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Giga-tronics

Operation & Maintenance Manual

Model 6062A
Synthesized RF Signal Generator

The instrument has a 7-digit serial number, shown on a sticker on the rear panel.
This manual applies to all serial numbers which begin with 96, 97, or 98.

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This warranty DOES NOT cover damage resulting from improper use, nor workmanship other than Giga-tronics service.

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About This Manual

This Operation and Maintenance Manual covers all aspects of the Giga-tronics Model 6062A Synthesized RF Signal Generator. The information required to operate, calibrate and maintain the instrument is provided.

Preface: In addition to a comprehensive Table of Contents and general information about the manual, the Preface also contains a record of changes made to the manual since its publication, and a description of Special Configurations. If you have ordered a user-specific manual, please refer to page xv for a description of the special configuration.

Chapter 1 — Introduction: This chapter contains a brief introduction to the instrument as well as the instrument's performance parameters.

Chapter 2 — Operation: A user's guide to the instrument and its controls.

Chapter 3 — Theory Of Operation: A description of the instrument's design and internal functioning, to the block diagram level.

Chapter 4 — Calibration And Testing: Procedures for inspection, calibration and performance testing.

Chapter 5 — Maintenance: Procedures for maintenance and troubleshooting.

Chapter 6 — Parts Lists: Parts lists for all circuit boards and other assemblies.

Chapter 7 — Diagrams: Component diagrams and schematic diagrams for all circuit boards and other assemblies.

Appendix A — Options: Descriptions of the available options for this instrument.

Changes that occur after publication of the manual, and special configuration data will be inserted as loose pages in the manual binder. Please insert and/or replace the indicated pages as detailed in the Technical Publication Change Instructions included with new and replacement pages.

Conventions

The following conventions are used in this product manual. Additional conventions not included here will be defined at the time of usage.

Warning

WARNING

The WARNING statement is enclosed in double lines and centered in the page. This calls attention to a situation, or an operating or maintenance procedure, or practice, which if not strictly corrected or observed, could result in injury or death of personnel. An example is the proximity of high voltage.

Caution

CAUTION

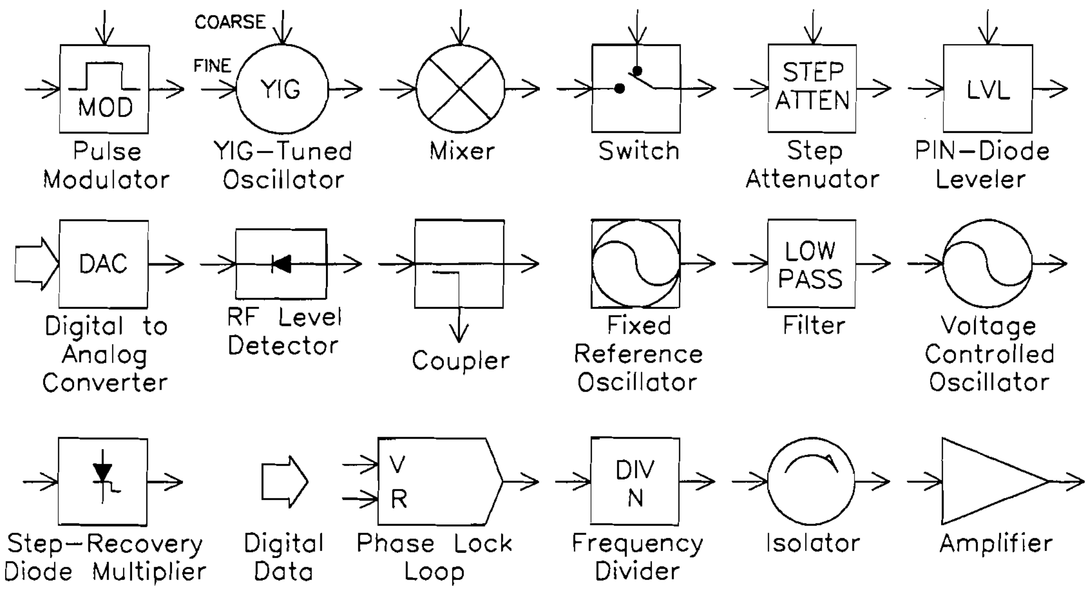
The CAUTION statement is enclosed within a single heavy line and centered in the page. This calls attention to a situation, or an operating or maintenance procedure, or practice, which if not strictly corrected or observed, could result in temporary or permanent damage to the equipment, or loss of effectiveness.

Notes

☛ NOTE: A NOTE highlights or amplifies an essential operating or maintenance procedure, practice, condition or statement.

SYMBOLS

Block diagram symbols frequently used in the manual are illustrated below.



Record of Manual Changes

This table is provided for your convenience to maintain a permanent record of manual change data. Corrected replacement pages will be issued as Technical Publication Change Instructions, and will be inserted at the front of the binder. Remove the corresponding old pages, insert the new pages, and record the changes here.

Change Instruction Number	Change Instruction Date	Date Entered	Comments

Special Configurations

When the accompanying product has been configured for user-specific application(s), supplemental pages will be inserted at the front of the manual binder.

When applicable, remove this page and replace it with the furnished Special Configuration supplemental page(s).

1 Introduction

1.1 Product Description

The 6062A Synthesized RF Signal Generator is designed for applications that require full programmability, good modulation, frequency accuracy, and output level performance with moderate spectral purity. It is well suited for testing a wide variety of RF components and systems including filters, amplifiers, mixers, and radios, particularly on-channel radio testing.

1.1.1 Features

- 0.10 to 1050 MHz frequency range in 10 Hz steps
- 1050 to 2100 MHz frequency range in 20 Hz steps
- +16 to -137 dBm signal level in 0.1 dB steps from 0.10 to 1050 MHz
- +13 to -137 dBm signal level in 0.1 dB steps from 1050 to 2100 MHz
- AM, FM, øM, and PM, internal or external
- Internal 400 Hz and 1000 Hz modulation oscillator
- Relative frequency and amplitude
- Volts/dBm conversion
- Store/recall memory
- Instrument (or controller) prompted software compensation
- Master/slave for frequency, amplitude, and modulation functions (IEEE-488 Interface controlled)
- Fluorescent display
- 5.25 inches high, rack mountable

The values of modulation, frequency, and amplitude are shown in the three displays across the front panel. When you press the STATUS key, UNCAL and REJECT ENTRY codes are displayed. The display also prompts you during the software compensation procedures.

The internal microprocessor controls all operator interface functions, performs background operations (such as status checks), and updates (strobes) the front panel displays. Whether you are using local control from the front panel or remote control over the IEEE-488 Interface, the microprocessor provides self-test and diagnostic capabilities. Economical instrument performance is achieved with software compensation and accuracy-enhancement circuitry (available as factory-prepared procedures).

The frequency range is 0.10 to 2100 MHz. The frequency is synthesized from a 10 MHz reference, which provides an output resolution of 10 Hz from 0.10 to 1050 MHz, and 20 Hz from 1050 to 2100 MHz. The relative frequency mode allows you to program the frequency in relation to a center or offset frequency.

This is convenient for testing filters and mixers. The output frequency stability and accuracy depends on the reference, and whether that reference is internal or external.

The internal reference frequency is a 10 MHz ambient crystal oscillator. If Option 130 (High Stability Reference) or Option 132 (Medium-Stability Reference) is installed, the oscillator is locked to the internal crystal oscillator. With the rear panel REF INT/EXT switch set to INT, the output frequency is synthesized from the internal 10 MHz crystal oscillator reference, and the internal oscillator (timebase) signal is available at the 10 MHz OUT connector.

The generator can be operated from an external 10 MHz timebase by setting the rear panel REF INT/EXT switch to EXT and applying a timebase signal to the REF IN connector. With the REF INT/EXT switch set to EXT, the Generator can be operated from an external 1, 2, 2.5, 5, or 10 MHz, 0.3 to 4 Vpp sine or square wave reference applied to the REF IN connector. In either position of the INT/EXT switch, the selected reference is available as a 10 MHz signal at the rear panel 10 MHz OUT connector.

The generator has two amplitude level ranges:

+16 to -137 dBm (1.41 V to 0.032 µV) over a frequency range of 0.10 to 1050 MHz.
+13 to -137 dBm (1 V to 0.032 µV) over a frequency range of 1050 to 2100 MHz.

The programming limits are +17 and -147.4 dBm, which correspond to limits of 1.58 V to 95 nV (0.01 µV) respectively. The level entry can be in dBm or volts, or it can be converted from one to the other. The relative amplitude mode accounts for cascaded gain or loss, or displays the level (in dB) relative to 1 µV or 1 mV.

The 6062A has internal and external amplitude, frequency, phase, and pulse modulation capabilities. The internal modulation oscillator is selectable between 400 and 1000 Hz. AM depths of 0 to 99% are available in 1% steps. FM deviation ranges of 1, 10, 100, and 400 kHz are available in steps of 1, 10, 100, and 1000 Hz respectively. Phase modulation deviation ranges of 0.10, 1.0, 10.0, and 40.0 radians (rad) are available in steps of 0.001, 0.01, 0.1, and 1 radian, respectively. The internal pulse duty cycle is approximately 50%. External pulse allows rates from dc up to 16 MHz, and duty cycles from 0 to 100%.

1.1.2 Required Equipment

An IEEE-488 interface cable is needed for remote control operation. Appropriate RF output cabling to fit the female type SMA output connector can be ordered from Giga-tronics as Accessory Cable Kit A001.

1.1.3 Tools and Test Equipment

No special tools are required to operate the generator. Test equipment required for calibration and performance verification is described in Chapter 4.

1.1.4 Cooling

A cooling fan is installed in the instrument. The cooling air intake and exhaust are located on the rear panel. Care must be taken to avoid obstructing the flow of air into and out of the instrument.

1.1.5 Cleaning

The air inlet screen should be cleaned whenever a significant amount of dirt or dust has accumulated. Whenever the covers are removed, the interior should be blown out with dry air at a low velocity.

1.1.6 Mnemonics

The mnemonics used on the schematics, block diagrams, wiring diagrams, truth tables, and in the text, are listed at the beginning of Chapter 7.

1.1.7 Options

Options available for the 6062A are detailed in Appendix A.

1.1.8 Accessories Included

The following accessories are included with the 6062A:

Description	Part Number	Qty
Operator Information Card[1]	797928	1
Instruction Manual	794842	1
Line Power Cord	284174	1
BNC Dust Cap	478982	2

[1]The Operator Information Card card presents useful information, such as error codes and special function codes. It has an adhesive backing so that it can be affixed to the top of the generator or to the remote operator console.

1.1.9 Accessories Available

The following accessories are available for the 6062A:

Description	Accessory No.
Rack Mount Kit (Includes 5.25-inch rack mount ears and 24-inch rack slides.)	Y6001
Rack Mount Kit w/o slides	Y6002
IEEE-488 Shielded Cable 1 meter	Y8021
IEEE-488 Shielded Cable 2 meters	Y8022
IEEE-488 Shielded Cable 4 meters	Y8023
Attenuator 50 Ω, 6 dB, BNC	Y9100
Attenuator 50 Ω, 14 dB, BNC	Y9101
Attenuator 50 Ω, 20 dB, BNC	Y9102
50 Ω Feed-through Termination, BNC	Y9103
Coaxial Cable 50 Ω, 3 feet, BNC (m) both ends	Y9111
Coaxial Cable 50 Ω 6 feet BNC, (m) both ends	Y9112
Min-Loss Pad 50 to 75 Ω	Y9301
Adapter N to BNC 75 Ω	Y9307
Adapter N to BNC 50 Ω	Y9308
Coaxial Cable N male to N male 6 ft	Y9315
Cap Non-shorting BNC	Y9316
50 Ω Termination, N	Y9317
50 Ω Coaxial Switch	PM 2122/02
Test Team Software	PM 2240/002

1.1.10 Receiving Inspection

Each Giga-tronics instrument must pass rigorous inspections and tests prior to shipment. Upon receipt, it should immediately be subjected to a performance check to ensure that operation has not been impaired during shipment. The performance verification procedure is described in Chapter 4 of this manual.

1.1.11 Preparation for Reshipment

These are procedures to reship the unit to the factory if it should become necessary.

To protect the instrument during reshipment, use the best packaging materials available. If possible use the original shipping container. If this is not possible, a strong carton or a wooden box should be used. Wrap the instrument in heavy paper or plastic before placing it in the shipping container. Completely fill the areas on all sides of the instrument with packaging material. Take extra precautions to protect the front and rear panels.

Seal the package with strong tape or metal bands. Mark the outside of the package **"FRAGILE — DELICATE INSTRUMENT"**. If corresponding with the factory or local Giga-tronics sales office regarding reshipment, please reference the full model number and serial number. If the instrument is being reshipped for repair, enclose all available pertinent data regarding the problem that has been found.

NOTE: If you are returning an instrument to Giga-tronics for service, first contact Giga-tronics Customer Service at **(800) 444-2878** or Fax at **(510) 328-4702** so that a return authorization number can be assigned. You can also contact Customer Service over their Internet e-mail address ***repairs@gigatronics.com***

1.2 Performance Specifications

Unless otherwise noted, the performance specifications are guaranteed over the specified environmental and ac power conditions, 20 minutes after turn-on and within the operating temperature range.

1.2.1 Frequency

Range:	0.1 to 2100.0 MHz in 4 bands: 0.1 to 244.99999 MHz 245 to 511.99999 MHz 512 to 1049.99999 MHz 1050 to 2100.0 MHz
Display:	9-1/2 digits
Resolution:	10 Hz from 0.1 to 1050 MHz 20 Hz from 1050 to 2100 MHz
Accuracy:	Same as reference (see Reference)
Reference (Internal):	The unit operates on an internal free-air 10 MHz crystal oscillator, aging <±0.5 ppm/month and <±10 ppm for 25 °C, ±25 °C. Internal reference signal (10 MHz) available at rear connector, level >0 dBm, terminated in 50 Ω
Reference (External):	Accepts 1, 2, 2.5, 5, or 10 MHz signal, at a level of 0.3 Vpp to 4.0 Vpp into 50 Ω termination

1.2.2 Amplitude

Range (Indicated):	+16 (+16 peak with AM enabled) to -137 dBm, from 0.1 to 1049.99999 MHz +13 (+13 peak with AM enabled) to -137 dBm, from 1050 to 2100 MHz. (Autoranging 6 dB step attenuator)
Display:	3-1/2 Digits
Resolution:	0.1 dB (<1% or 1 nV in volts) Annunciators for dB, dBm, V, mV, μV, dBm/mV, and dBm/μV
Accuracy:	±1 dB from +16 to -127 dBm, from 1 to 1049.99999 MHz (±1.5 dB at temperatures other than 23 °C ±5 °C) ±1.5 dB from +13 to -127 dBm, from 1050 to 2100 MHz ±2.0 dB from +16 to -127 dBm, from 0.1 to .99999 MHz
Source VSWR:	<1.5:1 below 1 dBm; <2.0:1 otherwise

1.2.3 Spectral Purity (CW Only)

Spurious:	<-60 dBc for offsets greater than 10 kHz and frequencies from 0.1 to 1049.9999 MHz <-54 dBc for offsets greater than 10 kHz and frequencies from 1050 to 2100 MHz ***Note:*** *Fixed frequency spurs are <-60 dBc or <-140 dBm, whichever is larger. The term "dBc" refers to decibels relative to the carrier frequency or, in this case, relative to the signal level.*
Harmonics:	<-30 dBc for levels ≤+13 dBm and frequencies ≥1 MHz <-25 dBc otherwise
Subharmonics:	<-45 dBc for frequencies from 1050 to 2100 MHz
Residual FM (rms in 0.3 to 3 kHz band):	<12 Hz for 0.1 to 244.99999 MHz, <6 Hz for 245 to 511.99999 MHz, <12 Hz for 512 to 1049.999 MHz, <24 Hz for 1050 to 2100 MHz.
Residual FM (rms in 0.05 to 15 kHz band):	<18 Hz for 0.1 to 244.99999 MHz, <9 Hz for 245 to 511.99999 MHz, <18 Hz for 512 to 1049.999 MHz, <36 Hz for 1050 to 2100 MHz.
Residual AM (in 0.05 to 15 kHz band):	<-60 dBc

1.2.4 Amplitude Modulation

Depth Range:	0% to 99%
Display:	2 digits
Resolution:	1%
Accuracy:	±(2% + 4% of setting) for internal rates to peak amplitude of +13 dBm for frequencies of 1 to 2100 MHz ±(3% + 5% of setting) for internal rates to peak amplitude of +13 dBm for frequencies of 0.1 to 0.99999 MHz.
Distortion:	<1.5% total harmonic distortion (THD) to 30% AM <3% THD to 70% AM, <5% THD to 90% AM, for frequencies of 10 to 1049.99999 MHz and peak amplitude<+13 dBm <3% THD to 70% AM, and <5% THD to 90% AM, for frequencies of 1050 to 2100 MHz and peak amplitude <+13 dBm <3% THD to 30% AM, <5% THD to 70% AM, and <7% THD to 90% AM for frequencies of 0.1 to 9.99999 MHz and peak amplitude <6 dBm
Bandwidth (3 dB):	20 Hz to 50 kHz DC to 50 kHz by special function ***Note:*** *Valid for RF frequency - Mod frequency ≥150 kHz*
Incidental FM:	<0.3 fm for internal rates and ≤30% AM, and frequencies from 1050 to 2100 MHz

1.2.5 Frequency Modulation

Deviation Ranges:	0 to 999 Hz, 1 to 9.99 kHz, 10 to 99.9 kHz, and 100 to 400 kHz
Maximum Deviation	(Mod Rate >.2 kHz): 400 kHz for RF frequencies from 1050 to 2100 MHz 200 kHz for RF frequencies from 512 to 1049.99999 MHz 100 kHz for RF frequenceis from 245 to 511.99999 MHz 200 kHz for RF frequencies from 0.1 to 244.99999 MHz (Mod Rate <.2 kHz): The lower of the figure quoted above for ≥.2 kHz, or 2 fm fo for RF frequencies from 245 to 2100 MHz 2 fm (fo + 800) for RF frequencies from 0.1 to 244.99999 MHz ***Where:*** fm = mod frequency in kHz, fo = RF frequency in MHz deviation is in kHz Specifications apply where: RF frequency - Dev ≥150 kHz RF frequency - Mod Rate ≥150 kHz
Display:	3 digits
Resolution:	To 3 digits
Accuracy:	±(7% +10 Hz) for rates of 0.3 to 20 kHz (does not include effects of residual FM)
Distortion:	<1% THD for rates of 0.3 kHz to 20 kHz (does not include effects of residual FM)
Bandwidth (3 dB):	20 Hz to 100 kHz (Note: valid if RF frequency - Mod frequency ≥150 kHz)
Incidental AM:	<1% AM at 1 kHz rate, for the maximum deviation or 50 kHz, whichever is less (valid if RF frequency ≥1 MHz)

1.2.6 Phase Modulation (ØM)

Deviation Ranges:	0 to .099 rad, .100 to .999 rad, 1.00 to 9.99 rad, and 10.0 to 40.0 rad
Maximum Deviation:	20 rad from 0.1 to 244.99999 MHz 10 rad from 245 to 511.99999 MHz 20 rad from 512 to 1049.99999 MHz 40 rad from 1050 to 2100 MHz
Display:	3 digits
Resolution:	To 3 digits
Accuracy:	±(7% + .01 rad) at 1 kHz rate (does not include effects of residual FM)
Distortion:	<1% THD at 1 kHz rate (does not include effects of residual FM)
Bandwidth (3 dB):	20 Hz to 100 kHz (Note: valid if RF frequency - Mod frequency ≥150 kHz)
Incidental AM:	<1% AM at 1 kHz rate

1.2.7 Pulse Modulation

RF Frequencies from 10 to 2100 MHz

On/Off Ratio:	80 dB minimum
Rise & Fall Times:	<15 ns
Level Error:	For pulse widths ≥50 ns, power in the pulse within ±0.5 dB of the measured CW level
Duty Cycle (ext mod):	0 to 100%
Rep Rate (ext mod):	dc to 16 MHz
Internal Pulse Modulation:	Internal rates, approximately 50% duty cycle
External Pulse Modulation:	The pulse input is TTL compatible and 50 Ω terminated with an internal active pull up. It can be modeled as 1.2 V in series with 50 Ω at the pulse modulation input connector. The instrument senses the input terminal voltage and turns the RF off when the terminal voltage drops below 1 V ±0.1 V. Maximum allowable applied voltage, ±10 V

RF Frequencies <10 MHz

Rise & Fall Times:	≤(2 × period of RF frequency)
Level Error:	For pulse widths ≥ (10 x period of RF frequency), power in the pulse will be within ±0.5 dB of the measured CW level
	(Other specifications are same as the 10 to 2100 MHz range)

1.2.8 Modulation Source

Internal:	0.4 kHz or 1 kHz, ±3% for 20 °C to 30 °C; Add ±0.1% per degree Centigrade outside this range
External:	±5 V maximum.; 1 V peak provides indicated modulation index Nominal input impedance is 600 Ω
Modes:	Any combination of AM and FM or ØM, internal or external, may be used. If external AM and FM or øM are enabled, the modulation input Z will drop to approximately 560 ohms. Pulse modulation is completely independent and can be used in conjunction with any other form(s) of modulation.

1.2.9 Non-Volatile Memory

Fifty instrument states are retained for 2 years (typically), even without ac line power applied.

1.2.10 Reverse Power Protection

Protection Level	Up to 25 W from a 50Ω source. Up to 25 Vdc Instrument output is ac coupled
Trip/Reset:	Flashing RF OFF annunciator indicates a tripped condition. Pushing RF ON/OFF button will reset the instrument. Protection is provided when the instrument is OFF.

1.3 General Specifications

Power:	100, 120, 220, 240 Vac ±10%, 47 to 63 Hz, <180 VA <15 VA, with Option 130 installed, and the Generator turned off (standby)

Line Voltage	Fuse Rating
100/120 Vac	1.5 AMP
220/240 Vac	0.75 AMP

Temperature Operating:	0 °C to 50 °C (32 °F to 122 °F)
Non-Operating:	-40 °C to 75 °C (-40 °F to 167 °F)
Humidity Range Operating:	95% to 30 °C, 75% to 40 °C, 45% to 50 °C
Altitude Operating:	Up to 10,000 ft
Vibration Non-Operating:	5 to 15 Hz at 0.06-in, 15 to 25 Hz at 0.04-in, and 25 to 55 Hz at 0.02-in, double amplitude (DA)
Shock (Non-Operating):	Bench handling in accordance with EN55011 and EN50082
IEEE-488 Interface Functions:	SH1, AH1, T5, TE0, L3, LE0, SR1, RL1, PP0, dc1, DT1, C0, and E1
Electromagnetic Compatibility:	The radiated emissions induce <3 µV (<1 µV of the generator output signal) into a 1-inch diameter, 2-turn loop, 1 inch from any surface as measured into a 50Ω receiver Also complies with the following standards: CE03 of MIL-STD-461B (Power and interconnecting leads), 0.015 MHz to 50 MHz RE02 of MIL-STD-461B (14 kHz to 10 GHz) FCC Part 15(j), class A EN55011, EN50082
Dimensions	Width: 43 cm (17 in) Height: 13.3 cm (5.25 in) Depth: 50.8 cm (20 in)
Weight:	<15.7 kg (35 lbs)

1.4 Supplemental Characteristics

The following characteristics are provided to assist in the application of the generator and to describe the typical performance that can be expected.

Frequency Switching Speed: <100 ms to be within 100 Hz

Amplitude Switching Speed: <100 ms to be within 0.1 dB

Amplitude Range: Programmable to +17 dBm and -147.4 dBm. Fixed-range, selected by special function, allows for more than 12 dB of vernier without switching the attenuator

Amplitude Accuracy: ±2.0 dB from -127.1 to -137 dBm from 0.1 to 2100 MHz

Noise (at 20-kHz offset):
<-116 dBc/Hz from 0.01 to 244.99999 MHz
<-122 dBc/Hz from 245 to 511.99999 MHz
<-116 dBc/Hz from 512 to 1049.99999 MHz
<-110 dBc/Hz from 1050 to 2100 MHz

Residual FM (rms in 0.3 to 3 kHz):

Freq. Range	.3 to 3 kHz	.05 to 15 kHz	CCIT
0.1 to 244.99999 MHz	8 Hz	12 Hz	7 Hz
245 to 511.99999 MHz	4 Hz	6 Hz	3.5 Hz
512 to 1049.99999 MHz	8 Hz	12 Hz	7 Hz
1050 to 2100 MHz	16 Hz	24 Hz	14 Hz

External Modulation: Annunciators indicate when a 1 Vp signal is applied, ±2%, over a 0.02 kHz to 100 kHz band

IEEE: All controls except the power switch and internal/external reference switch are remotely programmable through the IEEE-488 Interface (Std 488-1978). All status including the option complement are available remotely. The Store/Recall memory data may be transferred via an external controller. In talk-only, the appropriate commands are generated when the front panel step-up and step-down entries are made to control another signal generator.

Frequency Drift: <1 ppm/hr after 1-hour warmup at constant ambient temperature using internal free-air crystal

Pulse Modulation

Pulse Delay:
Off/On: 80 ns typical
On/Off: 65 ns typical

2

Operation

2.1 Installation

This chapter describes how to install and operate the 6062A Synthesized RF Signal Generator.

2.1.1 Mounting the Generator

The generator can be placed directly on a work bench or mounted in a 24-inch deep equipment rack by using the optional Y6001 or Y6002 Rack Mount Kit. Instructions for installing the 6062A with Rack Mount Kit are provided in the kit (see Section 1.1.9).

CAUTION

Allow at least 3-inches of clearance behind and on each side of the generator for proper air circulation.

2.1.2 Rear Panel Description

Figure 2-1 illustrates the rear panel. The functions are described following the figure.

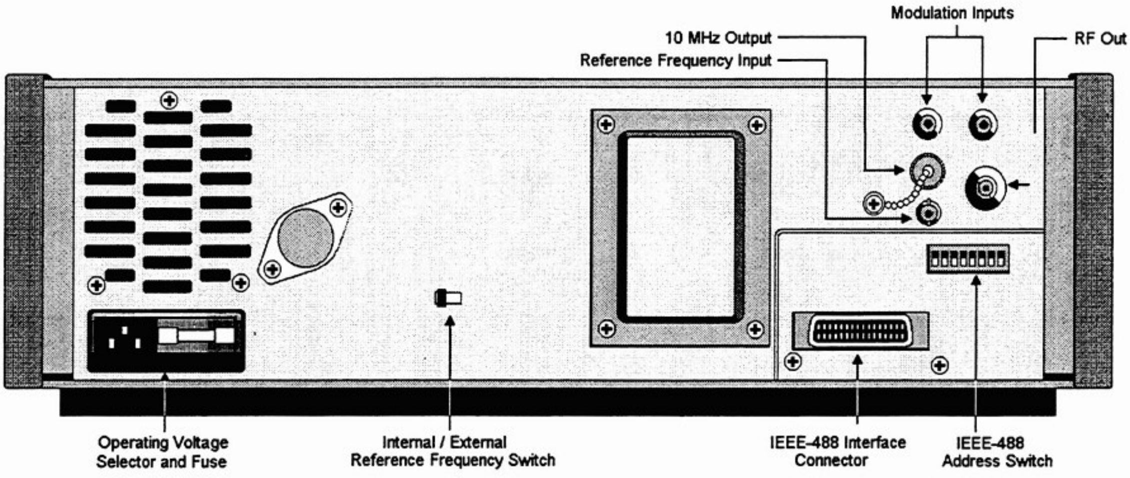


Figure 2-1. The Rear Panel

AC Input

The number visible through the window on the selector card indicates the nominal line voltage to which the generator must be connected. See Section 2.1.3 for the power and fuse requirements.

REF INT/EXT

The switch selects the generator reference frequency. When set to INT, the generator operates on the internal oscillator reference. The internal 10 MHz reference signal is available at the 10 MHz OUT connector. When set to EXT, the generator reference is a 1, 2, 2.5, 5, or 10 MHz signal applied to the external REF IN connector.

10 MHz Out

This output provides a 10 MHz sine wave >0 dBm level when terminated into 50 Ω.

REF In

This input accepts a 1, 2, 2.5, 5, or 10 MHz, 0.3 to 4 V_{pp} sine wave or square wave into 50 Ω nominal.

MOD Input

This input is present only with Option -830 to accept a 1 V peak external modulation signal.

Pulse MOD Input

This input is present only with Option -830 to accept a 1 V peak external pulse modulation signal.

RF Output

This BNC output (type N) is present only with Option -830 to provide the generator output signal.

IEEE-488 Interface

This connector enables remote operation of the generator through the IEEE-488 bus. To meet the specified radiated emissions, the IEEE-488 connector must be terminated with a shielded IEEE-488 cable, such as a Giga-tronics WMAS-06624 2M IEEE cable.

IEEE Address Switch

This 8-position DIP switch selects the generator bus address and the talk-only and listen-only modes.

2.1.3 Power and Fuse Requirements

The 6062A operates on a line voltage of 100/120 Vac (±10%) or 220/240 Vac (±10%). The line frequency must be between 48 and 63 Hz. The power consumption of the instrument is <180 VA with all options installed.

Before operating the instrument, make sure the voltage selection and fuses are compatible with the power source to be used.

☛ *NOTE:* The generator may be furnished with the voltage selector and fuse holder described in Section 2.1.4, or the VDE-approved fuse holder described in Section 2.1.5. Refer to the appropriate section for your generator.

CAUTION

The instrument may be damaged if you attempt to operate it while the line voltage selector and fuses are incorrect for the applied line voltage.

The generator has a 3-wire power cord with a 3-terminal polarized plug for connection to the power source and safety ground.

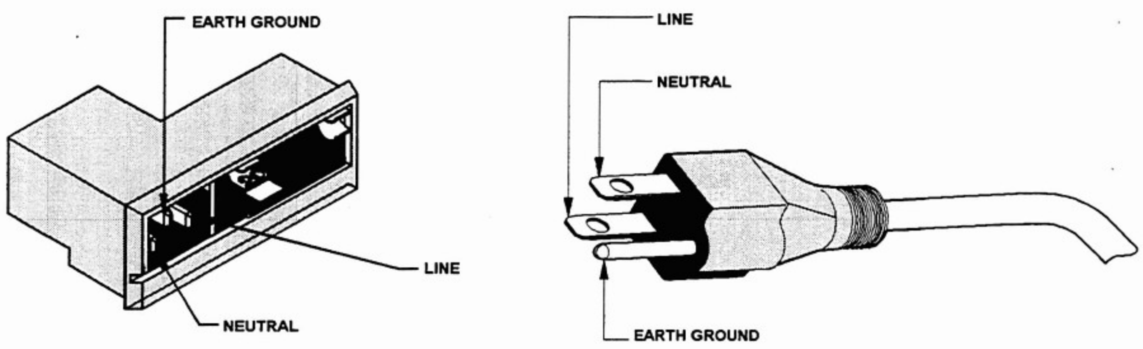


Figure 2-2. Power Line Connection

WARNING

The safety ground is connected directly to the chassis. If a 3-to-2 wire adapter is to be used, be sure to connect the ground lead from the adapter to earth ground. Failure to do this could cause the instrument to float above ground, posing a shock hazard.

2.1.4 Voltage and Fuse Selection

The line voltages and fuse ratings are:

Line Voltage	Fuse Rating
100/120 Vac, ±10%, 47 Hz to 63 Hz	1.5 AMP
220/240 Vac, ±10%, 47 Hz to 63 Hz	0.75 AMP

To select a different operating line voltage and fuse, refer to Figure 2-3 and proceed as follows:

1. Open the cover door, rotate the fuse-pull to the left, and remove the fuse.
2. Select the operating voltage by orienting the PC board so that the correct voltage label is on the top left side.
3. Push the board firmly back into the module slot.
4. Rotate the fuse-pull back into the normal position and reinsert the fuse into the holder. Use care to select the correct fuse value.

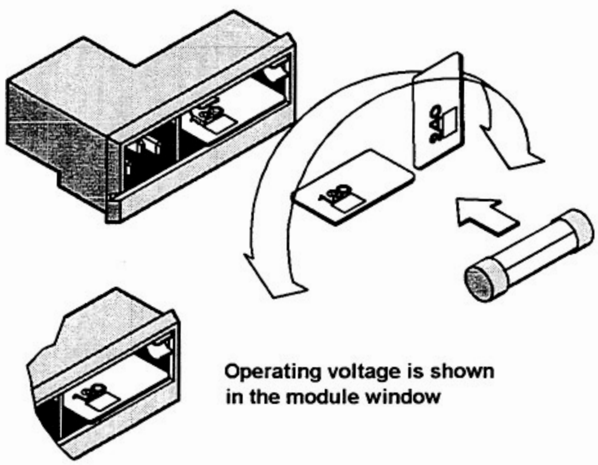


Figure 2-3. Voltage Selection and Fuse Requirements

2.1.5 VDE Type Voltage and Fuse Holder

The VDE-approved voltage selector and fuse holder are contained in a covered housing directly above the ac power connecter.

The line voltages and fuse ratings are:

Line Voltage	Fuse Rating
100/120 Vac, ±10%, 47 Hz to 63 Hz	1.5 AMP
220/240 Vac, ±10%, 47 Hz to 63 Hz	0.75 AMP

To gain access to the voltage selector and fuse, open the cover using a small screwdriver or similar tool and proceed as follows:

To change the voltage setting:

Use the same tool to remove the voltage selector (a small barrel-shaped component marked with voltage settings). Rotate the selector so that the desired voltage faces outward and place the selector back in its slot. Close the housing cover; the appropriate voltage should be visible through the window (see Figure 2-4).

To replace the fuse:

With the housing cover open, pull out the small drawer on the right side of the housing (it's marked with an arrow) and remove the old fuse. Replace with a new fuse, insert the drawer and close the housing cover (see Figure 2-4).

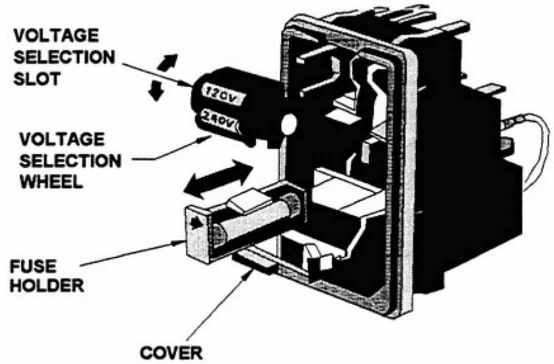


Figure 2-4. VDE Voltage Selector & Fuse Holder

2.2 Operation

This section contains general information on how to operate the 6062A generator. This includes all the information required to familiarize you with the instrument, and local (front panel) and remote (GPIB) operation.

Figure 2-5 shows the front panel controls, indicator, and connectors. The functions are described following the figure.

The 6062A normally operates with an internal reference oscillator. However, it can be operated from an external reference by setting the rear panel REF INT/EXT switch to EXT and connecting the external reference to the REF IN connector.

When the instrument is operating on the internal reference, a 10 MHz signal is present at the 10 MHz OUT connector on the rear panel. To meet the specified radiated emissions, this connector must be terminated with a BNC non-shorting dust cap. A dust cap, Giga-tronics part number JRDC-00001, is supplied with the generator for this purpose. If a cable is connected, it must be a double-shielded coaxial cable, such as RG-223, terminated in a 50 Ω load.

CAUTION

Output spectral degradation occurs if the generator is operated on internal reference with an external reference signal applied.

When the generator is turned on, a power-on self-test (POST) sequence is started. During the power-on sequence, the microprocessor tests the analog circuitry, the program ROM, the scratch-pad RAM, the compensation memory, and the front panel displays. The front panel displays are tested by turning on all segments for a brief period at the same time the rest of the self-tests are performed.

An error code will display if any of the self-tests fail. If you initiate any front panel entry before the power-on sequence is complete, the self-test will abort and the generator will reset to the state it was in when turned off. Table 2-2 lists the Instrument Preset State. Power-on instrument settings that relate to the IEEE-488 Interface are described in the Remote Operation paragraphs in this chapter. Power-on Self Tests are described in Section 5.4.

The output of the generator can be operated in a local or remote mode. The local mode uses the keys on the front panel. The remote mode is through the IEEE-488 controller. An overview of local control is presented first. Operating Reference in Section 2.5 is divided into two parts. The first part covers local and remote control operations that have similar entry methods. The second part, Remote Operation, contains information on commands or descriptions that pertain only to remote operations.

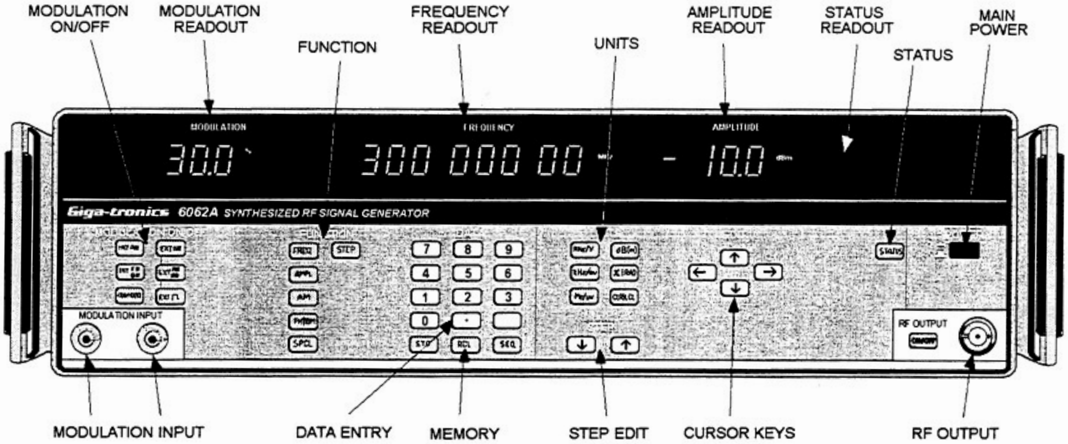


Figure 2-5. Front Panel Controls & Connectors

MODULATION Display

MODULATION is a 3-digit display with the indicators listed below to display the AM depth, FM deviation, source of modulation signal, and modulation frequency.

INT AM	The internal modulation oscillator signal is amplitude modulating the generator.
EXT AM	The generator is amplitude modulated by the signal connected to the MOD INPUT connector.
INT FM	The internal modulation oscillator signal is frequency modulating the generator.
EXT FM	The generator is frequency modulated by the signal connected to the MOD INPUT connector.
INT ϕM	The internal modulation oscillator signal is phase modulating the generator.
XT ϕM	The generator is phase modulated by the signal applied to the MOD INPUT connector.
INT ⎍	The internal modulation oscillator signal is pulse modulating the generator.
EXT ⎍	The generator is pulse modulated by the signal connected to the PULSE MOD INPUT connector.
STEP	The Step [↑] or [↓] keys (Step Entry) change the current Modulation display value.
%	The value displayed is AM Depth in percentage.
kHz DEV	The value displayed is FM Deviation in kHz.
rad	The value displayed is Phase Modulation Deviation in radians.
dBm	The value displayed is the target level in dBm when performing a level compensation procedure.
400 Hz	The internal modulating frequency is 400 Hz.
1000 Hz	The internal modulating frequency is 1000 Hz.
EXT HI	The external modulation signal is more than 2% above the nominal 1 V peak requirement for calibrated operation.
EXT LO	The external modulation signal is more than 2% below the nominal 1 V peak input requirement.

FREQUENCY Display

FREQUENCY is a 9-digit display with two indicators to display the output frequency of the generator. It also displays the special function code, status error codes, the memory location being stored or recalled, the relative and actual frequency (when REL is lit), and step frequency.

STEP	The Step [↑] or [↓] keys (Step Entry) affect the output frequency.
REL	The displayed frequency is relative to a reference frequency.
COMP	The compensation memory protection switch on the A2 Controller assembly is set to the enabled position.
FM	An FM compensation procedure is in progress.
OUT	An Output compensation procedure is in progress.
ATT	An Attenuator compensation procedure is in progress.

AMPLITUDE Display

AMPLITUDE is a 3-1/2 digit display with six indicators to display the output amplitude of the generator into a 50-ohm load.

STEP	The Step [↑] or [↓] keys (Step Entry) affect the output amplitude.
REL	The displayed amplitude is relative to a reference amplitude.
dBm	The output amplitude is in decibels relative to one milliwatt.
V	The output amplitude is in volts.
μV	The output amplitude is in microvolts.
mV	The output amplitude is in millivolts.

STATUS Display

The status display field is composed of 11 indicators to show the current status of the generator or instrument entry.

EXT REF	The rear panel REF switch is in the EXT (external) position.
REJ Entry	Lights when an invalid entry is made.
UNCAL	Turns on when a parameter entry is outside its specified range. This indicator flashes when any of the internal DACs have over- or under-flowed or when any abnormal operation is detected.
RF OFF	Turns on when the RF OUTPUT is disabled.
REMOTE	Turns on when the generator is in the remote (IEEE-488 Interface) mode of operation.
ADDR	Turns on when the generator is addressed to listen or talk.
SRQ	Turns on when the generator has asserted the IEEE-488 SRQ signal.

MODULATION ON/OFF

These keys select the type, source, and frequency of modulation. With the exception of the [400/1000] key, these keys operate as independent push-on/push-off switches for the given function. Any combination is allowed.

INT AM	Enables internal amplitude modulation at the frequency annunciated by the 400/1000 Hz indicator.

INT FM/ϕM — Enables internal frequency modulation at the frequency annunciated by the 400/1000 Hz indicator.

EXT AM — Enables external amplitude modulation using the signal applied to the MOD INPUT connector.

EXT FM/ϕM — Enables external frequency modulation using the signal applied to the MOD INPUT connector.

EXT ⎍ — Enables external pulse modulation using the signal applied to the pulse modulation input connector.

400/1000 — Sets the internal modulation oscillator frequency to 400 or 1000 Hz. The selected frequency is displayed only when INT AM, FM ϕM, or internal pulse is enabled (see Section 2.3.1).

FUNCTION

With exception of the [STEP] and [SPCL] keys, these keys operate as interlock switches that select the parameter to be entered or edited. For the [FREQ], [AMPL], [AM], and [FM] keys, the cursor appears in the corresponding display of the selected function.

FREQ — Selects the frequency parameter of the generator to be programmed by using the DATA, EDIT, or STEP entry keys.

AMPL — Selects the amplitude parameter of the generator to be programmed by using the DATA, EDIT, or STEP entry keys.

AM — Selects the amplitude modulation (AM) parameter of the generator to be programmed by using the DATA, EDIT, or STEP entry keys.

FM/ϕM — Selects the frequency modulation (FM) or phase modulation (ϕM) parameter of the generator to be programmed by using the DATA, EDIT, or STEP entry keys.

SPCL — Enables the special function mode. Special functions are called up by a two-digit code that is entered with the DATA keys. Refer to Section 2.3.9 for a detailed description of special functions.

Step — After one of the four parameter functions has been selected for programming, press [STEP] to perform a step change to that parameter. The step increase or decrease is performed every time the STEP [↑] or [↓] key is pressed.

DATA

This is a ten-digit numeric keypad for entering a parameter value or a special function code. It includes Memory Store/Recall.

MEMORY Store/Recall

STO — Used with the DATA keys to store the current instrument state in a memory location. Memory locations 01 through 50 are available.

RCL — Used with the DATA keys to recall an instrument state from a memory location. Memory locations 01 through 50 are available for operator-stored states; memory location 98 contains the Instrument Preset State (see Table 2-2).

SEQ — Sequentially recalls, in increasing location order, the instrument states stored in memory. While the [SEQ] key is pressed, successive memory locations are displayed. When [SEQ] is released, the location last displayed is recalled.

UNITS

These keys with exception of [CLR/LCL] serve as the terminating keystroke of a function entry, causing the generator to be programmed. The amplitude units keys are also used during Amplitude Units Conversion entries.

MHz/V	Used with the [FREQ], [FM], and [AMPL] function keys to program the numerical DATA entries in Megahertz (frequency or frequency modulation) or Volts (amplitude).
dB(m)	Used with the [AMPL] function key to program the numerical DATA entries in decibels per milliwatt.
kHz/mV	Used with the [FREQ], [FM], and [AMPL] function keys to program the numerical DATA in kilohertz (frequency or frequency modulation) or millivolts (amplitude).
%	Used with the [AM] function key to program the numerical DATA entries in percentage AM depth.
Hz/μV	Used with the [FREQ], [FM], and [AMPL] function keys to program the numerical DATA in hertz (frequency or frequency modulation) or microvolts (amplitude).
CLR/LCL	When the generator is in local operation, the [CLR/LCL] key clears the current entry and returns the generator to the previous state. When the instrument is in remote operation, it returns to local control.

STEP

These two keys work in conjunction with the [STEP] function key. These keys repeat while they are pressed.

↑	After a parameter is set to the Step function mode and the STEP indicator appears in the display field, this key increments the parameter by the step value previously programmed.
↓	After a parameter is set to the STEP function mode and the STEP indicator appears in the display field, this key decrements the parameter by the step value previously programmed.

EDIT

The function keys move the cursor to the desired display field; the left and right directional keys position the cursor (bright digit) within the selected display; and the up and down keys increase or decrease the parameter value. All four directional keys repeat while they are pressed.

STATUS

A push-and-hold key that displays the Uncal and Reject Entry status codes in the Modulation, Frequency, and Amplitude display fields.

POWER

A push-on/push-off switch to control line power to the generator.

MODULATION INPUT

A BNC connector for input of a 1 V peak external modulation signal.

RF OUTPUT

A standard RF connector at the output of the generator, with a push-on/push-off switch (with a corresponding RF OFF indicator in the STATUS display field) that enables or disables the RF output of the generator.

2.3 Local Control

The value of the operating parameters (amplitude, frequency, and modulation) can be controlled by any of the three methods available on the front panel, illustrated in Figure 2-5. The methods are:

- Direct entry with the numeric keypad (Function-Data-Units Entry)
- Incrementing or decrementing values with the *bright digit* cursor (cursor directional keys)
- Step-up or step-down entry (step resolution is operator-selective with the up/down cursor keys)

Other controls select power on/off, RF output, modulation, internal/external frequency reference, and status.

These methods all use different approaches but accomplish the same results. Redundant methods reduce the chance of error during complex test procedures that require continuously resetting parameters, or in those cases when a test is partly under remote control and only some of the parameters require changes.

The edit cursor used in the 6062A is a bright digit in the display. Move this cursor with the EDIT keys to the parameter to be changed. With the cursor positioned on the desired digit, you can change the value of the parameter as described in these procedures.

2.3.1 Function-Data-Units Entry

Changing a parameter with the Function-Data-Units entry method consists of:

1. Selecting the Function to be changed.
2. Entering the new numerical value of the parameter.
3. Selecting the Units of the numerical value (MHz, mV, etc).

   The command syntax for Function-Data-Units entries is:

   Select Function → Enter Data → Select Unit

4. Select one of the four parameters in the FUNCTION field. The cursor will appear in the corresponding display field. The presence of the cursor in the display indicates that the selected parameter is ready to be programmed or changed.

   For the amplitude and frequency functions, the entered data programs the displayed value. If the relative mode is enabled, the displayed value can be different from the actual output value. After a function is selected, that parameter or feature remains in the active programming mode until a new function is selected. Data for a selected parameter must be followed by a unit value and must be within the range specified for the function. The display field and the REJ ENTRY status indicator flash if the entered data is not within the specified range. A rejected entry does not affect the output of the generator. The output remains at its previous value until a new value is accepted.

   A function entry can be terminated at any time by the [CLR/LCL] key or by selecting another function.

5. Enter the data with the DATA numeric keys. Each entered digit appears at the cursor position. Move the cursor as necessary to enter all necessary digits in the display.
6. Select a UNITS key. This gives the data its unit value and causes the microprocessor to internally program the generator to the new state.

2.3.2 Edit Entry

Changing a parameter by the edit entry method is the fastest way to make vernier (incremental) changes to one of the four parameters. The EDIT keys are used with the four parameter FUNCTION Keys to position the cursor in the desired display field and then increase or decrease the value marked by the cursor.

The command syntax for EDIT entries is:

Select Display Field → Position Cursor → Change Parameter Value

1. Use one of the four FUNCTION keys to position the cursor in the appropriate display field.
2. Use the [→] or [←] EDIT keys to position the cursor to the desired resolution, and use the [↑] or [↓] EDIT keys to increase or decrease the value of the parameter marked by the cursor.

The position of the cursor within a display field is maintained when the cursor is moved from one display field to another.

The repeat rate of the [↑] or [↓] EDIT keys can be changed to a faster or slower rate (a medium repeat rate is the default) with a special function code. Refer to the List of Special Functions in Table 2-1 and the reference pages in this section for the method and code.

2.3.3 Step Entry

Changing parameters by the Step Entry method allows you to set the step resolution of a parameter, then to change that parameter by the amount programmed in the step function, using the [↑] or [↓] keys.

The command syntax for STEP entries is:

Select Step Function → Enter Data → Select Units → Change Parameter

1. Select the parameter to be changed by steps, using one of the FUNCTION keys followed by the [STEP] key to enable the Step function.
2. Program the step resolution with the DATA keys.
3. Select a UNIT key to give the data its absolute value.
4. The parameter value can now be changed, up or down by the programmed step amount with the [↑] or [↓] STEP keys.

While the [STEP] key is pressed, the display field of the selected parameter shows the step amount. The STEP indicator is lit in the display field currently affected by the [STEP] key.

The repeat rate of the [↑] or [↓] STEP keys can be changed to a faster or slower rate (a medium repeat rate is the default) with a Special Function code. Refer to the List of Special Functions in Table 2-1 and the reference material for the method and code.

A step entry is ignored when the result of that step entry would cause the value of the parameter to exceed its programmable limit.

2.3.4 Status and Clear Entries

The Status entry allows you to interrogate the generator for an explanation of uncalibrated or rejected entry operation (UNCAL or REJ ENTRY indicator is lit). Refer to Tables 2-18 and 2-19 for a complete list of status codes.

The [CLR/LCL] key can be used to clear a partial DATA entry or clear the flashing REJ ENTRY indicator.

2.3.5 RF Output

The RF Output ON/OFF switch enables or disables the RF output. This feature is useful in zeroing a power meter, finding the noise floor of a system, or determining the presence or source of an unknown signal (see Section 2.5.9).

At power-up, the RF output assumes the state it was in when the generator was turned off. Press [ON/OFF] to disable the output and turn on the RF OFF indicator in the STATUS display field. If the RF Output was off at power-on, press [ON/OFF] to enable output.

2.3.6 Modulation and Rate

The Modulation ON/OFF keys allow you to select any combination of modulation or no modulation. The Modulation display field indicates what combination of modulation has been selected. Each modulation key is a push-on push-off, except the [400/1000] key.

The [400/1000] key toggles the internal modulation oscillator between 400 and 1000 Hz. The 400 Hz and 1000 Hz indicators are on only when INT AM, FM, ϕM, or Pulse modulation is enabled.

2.3.7 Memory

Memory entry allows you to save up to 50 complete front panel settings for later recall. The memory store [STO], recall [RCL], and sequential recall [SEQ] keys are located below the Data keys.

The command syntax for memory operations follows. No memory location needs to be specified for the sequence operation.

Select Memory Function → Enter Memory Location

1. Press [STO] to store the current front panel setting. The last memory location stored or recalled is displayed in the Frequency display field.
2. Enter the two-digit memory location code with the Data keys. The location code must contain both digits (e.g., 01, 02, ...50). The two-digit code appears in the Frequency display field as it is entered.
3. Press [RCL] to recall a front panel setting. The last memory location stored or recalled is displayed in the Frequency display field.
4. Enter the memory location code with the Data keys of the desired front panel setting. The entry must contain both digits of the memory location code.

Memory location 98 contains the instrument preset (default) state that can be recalled at any time (see Table 2-2).

Press [SEQ] at any time to sequentially recall front panel settings. While [SEQ] is held down, the memory location codes of currently stored settings sequentially appear in the Frequency display field. When the last memory location (50) is reached, the sequence starts over at 01. When [SEQ] is released, the last recalled setting is displayed in the Frequency display field.

2.3.8 Software Compensation Procedures

The Software Compensation procedures allow you to update the instrument-specific compensation data after making required repairs. These procedures are easy to use and can be performed through the front panel (local) or under computer control (remote) through the IEEE-488 interface. Local procedures enable secondary function for many of the keys. Each remote procedure enables a special set of compensation commands and disallows much of the standard IEEE-488 command set. Refer to the Compensation Procedures in Section 5.8.

2.3.9 Special Functions

Special Function Entries allow you to enable several special operating functions in the generator. For example, special functions allow you to change the repeat rate of the STEP and EDIT keys, start the self-tests, display the results of the power-up self-tests, display the IEEE-488 address, enable relative and fixed-range features, and disable or enable special attenuation features. A complete list of Special Functions codes is in Table 2-1.

The command syntax for special function entries is as follows:

Select Special Function → Enter Special Function Code

Press [SPCL] and enter the special function code with the Data keys.

Table 2-1. List of Special Functions

Special Function Code	Operation
00	Clears all currently set special functions.
02	Initiates self-tests.
03	Display test. This test is detailed in Chapter 3.
04	Key test. This test is detailed in Chapter 3.
07	Set SRQ.
08	Reset SRQ.
09	Display instrument software revision level. Information appears in the MODULATION and FREQUENCY display fields for 5 seconds or until another key is pressed.
10	Display IEEE-488 mode and address in decimal form.
11	Display self-test results. Zeros in the display fields indicate that the self-tests have passed. See Chapter 4 for details of the self-test display.
12	Turn on displays.
13	Turn off all displays. All other functions still operate.
14	Initialize memory locations to Instrument Preset State. **Sto ?** appears in the FREQUENCY display field for 5 seconds. If during this time, the [STO] key is pressed, all memory locations are initialized.
15	Latch test. This test is detailed in Chapter 4.
16	Display option loading. See *Interrogate Commands* in this chapter for details.
17	Initiate self-test with RF on. This test is detailed in Chapter 4. The RF output can be programmed to levels as high as +19 dBm during this test.
20	Disable Relative Frequency. See Relative Function in this chapter.
21	Enable Relative Frequency. See Relative Function in this chapter.
30	Disable Relative Amplitude. See Relative Function in this chapter.
31	Enable Relative Amplitude. See Relative Function in this chapter.
40	Disable Internal Pulse Modulation. See Modulation Entry in this chapter.
41	Enable Internal Pulse Modulation. See Modulation Entry in this chapter.
50	Select dBm Amplitude Display Mode. See Amplitude Units Selection in this chapter.
51	Select dBmV Amplitude Display Mode. See Amplitude Units Selection in this chapter.
52	Select dBμV Amplitude Display Mode. See Amplitude Units Selection in this chapter.

Special Function Code	Operation
60	Disable DC AM mode. See Modulation Entry in this chapter.
61	Enable DC AM mode. See Modulation Entry in this chapter.
70	Set repeat rate for EDIT and STEP keys to medium.
71	Set repeat rate for EDIT and STEP keys to fast.
72	Set repeat rate for EDIT and STEP keys to slow.
75	Display Compensation Memory status. See Chapter 4.
76	Repair Compensation Memory Errors. See Chapter 4.
77	Load FM MEC PROM data into Compensation Memory. See Chapter 4.
78	Load Output MEC PROM data into Compensation Memory. See Chapter 4.
79	Load Attenuator MEC PROM data into Compensation Memory. See Chapter 4.
80	Enable Amplitude correction. Normal operation.
81	Disable Amplitude correction. RF output level can be up to 12 dB low.
82	Disable attenuator correction. Useful as a troubleshooting tool. RF input to attenuator is flat.
83	Program alternate 24 dB attenuation. See Chapter 4.
84	Program alternate 24 dB attenuation. See Chapter 4.
85	Program alternate 24 dB attenuation. See Chapter 4.
86	Program alternate 24 dB attenuation. See Chapter 4.
90	Disable Amplitude Fixed Range. See Amplitude Fixed Range in this Chapter.
91	Enable Amplitude Fixed Range. See Amplitude Fixed Range in this chapter.
95	Initiate FM Keyboard Compensation Procedure. See Chapter 4.
96	Initiate Output Keyboard Compensation Procedure. See Chapter 4.
97	Initiate Attenuator Keyboard Compensation Procedure. See Chapter 4.
98	Initiate Output with Default Attenuator Data Keyboard Compensation Procedure. See Chapter 4.

Table 2-2. Instrument Preset State

Function	Setting
Frequency	300.00000 MHz
Frequency Step	1.00000 MHz
Amplitude	-10.0 dBm
Amplitude Step	1 dB
Modulation Rate	1000 Hz
AM Depth	30%
AM Depth Step	1%
FM Deviation	5.0/.5 kHz
FM Deviation Step	100/10 Hz
Modulation Display	AM Depth
Cursor Location	Frequency Cursor
Frequency Cursor Position	1 MHz
Amplitude Cursor Position	1 dBm
AM Cursor Position	1 %
FM Cursor Position	10/1 Hz
Special Functions	20,30,40,50,60,70,80,90
INT AM	Off
EXT AM	Off
INT FM	Off
EXT FM	Off
Step Function	Frequency Step

2.4 Remote Operation

2.4.1 Remote-Control

The IEEE-488 Interface enables remote operation with any IEEE-488 bus controller. The generator can also be used on the IEEE-488 bus without a controller in a listen-only or talk-only mode by setting the rear panel IEEE-488 switches.

All functions can be remotely controlled except the front panel POWER switch and the rear panel REF INT/EXT switch. The IEEE-488 Interface provides additional commands not available with local control, such as data transfer and individual control of internal I/O control bits.

With the IEEE-488 Interface, two generators can track amplitude, frequency, or modulation in a master/slave configuration when using the front panel step-up and step-down entries on one of the instruments. For example, frequency tracking is convenient for tests involving mixers, and amplitude tracking is useful for two-tone intermodulation testing.

The following paragraphs describe how to operate the generator using the IEEE-488 Interface. The IEEE-488 Interface allows you to program the generator and operate instrument functions via the IEEE-488 bus (with the exception of the front panel POWER switch and the rear panel REF INT/EXT switch). The IEEE-488 Interface also provides additional programming features not accessible from the front panel.

The rest of this chapter is divided into two parts: the first part describes how to set up the generator for operation on the IEEE-488 bus and gives some typical programming examples. The first part also includes a complete list of the programming commands recognized by the generator software.

The second part describes the implementation of the IEEE-488 interface and programming features that are accessible only from the IEEE-488 Interface. The second part includes typical timing data, provided as an aid to system programmers. This information can assist in writing programs that have greater speed and efficiency.

The generator can be used with any IEEE-488 controller in the normal addressed mode. The following two additional modes are available for operation without a controller:

Listen-only mode
Talk-only mode

In the listen-only mode, the generator responds to all data messages on the IEEE-488 bus. In the talk-only mode, the generator sends commands on the IEEE-488 bus to program another 6062A or similar generator.

2.4.2 Setting Up the IEEE-488 Interface

Use the following procedure to set up the generator with the IEEE-488 Interface:

1. Connect a standard IEEE-488 cable between the generator and the IEEE-488 device.

> NOTE: The IEEE-488 Interface signal SHIELD (pin 12) can be disconnected (when using an IEEE-488 cable with a metallic hood) from instrument ground. To do this, use the left most address switch (as viewed from the rear panel).

2. Select the IEEE-488 address and mode as follows:

   a. Set both the LISTEN ONLY and TALK ONLY switches (located on the rear panel) to 0 (down). Set address switches 1 through 5 to the desired address, 0 through 30. For example, for an address of 1, set switches 2, 3 4, and 5 to 0 (down), and set switch 1 to 1 (up).

b. For talk-only operation, set the TALK ONLY switch to 1 (up).

c. For listen-only operation, set the LISTEN ONLY switch to 1 (up) and the TALK ONLY switch to 0 (down).

3. Verify the address and mode:

a. Press the [SPCL] and the [1] [0] keys. Verify that the selected address appears in decimal in the FREQUENCY display field.

b. If the talk-only mode or listen-only mode has been selected, **to** or **lo** appears to the left of the address in the FREQUENCY display field.

NOTE: The address switches are continuously monitored except when in remote. The TALK ONLY and LISTEN ONLY switches are only read when the generator is powered on.

2.4.3 Programming Commands

After the address and mode have been set, the generator can be programmed by an IEEE-488 controller or from another generator. Table 2-3 and Table 2-4 and the programming examples following them provide the basic information on how to program the generator.

More details about the commands can be found in two places. Commands that are available from the front panel are described in the first part of this section. Those commands that are only available from the IEEE-488 Interface are described in the Commands Descriptions paragraphs later in this section of the manual.

Table 2-3 is an index for the IEEE-488 Commands. It is a list of the command headers according to function. Table 2-4 lists all the remote commands that are recognized by the generator. The commands are listed alphabetically by function.

Table 2-3. Index of IEEE-488 Commands

Function	Command Headers
Amplitude Entry	AP, SP3x, RA, SP5x, SP8x, SP9x
Binary Learn Commands	LI, LM
Clear Commands	CB, CE, CL
Compensation Mode Commands	CM
Compensation Procedure Commands	CF, CP, IC, IH
Edit Entry	AB, DB, FB, PB, KB, KA, KD, KF, KP
Frequency Entry	FR, SP2x, RF
Interface Mode Commands	EM, RM, TM, VM, UM, @
Interrogate Commands	IA, ID, IE, II, IL, IO, IR, IS, IT, IU, IV, IZ
Memory Entry	RC, ST, SQ
Modulation Entry	AM, AE, AI, SP6x, DA, FM, FE, FI, MR, MF, PE, SP4x, PI
Monitor Commands	IB, OB, OD, RB, RW, DW, WB, WW, XA, XB, XD, XR
RF ON/OFF Entry	RO
Special Function Entry	SP
SRQ Commands	IM, SM, XF
Step Entry	FS, LS, PS, DS, SU, SD, FU, FD, LU, LD, PU, PD, DU, DD
Trigger Commands	CT, TR

Table 2-4. IEEE-488 Commands

Command Use	Command Header	Command Numeric	Command Suffix	Comments
Amplitude Entry				
Program Amplitude	AP	float	 V MV UV NV DB	Program displayed amplitude in units of: volts millivolts microvolts nanovolts dB, dBm, dBmV, or dBμV
Convert Amplitude Units	AP	none	 V MV UV NV DB	Change amplitude units to: volts millivolts microvolts nanovolts dB or dBm
Relative Amplitude	SP	30/31	none	Disable/enable relative amplitude operation.
Relative Amplitude	RA	0/1		Alternate programming command for disable/enable relative amplitude operation.
Amplitude Display Units	SP	50 51 52	none	Select dBm units. Select dBmV units. Select dBμV units.
Level Correction	SP	80 81 82	none	Enable all level correction. Disable all level correction. Disable attenuator correction.
Amplitude Fixed Range	SP	90/91	none	Disable/enable amplitude fixed-range operation.
Binary Learn Commands				
Store a Front Panel Setup	LI	int	string	The generator stores the string into the memory location specified by int. See the Command Descriptions paragraph for decoding the learn string.
Send a Front Panel Setup	LM	int	none	The generator responds with the contents of the memory location specified by int. See the Command Descriptions paragraph for decoding the learn string.
Clear Commands				
Clear IEEE-488 Output Buffer	CB	none	none	Clears IEEE-488 output buffer.
Clear error	CE	none	none	Clears the IEEE-488 rejected entry status.
Device Clear	CL	none	none	Clears the state and exits all compensation procedures.
Compensation Mode Commands				
Compensation Mode	CM	none	AT FM OD OT SV EX	Begin Attenuator compensation procedure. Begin FM compensation procedure. Begin Output with default attenuator compensation procedure. Begin Output compensation procedure. Save compensation data and exit compensation procedure. Exit compensation procedure without saving the data.

Command Use	Command Header	Command Numeric	Command Suffix	Comments
Compensation Procedure Commands				
Compensation FM Entry	CF	float	GZ MZ KZ HZ	Accept FM deviation reading from modulation analyzer during FM compensation procedure.
Compensation Amplitude Entry	CP	float	DB	Accept amplitude reading from power meter during level compensation procedure.
Interrogate Compensation Step Data	IC	none	FR TG	Interrogate the frequency of the current compensation procedure step. Interrogate the target level or FM deviation of the current compensation procedure step.
Interrogate Het Adjustment Data	IH	none	none	Interrogate the frequency and level offset necessary to make the het compensation adjustment. For example, +000012000, +00000000.30<EOR> indicates the adjustment should be made at 120 kHz and the level needs to be adjusted up .3 dB.
Edit Entry				
Position Amplitude Cursor	AB	float	V MV UV NV DB	Position the cursor in the AMPLITUDE display with the stated resolution. For example, enter AB10MV for 10 mV resolution.
Position FM Cursor	DB	float	GZ MZ KZ HZ RD	Position the cursor in the FM display with the stated resolution. For example, enter DB1KZ for 1 kHz resolution.
Position Frequency Cursor	FB	float	GZ MZ KZ HZ	Position the cursor in the FREQUENCY display with the stated resolution. For example, enter FB1MZ for 1 MHz resolution.
Position AM Cursor	PB	float	PC	Position the cursor in the AM display with the stated resolution. For example, enter PB1PC for 1% resolution.
Edit	KB	float	none	Edit the current cursor by float counts.
Edit Amplitude	KA	float	none	Move the cursor to the AMPLITUDE display and edit amplitude by float counts.
Edit FM	KD	float	none	Move the cursor to the FM display and edit FM by float counts.
Edit Frequency	KF	float	none	Move the cursor to the FREQUENCY display and edit frequency by float counts.
Edit AM	KP	float	none	Move the cursor to the AM display and edit AM by float counts.
Frequency Entry				
Frequency Programming	FR	float	 GZ MZ KZ HZ	Program displayed frequency in units of: gigahertz megahertz kilohertz hertz
Relative Frequency	SP	20/21	none	Disable/enable relative frequency operation.
Relative Frequency	RF	0/1	none	Alternate programming command for disable/enable relative frequency operation.

Command Use	Command Header	Command Numeric	Command Suffix	Comments
Interface Mode Commands				
Error Mode	EM	0/1	none	Disable/enable the clear error mode. If disabled, the IEEE-488 error status is cleared only when interrogated. If enabled, the error status is cleared when a new message is processed.
Record Mode	RM	0/1	none	Disable/enable the record mode. If disabled, the message unit is a command. If enabled, a message unit is a record. The message unit is the smallest group of characters that the generator processes.
Record Terminator Mode	TM	0/1	none	Selects the LF/CR character as the record terminator. The record terminator is used on input in the record mode and is sent following all output.
Output Valid Mode	VM	0/1	none	Disable/enable the output valid mode. In the output valid mode, the generator waits to process commands until the RF output has become valid.
Unbuffered Mode	UM	0/1	none	Disable/enable the unbuffered mode. If disabled, all input is buffered. If enabled, only one message unit is buffered.
@ Modes	@	int	none	The @ command can be used as an alternate method of programming interface modes.
Interrogate Commands				
Interrogate Attenuator Counts	IA	none	none	The generator responds with seven counts. Each count indicates the total number of attenuations for one of the seven attenuator sections in the generator.
Instrument Identification	ID	none	none	The generator responds with its model number (6062A).
Elapsed Time Indicator	IE	none	none	The generator responds with the total operating time since the generator was manufactured.
Interface Modes	II	none	none	Interrogate the interface modes selected. The generator responds with an unsigned integer.
Interrogate Error Log	IL	none	none	The generator responds with an error log entries. Each entry is an uncal error code or a self-test result and the elapsed time of when the error was logged.
Option Loading	IO	none	none	Interrogate the option loading. The generator responds with the message: d1, d2, d3 d1 is the instrument code. d2 is the digital and synthesizer options. d3 is the output options. See the Interrogate Commands for details.
Rejected Entry	IR	none	none	Interrogates the rejected entry error codes. The generator responds with three octal fields: AAAAA,BBBBB,CCCCC. See Table 2-19 for a list of rejected entry error codes.
Serial Number	IS	none	none	Interrogates the instrument serial number.
Self Test	IT	none	none	Interrogates the results of the self-tests. The generator responds with the self-test results. See Chapter 5 for self-test codes.

Command Use	Command Header	Command Numeric	Command Suffix	Comments
UNCAL	IU	none	none	Interrogates the uncalibrated output error codes. The generator responds with three octal fields: AAAAA,BBBBB,CCCCC. See Table 2-18 for a list of uncal error codes.
Software Version	IV	none	none	Interrogate the software version. The generator responds with the status message: Vxx.x where xx.x represents the current software revision level.
Compensation Memory Status	IZ	none	none	Interrogates the compensation memory status. The generator responds with three fields: AAAAA,BBBBB,CCCCC. See Table 2-18 or 2-19 for a list of status error codes.
Memory Entry				
Recall	RC	int	none	Recall the front panel setup stored at the memory location specified by int.
Store	ST	int	none	Store the current front panel setup at the memory location specified by int.
Sequence	SQ	none	none	Sequence (recall) to the next higher memory location.
Modulation Entry				
Program AM	AM	float	PC	Program AM depth in percent.
External AM	AE	0/1	none	Disable/enable external AM modulation.
Internal AM	AI	0/1	none	Disable/enable internal AM modulation.
DC coupled AM	SP	60/61	none	Disable/enable DC coupled AM.
DC coupled AM	DA	0/1	none	Alternate programming command for disable/enable DC coupled AM operation.
Program FM	FM	float	 GZ MZ KZ HZ RD	Program FM deviation in units of: gigahertz megahertz kilohertz Hertz radians
External FM	FE	0/1	none	Disable/enable external FM.
Internal FM	FI	0/1	none	Disable/enable internal FM.
Program Mod Freq	MR	0/1	none	Program modulation frequency to 400 Hz/1000 Hz.
Program Mod Freq	MF	float	 GZ MZ KZ HZ	Program modulation frequency in units of: gigahertz megahertz kilohertz Hertz
External Pulse	PE	0/1		Disable/enable external pulse modulation.
Internal Pulse	SP	40/41		Disable/enable internal pulse modulation.
Internal Pulse	PI	0/1		Alternate programming command for disable/enable internal pulse modulation operation.
Monitor Commands				
Input Bit	IB	none	BIT Designator	Respond with the value of the designated hardware bit.
Output Bit	OB	0/1	BIT Designator	Set the designated hardware bit to 0 or 1.
Output DAC	OD	int	DAC Designator	Set the value of the designated hardware DAC to the value specified by int.

Command Use	Command Header	Command Numeric	Command Suffix	Comments
Read Byte	RB	int	none	Read the value of the addressed byte. The generator responds with an unsigned integer.
Read Word	RW	int	none	Read the value of the addressed word. The generator responds with an unsigned integer.
Define Write Address	DW	int	none	Defines the address to be used by the write byte/word commands.
Write Byte	WB	int	none	Write int into the address specified with the define write address command.
Write Word	WW	int	none	Write int into the address specified with the define write address command.
Read Attenuation	XA	none	none	Read the current attenuation. The generator responds with an unsigned integer.
Write Attenuation	XB	none	none	Change attenuation to 6 dB times the unsigned integer. The integer can be 0 to 23.
Set Frequency Direct	XD	float	GZ MZ KZ HZ	Set the frequency hardware directly to the specified synthesizer frequency.
RF Output	XR	0/1	none	XR0 programs all attenuation. XR1 restores attenuation to its previous state.
RF On/Off Entry				
RF Output	RO	0/1	none	Turn RF output off/on.
Special Function Entry				
Special Functions	SP	00 02 03 04 07/08 09 10 11 12/13 14 15 16 17 20/21 30/31 40 50 51 52 70 71 72 75 76 77-79 80 81 82 83-86 90/91 95-98		Clears all special functions Initiates self-test Display check Key check Set/reset SRQ Display S/W rev and instr ID Display IEEE-488 address Display self-test results Turn on/off display Initialize memory Latch test Display option loading Initiates self-test with RF on Disable/enable relative freq Disable/enable relative ampl Disable/enable internal pulse Select dBm ampl display units Select dBmV ampl display units Select dBμV ampl display units Medium key repeat rate Fast key repeat rate Slow key repeat rate Display COMP memory status Repair COMP memory errors Copy MEC PROM data Enable all level correction Disable all level correction Disable attenuator correction Program alternate 24 dB attens Disable/enable ampl fixed rng Local COMP procedures

Command Use	Command Header	Command Numeric	Command Suffix	Comments
SRQ Commands				
Interrogate SRQ Mask	IM	none	none	Interrogate the SRQ mask. The generator responds with the decimal value of the SRQ mask.
Set SRQ	SM	int	none	The SRQ mask is set to int.
Local Operation Alert Mode	XF	0/1	none	Disable/enable a mode to set SRQ each time a local entry is made. This SRQ is enabled by setting the front panel bit in the SRQ mask.
Step Entry				
Program FREQ STEP Size	FS	float	 GZ MZ KZ HZ	Program frequency step size in units of: gigahertz megahertz kilohertz hertz
Program AMPL STEP Size	LS	float	 V MV UV NV DB	Program amplitude step size in units of: volts millivolts microvolts nanovolts dB or dBm
Program AM STEP Size	PS	float	PC	Program AM step size in percent.
Program FM STEP Size	DS	float	 GZ MZ KZ HZ RD	Program FM step size in units of: gigahertz megahertz kilohertz Hertz radians
Step Up/Down	SU/SD	none	none	Step the currently selected step function up/down one step.
Step Up/Down Frequency	FU/FD	none	none	Change the current step function to frequency and step frequency up/down one step.
Step Up/Down Amplitude	LU/LD	none	none	Change the current step function to amplitude and step amplitude up/down one step.
Step Up/Down AM	PU/PD	none	none	Change the current step function to AM and step AM up/down one step.
Step Up/Down FM	DU/DD	none	none	Change the current step function to FM and step FM up/down one step.
Trigger Commands				
Configure Trigger	CT	string	none	Configures the trigger. Each time a trigger command or a group execute trigger interface message is received, the generator executes the string of commands. The string record must end with a record terminator.
Trigger	TR	none	none	Trigger command. Equivalent to the group execute interface message. Upon processing the trigger command, the generator executes the string, which has been preprogrammed with the configure trigger command.

2.4.4 Programming Examples

The following three examples show how to use the IEEE-488 bus and use a variety of controllers to program the generator. In the first example, a Controller is used to program the generator. In the second example, two generators are configured to track each other in frequency. In the third example, a 1722A is used to program the generator with the frequency step up controlled by the trigger command.

Programming Example 1

Use the following procedure to program the generator with a Controller to this state:

Frequency	210 MHz
Amplitude	6 dBm
Modulation Freq.	1000 Hz
FM	5 kHz
Internal FM	ON
AM	15%
External AM	ON

1. Connect the generator to the Controller with an IEEE-488 cable.
2. Set the address switch of the generator as follows (as viewed from the rear):

   00000010

3. Enter the following program into the Controller:

```
1 ! Gigatronics BASIC program to control a 6062A.
2 ! The Address of the 6062A is 2.
3 A% = 2%
10 ! Clear the 6062A so that it is in a known state.
15 INIT PORT 0
20 REMOTE @A% \ CLEAR @A%
100 ! SET THE 6062A.
110 PRINT @A%, FR210MZ,AP6DB,MR1,FM5KZ,FI1,AM15PC,AE1
999 END
```

4. Run the program by typing on the Controller RUN ⟨RETURN⟩.

Programming Example 2

The 6062A Signal Generator can be connected to another 6062A Signal Generator in a master-slave configuration. In the following example, two generators are configured to track each other in frequency. This configuration can be used to track frequency, amplitude, AM, or FM.

1. Connect two 6062A Signal generators together with an IEEE-488 cable.
2. Set the rear panel address switch of the first generator (talker) as follows:

   00100000

3. Set the rear panel address switch of the second generator (listener) as follows:

   01000000

4. Manually program the talker generator as follows:

Function	Value	Key Sequence
Frequency	210 MHz	[FREQ] [2] [1] [0] [MHz|V]
Step Function	Frequency	[FREQ] [STEP]
Frequency Step	1.25 kHz	[1] [.] [2] [5] [kHz|mV]

5. Manually program the listener generator as follows:

Function	Value	Key Sequence
Frequency	195 MHz	[FREQ] [1] [9] [5] [MHz|V]
Step Function	Frequency	[FREQ] [STEP]
Frequency Step	1.25 kHz	[1] [.] [2] [5] [kHz|mV]

6. On the talker generator, press the [↑] STEP or [↓] STEP keys. Each time the key is pressed, the frequency of both generators increases or decreases by 1.25 kHz (the Frequency Step) at frequencies 15 MHz apart.

Different functions on each generator can be programmed to track in the master-slave configuration. In other words, while the master generator can be programmed to step increase 25 kHz FM, the Slave generator can be programmed to step 25% AM.

☛ NOTE: To use the step function feature for other functions, change the step function on the generators to the desired functions.

Programming Example 3

In the following example, the generator is programmed by a controller (via the IEEE-488 bus) to the same state as in Programming Example 1. Additionally, the frequency step size is set to 1.25 kHz, and the trigger buffer is programmed to execute the step up command when the trigger command is received. The SRQ mask of the generator is set to generate an SRQ when the RF output has settled and the generator is ready for more input from the bus.

The program then enters a loop where it waits for the ready SRQ, sends the GET (group execute trigger) interface message to step up the frequency, and waits again. At this time you should do the following:

1. Connect the generator to the Controller with an IEEE-488 cable.
2. Set the rear panel address switch of the generator as follows:

   00000111

3. Enter the following program into the Controller:

```
1 ! Gigatronics BASIC program to control a 6062A.
2 ! The address of the 6062A is 7.
3 A% = 7%
10 ! Clear the 6062A so that it is in a known state.
15 INIT PORT 0
20 REMOTE @A% \ CLEAR @A%
100 ! Set the 6062A.
110 PRINT @A%, FR210MZ,AP6DB,MR1,FM5KZ,FI1,AM15PC,AE1
120 ! Set the frequency step, output valid mode,
121 ! and configure the trigger buffer.
130 PRINT @A%, FS1.25KZ,VM1,CTSU
140 ! Set the SRQ mask to enable output valid SRQ
150 PRINT @A%, SM16
160 ! Wait for above commands to finish processing
170 WAIT 1000 \ S% = SPL (A%)
180 ! Trigger the first step up
190 TRIG @A%
300 ! Wait for SRQ
310 ON SRQ GOTO 800
320 WAIT FOR SRQ
800 OFF SRQ
810 ! Check the serial poll response
820 S% = SPL(A%)
830 IF (S% AND 64%+16%) 80% THEN PRINT s%; Bad Serial Poll Response
840 ! Trigger the next step up
850 TRIG @A%
860 ! Resume operation— waiting for next SRQ
870 RESUME 300
999 END
```

4. Run the program by typing on the Controller RUN ⟨RETURN⟩.

2.4.5 IEEE-488 Interface Functions

The generator implements a subset of interface functions defined by the IEEE Standard 488-1978. Table 2-5 summarizes the interface functions implemented.

Table 2-5. IEEE-488 Interface Functions

Function	Description
SH1	Complete source handshake capability
AH1	Complete acceptor handshake capability
T5	Basic talker, Talk only, Serial poll, Unaddressed if MLA
TE0	No extended talker capability
L3	Basic listener, Listen only, Unaddressed if MTA
LE0	No extended listener capability
SR1	Complete service request capability
RL1	Complete remote/local capability
PP0	No parallel poll capability
DC1	Complete device clear capability
DT1	Complete device trigger capability
C0	No controller capability
E1	Open-collector drivers

2.4.6 Address Mode

In the address mode, the generator can be operated from local (using the front panel keys) or from remote (using the IEEE-488 Interface). The following paragraphs describe the operation of the generator in both states and transitions between the states.

The available IEEE-488 messages and their descriptions for the address mode of operation are presented in Table 2-6.

Local Operation

The generator powers up in the local mode. When in local mode, the following conditions are present:

- The front panel indicator REM, is not lit.
- Device trigger (GET), device clear (DCL), and selected device clear (SDC) interface messages are ignored.
- All device dependent messages are ignored.
- If the data output was requested while the generator was in the remote mode, the data output of a talker can be sent.

Local to Remote

The generator switches from local to remote when the my listen address message (MLA) is received, and the Remote Enable (REN) signal is true.

When in the remote mode, the following conditions are present:

- The front panel REM indicator is lit.
- Device trigger (GET), device clear (DCL), and selected device clear (SDC) interface messages are processed.
- All device-dependent messages are processed during the remote mode.

Remote to Local

The generator switches from remote to local mode in one of the following ways: The IEEE-488 Go To Local (GTL) message is received, the remote enable signal REN is false, or a Return To Local (rtl) message is generated by pressing the front panel [CLR/LCL] key (if the generator is not in the local lockout mode).

The generator enters the local lockout mode when the Local Lockout message (LLO) is received. The generator exits the local lockout mode to the local mode when REN is false.

When switching from remote to local, unprocessed commands in the input buffer are processed until the input buffer is cleared or a front panel entry is made. Switching to local has no effect on the contents of the output buffer.

Table 2-6. IEEE-488 Address Mode Messages

Message	Operation	Description
pon Power-On	Talker	When powered up, the generator generates a Power-On message (pon) and clears its output buffer. The generator is not addressed to talk when powered up.
	Listener	The generator is not addressed to listen when the power is turned on.
	Service Request	The state of the Service Request (SRQ) signal on pon is determined by the SRQ mask. Because of the non-volatile memory, the SRQ mask is the same as when the power was removed. Therefore, if the SRQ mask enables the power on, output valid, or ready SRQs, the SRQ signal will be true during pon.
MTA My Talk Address	Talker	The generator is addressed to talk upon receipt of the MTA message. The front panel ADDR indicator is lit while the generator is addressed to talk.
	Listener	The generator unlistens when the MTA message is received.
MLA My Listen Address	Talker	The generator untalks when the MLA message is received.
	Listener	The generator is addressed to listen when the MLA message is received. The front panel ADDR indicator of the generator is lit while the generator is addressed to listen.
Data	Talker	The generator sends data to the IEEE-488 bus only when requested by a programming data message. Message formats are described in the Command Description paragraphs. An End of Record (EOR) character is sent with EOI asserted following all outputs. The EOR character is either a carriage return or a line feed, depending on the setting of the terminator mode. The parity bit is always zero. Multiple output requests are buffered until the buffer is full. Processing of programming data messages is stopped until the buffer is no longer full. The buffer can be cleared with the Clear Buffer command (CB). The buffer is also cleared on power up (pon), with a Clear Command (CL), or with a Device Clear interface message (DCL or SDC).
	Listener	Command syntax, error processing and input buffer overflow are described in the paragraphs on Command Processing. Refer to Table 2-3 for a list of IEEE-488 commands that are recognized by the generator.
IFC Interface Clear	Talker	The generator untalks and unlistens when the IFC message is received.
	Listener	The generator unlistens and untalks when the IFC message is received.
OTA Other Talk Address	Talker	The generator untalks when the OTA message is received.
SPE Serial Poll Enable	Talker	After receiving the SPE message, the generator responds with the serial poll status byte, if addressed to talk.
SPD Serial Poll Disable	Talker	After receiving the SPD message, the generator resumes normal talk operation.
ULA Unlisten Address	Listener	The generator unlistens when the ULA message is received.
RSV Request Service	Service	The front panel SRQ indicator is lit when the rsv message is sent. The generator can request service for several reasons. Each reason for service request can be individually masked with the set mask command (SM). The service request mask can be interrogated with the interrogate mask command (IM).
DCL Device Clear	Clear	The DCL message is ignored when in local. When the DCL message is received (during remote operation) the generator is cleared. Any characters in the input buffer are cleared followed by the same operation as the clear command (CL). The operation of the DCL message is identical to the operation of the selected device clear (SDC) message. The cleared state of the generator is described in the paragraphs on Power-On Conditions.

Message	Operation	Description
SDC Selected Device Clear	Clear	The SDC message is ignored during local operation. When the SDC message is received (during remote operation), the generator is cleared. Any characters in the input buffer are cleared followed by the same operation as the clear command (CL). The operation of the SDC message is identical to the operation of the device clear (DCL) message. The cleared state of the generator is described in the paragraphs on Power-On Conditions.
GET Group Execute Trigger	Trigger	The GET message is ignored during local operation. When the GET message is received (during remote operation), the generator executes a command string that has been preprogrammed with the Configure Trigger command (CT). The operation of the GET message is identical to the operation of the Trigger (TR) command.
Undefined IEEE-488 Commands		All undefined IEEE-488 commands are acknowledged by the generator handshake sequence, but no action is taken.

2.4.7 Talk-Only Mode

To select the talk-only mode, set the TALK ONLY address switch to 1 (up). If the talk-only address switch and the listen-only address switch are set to 1, the talk-only mode is selected.

In the talk-only mode, the listener, remote/local, service request, device clear, and device trigger interface functions do not apply.

If the talk-only mode is selected, the generator is always addressed to talk and the front panel ADDR indicator is always lit. The Step Up (SU) or Step Down (SD) message is sent when the [↑] STEP or [↓] STEP front panel keys are pressed. This output is not buffered and if no listener is connected to the IEEE-488 Interface, no output will be sent. A carriage return followed by line feed (with the EOI signal true) are always sent as the end of record. The generator must be cycled off/on to exit from the talk-only mode.

2.4.8 Listen-Only Mode

To select the listen-only mode, set the LISTEN ONLY address switch to 1 (up). If the talk-only address switch and the listen-only address switch are set to 1, the talk-only mode is selected.

If the listen-only mode is selected, the generator is always addressed to listen, and the front panel ADDR indicator is always lit. The generator listens and responds to all data messages on the IEEE-488 Interface. The response to data messages is the same as in the addressed mode of operation except that requests for talker output are ignored.

In the listen-only mode, the talker, remote/local, service request, device clear, and device trigger interface functions do not apply.

2.4.9 Command Syntax

The generator IEEE-488 bus commands alphabet consists of the letters A through Z (upper and lower case letters are treated equally), digits 0 through 9, and the following special characters:

@ . , ; + - CR LF

Spaces, tab characters, and the parity bit are ignored.

The IEEE-488 commands for the generator consist of the following three parts:

Header
Numeric
Suffix

The header is always required, but the numeric and suffix can be optional. This rule gives the following four possible combinations:

⟨HEADER⟩
⟨HEADER⟩⟨NUMERIC⟩
⟨HEADER⟩⟨NUMERIC⟩ ⟨SUFFIX⟩
⟨HEADER⟩⟨SUFFIX⟩

Multiple commands can be separated with one of the end of string (EOS) characters ; (semicolon) or , (comma). Use of EOS characters facilitates recovery in the event of a syntax error and will also enhance readability.

Command Header Syntax

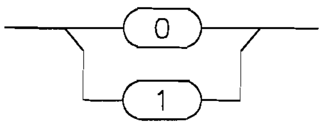
The command header is a two alpha-character string. A list of the IEEE-488 command headers used in the 6062A is in Table 2-3. The header determines the syntax of the numeric and suffix.

Numeric Data Syntax

There are four types of numeric data: Boolean, unsigned integer, floating point, and trigger string. The following paragraphs describes each of the four numeric data formats. A syntax diagram is included for each format.

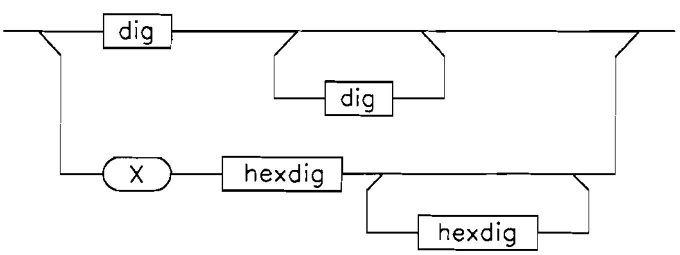
1. Boolean

Boolean numeric data must be either a 0 or a 1. All other characters will result in a syntax error.



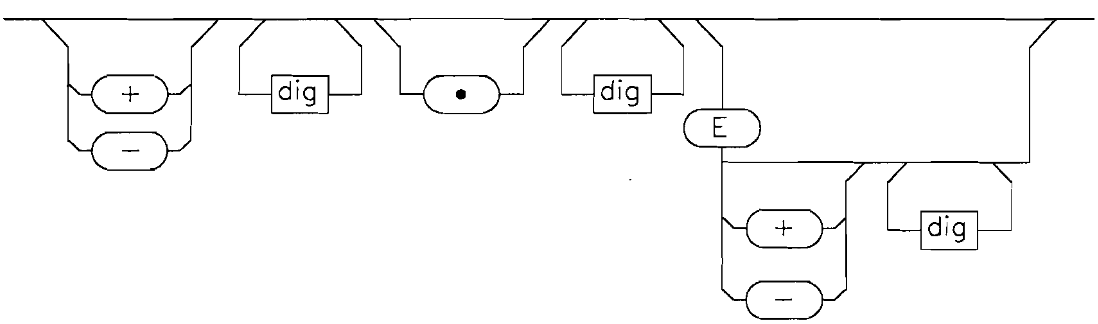
2. Unsigned Integer

Unsigned integers can be specified in decimal or in hexadecimal. Any number of decimal digits are accepted. However, values greater than 65,535 are rejected. Hexadecimal numbers are preceded by an X. Only 4 hexadecimal digits are accepted. Specifying a number in hexadecimal for the read word and read byte commands causes the response to be sent in hexadecimal. Decimal digits can be the numerals 0 through 9. Hexadecimal digits can be the hexadecimal digits 0 through F.



3. Floating Point

The floating-point numeric data format is the most flexible format. Digits can be the numerals 0 through 9. Any number of digits are accepted for both the number and the exponent. However, numbers greater than 2,147,483,629 are truncated, and exponents greater than 32,749 are rejected.

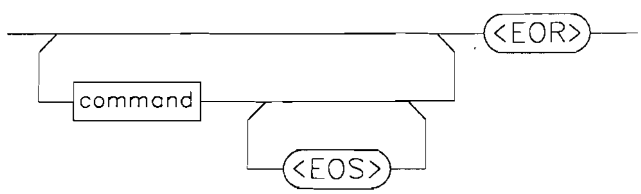


4. Trigger String

The trigger string numeric data is a string of generator commands terminated with an EOR. The string can be up to 71 characters not including the EOR. Commands in the string are not checked for validity until the trigger string is executed with the trigger command.

EOR is the end of record character. This character can be selected with the terminator mode command. TM0 selects the line feed character. TM1 selects the carriage return character. The IEEE-488 interface signal EOI asserted with any other character is also considered an end of record.

EOS is an end of string character, use either semicolon or comma.



Suffix Syntax

Suffixes are always one or two alpha-characters. Certain suffixes are used to scale the numeric (the same as the front panel UNITS keys). Other suffixes mnemonically designate hardware components. The five types of suffixes are described in Table 2-7.

Table 2-7. Suffix Types

Suffix Type	Suffix	Mnemonic	Equivalent Exponent
Frequency and FM	GZ MZ KZ HZ	GigaHertz MegaHertz kiloHertz Hertz	9 6 3 0
Amplitude	V MV UV NV DB	volts millivolts microvolts nanovolts dBm or dB	0 -3 -6 -9 0
AM	PC	percent	0
FM	GZ MZ KZ HZ RD	GigaHertz MegaHertz kiloHertz Hertz radians	9 6 3 0 0
DAC/BIT Designators	DAC and BIT designators are two alpha-character mnemonics that refer to hardware DACs and bits. Refer to the paragraphs on Monitor Commands for a complete list of designators.		
Learn Suffix	A learn suffix is a string of ASCII characters that contain coded memory location contents. Refer to the paragraphs on Binary Learn Commands for decoding of the learn string.		

2.4.10 Command Descriptions

The following paragraphs describe the remote IEEE-488 Interface operating commands that are not accessible from the front panel of the generator. IEEE-488 Interface commands that are accessible from the front panel of the generator are described earlier in this chapter.

Binary Learn Commands

Front panel setups are stored in the memory of the generator in a packed binary format. The binary learn commands are used to transfer this binary data between an IEEE-488 controller and the generator. These commands allow you to minimize the amount of programming commands needed to program the entire state. The binary learn commands are:

LM Learn Memory
LI Learn Interface

The syntax for the Learn Memory (LM) command is as follows:

LM Memory Location Code

The generator responds to the LM command with a string of 64 ASCII characters followed by an ⟨EOR⟩ (end of record character). This string represents the front panel settings (in a packed binary format) that were stored in the memory location specified.

NOTE: The ⟨EOR⟩, end of record character, is sent with EOI asserted. TM0 selects the line feed character, and TM1 selects the carriage return character.

Example:

IEEE-488 Command: LM98

Response:

BOABAAAAPPJMAAAKAAAAAAAABBOBKDAAAAAPECEAABPFEAAABAACEBBAGCLKKABAEAM
⟨EOR⟩

Refer to the learn string example (Figure 2-6, etc.) for information on how to decode this string.

The syntax for the Learn Interface LI Command is as follows:

LI Memory Location Code: Learn String

The generator stores the learn string in the memory location designated by the memory location code. If the memory location specified is 99, the instrument is programmed to the data sent in the learn string.

Example:

To program the generator to the Preset State:

LI99BOABAAAAPPJMAAAKAAAAAAAABBOBKDAAAAAPECEAABPEAAABAACEBBAGCLKKABAEM

The binary learn string in this example is the same as the learn string returned from memory location 98 which contains a record of the Preset State.

Instructions

1. Convert the hexadecimal number to a signed decimal number as follows:
   a. Multiply the most significant hexadecimal digit by 16.
   b. Add the next significant digit to the value obtained in Step 1.
   c. Multiply the sum of Step b by 16, and add in the next hexadecimal digit until the least significant hexadecimal digit has been added.

   NOTE: If the hexadecimal number started with 8 through F, the number is negative. Perform Step 4 for negative numbers.

   d. Subtract 16 from the number raised to the power of the number of digits.

   Example of Instruction 1:

   To convert hexadecimal number 1E:

   (1 * 16) + 14 = 30

   (Since the most significant digit is 1, the number is not negative.)

   To convert hexadecimal number FF9C:

   ((((15 * 16) + 15) * 16) + 9) * 16) + 12 = 65436

   (Since the most significant digit is F, the number is negative.)

   Using Step d; 16^4 = 65536, 65436 - 65536 = -100. The signed decimal equivalent to FF9C is -100.

2. Amplitude quantities have a number and a resolution associated with them. This applies to the Displayed Amplitude, Reference Amplitude, and Amplitude Step. Use the following procedure to identify the resolution of an amplitude quantity:
   a. If the resolution is A or B (hexadecimal), the resolution of the number is 0.1 dBm or 0.1 dB units.

   Example of Instruction 2:

   The Displayed Amplitude (in Figure 2-6) is -100 with a resolution of A.

   The actual displayed amplitude is -10.0 dBm.

   b. If the stored resolution is 0 through 9 (hexadecimal), the amplitude quantity is in volts. To convert the number to the actual amplitude in nanovolts, multiply the amplitude number by the power of ten represented by the resolution.

   Example:

   An Amplitude Step of 12, with a resolution of 6 would be an actual amplitude step of 12,000,000 nV or 12 mV.

   c. If the Relative Amplitude mode is off, the data stored in the reference amplitude location is not used.
   d. If the Relative Frequency mode is off, the data stored in the reference frequency location is not used.

3. FM and FM Step quantities have a number and a resolution associated with them. The resolution nibble is comprised of a 3-bit resolution value and a single bit units value. If the units value is 0, the FM quantity is in Hertz. If the units value is 1, it is a ϕM quantity in radians.

a. To convert the number to the FM quantity in Hz, multiply the number by the power of ten represented by the resolution. Example: The FM number (in Figure 2-6) is 500, with a resolution of 10 Hz. The actual FM deviation is 5000 Hz.

b. To convert the number to the ϕM quantity in radians, multiply the number by the power of ten represented by the resolution, and divide the result by 1000.

Example: A deviation of 123 with a resolution of 1 and units of 1 would be a ϕM deviation of 1.23 radians.

4. The checksum data is calculated by adding the data in the learn string, two hexadecimal digits at a time. The total, including the checksum, should add up to a number whose least significant two hexadecimal digits are 01.

5. Only the current state of these parameters is relevant, so they are only valid when learning memory location 99. Learn strings from all other memory locations have characters 65 and 66 set to AM. These parameters are provided as status information only and cannot be set using the learn interface command.

The memory location code must be an unsigned integer indicating the memory location to be learned. Memory location 99 refers to the current settings. Memory location 98 refers to the Preset State as listed in Table 2-2.

Characters in the learn string correspond to each generator function. A description of how to interpret the characters in the learn string is given in Figure 2-6. Table 2-8 shows the conversion from the learn string to the hexadecimal character.

Table 2-8. Learn Character to Hexadecimal Conversion

Learn Character	Hexadecimal Equivalent	Decimal Equivalent
A	0	0
B	1	1
C	2	2
D	3	3
E	4	4
F	5	5
G	6	6
H	7	7
I	8	8
J	9	9
K	A	10
L	B	11
M	C	12
N	D	13
O	E	14
P	F	15

Character Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Character	B	O	A	B	A	A	A	A	P	P	J	M	A	A	A	K	A	A

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
A	A	A	A	A	A	B	B	O	B	K	D	A	A	A	A	A	P	E	C	E	A	A

42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
B	P	E	A	A	A	B	D	A	E	E	B	B	A	G	B	L	K	K	M	P	A	C

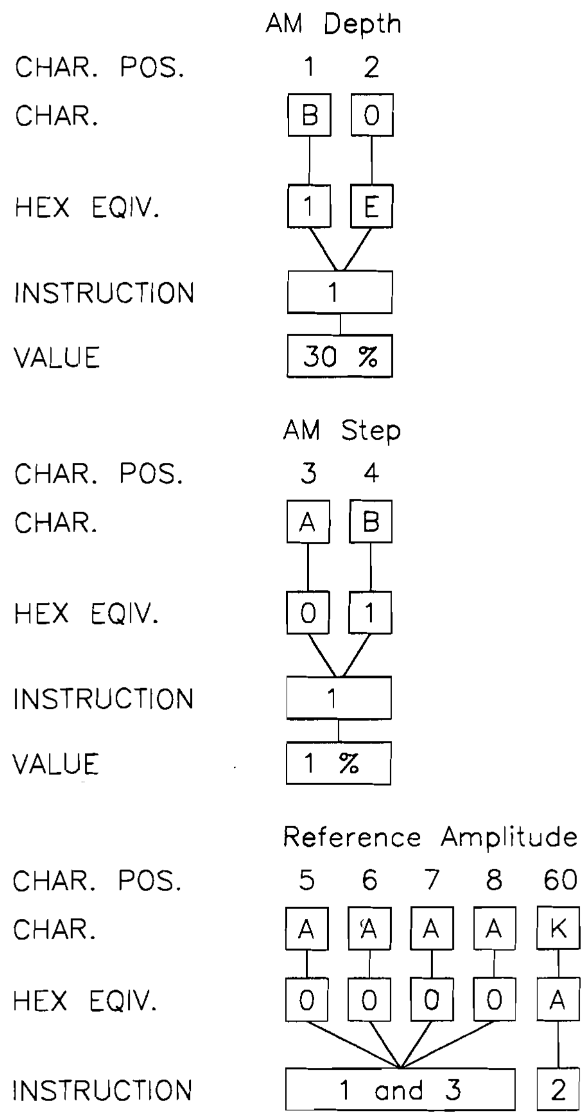


Figure 2-6. Learn String Example

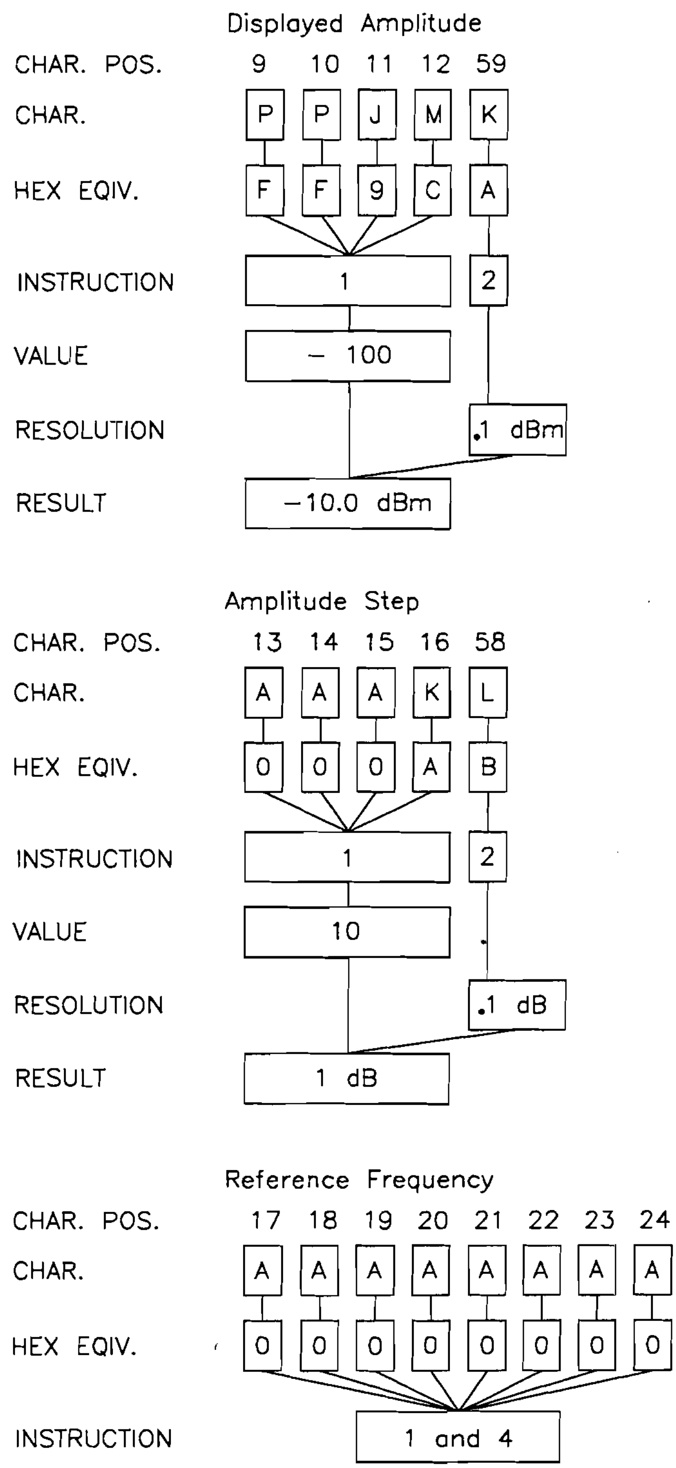


Figure 2-6. Learn String Example (Page 2 of 5)

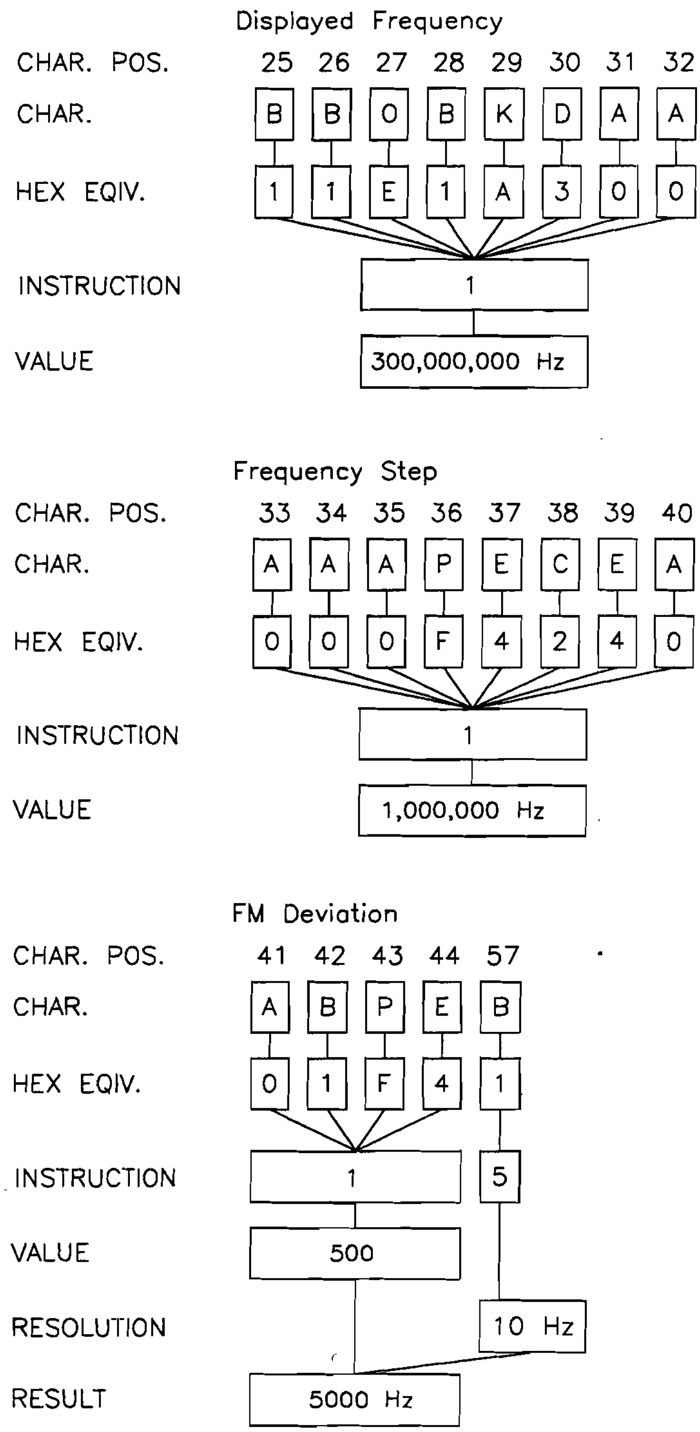


Figure 2-6. Learn String Example (Page 3 of 5)

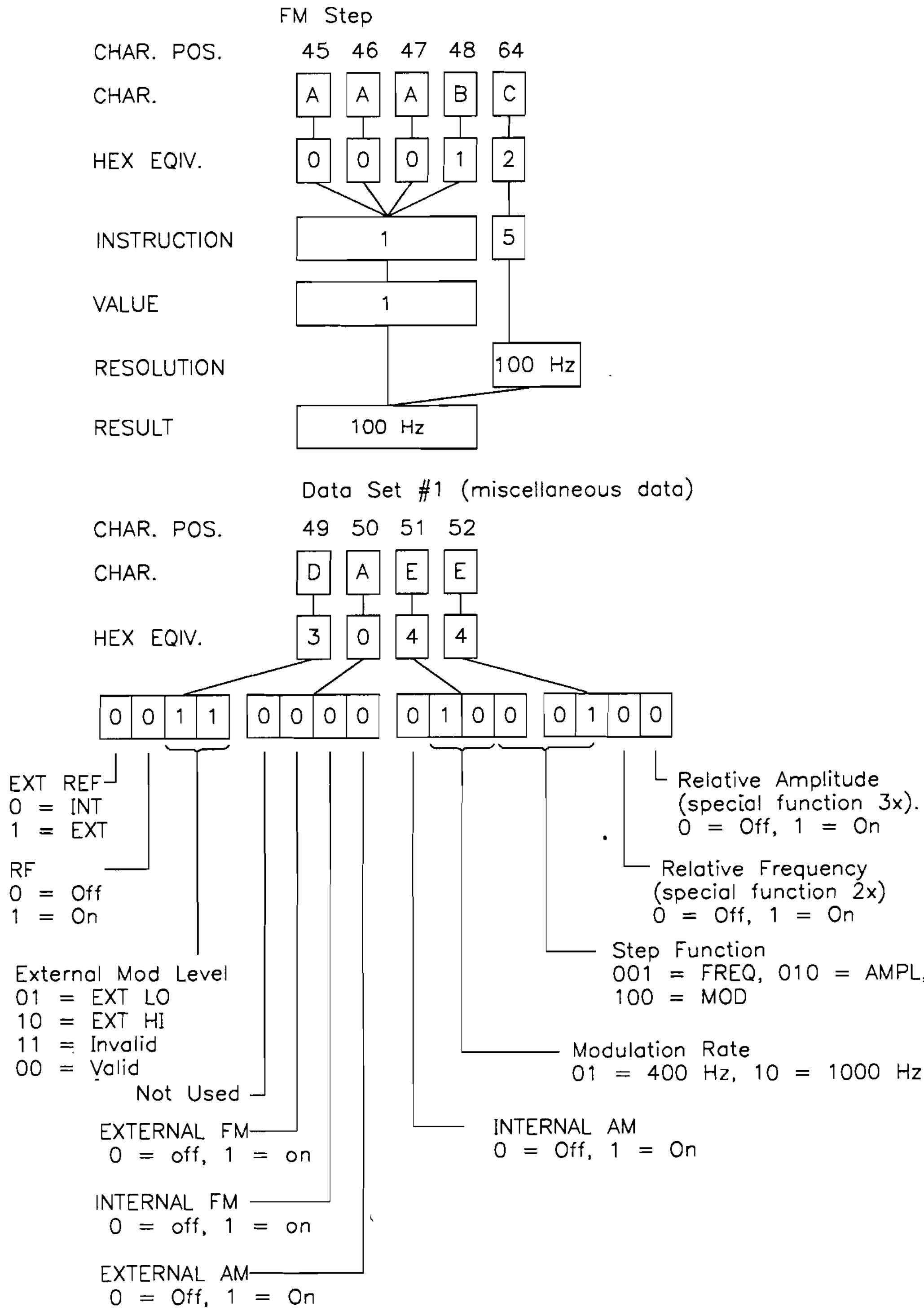


Figure 2-6. Learn String Example (Page 4 of 5)

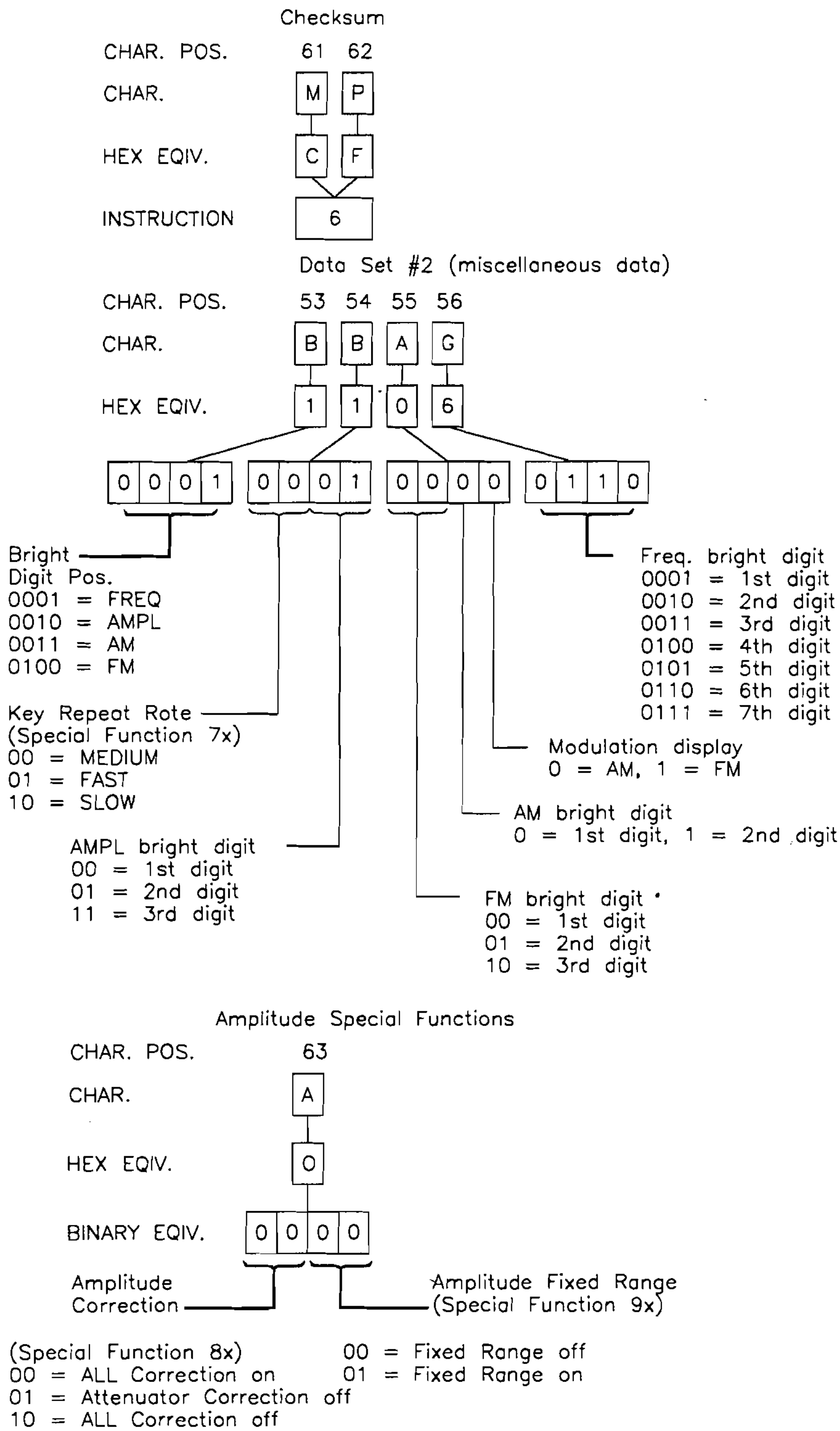


Figure 2-6. Learn String Example (Page 5 of 5)

Clear Commands

The following IEEE-488 clear commands are recognized by the generator:

CB = Clear IEEE-488 input buffer
CE = Clear IEEE-488 rejected entry error status
CL - Clear instrument

The CB command clears the generator output buffer. The output buffer should be cleared at the beginning of any remote program to synchronize data output. The output buffer is also cleared on power up, with the CL clear generator command, or by the SDC and DCL clear interface messages.

The CE command explicitly clears the error status. The error status is also cleared when it is interrogated with the IR command, or the CL clear generator command, or the SDC and DCL clear.

The CL command clears the state. The same actions are performed with the SDC and DCL clear interface messages. (In addition, the input buffer is cleared with the clear interface messages.) The following IEEE-488 commands are performed with the clear generator command: RC98, RO1, CE, CB, RM0, TM0, EM0, VM0, UM0, SM192, SP08, XF0, DW0, CT⟨EOR⟩. If a Software Compensation Procedure is in progress, it is exited immediately and all measured data is discarded.

Interface Mode Commands

Interface Mode commands are used to configure the generator for different modes of IEEE-488 interface operation. Since the generator knows when its RF output has settled, it can be configured to synchronize itself with the Controller. This eliminates WAIT statements in the program, which are normally used to allow time for the output of the controlled device to settle. Table 2-9 lists the Interface Mode Commands.

Table 2-9. Interface Mode Commands

Command	Description	Command Status
EM	Error Mode	1 = on, 0 = off
RM	Record Mode	1 = on, 0 = off
TM	Select Terminator	1 = CR, 0 = LF
UM	Unbuffered Mode	1 = on, 0 = off
VM	Valid Mode	1 = on, 0 = off

The error mode selects when the IEEE-488 rejected entry status is cleared. If turned on, the error status is cleared when a new message is processed. If turned off, the status is cleared only when interrogated with the IR (interrogate rejected entry) command or when explicitly cleared with the CE (clear error command).

The record mode selects whether the message unit is a record or a command. When turned on, the message unit is a record. When turned off, the message unit is a command.

The terminator mode selects the character used as the record terminator. The terminator character is not used for command processing unless the record mode is enabled. When turned on, the record terminator CR (carriage return) is used. If turned off, the record terminator LF (line feed) is used. The record terminator character is the last character in all IEEE-488 messages sent from the generator.

The unbuffered mode selects when messages from the IEEE-488 interface are processed. When turned on, messages are read from the IEEE-488 interface only when the microprocessor is ready to process them. In this mode, the input buffer will contain a maximum of one message. (A message can be one command or one record, depending on the setting of the record mode.) When turned off, messages are read from the IEEE-488 interface to the input buffer of the generator at the fastest rate. In this mode, the input buffer can contain up to 80 characters.

The valid mode selects when messages are processed by the generator microprocessor. When turned on, processing of a new message is begun only after the RF output has settled and become valid. When turned off, a new message is processed immediately after the completion of the previous message.

The interface modes can also be programmed using the command, @ n (where n is an integer). The interface modes are set to the value of n where n is the sum of the codes for the desired modes. The integer codes for the interface modes that can be programmed using the @ n commands are as follows:

Terminator Mode	= 1
Record Mode	= 2
Valid Mode	= 4
Unbuffered Mode	= 8
Error Mode	= 16

For example, to select the record mode and valid mode, the command is @ 6.

Interface Mode Example

In this example, the RF output of generator is connected to a circuit that is being measured by a voltmeter. The output of the generator must be settled before the voltmeter is given its command to make a measurement.

A program might look something like:

```
PRINT @1, CL,TM1,RM1,VM1,UM1     ! initialize the 6062, select modes
PRINT @1, FR100MZ,AP-25DB        ! program the 6062
PRINT @2, ?                      ! trigger the voltmeter
INPUT @2, R$                     ! get the reading
```

The entire record is transferred into the generator before processing begins. In this example, processing begins when the record terminator CR is received. The following character (Lf in this case) will not be received into the generator until the entire record is processed and the output has settled. No wait statement is needed between setting up the generator and taking the measurement because the generator will not handshake the LF character until its output has settled.

A record is a string of characters separated by <EOR>. A message is the smallest group of characters that the generator can process when programmed from the IEEE-488 interface.

NOTE: The output valid state of the generator occurs 45 ms after any hardware has been changed.

Interrogate Commands

Interrogate commands allow the status of the generator to be given over the IEEE-488 interface. These commands consist of headers only. The interrogate commands available on the IEEE-488 interface are:

IA Attenuator Actuation Log
ID Instrument ID
IE Elapsed Time Indicator
II Interface Mode Status
IL Hardware UNCAL and Self-Test Error Log
IO Option Loading
IR IEEE-488 Rejected Entry Status
IT Self-Test Results
IU UNCAL (uncalibrated) Status
IV Software Revision Level
IZ Compensation Memory Checksum Status

The IA command interrogates the attenuator actuation log. Each time an attenuator pad is removed from the RF path, the corresponding counter in non-volatile memory is incremented. This means that if an attenuator pad is removed when inserted, the count will only increment once. The generator responds to the IA command with seven counts (one for each pad). The counts are separated by commas, and the response is terminated with the end of record character (<EOR>).

Example:

Attenuator Section	Number of Actuations
A6DBL	102
A12DBL	99
A241L	1028
A242L	9
A243L	19,092
A244L	3908
A245L	412

The response to the IA command will be:

0000000102,0000000099,0000001028,0000000009,0000019092,0000003908,0000000412 <EOR>.

When the ID command is sent, the generator responds with its instrument model number (and end of record character) as in 6062A ⟨EOR⟩.

When the IE command is sent, the generator responds with the time the instrument has been in operation since it was manufactured. The time is 9 digits, a decimal point, a 10th digit and the ⟨EOR⟩ character. The time is in .1 hour units. For example, 000003459.3 ⟨EOR⟩ indicates 3459.3 hours of operation since manufacture.

The II command interrogates the current selection of interface modes. A 5-digit integer followed by the ⟨EOR⟩ character is the sum of the modes selected as follows:

Terminator mode	=	1
Record mode	=	2
Valid mode	=	4
Unbuffered mode	=	8
Error mode	=	16

The IL command interrogates the ten-entry error log in non-volatile memory. An error can be either a failed self-test or an uncalibrated condition as a result of a hardware status line (UNLOKL or UNLVLL). The elapsed time since the instrument was manufactured is also logged with the error.

Each of the ten error log entries consists of an uncalibrated (uncal) code or self-test code, followed by a semi-colon (;), followed by the elapsed time, followed by the end of record character (<EOR>). The format of the uncal code, self-test code, and elapsed time are identical to the response when interrogating the uncal code (IU), the self-test code (IT), and elapsed time (IE) respectively.

In response to the IEEE-488 command interrogate error log (IL) command, ten error log entries will be sent, with the most recent error sent first.

Example of an error log:

000,000,002,000;000039012.2 <EOR>

Self-test error (non-volatile memory failure) at 39012.2 hours since manufacture.

000,-000,002,000;000039012.1 <EOR> Self-test error (non-volatile memory failure) and the self-test sequence was aborted as indicated by the -. This error occurred at 39012.1 hours since the generator was manufactured.

000000,000000,000006;000020243.2 <EOR>

Amplitude became unleveled at 20243.2 hours since manufacture (third number = 4). In addition, the peak amplitude was set to >+13 dBm as indicated by the second uncal code (third number = 2).

000000,000000,000000;000000000.0 <EOR>

This special code means that there are no errors. One or more of the error log entries will be this code when less than ten errors have been logged since the generator was manufactured.

The number of characters in this response is much larger than the 80 characters in the output buffer. Therefore, if the entire response is not transferred to the IEEE-488 controller, the generator will not be able to respond to further programming commands. Any remaining portion of the response that is not to be transferred can be cleared only by sending a device clear to the generator.

The IO command interrogates the generator for its option complement. The returned record contains three integers, separated by commas, that indicates configuration of options. For the 6062A, the first number is always 4, which indicates that the generator being interrogated is in fact a 6062A. The two remaining numbers are the sum of the option related numbers as follows:

2nd Number

4 = -130 High-Stability Reference Option
16 = -132 Medium Stability Option

3rd Number

2 = -830 Rear Panel RF Output, MOD Input, & Pulse MOD Input Option

For example, 4,16,2 would indicate a 6062A with Options -132 and -830.

The IR command interrogates the generator for rejected entry error status. (See Table 2-19 for a list of rejected entry codes.) The returned record is the sum of errors that have been detected while processing IEEE-488 commands. The status is cleared when interrogated with the IR command. The status can also be explicitly cleared with the CE command and is also cleared on the CL command and the clear interface messages DCL and SDC.

The IS command interrogates the generator for the serial number. The serial number is an eight character ASCII string terminated with an <EOR>. The returned record is similar to the following:

01230000 <EOR>

The IT command interrogates the generator for the self-test results. The self-test results are reported in four fields. Any non-zero codes indicate that some tests have failed. Table 2-10 lists the self-test error code format. The self-tests are performed at power-up and can also be initiated with special function 02. Further details of the self-test results are listed in Chapter 4.

Table 2-10. Self-Test Error Codes

Mod	Freq		Ampl
AA	-BBB	CCC	DDD

AA = Modulation (AM and FM) test results
\- = If displayed, indicates the self-test did not complete
BBB = Frequency test results
CCC = Digital test results
DDD = Amplitude test results

The IU command interrogates the generator for the UNCAL entry status. (See Table 2-18 for a list of the UNCAL Error Codes.)

The IV command interrogates the generator for its current software revision level. The returned record is similar to the following:

V1.0 ⟨EOR⟩.

This means that the software revision level is Version 1.0.

The IZ command interrogates the generator for the compensation memory status. The status is returned as three fields separated by commas, as in the following example:

000010,100001,000000 <EOR>

See the paragraphs on Compensation Memory Status in Chapter 4 for details.

Monitor Commands

The generator monitor commands are intended for troubleshooting and maintenance procedures. They allow the hardware to be programmed to states not normally possible with the regular programming commands.

CAUTION

The output of the generator is not guaranteed if the generator hardware has been changed with these monitor commands.

There are three types of monitor commands: Input/Output, Read/Write, and Hardware Control. Table 2-11 lists the Input/Output types of monitor commands. Table 2-12 lists the Read/Write types of monitor commands. Table 2-13 lists the Hardware Control types of monitor commands.

Table 2-11. Input/Output Monitor Commands

Comd Name	Command	Value	Designator Name	Location
Read Input Bit	IB		EX exrefl	A2, U11-7
			HS hsoptl	A2, U11-17
			IE ieinl	A2, U11-8
			LF lrfm	A2, U40-8
			MH mlevhi	A2, U40-13
			ML mlevlo	A2, U40-7
			RO roptl	A2, U40-17
			RP rppl	A2, U11-11
			RT rptrpl	A2, U11-14
			SR shrefl	A2, U40-4
			TQ trseql	A2, U40-3
			UK unlok	A2, U11-3
			UV unlvl	A2, U11-18
			XA extra-a	A2, U40-14
			XB extra-b	A2, U40-18
Set Output Bit	OB	0 or 1	CL clr	A2, U17-12
			DA dcam	A6, U13-19
			EA extam	A6, U13-12
			EF extfm	A6, U13-6
			EP ext pulse	A6, U13-16
			FE fmen	A4, U19-19
			FP front-panel	A2, U17-5
			HO haocth	A6, U9-2
			HT het	A6, U9-6
			IA intam	A6, U13-9
			IF intfm	A6, U13-5
			IP int pulse	A6, U13-15
			LP mid	A6, U9-5
			MA rmux0	A4, U32-5
			MB rmux1	A4, U32-2
			MF mf4001	A6, U13-2
			MG module-gate	A2, U17-15
			MS trmodl	A4, U32-15
			NE nven	A2, U17-9
			PM phase mod	A6, U23-12
			RI rinh	A4, U32-9
			RR rprst	A2, U17-6
			SE shen	A4, U32-12
			SH shet	A4, U32-16
			VH vcohl	A6, U23-9
			VQ vcoq	A6, U23-15
			XA x21	A6, U9-19
			XB x2fl1	A6, U9-16
			XC x2fl2	A6, U9-15
			XD x2fl3	A6, U9-12
			XE x2fl4	A6, U9-9
			XO xoenl	A4, U32-6
			YA extra-a	A2, U17-19
			YB extra-b	A2, U17-2
			YC extra-c	A2, U17-16
Set Output DAC	OD	integer value		
		0-255	AM AM dac	A6, U19
		0-127	AT attenuator	A2, U27-5, 6, 9, 12, 15, 16, 19
		0-1023	FM FM dac	A6, U25-4 through 15
		0-7	FR FM range	A4, U19-12, 15, 16
		0-1023	KN kn dac	A4, U27-4 through 13
		0-1023	KV kv dac	A4, U29-4 through 13
		0-4095	LE level dac	A6, U21
		0-255	TC temp.comp.dac	A6, U19

Table 2-12. Read/Write Monitor Commands

Command Name	Command Syntax	Notes
Read byte	RB memory location	1
Read word	RW memory location	1
Define write address	DW memory location	2
Write byte	WB value	2
Write word	WW value	2

Notes:

1. The generator responds to these commands with the value of the byte or word in the memory location addressed. The memory location must be an unsigned integer. The value returned is followed by an ⟨EOR⟩. If the memory location is specified in hexadecimal, then the value is returned in hexadecimal preceded by an X.
2. The Define Write Address command specifies the write address used with the Write Byte and Write Word commands. When the Write Byte and Write Word commands are used, the specified data will be written to that write address.

Table 2-13. Hardware Control Monitor Commands

Command Name	Command Syntax	Notes
Read attenuation	XA	1
Set attenuation	XB integer	1
Set synthesizer frequency	XD floating point decimal MZ	2
RF on/off	XR 0 or 1	3

Notes:

1. The current settings of the Attenuator can be read or set. The attenuation is a number from 0 to 23 where the number specifies the multiple of 6-dB attenuation. Zero indicates no attenuation, and 23 is the maximum attenuation. Only the attenuators are changed with the XB command. The value of the attenuation will be output on the XA command as an unsigned integer followed by ⟨EOR⟩.
2. The XD command can be used to program the generator to the specified frequency. Only the synthesizer circuits on the A4 Synthesizer assembly are programmed. No offset is added, no filters are programmed, no VCO compensation is calculated, and no level correction is calculated.
3. XR0 programs all attenuation and XR1 restores the attenuator to its previous state.

SRQ Commands

The generator asserts the SRQ bus management line on the IEEE-488 interface bus whenever the generator requires service. The Controller can then perform a serial poll to determine the need for service. The set mask command is used to designate those needs that require service. The SRQ commands are as follows:

SM Set SRQ Mask
IM Interrogate SRQ Mask
XF Local Operation Alert Mode

The SRQ mask is set to the sum of the reason values listed in Table 2-14. These reason values correspond to the allowable reasons that will be requiring service. The SRQ Mask is set by the following command sequence:

SM Sum of Reasons

The generator asserts SRQ when one of the allowed reasons becomes true. The serial poll response is the sum of those values for reasons that are currently true, independent of the setting of the SRQ mask. For example, if the rejected entry SRQ is enabled with SM2 and a rejected entry occurs, the serial poll response will indicate that the generator generated the SRQ (value of 64) and that a rejected entry occurred (value of 2). In addition, other values can be set. The default SRQ mask is 192.

Table 2-14. SRQ Mask and Status Values

Value	Reason	True	False
1	Ready	Input buffer is empty and no commands are being processed.	Input buffer is not empty or commands are being processed.
2	Rejected Entry	IEEE-488 rejected entry; error code is not zero.	IEEE-488 rejected entry error; code is zero.
4	Uncalibrated	RF output is not calibrated. (Front panel UNCAL indicator is lit.)	RF output is calibrated. (Front panel UNCAL indicator is not lit.)
8	Power on	Instrument has powered up.	Special function 08.
16	Output valid	RF output is settled.	RF output is not settled.
32	Not Used		
64	RQS	SRQ mask AND'd with currently set values is not zero.	Reason for SRQ goes away or serial poll is performed.
128	Front panel	Special function 07.	Special function 08.

The IM command interrogates the current SRQ mask, and an integer is returned.

The XF command enables a mode that causes an SRQ to be generated any time the generator processes an entry. In this mode, a front panel SRQ is generated (i.e., the serial poll response indicates that a front panel SRQ is the cause of the SRQ). This mode is enabled and disabled with its own command, not through the Set SRQ Mask commands (as are all other SRQs). The Alert Mode is enabled/disabled as follows:

XF0 = Alert Mode off, XF1 = Alert Mode on.

Trigger Commands

The generator has the ability to preprogram a command string of arbitrary generator programming commands. This command string is executed whenever the trigger command TR or the IEEE-488 group execute trigger interface message (GET) is received. This method of programming the generator can be used when a long string of commands is to be sent to the generator over and over. The programming time is shortened by the time required to transmit the string of characters from the controller to the generator.

The trigger commands are as follows:

CT Configure Trigger
TR Execute Trigger Buffer

The configure trigger command is followed by a string of any generator programming commands up to 71 characters in length. The validity of the programming commands is not checked until the trigger buffer is executed. The power-on value of the trigger string is null (nothing).

The trigger command causes execution of the trigger buffer, which has been preprogrammed with the configure trigger command CT. The trigger buffer can also be executed by sending the IEEE-488 group execute trigger interface message (GET).

2.4.11 Command Processing

The following paragraphs describe how IEEE-488 commands are processed by the generator. Command processing is a term for how commands are executed and how errors are handled.

Command Execution

The execution of the IEEE-488 commands depends on the selection of interface modes with one exception: if an IEEE-488 input is buffered and the buffer becomes full, command execution starts and no further input is accepted until there is room in the input buffer. For more details, refer to the paragraphs on Interface Modes.

Error Handling

The generator detects two types of errors while processing IEEE-488 commands: syntax errors and processing errors. All errors are accumulated until the error status is interrogated or is explicitly cleared. The IEEE-488 rejected entry status is interrogated with the IR command. The error status is cleared with one of the following commands:

CE Clear Error Command
CL Clear Command
DCL or SDC Clear Interface Messages

The error status is also cleared on power-up.

The SRQ mask can be set to assert SRQ when an error is detected. The SRQ is unasserted when the error status is cleared.

Syntax errors are commands that do not have the correct syntax for the specified header. For example, FE5 is a syntax error because the external FM command requires a Boolean numeric field. Unrecognized headers are also syntax errors. An IEEE-488 syntax error causes all commands from the point of the error up to the next string terminator or record terminator to be ignored.

Processing errors are commands that are syntactically valid, but the requested value is outside the range of programmable values. For example, FR99GZ is syntactically correct, but the generator cannot be programmed to a frequency of 99 GHz. Command processing continues with the next command.

2.4.12 Timing Data

The programming time can be broken down into four groups:

1. Transfer of commands to generator
2. Command parsing time
3. Software programming time
4. Instrument settling time.

The total programming time depends on the selection of the interface modes. In some modes, programming steps are performed in parallel and can increase throughout. This section gives some typical timing data for the above four programming steps and describes how the interface modes affect their relative timing.

Transfer of Commands to Generator

The maximum rate of transfer is 0.4 to 0.5 ms per character. With most IEEE-488 controllers, all characters sent with a single output or print statement is transferred together at the maximum rate. The total time to transfer commands to the generator is obtained by multiplying the number of characters by the rate of transfer.

Command-Parsing Time

Command-parsing time is the sum of the time required to process the header, the numeric, and the suffix. Some commands do not have numerics or suffixes. Table 2-15 gives the typical time it takes to process the different components of a command.

Table 2-15. Command Parsing Time

Command Component	Time
Header	2 ms
Boolean Numeric	1 ms
Unsigned Integer Numeric	2 ms + 1 ms per character
Floating-Point Numeric	2 ms + 1 ms per character
Trigger-String Numeric	10 ms + 0.5 ms per character
Suffix	1 to 1.5 ms
Learn-Interface Suffix	40 ms

Software Programming Time

The minimum time required to process a command is 25 ms. Most of the commands that do not program the hardware (such as storing step values) are programmed in 25 ms. Table 2-16 gives the typical time value for programming the different functions in the generator.

Table 2-16. Typical Function Programming Time

Function	Time (in ms)	Notes
Frequency	70	1, 2, 3, 4
Amplitude in Volts	60	1, 2, 4, 5
Amplitude in dBm	95	1, 2, 4, 5
AM Depth	50	2, 4
FM Deviation	35	4
Modulation Frequency	25	
Enable/Disable AM	55	2
Enable/Disable FM	25	
Recall 98	190	6, 5
RF Output On	50	2
RF Output Off	35	

Notes

1. May take up to 5 ms longer if the relative mode is enabled.
2. Can save 10 ms if all level correction is disabled with special function 81.
3. Add 20 ms when frequency changes from greater than or equal to 245 MHz to less than 245 MHz.
4. Edits and steps may take up to 5 ms longer than the programming function directly.
5. Add 15 ms when the Attenuator settings change.
6. Recalls vary considerably depending on the stored data. Maximum is approximately 250 ms.

Instrument Settling Time

The software programming time typically exceeds the settling time of the RF circuitry; therefore, the instrument settling time can generally be excluded from throughput calculations. The exception is when level correction is disabled. Disabling level correction reduces the software programming time by 10 ms but does not affect the switching time of the frequency programming circuitry. A 10 ms settling delay should be added if level correction is disabled and a settled RF output is required.

Timing Optimization

Timing depends upon the interface modes selected. Read the paragraphs on Interface Mode Commands for a complete description of the interface modes.

The transfer of commands from the IEEE-488 controller to the generator can never be processed in parallel with anything else. The transfer of commands usually happens simultaneously, regardless which interface mode is selected.

The parsing of the command and programming the new instrument state is performed one message unit at a time. The record mode selects a command or a record as the message unit. The record mode off (RM0) is slower since there is extra processing between message units, and the message unit is smaller.

If the valid mode is enabled, the processing of message units is delayed until the generator has settled from the previous message. While the RF output is typically settled before the software finishes processing the command, enabling the valid mode adds an additional delay to insure that the output is settled before the next command is processed.

If the output of the generator does not need to be settled between programming strings, the valid mode should be turned off to speed up processing. If the output does not need to be settled between commands, but needs to be settled between records, enable the valid mode and the record mode. The instrument processes commands within the record as fast as possible and waits for the output to settle only between records.

2.4.13 Power-on Conditions

Table 2-17 lists the parameters at power-on. The remote clear commands can be used to reset all parameters except the last memory location and the remote/local state.

Table 2-17. IEEE-488 Power-On State

Parameter	State
Memory location parameters	Same as power-off [1]
RF on/off	Same as power off
Last memory location	Same as power off [2]
Remote/local state	Local
IEEE-488 output buffer	Cleared
IEEE-488 input buffer	Cleared
Valid mode	Same as power off
Record terminator	Same as power off
Unbuffered mode	Same as power off
Record mode	Same as power off
SRQ mask	Same as power off
Trigger configuration	Same as power off
SRQ interface signal	May be asserted [3]

Notes

1. The contents of memory location 98 (Preset State) is listed in Table 2-2
2. The last memory location is used for sequence operations.
3. If the SRQ mask has the power on, output valid, or ready SRQ enabled, the SRQ interface signal is asserted on power-on.

2.5 Operating Reference

This reference section describes local and remote operation for each generator function. The functions are arranged in alphabetical order. For each function, the syntax of the command, allowable data ranges, and other information is presented.

2.5.1 Amplitude and Frequency Entry

The following describes how to control the carrier frequency and amplitude by the Function-Data-Unit entry sequence. This method applies to both normal and relative operations. The Frequency display is a fixed-point display in MHz. The amplitude display is fixed point while displaying dBm, but is floating point when displaying voltage units.

The RF Output must be enabled for the generator to produce an output (see Section 2.5.9).

Command Syntax

[Select Function] [Enter Data] [Select Unit]

Summary

Command		Range	Resolution	Notes
Set Frequency				
Local: [FREQ] — DATA —	[MHz|V] [kHz|mV] [Hz|µV]	0.1 to 2100 MHz	10/20 Hz	1,2,3
Remote: FR — float —	GZ MZ KZ HZ	0.1 to 2100 MHz	10/20 Hz	1,2,4
Set Amplitude				
Local: [AMPL] — DATA —	dB(m)] [MHz|V] [kHz|mV] [Hz|µV]	-137 to +13/16 dBm 0.032 µV to 1.41/1.58 V	0.1 dBm 3 digits	3,5,6
Remote: AP — float —	DB V MV UV NV	-137 to +13/16 dBm 0.032 µV to 1.41/1.58 V	0.1 dBm 3 digits	4,5,6

Notes

1. Frequency ranging occurs at 245, 512, and 1050 MHz.
2. Frequency can be programmed with 10 Hz resolution when frequency <1050 MHz, and with 20 Hz resolution when frequency ≥1050 MHz.
3. FUNCTION ([FREQ] or [AMPL]) remains selected until another FUNCTION or [STEP], [STO], [RCL], or [SPCL] is pressed.
3. Floating-point number is indicated by the word *float*.
4. Amplitude uncalibrated range from -147.4 to -137.1 dBm. Also uncalibrated from +16.1 to +17 dBm when frequency <1050 MHz, and from +13.1 to +17 dBm when frequency ≥1050 MHz.
5. Amplitude ranging occurs at 1/2 V, 1/4 V, 1/8 V, ... $1/2^{23}$V with AM off and 1/4 V, 1/8 V, 1/16 V, $1/2^{24}$V with AM on.

Example

Set Frequency to 10.7 MHz and Amplitude to -7.5 dBm.

Local: [FREQ] [1] [0] [.] [7] [MHz|V]
[AMPL] [-] [7] [.] [5] [dB(m)]

Remote: FR10.7MZ,AP-7.5DB

Related Operations

Amplitude Fixed Range
Amplitude Units Conversion
Amplitude Units Selection
Cursor Edit Entry
Relative Function
Step Entry

2.5.2 Amplitude Fixed Range

The following information describes how to use the Fixed-Range special function. This special function fixes the current amplitude range (holds the currently selected step of the Step Attenuator). This function allows monotonic and nontransient level control over a limited range around those levels where the Step Attenuator normally autoranges. This level control can be accomplished with the Cursor Edit entry only.

The level vernier in fixed range has at least 18 dB of range.

Command Syntax

[Select Fixed Range] [Enable or Disable]

Summary

Command		Notes
Enable Fixed Range		
Local:	[SPCL] [9] — [1]	1
Remote:	SP 9 — 1	
Disable Fixed Range		
Local:	[SPCL] [9] — [0]	2
Remote:	SP 9 — 0	

Notes

1. The amplitude range is fixed only for Cursor Edit operations. Other methods of changing the amplitude cause the step attenuator to autorange if necessary.
2. With amplitude fixed range disabled, amplitude ranging occurs at 1/2 V, 1/4 V, 1/8 V, ... $1/2^{23}$V with AM off and 1/4 V, 1/8 V, 1/16 V, ... $1/2^{24}$V with AM on.

Example

Set the generator for monotonic and nontransient amplitude control (Cursor Edit only) over the range of the vernier level control below 0.25 V.

Local: [AMPL] [.] [2] [5] [MHzIV] [SPCL] [9] [1]

Remote: AP.25V,SP91

Related Operations

Cursor Edit Entry
Relative Function

2.5.3 Amplitude Units Conversion

The following information describes how to convert the displayed amplitude level from dBm to volts and volts to dBm. The output of the generator does not change during these operations.

Command Syntax

[Select Amplitude Function] [Select Unit]

Summary

Command			Notes
Convert dBm to volts			
Local:	[AMPL] —	[MHz|V] [kHz|mV] [Hz|µV]	1
Remote:	AP —	V MV UV NV	1
Convert volts to dBm			
Local:	[AMPL] —	[dB(m)]	
Remote:	AP —	DB	

Notes

Any voltage unit is accepted since the microprocessor automatically selects the units appropriate for the value being displayed.

Example

Change the displayed amplitude of -10.0 dBm to its voltage equivalent.

Local: [AMPL] [MHz|V]

Remote: APV

Related Operations

Relative Function
Amplitude Units Selection

2.5.4 Amplitude Units Selection

The following information describes how to select the alternate level display units. When the level is displayed as a dB quantity, units of dBm, dBmV, or dBµV can be selected by special function. Entering the special function code converts the displayed quantity to the selected units but does not change the output of the generator.

Command Syntax

[Select Amplitude Units] [Select Unit]

Summary

Command — Notes

Select dBm Display Units

Local:	[SPCL]	[5] — [0]
Remote:	SP	5 — 0

Select dBmV Display Units

Local:	[SPCL]	[5] — [1]
Remote:	SP	5 — 1

Select dBµV Display Units

Local:	[SPCL]	[5] — [2]
Remote:	SP	5 — 2

2.5.5 Cursor Edit Entry

The following information describes how to use a Cursor Edit Entry to change an instrument parameter. The output frequency, amplitude and the modulation indices can be modified with this entry method.

The RF output must be enabled for the generator to produce an output. (See the reference material on RF Output ON/OFF Entry.)

Command Syntax

[Select Display Field] [Position Cursor] [Change Parameter Value]

Summary

Command			Notes
Edit Frequency			
Local:	[FREQ] — EDIT [←]/[→] — EDIT [↑]/[↓]		1,2
Remote:	FB — float	GZ — KF float MZ KZ HZ	3,4,5
Edit Amplitude			
Local:	[AMPL] — EDIT [←]/[→] — EDIT [↑]/[↓]		1,2
Remote:	AB — float	DB — KA float V MV UV NV	3,4,5
Edit FM/ϕM Deviation			
Local:	[FM/ϕM] — EDIT [←]/[→] — EDIT [↑]/[↓]		1,2
Remote:	DB — float	GZ — KD float MZ KZ HZ RD	3,4,5
Edit AM Depth			
Local:	[AM] — EDIT [←]/[→] — EDIT [↑]/[↓]		1,2
Remote:	PB — float PC — KP float		3,4,5

Notes

1. The cursor field remains selected until another display field is selected.
2. The cursor position is maintained for each of the four functions so that the cursor can be moved from one display to another and back without losing its position in that previous display field.
3. Float equals floating-point number
4. In remote, the cursor is positioned within a display field using a decade value and associated unit. Minus signs are ignored.
5. In remote, the cursor is moved to the corresponding field and is increased or decreased by the signed integer following the KF,KA,KD,KP messages. The generic edit command KB can also be used to edit up or down the current cursor position. Positive integers do not require a sign.

Example 1

Edit the displayed amplitude of 9.7 dBm to 10.0 dBm.

Local: Put the cursor in the amplitude display by pressing [AMPL]. Select the least significant digit in that display by pressing EDIT [→] until the cursor is on that digit. Increase the value of that digit by pressing EDIT [↑] three times.

Remote: AB.1DB,KA3

Example 2

Edit the displayed FM Deviation from 5.0 kHz to 3.0 kHz.

Local: Put the cursor in the FM display by pressing [FM]. Select the 1-kHz digit by pressing the EDIT [→] or EDIT [←] until the cursor is on that digit. Decrease the value of that digit by pressing EDIT [↓] twice.

Remote: DB1KZ,KD-2

Related Operations

Relative Function
Amplitude Fixed Range

2.5.6 Memory Entry

The following information describes how to use the memory function to store and recall front panel settings. The generator has 50 memory locations that are retained for 2 years with the power off.

The sequence feature allows the operator to recall successive memory locations.

Command Syntax

[Select Memory Function] [Enter Memory Location]

Summary

Command		Notes
Store		
Local:	[STO] — [n] [n]	1,2,3
Remote:	ST — int	1,4
Recall		
Local:	[RCL] — [n] [n]	1,2,3
Remote:	RC — int	1,4
Sequence		
Local:	[SEQ]	5,6
Remote:	SQ	5

Notes

1. The memory locations available for operator use are 01 through 50. Additionally, the following special memory locations are available:
   Memory location 00 contains a backup-memory location. After a recall (or sequence) operation it contains the last front panel setting. After a store operation, it contains the data in the stored memory location before the store operation. Thus, a recall operation can be reversed by recalling location 00.
   Memory location 98 contains the Instrument Preset State.
   Memory location 99 contains the present instrument state.
2. In local control, two data digits must be entered to specify the memory location. The recall or store is performed when the second digit is released.
3. The last memory location specified (used for sequence operations) is displayed while the [STO] or [RCL] button is pressed.
4. An unsigned integer is indicated by 'int'.
5. The sequence operation recalls the next higher memory location, starting from the last memory location stored or recalled. No memory location needs to be specified. When the highest location is reached, the sequence starts over again at location 01.
6. While [SEQ] is pressed, the next memory location number is displayed and the memory location is recalled. This key is repeating.

Example

Recall the Instrument Preset State as shown in Table 2-2 (located in memory location 98). Change the frequency parameter to 302 MHz, then store the new front panel setting in memory location 06.

Local: [RCL] [9][8] EDIT [↑] [↑] [STO] [0][6]

Remote : RC98,KF2,ST6

2.5.7 Modulation Entry

The following information describes how to preset the modulation index (AM depth or FM/ϕM deviation), internal modulation rate (400 or 1000 Hz), and how to select the modulation source (internal and/or external).

The FUNCTION-DATA-UNIT method of selecting the modulation index is summarized in the following command syntax. The indices can also be modified using Cursor Edit or Step Entry. Since there is only one modulation display, the modulation index displayed is determined by the last modulation function key pressed.

Command Syntax

[Select Function] [Enter Data] [Select Unit]

Summary

Command			Range	Resolution	Notes
Set AM Depth					
Local:	[AM] — DATA — [%]		0 to 99%	1%	1,2
Remote:	AM — float — PC		0 to 99%	1%	1,2,3
Set FM Deviation					
Local:	[FM] — DATA —	[MHz/V] [kHz/mV] [Hz/μV]	0 to 400 kHz	3 digits	1,4,5
		[%/rad]	0 to 40.0 rad	3 digits	
Remote:	FM — float —	GZ MZ KZ HZ	0 to 400 kHz	3 digits	1,3,4,5
		RD	0 to 40.0 rad		
Select Modulation Rate					
Local:	[400/1000]				6
Remote:	MR 0 or 1				7
Enable or Disable Modulation					
Local:	[INT AM] INT FM ϕM] [EXT AM] [EXT FM ϕM] [EXT ⎍]				8,9
	[SPCL] [4] — [0] or [1]	10			
	[SPCL] [6] — [0] or [1]	11			

Command		Range	Resolution	Notes
Remote:	AI 0 or 1			12
	FI 0 or 1			
	AE 0 or 1			
	FE 0 or 1			
	PE 0 or 1			
	PI 0 or 1			10,12
	DA 0 or 1			11,12

Notes

1. This operation does not change the generator output unless the corresponding modulation is enabled.
2. Uncalibrated if peak amplitude exceeds +16 dBm when frequency <1050 MHz, or +13 dBm when frequency ≥1050 MHz.
3. Floating-point number is indicated by the word *float*.
4. Uncalibrated if FM is enabled and FM deviation is above 150 kHz.
5. The maximum FM deviation is dependent on the output frequency. Deviations up to 400 kHz or 40.0 radians can be entered regardless of the output frequency. However, the UNCAL indicator is flashed if the limits specified in Section 5.6.4 are exceeded.
6. Toggles between 400 and 1000 Hz only. An indicator shows selected rate only if internal modulation is on.
7. 0 selects a modulation rate of 400 Hz; 1 selects 1000 Hz.
8. These are ON/OFF operations; any combination is allowed.
9. Two indicators EXT HI and EXT LO are lit when external modulation is on, to indicate that the external modulation signal is 2% above or 2% below the nominal 1 V peak input requirement.
10. Internal pulse modulation can be enabled by special function or by the alternate IEEE-488 command PI. It can be enabled with any combination of the above modulations.
11. The DC coupled AM mode can be enabled by special function or by the alternate IEEE-488 command DA. The DC coupled AM mode works in conjunction with External AM and only affects the output of the generator if External AM is also enabled.
12. 0 turns the modulation source off; 1 turns it on.

Example

Set the FM deviation to 5 kHz, the modulation rate to 400 Hz, and internally modulate the carrier.

Local: [FM] [5] [kHz] [INT FM] [400/1000]

Remote: FM5KZ,MR0,FI1

Related Operations

Cursor Edit Entry
Step Entry

2.5.8 Relative Function

The following paragraphs describe how to change frequency and amplitude using the Relative mode. There are two steps:

1. Setting the reference.
2. Changing the parameter relative to that reference.

Setting the reference is done by setting the parameter to the desired value and then enabling the relative mode for that parameter. This causes the REL indicator to light and the displayed value to be zero in the corresponding display. The generator output does not change during these operations. In the relative mode, the usual means of changing the parameter can be used; i.e., Function, Step, or Cursor Edit Entry.

In the relative frequency mode, the actual frequency is the sum of the reference and the displayed frequency. The actual frequency can be displayed by pressing the [FREQ] key. If the 10/20 Hz frequency resolution boundary is crossed using the step or edit functions while in the relative frequency mode, a 10 Hz rounding quantity can be applied to the displayed frequency.

In the relative amplitude mode, the actual amplitude is the sum of the reference and the displayed amplitude when the reference and the displayed quantities have the same units. However, with mixed units (volts and dB), the actual amplitude is the voltage value scaled by the dB value. The actual amplitude can be displayed by pressing the [AMPL] key.

Command Syntax

[Select Relative Function] [Enable or Disable]

Summary

Command		Notes
Frequency		
Local:	[SPCL] [2] — [0] or [1]	1
Remote:	SP 2 — 0 or 1	1
Amplitude		
Local:	[SPCL] [3] — [0] or [1]	1
Remote:	SP 3 — 0 or 1	1

Note

Digit 1 enables the relative function; digit 0 disables the relative function.

Example

Set the amplitude to -15 dBV; i.e., 15 dB below 1 V.

Local: [AMPL] [1] [Hz|V] [SPCL] [3] [1] [AMPL] [-] [1] [5] [dB(m)]

Remote: AP1V,SP31,AP-15DB

Related Operations

Amplitude and Frequency Entry
Cursor Edit Entry
Step Entry

2.5.9 RF Output On/Off Entry

The following describes how to enable the output of the generator with the RF Output [ON/OFF] key and the corresponding remote code.

Command Syntax

[RF Output On/Off]

Summary

Command		Notes
RF Output On		
Local:	RF OUTPUT [ON/OFF] when RF OFF is on	1
Remote:	RO1	1
RF Output Off		
Local:	RF OUTPUT [ON/OFF] when RF OFF is off	
Remote:	RO0	

Note

Turning the RF Output on resets the RPP circuitry if it has tripped.

2.5.10 Special Function Entry

The following information describes how to use the Special Function Entry to use the special operating functions of the Signal generator. Table 2-1 lists the special functions available.

The special function code is a two-digit number. The first digit indicates the classification of the special function, and the second digit specifies the particular special function.

The special function is executed when the second special function code digit is entered. There are ten classes of special functions. The special functions in the 0(n) and 1(n) class cause an action to be performed. Classes 2(n) through 9(n) cause an instrument state to change. The status of classes 2(n) through 9(n) appears (left to right) in the frequency display field when [SPCL] is pressed.

Command Syntax

[Select Special Function] [Enter Special Function Code]

Command		Notes
Local:	[SPCL] — [n] [n]	
Remote:	SP — int	1

Example

Change the repeat rate of the EDIT and STEP keys to slow.

Local:	[SPCL] [7] [2]
Remote:	SP72

Note

The unsigned Integer is indicated by 'int'.

Related Operations

Fixed Range
Relative Function

2.5.11 Status & Clear Entry

The Status entry allows you to interrogate the generator for an explanation of either uncalibrated operation (UNCAL indicator is lit) or rejected entry operation (the REJ ENTRY indicator is lit).

When either the UNCAL or REJ ENTRY indicator is lit, press and hold the [STATUS] key to display the Uncalibrated or Rejected Entry Error Code Message. These messages provide detailed information on the nature of the uncalibrated or rejected entry condition. Table 2-18 contains a list and explanation of all the Uncalibrated Error Code Messages. Table 2-19 contains a list and explanation of all the Rejected Entry Error Code messages.

The [CLR/LCL] key can be used to clear a partial DATA entry or clear the flashing REJ ENTRY indicator. Press the [STATUS] key while an UNCAL indication exists to display the uncal error codes in three fields:

Table 2-18. UNCAL Error Codes

Code	Description
000 000 000	Indicates no UNCAL conditions
02 000 000	FM deviation/ϕM > (freq -150 kHz)
004 000 000 (F)	Excess FM deviation/ϕM, main or reference PLL unlocked
010 000 000 (F)	FM DAC at full scale
200 000 000	Multiple COMP memory checksum errors. See Compensation Memory Status in Table 2-4
000 010 000 (F)	Main or reference PLL unlocked
000 000 001	Level vernier >12 dB below bottom of the range
000 000 002	Peak amplitude >+16 dBm for freq <1050 MHz, or >+13 dBm for freq ≥1050 MHz.
000 000 004 (F)	Amplitude unleveled
000 000 010 (F)	Fixed-range level vernier at 0
000 000 020 (F)	Fixed-range level vernier at full scale
000 000 040 (F)	RPP tripped
000 000 100	Level below -137 dBm
000 000 200	Level correction disabled
000 000 400 (F)	RF output off

Notes:

1. Flashing codes denoted by (F) indicate abnormal operation or aberrated output. Non-flashing codes indicate operation outside the specified range.
2. Press [STATUS] while the REJ ENTRY indication exists to display the reject entry error codes listed in Table 2-19.

Table 2-19. Reject Entry Codes

Code	Description
000 000 000	No rejected entries
001 000 000	FM Dev/ϕM not between 0 and 400 kHz
002 000 000	FM Dev/ϕM Step not between 0 and 400 kHz
004 000 000	AM depth not between 0 and 99%
010 000 000	AM depth step not between 0 and 99%
020 000 000	IEEE-488 command syntax error
040 000 000	IEEE-488 input value out of range
100 000 000	MEC compensation PROM error
200 000 000	IEEE edit or step operation beyond allowed range
400 000 000	Invalid frequency in COMP memory
000 001 000	Frequency not between 100 kHz and 2100 MHz
000 004 000	Frequency step not between 0 and 1050 MHz
000 010 000	COMP data can not be stored if procedure incomplete
000 020 000	Invalid compensation command
000 040 000	Invalid memory location
000 100 000	Invalid data in memory
000 200 000	Special function not allowed
000 400 000	COMP data range error
000 000 001	Output amplitude not between 10 nV and 1.58 V
000 000 002	Insufficient resolution for units conversion
000 000 004	Units conversion to volts not allowed with reference in volts
000 000 010	Units conversion to dB not allowed with reference in volts
000 000 020	Amplitude step not between 0 and 164 dB or 0 and 1999 V
000 000 040	Units conversion on Amplitude or FM/ϕM step not allowed
000 000 100	Amplitude or FM/ϕM step and current amplitude display not in same units
000 000 200	COMP data from IEEE-488 out of range, or edit beyond COMP limits
000 000 400	Internal compensation data transfer error

Note:

The CLR/LCL key clears a partial DATA entry or clears the flashing REJ ENTRY indicator. Press [STATUS] while an UNCAL indication exists to display the Uncal error codes in three fields, listed in Table 2-18.

2.5.12 Step Entry

The following describes how to use the Step Entry function to change an instrument parameter. The RF Output must be turned on for the generator to produce an output (see Section 2.5.9.)

Command Syntax:

[Select Step Function] [Enter Data] [Select Units] [Change Parameter]

Summary:

Command		Range	Resolution	Notes
Frequency				
Local:	[FREQ][STEP] — DATA — [MHz|V] — STEP [↑]/[↓] [kHz|mV] [Hz|µV]	0 to 2100 MHz	10 Hz	
Remote:	FS —float— GZ — FU/FD MZ KZ HZ	0 to 2100 MHz	10 Hz	1,2
Amplitude				
Local:	[AMPL][STEP]—DATA — [dB(m)] — STEP [↑]/[↓] [MHz|V] [kHz|mV] [Hz|µv]	0 to 164 dB 0 nV to 1999 V	0.1 dB 3 digits	
Remote:	LS —float— DB —LU/LD V MV UV NV	0 to 164 dB 0 nV to 1999 V	0.1 dB 3 digits	1,2 1,2
FM/ϕM deviation				
Local:	[FM][STEP] —DATA — [MHz|V] — STEP [↑]/[↓] [kHz|mV] [Hz|µV] [%/rad]	0 to 400 kHz 0 to 40.0 rad	3 digits 3 digits	
Remote:	DS —float— GZ —DU/DD MZ KZ HZ RD	0 to 400 kHz 0 to 40.0 rad	3 digits 3 digits	1,2

Command		Range	Resolution	Notes
AM depth				
Local:	[AM][STEP] — DATA — %] — STEP [↑]/[↓]	0 to 99%	1%	
Remote:	PS —float — PC —PU/PD	0 to 99%	1%	1,2

Notes

1. Floating-point number is indicated by the word *float*.
2. Entering the step size from IEEE-488 does not select the step function. For example, FS10MZ does not select the step function; FD or FU must be used to select the frequency step function. The generic step up/down commands SU and SD can be used to step the current step function.

Example:

Recall the Instrument Preset State: [RCL] [9] [8]. Step the displayed frequency of 300 MHz, in 10 MHz steps, to 270 MHz.

Local: [FREQ] [STEP] [1] [0] [MHz|V] [↓] [↓] [↓] STEP

Remote: FS10MZ,FD,FD,FD

Related Operations

Relative Function

3

Theory of Operation

3.1 Introduction

This chapter describes the theory of operation for the 6062A Synthesized RF Signal Generator. There are four major sections:

- General Description
- Functional Description
- Software Operation
- Detailed Circuit Descriptions

The General Description briefly explains the functions and components of the three major modules of the 6062A. The Functional Description covers the main output parameters, amplitude, frequency, and modulation. The Software Operation section describes the software and how it affects the hardware. The detailed circuit description is a comprehensive explanation of the operation of each circuit assembly.

The 6062A has three major sections. The front section includes the keyboard and display for local control. The module section includes the frequency, level, modulation, and control circuits. The rear section includes the power supply, cooling fan, and assorted external connectors.

3.1.1 Front Panel Section

The front panel section is the operator interface. It includes the primary controls, connectors, and indicators. All front panel keys and displays (except the power switch that controls the power supply directly) are monitored and handled by the A2 Controller in the module section.

The front section consists of the elastomeric switches mounted in a sheet metal housing, the display lens, the POWER ON/OFF switch, and the MOD INPUT and RF OUTPUT connectors. The front section also includes the following printed circuit assemblies:

- A1 Display
- Switch

3.1.2 Module Section

The module section is a shielded enclosure with multiple compartments. It includes the circuits that generate the stimulus functions: Frequency, modulation, and amplitude. The A2 Controller is also located here. It controls the 6062A operation and, at power-on, determines if any options are installed by checking the option status bits.

The module section consists of a cast module frame with covers and gaskets, and includes the following printed circuit assemblies:

- A2 Controller
- A4 Synthesizer
- A5 VCO
- A7 Output
- A8 Attenuator

3.1.3 Rear Panel Section

The rear panel section consists of a fuse/filter/line-voltage selector switch (A3FL1), a transformer (A3T1), a fan (A3B1), and various external connectors. The rear section also includes the following electrical assemblies:

A3 IEEE-488 Interface
A9 Power Supply

The power supply is a linear design providing two +15 V, -15 V, +5 V, +37 V, +18 V, and 6 VAC to the 6062A. All the power supplies are series-pass regulated except the 6 VAC filament supply and the +18 V supply, which provides power to the Attenuator relays and Reverse Power Protector (RPP) relays.

The fuse/filter/line-voltage selector allows the 6062A to operate from 100, 120, 220, or 240 VAC. The transformer A3T1, with its two primary windings, accepts these four voltages and produces the necessary five secondary voltages. The Power Supply assembly rectifies, filters, and regulates the secondary voltages to produce the DC voltages required by the 6062A. The DC fan is connected to the unregulated +5 V supply. The fan operates only when line power is available and the front panel POWER switch is ON.

When installed, the Option 130 High-Stability Reference will also be located in the rear section. Option 130 operates whenever the generator is plugged into an active AC outlet, regardless of the position of the POWER switch.

3.2 Functional Description

The following paragraphs describe the key output parameters of the 6062A:

- Level
- Amplitude modulation
- Frequency
- Frequency modulation
- Phase modulation
- Pulse modulation

3.2.1 Level

Level control is provided by a step attenuator and a vernier level DAC. The A8 Attenuator provides coarse control. Fine level control is provided by a vernier level DAC that varies the automatic level control voltage (ALC). The microprocessor automatically controls the step attenuator and the vernier level DAC, and also applies level correction to compensate for the 6062A frequency response.

Level correction data for the Output and Attenuator assemblies are stored in the compensation memory on the A2 Controller assembly. The correction data is based on measurements of each assembly during calibration of the generator at the factory.

Level correction data is applied only to the vernier level DAC, and does not affect the coarse level control provided by the Attenuator.

All 6062A generators have the same attenuator pads inserted at a selected level even though the correction data is different for each generator.

To improve level accuracy in relation to temperature, the 6062A uses a software temperature compensation technique. This technique uses data that is the same for all units regardless of the options installed. See Section 5.8 for detailed information about software compensation.

3.2.2 Amplitude Modulation

The output of the level DAC is the leveling (ALC) loop control voltage. The 6062A output signal is amplitude modulated by varying this control voltage with the modulating signal. A 1 V peak modulating signal from the internal modulation oscillator or from the external MOD INPUT connector is applied to the AM DAC, a multiplying D-to-A Converter. The multiplying factor of this DAC, corresponding to the programmed percentage of modulation, is calculated by the A2 Controller assembly.

The modulation signal from the AM DAC is summed with a fixed DC reference voltage. The composite signal (DC plus modulation) is applied to the Level DAC, a level control-multiplying DAC. The multiplying factor for this DAC is also handled by the Controller and corresponds to the programmed signal level. The multiplying factor also includes the level correction information stored in the compensation memory.

Operation of the ALC loop causes the amplitude of the RF signal to conform to this varying control voltage, thus amplitude modulating the generator output.

3.2.3 Pulse Modulation

An input pulse signal triggers a comparator that drives a TTL gate. The gate output is converted to a different drive signal that controls transistor level shifters. These differential signals then drive a single-pole single-throw switch located in the main signal path before the final amplifier. An input voltage below 1 V turns the switch off if pulse is enabled; otherwise the switch is on.

3.2.4 Frequency

The 0.1 to 2100 MHz frequency coverage is divided into the following four bands:

HET band:	0.1 MHz to 244.99999 MHz
Mid band	245 MHz to 511.99999 MHz
High band	512 MHz to 1049.99999 MHz
X2 band	1050 to 2100 MHz

The high and mid bands are derived directly from a voltage-controlled oscillator (VCO) followed by a binary divider that is part of the main phase-locked loop (PLL).

The PLL synthesizes the mid band using a modified N-divider loop with a single-sideband (SSB) mixer in the feedback path. The reference frequency for the loop is 1 MHz, which would normally provide 1 MHz steps in a conventional N-divider loop. However, the 6062A provides 0.02 MHz steps by using a modified N-divider circuit with pulse deletion controlled by a rate multiplier.

Additional resolution is gained by introducing a signal from the sub-synthesizer circuit into the main PLL through the SSB mixer in the feedback path. This signal provides internal frequency in 5-Hz steps. The sub-synthesizer consists of a 14-bit rate multiplier followed by a divide-by-1000.

The main PLL bandwidth varies with the programmed frequency due to N changing and variations in the VCO tuning coefficient. The A2 Controller uses compensation to program the phase detector gain through the KN DAC to maintain a constant loop bandwidth. By keeping the loop bandwidth constant, loop stability and modulation transfer are controlled, ensuring accurate wideband FM.

3.2.5 Frequency Modulation

Frequency modulation is achieved by applying the modulation signal simultaneously to the PLL VCO and the phase detector. Both are necessary because modulating either the VCO or the phase detector alone results in FM with a high-pass filter characteristic, or phase modulation with a low-pass filter characteristic. The filter characteristic cutoff frequencies are equal to the PLL bandwidth.

The modulating signal applied to the PLL VCO and the Phase Detector is adjusted in amplitude by the KV DAC to compensate for variations in the VCO tuning coefficient. This compensation is done automatically by the Controller using compensation data measured on the VCO in each unit. This data is stored compensation memory.

By integrating the modulation signal applied to the phase detector and simultaneously applying the modulation signal to the VCO, the two effects are complementary and result in a flat FM response.

3.2.6 Phase Modulation

Phase modulation (ϕM) is achieved by differentiating the modulation input signal (internal or external) before applying the modulation signal to the frequency modulating circuits. The display is correspondingly changed to indicate the deviation in radians.

3.3 Software Operation

The 6062A software is executed on a Texas Instruments TMS 9995 microprocessor on the A2 Controller assembly. The program is stored in 48 K-bytes of ROM. A battery-backed CMOS RAM contains 4 kbytes of scratch pad RAM, 2 kbytes of non-volatile memory for front panel setups, and 2 kbytes of non-volatile memory. A 2-kbyte EEPROM contains a redundant copy of the instrument specific compensation data. In addition, there are 250 bytes of scratch pad RAM built into the microprocessor. The software provides the following general functions:

- Interfaces with the front panel keys and the IEEE-488 Interface to provide access to the generator functions.
- Configures the generator functions to produce the required output, and then applies linearization and compensation data to optimize the performance and resolution.
- Implements self-test and diagnostic functions.
- Provides software compensation procedures that allow you to generate the instrument-specific compensation data.

3.3.1 User Interface

The software is implemented with a simple operating system that allows several tasks to operate in a round-robin fashion on a equal priority basis. However, input and output to the front panel and to the IEEE-488 Interface execute at a higher priority and are handled as interrupt routines.

At power-on, the software performs a self-test and initializes both the RAM and the hardware. Three tasks are continuously in operation:

Service task
Key task
IEEE-488 task

The service task checks the status signals. The key task and IEEE-488 task process user input. A fourth task is activated only when needed to process certain UNCAL (uncalibrated) or REJ ENTRY (rejected entry) conditions that cause the STATUS display to flash.

3.3.2 Amplitude Control

Amplitude is programmed using a 23-step (6.02 dB per step) attenuator assembly and a 12-bit vernier level DAC. The level DAC settings depend on a combination of the programmed output level and amplitude correction data.

The amplitude correction data compensates for level inaccuracies and is a function of the frequency. Correction factors are stored in the compensation memory.

3.3.3 Attenuators

One 6 dB, one 12 dB, and five 24 dB sections of the A8 Attenuator are programmed in combination to provide course level control in 6 dB steps. The indicated voltages at which the Attenuator range is changed are 2-x volts, where:

x = 1, 2, 3, ...23 for non-AM operation, or

x = 2, 3, 4, ...24 for AM operation

Table 5-16 lists the Attenuator sections programmed for various displayed levels.

3.3.4 Level DAC

The level DAC setting is calculated from the output level. If level correction is enabled, the level DAC setting is further modified by the data stored in compensation memory.

To minimize level transients that could damage external circuitry, the following sequence is used in programming the Attenuators and the level DAC when the Attenuator setting is changed:

1. The LEVEL DAC is programmed to zero.
2. The attenuator sections are reprogrammed for correct attenuation.
3. After a 5 ms wait to allow the Attenuators to settle, the LEVEL DAC settings are programmed.

3.3.5 Temperature Compensation

The temperature compensation DAC (TC DAC) data is stored in the software as a function of the output frequency (F_o). This data is the same for each signal generator.

3.3.6 Reverse Power Protector

The reverse power protector (RPP) protects the unit from damaging voltages applied to the RF OUTPUT connector. The status line RPTRPL indicates whether the RPP circuitry has tripped. If the RPP trips, the RF output is programmed off, and the RF OFF indicator flashes. The RPP circuitry is reset by the operator turning the RF output on. This causes the Controller to reset the RPP by toggling RPRSTL and programming the RF on.

3.3.7 Frequency Reference Control

Programming of the frequency reference control bits depends on the setting of the INT/EXT reference switch as well as whether or not the High-Stability Reference or Medium-Stability Reference options are installed.

3.3.8 Frequency Control

The output frequency (F_o) is programmable with 10-Hz resolution from 0.1 to 1050 MHz and with 20-Hz resolution from 1050 to 2100 MHz. The filter and band control bits are programmed in nine bands and are determined by the output frequency. A synthesizer frequency is determined for each band.

The programming data of the KV and KN DACs are calculated from the synthesizer frequency and the instrument-specific VCO compensation data.

3.3.9 Modulation Modes

The nine modulation modes are:

- Internal AM
- External AM
- External DC AM
- Internal FM
- External FM
- Internal ϕM
- External ϕM
- Internal PM
- External PM

Modulation modes can be programmed separately or in any combination (only FM and ϕM are exclusive). The AM depth and FM deviation DACs are always programmed regardless of whether or not modulation is enabled. When enabling or disabling modulation, only the modulation control bits are programmed. The external DAC AM mode is enabled if both external AM and the DC AM special functions are enabled. Table 5-18 lists the control states for each modulation choice.

Modulation Frequency

The two internal modulation frequencies of 400 Hz and 1000 Hz are programmed with a single control bit MF400L. Table 5-19 lists the MF400L control states.

Amplitude Modulation

The generator allows amplitude modulation depth programming from 0 to 99% with 1% resolution. When the combination of signal amplitude and programmed AM depth exceeds +16 dBm peak from 0.1 to 1050 MHz or +13 dBm peak above 1050 MHz, the UNCAL indicator lights to warn that the output level is no longer guaranteed. Amplitude modulation depth is programmed using the 8-bit AM DAC, with a setting of 200 on the AM DAC corresponding to 100% AM modulation of the output frequency.

Frequency Modulation

Frequency modulation (FM) is programmable with three digits of resolution in the four decade ranges. The FM DAC is a 12-bit DAC programmed to the FM deviation in Hz divided by the resolution. In addition, the FM DAC is scaled to compensate for the effects of the frequency doubling circuitry. The FM and ϕM modes are selected by the control bit PMODL. Table 5-12 lists the settings of the FM DAC, FM Range, and PMODL bit settings.

The maximum programmable FM deviation is dependent on the RF output frequency. FM deviations up to 400 kHz may be entered regardless of the output frequency. However, the UNCAL indicator is flashed and the FM DAC is clamped at full scale if the entry is beyond the allowed upper limit for that frequency band. Table 5-13 lists the maximum programmable deviation in each frequency band.

Phase Modulation

Phase Modulation (ϕM) is programmable with three digits of resolution in four decade ranges. Phase modulation is internally normalized to 10 kHz, then programmed as FM deviation. The ϕM index is multiplied by 10 kHz (regardless of the modulation frequency) to get the equivalent FM deviation used to calculate the FM DAC and FM range bits. Table 5-14 lists the FM DAC, FM range, and PMODL bit settings.

The maximum programmable phase modulation deviation is dependent on the RF output frequency. Phase modulation deviations up to 40.0 radians may be entered regardless of the output frequency. However, the UNCAL indicator will flash and the FM DAC will clamp at full scale if the entry is beyond the allowed upper limit for that frequency band. Table 5-12 lists the maximum programmable phase modulation deviation in each frequency band.

3.3.10 Compensation Memory

The compensation memory contains the instrument specific compensation data for the VCO, Output, and Attenuator assemblies. The integrity of this data is crucial to the performance of the Generator. Two redundant copies of the data are kept in two separate non-volatile memory ICs. Hardware and software protection schemes guard against accidental destruction of the data. The compensation switch on the A2 Controller assembly must be set to the ON position when updating the compensation memory. The compensation memory self-test verifies the CRC checksums of each data segment. A detailed report of the compensation memory status can be interrogated from the front panel or the IEEE-488 interface. If compensation memory errors are detected by the self-test, the generator uses only the valid data segments. See Section 5.8 for more information on the compensation memory.

3.3.11 Power-On Self-Test (POST)

At power-on, the generator automatically self-tests the digital and analog circuits. If the unit fails any self-test, the results are automatically displayed as error codes. Several special functions are available for additional tests (see Section 2.3.9). Also, the microprocessor continuously monitors two status signals, UNLVL (unleveled) and UNLOK (unlocked).

The self-tests can also be invoked with the [SPCL] [0] [2] keys. The test results can be displayed in the four display fields with [SPCL] [1] [1] keys and can also be transmitted using the IEEE-488 Interface.

Self-tests 1 through 5 are digital checks that indicate the general functionality of the Controller assembly. Self-tests 6 through 10 use the two status signals UNLVL and UNLOK to test the general functionality of the RF circuitry.

During the self-test sequence all attenuators are programmed ON (maximum attenuation) to prevent unwanted signals at the output. In addition, the 6062A is programmed to the internal frequency reference because the self-tests fail if there is no reference supplied.

The self-test error codes and descriptions are listed in Section 5.4.3. A brief description of the different self-tests are described in the following:

Test 1 RAM is verified by writing data to each memory location and checking that the same data can be read back. Both the off-chip RAM and the on-chip RAM are tested in this way.

Test 2 The compensation data in the compensation EEPROM and in the battery-backed RAM is verified. The CRC checksum in each data segment (VCO, Output, and Attenuator) in both memory ICs are checked.

Test 3 Each memory location of the non-volatile RAM is checked with a checksum.

Test 4 The data in each word of the two software EPROMs is successively summed and rotated. The result of this procedure is compared with a checksum for each EPROM.

Test 5 The IEEE-488 circuitry is verified by the microprocessor writing data to the IEEE-488 chip and then reading it back.

Test 6 The low-pass and band-pass filters on the Output assembly are tested by setting the frequency within the pass band of the filters and verifying that the output is leveled. The frequency is then set outside of the pass band of the filters and the output should be unleveled.

Test 7 The synthesizer operation is verified by programming the unit to a normal operating frequency and checking to see that the unit is locked. The unit is then programmed to a synthesizer frequency below 225 MHz and then above 550 MHz and is checked to see that the unit unlocks.

Test 8 The Generator PLL operation is verified by forcing a large change in frequency. When this is done, the 6062A should become unlocked and then lock again.

Test 9 Frequency modulation is verified by simulating an over modulation condition, then checking the unlocked indicator. This is done by programming internal FM off and the KN DAC to zero.

Test 10 Amplitude modulation is verified by over-modulating the carrier and then checking the unleveled indicator. This is done by programming a high output level and programming INT AM on with a high AM depth.

3.3.12 Special Functions

There are several special function self-tests that are used as troubleshooting aids. Refer to Chapter 5 for detailed information regarding these troubleshooting tests.

3.3.13 Software Compensation Procedures

The software compensation procedures provide the user with the ability to generate the instrument-dependent FM, output, and attenuator compensation data. Section 5.8 describes the software compensation procedures in detail.

3.3.14 Status Signals

Three status signals indicate which option is installed in the Generator. These status bits are interrogated at power-on as follows:

HSOPTL indicates Option -130 High-Stability Reference is installed.

MSREFL indicates Option -132 Medium-Stability Reference is installed.

ROPTL indicates Option -830 Rear Panel RF OUTPUT, MOD Input, and Pulse MOD connectors are installed.

The status of the rear panel REF EXT/INT reference switch is continuously monitored with the EXREFL bit. The state of this bit is used by the Controller to display the EXTREF indicator on the front panel and to program the reference source.

The RF output is considered calibrated whenever the UNCAL indicator is off. If the calibrated limit of the Generator is exceeded, the UNCAL indicator is lit, but not flashing. However, the RF output is still considered usable.

The UNCAL indicator flashes when the output of the instrument is considered unusable. This is the result of a severe over-range condition or when one of the following analog status signals becomes active.

RPTRPL indicates that the RPP circuitry has tripped. If this occurs, the RF output is programmed off to provide additional protection to the instrument. The RF OFF and UNCAL indicators flash to indicate that RPP has tripped.

UNLOKL indicates one of several conditions. The PLL could be out-of-lock, the reference circuits could be out-of-lock, or the signal could indicate FM over-modulation (if FM is on). The UNCAL indicator flashes for any of these circumstances.

UNLVLL indicates that the output is unleveled. This could also be the result of amplitude over-modulation. With this condition, the UNCAL indicator flashes.

3.4 Detailed Circuit Descriptions

The Generator is divided into three major sections: the front panel section, the module section, and the rear panel section.

The front panel section is mounted in a sheet metal housing and consists of the A1 Display assembly, a switch circuit board and elastomeric switches. The front panel section also includes the display lens, the MOD INPUT connector, and the PULSE INPUT connector.

All of the front panel keys, except the POWER ON/OFF button, consist of an elastomeric membrane sandwiched between the switch circuit board and the front panel sheet metal housing. The switch circuit board consists of a 6-by-8 matrix of open switch contact pads. When a key is pressed, a conductive pad on the back of the elastomeric membrane connects a set of contract pads. The A2 Controller assembly software senses what row and column of the matrix are connected when a key is pressed.

The module section consists of a cast module frame with gasketed covers and includes the following electrical assemblies:

A2 Controller
A4 Synthesizer
A5 VCO
A6 Output Control
A7 Output
A8 Attenuator

The rear panel section consists of a fuse, a filter, a line-voltage selector circuit board, a transformer, the POWER ON/OFF switch and cable, the A9 Power Supply and the A3 IEEE-488 Interface assemblies, and a fan. The line-voltage selector circuit board accommodates four line voltages: 100, 120/220, and 240 volts. The line-voltage is determined by the orientation of the line-voltage selector circuit board.

The transformer with its two primary windings accepts the four voltages and produces the necessary five secondary voltages. The A9 Power Supply assembly rectifies, filters, and regulates these secondary voltages to produce the dc voltages required by the Generator. The dc fan is connected to the unregulated +5V supply.

3.4.1 Display PC Assembly (A1)

The A1 Display assembly provides a readout of the programmed modulation, frequency, amplitude parameters, and status information. This displayed information and the bright digit are controlled by the Controller assembly under the direction of the software. The display is comprised of two vacuum fluorescent displays and their associated control circuitry. The two displays are refreshed as four groups of nine display fields (usually a digit) each. The four groups share the digit (grid) strobes but have individual segment (anode) strobes.

Data Communications

Display data is sent through a byte-wide bidirectional data bus from the Controller and is latched by U1 through U5 on the display board. Latch select signals DIG1L, DIG2L, SEG1L, SEG2L, SEG3L, and SEG9L determine which latch receives the data. Level shifting buffer drivers U6 through U10 interface the TTL latches directly to the +37 V anodes of the vacuum fluorescent displays.

Display Filament Voltage

The 6.0 VAC filament voltage for the display is derived from a center-tapped winding on the power supply transformer, T1. The AC filament voltage is biased at +6.2 V above ground by circuitry on the Power Supply assembly to provide a cutoff potential for the displays.

Bright-Digit Cursor

The bright-digit cursor is achieved by providing three extra refresh cycles (strobes) to the specified digit. A grid current-limiting resistor (R3) provides uniform digit brightness by controlling electron depletion from the display cathode filaments.

Switchboard Interface

The digit strobe data latched by U1 is buffered by open collector inverters U13 and U15, and strobes the front panel switch matrix. The switch columns are strobed in unison with the display fields. The switch matrix status is read by the tri-state buffer U14.

Display Blanking

Monostable U11 and NOR gate U12 clear the display if new field or segment strobes are not received. This protects the display if the microprocessor stops refreshing. The display can be blanked manually by pressing [SPCL] [1] [3] which sets the signal CLRL and the output of U11 low, thus clearing latches U2 through U5. To restore the display, press [SPCL] [1] [2].

Modulation-Level Indicator

The external modulation-level indicator warns the operator when the modulation signal is not set to 1 V peak (±2% typically). The external modulation signal is compared in the dual-comparator, U16, with internal references of 0.98 and 1.02 V. Two status bits, MLEVLO and MLEVH1, are at the output of the 0.5 second dual one-shot, U17. If either of these reference voltages are exceeded, the two status bits are sensed by the controller that controls the EXT HI and EXT LO indicators in the MODULATION display field.

3.4.2 Controller PC Assembly (A2)

The Controller assembly, under the direction of the software, handles the data interface between the front panel, remote interface, and generator functions. The Controller assembly is located in a top side compartment of the module section.

The Controller assembly consists of the following functional groups:

- Microprocessor and its interface circuitry
- Attenuator control interface
- Front panel interface
- IEEE-488 Interface
- Memory ICs and addressing circuitry
- Module I/O circuitry
- Reset circuit
- Status and control latches

Microprocessor

The heart of the Controller assembly is U1, a TMS9995 16/8 bit microprocessor. The digital system clock signal is generated by an oscillator comprised of gates from U5 and crystal U41. L3 and C61 form a band-pass filter, which ensures that the crystal will oscillate at its fundamental frequency. When bidirectional buffer U4 is enabled, it provides additional drive current to the data bus signals. When U4 is disabled, it isolates the microprocessor from the system data bus. Buffers U33, U34, and U10 provide extra drive current to the microprocessor address and control signals.

Attenuator Control Interface

The attenuator control signals are latched by U27. Darlington drivers U30 and U31 control the Relay Driver assembly.

Front Panel Interface

Data is transferred to and from the front panel circuitry through tri-state bidirectional data buffer U18. This buffer is active when a front panel latch is addressed and the buffer control signal from U17 is low; otherwise, it is in the high-impedance state. The front panel latch select lines are decoded by U36. To reduce RF emissions from the 6062A, low-pass filters and bypass capacitors comprised of the following components are used on the following signals:

Signals	**Components**
Signal CLRL	R6 and C51
Latch select SEG1L	R7 and C53
Latch select SEG2L	R8 and C54
Latch select SEG3L	R9 and C55
Latch select SEG9L	R10 and C56
Latch select DIG1L	R11 and C57
Latch select DIG2L	C46
Buffer select KBINL	C49
Signal MLEVHI	C47
Signal MLEVLO	C48

In addition, capacitors C58 and C59 bypass the display filament supplies, and capacitor C43 is used to bypass the -15 volt supply. LC filters comprised of L1 and C50, and L2 and C52 are used on the +5 volt and +37 volt supplies to the front panel circuitry.

IEEE-488 Interface

Tri-state bidirectional buffer U3 buffers the data bus to the IEEE-488 Interface Assembly. Address and control lines to the assembly are buffered by tri-state buffer U2. These buffers are in the high-impedance state when the assembly is not addressed.

The active low interrupt signal IEINTL from the IEEE-488 Interface Assembly is connected to the level four interrupt on the microprocessor. R1 and C22 form a low-pass filter to suppress digital emissions from the 6062A.

Memory

The program instructions and constant data are stored in two 32K-byte EPROMs, U21 and U22. The scratch pad RAM, non-volatile front panel setups, and one copy of the compensation memory are contained in the battery-backed CMOS RAM U25. The 2K-byte EEPROM U24 contains a redundant copy of the compensation memory.

The compensation switch protects the compensation memory from accidental destruction. The switch is connected directly to the enable input of tri-state buffer U46. When disabled, the buffer disconnects the write enable input of the EEPROM from the microprocessor write enable signal. The decoder PAL U20 decodes the memory selects and provides the bank switching logic. U20 also contains the write protection logic for the battery-backed portion of the compensation memory.

Module I/O

Control data is transferred to the RF circuitry (located in the module section) through a byte wide unidirectional data bus. This data is retained on the RF circuit boards in latches. Select lines BSEL0L, BSEL1L, and address lines BAB2 through BAB0 are decoded into individual latch enables on the various RF circuit boards. Tri-state buffers U15 and U16 on the data and address lines provide extra drive current and allow these signals to float when inactive.

Flip-flop U42 gates the module I/O select pulse from U8 with the system clock to delay the leading edges of BSEL0L and BSEL1L to provide adequate latch setup times. D-flip-flop U9 latches address lines BAB2 through BAB0 to provide adequate latch hold times.

Reset

Comparator U7 and its associated circuitry generate the active low reset signal to the TMS9995. The reset signal is generated on power-up or if the +5 V supply drops below +5 V.

At power-up, R5 and C4 provide a slow-rising input signal to the Schmitt Trigger inverter pair U44. The output of the second inverter pulls the microprocessor reset input low, then drives it high after approximately 100 milliseconds. When the +5V supply is up, a reference voltage is set at the negative terminal (U7 pin 2). This reference voltage is one diode drop below the voltage at the positive terminal (U7 pin 3). When power is lost, the voltage at the positive terminal falls below the reference voltage held by C3, and the output of U7 is immediately pulled low. This discharges C4 and resets the microprocessor.

Status and Control

Tri-state buffers U11 and U40 read the three hardware fault detector status signals, UNLVL, UNLOKL and RPTRPL, the three option status signals HSOPTL, MSREFL, and ROPTL, and the status of the REF INT/EXT switch. Control and buffer enable signals are latched by U17.

3.4.3 IEEE-488 Interface Assembly (A3)

The IEEE-488 Interface Assembly uses an NEC uPD7210 Talker/Listener IC (U1) to handle all the IEEE-488 standard communications protocol. All data, address, and control lines to the 7210 are buffered on the Controller. Two MC3447 bus drivers (U3 and U4) interface the 7210 directly to the IEEE-488 bus.

Tri-state buffer U6 provides the status of the IEEE-488 rear panel address switches when the 6062A is interrogated. These switches determine the IEEE-488 bus address and talk-only (to) or listen-only (lo) modes. When opened, the switch just to the left of the IEEE-488 bus connector disconnects the bus shield ground from the system ground.

3.4.4 Synthesizer PC Assembly (A4)

The A4 Synthesizer assembly provides frequency control and modulation of the output. The Synthesizer assembly is located on the top side of the module section. Together with the VCO assembly and a 10 MHz reference frequency, the Synthesizer assembly simultaneously generates a high-band signal that spans 490 to 1050 MHz and a mid-band signal that spans 245 to 512 MHz.

The high-band and mid-band signals are coupled to the A6 Output Control assembly. Here, heterodyning extends the frequency coverage down to 0.01 MHz, and multiplying extends the Generator frequency coverage up to 2100 MHz.

The Synthesizer assembly consists of the following functional circuits that are described in the following paragraphs:

10 MHz Reference
Sub-Harmonic Reference
Main PLL
FM Processing
800/40 MHz PLL
Sub-Synthesizer

10-MHz Reference

The 6062A reference is the internal 10 MHz crystal oscillator. If Option -130 High-Stability Reference or Option -132 Medium-Stability Reference is installed, that oscillator is locked to the internal crystal oscillator. An external reference of 1, 2, 2.5, 5, or 10 MHz can also be locked to this oscillator.

The internal 10-MHz crystal oscillator (XO) is a crystal, Y1, and an FET transistor, Q39. The frequency is adjusted by C240 and R230. The oscillator signal from Q39 is buffered by Q40, converted to TTL by U55-B, and sent to the sub-harmonic phase detector, U68, and the rear output through a 10 MHz band-pass filter, C247 and L73. The 10 MHz reference is sent to both the 800/40-MHz loop-phase detector via U59, and the main loop-phase detector via U58.

Sub-Harmonic Reference

Comparator U67 forms an AC-to-TTL converter. Diodes CR20 and CR21 precondition the REF IN signal to protect the comparator. Resistors R148, R149, R153, and R217 provide hysteresis, preventing oscillation when there is no input.

MOS switch U70 connects the control voltage of the 10 MHz crystal oscillator to a bias network R229, R230, and R231, or to the loop amplifier, thus closing a phase-locked loop.

The phase detector and loop amplifier are made up of U68, Q26, Q27, Q38, and U69. The signal from the external reference input through the AC-to-TTL converter or the enhanced stability options is applied to the flip-flop clock input, U68-3, via U54. The 10 MHz signal from the crystal oscillator goes to the other flip-flop clock input, U68-11. The flip-flops are connected, so the width of the pulse that switches Q38 is the difference in time of these two signals (U68-3 and U68-11). The phase-detector operating point is set by R223 and R224.

The output of the loop amplifier is applied as the control signal to the frequency control input of the 10 MHz crystal oscillator through the control switch U70. The control switch, U70, is controlled by the Controller through the control line SHENL. This line is enabled when rear panel REF INT/EXT switch is set to EXT or when the enhanced stability options are present.

An out-of-lock detector is formed with one-shot U71. The out-of-lock detector provides a status output to the Controller that indicates the 10 MHz oscillator is not locked. An out-of-lock condition causes the loop amplifier to have a low-frequency beat note which triggers the one-shot to act as a pulse stretcher.

The output of the one-shot is an active-low signal and is combined through diode CR29 with other signals to form the UNLOK status signal.

Main Phase-Lock Loop

The main phase-lock loop (PLL) is a fractional divider PLL with a single-sideband mixer (SSB) in the feedback path. The oscillator for this loop is a separate assembly, the VCO assembly. All the remaining PLL circuitry is on the Synthesizer assembly.

The key signals to the main PLL are the 1 MHz reference signal from the 10 MHz reference circuit, the 245 MHz to 512 MHz signal from the binary divider, and the 20 kHz to 40 kHz signal from the sub-synthesizer circuit. The fractional division technique provides 20 kHz frequency resolution.

The SSB mixer, in conjunction with the sub-synthesizer, provides additional 5 Hz resolution at the Synthesizer frequency. This corresponds to 10 Hz resolution on the high band.

The main PLL consists of the VCO, the binary divider, the SSB mixer, the triple-modulus prescaler, the N-Divider, the phase detector, and the loop amplifier. All but the VCO are described in the following paragraphs. The VCO is discussed later in this section.

Binary Divider and Single-Sideband Mixer

The 490 MHz to 1050 MHz signal from the VCO via J107 is coupled to the binary divider, U1. Regulator Q1 provides +5 V for the divider. One output of U1 is coupled to the Output Control assembly through J104. The other output is amplified by Q2 and Q3. This signal is split into two quadrature (90° phase difference) signals by 3 dB coupler, U6.

This signal, and two other audio quadrature signals from U10, are summed in the double-balanced mixers U7 and U8 to produce two double-sideband suppressed-carrier signals. Because of the phase relationship of the outputs of the mixers, the summing of the two composite signals (in resistor network R21 and

R22) results in the upper-sideband component being suppressed. The predominate remaining signal is the lower-sideband signal.

The lower-sideband signal, spanning 245 MHz to 512 MHz in 20 kHz steps, is amplified by U9 and applied to the N-Divider where it is divided down to 1 MHz.

N-Divider

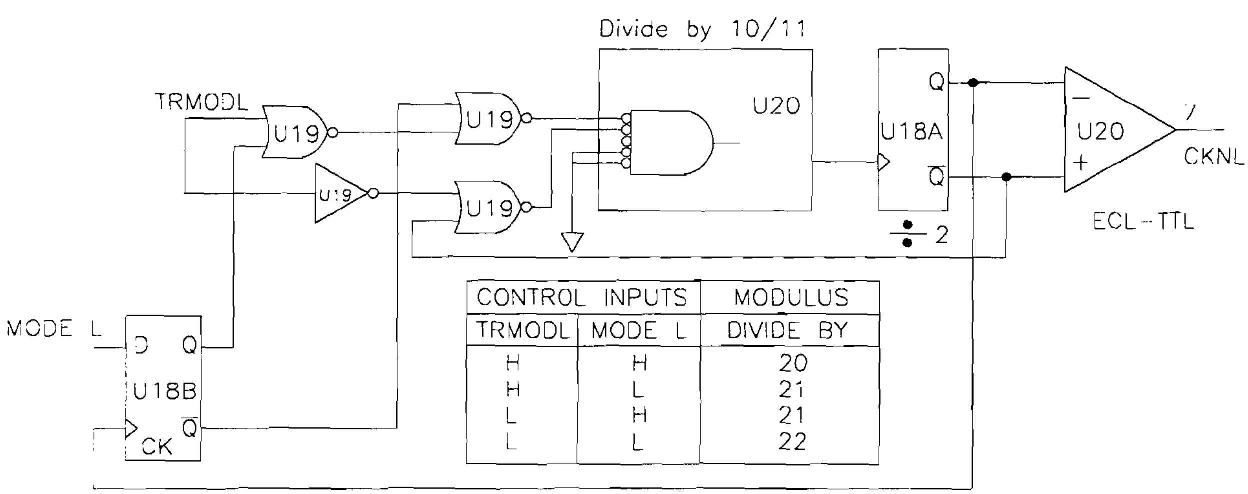
The main components of the N-Divider are:

- Triple-Modulus Prescaler (divide by 20/21/22) U18, U19, and U20
- N-Divider Custom Gate Array U17

The triple-modulus prescaler shown in Figure 3-1, consists of a divide by 10/11 (U20), divide-by-2 (U18A), synchronizing flip-flop (U18B), and quad NOR gates (U19). If all the inputs (E1, E2, E3, E4, and E5) to the 10/11 divider are low, the prescaler divides by 11, and the total division to the output (U20 pin 7) is 22. If any of the inputs are high, it divides by 10, and the total division is 20.

If inputs E1 and E3 are low, the modulus of the 10/11 divider is controlled by the output of the following divide-by-2 (U18A). Consequently, the prescaler divides by 10 half the time and by 11 the other half, resulting in a divide-by-21. U20 contains the ECL to TTL converter. U18B synchronizes the changing of the modulus with the clocking of the subsequent stages. The N-divider is clocked by the composite prescaler output U18A.

The operation of the triple-modulus prescaler is shown in Figure 3-1. The prescaler operates in conjunction with the N-divider gate array shown in Figure 3-2.



CONTROL INPUTS		MODULUS
TRMODL	MODE L	DIVIDE BY
H	H	20
H	L	21
L	H	21
L	L	22

Figure 3-1. Triple-Modulus Prescaler Operation

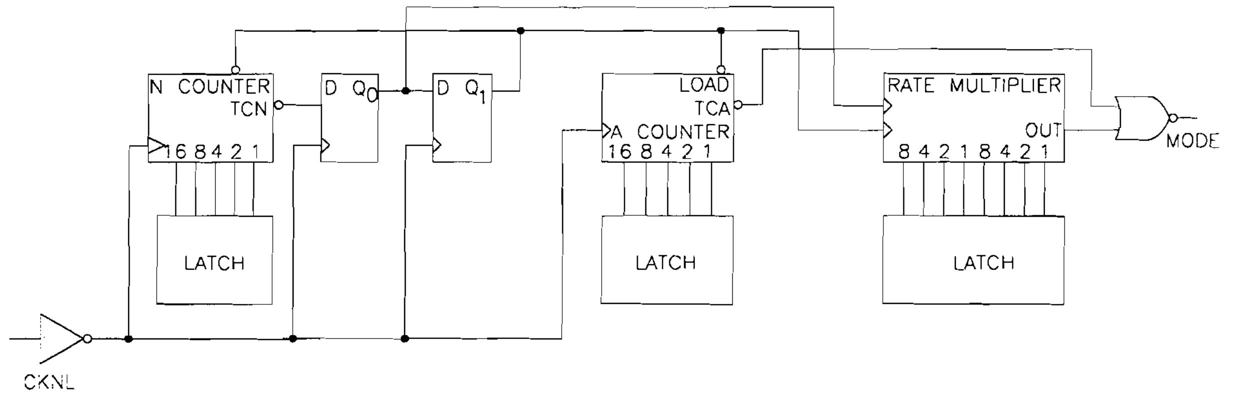


Figure 3-2. N-Divider Operation

The N-Divider gate-array contains two 5-bit binary counters (A and N), a BCD two-decade rate multiplier, and latches to interface to the microprocessor. The operation of the N and A counters is as follows:

At the beginning of a count cycle, a number is loaded into the A and N counters. The A counter is not at its terminal count, so the output is high, and the mode line (MODE L) is low. This causes the prescaler to divide by 21 (or 22, TRMODL = low). The mode line stays low for 31-A counts, where A is the programmed number. The mode line goes high, and the prescaler divides by 20 (or 21, TRMODL = low) for 31-N counts.

The total division is:

(P+1)*(31-A) + P*((31-N)-(31-A)) or P*(31-N) + (31-A)

On the 31st count, the counters are reinitialized. Figure 3-3 shows the timing for the A-counter programmed to 26, and the N-counter programmed to 18. Only the CKNL and MODE L signals shown in Figure 3-2 are accessible at U17, pin 6, and 22, respectively. Figure 3-3 shows the N-Divider timing diagram.

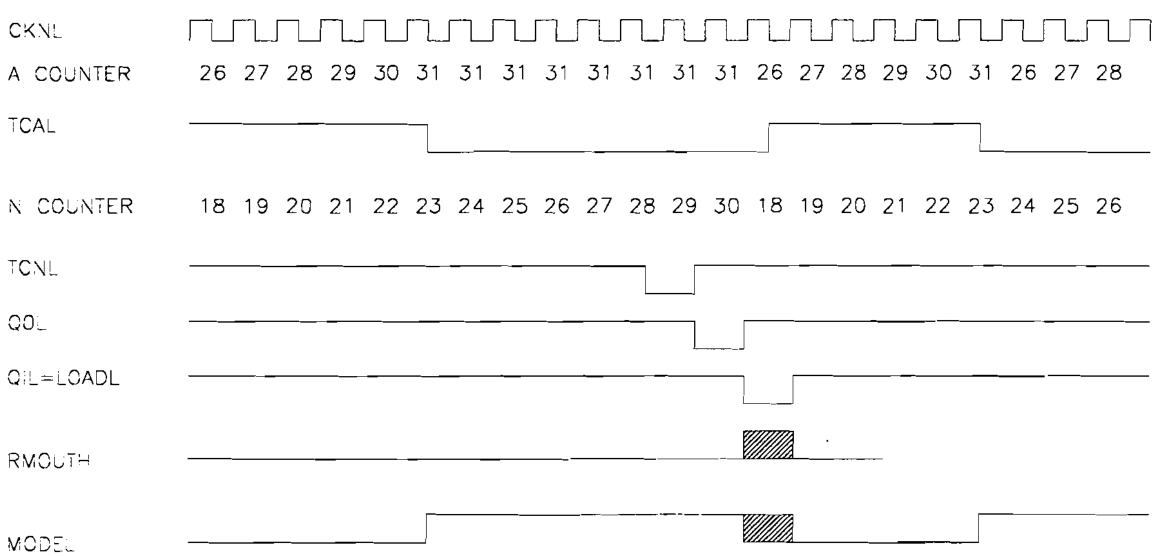


Figure 3-3. N-Divider Timing Diagram

The N-Divider gate array includes a two-decade rate multiplier that produces the fractional part of the division. It produces a pulse train with a programmed number of pulses for a 100-cycle frame of the 1 MHz N-divider output.

The programmed number ranges between zero and 98 in steps of two, corresponding to 20 kHz steps at the mid-band output frequency. The flip-flops in the rate multiplier get set up on count 29, and on count 30, a pulse may or may not be present depending on the programming of the rate multiplier. This is the shaded pulse in the timing diagram, Figure 3-3.

Irregularly spaced rate-multiplier pulses cause the mode line to go low, and the prescaler divides by P+1 at a rate equal to the rate multiplier programming. At a division of 255, the N and A counters are normally programmed to 15. This means the divider is always dividing by 21; consequently, there is no place to slip in the rate-multiplier pulses.

A 20/21 dual-modulus prescaler will not allow division from 245 to 525 without holes. For example 252 is 0 frames of 20 and 12 frames of 21. Consequently, there is no place to slip in the rate-multiplier pulses. It is not possible to divide by 253.

By using a triple-modulus prescaler, these problems are solved. Continuing with the previous example 252 is 12 frames of 21 and 0 frames of 22. The divider functions by allowing the prescaler to divide by

22 at a rate equal to the rate-multiplier frequency. Number 253 is 11 frames of 21 and 1 frame of 22. A software algorithm determines whether to operate in the 20/21 mode (TRMODL =1) or 21/22 mode (TRMODL =0).

The frequency at the output of the N-divider gate array, is $(F_o - F_s - F_d)/N$; where F_o is the VCO output frequency, F_s is the sub-synthesizer frequency, and F_d is the fractional-division frequency.

Phase Detector

The 1 MHz reference signal from divide-by-10 U58, and the 1 MHz signal from the N-divider U17 are connected to a digital phase-frequency detector (U43, U44, U45). If the N-divider output is greater than the reference frequency, the level at TP38 is high. When the output of the level shifter Q16 is above ground, then CR12 is turned off. This allows current from Q19 to flow through CR13 into the integrator, decreasing the voltage at the integrator output, U48 Pin 6, which then lowers the frequency of the VCO until the reference and the N-divider output are the same frequency.

Similarly, if the N-divider output frequency is below the reference, TP39 is low, and the voltage at the output of level shifter Q17 is below ground, turning off CR15 and allowing current from R108 to flow through CR14 out of the integrator. This raises the voltage at the output of the integrator, which raises the VCO frequency. The phase-frequency detector is designed so that if the phase between the reference and N-Divider output slips more than two cycles in either direction, the corresponding phase-detector output is high or low. This provides twice the integrator current during acquisition as a conventional phase-frequency detector.

R107 provides a small bias current to the integrator to bias the phase detector at approximately 2.5 radians; consequently, the down-pump is normally always on. If the up-pump comes on, indicating an over-modulation condition, the pulses are detected by the one-shot, U47 that produces the UNLOK status that is then sensed by the Controller.

For flat FM response, it is necessary for the PLL bandwidth to be constant at all VCO frequencies. Two factors cause the loop bandwidth to change: the VCO tuning coefficient (Kv) and the divider ratio.

During calibration of the VCO, the Kv is measured at many frequencies across the band, and compensation data is stored in the compensation memory. The software uses this data along with N to control the PLL bandwidth in a compensating manner. The PLL bandwidth is controlled by changing the current to the down-pump via the KN DAC, U27, and the voltage-to-current converter, U46, Q18, and Q19.

Loop Amplifier

The loop amplifier-integrator consists of operational amplifier U48, C118 and R91. Capacitors C121 and C119 filter the 1 MHz reference. The output of the integrator is connected to a multi-pole LC filter (R92, C123, C99, C124, C126, C125, L49, L50, and R93) that attenuates the delete rate (20 and 40 kHz) and reference 1 MHz spurs.

Diodes CR9 and CR10 stabilize the loop during switching. The filter is buffered by the Darlington emitter-follower Q20, which is biased at 10 mA by Q21. Additional lead/lag compensation is provided by R99, R101, and C131. Proper termination for the filter is provided by R93 and Q22. The voltage for the loop amplifier is regulated to approximately +30V by Q15.

Amplifier U49 is a precision clamp to keep the VCO frequency above a minimum value for oscillation, and below a maximum above which the N-divider would not divide correctly. The photoisolator U50 detects when the clamp is active, indicating an out-of-lock condition. This signal is ORed with the signal from one-shot U47 and sent to the microprocessor as the UNLOK status.

FM Processing

To provide FM accuracy, the FM signal FMV from the Output Control assembly is first processed by the KV DAC (U28, and U29) to compensate for the VCO tuning coefficient. The KV DAC setting is proportional to 1/Kv, where Kv is the tuning coefficient. This correction is stored in the compensation memory on the Controller assembly.

Range switching is provided by resistors R77, R78, R79, and FETs Q10, Q11, and Q12. Comparator U42 converts TTL levels to 0V (on), and -15 V (off) required by the FETs. U41C buffers the range switch, and in conjunction with R82, provides an overall FM adjustment. At this point, the audio signal splits into two paths. The path that connects to the integrator, U41A, is for modulation frequencies inside the loop bandwidth.

The path that sums with the VCO control voltage at P102 is for frequencies outside the loop bandwidth. U41D is an active high-pass filter that compensates for the non-ideal integrator and the AC coupling to the VCO tuning port.

The output of U41D is summed with the VCO control voltage via R88 and C117. FET Q13 allows the FM to be turned off. The audio signal is also processed by integrator U41A, R85, R86, and C115. The audio signal is AC coupled into the phase-detector integrator via R89, R90, C116, and FET Q14. (Resistor R90 adjusts the low frequency FM gain). This integrator makes the phase modulation produced at the Phase Detector appear as FM.

800/40 MHz PLL

When the 6062A is operated in the HET band, the 800 MHz oscillator is locked to the 10-MHz Reference and provides a local oscillator for the heterodyne circuit on the Output Control assembly. It also provides a 40 MHz signal to the sub-synthesizer clock generator.

The 800 MHz VCO is connected to the divide-by-four, U61, followed by a divide-by-five, U62 and U63, providing 40 MHz to the sub-synthesizer clock generator through selector U64. When the 6062A is not in the HET band, the 800 MHz oscillator and the first divide-by-four are disabled by turning off Q28 (HET).

The 40 MHz Oscillator consisting of U64, L66, and CR24, is selected by U64. The 40 MHz balanced ECL signal from U64 drives the two-phase clock generator. A self-biased gate, U65, converts ECL to TTL. U66 divides the 40 MHz signal by four to produce a 10 MHz signal that is compared against the 10 MHz reference in the phase detector U59 and U65.

Op-amp U60, resistor network Z9, and C181, C185, C186, and C201 integrate the phase detector pulses to produce a DC control voltage for the 800 MHz VCO and the 40 MHz VCO.

800 MHz VCO

The 800 MHz VCO is a low noise, limited range, voltage-controlled oscillator for the 800 MHz PLL. The basic oscillator uses two active devices operating as negative resistance elements, coupled symmetrically to a resonator made up of two varactors and an adjustable capacitor. Each device is followed by an amplifier and isolation pad. This provides two coherent outputs of +5 dBm to the PLL and 0 dBm to the Output Control assembly.

The oscillator transistors Q32 and Q35 are biased at 13 mA by R182 and R191. The voltage at the collectors of Q32 and Q35 is typically +2.5 V. The two 6-dB amplifiers Q33 and Q37 are biased so that the voltage at their emitters is about +0.3V, and the voltage at their bases is about +1 V with the collectors at +6.5 V.

The PLL control voltage from U60 provides the tuning voltage for the dual varactors CR26 and CR27. The adjustable capacitor C206 is set to provide +16V on the varactor to optimize the VCO noise characteristic. The output attenuators consisting of R186, R187, R189, R197, R198, and R200 provide isolation for the outputs. The VCO signal is coupled to the A6 Output Control assembly by a through-the-plate coaxial connector P108 at the 0 dBm level. The other VCO signal is connected to the divider U61 to provide the feedback for the PLL.

Sub-Synthesizer

The sub-synthesizer consists of the clock generator, U34, U35, Q4, Q5, the gate-array, U33, the divide by 500, U15, and U16, and the low-pass filter L11 and L17. Internal to the sub-synthesizer gate-array, U33, are a divide-by-two, a 3 1/2 decade-rate multiplier, and associated latches.

The balanced 40 MHz ECL clock signal is converted to TTL in Q4 and Q5, and converted to a two-phase 20 MHz clock in U34, U35.

The input frequency to the rate-multiplier is 20 MHz. The output frequency can be programmed from zero to 19.995 MHz in 5 kHz steps. This signal is ORed with the other phase of the 20 MHz clock to produce 20 MHz to 39.995 MHz at U33 pin 1. It is also divided by two for the output at U33 pin 23, by ten in U15, and again by 50 in U16 to produce 20 kHz to 39.995 kHz in 5 Hz steps. This TTL signal at TP11 is filtered by L11, L17 and C41, C42, C48, C50, and C51. Op-amp, U10 forms an active quadrature generator, and the output pins 14 and 8 are offset by 90 degrees. These two signals are the 20 kHz to 40 kHz inputs for the Main PLL single-sideband mixer.

3.4.5 VCO PC Assembly (A5)

The A5 VCO assembly is the heart of the main PLL. It produces the signal that is further processed to become the generated output. The VCO assembly is located in a bottom side compartment of the module section.

The VCO tunes over a frequency range of 490 MHz to 1050 MHz in 4 bands, programmed by binary control signals Q and H/L, as follows:

Band	Frequency Range (MHz)	Q	H/L
L1	490 - 639.99999	0	0
L2	640 - 729.99999	1	0
H1	730 - 889.99999	1	1
H2	890 - 1050	0	1

The control voltage varies from about +2 V to +16V in each of the four bands, and varies approximately linearly with frequency in each band. The VCO assembly contains two oscillator circuits of similar design, but with different element values and transmission line lengths, to cover 490 MHz to 730 MHz (L bands oscillator) and 730 MHz to 1050 MHz (H bands oscillator).

Each oscillator uses a transistor (Q1, Q2) configured as a negative resistance device. The voltage at the collector of Q1 is about 7.2 V at 1050 MHz, and the voltage at the collector of Q2 is about 8.1 V at 700 MHz. Each oscillator transistor is coupled loosely to a resonator that consists of a microstrip transmission line in series with a varactor diode (CR1, CR2) and a switchable value capacitor circuit (C3, C4, C7, C8, and associated components).

Each oscillator operates in two bands, selected by switching the capacitance value from varactor cathode to ground. For the H bands oscillator, C3 is selected for H2 band operation, while C3 in parallel with C4 is selected for H1 band. For the L bands oscillator, C7 is selected for L2 band operation, while C7 in parallel with C8 is selected for L1 band. The PLL control voltage from the Synthesizer assembly at P202 provides the tuning voltage for varactor diodes CR1 and CR2.

The +13 dBm nominal signal from each oscillator is applied to a 12 dB attenuator that provides isolation (R8-R10, R14-R16), and then to a low pass filter that attenuates harmonics to -15 dBc nominal (C16, C17, C24, C25). A PIN diode switch selects the signal from the ON oscillator, while the other oscillator is disabled by shorting the resonator to ground with a PIN diode switch (CR3, CR4, CR9, CR10). The signal is next applied to a signal splitter/attenuator that provides further isolation (R18, R19, R20, R23, R24).

One signal splitter output goes to 11 dB amplifier U1. This amplifier provides further isolation and also boosts the signal to about +3 dBm. The boosted signal is connected to the Output Control assembly by a plug-in capacitor, C1. This capacitor allows either the VCO assembly or the Output Control assembly to be removed independently from the module section without the use of a soldering iron.

The other signal splitter output goes to series connected 11 dB amplifiers U2 and U3. Two amplifiers are required for adequate isolation from the Synthesizer assembly. The +3 dBm output signal from U3 is connected to the Synthesizer assembly by a through-the-plate coaxial connector P204.

Amplifiers U1, U2, and U3 are biased at about +1.5 V at their inputs, and +4.5 V at their outputs.

The binary band control signals Q and H/L are connected from the Output Control assembly to the VCO assembly with a cable assembly W1 that plugs onto connector pins on the Output Control assembly. The control signals are level shifted by dual operational amplifier U4, which acts as a comparator.

3.4.6 Output PC Assembly (A6 and A7)

The A6 Output Control assembly and the A7 Output assembly are integrated. The following paragraphs describe the circuitry of the two assemblies as a single assembly (Output Assembly). The Output Assembly accepts RF signals from the Synthesizer and the VCO assemblies and command signals from the Controller assembly. The Output Assembly provides a 0.1- to 2100-MHz RF signal to the Attenuator Assembly.

The Output Assembly reduces harmonic distortion components in the RF signal, controls RF signal amplitude and introduces AM and Pulse. Also, the Output Assembly generates the low (heterodyne) frequency band from 0.1 MHz to 245 MHz through mixing, and the X2 frequency band from 1050 to 2100 MHz by doubling the high band. It also generates a modulation signal to provide internal AM and FM, ϕM, and Pulse, and provides a digital interconnect path between the Controller and Synthesizer.

RF Path

The RF path begins with the two RF signals from the VCO and the Synthesizer assemblies. The SPDT (single-pole double-throw) band-switch circuit selects between the 512 MHz to 1050 MHz signal at P6 and the 245 MHz to 512 MHz signal at P7. The selected signal is applied to buffer amplifier U38 and U39.

The 245 to 512 MHz signal directly generates the mid-band output signal. The 512 MHz to 1050 MHz signal generates the high-band output signal directly and the 0.1 MHz to 245 MHz low-band output signal by mixing with an 800 MHz LO signal. The 1050- to 2100-MHz X2 frequency band is generated from the high band with a frequency doubler.

The buffer amplifier consists of an input attenuator followed by monolithic RF amplifiers U38 and U39 and has 7-dB gain. Following the buffer amplifier is a printed low-pass filter and a X2-band select switch consisting of PIN diodes CR7 through CR10. This switch either routes the signal to a low-pass filter circuit for frequencies from 245 to 1050 MHz, or to a doubler circuit for 1050 to 2100 MHz.

For operation in the 245 to 1050 MHz frequency band, the RF signal is routed through CR8 to a cascade of low-pass filters. These filter circuits consist of combinations of discrete components and printed traces that suppress harmonics in the RF output signal. The first filter section is switched into the RF path via PIN diodes CR12 through CR16 by asserting MIDH when the Generator is operated in the mid band (245 to 512 MHz). PIN diodes CR17 through CR19 select capacitors C16, C18, and C20 whenever HAOCTH is asserted to change the section cutoff frequency from 512 to 350 MHz. The third section provides harmonic filtering for the two higher bands, 512 to 730 MHz, and 730 to 1050 MHz. PIN diodes CR20 through CR22 select capacitors C24, C26, and C28 to change the cutoff frequency from 1050 to 730 MHz whenever HAOCTH is not asserted.

For operation in the X2 band from 1050 to 2100 MHz, the RF signal is directed through CR7 to the frequency doubler and associated filters on the A6 Output Control assembly. The control signal X2L is asserted at -15 V. A signal of approximately +9 dBm (±2 dB) at the input of U1 becomes +14 dBm (±1dB) at the input to balance T1. U1 and U2 operate as a limiter to control the amplitude and limit signal variations to this point. T1 generates a balanced drive for rectifier CR26 with a resulting second harmonic of +4 dBm (±2 dB) at the output of C134. In addition, a strong fundamental component and third harmonic are also present.

The remaining circuitry splits the signal into four frequency bands: 1050 to 1250 MHz, 1250 to 1450 MHz, 1450 to 1750 MHz, and 1750 to 2100 MHz. The circuitry then acts as a bandpass filter for the signal, leaving only the desired second harmonic. Filter 1 is the topmost filter on the 9-layer stripline quad filter assembly. When CR27 is on, CR29 is on and CR28 is off and a signal is delivered through this filter. Logic signal X2FL1L is at -15 V to produce this result. Meanwhile, X2FL2L, X2FL3L, X2FL4L are at +15 V to turn off the other three parallel paths. The other three paths operate in a similar manner. Operation can be observed by switching the frequency and observing voltages at the coil end of the appropriate resistors (see Table 3-1).

Table 3-1. Bandpass Logic States

Band (MHz)	R47	R48	R49	R50	R51	R52	R53	R54
1050 to 1250	-0.8V	-0.8V	+14V	+0.8V	+0.8V	+0.8V	+0.8V	+0.8V
1250 to 1450	+14V	-0.8V	-1.6V	-0.8V	+0.8V	+0.8V	+0.8V	+0.8V
1450 to 1750	+14V	+0.8V	+14V	+0.8V	-1.6V	-0.8V	+0.8V	+0.8V
1750 to 2100	+14V	+0.8V	+14V	+0.8V	+0.8V	+0.8V	-1.6V	-0.8V

The output signal from the switched filters is amplified by U8 (8 dB gain) to a level of 3 dBm (±2.5 dB) at the input to the RF modulator. CR43 and CR44 serve as a switch to turn off this signal when 0.245 to 1.05 GHz is being sent to the modulator. Likewise, CR45 and CR46 exclude the lower frequencies when 1.05 to 2.1 GHz is required.

The amplitude modulator on the A7 Output assembly consists of PIN diodes CR1 through CR7 and associated components, and receives the RF signal from the A6 Output Control assembly through W1. The modulator is a voltage-controlled variable attenuator that provides AM and output level control. Modulator control voltage is determined by the leveling-loop circuitry. The leveling loop is described in Section 3.4.6.

U1, U2, U3, Q2, and associated components follow the modulator in the signal path and form a four-stage, 25-dB gain, 245- to 2100-MHz amplifier. This amplifier drives a 3-dB power splitter that consists of resistors R28 through R31 and associated printed transmission lines.

One power-splitter output drives the leveling-loop detector diode CR8. The other output goes to a 2-dB gain buffer amplifier that includes Q4 and associated components. The HET band switch follows the buffer amp and consists of PIN diodes CR10 through CR15 and biasing components. In the 245- to 2100-MHz position, the signal passes through diodes CR11 through CR14 to the pulse modulator, U5 through U7. The output amplifier follows the pulse modulator and consists of FET Q9 and associated components. This low distortion amplifier has 9 dB gain and output capability of 19 dBm.

For low-band operation (0.1 to 245 MHz), the signal from the power splitter is routed through CR10 and W2 to the HET band circuitry on the A6 Output Control assembly. The RF signal first passes through an adjustable attenuator consisting of R61 through R66, and then to the RF port of U3 (a double-balanced mixer). The signal frequency at the mixer RF port varies from 800.1 to 1045 MHz. The 800-MHz local oscillator (LO) signal for the mixer comes from the A4 Synthesizer assembly through P8 and is amplified by Q37. This fixed-tuned amplifier has 13 dB of gain and provides a 10-dBm signal at the mixer LO port.

The mixer 0.1- to 245-MHz output signal is passed through a diplexing low-pass filter (C194 through C205, R59, R60) that suppresses unwanted mixer spurious products while maintaining a 50 Ω load at the mixer IF port. The filtered IF signal is amplified by a three-stage IF amplifier consisting of Q34, Q35, Q36 and associated components.

The IF amplifier gain increases with frequency and is nominally 35 dB at 0.1 MHz and 37 dB at 245 MHz. This gain characteristic compensates for the increasing loss with frequency of the mixer and the diplexing low-pass filter. The output of the IF amplifier passes through W3 to a 245-MHz low-pass filter on the A7 Output assembly (C53, C54, C55 and printed inductors L14 and L15). Following this filter, the signal passes through PIN diode CR15, the pulse modulator, and the output amplifier. The +15 V power supply for the LO and IF amplifiers is switched off by Q20 when the instrument is operating in the 245- to 2100-MHz bands to avoid introducing spurious products in the instrument output.

Leveling Loop

The leveling loop accepts the unleveled 245 MHz to 2100 MHz signal from the switchable low-pass filters and doubler-filter circuits on the Output Control. The leveling loop generates a leveled signal at the power splitter output on the Output assembly that feeds the buffer amplifier. The leveled signal is proportional to the leveling loop control voltage that is generated by the level-control circuit. The signal amplitude at the other output of the power splitter is detected by a Schottky detector diode, CR8.

This diode generates a temperature-dependent DC voltage, which is a non-linear function of the applied RF voltage, so temperature compensation and linearization are necessary. The detector diode signal is low-pass filtered by L10 and C35, and is offset by the voltage across temperature-compensating diode CR9. Q25, Q26 and associated components on the A6 Output Control assembly form a current source circuit that provides bias current for CR9 and CR8.

The offset detector diode voltage at U29-A pin 5 on the Output Control assembly is linearized by amplifier U29-A and its associated feedback components. Potentiometer R113 provides detector linearity adjustment. Thus, the voltage at U29-A pin 7 is proportional to the RF voltage at detector diode CR8.

This voltage is divided and applied to the loop integrator amplifier at U29-B pin 2. This amplifier drives the modulator through a modulator-linearizer circuit and maintains the voltage level (via the ALC loop) at U29-B pin 2 equal to that on pin 3. The voltage on pin 3 is a function of the leveling loop control voltage applied to R121 (available on TP7). R121, R122, CR64, and CR57 form an additional detector-linearizing network that is active for low RF levels. Amplitude modulation is achieved by summing an appropriately scaled modulation signal with the dc leveling loop control voltage applied to R121.

The amplitude modulator consists of PIN diodes CR1 through CR7 and associated components. Attenuation through the modulator is a function of bias current through the PIN diodes. This current is provided by the modulator linearizer circuit on the Output Control assembly. U31 and associated components provide modulator series diode current, while U32 and associated components provide shunt diode current.

Modulator attenuation is thus approximately proportional to the modulator control voltage on TP8. Proportionality is required to maintain constant leveling loop bandwidth as modulator attenuation varies. Minimum attenuation is obtained with a modulator control voltage of 10 V, while maximum attenuation is obtained with 0 V.

Comparator U15-D and associated components form an unleveled indicator circuit. The comparator senses the modulator control voltage at U29-B pin 1. This voltage is normally less than +11 V, and the comparator output is high. If the modulator control voltage exceeds +11 V, the modulator attenuation is at a minimum, and the leveling loop becomes inoperative (unleveled). This condition could be due to a fault or some abnormal operation such as over-modulation. In this case, the comparator output (UNLVLL) goes low. The Controller senses this low and causes the front panel UNCAL indicator to flash and displays an unleveled status if interrogated.

Level Control

The output level is set by the level-control circuit. Inputs to this audio signal processing circuit are the internal and external modulation signals, a DC reference voltage, and the digital control commands. The circuit output is the leveling loop control voltage that provides vernier level control of the output. Digitally encoded level, modulation depth, and temperature-compensation information are provided by the Controller.

Selection of the internal or external modulating signal, or no modulation, is made by analog switches U27-A, U27-B, and Op-amp U28-B. The selected, buffered modulation signal at U28-B pin 7 is applied to pin 4 of U19, a dual 8-bit DAC. U19, with U20-A, acts as a digitally programmed variable attenuator and controls AM depth.

Binary AM depth control information from the Controller is applied to DAC U19. The output at U20-A pin 7 is the modulation signal scaled to the programmed AM depth. This signal is summed by op-amp U20-B with a dc reference current provided by CR50. The output at U20-B pin 8 is called the 1+AM signal. This signal provides the desired AM depth when scaled by the level DAC and applied to the leveling loop. AM depth adjustment is provided by potentiometer R97 and AM DAC offset by R46.

The RF output amplitude is temperature compensated in a frequency-dependent manner as follows. The 1+AM signal is applied to pin 18 of dual 8-bit DAC U19, the DAC B reference input. The DAC output, at U20-C pin 1, is the 1+AM signal attenuated by an RF frequency-dependent factor provided by the

Controller using constants stored in the firmware. This voltage is applied to a resistor/thermistor network that includes R77, R78, R80, and RT79.

The network output is the 1+AM signal attenuated by an RF frequency and temperature-dependent factor, and is applied to summing op-amp U20-D. The 1+AM signal is also applied to this summing amplifier. Thus, the voltage at U20-D pin 14 is the temperature-compensated and scaled 1+AM signal.

This signal is applied to the reference input of Level DAC U21. This 14-bit DAC, with op-amp U35-A, controls the Output assembly RF output amplitude. The DAC output voltage, at U35-A pin 7, is the temperature-compensated 1+AM signal multiplied by a factor proportional to the 14-bit level control number provided by the Controller. This voltage is the leveling loop control voltage. The RF output level adjustment is provided by potentiometer R82, and DAC offset voltage adjustment is provided by potentiometer R86.

Modulation Oscillator

The modulation oscillator generates a leveled sine wave of 400 Hz or 1 kHz and is the modulation source for the internal AM, FM, ϕM , and pulse functions. The oscillator is a level-controlled Wien-Bridge type and consists of op-amps U22-A, U22-B and associated components. Frequency is determined by the series RC time constant of the components between pins 5 and 7 of U22-B and by the parallel RC time constant of the components from U22 pin 5 to ground. The modulation frequency control line, MF400L, originating at the latch U13, selects either 400-Hz or 1-kHz operation, and is selected by switching resistors with JFETs Q22 and Q23.

The amplitude of oscillation is controlled by an ALC loop that varies the resistance on U22-B pin 6 to ground. This resistance comprised of R107 and the drain resistance of Q24, is nominally 2 kΩ. The oscillator signal amplitude is sensed by rectifier CR52. The average current through CR52 is made equal to the reference current in R100 by integrator-amplifier U22-A. Level adjustment is set by potentiometer R99. Temperature compensation is provided by R101, R102, and CR51.

FM and ϕM Deviation Control

The FM and ϕM modulation signal source and deviation control circuits are on the Output assembly. Analog switches U26-A, U26-C, and op-amp U28-A select the internal or external FM signal, or no modulation. ϕM is obtained by differentiating the modulating signal and selecting either external or internal modulation with analog switches U26-B and U26-D. The selected and buffered modulating signal at U28-A pin 1 is applied to FM DAC U25. This DAC provides fine control of the FM deviation. (The coarse control FM circuitry is part of the Synthesizer assembly). The output of the DAC, at U35-B pin 1, is the modulation signal multiplied by a factor proportional to the 12-bit FM deviation control provided by the Controller assembly.

For output frequencies below 245 MHz, and from 512 to 1050 MHz, the FM DAC setting is halved to account for the effective frequency doubling that occurs on these bands. For frequencies above 1050 MHz, the FM DAC setting is quartered to account for the effective frequency quadrupling in this band.

Pulse Modulation Control

External modulation is provided by the user controlling the voltage at the external modulation input connector. This input is one input to comparator U33. The reference input, composed of R147 and R148, is held at 1V. The connector input is held high by R144, R145, and R146 at 1.2V. This input can be lowered with TTL, a resistor less than 150 ohms, a pulse generator, or even a sine-wave generator. Lowering this input brings the output of the comparator (U33A) high. If EXTPUH is high (pulse modulation on), then U34A output is low, which brings U34C high. U4A converts this to a differential drive with the base of Q7 and Q8 high, and the base of Q5 and Q6 low. Level shifting resistors R49 through R52 translate this into 0V at pin A, and -6V at pin B for the off switch condition.

For internal pulse, the comparator U33B is driven by the internal oscillator of the instrument. This signal is combined with external pulse to produce the final drive logic.

3.4.7 Attenuator PC Assembly (A8)

The A8 Attenuator assembly consists of the Attenuator assembly and the Relay Driver for reverse power protection. The Attenuator is enclosed in a metal housing mounted on the top side of the module section. It is controlled by the microprocessor to provide coarse control of the output level. The high-level signal from the A6 and A7 Output assembly is applied to the Attenuator which provides 0 to 138 dB of attenuation in 6 dB steps to this signal before it goes to the RF OUTPUT connector.

Compensation data for the attenuator in each unit is stored in the compensation memory located on the Controller assembly. The program uses this data to correct for the combined deviations of the attenuator sections in use. Refer to Section 3.4.6 for more details on level correction.

The Attenuator Assembly provides an attenuation range from 0 dB to 138 dB in 6 dB steps and consists of seven independently cascaded 50 ohm attenuation sections, a 6 dB, a 12 dB, and five 24 dB sections. Each section consists of a DPDT relay and a *pi* attenuator pad.

One relay position (when power is applied to the relay) provides a straight path for the RF signal, and the other position (no power applied to the relay) inserts the attenuator pad into the RF signal path. All seven relays are inside individual shielded compartments in the Attenuator housing.

The control of the Attenuator relays is latched via U27, the open-collector drivers U30 and U31 on the Controller assembly and transistor drivers on the Relay Driver assembly. For calibration and troubleshooting purposes, special functions 83 through 86 allow the direct selection of four of the five 24 dB attenuators. The other 24 dB attenuator is selected by programming the appropriate level (-12 dBm).

Coupling capacitors C8 protects against DC or low-frequency power. The diode limiter, consisting of CR2 and CR3, provides protection against medium RF Power levels and short-term (fast acting) protection against high RF power levels. Long-term (latched) protection is provided by relay K8 whenever the reverse RF power exceeds a preset level.

RF power detected by CR1 is compared with the preset voltage in one section of comparator U1. When the detected voltage exceeds the set value, the output of U1 pin 14 goes negative, turning off Q8 and Q9. This deactivates K8 to the protect position. In the protect position, the output is disconnected from the output connector.

CR11 and R34 form a latching network such that K8 remains in the protect position until the RF Output is reset by an RF ON entry. The output of the comparator is buffered and sent as RPTRPL to the Controller assembly for processing. The Controller assembly annunciates the RPP trip condition by flashing the UNCAL and RF OFF indicators.

3.4.8 Power Supply Assembly (A9)

The bridge rectifiers in the power supply are used in either a bridge or full-wave center-tapped configuration with capacitor input filters. Table 3-2 lists the rectifier configurations as well as the component designations for the various supplies.

Table 3-2. Power Supply Rectifiers

Supply	Rect.	Config.	Cap	Regulator	Remarks
+37	CR6	Bridge	C11	A9 U4	Adjustable
+15	CR2	CT/FW	C2	A9 U5	Fixed
+15	CR2	CT/FW	C2	A9 U1	Fixed
-15	CR2	CT/FW	C5	A9 U2	Fixed
+5	CR5	CT/FW	C8	A3 U3	Fixed
+18	CR1	Bridge	C1		Unregulated relay supply
FIL	6 VAC with center-tap biased at 6.2 VDC.				

The two +15 V, the -15 V, and the +5 V supplies use conventional three-terminal IC regulators with internal current-limiting and temperature protection. All three 15 V regulators have reverse voltage protection diodes CR3, 4, and 8.

The +37 V regulator voltage is adjustable via R3. A 6.2 V supply is developed from the +37 V supply through resistor R4 and zener diode CR7 and is applied to the center tap of the 6 VAC filament supply. This provides grid bias for the front panel displays. All regulators (except +37 V) have their common reference terminals brought out to an external ground point on the module section to reduce power supply ripple (P2).

Triac U6 is a voltage surge protector to protect against line voltage surges as well as overvoltage in case of a wrong setting of the selector switch.

Switch S1 is the REF INT/EXT reference selection switch and is not functionally part of the power supply.

4

Calibration & Testing

4.1 Introduction

This chapter describes the calibration and adjustment procedures for the 6062A Synthesized RF Signal Generator. Periodic calibration is recommended at least once per year.

Calibration and Test procedures for options are in Appendix A.

The recommended test equipment for calibration and adjustments is listed in Table 4-1.

4.1.1 Safety

This is a Safety Class I instrument. It is provided with a protective earth terminal. Warnings and cautions are for your protection and to avoid damage to the equipment.

Because some procedures described here are done with power applied to the generator and with protective covers removed, service should be done only by trained service personnel. Where service can be performed without power applied, the line power should be unplugged from the generator.

WARNING

Do not interrupt the protective grounding connection. To do so would create a potential shock hazard that could result in personal injury.

Secure the instrument against unintended operation if it is likely that this protection has been impaired. Use only fuses of the proper rating.

Caution

To avoid damage to the generator, disconnect it from the AC line source before removing any PC assembly.

4.1.2 Recommend Test Equipment

Table 4-1 lists the recommended test equipment for calibration and test procedures.

Table 4-1. Recommended Test Equipment

Instrument Name	Minimum Requirement	Mfr's Designation	Notes
DVM	5 1/2-Digit, 0.3% DC-20 kHz	JF 8842A-09	C,P
DMM	3 1/2-Digit, 1% DC and 1 KHz	JF 8020B	C,P
Wideband Amplifier	>25-dB gain, 0.4 to 1050 MHz NF <9 dB.	HP 8447D-010	P,4
RF-Spectrum Analyzer	0.1 to 1.5 GHz, 1-kHz BW	HP 8558B/182T	P
RF Voltmeter	0.01 to 700 MHz, 0.01 to 3 V±10%	HI RF 801	2
Frequency Counter	0.01-1050 MHz; 10 Hz res; 0.1V	JF 7220A	C,P
Modulation Analyzer	Input: 0.4 to 1050 MHz, 0 to +20 dBm AM: 10 to 90%, ±1%, FM: 0.1 to 100 kHz dev ±1%	HP 8901A	C,P,4
Distortion Analyzer	1 to 10% rng, ±1 dB, 0.4 and 1 kHz	HP 339B	C,P,4
Power Meter	Instrumentation accuracy <±1%	HP 435B	C,P,4
Sensor	-30 to 20 dBm; SWR <1.2 for 0.4 to 1 MHz, <1.1 for 1 to 1050 MHz	HP 8482A	4
Low-Level Sensor	-67 to -20 dBm; SWR <1.4 for 10 to 30 MHz <1.15 for 30 to 1050 MHz	HP 8484A	4
Attenuator, 60 dB	0.4 to 1050 MHz SWR <1.1	Narda 777C	P,4,5
LF Synthesized Sig-Gen	10 Hz to 11 MHz, 10 Hz steps, Spurs and Harm <-50dB, 1 Vp	JF 6011A	C,P
HF Synthesized Sig-Gen	10 MHz to 1050 MHz, 5 MHz steps	Giga-tronics 6062	P
Frequency Standard	House Standard, 10 MHz	—	C,P
Test Cable	Dual pin to BNC	732891	C
Adapter, Coax	50 ohm, Type-N(m) to BNC(f)	Y9308	C,P
Two-Turn Loop	For Leakage test (See Figure 4-28)	Homebuilt	P,3
VSWR Bridge	10 MHz to 1000 MHz	Wiltron 62N50	P
Type-N Termination	50 ohm	Y9317	P
Coaxial Cable, 50 ohm	3 ft, BNC both ends	Y9111	C,P
Coaxial Cable, 50 ohm	6 ft, BNC both ends	Y9112	C,P
Screwdriver, electric	Set to 7 inch-pounds torque	Jergens-CL6500/CLT50	C

Notes

1. C = Calibration; P = Performance Test
2. Helper Instruments.
3. Two-Turn, 1-inch diameter loop made of #18 enamel wire soldered to a BNC connector. Figure 4-28 shows a two-turn loop.
4. The HP 8902A/11722A Measuring Receiver can be used in place of the wideband amplifier, 60-dB Attenuator, HP 8901A, HP 339B, and the HP 435B/8482A/8484A for the alternate performance test.
5. VSWR verified and actual attenuation calibrated to ±0.2 dB by the operator at application frequencies.

4.2 Calibration Procedures

Calibration procedures for the Power Supply, Display, Synthesizer, and Output Control printed circuit assemblies (PCAs) are contained in this chapter.

Periodic calibration is recommended once a year.

4.2.1 Power Supply Adjustment

This procedure covers the +37 V adjustment on the A9 Power Supply assembly. This is the only adjustment on the Power Supply assembly. This adjustment is accessible through a hole in the bottom lip of the rear panel.

See Figure 4-1 for the location of the power supply test points.

Test Equipment:

DMM

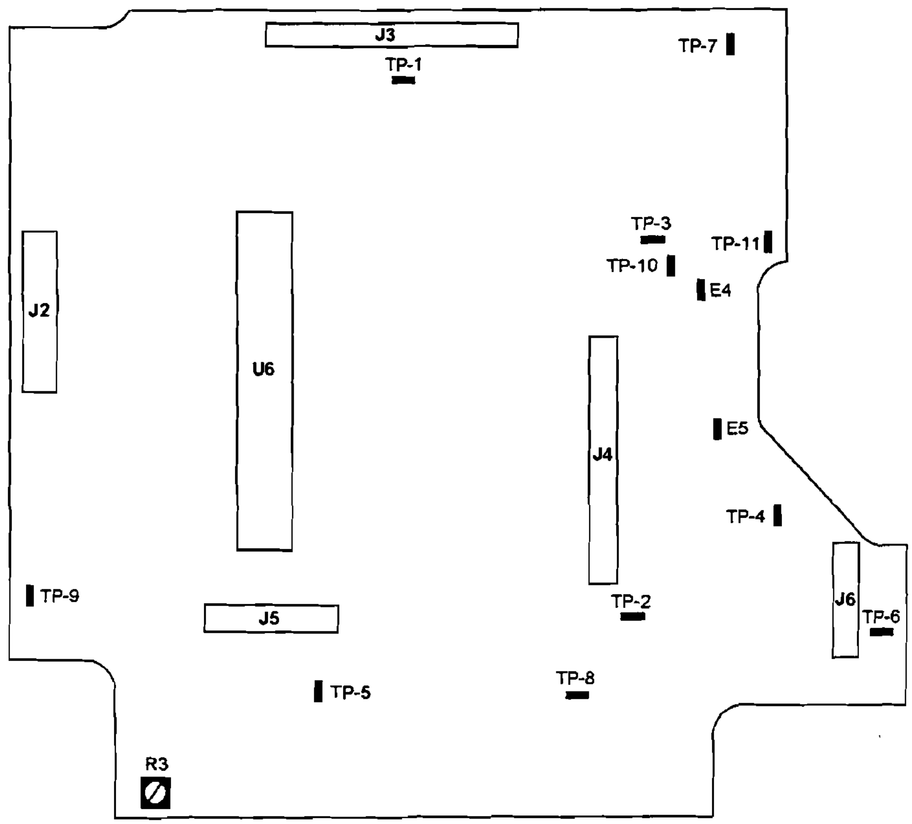


Figure 4-1. Power Supply Test Points

Procedure:

Adjust R3 for +37 V at TP5.

1. Remove the top and bottom instrument covers.
2. Connect the DMM to TP5 with the ground lead (black wire) connected to the power distribution connection point on the module plate.

3. Program the generator to [RCL] [9][8].
4. Adjust R3 for a DMM reading of +37.00 ± 0.05 V.
5. Verify the other supply voltages at the test points listed in the following:

TP	Voltage Limits
11	14.5 to 15.7
3	14.5 to 15.7
2	-14.5 to -15.7
4	4.85 to 5.20
1	17.4 to 22.6

NOTE: The voltage at TP1 depends on the line voltage. The limits shown are for a line voltage that exactly equals the line voltage selector setting, i.e., 100, 120, 220, or 240 Vac.

6. Remove the test leads, and reinstall the top and bottom instrument covers.

4.2.2 External Modulation Level Indicator Adjustment

This procedure covers the adjustment of the External Modulation Level Indicator on the A1 Display. This adjustment is independent of other adjustments and assumes proper circuit operation.

Test Equipment:

DVM

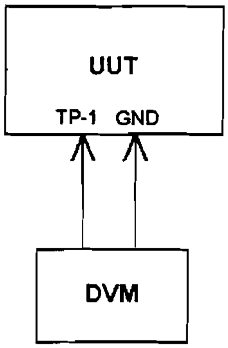


Figure 4-2. External Modulation Level Adjustment

Procedure:

Adjust R16 for 0.98 V at TP1. R16 is located below TP1 on the rear of the A1 Display assembly, just above the power switch.

1. Remove the top cover of the generator to access the Display assembly.
2. Connect the DVM to measure the dc voltage at TP1 relative to the chassis.
3. Adjust R16 for +0.9800 ±.0005 VDC.

4.2.3 Synthesizer PC Assembly

Each of the following adjustment procedures is independent; they can be done individually or in any sequence. Figure 4-3 shows the top view of the module plate.

The following are routine adjustments for the A4 Synthesizer assembly:

- 10 MHz Adjustment
- FM Cal Adjustments, including FM Calibration, Low-Rate Deviation, and FM Flatness

The following need adjustment only if the associated circuits are repaired:

- 20/40 kHz Notch Filter Adjustment
- VCO Clamp Adjustments
- 800 MHz Oscillator Adjustment
- 10 MHz Lock-Range Centering Adjustment

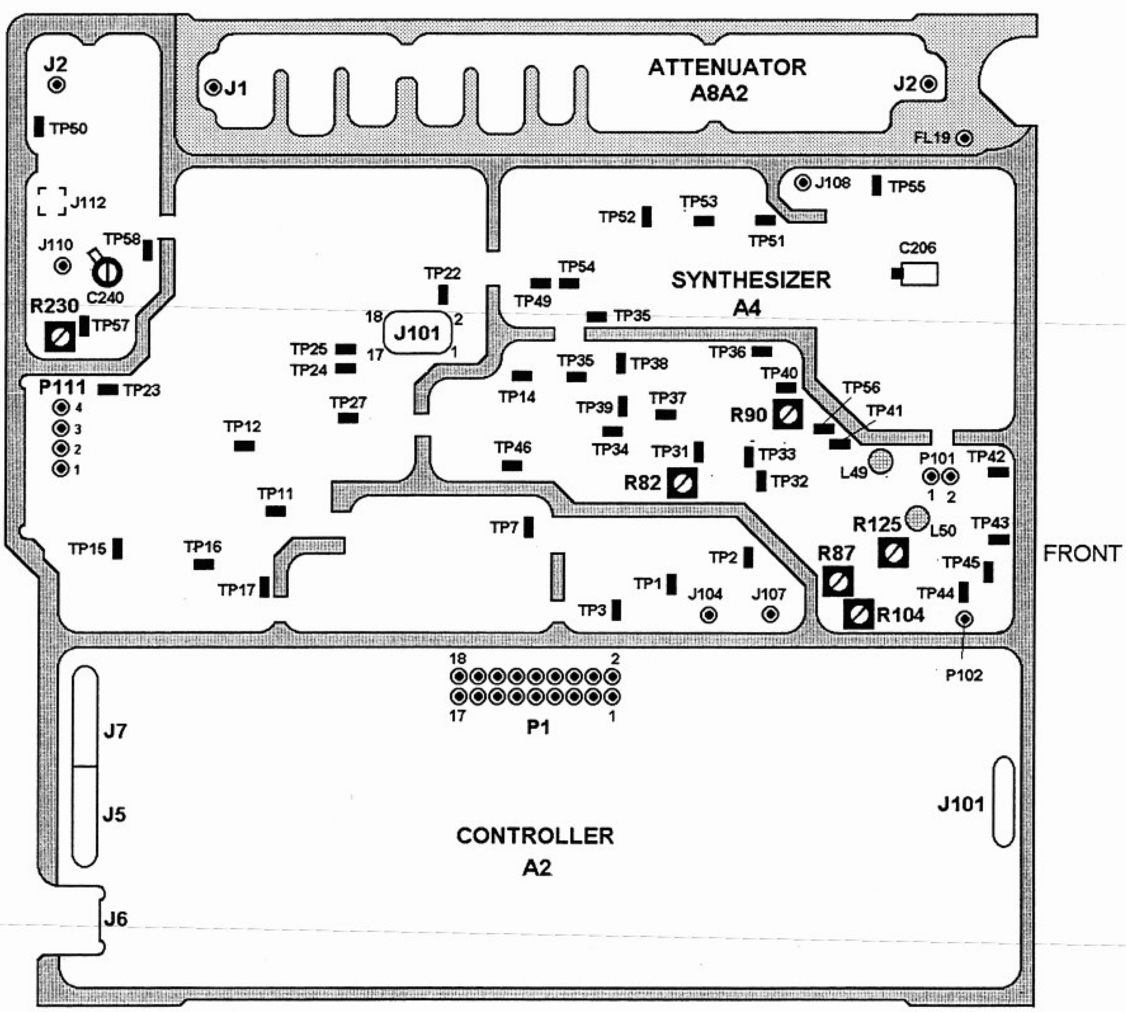


Figure 4-3. Module Plate, Top View

10 MHz Reference Frequency Adjustment

The accuracy of the reference frequency adjustment depends on the accuracy of the Frequency Standard.

If either Option -130 High-Stability Reference, or Option -132 Medium-Stability Reference is installed, skip the following procedure and use the adjustment procedures in Appendix A of this manual.

Test Equipment:

Frequency Standard
Oscilloscope

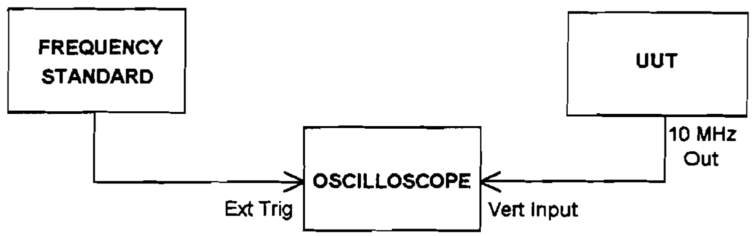


Figure 4-4. 10 MHz Reference Frequency Adjustment

Procedure:

The reference waveform is viewed on the oscilloscope while triggering on the Frequency Standard. The 10-MHz reference frequency is adjusted with R230 for a stationary display.

1. Remove the instrument top cover and the R230 access hole plug from the module plate cover.
2. Connect 10 MHz OUT on the rear panel to the oscilloscope vertical input.
3. Connect the Frequency Standard output to the oscilloscope external trigger input.
4. Set the REF INT/EXT switch on the rear panel to INT, and set the vertical controls of the oscilloscope to display the 10-MHz signal.
5. Set the oscilloscope for external triggering and adjust the timebase for 0.1 µs/div.
6. Adjust R230 for a drift of less than one cycle per second.

FM Adjustments

The FM Cal adjustment, R82, sets the overall deviation accuracy, whereas the Low-Rate Deviation adjustment, R90, equalizes the low and high rate deviation. The FM Flatness adjustment, R87, equalizes the deviation across the band from 0.2 to 10 kHz.

Test Equipment:

Modulation Analyzer
LFSSG
DVM

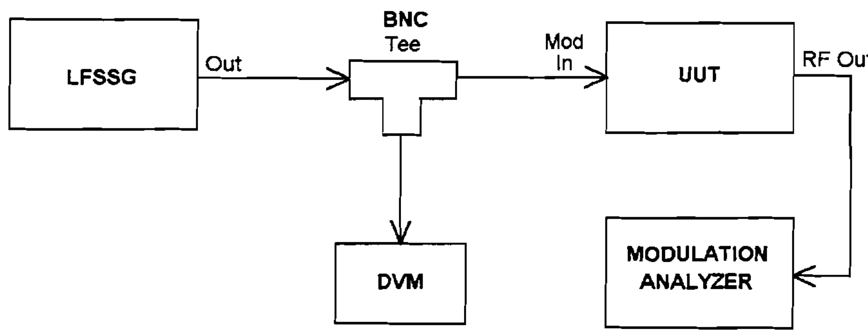


Figure 4-5. FM Adjustments

Procedure:

The FM deviation of the generator, as measured with the Modulation Analyzer, is adjusted to agree with the programmed deviation at 10 kHz, 0.2 kHz and 0.5 kHz rates by adjusting R82, R90, and R87, respectively.

1. Remove the instrument cover and the FM CAL, FM Flatness, and Low-Rate Deviation access hole plugs from the cover of the module plate.
2. Connect the output of the LFSSG to the MOD IN connector and to the DVM with a BNC tee.
3. Connect the generator RF output to the Modulation Analyzer input.
4. Program the Modulation Analyzer to measure FM + peak. No filters should be active.
5. Program the generator to the [RCL] [9] [8]. Then program the generator to 385.5 MHz, 7 dBm, EXT FM, 99.9 kHz deviation.
6. Program the LFSSG to 10 kHz and 0.7071 V_{rms}, as measured with the DVM.
7. Adjust R82 for 100.0 kHz, as measured by the Modulation Analyzer.
8. Program the LFSSG to 0.2 kHz and 0.7071 V_{rms}, as measured by the DVM.
9. Adjust R90, the low-rate deviation for 100.0 kHz, as measured on the Modulation Analyzer.
10. Program the LFSSG to 500 Hz.
11. Adjust R87 for 100.0 kHz as measured on the Modulation Analyzer.
12. Repeat steps 6 through 11 until the deviation flatness is 100.0 kHz ± 0.3 kHz.
13. Turn the EXT FM off and note the Modulation Analyzer peak deviation (noise) reading.
14. Turn the EXT FM on.
15. Program the LFSSG to 10 kHz and 0.7071 V_{rms} as measured by the DVM.
16. With the Modulation Analyzer, alternately measure +Peak and -Peak FM, and adjust R82 so the readings are symmetrical, about 99.9 kHz plus the noise noted in step 13.

20 kHz and 40 kHz Notch Filter Adjustments

These adjustments are normally required only when L49, L50, C123, C99, C124, C126 or C125 are replaced, or unless the generator has been subjected to severe usage.

Test Equipment:

RF Spectrum Analyzer
LFSSG

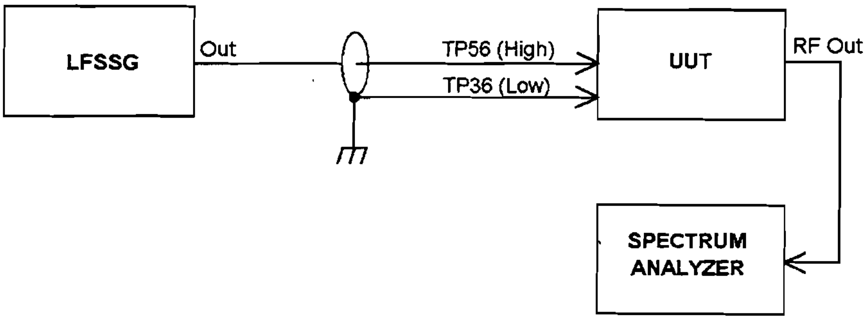


Figure 4-6. Notch Filter Adjustments

Procedure:

The 20 kHz and 40 kHz Notch Filters are adjusted with L49 and L50 for sideband level nulls using the RF Spectrum Analyzer.

1. Remove the instrument and the module plate top covers.
2. Connect the LFSSG to TP56 (high) and TP36 (low) with clip leads.
3. Program LFSSG to 20 kHz and 0.2 V_{rms}, terminated.
4. Connect the generator RF output to the RF Spectrum Analyzer input.
5. Program the generator to 300 MHz and +13 dBm.
6. Adjust the RF Spectrum Analyzer to display the signal centered on the display.
7. Set the span to 10 kHz/division and 1 kHz bandwidth. The 20 kHz sidebands should be visible.
8. Adjust L49 to minimize the 20-kHz sidebands.
9. Program the LFSSG to 40 kHz.
10. Adjust L50 to minimize the 40 kHz sidebands.

VCO Voltage-Clamp Adjustment

The VCO voltage-clamp adjustment is normally required when either the A5 VCO or A4 Synthesizer assembly has been replaced or when either of these assemblies has been subjected to repair or modifications.

Test Equipment:

Frequency Counter
DMM

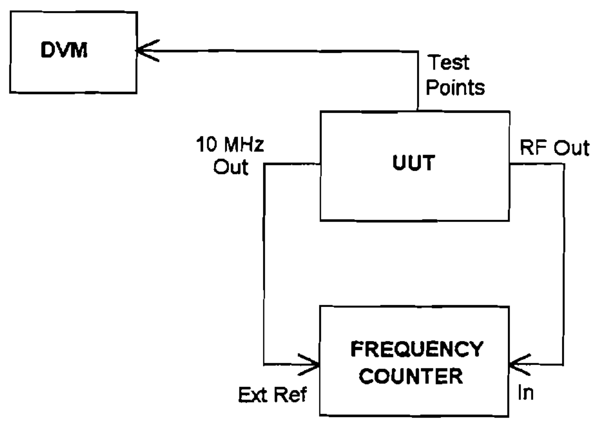


Figure 4-7. VCO Voltage-Clamp & 800 MHz Oscillator

Procedure:

The PLL is disabled to cause the VCO frequency to be at the limits of its range.

1. Remove the instrument and module plate top covers.
2. Connect the rear panel 10 MHz OUT to the Frequency Counter 10 MHz reference input, and connect the generator RF output to the Frequency Counter input (see Figure 4-7).
3. Program the generator to [RCL] [9] [8], 500 MHz and +13 dBm.
4. Use a clip lead and carefully short TP14 to ground to cause the VCO to go to the upper frequency limit.
5. Adjust R104 for 540 MHz ±1 MHz.
6. Remove the shorting clip lead from TP14.
7. Program the generator for 250 MHz (still at +13 dBm).
8. Use a clip lead and carefully short TP35 to ground to cause the VCO to go to its lower frequency limit.
9. Adjust R125 for 237 MHz ±1 MHz.
10. Remove the shorting clip lead from TP35.

800 MHz Oscillator Adjustment

This adjustment is normally not required unless components in the 800-MHz oscillator are replaced or the generator has been subjected to severe usage.

Test Equipment:

Frequency Counter
DMM

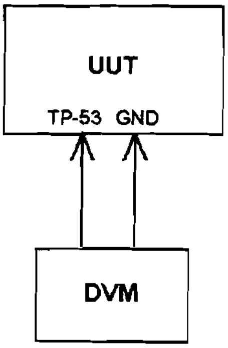


Figure 4-8. External Modulation Level Adjustment

Procedure:

The PLL control voltage operating point is adjusted to 16 V while the loop is phase-locked.

1. Remove the instrument and the module plate top covers.
2. Program the generator to [RCL] [9] [8]; then, program 200 MHz.
3. Connect the DMM to measure voltage between TP53 and the chassis (see Figure 4-8).
4. Adjust C206 for 16.0 V ±0.5 V.

10 MHz Lock-Range Centering Adjustment

The reference output and the LFSSG signal are viewed simultaneously on the oscilloscope for frequencies near the limit of the lock-in range. The 10 MHz crystal oscillator is adjusted for a stable display on the oscilloscope at both upper and lower limits. The external reference input level to the generator is reduced to determine sensitivity.

Test Equipment:

Frequency Standard
Low Frequency Synthesized Signal Generator (LFSSG)
Oscilloscope
BNC Tee

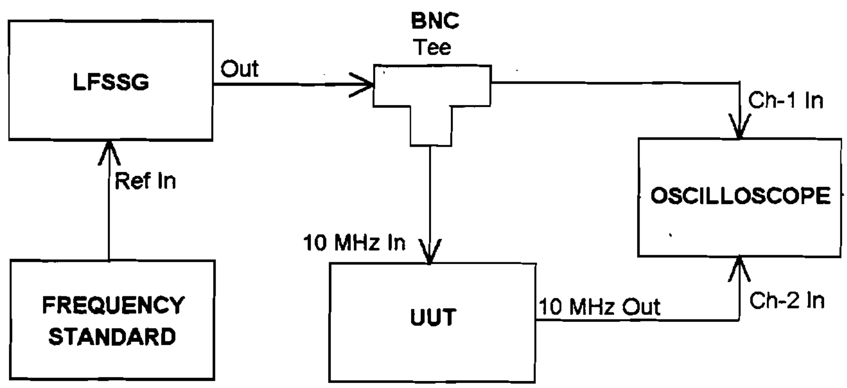


Figure 4-9. 10 MHz Lock-Range Centering Adjustment

Procedure:

1. Remove the top cover and the 10 MHz adjustment access hole plug from the module plate. See Figure 4-3 for the 10 MHz adjustment location (C240).
2. Connect the frequency standard to the reference input of the LFSSG.
3. Connect the LFSSG output to the oscilloscope vertical input channel 1 using a BNC tee, and connect the cable to 10 MHz IN with a cable less than three feet in length.
4. Connect 10 MHz OUT on the rear panel to the oscilloscope vertical input channel 2.
5. Program the LFSSG to 10 MHz and 0 dBm.
6. Set the rear panel REF INT/EXT switch to EXT.
7. Set the vertical controls of the oscilloscope to display both the LFSSG output and the 10 MHz signal. Set the triggering to channel 1, and adjust the timebase for 0.1µs/div.
8. Edit the LFSSG to 220 Hz above 10 MHz (10.00022 MHz).
9. If the signals are unlocked, adjust C240 for a locked condition. Verify the UNCAL indicator is not lit.
10. Adjust C240 clockwise until the two waveforms are not synchronized (break lock). Verify the UNCAL indicator is flashing.
11. Turn C240 counterclockwise to the first stable, locked point.
12. Edit the LFSSG to 220 Hz below 10 MHz (9.99978 MHz).
13. Verify Locked Condition: Two wave forms synchronized and UNCAL indicator is not lit.
14. Program the LFSSG to 10 MHz.
15. Reduce the level of LFSSG until the signals displayed on the oscilloscope indicate an unlock condition.
16. Increase the LFSSG level until the oscilloscope first indicates the locked-point. Verify that this level is less than 300 mVpp as measured with the oscilloscope.
17. Perform the 10 MHz Reference Frequency adjustment procedure described on page 4-7.

4.2.4 Output Assembly Adjustment

This procedure covers the adjustments on the A6 + A7 Output assembly as follows:

- Level DAC Offset
- AM DAC Offset
- Modulation Oscillator Level
- External Phase Modulation Deviation
- Internal Phase Modulation Deviation
- Detector Offset
- AM Depth
- RF Level
- Het Level

These adjustments are accessed through the hole plugs in the top module cover. Refer to Figure 4-10 to identify the access hole plug corresponding to a particular test point and adjustment. Any adjustment can be made independently unless it is noted that it interacts with another adjustment. Interdependent adjustments must be done in the sequence presented. If more than one adjustment is necessary, do them in the sequence presented.

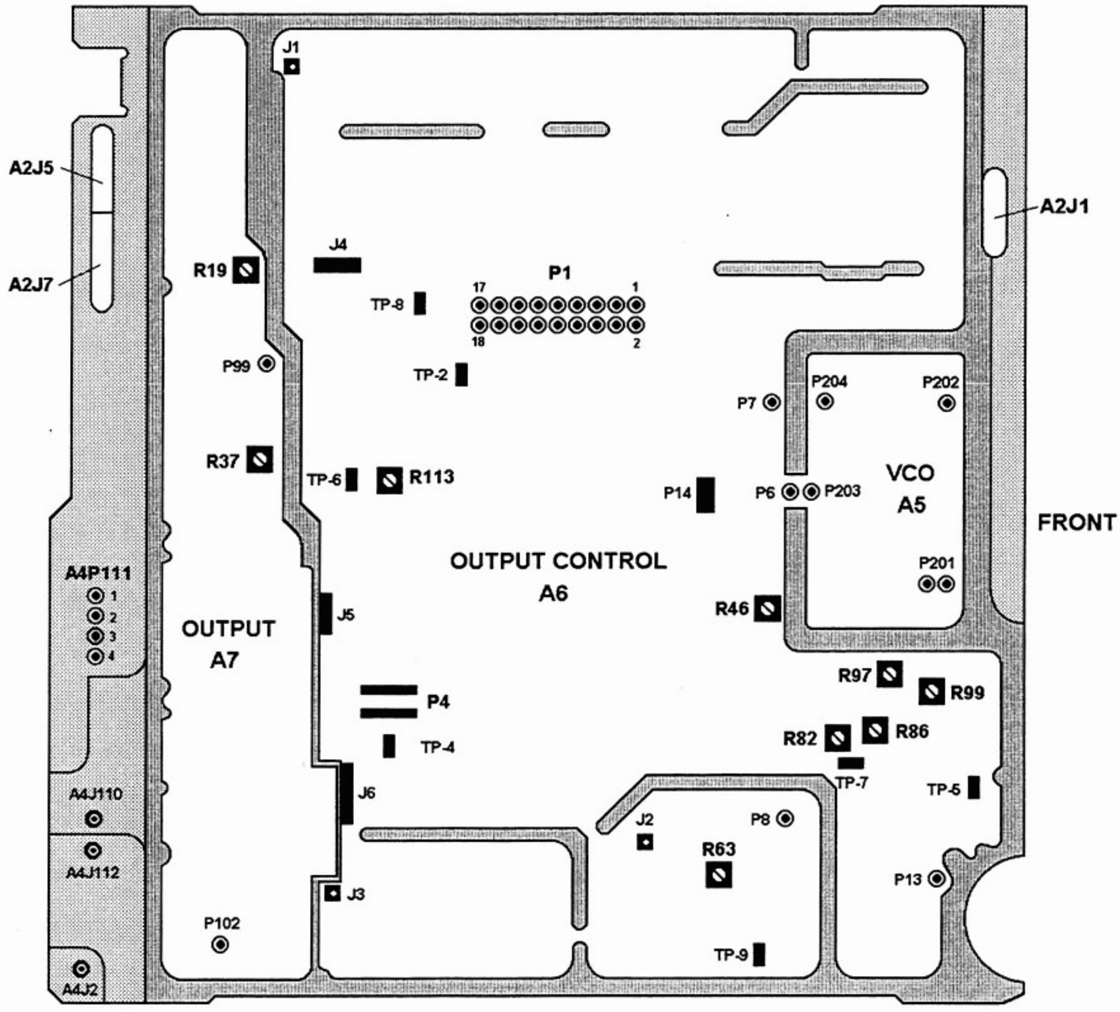


Figure 4-10. Module Plate, Bottom View

Level DAC Offset

This adjustment is normally required only when U35 or any associated components are replaced or when the adjustment has been changed or has shifted.

Test Equipment:

DVM

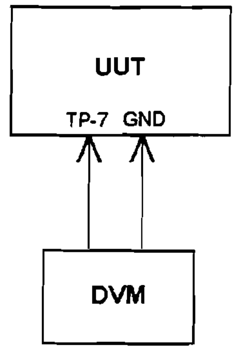


Figure 4-11. Level DAC Offset Adjustment

CAUTION

This adjustment directly affects the output level and should not be adjusted indiscriminately.

Procedure:

The Level DAC Offset, R86, is adjusted for 0 ±0.5 mV at TP7 with the RF output turned OFF.

1. Remove the bottom cover and access hole plugs for TP7 and R86.
2. Program the generator to [RCL] [9] [8], and switch the RF output to OFF.
3. Connect the DVM to measure the voltage between TP7 and the power distribution connection point on the module plate.
4. Adjust R86 for an indication of 0 mV ±0.5 mV.
5. Switch the RF output to ON.
6. Replace the access hole plug.

AM DAC Offset

The AM DAC Offset adjustment is normally required only when U20 or any associated components are replaced, or when the adjustment has been changed or has shifted.

CAUTION

This adjustment directly affects the output level and should not be adjusted indiscriminately.

Test Equipment:

DVM

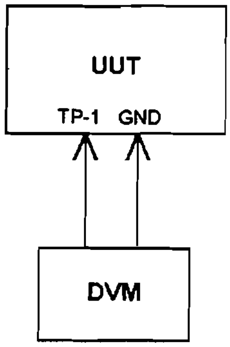


Figure 4-12. AM DAC Offset Adjustment

Procedure:

The AM DAC Offset is adjusted with R46 for ±0.5 mV at TP1 with AM off.

1. Access R46 by removing the bottom instrument cover and removing the access hole plugs for TP1 and R46.
2. Program the generator to [RCL] [9] [8].
3. Connect the DVM to measure the voltage between TP1 and the power distribution connection point on the module plate.
4. Adjust R46 for an indication of 0 mV ±0.5 mV.
5. Replace the access hole plugs.

Modulation Oscillator Level Adjustment

This adjustment sets the modulation oscillator level, which is normally required only when components in the modulation oscillator or modulation switching circuits have been replaced, or the adjustment has been changed or has shifted.

Test Equipment:

Modulation Analyzer
DVM
Low Frequency Synthesized Signal Generator (LFSSG)
BNC Tee

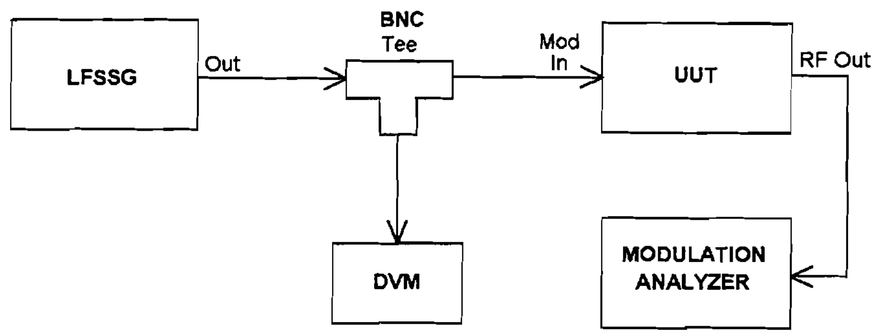


Figure 4-13. Modulation Oscillator Level Adjustment

Procedure:

The AM depth, with internal modulation, is adjusted with R99 to equal the AM depth with a 1 Vp external modulation signal as measured with the Modulation Analyzer.

1. Remove the bottom cover and the hole plugs for access to R99.
2. Connect the output of the LFSSG to the MOD IN connector and the DVM using a BNC tee.
3. Program the generator to RCL [9] [8], then program the generator to 350 MHz, 7 dBm, and EXT AM at 90% AM depth.
4. Program the LFSSG for 1 kHz and a voltage of 0.7071 V_{rms}, as measured by the DVM.
5. Connect the generator RF output to the Modulation Analyzer RF input.
6. Program the Modulation Analyzer to measure +Peak AM in a 0.3- to 15-kHz bandwidth.
7. Note the measured AM depth reading with the Modulation Analyzer.
8. Turn off the EXT AM control and turn on the INT AM control.
9. Program the generator for 1000 Hz modulation frequency.
10. Adjust R499 for an AM depth equal to that noted in step 7.
11. Turn off the INT AM control.
12. Replace the access hole plugs.

External Phase Modulation Deviation Adjustment

The external phase modulation adjustment is normally required only when the adjustment has been changed or has shifted.

Test Equipment:

Modulation Analyzer
DVM
Low-Frequency Synthesized Signal Generator (LFSSG)
BNC Tee

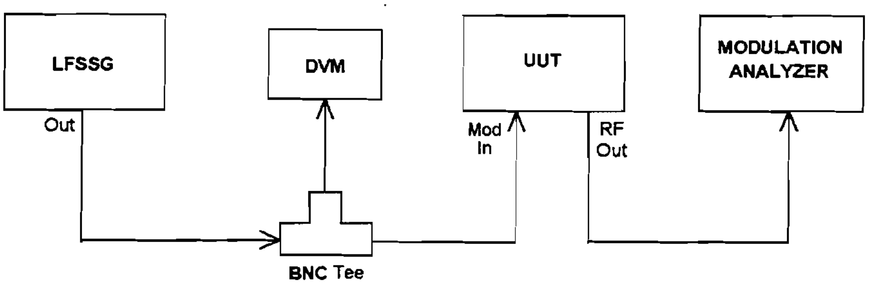


Figure 4-14. External PM Deviation Adjustment

Procedure:

Adjust C214 for equal frequency deviation as measured with the modulation analyzer for the following two setups:

EXT FM, 100 kHz deviation, external 10 kHz modulation signal EXT phase modulation, 10 radians deviation, external 10 kHz modulation signal

1. Remove the bottom instrument cover and the access hole plug for C214.
2. Connect the output of the LFSSG to the generator MOD IN and the DVM using a BNC tee.
3. Program the generator to [RCL] [9] [8], EXT FM, and 100 kHz FM deviation.
4. Program the LFSSG for 10 kHz and .7071 V_{rms} as measured by the DVM.
5. Connect the generator RF output to the Modulation Analyzer RF input.
6. Program the Modulation Analyzer to measure + peak FM in a .3- to 15-kHz bandwidth.
7. Note the measured FM deviation.
8. Program the generator to 10 radians phase deviation.
9. Adjust C214 for a measured frequency deviation equal to that noted in step 7.
10. Replace the external phase modulation deviation adjustment access hole plug.

Internal Phase Modulation Deviation Adjustment

The internal phase modulation adjustment is normally required only when the adjustment has been changed or has shifted.

Test Equipment:

Modulation Analyzer
DVM
Low-Frequency Synthesized Signal Generator (LFSSG)
BNC Tee

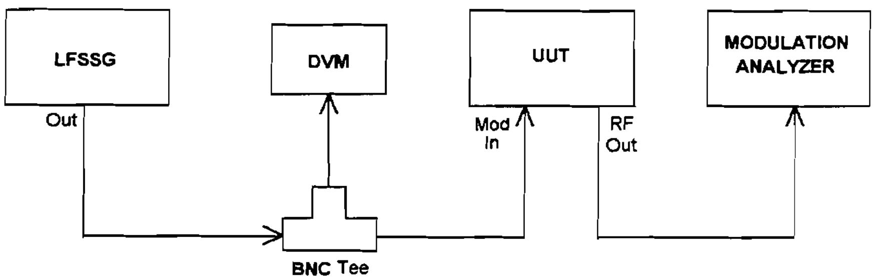


Figure 4-15. Internal PM Deviation Adjustment

Procedure:

Phase deviation, with internal modulation, is adjusted through C217 to equal phase deviation with a 1.05 kHz 1 V peak external modulation signal as measured with the Modulation Analyzer.

1. Remove the bottom instrument cover and the access hole plug for C217.
2. Connect the output of the LFSSG to the generator MOD IN and the DVM using a BNC tee.
3. Program the generator to [RCL] [9] [8], EXT phase modulation, and 10 radians phase deviation.
4. Program the LFSSG for 1.05 kHz and .7071 V rms as measured by the DVM.
5. Connect the generator RF Output to the Modulation Analyzer RF input.
6. Program the Modulation Analyzer to measure + peak phase deviation in a .3 to 3 kHz bandwidth.
7. Note the measured phase deviation reading with the Modulation Analyzer.
8. Turn off the EXT phase modulation control and turn on the INT phase modulation control.
9. Program the generator for 1000 Hz modulation frequency.
10. Adjust C217 for measured phase deviation equal to that measured in step 6.
11. Replace the internal phase modulation deviation access hole plug.

Detector Offset Adjustment

This adjustment sets the detector offset voltage. This adjustment is normally required only when components in the detector or detector linear circuits have been replaced or when the adjustment has been changed or has shifted. If the Detector Offset is adjusted, perform the AM Depth adjustment.

CAUTION

This adjustment directly affects the output level and should not be adjusted indiscriminately.

Test Equipment:

Power Meter and Sensor

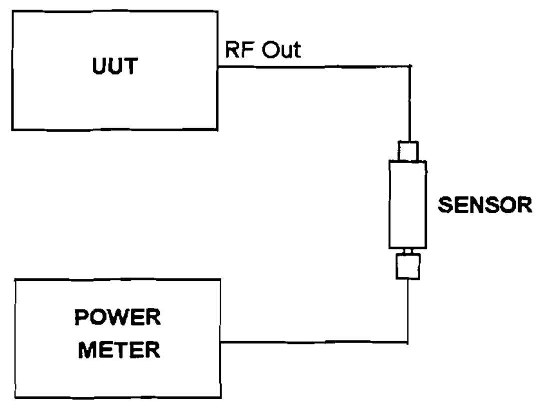


Figure 4-16. Detector Offset Adjustment

Procedure:

NOTE: The generator must be operated at room temperature for at least one hour with the module plate cover in place before continuing with this adjustment procedure.

The Detector Offset is adjusted with R113 to provide a 30 dB change in output power for a 30 dB change in the Level DAC with level correction disabled, and while operating in fixed range.

1. Remove the bottom cover to access R113.
2. Program the generator to [RCL] [9] [8], then program the generator to 350 MHz and 12 dBm.
3. Program the generator to [SPCL] [9] [1]. This special function enables the amplitude fixed range.
4. Remove the Detector Offset adjustment access hole plug from the bottom module plate cover.
5. Zero the Power Meter.
6. Connect the Power Sensor to the RF output.
7. Program the generator to +12 dBm.
8. Note the Power Meter reading.
9. Program the generator for -18 dBm, using the EDIT keys.
10. Adjust R113 for a Power Meter reading of 30 dB ±0.1 dB below the reading obtained in step 8.

11. Repeat the previous four steps until the difference between the power measurements is 30 ±0.1 dBm. This adjustment should require three or fewer iterations.
12. Program the generator to +17 dBm, using the EDIT keys. Note the Power Meter reading.
13. Program the generator for +2 dBm using the EDIT keys. Verify that the Power Meter reading is 15 dB ±.2 dB below the previous reading.
14. Program the generator for [SPCL] [0] [0]. This disables the amplitude fixed range.
15. Disconnect the Power Sensor and replace the Detector Offset adjustment access hole plug.

AM Depth Adjustment

This adjustment is normally required only when components in the AM signal processing circuits have been replaced, or the adjustment has been changed or shifted. If this adjustment is made, it is necessary to perform the RF Level adjustment after the AM Depth adjustment has been made.

CAUTION

This adjustment directly affects the output level and should not be adjusted indiscriminately.

Test Equipment:

DVM
Modulation Analyzer
LFSSG

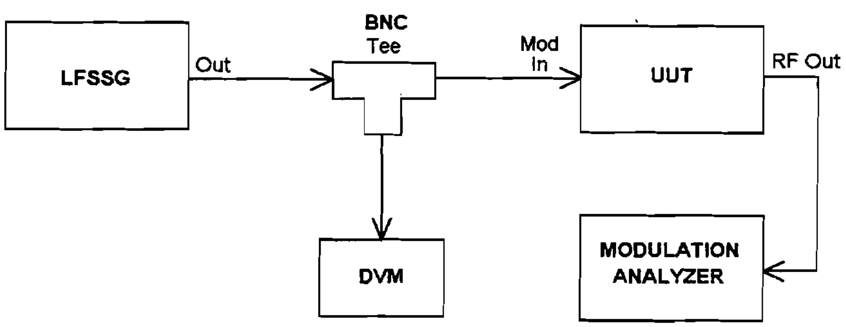


Figure 4-17. AM Depth Adjustment

Procedure:

> NOTE: The generator must be operated at room temperature for at least one hour with the module plate covers in place before continuing with this adjustment procedure.

Adjust the AM Depth with R97 for 90% AM depth as measured with the Modulation Analyzer when the generator is programmed to 90% AM.

1. Remove the AM Depth adjustment access hole plug from the bottom module plate cover.
2. Connect the output of the LFSSG to the MOD IN connector and to the DVM using a BNC Tee.
3. Program the generator to [RCL] [9] [8], then program the generator for 350 MHz, +1 dBm, and EXT AM at 90% AM depth.
4. Program the LFSSG for 1 kHz and a voltage of 0.7071 V_{rms}, as measured with the DVM.
5. Connect the generator RF output to the Modulation Analyzer input.
6. Program the Modulation Analyzer to measure AM + Peak, in a 0.05-kHz to 15-kHz bandwidth.
7. Alternately measure +PEAK and -PEAK and adjust R97 until the readings are symmetrical (about 90%).
8. Replace the AM Depth adjustment access hole plug.

RF Level Adjustment

This adjustment is required if any of the following events occur:

- The A6 - A7 Output assembly, or the A8 Attenuator assembly has been replaced.
- The AM Depth adjustment is made.
- The Level DAC or any associated components are replaced.
- The RF Level adjustment has been inadvertently changed or shifted.

CAUTION

This adjustment directly affects the output level and should not be adjusted indiscriminately.

Test Equipment:

Power Meter and Sensor

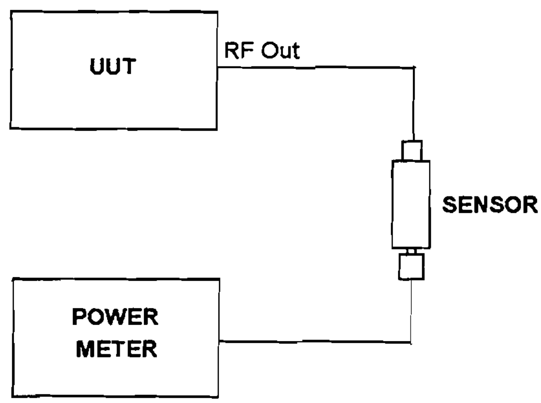


Figure 4-18. RF Level Adjustment

Procedure:

NOTE: The generator must be operated at room temperature for at least one hour with the module plate covers in place before continuing with this adjustment procedure.

With the generator programmed to +9 dBm, adjust the RF Level with R82 for +9 dBm output, as measured with the Power Meter.

1. Program the generator to [RCL] [9] [8], then program the generator to 350 MHz, +9 dBm, and turn all modulation OFF.
2. Zero the Power Meter.
3. Remove the RF Level adjustment access hole plug from the bottom module plate cover.
4. Connect the Power Sensor to the RF connector.
5. Adjust R82 for an RF Level reading of exactly +9 dBm on the Power Meter.
6. Replace the RF Level adjustment access hole plug.

Het Level Adjustment

This adjustment is normally required only when components in the het band circuits have been replaced or when the adjustment has been changed or has shifted.

CAUTION

This adjustment directly affects the output level and should not be adjusted indiscriminately.

Test Equipment:

Power Meter
Sensor

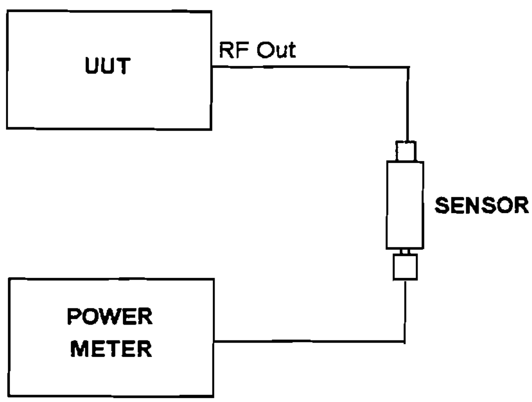


Figure 4-19. Het Level Adjustment

Procedure:

NOTE: The generator must be operated at room temperature for at least one hour with the module covers in place before continuing with this adjustment procedure.

With the generator programmed to +9 dBm, adjust the Het Level with R63 for equal output power at 100 MHz and 350 MHz.

1. Program the generator to [RCL] [9] [8], then program the generator to 350 MHz and +9 dBm.
2. Zero the Power Meter.
3. Remove the Het Level adjustment access hole plug from the bottom module plate cover.
4. Connect the Power Sensor to the RF output. Note the Power Meter reading.
5. Program the generator to 100 MHz.
6. Adjust R63 for a reading equal to that previously noted.
7. Replace the Het Level adjustment access hole plug.

4.3 Performance Tests

This section describes the performance tests for the key parameters of the 6062A, using the instrument specifications as the performance standard. These covers-on performance tests can be used as an acceptance test upon receipt of the instrument, as an indication that repair and/or calibration is required, or as a performance verification after completing repairs or calibration of the instrument. Individual performance tests can be used as troubleshooting aids.

The 6062A must be warmed up with all covers in place for at least 20 minutes before starting the performance tests.

4.3.1 Test Equipment

Table 4-1 lists the recommended test equipment for the performance tests. Figure 4-28 illustrates a two-turn Loop.

4.3.2 Power-On Self-Test (POST)

This performance test is the built-in POST that performs a simple functional check of the instrument. The test is begun each time the generator is turned on. Press any of the Function keys or the [CLR/LCL] key to abort the test.

Requirement:

The generator successfully passes the self test.

Procedure:

1. Start the test with the power off.
2. Press the POWER on. The generator automatically starts the self tests, which include lighting all indicators and every segment of the display. This test takes five seconds.

If the instrument fails any of the self tests, the results are shown in the four display fields. See the paragraphs on Self Test Description located in Chapter 5 for the interpretation of the test failure codes.

If the generator passes the self test, it is automatically returned to the same front panel condition that existed prior to power-on. The IEEE-488 Interface is programmed to local control.

4.3.3 Frequency Accuracy Test

The internal timebase is compared to that of a Frequency Standard. This procedure is for a 6062A with a standard timebase. If the generator has the optional timebases installed (Option -130 or -132), use the procedure in Appendix A to verify that the optional timebase frequency is within the specified limits.

Requirement:

The frequency of the timebase is within the specified limits.

Test Equipment:

Frequency Standard
Frequency Counter

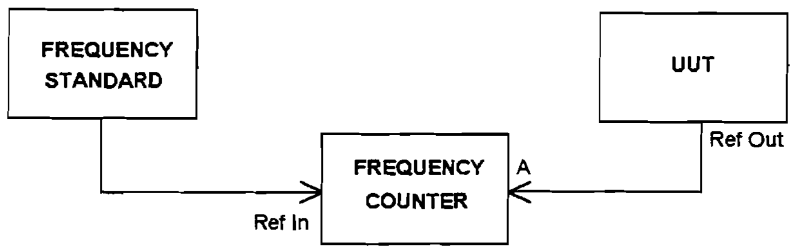


Figure 4-20. Frequency Accuracy Test

Procedure:

1. Connect the Frequency Standard output to the 10 MHz REF IN connector on the Frequency Counter and switch the Counter to Ext. Ref.
2. Switch the generator to internal reference.
3. Connect the REF OUT connector to the Frequency Counter channel A input connector.
4. Verify that the counter display is 10 MHz ±25 Hz.

4.3.4 Synthesis Test

Use a Frequency Counter operating on a common reference with the generator. The generator output frequency is measured at several programmed frequencies.

Failing this test indicates the need to repair and/or recalibrate the A4 Synthesizer assembly and/or the A5 VCO assembly.

Requirement:

The measured and programmed frequencies agree within ± one count.

Test Equipment:

Frequency Counter

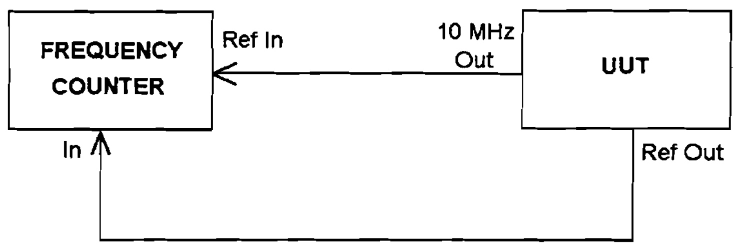


Figure 4-21. Synthesis Test Setup

Procedure:

1. Connect the generator 10 MHz OUT to the Frequency Counter 10 MHz reference input, and connect the RF output to the Frequency Counter input.
2. Set the REF INT/EXT Switch to INT.
3. Program the generator to [RCL] [9] [8].
4. Program the generator frequency to 111.11111 MHz.
5. Program the generator frequency step to 111.11111 MHz.
6. Verify that the Frequency Counter reading agrees with the frequency ± one count as the generator frequency is stepped from 111.11111 MHz to 999.99999 MHz.

4.3.5 High-Level Accuracy Test

This test verifies the high-level accuracy of the generator and also verifies that the amplitude correction factors for the individual Attenuator sections are correct. This test, in conjunction with the mid-level accuracy and low-level accuracy tests, verifies the overall level performance of the generator.

The output power is measured with a Power Meter at various frequencies. First, the step attenuator is set for zero attenuation; then each attenuator section is individually programmed. Finally, the output level accuracy and attenuator section errors are computed.

If a Measuring Receiver is available for level testing, then proceed directly to the Alternate-Level Accuracy Test procedure.

Failing this performance test indicates the need to repair and/or replace the A6 Output Control and the A7 Output and/or the A8 Attenuator assemblies. To determine which assembly is at fault, use Chapter 5 in this manual for Troubleshooting procedures.

The test frequencies of this procedure provide reasonable confidence of the amplitude accuracy of the generator. However, additional test frequencies can be included in this test.

Requirement:

The output level accuracy, the attenuator section errors and the sum of the attenuator section errors at each test frequency are:

<±2dB from 0.1 to 0.99999 MHz
<±1dB from 1.0 to 1049.99999 MHz
<±1.5dB from 1050 to 2100 MHz

Test Equipment:

Power Meter with a Sensor

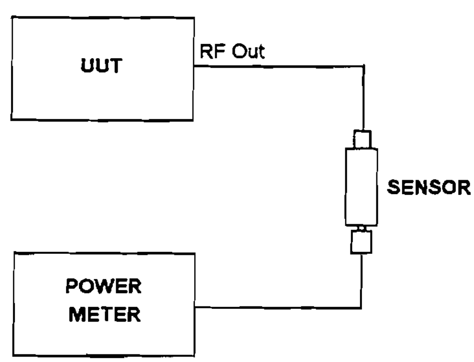


Figure 4-22. High-Level Accuracy Test Setup

Procedure:

1. Calibrate and zero the Power Meter.
2. Program the generator to [RCL] [9] [8].
3. Connect the Power Sensor to the RF output.
4. Program the generator frequency to 0.1 MHz.
5. Select each attenuator section by programming the amplitude to the levels shown in Table 4-2 High-Level Accuracy test conditions, and record the measured power at each level.

NOTE: To test Attenuator sections 4 through 7, program the generator to -12 dBm, and key in [SPCL] [8] [3] through [8] [6], respectively.

6. For each programmed level of Table 4-2, compute the output power error (subtract the programmed power in dBm from the measured power in dBm). These errors must not exceed ±1.0 dB.
7. For attenuator sections 1 through 7, subtract the measured power for section zero from the sum of the measured power for that section and the nominal attenuation for that section, e.g., (-M0+M1+6) for section 1. The eight section errors and their sum must not exceed ±1.0 dB.
8. Repeat steps 4 through 7 with the generator programmed to each of the following frequencies:
   a. 120 MHz, 244 MHz, 245 MHz, 850 MHz, and 1050 MHz.
   b. To illustrate the procedure, Table 4-3 is an example in which the measured power and the error calculations are shown. This example is for one frequency, and these measurements and calculations are repeated at other frequencies. In this case, the section errors and the sum of the section errors are within the test limits and, therefore, the generator passed.

Table 4-2 lists the parameters of the high-level accuracy test. Table 4-3 is a sample of high-level accuracy test conditions.

Table 4-2. High-Level Accuracy Test Conditions

Output Power						
Attenuation		Program (dBm)	Measured (dBm)	Error (dB)	Section Error (dB)	Limit (dB)
Section	Nominal					
0	0	+12	M0	M0-12	M0-12	±1.0
1	6	+6	M1	M1-6	-M0+M1+6	±1.0
2	12	0	M2	M2-0	-M0+M2+12	±1.0
3	24	-12	M3	M3+12	-M0+M3+24	±1.0
4	24	-12 [SPCL] [8][3] M4		M4+12	-M0+M4+24	±1.0
5	24	-12 [SPCL] [8][4] M5		M5+12	-M0+M5+24	±1.0
6	24	-12 [SPCL] [8][5] M6		M6+12	-M0+M6+24	±1.0
7	24	-12 [SPCL] [8][6] M7		M7+12	-M0+M7+24	±1.0
					Sum of Errors	±1.0

Table 4-3. High-Level Accuracy Test Conditions Sample

Output Power						
Attenuation		Program (dBm)	Measured (dBm)	Error (dB)	Section Error (dB)	Limit (dB)
Section	Nominal					
0	0	+12	+12.2	+0.2	+12.2-12.0	+0.2
1	6	+6	+05.9	-0.1	-12.2+5.9+6	+0.3
2	12	0	-00.2	-0.2	-12.2-0.2+12	-0.4
3	24	-12	-12.1	-0.1	-12.2-12.1+24	-0.3
4	24	-12 [SPCL] [8][3] -11.8		+0.2	-12.2-11.8+24	+0.0
5	24	-12 [SPCL] [8][4] -12.0		+0.0	-12.2-12.0+24	-0.2
6	24	-12 [SPCL] [8][5] -12.3		-0.3	-12.2-12.3+24	-0.5
7	24	-12 [SPCL] [8][6] -11.9		+0.1	-12.2-11.9+24	-0.1
					Sum of Errors	-1.0

4.3.6 Mid-Level Accuracy Test

The mid- level accuracy is verified from -24 to -66 dBm at frequencies of 10, 120, 244, 245, 850, 1050, 1051, 1500, 1800, and 2100 MHz, using the Power Meter with a Low-Level Sensor.

This test, in conjunction with the High-Level Accuracy Test and the Low-Level Accuracy Test, verifies the overall level performance of the generator.

It is convenient to use the RF ON/OFF control when zeroing the Power Meter.

Requirement:

Amplitude accuracy is:

<±2dB from 0.1 to 0.99999 MHz
<±1dB from 1.0 to 1049.99999 MHz
<±1.5dB from 1050 to 2100 MHz

Test Equipment:

Power Meter
Low-Level Sensor

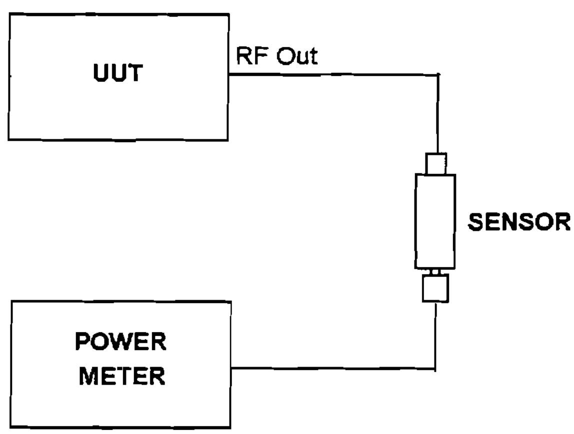


Figure 4-23. Mid-Level Accuracy Test Setup

Procedure:

1. Program the generator to the Instrument Preset State [RCL] [9] [8], and then program 10 MHz and -24 dBm.
2. Calibrate the Power Meter.
3. Connect the Power Meter with a Low-Level Sensor to the RF output.
4. Zero the Power Meter.
5. With the Power Meter, measure the output power (in dBm). It should agree with the programmed level within ±1.0 dB.
6. Repeat step 5 for levels of -30, -36, -42, -48, -54, -60, and -66 dBm.
7. Repeat step 5 to 6 for frequencies of 120, 244, 245, 850, 1050, 1051, 1500, 1800, and 2100 MHz.

4.3.7 Low-Level Accuracy Test

An RF Spectrum Analyzer and two amplifiers are used to verify the level accuracy at -127 dBm and at frequencies of 10, 120, 244, 245, 850, 1050, 1051, 1500, 1800, and 2100 MHz.

This test, in conjunction with the mid-level accuracy and high-level accuracy tests, verifies the overall level performance of the generator. Failing this test, but passing the high-level accuracy test, probably indicates a leak-around problem in the attenuator.

1. Check for a broken feed-through filter or improper mechanical assembly, i.e., loose screws and/or damaged or misplaced gaskets.
2. It is convenient to use the generator RF ON/OFF control when zeroing the Power Meter.

Requirement:

Amplitude accuracy is:

<±2dB from 0.1 to 0.99999 MHz
<±1dB from 1.0 to 1049.99999 MHz
<±1.5dB from 1050 to 2100 MHz

Test Equipment:

Wideband Amplifier
1.3 to 2.1 GHz Amplifier
60-dB Attenuator
RF Spectrum Analyzer
Power Meter
Low-Level Sensor

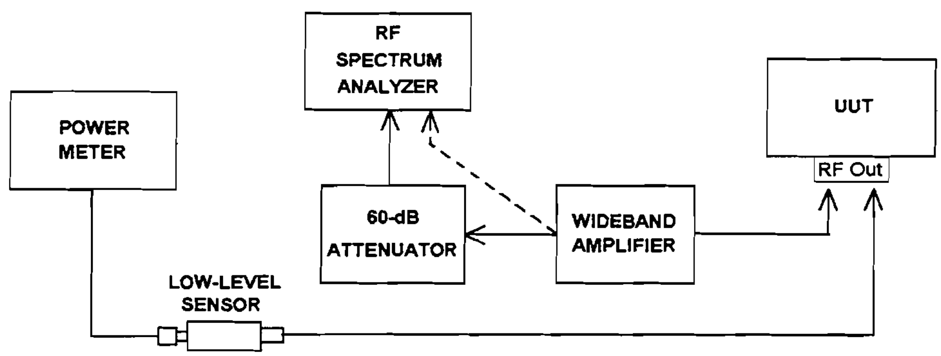


Figure 4-24. Low-Level Accuracy Test Setup

Procedure:

1. Program the generator to the Instrument Preset State [RCL] [9] [8], then program 10 MHz and -67 dBm.
2. Calibrate and then connect the Power Meter with a Low-Level Sensor to the RF output.
3. Zero the Power Meter.
4. With the Power Meter, measure the output power (in dBm) and record the measurement as the variable P.
5. Connect RF output through the 60-dB Attenuator and the Wideband Amplifier to the input of the RF Spectrum Analyzer. Use well shielded cables to avoid leakage that could affect the measurement.

6. Adjust the Analyzer to display the signal, using a resolution bandwidth of 1 kHz and a vertical display of 1 dB/Div. Adjust the reference level so that the response is at a convenient reference point on the display, e.g., 2 dB below top scale. This signal response corresponds to a level of (P-A) dBm, where A is the value of the 60 dB Attenuator.
7. Program the generator to a level of -127 dBm, remove the 60-dB Attenuator, and note the difference in the resulting response on the Spectrum Analyzer from the previous response (P-A). The actual output level is (P-A) plus this difference and should agree with the programmed level to within ±1.0 dB.
8. Repeat steps 3 through 7 for frequencies of 120, 244, 245, 850, and 1050 MHz.
9. Substitute the 1.3 to 2.1 GHz Amplifier for the Wideband amplifier and repeat steps 4 through 7 for frequencies of 1500, 1800, and 2100 MHz.

4.3.8 Alternate-Level Accuracy Test

A Measuring Receiver is used to verify the level accuracy at various amplitude and frequency settings that test all level ranges of the generator on all RF bands.

This test is a more comprehensive test than the High-Level, Mid-Level, and Low-Level Accuracy tests.

Failing this test at levels above approximately -50 dBm, indicates the need to repair or replace the A6 Output Control, the A7 Output, or the A8 Attenuator assembly.

Failing this test at lower levels probably indicates an RF-leakage problem with the A8 Attenuator assembly. Check for loose connectors, loose screws, improper gasket or a broken feed-through filter.

Because of operational subtleties in Measurement Receivers and the intent to reduce the risk of measurement errors, the following procedure is written around the use of the HP 8902A as the Receiver and the HP 11793A as the microwave converter.

NOTE: The calibration factors for the Sensor Module must be stored into the Measurement Receiver Cal Factor Table prior to performing calibrated RF power measurements. Correctly entered Cal Factors can be verified on the HP 8902A by using special functions 37.5 and 37.6 (refer to owner's manual).

Requirement:

Amplitude accuracy is:

<±2dB from 0.1 to 0.99999 MHz, from +16 dBm to -127 dBm
<±1dB from 1.0 to 1049.99999 MHz, from +16 dBm to -127 dBm
<±1.5dB from 1050 to 2100 MHz, from +13 dBm to -127 dBm

Test Equipment:

Measuring Receiver
Sensor Module
Microwave Converter
HFSSG
1.3 to 2.1 GHz Amplifier
Power Supply

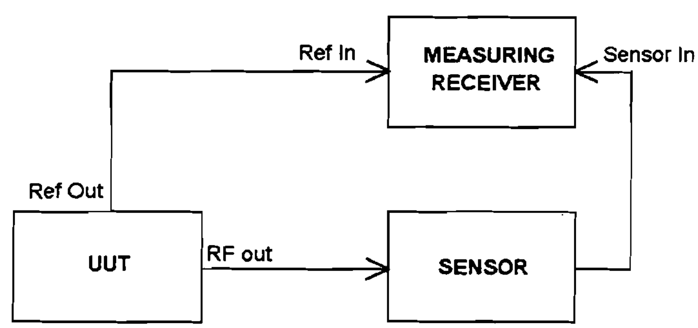


Figure 4-25. Alternate-Level Accuracy Equipment Setup

Procedure:

A. Level Measurements Below 1300 MHz:

1. Perform the Power Meter zero and self-calibration for the measurement receiver (refer to owner's manual).
2. Connect all instruments as shown in Figure 4-25.

3. Program the generator to [RCL] [9] [8], 10 MHz, +13 dBm, and [AMPL] [STEP] 6.1 dB.
4. Program the Measurement Receiver to RF-POWER mode and toggle the [LOG/LIN] button to display dBm. To enable the correct cal factor selection, tune the internal LO on the Measurement Receiver to that of the RF output ([1] [0] [MHz] for the first frequency).
5. Step the level from +13 dBm to -11.4 dBm using the STEP [ ] key. Verify that each level measured with the Measuring Receiver agrees with the generator programmed level and is within ±1 dB.
6. Select TUNED-RF LEVEL on the Measuring Receiver, wait for a displayed reading, and then press the CALIBRATE button. Verify that the Recal annunciator goes out and a stable reading is displayed again.
7. Step the generator from -11.4 to -127.3 dBm, again observing that each stepped level is within ±1 dB.

NOTE: When the Recal annunciator on the Measurement Receiver lights while stepping through levels, press the CALIBRATE button on the Measuring Receiver and wait for a stable reading.

8. Repeat steps 4 through 7 for each of the following frequencies:

   120, 244, 245, 380, 511, 850, and 1049 MHz

B. Level Measurements Above 1300 MHz:

RF frequencies above 1300 MHz must be down-converted through a Microwave Converter to a usable IF frequency before measurements can be made. Therefore, the Measurement Receiver must be put into a Frequency-Offset mode so its internal L.O. can adjust between the RF and IF frequencies. For proper measurements in this mode, the Sensor Module calibration factors must once again be loaded into a special Frequency-Offset cal factor table (for the HP 8902A press [27.1] [SPCL] to get into the Frequency-Offset cal factor table and then enter or verify the Sensor Module cal factors the same way as in the normal mode by using special functions 37.n).

1. Set up the equipment as shown in Figure 4-26.

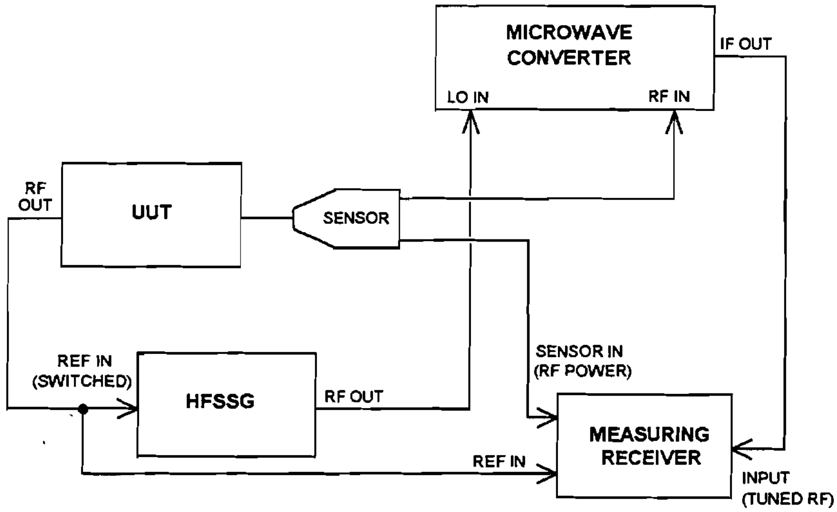


Figure 4-26. Low-Level Setup Above 1300 MHz (a)

2. Program the generator to 1400 MHz and +13 dBm.
3. Program the Local Oscillator (HFSSG) to the generator frequency +120.53 MHz (1520.53 MHz in this case) and +8 dBm.
4. Program the Measurement Receiver to the Frequency mode and then to the special Frequency-Offset mode. (On the HP 8902A program [27.3] [SPCL], then the HFSSG frequency (1520.53 MHz), followed by the generator frequency (1400 MHz)). The displayed reading should be the generator output (1400 MHz in this case).
5. Program the Measurement Receiver to RF Power mode and toggle the [LOG/LIN] button to display dBm.
6. Step the generator from +13 dBm down to -11.4 dBm, observing that each stepped level is within ±1.5 dBm.
7. Program the Measuring Receiver to the Tuned RF Level mode, wait for a stable reading, then press the CALIBRATE button. Verify the Recal annunciator goes out and a stable reading is displayed.
8. Step the generator from -11.4 dBm down to -84.6 dBm observing that each stepped level is within ±1.5 dB.
9. When the Recal annunciator on the Measurement Receiver lights while stepping through generator levels, press the CALIBRATE button on the Measuring Receiver and wait for a stable reading.

☛ **NOTE:** The following steps incorporate the use of a Level Amplifier (required for the Microwave Converter) for generator levels 90 dBm. The amplifier must be gain-corrected at each new frequency.

---

10. Observe the displayed reading at the -84.6 dBm level and note this as the reference. Disconnect the RF cable leading from the generator to the Microwave Converter RF-input and insert the Level Amplifier (refer to Figure 4-27).

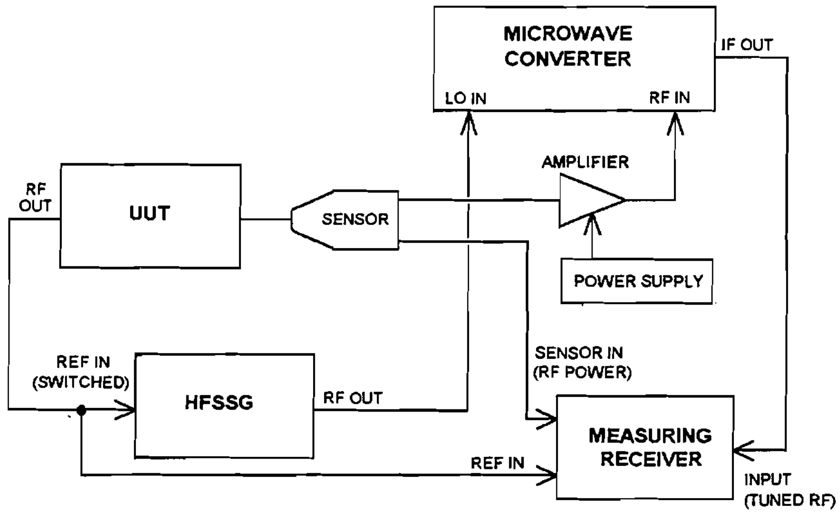


Figure 4-27. Low-Level Setup Above 1300 MHz (b)

11. Wait for the Measurement Receiver to regain the signal and stabilize. Observe the new reading. Subtract the previously obtained reference reading in step 9 from this amplified reading and note it as the amplifier gain.
12. Example: -54.5 (amplified reading) - (-84.6) (reference reading) = +30.1 (amplifier gain)
13. Step the generator from -84.6 dBm down to -127.3 dBm observing that each stepped level minus the amplifier gain is within ±1.5 dB.
14. Reading - Amplifier Gain = generator RF level
15. Repeat steps 3 through 11 for 1600, 1900 and 2100 MHz. (program the HFSSG to the generator frequency +120.53 MHz) and observe a ±1.5 dB measurement:

If you are using a Local Oscillator (HFSSG) with a frequency range that does not extend to 2250.53 MHz, it is necessary to program the HFSSG frequency 120.53 MHz lower than the generator frequency at the higher frequency levels. In this case use a generator frequency of 1900 MHz as the switchover point. At 1900 MHz, program the HFSSG to 1779.47 MHz and then the Measuring Receiver to [27.3] [SPCL] [1779.47] [MHz] [1900] [MHz].

4.3.9 Output Leakage Test

The output signal leakage is verified with a two-turn loop by measuring the induced signal with a spectrum analyzer and comparing it to a 1 μV reference established at each frequency from the generator.

Failing this test probably indicates a broken feed-through filter or improper mechanical assembly, i.e.; loose screws and/or damaged or misplaced gaskets.

Requirement:

The radiated emissions induce less than 1 μV of the output signal into a 1-inch diameter, two-turn loop, 1 inch away from any surface of the generator as measured into a 50-ohm receiver.

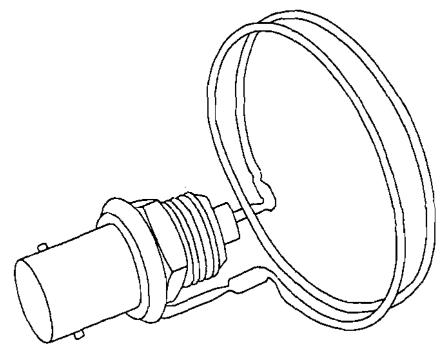


Figure 4-28. Two-Turn Loop

Test Equipment:

Wideband Amplifier
1.3 to 2.1 GHz Amplifier
RF Spectrum Analyzer
Two-Turn Loop
Type-N Termination

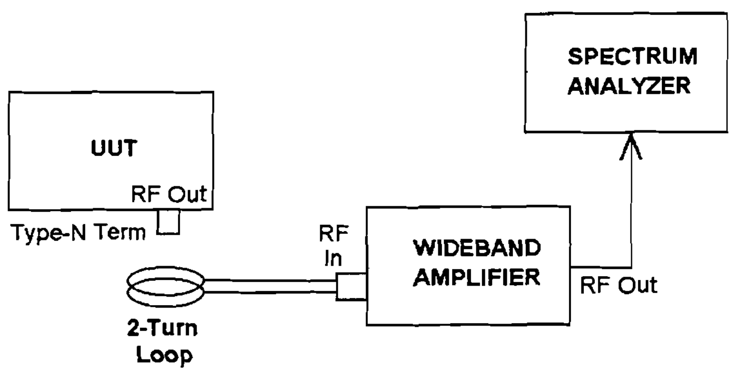


Figure 4-29. Output Leakage Test

NOTE: A screen room may be required depending on the RF environment.

Refer to the procedure on the next page.

Procedure:

1. Connect the RF output to the Wideband Amplifier input, and connect the Amplifier output to the Spectrum Analyzer input. Use well shielded cables to avoid leakage which could affect the measurement.
2. Program the generator to the Instrument Preset State, [RCL] [9] [8].
3. Program the generator to -107 dBm.
4. Adjust the Spectrum Analyzer to display the signal for a convenient reference, using a vertical scale of 10 dB/division, a resolution bandwidth of 3 kHz, and a span/division of 5 kHz/division.
5. Disconnect the Amplifier and terminate OUTPUT with Type-N termination.
6. Connect the two-turn loop to the Amplifier input.
7. Program the generator to +13 dBm.
8. Verify that the leakage is less than -107 dBm (1 µV), as indicated by the Spectrum Analyzer by moving the two-turn loop over the surface at a distance of 1 inch.
9. Repeat steps 3 through 8 at 550, 850, and 1050 MHz.
10. Replace the Wideband Amplifier with the 1.3 to 2.1 GHz Amplifier and repeat steps 3 through 8 at 1100, 1700, and 2100 MHz.

4.3.10 Harmonic, Spurious, and Subharmonic Test

Using a Spectrum Analyzer, the level of the harmonic, spurious, and subharmonic signals are compared to the desired signal at various programmed frequencies.

Requirement:

RF harmonics <-30 dBc for levels ≤+13 dB and frequencies ≥ 1 MHz; <-25 dB elsewhere.

Spurious (non-harmonic) <-60 dBc for offsets >10 kHz, and frequencies from 0.1 to 1049.99999 MHz; <-54 dBc for offsets greater than 10 kHz and frequencies from 1050 to 2100 MHz.

Subharmonics <-45 dBc for output frequencies from 1050 to 2100 MHz.

Test Equipment:

RF Spectrum Analyzer

Procedure:

1. Connect the RF output to the Spectrum Analyzer input.
2. Program the generator to [RCL] [9] [8].
3. Program the generator to +16 dBm and 0.1 MHz.
4. Set the Spectrum Analyzer controls to display the output signal and its harmonics (at least three harmonics wherever possible). Be careful not to overload the Analyzer input. Overloading the Analyzer causes it to generate harmonics, thus invalidating the test.
5. Verify that all the harmonics are more than 25 dB below the fundamental signal.
6. Program the generator to 13.0 dBm.
7. Verify that all the harmonics are more than 30 dB below the fundamental signal for the following frequencies:

   50, 240, 300, 450, 600, 750, 1000, 1200, and 1400 MHz.
8. Program the generator to 185 MHz and 16.0 dBm.
9. Verify the spur at 245 MHz is <-60 dBc.
10. Program the generator to 244 MHz.
11. Verify the spur at 312 MHz is <-60 dBc.
12. Program the generator to 244.99 MHz, 0 dBm.
13. Set the Spectrum Analyzer controls for the appropriate reference level, center frequency, span, and resolution to display the signals and spurs frequencies with appropriate noise floor and signal resolution for the following steps.
    a. Verify the spurs at the offsets of 20, 30, 35, and 40 kHz are <-60 dBc.
    b. Verify the spurs at the offsets of 1 and 10 MHz are <-60 dBc.
    c. Verify the spurs at 10, 20, and 30 MHz are <-60 dBc.
    d. Verify the spurs at 800 and 1044.99 MHz are <-60 dBc.
    e. Program the generator to 920 MHz
    f. Verify the spur at 460 MHz is <-60 dBc.
    g. Program the generator to 1249 MHz.
    h. Verify the subharmonic at 1873.5 MHz is <-45 dBm
    i. Program the generator to 1749 MHz.

j. Verify the subharmonic at 1311.75 MHz is <-45 dBm

k. Program the generator to 2100 MHz.

l. Verify the subharmonic at 1050 MHz is <-45 dBm

m. Program the generator to 1450 MHz.

n. Verify the subharmonic at 725 MHz is <-45 dBm

o. Program the generator to 1740 MHz.

p. Verify the subharmonic at 870 MHz is <-45 dBm

4.3.11 Modulation Tests

These tests use the Modulation Analyzer to verify modulation accuracy and residual and incidental modulation of the generator. The modulation distortion is verified by measuring the demodulated output of the Modulation Analyzer with a Distortion Analyzer. The internal modulation oscillator frequency is measured using the Frequency Counter on the demodulated output of the Modulation Analyzer. Table 4-4 lists the requirements for the modulation tests.

Failing this performance test indicates the need for repair and/or recalibration of the associated circuitry.

Where residual noise affects the Modulation Analyzer measurements accuracy, apply correction methods provided by the Modulation Analyzer manufacturer.

Table 4-4. Modulation Test Requirements

Requirements parameter	Specification
MOD Freq	<±3% at 0.4 or 1 kHz for 20 to 30°C; add ±0.1%/5 degrees C outside this range.
AM Accuracy	<±(2% + 4% of setting) for internal rates, for peak amplitudes of +13 dBm or less, and for frequencies of 1 to 1049.99999 MHz. <±(2% + 4% of setting) for internal rates, for peak amplitudes of +13 dBm or less, and for frequencies of 1000 to 1049.99999 MHz. <±(2% + 4% of setting) for internal rates, for peak amplitudes of +16 dBm or less, and for frequencies of 0.1 to 0.99999 MHz.
AM Distortion	<1.5% THD up to 30% AM, <3% to 70%, <5% to 90%, at internal rates and frequencies of 1 to 1049.99999 MHz. <3% THD up to 70% AM, and <5% THD to 90%, at internal rates and frequencies of 1050 to 2100 MHz. <3% THD up to 30% AM, <5% to 70%, <7% to 90%, at internal rates and frequencies of 0.1 to 0.99999 MHz.
Residual AM	<0.1% rms (-60 dBc) in a 0.05 to 15-kHz bandwidth
Incidental FM	<0.3 fm for internal rates, <30% am. and frequencies from 0.1 to 1049.99999 MHz. <0.6 fm for internal rates, <30% am. and frequencies from 1050 to 2100 MHz.
FM Accuracy	<±7% (7% + 10 Hz) for rates of 0.3 kHz to 20 kHz.
FM Distortion	<1% THD for rates of 0.3 kHz to 20 kHz.
Residual FM	rms in a 0.3-kHz to 3-kHz band: <12 Hz for 0.1 to 244.99999 MHz <6 Hz for 245 to 511.99999 MHz. <12 Hz for 512 to 1049.99999 MHz. <24 Hz for 1050 to 2100 MHz rms in a 0.05-kHz to 15-kHz band: <18 Hz for 0.1 to 244.99999 MHz <9 Hz for 245 to 511.99999 MHz. <18 Hz for 512 to 1049.99999 MHz. <36 Hz for 1050 to 2100 MHz
Incidental AM	<1% AM at 1-kHz rate and for deviation <50 kHz.

See Setup and Procedure on next page

NOTE: The following procedures must be done in sequential order to ensure that the proper equipment is connected and appropriate programs are enabled.

Test Equipment:

Modulation Analyzer
Distortion Analyzer
Frequency Counter
LFSSG
DVM
HFSSG

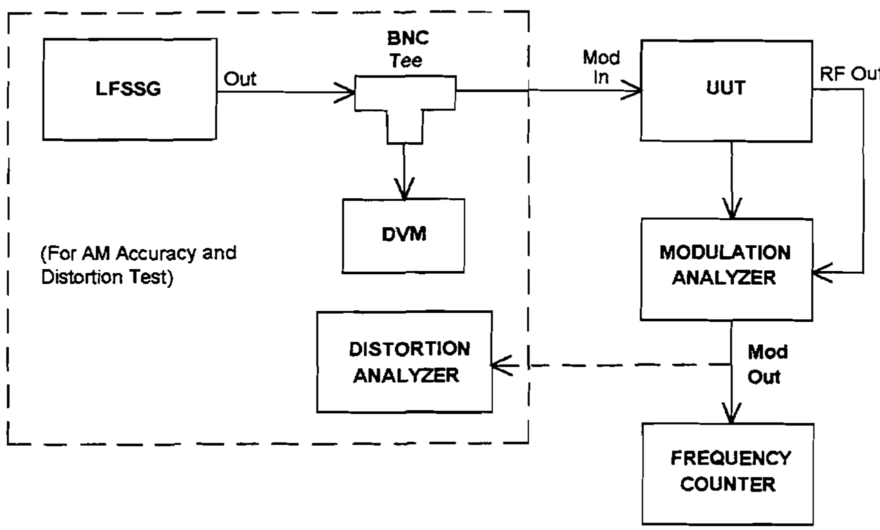


Figure 4-30. AM Tests Setup

Procedure:

The settings in this procedure are chosen to provide a strong confidence of the modulation performance of the generator throughout its range. However, performance also can be checked at other instrument settings if desired.

The FM deviation accuracy depends upon software correction data stored in the compensation EEPROM derived from the measured data of the particular VCO assembly installed in the generator.

Procedures for each of the tests in Table 4-4 are as follows:.

Internal Modulation Oscillator Frequency Test

1. Connect the RF output to the Modulation Analyzer input.
2. Connect the Modulation Analyzer modulation output to the Frequency Counter input.
3. Program the Modulation Analyzer to measure AM depth in a 0.05-kHz to 15-kHz bandwidth.
4. Program the generator to [RCL] [9] [8]. Program the generator for 90% INT AM at a 1-kHz rate and a level of +1 dBm.
5. Verify that the Counter reads between 970 and 1030 kHz.
6. Program the generator to a modulation frequency of 400 Hz.
7. Verify the Counter reads between 388 Hz and 412 Hz.

Internal AM Accuracy Test

1. Measure the mean AM depth, (+PEAK plus -PEAK)/2, with the Modulation Analyzer.
2. Verify that the mean AM depth is between 84.4% and 95.6%.
3. Program the generator to a modulation frequency of 1 kHz.
4. Verify that the mean AM depth is between 84.4% and 95.6%.

AM Accuracy and Distortion Test

1. Connect the output of the LFSSG to the MOD INPUT and the DVM (use a BNC T connector).
2. Program the generator for a frequency of 0.2 MHz, 1 dBm level, and EXT AM at 30% AM depth.
3. Program the LFSSG for 1 kHz at 0.7071 V_{rms} as measured by the DVM.
4. Connect the modulation output of the Modulation Analyzer to the input of the Distortion Analyzer.
5. Set the Distortion Analyzer to measure the THD of the 1-kHz modulation signal.
6. Verify that the mean AM depth (+PEAK plus -PEAK)/2, is between 26.5% and 34.5%.
7. Verify that the THD is less than 3%.
8. Program the remaining combinations of RF frequency, level, and AM depth listed in Table 4-5.
9. Verify that the mean AM depth for each combination is between the allowed limits and that the THD is less than the allowed limit. The allowed limit depends on programmed depth, RF, and level as listed in Table 4-6.
10. Disconnect the LFSSG from the generator.

Table 4-5. AM Test Conditions

FREQUENCY (MHz)	LEVEL (dBm)	AM (%)
0.2	1	30
		70
		90
	10	30
		70
		90
244.9	1	70
		90
	10	70
		90
245	1	70
		90
	10	70
		90
512	1	70
		90
	10	70
		90
1050	1	70
		90
	7	70
		90
1250	1	70
		90
	7	70
		90

Table 4-6. AM Depth Range

Frequency	Programmed depth (%)	Mean Am Depth (%)		Maximum THD (%)
		Min	Max	
1 to 2100 MHz	30	26.8	33.2	1.5 (3%, 1050 to 2100 MHz
	70	65.2	74.8	3
	90	84.4	95.6	5
	70	63.5	76.5	5
	90	82.5	97.5	7

Residual AM Test

1. Program the generator to 100 MHz, +7 dBm, and no modulation.
2. Program the Modulation Analyzer to measure rms (or average) AM in a 0.05 kHz to 15 kHz bandwidth.
3. Verify the residual AM is less than 0.1% rms (or 0.09% average).

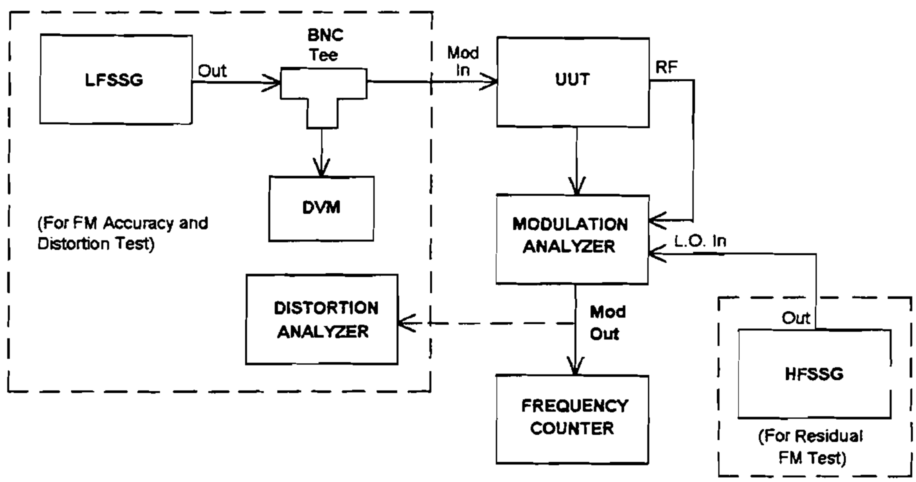


Figure 4-31. FM Tests Setup

Incidental FM Test

1. Program the generator for 30% INT AM at 1 kHz, at 1049.9 MHz, and 10 dBm.
2. Program the Modulation Analyzer to measure peak FM deviation in a 0.3 to 3 kHz bandwidth.
3. Verify the incidental FM is less than 300 Hz.

NOTE: It may be necessary to compensate for residual noise effects using the procedure presented in the Modulation Analyzer manual.

FM Accuracy and Distortion Test

1. Connect the LFSSG output to the MOD INPUT connector and the DVM (use a BNC T connector).
2. Program the Modulation Analyzer to measure peak FM in a 0.05 kHz to 20 kHz bandwidth.
3. Program the generator frequency to 245 MHz, 7 dBm, 99.9 kHz and EXT FM.
4. Set the LFSSG to 10 kHz and adjust its level so the DVM reads 707.1 m V_{rms}.
5. Set the Distortion Analyzer to measure distortion at 10 kHz.
6. Verify that the Modulation Analyzer reading is between 93 kHz to 107 kHz, and the THD is less than 1% as the frequency is stepped up to 1045 MHz in 50 MHz steps. (Tip: use the instrument FREQ STEP feature.)
7. Set the LFSSG to 0.4 kHz and adjust its level so the DVM reads 707.1 mV_{rms}.
8. Program the Modulation Analyzer to measure FM in a 0.05 kHz to 3 kHz bandwidth.
9. Set the Distortion Analyzer to measure distortion at 0.4 kHz.
10. Verify that the Modulation Analyzer reading is between 93 kHz to 107 kHz, and the THD is less than 1% as the frequency is stepped down to 245 MHz in 50 MHz steps.
11. Program the generator to 9.99 kHz deviation.

12. Verify that the Modulation Analyzer reading is between 9.3 kHz and 10.7 kHz.
13. Program the generator to 0.999 kHz deviation.
14. Verify that the Modulation Analyzer reading is between 0.93 and 1.07 kHz.

NOTE: It may be necessary to compensate for residual noise effects using the procedure presented in the Modulation Analyzer manual.

15. Disconnect the LFSSG from the generator.

Incidental AM Test

1. Program the generator for 50 kHz deviation, INT FM only, at 1 kHz, a level of 7 dBm and a frequency of 11 MHz.
2. Program the Modulation Analyzer to measure peak AM in a 0.3 kHz to 3 kHz bandwidth.
3. Verify that the incidental AM is less than 1%.

Residual FM Test

1. Program the generator for a frequency of 10.03999 MHz at +7 dBm and no modulation.
2. Program the HFSSG to 11.53999 MHz and 1.0 dBm.
3. Connect the HFSSG output to the Modulation Analyzer external LO input connector.
4. Program the Modulation Analyzer to measure average FM in the .3 to 3 kHz bandwidth.
5. Verify that the Modulation Analyzer reading is less than 10 Hz.
6. Verify that the Modulation Analyzer reading is less than 10 Hz average at the following frequencies. Program the external LO to a frequency 1.5 MHz higher than the frequency in each case:
   a. 89.03999 MHz
   b. 90.03999 MHz
   c. 244.03999 MHz
7. Verify that the Modulation Analyzer reading is less than 5 Hz average at the following frequencies. Program the external LO to a frequency 1.5 MHz higher than the frequency in each case:
   a. 319 MHz
   b. 364 MHz
   c. 511 MHz
8. Verify that the Modulation Analyzer reading is less than 10 Hz average at the following generator frequencies. Program the external LO to a frequency 1.5 MHz higher than the frequency in each case:
   a. 512.002 MHz
   b. 639.002 MHz
   c. 640.002 MHz
   d. 729.002 MHz

e. 730.002 MHz

f. 889.002 MHz

g. 890.002 MHz

h. 1049.002 MHz

9. Change the Modulation Analyzer to measure average FM in the .05 to 15 kHz bandwidth.
10. Program the LO to a frequency 1.5 MHz higher than the generator frequency in each case.
11. Verify that the Modulation Analyzer reading is less than 16 Hz average at the frequencies in step 8..
12. Verify that the Modulation Analyzer reading is less than 8 Hz average for the frequencies in step 7.
13. Verify that the Modulation Analyzer reading is less than 16 Hz average for the frequencies in step 6.

4.3.12 VSWR Tests

These tests use a VSWR bridge and a Spectrum Analyzer to verify VSWR of the generator.

NOTE: The following procedures must be done in sequential order to ensure that the proper equipment is connected and appropriate programs are enabled.

Requirement:

The output VSWR is less than 1.5:1 for output levels <+1 dBm; otherwise <2:1.

Test Equipment:

VSWR bridge
RF Spectrum Analyzer
High Frequency Synthesized
Signal Generator (HFSSG)

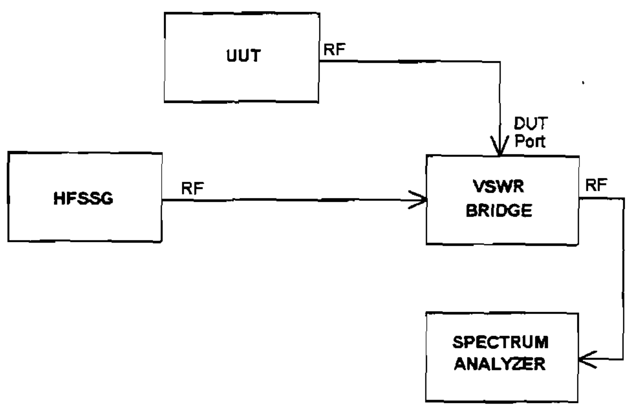


Figure 4-32. VSWR Tests

Procedure:

The settings in this procedure are chosen to provide confidence in the VSWR performance of the generator throughout its range. Performance also can be checked at other attenuator settings.

Mid-Frequency Band at Low Level Test

1. With the generator turned on, reset it by selecting [RCL] [9] [8].
2. Program the generator to 1 MHz at +0.9 dBm.
3. Select special function Fixed Range on the generator by pressing [SPCL] [9] [1].
4. Use the EDIT function on the generator to edit the amplitude to -30.1 dBm. Verify that the UNCAL annunciator illuminates.

NOTE: This procedure leaves the output attenuators set as they would be for a +0.9 dBm output level, but uses the electronic control to turn down the RF level coming out of the generator.

5. Connect the generator to the Device Under Test port of the VSWR Bridge.
6. Connect the Spectrum Analyzer to the RF OUT port of the VSWR Bridge.
7. Connect the HFSSG to the RF IN port of the VSWR Bridge.
8. Program the HFSSG to 10 MHz at +13 dBm.
9. Set the Spectrum Analyzer to display approximately 10 to 250 MHz and set the Reference Level to +10 dBm.

10. Step the HFSSG from 10 to 240 MHz in 10-MHz steps. Locate the frequency at which the reflected signal (displayed by the spectrum analyzer) is maximum and record this level. This is the point with worst-case VSWR.
11. Disconnect the generator from the VSWR bridge and record the new level.
12. Calculate the Return Loss (difference) between the two recorded levels. The difference must be at least 14 dB (14 dB of Return Loss = 1.5:1 VSWR).

High-Frequency Bands at Low Level Test

1. Program the generator to 250 MHz at +0.9 dBm.
2. Select the special function fixed range on the generator by pressing [SPCL] [9] [1].
3. Use the EDIT function to edit the amplitude to -30.1 dBm.
4. Connect the generator to the Device Under Test port of the VSWR Bridge.
5. Set the Spectrum Analyzer to cover a frequency span of 250 to 2100 MHz.
6. Step the HFSSG from 250 to 2100 MHz in 50-MHz steps. Locate the frequency at which the reflected signal is maximum and record this level.
7. Disconnect the generator from the VSWR bridge and record the new level.
8. Calculate the Return Loss between the two recorded levels. The difference must be at least 14 dB.

High-Frequency Bands at High Level Test

1. Program the generator to +10 dBm.
2. Select the special function fixed range on the generator by pressing [SPCL] [9] [1].
3. Use the EDIT function to edit the amplitude to -30 dBm.
4. Connect the generator to the Device Under Test port of the VSWR Bridge.
5. Step the HFSSG from 250 to 2100 MHz in 50-MHz steps. Locate the frequency at which the reflected signal is maximum and record this level.
6. Disconnect the generator from the VSWR bridge and record the new level.
7. Calculate the Return Loss between the two recorded levels. The difference must be at least 9.5 dB (9.5 dB of Return Loss = 2:1 VSWR).

Mid-Frequency Band at High Level Test

1. Program the generator to 1 MHz at +10 dBm.
2. Select the special function fixed range on the generator by pressing [SPCL] [9] [1].
3. Use the EDIT function to edit the amplitude to -30 dBm.
4. Connect the generator to the Device Under Test port of the VSWR Bridge.
5. Set the Spectrum Analyzer to display approximately 10 to 250 MHz.
6. Step the HFSSG from 10 to 240 MHz in 10-MHz steps. Locate the frequency at which the reflected signal is maximum and record this level.
7. Disconnect the generator from the VSWR bridge and record the new level.
8. Calculate the Return Loss between the two recorded levels. The difference must be at least 9.5 dB.
9. Reset the generator by selecting [RCL] [9] [8].

4.3.13 Pulse Tests

The Pulse Tests check the static and dynamic operation of pulse modulation.

REQUIREMENTS:

Proper pulse operation is tested by checking: static on/off ratio greater than 80 dB, dynamic rise and fall time <15 nS, and level error <0.5 dB.

TEST EQUIPMENT:

RF Spectrum Analyzer
Pulse Generator
Power Meter
Power Sensor (High-Level)
50 Ω Termination
Oscilloscope Detector

> NOTE: The following procedures must be done in sequential order to ensure that the proper equipment is connected and appropriate programs are enabled.

Procedure:

Static Test

1. Program the generator to 2100 MHz and +10 dBm.
2. Connect a 50 Ω termination to the Pulse Modulation input connector.
3. Connect the generator RF OUTPUT to the RF Spectrum Analyzer input.
4. Set the RF Spectrum Analyzer controls to display the output of the generator using a span of approximately 50 kHz and a resolution bandwidth of approximately 1 kHz.
5. Activate pulse modulation by pressing the External Pulse key on the generator.
6. Observe the level change on the RF Spectrum Analyzer. The change should exceed 80 dB.
7. Deactivate external pulse by pressing the External Pulse key on the generator and repeat steps 4 through 6 for generator frequencies of 10, 100, 500, 1050, 1500, and 2000 MHz.

Dynamic Test

1. Program the generator to 2100 MHz, +10 dBm, and external pulse modulation.
2. Remove the 50 Ω termination at the generator Pulse Modulation input connector, then connect the Pulse Generator to the generator pulse input connector.
3. Set the Pulse Generator to a repetition rate of 5 MHz, +3 V pulse level, and roughly a 50% duty cycle. If the Pulse Generator output is not 50 Ω impedance, then carefully monitor the pulse input at the generator for correct level and without signal distortion.
4. Connect the output of the generator to the Detector.
5. Terminate the Detector into 50 Ω at the Oscilloscope input.
6. Set the timebase of the Oscilloscope to 10 nS/division (or smaller using the magnifier).
7. Use the Oscilloscope channel to invert the detector output signal.
8. Trigger the Oscilloscope on this signal.

9. Set the variable position and gain on the Oscilloscope so that the signal extends from 0% to 100% on the graticule.
10. Measure the rise/fall time from the 90% to the 10% coordinates.
11. Verify that the rise/fall time is <15 nS.
12. Repeat step 6 through 11 at 1500, 1050, and 500 MHz. The timebase of the Oscilloscope should also be readjusted if necessary.
13. Remove the Detector and reconnect the generator directly into the Oscilloscope (still terminated at 50 Ω).
14. Change the repetition rate of the Pulse Generator to .5 MHz.
15. Verify that the rise/fall time is <15 nS for RF frequencies of 100 and 50 MHz.

Level Error Test

1. Remove the generator and connect the Pulse Generator directly into the Oscilloscope. If the Pulse Generator output is 50 Ω impedance, then terminate the Oscilloscope input at 50 Ω.
2. Set the Pulse Generator to 5-MHz repetition rate, +3 V level, and 50% duty cycle.
3. Adjust the Oscilloscope position and gain controls for easy full scale viewing.
4. Readjust the pulse duty cycle for exactly 50% as measured at the 1 V level of the Oscilloscope.
5. Remove the Pulse Generator from the Oscilloscope and connect it to the pulse input of the generator. If the Pulse Generator output is not 50 Ω impedance, then monitor the pulse input at the generator for correct level without signal distortion.
6. Program the generator to 244 MHz, +7 dBm, and external pulse modulation.
7. Connect the generator output to the RF Spectrum Analyzer input.
8. Set the RF Spectrum Analyzer to observe a three line spectra on either side of the center line spectra. The center spectra may be verified by turning pulse modulation off. (A convenient spectrum analyzer setting is 5 MHz./div span and 100-kHz resolution bandwidth).
9. Adjust the duty cycle of the Pulse Generator for exactly 50% duty cycle by nulling the second line from the center line (approximately 10-MHz offset). A null of at least -30 dBc should be established.
10. Replace the RF Spectrum Analyzer with the Power Meter and set the Power Meter to the reference setting.
11. Turn the pulse modulation off and note the meter reading. The difference between the meter reading and 3.01 dB is the pulse level error. This error should be less than .5 dB.
12. Repeat steps 6 through 11 for 2100, 1049, and 50 MHz.

5

Maintenance

5.1 General

The 6062A Synthesized RF Signal Generator should be periodically tested. If it does not pass all performance tests described in this chapter, it should be calibrated using the procedures in Chapter 4.

Testing should be performed at one year intervals unless the generator has been operated in an extremely dirty or chemically contaminated environment, or severely abused (such as being dropped). In such cases, more frequent maintenance is required (immediate maintenance is required if the generator has been severely abused).

5.1.1 Cleaning

The exterior of the unit, including the front panel, can be cleaned with a cloth dampened with a commercial glass cleaner. Alcohol and other solvents should not be used.

Over long periods of time the cooling fan may cause dust to accumulate inside the instrument and at vent openings. The dust can be eliminated by removing the top and bottom covers and blowing out the interior of the instrument with air from a compressor (this should be done during annual testing and calibration).

5.2 Assembly Removal Procedures

This section describes how to access and remove the following major assemblies:

- Front Section
- Rear Section
- A4 Synthesizer
- A7 Output
- A8 Attenuator
- A5 VCO

Access to other assemblies is largely self-explanatory and is not detailed in this manual.

WARNING

Before performing any disassembly of the 6062A, turn off the generator, remove the power cord from the power receptacle, and remove the exterior top and bottom covers. Failure to follow this warning can result in severe or fatal injury to service personnel from high voltages.

To install the assemblies, reverse the disassembly steps. Be certain the pin connectors and filter sockets are straight when replacing the boards.

5.2.1 Front Section

1. Disconnect the MOD INPUT wire W1 at the front of the Attenuator module.
2. Disconnect the front panel display ribbon cable at the controller.
3. Carefully remove the decals from both front panel handles. If the decals are damaged during removal, replacement decals can be ordered from Giga-tronics (part number 685214).
4. Remove the five flathead screws from each front panel handle.

5.2.2 Rear Section

1. Disconnect the Synthesizer, Controller, and Attenuator power cable at the power supply.
2. If the High-Stability Reference option is installed, disconnect the oscillator power cable from the Auxiliary power supply.
3. Remove the IEEE-488 Interface Assembly from the back of the instrument rear panel.
4. Remove the inside part of the 10 MHz OUT and the REF IN connectors.
5. Carefully remove the decals for both rear panel handles. If the decals are damaged during removal, replacement decals can be ordered from Giga-tronics (part number 685214).
6. Remove the five flathead screws from each handle and swing the rear panel assembly out from the generator.
7. If you need to completely detach the rear panel assembly from the generator, disconnect the front panel power switch.

5.2.3 Synthesizer PC Assembly (A4)

1. Remove the #6 screws holding the top shield cover. Remove the shield cover.
2. Remove the #6 screws holding the board. Carefully remove the board.

5.2.4 Output PC Assembly (A7)

1. Remove the #6 screws holding the bottom shield cover. Remove the shield cover.
2. Remove the plug-in coupling capacitor between the Output and the VCO boards.
3. Remove the #6 screws holding the board. Carefully remove the board.

5.2.5 Attenuator Assembly (A8)

1. Disconnect the SMA connector at the Attenuator that leads to the RF output.
2. Disconnect the control harness from the Relay Driver/RPP assembly.
3. Remove #6 screws holding the assembly.

5.2.6 VCO PC Assembly (A5)

1. Remove the #6 screws holding the bottom shield cover. Remove the shield cover.
2. Remove the plug-in capacitor that couples the Output board to the VCO.
3. Remove the cable from the VCO to the Output board.
4. Remove the #6 screws holding the assembly. Remove the board.

5.3 Repair and Replacement

Usually, the generator is most easily repaired by identifying the defective module and replacing it. Alternately, you may wish to troubleshoot down to the component level and replace the defective part.

After any module repair or replacement, the adjustments particular to the module in the following paragraphs should be completed, followed by the appropriate performance tests of the generator. Problems are generally caused by operator error, out-of-specs performance, or by catastrophic failure. The correction strategy is different in each case.

Although most operator errors are detected and indicated, some are not, and may be mistaken for an out-of-specs condition. Those operator errors that are detected are indicated with either a steady or flashing UNCAL indicator. Refer to the operational information in Chapter 2 and the specifications in Chapter 1 for more information on operation.

Out-of-specs performance can usually corrected by performing the appropriate adjustment procedures. Use the Performance Tests in Chapter 4 to determine which parameters need adjustment. Refer also to the troubleshooting procedures in Section 5.4 for more information.

If the problem is not an operator error and is not corrected by adjustment, the generator has a catastrophic failure. The task is then to isolate the fault and make appropriate repairs. The UNCAL and self-test failure codes usually provide a good indication of the cause of the problem. Using the Performance Tests in this situation may help to determine which parameters are not affected.

An experienced technician should be able to isolate the defective component and replace it, with reference to the information in Chapter 3 and the troubleshooting information in this chapter. The schematics and component diagrams are in Chapter 7 (see Appendix A for options).

Most parts are replaced by ordinary methods. The parts requiring special attention are the chip components located on the A5 VCO assembly. The chip components should be replaced using a 600 °F soldering iron, such as an Ungar 50T7 with a #76 heater and a #88 tip, and 2% silver solder paste, such as Electro Science Fabrication SP-37D1 or similar wire solder.

5.4 Troubleshooting

To isolate a fault, it is important to note the conditions under which the symptoms are observed and if the symptoms change with different states of the instrument, such as different RF bands or levels, only when FM is on, only under remote control, etc.

If the symptom is a blank front panel or no response to keystrokes, the fault is most likely a digital or power supply problem. If the power supply and cables are good, go to the digital troubleshooting paragraphs in Section 5.5.

If the front panel appears to function properly, but the RF output is abnormal or there is a flashing UNCAL indication, the cause is likely an analog circuit problem (although it could be a control problem).

A properly operating front panel indicates that the majority of the Controller circuitry is functional. It is possible, however, that a digital control problem could exist and cause the RF output to be incorrect. If a digital problem is suspected, go to the Digital and Control troubleshooting paragraphs after checking the power supply.

5.4.1 Special Functions

There are several special function self-tests that can be used to assist the technician in troubleshooting the generator. A few of the special functions used during troubleshooting are described in the following paragraphs. For a complete list of all special functions, see Table 2-1.

Special Function 03, Display Check

The front panel displays can be checked any time by pressing the [SPCL] [0] [3] keys. When this is done the microprocessor lights all display segments. This test is terminated by pressing any key on the instrument.

Special Function 04, Key Check

Check the normally open front panel keys by pressing the [SPCL] [0] [4] keys. For each key pressed, the code is displayed in the FREQUENCY display field. Pressing [CLR/LCL] key exits this check. The test will time out after approximately 8 seconds if no keys are pressed.

Special Function 15, Latch Test

Special function 15 initiates a built-in latch control test that is useful in verifying that the A2 Controller assembly is sending valid data to the latches of the Output and Synthesizer assemblies. This special function sends an alternating bit pattern (101010 10 binary) to each 8-bit latch, and displays **Latch AA**. Pressing the EDIT [↓] key changes the bit pattern to 01010101, and **Latch 55** is displayed. Pressing the EDIT [↑] key changes the pattern back to 10101010. Pressing any other key causes the instrument to exit the test.

This special function is intended as a troubleshooting tool to check the operation of the digital circuitry and the latches on the analog assemblies. Since the generator is programmed to an abnormal state, its output is turned off by programming full attenuation.

Special Function 17, Initiate Self Tests With RF ON

Special function 17 initiates a special troubleshooting self test. This special function initiates the self tests with the RF output enabled so that diagnostic equipment may be connected. It stops after each self test failure, leaving the generator configured as it was when the failure was detected. Press any front panel key to resume the test. Refer to Section 5.4.3 for details of the individual tests.

CAUTION

The RF output may reach +17 dBm during this test. Equipment that may be damaged by this power level should be disconnected from the system.

Special Functions 83 Through 86 Alternate Attenuators

Special functions 83 through 86 program alternate 24-dB Attenuators. The alternate 24-dB attenuators are normally used only when low levels are programmed too low to be verified with a power meter during service. These special functions allow the alternate attenuators, A242L through A245L, to be programmed one at a time, thus keeping the level high. The first 24-dB attenuator, denoted A241L, is automatically programmed for levels between -17.0 dBm and -11.1 dBm with AM off. These special functions allow the other attenuators, A242L through A245L, to be programmed in the same range.

These special functions also turn off relative amplitude, amplitude fixed range, and all modulation; and turn RF and level correction on. If the level is not in the specified range, -12 dBm will be programmed. Any new entry that normally programs the attenuators causes the default (normal) attenuators to be programmed.

5.4.2 UNCAL Conditions

There are two hardware fault detectors, the unlock detector on the Synthesizer assembly, and the unleveled detector on the Output assembly. These two fault detectors are constantly monitored by the Controller, and if asserted, cause a flashing UNCAL indication. The detectors are also used during the self test to check the general operation of the generator.

It is very important to interrogate and note the UNCAL code if there is an UNCAL indication.

If the generator has a UNCAL condition, interrogate the UNCAL code by pressing the [STATUS] key and interpret the code (see Table 2-18 in this manual). Take note if the code indicates that either UNLOK or UNLVL conditions have been asserted. Other codes denote over or under range conditions (operator errors) that should be cleared but are not pertinent to troubleshooting.

An unleveled UNCAL code usually indicates a problem on the Output assembly. An unlocked UNCAL code indicates a problem on the Synthesizer assembly. It is possible to have an Unleveled UNCAL condition due to a problem with the Synthesizer assembly that is not detected by the UNLOK detector.

Check for a different UNCAL code when other RF bands, levels or functions (FM or AM) are selected for a more complete analysis of the symptoms. For example, if the code indicates that UNLOK is asserted only with FM on, and not with FM off, it may be indicating an over-modulation condition. See the performance specifications in Chapter 1 for the FM limitations.

5.4.3 Self-Test Error Codes

The self-test is started whenever the generator is turned on. It may also be started by [SPCL] [0] [2]. If the generator fails any of the self tests, the self-test failure report is displayed until any key is pressed. The self-test report can also be displayed by [SPCL] [1] [1]. The report is presented in display fields as shown in Figure 5-1.

The four groups in the self-test report (denoted by A's, B's, C's and D's in Figure 5-1) correspond to different test categories. These tests are described below, including a tabulation of the state of the generator, and the test codes that result if any test fails to achieve the expected result.

During the self test, the step attenuator is programmed to maximum attenuation, and the internal frequency reference is selected. The analog circuit tests make use of the unleveled (UNLVL) and unlocked (UNLOK) status detectors, whereas the digital circuit tests make use of write/read techniques.

A minus sign in the Frequency display indicates that the self test was aborted by a front panel entry.

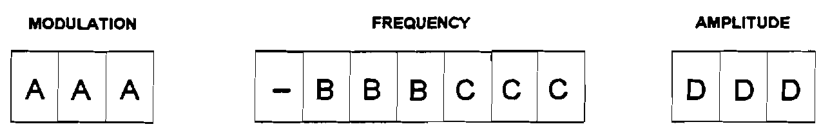


Figure 5-1. Self-Test Error Code Display

Multiple error codes in one field are summed together.

Example:

Code 220 = 200 and 020.

Understanding how these tests are done can provide more meaning to the results and can assist in understanding how they relate to other symptoms. A successful self-test is reported with all zeros.

During the self-test, the step attenuator is programmed to maximum attenuation and the internal frequency reference is selected. The analog circuit tests make use of the unleveled (UNLVL) and unlocked (UNLOK) status detectors, whereas the digital circuit tests make use of write/read techniques.

AM and FM Tests

Self-test code AAA is the result of the AM and FM tests. During these tests, level correction is applied. During the four AM tests, a normal AM depth, which should produce a leveled condition, and an abnormally high AM depth, which should provide an unleveled condition, is set for each modulation frequency. During the two FM tests, a normal FM deviation is set, which should produce a locked condition, and then an abnormally high deviation is set, which should produce an unlocked condition. Table 5-1 lists the AM and FM tests.

Table 5-1. AM Tests

Error Code AAA BBB CCC DDD	Freq (MHz)	Level (dBm)	AM (%)	Mod Freq (HZ)	Expected Result
001 000 000 000	2100.00000	10.7	30	400	Leveled
002 000 000 000	2100.00000	17	127	400	Unleveled
004 000 000 000	2100.00000	10.7	30	1000	Leveled
010 000 000 000	2100.00000	17	127	1000	Unleveled
100 000 000 000	1049.99999	13.7	30	1000	Leveled

Table 5-2. FM Tests

Error Code AAA BBB CCC DDD	Freq (MHz)	Level (dBm)	Mod Freq (Hz)	KNDAC	FM DAC	INT FM	FM Range	Expected Result
020 000 000 000	350	-10	400	Normal	4095	On	4	Locked
040 000 000 000	350	-10	400	0	4095	Off	4	Unlocked

Synthesizer Tests

Self-test code BBB is the result of the synthesizer tests. In the first three test steps, the Synthesizer assembly main PLL operation is verified by programming a large change in frequency. This should cause a momentary unlocked condition that should clear as the frequency settles to the new frequency.

The synthesizer is checked by programming 225 MHz, which is outside the normal operating frequency range and should result in an unlocked condition. Next, program 385 MHz, which should result in a locked condition. Next, program 550 MHz, which is again outside the normal range and should result in unlocked condition. Table 5-3 lists the synthesizer test results.

Table 5-3. Synthesizer and Reference Tests

Error Code AAA BBB CCC DDD	Maximum Synth Freq (MHz)	Wait (ms)	Expected Result
000 001 000 000	245	120	Locked
000 002 000 000	525	5	Unlocked
000 004 000 000	525	95	Locked
000 010 000 000	225	120	Unlocked
000 020 000 000	385	120	Locked
000 040 000 000	550	120	Unlocked

Digital Tests

Self-test code CCC is the result of the digital tests. The IEEE-488 interface is verified by writing data to the IEEE-488 chip (A3U1), then reading it back. The checksum of each memory location of the non-volatile RAM is verified.

The RAM is verified by writing data to each memory location and checking that the same data can be read back. Both the off-chip RAM (A3U25) and the on-chip RAM (A2U1) are tested in this manner. The RAM test is only done during the power-on self test.

The compensation data in the battery-backed RAM (A2U25) and in the compensation EEPROM (A2U24) is checked by verifying the CRC checksums. A self-test error is reported if any checksums are invalid, or if the compensation data in both memory ICs are not identical. If compensation memory errors are detected, the software adjusts its internal pointers to use only the valid data segments. If both memory ICs have invalid data in a particular data segment, the UNCAL indicator turns on to warn that the performance of the generator may be degraded.

All compensation memory errors are reported as a single self-test code. A detailed description of the compensation memory errors can be interrogated from the front panel or from the IEEE-488 Interface. Refer to Section 5.4.3 for Software Compensation details.

The data in the address location of the two program EPROMs (A2U21, 22) are successively summed and rotated. The result of this procedure is compared with a checksum for each EPROM. Table 5-4 lists the digital test results (CCC field) .

Table 5-4. Digital Tests

Error Code AAA BBB CCC DDD	Digital Test
000 000 001 000	IEEE-488 interface test
000 000 002 000	Non-volatile memory test
000 000 004 000	RAM test
000 000 010 000	Compensation memory test
000 000 100 000	Lower program EPROM checksum
000 000 200 000	Upper program EPROM checksum

Output Filter Tests

Self-test code DDD is the result of the Output filter tests. During these tests, the level is programmed to +13.0 dBm with level correction applied. The low-pass filters on the A6 Output assembly are tested by setting the frequency near the high end of each of the four half-octave non-het bands and checking for a leveled condition. Then, the frequency is set above the cutoff frequencies of two of the filters, and the output is checked for an unleveled condition.

The Band-pass Filters that operate in the double band are tested by setting the frequency at each of the filter band edges and verifying that the output is leveled. Then, the frequency is set to the top and bottom of the double band with all filters disabled. The output should be unleveled.

Table 5-5 lists the DDD field Results. Due to the number of filter tests, there are filter test codes in fields AAA, BBB and CCC as well as DDD.

Table 5-5. Output Filter Tests

Error Code	Freq (MHz)	MIDL	HAD CTL	X2L	X2FL 1L	X2FL 2L	X2FL 3L	X2FL 4L	Expected Result
000 000 000 001	349.99999	0	0	1	1	1	1	1	leveled
000 000 000 002	511.99999	0	1	1	1	1	1	1	leveled
000 000 000 004	729.99999	1	1	1	1	1	1	1	leveled
000 000 000 010	1049.99999	1	0	1	1	1	1	1	leveled
000 000 000 020	490.00000	0	0	1	1	1	1	1	unleveled
000 000 000 040	1024.00000	1	1	1	1	1	1	1	unleveled
000 000 000 100	1250.00000	1	1	0	0	1	1	1	leveled
000 000 000 200	1250.00000	1	1	0	1	0	1	1	leveled
000 000 000 400	1450.00000	1	1	0	1	0	1	1	leveled
200 000 000 000	1450.00000	1	1	0	1	1	0	1	leveled
400 000 000 000	1750.00000	1	1	0	1	1	0	1	leveled
000 200 000 000	1750.00000	1	1	0	1	1	1	0	leveled
000 400 000 000	1050.00000	1	1	0	1	1	1	1	unleveled
000 000 400 000	2100.00000	1	1	0	1	1	1	1	unleveled

Compensation Memory Status

The compensation memory status information is updated whenever the digital self tests are run. A detailed report of the compensation memory status is given when interrogated by pressing [SPCL] [7] [5] from the front panel or through the IEEE-488 Interface using the IZ command.

The status is reported in four groups: the data origin, the EEPROM checksum status, the battery-backed RAM checksum status, and the memory comparison status. While each of the status groups report different information, each group is comprised of three digits, which give the status of the FM, output, and attenuator data segments respectively. Figure 5-2 shows the format of the compensation memory status display.

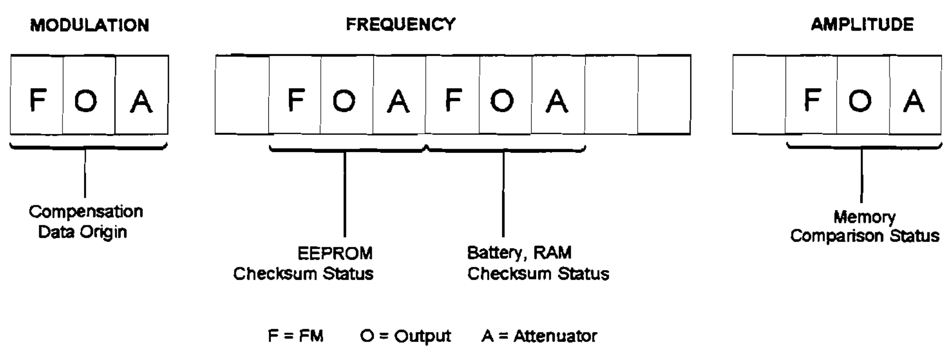


Figure 5-2. Compensation Memory Status Display

The data origin group shows how the compensation data in each of the segments was generated. The compensation data can be generated by the Giga-tronics factory, module exchange, or by using the Software Compensation Procedures in Section 5.8.

The EEPROM and battery-backed RAM checksum status group reports invalid CRC checksums. A one (1) in the corresponding digit signifies that the data segment has an invalid checksum, and a zero (0) signifies that the checksum is valid. When interrogated through the IEEE-488 Interface, the EEPROM and RAM status words are output together as a single 6-digit word.

The memory comparison status group reports an error if the corresponding data segments in the two memory ICs do not have identical data, yet both have valid checksums. This condition could arise when swapping the compensation memory ICs as part of the A2 Controller module exchange procedure. While this situation should rarely occur, it must be detected so that corrective action can be taken.

Repairing Compensation Memory Checksum Errors

Maintaining two redundant copies of the compensation data makes it possible to repair many compensation memory checksum errors. As long as one copy of the compensation data is valid, it may be copied to the other memory IC. Each data segment (FM, output, or attenuator) is handled independently.

Special function 76 attempts to repair all detected compensation memory checksum errors. It checks the compensation memory status and copies each good data segment to the corresponding bad segment in the other memory IC. The message **Sto** is displayed in the frequency field while the special function is working. If both data segments have invalid data, the special function cannot repair either checksum. If all checksums are valid, the special function does not display the **Sto** message, nor does it transfer any data.

The special function also resolves the situation where both memory ICs have valid checksums, but the data is not identical. Priority is given to the data in the compensation EEPROM, thus copying the affected data segments in the compensation EEPROM to the battery-backed RAM. This is why it is suggested that the compensation EEPROM be swapped when using the module exchange procedures for exchanging the A2 Controller assembly.

After completing the updates, the special function executes the compensation memory self test (if there are any unresolved errors) and displays the updated status for 5 seconds.

5.4.4 Output Signal

Check the RF output signal with a spectrum analyzer or a counter at various frequencies on each of the three RF bands and at the state where an UNCAL condition exists. If the frequency is incorrect or erratic, check the power supply first. If the power supply functions properly, refer to the Synthesizer troubleshooting procedures. Table 5-6 lists the band, filter, and frequency programming data for the output frequency (at the source).

The RF Spectrum Analyzer can also be used to check to see if the modulation functions are generally working. If a modulation problem exists, go to the appropriate AM or FM troubleshooting sections further in this chapter after checking the power supply.

If the frequency is stable and correct, but the output level is abnormal, the problem is most likely in either the A6 Output Control or the A7 Output assembly. Check the power supply, then go to the Output Level troubleshooting procedure in Section 5.6.5.

With a clear knowledge of the symptoms and the conditions under which the UUT fails, the next task is to isolate the problem. Remove the top and bottom instrument covers and visually inspect the interior for loose cables, connectors, etc. Also be alert for the characteristic odor of burned resistors.

Table 5-6. Band, Filter and Frequency Program Data

Output Frequency (F_o)	MIDL	HAO CTL	HETL	SHE TL	X2L	X2FL 1L	X2FL 2L	X2FL 3L	X2F L4L	Synth. Freq (F_s)
0.01 - 244.99999 MHz	1	1	0	0	1	1	1	1	1	(800 +Fo)/2
245 - 349.99999 MHz	0	0	1	1	1	1	1	1	1	F_o
350 to 511.99999 MHz	0	1	1	1	1	1	1	1	1	F_o
512 - 729.99999 MHz	1	1	1	1	1	1	1	1	1	F_o / 2
730 - 1049.99999 MHz	1	0	1	1	1	1	1	1	1	F_o / 2
1050 - 1249.99999 MHz	1	1	1	1	0	0	1	1	1	F_o / 4
1250 - 1449.99999 MHz	1	1	1	1	0	1	0	1	1	F_o / 4
1450 - 1749.99999 MHz	1	1	1	1	0	1	1	0	1	F_o / 4
1750 - 2100.00000 MHz	1	1	1	1	0	1	1	1	0	F_o / 4
1 = TTL High 0 = TTL Low										

Table 5-7. VCO Band Control

Synthesizer Frequency (F_s)	V	V_{COQ}
220.00000 to 319.99999 MHz	0	0
320.00000 to 364.99999 MHz	0	1
365.00000 to 444.99999 MHz	1	1
445.00000 to 550.00000 MHz	1	0

5.4.5 Power Supply Voltages

The Power Supply consists of the Power Supply PC and the T1 transformer mounted together with a bracket. The power supply is electrically preadjusted and needs no adjustment after installation.

Remove the top and bottom instrument covers and visually inspect the interior for loose cables, connectors, etc. Also be alert for the characteristic odor of burned resistors, etc.

WARNING

Do not interrupt the protective grounding connection. To do so would create a potential shock hazard that could result in personal injury. Secure the instrument against unintended operation if it is likely that this protection has been impaired. Use only 250 V fuses of the proper current rating.

Because the procedures described here are done with power applied to the generator and with protective covers removed, testing should be done only by trained service personnel who understand the hazards involved.

CAUTION

To prevent damage to the generator, turn off the instrument before removing any PC assembly, and before disconnecting any power distribution cables.

Check all power supply voltages. If one supply voltage is unusually low, this could indicate an abnormal load on that supply due to a fault. To isolate the fault, check the abnormal voltage before and after disconnecting the power cable one at a time to the A2 Controller, A4 Synthesizer, A8 Attenuator, and the cable from the A2 Controller to the front panel.

CAUTION

To prevent damage to the generator, turn off the instrument before disconnecting power distribution cables.

Table 5-8 lists the typical dc and ripple voltages (relative to ground connection on the module plate) at the key test points of the Power Supply assembly. These characteristics apply for [RCL] [9] [8].

The unregulated dc and ripple voltages are those expected with a line voltage of 120 Vac at 60 Hz. The dc voltages are expected values as measured with a digital voltmeter with respect to the power supply ground connection on the module plate.

The ripple voltages are expected values as measured with an oscilloscope with respect to the power supply ground connection on the module plate, and are the peak-to-peak values of a 120-Hz waveform.

The characteristics of the unregulated +18 V relay supply depend directly on the line voltage and the load (the state of the instrument). For example, at 120 Vac:

- At 50 MHz and 13 dBm, Vdc is typically 19.0 V with .25 Vpp ripple.
- At 50 MHz and RF off, Vdc is typically 20.0 V with 0 Vpp ripple.

Table 5-8. Power Supply Characteristics

Supply	Unregulated Voltages			Regulated Voltages		
	TP	Vdc	Ripple (Vpp)	TP	Vdc	Ripple (mVpp)
+37	9	47	0.5	5	36.9 to 37.1	2
+15 Syn	7	22	0.5	11	14.5 to 15.7	0.5
+15 Out				3	14.5 to 15.7	0.5
-15	8	-23	0.2	2	-14.5 to -15.7	0.5
+5	10	9	1	4	4.75 to 5.25	1
+18	1	23	0.35	None	None	None

5.5 Digital and Control Troubleshooting

If the symptoms indicate a digital or control problem, the following suggestions may help you isolate the fault to a particular functional circuit. In this manual, refer to the schematic diagrams in Chapter 7, and refer to Chapter 3 for the Theory of Operation.

First, verify that all assemblies are receiving the correct voltages from the power supply.

The most obvious symptom of failure in the Controller assembly is a blank front panel. A properly operating front panel indicates that most of the Controller circuitry is functional. If the front panel is totally blank or unresponsive to any keystrokes, the microprocessor kernel should be checked first. See Section 5.5.3.

If the front panel is operating correctly but the RF output is incorrect, determine if the fault is on the Controller side of connector P1. The control to most of the audio and RF analog circuitry passes through P1 via buffers U15 and U16 on the A2 Controller assembly.

5.5.1 Control Activity

This can be checked by verifying data activity on the data and address lines of P1. Program the bright digit for 100 Hz resolution in the Frequency display. While pressing the EDIT [↑] key, observe with an oscilloscope the activity on P1. Pressing one of the EDIT keys sends bursts of frequency and level control data through the buffers.

Although it is difficult to determine if the data, (BD0-7) and address (BAB0-2) signals on P1 are valid at any given time, the most common failures seen at this point are totally inactive signals. Between bursts, the data and address signals are in the high impedance state (tri-stated). Be careful not to confuse this high impedance state with total inactivity. Observing these signals on a known good generator may be helpful.

If signals are found to be totally inactive, inspect the buffer control signals on U15 (pin 1), and U16 (pins 1 and 19) of the A2 Controller assembly. If the buffer control signals are active, check the buffer inputs that correspond to the inactive outputs. If the inputs show activity, replace the buffer and again check the signals. If, however, the inputs to the buffers are also inactive, trace the signals back and determine the fault location.

If all data and address signals show activity and their timing roughly corresponds to the select signals BSEL0L and BSEL1L, assume for now that the Controller is sending the correct data and continue on.

5.5.2 Latch Control

Use the [SPCL] [1] [5] keys to check each available latch on the RF circuit boards to verify that the correct data is reaching them. Passing this test is a good indication that the fault is not in the A2 Controller assembly.

If an IEEE-488 Bus Controller is available, additional bit-level control of the hardware is available by using the monitor commands (see Table 2-11). These commands allow you to directly control the DACs or read and write data to any desired location.

5.5.3 Microprocessor Kernel

Connect an oscilloscope probe to the external clock input of U1 pin 2 on the A2 Controller. There should be a symmetrical 10 MHz square wave with an adequate TTL logic level. If the signal deviates from this description, refer to Chapter 3 for assistance in troubleshooting the clock oscillator circuit.

5.5.4 Power Reset

Connect an oscilloscope probe to the RESET input at U1-22. The signal should generate a low to high transition on power-up and remain high during normal operation. Turning the power on and off generates active low reset pulses to U1. If a problem with the reset circuit is suspected, refer to Chapter 3 and troubleshoot the reset circuitry.

5.5.5 Microprocessor Inputs

Input pins to U1, CRUIN (pin 13) , INT1 (pin 15), HOLD (pin 18), NMI (pin 21), and READY (pin 23), should all be high. If any of these signals are not high, correct the fault before continuing.

5.5.6 IEEE-488 Interrupt

Verify that the IEEE-488 Interface interrupt signal IEINTL is in the inactive (high) state. If IEINTL is active, either troubleshoot the interface to the IEEE-488 Interface assembly or temporarily bend out pin 14 of U1 and tie it to +5 V through a resistor.

After completing the above steps, there should be activity on the address, data, and control lines as the microprocessor executes instructions.

5.5.7 Microprocessor Bus

The dynamic nature of microprocessor bus circuitry makes it very difficult to verify the data transmitted at any given time. However, most common bus faults show recognizable symptoms. Look at each of the data (D0 to D7), address (A0 to A15), and bus control (CLKOUT, DBINL, WEL, MEML) signals with an oscilloscope.

Suspect inactive signals or signals that enter invalid logic states. Also compare the driver inputs and outputs of buffered signals. A combination of observation and experience is helpful here. An ohmmeter or a pulse generator may be useful in further investigating suspected signals.

5.5.8 Address Decoder

Several levels of address decoding are used to select all the memory and I/O devices. The inputs to the address decoders come from the buses and present challenges similar to troubleshooting the buses. A suggested approach is to first choose a decoding path to a particular device or group of devices. Start at the highest level of decoding, and one at a time verify that each part in the path is good.

5.5.9 Display and Controls

If the display shows signs of activity, but has missing or bright digits or segments, the problem is most likely in U18 on the A2 Controller assembly or on one of the data latches or drivers on the A1 Display assembly. If the display is blank and the Controller is operational, check the various power supplies and the display blanking circuitry on the A1 Display assembly.

Two special function-service tests are available to test the front panel indicators and keys. [SPCL] [0] [3] keys check the front panel displays by lighting all segments. This test is aborted by pressing any key on the generator.

The [SPCL] [0] [4] keys allow all normally open keys to be checked. As each key is pressed, its row and column address is displayed in the center of the Frequency display field. See Table 5-9 for the address codes for each key. This test is exited by a clear entry.

Table 5-9. Address Codes for Front Panel Keys

Key	Code	Key	Code
[INTAM]	1	[RCL]	24
[INT FM ϕM]	2	[9]	25
[400/1000]	3	[6]	26
[EXTAM]	4	[3]	27
[EXT FM ϕM]	5	[-]	28
[EXT PM]	6	[SEQ]	29
[FREQ]	9	[MHz|V]	30
[AMPL]	10	[kHz|V]	31
[AM]	11	[Hz|uV]	32
[FM | ϕM]	12	STEP[↓]	33
[SPCL]	13	[dB(m)]	34
[STEP]	14	[%|rad]	35
[7]	15	[CLR|LCL]	(Exit Test)
[4]	16	STEP[↑]	37
[1]	17	EDIT[←]	38
[0]	18	EDIT↑]	40
[STO]	19	EDIT↓]	41
[8]	20	EDIT→]	43
[5]	21	[STATUS]	45
[2]	22	RF [ON/OFF]	46
[.]	23		

5.6 Synthesizer Troubleshooting

NOTE: All frequencies mentioned are synthesized. Hence, they are exact (coherent with the 10-MHz reference), unless noted as approximate.

If the generator level is inaccurate or an unleveled condition exists, the A6 + A7 Output assembly is probably at fault. If an unlock condition exists, the problem is in the A4 Synthesizer or the A5 VCO assembly. If the output frequency is in error or erratic, there is likely a problem with the A4 Synthesizer assembly. However, if the unlocked condition occurs only when using an external reference, the problem is probably in the sub-Harmonic reference circuitry.

If the unlocked condition exists with REF INT/EXT set to INT, be sure no signal is applied to the REF IN connector. An external signal applied (while operating on internal reference) can cause the main loop to unlock.

Check if the generator frequency is stuck high or low. Check the dc voltage at TP44. If it is approximately 1.5 V, go to the Reference Circuitry Check in the following paragraphs.

If the voltage at TP44 is approximately 22 V, the problem is associated with the main PLL, i.e., VCO, UHF binary divider, buffer amplifier, SSB mixer, triple-modulus prescaler, or N-Divider.

Table 5-10 lists the characteristics of the signals at the various test points on the Synthesizer assembly. The range of the signal and the expected value for a typical instrument state are given. The values in the TYPICAL column are for the UUT programmed to 160.11999 MHz, INT FM on at 1 kHz, and 99.9 kHz deviation.

Table 5-10. Synthesizer PC Assembly Test Points

Test Point	Signal Type	Range	Typical	Function
TP1	RF	245 to 525 MHz	480.059995 MHz; -7 dBm	All frequency digits
TP2	GROUND			
TP3	RF	245 to 525 MHz	480.059995 MHz; +4 dBm	All frequency digits
TP7	GROUND			
TP11	TTL	20 to 39.995 kHz	39.995 kHz	10 K, 1 K, 100, and 10 Hz Digits
TP12	TTL	1 to 1.99975 MHz	1.99975 MHz	10 K, 1 K, 100, and 10 Hz Digits
TP13	GROUND			
TP14	TTL	1 MHz (AL)	1 MHz	1 MHz and lower digits
TP15	TTL	0.02 to 1 MHz	20 kHz	
TP16	TTL	12 to 26 MHz	24 MHz	All frequency digits
TP17	RF	245 to 525 MHz	480.02 MHz; -17 dBm	All frequency digits
TP22	AUDIO	0 to 0.7 V_{rms}	0.68 V_{rms}	FM Deviation
TP23	GROUND			
TP24	TTL	20 MHz, 12.5 ns (AH)	20 MHz	
TP25	TTL	20 MHz, 12.5 ns (AH)	20 MHz	
TP26	GROUND			
TP27	TTL	10 to 19.9975 MHz	19.9975 MHz	10 K, 1 K, 100 and 10 Hz Digits
TP31	GROUND			

Test Point	Signal Type	Range	Typical	Function
TP32	AUDIO	0 to 0.8 V_{rms}	0.18 V_{rms}	FM Deviation, and Frequency
TP33	AUDIO	0 to 0.8 V_{rms}	0.18 V_{rms}	FM Deviation, and Frequency
TP34	dc	30 ±0.5 V	30 Vdc	
TP35	TTL	1 MHz	1 MHz	1 MHz Reference
TP36	GROUND			
TP37	dc	-1 to -6 V	-2.7 Vdc	Frequency
TP38	TTL	1 MHz 200 ns (AH)	1 MHz 200 ns	
TP39	TTL	1 MHz 10 ns (AL)	1 MHz 10 ns	
TP40	dc	2 to 22 V	17.7 Vdc	Frequency
TP41	dc	2 to 22 V	17.3 Vdc	Frequency
TP42	GROUND			
TP43	dc	2 to 22 V	17.3 Vdc	Frequency
TP44	dc	2 to 22 V	16.2 Vdc	Frequency
TP45	GROUND			
TP46	TTL	low = unlocked high = locked	TTL high	
TP49	TTL	10 MHz 20 ns (AL)	10 MHz, 20 nS	
TP50	TTL	10 MHz	10 MHz	
TP51	GROUND			
TP52	TTL	10 MHz 10 ns (AL)	10 MHz, 10 nS	
TP53	dc	7.5 ±1 V 16 ±2 V	16 Vdc	Above 245 MHz Below 245 MHz
TP54	TTL	10 MHz	10 MHz	
TP55	RF	800 MHz	800 MHz; -10 dBm	Below 245 MHz
TP56	INPUT			To test low-pass filters
AH = active high AL = active low				

5.6.1 Reference Circuitry

There should be a 10 MHz square wave at U55-12. If there is no signal at this point, the problem is in the internal 10 MHz crystal oscillator. The frequency should change as R230 is adjusted. The dc voltage at TP57 should vary from 4 to 6 volts as R230 is adjusted. If there is an external signal connected, with the switch set to EXT, there should be a TTL signal at U67-11. The same signal should appear at U68-3. If either of the enhanced stability options is present, with the switch set to INT, there should also be a 10 MHz TTL signal at U68-3. If the loop is locked, there should be a stable dc voltage at the output of the loop amp, U69-6.

Table 5-11 lists the relationship between various reference frequency configurations and the control of the reference circuitry.

Table 5-11. Frequency Reference Control

Option Installed	INT / EXT REF	Bit				
High- or Medium-Stability	INT / EXT	RMUX1H	RMUX0H	RINH	X0ENL	SHENL
No	INT EXT	0 0	0 0	0 0	0 0	1 0
Yes	INT EXT	0 0	1 0	0 0	1 0	1 0
1 = TTL High 0 = TTL Low						

5.6.2 Main Phase Lock Loop

If the voltage at TP44 is approximately 22 V, connect a variable power supply to TP41. This allows the frequency of the VCO to be controlled directly. Use an RF Spectrum Analyzer or Counter to monitor the generator output.

Program the UUT to 640 MHz. If the power supply can be adjusted to obtain an output frequency of about 640 MHz, the VCO is OK; proceed to the next paragraph. If the power supply cannot be adjusted to obtain about 640 MHz output frequency, troubleshoot the VCO or the circuitry between TP41 and TP44.

Program the UUT to 320 MHz. If you can adjust the power supply to obtain about 320 MHz output from the VCO, the VCO and binary divider are OK. Proceed to Section 5.6.6. If you cannot change the frequency, the problem is either the VCO or the UHF binary divider (U1).

Check the signal at TP1. It should be the same as the output frequency. The level after the buffer amplifier, Q3, Q4, at TP3 (use RF test cable) should be approximately +3 dBm. The signal at TP17 should be a single-sideband signal with the lower sideband component (the desired signal) at about -20 dBm. If the only signal is the carrier frequency (same frequency as TP3), check the quadrature generator, and the sub-synthesizer circuitry. The signal out of the triple-modulus prescalar should be approximately 16 MHz (with the output frequency set to approximately 320 MHz). The output of the N-Divider, TP14, should be approximately 1 MHz.

As the UUT frequency is programmed, the frequency at TP14 should change, since the divide ratio is being changed. If the frequency is not 1 MHz and/or it does not change, the problem is probably with the N-Divider gate array, U17, or the interface to the microprocessor.

If both the reference (at TP35) and the N-Divider signals at the phase detector are 1 MHz, the loop should lock when the operator removes the variable power supply. If the loop does not lock, check the KNV voltage at TP37. With the generator programmed to 320 MHz, TP37 should be approximately -2 to

-3 V. If this voltage is not correct, check the DAC U27, latches U26 and U30, and op-amp U28. This voltage should also change as the operator changes the generator frequency.

If the KN DAC appears to function, the problem is with the phase detector. Reconnect the variable power supply as before, and adjust the voltage for an approximately 1 MHz signal at U44-3. With this frequency slightly above 1 MHz, TP38 should be high and TP39 should be low.

With this frequency slightly below 1 MHz, TP38 should be low and TP39 should be high. The only remaining circuitry is the loop amp U48 and the current source, U46, Q18, and Q19.

If the loop is locked, but the 1 MHz, 10 MHz, or 100 MHz digits cannot be programmed, the problem is either the N-divider or the interface to the microprocessor. If the 100 kHz or 10 kHz digit is inoperative or the frequency jumps as the 1 MHz digit is programmed, the problem is likely the triple-modulus prescalar. If the lower order (1 kHz, 100 Hz, 10 Hz) digits cannot be programmed, the problem is the sub-synthesizer or single sideband mixer.

5.6.3 Sub-Synthesizer and HET (800 MHz), 40 MHz Loop

The frequency at TP24 and TP25 should be 20 MHz. The frequency at U64 pins 14 and 15 should be 40 MHz. If the 40 MHz signal is present, but not the 20 MHz, the problem is most likely with Q4, Q5, U34, or U35. If the 40-MHz signal is in error, the problem is in the 40 MHz loop.

Check the frequency at the 40 MHz VCO, U64-3. It should be 40 MHz. If it is not, lift the op-amp end of R169 and connect it to a variable power supply set to approximately 6 V. The signal at U64-3 should be approximately a 40 MHz ECL level signal (approximately 3.2 to 4.2 V). By varying the supply voltage, the frequency should change. A similar signal should be present at U64-2. Check to see if U64-11 is ECL low (approximately 3.2 V).

The output of TTL buffer U65-8 should be approximately 40 MHz. The output of the divide-by-4, U66, should be approximately 10 MHz. Once again, if the frequency is greater than 10 MHz, pulses should exist at TP52 and the output of op-amp U60-6 should be low. If the frequency is below 10 MHz, pulses should exist at TP49, and the op-amp should be high (approximately 24 V). The loop should lock when the operator reconnects R169.

If all TP checks are correct and the 800 MHz oscillator is not locked when in the HET band, the problem is either with the 800 MHz VCO, the divide-by-4 (U61), the divide-by-5 (U62, U63), or the logic that controls the switched +5 V.

Program the UUT to 320 MHz. The frequency at TP27 (the output of the sub-synthesizer gate array U33) should be 10 MHz if the input signals are correct. The frequency at TP12 should be 1 MHz, and TP11 should be 20 kHz. There should be a 20 kHz sine wave at the hot end of R33. The signals at the output of the active quadrature generator, U10-8 and U10-14 should be approximately 300 mVpp sine waves that are 90 degrees apart in phase. Use a dual-trace Oscilloscope for verification.

The frequency at TP27 should change 500 kHz for a 1 kHz change in the programmed frequency, and 50 kHz for a 100 Hz change, etc.

5.6.4 FM Circuitry

Program the UUT to 500 MHz, INT FM, 99.9 kHz deviation, and 1 kHz modulation frequency. There should be a 2 Vpp, 1 kHz sine wave at TP22. Program 50 kHz deviation, and the level should drop to 1 Vpp. Reprogram the deviation to 99.9 kHz. The level of the output of the KV DAC, U28-7 will be approximately 0.9 Vpp depending on the FM correction value (KV) in the EPROM.

The signals at TP32 and TP33 should be approximately the same, depending on how R87 is set. The output of the audio integrator should be about 1 Vpp. To check the FM range, program the UUT to 9.99 kHz deviation. The ac voltage at TP32 should drop to 10% of the 99.9 kHz value. Program 999 Hz, and the voltage should drop to 1% of the 99.9 kHz value.

The INT/EXT FM selection is done on the A6 Output assembly. The controls are listed in Table 5-18.

Tables 5-12 through 5-14 provide FM range and FM DAC (10 bits) control information. The following applies for all of these figures:

Het Band, fb = 2
Synthesizer Band, fb = 1
VCO Band, fb = 2
Double Band, fb = 4

Table 5-12. FM Deviation Limits

RF Output Frequency Band (MHz)	Maximum Programmable FM Deviation	Maximum Programmable ϕM Deviation
.100 to 244.99999	204 kHz	20.4 rad
245 to 511.99999	102 kHz	10.2 rad
512 to 1049.99999	204 kHz	20.4 rad
1050 to 2100.00000	400 kHz	40.0 rad

Table 5-13. FM Deviation Control

FM Deviation (Hz)	FM 0 - 11 (bits)[1]	FMRN (bits)	PMODL (bit)
0 to 999	(FM Deviation x 4)/fb	1	1
1000 to 9990	(FM Deviation x .4)/fb	2	1
10000 to 99990	(FM Deviation x .04)/fb	4	1
100000 to 400000	(FM Deviation x .04)/fb	4	1

Table 5-14. Phase Modulation Control

Phase Modulation (rad)	FM 0 - 11 (bits)[1]	FMRN (bits)	PMODL (bit)
0 to .099	(ϕM Deviation x 40000)/fb	1	0
.100 to .999	(ϕM Deviation x 4000)/fb	2	0
1.00 to 9.99	(ϕM Deviation x 400)/fb	4	0
10.00 to 40.00	(ϕM Deviation x 400)/fb	4	0

1. fb = 2 HET Band
fb = 1 Synthesizer Band
fb = 2 VCO Band
fb = 4 Double Band

5.6.5 Output Level

If the generator level is inaccurate or an unleveled condition exists, the A6 + A7 Output assembly or the A8 Attenuator assembly is probably at fault. If an unleveled condition exists, the problem is in the circuitry ahead of the detector (see Section 5.6.9).

If there is no unleveled condition, the problem is likely in the circuitry following the ALC Loop, which includes the buffer amp Q4, the A8 Attenuator, the heterodyne circuit, the pulse modulator, and the output amplifier, Q9. If the level problem only exists below 245 MHz, then troubleshoot the heterodyne circuitry. If the problem exists only above 1050 MHz, troubleshoot the X2 circuitry. If the problem is not frequency dependent and if the level is accurate above +7 dBm but inaccurate below +7 dBm, then the A8 Attenuator is at fault.

5.6.6 Output Test Point Signals

Table 5-15 presents the nominal characteristics of the signals at the various test points on the Output assembly (A6 + A7). The range of the signal and the expected value for the Instrument Preset State [RCL] [9] [8] are given.

Table 5-15. A6 Output Control PCA Test Points

Test Point	Signal Type	Range	Typical for RCL 98	Signal Description
TP1	dc	±15 mV	0 mV	AM DAC offset
TP2	dc + Audio	+14 V to 0 V	2.6 V	Detector linearizer output
TP3	n/a	This test is an input for factor test of the ALC loop		
TP4	dc + Audio	0 to .70 Vrms	0 Vrms	FM modulation to synthesizer
TP5	dc + Audio	400 or 1000 Hz .71 Vrms	400 Hz .71 Vrms	Modulation oscillator output
TP6	dc + Audio	0 to 2 Vdc	0.45 Vdc	Detector diode voltage
TP7	dc + Audio	0.04 to 3.0 Vdc nominal	1.0 Vdc	Leveling loop control voltage.
TP8	dc + Audio	-14 to +14 Vdc nominal	2.0 Vdc	Modulator control voltage.
TP9	RF	800 Hz -8 dBm	no signal	Het Mixer LO signal

5.6.7 Attenuator Level Control

Table 5-16 lists the A8 Attenuator Assembly sections that are inserted in the RF output path for the various level ranges of the generator. This information is useful in isolating a faulty section. The sections are labeled by the control line mnemonics at latch U27 on the A2 Controller assembly. Note that the section is inserted in the RF output path when there is no power applied to the relay.

If the Level problem exists above +7 dBm, the through path (0 dB attenuation) of the A8 Attenuator assembly may be faulty.

Table 5-16. Attenuator Level Control

Amplitude Range in dBm				Attenuator Sections Inserted Indicated by X						
AM Off		AM On		A6DBL	A12DBL	A241L	A242L	A243L	A244L	A245L
7.0	19.0	1.0	9.0							
1.0	6.9	-5.0	0.9	X						
-5.0	0.9	-11.0	-5.1		X					
-11.0	-5.1	-17.0	-11.1	X	X					
-17.0	-11.1	-23.1	-17.1			X				
-23.1	-17.1	-29.1	-23.2	X		X				
-29.1	-23.2	-35.1	-29.2		X	X				
-35.1	-29.2	-41.1	-35.2	X	X	X				
-41.1	-35.2	-47.1	-41.2			X	X			
-47.1	-41.2	-53.2	-47.2	X		X	X			
-53.2	-47.2	-59.2	-53.3		X	X	X			
-59.2	-53.3	-65.2	-59.3	X	X	X	X			
-65.2	-59.3	-71.2	-65.3			X	X	X		
-71.2	-65.3	-77.2	-71.3	X		X	X	X		
-77.2	-71.3	-83.3	-77.3		X	X	X	X		
-83.3	-77.3	-89.3	-83.4	X	X	X	X	X		
-89.3	-83.4	-95.3	-89.4			X	X	X	X	
-95.3	-89.4	-101.3	-95.4	X		X	X	X	X	
-101.3	-95.4	-107.4	-101.4		X	X	X	X	X	
-107.4	-101.4	-113.4	-107.5	X	X	X	X	X	X	
-113.4	-107.5	-119.4	-113.5			X	X	X	X	X
-119.4	-113.5	-125.4	-119.5	X		X	X	X	X	X
-125.4	-119.5	-131.4	-125.5		X	X	X	X	X	X
-147.0	-125.5	-147.0	-131.5	X	X	X	X	X	X	X

5.6.8 Attenuator Check

Attenuator problems are most likely to be relay contacts. To isolate the faulty attenuator section, connect a power meter to the RF OUTPUT connector, and check the 0.1 MHz and 2100 MHz frequencies.

Table 5-17. Attenuator Levels

Attenuator	Prog Level	Special Function	Observed Level (Nominal)
6dB	+6dBm	—	+6dBm
12dB	0dBm	—	0dBm
24dB #1	-12dBm	—	-12dBm
24dB #2	-12dBm	83	-12dBm
24dB #3	-12dBm	84	-12dBm
24dB #4	-12dBm	85	-12dBm
24dB #5	-12dBm	86	-12dBm

The through-path operation of the A8 Attenuator Assembly can be roughly checked by removing the instrument and module bottom covers. Program the frequency to 1 MHz and the level to +13 dBm. Measure (with a high-impedance probe and an RF voltmeter or an oscilloscope) the level at P102 of the A7 Output assembly with a power meter connected to the RF OUTPUT connector. If the voltmeter measures a nominal 1 V_{rms}, but the power meter does not read +13 dBm, then the signal is not getting through the Attenuator module, and the A8A2 Attenuator assembly is at fault.

If the level problem is subtle rather than catastrophic, a more accurate check is required to determine if the fault is the A8 Attenuator Assembly or the Output assembly. Such a check is made by removing the Attenuator Assembly, attaching an adapter (6062A-4234; P/N 808477) to the interconnect point, and making power meter measurements of the Output assembly (A6 + A7). Use [SPCL] [8] [2] to disable the Attenuator correction factors. The level at this point should be flat over 0.1 to 2100 MHz within typically 0.2 dB and should agree with the programmed level within 2 dB.

If the problem has been isolated to the Output assembly and there are no self-test errors or flashing UNCAL conditions, the problem is probably in the circuits following the ALC loop. If the problem is only in the Het band (frequency <245 MHz), check the Het band switch and controls, the Het band circuits (mixer, filter, and amplifier), and the local oscillator signal (800 MHz, nominal -10 dBm at TP9). If the problem is at all frequencies, see Section 5.6.5.

5.6.9 Unleveled Condition

If there are self-test failures and/or unleveled indications, the problem is probably in, or prior to, the ALC loop. If the problem is isolated to a specific frequency band (or bands) and other bands work properly, check signal inputs and controls to the various filters that precede the modulator. See Table 5-6 for band definition. If all frequency bands are affected, the leveling ALC loop or associated controls and inputs are probably at fault.

The unlevel indication can result if the RF signal at the input to the A7 Output assembly is excessively low. This signal can be measured at connector J1 on the A6 Output Control assembly with a power meter. The signal typically varies from -4 to +4 dBm, depending on frequency. A power reading outside this range indicates a problem in the RF path on the A6 Output Control assembly.

TP8 (modulator control voltage) is a good place to monitor. With the instrument programmed to +16 dBm, the voltage on TP8 should be between +2V and +9 Vdc (+4V to +8 Vdc typical). Another place to monitor is TP7 (ALC control voltage). With the instrument programmed for [RCL] [9] [8], the voltage should be approximately 1.0 Vdc. With the RF output switched off, the voltage at TP7 should be 0 Vdc.

When the problem is isolated to a specific area, use the schematic, Theory of Operation, Test Point Chart, and normal troubleshooting techniques to isolate the fault.

5.7 AM Troubleshooting

The following paragraphs provide information that help the operator to trace an AM problem to a specific circuit on the A6 + A7 Output assembly.

5.7.1 Internal/External AM

If an AM problem exists, determine if the problem occurs with internal AM, external AM or both. This check is done by connecting a 1 V peak (2 Vpp), 1 kHz signal source to the external MOD INPUT of the UUT and measuring AM depth. Use a Modulation Analyzer. Program the UUT to external AM and then to internal AM at 1 kHz internal modulation rate. The measured AM should agree with the programmed depth within a few percent. Tables 5-18 and 5-19 provide control information for modulation and modulation frequency selection.

If the internal AM does not agree, but external AM is OK, the Modulation Oscillator is likely at fault. If external AM is bad, but internal AM is OK, then the problem is somewhere between the external MOD INPUT and the AM DAC. If both the external and internal AM fail, the problem is likely being caused by either the modulation signal-processing circuit or the leveling loop. To determine which circuit is faulty, perform the following test.

Table 5-18. Modulation On/Off Control

DC AM	EXT AM	INT AM	DCAML	EXTAML	INTAML
Off	Off	Off	1	1	1
Off	Off	On	1	1	0
Off	On	Off	1	0	0
Off	On	On	1	0	0
On	Off	Off	1	1	1
On	Off	On	1	1	0
On	On	Off	0	1	1
On	On	On	0	1	0
EXT FM ϕM	**INT FM ϕM**		**EXTFML**	**INTFML**	**FMENH**
Off	Off		1	1	0
Off	On		1	0	1
On	Off		0	1	1
On	On		0	0	1
EXT PULSE	**INT PULSE**		**EXTPUL**	**INTPUL**	
Off	Off		1	1	
Off	On		1	0	
On	Off		0	1	
On	On		0	0	
1 = TTL High 0 = TTL Low					

Table 5-19. Modulation Frequency Control

Frequency	MF400L
400 Hz	0
1 kHz	1
1 = TTL High 0 = TTL Low	

5.7.2 ALC Loop Control Voltage

Procedure:

1. Connect a 1 V peak (2 Vpp), 1 kHz signal source to the external MOD INPUT.
2. Program the UUT for 350 MHz, 7 dBm, 71% AM depth, and EXT AM ON.
3. Measure the ac and the dc voltage at TP7. The RMS voltage should be nominally 50% of the dc voltage.
4. Program the UUT for 35% AM depth. The RMS voltage should be nominally 25% of the dc voltage.

If the UUT fails this test, the problem lies somewhere between the EXT MOD input and TP7 (ALC loop-control voltage). To further localize the problem, the same test can be done by measuring the ac voltage at U21-1 (input to level DAC). If the measured ac voltage does not change as programmed AM depth is changed, either the AM DAC or its control is at fault. The AM DAC (U19) is an 8-bit DAC and is set to twice the programmed AM depth, e.g., 180 for 90% AM.

If the UUT passes this test, then the ALC loop control voltage is correct, and the problem is in the ALC loop. A likely cause of excessive AM depth error and harmonic distortion is detector non-linearity. The following test checks detector linearity.

Detector Linearity

Procedure:

1. Install the plate covers and let the UUT warm up at room temperature for one hour.
2. Program the UUT for 350 MHz, +17 dBm, modulation OFF.
3. Program [SPCL] [9] [1] to enable the amplitude fixed range.
4. Measure the power with a power meter at the generator RF OUTPUT. Note the reading.
5. Program the generator for 2 dBm with the EDIT keys. The measured power should be 15 dB ±0.2 dB below the reading noted in step 4.
6. Program the generator for -13 dBm with the EDIT keys. The measured power should be 30 dB ±0.4 dB below the noted reading.
7. Program the generator for [SPCL] [0] [0].

If the generator fails this test, the problem is likely to be in the detector or detector-linearizer circuit. If it passes the test, the problem is constrained to the other ALC loop elements, and is likely to be a bandwidth problem associated with the loop amplifier or the modulator or modulator-linearizer circuit.

5.7.3 RPP Control

When servicing the A8A1 Relay Driver/RPP assembly, use the three dual-pin test points to aid in the troubleshooting of the assembly. The RPP can be tripped (to the protect position) by momentarily shorting the two points of TP1. It can be reset by momentarily shorting TP2. Shorting TP3 reduces the level required to trip the Attenuator, so it trips on the generator output. This provides a convenient way to verify the operation of the entire trip circuitry, although at a reduced trip level.

To check the trip function with TP3 shorted, program the generator to an output level of +10 dBm and terminate the instrument output in 50 Ω. Then program it for fixed amplitude range ([SPCL] [9] [1]). This allows the level to be varied from a low value up to the maximum value without transients that might otherwise trip the RPP. Then, starting at a low level, such as -10 dBm (with the RPP reset), increase (EDIT) the generator level in 1 dB steps until the RPP trips. RPP trip normally occurs between +10 and +15 dBm.

5.8 Software Compensation Procedures

5.8.1 Introduction

The VCO assembly, Output Assembly (A6 + A7), and Attenuator Assembly are software compensated with data stored in the compensation memory. If components on these assemblies that affect the software compensation are replaced, the data in the memory needs to be updated. This section provides the information and procedures on how to update the compensation data.

The local compensation procedures can be performed with minimal test equipment. If an IEEE-488 controller is available, remote commands can automate the compensation procedures. Both the local and remote procedures are easy to use as the software in the generator does most of the work.

5.8.2 Software Compensation Description

The compensation memory is protected from accidental damage by the compensation switch #6 on the Controller assembly. The switch must be set ON to perform any of the compensation procedures described in this section. The COMP annunciator on the front panel will be turned on to indicate that the switch is ON. The switch must be set OFF at the end of the procedure.

These compensation procedures are used after certain repairs have been made to the hardware. Initial adjustments are necessary to set the hardware to a nominal state. Final calibration adjustments at the end of the procedure are also needed to fully calibrate the instrument.

The compensation procedures are necessary if a repair is made involving a component that affects the software compensation. Those components are identified in the Parts Lists in Chapter 6. Table 5-20 lists the commands to initiate the compensation procedures. The FM Compensation Procedure is necessary if a repair is made on the A5 VCO assembly.

Table 5-20. Software Compensation Commands

Remote IEEE-488 Command	Local Special Function	Description
cmfm	95	FM compensation procedure
cmot	96	Output compensation procedure
cmat	97	Attenuator compensation procedure
cmod	98	Output compensation procedure with default attenuator data

There are three level-compensation procedures:

- Output
- Output with default attenuator data
- Attenuator.

Output compensation is normally performed if a repair is made on either the Output Control or the Output assembly. Attenuator compensation is normally done if a repair is made on the Attenuator Assembly. Refer to the paragraphs on Level Compensation Notes (further on in this section) for instructions on selecting the correct level compensation procedure.

Each compensation procedure involves adjusting a DAC (digital-to-analog converter) to match the target value. The RF output is measured with an external power meter or modulation analyzer. This sequence is repeated until all data has been measured.

In the local procedures, the EDIT keys are used to increase and decrease the DAC adjustment. If the measured value is a long way from the target value, the [RCL] key may be used to program the same DAC adjustment as previously programmed. This will often be close to the desired value.

The STEP [↑]/[↓] keys move to the next or previous measurement step. Previous measurements can also be reviewed in this manner. You should review the data before storing it in memory.

Press [STO] twice to store the measured data in the compensation memory. All measurement steps in the procedure must be measured before the data can be stored.

Press [CLR|LCL] twice at any time to abort the procedure. All data measured so far in the procedure will be discarded.

In the remote procedures, an IEEE-488 controller programs external instruments to make measurements. These measurements are sent to the generator, which adjusts its internal settings accordingly. The generator indicates when it is ready for a new measurement by responding to the interrogate compensation frequency command IC FR. The target value can also be interrogated by the controller at each measurement step. The frequency and target value can be used to program the measurement equipment for more accurate and/or faster operation. A special frequency code is returned when all measurement steps have been measured.

The controller must send the store command CM SV at the end of the procedure to save the new data. The procedure can be aborted at any time with the exit command CM EX, or the clear command CL.

Table 5-21 lists the errors that are detected during a compensation procedure.

Table 5-21. Software Compensation Rejected Entry Codes

Error Code	Description
000 000 200	Compensation data from IEEE-488 out of range or EDIT [↑] or [↓] operation past the top or bottom of the DAC.
000 000 400	Internal compensation data transfer error. Check hardware with self-test.
000 002 000	Compensation switch not on.
000 010 000	Attempt to store compensation data without measuring data at all steps.
000 020 000	Invalid IEEE-488 compensation command or invalid [RCL] entry.
000 400 000	Not enough level compensation available or FM data range error.
020 000 000	IEEE-488 command syntax error.
040 000 000	IEEE-488 input value out of range.
100 000 000	MEC compensation PROM error. PROM ID not correct or checksum error.
400 000 000	Invalid frequency in level compensation data.

5.8.3 Compensation Accuracy Notes

Proper use of the software compensation procedures will restore the operating specifications of the generator. However, failure to follow the guidelines in this section may result in less than optimal or out-of-spec operation.

1. The equipment used in these procedures must be of sufficient accuracy. Refer to Table 4-1 for the test equipment requirements.
2. Test equipment must be calibrated according to the manufacturer's instructions.
3. During both the Output and Attenuator Compensation Procedures, cal factors for the power meter must be set for each new frequency. For the Output Compensation Procedures only, the power meter must be zeroed once at the beginning. For the Attenuator Compensation Procedure, it is sufficient to zero the power meter at the beginning and then at the first 24-dB attenuator (target level of -14 dBm) at each frequency.
4. Output and attenuator level measurements must be made with the High-Level Power Sensor at the RF OUTPUT connector. Do not use a length of cable between the RF OUTPUT connector and the Power Sensor.
5. For the local procedures, the FM and Attenuator Compensation Procedures may take many minutes. Ensure that the measured value matches the target value for each measurement step.

5.8.4 Level Compensation Notes

All level compensation procedures (output, attenuator, and output with default) involve making measurements at the front or rear panel RF OUTPUT connector. The level being measured includes both the output and attenuator circuits. This means that errors in one circuit may be compensated for when you are performing the compensation procedure for the other circuit. The resultant mixing of the corrections is usually not a problem since the level seen at the RF output connector includes the sum of both the output and attenuator corrections. However, in some situations, additional steps may be necessary.

If the compensation data of the output and attenuator circuits are both generated by the user, the level compensation data may be mixed. At the Giga-tronics factory or with module exchange (MEC) assemblies, each circuit is compensated for separately so the level compensation data is never mixed.

To determine the data origin of the compensation memory, press [SPCL] [7] [5] from the front panel, or send IZ from the IEEE-488 interface. The number displayed (three digits) in the MODULATION field or the first number sent to the IEEE-488 interface indicates the data origin. The first digit is for FM, the second for Output, and the third for Attenuator data type. Table 5-22 lists the data origin codes.

Table 5-22. Compensation Memory Data Origin

Code	Origin
0	Factory-generated data
1	MEC data
2	User-generated data
3	Data is corrupt

Even if the level compensation data has been mixed, the amount of mixing may be small and the normal compensation procedures will work. If the amount of mixing is large, the maximum allocation for compensation may be exceeded when trying to perform the procedure.

The maximum compensation allowed for the attenuator section is 8.0 dB. The maximum range of the compensation values allowed for the output section is 4.0 dB without the rear output option (Option -830) and 4.8 dB when the option is installed. Table 5-23 summarizes the maximum allocation for each of the level circuits. The composite correction limits (output + attenuator) are 12.0 dB without the rear output option and 12.8 dB when the option is installed.

Table 5-23. Maximum Level Compensation Allocation

Circuit	Rear Output Option	Maximum Compensation
Attenuator	N/A	8.0 dB
Output	No	4.0 dB
Output	Yes	4.8 dB

The output compensation limit checks are performed on the het band measurements (freq <245 MHz) and the non-het band measurements separately. The limit check is partitioned because the highest level in the het band is adjusted to be 3 dB lower than the highest level outside of the het band.

For example, if the rear output option (Option -830) is not installed, all measurements at frequencies below 245 MHz must be within a 4.0-dB range and all measurements at frequencies above 245 MHz must also be within a 4.0-dB range, but there may be a 3-dB offset between the two ranges. As a result, the het band may require more than 4 dB of total compensation. This is not a problem since the attenuators do not require much correction at frequencies below 245 MHz so the sum of the output and attenuator corrections will not exceed the 12-dB composite correction limit.

There is no way to tell before running the compensation procedure if the maximum allocation will be exceeded. If the store operation at the end of the procedure is rejected with error code 000 400 000, the maximum allocation has been exceeded. If the circuits are operating correctly, there are two possible causes for this error.

1. If the Het circuitry on the A7 Output assembly has been repaired, and the HET Level Adjustment has been performed (see Chapter 4), a more exact adjustment may need to be performed. This is done from the front panel as described in the Het Compensation Adjustment procedure found later in this section. From the IEEE-488 interface, the adjustment data is available over the bus as described in the Remote Level Compensation Procedure.
2. Too much mixing of compensation data has occurred. The Output Compensation Procedure with Default Attenuator Data ([SPCL] [9] [8] or CMOD) must be used to reduce the mixing. In this procedure, the output is compensated using the last Giga-tronics factory or MEC data for the attenuator circuit. Following this procedure, the Attenuator Compensation Procedure must be performed.

This mixing of level compensation data also means that when any of the Output or Attenuator assemblies are replaced with the Module Exchange Program, the compensation procedure for the other circuit may need to be performed. If the data of both the Output and Attenuator are generated by the user prior to exchanging the module, the appropriate compensation procedure must be performed. In all other cases, no compensation procedures are needed.

5.8.5 Local and Remote Compensation Adjustments

The following paragraphs describe the manual adjustments required to perform the software compensation procedures. These adjustments are required for both local and remote procedures. The operator should also read the appropriate compensation procedure before making any adjustments to the generator. See the paragraphs on Local Compensation Procedures and Remote Compensation Procedures.

5.8.6 Initial FM Compensation Adjustments

This procedure is required prior to performing the FM Compensation Procedures (both local and remote).

The UUT must be operated at room temperature for at least one hour with the module plate covers in place before continuing with this procedure.

CAUTION

Do not turn the power off while the compensation switch is ON. The compensation switch protects the compensation memory from accidental damage during power on and power off.

Test Equipment:

Modulation Analyzer
Low-Frequency Synthesized Signal Generator (LFSSG)
DVM

Procedure:

1. Access the top module cover by removing the top instrument cover.
2. Remove the controller switch access cover.
3. Perform the VCO Upper-Clamp Adjustment as described in Section 4.2.3.
4. Set compensation switch #6 on. Verify that the COMP annunciator is lit on the front panel.
5. Connect the UUT RF OUTPUT to the Modulation Analyzer.
6. Connect the output of the LFSSG to the UUT MOD INPUT connector and the DVM. (Use a BNC T connector.)
7. Press [EXT FM] to turn external FM on.
8. Set the LFSSG to 10 kHz and adjust its level until the DVM reads 707.1 mV_{rms}.

5.8.7 Final FM Compensation Adjustments

This procedure is required following both of the FM Compensation Procedures (local and remote).

Procedure:

1. Set compensation switch #6 off.
2. Verify that the COMP annunciator is not lit on the front panel.
3. Perform the FM Adjustments, R82, R90, and R87 as described in Section 4.2.3.
4. Replace the controller switch access cover.
5. Replace the top instrument cover.

5.8.8 Initial Output Compensation Adjustments

The UUT must be operated at room temperature for at least one hour with the module plate covers in place before continuing with this compensation procedure. This procedure is required prior to performing either local or remote output compensation procedures.

CAUTION

Do not turn the power off while the compensation switch is set on. The compensation switch protects the compensation memory from accidental damage during power on and power off.

Test Equipment:

Power Meter
Power Sensor (High-Level)

Procedure:

1. Access the top module cover by removing the top instrument cover.
2. Remove the controller switch access cover.
3. Set compensation switch #6 on.
4. Verify that the COMP annunciator is lit on the front panel.
5. Perform the Output Assembly Adjustments as described in Section 4.2.4.
6. Connect the UUT RF OUTPUT to the Power Sensor.

5.8.9 Final Output Compensation Adjustments

This procedure is required following both local and remote output compensation procedures.

Procedure:

1. Set controller switch #6 off.
2. Verify that the COMP annunciator is not lit on the front panel.
3. Replace the controller switch access cover.
4. Perform the RF Level Adjustment as described in Section 4.2.4.
5. Replace the top instrument cover.

5.8.10 Initial Attenuator Compensation Adjustments

The UUT must be operated at room temperature for at least one hour with the module plate covers in place before continuing with this compensation procedure.

This procedure is required prior to performing either the local or remote attenuator compensation procedures.

CAUTION

Do not turn the power off while the compensation switch is set on. The compensation switch protects the compensation memory from accidental damage during power on and power off.

Test Equipment:

Power Meter
Power Sensor (High-Level)

Procedure:

1. Access the top module cover by removing the top instrument cover.
2. Remove the controller switch access cover and set compensation switch #6 on.
3. Verify that the COMP annunciator is lit on front panel.
4. Connect the UUT RF OUTPUT to the Powei Sensor.
5. Program the UUT to 1 MHz, +10.0 dBm, [SPCL] [8] [2].
6. Measure the RF level. If this is more than +10.0 dBm ±0.5 dB, the A7 Output assembly or A8 Attenuator Assembly is not operating correctly. Refer to Section 5.4 for troubleshooting and repair information.

5.8.11 Final Attenuator Compensation Adjustments

This procedure is required following both local and remote attenuator compensation procedures.

Procedure:

1. Set compensation switch #6 off.
2. Verify that the COMP annunciator is not lit on the front panel.
3. Replace the controller switch access cover.
4. Perform the RF Level Adjustment as described in Section 4.2.4.
5. Replace the top instrument cover.

5.8.12 Het Compensation Adjustment

If the Output Compensation Procedure (either local or remote) cannot be stored because the maximum compensation allocation has been exceeded, follow this procedure to adjust the het level.

CAUTION

Do not turn the power off or change the compensation switch until the store operation is complete. Doing so could damage the contents of the compensation memory.

Procedure:

1. Review each measurement step in the Output Compensation Procedure with the STEP [↓] key.
2. Note the minimum level DAC adjustment in the non-het band (L1) and in the het band (L2).
3. Note the frequency at which the minimum level DAC adjustment occurs in the het band. (Frequencies below 245 MHz are in the het band.)
4. Step up to the frequency noted in step 3 using the STEP [↑] key.
5. Note the RF level as measured by the Power Meter (L3).
6. Calculate the following: L3 - L1 + L2 -3 dB
7. Adjust R63 for a reading equal to the level calculated in step 6.
8. Press and hold the STEP [↓] key until the first measurement step is reached.
9. Set the CAL factor on the Power Meter for the displayed frequency.
10. Use the EDIT [↑] and [↓] keys until the Power Meter reads 10 dBm.
11. Press STEP [↑] to go to the measurement step.
12. Repeat steps 9 through 11 until the last frequency in the het band is reached.
13. Press [STO]. Sto ? will be displayed.
14. Press [STO] again to confirm and store the data in the compensation memory. —Sto— will be displayed for approximately 10 seconds until the store operation is complete.
15. Perform the Final Output Compensation Adjustments procedure described earlier in this section.

5.8.13 Local Compensation Procedures

Table 5-24 summarizes the operation of the front panel keys used during the local compensation procedures. All other keys are ignored.

NOTE: If IEEE-488 programming commands are received while running a local compensation procedure, all data from the procedure will be lost. Make sure that the IEEE-488 cable is not connected when running any of the local compensation procedures.

Table 5-24. Summary of Local Compensation Entries

Key	Description
CLR|LCL	Abort compensation procedure. Clr ? will display. Press CLR|LCL again to confirm. Press any other key to resume the procedure.
EDIT [↑]	Increase the DAC adjustment.
EDIT [↓]	Decrease the DAC adjustment.
EDIT [<]	Move the cursor to the left for course DAC adjustment.
EDIT [>]	Move the cursor to the right for fine DAC adjustment.
STATUS	Display UNCAL or REJected ENTRY code. See Table 2-18 for a list of UNCAL codes. See Table 2-19 for a list of REJected ENTRY codes.
STEP [↑]	Store displayed DAC adjustment and go to the next step. For new steps, the DAC is programmed to the data currently in the compensation memory. For previously measured steps, the DAC is programmed to data from the current procedure.
STEP [↓]	Review previously measured step.
STO	Store compensation data and exit the procedure. All steps in the procedure must be measured before the data can be stored. **Sto ?** will display. Press [STO] again to confirm. Press any other key to resume the procedure.
RCL	Restore DAC adjustment from the previous step.
RF [ON/OFF]	Turn RF output off and on. Used when zeroing a power meter. When the RF output is off, only the RF [ON/OFF] key is allowed.

5.8.14 FM Compensation Procedure

This adjustment is required only if a repair is made on the A5 VCO assembly involving a component that affects the software compensation.

The FM Compensation Procedure involves adjusting the KV DAC (U28 and U29 on the A4 Synthesizer assembly) until the measured FM deviation is 99.9 kHz. This sequence is repeated for each of 281 frequencies. This procedure typically takes 45 minutes to perform, excluding the initial and final adjustments.

The UUT must be operated at room temperature for at least one hour with the module plate covers in place before continuing with this compensation procedure.

CAUTION

Do not turn the power off or change the compensation switch until the store operation is complete. Doing so could damage the contents of the compensation memory.

The target FM deviation of 99.9 kHz is displayed in the MODULATION field. The RF frequency is displayed in the FREQUENCY field. The frequencies are 245.5 to 525.5 MHz in 1-MHz increments. The KV DAC value is displayed in the AMPLITUDE field.

Figure 5-3. Sample FM Compensation Display

Test Equipment:

Modulation Analyzer
Low-Frequency Synthesized Signal Generator (LFSSG)
DVM

Procedure:

1. Perform the Initial FM Compensation Adjustments procedure described earlier in this section.
2. Program the Modulation Analyzer to measure peak FM in a 0.05 to >200-kHz bandwidth.
3. Press [SPCL] [9] [5] to enter the FM compensation mode.
4. Verify that the FM annunciator is turned on below the COMP annunciator.
5. Use the EDIT [↑] and [↓] keys until the Modulation Analyzer reads 99.9 kHz.
6. Press STEP [↑] to go to the next measurement step.
7. Repeat steps 5 and 6 until the measurement step at 525.5 MHz has been completed.
8. Press [STO]. Sto ? will be displayed.
9. Press [STO] again to confirm and store the data in compensation memory. —Sto— will be displayed for approximately 8 seconds until the store operation is complete.
10. Perform the Final FM Compensation Adjustments procedure described earlier in this section.

5.8.15 Output Compensation Procedures

The Output Compensation Procedures involve adjusting the level DAC (U21 on the A6 Output Control assembly) until the measured RF level is 10 dBm. This sequence is repeated for each of up to 60 frequencies. This procedure typically takes 10 minutes to perform, excluding the initial and final adjustments.

This procedure is required if a repair is made on either the A6 Output Control or the A7 Output assembly involving a component that affects the software compensation. It is also required in certain situations if level compensation procedures have been used before. Refer to the paragraphs earlier in this section on Level Compensation Notes.

This procedure covers both the Output Compensation Procedure (special function 96) and the Output Compensation Procedure with Default Attenuator Data (special function 98).

The UUT must be operated at room temperature for at least one hour with the module plate covers in place before continuing with this compensation procedure.

CAUTION

Do not turn the power off or change the compensation switch until the store operation is complete. Doing so could damage the contents of the compensation memory.

The target RF output level of 10 dBm is displayed in the MODULATION field. The RF frequency is displayed in the FREQUENCY field. The frequencies may vary from instrument to instrument. The level DAC adjustment is displayed in the AMPLITUDE field.

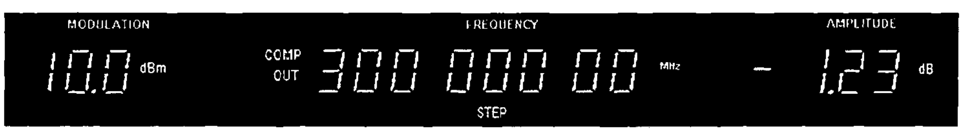


Figure 5-4. Sample Output Compensation Display

Test Equipment:

Power Meter
Power Sensor (High-Level)

Procedure:

1. Perform the Initial Output Compensation Adjustments described earlier in this section.
2. Press [SPCL] [9] [6] to enter output compensation mode. Verify that the OUT annunciator is lit below the COMP annunciator.

   — or —

   Press [SPCL] [9] [8] to enter output compensation mode with default attenuator compensation data. Verify that the OUT and ATT annunciators are lit below the COMP annunciator.
3. Press RF OUTPUT [ON/OFF].

4. Zero the Power Meter.
5. Press RF OUTPUT [ON/OFF].
6. Set the CAL factor on the Power Meter for the displayed frequency.
7. Use the EDIT [↑] and [↓] keys until the Power Meter reads 10 dBm.
8. Press STEP [↑] to go to the next measurement step.
9. Repeat steps 6 through 8 until the last measurement step has been completed (frequency of 2100 MHz).
10. Press [STO]. **Sto ?** will be displayed.
11. Press [STO] again to confirm and store the data in the compensation memory. —Sto— will be displayed for approximately 10 seconds until the store operation is complete.

> ☛ NOTE: If the store operation is rejected (flashing —Sto—), press [STATUS] to determine the cause of the rejected entry. If the display indicates not enough level compensation available (code 000 400 000), refer to the Het Compensation Adjustment procedure described earlier in this section.

12. Perform the Final Output Compensation Adjustments procedure described in Section 5.8.9.

5.8.16 Attenuator Compensation Procedure

This adjustment is required if a repair is made on the A8 Attenuator Assembly involving a component that affects the software compensation. It is also required in certain situations if level compensation procedures have been used before. Refer to the paragraphs on Level Compensation Notes.

The Attenuator Compensation Procedure involves adjusting the level DAC (U21 on the A6 Output Control assembly) until the measured RF level matches the target level. This sequence is repeated for each attenuator at every frequency. There are eight measurement steps (seven attenuators plus the through-path) and up to 30 frequencies at which the attenuator compensation is measured. This procedure typically requires 45 minutes to perform. Table 5-25 lists the target levels for each of the attenuators.

Table 5-25. Attenuator Target Levels

Attenuator	Target Level
None	10 dBm
A6DBL	4 dBm
A12DBL	-2 dBm
A241L	-14 dBm
A242L	-14 dBm
A243L	-14 dBm
A244L	-14 dBm
A245L	-14 dBm

The UUT must be operated at room temperature for at least one hour with the module plate covers in place before continuing with this compensation procedure.

CAUTION

Do not turn the POWER switch off or change the compensation switch until the store operation is complete. Doing so could damage the contents of the compensation memory.

The target RF output level is displayed in the MODULATION field. The RF frequency is displayed in the FREQUENCY field. The frequencies may vary from instrument to instrument. The level DAC adjustment is displayed in the AMPLITUDE field.

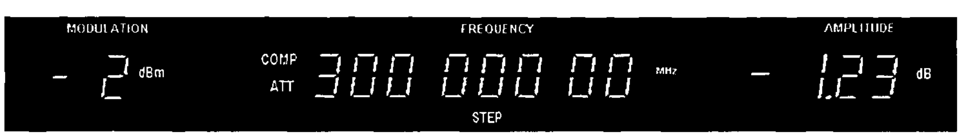


Figure 5-5. Sample Attenuator Compensation Display

Test Equipment:

Power Meter
Power Sensor (High-Level)

Procedure:

1. Perform the Initial Attenuator Compensation Adjustments procedure described earlier in this section.
2. Press [SPCL] [9] [7] to enter the attenuator compensation mode.
3. Verify that the ATT annunciator is lit below the COMP annunciator.
4. Press RF OUTPUT [ON/OFF].
5. Zero the Power Meter.
6. Press RF OUTPUT [ON/OFF].
7. Set the CAL factor on the Power Meter for the displayed frequency for each new frequency (target level of 10 dBm).
8. Press the EDIT [↑] and [↓] keys until the Power Meter reads the target value.
9. Press STEP [↑] to go to the next measurement step.
10. For the first 24-dB attenuator (target level of -14 dBm), the Power Meter must be zeroed.
11. Repeat steps 7 through 10 until the last measurement step (fifth 24-dB attenuator at frequency of 2100 MHz) has been measured.
12. Press [STO]. Sto ? will be displayed.
13. Press [STO] again to confirm and store the data in the compensation memory. —Sto— will be displayed for approximately 45 seconds until the store operation is complete.
14. Perform the Final Attenuator Compensation Adjustments procedure described earlier in this section.

5.8.17 Remote Compensation Procedures

The remote compensation commands can be used to automate the compensation procedures with an IEEE-488 controller. The remote procedures are easier to use and are less prone to errors than their corresponding local procedures.

The IEEE-488 controller program for all of the compensation procedures consists of the following elements:

```
Initialize meter
Initiate 6062A compensation mode
Loop
   Ask 6062A for frequency
   Exit loop if frequency is special code
   Get reading from meter
   Send meter reading to 6062A
   End of loop
Store compensation data
Exit 6062A compensation mode
```

This simple program makes it easy to automate the compensation procedures. There is no need to know how many steps are in each procedure or anything about the internal workings of the 6062A. The programmer must only know how to program the external measurement instruments. Sample programs are provided later in this section.

For the FM Compensation Procedures, the meter is a Modulation Analyzer set to measure FM deviation. For the Level Compensation Procedures, the meter is a Power Meter or a Modulation Analyzer set to measure RF power. The programmer must be familiar with these measurement instruments to ensure that the readings are settled. In addition, for the level procedures, calibration factors must be applied to the readings, and the measurement instrument must be zeroed periodically.

Table 5-26 lists the IEEE-488 commands that are used for the remote software compensation procedures. All IEEE-488 commands not listed in the table are rejected while performing one of the compensation procedures. Furthermore, the software compensation commands are rejected unless one of the software compensation procedures is being performed.

Table 5-26. Software Compensation IEEE-488 Commands

Command Use	Command			Comments
	Header	Numeric	Suffix	
MODE Commands				
Compensation Mode	CM	None	AT FM OD OT SV EX	Begin Attenuator compensation procedure Begin FM compensation procedure. Begin Output with default attenuator compensation procedure. Begin Output compensation procedure. Save data and exit compensation procedure. Exit compensation procedure without saving data.
PROCEDURE Commands				
Compensation FM Entry	CF	Float	GZ MZ kZ HZ	Accept FM deviation reading from modulation analyzer during FM compensation procedure.
Compensation Amplitude Entry	CP	Float	dB	Accept amplitude reading from the power meter during level compensation procedure.
Interrogate Compensation Step Data	IC	None	FR TG	Interrogate the frequency of the current compensation procedure step. Interrogate the target level or target FM deviation of the current compensation procedure step.
Interrogate Het Adjustment Data	IH	None	None	Interrogate the frequency and level offset necessary to make the het compensation adjustment. For example: +0000120000,+00000000.30<EOR> indicates the adjustment should be made at 120 kHz and the level needs to be adjusted up .3 dB.
CLEAR Commands				
Clear Output Buffer	CB	None	None	Clear IEEE-488 output buffer.
Clear Error	CE	None	None	Clear the IEEE-488 rejected entry status.
Device Clear	CL	None	None	Exit the compensation procedure and clear the instrument state.
INTERROGATE Commands				
REJected Entry	IR	None	None	Interrogate the rejected entry error codes. The generator responds with three octal fields: AAAAAA BBBBBB CCCCCC. See Table 2-19 for rejected error codes.
UNCAL	IU	None	None	Interrogate the uncalibrated output error codes. The generator responds with three octal fields: AAAAAA BBBBBB CCCCCC. See Table 2-18 for a list of uncal error codes.
Compensation Memory Status	IZ		None	Interrogate the compensation memory status. The generator responds with three octal fields: AAAAAA BBBBBB CCCCCC. See Tables 2-18 and 2-19 for status codes.
RF ON/OFF Entry				
RF Output	RO	0/1	None	Turn RF output off / on.

5.8.18 Remote FM Compensation

The Remote FM Compensation procedure is initiated with the cmfm command.

The main loop of the compensation program involves asking the generator for the frequency, getting the frequency, getting a reading from the modulation analyzer, and sending the reading to the generator. The generator will use the reading to adjust the KV DAC (U28 and U29 on the A4 Synthesizer assembly) closer to the desired target FM deviation of 99.9 kHz. The generator will continue to adjust the DAC until two successive readings are received within the error tolerance. Then it will program the next measurement step.

When all the measurement steps have been measured, the generator will send the special frequency code 9E+09<EOR> in response to the interrogate command ICFR. This should be used to exit the main loop of the compensation program. To save the measured data, use the cmsv command.

The programmer must initialize the Modulation Analyzer to measure peak FM deviation in a 0.05- to 200-kHz bandwidth. The programmer must also ensure that readings sent to the generator are fully settled.

The sample program in this section is written in BASIC for a Giga-tronics 1720A or 1722A Instrument Controller and uses an HP 8901 Modulation Analyzer to make the FM deviation measurements. The program is easy to modify for another IEEE-488 controller or another measurement instrument.

The sample program could be enhanced in a number of areas. It may run faster if the modulation analyzer is programmed directly to the new frequency. It may also run faster if the programmer writes a more sophisticated subroutine to get FM deviation readings.

Ideally the average of the positive and negative peak FM deviation should be measured. If the Modulation Analyzer does not have an average mode, a positive peak measurement and a negative peak measurement could be made and averaged. This is not usually necessary since the positive and negative peak values are adjusted to be the same.

Some manual adjustments must be made prior to and after running the FM Compensation program. Refer to the Initial FM Compensation Adjustments and Final FM Compensation Adjustments described earlier in this section.

A program similar to the one starting on the next page can be used to generate the FM compensation data.

```
10 !
11 !      Disclaimer:
12 !
13 !      This program is provided AS IS. No indemnity or warranties
14 !      are provided, whether expressed or implied. Giga-tronics specifically
15 !      disclaims the implied warranties or merchantability and fitness
16 !      for the purpose or use. In no event shall Giga-tronics be liable for
17 !      any loss of data, use, profits or goodwill, or for special,
18 !      incidental, consequential or other similar damages.
19 !
20 !      Giga-tronics 6062A Signal Generator FM compensation control program.
30 !      Runs on a Giga-tronics or Fluke 1720A or 1722A controller.
40 !
50 !      Initialization
60 !
70       INIT PORT 0%
80       A% = 2%    !    IEEE-488 address of Signal Generator
90       AM% = 14% !    IEEE-488 address of Modulation Analyzer
100      PRINT @ A%,cl \ WAIT 500    !    initialize Signal Generator
110      GOSUB 3000    !    initialize Modulation Analyzer
120      !
130      PRINT @ A%,cmfm  !    enter FM compensation mode
140      PRINT @ A%,ir \ INPUT LINE @ A%,A$ \ A$ = LEFT(A$,20)
150      IF (A$ = 0 00000,000000,000000) THEN GOTO 1000
160      PRINT There is an error with the 6062A.
170      PRINT Rejected Entry code: ;A$
180      STOP

1000     !
1010     !    Main loop
1020     !
1030     !    get frequency, exit main loop on last frequency
1040     PRINT @ A%,icfr \ INPUT @ A%,F
1050     IF (F = 9E9) GOTO 2000
1060     !
1070     !    check for synthesizer unlocked condition which may occur
1080     !    if the COMP memory contains bad data. If unlocked, send
1090     !    a small dummy reading to 6062A to increase the KV DAC
1100     !    (don't read the meter).
1110     WAIT 100 \ PRINT @A%,iu \ INPUT LINE @ A%,A$ \ A$ = LEFT(A$,6)
1120     IF (A$ = 000004) THEN RD = 100 \ GOTO 1180
1130     !
1140     !    get modulation analyzer reading
1150     GOSUB 4000    !    reading - RD
1160     !
1170     !    send modulation analyzer reading to 6062A
1180     PRINT @ A%,cf;RD;hz 1190 GOTO 1000
```

```
2000   !
2010   !   Store results
2020   !
2030   PRINT @ A%,cmsv ! save data in compensation memory
2040   WAIT 5000  !    wait 5 seconds for store to complete
2050   PRINT @ A%,ir \ INPUT LINE @ A%,A$ \ A$ = LEFT(A$,20)
2060   IF (A$ = 000000,000000,000000) THEN GOTO 2900
2070   PRINT The store operation failed.
2080   PRINT Rejected Entry code: ;A$
2090   STOP
2900   LOCAL
2910   END

3000   !
3010   !   Subroutine to initialize HP 8901 Modulation Analyzer
3020   !
3030   PRINT @ AM%,AUM2T0 !      Automatic operation, FM, Free Run
3040   PRINT @ AM%,H1L0D1 ! 50 Hz HP Filter on, LP Filters off, Peak+
3050   RETURN

4000   !
4010   !   Subroutine to get readings from HP 8901 Modulation Analyzer
4020   !   Give the modulation analyzer 700 msec to settle. Then get
4030   !   readings until two are within 100 Hz. Get one more reading
4035   !   and return the average of all three.
4040   !
4050   INPUT @ AM%,R1
4060   !
4070   WAIT 700
4100   INPUT @ AM%,RD
4110   IF ABS(RD-R1) < = 100 THEN GOTO 4200
4120   R1 = RD
4130   GOTO 4100
4200   R1 = RD + R1
4210   INPUT @ AM %,RD
4220       RD = (RD + R1)/3
4230   RETURN
```

5.8.19 Remote Level Compensation

The remote level compensation procedures are initiated with the cmot, cmat, or cmod for the Output, Attenuator, and Output with Default Attenuator Data Compensation Procedures respectively. The sequence for running the procedures is so similar that one program can be written to perform all three procedures.

The main loop of the compensation program involves asking the generator for the frequency, getting the frequency, getting a reading from the power meter, and sending the reading to the generator. The generator will use the reading to adjust the level DAC (U21 on the A6 Output Control assembly), closer to the desired target level. The target level for the output procedures is +10 dBm. The target levels for the attenuator procedure are listed in Table 5-25. The generator will continue to adjust the DAC until two successive readings are received within the error tolerance. Then it will program the next measurement step.

When all the measurement steps have been measured, the generator will send the special frequency code 9E+09<EOR> in response to the interrogate command ICFR. This should be used to exit the main loop of the compensation program. To save the measured data, use the cmsv command.

The programmer must initialize the power meter to measure dBm. The programmer must also ensure that readings sent to the 6062A are fully settled and that calibration factors are applied to the readings.

The power meter must also be zeroed periodically. This should be done at the beginning of the program for all procedures. For the attenuator procedures, the meter should also be zeroed for the first 24-dB attenuator (target level of -14 dBm). This can be checked by interrogating the target level.

The sample program in this section is written in BASIC for a Giga-tronics 1720A or 1722A Instrument Controller and uses an HP 463A Power Meter to make the RF level measurements. The program is easy to modify for another IEEE-488 controller or another measurement instrument.

The sample program could be made faster by writing a more sophisticated subroutine to get readings from the power meter.

If the output compensation procedure fails because there is not enough level compensation available, the Het Compensation Adjustment may need to be performed. The ih command can be used to interrogate the frequency and level at which to make the adjustment on the A6 Output Control assembly. Exit the compensation mode, and program the generator to +10 dBm and the interrogated frequency. Measure the RF level. Adjust R63 on the A6 Output Control assembly for a level equal to the measured level plus the interrogated level.

Some manual adjustments must be made prior to and after running the level compensation program. These are described earlier in this section entitled as follows:

Initial Output Compensation Adjustments

Final Output Compensation Adjustments

Initial Attenuator Compensation Adjustments

Final Attenuator Compensation Adjustments

A program similar to the one starting on the next page can be used to generate the output or attenuator compensation data.

```
10    !
11    !   Disclaimer:
12    !
13    !   This program is provided AS IS. No indemnity or warranties
14    !   are provided, whether expressed or implied. Giga-tronics specifically
15    !   disclaims the implied warranties or merchantability and fitness
16    !   for the purpose or use. In no event shall Giga-tronics be liable for
17    !   any loss of data, use, profits or goodwill, or for special,
18    !   incidental, consequential or other similar damages.
19    !
20    !   Giga-tronics 6062A Signal Generator Level compensation control program.
30    !   Runs on a Giga-tronics or Fluke 1720A or 1722A controller.
40    !
50    INIT PORT 0
60    A% = 2% ! IEEE-488 address of Signal Generator
70    AP% = 13% ! IEEE-488 address of Power Meter
80    PRINT @ A%,cl \ WAIT 500   !   initialize Signal Generator
90    GOSUB 3000   !   initialize Power Meter
100   GOSUB 7000   !   set up CAL factor tables
500   !
510   !   Ask operator which compensation mode to use
520   !
530   MD% = 0% ! default is output
540   PRINT Enter compensation mode:
550   PRINT 0 for output
560   PRINT 1 for attenuator
570   PRINT 2 for output with default attenuator
580   INPUT MD%
590   IF (MD%  0 OR MD%  2%) GOTO 500
600   IF (MD% = 0%) THEN MD$ = ot
610   IF (MD% = 1%) THEN MD$ = at
620   IF (MD% = 2%) THEN MD$ = od
630   !
640   PRINT @ A%,cm;MD$ ! enter compensation mode
650   PRINT @ A%,ir \ INPUT LINE @ A%,A$ \ A$ = LEFT(A$,20)
660   IF (A$ = 000000,000000,000000) THEN GOTO 800
670   PRINT There is an error with the 6062A.
680   PRINT Rejected Entry code: ;A$
690   STOP
800   !
810   GOSUB 5000   !   zero power meter
820   TL = 10 !   flag used to determine when to zero meter
1000  !
1010  !   Main loop
1020  !
1030  !   get frequency , exit main loop on last frequency
1040  PRINT @ A%,icfr \ INPUT @ A%,F
1050  IF (F = 9E9) GOTO 2000
1060  !
1070  !   zero power meter before measuring first 24 dB attenuator
1080  !   (target level changes from -2 dBm to -14 dBm).
1090  PRINT @ A%,ictg \ INPUT @A%,T
1100  IF ((T = -14) AND (TL = -2)) THEN GOSUB 5000   ! zero power meter
1110  TL = T
1120  !
1130  !   get power meter reading
1140  GOSUB 4000   !   reading - > RD
1150  !
1160  !   send power meter reading to 6062A
```

```
1170    PRINT @ A%,cp;RD;db
1180    GOTO 1000

2000    !
2010    !   Store results
2020    !
2030    PRINT @ A%,cmsv ! save data in compensation memory
2040    WAIT 45000 !    wait 45 seconds for store to complete
2050    PRINT @ A%,ir \ INPUT LINE @ A%,A$ \ A$ = LEFT(A$,20)
2060    IF (A$ = 000000,000000,000000) THEN GOTO 2900
2070    IF (MD$  at) AND (A$ = 000000,000400,000000) THEN GOTO 2500
2080    PRINT The store operation failed.
2090    PRINT Rejected Entry code: ;A$
2100    STOP
2500    !
2510    !   Handle not enough level compensation case
2520    !
2525    LOCAL @AP%
2530    PRINT @ A%,ih \ INPUT @ A%,F,L
2540    PRINT @ A%,cmex,fr;F;mz,ap10dB
2550    PRINT Not enough level compensation available.
2560    M$ = higher \ IF (L) THEN M$ = lower
2570    PRINT Adjust R227 on Output PCA for a power reading ;ABS(L);
2580    PRINT dB ;M$ \ PRINT than it currently is.
2590    PRINT Rerun level compensation when adjustment is complete.
2600    LOCAL \ STOP
2900    LOCAL
2910    END

3000    !
3010    !   Subroutine to initialize HP 436A Power Meter
3020    !   P$ is used when zeroing the power meter too
3030    !
3040    P$ = D+9H ! dBm mode, no CAL factor, auto range, Hold
3050    PRINT @ AP%,P$
3060    PRINT @ AP%,I ! get first reading
3070    INPUT LINE @ AP%,RD$ ! throw it away
3080    RETURN

4000    !
4010    !   Subroutine to get readings from HP 436A Power Meter
4020    !
4030    !   Get two readings within .01 dB, then read eight
4040    !   more and return the average of all ten.
4050    !
4060    !   set delay to 200 ms or 400 ms if 24 dB pad
4070    WT% = 200%
4080    IF( T = -14 ) THEN WT% = 400%
4090    !
4100    !   wait 2 seconds
4110    WAIT 2000 \ PRINT @ AP%,I \ INPUT LINE @ AP%,RD$
4120    !
4130    R1 = VAL(RIGHT(RD$,4))
4480    !
4490    !   get settled reading
4500    !
4510    WAIT WT% \ PRINT @ AP%,I \ INPUT LINE @ AP%,RD$
4520    RD = VAL(RIGHT(RD$,4))
```

```
4530    IF ABS(RD-R1) < = .01 THEN GOTO 4600
4540    R1 = RD
4550    GOTO 4500
4580    !
4590    !   The reading is in the settled range, now average more.
4600    R1 = R1 + RD ! sum includes last 2 readings
4605    AV = 10.0
4610    FOR I% = 1% TO (AV-2)
4620    PRINT @ AP%,I \ INPUT LINE @ AP%,RD$
4630    RD = VAL(RIGHT(RD$,4))
4640    R1 = R1 + RD
4650    NEXT I%
4660    RD = R1 / AV
4670    !
4800    GOSUB 6000     !    power meter CAL factor - > CF
4810    RD = RD + CF
4840    RETURN

5000    !
5010    !   Subroutine to zero HP 436A Power Meter
5020    !   P$ is set up in the power meter initialization routine
5030    !
5040    PRINT @ A%,ro0 \ WAIT 3000
5050    PRINT @ AP%,Z1T \ WAIT 30
5060    PRINT @ AP%,P$ \ WAIT 5000
5070    PRINT @ A%,ro1 \ WAIT 30
5080    RETURN

6000    !
6010    !   Subroutine to compute power meter CAL factor
6020    !
6030    !   use first data point if frequency is low
6040    CF = 10 * LOG(1/CA(1%))
6050    IF (F/1.0E6 < = FR(1%)) THEN RETURN
6060    !
6070    !   use last data point if frequency is high
6080    CF = 10 * LOG(1/CA(30%))
6090    IF (F/1.0E6) = FR(30%) THEN RETURN
6100    !
6110    !   search table for closest frequency points
6120    I% = 1%
6130    IF (F/1.0E6  FR( I%)) THEN GOTO 6500
6140    I% = I% + 1%
6150    GOTO 6130
6500    !
6510    !   interpolate between frequency points
6520    D = (F/1.0E6 - FR(I%-1%)) / (FR(I%)-FR(I%-1%))
6530    C = ( D * (CA(I%)-CA(I%-1%)) ) + CA(I%-1%)
6540    !
6550    !   convert ratio to dB
6560    CF = 10 * LOG(1/C)
6570    RETURN
```

```
7000   !
7010   !   Subroutine to set up CAL factor tables
7020   !
7030   !   Number of frequencies used - Maximum of 30
7040   DATA 11
7050   !   List of Frequencies, in MHz
7060   DATA .1, .3, 1, 3, 10
7070   DATA 30, 100, 300, 1000, 1700, 2100
7080   !   CAL factors to match the frequency list
7090   DATA .969, .994, .996, .999, .997,
7100   DATA .999, .991, .988, .986, .988, .987,
7110   !
7120   DIM FR(30%), CA(30%)
7130   !
7140   READ N% \ IF (N%  30%) THEN N% = 30%
7150   FOR I% = 1% TO N%
7160   READ FR(I%) ! load frequency table
7170   NEXT I%
7180   !
7190   FOR I% = 1% TO N%
7200   READ CA(I%) ! load CAL factor table
7210   NEXT I%
7220   !
7230   FOR I% = N%+1% TO 30%
7240   FR(I%) = FR(N%) ! fill in rest of tables
7250   CA(I%) = CA(N%)
7260   NEXT I%
7270   RETURN
```

6

Parts Lists

6.1 Introduction

This chapter contains the parts lists for all major and minor assemblies in the Model 6062A Synthesized RF Signal Generator. A List of Manufacturers is included in Section 6.2.

6062A RF SIGNAL GENERATOR, Rev E

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
2	6604200100	1	58900	6604200100	6062A CABINETIZING ASSY
3	698472	1	58900	698472	PIN TEST BASE
5	HT00-00409	15	53421	T-18R	4 WHITE CABLE TIE
6	GGS0-00003	0	30187	0097-500-08	GROUND STRIP
7	657627	2	58900	657627	CHASSIS SIDE
8	GGS0-00002	0	30187	97-520-08	GROUND STRIP
9	774489	1	58900	774489	BRACKET, POWER SWITCH
13	774075	1	58900	774075	COVER PLATE, IEEEE
14	657650	1	58900	657650	IEEE MTG BRACKET
16	794958	1	58900	794958	COVER, SYNTHESIZER, PLAT
18	HTM0-00003	6	06383	ABMM-1	CABLE TIE ANCHOR
19	797944	1	58900	797944	COVER, OUTPUT, PLATED
20	541730	11	58900	541730	AIDE,PCB PULL
23	HSDH-61004	1	73734	111415	6-32 X 5/8 M/F SPACER
25	808550	1	58900	808550	MODULATOR,BARRIER
28	812529	1	58900	812529	BARRIER,9-LAYER FILTER,
29	812727	1	58900	812727	AMPLIFIER SHIELD
30	797951	1	58900	797951	COVER, PULSE MODULATOR,
32	657593	1	58900	657593	FRONT PANEL SM
33	797886	1	58900	797886	DECAL, FRONT PANEL
34	537803	1	58900	537803	BUSHING INSULATION R.F.
35	797910	1	58900	797910	DECAL, LENS
36	731356	1	58900	731356	ELASTOMERIC
37	657718	1	58900	657718	LENS DISPLAY
38	812818	1	58900	812818	SHIELD,DISPLAY
39	774471	1	58900	774471	BRACKET,RF OUTPUT,PLATED
40	797902	1	58900	797902	SWITCH,RUBBER,CENTER
42	657601	4	58900	657601	CORNER BRACKET
43	797894	1	58900	797894	SWITCH,RUBBER,LEFT
44	716852	1	58900	716852	SHIELD, SWITCH RF
45	JRXB-00200	1	95077	SF1132-6002	N TO SMA ADAPTER
47	538256	1	58900	538256	BUSHING COVER RF OUTPUT
48	760231	2	58900	760231	PLUG, BUTTON
49	731307	1	58900	731307	TRANSFORMER COVER, PAINT
50	748640	1	58900	748640	RETAINER,AUX P.S. CONN
51	HICP-50048	2	06915	N8B	CABLE CLAMP
52	792721	1	58900	792721	FAN SKIRT
53	30680	1	58900	30680	REAR PANEL 6062
54	HQIS-00001	4	55285	7403-09FR-54	SILICONE INSULATOR
55	105BF12100	4	58900	105BF12100	FM DRIVER HEATSINK

6062A RF SIGNAL GENERATOR, Rev E (continued)

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
56	FMAC-00150	1	03614	SS2-15A	1.5A MB FUSE 3AG
57	HQIS-00030	1	55285	K4-05	TO3 INSULATOR
58	HQH0-00030	1	9B003	7-423BA	T03 HEATSINK
60	420893	1	58900	420893	PUSHBUTTON,LG RECT,GREEN CL RE
61	LCR0-78700	1	54583	H5C2T20-7.5-14.5E	FERRITE TOROIDAL CORE
70	70508	REF	58900	70508	6062A FRONT PANEL INSTR
71	70510	REF	58900	70510	6062A FRONT PANEL INSTR
72	70514	REF	58900	70514	6062A REAR PANEL INSTR
73	70517	REF	58900	70517	6062A OUTPUT INSTR
74	70524	REF	58900	70524	6062A ATTEN INSTR
75	70532	REF	58900	70532	6062A PULSE COVER INSTR
76	70536	REF	58900	70536	6062A CONTROLLER INSTR
80	30527	REF	58900	30527	606X,608X ENVIRON TEST
81	30530	REF	58900	30530	ATTEN FUNCTIONAL TEST
82	30532	REF	58900	30532	606X TEAM AUDIT PROCED
96	BD00-03012	1	67088	8312-6/32 INSERT	12VDC 3.15 FAN
10	774190	1	58900	774190	SHIELD, HET
101	HWFS-60500	3	96906	MS15795-805	#6 X 5/16 FLAT WASHER
103	HBFU-83204	3	58900	HBFU-83204	8-32 X 1/4 FLAT
104	HWHN-40401	4	7U905	A364-164	NYLON SHOULDER WASHER
105	HBPP-83244	4	96906	MS51957-5C	8-32 X 2 3/4 PAN
106	HWFS-80600	8	96906	MS15795-807	#8 X 3/8 FLAT WASHER
107	HWHF-60501	2	7U905	5604-47	FIBER SHOULDER WASHER
108	HNNS-63205	9	96906	FZ1NTM-62	6-32 LOCKING NUT
110	HWFA-40401	4	7U905	5712-160-60	#4 X 1/4 FLAT WASHER
112	HWFF-A0800	4	7U905	5602-36-32	FIBER FLAT WASHER
113	HBPL-63210	2	73734	SEE SPEC	6-32 X 5/8 LOCKING SCREW
114	HWFS-60400	3	7U905	5710-23-15-P	#6 X 1/4 FLAT WASHER
115	HWDS-60400	2	96906	M575044***	DOME WASHER
126	HWFN-A0500	2	7U905	5622-25-7	MYLAR FLAT WASHER
127	JMSF-00005	2	55566	854737	MALE/FEMALE JACK SCREW
133	HWFT-30400	11	7U905	5612-124-31	TEFLON FLAT WASHER
135	HLLT-K1114	1	79963	761-375	3/8 (BNC) SOLDER LUG
137	HLLT-60212	2	79963	505-144 # 6	#6 SOLDER LUG
138	HWIS-G0800	3	96906	MS35333-74	1/4 INT TOOTH LK WASHER
139	HSDR-80807	3	3Z990	51090-1	8-32 SHOCK MOUNT SPACER
A 1	795021	1	58900	795021	PCA, DISPLAY
A 2	797878	1	58900	797878	PCA, CONTROLLER
A 3	657833	1	58900	657833	IEEE PCA
A 4	812446	1	58900	812446	PCA, SYNTHESIZER
A 5	797837	1	58900	797837	PCA, VCO
A 6	797860	1	58900	797860	PCA, OUTPUT CONTROL
A 7	797845	1	58900	797845	PCA, OUTPUT
A 9	657825	1	58900	657825	POWER SUPPLY PCA
A 12	657775	1	58900	657775	SWITCH PWB
A 159	848093	1	58900	848093	ASM.,MODULE FILTER 6062
A 8	30067	1	58900	30067	ATTENUATOR ASSY, 606X
A2A5C 8	CK51-04220	1	31433	C1206C224K5RAC	.22UF Y5V CHIP CERAMIC
C 1	CC50-B2100	1	31433	C322C102J5G5CA	1000PF CERAMIC COG
C 2	CC00-01270	1	04222	SR151A271JAT	270PF CERAMIC COG
C 23	CC00-B3100	1	04222	SR591C103KAATR1A	.01UF CERAMIC X7R
	GRD0-00000	1	1BX85	C1929V	360 KB 5.25" DISKETTE
J 2	748699	1	58900	748699	CABLE ASSY, RF, REF IN
J 3	748681	1	58900	748681	CABLE ASSY, RF, REF
J 7	JRBA-00200	1	2M631	228553-1	SMB M TO SMB M ADAPTER
MP 18	535294	REF	58900	535294	DECAL, DATA DISK
T 1	717959	1	58900	717959	TRANSFORMER, POWER
U 2	URC0-07915	1	27014	LM7915CT	MC7915CT 1A -15V REG
U 3	URK0-03230	1	27014	LM323K	LM323K 5V 3A TO3 REGULATOR
U 4	URC0-00317	1	27014	LM317T	LM317C ADJ 3 TERM REG
U 5	URC0-00780	1	04713	TL780-15CKC	TL780-15CKC 15V 1.5A
U 7	URC0-07815	1	66958	L7815CV	MC7815CT 1A 15V REG

6062A RF SIGNAL GENERATOR, Rev E (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
U	21	797985	1	58900	797985	6062A S/W PROM V 1.1
U	22	797977	1	58900	797977	6062A S/W PROM V1.1
W	1	WCAS-18004	1	0DJ29	P-3636-600-5204	4" 18GHZ SEMI-FLEX COAX
W	6	738542	1	58900	738542	CABLE ASSY, MOD INPUT,
W	7	738500	1	58900	738500	CABLE ASSY MOD INPUT,FRT
W	9	738534	1	58900	738534	CABLE ASSEMBLY,
W	10	738526	1	58900	738526	CABLE ASSEMBLY,
W	15	30281	1	58900	30281	LINE FILTER CABLE ASY
W	24	752725	1	58900	752725	CABLE ASSEMBLY,
W	28	748681	1	58900	748681	CABLE ASSY, RF, REF
XU	1	JIB1-07215	1	30035	SS-109-1-07	7 PIN STRIPLINE SOCKET
XU	2	JIB1-07215	1	30035	SS-109-1-07	7 PIN STRIPLINE SOCKET

6604200100 6062A CABINETIZING ASSY, Rev B

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	525998	2	58900	525998	SIDE TRIM 18
2	653923	4	58900	653923	FOOT, SINGLE BAIL TYPE
3	656173	4	58900	656173	HANDLE, FRONT 5.25 IN
4	685214	4	58900	685214	DECAL, REAR CORNER
5	704866	1	58900	704866	TOP COVER
6	704874	1	58900	704874	BOTTOM COVER
7	794842	1	58900	794842	6062A INSTRUCTION MANUAL
8	794859	1	58900	794859	MANUAL, 6062 GETTING STARTED
9	797928	1	58900	797928	DECAL, OPERATION
10	812636	1	58900	812636	IEEE REFERENCE GUIDE
11	HPM0-00250	15	18310	790-3002	1/4 HOLE PLUG
12	HPM0-00500	3	18310	790-3008	1/2 HOLE PLUG
13	JRDC-00001	2	02660	CW-123/U	BNC CAP
14	WMP0-03006	1	16428	17506C	RT ANG IEC POWER CORD

795021 PCA, DISPLAY (A1), Rev F

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	0	6062A-1011	REF	58900	6062A-1011	6062 DISPLAY SCHEMATIC
C	1	CE63-R6100	1	0H1N5	CEBSMJ100M	10UF 63V RADIAL
C	2	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	3	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	4	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	5	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	6	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	7	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	8	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	9	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	10	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	11	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	12	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	13	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	14	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	15	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	16	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	17	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	18	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	23	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	24	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	25	CT06-R6390	1	56289	199D396X06R3DE2	39UF 6V TANTALUM
C	26	CT06-R6390	1	56289	199D396X06R3DE2	39UF 6V TANTALUM
C	27	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	28	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	29	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	30	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
DS	1	792713	1	0LU72	CP2210	FLUORESCENT,FREQUENCY
DS	2	698464	1	0LU72	CP2075	FLUORESCENT AMPLITUDE
E	1	JIA0-01280	1	79963	834	FASTON TAB TERMINAL
J	103	JIA0-01198	1	2M631	60599-3	MALE PIN CONNECTOR
J		JIA0-01165	14	2M631	87022-1	MALE PIN CONNECTOR
MP	2	HFFA-00002	1	58900	HFFA-00002	SQUARE BLACK RUBBER FOOT
MP	3	HFFA-00002	1	58900	HFFA-00002	SQUARE BLACK RUBBER FOOT
MP	4	HFFA-00002	1	58900	HFFA-00002	SQUARE BLACK RUBBER FOOT
MP	5	HFFA-00002	1	58900	HFFA-00002	SQUARE BLACK RUBBER FOOT
MP	6	HFFA-00002	1	58900	HFFA-00002	SQUARE BLACK RUBBER FOOT
MP	7	HFFA-00002	1	58900	HFFA-00002	SQUARE BLACK RUBBER FOOT
MP	8	HFFA-00002	1	58900	HFFA-00002	SQUARE BLACK RUBBER FOOT
MP	9	HFFA-00002	1	58900	HFFA-00002	SQUARE BLACK RUBBER FOOT
MP	10	HFFA-00002	1	58900	HFFA-00002	SQUARE BLACK RUBBER FOOT
MP		794941	1	58900	794941	PWB, DISPLAY
R	1	RN55-31000	1	19701	RN55C1003F	100 K OHMS 1% MET FILM
R	2	RN55-31000	1	19701	RN55C1003F	100 K OHMS 1% MET FILM
R	3	RN55-06190	1	81349	RNC55H6190FM	619 OHMS 1% MET FILM
R	4	RN55-19090	1	91637	RN55C9091F	9.09 K OHMS 1% MET FILM
R	5	RN55-23160	1	91637	RN55C3162F	31.6 K OHMS 1% MET FILM
R	6	RN55-18060	1	81349	RNC55H8061FM	8.06K OHMS 1% MET FILM
R	7	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	8	RN55-24870	1	91637	RN55C4872F	48.7 K OHMS 1% MET FILM
R	9	RN55-23010	1	91637	RN55C3012F	30.1 K OHMS 1% MET FILM
R	10	RN55-23010	1	91637	RN55C3012F	30.1 K OHMS 1% MET FILM
R	11	RN50-21000	1	81349	RNC50K1002FS	10.0 K OHMS 1% MET FILM
R	12	RN50-21000	1	81349	RNC50K1002FS	10.0 K OHMS 1% MET FILM
R	13	RN50-21000	1	81349	RNC50K1002FS	10.0 K OHMS 1% MET FILM
R	14	RN50-21000	1	81349	RNC50K1002FS	10.0 K OHMS 1% MET FILM
R	15	RN50-05620	1	81349	RNC50K5620FS	562 OHMS 1% METAL FILM
R	16	RAPA-15004	1	32977	3386S-1-502	5K OHM POT 1T PC MOUNT
U	1	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	2	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	3	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	4	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F

795021 PCA, DISPLAY (A1), Rev F (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
U	5	UTN0-01741	1	04713	SN74LS174N	74LS174N HEX D FLIP-FLOP
U	6	UIN0-06118	1	52063	XR6118P	UDN-6118A DISPLAY DRIVER
U	7	UIN0-06118	1	52063	XR6118P	UDN-6118A DISPLAY DRIVER
U	8	UIN0-06118	1	52063	XR6118P	UDN-6118A DISPLAY DRIVER
U	9	UIN0-06118	1	52063	XR6118P	UDN-6118A DISPLAY DRIVER
U	10	UIN0-06118	1	52063	XR6118P	UDN-6118A DISPLAY DRIVER
U	11	UTN0-01231	1	27014	DM74LS123N	SN74LS123N DUAL ONE SHOT
U	12	UTN0-00211	1	18324	DM74LS21N	74LS21N DUAL 4 IN AND
U	13	UTN0-00160	1	27014	SN7416N	7416N HEX INVERTER
U	14	UTN0-03671	1	27014	DM74LS367AN	74LS367N HEX BUFFER
U	15	UTN0-00160	1	27014	SN7416N	7416N HEX INVERTER
U	16	ULN0-00393	1	01245	LM393P	LM393N VOLT COMPARATOR
U	17	UTN0-01231	1	27014	DM74LS123N	SN74LS123N DUAL ONE SHOT
U	18	ULP0-01034	1	24335	AD589LH	LT1034CZ-1.2 REFERENCE
U	19	UTN0-00741	1	04713	74LS74AN	74LS74 DUAL D FLIP FLOP
W	8	738476	1	58900	738476	CABLE ASSEMBLY,
Z	1	RM9S-31000	1	32977	4610X-101-104	100K OHM X 9 SIP NETWRK
Z	2	RM9S-21000	1	32977	4610X-101-103	10K OHM X 9 SIP NETWRK

797878 PCA, CONTROLLER (A2), Rev G

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	1	795005	1	58900	795005	PWB, CONTROLLER
	2	GF00-00001	1	58900	GF00-00001	CONDUCTIVE FOAM
	0	6062A-1028	REF	58900	6062A-1028	6062 CONTROLLER SCHEMATIC
	75	JIA0-01165	53	2M631	87022-1	MALE PIN CONNECTOR
	77	JIB0-01288	19	2M631	50871-1	FEMALE PIN CONNECTOR
C	1	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C	2	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	3	CT35-R4470	1	31433	T368A474M035AS	.47UF 35V TANTALUM
C	4	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	5	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	6	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	7	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	10	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	11	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	12	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	13	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	16	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	18	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	19	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	21	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	22	CC00-B1220	1	59660	2DDH60N221K	220PF Z5F CERAMIC DISC
C	23	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	24	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	25	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	28	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	29	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	30	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	31	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	34	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	35	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	39	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	41	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	42	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	43	CC00-C2100	1	72982	68U202P1KV	2000PF CERAMIC Z5U
C	44	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	45	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	46	CC00-B1220	1	59660	2DDH60N221K	220PF Z5F CERAMIC DISC
C	47	CC00-B1220	1	59660	2DDH60N221K	220PF Z5F CERAMIC DISC
C	48	CC00-B1220	1	59660	2DDH60N221K	220PF Z5F CERAMIC DISC
C	49	CC00-B1220	1	59660	2DDH60N221K	220PF Z5F CERAMIC DISC
C	50	CC00-C2100	1	72982	68U202P1KV	2000PF CERAMIC Z5U
C	51	CC00-B1220	1	59660	2DDH60N221K	220PF Z5F CERAMIC DISC
C	52	CC00-C2100	1	72982	68U202P1KV	2000PF CERAMIC Z5U
C	53	CC00-B1220	1	59660	2DDH60N221K	220PF Z5F CERAMIC DISC
C	54	CC00-B1220	1	59660	2DDH60N221K	220PF Z5F CERAMIC DISC
C	55	CC00-B1220	1	59660	2DDH60N221K	220PF Z5F CERAMIC DISC
C	56	CC00-B1220	1	59660	2DDH60N221K	220PF Z5F CERAMIC DISC
C	57	CC00-B1220	1	59660	2DDH60N221K	220PF Z5F CERAMIC DISC
C	58	CC00-C2100	1	72982	68U202P1KV	2000PF CERAMIC Z5U
C	59	CC00-C2100	1	72982	68U202P1KV	2000PF CERAMIC Z5U
C	60	CC00-B1100	1	59660	808-000-S3N0-101	100PF CERAMIC Z5F
C	61	CC00-00560	1	31433	C315C560G1G5CA	56PF CERAMIC COG
CR	1	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
J	6	JIA2-26318	1	2M631	1-87230-3	26 PIN STRIPLINE PLUG
L	1	320911	1	58900	320911	CHOKE, 6 TURN
L	2	320911	1	58900	320911	CHOKE, 6 TURN
L	3	LAD0-05470	1	91637	IMS 5 4.7 UH 5%	4.7 UH INDUCTOR
L	4	320911	1	58900	320911	CHOKE, 6 TURN
R	1	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R	2	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	3	RN55-22000	1	81349	RNC55H2002FM	20 K OHMS 1% MET FILM
R	4	RN55-33920	1	19701	RN55C3923F	392 K OHMS 1% MET FILM
R	5	RN55-31000	1	19701	RN55C1003F	100 K OHMS 1% MET FILM

797878 PCA, CONTROLLER (A2), Rev G (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
R	6	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R	7	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R	8	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R	9	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R	10	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R	11	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R	12	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R	13	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	14	RN55-11300	1	91637	RN55C1301F	1.3 K OHMS 1% MET FILM
R	15	RN55-11300	1	91637	RN55C1301F	1.3 K OHMS 1% MET FILM
S	1	SDP0-00601	1	81073	76SB06S	6 SPST DIP SWITCH
U	1	UGN0-09572	1	01245	MP9572N	MP9572N 16 BIT COMPUTER
U	2	UTN0-03671	1	27014	DM74LS367AN	74LS367N HEX BUFFER
U	3	UTN0-02451	1	27014	DM74LS245N	SN74LS245N 8X TRANSCEIVE
U	4	UTN0-02451	1	27014	DM74LS245N	SN74LS245N 8X TRANSCEIVE
U	5	UTN0-00041	1	04713	SN74LS04N	SN74LS04 HEX INVERTER
U	7	ULN0-00393	1	01245	LM393P	LM393N VOLT COMPARATOR
U	8	UTN0-00101	1	27014	DM74LS10N	SN74LS10 TRIPLE NAND
U	9	UTN0-01741	1	04713	SN74LS174N	74LS174N HEX D FLIP-FLOP
U	10	UTN0-00327	1	18324	N74S32N	74S32N QUAD 2 IN OR
U	11	UTN0-03731	1	18324	SN746S373N	74LS373 OCTAL D F-F
U	14	UTN0-01391	1	27014	DM74LS139N	74LS139N 2 TO 4 LINE DEC
U	15	UTN0-02441	1	04713	74LS244N	SNL4LS244N 8X DRIV/RECV
U	16	UTN0-02441	1	04713	74LS244N	SNL4LS244N 8X DRIV/RECV
U	17	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	18	UTN0-02451	1	27014	DM74LS245N	SN74LS245N 8X TRANSCEIVE
U	24	UMN0-02816	1	60395	XLS2816AP-250	X2816BP EEPROM
U	25	UMN1-01225	1	66958	DS1225AB-150	DS1225 8K X 8 N/V RAM
U	27	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	30	ULN0-02003	1	18324	ULN2003N	ULN2003AN 7 TRANS ARRAY
U	31	ULN0-02003	1	18324	ULN2003N	ULN2003AN 7 TRANS ARRAY
U	33	UTN0-02441	1	04713	74LS244N	SNL4LS244N 8X DRIV/RECV
U	34	UTN0-02441	1	04713	74LS244N	SNL4LS244N 8X DRIV/RECV
U	35	UTN0-01381	1	27014	DM74LS138N	SN74LS138N 3 TO 8 DEC
U	36	UTN0-01381	1	27014	DM74LS138N	SN74LS138N 3 TO 8 DEC
U	37	UTN0-00321	1	18324	N74LS32N	SN74LS32N QUAD OR
U	40	UTN0-03731	1	18324	SN746S373N	74LS373 OCTAL D F-F
U	42	UTN0-01121	1	27014	DM74LS112AN	74LS112 DUAL J-J F-F
U	44	UTN0-00141	1	27014	DM74LS14N	74LS14N HEX SCHMITT INV
U	46	UTN0-01251	1	27014	74LS125N	MC74LS125N QUAD BUFFER
U	20	UPP0-00001	1	58900	UPP0-00001	PAL16L8ACN GATE ARRAY
XU	1	JSP0-10040	1	2M631	2-641874-1	40 PIN DIP SOCKET
XU	20	JSP0-10020	1	2M631	2-641870-1	20 PIN DIP SOCKET
XU	21	JSP0-10028	1	2M631	2-641873-1	28 PIN DIP SOCKET
XU	22	JSP0-10028	1	2M631	2-641873-1	28 PIN DIP SOCKET
XU	24	JSP0-10024	1	2M631	2-641266-1	24 PIN DIP SOCKET
XU	25	JSP0-10028	1	2M631	2-641873-1	28 PIN DIP SOCKET
XU	26	JSP0-10024	1	2M631	2-641266-1	24 PIN DIP SOCKET
XU	30	JSP0-10016	1	2M631	2-614610-2	16 PIN DIP SOCKET
XU	31	JSP0-10016	1	2M631	2-614610-2	16 PIN DIP SOCKET
Y	1	Y180-01000	1	58756	MP100	10MHZ FUND XTAL
Z	1	RM9S-14700	1	32977	4610X-101-472	4.7K OHM X 9 SIP NETWRK
Z	2	RM9S-21000	1	32977	4610X-101-103	10K OHM X 9 SIP NETWRK
Z	3	RM9S-21000	1	32977	4610X-101-103	10K OHM X 9 SIP NETWRK
Z	4	RM9S-21000	1	32977	4610X-101-103	10K OHM X 9 SIP NETWRK
Z	5	RM9S-21000	1	32977	4610X-101-103	10K OHM X 9 SIP NETWRK

657833 IEEE PCA (A3), Rev G

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	1	657809	1	58900	657809	IEEE PWB
	0	6060A-1033	REF	58900	6060A-1033	606x IEEE-488 SCHEMATIC
	59	856224	2	58900	856224	BOARD SPACER
C	1	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	2	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	3	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	4	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	6	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	7	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	9	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	10	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	11	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
J	1	JMFP-02401	1	02660	57-92245-12	24 PIN IEEE CONNECTOR
L	1	320911	1	58900	320911	CHOKE, 6 TURN
L	2	320911	1	58900	320911	CHOKE, 6 TURN
L	3	320911	1	58900	320911	CHOKE, 6 TURN
P	1	JIS2-26320	1	0JNR4	67118-013	26 PIN STRIPLINE SOCKET
R	1	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
S	1	SDP0-20801	1	81073	76PSB08S	8 SPST DIP SWITCH
U	1	UGN0-07210	1	4T165	UPD7210C	UPD7210C GPIB
U	3	UIN0-03447	1	04713	MC3447P3	MC3447P3 TRANSCEIVER
U	4	UIN0-03447	1	04713	MC3447P3	MC3447P3 TRANSCEIVER
U	6	UTN0-03731	1	18324	SN746S373N	74LS373 OCTAL D F-F
U	7	UTN0-02451	1	27014	DM74LS245N	SN74LS245N 8X TRANSCEIVE
U	8	UTN0-00081	1	27014	DM74LS08N	SN74LS08 QUAD AND
Z	1	RM9S-21000	1	32977	4610X-101-103	10K OHM X 9 SIP NETWRK
Z	2	RM9S-21000	1	32977	4610X-101-103	10K OHM X 9 SIP NETWRK
Z	3	RM9S-21000	1	32977	4610X-101-103	10K OHM X 9 SIP NETWRK
Z	4	RM9S-21000	1	32977	4610X-101-103	10K OHM X 9 SIP NETWRK

812446 PCA, SYNTHESIZER (A4), Rev AS

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	1	792630	1	58900	792630	PWB, SYNTHESIZER
	0	6060B-1017	REF	58900	6060B-1017	606x SYNTHESIZER SCH
	458	774455	1	58900	774455	BRACKET, SMB
	480	JIA0-01165	10	2M631	87022-1	MALE PIN CONNECTOR
	484	HT00-00300	1	98159	2829-75-2	COMPONENT HOLDER
	493	JIB1-01143	4	2M631	2-332070-7	FEMALE PIN CONNECTOR
	494	JIA0-01284	8	2M631	1-87022-3	MALE PIN CONNECTOR
	496	JIB0-01288	7	2M631	50871-1	FEMALE PIN CONNECTOR
	498	JIA0-01280	15	79963	834	FASTON TAB TERMINAL
C	1	CK50-00027	1	95275	VJ0805A2R7DXAM	2.7PF COG CHIP CERAMIC
C	2	CK50-00027	1	95275	VJ0805A2R7DXAM	2.7PF COG CHIP CERAMIC
C	3	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	4	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	5	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	6	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	7	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	8	CC00-00068	1	72982	RPE110COG6R8C100	6.8PF CERAMIC COG
C	9	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	10	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	11	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	12	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	13	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	14	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	15	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	16	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	17	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	18	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	19	CC00-00047	1	72982	RPE110COG4R7C100V	4.7PF CERAMIC COG
C	20	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	21	CC00-00068	1	72982	RPE110COG6R8C100	6.8PF CERAMIC COG
C	22	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	23	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	24	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	25	CK50-00100	1	95275	VJ0805A100JXAMB	10 PF NPO CHIP
C	26	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	27	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	29	CC00-00470	1	31433	C315C470G2G5CA	47PF CERAMIC COG
C	30	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	31	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	32	CF00-R1470	1	68919	FKP2/470/100/1	470PF 100V POLYPROPYLENE
C	33	CF00-R1100	1	4U402	KP1830-110-01-1	100PF 100V POLYPROPYLENE
C	34	CF00-R1330	1	68919	FKP2/330/100/1	330PF 100V POLYPROPYLENE
C	35	CF00-R2100	1	68919	FKP2-1000/100/1	1000PF 100V POLYPROPYLEN
C	36	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	37	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	38	CC00-00470	1	31433	C315C470G2G5CA	47PF CERAMIC COG
C	39	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	40	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	41	CF50-R3470	1	65964	MMK5473K50L4C	.047UF 50V POLYESTER
C	42	CF50-R3470	1	65964	MMK5473K50L4C	.047UF 50V POLYESTER
C	43	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	48	CF50-R3150	1	65964	MMK5153K50L4C	.015UF 50V POLYESTER
C	49	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	50	CF50-R3820	1	65964	MMK5823K50L4C	.082UF 50V POLYES
C	51	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	52	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	53	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	54	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	55	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	59	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	60	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	61	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	62	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P

812446 PCA, SYNTHESIZER (A4), Rev AS (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
C	63	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	64	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	69	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	70	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	71	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	72	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	73	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	74	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	75	CC00-00220	1	04222	SR151A220GAT	22PF CERAMIC COG
C	76	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	77	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	78	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	79	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	80	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	81	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	83	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	84	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	85	CC00-00220	1	04222	SR151A220GAT	22PF CERAMIC COG
C	86	CC00-00220	1	04222	SR151A220GAT	22PF CERAMIC COG
C	87	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	88	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	89	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	91	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	92	CT35-R6100	1	56289	199D106X0035DE2	10UF 35V TANTALUM
C	93	CT35-R6100	1	56289	199D106X0035DE2	10UF 35V TANTALUM
C	94	CT50-R6100	1	56289	199D106X0050FE3	10UF 50V TANTALUM
C	95	CC00-00220	1	04222	SR151A220GAT	22PF CERAMIC COG
C	98	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	99	CF00-02750	1	84411	JF91 .0075UF 2% 100V	.0075UF 100V POLYSTYRENE
C	100	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	101	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	102	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	103	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	104	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	105	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	106	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	108	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	109	CT20-R6150	1	04222	TAP156K020CCS	15UF 20V TANTALUM
C	110	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	111	CT20-R6150	1	04222	TAP156K020CCS	15UF 20V TANTALUM
C	112	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	113	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	114	CF50-R4220	1	65964	MMK5224J50L4C	.22UF 50V POLYESTER
C	115	CF50-02786	1	84411	JF98.0786UF;1%50V	.0786UF 50V POLYPROPYLEN
C	116	CT20-R5330	1	56289	199D335X0020BA2	3.3UF 20V TANTALUM
C	117	CT20-R5330	1	56289	199D335X0020BA2	3.3UF 20V TANTALUM
C	118	CF50-R4470	1	65964	MMK5474K50L4C	.47UF 10% POLYESTER
C	119	CC50-B2100	1	31433	C322C102J5G5CA	1000PF CERAMIC COG
C	120	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	121	CC50-B2100	1	31433	C322C102J5G5CA	1000PF CERAMIC COG
C	122	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	123	CF00-03220	1	74840	223MPW160J	.022 UF 100V 5% POLY FLM
C	124	CF00-03560	1	84411	807 56000PF 5% 125V CS3	.056UF 100V POLYSTYRENE
C	126	CF00-02150	1	90201	JF91.0015UF;2%;1	.0015UF 100V POLYSTYRENE
C	127	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	128	CT35-R6100	1	56289	199D106X0035DE2	10UF 35V TANTALUM
C	129	CT20-R6820	1	56289	199D826X0020FE3	82UF 20V TANTALUM
C	130	CT20-R6820	1	56289	199D826X0020FE3	82UF 20V TANTALUM
C	131	CF50-06100	1	56289	LP66N1A106J	10UF 50V POLYCARBONATE
C	132	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	133	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	134	CT20-R6150	1	04222	TAP156K020CCS	15UF 20V TANTALUM
C	135	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER

812446 PCA, SYNTHESIZER (A4), Rev AS (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
C	136	CT15-R5220	1	31433	T355A225K016AS	2.2UF 15V TANTALUM
C	137	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	138	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	139	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	140	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	141	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	142	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	143	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	144	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	145	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	146	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	151	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	152	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	153	CC50-02470	1	31433	C315C472K1R5CA	.0047 UF CERAMIC X7R
C	154	CC50-02470	1	31433	C315C472K1R5CA	.0047 UF CERAMIC X7R
C	155	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	156	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	157	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	158	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	159	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	160	CC50-02470	1	31433	C315C472K1R5CA	.0047 UF CERAMIC X7R
C	161	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	162	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	163	CF50-R3220	1	65964	MMK5223K50L4C	.022UF 50V POLYESTER
C	164	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	165	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	166	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	167	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	168	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	169	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	170	CC00-00330	1	04222	SR151A330GAT	33PF CERAMIC COG
C	171	CC00-00470	1	31433	C315C470G2G5CA	47PF CERAMIC COG
C	173	CE16-R7220	1	0H1N5	CEUSM1C221M	220UF 16V RADIAL
C	174	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	175	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	176	CF50-R4270	1	65964	BF014E0274K	.27UF 50V POLYESTER
C	177	CF50-R4150	1	65964	MMK5154K50L4C	.15UF 50V POLYESTER
C	178	CT35-R5680	1	31433	CX12M685M	6.8UF 35V TANTALUM
C	179	CC50-02220	1	31433	C315C222M1R5CA C9248	2200PF CERAMIC X7R
C	180	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	181	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	182	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	183	CF50-R4470	1	65964	MMK5474K50L4C	.47UF 10% POLYESTER
C	184	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	185	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	186	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	187	CF50-R4470	1	65964	MMK5474K50L4C	.47UF 10% POLYESTER
C	188	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	189	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	190	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	191	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	192	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	193	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	194	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	195	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	196	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	197	CC00-00100	1	04222	SR151A100GAT	10PF CERAMIC COG
C	198	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	199	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	200	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	201	CC00-00680	1	31433	C315C680G1G5CA	68PF CERAMIC COG
C	202	CC00-00470	1	31433	C315C470G2G5CA	47PF CERAMIC COG
C	204	CC00-01330	1	04222	SR291A331JAT	330PF CERAMIC COG

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Item		Part Number	Qty	Cage	Mfr's Part Number	Description
C	205	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	206	CV01-01010	1	72982	MVM010W-3	.8-10PF VARIABLE
C	207	CF50-R3820	1	65964	MMK5823K50L4C	.082UF 50V POLYES
C	208	CE16-R7220	1	0H1N5	CEUSM1C221M	220UF 16V RADIAL
C	209	CE16-R7220	1	0H1N5	CEUSM1C221M	220UF 16V RADIAL
C	210	CC00-01180	1	31433	C315C181J2G5CA	180PF CERAMIC COG
C	211	CC00-01180	1	31433	C315C181J2G5CA	180PF CERAMIC COG
C	212	CK51-02100	1	95275	VJ0805Y102KXBMT	1000PF X7R CHIP CERAMIC
C	213	CK50-00068	1	95275	VJ0805Q6R8DXBMT	6.8PF COG CHIP CERAMIC
C	214	CC00-01180	1	31433	C315C181J2G5CA	180PF CERAMIC COG
C	215	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	216	CC00-01180	1	31433	C315C181J2G5CA	180PF CERAMIC COG
C	217	CK50-00043	1	72982	GRH708C0G4R3C200AL	4.3PF COG CHIP CERAMIC
C	218	CC00-01180	1	31433	C315C181J2G5CA	180PF CERAMIC COG
C	219	CC00-00100	1	04222	SR151A100GAT	10PF CERAMIC COG
C	220	CC00-00039	1	72982	RPE110COG3R9C100	3.9PF CERAMIC COG
C	221	CE16-R7470	1	55680	UVX1C471MPA	470 UF 16V RADIAL LEAD
C	222	CK51-02100	1	95275	VJ0805Y102KXBMT	1000PF X7R CHIP CERAMIC
C	223	CK50-00068	1	95275	VJ0805Q6R8DXBMT	6.8PF COG CHIP CERAMIC
C	224	CC00-01180	1	31433	C315C181J2G5CA	180PF CERAMIC COG
C	225	CC00-01180	1	31433	C315C181J2G5CA	180PF CERAMIC COG
C	226	CC00-01180	1	31433	C315C181J2G5CA	180PF CERAMIC COG
C	227	CC00-00100	1	04222	SR151A100GAT	10PF CERAMIC COG
C	228	CC00-01180	1	31433	C315C181J2G5CA	180PF CERAMIC COG
C	230	CC00-01180	1	31433	C315C181J2G5CA	180PF CERAMIC COG
C	231	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	232	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	233	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	234	CC50-01470	1	31433	C315C471K1G5CA	470 PF CERAMIC NPO
C	240	CV00-01010	1	72982	MVM010T	1-10PF AIR VARIABLE
C	242	CC00-00220	1	04222	SR151A220GAT	22PF CERAMIC COG
C	243	CC00-00220	1	04222	SR151A220GAT	22PF CERAMIC COG
C	244	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	245	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	246	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	247	CC00-00100	1	04222	SR151A100GAT	10PF CERAMIC COG
C	248	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	249	CT10-R6470	1	56289	199D476X0010DE2	47UF 10V TANTALUM
C	250	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	251	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	252	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	253	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	254	CC50-02470	1	31433	C315C472K1R5CA	.0047 UF CERAMIC X7R
C	58	CT06-R6390	1	56289	199D396X06R3DE2	39UF 6V TANTALUM
C	82	CT06-R6390	1	56289	199D396X06R3DE2	39UF 6V TANTALUM
C	107	CT06-R6390	1	56289	199D396X06R3DE2	39UF 6V TANTALUM
C	125	CF00-03270	1	84411	JF91-SEE SPEC	.027UF 100V POLYSTYRENE
C	150	CT06-R6390	1	56289	199D396X06R3DE2	39UF 6V TANTALUM
CR	2	DRAE-02007	1	55801	DT-2007	DT2007 6.35V REF DIODE
CR	5	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	6	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	7	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	8	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	11	DZAB-00961	1	07263	IN961B	1N961B 10V ZENER
CR	12	DSA0-06264	1	26840	5082-2835	5082-6264 SCHOT DIODE
CR	13	DSA0-06264	1	26840	5082-2835	5082-6264 SCHOT DIODE
CR	14	DSA0-06264	1	26840	5082-2835	5082-6264 SCHOT DIODE
CR	15	DSA0-06264	1	26840	5082-2835	5082-6264 SCHOT DIODE
CR	16	DZAB-00756	1	27014	1N756A-NAT	1N756A 8.2V ZENER
CR	17	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	18	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	20	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	21	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE

812446 PCA, SYNTHESIZER (A4), Rev AS (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
CR	22	DVA0-02208	1	4T165	1S2208	1S2208 2-11PF DIODE
CR	24	DVA0-02208	1	4T165	1S2208	1S2208 2-11PF DIODE
CR	26	DVA0-00515	1	3W023	BB515 E7908TR	BB515 2-18PF DIODE
CR	27	DVA0-00515	1	3W023	BB515 E7908TR	BB515 2-18PF DIODE
CR	28	DVA0-02208	1	4T165	1S2208	1S2208 2-11PF DIODE
CR	29	DSA0-06264	1	26840	5082-2835	5082-6264 SCHOT DIODE
CR	30	DAM2-00014	1	0B549	BAR14-1	BAR14-1 DUAL PIN DIODE
J	2	JRBM-10100	1	95077	SMB*M	SMB M PANEL MOUNT
J	101	JIB1-09215	1	30035	SS-109-1-09	9 PIN STRIPLINE SOCKET
J	102	JIB1-09215	1	30035	SS-109-1-09	9 PIN STRIPLINE SOCKET
J	112	JRBM-10100	1	95077	SMB*M	SMB M PANEL MOUNT
L	1	320911	1	58900	320911	CHOKE, 6 TURN
L	2	LAD0-04100	1	91637	IMS 5 .10 UH 10%	.10UH INDUCTOR
L	3	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	4	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	5	LCR0-13800	1	3W023	56-590-65-4B	FERRITE TUBE CORE
L	10	LCR0-13800	1	3W023	56-590-65-4B	FERRITE TUBE CORE
L	11	LAD0-07150	1	72259	WEE 150 5%	150 UH INDUCTOR
L	17	LAD0-07220	1	72259	8450-224	220 UH INDUCTOR
L	18	320911	1	58900	320911	CHOKE, 6 TURN
L	19	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	20	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	21	320911	1	58900	320911	CHOKE, 6 TURN
L	23	320911	1	58900	320911	CHOKE, 6 TURN
L	29	320911	1	58900	320911	CHOKE, 6 TURN
L	30	320911	1	58900	320911	CHOKE, 6 TURN
L	31	320911	1	58900	320911	CHOKE, 6 TURN
L	32	320911	1	58900	320911	CHOKE, 6 TURN
L	34	320911	1	58900	320911	CHOKE, 6 TURN
L	40	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	41	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	42	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	43	LAD0-06100	1	72259	9250-103	10 UH INDUCTOR
L	44	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	49	704999	1	58900	704999	INDUCTOR ADJ 8.4MH
L	50	705004	1	58900	705004	INDUCTOR ADJ 11.1MH
L	54	LAD1-07270	1	72259	WEE 270 5%	270 UH INDUCTOR
L	56	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	57	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	58	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	59	738484	1	58900	738484	INDUCTOR, 125UH
L	62	LAD0-07470	1	72259	WD-IM-470UH	470 UH INDUCTOR
L	63	LCR0-13800	1	3W023	56-590-65-4B	FERRITE TUBE CORE
L	64	LCR0-13800	1	3W023	56-590-65-4B	FERRITE TUBE CORE
L	65	320911	1	58900	320911	CHOKE, 6 TURN
L	66	LAD0-04820	1	72259	WEE-.82	.82 UH INDUCTOR
L	67	LCR0-19000	1	0B549	DI-1855	FERRITE CORE
L	68	LCR0-19000	1	0B549	DI-1855	FERRITE CORE
L	70	LAB0-03470	1	99800	1026-08	.047 UH INDUCTOR
L	71	LAD0-04100	1	91637	IMS 5 .10 UH 10%	.10UH INDUCTOR
L	72	LAD0-04100	1	91637	IMS 5 .10 UH 10%	.10UH INDUCTOR
L	73	LAD0-06220	1	91637	9250-223	22 UH INDUCTOR
Q	1	URP0-78050	1	27014	MC78L05ACZ	MC78L05 .1A 5V REG
Q	2	QBPS-03906	1	56289	2N3906	2N3906 .2A 40V PNP
Q	3	QBNS-00096	1	04713	BFR-96	BFR 96 15V 4.5GHZ FT
Q	4	QBPS-05771	1	27014	ST5771-2	2N5771 15V 850MHZ PNP
Q	5	QBPS-05771	1	27014	ST5771-2	2N5771 15V 850MHZ PNP
Q	10	QJNS-02464	1	17856	21936	J2464 125OHM N CH JFET
Q	11	QJNS-02464	1	17856	21936	J2464 125OHM N CH JFET
Q	12	QJNS-02464	1	17856	21936	J2464 125OHM N CH JFET
Q	13	QMNS-00215	1	17856	SD215DE	SD215DE D-MOS FET
Q	14	QMNS-00215	1	17856	SD215DE	SD215DE D-MOS FET
Q	15	QBNS-03904	1	56289	2N3904	2N3904 .2A 40V NPN

812446 PCA, SYNTHESIZER (A4), Rev AS (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
Q	16	QBNS-00918	1	07263	FPN918	MPS918 50MA 15V NPN
Q	17	QBNS-00918	1	07263	FPN918	MPS918 50MA 15V NPN
Q	18	QBPS-04250	1	27014	PN4250	2N4250 40V 2DB NF PNP
Q	19	QBPS-04250	1	27014	PN4250	2N4250 40V 2DB NF PNP
Q	20	QBNS-00013	1	27014	MPSA-13-NAT	MPSA13 .3A 30V NPN
Q	21	QBNS-03904	1	56289	2N3904	2N3904 .2A 40V NPN
Q	22	QBPS-03906	1	56289	2N3906	2N3906 .2A 40V PNP
Q	23	QBNS-03904	1	56289	2N3904	2N3904 .2A 40V NPN
Q	26	QBNS-06520	1	27014	MPS6522	MPS6520 .1A 25V NPN
Q	27	QBNS-06520	1	27014	MPS6522	MPS6520 .1A 25V NPN
Q	28	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	32	QBNS-02135	1	4T165	NE02135D	NE02135D 70MA 12V 4.5GHZ
Q	33	QBNS-00091	1	34553	BFR-91-AMP	BFR91 12V 5GHZ NPN
Q	35	QBNS-02135	1	4T165	NE02135D	NE02135D 70MA 12V 4.5GHZ
Q	37	QBNS-00091	1	34553	BFR-91-AMP	BFR91 12V 5GHZ NPN
Q	38	QBNS-06520	1	27014	MPS6522	MPS6520 .1A 25V NPN
Q	39	QJNS-00310	1	17856	SNJ7227 (FLUKE# 403634)	J310 16DB 1.5NF RF FET
Q	40	QJNS-00310	1	17856	SNJ7227 (FLUKE# 403634)	J310 16DB 1.5NF RF FET
Q	41	QBPS-05771	1	27014	ST5771-2	2N5771 15V 850MHZ PNP
Q	42	QBPS-05771	1	27014	ST5771-2	2N5771 15V 850MHZ PNP
R	1	RC20-00680	1	01121	RC20GF680J	68 OHMS 5% 1/2W CARBON
R	2	RF07-00005	1	65970	CF1/4 R51 J	0.5 OHMS 5% CARB FILM
R	3	RN50-00511	1	91637	RNC50H51R1FS	51.1 OHMS 1% METAL FILM
R	5	RK05-00150	1	91637	CRCW1206-150JB02	15.0 OHM 5% FILM SMT
R	6	RK05-03900	1	91637	CRCW1206-391JB02	390 OHM 5% FILM SMT
R	7	RK05-03900	1	91637	CRCW1206-391JB02	390 OHM 5% FILM SMT
R	9	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R	10	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	11	RN55-13320	1	3W023	RN55C3321F	3.32 K OHMS 1% MET FILM
R	12	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	13	RC20-02700	1	01121	RC20GF271J	270 OHM 5% 1/2W CARBON
R	14	RK05-00150	1	91637	CRCW1206-150JB02	15.0 OHM 5% FILM SMT
R	15	RK05-00150	1	91637	CRCW1206-150JB02	15.0 OHM 5% FILM SMT
R	20	RF50-00475	1	91637	CCF50-47.5^1%T1T/R	47.5 OHMS 1% MET FILM
R	21	RN50-00150	1	81349	RNC50H15R0FS	15.0 OHMS 1% MET FILM
R	22	RN50-00150	1	81349	RNC50H15R0FS	15.0 OHMS 1% MET FILM
R	23	RN55-00562	1	19701	RN55C56R2F	56.2 OHMS 1% MET FILM
R	24	RN55-00562	1	19701	RN55C56R2F	56.2 OHMS 1% MET FILM
R	25	RF50-00511	1	91637	CCF50-51.1^1%T1T/R	51.1 OHMS 1% MET FILM
R	26	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R	27	RN55-21820	1	91637	RN55C1822F	18.2 K OHMS 1% MET FILM
R	28	RN55-21070	1	91637	RN55C1072F	10.7 K OHMS 1% MET FILM
R	29	RN55-21130	1	91637	RN55C1132F	11.3 K OHMS 1% MET FILM
R	30	RN55-22870	1	91637	RN55C2872F	28.7 K OHMS 1% MET FILM
R	31	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R	32	RF50-00511	1	91637	CCF50-51.1^1%T1T/R	51.1 OHMS 1% MET FILM
R	33	RN55-00511	1	07115	RN55C51R1F	51.1 OHMS 1% MET FILM
R	39	RN55-02000	1	81349	RNC55H2000FP	200 OHMS 1% MET FILM
R	40	RN55-00562	1	19701	RN55C56R2F	56.2 OHMS 1% MET FILM
R	41	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	42	RN55-01820	1	91637	RN55C1820F	182 OHMS 1% MET FILM
R	43	RN55-00909	1	81349	RNC55H90R9FM	90.9 OHMS 1% MET FILM
R	44	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	45	RN50-00511	1	91637	RNC50H51R1FS	51.1 OHMS 1% METAL FILM
R	46	RF50-05110	1	91637	CCF-505110F	511 OHMS 1% MET FILM
R	48	RN55-02210	1	3W023	RN55C2210F	221 OHMS 1% MET FILM
R	49	RF50-00392	1	91637	CCF50-39R2^1%T1T/R	39.2 OHMS 1% MET FILM
R	50	RF50-00825	1	91637	CCF50-82.5^1%T1T/R	82.5 OHMS 1% MET FILM
R	51	RF50-01300	1	91637	CCF-501300F	130 OHMS 1% MET FILM
R	55	RN55-12740	1	91637	RN55C2741F	2.74K OHMS 1% MET FILM
R	56	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	57	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	58	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM

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Item		Part Number	Qty	Cage	Mfr's Part Number	Description
R	65	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R	66	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	67	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	68	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	69	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	72	RN55-25110	1	91637	RN55C5112F	51.1 K OHMS 1% MET FILM
R	73	RN55-13320	1	3W023	RN55C3321F	3.32 K OHMS 1% MET FILM
R	74	RN55-11500	1	3W023	RN55C1501F	1.5 K OHMS 1% MET FILM
R	75	RN55-14220	1	81349	RNC55H4221FM	4.22K OHMS 1% MET FILM
R	76	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	77	RN57-29000	1	91637	CMF609002FT1	90K OHMS .1% MET FILM
R	78	RN57-19000	1	91637	CMF609001FT1	9K OHMS .1% MET FILM
R	79	RN57-11000	1	91637	CMF55C1001B	1K OHM .1% MET FILM
R	80	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R	81	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	82	RAPA-15003	1	32977	3386R-1-502	5K OHM POT 1T PC MOUNT
R	83	RN55-27500	1	19701	RN55C7502F	75.0 K OHMS 1% MET FILM
R	84	RN55-16490	1	81349	RNC55H6491FM	6.49K OHMS 1% MET FILM
R	85	RN55-16040	1	81349	RNC55H6041FM	6.04K OHMS 1% MET FILM
R	86	RN55-32000	1	91637	RN55C2003F	200 K OHMS 1% MET FILM
R	87	RAPA-15003	1	32977	3386R-1-502	5K OHM POT 1T PC MOUNT
R	88	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R	89	RN55-15110	1	91637	RN55C5111F	5.11 K OHMS; METAL FILM
R	90	RAPA-11000	1	32977	3386R-1-102	1K OHM POT 1T PC MOUNT
R	91	RN55-13830	1	81349	RNC55H3831FM	3.83K OHMS 1% MET FILM
R	92	RN55-04990	1	19701	RN55C4990F	499 OHMS 1% MET FILM
R	93	RN55-04990	1	19701	RN55C4990F	499 OHMS 1% MET FILM
R	94	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	95	RN55-19090	1	91637	RN55C9091F	9.09 K OHMS 1% MET FILM
R	96	RN55-08250	1	91637	RN55C8250F	825 OHMS 1% MET FILM
R	97	RN55-16810	1	91637	RN55C6811F	6.81 K OHMS 1% MET FILM
R	98	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R	99	RN55-11500	1	3W023	RN55C1501F	1.5 K OHMS 1% MET FILM
R	100	RN55-11500	1	3W023	RN55C1501F	1.5 K OHMS 1% MET FILM
R	101	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R	102	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	103	RN55-11500	1	3W023	RN55C1501F	1.5 K OHMS 1% MET FILM
R	104	RAPA-22000	1	32977	3386R-1-203	20K OHM POT 1T PC MOUNT
R	105	RUC0-21000	1	59124	CF1/4 103JVT	10K OHM 5% CARBON FILM
R	106	RUC0-04700	1	59124	CF1/4 471JVT	470 OHM 5% CARBON FILM
R	107	RN55-13480	1	81349	RNC55H3481FM	3.48K OHMS 1% MET FILM
R	108	RN55-11270	1	81349	RNC55H1271FM	1.27K OHMS 1% MET FILM
R	109	RC20-05100	1	01121	RC20GF511J	510 OHM 5% 1/2W CARBON
R	110	RN55-00365	1	81349	RNC55H36R5FP	36.5 OHMS 1% MET FILM
R	111	RC20-05100	1	01121	RC20GF511J	510 OHM 5% 1/2W CARBON
R	112	RN55-00365	1	81349	RNC55H36R5FP	36.5 OHMS 1% MET FILM
R	113	RN55-04990	1	19701	RN55C4990F	499 OHMS 1% MET FILM
R	114	RN55-04990	1	19701	RN55C4990F	499 OHMS 1% MET FILM
R	115	RN55-04990	1	19701	RN55C4990F	499 OHMS 1% MET FILM
R	116	RN55-11270	1	81349	RNC55H1271FM	1.27K OHMS 1% MET FILM
R	117	RN55-02210	1	3W023	RN55C2210F	221 OHMS 1% MET FILM
R	118	RN55-02210	1	3W023	RN55C2210F	221 OHMS 1% MET FILM
R	119	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	120	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	121	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R	122	RN55-18250	1	91637	RN55C8251F	8.25 K OHMS 1% MET FILM
R	123	RN55-23320	1	91637	RN55C3322F	33.2 K OHMS 1% MET FILM
R	124	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	125	RAPA-15005	1	32977	3329H-1-502	5K OHM POT 1T PC MOUNT
R	127	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	129	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	133	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	134	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM

812446 PCA, SYNTHESIZER (A4), Rev AS (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
R	135	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	136	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	137	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	138	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	139	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	145	RF50-03010	1	91637	CCF-503010F	301 OHMS 1% MET FILM
R	146	RF50-00182	1	91637	CCF50-18.2^1%T1T/R	18.2 OHMS 1% MET FILM
R	147	RF50-00475	1	91637	CCF50-47.5^1%T1T/R	47.5 OHMS 1% MET FILM
R	148	RF50-21000	1	91637	CCF-501002F	10K OHMS 1% MET FILM
R	149	RN50-03320	1	91637	RNC50J3320FS	332 OHMS 1% METAL FILM
R	150	RN50-11210	1	81349	RNC50K1211FS	1.21 K OHMS 1% MET FILM
R	151	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	152	RN55-04750	1	91637	RN55C4750F	475 OHMS 1% MET FILM
R	153	RF50-21000	1	91637	CCF-501002F	10K OHMS 1% MET FILM
R	154	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	159	RF07-00005	1	65970	CF1/4 R51 J	0.5 OHMS 5% CARB FILM
R	160	RN55-07500	1	81349	RNC55H7500FM	750 OHMS 1% MET FILM
R	161	RN55-00511	1	07115	RN55C51R1F	51.1 OHMS 1% MET FILM
R	162	RF50-21000	1	91637	CCF-501002F	10K OHMS 1% MET FILM
R	163	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	164	RN55-03010	1	91637	RN55C3010F	301 OHMS 1% MET FILM
R	165	RF50-05110	1	91637	CCF-505110F	511 OHMS 1% MET FILM
R	167	RF50-05110	1	91637	CCF-505110F	511 OHMS 1% MET FILM
R	169	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	170	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	171	RF50-05110	1	91637	CCF-505110F	511 OHMS 1% MET FILM
R	172	RF50-05110	1	91637	CCF-505110F	511 OHMS 1% MET FILM
R	177	RF50-05110	1	91637	CCF-505110F	511 OHMS 1% MET FILM
R	178	RF07-00056	1	65970	R25X-R02-J-5R6	5.6 OHMS 5% CARB FILM
R	179	RF07-00056	1	65970	R25X-R02-J-5R6	5.6 OHMS 5% CARB FILM
R	180	RN55-01780	1	81349	RNC55H1780FM	178 OHMS 1% MET FILM
R	181	RN55-11050	1	81349	RNC55H1051FM	1.05K OHMS 1% MET FILM
R	182	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	183	RN55-13240	1	81349	RNC55H3241FM	3.24K OHMS 1% MET FILM
R	184	RF50-01820	1	91637	CCF-501820F	182 OHMS 1% MET FILM
R	185	RN55-02490	1	81349	RNC55H2490FM	249 OHMS 1% MET FILM
R	186	RF50-00475	1	91637	CCF50-47.5^1%T1T/R	47.5 OHMS 1% MET FILM
R	187	RF50-01210	1	91637	CCF-501210F	121 OHMS 1% MET FILM
R	188	RF50-00121	1	91637	CCF50-12.1^1%T1T/R	12.1 OHMS 1% MET FILM
R	189	RF50-01210	1	91637	CCF-501210F	121 OHMS 1% MET FILM
R	190	RF07-00051	1	65970	R25X-R02-J-5R1	5.1 OHMS 5% CARB FILM
R	191	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	192	RN55-01780	1	81349	RNC55H1780FM	178 OHMS 1% MET FILM
R	193	RN55-11050	1	81349	RNC55H1051FM	1.05K OHMS 1% MET FILM
R	194	RN55-13240	1	81349	RNC55H3241FM	3.24K OHMS 1% MET FILM
R	195	RF50-01820	1	91637	CCF-501820F	182 OHMS 1% MET FILM
R	196	RF50-00121	1	91637	CCF50-12.1^1%T1T/R	12.1 OHMS 1% MET FILM
R	197	RF50-01820	1	91637	CCF-501820F	182 OHMS 1% MET FILM
R	198	RF50-00301	1	91637	CCF50-30.1^1%T1T/R	30.1 OHMS 1% MET FILM
R	199	RN55-02490	1	81349	RNC55H2490FM	249 OHMS 1% MET FILM
R	200	RF50-01820	1	91637	CCF-501820F	182 OHMS 1% MET FILM
R	201	RF07-00005	1	65970	CF1/4 R51 J	0.5 OHMS 5% CARB FILM
R	209	RF07-00005	1	65970	CF1/4 R51 J	0.5 OHMS 5% CARB FILM
R	210	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	211	RF50-05110	1	91637	CCF-505110F	511 OHMS 1% MET FILM
R	212	RF50-01000	1	91637	CCF-501000F	100 OHMS 1% MET FILM
R	213	RF50-02000	1	91637	CCF-502000F	200 OHMS 1% MET FILM
R	214	RF50-02000	1	91637	CCF-502000F	200 OHMS 1% MET FILM
R	217	RN50-03320	1	91637	RNC50J3320FS	332 OHMS 1% METAL FILM
R	218	RF50-00475	1	91637	CCF50-47.5^1%T1T/R	47.5 OHMS 1% MET FILM
R	219	RF50-00475	1	91637	CCF50-47.5^1%T1T/R	47.5 OHMS 1% MET FILM
R	220	RN50-02740	1	81349	RNC50K2740FS	274 OHMS 1% METAL FILM
R	221	RN55-21500	1	91637	RN55C1502F	15 K OHMS 1% MET FILM

812446 PCA, SYNTHESIZER (A4), Rev AS (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
R	222	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	223	RN55-16040	1	81349	RNC55H6041FM	6.04K OHMS 1% MET FILM
R	224	RN55-21500	1	91637	RN55C1502F	15 K OHMS 1% MET FILM
R	225	RF50-21000	1	91637	CCF-501002F	10K OHMS 1% MET FILM
R	226	RF50-21000	1	91637	CCF-501002F	10K OHMS 1% MET FILM
R	227	RN55-31000	1	19701	RN55C1003F	100 K OHMS 1% MET FILM
R	228	RN55-00562	1	19701	RN55C56R2F	56.2 OHMS 1% MET FILM
R	229	RN55-19090	1	91637	RN55C9091F	9.09 K OHMS 1% MET FILM
R	230	RAPA-12001	1	32977	3329H-1-202	2K OHM POT 1T PC MOUNT
R	231	RN55-14020	1	81349	MF55C4021FL	4.02K OHMS 1% MET FILM
R	232	RN55-11300	1	91637	RN55C1301F	1.3 K OHMS 1% MET FILM
R	233	RF50-06810	1	91637	CCF50-6810F	681 OHMS 1% MET FILM
R	234	RN55-21500	1	91637	RN55C1502F	15 K OHMS 1% MET FILM
R	235	RN55-41000	1	19701	RN55C1004F	1 M OHMS 1% MET FILM
R	236	RN50-05620	1	81349	RNC50K5620FS	562 OHMS 1% METAL FILM
R	237	RN50-01000	1	81349	RNC50K1000FS	100 OHMS 1% METAL FILM
R	238	RN50-03920	1	81349	RNC50K3920FS	392 OHMS 1% METAL FILM
R	239	RN50-03920	1	81349	RNC50K3920FS	392 OHMS 1% METAL FILM
R	240	RN50-03320	1	91637	RNC50J3320FS	332 OHMS 1% METAL FILM
R	241	RF50-00301	1	91637	CCF50-30.1^1%T1T/R	30.1 OHMS 1% MET FILM
R	242	RF50-02000	1	91637	CCF-502000F	200 OHMS 1% MET FILM
R	250	RF07-00005	1	65970	CF1/4 R51 J	0.5 OHMS 5% CARB FILM
U	1	UIN0-00581	1	4T165	UPB581C	UPB581C DIVIDE BY 2
U	2	MA18-10001	1	4T165	UPC1688G	.02-.9GHZ +2DBM AMP SMT
U	3	MA10-10002	1	4T165	UPC1675G	.1-1.9GHZ AMP SMT
U	6	704965	1	58900	704965	3DB COUPLER
U	7	MMDB-00001	1	63155	S-1-03	1-500MHZ 500MHZ IF MIX
U	8	MMDB-00001	1	63155	S-1-03	1-500MHZ 500MHZ IF MIX
U	9	UAG0-01654	1	4T165	UPC1654A	UP1654A UHF/VHF AMP
U	10	UON0-00084	1	04713	LF347N-MOT	TL084CN OP AMP
U	15	UTN0-01967	1	27014	74S196N	74S196N DIV BY 2/5
U	16	UTN0-03901	1	04713	74LS390N	SN74LS390N DUAL COUNTER
U	17	30223	1	58900	30223	N DIVIDER GATE ARRAY PCA
U	18	UEN1-10131	1	04713	MC10H131P	MC10H131P DUAL D F/F
U	19	UEN1-10102	1	04713	MC10H102PC	MC10H102 QUAD NOR GATES
U	20	UIL0-01190	1	52648	SP8680B/DG	SP8680B PRESCALER
U	26	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	27	UIN0-07533	1	24335	AD7533LN	AD7533LN 10 BIT DAC
U	28	UON0-00072	1	01245	TL072CP	TL072CP DUAL FET OP AMP
U	29	UIN0-07533	1	24335	AD7533LN	AD7533LN 10 BIT DAC
U	30	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	31	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	32	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	33	30219	1	58900	30219	SUB SYNTH GATE ARRAY PCA
U	34	UTN0-00008	1	18324	N74F00N	74F00PC 2-IN NAND
U	35	UTN0-00744	1	04713	MC74F74N	MC74F7AN 100MHZ DUAL D
U	37	UTN0-01381	1	27014	DM74LS138N	SN74LS138N 3 TO 8 DEC
U	38	UTN0-02441	1	04713	74LS244N	SNL4LS244N 8X DRIV/RECV
U	41	UON0-00074	1	01245	TL074CN	TL074CN QUAD FET OP AMP
U	42	ULN0-00339	1	17856	SG339N	LM339N COMPARATOR
U	43	UTN0-00747	1	27014	DM74S74N	74S74 D-FLIP FLOPS
U	44	UTN0-00747	1	27014	DM74S74N	74S74 D-FLIP FLOPS
U	45	UTN0-00007	1	27014	DM74S00N	74S00 2 IN NAND
U	46	ULN0-03096	1	02735	CA3096E	CA3096E 5 TRANS ARRAY
U	47	UTN0-01221	1	01245	SN74LS122N	74LS122N MONOSTABLE MULT
U	48	UON0-00356	1	04713	LF356BN-MOT	LF356BN OP AMP
U	49	UON0-00358	1	18324	LM358/CR999N	LM358 OP AMP
U	50	UIN0-00006	1	0B549	ILCT-6	ILCT-6 DUAL OPTOISOLATOR
U	54	UTN0-00007	1	27014	DM74S00N	74S00 2 IN NAND
U	55	UTN0-00047	1	27014	DM74S04N	74S04N HEX INVERTER
U	58	UTN0-01967	1	27014	74S196N	74S196N DIV BY 2/5
U	59	UTN0-00747	1	27014	DM74S74N	74S74 D-FLIP FLOPS
U	60	UON0-00356	1	04713	LF356BN-MOT	LF356BN OP AMP

812446 PCA, SYNTHESIZER (A4), Rev AS (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
U	61	ULN0-03199	1	02735	CA3199E	CA3199E DIVV BY 4 1.3 GH
U	62	UEN1-10131	1	04713	MC10H131P	MC10H131P DUAL D F/F
U	63	UEN1-10131	1	04713	MC10H131P	MC10H131P DUAL D F/F
U	64	UEN0-10105	1	04713	MC10105P	MC10105P TRIPLE OR/NOR
U	65	UTN0-00007	1	27014	DM74S00N	74S00 2 IN NAND
U	66	UTN0-00744	1	04713	MC74F74N	MC74F7AN 100MHZ DUAL D
U	67	ULN0-00361	1	27014	LM361N	LM361N COMPARATOR
U	68	UTN0-00747	1	27014	DM74S74N	74S74 D-FLIP FLOPS
U	69	UON0-00356	1	04713	LF356BN-MOT	LF356BN OP AMP
U	70	ULN0-00301	1	17856	DG301ACJ	DG301ACJ SPDT SWITCH
U	71	UTN0-01221	1	01245	SN74LS122N	74LS122N MONOSTABLE MULT
W	1	716985	1	58900	716985	CABLE ASSY, RF JUMPER
W	2	716985	1	58900	716985	CABLE ASSY, RF JUMPER
W	3	WMT0-2670X	0	58900	WMT0-2670X	#26 TWISTED PAIR
W	4	WSIB-2295X	0	58900	WSIB-2295X	22 GA PVC COLOR 95
X	48	JSP0-10008	1	09922	DIL08P-108T	8 PIN DIP SOCKET
X	50	JSP0-10008	1	09922	DIL08P-108T	8 PIN DIP SOCKET
Y	1	Y350-01000	1	71034	BK3-1B(10MHZ)	10MHZ FUND XTAL
Z	1	RM8D-21001	1	73188	898-3-R10KF	10K OHM X 8 DIP NETWORK
Z	5	RM9S-05100	1	32977	4610X-101-511	510 OHM X 9 SIP NETWRK
Z	6	RM5S-31000	1	32977	4606X-101-104	100K OHMS X 5 SIP NETWK
Z	9	RM8D-11000	1	32977	4116R-001-102	1K OHM X 8 DIP NETWRK
Z	10	RM5S-05100	1	32977	4606X-101-511	510 OHMS X 5 SIP NETWK

797837 PCA, VCO (A5), Rev P

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	1	794966	1	58900	794966	PWB, VCO
	0	6061A-1016	REF	58900	6061A-1016	606x VCO SCHEMATIC
C	1	CC50-B2180	1	31433	C322C182J1G5CA	1800PF CERAMIC COG
C	2	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	3	CK50-00018	1	72982	ATC100A1R8BP150X	1.8PF CHIP CAPACITOR
C	4	CK50-00018	1	72982	ATC100A1R8BP150X	1.8PF CHIP CAPACITOR
C	5	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	6	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	7	CK50-00018	1	72982	ATC100A1R8BP150X	1.8PF CHIP CAPACITOR
C	8	CK50-00036	1	72982	ATC100A3R6BP150X	3.6PF CHIP CAPACITOR
C	9	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	10	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	11	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	13	CK50-X0047	1	72982	GRH708COG4R7C200AL	4.7PF COG CHIP CERAMIC
C	14	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	15	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	16	CK50-00033	1	72982	GRH708COG3R3D200AL	3.3PF COG CHIP CERAMIC
C	17	CK50-X0018	1	72982	GRH708C0G1R8C200VP	1.8PF COG CHIP CERAMIC
C	18	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	19	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	21	CK50-00100	1	95275	VJ0805A100JXAMB	10 PF NPO CHIP
C	22	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	23	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	24	CK50-X0027	1	72982	GRH708G2R7C200AL	2.7PF COG CHIP CERAMIC
C	25	CK50-X0047	1	72982	GRH708COG4R7C200AL	4.7PF COG CHIP CERAMIC
C	26	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	27	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	28	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	29	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	31	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	32	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	33	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	34	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	35	CE16-R7470	1	55680	UVX1C471MPA	470 UF 16V RADIAL LEAD
C	36	CE16-R7470	1	55680	UVX1C471MPA	470 UF 16V RADIAL LEAD
C	37	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	38	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	39	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	40	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
CR	1	DVA0-00515	1	3W023	BB515 E7908TR	BB515 2-18PF DIODE
CR	2	DVA0-00515	1	3W023	BB515 E7908TR	BB515 2-18PF DIODE
CR	3	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	4	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	6	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	7	DAA0-04241	1	26840	MP5X5424	QPND-4241 PIN DIODE
CR	8	DAA0-00483	1	3W023	BA483	BA483 PIN DIODE
CR	9	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	10	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	11	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	13	DAA0-04241	1	26840	MP5X5424	QPND-4241 PIN DIODE
J	201	JIB0-01288	1	2M631	50871-1	FEMALE PIN CONNECTOR
J	202	JIB0-01288	1	2M631	50871-1	FEMALE PIN CONNECTOR
J	203	JIB0-01011	1	0JNR4	75060-012	FEMALE PIN CONNECTOR
J	205	JIB0-01288	1	2M631	50871-1	FEMALE PIN CONNECTOR
L	1	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	2	LSA0-04180	1	0KA21	1008G181KTE	.18 UH INDUCTOR SMT
L	3	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	4	LSA0-04180	1	0KA21	1008G181KTE	.18 UH INDUCTOR SMT
L	5	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	6	LSA0-04180	1	0KA21	1008G181KTE	.18 UH INDUCTOR SMT
L	7	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	8	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
P	204	698472	1	58900	698472	PIN TEST BASE

797837 PCA, VCO (A5), Rev P (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
Q	1	QBNS-21935	1	4T165	NE21935D	NE21935 80MA 10V 8GHZ
Q	2	QBNS-02135	1	4T165	NE02135D	NE02135D 70MA 12V 4.5GHZ
R	1	RK05-11200	1	91637	CRCW1206-122JB02	1.2K OHM 5% FILM SMT
R	2	RK05-11000	1	91637	CRCW1206-102JB02	1K OHM 5% FILM SMT
R	3	RK05-12000	1	91637	CRCW1206-202JB02	2K OHM 5% FILM SMT
R	4	RK05-12000	1	91637	CRCW1206-202JB02	2K OHM 5% FILM SMT
R	5	RF50-02000	1	91637	CCF-502000F	200 OHMS 1% MET FILM
R	6	RF50-04640	1	91637	CCF-504640F	464 OHMS 1% MET FILM
R	7	RF50-03010	1	91637	CCF-503010F	301 OHMS 1% MET FILM
R	8	RK05-00820	1	91637	CRCW1206-820JB02	82.0 OHM 5% FILM SMT
R	9	RK05-00910	1	91637	CRCW1206-910JB02	91.0 OHM 5% FILM SMT
R	10	RK05-00820	1	91637	CRCW1206-820JB02	82.0 OHM 5% FILM SMT
R	11	RF50-02000	1	91637	CCF-502000F	200 OHMS 1% MET FILM
R	12	RF50-06810	1	91637	CCF50-6810F	681 OHMS 1% MET FILM
R	13	RF50-03010	1	91637	CCF-503010F	301 OHMS 1% MET FILM
R	14	RK05-00820	1	91637	CRCW1206-820JB02	82.0 OHM 5% FILM SMT
R	15	RK05-00910	1	91637	CRCW1206-910JB02	91.0 OHM 5% FILM SMT
R	16	RK05-00820	1	91637	CRCW1206-820JB02	82.0 OHM 5% FILM SMT
R	17	RK05-12000	1	91637	CRCW1206-202JB02	2K OHM 5% FILM SMT
R	18	RK05-03900	1	91637	CRCW1206-391JB02	390 OHM 5% FILM SMT
R	19	RK05-00470	1	91637	CRCW1206-470JB02	47.0 OHM 5% FILM SMT
R	20	RK05-01200	1	91637	CRCW1206-121JB02	120 OHM 5% FILM SMT
R	21	RN55-02430	1	19701	RN55C2430F	243 OHMS 1% MET FILM
R	22	RN55-00909	1	81349	RNC55H90R9FM	90.9 OHMS 1% MET FILM
R	23	RK05-01800	1	91637	CRCW1206-181JB02	180 OHM 5% FILM SMT
R	24	RK05-00680	1	59124	RM73B-2B	68 OHM 5% FILM SMT
R	25	RN55-02430	1	19701	RN55C2430F	243 OHMS 1% MET FILM
R	26	RN55-00475	1	3W023	RN55C47R5F	47.5 OHMS 1% MET FILM
R	27	RN55-02430	1	19701	RN55C2430F	243 OHMS 1% MET FILM
R	28	RN55-00200	1	81349	RNC55H20R0FM	20.0 OHMS 1% MET FILM
R	29	RN55-00200	1	81349	RNC55H20R0FM	20.0 OHMS 1% MET FILM
R	30	RF50-21000	1	91637	CCF-501002F	10K OHMS 1% MET FILM
R	31	RF50-06810	1	91637	CCF50-6810F	681 OHMS 1% MET FILM
R	32	RK05-03300	1	91637	CRCW1206-331JB02	330 OHM 5% FILM SMT
R	33	RN55-00562	1	19701	RN55C56R2F	56.2 OHMS 1% MET FILM
R	34	RN55-00562	1	19701	RN55C56R2F	56.2 OHMS 1% MET FILM
R	35	RK05-03300	1	91637	CRCW1206-331JB02	330 OHM 5% FILM SMT
R	36	RK05-11200	1	91637	CRCW1206-122JB02	1.2K OHM 5% FILM SMT
U	1	MA12-00002	1	24539	MSA-0385	0-2.5GHZ +10DBM AMP
U	2	MA12-00002	1	24539	MSA-0385	0-2.5GHZ +10DBM AMP
U	3	MA12-00002	1	24539	MSA-0385	0-2.5GHZ +10DBM AMP
U	4	UON0-00072	1	01245	TL072CP	TL072CP DUAL FET OP AMP
W	1	798207	1	58900	798207	CABLE ASSY, VCO

797860 PCA, OUTPUT CONTROL (A6), Rev AN

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	1	794990	1	58900	794990	PWB, OUTPUT CONTROL
	2	GF00-00001	1	58900	GF00-00001	CONDUCTIVE FOAM
	0	6062A-1026	REF	58900	6062A-1026	6062 OUTPUT CONTROL SCH
	289	808543	1	58900	808543	CHOKE, TWO 3-TURN BEADS
	291	LCR0-13800	6	3W023	56-590-65-4B	FERRITE TUBE CORE
	300	JIA0-01280	6	79963	834	FASTON TAB TERMINAL
	301	HSTS-60204	1	55566	3045B632B14MOD=.	6-32 X 1/10 SWAGE SPACER
	302	JIA0-01165	20	2M631	87022-1	MALE PIN CONNECTOR
	304	JIA0-01284	15	2M631	1-87022-3	MALE PIN CONNECTOR
	308	698472	2	58900	698472	PIN TEST BASE
	312	JIB0-01288	19	2M631	50871-1	FEMALE PIN CONNECTOR
	314	JIB0-01257	14	2M631	50864-1	FEMALE PIN CONNECTOR
	319	HT00-00300	2	98159	2829-75-2	COMPONENT HOLDER
	321	774190	1	58900	774190	SHIELD, HET
	322	GGS0-00002	0	30187	97-520-08	GROUND STRIP
C	1	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	2	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	3	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	4	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	5	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	6	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	7	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	8	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	9	CC00-00100	1	04222	SR151A100GAT	10PF CERAMIC COG
C	10	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	11	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	13	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	14	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	15	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	16	CC00-00056	1	72982	RPE110COG5R6C100	5.6PF CERAMIC COG
C	17	CC00-00039	1	72982	RPE110COG3R9C100	3.9PF CERAMIC COG
C	18	CC00-00056	1	72982	RPE110COG5R6C100	5.6PF CERAMIC COG
C	19	CC00-00027	1	72982	RPE110COG2R7C100	2.7PF CERAMIC COG
C	20	CC00-00056	1	72982	RPE110COG5R6C100	5.6PF CERAMIC COG
C	21	CC00-00056	1	72982	RPE110COG5R6C100	5.6PF CERAMIC COG
C	22	CC00-00033	1	72982	RPE110COG3R3C100	3.3PF CERAMIC COG
C	23	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	24	CC00-00022	1	72982	RPE110COG2R2C100	2.2PF CERAMIC COG
C	25	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	26	CC00-00022	1	72982	RPE110COG2R2C100	2.2PF CERAMIC COG
C	27	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	28	CC00-00018	1	72982	RPE110COG1R8C100	1.8PF CERAMIC COG
C	29	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	31	CC00-00047	1	72982	RPE110COG4R7C100V	4.7PF CERAMIC COG
C	32	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	33	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	34	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	35	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	36	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	37	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	38	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	39	CK50-X0047	1	72982	GRH708COG4R7C200AL	4.7PF COG CHIP CERAMIC
C	41	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	43	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	44	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	46	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	47	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	49	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	50	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	51	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	52	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	53	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	54	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO

797860 PCA, OUTPUT CONTROL (A6), Rev AN (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
C	55	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	56	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	57	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	58	CT06-R7220	1	56289	199D227X06R3FE3	220UF 6V TANTALUM
C	59	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	60	CC00-00330	1	04222	SR151A330GAT	33PF CERAMIC COG
C	61	CT25-R6220	1	56289	199D226X0025DE2	22UF 25V TANTALUM
C	62	CC00-00330	1	04222	SR151A330GAT	33PF CERAMIC COG
C	63	CC00-00330	1	04222	SR151A330GAT	33PF CERAMIC COG
C	64	CC00-00470	1	31433	C315C470G2G5CA	47PF CERAMIC COG
C	65	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	66	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	67	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	68	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	69	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	70	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	71	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	72	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	73	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	74	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	75	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	76	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	77	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	78	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	79	CF50-02786	1	84411	JF98.0786UF;1%50V	.0786UF 50V POLYPROPYLEN
C	80	CF50-02786	1	84411	JF98.0786UF;1%50V	.0786UF 50V POLYPROPYLEN
C	81	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	82	CT35-R5220	1	56289	199D225X9035BE2	2.2UF 35V TANTALUM
C	83	CT25-R5470	1	56289	199D475X0025BE2	4.7UF 25V TANTALUM
C	84	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C	85	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C	86	CT35-R4470	1	31433	T368A474M035AS	.47UF 35V TANTALUM
C	87	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	88	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	89	CV00-10120	1	72982	TZ03R121FR174	10-120 PF VARIABLE
C	90	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	91	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	92	CT25-R6220	1	56289	199D226X0025DE2	22UF 25V TANTALUM
C	93	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	94	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	95	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	96	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	97	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	98	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	99	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	100	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	101	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	102	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	103	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	104	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	105	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	106	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	107	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	108	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	109	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	110	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	111	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	112	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	113	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	114	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	115	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	116	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	117	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER

797860 PCA, OUTPUT CONTROL (A6), Rev AN (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
C	118	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	119	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	120	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	121	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	122	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	123	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	124	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	125	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	126	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	127	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	128	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	129	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	130	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	131	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	133	CC00-00012	1	72982	RPE110COG1R2C100	1.2PF CERAMIC COG
C	134	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	135	CC00-00015	1	72982	RPE110COG1R5C100	1.5PF CERAMIC COG
C	136	CC00-00015	1	72982	RPE110COG1R5C100	1.5PF CERAMIC COG
C	137	CE35-R5470	1	0H1N5	CE04W1V4R7MD	4.7UF 35V RADIAL
C	138	CE35-R5470	1	0H1N5	CE04W1V4R7MD	4.7UF 35V RADIAL
C	139	CK51-02100	1	95275	VJ0805Y102KXBMT	1000PF X7R CHIP CERAMIC
C	140	CE16-R6220	1	62643	SRAC16VB22RM5X7C	22UF 16V RADIAL
C	141	CE35-R6150	1	0H1N5	CE04W1V150MD	15UF 35V RADIAL
C	142	CE16-R6220	1	62643	SRAC16VB22RM5X7C	22UF 16V RADIAL
C	143	CE35-R6150	1	0H1N5	CE04W1V150MD	15UF 35V RADIAL
C	144	CC50-03100	1	31433	C315C103K5R5CA C9248	.01 UF CERAMIC X7R
C	145	CC50-03100	1	31433	C315C103K5R5CA C9248	.01 UF CERAMIC X7R
C	146	CE35-R6150	1	0H1N5	CE04W1V150MD	15UF 35V RADIAL
C	147	CE35-R6150	1	0H1N5	CE04W1V150MD	15UF 35V RADIAL
C	148	CC50-03100	1	31433	C315C103K5R5CA C9248	.01 UF CERAMIC X7R
C	149	CK51-02100	1	95275	VJ0805Y102KXBMT	1000PF X7R CHIP CERAMIC
C	150	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	151	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	152	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	153	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	155	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	156	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	157	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	159	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	160	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	161	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	163	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	164	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	165	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	166	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	167	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	168	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	169	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	170	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	171	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	172	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	175	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	177	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	178	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	179	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	180	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	181	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	182	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	183	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	184	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	185	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	187	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	188	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER

797860 PCA, OUTPUT CONTROL (A6), Rev AN (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
C	189	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	190	CC00-00068	1	72982	RPE110COG6R8C100	6.8PF CERAMIC COG
C	191	CC00-00390	1	04222	SR151A390GAT	39PF CERAMIC COG
C	192	CC00-00270	1	04222	SR151A270GAT	27PF CERAMIC COG
C	193	CC00-00270	1	04222	SR151A270GAT	27PF CERAMIC COG
C	194	CC00-00082	1	72982	RPE110COG8R2C100	8.2PF CERAMIC COH
C	195	CC00-00047	1	72982	RPE110COG4R7C100V	4.7PF CERAMIC COG
C	196	CC00-00120	1	04222	SR151A120GAT	12PF CERAMIC COG
C	197	CC00-00100	1	04222	SR151A100GAT	10PF CERAMIC COG
C	198	CC00-00027	1	72982	RPE110COG2R7C100	2.7PF CERAMIC COG
C	199	CC00-00082	1	72982	RPE110COG8R2C100	8.2PF CERAMIC COH
C	200	CC00-00047	1	72982	RPE110COG4R7C100V	4.7PF CERAMIC COG
C	201	CC00-00047	1	72982	RPE110COG4R7C100V	4.7PF CERAMIC COG
C	202	CC00-00047	1	72982	RPE110COG4R7C100V	4.7PF CERAMIC COG
C	203	CC00-00047	1	72982	RPE110COG4R7C100V	4.7PF CERAMIC COG
C	204	CC00-00068	1	72982	RPE110COG6R8C100	6.8PF CERAMIC COG
C	205	CC00-00270	1	04222	SR151A270GAT	27PF CERAMIC COG
C	206	CC00-01100	1	04222	SR201A101GAT	100PF CERAMIC COG
C	207	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	208	CC00-00033	1	72982	RPE110COG3R3C100	3.3PF CERAMIC COG
C	209	CC00-00033	1	72982	RPE110COG3R3C100	3.3PF CERAMIC COG
C	210	CC00-00047	1	72982	RPE110COG4R7C100V	4.7PF CERAMIC COG
C	212	CF00-02150	1	90201	JF91.0015UF;2%;1	.0015UF 100V POLYSTYRENE
C	213	CC00-00330	1	04222	SR151A330GAT	33PF CERAMIC COG
C	214	CV00-10120	1	72982	TZ03R121FR174	10-120 PF VARIABLE
C	215	CF00-02150	1	90201	JF91.0015UF;2%;1	.0015UF 100V POLYSTYRENE
C	216	CC00-00330	1	04222	SR151A330GAT	33PF CERAMIC COG
C	217	CV00-10120	1	72982	TZ03R121FR174	10-120 PF VARIABLE
C	218	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C	219	CE25-R6470	1	61058	ECEA1EU470	47 UF 25V RADIAL LEAD
C	220	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	221	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	222	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	223	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	224	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	225	CT25-R6220	1	56289	199D226X0025DE2	22UF 25V TANTALUM
C	226	CK50-00120	1	95275	VJ0805Q120JXT	12PF COG CHIP CERAMIC
C	227	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	228	CK50-00120	1	95275	VJ0805Q120JXT	12PF COG CHIP CERAMIC
C	229	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	230	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	231	CC50-01100	1	31433	C315C101J2G5CA C9248	100 PF CERAMIC NPO
CR	1	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	2	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	3	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	4	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	5	DAA0-03379	1	26840	5082-3379	5082-3379 PIN DIODE
CR	6	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	7	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	8	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	9	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	10	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	12	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	13	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	14	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	15	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	16	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	17	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	18	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	19	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	20	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	21	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE
CR	22	DAA0-00523	1	96341	MA4P523	MA4P523 PIN DIODE

797860 PCA, OUTPUT CONTROL (A6), Rev AN (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
CR	23	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	26	TDMC-00030	1	96341	MA4E807	DIODE BRIDGE
CR	27	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	28	DAC0-07410	1	59365	A5X1053-S7	MPN7410 PIN DIODE
CR	29	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	30	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	31	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	32	DAC0-07410	1	59365	A5X1053-S7	MPN7410 PIN DIODE
CR	33	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	34	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	35	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	36	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	37	DAC0-07410	1	59365	A5X1053-S7	MPN7410 PIN DIODE
CR	38	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	39	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	40	DAC0-07410	1	59365	A5X1053-S7	MPN7410 PIN DIODE
CR	41	DAC0-07410	1	59365	A5X1053-S7	MPN7410 PIN DIODE
CR	42	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	43	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	44	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	45	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	46	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	47	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	48	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	49	DZAB-00751	1	27014	1N751A	1N751A 5.1V ZENER
CR	50	DRAE-00823	1	04713	1N823	1N823 6.3V REF DIODE
CR	51	DSA0-06264	1	26840	5082-2835	5082-6264 SCHOT DIODE
CR	52	DSA0-06264	1	26840	5082-2835	5082-6264 SCHOT DIODE
CR	53	DZAB-00749	1	27014	1N749A	1N749A 4.3V ZENER
CR	54	DZAB-00749	1	27014	1N749A	1N749A 4.3V ZENER
CR	55	DSA0-00916	1	27014	1N916B	1N916B G.P. DIODE
CR	56	DSA0-00916	1	27014	1N916B	1N916B G.P. DIODE
CR	57	DSA0-02800	1	26840	ND4974-7E	5082-2800 SCHOT DIODE
CR	58	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	59	DZAB-00751	1	27014	1N751A	1N751A 5.1V ZENER
CR	60	DZAB-00965	1	27014	1N965B	1N965B 15V ZENER
CR	61	DSA0-06264	1	26840	5082-2835	5082-6264 SCHOT DIODE
CR	62	DSA0-06264	1	26840	5082-2835	5082-6264 SCHOT DIODE
CR	64	DSA0-02800	1	26840	ND4974-7E	5082-2800 SCHOT DIODE
CR	65	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	66	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	67	DAC0-07484	1	59365	MPN-7484-E28	MPN 7484 PIN DIODE
CR	68	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	69	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	70	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
J	1	JRBM-00100	1	98291	B51-351-0000-220	SMB M PC MOUNT
J	2	JRBM-00100	1	98291	B51-351-0000-220	SMB M PC MOUNT
J	3	JRBM-00100	1	98291	B51-351-0000-220	SMB M PC MOUNT
J	4	JIA0-01165	3	2M631	87022-1	MALE PIN CONNECTOR
J	5	JIA0-01165	6	2M631	87022-1	MALE PIN CONNECTOR
J	6	JIA0-01165	6	2M631	87022-1	MALE PIN CONNECTOR
L	3	320911	1	58900	320911	CHOKE, 6 TURN
L	4	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	5	463448	1	58900	463448	INDUCTOR, 10 TURNS
L	6	463448	1	02113	463448	INDUCTOR, 10 TURNS
L	7	463448	1	58900	463448	INDUCTOR, 10 TURNS
L	8	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	9	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	10	LAD0-04680	1	24759	MR-0.68-10%	.68 UH INDUCTOR
L	11	463448	1	58900	463448	INDUCTOR, 10 TURNS
L	12	463448	1	58900	463448	INDUCTOR, 10 TURNS
L	13	LAD0-07390	1	72259	WEE-390	390 UH INDUCTOR
L	14	LAD0-07390	1	72259	WEE-390	390 UH INDUCTOR

797860 PCA, OUTPUT CONTROL (A6), Rev AN (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
L	15	LAD0-07220	1	72259	8450-224	220 UH INDUCTOR
L	18	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	19	808543	1	58900	808543	CHOKE, TWO 3-TURN BEADS
L	21	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	22	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	24	463448	1	58900	463448	INDUCTOR, 10 TURNS
L	25	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	26	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	27	463448	1	58900	463448	INDUCTOR, 10 TURNS
L	29	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	30	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	33	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	34	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	36	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	38	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	40	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	42	463448	1	58900	463448	INDUCTOR, 10 TURNS
L	43	463448	1	58900	463448	INDUCTOR, 10 TURNS
L	44	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	46	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	50	320911	1	58900	320911	CHOKE, 6 TURN
L	51	320911	1	58900	320911	CHOKE, 6 TURN
L	52	320911	1	58900	320911	CHOKE, 6 TURN
L	53	463448	1	58900	463448	INDUCTOR, 10 TURNS
L	54	463448	1	58900	463448	INDUCTOR, 10 TURNS
L	55	463448	1	58900	463448	INDUCTOR, 10 TURNS
MP	4	794933	1	58900	794933	PWB, QUAD BANDPASS FILTE
P	4	JIA1-04230	1	0JNR4	68000-104	4PIN STRIPLINE PLUG
Q	3	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	4	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	5	QBNS-06560	1	27014	MPS6560	MPS6560 .5A 25V NPN
Q	6	QBNS-06560	1	27014	MPS6560	MPS6560 .5A 25V NPN
Q	7	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	8	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	9	QBNS-06560	1	27014	MPS6560	MPS6560 .5A 25V NPN
Q	10	QBNS-06560	1	27014	MPS6560	MPS6560 .5A 25V NPN
Q	11	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	12	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	13	QBNS-06560	1	27014	MPS6560	MPS6560 .5A 25V NPN
Q	14	QBNS-06560	1	27014	MPS6560	MPS6560 .5A 25V NPN
Q	15	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	16	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	17	QBNS-06560	1	27014	MPS6560	MPS6560 .5A 25V NPN
Q	18	QBNS-06560	1	27014	MPS6560	MPS6560 .5A 25V NPN
Q	19	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	20	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	21	QBNS-06560	1	27014	MPS6560	MPS6560 .5A 25V NPN
Q	22	QJNS-02317	1	95077	IFC61578(SNJ132172)	J2317 30 OHM N CH JFET
Q	23	QJNS-02317	1	95077	IFC61578(SNJ132172)	J2317 30 OHM N CH JFET
Q	24	QJNS-02726	1	95077	F2726	F2726 165 OHM N CH JFET
Q	25	QBPS-03906	1	56289	2N3906	2N3906 .2A 40V PNP
Q	26	QBNS-03904	1	56289	2N3904	2N3904 .2A 40V NPN
Q	28	QBPS-04250	1	27014	PN4250	2N4250 40V 2DB NF PNP
Q	31	QBPS-03906	1	56289	2N3906	2N3906 .2A 40V PNP
Q	32	QBPS-03906	1	56289	2N3906	2N3906 .2A 40V PNP
Q	33	QBPS-03906	1	56289	2N3906	2N3906 .2A 40V PNP
Q	34	QBNS-00091	1	34553	BFR-91-AMP	BFR91 12V 5GHZ NPN
Q	35	QBNS-00096	1	04713	BFR-96	BFR 96 15V 4.5GHZ FT
Q	36	QBNS-00096	1	04713	BFR-96	BFR 96 15V 4.5GHZ FT
Q	37	QBNS-73435	1	4T165	NE73435	NE73435 50MA 14V 3GHZ
R	1	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	2	RN50-00221	1	91637	RNC50H22R1FS	22.1 OHM 1% METAL FILM
R	3	RN50-00511	1	91637	RNC50H51R1FS	51.1 OHMS 1% METAL FILM

797860 PCA, OUTPUT CONTROL (A6), Rev AN (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
R	4	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	5	RN50-01620	1	81349	RNC50K1620FS	162 OHMS 1% METAL FILM
R	6	RN50-00750	1	81349	RNC50K75R0FS	75.0 OHMS 1% MET FILM
R	7	RN50-00750	1	81349	RNC50K75R0FS	75.0 OHMS 1% MET FILM
R	8	RC20-04300	1	01121	RC20GF431J	430 OHM 5% 1/2W CARBON
R	9	RC20-03000	1	01121	RC20GF301J	300 OHM 5% 1/2W CARBON
R	10	RN55-00475	1	3W023	RN55C47R5F	47.5 OHMS 1% MET FILM
R	11	RN55-00475	1	3W023	RN55C47R5F	47.5 OHMS 1% MET FILM
R	12	RN55-00475	1	3W023	RN55C47R5F	47.5 OHMS 1% MET FILM
R	13	RN55-00475	1	3W023	RN55C47R5F	47.5 OHMS 1% MET FILM
R	14	RN55-00221	1	91637	RN55C22R1F	22.1 OHMS 1% MET FILM
R	15	RN55-00221	1	91637	RN55C22R1F	22.1 OHMS 1% MET FILM
R	16	RN55-00221	1	91637	RN55C22R1F	22.1 OHMS 1% MET FILM
R	17	RN55-00221	1	91637	RN55C22R1F	22.1 OHMS 1% MET FILM
R	19	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	20	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS.1% MET FILM
R	21	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	23	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	24	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	25	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	26	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	27	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	28	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	29	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	31	RN55-13010	1	91637	RN55C3011F	3.01 K OHMS 1% MET FILM
R	32	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	33	RN55-02870	1	91637	RN55C2870F	287 OHMS 1% MET FILM
R	34	RN55-03650	1	81349	RNC55H3650FM	365 OHMS 1% MET FILM
R	35	RC20-01500	1	01121	RC20GF151J	150 OHM 5% 1/2W CARBON
R	36	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	37	RN55-02870	1	91637	RN55C2870F	287 OHMS 1% MET FILM
R	38	RN65-02870	1	91637	CMF65-2870FT1	287 OHMS 1% MET FILM
R	39	RN65-03480	1	91637	CMF65-3480FT1	348 OHMS 1% MET FILM
R	40	RN65-03480	1	91637	CMF65-3480FT1	348 OHMS 1% MET FILM
R	41	RN55-18450	1	81349	RNC55H8451FM	8.45K OHMS 1% MET FILM
R	42	RN55-16650	1	81349	RNC55H6651FM	6.65K OHMS 1% MET FILM
R	43	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	44	RN55-02870	1	91637	RN55C2870F	287 OHMS 1% MET FILM
R	45	RC20-01500	1	01121	RC20GF151J	150 OHM 5% 1/2W CARBON
R	46	RAPA-21000	1	32977	3386R-1-103	10K OHM POT 1T PC MOUNT
R	47	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	48	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	49	RN55-11500	1	3W023	RN55C1501F	1.5 K OHMS 1% MET FILM
R	50	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	51	RN55-11500	1	3W023	RN55C1501F	1.5 K OHMS 1% MET FILM
R	52	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	53	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	54	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	55	RN65-03830	1	91637	CMF65-3830FT1	383 OHMS 1% MET FILM
R	56	RN55-12740	1	91637	RN55C2741F	2.74K OHMS 1% MET FILM
R	57	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	58	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	59	RN50-01000	1	81349	RNC50K1000FS	100 OHMS 1% METAL FILM
R	60	RN50-01000	1	81349	RNC50K1000FS	100 OHMS 1% METAL FILM
R	61	RN50-00681	1	81349	RNC50K68R1FS	68.1 OHMS 1% METAL FILM
R	62	RN50-01620	1	81349	RNC50K1620FS	162 OHMS 1% METAL FILM
R	63	RAPA-01000	1	32977	3386R-1-101	100 OHM POT 1T PC MOUNT
R	64	RN50-00332	1	81349	RNC50K33R2FS	33.2 OHMS 1% METAL FILM
R	65	RN50-01620	1	81349	RNC50K1620FS	162 OHMS 1% METAL FILM
R	66	RN50-00681	1	81349	RNC50K68R1FS	68.1 OHMS 1% METAL FILM
R	67	RN50-11000	1	91637	RNC50H1001F	1.00 K OHMS 1% MET FILM
R	69	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	70	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM

797860 PCA, OUTPUT CONTROL (A6), Rev AN (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
R	71	RN55-02740	1	91637	RN55C2740F	274 OHMS 1% MET FILM
R	72	RN55-06190	1	81349	RNC55H6190FM	619 OHMS 1% MET FILM
R	73	RN55-18450	1	81349	RNC55H8451FM	8.45K OHMS 1% MET FILM
R	75	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	76	RN55-13400	1	81349	RNC55H3401FM	3.4K OHMS 1% MET FILM
R	77	RN55-21820	1	91637	RN55C1822F	18.2 K OHMS 1% MET FILM
R	78	RN55-11400	1	81349	RNC55H1401FM	1.4K OHMS 1% MET FILM
R	80	RN55-08870	1	81349	RNC55H8870FM	887 OHMS 1% MET FILM
R	82	RAPA-05000	1	32977	3386R-1-501	500 OHM POT 1T PC MOUNT
R	83	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R	84	RN55-00475	1	3W023	RN55C47R5F	47.5 OHMS 1% MET FILM
R	85	RN55-25620	1	91637	RN55C5622F	56.2 K OHMS 1% MET FILM
R	86	RAPA-21000	1	32977	3386R-1-103	10K OHM POT 1T PC MOUNT
R	87	RN55-41000	1	19701	RN55C1004F	1 M OHMS 1% MET FILM
R	88	RN55-00715	1	81349	RNC55H71R5FM	71.5 OHMS 1% MET FILM
R	89	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R	90	RN55-13320	1	3W023	RN55C3321F	3.32 K OHMS 1% MET FILM
R	91	RN55-00348	1	81349	RNC55H34R8FM	34.8 OHMS 1% MET FILM
R	92	RN55-13320	1	3W023	RN55C3321F	3.32 K OHMS 1% MET FILM
R	93	RN55-00348	1	81349	RNC55H34R8FM	34.8 OHMS 1% MET FILM
R	94	RN55-00715	1	81349	RNC55H71R5FM	71.5 OHMS 1% MET FILM
R	95	RN55-14990	1	91637	RN55C4991F	4.99 K OHMS 1% MET FILM
R	96	RN55-24990	1	19701	RN55C4992F	49.9 K OHMS 1% MET FILM
R	97	RAPA-22000	1	32977	3386R-1-203	20K OHM POT 1T PC MOUNT
R	98	RN55-14320	1	91637	RN55C4321F	4.32 K OHMS 1% MET FILM
R	99	RAPA-31000	1	32977	3386R-1-104	100K OHM POT 1T PC MOUNT
R	100	RN55-31470	1	81349	CMF55T2147K1%	147 K OHMS 1% MET FILM
R	101	RN55-33010	1	91637	RN55C3013F	301 K OHMS 1% MET FILM
R	102	RN55-22320	1	91637	RN55C2322F	23.2 K OHMS 1% MET FILM
R	103	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	104	RN55-16340	1	81349	RNC55H6341FM	6.34K OHMS 1% MET FILM
R	105	RN55-11540	1	81349	RNC55H1541FM	1.54K OHMS 1% MET FILM
R	106	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	107	RN55-11690	1	81349	RNC55H1691FM	1.69K OHMS 1% MET FILM
R	108	RN55-14020	1	81349	MF55C4021FL	4.02K OHMS 1% MET FILM
R	109	RN55-06810	1	91637	RN55C6810F	681 OHMS 1% MET FILM
R	110	RN55-22000	1	81349	RNC55H2002FM	20 K OHMS 1% MET FILM
R	111	RN55-31000	1	19701	RN55C1003F	100 K OHMS 1% MET FILM
R	112	RN55-26650	1	91637	RN55C6652F	66.5 K OHMS 1% MET FILM
R	113	RAPA-12000	1	32977	3386R-1-202	2K OHM POT 1T PC MOUNT
R	114	RN55-22000	1	81349	RNC55H2002FM	20 K OHMS 1% MET FILM
R	115	RN55-24990	1	19701	RN55C4992F	49.9 K OHMS 1% MET FILM
R	116	RN55-22150	1	91637	RN55C2152F	21.5 K OHMS 1% MET FILM
R	117	RN55-23480	1	19701	RN55C3482F	34.8 K OHMS 1% MET FILM
R	118	RN55-21690	1	91637	RN55C1692F	16.9 K OHMS 1% MET FILM
R	119	RN55-12550	1	81349	RNC55H2551FM	2.55K OHMS 1% MET FILM
R	120	RN55-04990	1	19701	RN55C4990F	499 OHMS 1% MET FILM
R	121	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	122	RN55-23740	1	91637	RN55C3742F	37.4 K OHMS 1% MET FILM
R	123	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	124	RF07-00010	1	65970	R25J1R0TR	1.0 OHMS 5% CARB FILM
R	125	RN55-11540	1	81349	RNC55H1541FM	1.54K OHMS 1% MET FILM
R	126	RN55-13480	1	81349	RNC55H3481FM	3.48K OHMS 1% MET FILM
R	127	RN55-22430	1	91637	RN55C2432F	24.3 K OHMS 1% MET FILM
R	128	RN55-16040	1	81349	RNC55H6041FM	6.04K OHMS 1% MET FILM
R	129	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	130	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	131	RN55-31240	1	3W023	RN55C1243F	124 K OHMS 1% MET FILM
R	132	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	133	RN55-22430	1	91637	RN55C2432F	24.3 K OHMS 1% MET FILM
R	134	RN55-28060	1	91637	RN55C8062F	80.6 K OHMS 1% MET FILM
R	135	RN55-21540	1	91637	RN55C1542F	15.4 K OHMS 1% MET FILM
R	136	RN55-03740	1	81349	RNC55H3740FM	374 OHMS 1% MET FILM

797860 PCA, OUTPUT CONTROL (A6), Rev AN (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
R	137	RN55-22000	1	81349	RNC55H2002FM	20 K OHMS 1% MET FILM
R	138	RN55-22940	1	91637	RN55C2942F	29.4 K OHMS 1% MET FILM
R	139	RN55-22000	1	81349	RNC55H2002FM	20 K OHMS 1% MET FILM
R	140	RN55-13740	1	81349	RNC55H3741FM	3.74K OHMS 1% MET FILM
R	141	RN55-21740	1	91637	RN55C1742F	17.4K ohms 1% met film
R	142	RN55-00475	1	3W023	RN55C47R5F	47.5 OHMS 1% MET FILM
R	143	RN55-25620	1	91637	RN55C5622F	56.2 K OHMS 1% MET FILM
R	144	RN65-01300	1	91637	CMF65-1300FT1	130 OHMS 1% MET FILM
R	145	RN65-02050	1	91637	CMF65-2050FT1	205 OHMS 1% MET FILM
R	146	RN65-01300	1	91637	CMF65-1300FT1	130 OHMS 1% MET FILM
R	147	RN55-04990	1	19701	RN55C4990F	499 OHMS 1% MET FILM
R	148	RN55-01240	1	81349	RNC55H1240FM	124 OHMS 1% MET FILM
R	149	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	150	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R	151	RN55-05620	1	91637	RN55C5620F	562 OHMS 1% MET FILM
R	152	RN55-23320	1	91637	RN55C3322F	33.2 K OHMS 1% MET FILM
R	153	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	154	RN55-21500	1	91637	RN55C1502F	15 K OHMS 1% MET FILM
R	155	RN55-13160	1	91637	RN55C3161F	3.16 K OHMS 1% MET FILM
R	156	RN55-23320	1	91637	RN55C3322F	33.2 K OHMS 1% MET FILM
R	157	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	158	RN55-11210	1	91637	RN55C1211F	1.21 K OHMS 1% MET FILM
R	159	RK05-00330	1	91637	CRCW1206-330JB02	33.0 OHM 5% FILM SMT
R	160	RK05-01800	1	91637	CRCW1206-181JB02	180 OHM 5% FILM SMT
R	161	RK05-01800	1	91637	CRCW1206-181JB02	180 OHM 5% FILM SMT
R	162	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	163	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	164	RN50-00150	1	81349	RNC50H15R0FS	15.0 OHMS 1% MET FILM
R	165	RN50-00150	1	81349	RNC50H15R0FS	15.0 OHMS 1% MET FILM
R	166	RN50-00110	1	81349	RNC50K11R0FS	11.0 OHMS 1% MET FILM
R	167	RN50-00182	1	81349	RNC50K18R2FS	18.2 OHMS; 1% MET FILM
R	168	RN50-00182	1	81349	RNC50K18R2FS	18.2 OHMS; 1% MET FILM
R	169	RN50-00110	1	81349	RNC50K11R0FS	11.0 OHMS 1% MET FILM
R	170	RN50-00182	1	81349	RNC50K18R2FS	18.2 OHMS; 1% MET FILM
R	171	RN50-00182	1	81349	RNC50K18R2FS	18.2 OHMS; 1% MET FILM
R	172	RN50-00110	1	81349	RNC50K11R0FS	11.0 OHMS 1% MET FILM
R	173	RN55-15360	1	81349	RNC55H5361FM	5.36K OHMS 1% MET FILM
R	174	RC20-03000	1	01121	RC20GF301J	300 OHM 5% 1/2W CARBON
R	175	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	176	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	177	RK05-00910	1	91637	CRCW1206-910JB02	91.0 OHM 5% FILM SMT
R	178	RK05-01500	1	91637	CRCW1206-151JB02	150 OHM 5% FILM SMT
R	179	RK05-01500	1	91637	CRCW1206-151JB02	150 OHM 5% FILM SMT
R	180	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	181	RN55-00332	1	3W023	RN55C33R2F	33.2 OHMS 1% MET FILM
R	182	RC20-11000	1	01121	EB-102-5	1 K OHMS 5% 1/2 CARBON
R	183	RK05-00180	1	91637	CRCW1206-180JB02	18.0 OHM 5% FILM SMT
R	184	RK05-03000	1	91637	CRCW1206-301JB02	300 OHM 5% FILM SMT
R	185	RK05-03000	1	91637	CRCW1206-301JB02	300 OHM 5% FILM SMT
R	186	RN55-31000	1	19701	RN55C1003F	100 K OHMS 1% MET FILM
R	187	RN55-24750	1	19701	RN55C4752F	47.5 K OHMS 1% MET FILM
R	188	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
RT	79	RTC0-21000	1	75263	41D2	10 K NEG TC THERMISTOR
U	1	MA21-00001	1	24539	PST-J9127	0-1GHZ +12DBM AMP
U	2	MA06-00001	1	04713	MWA330	0-1GHZ 15DBM AMPLIFIER
U	3	MMDC-20001	1	15542	TFM-2P-8	.01-1GHZ 1GHZ IF MIXER
U	8	MA08-00003	1	24539	MSA-0435-X	0-3000 MHZ +13DBM AMP
U	9	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	10	UON0-00444	1	27014	LF444CN	LF444CN OP AMP
U	11	UON0-00444	1	27014	LF444CN	LF444CN OP AMP
U	12	UON0-00444	1	27014	LF444CN	LF444CN OP AMP
U	13	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	14	ULN0-00339	1	17856	SG339N	LM339N COMPARATOR

797860 PCA, OUTPUT CONTROL (A6), Rev AN (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
U	15	ULN0-00339	1	17856	SG339N	LM339N COMPARATOR
U	16	UTN0-01381	1	27014	DM74LS138N	SN74LS138N 3 TO 8 DEC
U	18	UTN0-00111	1	04713	74LS11	74LS11 TRIPLE 3 IN AND
U	19	UIN0-07528	1	24335	PM7528HP	AD7528JN 8 BIT DAC
U	20	UON0-00074	1	01245	TL074CN	TL074CN QUAD FET OP AMP
U	21	UIN0-07534	1	24335	AD7534KN	AD7534JN 14 BIT DAC
U	22	UON0-00072	1	01245	TL072CP	TL072CP DUAL FET OP AMP
U	23	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	24	UTN0-02731	1	27014	DM74LS273N	74LS273 OCTAL D F-F
U	25	UIN0-07541	1	24335	AD7541AKN	AD7541 12 BIT MULT D/A
U	26	ULN0-04066	1	66958	HCF4066BEY	CD4066BE SWITCH
U	27	ULN0-04066	1	66958	HCF4066BEY	CD4066BE SWITCH
U	28	UON0-00412	1	27014	LF412CN	LF412CN OP AMP
U	29	UON0-00072	1	01245	TL072CP	TL072CP DUAL FET OP AMP
U	30	URC0-07908	1	04713	MC7908CT	MC7908CT 1.5A -8V REG
U	31	UON0-00411	1	27014	LF411ACN	LF411ACN OP AMP
U	32	UON0-00411	1	27014	LF411ACN	LF411ACN OP AMP
U	33	ULN0-00522	1	18324	NE 522N	NE522N COMPARATOR
U	34	UTN0-00007	1	27014	DM74S00N	74S00 2 IN NAND
U	35	UON0-00072	1	01245	TL072CP	TL072CP DUAL FET OP AMP
U	36	UTN0-00321	1	18324	N74LS32N	SN74LS32N QUAD OR
U	37	ULN0-00339	1	17856	SG339N	LM339N COMPARATOR
U	38	MA12-00002	1	24539	MSA-0385	0-2.5GHZ +10DBM AMP
U	39	MA12-00002	1	24539	MSA-0385	0-2.5GHZ +10DBM AMP
W	1	808600	1	58900	808600	SEMI-RIGID CABLE PREPPED
W	2	812545	1	58900	812545	CABLE ASSY
W	3	812594	1	58900	812594	SEMI-RIGID CABLE,.086
W	5	716985	1	58900	716985	CABLE ASSY, RF JUMPER
Z	1	RM9S-21000	1	32977	4610X-101-103	10K OHM X 9 SIP NETWRK
Z	2	RM8D-21001	1	73188	898-3-R10KF	10K OHM X 8 DIP NETWORK
Z	3	RM4S-21000	1	58756	770-83-R102	1K OHM X 4 SIP NETWORK
Z	4	RM4S-21000	1	58756	770-83-R102	1K OHM X 4 SIP NETWORK
Z	5	RM7S-21001	1	32977	4608X-101-103	10K OHMS X 7 SIP NETWK

797845 PCA, OUTPUT (A7), Rev AA

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	1	794974	1	58900	794974	PWB, OUTPUT
	2	GF00-00001	1	58900	GF00-00001	CONDUCTIVE FOAM
	0	6062A-1024	REF	58900	6062A-1024	6062 OUTPUT SCHEMATIC
	170	JIB0-01288	1	2M631	50871-1	FEMALE PIN CONNECTOR
	171	698472	1	58900	698472	PIN TEST BASE
	174	HBRS-08006	2	58900	HBRS-08006	0-80 X 3/8 ROUND
	175	808469	1	58900	808469	FET HEAT SINK, PLATED
	176	HT00-00300	3	98159	2829-75-2	COMPONENT HOLDER
	177	HNKS-44004	2	96906	MS35649-***	4-40 KEP NUT
	178	HNPP-08004	2	46384	MS-080-1	0-80 PRESS NUT
	180	HBXP-44006	2	26233	NS132CR440R6	4-40 X 3/8 82DEG FLAT
C	1	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	2	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	3	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	4	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	5	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	6	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	7	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	8	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	9	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	10	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	11	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	12	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	13	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	14	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	15	CK50-00470	1	04222	08051A470JATMA	47PF COG CHIP CERAMIC
C	16	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	17	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	18	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	19	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	20	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	21	CK50-00470	1	04222	08051A470JATMA	47PF COG CHIP CERAMIC
C	22	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	23	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	24	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	25	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	26	CK50-00470	1	04222	08051A470JATMA	47PF COG CHIP CERAMIC
C	27	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	28	CK50-00003	1	72982	MA1803R3BT	.3PF CHIP CAPACITOR
C	29	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	30	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	31	CK50-00027	1	95275	VJ0805A2R7DXAM	2.7PF COG CHIP CERAMIC
C	32	CK50-00027	1	95275	VJ0805A2R7DXAM	2.7PF COG CHIP CERAMIC
C	33	CK50-00470	1	04222	08051A470JATMA	47PF COG CHIP CERAMIC
C	34	CK50-00470	1	04222	08051A470JATMA	47PF COG CHIP CERAMIC
C	35	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	36	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	37	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	38	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	39	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	40	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	41	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	42	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	43	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	44	CK50-00010	1	95275	VJ0805A1ROKAMB	1 PF NPO CHIP
C	45	CK50-X0018	1	72982	GRH708C0G1R8C200VP	1.8PF COG CHIP CERAMIC
C	46	CK50-00470	1	04222	08051A470JATMA	47PF COG CHIP CERAMIC
C	47	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	48	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	49	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	50	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	51	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
C	52	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO

797845 PCA, OUTPUT (A7), Rev AA (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
C	53	CK50-00082	1	72982	GRH708C0G8R2D200AL	8.2PF COG CHIP CERAMIC
C	54	CK50-00180	1	95275	VJ0805Q180JXAT	18PF COG CHIP CERAMIC
C	55	CK50-00082	1	72982	GRH708C0G8R2D200AL	8.2PF COG CHIP CERAMIC
C	56	CK50-00120	1	95275	VJ0805Q120JXT	12PF COG CHIP CERAMIC
C	57	CK50-00120	1	95275	VJ0805Q120JXT	12PF COG CHIP CERAMIC
C	58	CK50-00120	1	95275	VJ0805Q120JXT	12PF COG CHIP CERAMIC
C	59	CK50-00120	1	95275	VJ0805Q120JXT	12PF COG CHIP CERAMIC
C	60	CK50-00120	1	95275	VJ0805Q120JXT	12PF COG CHIP CERAMIC
C	61	CK50-00120	1	95275	VJ0805Q120JXT	12PF COG CHIP CERAMIC
C	62	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	63	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	64	CK52-04150	1	95275	VJ7863X154MFA	.15UF X7R CHIP CERAMIC
C	65	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	66	CT35-R5100	1	31433	T356A105M035AS	1UF 35V TANTALUM
C	67	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	68	CK53-03470	1	72982	GRRM41X7R473K050AL	.047UF X7R CHIP CERAMIC
C	69	CK51-03270	1	04222	12065C273JA8060R	.027UF X7R CHIP CERAMIC
C	70	CK51-03390	1	04222	12065C393JA80600	.039UF X7R CHIP CERAMIC
C	71	CK52-04150	1	95275	VJ7863X154MFA	.15UF X7R CHIP CERAMIC
C	72	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	73	CK50-X0047	1	72982	GRH708COG4R7C200AL	4.7PF COG CHIP CERAMIC
C	74	CC00-00007	1	04222	SR151A684CAT	.68PF CERAMIC COG
C	75	CK50-01100	1	95275	VJ0805A101JXBMT	100 PF CERAMIC NPO
CR	1	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	2	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	3	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	4	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	5	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	6	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	7	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	8	DSA2-05463	1	26840	PSDI-A9553	QSCH-5463 DIODE PAIR
CR	9	DSA2-05463	1	26840	PSDI-A9553	QSCH-5463 DIODE PAIR
CR	10	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	11	DAC0-02636	1	59365	MX-2636	MX2636 PIN DIODE
CR	12	DAC0-02636	1	59365	MX-2636	MX2636 PIN DIODE
CR	13	DAC0-02636	1	59365	MX-2636	MX2636 PIN DIODE
CR	14	DAC0-02636	1	59365	MX-2636	MX2636 PIN DIODE
CR	15	DAC0-02070	1	59365	MX2070(E28)	MX2070 PIN DIODE
CR	16	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	17	DZAB-00960	1	04713	1N960B	1N960B 9.1V ZENER
FL	1	LFS1-08716	1	2M631	859652-1	FEED THRU FILTER
FL	2	LFS2-08716	1	2M631	859612-1	FEED THRU FILTER
FL	3	LFS2-08716	1	2M631	859612-1	FEED THRU FILTER
FL	4	LFS2-08716	1	2M631	859612-1	FEED THRU FILTER
FL	5	LFS2-08716	1	2M631	859612-1	FEED THRU FILTER
L	1	808543	1	58900	808543	CHOKE, TWO 3-TURN BEADS
L	2	808543	1	58900	808543	CHOKE, TWO 3-TURN BEADS
L	3	808543	1	58900	808543	CHOKE, TWO 3-TURN BEADS
L	4	808543	1	58900	808543	CHOKE, TWO 3-TURN BEADS
L	5	808543	1	58900	808543	CHOKE, TWO 3-TURN BEADS
L	6	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	7	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	8	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	9	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	10	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	11	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	12	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	13	LSA0-04120	1	02113	1008HS-121XKBB	.12 UH INDUCTOR SMT
L	16	808543	1	58900	808543	CHOKE, TWO 3-TURN BEADS
L	17	LAD0-07390	1	72259	WEE-390	390 UH INDUCTOR
L	18	320911	1	58900	320911	CHOKE, 6 TURN
L	19	LAD0-06560	1	72259	WEE-56	56 UH INDUCTOR
L	20	808543	1	58900	808543	CHOKE, TWO 3-TURN BEADS

797845 PCA, OUTPUT (A7), Rev AA (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
L	21	808543	1	58900	808543	CHOKE, TWO 3-TURN BEADS
L	22	LAD0-06560	1	72259	WEE-56	56 UH INDUCTOR
L	23	463448	1	58900	463448	INDUCTOR, 10 TURNS
Q	1	QBPS-03906	1	56289	2N3906	2N3906 .2A 40V PNP
Q	2	QBNS-15140	1	58900	QBNS-15140	B15V140-05 9DB 2GHz
Q	3	QBPS-03906	1	56289	2N3906	2N3906 .2A 40V PNP
Q	4	QBNS-15140	1	58900	QBNS-15140	B15V140-05 9DB 2GHz
Q	5	QBPS-05771	1	27014	ST5771-2	2N5771 15V 850MHZ PNP
Q	6	QBPS-05771	1	27014	ST5771-2	2N5771 15V 850MHZ PNP
Q	7	QBPS-05771	1	27014	ST5771-2	2N5771 15V 850MHZ PNP
Q	8	QBPS-05771	1	27014	ST5771-2	2N5771 15V 850MHZ PNP
Q	9	QG0P-00086	1	26840	ATF-45101	ST86-10187 2-10 GHZ FET
R	1	RK05-02700	1	91637	CRCW1206-271JB02	270 OHM 5% FILM SMT
R	2	RK05-00180	1	91637	CRCW1206-180JB02	18.0 OHM 5% FILM SMT
R	3	RK05-02700	1	91637	CRCW1206-271JB02	270 OHM 5% FILM SMT
R	4	RK05-11000	1	91637	CRCW1206-102JB02	1K OHM 5% FILM SMT
R	5	RK05-00750	1	91637	CRCW1206-750JB02	75.0 OHM 5% FILM SMT
R	6	RK05-00750	1	91637	CRCW1206-750JB02	75.0 OHM 5% FILM SMT
R	7	RK05-00390	1	91637	CRCW1206-390JB02	39.0 OHM 5% FILM SMT
R	8	RK05-00390	1	91637	CRCW1206-390JB02	39.0 OHM 5% FILM SMT
R	9	RK05-00750	1	91637	CRCW1206-750JB02	75.0 OHM 5% FILM SMT
R	10	RK05-00750	1	91637	CRCW1206-750JB02	75.0 OHM 5% FILM SMT
R	11	RK05-04700	1	91637	RCWP-1206(XXX)J	470 OHM 5% FILM SMT
R	12	RK05-11000	1	91637	CRCW1206-102JB02	1K OHM 5% FILM SMT
R	13	RK05-03900	1	91637	CRCW1206-391JB02	390 OHM 5% FILM SMT
R	14	RK05-03900	1	91637	CRCW1206-391JB02	390 OHM 5% FILM SMT
R	15	RN65-01210	1	91637	CMF65-1211FT1	121 OHMS 1% MET FILM
R	16	RK05-03900	1	91637	CRCW1206-391JB02	390 OHM 5% FILM SMT
R	17	RN65-01300	1	91637	CMF65-1300FT1	130 OHMS 1% MET FILM
R	18	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	19	RAPA-00200	1	32977	3386R-1-200	20 OHM POT 1T PC MOUNT
R	20	RN55-21500	1	91637	RN55C1502F	15 K OHMS 1% MET FILM
R	21	RK05-12000	1	91637	CRCW1206-202JB02	2K OHM 5% FILM SMT
R	22	RK05-00750	1	91637	CRCW1206-750JB02	75.0 OHM 5% FILM SMT
R	23	RK05-01800	1	91637	CRCW1206-181JB02	180 OHM 5% FILM SMT
R	24	RK05-00220	1	19701	9C12063A22R0JLRT	22.0 OHM 5% FILM SMT
R	25	RK05-00220	1	19701	9C12063A22R0JLRT	22.0 OHM 5% FILM SMT
R	26	RN65-00806	1	91637	CMF65-80R6FT1	80.6 OHMS 1% MET FILM
R	28	RK05-02000	1	91637	CRCW1206-201JB02	200 OHM 5% FILM SMT
R	29	RK05-03000	1	91637	CRCW1206-301JB02	300 OHM 5% FILM SMT
R	30	RK05-03900	1	91637	CRCW1206-391JB02	390 OHM 5% FILM SMT
R	31	RK05-02700	1	91637	CRCW1206-271JB02	270 OHM 5% FILM SMT
R	32	RK05-01200	1	91637	CRCW1206-121JB02	120 OHM 5% FILM SMT
R	33	RK05-02200	1	91637	CRCW1206-221JB02	220 OHM 5% FILM SMT
R	34	RK05-00220	1	19701	9C12063A22R0JLRT	22.0 OHM 5% FILM SMT
R	35	RK05-02200	1	91637	CRCW1206-221JB02	220 OHM 5% FILM SMT
R	36	RN55-21500	1	91637	RN55C1502F	15 K OHMS 1% MET FILM
R	37	RAPA-15003	1	32977	3386R-1-502	5K OHM POT 1T PC MOUNT
R	38	RN55-15620	1	91637	RN55C5621F	5.62 K OHMS 1% MET FILM
R	39	RK05-12000	1	91637	CRCW1206-202JB02	2K OHM 5% FILM SMT
R	40	RK05-01800	1	91637	CRCW1206-181JB02	180 OHM 5% FILM SMT
R	41	RK05-00270	1	91637	CRCW1206-270JB02	27.0 OHM 5% FILM SMT
R	42	RK05-00270	1	91637	CRCW1206-270JB02	27.0 OHM 5% FILM SMT
R	43	RN65-00665	1	91637	CMF65-66R5FT1	66.5 OHMS 1% MET FILM
R	44	RK05-03900	1	91637	CRCW1206-391JB02	390 OHM 5% FILM SMT
R	45	RK05-04700	1	91637	RCWP-1206(XXX)J	470 OHM 5% FILM SMT
R	46	RK05-04700	1	91637	RCWP-1206(XXX)J	470 OHM 5% FILM SMT
R	47	RC20-04700	1	01121	EB-471-5	470 OHM 5% 1/2W CARBON
R	48	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	49	RN55-00200	1	81349	RNC55H20R0FM	20.0 OHMS 1% MET FILM
R	50	RN65-01210	1	91637	CMF65-1211FT1	121 OHMS 1% MET FILM
R	51	RN55-00200	1	81349	RNC55H20R0FM	20.0 OHMS 1% MET FILM
R	52	RN65-01210	1	91637	CMF65-1211FT1	121 OHMS 1% MET FILM

797845 PCA, OUTPUT (A7), Rev AA (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
R	53	RK05-04700	1	91637	RCWP-1206(XXX)J	470 OHM 5% FILM SMT
R	54	RK05-00100	1	91637	CRCW1206-100JB02	10.0 OHM 5% FILM SMT
R	55	RK05-04700	1	91637	RCWP-1206(XXX)J	470 OHM 5% FILM SMT
R	56	RK05-13900	1	91637	CRCW1206-392JB02	3.9K OHM 5% FILM SMT
R	57	RK05-12000	1	91637	CRCW1206-202JB02	2K OHM 5% FILM SMT
R	58	RN55-22430	1	91637	RN55C2432F	24.3 K OHMS 1% MET FILM
R	59	RN55-24750	1	19701	RN55C4752F	47.5 K OHMS 1% MET FILM
R	60	RN55-23920	1	91637	RN55C3922F	39.2 K OHMS 1% MET FILM
R	61	RN55-23480	1	19701	RN55C3482F	34.8 K OHMS 1% MET FILM
R	62	RN55-31000	1	19701	RN55C1003F	100 K OHMS 1% MET FILM
R	63	RW03-00330	1	91637	RS-2B-33 OHM-1%	33 OHM 2W WIREWOUND
R	64	RK05-01500	1	91637	CRCW1206-151JB02	150 OHM 5% FILM SMT
R	65	RK05-01500	1	91637	CRCW1206-151JB02	150 OHM 5% FILM SMT
R	66	RK05-00220	1	19701	9C12063A22R0JLRT	22.0 OHM 5% FILM SMT
R	67	RN50-00243	1	81349	RNC50H24R3FS	24.3 OHMS 1% MET FILM
R	68	RN50-00243	1	81349	RNC50H24R3FS	24.3 OHMS 1% MET FILM
R	69	RN50-00243	1	81349	RNC50H24R3FS	24.3 OHMS 1% MET FILM
R	70	RN50-00243	1	81349	RNC50H24R3FS	24.3 OHMS 1% MET FILM
R	71	RN50-01620	1	81349	RNC50K1620FS	162 OHMS 1% METAL FILM
U	1	MA06-00002	1	24539	SMA85-2025	.05-2GHZ +12DBM AMP
U	2	MA06-00002	1	24539	SMA85-2025	.05-2GHZ +12DBM AMP
U	3	MA08-10002	1	24539	SMA86-0313	.05-2.5GHZ +9DBM AMP
U	4	UIN0-09638	1	27014	DS9638CN	UA9638TC LINE DRIVER
U	5	MRSS-11002	1	96341	SW-902	SPST FET RF SWITCH
U	6	MRSS-11002	1	96341	SW-902	SPST FET RF SWITCH
U	7	MRSS-11002	1	96341	SW-902	SPST FET RF SWITCH
U	8	UON0-00358	1	18324	LM358/CR999N	LM358 OP AMP
W	1	808568	1	58900	808568	CABLE ASSY RF
W	2	808576	1	58900	808576	CABLE ASSY, RF
W	3	808584	1	58900	808584	CABLE ASSY, RF
W	4	808519	1	58900	808519	CABLE ASSY, MOD CONTROL
W	5	808527	1	58900	808527	CABLE ASSY,HET/FUND
W	6	808535	1	58900	808535	CABLE ASY,PULSE MOD CTRL

30067 ATTENUATOR ASSY (A8), 606X, Rev A

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	3	848098	1	58900	848098	ATTENUATOR HOUSING
	101	HBPP-63206	1	26233	NS137CR632R6	6-32 X 3/8 PAN
	102	HBPP-63210	7	26233	NS137CR632R10	6-32 X 5/8 PAN
A8A2	4	30467	1	58900	30467	606X ATTENUATOR PCA
A8A1	5	794982	1	58900	794982	PCA, RELAY DRIVER

794982 PCA, RELAY DRIVER (A8A1), Rev G

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	1	794925	1	58900	794925	PWB, RELAY DRIVER
	0	6062A-1045	REF	58900	6062A-1045	606x RELAY DRIVER SCH
	44	HSCS-60404	7	06540	9533B-A-140	#6 X 1/4 SWAGE CLR SPACE
	46	JIB0-01288	11	2M631	50871-1	FEMALE PIN CONNECTOR
C	1	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	2	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	3	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	4	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	5	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	6	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	7	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	8	CC50-03100	1	31433	C315C103K5R5CA C9248	.01 UF CERAMIC X7R
C	9	CC50-03100	1	31433	C315C103K5R5CA C9248	.01 UF CERAMIC X7R
C	10	CC51-04220	1	04222	SR205E224MAA	.22UF CERAMIC Z5U
C	11	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	12	CC50-03100	1	31433	C315C103K5R5CA C9248	.01 UF CERAMIC X7R
C	13	CC50-03100	1	31433	C315C103K5R5CA C9248	.01 UF CERAMIC X7R
C	14	CE36-R6220	1	55680	USA1V220MCA	22UF 35V RADIAL
C	15	CT50-R5470	1	56289	199D475X0050DE2	4.7UF 50V TANTALUM
C	16	CC51-04220	1	04222	SR205E224MAA	.22UF CERAMIC Z5U
CR	1	DZAB-00972	1	27014	IN972B	1N972A 30V ZENER
CR	2	DZAB-00972	1	27014	IN972B	1N972A 30V ZENER
CR	3	DZAB-00972	1	27014	IN972B	1N972A 30V ZENER
CR	4	DZAB-00972	1	27014	IN972B	1N972A 30V ZENER
CR	5	DZAB-00972	1	27014	IN972B	1N972A 30V ZENER
CR	6	DZAB-00972	1	27014	IN972B	1N972A 30V ZENER
CR	7	DZAB-00972	1	27014	IN972B	1N972A 30V ZENER
CR	8	DZAB-00750	1	98291	1N750A-ITT	1N750A 4.7V ZENER
CR	9	DZAB-00750	1	98291	1N750A-ITT	1N750A 4.7V ZENER
CR	10	DRAD-02188	1	14552	DT750120A	DT2188 6.4V REF DIODE
CR	11	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	12	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	13	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	14	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	15	DZAB-00972	1	27014	IN972B	1N972A 30V ZENER
CR	16	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	17	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
CR	18	DZAB-00750	1	98291	1N750A-ITT	1N750A 4.7V ZENER
J	1	JIA1-06230	1	0JNR4	68000-106	6PIN STRIPLINE PLUG
L	1	320911	1	58900	320911	CHOKE, 6 TURN
L	2	320911	1	58900	320911	CHOKE, 6 TURN
L	3	320911	1	58900	320911	CHOKE, 6 TURN
L	4	320911	1	58900	320911	CHOKE, 6 TURN
L	5	320911	1	58900	320911	CHOKE, 6 TURN
L	6	320911	1	58900	320911	CHOKE, 6 TURN
L	7	320911	1	58900	320911	CHOKE, 6 TURN
L	8	320911	1	58900	320911	CHOKE, 6 TURN
L	9	320911	1	58900	320911	CHOKE, 6 TURN
L	10	320911	1	58900	320911	CHOKE, 6 TURN
L	11	LAD0-06820	1	72259	WEE-82	82 UH INDUCTOR
L	12	LAD1-06470	1	72259	WEE 47 5%	47 UH INDUCTOR
L	13	LAD1-06470	1	72259	WEE 47 5%	47 UH INDUCTOR
Q	1	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	2	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	3	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	4	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	5	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	6	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	7	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
Q	8	QBNS-06560	1	27014	MPS6560	MPS6560 .5A 25V NPN
Q	9	QBPS-06562	1	27014	MPS6562	MPS6562 .5A 25V .6W PNP
R	1	RN55-05110	1	81349	RNC55H5110FM	511 OHMS 1% MET FILM
R	2	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM

794982 PCA, RELAY DRIVER (A8A1), Rev G (continued)

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
R	3	RF07-00010	1	65970	R25J1R0TR	1.0 OHMS 5% CARB FILM
R	4	RN55-05110	1	81349	RNC55H5110FM	511 OHMS 1% MET FILM
R	5	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	6	RF07-00010	1	65970	R25J1R0TR	1.0 OHMS 5% CARB FILM
R	7	RN55-05110	1	81349	RNC55H5110FM	511 OHMS 1% MET FILM
R	8	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	9	RF07-00010	1	65970	R25J1R0TR	1.0 OHMS 5% CARB FILM
R	10	RN55-05110	1	81349	RNC55H5110FM	511 OHMS 1% MET FILM
R	11	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	12	RF07-00010	1	65970	R25J1R0TR	1.0 OHMS 5% CARB FILM
R	13	RN55-05110	1	81349	RNC55H5110FM	511 OHMS 1% MET FILM
R	14	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	15	RF07-00010	1	65970	R25J1R0TR	1.0 OHMS 5% CARB FILM
R	16	RN55-05110	1	81349	RNC55H5110FM	511 OHMS 1% MET FILM
R	17	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	18	RF07-00010	1	65970	R25J1R0TR	1.0 OHMS 5% CARB FILM
R	19	RN55-05110	1	81349	RNC55H5110FM	511 OHMS 1% MET FILM
R	20	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	21	RF07-00010	1	65970	R25J1R0TR	1.0 OHMS 5% CARB FILM
R	22	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	23	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	24	RN55-23010	1	91637	RN55C3012F	30.1 K OHMS 1% MET FILM
R	25	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	27	RN55-11070	1	81349	RNC55H1071FM	1.07K OHMS 1% MET FILM
R	28	RN55-04220	1	81349	RNC55H4220FM	422 OHMS 1% MET FILM
R	29	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	30	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	31	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	32	RN55-11500	1	3W023	RN55C1501F	1.5 K OHMS 1% MET FILM
R	33	RN55-00562	1	19701	RN55C56R2F	56.2 OHMS 1% MET FILM
R	34	RN55-31000	1	19701	RN55C1003F	100 K OHMS 1% MET FILM
R	35	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	36	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	37	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	38	RN55-05110	1	81349	RNC55H5110FM	511 OHMS 1% MET FILM
R	39	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	40	RF07-00010	1	65970	R25J1R0TR	1.0 OHMS 5% CARB FILM
R	41	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	42	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	43	RN55-21300	1	91637	RN55C1302F	13 K OHMS 1% MET FILM
R	44	RN55-12000	1	81349	RNC55H2001FM	2.00 K OHMS 1% MET FILM
R	45	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
R	46	RN55-04750	1	91637	RN55C4750F	475 OHMS 1% MET FILM
R	47	RN55-21210	1	91637	RN55C1212F	12.1 K OHMS 1% MET FILM
R	48	RN55-14320	1	91637	RN55C4321F	4.32 K OHMS 1% MET FILM
R	49	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
U	1	UON0-00084	1	04713	LF347N-MOT	TL084CN OP AMP

30467 606X ATTENUATOR PCA (A8A2), Rev A

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	1	795013	1	58900	795013	PWB, 2 GHZ ATTENUATOR/RP
	2	30468	REF	58900	30468	606X ATTENUATOR SCH
	5	HBPP-63206	2	26233	NS137CR632R6	6-32 X 3/8 PAN
	37	JIB0-01288	11	2M631	50871-1	FEMALE PIN CONNECTOR
	40	803247	8	58900	803247	RELAY WASHER
C	1	CK51-02100	1	95275	VJ0805Y102KXBMT	1000PF X7R CHIP CERAMIC
C	2	CT15-S5470	1	56289	195D475X0016V2B	4.7UF TANTALUM SMT
C	3	CT15-S5470	1	56289	195D475X0016V2B	4.7UF TANTALUM SMT
C	4	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	5	CT15-S5470	1	56289	195D475X0016V2B	4.7UF TANTALUM SMT
C	6	CT15-S5470	1	56289	195D475X0016V2B	4.7UF TANTALUM SMT
C	7	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	9	CK51-02100	1	95275	VJ0805Y102KXBMT	1000PF X7R CHIP CERAMIC
CR	1	DSA0-02800	1	26840	ND4974-7E	5082-2800 SCHOT DIODE
CR	2	TDLP-03000	1	59365	M5X3111	LIMITER DIODE
CR	3	TDLP-03000	1	59365	M5X3111	LIMITER DIODE
J	1	JIB1-01143	1	2M631	2-332070-7	FEMALE PIN CONNECTOR
J	2	JRAF-00100	1	8K805	2062-3204-00	SMA F PC PANEL
K	1	SEP0-30202	1	9W482	3SDS5002G1	DPDT 18V RELAY
K	2	6601100550	1	11532	J412L	RELAY;DPDT;SCREENED;GRN
K	3	SEP0-30202	1	9W482	3SDS5002G1	DPDT 18V RELAY
K	4	SEP0-30202	1	9W482	3SDS5002G1	DPDT 18V RELAY
K	5	6601100550	1	11532	J412L	RELAY;DPDT;SCREENED;GRN
K	6	SEP0-30202	1	9W482	3SDS5002G1	DPDT 18V RELAY
K	7	SEP0-30202	1	9W482	3SDS5002G1	DPDT 18V RELAY
K	8	6601100550	1	11532	J412L	RELAY;DPDT;SCREENED;GRN
L	1	320911	1	58900	320911	CHOKE, 6 TURN
L	2	320911	1	58900	320911	CHOKE, 6 TURN
R	1	RK50-02000	1	91637	CRCW1206-2000FB02	200 OHM 1% FILM SMT
R	2	RK50-02000	1	91637	CRCW1206-2000FB02	200 OHM 1% FILM SMT
R	3	RK50-00562	1	91637	CRCW1206-56R2FB02	56.2 OHM 1% FILM SMT
R	4	RK50-00562	1	91637	CRCW1206-56R2FB02	56.2 OHM 1% FILM SMT
R	5	RK50-00931	1	91637	CRCW1206-93R1FB02	93.1 OHM 1% FILM SMT
R	6	RK50-00825	1	91637	CRCW1206-82R5FB02	82.5 OHM 1% FILM SMT
R	7	RK50-00825	1	91637	CRCW1206-82R5FB02	82.5 OHM 1% FILM SMT
R	8	RK50-02000	1	91637	CRCW1206-2000FB02	200 OHM 1% FILM SMT
R	9	RK50-02000	1	91637	CRCW1206-2000FB02	200 OHM 1% FILM SMT
R	10	RK50-00562	1	91637	CRCW1206-56R2FB02	56.2 OHM 1% FILM SMT
R	11	RK50-00562	1	91637	CRCW1206-56R2FB02	56.2 OHM 1% FILM SMT
R	12	RK50-02000	1	91637	CRCW1206-2000FB02	200 OHM 1% FILM SMT
R	13	RK50-02000	1	91637	CRCW1206-2000FB02	200 OHM 1% FILM SMT
R	14	RK50-00562	1	91637	CRCW1206-56R2FB02	56.2 OHM 1% FILM SMT
R	15	RK50-00562	1	91637	CRCW1206-56R2FB02	56.2 OHM 1% FILM SMT
R	16	RK50-00374	1	91637	CRCW1206-37R4BB02	37.4 OHM 1% FILM SMT
R	17	RK50-01500	1	91637	CRCW1206-1500FB02	150 OHM 1% FILM SMT
R	18	RK50-01500	1	91637	CRCW1206-1500FB02	150 OHM 1% FILM SMT
R	19	RK50-02000	1	91637	CRCW1206-2000FB02	200 OHM 1% FILM SMT
R	20	RK50-02000	1	91637	CRCW1206-2000FB02	200 OHM 1% FILM SMT
R	21	RK50-00562	1	91637	CRCW1206-56R2FB02	56.2 OHM 1% FILM SMT
R	22	RK50-00562	1	91637	CRCW1206-56R2FB02	56.2 OHM 1% FILM SMT
R	23	RK50-02000	1	91637	CRCW1206-2000FB02	200 OHM 1% FILM SMT
R	24	RK50-02000	1	91637	CRCW1206-2000FB02	200 OHM 1% FILM SMT
R	25	RK50-00562	1	91637	CRCW1206-56R2FB02	56.2 OHM 1% FILM SMT
R	26	RK50-00562	1	91637	CRCW1206-56R2FB02	56.2 OHM 1% FILM SMT
R	27	RN50-21000	1	81349	RNC50K1002FS	10.0 K OHMS 1% MET FILM
R	28	RN50-01300	1	81349	RC05GF131J	130 OHMS 1% METAL FILM

657825 POWER SUPPLY PCA (A9), Rev M

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	1	657791	1	58900	657791	POWER SUPPLY PWB
	0	6060A-1031	REF	58900	6060A-1031	606x POWER SUPPLY SCH
	63	JIA0-01280	5	79963	834	FASTON TAB TERMINAL
	66	HQH0-52200	1	13103	6025B-TT	T0220 HEATSINK
	67	HBPP-44004	1	26233	NS137CR440R4	4-40 X 1/4 PAN
	68	HNSS-44004	1	96906	MS35649-244	4-40 HEX NUT
	71	WSIB-200XX	3	58900	WSIB-200XX	20 GA PVC COLOR 0
	69	WSIB-205XX	2	58900	WSIB-205XX	20 GA PVC COLOR 5
	70	WSIB-204XX	2	58900	WSIB-204XX	20 GA PVC COLOR 4
C	1	CE35-R8221	1	55680	LGF1V222MHSZ	2200UF 35V RADIAL
C	2	CE35-R9100	1	55680	LGF1V103MHSB	10000UF 35V RADIAL
C	3	CC50-B4100	1	31433	C322C104M5R5CA	.1UF CERAMIC X7R
C	4	CT35-R5680	1	31433	CX12M685M	6.8UF 35V TANTALUM
C	5	CE35-R9100	1	55680	LGF1V103MHSB	10000UF 35V RADIAL
C	6	CC50-B4100	1	31433	C322C104M5R5CA	.1UF CERAMIC X7R
C	7	CT35-R5680	1	31433	CX12M685M	6.8UF 35V TANTALUM
C	8	CE25-R9150	1	55680	LGK1E153MHSB	15000UF 25V RADIAL
C	9	CT25-R5220	1	31433	T355B225K025AS	2.2 UF 25V RADIAL LEAD
C	10	CT25-R6220	1	56289	199D226X0025DE2	22UF 25V TANTALUM
C	11	CE80-R7820	1	55680	LGQ1K821MHSZ	820 UF 80 V RADIAL
C	12	CC50-B4100	1	31433	C322C104M5R5CA	.1UF CERAMIC X7R
C	13	CT50-R5470	1	56289	199D475X0050DE2	4.7UF 50V TANTALUM
C	14	CT50-R5470	1	56289	199D475X0050DE2	4.7UF 50V TANTALUM
C	15	CT35-R5680	1	31433	CX12M685M	6.8UF 35V TANTALUM
C	16	CF00-R4220	1	4U402	MKT1822-224/015	.22UF 100V POLYESTER
C	17	CF00-R4220	1	4U402	MKT1822-224/015	.22UF 100V POLYESTER
C	18	CF00-R4220	1	4U402	MKT1822-224/015	.22UF 100V POLYESTER
C	19	CF00-R4220	1	4U402	MKT1822-224/015	.22UF 100V POLYESTER
C	20	CT35-R5680	1	31433	CX12M685M	6.8UF 35V TANTALUM
C	21	CT25-R5220	1	31433	T355B225K025AS	2.2 UF 25V RADIAL LEAD
C	22	CT25-R5220	1	31433	T355B225K025AS	2.2 UF 25V RADIAL LEAD
CR	1	DBMC-00002	1	14936	2KBP01M	2A 100V BRIDGE
CR	2	DBMC-00002	1	14936	2KBP01M	2A 100V BRIDGE
CR	3	DPAC-04002	1	98291	1N4002-ITT	1N4002 1A 100V DIODE
CR	4	DPAC-04002	1	98291	1N4002-ITT	1N4002 1A 100V DIODE
CR	5	DPMB-01545	1	04713	MBR1545CT	MBR1545 7.5A 45V RECT
CR	6	DBMC-00002	1	14936	2KBP01M	2A 100V BRIDGE
CR	8	DPAC-04002	1	98291	1N4002-ITT	1N4002 1A 100V DIODE
J	1	JIA1-12450	1	27264	09-80-1223	12PIN STRIPLINE PLUG
J	2	JIA1-05450	1	2M631	641202-5	5PIN STRIPLINE PLUG
J	4	JHLP-10015	1	2M631	1-641126-5	15PIN LOCKING HEADER
J	5	JHLP-10006	1	2M631	641126-6	6PIN LOCKING HEADER
J	6	JHLP-10007	1	2M631	641126-7	7PIN LOCKING HEADER
R	1	RN55-02490	1	81349	RNC55H2490FM	249 OHMS 1% MET FILM
R	2	RN55-16650	1	81349	RNC55H6651FM	6.65K OHMS 1% MET FILM
R	3	RAPA-11001	1	32977	3386S-1-102	1K POT 1T PC MOUNT
R	4	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	6	RF07-00051	1	65970	R25X-R02-J-5R1	5.1 OHMS 5% CARB FILM
R	7	RF07-00051	1	65970	R25X-R02-J-5R1	5.1 OHMS 5% CARB FILM
R	8	RF07-00051	1	65970	R25X-R02-J-5R1	5.1 OHMS 5% CARB FILM
R	9	RF07-00051	1	65970	R25X-R02-J-5R1	5.1 OHMS 5% CARB FILM
R	10	RN55-02210	1	3W023	RN55C2210F	221 OHMS 1% MET FILM
R	11	RF07-00010	1	65970	R25J1R0TR	1.0 OHMS 5% CARB FILM
R	12	RF07-00005	1	65970	CF1/4 R51 J	0.5 OHMS 5% CARB FILM
R	13	RN55-02210	1	3W023	RN55C2210F	221 OHMS 1% MET FILM
S	1	SLP0-10202	1	1BR23	GS113-(0018)G20-32	DPDT SLIDE SWITCH
U	6	QTTP-02800	1	04713	T2800B-POW	T2800B 8A 200V TRIAC
VR	7	DZAB-00753	1	27014	1N753A	1N753A 6.2V ZENER
VR	9	DZAC-05372	1	14552	1N5372B	1N5372B 62V ZENER
VR	10	DZAC-05372	1	14552	1N5372B	1N5372B 62V ZENER

6.2 List of Manufacturers

The names and addresses of manufacturers cited in the preceding parts lists are shown on the following pages. Each manufacturer is listed under its CAGE number (COMMERCIAL AND GOVERNMENT ENTITY), as noted in the parts lists. In a few cases, no CAGE number has been assigned; these manufacturers are referenced by Giga-tronics codes which are shown at the end of the list.

Cage	Name	Address
0ABX4	Comptec Inc	7837 Custer School Rd Custer, WA 98240
0AG18	Hirose Electric USA Inc	Chatsworth, CA
0AX52	Ditom Microwave Inc	1180 Coleman Ave #103 San Jose, CA 95110
0BE81	Aerovox-Mallory	20 Aberdeen Dr Glasgow, KY 42141
0B0A9	Dallas Semiconductor Corp	6350 Beltwood Pky S Dallas, TX 75244
0B549	Siemens Components Inc Semiconductor Group	2191 Laurelwood Rd Santa Clara, CA 95054
0D2A6	Mitsubishi Electronics Inc	1050 East Arques Ave Sunnyvale, CA 94086
0D3V2	Menlo Industries Inc	44060 Old Warm Springs Blvd Fremont, CA 94538
0EUK7	All American Transistor of California Inc	369 Van Ness Way Suite 701 Torrance, CA 90501
0GP12	Radiall Inc	150 Long Beach Blvd Stratford, CT 06497
0GYA7	Signal Transformer Co	500 Bayview Ave Inwood, NY 11696
0HS44	Pacific Millimeter	189 Linbrook Dr San Diego, CA 92111
0HFH6	Futaba Corporation of America	555 West Victoria St Compton, CA 90220
0HFJ2	Microplastic	9180 Gazette Ave Chatsworth, CA 91311
0HIN5	Marcon America Corp	998 Forest Edge Dr Vernon Hills, IL 60061
0H379	Aerowave Inc	344 Salem St Medford, MA 02155
0J7V3	Amp Inc	19200 Stevens Creek Blvd Suite 1 Cupertino, CA 95014
0JNR4	Dupont Eelectronics Customer Service Center	825 Old Trail Rd PO Box 80019 Wilmington, DE 19880-0019
0KA21	Stetco Inc	3344 Schierhorn Ct Franklin Park, IL 60131
00443	Waveline Inc	160 Passaic Ave West Caldwell, NJ 07006
00656	Aerovox Inc	740 Belleville Ave New Bedford, MA 02745
00750	Air Track Mfg Corp	College Park, MD
00809	Croven Crystals	500 Beech St Whitby, Ontario, CAN L1N5S5
00815	Midland - Ross	357 Beloit St Burlington, WI 53105
01121	Allen-Bradley Co	1201 South 2nd St Milwaukee, WI 53204
01295	Texas Instruments Inc	13500 N Central Expwy Dallas, TX 75265
01963	Cherry Electrical Products Corp	3600 Sunset Ave Waukegan, IL 60087
02113	Coilcraft Inc	1102 Silver Lake Dr Cary, IL 60013-1658
02490	Electronic Devices Inc	Hampden, MA
02660	Amphenol Corp	358 Hall Ave Wallingford, CT 06492
02735	RCA Corp	Route 202 Somerville, NJ 08876

Cage	Name	Address
03614	Bussman Mfg	114 Old St Rd PO Box 144 St Louis, MO 63178
04222	AVX Ceramics Div of AVX Corp	19th Ave South PO Box 867 Myrtle Beach, SC 29577
04426	ITW Switches	6615 West Irving Park Rd Chicago, IL 60634
04552	Grace W R and Co	869 Washington St Canton, MA 02021
51167	Aries Electronics Inc	62 Trenton Ave Frenchtown, NJ 08825
51284	Mos Technology Inc	950 Rittenhouse Rd Norristown, PA 19401
51642	Centre Engineering Inc	2820 East College Ave State College, PA 16801
51705	Ico-Rally Corp	2575 East Bayshore Rd Palo Alto, CA 94303
52063	Exar Integrated Systems	2222 Gume Dr PO Box 49007 San Jose, CA 95161-9007
52072	Circuit Assembly Corp	18 Thomas St Irvine, CA 92718
52648	Plessey Trading Corp	1641 Kaiser Ave Irvine, CA 92714
52683	Baytron Co Inc	344 Salem St Medford, MA 02155
52763	Stettner Electronics Inc	6135 Airways Blvd Chattanooga, TN 37421
52840	Western Digital Corp	3128 Red Hill Ave Costa Mesa, CA 92626
53387	Minnesota Mining & Mfg Co Electronic Products Div 3M	Austin, TX
53421	Tyton Corp	7930 N Faulkner Rd PO Box 23055 Milwaukee, WI 53223
53673	Thomson-CSF Components Corp	6660 Variel Ave Canoga Park, CA 91304
54186	Micro Power Systems Inc	3100 Alfred St Santa Clara, CA 95050
54343	Riedel M W and Co	300 Cypress Ave Alhambra, CA 91801
54487	Micronetics Inc	36 Oak St Norwood, NJ 07648
54516	National Cable Molding Corp	136 San Fernando Rd Los Angeles, CA 90031
54558	SDI Inc	North Billerica, MA
54583	TDK Electronics Corp	12 Harbor Park Dr Port Washington, NY 11550
55153	Dielectric Laboratories Inc	69 Albany St Cazenovia, NY 13035
55261	LSI Computer Systems Inc	1235 Walt Whitman Rd Melville, NY 11747
55285	Bergquist Co Inc	5300 Edina Industrial Blvd Minneapolis, MN 55435
55322	Samtec Inc	810 Progress Blvd PO Box 1147 New Albany, IN 47150
55387	Pamtech	8030 Remmet Ave Canoga Park, CA 91304
55566	RAF Electronic Hardware Inc	95 Silvermine Rd Seymour, CT 06483-3915
55576	Synertek	3001 Stender Way Santa Clara, CA 95051
55680	Nichicon America Corp	927 E State Pky Schaumburg IL 60195
55801	Compensated Devices Inc	166 Tremont St Melrose, MA 02176-2204
55989	Semicon Inc Div of the Lorvic Corp	8810 Frost Ave St. Louis, MO 63134-1002
56248	Consolidated Refining Co	115 Hoyt Ave Mamaroneck, NY 10543
56289	Sprague Electric Co	87 Marshall St North Adams, MA 01247
56501	Thomas & Betts Corp	1001 Frontier Rd Bridgewater, NJ 08807

Cage	Name	Address
56563	Alatec Products	12747 Saticoy St North Hollywood, CA 91605
56866	Quality Thermistor Inc	2147 Centurion Pl Boise, ID 83709
57032	Daden Associates Inc	23011 Moulton Pky A-12 Laguna Hills, CA 92653
57793	United Microwave Products Inc	185 West 205th St Torrance, CA 90503
57834	Brim Electronics Inc	120 Home Pl Lodi, NJ 07644-1514
58090	Thermometrics Inc	808 Rt 1 Edison, NJ 08817-4624
58202	Innowave Inc	15555 Concord Circle Morgan Hill, CA 95037
58361	General Instrument Corp Optoelectronics Div	3400 Hillview Ave Palo Alto, CA 94304
58377	National Electronics	11731 Markon Dr Garden Grove, CA 92641
58684	Magnetec Corp	61 W Dudleytown Rd Bloomfield, CT 06002
58756	CTS Corp Electromechanical Div	1142 W Beardsley Ave Elkhart, IN 46514
58758	Zambre Co Inc	2134M Old Middlefield Way Mountain View, CA 94043-2404
58900	Giga-tronics Inc	4650 Norris Canyon Road San Ramon, CA 94583
59124	KOA Speer Electronics Inc	Bolivar Dr PO Box 547 Bradford, PA 16701
59365	Metelics Corp	975 Stewart Dr Sunnyvale CA 94086
59660	Tusonix Inc	2155 N Forbes Blvd #107 Tucson, AZ 85745
59942	AVX Filters Corp	11144 Penrose St Sun Valley, CA 91352
59980	Midwest Polychem Ltd	1502 N 25th Ave Melrose Park, IL 60160
6A566	Tecknit Corp	320 North Nopal St Santa Barbara, CA 93103
6V806	Frammar Mfg Inc (formerly Omni Spectra Corp)	6859 Tujunga Ave North Hollywood CA 91605
6Y341	Microwave Technology Inc	4268 Solar Way Fremont, CA 94538
60393	Precision Resistive Products	655 Main St Mediapolis, IA 52637
60395	Xicor Inc	851 Buckeye Ct Milpitas, CA 95035
60450	Microwave Components Inc	7 Meehan Dr Chelmsford, MA 01824
60583	Narda Microwave Corp	11040 White Rock Rd Suite 200 Rancho Cordova, CA 95670
60644	CSDC	PO Box 2116 Wayne, NJ 07470
61104	Aris Engineering Corp	30 Bond St Haverhill, MA 01830
61429	Fox Electronics Inc	5570 Enterprise Pky Ft. Myers, FL 33905
61485	Hitachi Denshi America Ltd	175 Crossways Park W Woodbury, NY 11797
61529	Aromat Corp	629 Central Ave New Providence, NJ 07974
61638	Advanced Interconnections	5 Energy Way West Warwick, RI 02893
61772	Integrated Device Technology	3236 Scott Blvd PO Box 58015 Santa Clara, CA 95052
61802	Toshiba International	13131 West Little York Rd Houston, TX 77041
61964	Omron Electronics Inc	1E Commerce Schaumburg, IL 60173
62277	Atlas Wire and Cable Corp	133 S Van Norman Rd Montebello, CA 90640

Cage	Name	Address
62331	Krytar Inc	1292 Anvilwood Ct Sunnyvale, CA 94086
62559	Schroff Inc	170 Commerce Dr Warwick, RI 02886
62643	United Chemicon Inc	9806 Higgins St Rosemont, IL 60018
63058	McKenzie Socket Technology Inc	44370 Old Warm Springs Blvd Fremont, CA 94538
63132	Time Microwave	398 Martin Ave Santa Clara, CA 95050
63345	Overland Products Co Inc	1687 Airport Rd Fremont, NE 68025
63468	Electro Dynamics	5625 Foxridge Dr Shawnee Mission, KS 66201
63542	Hall-Mark Electronics Corp	11333 Pagemill Rd Dallas, TX 75243
64135	Filter Concepts	2624 S Rousselle St Santa Ana, CA 92707
64155	Linear Technology Corp	1630 McCarthy Blvd Milpitas, CA 95035
64671	Inmet Corp	300 Dino Dr Ann Arbor, MI 48103
64859	AP Products Inc	9325 Progress Parkway Mentor, OH 44061
65032	Rogers Corp	PO Box 700 Chandler, AZ 85224
65449	Amtex Intl Inc	1878 Star Batt Rochester, MI 48063
65517	Ayer Engineering Co	1250 West Roger Rd Tucson, AZ 85705
65664	Catamount Mfg Inc	158 Governor Dr PO Box 720 Orange, MA 01364
65940	Rohm Corp	8 Whatney Irvine, CA 92714
65964	EVOX-RIFA Inc	100 Tri-State Intl. Suite 290 Lincolnshire, IL 60069
66039	Kaycor International	1732 Central St Evanston, IL 60201
66148	Fairlane Fluid/Air Products	23435 Industrial Park Dr Farmington, MI 48024
66449	Microsource Inc	1269 Corporate Center Pky Santa Rosa, CA 95407
66466	Standard Instrumentation Inc	3322 Pennsylvania Ave Charleston, WV 25302
66544	Continental Microwave & Tool Co	10 Merrill Industrial Dr Hampton, NH 03842-0998
66579	Waferscale Intergraton	47280 Kato Rd Fremont, CA 94538
66958	SGS Semiconductor Corp	7117 E 3rd Ave Scottsdale, AZ 52251
67297	Herotek Inc.	222 N Wolfe Rd Sunnyvale, CA 94086
68459	River Run Enterprises Inc	2001 Jefferson Davis Ave Selma, AL 36701
68630	Tadiran Electronics Industries Inc	3000 Dundee Rd Northbrook IL 60062
7E222	Littlefuse Tracor Inc	800 E Northwest Hwy Des Plaines, IL 60016
7E585	Zero Mfg	777 Front St Burbank, CA 91303
7M800	Analog Devices Inc	2444 Moorpark Ave San Jose, CA 95128
7U905	Seastrom Inc	2351 Kentucky Ave Indianapolis, IN 46241-4827
7W263	Huber and Suhner Ltd	Tumbleinstrass 20 Pfaffikon, Switz CH-8330
70364	American Electric Switch Corp	Route 4 Rocky Hill Hwy Lancaster, SC 29720
70903	Belden Corp	200 South Batavia Ave Geneva, IL 60134
71034	Bliley Electric Co	2545 W Grandview Blvd Erie, PA 16508
71218	Bud Industries	4605 E 355th St Willoughby, OH 44094

Cage	Name	Address
71450	CTS Corp	1201 Cumberland Ave West Lafayette, IN 47906
71468	ITT Corp, ITT Cannon Div	666 E Dyer Rd Santa Ana, CA 92702
71785	Labinal Components and Systems Inc	1521 Morse Ave Elk Grove Village, IL 60007
72259	Nytronics Inc	475 Park Ave South New York, NY 10016
72982	Murata Erie North America Inc	645 West 11th St Erie, PA 16512
73138	Beckman Industrial	4141 Palm St Fullerton, CA 92635
73734	Federal Screw Products Inc	3917 N Kedzie Ave Chicago, IL 60618-3415
74840	Illinois Capacitor Inc	3757 W Touhy Ave Lincolnwood, IL 60645
74970	Johnson E F Co	299 10th Ave South West Waseca, MN 56093
75263	Keystone Carbon Co Inc	1935 State St St Marys, PA 15857
75332	Kings Electronics Co Inc	Brooklyn, NY (relocated; see CAGE 91836)
75378	CTS Knights Inc	400 Reimann Ave Sandwich, IL 60548
75915	Tracor Littlefuse Inc	800 East Northwest Hwy Des Plains, IL 60016
78553	Eaton Corp Engineered Fasteners Div	14701 Detroit Ave Lakewood, OH 44107-4101
79963	Zierick Mfg Co	Radio Circle Mt Kisko, NY 10549
8B649	Intel Corp	3065 Bowers Ave Santa Clara, CA 95051
8E631	Solitron-MIC	Port Salerno, FL (relocated; see CAGE 95077)
8G639	Wavecom	Sunnyvale, CA 94086
8K805	Omni Spectra Inc	Los Altos, CA
8Z313	LMS Electronics	34101 Monroe Rd Charlotte, NC 28205
81073	Grayhill Inc	561 Hillgrove Ave La Grange, IL 60525
81312	Winchester Electronics	400 Park Rd Watertown, CT 06795
81349	'Military specification promulgated by military departments/agencies under authority of Defense Standardization Manual 4120 3-M.'	
81703	Mulberry Metal Products Inc	2199 Stanley Terrace Union, NJ 07083
81774	Carol Wire and Cable Corp	249 Roosevelt Ave Pawtucket, RI 02860
82152	Transco Products Inc	4241 Glenco Ave Marina Del Ray, CA 90295
82199	Polarad Electronics Inc	5 Delaware Drv Lake Success, NY 11042
82877	Rotron Inc	7 Hasbrouck Lane Woodstock, NY 12498
83330	Kulka Smith Inc	1913 Atlantic Ave Manasquan, NJ 08736
84084	American Iron and Machine Work	720 Industrial Blvd Oklahoma City, OK
84171	ARCO Electronics	400 Moreland Rd Commack, NY 11725-5707
84411	American Shizuki Corp	301 W O St Ogallala, NE 69153
86797	Rogan Corp	3455 Woodhead Dr Northbrook, IL 60062
88245	Winchester Electronics	13536 Saticoy St Van Nuys, CA 91409
89110	Amp Inc	1595 South Mt Joy St Elizabethtown, PA 17022

Cage	Name	Address
9B003	Dynamics Corp of America Electronics Systems Div	Encino, CA
9W826	EZ Form Cable Corp	315 Peck St Bldg 24 New Haven, CT 06513
9Z397	Fujitsu Component of America Inc	3320 Scott Blvd Santa Clara, CA 95054-3101
90201	Mallory Capacitor Co	4760 Kentucky Ave Indianapolis, IN 46206
91303	KOL Inc	St Paul, MN
91506	Augat Inc	452 John Dietsch Blvd Attleboro Falls, MA 02763
91637	Dale Electronics Inc	1122 23rd St Columbus, NE 68601-3632
91662	Elco Corp	Industrial Park Huntington, PA 16652
91833	Keystone Electronics Corp	31-07 20th Rd Astoria, NY 11105
91836	Kings Electronics Co Inc	40 Marbledale Road Tuckahoe, NY 10707-3420
92194	Alpha Wire Corp	711 Lidgerwood Ave Elizabeth, NJ 07207
93459	Weinschel Engineering Co	1 Weinschel Lane Gaithersburg, MD 20877
94696	Magnecraft	1910 Techny Rd Northbrook, IL 60062
95054	Sermax Corp	Milwaukee, WI
95077	Solitron Devices Inc Solitron/Microwave Div	1177 Blue Heron Blvd Bldg 2 Riviera Beach, FL 33404
95146	Alco Electronics Products Inc	1551 Osgood St North Andover, MA 01845
95275	Vitramon Inc	Box 544 Bridgeport CT 06601
95348	Gordos Arkansas Inc	1000 N 2nd St PO Box 824 Rogers, AR 72757
95987	Weskesser Co Inc	727 West Glendale Ave Milwaukee, WI 53209
96341	Microwave Associates Inc	NW Industrial Park S Ave Burlington, MA 01803
96733	San Fernando Electric Mfg Co	1501 First St San Fernando, CA 91341
98291	ITT Sealectro	585 E Main St New Britain, CT 06051
99800	American Precision Industries Inc Delevan Div	270 Quaker Rd East Aurora, NY 14052-2114
99899	Narda Microwave/Loral Corp	435 Moreland Rd Hauppage, NY 11788
04713	Motorola Inc	5005 East McDowell Rd Phoenix, AZ 85008
05236	Jonathan Manufacturing Corp	1101 South Acacia Ave Fullerton, CA 92631
05245	Corcom Inc	1600 Winchester Rd Libertyville, IL 60048
05276	ITT Pomona Electronics Div	1500 E 9th St PO Box 2767 Pomona, CA 91766
05791	Lyn-Tron Inc	3150 Damon Way Burbank, CA 91505
05820	EG and G Wakefield Engineering	60 Audubon Rd Wakefield, MA 01880
05905	Jerobee Industries Inc	Redmond, WA
06049	Topaz Inc	9192 Topaz Way San Diego, CA 92123
06090	Raychem Corp	300 Constitution Dr Menlo Park, CA 94025-1111
06349	Cam-Lok Div Empire Product Inc	10540 Chester Rd Cincinnati, OH 45215
06383	Panduit Corp	17301 Ridgeland Tinley Park, IL 60477

Cage	Name	Address
06540	New Haven Mfg Corp Amatom Div	446 Blake St New Haven, CT 06515
06776	Robinson Nugent Inc	800 East 8th St New Albany, IN 47150
06915	Richco Plastics Co	5825 N Tripp Ave Chicago, IL 60646-6013
07115	Corning Glass Works	Houghton Pk Corning, NY 14830
07180	Sage Laboratories Inc	East Natick Industrial Park 3 Huron Dr Natick, MA 01760
07263	Fairchild Semiconductor Corp	Cupertino, CA
07512	Oak Materials Group Inc	McCaffery St Hoosick Falls, NY 12090
07556	Calabro Industries Inc	1372 Enterprise Dr West Chester, PA 19380
09022	Cornell-Dubilier Electronics	1605 East Rodney French Blvd New Bedford, MA 02741
09353	C and K Components Inc	15 Riverdale Ave Newton, MA 02158
09922	Burndy Corp	1 Richards Ave Norwalk, CT 06856
09969	Dale Electronics Inc	East Highway 50 PO Box 180 Yankton, SD 57078
1AU47	Lucas Weinschel Inc	1 Weinschel Ln PO Box 6001 Gaithersburg, MD
1BH13	Fenwall Electronics Inc	64 Fountain St Framingham, MA 01701-6211
1BR23	CW Industries Inc	Atlanta, GA 04000
1CY63	Sierra Microwave Technology	11295-B Sunrise Gold Circle Rancho Cordova, CA 95670
1DS68	Sumner Mfg Inc	Hwy 411 S-Sumner Dr PO Drawer A Rome, GA 30162
1ES66	Maxim Intergrated Products	510 North Pastoria Ave Sunnyvale, CA 94086
1E584	Electrical Wire Products Bay Associates Inc	150 Jefferson Dr Menlo Park, CA 94025-1115
1FN41	Atmel Corp	2125 Onel Dr San Jose, CA 95131
1JJ60	Applied Tooling and Mfg Inc	1115 Industrial Ave Escondido, CA 92025
1W232	Spacek Labs	528 Santa Barbara St Santa Barbara, CA 93101
1Y147	Virtech	805 G University Ave Los Gatos, CA 95030
11532	Teledyne Relays	12525 Daphne Ave Hawthorne, CA 90250
11769	Elco/Dyntech Div of Elco Corp	1225 East Wakeham Ave Santa Ana, CA 92702
12020	Ovenaire Div of Electronic Tech	706 Forrest St Charlottesville, VA 22901
12457	Merrimac Industries Inc	41 Fairfield Pl West Caldwell, NJ 07006
13103	Thermalloy Co Inc	2021 W Valley View Lane PO Box 810839 Dallas, TX 75381
13511	Amphenol Cadre Div Bunker Ramo Corp	Los Gatos, CA
13708	Allied Components	Inglewood, CA
13919	Burr-Brown Corp	6730 S Tucson Blvd Tucson, AZ 85734
14482	Watkins-Johnson Co	3333 Hillview Ave Palo Alto, CA 94304
14552	Microsemi Corp	2830 S Fairview St Santa Ana, CA 92704-5948
14604	Elmwood Sensors Inc	500 Narragansett Park Dr Pawtucket, RI 02861
14936	General Instrument Corp Power Semiconductor Div	600 West John St Hicksville, NY 11802

Cage	Name	Address
15268	RHG Electronics Laboratory Inc	161 East Industry Ct Deer Park, NY 11729
15450	Erie Specialty Products Inc	645 W 11th Street Erie, PA 16512
15542	Mini-Circuits Laboratory	2625 East 14th St Brooklyn, NY 11235
15915	Tepro of Florida Inc	2608 Enterprise Rd Clearwater, FL 33517
16179	M/A-Com Omni Spectra Inc	21 Continental Blvd Merrimack, NH 03054
16352	Codi Semiconductor Inc	144 Market Street Kenilworth, NJ 07033
16428	Cooper Industries Inc	350 NW N St Richmond, IN 47374
16453	Western Microwave Inc	495 Mercury Dr Sunnyvale, CA 94086
16508	Aerovox Corp	19th Ave S PO Box 867 Myrtle Beach, SC 29577
16733	Radio Frequency Systems Inc Cablewave Systems Div	60 Dodge Ave North Haven, CT 06473
17217	Gore W L and Associates Inc	555 Paper Mill Rd Newark, DE 19714
17540	Alpha Industries Inc	20 Sylvan Rd Woburn, MA 01801
17856	Siliconix Inc	2201 Laurelwood Rd Santa Clara, CA 95054
18041	Diodes Inc Power Components Div	21243 Ventura Blvd Woodland Hills, CA 91364-2109
18310	Concord Electronics Corp	30 Great Jones St New York, NY 10012
18324	Signetics Corp	4130 South Market Ct Sacramento, CA 95834
18364	Mag-Tool Co	940 American St San Carlos, CA 94070
18714	RCA Corp Findlay Plant	1700 Fostoria Rd Findlay, OH 45840
18736	Voltronics Corp	West St East Hanover, NJ 07936
19701	Mepco/Electra Inc	PO Box 760 Mineral Wells, TX 76067
2J873	Celeritex Inc	617 River Oaks Pky San Jose, CA 95134
2J899	Dynawave Inc	94 Searle St PO Box 938 Georgetown, MA 01833
2M734	Panasonic Co	PO Box 1502 Secaucus, NJ 07094
2M881	Harris Corp Harris Semiconductor	883 Stierling Rd Suite 8120 Mountain View, CA 94043-1930
2R182	Smith H H Co	325 N Illinois St Indianapolis, IN 46204-1703
2V941	Microsource Inc	1269 Corporate Ctr Pky Santa Rosa, CA 95407
20550	Engineering Mfg Co	Sheboygan, WI
20944	Wiltron Co	805 East Middlefield Rd Mountain View, CA 94042
20999	Minnesota Mining and Mfg Co	3M Center St Paul, MN 55101
21604	Buckeye Stamping Co	555 Marion Rd Columbus, OH 43207
21847	TRW Microwave Inc	825 Stewart Dr Sunnyvale, CA 94086
22519	Data Delay Devices	385 Lakeview Ave Clifton, NJ 07011
23499	Judd Wire Inc	870 Los Vallecitos Blvd San Marcos, CA 92069
23899	Van Petty Mfg Inc	1168 Tourmaline Dr Newbury Park, CA 91320
23936	Pamotor	770 Airport Blvd Burlingame, CA 94010

Cage	Name	Address
24355	Analog Devices Inc	Rt 1 Industrial Park Norwood, MA 02062
24539	Avantek Inc	3175 Bowers Ave Santa Clara, CA 95054
24759	Lenox-Fugle Electronics Inc	100 Sylvania Place South Plainfield, NJ 07080-1448
24931	Specialty Connector Co Inc	2100 Earlywood Dr PO Box 547 Franklin, IN 46131
24995	Environmental Container System	3560 Rouge River Hwy Grants Pass, OR 97526
26066	Minnesota Mining and Mfg. Co	3M Center St Paul, MN 55101
26629	Frequency Sources Inc	16 Maple Rd Chelmsford, MA 01824
26692	B and S Tool & Die Company	2300 Sulphur Spring Rd Baltimore, MD 21227
26922	Cetec Corp	9900 Baldwin Place El Monte, CA 91731
26923	Control Master Products Inc	1062 Shary Circle Concord, CA 94518
27014	National Semiconductor Corp	2900 Semiconductor Dr Santa Clara, CA 95051
27264	Molex Inc	2222 Wellington Ct Lisle, IL 60532
27802	Vectron Laboratories Inc	166 Gover Ave Norwalk, CT 06850
27851	Film Microelectronics	17 A St Burlington, MA 01803
28480	Hewlett Packard Co	3000 Hanover St Palo Alto, CA 94304
28520	Heyco Molded Products	750 Boulevard PO Box 160 Kenilworth, NJ 07033
29005	Storm Products Co	112 South Glasglow Ave Inglewood, CA 90301
29111	Trak Microwave Corp	735 Palomar Ave Sunnyvale, CA 94086
29990	American Technical Ceramics	One Nordon Lane Huntington Stn, NY 11746
3A054	McMaster-Carr Supply Co	9630 Norwalk Blvd Santa Fe Springs, CA 90670
3E364	Vemaline	333 Strawberry Field Rd Warwick, RI 02887
3W023	Philips Components Discrete Product Div	5083 Kings Hwy Saugerties, NY 12477
3Z990	Tech Pro Inc	6243 E US Hwy 98 Panama City, FL 32404-7434
30035	Jolo Industries Inc	13921 Nautilus Dr Garden Grove, CA 92643-4026
30817	Instrument Specialties Co Inc	Exit 53 Route 80 PO Box A Delaware Water Gap, PA 18327
31433	Kemet Electronics Corp	2835 Kemet Way Simpsonville, SC 29681
31703	Gudrun Frederickson Co	Oakland, CA
31757	Micrpac Industries Inc	905 E Walnut St Garland, TX 75040
31781	Edac Inc	40 Tiffield Rd, Scarborough, Ont CAN M1V 5B6
31918	ITT Schadow Inc	8081 Wallace Rd Eden Prarie, MN 55344
32293	Intersil Inc	2450 Walsh Ave Santa Clara, CA 95051
32559	Bivar Inc	4 Thomas St Irvine, CA 92718
32767	Griffith Plastics Corp	1027 California Dr Burlingame, CA 94010
32997	Bourns Inc Trimpot Division	1200 Columbia Ave Riverside, CA 92507
33592	Miteq Inc	100 Davids Dr Huappauge, NY 11787
34031	Analog Devices	7810 Success Rd Greensboro, NC 27409

Cage	Name	Address
34078	Midwest Microwave Inc	3800 Packard Rd Ann Arbor, MI 48104
34335	Advanced Micro Devices Inc	901 Thompson Place Sunnyvale, CA 94086
34553	Amperex Electronic Corp	Hauppauge, NY 32732
34576	Rockwell International Corp	4311 Jamboree Rd Newport Beach, CA 92660
34781	MCW Industries	129 Southside Drive Charlotte, NC 28210
34785	Dek Inc	3480 Swenson Ave St Charles, IL 60174
36437	Star Stainless Products Ltd	Montreal, Que CAN H4T1N8
4F708	Hammond Mfg Co US Inc	1690 Walden Drive Buffalo, NY 14225
4R125	Magnetec Corp	61 W Dudleytown Rd Bloomfield, CT 06002
4S028	Brady W M Co Industrial Products Div	Milwaukee, WI
4T165	NEC Electronics USA Inc Electron Div	401 Ellis St P.O. Box 7241 Mountain View, CA 94039
4U402	Roederstein Electronics Inc	2100 W Front St Statesville, NC 28677-3651
4U751	Advanced Semiconductors Inc	7525 Etmel Ave Unit 6 North Hollywood, CA 91605-1912
46384	Penn Engineering & Mfg Corp	Old Easton Rd PO Box 1000 Danboro, PA 18916
5H281	Allmetal Screw Products	Arlington, TX
5J927	Interface Technology Div of Dynatech Corp	2100 E Alcosta Ave Glendora, CA 91740
50721	Datel Inc	11 Cabot Blvd Mansfield, MA 02048

7 Diagrams

7.1 Introduction

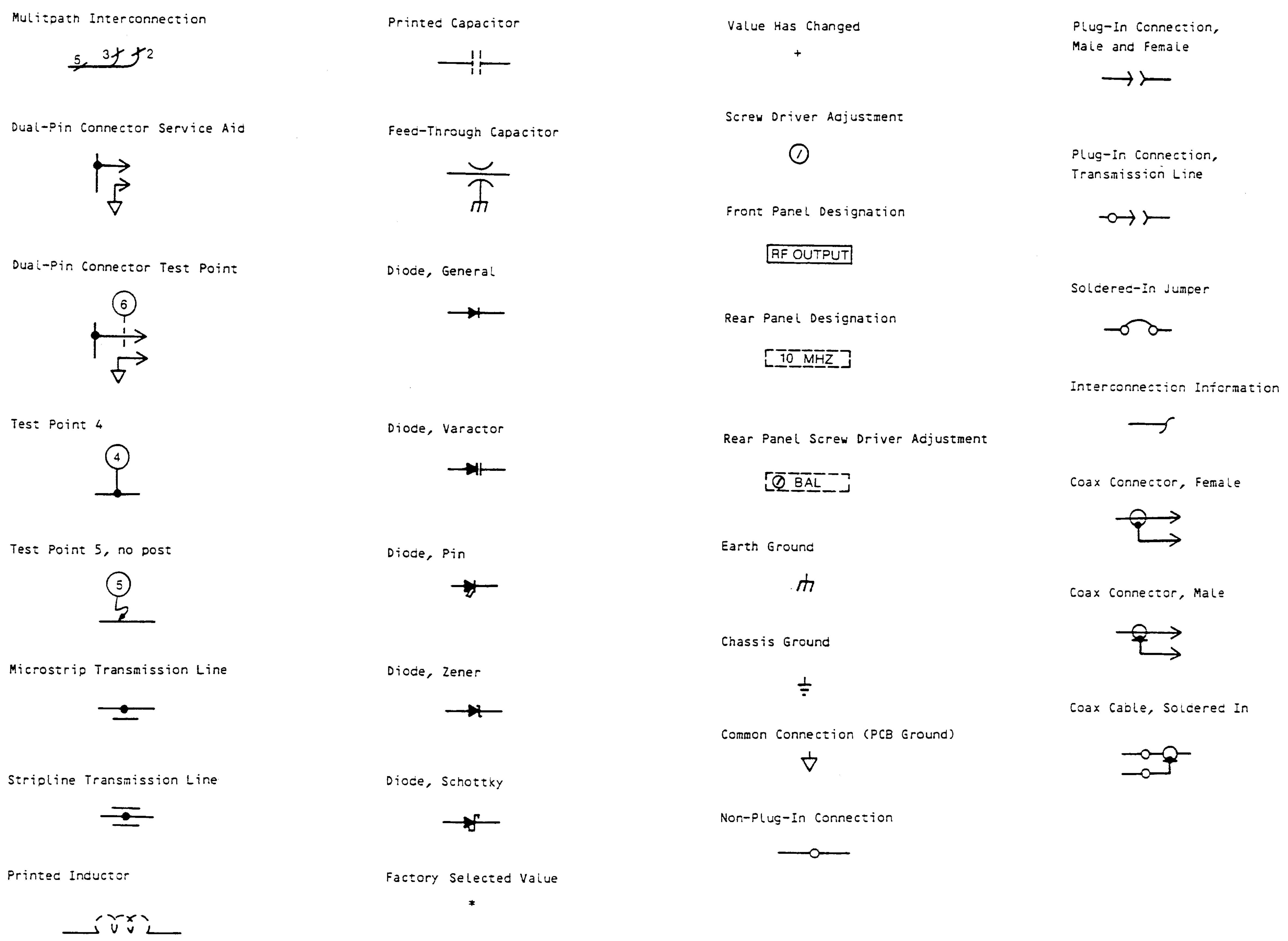
This chapter contains assembly drawings and circuit schematics for the Model 6062A Synthesized RF Signal Generator.

Parts lists for all assemblies are contained in Chapter 6.

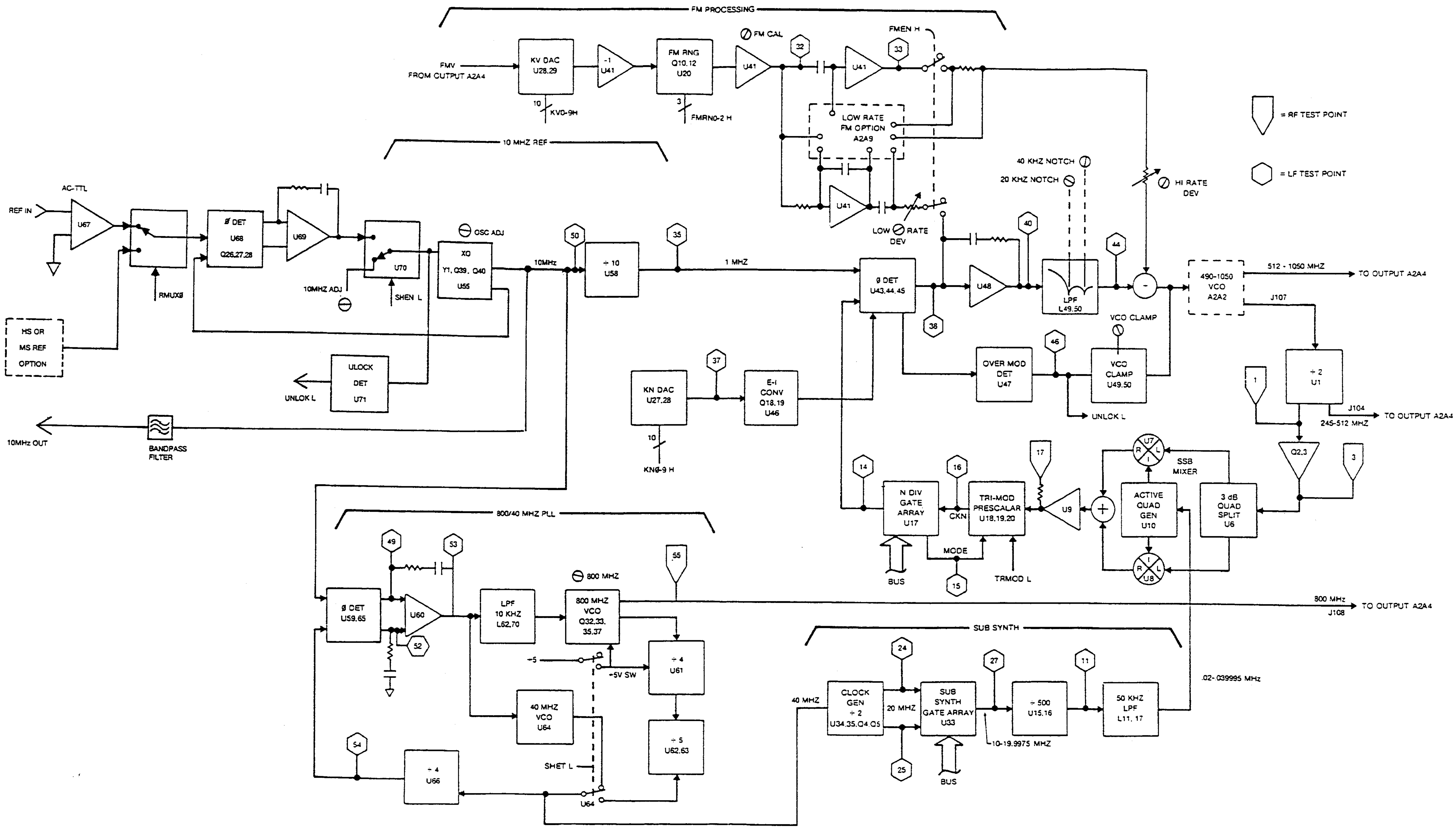
MNEMONIC	*DESCRIPTION*	*SIGNAL TYPE **		*MNEMONIC*	*DESCRIPTION*	*SIGNAL TYPE **
A 0-15	Address	B		KBIN	Keyboard Input Select	H
A12DB	Attenuator 12-dB Section Control	L		KN 0-9	PLL Gain Compensation DAC	H
A24(1-5)	Attenuator 24-dB Section Controls	L		KNV	Main PLL Gain Compensation Voltage	DC
A6DB	Attenuator 6-dB Section Control	L		KV 0-9	VCO Compensation DAC Control	H
BAB 0-3	Module Section Address	H		LEV 0-11	RF Level DAC Control	H
BD 0-7	Module Section Data	B		LRFM	Low-Rate FM Option Installed	L
BSEL 0.1	Module Section Select	L		MF400	Modulation Frequency Control	L
CKN	N-Divider Clock	L		MID	Mid Band Control	L
CLR	Display Clear	L		MLEVHI	External Modulation High-Level Status	H
D 0-7	Data	B		MLEVLO	External Modulation Low-Level Status	H
DBIN	Read Enable	L		MODE	Triple-Modulus Prescaler	L
DD 0-7	Display Data	B		NVCS	NVM RAM Chip Select	L
DIG	Display Digit Select	L		NVEN	NVM Enable	L
EXREF	External Reference Control	L		NVIN	NVM Installed	L
EXTAM	External AM Control	L		RIN	10-MHz Output Buffer Enable	H
EXTFM	External FM Control	L		RMUX0,1	Reference Multiplexer Select	H
FIL 1.2	Display Filament Supply	AC+DC		ROPT	Rear Output Option Installed	L
FM 0-9	FM Deviation DAC Control	H		RPP	RPP Option Installed	L
FMEN	FM Enable	H		RPRST	RPP Reset Control	H
FMRNG 0-2	FM Range Control	H		RPTRP	RPP Tripped Status	L
FMV	FM Audio	AF		SEG 1-3,9	Display Segment Select	L
HAOCT	Half-Octave Control	H		SHEN	Sub-Harmonic Reference Control	L
HET	Het (low) Band Control	L		SHET	Synthesizer Heterodyne Control	L
HSOPT	High-Stability Option Installed	L		SHREF	Sub-Harmonic Ref Option Installed	L
IEA 13-15	IEEE Address Bus	B		SHTUNE	Sub-Harmonic Ref Tuning Voltage	DC
IEADR	IEEE Address Latch Enable	L		TBOUT	Output Test Bit	H
IECS	IEEE Chip Enable	L		TBSYN	Synthesizer Test Bit	H
IED 0-7	IEEE Data Bus	B		TRMOD	Triple-Modulus Prescaler Select	L
IEDB	IEEE Read Enable	L		TRSEQ	Remote Sequence Trigger	L
IEIN	IEEE Option Installed	L		TUNE	Main PLL Tuning Voltage	DC
IEINT	IEEE Interrupt	L		UNLOK	PLL Unlocked or Overmodulated Status	L
IEW	IEEE Write Enable	L		UNLVL	ALC Loop Unleveled Status	L
INTAM	Internal AM Control	L		WE	Write Enable	L
INTFM	Internal FM Control	L		XOEN	10-MHz Crystal Oscillator Control	L

* Six SIGNAL types are listed in the following:

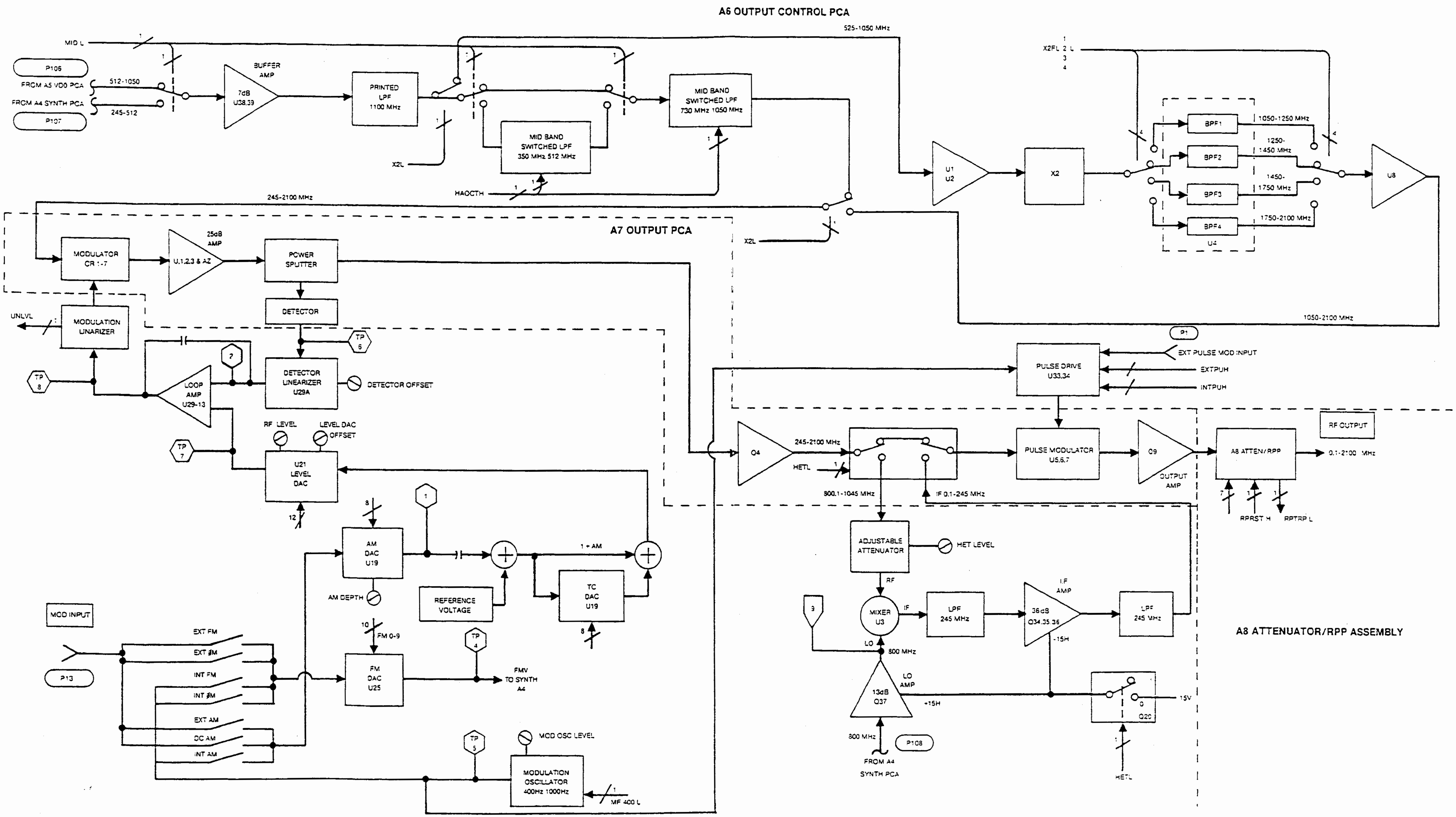
DC = DC Control
AC = Line Frequency
AF = Audio (modulation) Signal
L = Logic (binary) Signal, active low at the source
H = Logic (binary) Signal, active high at the source
B = Dynamic bus



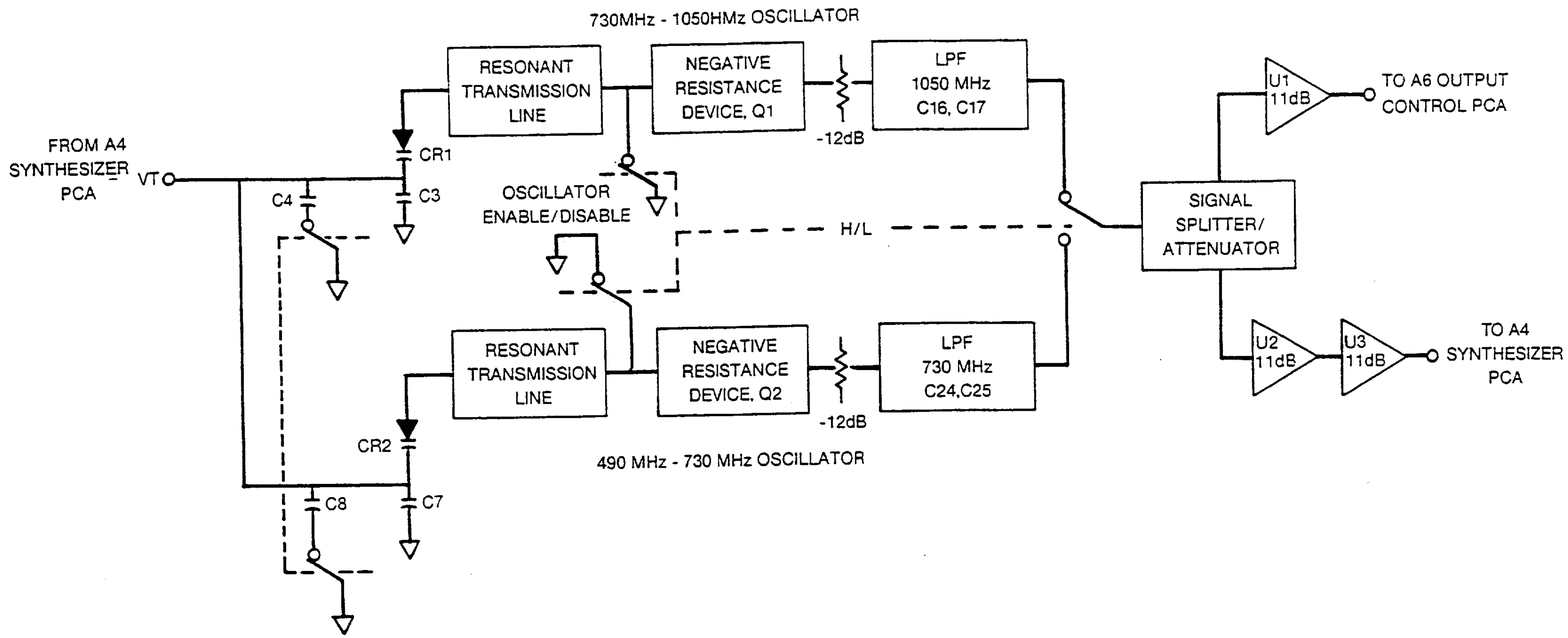
Schematic Symbols
Sheet 1 of 1

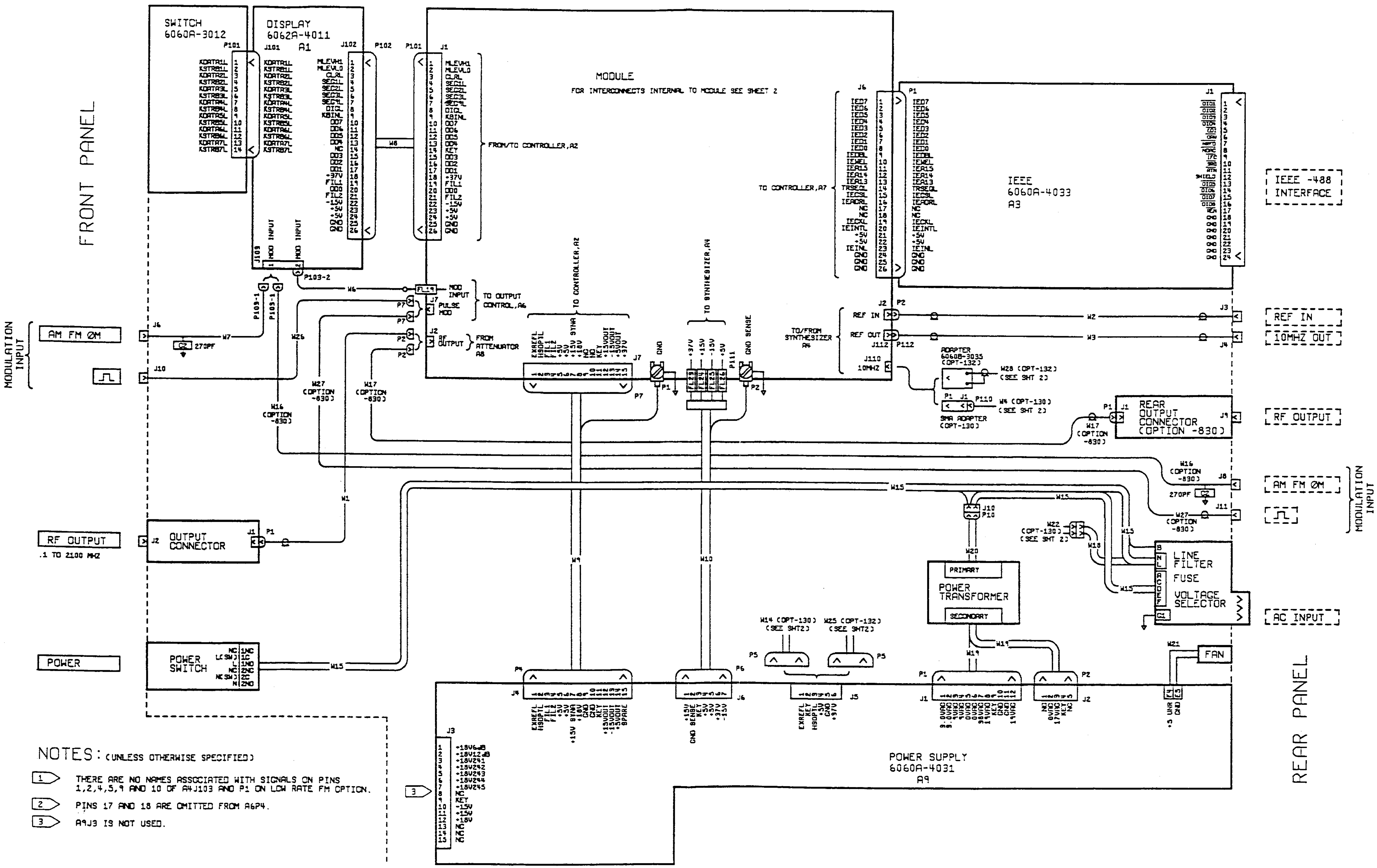


Synthesizer Block Diagram
Sheet 1 of 1



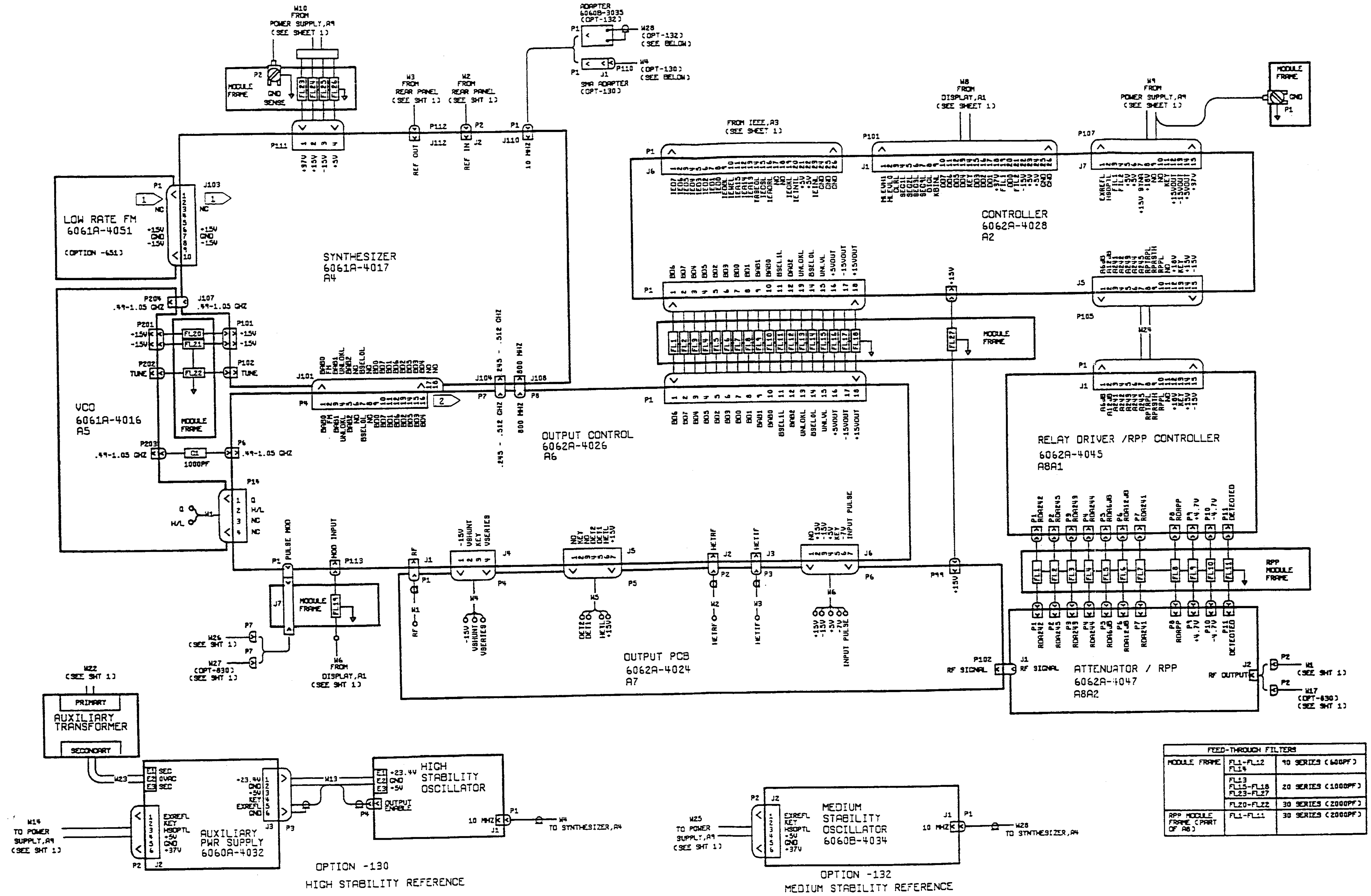
Output Block Diagram
Sheet 1 of 2


730MHz - 1050HMz OSCILLATOR
RESONANT TRANSMISSION LINE
NEGATIVE RESISTANCE DEVICE, Q1
LPF 1050 MHz C16, C17
-12dB
FROM A4 SYNTHESIZER PCA
VT
CR1
C3
C4
OSCILLATOR ENABLE/DISABLE
H/L
U1 11dB
TO A6 OUTPUT CONTROL PCA
SIGNAL SPLITTER/ ATTENUATOR
RESONANT TRANSMISSION LINE
NEGATIVE RESISTANCE DEVICE, Q2
LPF 730 MHz C24,C25
-12dB
U2 11dB
U3 11dB
TO A4 SYNTHESIZER PCA
CR2
490 MHz - 730 MHz OSCILLATOR
C8
C7



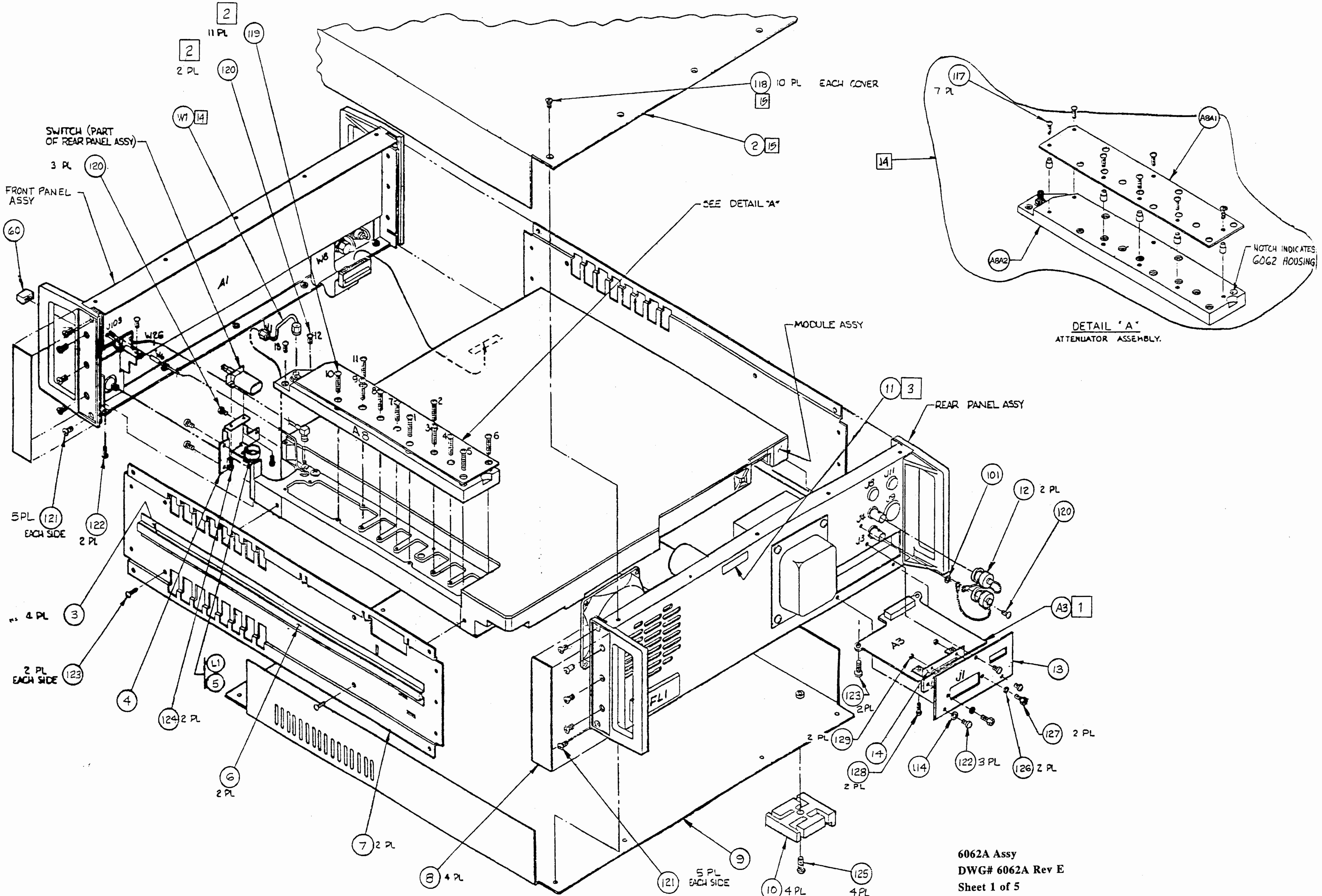
Interconnection Diagram

Sheet 1 of 2

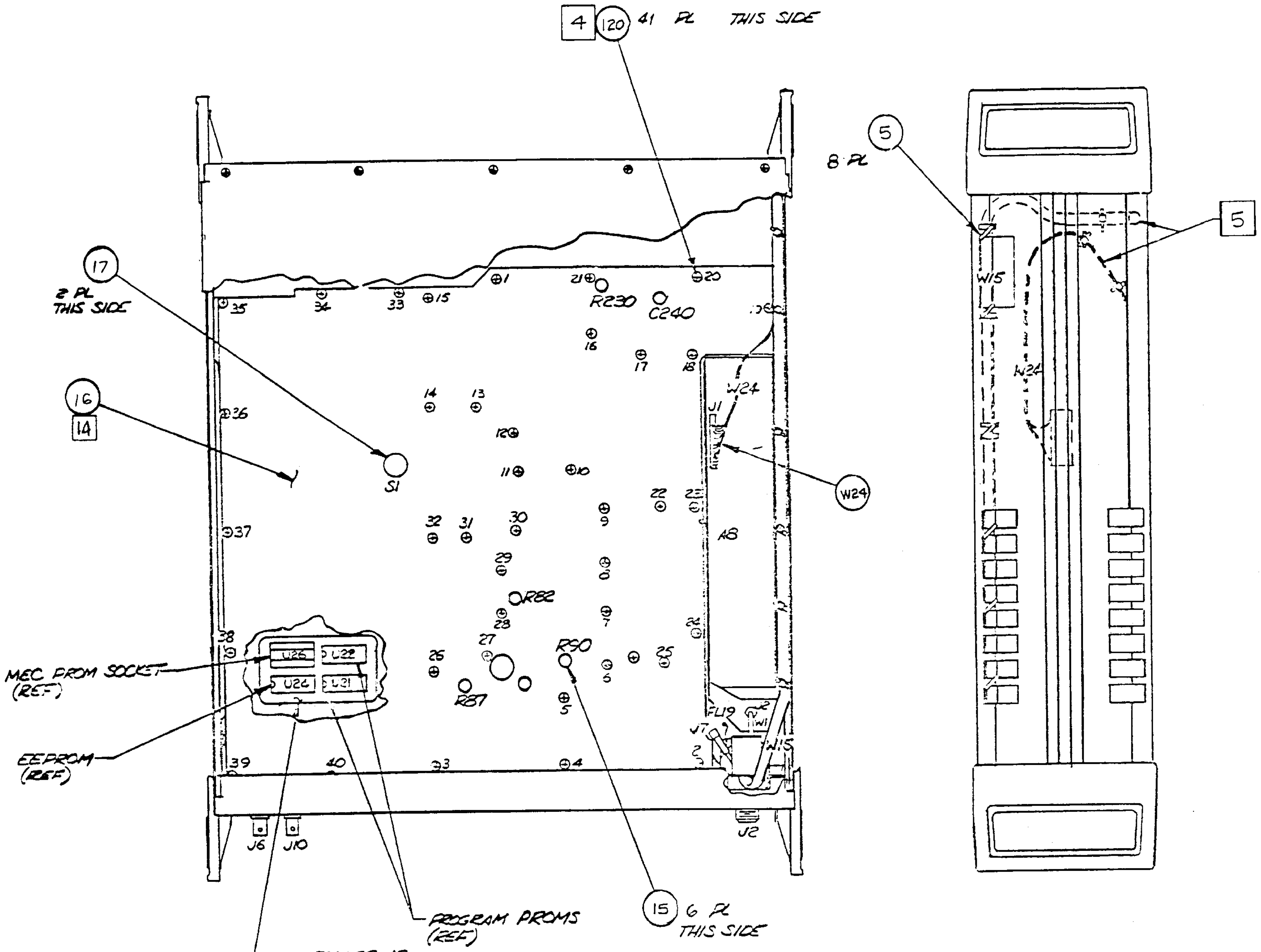


FEED-THROUGH FILTERS		
MODULE FRAME	FL1-FL12 FL14	10 SERIES (600PF)
	FL13 FL15-FL18 FL23-FL27	20 SERIES (1000PF)
	FL20-FL22	30 SERIES (2000PF)
RPP MODULE FRAME (PART OF A8)	FL1-FL11	30 SERIES (2000PF)

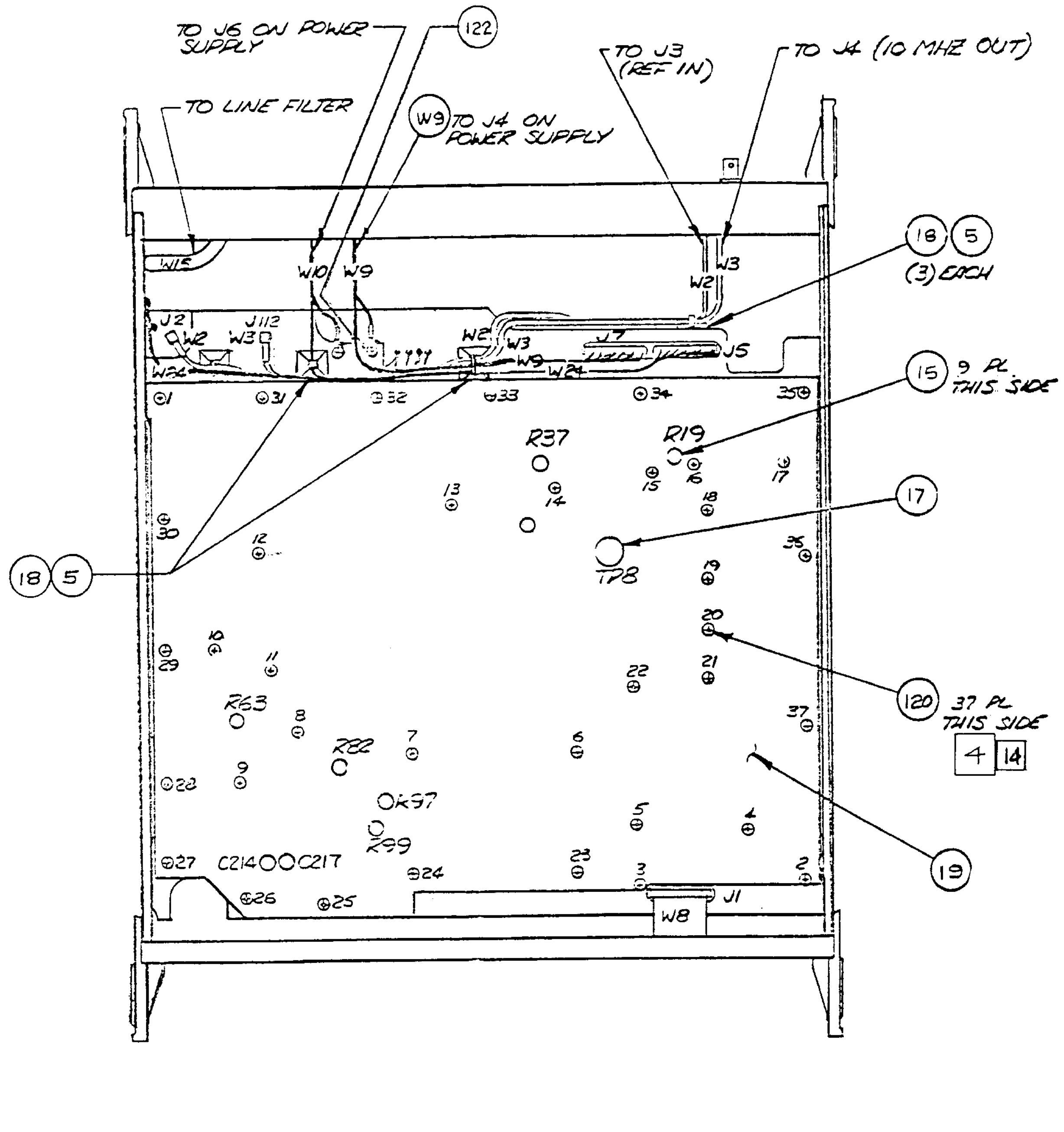
Interconnection Diagram
Sheet 2 of 2



6062A Assy
DWG# 6062A Rev E
Sheet 1 of 5



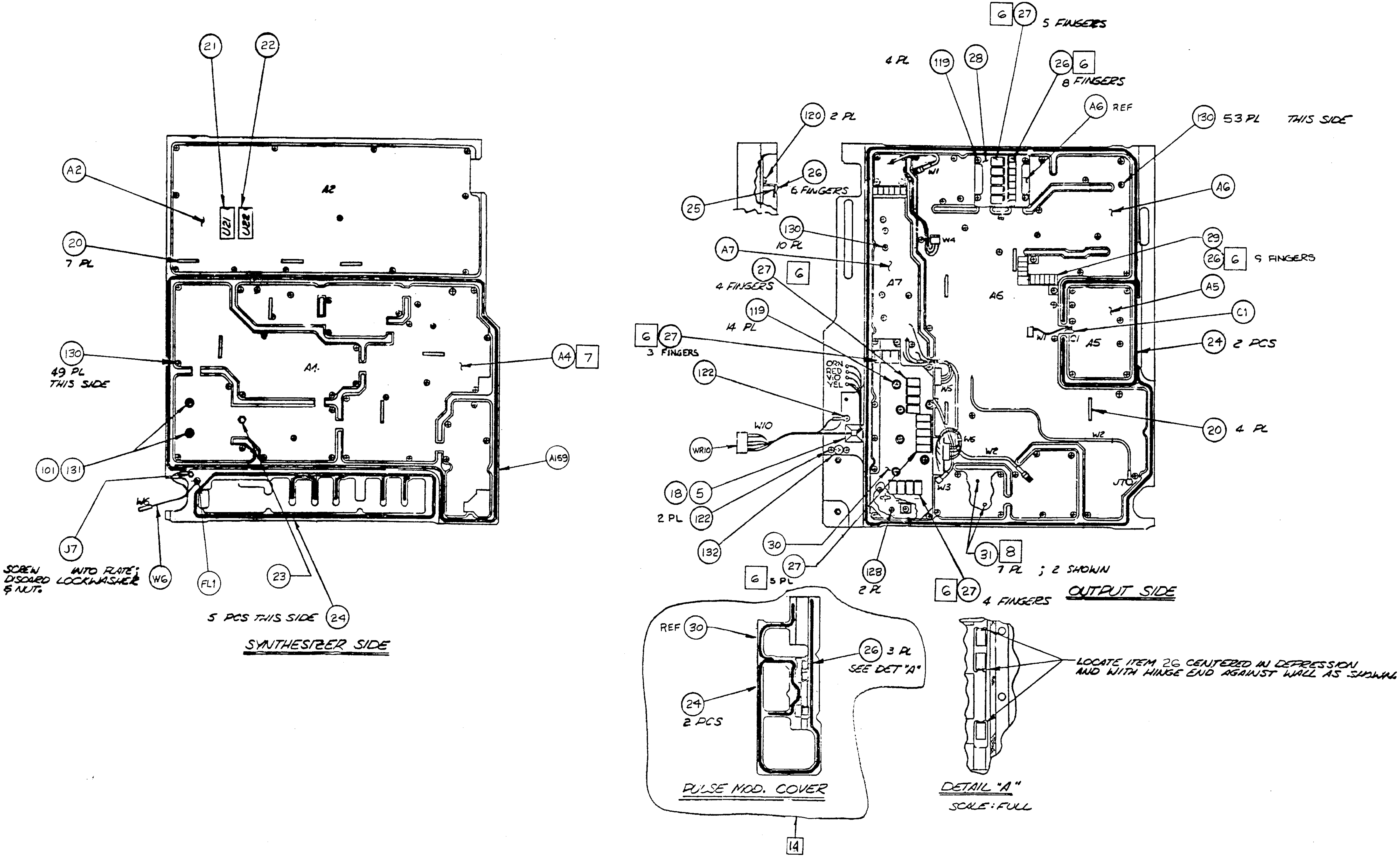
CONTROLLER/SYNTHESIZER SIDE



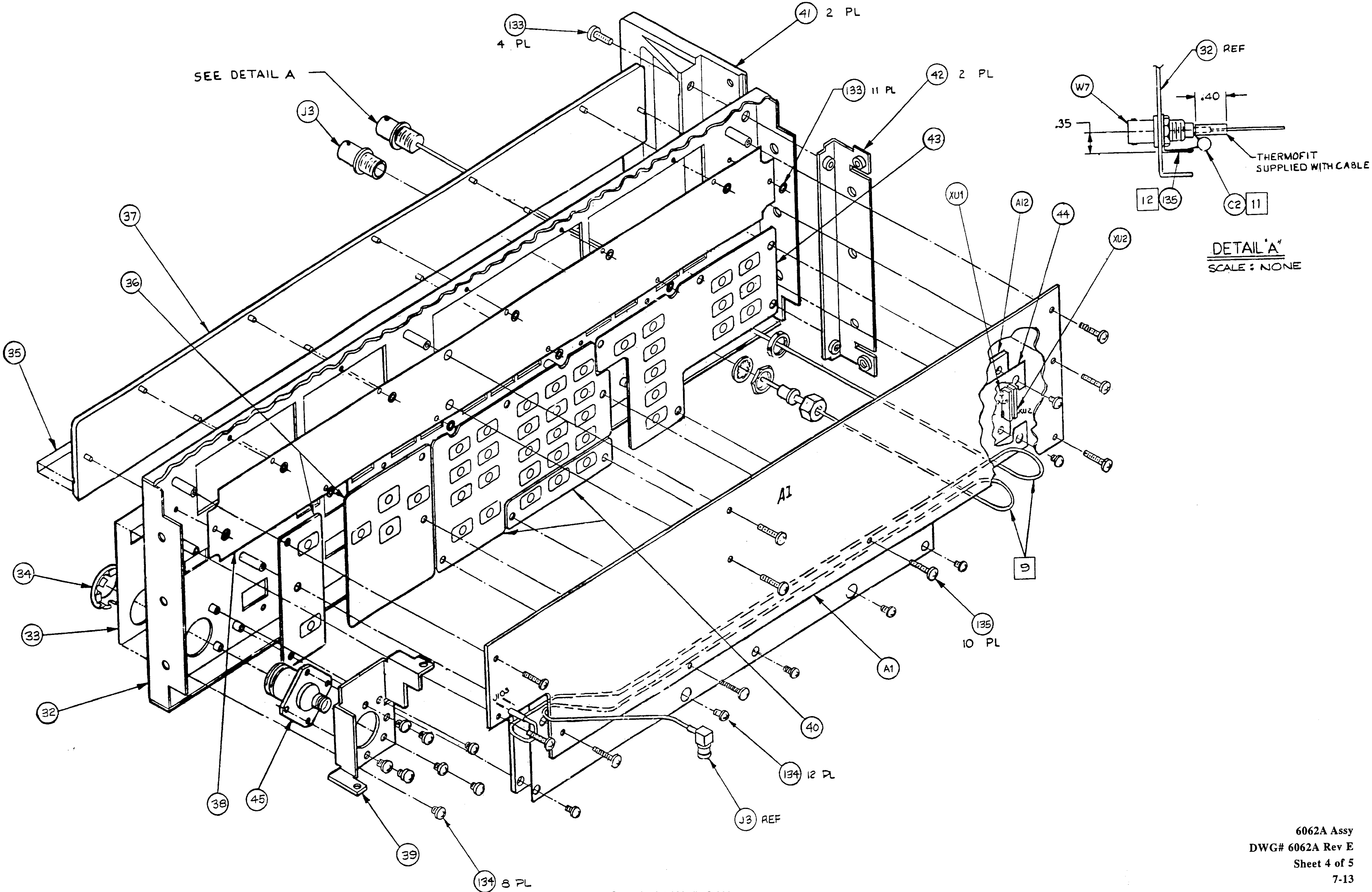
OUTPUT SIDE

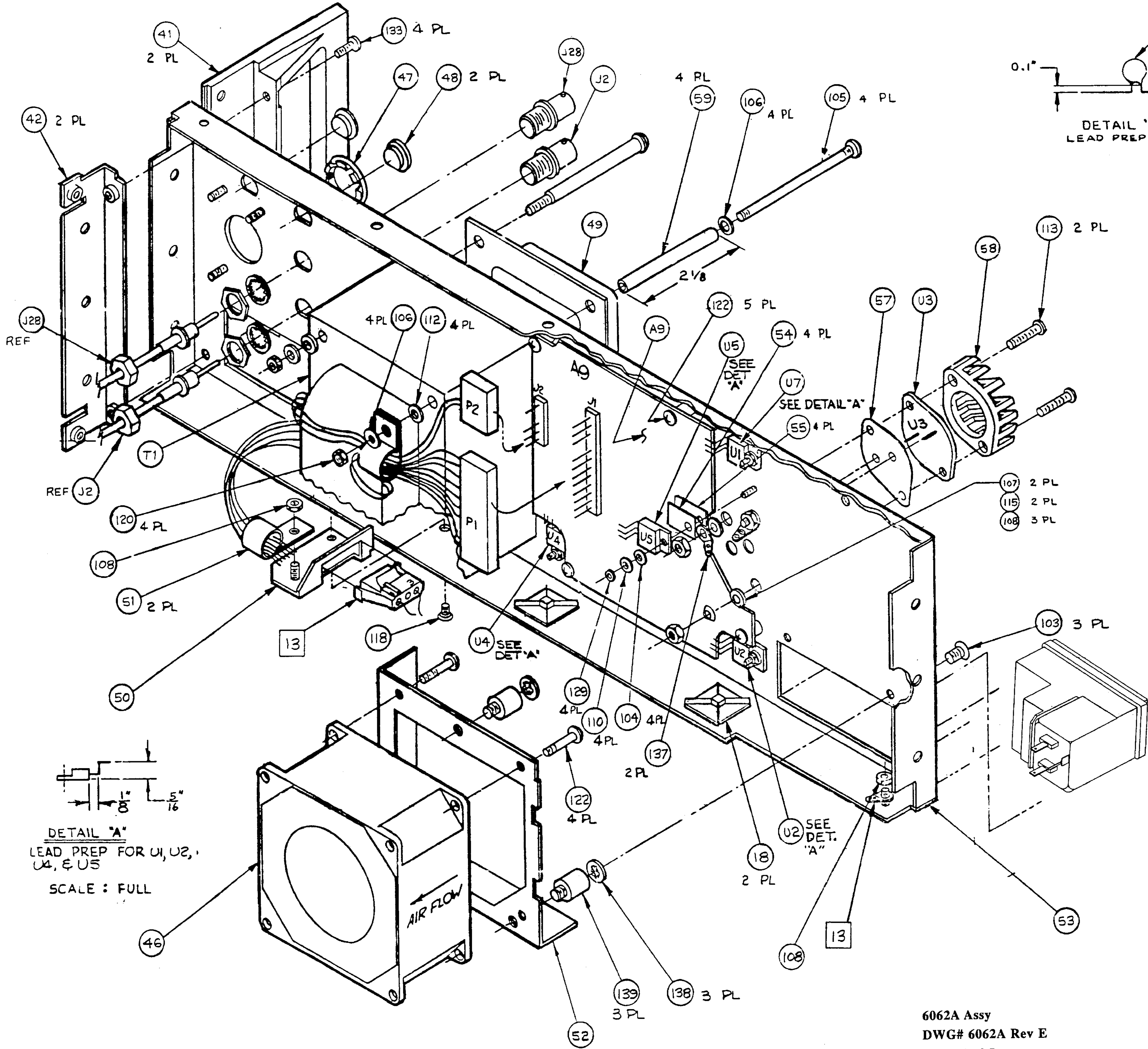
WIRE LIST					
PART NO.	TYPE	COLOR	AM'T	LENGTH	TAPE
135400	22C	WHT/GRN	1	1.2"	17/457
113852	THERMOFIT	BLK	4	2-1/8"	4/178
135483	22C	GRN	1	2"	31/69
115755	22C	YEL	1	2"	31/70
115717	22C	BLK	1	3"	31/71
597849	TWISTED PAIR		1	5-1/2"	17/455

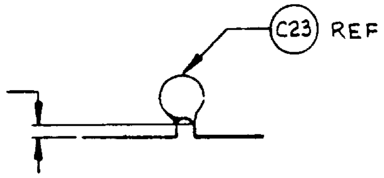
6062A Assy
DWG# 6062A Rev E
Sheet 2 of 5



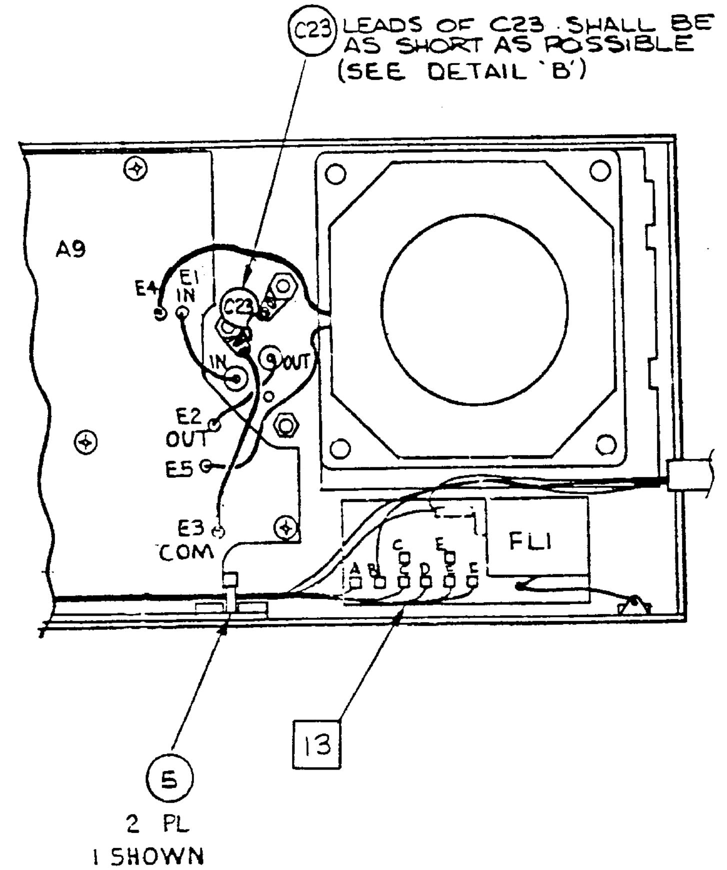
6062A Assy
DWG# 6062A Rev E
Sheet 3 of 5


SEE DETAIL A
133
4 PL
41 2 PL
42 2 PL
133 11 PL
43
J3
37
36
35
34
33
32
38
45
39
134 8 PL
40
134 12 PL
J3 REF
A1
135
10 PL
9
XU1
A12
44
XU2
32 REF
W7
.40
.35
THERMOFIT
SUPPLIED WITH CABLE
12
135
C2
11
J103
DETAIL "A"
SCALE: NONE





DETAIL 'B'
LEAD PREP FOR C23



DETAIL "A"
LEAD PREP FOR U1, U2, U4, & U5

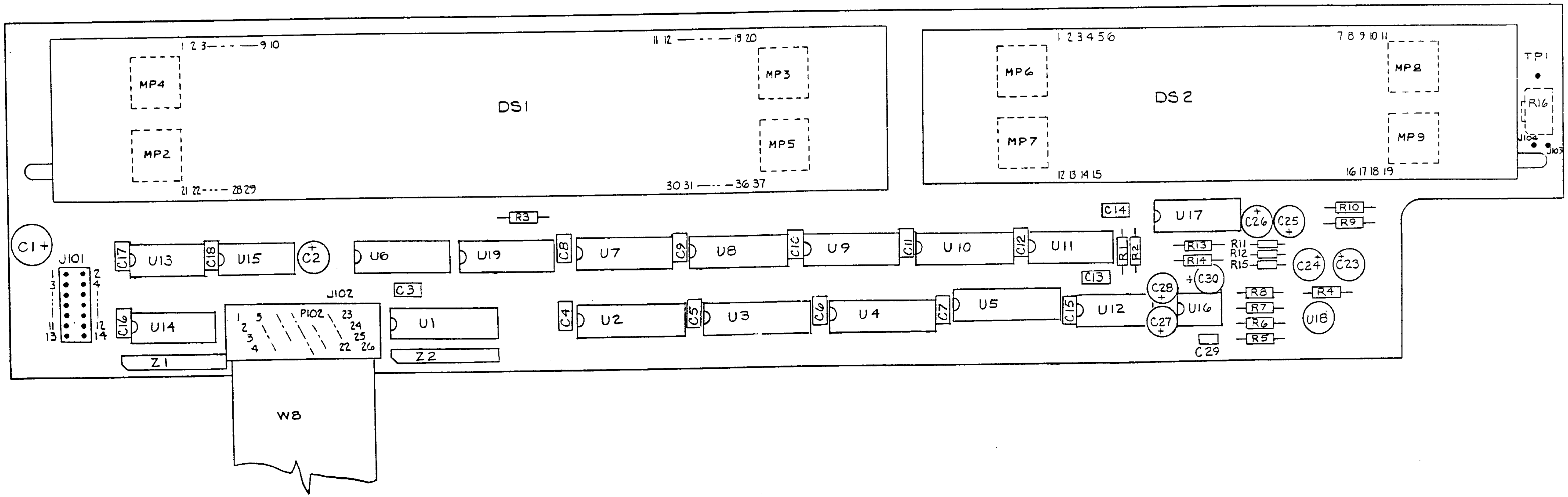
SCALE : FULL

WIRE CHART				
FROM	COLOR	TO	LENGTH	COMMENTS
A9–E1	GRN	U3–IN	2"	
A9–E2	YEL	U3–OUT	2"	
A9–E3	BLK	U3–COM	3"	MUST BE NO ELECTRICAL CONTACT BETWEEN U3–COM & REAR PANEL
A9–E4	RED	B1	4–1/2"	
A9–E5	BLK	B1	4–1/2"	

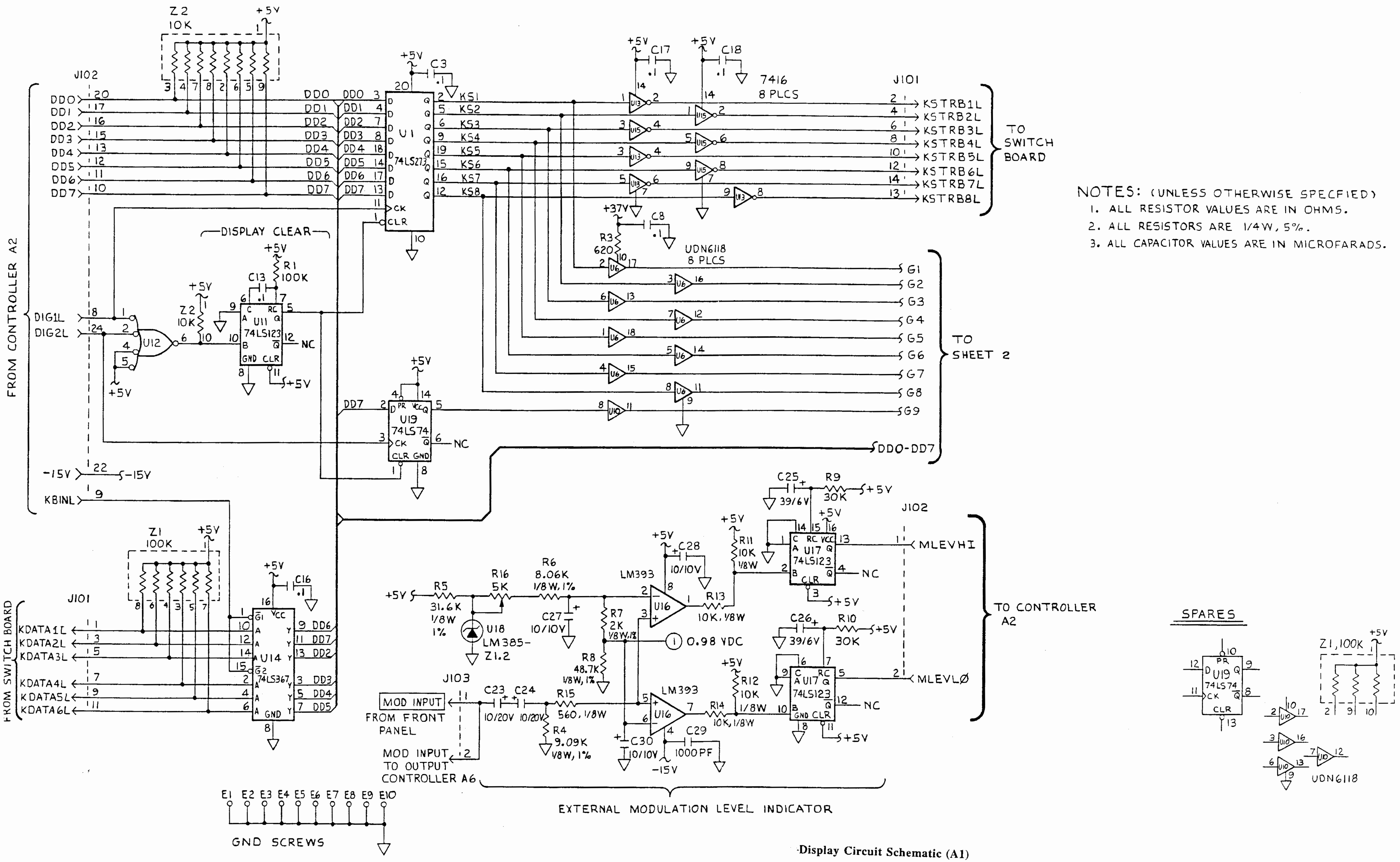
NOTES: UNLESS OTHERWISE SPECIFIED

13 VOLTAGE SELECTOR CARD IN ITEM W15 MUST BE IN 10V POSITION.

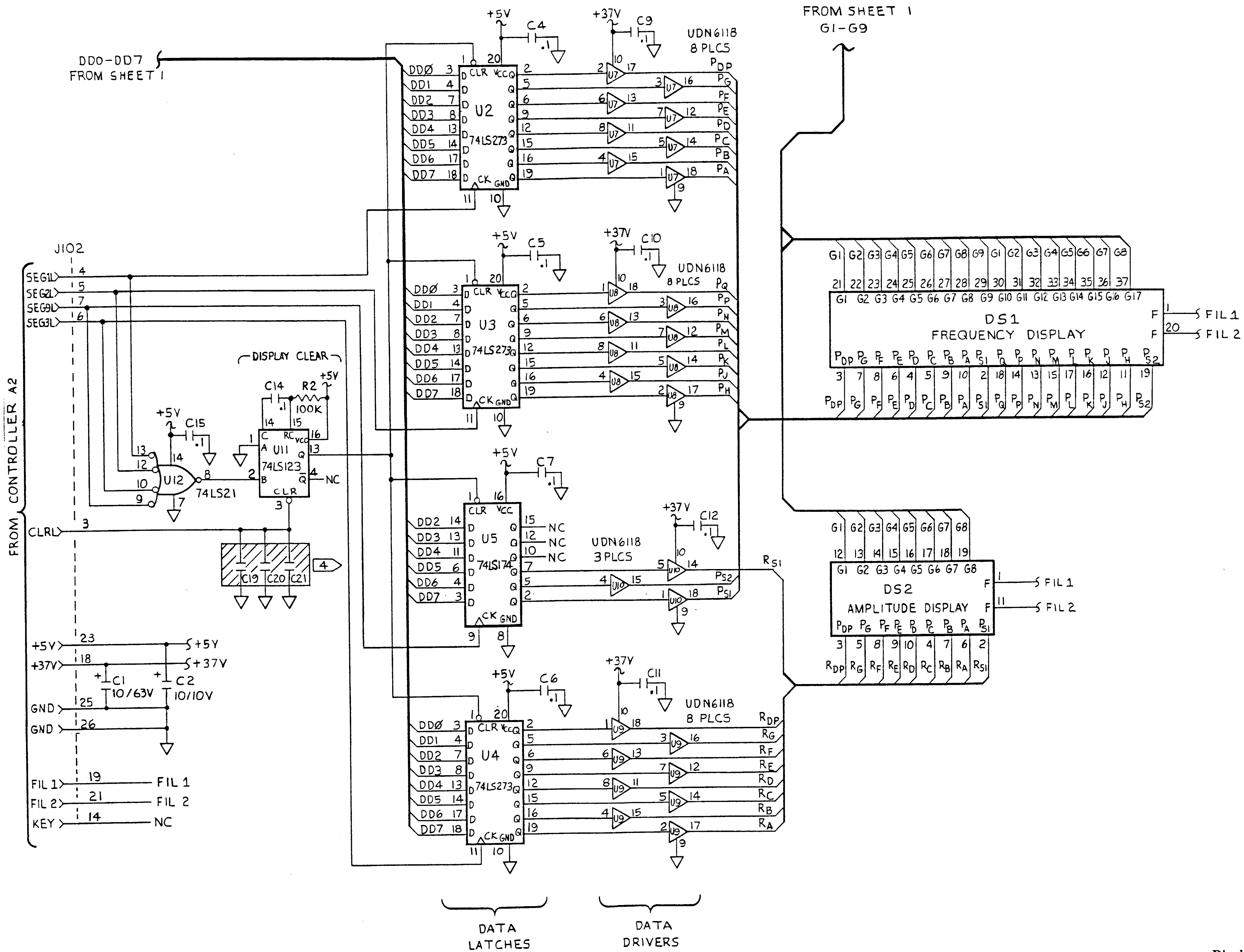
6062A Assy
DWG# 6062A Rev E
Sheet 5 of 5



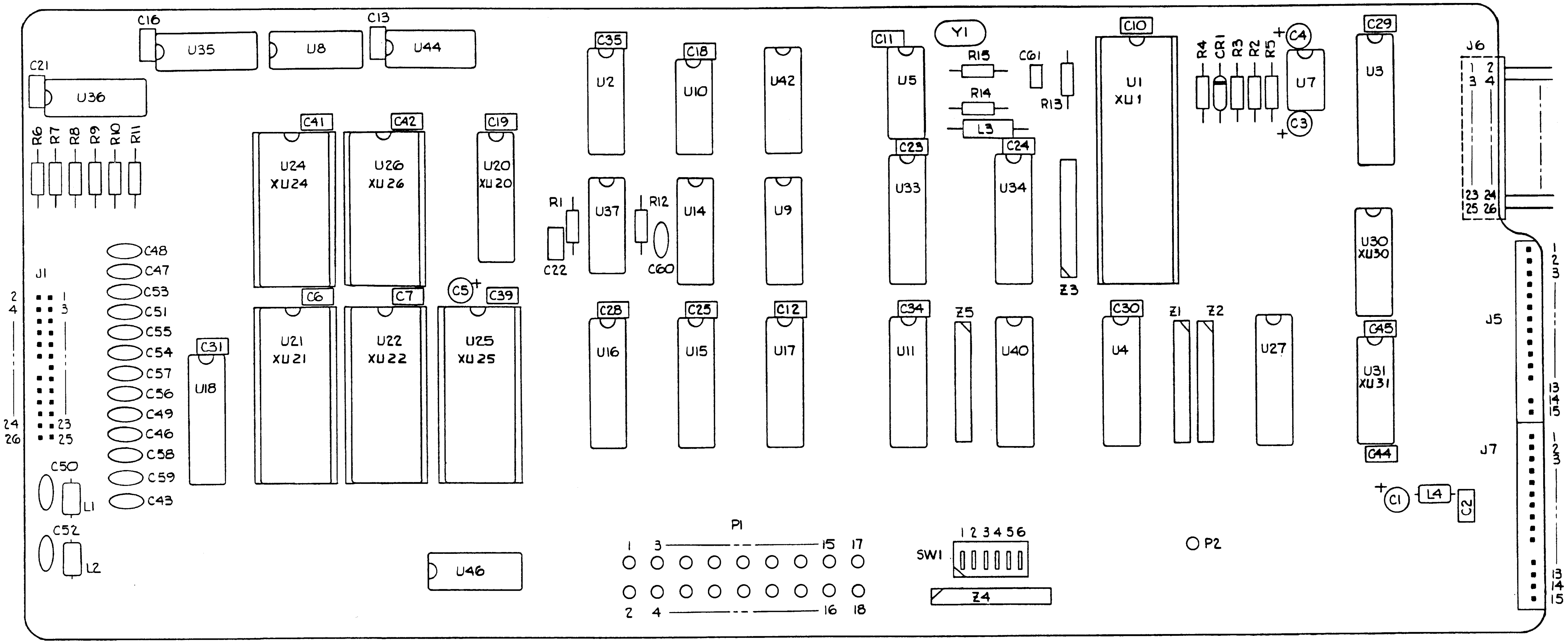
Display PC Assy (A1)
PART# 795021 Rev F
DWG# 6062A-1611 Rev 01
Sheet 1 of 1



Display Circuit Schematic (A1)
PART# 795021 Rev F
DWG# 6062A-1011 Rev B
Sheet 1 of 2



Display Circuit Schematic (A1)
PART# 795021 Rev F
DWG# 6062A-1011 Rev B
Sheet 2 of 2

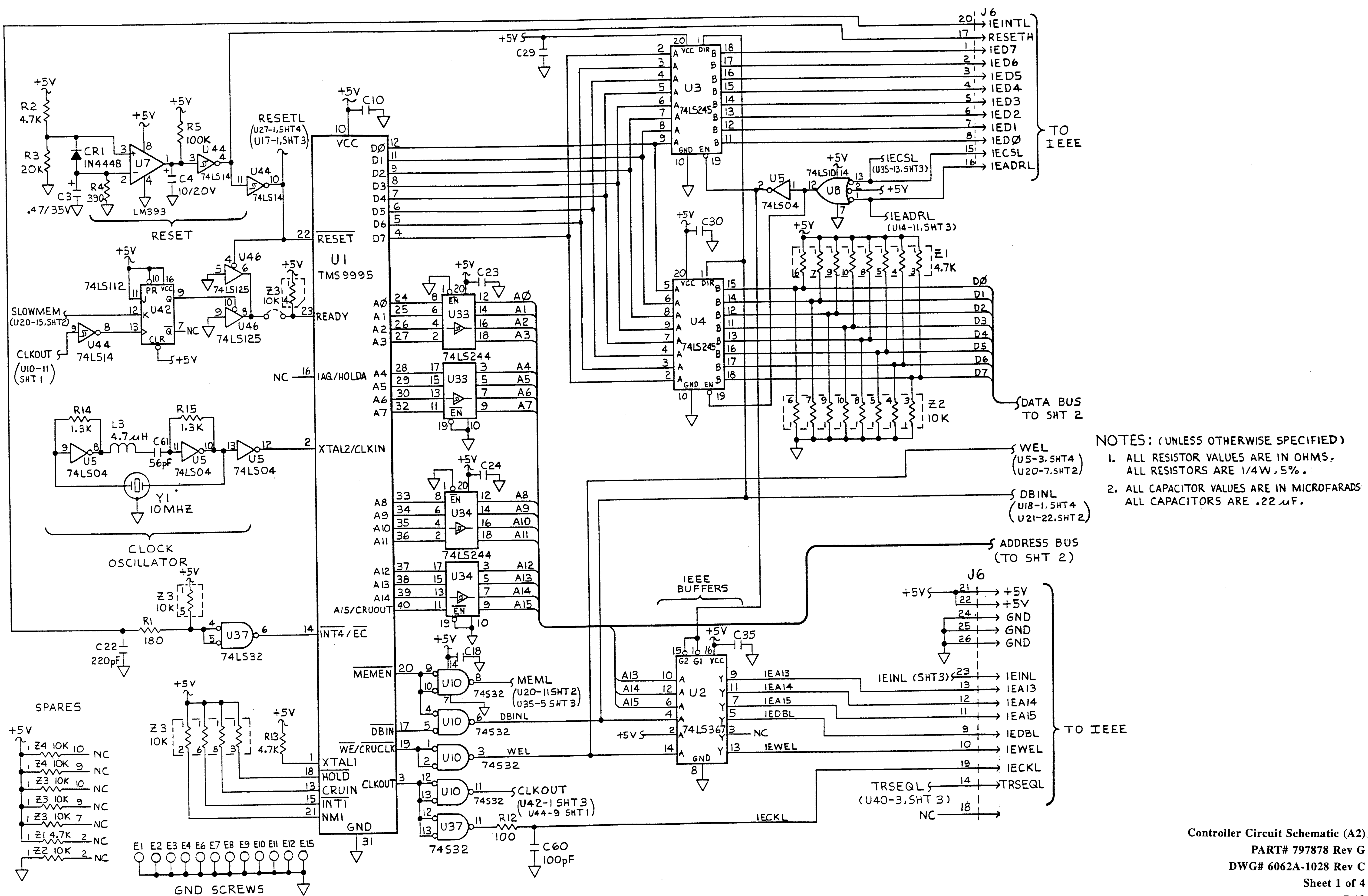


SWITCH SETTINGS

(SECTIONS NOT LISTED SHALL BE IN "OFF" POSITION)

SWITCH SECTION SET IN "ON" POSITION	FUNCTION
4	REAR OUTPUT INSTALLED OPTION -830
6	COMP ENABLE

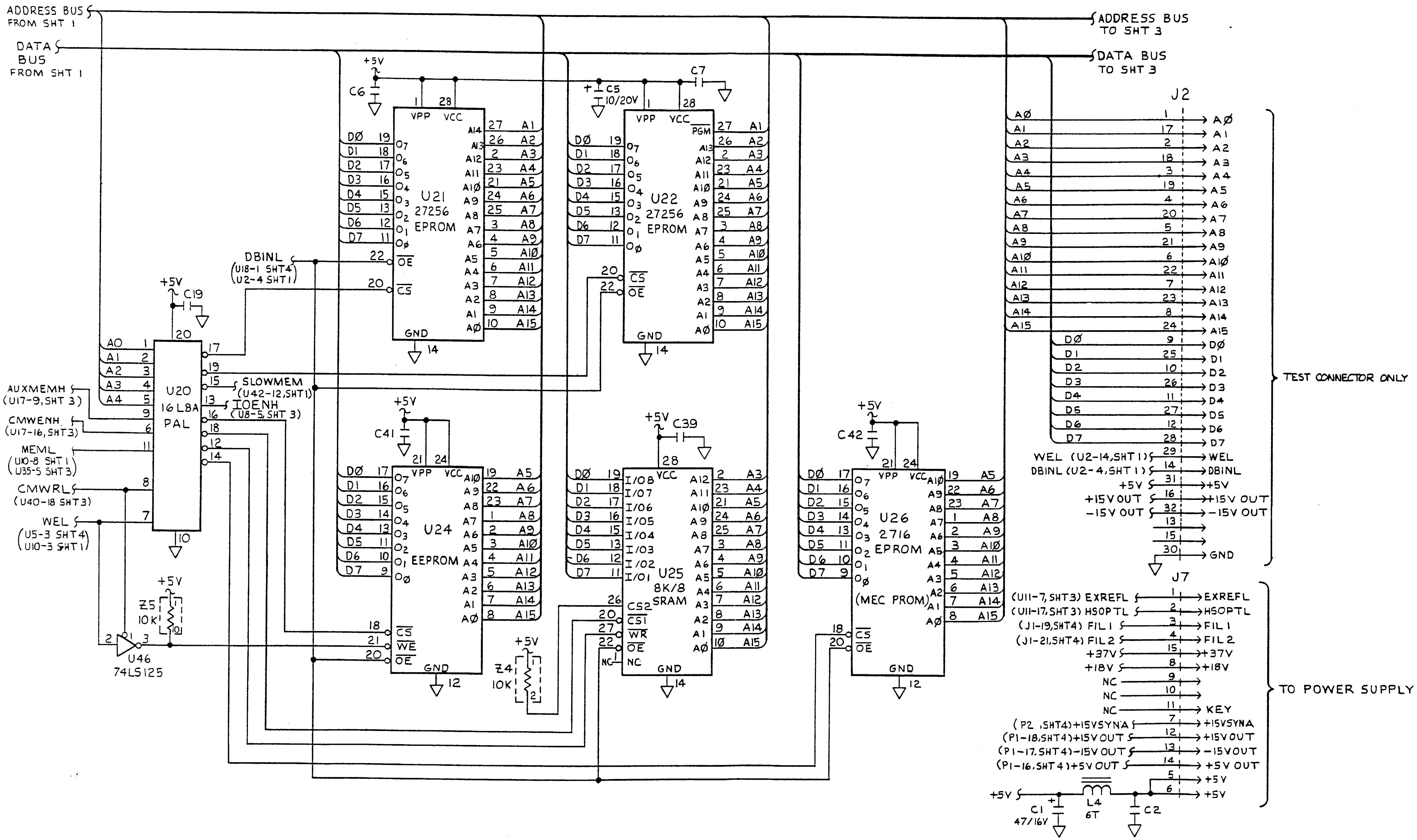
Controller PC Assy (A2)
PART# 797878 Rev G
DWG# 6062A-1628 Rev 01
Sheet 1 of 1



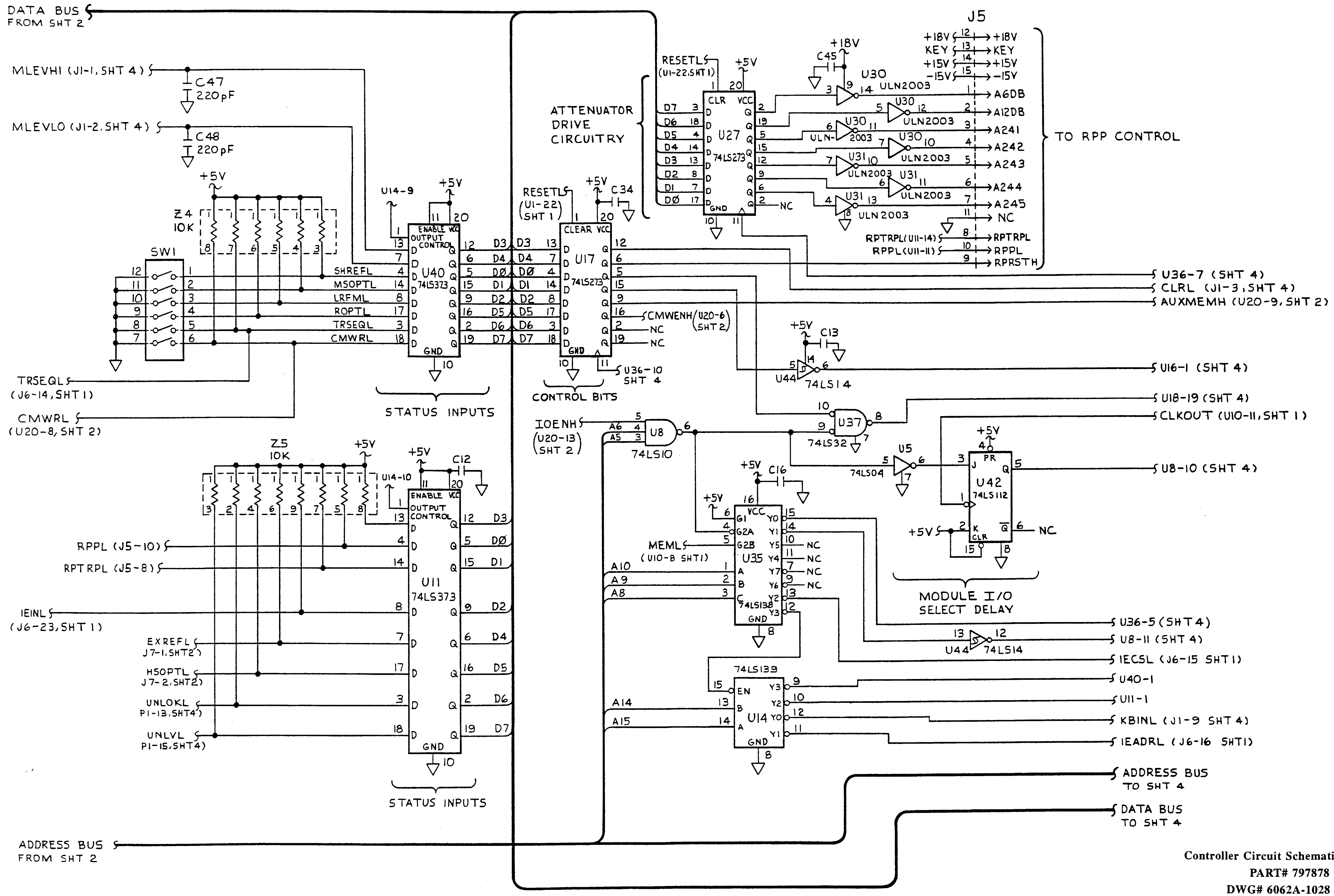
NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTOR VALUES ARE IN OHMS. ALL RESISTORS ARE 1/4W, 5%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS. ALL CAPACITORS ARE .22 µF.

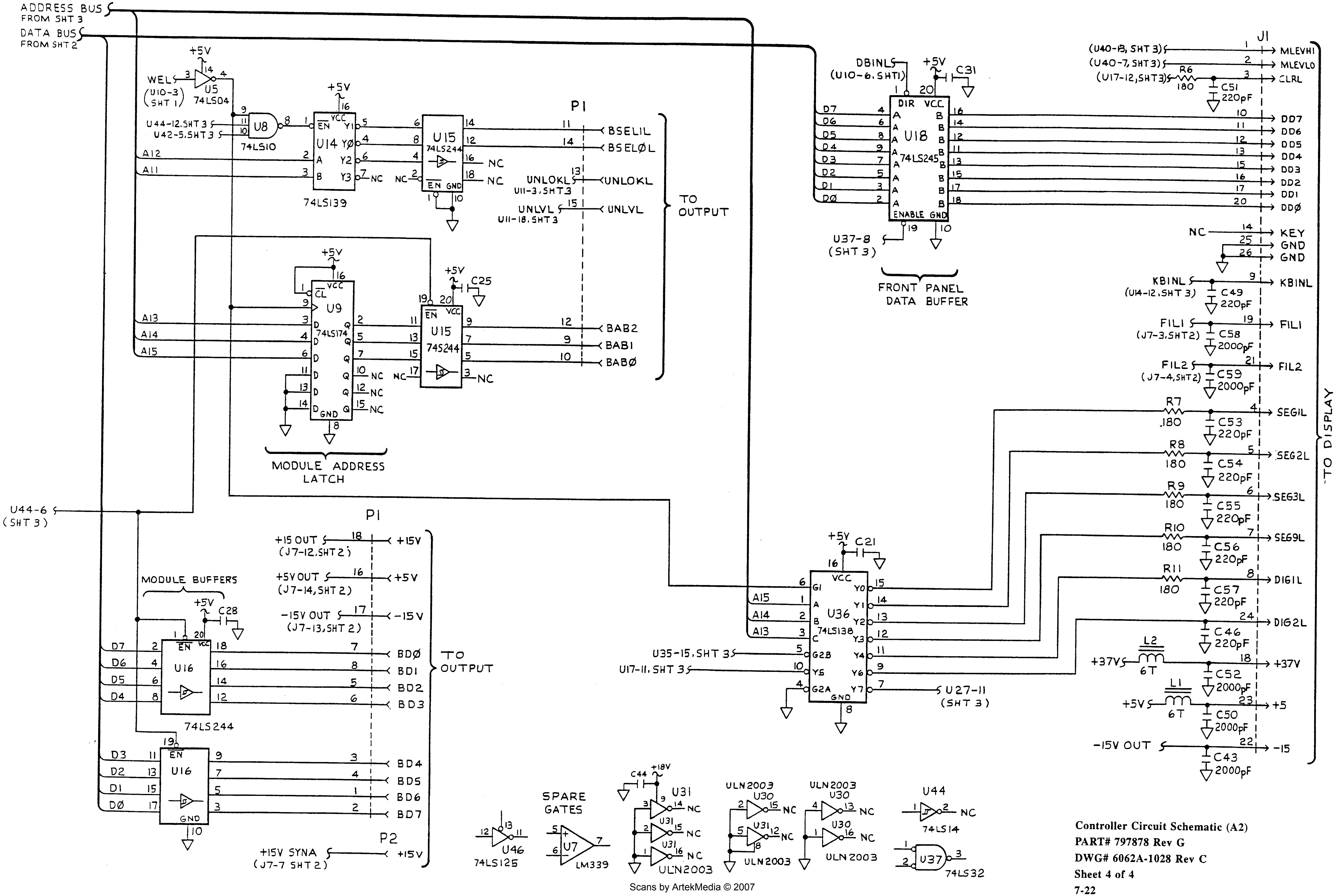
Controller Circuit Schematic (A2)
PART# 797878 Rev G
DWG# 6062A-1028 Rev C
Sheet 1 of 4



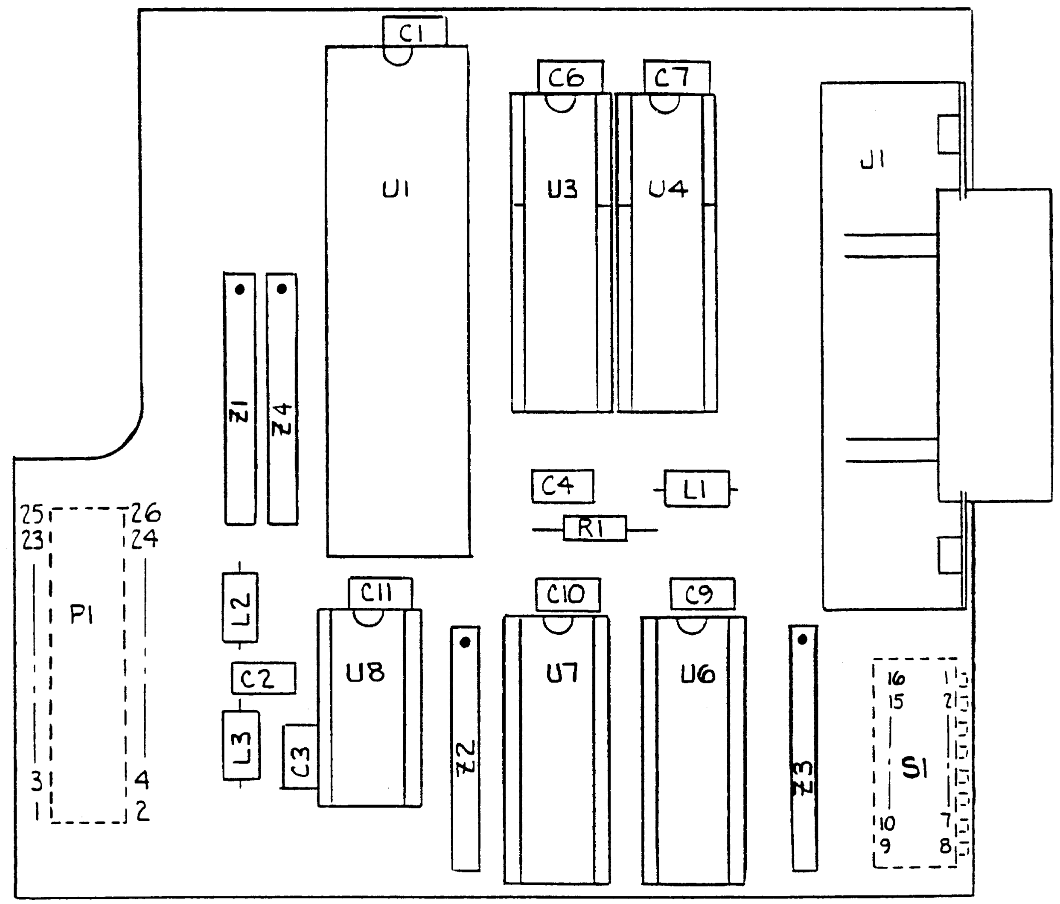
Controller Circuit Schematic (A2)
PART# 797878 Rev G
DWG# 6062A-1028 Rev C
Sheet 2 of 4



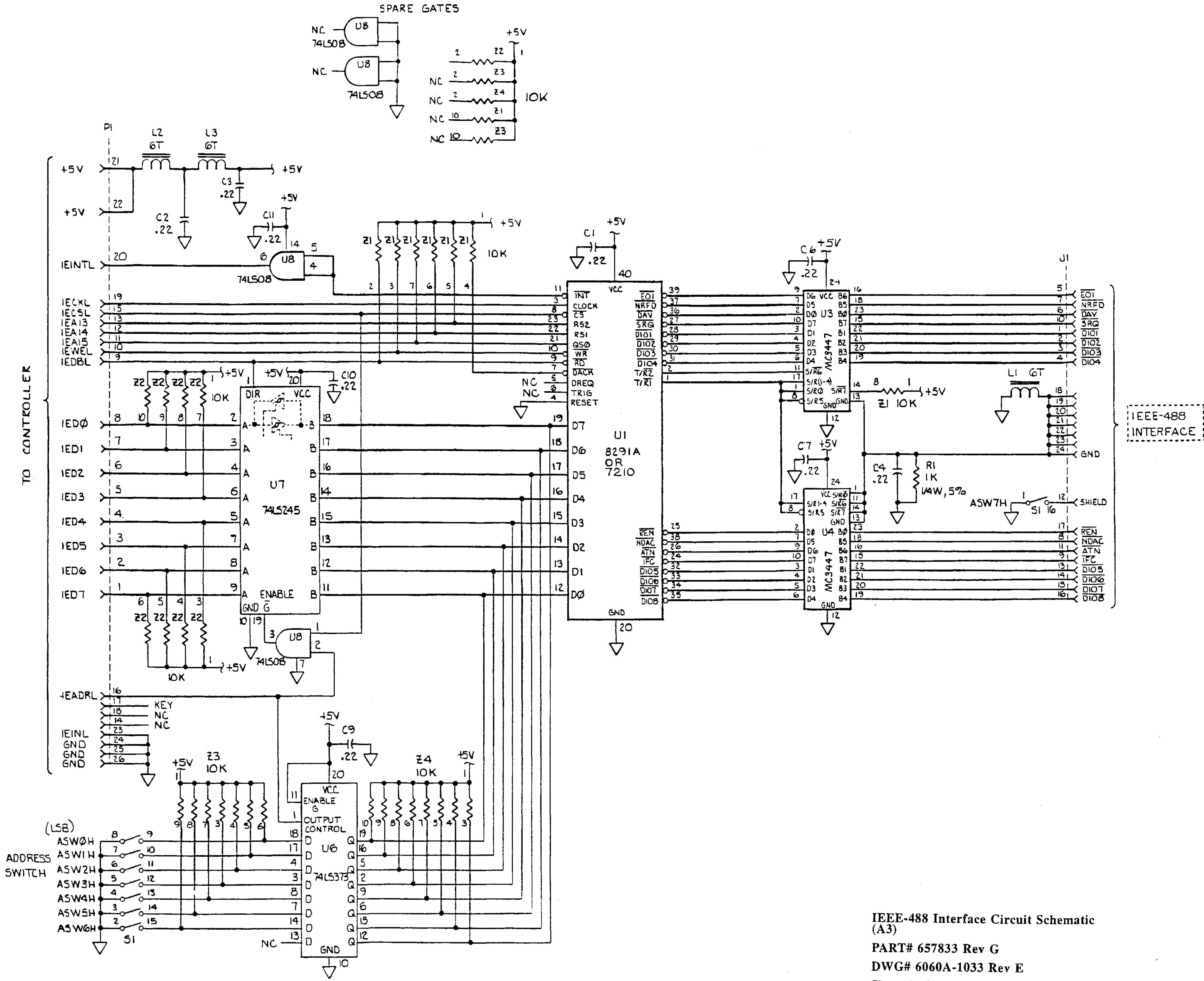
Controller Circuit Schematic (A2)
PART# 797878 Rev G
DWG# 6062A-1028 Rev C
Sheet 3 of 4



Controller Circuit Schematic (A2)
PART# 797878 Rev G
DWG# 6062A-1028 Rev C
Sheet 4 of 4



IEEE-488 Interface PC Assy (A3)
PART# 657833 Rev G
DWG# 6060A-1633 Rev B
Sheet 1 of 1



NOTES: (UNLESS OTHERWISE SPECIFIED.)

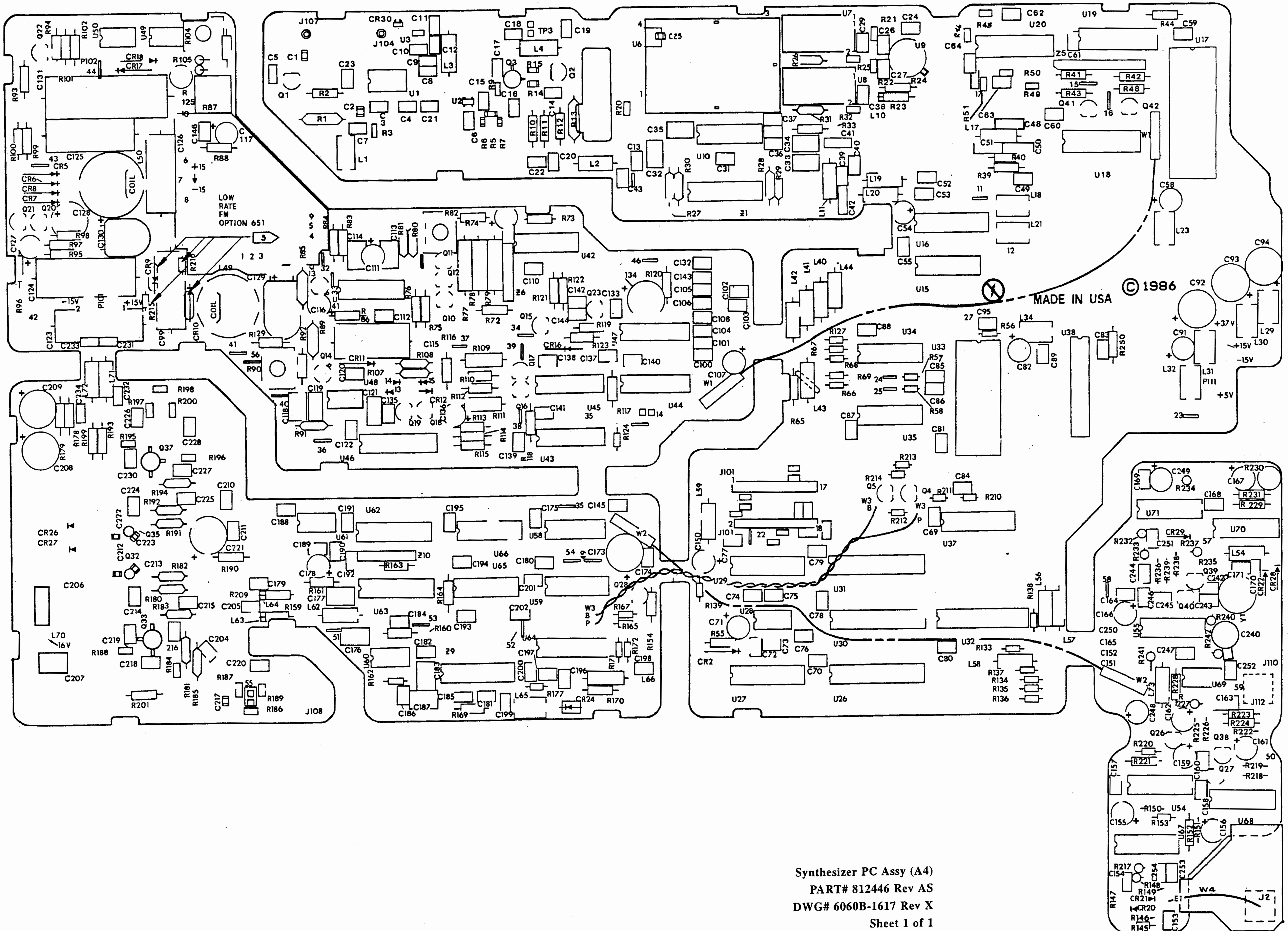
1. ALL RESISTOR VALUES ARE IN OHMS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.

IEEE-488 Interface Circuit Schematic (A3)

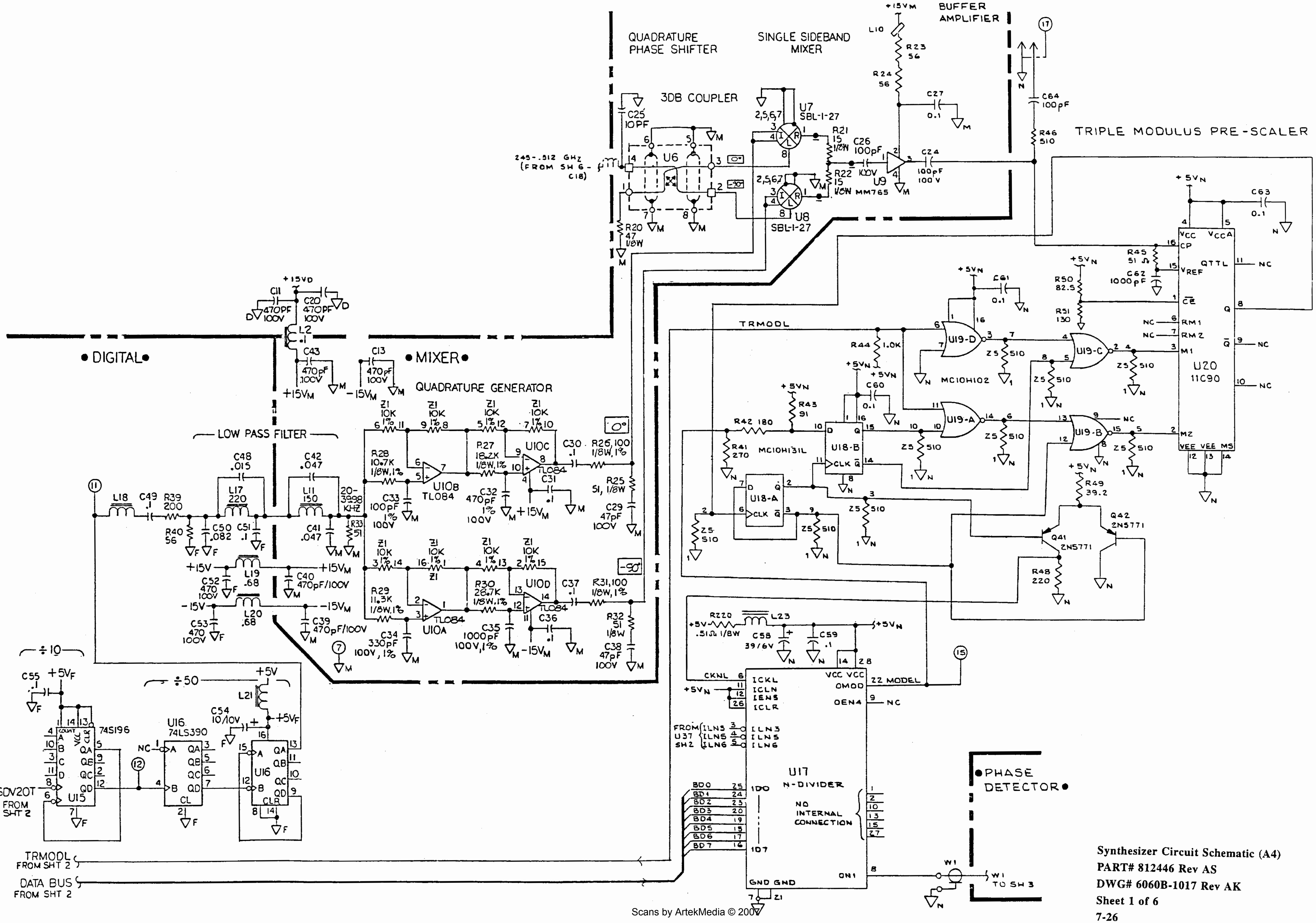
PART# 657833 Rev G

DWG# 6060A-1033 Rev E

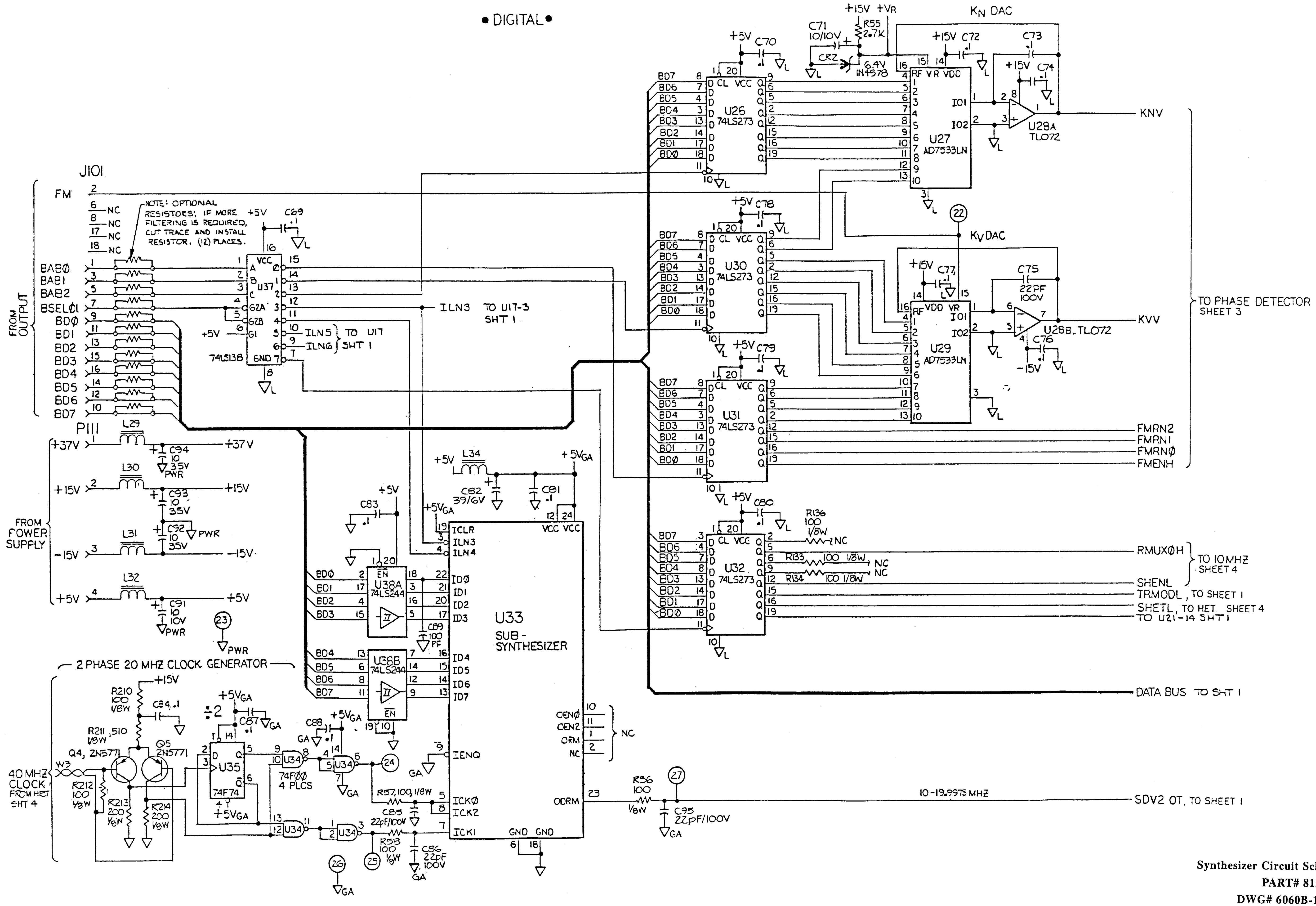
Sheet 1 of 1



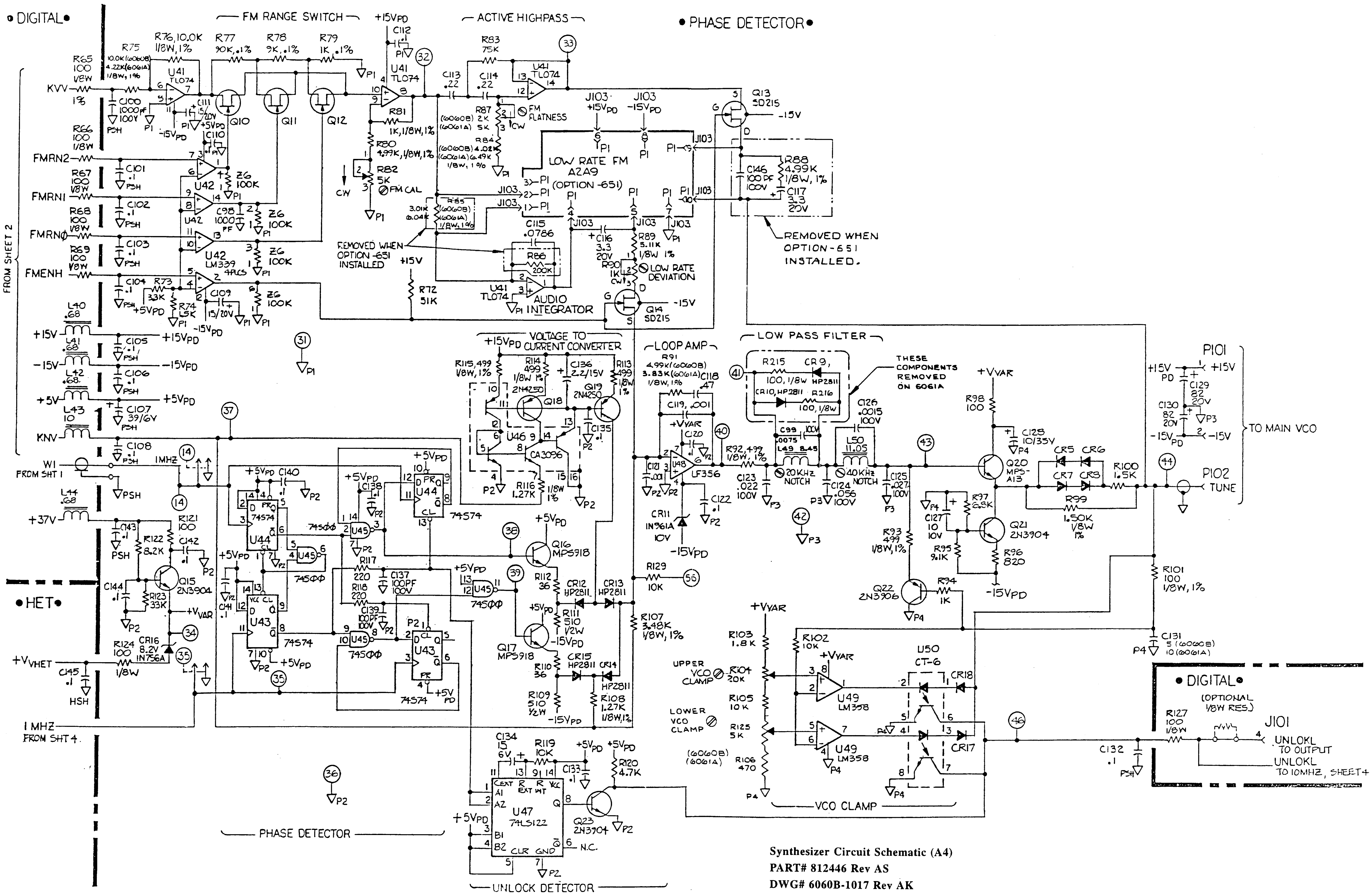
Synthesizer PC Assy (A4)
PART# 812446 Rev AS
DWG# 6060B-1617 Rev X
Sheet 1 of 1



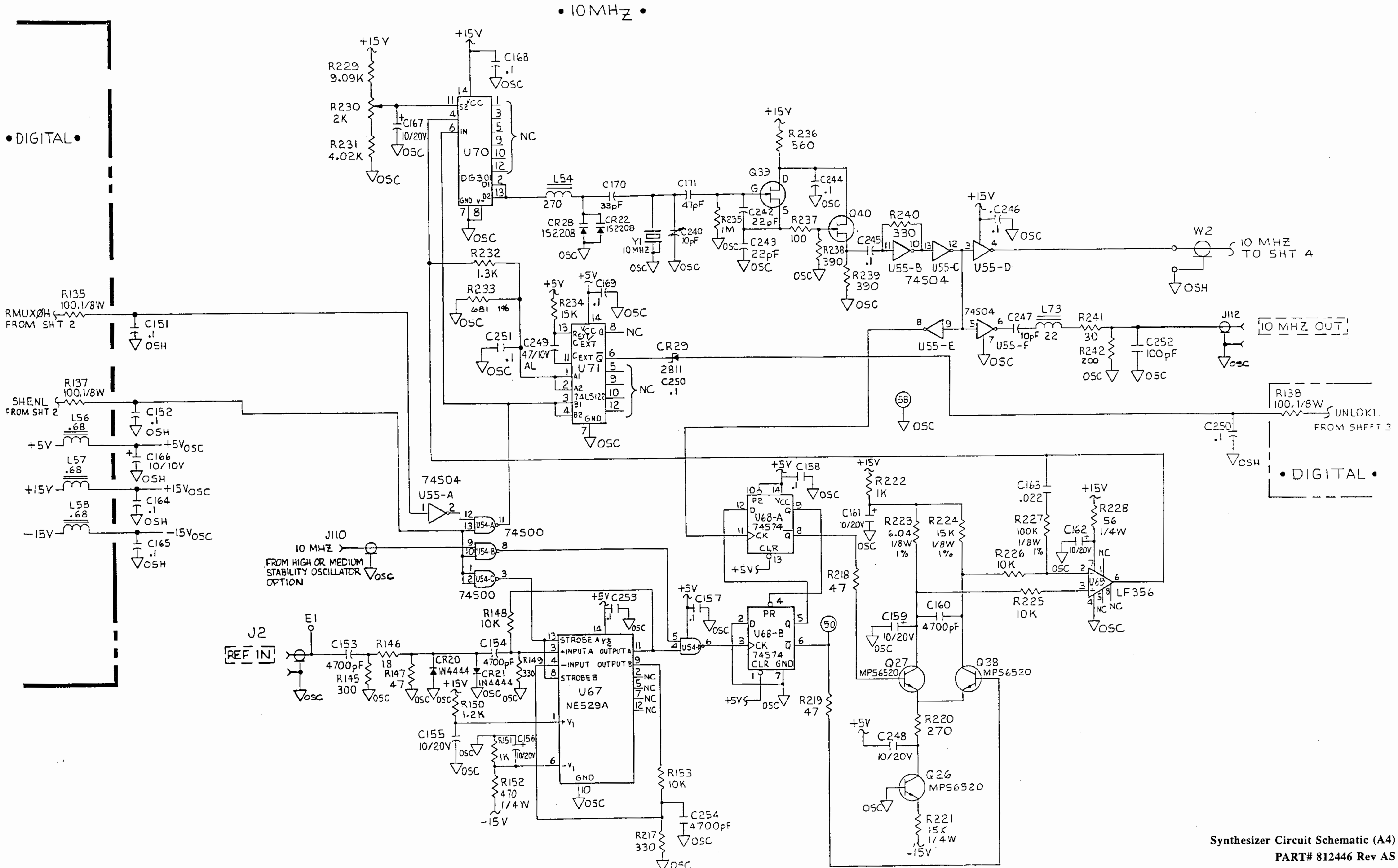
Synthesizer Circuit Schematic (A4)
PART# 812446 Rev AS
DWG# 6060B-1017 Rev AK
Sheet 1 of 6
7-26



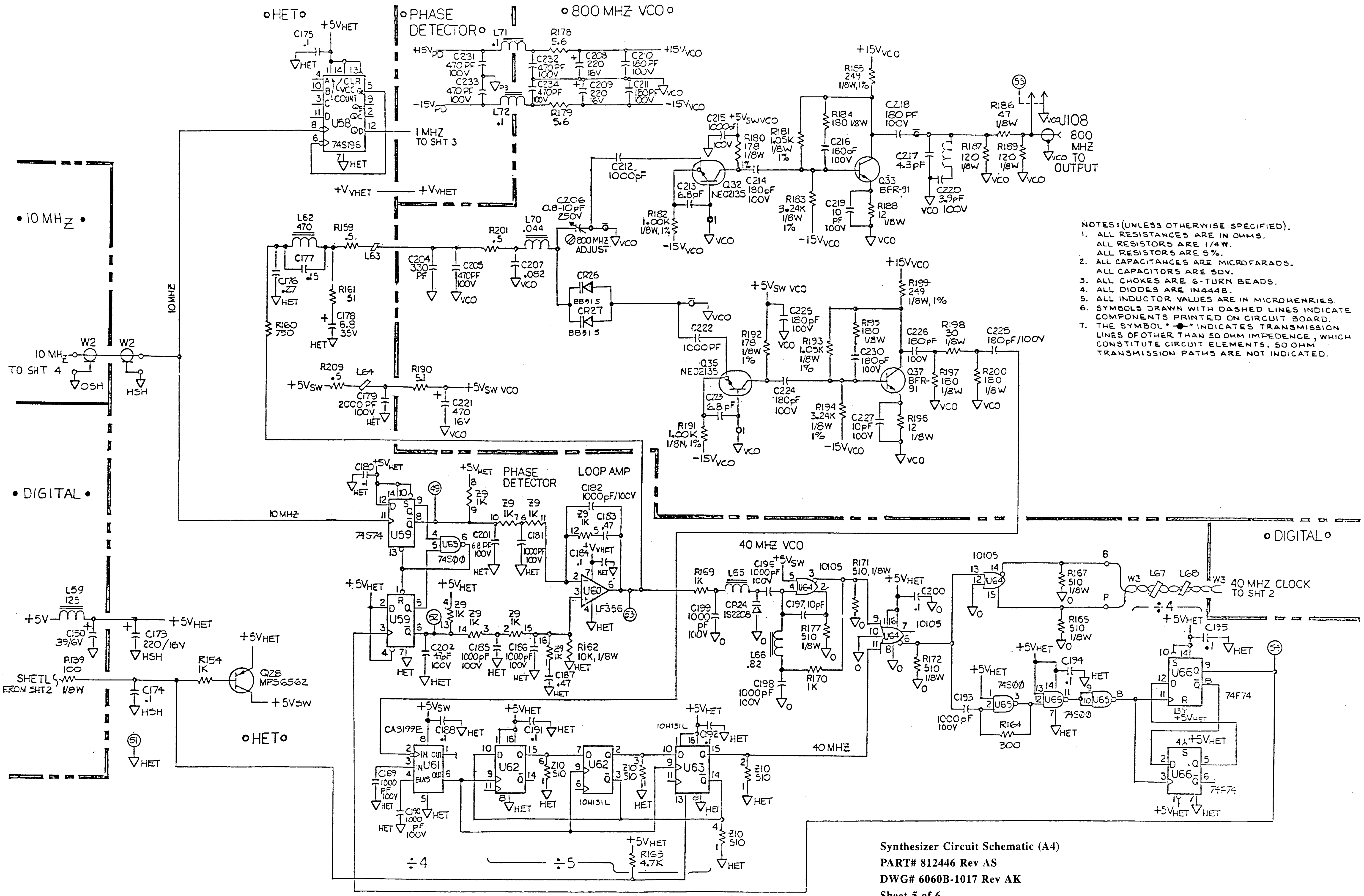
Synthesizer Circuit Schematic (A4)
PART# 812446 Rev AS
DWG# 6060B-1017 Rev AK
Sheet 2 of 6



Synthesizer Circuit Schematic (A4)
PART# 812446 Rev AS
DWG# 6060B-1017 Rev AK
Sheet 3 of 6



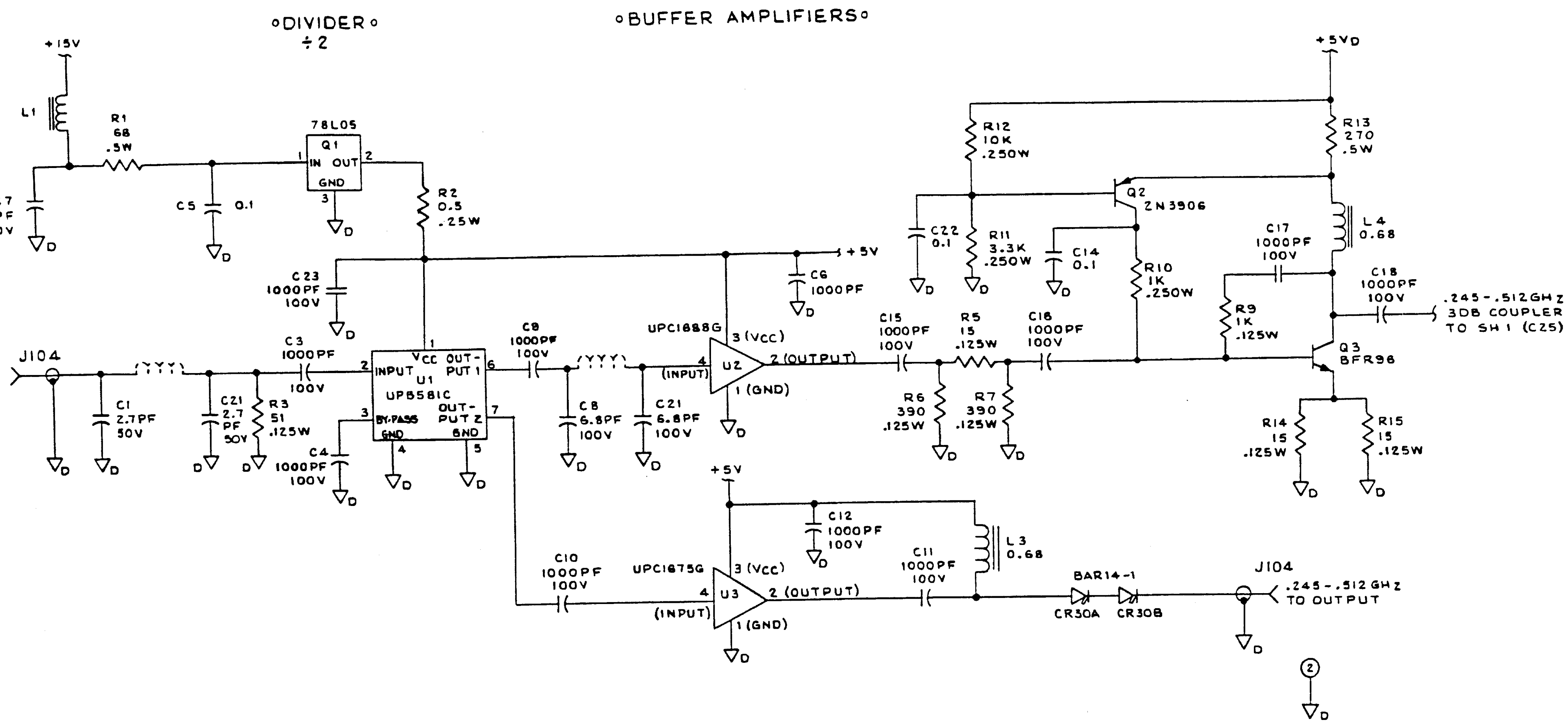
Synthesizer Circuit Schematic (A4)
PART# 812446 Rev AS
DWG# 6060B-1017 Rev AK
Sheet 4 of 6



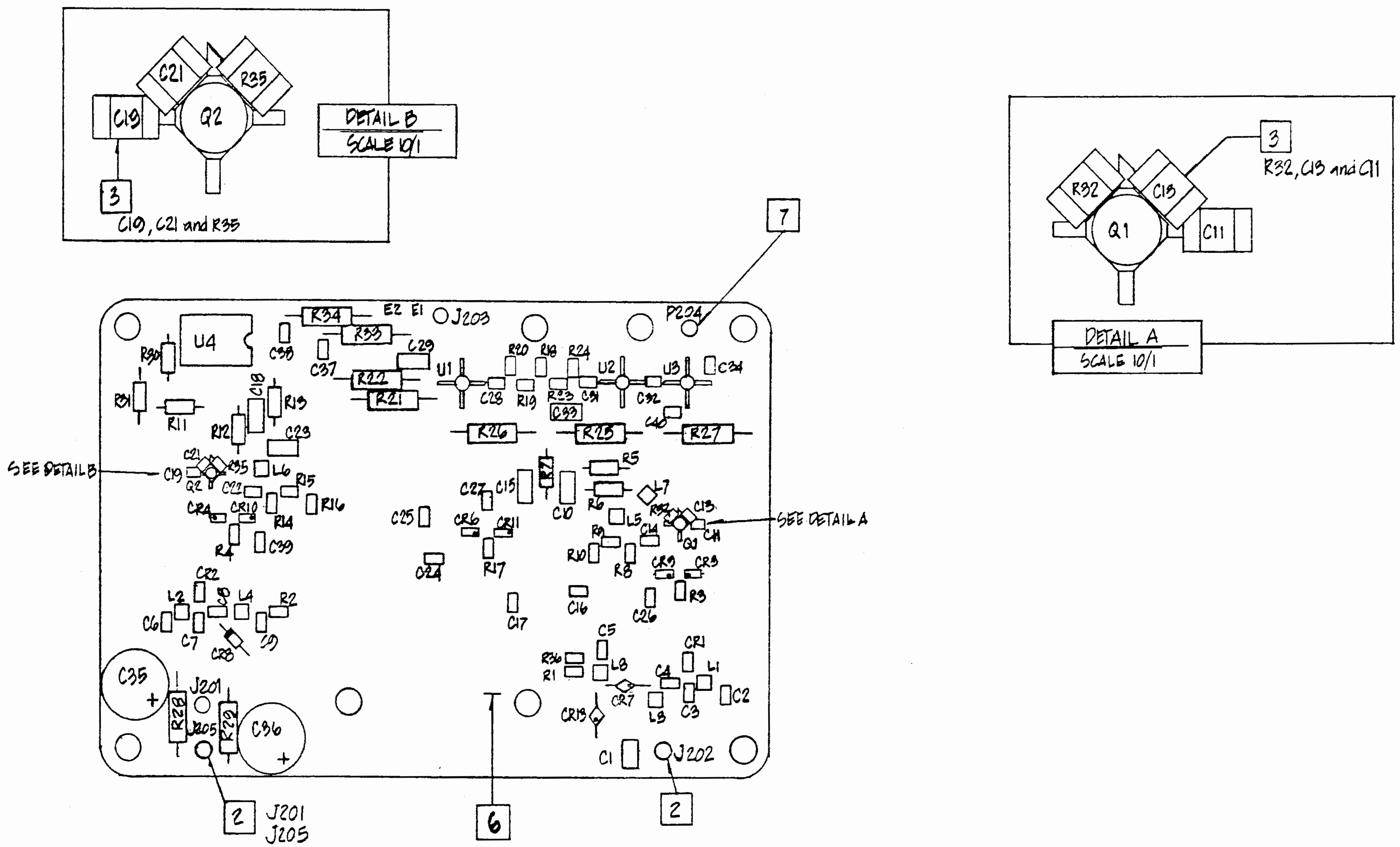
NOTES: (UNLESS OTHERWISE SPECIFIED).

1. ALL RESISTANCES ARE IN OHMS.
   ALL RESISTORS ARE 1/4W.
   ALL RESISTORS ARE 5%.
2. ALL CAPACITANCES ARE MICROFARADS.
   ALL CAPACITORS ARE 50V.
3. ALL CHOKES ARE 6-TURN BEADS.
4. ALL DIODES ARE IN4448.
5. ALL INDUCTOR VALUES ARE IN MICROHENRIES.
6. SYMBOLS DRAWN WITH DASHED LINES INDICATE COMPONENTS PRINTED ON CIRCUIT BOARD.
7. THE SYMBOL "-●-" INDICATES TRANSMISSION LINES OF OTHER THAN 50 OHM IMPEDENCE, WHICH CONSTITUTE CIRCUIT ELEMENTS. 50 OHM TRANSMISSION PATHS ARE NOT INDICATED.

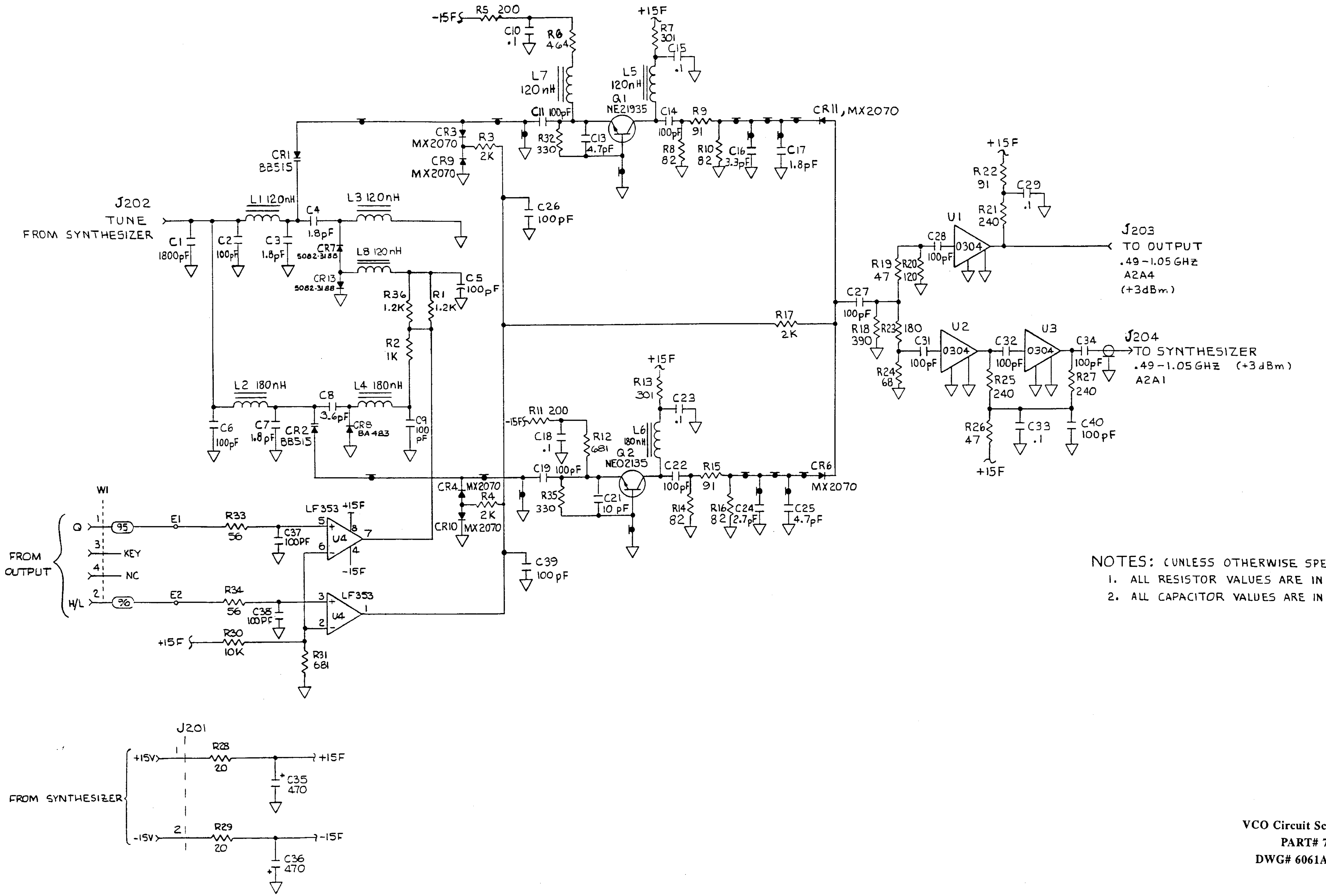
Synthesizer Circuit Schematic (A4)
PART# 812446 Rev AS
DWG# 6060B-1017 Rev AK
Sheet 5 of 6



Synthesizer Circuit Schematic (A4)
PART# 812446 Rev AS
DWG# 6060B-1017 Rev AK
Sheet 6 of 6



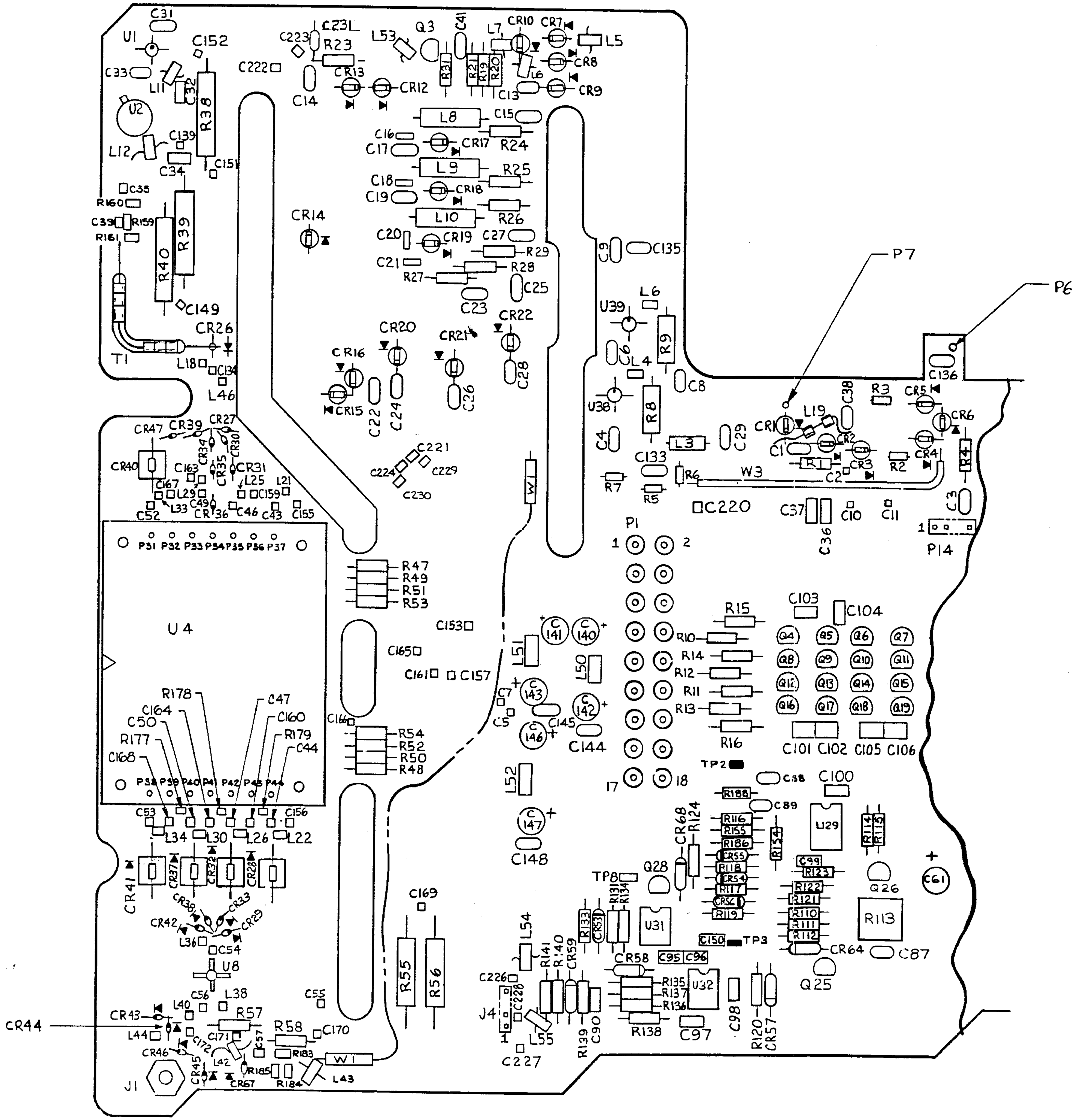
VCO PC Assy (A5)
PART# 797837 Rev P
Sheet 1 of 1



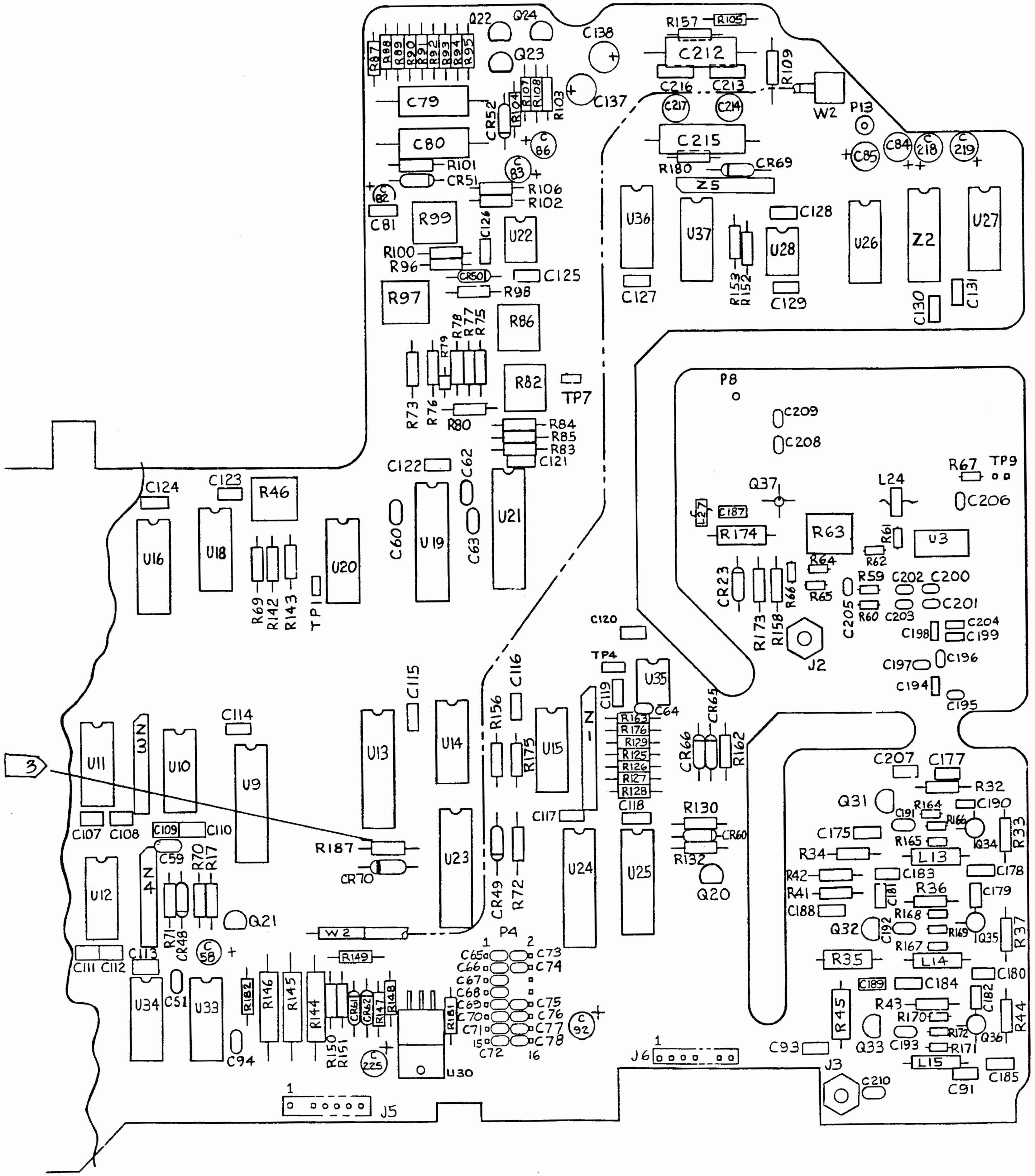
NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTOR VALUES ARE IN OHMS, 5%
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.

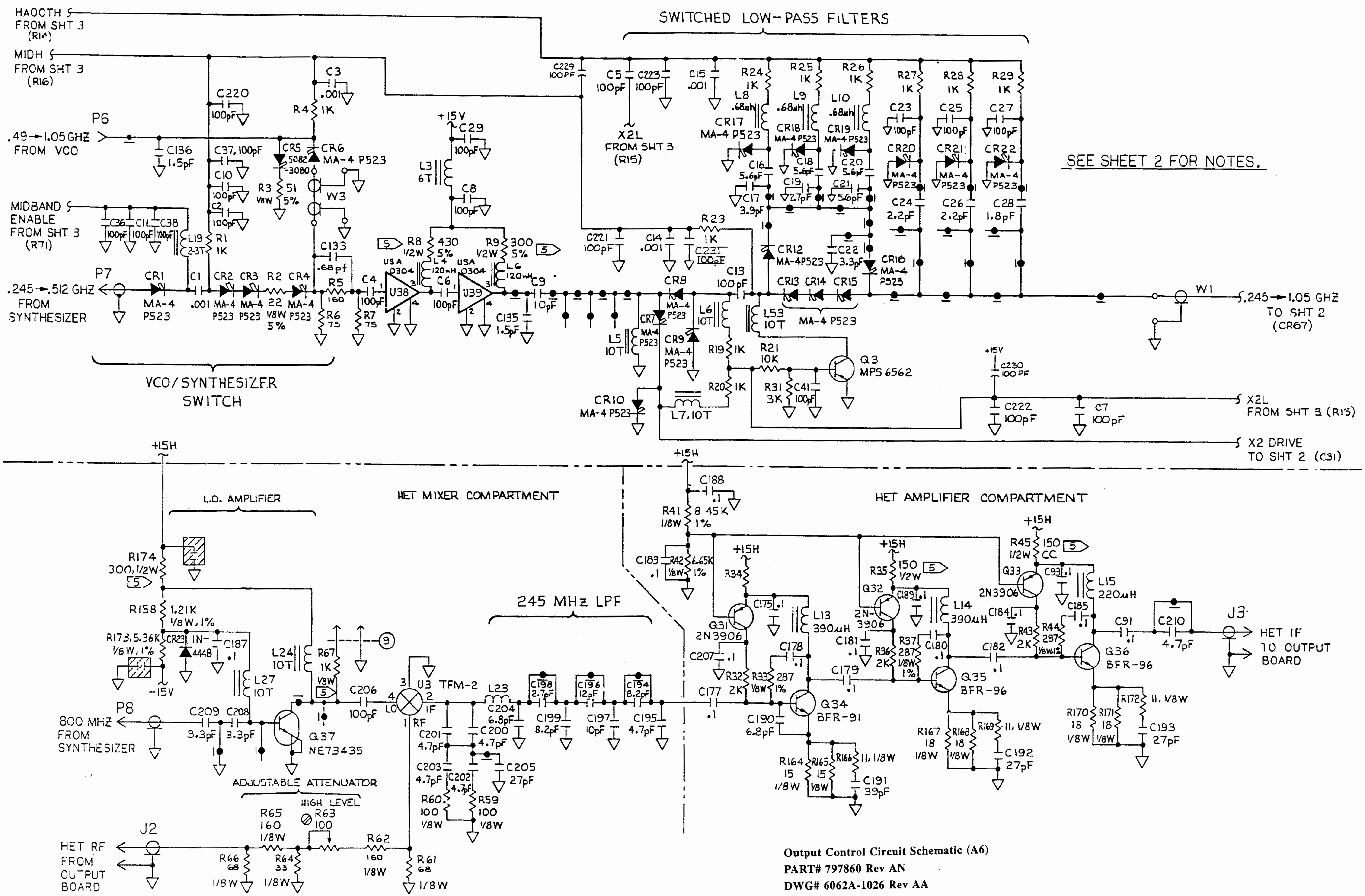
VCO Circuit Schematic (A5)
PART# 797837 Rev P
DWG# 6061A-1016 Rev G
Sheet 1 of 1



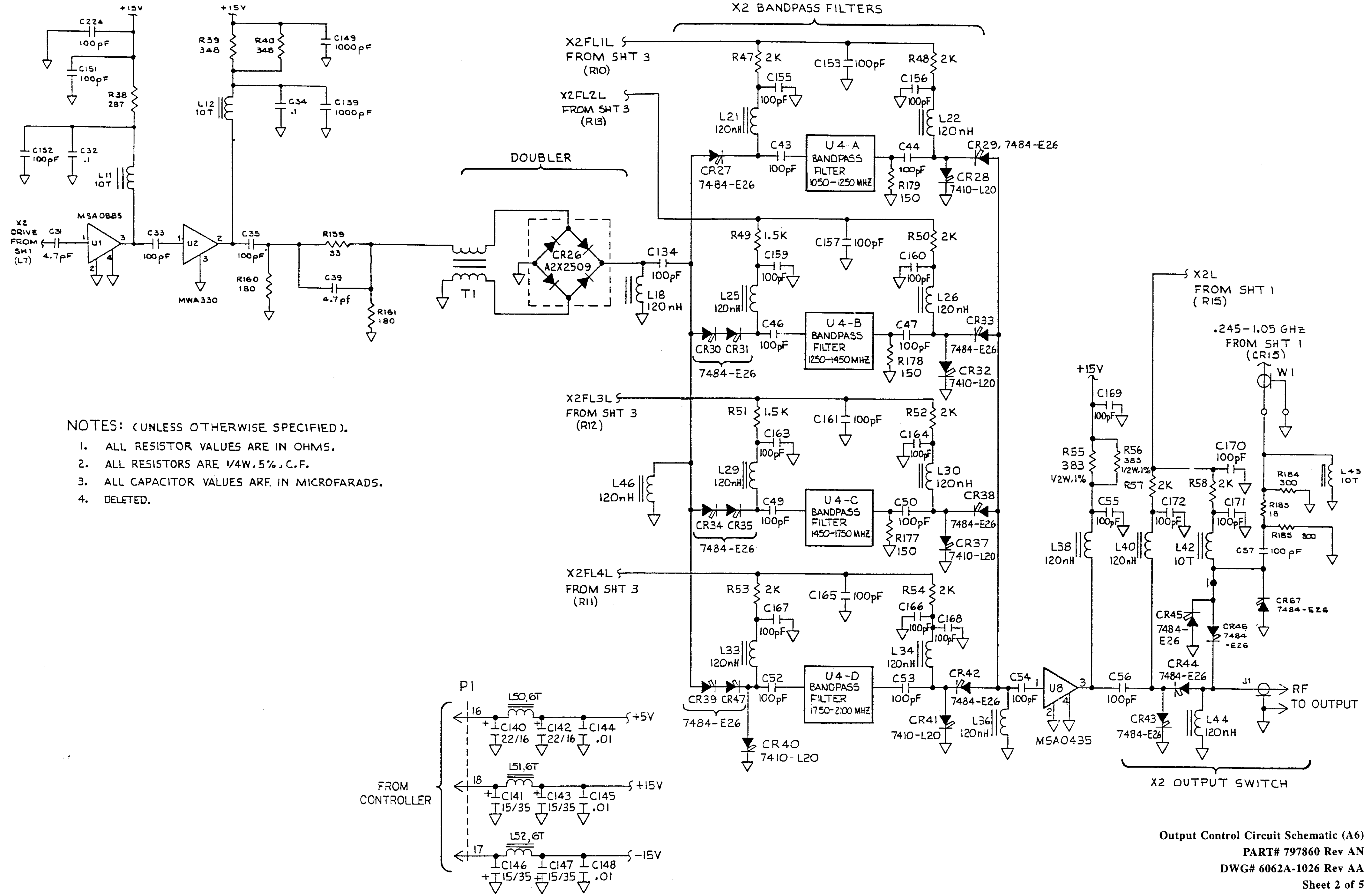
Output Control PC Assy (A6)
PART# 797860 Rev AN
DWG# 6062A-1626 Rev U
Sheet 1 of 2



Output Control PC Assy (A6)
PART# 797860 Rev AN
DWG# 6062A-1626 Rev U
Sheet 2 of 2



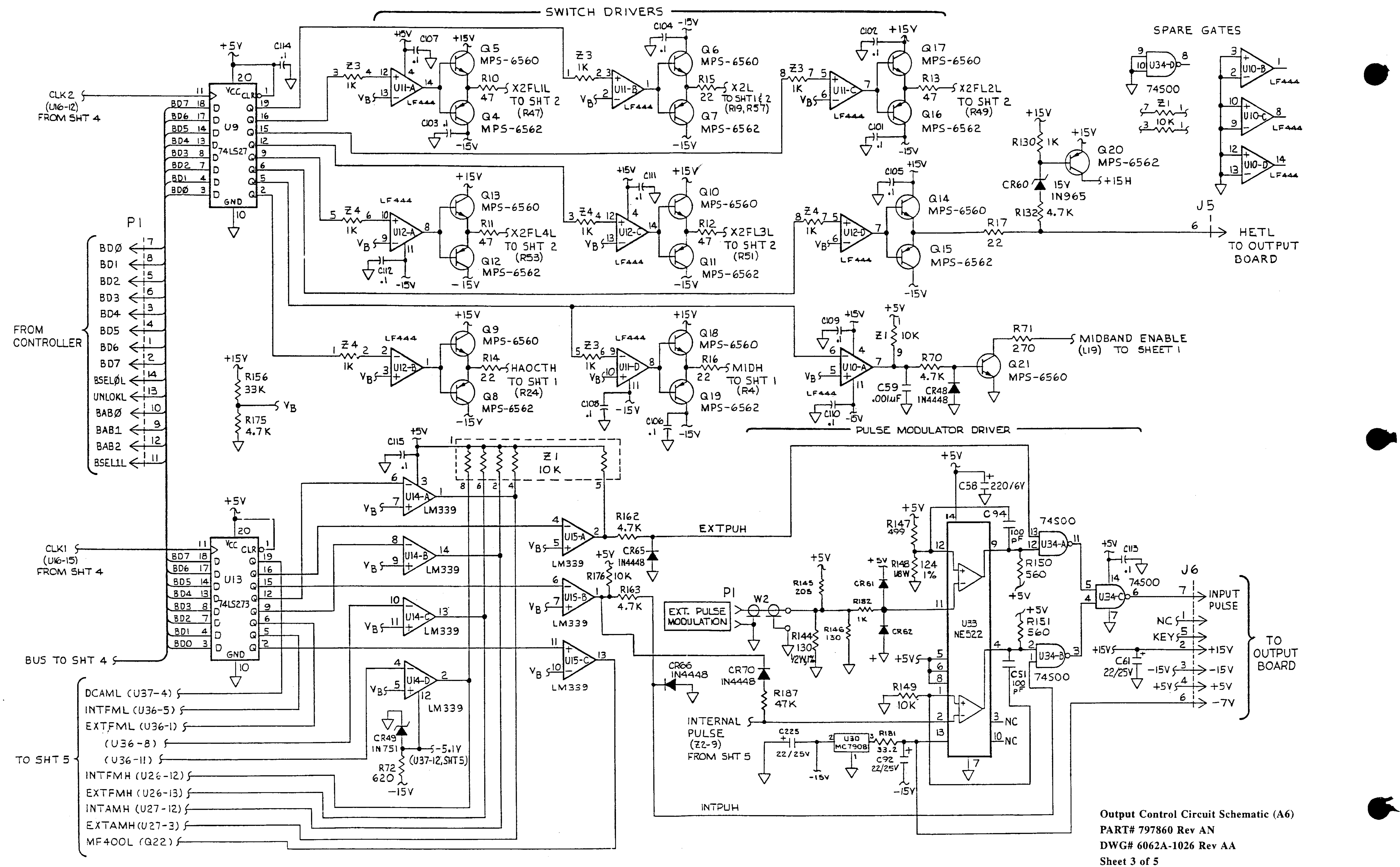
Output Control Circuit Schematic (A6)
PART# 797860 Rev AN
DWG# 6062A-1026 Rev AA
Sheet 1 of 5



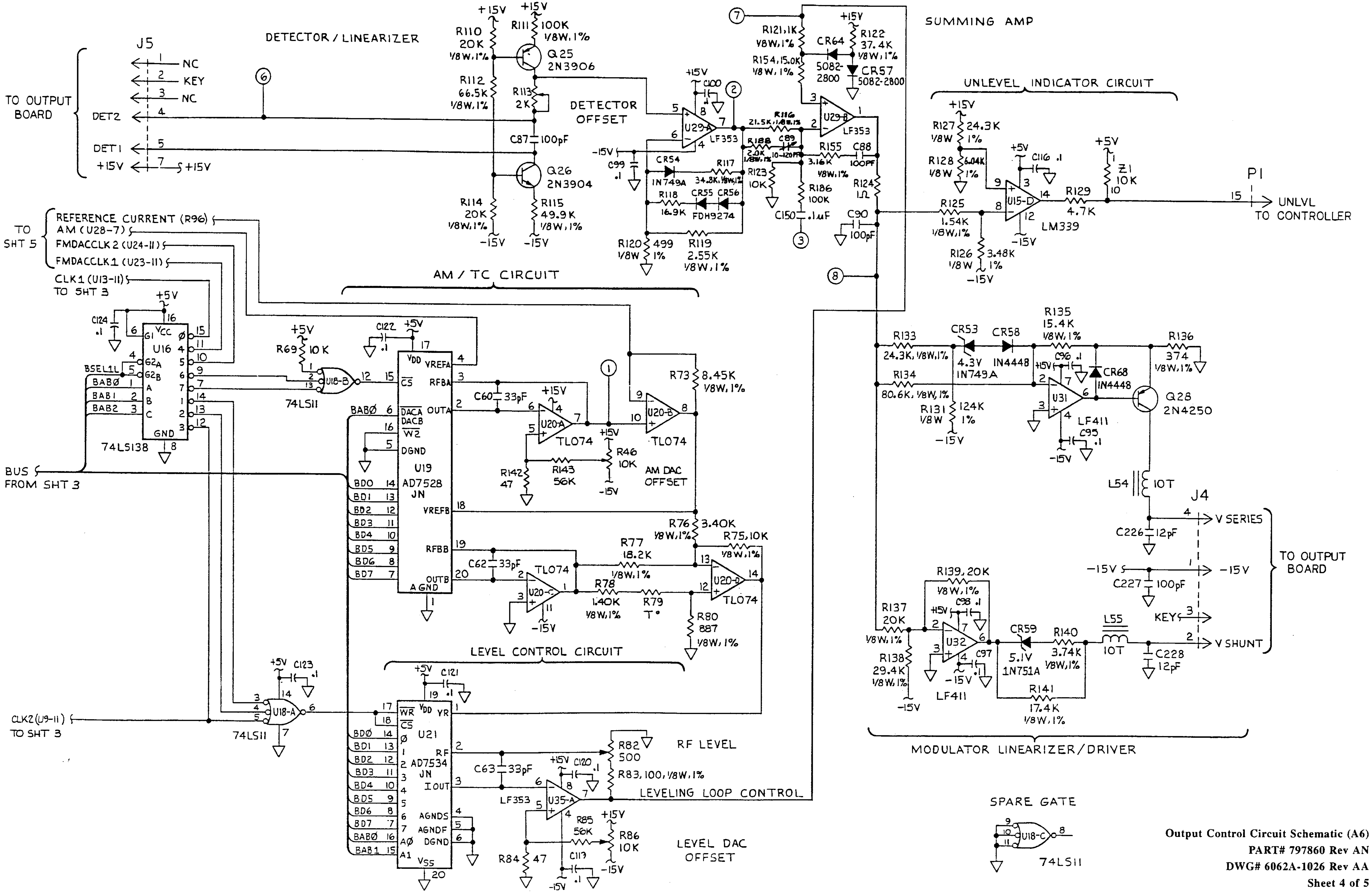
NOTES: (UNLESS OTHERWISE SPECIFIED).

1. ALL RESISTOR VALUES ARE IN OHMS.
2. ALL RESISTORS ARE 1/4W, 5%, C.F.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.
4. DELETED.

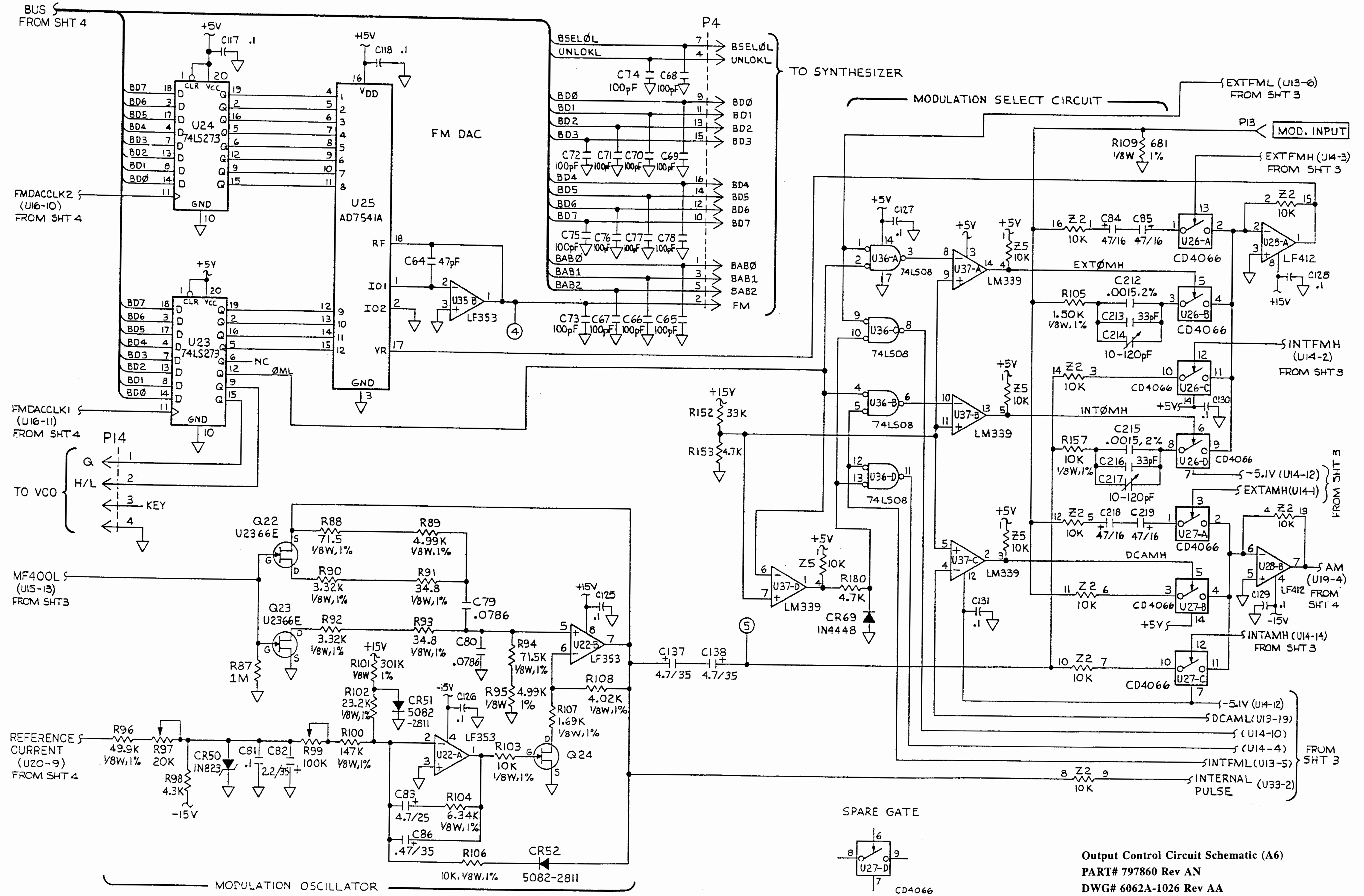
Output Control Circuit Schematic (A6)
PART# 797860 Rev AN
DWG# 6062A-1026 Rev AA
Sheet 2 of 5



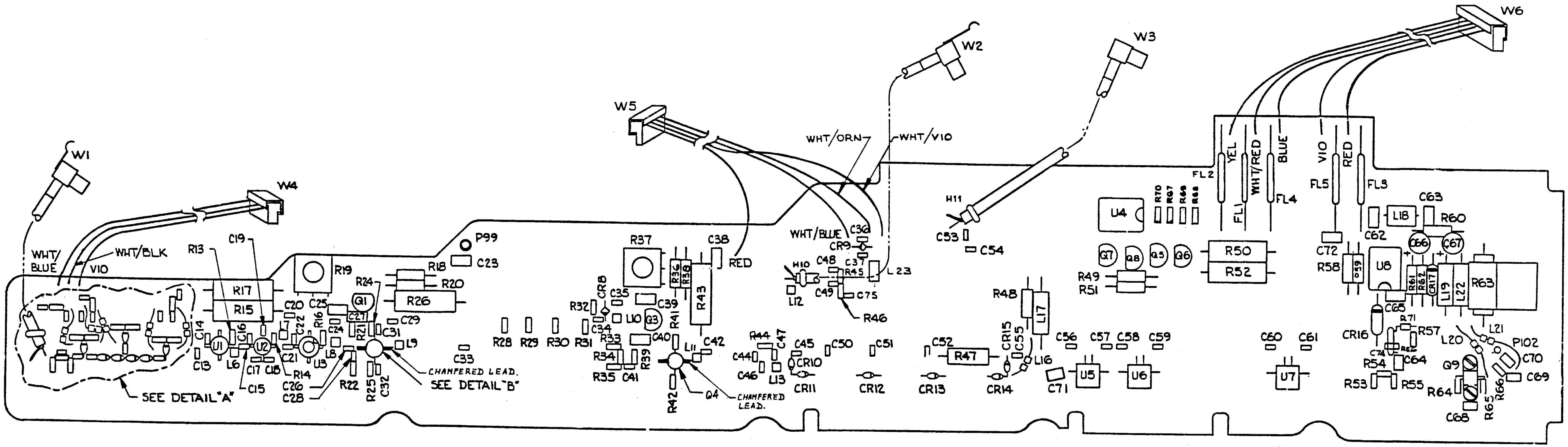
Output Control Circuit Schematic (A6)
PART# 797860 Rev AN
DWG# 6062A-1026 Rev AA
Sheet 3 of 5

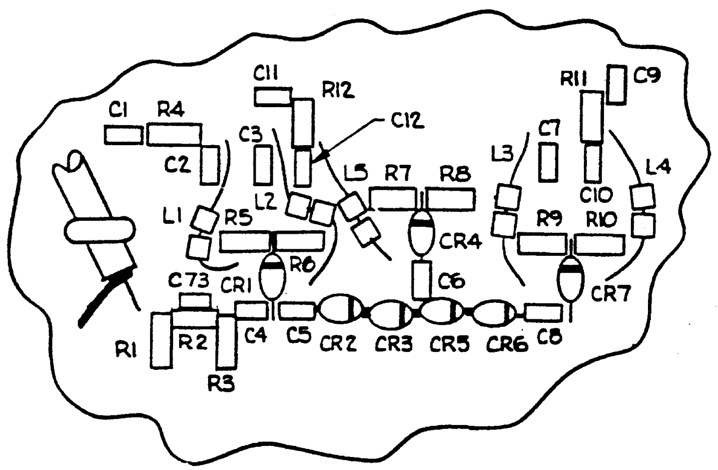


Output Control Circuit Schematic (A6)
PART# 797860 Rev AN
DWG# 6062A-1026 Rev AA
Sheet 4 of 5

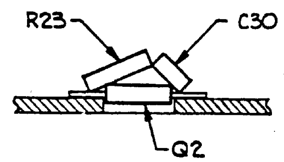


Output Control Circuit Schematic (A6)
PART# 797860 Rev AN
DWG# 6062A-1026 Rev AA
Sheet 5 of 5
7-40



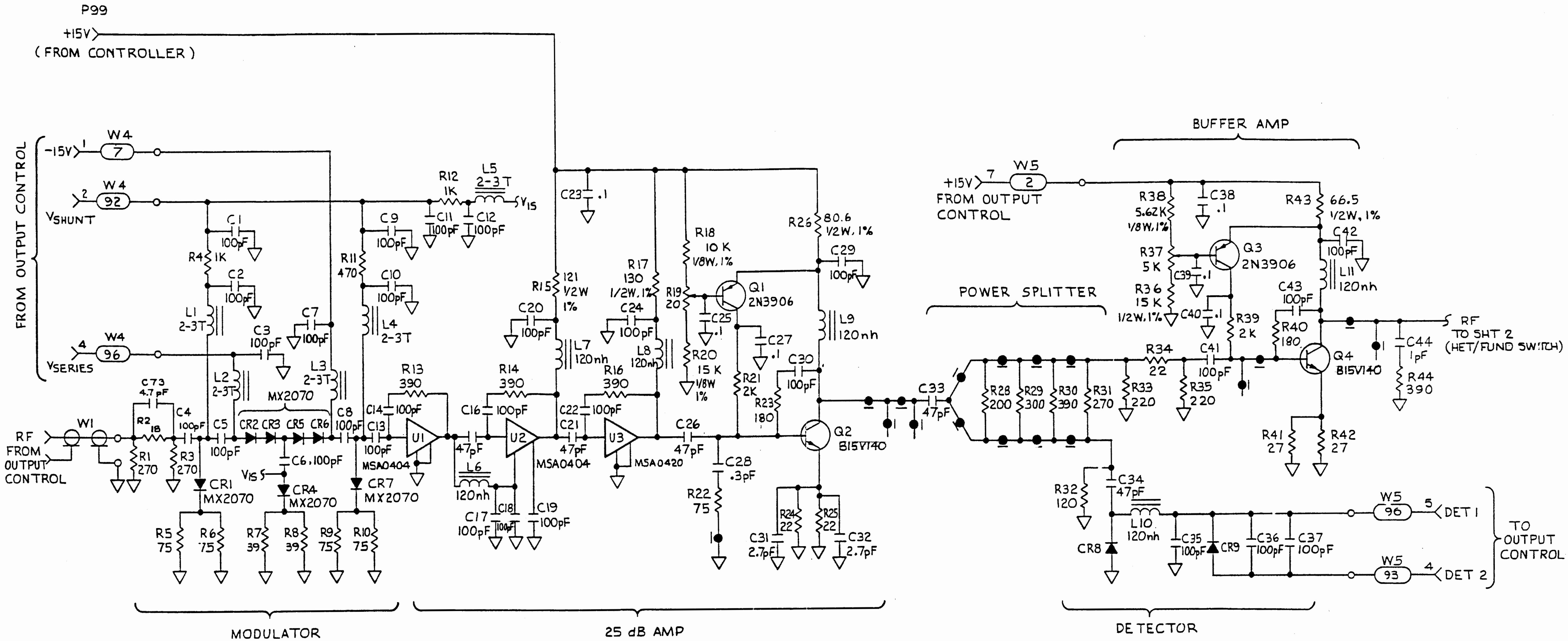


DETAIL "A"
NO SCALE



DETAIL "B"
NO SCALE

Output PC Assy (A7)
PART# 797845 Rev AA
DWG# 6062A-1624 Rev J
Sheet 1 of 1

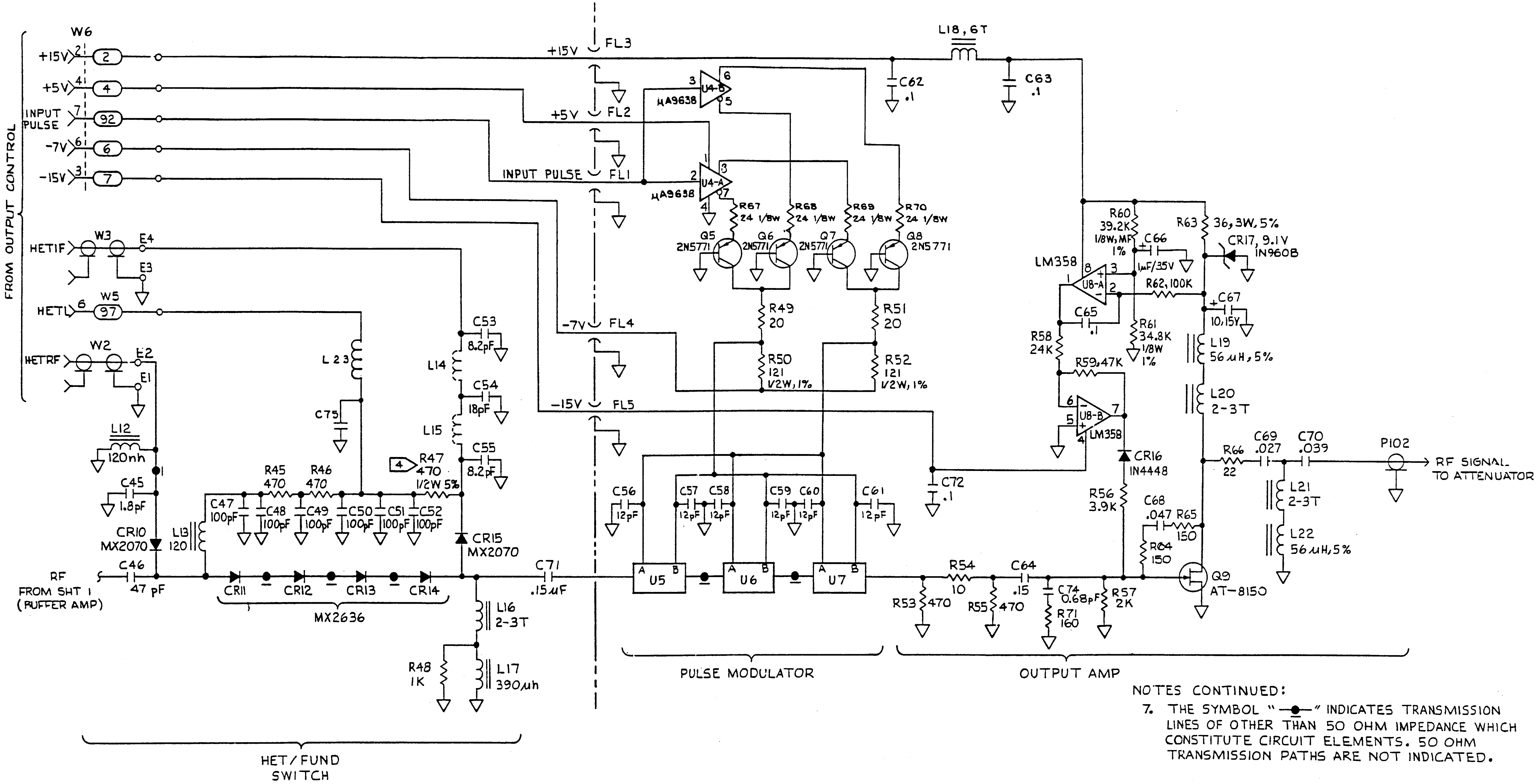


NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTOR VALUES ARE IN OHMS.
2. ALL RESISTORS ARE 1/4W, 5%.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.

4 INDICATED 5% CC RESISTORS SHALL BE ACCEPTED BY ICT IF THEIR VALUE IS WITHIN ±10% OF NOMINAL.

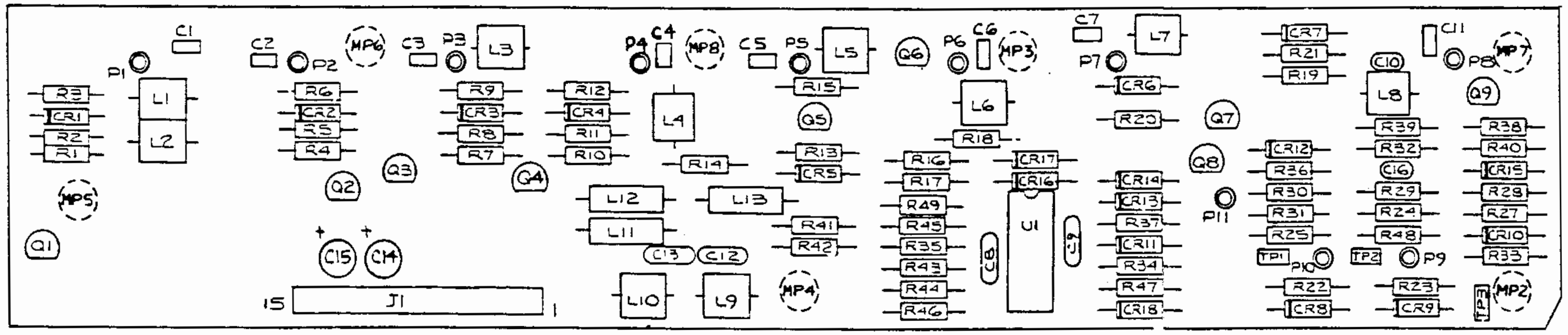
Output Circuit Schematic (A7)
PART# 797845 Rev AA
DWG# 6062A-1024 Rev M
Sheet 1 of 2



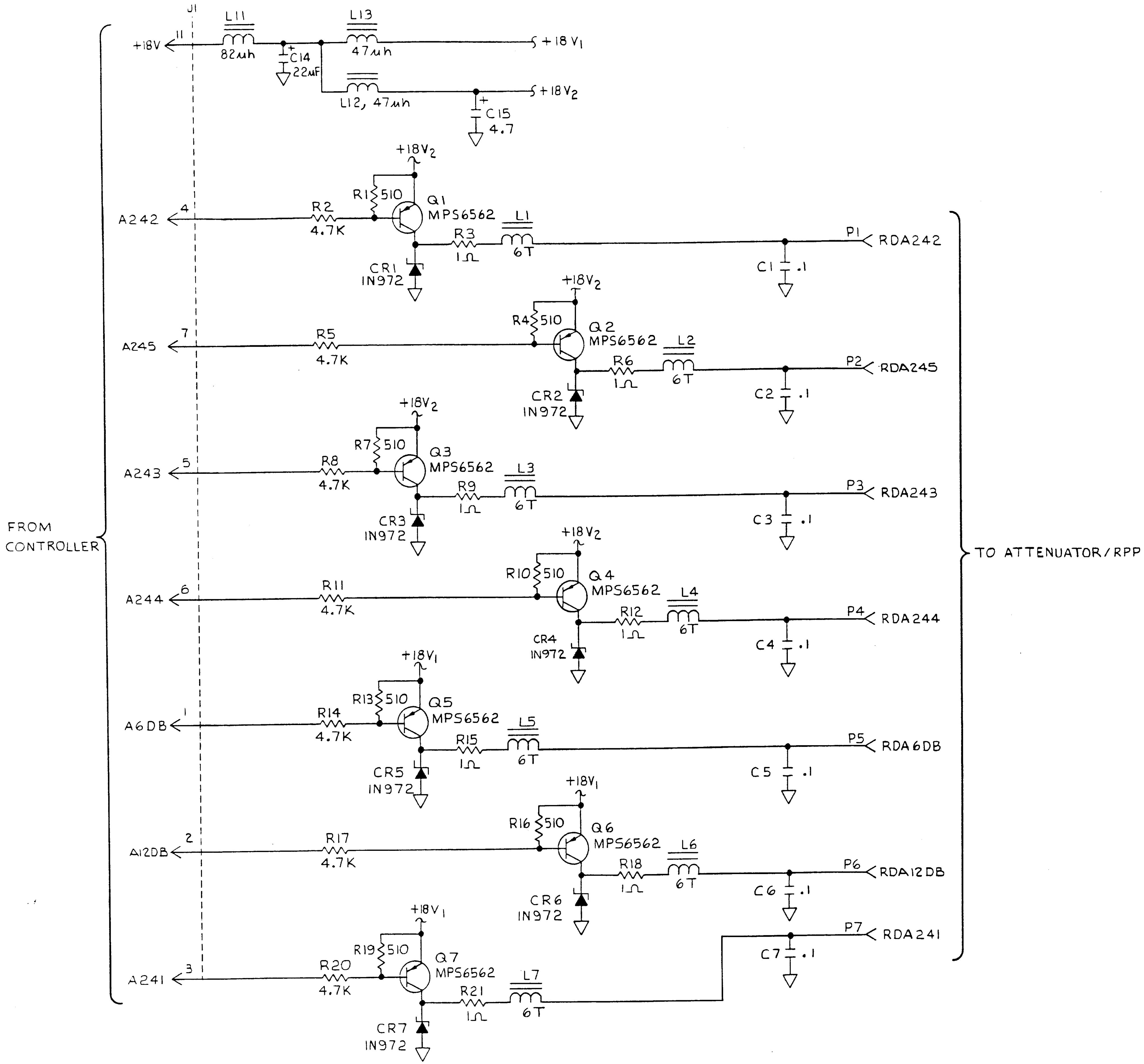
NOTES CONTINUED:

7. THE SYMBOL "—●—" INDICATES TRANSMISSION LINES OF OTHER THAN 50 OHM IMPEDANCE WHICH CONSTITUTE CIRCUIT ELEMENTS. 50 OHM TRANSMISSION PATHS ARE NOT INDICATED.

Output Circuit Schematic (A7)
PART# 797845 Rev AA
DWG# 6062A-1024 Rev M
Sheet 2 of 2



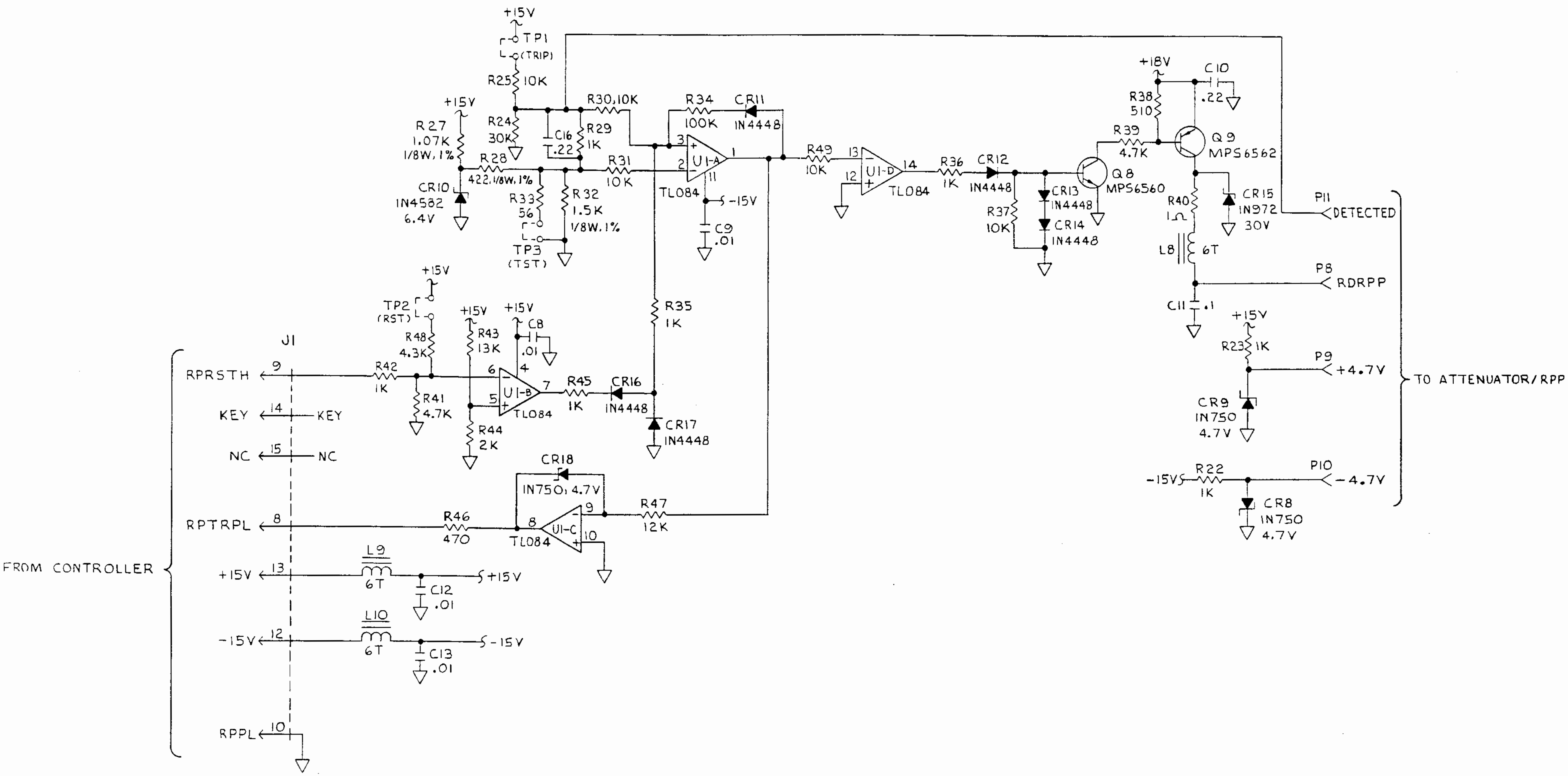
Relay Driver PC Assy (A8A1)
PART# 794982 Rev G
DWG# 6062A-1645 Rev B
Sheet 1 of 1



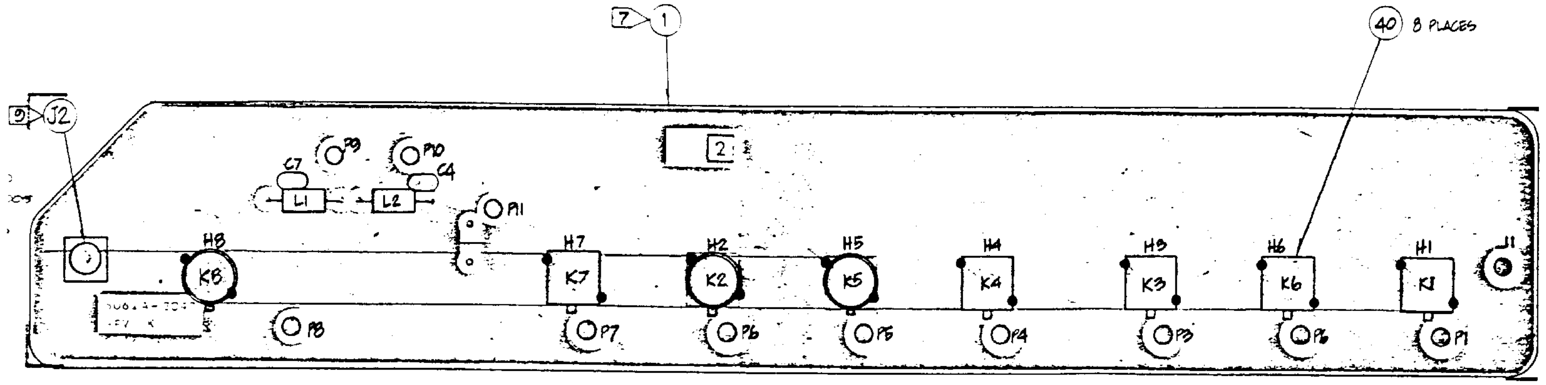
NOTES: (UNLESS OTHERWISE SPECIFIED.)

1. ALL RESISTORS ARE 1/4W, 5%.
   ALL RESISTOR VALUES ARE IN OHMS.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.

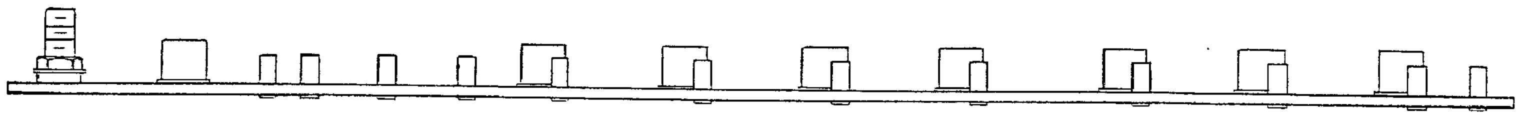
Relay Driver Circuit Schematic (A8A1)
PART# 794982 Rev G
DWG# 6062A-1045 Rev A
Sheet 1 of 2

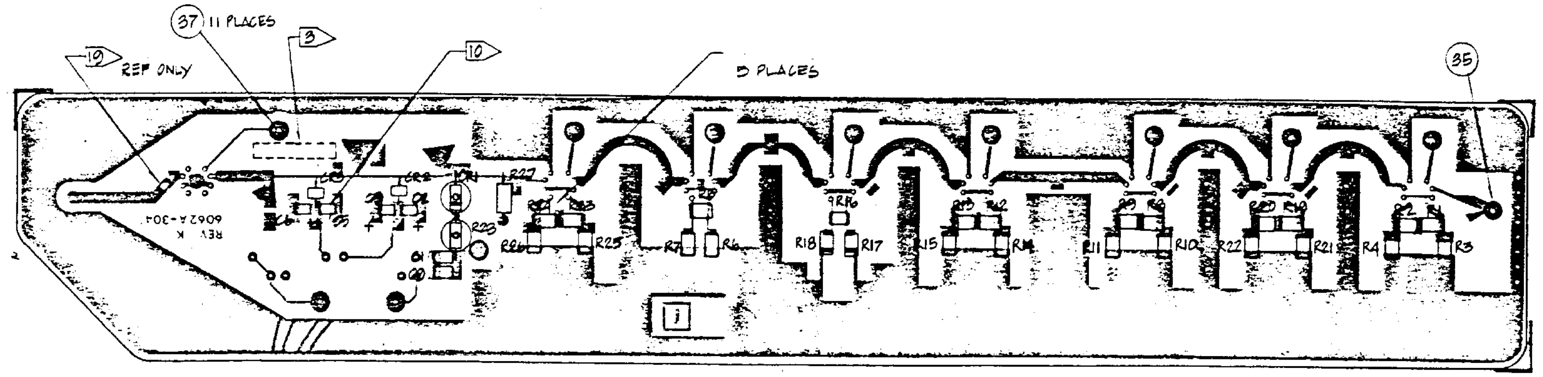


Relay Driver Circuit Schematic (A8A1)
PART# 794982 Rev G
DWG# 6062A-1045 Rev A
Sheet 2 of 2

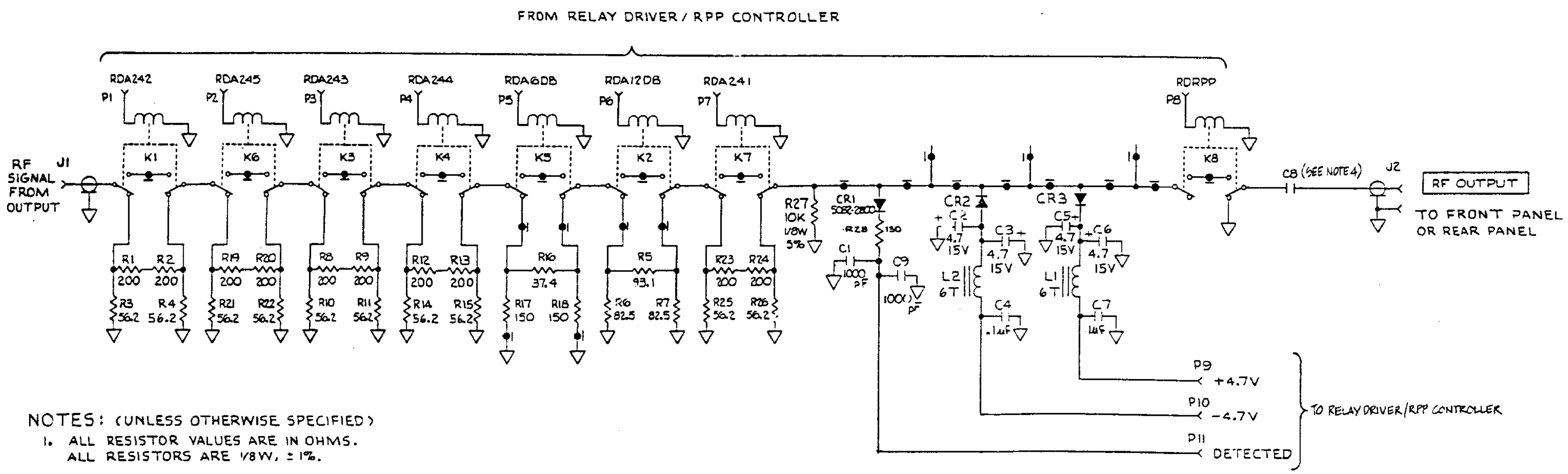


CIRCUIT 2





CIRCUIT 1

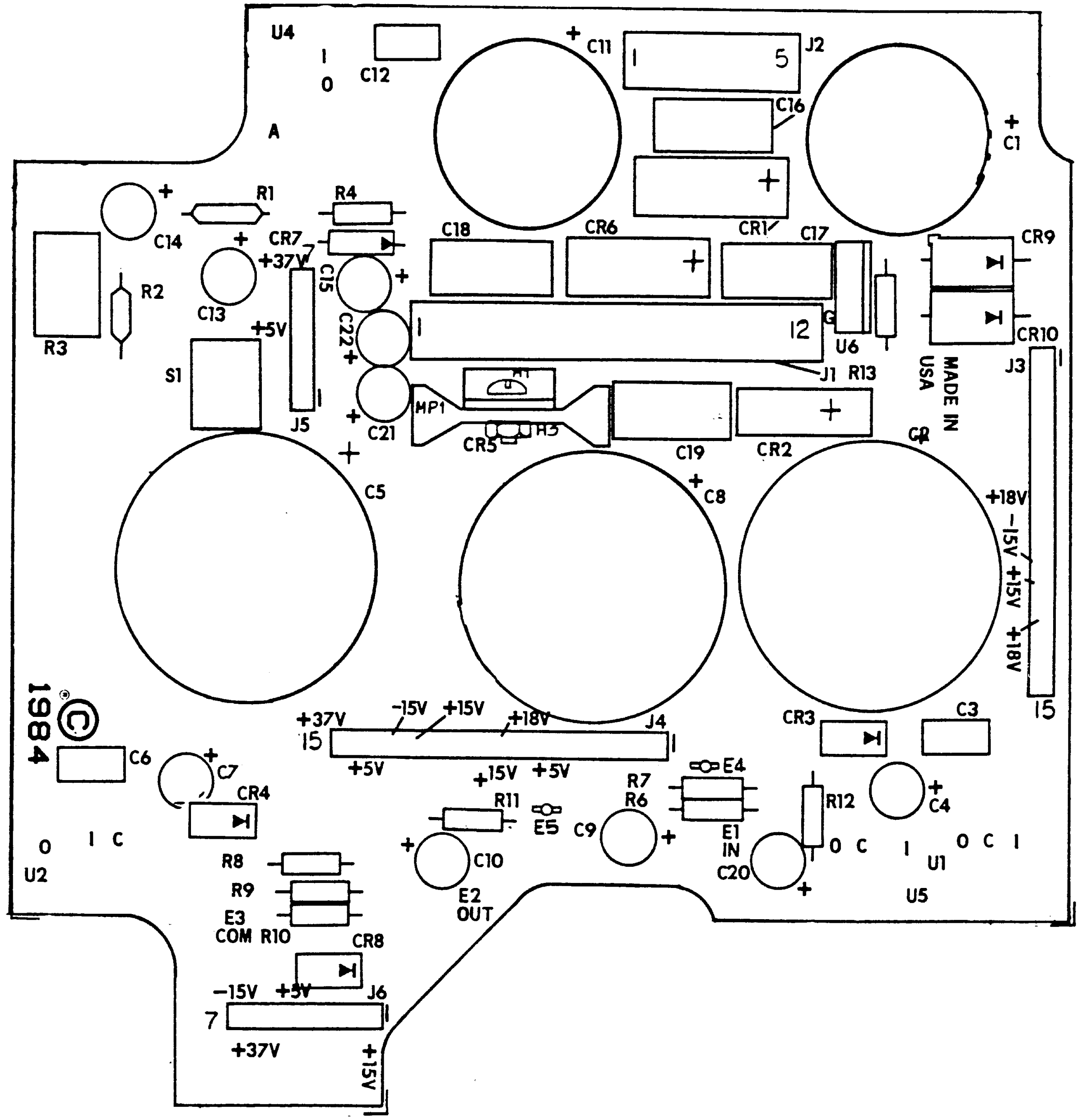


NOTES: (UNLESS OTHERWISE SPECIFIED)

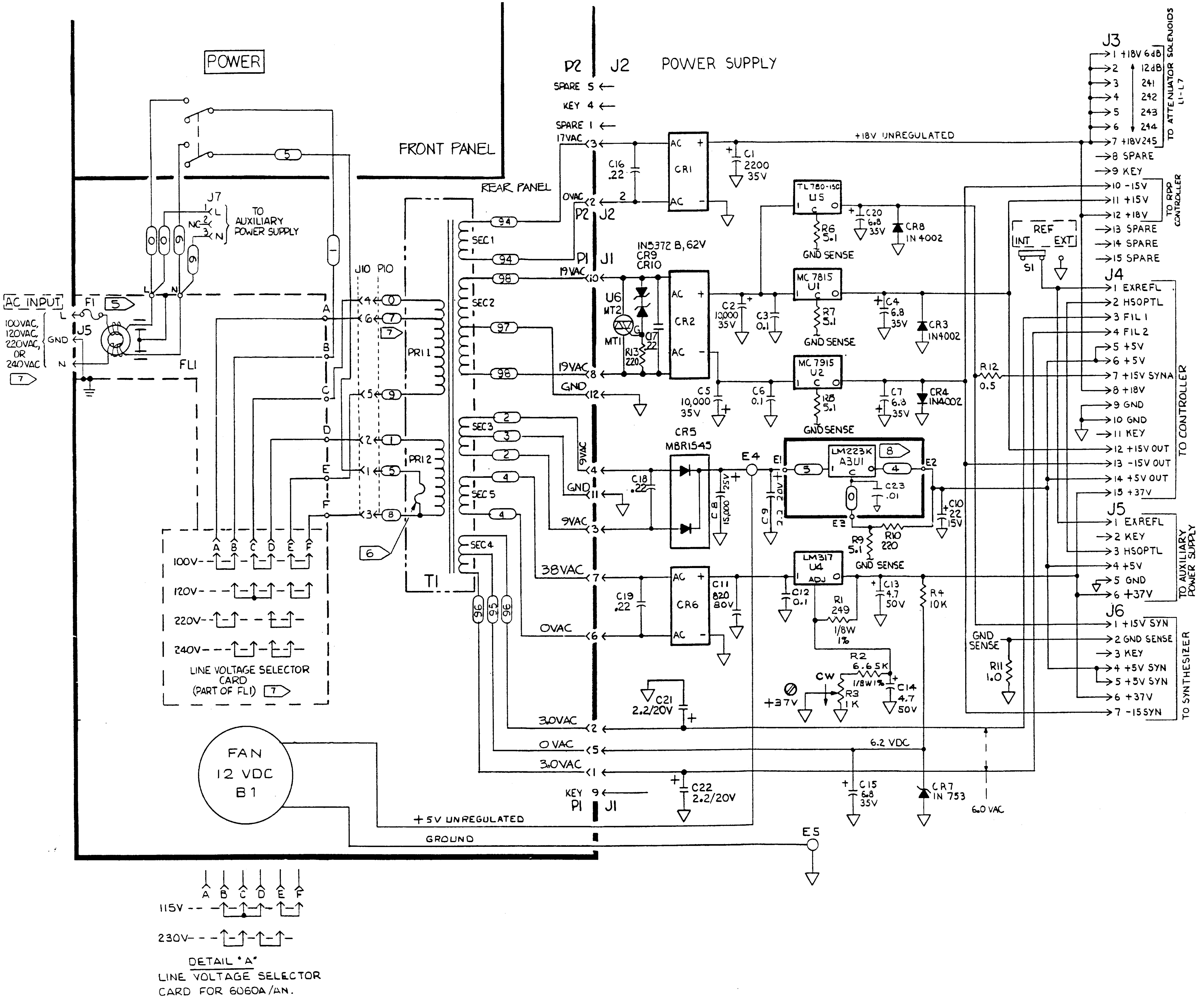
1. ALL RESISTOR VALUES ARE IN OHMS.
   ALL RESISTORS ARE 1/8W, ± 1%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.

606X Attenuator PC Assy and Circuit Schematic (A8A2)
DWG# 30467 Rev A
DWG# 30468 Rev A
Sheet 1 of 1

CIRCUIT 2



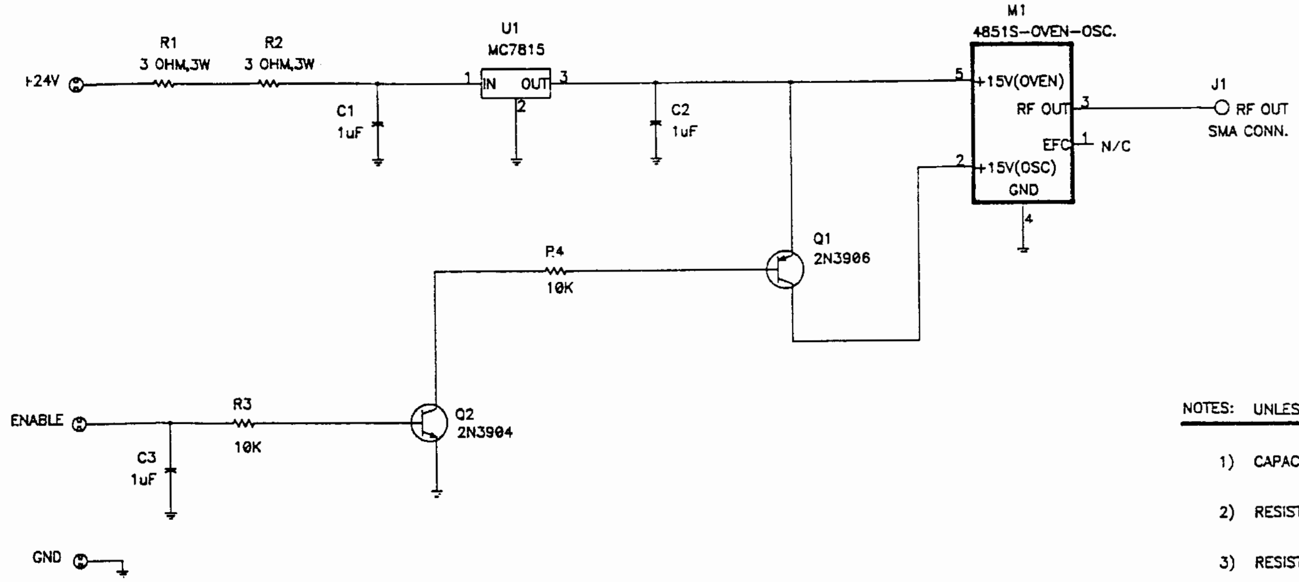
Power Supply PC Assy (A9)
PART# 657825 Rev M
DWG# 6060A-1631 Rev D
Sheet 1 of 1



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTANCES IN OHMS. ALL RESISTORS 1/4W, 5%.
2. ALL CAPACITANCES IN MICROFARADS.

Power Supply Circuit Schematic (A9)
PART# 657825 Rev M
DWG# 6060A-1031 Rev P
Sheet 1 of 1

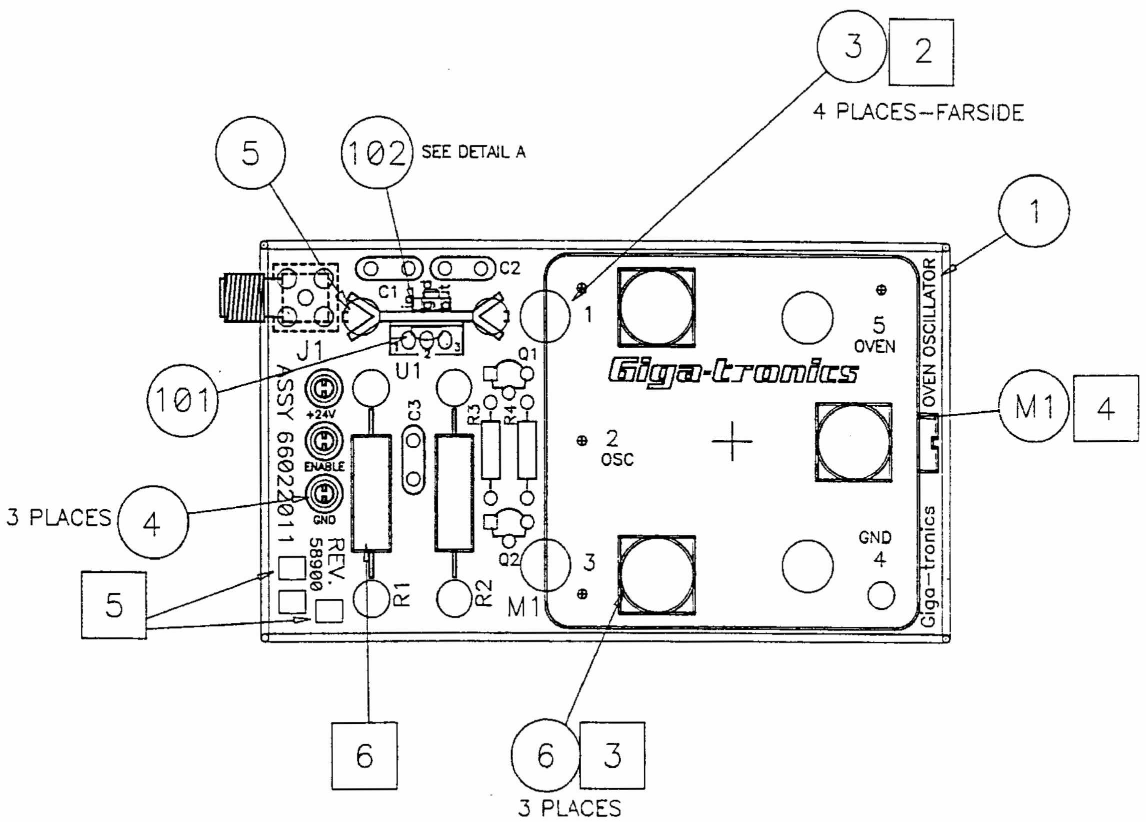


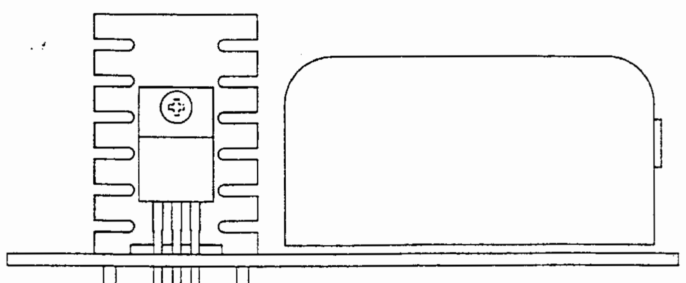
NOTES: UNLESS OTHERWISE SPECIFIED.

1) CAPACITOR VALUES ARE IN uF.

2) RESISTORS VALUES ARE IN OHMS.

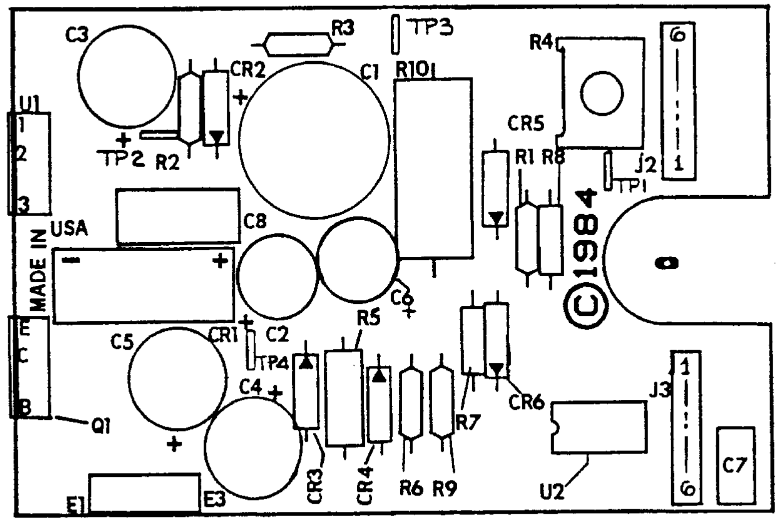
3) RESISTORS ARE 1/4W 1%

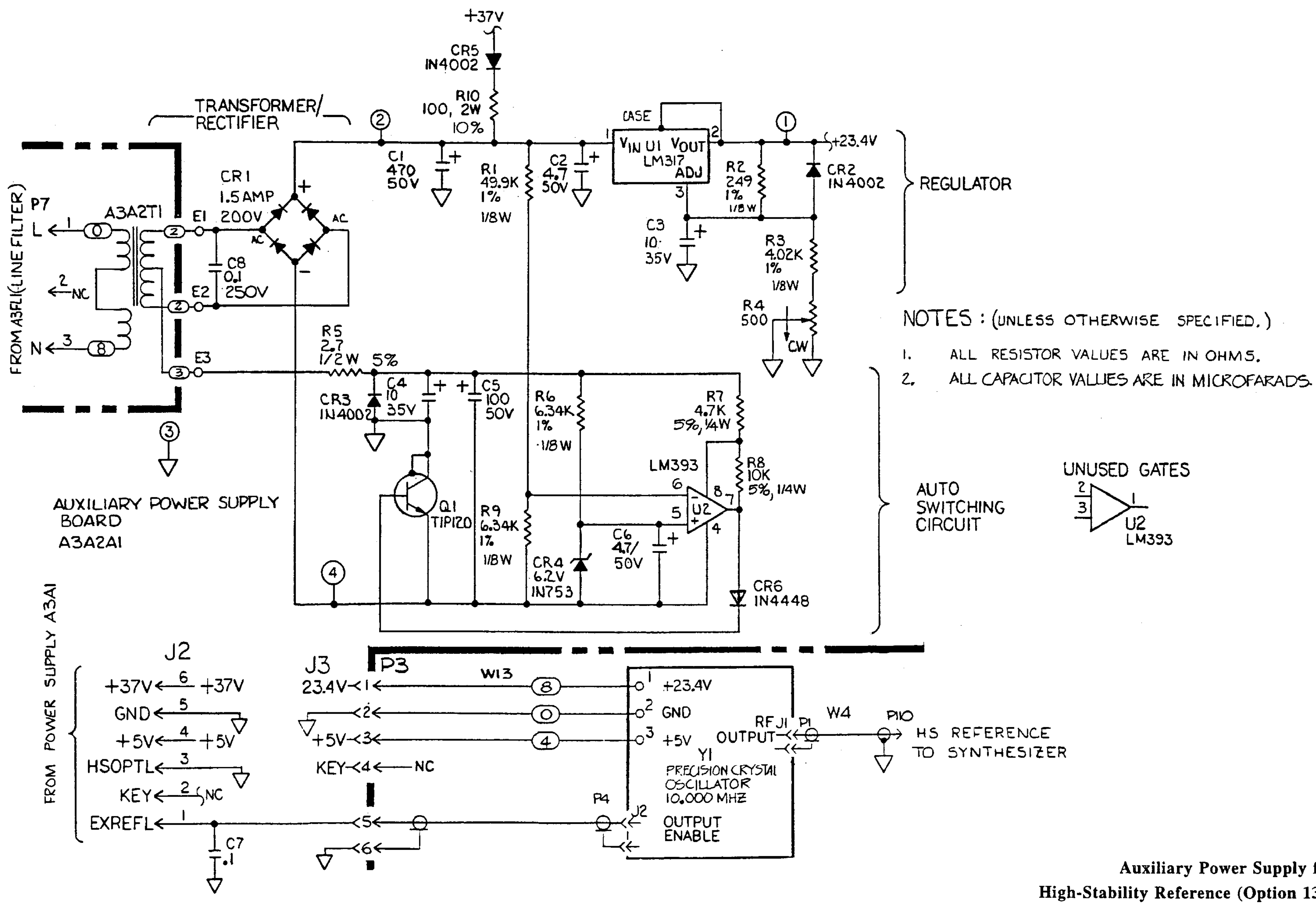




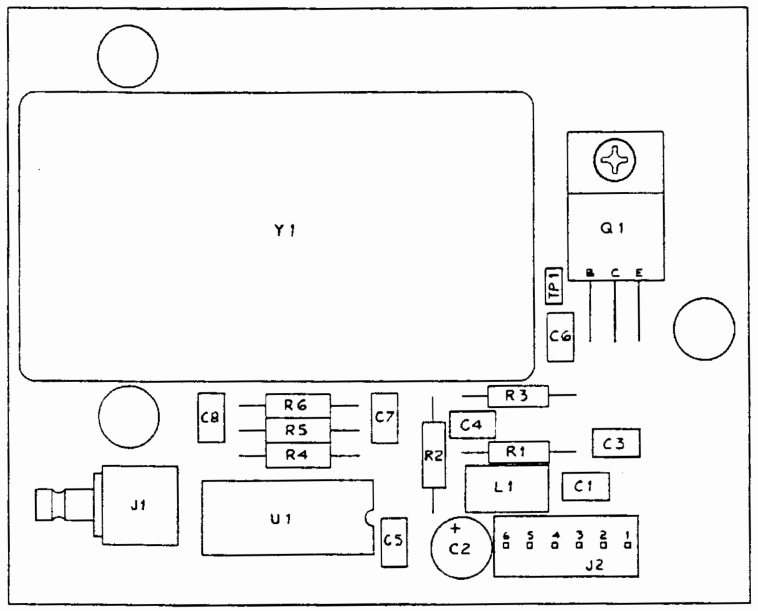
DETAIL A

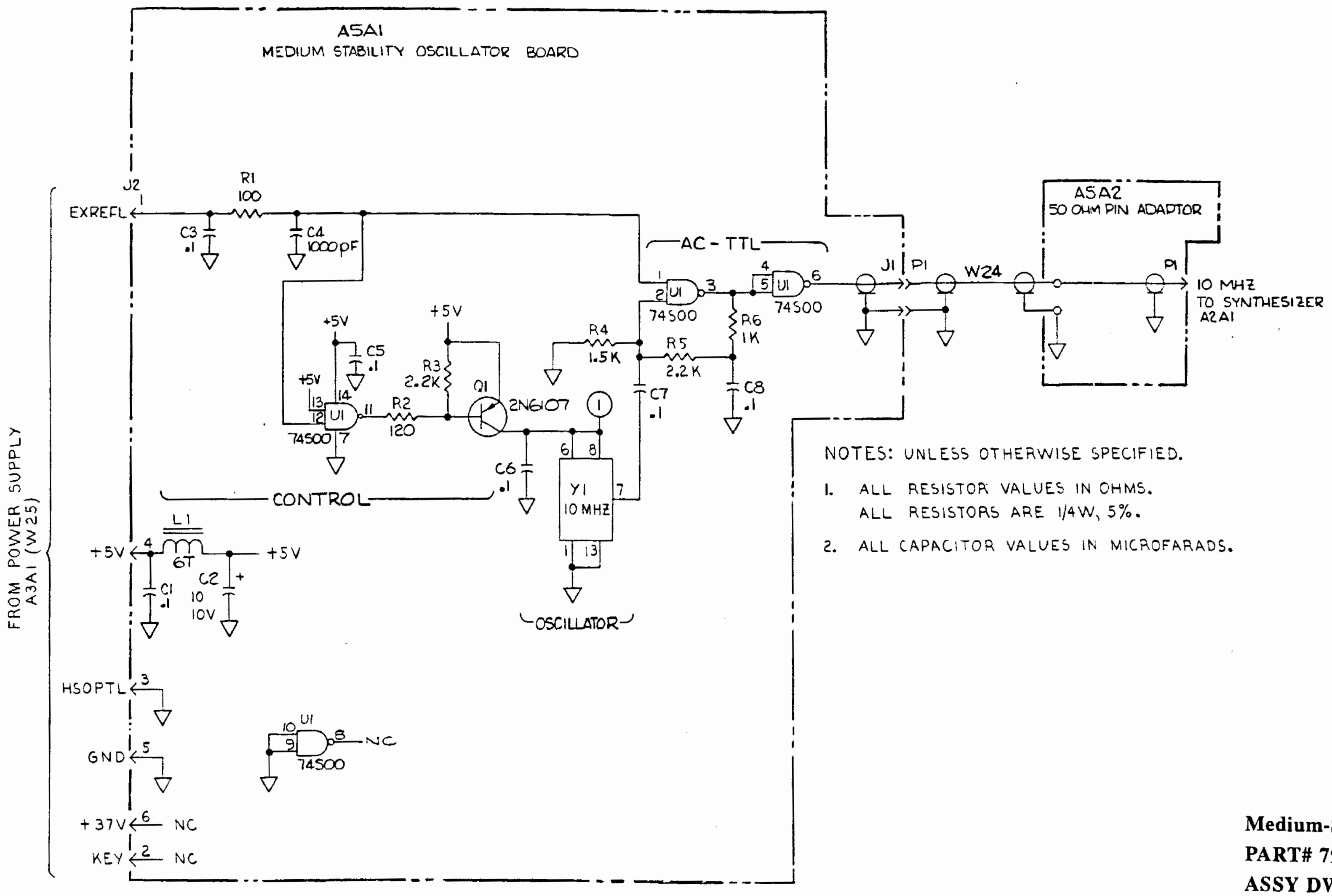
606X Option 130 PC Assy and
Circuit Schematic
DWG# 6602201100 Rev A
DWG# 660BS01100 Rev A
Sheet 1 of 1





Auxiliary Power Supply for
High-Stability Reference (Option 130)
PART# 731364 Rev G
ASSY DWG# 6060A-1632 Rev 01
SCHEMATIC DWG# 6060A-1032 Rev B
Sheet 1 of 1





NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL RESISTOR VALUES IN OHMS.
   ALL RESISTORS ARE 1/4W, 5%.
2. ALL CAPACITOR VALUES IN MICROFARADS.

Medium-Stability Reference (Option 132)
PART# 792747 Rev E
ASSY DWG# 6060B-1634 Rev 01
SCHEMATIC DWG# 6060B-1034 Rev A
Sheet 1 of 1

A

Options

A.1 Introduction

This appendix contains the theory of operation, a circuit description, and maintenance instructions for each option. The following options are currently available:

Option	Part Number
Option -130 High-Stability Reference	29836
Option -132 Medium-Stability Reference	29837
Option -830 Rear Panel RF Output and Mod Input	29857
Option Y6001 Rack Mount with Slides	29840
Option Y5002 Rack Mount without Slides	29841
Option A011 Carrying Case	29871

A.2 Option -130 — High-Stability Reference

A.2.1 Introduction

Option -130 configures the generator reference to be supplied by the High-Stability Reference when the rear panel REF INT/EXT switch is set to INT.

A.2.2 Operation

The High-Stability Reference circuit consists of an Auxiliary Power Supply and an ovened Oscillator. The Auxiliary Power Supply is mounted inside the generator on the rear panel, and the Oscillator is mounted inside on the side rail. Only the Auxiliary Power Supply is field repairable and is described here.

A.2.3 Circuit Description

The Auxiliary Power Supply is connected directly to the line power on the fuse/filter/line-voltage selector assembly to supply power to the ovened oscillator even when the POWER switch is off. The Auxiliary Power Supply PC assembly (A3A2A1) includes a linear-regulated supply and an automatic line-voltage selector circuit.

The linear-regulated supply consists of a diode rectifier bridge CR1, filter capacitor C1, voltage regulator U1, and associated resistors R2, R3, and R4. The circuit associated with CR3, Q1, and U2, provides automatic line voltage selection between two line-voltage ranges. This is implemented by configuring the rectifier circuit as a bridge rectifier for the lower line voltages or as a center-tapped, full-wave rectifier for the higher line voltages.

At low line voltages (less than approximately 150 VAC), transistor Q1 is conducting, thus grounding the minus terminal of rectifier CR1 and causing diode CR3 to be reverse biased. This causes the full secondary voltage of T1 to be rectified by the bridge rectifier, CR1.

When the line voltage is greater than 180 VAC, (there is approximately 30 V hysteresis), the comparator U2 turns off transistor Q1. Diode CR3 becomes forward biased, and the transformer center tap is effectively grounded. The voltage applied to the rectifier CR1 is then half the secondary voltage.

The comparator U2 input voltages are set by resistors R1, R6, R9, and zener diode CR4. U2 controls the base of transistor Q1. The comparator switching point is set between the low and high line voltages, with sufficient hysteresis to accommodate variations in input loading. At very low line voltages, the resistor diode combination R10 and CR5, from the 37 V output of the main power supply, augment the Auxiliary Power Supply.

The Ovened Oscillator output is disabled when the control line EXREFL is set low, (the REF INT/EXT switch is set to EXT during external reference operation). The status line HSOPTL, normally at +5 V, is pulled to ground when the High-Stability Reference option is installed.

A.2.4 Adjustments

Test Equipment

Frequency Standard
Oscilloscope
Two 3-ft. 50-ohm coaxial cables, Y9111

Procedure

The voltage adjustment (A3A2A1-R4) should be made after the first half hour of the three-hour warmup period has begun. For the best results in the frequency accuracy adjustment, the generator should be operated at room temperature for at least three hours before continuing with the adjustment procedures.

The High-Stability Reference Power supply voltage is first adjusted, then the generator reference and the Frequency Standard waveforms are viewed on the oscilloscope while triggering on the Frequency Standard. The ovened oscillator FREQ ADJ, COARSE, and then FINE are adjusted for a stationary display.

Voltage Adjustment

1. Remove the top cover.
2. Connect the DMM to the generator. Connect the positive lead to TP1 and the negative lead to TP3.
3. Adjust R4 for 23.4 ±0.1 V.
4. Remove the DMM connections from the generator and replace the top cover (temporarily). Wait the remaining warmup time, and perform the frequency accuracy adjustment.

Frequency Adjustment

1. Remove the top cover and the two FREQ ADJ access screws from the top of the ovened oscillator.
2. Connect the Frequency Standard signal to the oscilloscope vertical input channel 1, 50 Ω termination. Connect the generator rear panel 10 MHz OUT to the oscilloscope vertical input channel 2, 50 Ω termination.
3. Set the rear panel REF INT/EXT switch to INT.
4. Set the vertical controls of the oscilloscope to display the 10 MHz signal and the Frequency Standard 10 MHz signal. Set for internal triggering on channel 1, and adjust timebase for 0.1 µsec/div.
5. Adjust the oscilloscope COARSE, and then adjust the FINE controls for a drift of less than one cycle in 10 seconds (for 0.01 ppm or better if desired).

A.2.5 Option -130 Parts Lists

The following is the parts list for Option -830. Assembly and schematic diagrams for the High Stability Reference circuit are in Chapter 7.

29836 OPT 130 HIGH STAB TIME BASE, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	6602201100	1	58900	6602201100	606X OPTION 130 PCA
2	716860	1	58900	716860	MOUNTING PLATE,HI STAB
3	716845	1	58900	716845	PIN, SMA ADPTR, HS REF
4	JRAB-00300	1	95077	CD15191CCSF	SMA F TO SMA F
5	745158	1	58900	745158	BLOCK,SMA ADAPTER,PLATED
6	HTM0-00003	2	06383	ABMM-1	CABLE TIE ANCHOR
7	HT00-00409	2	53421	T-18R	4 WHITE CABLE TIE
101	HBPP-63206	2	26233	NS137CR632R6	6-32 X 3/8 PAN
102	HBPP-63204	3	26233	NS137CR632R4	6-32 X 1/4 PAN
103	HBXP-44004	4	26233	NS132CR440R4	4-40 X 1/4 82DEG FLAT
104	HNNS-63205	3	96906	FZ1NTM-62	6-32 LOCKING NUT
A3A2A 1	731364	1	58900	731364	PCA, AUXILIARY POWER
W 4	738567	1	58900	738567	CABLE ASSY HS 10MHZ,SEMI-RIGID
W 13	6602201200	1	58900	6602201200	606X OVEN OSCILLATOR CABLE ASY
W 14	748707	1	58900	748707	CABLE ASSY, AUX POWER

6602201100 606X OPTION 130 PCA, Rev: A

Item	Part Number	Qty	Cage	Mfr's Part Number	Description
1	6602301100	1	58900	6602301100	606X OVEN OSCILLATOR PCB
2	660BS01100	REF	58900	660BS01100	606X OPTION 132 SCHEMATIC
3	HSTS-40804	4	55566	3051-B-440-A-9	4-40 X 1/2 SWAGE SPACER
4	ETSB-06224	3	58900	ETSB-06224	BIFURCATED TERMINAL
5	HQH0-52200	1	13103	6025B-TT	T0220 HEATSINK
6	4202355700	3	58900	4202355700	INSULATOR .40 DIA.X .06 THK PL
101	HBPP-44005	1	26233	NS137CR440R5	4-40 X 5/16 PAN
102	HNKS-44004	1	96906	MS35649-***	4-40 KEP NUT
C 1	CC50-05100	1	56289	2C25Z5U105M050B	1 UF CERAMIC Z5U
C 2	CC50-05100	1	56289	2C25Z5U105M050B	1 UF CERAMIC Z5U
C 3	CC50-05100	1	56289	2C25Z5U105M050B	1 UF CERAMIC Z5U
J 1	JRAF-10101	1	02660	901-143	SMA F PC MOUNT
M 1	OXO7-00010	1	00136	4851SHLS15C89M10M	10 MHZ OVEN OSCILLATOR
Q 1	QBPS-03906	1	56289	2N3906	2N3906 .2A 40V PNP
Q 2	QBNS-03904	1	56289	2N3904	2N3904 .2A 40V NPN
R 1	RW03-00030	1	91637	RS-2B-3R-1%	3 OHM 2W WIREWOUND
R 2	RW03-00030	1	91637	RS-2B-3R-1%	3 OHM 2W WIREWOUND
R 3	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R 4	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
U 1	URC0-07815	1	66958	L7815CV	MC7815CT 1A 15V REG

731364 PCA, AUXILIARY POWER, Rev: G

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	1	731372	1	58900	731372	SUPPLY
	35	HNNS-44004	2	73734	78000	4-40 LOCKING NUT
	41	JIA0-01165	10	2M631	87022-1	MALE PIN CONNECTOR
	45	JIA0-01280	4	79963	834	FASTON TAB TERMINAL
	52	716977	1	58900	716977	XFORMER RETAINER,HI STAB
	53	716878	1	58900	716878	TRANSFORMER MNT,HI STAB
	55	HBBH-44020	2	58900	HBBH-44020	4-40 X 1/4 BUTTON HEAD
	56	HBPP-44006	4	26233	NS137CR440R6	4-40 X 3/8 PAN
	57	HBPP-63204	3	26233	NS137CR632R4	6-32 X 1/4 PAN
	58	HBYP-44005	2	58900	HBYP-44005	4-40 X 5/16 82DEG FLAT
	59	HQIS-00001	2	55285	7403-09FR-54	SILICONE INSULATOR
	62	HWHN-40401	2	7U905	A364-164	NYLON SHOULDER WASHER
	63	HNKS-44004	2	96906	MS35649-***	4-40 KEP NUT
C	1	CE50-R7470	1	62643	SXE50VB471M18X15MC	470UF 50V RADIAL
C	2	CT50-R5470	1	56289	199D475X0050DE2	4.7UF 50V TANTALUM
C	3	CT35-R6100	1	56289	199D106X0035DE2	10UF 35V TANTALUM
C	4	CT35-R6100	1	56289	199D106X0035DE2	10UF 35V TANTALUM
C	5	CE50-R7100	1	0H1N5	CEUSM1H101M	100UF 50V RADIAL
C	6	CT50-R5470	1	56289	199D475X0050DE2	4.7UF 50V TANTALUM
C	7	CF50-R4100	1	65964	MMK5104K50L4C	.1UF 50V POLYESTER
C	8	CF00-R4100	1	65964	MMK10104100L4C	.1UF 100V POLYESTER
CR	1	DBMD-00001	1	14936	KBP02M	1A 200V BRIDGE RECTIFIER
CR	2	DPAC-04002	1	98291	1N4002-ITT	1N4002 1A 100V DIODE
CR	3	DPAC-04002	1	98291	1N4002-ITT	1N4002 1A 100V DIODE
CR	4	DZAB-00753	1	27014	1N753A	1N753A 6.2V ZENER
CR	5	DPAC-04002	1	98291	1N4002-ITT	1N4002 1A 100V DIODE
CR	6	DSA0-04448	1	11532	1N4448	1N4448 SWITCHING DIODE
Q	1	QBNP-00120	1	66958	TIP120-SGS	TIP120 5A 60V NPN
R	1	RN55-24990	1	19701	RN55C4992F	49.9 K OHMS 1% MET FILM
R	2	RN55-02490	1	81349	RNC55H2490FM	249 OHMS 1% MET FILM
R	3	RN55-14020	1	81349	MF55C4021FL	4.02K OHMS 1% MET FILM
R	4	RAPA-05000	1	32977	3386R-1-501	500 OHM POT 1T PC MOUNT
R	5	RC20-00027	1	01121	RC20GF2R7J	2.7 OHM 5% 1/2W CARBON
R	6	RN55-16340	1	81349	RNC55H6341FM	6.34K OHMS 1% MET FILM
R	7	RN55-14750	1	91637	RN55C4751F	4.75 K OHMS 1% MET FILM
R	8	RN55-21000	1	19701	RN55C1002F	10 K OHMS 1% MET FILM
R	9	RN55-16340	1	81349	RNC55H6341FM	6.34K OHMS 1% MET FILM
R	10	RC42-01000	1	01121	RC42GF101J	100 OHM 10% 2W CARBON
T	1	731281	1	58900	731281	TRANSFORMER,AUXILIARY
U	1	URC0-00317	1	27014	LM317T	LM317C ADJ 3 TERM REG
U	2	ULN0-00393	1	01245	LM393P	LM393N VOLT COMPARATOR

A.3 Option -132 — Medium-Stability Reference

A.3.1 Introduction

This option provides the generator with a medium-stability frequency reference.

A.3.2 Operation

The Medium-Stability Reference is selected as the generator reference when the rear panel REF INT/EXT switch is set to INT.

The Medium-Stability Reference does not have standby power nor is its oven kept warm during external reference operation. Therefore, each time the Medium-Stability Reference is selected, a warm-up time of typically 5 to 10 minutes is required to meet specifications. A *Freq. Uncal* condition may be observed during this warm-up period.

A.3.3 Circuit Description

The A5A1 Medium-Stability Reference circuit consists of an Ovened Oscillator (Y1) and an AC-to-TTL Converter. The A5A1 Medium-Stability Reference PCA is field repairable. The ovened oscillator is not field repairable and is not described here.

The A5A1 Medium-Stability Reference PCA is mounted on the left side rail. The PCA is connected to the +5 V power supply and to control signals via cable W25. The output is connected to the A4 Synthesizer assembly through cable W24.

Two NAND gates of U1 are used to convert the oscillator AC-coupled output to a TTL signal. Another NAND gate of U1 and transistor Q1 control the power for the oven and oscillator circuit of Y1.

When the REF INT/EXT switch is set to EXT for external reference operation, the control line EXREFL is set low. This disables the oven and oscillator circuit of Y1 and also disables the AC-to-TTL Converter to prevent it from oscillating spuriously.

A.3.4 Adjustment

This procedure is used to adjust the frequency of the Medium-Stability Reference. For the best results, the generator should be warmed up at room temperature before proceeding with the adjustment procedure (see step 1 below).

Test Equipment

Frequency Standard
Oscilloscope
Two 3-ft, 50-ohm coaxial cables (Accessory Y9111)

Procedure

In this procedure, the waveforms of the generator and the Frequency Standard are viewed on the oscilloscope while triggering on the Frequency Standard. The ovened oscillator FREQ ADJ control is then adjusted for a stationary display.

An alternate method of adjustment is to count the 10 MHz reference signal at the 10 MHz OUT connector with a counter that has a suitably stable and accurate reference.

1. Turn the generator on, set the REF INT/EXT switch to INT, and then wait one hour. If the generator has already warmed up for at least 40 minutes, it is sufficient to wait an additional 20 minutes after the REF INT/EXT switch is set to INT.
2. Remove the top cover. The frequency adjustment control is located on the center top of the PCA and is accessed through the upper rear left side panel of the generator.

3. Connect the Frequency Standard output signal to the oscilloscope vertical input channel 1, with 50 Ω termination. Connect the generator rear panel 10 MHz OUT to the oscilloscope vertical input channel 2, with 50 Ω termination.
4. Set the vertical controls of the oscilloscope to display the 10 MHz signal and the Frequency Standard 10 MHz signal. Set the oscilloscope for internal triggering on channel 1 and adjust the timebase for 0.1 usec/division.
5. Adjust the oscillator FREQ for a drift of less than one cycle in 10 seconds (or a counter frequency within 0.1 Hz of 10 MHz) for 0.01 ppm or better if desired.

A.3.5 Option -132 Parts Lists

The following is the parts list for the Option -132 Medium Stability Time Base. Assembly and schematic diagrams for Option -132 are in Chapter 7.

29837 OPT 132 MED STAB TIME BASE, Rev: A

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	2	792770	1	58900	792770	PWB, 50 OHM PIN ADAPTER
	3	698472	1	58900	698472	PIN TEST BASE
	6	HBPP-63204	3	26233	NS137CR632R4	6-32 X 1/4 PAN
	7	HBPP-63204	2	26233	NS137CR632R4	6-32 X 1/4 PAN
	8	WKAC-09300	0	92194	FIT-221-3/32	3/32 SHRINK TUBING
A	34	792747	1	58900	792747	PCA, MEDIUM STAB OSC
W	24	546366	1	58900	546366	CABLE ASSY
W	25	792804	1	58900	792804	CABLE ASY,CTRL,MSO OPT

792747 PCA, MEDIUM STAB OSC, Rev: E

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	1	792739	1	58900	792739	PWB, MEDIUM STABILITY OS
	19	HSTS-40204	1	55566	3045-B-440-A	4-40 X 1/8 SWAGE SPACER
	20	HSTS-60404	3	55566	3047-B-632-A-02	6-32 X 1/4 SWAGE SPACER
	21	HBPP-44004	1	26233	NS137CR440R4	4-40 X 1/4 PAN
C	1	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	2	CT26-R6100	1	31433	T356E106M025AS	10UF 25V TANTALUM
C	3	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	4	CC50-02100	1	31433	C315C102K1R5CA	.001 UF CERAMIC Y5P
C	5	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	6	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	7	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
C	8	CF51-R4100	1	68919	MKS02-.1/63/20	.1UF 50V POLYESTER
J	1	JRBM-00101	1	98291	051-053-0349-220	SMB M RTANG PC MOUNT
J	2	JHLP-10006	1	2M631	641126-6	6PIN LOCKING HEADER
L	1	320911	1	58900	320911	CHOKE, 6 TURN
Q	1	QBPP-06107	1	27014	2N6107-NAT	2N6107 7A 70V 40W PNP
R	1	RN55-01000	1	91637	RN55C1000F	100 OHMS 1% MET FILM
R	2	RN55-01210	1	91637	RN55C1210F	121 OHMS 1% MET FILM
R	3	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R	4	RN55-11500	1	3W023	RN55C1501F	1.5 K OHMS 1% MET FILM
R	5	RN55-12210	1	91637	RN55C2211F	2.21 K OHMS 1% MET FILM
R	6	RN55-11000	1	3W023	RN55C1001F	1 K OHMS 1% MET FILM
TP	1	JIA0-01280	1	79963	834	FASTON TAB TERMINAL
U	1	UTN0-00007	1	27014	DM74S00N	74S00 2 IN NAND
Y	1	30146	1	58900	30146	OPT 132 REPLACEMENT OSC PCA

A.4 Option -830 — Rear Panel RF Output & Mod Input

A.4.1 Introduction

Option -830 relocates the RF OUTPUT and MOD INPUT connectors from the front panel to the rear panel of the generator. An insulating spacer is used when the RF OUTPUT connector is mounted on the rear panel to reduce ground loops. A longer semi-rigid coaxial SMA cable assembly (W17) replaces the standard cable (W1). The option switch on the Controller is set to indicate that the option is installed.

A.4.2 Operation

The additional signal loss of this longer cable is compensated using instrument-independent correction data stored in the Output Calibration EPROM. The Controller applies this correction data only when the rear panel RF Output option jumper (S1 pin 4) is installed on the Controller PCA.

A.4.3 Circuit Description

This option does not change the operation or specifications of the generator.

A.4.4 Maintenance

This option does not change the performance tests, calibration, adjustment, or service of the generator.

A.4.5 Parts List

The following is the parts list for the Option -830. Assembly and schematic diagrams for Option -830 are in Chapter 7.

29857 OPT 830 REAR RF OUT/MOD IN, Rev: A

Item		Part Number	Qty	Cage	Mfr's Part Number	Description
	2	HFFA-00001	3	EFR	8112-BLK	ROUND BLACK RUBBER FOOT
	3	774505	1	58900	774505	MOUNTING PLATE, REAR RF
	4	HNKS-44004	4	96906	MS35649-***	4-40 KEP NUT
	7	HT00-00409	15	53421	T-18R	4 WHITE CABLE TIE
	8	HBXP-44004	4	26233	NS132CR440R4	4-40 X 1/4 82DEG FLAT
	9	HICP-25042	2	06915	N4B	CABLE CLAMP
	12	HLLT-K1114	1	79963	761-375	3/8 (BNC) SOLDER LUG
	15	HWFS-60500	2	96906	MS15795-805	#6 X 5/16 FLAT WASHER
C	1	CC00-01270	1	04222	SR151A271JAT	270PF CERAMIC COG
L	1	LCR0-78700	1	54583	H5C2T20-7.5-14.5E	FERRITE TOROIDAL CORE
L	2	LCR0-78700	1	54583	H5C2T20-7.5-14.5E	FERRITE TOROIDAL CORE
L	3	LCR0-78700	1	54583	H5C2T20-7.5-14.5E	FERRITE TOROIDAL CORE
L	4	LCR0-78700	1	54583	H5C2T20-7.5-14.5E	FERRITE TOROIDAL CORE
L	5	LCR0-78700	1	54583	H5C2T20-7.5-14.5E	FERRITE TOROIDAL CORE
L	6	LCR0-78700	1	54583	H5C2T20-7.5-14.5E	FERRITE TOROIDAL CORE
L	7	LCR0-78700	1	54583	H5C2T20-7.5-14.5E	FERRITE TOROIDAL CORE
L	8	LCR0-78700	1	54583	H5C2T20-7.5-14.5E	FERRITE TOROIDAL CORE
L	9	LCR0-78700	1	54583	H5C2T20-7.5-14.5E	FERRITE TOROIDAL CORE
W	1	738559	1	58900	738559	CABLE ASSY, SR, REAR RF OUT
W	2	738518	1	58900	738518	CABLE ASSY, MOD INPUT,
W	3	808501	1	58900	808501	CABLE ASY,PULSE MOD,REAR

A.5 Option Y6001 — Rack Mount with Slides

This is a kit for mounting the instrument in a standard equipment rack. The kit includes mounting slides. The kit can be ordered from Giga-tronics with part number 29840.

A.6 Option Y6002 — Rack Mount without Slides

This is a kit for mounting the instrument in a standard equipment rack. The kit does not include mounting slides. The kit can be ordered from Giga-tronics with part number 29841.

A.7 Option A011 — Carrying Case

This is a special protective case for transporting the instrument between work sites. It can be ordered from Giga-tronics with part number 29871.

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Giga-tronics 6062A OPERATOR INFORMATION CARD

REJECTED ENTRY CODES (Press the [STATUS] key to display codes)

000 000 000 = no rejected entries.
001 000 000 = FM Dev/ØM not between 0 and 400 kHz
(40.0 kHz with option -651)
002 000 000 = FM Dev/ØM Step not between 0 and 400 kHz
(40.0 kHz with option-651)
004 000 000 = AM Depth not between 0 and 99%
010 000 000 = AM Depth Step not between 0 and 99%
020 000 000 = IEEE-488 command syntax error
040 000 000 = IEEE-488 input value out of range
100 000 000 = MEC compensation PROM error
200 000 000 = IEEE edit or step operation beyond allowed range
400 000 000 = Invalid frequency in COMP memory

000 001 000 = Frequency not between 100 kHz and 2100 MHz
000 002 000 = COMP switch not enabled or low-rate FM option not disabled
000 004 000 = Frequency Step not between 0 and 2100 MHz
000 010 000 = COMP data may not be stored if procedure incomplete
000 020 000 = Invalid compensation command
000 040 000 = Invalid memory location
000 100 000 = Invalid data in memory
000 200 000 = Special function not allowed
000 400 000 = COMP data range error

000 000 001 = Output amplitude not between 10 nV and 1.58V
000 000 002 = Insufficient resolution for units conversion
000 000 004 = Units conversions to volts not allowed with reference in volts
000 000 010 = Units conversions to dB not allowed with reference in volts
000 000 020 = Amplitude Step not between 0 and 164 dB or 0 and 1999V
000 000 040 = Units conversion of Amplitude or FM/ØM Step not allowed
000 000 100 = Amplitude or FM/ØM step and current display not in same units
000 000 200 = COMP data from IEEE-488 out of range or edit beyond COMP limits
000 000 400 = Internal compensation data transfer error

UNCAL CODES (Press the [STATUS] key to display codes)

Flashing codes (denoted by *) indicate abnormal operation or aberrated output.
Non-flashing codes indicate operation outside specified range.

000 000 000 = no uncal conditions
002 000 000 = Excess FM Dev/ØM for output freq < .350 MHz
* 004 000 000 = Excess FM Dev/ØM, main or reference PLL unlocked
* 010 000 000 = FM DAC at full scale
200 000 000 = Multiple COMP memory checksum errors
* 000 010 000 = Main or reference PLL unlocked
000 000 001 = Level vernier>12 db below bottom of range
000 000 002 = Peak amplitude > +16 dBm for freq < 1050 MHz or
> +13 dBm for freq >= 1050 MHz
* 000 000 004 = Amplitude unleveled
* 000 000 010 = Fixed-range level vernier at 0
* 000 000 020 = Fixed-range level vernier at full scale
* 000 000 040 = RPP tripped
000 000 100 = Level < -137 dBm
000 000 200 = Level correction disabled
* 000 000 400 = RF off

SPECIAL FUNCTION OPERATION (Press the [SPCL] key, then press the 2-digit code)

The two-digit code consists of a class numeric followed by a mode numeric. The activated modes of classes 2 through 9 are shown in the FREQUENCY display field while the [SPCL] key is pressed. For example, reading from left to right, 01000201 indicates that relative amplitude, slow key-repeat-rate, and amplitude fixed-range are selected.

Code	Function	Code	Function
00	Clears all special functions	30/31	Disable/enable relative ampl
02	Initiates self test	40/41	Disable/enable internal pulse
03	Display check	50/51/52	Select dBm/dBmV/dBuV ampl mode
04	Key check	60/61	Disable/enable DC AM
07/08	Set/reset SRQ	70/71/72	Medium/fast/slow key-rep-rate
09	Display S/W rev & instr ID	75	Display COMP memory status
10	Display IEEE-488 address	76	Repair COMP memory errors
11	Display self test results	77/78/79	Copy FM/Output/Atten MEC PROM data
12/13	Turn on/off Display	80	Enable amplitude correction
14	Initialize Memory	81	Disable all level correction
15	Latch test	82	Disable attenuator correction
16	Display Option Loading	83-86	Program alternate 24 dB atten
17	Initiates self test with RF on	90/91	Disable/enable ampl fixed-rng
20/21	Disable/enable relative freq	95/98	Keyboard compensation procedures

SELF TEST RESULTS (Press the [SPCL] [1] [1] keys to display the results)

The self test results are reported in the four display fields as follows:

aaa -bbb ccc ddd

AM/FM Tests, Self Test incomplete, Freq Tests, Digital Tests, Ampl Tests

000 000 000 000 indicates all tests passed.

MEMORY

Instrument settings may be stored in locations 01 through 50 and later recalled from Non-Volatile Memory. Location 98 contains the Instrument Preset State.

REV 0 P/N 797928

Giga-tronics

Technical Publication Change Instructions

Updated replacement pages and/or drawings are attached to these Change Instructions. Please remove and discard the corresponding pages and/or drawings, and replace them with the attached pages and/or drawings. Failure to make these replacements may result in loss of product efficiency and possible failure.

Page numbers with an "a" suffix denote pages that have been changed. Specific changes are identified by change bars in corresponding margins. A replacement page with no suffix has not been changed but is included only because it is part of the changed page. Replacement pages will become standard pages without a number suffix in the next printing of this manual.

For record purposes, you are encouraged to retain these Change Instructions as a permanent part of the manual.

Product:	Model 6062A RF Signal Generator
Manual Part Number:	794842
Manual Revision:	C
Print Date:	May 1997
Change Instructions No:	6062A-003
Date:	November 1997

To update your product technical manual, please replace the page(s) indicated below:

PCN	Current Page No.	Replacement Page No.	Remarks
	4-7 and 4-8	4-7a and 4-8	

10 MHz Reference Frequency Adjustment

The accuracy of the reference frequency adjustment depends on the accuracy of the Frequency Standard.

If either Option -130 High-Stability Reference, or Option -132 Medium-Stability Reference is installed, skip the following procedure and use the adjustment procedures in Appendix A of this manual.

Test Equipment:

Frequency Standard
Oscilloscope

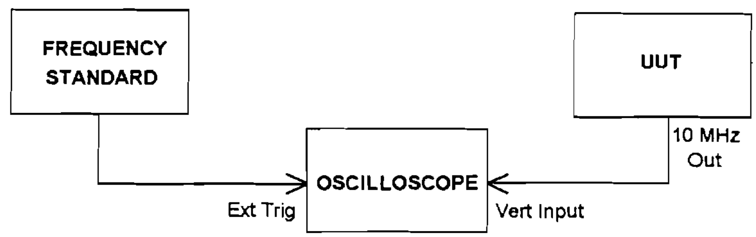

Figure 4-4. 10 MHz Reference Frequency Adjustment

Procedure:

The reference waveform is viewed on the oscilloscope while triggering on the Frequency Standard. The 10-MHz reference frequency is adjusted with C240 for a stationary display (C240 is located adjacent to R230).

1. Remove the instrument top cover and the C240 access hole plug from the module plate cover.
2. Connect 10 MHz OUT on the rear panel to the oscilloscope vertical input.
3. Connect the Frequency Standard output to the oscilloscope external trigger input.
4. Set the REF INT/EXT switch on the rear panel to INT, and set the vertical controls of the oscilloscope to display the 10-MHz signal.
5. Set the oscilloscope for external triggering and adjust the timebase for 0.1 µs/div.
6. Adjust C240 for a drift of less than one cycle per second.

FM Adjustments

The FM Cal adjustment, R82, sets the overall deviation accuracy, whereas the Low-Rate Deviation adjustment, R90, equalizes the low and high rate deviation. The FM Flatness adjustment, R87, equalizes the deviation across the band from 0.2 to 10 kHz.

Test Equipment:

Modulation Analyzer
LFSSG
DVM

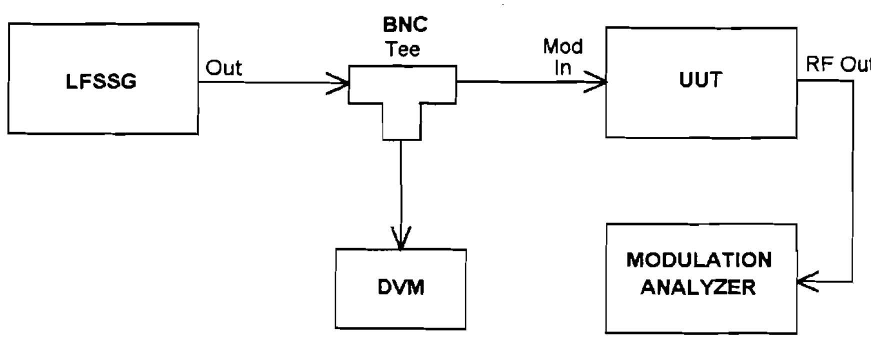

Figure 4-5. FM Adjustments

Procedure:

The FM deviation of the generator, as measured with the Modulation Analyzer, is adjusted to agree with the programmed deviation at 10 kHz, 0.2 kHz and 0.5 kHz rates by adjusting R82, R90, and R87, respectively.

1. Remove the instrument cover and the FM CAL, FM Flatness, and Low-Rate Deviation access hole plugs from the cover of the module plate.
2. Connect the output of the LFSSG to the MOD IN connector and to the DVM with a BNC tee.
3. Connect the generator RF output to the Modulation Analyzer input.
4. Program the Modulation Analyzer to measure FM + peak. No filters should be active.
5. Program the generator to the [RCL] [9] [8]. Then program the generator to 385.5 MHz, 7 dBm, EXT FM, 99.9 kHz deviation.
6. Program the LFSSG to 10 kHz and 0.7071 V_{rms}, as measured with the DVM.
7. Adjust R82 for 100.0 kHz, as measured by the Modulation Analyzer.
8. Program the LFSSG to 0.2 kHz and 0.7071 V_{rms}, as measured by the DVM.
9. Adjust R90, the low-rate deviation for 100.0 kHz, as measured on the Modulation Analyzer.
10. Program the LFSSG to 500 Hz.
11. Adjust R87 for 100.0 kHz as measured on the Modulation Analyzer.
12. Repeat steps 6 through 11 until the deviation flatness is 100.0 kHz ± 0.3 kHz.
13. Turn the EXT FM off and note the Modulation Analyzer peak deviation (noise) reading.
14. Turn the EXT FM on.
15. Program the LFSSG to 10 kHz and 0.7071 V_{rms} as measured by the DVM.
16. With the Modulation Analyzer, alternately measure +Peak and -Peak FM, and adjust R82 so the readings are symmetrical, about 99.9 kHz plus the noise noted in step 13.