7/U8 (strobe and clock) couple the high frequency components of their output square waves into ground return mux FETs Q2-Q6. Since these square waves go through a filter network (chassis-mounted filtercon) having a capacitor to ground, current spikes often result. The transformers couple the high frequency components of equal magnitude but opposite polarity back into the ground system to cancel these spikes.

6E-5.4 U4 Fine Loop Flip-Flop

U4 is a 1-bit latch that provides the additional 17th bit required for the frequency dividers on the A11 Fine Loop Divider PCB. (The serial-data bus is only a 16-bit bus.)

6E-6 A8 SERIAL I/O PCB, DETAILED CIRCUIT DESCRIPTION

6E-6.1 Microprocessor Interface

The microprocessor data bus from A24 PCB goes to U5, U9, and U11. U5 is an 8-bit data latch for controlling the path of the serial data, U9 is a read/write shift register for sending and receiving serial data, and U11 is a write-only shift register for sending serial data. Since the serial I/O always sends or receives data in 16-bit segments, two shift registers are required, however, when receiving serial data, the microprocessor only uses 8 bits of data. This is why there is only one read shift register.

The A8 PCB is addressed by the **PA0-PA2** (Processor Address) lines and the **LPA22** (Low Processor Address) line. The **PA0-PA2** lines are common to all PCBs that the microprocessor sends data to, however, the **LPA22** line goes only to the A8 Serial I/O PCB. These address lines are decoded by U1 3-to-8 decoder. Only one of the outputs of U1 will be active low at any time. The pulses out of U1 are also only about 800 ns wide. These outputs from the decoder are normally referred to as a "strobe" as they normally are used only to latch data into a data latch or start and stop some function.

6E-6.2 Clock Timer

U7 is a free running oscillator at about 600 kHz and is controlled by the state of flip flop U4B. R6, R7, and C9 control the frequency of the signal from U1. When the processor wants to read or write to the A8 Serial I/O PCB, it first loads data into the data latches, and then clocks U4B with a strobe from U1-14 to start the clock. This strobe also latches the final data into U11 and resets the U8 counter. U4B-9 goes high and U7 oscillates at 600 kHz. The output of U7 is divided by two to get a 50% duty cycle; it clocks the U9 and U11 shift registers via U2C.

At U8-6, the 600 kHz is divided by 16 and goes to U8-13 where it is divided by 2. The signal at U8-10 goes to U2 where it is inverted. It then goes to U4B and clears (sets pin 9 to 0) the flip-flop that turns the U7 clock oscillator off after 32 cycles have occurred. Figure 6E-1 illustrates the clock timing sequence for a serial read or write.

U3A reads the output (busy bit) of U4 which tells the microprocessor if the serial I/O is in the process of converting serial data to parallel data or parallel data to serial data. When U3-1 is set low by the U1 decoder, the state of U4B is placed on **D0** of the data bus where its status is read by the processor.

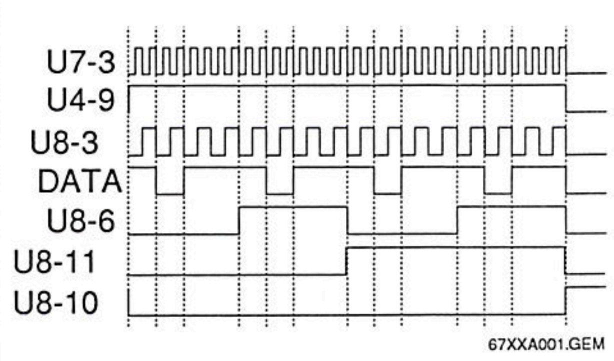


Figure 6E-1. Serial I/O Data Transfer Timing

6E-6.3 Shift Registers

At the same time flip-flop U4B is strobed, pin 1 of U11 is strobed; this loads any data on the data bus into its registers. On the rising edge of each clock, the data in this register is shifted 1 bit toward the output at pin 9. At the same time, data on pin 10 is shifted into the registers, replacing the data that was previously in the register.

Previous to U11 being loaded with parallel data, U9 is loaded when U1-12 goes low. At the same time U11 is clocked, U9 is clocked; this shifts the latched data to U9-17 output – 1 bit for each clock cycle. At the same time data is being shifted out on U9-17, data from from U11-9 is being shifted into U9-11. This continues until all 16 bits stored in U9 and U11 are shifted to the output of U9.

6E-6.4 Multiplexers

At the same time data is shifted out of the shift registers on the A8 PCB, it is being shifted into registers on the destination PCB. The path that the data and clock signals take is determined by the U6 and U12 multiplexers which are themselves controlled by data latch U5. If, for example, the data is destined for the A6 Coarse Loop Divider PCB, the address inputs on U6 pins 1, 15, and 16 will route the signal pin 8 to pin 5. At the same time, the address inputs on U12 pins 1, 15, and 16 will route the clock signal to the A6 Coarse Loop Divider PCB.

Since the A1 and A2 front panel PCBs have more latches than 16 bits of data can handle, a front panel strobe is provided by multiplexer U10. This strobe is the same signal that resets the U4B clock control flip-flop. In this case, 8 bits of the data going to the front panel contain the actual data to be sent to the front panel latches, and the other 8 bits of data contain the address information for the data latch where this data is to be latched. The 8 bits of data and 8 bits of address information is loaded into two shift registers on the A2 Front Panel Control PCB. The shift register for the 8 bits of data is tied to an internal parallel 8 bit data bus. The shift register for the address information is tied to some address decoders. Once the data and address information has been shifted into the registers, the strobe at U10-5 will go low and latch the data into the addressed data latch.

6E-6.5 Ground Return Multiplexer

All of the serial data and clock signals go to destinations which have chassis-mounted filtercons as an interconnection device. The filtercons are a π-filter network with approximately 1500 pF of capacitance to ground. These are used for the signal and power supply lines for the phase lock circuits and front panel circuits. These filter networks reduce crosstalk between the circuits in the RF casting and prevent their RF signals from radiating from the 67XXA (for EMC – Electro-Magnetic Compatibility considerations).

Driving the capacitance of the filtercons with TTL signals causes high frequency ground currents that can not only affect other circuits connected to the ground, but also cause undesireable radiation of the signals; this also degrades the EMC performance of the instrument. T1 thru T4 couple these high frequency TTL signal components to a multiplexer consisting of Q2 thru Q6. These transistors are low resistance (less than 5 Ohms) FET switches controlled by data latch U5. The inverted high frequency components are coupled back into the grounding system to oppose the currents caused by the filtercons, thereby reducing the overall ground current effects and improving EMC performance.

6E-6.6 Serial Data Input

When any key on the front panel is pressed, an interrupt is sent to the microprocessor. The key code is loaded into a shift register on the A2 Front Panel Control PCB at the same time. The microprocessor sets data latch U5 to enable the U10B **FP DATA** (front panel data) path and the U12 **FP CLK** (front panel clock) path. It then starts the U7 clock oscillator which shifts the data from the front panel shift register into register U11 and then register U9. Upon completion of the conversion cycle, the processor strobes U9 to place the data in its registers on the data bus via U1-15 strobe.

6E-6.7 External Reference Detected Siganl Input

If an external 10 MHz reference signal is applied to the 67XXA rear panel 10 MHz REF INPUT BNC connector, the A7 Reference Divider PCB causes the **EXT REF DET** line to go to TTL high. During housekeeping, the state of this line is read by the microprocessor via U10-11 on the A8 Serial I/O PCB. In this case, the clock signal will not be sent from U12 to the other PCBs on the serial data bus. Only the 1 bit will be shifted to the **D0** line by the 16 clock cycles.

6E-6.8 Fine Loop Data (FLD12) Latch

U4A is a D-type flip-flop used as a 1 bit data latch. The data on **D0** is set for the desired state, then the U1-10 strobe clocks this data to the output on U4A-5 where it goes to the A11 Fine Loop Divider PCB (the fine loop dividers need 17 bits of information). **FLD12** goes high only when the frequency of the fine loop equals 300 MHz.

6E-7 DIGITAL CONTROL ASSEMBLIES, TROUBLESHOOTING

Digital control assembly troubleshooting is covered entirely in Table 6E-2.

6E-8 DIGITAL CONTROL ASSEMBLIES, SERVICE SHEETS

Table 6E-1 on the first page of this section presents the arrangement of the block diagram, schematics, and parts locater diagrams for the A8 PCB, the A23 PCB, and the A24 PCB.

Table 6E-2. Digital Control Troubleshooting (1 of 7)

Trouble / Error Code	Troubleshooting Procedure
	General Digital Control Assemblies Troubleshooting
Preliminary Checks at Power On	In normal operation, at turn on the following occurs: 1) The front panel LCDs and LEDs light in a random pattern for a few seconds, then blank while self test runs; 2) After self test finishes, the front panel displays the set-up that was present when instrument power was last turned off. If the LCDs and LEDs don't change from their initial random patten and the front panel controls are inoperative, the problem lies in either the Digital Control assemblies or the Front Panel assemblies (section 6D). Observe the rear panel HORIZ OUT signal with an oscilloscope or the RF OUTPUT with a frequency counter. If the 67XXA sweeps or there is a phase locked RF signal from the RF OUTPUT, the A23 Microprocessor PCB is operating. Go to the A8 Serial I/O PCB troubleshooting below. • If the 67XXA is not sweeping or there is no phase locked RF OUTPUT, the A23 PCB or A24 PCB is faulty. To verify, observe the signal at XA17-13. You should see 800 ns TTL pulses occuring about every 50 ms; this indicates that the microprocessor is performing its housekeeping routines. The A23 PCB is not likely to be causing the problem. Proceed to A8 Serial I/O PCB troubleshooting below. • If no pulses are observed at XA17-13, turn the unit off and remove the A24 GPIB PCB. Turn the power back on. • If the unit returns to normal operation, then go to the A24 GPIB PCB troubleshooting in this table. **NOTE** Without A24 being installed, E24-0 error code will display during power up self test. The response to the operation of the front panel will be somewhat slower. • If the unit still does not resume normal operation go to the A23 Microprocessor PCB troubleshooting in this table.
	A8 Serial I/O PCB Troubleshooting
	One of the easiest ways to observe the signal from and to the A8 board is to set the 67XXA for a full-band step sweep. This will cause the A8 PCB to write data to every PCB on the serial bus. Syncronize an oscilloscope to U2-8 signals and observe the clock pulses and data pulses to each device as the 67XXA writes to each PCB. If you are interested in looking at one output in particular, set up the front panel for an operation that will address that particular board. Examples are given below.
A6 Coarse Loop Divider Write Data Test	**SHIFT, TRIGGER, 012** allows you to increment and decrement the frequency of the A4 Coarse Loop Oscillator which require a write to the A6 Coarse Loop Divider PCB.
A11 Fine Loop Divider Write Data Test	**SHIFT, TRIGGER, 012** allows you to increment and decrement the frequency of the A9 Fine Loop Oscillator which require a write to the A11 Fine Loop Divider PCB. **FLD12** at A8-40 goes high at any Fine Loop frequency of 300 MHz or above.

Table 6E-2. Digital Control Troubleshooting (2 of 7)

<table>
<tr><th>Trouble / Error Code</th><th>Troubleshooting Procedure</th></tr>
<tr><td></td><td>A8 Serial I/O PCB Troubleshooting (Continued)</td></tr>
<tr><td>A13 Pulse Generator Write Data Test</td><td>SHIFT, PULSE WIDTH allows you to increment and decrement the pulse width requiring a write to the A13 Board.</td></tr>
<tr><td>A2 Front Panel Control Write Data Test</td><td>Going to an analog or step sweep mode causes a continuous write to the front panel to update the SWEEP LED. Pressing CW SELECT continuously sends an interrupt the the A23 Microprocessor and causes it to read the keycode from the front panel assemblies. In CW mode, with no keys pressed, you should get a read about every 50 ms as the microprocessor reads the status of the external reference detector EXT REF DET.
• Any individual PCB not getting a data or clock signal indicates that the U5 data latch has a defective bit.
• If any PCB is getting a data signal but no clock signal, it indicates that U12 is defective.
• If a PCBis getting a clock signal but no data signal, it indicates that U6 is defective.
• No front panel strobe indicates a defective U10.
• No clock output from U7 indicates either a defective U7, U4B, or U1.
• An incorrect number of clock cycles indicates a defective U8 or U2 (see Figure 6E-1).</td></tr>
<tr><td>E8-10</td><td>To troubleshoot the A8 Serial I/O PCB, the A23 Microprocessor and A24 GPIB PCBs must be operating. The following procedure assumes that control of front panel has been lost becaused of an inoperative A8 PCB. This procedure uses a GPIB controller to control the 67XXA.
• Connect the GPIB controller. Write a program to put the 6700A in a loop that will constantly exercise the A8 Serial I/O. The following program, written for a Wiltron 85 controller, will provide this control.
10 OUTPUT 705;"F1 GH F2 GH"
20 OUTPUT 705;"CF1 SQP"
30 WAIT 5
40 OUTPUT 705;"CF2 SQP"
50 WAIT 5
60 GOTO 20
The above program alternates between F1 and F2 with a 1 kHz square wave at the F1 frequency. This requires serial data to be sent to the following PCBs: A2 Front Panel Control, A6 Coarse Loop Divider, A11 Fine Loop Divider, and A13 Pulse Generator.
• Monitor the test points shown below with an an oscilloscope. You should see a 32-cycle burst of square wave clock pulses each time the A23 Microprocessor writes to the PCB. The internal PRF of this burst will be approximately 200 kHz.
<u>Test Points:</u>
XA8-26 Front Panel Clock (FP CLK)
XA8-39 Fine Loop Clock (FL CLK)
XA8-36 Coarse Loop Clock (CL CLK)
XA8-34 Pulse Trigger Clock (PLS TRIG CLK)
XA8-31 Pulse Generator Clock (PG CLK)
If any one of these signal are missing, it indicates a defective A8U12 multiplexer or A8U5 data latch.
If all of these signals are missing, it indicates that the timer—composed of A8U4, A8U3, A8U7, A8U8, and A8U2—or the A8U1 address decoder is defective.</td></tr>
</table>

Table 6E-2. Digital Control Troubleshooting (3 of 7)

Trouble / Error Code	Troubleshooting Procedure
	A8 Serial I/O PCB Troubleshooting (Continued)
Serial Data Output Checks	The following procedure checks the serial data output to the PCBs. It assumes that the clock signals checked previously are proper. Monitor each of the test points shown below with an oscilloscope (with the previous GPIB program running). At each test point, you should see 16 bits, either 1's or 0's, at approximately a 100 kHz rate. (This rate occurs as it takes 2 clock cycles for each data bit.) Test Points: XA8-25 Front Panel Data (**FP DATA**) XA8-37 Fine Loop Data (**FL DATA**) XA8-33 Coarse Loop Data (**CL DATA**) XA8-30 Pulse Generator Data (**PG DATA**) Pulse Generator data is transmitted during both Pulse Trigger Clock and Pulse Generator Clock cycles. The following assumes that data is present; that is, that the pulse train is changing from 1's to 0's at some random rate. • If only some of the test points have no data being transmitted, the A8U6 multiplexer is defective. • If all of the data signals are missing, shift registers A8U9 or A8U11 are likely suspects. • If the first half of the 16-bit data stream is always the same on each data line, it indicates a defective A8U9. • If the second half of the 16-bit data stream is always the same on each data line, it means A8U11 is defective.
FLD12 Check	The **FLD12** data line at XA8-40 may be checked as follows. • Disable above the GPIB program. Press SHIFT, TRIGGER, 011. This lets you tune the Fine Loop oscillator with the front panel keypad. • Monitor XA8-40. At any frequency below 300 MHz, it should be TTL low. At any frequency 300 MHz and above, the level should be TTL high. • If **FLD12** is not switching as mentioned above, A8U4 is defective. • Although the front panel may be receiving the proper clock and data signal, it also requires a strobe to latch this data into the latches on the A2 PCB. Monitor this strobe at XA8-29 with an oscilloscope. During the final clock cycle of the 32 bit clock stream to the front panel, you should see a 5 μs wide pulse. If this pulse is not observed, the A8U10 multiplexer is defective. • If the front panel displays indicate the front panel setup but the 67XXA will not respond to the keypad input, there is a problem in either the Front Panel assemblies or the A8 Serial I/O receiving system.To check this, monitor A28J1-7 with an oscilloscope. Each time a key is pressed, this line, **KEYPAD INT**, should go to a TTL high. If this does not happen, refer to section 6D, Front Panel Troubleshooting. • If the front panel is sending the interrupt, monitor XA8-26. When you press a front panel key you should see a 32-cycle clock stream at this point. • If this signal is not present, refer to section 6D, Front Panel Troubleshooting. • If this signal is present, monitor XA28-28 with an oscilloscope. When you press a front panel key, you should see a serial data stream. This indicates that the front panel is sending the data. If there is a data stream, A8U10 or A8U2 is defective. If there is no data stream, refer to section 6D, Front Panel Troubleshooting.

Table 6E-2. Digital Control Troubleshooting (4 of 7)

Trouble / Error Code	Troubleshooting Procedure
	A23 Microprocessor PCB Troubleshooting
E23-10	This error code indicates that A23U25 has failed a read/write test. If the data here is corrupted, it can lead to very erratic front panel displays and instrument operation. This is because the front panel setups are stored here when the instrument is turned off. • Replace A23U25 and perform the following procedure. With the 67XXA in STANDBY, press and hold the RF ON/RF OFF key. Press the STANDBY/ON key to turn the instrument on. After the displays blank and the self test has started, release the RF ON/RF OFF key. This procedure overwrites all information stored in the non-volatile RAM, including the 9 stored front panel setups with their default values. (The RESET key overwrites only the front panel setup that you had at instrument turn on.)
E23-11	This error code indicates that A23U26 has failed the read/write test. • Replace A23U26. However, since false information in the volatile RAM can lead to unpredicable operation, the following procedure eliminates the possibility of corrupted data in non-volatile RAM caused by a defective A23U26. With the 67XXA in STANDBY, press and hold the RF ON/RF OFF key. Press the STANDBY/ON key to turn the instrument on. After the displays blank and the self test routine has started, release the RF ON/RF OFF key.
E23-12	This error code indicates A23U29 has failed the read/write test. • Replace A23U29. Since false information in the volatile ram can lead to unpredicable operation, the following procedure eliminates the possibility of corrupted data in non-volatile ram caused by a defective A23U29. With the 67XXA in STANDBY, press and hold RF ON/RF OFF key. Press the STANDBY/ON key to turn the instrument on. After the displays blank and the self test routine has started, release the RF ON/RF OFF key.
E23-14	This error code indicates A23U24 Personality PROM data is corrupted, which can lead to very erratic instrument operation. • Replace A23U24 with an EPROM having the same options and version number as the defective unit. Perform the following procedure to eliminate the possibility of corrupted data in non-volatile ram caused by a defective A23U24. With the 67XXA in STANDBY, press and hold the RF ON/RF OFF key. Press the STANDBY/ON key to turn the instrument on. After the displays blank and the self test routine has started, release the RF ON/RF OFF key.

Table 6E-2. Digital Control Troubleshooting (5 of 7)

<table>
<tr><th>Trouble / Error Code</th><th>Troubleshooting Procedure</th></tr>
<tr><td></td><td>A23 Microprocessor PCB Troubleshooting (Continued)</td></tr>
<tr><td>E23-14
(Continued)</td><td>If A23U24 is not available with the same version number as the old EPROM, or if the firmware is to be updated with a new version, A23U24, A23U22, and A23U23 must be replaced as a set. After replacing these EPROMs, perform the following procedure.
• With the 67XXA in STANDBY, press and hold the RF ON/RF OFF key. Press the STANDBY/ON key to turn the instrument on. After the displays blank and the self test routine has started, release the RF ON/RF OFF key.
• On the A23 PCB, move the CAL/NORMAL jumper from the NORM to the CAL position (do not turn the unit off).
• Press SHIFT, TRIGGER, 097. This performs a check-sum and stores the results in non-volatile RAM.
• Move the CAL/NORMAL jumper from the CAL position to the NORM position.
• Press SELF TEST. If the self test routine results display error codes, refer to the appropriate error code action (see section 6C Error Code Summary table).</td></tr>
<tr><td>E23-15</td><td>This error code indicates the the A23U22 EEPROM data is corrupted. This can lead to very erratic instrument operation.
• Replace A23U22 with an EPROM having the same options and version number as the defective unit. Perform the following procedure to eliminate the possibility of corrupted data in non-volatile RAM caused by a defective A23U22.
With the 67XXA in STANDBY, press and hold the RF ON/RF OFF key. Press the STANDBY/ON key to turn instrument on. After the displays blank and the self test has started, release the RF ON/RF OFF key.
If A23U22 is not available with the same version number as the old EPROM, or if the firmware is to be updated with a new version, A23U24, A23U22, and A23U23 must be replaced as a set. After replacing these EPROMs, perform the following procedure.
• With the 67XXA in STANDBY, press and hold the RF ON/RF OFF key. Press the STANDBY/ON key to turn the instrument on. After the displays blank and the self test routine has started, release the RF ON/RF OFF key.
• On the A23 PCB, move the CAL/NORMAL jumper from the NORM to the CAL position (do not turn the unit off).
• Press SHIFT, TRIGGER, 097. This performs a check-sum and stores the results in non-volatile RAM.
• Move the CAL/NORMAL jumper from the CAL position to the NORM position.
• Press SELF TEST. If the self test routine results display error codes, refer to the appropriate error code action (see section 6C Error Code Summary table).</td></tr>
</table>

Table 6E-2. Digital Control Troubleshooting (6 of 7)

Trouble / Error Code	Troubleshooting Procedure
	A23 Microprocessor Troubleshooting PCB (Continued)
E23-16	This error code indicates that A23U23 EEPROM data is corrupted. This can lead to very erratic instrument operation. • Replace A23U23 with an EPROM having the same options and version number as the defective unit. Perform the following procedure to eliminate the possibility of corrupted data in non-volatile RAM caused by a defective A23U23. With the 67XXA in STANDBY, press and hold the RF ON/RF OFF key. Press the STANDBY/ON key to turn the instrument on. After the displays blank and the self test routine has started, release the RF ON/RF OFF key. If A23U23 is not available with the same version number as the old EPROM, or if the firmware is to be updated with a new version, A23U24, A23U22, and A23U23 must be replaced as a set. After replacing these EPROMs, perform the following procedure. • With the 67XXA in STANDBY, press and hold the RF ON/RF OFF key. Press the STANDBY/ON key to turn the instrument on. After the displays blank and the self test routine has started, release the RF ON/RF OFF key. • On the A23 PCB, move the CAL/NORMAL jumper from the NORM to the CAL position. • Press SHIFT, TRIGGER, 097. This performs a check-sum and stores the results in non-volatile RAM. • Move the CAL/NORMAL jumper from the CAL position to the NORM position. • Press SELF TEST. If the self test routine results display error codes, refer to the appropriate error code action (see section 6C Error Code Summary table).
E23-17, E23-18, or E23-19	This error code indicates that an EPROM checksum error has occurred. Follow the E23-15 procedure.
E23-20	This error code indicates that the non-volatile RAM A23U25 is not holding the stored data when the instrument is turned off. However, it may still pass the E23-10 error code test. • With the 67XXA in STANDBY, press and hold RF ON/RF OFF key. Press the STANDBY/ON key to turn the instrument on. After the displays blank and the self test routine has started, release the RF ON/RF OFF key. • Press SELF TEST. • If E23-20 error code still remains, see the E23-10 error code procedure. • If the E23-20 error code is not displayed, set the unit to STANDBY and wait for a few minutes, then turn the unit back on. If the E23-20 error code returns during the self test, see the E23-10 error code procedure. • If the E23-20 error code is not displayed, the unit has returned to normal operation.
E23-21	This error code indicates that an I/O error has occurred. Check the I/O hardware circuits.

Table 6E-2. Digital Control Troubleshooting (7 of 7)

<table>
<tr><th>Trouble / Error Code</th><th>Troubleshooting Procedure</th></tr>
<tr><td></td><td>A23 Microprocessor PCB Troubleshooting (Continued)</td></tr>
<tr><td>E23-22</td><td>This error code indicates that the A23 PCB is inoperative and will not initialize or perform the self test routine.
• Monitor A23TP4 with an oscilloscope. You should see TTL signals at approximately a 5 MHz rate. This indicates that the microprocessor is operating.
• If the signal at A23TP4 is not as it should be, check A23U1-11 for a TTL high. If this signal is 0V, the A23U32 circuit is defective.
• If the signal at A23U1-11 is a TTL high, A23U1 is most likely defective.
• If the microprocessor appears to be operating, replace A23U22, A23U23, and A23U24 and perform the procedures under E23-14 error code troubleshooting.
If the above procedures does not restore the A23 PCB to normal operation, perform the following procedure.
• Remove the J1 jumper and set the A23 SERV\NORM (at U9) switch to SERV. This puts the microprocessor in a loop so that it toggles all data and address lines.
• Check each of the data latches for a bit that is not toggling. Such a bit indicates a defective latch.
• Replace the defective latch and perform the E23-14 troubleshooting procedure.
NOTE
Return the SERV/NORM switch to NORM after completing the troubleshooting procedures.</td></tr>
<tr><td></td><td>A24 GPIB PCB Troubleshooting</td></tr>
<tr><td>E24-0</td><td>This error code indicates that the A24 PCB is not present or is not operational. If the A24 PCB is actually present, perform the following procedures.
• Replace the A24U10 EPROM.
• If the A24 PCB does not resume normal operation after replacing A24U10, set the A24 SERV/NORM switch to SERV and remove the A24J1 jumper. Check each address and data line to ensure that each is toggling.
• If none of the data and address lines are active, replace A24U1.
• If the data and address lines are active, check each data latch for a bit that is not active and replace the defective data latch. (See the E23-14 procedure for a test to determine whether a bit is active.)
NOTE
Return the SERV/NORM switch to NORM after completing the troubleshooting procedures.

One of the GPIB indicator LEDs on the front panel is illuminated at all times even when the GPIB interface is not connected to a controller or when the 67XXA hangs up the GPIB bus.
• Check each of the GPIB interface ICs, A23U5 and A23U6, for an inactive bit and replace either defective IC.</td></tr>
</table>

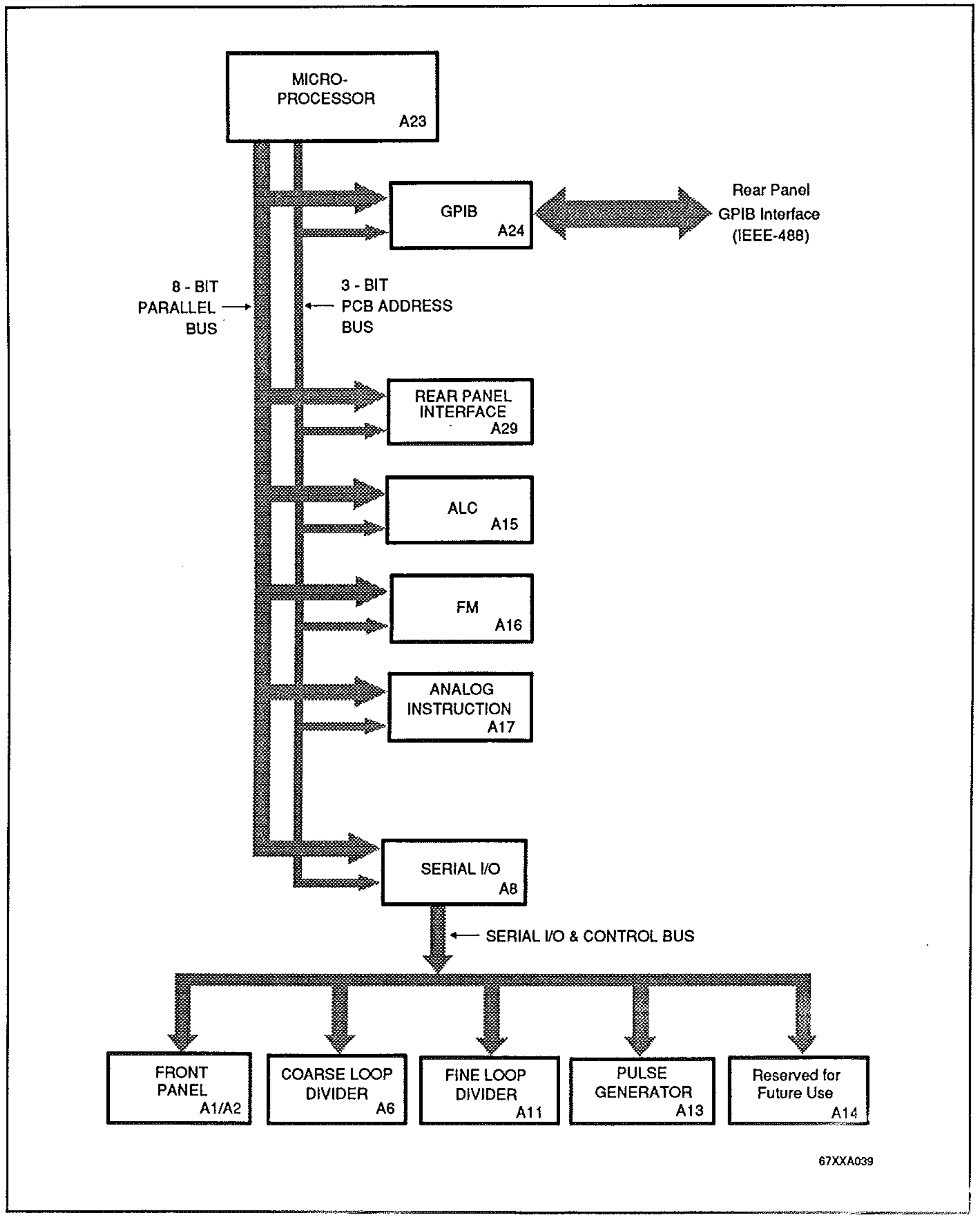


Figure 6E-2. Digital Control Assemblies Overall Block Diagram

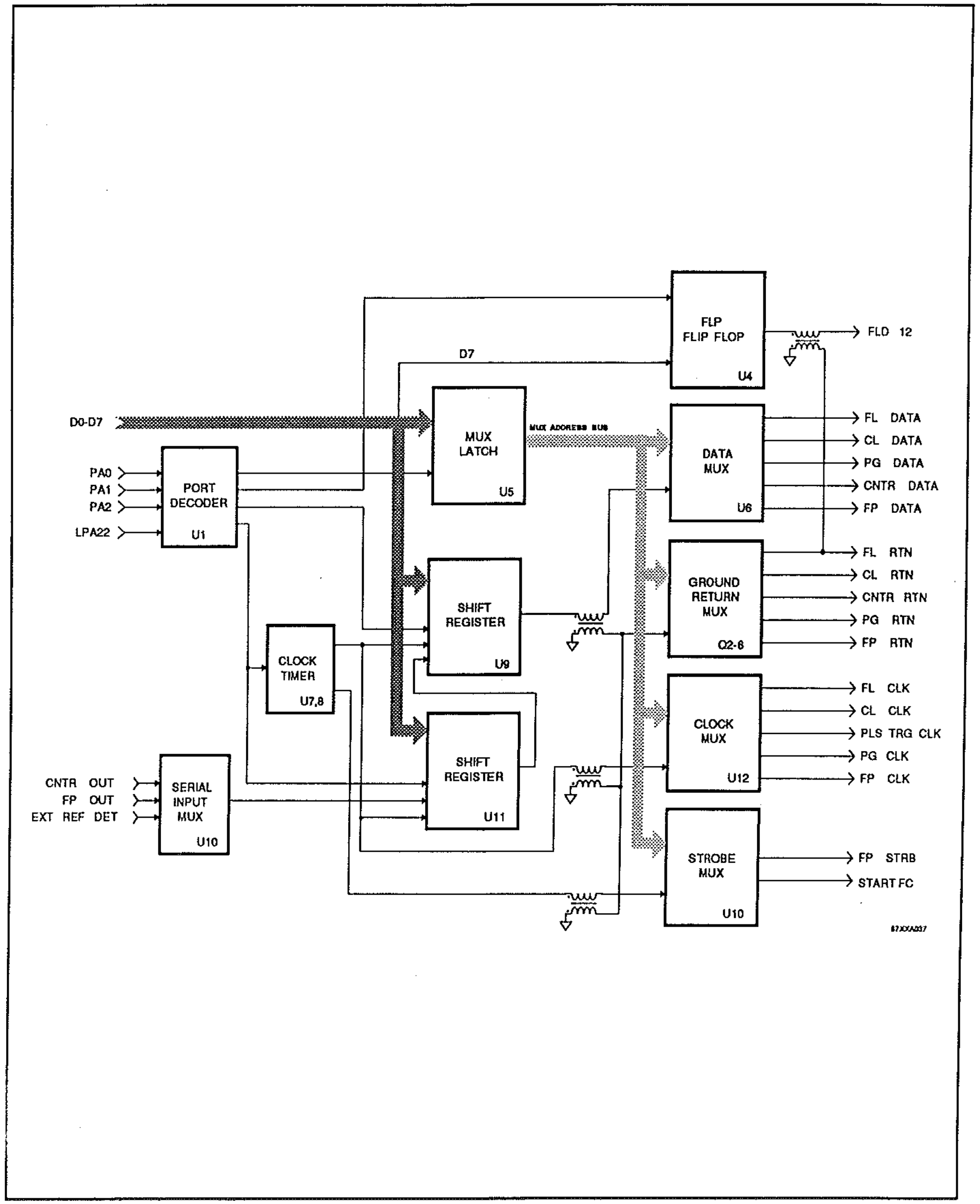


Figure 6E-3. A8 Serial I/O PCB Block Diagram

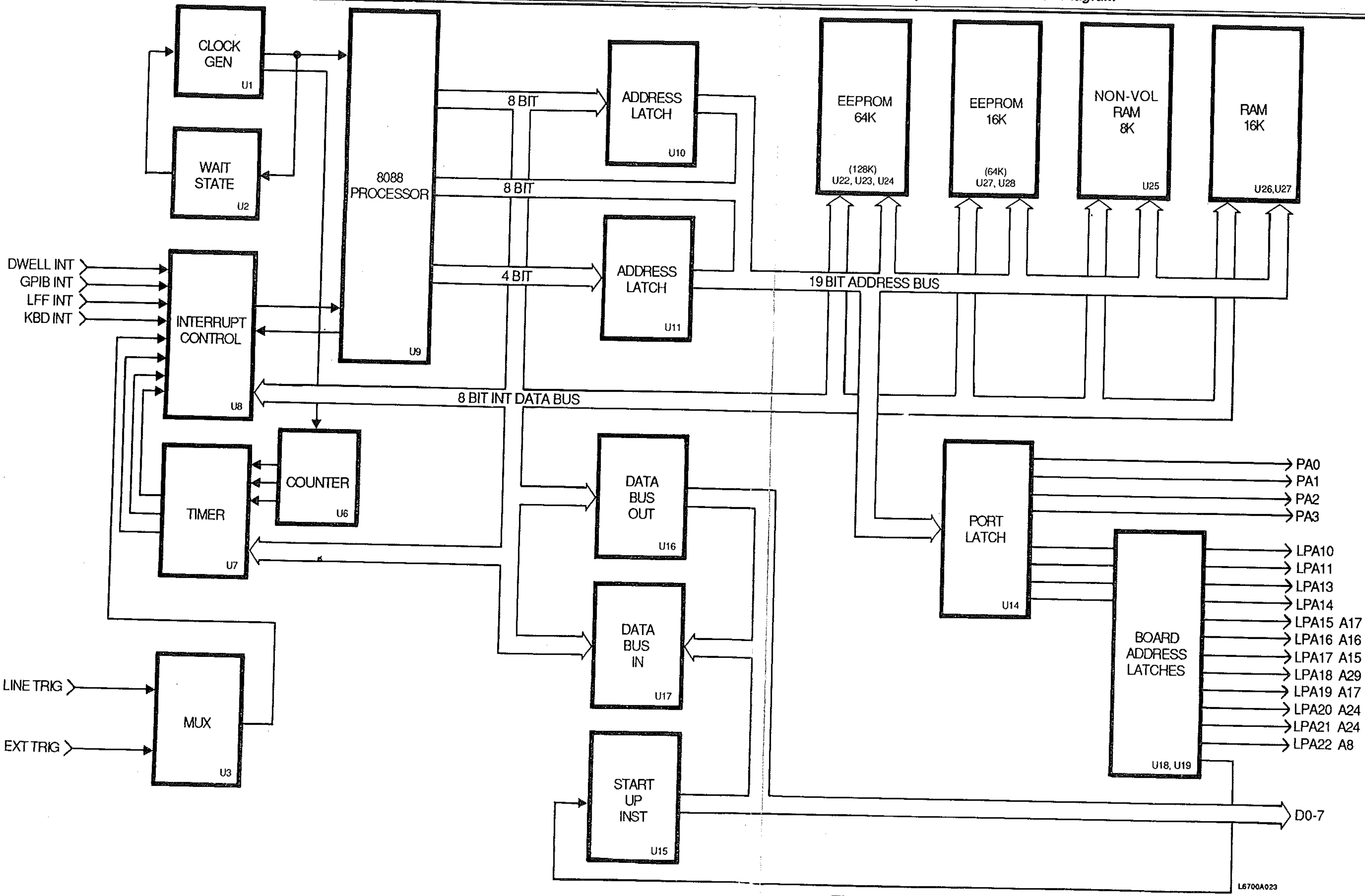


Figure 6E-4. A23 Microprocessor PCB Block Diagram

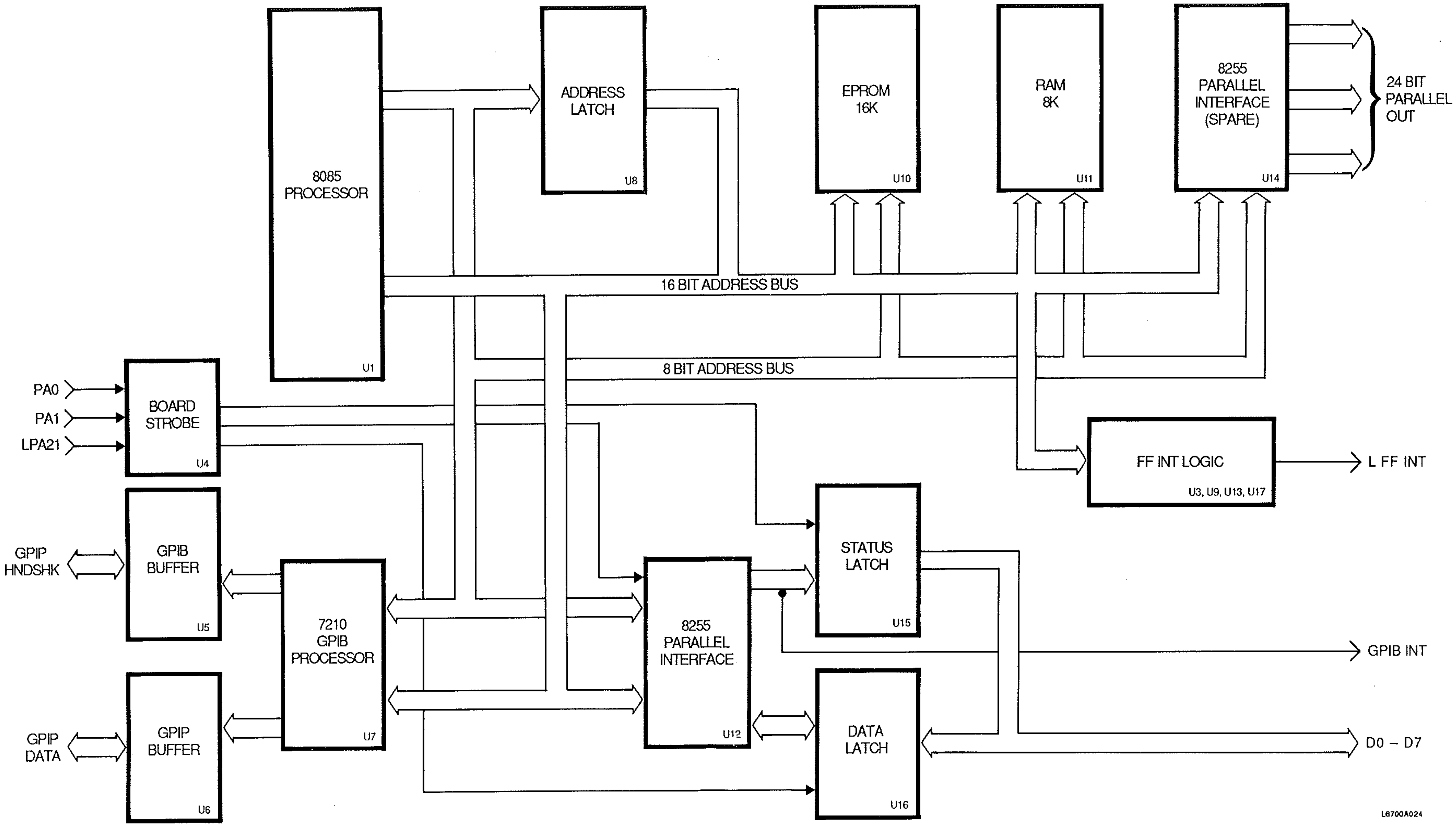
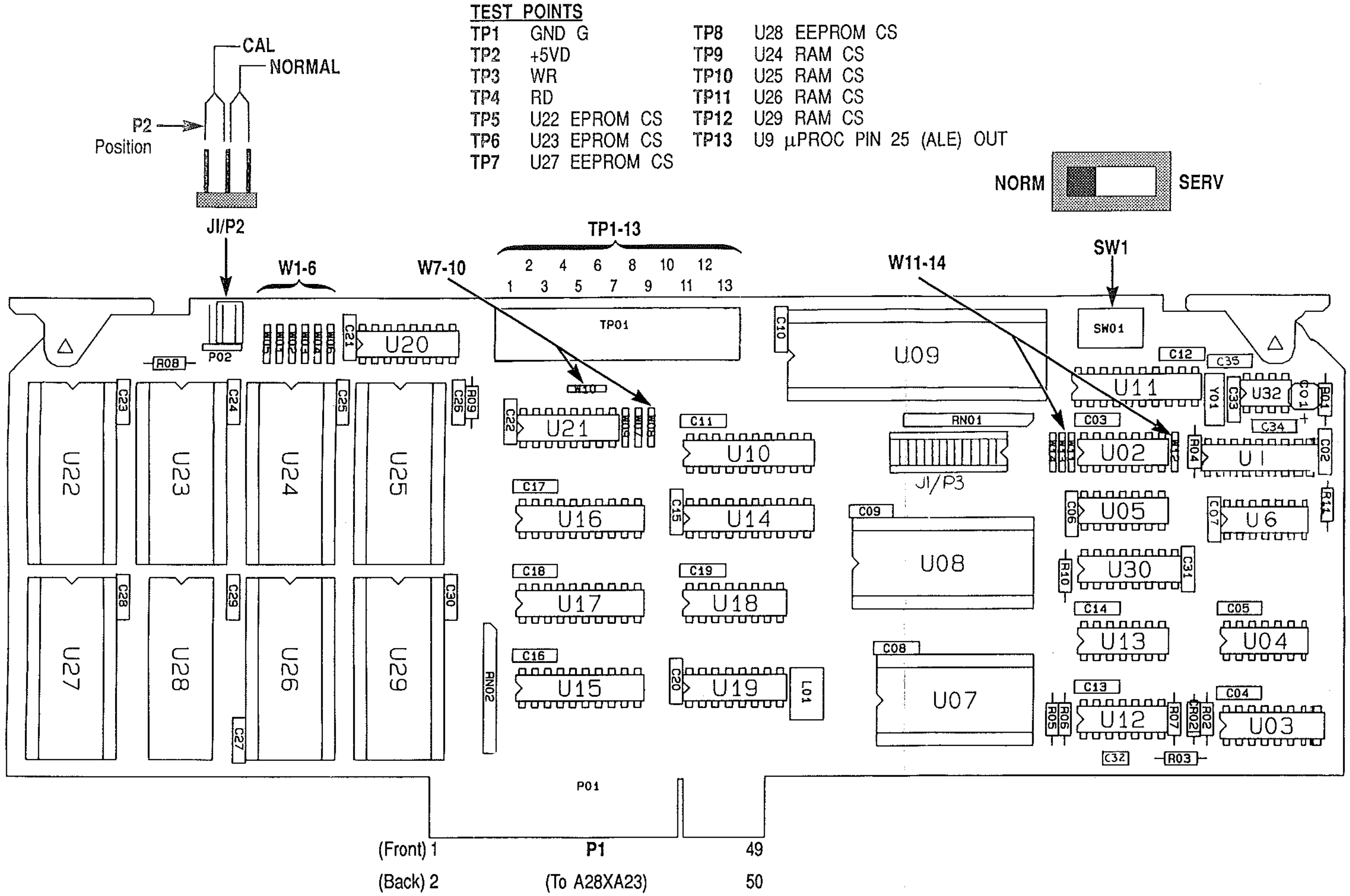
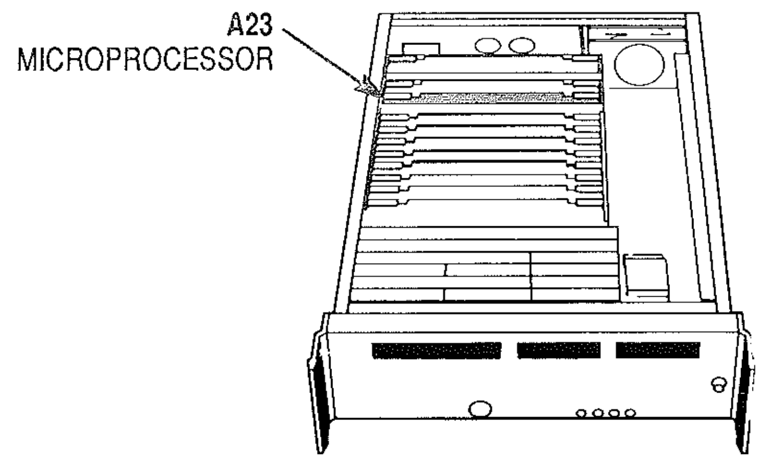


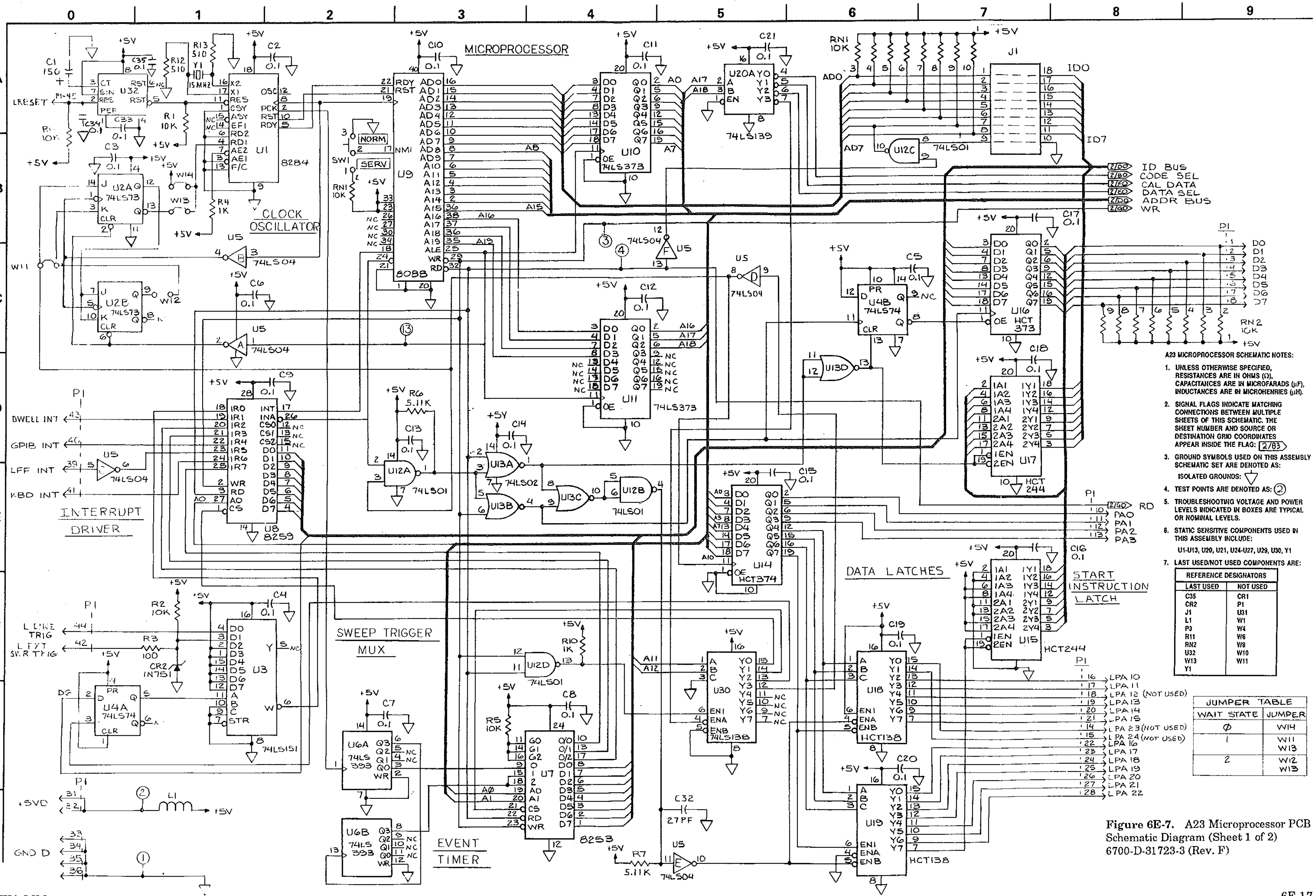
Figure 6E-5. A24 GPIB PCB Block Diagram





NOTE:
Leading zeros on component number references may be disregarded.

Figure 6E-6. A23 Microprocessor PCB Parts Locater Diagram
6700-D-31723-3 (Rev. F)



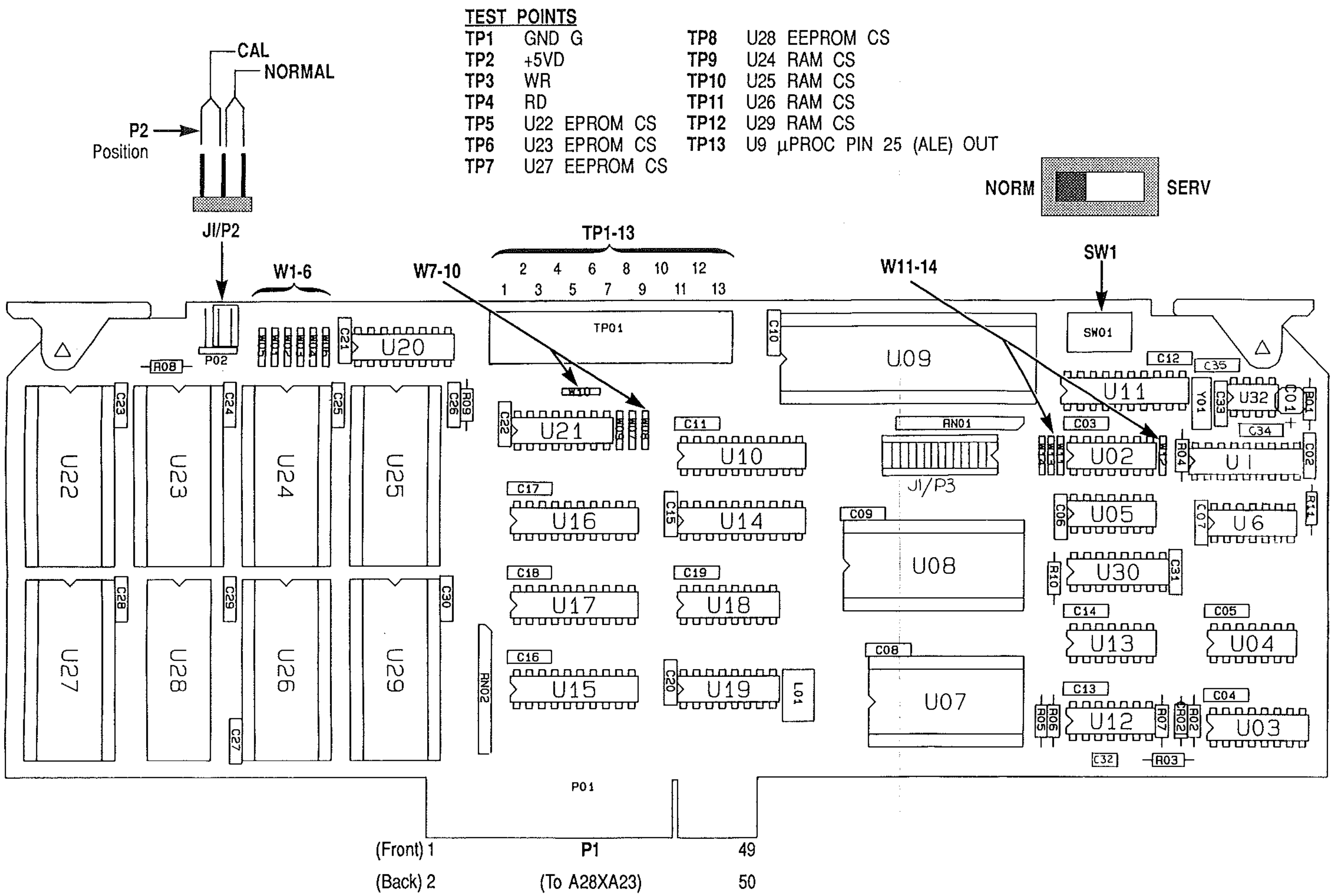
A23 MICROPROCESSOR SCHEMATIC NOTES:

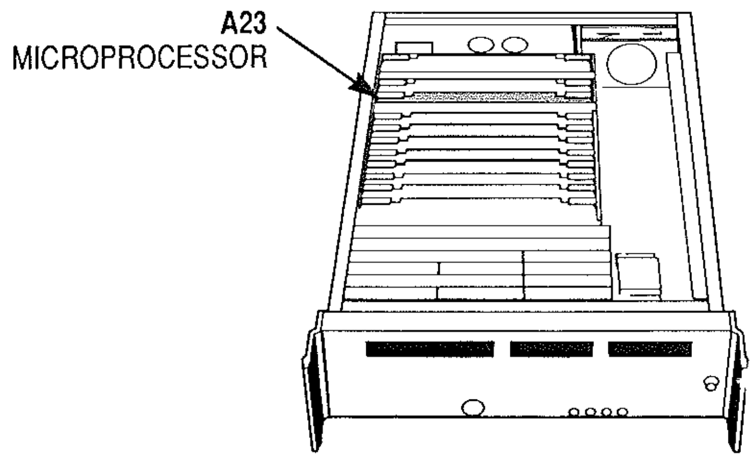
1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   ISOLATED GROUNDS: ▽
4. TEST POINTS ARE DENOTED AS: (2)
5. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
6. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   U1-U13, U20, U21, U24-U27, U29, U30, Y1
7. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C35	CR1
CR2	P1
J1	U31
L1	W1
P3	W4
R11	W6
RN2	W8
U32	W10
W13	W11
Y1	

JUMPER TABLE	
WAIT STATE	JUMPER
Ø	W14
1	W11 W13
2	W12 W13

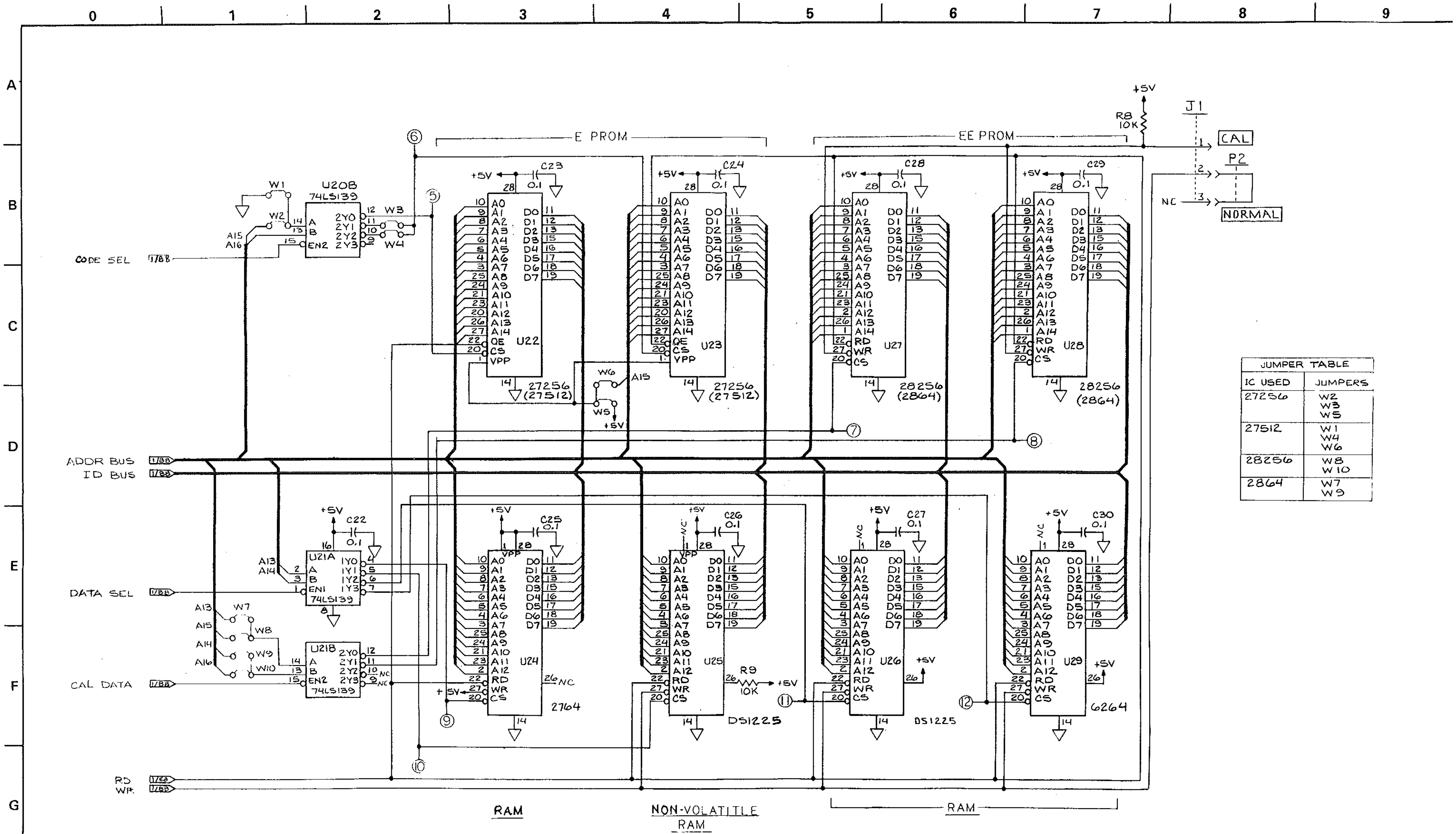
Figure 6E-7. A23 Microprocessor PCB Schematic Diagram (Sheet 1 of 2)
6700-D-31723-3 (Rev. F)





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6E-6. A23 Microprocessor PCB Parts Locater Diagram
6700-D-31723-3 (Rev. F)



JUMPER TABLE

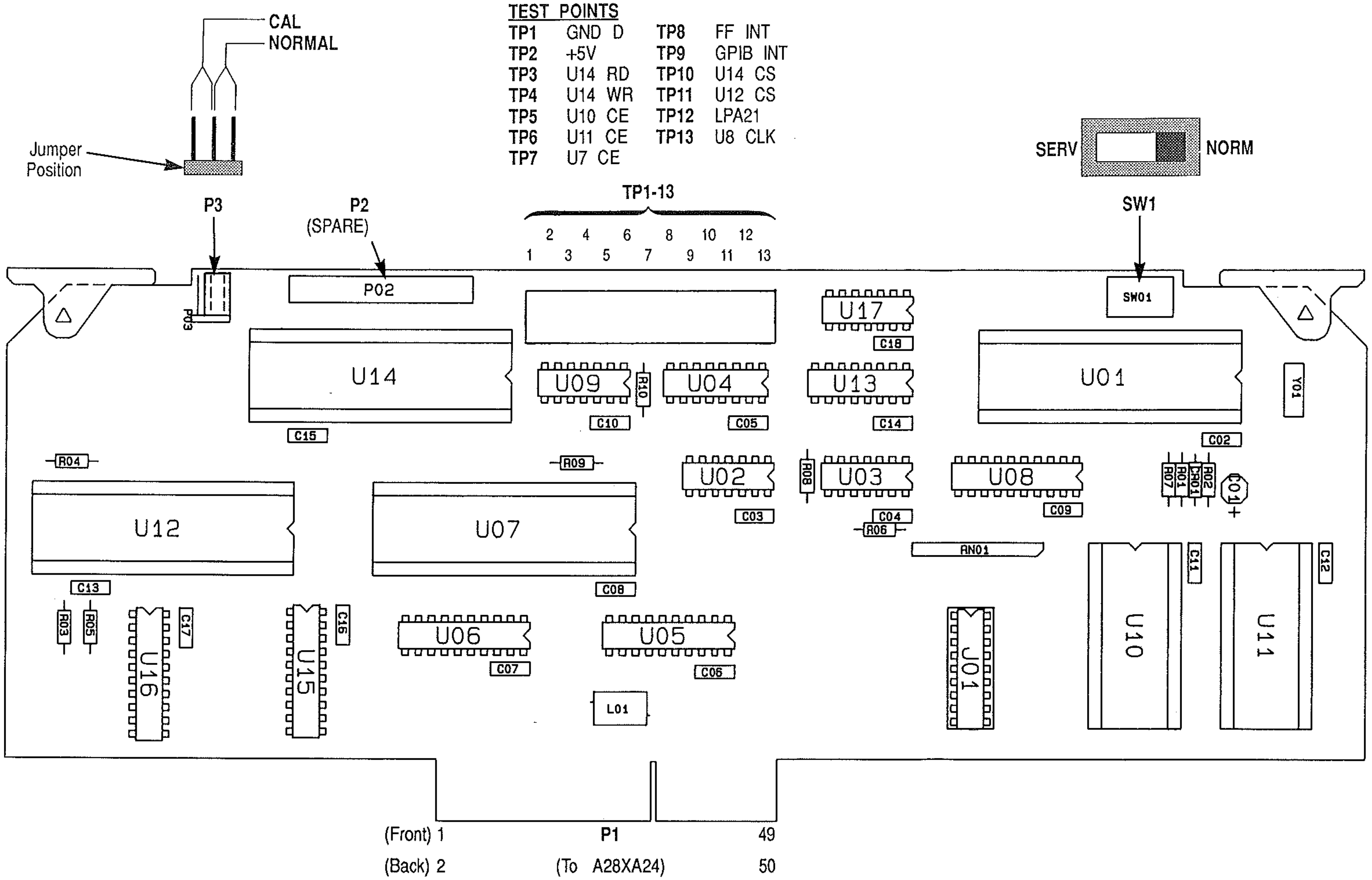
IC USED	JUMPERS
27256	W2 W3 W5
27512	W1 W4 W6
28256	W8 W10
2864	W7 W9

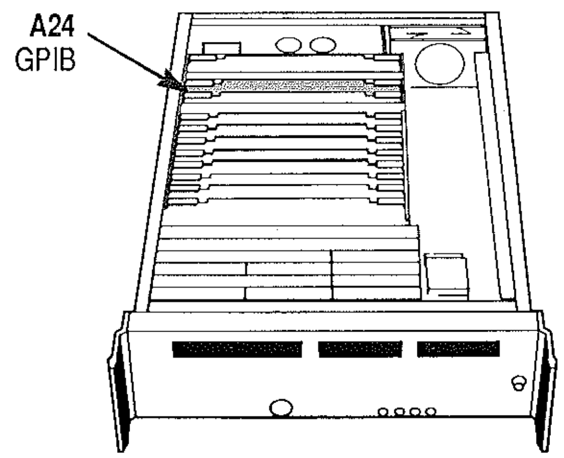
A23 MICROPROCESSOR SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS: ISOLATED GROUNDS: ▽
4. TEST POINTS ARE DENOTED AS: (2)
5. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
6. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE: U1-U13, U20, U21, U24-U27, U29, U30, Y1
7. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C35	CR1
CR2	P1
J1	U31
L1	W1
P3	W4
R11	W6
RN2	W8
U32	W10
W13	W11
Y1	

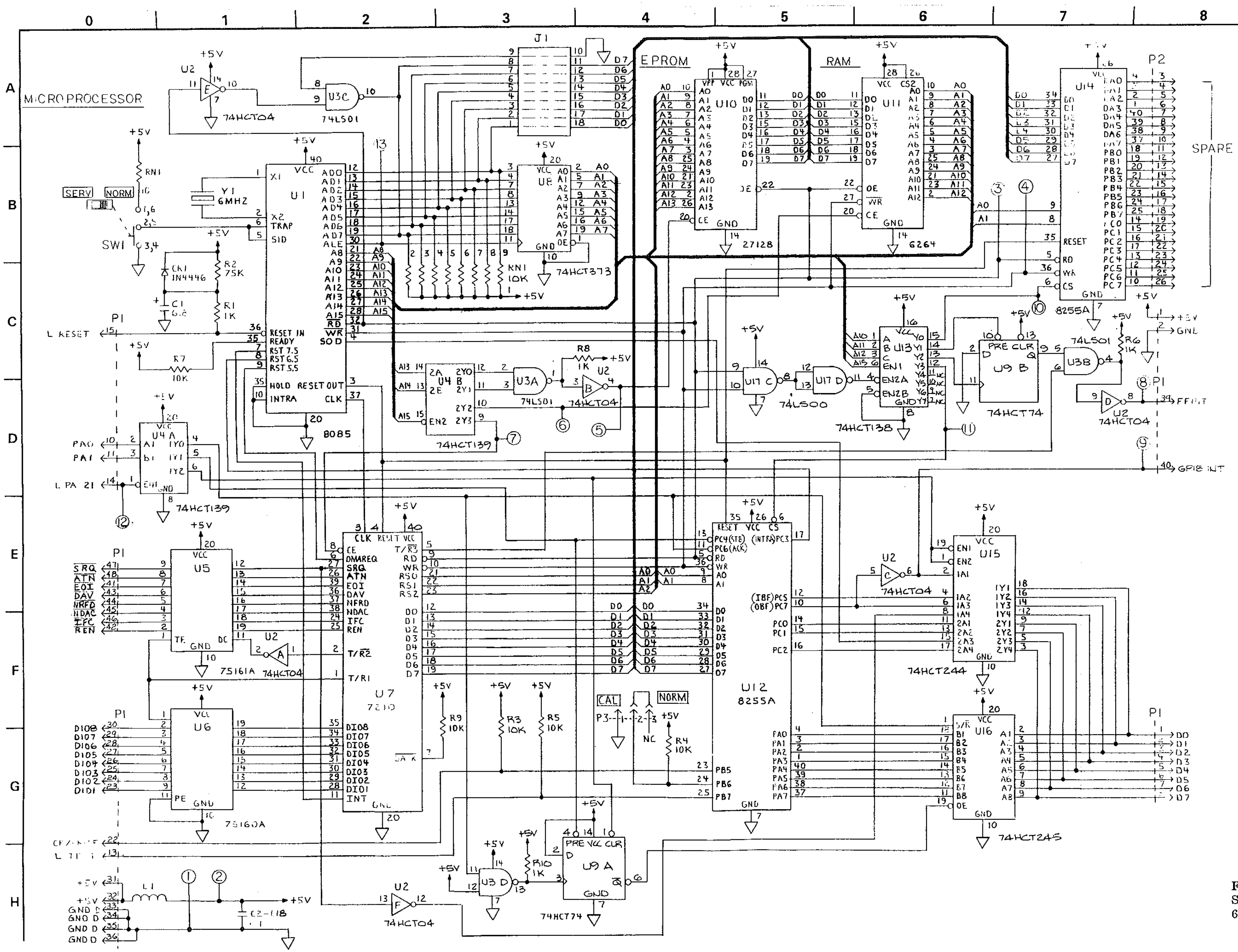
Figure 6E-7. A23 Microprocessor PCB Schematic Diagram (Sheet 2 of 2) 6700-D-31723-3 (Rev. F)





NOTE:
Leading zeros on component number references may be disregarded.

Figure 6E-8. A24 GPIB PCB Parts Locater Diagram
6700-D-31724-3 (Rev. B)



A24 GPIB SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   ISOLATED GROUNDS: ▽
3. TEST POINTS ARE DENOTED AS: (2)
4. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
5. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   U1, U3, U5-U7, U10-U12, U17, Y1
6. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C18	NONE
CR1	
J1	
L1	
P3	
R10	
RN1	
SW1	
TP13	
U17	
Y1	

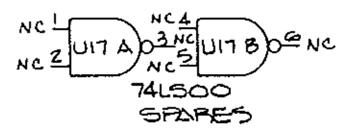
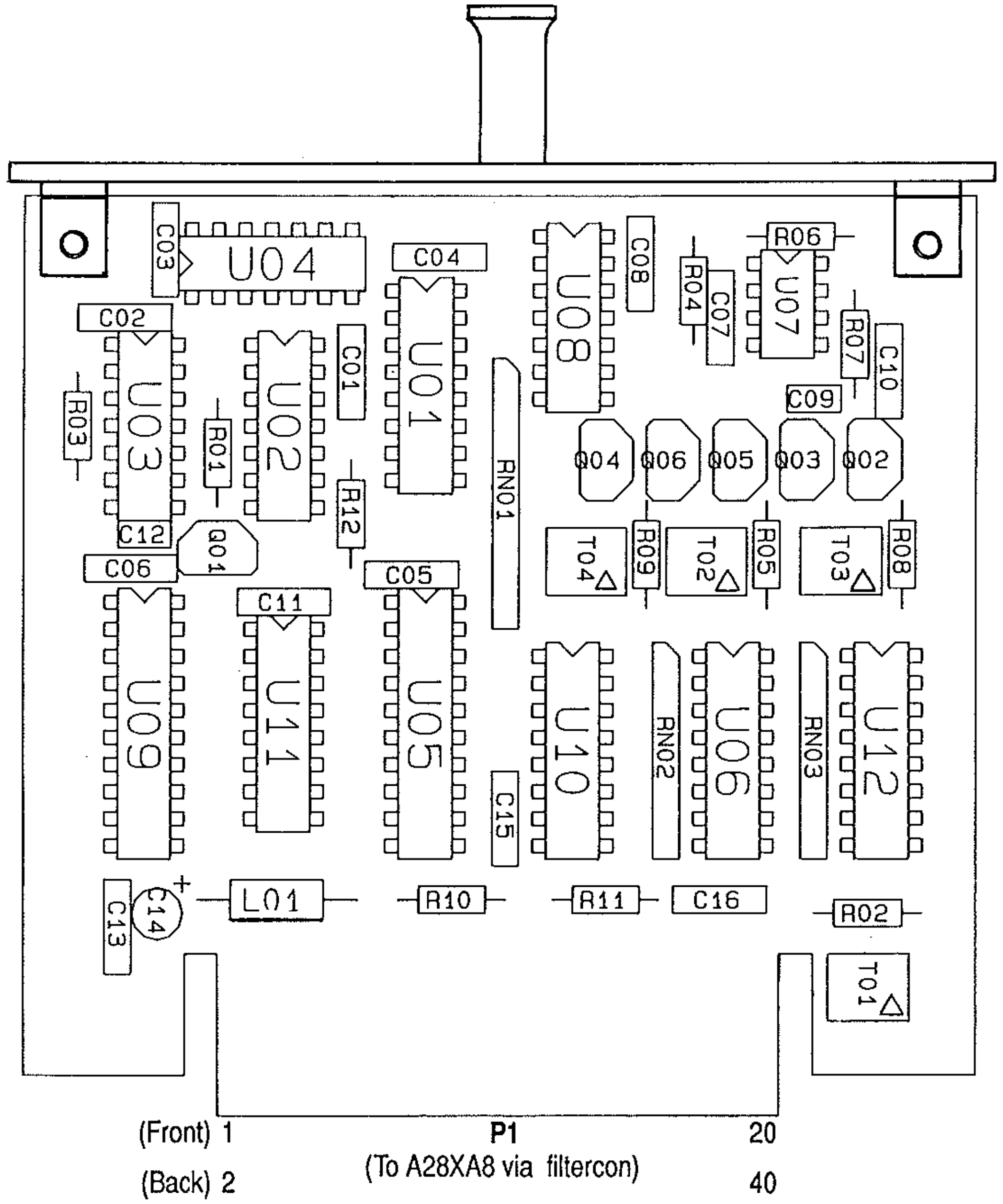
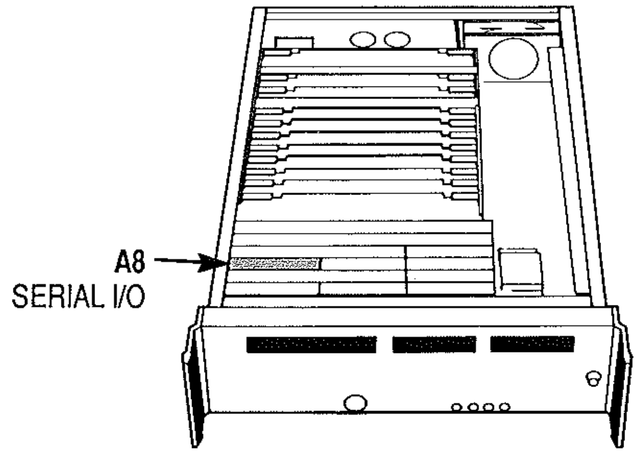


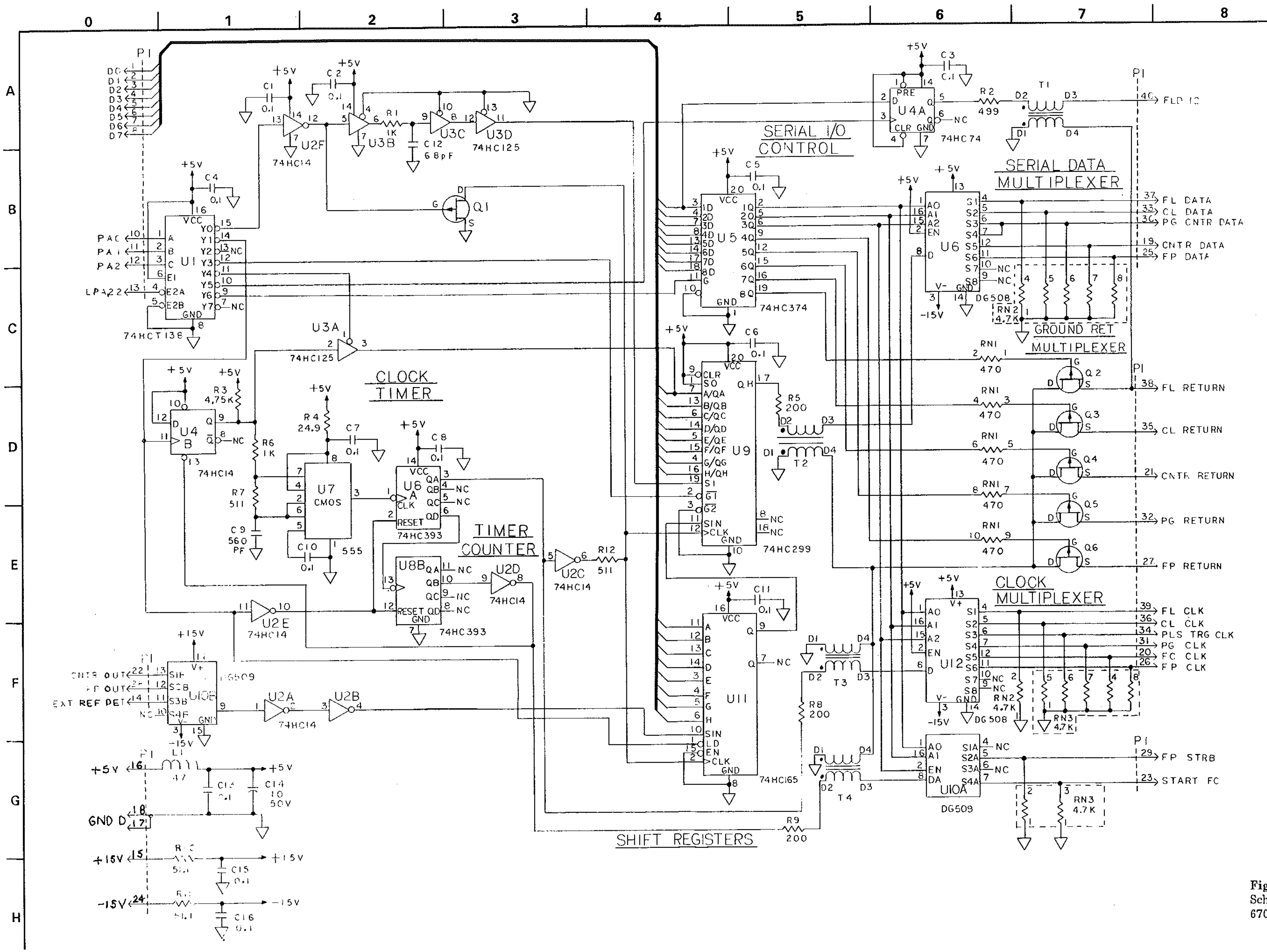
Figure 6E-9. A24 GPIB PCB Schematic Diagram (Sheet 1 of 1) 6700-D-31724-3 (Rev. B)





NOTE:
Leading zeros on component number references may be disregarded.

Figure 6E-10. A8 Serial I/O PCB Parts Locater Diagram
6700-D-31708-3 (Rev. C)



A8 SERIAL I/O SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. FILTERCONS ARE USED BETWEEN THIS PCB EDGE CONNECTOR AND THE A28 MOTHERBOARD CONNECTOR. EACH SIGNAL PATH CONNECTION HAS (TYPICALLY) 1500pF CAPACITANCE BETWEEN IT AND CHASSIS GROUND.
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:

   ISOLATED GROUND: ▽
4. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:

   Q1-Q6, U6, U7, U10, U12
5. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C16 L1 Q6 R12 RN3 T4 U12	NONE

Figure 6E-11. A8 Serial I/O PCB Schematic Diagram (Sheet 1 of 1)
6700-D-31708-3 (Rev. C)

6F – INPUTS/OUTPUTS A27 and P/O A29 PCBs

6F-1 INPUTS/OUTPUTS ASSEMBLIES: A27 and A29 PCBs

This section contains service information for the PCB assemblies listed in Table 6F-1 below. Refer also to the general reference information in sections 6A, 6B, and 6C.

Table 6F-1. Inputs/Outputs Service Information

Documentation	Reference	Page
OVERALL ASSEMBLY LEVEL		
Overall Description	Para. 6F-2	6F-1
Block Diagram	Fig. 6F-1	6F-1
Troubleshooting	Tbl. 6F-1	6F-6
PCB LEVEL		
A27 Auxiliary I/O PCB		
General Circuit Description	Para. 6F-3	6F-2
Detailed Circuit Description	Para. 6F-5	6F-3
Troubleshooting	Tbl. 6F-2	6F-7
Schematic (Sheet 1 of 1)	Fig. 6F-4	6F-13
Parts Locater Diagram	Fig. 6F-3	6F-12
A29 Rear Panel Interface		
General Circuit Description	Para. 6F-4	6F-2
Detailed Circuit Description	Para. 6F-6	6F-3
Block Diagram	Fig. 6F-2	6F-11
Troubleshooting	Tbl. 6F-2	6F-7
Schematic (Sheet 1 of 5)	Fig. 6F-5	6F-15
Schematic (Sheet 2 of 5)	"	6F-17
Schematic (Sheet 3 of 5)	"	6F-19
Schematic (Sheet 4 of 5)	"	6F-21
Schematic (Sheet 5 of 5)	"	6F-23
Parts Locater Diagram	Fig. 6F-5	6F-14,16, 18,20,22

6F-2 INPUTS/OUTPUTS ASSEMBLIES, OVERALL DESCRIPTION

This section covers the PCB assemblies that handle the rear panel BNC connector signal inputs. Generally, these are signals that interface the 67XXA with other instruments, such as a network analyzer. As shown in the block diagram in Figure 6F-1, these circuits reside completely on the A29 Rear Panel Interface PCB and on the A27 Auxiliary I/O PCB. All interface signals are entirely under microprocessor contol.

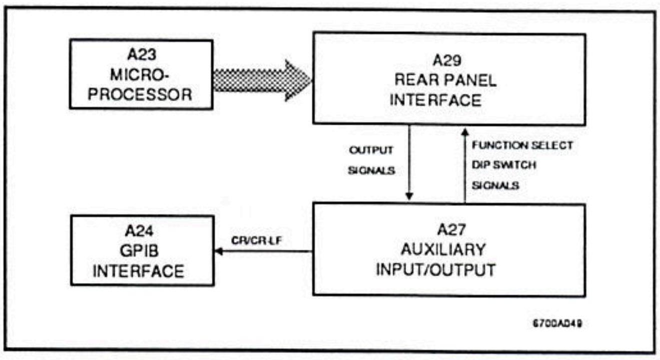


Figure 6F-1. Inputs/Outputs Block Diagram

The A27 Aux I/O PCB's primary purpose is to route all interface signals to the appropriate 67XXA rear panel connector. Additionally, two relays on the A27 PCB control penlift drive and determine retrace and blanking signal polarity. (The A27 PCB has no interaction with, or control of, signal inputs from the *front panel.*)

The A29 Rear Panel Interface has several primary functions:

- Using a 0-10V analog ramp and a +10V reference from the A17 Analog Instruction PCB, and digital information from the A23 Microprocessor PCB, the A29 PCB DAC circuits construct HORIZ OUTPUT, V/GHz, and ALC SLOPE signals.
- Instrument interface signals such as retrace and band switch blanking, penlift control, lock output, sequential sync, and markers are latched on the A29 PCB.
- Microwave deck control circuits reside on the A29 PCB for: attenuator control, sampler switch drive, RF output band switch drive, switched filter drive, down converter selection, and modulator drive.

6F-3 A27 AUXILIARY I/O PCB, GENERAL DESCRIPTION

Refer to the schematic in Figure 6F-4 for the following circuit discussion.

The A27 Aux I/O PCB interfaces the signals from the A29 Rear Panel Interface PCB to the rear panel connectors. J1 is a 25-pin D-type connector that connects to the WILTRON 560A or 561 Scalar Network Analyzer. Many of its signals parallel the signals on the rear panel BNC connectors. J2 is a 14-pin DIL connector that interfaces to a ribbon cable. The wires of this ribbon cable are then connected to the BNC connectors on the rear panel.

The S1 DIP switch provides for selecting default operational parameters. The A23 Microprocessor PCB (main microprocessor) reads the switch positions of all but one of the S1 switches from a latch on the A29 Rear Panel Interface PCB. The switch position of the remaining switch, CR/CR-LF, is read by the microprocessor on the A24 GPIB PCB.

Relay K1 routes either the positive or the negative blanking signals to the connectors depending on the position of the BLANK +/– SEL switch on S1.

Relay K2 is the penlift relay. It can be either normally closed or normally open during sweep. Its condition is set by the PEN LIFT +/– SEL switch on S1.

6F-4 A29 REAR PANEL INTERFACE PCB, GENERAL DESCRIPTION

Refer to the A29 block diagram in Figure 6F-2 for the following description.

The U3 Switch Position Latch senses the settings of the S1 DIP Switch located on the A27 Aux I/O board. This latch is read every 50 ms by the A23 Microprocessor during housekeeping routines. The U1 Mem Seq Latch interfaces sweep dwell, memory sequence, and the RF unleveled LED signal to the A23 Microprocessor PCB. The status of these signals is monitored during housekeeping and is summed with the operational routines in the microprocessor. The U8 DAC LSB Latch and U9 DAC MSB Latch respectively buffer the 4-Bit DAC LSB Bus and the 8-Bit DAC MSB Bus to the DACs that determine the V/GHz and horizontal outputs.

During analog sweep, the ramp coming from the A17 Analog Instruction PCB goes to U11 through the U12 analog switch. From U11, the signal goes to the A27 PCB (via the A28 Motherboard PCB) then to the rear panel HORIZ OUTPUT connector. During CW or stepped sweep operation, a dc voltage from the stepped sweep DAC goes through the U12 analog switch to U11.

The U13 V/GHz Width DAC and the U15 Offset DAC circuits provide the 0.5V/GHz and 1V/GHz necessary for interfacing to some network analyzers. During analog sweep, the ramp from the A17 Analog Instruction PCB goes to the U13 V/GHz Width DAC. This DAC attenuates the ramp according to the sweep width and applies the attenuated ramp to summing amplifier U14. Here, the ramp sums with the dc voltage from the U15 V/GHz Offset DAC. The voltage from U15 is set according to the center frequency of the sweep. U14 then amplifies the sum of these two voltages and applies them to the A27 PCB, via the A28 Motherboard PCB. In CW or stepped sweep, U13 is set for zero output; thus, only the voltage from U15 goes to the U14 amplifier.

The outputs from the U13 and U15 DACs also go to U16. An offset voltage (2 GHz SLOPE OFFSET) also goes to U16, via U12 analog switch. This voltage sets U16 so that a 0V output corresponds to 2V (1V/GHz) or 1V (0.5V/GHz) of the V/GHz output. This allows independent control of the slope for Band 0 and Bands 1–4. The output of U16 goes to the A15 ALC PCB where it is summed with the ALC reference voltage. This corrects for any any slope in the output power due to the optional step attenuator.

The U4 Blank and Seq Sync Latch provides the blanking, sequential sync, markers, and penlift controls to the A27 Aux I/O PCB. There, they are interfaced to the rear panel BNC connectors.

The ALC circuits are also resident on the A29 PCB; they are discussed in the A29 Detailed Circuit Description and in section 6M, ALC/Pulse Modulation.

6F-5 A27 AUXILIARY I/O PCB DETAILED CIRCUIT DESCRIPTION

The A27 PCB, shown in the Figure 6F-4 schematic, is an interface from the A28 Motherboard to the rear panel BNC connectors and the D-type AUX I/O connector. J1, the PCB-mounted AUX I/O connector, is intended to interface with either a Wiltron 560, 560A, or 561 Network Analyzer. There is also a DIP switch for setting the default parameters for several functions.

Q2 is controlled by a TTL signal from the A29 Rear Panel Interface PCB and drives K2 pen lift relay. Q1 is also controlled by the A29 PCB and drives K1 relay. K1 connects the RETRACE BLANK OUTPUT and BAND SWITCH BLANK on the rear panel to either the positive or negative signals from A29. The BLANKING +/– switch portion of S1 DIP switch determines the position of K1.

In the open position, the S1 switches cause a TTL high signal to be on its input pins. Closing any one of these switches grounds that signal. This TTL high or low is monitored by a data latch on the A29 Rear Panel Interface PCB. The A23 Microprocessor then sets the related function according to the position of this switch.

The switch functions are:

- **PEN LIFT +/–** causes the pen lift relay to be either open or closed during sweep.
- **BLANK +/–** selects either positive or negative retrace and bandswitch blanking via K1 relay.
- **PULSE +/–** selects whether a positive TTL level applied to the front or rear panel pulse inputs will turn RF power *on* or *off*.
- **V/GHZ** sets either 1V/GHz or 0.5V/GHz for the rear panel BNC connector output level.
- **AC/DC AM** selects either ac or dc coupling for the front and rear panel AM inputs.
- **RETRACE RF ON/OFF** selects either RF *on* during retrace or RF *off* during retrace (in analog and step sweep).
- **Δ FREQ RF ON/OFF** select either RF on or RF off when switching between frequencies in step sweep.
- **CR–CR/LF** selects either the CR and CR/LF characters for GPIB terminators. This signal comes from the A24 GPIB PCB.

6F-6 A29 REAR PANEL INTERFACE PCB DETAILED CIRCUIT DESCRIPTION

Refer to the five-sheet schematic set in Figure 6F-6 for the following discussions.

NOTE

Descriptions of the A29 PCB's ALC circutry is presented here to maintain continuity of the A29 service information and to reduce the bulk of foldouts in section 6M. Please note that the Inputs/Outputs circuitry and ALC circuitry is electrically separate; each uses separate power supply and ground references.

6F-6.1 Microprocessor Interface

As shown on schematic sheet 1, U1 latch monitors the state of **L MEM SEQ IN**, **L SWEEP DWELL IN**, and **L RF UNLVLD**. The A23 Microprocessor reads the state of these lines during housekeeping approximately every 50 ms. U2B and U2C are arranged as a flip-flop. When an unleveled condition occurs, U2C-8 goes high. When the microprocessor reads U1 and determines that an unleveled condition has occured, it sends the proper signals to U6 which resets U2B and U2C. (This procedure is used for the ALC's automatic EXT GAIN CAL, initiated from the 67XXA front panel.)

When the rear panel MEMORY SEQ INPUT is brought low, **L MEM SEQ IN** is sensed by U1. The A23 Microprocessor reads U1 and determines when this line has been brought low. It then begins the procedures to sequence the current front panel setup to the next setup that is stored in memory.

L SWEEP DWELL IN also comes from the rear panel to the A29 PCB (it also goes to the A17 Analog Instruction PCB). When the 67XXA is sweeping and this line is brought low, the sweep dwells (stops and waits). This dwell is also monitored by the A23 Microprocessor via latch U1.

Latch U3 monitors the state of the rear panel DIP switches. The A23 Microprocessor reads U3 during housekeeping and changes effected functions associated with the rear panel switch labels.

U6 and U7 are address decoders that are controlled directly by the A23 Microprocessor. The outputs are typically 800 ns wide pulses that load data latches or DACs. U6-9 strobe resets the U2B-U2C flip-flop.

U4 data latch provides the rear panel signals for blanking, marker, sequential sync, lock output, and penlift relay drive. U5A inverts the TTL output of U4 to provide for negative retrance blanking. U5B inverts the bandswitch blanking. The blanking polarity signal drives the blanking polarity relay on the A27 Aux I/O PCB to select either plus or minus retrace and band switch blanking. The state of this signal is determined by the A23 Microprocessor from either the switch position on the rear panel via U3 or the GPIB.

U5C supplies the sequential sync output to the rear panel. It is comprised of a plus TTL input from U4-19 during retrace and band switch blanking. The plus marker TTL signal from U4-15 is inverted by U5C. This causes the sequential sync to go to –5V for a marker. When a marker is selected from the front panel, such as F5, the signal at U5-16 also goes positive at the same time as the signal at U4-15. This signal is also inverted by U5C. It adds this to the marker from U4-19 which provides a –10 v enhanced marker output for the F5 marker. The other markers remain at –5V at the sequential sync output.

Shown on sheet 2 of the A29 PCB schematic set, U8 and U9 data latches provide for a buffered 12-bit data bus for the 12-bit DACs and an 8-bit data bus for other latches used on the A29 PCB. In addition, U8 provides **L ALT EN** and **L ALT 1** signals to the rear panel AUX I/O connector. These signals are required for operation with the 560A or 561 network analyzers in their alternate sweep mode of operation.

6F-6.2 12 Bit DACs

The data for digital-to-analog converters U10, U13, and U15 are first latched onto the internal data bus by U8 and U9 data latches. The data is then strobed into the internal latches in the DAC.

U10 and U11A provide the horizontal output to the rear panel in CW or step sweep mode of operation. In analog sweep, an analog ramp from the A17 Analog Instruction PCB goes to the rear panel. These two horizontal output signals are selected by U12A and U12D analog switches. They are then buffered by U11B.

U12 and U11D provide the V/GHz ramp signal in analog sweep and the slope control signal from the A15 ALC PCB. U16 and U16A provide the offset for the ramp signal from U11D in analog sweep and the dc V/GHz during CW or stepped sweep. This also combines with the ramp signal in U16B to provide the ALC slope signal for the A15 ALC PCB. U12C and U12B provide an offset to the slope signal for the A15 ALC PCB; it will be 0V at 2 GHz. U12B supplies the offset for 1V/GHz and U12C supplies the offset for 0.5V/GHz. The position of these switches is controlled by U8 via the A23 Microprocessor. There is a physical switch on the rear panel that is monitored via U3 by the microprocessor which then sets the position of these switches.

U14 amplifies the signals from the V/GHz slope and offset DACs for the normal 1V/GHz or 0.5V/GHz at the rear panel. U16B buffers these same signals for application to A15 ALC PCB.

Voltage regulator VR1 supplies –5V to U14 and to the PIN switch drivers.

6F-6.3 Step Attenuator and Relay Drivers

On sheet 3 of the A29 schematic set is U18, a data latch for controlling the state of the microwave deck step attenuator and relay drivers. U17 inverts one of the signals to each of the dual drivers. The U19-U23 drivers require one input to go low as the other goes high. They have open collector outputs to drive the relay coils and are protected by the diodes on each output.

The output of U19 drives transistor switches for an optional relay. It switches +22V to either side of a relay coil via Q1 and Q2.

U20-U23 drive the step attenuator coils. The common line to the step attenuator coils, **ATTEN SUPPLY**, is +22V via P2-23, 24. To switch a step attenuator section in, U20-3 goes open and U20-5 connects the other coil to ground. The inverse is true for removing a step attenuator section.

6F-6.4 PIN Switch Drivers

Shown on sheet 4 of the A29 PCB schematic set is U24, a data latch that controls the selection of the PIN switch drivers. These drivers supply the current for the 4-pole sampler multiplexing switch, the 4-pole main RF output multiplexing switch, and the switched filter, all of which are mounted on the microwave deck.

Each of the drivers is identical except for the resistors determining the current to the PIN switch, therefore, only one driver is discussed.

When U25A-1 is high, the switch driver is in the off mode. Under this condition, the contacts of U25A are open. U29A is saturated by the current through RN3 and supply approximately 4.3V across R49. The current through R49 determines the current to the 20-26.5 GHz port on the main output multiplexing switch and turns it off. The base of Q3 is then at the same potential as the emitter, turning it off.

When U25A-1 goes low, the contacts of U25A close. Q3 is turned on by the current through RN3 and supply current through R53 to the PIN switch, turning it on. The value of R53 determines the current through the PIN diodes in the switch. U29A no longer receives enough base drive, an it turns off.

6F-6.5 PIN Mode Shaper

Refer to sheet 5 of the A29 PCB schematic set. The ALC control signal from the A15 PCB goes to U36, a unity gain differential receiver. From U36, the signal goes to U37 which is configured as a log amplifier. U37 logs the voltage which results in the log of the level amplifier. The U40B transistor in the feedback path of U37 is configured as a diode and has a very high resistance at low input signal levels. As the input signal to U37 goes higher, the output supplies more current to the diode and its resistance decreases causing the gain of U37 to decrease. This change in the resistance of the diode is a logarithmic function so the output of U37 is the log of the input.

The output of U37 goes to U38 which has a gain of a little less than 1. In the 26.5-40 GHz band, U48C parallels R90 with R89. This helps compensate for the characteristics of the doubler/amplifier used in this band. The output of U38 goes to U45C, another transistor configured as a diode. In order for the current in U40C to keep from becoming too small at low signal levels, it must be biased by a small amount of current. This bias is provided by the voltage drop of U40D transistor, which is configured as a diode. The current for this voltage across U40D is provided by R94 from the precision +10V reference supply. CR44 connects the output of U39 back to the input of U38 during overdrive conditions to prevent the output of U38 from going up against the supply rails.

U40D has the same effect at low input signal levels as U40B, that is, its resistance increases. However, since U40D is now in the input of U39, its increase in resistance with lower input voltages results in a decrease in the gain of U39. This performs an antilog function of the voltage from U38, resulting in a nonlinear output voltage versus the ALC control input voltage at U36.

By feeding some of the input signal around U37 and U38 and summing it into U39, the nonlinear output of U39 approximately cancels the nonlinearity of the PIN diodes in the control modulators. This results in a linear change in RF voltage from the control modulator versus the linear input voltage from the ALC level amplifier on the A15 ALC PCB

U48D analog switch parallels R99 with R98 in the 26.5-40 GHz band to further compensate for the characteristics of the doubler/amplifier used in this band. It has the characteristic that each 1 dB change of input power produces a 2 dB change of the output power.

In the 6769A, the two spare sections of U48 are used to provide an adjustment for R99. This improves the loop bandwidth that changes from one band to the other due to the different characteristics of the control modulators.

From U39, the signal goes to U41 quad analog switch. These switches multiplex the signal to the 4 PIN current drivers. These switches are selected by data latch U47.

6F-6.6 PIN Current Drivers

There are 4 PIN current drivers, all identical. These drivers provide the current control for up to 4 control modulators (located on the microwave deck). Since the PIN current drivers are all identical, only one is discussed.

U42 and U46B are configured as constant current sources. Since U46B is an emitter follower, the output of U42 appears at the emitter of U46B, offset by approximately 0.6V. The feedback is provided by R125. Since R129 is a known resistance, a known voltage on the emitter of U46B provides a known current through R129. However, the control modulator diodes with their bias networks typically have approximately 1V across them in the forward biased condition. This voltage also changes with temperature and with individual diodes characteristics. To prevent these voltage changes from affecting the current, R118 feeds this voltage back to the non-inverting input of U42. This provides a constant current that is independent of the voltage at A29J1-2.

CR45 provides protection of U46B when a transient would cause U42 output to go negative. This would break the feedback loop and cause U42 to go against the supply rail. This would be beyond the reverse bias capabilities of U46B.

6F-7 INPUTS/OUTPUTS ASSEMBLIES, TROUBLESHOOTING

Troubleshooting procedures in Table 6F-2 cover the A27 Aux I/O PCB and the A29 Rear Panel Interface circuits covered in this section (additional ALC circuit troubleshooting can be found in section 6M).

6F-8 INPUTS/OUTPUTS ASSEMBLIES, SERVICE SHEETS

Table 6F-1 on the first page of this section presents the arrangements of the block diagrams, schematics, and parts locater diagrams for the A27 and A29 PCBs.

Table 6F-2. Inputs/Outputs Troubleshooting (1 of 4)

Trouble / Error Code	Troubleshooting Procedure
	Problems in the Inputs/Outputs Assemblies can be localized to the A27 Aux I/O, A29 Rear Panel Interface, or their associated interconnections. Most of the input/output signals are either derived via the A23 Microprocessor or cause the A23 Microprocessor to take a particular action. The following procedures are grouped into three categories: • General Front/Rear Panel BNC Connector Troubleshooting • A27 Aux I/O PCB Troubleshooting • A29 Rear Panel Interface PCB Troubleshooting
	General Front/Rear Panel BNC Connector Troubleshooting
MEMORY SEQ INPUT	Check that the contact closure at the input is being received by the A29 PCB (A29P3-9). If it is being received, A29U1 or A29U6 circuits are the cause of the problem. If it is not being received by the A29 board, there is an open circuit between the BNC connector and the A29 PCB via the A27 or A28 PCBs.
SWEEP DWELL INPUT	Check that a ground applied to the input reaches A28XA17-54. If it does not, there is an open circuit between the BNC connector and XA17 via the A27 and A28 PCBs. If the signal is reaching the A17 PCB, the cause of the problem is either the A17U23 or A17U4 circuits.
HIGH RES INPUT	Press SHIFT, TRIGGER, 011. Note the frequency of the Fine Loop Oscillator on the FREQUENCY display. Set an external signal source to 1/10th of this frequency at 0 dBm output power and connect it to the HIGH RES INPUT on the 67XXA rear panel. Press SHIFT RESET to return to normal front panel operation and then press SHIFT, TRIGGER, 002. Observe the RF output of the 67XXA with a frequency counter or spectrum analyzer. Increase or decrease the external signal source frequency by 1 MHz. The 67XXA output should also increase or decrease by 1 MHz. • If the 67XXA frequency does not change as described above, check that the signal is being received at A12J2. If the signal from the external source is not at A12J2, replace the cable from the rear panel to A12J2. If the signal is there, check A28XA12-3. This signal should be a TTL low. If it is not a TTL low, the A16U9 data latch is most likely defective. If this signal is correct and the external source signal is reaching A12J2, go to the YIG Loop troubleshooting in section 6J.
10 MHz REF INPUT	Apply a 10 MHz ±100 Hz, 0 dBm signal to the 67XXA rear panel 10 MHz REF INPUT. The front panel FREQUENCY display should show the EXT REF message on the right side of the display and the unit should be phase locked in the CW mode of operation. If the EXT REF message is not displayed, check A28XA7-3. This should be a TTL high. If it is not, go to the Reference Loop troubleshooting in section 6G. If this signal is a TTL high, either A8U10 and its associated circuits or A2U15 and its associated circuits are defective.
10 MHz REF OUTPUT	If there is no 10 MHz REF OUTPUT, go to the A7 Reference Divider PCB troubleshooting in section 6G.

Table 6F-2. Inputs/Outputs Troubleshooting (2 of 4)

Trouble / Error Code	Troubleshooting Procedure
	General Front/Rear Panel BNC Connector Troubleshooting (Continued)
SWEEP TRIGGER INPUT	Set the 67XXA for an F1-F2 analog sweep. Ensure that the TRIGGER is in the EXT mode. Press SHIFT, INT 1 KHz RATE and connect the rear panel PULSE SYNC OUTPUT to the rear panel SWEEP TRIGGER INPUT. If the sweep is not triggering, it indicates either the signal is not reaching A28XA23-42 or A23U3, A23U4 circuits are defective. • If the 1 kHz signal is not reaching A28XA23-42, it points to an open circuit from the rear panel connector via A27 to the A23 PCB.
One or more of the following rear panel outputs is (are) incorrect: BAND SWITCH BLANK, RETRACE BLANK OUTPUT, LOCK OUTPUT, SEQ SYNC OUTPUT, PEN LIFT, MARKER OUTPUT	These signals are generated by the A29U4 data latch and A29U5 buffer amplifier. Either one of these circuits can cause an improper output of one or more of the outputs. If you can get one or the other plus/minus polarity RETRACE BLANK and BANDSWITCH BLANK signals, but you cannot get both polarities, it indicates the A29U4 data latch or A27Q1-K1 is defective. An inoperative PENLIFT indicates either A29U4 data latch or A27Q2-K2 circuits are bad. The absence of a LOCK OUTPUT signal indicates a defective A29U4 data latch or interconnect between the A29 PCB and the BNC output connector.
No output from LOCK OUTPUTwhen 67XXA is actually phase locked	This signal is generated by the A29U4 data latch and A29U5 buffer amplifier. Either one of these circuits can cause an improper output of one or more of the outputs. The absence of a LOCK OUTPUT signal indicates a defective A29U4 data latch or interconnect between the A29 PCB and the BNC output connector.
V/GHz OUTPUT	This indicates A29U11, U13, U14, U15, or U16 circuits are defective. • Check A29P1-1 for the +10V reference. If this voltage is not present, go to the A17 Analog Instruction troubleshooting in section 6K. • Check A29U11-8 foı −10V. If this voltage is not present, A29U11 circuit is defective. With the FUNCTION SELECT switch set to 1V/GHz and the 67XXA set for a CW frequency of ≤20 GHz, the voltage at A29U16-1 should be approximately 1/2 (10K/20.5K) of the frequency indicated on the front panel FREQUENCY display. If this voltage is incorrect, either A29U16 or A29U15 circuits are defective. If this voltage is correct and the voltage at A29U11-14 is 0V, but the voltage at A29U14-6 is incorrect, it indicates that the A29U14-6 circuit is defective. The proper voltage at A29U14-6 is 2.05 times the voltage at A29U16-1. • If the voltage at A29U11-14 is not 0V under the above conditions, A29U11 or A29U13 circuit is defective. Press ΔF F5 and ENTER ΔF keys. Enter 1 GHz on the keypad. Use the scan keys to select F5 and enter a frequency below 19 GHz. The peak-to-peak voltage at A29U11-14 should be 0.488 V. If the voltage is incorrect, either the A29U11 or A29U13 circuits are defective. If this voltage is proper but the peak-to-peak voltage at A29U14-6 is not 1V, the A29U14 circuit is defective.

Table 6F-2. Inputs/Outputs Troubleshooting (3 of 4)

Trouble / Error Code	Troubleshooting Procedure
	General Front/Rear Panel BNC Connector Troubleshooting (Continued)
No HORIZ OUTPUT in analog sweep	Check that the A17 analog instruction board is sweeping by looking at A29P1-2 with an oscilloscope. There should be a 0 to 10V ramp at this point. If not, go to the A17 Analog Instruction PCB troubleshooting in section 6K. If the ramp is present at A29P1-2, but not at U11-7, U12D or U2A is defective.
No PULSE SYNC OUTPUT	Refer to the A13 Pulse Generator PCB troubleshooting in section 6M.
Front panel EXT FM or rear panel FM INPUT inoperative	Go to the FM troubleshooting in section 6J.
Front panel EXT AM or rear panel AM INPUT inoperative	Go to the ALC troubleshooting in section 6M.
Front panel EXT LEVEL or rear panel PULSE INPUT inoperative	Go to the ALC troubleshooting in section 6M.
	A27 Aux I/O PCB Troubleshooting
One or more of the rear panel FUNCTION SELECT switch settings inoperative	Check A27S1 for closure of the switch contacts. The output of these switch settings should be 0V or a TTL high, depending on the position of the switch. Also check that the signals are going through the A28 Motherboard PCB to the A29 Rear Panel Interface PCB; refer to the A28 Motherboard schematic signal lines in section 6P. If the signals are arriving at the A29 PCB, the A29U3 data latch or A29U6 address decoder are the most likely suspects. **NOTE** The CR-CR/LF positions of A27S1 are monitored by the A24 GPIB board.
	A29 Rear Panel Interface PCB Troubleshooting
CW Horiz DAC	Check this DAC in the CW or step sweep mode. It should have a 0V output at the low end frequency of the unit (or the low end frequency of the step sweep), and +10V at the high end of the unit frequency range in CW (or the high end of the sweep in step sweep). If the output does not change, check that the strobe is getting to U10-2. If there is an eratic output, first check U16A-1. Its voltage output should be about 1/3 of the output frequency indication in CW and go in a linear step from 1/3 of the sweep start frequency indication to 1/3 of the stop frequency indication with no eratic jumps. If this DAC has the same characteristic as the CW Horiz DAC, it indicates either U8 and U9 data latches are defective. If the U15 DAC check okay but the U10 DAC is erratic, it indicates U10 DAC is defective. If there is an output at U11-1 but no output at U11-7, it indicates U12 analog switch or U2 inverter is defective. (Make sure you are in CW or step sweep for this check.)

Table 6F-2. Inputs/Outputs Troubleshooting (4 of 4)

Trouble / Error Code	Troubleshooting Procedure
	A29 Rear Panel Interface PCB Troubleshooting (Continued)
Microprocessor Interface Problems	Check U1 and U3 data latches; monitor the inputs with an oscilloscope while switching the rear panel switches or apply a ground to the appropriate rear panel BNC inputs. If the level changes on the input pins, the interconnection circuitry is in order. Check that the corresponding function occurs by monitoring that function and changing the switch position or signal input to the rear panel BNC connectors. As an example, observe the swept RF output with an oscilloscope and a crystal detector. Then change the **RETRACE RF ON/OFF** switch on the rear panel. This should cause the RF during retrace to go on and off. Penlift relay contacts can be checked with an ohmmeter. In one position of the **PENLIFT** +/- switch, the contacts should close during sweep and open during retrace. In the other position, the contacts should open during sweep and close during retrace. U4 data latch may be checked from the rear panel by monitoring the blanking, marker, sequential sweep, bandswitch blanking, etc. If the signal outputs are not on the rear panel BNC connectors, trace them back to U4 data latch. If they are not coming out of the data latch, U4 is most likely defective.
V/GHZ Slope DAC	Set the 67XXA for a full band sweep by pressing SHIFT, RESET, F1-F2 SWEEP, ANALOG SWEEP. Look at U11-14 with an oscilloscope and adjust the F2 frequency from its maximum to minimum. The output voltage of U11D should go from approximately 1/3 of the F2 frequency indication (with the rear panel switch set to 1V/GHZ) to 0V when the F2 frequency indication is the same as the F1 frequency indication. When the rear panel switch is in the 0.5V/GHz position, it should go from approximately 1/6 of the F2 frequency to 0V when F2 is the same as F1. If there are erratic jumps, check the CW Horiz DAC. If it is also erratic, U8 or U9 data latches are most likely defective. If they are in order, U13 DAC is most likely defective.
V/GHZ Offset DAC	Set the 67XXA for a full band sweep by pressing SHIFT, RESET, F1-F2 SWEEP, STEP SWEEP. Check U16-1 with an oscilloscope. The voltage should go from approximately 1/3 of the F1 frequency indication (with the rear panel switch set to 1V/GHz) to approximately 1/3 of the F2 frequency indication when the F1 frequency is the same as the F2 frequency. If the output is not a smooth change or is erratic, check the CW Horiz DAC. If it is also erratic, U8 or U9 data latches are most likely defective. If not, then U15 DAC is most likely defective. Check U14 by checking the V/GHz output with the CW frequency output. If it is not proper but the DACs check okay, then U14 is most likely defective. The output of U16B is used for the ALC slope control on the A15 ALC PCB. Its output should be the sum of the V/GHZ Slope DAC and the V/GHZ Offset DAC. The frequency at which its output passes through 0V is 2 GHz (with the rear panel switch set to 1V/GHz or 0.5V/GHz. If U16B output does not pass through 0V at 2 GHz, check U12B and U12C analog switches and the +10V reference from A29P1-1 (which comes from the A17 Analog instruction PCB).
	Miscellaneous Inputs/Outputs Troubleshooting
Network analyzer will not operate in Alternate Sweep Mode with 67XXA	Press SHIFT RESET. Press F1-F2 and SHIFT F3-F4 ALT. Set the 67XXA for analog sweep. Monitor pin 4 of rear panel AUX I/O connector J1 (on the A27 Aux I/O PCB). It should be 0V. Monitor pin 7 of J1. It should be 5V during one sweep and 0V during the next. If these signals are not present, check the interconnect between the A27 and A29 PCBs via the A28 PCB. If this is proper, the A29U8 circuit is defective.

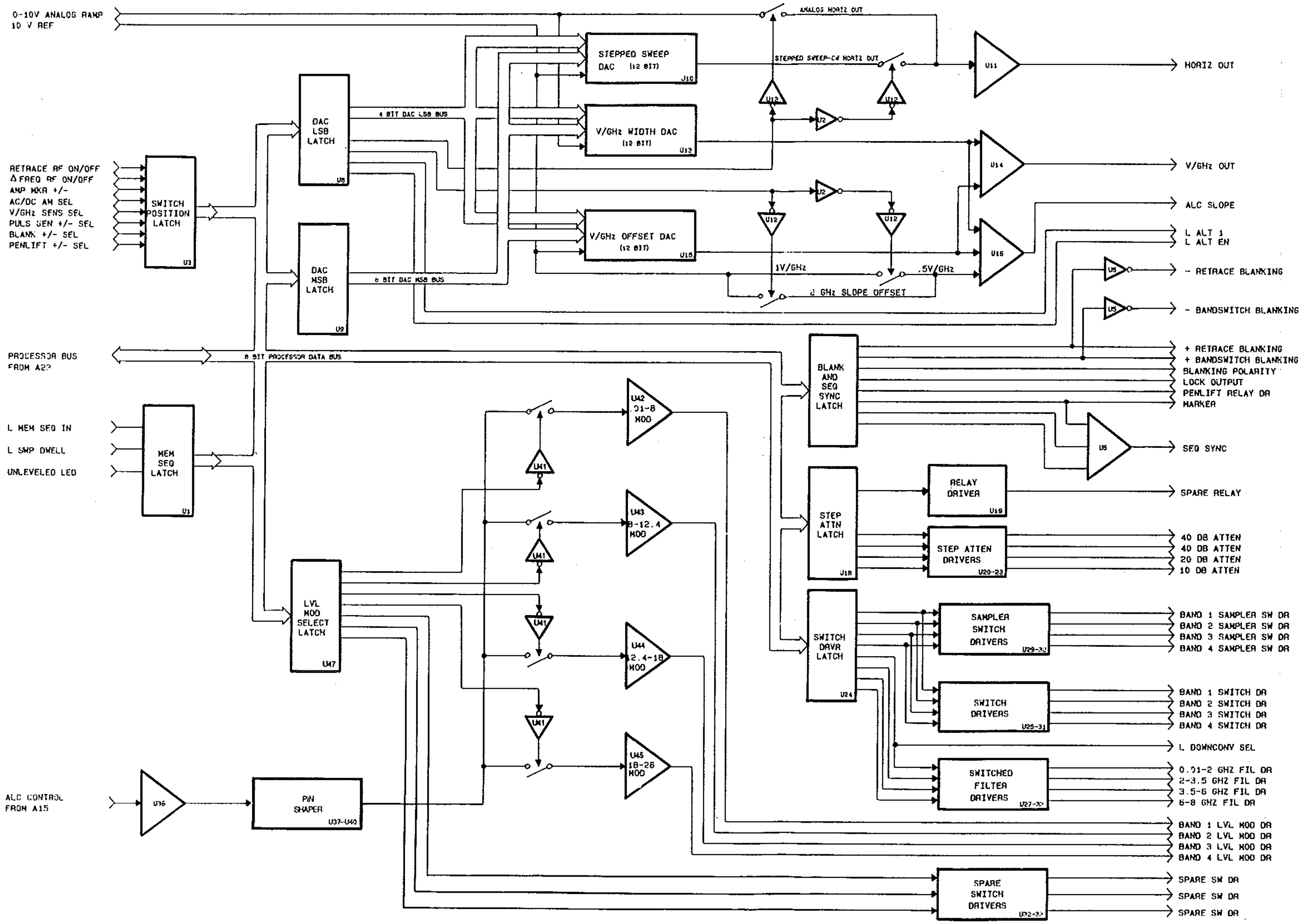
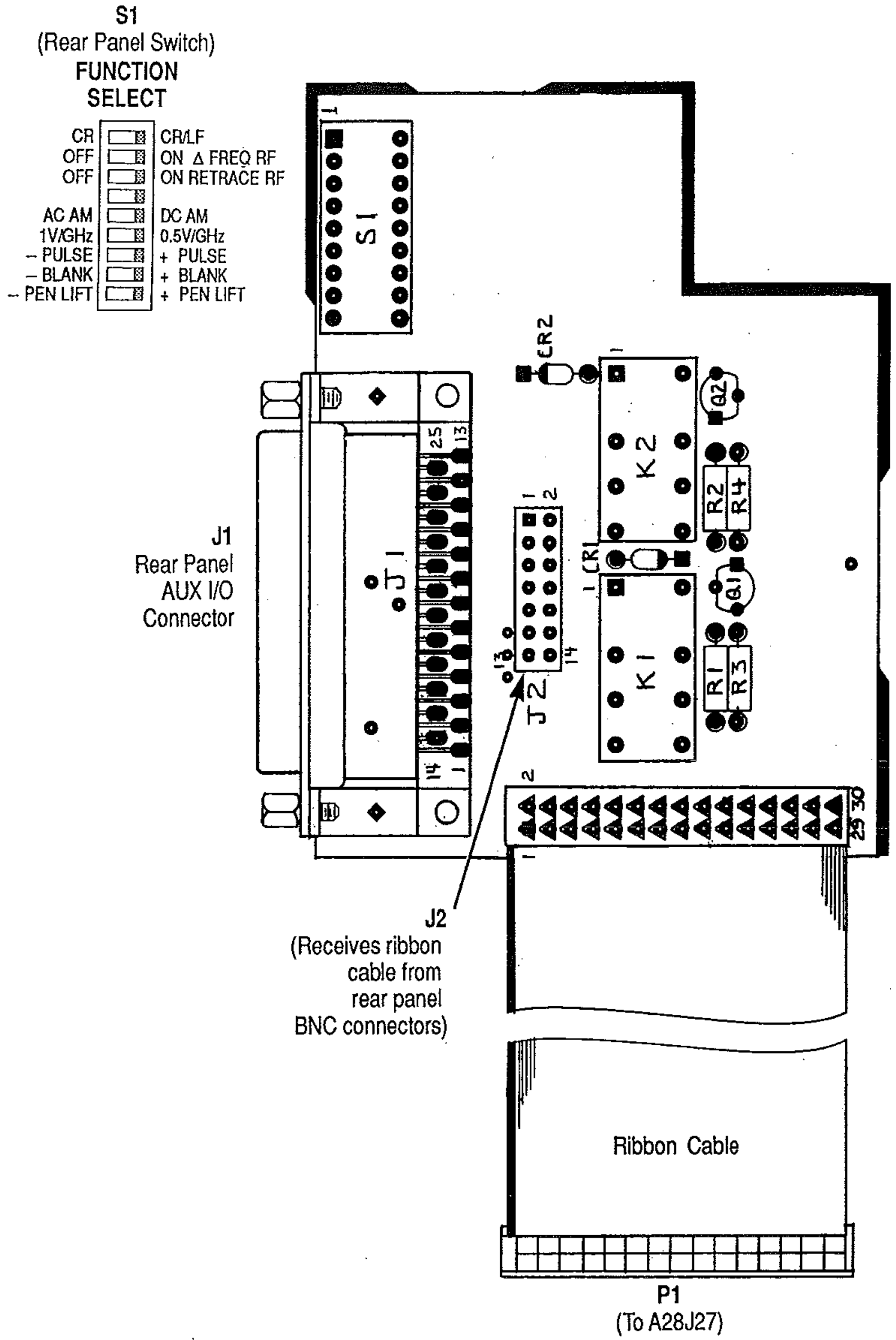


Figure 6F-2. A29 Rear Panel Interface PCB Block Diagram



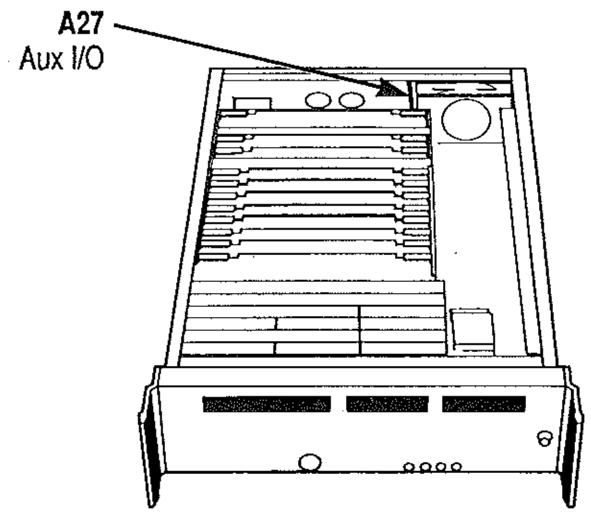


Figure 6F-3. A27 Aux I/O PCB Parts Locater Diagram
6700-D-31727-3 (Rev. B)

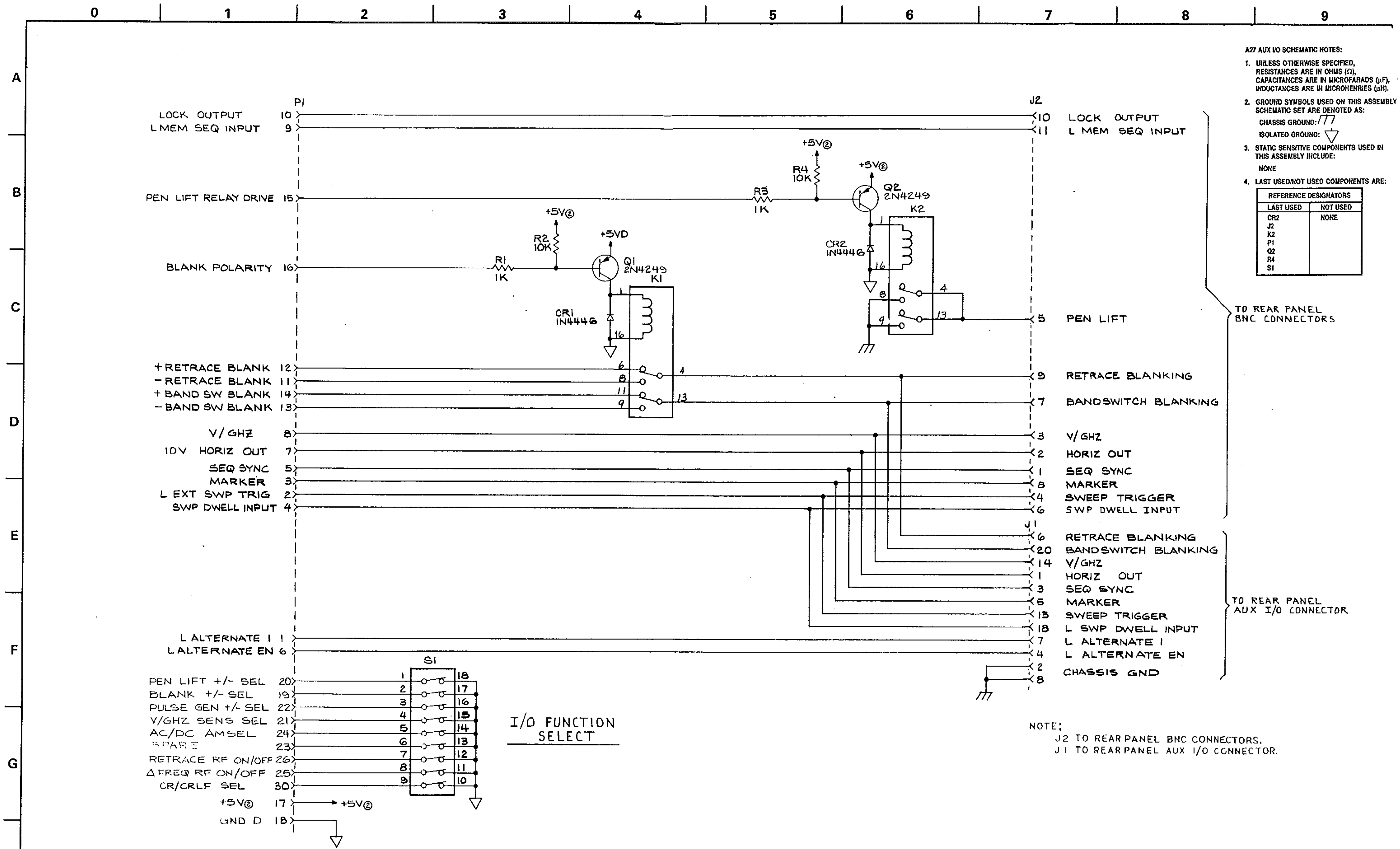
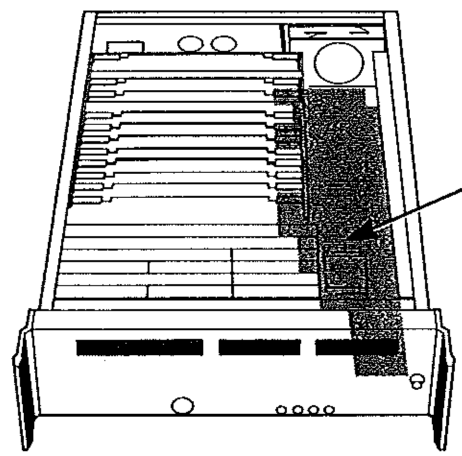


Figure 6F-4. A27 Aux I/O PCB Schematic Diagram (Sheet 1 of 1)
6700-D-31727-3 (Rev. B)



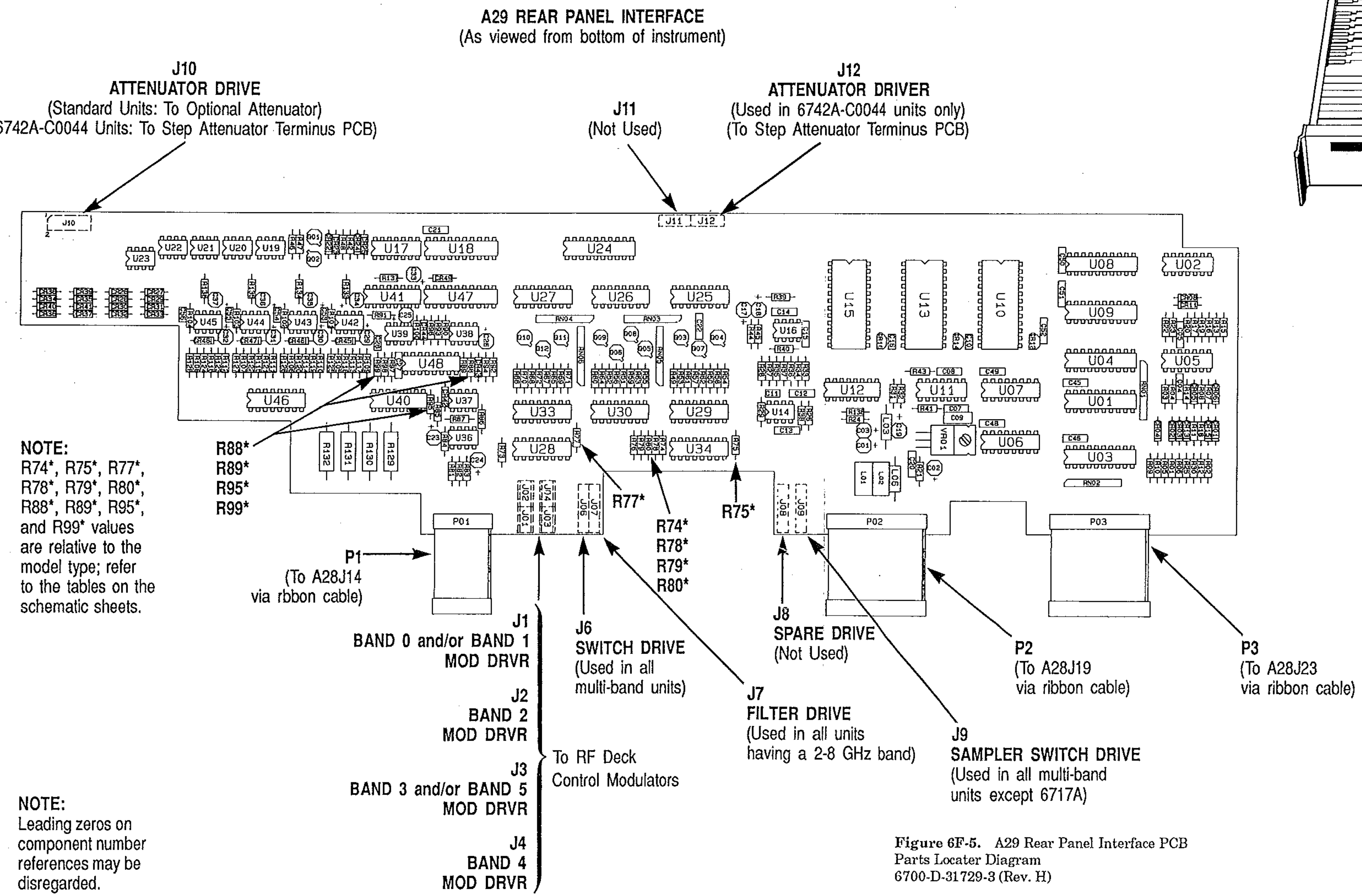
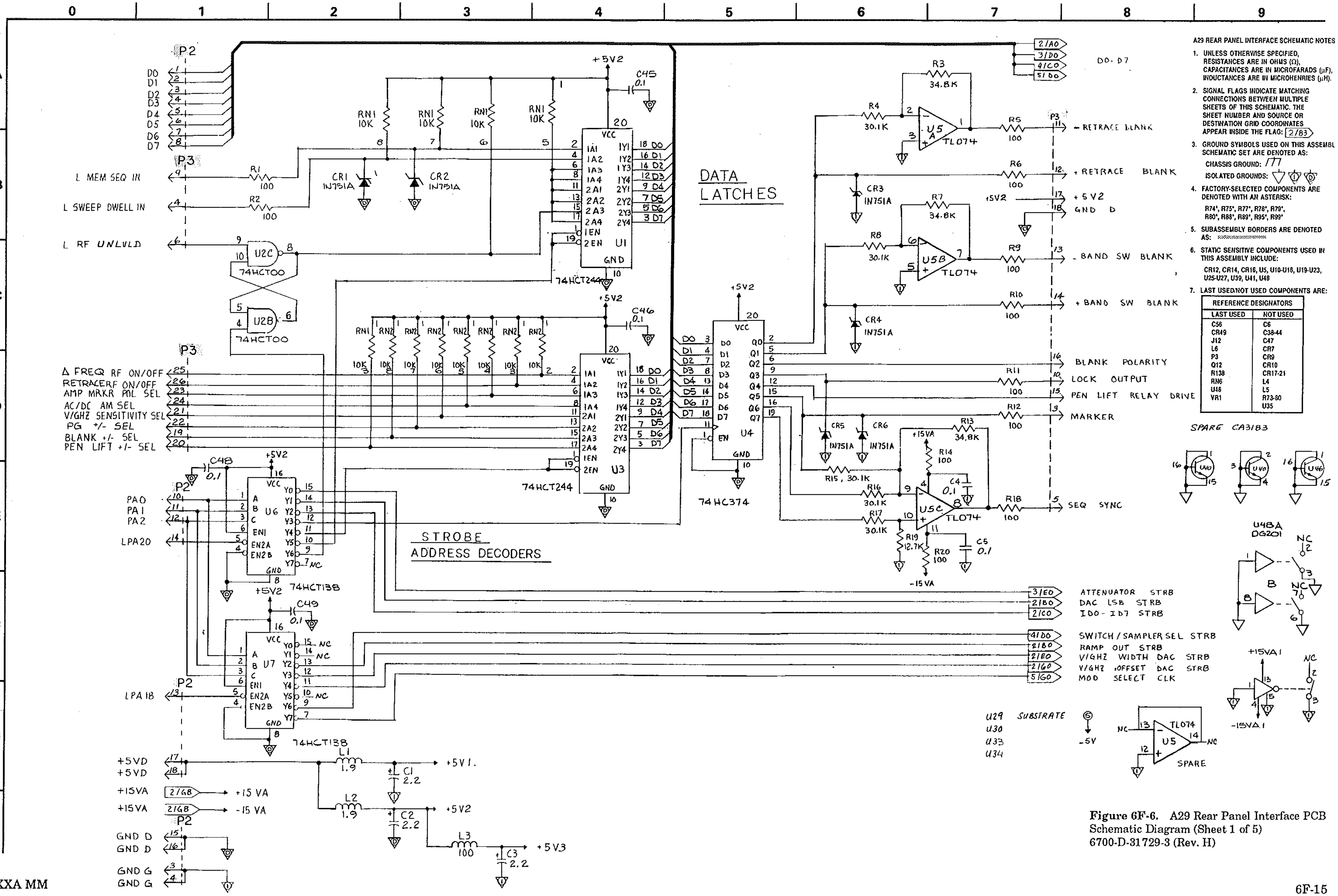


Figure 6F-5. A29 Rear Panel Interface PCB Parts Locater Diagram
6700-D-31729-3 (Rev. H)

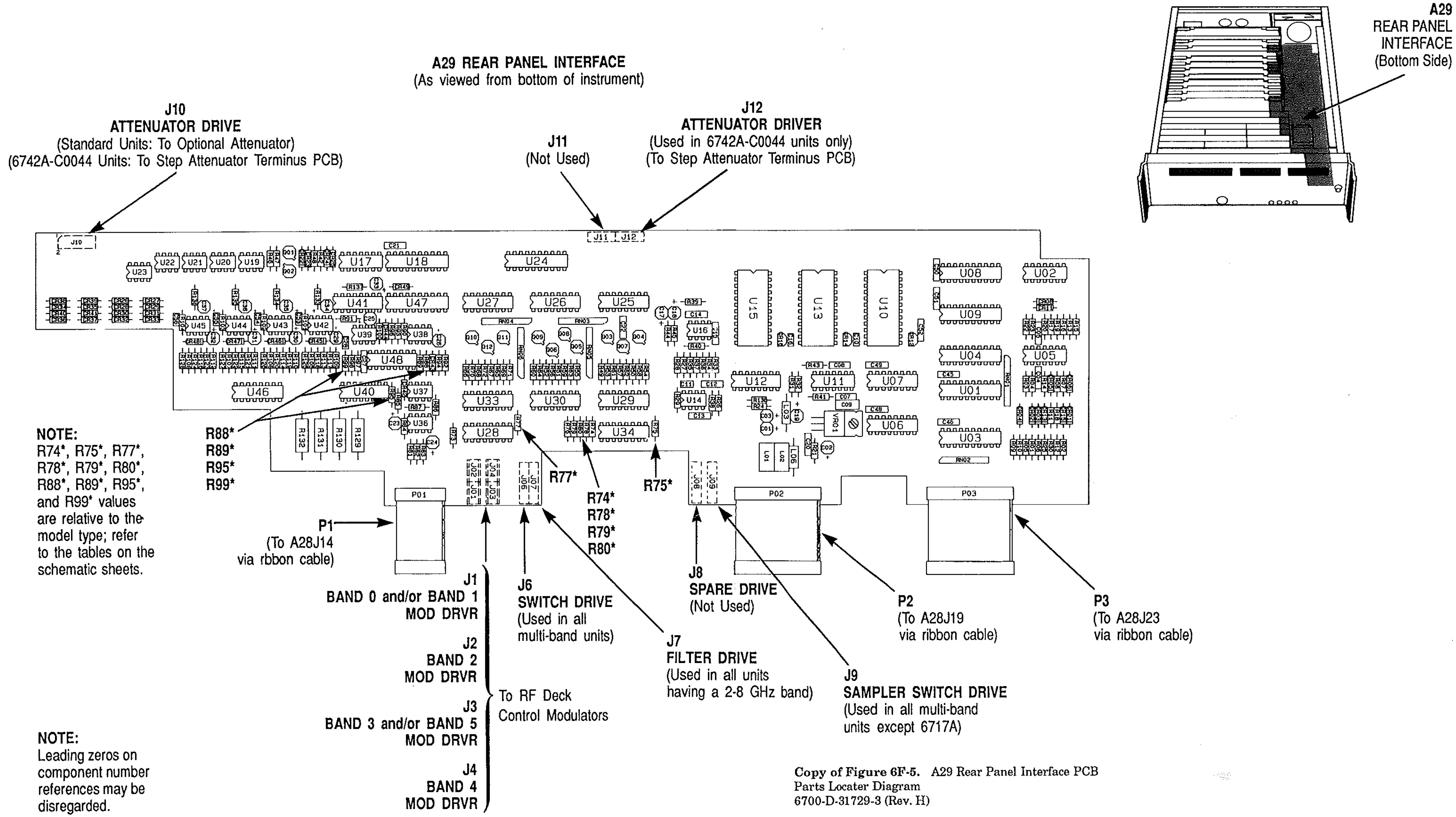


A29 REAR PANEL INTERFACE SCHEMATIC NOTES

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBL SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUNDS:
4. FACTORY-SELECTED COMPONENTS ARE DENOTED WITH AN ASTERISK:
   R74*, R75*, R77*, R78*, R79*, R80*, R88*, R89*, R95*, R99*
5. SUBASSEMBLY BORDERS ARE DENOTED AS:
6. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   CR12, CR14, CR16, U5, U10-U16, U19-U23, U25-U27, U39, U41, U48
7. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C56	C6
CR49	C38-44
J12	C47
L6	CR7
P3	CR9
Q12	CR10
R138	CR17-21
RN6	L4
U48	L5
VR1	R73-80
	U35

Figure 6F-6. A29 Rear Panel Interface PCB Schematic Diagram (Sheet 1 of 5) 6700-D-31729-3 (Rev. H)



Copy of Figure 6F-5. A29 Rear Panel Interface PCB Parts Locater Diagram
6700-D-31729-3 (Rev. H)

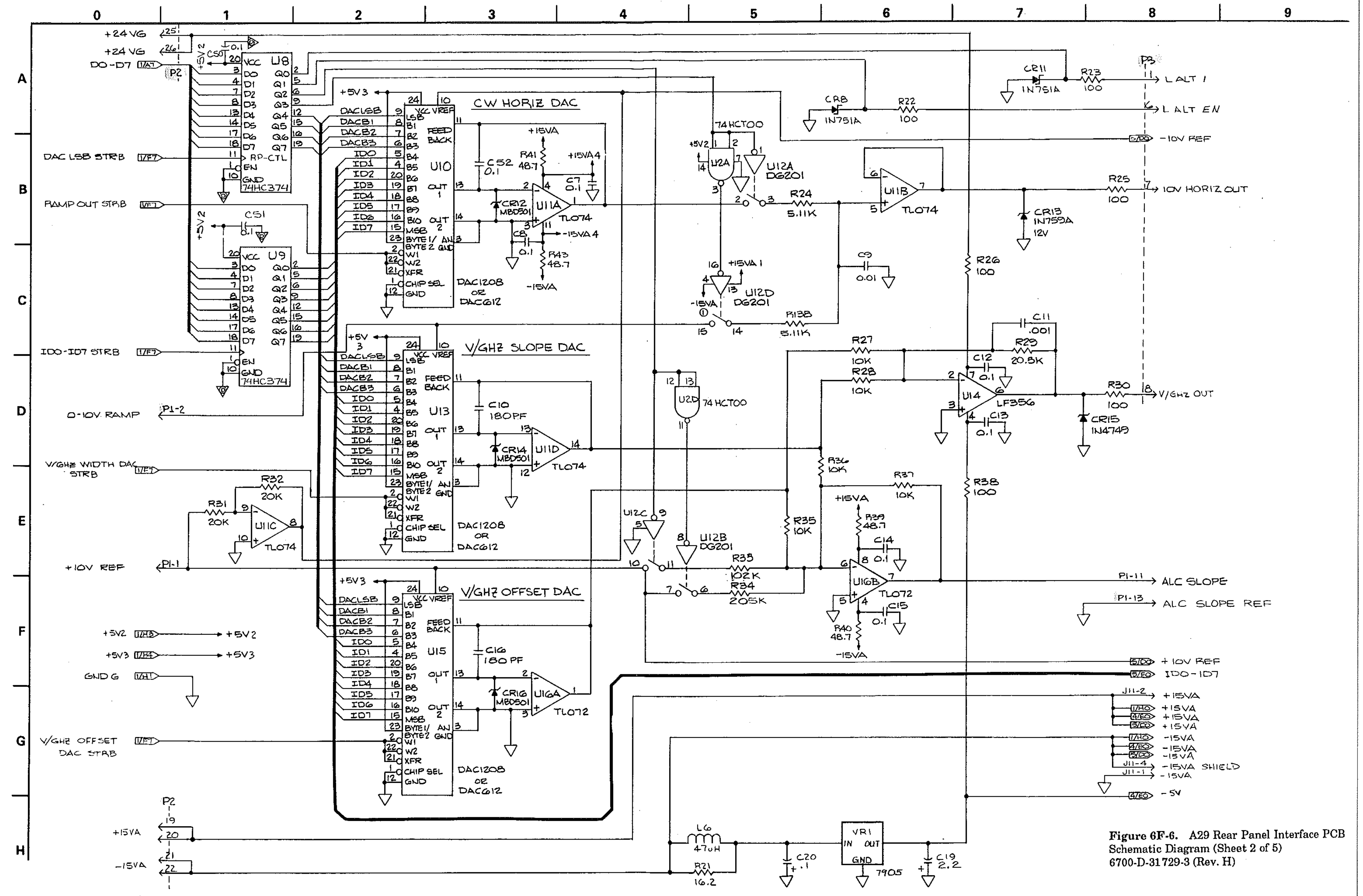
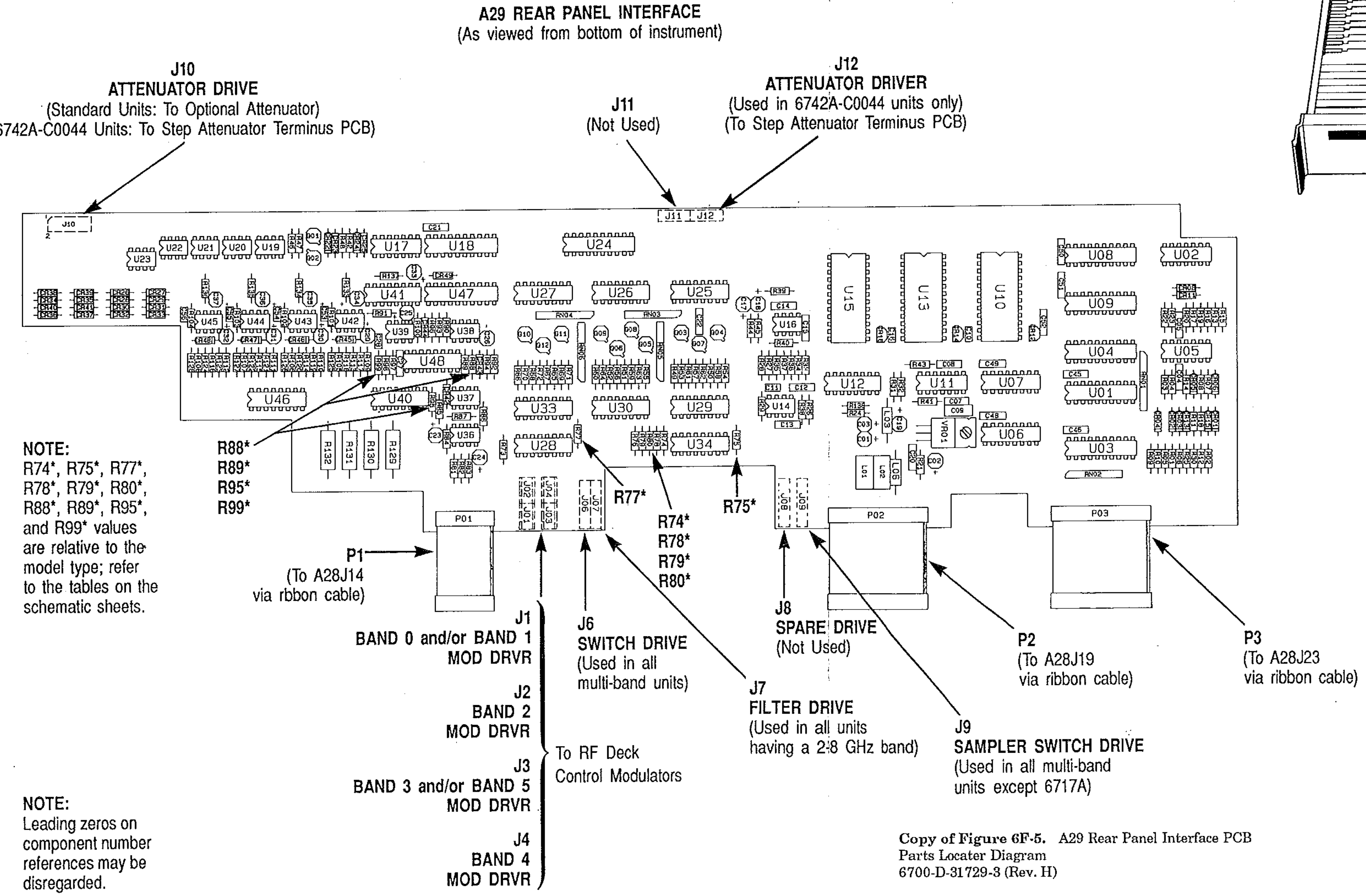
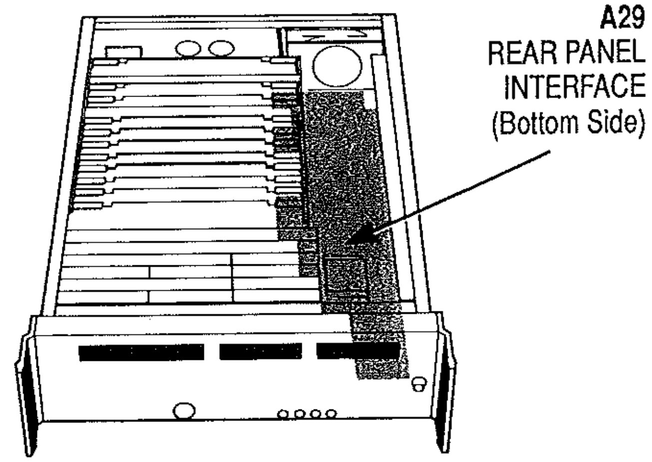


Figure 6F-6. A29 Rear Panel Interface PCB Schematic Diagram (Sheet 2 of 5)
6700-D-31729-3 (Rev. H)





NOTE:
R74*, R75*, R77*, R78*, R79*, R80*, R88*, R89*, R95*, and R99* values are relative to the model type; refer to the tables on the schematic sheets.

NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6F-5. A29 Rear Panel Interface PCB Parts Locater Diagram
6700-D-31729-3 (Rev. H)

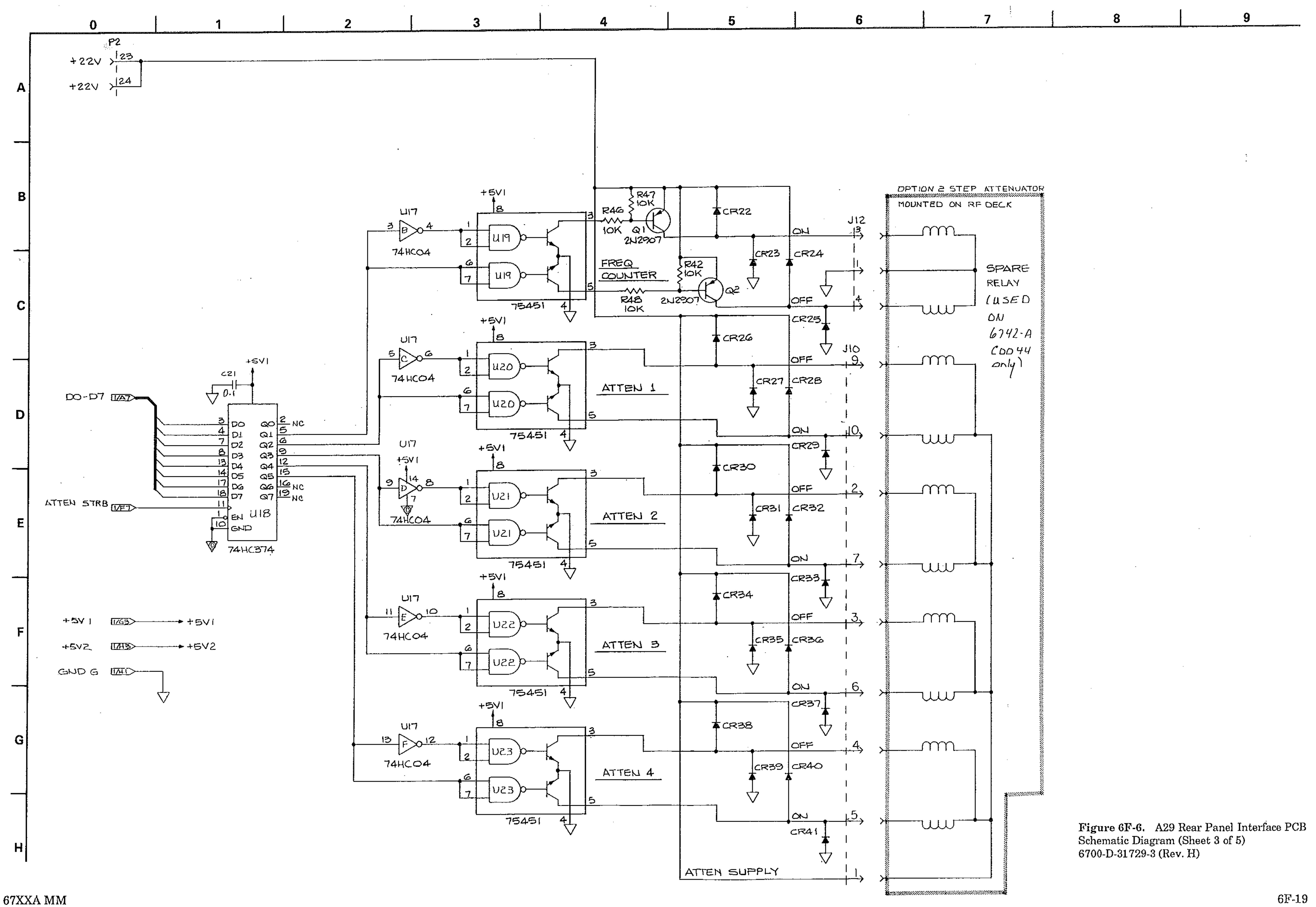
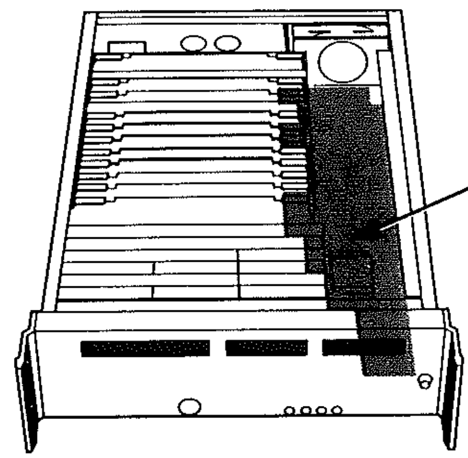
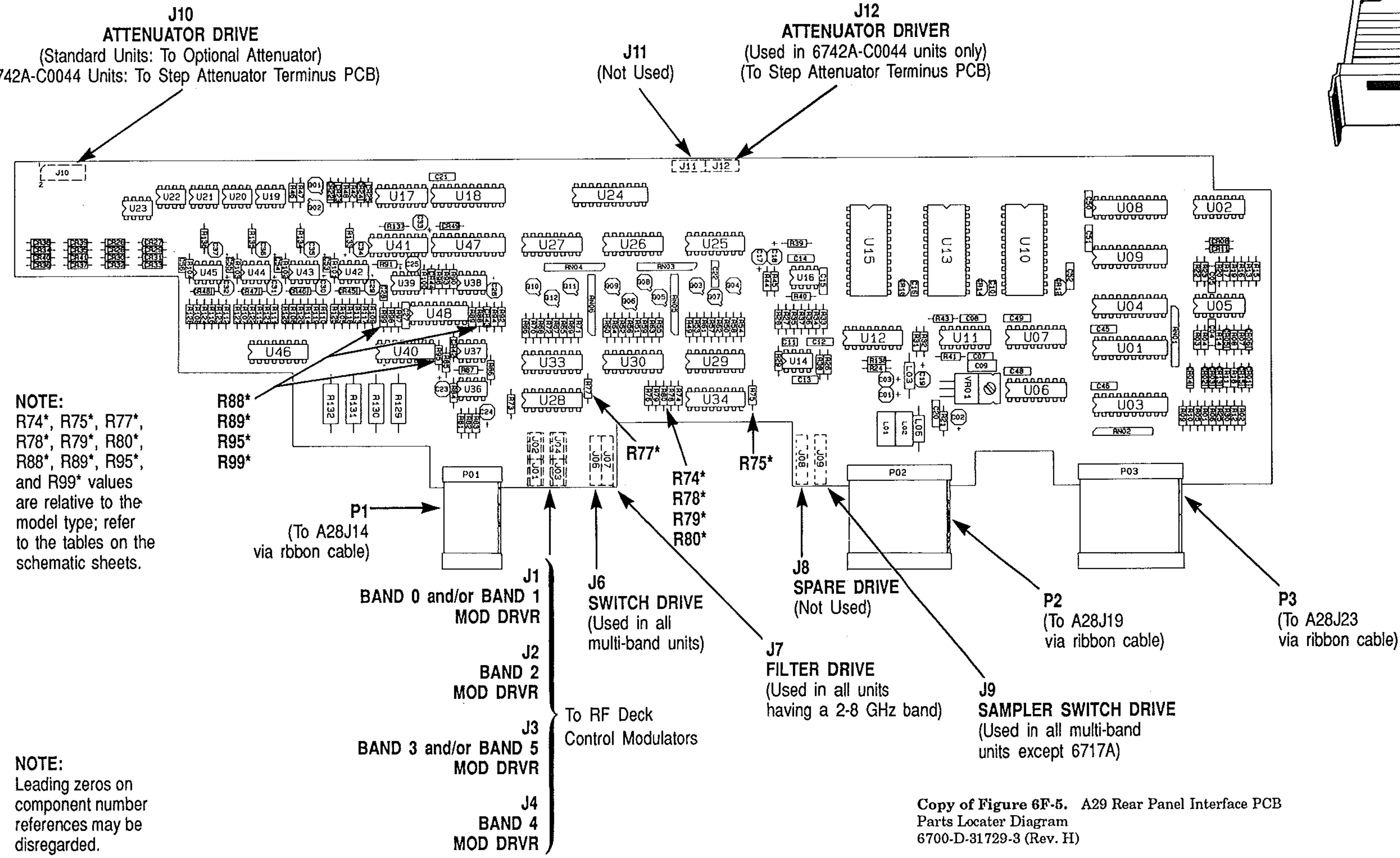


Figure 6F-6. A29 Rear Panel Interface PCB Schematic Diagram (Sheet 3 of 5)
6700-D-31729-3 (Rev. H)



A29 REAR PANEL INTERFACE
(As viewed from bottom of instrument)



NOTE:
R74*, R75*, R77*, R78*, R79*, R80*, R88*, R89*, R95*, and R99* values are relative to the model type; refer to the tables on the schematic sheets.

NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6F-5. A29 Rear Panel Interface PCB Parts Locater Diagram
6700-D-31729-3 (Rev. H)

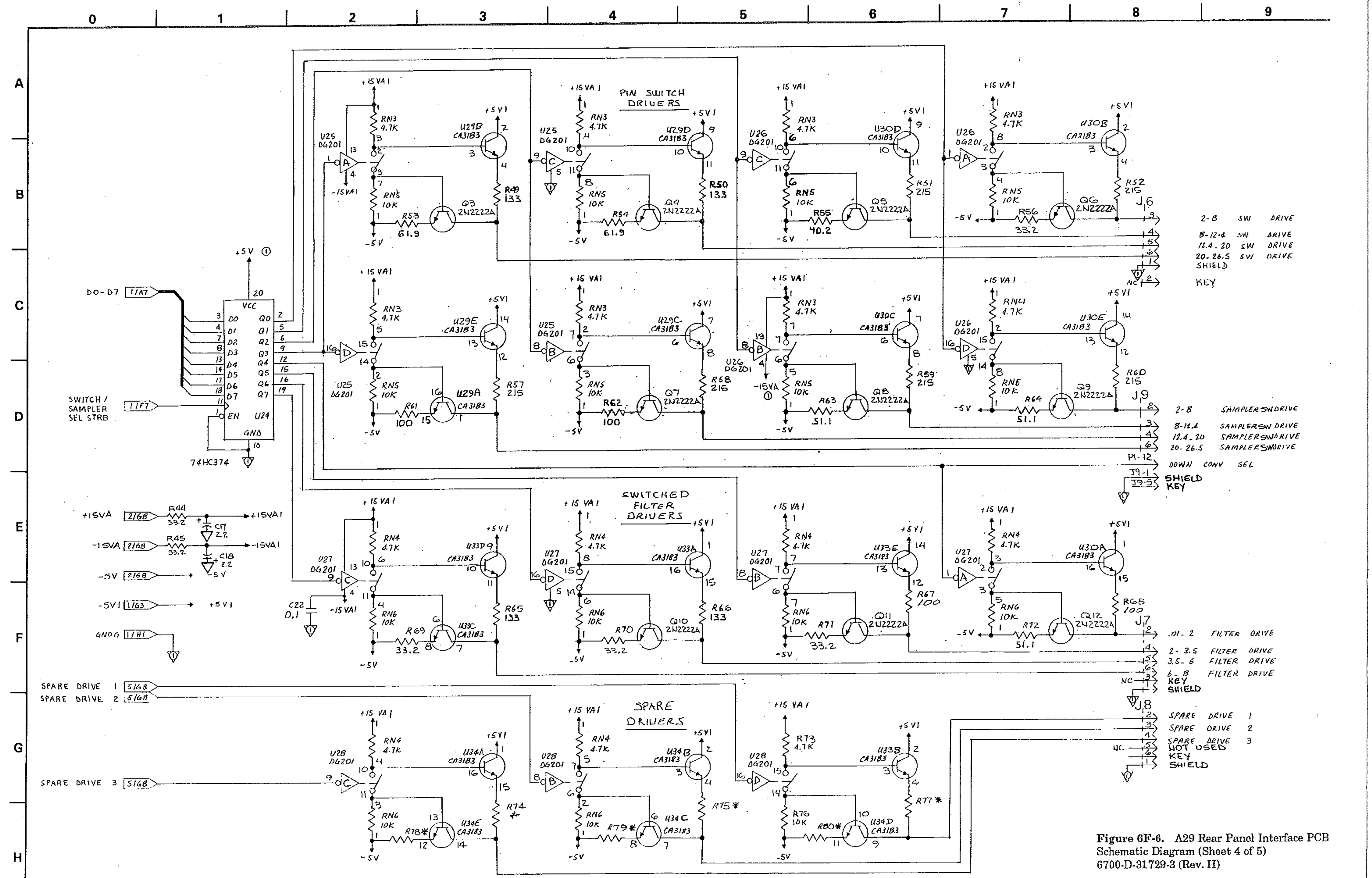
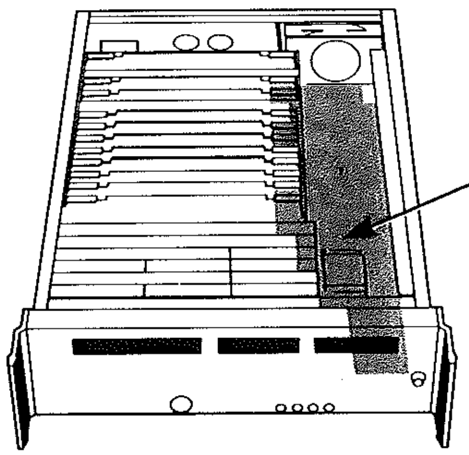
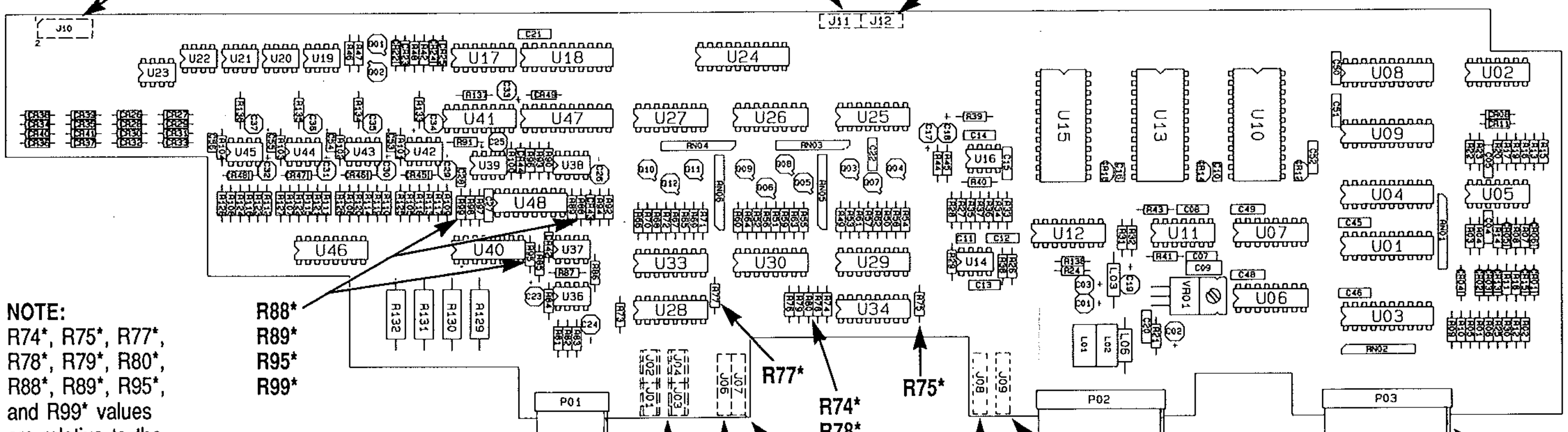


Figure 6F-6. A29 Rear Panel Interface PCB Schematic Diagram (Sheet 4 of 5)
6700-D-31729-3 (Rev. H)





NOTE:
R74*, R75*, R77*, R78*, R79*, R80*, R88*, R89*, R95*, R99* values are relative to the model type; refer to the tables on the schematic sheets.

NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6F-5. A29 Rear Panel Interface PCB Parts Locater Diagram
6700-D-31729-3 (Rev. H)

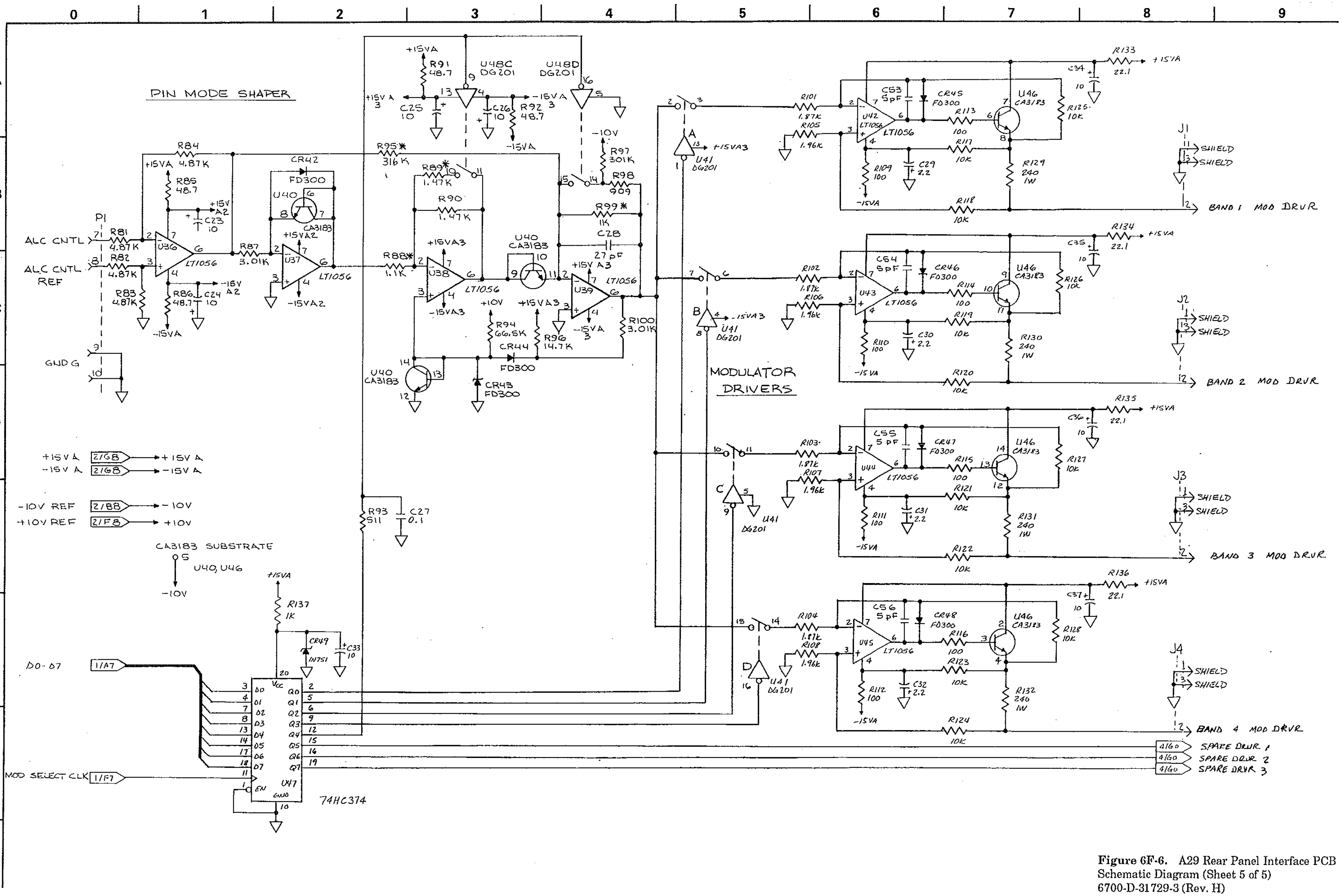


Figure 6F-6. A29 Rear Panel Interface PCB Schematic Diagram (Sheet 5 of 5)
6700-D-31729-3 (Rev. H)

6G – REFERENCE LOOP
A5, A7, A10 PCBs and Crystal Oscillator

6G-1 REFERENCE LOOP ASSEMBLIES: A5, A7, A10 PCBs and Crystal Oscillator

This section contains service information for the reference loop assemblies listed in Table 6G-1 below. Refer also to the general reference information in sections 6A, 6B, and 6C.

Table 6G-1. Reference Loop Service Information

Documentation	Reference	Page
OVERALL ASSEMBLY LEVEL		
Overall Description	Para. 6G-2	6G-1
Block Diagram	Fig. 6G-1	6G-9
Troubleshooting	Tbl. 6G-2	6G-5
PCB LEVEL		
A5 Reference Oscillator PCB		
Detailed Circuit Description	Para. 6G-3	6G-4
Troubleshooting	Tbl. 6G-2	6G-5
Schematic (Sheet 1 of 1)	Fig. 6G-3	6G-11
Parts Locater Diagram	Fig. 6G-2	6G-10
A7 Reference Divider PCB		
Detailed Circuit Description	Para. 6G-4	6G-2
Troubleshooting	Tbl. 6G-2	6G-5
Schematic (Sheet 1 of 1)	Fig. 6G-5	6G-13
Parts Locater Diagram	Fig. 6G-4	6G-12
A10 Reference Buffer PCB		
Detailed Circuit Description	Para. 6G-5	6G-4
Troubleshooting	Tbl. 6G-2	6G-5
Schematic (Sheet 1 of 1)	Fig. 6G-7	6G-15
Parts Locater Diagram	Fig. 6G-6	6G-14

6G-2 REFERENCE LOOP ASSEMBLIES, OVERALL DESCRIPTION

Refer to the block diagram in Figure 6G-1 for the following discussion.

The Reference Loop is comprised of the 10 MHz Crystal Oscillator Assembly, the A5 Reference Oscillator PCB, the A7 Reference Divider PCB, and the A10 Reference Buffer PCB. The function of the Reference Loop is to translate the frequency accuracy and stability of the 10 MHz reference signal (from the internal crystal reference or an external synthesized source) to the A4 Coarse Loop Oscillator PCB, the A9 Fine Loop Oscillator PCB, the 0.01-2 GHz Down Converter, and the A13 Pulse Generator.

The 500 MHz surface-acoustical-wave (SAW) oscillator on the A5 PCB is applied to three buffer amplifiers which provide isolation between the A6 Coarse Loop Divider PCB, the A7 Reference Divider PCB, and the Down Converter. The 500 MHz applied to the A7 Reference Divider PCB is divided by 10 and then divided by 5. (The 50 MHz resulting from the divide by 10 is also buffered and applied to an output reserved for future use.). The 10 MHz resulting from the divide-by-5 is applied to the A7 PCB's phase/frequency detector and to a buffer amp which drives the A10 Reference Buffer PCB.

The internal 10 MHz crystal reference and the external 10 MHz reference (when used) are applied to buffer amplifiers and then to the Reference Select Logic. The presence of an external reference is detected by this control logic and automatically switches the output to the reference phase detector. When an external reference is used, the control logic also supplies a signal to turn off the internal 10 MHz oscillator and to tell the A23 Microprocessor PCB to illuminate the EXT REF message on the front panel FREQUENCY display. The 10 MHz from the dividers on the A7 PCB is compared with the 10 MHz from the internal or external reference resulting in a + or – phase error. This is applied to the loop amplifier that controls the frequency of the 500 MHz SAW oscillator. This corrects for any drift of the SAW oscillator due to time and temperature.

The output of the phase detector is zero when the SAW is phase locked. This output is also monitored by the A23 Microprocessor PCB to detect an unlocked condition that is then shown (1) as an error code during self test, and (2) by the illumination of the UNLOCKED LED on the front panel. (There are several Reasons for the UNLOCKED LED to be illuminated. If it is illuminated when it should not be, that is in CW or Stepped Sweep modes, a self test indicates the area causing the unlocked condition.)

In addition to the phase lock monitor, the output of the loop amplifier is monitored by the A23 Microprocessor PCB via the DVM circuits on the A17 Analog Instruction PCB. This is displayed on the LEVEL DISPAY as a voltage for use in calibration of the SAW oscillator's center frequency.

6G-3 A5 REFERENCE OSCILLATOR, CIRCUIT DESCRIPTION

Refer to the A5 PCB schematic diagram in Figure 6G-3 for the following discussion.

6G-3.1 Loop Amplifier

The A7 Reference Divider PCB phase error signal goes to the differential receiver/loop amplifier U1. U1 has a very high gain at dc; the gain decreases as the input frequency increases (controlled by R6 and C5). R5 and C4, in the other input leg of the amplifier, have the same values as R6 and C5. This allows U1 to act as a true differential receiver. The differential receiver action rejects common mode signals on the two inputs.

The positive (+) supply of U1 goes to the +24V supply via decoupling network R7 and C3. Since U1 can operate only from a total of 30 Vp-p, the negative terminal goes to a −5.6V supply. R11, C7, and CR2 provide the −5.6V for U1. CR1 limits the output swing of U1 to −0.6V to prevent forward biasing the varactor diode CR3.

R8, R9, and R10 (which are factory selected) provide a voltage divider from +24V to the output voltage of U1. This gives the proper voltage range for the tuning varactor diode CR3. The output swing of U1 is from approximately −0.6V to +22V. The voltage swing at the junction of R9, R10, and R12 is approximately +23V to +6V.

R13 and R14 divide the output voltage of U1 by approximately 2.77V so that it can be monitored by the DVM circuit on the A17 Analog Instruction PCB. This is used for self test and for troubleshooting purposes. When SHIFT, TRIGGER, 010 is pressed, the LEVEL display on the front panel indicates the divided voltage. It is used for centering the frequency of the SAW oscillator, Y1, to the tuning voltage. The A23 Microprocessor PCB applies the proper multiplication factor to correct for the voltage divider action of R13 and R14.

6G-3.2 Oscillator

The SAW resonator, in conjunction with CR3 and the printed circuit inductor, is the frequency determining component for Q2. The output of Q2 goes to a low pass filter network consisting of C9-15 and some printed circuit inductors. This low pass filter network provides the necessary 180 degree phase shift to sustain oscillation.

The output of Q2 is coupled to the base of Q3 via a wire jumper coupling loop W1. The coupling loop configuration decreases the load on Q3, thereby increasing the Q of the circuit. (The SAW resonator itself has a Q of 7,000.) R19 and R20 provide the bias for Q3. The output of Q3 goes to three buffer amplifiers that prevent the reflection of signals from external devices to the SAW oscillator. They also prevent the signals from coupling to the other outputs and causing spurious responses.

6G-3.3 Buffer Amplifiers

The three buffer amps, Q1, Q4, and Q5, are all configured the same, however, their biases are slightly different to provide the necessary output signal levels.

R37 is adjusted for the proper input power to the Down Converter.

Q6 and Q7 are capacitance multipliers that filter the 15V supplies from the A22 Regulator PCB. They multiply the base capacitance by the beta of the transistor and provide about 40 dB rejection of noise and ripple on the power supplies.

6G-4 A7 REFERENCE DIVIDER PCB, DETAILED CIRCUIT DESCRIPTION

Refer to the A7 PCB schematic diagram in Figure 6G-5 for the following discussion.

6G-4.1 500 MHz Input

The 500 MHz from A5 goes to impedance matching network R1, R2, and R3. From there it goes to a buffer amplifier Q1 and is coupled by C3 to a divide-by-10 integrated circuit U1. The 50 MHz TTL output of

U1 goes to two divide-by-5 circuits, U3 and U4, and buffer amplifier Q7. (Q7 provides isolation from the connector reserved for future use.)

6G-4.2 Divide-by-Five

U3, U4, and part of U2 comprise a divide-by-five circuit that drops the frequency from 50 MHz to 10 MHz and applies it to the U6 phase detector circuit, which operates at 10 MHz.

6G-4.3 10 MHz Input Circuit

In order to convert its sine wave to a TTL level, the crystal oscillator inputs 10 MHz to a buffer amplifier and squaring circuit Q8. CR7 acts as a switch for the bias current of Q8, which is furnished by R13. CR8 prevents saturation of Q8. The output of Q8 goes to NAND gate U5. Normally, U5-12 functions at a TTL high, so U5 inverts the 10 MHz input. From U5-11, the 10 MHz goes to U5-4 which also has a TTL high on pin 5. The output of U5-6 then goes to the U6 phase/frequency comparator.

6G-4.4 External 10 MHz Input Circuit

If a 10 MHz signal is present at J4, it goes to buffer amplifier Q4 which converts it to TTL levels and applies it to U5-10. The output of Q4 also goes to CR5 and CR6, which are configured as a full-wave rectifier. The dc output of the rectifier turns on Q5, pulling the collector to ground. This ground signal disables U5, causing its output at pin 11 to go to a TTL high. U2C inverts the ground signal from Q5 and applies a TTL high to U5-9. This enables the 10 MHz from the rear panel to go to the phase detector via U5B. The TTL high also goes to P1 and then to the A8 Serial I/O PCB via the A28 Motherboard PCB. The A23 Microprocessor PCB reads the signal during housekeeping routines (approximately every 50 ms). It then instructs the front panel to activate the EXT REF annunciator on the FREQUENCY display via the A8 Serial I/O and A2 Front Panel Control PCBs. The signal from U2C also turns on Q6. The collector of Q6 goes to the internal 10 MHz crystal oscillator via the A28 Motherboard PCB and pulls the line to ground. It then shuts off the internal 10 MHz oscillator to prevent spurious responses. The output of the divide-by-five goes to the Q3 buffer amplifier as well as the phase detector. From Q3, the 10 MHz goes to the A10 Reference Buffer. The rest of the instrument uses this 10 MHz signal for reference.

NOTE

This 10 MHz comes from the 500 MHz reference oscillator and is not the same 10 MHz signal that comes from the internal 10 MHz crystal oscillator. When the SAW oscillator is unlocked, the 10 MHz reference for the rest of the instrument is off frequency by the same percentage as the 500 MHz is from its locked frequency. When the unlocked SAW is 50 kHz high, the 10 MHz at A5J3 is 10 kHz high (50 kHz/50). Although the Reference Loop is unlocked, the Coarse, Fine, and YIG Loops still lock, but at a corresponding frequency offset. For example, when the 500 MHz oscillator is 50 kHz high, the locked Fine Loop Oscillator is 20 kHz high at 200 MHz. Under the above conditions, the Coarse Loop is 40 kHz high when locked at 400 MHz.

6G-4.5 Phase/Frequency Detector

U5A and U6 comprise a "D" flip-flop phase/frequency detector. When the 10 MHz signals at U6-1 and U6-13 are in phase, the rising edges transfer the +5V on pins 3 and 11 to the output pins 5 and 9. Since pins 1 and 2 of U5A go high at the same time, U5A-3 goes low and clears U6A and U6B, setting their Q output low again. This causes a pulse of approximately 20 ns (due to the propagation delay of U5A and U6) at pins 5 and 9 of U6

When the 10 MHz clock at U6-1 is delayed by 90 degrees (25 ns at 10 MHz), U5A-1 goes high 25 ns after U5A-2. This results in a pulse of approximately 45 ns at U6-9 and a 20 ns pulse at U6-5. When the 10 MHz clock at U6-1 is ahead by 90 degrees, U6-5 has the 45 ns pulse and U6-9 has the 20 ns pulse.

R23-C19 and R25-C20 integrate the outputs of U6, which go to the differential receiver (U7). If one of the outputs of U6 has a wider pulse than the other, the dc voltage resulting from the integration of that pulse will be higher than the dc voltage resulting from the narrow pulse. U17 amplifies this dc voltage difference, which then goes to the loop amplifier on the A5 Reference Oscillator PCB.

Because the phase lock loop corrects the frequency until there is zero phase difference, the output from U7 is 0V when the Reference Loop is phase locked.

When the loop is unlocked, the phase detector has maximum output and the output from U7 is approximately ±12V.

The output of U7 also goes to a decoupling network for the phase detector (R37, C22, and R39) before it goes to the DVM circuit on the A17 Analog Instruction PCB. The A23 Microprocessor PCB monitors this point via the A17 PCB DVM circuit to determine if the Reference Loop is locked or not.

The 5V supply for this board comes from on-board regulator VR1. This regulator helps isolate both the 50 kHz switching signals from the power supply and the digital and microprocessor noise on the normal 5V supply. The raw supply for VR1 comes from the +9VLP unregulated supply on the A25 Switching Power Supply PCB.

6G-5 A10 REFERENCE BUFFER PCB, DETAILED CIRCUIT DESCRIPTION

Refer to the A10 schematic diagram in Figure 6G-7 for the following discussion.

6G-5.1 Input

The 10 MHz input at J4 comes from the A7 Reference Divider PCB. Q1 buffers it and then applies it to the four output buffer amplifiers. The buffer amplifiers going to J1, J2, and J3 are identical. The buffer amplifier for the J5 rear panel output provides additional isolation and protection from any signal applied to the J5 output.

This high isolation prevents destination circuit signals from going to the other circuits. For example, any 200 to 321 MHz signal that comes from the A11 Fine Loop Divider PCB and goes back into J1 will be attenuated by 40 dB at the J2 and J3 outputs. This prevents interaction of circuits requiring the 10 MHz reference and reduces the possibilities of spurious responses.

6G-5.2 Buffer Amplifiers

Q1 is configured as an emitter follower and receives its bias from R3 and R4. This bias sets the collector current at approximately 5 ma. R7, R8, R9, and R10 split the signal from Q1 into four paths.

Q2 is also configured as an emitter follower and receives its bias from the emitter of Q1. Its collector current is approximately 3 ma. The signal, which is ac coupled to Q6, receives its bias from R14 and R15, and has a collector current of approximately 13 ma. The signal is amplified approximately three times to overcome the losses from the splitter and emitter followers. Then, after being ac coupled, it goes to the J1 output. The peak amplitude of the J1, J2, and J3 outputs is approximately 0.2V. The other two buffer amplifiers (consisting of Q3, Q4, Q7, and Q8) operate the same as the first buffer amplifier.

Q5, an emitter follower, has a collector current of approximately 3 ma. It applies its signal to a voltage divider consisting of L3, Q9, R38, Q11, and L4. The divider, which has a current of approximately 2 ma, sets the collector current for Q10 and Q12 at approximately 10 ma. Q9 and Q11, configured as diodes, provide temperature compensation for Q10 and Q12. CR1 and CR2 prevent Q10 and Q12 from becoming saturated. CR3 and CR4 prevent damage to Q10 and Q12 by clamping any signal inadvertently applied to the J5 output. R39 provides the 50 ohm source impedance for the J5 output and current limits any signal applied to J5.

VR1, a 3-terminal on-board regulator, provides the 5V supply. It receives its voltage from the A25 Switching Power Supply +9VLP raw supply.

6G-6 REFERENCE LOOP ASSEMBLIES, TROUBLESHOOTING

Troubleshooting procedures in Table 6G-2 cover the A5 Reference Oscillator PCB, the A7 Reference Divider PCB, and the A10 Reference Buffer PCB.

6G-7 REFERENCE LOOP ASSEMBLIES, SERVICE SHEETS

Table 6G-1 on the first page of this section presents the arrangements of the block diagrams, schematics, and parts locater diagrams for the A5, A7 and A10 PCBs.

Table 6G-2. Reference Loop Troubleshooting (1 of 4)

Trouble / Error Code	Troubleshooting Procedure
	A5 Reference Oscillator PCB Troubleshooting
	NOTE It is recommended that the A5 Reference Oscillator PCB be returned to Wiltron on an exchange basis. The alignment of the coupling loops or the movement of the capacitors in the phase-shift network for the SAW oscillator can significantly affect the operation of this circuit. The troubleshooting notes below provide information on some minor repairs that can usually be made without affecting operation of the SAW oscillator. These should only be attempted in emergency situations.
Low Output Level(s)	A low output usually results from one of the buffer amplifiers. A defective buffer amplifier can also affect the output of the other amplifiers. The best way to determine which amplifier is defective is to measure the dc collector voltages. Q3 can also affect all the output levels. Extra care must be used when replacing this transistor because the coupling loop is in its base leg. These transistors have a small insulating washer beneath them. It is important to leave this washer between the transistor and the PCB. Also, the transistors must press against the insulator and PCB to minimize the lead length. Not doing this can severely degrade the assembly's performance. If U1 is defective, the output is usually against the supply rail. However, if the phase detector is defective, it can also cause the U1 output to go to the supply rail. Open the input to U1 and apply a negative external voltage source to tune the oscillator. Connecting test points 1 and 2 with a jumper fixes the gain of U1. By adjusting the external voltage source, the output of U1 appears along with the frequency of the SAW oscillator. The SAW oscillator has a tuning range of approximately –20 kHz to +50 kHz, centered at 500 MHz. The best way to see this is either with a synthesized spectrum analyzer, such as the TEK 494 or HP 8566, or a frequency counter. For best overall accuracy, set the synthesizer or counter for an external reference and connect the 10 MHz REF OUTPUT on the 67XXA rear panel to the external reference input of the spectrum analyzer or counter. The output power of the A5 board outputs is measured with the other outputs terminated in 50 ohms. The measurements are as follows: • J1: 0 dBm +1 dB/–1 dB • J2: +7 dBm +0 dB/–1 dB • J3: –3 dBm +/–.2 dB (Adjust R37.) If the output from J3 is too low or too high, it can cause spurious signals in the 0.01-2 GHz frequency range. For adjustment of C9, follow the procedure under the E5-13 error code. Shorting the +15V supplies to ground on the A5 PCB usually damages Q6 and Q7. Check this by noting the emitter-base and collector-emitter voltage drops. • The emitter-base voltage drop should be approximately 0.5 to 0.7 Vdc. The collector-emitter voltage drop should be approximately 0.2 to 0.4 Vdc. **NOTE** Keep J1 connected to maintain 500 MHz.

Table 6G-2. Reference Loop Troubleshooting (2 of 4)

Trouble / Error Code	Troubleshooting Procedure
	A5 Reference Oscillator PCB Troubleshooting (Continued)
E5-10	The self test was not able to determine the failure mode by using the E5-11 through E5-13 code tests. This indicates a failure in either the A5 or A7 PCB, or in the 10 MHz crystal oscillator circuit. To troubleshoot: • Press SHIFT, RESET. • Press SHIFT, TRIGGER, then enter 0 1 0 from the keypad. The FREQUENCY display indicates 500 MHz and the LEVEL displays a voltage from −0.3V to +7.5V. • Connect a frequency counter to A5J3. • Connect a power meter to A5J1. If the LEVEL display indicates approximately +7.5V: • The frequency counter should indicate 500.050 MHz ±4 kHz. • The power meter should indicate 0 dBm ±1 dB. If the LEVEL display indicates approximately −0.3V: • The counter should indicate 499.980 MHz ±4 kHz. • The power meter should indicate 0 dBm ±1 dB. If the power meter indication is low or 0 dBm, the problem is in the A5Q4 circuit. If the counter does not count and the power meter is low or 0 dBm, the problem is either with the A5Q2 or A5Q3 circuit. If power meter indication is correct, move the power meter to A5J2 and terminate A5J1 into 50Ω. The power meter should indicate +7 dBm +0 dB/−1 dB. If the power meter indication is low or 0 dB, the problem is in the A5Q2 circuit. See the A5 PCB troubleshooting hints on the previous page. Connect the power meter to A5J3. It should read −3 dBm ±0.2 dB. If not, adjust A5R29. R37 If the A5 PCB meets the above specifications, but the unit will still not lock, refer to error codes E5-11 and E5-12 for troubleshooting.
E5-11	Connect an external 10 MHz reference (10 MHz ±100 Hz) to the 67XXA rear panel 10 MHz REF INPUT connector. Press SELF TEST. • If error code E5-11 is no longer displayed, the problem is the 10 MHz internal reference oscillator or the A7Q8 circuit. • If error code E5-11 is still present, the problem is in the A7U5, A7U6, or A5U7 circuit. See the A7 PCB troubleshooting hints.
E5-12	Connect a spectrum analyzer to A5J1. The spectrum analyzer should display a signal at 500.050 MHz at approximately 0 dBm. • If the signal is present, the problem is in the A7Q1, A7U1, A7U4, A7U6 or A7U7 circuit. • If the 500.050 MHz signal is not observed on the spectrum analyzer, refer to error code E5-10 for troubleshooting.

Table 6G-2. Reference Loop Troubleshooting (3 of 4)

Trouble / Error Code	Troubleshooting Procedure
	A5 Reference Oscillator PCB Troubleshooting (Continued)
E5-13	The following calibration of the Reference Oscillator frequency should be done only when the E5-13 error code is displayed. It should *not* be performed as a routine calibration. • Install the A5 PCB on an extender board. • Connect a frequency counter to A5J3. • Remove the connection between A5J1 and A7J1. • Adjust C9 for 500.050 MHz. • Press SHIFT, TRIGGER, and enter 0 1 0 from the keypad. • Reconnect A5J1 to A7J1. • The level display should indicate approximately +3V. • Note and record the reading. • Remove the A5 PCB from the extender, and reinstall it in the 67XXA. • Note the LEVEL display indication. • Subtract this reading from the reading previously noted. • Install A5 on the extender board again. Adjust C9 until the LEVEL display indicates the first recorded reading plus the difference between the first and second reading ±0.02V. *Example:* Assume the first reading is 3.00V and that the second reading is 3.10V. You would adjust C9 for 2.90V ±0.02V [3.00 – 3.10 = –0.1; 3.00 + (–0.1) = 2.90V ±0.02V]. Install the A5 PCB in the RF casting without the extender. The level display should remain at the first recorded indication ±0.05V.

Table 6G-2. Reference Loop Troubleshooting (4 of 4)

Trouble / Error Code	Troubleshooting Procedure
	A7 Reference Divider PCB Troubleshooting
	When the A7 board operates normally, loss of the 500 MHz input at J1 causes the voltage at P1-6 to go to approximately −12V and loss of the 10 MHz reference at J5 causes this voltage to go to +12V. To check the 500 MHz path, apply a 500 MHz, 0 dBm signal from an external synthesizer to A5J1. Measure a 10 MHz signal of approximately 2 Vp-p at J3. Measure A5TP1 if you don't get this signal. You should get a 50 MHz TTL signal. If this signal is not there, either Q1 or U1 is defective. If this signal appears, measure A5TP2. If no signal appears, U2, U3, or U4 is defective. If there is a signal at TP2, but none at J3, then the Q3 circuit is defective. The 10 MHz path is relatively easy to trace with a normal oscilloscope. There should be a 10 MHz signal at A5TP3. Trace this signal back from there. With 10 MHz applied from an external source, the internal crystal oscillator should turn off and you can trace the signal back to J4. To use the internal crystal oscillator in place of an external 10 MHz source, lift one end of R26. This will keep the external 10 MHz circuitry from turning the internal oscillator off. With the 10 MHz operating, you can adjust the 500 MHz signal slightly above and below 500 MHz and observe U7-6. This voltage should go from approximately +12V for a high frequency, to −12V for a low frequency. This indicates that the phase detector circuits are operating. Use a 50 MHz (or greater) scope to observe the outputs of U6 and see the pulses. A sweep is usually not stable enough for this purpose. There is too much residual FM and you cannot get a stable pulse. When the 67XXA and another synthesizer use the same time base, a stable signal can be obtained at the U6 output by adjusting the 500 MHz to where its divided 10 MHz signal is exactly the same as the time base. However, the phase offset will always give a dc output voltage from U7, and the pulses from U6 will have unequal widths. Some synthesizers have an adjustable variable phase. This allows the U6 and U7 outputs to be observed by adjusting the phase of the external synthesizer. An external synthesizer can also work with the External 10 MHz reference. Do not try to measure phase noise under these conditions, however, unless the phase noise of the external synthesizer is equal to or better than the internal 10 MHz crystal.
	A10 Reference Buffer PCB Troubleshooting
	This board is very easy to troubleshoot with an oscilloscope and digital voltmeter. Apply a 10 MHz, −2 dBm signal to J4 and measure the outputs with an oscilloscope or power meter. Then measure the dc voltages shown on the schematic to localize the defective component.

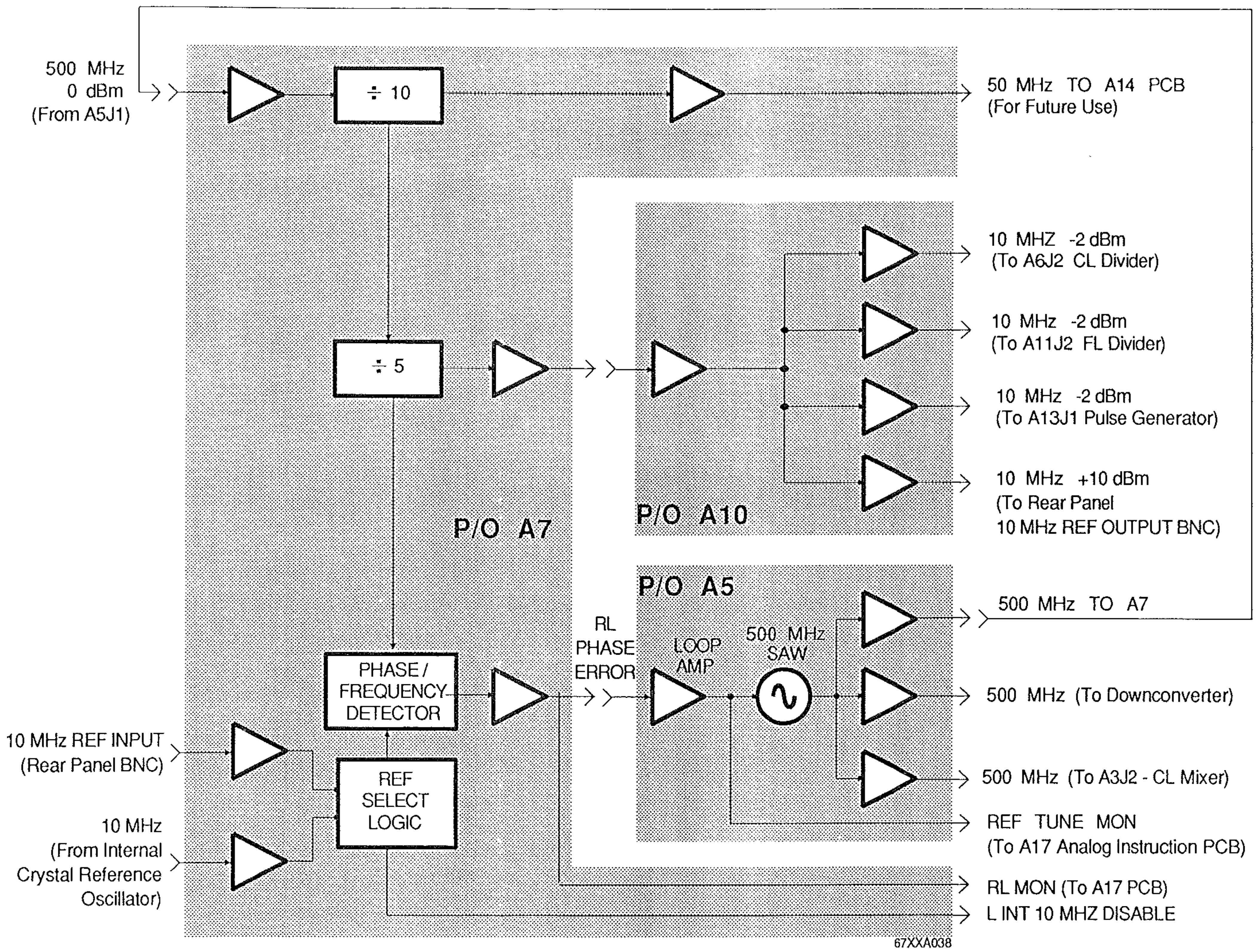
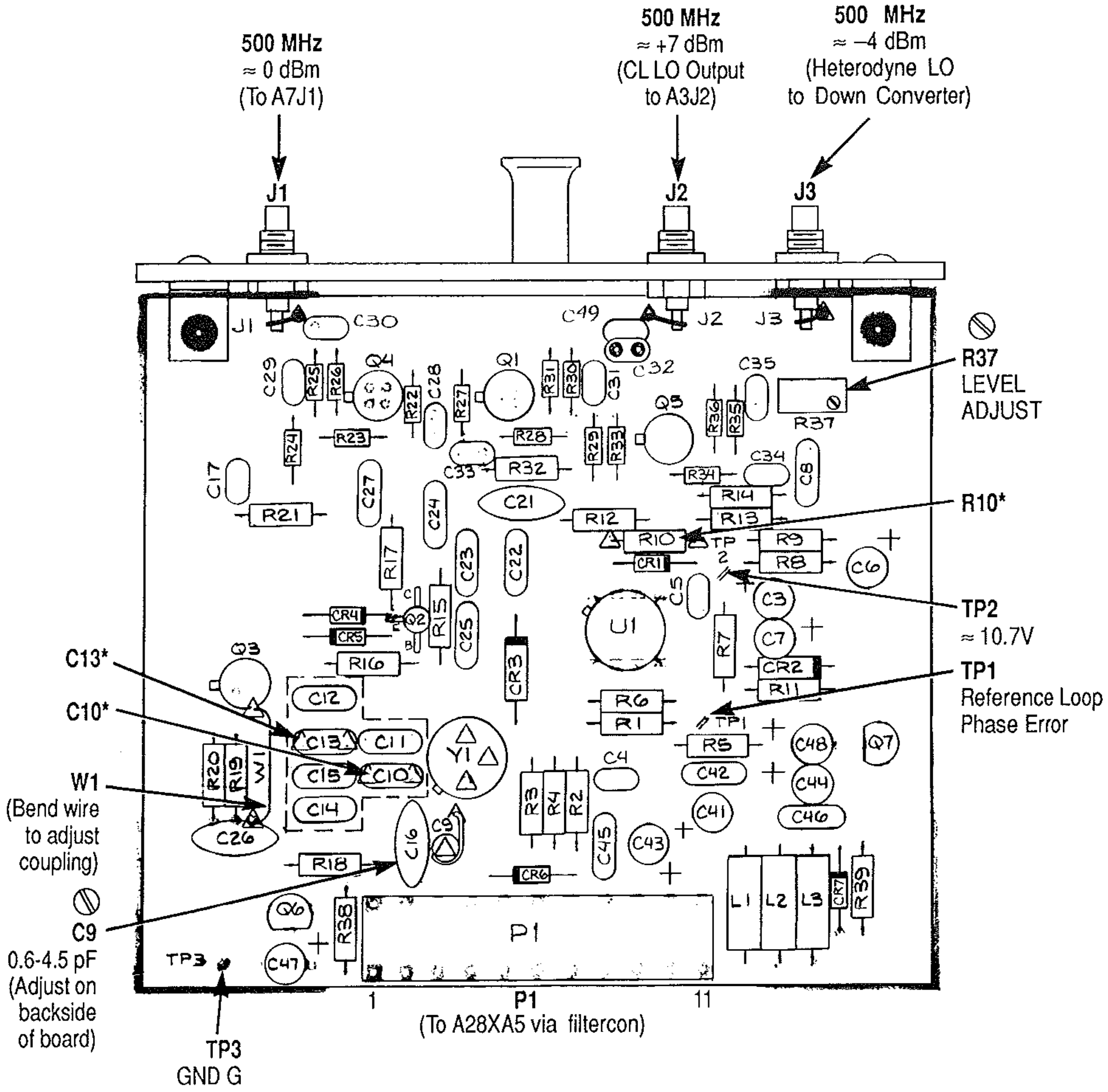


Figure 6G-1.
Reference Loop Block Diagram



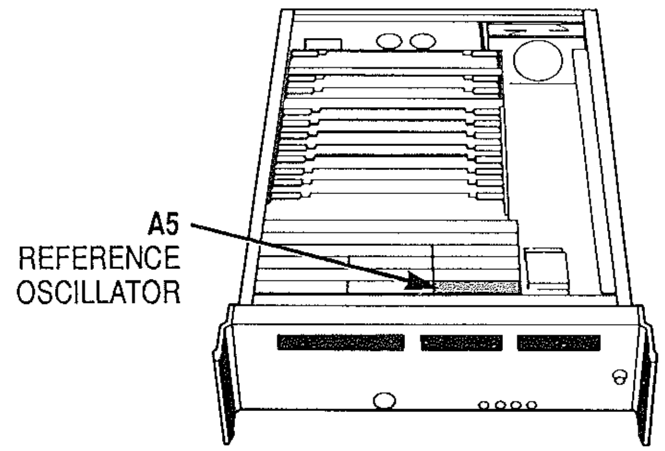
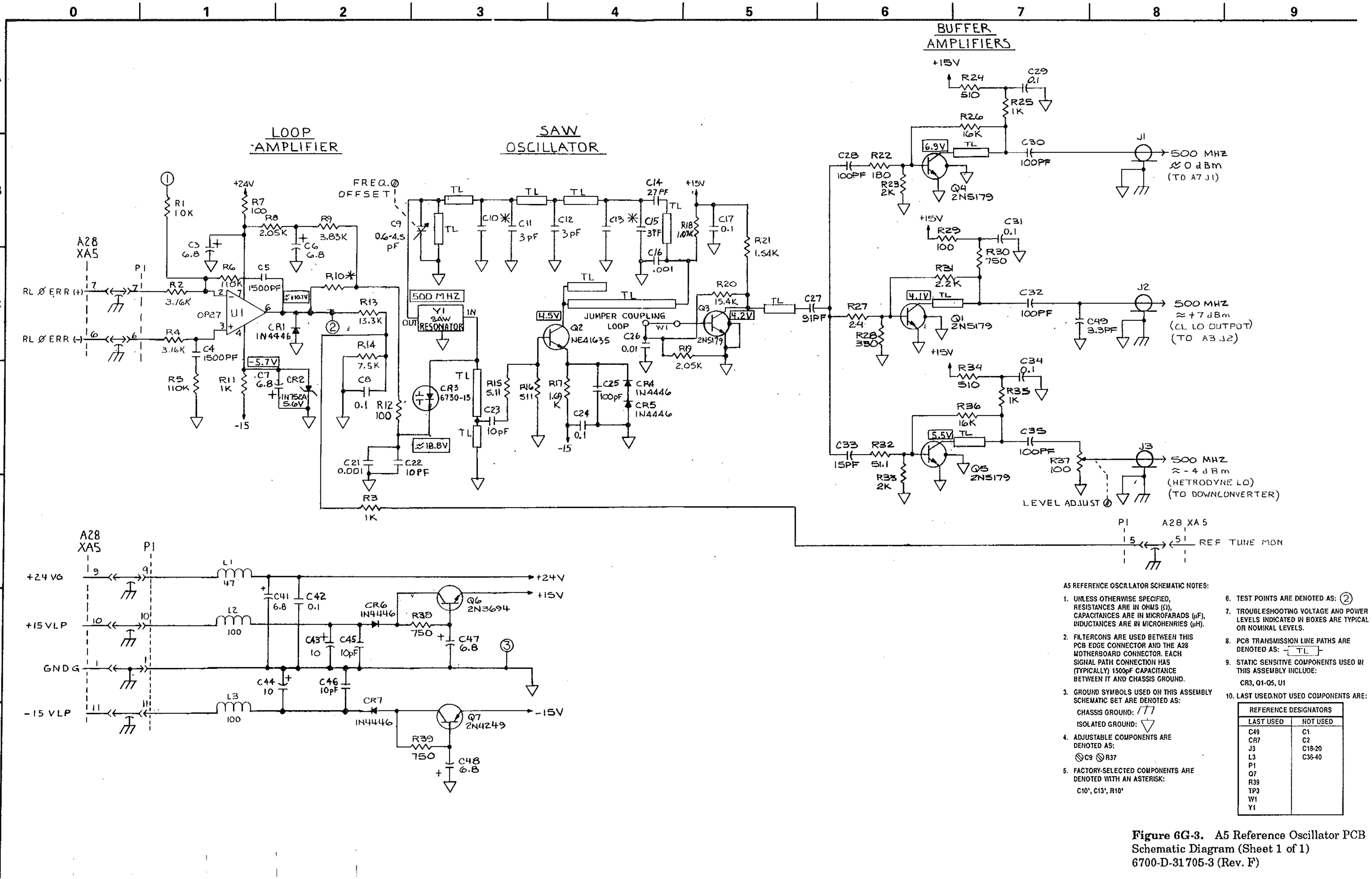


Figure 6G-2. A5 Reference Oscillator PCB Parts Locater Diagram
6700-D-31705-3 (Rev. F)

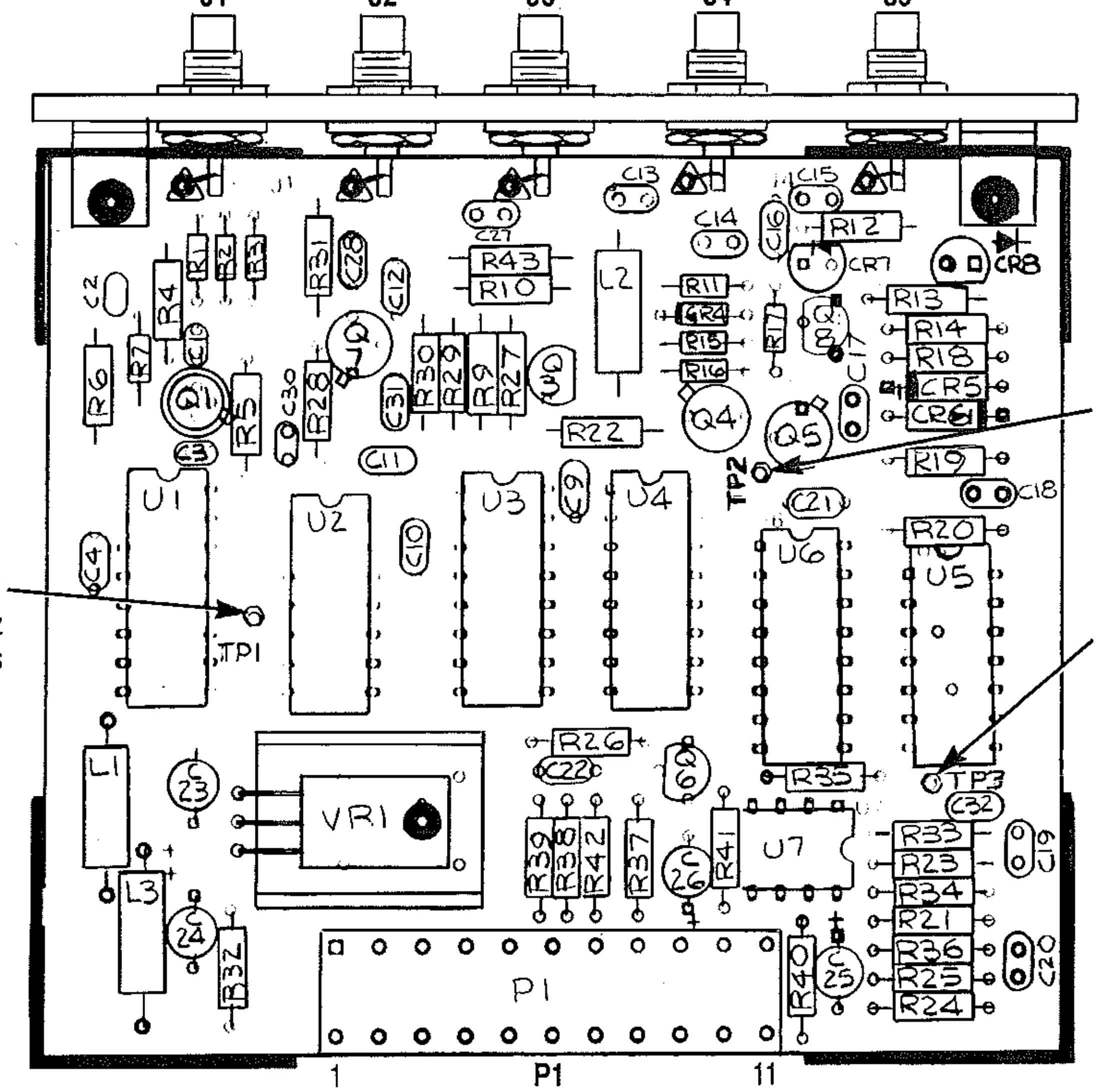


A5 REFERENCE OSCILLATOR SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. FILTERCONS ARE USED BETWEEN THIS PCB EDGE CONNECTOR AND THE A28 MOTHERBOARD CONNECTOR. EACH SIGNAL PATH CONNECTION HAS (TYPICALLY) 1500pF CAPACITANCE BETWEEN IT AND CHASSIS GROUND.
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUND:
4. ADJUSTABLE COMPONENTS ARE DENOTED AS:
   C9 R37
5. FACTORY-SELECTED COMPONENTS ARE DENOTED WITH AN ASTERISK:
   C10*, C13*, R10*
6. TEST POINTS ARE DENOTED AS: (2)
7. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
8. PCB TRANSMISSION LINE PATHS ARE DENOTED AS: TL
9. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   CR3, Q1-Q5, U1
10. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C49	C1
CR7	C2
J3	C18-20
L3	C36-40
P1	
Q7	
R39	
TP3	
W1	
Y1	

Figure 6G-3. A5 Reference Oscillator PCB Schematic Diagram (Sheet 1 of 1)
6700-D-31705-3 (Rev. F)



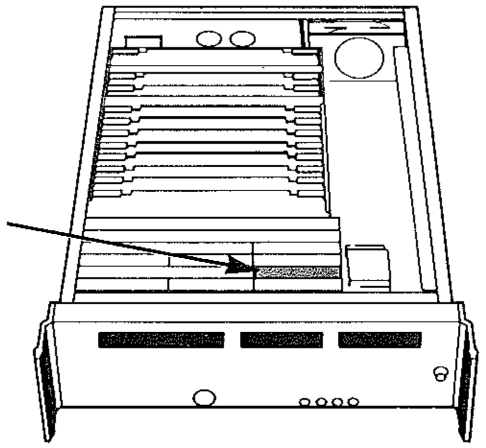
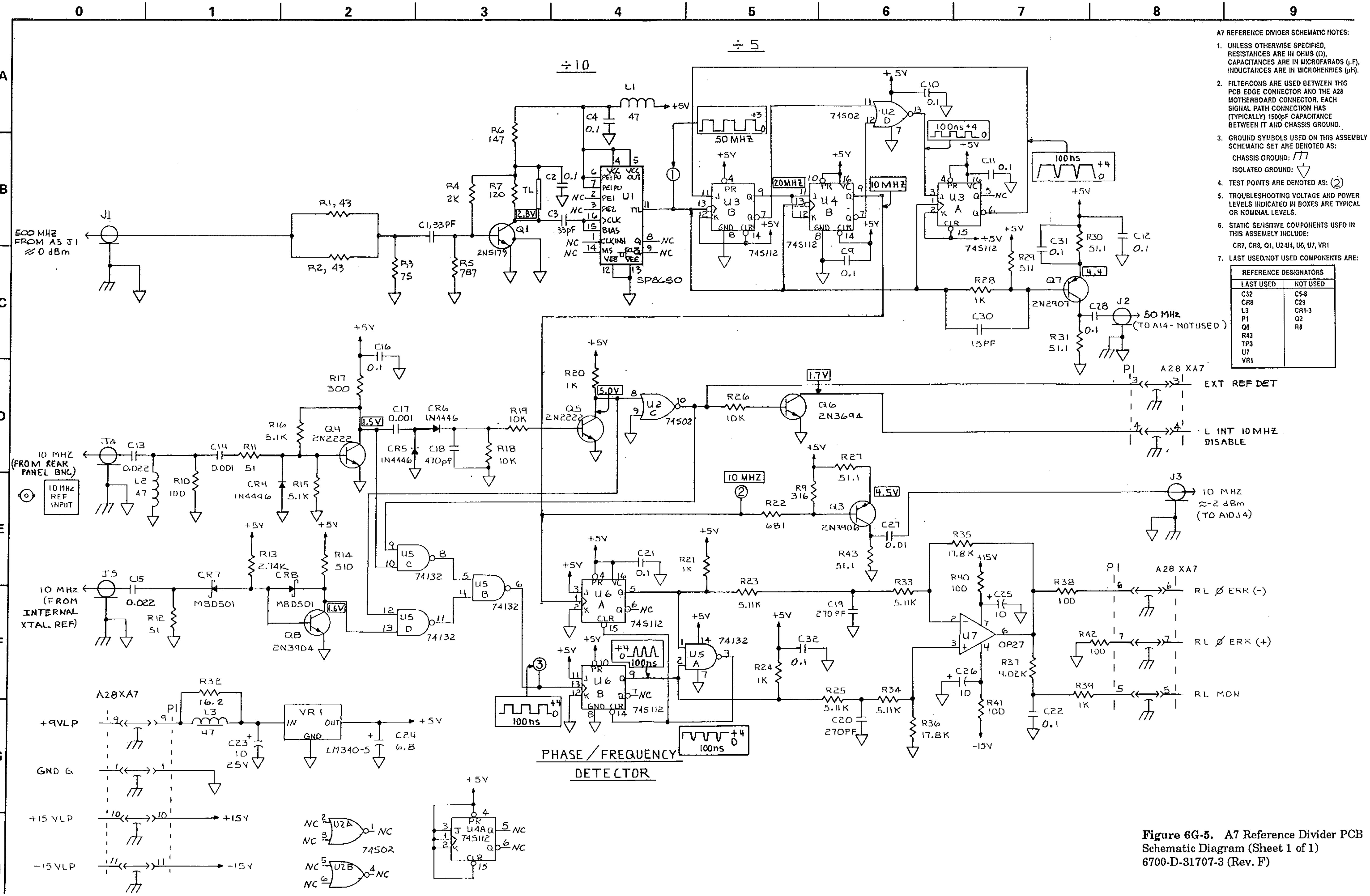


Figure 6G-4. A7 Reference Divider PCB Parts Locater Diagram
6700-D-31707-3 (Rev. E)

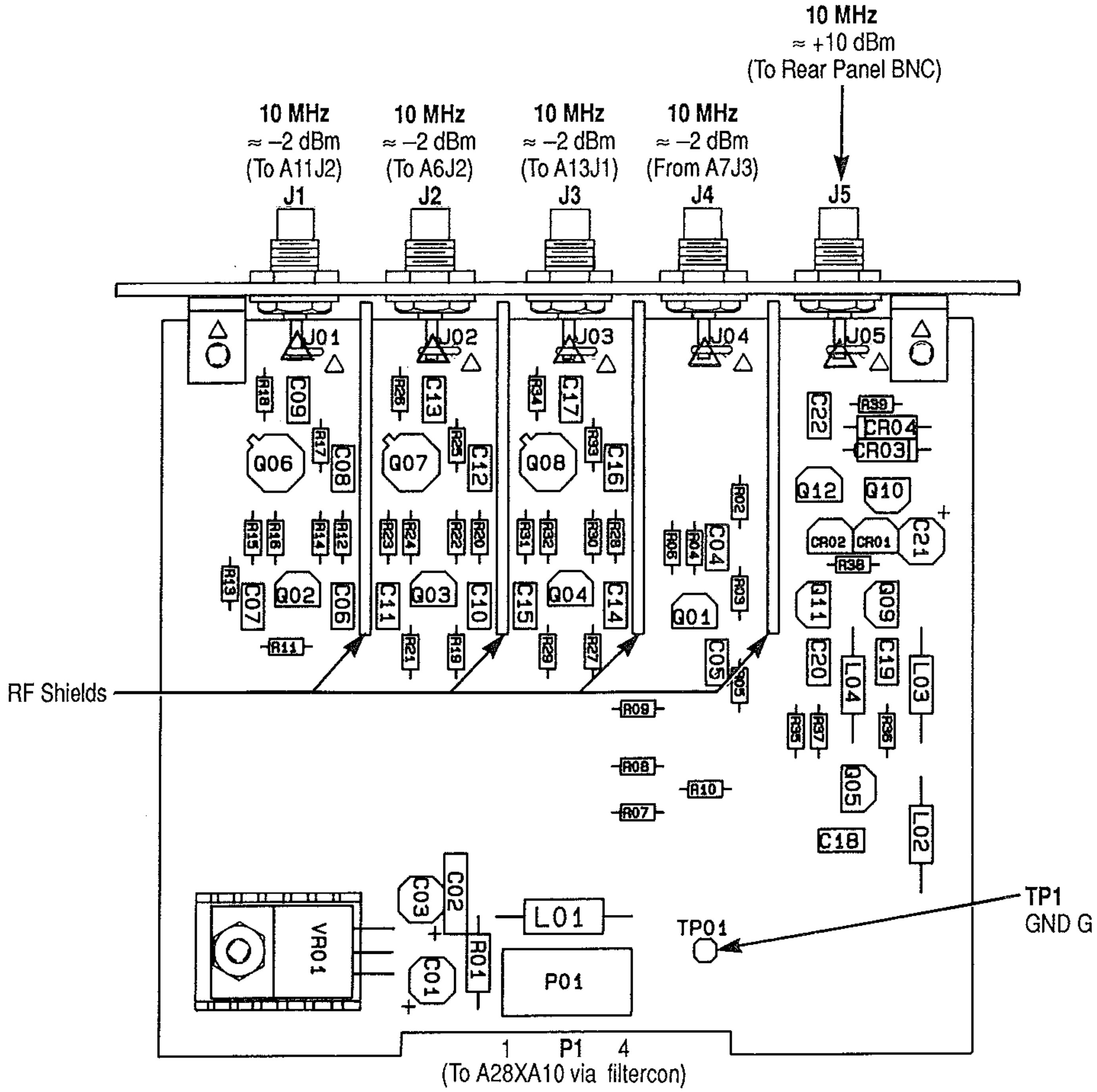


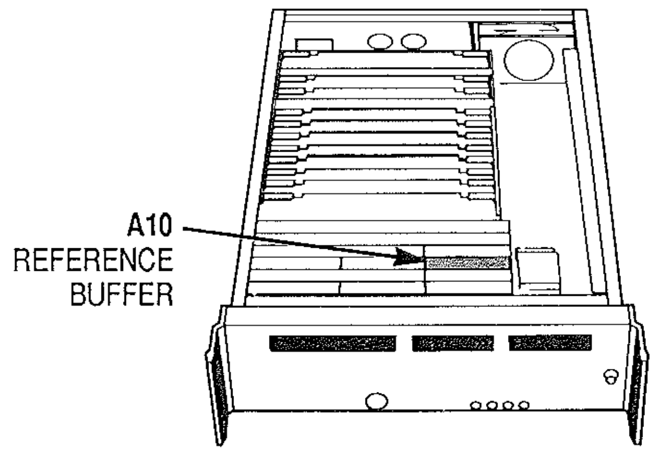
A7 REFERENCE DIVIDER SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. FILTERCONS ARE USED BETWEEN THIS PCB EDGE CONNECTOR AND THE A28 MOTHERBOARD CONNECTOR. EACH SIGNAL PATH CONNECTION HAS (TYPICALLY) 1500pF CAPACITANCE BETWEEN IT AND CHASSIS GROUND.
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUND:
4. TEST POINTS ARE DENOTED AS: (2)
5. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
6. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   CR7, CR8, Q1, U2-U4, U6, U7, VR1
7. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C32	C5-8
CR8	C29
L3	CR1-3
P1	Q2
Q8	R8
R43	
TP3	
U7	
VR1	

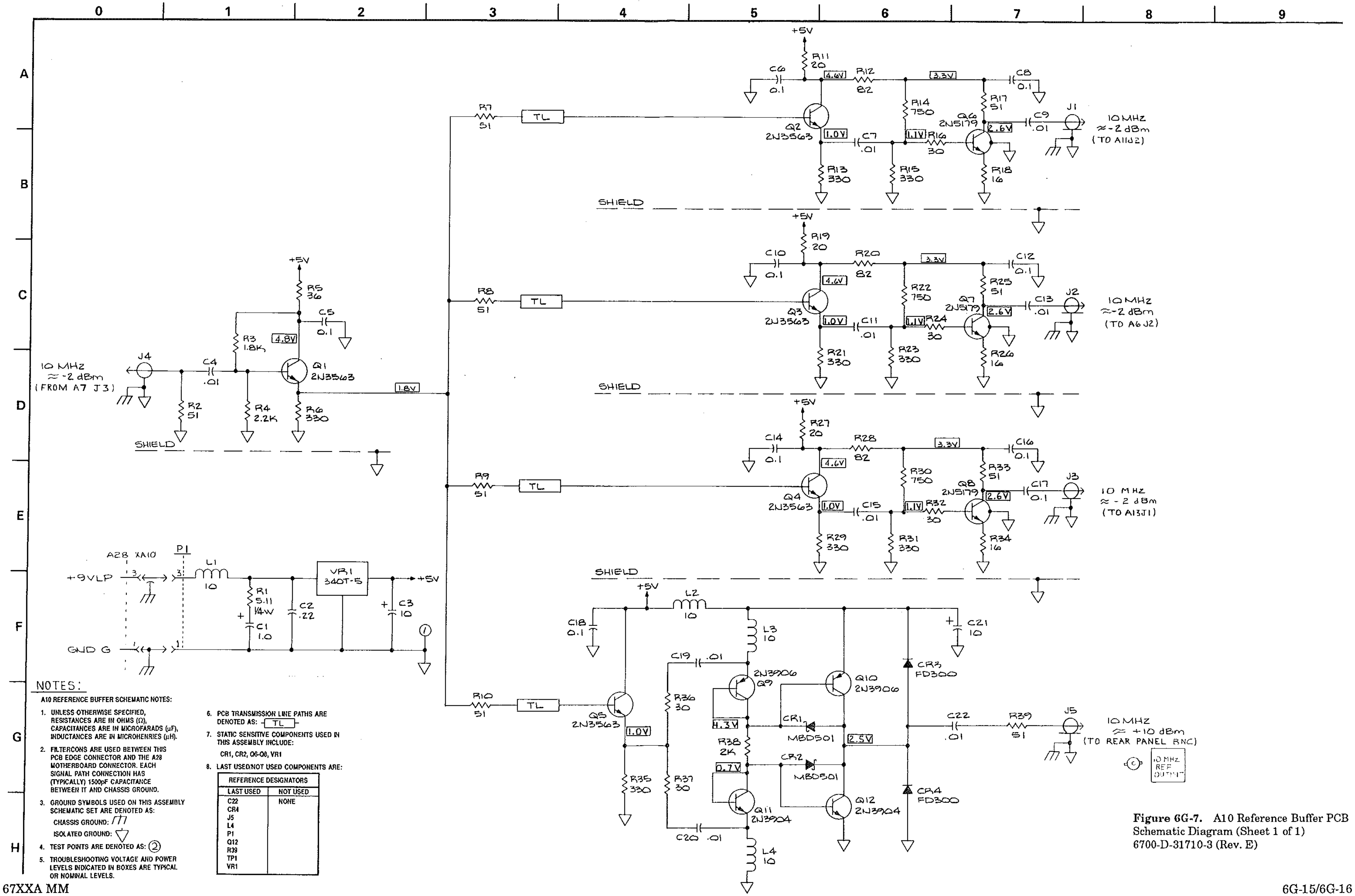
Figure 6G-5. A7 Reference Divider PCB Schematic Diagram (Sheet 1 of 1)
6700-D-31707-3 (Rev. F)





NOTE:
Leading zeros on component number references may be disregarded.

Figure 6G-6. A10 Reference Buffer PCB Parts Locater Diagram
6700-D-31710-3 (Rev. D)



NOTES:

A10 REFERENCE BUFFER SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (µF), INDUCTANCES ARE IN MICROHENRIES (µH).
2. FILTERCONS ARE USED BETWEEN THIS PCB EDGE CONNECTOR AND THE A28 MOTHERBOARD CONNECTOR. EACH SIGNAL PATH CONNECTION HAS (TYPICALLY) 1500pF CAPACITANCE BETWEEN IT AND CHASSIS GROUND.
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUND:
4. TEST POINTS ARE DENOTED AS: (2)
5. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
6. PCB TRANSMISSION LINE PATHS ARE DENOTED AS: TL
7. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   CR1, CR2, Q6-Q8, VR1
8. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C22	NONE
CR4	
J5	
L4	
P1	
Q12	
R39	
TP1	
VR1	

Figure 6G-7. A10 Reference Buffer PCB Schematic Diagram (Sheet 1 of 1)
6700-D-31710-3 (Rev. E)

6H – COARSE LOOP A3, A4, and A6 PCBs

6H-1 COARSE LOOP ASSEMBLIES: A3, A4, and A6 PCBs

This section contains service information for the coarse loop assemblies listed in Table 6H-1 below. Refer also to the general reference information in sections 6A, 6B, and 6C.

Table 6H-1. Coarse Loop Service Information

Documentation	Reference	Page
OVERALL ASSEMBLY LEVEL		
Overall Description	Para. 6H-2	6H-1
Block Diagram	Fig. 6H-6	6H-11
Troubleshooting	Tbl. 6H-2	6H-7
PCB LEVEL		
A3 Coarse Loop Mixer PCB		
Detailed Circuit Description	Para. 6H-3	6H-2
Troubleshooting	Tbl. 6H-2	6H-7
Schematic (Sheet 1 of 1)	Fig. 6H-8	6H-13
Parts Locater Diagram	Fig. 6H-7	6H-12
A4 Coarse Loop Oscillator		
Detailed Circuit Description	Para. 6H-4	6H-2
Troubleshooting	Tbl. 6H-2	6H-7
Schematic (Sheet 1 of 1)	Fig. 6H-10	6H-15
Parts Locater Diagram	Fig. 6H-9	6H-14
A6 Coarse Loop Divider PCB		
Detailed Circuit Description	Para. 6H-5	6H-3
Troubleshooting	Tbl. 6H-2	6H-7
Schematic (Sheet 1 of 2)	Fig. 6H-12	6H-17
(Sheet 2 of 2)	"	6H-19
Parts Locater Diagram	Fig. 6H-11	6H-16,18

6H-2 COARSE LOOP ASSEMBLIES, OVERALL DESCRIPTION

Refer to the block diagram in Figure 6H-6 for the following discussion.

The Coarse Loop is comprised of the A3 Coarse Loop Mixer PCB, the A4 Coarse Loop Oscillator PCB, and the A6 Coarse Loop Divider PCB.

The primary function of the Coarse Loop is to provide the coarse tuning frequency for the YIG oscillators. The A4 Coarse Loop Oscillator PCB has a voltage-controlled oscillator (VCO) using a varactor diode to generate an outpout frequency of 396-440 MHz. The oscillator output is buffered then delivered to the A3 Coarse Loop Mixer PCB. The oscillator signal is mixed with a fixed 500 MHz reference signal from the A5 Reference Oscillator PCB to generate a resulting intermediate frequency (IF). This 60-104 MHz IF signal passes through a 120 MHz low pass filter, then goes to a limiter/amplifier that prevents amplitude modulated noise from being translated to frequency modulated phase noise errors in the following A5 PCB phase/frequency detector circuit.

The amplified and limited IF signal is now divided by a series of circuits – first integer dividers, then fractional division circuits. The integer divider circuits provide 2 MHz frequency steps of the A4 VCO. The A6 phase/frequency detector compares these steps to a 2 MHz reference signal that is derived from a 10 MHz Reference Loop output signal (previously divided by 5 on the Reference loop's A10 Reference Buffer PCB). The phase/frequency output signal is used to tune the A4 PCB's VCO.

At high YIG oscillator frequencies, steps finer than 2 MHz are needed. The A6 fractional divide circuits provide this capability under control of serial data input from the A8 Serial I/O PCB (which is controlled by the A23 Microprocessor from information derived by the DVM circuits on the A17 Analog Instruction PCB.

6H-3 A3 COARSE LOOP MIXER, DETAILED CIRCUIT DESCRIPTION

Refer to the A3 PCB schematic in Figure 6H-8 for the following discussion.

6H-3.1 Local Oscillator (LO) Input

The 500 MHz LO input to A3J2 comes from A5J2 on the A5 Reference Oscillator PCB at a level of +7 dBm. It goes to a 6 dB attenuator consisting of R11, R12, and R13. From the attenuator, the +1 dBm signal goes to the Q2 amplifier where it is amplified to +7 dBm again. This attenuation and amplification isolates the signal, thus preventing it from reflecting back into the A5 Reference Oscillator PCB and causing spurious responses.

R14 and R15 biases Q2 for a collector current of 11 mA. C9 couples the signal from the collector of Q2 to the U1 double balanced mixer.

6H-3.2 RF Input

The 396-440 MHz coarse loop signal comes from A4J2 and goes to A3J3. R1, R2, and R3 attenuate the signal by 20 dB. This provides isolation, preventing the 500 MHz reference oscillator signal and the IF from the mixer from reflecting into the coarse loop oscillator.

The –20 dBm signal on the base of Q1 is amplified by 9 dB, thereby providing a –11 dBm signal level at its output. This signal goes to a 6 dB attenuator consisting of R9 and R10. R4 and R5 bias Q1 for a collector current of 5 mA. The –17 dBm signal then goes to the U1 mixer where it mixes with the 500 MHz LO signal. The resulting IF signal is approximately –26 dBm at this point and covers a frequency range of 60 to 104 MHz.

6H-3.3 Limiter/Amplifier

From the mixer, the IF signal goes to a five-element low pass filter consisting of L2, L3, C10, C11, and C12. R18 provides the proper termination for the mixer and low pass filter. At this point, the IF signal is approximately –29 dBm. C13 couples this signal to Q3, providing a gain of approximately 23 dB. R19 and R20 bias Q3 for a collector current of 5 mA. C15 couples the IF signal to Q4 and Q5 which are arranged as an ac-coupled (by C16) differential amplifier. When not limiting, Q4 and Q5 have a gain of about 12 dB. With a –6 dBm input signal, Q4 and Q5 have a gain of about 6 dB. This limiting prevents any AM on the IF signal from showing up as FM in the phase detector. This would degrade the phase noise performance of the oscillator.

R23 and R24 bias Q4 to yield a collector current of about 3.6 mA and R29 and R30 bias Q5 for a collector current of about 3.6 mA. When the signal on the base of Q4 increases beyond a certain point, the maximum current of Q5 will no longer allow amplification. As the input to Q4 increases, the output of Q5 remains constant. The output of Q5 goes to the Q6 emitter follower which has a nominal 8 mA collector current. From there, the signal goes to A6J1 on the A6 Coarse Loop Divider PCB. R34 provides the 50 Ohm source match of the output, and C21 blocks the dc component on the Q6 emitter from being applied to the A6 PCB.

6H-4 A4 COARSE LOOP OSCILLATOR, DETAILED CIRCUIT DESCRIPTION

Refer to the A4 PCB schematic in Figure 6H-10 for the following discussion.

6H-4.1 Input Amplifier

The phase detector error signal, from the A11 Coarse Loop Divider PCB, goes to P1-7 and then to U1A, a unity gain differential receiver. From U1A, it goes to a four-element low pass filter consisting of L10, C25, L11, and C27. This low pass filter reduces the 2 MHz power level of the error signal to bring the 2 MHz sidebands on the VCO output within acceptable limits. In order to keep the sidebands off the final RF output, they must be at least –109 dBc. The filter also reduces the 600 kHz, 800 kHz, and 1 MHz fractional division sidebands to –41 dBc, –28 dBc, and –89 dBc, respectively.

6H-4.2 Loop Amplifier

From the low pass filter, the signal goes to U1B, the loop amplifier. R26 and C21 set the loop response to approximately 25 kHz. As the oscillator tunes to a lower frequency, its output frequency versus its input voltage (on the varactor tuning diodes) increases, causing a change in loop gain. When the tuning voltage goes negative (approximately –0.6V) at the output of U1B, CR5 starts conducting and puts R27 and C29 in parallel with R26 and C21. This reduces the loop bandwidth to compensate for the increased gain caused by the increased tuning sensitivity of the VCO. The increased sensitivity results from the nonlinearity of the CR1 and CR2 varactor diodes. The voltage at which CR5 conducts is set by CR6, CR7, and R29. CR6 provides temperature compensation for CR7.

The output of the loop amplifier goes to the CR1 and CR2 varactor tuning diodes through R10 and C14 filter network. It also goes to a voltage divider consisting of R22 and R24. The voltage, filtered by C28, and the current, limited by R23, go to the DVM circuits on the A17 Analog Instruction PCB where they are then monitored by the A23 Microprocessor.

NOTE

Pressing SHIFT, TRIGGER, O 1 2 displays the voltage on the front panel LEVEL display for troubleshooting and calibration.

The parallel configuration of CR1 and CR2 forms a series resonant tank circuit with the resonator transmission line. C8 and C9 prevent the dc tuning voltage from being applied to the transmission line. L4 and L5 decouple any RF signal present on the tuning diodes from the tuning voltages. Since the output range of U1B can go from approximately +13V to −13V, the tuning diodes are biased with a reference voltage of −15V to prevent them from being forward biased; R9 supplies this voltage, and C10 and C11 filter it. This allows a voltage swing on the varactor diodes of approximately 26V, thereby enabling the Q3 oscillator to be tuned throughout its 396-440 MHz frequency range.

6H-4.3 Oscillator

Q3, a modified Hartley oscillator, couples its feedback from the transmission line to its base via a jumper coupling loop. R15 and R8 furnish collector voltage while R12 and R14 set collector current. C18, C20, C22, and C23 provide decoupling to prevent any RF signal from going into the power supplies. C19 has a fine frequency adjustment to center its range in the center of the varactor diodes' range.

6H-4.4 Buffer Amplifiers

Q1, a buffer amplifier, couples the RF from the resonant transmission line to the base via a coupling loop. R1 and R2 set the collector current. C1 decouples the RF feedback through R2. The RF from the collector of Q1 is coupled through a matching network (C7, R13) to A4J1. Then it goes to the A31 Power Amplifier/Multiplier (on the microwave deck).

The Q2 amplifier is the same as the Q1 amplifier except that it couples the RF capacitively instead of inductively. Its output also goes to a matching network consisting of the printed circuit transmission line (C12). The output from J2 goes to the A3 Coarse Loop Mixer PCB where it mixes with the 500 MHz output from the A5 Reference Oscillator PCB.

6H-5 A6 COARSE LOOP DIVIDER, DETAILED CIRCUIT DESCRIPTION

Refer to the A6 PCB schematic in Figure 6H-12 for the following discussion.

6H-5.1 10 MHz Reference Input

On sheet 2 of the A6 PCB schematic, A6J2 receives a 10 MHz reference signal input at a level of approximately −2 Bm from A10J2. The signal goes to termination resistor R68 and then to the emitter of Q2. Q2 is configured as a temperature-compensating diode for Q3. Q3 amplifies the signal to TTL levels and applies it to U16, a divider. CR6 improves the 10 MHz input signal rise time by preventing Q3 from becoming saturated. U16 is a presetable decade/bi-quinary counter that is configured as a divide-by-5. The output of U16 is a 2 MHz TTL-level signal that goes to the U17 phase detector and serves as the reference frequency for the coarse loop divider.

6H-5.2 Coarse Loop Mixer Input

On sheet 1 of the A6 schematic, the −2 dBm, 60-104 MHz input signal to A6J1 (from A3J1) is terminated by R2. C12 couples the signal to Q1 which has a gain of approximately 2. R3 and R4 bias Q1 for a collector current of approximately 10 mA.

6H-5.3 Serial Input Control

The U2 and U6 shift registers control the fractional division control and the two counters. The clock signal from the A8 Serial I/O PCB is an approximately 400 kHz TTL-level signal with a poor rise time. U1 is a Schmitt trigger that improves the rise and fall times of the clock and data signals from the A8 Serial I/O PCB. The signals require two clock pulses per data bit to be transmitted into the shift registers. Since there are two shift registers in series, it requires 16 bits to load all of the counters and fractional division control. Therefore, the A23 Microprocessor requires 32 clock cycles each time it writes to the A6 Coarse Loop Divider PCB. U2 pin 2 receives the data and shifts it to U6.

Once the 32 clock cycles are complete, U2 and U6 outputs remain in a stable condition until the coarse loop divider is written to again. Each time the frequency of the coarse loop oscillator must be changed, the U2 and U6 shift registers receive new data to program its counters and fractional division control.

6H-5.4 Two-Modulus Prescaler

C14 couples the output of Q1 to U10, which is used as a divide-by-5 or divide-by-6, depending on the state of the control input signal on pin 9. R8 and C15 form a bias network that sets the threshold of the pin 15 input. The TTL-level output frequency of U10 goes from 12 MHz to 20.8 MHz in the divide-by-5 mode and 10 MHz to 17.33 MHz in the divide-by-6 mode. U8 pin 11 controls the signal to U10 pin 9. The U3 frame counter controls U5A via the carry output on U3 pin 15, U5B, and the U8 divide-by-6 counter. When the signal on U10-9 is high, U10 divides by 5; when it is low, U10 divides by 6.

NOTE

Early versions of the 67XXA utilized a pair of 4-input NAND gates on the Q outputs of U3 and U8; they were deleted in later models (A6 PCB Rev. F) and the pin 15 carry output of each is used instead.

6H-5.5 Frame Counter (Divide-by-5/6 Counter)

U3 is a synchronous 4-bit counter configured on pin 1 to count up; the up/down control is tied to +5V. It counts the number of input pulses from U10-7. When the outputs of U3 reach 1111, a carry is generated and the output of U3 pin 15 goes low. This sets the counter for a new count sequence. During the next clock cycle at U5-11, the low output of U3-15 transfers to the U5 flip flop output at pin 9. This output should always be a 2 MHz signal.

At the same time U3 loads for a count of 10, U8 loads for a count of 0. U8-11 goes low after loading. This low causes the input at U10-9 to go high resulting in a divide-by-5 from U10.

For example, at a 400 MHz A4 Coarse Loop Oscillator frequency, the signal at A6J1 is 100 MHz. In this example, U10 is dividing by 5 because the input at U10 pin 9 is low. The U3 counter is loaded for a count of 10 (see Figure 6H-1 for waveforms). After 10 cycles from U10, the counter loads again and counts another 10 cycles. Since U10 is dividing by 5

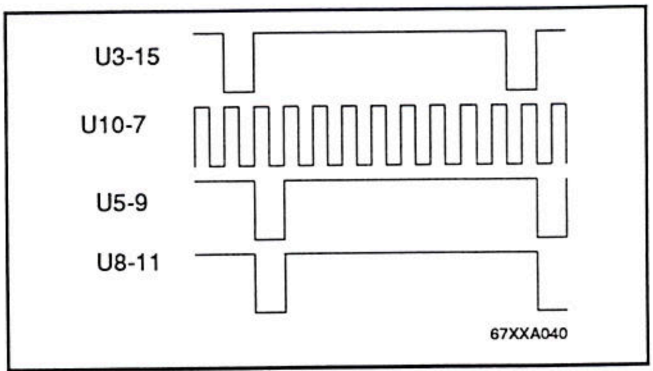


Figure 6H-1. Frame Counter Waveforms

and U3 is dividing by 10, the net division is 50. The signal at U5-9 is 2 MHz only when the input frequency to U10 is at the 100 MHz point in the range of 60-104 MHz input frequency variation. At this time, a 2 MHz resulting signal is available for phase locking the A4 Coarse Loop VCO.

6H-5.6 Divide-by-6 Counter

Figure 6H-2 shows the sequence of events for an A4 VCO frequency of 402 MHz. U8 is the same type counter as U3 and operates the same. The outputs from U8 go to U4 and, when they are all high, the output of U4 goes low. This presets the output at U5-9 to a high, causing U10 to divide-by-5. U10 divides by 5 for 5 cycles at U10-7 if U8 is loaded for a count of 4 at the same time that U3 is loaded for a count of 9, and will divide by 6 for 4 cycles. This means that the division ratio is 54 for 4/9ths of the time and 45 for 5/9ths of the time. This results in [(45 X 5) / 9 = 25] + [(54 X 4) / 9 = 24] = 49. A division ratio of 49 times the 2 MHz reference frequency at U5-9 results in an input frequency of 98 MHz. 500 MHz A5 Reference Oscillator PCB frequency minus the 402 MHz A4 PCB's VCO frequency gives a 98 MHz input frequency to U10.

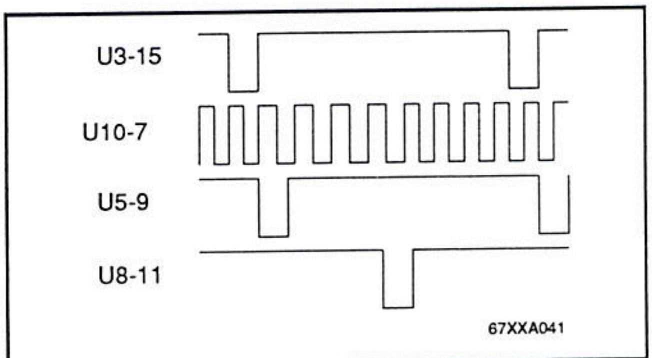


Figure 6H-2. Counter Waveforms (U6 Count = 4)

Figure 6H-3 is the same as Figure 6H-2 except the U8 counter is loaded for a count of 3 instead of 4. This results in [(45 X 6) / 9 = 30] + [(54 X 3) / 9 = 18] = 48. A division ratio of 48 times the 2 MHz reference frequency at U5-9 results in an input frequency to U10 of 96 MHz. 500 MHz A5 reference frequency minus the 404 MHz A4 PCB's VCO frequency results in 96 MHz at U10 input.

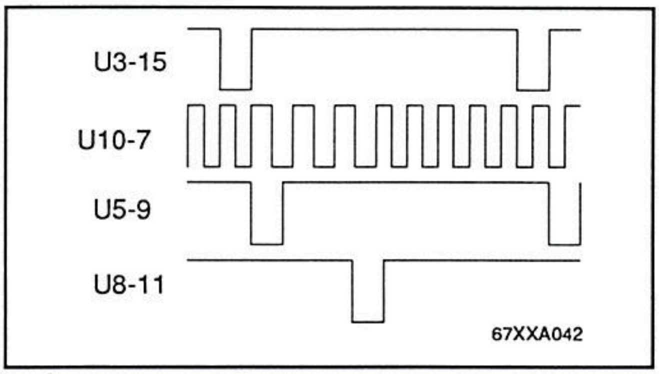


Figure 6H-3. Counter Waveforms (U6 Count = 3)

6H-5.7 Fractional Division Control

The integer division results in 2 MHz steps of the A4 Coarse Loop Oscillator. However, at higher RF output frequencies, 2 MHz steps are insufficient. At an RF output frequency of 18 GHz, the coarse loop frequency is multiplied by 41. This results in the next step of the coarse loop oscillator causing an 82 MHz frequency in the next comb line. Since these comb lines must have a minimum spacing of 20 MHz (Fine Loop Frequency divided by 10), the unit has a frequency gap. To solve this problem, fractional division is used to fill in the gaps. The fractional division results in a coarse loop resolution of 200 kHz. 200 MHz multiplied by 41 results in a 8.2 MHz step for the comb lines. This is well within the 20 to 32 MHz range of the fine loop.

U9 is an adder circuit that controls the U8 counter. When U6 latches the count on its outputs, they go from the input of U9 to the output of U9 and then to the input of U8 unmodified as long as U9-7 is high. When U9-7 goes low, the binary number represented by the outputs of U9 increases by 1. This decreases the count of U8 by 1 as U8 counts up until 1111 is on its outputs.

U7, another type of counter called a rate multiplier, controls the state of U9-7. U7 counts the number of 2 MHz pulses from U5-8. If U7 is programmed for 1 output for each 10 pulses in, every tenth pulse from U5-9 loads U8 for a count of 1 less for that cycle. This means U10 divides-by-5 10% more of the time, resulting in an overall frequency increase of 200 kHz. Using the frequency examples above in the integer division, dividing by 49 for 9 cycles and 48 for 1 cycle results in a division ratio of 48.9 [(49 X 9 + 48) / 10] = 48.9. This results in a frequency of 48.9 X 2 = 97.8 MHz. 500 MHz A5 Reference Oscillator frequency minus 402.2 MHz results in a 97.8 MHz input frequency to U10.

By loading different counts into U7, any 200 kHz step can be obtained between the integer division steps. The output at U7-5 goes low for every input count, however, it remains low only during the loading of U8 for the number of counts programmed into U7 (see Figure 6H-4).

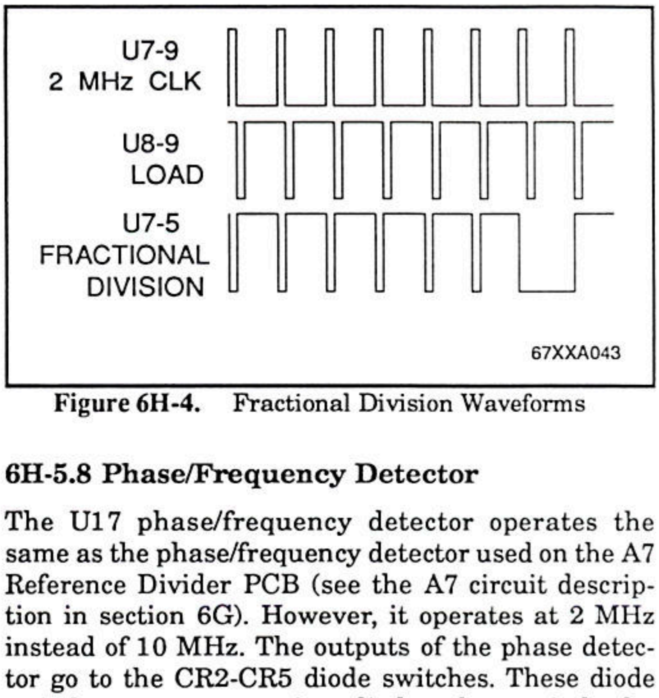


Figure 6H-4. Fractional Division Waveforms

6H-5.8 Phase/Frequency Detector

The U17 phase/frequency detector operates the same as the phase/frequency detector used on the A7 Reference Divider PCB (see the A7 circuit description in section 6G). However, it operates at 2 MHz instead of 10 MHz. The outputs of the phase detector go to the CR2-CR5 diode switches. These diode switches act as steering diodes that switch the decoupled +15V from R15 into the phase detector.

The R16-C24 and R17-C25 filters integrate the 2 MHz pulses into a dc voltage for application to U19. R18 and R19 provide the bias voltage to CR3 and CR5 for proper switching action.

When the outputs at U17-5 and U17-9 are low, CR2 and CR4 conduct and CR3 and CR5 shut off. When the output U17-5 (about 20 ns wide) and U17-9 (about 40 ns wide) go high, CR2 and CR4 will shut off and CR3 and CR5 conduct the current from R13 and R14 into the filter networks. This switching occurs at 2 MHz, (Coarse Loop reference frequency).

The charge on C24 and C25 sums with the current through R18 and R19 and goes to U19. The U19 output is the difference between the two inputs on pins 2 and 3. C26 and C29 provide additional filtering of the 2 MHz reference frequency.

At zero phase difference, the output sensitivity (output pulse width versus phase difference) of the D-type flip-flop phase detector decreases dramatically. When the phase detector operates in this region, this decrease drastically affects the loop gain and thereby, the loop bandwidth. This can cause loop instability and poor phase noise performance of the loop. This point of the phase detector is also called the dead zone or stupid zone.

To overcome this problem, an offset is provided which forces the phase detector to operate at an offset resulting in the two different pulse widths from U17-5 and U17-9. This offset for the coarse loop is approximately 5°. R18 and R19, in addition to providing a bias for CR3 and CR4 diodes, provide this offset by having different values.

If the inputs to U17 are the same frequency at 0 degrees offset, the output pulses from U17-5 and U17-9 are of equal width. Since the inputs to the integrating filters and thereby U17 would be the same, R18, being lower in value than R19, would cause the output of U19 to go slightly negative. However, in a closed loop operation, the loop amplifier on the A4 Coarse Loop Oscillator PCB forces the output of U19 to be 0V when phase locked. The U17-9 output would then have a wider pulse output to counteract the extra current from R18.

6H-5.9 Notch Filters

The phase information contained on the ouput of U19 goes to the notch filters before going to the loop amplifier on the A4 Coarse Loop Oscillator PCB. When the divider is set for fractional division, there is a 200 kHz component and its related harmonics on the output of U19. These 200 kHz components and related harmonics cause 200, 400, 600, and 800 kHz sidebands on the A4 Coarse Loop Oscillator output. The sidebands multiply, along with the Coarse Loop Oscillator signal, and show up on the final RF output. If the 200 kHz sideband is −40 dBc on the Coarse Loop Oscillator output, it results in −8 dBc sidebands on an 18 GHz RF Output signal, assuming there are no other losses in the system. The notch filter reduces these levels so they are typically better than −70 dBc on the final RF output. Notch filters are used since they have much less phase shift at the frequency outside of the notching action and allow a wider loop bandwidth. Active notch filters offer a very high rejection in a smaller size than could be realized with discrete components only.

The A6 Coarse Loop Divider PCB contains three notch filters; two each for 200 kHz and one each for 400 kHz since these are the predominant fraction division sidebands. The 400 kHz low pass filter, located on the A4 Coarse Loop Oscillator PCB, reduces the other harmonically related signals. Figure 6H-5 shows the waveform relationships for a notch filter at resonance.

The first waveform shown is the signal at the junction of R45 and C40, which is the input to the filter. At resonance, C38 and C39 in parallel have a reactance of about 332 Ohms, or about the same value as R47. C40 and C41 has a reactance of about 665 Ohms, or the value of R45 and R46.

The voltage at the junction of C40, R47, and C41 leads the input voltage by 45°. The voltage at the juction of R45, C38, C39 and R46 lags by 45°. The resulting current in R46, therefore, lags the input voltage by 45°. Since the current in C41 leads the voltage by 90°, the resulting current into the summing node at U20-5 leads the input voltage by 135°. This results in the two currents being cancelled, since they are 180° out of phase.

The current at the summing node changes phase and amplitude at either side of the resonance. This produces a voltage drop which is amplified by U20B, a unity gain buffer. The output of U20B also goes to U20A through resistive divider R50 and R51. U20A provides positive feedback to the twin-T filter network, causing a sharper notching action of the filter. Off resonance, the output of U20A is slightly less than the output of U20B. The output of U20A, which is in phase with the input of U20B, reduces the phase shift caused by C38, C39, and R32 by making the capacitor seem very small in value, and the resistor seem very large in value. The gain of U20A determines the sharpness of the filter. The gain of U20A is set so that, with the tolerance of the components in the twin-T network, the notch has sufficient rejection of the unwanted signal.

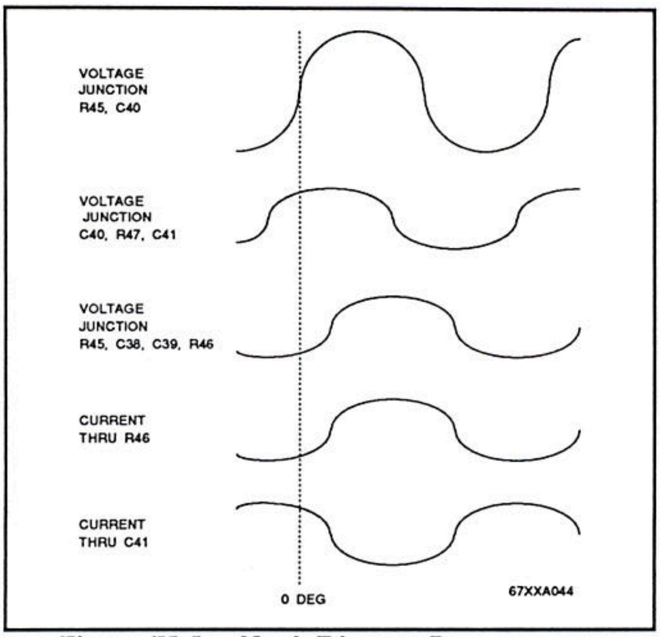


Figure 6H-5. Notch Filters at Resonance

U21 is a 400 kHz notch filter and U22 is an additional 200 kHz notch filter. R43 and R44 provide a monitor point for the A17 Analog Instruction DVM circuit. The A23 Microprocessor monitors this point via the DVM to determine if the Coarse Loop is phase locked or not. When the Coarse Loop is phase locked, the voltage at P1-5 stays very close to 0V.

6H-6 COARSE LOOP ASSEMBLIES, TROUBLESHOOTING

Troubleshooting procedures in Table 6H-2 cover the A3 Coarse Loop Mixer PCB, A4 Coarse Loop Oscillator PCB, and the A6 Coarse Loop Divider PCB.

6H-7 COARSE LOOP ASSEMBLIES, SERVICE SHEETS

Table 6H-1 on the first page of this section presents the arrangements of the block diagrams, schematics, and parts locater diagrams for the A3, A4 and A6 PCBs.

Table 6H-2. Coarse Loop Troubleshooting (1 of 4)

Trouble / Error Code	Troubleshooting Procedure
	A3 Coarse Loop Mixer PCB Troubleshooting
	Before troubleshooting any of the boards associated with the Coarse Loop (A3, A4, A6), ensure that the reference loop (A5, A7, and A10) is operating properly. Connect A3J2 to A5J2 on the Reference Oscillator. Connect a sweeper or synthesizer, in the frequency range of 350 to 440 MHz at 0 dBm output, to A3J3. Connect a spectrum analyzer to A3J1. While sweeping from 350 MHz (150 MHz IF) to 440 MHz (60 MHz IF), a signal of approximately 0 dBm should appear on the analyzer display. The limiter/amplifier is operating properly if only a few tenths of a dB change appears when the input power is increased or decreased by 3 dB from 0 dBm. By decreasing the input power to about –10 to –20 dBm, the output should decreas; this indicates that the limiter is no longer limiting. If, at 380 MHz (120 MHz IF), the J1 output decreases and at 350 MHz (150 MHz IF), the power drops by about 15 to 20 dB, the A3 PCB is operating properly. If the A3 is not operating properly, check the bias voltages on the transistors (shown on the schematic) with a DVM. A defective transistor or decoupling network can be localized very quickly this way. When a probe is used with a spectrum analyzer to trace a signal, the power level and frequency of an RF signal is easy to see. For the power level, however, it may be necessary to calibrate the probe with a known power level at the frequency of interest. Normally, in this frequency range, a high quality X1 oscilloscope probe can be used with the spectrum analyzer, however, either the probe or the spectrum analyzer must be AC coupled. The spectrum analyzer usually has the maximum allowable DC voltage input indicated on the front panel. A 500 pF capacitor can be added in series with the scope probe tip if the spectrum analyzer is not AC coupled. Keep the capacity leads as short as possible or use one of the capacitor leads as a probe tip. The voltages and power levels shown on the schematic are nominal power levels. The unit operates efficiently with the voltages varying approximately 5-10% and the power levels varying 2-3 dB. Normally, the power level variations are not on the A3 board itself, but are a result of circuit loading by the test setup or inaccuracies in the measurement equiment.

Table 6H-2. Coarse Loop Troubleshooting (2 of 4)

<table>
<tr><th>Trouble / Error Code</th><th>Troubleshooting Procedure</th></tr>
<tr><td></td><td>A4 Coarse Loop Oscillator Troubleshooting</td></tr>
<tr><td></td><td>
Measuring the phase noise of the A4 Coarse Loop Oscillator requires either a very sophisticated phase noise measurement system or a very sophisticated spectrum analyzer. The phase noise of the 67XXA at 10 GHz is specified at –70 dBc (1 kHz away from the carrier in a 1 Hz bandwidth). Since the phase noise of the coarse loop is multiplied along with the frequency, the coarse loop phase noise must be better than –98 dBc:
20 X Log(10,000/400) = 28 dB   –70 + –28 = –98 dBc)
For example, the Tektronics 494 spectrum analyzer has noise sidebands that are specified for –70dBc in a 100 Hz bandwidth. When resolved to a 1 Hz bandwidth, the sidebands equal –90 dBc. To measure the phase noise of the 494 at 400 MHz, connect it to the Coarse Loop Oscillator.
SHIFT, TRIGGER, 012 displays the frequency of the Coarse Loop Oscillator on the 67XXA FREQUENCY display, and the VCO tuning voltage on the LEVEL display. Adjusting the DECREASE/INCREASE keys increment the Coarse Loop frequency by as little as 200 kHz steps. The increment size can also be set. To measure the output at A4J2, connect A4J1 to A3J3. This allows the Coarse Loop to remain phase locked.
When observing the A4J1 or A4J2 signal on a spectrum analyzer, several sidebands appear. These sideband frequencies result from the reference frequency (2 MHz) of the phase detector and, at any frequency between the 2 MHz increments of the reference frequency, fractional division. These signals must be at certain maximum levels in order to not appear on the final RF output and to not cause locking problems. These frequencies are shown below with their maximum acceptable levels.

50 KHz –81 dBc (switching power supply)
100 KHz –69 dBc (switching power supply)
200 KHz –46 dBc (fractional division)
400 KHz –54 dBc (fractional division)
600 KHz –41 dBc (fractional division)
800 KHz –28 dBc (fractional division)
1 MHz –89 dBc (fractional division)
2 MHz –109 dBc (reference frequency)
4 MHz –109 dBc (reference frequency)

A decoupling network is defective on either the A3, A4, or A6 PCB if the 50 kHz and/or 100 kHz sidebands are out of spec. The A4 board is the most sensitive. Also, these sidebands must be measured with the boards installed in the casting. The 200 kHz or 400 kHz notch filters on the A6 PCB are defective if the 200 kHz or 400 kHz sidebands are out of spec (see A6 PCB troubleshooting). If any of the sidebands above 400 kHz are out of spec, either the phase detector integrator filters on the A6 board (2 MHz) or the low pass filter on the output of the loop amplifier (A4U1) is defective.
NOTE
Except for U1 and its associated components, or Q1 and Q2, do not try to replace any of the oscillator components associated with Q3. Use extra care in handling the board and do not bend the coupling loops or move any of the capacitors associated with the Q1, Q2, and Q3 circuits.
Q3 is difficult to replace. Even changing the amount of solder on its leads or overheating the transistor can degrade its performance to where it no longer operates. When replacing Q1 or Q2 make the leads as short as possible to reduce lead inductance. Replacing these transistors can be very difficult. It's easier to replace the board with an exchange board.
</td></tr>
</table>

Table 6H-2. Coarse Loop Troubleshooting (3 of 4)

Trouble / Error Code	Troubleshooting Procedure
	Normally, no adjustments are needed when replacing an A4 exchange PCB although C19 may need adjustment in some cases. Follow the procedure under the E4-13 error code.
E4-10	This error code test checks the A6 phase detector output voltage. If the A4 Coarse Loop Oscillator is locked, it then checks to see if calibration is required. If the A4 is not phase locked, the processor performs the E4-11 through E4-13 tests to further localize failure. The E4-10 error code indicates that the processor was not able to localize the failure mode by using the E4-11 through E4-13 code tests. This indicates a failure in either the A3, A4 or A6 PCB. To troubleshoot, perform E4-12 and E4-11 error code troubleshooting tests.
E4-11	The processor has determined that the Coarse Loop is not phase locked. It checks if the error voltage is negative. If it is negative, the most likely cause is a failure in the 10 MHz reference signal supplied by the A10 Reference Buffer PCB. • Connect a spectrum analyzer to A10J2. The spectrum analyzer should indicate a 10 MHz signal of approximately 0 dBm. If there is no 10 MHz signal, go to the A10 troubleshooting in section 6G. If there is a 10 MHz signal, reconnect A6J2 cable to A10J2. • Install the A6 board on an extender. Connect the J1 and J2 connectors to their appropriate destinations with extender cables. With an oscilloscope, check A6TP3 for 2 MHz TTL pulses. If there are no TTL pulses at A6TP3, the A6Q2, Q3, or U16 circuits are defective. If there are TTL pulses at A6TP3, go to A6 Coarse Loop Divider troubleshooting.
E4-12	The processor has determined the coarse loop is not phase locked. It checks if the error voltage is positive. If it is positive, the most likely cause is a failure in the 396-440 MHz output of the A4 Coarse loop Oscillator PCB or the A3 Coarse Loop Mixer PCB. Connect a spectrum analyzer to A4J1. The spectrum analyzer should display a signal at approximately 396 MHz or less at approximately –1 to –3 dBm. If not, go to the A4 Coarse Loop Oscillator troubleshooting. If the signal is present, connect the spectrum analyzer to A4J2 and connect the cable that was on A4J2 to A4J1. There should be a signal of approximately 396 MHz or less at –1 to –3 dBm. If this signal is present, go to the A3 Coarse Loop Mixer troubleshooting. If it is not present, go to the A4 Coarse Loop Oscillator troubleshooting.
E4-13	**CAUTION** The following calibration of the Coarse Loop Oscillator frequency should be under taken only when the E4-13 error code is displayed; it should not be performed as a routine calibration. Use caution in handling the board. If the coupling loops are moved, it will require factory recalibration. Install the A4 PCB on an extender board. Connect a frequency counter to A4J1. Remove the connection between A4J2 and A3J3. Adjust A4C19 for 442 ±1 MHz. Press SHIFT, TRIGGER, 012. Press 4, 4, 0, MHz. Reconnect A4J2 to A3J3. The level display should indicate approximately +11V. Note and record the reading. Remove A4 from the extender, and reinstall A4. Note the LEVEL display indication. Subtract this reading from the ≈11V reading noted above. Reinstall A4 on the extender board. Adjust C9 until the LEVEL display indicates the first recorded reading plus the difference between the first and second reading ±0.02V. *Example:* Assume the first reading is 11.00V and that the second reading is 11.10V. You would adjust C9 for 10.90V ±0.02V [11.00 – 11.10 = –0.1; 11.00 + (–0.1) = 10.90V ±0.02V]. Install the A4 PCB in the RF casting without the extender. The level display should remain at the first recorded indication ±0.05V.

Table 6H-2. Coarse Loop Troubleshooting (4 of 4)

Trouble / Error Code	Troubleshooting Procedure
	A6 Coarse Loop Divider PCB Troubleshooting
10 MHz Input Circuit	If the collector of Q3 does not have a 10 MHz TTL signal, either Q2 or Q3 is defective. The output of U16-12 is a 2 MHz pulse. If not, and there is an input on U16-6, U16 is defective.
CL IF Input	The collector of Q1 has about +3.7 VDC on it. Without an oscilloscope of sufficient bandwidth, the 10-104 MHz input is difficult to see. The RF there is approximately 1 to 2 Vp-p. The output from U10 is the input signal divided by 5 or 6, depending on the state of U10-9. Use SHIFT, TRIGGER, 012 to set the frequency of the dividers. A convenient frequency to set the dividers to is 400 MHz. This provides divide-by-5 action and a 20 MHz output, which can be seen with most oscilloscopes. You can also apply a 100 MHz, 0 dBm signal from an external source to A6J1 to provide a known signal in case the Coarse Loop Oscillator is not operating properly. Using an external signal source as mentioned above, you can step the divider to various frequencies and observe the waveforms as shown in Figures 6H-1 through 6H-5. As an example, if you suspect U9 is operating improperly, note the output on U9 pins 1, 13, 4, and 10. Grounding U9 pin 7 shifts the binary count by one. U7 pin 5 has an output for each input except when fractional division is not being used. Some of these pulses are wider than others, depending on the count programmed into U7.
Phase Detector	Without the 2 MHz clock on U17 pin 13, U17 pin 5 is always high and U17 pin 9 is always low. If the clock on U17 pin 1 is missing, the reverse is true. An external synthesizer can be used when the external reference is connected to the 67XXA EXT 10 MHz INPUT and the output is connected to A6J1. Pulses from U17 pin 5 and U17 pin 9 appear when the Coarse Loop is programmed for 400 MHz and a 100 MHz, 0dBm output comes from the external synthesizer. The width of these pulses depends on the phase relationship of the external synthesizer to the 67XXA time base. Some synthesizers have an adjustable phase allowing the pulse widths of U17 to be changed. The minimum pulse width is approximately 20 ns. The output of U19 pin 6 is monitored by adjusting the phase of the external source. At exactly 0 degrees phase difference, the output of U19 is slightly negative. To check this, lift U17 pin 1 from the PCB and connect it to TP3. This provides 20 ns pulses from U17 pins 9 and 5, and a slight negative voltage at U19 pin 6. The switching of the CR2 and CR5 diodes can be checked this way also. Another way to check U19 is to jumper TP4 to the juction of CR5, C25, and R17. U19 pin 6 again has a slight negative output voltage of approximately 400 mV.
Notch Filters	A defective notch filter appears as 200 or 400 kHz sidebands on the A4 Coarse Loop Oscillator. To check the notch filters, use SHIFT, TRIGGER, 012 to set the Coarse Loop Oscillator to 400 MHz (no fractional division, integer division only) and apply an external oscillator through a 10 KOhm resistor into U19 pin 2. To see where the notches peak, adjust the oscillator approximately by 200 kHz or 400 kHz and observe the outputs of the filter with an oscilloscope. If they do not peak with a few kHz of their intended frequency, then one of the capacitors or resistors in the twin-T network has probably changed value. At the notch frequency, the output of the positive feedband amplifiers (U20A, U21A, and U22A) is 0 VAC. The DC output on the B amplifiers is the same as the output of U19 pin 6. The output of the A amplifiers is less.

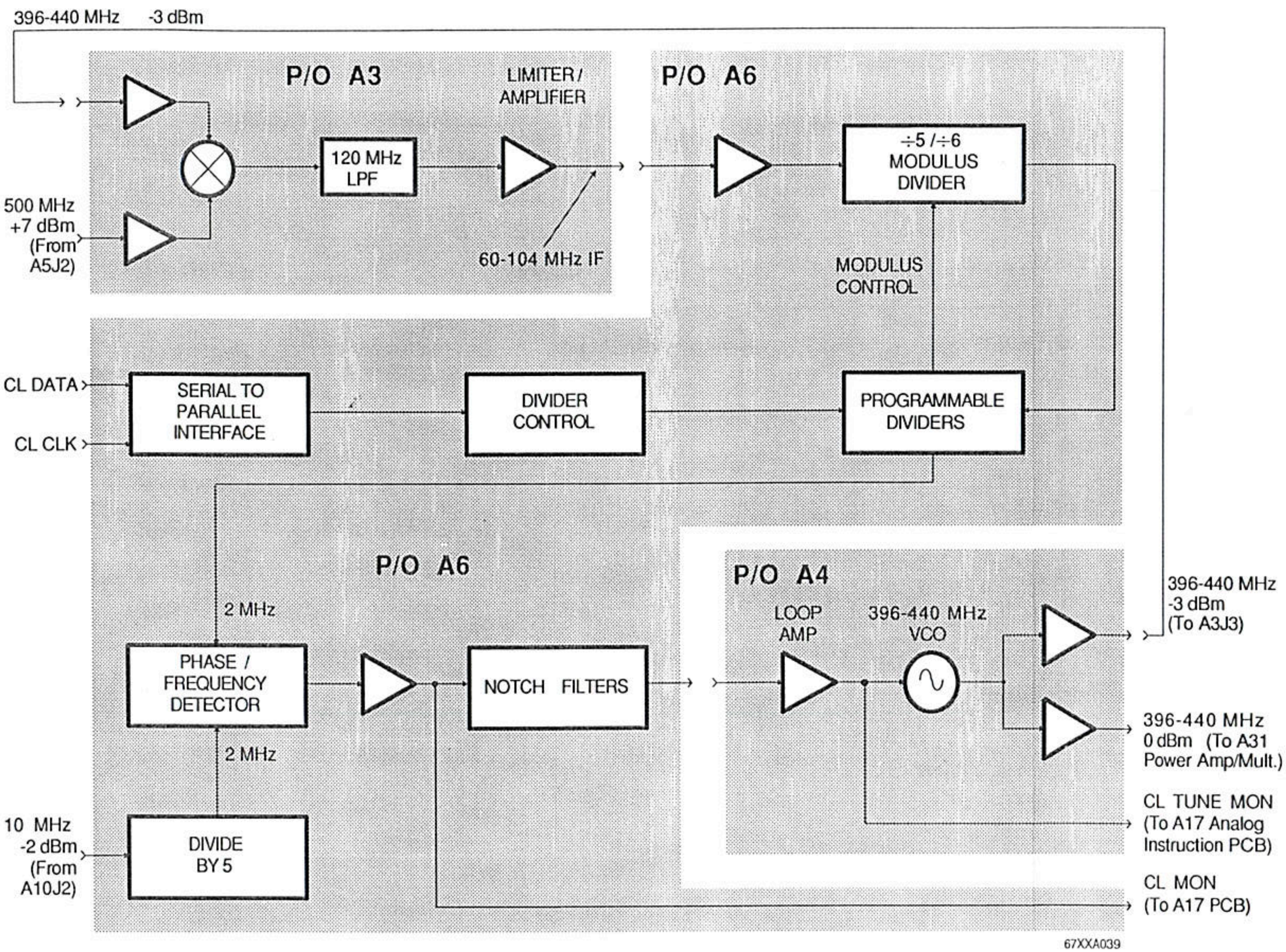
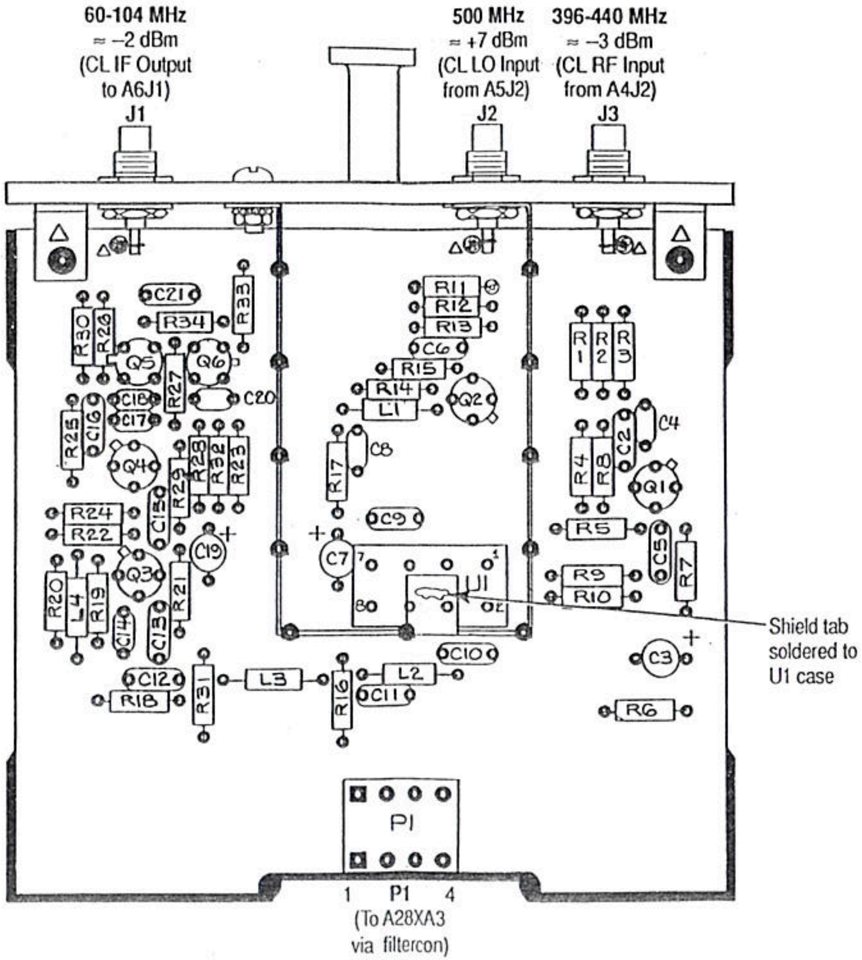


Figure 6H-6. Coarse Loop Block Diagram



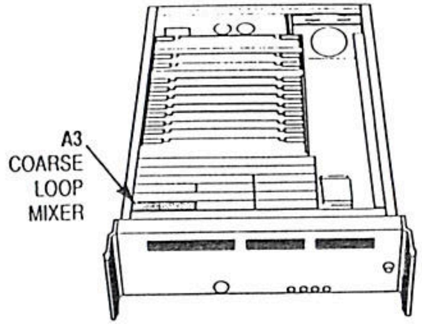
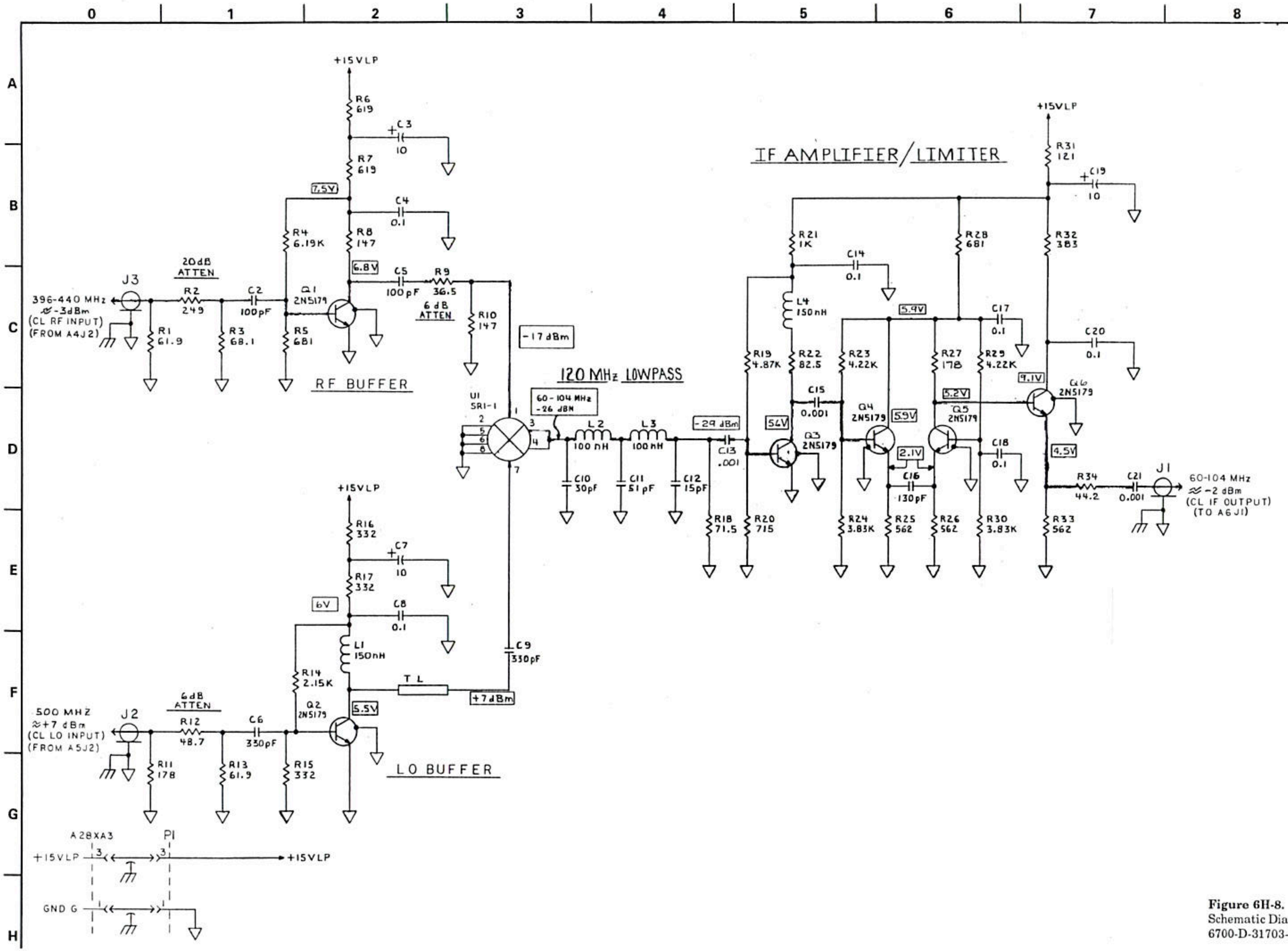


Figure 6H-7. A3 Coarse Loop Mixer PCB Parts Locater Diagram
6700-D-31703-3 (Rev. C)

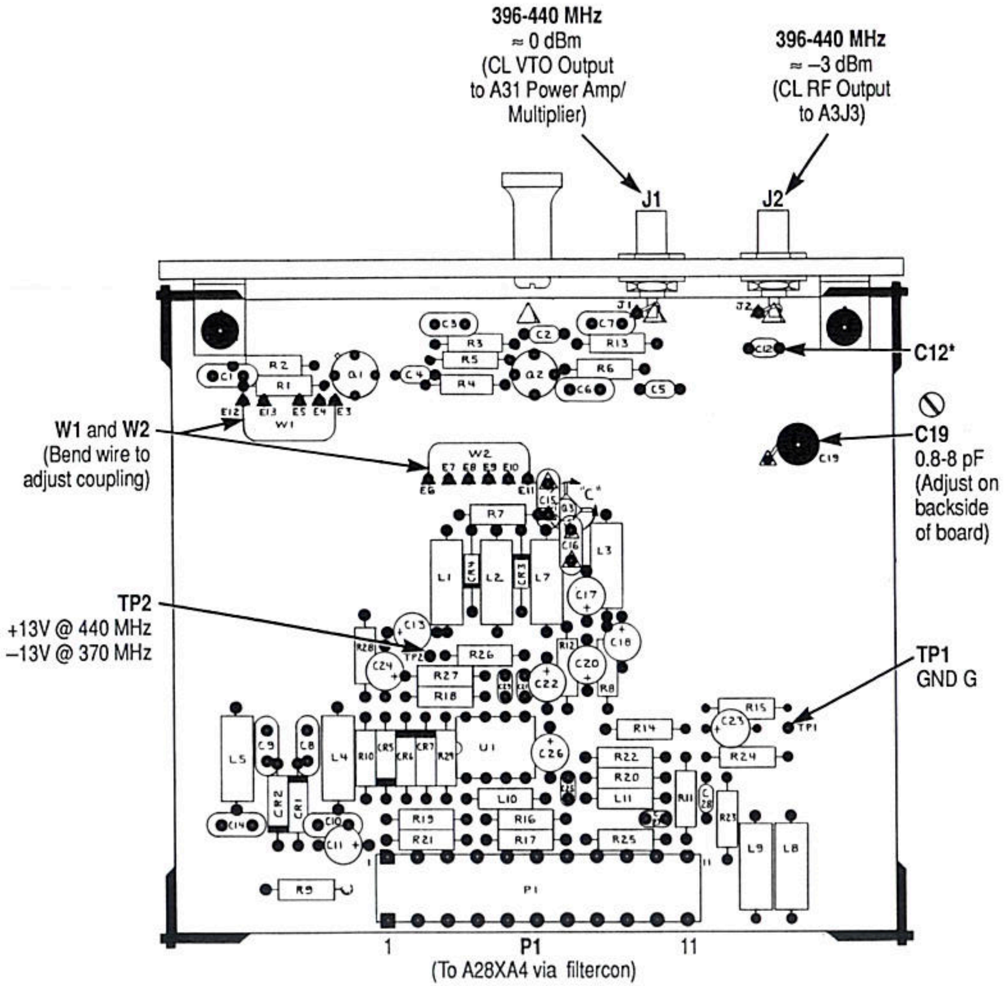


A3 COARSE LOOP MIXER SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. FILTERCONS ARE USED BETWEEEN THIS PCB EDGE CONNECTOR AND THE A28 MOTHERBOARD CONNECTOR. EACH SIGNAL PATH CONNECTION HAS (TYPICALLY) 1500 pF CAPACITANCE BETWEEN IT AND CHASSIS GROUND.
3. GROUND SYMBOLS USED ON THIS ASSEMB SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUND:
4. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
5. PCB TRANSMISSION LINE PATHS ARE DENOTED AS: TL
6. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   Q1-Q6
7. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C21	C1
J3	
L4	
P1	
Q6	
R34	
U1	

Figure 6H-8. A3 Coarse Loop Mixer PCB Schematic Diagram (Sheet 1 of 1)
6700-D-31703-3 (Rev. C)



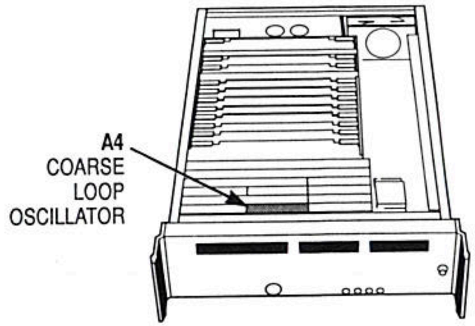
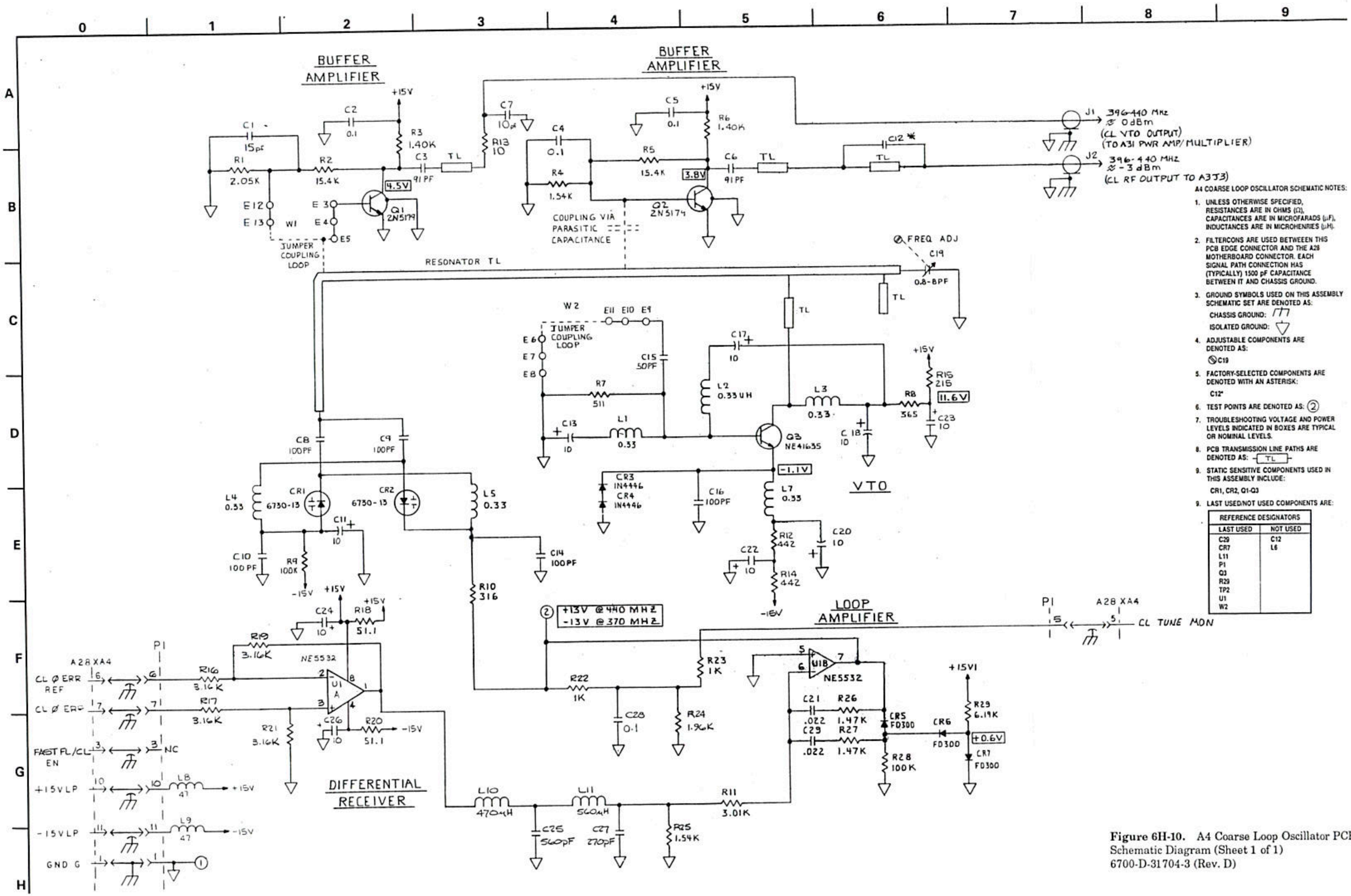


Figure 6H-9. A4 Coarse Loop Oscillator PCB Parts Locater Diagram
6700-D-31704-3 (Rev. D)

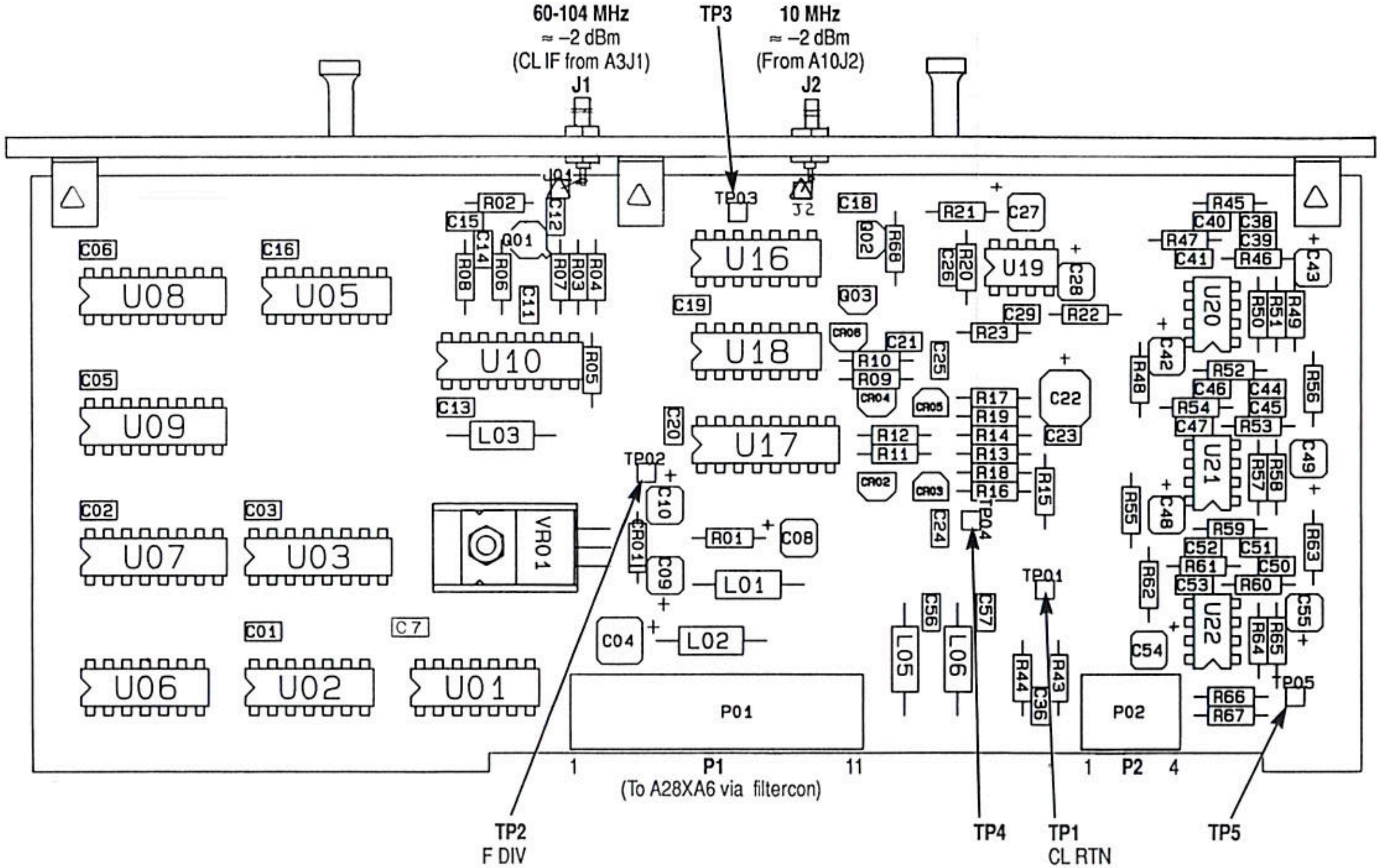


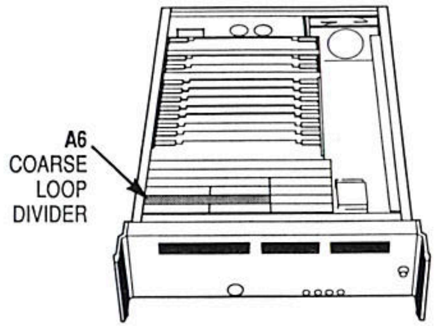
A4 COARSE LOOP OSCILLATOR SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. FILTERCONS ARE USED BETWEEEN THIS PCB EDGE CONNECTOR AND THE A28 MOTHERBOARD CONNECTOR. EACH SIGNAL PATH CONNECTION HAS (TYPICALLY) 1500 pF CAPACITANCE BETWEEN IT AND CHASSIS GROUND.
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUND:
4. ADJUSTABLE COMPONENTS ARE DENOTED AS:
   C19
5. FACTORY-SELECTED COMPONENTS ARE DENOTED WITH AN ASTERISK:
   C12*
6. TEST POINTS ARE DENOTED AS: (2)
7. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
8. PCB TRANSMISSION LINE PATHS ARE DENOTED AS: TL
9. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   CR1, CR2, Q1-Q3
9. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C29	C12
CR7	L6
L11	
P1	
Q3	
R29	
TP2	
U1	
W2	

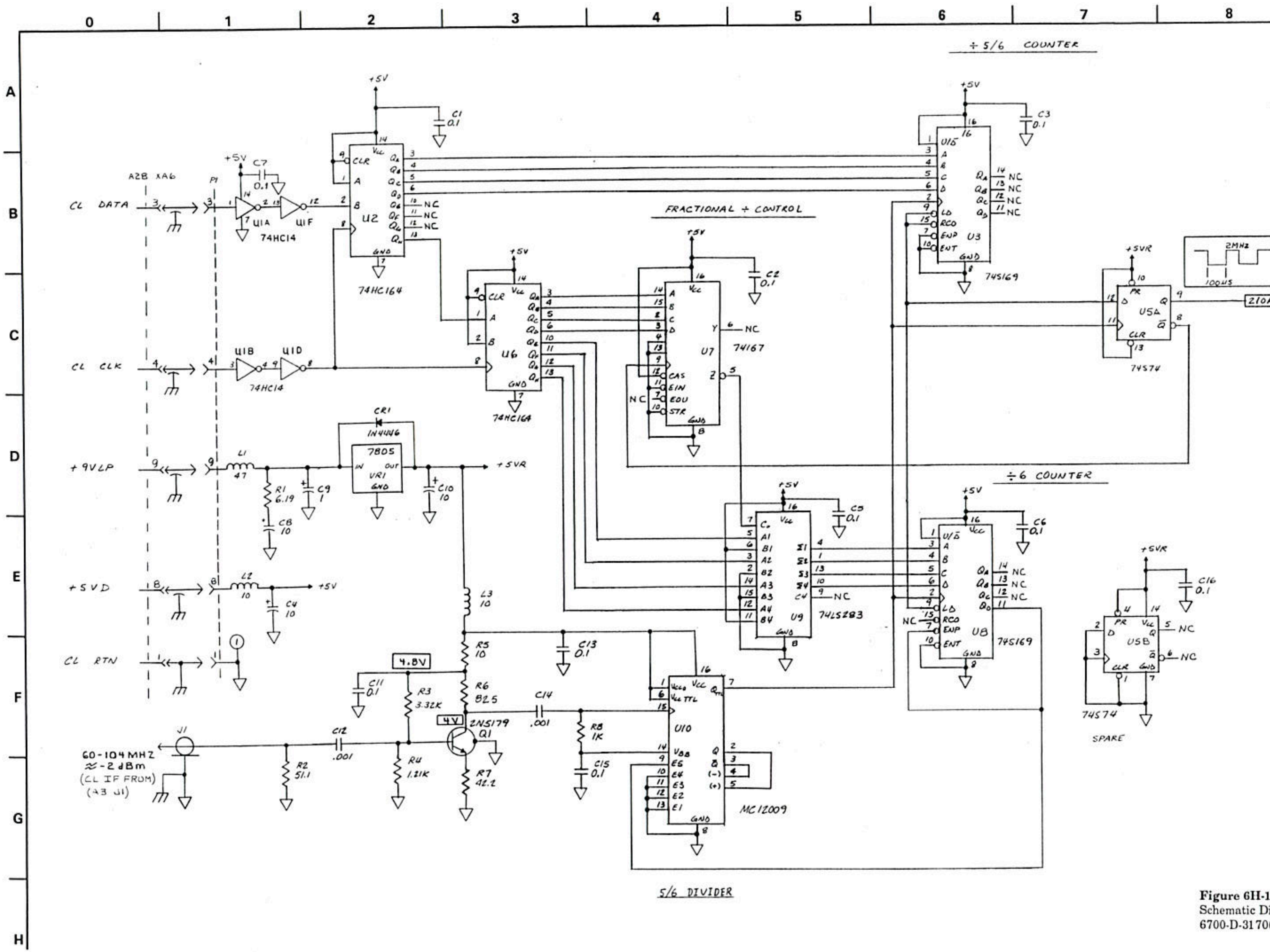
Figure 6H-10. A4 Coarse Loop Oscillator PCB Schematic Diagram (Sheet 1 of 1)
6700-D-31704-3 (Rev. D)





NOTE:
Leading zeros on component number references may be disregarded.

Figure 6H-11. A6 Coarse Loop Divider PCB Parts Locater Diagram
6700-D-31706-3 (Rev. F)

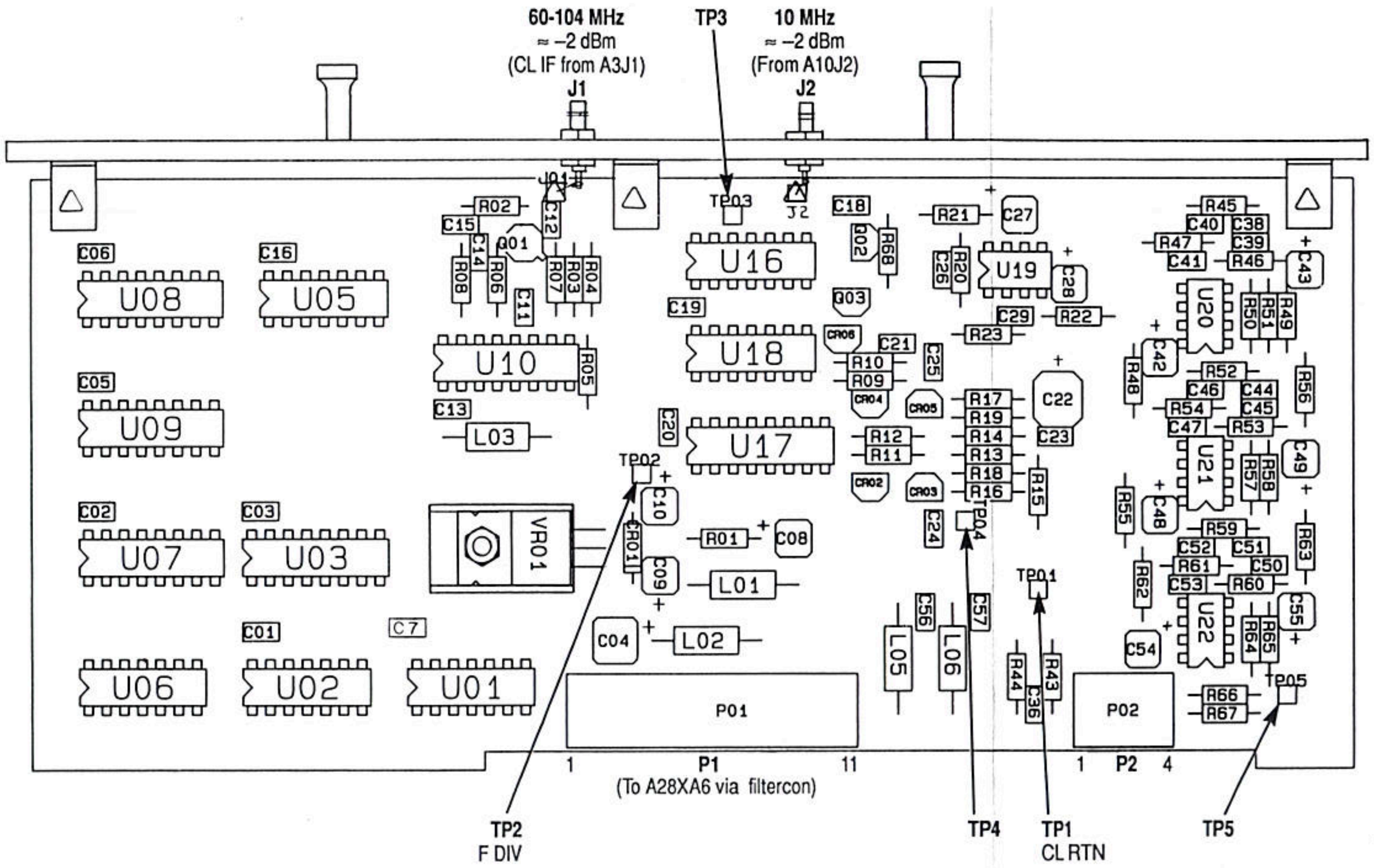


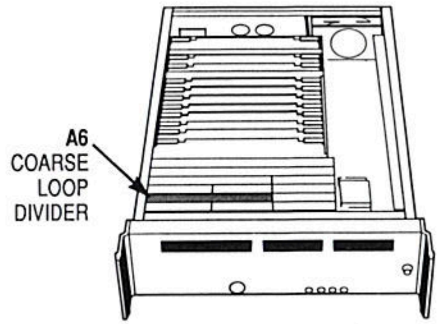
A6 COARSE LOOP DIVIDER SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. FILTERCONS ARE USED BETWEEN THIS PCB EDGE CONNECTOR AND THE A28 MOTHERBOARD CONNECTOR. EACH SIGNAL PATH CONNECTION HAS (TYPICALLY) 1500pF CAPACITANCE BETWEEN IT AND CHASSIS GROUND.
4. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUND:
5. TEST POINTS ARE DENOTED AS: (2)
6. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
7. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   CR3, Q1-Q5, U1
8. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C57	C17
CR6	C30-35
L6	C37
P2	L4
Q3	R24-42
R68	U11-15
TP5	
U22	
VR1	

Figure 6H-12. A6 Coarse Loop Divider PCB Schematic Diagram (Sheet 1 of 2)
6700-D-31706-3 (Rev. F)





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6H-11. A6 Coarse Loop Divider PCB Parts Locater Diagram
6700-D-31706-3 (Rev. F)

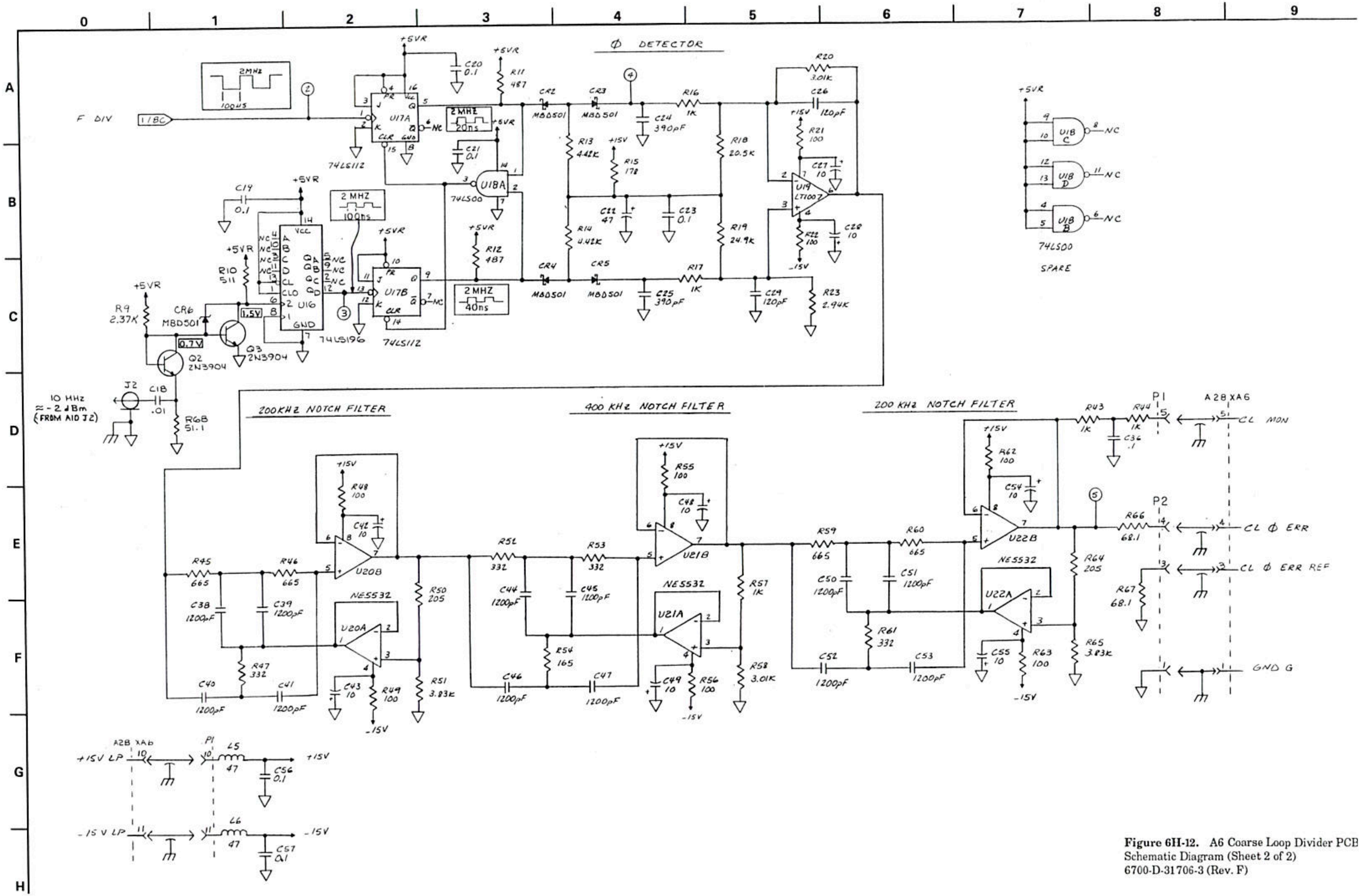


Figure 6H-12. A6 Coarse Loop Divider PCB Schematic Diagram (Sheet 2 of 2)
6700-D-31706-3 (Rev. F)

6I – FINE LOOP A9 and A11 PCBs

6I-1 FINE LOOP ASSEMBLIES: A9 and A11 PCBs

This section contains service information for the coarse loop assemblies listed in Table 6I-1 below. Refer also to the general reference information in sections 6A, 6B, and 6C.

Table 6I-1. Fine Loop Service Information

Documentation	Reference	Page
OVERALL ASSEMBLY LEVEL		
Overall Description	Para. 6I-2	6I-1
Block Diagram	Fig. 6I-2	6I-9
Troubleshooting	Tbl. 6I-2	6I-6
PCB LEVEL		
A9 Fine Loop Oscillator PCB		
Detailed Circuit Description	Para. 6I-3	6I-2
Troubleshooting	Tbl. 6I-2	6I-6
Schematic (Sheet 1 of 1)	Fig. 6I-4	6I-11
Parts Locater Diagram	Fig. 6I-3	6I-10
A11 Fine Loop Divider PCB		
Detailed Circuit Description	Para. 6I-4	6I-3
Troubleshooting	Tbl. 6I-2	6I-6
Schematic (Sheet 1 of 1)	Fig. 6I-6	6I-13
(Sheet 1 of 1)	Fig. 6I-6	6I-15
Parts Locater Diagram	Fig. 6I-5	6I-12

6I-2 FINE LOOP ASSEMBLIES, OVERALL DESCRIPTION

Refer to the block diagram in Figure 6I-2 for the following discussion.

The Fine Loop circuits provide the fine tuning frequencies for the YIG Loop circuits. The Fine Loop is comprised of the A9 Fine Loop Oscillator PCB and the A11 Fine Loop Divider PCB.

The primary circuit on the A9 Fine Loop Oscillator PCB is the 200-321 MHz voltage controlled oscillator (VCO). Its output is eventually divided and used as a reference signal on the A12 YIG Phase Detector PCB. The A9 PCB works in conjunction with the A11 Fine Loop Divider PCB; its circuits provide the necessary dividers and the phase/frequency detector circuit to accurately control the A9 PCB's VCO.

The A11 Fine Loop Divider PCB receives three signal inputs:

- A10 MHz reference signal from the A10 Reference Buffer PCB,
- Serial data and clock signals from the A8 Serial I/O PCB, and
- The buffered output of the A9 Fine Loop 200-321 MHz VCO.

As indicated on the block diagram, the 10 MHz reference signal is divided by 100 and used as a reference signal for the 67XXA's switching power supply circuits. The serial data and clock signals from the A8 Serial I/O PCB originate in the A23 Microprocessor PCB. An appropriate divide number is programmed into the A11 PCB to arrive at a 100 kHz signal input to the Fine Loop phase/frequency detector. There, it is compared to the 100 kHz reference signal. An error correction signal is generated for tuning the A9 PCB's VCO. Notch filters eliminate any high frequncy components.

The phase error signal is first amplified, then shaped to compensate for the nonlinear tuning characteristics of the oscillator's varactor diodes while maintaining loop bandwidth.

An external 10 MHz frequency synthesizer may be used in place of the 67XXA's internal crystal oscillator when finer frequency resolution is needed. The A9 PCB receives a TTL-level signal that disables the VCO to eliminate possible spurious responses from being generated.

6I-4 A11 FINE LOOP DIVIDER CIRCUIT DESCRIPTION

Refer to the A11 PCB schematic in Figure 6-6 for the following discussion.

6I-4.1 10 MHz Input Circuit

Sheet 2 of the schematic set shows the 10 MHz Reference signal input at A11J2 which comes from A10J1. It goes to Q3 via Q2, which provides temperature compensation. Q3 converts the signal to TTL levels to drive U19, a dual bi-quinary divider. U19 divides the 10 MHz by 100 resulting in a 100 kHz TTL output for the U20 phase/frequency detector.

The 100 kHz signal also goes to U10 pins 9 and 10 where it is buffered and then sent to the A25 Switching Power Supply PCB. R10 and the capacitance on the chassis-mounted filtercon at P1 pin 7 provide filtering to improve EMI performance. The A25 Power Supply is injection locked to this signal to ensure that the frequency will not zero beat with the reference frequencies in the phase lock loops. This would cause spurious signals on the RF Output at a frequency offset from the carrier by the difference of the switching power supply frequency and the 100 kHz reference frequency.

6I-4.2 200-321 MHz Fine Loop Input

The 200-321 MHz signal at A11J1, shown on sheet 1 of the schematic set comes from A9J1. It goes to Q1 which is biased by R3 and R4 for a collector current of 10 mA and has a gain of about 5. From the collector of Q1, the signal goes to U14, and dual modulus divide-by-10/11. For the divide-by-11 to be enabled, both the PE1 and PE2 inputs must be in a low state; this is controlled by U13. R54, R55, R7, and R8 provide level shift of the TTL outputs of U13 to the ECL input levels required by U14. The TTL compatible output of U14-11 goes to inverter U15, then to counters U3, U8, and U12.

6I-4.3 Serial Input Circuits

The serial data from the A8 Serial I/O PCB goes to Schmitt trigger input TTL inverter U1 which improves transition times of the input. The signal goes to another inverter and then to U2, a shift register. U2-13 is connected to the input of U6, another shift register. **FL CLK** from the A8 PCB shifts the data input, which is 16 bits long, into the registers. The U1 Schmitt trigger buffers the clock signal.

Once data is shifted into the shift registers, the parallel outputs hold the data until new data is shifted in. The parallel data sets the count of the counters and fractional division control circuits.

FLD 12, also from the A8 PCB, is the only signal that is not sent serially for control of the A11 PCB. It is normally low and goes to a TTL high only at Fine Loop VCO frequencies of 300 MHz or greater.

6I-4.4 Counter Circuits

Decade counter U3 determines the count for the 10 MHz decade. U5 counts by either 2 or 3, depending on the condition of the **FLD 12** input control. U8 is the same as U5 except that it counts the pulses for the 1 MHz decade. U12 determines the number of output cycles of U14 when U14 is in the divide-by-11 state instead of the divide-by-10 state. U12 operates in both the 100 kHz decade steps and the 10 kHz fractional division steps. U7, in combination with U11, provides the counts for fractional division used to obtain the 10 kHz resolution of the Fine Loop.

Figure 6I-1 shows the control waveforms for modulus divider U14. The 100 kHz signal at U9 pin 5 goes to the phase/frequency detector to be compared with the divided 10 MHz reference frequency. This signal results from the signal at U4 pin 6. U9 provides 2 clock cycles of delay and determines the 100 ns pulse width for the signal at U9 pin 5. The signal at U9 pin 6, which is the inverted U9 pin 5 signal, reloads the counters for the next 100 kHz cycle.

The U9-6 signal also sets U13-5 low and U13-9 high. Also, it loads two counts into the U12 counter, which is programmed for this at 200 MHz. After two

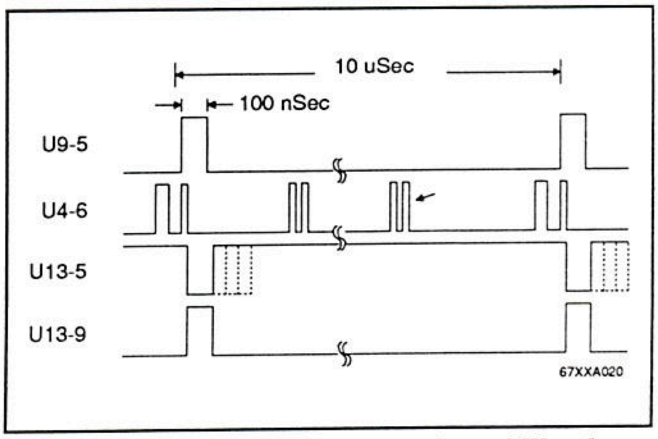


Figure 6I-1. U14 Modulus Divider Control Waveforms

and R47 which provide filtering and isolation and to the A17 Analog Instruction PCB DVM circuit. The A23 Microprocessor monitors this signal via the A17 PCB's DVM to determine if the Fine Loop is phase locked. When the Fine Loop is phase locked, this voltage is very close to 0V.

6I-5 FINE LOOP ASSEMBLIES, TROUBLESHOOTING

Troubleshooting procedures in Table 6I-2 cover the A9 Fine Loop Oscillator PCB and the A11 Fine Loop Divider PCB.

6I-6 FINE LOOP ASSEMBLIES, SERVICE SHEETS

Table 6I-1 on the first page of this section presents the arrangements of the block diagrams, schematics, and parts locater diagrams for the A9 and A11 PCBs.

Table 6I-2. Fine Loop Troubleshooting (2 of 3)

Trouble / Error Code	Troubleshooting Procedure
	A9 Fine Loop Oscillator PCB Troubleshooting (Continued)
E9-10	This test checks the A11 PCB's phase detector output voltage. If the A9 Fine Loop Oscillator is locked, it then checks to see if calibration is required. If the A9 is not phase locked, the A23 Microprocessor performs the E9-11 through E9-13 tests to further localize failure. The E9-10 error code indicates the processor was not able to localize the failure mode by using the E9-11 through E9-13 code tests. This indicates a failure in either the A9 or A11 PCB. To troubleshoot: • Perform E9-12 troubleshooting tests. • Perform E9-11 troubleshooting tests.
E9-11	If the error voltage is positive, the most likely cause is a failure in the 200-321 MHz output of the A9 PCB or the A11 Fine Loop phase/frequency detector. • Disconnect A9J1. • Connect a spectrum analyzer to A9J2. The signal frequency should be >330 MHz and <380 MHz at –7 dBm. If this is not the case, go to the previous A9 PCB troubleshooting hints.
E9-12	The A23 Microprocessor has determined that the Coarse Loop is not phase locked. It checks if the error voltage is negative. If the error voltage is negative, the most likely cause is a failure in the 10 MHz reference signal supplied by the A10 Reference Buffer PCB. • Connect a spectrum analyzer to A10J1. The spectrum analyzer should indicate a 10 MHz signal of approximately 0 dBm. • If there is no 10 MHz signal, go to the A10 PCB troubleshooting in section 6G. If there is a 10 MHz signal, reconnect A11J1 cable to A10J1, and go to the following A11 PCB troubleshooting hints.
E9-13	This error indicates a failure in the tuning voltage circuit for the A9 Fine Loop Oscillator. Go to A9 PCB Linearizer (Tuning Shaper) troubleshooting hints.
	A11 Fine Loop Divider PCB Troubleshooting
	Troubleshooting the A11 Fine Loop Divider PCB is almost the same as troubleshooting the A6 Coarse Loop Divider PCB (in section 6H), since both boards perform the same type of functions. For example, an external signal source can be used in place of the A9 Fine Loop Oscillator. This sometimes makes it easier to observe the waveforms in the divider circuits.
Fractional Division Sidebands	If the fractional division sidebands are out of specification on the A9 Fine Loop Oscillator, one of the notch filters is probably defective. If the 40 kHz sideband is out of spec, the 40 kHz notch filter is defective. If the 10 kHz sideband is out of specification, either one of the 10 KHz notch filters is defective. One way to check this is to inject a signal at TP4 with an audio oscillator. Adjust the frequency around the notch frequency while observing the output of the filter with an oscilloscope. Typical rejection should be about 40 dB at the notch frequency. For more sensitivity, use a spectrum analyzer with a scope probe and observe the outputs of the filter. Be sure, however, that the spectrum analyzer can handle any dc voltage that the probe might come in contact with. If the spectrum analyzer cannot handle all dc voltages, or it loads down the circuit under test, put a 0.1 uf capacitor in series with the scope probe.

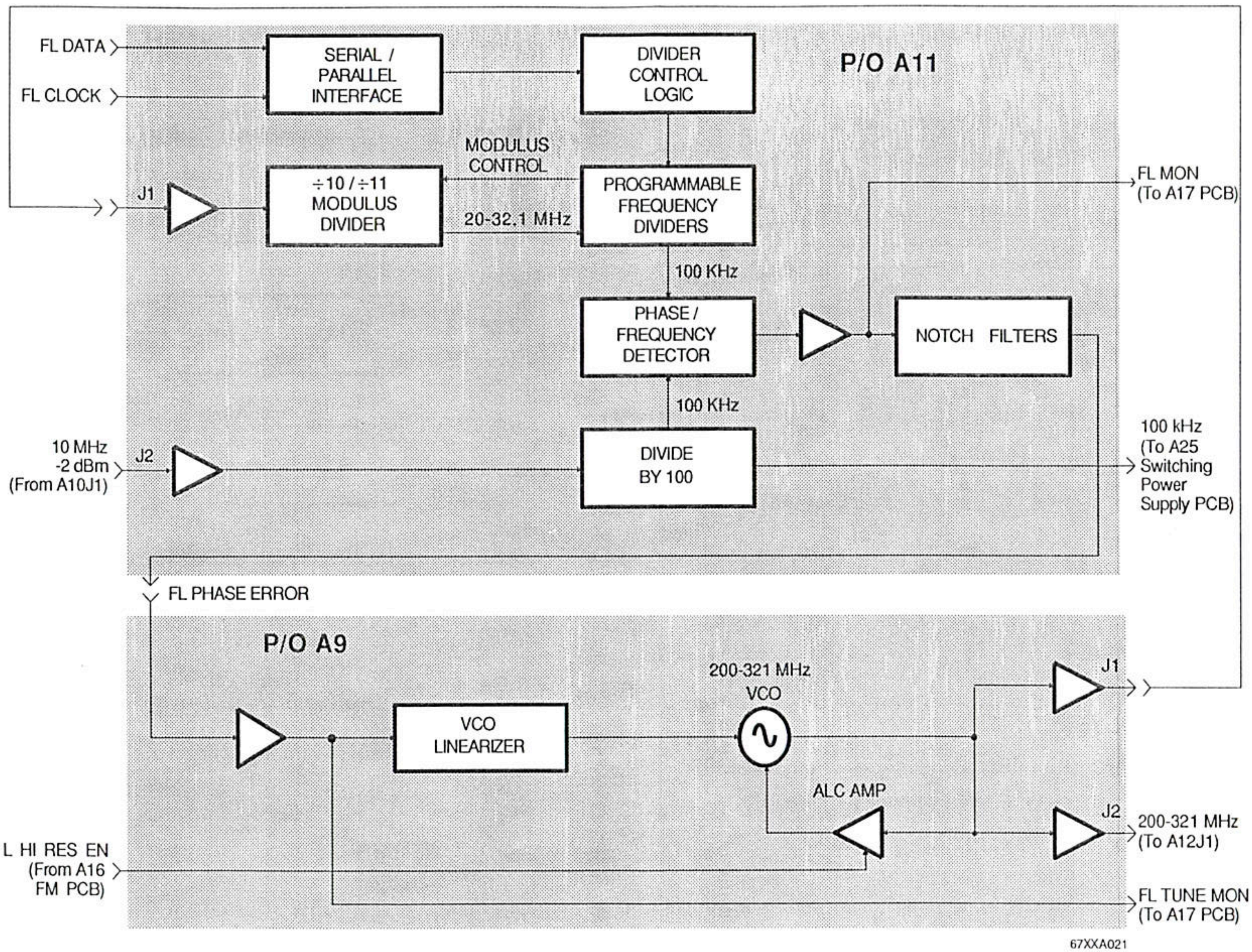
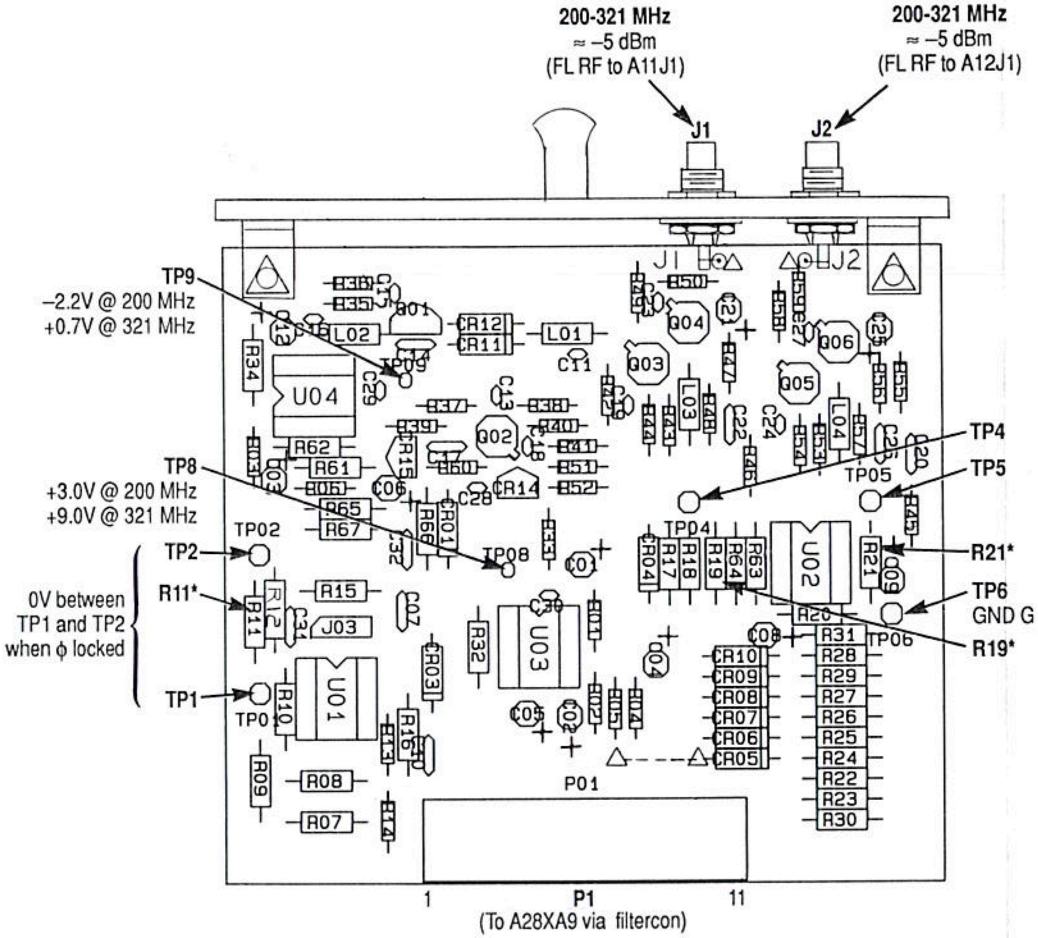


Figure 6I-2. Fine Loop Block Diagram



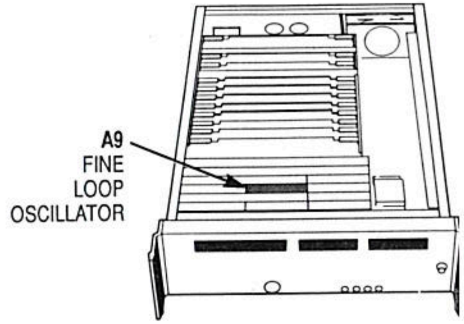


Figure 6I-3. A9 Fine Loop Oscillator PCB Parts Locater Diagram
6700-D-31709-3 (Rev. E)

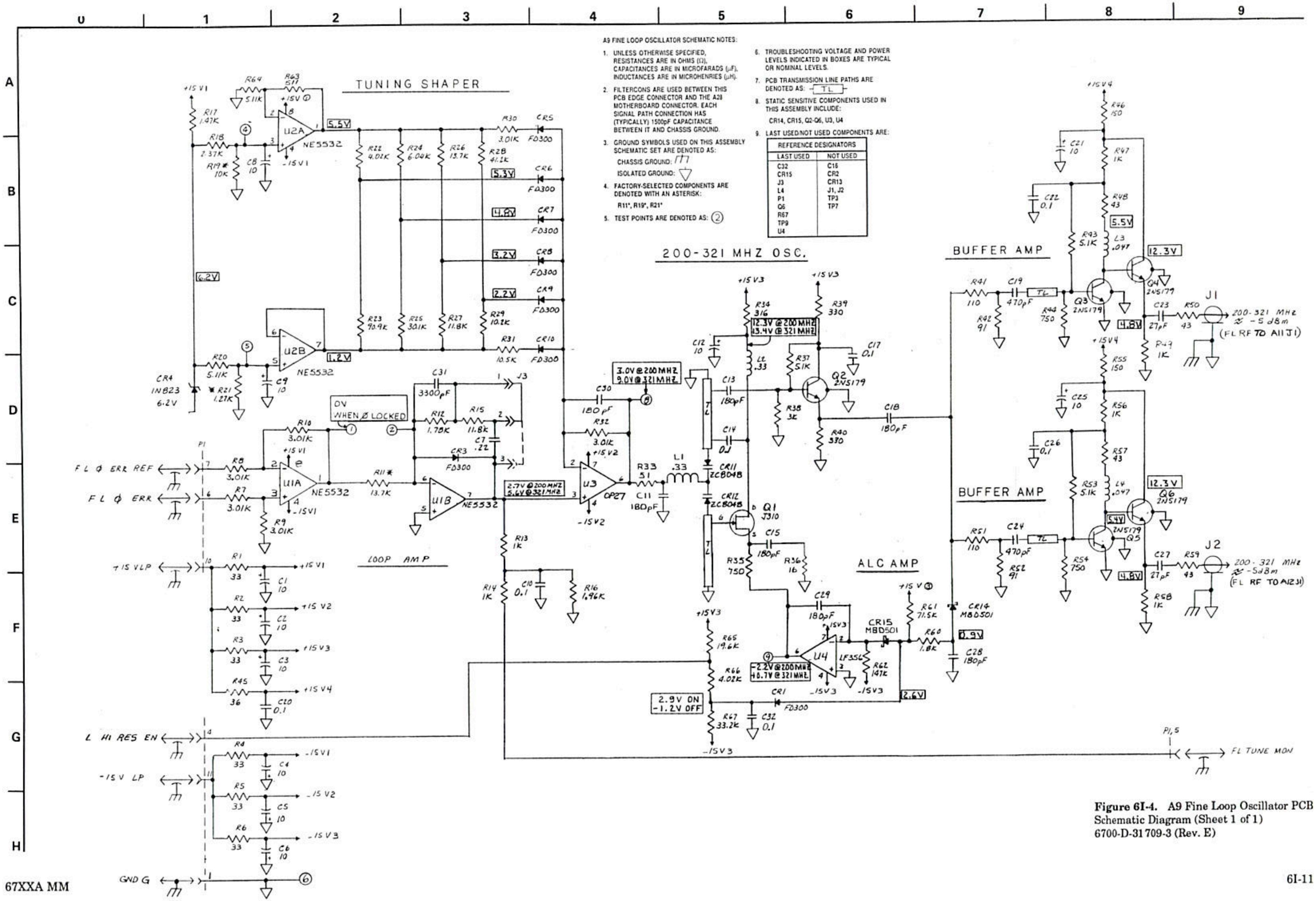
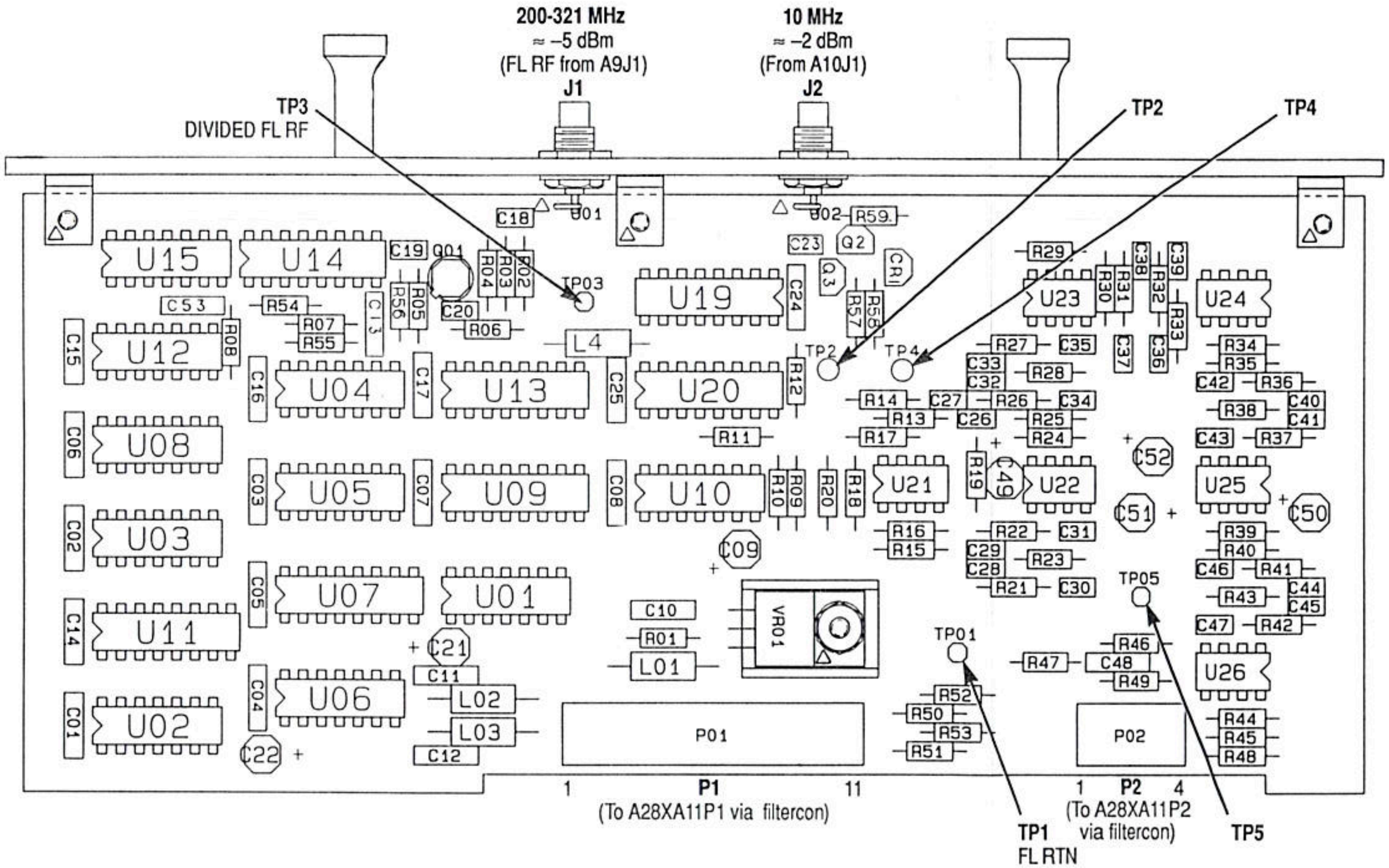
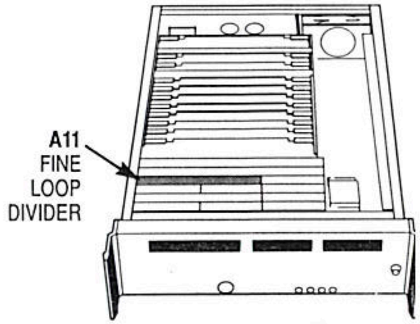


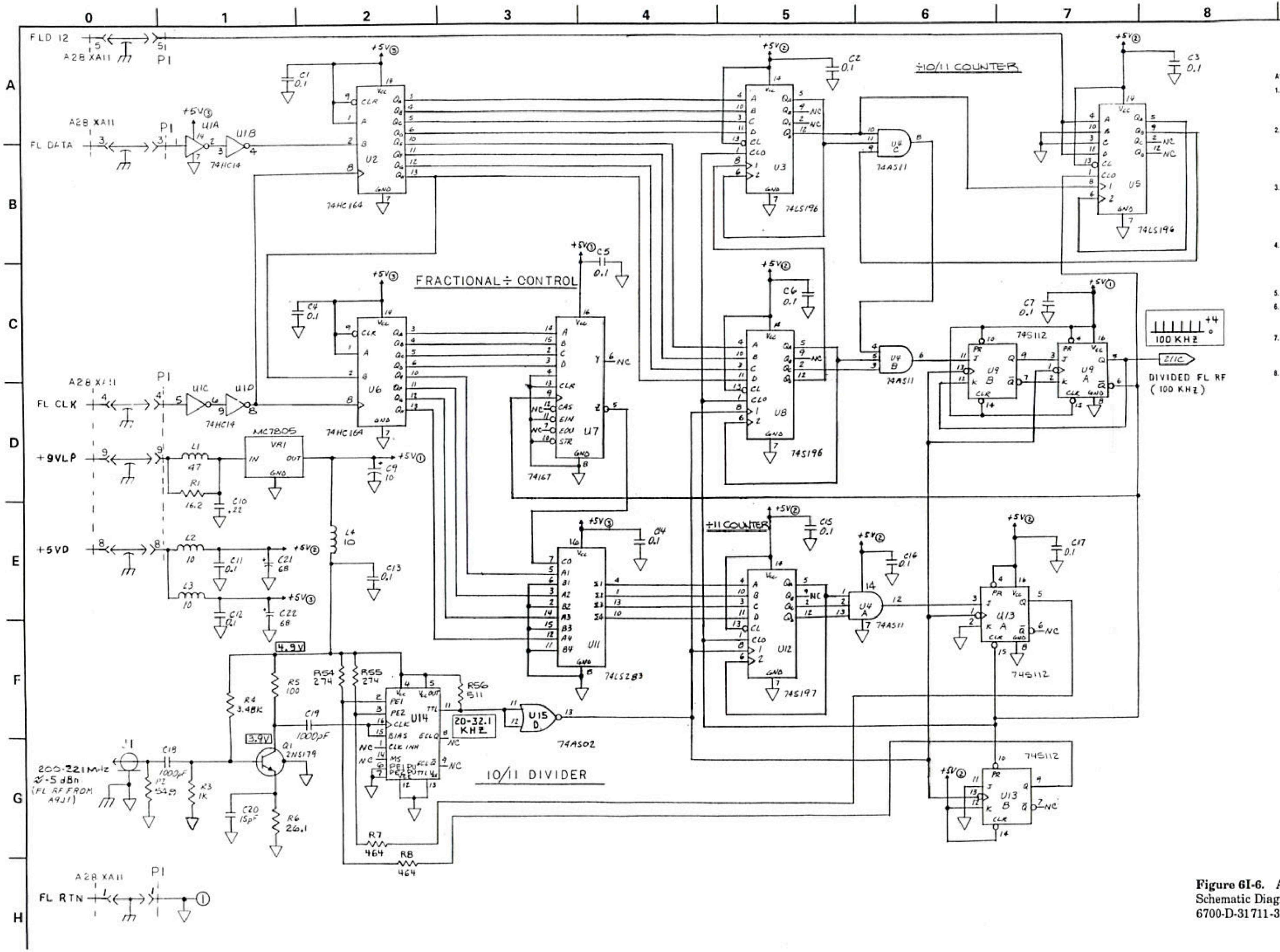
Figure 6I-4. A9 Fine Loop Oscillator PCB Schematic Diagram (Sheet 1 of 1)
6700-D-31709-3 (Rev. E)





NOTE:
Leading zeros on component number references may be disregarded.

Figure 6I-5. A11 Fine Loop Divider PCB Parts Locater Diagram
6700-D-31711-3 (Rev. F)

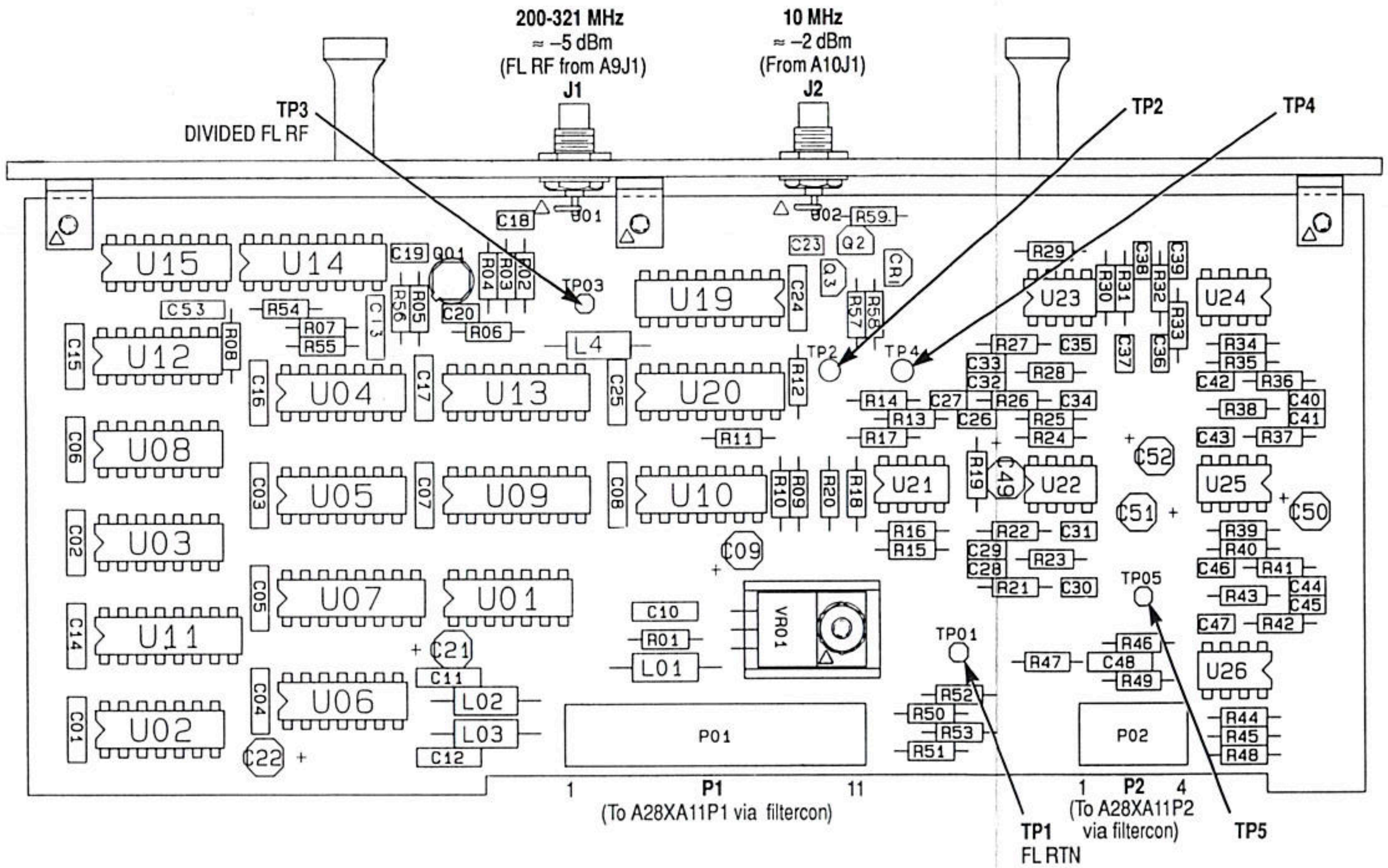


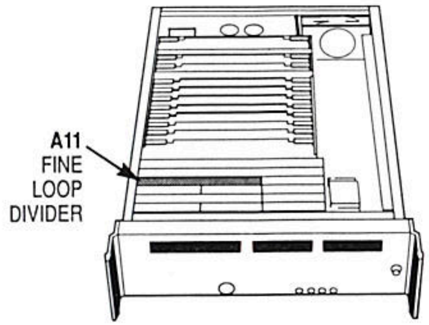
A11 FINE LOOP DIVIDER SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. FILTERCONS ARE USED BETWEEN THIS PCB EDGE CONNECTOR AND THE A28 MOTHERBOARD CONNECTOR. EACH SIGNAL PATH CONNECTION HAS (TYPICALLY) 1500pF CAPACITANCE BETWEEN IT AND CHASSIS GROUND.
4. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUNDS:
5. TEST POINTS ARE DENOTED AS: (2)
6. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
7. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   CR1, Q1, U3, U5, U7-U13, U19, VR1
8. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C53	U16-18
CR1	
L4	
P2	
Q3	
R59	
TP5	
U26	
VR1	

Figure 6I-6. A11 Fine Loop Divider PCB Schematic Diagram (Sheet 1 of 2)
6700-D-31711-3 (Rev. G)





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6I-5. A11 Fine Loop Divider PCB Parts Locater Diagram
6700-D-31711-3 (Rev. F)

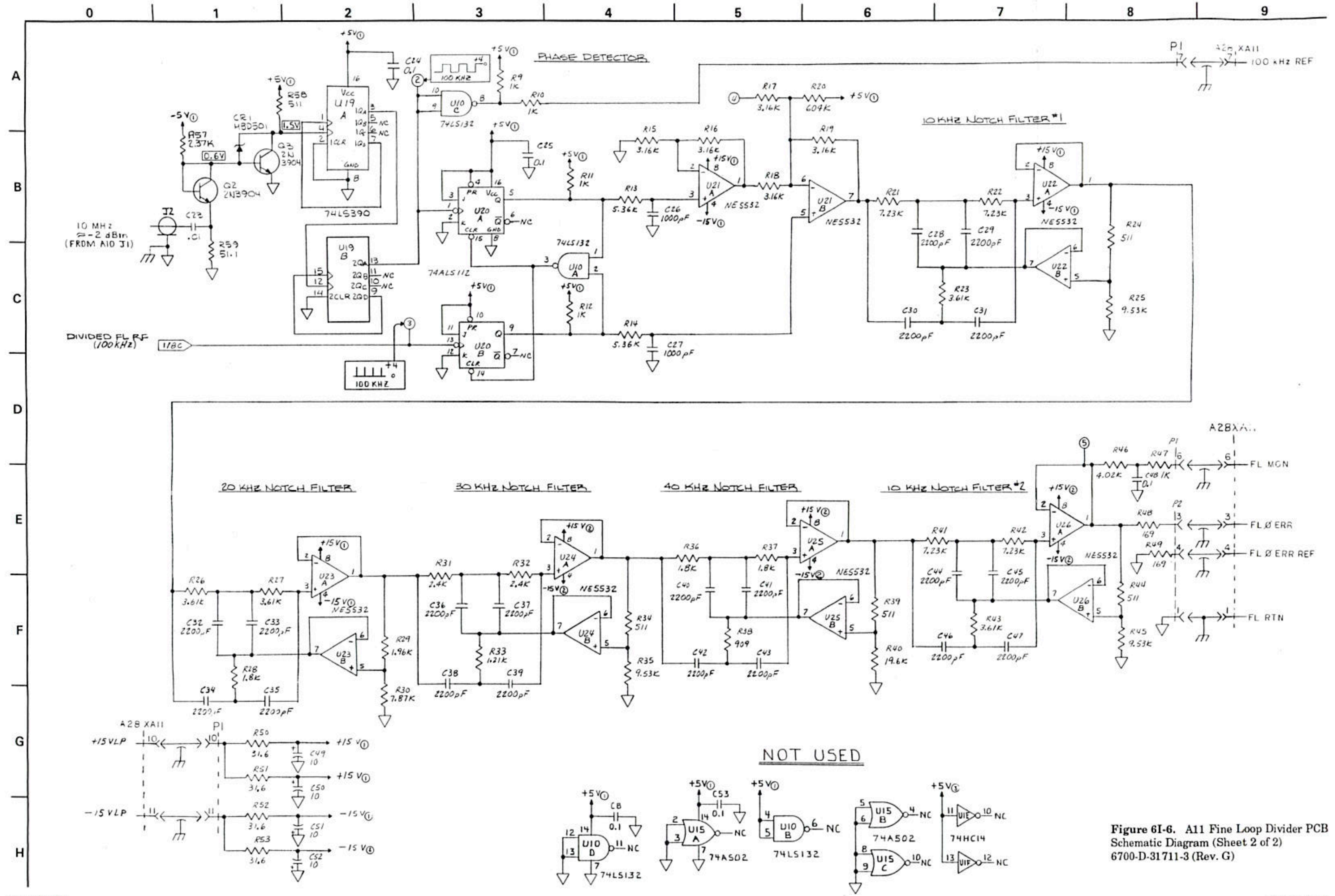


Figure 6I-6. A11 Fine Loop Divider PCB Schematic Diagram (Sheet 2 of 2) 6700-D-31711-3 (Rev. G)

6J-1 FREQUENCY MODULATION (FM) SUBSYSTEM: A16, A12, A30, and A31 PCBs

6J-1.1 FM Subsystem Overall Circuit Description

The FM Subsystem has provisions for frequency modulation in both phase-locked and unlocked modes of operation. A16 FM PCB also contains a portion of the YIG phase-lock loop circuit.

The FM signal from the rear panel goes to an input amplifier and then to analog switch S2. In the unlocked mode, it then goes to the FM amplifier located on the YIG driver. The FM amplifier drives the FM coil in the YIG oscillator. This coil modulates the magnetic field that results from the current flow through the main tuning coil. The modulation of this magnetic field changes the frequency of the YIG oscillator at the rate of the modulating frequency. Maximum deviation in the unlocked mode is ±25 MHz.

In the phase-lock mode, part of the RF from the YIG oscillator goes to the phase-lock circuitry. This circuitry compares the oscillator frequency with the fine- and coarse-loop-oscillator frequencies and sends an error signal to the A16 PCB phase-lock loop amplifier. From this amplifier, the error signal goes through S4 to the FM amplifier on the A18–A21 YIG Driver PCBs. There, it shifts the frequency of the YIG oscillator to correct for any frequency errors. Modulation frequencies below the loop bandwidth, approximately 10 kHz, going through S2 would be removed by the phase-lock loop. The integrator provides modulation at the frequencies encompassed by the phase-lock loop bandwidth.

The FM signal in the phase-lock mode also goes to the Integrater. This integrator amplifies the modulating frequences by about the same amount as the phase-lock loop has gain. That is, at low frequencies, the Integrator has a very high gain that decreases as the modulating frequency increases. The output of the Intergrator goes through the closed contacts of S1. (S2 is also closed at this time.) This allows the Phase Lock circuitry to cancel the correction error signal caused by the frequency modulation.

In analog sweeps >50 MHz, the ramp voltage from the A17 PCB goes to the Sweep Amp. The Sweep Amp applies the ramp through S3 to the FM Amp on the

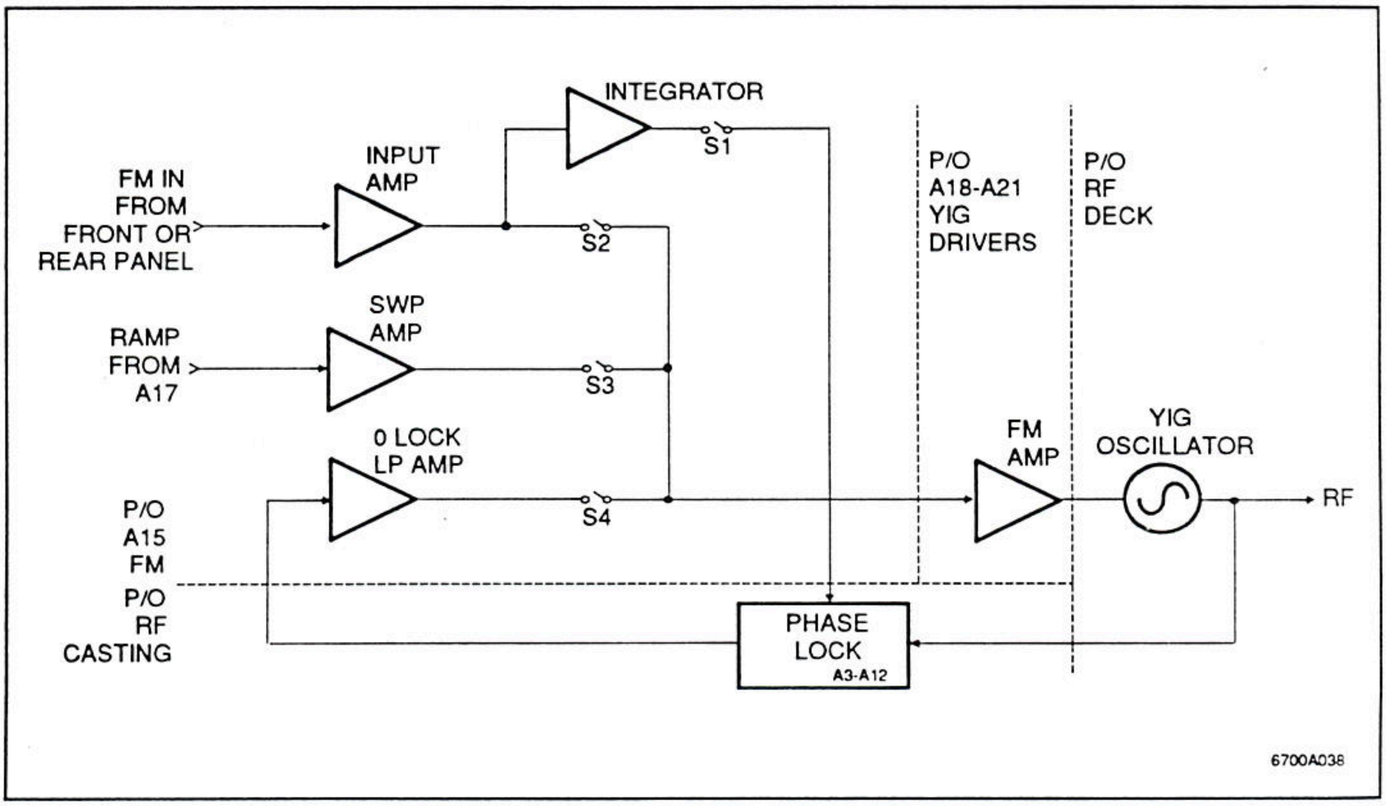


Figure 6J-1. FM Subsystem Block Diagram

A18–A21 YIG Driver PCBs. This improves the residual FM characteristics during narrow band sweeps.

6J-1.2 A16 FM PCB Circuit Description

The A16 FM PCB provides for phase locking, FM, and narrow band sweep operations. Foldout Figure 6J-2 shows the block diagram of the FM PCB.

a. ***Digital Control***
All of the functions of the A16 PCB are controlled by the main microprocesser on the A23 PCB. The data bus goes to the U9 Cntrl Latch for control of some of the functions. Data Latch U6 buffers the microprocessor data bus from the internal data bus. The U7 FM Cntrl Latch provides control for the various analog switches on theA16 PCB. The U5 Addr Decoder decodes the PA0–PA2 lines for latching data into the various latches and DACs. U5 is controlled by the low-active L PA16 control line from the microprocessor. This line only goes to the A16 PCB.

b. ***Phase-Lock Operation***
The phase-lock error signal from the A12 YIG Phase Detector goes to buffer amplifier U19B. The U27 False Lock Detector prevents a false lock on signals that result from the IF output of the Sampler/IF Amplifier going through a zero beat. From U19B, the error signal goes to notch filters. They remove the fractional-division sidebands that result from the fine- and coarse-loop oscillators. During the time that phase-lock is being aquired, switch U22C closes to bypass these filters and give a faster locking time. After phase-lock is acquired, U22C opens to insert the notch filters. The error signal then goes to loop amplifier U23. In unlocked modes, analog switch U18B closes to keep the U23 output signal off of the operational amplifier's supply rail.

From U23 the error signal goes through analog switch U18C to the U24 FM Deviation Limiter. U24 limits the deviation of the FM system to approximately ±40 MHz, which prevents saturation of the circuits following U24. This improves response time and eliminates overdrive conditions.

From U24, the error signal goes to output amplifier U25 and to the U20 FM Sensitivity Cal DAC. The Cal DAC can adjust the sensitivity approximately ±10%. Since there is a variation in YIG oscillator sensitivities, and there are component variation in the FM driver itself, the Cal DAC provides a means to compensate for these variations. The Cal DAC data for each YIG oscillator driver is stored in EEPROM on the A23 PCB. At the bandswitch points, this data sets the DAC so that each YIG driver has the same sensitivity. This provides for a more constant loop gain. It is also a requirement for a calibrated FM and sweep width.

c. ***FM Input Amplifiers***
The front and rear panel FM inputs go to differential receiver U1. U2 sums these signals and applies them to the three filter networks. In the phase-lock operation, the phase detector does not have the range to allow DC FM. At FM deviations of 300 KHz/V, the signal goes through the 30 Hz HPF (high-pass filter). At deviations between 300 kHz/V and 5 MHz/V, it goes through the 1 kHz HPF. The microprocessor selects these filters based on the deviation range selected by the operator.

In the unlocked FM mode, the microprocessor selects the DC FM path and extends the FM deviation range from dc to 25 MHz/V. From the selected filter, the FM signal goes to buffer amplifier U4. U4 applies the FM signal to both the U10 FM Attn DAC and to the U28 FM Peak Detector. U10, in combination with the U12/ U13 40 dB Attn, provides selection of the FM sensitivity range with an 8196-bit resolution from 25 MHz/V to 10 kHz/V.

d. ***Unlocked FM***
From the 40 dB Attn, the FM signal goes to the U24 FM Deviation Limiter via U18D. At this time, the U18C and U18A switch contacts are open. The signal then goes through the limiter and FM sensitivity circuits to the YIG driver. The output of U4 that goes to the U28 FM Peak Detector is peak detected to a dc voltage. The microprocesssor monitors this voltage via the DVM on the A17 PCB. If you select the FM MEASURE function on the front panel, the microprocessor calculates the actual FM deviation from the attenuator DAC setting and the peak detector output. If the input to the FM circuit is 1V Peak, then the indication in the FM MEASURE function will agree with the deviation range set by the attenuator DAC.

e. ***Locked FM***

In the phase-lock mode, the U18C and U18D switch contacts will be closed, which supplies the FM signal to the FM Limiter. The FM Integrator will also be enabled by analog switch U14. The FM Integrator will then amplify the FM signal and apply it to the phase detector via analog switch U29. The U20 Phase Mod Cal DAC provides a means of calibrating the FM deviation in the phase-lock mode. It has approximately a 20% adjustment range. The U30 Phase Mod Peak Detector performs the same function as theU28 FM Peak Detector. In addition, it supplies a voltage to the Overmod Cutoff section of U30. If the output of the phase modulation circuitry is too high, the Overmod Cutoff circuit will cause a loss of phase lock. U30 monitors the voltage from the peak detector and removes the signal from the A12 Phase Detector PCB if it becomes high enough to cause a loss of phase-lock.

f. ***High Resolution***

The 6700A has a minimum resolution of 1 kHz. If a lower resolution is required—1 Hz, for example—an external 20–32.1 MHz synthesizer can be used. In this mode, the A16 PCB supplies the L HI RESOLUTION line to both disable the fine loop oscillator and to enable the A12 YIG Phase Detector PCB circuitry. The 6700A then has the resolution of the external synthesizer.

6J-1.3 A18-A21 YIG Driver PCBs Circuit Description

The A18 thru A21 YIG Driver PCBs are described in section 6L.

6J-1.4 FM Subsystem Schematics

Figures 6J-4 provides schematics for the A16 FM PCB. Figures 6J-5 provides the schematic for the A12 FM PCB.

6J-1.5 FM Subsystem Troubleshooting

Troubloeshooting information is provided in section 6C Troubleshooting.

NOTE

Pages 6J-4, 6J-5, and 6J-6
are blank.

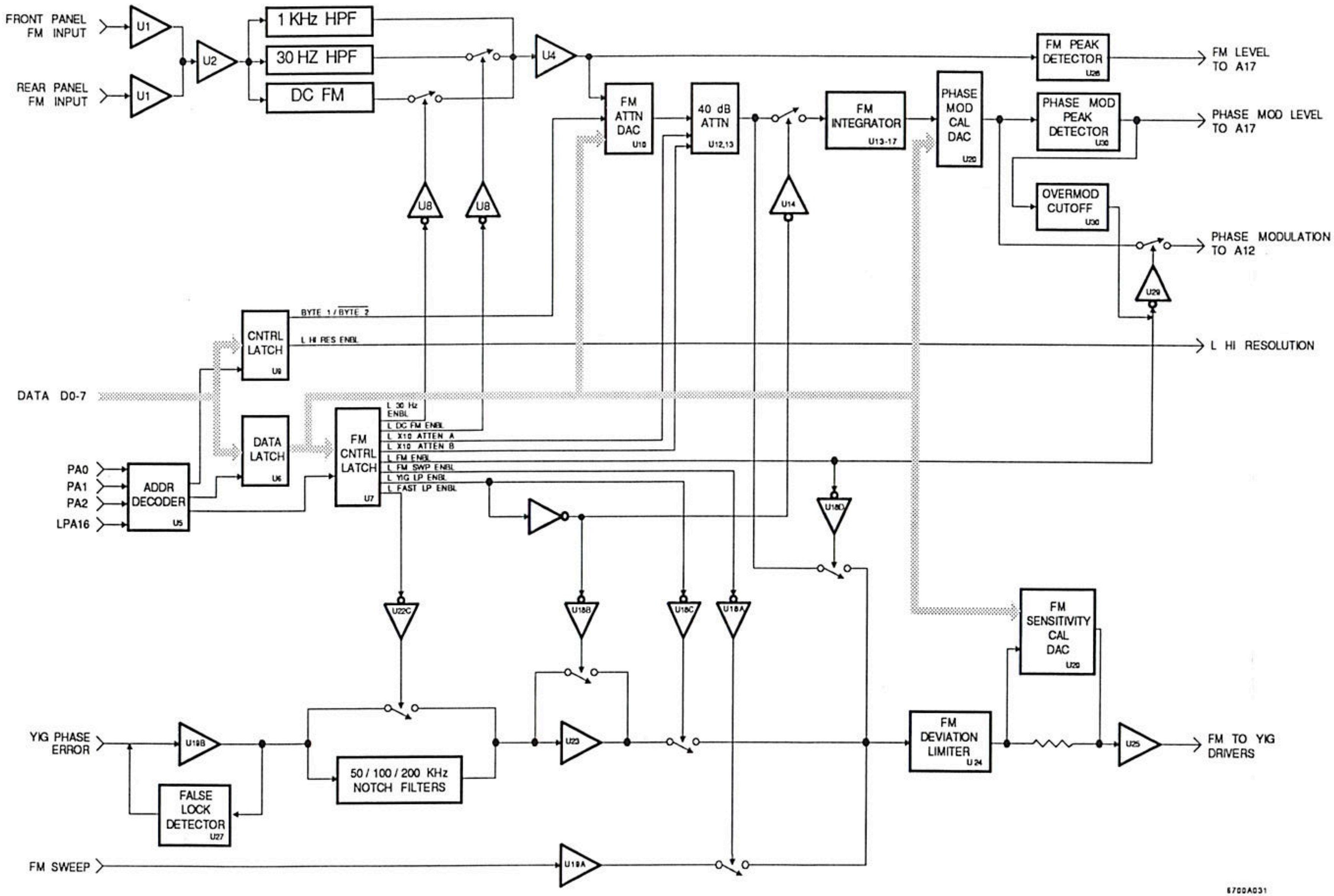
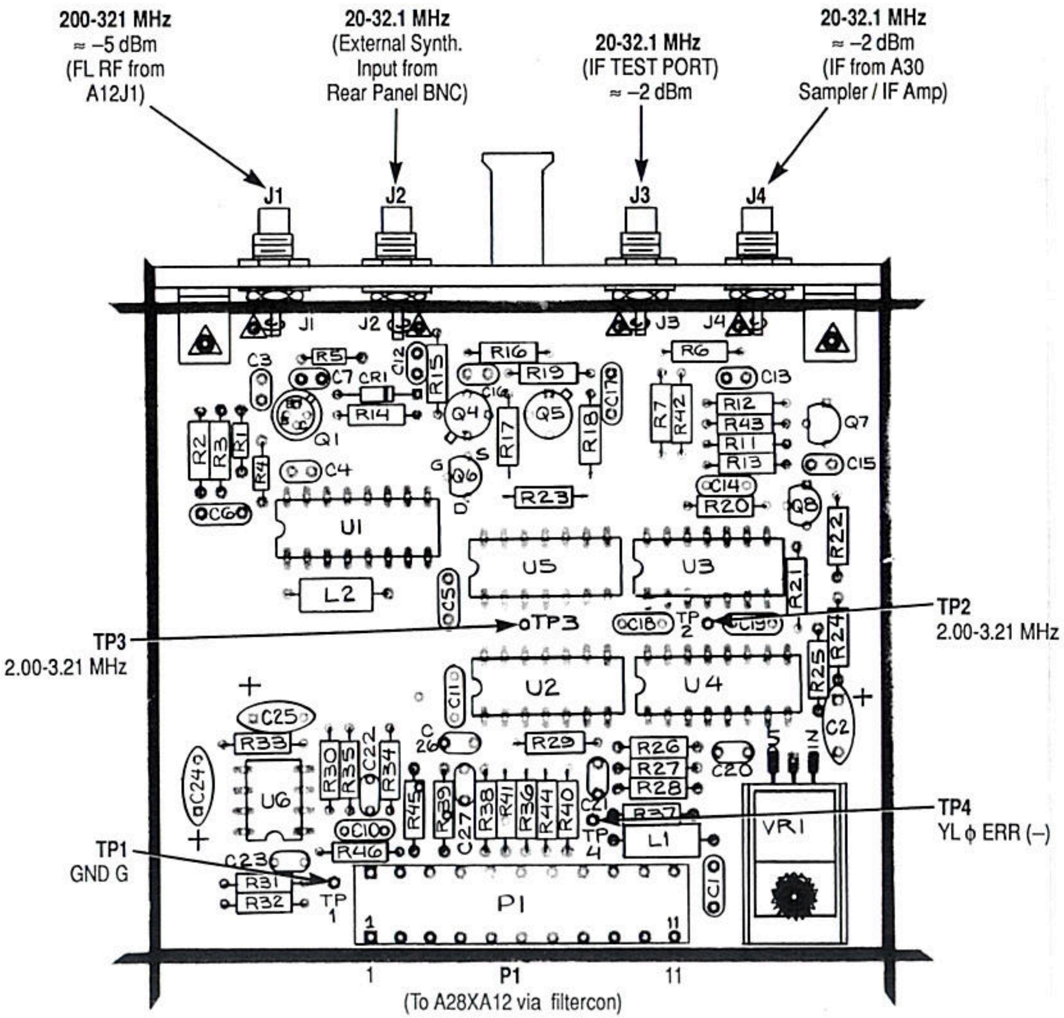
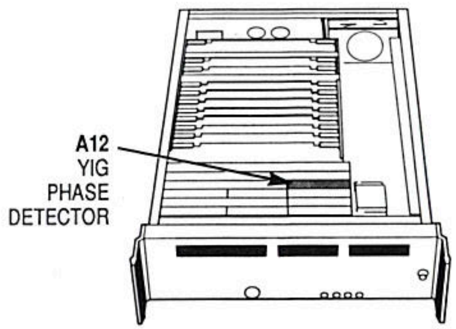


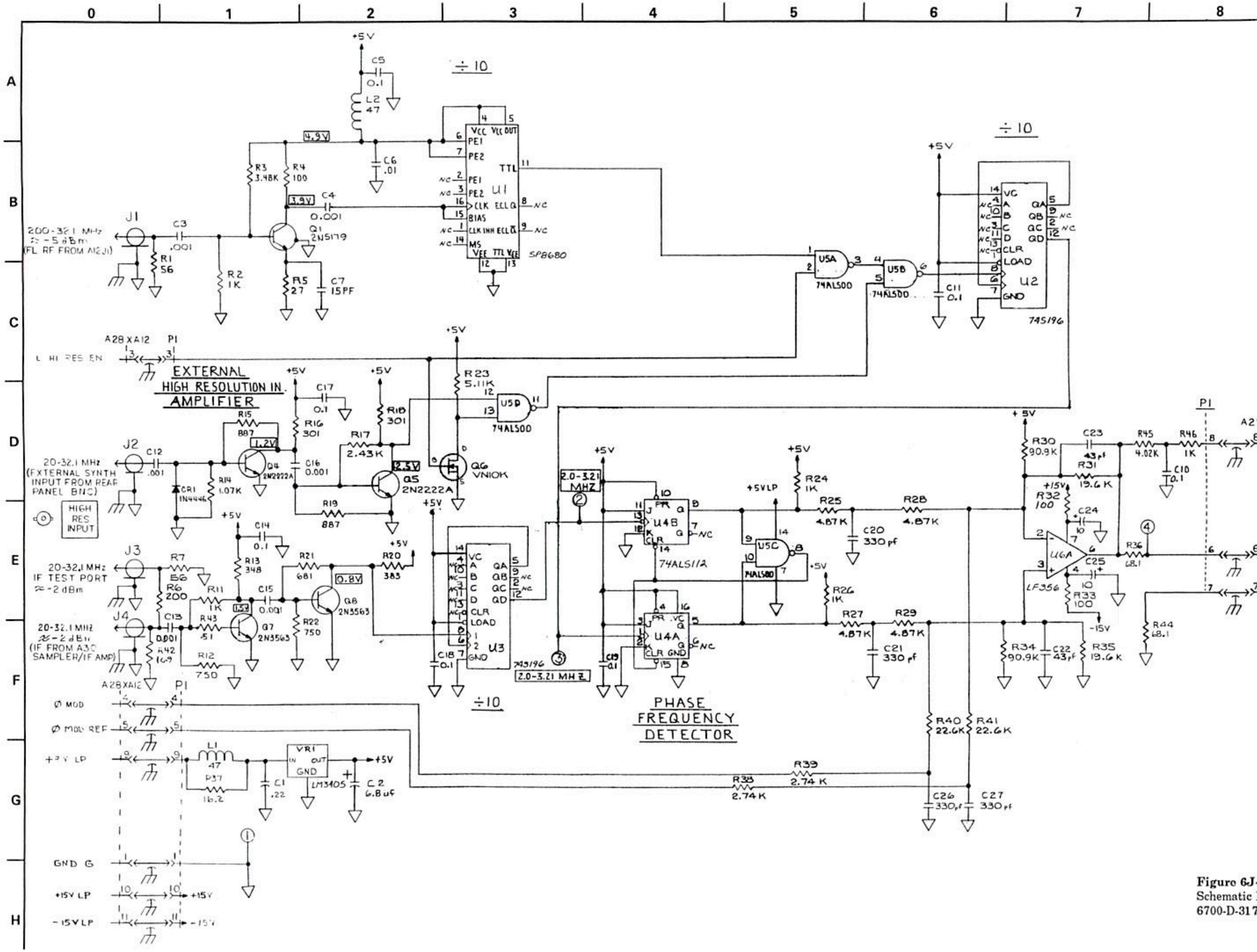
Figure 6J-3. A16 FM PCB Block Diagram





NOTE:
Leading zeros on component number references may be disregarded.

Figure 6J-4. A12 YIG Phase Detector PCB Parts Locater Diagram
6700-D-31712-3 (Rev. D)



A12 YIG PHASE DETECTOR SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. FILTERCONS ARE USED BETWEEN THIS PCB EDGE CONNECTOR AND THE A28 MOTHERBOARD CONNECTOR. EACH SIGNAL PATH CONNECTION HAS (TYPICALLY) 1500pF CAPACITANCE BETWEEN IT AND CHASSIS GROUND.
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUND:
4. TEST POINTS ARE DENOTED AS: (2)
5. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
6. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   Q1, Q6, U2, U3, U5, U6, VR1
7. LAST USED/NOT USED COMPONENTS ARE:

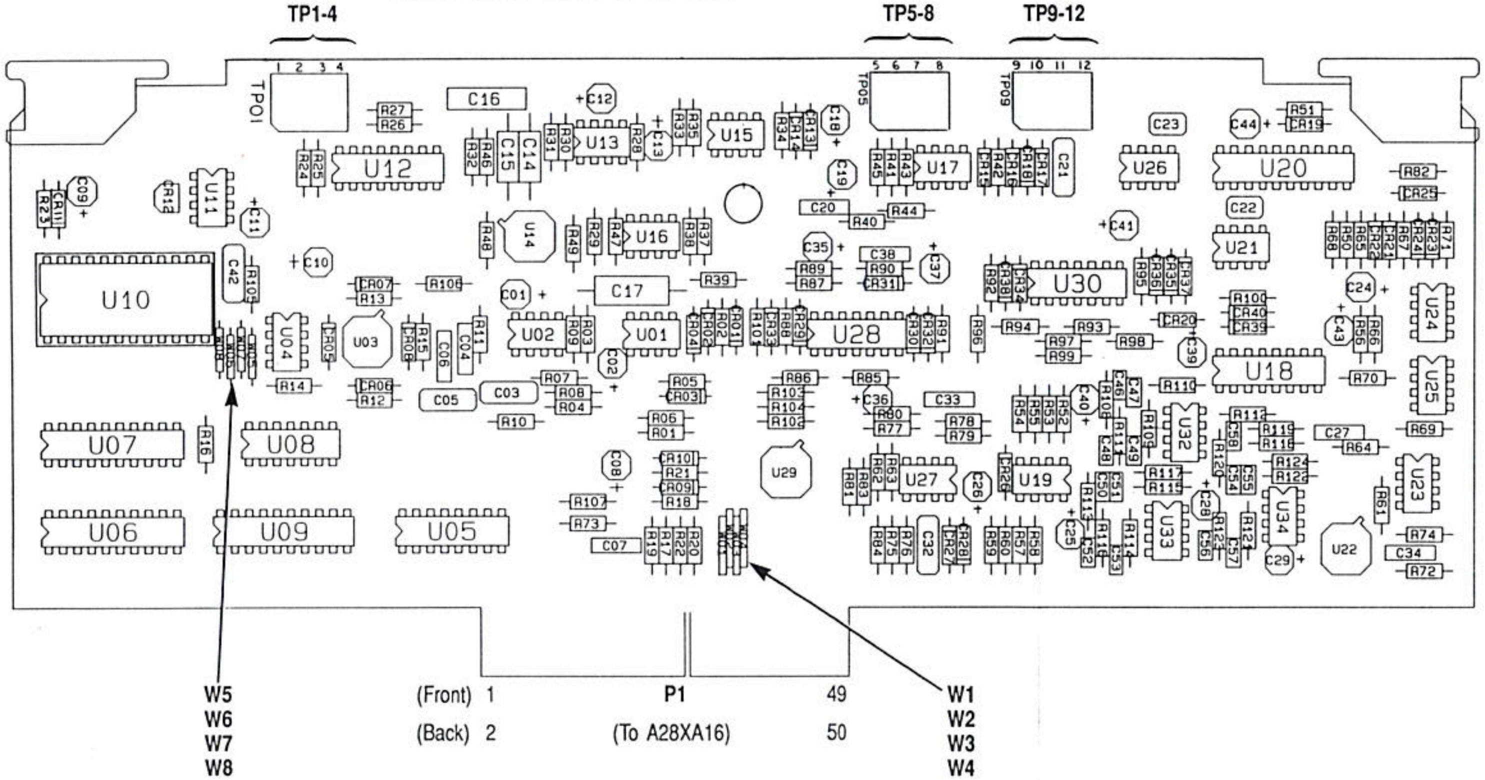
REFERENCE DESIGNATORS	
LAST USED	NOT USED
C27	C8
CR1	C9
L2	Q2
P1	Q3
Q8	R8-10
R46	
TP4	
U6	
VR1	

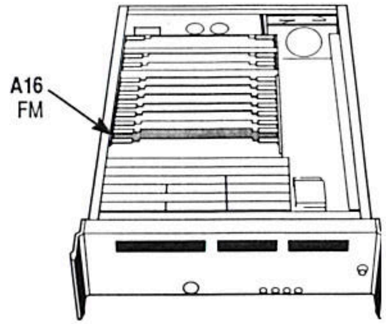
Figure 6J-5. A12 YIG Phase Detector PCB Schematic Diagram (Sheet 1 of 1) 6700-D-31712-3 (Rev. D)

TEST POINTS

TP1	GND G	**TP7**	ϕ MOD
TP2	FM	**TP8**	Not Used
TP3	FM ATTEN DAC OUT	**TP9**	GND G
TP4	ATTEN FM	**TP10**	FM SENS DAC OUT
TP5	GND G	**TP11**	FM DEV LIMITER OUT
TP6	FALSE LOCK DET OUT	**TP12**	FM (+)

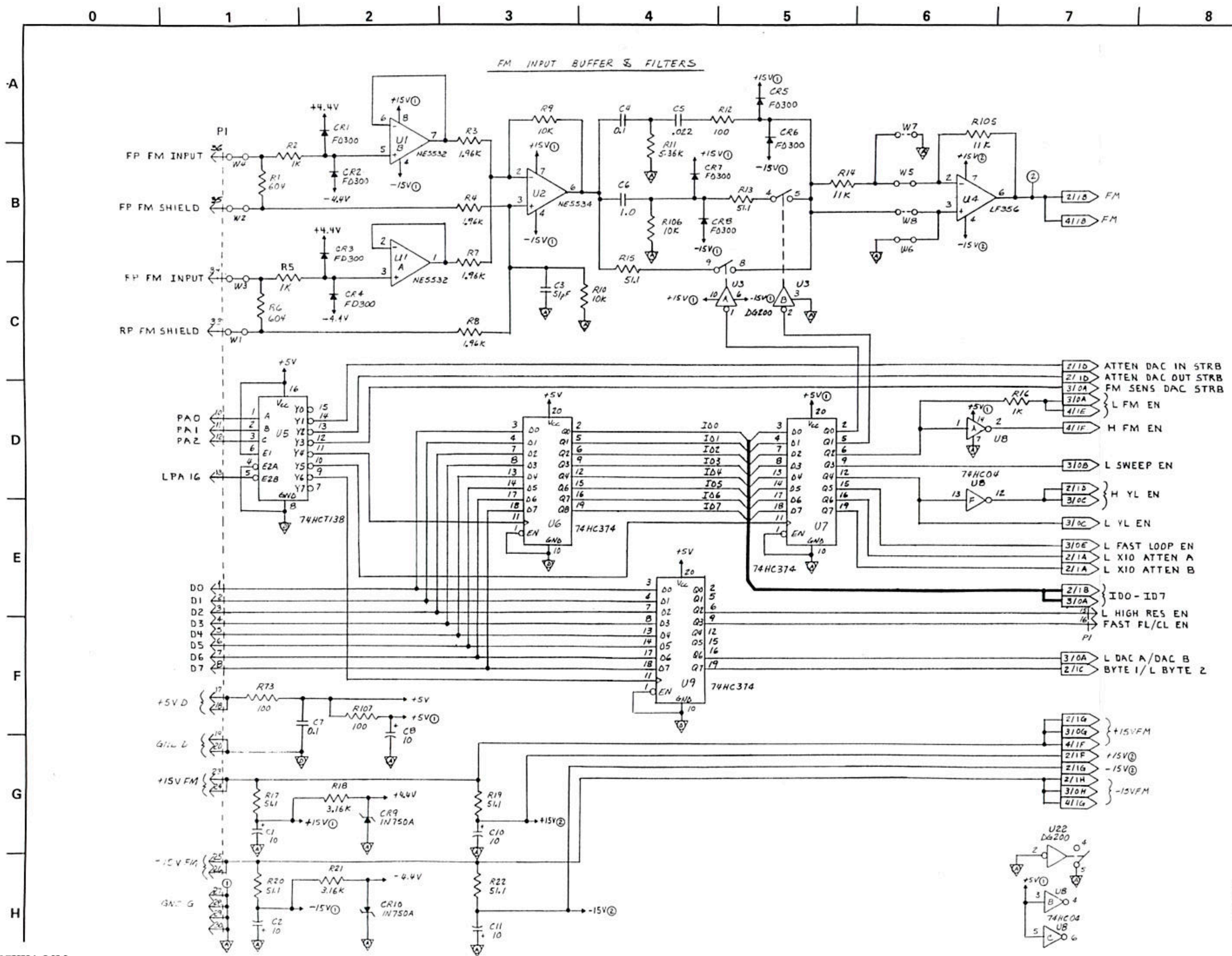
All test point measurements are made with reference to GND G (TP1 or TP9).





NOTE:
Leading zeros on component number references may be disregarded.

Figure 6J-6. A16 FM PCB Parts Locater Diagram 6700-D-31716-3 (Rev. F)



A16 FM SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS: ISOLATED GROUND: A D
4. TEST POINTS ARE DENOTED AS: (2)
5. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
6. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE: CR12, U1-U5, U10-U19, U21-U30, U32-U34
7. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C58	C30
CR40	C31
R124	C45
TP12	R36
U34	U8B
W8	U8C
	U22B

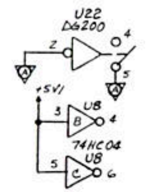
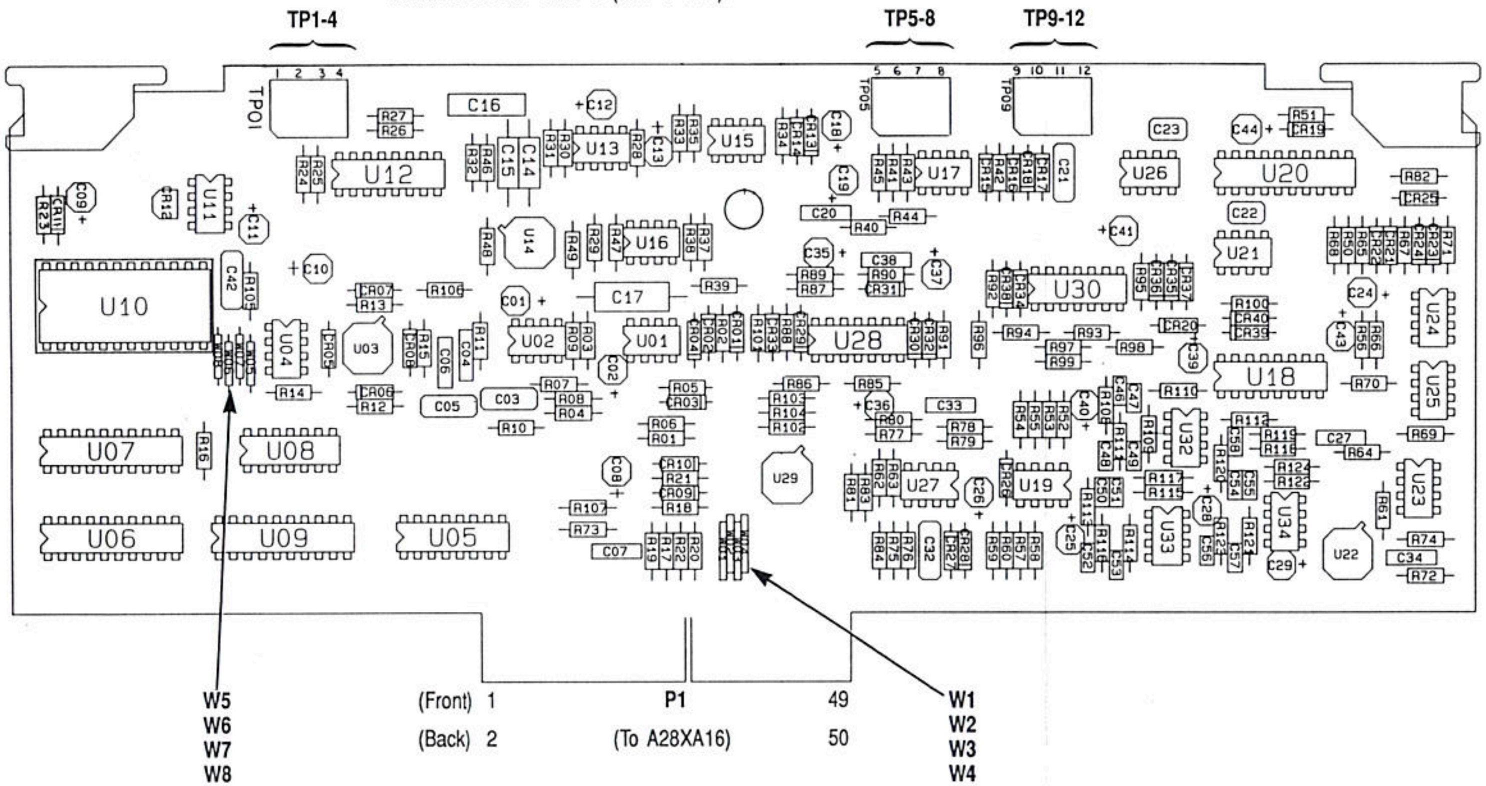


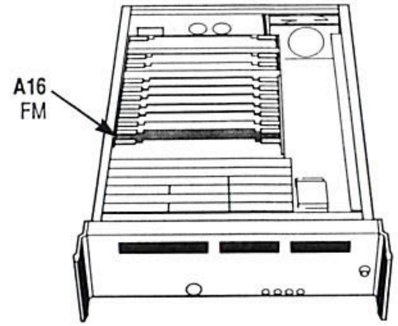
Figure 6J-7. A16 FM PCB Schematic Diagram (Sheet 1 of 4) 6700-D-31716-3 (Rev. F)

TEST POINTS

TP1	GND G	TP7	ϕ MOD
TP2	FM	TP8	Not Used
TP3	FM ATTEN DAC OUT	TP9	GND G
TP4	ATTEN FM	TP10	FM SENS DAC OUT
TP5	GND G	TP11	FM DEV LIMITER OUT
TP6	FALSE LOCK DET OUT	TP12	FM (+)

All test point measurements are made with reference to GND G (TP1 or TP9).





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6J-6. A16 FM PCB Parts Locater Diagram
6700-D-31716-3 (Rev. F)

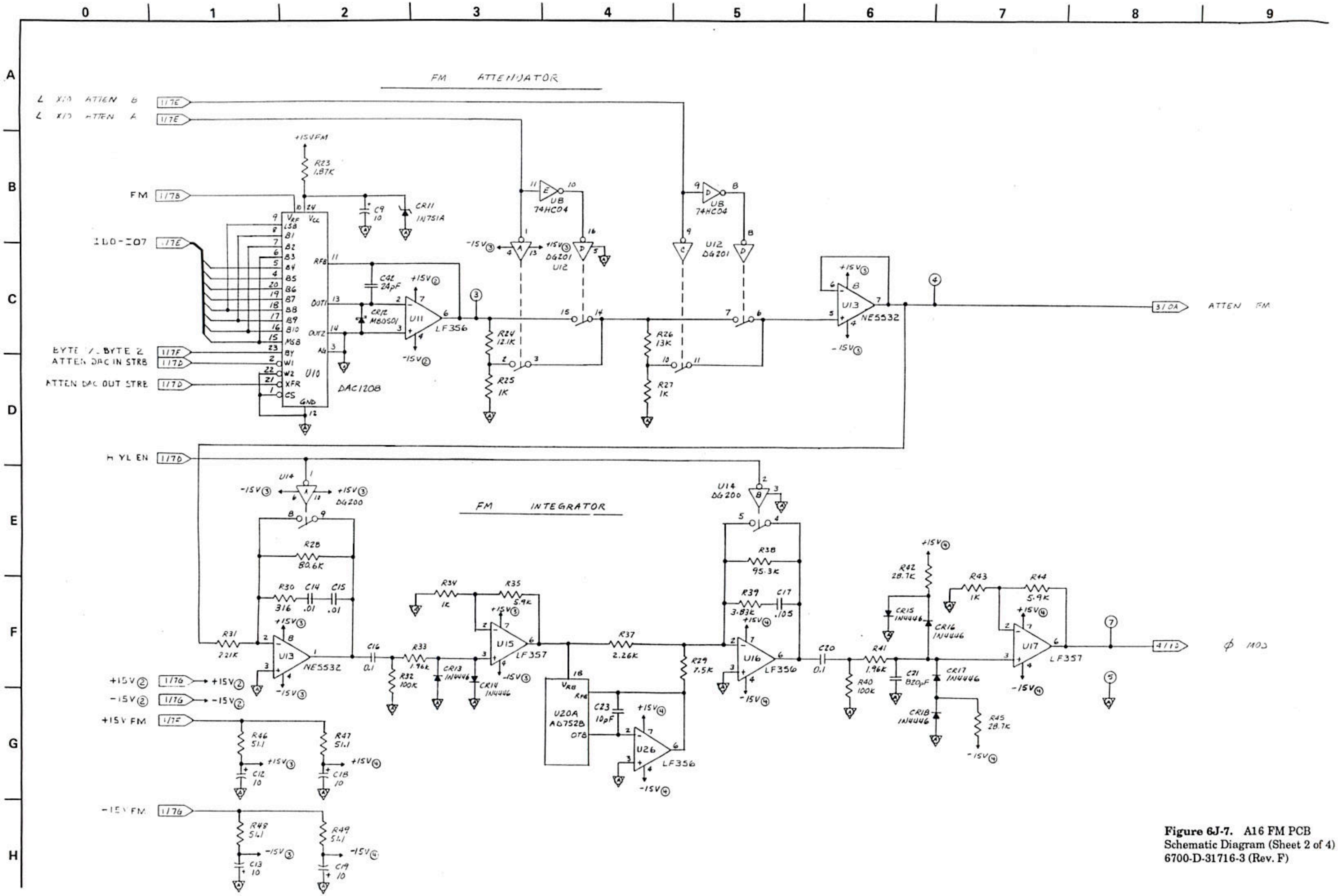
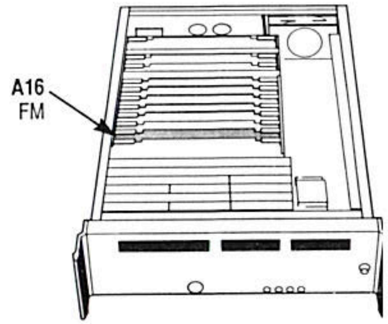


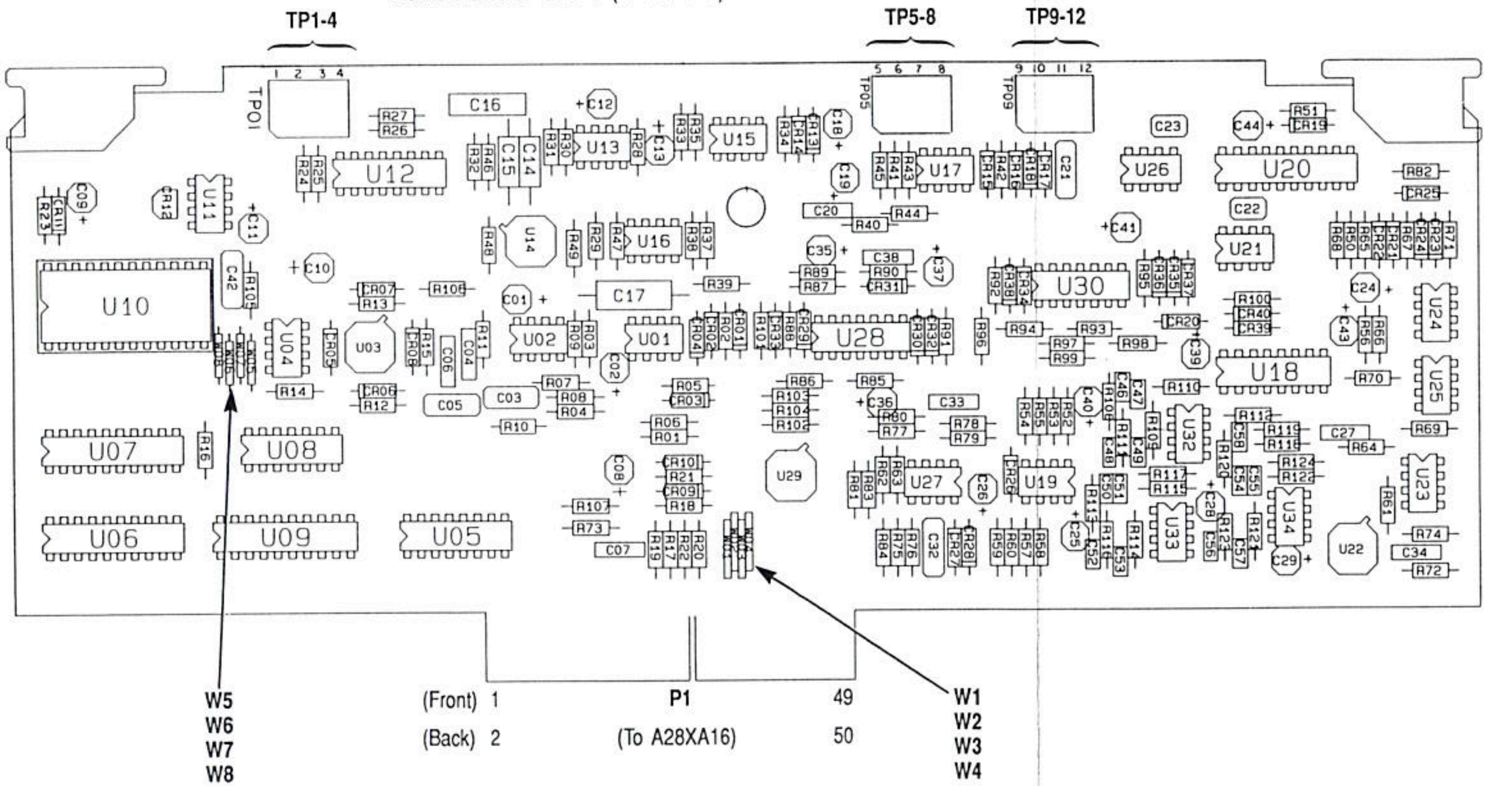
Figure 6J-7. A16 FM PCB Schematic Diagram (Sheet 2 of 4) 6700-D-31716-3 (Rev. F)

TEST POINTS

TP1	GND G	**TP7**	φ MOD
TP2	FM	**TP8**	Not Used
TP3	FM ATTEN DAC OUT	**TP9**	GND G
TP4	ATTEN FM	**TP10**	FM SENS DAC OUT
TP5	GND G	**TP11**	FM DEV LIMITER OUT
TP6	FALSE LOCK DET OUT	**TP12**	FM (+)

All test point measurements are made with reference to GND G (TP1 or TP9).





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6J-6. A16 FM PCB Parts Locater Diagram
6700-D-31716-3 (Rev. F)

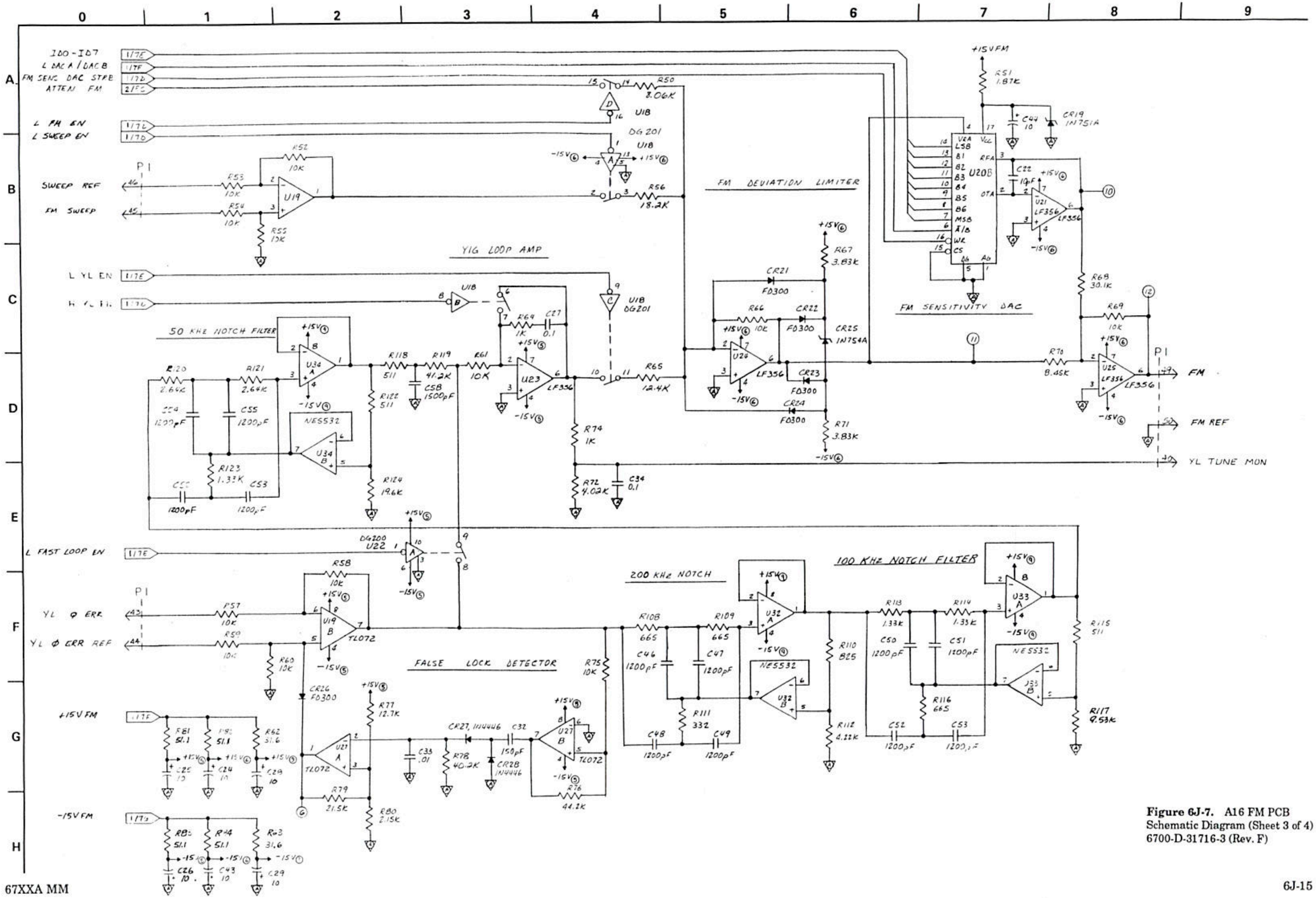
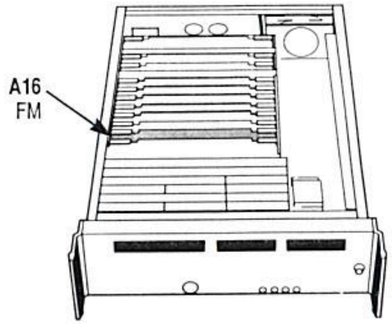


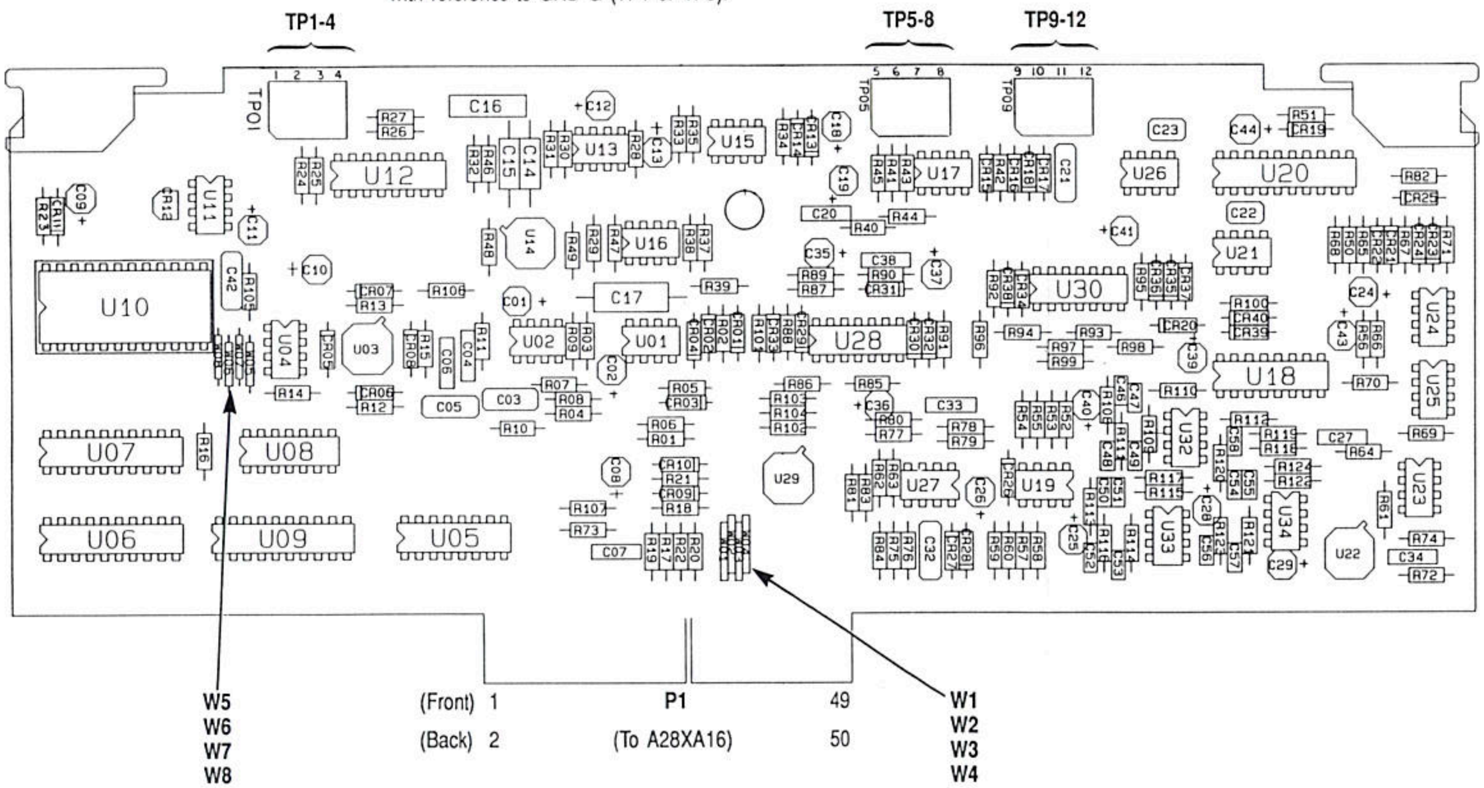
Figure 6J-7. A16 FM PCB Schematic Diagram (Sheet 3 of 4) 6700-D-31716-3 (Rev. F)



TEST POINTS

TP1	GND G	TP7	φ MOD
TP2	FM	TP8	Not Used
TP3	FM ATTEN DAC OUT	TP9	GND G
TP4	ATTEN FM	TP10	FM SENS DAC OUT
TP5	GND G	TP11	FM DEV LIMITER OUT
TP6	FALSE LOCK DET OUT	TP12	FM (+)

All test point measurements are made with reference to GND G (TP1 or TP9).



NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6J-6. A16 FM PCB Parts Locater Diagram
6700-D-31716-3 (Rev. F)

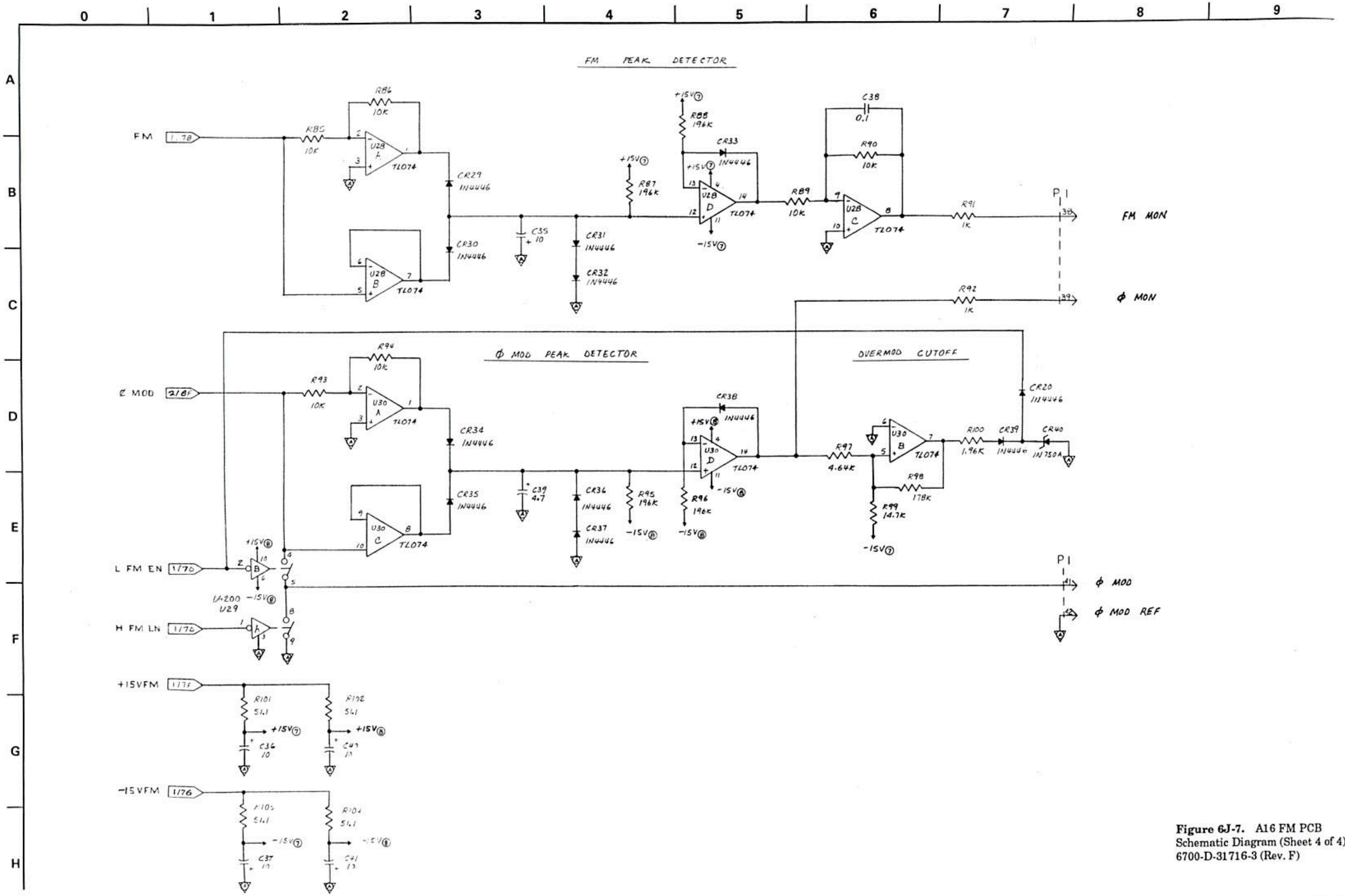
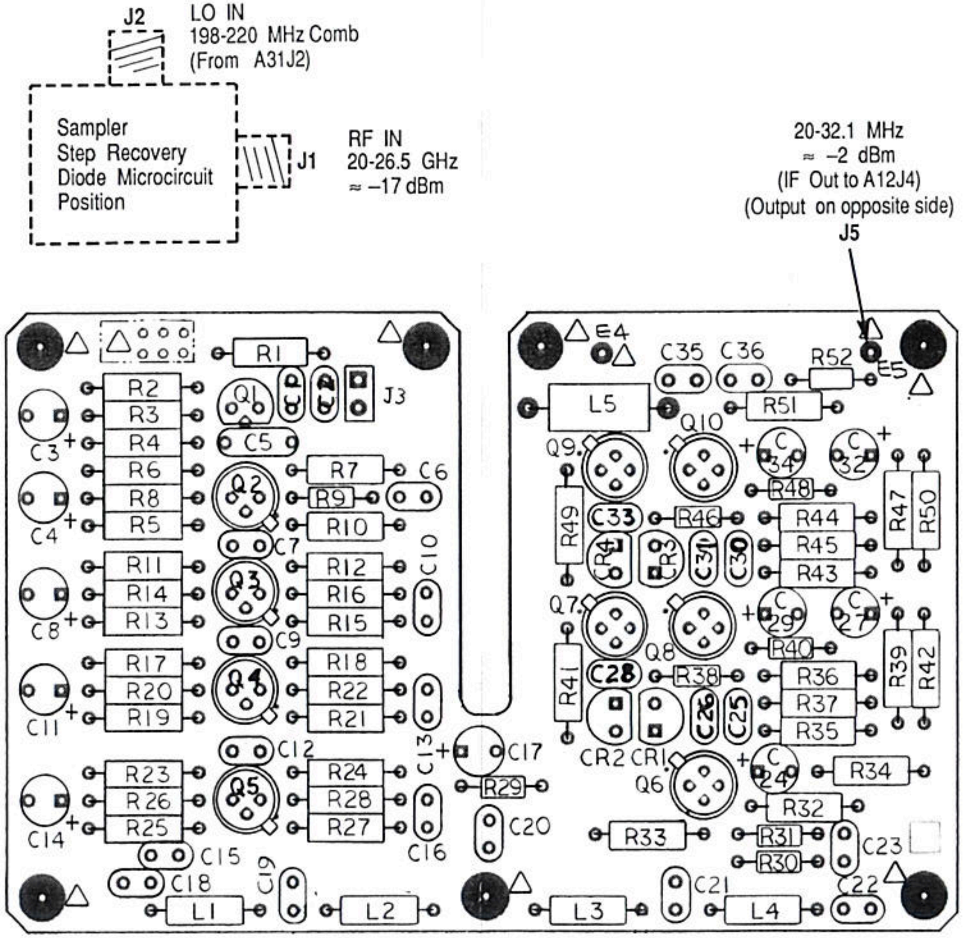


Figure 6J-7. A16 FM PCB Schematic Diagram (Sheet 4 of 4) 6700-D-31716-3 (Rev. F)



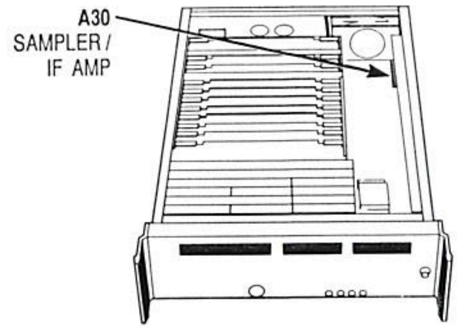
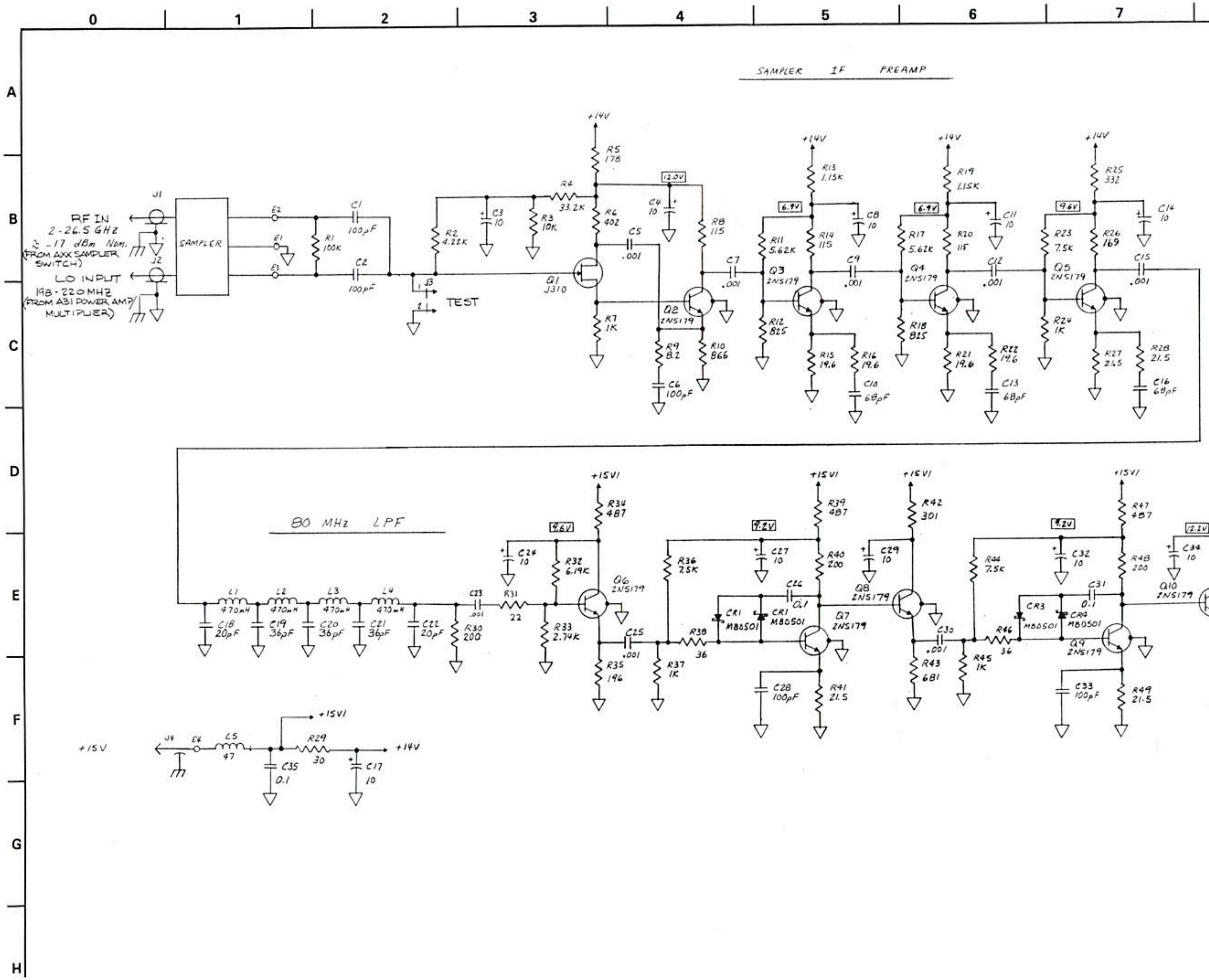


Figure 6J-8. A30 Sampler/IF Amplifier PCB Parts Locater Diagram
6700-D-31730-3 (Rev. E)

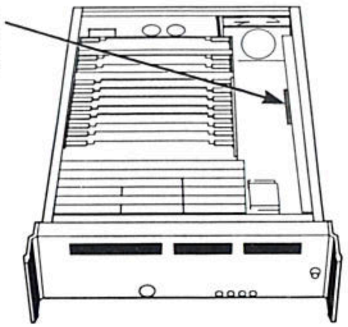


A30 SAMPLER/IF AMPLIFIER SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (µF), INDUCTANCES ARE IN MICROHENRIES (µH).
2. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUND:
3. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C36 CR4 J5 L5 P1 Q10 R52	NONE

Figure 6J-9. A30 Sampler/IF Amplifier PCB Schematic Diagram (Sheet 1 of 1)
6700-D-31730-3 (Rev. E)



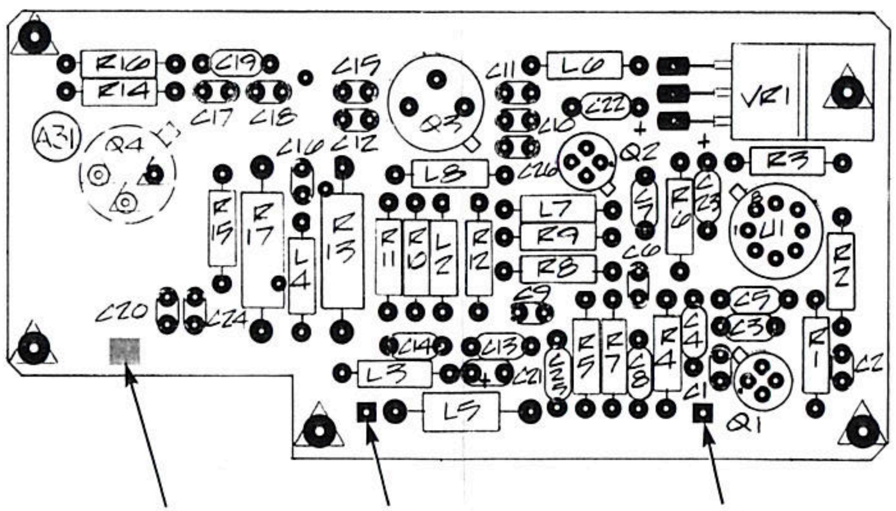


Figure 6J-10. A31 Power Amp/Multiplier PCB Parts Locater Diagram
6700-C-18660 (Rev. C)

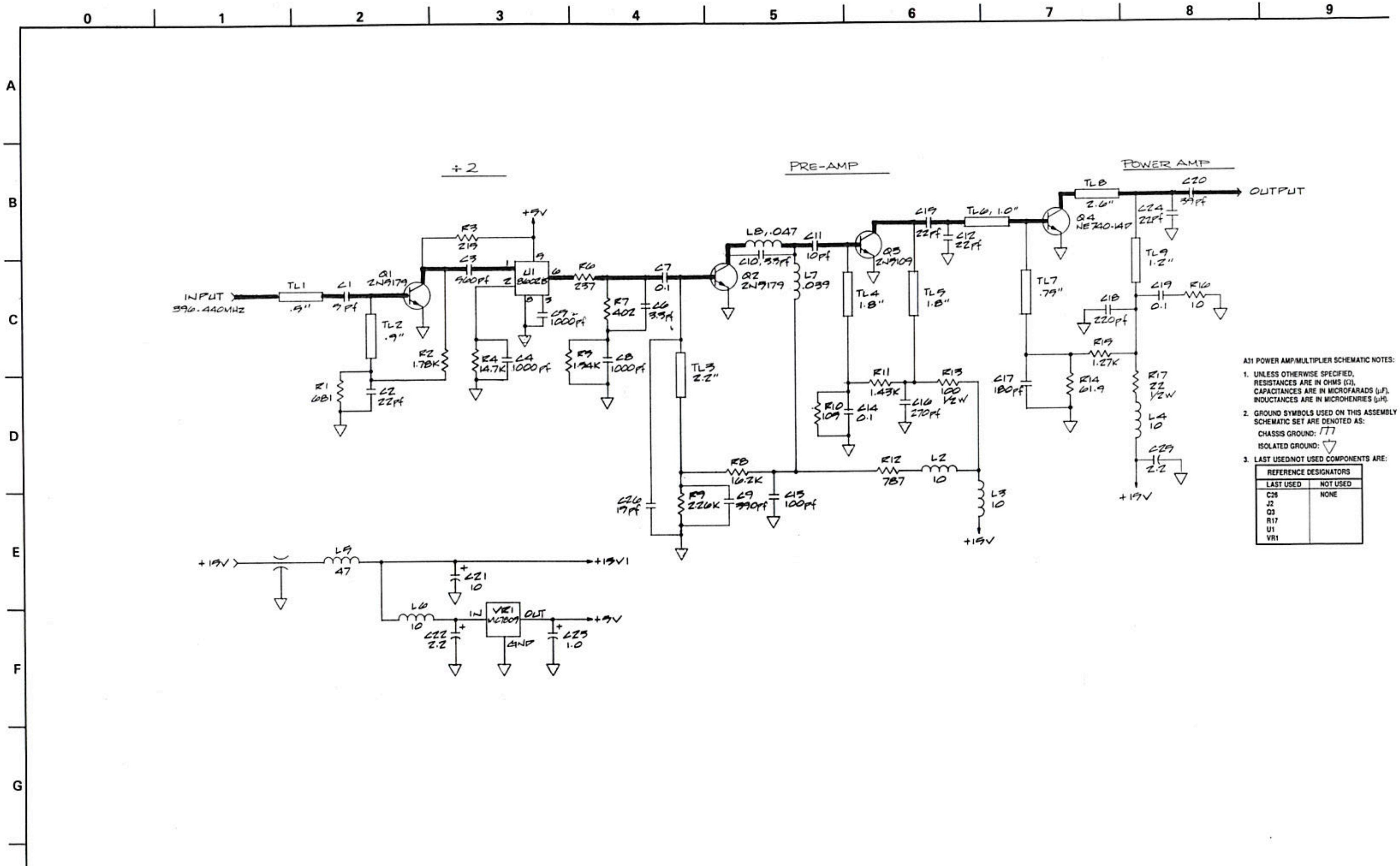


Figure 6J-11. A31 Power Amp/Multiplier PCB Schematic Diagram (Sheet 1 of 1)
6700-C-18660 (Rev. C)

6K – ANALOG INSTRUCTION A17 PCB

6K-1 ANALOG INSTRUCTION ASSEMBLY: A17 PCB

This section contains service information for the A17 Analog Instruction PCB assembly listed below in Table 6K-1. Refer also to the general reference information in sections 6A, 6B, and 6C.

Table 6K-1. Analog Instruction Service Information

Documentation	Reference	Page
OVERALL ASSEMBLY LEVEL		
Overall Description	Para. 6K-2	6K-1
Block Diagram	Fig. 6K-9	6K-19
Troubleshooting	Tbl. 6K-6	6K-17
PCB LEVEL		
A17 Analog Instruction PCB		
General Circuit Descriptions:		
Microprocessor Interface/ Internal Data Bus	Para. 6K-3	6K-2
Ramp Generator	Para. 6K-4	6K-2
±10V Reference Supplies	Para. 6K-5	6K-3
Frequency Instruction	Para. 6K-6	6K-3
Digital Voltmeter (DVM)	Para. 6K-7	6K-4
Power Meter	Para. 6K-8	6K-5
Detailed Circuit Descriptions:		
Microprocessor Interface/ Internal Data Bus	Para. 6K-9	6K-7
Ramp Generator	Para. 6K-10	6K-8
±10V Reference Supplies	Para. 6K-11	6K-11
Frequency Instruction	Para. 6K-12	6K-11
Digital Voltmeter (DVM)	Para. 6K-13	6K-14
Power Meter	Para. 6K-14	6K-15
Troubleshooting	Tbl. 6K-6	6K-17
Schematic (Sheet 1 of 4)	Fig. 6K-11	6K-21
(Sheet 2 of 4)	"	6K-23
(Sheet 3 of 4)	"	6K-25
(Sheet 4 of 4)	"	6K-27
Parts Locater Diagram	Fig. 6K-10	6K-20, 22,24,26

6K-2 ANALOG INSTRUCTION ASSEMBLY, OVERALL DESCRIPTION

Refer to the block diagram in Figure 6K-11 for the following discussion.

The Analog Instruciton is comprised solely of the A17 Analog Instruction PCB. The A17 PCB controls the analog operations within the 67XXA. Its circuits are divided into the functional groups described below. Although analog, the A17 is entirely under A23 Microprocessor control. Through the use of high-precision analog-to-digital converters (ADCs), digital-to-analog converters (DACs), and operational amplifiers (Op Amps), there are no hardware adjustments required for correct operation.

The A17 Analog Instruction PCB is described in the following parts:

- **Microprocessor Bus Interface and Internal Data Bus** – Separate bus and control lines are used to provide noise immunity.
- **Ramp Generator** – This circuit provides the analog sweep ramp. Additionally, it determines where the bandswitch points and the markers are to be placed.
- **+10V Reference Supplies** – This circuit provides the reference voltages for the DVM circuits.
- **Frequency Instruction** – This circuit has two modes of operation: CW and sweep. In the CW mode, a dc voltage goes to the appropriate YIG driver to coarse tune the YIG for phase-lock operation. In the sweep mode, this circuit adjusts the amplitude of the ramp from the ramp generator circuit. It sums this ramp with the dc CW tune voltage to provide a sweep voltage to the appropriate YIG driver.
- **Digital Voltmeter (DVM)** – The DVM crcuit does the following:
  (1) Monitors the phase-lock loops to determine if the system is phase locked.
  (2) Measures the percentage of AM and FM deviation when the RF output is modulated.
  (3) Monitors various other points in the 67XXA during self-test and calibration routines.
  (4) Interfaces between the A23 Microprocessor and the various analog circuits in the instrument.
- **Power Meter** – The power meter circuit, used in conjunction with a WILTRON 560 series detector head, allows measurement of an external RF source—or of the 67XXA RF output itself.

6K-3 MICROPROCESSOR INTERFACE AND INTERNAL DATA BUS, GENERAL DESCRIPTION

Refer to the A17 PCB block diagram in Figure 6K-11 for the following discussion.

The A17 PCB is addressed by the A23 Microprocessor PCB with address lines **L PA15** and **L PA19**. These two address lines are assigned *only* to this assembly, whereas the **PA0-PA2** address lines are common to all of the boards on the A23 Microprocessor bus. **L PA15** and **L PA19** actually address a particular latch on the A17 PCB.

L **PA15**, in conjunction with **PA0-PA2**, addresses only the digital voltmeter, power meter, and band select latches—circuits also addressed directly by the A23 Microprocessor. Addressing the circuits in this manner, provides isolation from the ramp generator and frequency instruction circuits.

L PA19, in conjunction with **PA0-PA2,** addresses the ramp integrator and frequency instruction portions of the A17 PCB. These circuits are buffered from the A23 Microprocessor data bus to provide noise immunity when not being addressed by the microprocessor. This internal data bus is further extended to a 16-bit bus. A 16-bit bus is needed for the circuit's 16- and 12-bit DACs. The second 8-bit bus comes from the DAC LSB (least-significant bit) latch.

The YIG driver select latch selects the YIG oscillator to which the frequency instruction's voltages are to be applied. In addition, it also supplies signals for the following A18-A21 YIG Oscillator PCB circuits:

- The RF Off circuit, which turns off the YIG oscillators (via **L RF OFF**).
- The CW Filter circuit, which switches a filter capacitor across the YIG oscillator's main tuning coil for CW operation and narrow band sweeps.

6K-4 RAMP GENERATOR, GENERAL DESCRIPTION

This circuit consists of parts of the Ramp Control Latch, Sweep Time DAC, Ramp Comp(arator) DAC, Ramp Comp(arator), and Ramp Control Logic, plus the Ramp Integrator itself.

The integrator charges through the integrator capacitor. It does so at a rate determined by the voltage from the Sweep Time DAC applied through a resistor. There are three of these resistors: one for sweep times of ≤1 second, another for sweep times >1 second, and a third for the retrace-to-discharge time. The selection between the two resistors for the sweep time is determined by the front panel setting of the sweep time. The selection of the resistor for the retrace-to-discharge time is determined by the A23 Microprocessor in conjunction with the Ramp Control Logic.

The output of the sweep integrator goes to the Ramp Comparator. The other input to the Ramp Comparator comes from the Ramp Comparator DAC. The top (high end) of the ramp is –10V and the bottom (low end) is 0V. With the DAC set at –10V (and with the Sweep Time DAC set so that the ramp charges), as the ramp reaches –10V, the comparator switches states. This change of state triggers the Ramp Comparator logic. This logic opens the switch that applies the charging current from the Sweep Time DAC. This sends a dwell interrupt to the A23 Microprocessor.

Upon receiving the dwell interrupt, the A23 Microprocessor interrupts what it is doing and sends an acknowledgement. The ramp then holds at –10V for approximately 20 ms. During this time, the A23 Microprocessor phase locks the RF signal, determines the frequency error, and stores this error-value for later use. When this is accomplished, the A23 Microprocessor PCB:

- Turns off the RF OUTPUT power
- Sets the blanking and sequential sweep signals on the A29 Rear Panel Interface PCB
- Turns off the automatic level control (ALC).

After the A23 Microprocessor completes its top-of-the-ramp tasks, it does the following:

- It tells the Ramp Control Logic to close the switch that discharges the integrator capacitor to 0V.
- It sets the Ramp Comparator DAC to 0V. This releases the dwell and allows the ramp to start towards 0V.

During this ramp discharge (retrace) of approximately 30 ms, the A23 Microprocessor:

- Calculates the errors for the correction of the frequency on the next setup, and
- Prepares the phase lock loops to lock at the bottom of the sweep.

When the ramp reaches 0V, the Ramp Comparator changes states again. This tells the Ramp Control

Logic to open the discharge current switch. The A23 Microprocessor then phase locks the RF at the new frequency and adds any correction value that was calculated during retrace. It then turns the RF on via the ALC board and changes the state of the blanking and sequential sync signal via the A29 Rear Panel Interface PCB. Everything is allowed to settle for a few milliseconds, then the dwell is released and the ramp starts on it way to –10V again.

If, during the sweep, oscillators have to be bandswitched, the Ramp Comparator DAC is set to the calculated voltage for this bandswitch instead of the –10V value. During this bandswitch dwell, the A23 Microprocessor will lock the previous oscillator that was sweeping and determine the error, if any, then turn it off. After so doing, it:

- Turns on the next oscillator.
- Phase-locks it, and determines the frequency error, if any.
- Sets the Ramp Comparator DAC for the next dwell point.
- Clears the dwell and sends the ramp to –10V.

If a frequency marker within the sweep range of the sweep has been selected, the voltage at which this marker is to occur is programmed into the Ramp Comparator DAC. When the ramp reaches this voltage, the Ramp Comparator output changes states and the sweep again dwells. However, during this dwell, the frequency is not phase locked as at the other dwell points. If the VIDEO marker is selected, there will be a 5 volt pulse from the rear panel interface applied to the rear panel during this time.

The integrator ramp is also buffered and amplified, then applied to the frequency instruction circuits as a –10V to +10V ΔF ramp. It is buffered and inverted and sent through the A29 Rear Panel Interface PCB to the HORIZ OUTPUT BNC connector.

6K-5 ±10V REFENCE SUPPLIES, GENERAL DESCRIPTION

There are four reference supplies on the A17 Analog Instruction PCB:

- +10V REF T
- –10V REF T
- +10V REF 2
- –10V REF 2

The ±10V REF T supplies are used for reference for the ramp generator and frequency instruction circuits. They also supply +10V REF T to the A18-A21 YIG Driver PCBs and a +10V REF to the A29 Rear Panel Interface. The ±10V REF 2 references supply reference voltages for the DVM and power meter circuits.

6K-6 FREQUENCY INSTRUCTION, GENERAL DESCRIPTION

These circuits provide the analog tuning voltages for the A18-A21 YIG Driver PCBs in both the CW and swept operational modes.

In the CW mode of operation, a dc voltage from the 16-bit Tune DAC is applied to the YIG Driver PCBs. When the +10V reference is switched to the Tune DAC, the DAC has a range of 0V to –10V. Conversely, when the –10V reference is switched to the Tune DAC, the DAC has a range of 0V to +10V. To allow for circuit tolerances, the actual voltage applied to the YIG Driver PCB is approximately –1V at the low end and –9V at the high end of the YIG tuning range. This provides approximately 50,000 steps of tuning for each oscillator (of the 65,536 available in the Tune DAC).

Example: For a 2-8 GHz YIG oscillator, 2 GHz occurs at approximately –1V and 8 GHz occurs at approximately –9V. With 50,000 steps, this results in 120 kHz/step resolution (8 GHz – 2 GHz = 6 GHz; 6 GHz/50,000 steps = 120 kHz/step). This 120 kHz resolution is further improved by the phase lock loops, which have a 1 kHz resolution.

The 8V range (9V–1V=8V) results in a voltage step of 160 µV (8V/50,000=0.000160V) for the above example.

This –1V and –9V may vary as much as 10%, depending on the YIG oscillator and its driver. However, a particular YIG driver/YIG oscillator for the 2-8 GHz band will be the same whether it is used in a 2-20 GHz unit, a 10 MHz-26.5 GHz unit, or a 2-8 GHz unit.

The actual voltages for each YIG driver are stored as a DAC word in non-volatile memory at the time of frequency calibration. These calibration voltages are used in all of the A23 Microprocessor calculations for analog sweep, stepped sweep and CW frequencies. Table 6K-2 shows the most commonly used YIG frequency bands in the 67XXA.

Table 6K-2. Oscillator Bandswitch Voltages

OSCILLATOR	LOW END VOLTAGE (VOLTS)	HIGH END VOLTAGE (VOLTS)	FREQUENCY RESOLUTION (KHz)	VOLTAGE RESOLUTION (MICROVOLTS)
2-8 GHz	-1V	-9V	120	160
2-8.4 GHz	-1V	-9V	128	160
8-12.4 GHz	-1V	-9V	88	160
12.4-20 GHz	-1V	-9V	152	160
13.25-20 GHz	-1V	-9V	135	160
18-26.5 GHz	-1V	-9V	170	160
20-26.5 GHz	-1V	-9V	130	160

YIG oscillators have a typical linearity of 0.05%. At higher frequencies, this can lead to significant error (≈13 MHz @ 20-26 GHz). Although not so important in CW or stepped sweep modes, this error this can lead to significant inaccuracies in an analog sweep. The error is reduced with the use of a Linearity DAC.

The frequency instruction output to the A18-A21 YIG Driver PCBs is also applied to the Linearity DAC circuit. The output of this circuit, which is used to reduce the linearity errors, is fed back to the input of the output buffer amplifier as either a positive or negative voltage. Both the breakpoint and the magnitude of this voltage are programmable. The voltage is stored for each YIG band at the time of frequency calibration. Figure 6K-1 shows a typical YIG

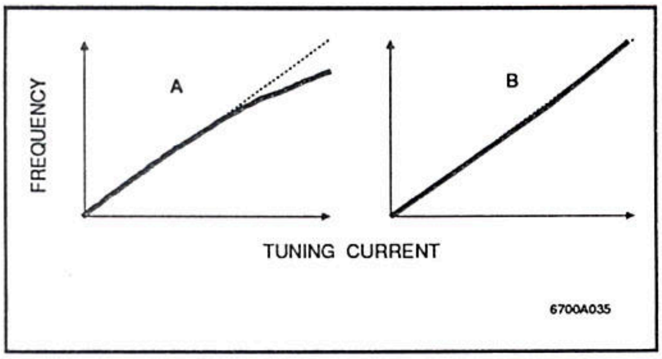


Figure 6K-1. Frequency-vs-Tuning Current Graph

frequency versus tuning current curve as the "A" graph. Graph "B" shows the curve after correction by the Linearity DAC.

The Sweep Width DAC receives a +10V to –10V ramp from the ramp generator and attenuates it according to the selected sweep width. When sweeping a single YIG oscillator, the Sweep Width DAC attenuates the 20V peak-to-peak ramp down to the 8V peak-to-peak swing required for the YIG driver. Since the attenuated ramp goes from –4V to +4V the Tune DAC sums a –5V offset with the attenuated ΔF ramp to provide the necessary –1V to –9V tuning range for the YIG. (The Sweep Width DAC inverts the ΔF ramp, and the summing amplifier inverts the input signals.)

When broadband sweeps are selected—such as 2-20 GHz—the slope of the ΔF ramp is insufficient to cover the frequency range of each of the YIG oscillators used. In this case, the gain of the summing amplifier is switched to provide a gain of four for both the ramp voltage and the Tune DAC voltage. This allows the Sweep Width DAC to still attenuate.

Figure 6K-2 shows the relationship of the ΔF ramp, Sweep Width DAC attenuation settings, and Tune DAC voltage required for a typical broadband sweep.

In narrow band sweeps (≤2 MHz), the output of the Sweep Width DAC does not go to the summing amplifier. The ΔF ramp is then applied to the A16 FM PCB, where it sweeps the FM coil of the YIG oscillator. The Tune DAC is set to the center frequency of the narrow band sweep and the CW filter (located across the main tuning coil) is enabled. The FM sweep DAC provides reduced residual FM and improved resolution for the narrow band sweeps.

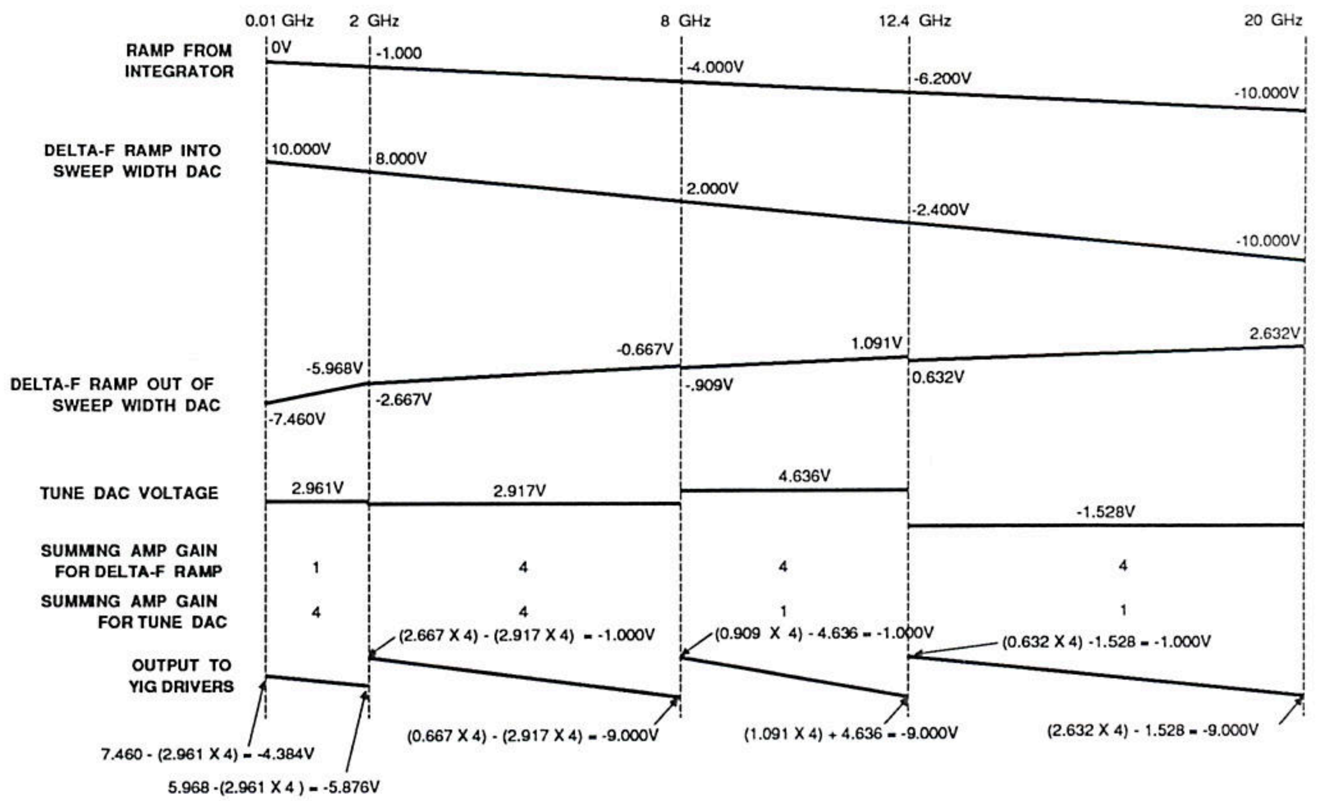
6K-7 DIGITAL VOLTMETER (DVM), GENERAL DESCRIPTION

The digital voltmeter circuit consists of a 12-bit analog-to-digital converter (ADC), a 24 channel multiplexer, and a sample/hold network. It has a +10V to –10V basic range and two auto ranges of ±20V and ±100V.

The three 8-to-1 multiplexers are addressed by the DVM and Multiplexer (Mux) Control Latch to select which channel is to be measured. This voltage then goes to a sample/hold circuit. This circuit holds this voltage during the conversion of the ADC to provide noise immunity.

The A23 Microprocessor accesses the A17 PCB's DVM at least once every 50 ms as a function of its housekeeping routines. Additionally, when certain operations are in progress — such as during phase locking — the microprocessor accesses the DVM more frequently. The maximum conversion time for the ADC is 30 μs.

Table 6K-3 shows the DVM channels and their basic functions.



NOTES:
1. The tuning voltages, -1V & -9V, are typical tuning voltages for the yigs and will vary from one yig to another.
2. The voltages given are rounded off to the nearest millivolt.
3. The above figure is for a typical 6747A. Other models will vary as far as switchpoint voltages and dac settings.
4. These voltages and gain settings will also depend on the sweep width and center frequency settings.

6700A036

Figure 6K-2. DVM Channels and Functions

6K-8 POWER METER, GENERAL DESCRIPTION

The power meter circuit in conjunction with a WILTRON 560-Series detector is used to measure power from either an external RF source or of the 67XXA itself. It consists of the following:

- A buffer amplifier for the temperature compensating thermistor, located in the detector head.
- A buffer amplifier for measuring the calibration offset, also located in the detector head.
- An amplifier/synchronous detector for the diode voltage.

The input Chopper Amplifier chops the dc signal from the detector at about a 10 Hz rate. This ac signal is then applied to the Programmable Amplifier, a switched gain amplifier, for amplification. The gain of this amplifier ranges from 10,000 at low signal levels to 1 at high signal levels.

Following amplification, the ac signal goes to the Synchronous Detector. This detector converts the signal back to a suitable dc voltage for measurement by the DVM. This chopper/synchronous detector system minimizes dc offset and drift errors at low signal levels.

Table 6K-3. Oscillator Bandswitch Voltages

Multiplexer Inputs	*Monitor Lines (to DVM)*	*Monitor Functions*
	Reference Loop	Measures the phase lock conditions of the reference loop from A7 .
	Course Loop	Measures the phase-lock condition of the coarse loop from A6.
	Fine Loop	Measures the phase-lock condition of the fine loop from A11
	Knob	Measures the dc voltage from the A2 PCB DECREASE INCREASE knob circuit. (the control is on the from panel .)
	YIG Loop	Measures the phase-lock condition of the YIG loop from A12.
Frequency Mod Phase Mode	FM/PM	Measures the FM deviation from A16 for display on the front panel MODULATION/TIME display.
	PS1 PS2	Measures the status of the regulated power supplies on the A22 Regulator PCB.
Band 0 Det Therm Band 1-4 Det Therm 10V Reference AM Peak AM Through Detector Shaper Slope	ALC1 ALC2	Measures the thermistor voltages of the leveling detectors for temperature compensation. Measures the reference supplies for self test. Measures the AM for display on the MODULATION/TIME display. Measures the detector shaper and slope for use in calibration and test. All of these signals come from the A15 PCB.
	Pulse	Used for self test of the A13 PCB Pulse Generator.
	DVM	Connect to analog ground. Used to zero the DVM.
	Fine Loop Tune	Monitors the tuning voltage of the fine loop oscillators from A9.
	Coarse Loop Tune	Monitors the tuning voltage of the coarse loop oscillators from A4
	Reference Loop Tune	Monitors the tuning voltage of the reference loop oscillators from A5 for calibration and test
	YIG Loop Tune	Monitors the YIG loop phase-lock error from the A12 PCB. Used in the Analog Sweep mode.
	Detector Thermistor	Monitors the thermistor in the power meter head (Series 560 Detector). From the external detector.
	Power Meter	Monitors the output of the power meter ircuit on the A17 PCB for display on the MODULATION/TIME display.
	+10V T	Monitors the reference voltage from the A17 PCB for selt test purposes.
	Tune	Monitors the Tune DAC output from the A17 PCB that goes to the YIG drivers
	DVM	Use as a digital voltmetere for calibration and troubleshooting.

6K-9 MICROPROCESSOR BUS INTERFACE AND INTERNAL DATA BUS, DETAILED CIRCUIT DESCRIPTIONS

Refer to the A17 Analog Instruction PCB schematic set for the following discussion.

Shown on sheet 1 of the schematic set are the A23 Microprocessor PCB's data bus lines — **D0-D7**. They are connected directly to U1, U2, U3, U16, and U40. The A23 Microprocessor PCB's address bus lines **PA0, PA1**, and **PA2** — are connected directly to U14 and U17.

U1 and U16 are 8-bit, D-type flip-flops with a clear function. Data is first put on the inputs then latched in with the low to high transistion of the strobe from the 3-to-8 decoder U14. The clear, or master reset (MR), is tied thru RN1 to +5V and thru C10 to ground. At power on, the MR is at 0V which sets the output of U1 and U16 to a low state. After about 10 ms, U1 and U16 may then be written to by the A23 Microprocessor. This prevents the YIG Driver select lines from going to a low state and turning on all of the YIG oscillators at the same time during power on. It also disables U3, the DVM, from accessing the A23 Microprocessor bus at the critical power on condition.

U1 controls analog multiplexers U7, U9, and U13, and the DVM, which is a 12-bit analog-to-digital converter. U40 is used to control operation of the power meter circuit. It is an 8-bit, edge-triggered latch with the oututs enabled at all times by the ground at pin 1. The ouputs will change only on the low to high transition of the strobe applied to pin 11. U16 provides the band selects for the YIG oscillators, the CW filter, RF OFF functions, and ranging for the DVM circuit. U2 is the latch for the internal data bus. It is an 8-bit, D-type transparent latch with tri-state outputs. As long as the enable intput on pin 11 is high, the outputs will follow the inputs. This internal data bus provides isolation of the A23 Microprocessor bus from the sensitive DAC's located in the ramp generator and frequency instruction circuits.

U14 and U17 3-to-8 decoders are used to decode the A23 Microprocessor's **PA0-PA2** address information. They also provide a strobe pulse to the various latches and DAC's having their own built-in latches to latch the data from the data bus. The **PA0, PA1**, and **PA2** logic signals are applied to pins 1, 2, and 3 respectively. When the **L PA15** signal for U14 or the **L PA19** signal for U17 goes low, the three inputs will be decoded to one of the 8 outputs. This "strobe", about 400 ns wide, will then latch the data on the A23 Microprocessor data bus to the appropriate latch on the A17 PCB.

The internal data bus from transparent latch U2 is connected to the 8-bit latches U8, U11, and DAC's U18, U24, U34, U38, U42.

U18, and U24 are 12-bit DAC's; U34 and U38 are 16-bit DAC's. These 4 and 8 extra bits are obtained with the U8 latch. The least significant nibble (in the case of the 12-bit DACs) or least significant byte (in the case of the 16-bit DACs) is first loaded into U8 latch by U2 latch. Then, the next 8 bits are put on the internal data bus by U2. The appropriate DAC is then strobed to latch the 12 or 16 data bits into the internal latches of the DAC.

The parallel loading of the 12 or 16 bits eliminates the "glitching" of the DAC's that would occur by loading the first byte and then the second byte into the DAC itself.

Ull latch is the ramp and frequency instruction control latch. Both U8 and U11 latches are referenced to "T" ground and have the 5V supplied from R57, C30, CR11 Zener diode supply. This provides further isolation of the circuits that they feed from the A23 Microprocessor bus and the 5V digital power supply.

6K-10 RAMP GENERATOR CIRCUITS, DETAILED CIRCUIT DESCRIPTIONS

The Ramp Generator circuits, shown on sheet 2 of the schematic set, are described in the following sub-groups:

- Ramp Integrator
- Marker Switch Point DAC
- Marker Switch Point Comparator
- Ramp Control Logic

6K-10.1 Ramp Integrator

The ramp integrator is comprised of U18, U19, and U20 with their associated components. U18 is a 12-bit DAC (4096 point resolution). It supplies current to U19A. Bits 0-4 are first latched into U8, then bits 5-11 are put on the internal data bus through the U2 transparent latch. The W1, W2, and XFR lines, which are tied together, are brought low for about 400 ns. This transfers the 12 bits of data to the internal latches of U18; the output of U18 will then change.

Since the maximum output of U19A is +10V, R20 and R21 have a 1% tolerance and C14 has a 10% tolerance The actual output voltage of U19A will vary from one unit to the next. This tolerance build-up is handled throguh software calibration correction values. The typical output of U19A at a 30 ms sweep speed will be approximately +8V. At a sweep speed of 999 ms, this voltage will approach 0V.

The output of U19A is applied to pin 3 of analog switch U20A. This switch is closed for a forward ramp and open for retrace or dwell. From pin 2 of U20A, the voltage is applied to R20. At the junction of R20 and R21, a current through R19 and pins 6 and 7 of U20B from –10V is summed in during retrace of the ramp. R21 is in series with R20 from the 1s to 99s sweep speed range. At sweep speeds less than 1s, R21 is shorted by pins 10 & 11 of the U20C analog switch. From the junction of R20 and pin 10 of U20C, the U19A output voltage/R20 current is applied to U19B. U19B output will charge C14. Since U19B has a typical gain of 200,000, this produces a very linear ramp. See Figure 6K-3 for U19 switch conditions in relation to the ramp.

When the ramp generator is not being used, U20D pins 14 and 15 will be closed — shunting C14 with R22. This prevents the output of U19B from going to the supply rails when not being used.

6K-10.2 Marker-Switch Point DAC

Also shown on sheet 2 of the schematic set are U24 and U25 which comprise the Marker-Switch Point DAC circuit. Operation of this circuit is the same as the Sweep Time DAC, U18.

U25 has an additional resistor R32 in the feedback not found in the U18-U19 DAC circuit. The output of the DAC without this resistor will always be about 25 mV less then –10V. R32 calibrates the output to be within typically 3 mV at full scale. U25-6 output, which goes from 0V to –10V, is applied to the Switch Point Comparator which consists of U26 and U27.

6K-10.3 Marker-Switch Point Comparator

The Marker-Switch Point Comparator, U26 and U27, in conjuction with the Marker-Switch Point DAC, U24 and U25, provide a logic signal to the ramp control logic which starts the "dwell." This dwell occurs at the top and bottom of the ramp, at each bandswitch point (for multiband units), and at each selected marker. At the bandswitch dwell, oscillators are switched and phase locked. At a marker, the ramp is only held in the dwell condition for a short time to give an intensity indication when used with an oscilloscope or network analyzer. At the top and bottom ramp dwells, the direction of the ramp is changed.

U26 is a very low input-offset operational amplifier that provide precise comparison between the Marker-Switch Point DAC output and the Ramp Integrator output. This inaccuracy is in the microvolt range. However, U26 is relatively slow, so the output swing is limited from +0.6V to –0.6V from the input voltage at pin 3 by CR4 and CR5. U26 pin 6 is applied to U27 pin 2 and compared again with the U25 pin 6 output. Since the output of U26 swings through the comparison voltage of U25 very quickly in comparison with the ramp voltage, the error due to the typical 3 mV offset of U27 is eliminated.

Figure 6K-4 shows the relationship of the voltages for the comparator circuit. Waveform B shows the output of the Marker-Switch Point DAC. At T2, this voltage is –5V. The solid line in Waveform C shows that the output of U26 is –5.6V. As the ramp voltage from U19B integrator reaches –5V, U26 output goes

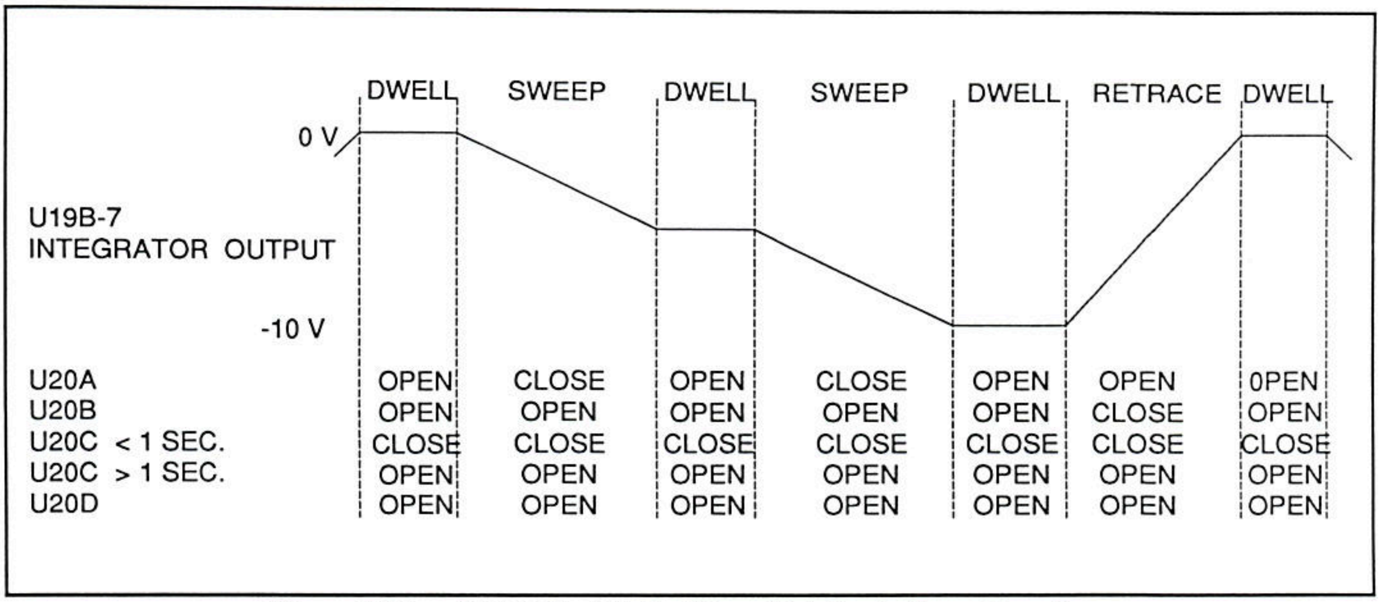


Figure 6K-3. A17U19 Switch Conditions (Relative to Sweep Ramp)

from –5.6V to –4.4V. This voltage is compared with the –5V on pin 3 of U27. As the voltage at pin 2 reaches –5V, the open collector output U27 pin 7 is pulled to a TTL high by RN1 (The dashed line in wavefom C represents the voltage at U27 pin 3 and U26 pin 3. The solid line, the voltage at U26 pin 2 and U27 pin 2).

At time T3 on waveform C, with the sweep ramp still at –5V, the output of the Marker-Switch Point DAC is set to –10V. The voltage at U26 pin 6 then goes from –4.4V to –10.6V and U27 pin 7 returns to a TTL low. The dwell is released and the ramp heads toward –10V.

6K-10.4 Ramp Control Logic

The Ramp Control Logic circuits control when the ramp is in the sweep, retrace, or dwell mode. The dwell signal from U27 pin 7 or **L SWP DWELL** from the rear panel BNC connector determines the start of each dwell. All other control signals and timing are determined by the A23 Microprocessor PCB. **L DWELL EN** enables the dwell signal from U27 pin 7, **CLR DWELL STRB** terminates the dwell, and **L RETRACE** determines if the ramp is sweeping or retracing.

Figure 6K-4 also shows the sequence of events for a typical sweep. The dwell at –5V could be either a marker or bandswitch dwell. The dwells at the bottom (0V) and top (–10V) of the ramp are on all cases of a sweep.

Just before T0, the ramp is retracing. Dwell is enabled (waveform G), and Retrace is high (waveform E). As the ramp reaches 0V, the output of U27 pin 7 switches from a high to a low (waveform D). The transition causes the output of U6 pin 11 (waveform F) to go high, U6 pin 8 to go low (waveform H), and triggers U5 pin 11 flip-flop to go low (waveform J). The output of U5 pin 11 is inverted by U4E and sent to the A23 Microprocessor as an interupt. The output of U5 pin 11 is also applied to U23 pin 2. From U23 pin 3, it is inverted by U4C and applied to U23 pin 4 and U23 pin 9. Since **L RETRACE** is true, there will be no change in the output of U23 pin 6, but the output of U23 pin 8,

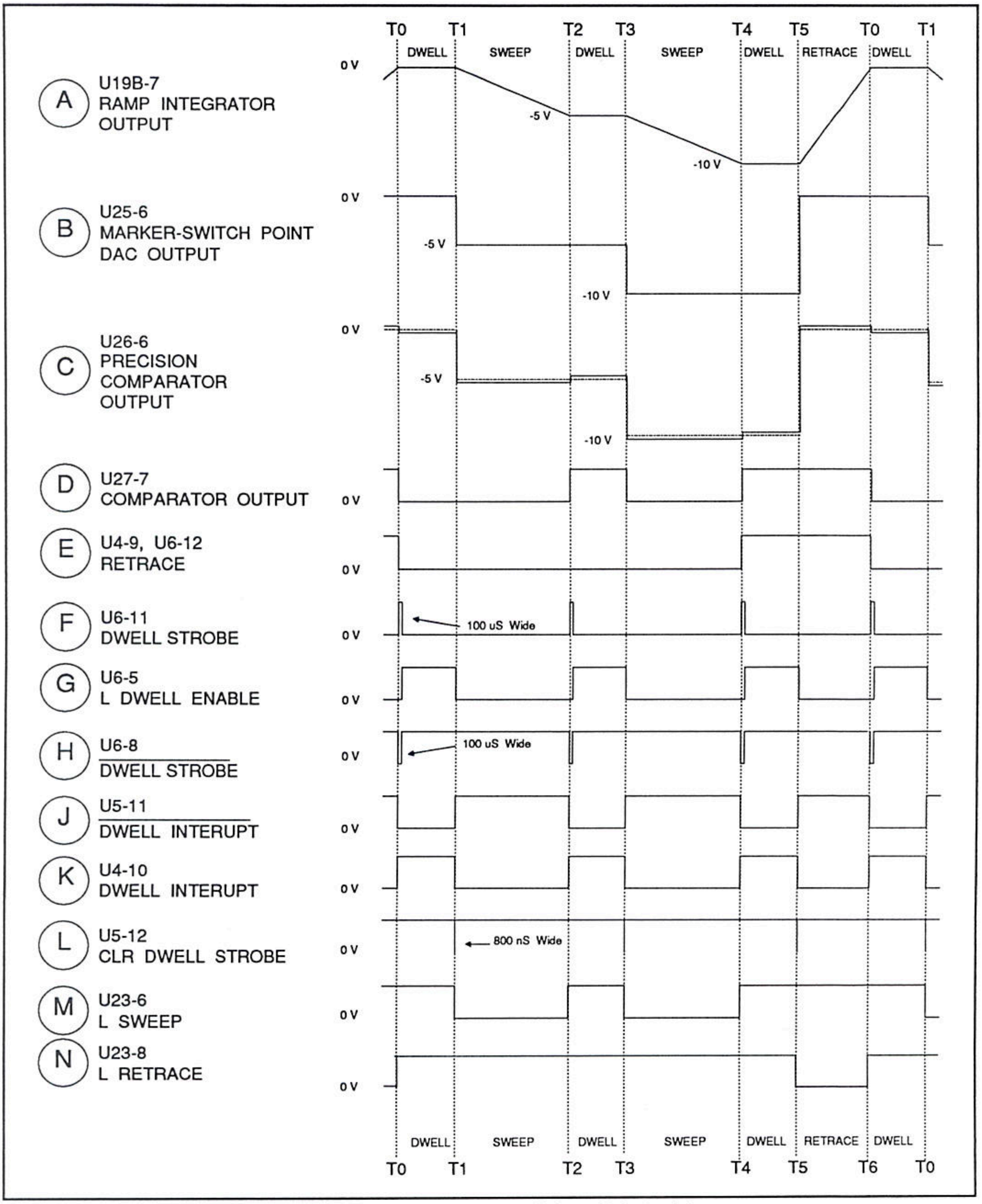


Figure 6K-4. Comparator Circuit Voltage Relationships which was low, will now go high. This will open the U20B analog switch supplying integrator current for the retrace. The output of the integrator will now be at 0V and will remain there for the duration of the dwell.

Approximately 100 µs after T0, the A23 Microprocessor sets the **L DWELL EN** high. Since U6 pin 6 and U6 pin 11 are each a open-collector wired-or configuration, the high **L DWELL EN** signal will cause U6 pin 6 to go low to the condition that it was in prior to T0. During the rest of the dwell, from T0 to T1, the processor performs various tasks such as setting the frequency instruction DAC's to their proper outputs, phase locking the RF signal, checking for any frequency error, and turning RF on in preparation to resume sweeping.

At T1, the A23 Microprocessor sets the Marker-Switch Point DAC to the value for the next dwell. This value will depend on the 67XXA model, sweep width, and marker settings. The **CLR DWELL STRB** (waveform L) will then be applied to U5 pin 12. This changes the state of flip-flop U5. Since the **RETRACE** signal to U4 pin 9 is not low, U5 pin 11 output will be routed via U23A, U4C and U23B to U20A analog switch. U20A analog switch closes and the ramp starts toward –10V. The **L DWELL EN** line also goes low to enable the dwell from U27 comparator pin 7.

At the next dwell (T2 and T3), the events of T0 and T1 will repeat.

6K-11 ±10V REFERENCE SUPPLIES, DETAILED CIRCUIT DESCRIPTION

There are four reference supplies on the A17 Analog Instruction PCB:
- +10V REF T
- –10V REF T
- +10V REF 2
- –10V REF 2

The ±10V REF T supplies are used for reference for the ramp generator and frequency instruction circuits. They also supply +10V REF T to the A18-A21 YIG Driver PCBs and a +10V REF to the A29 Rear Panel Interface. The ±10V REF 2 references supply reference voltages for the DVM and power meter circuits.

U30 is a precision 10V regulator used as reference for U31. U31A buffers and filters the precision regulator output for +10V REF "T" supply. U31B inverts the +10V and filters it for the –10V REF.

U28 and U29 circuits operate in an identical manner to the U30 and U31 circuits.

6K-12 FREQUENCY INSTRUCTION, DETAILED CIRCUIT DESCRIPTIONS

The Frequency Instruction circuits consists of the following subparts:
- Tune DAC
- Sweep Width DAC
- Analog Sweep Correction
- Linearizer DAC

6K-12.1 Tune DAC

Shown on sheet 3 of the schematic set is U34, a 16-bit multiplying DAC with 65,536 points of resolution. Dividing 10V by 65,536 results in 152.6 µV per point. The DAC input is first loaded by U8, then U2. Pins 19 and 20 are then strobed; this loads the internal latches of the DAC. The reference input is pin 13 and is supplied with either the +10V REF T or –10V REF T supply through analog switches U33A and U33B. U35 converts the DAC output current to a voltage that is inverted from the input reference voltage on U34 pin 13. Analog switch U33D in the feedback path of U35 compensates for the voltage drop and temperature drift of U33A and U33B.

In CW mode of operation, U33A will be closed; this results in a 0 to +10V output at U35 pin 6. This voltage is applied through U41B to R51 and U37. This is a unity gain inverting path, so U37 pin 6 output can go from 0V to –10V. U41B and U33C provide temperature drift compensation.

In broadband sweep modes, it is necessary that the U34 offset a very high ΔF ramp voltage. At this time, U41A closes and puts R52 in parallel with R51. This results in a gain of 4 for U37.

6K-12.2 Sweep Width DAC

Also shown on sheet 3 of the schematic set are U38 and U39 which comprise the sweep width control circuit. The DAC and amplifier are identical to the tune DAC. The reference input is a –10V to +10V ΔF ramp. U39 inverts this ramp and applies it to U36 analog switch. U36A provides a gain of 1 while U36A together with U36B provide a gain of 4. This ΔF ramp is then summed with the tune DAC output. See Figure 6K-5 for a description of the gain settings for various sweep widths.

The ΔF ramp is also applied to P1 pin 63 which goes to the A16 FM PCB. When the sweep width is ≤50 MHz, the ramp is applied to the FM coil of the YIG oscillator instead of to the main coil. Under this condition, both U36A and U36B are open and an analog switch on the A16 PCB is closed. The tune DAC then sets the voltage for the center frequency of the sweep.

6K-12.3 Analog Sweep Correction

In analog sweep, the frequencies on both sides of each band switch point and at the top and bottom of the sweep are phase locked. The phase lock error voltage is read and, on the next sweep, the tune DAC and sweep width DAC are adjusted by the A23 Microprocessor PCB for improved accuracy. During sweeps <50 MHz, the center frequency of the sweep is phase locked and corrected. This is accomplished at the top of the sweep by opening the analog switch on the A16 FM PCB to remove the ΔF ramp from the FM coil.

At a point where the 67XXA phase locks during a sweep, as indicated previously, the A23 Microprocessor sets the appropriate DACs to get the frequency requested. The frequency is phase locked and the error voltage, wich is approximately 1 volt/MHz, is measured. During retrace of the sweep, the A23 Microprocessor calculates the new DAC setting to correct these errors. The next sweep, the errors are corrected and accuracy checked. The accuracy is continuously checked each sweep so than any temperature drift or drift with time will automatically be corrected.

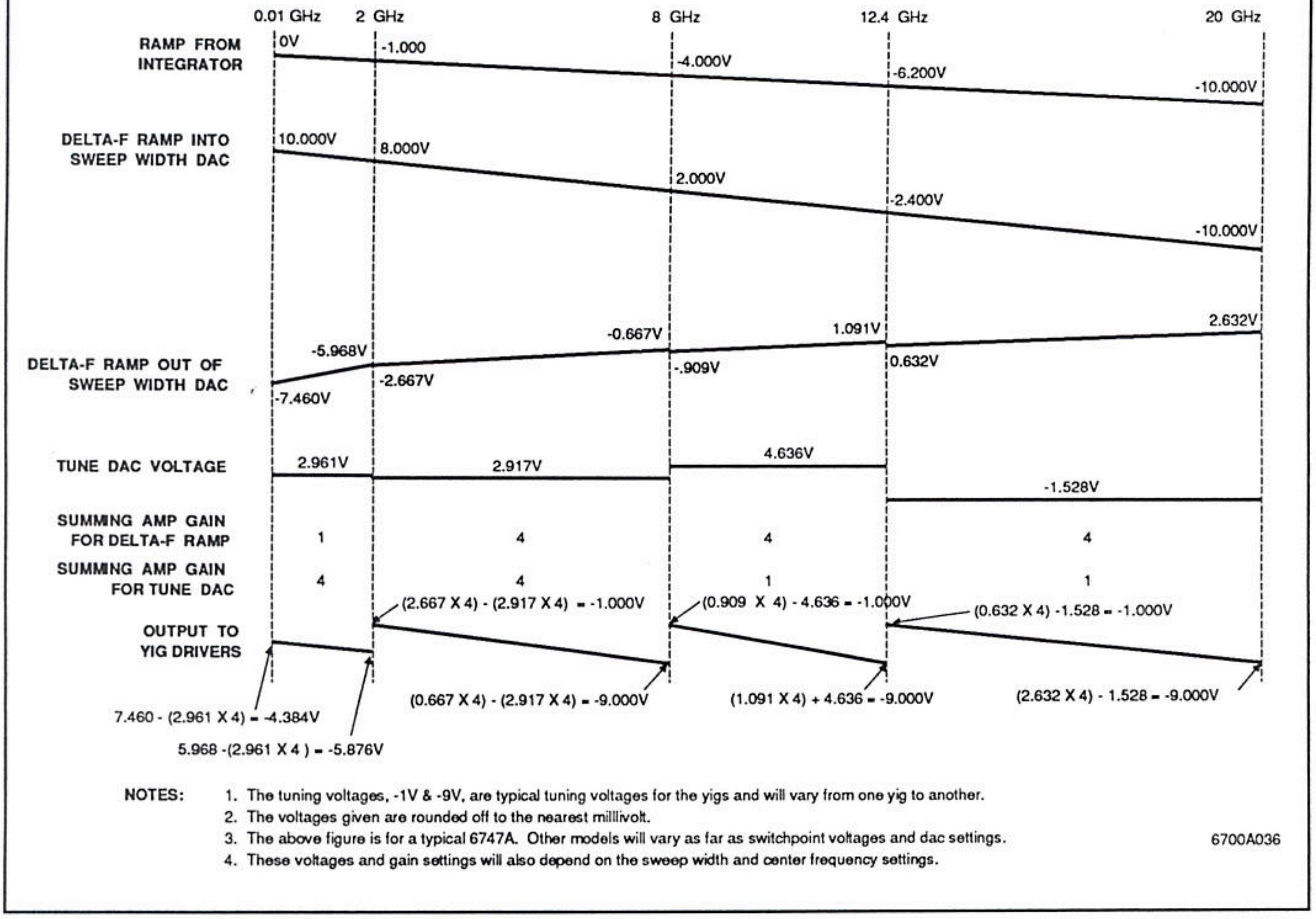


Figure 6K-5. YIG Oscillator Tuning Voltages

6K-12.4 Linearizer DAC

YIG oscillators have a linear frequency output with a linear tuning current input. However, they do have some nonlinearities on the order of 0.05%; these are typically at the top third of the band. Any nolinearity can cause significant errors in analog sweep between the two phase locked end points (see Figure 6K-6).

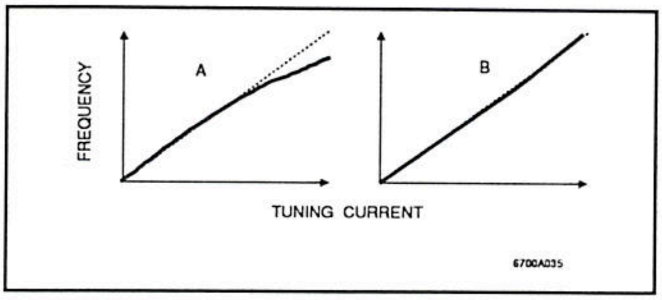


Figure 6K-6. Frequency Versus Tuning Voltage

U42, U32, and Q1 on sheet 3 of the schematic set form a programmable linearizer to reduce the frequency errors caused by noninearity of the YIG oscillator.

Figure 6K-7 illustrates some of the possible settings of the linearizer DAC. U42 is a dual 8-bit DAC. Side B uses –10V REF T as a reference and is used to set the breakpoint of the linearizer. The output of U32C is summed with the tune output voltage from U37 pin 6 at the base of Q1. If the breakpoint DAC is set to +5V and the output of the tune is 0V, the base of Q1 will be at +0.6V, thereby setting the input to U42 pin 4 to 0V. As the output of U37 pin 6 goes higher than –5V, the input to U42 pin 4 will then start following the sweep. The output of U32 pin 7 is inverted from U42 pin 4 input and applied through R68 to U32 pin 13.

If linearizer DAC U42A is set to half of full scale (7F hex; 0111-1111 binary), then the output of U32B will be half of the input at U42 pin 4 and of opposite polarity. The output of Q1 is also tied to R61 which is twice the value of R68. Since the currents through R61 and R68 are equal and opposite, the output of U32D will be 0V. If U42A is set to some other value, then these currents will not be equal and opposite and their difference will be amplified by U32D. The polarity will be determined by the direction of the setting of U42A away from the halfway point of full scale. The magnitude of the output will be determined by both the setting of U42A and U42B with the maximum output being with U42B set to 0V and U42A being at no output or at full scale output.

The output of U32D will be summed through R56 with the tune DAC and sweep width DAC voltages. This then adds to or subtracts from the normal output voltage of U37 pin 6 to provide the correction for YIG linearity.

Calibration of the linearity is done automatically during the frequency calibration of each YIG oscillator by the A23 Microprocessor. In multiband 67XXA models, the values loaded into the linearization DACs will change at each bandswitch point. This automatically corrects for the YIG linearity in both CW and sweep modes of operation.

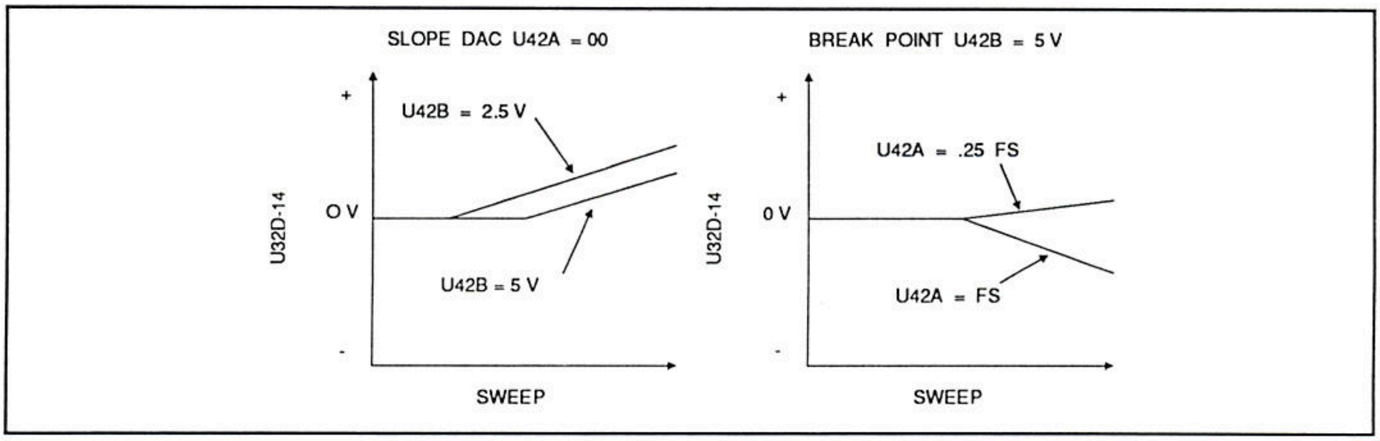


Figure 6K-7. Linearizer DAC Settings

6K-13 DIGITAL VOLTMETER, DETAILED CIRCUIT DESCRIPTION

U3, on sheet 1 of the schematic set, is an analog-to-digital converter (ADC) connected directly to the A23 Microprocessor bus. It has its own built-in DAC that is compared with the input analog signal at pin 14. Using a successive approximation algorithum in its own built-in microprocessor, it adjusts the DAC until its output equals the analog input. It then creates the digital word to set the value of the A17 PCB DAC that is available to the A23 Microprocessor.

The analog input to U3 pin 14 is comes from the Sample/Hold integrated circuit, U10 pin 5. The signal applied to U10 pin 3 charges C8 when an analog-to-digital conversion is not taking place. During the convert mode (analog-to-digital conversion) of U3, the STS line, pin 28, goes low. STS is inverted by U4B and applied to U10 pin 8. This puts U10 in the "HOLD" mode so that the input to U3 will be stable during its conversion, even though the input to U10 may be changing.

Figure 6K-8 shows the control signal timing for operation of the DVM in both the 8-bit and 12-bit conversion modes.

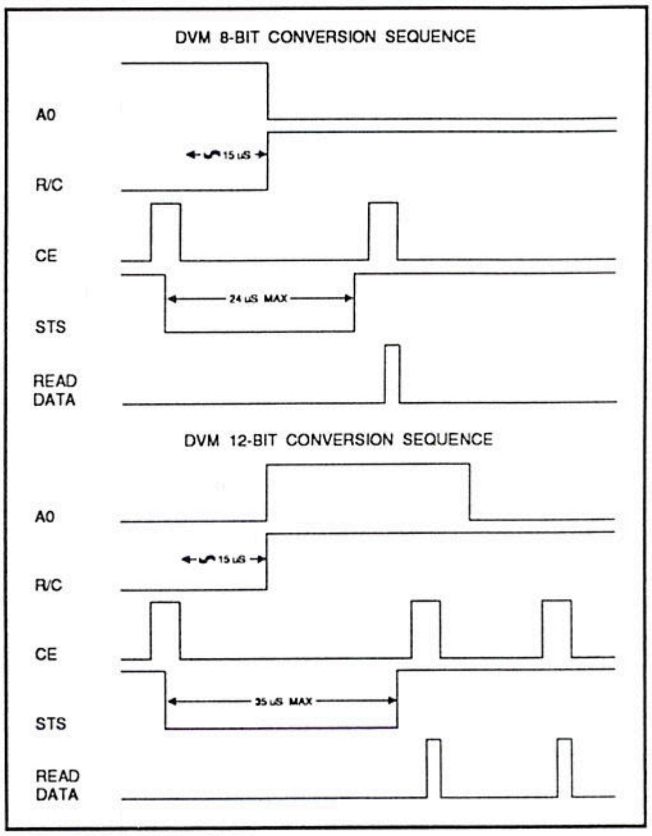


Figure 6K-8. DVM Control Signal Timing

At the start of the conversion, A0 (U3 pin 4) determines if an 8-bit or 12-bit conversion is to be made. R/C (U3 pin 5) determines if U3 is to do a conversion or to make the conversion data available to the A23 Microprocessor (read). The CE input (U3 pin 6) is brought high for approximately 800 ns. The STS line from U3 pin 28 goes low approximately 200 ns after the CE goes high to tell the sample/hold U10 to go into hold. About 15 µs later, the A0 and R/C lines change state in preparation for a read cycle. An 8-bit conversion takes a maximum of 24 µs and a 12-bit conversion takes a maximum of 35 µs. The processor waits after the initiate conversion 27 µs and 36 µs, respectively, and then initiates a read.

For an 8-bit conversion, the read is initiated by bringing the CE line high for approximately 800 µs. Shortly there after, U3 puts the data on the processor bus where it is read by the A23 Microprocessor. For a 12-bit conversion, the read cycle must be initiated twice. During the first read cycle, the processor reads the LSB which contains the 4 least significant bits and 4 zeros. During the second read cycle, the processor reads the MSB which is the full 8 bits.

A0 and R/C are set by the A23 Microprocessor via U1. CE is set by either U14 pin 13 or 14 which are also controlled by the processor. +10V REF 2 is applied to U3 pin 10, rather than using the internal reference of the A-D converter itself, to improve accuracy. It is also applied to B/P OFF (bipolar offset) to allow the DVM to have a full-scale operating range of +10V to –10V. For a 12-bit conversion, this allows 11-bit resolution for 0V to +10V and 11-bit resolution for 0V to –10V or 5 mV resolution for +10V to –10V.

U15 provides an additional two ranges for the DVM. When U15A switch is closed, the range of the DVM is +20V to –20V for all inputs except U13 pin 4 which is +100V to –100V. U15B provides for a +20 to –10V range for the U12 pin 4 input.

U13 pin 4 input is tied to TP2 through R15. This provides an internal DVM for general test and troubleshooting purposes. It has a range of +100V to –100V and is auto-ranging for maximum resolution. This DVM is accessed from the front panel by pressing SHIFT, TRIGGER, 083. The voltage is then indicated on the **LEVEL** display on the front panel.

Table 6K-4. DVM Multiplexer Truth Table

	EN	A0	A1	A2
NONE	0	X	X	X
S1	1	0	0	0
S2	1	1	0	0
S3	1	0	1	0
S4	1	1	1	0
S5	1	0	0	1
S6	1	1	0	1
S7	1	0	1	1
S8	1	1	1	1

The various inputs to the DVM are applied through analog multiplexers (MUXs) U7, U9, and U13. These are 8-to-1 multiplexers and are controled by the A23 Microprocessor via U1.

Table 6K-4 shows the truth table for logic inputs versus analog input for each selected output.

6K-14 POWER METER, DETAILED CIRCUIT DESCRIPTION

The power meter circuit, shown on sheet 4 of the schematic set, is a programmable gain amplifier and digital logrithmic amplifier. At low voltages, the amplifier has a gain of up to 10,000. The curve fitting of the detector output to a logrithmic (dB) scale is performed by the A23 Microprocessor from a stored data table. The power meter circuit also has provision for correcting the temperature and the frequency calibration factors of the detector automatically. The indicator for the power meter is the front panel LEVEL display and is enabled when the EXT PWR MTR key is pressed. If there is no detector physically connected to the rear panel or if there is no RF power applied to the detector, the display will indicate LLL.

6K-14.1 Input Chopper Amplifier

The dc voltage from the detector is applied to A17 pin 47 through R65 to quad-analog switch U46. When **L SAMPLE 1** is true, U46A and U46C are closed connecting the detector to U47 pin 5. U47 and U48A are arranged as an instrumentation amplifier. U48 pin 7 will follow the input to U47B. When **L SAMPLE 2** is true, the connector is then connected to U47 pin 3. U48A will then invert this signal and its output will be equal but opposite of when **L SAMPLE 1** is true. This chopping is done at a 10 Hz rate, controlled by the A23 Microprocessor during housekeeping.

Table 6K-5. Programmable Gain Amplifier (Gain Versus Detector Input Voltage)

POWER LEVEL	+10 dBm	0 dBm	-10 dBm	-20 dBm	-30 dBm	-40 dBm
DETECTOR OUTPUT	-441 mV	-172 mV	-34.2 mV	-4.39 mV	-459 uV	-50 uV
L 1X A	0	0	1	1	1	1
L 10X A	1	1	0	0	1	1
L 100 A	1	1	1	1	0	0
L 1X B	1	1	1	1	1	1
L 10X B	0	0	0	1	1	1
L 100X B	1	1	1	0	0	0
TOTAL GAIN	10	10	100	1,000	10,000	10,000
V DET (TP 10)	4.41 V	1.72 V	3.42 V	4.39 V	4.59 V	0.5 V

6K-14.2 Programmable Gain Amplifier

U48B and U51A are the same and each has a gain of from 1 to 100. The 10 Hz square wave from U48 pin 7 is applied to U48B and amplified. It is then ac coupled to U51A where it is again amplified and applied to U50A and U52B analog switches. Table 6K-5 shows the gain versus detector input voltage.

6K-14.3 Synchronous Detector

The synchronous detector converts the amplified 10 Hz square wave back to a dc voltage appropriate for the A17 PCB's DVM circuit. When **L SAMPLE 1** is true, the amplified detector voltage into U50A and U50B analog switches is negative; U50A switch will be closed. The negative detector signal will be routed through U51B to the inverting input of U52B. When **L SAMPLE 2** is true, the amplified detector voltage into U50A and U50B will be positive. U50B switch will be closed. The positive detector signal will then be routed through U52A to the non-inverting input of U52B. In both cases, the output of U42B will be positive.

6K-14.4 Temperature Compensation and Offset Amplifiers

U45B and U45C are connected in a bridge configuration. The detector thermistor is 1 MOhm at 25°C. At this time, the voltage at pins 5 and 6 of U45 will be –5V and the bridge will be balanced. As the temperature of the thermistor decreases, the voltage at the junction of R98 and R94 will go toward 0V. This will cause the output of U45B to go negative. As the temperature decreases, the output of U45B will go positive. This voltage change is read by the A17 PCB's DVM and the A23 Microprocessor and is used to correct the power reading on the front panel LEVEL display as the temperature of the detector changes.

The detector also has a 1 MOhm nominal resistance connected to the input of U45C. The actual value of the resistor is determined during calibration of the detector head itself. The voltage change caused by this calibration resistor is also read by the A17 PCB's DVM and A23 Microprocessor. It is used so that for a given power, the front panel LEVEL display will be the same for any compatible detector head.

6K-15 ANALOG INSTRUCTION PCB, TROUBLESHOOTING

Troubleshooting procedures in Table 6K-6 cover the A17 Analog Instruction PCB.

6K-16 ANALOG INSTRUCTION PCB, SERVICE SHEETS

Table 6K-1 on the first page of this section presents the arrangements of the block diagrams, schematics, and parts locater diagrams for the A17 PCB.

Table 6K-6. Analog Instruction Troubleshooting (1 of 2)

Trouble / Error Code	Troubleshooting Procedure
	A17 Analog Instruction PCB Troubleshooting Routines
SHIFT, TRIGGER, 191 Tune DAC Test	Sweeps Tune DAC from 0 to 100% and dwells at top and bottom with: • Tune DAC Output set to "–" • Fast Retrace • Gain set to 1
SHIFT, TRIGGER, 192 Sweep Width DAC Test	Sweeps Sweep Width DAC from 0 to 100% and dwells at top and bottom with: • Integrator off • Fast Retrace • Gain set to 1
SHIFT, TRIGGER, 193 Tune and Sweep Width Linearity Test	191 and 192 performed at same time.
SHIFT, TRIGGER, 194 Linearizer Slope DAC Test	Sweeps Linearizer Slope DAC from 0 to 100% with: • Breakpoint DAC set to 0 • Tune DAC set to 71.667% • Gain 1 open • Sweep Width Gain 1 and 4 open
SHIFT, TRIGGER, 195 Linearizer Breakpoint DAC Test	Sweep Linearizer Breakpoint DAC from 0 to 100% with: • Slope DAC set to 100% • Tune DAC set to 71.667% • Gain 1 open • Sweep Width Gain 1 and 4 open
SHIFT, TRIGGER, 196 Sweep Time DAC Test	Sweep the Sweep Time DAC from 0 to 100% with: • Ramp Integrator off • Clear Dwell • Disable Dwell • No Retrace • Sweep Time Range set to less than 1 second • Ignore Dwell Interrupt
SHIFT, TRIGGER, 197 Marker-Switch Point DAC	Sweep Marker-Switch Point DAC with • Disable Dwell • Clear Dwell • Ignore Dwell Interupt • Sweep Time Range set to 1 second • Sweep Time DAC to 100% • Integrator off
SHIFT, TRIGGER, 198 Ramp Generator Open-Loop Test	Operate Switch-Point DAC with open loop test to test control logic of: • L Dwell Enable • Clear Dwell • Retrace

Table 6K-6. Analog Instruction Troubleshooting (2 of 2)

Trouble / Error Code	Troubleshooting Procedure
	A17 Analog Instruction PCB Troubleshooting Routines (Continued)
SHIFT, TRIGGER, 150 **DVM Linearity test**	Sweeps the Tune DAC in 5 mV steps (Gain 1). The A23 Microprocessor reads the DVM, then outputs the value to the Sweep Width DAC with: • Integrator off • Gain 1 & 4 open
SHIFT, TRIGGER, 151 **Use DVM as external DVM (TP2)**	Displays the DVM voltage in the front panel LEVEL display.
SHIFT, TRIGGER, 152 **MUX Test**	Displays the DVM voltage in the front panel LEVEL display. Use front panel DECREASE/INCREASE keys to increment through MUX ports. Displays the active MUX port on the front panel MODULATION display.

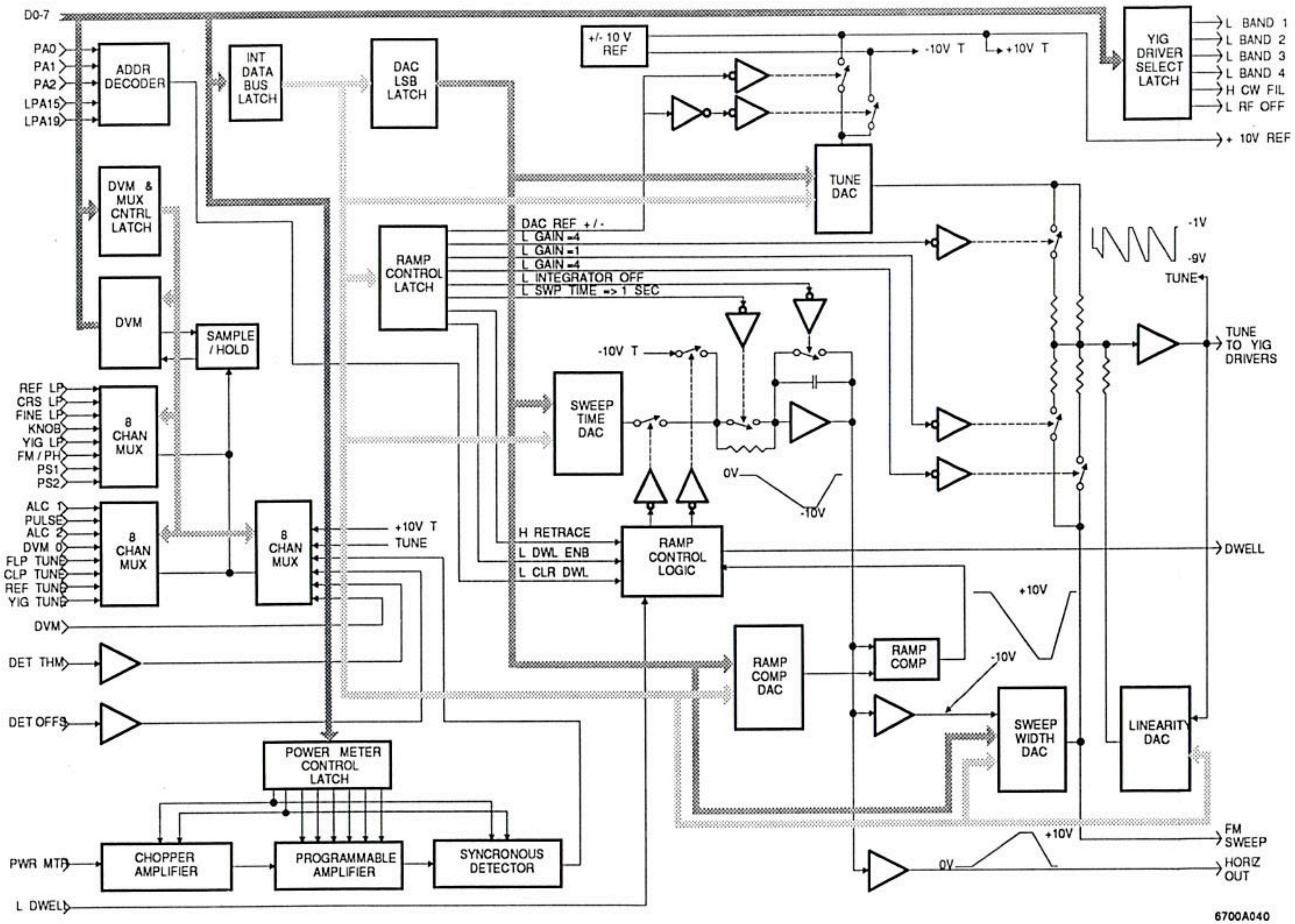
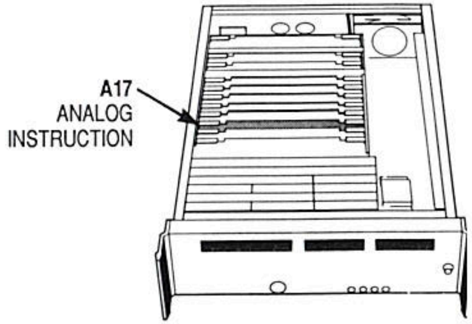


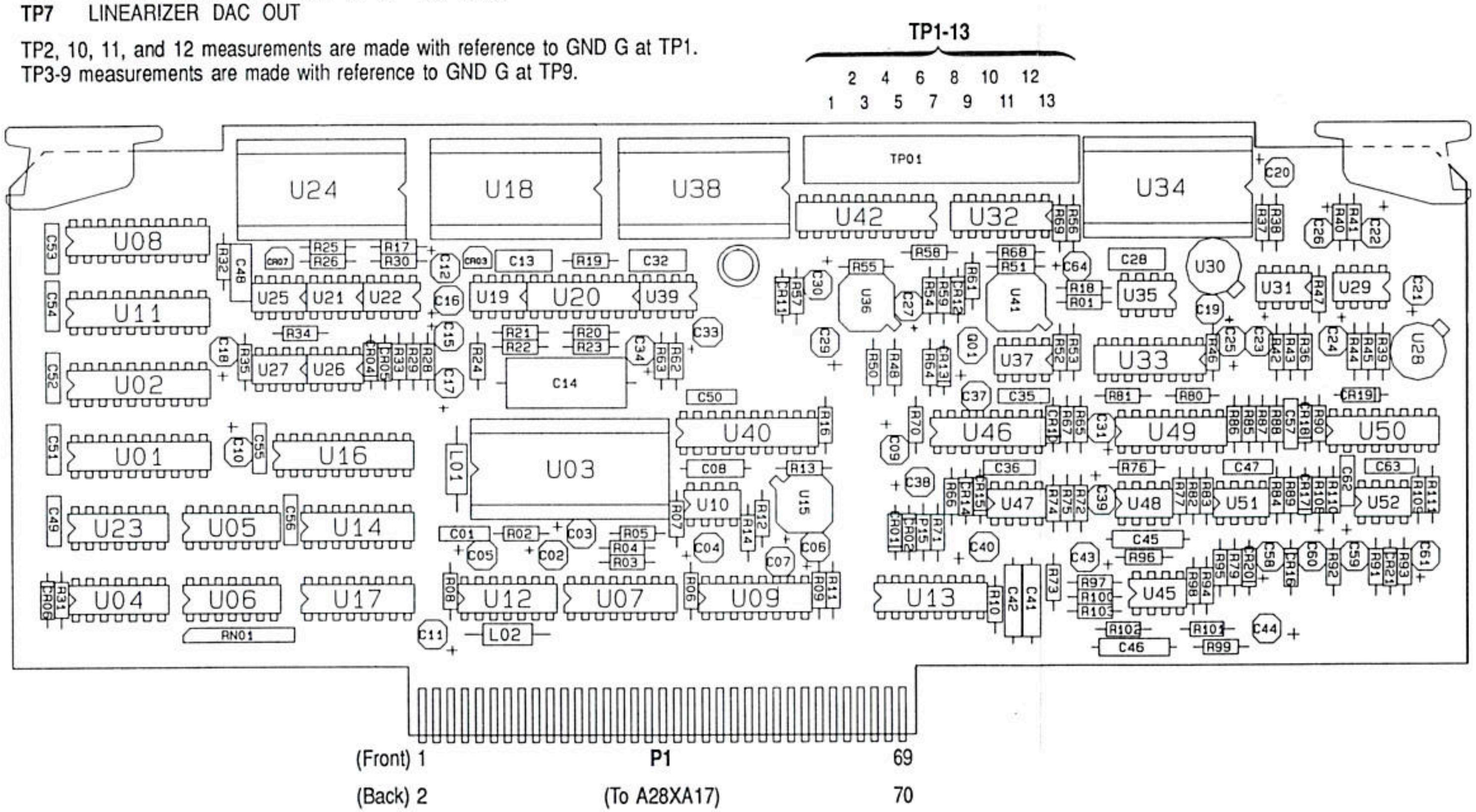
Figure 6K-9. A17 Analog Instruction PCB Block Diagram

TEST POINTS

TP1	GND G	TP8	FM SWP
TP2	DVM EXT INPUT	TP9	GND G
TP3	20V ΔF	TP10	V DET
TP4	TUNE DAC OUT	TP11	V TH
TP5	TUNE	TP12	V dBm
TP6	SWITCH POINT DET OUT	TP13	Not Used
TP7	LINEARIZER DAC OUT		

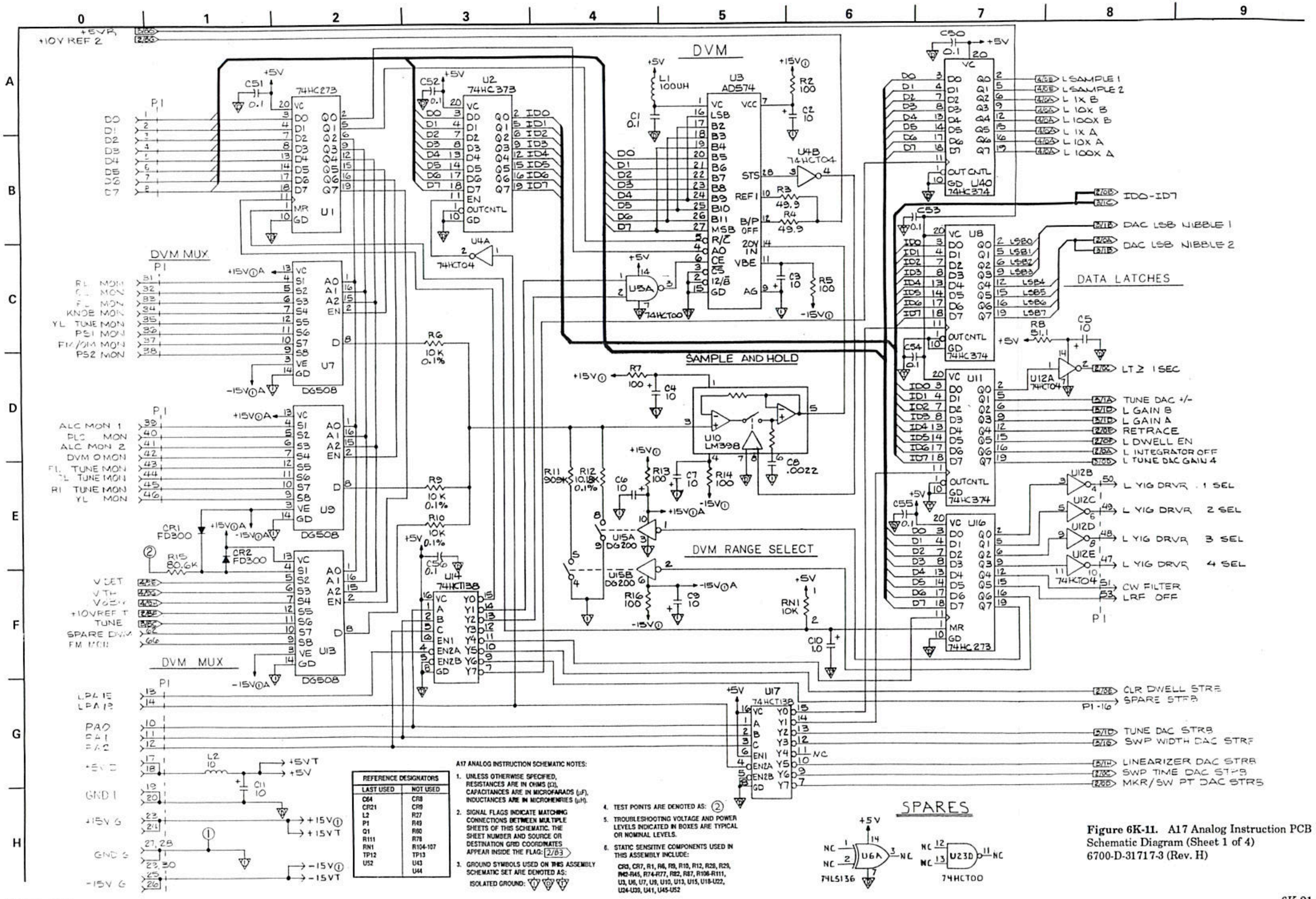
TP2, 10, 11, and 12 measurements are made with reference to GND G at TP1.
TP3-9 measurements are made with reference to GND G at TP9.





NOTE:
Leading zeros on component number references may be disregarded.

Figure 6K-10. A17 Analog Instruction PCB Parts Locater Diagram
6700-D-31717-3 (Rev. G)



REFERENCE DESIGNATORS	
LAST USED	NOT USED
C64	CR8
CR21	CR9
L2	R27
P1	R49
Q1	R60
R111	R78
RN1	R104-107
TP12	TP13
U52	U43
	U44

A17 ANALOG INSTRUCTION SCHEMATIC NOTES:

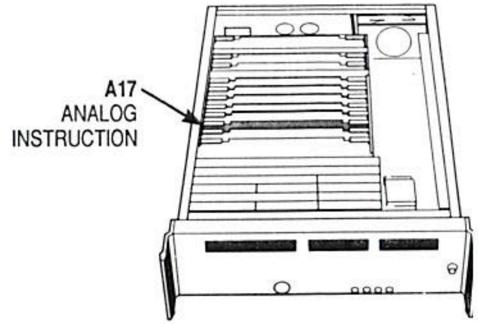
1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS: ISOLATED GROUND: I D T
4. TEST POINTS ARE DENOTED AS: (2)
5. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
6. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE: CR3, CR7, R1, R6, R9, R10, R12, R28, R29, R42-R45, R74-R77, R82, R87, R106-R111, U3, U6, U7, U9, U10, U13, U15, U18-U22, U24-U39, U41, U45-U52

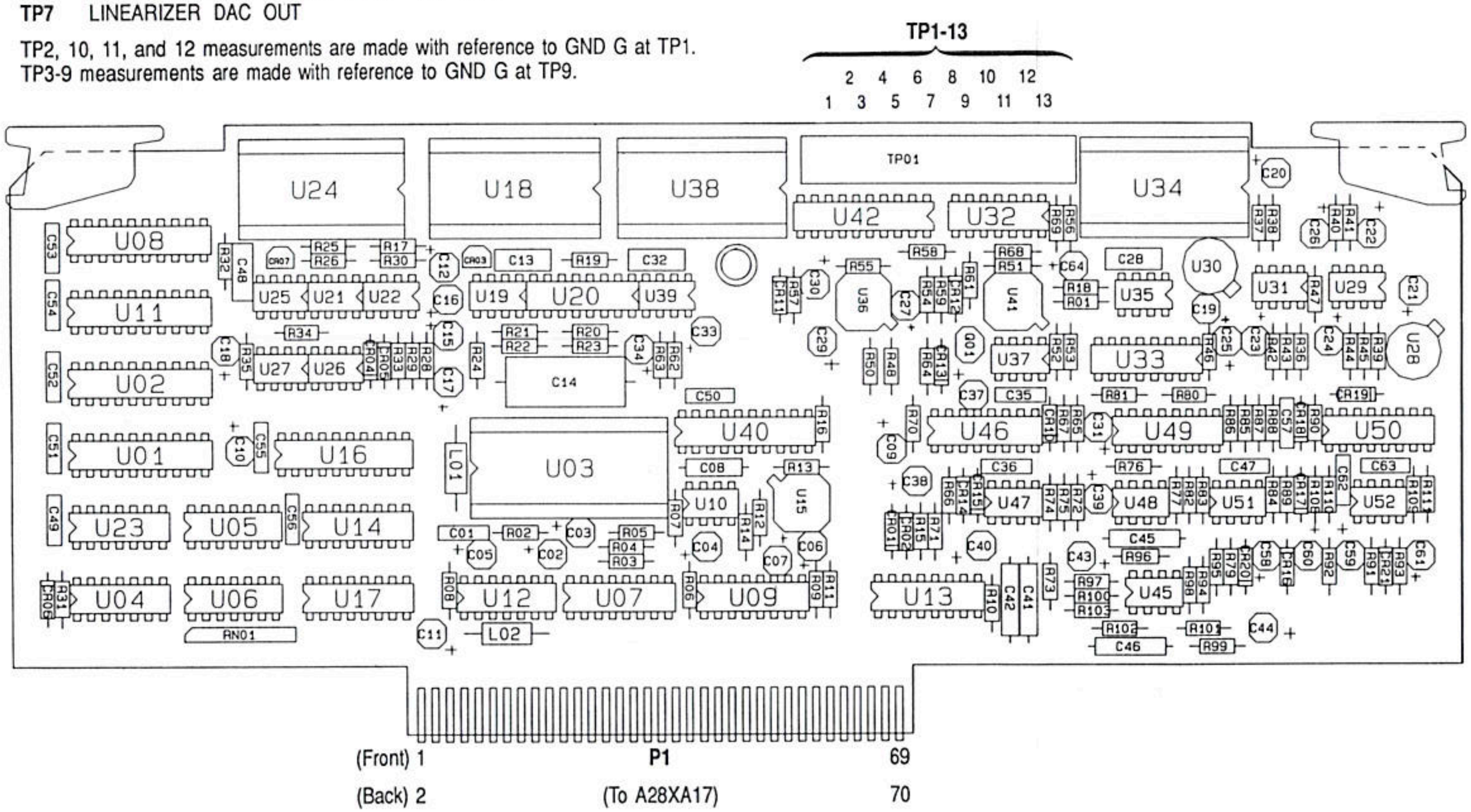
Figure 6K-11. A17 Analog Instruction PCB Schematic Diagram (Sheet 1 of 4)
6700-D-31717-3 (Rev. H)

TEST POINTS

TP1	GND G	TP8	FM SWP
TP2	DVM EXT INPUT	TP9	GND G
TP3	20V ΔF	TP10	V DET
TP4	TUNE DAC OUT	TP11	V TH
TP5	TUNE	TP12	V dBm
TP6	SWITCH POINT DET OUT	TP13	Not Used
TP7	LINEARIZER DAC OUT		

TP2, 10, 11, and 12 measurements are made with reference to GND G at TP1.
TP3-9 measurements are made with reference to GND G at TP9.





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6K-10. A17 Analog Instruction PCB Parts Locater Diagram
6700-D-31717-3 (Rev. G)

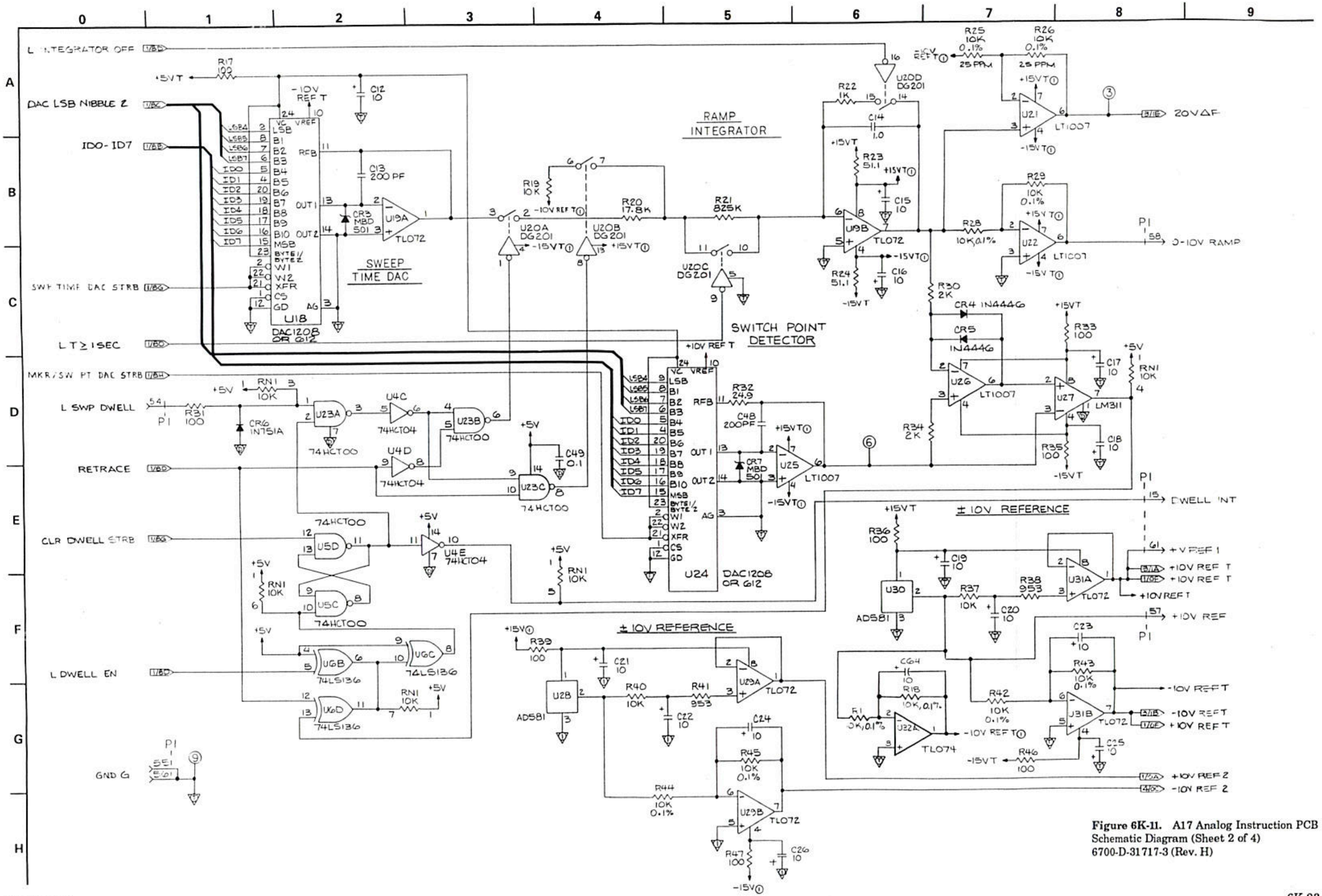
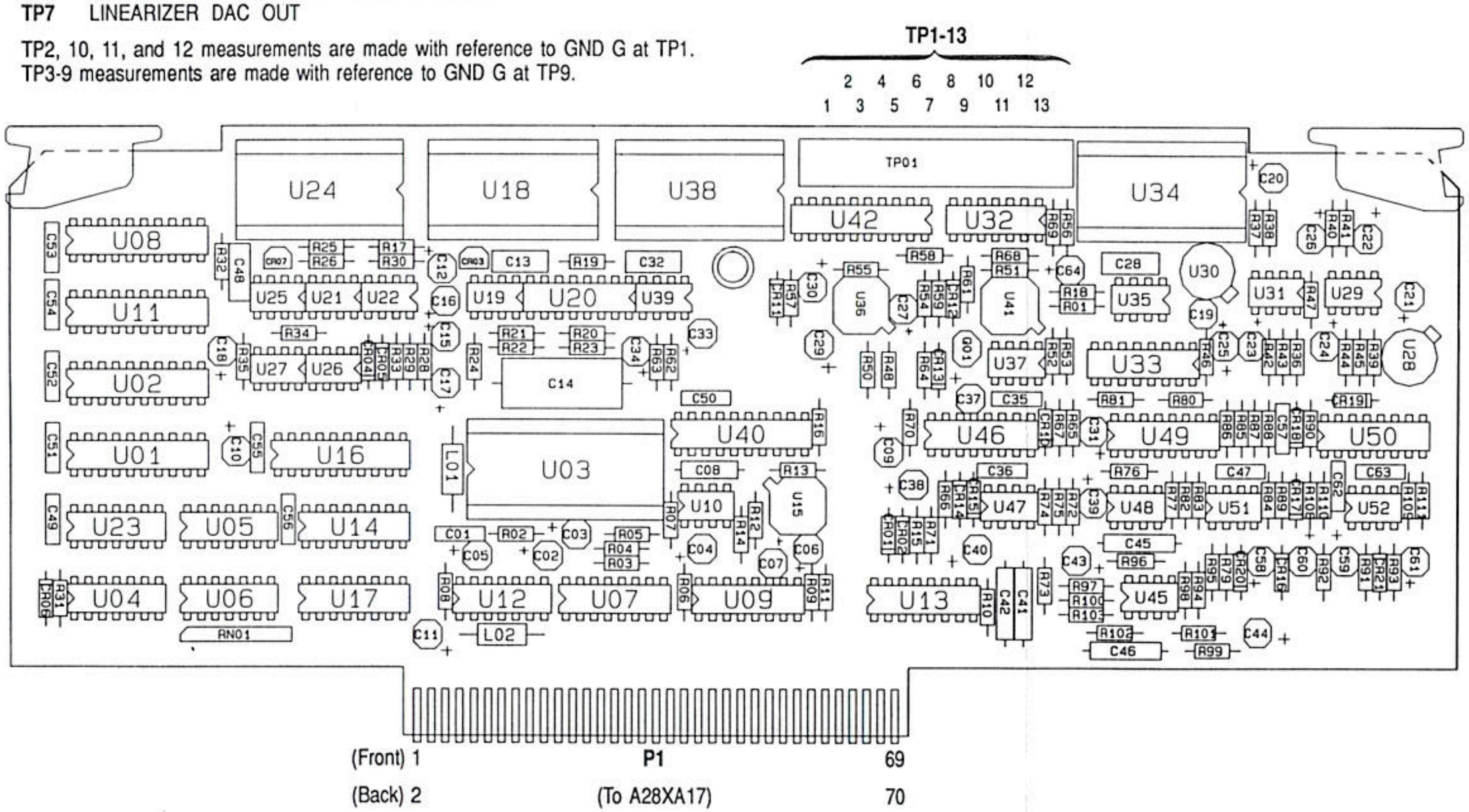


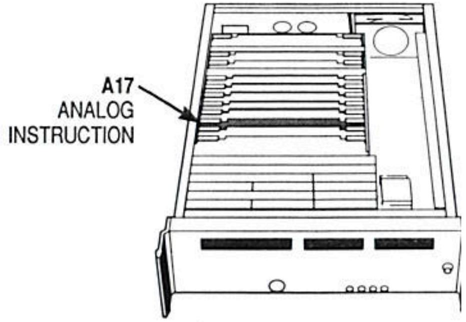
Figure 6K-11. A17 Analog Instruction PCB Schematic Diagram (Sheet 2 of 4)
6700-D-31717-3 (Rev. H)

TEST POINTS

TP1	GND G	**TP8**	FM SWP
TP2	DVM EXT INPUT	**TP9**	GND G
TP3	20V ΔF	**TP10**	V DET
TP4	TUNE DAC OUT	**TP11**	V TH
TP5	TUNE	**TP12**	V dBm
TP6	SWITCH POINT DET OUT	**TP13**	Not Used
TP7	LINEARIZER DAC OUT		

TP2, 10, 11, and 12 measurements are made with reference to GND G at TP1.
TP3-9 measurements are made with reference to GND G at TP9.





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6K-10. A17 Analog Instruction PCB Parts Locater Diagram
6700-D-31717-3 (Rev. G)

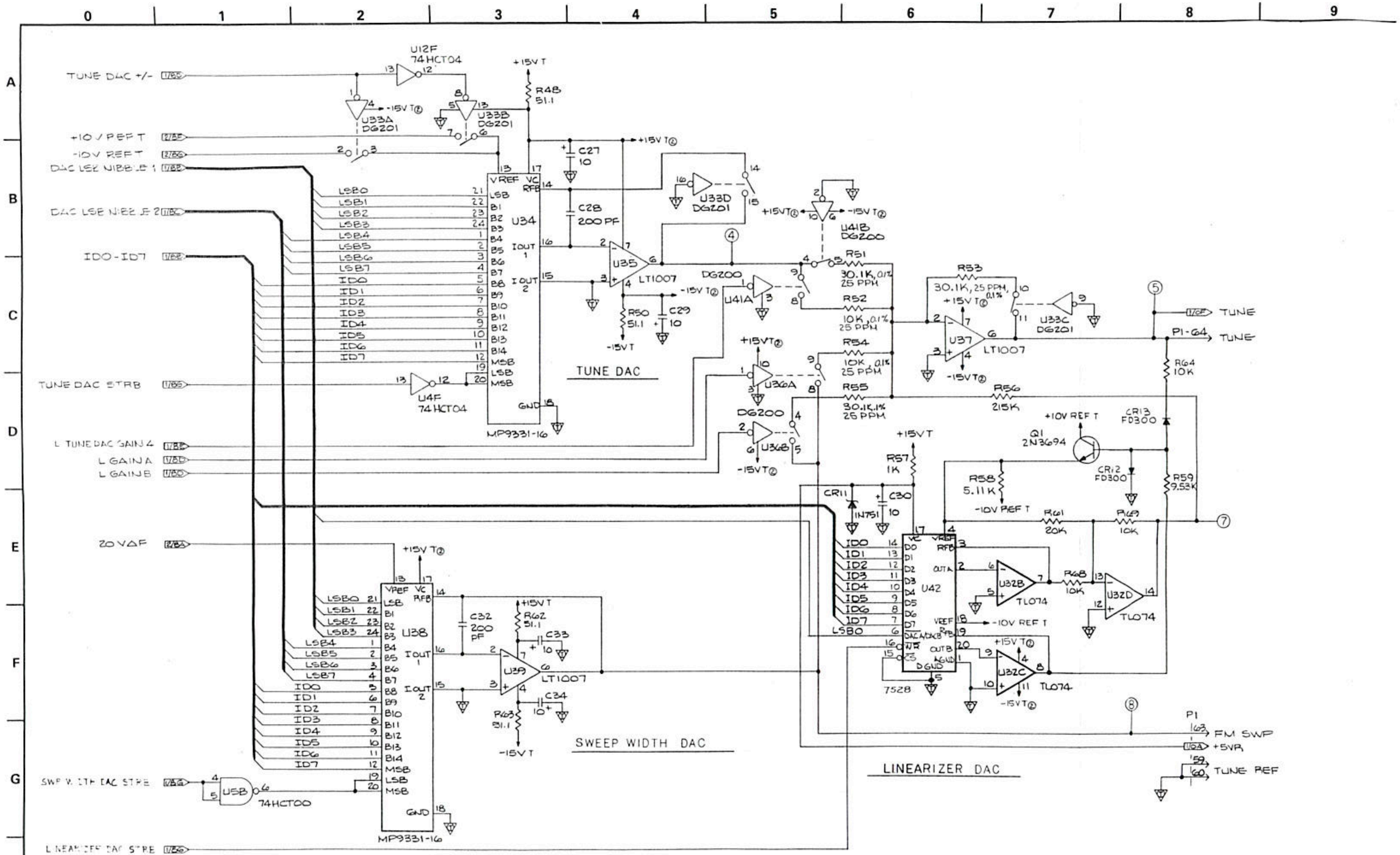
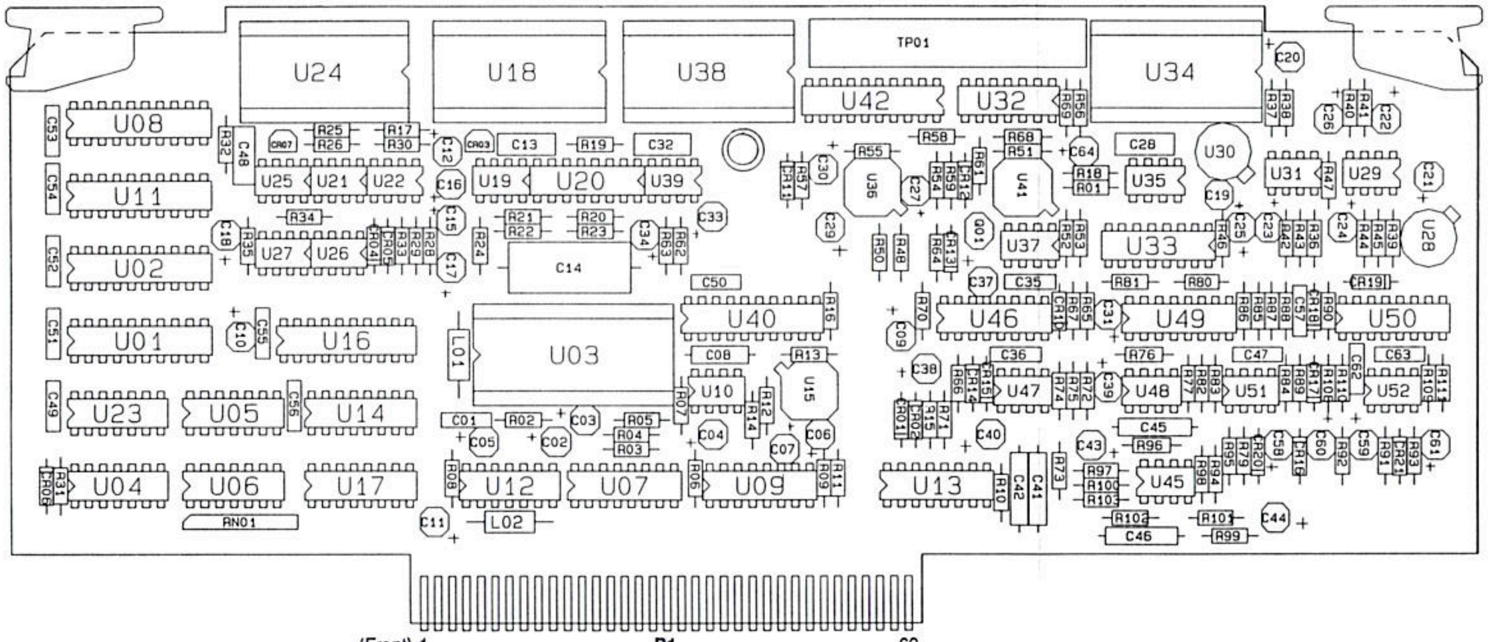


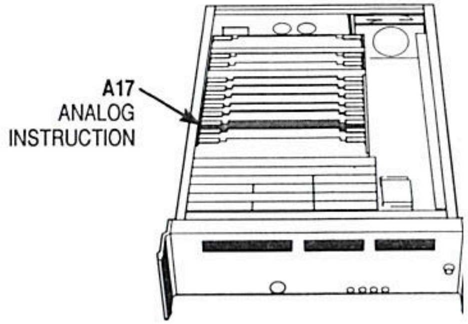
Figure 6K-11. A17 Analog Instruction PCB Schematic Diagram (Sheet 3 of 4) 6700-D-31717-3 (Rev. H)

TEST POINTS

TP1	GND G	TP8	FM SWP
TP2	DVM EXT INPUT	TP9	GND G
TP3	20V ΔF	TP10	V DET
TP4	TUNE DAC OUT	TP11	V TH
TP5	TUNE	TP12	V dBm
TP6	SWITCH POINT DET OUT	TP13	Not Used
TP7	LINEARIZER DAC OUT		

TP2, 10, 11, and 12 measurements are made with reference to GND G at TP1.
TP3-9 measurements are made with reference to GND G at TP9.





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6K-10. A17 Analog Instruction PCB Parts Locater Diagram
6700-D-31717-3 (Rev. G)

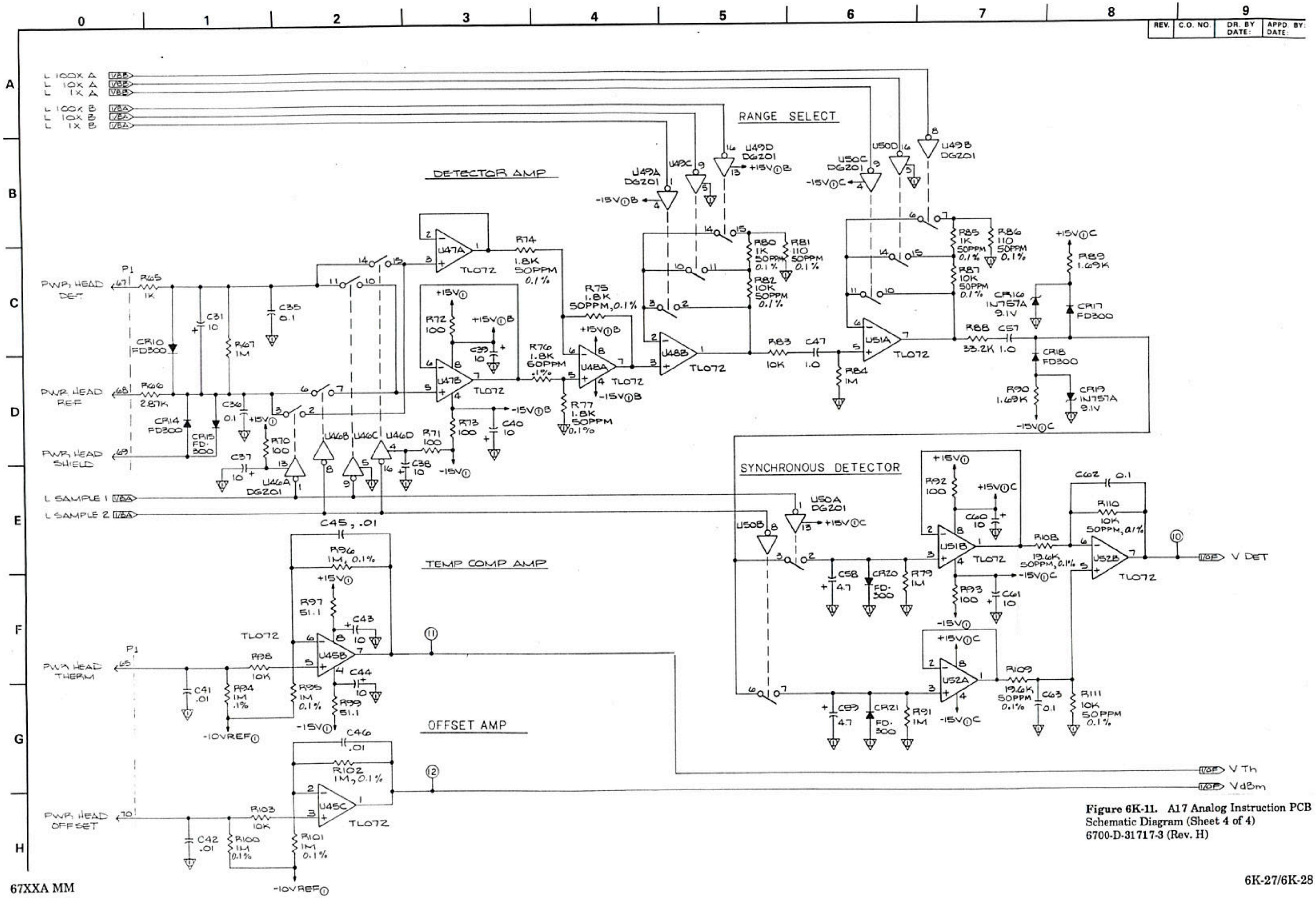


Figure 6K-11. A17 Analog Instruction PCB Schematic Diagram (Sheet 4 of 4) 6700-D-31717-3 (Rev. H)

6K-1 YIG DRIVER SUBSYSTEM: A18-A21 PCBs

6K-1.1 YIG Driver PCB Circuit Description

The A18 thru A21YIG Driver PCBs provide the FM driver, main tuning-current driver, and bias supplies for each oscillator. The A18–A21 PCBs are identical.in their circuit design. The only differences between them is in the values and quantity of some components–such as resistors, capacitors, and diodes—used to generate the different frequency ranges. The PCBs and their frequency range are as follows:

A18 PCB — 2-to-8 GHz
A19 PCB — 8-to-12 GHz
A20 PCB — 12-to-18 GHz
A21 PCB — 18-to-26.5 GHz

Not all A18–A21 PCBs are installed in each model. Only those with appropriate frequency ranges are fitted. For example, A18 thru A20 are installed in the 6747A, A18 thru A21 in the 6759A, but only A20 and A21 in the 6742A.

Refer to the block diagram in Figure 6L-1 and the schematic in Figure 6L-3 for the following circuit description.

*a. **FM driver.***
The YIG driver receives its FM signal from the A16 FM PCB (see section 6J). It goes to the U1 differential receiver and then to a filter network to improve frequency response. From the filter network, the FM signal goes to the U3 FM control amp which controls the Q1 and Q2 driver transistors. The current through the FM coil in the oscillator located on the RF deck is sensed by the FM sense resistor and fedback for a closed loop system.

The voltage developed across the feedback resistor also goes to U4. U4 applies the FM signal into the main tuning coil control amplifier when the CW filter is in. This cancels the magnetic coupling between the FM coil and the main coil. No coupling provides a linear sweep when the sweep width is less than 50 MHz.

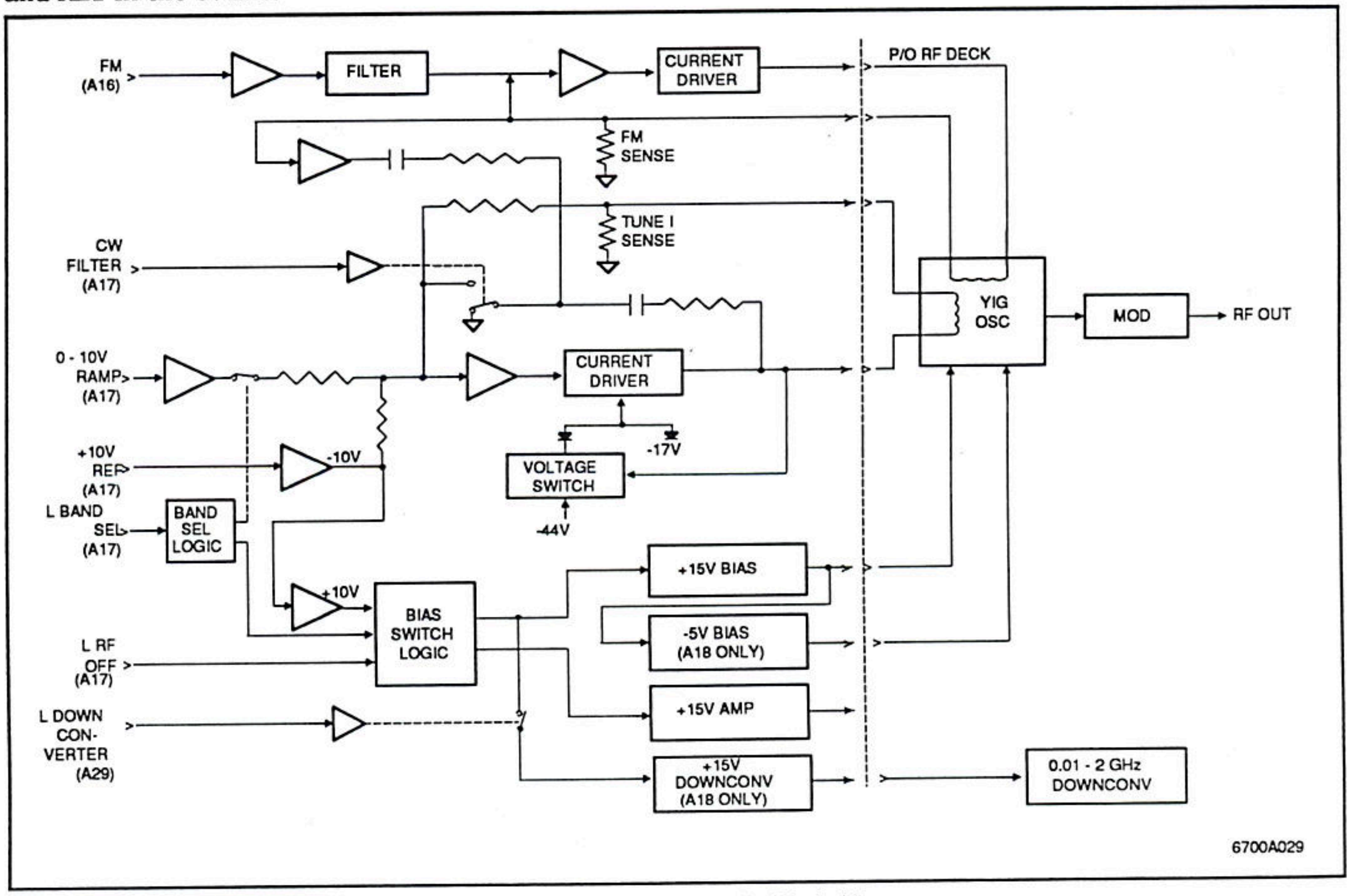


Figure 6P-1. YIG Driver PCB Block Diagram

b. ***Main Tuning Coil Driver.***
The A17 analog instruction board generates a 0 to –10V ramp and applies it to differential receiver U4. From U4 it goes through analog switch U12, which is closed when the YIG driver is selected. The A17 PCB also applies a +10V reference to the U4 differential receiver. This voltage provides an offset for the YIG oscillator start frequency. The start-frequency and reference signals are summed by control amplifier U6 and used to control current driver transistor Q5. This transistor furnishes a current through the main tuning coil. The tune sense resistor senses this current and feeds it back to U6 to complete the control loop.

During fast sweeps—or stepping operations with the GPIB—the main tuning coil requires more voltage to speed up the current change in the main tuning coil. Transistor Q8 furnishes –43V on demand. This higher voltage increases the speed at which the current can change in the main tuning coil. This allows for a much lower power dissipation then with having the –43V continuously applied . This switching is automatic and occurs whenever the voltage requirement exceeds approximately –12.5V.

The CW filter reduces the bandwidth of the main tuning coil driver from approximately 6 kHz to 30 Hz, either when in the CW mode or with sweep widths less than 50 MHz. This reduced bandwidth improves the residual FM performance at narrow sweep widths and in CW operation. The CW filter also allows for the wide bandwidth required for fast broadband sweeps. Integrated circuit U5 switches a resistor-capacitor (RC) circuit into the U6 feedback network to provide this wider bandwidth. The CW switching is controlled by the microprocessor and is completely automatic.

c. ***Bias Supplies.***
The 10V reference from the A17 PCB also supplies the reference voltage for the bias supplies for the YIG oscillators. It goes to U7 which is controlled by the **L RF OFF** and **L BANDSELECT** lines from the A17 PCB. When the RF is turned off via the front panel or a frequency has been selected in another band, U7 removes the reference 10V for the bias supplies. This turns these supplies off, thereby turning off the YIG oscillators.

Each YIG oscillator receives +15V from its bias supply. Typical current is 300 mA. Each YIG oscillator also has an internal regulator which re-regulates the 15V to the appropriate voltage for that oscillator. The 2–8 GHz YIG oscillator also requires a –5V bias furnished by U9 and Q13. Only the A18 YIG driver contains the –5V circuitry installed on the PCB.

The +15V Amp supplies are identical to the YIG bias supplies. These supplies are used for optional amplifiers in high RF output power units.

For the A18 PCB 2–8 GHz oscillator, there is a +15V supply for the 0.01–2 GHz Downconverter. The 10V reference voltage is switched by U2 and goes to U10, which controls Q16. When operating in this frequency range, the +15V goes to the downconverter and turns it on. Outside of this range, the **L DOWNCONVERTER SELECT** line goes HIGH, which in turn causes the +15V to go to 0V. The **L DOWNCONVERTER SELECT** line comes from the A29 Rear Panel Interface PCB.

6K-1.2 YIG Driver Subsystem Schematics

Figure 6L-63 provides a 3-sheet schematic for the A18–A21 YIG Driver PCBs. Note the factory select resistors and capacitors that customize each board forthe specific frequency range oscillator.

6K-1.3 YIG Driver Subsystem Troubleshooting

Section 6C provides troubleshooting procedures for the YIG Driver Subsystem.

NOTE

Pages 6L-2, 6L-3, and 6L-4
are blank.

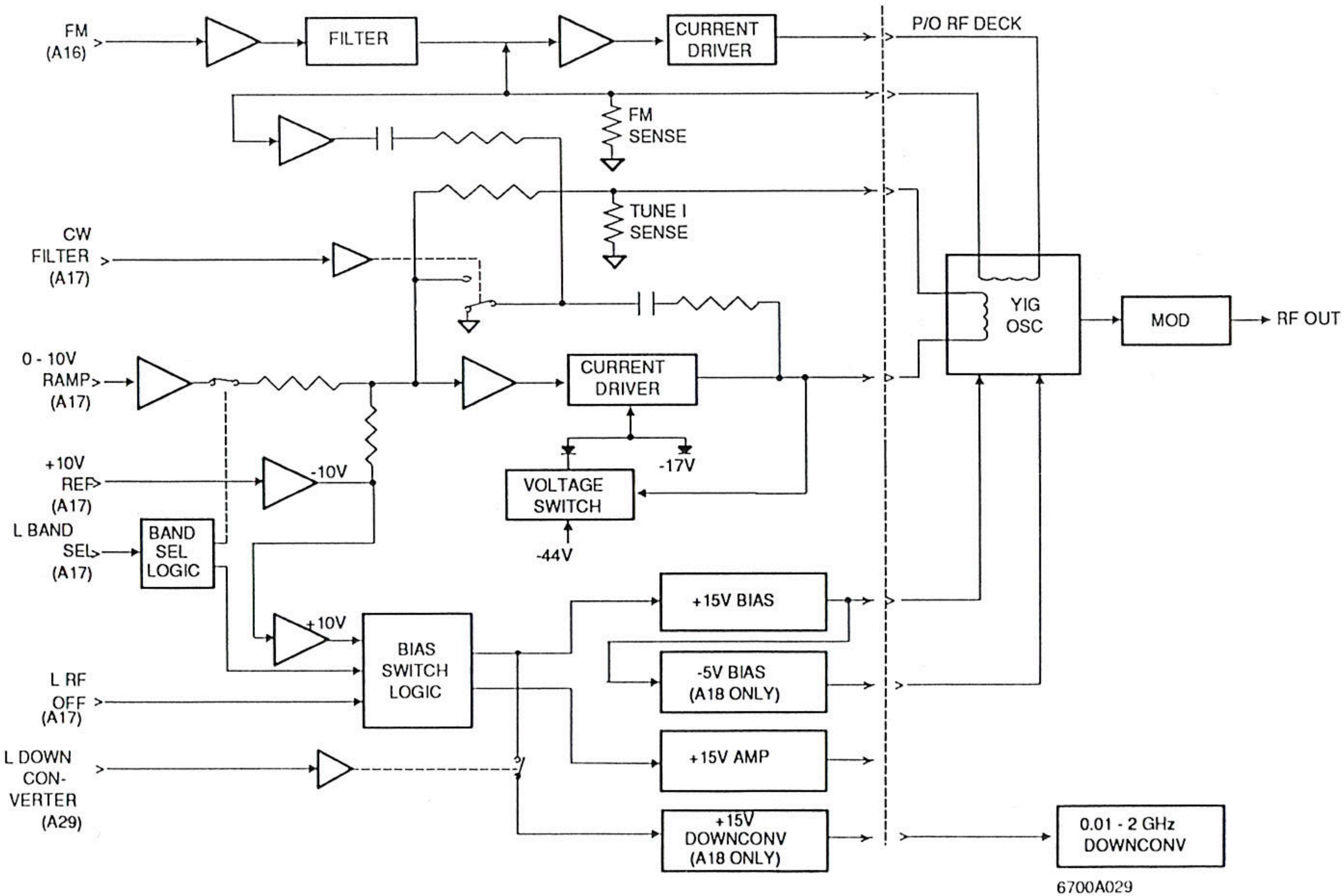
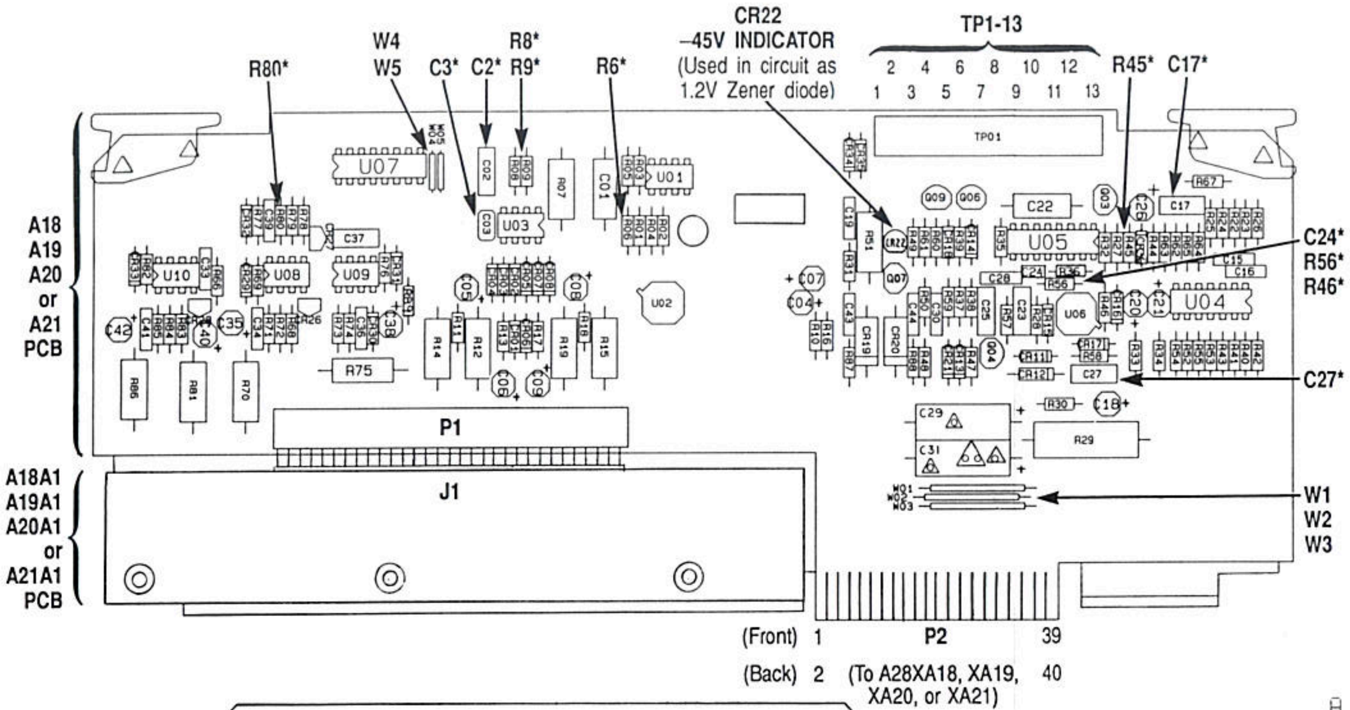
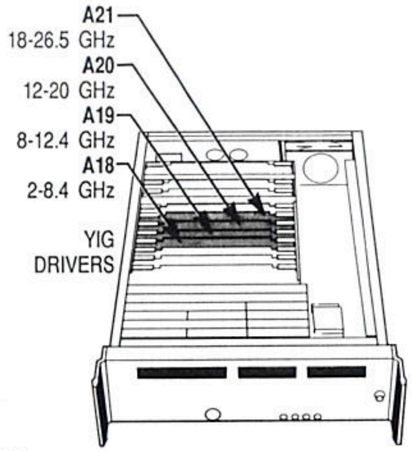


Figure 6L-1. A18, A19, A20, or A21 YIG Driver PCB Block Diagram

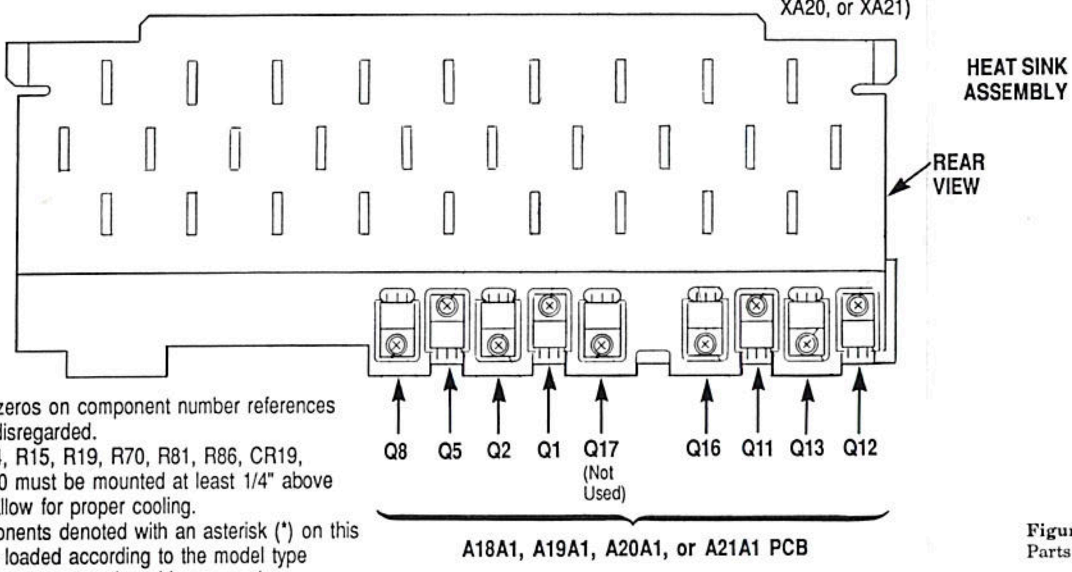


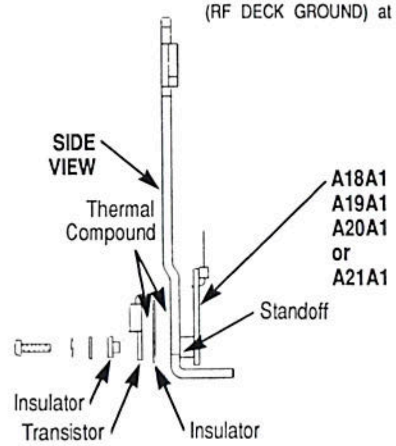
TEST POINTS

TP1	FM COIL CIRCUITS GND (GND G)
TP2	FM COIL (+)
TP3	FM COIL (–)
TP4	MAIN COIL (+)
TP5	MAIN COIL (–)
TP6	MAIN COIL CIRCUITS GROUND (GND G)
TP7	+22V HEATER
TP8	+15V AMP
TP9	+15V DOWN CONV
TP10	–5V BIAS
TP11	BIAS SENSE (RF DECK GROUND)
TP12	+15V BIAS
TP13	Not Used



TP2 and TP3 measurements are made with reference to FM COIL CIRCUITS GROUND (GND G) at TP1.
TP4 and TP5 measurements are made with reference to MAIN COIL CIRCUITS GROUND (GND G) at TP6.
TP7-12 measurements are made with reference to BIAS SENSE (RF DECK GROUND) at TP11.

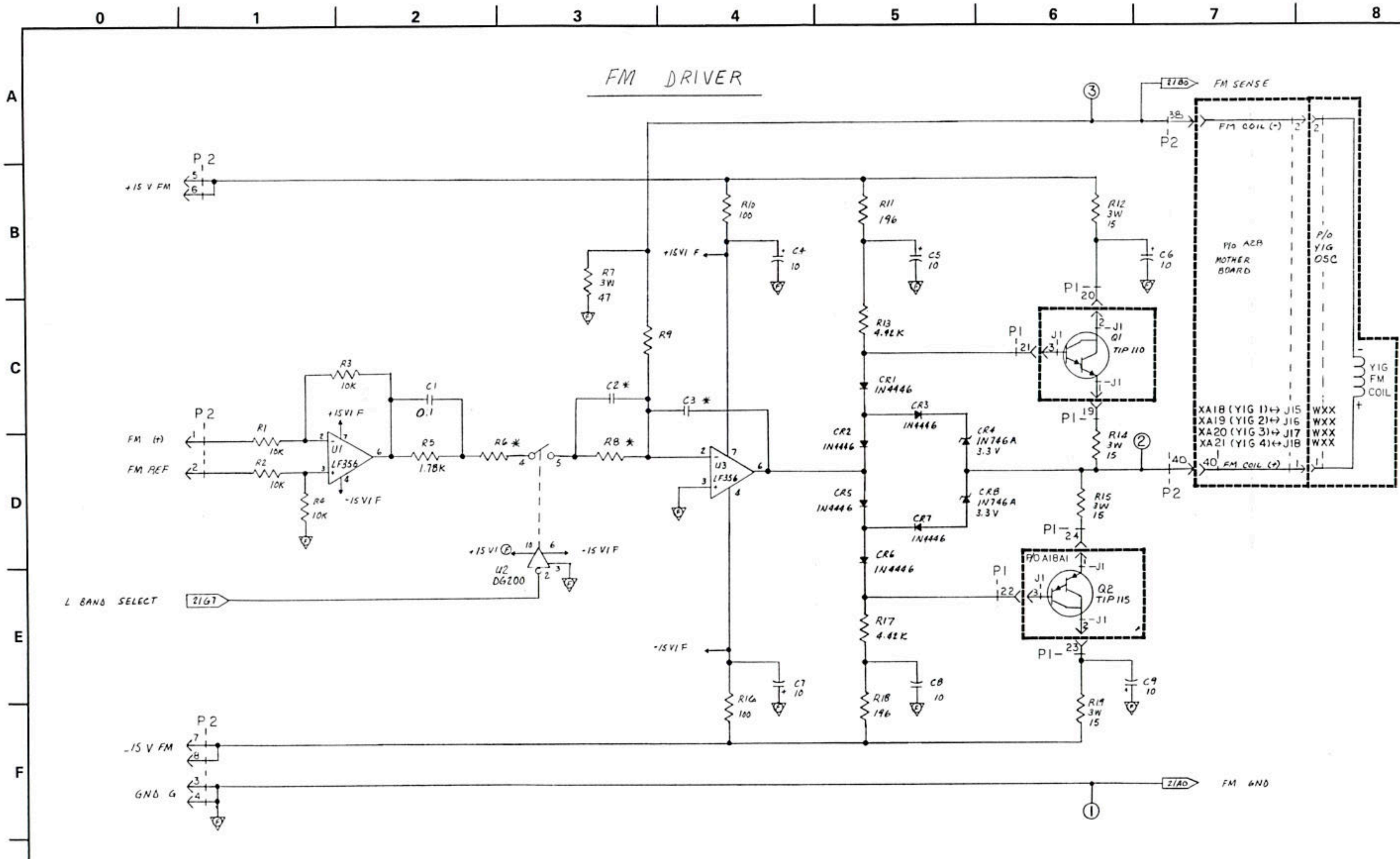




NOTES:
1. Leading zeros on component number references may be disregarded.
2. R12, R14, R15, R19, R70, R81, R86, CR19, and CR20 must be mounted at least 1/4" above PCB to allow for proper cooling.
3. All components denoted with an asterisk (*) on this page are loaded according to the model type frequency range; see the tables on each schematic sheet for the appropriate values.

Figure 6L-2. A18, A19, A20, or A21 YIG Driver PCB Parts Locater Diagram

A18 PCB (2-8 GHz): 6700-D-31718-4 (Rev. B)
A18 PCB (2-8 GHz): 6700-D-31718-9 (Rev. B)
A19 PCB (8-12.4 GHz): 6700-D-31718-5 (Rev. B)
A20 PCB (12.4-20 GHz): 6700-D-31718-6 (Rev. B)
A21 PCB (20-26.5 GHz): 6700-D-31718-7 (Rev. B)
A21 PCB (18-26.5 GHz): 6700-D-31718-8 (Rev. B)



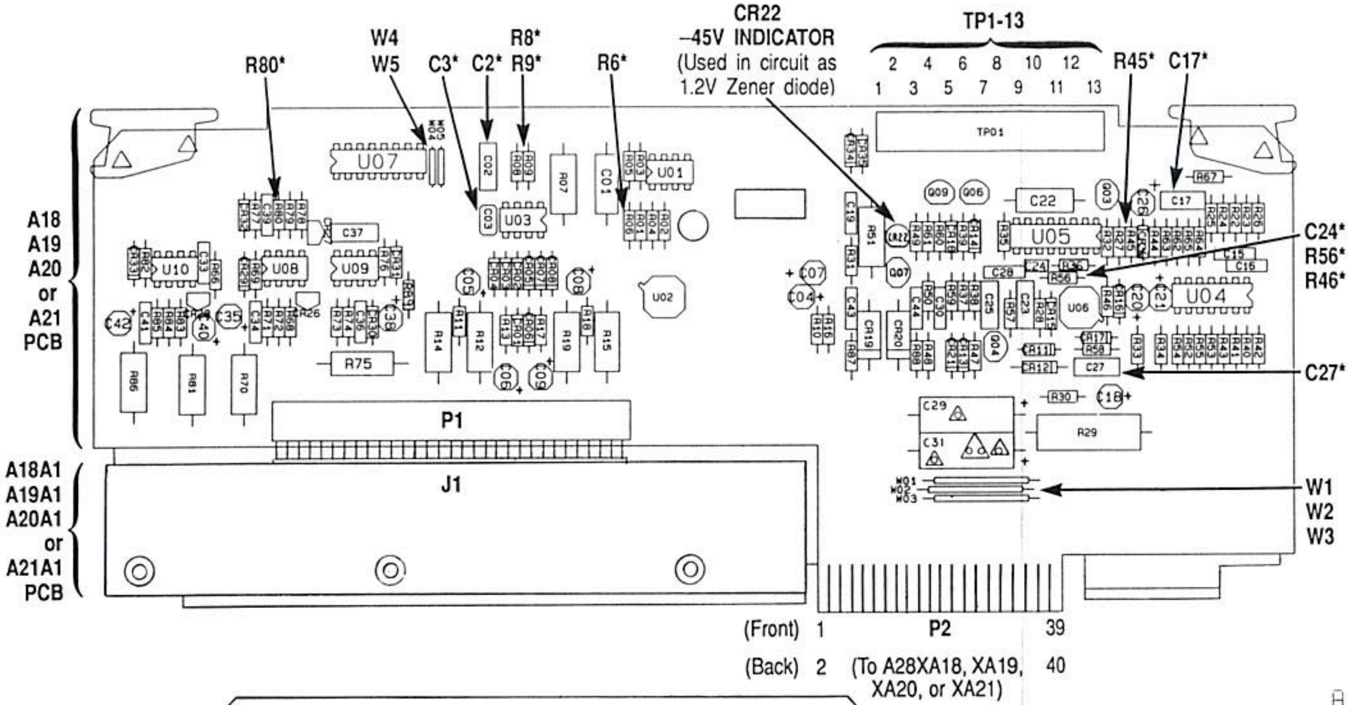
			COMPONENT VALUES				
ASSY	DES	FREQ RANGE	R6*	R8*	R9*	C2*	C3*
-4	A18	2-8 GHz	12.7K	1.87K	12.4K	1000pF	10pF
-5	A19	8-12.4 GHz	12.1K	2.74K	12.4K	680pF	10pF
-6	A20	12.4-20 GHz	12.7K	1.87K	8.25K	1000pF	15pF
-7	A21	20-26.5 GHz	12.7K	1.87K	10.2K	1000pF	15pF
-8	A21	18-26.5 GHz	12.7K	1.87K	10.2K	1000pF	15pF

A18 YIG DRIVER SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUNDS:
4. FACTORY-SELECTED COMPONENTS ARE DENOTED WITH AN ASTERISK:
   C2*, C3*, C17*, C24*, C27*, R5*, R8*, R9*, R46*, R56*, R80*,
5. TEST POINTS ARE DENOTED AS: (2)
6. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
7. SUBASSEMBLY BORDERS ARE DENOTED AS:
8. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   CR26, CR27, R28, R62-65, Q3, U1-U7
9. LAST USED/NOT USED COMPONENTS ARE:

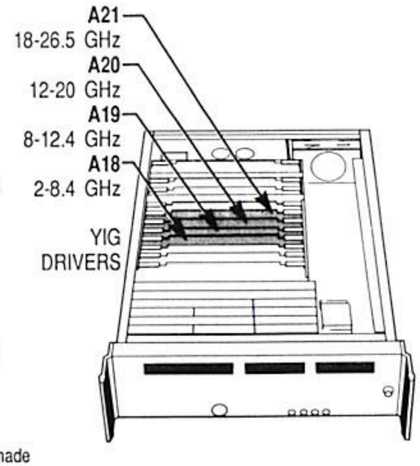
REFERENCE DESIGNATORS	
LAST USED	NOT USED
C44 CR36 P1 Q9 R88 TP1 U10 W5	(See factory-selected resistor tables.)

Figure 6L-3. A18, A19, A20, or A21 YIG Driver PCB Schematic Diagram (Sheet 1 of 3)
A18 PCB (2-8 GHz): 6700-D-31718-4 (Rev. B)
A18 PCB (2-8 GHz): 6700-D-31718-9 (Rev. B)
A19 PCB (8-12.4 GHz): 6700-D-31718-5 (Rev. B)
A20 PCB (12.4-20 GHz): 6700-D-31718-6 (Rev. B)
A21 PCB (20-26.5 GHz): 6700-D-31718-7 (Rev. B)
A21 PCB (18-26.5 GHz): 6700-D-31718-8 (Rev. B)

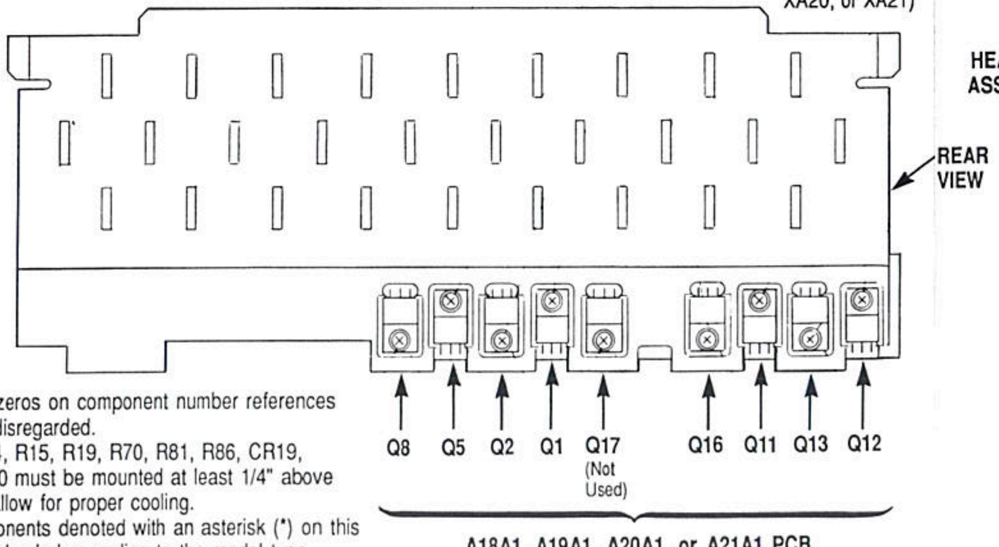


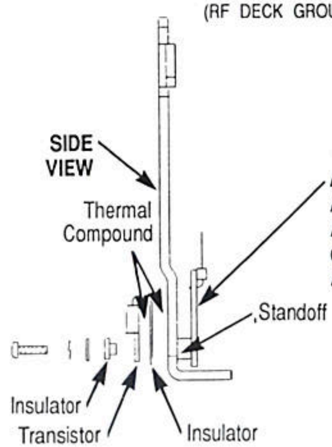
TEST POINTS

TP1	FM COIL CIRCUITS GND (GND G)
TP2	FM COIL (+)
TP3	FM COIL (−)
TP4	MAIN COIL (+)
TP5	MAIN COIL (−)
TP6	MAIN COIL CIRCUITS GROUND (GND G)
TP7	+22V HEATER
TP8	+15V AMP
TP9	+15V DOWN CONV
TP10	−5V BIAS
TP11	BIAS SENSE (RF DECK GROUND)
TP12	+15V BIAS
TP13	Not Used



TP2 and TP3 measurements are made with reference to FM COIL CIRCUITS GROUND (GND G) at TP1.
TP4 and TP5 measurements are made with reference to MAIN COIL CIRCUITS GROUND (GND G) at TP6.
TP7-12 measurements are made with reference to BIAS SENSE (RF DECK GROUND) at TP11.



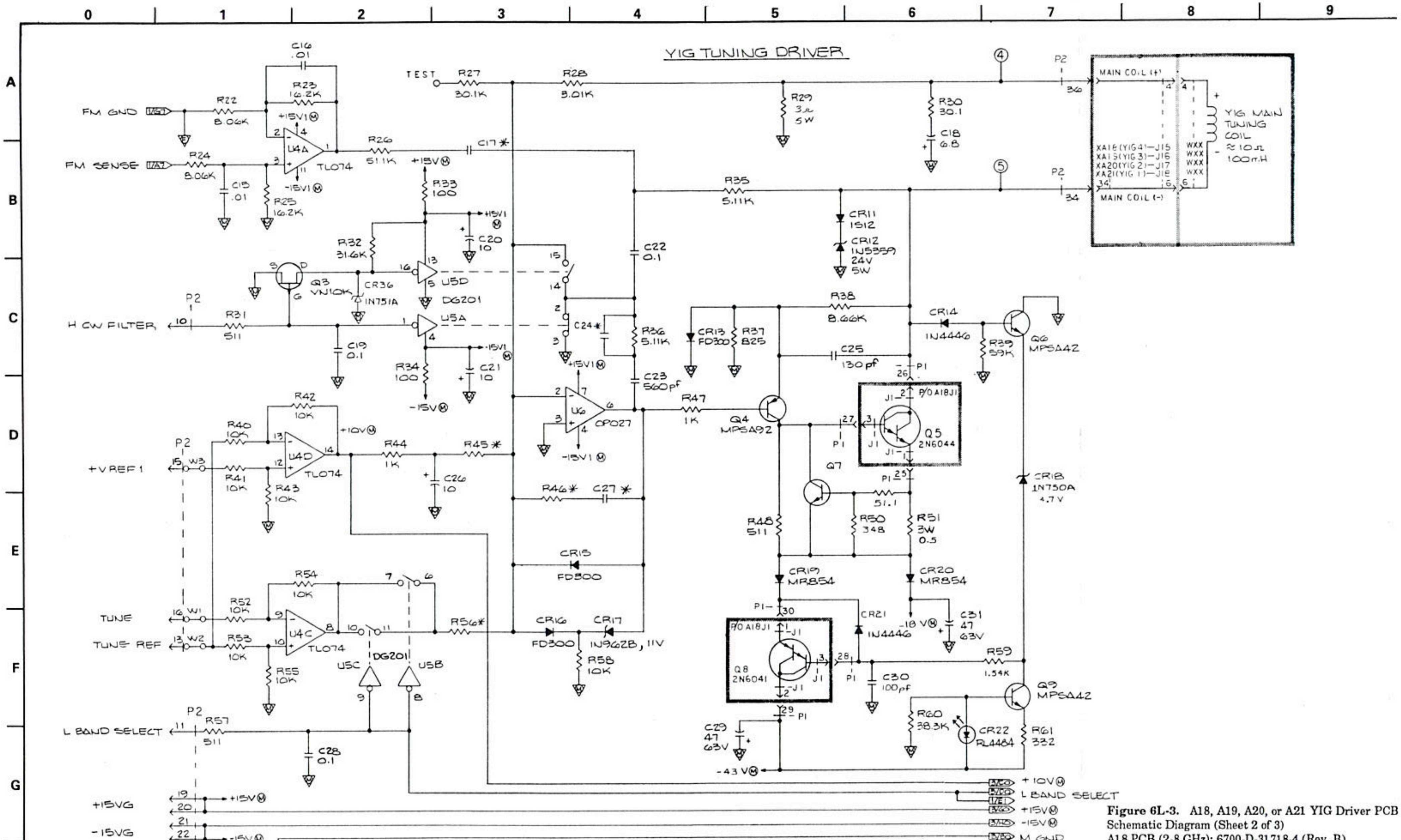


NOTES:

1. Leading zeros on component number references may be disregarded.
2. R12, R14, R15, R19, R70, R81, R86, CR19, and CR20 must be mounted at least 1/4" above PCB to allow for proper cooling.
3. All components denoted with an asterisk (*) on this page are loaded according to the model type frequency range; see the tables on each schematic sheet for the appropriate values.

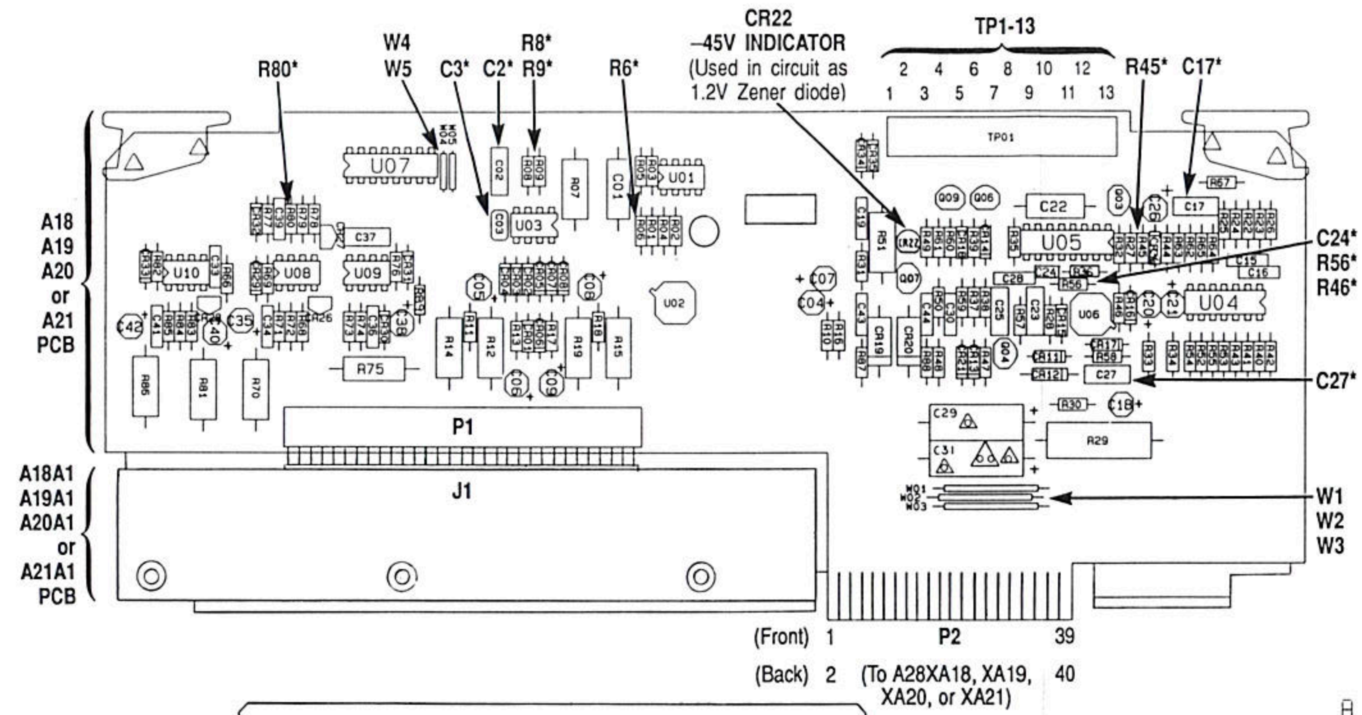
Copy of Figure 6L-2. A18, A19, A20, or A21 YIG Driver PCB Parts Locater Diagram

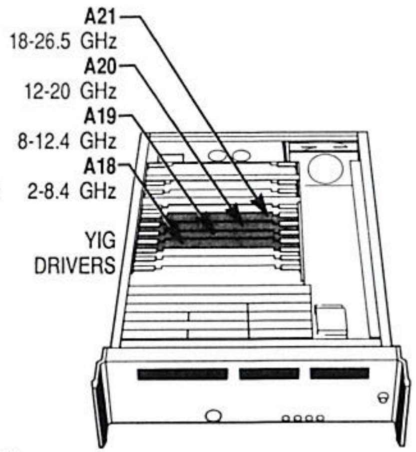
A18 PCB (2-8 GHz): 6700-D-31718-4 (Rev. B)
A18 PCB (2-8 GHz): 6700-D-31718-9 (Rev. B)
A19 PCB (8-12.4 GHz): 6700-D-31718-5 (Rev. B)
A20 PCB (12.4-20 GHz): 6700-D-31718-6 (Rev. B)
A21 PCB (20-26.5 GHz): 6700-D-31718-7 (Rev. B)
A21 PCB (18-26.5 GHz): 6700-D-31718-8 (Rev. B)



ASSY	DES	FREQ RANGE	COMPONENT VALUES R45*	R56*	C17*	C27*	R46*	C24*
-4	A18	2-8 GHz	105K	44.2K	200pF	.018	464K	39pf
-5	A19	8-12.4 GHz	26.1K	34.8K	360pf	.01	499K	39pf
-6	A20	12.4-20GHz	14.3K	17.8K	270pf	4700pF	422K	39pf
-7	A21	20.0-26.5GHz	15K	30.9K	470pf	4700pF	499K	68pf
-8	A21	18.0-26.5 GHz	16.2K	33.2K	470pF	4700pF	499K	68pf

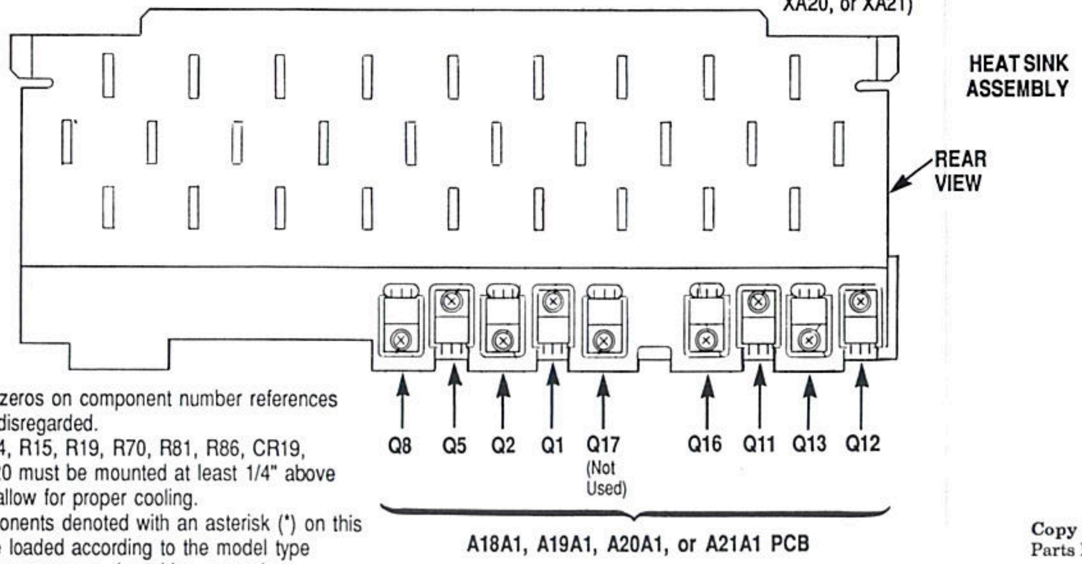
Figure 6L-3. A18, A19, A20, or A21 YIG Driver PCB Schematic Diagram (Sheet 2 of 3)
A18 PCB (2-8 GHz): 6700-D-31718-4 (Rev. B)
A18 PCB (2-8 GHz): 6700-D-31718-9 (Rev. B)
A19 PCB (8-12.4 GHz): 6700-D-31718-5 (Rev. B)
A20 PCB (12.4-20 GHz): 6700-D-31718-6 (Rev. B)
A21 PCB (20-26.5 GHz): 6700-D-31718-7 (Rev. B)
A21 PCB (18-26.5 GHz): 6700-D-31718-8 (Rev. B)

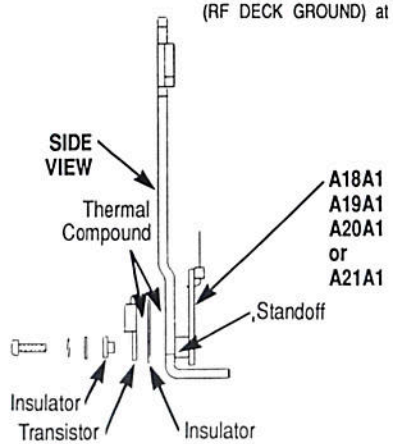




TEST POINTS	
TP1	FM COIL CIRCUITS GND (GND G)
TP2	FM COIL (+)
TP3	FM COIL (–)
TP4	MAIN COIL (+)
TP5	MAIN COIL (–)
TP6	MAIN COIL CIRCUITS GROUND (GND G)
TP7	+22V HEATER
TP8	+15V AMP
TP9	+15V DOWN CONV
TP10	–5V BIAS
TP11	BIAS SENSE (RF DECK GROUND)
TP12	+15V BIAS
TP13	Not Used

TP2 and TP3 measurements are made with reference to FM COIL CIRCUITS GROUND (GND G) at TP1.
TP4 and TP5 measurements are made with reference to MAIN COIL CIRCUITS GROUND (GND G) at TP6.
TP7-12 measurements are made with reference to BIAS SENSE (RF DECK GROUND) at TP11.





NOTES:

1. Leading zeros on component number references may be disregarded.
2. R12, R14, R15, R19, R70, R81, R86, CR19, and CR20 must be mounted at least 1/4" above PCB to allow for proper cooling.
3. All components denoted with an asterisk (*) on this page are loaded according to the model type frequency range; see the tables on each schematic sheet for the appropriate values.

Copy of Figure 6L-2. A18, A19, A20, or A21 YIG Driver PCB Parts Locater Diagram

A18 PCB (2-8 GHz): 6700-D-31718-4 (Rev. B)
A18 PCB (2-8 GHz): 6700-D-31718-9 (Rev. B)
A19 PCB (8-12.4 GHz): 6700-D-31718-5 (Rev. B)
A20 PCB (12.4-20 GHz): 6700-D-31718-6 (Rev. B)
A21 PCB (20-26.5 GHz): 6700-D-31718-7 (Rev. B)
A21 PCB (18-26.5 GHz): 6700-D-31718-8 (Rev. B)

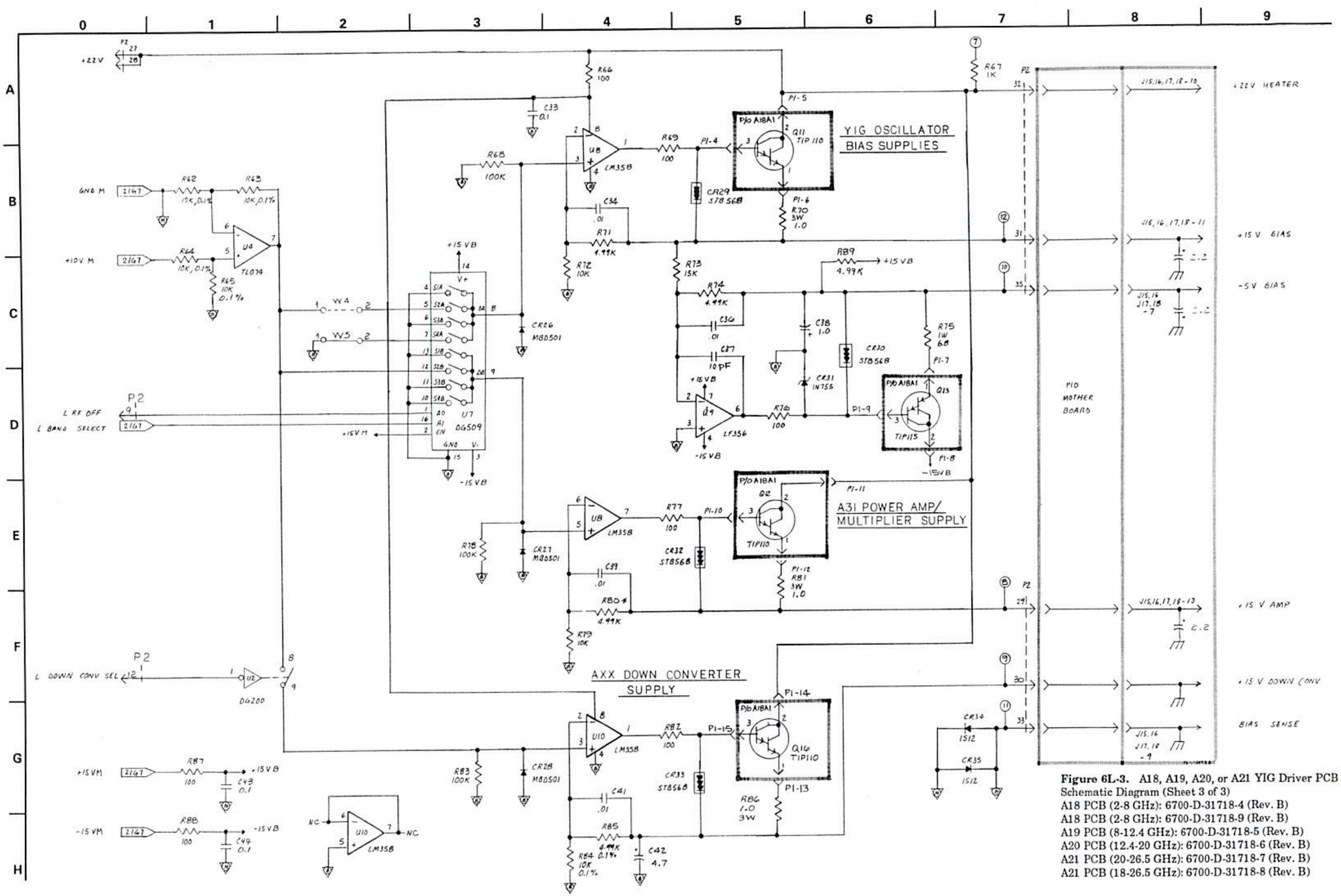


Figure 6L-3. A18, A19, A20, or A21 YIG Driver PCB Schematic Diagram (Sheet 3 of 3)
A18 PCB (2-8 GHz): 6700-D-31718-4 (Rev. B)
A18 PCB (2-8 GHz): 6700-D-31718-9 (Rev. B)
A19 PCB (8-12.4 GHz): 6700-D-31718-5 (Rev. B)
A20 PCB (12.4-20 GHz): 6700-D-31718-6 (Rev. B)
A21 PCB (20-26.5 GHz): 6700-D-31718-7 (Rev. B)
A21 PCB (18-26.5 GHz): 6700-D-31718-8 (Rev. B)

6-11 ALC / PULSE MODULATION SUBSYSTEM: A15, A13, and A29 PCBs

6-11.1 A15 ALC (Automatic Level Control) PCB Circuit Description

The A15 ALC PCB controls the RF output power level through a feedback system. It also provides amplitude modulation capabilities and control of the RF during pulse operation.

The ALC circuitry is controlled by the microprocessor. When you select a power level from either the front panel or the GPIB, the microprocessor sets the level-reference voltage. The level amplifier sends an error signal to the PIN drivers. The PIN modulators then change the level of the RF signal until the detected RF voltage equals the reference voltage.

The AM signal from an external generator is summed to the level reference voltage for AM operation. The RF output must then change with the reference voltage so that the RF envelope duplicates the AM signal. The major ALC circuits are discussed below, and a block diagram is provided in foldout Figure 6M-1 on the facing page.

a. ***Microprocessor Control.***
The ALC internal data bus is buffered from the main processor data bus by a transparent latch. When the ALC board is addressed, the data on the microprocessor bus transfers directly to the internal data bus. The address decoders then strobe the appropriate data latch or digital-to-analog converter (DAC) for which the data is meant.

b. ***ALC Reference.***
A precision 10 volts is used as the reference for the ALC loop. It is summed with the ALC slope from the A29 Rear Panel Interface PCB and the AM signal from the AM circuits on the ALC board. The total reference voltage goes to the 12-Bit Level DAC. The microprocessor sets the voltage level of this DAC to be the same as that of the detected RF signal. To improve resolution, the output of the Level DAC goes to the 8-Bit Level Range DAC. The combination of the 12-bit Level DAC with the 8-bit Range DAC provides a 1 million-bit resolution over the typical 20 dB control range of the level loop.

c. **AM Circuit.**
The AM signal from either the front or rear panel is buffered by an amplifier and goes to the AM Peak Detector, AM Trough Detector, and the %AM DAC. The Peak and Trough Detectors provide dc output voltages proportional to the amplitude of the AM input signal. These dc voltages go to the Analog Mux (multiplexer) where they can then be measured by the digital voltmeter on the A17 Analog Instruction PCB.

The %AM DAC is adjusted by the microprocessor to provide the necessary AM voltage required for the %AM range. The range is selected either from the front panel or from the GPIB. If the input signal is 1 volt peak, then the %AM will equal the %AM range. If the input signal is not 1 volt peak, then the %AM will be something other than the %AM range. (This percentage can be measured using the front panel AM MEASURE function.) After a range has been selected, the microprocessor measures the voltages from the peak and trough detectors. Since it knows what %AM range is selected, it can calculate the actual %AM from the peak and trough measurements.

The AM voltage is summed with the ALC reference voltage before being applied to the Level DAC. This maintains a constant-percentage AM signal with a changing reference-level voltage.

d. **ALC Slope.**
This circuit corrects for an increasing or decreasing output power-vs-frequency. This is generally a decreasing-output-with-an-increasing-frequency due to the optional step attenuator that follows the level detector. The A29 Rear Panel Interface PCB supplies a signal from the V/GHz circuit that has a linear-voltage change with a

linear-frequency change. This signal goes to the ALC Slope DAC which has the capability to change this slope voltage to be either an increasing or decreasing voltage relative to the RF output frequency. This DAC setting is stored by the microprocessor in the EEPROM (Electronically Erasable Programmable Read Only Memory) during calibration.

The slope DAC has two settings. One is for ≤2 GHz (≤26.5 GHz on the 6742A). The other is for >2 GHz (>26.5 GHz on the 6742A). This slope is used only in the analog sweep mode. In either a CW or stepped-sweep mode, he microprocessor provides the change-in-power-vs-frequency compensation from data stored in the EEPROM during ALC calibration.

e. ***Detector Preamps.***

There are two detector preamplifiers: Band 0 Det and Band 1-4 Det. The Band 0 Det is for ≤l2 GHz (≤26.5 GHz in the 6742A) and the other is for >2 GHz (>26.5 GHz in the 6742A). They amplify the low-level-detector voltage by five and transform the 2 kΩ output impedance of the detector diode to less than 50Ω. Each preamp is composed of a low- and high-frequency amplifier. The high-frequency amplifier has a very high gain at high frequencies to compensate for the diode output capacitance and the interconnecting cable capacitance.

The output of the preamplifiers goes to an analog switch. This switch determines which preamp is to be used. If operating in the pulse modulation mode, the preamp signal is routed through a sample/hold circuit.Without pulse modulation, the preamplifier signal is routed through another X5 gain stage (Linear Buffer Amp) for application to the Detector Linearizer.

f. **External Level Circuit.**

In this mode, an external detector is connected to the front panel EXT ALC connector. Its output goes to a X5 preamplifier located on the A2 Front Panel Control PCB. From there, the amplified output goes to a X2-gain external-detector-buffer amplifier (U21). This amplifier has an internal switch (not shown) to reduce its gain to less than one. This switch is typically closed when a power meter is used for external leveling. A power meter usually has an output of 1 volt, much higher than a directional detector. The external ALC gain calibration performed by the microprocessor will sense this much-higher voltage and automatically close the switch to lower circuit gain

The output of U21 goes to the Autopolarity Detector. This circuit automatically senses the polarity of the external-level detector an switches it to the Ext ALC Gain DAC. From this DAC, it goes to an analog switch. This switch closes to apply the signal to the Linearizer Buffer Amp.

g. **External Gain Cal.**

External level detector output voltages can vary a large amount. This variation is also influenced by the coupling factor of the directional coupler or power spitter used. A means of calibrating the external detector voltage to a level usable by the ALC loop is provided. This calibration is implemented from the front panel and is performed by the microprocessor. The sequence of events when the Ext Gain Cal button is pressed is as follows.

1. The internal detector (Band 0 and Band 1-4 inputs) is switched into the Linearizer Buffer Amp.
2. The Ext ALC Gain DAC is set to a low value (high attenuation).
3. The output of the Ext ALC Gain DAC is summed with the output of the Linearizer Buffer Amp via R126 and R127. The voltage at the junction of these two resistors goes to a gain-calibration comparator (located within the Unleveled Comparators).
4. If the voltage is too high, the comparator pulls the L UNLEVELED line low. (The microprocessor monitors the state of this line via the A29 Rear Panel Interface PCB.)
5. The microprocessor then closes the switch that reduces the gain of the Ext Detector Amplifier.
6. After closing the switch, it steps the bits of the Ext ALC Gain DAC and monitors the L UNLEVELED line with each step.
7. When the microprocessor determines the correct DAC setting, it opens the switch supplying the internal detector voltage to the linearizer buffer amp and closes the switch that supplies the external detector voltage.
8. The RF power at the output of the external level detector will then equal the power for which the 6700A is set in the INT leveling mode.

h. **Detector Linearizer.**

The percentage of amplitude modulation is a ratio of the modulating voltage vs the RF carrier voltage. The detectors used for leveling are square-law devices; that is, the output voltage is related to the input *power*. The Detector Linearizer translates the square-law response of the detector so that the leveling loop sees the level detector response as a voltage output versus the RF *voltage* input. This linear response is necessary for both AM distortion and for maintaining a constant %AM with changing power levels.

i. ***ALC Gain DAC.***
The level reference voltage from the Level Range DAC and the output from the Detector Linearizer are of equal value but opposite polarity when the 6700A is leveled. These voltages go the ALC Gain DAC. This DAC adjusts the overall loop gain and bandwidth. Its setting is determined during calibration for each frequency band. At the bandswitch point, (in a multiband unit) the microprocessor sets the DAC to the value saved in EEPROM during calibration.

j. ***Level Amplifier.***
The signal from the ALC Gain DAC goes to the level amplifier in a *non-pulse-modulation* mode. When the RF is being pulse modulated, the signal goes to the Level Amp Sample/Hold (U32). There, the voltage is stored in a holding capacitor (not shown) during the RF-on condition of the pulse. It is then used to supply the signal voltage during the RF-off condition of the pulse. This prevents the Level Amp from shifting the output level during the on/off condition of the pulse, which causes distortion of the pulse waveform.

The output of the Level Amp goes to the A29 Rear Panel Interface PCB to control the PIN diode current drivers. The ac portion of the output feeds back to some frequency compensation capacitors. These capacitors in combination with the setting of the ALC Gain DAC determine the overall loop bandwidth. In a non-pulse mode, the bandwidth is typically 70 kHz. In the pulse mode, the bandwidth is approximately 20 kHz. This bandwidth also depends on the pulse width and repetition frequency of the pulse modulation. When externally leveled with a power meter, the loop bandwidth is approximately 0.6 Hz. This narrow bandwidth compensates for the slow response of a power meter.

k. ***Sample/Hold.***
The input signal for this circuit comes from the A13 Pulse Generator PCB. It is synchronized with the pulse drive to the pulse modulators. It is also delayed approximately 50 ns from the pulse modulator signal. When the RF is turned off during pulse operation, the voltage from the detector preamplifiers and the Detector Linearizer are held by a storage capacitor. The pulse transition times are typically 3 ns. The Detector linearizer and Level Amp cannot follow these fast transitions. The holding of these voltages prevents these amplifiers from trying to follow fast transitions that they are incapable of following.

l. ***Unleveled/ Ext ALC Cal Logic.***
In normal operation, this circuit senses the output of the Level Amp. If the RF output does not reach the power level requested, then the Level Amp goes outside of its normal +3V to 0V operating range. When this occurs, the logic pulls the L UNLEVELED line low. When the this line is low, it

1. turns on the front panel UNLEVELED indicator and
2. signals the processor (via the A29 PCB) that the ALC loop is no longer controlling the RF output level.

When an Ext Gain Cal operation is performed, the sensing of the Level Amp is disabled and this line is used as an indicator for the automatic gain calibration performed by the microprocessor.

m. ***Detector Thermistors.***
The internal level detectors have a built-in thermistor. These two circuits translate their respective detector-thermistor's changing resistance-with-temperature value into a voltage change. This voltage is monitored by the A17 PCB DVM circuit. As the ambient temperature changes, the microprocessor compensates for the output level. This provides a very stable RF-output-vs-temperature.

6-11.2 A13 Pulse Generator PCB Circuit Description

The A13 PCB provides the internal pulse generating function. It contains three major circuits: a 10-Hz-to-1-MHz programmable pulse generator, microprocessor interface, and a current drivers for the pulse PIN diodes in the control modulators. It also has the capability of interfacing an external pulse source to the control modulators. The external source may also be used to gate the internal pulse generator. The following paragraphs describe the three major circuits, and the foldout Figure 6M-2 provides a block diagram.

a. Processr Interface.
The microprocessor controls the pulse generator from commands received from either the front panel or the GPIB. It talks to the pulse generator through the A8 Serial I/O PCB. The Serial-Parallel Interface circuits convert the A8 serial data into parallel data and latches it. There are two clock signals for synchronization of the data. They are the Pulse Generator Clock and the Pulse Trigger Clock.

The data received with the Pulse Generator Clock sets the pulse frequency and width. The data received with the Pulse Trigger Clock selects the operational mode and the appropriate PIN driver for pulsing.

b. Pulse Generator.
The Frequency Dividers receive their 10 MHz Reference from the A10 Reference Divider PCB. The 10 MHz is divided down to 10 kHz, 100 kHz and 1 MHz. These signal provide the clock frequencies for the rest of the circuit.

The proper clock frequency for either pulse width or pulse repetition frequency is selected by the Pulse Rep Freq Clock Select and Pulse Width Clock Select multiplexers. The selected clock frequencies then go to programmable dividers.

The Pulse Rep Freq Cntr output goes to the Pulse Source Select circuit. In the internal mode, this signal goes to the Pulse Start FF (flip-flop multivibrator) and to the Gate Edge FF. The Pulse Start FF sets the Pulse FF. The Gate Edge FF is also set and then immediately reset by the Gate Edge Clear FF.

The output from the Pulse FF triggers the Pulse Width Cntr to start its count down. At the end of the count, The Pulse Stop FF is set which resets the Pulse FF and reloads the Pulse Width Cntr in preparation for the next pulse. At the end of its count, the Pulse Rep Freq Cntr triggers the Pulse Start FF again and the process repeats.

The Pulse Source Select circuit also allows gating of the internal pulse generator by an external source. The external source connects to the normal pulse input on either the front or rear panel. In this mode, the external source turns the internal pulse generator on or off. The external source must have a lower frequency and wider pulse width than the internal pulse generator.

The output of the Pulse FF goes to the rear panel as a sync pulse (via U26) and to the 100 ns Res FF. The 100 ns Res FF output is a minimum of 100 ns wide and goes in 100 ns steps determined by the 10 MHz clock frequency. The output of the 100 ns Res FF goes either to the 25 ns Res Gen or bypasses it via the Res Select multiplexer.

The 25 ns Res Gen is a delay line with three outputs. These three outputs are delayed by 25, 50, and 75 nanoseconds. The selection of these outputs OR'ed together provide 25 ns pulse width resolution from 25 ns o 100 us pulse width. Figure 6M-60 (facing page) shows how this is accomplished.

The U2 Exclusive NOR gate provides the capability of inverting the puse to the Mode Select circuit. The Mode Select provides the PIN drivers with either the internal pulse signal or an external pulse signal.

c. Pulse PIN Drivers.
The output of the Mode Select circuit goes to a Delay then goes to the A15 ALC PCB as the L SAMPLE/HOLD signal. This signal synchronizes the leveling loop to the pulse-on and pulse-off conditions. The Mode Select output also goes to the Pulse Mux. This multiplexer selects to which PIN driver the pulse signal is to be applied. The PIN drivers are high-speed high-current drivers. They provide the PIN diode with the drive for fast switching. The drivers are selected by the U34 Serial/Parallel Interf latch.

6-11.3 A29 Rear Panel Interface PCB Circuit Description (Including RF components on the Microwave Deck)

The following circuit description applies only to the part of the A29 board that comes under the Power Level Control Subsystem. Refer to Section 6F Inputs/Outputs for the A29 Schematic.

a. ALC Control

The ALC control signal from the A15 PCB goes to U36, a unity gain differential receiver. From U36 it goes to the PIN shaping circuit consisting of U37 through U40. This circuit shapes the drive voltage from the level control amplifier and changes its power level. The gain for the drive voltage is increased, thereby maintaining a more constant gain for the level control amplifier. Holding the gain of the level amplifier more constant improves the bandwidth during AM operation.

From the PIN Shaper the level control signal goes to Analog Switch U41. This switch multiplexes the signal to the various pin modulator drivers, depending on which band Lvl Mod(ulator) Select Latch U47 has selected.

There are four pin modulator drivers (0.01–8 GHz Mod, 8–12.4 GHz Mod, 12.4–18 GHz Mod, and 18–26 GHz Mod). These pin drivers are all identical in their circuit design. Figure 6M-49 provides a schematic of one of these circuits. The transistor supplies a voltage to R129. The R125 feedback resistor holds this voltage constant relative to the input voltage at R101. The feedback from R118 provides a correction for the voltage drop in the PIN diode and for any resistance in the circuit. Because of this correction, the voltage on the emitter remains constant relative to the voltage at the R118/R129 junction. This provides a true current source so that the current through R129, and thereby the PIN diode, is independent of the diode voltage drop. It is also independent of the diode's series resistance, the voltage drop of which changes with the amount of current being applied and the temperature of the diode.

b. Control Modulator

The control modulator (Figure 6M-50) provides the variable attenuator for control of the RF power from the YIG oscillator.

Part of the RF input is coupled out before modulation to a sampled RF output. This sampled RF goes to the multiplexing switch for the phase-lock circuitry. PIN diodes CR1 and CR2 are controlled by the level modulator driver. They act as variable resistors and have zero ohms at full drive current. This reflects all of the RF back into the oscillator. C3, C4, and L2 form a "T" filter between the level modulator diodes and the pulse diodes to prevent the high-speed video pulses for the pulse diodes from modulating the level modulator diodes. CR3, CR4, and CR5 are the pulsing diodes; the are supplied by a current source located on the A13 Pulse Generator PCB. These diodes are either full-on or full-off. They act as a switch rather than a variable attenuator. At the RF output C6 and L4 act as a high-pass filter to block the pulse modulator video pulse from going to the front panel output.

The 2–8 GHz control mondulator differs from the other control modulators in that it has an additional RF output for the Downconverter. The level modulator diodes and pulse diodes provide the power control for both the 2–8 GHz and the 0.01–2 GHz bands. The frequencies in the 0.01–2 GHz band are the difference frequencies derived from mixing the Control Modulator 4.51–6.5 GHz output with a 4.5 GHz local oscillator located within the downconverter.

c. PIN Switch Driver

There are 15 pin switch drivers on the A29 PCB. All of these drivers operate identically. There are 4 for the main RF output multiplexing switch, 4 for the sampler multiplexing switch, four for the switched filter, and 3 spares. Figure 6M-52 shows a schematic of the pin switch driver.

U31, a transistor array, operates as a bank of saturated switches. R52 and R56 limit the current going to the PIN diodes in the switches. In some cases, there will be no current flow. For this discussion, assume that a voltage is providing the proper reverse bias for the diodes. When this happens the series resistor provides current limiting to protect the transistor in case of a short circuit.

Analog switch U26 provides base current for switching the transistors. Its contol comes from a TTL latch that is microprocessor controlled.

The voltage present at the U26 output can vary between +5 and –5V, depending upon the configuration of the pin switch. A positive voltage indicates that the switch is in the off state; conversely, a negative voltage indicates an on condition.

d. ***Switched Filter***

The switched filter is installeed in models containing a 2–8 GHz oscillator. It provides rejection of the harmonics generated by the 2–8 GHz oscillator and multiplexing of the 0.01–2 GHz RF from the downconverter. Figure 6M-53 shows a simplified schematic of the Switched Filter.

At the 2-8 GHz RF Input, inductor L1 provides high-pass filtering to ground for the video from the pulse modulator. (This modulator is located in the control modulator.) From here, the signal has three paths. The RF filtering for the path through CR1, CR3, and CR4 is provided by an 8 GHz low-pass filter physically located on the main RF mux switch. (On the 6717A 0.01-8 GHz and 6719A 2-8 GHz units, this filter is located on the output of the switched filter, as a main mux switch is not installed in these units.) The 6 GHz and 3.5 GHz paths are identical to the 8 GHz path other than the low-pass filters. For the 0.01-2 GHz band the RF output of the downconverter goes through CR11. (Unless otherwise shown on the schematic, the inductors are zero ohms resistance.)

e. ***Main Mux Switch***

The Main Mux switch multiplexes the various control modulator outputs into a common output port.

The ports greater than 8 GHz have additional video filtering for the pulse from the control modulator. The 0.01–8 GHz and 8–12.4 GHz ports have only series diodes arranged to provide minimum harmonic generation at high input power. In the off condition, these two ports do not draw current and have only a high reverse voltage to turn off the diodes. The series-shunt configuration of the 12.4–20 GHz and 20–26.5 GHz ports will draw approximately 20 ma current in both off and on conditions. Again, positive is off and negative is on. This switch is not installed in units in having only one oscillator.

f. ***Sampler Mux Switch***

The Sampler Mux switch multiplexes the sampled RF output of each of the control modulators to a common port. From here, the RF goes to the sampler for the YIG phase-lock loop. This sampler is simpler in construction, as it does not have to pass 10 MHz. Also, the harmonic generation from the high-power input to the PIN diodes is not a requirement here, since the maximum input is approximately –15 dBm. The Sampler Mux switch is not used in single-band units having only one oscillator.

g. ***Step Attenuator Control***

There are four drivers for the step attenuator. They will handle either a four-section attenuator or a three-section attenuator. In the case of a three-section attenuator, one of the drivers is not used. There are serveral possiblities for step attenautors.

- Four-section Attenuator with 10, 20, 30, and 30 dB sections (90 dB)
- Four-section Attenuator with 10, 20, 40, and 40 dB sections (110dB)
- Four-section Attenuator with 10, 20, 20, and 20 dB sections (70 dB)
- Three-section Attenuator with 10, 20, and 30 dB sections (70 dB)

The attenuator steps are entirely under control of the microprocessor through Latch U18.

Relay driver U19 is almost identical to a section driver for the step attenuator. It is provided for future use to drive a relay.

6-11.4 ALC / Pulse Modulation Subsystem Schematics

Figures 6M-3 thru 6 provide schematics of the A13 and A15 PCBs. Additional schematic information is provided in Section 6F for the A29 Rear Panel Interface PCB circuitry relative to this section.

6-11.5 RF Power and Control Subsystem Troubleshooting

Section 6C provides troubleshooting procedure for this and other subsystems.

NOTE

Pages 6M-7 through 6M-10
are blank.

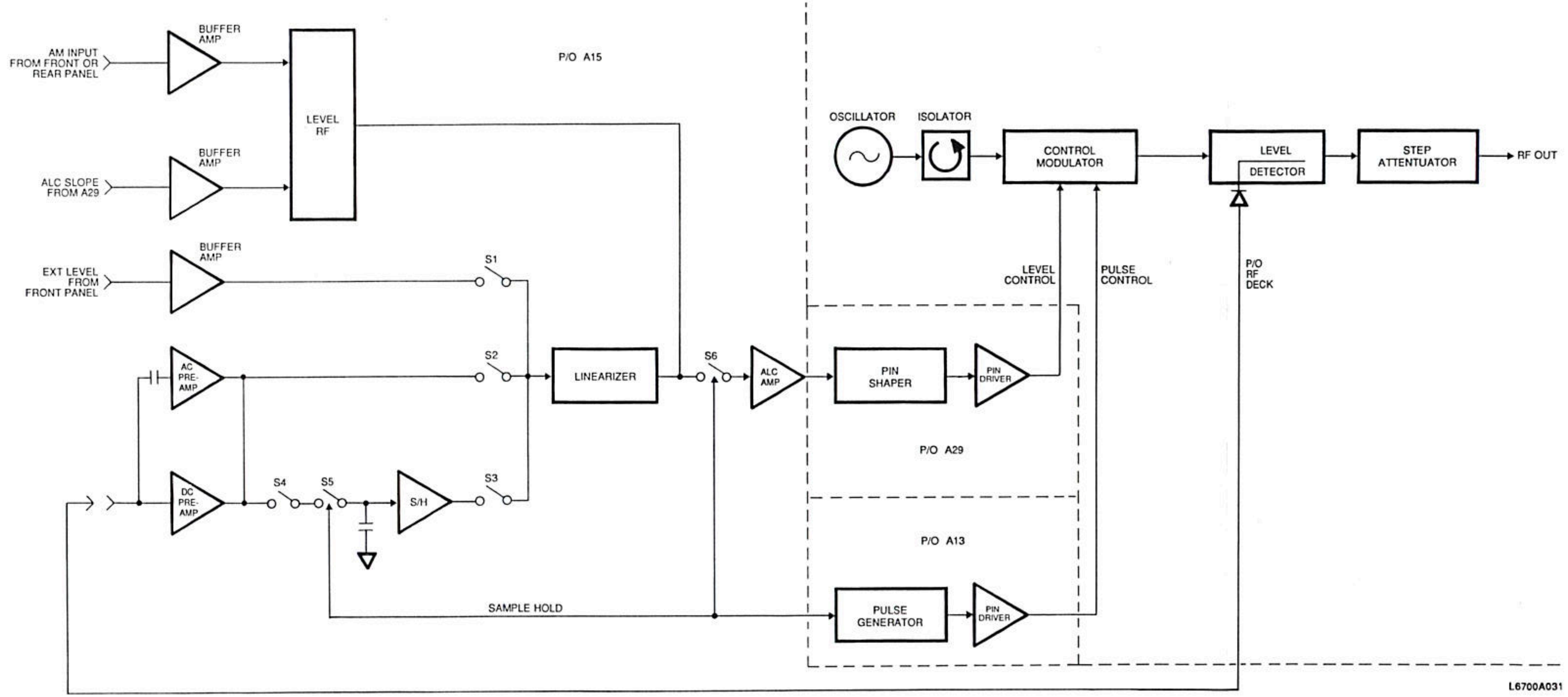


Figure 6M-1. Overall ALC/Pulse Modulation Block Diagram

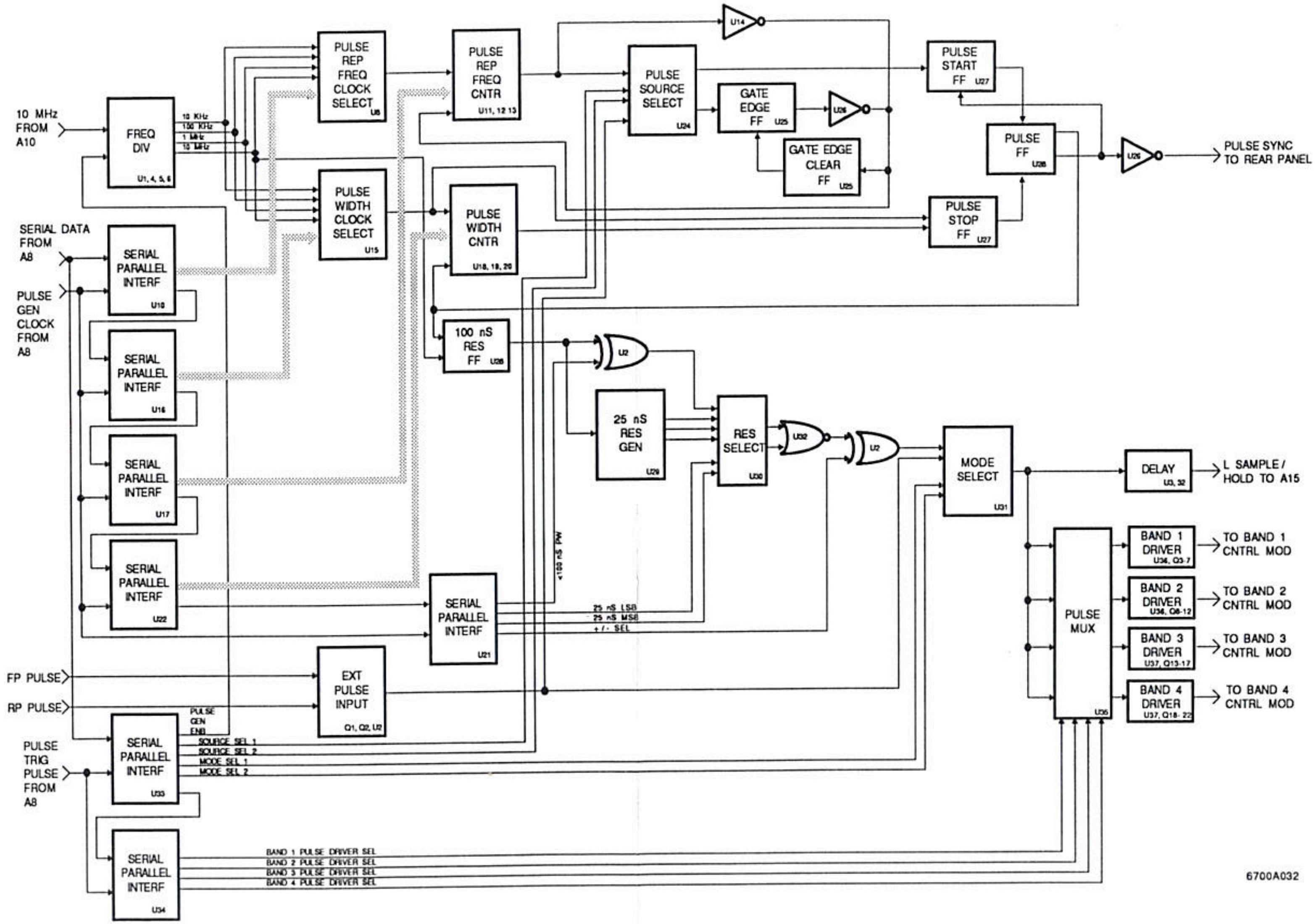


Figure 6M-2. A13 Pulse Generator PCB Block Diagram

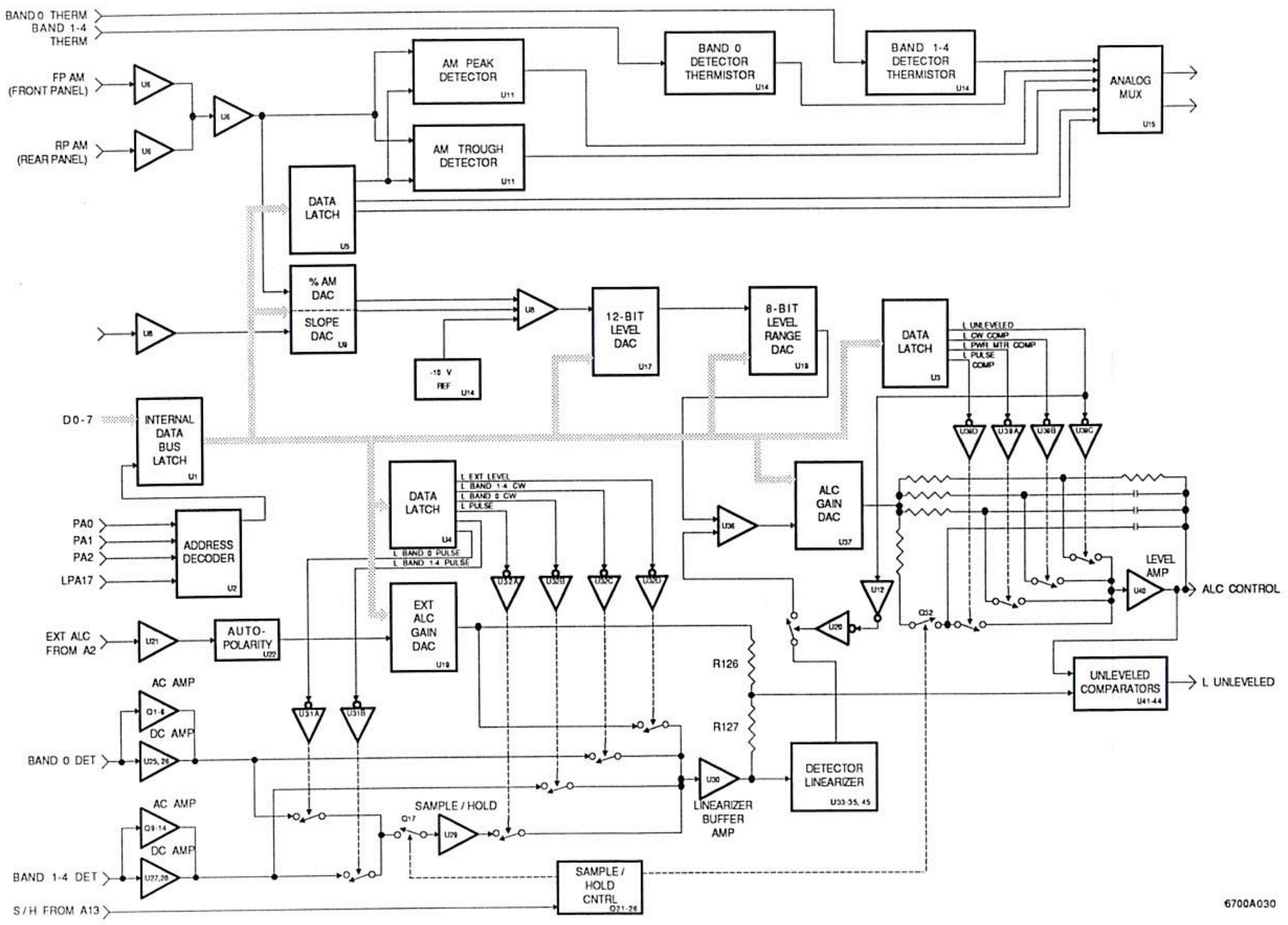
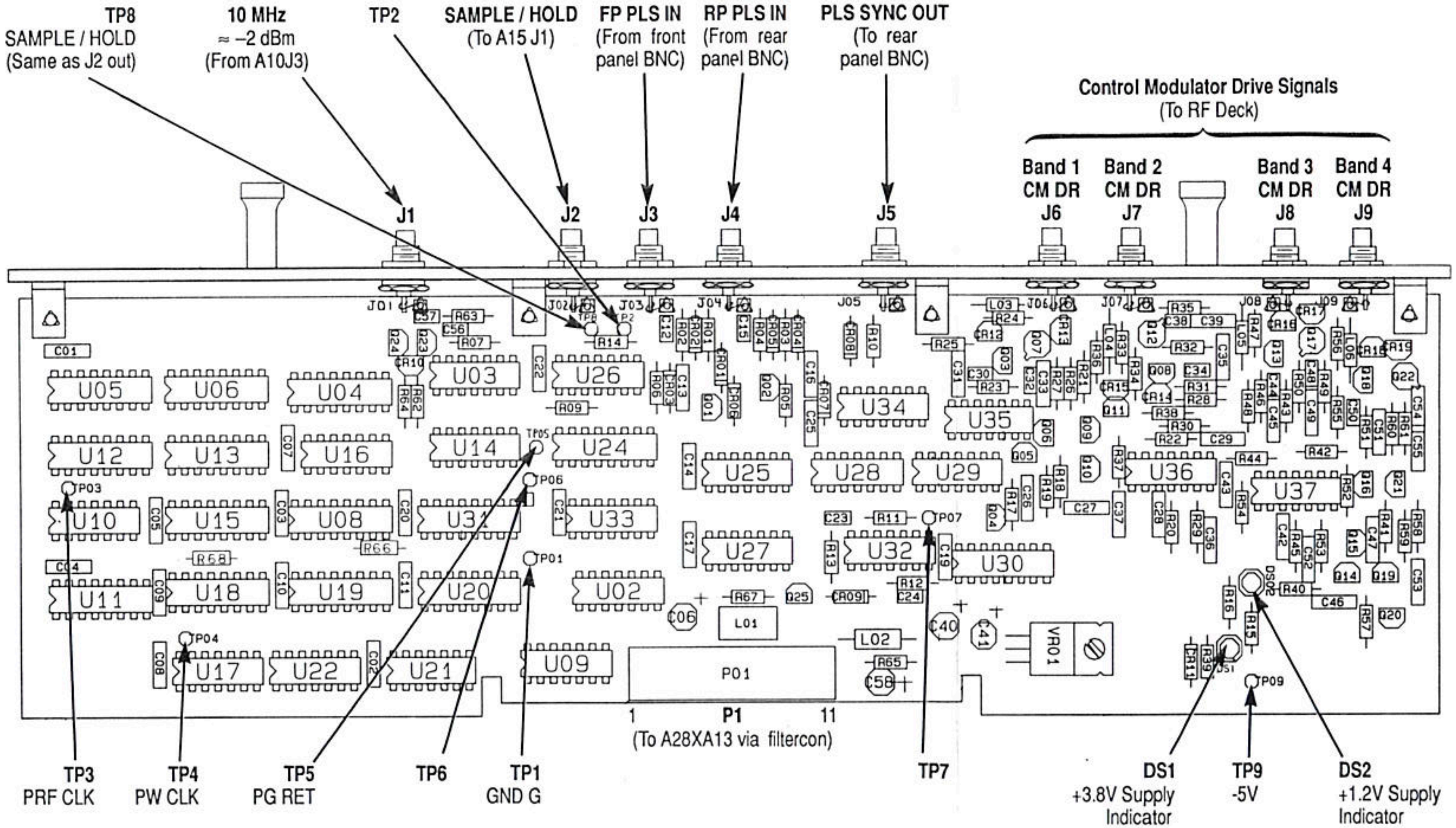
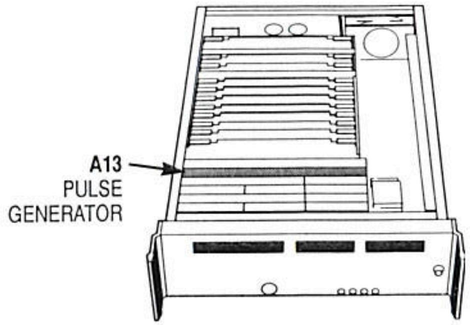


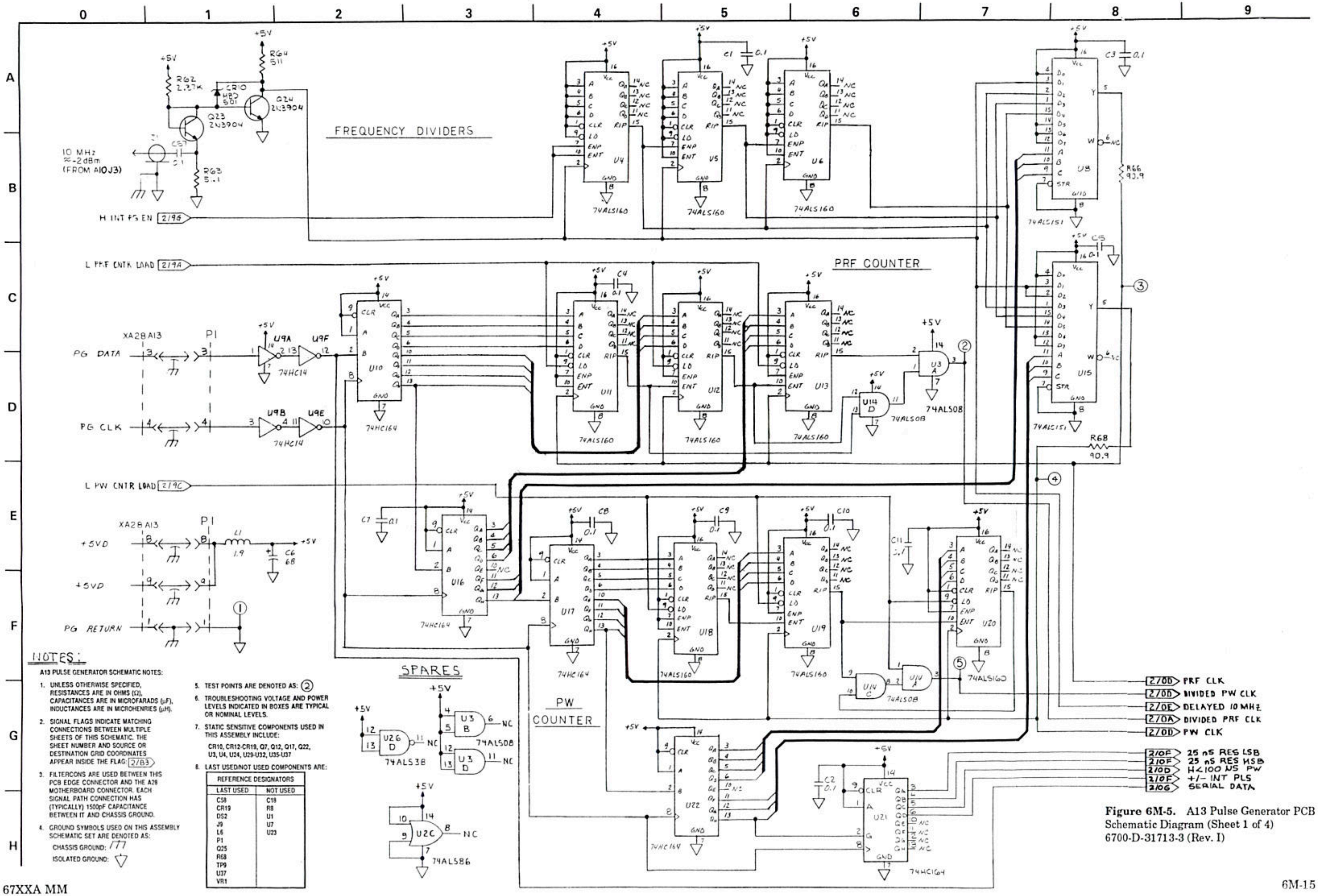
Figure 6M-3. A15 ALC PCB Block Diagram





NOTE:
Leading zeros on component number references may be disregarded.

Figure 6M-4. A13 Pulse Generator PCB Parts Locater Diagram
6700-D-31713-3 (Rev. I)



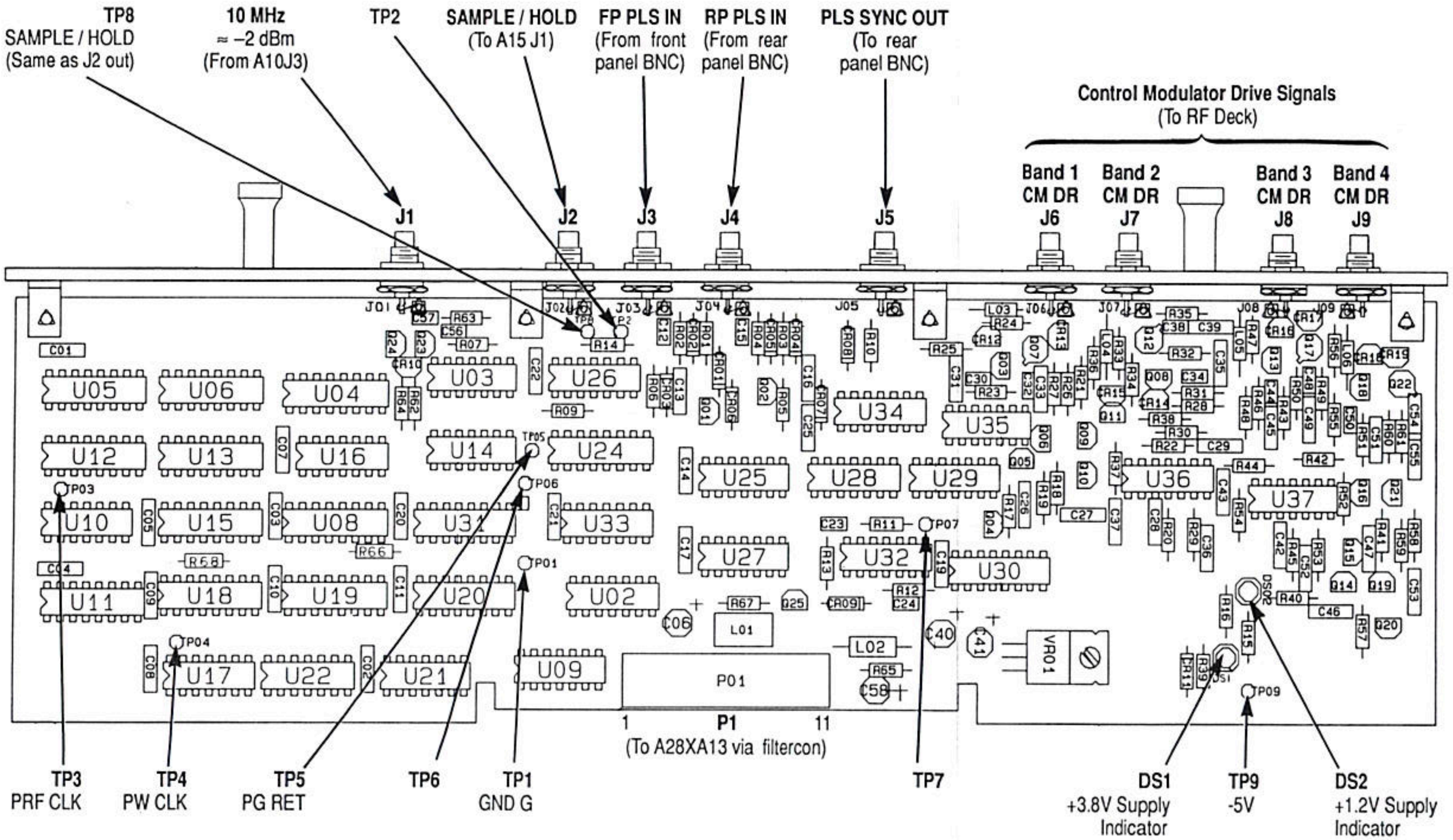
NOTES:

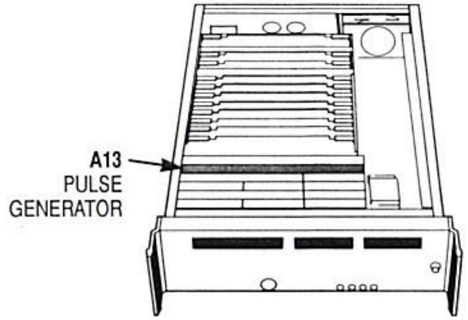
A13 PULSE GENERATOR SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. FILTERCONS ARE USED BETWEEN THIS PCB EDGE CONNECTOR AND THE A28 MOTHERBOARD CONNECTOR. EACH SIGNAL PATH CONNECTION HAS (TYPICALLY) 1500pF CAPACITANCE BETWEEN IT AND CHASSIS GROUND.
4. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUND:
5. TEST POINTS ARE DENOTED AS: (2)
6. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
7. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   CR10, CR12-CR19, Q7, Q12, Q17, Q22, U3, U4, U24, U29-U32, U35-U37
8. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C58	C18
CR19	R8
DS2	U1
J9	U7
L6	U23
P1	
Q25	
R68	
TP9	
U37	
VR1	

Figure 6M-5. A13 Pulse Generator PCB Schematic Diagram (Sheet 1 of 4)
6700-D-31713-3 (Rev. I)





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6M-4. A13 Pulse Generator PCB Parts Locater Diagram
6700-D-31713-3 (Rev. I)

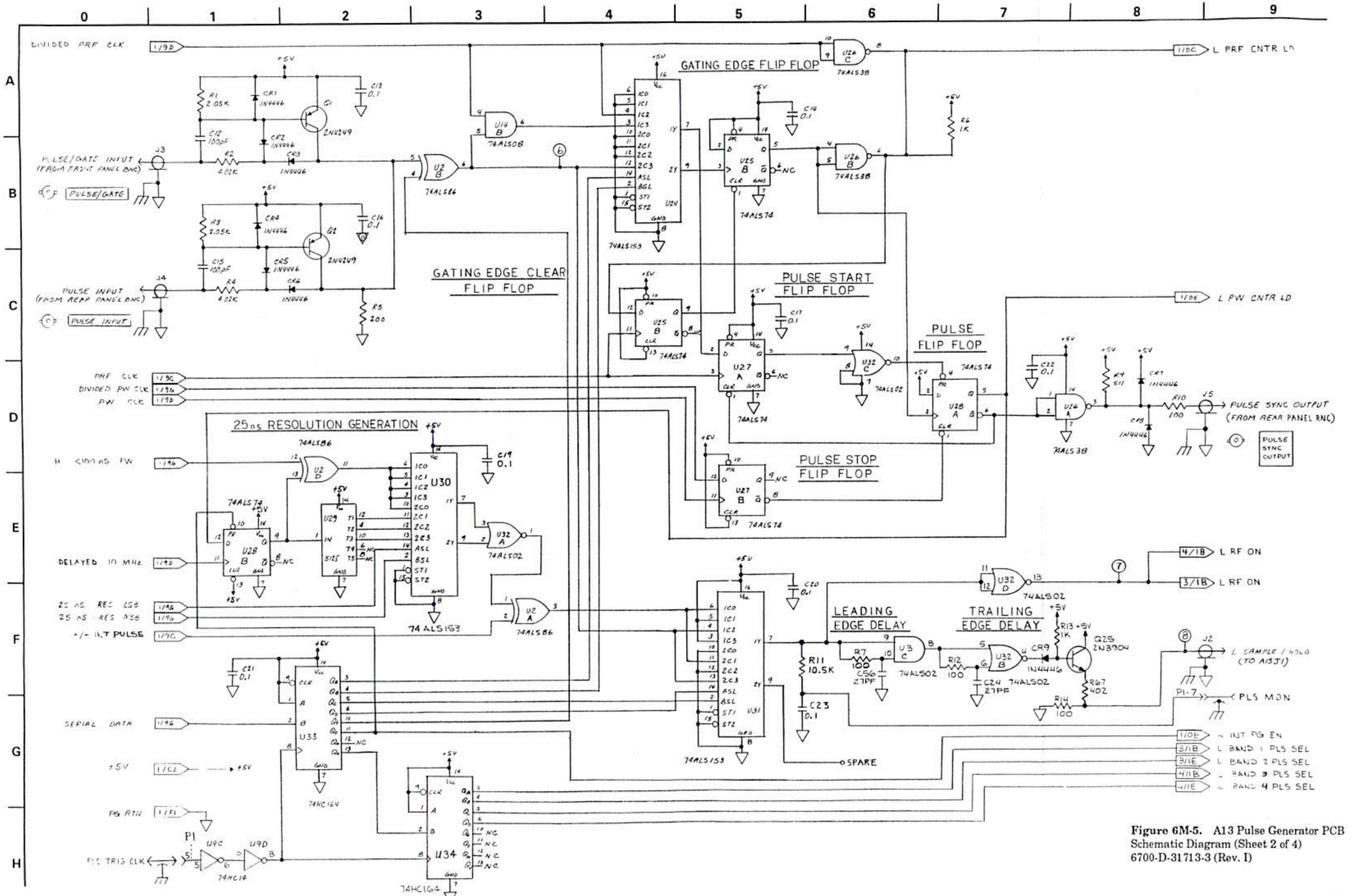
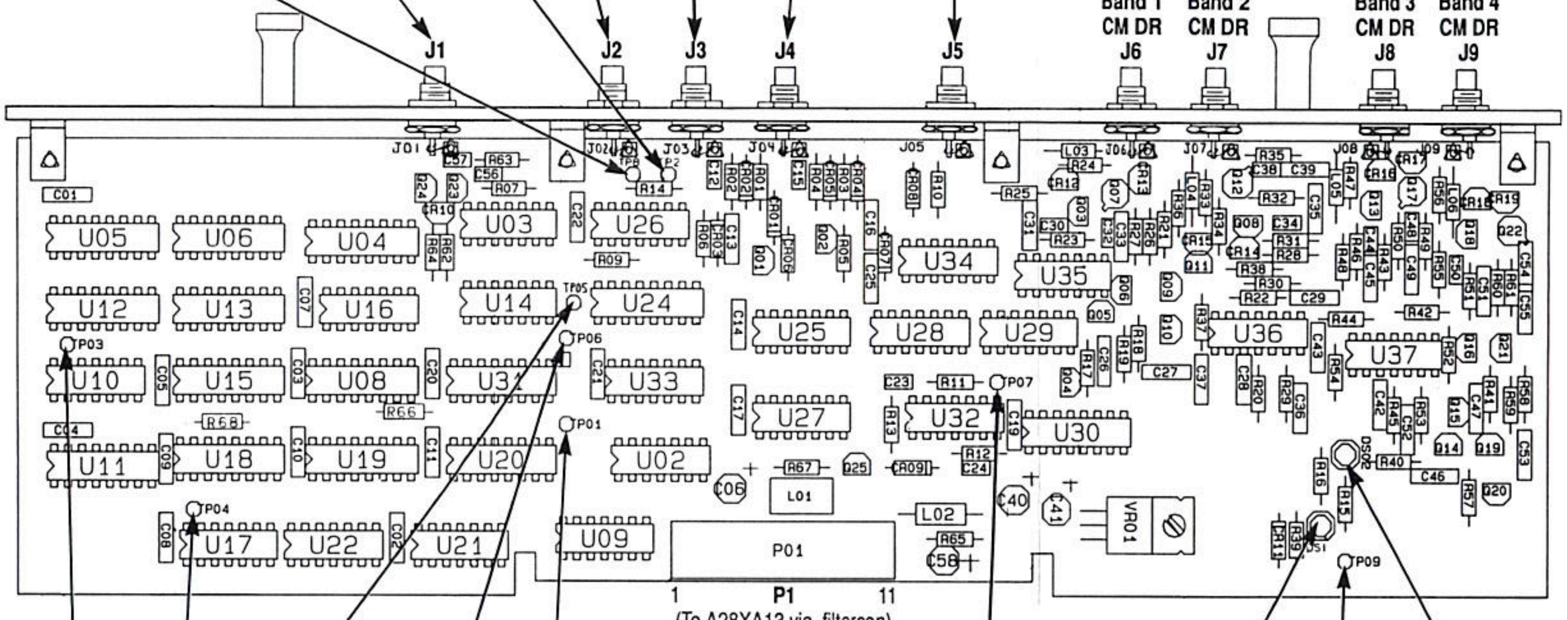
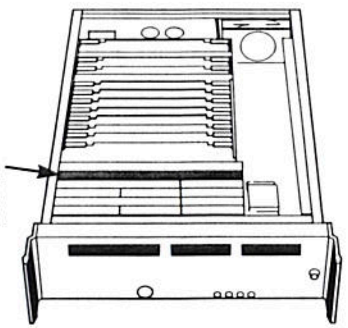


Figure 6M-5. A13 Pulse Generator PCB Schematic Diagram (Sheet 2 of 4) 6700-D-31713-3 (Rev. I)





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6M-4. A13 Pulse Generator PCB Parts Locater Diagram
6700-D-31713-3 (Rev. I)

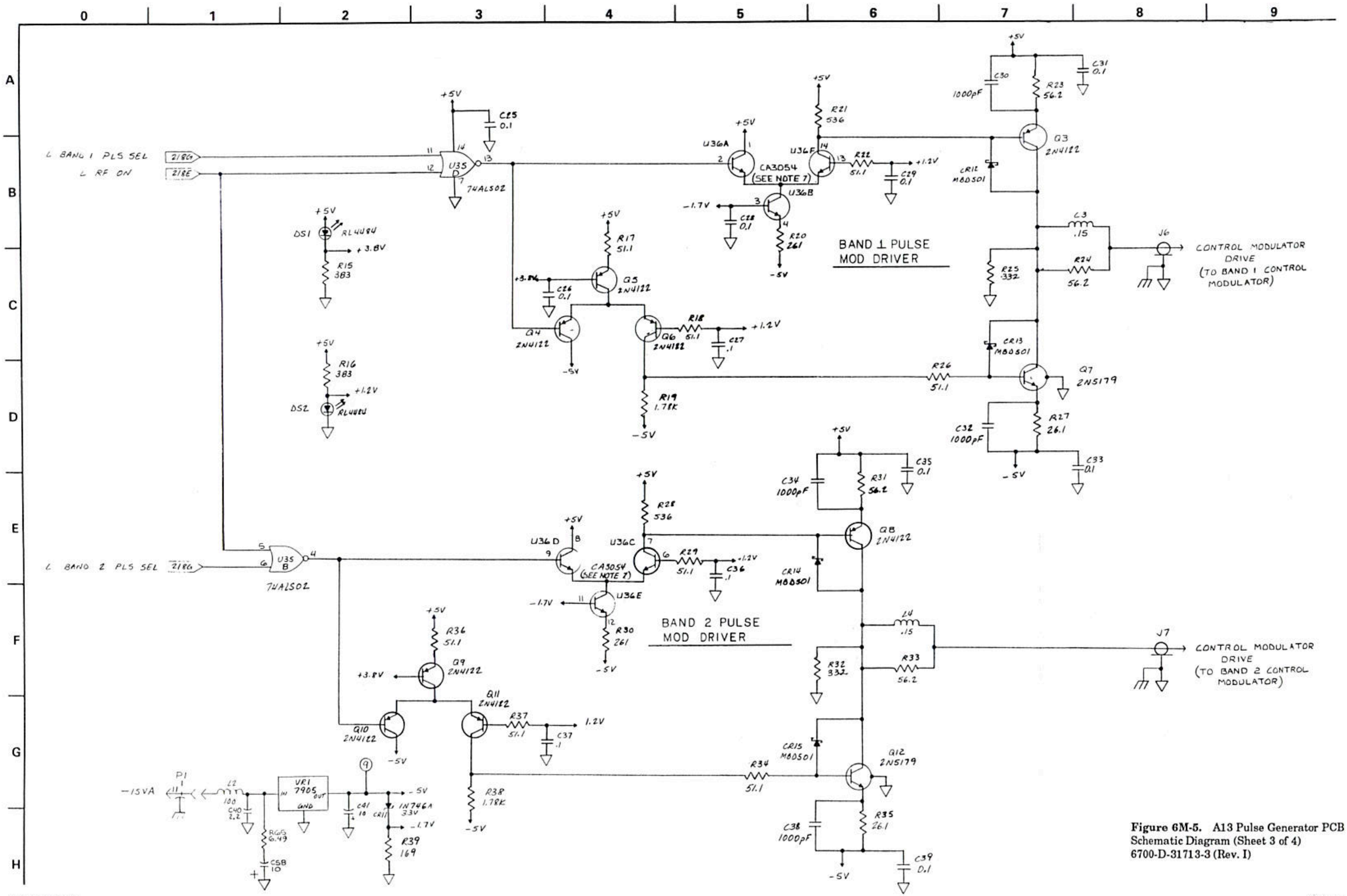
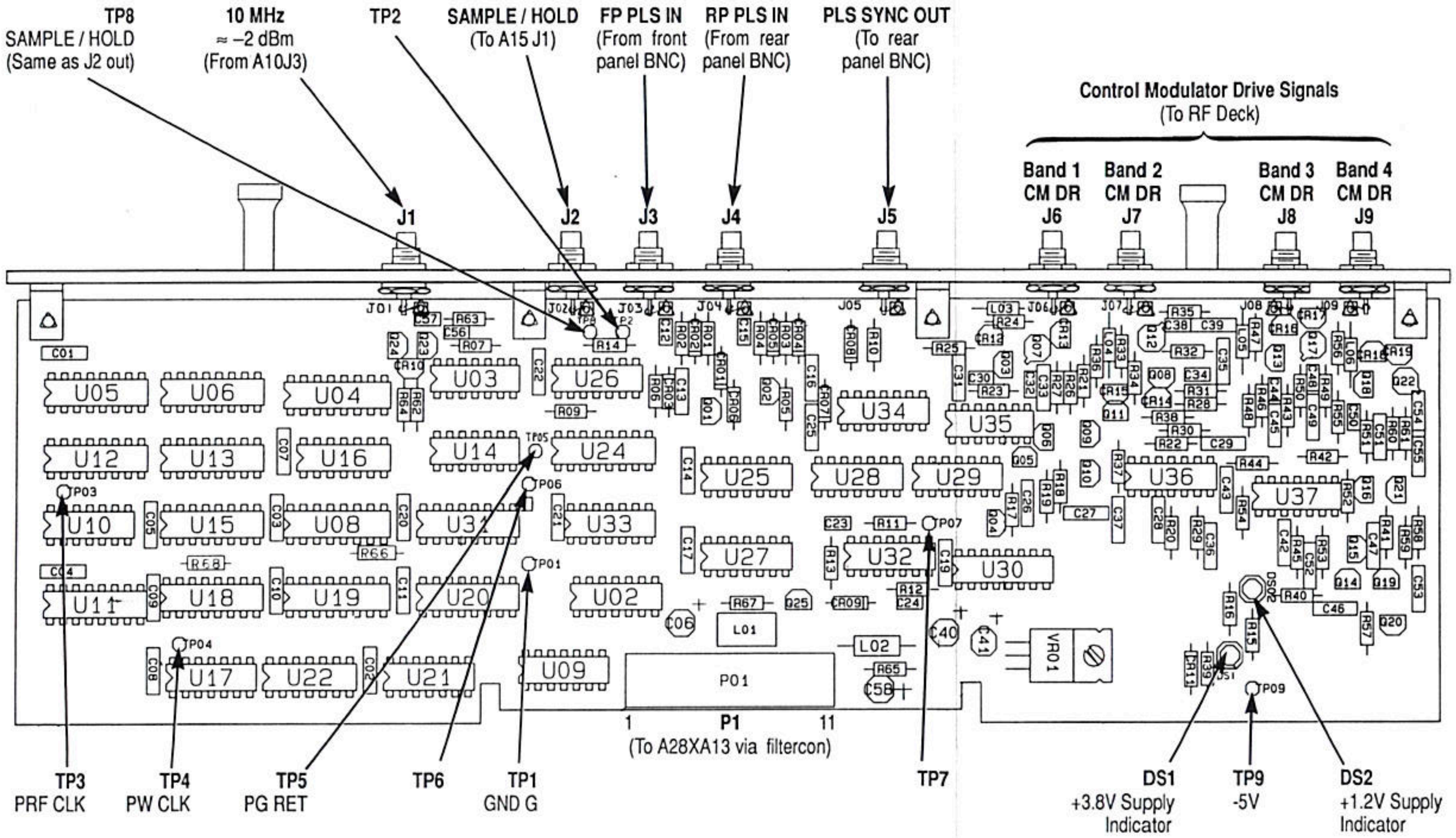
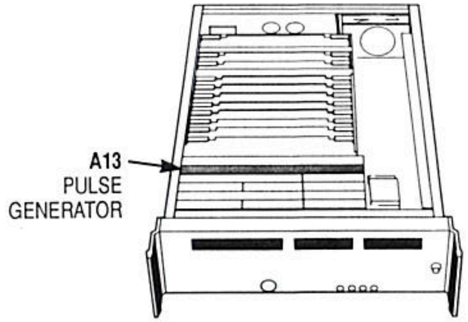


Figure 6M-5. A13 Pulse Generator PCB Schematic Diagram (Sheet 3 of 4) 6700-D-31713-3 (Rev. I)





NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6M-4. A13 Pulse Generator PCB Parts Locater Diagram
6700-D-31713-3 (Rev. I)

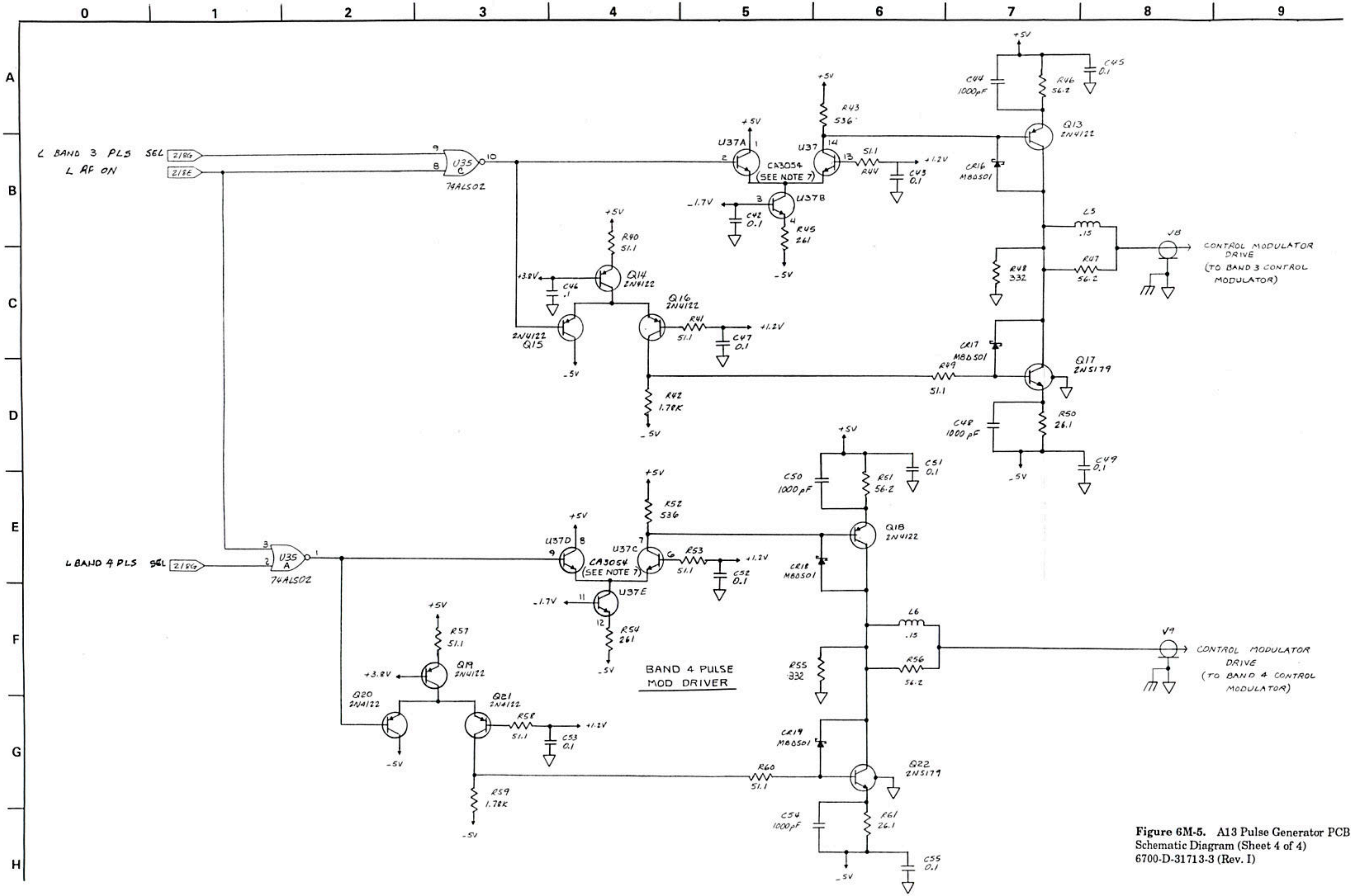
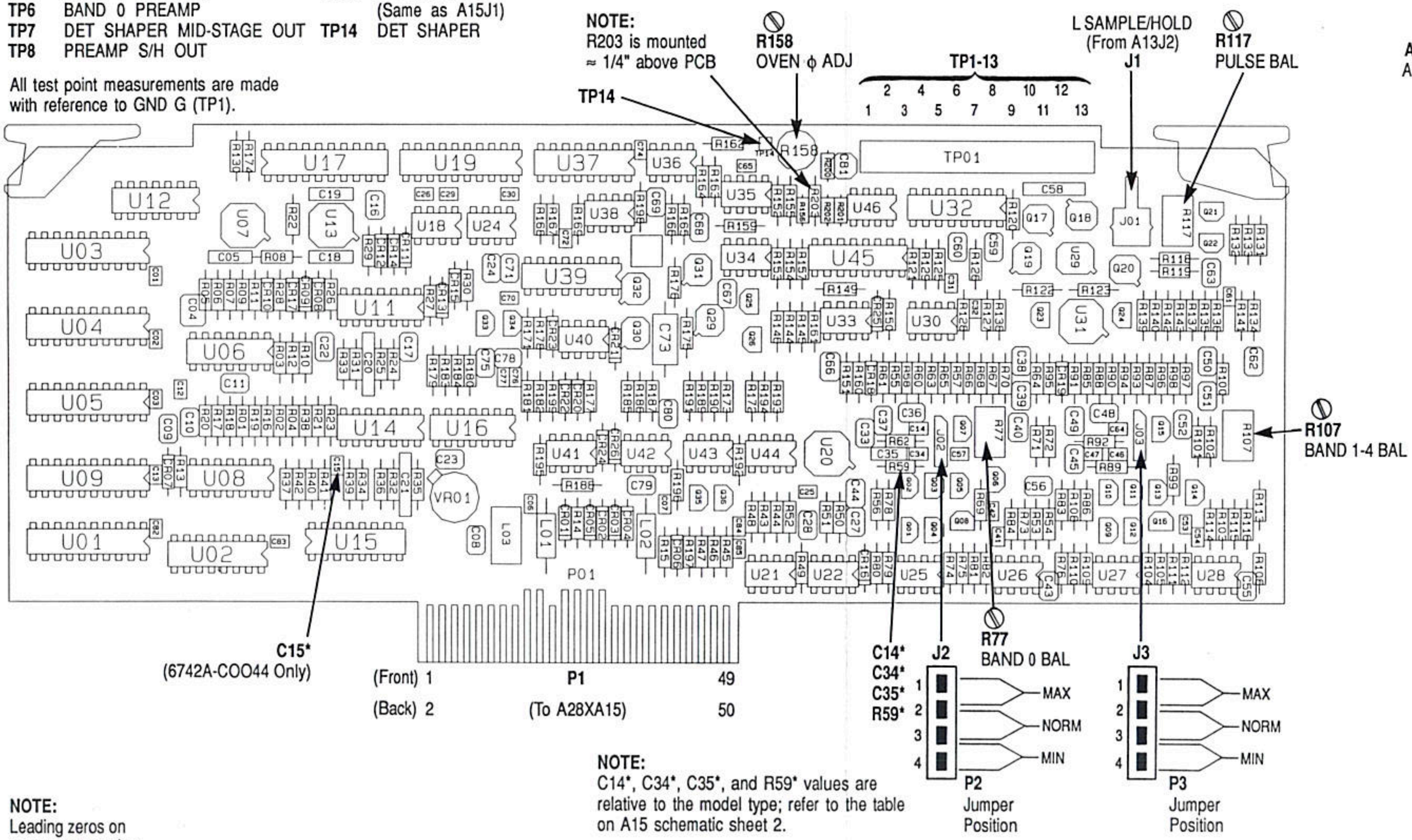


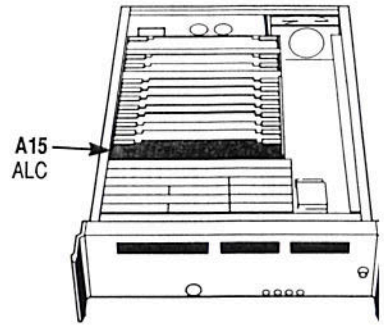
Figure 6M-5. A13 Pulse Generator PCB Schematic Diagram (Sheet 4 of 4)
6700-D-31713-3 (Rev. I)

TEST POINTS

TP1	GND G	**TP9**	(ALC) SLOPE B
TP2	BUFFERED AM INPUT	**TP10**	LEVEL AMP OUT
TP3	ALC REF	**TP11**	Not Used
TP4	EXT LVL	**TP12**	Not Used
TP5	BAND 1-4 PREAMP	**TP13**	L SAMPLE/HOLD (Same as A15J1)
TP6	BAND 0 PREAMP		
TP7	DET SHAPER MID-STAGE OUT	**TP14**	DET SHAPER
TP8	PREAMP S/H OUT		

All test point measurements are made with reference to GND G (TP1).

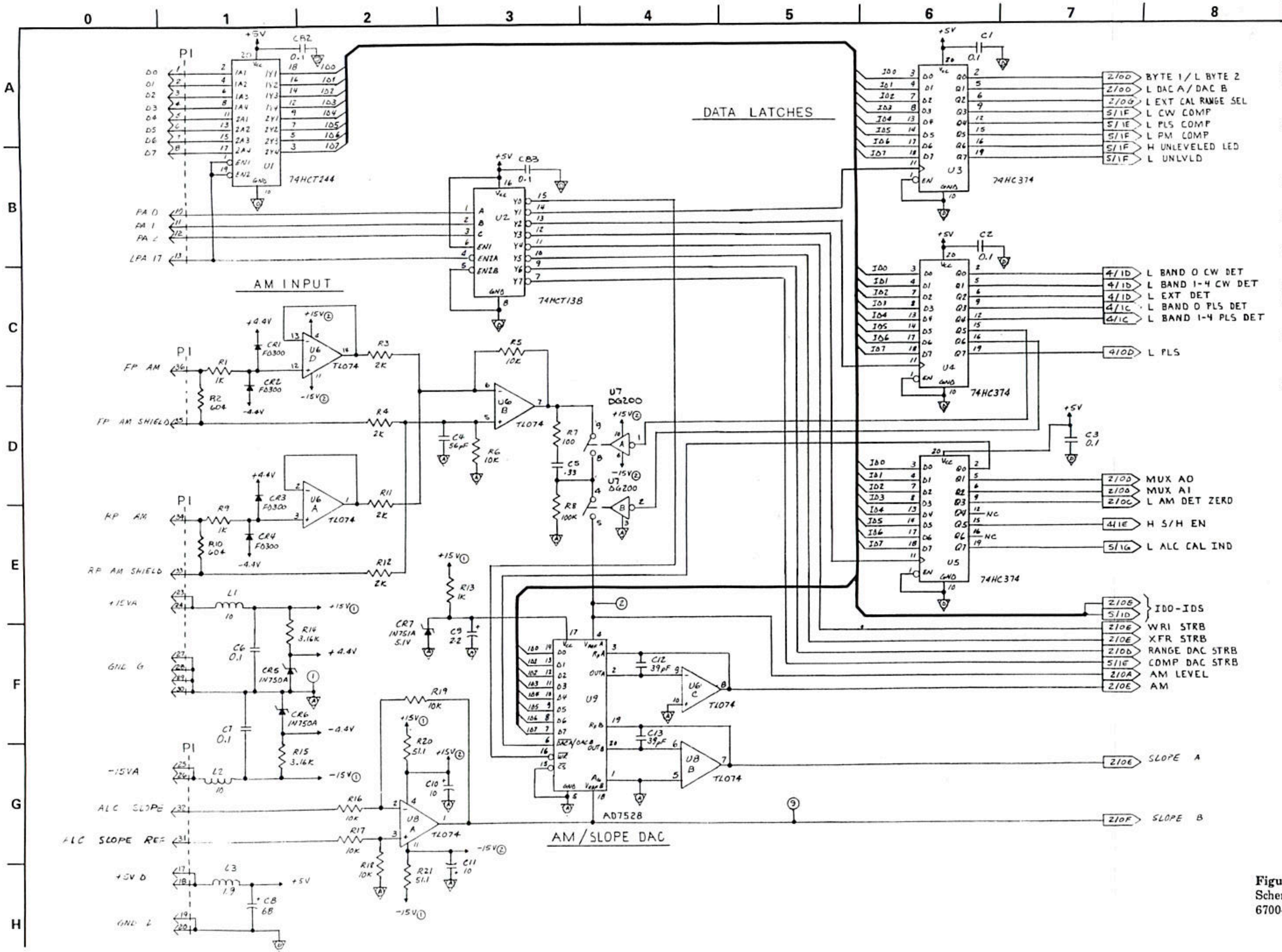




NOTE:
C14*, C34*, C35*, and R59* values are relative to the model type; refer to the table on A15 schematic sheet 2.

NOTE:
Leading zeros on component number references may be disregarded.

Figure 6M-6. A15 ALC PCB Parts Locater Diagram
6700-D-31715-3 (Rev. K)



A15 ALC SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   ISOLATED GROUND: A C D
4. ADJUSTABLE COMPONENTS ARE DENOTED WITH AN ASTERISK:
   R77 R107 R115 R158
5. FACTORY-SELECTED COMPONENTS ARE DENOTED WITH AN ASTERISK
   C14*, C15*, C34*, C35*, R59*
6. TEST POINTS ARE DENOTED AS:
7. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
8. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   R127, R128, U6-U8, U11, U13-U15, U17, U18, U20-U22, U24, U26, U28, U29, U32-U39, U41-U44, U46, VR1
9. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C85	Q27
CR26	Q28
J3	R124
L3	R148
P3	U10
Q36	U23
R203	U30
TP14	
U46	
VR1	
W2	

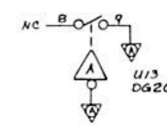
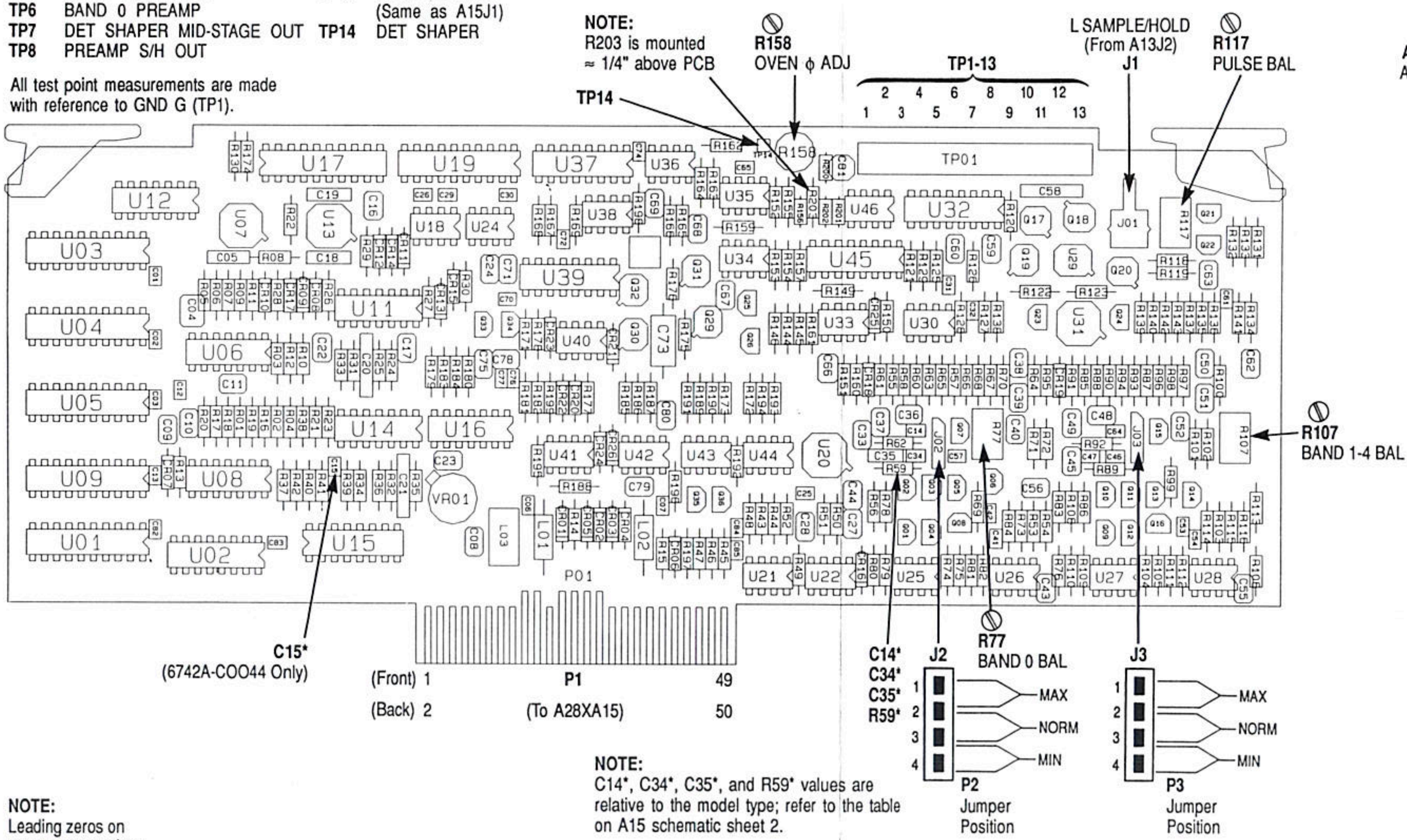


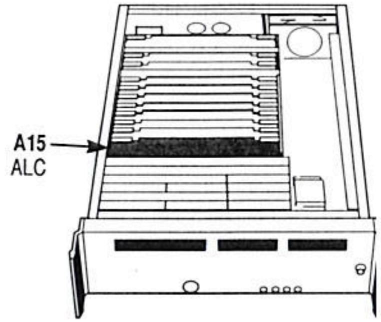
Figure 6M-7. A15 ALC PCB Schematic Diagram (Sheet 1 of 5) 6700-D-31715-3 (Rev. K)

TEST POINTS

TP1	GND G	**TP9**	(ALC) SLOPE B
TP2	BUFFERED AM INPUT	**TP10**	LEVEL AMP OUT
TP3	ALC REF	**TP11**	Not Used
TP4	EXT LVL	**TP12**	Not Used
TP5	BAND 1-4 PREAMP	**TP13**	L SAMPLE/HOLD (Same as A15J1)
TP6	BAND 0 PREAMP	**TP14**	DET SHAPER
TP7	DET SHAPER MID-STAGE OUT		
TP8	PREAMP S/H OUT		

All test point measurements are made with reference to GND G (TP1).





NOTE:
C14*, C34*, C35*, and R59* values are relative to the model type; refer to the table on A15 schematic sheet 2.

NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6M-6. A15 ALC PCB Parts Locater Diagram 6700-D-31715-3 (Rev. K)

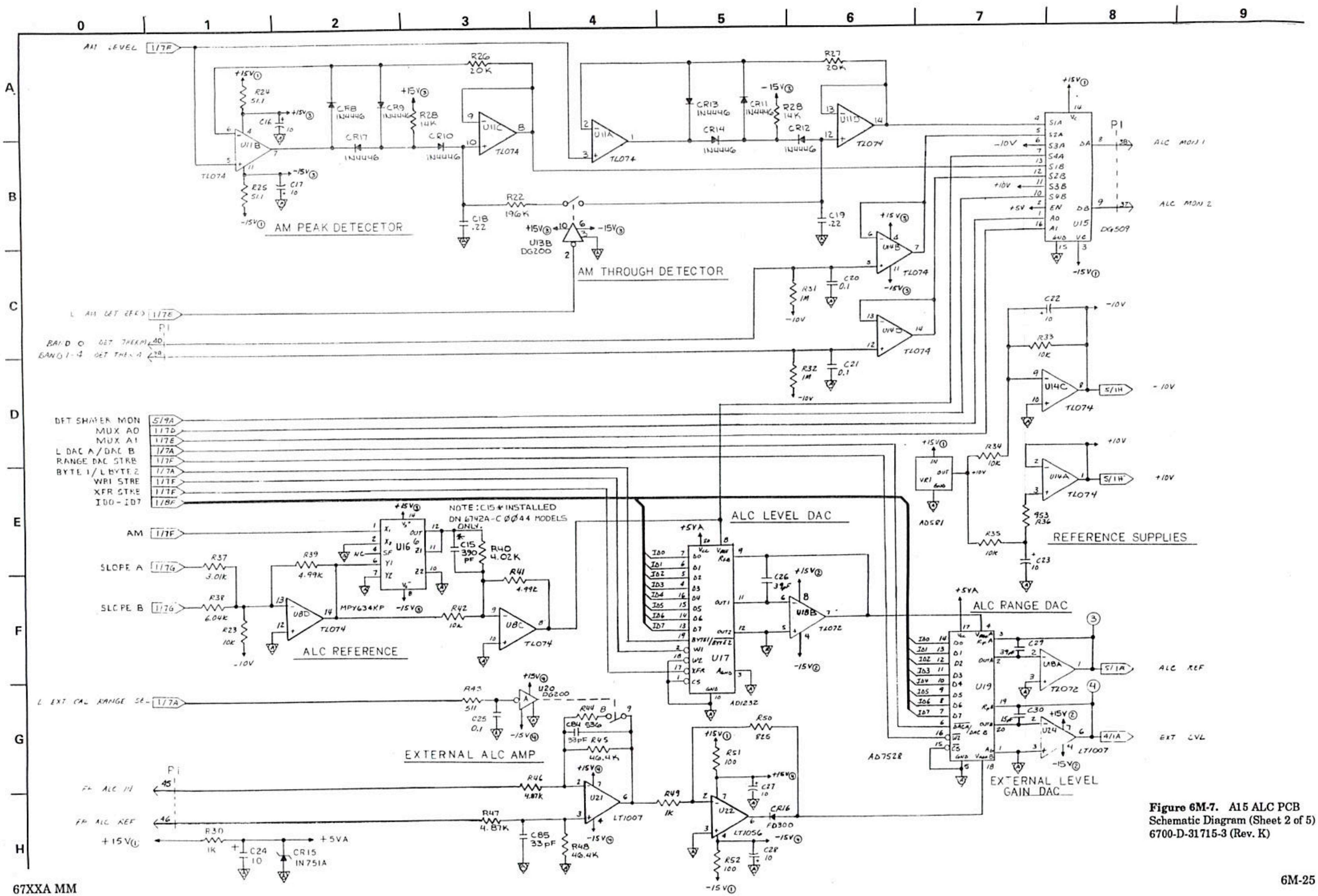
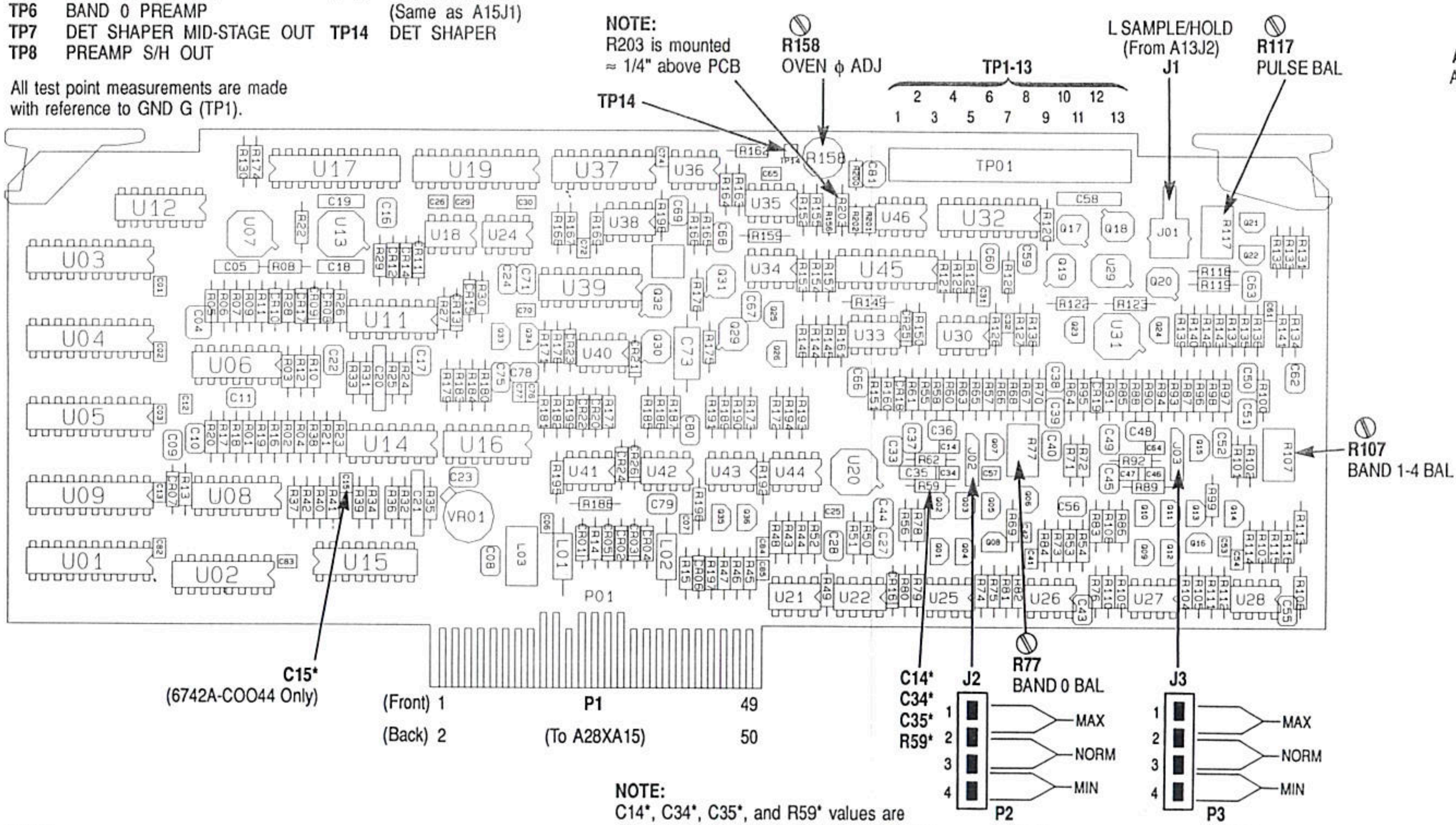


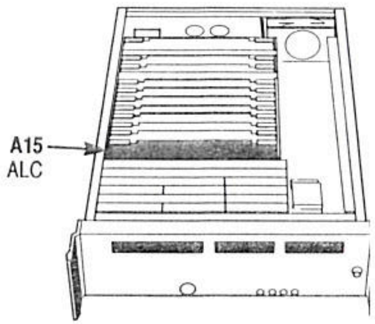
Figure 6M-7. A15 ALC PCB Schematic Diagram (Sheet 2 of 5) 6700-D-31715-3 (Rev. K)

TEST POINTS

TP1	GND G	**TP9**	(ALC) SLOPE B
TP2	BUFFERED AM INPUT	**TP10**	LEVEL AMP OUT
TP3	ALC REF	**TP11**	Not Used
TP4	EXT LVL	**TP12**	Not Used
TP5	BAND 1-4 PREAMP	**TP13**	L SAMPLE/HOLD (Same as A15J1)
TP6	BAND 0 PREAMP	**TP14**	DET SHAPER
TP7	DET SHAPER MID-STAGE OUT		
TP8	PREAMP S/H OUT		

All test point measurements are made with reference to GND G (TP1).

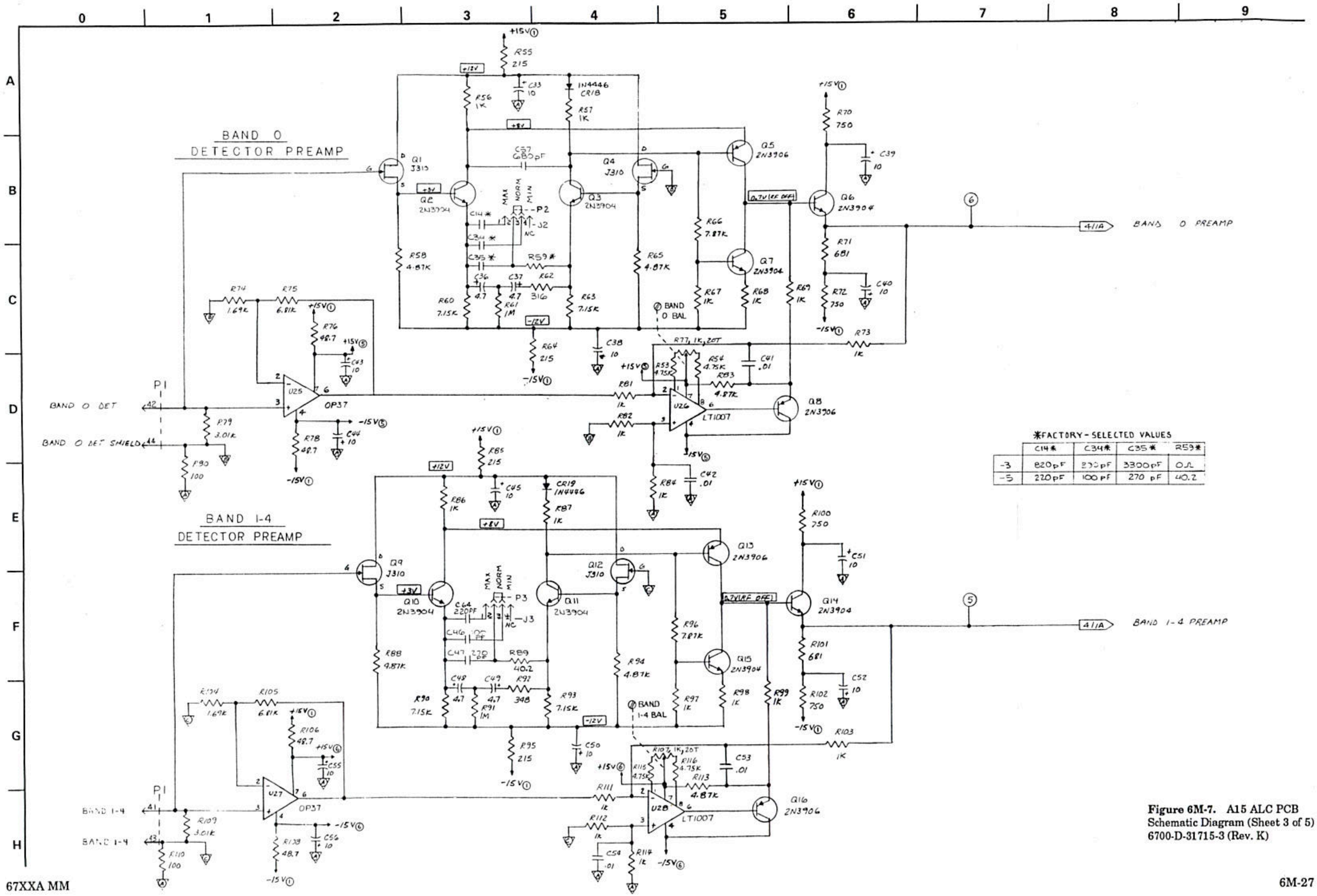




NOTE:
C14*, C34*, C35*, and R59* values are relative to the model type; refer to the table on A15 schematic sheet 2.

NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6M-6. A15 ALC PCB Parts Locater Diagram
6700-D-31715-3 (Rev. K)



*FACTORY-SELECTED VALUES

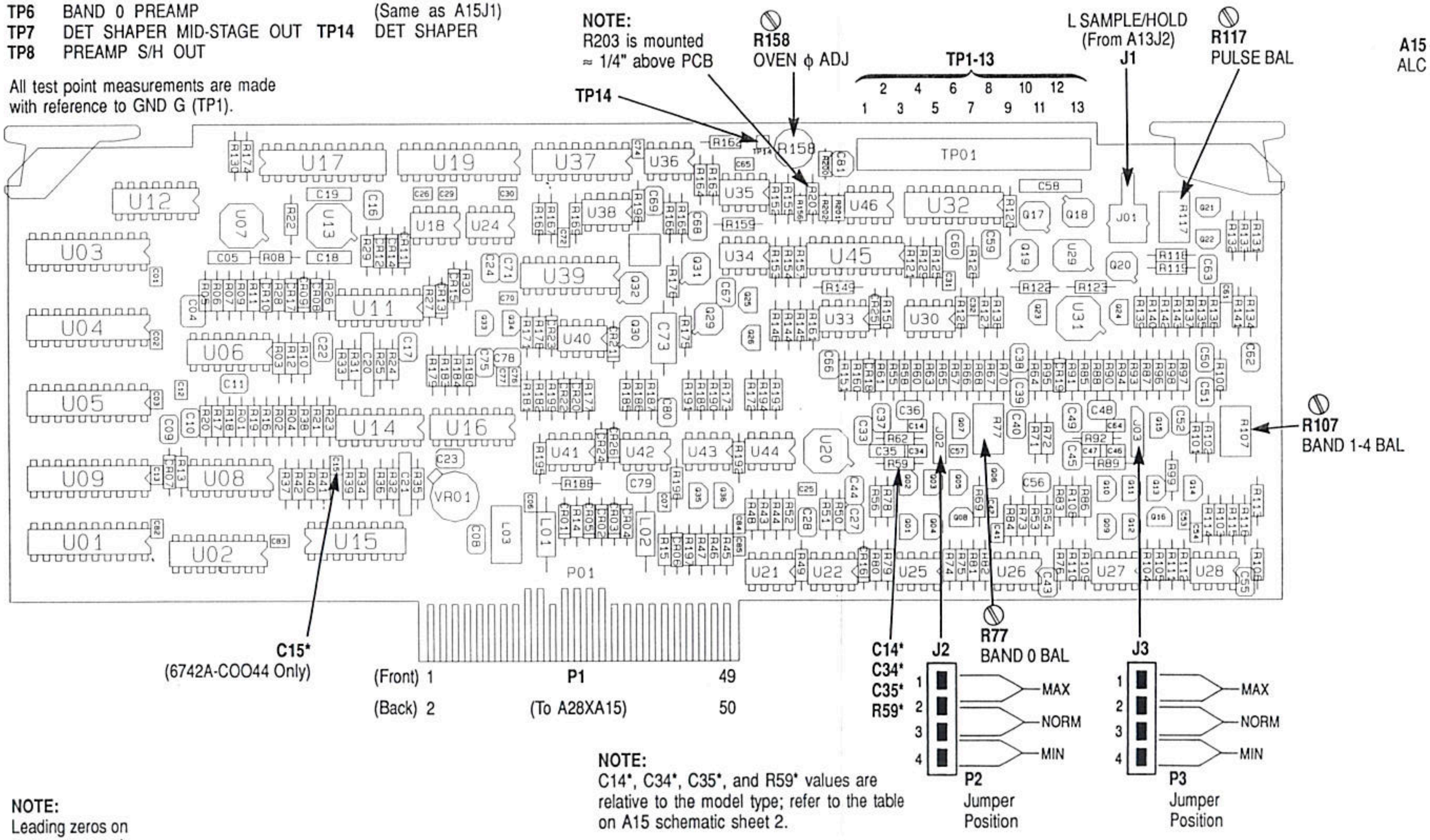
	C14*	C34*	C35*	R59*
-3	820pF	[illegible]	3300pF	0Ω
-5	220pF	100 pF	270 pF	40.2

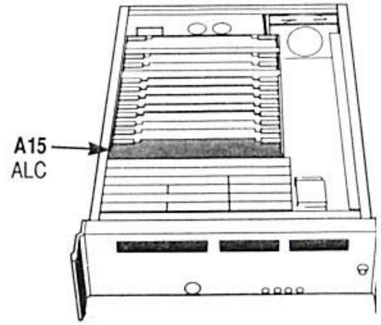
Figure 6M-7. A15 ALC PCB Schematic Diagram (Sheet 3 of 5) 6700-D-31715-3 (Rev. K)

TEST POINTS

TP1	GND G	**TP9**	(ALC) SLOPE B
TP2	BUFFERED AM INPUT	**TP10**	LEVEL AMP OUT
TP3	ALC REF	**TP11**	Not Used
TP4	EXT LVL	**TP12**	Not Used
TP5	BAND 1-4 PREAMP	**TP13**	L SAMPLE/HOLD (Same as A15J1)
TP6	BAND 0 PREAMP	**TP14**	DET SHAPER
TP7	DET SHAPER MID-STAGE OUT		
TP8	PREAMP S/H OUT		

All test point measurements are made with reference to GND G (TP1).





NOTE:
C14*, C34*, C35*, and R59* values are relative to the model type; refer to the table on A15 schematic sheet 2.

NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6M-6. A15 ALC PCB Parts Locater Diagram
6700-D-31715-3 (Rev. K)

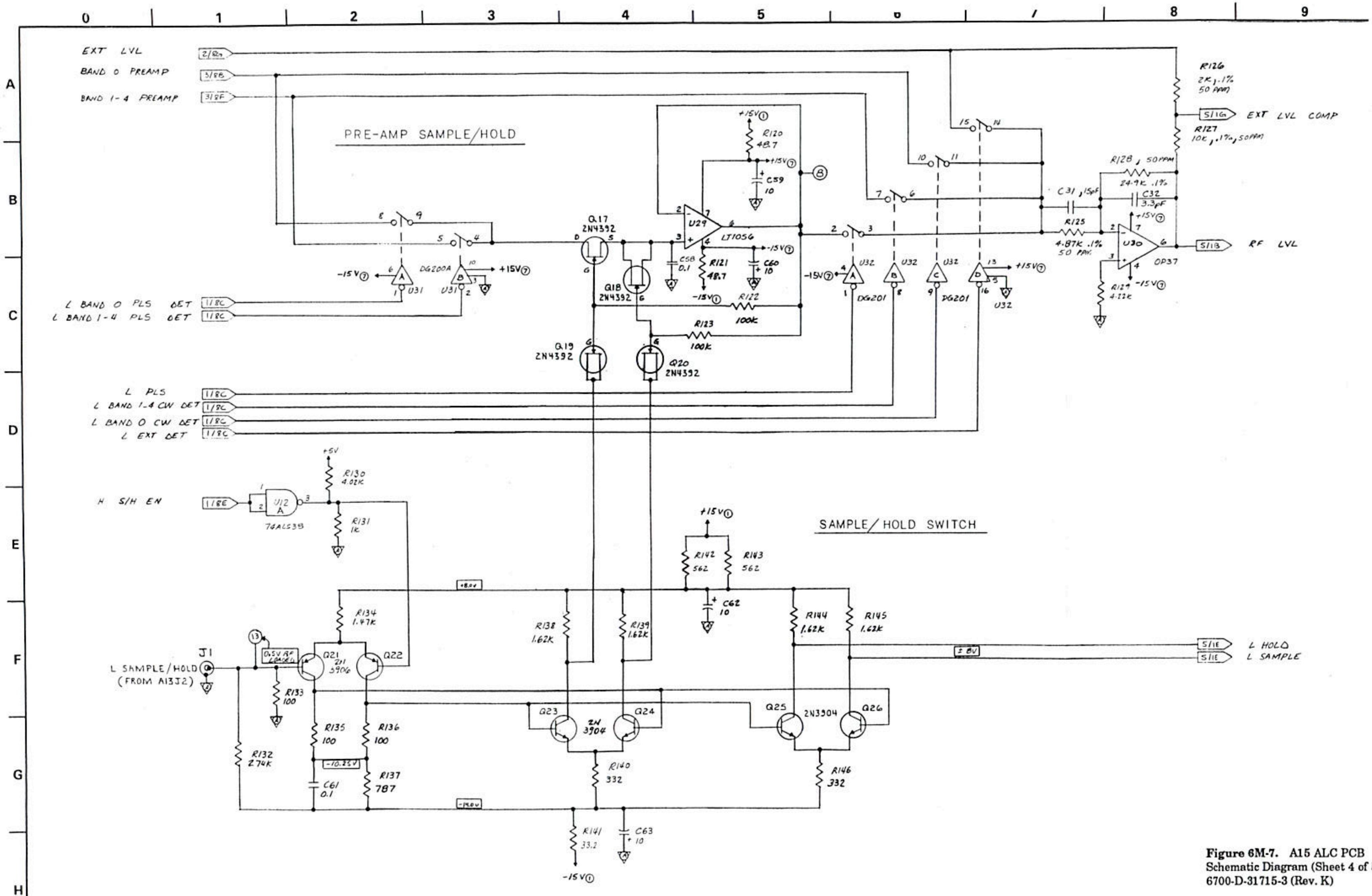
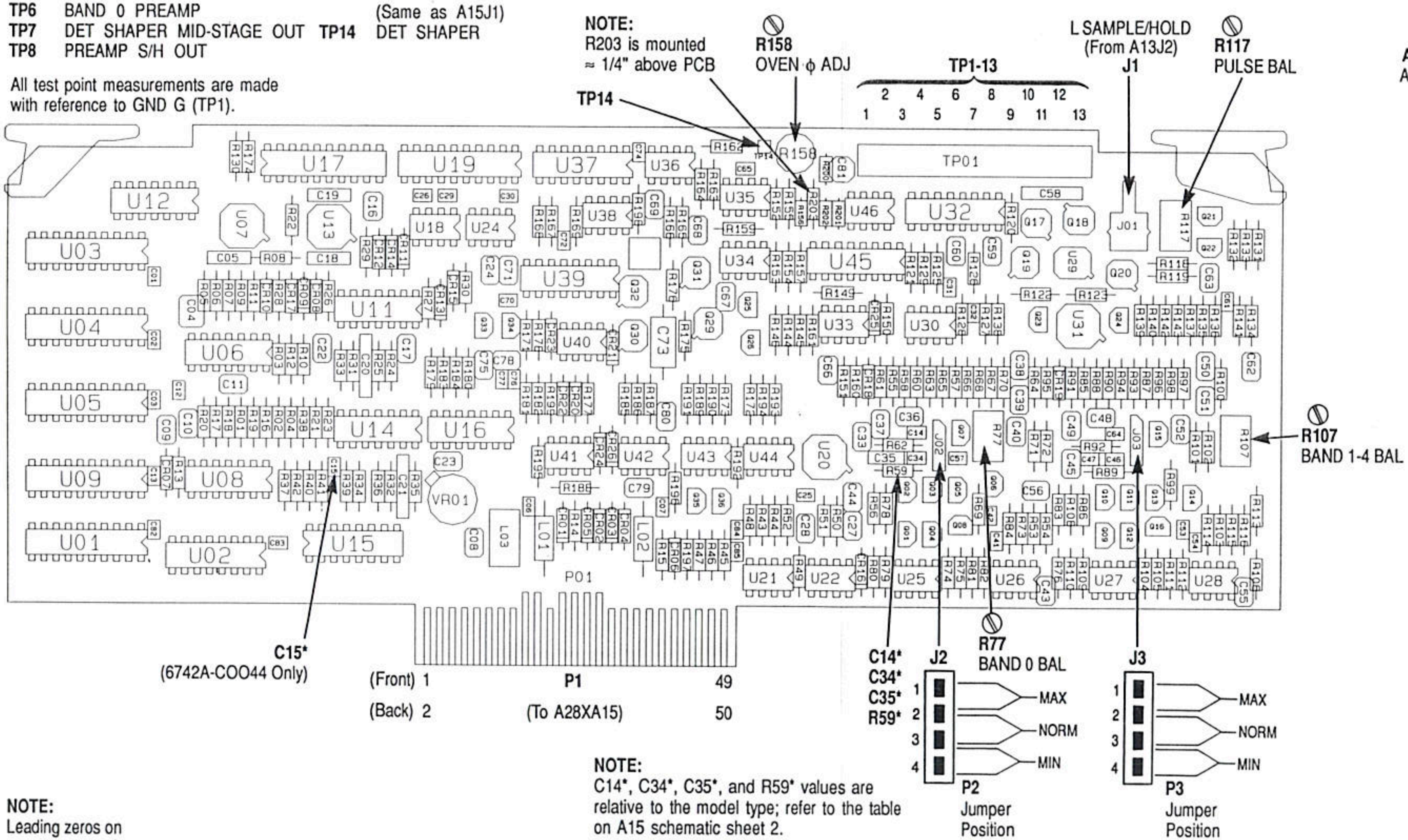


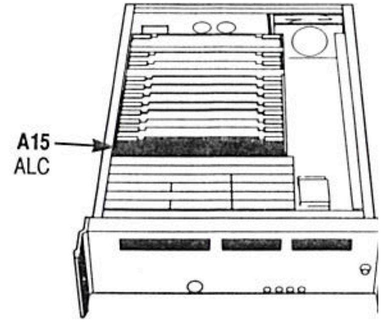
Figure 6M-7. A15 ALC PCB Schematic Diagram (Sheet 4 of 5) 6700-D-31715-3 (Rev. K)

TEST POINTS

TP1	GND G	**TP9**	(ALC) SLOPE B
TP2	BUFFERED AM INPUT	**TP10**	LEVEL AMP OUT
TP3	ALC REF	**TP11**	Not Used
TP4	EXT LVL	**TP12**	Not Used
TP5	BAND 1-4 PREAMP	**TP13**	L SAMPLE/HOLD (Same as A15J1)
TP6	BAND 0 PREAMP	**TP14**	DET SHAPER
TP7	DET SHAPER MID-STAGE OUT		
TP8	PREAMP S/H OUT		

All test point measurements are made with reference to GND G (TP1).





NOTE:
C14*, C34*, C35*, and R59* values are relative to the model type; refer to the table on A15 schematic sheet 2.

NOTE:
Leading zeros on component number references may be disregarded.

Copy of Figure 6M-6. A15 ALC PCB Parts Locater Diagram 6700-D-31715-3 (Rev. K)

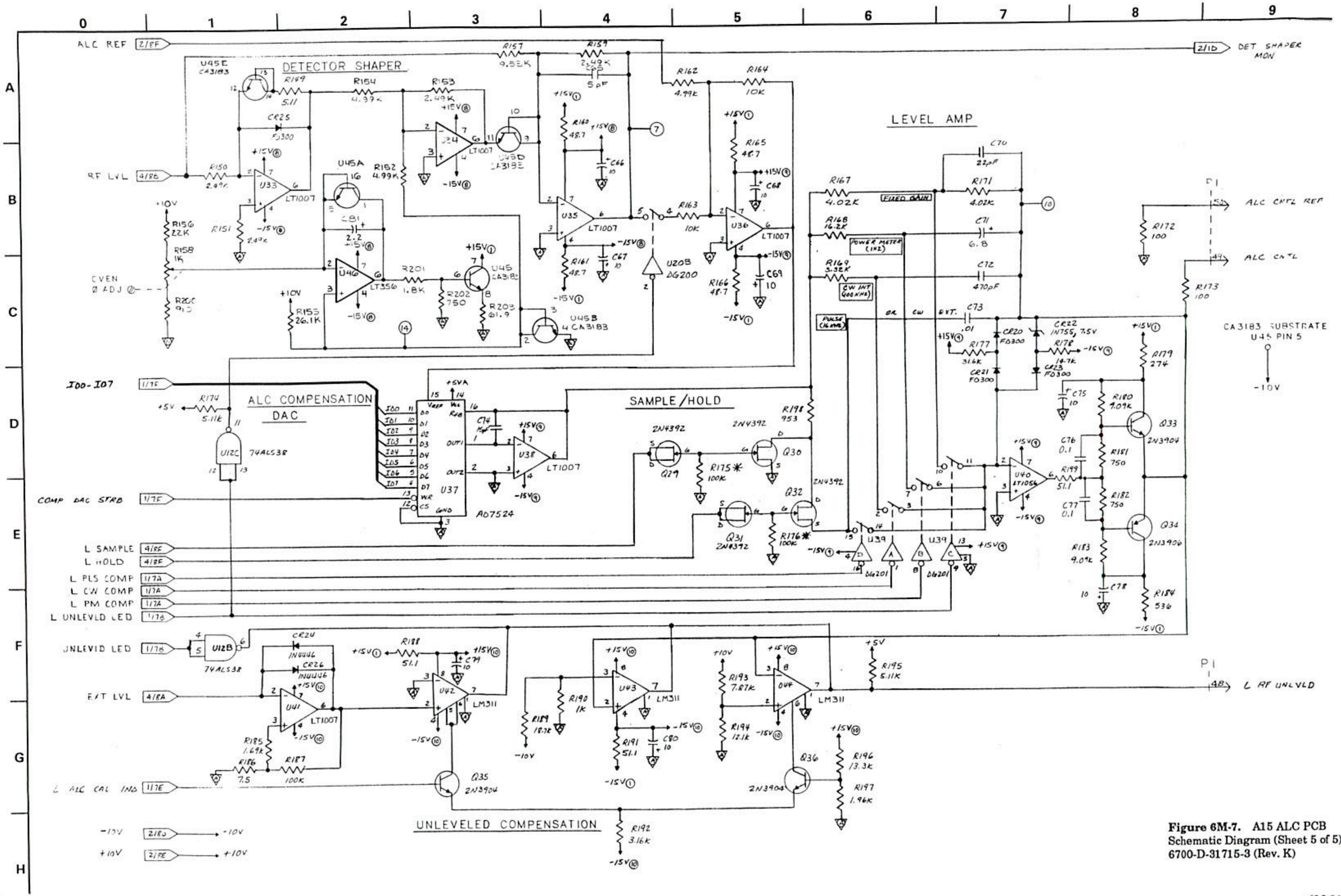


Figure 6M-7. A15 ALC PCB Schematic Diagram (Sheet 5 of 5) 6700-D-31715-3 (Rev. K)

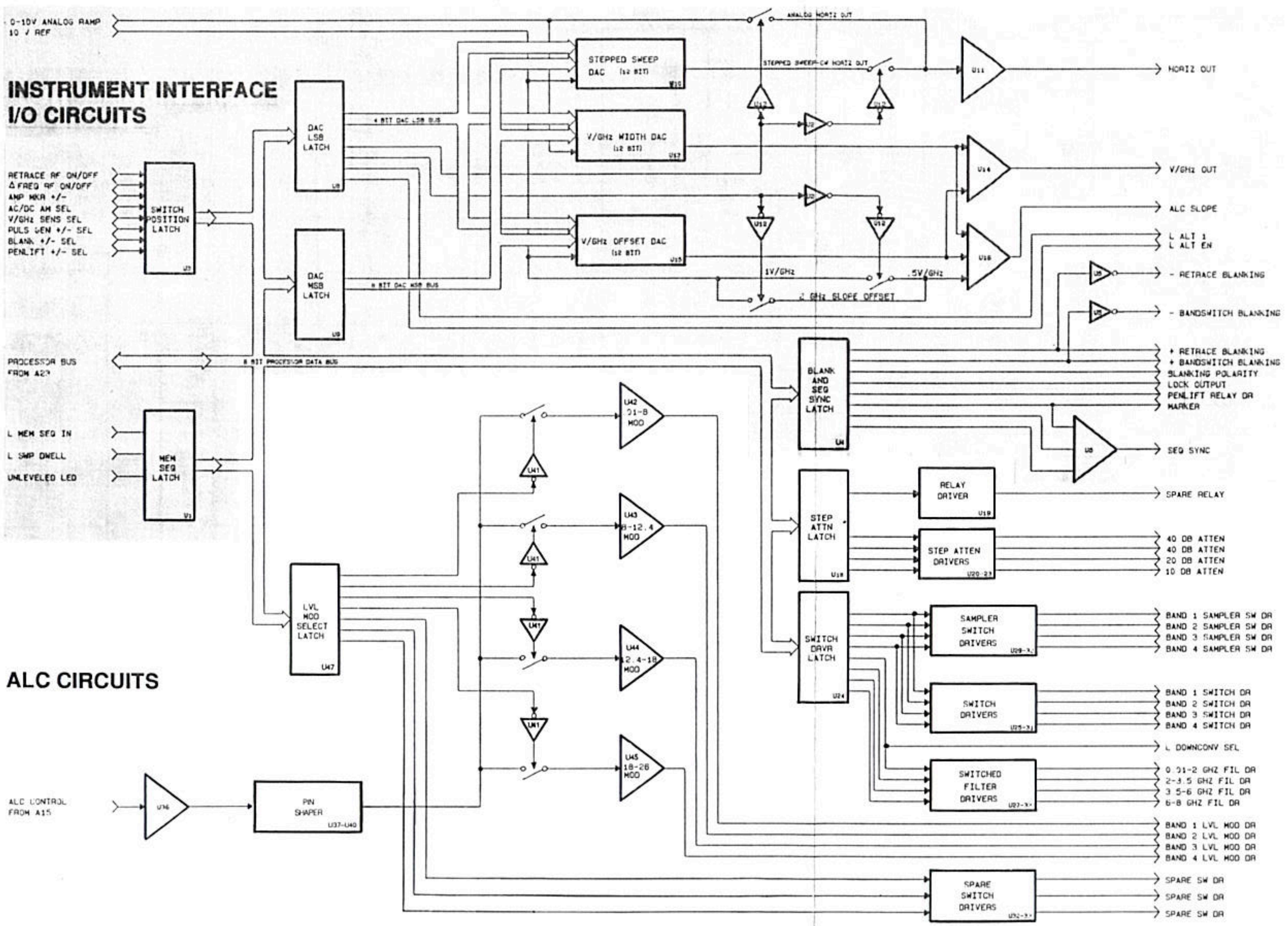


Figure 6M-8. A29 Rear Panel Interface PCB Block Diagram

6-1 POWER SUPPLY SUBSYSTEM: A22, A26, AND A27 PCBs

6-1.1 Power Supply Subsystem Overall Circuit Description

The Power Supply Subsystem is a switching, +5V converter supply that also contains the ±18V, +22V, +24V, –18V and –50V regulated voltage supplies. Simplified schematics are shown in Figures 6N-1, 6N-2, and 6N-3. An overall block diagram is shown in Figure 6N-4.

WARNING

> Voltages hazardous to life are present all throughout the Power Supply Subsystem, *even when the front panel POWER switch is in standby.* The AC line voltages and the +24 Vdc 1 supply are always on, whenever the line cord is connected to a voltage source. Consequently, use care to avoid electrical shock anytime maintenance is being performed.

As shown in foldout Figure 6N-4, the switching power supply circuits and components are dispersed over the following PCBs and assemblies.

a. ***A52 Rear Panel Assembly:*** This assembly contains the Line Filter, Line Voltage Selector Switch and the Standby Line Transformer.

b. ***A28 MotherboardPCB:*** This PCB contains the Line Filter, Line Rectifier, and Power On/Standby Relay.

c. ***A25 Switching Power Supply PCB:*** This PCB contains the ±165 Vdc Filter, Overcurrent Sense, Switching Transistors, 50 kHz Generator (pulse-width modulator and control transistors), Control Amplifier, Shut-Down Timer and Soft-Start Control, +5V Overvoltage Detector, Temperature Detector, and Out-of-Reg Sense circuits.

d. ***A22 Regulator PCB.*** This PCB contains the +24V, –15V, ±15V, -18V and -43V Regulator circuits.

Line power (120 Vac or 220 Vac) enters the synthesizer via the rear panel Line Filter Module, Line Voltage Selector Switch and goes to the Line Transformer rear panel assembly. This transformer autotransforms the line voltage and supplies 30 Vac to the 30V bridge rectifier on the A28 Mother Board. The 30V unregulated LDC is then supplied to the +24V regulator on the A22 Regulator PCB and the +24V fan regulator on the A28 Mother Board.

On the A22 PCB, the 30 VDC is regulated to +24 Vdc which supplies heater circuit in the 10 MHz reference oscillator oven and the front panel POWER Switch. When the POWER switch is pressed to ON, this +24 VDC voltage is applied to the A28K1 relay and the Q2 transistor switch. A28K1 supplies the line voltage to the Line Rectifier circuit. Q2 turns off Q1 which turns on the +24V fan regulator.

The Line Rectifier circuit is a full-wave voltage doubler (120V line) or a full-wave bridge rectifier (220V line). This rectifier outputs +165 Vdc and -165 Vdc voltages for either a 120 Vac or a 220 Vac line-voltage value. The two 165 Vdc voltages are filtered by FL1 on the A28 PCB then supplied to the Switching Transistors, via the Overcurrent Sense circuit.

As shown in Figure 6N-3 on the next page, the Switching Transistors, Q6 and Q7, alternately switch between +165 Vdc and –165 Vdc at a 50 kHz rate. The outputs from Q6 and Q7 form a composite waveform (Figure 6N-2), the peak-to-peak value of which is directly proportional to the peak value of the 220V line or to the peak-to-peak value of the 120V line. This waveform is coupled to the five secondary windings of A20T2.

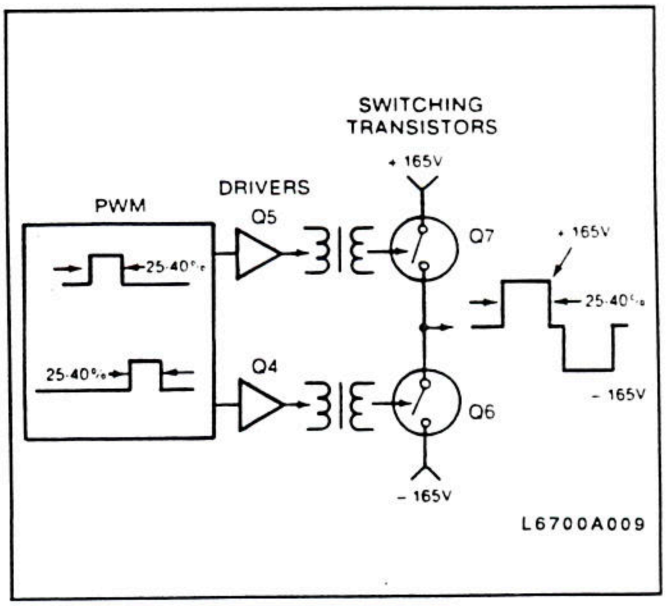


Figure 6N-1. Switching Transistors and Transistor Drivers

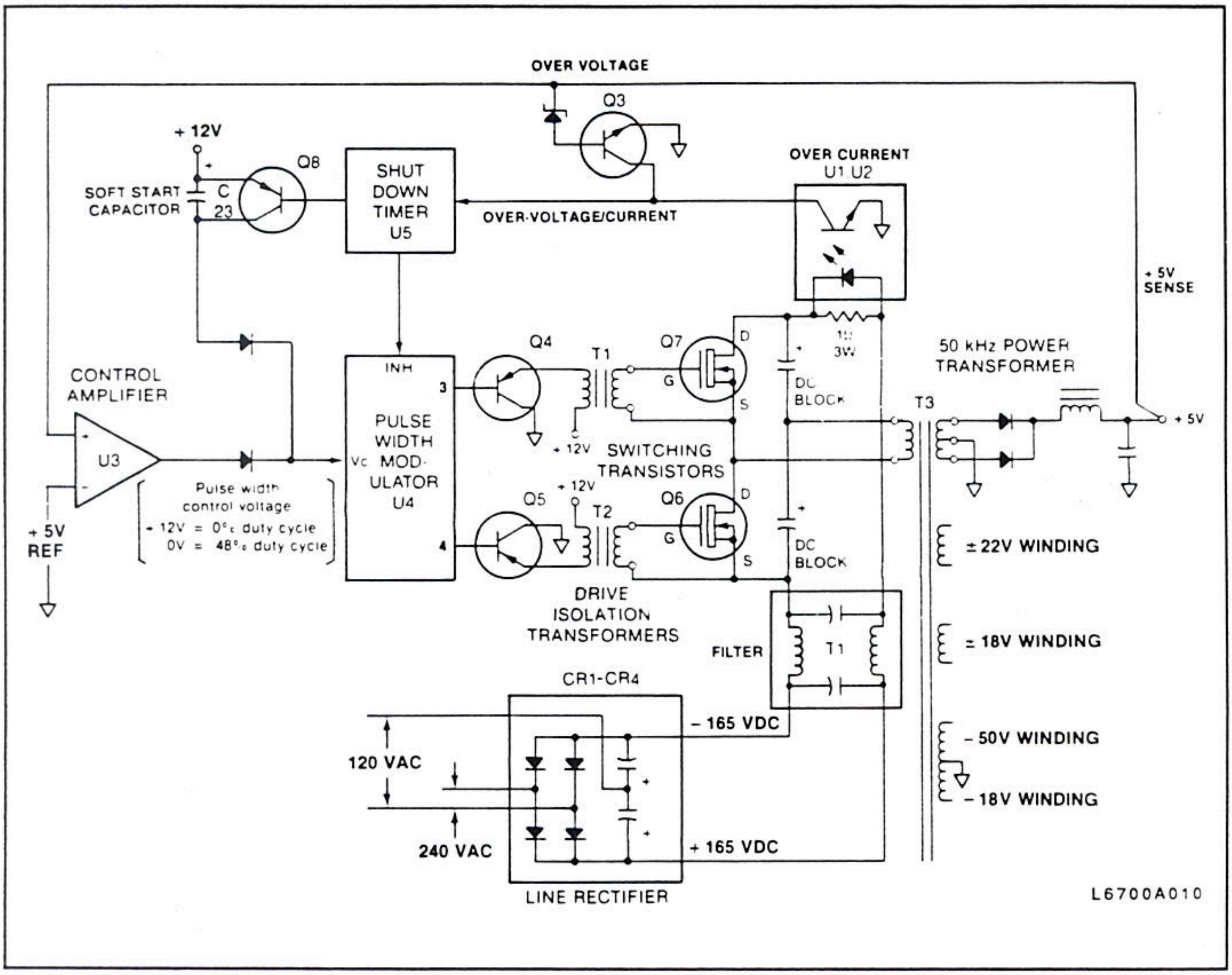


Figure 6N-2. Power Supply Subsystem, Simplified Schematic

The reduced voltages in these A25T3 windings—like the output of Q6 and Q7—is proportional to the line voltage. These reduced voltages are rectified and passed through inductors that function as integrators. The output voltages from these inductors are proportional to both the line voltage and the duty cycle of the output from the Pulse Width Modulator circuit (T1 in Figure 6N-4).

The Pulse Width Modulator (PWM) circuit controls the on/off ratio of the switching transistors. It develops a train of pulses, the duty cycle of which varies between 25% and 40% (approximately). This duty cycle depends on the amplitude of the PWM control voltage, "Vc." The amplitude of this voltage is determined by either the Shut-Down Timer and Soft Start circuit or the Control Amplifier.

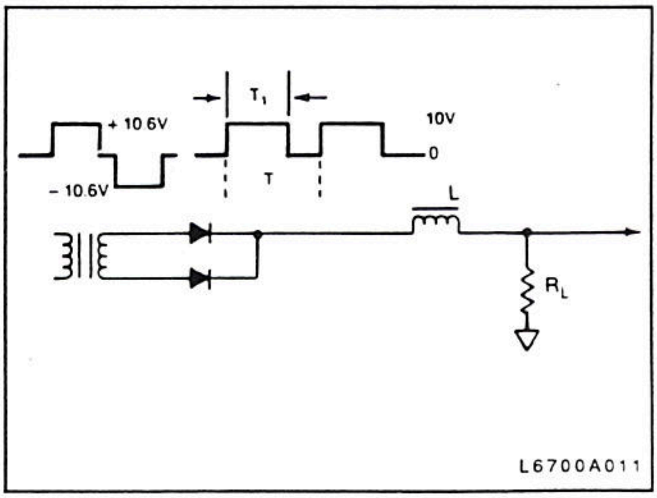


Figure 6N-3. A22 Regulators, Simplified Schematic

The Control Amplifier monitors the output from the 5V supply and uses it to control the duty cycle of the Pulse Width Modulator. The input to this amplifier is the +5V SENSE line from the motherboard that senses the voltage across the +5V load. The amplifier's output is a 0 to 12-volt signal that forces the PWM to output the correct duty cycle for maintaining +5 volts at the sense line.

The Soft Start portion of the Shut Down Timer and Soft Start circuit causes the +5V supply to come on line at its minimum voltage level (soft start).

The input to this circuit is a dc voltage (+12 volts from the +12V Regulator) that results from the front panel POWER switch having been pressed to ON. At the instant this switch is pressed on, +12 volts is applied to the "Vc" pin of the PWM through C23. With this pin at +12 volts, the duty cycle of the PWM output pulse train is minimum, thus causing the output of the +5V supply to be minimum. As C23 charges, the subsequently decreasing voltage at the Vc pin causes the duty cycle of the output pulse train to increase. This decreasing Vc voltage, in turn, causes the +5V supply output voltage to rise. When the Control Amplifier senses that +5 volts has been reached (approximately 20 ms), regulation occurs.

The Shut Down Timer portion of the Shut Down Timer and Soft Start circuit shuts down the +5V supply when an overvoltage or overcurrent condition occurs.

The input to this circuit is the sense line from the Overvoltage and Overcurrent circuits. If an overvoltage or overcurrent condition is sensed, this line goes LOW and causes the Shut Down Timer to generate a 1-second pulse (approximately).

The leading edge of this 1-second pulse causes the PWM's "Vc" pin to go to +12 volts and its "INH" pin to go LOW. The INH pin going LOW causes the PWM to turn off and thus shut down the switching trnsistors. The lagging edge of this 1-second pulse causes the INH pin on the PWM to return HIGH, thus causing the power supply to soft-start.

If the overvoltage/overcurrent condition that started the above cycle is still present, the Shut Down Timer generates another pulse and again causes the supply to shut down. This cycling operation continues until the overvoltage or overcurrent condition has been corrected or until the POWER switch has been pressed to standby.

Going back to the five secondary windings on A25T3 (Figure 6C-5), the output from the A25 PCB goes to the regulators on the A22 PCB. The –50V rectifier supplies the –43V Regulator. The +22V rectifier supplies a +22V unregulated voltage to the motherboard. The –18 Volt G rectifier supply the –15V A, G, and FM Regulators. The +18 volt G rectifier supply the +15 volt A, G, and FM Regulators. The –18 volt (T) rectifier supplies the –18 volt TUNING voltage to the motherboard. The +9V LP supplies an unregulated +9V to the +5V regulators located on the A5, A6, A7, A10, A11 and A12 phase lock assemblies.

6-1.2 A22 Regulator Board Circuit Description

a. ***+24V VR1 Regulator.*** VR1 is an adjustable 3-terminal regulator. The output voltage is set by R1 and R2. The 24V is supplied for the 10 MHz Crystal oscillator and front panel power switch on A1 when the 6700A is either ON or in STANDBY. When the POWER switch is in the ON position, the +24 Vdc is also supplied to the A4 PCB Coarse Loop Oscillator and the A5 PCB Reference Oscillator.

b. ***–18V and –43V Tune Regulators*** . The 18V and 43V Regulators supply the current-maintaining coils of the YIG oscillators. Normally, the tuning current drivers for the YIGs pull current from the 18V supply. However, during fast analog sweeps or frequency-stepping operations, the YIG coil requires a higher voltage to drive the current through the inductive coil. Thus, when either of these operations is requested, the YIG-tuning-current driver automatically switches to the 43V supply. This higher voltage provides the potential needed, while also reducing the overall power dissipation of the 6700A.

VR2 is a precision 10V regulator that funishes the reference voltage for the 18V and 43V supplies. It also provides circuit protection for the 43V supply. If the 18V supply shorts to ground, the regulator removes the reference voltage from the 43V supply, thus shutting it down also. This prevents the YIG drivers from automatically switching to the 43V supply, thereby causing excessive power dissipation.

Q2 and Q4 in conjunction with R6, R7, and R17 provide short-circuit current limiting. Q7 and Q8 provide a foldback during short-circuit conditions. Foldback reduces the amount of short-circuit current to about 20% of that at which the supply starts to current limit. This prevents excessive power dissipation from destroying the Q1 and Q5 series-regulator transistors. Q3 and Q6 provide voltage level-shifting to allow the limited output swing of U1 to control the series regulators.

c. ***±15V Supplies***. The ±15VA, ±15V LP, ±15V G, and ±15V FM supplies are all regulated by three-terminal regulators. These regulators have their own built-in current limit and foldback circuits. The four ± supplies improve isolation between the various circuits and eliminate the need for extremely high-current power supplies.

d. ***Power Supply Monitor***. U2 contains summing amplifiers in which the various voltages are summed together resulting in a 0V output at U21 and U27. The supplies are weighted by the input resistors in such a way that by measuring the magnitude and polarity, the microprocessor can test if any of the supplies are out of regulation or short circuited. The PS1 and PS2 lines are monitored by the digital voltmeter on the A17 Analog Instruction Board.

6-1.3 A28 Motherboard Circuit Description

a. ***Line Rectifier***. CR1–CR4 are bridge rectifiers. C4 and C3 are filter capacitors for the rectified line voltage. FL1 filters the 50 kHz switching transients, and prevents them from getting onto the ac power line.

b. ***Standby Rectifier***. CR6–CR9 are a bridge rectifiers for the +30 Vdc line. Their output goes to the A22 Regulator PCB,where it is regulated to +24V. Q3 converts the line ripple to TTL levels. These levels go to the A23 Microprocessor PCB, where they synchronize the sweep to the power-line frequency.

c. ***Fan Regulator***. VR1 regulates the 24V for the brushless DC fan. In the STANDBY mode, Q1 grounds the "ADJ" pin on the adjustable three--terminal regulator. This sets its output voltage to approximately 1V. When the 6700A is on, Q1 is open. This allows R11 and R12 to set the VR1 output to 24V.

d. ***+22V Clamp***. The +22V supply is unregulated when operating without a load. During such operation, its output goes to +44V. To prevent circuit damage, Q4 clamps the +22 volts to approximately +26V. CR10 and CR11 provide this clamping.

The +22V supplies the YIG heaters, YIG bias regulators on the A18–A21 PCBs, and the optional step attenuator.

6-1.4 Power Supply Subsystem Schematics

Figures 6N-4 thru 6N-10 provide schematics for the A25 Switching Power Supply PCB, A22 Regulator PCB, and applicable circuits on the A28 Motherboard PCB.

6-1.5 Power Supply Subsystem Troubleshooting

Section 6C provides troubleshooting procedures for the power supply subsystem.

NOTE

Pages 6N-5 and 6N-6
are blank.

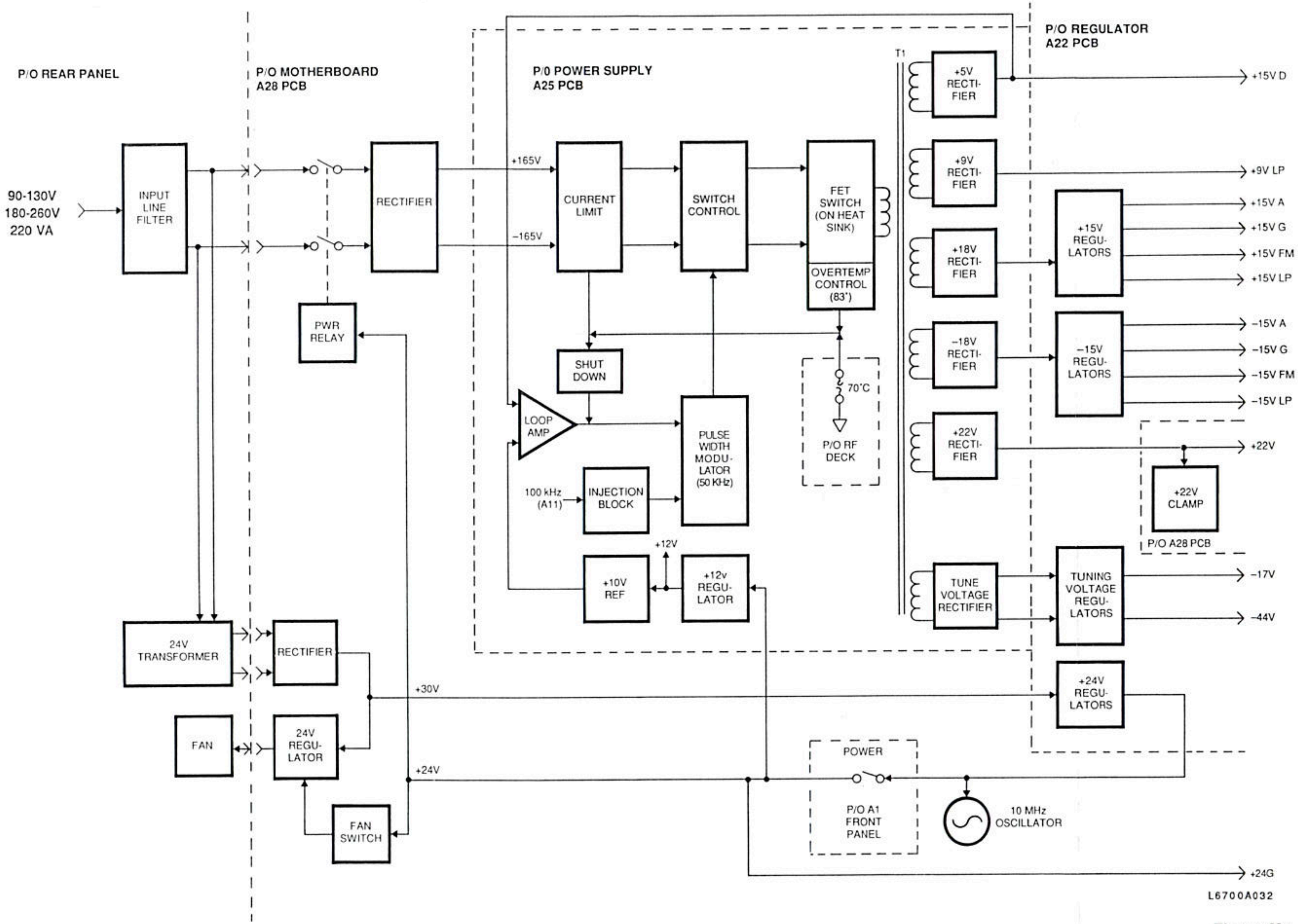
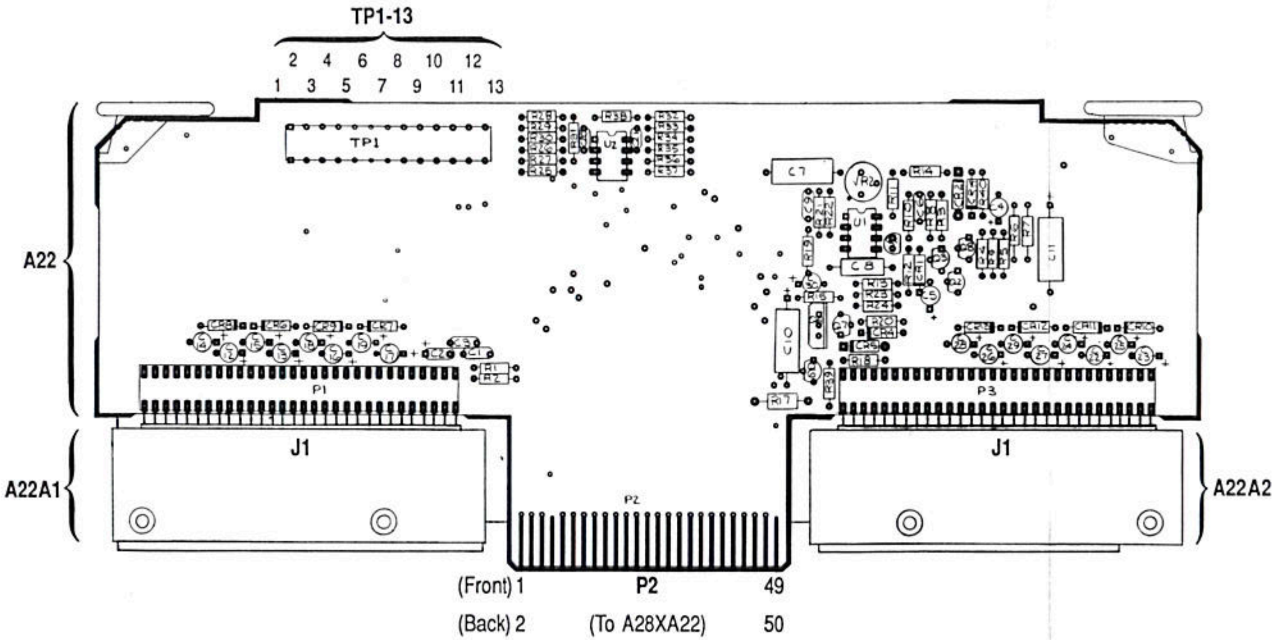


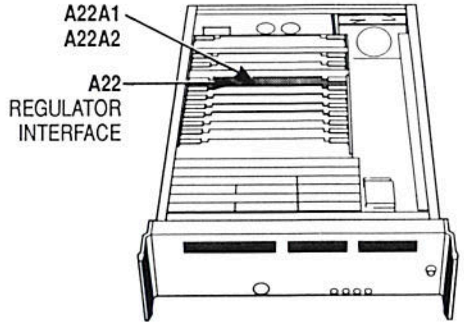
Figure 6N-4. Overall Power Supply Block Diagram

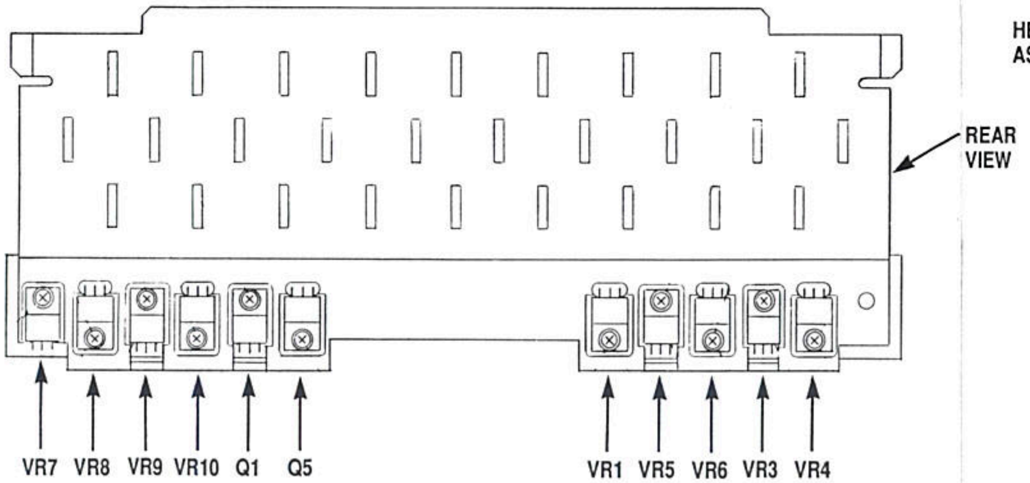


TEST POINTS

TP1	GND G
TP2	+22V
TP3	−15VFM
TP4	+15VFM
TP5	−15VG
TP6	+15VG
TP7	−15VA
TP8	+15VA
TP9	−15VLP
TP10	+15VLP
TP11	+24V1
TP12	−18V
TP13	−43V

All measurements are made with reference to GND G at TP1.





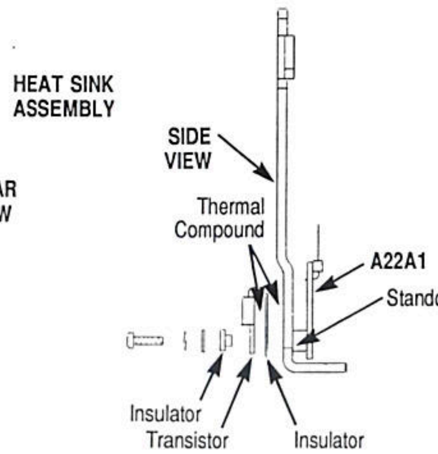
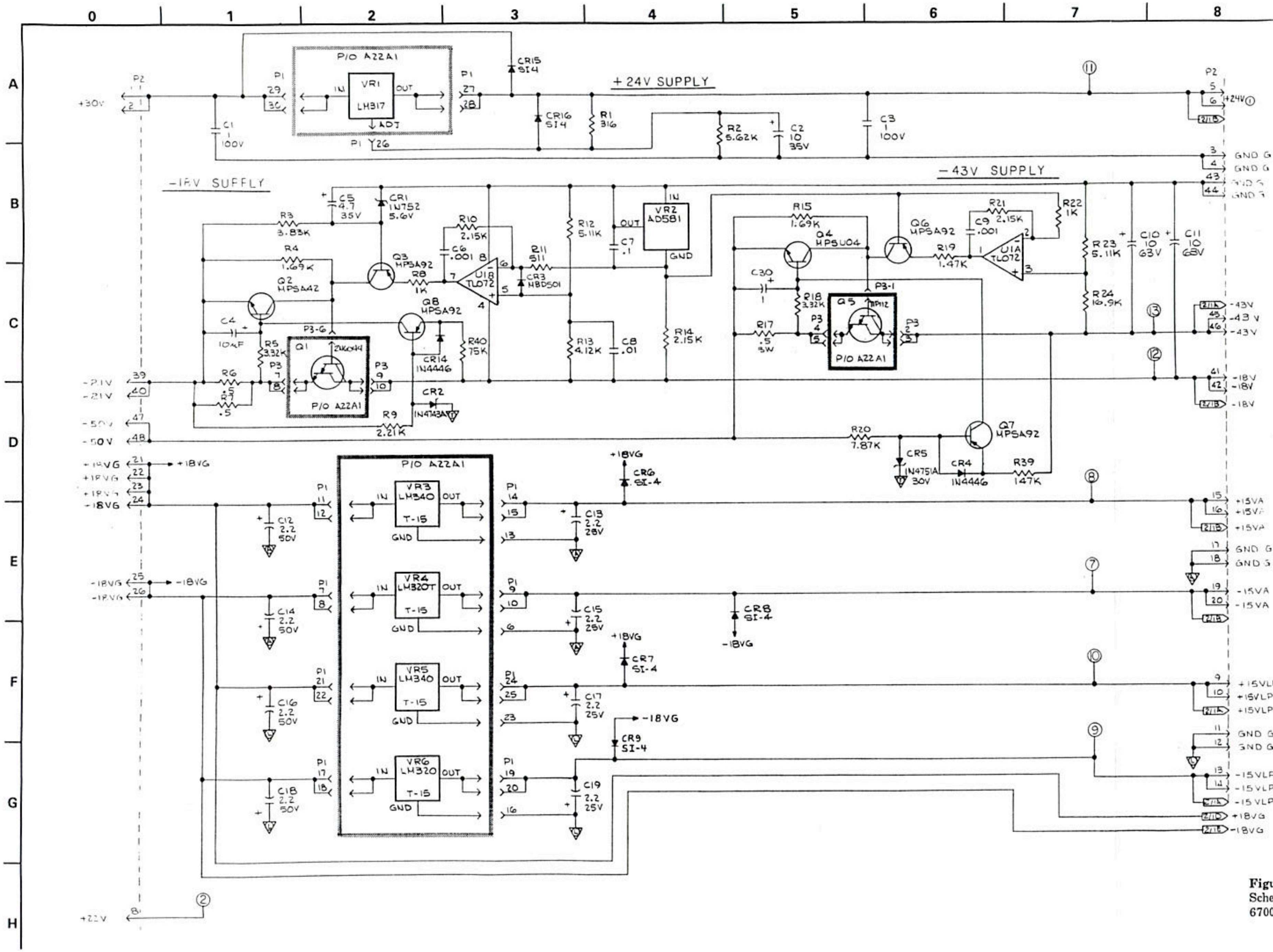


Figure 6N-5. A22 Regulator PCB Parts Locater Diagram 6700-D-31722-3 (Rev. D)

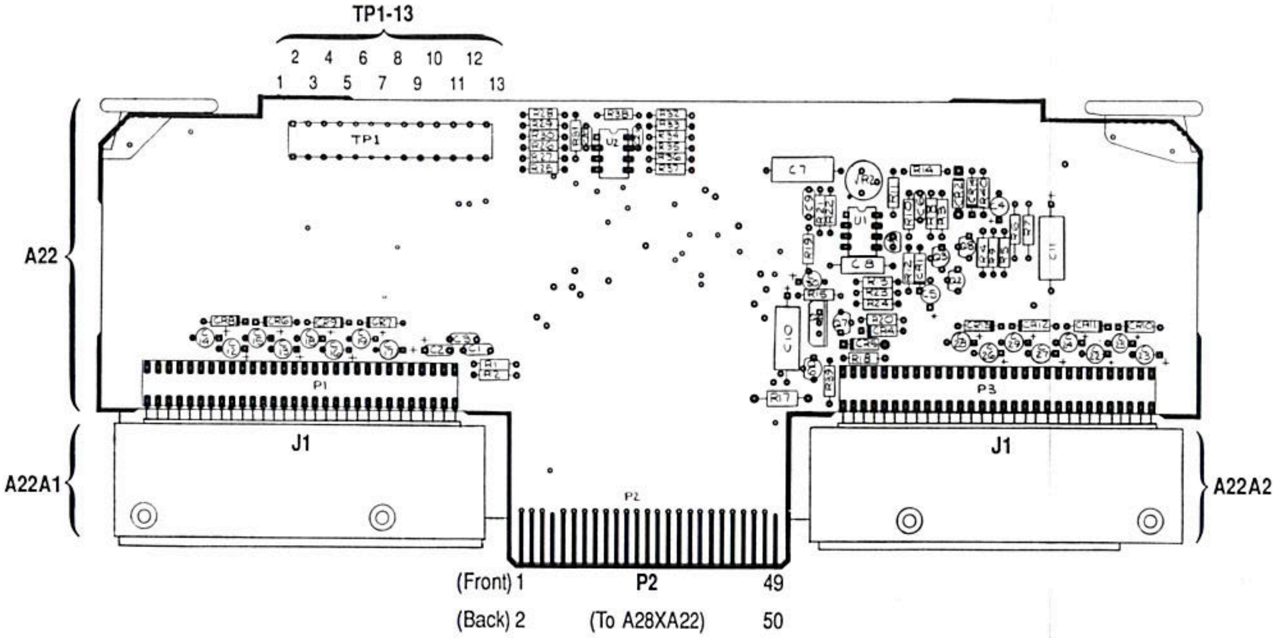


A22 REGULATOR INTERFACE SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUNDS: A F G L T
4. TEST POINTS ARE DENOTED AS: (2)
5. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
6. SUBASSEMBLY BORDERS ARE DENOTED AS:
7. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   CR3, U1, U2, VR2
8. LAST USED/NOT USED COMPONENTS ARE:

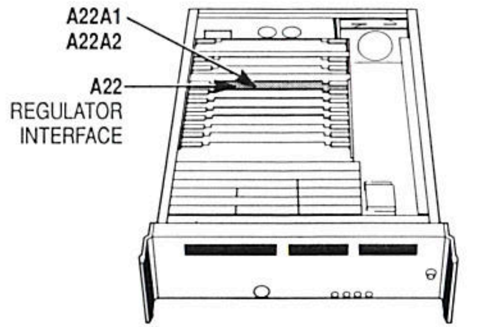
REFERENCE DESIGNATORS	
LAST USED	NOT USED
C30 CR14 Q8 R40 TP13 U2	NONE

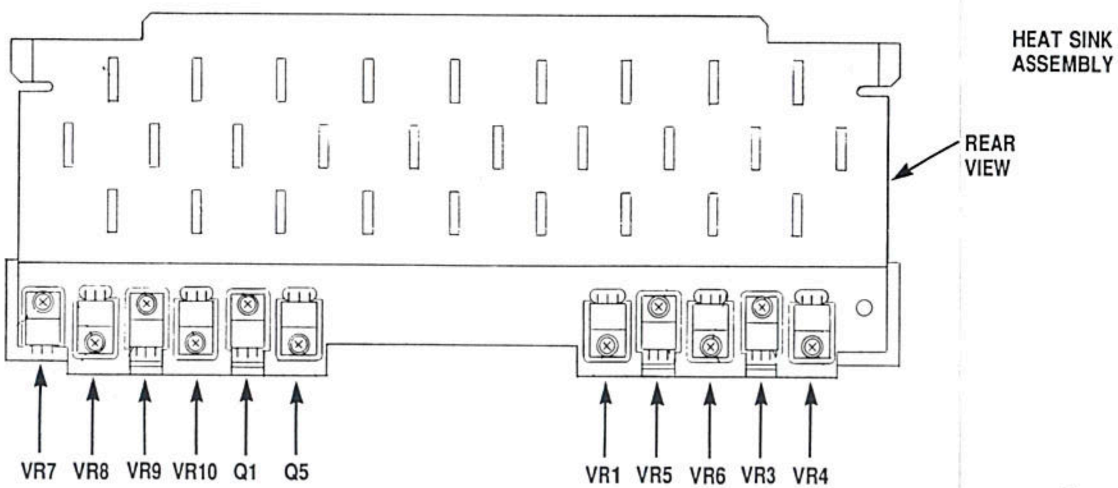
Figure 6N-6. A22 Regulator PCB Schematic Diagram (Sheet 1 of 2) 6700-D-31722-3 (Rev. F)

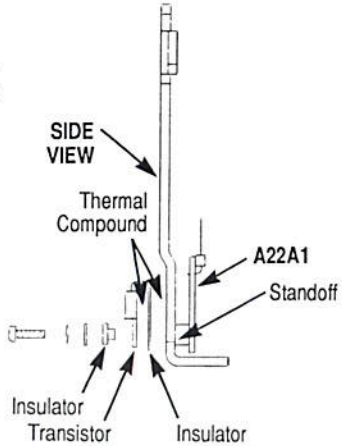


TEST	POINTS
TP1	GND G
TP2	+22V
TP3	−15VFM
TP4	+15VFM
TP5	−15VG
TP6	+15VG
TP7	−15VA
TP8	+15VA
TP9	−15VLP
TP10	+15VLP
TP11	+24V1
TP12	−18V
TP13	−43V

All measurements are made with reference to GND G at TP1.







Copy of Figure 6N-5. A22 Regulator PCB Parts Locater Diagram
6700-D-31722-3 (Rev. D)

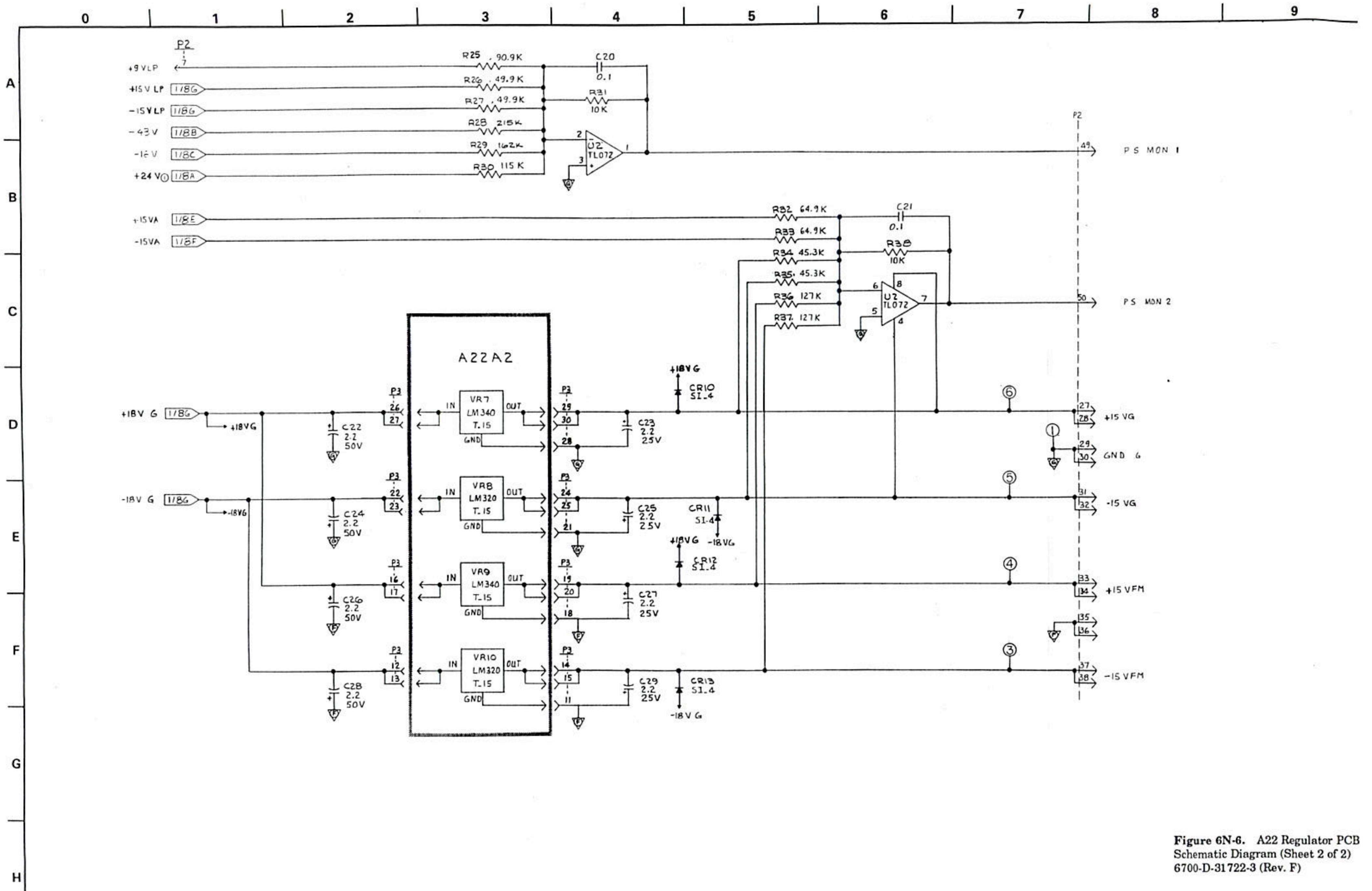
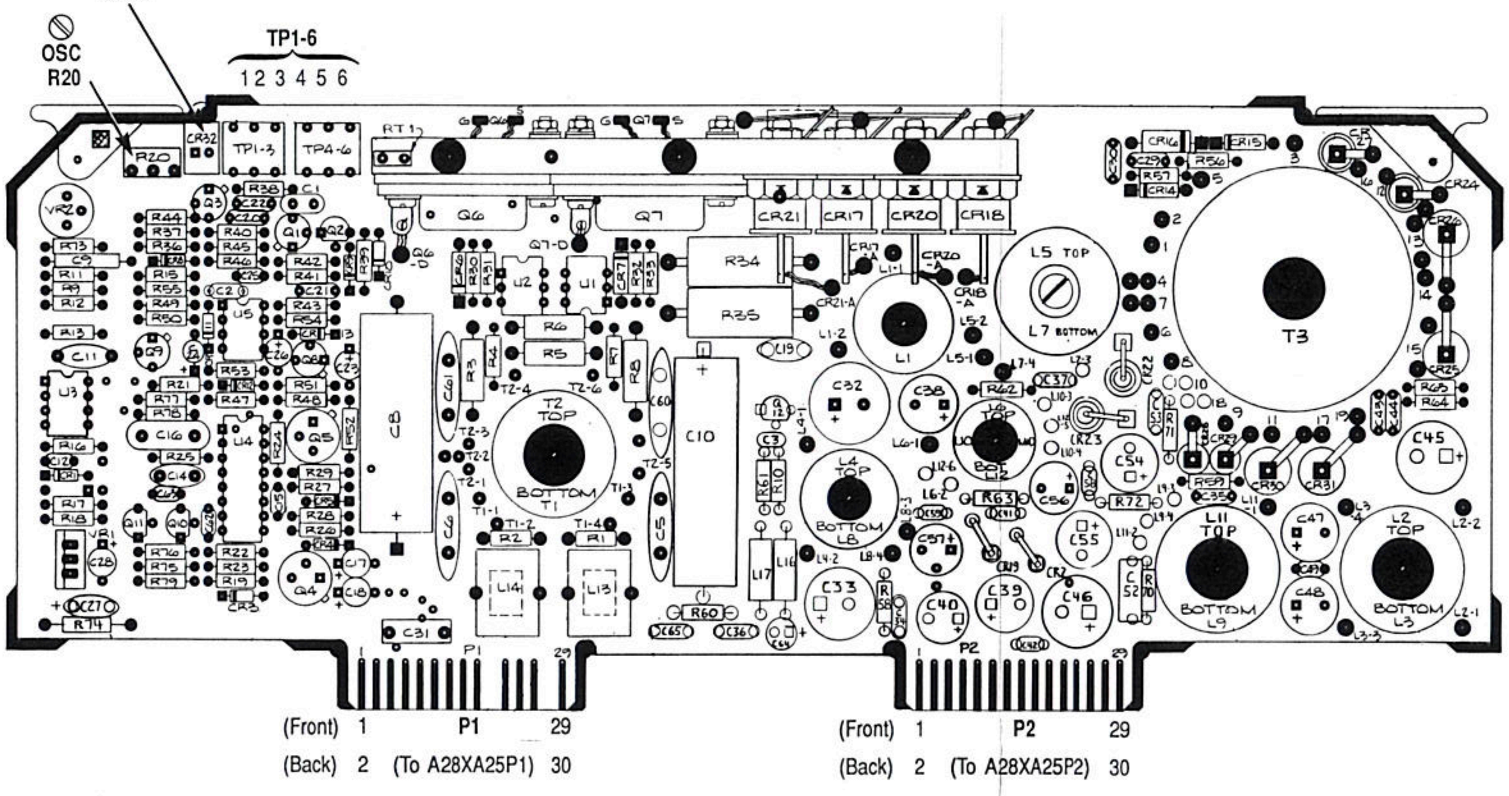


Figure 6N-6. A22 Regulator PCB Schematic Diagram (Sheet 2 of 2) 6700-D-31722-3 (Rev. F)

TEST POINTS
TP1 GND G
TP2 +5VD
TP3 U4 PIN 14 (OSC)
TP4 PRIMARY DRIVE
TP5 PRIMARY +
TP6 PRIMARY –



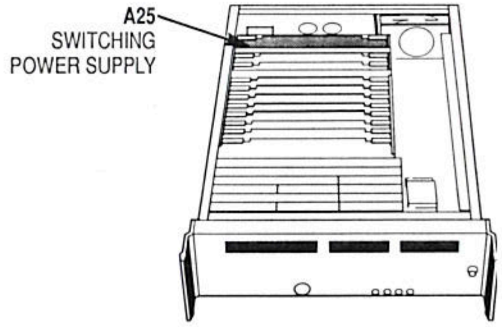
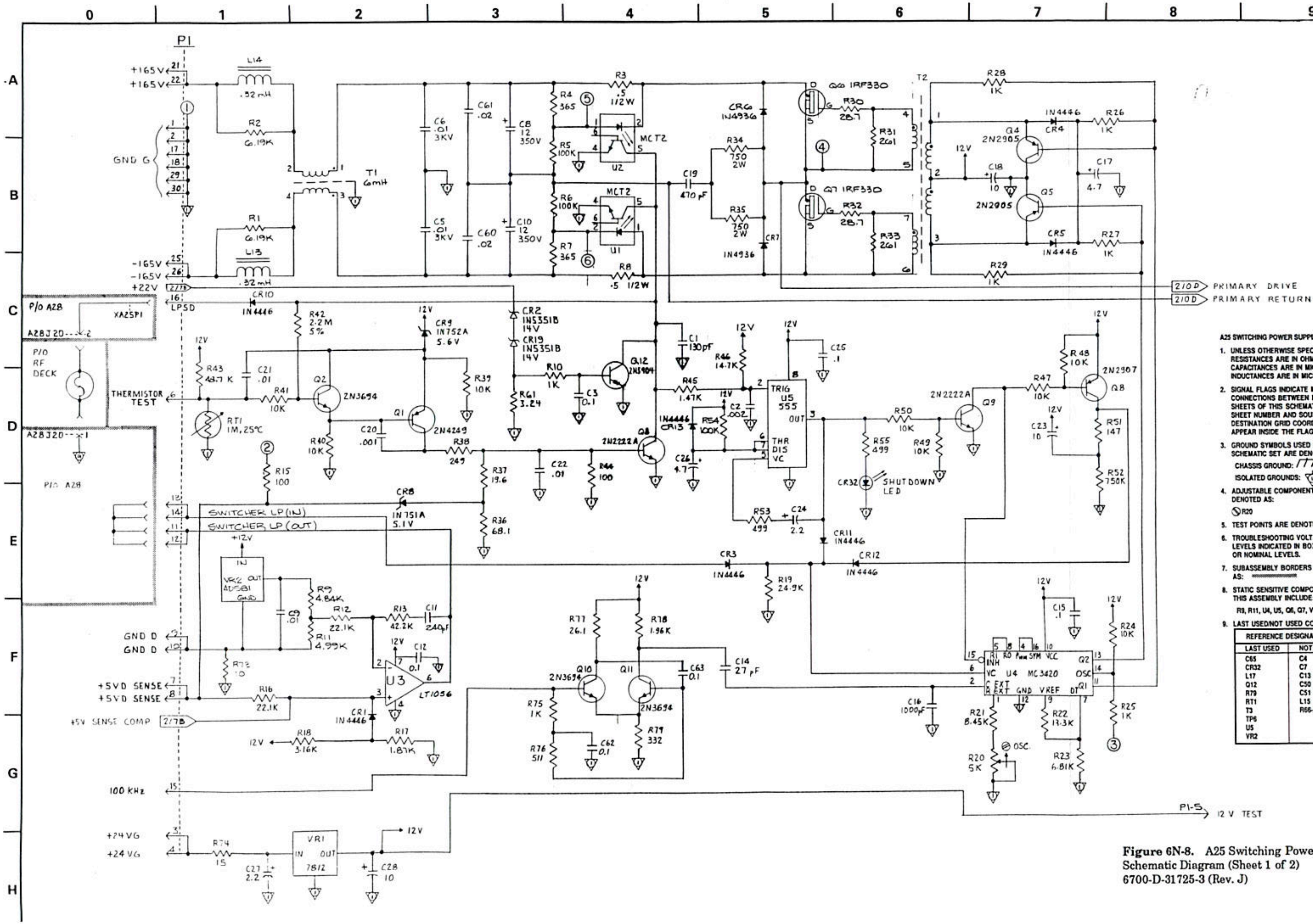


Figure 6N-7. A25 Switching Power Supply PCB Parts Locater Diagram
6700-D-31725-3 (Rev. H)

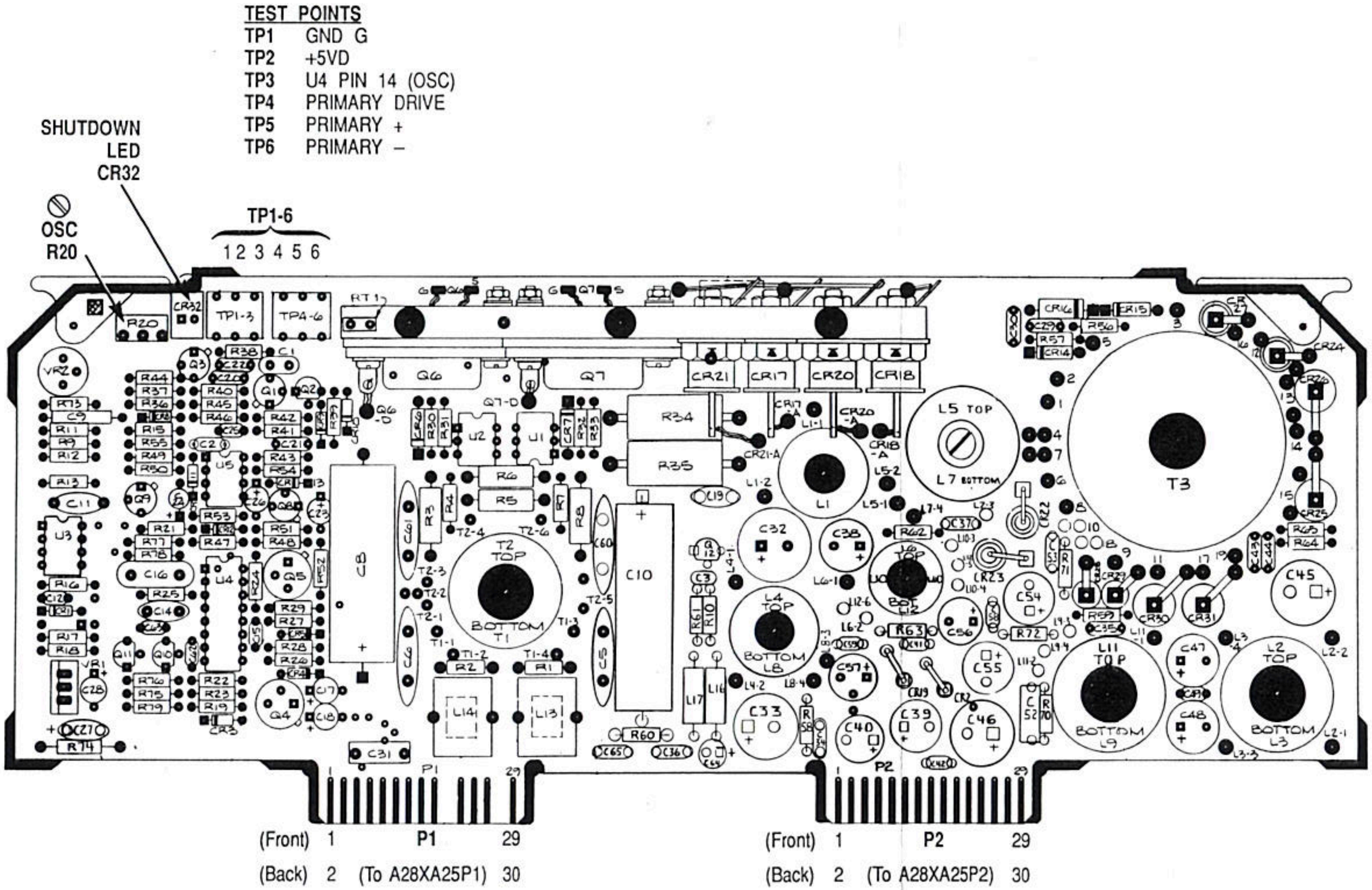


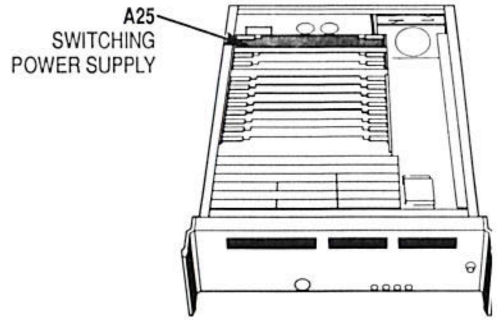
A25 SWITCHING POWER SUPPLY SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUNDS:
4. ADJUSTABLE COMPONENTS ARE DENOTED AS:
   R20
5. TEST POINTS ARE DENOTED AS: (2)
6. TROUBLESHOOTING VOLTAGE AND POWER LEVELS INDICATED IN BOXES ARE TYPICAL OR NOMINAL LEVELS.
7. SUBASSEMBLY BORDERS ARE DENOTED AS:
8. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   R9, R11, U4, U5, Q6, Q7, VR1, VR2
9. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C65	C4
CR32	C7
L17	C13
Q12	C50
R79	C51
RT1	L15
T3	R66-69
TP6	
U5	
VR2	

Figure 6N-8. A25 Switching Power Supply PCB Schematic Diagram (Sheet 1 of 2)
6700-D-31725-3 (Rev. J)





Copy of Figure 6N-7. A25 Switching Power Supply PCB Parts Locater Diagram
6700-D-31725-3 (Rev. H)

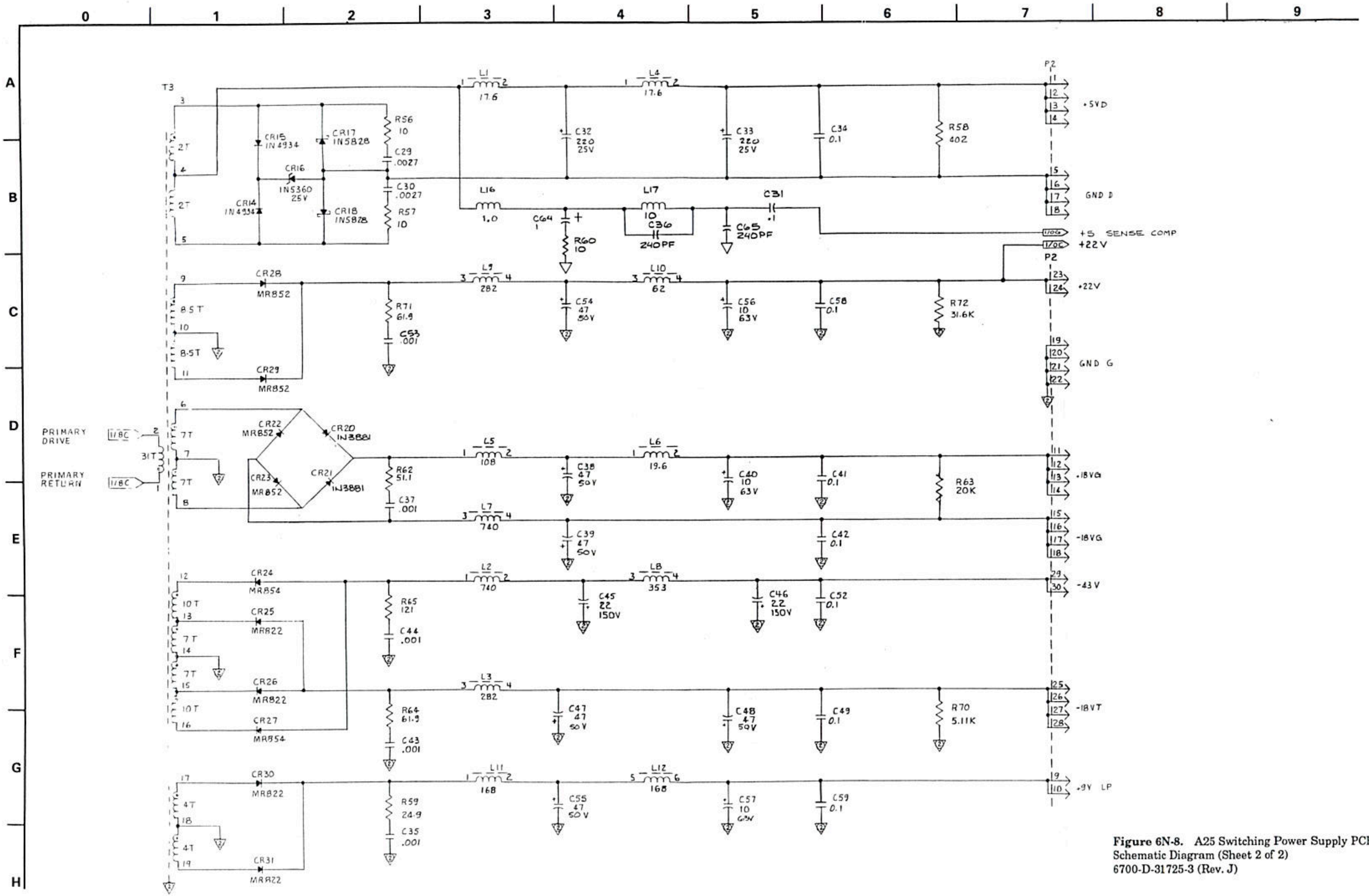
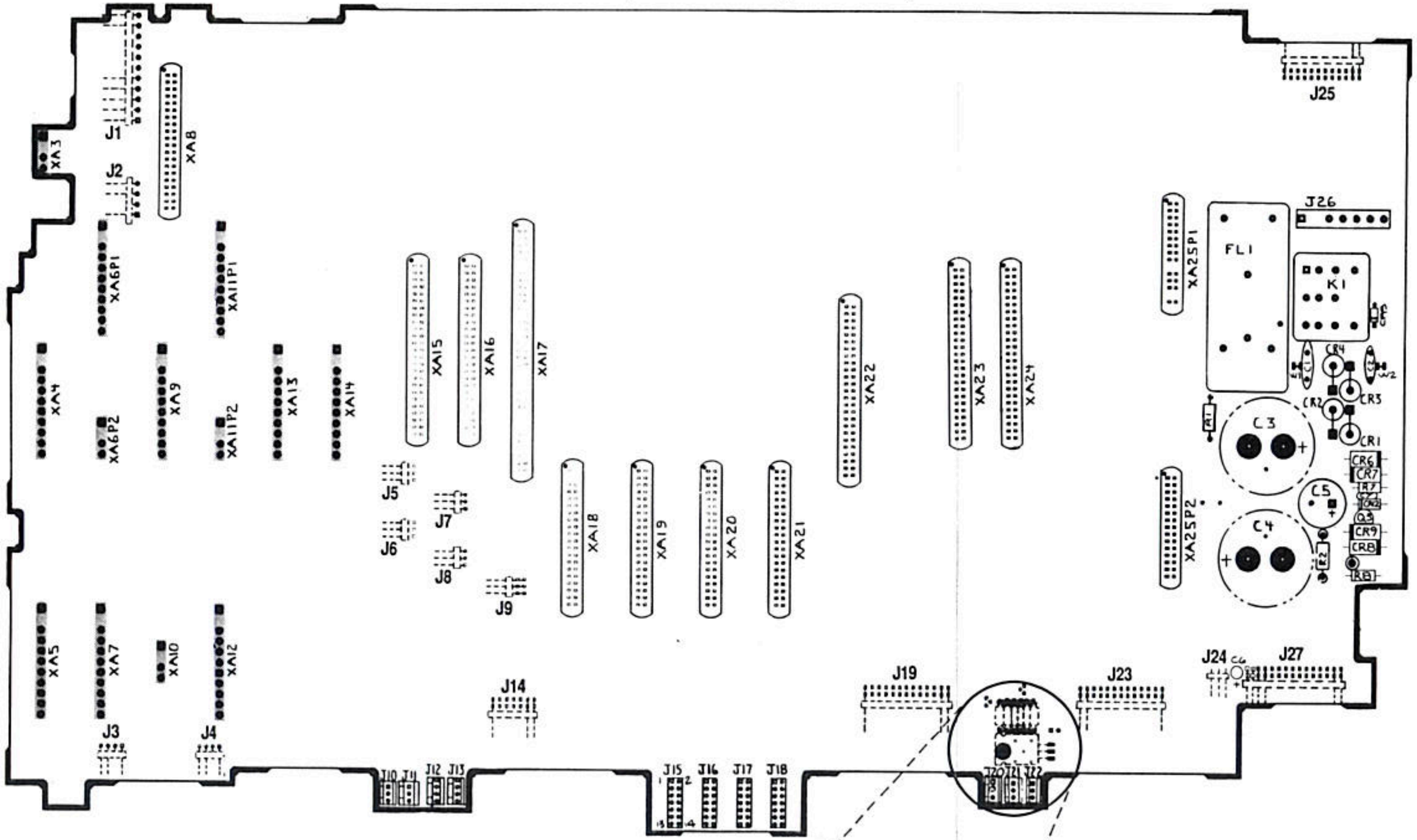
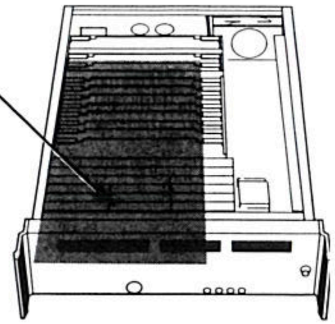


Figure 6N-8. A25 Switching Power Supply PCB Schematic Diagram (Sheet 2 of 2)
6700-D-31725-3 (Rev. J)

A28 MOTHERBOARD
(As viewed from *top* of instrument)



A28
MOTHERBOARD
(Bottom Side)



NOTES:

1. Filtercons are designated as:
   Each signal path connection has (typically) 1500 pF capacitance between it and chassis ground.
2. J1-9, J14, J19, J23-25, and J27 are mounted on the bottom side of the A28 PCB.

Fan Power Supply Components
(As viewed from *bottom* of instrument)

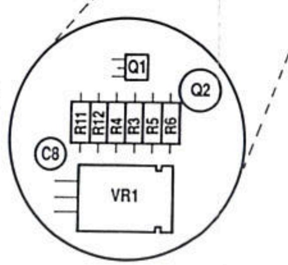
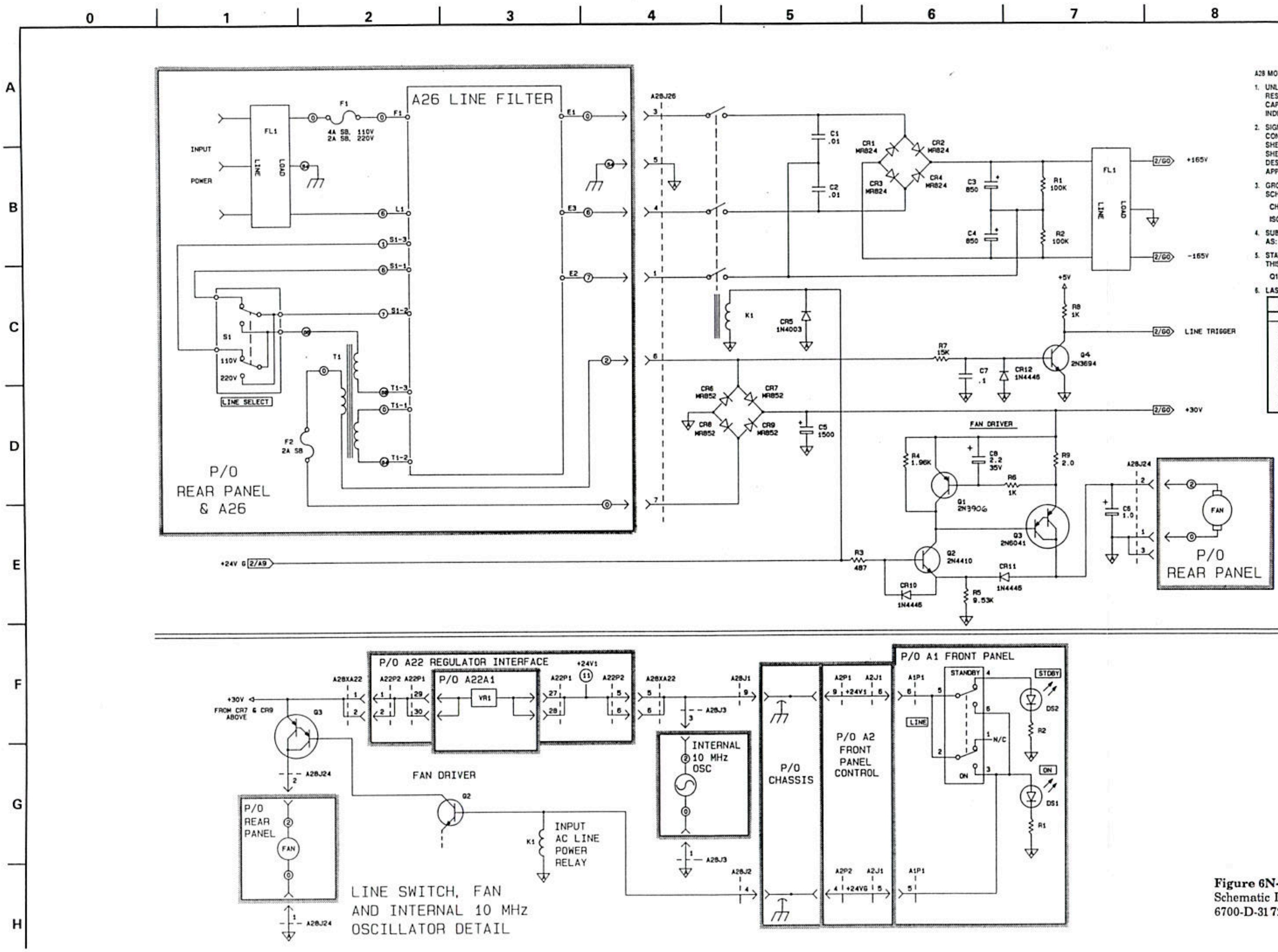


Figure 6N-9. A28 Motherboard PCB Parts Locater Diagram
6700-D-31728-3 (Rev. D)



A28 MOTHERBOARD SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUNDS:
4. SUBASSEMBLY BORDERS ARE DENOTED AS:
5. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   Q1, VR1
6. LAST USED/NOT USED COMPONENTS ARE:

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C8 CR12 FL1 J27 K1 Q4 R12 RT2 RV2 XA17	NONE

Figure 6N-10. A28 Motherboard PCB Schematic Diagram (Sheet 1 of 1) 6700-D-31728-3 (Rev. D)

6P-1 INTERCONNECT SUBSYSTEM: A28 MOTHERBOARD PCB

6P-1.1 Motherboard Interconnect Circuit Description

The A28 Motherboard PCB is primarily an interconnect subsystem. It contains connectors and signal pathways for linking together the various circuit subsystems. Refer to Figure 6P-1 for the RF Casting coaxial cable interconnections and to fold-out Figure 6P-2 for an overall diagram of the wire and ribbon cable connections. All circuit subsystems are mounted directly onto the A28 PCB connector bus or cabled to remote connectors on the motherboard.

a. RF Casting Interconnect

Figure 6P-1 shows the RF Casting interconnections. These interconnections use coaxial cables for the RF signals, and filtercons for the dc and control signals.

b. Motherboard Power Input Circuit

Also included on the A28 Motherboard PCB are line and standby rectifiers, as well as the dc power regulator for the system fan. Refer to Figure 6P-4, sheet 1, for the following discussion. The summary diagram, at the bottom of the schematic represents the input power switching. This summary simplifies the analysis of the input power.

The AC current goes through the A22 PCB into the S46 front panel power switch on the A1 PCB, and into the 10 MHz crystal oscillator on the A28 PCB. The oscillator is powered when the system is connected to a power source.

Referring to the schematic, sheet 1, of the A28 Motherboard PCB, the 110/220 VAC input power is supplied to the rear panel. From there it goes into the line circuits when the power switch is ON, or to the standby circuits when the power switch is OFF.

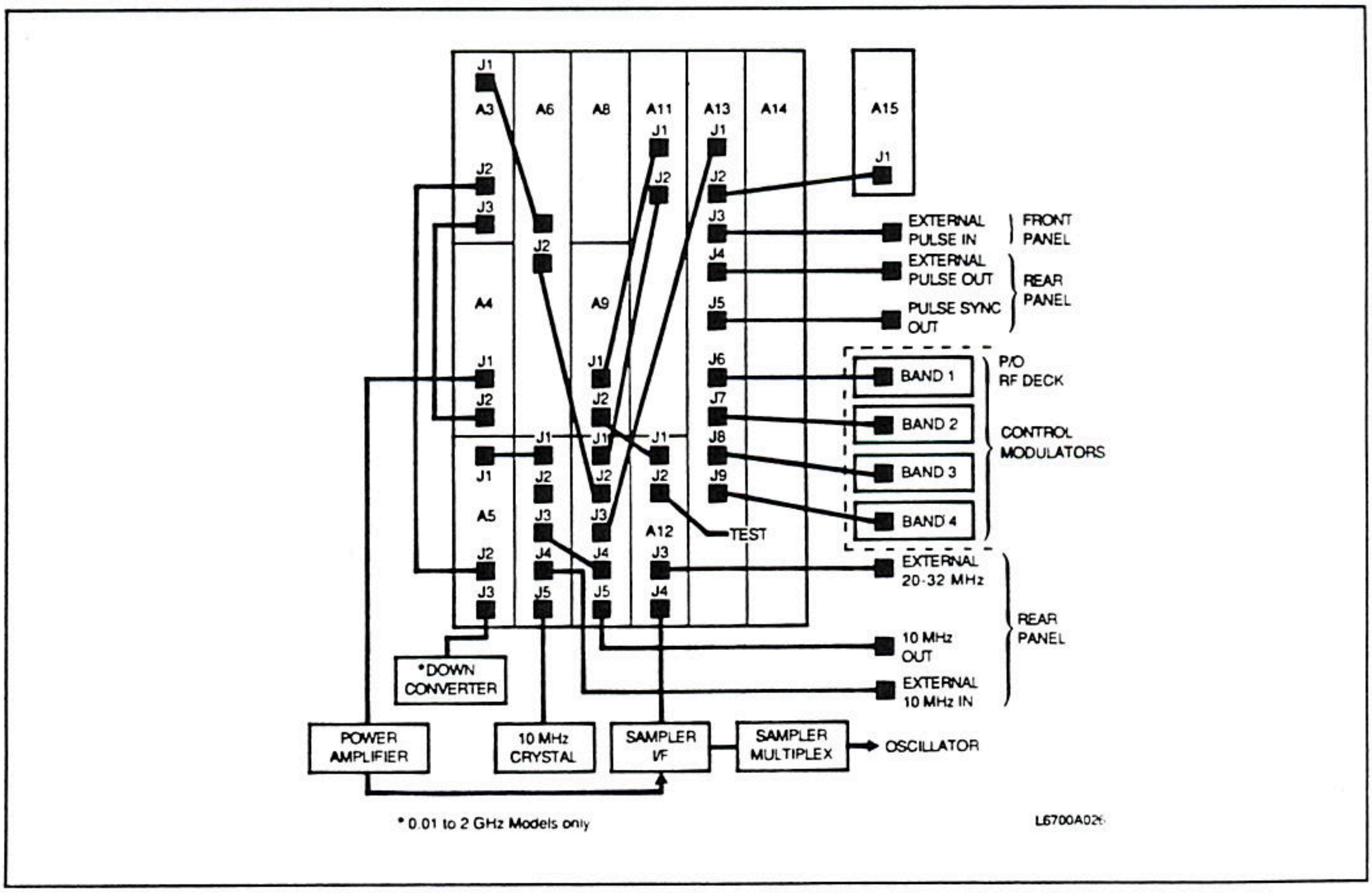


Figure 6P-1. RF Casting Interconnect Diagram

In the standby mode, the input power goes through a power transformer that converts 110/220 VAC to 30 VAC. The 30 VAC then goes into the CR6-CR9 standby rectifiers. In parallel with the rectifiers, the current goes to Q3 where it is converted to a TTL square-wave at line frequency (50, 60 or 400 Hz). The output of the rectifiers goes to the A22 Regulator PCB, where the current is regulated to 24 Vdc.

The output of the rectifiers also goes to Q1, which grounds the ADJ pin of the VR1 adjustable regulator in the standby mode. This creates a low power output that is not capable of driving the fan. When the power switch is on, Q1 is open and a 24 Vdc signal is output from VR1 to drive the system fan.

With the front panel power switch set in the ON position, the 24 Vdc line from the A22 PCB goes through the A1 and A2 PCBs back into the A28 PCB. The 24 Vdc then goes into the K1 relay and causes the switch block in the line circuits to close.

Referring back to the schematic, when the switch block closes, the 110/220V power signal goes into the line rectifiers (CR1-CR4). These rectifiers comprise a full-wave voltage doubler (110V line) or a full-wave bridge rectifier (220V line). The ±165 Vdc outputs then go to the A25 Power Supply PCB.

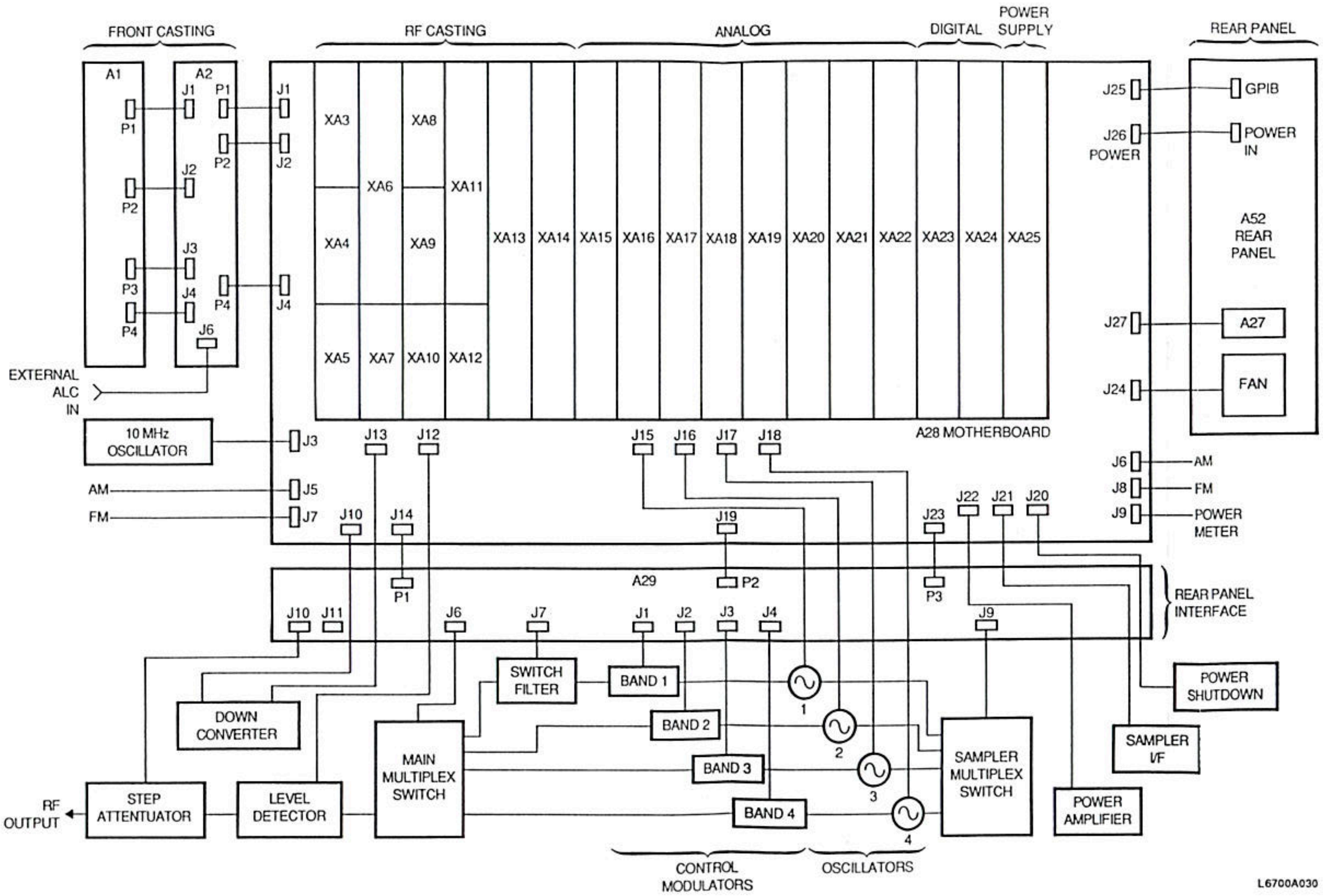
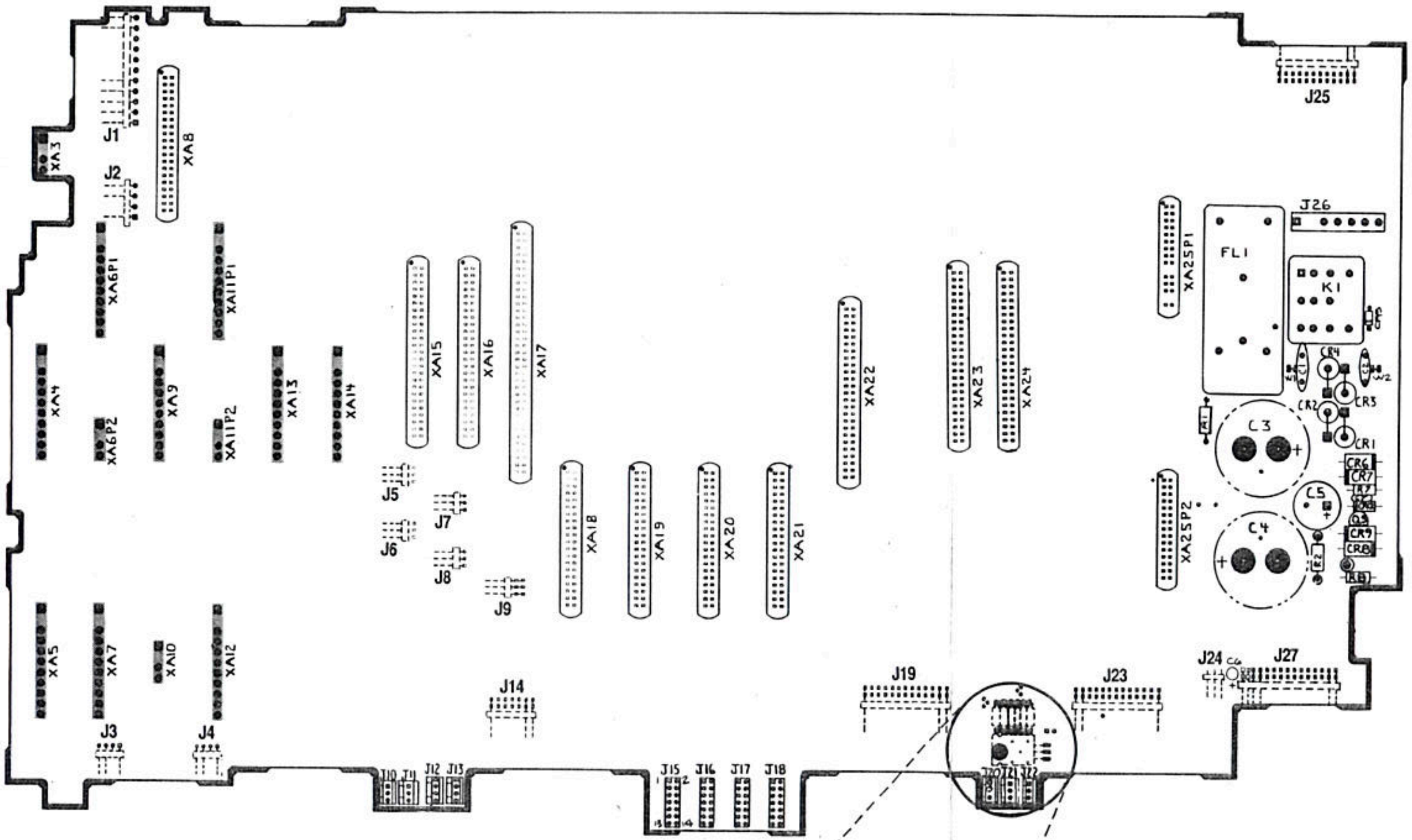
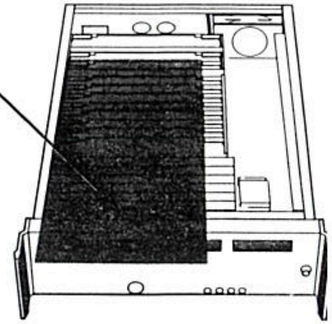


Figure 6P-2. Overall Instrument Wire/Ribbon Cable Interconnect Diagram

A28 MOTHERBOARD
(As viewed from *top* of instrument)



A28
MOTHERBOARD
(Bottom Side)



NOTES:
1. Filtercons are designated as:
Each signal path connection has (typically) 1500 pF capacitance between it and chassis ground.
2. J1-9, J14, J19, J23-25, and J27 are mounted on the bottom side of the A28 PCB.

Fan Power
Supply Components
(As viewed from
bottom of instrument)

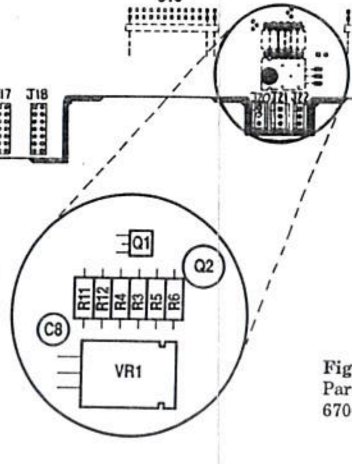
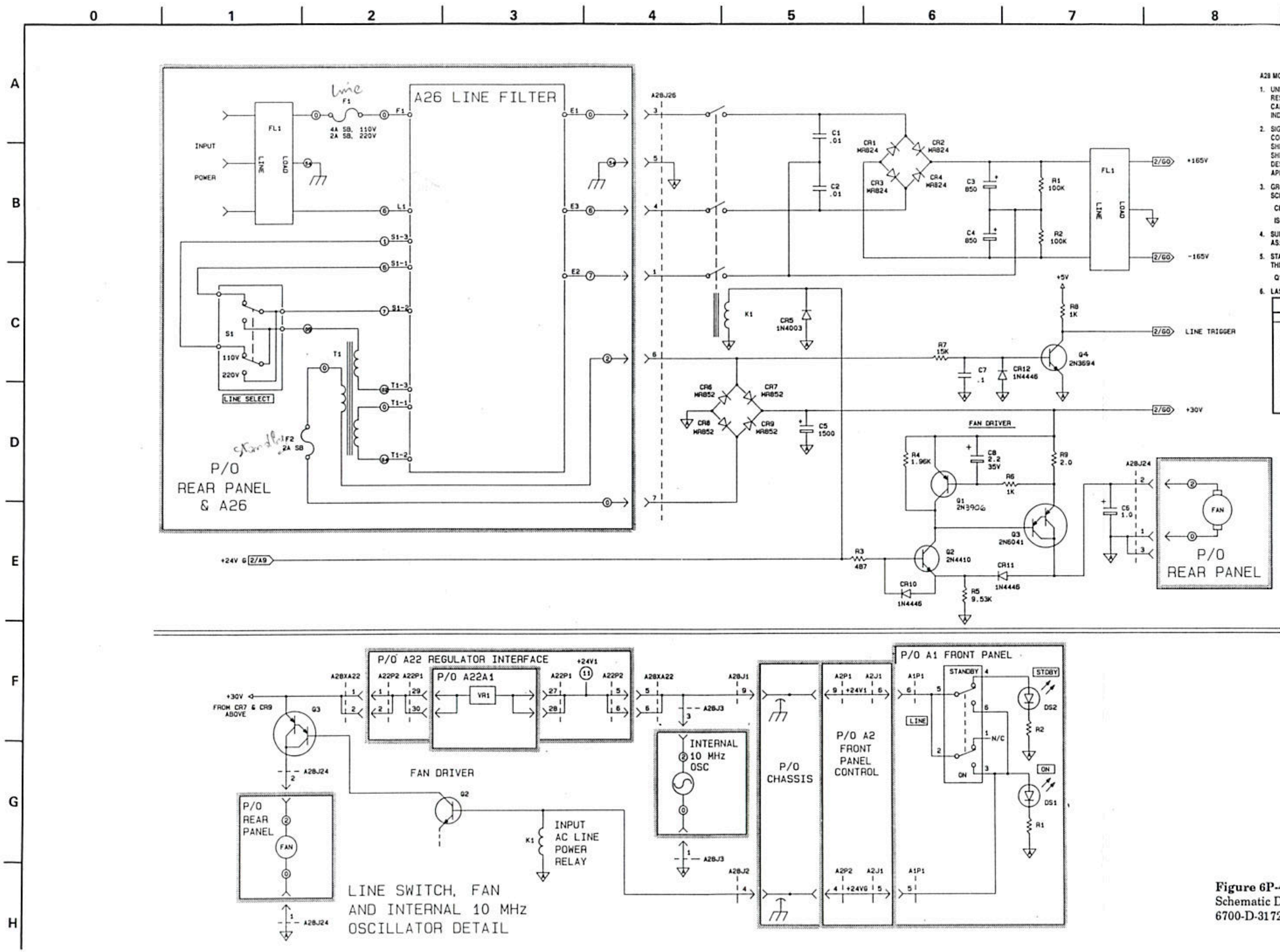


Figure 6P-3. A28 Motherboard PCB Parts Locater Diagram
6700-D-31728-3 (Rev. D)



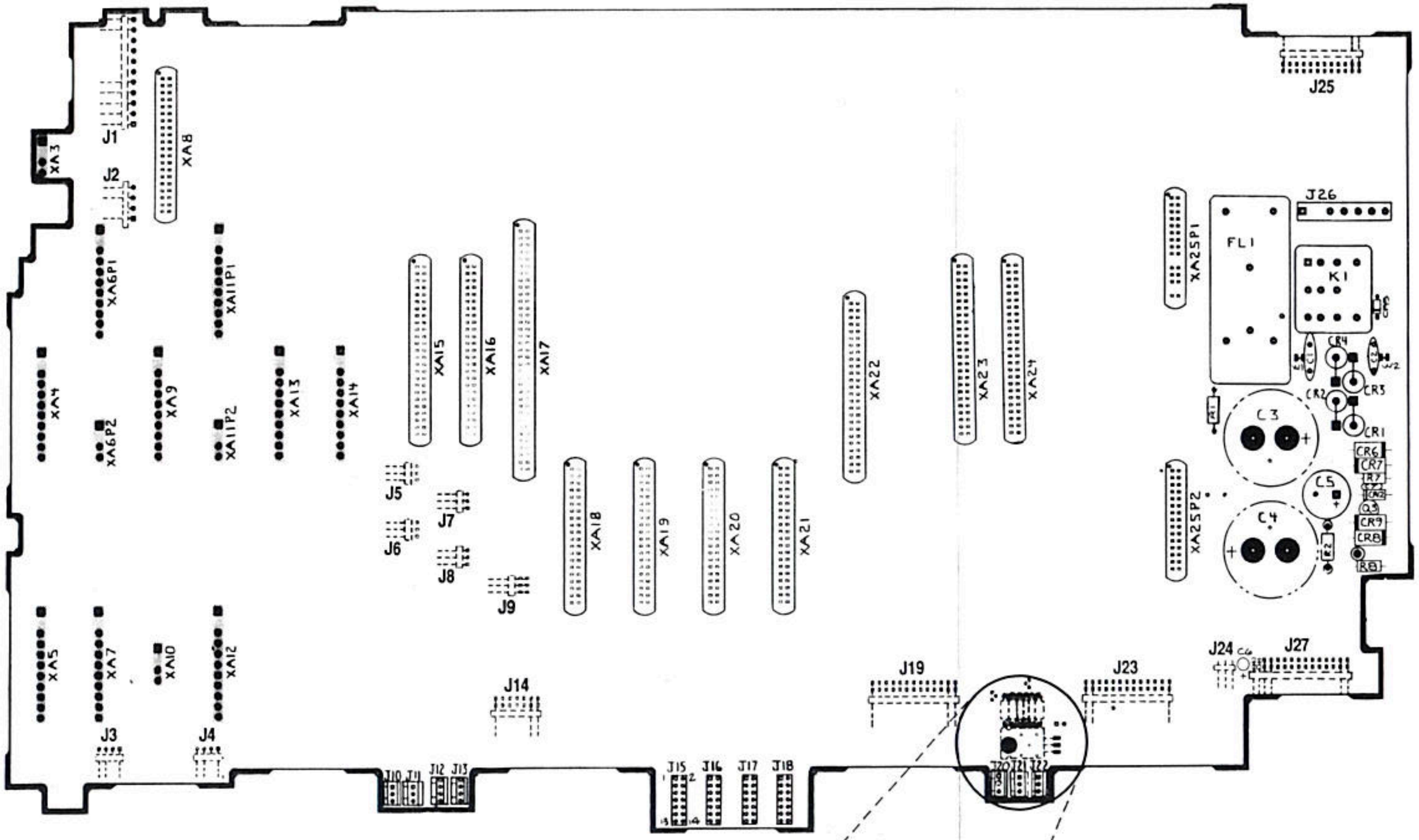
A28 MOTHERBOARD SCHEMATIC NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS (Ω), CAPACITANCES ARE IN MICROFARADS (μF), INDUCTANCES ARE IN MICROHENRIES (μH).
2. SIGNAL FLAGS INDICATE MATCHING CONNECTIONS BETWEEN MULTIPLE SHEETS OF THIS SCHEMATIC. THE SHEET NUMBER AND SOURCE OR DESTINATION GRID COORDINATES APPEAR INSIDE THE FLAG: 2/B3
3. GROUND SYMBOLS USED ON THIS ASSEMBLY SCHEMATIC SET ARE DENOTED AS:
   CHASSIS GROUND:
   ISOLATED GROUNDS:
4. SUBASSEMBLY BORDERS ARE DENOTED AS:
5. STATIC SENSITIVE COMPONENTS USED IN THIS ASSEMBLY INCLUDE:
   Q1, VR1
6. LAST USED/NOT USED COMPONENTS ARE:

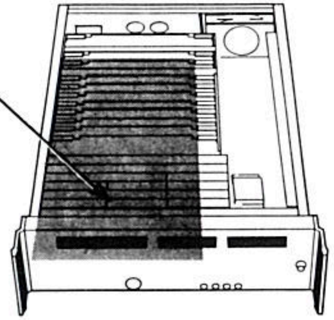
REFERENCE DESIGNATORS	
LAST USED	NOT USED
C8 CR12 FL1 J27 K1 Q4 R12 RT2 RV2 XA17	NONE

Figure 6P-4. A28 Motherboard PCB Schematic Diagram (Sheet 1 of 2)
6700-D-31728-3 (Rev. D)

A28 MOTHERBOARD
(As viewed from *top* of instrument)

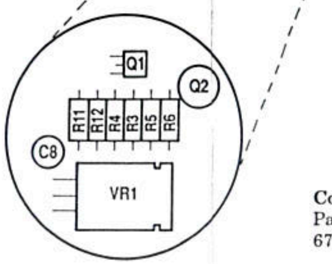


A28
MOTHERBOARD
(Bottom Side)



NOTES:
1. Filtercons are designated as:
●●●●●●●●●● ■
Each signal path connection has (typically) 1500 pF capacitance between it and chassis ground.
2. J1-9, J14, J19, J23-25, and J27 are mounted on the bottom side of the A28 PCB.

Fan Power Supply Components
(As viewed from *bottom* of instrument)



Copy of Figure 6P-3. A28 Motherboard PCB Parts Locater Diagram
6700-D-31728-3 (Rev. D)

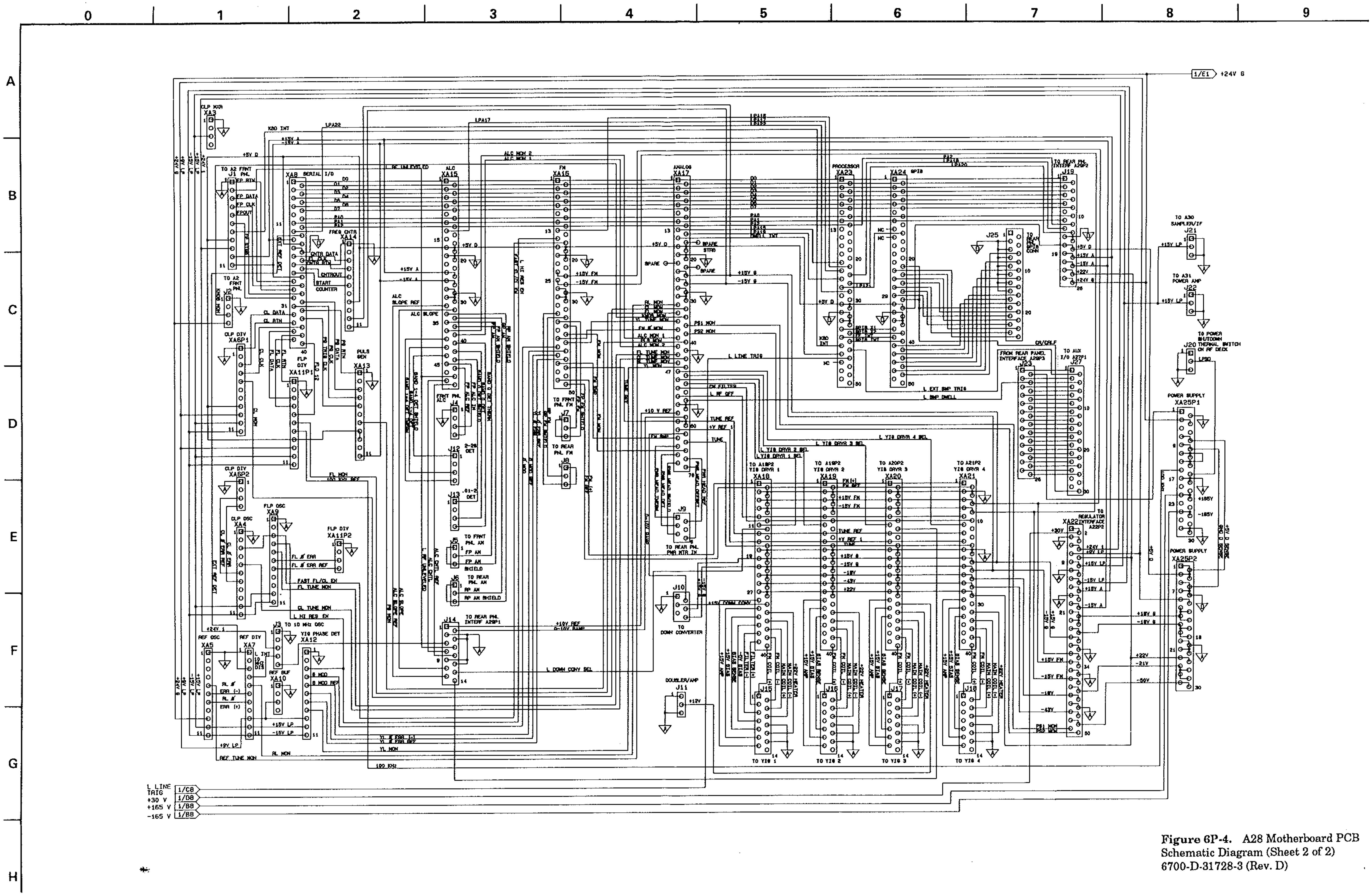
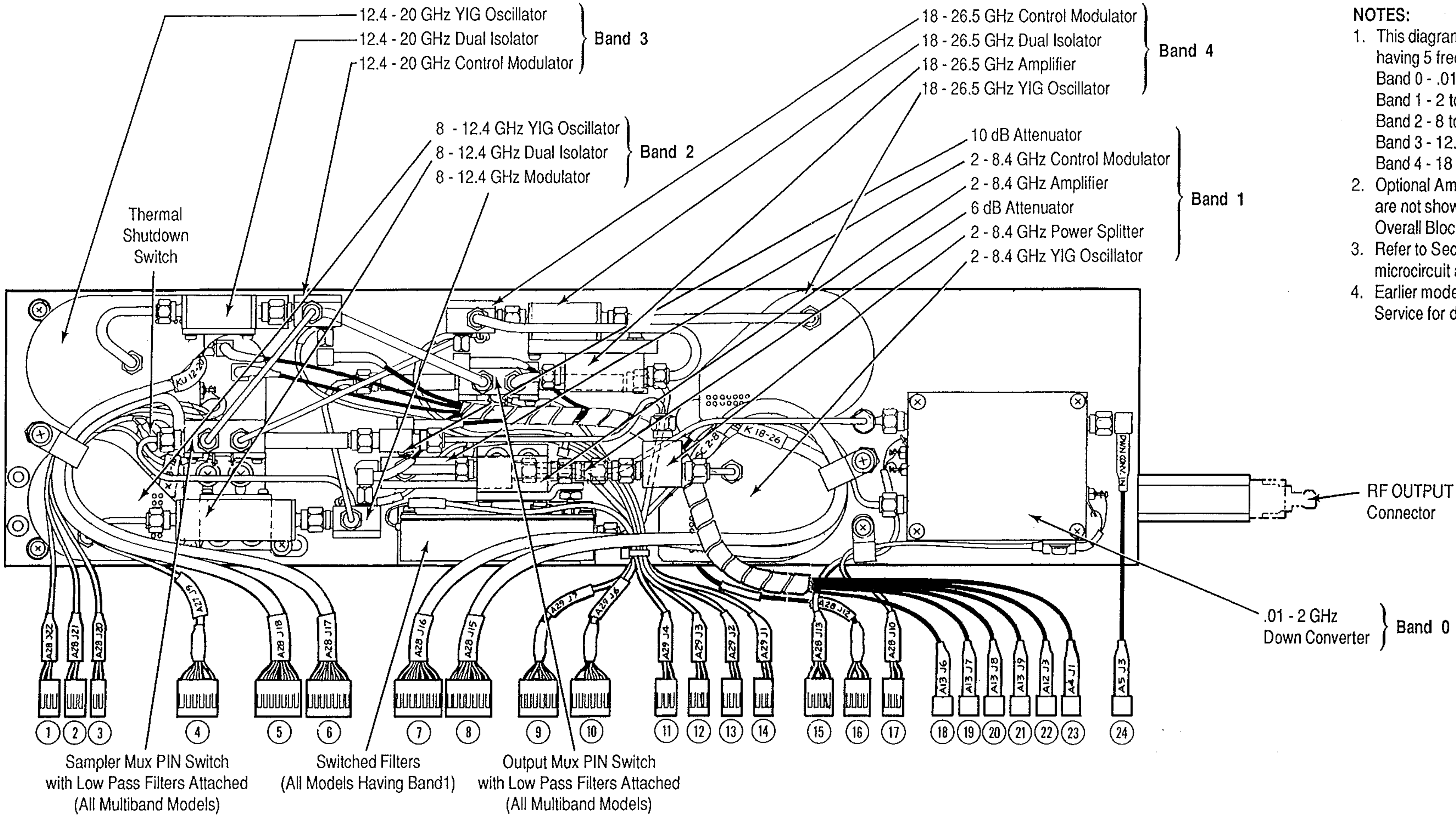


Figure 6P-4. A28 Motherboard PCB Schematic Diagram (Sheet 2 of 2) 6700-D-31728-3 (Rev. D)



NOTES:

1. This diagram reflects a typical 6759A having 5 frequency bands
   Band 0 - .01 to 2 GHz
   Band 1 - 2 to 8.4 GHz
   Band 2 - 8 to 12.4 GHz
   Band 3 - 12.4 to 20 GHz
   Band 4 - 18 to 26.5 GHz
2. Optional Amplifiers for high power models are not shown. Refer to Figure 6B-1 Overall Block Diagram.
3. Refer to Section 5 Parts Lists for specific microcircuit and cable part number information
4. Earlier models differ slightly; contact Customer Service for detailed information.

Figure 6Q-1. Typical Microwave Deck Parts Locater Diagram (Sheet 1 of 2; Top View) for all Models With Frequency Ranges From 0.01 to 26.5 GHz

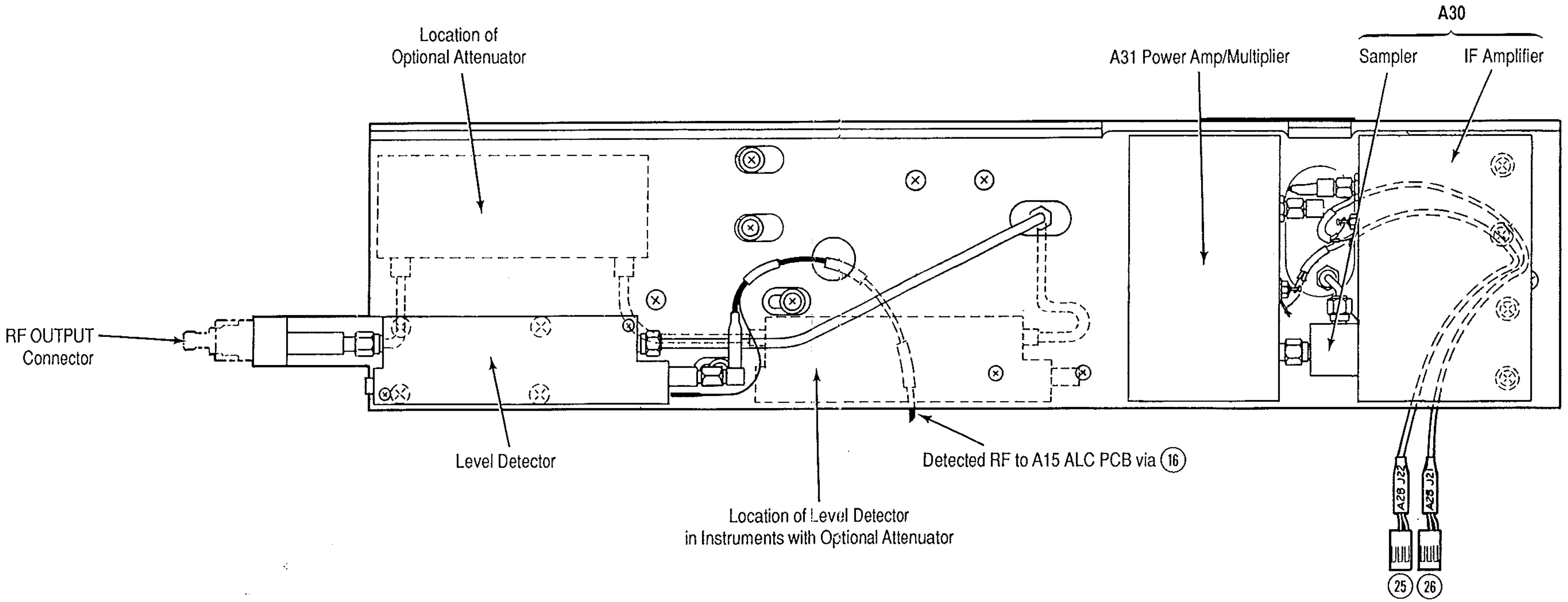


Figure 6Q-1. Typical Microwave Deck Parts Locater Diagram (Sheet 2 of 2; Bottom View) for all Models With Frequency Ranges From 0.01 to 26.5 GHz

SECTION VII
DISASSEMBLY AND REPAIR PROCEDURES

CONTENTS

SECTION VII
DISASSEMBLY AND REPAIR

7-1 INTRODUCTION

The disassembly procedures in this section show how to gain access to major instrument parts for troubleshooting or maintenance.

WARNING

Hazardous voltages are present inside the instrument when ac line power is connected. The instrument must be turned off and the line cord must be disconnected before removing any covers or panels. Repair procedures should only be performed by service persons who are fully aware of the potential hazards.

7-2 DISASSEMBLY PROCEDURES

7-2.1 Removing the Cover

1. Turn off the power. Disconnect all external cables.
2. Place the system onto the handles so that the rear panel is facing up (Figure 7-1).

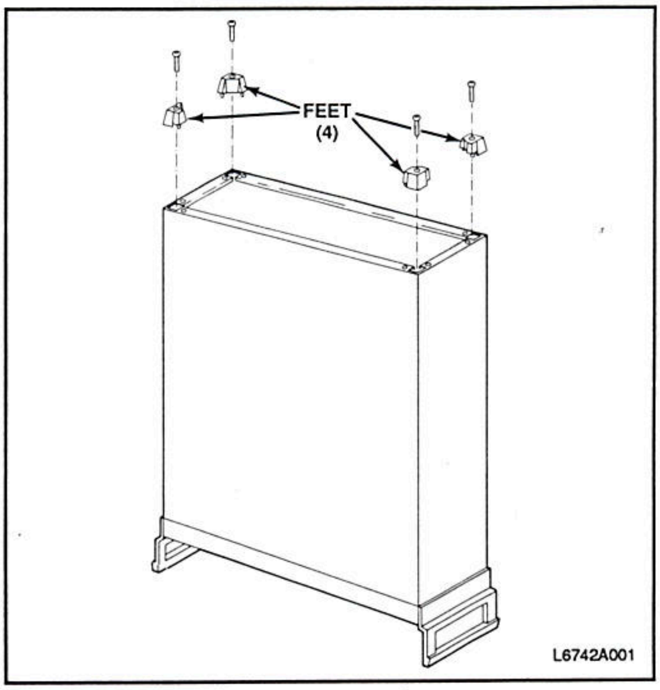


Figure 7-1. Removing the cover

3. Remove the four feet.
4. Remove the cover.

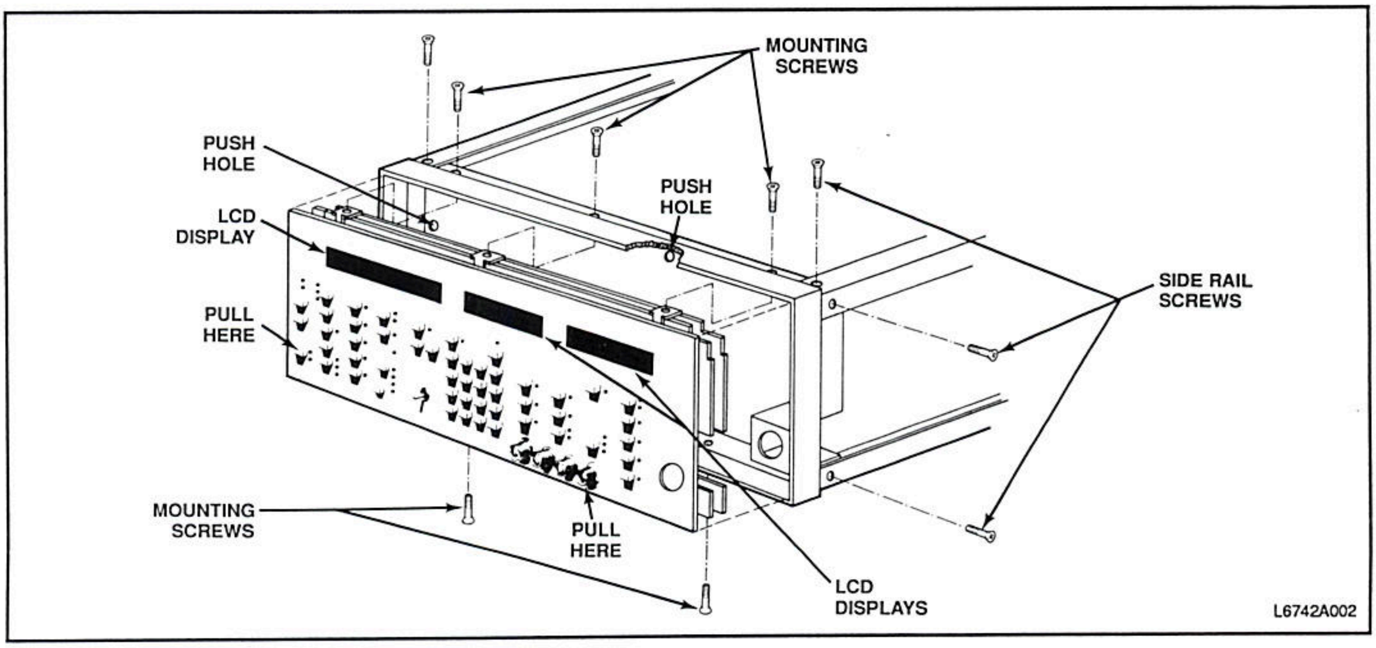


Figure 7-2. Front Panel Assembly and Casting

7-2.2 Removing the Front Panel

There are two aspects to removing the Front Panel: removing the front panel assembly, and removing the entire front panel casting.

a. Removing the Front Panel Assembly

1. Remove the cover as described in paragraph 7-2.1.
2. Remove the five mounting screws – three top, two bottom (see Figure 7-2).
3. Pull the front panel assembly away from the casting.
4. Unplug the three ribbon cables from the back of the front panel assembly.

NOTE

If the assembly fit is very tight and is difficult to pull out, push the assembly out from the inside of the instrument. Two holes are provided in the back of the front panel casting (see Figure 7-2). Carefully poke an insulated tool through each hole to gently force the panel assembly free.

REASSEMBLY HINT

- Apply even pressure on the four corners of the assembly as it is pushed back into place.

CAUTION

Do not push directly on the LCD Displays which are mounted into the front panel assembly; they may break.

b. Removing the Front Panel Casting

1. Remove the cover as described in paragraph 7-2.1.
2. Unplug the A13J3 cable and push it through the grommet on the chassis (Figure 7-3).
3. Turn the instrument over on its top.
4. Remove the cable shield from its mounting pins (Figure 7-4).
5. Unplug the following cables from the motherboard: A28J3, A28J4, A28J5, and A28J7.
6. Unplug all cables that connect the front panel to the motherboard.

NOTE

Remember the orientation of J1 and J2 cables; they are not keyed. WILTRON uses the following pin/color convention for the first four pins:

Pin 1 – Tan
Pin 2 – Red
Pin 3 – Orange
Pin 4 – Yellow

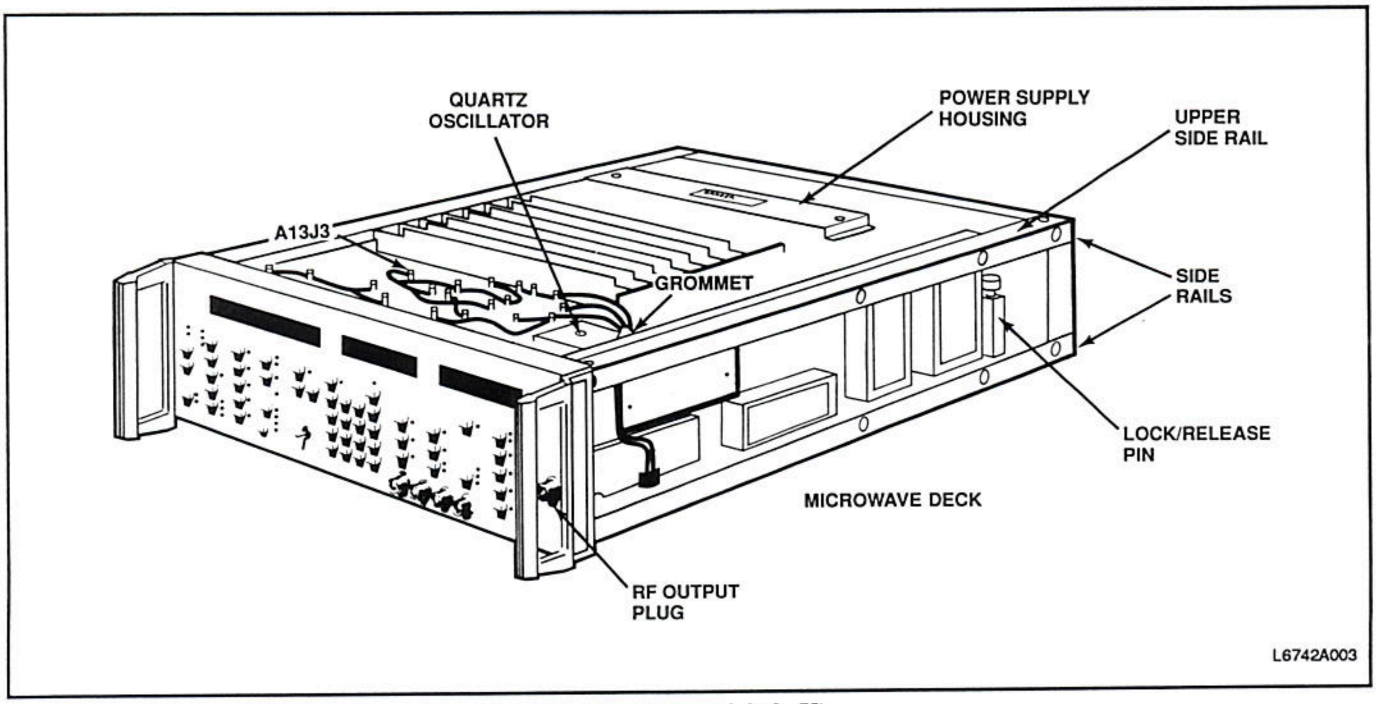


Figure 7-3. Top and Side Views

7. Remove the clamp from the A13J3 cable.
8. Remove the left and center motherboard mounting screws.
9. Lift the left-front corner of the motherboard just enough to move the A28J5 and A28J7 cables out from under the PCB.
10. Remove the mounting screw at the center of the front panel casting.
11. Remove the eight screws that secure the front panel casting to the side rails.
12. Remove the front mounting screw from the quartz oscillator housing (Figure 7-3).

CAUTION

Before sliding the front panel away from the chasis, check to ensure that the support screws are tight, and that the deck is secure (Figure 7-4).

13. Slide the front panel forward.

NOTE

If the front panel is held too tightly into place by the side rails, loosen the screws along the side rails.

CAUTION

When replacing the front panel protect the cables so they are not pinched or cut. Also, protect the RF OUTPUT connector from being damaged.

7-2.3 Removing the Rear Panel

There are two aspects to removing the rear panel: opening the rear panel to access internal components, and removing the rear panel casting for replacement or maintenance.

a. Opening the Rear Panel

1. Remove the cover as described on paragraph 7-2.1.
2. Turn the system over so that the bottom is accessible.
3. Unplug the cables from J25, J27, and the A28J24 fan cable (Figure 7-4).
4. Turn the system over again to make the top accessible.
5. Remove the two nuts from the back side of the power supply housing.
6. Remove the eight screws that secure the rear panel to the side rails.

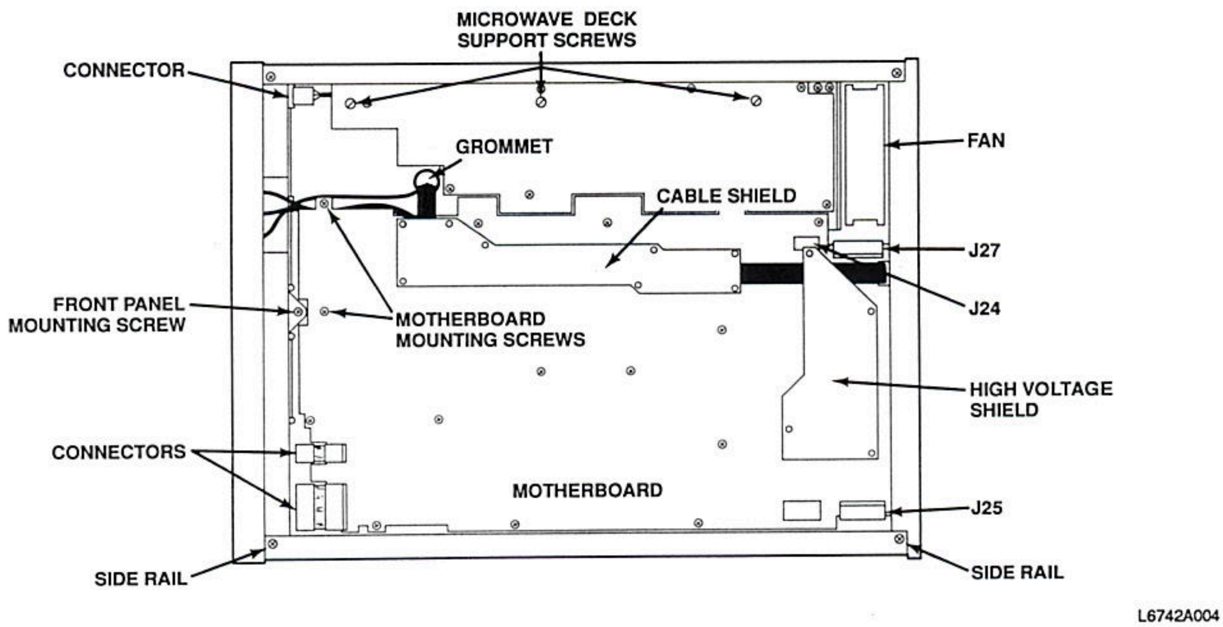


Figure 7-4. Bottom View

7. Slide the rear panel out of the side rails.

CAUTION

Take care to protect the cables that are still connected between the rear panel and the motherboard.

8. Remove the cable from J26 (on the top of the motherboard – not visible in Figure 7-4).
9. The rear panel is now sufficiently disassembled to allow troubleshooting and maintenance.

b. Removing the Rear Panel Casting

To completely disassemble the rear panel from the system, perform the following steps then follow the instructions in paragraph 7-2.3a.

1. Remove the cover as described in paragraph 7-2.1.
2. Looking at the top of the system, remove the cables from A13J4, A13J5, A12J2, A10J5, and A7J4.
3. Pass these cables through the grommet, to the bottom of the motherboard (Figure 7-5).
4. Turn the system over so the bottom is accessible.
5. Remove the cable and high voltage shields.
6. Unplug the A28J6, A28J8, and A28J9 cables from the motherboard.
7. Follow instructions in paragraph 7-2.3a to complete the disassembly of the rear panel.

NOTE

This technique is also useful when replacing a single cable or BNC from the rear panel.

Reassembly Hints

- When sliding the rear panel into the side rails, align the mounting bracket onto the two bolts from the power supply housing.

7-2.4 Lowering the Microwave Deck

The microwave deck is located behind the front panel RF OUTPUT connector on the right side of the 67XXA. The deck may be rotated to the side to expose its components for troubleshooting and repair. The deck is supported at the front by the front casting and at the rear by a pillow block. Three screws, accessible through the A29 Rear Panel Interface PCB at the bottom of the instrument, secure the bottom of the microwave deck. The rear support pillow block has a lock/release pin that must be lifted before rotating the deck to the side.

1. Remove the cover as described in paragraph 7-2.1.
2. Remove the screws that secure the upper side rail to the front and rear panels (Figure 7-4).

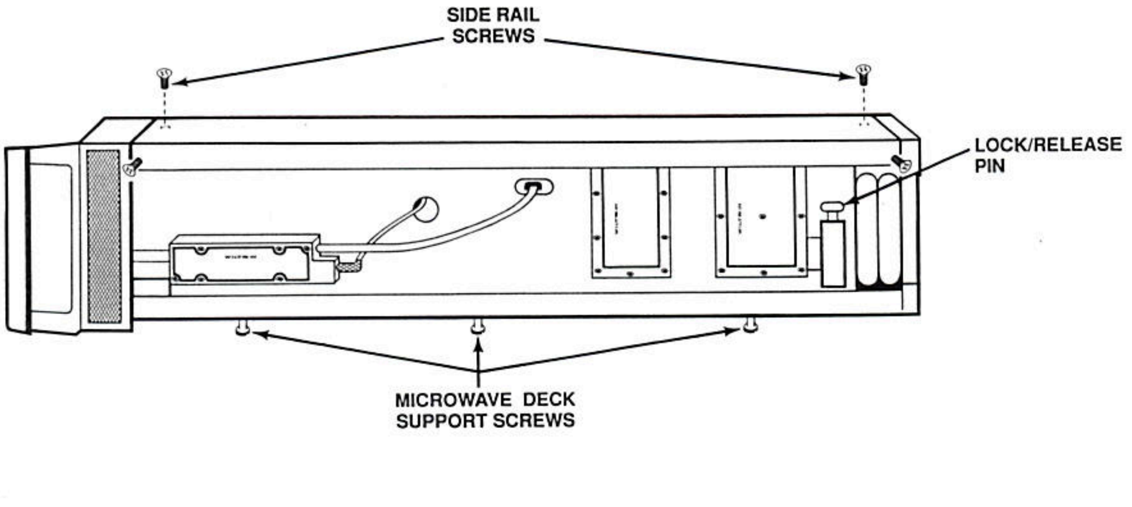


Figure 7-5. Lowering the Microwave Deck

3. Loosen the three support screws.
4. Lift the lock/release pin.
5. Turn the microwave deck out from the top until the release pin clicks into place, locking the deck in the lowered position.

Reassembly Hints

- Lift the release pin to raise the deck back into the upright position.
- Ensure the A28J16 and A28J17 cables are positioned over the nearby semi-rigid cables.
- Raise the microwave deck until the release pin clicks into place, locking the deck into the upright position.
- Tighten the support screws underneath the motherboard.