HP 8660D
SYNTHESIZED SIGNAL GENERATOR
SERVICE MANUAL
(Including Options 001, 002, 003, and 005)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed:

2718A to 2720A

For additional important information about serial numbers, refer to "INSTRUMENTS COVERED BY THIS MANUAL" in Section 1.

EAST 24001 MISSION AVENUE, TAF C-34, SPOKANE, WASHINGTON, U.S.A. 99220

Service Manual Part Number (Volume 2) 08660-90104

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HEWLETT PACKARD

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Thanks

Dave & Lynn Henderson

Dave & Lynn Henderson
Artek Media

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This product is a Safety Class I instrument (provided with a protective earth terminal).

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage and the correct fuse is installed.

SAFETY EARTH GROUND

An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set.

SAFETY SYMBOLS


Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).


Indicates hazardous voltages.


Indicates earth (ground) terminal.

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

WARNING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection).

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

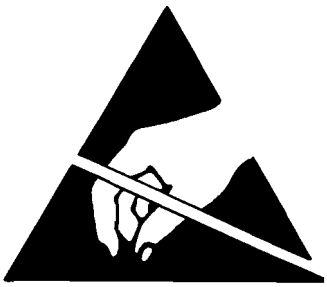
If this instrument is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the power source.

Servicing instructions are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

For continued protection against fire hazard, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example, normal blow, time delay, etc.). Do not use repaired fuses or short circuited fuseholders.



ATTENTION
Static Sensitive Devices

This instrument was constructed in an ESD (electro-static discharge) protected environment. This is because most of the semiconductor devices used in this instrument are susceptible to damage by static discharge.

Depending on the magnitude of the charge, device substrates can be punctured or destroyed by contact or mere proximity of a static charge. The results can cause degradation of device performance, early failure, or immediate destruction.

These charges are generated in numerous ways such as simple contact, separation of materials, and normal motions of persons working with static sensitive devices.

When handling or servicing equipment containing static sensitive devices, adequate precautions must be taken to prevent device damage or destruction.

Only those who are thoroughly familiar with industry accepted techniques for handling static sensitive devices should attempt to service circuitry with these devices.

In all instances, measures must be taken to prevent static charge build-up on work surfaces and persons handling the devices.

For further information on ESD precautions, refer to "SPECIAL HANDLING CONSIDERATIONS FOR STATIC SENSITIVE DEVICES" in Section VIII Service Section.

VOLUME 2 CONTENTS

Section 6
REPLACEABLE PARTS

6-1. INTRODUCTION TO THIS SECTION

This section contains information for ordering parts. Table 6-1 lists reference designations, and Table 6-2 lists abbreviations that are used in the Replaceable Parts List. Table 6-3 lists all replaceable parts in the instrument. Table 6-4 contains the names and addresses that correspond to the manufacturer's code numbers listed in Table 6-3. Also included in this section are photographs and drawings to aid in identifying and ordering chassis mounted parts and mechanical parts.

6-2. REFERENCE DESIGNATIONS AND ABBREVIATIONS USED IN THIS MANUAL

Table 6-1 lists the reference designation letters for electrical parts in the instrument. The letter designations found in Table 6-1 are coupled with numeric designations to provide a unique reference designation for each part in the instrument. For example A20R1 is the reference designation of a particular resistor R1 on assembly A20.

Table 6-2 lists abbreviations used in the parts list and on schematics.

6-3. REPLACEABLE PARTS LIST

Table 6-3 is a list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components with reference designations in alphanumeric order. Mechanical parts such as heatsinks, insulators, screws and other hardware are listed at the end of each assembly under **MISCELLANEOUS PARTS.**

b. Chassis-Mounted electrical parts with reference designations in alphanumeric order.

c. Mechanical parts with reference designations in alphanumeric order.

Ordering Parts.

Instrument Serial Numbers.

Attached to the rear of the instrument is a serial-number plate. The first four digits and the letter are the instrument serial-number prefix. The last five digits (serial-number suffix) are unique to each instrument. When parts in the instrument are changed, the serial-number prefix of the instrument may also change. This means that sometimes a part will be listed more than once in the the replaceable parts list along with a serial-number prefix or range of serial-number prefixes. Find the serial-number prefix on the serial plate of your instrument and order the part listed under the corresponding prefix in the table. If no serial prefix information is listed, the part is compatible in instruments of all serial numbers.

NOTE

It is possible that some assemblies in your instrument have been updated (through service or retrofitting) to reflect changes made to instruments with serial-number prefixes later than that shown on your instrument serial-number tag. Be sure to note the board number of the assembly being repaired or replaced when ordering parts for your instrument.

How to Order

To order a part in the Replaceable Parts List, call or write the nearest Hewlett-Packard Sales Office. Have the following information ready to speed the ordering process:

1. The Hewlett-Packard part number with the check digit (CD). (The check digit will ensure accurate and timely processing of your order.)
2. The quantity required.
3. An approved purchase order number. (Sometimes required.)

NOTE

Within the USA, it is better to order directly from the HP Parts Center in Mountain View California. Ask your nearest HP office for information and forms for the "Direct Order System".

Replaceable Parts List Updating (Manual Updates)

A "MANUAL UPDATES" packet is shipped with the manual, when necessary, to provide the most current information available at the time of shipment. These packets consist of replacement and addition pages which should be incorporated into the manual to bring it up to date.

Hewlett-Packard offers a Documentation Update Service that will provide you with further updates as they become available. If you operate or service instruments of different serial prefixes, we strongly recommend that you join this service immediately to ensure that your manual is kept current. For more information, refer to the Documentation Update Service reply card included in this manal, or call: Technical Writing Department (509) 922-4001,

or write:

Hewlett-Packard Company
Technical Writing Department
24001 E. Mission - TAF C-34
Spokane, WA 99220

6-4. CHASSIS PART LOCATIONS AND REFERENCE DESIGNATIONS

Front and rear panel chassis parts are identified in Figures 6-1 and 6-2. These figures are located at the end of this section. Mechanical parts have reference designations that begin with the letters MP and they are listed at the end of Table 6-3.

6-5. RECOMMENDED SPARES LIST

Stocking spare parts for an instrument is often done to ensure quick return to service after a malfunction occurs. Hewlett-Packard has prepared a "Recommended Spares" list for this instrument. The contents of the list are based on failure reports and repair data. Quantities given are for one year of parts support. You can request a complimentary copy of the "Recommended Spares" list from your nearest Hewlett-Packard office.

When stocking parts to support more than one instrument or to support a variety of Hewlett-Packard instruments, it may be more economical to work from one consolidated list rather than simply adding together stocking quantities from the individual instrument lists. Hewlett-Packard will prepare consolidated "Recommended Spares" lists for any number or combination of instruments. Contact your nearest Hewlett-Packard office for details.

Table 6–1. Reference Designations

REFERENCE DESIGNATIONS

A ..... assembly
AT ..... attenuator; isolator; termination
B ..... fan; motor
BT ..... battery
C ..... capacitor
CP ..... coupler
CR ..... diode; diode thyristor; varactor
DC ..... directional coupler
DL ..... delay line
DS ..... annunciator; signaling device (audible or visual); lamp; LED
E ..... miscellaneous electrical part
F ..... fuse
FL ..... filter
H ..... hardware
HY ..... circulator
J ..... electrical connector (stationary portion); jack
K ..... relay
L ..... coil; inductor
M ..... meter
MP ..... miscellaneous mechanical part
P ..... electrical connector (movable portion); plug
Q ..... transistor; SCR; triode thyristor; FET
R ..... resistor
RT ..... thermistor
S ..... switch
T ..... transformer
TB ..... terminal board
TC ..... thermocouple
TP ..... test point
U ..... integrated circuit; microcircuit
V ..... electron tube
VR ..... voltage regulator; breakdown diode
W ..... cable; transmission path; wire
X ..... socket
Y ..... crystal unit (piezo-electric or quartz)
Z ..... tuned cavity; tuned circuit

Table 6–2. Abbreviations (1 of 2)

ABBREVIATIONS

A ..... ampere
ac ..... alternating current
ACCESS ..... accessory
ADJ ..... adjustment
A/D ..... analog-to-digital
AF ..... audio frequency
AFC ..... automatic frequency control
AGC ..... automatic gain control
AL ..... aluminum
ALC ..... automatic level control
AM .... amplitude modulation
AMPL ..... amplifier
APC ..... automatic phase control
ASSY ..... assembly
AUX ..... auxiliary
avg ..... average
AWG ..... American wire gauge
BAL ..... balance
BCD ..... binary coded decimal
BD ..... board
BECU ..... beryllium copper
BFO ..... beat frequency oscillator
BH ..... binder head
BKDN ..... breakdown
BP ..... bandpass
BPF ..... bandpass filter
BRS ..... brass
BWO ..... backware-wave oscillator
CAL ..... calibrate
ccw ..... counter-clockwise
CER ..... ceramic
CHAN ..... channel
cm ..... centimeter
CMO ..... cabinet mount only
COAX ..... coaxial
COEF ..... coefficient
COM ..... common
COMP ..... composition
COMPL ..... complete
CONN ..... connector
CP ..... cadmium plate
CRT ..... cathode-ray tube
CTL ..... complementary transistor logic
CW ..... continuous wave
cw ..... clockwise
cm ..... centimeter
D/A ..... digital-to-analog
dB ..... decibel
dBm ..... decibel referred to 1 mW
dc ..... direct current
deg ..... degree (temperature interval or difference)
...° ..... degree (plane angle)
°C ..... degree Celsius (centigrade)
°F ..... degree Fahrenheit
°K ..... degree Kelvin
DEPC ..... deposited carbon
DET ..... detector
diam ..... diameter
DIA ..... diameter (used in parts list)
DIFF AMPL ..... differential amplifier
div ..... division
DPDT ..... double-pole, double-throw
DR ..... drive
DSB ..... double sideband
DTL ..... diode transistor logic
DVM ..... digital voltmeter
ECL ..... emitter coupled logic
EMF ..... electromotive force
EDP ..... electronic data processing
ELECT ..... electrolytic
ENCAP ..... encapsulated
EXT ..... external
F ..... farad
FET .... field-effect transistor
F/F ..... flip-flop
FH ..... flat head
FIL H ..... fillister head
FM .... frequency modulation
FP ..... front panel
FREQ ..... frequency
FXD ..... fixed
g ..... gram
GE ..... germanium
GHz ..... gigahertz
GL ..... glass
GRD ..... ground(ed)
H ..... henry
h ..... hour
HET ..... heterodyne
HEX ..... hexagonal
HD ..... head
HDW ..... hardware
HF ..... high frequency
HG ..... mercury
HI ..... high
HP ..... Hewlett-Packard
HPF ..... high pass filter
HR ..... hour (used in parts list)
HV ..... high voltage
Hz ..... Hertz
IC ..... integrated circuit
ID ..... inside diameter
IF ..... intermediate frequency
IMPG ..... impregnated
in ..... incandescent
INCL ..... include(s)
INP ..... input
INS ..... insulation
INT ..... internal
kg ..... kilogram
kHz ..... kilohertz
k ..... kilohm
kV ..... kilovolt
lb ..... pound
LC ..... inductance-capacitance
LED ..... light-emitting diode
LF ..... low frequency
LG ..... long
LH ..... left hand
LIM ..... limit
LIN ..... linear taper (used in parts list)
LK WASH ..... lock washer
LO ..... low; local oscillator
LOG ..... logarithmic taper (used in parts list)
log ..... logarithm(ic)
LPF ..... low pass filter
LV ..... low voltage
m ..... meter (distance)
mA ..... milliampere
MAX ..... maximum
M ..... megohm
MEG ..... meg (10^6) (used in parts list)
MET FLM ..... metal film
MET OX ..... metallic oxide
MF ..... medium frequency; microfarad (used in parts list)
MFR ..... manufacturer
mg ..... milligram
MHz ..... megahertz
mH ..... millihenry
mho ..... mho
min ..... minute (time)
...' ..... minute (plane angle)
MINAT ..... miniature
mm ..... millimeter

NOTE

All abbreviations in the parts list will be in upper-case.

Table 6–2. *Abbreviations (2 of 2)*

MOD .... modulator
MOM ..... momentary
MOS ..... metal-oxide semiconductor
ms ..... millisecond
MTG ..... mounting
MTR ..... meter (indicating device)
mV ..... millivolt
mVac ..... millivolt, ac
mVdc ..... millivolt, dc
mVpk ..... millivolt, peak
mVp-p ..... millivolt, peak-to-peak
mVrms ..... millivolt, rms
mW ..... milliwatt
MUX ..... multiplex
MY ..... mylar
μA ..... microampere
μF ..... microfarad
μH ..... microhenry
μmho ..... micromho
μs ..... microsecond
μV ..... microvolt
μVac ..... microvolt, ac
μVdc ..... microvolt, dc
μVpk ..... microvolt, peak
μVp-p ..... microvolt, peak-to-peak
μVrms ..... microvolt, rms
μW ..... microwatt
nA ..... nanoampere
NC ..... no connection
N/C ..... normally closed
NE ..... neon
NEG ..... negative
nF ..... nanofarad
NI PL ..... nickel plate
N/O ..... normally open
NOM ..... nominal
NORM ..... normal
NPN ..... negative-positive-negative
NPO ..... negative-positive zero (zero temperature coefficient)
NRFR ..... not recommended for field replacement
NSR ..... not separately replaceable
ns ..... nanosecond
nW ..... nanowatt
OBD .... order by description
OD ..... outside diameter
OH ..... oval head
OP AMPL ..... operational amplifier
OPT ..... option
OSC ..... oscillator
OX ..... oxide
oz ..... ounce
Ω ..... ohm
P ..... peak (used in parts list)
PAM ..... pulse-amplitude modulation
PC ..... printed circuit
PCM .... pulse-code modulation; pulse-count modulation
PDM ..... pulse-duration modulation
pF ..... picofarad
PH BRZ .... phosphor bronze
PHL ..... Phillips
PIN ..... positive-intrinsic-negative
PIV ..... peak inverse voltage
pk ..... peak
PL ..... phase lock
PLO .... phase lock oscillator
PM ..... phase modulation
PNP ..... positive-negative-positive
P/O ..... part of
POLY ..... polystyrene
PORC ..... porcelain
POS ..... positive; position(s) (used in parts list)
POSN ..... position
POT ..... potentiometer
p-p ..... peak-to-peak
PP ..... peak-to-peak (used in parts list)
PPM ..... pulse-position modulation
PREAMPL ..... preamplifier
PRF ..... pulse-repetition frequency
PRR .... pulse repetition rate
ps ..... picosecond
PT ..... point
PTM ..... pulse-time modulation
PWM ..... pulse-width modulation
PWV ..... peak working voltage
RC ..... resistance-capacitance
RECT ..... rectifier
REF ..... reference
REG ..... regulated
REPL ..... replaceable
RF ..... radio frequency
RFI ..... radio frequency interference
RH ... round head; right hand
RLC ..... resistance-inductance-capacitance
RMO ..... rack mount only
rms ..... root-mean-square
RND ..... round
ROM ..... read-only memory
R&P ..... rack and panel
RWV ..... reverse working voltage
S ..... scattering parameter
s ..... second (time)
..." ..... second (plane angle)
S-B ..... slow-blow (fuse) (used in parts list)
SCR ..... silicon controlled rectifier; screw
SE ..... selenium
SECT ..... sections
SEMICON .... semiconductor
SHF .... superhigh frequency
SI ..... silicon
SIL ..... silver
SL ..... slide
SNR .... signal-to-noise ratio
SPDT ..... single-pole, double-throw
SPG ..... spring
SR ..... split ring
SPST ..... single-pole, single-throw
SS ..... Service Sheet
SSB ..... single sideband
SST ..... stainless steel
STL ..... steel
SQ ..... square
SWR .... standing-wave ratio
SYNC ..... synchronize
T ..... timed (slow-blow fuse)
TA ..... tantalum
TC ..... temperature compensating
TD ..... time delay
TERM ..... terminal
TFT ..... thin-film transistor
TGL ..... toggle
THD ..... thread
THRU ..... through
TI ..... titanium
TOL ..... tolerance
TRIM ..... trimmer
TSTR ..... transistor
TTL ..... transistor-transistor logic
TV ..... television
TVI .... television interference
TWT ..... traveling wave tube
U ..... micro (10^{-6}) (used in parts list)
UF ..... microfarad (used in parts list)
UHF ..... ultrahigh frequency
UNDEF ..... undefined
UNREG ..... unregulated
V ..... volt
VA ..... voltampere
Vac ..... volts, ac
VAR ..... variable
VCO ..... voltage-controlled oscillator
Vdc ..... volts, dc
VDCW ..... volts, dc, working (used in parts list)
V(F) ..... volts, filtered
VFO ..... variable-frequency oscillator
VHF ..... very-high frequency
Vpk ..... volts, peak
Vp-p ..... volts, peak-to-peak
Vrms ..... volts, rms
VSWR ..... voltage standing wave ratio
VTO ..... voltage-tune oscillator
VTVM ..... vacuum-tube voltmeter
V(X) ..... volts, switched
W ..... watt
W/ ..... with
WIV ..... working inverse voltage
WW ..... wirewound
W/O ..... without
YIG ..... yttrium-iron-garnet
Z_o ..... characteristic impedance

NOTE

All abbreviations in the parts list will be in upper-case.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1						
A1	08660-60412	4	1	DIGITAL CONTROL UNIT (DCU) ASSEMBLY	28480	08660-60412
A1J1	08660-60415	7	1	CABLE ASSEMBLY (0/9) A1A2J3 TO A1S1	28480	08660-60415
A1MP1	08660-00011	3	1	DCU TOP COVER	28480	08660-00011
A1MP2	08660-80012	0	1	DCU BOTTOM COVER	28480	08660-60012
A1MP3	08660-20391	4	1	DCU CASTING	28480	08660-20391
A1MP4	08660-00121	8	1	FRONT PANEL	28480	08660-00121
A1MP5	08660-00122	7	1	FRONT SUB-PANEL	28480	08660-00122
A1MP6	08860-00123	8	1	RFI GASKET	28480	08660-00123
A1MP7	08860-40109	4	1	KEY PAD, FLUBBER	28480	08880-40109
A1MP8	08660-20392	5	1	WINDOW	28480	08860-20392
A1MP9	0370-1303	3	1	KNOB, RPG (ROUND)	28480	08660-00121
A1MP10	2200-0101	0	7	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A1MP11	2200-0107	6	2	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A1MP12	5041-0944	4	1	KEYCAP, POWER	28480	5041-0944
A1MP13	1252-1982	5	1	INTERCONNECT, ELASTOMERIC	28480	1252-1982
A1MP14	0590-1251	6	1	NUT-SPCLY 15/32-32-THD .1-IN-THK .582-WD	00000	0590-1251
A1MP15				NOT ASSIGNED		
A1MP16	08880-00039	5	1	INSULATOR	28480	08660-00039
A1MP17	1258-0216	0	1	MULTI-B-JUMP	28480	1258-0216
A1MP18	2190-0022	1	1	WASHER-LK INTL T 3/8 IN .384-IN-ID	00000	ORDER BY DESCRIPTION
A1MP19	2200-0103	2	4	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	2200-0103
A1MP20	2360-0122	3	2	SCREW-MACH 6-32 .5-IN-LG 82-DEG	00000	ORDER BY DESCRIPTION
A1MP21	2360-0190	5	4	SCREW-MACH 8-32 .188-IN-LG 100-DEG	00000	ORDER BY DESCRIPTION
A1MP22	2950-0043	8	1	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
A1S1	3101-2720	4	1	SWITCH-PB SPST-NO ALTNG .125A 115 VAC (ON/STBY SWITCH)	28480	3101-2720
A1W1	08880-60411	3	1	CABLE ASSEMBLY (0) A1A6J10 TO A1W1J1	28480	08680-60411
A1W2	08660-80413	5	1	CABLE ASSEMBLY) A1A6J9 TO A3A1J4	28480	08660-80413

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1A1						
A1A1	08660-60398	5	1	DISPLAY ASSEMBLY	28480	08660-60398
A1A1C1	0180-0491	5	2	CAPACITOR-FXD 10UF +-20% 25VDC TA	28480	0180-0491
A1A1C2	0180-0491	5	2	CAPACITOR-FXD 10UF +-20% 25VDC TA	28480	0180-0491
A1A1DS1	1990-0759	6	1	LED-LIGHT BAR MODULE LUM-INT-3MCD	28480	HLMP-2629
A1A1DS2	1990-0700	7	5	LED-LIGHT BAR MODULE LUM-INT=11MCD	28480	HLMP-2490
A1A1DS3	1990-0700	7		LED-LIGHT BAR MODULE LUM-INT=11MCD	28480	HLMP-2490
A1A1DS4	1990-0700	7		LED-LIGHT BAR MODULE LUM-INT=11MCD	28480	HLMP-2490
A1A1DS5	1990-0700	7		LED-LIGHT BAR MODULE LUM-INT=11MCD	28480	HLMP-2490
A1A1DS6	1990-0700	7		LED-LIGHT BAR MODULE LUM-INT=11MCD	28480	HLMP-2490
A1A1J1	1251-8667	5	1	CONN-POST TYPE .100-PIN-SPCG 20 CONT	28480	1251-8667
A1A1J2	1251-8494	8	1	CONN-POST TYPE .100-PIN-SPCG 24-CONT	28480	1251-8494
A1A1R1	1810-0557	2	1	NETWORK-RES 16-DIP22.0 OHM X 8	01121	316B220
A1A1R2	0698-7248	1	3	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	CT3-1/8-TO-3181-F
A1A1R3	0698-7248	1	3	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	CT3-1/8-TO-3161-F
A1A1R4	0698-7248	1	3	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	CT3-1/8-TO-3161-F
A1A1R5	0698-7213	0	3	RESISTOR 110 1% .05W FTC=0+-100	24546	CT3-1/8-TO-111-F
A1A1R6	0698-7213	0	3	RESISTOR 110 1% .05W FTC=0+-100	24546	CT3-1/8-TO-111-F
A1A1R7	0698-7213	0	3	RESISTOR 110 1% .05W FTC=0+-100	24546	CT3-1/8-TO-111-F
A1A1U1	1990-1116	1	5	DISPLAY-NUM-SEG .015-CHAR .3-H RED	28480	HDSP-7513
A1A1U2	1990-1116	1	5	DISPLAY-NUM-SEG .015-CHAR .3-H RED	28480	HDSP-7513
A1A1U3	1990-1116	1	5	DISPLAY-NUM-SEG .015-CHAR .3-H RED	28480	HDSP-7513
A1A1U4	1990-1116	1	5	DISPLAY-NUM-SEG .015-CHAR .3-H RED	28480	HDSP-7513
A1A1U5	1990-1116	1	5	DISPLAY-NUM-SEG .015-CHAR .3-H RED	28480	HDSP-7513
A1A1U6	1990-1116	1	5	DISPLAY-NUM-SEG .015-CHAR .3-H RED	28480	HDSP-7513
A1A1U7	1990-1116	1	5	DISPLAY-NUM-SEG .015-CHAR .3-H RED	28480	HDSP-7513
A1A1U8	1990-1116	1	5	DISPLAY-NUM-SEG .015-CHAR .3-H RED	28480	HDSP-7513
A1A1U9	1990-1116	1	5	DISPLAY-NUM-SEG .015-CHAR .3-H RED	28480	HDSP-7513
A1A1U10	1990-1116	1	5	DISPLAY-NUM-SEG .015-CHAR .3-H RED	28480	HDSP-7513
A1A1U11	1858-0010	2		TRANSISTOR ARRAY 14-PIN PLSTC DIP	04713	MPQ2906
A1A1U12	1858-0010	2		TRANSISTOR ARRAY 14-PIN PLSTC DIP	04713	MPQ2906
A1A1U13	1858-0010	2		TRANSISTOR ARRAY 14-PIN PLSTC DIP	04713	MPQ2906
A1A1U14	1858-0010	2		TRANSISTOR ARRAY 14-PIN PLSTC DIP	04713	MPQ2906
A1A1U15	1858-0010	2		TRANSISTOR ARRAY 14-PIN PLSTC DIP	04713	MPQ2906
A1A1U16	1858-0010	2		TRANSISTOR ARRAY 14-PIN PLSTC DIP	04713	MPQ2906
				A1A1 MISCELLANEOUS		
A1A1MP1	1200-1350	2	20	SOCKET-STRIP 5-CONT DIP-SLDR (FOR U1-10)	28480	1200-1350
A1A1MP2	1200-0507	9	1	SOCKET IC 16-CONT DIP-SLDR (FOR DS1)	28480	1200-0507
A1A1MP3	1200-0927	7	5	SOCKET STRP 8-CONT DIP-SLDR (UNDER DS2-6)	28480	1200-0927

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1A2						
A1A2	08660-60399	6	1	KEYBOARD ASSEMBLY	28480	08660-60399
A1A2DS1	1990-1184	3	11	LED-YELLOW	28480	1990-1184
A1A2DS2	1990-1184	3		LED-YELLOW	28480	1990-1184
A1A2DS3	1990-1184	3		LED-YELLOW	28460	1990-1184
A1A2DS4	1990-1184	3		LED-YELLOW	28480	1990-1184
A1A2DS5	1990-1184	3		LED-YELLOW	28480	1990-1184
A1A2DS6	1990-1184	3		LED-YELLOW	28480	1990-1184
A1A2DS7	1990-1184	3		LED-YELLOW	28480	1990-1184
A1A2DS8	1990-1184	3		LED-YELLOW	28480	1990-1184
A1A2DS9	1990-1184	3		LED-YELLOW	28480	1990-1184
A1A2DS10	1990-1184	3		LED-YELLOW	28480	1990-1184
A1A2DS11	1990-1184	3		LED-YELLOW	28480	1990-1184
A1A2J1				NOT ASSIGNED		
A1A2J2	1251-8821	3	1	CONN-POST TYPE .100-PIN-SPCG 5-CONT	28480	1251-8821
A1A2J3	1251-8948	5	1	CONN-POST TYPE 2.50-PIN-SPCG 2-CONT	28480	1251-8948

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1A3						
A1A3	08660-60400	0	1	MICROPROCESSOR ASSEMBLY	28480	08660-60400
A1A3C1	0160-4791	4	1	CAPACITOR-FXD 10PF +-5% 100VDC CER 0+-30	28480	0160-4791
A1A3C2	0160-4832	4	18	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C3	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C4	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C5	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C6	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C7	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C8	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C9	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28460	0160-4832
A1A3C10	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C11	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C12	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C13	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C14	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C15	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C16	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C17	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C18	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C19	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A3C20	0180-0491	5		CAPACITOR-FXD 10UF +-20% 25VDC TA	28480	0160-0491
A1A3C21	0180-0376	5	2	CAPACITOR-FXD .47UF +-10% 35VDC TA	58289	150D474X9035 A2
A1A3C22	0180-0378	5		CAPACITOR-FXD .47UF +-10% 35VDC TA	58289	150D474X9035 A2
A1A3C23	0180-2618	2	1	CAPACITOR-FXD 33UF +-10% 10VDC TA	25088	D33GS181OK
A1A3C24	0180-0491	5		CAPACITOR-FXD 10UF +-20% 25VDC TA	28480	0180-0491
A1A3C25	0180-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0180-4801
A1A3J1	1251-7307	8	2	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-7307
A1A3J2	1251-7307	8		CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-7307
A1A3J3	1251-4927	2	2	CONNECTOR 18-PIN M POST TYPE	28480	1251-4927
A1A3J4	1251-4927	2		CONNECTOR 16-PIN M POST TYPE	28480	1251-4927
	1251-5595	2		POLARIZING KEY-POST CONN	28480	1251-5595
A1A3J5	1251-5380	3	2	CONNECTOR 2-PIN M POST TYPE	28480	1251-5380
A1A3Q1	1854-0210	8	1	TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A1A3R1	1810-0275	1	1	NETWORK-RES 10-SIP 1.0K OHM X 9	28480	1810-0275
A1A3R2	1810-0503	8	1	NETWORK-RES 18 DIP 3.3K OHM X 8	28480	1810-0503
A1A3R3	1810-0283	1	2	NETWORK-RES 16-DIP 270.O OHM X 8	28480	1810-0283
A1A3R4	1810-0283	1		NETWORK-RES 16-DIP 270.O OHM X 8	28480	1810-0283
A1A3R5	0698-7244	7	2	RESISTOR 2.15K 1% .O5W F TC=0+-100	24548	CT3-1/8-TO-2151-F
A1A3R6	0698-7260	7	5	RESISTOR 10K 1% .05W F TC=0+-100	24546	CT3-1/8-TO-1002-F
A1A3R7	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24548	CT3-1/8-TO-1002-F
A1A3R8	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24548	CT3-1/8-TO-1002-F
A1A3R9	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	CT3-1/8-TO-1002-F
A1A3R10	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24548	CT3-1/8-TO-1002-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1A3R11	0698-7247	0	1	RESISTOR 2.87K 1% .05W F TC=0+-100	24546	CT3-1/8-TO-2871-F
A1A3R12	0698-7227	6	1	RESISTOR 422 1% .05W F TC=0+-100	24546	CT3-1/8-TO-422R-F
A1A3R13	0698-7248	1	1	RESISTOR 3.18K 1% .05W F TC=0+-100	24546	CT3-1/8-TO-3161-F
A1A3R14	0698-7244	7		RESISTOR 2.15K 1% .O5W F TC=0+-100	24546	CT3-1/8-TO-2151-F
A1A3TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A3TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A3TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28460	1251-0600
A1A3TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A3U1	1820-2369	9	1	IC OSC TTL LS DUAL	01295	SN74LS629N
A1A3U2	1820-3929	9	1	IC-8BIT MPU WITH CLOCK AND OPTIONAL RAM	04713	MC68B02P
A1A3U3	1820-3239	4	1	IC DRVR TTL ALS BUS OCTL	01295	SN71491N
A1A3U4	06660-80043	9	1	EPROM #1	28480	08660-80043
A1A3U5	1818-3814	6	1	IC CMOS 16384 (16K) STAT RAM 150-NS 3-S	S4013	HM6116ALP-15
A1A3U6	1820-3100	8	1	IC DCDR TTL ALS BIN 3-TO-8-LINE 3 INP	01295	SN74ALS138N
A1A3U7	1820-3934	8	1	IC XLTR CMOS TTL-TO-MOS QUAD	3L585	CD40109BH CHIP
A1A3U8	1820-2983	3	1	IC PERIPHERAL INTERFACE ADAPTER; CLK=2MHZ	04713	MC88B21P
A1A3U9	1820-3376	0	1	IC INV TTL ALS HEX	01295	SN71741N
A1A3U10	1820-2856	7	1	IC GATE TTL ALS NAND QUAD 2-INP	01295	SN71338N
A1A3U11	1820-2635	2	1	IC GATE TTL ALS AND QUAD 2-INP	01295	SN74ALS08N
A1A3U12	1820-2488	3	2	IC FF ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74N
A1A3U13	1820-1423	4	2	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A1A3U14	1820-1423	4		IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A1A3U15	1820-2488	3		IC FF ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74N
A1A3U18	1820-2150	8	1	IC MICPROC-ACCESS NMOS	34649	D8279-5
A1A3U17	1820-2053	8	1	IC DCDR TTL LS BCD 4-TO-16-LINE	18324	74LS154N
A1A3U18	1820-1427	8	1	IC DCDR TTL LS 2-TO-4-LINE DUAL 2 INP	01295	SN74LS156N
A1A3VR1	1902-0947	9	1	DIODE-ZNR 3.8V 5% DO-35 PD=.4W TC=-.036%	28480	1902-0947
A1A3W1	1258-0209	9	1	JUMPER-REMOVABLE 2 POSITION; .200 IN	28480	1258-0209
A1A3Y1	0410-0779	1	1	CRYSTAL-QUARTZ 8 MHZ HC-18/U HLDR	28480	0410-0779
				A1A3 MISCELLANEOUS		
A1A3MP1	1400-0973	7	1	CLIP CMPNT .139-.145-DIA STL (FOR Y1)	91508	6180-1A
A1A3MP2	1200-0553	5	1	SOCKET-IC 28-CONT DIP-SLDR (FOR U4)	28480	1200-0553
A1A3MP1	1200-0654	7	1	SOCKET-IC 40-CONT DIP DIP-SLDR (FOR U2)	28480	1200-0654

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1A4						
A1A4	08660-60402	2	1	SWEEP COUNT ASSEMBLY	28480	08660-60402
A1A4C1	0180-0197	8	2	CAPACITOR-FXD 2.2UF +-10% 20VDC TO	56289	150D225X9020A2
A1A4C2	0180-0197	8		CAPACITOR-FXD 2.2UF +-10% 20VDC TO	56289	150D225X9020A2
A1A4C3	0180-0218	4	1	CAPACITOR-FXD .15UF +-10% 35VDC TA	56289	150D154X9035A2
A1A4J1	1251-7307	8	1	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-7307
A1A4Q1	1854-0071	7	1	TRANSISTOR NPN 2N3054 SI TO-66 PD=25W	04173	2N3054
A1A4R1	0698-3154	0	6	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4221-F
A1A4R2	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4221-F
A1A4R3				NOT ASSIGNED		
A1A4R4	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4221-F
A1A4R5	0757-0485	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1003-F
A1A4R6	0757-0472	5	1	RESISTOR 200K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-2003-F
A1A4R7	0698-6248	9	3	RESISTOR 400K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4003-F
A1A4R8	0698-6248	9		RESISTOR 400K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4003-F
A1A4R9	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-3481-F
A1A4R10	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-2151-F
A1A4R11	2100-3123	0	1	RESISTOR-TRMR 500 10% C SIDE ADJ 17-TRN	32997	3008P-1-5O1
A1A4R12	0698-6248	9		RESISTOR 400K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4003-F
A1A4R13	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-TO-751-F
A1A4R14	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1211-F
A1A4R15	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1002-F
A1A4R16	0757-0449	6	1	RESISTOR 20K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-2002-F
A1A4R17	0698-4008	5	1	RESISTOR 40K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4002-F
A1A4R18	0698-3201	8	1	RESISTOR 80K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-8002-F
A1A4R19	0757-0280	3	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1001-F
A1A4R20	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4221-F
A1A4R21	0757-0422	5	1	RESISTOR 909 1% .125W F TC=0+-100	24546	CT4-1/8-TO-909R-F
A1A4R22	0757-0283	6	1	RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-2001-F
A1A4R23	0698-5808	5	1	RESISTOR 4K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4001-F
A1A4R24	0698-3200	7	1	RESISTOR 8K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-8001-F
A1A4R25	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-TO-751-F
A1A4R28	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4221-F
A1A4R27	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-4221-F
A1A4R28	2100-3122	9	3	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	32997	3006-P-1-101
A1A4R29	2100-3122	9		RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	32997	3006-P-1-101
A1A4R30	2100-3122	9		RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	32997	3006-P-1-101
A1A4R31	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1001-F
A1A4R32	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1001-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1A4U1	1828-0271	0	1	IC OP AMP GP 8-DIP-P PKG	01295	SN72741P
A1A4U2	1820-1438	1	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS257AN
A1A4U3	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A1A4U4	1820-1207	2	1	IC GATE TTL LS NAND 8-INP	01295	SN74LS30N
A1A4U5	1820-1277	6	3	IC COUNTER TTL LS DECD UP/DOWN SYNCHRO	01295	SN74LS192N
A1A4U6	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A1A4U7	1820-0577	7	3	IC INV TTL HEX 1-INP	01295	SN7416N
A1A4U8	1820-1277	6		IC COUNTER TTL LS DECD UP/DOWN SYNCHRO	01295	SN74LS192N
A1A4U9	1820-1144	6	2	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A1A4U10	1820-1277	6		IC COUNTER TTL LS DECD UP/DOWN SYNCHRO	01295	SN74LS192N
A1A4U11	1820-0577	7		IC INV TTL HEX 1-INP	01295	SN7416N
A1A4U12	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A1A4U13	1820-0577	7		IC INV TTL HEX 1-INP	01295	SN7416N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1A5						
A1A5	08660-60401	1	1	INTERFACE ASSEMBLY	28480	08660-60401
A1A5C1	0160-4832	4	19	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C2	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C3	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C4	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C5	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C6	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C7	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C8	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C9	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C10	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C11	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C12	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C13	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C14	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C15	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C16	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C17	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C18	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C19	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A1A5C20	0180-0491	5	2	CAPACITOR-FXD 10UF +-20% 25VDC TA	28480	0180-0491
A1A5C21	0180-0491	5		CAPACITOR-FXD 10UF +-20% 25VDC TA	28480	0180-0491
A1A5C22	0160-2618	2	1	CAPACITOR-FXD 33UF +-10% 10VDC TA	25088	DG33GS1B10K
A1A5J1	1251-7307	6	1	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-7307
A1A5J2	1251-7307	8	1	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-7307
A1A5J3	1251-4927	2	1	CONNECTOR 16-PIN M POST TYPE	28480	1251-4927
A1A5J4	1251-4927	2	1	CONNECTOR 16-PIN M POST TYPE	28480	1251-4927
A1A5R1	1810-0275	1	1	NETWORK-RES 10-SIP 1.0K OHM X 9	28480	1810-0275
A1A5R2	0698-7253	8	1	RESISTOR 5.11K 1% .05W F TC=0+-100	24546	CT3-1/8-TO-5111-F
A1A5R3	0698-7272	1	1	RESISTOR 31.6K 1% .05W F TC=0+-100	24546	CT3-1/8-TO-3162-F
A1A5S1	3101-2126	4	1	SWITCH-SL 5SPDT DIP-SLIDE-ASSY .1A	28480	3101-2126
A1A5TP1	1251-0600	0	3	CONNECTOR-SGL CONAT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A5TP2	1251-0600	0		CONNECTOR-SGL CONAT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A5TP3	1251-0600	0		CONNECTOR-SGL CONAT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A5U1	1820-3513	7	1	IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	27014	DS75161AN
A1A5U2	1820-3431	8	1	IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	27014	DS75160AN
A1A5U3	1820-2657	8	1	IC GATE TTL ALS OR QUAD 2-INP	01295	SN74ALS32N
A1A5U4	1820-2551	1	1	IC-GENERAL PURPOSE INTERFACE BUS ADAPTER	01295	TMS9914AJDL
A1A5U5	1820-3239	4	1	IC DRVR TTL ALS BUS OCTL	01295	SN71491N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1A5U8	1820-2757	9	8	IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS57AN
A1A5U7	1820-2983	3	1	IC PERIPHERAL INTERFACE ADAPTER; CLK=2MHZ	04713	MC881321P
A1A5U8	1820-2488	3	1	IC FF ALS D-TYPE POS-EDGE-TRIG	01295	SN74ALS74N
A1A5U9	1820-3239	4	1	IC DRVR TTL ALS BUS OCTL	01295	SN71491N
A1A5U10	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS57AN
A1A5U11	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS57AN
A1A5U12	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS57AN
A1A5U13	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS57AN
A1A5U14	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS57AN
A1A5U15	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS57AN
A1A5U16	1820-2757	9		IC FF TTL ALS D-TYPE POS-EDGE-TRIG OCTL	01295	SN74ALS57AN
A1A5U17	1820-1423	4	1	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A1A5U18	1820-1991	1	3	IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS390N
A1A5U19	1820-1991	1		IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS390N
A1A5U20	1820-1991	1		IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS390N
A1A5U21	1820-3764	0	1	IC MUXR/DATA-SEL TTL AS 8-TO-1-LINE	01295	SN74ALS251N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1A6						
A1A6	08660-60405	5	1	DCU MOTHERBOARD ASSEMBLY (DOES NOT INCLUDE A1A6W1)	28480	08660-60405
A1A6J1	1251-8666	4	1	CONN-POST TYPE .100-PIN-SPCG 20-CONT	28480	1251-8666
A1A6J2	1251-8603	9	1	CONN-POST TYPE .100-PIN-SPCG 24-CONT	28480	1251-6603
A1A6J3	1251-7300	1	5	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-7300
A1A6J4	1251-7300	1		CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-7300
A1A6J5	1251-7300	1		CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-7300
A1A6J6	1251-7300	1		CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-7300
A1A6J7	1251-7300	1		CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-7300
A1A6J8				NOT ASSIGNED		
A1A6J9	1251-8929	2	1	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-8929
A1A6J10	1250-1255	1	1	CONNECTOR RF SMB MPC 5-OHM	28480	1250-1255
A1A6J11-J80				NOT ASSIGNED		
A1A6J81	1251-4549	4	1	CONNECTOR 7-PIN M POST TYPE	28480	1251-4549
A1A6J82	1251-4549	4	1	CONNECTOR 7-PIN M POST TYPE	28480	1251-4549
A1A6J83	1251-4549	4	1	CONNECTOR 7-PIN M POST TYPE	28480	1251-4549
A1A6J84	1251-4549	4	1	CONNECTOR 7-PIN M POST TYPE	28480	1251-4549
A1A6P1	1251-0600	0	1	CONNECTOR-SGL CONAT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A6P2	1251-0600	0	1	CONNECTOR-SGL CONAT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A6P3	1251-0600	0	1	CONNECTOR-SGL CONAT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A1A6W1	08660-60416	8	1	CABLE ASSEMBLY (0/9/92) A1A6P1-P3 TO A23J7	28480	08660-60416

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A2						
A2	08660-60020	0	1	BOARD ASSEMBLY, INTERCONNECTION	28480	08660-60020
A2C1	0160-4822	2	28	CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A2C2	0160-4622	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4822
A2C3	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4822
A2C4	0160-4622	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4822
A2C5	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A2C6	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4822
A2C7	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4822
A2C8	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A2C9	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A2C10	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A2C11	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A2C12	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A2C13	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4822
A2C14	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A2C15	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4822
A2C16	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4822
A2C17	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4622
A2C18	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4822
A2C19	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A2C20	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4822
A2C21	0160-4832	9		CAPACITOR-FXD .01UF 10% 100VDC CER	28460	0160-4832
A2C22	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28460	0180-4832
A2C23	0160-4832	9		CAPACITOR-FXD .01UF 10% 100VDC CER	28460	0180-4832
A2C24	0160-4832	9		CAPACITOR-FXD .01UF 10% 100VDC CER	28480	0160-4832
A2C25	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4622
A2C26	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A2C27	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4622
A2C28	0160-4832	4		CAPACITOR-FXD .01UF +60-20% 100VDC CER	28480	0160-4832
A2C29	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A2C30	0160-4832	4		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4832
A2C31	0160-4832	4		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-4832
A2C32	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28460	0160-4822
A2C33	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28460	0160-4822
A2C34	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28460	0160-4822
A2C35	0160-4822	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A2C38	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28460	0160-4822
A2C37	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-4822
A2C38	0160-4822	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28460	0160-4822
A2C39	0160-4622	2		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0180-4822
A2C40	0160-4622	2		CAPACITOR-FXD 1000PF +-5% 100VDC CER	28480	0160-4822
A2C41	0160-4832	4		CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A2C42	0160-4832	9		CAPACITOR-FXD .01UF 10% 100VDC CER	28480	0160-4832
A2C43	0180-4832	9		CAPACITOR-FXD .01UF 10% 100VDC CER	28480	0160-4832
A2C44	0180-4832	9		CAPACITOR-FXD .01UF 10% 100VDC CER	28480	0160-4832

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A2J1	1250-1255	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1255
A2J2	1250-1255	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1255
A2J3	1250-1255	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1255
A2J4	1250-1255	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1255
A2W2	08660-60080	2	1	CABLE ASSEMBLY, GRAY	28480	08660-60080
A2XA8-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA8-2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA9-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA10-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA10-2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA11-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA11-2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA12-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA12-2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA13-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA13-2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA14-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA14-2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA15-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA15-2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA16-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA16-2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA17-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA17-2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA18-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA18-2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA19-1	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2XA19-2	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A3A1						
A3A1	08660-60403	3	1	FRONT INTERFACE ASSEMBLY	28480	08660-60403
A3A1J1				NOT ASSIGNED		
A3A1J2				NOT ASSIGNED		
A3A1J3	0360-1638	4	1	CABLE TRANSITION 34-TERM INSUL DSPL TYPE	28480	0360-1638
A3A1J4	1251-8929	2	1	CONN-POST TYPE .100-PIN-SPCG 50-CONT	28480	1251-8929
A3A1R1	0698-7210	7	9	RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-T0-82R5-F
A3A1R2	0698-7210	7	9	RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-T0-82R5-F
A3A1R3	0698-7210	7	9	RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-T0-82R5-F
A3A1R4	0698-7210	7	9	RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-T0-82R5-F
A3A1R5	0698-7210	7	9	RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-T0-82R5-F
A3A1R6	0698-7210	7	9	RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-T0-82R5-F
A3A1R7	0698-7210	7	9	RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-T0-82R5-F
A3A1R8	0698-7210	7	9	RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-T0-82R5-F
A3A1R9	0698-7210	7	9	RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-T0-82R5-F
A3A2						
A3A2	08660-60404	4	1	REAR INTERFACE ASSEMBLY	28480	08660-60404
A3A2W1	08660-60410	2		RIBBON CABLE ASSEMBLY (FROM A3A1J3 TO A3A2J3)	28480	08660-60410
A3A3						
A3A3	08660-60025	5	1	BOARD ASSEMBLY, DIGITAL INTERCONNECT	28480	08660-60025
A3A3J1	1250-1255	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1255
A3A3J2	1250-1255	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-1255

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4						
A4	08660-60042	6	1	LOOP ASSEMBLY, H.F.	28480	08660-60042
A4C1	0160-2437	1	17	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C2	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C3	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C4	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C5	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C6	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C7	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C8	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C9	0160-3744	5	6	CAPACITOR-FDTHRU 1000PF +80 -20% 200V	28480	0160-3744
A4C10	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C11	0160-3744	5		CAPACITOR-FDTHRU 1000PF +80 -20% 200V	28480	0160-3744
A4C12	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C13	0160-3744	5		CAPACITOR-FDTHRU 1000PF +80 -20% 200V	28480	0160-3744
A4C14	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C15	0160-3744	5		CAPACITOR-FDTHRU 1000PF +80 -20% 200V	28480	0160-3744
A4C16	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C17	0160-3744	5		CAPACITOR-FDTHRU 1000PF +80 -20% 200V	28480	0160-3744
A4C18	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C19	0160-3744	5		CAPACITOR-FDTHRU 1000PF +80 -20% 200V	28480	0160-3744
A4C20	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C21	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C22	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4C23	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A4J1	1250-0901	2	13	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4J2	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4J3	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4J4	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4J5	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4J6	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4J7	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4J8	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4J9	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4J10	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4J11				NOT ASSIGNED		
A4J12	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4J13	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A4L1	9140-0144	0	3	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A4W1	08660-60080	2	1	CABLE ASSEMBLY, GRAY (A4J6 TO A4A3C6)	28480	08660-60080
A4W2	08660-60050	6	1	CABLE ASSEMBLY, GRAY (A4J6 TO A4J13)	28480	08660-60050
A4W3	08660-60063	1	1	CABLE ASSEMBLY, GRAY (A4J11 TO A4A7J1)	28480	08660-60063
A4W4	08660-60055	1	1	CABLE ASSEMBLY, GRAY A4J11 TO A4J10)	28480	08660-60055

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
				A4 MISCELLANEOUS		
A4MP1	08660-00014	6	1	COVER, REF. OSC.	28480	08660-00014
A4MP2	08660-00015	7	1	COVER, REF. DIVIDER	28480	08660-00015
A4MP3	08660-00016	8	1	COVER, REF. PHASE DETECTOR	28480	08660-00016
A4MP4	08660-00017	9	1	COVER, DIVIDE BY TWO	28480	08660-00017
A4MP5	08660-00018	0	1	COVER, PRETUNE	28480	08660-00018
A4MP6	08660-00019	1	1	COVER, VCO	28480	08660-00019
A4MP7	08660-00020	4	1	COVER, PHASE DETECTOR	28480	08660-00020
A4MP8	08660-20063	7	1	HOUSING, H.F. LP	28480	08660-20063
A4MP9	08660-20371	0	1	POLYIRON SHIELD	28480	08660-20371
A4MP10	0624-0077	5	44	SCREW-TPG 4-40 .312-IN-LG PAN-HD-POZI (ATTACH COVERS TO HOUSING)	00000	ORDER BY DESCRIPTION
A4MP11	0624-0099	2	2	SCREW-TPG 4-40 .375-IN-LG PAN-HD-POZI (ATTACH A4A8 TO HOUSING)	00000	ORDER BY DESCRIPTION
A4MP12	3030-0020	2	3	SCREW-SET 10-32 .25-IN-LG SMALL CUP-PT (ATTACHES TO HOUSING NEAR C16)	00000	ORDER BY DESCRIPTION
A4MP13	3050-0176	3	1	SCREW-TPG 4-40 .375-IN-LG PAN-HD-POZI (ATTACHES HOUSING INTO FRAME)	00000	ORDER BY DESCRIPTION

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A1						
A4A1	08660-80003	9	1	BOARD ASSEMBLY, REF. DIVIDER	28480	08660-80003
A4A1C1	0160-2201	7	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A4A1C2	0180-0118	1	7	CAPACITOR-FXD 8.8UF+-10% 35VDC TA	56289	150D685X9035B2
A4A1C3	0180-0229	7	5	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A4A1C4	0160-2199	2	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A4A1C5	0160-0154	5	2	CAPACITOR-FXD 2200PF +-10% 200VDC POLYE	28480	0160-0154
A4A1C6	0160-0154	5		CAPACITOR-FXD 2200PF +-10% 200VDC POLYE	28480	0160-0154
A4A1C7	0160-0297	7	1	CAPACITOR-FXD 1200PF +-10% 200VDC POLYE	28480	0180-0297
A4A1CR1	1902-0048	1	1	DIODE-ZNR 6.81V 5% DO-35 PD=.4W	28460	1902-0048
A4A1L1	9100-1842	1	2	INDUCTOR RF-CH-MLD 270UH 5% .2DX.45LG	28480	9100-1842
A4A1L2	9100-1842	1		INDUCTOR RF-CH-MLD 270UH 5% .2DX.45LG	28480	9100-1842
A4A1L3	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A4A1Q1	1854-0019	3	15	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A1Q2	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A1Q3	1854-0045	5	3	TRANSISTOR NPN SI TO-18 PD=500MW	28480	1854-0045
A4A1R1	0757-0444	1	11	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A4A1R2	0698-3622	7	1	RESISTOR 120 5% 2W MO TC=0+-200	28460	0698-3622
A4A1R3	0698-0083	8	23	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A4A1R4	0757-0280	3	28	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A1R5	0757-0394	0	22	RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A1R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A1R7	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A4A1R8	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-1001-F
A4A1R9	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A1R10	0757-0260	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A1R11	0696-3441	6		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A4A1R12	0698-3441	6		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A4A1R13	0698-3441	6		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A4A1R14	0757-0401	0	21	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A1U1	1820-0054	5	18	IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A4A1U2	1820-0055	6	2	IC CNTR TTL DECD SYNCHRO POS-EDGE-TRIG	01295	SN7490AN
A4A1U3	1820-0055	6		IC CNTR TTL DECD SYNCHRO POS-EDGE-TRIG	01295	SN7490AN

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A2						
A4A2	08660-60002	6	1	BOARD ASSEMBLY, REF. PHASE DETECTOR	28480	08660-60002
A4A2C1	0160-0100	3	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A4A2C2	0160-0118	1		CAPACITOR-FXD 8.8UF+-10% 35VDC TA	56289	150D685X9035B2
A4A2C3	0160-0226	6	10	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A4A2C4	0160-2055	9	79	CAPACITOR-FXD .01UF +60-20% 100VDC CER	28480	0160-2055
A4A2C5	0160-1746	5	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	58289	150D156X9020B2
A4A2C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C7	0160-2055	9		CAPACITOR-FXD .01UF +60-20% 100VDC CER	28480	0160-2055
A4A2C8	0160-2055	9		CAPACITOR-FXD .01UF +60-20% 100VDC CER	28480	0160-2055
A4A2C9	0160-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	58289	150D336X9010B2
A4A2C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C11*	0160-2201	7	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	28480	0160-2201
A4A2C12	0160-2308	5	1	CAPACITOR-FXD 36PF +-5% 300VDC MICA	28480	0160-2308
A4A2C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C15	0160-2055	9		CAPACITOR-FXD .01UF +60-20% 100VDC CER	28480	0160-2055
A4A2C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C20	0160-2204	0	8	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A4A2C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A2C22	0160-1743	2	1	CAPACITOR-FXD .1UF+-10% 35VDC TA	56289	150D104X9035A2
A4A2C23	0160-3537	4	2	CAPACITOR-FXD 680PF +-5% 100VDC MICA	28480	0160-3537
A4A2C24	0160-2205	1	3	CAPACITOR-FXD 120PF +-5% 300VDC MICA	28480	0160-2205
A4A2C25	0160-3064	2	2	CAPACITOR-FXD 1000PF +-5% 300VDC MICA	28480	0160-3064
A4A2C26	0160-2205	3	1	CAPACITOR-FXD .33UF+-10% 35VDC TA	58289	150D334X9035A2
A4A2C27	0160-2055	9		CAPACITOR-FXD .01UF +60-20% 100VDC CER	28480	0160-2055
A4A2CR1	1902-0041	4	7	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A4A2CR2	1901-0040	1	33	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A2CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4A2CR4	1901-0179	7	4	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A4A2CR5	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A4A2L1	9100-1629	4	19	INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A4A2L2	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1829
A4A2L3	9100-2260	1	2	INDUCTOR RF-CH-MLD 1.8UH 10% .105DX.26LG	28480	9100-2280
A4A2L4	9140-0129	1	2	INDUCTOR RF-CH-MLD 220UH 5% .168DX.385LG	28480	9140-0129
A4A2L5	9140-0237	2	1	INDUCTOR RF-CH-MLD 200UH 5% .166DX.385LG	28460	9140-0237
A4A2Q1	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=380MW	28480	1854-0019
A4A2Q2	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2Q3	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=380MW	28480	1854-0019
A4A2Q4	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2Q5	1853-0015	7	4	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A4A2Q6	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=380MW	28480	1854-0019
A4A2Q7	1853-0020	4	1	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4A2Q8	1854-0071	7	5	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4A2Q9	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4A2Q10	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A2Q11	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A2R1	0698-3440	7	15	RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-198R-F
A4A2R2	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24548	CT4-1/8-T0-215R-F
A4A2R3	0757-0442	9	59	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4A2R4	0757-0441	8	13	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A4A2R5	0757-0418	7	19	RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A4A2R6	0757-0280	3	28	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A2R7	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A2R8	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A4A2R9	0757-0438	3	5	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A4A2R10	0698-3156	2	4	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A4A2R11	0698-3628	3	1	RESISTOR 220 5% 2W MO TC=0+-200	28480	0698-3628
A4A2R12	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24548	CT4-1/8-T0-101-F
A4A2R13	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24548	CT4-1/8-TO-1981-F
A4A2R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A2R15	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A2R16	0698-0082	7	15	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A4A2R17	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A4A2R18	0698-0084	9	9	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A4A2R19	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A2R20	0698-3132	4	9	RESISTOR 261 1% .125W F TC=0+-100	24548	CT4-1/8-T0-2610-F
A4A2R21	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A4A2R22	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A4A2R23	0698-3438	3	9	RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A4A2R24	0757-0346	2	12	RESISTOR 10 1% .125W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A4A2R25	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A4A2R26	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A4A2R27	0757-0418	9	6	RESISTOR 619 1% .125W F TC=0+-100	24546	CT4-1/8-T0-619R-F
A4A2R28	0698-3158	4	2	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2372-F
A4A2R29	0698-3154	0	6	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A4A2R30	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A4A2R31	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4A2R32	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A4A2R33	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A4A2R34	0698-3453	2	1	RESISTOR 196K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1963-F
A4A2R35	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A4A2R36	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A4A2R37	0757-0290	5	3	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A4A2R38	0698-3444	1	10	RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A4A2R39	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A4A2R40	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A4A2R41	0757-0288	1	3	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A4A2R42*	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A2R43	0757-0420	3	3	RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A4A2R44	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A2R45	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+-100	24546	CT4-1/8-T0-681R-F
A4A2R46	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4A2R47	0698-3446	3	5	RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-T0-363R-F
A4A1R48	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A2T1	06660-60369	0	1	TRANSFORMER, RF, GREEN	28480	06660-60369
A4A2U1	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LSOON
A4A2Z1	9170-0029	3	1	CORE-SHIELDING BEAD	28480	9170-0029

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A3						
A4A3	08660-60004	0	1	BOARD ASSEMBLY, REF. DIVIDE BY TWO	28480	08660-60004
A4A3C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C2	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A4A3C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C4	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A4A3C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C11	0160-0978	1	1	CAPACITOR-FXD 1500PF +-1% 500VDC MICA	28480	0160-0978
A4A3C12	0160-2534	9	1	CAPACITOR-FXD 300PF +-1% 300VDC MICA	28480	0160-2534
A4A3C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C15	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A4A3C16	0140-0197	4	1	CAPACITOR-FXD 180PF +-5% 300VDC MICA	72136	DM15F181J0300WV1CR
A4A3C17	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A4A3C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A3C19	0140-0197	4	1	CAPACITOR-FXD 180PF +-5% 300VDC MICA	72136	DM15F181J0300WV1CR
A4A3CR1	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A4A3L1	9100-0346	2	2	INDUCTOR RF-CH-MLD 1UH 1% .166DX.365LG	28480	9100-0348
A4A3L2	9100-0348	2		INDUCTOR RF-CH-MLD 1UH 1% .186DX.385LG	28480	9100-0348
A4A3Q1	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q2	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q3	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q4	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A3Q5	1854-0345	8	6	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A3R1	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A3R2	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A4A3R3	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A4A3R4	0757-0614	9	1	RESISTOR 511 1% .5W F TC=0+-100	28480	0757-0814
A4A3R5	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A4A3R6	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A4A3R7	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A3R8	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A4A3R9	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A4A3R10	0698-3434	9	2	RESISTOR 34.8 1% .125W F TC=0+-100	24546	CT4-1/8-T0-34R8-F
A4A3R11	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A3R12	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A4A3R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4A3R14	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A3R15	0757-0421	4	10	RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A3R16	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R8-F
A4A3R17	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A3R18	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A4A3R19	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4A3R20	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A4A3R21	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	CT4-1/8-T0-619R-F
A4A3R22	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A3R23	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A4A3R24	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A4A3R25	0757-0397	3	5	RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
A4A3R26	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	CT4-1/8-T0-619R-F
A4A3U1	1820-0469	6	2	IC FF TTL H J-K NEG-EDGE-TRIG	01295	SN74H102N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A4						
A4A4	08660-60375	8	1	BOARD ASSEMBLY, REF. VCO	28480	08660-60375
A4A4C1	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A4A4C2	0121-0451	3	3	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0106-028
A4A4C3	0160-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A4A4C4	0160-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A4A4C5	0160-0214	8	1	CAPACITOR-FXD 10PF +-5% 500VDC CER	28480	0160-0214
A4A4C8	0160-2263	1	1	CAPACITOR-FXD 18PF +-5% 500VDC CER 0+-30	28480	0160-2263
A4A4C7	0160-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A4A4C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C10*	0160-2306	3	1	CAPACITOR-FXD 27PF +-5% 300VDC MICA	28480	0160-2306
A4A4C11	0140-0190	7	4	CAPACITOR-FXD 39PF +-5% 300VDC MICA	72136	DM15E390J0300WV1CR
A4A4C12	0160-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A4A4C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C17	0121-0048	2	1	CAPACITOR-V TRMR-CER 9-35PF 200V PC-MTG	52763	304322 9/35PF N850
A4A4C18	0160-3879	7	2	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4A4C19	0160-2327	6	3	CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-X5R-102M
A4A4C20	0140-0190	7		CAPACITOR-FXD 39PF +-5% 300VDC MICA	72136	DM15E390J0300WV1CR
A4A4C21	0140-0190	7		CAPACITOR-FXD 39PF +-5% 300VDC MICA	72136	DM15E390J0300WV1CR
A4A4C22	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C23	0121-0451	3		CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0106-028
A4A4C24	0160-2327	8		CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-X5R-102M
A4A4C25	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C26	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C27	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C28	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4A4C29	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C30	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C31	0121-0451	3		CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0106-026
A4A4C32	0160-2327	8		CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-X5R-102M
A4A4C33	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C34	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C35	0160-2284	2		CAPACITOR-FXD 20PF +-5% 500VDC CER	72136	DM15E390J0300WV1CR
A4A4C36	0160-2306	3	1	CAPACITOR-FXD 27PF +-5% 300VDC MICA	28480	0160-2306
A4A4C37	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C38	0160-2205	1		CAPACITOR-FXD 120PF +-5% 300VDC MICA	28480	0160-2205
A4A4C39	0160-2205	1		CAPACITOR-FXD 120PF +-5% 300VDC MICA	28480	0160-2205
A4A4C40	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A4C41	0121-0448	8	1	CAPACITOR-V TRMR-CER 2.5-5PF 63V PC-MTG	28480	0121-0448
A4A4CR1	0122-0267	5	1	DIODE-VVC 10PF 5% C2/C20-MIN=2 BVR=20V	28480	0122-0267
A4A4CR2	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A4E1	9170-0029	3	1	CORE-SHIELDING BEAD	28480	9170-0029
A4A4L1	9100-1623	8	1	INDUCTOR RF-CH-MLD 27UH 5% .166DX.385LG	28480	9100-1623
A4A4L2	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A4A4L3	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A4A4L4	08660-80002	0	1	INDUCTOR	28480	08660-80002
A4A4L5	08660-80009	7	3	INDUCTOR	28480	08860-80009
A4A4L6	9100-2247	4	3	INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A4A4L7	9100-2247	4		INDUCTOR RF-CH-MLD 100NH 10% .105DX.26LG	28480	9100-2247
A4A4L8				PART OF PRINTED CIRCUIT BOARD		
A4A4L9				PART OF PRINTED CIRCUIT BOARD		
A4A4L10	9140-0519	3		INDUCTOR RF-CH-MLD 220NH 5%	28480	9140-0519
A4A4L11	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	28480	9140-0158
A4A4L12*	9140-0524	3	2	INDUCTOR RF-CH-MLD 560NH 5%	28480	9140-0524
A4A4Q1	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A4Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A4Q3	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A4Q4	1854-0345	8	4	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A4Q5	1854-0540	5	8	TRANSISTOR NPN SI TO-72 PD=200MW FT=1GHZ	04713	MM8006
A4A4Q6	1854-0540	5		TRANSISTOR NPN SI TO-72 PD=200MW FT=1GHZ	04713	MM8006
A4A4Q7*	1854-0540	5		TRANSISTOR NPN SI TO-72 PD=200MW FT=1GHZ	04713	MM6006
A4A4Q8*	1854-0345	8	4	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A4Q9	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4A4R1	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4A4R2	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A4R3	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	CT4-1/8-T0-619R-F
A4A4R4	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A4R5	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A4A4R6	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A4R7	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A4A4R8	0757-0278	9	3	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1781-F
A4A4R9	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A4A4R10	0698-3153	9	4	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3831-F
A4A4R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4A4R12	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4A4R13	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A4A4R14	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A4A4R15	0757-0422	5	2	RESISTOR 909 1% .125W F TC=0+-100	24546	CT4-1/8-T0-909R-F
A4A4R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A4R17	0757-1094	9	8	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
A4A4R18	0698-3434	9		RESISTOR 34.8 1% .125W F TC=0+-100	24546	CT4-1/8-T0-34R8-F
A4A4R19	0757-0396	4	3	RESISTOR 75 1% .125W F TC=0+-100	24546	CT4-1/8-T0-75R0-F
A4A4R20	0757-1000	7	1	RESISTOR 51.1 1% .5W F TC=0+-100	28480	0757-1000
A4A4R21	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A4A4R22	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3831-F
A4A4R23	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A4A4R24	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A4A4R25	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3831-F
A4A4R26	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A4R27	0698-3155	1	10	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4841-F
A4A4R28	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A4R29*	0698-7222	1	1	RESISTOR 261 1% .05W F TC=0+-100	24546	CT3-1/8-TO-26R-F
A4A4R30	0698-3448	3		RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-T0-383R-F
A4A4R31	0757-0422	5		RESISTOR 909 1% .125W F TC=0+-100	24546	CT4-1/8-T0-909R-F
A4A4R32	0698-7195	7	1	RESISTOR 19.6 1% .05W F TC=0+-100	24546	CT3-1/8-TO-19R6-F
A4A4R33	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1471-F
A4A4R34	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-TO-511R-F
A4A4U1	1820-2934	4	1	IC PRESCR ECL	04713	MC12009P
				A4A4 MISCELLANEOUS		
A4A4MP1	1205-0037	0		HEAT SINK TO-18-CS (FOR Q7)	28480	1205-0037

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A5						
A4A5	08660-60005	1	1	BOARD ASSEMBLY, VCO & AMPLIFIERS	28480	08660-60005
A4A5C1	0160-0565	2	19	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-0565
A4A5C2	0160-3876	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A5C3	0121-0452	4	2	CAPACITOR-V TRMR-AIR 1.3-5.4PF 175V	74970	187-0103-028
A4A5C4	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3876
A4A5C5	0160-3876	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A5C6	0160-2250	6	2	CAPACITOR-FXD 5.1PF +-.25PF 500VDC CER	28480	0160-2250
A4A5C7*	0160-2266	4		CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A4A5C8*	0160-2266	4		CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A4A5C9	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A5C10	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A5C11	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A5C12	0160-3876	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3876
A4A5C13*	0160-2266	4		CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A4A5C14*	0160-2266	4		CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A4A5C15	0160-3876	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3676
A4A5C16	0160-0576	5	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4A5C17	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3676
A4A5C18	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3676
A4A5C19*	0160-2255	1		CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A4A5C20*	0160-2255	1		CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A4A5C21	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A5C22	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A4A5C23	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A5C24	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A5CR1	0122-0248	8	1	DIODE-VVC 1N5140A 10PF 5% C4/C60-MIN=2.6	01281	1N5140A
A4A5CR2	1901-1034	5	1	DIODE-STABISTOR 90V DO-34	03508	MPD400
A4A5FL1	08660-20038	6	1	FILTER, L.P. 600 MHZ	28480	08660-20038
A4A5FL2	08660-20370	9	1	FILTER, HP 300MHZ	28480	08660-20370
A4A5L1				PART OF PRINTED CIRCUIT BOARD		
A4A5L2	9100-2250	9	6	INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A4A5L3	08660-80006	4	4	INDUCTOR	28480	08660-80006
A4A5L4	08660-80006	4		INDUCTOR	28480	08660-80006
A4A5L5	9100-2250	9		INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A4A5L6	9100-2250	9		INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A4A5L7	08660-80006	4		INDUCTOR	28480	08660-80006
A4A5L8	08660-80006	4		INDUCTOR	28480	08660-80006
A4A5L9	9100-2250	9		INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A4A5L10	9140-0143	9	1	INDUCTOR RF-CH-MLD 3.3UH 10% .105DX.26LG	28480	9140-0143
A4A5L11	08660-60009	7		INDUCTOR	28480	08660-80009
A4A5L12	08660-60009	7		INDUCTOR	28480	08660-80009
A4A5L13	9100-2250	9		INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250
A4A5L14	9100-2250	9		INDUCTOR RF-CH-MLD 180NH 10% .105DX.26LG	28480	9100-2250

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A5Q1	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A5Q2	1854-0540	5		TRANSISTOR NPN SI TO-72 PD=200MW FT=1GHZ	04713	MM8006
A4A5Q3	1854-0540	5		TRANSISTOR NPN SI TO-72 PD=200MW FT=1GHZ	04713	MM8006
A4A5Q4	1854-0540	5		TRANSISTOR NPN SI TO-72 PD=200MW FT=1GHZ	04713	MM8006
A4A5Q5	1854-0540	5		TRANSISTOR NPN SI TO-72 PD=200MW FT=1GHZ	04713	MM8006
A4A5Q6	1854-0540	5		TRANSISTOR NPN SI TO-72 PD=200MW FT=1GHZ	04713	MM8006
A4A5Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4A5R1	0698-7244	7		RESISTOR 2.15K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-2151-F
A4A5R2	0698-7244	7		RESISTOR 2.15K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-2151-F
A4A5R3	0698-7238	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-1001-F
A4A5R4	0698-7240	3		RESISTOR 1.47K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-1471-F
A4A5R5	0698-7205	0	2	RESISTOR 51.1 1% .05W F TC=0+-100	24546	CT3-1/8-TO-51R1-F
A4A5R6	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	CT3-1/8-T0-10R0-F
A4A5R7	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	CT3-1/8-TO-51R1-F
A4A5R8	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	CT3-1/8-T0-10R0-F
A4A5R9	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	CT3-1/8-T0-511R-F
A4A5R10	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	CT3-1/8-T0-511R-F
A4A5R11	0698-7256	1	10	RESISTOR 6.81K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-8811-F
A4A5R12	0698-7248	1	17	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-3161-F
A4A5R13	0698-7256	1	10	RESISTOR 6.81K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-8811-F
A4A5R14	0698-7248	1	17	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	CT3-1/6-T0-3161-F
A4A5R15	0696-7221	0	8	RESISTOR 237 1% .05W F TC=0+-100	24546	CT3-1/8-T0-237R-F
A4A5R16	0698-7221	0	8	RESISTOR 237 1% .05W F TC=0+-100	24546	CT3-1/8-T0-237R-F
A4A5R17	0698-7264	1	4	RESISTOR 14.7 1% .05W F TC=0+-100	24546	CT3-1/8-T0-14R7-F
A4A5R18	0698-7225	4	11	RESISTOR 348 1% .05W F TC=0+-100	24546	CT3-1/8-T0-348R-F
A4A5R19	0698-7264	1	4	RESISTOR 14.7 1% .05W F TC=0+-100	24546	CT3-1/6-T0-14R7-F
A4A5R20	0698-7225	4	11	RESISTOR 348 1% .05W F TC=0+-100	24546	CT3-1/8-T0-348R-F
A4A5R21	0698-7256	1	10	RESISTOR 6.81K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-6811-F
A4A5R22	0696-7248	1	17	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-3161-F
A4A5R23	0698-7256	1	10	RESISTOR 6.81K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-6811-F
A4A5R24	0698-7248	1	17	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-3161-F
A4A5R25	0698-7219	6		RESISTOR 196 1% .05W F TC=0+-100	24546	CT3-1/8-T0-196R-F
A4A5R26	0696-7219	6		RESISTOR 196 1% .05W F TC=0+-100	24546	CT3-1/8-T0-196R-F
A4A5R27	0698-7264	1	4	RESISTOR 14.7 1% .05W F TC=0+-100	24546	CT3-1/8-T0-14R7-F
A4A5R28	0698-7224	3		RESISTOR 316 1% .05W F TC=0+-100	24546	CT3-1/8-T0-316R-F
A4A5R29	0698-7264	1	4	RESISTOR 14.7 1% .05W F TC=0+-100	24546	CT3-1/8-T0-14R7-F
A4A5R30	0698-7224	3		RESISTOR 316 1% .05W F TC=0+-100	24546	CT3-1/8-T0-316R-F
A4A5R31	0698-7258	1	10	RESISTOR 6.81K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-6611-F
A4A5R32	0698-7248	1	17	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-3161-F
A4A5R33	0698-7256	1	10	RESISTOR 6.81K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-6811-F
A4A5R34	0698-7248	1	17	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-3161-F
A4A5R35	0698-7216	3		RESISTOR 147 1% .05W F TC=0+-100	24546	CT3-1/8-T0-147R-F
A4A5R36	0698-7216	3		RESISTOR 147 1% .05W F TC=0+-100	24546	CT3-1/8-T0-147R-F
A4A5R37*	0698-7218	5	6	RESISTOR 178 1% .05W F TC=0+-100	24546	CT3-1/6-T0-178R-F
A4A5R38*	0698-7227	8	1	RESISTOR 422 1% .05W F TC=0+-100	24546	CT3-1/8-TO-422-F
A4A5R39*	0698-7199	1	1	RESISTOR 28.7 1% .05W F TC=0+-100	03888	CT3-1/8-T0-28R7-F
A4A5R40*	0698-7190	2	1	RESISTOR 12.1 1% .05W F TC=0+-100	24546	CT3-1/8-T0-12R1-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A5R41*	0698-7218	5	6	RESISTOR 178 1% .05W F TC=0+-100	24546	CT3-1/8-T0-178R-F
A4A5R42*	0698-7227	6	1	RESISTOR 422 1% .05W F TC=0+-100	24546	CT3-1/8-TO-422-F
A4A5T1	08660-60003	1	1	TRANSFORMER, ISOLATOR	28480	08660-60003
				A4A5 MISCELLANEOUS		
A4A5MP1	0340-0447	1		INSULATOR-XSTR DAP-GL (FOR Q1-7)	28480	0340-0447
A4A5MP2	0360-0042	4	5	TERMINAL SOLDER LUG PL-MTG FOR #6 SCR (FOR FL1, FL2)	00000	ORDER BY DESCRIPTION

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A6						
A4A6	08660-60381	6	1	BOARD ASSEMBLY, PRETUNE	28480	08660-60381
A4A6C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4A6C2	0180-0183	2	5	CAPACITOR-FXD 10UF+75-10% 50VDC AL	56289	30D106G050CB2
A4A6C3	0180-0183	2		CAPACITOR-FXD 10UF+75-10% 50VDC AL	56289	30D106G050CB2
A4A6C4	0160-0141	2	4	CAPACITOR-FXD 50UF+75-10% 50VDC AL	56289	30D506G050DD2
A4A6C5	0121-0452	4		CAPACITOR-V TRMR-AIR 1.3-5.4PF 175V	74970	187-0103-026
A4A6C6*	0160-2263	1	1	CAPACITOR-FXD 18PF +-5% 500VDC CER 0+-30	28480	0160-2263
A4A6C7	0160-0174	9	10	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A4A6C8	0160-0197	8	3	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A4A6C9	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A6C10	0180-0183	2		CAPACITOR-FXD 10UF+75-10% 50VDC AL	56289	30D106G050CB2
A4A6C11	0160-3537	4		CAPACITOR-FXD 680PF +-5% 100VDC MICA	28480	0160-3537
A4A6CR1	1901-0033	2	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A4A6CR2	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A4A6CR3	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A4A6CR4	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A4A6CR5	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A4A6CR6	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A4A6CR7	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A4A6CR8	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A4A6CR9	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A4A6CR10	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A4A6CR11	1902-0943	5	2	DIODE-ZNR 2.4V 5% DO-35 PD=.4W TC=-.037%	28480	1902-0943
A4A6L1	9140-0178	0	1	INDUCTOR RF-CH-MLD 12UH 10% .166DX.385LG	28480	9140-0178
A4A6L2	9100-1643	2	1	INDUCTOR RF-CH-MLD 300UH 5% .2DX.45LG	28480	9100-1643
A4A6Q1	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4A6Q2	1853-0360	5	13	TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q3	1853-0360	5		TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q4	1853-0360	5		TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q5	1853-0360	5		TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q6	1853-0360	5		TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q7	1853-0360	5		TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q8	1853-0360	5		TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q9	1853-0360	5		TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q10	1853-0360	5		TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q11	1853-0360	5		TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q12	1853-0360	5		TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q13	1853-0360	5		TRANSISTOR PNP 2N3799A SI TO-18 PD=360MW	04713	2N3799A
A4A6Q14	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4A6R1	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A4A6R2	2100-3818	0	2	RESISTOR-TRMR 5K 10% C TOP-ADJ 10-TRN	32997	3262W-1-502
A4A6R3	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	CT4-1/8-T0-619R-F
A4A6R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A6R5	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A6R6	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A4A6R7	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A6R8	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
A4A6R9	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6251-F
A4A6R10				NOT ASSIGNED		
A4A6R11	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A4A6R12	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A4A6R13	2100-3817	9	2	RESISTOR-TRMR 2K 10% C TOP-ADJ 10-TRN	32997	3262W-1-202
A4A6R14	0757-0200	7	11	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A4A6R15	2100-3822	6	3	RESISTOR-TRMR 100 10% C TOP-ADJ 10-TRN	32997	3262W-1-101
A4A6R16				NOT ASSIGNED		
A4A6R17	0698-3156	2	14	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A4A6R18	0757-0405	4	4	RESISTOR 162 1% .125W F TC=0+-100	24546	CT4-1/8-T0-162R-F
A4A6R19*	0698-3441	8	6	RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A4A6R20	2100-3822	6		RESISTOR-TRMR 100 10% C TOP-ADJ 10-TRN	32997	3262W-1-101
A4A6R21	0698-3409	8	1	RESISTOR 2.37K 1% .5W F TC=0+-100	28480	0698-3409
A4A6R22	2100-3822	6		RESISTOR-TRMR 100 10% C TOP-ADJ 10-TRN	32997	3262W-1-101
A4A6R23	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A6R24				NOT ASSIGNED		
A4A6R25	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A4A6R26	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A4A6R27	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A4A6R28	2100-3821	5	1	RESISTOR-TRMR 200 10% C TOP-ADJ 10-TRN	32997	3262W-1-201
A4A6R29	0757-0836	5	1	RESISTOR 7.5K 1% .5W F TC=0+-100	28480	0757-0836
A4A6R30	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A6R31				NOT ASSIGNED		
A4A6R32	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1472-F
A4A6R33	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A4A6R34	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A4A6R35	2100-3820	4	3	RESISTOR-TRMR 500 10% C TOP-ADJ 10-TRN	32997	3262W-1-501
A4A6R36				NOT ASSIGNED		
A4A6R37	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A4A6R38	0698-3441	6		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A4A6R39	0757-0440	7	3	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A4A6R40	2100-3820	4		RESISTOR-TRMR 500 10% C TOP-ADJ 10-TRN	32997	3262W-1-501
A4A6R41				NOT ASSIGNED		
A4A6R42	0698-3156	2	5	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A4A6R43	0698-0062	7		RESISTOR 484 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A4A6R44	2100-3620	4		RESISTOR-TRMR 500 10% C TOP-ADJ 10-TRN	32997	3262W-1-501
A4A6R45				NOT ASSIGNED		
A4A6R46	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A4A6R47	0757-0417	6	1	RESISTOR 562 1% .125W F TC=0+-100	24546	CT4-1/8-T0-562R-F
A4A6R48	2100-3819	1	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 10-TRN	32997	3262W-1-102
A4A6R49				NOT ASSIGNED		
A4A6R50	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A4A6R51	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A6R52	2100-3817	9		RESISTOR-TRMR 2K 10% C TOP-ADJ 10-TRN	32997	3262W-1-202
A4A6R53				NOT ASSIGNED		
A4A6R54	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A6R55	0757-0426	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A4A6R56	2100-3616	0		RESISTOR-TRMR 5K 10% C TOP-ADJ 10-TRN	32997	3262W-1-502
A4A6R57				NOT ASSIGNED		
A4A6R58	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A4A6R59	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A4A6R60	2100-3616	6	1	RESISTOR-TRMR 10K 10% C TOP-ADJ 10-TRN	32997	3262W-1-103
A4A6R61	0757-0447	4	3	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1622-F
A4A6R62	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A4A6R63	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4A6R64	0698-0064	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A4A6R65	0698-7264	5	1	RESISTOR 100K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-1003-F
A4A6U1	1820-0214	9	1	IC DCDR TTL BCD-T-DEC 4-TO-10-LINE	01295	SN7442AN
				A4A6 MISCELLANEOUS		
A4A6MP1	1200-0767	3	1	SOCKET-IC 16-CONT DIP-SLDR (FOR U1)	28480	1200-0767
A4A6MP2	1205-0037	0		HEAT SINK TO-16-CS (FOR Q12, Q13)	28480	1205-0037
A4A6MP3	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A7						
A4A7	08860-60006	2	1	BOARD ASSEMBLY,PHASE DETECTOR	28480	08660-60006
A4A7C1	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A7C2	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A7C3	0180-2214	4	3	CAPACITOR-FXD 90UF+75-10% 16VDC AL	56289	30D906G016CC2
A4A7C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4A7C5	0160-3878	8		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A7C6	0180-2214	4		CAPACITOR-FXD 90UF+75-10% 16VDC AL	56289	30D906G016CC2
A4A7C7	0180-0049	9	4	CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A4A7C8	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4A7C9	0160-0839	3	1	CAPACITOR-FXD 110PF +-1% 300VDC MICA	28480	0160-0839
A4A7C10	0160-3064	2	1	CAPACITOR-FXD 1000PF +-5% 300VDC MICA	28480	0160-3064
A4A7C11	0160-0182	9	2	CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-0182
A4A7C12	0160-0182	9		CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-0182
A4A7C13	0160-2250	6		CAPACITOR-FXD 5.1PF +-.25PF 500VDC CER	28480	0160-2250
A4A7C14	0160-2266	4		CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A4A7C15	0180-1745	4	1	CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A4A7C16	0160-2266	4		CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A4A7C17	0160-2264	2	1	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A4A7C18	0180-0291	3	13	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A4A7C19	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A4A7C20	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A4A7C21	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A4A7C22	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A4A7C23	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A4A7C24	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A4A7C25	0180-0183	2		CAPACITOR-FXD 10UF+75-10% 50VDC AL	56289	30D106G050CB2
A4A7C26	0160-2266	4		CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	28480	0160-2266
A4A7CR1	1901-0189	9	1	DIODE-STEP RECOVERY	28480	1901-0189
A4A7CR2	1906-0098	9	4	DIODE-MATCHED 1V	28480	1906-0098
A4A7CR3	1906-0098	9		DIODE-MATCHED 1V	28480	1906-0098
A4A7CR4	1906-0098	9		DIODE-MATCHED 1V	28480	1906-0098
A4A7CR5	1906-0098	9		DIODE-MATCHED 1V	28480	1906-0098
A4A7CR6	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A4A7CR7	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A4A7CR8	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A4A7CR9	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A4A7CR10	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A4A7J1	1250-0836	2	1	CONNECTOR-RF SMC M PC 50-OHM	28480	1250-0836
A4A7L1	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	28480	9140-0144
A4A7L2	9140-0210	1	2	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4A7L3	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4A7L4	9100-2260	1		INDUCTOR RF-CH-MLD 1.8UH 10% .105DX.26LG	28480	9100-2260
A4A7L5	9100-2254	3		INDUCTOR RF-CH-MLD 390NH 10% .105DX.26LG	28480	9100-2254
A4A7L6	08660-80005	3	2	INDUCTOR	28480	08660-80005
A4A7L7	08660-80005	3		INDUCTOR	28460	08660-80005

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A7Q1	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A7Q2	1654-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A4A7Q3	1853-0034	0	7	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A4A7Q4	1855-0049	1	3	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0049
A4A7Q5	1853-0007	7		TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A4A7Q6	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0023
A4A7R1	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	CT4-1/8-T0-75R0-F
A4A7R2	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A4A7R3	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A7R4	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-198R-F
A4A7R5	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A4A7R6	0698-3437	2	3	RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A4A7R7	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24548	CT4-1/8-T0-287R-F
A4A7R8	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24548	CT4-1/8-T0-10R0-F
A4A7R9	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A4A7R10	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A7R11	0757-0278	7	1	RESISTOR 81.9 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6192-F
A4A7R12	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A4A7R13	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A7R14	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A7R15	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A7R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A7R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A4A7R18	2100-1986	9	2	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	82PR1K
A4A7R19	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A7R20	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A7R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-1002-F
A4A7R22	2100-1988	9		RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	82PR1K
A4A7R23*	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4A7R24	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A7R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A4A7R26	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-1471-F
A4A7R27	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A7R28	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A4A7R29	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-348R-F
A4A7R30	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A7R31	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24548	CT4-1/8-T0-348R-F
A4A7R32	0698-3101	7	1	RESISTOR 2.87K 1% .5W F TC=0+-100	28480	0698-3101
A4A7R33	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A4A7R34	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A4A7T1	08660-80011	1	1	TRANSFORMER, TRIFILAR	28480	08660-80011
A4A7T2	08660-80010	0	1	TRANSFORMER, BIFILAR	28480	08660-80010
				A4A7 MISCELLANEOUS		
A4A7MP1	1205-0031	4		THERMAL LINK TO-18-CS (FOR Q1, Q2)	28480	1205-0037
A4A7MP2	1205-0037	0		HEAT SINK TO-18-CS (FOR Q3, Q6)	28480	1205-0037

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4A8						
A4A8	08660-60409	9	1	100 MHZ BAND PASS FILTER	28480	08660-60409

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A5						
A5	08660-60327	0	1	BOARD ASSEMBLY, REGULATOR	28480	08660-60327
A5C1	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A5C2	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A5C3	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A5C4	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A5C5	0160-2207	3	1	CAPACITOR-FXD 300PF +-5% 300VDC MICA	28480	0160-2207
A5C6	0180-1704	5	4	CAPACITOR-FXD 47UF+-10% 6VDC TA	56289	150D476X9006B2
A5C7	0180-0183	2		CAPACITOR-FXD 10UF+75-10% 50VDC AL	56289	30D106G050CB2
A5C8	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A5C9	0160-2208	4	1	CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A5C10	0180-1704	5		CAPACITOR-FXD 47UF+-10% 6VDC TA	56289	150D476X9006B2
A5C12	0160-2226	6	1	CAPACITOR-FXD 2200PF +-5% 300VDC MICA	28480	0160-2226
A5C13	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A5C14	0160-2207	5	4	CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A5C15	0180-0269	5	2	CAPACITOR-FXD 1UF+50-10% 150VDC AL	56289	30D105G150BA2
A5C17	0160-2218	6		CAPACITOR-FXD 1000PF +-5% 300VDC MICA	28480	0160-2218
A5C18	0180-0269	5		CAPACITOR-FXD 1UF+50-10% 150VDC AL	56289	30D105G150BA2
A5C19	0160-0141	2		CAPACITOR-FXD 50UF+75-10% 50VDC AL	56289	30D506G050DD2
A5CR1	1902-3104	8	1	DIODE-ZNR 5.62V 5% DO-35 PD=.4W	28480	1902-3104
A5Q1	1853-0213	7	5	TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A5Q2	1853-0451	5	11	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A5Q3	1853-0213	7		TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
	1205-0011	0	2	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A5Q4	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A5Q5	1853-0213	7		TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
	1205-0011	0		HEAT SINK TO-5/TO-39-CS	28480	1205-0011
A5Q6	1853-0326	3	1	TRANSISTOR PNP SI PD=1W FT=50MHZ	04713	MPS-U51
A5R1	0757-0397	3		RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
A5R2	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	CT4-1/8-T0-10R0-F
A5R3	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A5R4	0757-0397	3		RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
A5R5	0757-0397	3		RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
A5R6	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	CT4-1/8-T0-75R0-F
A5R7	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A5R8	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A5R9	0757-0397	3		RESISTOR 68.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-68R1-F
A5R10	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-T0-383R-F
A5R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A5R12	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A5R13	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A5R14	0698-3161	9	1	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3832-F
A5R15	0757-0424	7	11	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A5R16	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A5R17	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A5R18	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A5R19	0698-3136	8	3	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1782-F
A5R20	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
A5R21	2100-1973	4	1	RESISTOR-TRMR 200 10% WW TOP-ADJ 20-TRN	02660	3810P-201

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. *Replaceable Parts*

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A5R22	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1781-F
A5R23	0698-3152	8		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3481-F
A5R24	2100-1799	2	1	RESISTOR-TRMR 500 10% WW SIDE-ADJ 20-TRN	02660	3810P-501
A5R25	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A5R26	2100-2852	0	1	RESISTOR-TRMR 1K 10% WW SIDE-ADJ 20-TRN	02660	3810P-102
A5R27	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A5R28	2100-1739	0	1	RESISTOR-TRMR 5K 10% WW SIDE-ADJ 20-TRN	02660	3810P-502
A5R29	0698-3136	8		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1782-F
A5U1	1826-0018	1	1	IC 204 V RGLTR TO-100	04713	MLM204G
A5U2	1826-0004	7	1	IC 304 V RGLTR TO-100	07263	UA304HC
A5U3	1826-0017	2	1	IC V RGLTR TO-99	27014	LM205H
A5U4	1820-0247	8	1	IC V RGLTR TO-99	27014	LM305H
				A5 MISCELLANEOUS		
A5MP1	1205-0011	0		HEAT SINK TO-5/TO-39-CS (FOR Q3, Q5)	28480	1205-0011
A5MP2	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A5MP3	1400-0263	8	1	BRACKET-RETANG .438-LG X .781-LG .375-WD	28480	1400-0263

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6						
A8	08660-60276	8	1	FAN ASSEMBLY, 400 HZ	28480	08660-60265
A6Q1	1854-0072	8	1	TRANSISTOR NPN 2N3054 SI TO-66 PD=25W	3L585	2N3054
A8Q2	1853-0052	2	1	TRANSISTOR PNP 2N3740 SI TO-66 PD=25W	04713	2N3740
A8Q3				NOT ASSIGNED		
A6Q4	1854-0083	7	3	TRANSISTOR NPN 2N3055 SI TO-3 PD=115W	3L585	2N3055
A6Q5	1853-0059	9	1	TRANSISTOR PNP 2N3791 SI TO-3 PD=150W	04713	2N3791
A6Q6				NOT ASSIGNED		
A6Q7	1854-0063	7		TRANSISTOR NPN 2N3055 SI TO-3 PD=115W	3L585	2N3055
A6Q8	1854-0083	7		TRANSISTOR NPN 2N3055 SI TO-3 PD=115W	3L585	2N3055
A6Q9				NOT ASSIGNED		
A8Q10	1854-0313	0	1	TRANSISTOR NPN 2N3771 SI TO-3 PD=150W	3L585	2N3771
A6R1	0811-3410	3	1	RESISTOR .165 1% 25W PW TC=0+-90	28480	0811-3410
A6W1	08660-60379	2	1	GROUND CABLE #18 AWG (WHT/GRN/YEL)	28480	08660-60379
				A6 MISCELLANEOUS		
A8MP1	08660-00063	5	1	FAN SHIELD	28480	08660-00063
A6MP2	2510-0109	5	4	SCREW-MACH 8-32 .625-IN-LG PAN-HD-POZI (ATTACH FAN SHIELD TO HEATSINK COVER)	00000	ORDER BY DESCRIPTION
MP3	2190-0017	4	4	WASHER-LK HLCL NO.8 .168-IN-ID (FOR MP2)	00000	ORDER BY DESCRIPTION
MP4	3050-0066	8	4	WASHER-FL MTLC NO.6 .147-IN-ID (FOR MP2)	00000	ORDER BY DESCRIPTION
A6MP5	08660-00064	6	1	HEAT SINK COVER	28480	08660-00064
A6MP6	08660-20173	0	1	HEAT SINK	28480	08660-20173
A8MP7	08660-40001	5	2	INSULATOR (FOR Q1, Q2)	28480	
A6MP8	08660-40002	6	5	INSULATOR (FOR Q4, Q5, Q7, Q8, Q10)	28480	
A6MP9	0340-0182	7	1	INSULATOR-XSTR ALUMINUM (FOR Q1, Q2)	28480	0340-0162
A6MP10	1200-0043	8	1	INSULATOR-XSTR ALUMINUM (FOR Q4, Q5, Q7, Q8, Q10)	28480	1200-0043
A6MP11	0403-0026	6	1	PLUG-HOLE BDR-HD FOR .187-D-HOLE NYL	02786	207-120241-03-0101
A8MP12	2200-0113	4	14	SCREW-MACH 4-40-.625-IN-LG PAN-HD-POZI (FOR Q1, Q2, Q4, Q5, Q7, Q8, Q10)	00000	ORDER BY DESCRIPTION

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6A1						
A6A1	08660-60333	8	1	BOARD ASSEMBLY, PRE-REGULATOR	28480	08660-60333
A6A1C1	0180-0141	2		CAPACITOR-FXD 50UF+75-10% 50VDC AL	56289	30D506G050DD2
A6A1C2	0180-0141	2		CAPACITOR-FXD 50UF+75-10% 50VDC AL	56289	30D506G050DD2
A6A1C3	0180-0089	7	1	CAPACITOR-FXD 10UF+50-10% 150VDC AL	56289	30D106F150DD2
A6A1C4	0150-0121	5	26	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6A1C5	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6A1C6	0160-3094	8	2	CAPACITOR-FXD .1UF +-10% 100VDC CER	28480	0160-3094
A6A1C7	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6A1C8	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6A1C9	0160-3094	8		CAPACITOR-FXD .1UF +-10% 100VDC CER	28480	0160-3094
A6A1CR1	1902-3263	8	1	DIODE-ZNR 24.9V 2% DO-35 PD=.4W	28480	1902-3263
A6A1CR2	1902-3203	6	1	DIODE-ZNR 14.7V 5% DO-35 PD=.4W	28480	1902-3203
A6A1CR3	1902-3333	3	1	DIODE-ZNR 46.4V 5% DO-35 PD=.4W	28480	1902-3333
A6A1Q3	1853-0213	7		TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A6A1Q6	1853-0213	7		TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A6A1Q9	1854-0361	8	1	TRANSISTOR NPN 2N4239 SI TO-5 PD=6W	04713	2N4239
A6A1R1	0698-3447	4	6	RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A6A1R2	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A6A1R3	0757-0274	5	4	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1211-F
A6A1R4	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A6A1R5	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A6A1R6	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1211-F
A6A1R7	0612-0014	9	1	RESISTOR .5 3% .5W PW TC=0+-90	28480	0812-0014
A6A1R10	0612-0020	7	1	RESISTOR .39 5% 3W PW TC=0+-90	91637	CW2B1-3-T2-39/100-J
A6A1R11	0611-1670	3	1	RESISTOR 2.2 5% 2W PW TC=0+-400	75042	BWH2-2R2-J
A6A1XA20-1	1251-2035	9	1	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A6A2						
A6A2	08660-20389	0	1	FAN ASSEMBLY	28480	06660-20389
A6A3						
A6A3	08660-60386	3	1	FAN DRIVER ASSEMBLY	28480	08660-60388
A6A3R1	0698-3613	6	1	RESISTOR 39 5% 2W MO TC=0+-200	27167	FP42-2-T00-39R0-J

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A7						
A7	0960-0443	1	1	POWER LINE MODULE/FILTER	28480	0960-0443
A7C1	0160-4065	5	1	CAPACITOR-FXD .1UF +-20% 250VAC(RMS)	28480	0160-4065
A7F1	2110-0365	7	1	FUSE 4A 250V TD 1.25X.25 (FOR 110/120V OPERATION)	28480	2110-0365
A7F1	2110-0303	3	1	FUSE 2A 250V TD 1.25X.25 UL (FOR 220/240V OPERATION)	28480	2110-0303
A7R1	0857-0306	4	1	THERMISTOR DISC 10-OHM TC=-3.8%/C-DEG	28480	0857-0306
A7TB1	0960-0736	5	1	LINE VOLTAGE SELECTION CARD	28480	0960-0736

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A8						
A8	08860-60014	2	1	BOARD ASSEMBLY, N3 OSCILLATOR	28480	08660-60014
A8C1	0180-0058	0	7	CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A8C2	0180-1704	5		CAPACITOR-FXD 47UF+-10% 6VDC TA	56289	150D476X9006B2
A8C3	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A8C4	0180-0049	9		CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A8C5	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A8C6	0160-3459	9	4	CAPACITOR-FXD .02UF +-20% 100VDC CER	28480	0160-3459
A8C7	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A8C8	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A8C9	0160-3459	9		CAPACITOR-FXD .02UF +-20% 100VDC CER	28480	0160-3459
A8C10	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A8C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C12	0160-0386	5	9	CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0386
A8C13	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A8C14	0160-4084	8	4	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A8C16	0160-0386	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0386
A8C17	0160-0386	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0386
A8C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C22	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A8CR3	0122-0299	9	1	DIODE-VVC 82PF 5% C2/C20-MIN=2 BVR=20V	28480	0122-0299
A8L1	9100-1829	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A8L2	9140-0114	4	7	INDUCTOR RF-CH-MLD 10UH 10% .188DX.385LG	28480	9140-0114
A8L3	9100-1829	4		INDUCTOR RF-CH-MLD 47UH 5% .168DX.385LG	28480	9100-1629
A8L4	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A8L5	9100-2815	2	3	INDUCTOR 700NH 10% .342WX1.328LG Q=150	28480	9100-2815
A8L6	9140-0179	1	14	INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A8L7	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A8Q1	1854-0092	2	12	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A8Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A8Q3	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A8Q4	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A8Q5	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A8Q6	1854-0087	5	5	TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A8Q7	1855-0081	1	3	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0081
A8Q8	1853-0036	2	29	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0038
A8Q9	1853-0038	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A8Q10	1853-0038	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A8Q11	1853-0038	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A8Q12	1854-0087	5		TRANSISTOR NPN SI PD=380MW FT=75MHZ	28480	1854-0087
A8R2	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1821-F
A8R3	0757-0428	1		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1821-F
A8R4	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A8R5	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A8R6	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A8R7	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A8R8	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A8R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A8R10	0757-0479	2	3	RESISTOR 392K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-3923-F
A8R11	0757-0472	5	3	RESISTOR 200K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2003-F
A8R12	0757-0465	8	3	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A8R13	0698-3228	9	3	RESISTOR 49.9K 1% .125W F TC=0+-100	28480	0698-3228
A8R15	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A8R16	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A8R17	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2871-F
A6R18*	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2152-F
A8R19	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A8R20	0757-0199	3	4	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2152-F
A8R21	0698-0085	0		RESISTOR 2.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2811-F
A8R22	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A8R23	0698-4037	0	2	RESISTOR 48.4 1% .125W F TC=0+-100	24546	CT4-1/8-T0-48R4-F
A8R24	2100-1780	7	3	RESISTOR-TRMR 5K 5% WW SIDE-ADJ 1-TRN	28480	2100-1760
A8R25	0698-4002	9	2	RESISTOR 5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5001-F
A8R26	2100-1759	4	3	RESISTOR-TRMR 2K 5% WW SIDE-ADJ 1-TRN	28480	2100-1759
A8R27	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1962-F
A8R28	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2372-F
A8R30	0698-3158	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A8R31	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A8R32	0757-0279	0		RESISTOR 3.18K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3181-F
A8R33	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A8R34	0757-0443	0	2	RESISTOR 11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1102-F
A8R35	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2152-F
A8R36	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A8R36	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A8R39	0683-8245	9	3	RESISTOR 820K 5% .25W FC TC=-800/+900	01121	CB8245
A8R40	0698-3243	8	7	RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A8R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A8R42	0698-3440	7		RESISTOR 198 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A8R43	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A8R44	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A8R45	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A8R46	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-348R-F
A8R47	0757-0403	2	3	RESISTOR 121 1% .125W F TC=0+-100	24546	CT4-1/8-T0-121R-F
A8R48	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A8R49	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-348R-F
A8R50	0698-3436	3		RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A8U1	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A8U2	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A8U3	1820-0751	9	1	IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A9						
A9	08660-60045	9	1	CABLE ASSEMBLY, LOOP BOX	28480	08660-60045
A9W1	8120-1727	4	1	CABLE-FL-RBN 28AWG 28-CNDCT GRA-JKT	28480	8120-1727
A9A1						
A9A1	08660-60037	9	1	BOARD ASSEMBLY, DIGITAL PROGRAM	28480	08660-60037
A9A1E1	0360-1636	4	1	CABLE TRANSITION 34-TERM INSUL DSPL TYPE	28480	0360-1636
A9A1R1	0698-7210	7	28	RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R2	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R3	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R4	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R5	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R6	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R7	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R8	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R9	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R10	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R11	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R12	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R13	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R14	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R15	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R16	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R17	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R18	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R19	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R20	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R21	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R22	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R23	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R24	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R25	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R26	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R27	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F
A9A1R28	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	CT3-1/8-TO-82R5-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A10						
A10	06660-60013	1	1	BOARD ASSEMBLY, N3 PHASE DETECTOR	28480	08660-60013
A10C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C3	0180-0058	0		CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A10C4	0180-2206	4	2	CAPACITOR-FXD 60UF+-10% 6VDC TA	56289	150D606X9006B2
A10C5	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A10C6	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A10C7	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A10C8	0160-0157	8	2	CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A10C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C10	0150-0121	5		CAPACITOR-FXD .1UF +60-20% 50VDC CER	28480	0150-0121
A10C11	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A10C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C13	0140-0172	5	2	CAPACITOR-FXD 3000PF +-1% 100VDC MICA	72136	DM19F302F0100WV1CR
A10C14	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D338X9010B2
A10C15	0180-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C16	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A10C17	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A10C18	0150-0121	5		CAPACITOR-FXD .1UF +60-20% 50VDC CER	28480	0150-0121
A10C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A10C22	0160-3539	6	2	CAPACITOR-FXD 820PF +-5% 100VDC MICA	28480	0160-3539
A10C23	0160-2453	1	2	CAPACITOR-FXD .22UF +-10% 80VDC POLYE	28480	0160-2453
A10C24	0170-0040	9	2	CAPACITOR-FXD .047UF +-10% 200VDC POLYE	56289	292P47392
A10CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A10CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A10CR3	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A10CR4	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A10L1	9100-1829	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1829
A10L2	9140-0114	4		INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A10L3	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A10L4	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .186DX.385LG	28480	9140-0179
A10L5	9100-1650	1	2	INDUCTOR RF-CH-MLD 660UH 5% .2DX.45LG	28480	9100-1650
A10L6	9140-0114	4		INDUCTOR RF-CH-MLD 10UH 10% .168DX.385LG	28480	9140-0114
A10L7	9100-1652	3	2	INDUCTOR RF-CH-MLD 820UH 5% .2DX.45LG	28480	9100-1652
A10Q1	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A10Q2	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A10Q3	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A10Q4	1855-0049	1		TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0049
A10Q5	1854-0045	5		TRANSISTOR NPN SI TO-18 PD=500MW	28480	1854-0045
A10Q6	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A10Q7	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A10R1	0698-0082	7		RESISTOR 484 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4840-F
A10R2	0757-0289	2	2	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A10R3	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A10R4	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A10R5	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/6-T0-511R-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A10R6	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-T0-383R-F
A10R7	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A10R8	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A10R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A10R10	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A10R11	0698-3450	9	2	RESISTOR 42.2K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-4222-F
A10R12	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-1822-F
A10R13	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-1101-F
A10R14	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A10R15	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-625R-F
A10R16	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A10R17	0698-3430	5	2	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A10R18	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A10R19	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A10R20	0757-0421	4		RESISTOR 625 1% .125W F TC=0+-100	24546	CT4-1/6-T0-625R-F
A10R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/6-T0-1002-F
A10R22	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A10R23	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A10R24	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3831-F
A10R25	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A10R26	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24548	CT4-1/8-T0-51R1-F
A10R27	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A10R28	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A10R29	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A10R30	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A10R31	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A10R32	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A10R33	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A10R34	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-1101-F
A10R35	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A10R36	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A10T1	08660-80001	9	2	TRANSFORMER, SAMPLER	28480	08660-80001
A10U1	1820-1213	0	4	IC FF TTL LS J-K NEG-EDGE-TRIG PRESET	01295	SN74LS113AN
A10U2	1820-1213	0	4	IC FF TTL LS J-K NEG-EDGE-TRIG PRESET	01295	SN74LS113AN
A10U3	1820-1203	8	2	IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A10U4	1620-0751	9	7	IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N
A10U5	1820-0751	9		IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N
A10U6	1820-0751	9		IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N
A10U7	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A11						
A11	08660-60019	7	1	BOARD ASSEMBLY, SL2 OSCILLATOR	28480	08660-60019
A11C1	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11C2	0180-0058	0		CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A11C3	0180-1704	5		CAPACITOR-FXD 47UF+-10% 6VDC TA	56289	150D476X9006B2
A11C4	0180-2214	4		CAPACITOR-FXD 90UF+75-10% 18VDC AL	56289	30D906G016CC2
A11C5	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11C8	0180-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A11C7	0180-0049	9		CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A11C6	0180-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A11C9	0180-0118	1		CAPACITOR-FXD 6.6UF+-10% 35VDC TA	56289	150D685X9035B2
A11C10	0180-2210	0	2	CAPACITOR-FXD 2UF+50-10% 150VDC AL	56289	30D205F150BB2
A11C11	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A11C12	0180-0374	3	3	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A11C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C14	0180-0388	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0180-0386
A11C15	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A11C18	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A11C17	0121-0059	7	2	CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304324 2/8PF NPO
A11C18	0180-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A11C19	0160-0386	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0180-0386
A11C20	0180-0386	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0180-0386
A11C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C22	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C23	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C24	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A11C25	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D228X9015B2
A11C28	0180-2207	5		CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A11C27	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A11C28	0180-2028	6	1	CAPACITOR-FXD 2700PF +-5% 500VDC MICA	28480	0160-2028
A11CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR13	0122-0284	8	2	DIODE-VVC 1N5148A 47PF 5% C4/C60-MIN=3.2	04713	1N5148A
A11CR14	0122-0282	6	2	DIODE-VVC 1N5147A 39PF 5% C4/C60-MIN=3.2	04713	1N5147A
A11CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR16	1901-0518	8	1	DIODE-SM SIG SCHOTTKY	28480	1901-0518

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A11L1	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A11L2	9140-0114	4		INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A11L3	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.365LG	28480	9100-1629
A11L4	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A11L5	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A11L8	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A11L7	9100-1829	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A11L8	9100-2815	2		INDUCTOR 700NH 10% .342WX1.328LG Q=150	28480	9100-2815
A11L9	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .188DX.385LG	28480	9140-0179
A11L10	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28460	9140-0179
A11L11	9140-0129	1		INDUCTOR RF-CH-MLD 220UH 5% .166DX.385LG	28480	9140-0129
A11L12	9100-0388	6	1	INDUCTOR RF-CH-MLD 330NH 10% .105DX.28LG	28480	9100-0368
A11Q1	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A11Q2	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0081
A11Q3	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A11Q4	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A11Q5	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A11Q6	1854-0087	5		TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A11Q7	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11Q8	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11Q9	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11Q10	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11Q11	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11Q12	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11Q13	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11Q14	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11Q15	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A11Q16	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11Q17	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11Q18	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28460	1853-0036
A11Q19	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28460	1853-0036
A11Q20	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28460	1853-0036
A11R1	0698-0083	6		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R2	0698-0083	6		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R3	0698-0083	6		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R4	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R5	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R6	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R7	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R8	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R9	0757-0479	2		RESISTOR 392K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-3923-F
A11R10	0757-0472	5		RESISTOR 200K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2003-F
A11R11	0757-0485	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A11R12	0698-3228	9		RESISTOR 49.9K 1% .125W F TC=0+-100	28480	0698-3226
A11R13	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1211-F
A11R14	0757-0460	1	1	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6192-F
A11R15	2100-1760	7		RESISTOR-TRMR 5K 5% WW SIDE-ADJ 1-TRN	28480	2100-1760

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A11R16	0698-3158	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A11R17	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R18	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R19	2100-1759	4		RESISTOR-TRMR 2K 5% WW SIDE-ADJ 1-TRN	28480	2100-1759
A11R20	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A11R21	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5821-F
A11R22	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R23	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A11R24	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A11R25	0698-0083	6		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R27	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5112-F
A11R28	0757-0461	2	2	RESISTOR 66.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6612-F
A11R29	0757-0464	5	2	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-9092-F
A11R30	0757-0467	6	2	RESISTOR 121K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1213-F
A11R31	0757-0466	7		RESISTOR 110K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1103-F
A11R32	0698-3243	6		RESISTOR 176K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A11R33	0698-3243	6		RESISTOR 176K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A11R34	0698-3266	5	4	RESISTOR 237K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2373-F
A11R35	0698-3266	5		RESISTOR 237K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2373-F
A11R36	0698-3459	6	2	RESISTOR 383K 1% .125W F TC=0+-100	28480	0698-3459
A11R37	0698-3162	0	2	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
A11R38	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A11R39	2100-2574	3	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A11R40	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A11R41	0698-0083	6		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R42	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R43	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A11R44	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A11R45	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	CT4-1/8-T0-162R-F
A11R46	0698-3439	4		RESISTOR 178 1% .125W F TC=0+-100	24546	CT4-1/8-T0-178R-F
A11R47	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A11R48	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A11R49	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	CT4-1/8-T0-287R-F
A11R50	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-348R-F
A11R51	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A11R52	0699-0295	6		RESISTOR 464 1% .125W F TC=0+-100	28480	0699-0295
A11R53	0757-0317	7	2	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1331-F
A11R54	2100-2574	3		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A11R55	0698-3258	5	1	RESISTOR 5.36K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5361-F
A11R56	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A11R57	0757-0834	3	2	RESISTOR 5.62K 1% .5W F TC=0+-100	28480	0757-0834
A11R58	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R59	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R60	2100-2633	5	3	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A11R61	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A11R62	0757-0441	8		RESISTOR 6.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6251-F
A11R63	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R64	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R65	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/6-T0-3161-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A11R66	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R67	2100-2633	5		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A11R68	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A11R69	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A11R70	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R71	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R72	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1962-F
A11R73	2100-2521	0	2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A11R74	0699-0294	5		RESISTOR 9.09K 1% .125W F TC=0+-100	28480	0699-0294
A11R75	0698-0083	6		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R78	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R77	2100-2521	0		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A11R78	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A11R79	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R80	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R81	0683-8245	9		RESISTOR 820K 5% .25W FC TC=-800/+900	01121	CB8245
A11R82	0698-3243	8		RESISTOR 176K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A11R83	2100-2489	9	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	30983	ET50X502
A11R84	0698-3136	8		RESISTOR 17.8K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1782-F
A11R85	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A11R66	0899-0295	6		RESISTOR 464 1% .125W F TC=0+-100	28480	0699-0295
A11R87	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A11R88	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R89	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A11R90	2100-2522	1	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A11R91	0757-0123	3	1	RESISTOR 34.8K 1% .125W F TC=0+-100	26480	0757-0123
A11R92	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	CT4-1/8-T0-121R-F
A11R93	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A11R94	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/6-T0-316R-F
A11R95	0699-0282	1		RESISTOR 2.61K 1% .125W F TC=0+-100	28460	0699-0282
A11R96	0757-0402	1	1	RESISTOR 110 1% .125W F TC=0+-100	24546	CT4-1/8-T0-111-F
A11R97	0699-0294	5		RESISTOR 9.09K 1% .125W F TC=0+-100	28480	0699-0294
A11R98	0699-0282	1		RESISTOR 2.61K 1% .125W F TC=0+-100	26480	0699-0282
A11R99	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/6-T0-825R-F
A11R100	0757-0395	1	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	CT4-1/8-T0-56R2-F
A11R101	0696-3439	4		RESISTOR 178 1% .125W F TC=0+-100	24546	CT4-1/8-T0-178R-F
A11R102	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A11R103	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A11R104	0699-0295	6		RESISTOR 464 1% .125W F TC=0+-100	28480	0699-0295
A11R105	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A11R106	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A11R107	0757-0260	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A11U1	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A11U2	1620-0214	9	1	IC DCDR TTL BCD-TO-DEC 4-TO-10-LINE	01295	SN7442AN
A11U3	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A12						
A12	08660-60018	8	1	BOARD ASSEMBLY, SL2 DETECTOR	28480	08660-60018
A12C1	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A12C2	0180-2207	5		CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A12C3	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0180-0174
A12C4	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A12C5	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A12C6	0180-0058	0		CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A12C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C8	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A12C9	0160-0301	4	2	CAPACITOR-FXD .012UF +-10% 200VDC POLYE	28480	0160-0301
A12C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C11	0160-0301	4		CAPACITOR-FXD .012UF +-10% 200VDC POLYE	28480	0160-0301
A12C12	0160-2261	9	2	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A12C13	0160-2261	9		CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A12C14	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A12C15	0160-2141	6	1	CAPACITOR-FXD 3.3UF+-10% 50VDC TA	56289	150D335X9050B2
A12C16	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C17	0180-0058	0		CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A12C18	0160-0299	9	2	CAPACITOR-FXD 1800PF +-10% 200VDC POLYE	28480	0160-0299
A12C19	0160-0939	4	1	CAPACITOR-FXD 430PF +-5% 300VDC MICA	28480	0160-0939
A12C20	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A12C21	0160-0299	9		CAPACITOR-FXD 1800PF +-10% 200VDC POLYE	28480	0160-0299
A12C22	0160-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A12C23	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12C24	0160-3534	1	1	CAPACITOR-FXD 510PF +-5% 100VDC MICA	28480	0160-3534
A12C25	0160-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A12E1	0955-0292	7	1	MIXER, DC-600MHZ	28480	0955-0292
A12L1	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A12L2	9140-0114	4		INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A12L3	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A12L4	9100-1821	8	1	INDUCTOR RF-CH-MLD 18UH 10% .166DX.385LG	28480	9100-1821
A12L5	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A12L6	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A12L7	9100-1658	9	1	INDUCTOR RF-CH-MLD 1.8MH 5% .23DX.57LG	28480	9100-1658
A12Q1	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A12Q2	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A12Q3	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A12Q4	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A12Q5	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A12Q6	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A12Q7	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A12Q8	1853-0038	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0038
A12Q9	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A12Q10	1853-0038	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A12Q11	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A12Q12	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=800MHZ	28480	1854-0092
A12R1	0757-0399	5	2	RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A12R2	0757-0400	9	2	RESISTOR 90.9 1% .125W F TC=0+-100	24546	CT4-1/8-T0-90R9-F
A12R3	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A12R4	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2871-F
A12R5	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2871-F
A12R6	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-348R-F
A12R7	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A12R8	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A12R9	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A12R10	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A12R11	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A12R12	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A12R13	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A12R15	0757-0294	9	1	RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A12R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A12R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A12R18	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A12R19	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A12R20	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A12R21	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A12R22	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A12R23	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A12R24	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A12R25	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A12R26	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A12R27	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A12R28	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A12R29	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A12R30	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A12R31	0683-3955	8	1	RESISTOR 3.9M 5% .25W FC TC=-900/+1100	01121	CB3955
A12R32	0683-2055	7	1	RESISTOR 2M 5% .25W FC TC=-900/+1100	01121	CB2055
A12R33	0683-1055	5	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A12R34	0698-3263	2	1	RESISTOR 500K 1% .125W F TC=0+-100	26460	0698-3263
A12R35	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A12R36	0696-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A12R37	2100-2633	5		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A12R38	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A12R39	0696-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/6-T0-2371-F
A12R40	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	CT4-1/8-T0-619R-F
A12R41	0696-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/6-T0-4641-F
A12R42	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/6-T0-1001-F
A12R43	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A12R44	0696-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	CT4-1/8-T0-287R-F
A12R45	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2871-F
A12R46	0698-0064	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A12R47	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A12R48	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A12R49	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A12R50	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A12R51	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A12U1	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A12U2	1820-0077	2	1	IC FF TTL D-TYPE POS-EDGE-TRIG CLEAR	01295	SN7474N
A12U3	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A12U4	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A12U5	1820-0068	1	1	IC GATE TTL NAND TPL 3-INP	01295	SN7410N
A12U6	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A12U7	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A12U8	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A12U9	1820-0751	9		IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A13						
A13	08880-60012	0	1	BOARD ASSEMBLY, N2 OSCILLATOR	28480	08880-60012
A13C1	0180-0058	0		CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A13C2	0180-0228	8		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A13C3	0180-0049	9		CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A13C4	0180-2207	5		CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A13C5	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A13C6	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A13C7	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A13C8	0160-3459	9		CAPACITOR-FXD .02UF +-20% 100VDC CER	28480	0180-3459
A13C10	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A13C11	0180-0116	1		CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A13C12	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A13C13	0180-2210	0		CAPACITOR-FXD 2UF+50-10% 150VDC AL	56289	30D205F150BB2
A13C14	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A13C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C18	0180-0388	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0388
A13C17	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A13C18	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A13C19	0121-0059	7		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304324 2/8PF NPO
A13C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0180-2055
A13C22	0160-0386	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0386
A13C23	0160-0388	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0386
A13C24	0180-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C25	0180-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C28	0180-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C27	0180-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A13C28	0180-3459	9		CAPACITOR-FXD .02UF +-20% 100VDC CER	28480	0160-3459
A13C29	0160-0163	6	1	CAPACITOR-FXD .033UF +-10% 200VDC POLYE	28480	0160-0163
A13CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13CR8	0122-0284	8		DIODE-VVC 1N5148A 47PF 5% C4/C60-MIN=3.2	04713	1N5148A
A13CR9	0122-0282	6		DIODE-VVC 1N5147A 39PF 5% C4/C60-MIN=3.2	04713	1N5147A
A13CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13CR16	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A13L1	9100-1829	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A13L2	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .168DX.385LG	28480	9100-1629
A13L3	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A13L4	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .168DX.385LG	28480	9100-1629
A13L5	9100-2815	2		INDUCTOR 700NH 10% .342WX1.328LG Q=150	28480	9100-2815

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A13L6	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A13L7	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A13L8	9100-1674	9	1	INDUCTOR RF-CH-MLD 7.5MH 5% .25DX.75LG	28480	9100-1874
A13Q1	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=800MHZ	28480	1854-0092
A13Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A13Q3	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A13Q4	1854-0087	5		TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A13Q5	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A13Q6	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A13Q7	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A13Q8	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A13Q9	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0081
A13Q10	1854-0087	5		TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A13Q11	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A13Q12	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A13Q13	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A13Q14	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A13Q15	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A13Q16	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	24480	1853-0036
A13R1	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A13R2	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A13R3	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1821-F
A13R4	0757-0426	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A13R5	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A13R6	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A13R7	0757-0426	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A13R8	0757-0426	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-1821-F
A13R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R10	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R12	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R15	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R16	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R17	0757-0479	2		RESISTOR 392K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-3923-F
A13R18	0757-0472	5		RESISTOR 200K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2003-F
A13R19	0757-0485	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A13R20	0698-3228	9		RESISTOR 49.9K 1% .125W F TC=0+-100	28480	0698-3228
A13R21	0757-0124	4	1	RESISTOR 39.2K 1% .125W F TC=0+-100	28480	0757-0124
A13R22	0757-0449	6	1	RESISTOR 20K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2002-F
A13R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R24	0698-4002	9		RESISTOR 5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5001-F
A13R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R26	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A13R27	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1211-F
A13R28	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A13R29	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2152-F
A13R30*	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A13R31	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/6-T0-4842-F
A13R32	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4841-F
A13R33	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-2611-F
A13R34	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A13R35	0698-4037	0		RESISTOR 46.4 1% .125W F TC=0+-100	24546	CT4-1/8-T0-46R4-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A13R36*	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A13R37	2100-1759	4		RESISTOR-TRMR 2K 5% WW SIDE-ADJ 1-TRN	28480	2100-1759
A13R39	2100-1780	7		RESISTOR-TRMR 5K 5% WW SIDE-ADJ 1-TRN	28480	2100-1780
A13R40	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A13R41	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A13R42	0757-0317	7		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1331-F
A13R43	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2152-F
A13R44	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R45	0757-0834	3		RESISTOR 5.62K 1% .5W F TC=0+-100	28480	0757-0834
A13R46	0698-3459	8		RESISTOR 383K 1% .125W F TC=0+-100	28480	0698-3459
A13R47	0698-0062	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A13R48	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A13R49	0698-3268	5		RESISTOR 237K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2373-F
A13R50	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A13R52	0757-0443	0		RESISTOR 11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1102-F
A13R53	0698-3266	5		RESISTOR 237K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2373-F
A13R54	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-348R-F
A13R55	0698-3243	8		RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A13R56	0698-3443	0		RESISTOR 267 1% .125W F TC=0+-100	24546	CT4-1/8-T0-267R-F
A13R57	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A13R58	0698-3243	8		RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A13R59	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A13R60*	0757-0463	4	2	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8252-F
A13R61	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A13R62	0683-8245	9		RESISTOR 820K 5% .25W FC TC=-800/+900	01121	CB8245
A13R63	0698-3243	8		RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A13R64	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A13R65	0757-0467	8		RESISTOR 121K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1213-F
A13R66	0698-3439	4		RESISTOR 176 1% .125W F TC=0+-100	24546	CT4-1/8-T0-176R-F
A13R67	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A13R68	0698-0062	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A13R69	0757-0464	5		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-9092-F
A13R70	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	CT4-1/8-T0-162R-F
A13R71	0757-0461	2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6812-F
A13R72	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A13R73	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A13R74	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A13R75	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-346R-F
A13R76	0757-0403	2		RESISTOR 121 1% .125W F TC=0+-100	24546	CT4-1/8-T0-121R-F
A13R77	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A13R78	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5112-F
A13R79	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A13R80	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A13R81*	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A13R82	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+-100	24546	CT4-1/8-T0-90R9-F
A13R83	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A13R84	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A13R85	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A13U1	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A13U2	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A13U3	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A14						
A14	08660-60011	9	1	BOARD ASSEMBLY, N2 PHASE DETECTOR	28480	08660-60011
A14C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C3	0180-0058	0		CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A14C4	0160-2206	4		CAPACITOR-FXD 80UF+-10% 8VDC TA	56289	150D606X9006B2
A14C5	0160-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A14C6	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A14C7	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A14C8	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A14C9	0160-0157	8		CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A14C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C11	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A14C12	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A14C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C14	0140-0172	5		CAPACITOR-FXD 3000PF +-1% 100VDC MICA	72136	DM19F302F0100WV1CR
A14C15	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C16	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A14C17	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A14C18	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A14C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A14C22	0160-3539	8		CAPACITOR-FXD 820PF +-5% 100VDC MICA	28480	0160-3539
A14C23	0160-2453	1		CAPACITOR-FXD .22UF +-10% 80VDC POLYE	28480	0160-2453
A14C24	0170-0040	9		CAPACITOR-FXD .047UF +-10% 200VDC POLYE	56289	292P47392
A14C25	0160-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A14C26	0160-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A14CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A14CR3	1901-0179	7	2	DIODE-SCHOTTKY 12V 100PS	28480	1901-0179
A14CR4	1901-0179	7	2	DIODE-SCHOTTKY 12V 100PS	28480	1901-0179
A14L1	9100-1829	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1829
A14L2	9140-0114	4		INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A14L3	9100-1829	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1829
A14L4	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A14L5	9140-0114	4		INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A14L6	9100-1814	7	1	INDUCTOR RF-CH-MLD 620NH 10%	28480	9100-1614
A14L7	9100-1650	1		INDUCTOR RF-CH-MLD 680UH 5% .2DX.45LG	28480	9100-1650
A14L8	9100-1852	3		INDUCTOR RF-CH-MLD 820UH 5% .2DX.45LG	28480	9100-1852
A14Q1	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A14Q2	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A14Q3	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A14Q4	1855-0049	1		TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0049
A14Q5	1854-0045	5		TRANSISTOR NPN SI TO-18 PD=500MW	28480	1854-0045
A14Q6	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A14Q7	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=800MHZ	28480	1854-0092

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A14R1	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C-1/8-T0-1332-F
A14R2	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A14R3	0757-0439	4		RESISTOR 6.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A14R4	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A14R5	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A14R6	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A14R7	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A14R8	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-T0-383R-F
A14R9	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A14R10	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A14R11	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A14R12	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A14R13	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4222-F
A14R14	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1622-F
A14R15	0698-3430	5		RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A14R16	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A14R17	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A14R18	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A14R19	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A14R20	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A14R21	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A14R22	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A14R23	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A14R24	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A14R25	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A14R26	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A14R27	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A14R28	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A14R29	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A14R30	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A14R31	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A14R32	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A14R33	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A14R34	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A14R35	0757-1094	9		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1471-F
A14R36	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/6-T0-511R-F
A14T1	08660-80001	9		TRANSFORMER, SAMPLER	26480	08660-80001
A14U1	1620-1213	0		IC FF TTL LS J-K NEG-EDGE-TRIG PRESET	01295	SN74LS113AN
A14U2	1620-1203	6		IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A14U3	1820-0469	6		IC FF TTL H J-K NEG-EDGE-TRIG	01295	SN74H102N
A14U4	1820-1213	0		IC FF TTL LS J-K NEG-EDGE-TRIG PRESET	01295	SN74LS113AN
A14U5	1620-0751	9		IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N
A14U6	1620-0751	9		IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N
A14U7	1620-0751	9		IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N
A14U8	1620-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A15						
A15	08660-60018	4	1	BOARD ASSEMBLY, SL1 DETECTOR	28480	08660-60016
A15C1	0160-2055	9	51	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A15C2	0150-0121	5	16	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C3	0160-0174	9	5	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A15C4	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A15C6	0180-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3458
A15C7	0180-0058	0	5	CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A15C8	0180-2207	5	2	CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A15C9	0180-0058	0		CAPACITOR-FXD 50UF+75-10% 25VDC AL	56269	30D506G025CC2
A15C10	0160-2261	9	2	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A15C11	0160-2261	9		CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	28480	0160-2261
A15C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28460	0160-2055
A15C13	0160-2204	0	4	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28460	0160-2204
A15C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A15C15	0160-0298	6	2	CAPACITOR-FXD 1500PF +-10% 200VDC POLYE	28480	0160-0298
A15C16	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28460	0150-0121
A15C17	0160-0298	8		CAPACITOR-FXD 1500PF +-10% 200VDC POLYE	28480	0160-0298
A15C18	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A15C19	0180-0291	3	3	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A15C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A15C21	0160-2206	4	1	CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A15C22	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28460	0160-0174
A15L1	9140-0179	1	11	INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28460	9140-0179
A15L2	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28460	9140-0179
A15L3	9140-0114	4	3	INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A15L4	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28460	9140-0179
A15L6	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A15L7	9100-1659	0	1	INDUCTOR RF-CH-MLD 1.8MH 5% .23DX.57LG	28480	9100-1659
A15L8	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .186DX.385LG	28480	9140-0179
A15Q1	1854-0092	2	20	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A15Q2	1853-0015	7	2	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A15Q3	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A15Q4	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A15Q5	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A15Q6	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A15R1	0698-3156	2	4	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A15R2	0698-0082	7	15	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4840-F
A15R3	0757-0379	1	1	RESISTOR 12.1 1% .125W F TC=0+-100	19701	MF4C1/8-T0-12R1-F
A15R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A15R6	0757-0260	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A15R7	0757-0421	4	5	RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A15R8	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-625R-F
A15R9	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4840-F
A15R10	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4840-F
A15R11	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A15R12	0757-0200	7	12	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A15R13	0698-3441	8	6	RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A15R14	2100-2633	5	3	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A15R15	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A15R16	0698-3150	8	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A15R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A15R18	0698-3155	1	6	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A15R19	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A15R20	0757-0424	7	4	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A15R21	0757-0417	6	1	RESISTOR 562 1% .125W F TC=0+-100	24546	CT4-1/8-T0-562R-F
A15R22	0698-3151	7	3	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2871-F
A15R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A15R24	0698-0064	9	3	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A15R25	0757-0401	0	10	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A15R26	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+-100	24546	CT3-1/8-T0-1001-F
A15R27	0757-0416	7	5	RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A15U1	1820-0054	5	10	IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A15U2	1820-0077	2	1	IC FF TTL D-TYPE POS-EDGE-TRIG CLEAR	01295	SN7474N
A15U3	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A15U4	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A15U5	1820-0751	9	4	IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N
A15U6	1820-0751	9		IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N
A15U7	1820-0068	1	1	IC GATE TTL NAND TPL 3-INP	01295	SN7410N
A15U8	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A15U9	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A15U10	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A16						
A16	08660-60009	5	1	BOARD ASSEMBLY, N1 PHASE DETECTOR	28480	08660-60009
A16C1	0180-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C2	0180-0058	0		CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A16C3	0160-2206	4	1	CAPACITOR-FXD 80UF+-10% 6VDC TA	56289	150D606X9006B2
A16C4	0180-0228	6	5	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A16C5	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C7	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C8	0160-0297	7	1	CAPACITOR-FXD 1200PF +-10% 200VDC POLYE	28480	0160-0297
A16C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C10	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C11	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C13	0160-0937	2	1	CAPACITOR-FXD 1000PF +-2% 300VDC MICA	28480	0160-0937
A16C14	0160-3459	9	2	CAPACITOR-FXD .02UF +-20% 100VDC CER	28480	0160-3459
A16C15	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C16	0160-0197	6	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A16C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C18	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A16C19	0180-0226	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A16C20	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A16C22	0160-3539	6	1	CAPACITOR-FXD 620PF +-5% 100VDC MICA	28480	0160-3539
A16C23	0160-1746	5	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A16C24	0180-0229	7	6	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A16C25	0160-3459	9		CAPACITOR-FXD .02UF +-20% 100VDC CER	28480	0160-3459
A16C26	0160-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A16C27	0160-0134	1	2	CAPACITOR-FXD 220PF +-5% 300VDC MICA	28480	0160-0134
A16C28	0160-2307	4		CAPACITOR-FXD 47PF +-5% 300VDC MICA	28480	0160-2307
A16C29	0160-0302	5	1	CAPACITOR-FXD .016UF +-10% 200VDC POLYE	28480	0160-0302
A16C30	0160-0945	2	2	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0180-0945
A16C31	0140-0200	0	1	CAPACITOR-FXD 390PF +-5% 300VDC MICA	72136	DM15F391J0300WV1CR
A16CR1	1902-3104	6	1	DIODE-ZNR 5.62V 5% DO-35 PD=.4W	28480	1902-3104
A16CR2	1901-0040	1	34	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A16CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A16CR4	1901-0179	7	2	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A16CR5	1901-0179	7		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A16CR6	1902-0025	4	1	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.06%	28480	1902-0025
A16L1	9100-1829	4	10	INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A16L2	9140-0114	4		INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A16L3	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A16L4	9100-1614	7	1	INDUCTOR RF-CH-MLD 620NH 10%	28480	9100-1614
A16L5	08660-80017	7	2	INDUCTOR ASSEMBLY	28480	08660-80017
A16L6	08660-80018	8		INDUCTOR ASSEMBLY	28480	08660-80017

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A16Q1	1853-0034	0	2	TRANSISTOR PNP SI TO-18 PD=380MW	28480	1853-0034
A16Q2	1853-0034	0		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A16Q3	1855-0597	4	1	TRANSISTOR J-FET P-CHAN D-MODE TO-92 SI	28480	1855-0597
A16Q4	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A16Q5	1853-0459	3		TRANSISTOR PNP SI PD=625MW FT=200MHZ	28480	1853-0459
A16Q6	1854-0045	5	1	TRANSISTOR NPN SI TO-18 PD=500MW	28480	1854-0045
A16R1	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R2*	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A18R3	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-4641-F
A16R4	0696-0062	7		RESISTOR 464 1% .125W F TC=0+-100	24548	CT4-1/6-T0-4640-F
A16R5	0757-1092	7	1	RESISTOR 267 1% .5W F TC=0+-100	28480	0757-1092
A16R6	0757-0289	2	3	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/6-T0-1332-F
A16R7	0757-0439	4	2	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A16R8	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R9	0757-0420	3	4	RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A16R10	0698-0085	0	5	RESISTOR 2.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A16R11	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/6-T0-511R-F
A16R12	0757-0442	9	41	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R13	0698-3446	3	2	RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/6-T0-383R-F
A16R14	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A16R15	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R16	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A18R17	0757-0418	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A16R18	0698-3450	9	2	RESISTOR 42.2K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-4222-F
A16R19	0757-0447	4	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1822-F
A18R20	0698-3430	5	1	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A16R21	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-1101-F
A18R22	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24548	CT4-1/8-T0-825R-F
A16R23	0698-3447	4	5	RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A16R24	0757-0279	0	8	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A16R25	0696-3153	9	3	RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3831-F
A16R26	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A16R27	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A16R28	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A16R29	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A16R30	0757-0394	0	4	RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A16R31	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/6-T0-51R1-F
A16R32	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A16R33	0698-3162	0	3	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/6-T0-4642-F
A16R34	0698-3450	9		RESISTOR 42.2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4222-F
A16R35	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A16R36	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A16R37	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A16R38	2100-1760	7	3	RESISTOR-TRMR 5K 5% WW SIDE-ADJ 1-TRN	28480	2100-1760
A16R39	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A16R40	0757-0274	5	3	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1211-F
A16R41	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A16R42	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	CT4-1/6-T0-1471-F
A16R43	0698-3158	4	1	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2372-F
A16R44	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A16R45	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A16R46	0757-0440	7	2	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A16R47	0757-0441	6	4	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A16T1	08660-80001	9	1	TRANSFORMER. SAMPLER	28480	08660-80001
A16TP1	1251-0600	0	8	CONNECTOR-SGL CONT PIN 1.14-IN-BSC-SZ SQ	28480	1251-0600
A16TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-IN-BSC-SZ SQ	28480	1251-0600
A16TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-IN-BSC-SZ SQ	28480	1251-0600
A16TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-IN-BSC-SZ SQ	28480	1251-0600
A16TP5	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-IN-BSC-SZ SQ	28480	1251-0600
A16TP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-IN-BSC-SZ SQ	28480	1251-0600
A16TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-IN-BSC-SZ SQ	28480	1251-0600
A16TP8	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-IN-BSC-SZ SQ	28480	1251-0600
A16U1	1820-0056	9	1	IC OP AMP GP TO-99 PKG	24046	T0A 2709V
A16U2	1820-1213	0		IC FF TTL LS J-K NEG-EDGE-TRIG PRESET	01295	SN74LS113AN
A16U3	1820-1213	0		IC FF TTL LS J-K NEG-EDGE-TRIG PRESET	01295	SN74LS113AN
A16U4	1820-0469	8	1	IC FF TTL H J-K NEG-EDGE-TRIG	01295	SN74H102N
A16U5	1820-0751	9		IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N
A16U6	1820-0751	9		IC CNTR TTL DECD NEG-EDGE-TRIG PRESET	01295	SN74196N
A16U7	1820-1203	8	2	IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
				A16 MISCELLANEOUS		
A16MP1	08660-20155	8	2	INDUCTOR SHIELD	28480	08660-20155

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A17						
A17	08660-60010	8	1	BOARD ASSY, N1 OSCILLATOR	28480	08660-60010
A17C1	40180-0058	2	1		28480	40180-0058
A17C2	0180-2215	5	1	CAPACITOR-FXD 170UF+75-10% 15VDC AL	56289	30D177G015DD2
A17C3	0180-0049	9	4	CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A17C4	0180-1704	5	2	CAPACITOR-FXD 47UF+-10% 6VDC TA	56289	150D478X9006B2
A17C5	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A17C6	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A17C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C8	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A17C9	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D228X9015B2
A17C10	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A17C11	0180-0183	2	2	CAPACITOR-FXD 10UF+75-10% 50VDC AL	56289	30D106G050CB2
A17C12	0180-0374	3	1	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A17C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C14	0160-3047	1	1	CAPACITOR-FXD 3280PF +-1% 100VDC MICA	28480	0160-3047
A17C15	0160-0386	5	6	CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0386
A17C16	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C17	0121-0059	7	2	CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304324 2/8PF NPO
A17C18	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A17C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C20	0160-0301	4	3	CAPACITOR-FXD .012UF +-10% 200VDC POLYE	28480	0160-0301
A17C21	0160-3092	6	1	CAPACITOR-FXD 1600PF +-1% 100VDC MICA	28480	0160-3092
A17C23	0160-0386	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0386
A17C24	0160-0386	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0386
A17C25	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C26	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C27	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C28	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C29	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C30	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C31	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C32	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C33	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A17C34	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C35	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C36	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17C37	0160-0162	5	1	CAPACITOR-FXD .022UF +-10% 200VDC POLYE	28480	0160-0162
A17C38	0140-0210	2	1	CAPACITOR-FXD 270PF +-5% 300VDC MICA	72138	DM15F271J0300WV1CR
A17C39	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A17CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A17CR6	0122-0264	8	2	DIODE-VVC 1N5148A 47PF 5% C4/C60-MIN=3.2	04713	1N5148A
A17CR7	0122-0282	6	2	DIODE-VVC 1N5147A 39PF 5% C4/C60-MIN=3.2	04713	1N5147A
A17CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR16	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17CR17	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A17L1	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .188DX.385LG	28480	9100-1629
A17L2	9100-2582	8	2	INDUCTOR RF-CH-MLD 100UH 10%	28480	9100-2582
A17L3	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A17L4	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .188DX.385LG	28480	9100-1629
A17L5	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .188DX.385LG	28480	9140-0179
A17L6	9100-2815	2	2	INDUCTOR 700NH 10% .342WX1.328LG Q=150	28480	9100-2815
A17L7	9100-1852	3	1	INDUCTOR RF-CH-MLD 820UH 5% .2DX.45LG	28480	9100-1852
A17L8	9100-2566	0	1	INDUCTOR RF-CH-MLD 270UH 10%	28480	9100-2566
A17L9	9100-2568	2	1	INDUCTOR RF-CH-MLD 390UH 10%	28480	9100-2568
A17Q1	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A17Q2	1853-0451	5	8	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A17Q3	1854-0345	8	2	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A17Q4	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=380MW	01295	2N3799
A17Q5	1855-0081	1	2	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0081
A17Q6	1854-0087	5	3	TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A17Q7	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A17Q8	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A17Q9	1854-0087	5		TRANSISTOR NPN SI PD=380MW FT=75MHZ	28480	1854-0087
A17Q10	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A17Q11	1853-0036	2	25	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q12	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q13	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q14	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q15	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A17Q16	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q17	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q18	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17Q19	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A17R1	0757-0428	1	8	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A17R2	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A17R3	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A17R4	0757-0426	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A17R5	0757-0426	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1821-F
A17R6	0757-0426	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1821-F
A17R7	0757-0426	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1821-F
A17R8	0757-0428	1		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1621-F
A17R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A17R10	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A17R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A17R12	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A17R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A17R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A17R15	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A17R16	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A17R17	0757-0479	2	2	RESISTOR 392K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-3923-F
A17R18	0757-0472	5	2	RESISTOR 200K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2003-F
A17R19	0757-0485	6	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A17R20	0698-3228	9	2	RESISTOR 49.9K 1% .125W F TC=0+-100	28480	0698-3228
A17R21	0757-0124	4	1	RESISTOR 39.2K 1% .125W F TC=0+-100	28480	0757-0124
A17R22	0757-0449	8	1	RESISTOR 20K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2002-F
A17R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A17R24	0698-4002	9	1	RESISTOR 5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5001-F
A17R25	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A17R26	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A17R27	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2811-F
A17R28	2100-1760	7		RESISTOR-TRMR 5K 5% WW SIDE-ADJ 1-TRN	28480	2100-1760
A17R29*	0698-3158	2		RESISTOR 14.7K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1472-F
A17R30	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1211-F
A17R31	2100-1759	4	2	RESISTOR-TRMR 2K 5% WW SIDE-ADJ 1-TRN	28480	2100-1759
A17R32*	0757-0290	5	2	RESISTOR 8.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A17R33	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A17R34	0757-0199	3	2	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2152-F
A17R35	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2811-F
A17R36	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A17R37	0698-4037	0	1	RESISTOR 46.4 1% .125W F TC=0+-100	24548	CT4-1/8-T0-48R4-F
A17R38	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4842-F
A17R39	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A17R40	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A17R41	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A17R42	0757-0834	3	2	RESISTOR 5.62K 1% .5W F TC=0+-100	28480	0757-0834
A17R43	0757-0317	7	4	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1331-F
A17R44	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2152-F
A17R45	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A17R46	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24548	CT4-1/8-T0-215R-F
A17R47	0698-3459	8	2	RESISTOR 383K 1% .125W F TC=0+-100	28480	0698-3459
A17R48	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A17R49	0757-0835	4	1	RESISTOR 6.81K 1% .5W F TC=0+-100	28480	0757-0835
A17R50	0698-3268	5	4	RESISTOR 237K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2373-F
A17R51	0698-3440	7	8	RESISTOR 196 1% .125W F TC=0+-100	24548	CT4-1/8-T0-196R-F
A17R52	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A17R53	0698-3266	5		RESISTOR 237K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2373-F
A17R54	0698-3445	2	4	RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-348R-F
A17R55	0698-3243	8	6	RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A17R56	0698-3443	0	4	RESISTOR 287 1% .125W F TC=0+-100	24546	CT4-1/8-T0-287R-F
A17R57	0698-3243	8		RESISTOR 178K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-1783-F
A17R58	0698-3132	4	4	RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A17R59	0757-0466	7	2	RESISTOR 110K 1% .125W F TC=0+-100	24548	CT4-1/8-T0-1103-F
A17R60	0883-8245	9	2	RESISTOR 820K 5% .25W FC TC=-800/+900	01121	CB8245

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A17R61	0698-3243	8		RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A17R62	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A17R63	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A17R64	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A17R65	0757-0467	8	2	RESISTOR 121K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1213-F
A17R66	0698-3439	4	2	RESISTOR 178 1% .125W F TC=0+-100	24546	CT4-1/8-T0-178R-F
A17R67	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A17R68	0698-3154	0	9	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A17R69	0757-0464	5	2	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-9092-F
A17R70	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-348R-F
A17R71	0757-0405	4	2	RESISTOR 162 1% .125W F TC=0+-100	24546	CT4-1/8-T0-162R-F
A17R72	0757-0481	2	2	RESISTOR 66.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6812-F
A17R73	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	24546	CT4-1/8-T0-121R-F
A17R74	0698-3444	1	10	RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A17R75	0698-3437	2	2	RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A17R76	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5112-F
A17R77	0698-3442	9	4	RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A17R78	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A17R79	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A17R80	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R81	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A17R82	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A17R83	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A17R84	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/6-T0-318R-F
A17R85	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-318R-F
A17R86	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A17R87	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A17R88	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-318R-F
A17R89	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A17R90	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A17R91	0698-3433	8	2	RESISTOR 26.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-2BR7-F
A17R92	0698-3432	7	1	RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A17R93	0698-3433	8		RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-2BR7-F
A17R94	0696-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A17R95	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A17R96	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R97	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3631-F
A17R98	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A17R99	0698-3441	6		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A17U1	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A17U2	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A18						
A18	08660-60015	3	1	BOARD ASSY, SL1 MIXER	28480	08680-80015
A18C1	0180-1704	5		CAPACITOR-FXD 47UF+-10% 8VDC TA	58289	150D476X9006B2
A18C3	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C5	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A18C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C8	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C10	0180-0301	4		CAPACITOR-FXD .012UF +-10% 200VDC POLYE	28480	0180-0301
A18C11	0160-0301	4		CAPACITOR-FXD .012UF +-10% 200VDC POLYE	28480	0180-0301
A18C12	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A18C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C14	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C15	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A18C18	0180-2214	4	2	CAPACITOR-FXD 90UF+75-10% 18VDC AL	58289	30D906G018CC2
A18C17	0160-2327	8	1	CAPACITOR-FXD 1000PF +-20% 100VDC CER	51842	150-110-X5R-102M
A18C19	0180-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A18C20	0180-0141	2	2	CAPACITOR-FXD 50UF+75-10% 50VDC AL	58289	30D506G050DD2
A18C21	0180-1819	3	1	CAPACITOR-FXD 100UF+75-10% 50VDC AL	56289	30D107G050DH2
A18C22	0180-0141	2		CAPACITOR-FXD 50UF+75-10% 50VDC AL	58289	30D506G050DD2
A18CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A18CR2	1901-0518	8	1	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A18E1	0955-0292	7	1	MIXER, DC-600MHZ	28480	0955-0292
A18L1	9100-1829	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1829
A18L2	9140-0114	4		INDUCTOR RF-CH-MLD 10UH 10% .166DX.385LG	28480	9140-0114
A18L3	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A18L4	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A18L5	9100-1621	6	1	INDUCTOR RF-CH-MLD 18UH 10% .166DX.385LG	28480	9100-1621
A18L8	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A18Q1	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A18Q2	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A18Q3	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A18Q4	1854-0087	5		TRANSISTOR NPN SI PD=380MW FT=75MHZ	28480	1854-0087
A18Q5	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q6	1853-0038	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q7	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q8	1853-0038	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q9	1853-0038	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q10	1853-0038	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q11	1853-0038	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0038
A18Q12	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q13	1853-0038	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q14	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A18Q15	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A18Q16	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q17	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q18	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=800MHZ	28480	1854-0092
A18Q19	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q20	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q21	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q22	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q23	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18Q24	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A18R1	0698-0083	8	17	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R2	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A16R3	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A16R4	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R5	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R6	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R7	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A16R8	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A16R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R10	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R12	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R15	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R16	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R17	0757-0479	2		RESISTOR 392K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-3923-F
A18R18	0757-0472	5		RESISTOR 200K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2003-F
A18R19	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A16R20	0698-3226	9		RESISTOR 49.9K 1% .125W F TC=0+-100	28480	0698-3226
A16R21	0683-3955	6	1	RESISTOR 3.9M 5% .25W FC TC=-900/+1100	01121	CB3955
A18R22	0683-2055	7	1	RESISTOR 2M 5% .25W FC TC=-900/+1100	01121	CB2055
A16R23	0683-1055	5	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A18R24	0696-3283	2	1	RESISTOR 500K 1% .125W F TC=0+-100	28480	0696-3283
A18R25	0696-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A16R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R27	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A18R28	0696-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A16R29	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A18R30	0696-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A16R31	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A18R32	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A18R33	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R34	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R35	2100-2574	3	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A16R36	0698-3155	1		RESISTOR 4.84K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4841-F
A16R37	0699-0295	6		RESISTOR 484 1% .125W F TC=0+-100	28480	0699-0295
A18R38	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R39	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R40	2100-2574	3		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A18R41	0698-3258	5	1	RESISTOR 5.36K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5361-F
A18R42	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R43	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R44	2100-2633	5		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A18R45	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A18R46	0757-0399	5	2	RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A18R47	0757-0400	9	1	RESISTOR 90.9 1% .125W F TC=0+-100	24546	CT4-1/8-T0-90R9-F
A18R48	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A18R49	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R50	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R51	2100-2633	5		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A18R52	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A18R53	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R54	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R55	2100-2521	0	2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A18R56	0699-0294	5	3	RESISTOR 9.09K 1% .125W F TC=0+-100	28480	0699-0294
A18R57	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A18R58	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2871-F
A18R59	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2871-F
A18R60	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R61	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R62	2100-2521	0		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A18R63	0757-0444	1	2	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A18R64	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-348R-F
A18R65	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R66	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R67	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R68	2100-2489	9	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	30983	ET50X502
A18R69	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1782-F
A18R70	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A18R71	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3161-F
A18R72	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1961-F
A18R73	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A18R74	2100-2522	1	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A18R75	0757-0123	3	1	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A18R76	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A18R77	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A18R78	0699-0282	1		RESISTOR 2.61K 1% .125W F TC=0+-100	28480	0699-0282
A18R79	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A18R80	0699-0294	5	3	RESISTOR 9.09K 1% .125W F TC=0+-100	28480	0699-0294
A18R81	0699-0295	6		RESISTOR 464 1% .125W F TC=0+-100	28480	0699-0295
A18R82	0899-0282	1		RESISTOR 2.61K 1% .125W F TC=0+-100	28480	0699-0282
A18R83	0699-0295	6		RESISTOR 464 1% .125W F TC=0+-100	28480	0699-0295
A18R84	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A18R85	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A18R86	0757-0260	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A18R87	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A18U1	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A18U2	1820-0054	5		IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A18U3	1820-0214	9	1	IC DCDR TTL BCD-TO-DEC 4-TO-10-LINE	01295	SN7442AN

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A19						
A19	08660-60017	5	1	BOARD ASSY, SL1 OSCILLATOR	28480	08660-60017
A19C1	0180-0049	9		CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A19C2	0180-0058	0		CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A19C3	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A19C4	0180-0228	8		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D228X9015B2
A19C5	0160-0945	2		CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A19C6	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A19C7	0180-2214	4		CAPACITOR-FXD 90UF+75-10% 18VDC AL	56289	30D906G016CC2
A19C8	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A19C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C10	0160-0161	4	2	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A19C11	0180-2030	0	1	CAPACITOR-FXD 1200PF +-5% 500VDC MICA	28480	0160-2030
A19C12	0160-0161	4		CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A19C13	0160-0386	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0386
A19C14	0170-0082	9	2	CAPACITOR-FXD .01UF +-20% 50VDC POLYE	84411	601PE1030R5W1
A19C15	0180-0049	9		CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A19C16	0180-0183	2		CAPACITOR-FXD 10UF+75-10% 50VDC AL	56289	30D106G050CB2
A19C17	0170-0082	9		CAPACITOR-FXD .01UF +-20% 50VDC POLYE	84411	601PE1030R5W1
A19C18	0121-0059	7		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	52763	304324 2/8PF NPO
A19C19	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0180-2204
A19C20	0160-0386	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0386
A19C21	0160-0386	5		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0160-0386
A19C22	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C23	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C24	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C25	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C26	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C27	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C28	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C29	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C30	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C31	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C32	0140-0195	2	1	CAPACITOR-FXD 130PF +-5% 300VDC MICA	72136	DM15F131J0300WV1CR
A19C33	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A19C34	0160-2202	8	1	CAPACITOR-FXD 75PF +-5% 300VDC MICA	28480	0160-2202
A19C35	0160-2200	6	1	CAPACITOR-FXD 43PF +-5% 300VDC MICA	28480	0160-2200
A19C36	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A19C37	0160-0157	8	1	CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A19C38	0160-0184	7	1	CAPACITOR-FXD .039UF +-10% 200VDC POLYE	28480	0160-0184
A19C39	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0180-2204
A19CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A19CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR12	0122-0284	6		DIODE-VVC 1N5146A 47PF 5% C4/C60-MIN=3.2	04713	1N5146A
A19CR13	0122-0282	6		DIODE-VVC 1N5147A 39PF 5% C4/C60-MIN=3.2	04713	1N5147A
A19CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19CR16	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19L1	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A19L2	9100-2562	6		INDUCTOR RF-CH-MLD 100UH 10%	28480	9100-2562
A19L3	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A19L4	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A19L5	9100-2572	8	1	INDUCTOR RF-CH-MLD 620UH 10%	28480	9100-2572
A19L6	9100-2815	2		INDUCTOR 700NH 10% .342WX1.328LG Q=150	28480	9100-2815
A19L7	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A19L8	9140-0179	1		INDUCTOR RF-CH-MLD 22UH 10% .166DX.385LG	28480	9140-0179
A19L9	9100-1611	4	2	INDUCTOR RF-CH-MLD 220NH 20%	28480	9100-1611
A19L10	9100-1611	4		INDUCTOR RF-CH-MLD 220NH 20%	28480	9100-1611
A19Q1	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A19Q2	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A19Q3	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A19Q4	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0081
A19Q5	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A19Q6	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A19Q7	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A19Q8	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A19Q9	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A19Q10	1854-0022	8	1	TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A19R1	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2810-F
A19R2	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A19R3	2100-1760	7		RESISTOR-TRMR 5K 5% WW SIDE-ADJ 1-TRN	28480	2100-1760
A19R4	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5112-F
A19R5	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A19R6	0757-0460	1	1	RESISTOR 81.9K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6192-F
A19R8	0757-0461	2		RESISTOR 88.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6812-F
A19R9	2100-1759	4		RESISTOR-TRMR 2K 5% WW SIDE-ADJ 1-TRN	28480	2100-1759
A19R10	0757-0439	4		RESISTOR 8.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8811-F
A19R11	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A19R12	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	CT4-1/8-T0-162R-F
A19R13	0757-0484	5		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-9092-F
A19R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A19R15	0698-3439	4		RESISTOR 178 1% .125W F TC=0+-100	24546	CT4-1/8-T0-178R-F
A19R16	0757-0467	8		RESISTOR 121K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1213-F
A19R17	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A19R18	0757-0468	7		RESISTOR 110K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1103-F
A19R19	0757-0834	3		RESISTOR 5.62K 1% .5W F TC=0+-100	28480	0757-0834
A19R20	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2810-F
A19R21	0698-3243	8		RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A19R22	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	CT4-1/8-T0-287R-F
A19R23	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A19R24	0698-3440	7		RESISTOR 198 1% .125W F TC=0+-100	24546	CT4-1/8-T0-198R-F
A19R25	0698-3243	8		RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A19R26	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-348R-F
A19R27	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3181-F
A19R28	0698-3266	5		RESISTOR 237K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2373-F
A19R29	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A19R30	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A19R31	0698-3266	5		RESISTOR 237K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2373-F
A19R32	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A19R33	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A19R34	0698-3459	8		RESISTOR 383K 1% .125W F TC=0+-100	28480	0698-3459
A19R35	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4642-F
A19R36	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1962-F
A19R37	0757-0286	1		RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A19R38	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A19R39	0757-0317	7		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1331-F
A19R40	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A19R41	0683-6245	9		RESISTOR 620K 5% .25W FC TC=-800/+900	01121	CB6245
A19R42	0698-3243	8		RESISTOR 178K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1783-F
A19R43	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-T0-383R-F
A19R44	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A19R45	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A19R46	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A19R47	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A19R48	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A19R49	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A19R50	0698-3440	7		RESISTOR 196 1% .125W F TC=0+-100	24546	CT4-1/8-T0-196R-F
A19R51	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A19R52	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A19R53	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5621-F
A19R54	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4221-F
A19R55*	0757-0280	3	14	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R56	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A19R57	0698-3447	4		RESISTOR 422 1% .125W F TC=0+-100	24546	CT4-1/8-T0-422R-F
A19R58	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A19R59	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A19R60	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A19R61	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A19R62	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A19R63	0757-0180	2	1	RESISTOR 31.6 1% .125W F TC=0+-100	28480	0757-0180
A19R64	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A19R65	0698-3443	0		RESISTOR 267 1% .125W F TC=0+-100	24546	CT4-1/8-T0-287R-F
A19R66	0757-0294	9	1	RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A19R67	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	CT4-1/8-T0-287R-F
A19R68	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A19R69	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1211-F
A19R70	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A19R71	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3631-F
A19R72	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A20						
A20	08660-60390	7	1	RECTIFIER ASSEMBLY (INCLUDES ALL A20 PARTS EXCEPT A20C1-3, A20C6; CHASSIS PARTS CR2, CR3, AND MISCELLANEOUS PARTS NOT PERMANENTLY ATTACHED TO THE CIRCUIT BOARD)	28480	08660-60384
A20	08660-80335	7	1	RECTIFIER ASSEMBLY (INCLUDES ALL A20 PARTS INCLUDING A20C1-3, A20C6 AND CHASSIS PARTS CR2, CR3,)	28480	08660-60384
A20C1	0180-2530	7	1	CAPACITOR-FXD 3900UF+75-10% 50VDC AL	28480	0180-2530
A20C2	0180-2397	4	1	CAPACITOR-FXD .018F+75-10% 25VDC AL	56289	38D183G025BB2B
A20C3	0180-2389	0	1	CAPACITOR-FXD 3600UF+75-10% 40VDC AL	00853	500362U040AB2B
A20C4	0180-2844	4	2	CAPACITOR-FXD 470UF +100-10% 50VDC AL	56289	500D477H050F17
A20C5	0180-2844	4		CAPACITOR-FXD 470UF +100-10% 50VDC AL	56289	500D477H050F17
A20C6	0180-2334	9	1	CAPACITOR-FXD 3900UF+75-10% 75VDC AL	56289	38D392F075BB2B
A20C7	0180-2154	1	1	CAPACITOR-FXD 1900UF+75-10% 15VDC AL	28480	0180-2154
A20C8	0180-0058	0		CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A20C9	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	58289	150D336X9010B2
A20C10	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	58289	150D228X9015B2
A20C11	0180-0049	9		CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A20C12	0180-2661	5		CAPACITOR-FXD 1UF+10% 50VDC TA	25088	DIROGS1A5OK
A20C13	0180-2661	5		CAPACITOR-FXD 1UF+10% 50VDC TA	25088	DIROGS1A5OK
A20CR1-3				NOT ASSIGNED		
A20CR4	1901-0638	3	3	DIODE-FW BRDG 100V 4A	04713	MDA-970-2
A20CR5	1901-0638	3		DIODE-FW BRDG 100V 4A	04713	MDA-970-2
A20CR6	1901-0638	3		DIODE-FW BRDG 100V 4A	04713	MDA-970-2
	1251-2772	1		CONNECTOR-SGL CONT SKT .052-IN-BSC-SZ	28480	1251-2772
A20CR7	1884-0024	3	1	THYRISTOR-SCR VRRM=200	28480	1884-0024
A20CR8	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A20F1	2110-0523	9	1	FUSE 10A 32V NTD 1.25X.25	75915	311010
A20F2	2110-0332	8	7	FUSE 3A 125V .25X.27	28480	2110-0332
A20F3	2110-0332	8		FUSE 3A 125V .25X.27	28480	2110-0332
A20F4	2110-0332	8		FUSE 3A 125V .25X.27	28480	2110-0332
A20F5	2110-0332	8		FUSE 3A 125V .25X.27	28480	2110-0332
A20F6	2110-0332	8		FUSE 3A 125V .25X.27	28480	2110-0332
A20F7	2110-0332	8		FUSE 3A 125V .25X.27	28480	2110-0332
A20F8	2110-0332	8		FUSE 3A 125V .25X.27	28480	2110-0332
A20Q1	1855-0517	8		TRANSISTOR MOSFET P-CHAN E-MODE TO-220	28480	1855-1517
A20Q2	1855-0645	3		TRANSISTOR MOSFET N-CHAN E-MODE TO-220	28480	1855-0845
A20Q3	1855-0492	8		TRANSISTOR MOSFET N-CHAN E-MODE TO-220	28480	1855-0492
A20Q4	1855-0492	8		TRANSISTOR MOSFET N-CHAN E-MODE TO-220	28480	1855-0492
A20Q5	1854-0813	5		TRANSISTOR NPN 2N3501S SI TO-39 PD=1W	02037	1854-0813
A20R1	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A20R2	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A20R3	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A20R4	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A20R5	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A20R6	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A20R7	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-TO-1002-F
A20R8	0698-3157	3		RESISTOR 19.8K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1982-F
A20R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A20R10	0698-3157	3		RESISTOR 19.6K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1962-F
A20R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A20R12	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A20R13	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	CT4-1/8-T0-1332-F
A20R14	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5112-F
A20R15	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A20R16	0757-0747	7		RESISTOR 5.11K 1% .25W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A20R17	0698-7267	1		RESISTOR 19.6K 1% .05W F TC=0+-100	24546	CT4-1/8-T0-1962-F
A20U1	1826-0423	4		IC V RGLTR TO-3	27014	1826-0423
A20XA5	1251-1626	2	1	CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	28480	1251-1626
				A20 MISCELLANEOUS		
A20MP1	0360-0009	3	3	TERMINAL-SLDR LUG PL-MTG FOR-#6-SCR (A23 TO A20, AND A20 TO FRAME)	28480	0360-0009
A20MP2	2680-0099	1	8	SCREW-MACH 10-32 .375-IN-LG PAN-HD-POZI (ATTACH A20C1, C2, C3, C8 TO A20)	00000	ORDER BY DESCRIPTION
A20MP3	4040-0554	9	1	CAPACITOR COVER (FOR A20C1, C2, C3, C6)	28480	4040-0554
A20MP4	0360-0053	7	5	TERMINAL-SLDR LUG LK-MTG FOR-#10-SCR (FOR A20C1, C2, C3)	28480	0360-0053
A20MP5	0360-0001	5	1	TERMINAL-SLDR LUG LK-MTG FOR-#8-SCR (FOR A20C2)	28480	0360-0053
A20MP6	2190-0007	2	1	WASHER-LK INTL-T NO. 8 .141-IN-ID (FOR A20C2)	00000	ORDER BY DESCRIPTION
A20MP7	2190-0011	8	5	WASHER-LK INTL-T NO. 10 .195-IN-ID (FOR A20C1, C3, C8, CR7)	00000	ORDER BY DESCRIPTION
A20MP8	2190-0011	8	5	WASHER-LK INTL-T NO. 10 .195-IN-ID (FOR A20C1, C3, C6, CR7)	00000	ORDER BY DESCRIPTION
A20MP9	2740-0001	3	1	NUT-HEX-DBL-CHAM 10-32-THD .109-IN-THK (FOR CR7)	00000	ORDER BY DESCRIPTION
A20MP10	2110-0289	0	2	FUSEHOLDER-CLIP TYPE.25D-FUSE (FOR A20F1)	28480	2110-0289
A20MP11	1251-2313	8	14	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND (FOR A20F2 THRU F8: 2 EACH)	28480	1251-2313
A20MP12	1205-0888	7	2	HEAT SINK TO-220-CASE (UNDER A20Q1, Q2)	28480	1205-0888
A20MP13	2260-0001	5	2	NUT-HEX-DBL-CHAM 4-40-THD .094-IN-THK (ATTACH A20Q1, Q2 TO HEATSINK)	00000	ORDER BY DESCRIPTION
A20MP14	2190-0584	0	2	WASHER-LK HLCL 2.5 MM 2.6-MM-ID (FOR A20Q1, Q2)	00000	ORDER BY DESCRIPTION
A20MP15	3050-0105	6	8	WASHER-FL MTLC NO. 4 .125-IN ID (FOR A20Q1, Q2)	00000	ORDER BY DESCRIPTION

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A20MP16	2200-0143	0	2	SCEW-MACH 4-40 .375-IN-LG PAN-HD-POZI (ATTACH A20Q3, Q4 TO A20)	00000	ORDER BY DESCRIPTION
A20MP17	2260-0009	3	2	NUT-HEX-W/LKWSHR 4-40-THD .094-IN-THK (ATTACH A20Q3, Q4 TO A20)	00000	ORDER BY DESCRIPTION
A20MP18	2200-0107	6	2	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI (ATTACH A20U1 TO A20)	00000	ORDER BY DESCRIPTION
A20MP19	0340-0875	9	1	INSULATOR-XSTER THERM-CNDCT (UNDER A20U1)	28480	0348-0875
A20MP20	1205-0312	4	1	HEAT SINK SGL TO-3-CASE (UNDER A20U1)	28480	1205-0312
A20MP21	2420-0001	5	1	NUT-HEX-W/LKWSHR 6-32 .109-IN-THK (FOR A7 GROUND LUG)	00000	ORDER BY DESCRIPTION
A20MP22	2360-0210	0	2	SCREW-MACH 6-32 .625PIN LG 82 DEG (ATTACHES CR1, CR2 TO FRAME)	00000	ORDER BY DESCRIPTION
A20MP23	2420-0003	7	2	NUT-HEX-DBL CHAM 6-32-THD .094-IN-THK (ATTACHES CR1, CR2 TO FRAME)	00000	ORDER BY DESCRIPTION
A20MP24	3050-0010	1	2	WASHER-FL MTLC NO. 6 .147-IN-ID (FOR CR1, CR2)	00000	ORDER BY DESCRIPTION
A20MP25	2190-0018	5	2	WASHER-LK HLCL NO. 6 .141-IN-ID (FOR CR1, CR2)	00000	ORDER BY DESCRIPTION

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A21						
A21	0960-0151	8	1	OSCILLATOR-CRYSTAL 10 MHZ: STABILITY (EXCEPT OPT'S 001 AND 002)	28480	0960-0151
A21						
A21	0960-0150	7	1	OSCILLATOR-CRYSTAL 10 MHZ: STABILITY (OMIT A21 ASSY FOR OPT 002)	28480	0960-0150

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A22						
A22	08660-60320	3	1	SWITCH ASSY, REFERENCE	28480	08660-60320
A22C1	0160-2437	1	5	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A22C2				NOT ASSIGNED		
A22C3	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A22C4	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A22C5	0160-2437	1		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A22J1	1250-0901	2	3	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A22J2	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A22J3	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
A22J4	1250-0901	2		CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0901
				A22 MISCELLANEOUS		
	08660-20051	3	1	HOUSING, REFERENCE SWITCH	28480	08660-20051
	08660-00009	9		COVER, SWITCH HOUSING	28480	08660-00009
	08660-00113	1		DAMPING PAD (FOAM)	28480	08660-00113

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A22A1						
A22A1	08660-60323	6	1	10 MHZ FILTER ASSEMBLY	28480	08660-60323
	08660-60319	0	1	10 MHZ FILTER BOARD ASSEMBLY (INCLUDES ALL A22A1 PARTS EXCEPT W1, Y1, AND	28480	08660-60319
A22A1C1	0160-0575	4	6	CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A22A1C2	0160-2264	2	1	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A22A1C3	0121-0446	6	1	CAPACITOR-V TRMR-CER 4.5-20PF 160V	28480	0121-0446
A22A1C4	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A22A1C5	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A22A1C6	0160-2207	5		CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2
A22A1C7	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A22A1C8	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A22A1C9	0160-0575	4		CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A22A1K1	0490-0916	6	6	RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A22A1L1	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX.385LG	28480	9100-1629
A22A1L2	9140-0237	2	1	INDUCTOR RF-CH-MLD 200UH 5% .166DX.385LG	28480	9140-0237
A22A1Q1	1854-0019	3	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A22A1Q2	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A22A1R1	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A22A1R2	2100-3053	5	1	RESISTOR-TRMR 20 20% C SIDE-ADJ 17-TRN	02111	43P200
A22A1R3	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22A1R4	0757-0317	7		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1331-F
A22A1R5	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A22A1R6	2100-2010	2	1	RESISTOR-TRMR 10 20% C TOP-ADJ 1-TRN	73138	62PR10
A22A1R7	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A22A1R8	0757-0317	7		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1331-F
A22A1R9	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22A1W1	08660-60083	5	1	CABLE ASSEMBLY, COAX, GRAY	26480	08660-60083
A22A1Y1	0410-0649	4	1	CRYSTAL-QUARTZ 10.0000 MHZ	28480	0410-0649
A22A1Z1	9170-0029	3	2	CORE-SHIELDING BEAD	28480	9170-0029
A22A1Z2	9170-0029	3		CORE-SHIELDING BEAD	28480	9170-0029
				A22A1 MISCELLANEOUS		
	1200-0173	5	1	INSULATOR-XSTR DAP-GL (FOR A22A1Y1)	28480	1200-0173
	1251-2194	1	3	CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ (FOR A22A1Y1)	26480	1251-2194

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A22A2						
A22A2	08660-60026	6	1	BOARD ASSY, REFERENCE AMPLIFIER SWITCH	28480	08660-60026
A22A2C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22A2C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22A2C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22A2C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22A2C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22A2C6	0160-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A22A2C7	0160-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A22A2C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A22A2C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28460	0160-2055
A22A2CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22A2CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A22A2K1	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A22A2K2	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A22A2K3	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A22A2L1	9140-0118	8	1	INDUCTOR RF-CH-MLD 500UH 5% .2DX.45LG	28480	9140-0118
A22A2L2	9140-0144	0	1	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.28LG	28480	9140-0144
A22A2Q1	1854-0071	7	2	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22A2Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22A2Q3	1853-0020	4	1	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A22A2R1	0698-7227	8	1	RESISTOR 422 1% .05W F TC=0+-100	24548	CT3-1/8-TO-422R-F
A22A2R2	0698-7222	1	2	RESISTOR 261 1% .05W F TC=0+-100	24548	CT3-1/8-TO-261R-F
A22A2R3	0698-7240	3	1	RESISTOR 1.47K 1% .05W F TC=0+-100	24548	CT3-1/8-T0-1471-F
A22A2R4	0698-7248	1	1	RESISTOR 3.16K 1% .05W F TC=0+-100	24548	CT3-1/8-T0-3161-F
A22A2R5	0698-7222	1		RESISTOR 261 1% .05W F TC=0+-100	24548	CT3-1/8-TO-261R-F
A22A2R6	0698-7212	9	1	RESISTOR 100 1% .05W F TC=0+-100	24548	CT3-1/8-TO-100R-F
A22A2R7	0698-7229	8	1	RESISTOR 511 1% .05W F TC=0+-100	24548	CT3-1/8-TO-511R-F
A22A2R8	0698-7188	8	2	RESISTOR 10 1% .05W F TC=0+-100	24548	CT3-1/8-TO-10R-F
A22A2R9	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24548	CT3-1/8-TO-10R-F

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A23						
A23	08660-60044	8	1	WIRING HARNESS, MAIN	28480	08660-60044
A23J3	1251-0085	5	1	CONNECTOR 38-PIN F MICRO RIBBON	28480	1251-0085
	1251-3088	4		CONTACT-CONN U/W-RECT MALE CRP	28480	1251-3088
	1251-0545	2		COAX ASSEMBLY MALE FOR RECT SERIES; USED	28480	1251-0545
A23J4	1251-2663	9	1	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2663
A23J4	1251-0544	1	2	CONNECTOR 42-PIN M RECTANGULAR	28480	1251-0544
A23J5	1251-0544	1		CONNECTOR 42-PIN M RECTANGULAR	28480	1251-0544
A23J6	1251-0547	4	1	CONNECTOR 86-PIN M RECTANGULAR	28480	1251-0547
A23J7	1251-1017	5	1	CONNECTOR 4-PIN WINCH JF	28480	1251-1017
				A23 MISCELLANEOUS		
A23MP1	08660-20052	4	1	GUIDE PIN	28480	08660-20052
A24						
A24	5061-4824	9	1	ROTARY PULSE GENERATOR (RPG) ASSEMBLY	28480	5061-4824
				A24 MISCELLANEOUS		
A24MP1	0370-1303	3	1	RPG KNOB	28480	0370-1303
A24MP2	2190-0022	1	1	WASHER-LK INTERNAL TOOTH 3/8 IN .384-IN-ID	00000	ORDER BY DESCRIPTION
A24MP3	2950-0043	8	1	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
CR1	1901-1001	6	1	DIODE-CT-RECT 50V 10A	28480	1901-1001
CR2	1906-0065	0	2	DIODE-FW BRDG 100V 10A	28480	1906-0065
CR3	1906-0065	0		DIODE-FW BRDG 100V 10A	28480	1906-0065
L1	9170-0499	1	1	CORE-TOROID AL=2135-NH/T	28480	9170-0499
S1	3101-1235	4	1	SWITCH-SL DPDT STD 1.5A 125VAC SLDR-LUG (INT/EXT REFERENCE SWITCH)	28480	3101-1235
T1	9100-3543	5	1	TRANSFORMER-POWER 100/120/220/240V	28480	9100-3543
W1	08660-60061	9		CABLE ASSEMBLY (9) (A22J1 TO W1J1, REF INPUT)	28480	08660-60061
W2	08660-60062	0	1	CABLE ASSEMBLY (9) (A22J2 TO A21J1)	28480	08660-60062
W3	08660-60054	0	1	CABLE ASSEMBLY (9) (A22J4 TO A4J5)	28480	08660-60048
W4	08660-60048	0	1	INTERFACE CABLE ASSEMBLY (RIBBON) A1A11XA11-1 TO A3XA2	28480	08660-60046
W5	08660-60056	2	1	CABLE ASSEMBLY (3) (A4J1 TO A3A3J1)	28480	08660-60065
W6	08660-60326	9	1	CABLE ASSY 100 MHZ BAND PASS FILTER INPUT (A4J8 TO A4A8, INPUT)	28480	08660-60326
W7	08660-60058	4	1	CABLE ASSEMBLY (92) (A4J7 TO A23J5)	28480	08660-60058
W8	08660-60057	3	1	CABLE ASSEMBLY (95) (A4J9 TO A23J6)	28480	08660-60057
W9	08660-60071	1	1	CABLE ASSEMBLY (91) (A4A8, OUTPUT TO A23J8)	28480	08660-60326
W10	08660-60052	8	1	CABLE ASSEMBLY (2) (A4J3 TO A2J3)	28480	08660-60052
W11	08660-60053	9	1	CABLE ASSEMBLY (1) (A4J2 TO A2J1)	28480	08660-60053
W12	08660-60075	5	1	CABLE ASSEMBLY (5) (A4J4 TO A2J2)	28480	08660-60075
W13	08660-60087	5	1	CABLE ASSEMBLY (92) (A23J6 TO A23J5)	28480	08660-60067
W14	08660-60086	4	1	CABLE ASSEMBLY (96) (A23J6 TO A23J5)	28480	08660-60086
W15	08660-60059	5	1	CABLE ASSEMBLY (94) (A4J12 TO A23J6)	28480	08660-60059
W16	08660-60081	3	1	CABLE ASSEMBLY (92) (A23J6 TO A23J4)	28480	08660-60081
W17	08660-60074	4	1	CABLE ASSEMBLY (91) (A23J6 TO A23J4)	28480	08660-60074
W18	08660-60072	2	1	CABLE ASSEMBLY (93) (A23J6 TO A23J4)	28480	08660-60072

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
W19	08660-60073	3	1	CABLE ASSEMBLY (94) (A23J6 TO A23J4)	28480	08660-60073
W20	11661-60026	4	1	CABLE ASSEMBLY (66) (W13J1 TO HP 11661 J2)	28480	11661-60026
W21	11661-60026	6	1	CABLE ASSEMBLY (8) (W12J1 TO HP 11661 J1)	28460	11661-60028
W22	08660-60061	9	1	CABLE ASSEMBLY (9) (A22J3 TO W22J2, REF OUTPUT)	28480	08660-60061
W23	08660-60060	8	1	CABLE ASSEMBLY (93) (A2J4 TO A23J8)	28480	08660-60060
W24	08660-60093	7	1	CABLE ASSEMBLY (95) (A23J5 TO A23J6)	28480	08660-60093
W25	08660-60094	8	1	CABLE ASSEMBLY (97) (A23J5 TO A23J8)	28480	08660-60094

†Refer to Section 7 for update information. *Factory Selected Component (Refer to Section 5).

Table 6-4. Code List of Manufacturers

Mfr. Code	Manufacturer Name	Address	Zip Code
00000	ANY SATISFACTORY SUPPLIER		
00115	ACE GLASS INC	VINELAND, NJ	08360
00853	SANGAMO ELEC CO S CAROLINA DIV	PICKENS, SC	29671
01121	ALLEN-BRADLEY CO	MILWAUKEE, WI	53204
01281	TRW INC SEMICONDUCTOR DIV	LAWNDALE, CA	90260
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS, TX	75222
01538	SMALL PARTS INC	COSTA MESA, CA	92626
02111	SPECTROL ELECTRONICS CORP	CITY OF IND, CA	91745
02660	BUNKER RAMO CORP AMPHENOL CONN DIV	BROADVILLE, IL	60153
02768	ILLINOIS TOOL WORKS INC FASTEX DIV	DES PLAINES, IL	60016
03508	GE CO SEMICONDUCTOR PROD DEPT	AUBURN, NY	13201
03888	K D I PYROFILM CORP	WHIPPANY, NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX, AZ	85008
06001	MEPCO ELECTRA CORP	COLUMBIA, SC	29063
06665	PRECISION MONOLITHICS INC	SANTA CLARA, CA	95050
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW, CA	94042
07322	MINNESOTA RUBBER CO	MINNEAPOLIS, MN	55416
1F556	PRECISION LAMP INC	COTATI, CA	94040
18324	SIGNETICS CORP	SUNNYVALE, CA	94086
24046	TRANSITRON ELECTRONIC CORP	WAKEFIELD, MA	01880
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD, PA	16701
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA, CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO, CA	94304
3L585	RCA CORP SOLID STATE DIV	SOMERVILLE, NJ	
30983	MEPCO/ELECTRA CORP	SAN DIEGO, CA	92121
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE, CA	92507
51642	CENTRE ENGINEERING INC	STATE COLLEGE, PA	16801
52763	STETTNER ELECTRONICS INC	CHATTANOOGA, TN	13035
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS, MA	01247
72136	ELECTRO MOTIVE CORP	FLORENCE, SC	06226
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON, CA	92634
74970	JOHNSON E F CO	WASECA, MN	56093
75042	TRW INC PHILADELPHIA DIV	PHILADELPHIA, PA	19108
75915	LITTELFUSE INC	DES PLAINES, IL	60016
84411	TRW CAPACITOR DIV	OGALLALA, NE	69153
91637	DALE ELECTRONICS INC	COLUMBUS, NE	68601

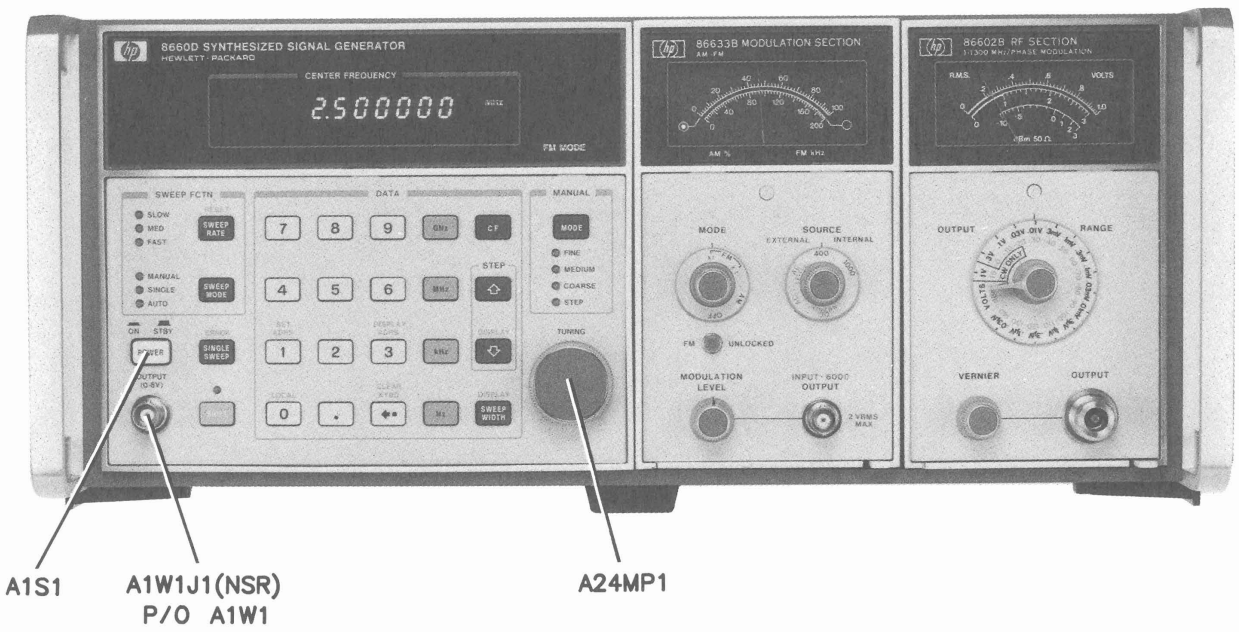


Figure 6–1. *Parts Identification (Front View)*

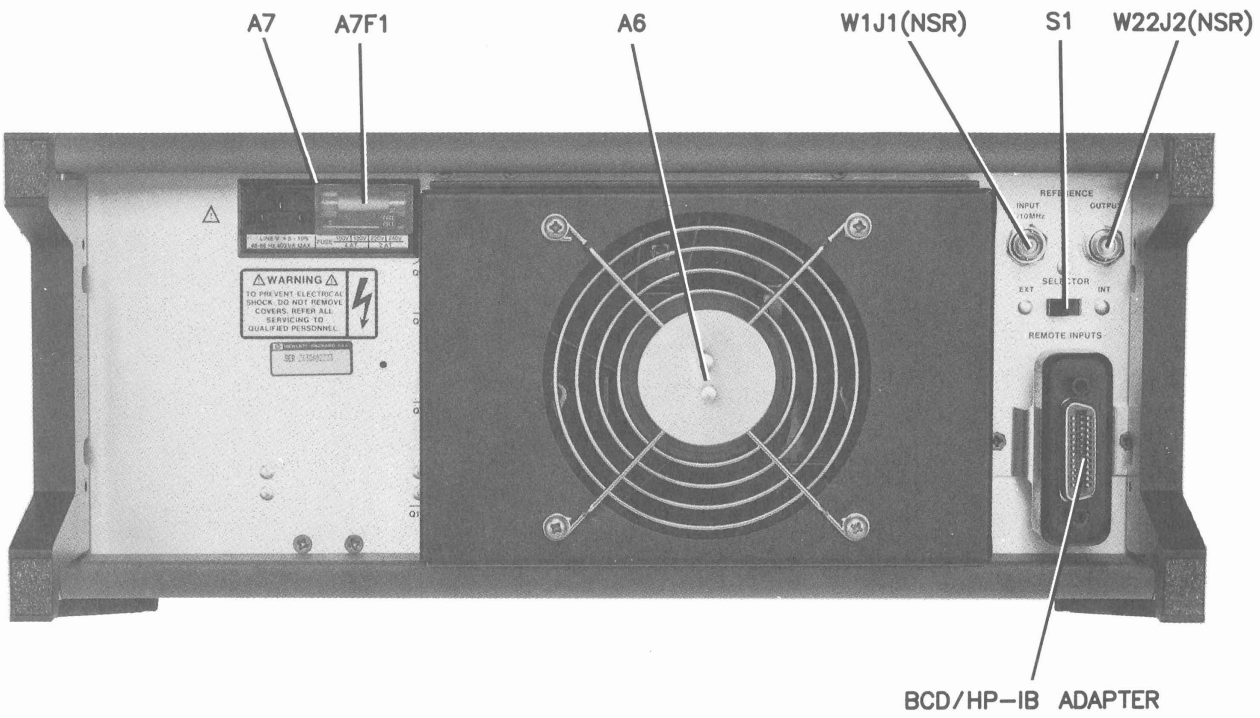


Figure 6–2. *Parts Identification (Rear View)*

Section 7
INSTRUMENT CHANGES

7-1. INTRODUCTION TO THIS SECTION

This section is intended to contain instrument modification recommendations and procedures that could improve the performance and reliability of your instrument. Refer to *Instruments Covered by This Manual,* paragraph 1-5 in Section 1 of the HP 8660D Operation and Calibration Manual for important information about serial number coverage.

There are no instrument modification recommendations or procedures at this time.

Section 8
SERVICE

INTRODUCTION

This section of the manual is designed to aid the technician in returning the instrument to proper operating condition in the shortest time possible should a malfunction occur in any of the operating circuits.

PRINCIPLES OF OPERATION

Each of the phase locked loops, the interface circuits and the Digital Control Unit are briefly explained and are graphically shown on Service Sheet 1.

TROUBLESHOOTING

In general, this section is designed to aid in isolating the assembly, circuit, or Plug-in Section which is causing faulty operation. Service Sheets provide a schematic, and a component locations diagram.

RECOMMENDED TEST EQUIPMENT

Test equipment and accessories required to service the Model 8660D are listed preceding each troubleshooting procedure. A comprehensive list can be found in Table 1-2. If the equipment listed is not available, equipment that meets the minimum specifications shown may be substituted.

Also listed in Table 1-2 is Service Kit HP Model 11672A. This kit consists of extension cables, cable adapters and an alignment tool. The items within the kit are listed individually in Table 1-2. The entire kit, or any part within the kit may be ordered separately.

REPAIR

Factory Selected Components

Some component values are selected at the time of final checkout at the factory. Usually these values are not extremely critical; they are selected to provide optimum compatibility with associated components. These components are identified on individual schematics by an asterisk (*).

Factory selected components and suggested range of values are listed in Table 8-1 and 8-2.

The recommended procedure for replacing a factory selected component is as follows:

a. Try the original value, then perform the test specified in Section 5 of the HP 8660D Operation and Calibration Manual for the circuit being repaired.

b. If the specified test cannot be satisfactorily performed, try the typical value shown in the parts list and repeat the test.

c. If the test results are still not satisfactory, substitute various values within the tolerances specified in Table 8-1 until the desired result is achieved.

Table 8–1. *Factory Selected Components (1 of 2)*

Designation	Location	Purpose	Range of Values
A4A2C11	Reference Loop	A variable 10 MHz signal (at −45 dB) is connected in parallel with the 10 MHz reference signal to A4J5. The frequency is varied to show the 3 dB points. The capacitor is selected for the reference loop 3 dB bandwidth of 60 to 160 kHz (±30 to ±80 kHz) measured at the 100 MHz output.	38 to 72 pF
A4A2R42	Phase Detector	To achieve correct phase error signal level.	100 to 422 ohms
A4A4C10	Reference VCO	To set reference loop bandwidth and capture range. Interacts with A4A2C11.	10 to 56 pF
A4A4L12	Reference Loop	To control output level of 100 MHz	0.34 to 1.0 μH
A4A4Q7	Reference Loop	To optimize performance of 500 MHz tuned amplifier	
A4A4Q8	Reference Loop	To optimize performance of 100 MHz tuned amplifier	
A4A4R29	Reference VCO and Divider	To compensate for variations in the 100 MHz reference output level. Selected for an output level of +11 to +13 dBm into a 50 ohm load at the output of A4A8.	42.2 to 196 ohms
A4A5C7,C8, C13, C14, C19, C20	HF Loop VCO	If one or more of the amplifiers in the 340 to 450 MHz tuned amplifier stages are overdriven, a one half frequency harmonic spur will track the output signal. Reduce the drive to the overdriven stage by decreasing the value of the appropriate capacitor. After selecting a capacitor, be sure there is sufficient output to drive the amplifier.	7.5 to 24 pF
A4A5R38, 40, and 42 (50 ohm pad)	HF VCO	To compensate for variations in the 350/450 MHz output level. Selected for a level of +10 to +13 dBm.	See Table 8–2.
A4A5R37, 39, and 41 (50 ohm pad)	HF Loop	To compensate for variations in the 350/450 MHz output level to the phase detector. Selected for a level of +10 to +12 dBm.	See Table 8–2.
A4A6C6	HF Loop	To ensure tuning range sufficient to trap the 10 MHz signal.	16 to 24 pF
A4A6R19	HF Loop	To center the travel of A4A6R20 Profile Adjust	287 to 422 ohms
A4A7R23	Sampling Phase Detector	To permit adjustment of A4A7R22. See paragraph 5-30 step 2b.	7.5k to 11k

Table 8–1. *Factory Selected Components (2 of 2)*

Designation	Location	Purpose	Range of Values
A8R18	N3 Oscillator	To aid in balancing Summing loop for Varactor tuning	19.6k to 25k
A8R25	N3 Oscillator		4k to 6k
A13R30	N2 VCO	To center range of associated potentiometer.	5.62k to 8.25k
A13R36	N2 VCO	To center range of associated potentiometer.	12.1k to 17.4k
A13R60	N2 VCO	To compensate for variations in the Varactor diode by reducing phase error output of the N2 assembly. Selected for an output at A2TP10 phase monitor of 0.00 ±0.35 Vdc	68k to 120k
A13R81	N2 VCO	To produce the most symmetrical square wave at A14aTP1. See Service Sheet 9A and 10.	23.7 to 237 ohms
A16R2	N1 Phase Detector	To compensate for variations in U7A switching characteristics.	825 ohms to 1.21k
A17R29	N1 VCO	To center range of associated potentiometer.	12.1k to 17.4k
A17R32	N1 VCO	To center range of associated potentiometer.	5.11k to 7.5k
A19R55	SL1 Oscillator	To set the SL1 Oscillator output between −3 & −5 dBm.	511 ohms to 1.47k

Table 8–2. *Range of Values*

Resistor	2 dB	3 dB	4 dB	5 dB	6 dB	7 dB	8 dB
R37,R38,(R41,R42)	422	287	315	178	147	133	115
R39(R40)	12.1	17.8	23.7	28.7	34.8	46.4	51.1

Board Repair

Etched Circuits. The etched circuit boards in the Synthesized Signal Generator are of the plated-through type consisting of metallic conductors bonded to both sides of insulating material. The metallic conductors are extended through the component mounting holes by a plating process. Soldering can be done from either side of the board with equally good results.

a. Avoid unnecessary component substitution; it can result in damage to the circuit board and/or adjacent components.

b. Do not use a high-power soldering iron on etched boards. Excessive heat may lift a conductor or damage the board.

c. Use a suction device or wooden toothpick to remove solder from component mounting holes.

NOTE

Do not use a sharp metal object such as an awl or twist drill for this purpose. Sharp objects may damage the plated-through conductor.

Etched Conductor Repair. A broken or burned section of conductor can be repaired by bridging the damaged section with a length of tinned copper wire. Allow adequate overlay and remove any varnish from etched conductor before soldering wire into place.

Component Replacement. Remove defective component from board.

NOTE

Although not recommended on boards with high-frequency signals or where both sides of a board are accessible, axial lead components, such as resistors and tubular capacitors, can be replaced without unsoldering. Clip leads near body of defective component, remove component and straighten leads left in board. Wrap leads of replacement component one turn around original leads. Solder wrap connections and clip off excess lead.

If component was unsoldered, remove solder from mounting holes, and position component as original was positioned. DO NOT FORCE LEADS INTO MOUNTING HOLES: sharp lead ends may damage plated-through conductor.

Transistor Replacement. To replace a transistor, proceed as follows:

a. Do not apply excessive heat.

b. If possible, use long-nose pliers between transistor and hot soldering tools.

c. When installing replacement transistors, ensure sufficient lead length to dissipate soldering heat by using about the same length of exposed lead as used for the original transistor.

d. Integrated circuit replacement instructions are the same as for transistors.

Some transistors are mounted on heat sinks for good heat dissipation. This requires good thermal contact with mounting surfaces. To assure good thermal contact for a replacement transistor, coat both sides with Dow Corning No. 5 silicone compound or equivalent before fastening the transistor to the chassis. Dow Corning No. 5 compound is available in 8 oz. tubes: order HP part number 9500-0059.

Diode Replacement. Solid state diodes have many different physical forms. This sometimes results in confusion as to which lead is the anode (positive), since all diodes are not marked with the standard symbols. If doubt exists as to polarity, an ohmmeter may be used to determine the proper connection. It is necessary to know the polarity of the ohms lead for the ohmmeter used. When the ohmmeter indicated the least diode resistance, the cathode of the diode is connected to the ohmmeter lead which is negative with respect to the other lead. Replacement instructions for diodes are the same as those listed for transistors.

MODULE EXCHANGE

Assemblies are no longer available on an exchange-for-credit basis.

SAFETY REQUIREMENTS

Safety requirements are listed directly preceding Section 1 in the HP 8660D Operation and Calibration Manual. They are also called out where required in the Manual.

SERVICE AIDS

Pozidriv Screwdrivers

Many of the screws in the instrument appear to be Phillips, but are not. To avoid damage to the screw slots, Pozidriv screwdrivers should be used.

Extender Boards

Extender boards are furnished (accessory kit part number 08660-60417). These boards and other furnished assemblies are listed in Section 1 of the Operation and Calibration Manual. The extender boards may be used to extend any plug-in board free of the chassis for maintenance.

Part Locator Aids.

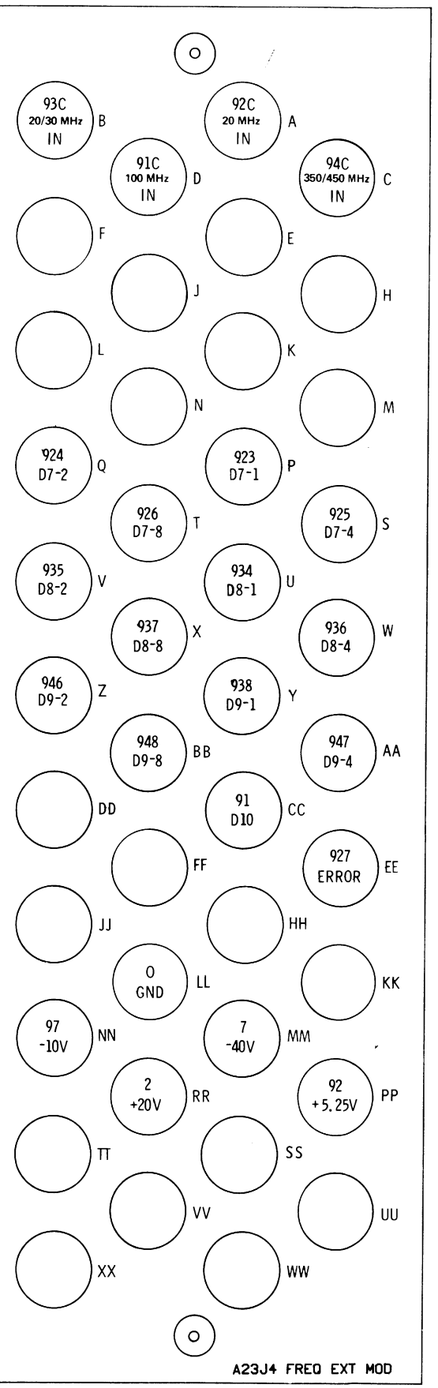
The locations of individual components mounted on printed circuit boards or other assemblies are shown on the appropriate schematic page or the page opposing it. The part reference designator is the assembly number followed by the schematic reference designator (for example, A6R9 is R9 on the A6 assembly). For specific component description and ordering information refer to the parts list in Section 6.

Servicing Aids on Printed Circuit Boards

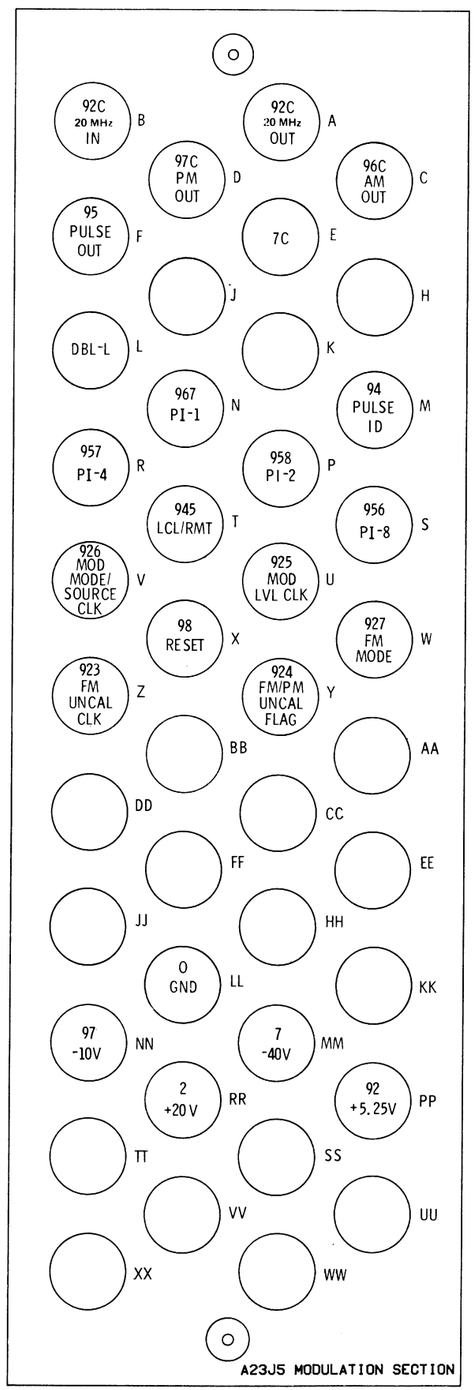
The servicing aids include test points, transistor and Integrated circuit designations, adjustment callouts and assembly stock numbers.

Plug-In Connectors Detail

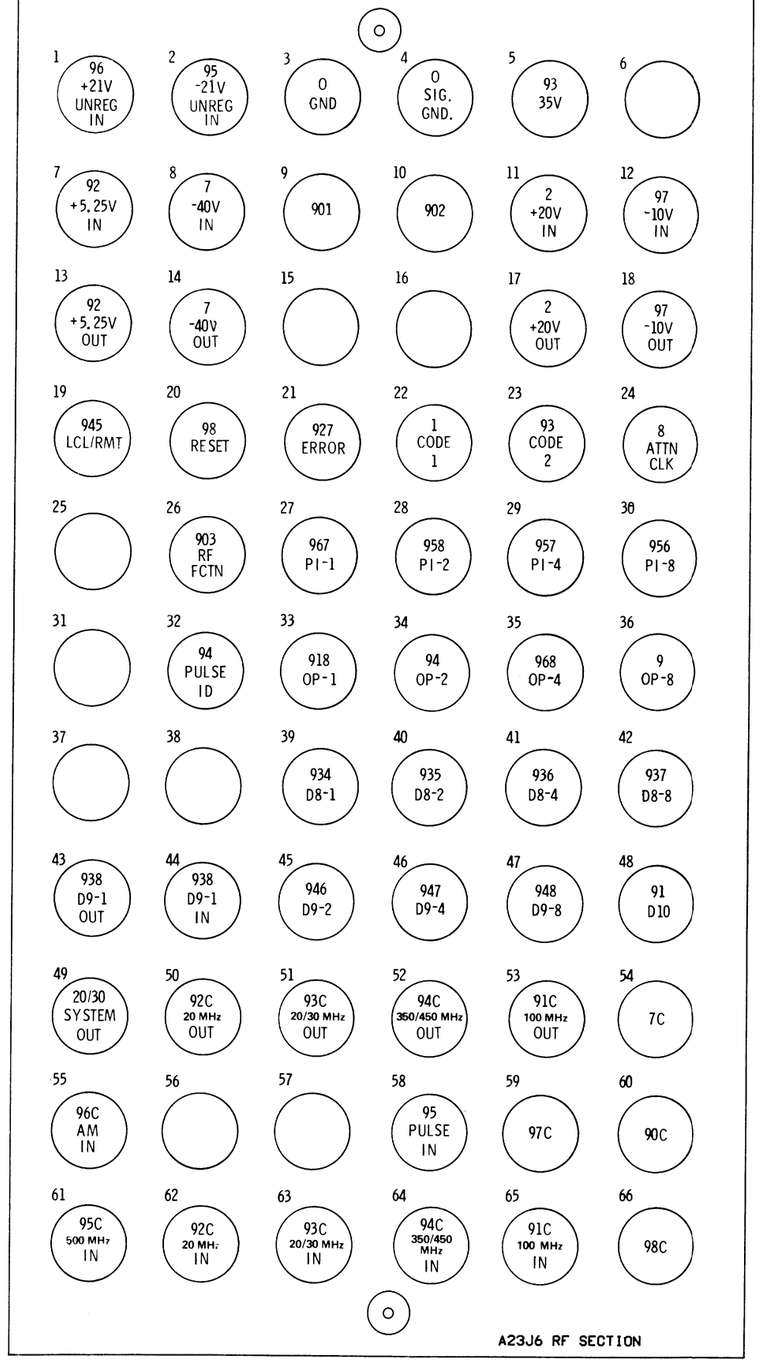
Pin identification for RF plug-ins can be made using Figure 8-1. If pins are bent or broken, refer to accompanying notes for part numbers and tools required form repair.



A23J4 FREQ EXT MOD



A23J5 MODULATION SECTION



A23J6 RF SECTION

NOTES

1. The following Winchester Catalog number tools are used to remove and install pins, REMOVE 107-1005, INSTALL 107-1015.
2. Coax pins are HP Part Number 1251-0545 with mating pin in plug-ins HP Part Number 1251-0546.
3. Regular pins are HP Part Number 1251-3088 with mating pin in plug-ins HP Part Number DC (1 wire)1251-3087 & mating pin in plug-ins HP Part Number DC (2 wire)1251-1911

Figure 8-1 Plug-In Connector Detail

Service Sheet 1

BLOCK DIAGRAM

- **Overall**

GENERAL

The Hewlett-Packard Model 8660D is a signal generator which utilizes synthesizer techniques to produce precise RF output signals. These signals may be selected in increments as small as one Hz.

Each step in the generation of the output frequency is controlled by phase locked loops. This ensures that the output frequency is exactly that selected by front panel (or remote) controls.

All of the seven phase locked loops are referenced to a single source. This source may be the internal temperature controlled crystal oscillator or an external frequency standard of 5 or 10 MHz.

The Model 8660D mainframe does not provide a direct RF output, except for the reference signal which may be used as a time base for external equipment. The signals generated within the mainframe are used in plug-in modules which utilize mixing techniques to provide the selected output RF signals.

REFERENCE LOOP

The reference loop consists of four circuit boards mounted in the A4 assembly. Schematics, a more comprehensive circuit analysis, and troubleshooting information are provided by Service Sheets 2 and 3.

All of the signals generated within the Model 8660D mainframe are derived from the 100 MHz master oscillator in the reference loop. The master oscillator is a voltage controlled oscillator which is phase locked to a stable reference (the 10 MHz INT or an EXT standard). The 100 MHz oscillator is located in the A4A4 assembly.

Also included in the A4A4 assembly are divide-by-five and multiply-by-five circuits. The outputs from the A4A4 assembly are 500 MHz, 100 MHz, and 20 MHz. The 20 MHz output from the A4A4 assembly is sampled in the reference loop phase detector to provide a phase correction signal to the master oscillator. The 20 MHz signal is also applied to the A4A3 assembly where it is divided by two to provide a 10 MHz signal for use in the A4A1 reference dividers and in the high frequency phase locked loop.

The reference loop input circuit (A4A2) converts the signal from the reference oscillator into sharp short-duration pulses to open a sampler gate which samples the 20 MHz signal from the A4A4 assembly. The sampled signal is used to generate an error signal which biases the varactor in the 100 MHz voltage controlled oscillator in the A4A4 assembly to maintain the phase locked condition.

The A4A1 assembly divides the 10 MHz input from the A4A3 assembly by five to provide a 2 MHz clock for the digital control unit. The 2 MHz signal is divided by five to provide a 400 kHz signal to the phase detector in the N1 loop. The 400 kHz is twice divided by two to provide 100 kHz signals to the phase detectors in the N2 and N3 loops.

HIGH FREQUENCY LOOP

The HF loop consists of three circuit boards mounted in the A4 assembly. Schematics, a more comprehensive circuit analysis, and troubleshooting information are provided by Service Sheets 4, 5, and 6.

The HF loop provides digitally controlled RF signals between 350 and 450 MHz in precisely selected 10 MHz increments.

The sampling phase detector (A4A7) compares the voltage controlled oscillator (A4A5) output to a 10 MHz signal from the reference loop and provides an output to phase lock the voltage controlled oscillator to the reference signal. The phase detector assembly contains a pulse generator, a sampler and signal processing circuit.

The frequency of the voltage controlled oscillator (A4A5) is roughly pretuned by a digital-to-analog converter located in the A4A6 assembly. The error signal from the A4A7 assembly is summed with the output of the digital-to-analog converter to maintain the phase locked condition. The A4A5 assembly also contains two identical three-stage amplifiers. These amplifiers serve as buffers to isolate any extraneous signals at their outputs from the oscillator. One of the amplifiers provides an output to the RF plug-in; the other output goes to the HF loop sampling phase detector.

The A4A6 pretuning circuit consists of a digital-to-analog converter which roughly pretunes the voltage controlled oscillator to the 10 MHz increment between 350 and 450 MHz selected by CF digits 8 and 9 of the front panel (or remote) controls. The pretuning cannot, by itself, set the voltage controlled oscillator frequency accurately; it does set the frequency within the capture range of the loop.

The A4A6 assembly also contains a summing circuit which sums the negative dc level from the digital-to-analog converter with the current from a +20 volt source and the output of the phase detector. The output from the summing circuit precisely controls the frequency of the voltage controlled oscillator.

DIVIDE BY N LOOP N1

The purpose of the N1 loop is to generate digitally controlled RF signals in the range of 19.8 to 29.7 MHz in selectable 100 kHz increments. The voltage controlled oscillator is phase locked to a 400 kHz reference signal which is derived from the master oscillator in the reference loop. The output of the N1 loop is applied to summing loop 1.

The N1 loop circuits are mounted on two circuit boards, A16 and A17. Schematics, a more comprehensive circuit analysis, and troubleshooting information are provided by Service Sheets 7 and 8.

The A16 phase detector assembly contains a programmable divider, a sampling phase detector and signal processing circuit.

The programmable divider divides by a number determined by CF digits 6 and 7 of the front panel (or remote) controls. The terminal count of the programmable divider is always 297. The actual number of cycles counted is determined by the count programmed into the divider prior to the start of each count cycle. The output of the programmable divider is always 200 kHz when the loop is locked.

The output frequency of the N1 loop may be determined by subtracting the CF digits 7 and 6 information from 29.7 MHz. As an example, if CF digits 7 and 6 are set for 3.4 MHz, the N1 output frequency will be 26.3 MHz (29.7 − 3.4).

The sampling phase detector uses the 100 kHz pulses from the programmable divider to sample the 400 kHz reference signal and provides an error output to the summing circuit in the A17 assembly.

The signal processing circuit consists of an operational amplifier with lead and lag compensation.

The A17 assembly contains a digital-to-analog converter, a voltage controlled oscillator and a summing circuit.

The digital-to-analog converter converts the digital inputs from CF digits 6 and 7 to a dc level which roughly pretunes the voltage controlled oscillator to a frequency within the capture range of the loop.

The summing circuit sums the current from the negative digital-to-analog converter source with current from a +20 volt source and the error signal from the phase detector to precisely control the voltage controlled oscillator frequency.

DIVIDE BY N LOOP N2

The purpose of the N2 loop is to generate digitally controlled RF signals in the range of 19.80 to 29.79 MHz in selected 10 kHz increments.

The voltage controlled oscillator is phase locked to a 100 kHz reference which is derived from the master oscillator in the reference section. The output of the N2 loop is applied to summing loop 2 (summing loop 1 in option 004 instruments).

The N2 loop circuits are mounted on two circuit boards, A13 and A14. Schematics, a more comprehensive circuit analysis, and troubleshooting information are provided by Service Sheets 9 and 10.

Operation of the N2 loop is virtually the same as operation of the N1 loop. The reference input is 100 kHz and the output of the programmable divider is always 10 kHz when the loop is locked. The digital inputs are from CF digits 3, 4, and 5 (or remote controls) and range from 000 to 999.

The programmable divider count always terminates in a count of 2979. The output frequency in MHz of the oscillator may be calculated by subtracting the programmed digital input from CF digits 5, 4 and 3 from 2979 and dividing the results by 100. Example: with CF digits 5, 4, and 3 set to 222 the output frequency will be 27.57 MHz: $\frac{2979-222}{100}$.

DIVIDE BY N LOOP N3

The purpose of the N3 loop is to generate digitally controlled RF signals in the range of 20.01 to 21.00 MHz in selectable 10 kHz increments. The voltage controlled oscillator is phase locked to a 100 kHz reference which is derived from the master oscillator in the reference section. The output from the N3 phase locked loop is divided by ten and the resulting 2.001 to 2.100 MHz (1 kHz steps) signal is applied to summing loop 2.

The N3 loop circuit is mounted on two circuit boards, A8 and A10. Schematics, a more comprehensive circuit analysis, and troubleshooting information are provided by Service Sheets 11 and 12.

Operation of the N3 loop is virtually identical to operation of the N1 and N2 loops. The reference signal is 100 kHz and the output of the programmable divider is always 10 kHz when the loop is phase locked. The digital inputs are from CF digits 1 and 2, and range from 00 to 99.

The programmable divider count always terminates in a count of 2100. The output frequency in MHz of the voltage controlled oscillator may be calculated by subtracting the programmed digital input from CF digits 2 and 1 from 2100 and dividing the result by 100. Example: with CF digits 2 and 1 set to 34, the output frequency of the voltage controlled oscillator will be 20.66 MHz: $\frac{2100-34}{100}$. Since the voltage controlled oscillator output is divided by 10, the output to summing loop 2 will be 2.066 MHz.

SUMMING LOOP 2

The purpose of SL2 is to generate digitally controlled RF signals in the range of 20.0001 to 30.0000 MHz in selectable 100 Hz increments. The output frequency of the SL2 voltage controlled oscillator is equal to the sum of the N2 output and the divided-by-ten output of the N3 assembly. The inputs to the digital phase detector are the divided-by-ten output of the N3 assembly and the output from a mixer which detects the difference frequency of the N2 output and the SL2 voltage controlled oscillator. The output of SL2 is applied to SL1.

The SL2 circuits are mounted on two circuit boards, A11 and A12. Schematics, a more comprehensive circuit analysis, and troubleshooting information are provided by Service Sheets 13 and 14.

The SL2 phase detector A12 is completely digital; it compares the relative positions (in time) of two sets of pulses and provides an error signal to correct phase errors or a dc level to correct frequency errors. One of the inputs to the phase detector is the divided by ten output of the N3 A8 assembly. The other input to the phase detector is the difference frequency between the N2 loop output and the SL2 voltage controlled oscillator output. When the loop is locked, both phase detector input signals are at the same frequency (1:1 ratio). When the ratio between the two signals is not 1:1 the difference

is detected by a sense circuit which disables the phase detector. The phase detector output goes low if the SL2 voltage controlled oscillator frequency is high. The pretuning circuit and the voltage controlled oscillator are contained in the A11 assembly.

The pretuning circuit is a digital-to-analog converter controlled by CF digits 3, 4, and 5. The digital-to-analog converter for the CF digit three is physically located on the A12 assembly. The pretuning circuit roughly presets the voltage controlled oscillator to a frequency within the capture range of the loop. A summing circuit sums the negative current from the digital-to-analog converter circuit with a current from a +20 volt source and the output of the SL2 digital phase detector to precisely set the output frequency of the voltage controlled oscillator. The output from the voltage controlled oscillator is applied to SL1 and to a mixer in the A12 assembly.

The output frequency of SL2 is equal to the N2 frequency plus the divided-by-ten input from the N3 circuit.

SUMMING LOOP 1

The purpose of SL1 is to generate digitally controlled RF signals in the range of 20.000001 to 30.0 MHz in selectable increments as small as 1 Hz. The output frequency of the SL1 voltage controlled oscillator is equal to the sum of the N1 output and the divided-by-one-hundred output of SL2. The inputs to the digital phase detector are the divided-by-one hundred output of the SL2 assembly and the output from a mixer which detects the difference frequency of the N1 output and the SL1 voltage controlled oscillator. The output of SL1 is applied to the RF Section plug-in.

The SL1 circuits are mounted on three circuit boards, A15, A18, and A19. Schematics, a more comprehensive circuit analysis, and troubleshooting information are provided on Service Sheets 15, 16, and 17.

Operation of SL1 is the same as operation of SL2 except that the phase detector inputs are the divided-by-one hundred output of SL2 and the difference frequency between the output of N1 and the SL1 oscillator. The output frequency can be found using the following formula:

$N1 + \frac{SL2}{100}$ or $N1 + \frac{N2}{100} + \frac{N3}{1000}$.

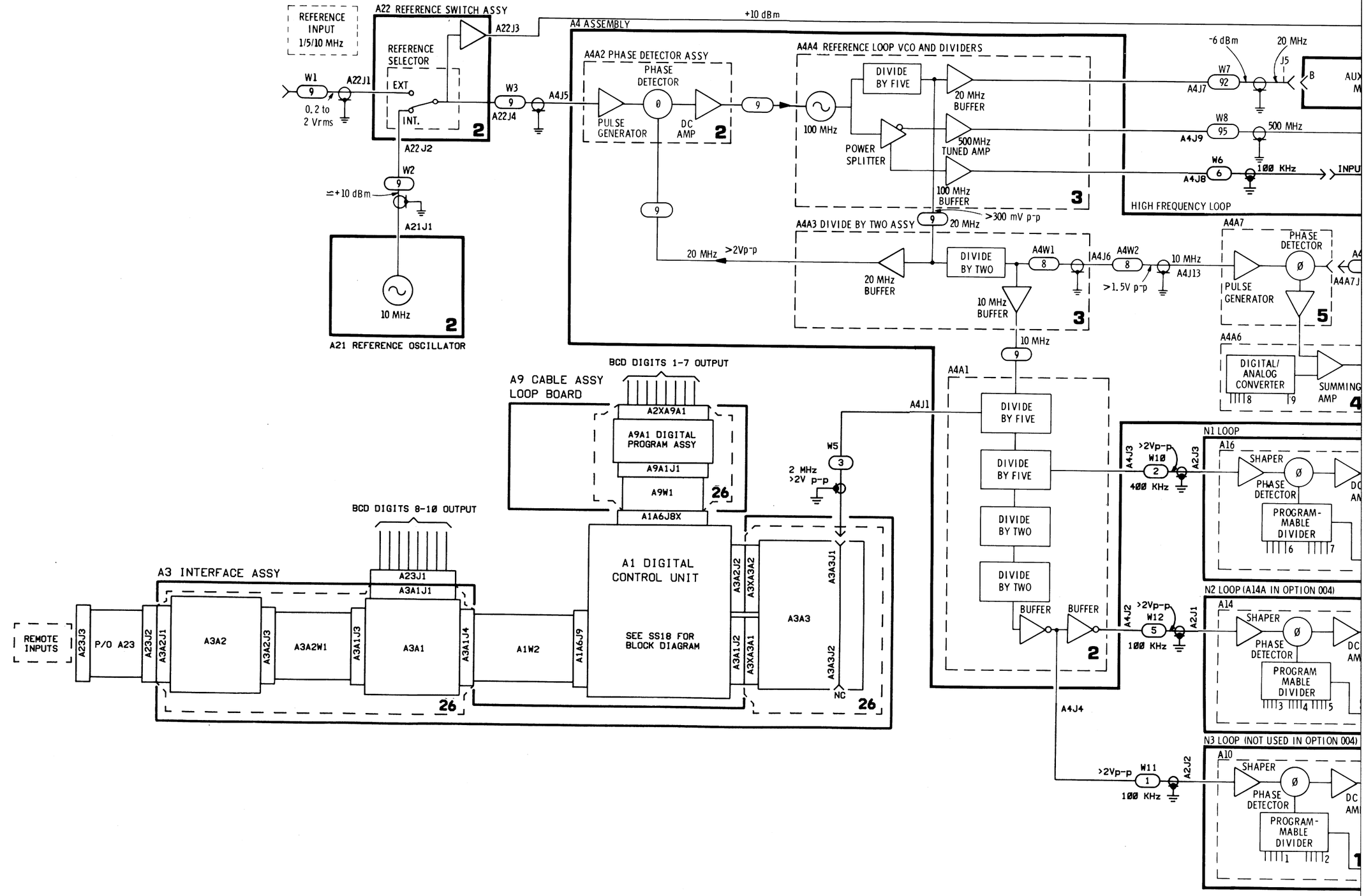
RF SECTION

The RF Section plug-in processes the outputs from the mainframe to provide the desired output frequency.

Information relative to operation and service of the RF Section is provided in a separate manual.

DIGITAL CONTROL UNIT

Service Sheet 18 provides a logic diagram of the digital control unit.



+10 dBm

W22 9 — REFER OUT

A4A4 REFERENCE LOOP VCO AND DIVIDERS

9 — 100 MHz — DIVIDE BY FIVE — 20 MHz BUFFER — POWER SPLITTER — 500MHz TUNED AMP — 100 MHz BUFFER — >300 mV p-p — 3

A4A3 DIVIDE BY TWO ASSY

9 20 MHz — 20 MHz BUFFER — DIVIDE BY TWO — A4W1 8 — A4J6 — A4W2 8 — >1.5V p-p — 10 MHz A4J13 — 10 MHz BUFFER — 3

10 MHz 9

-6 dBm, 20 MHz — W7 92 A4J7 — J5 — B — AUXILIARY SECTION -OR- MODULATION SECTION — A — C — J5 — W13 92 — REF 20 MHz OR FM 20 MHz — W14 96 — AM 100% - 1 Vrms

W8 95 A4J9 — 500 MHz — >+3 dBm

W6 6 A4J8 — 100 KHz — INPUT — A4A8 ASSY — OUTPUT — W9 91 — >+10 dBm

HIGH FREQUENCY LOOP

A4A7 — PHASE DETECTOR — PULSE GENERATOR — 5 — A4W3 8 — A4A7J1 — A4J11 — A4W4 8 — A4J10

A4A5 — BUFFER — BUFFER — 350-450 MHz — 6 — >10 dBm — W15 94 — A4J12 — 350-450 MHz — J6

A4A6 — DIGITAL/ANALOG CONVERTER — SUMMING AMP — 4

FREQUENCY EXTENSION MODULE

J4 — J2 — J1 — W16 92 — W17 91 — W18 93 — W19 94 — W20 86 — W21 8

20 MHz | 100 MHz | 20-30 MHz | 350-450 MHz | 2750-3950 MHz | 3950-4050 MHz — ±5 MHz (IN STEP)

J6 — 64 65 61 55 62 50 53 51 52

RF SECTION — RF OUTPUT

J6 — 63 — 20.000001 - 30 MHz >-7 dBm

SUMMING LOOP 1

19.8 - 29.7 MHz >0.4V p-p

A18 — MIXER — BUFFER — BUFFER — DIGITAL/ANALOG CONVERTER — 16

A19 — BUFFER — A2W1 8 — A15 — DIVIDE BY 100 — PHASE DETECTOR — BUFFER — A2W2 8 — 15

SUMMING AMP — 20.000001 - 30.0 MHz — POWER SPLITTER — BUFFER — BUFFER — 17 — A2J4 — W23 93

20.0001 - 30 MHz >1V P/P

SUMMING LOOP 2 (NOT USED IN OPTION 004)

A12 — MIXER — BUFFER — DIVIDE BY TEN — PHASE DETECTOR — DC AMP — 13

A11 — SUMMING AMP — BUFFER — 20.0001-30.0 MHz — DIGITAL/ANALOG CONVERTER — BUFFER — BUFFER — 14 — XA11-1-2

2.001 - 2.1 MHz >0.5V p-p — XA8-1-4

N1 LOOP

A16 — SHAPER — PHASE DETECTOR — DC AMP — PROGRAM-MABLE DIVIDER — 7

A17 — SUMMING AMP — 19.8 - 29.7 MHz — BUFFER — BUFFER — DIGITAL/ANALOG CONVERTER — BUFFER — 8 — XA17-1-2

N2 LOOP (A14A IN OPTION 004)

A14 — SHAPER — PHASE DETECTOR — DC AMP — PROGRAM MABLE DIVIDER — 9

A13 — SUMMING AMP — 19.8 - 29.79 MHz — BUFFER — BUFFER — DIGITAL/ANALOG CONVERTER — BUFFER — 10 — 19.8-29.79 MHz >275 mV p-p — XA13-1-4

N3 LOOP (NOT USED IN OPTION 004)

A10 — SHAPER — PHASE DETECTOR — DC AMP — PROGRAM-MABLE DIVIDER — 11

A8 — SUMMING AMP — 20.01 - 21.00 MHz — BUFFER — BUFFER — DIGITAL/ANALOG CONVERTER — BUFFER — DIVIDE BY TEN — 12

A4A1

A4J1 — DIVIDE BY FIVE — DIVIDE BY FIVE — DIVIDE BY TWO — DIVIDE BY TWO — BUFFER — BUFFER — 2

W5 3 — 2 MHz >2V p-p — 26

A3A3 — A3A2J2 — A3XA3A2 — A3A1J2 — A3XA3A1 — A3A3J1 — A3A3J2 — NC — 26

A4J4

A4J3 — >2Vp-p — W10 2 — 400 KHz — A2J3

A4J2 — >2Vp-p — W12 5 — 100 KHz — A2J1

>2Vp-p — W11 1 — 100 KHz — A2J2

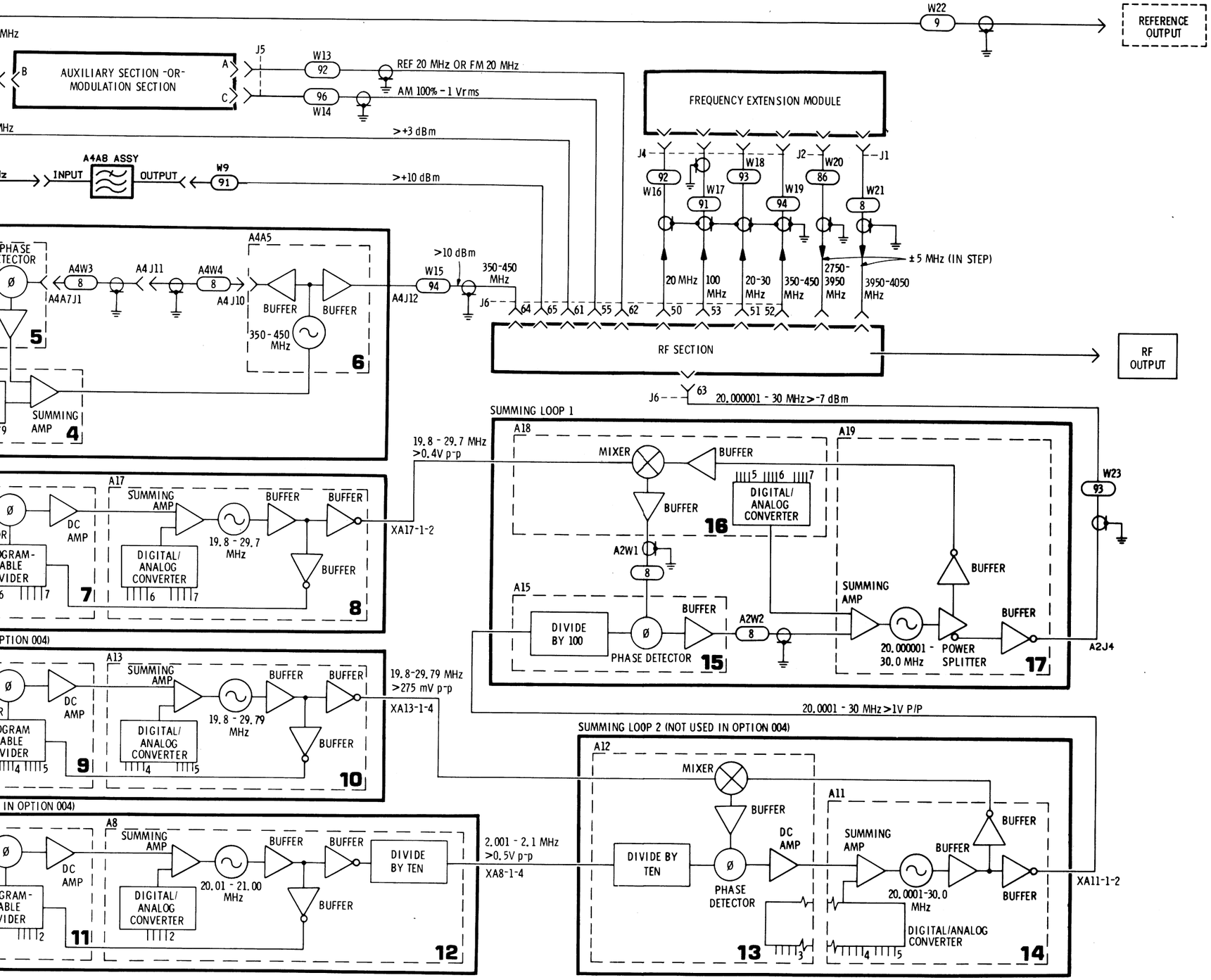


Figure 8–2 Block Diagram

Service Sheet 2

ASSEMBLY

- **Part Of Reference Loop Circuits**

When repairing the reference loop, only one of the four covers should be removed at any given time. Operating the instrument with the voltage controlled oscillator cover removed may cause faulty or erratic performance after required repairs have been completed.

NOTE

After making repairs in any part of the reference loop circuits, Adjustment 3 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Digital Voltmeter	HP 3478A
Test Oscillator	HP HP 3325A
Oscilloscope (with 10:1 divider probes)	HP 54200A
Frequency Counter	HP 5385A

REFERENCE LOOP, GENERAL

The reference loop consists of four circuit boards located in the A4 assembly. This service sheet provides information about circuit operation and test procedures for the reference oscillator, reference amplifier and relays, the phase detector and the divide-by-five and divide-by-two circuits. Schematic diagrams, text and troubleshooting information for the voltage controlled oscillator and divide-by-two circuits appear on Service Sheet 3.

The accuracy and stability of all the signals generated in the HP 8660D mainframe are traceable to the reference loop outputs.

The reference loop provides output frequencies of 500 MHz, 100 MHz, 20 MHz, 10 MHz, 2 MHz, 400 kHz, and 100 kHz. These signals are used in other circuits in the mainframe and in the plug-in sections. All of the reference section outputs are derived from a 100 MHz master oscillator which is phase locked to a stable reference source. The reference signal may be supplied by the internal reference oscillator or by an external reference standard. The reference signal may be 5 or 10 MHz at a level of 0.2 to 2 Vrms.

Reference Oscillator, Amplifier and Relays

The HP 8660D (except for option 002 instruments) contains a 10 MHz temperature controlled crystal oscillator which is used as a reference source. Also included are switching relays and a buffer amplifier. The buffer amplifier serves to isolate the reference oscillator when its output is used as a reference source for external equipment.

Test Procedure 1

Test 1-a Connect the oscilloscope to the HP 8660D rear panel REFERENCE OUTPUT connector.

If the internal reference is being used the oscilloscope should display a 10 MHz signal at about 4 Vpp.

If an external reference is used the oscilloscope should display the reference frequency at about the same level as the reference signal input.

If the signal is present proceed to test 1-b. If the signal is not present proceed to test 1-c.

Test 1-b Disconnect the coaxial cable from A4J5 (REF INPUT) and connect the oscilloscope to the end of the cable.

If the internal reference is being used, the oscilloscope should display a 10 MHz signal at about 5 Vpp.

If an external reference is used, the oscilloscope should display the input reference signal.

If the signal appeared in test 1-a, but does not appear in test 1-b, the cable between the A4A2 assembly and the reference relay/amplifier is probably defective.

If the correct signal is observed in test 1-b, proceed to TEST PROCEDURE 2.

Test 1-c If the signal was not present in test 1-a, tilt the A4 assembly out of the frame, disconnect the coaxial cable from the reference oscillator assembly and connect the reference oscillator output to the oscilloscope.

The oscilloscope should display a 10 MHz signal at about 7 Vpp.

If the signal is not present, check for dc levels as follows: terminal 1, +20V, terminal 2 +35V (oven voltage) and terminal 6, +5.2V (when present indicates thermostat is open, temperature stabilized).

If the voltages are correct the reference oscillator assembly (A21) is defective.

NOTE

The reference oscillator assembly is not a field repairable unit. Replacement is recommended.

If the signal is present at the reference oscillator output, check the SELECTOR switch, the relay assembly (A22A1) and the reference amplifier (A22A2).

PHASE DETECTOR ASSEMBLY (A4A2), GENERAL

The phase detector consists of three basic circuits; a pulse generator a sampler and circuit to process the error signal.

The pulse generator converts the reference signal to very sharp, short duration pulses. These pulses are used to forward bias the sampler gate diodes.

The sampler gate provides a means of comparing the pulses generated from the reference signal to the 20 MHz signal from the A4A3 assembly. An error signal is developed to control the voltage controlled oscillator in the A4A4 assembly when a phase error exists.

Pulse Generator

The pulse generator consists of Q1 through Q5, U1, T1, and associated components.

The reference input to Q1 may be 5 or 10 MHz. Q1 and Q2 act as an amplifier for low level signals and as a limiter for high level signals. Q3 acts as a limiter to ensure that the input to NAND gate U1A is always the same when the input reference signal is 0.2 to 2 vVrms. The output from Q3 is essentially a square wave with a slow rise time and a fast fall time; it is clipped, top and bottom, and it is approximately 5 Vpp.

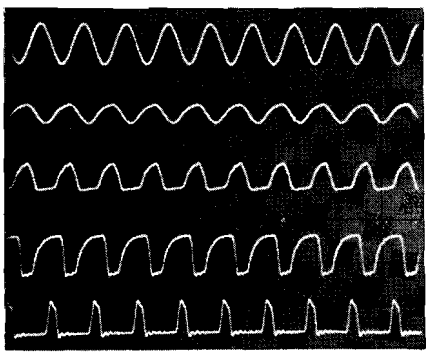
U1, C11 and R20 are used as a pulse shaper. The output of U1A is differentiated by C11 and R20 and inverted by U1B. The sharp pulses (20 to 25 nanoseconds) are inverted by U1D to provide positive-going pulses to drive Q4/Q5.

Q4/Q5 comprise a complementary emitter-follower pair; its purpose is to provide a low impedance drive to T1.

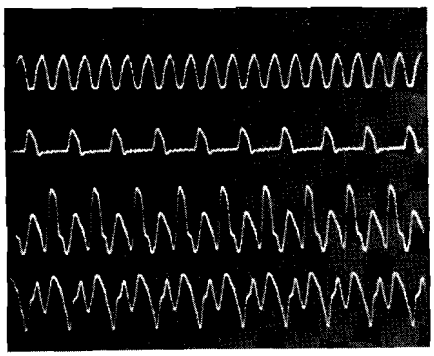
Test Procedure 2

Test 2-a Composite waveform SS2-1 and trace 2 of composite waveform SS2-2 illustrate the development of the 10 MHz pulses derived from the internal reference signal. The pulses are used to drive the sampling phase detector diode gates. Observing the individual waveforms on an oscilloscope should enable the technician to quickly isolate a malfunction in the circuit to an individual stage or to the reference oscillator/switching circuits.

There are no loops or feedback circuits in the pulse generator circuit. It is safe to assume when a correct waveform is observed that all preceding portions of the circuit are operating properly.



Composite Waveform SS2-1



Composite Waveform SS2-2

Sampler

Sampler diodes CR4 and CR5 are normally reverse biased. When the sampling pulse appears across the secondary of T1 it is coupled through C18 and C19 to forward bias CR4 and CR5. Since the gate pulses are equal in amplitude but opposite in polarity, they will cancel at the junction of R32, R33, R34, and C20.

While CR4 and CR5 are forward biased the sampling gate is open and the 20 MHz signal from the A4A3 assembly is sampled. If the 20 MHz input from the A4A3 assembly is not phase locked to the pulses from the reference signal an ac signal will appear on the base of Q7. The polarity of the signal at any given time depends on the polarity of the 20 MHz signal from the A4A3 assembly when the last sample was taken. The amplitude of the ac signal at any given time depends on what portion of the 20 MHz sine wave the last sample was taken from.

Each time CR4 and CR5 are forward biased the charge on C20 will change unless the phase relationship is the same as it was in the previous sample. The time constant of C20 and R34 is long and since the time between samples is never more than one microsecond, C20 cannot discharge appreciably between sampling pulses.

The reverse bias levels for CR4 and CR5 are maintained at the same levels (opposite polarities) by voltage divider networks.

Test Procedure 3

Test 3-a An oscilloscope loads the sampling circuit at TP3 and TP4 to a point where accurate analysis of the signal is not possible. However, observing the waveforms and comparing them to the typical waveforms shown in composite waveform SS2-2 will provide an adequate indication that the circuit is or is not functioning properly. The important points to observe are the two-to-one frequency ratio between the 20 MHz signal and the pulses, and the time coincidence of the positive-going and negative-going pulses at TP3 and TP4 with the pulses at TP1.

Error Signal Amplifier

When a phase difference between the reference signal and the 20 MHz input exists, a signal appears on C20. This signal is amplified and used to correct the frequency or the voltage controlled oscillator in the A4A4 assembly.

Q7 and Q9 provide a high impedance input for the sampler output. Q8 and Q10 comprise a differential amplifier. Emitter-follower Q11 provides the output to the A4A4 assembly.

Test Procedure 4

Test 4-a Connect an oscilloscope to the A4A2 output labeled VCO. With the input 10 MHz reference disconnected from A4J5, (REF INPUT) connect a test oscillator (output 0 dBm, 3 kHz) to A4A2TP2. (The exact frequency is unimportant - 3 kHz chosen arbitrarily.)

Vary the output level of the test oscillator and note that the A4A2 output level displayed on the oscilloscope varies.

NOTE

If the A4A2 output does not vary when the test oscillator output is varied, use the oscilloscope to check back through the stages for a point in the circuit where the level does change with a change in the output level of the test oscillator. The following stage is probably defective.

Reference Divide-by-Five and Divide-by-Two Assembly A4A1

The A4A1 assembly divides the 10 MHz input from the A4A3 assembly four times; two times by five and two times by two. The assembly provides a 100 kHz signal to the N2 and N3 loops and a 400 kHz signal to the N1 loop.

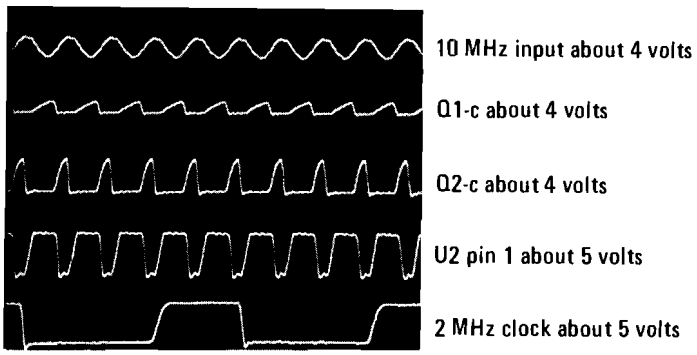
Q3 and CR1 reduce the +20V input to +5V for operation of all circuits in the assembly. This method of providing power is used to minimize the effect of ac ripple on the power supply.

Q1 isolates the circuit from the 10 MHz source. Q2 amplifies the 10 MHz input and NAND gate U1A shapes it into pulses to drive U2. U2 provides a divided-by-five 2 MHz output at pin 8 which is used as a clock signal in the digital control unit. The 2 MHz output is also available at pin 11 of U2 and is used to drive U3.

U3 divides the 2 MHz input from pin 11 of U2 by five and provides outputs of 400 kHz at pins 8 and 11. The 400 kHz output at U3 pin 8 is used as the phase detector reference in the N1 loop. The 400 kHz at pin 11 of U3 is coupled to U3 pin 14 and divided by two. The 200 kHz output of U3 at pin 12 is coupled back to U2 pin 14 through NAND gate U1C and again divided by two. The 100 kHz output from U2 pin12 is coupled through NAND gate U1B to the phase detector in the N3 loop. The 100 kHz signal is also coupled through NAND gate U1D to the phase detector in the N2 loop.

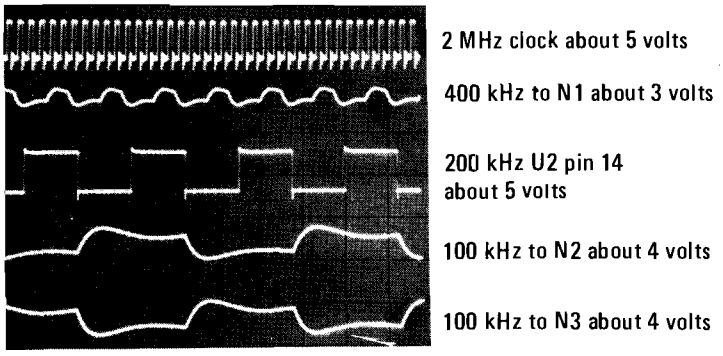
Test Procedure 5

Composite waveform SS2-3 illustrates the development of pulses from the 10 MHz reference input and the 2 MHz clock output to the digital control unit.



Composite Waveform SS2-3

Composite waveform SS2-4 illustrates the development of the 400 kHz and 100 kHz N loop reference signals from the 2 MHz clock signals.



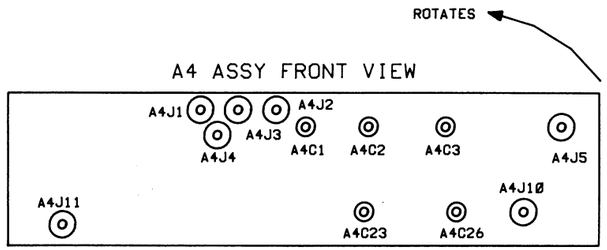
Composite Waveform SS2-4

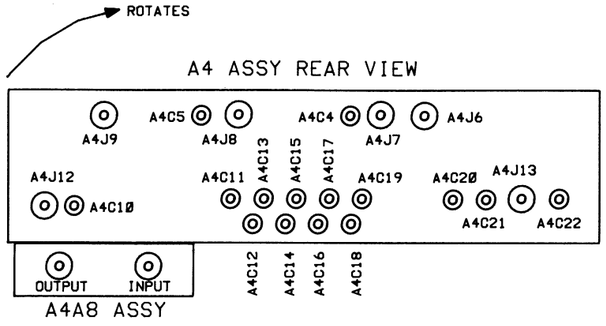
There are no loops or feedback paths in the circuit. It is safe to assume that when the proper waveform is observed at any point that preceding stages are functioning properly.

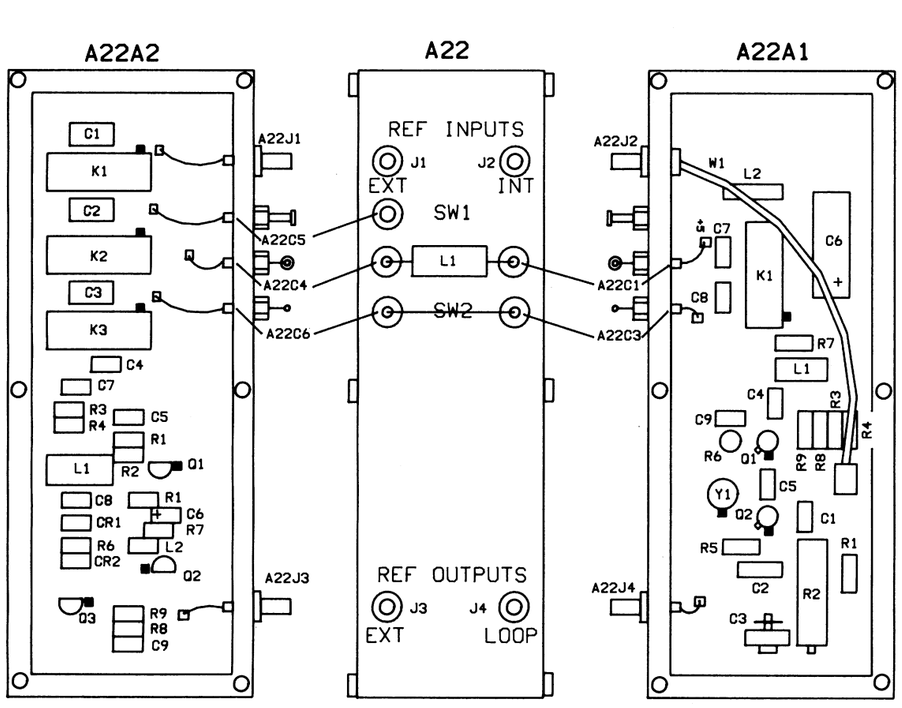
Observing the waveforms at the test points specified should enable the technician to quickly isolate the cause of a malfunction to a specific stage or component.

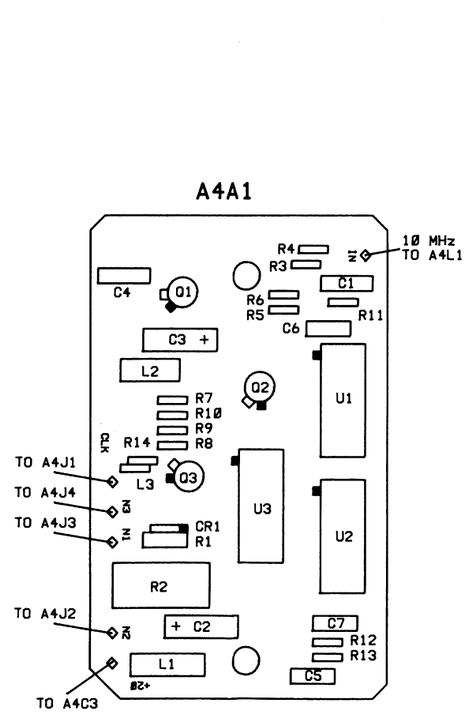
NOTES:

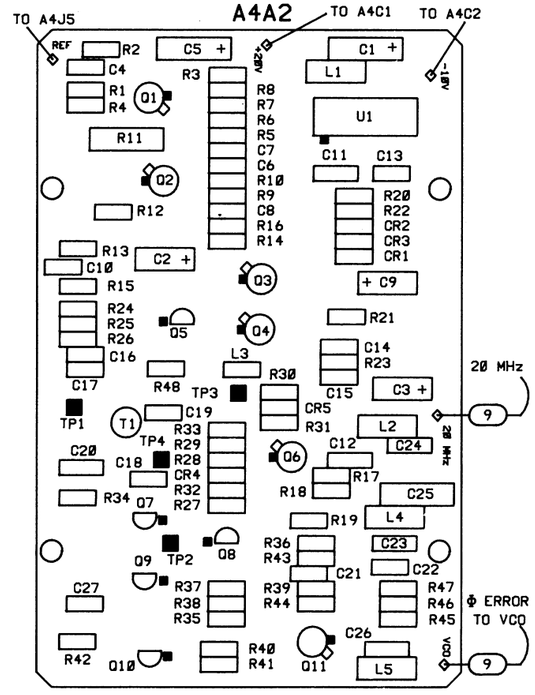
1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
2. L1 is part of A22 assembly.

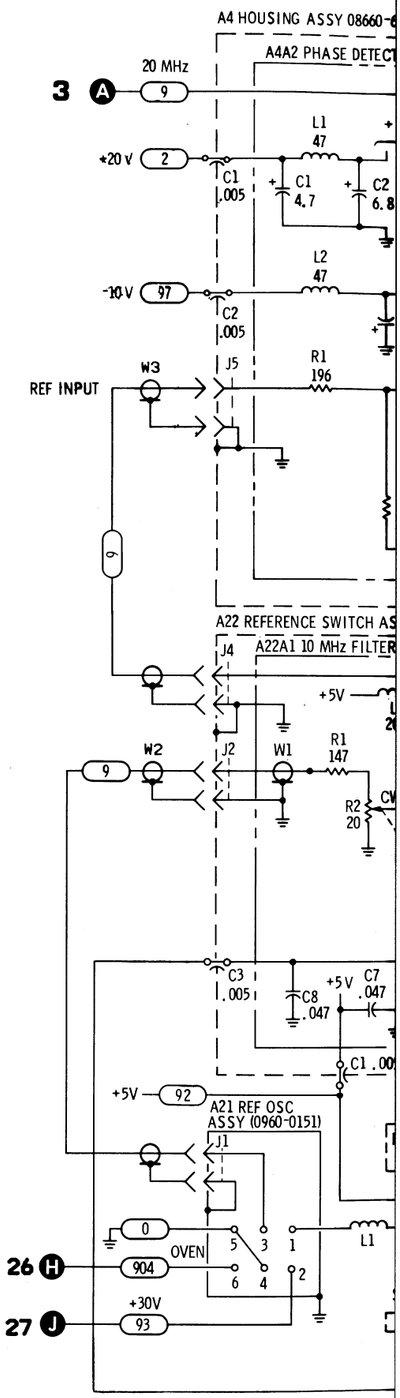




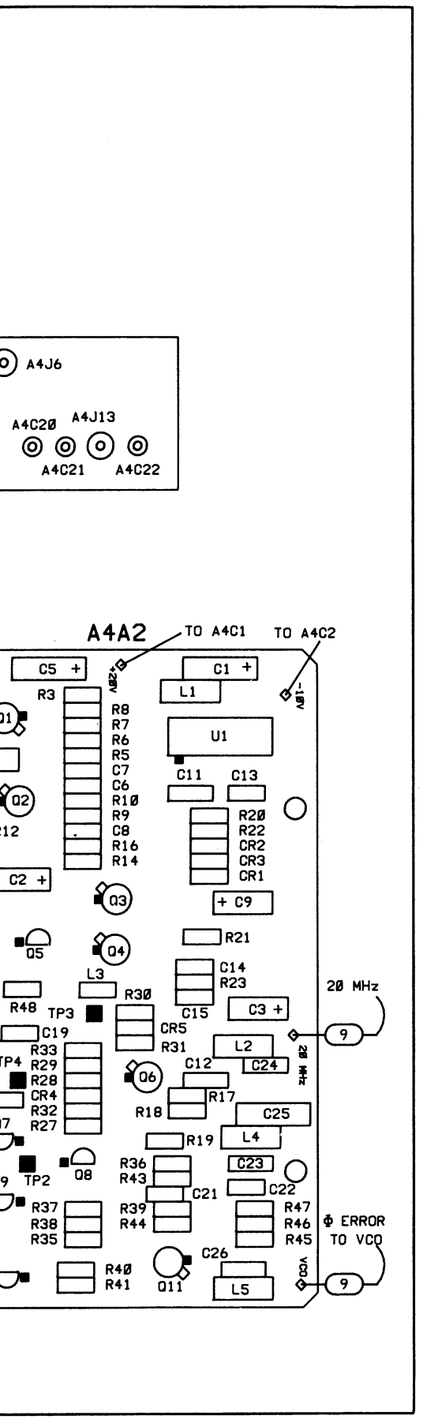


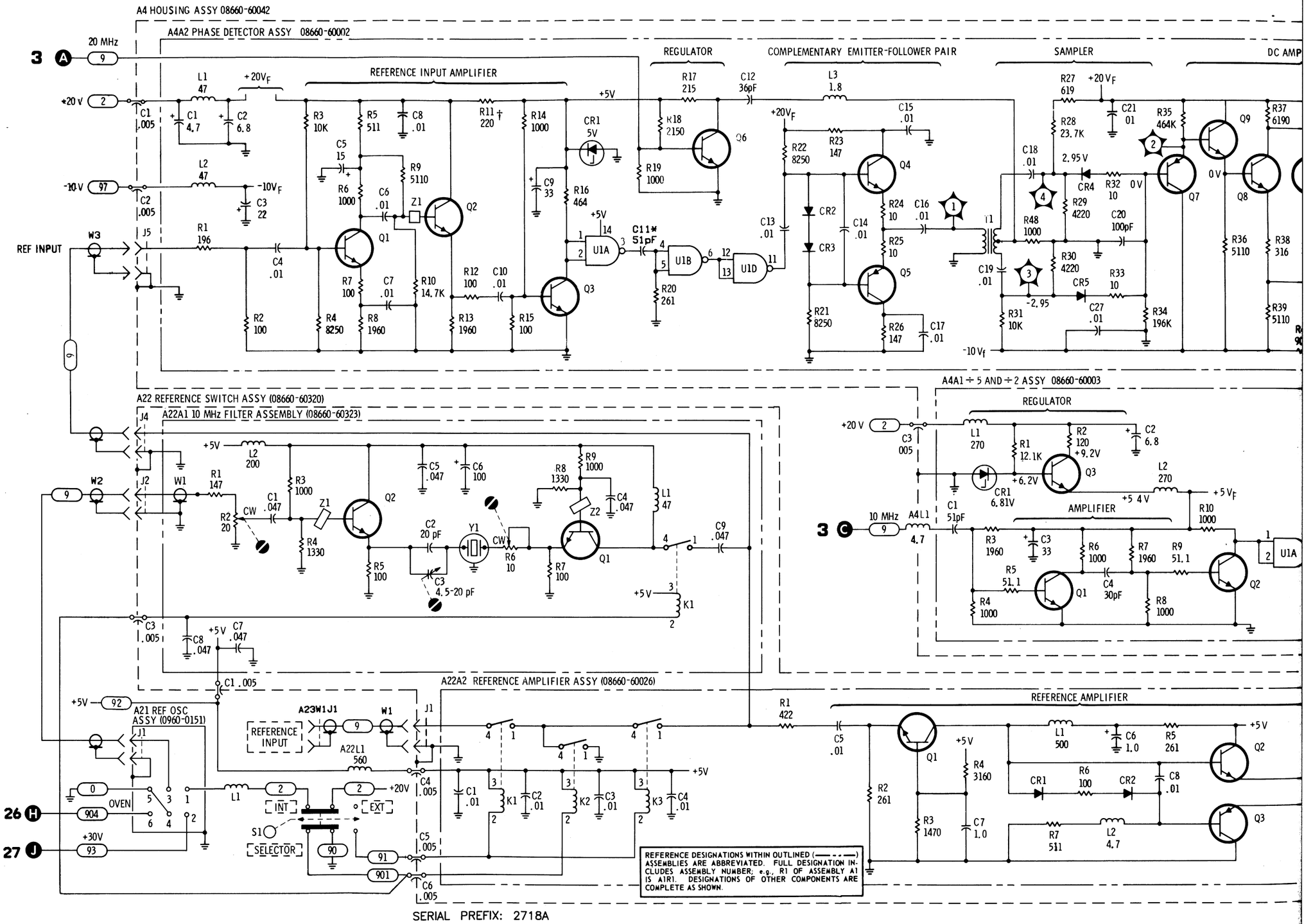






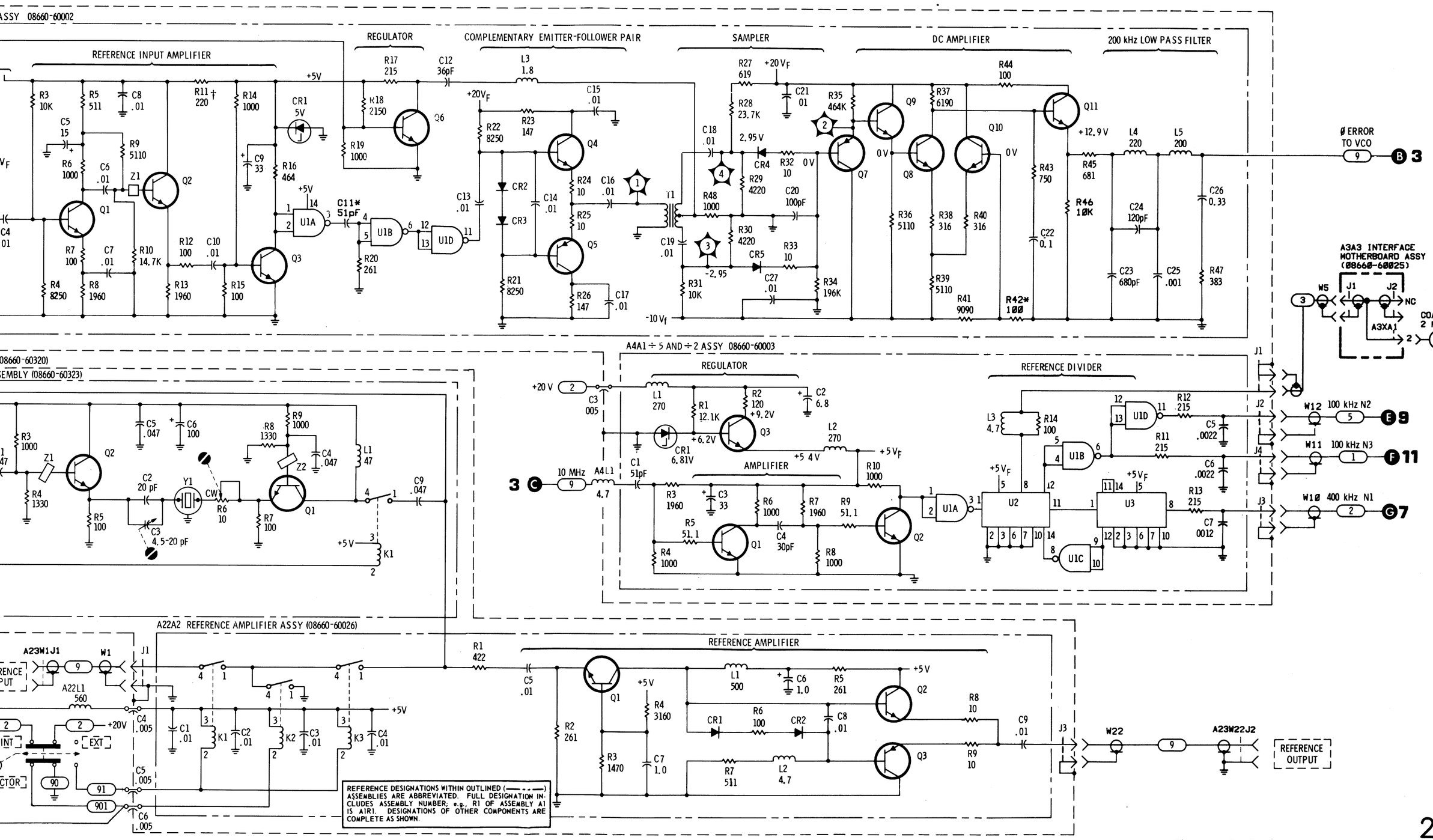
Component Locators





REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - -) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

SERIAL PREFIX: 2718A



SERIAL PREFIX: 2718A

Figure 8-3 Reference Loop Circuits

Service Sheet 3

ASSEMBLY

- **Part of Reference Loop Circuits**

When repairing the reference loop only one of the four covers should be removed at any given time. Operation of the instrument with the voltage controlled oscillator cover removed may cause faulty or erratic performance after repairs have been completed.

NOTE

After making repairs in any part of the reference loop circuits, Adjustment 3 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Digital Voltmeter ..... HP 3478A
Oscilloscope (with 10:1 divider probes) ..... HP 54200A
Frequency Counter ..... HP 5385A

REFERENCE LOOP GENERAL

The reference loop consists of four circuit boards located in the A4 assembly. Service Sheet 2 provides information about circuit operation and test procedures for the reference oscillator, reference amplifier and relays, the phase detector and the divide-by-five and divide-by-two circuits. Schematic diagrams, text and troubleshooting information for the voltage controlled oscillator and divide-by-two circuits appear on this service sheet.

The accuracy and stability of all the signals generated in the HP 8660D mainframe are traceable to the reference loop circuits.

The reference loop provides output frequencies of 500 MHz, 100 MHz, 20 MHz, 10 MHz, 2 MHz, 400 kHz, and 100 kHz. These signals are used in other circuits in the mainframe and in the plug-in sections. All of the reference section outputs are derived from a 100 MHz master oscillator which is phase locked to a stable reference source. The reference signal may be supplied by the internal reference oscillator or by an external reference standard. The reference signal may be 5 or 10 MHz at a level of 0.2 or 2 Vrms.

Oscillator, Power Splitter, 500 MHz Amplifier and 100 MHz Amplifier

Q3 and associated components comprise a 100 MHz voltage controlled oscillator. Varactor CR1 is biased by the output of the A4A2 phase detector to assure that the oscillator is phase locked to the reference signal at 100 MHz.

The oscillator output is capacitively coupled to the base of Q4 which functions as a power splitter.

Q9 and associated components provide isolation from the +20V power supply for the oscillator and power splitter to minimize effects of ac power supply ripple or line variations.

The collector output of Q4 is capacitively coupled to A8, a 100 MHz tuned amplifier which functions as a buffer stage. The times five function is accomplished by Q7 which is tuned to 500 MHz. The 500 MHz output from the Q7 tank circuit is capacitively coupled to Q6, another 500 MHz tuned amplifier which also provides isolation.

The emitter output of Q4 is capacitively coupled to the base of Q5 which functions as a 100 MHz tuned amplifier buffer stage. This output is used in the Frequency Extension Module (HP 11661A).

Test Procedure 1

NOTE

If the signal frequency is close to that specified in the following tests but is erratic, or not exact, the trouble is probably in the Phase Detector circuit. Refer to Service Sheet 2.

Test 1-a With the A4A4 assembly cover removed, use the counter and spectrum analyzer (separately) to check the 500 MHz output. The counter should indicate exactly 500 MHz and the oscilloscope should display a sine wave at about >+3 dBm.

If the signal is present, proceed to test 1-d. If the signal is not present proceed to test 1-b.

Test 1-b. Connect the oscilloscope and the counter (separately) to Q4-c. The counter should indicate exactly 100 MHz and the oscilloscope should display a sine wave at about 2.5 Vpp.

If the signal is present, but was not present in test 1-a, check Q6, Q7, Q8, and associated components. If the signal is not present, proceed to test 1-c.

Test 1-c. Connect the oscilloscope and the counter (separately) to Q4-b. The counter should indicate exactly 100 MHz and the oscilloscope should display a sine wave at about 0.4V.

If the signal is present but was not present in previous tests, Q4 is probably defective. If the signal is not present, Check Q3, Q9 and associated components.

Test 1-d. Use the oscilloscope and the counter (separately) to check the 100 MHz output. The counter should indicate exactly 100 MHz and the oscilloscope should display a sine wave at about 0.5V.

If the signal is not present, but was present in test 1-a, check Q5 and associated components. If the signal is present, proceed to Test Procedure 2.

20 MHz Outputs

A third 100 MHz signal is capacitively coupled from the oscillator tank circuit to the base of 100 MHz tuned amplifier Q2. The output of Q2 is used to drive a divide-by-five circuit (U1) which provides the 20 MHz output. The 20 MHz output is used to drive the divide-by-two circuit in the A4A3 assembly. The 20 MHz signal is also coupled to 20 MHz tuned amplifier Q1 for use in circuits external to the reference loop.

Test Procedure 2

Test 2-a Connect the oscilloscope to the 20 MHz output from Q1. The display should be similar to that shown in the center trace of composite waveform SS3-1. Proceed to test 2-b.

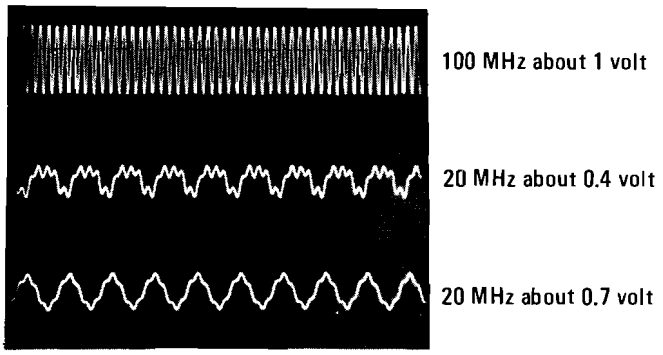
Test 2-b Connect the oscilloscope to the 20 MHz output which goes to the A4A3 assembly. The display should be similar to that shown in the lower trace of composite waveform SS3-1.

If the correct signal is present but was not present in test 2-a, check Q1 and associated components.

If the signal is not present proceed to test 2-c.

Test 2-c Connect the oscilloscope to Q2-c. The oscilloscope display should be similar to the top trace in composite waveform SS3-1. If the signal is present but was not present in test 2-b, U1 is probably defective.

If the signal is not present at Q2-c, Q2 is probably defective.



Composite Waveform SS3-1

Divide-by-Two Circuit A4A3

The A4A3 assembly provides 10 MHz outputs to the HF Loop (A4A7) phase detector, and to the divide-by-five and divide-by-two circuits (A4A1). It also provides a 20 MHz output for use in the reference loop phase detector A4A2.

Q1 and Q2 amplify the 20 MHz signal from the A4A4 assembly and applies it to U1 which divides by two. The +5V required for operation of U1 is derived from the +20V supply by R4 and CR1 to minimize effects of power supply ac ripple and line variations.

The output from U1 is capacitively coupled out to the HF Loop as a reference signal. It is also coupled through Q3 to 10 MHz tuned amplifier Q5. The 10 MHz output from Q5 is used in the divide-by-five and divide-by-two circuits (A4A1).

The 20 MHz output of Q2 is also coupled through tuned amplifier Q4 to the A4A2 phase detector assembly.

Test Procedure 3

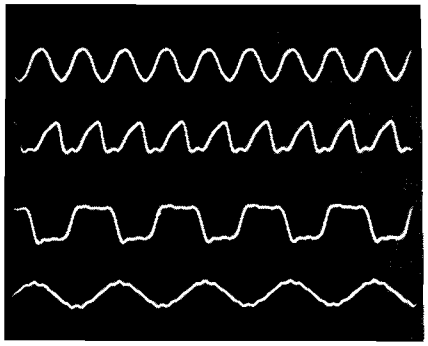
Test 3-a Connect the oscilloscope to the 10 MHz output to the A4A1 assembly. The oscilloscope display should be about as shown in the bottom trace of composite waveform SS3-2. Verify that the frequency is exactly 10 MHz with the counter.

If the signal is not present proceed to test 3-b. If the signal is present, proceed to test 3-d.

Test 3-b Connect the oscilloscope to the 10 MHz output which goes to the A4A4 assembly. The oscilloscope display should be about as shown in the next-to-the-bottom trace of composite waveform SS3-2. Verify that the frequency is exactly 10 MHz with the counter.

If the signal is present but was not present in test 3-a, check Q3, Q5 and associated components. If the signal is not present proceed to test 3-c.

Test 3-c Connect the oscilloscope to U1 pin 12. The oscilloscope display should be similar to the second from the top trace in composite waveform SS3-2.



Composite Waveform SS3-2

NOTE

The counter may be used to verify that the frequency is approximately 20 MHz. However, this point in the circuit is critical; the additional load on the circuit will probably disturb the phase lock loop balance.

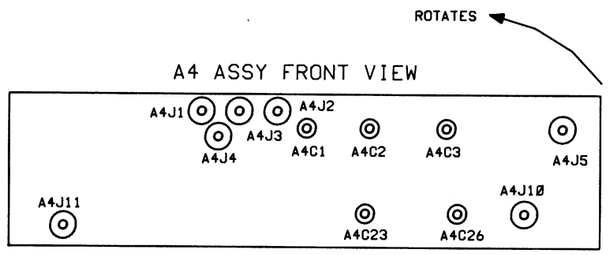
If the display is correct but was not correct in previous tests, U1 is probably defective. If the display is not correct, check Q1, Q2, and associated components.

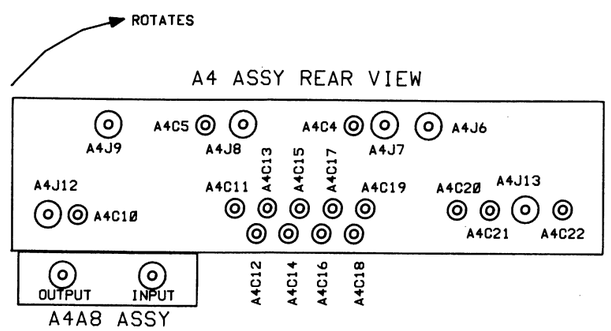
Test 3-d Connect the oscilloscope and the counter (separately) to the 20 MHz output of the A4A2 assembly. The oscilloscope display should be similar to that shown in the top trace of composite waveform SS3-2. The counter readout should be exactly 20 MHz.

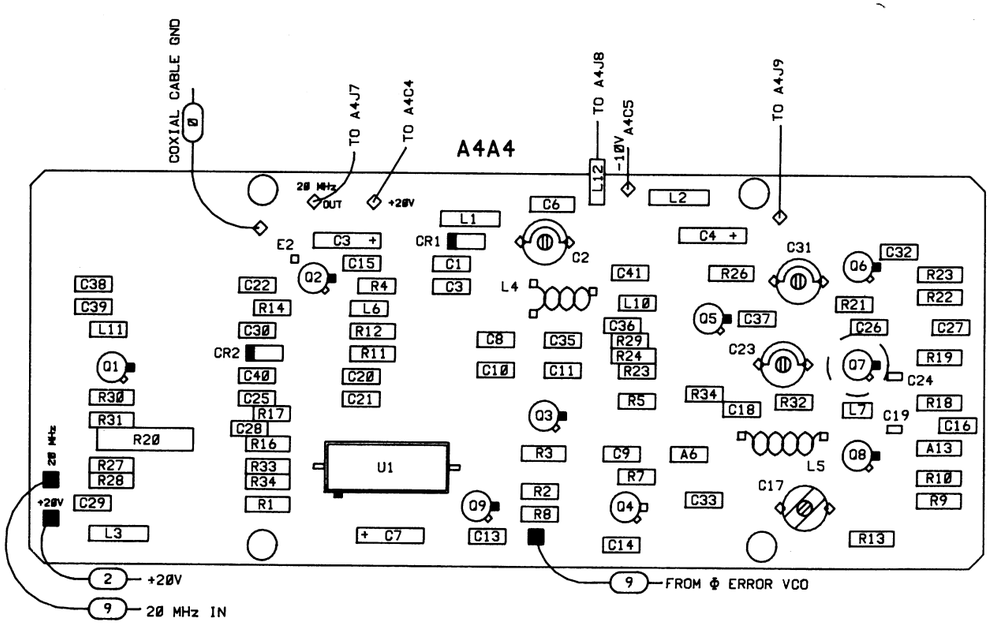
If the correct signal is not present, check Q4 and associated components.

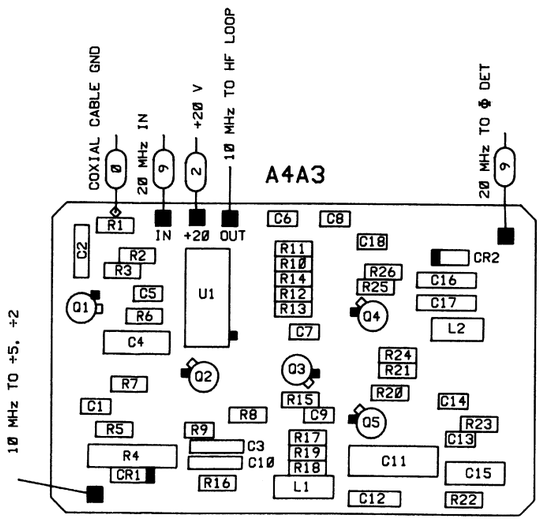
NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
2. L8 and L9 are part of the printed circuit board.





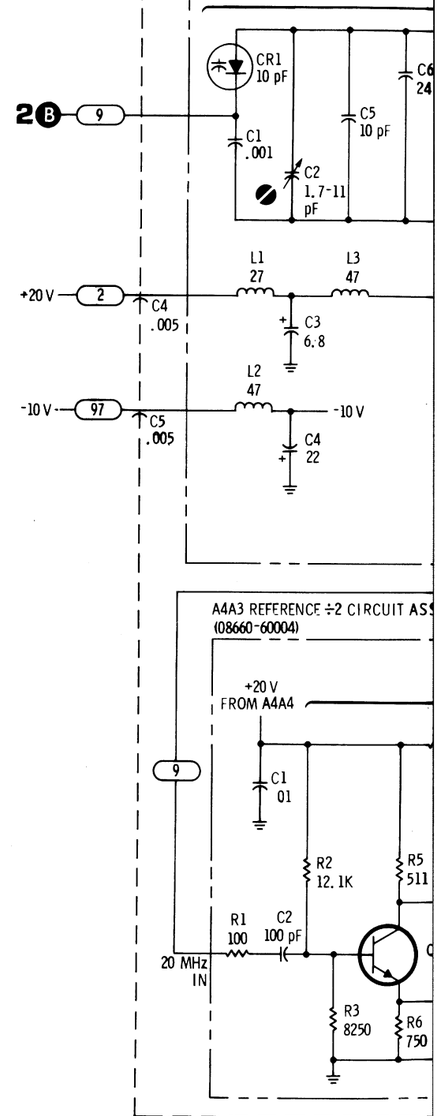




Component Locator

A4 HOUSING ASSY 08660-60042

A4A4 REFERENCE VCO ASSY (Ø



SERIAL PREFIX: 2718A

A4 HOUSING ASSY 08660-60042

A4A4 REFERENCE VCO ASSY (08660-60375)

REGULATOR

100 MHz TUNED AMPLIFIER

X5 CIRCUIT

VCO

POWER SPLITTER

100 MHz AMPLIFIER

20 MHz TUNED AMPLIFIER

100 MHz TUNED AMPLIFIER

REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - —) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

A4A3 REFERENCE ÷2 CIRCUIT ASSY (08660-60004)

10 MHz TUNED AMPLIFIER

20 MHz AMPLIFIER

SERIAL PREFIX: 2718A

Figure 8-4 Reference Lo

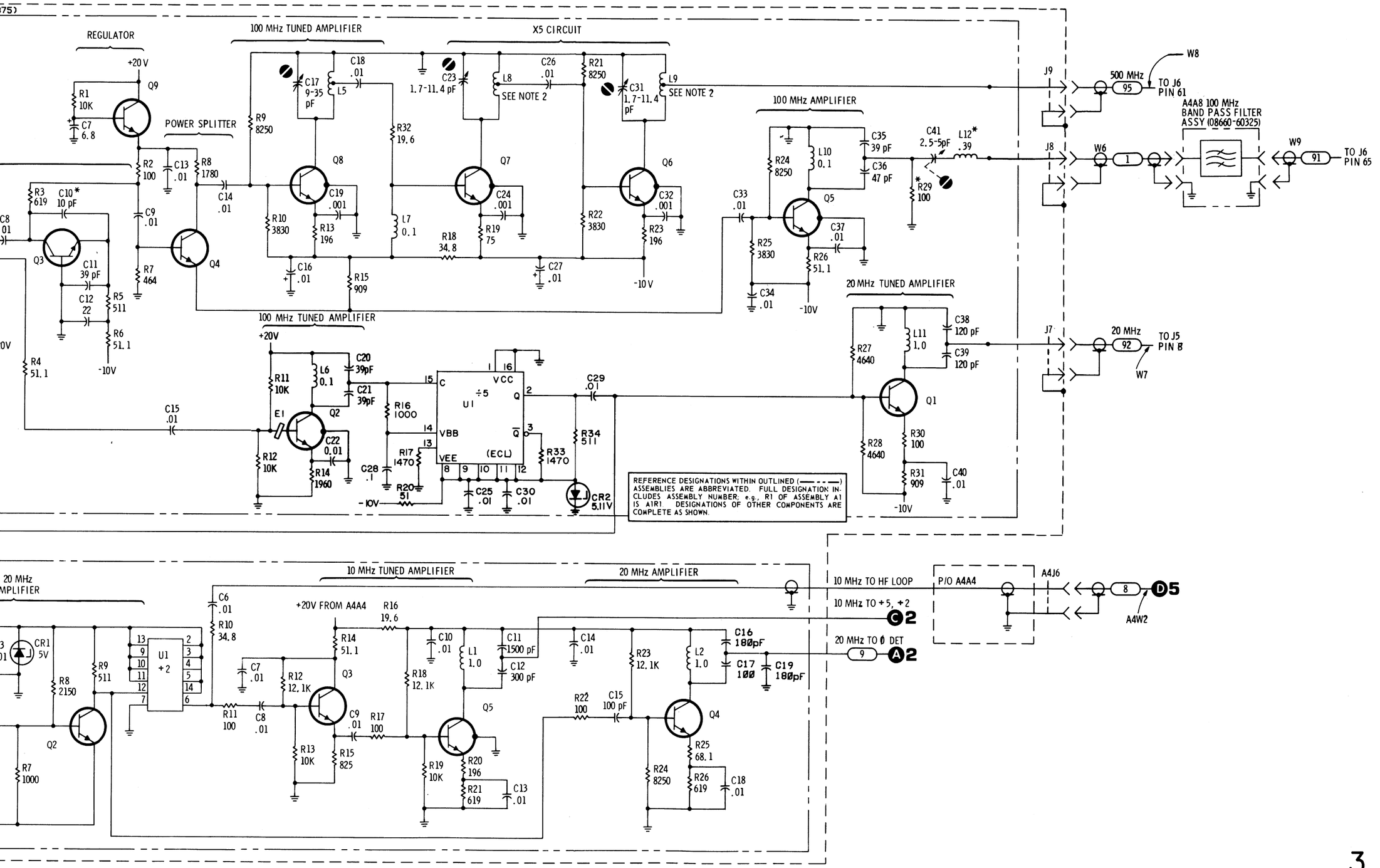


Figure 8-4 Reference Loop Circuits

Service Sheet 4

ASSEMBLY

- **Pretuning Assembly**

The A4A6 assembly, a part of the three-assembly High Frequency Loop, is shown schematically and described on this Service Sheet. The other two assemblies A4A5 and A4A7, are shown schematically and described on Service Sheets 5 and 6.

NOTE

After making repairs in any parts of the HF Loop circuits, Adjustment 6 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Digital Voltmeter ..... HP 3478A

HIGH FREQUENCY LOOP GENERAL INFORMATION

The purpose of the HF Loop is to provide a precise digitally controlled output frequency between 350 and 450 MHz in 10 MHz increments. This output is used in the internal extension module and in the plug-in RF Sections to provide the desired output signal.

Pretuning Circuit

Q1 through Q11, U1, and associated components comprise a digital-to-analog converter which pretunes the A4A5 voltage controlled oscillator. The pretuning circuit cannot, by itself, set the oscillator frequency precisely; it does set the frequency within the capture range of the loop.

Integrated circuit U1 is a decoder which converts the BCD input from CF digit 8 to individual select lines which turn on one of nine transistors connected in a resistive network. The transistor which is turned on effectively grounds one point in the resistive network. The voltage level output to the voltage controlled oscillator depends on which transistor is turned on. The voltage varies from about −7V (350 MHz) to about −34V (450 MHz).

A single input line, representative of BCD '1' from CF digit 9 drives Q1 to turn on Q11. Q11, the tenth transistor switch in the pretuning network, grounds the lowest resistance point in the network; it pretunes the voltage controlled oscillator to 350 MHz.

Test Procedure 1

Test 1-a With the digital voltmeter connected to the junction of R15, R18 and R19 set the CF as shown in Table 8-3. The voltages shown in the table are typical; the actual voltage levels will depend on the characteristics of the varactor used in the voltage controlled oscillator.

If changing the setting of CF digit 8 through its range does not result in a change in the dc level at the junction of R15, R18 and R19, U1 may be defective.

Test 1-b Use the digital voltmeter to check the A, B, C, and D inputs to U1 from CF digit 8. These inputs are binary 1 2 4 8 positive true logic. Example: with CF digit 8 set to a 3, U1 pins 15 and 14 should be high, (about +4V) and pins 12 and 13 should be low (about 0.3V). If the A, B, C, and D inputs to U1 are correct, use the digital voltmeter to check the U1 output. (Example: if thumbwheel digit 8 is set to a 3, inputs A and B will be high and U1 pin 4 will go low.)

Operation of transistors Q2 through Q11 may be checked by checking the dc level at their collectors which are connected to the transistor shell. The numbers plated on the circuit board next to the potentiometers correspond to CF digits 8 and 9. CF digit 8 controls Q2 through Q10 and CF digit 9 drives Q1 to control Q11. The metallic shell (collector) of the transistor selected goes low (0.1V or less).

Summing Circuit

Common base current source Q13 sums the output of the digital to analog converter, current from a +20V source (R13), and the error signal from the A4A7 sampling phase detector. The output of the digital to analog converter is partially controlled by common base current source Q14. Conduction of Q14 is controlled by a temperature sensitive stabistor diode on the voltage controlled oscillator circuit board. The current from Q14 is injected into the pretuning network to provide correct compensation for the voltage controlled oscillator drift characteristics. Q12 provides a means of coupling the error signal from the phase detector through C7 to the voltage controlled oscillator in the A4A5 assembly.

Test Procedure 2

Test 2-a Connect the digital voltmeter to the A4A6 output labeled FREQ on the circuit board. Set the CF digits as shown in Table 8-3. The voltages shown are typical; actual voltage levels depend on the characteristics of the varactor in the voltage controlled oscillator.

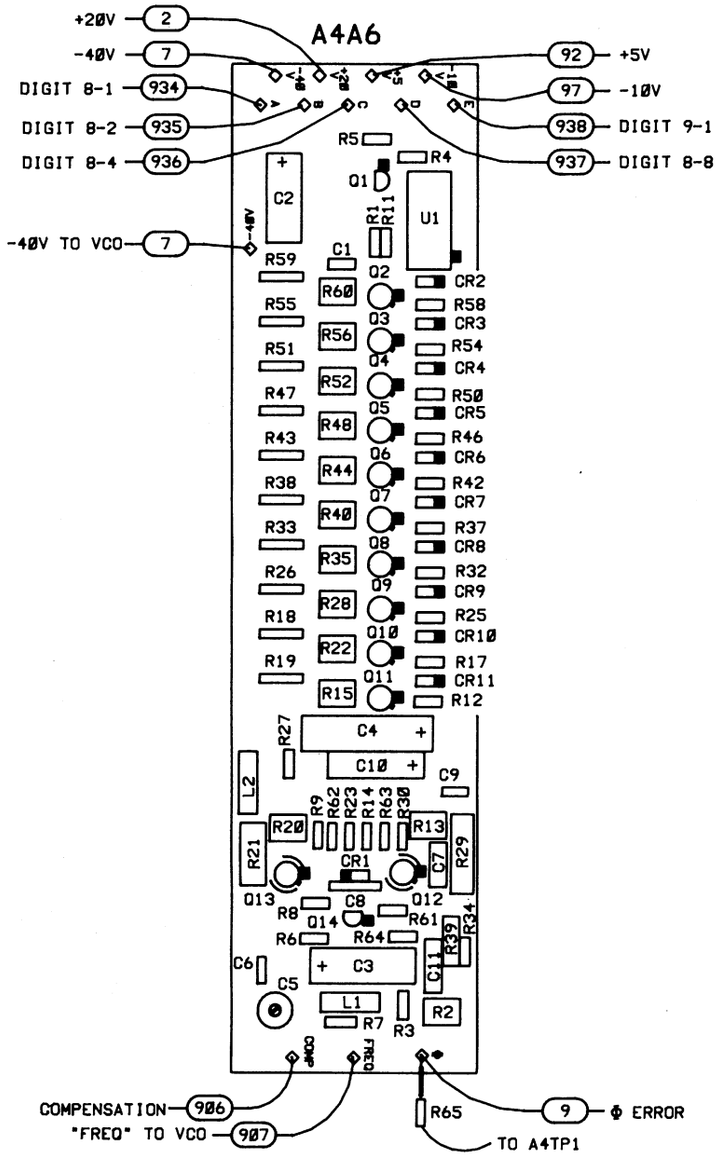
If the voltages were correct in test 1-a but are not in test 2-a, check Q12, Q13, and associated components.

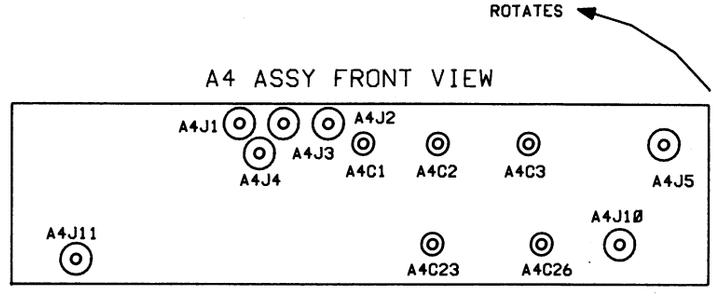
Table 8-3. *Pretuning DC Levels*

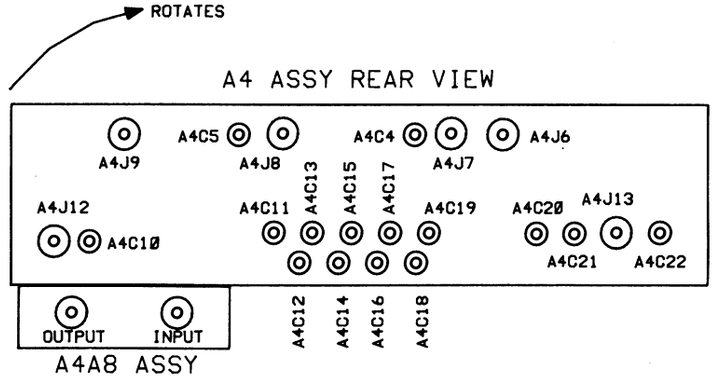
Center Frequency (MHz)	Test 1-a DC Level	Test 2-a DC Level
0000.010000	−34.7V	−34.5V
0010.010000	−28.3V	−29.3V
0020.010000	−23.1V	−25.0V
0030.010000	−18.7V	−21.4V
0040.010000	−14.9V	−18.4V
0050.010000	−11.6V	−15.7V
0060.010000	−8.9V	−13.5V
0070.010000	−6.5V	−11.6V
0080.010000	−4.5V	−9.9V
0090.010000	−2.6V	−8.4V
0100.010000	−1.1V	−7.2V

NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.







Component Locator

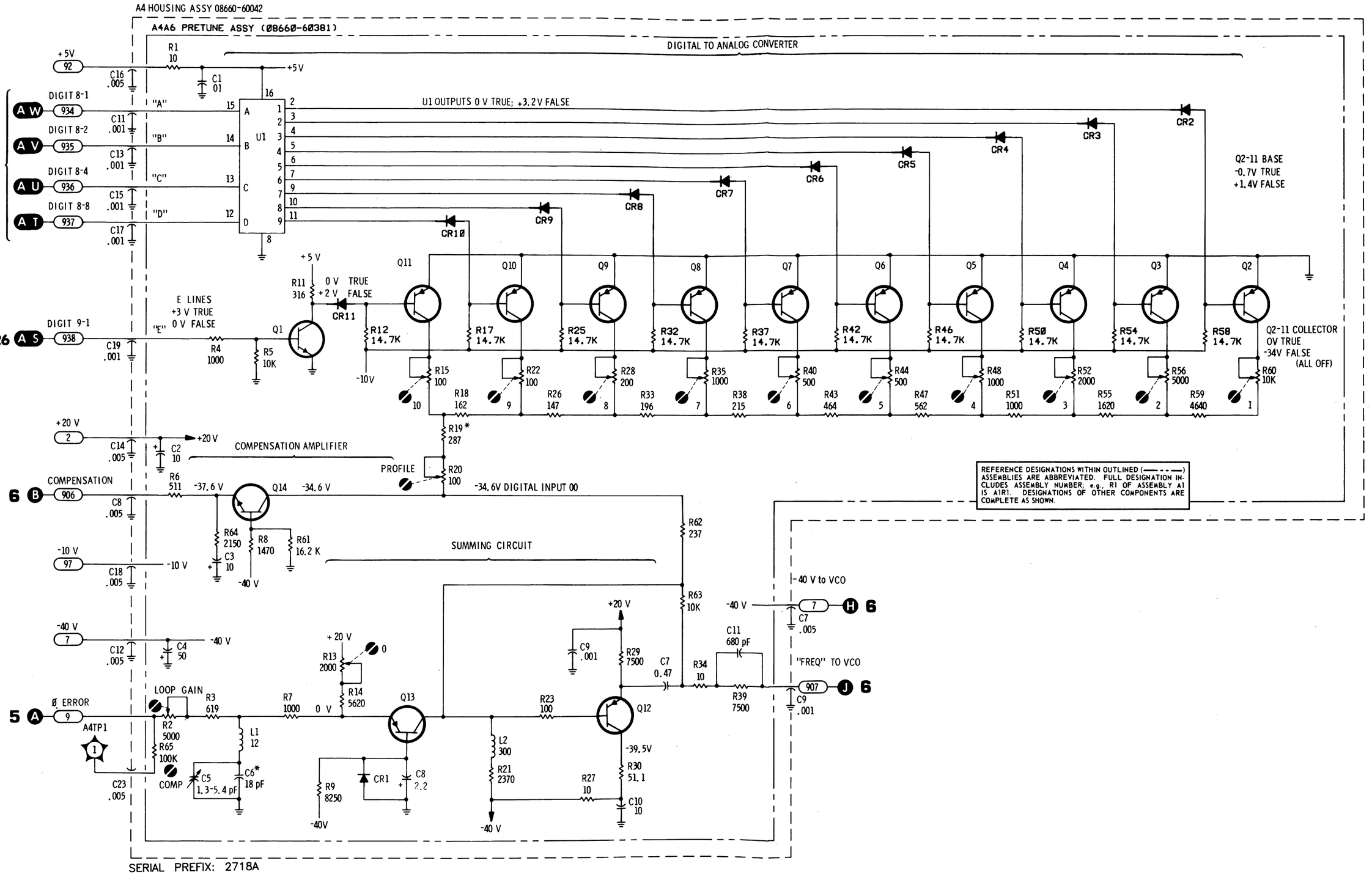


Figure 8–5 Pretuning Assembly

Service Sheet 5

ASSEMBLY

- **Sampling Phase Detector (A4A7)**

The A4A7 assembly, a part of the three-assembly High Frequency Loop, is shown schematically and described on this Service Sheet. The other two assemblies, A4A5 and A4A6, are shown schematically and described on Service Sheets 4 and 6.

NOTE

After making repairs in any part of the HF Loop circuits, Adjustment 6 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Oscilloscope (with 10:1 divider probes)	HP 54200A
Test Oscillator	HP 3325A
Digital Voltmeter	HP 3478A

HIGH FREQUENCY LOOP GENERAL INFORMATION

The purpose of the HF Loop is to provide a precise digitally controlled output frequency between 350 and 450 MHz in 10 MHz increments. This output is used in the internal extension module and in the plug-in RF Sections to provide the desired output signal.

The sampling phase detector compares the voltage controlled oscillator output to a 10 MHz signal from the reference section. The output of the phase detector circuit is a beat note or a varying dc level. The phase detector assembly contains a pulse generator, a sampler, and a signal processing circuit.

Pulse Generator

Q1 and Q2 comprise a non-saturating, limiting amplifier. It provides a constant amplitude square wave (about 6V) derived from the 10 MHz reference signal. The circuit is designed to minimize the sensitivity of the output ac swing to power supply ripple.

The output of Q2 is applied to Q3 which converts the signal to a stable current waveform. A two-to-one step-down transformer (T1) is used in conjunction with Q3 to provide the additional current required to drive the step-recovery diode CR1.

When Q3 conducts heavily CR1 is reverse biased by the signal which appears across the secondary winding of T1. When Q3 is turned off, the collapsing inductive field of the T1 primary winding and the resonant circuit of L5 and C10 cause a flyback action which drives CR1 into conduction. L4 and C9 also enhance the flyback action.

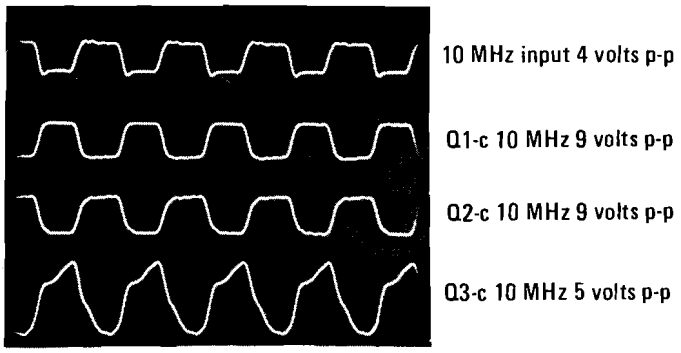
NOTE

One of the characteristics of a step-recovery diode, also called a charge-storage diode, is that the junction transition capacitance accumulates a charge while the diode is forward biased.

When the pulse which forward biased CR1 has ended, CR1 is again reverse biased; however, current will flow in the reverse direction until the charge stored in CR1 is depleted. When the charge stored in CR1 is depleted current flow stops abruptly; the sharp current transition causes L6 and L7 to develop large narrow voltages spikes of about 6V amplitude and one nanosecond in duration. The pulse is positive-going at L7 and negative-going at L6. These pulses are coupled through C10, C11 and balun T2 to forward bias the diodes in the sampler bridge. Balun T2 improves amplitude balance of the pulses.

Test Procedure 1

Test 1-a Composite waveform SS5-1 illustrates the correct waveforms for the three stages of the pulse generator.



Composite Waveform SS5-1

NOTE

Since an oscilloscope would load the remainder of the pulse generator circuit, and due to the short duration of the gate pulse, waveform analysis is not practicable. If the waveforms are as shown in SS5-1 and the loop does not phase lock, proceed to test procedure 2.

SAMPLER AND SIGNAL PROCESSOR

The sampler is a matched quad diode gate which is normally reverse biased. When the step-recovery diode generates the gate pulse, all four of the sampler gate diodes are simultaneously forward biased. When the sampler gate diodes are forward biased a sample of the signal from the A4A5 voltage controlled oscillator is taken and stored in C13.

Q4 and Q5 comprise a differential amplifier. The non-inverting input (G2) is derived from the sampling circuit. The output is applied to emitter-follower Q6 which provides a low impedance phase error output. The output of Q6 is also fed back to the differential amplifier inverting input (G1) to close the loop at unity gain. The holding capacitor C13 is connected directly between the two inputs to Q4; this bootstraps C13 to extend the sample frequency response.

CR8 and CR9 provide reverse bias voltages for the sampling gate diodes. These bias voltages are balanced and centered on the output signal to improve sampler efficiency.

R18 controls the response of the sampler by varying the amount of back-bias for the bridge; it is adjusted for maximum frequency response with minimum peaking.

R22 controls the quiescent output level to the summing circuit in A4A6; it should be adjusted for zero output with the input from the voltage controlled oscillator disconnected.

If the voltage controlled oscillator output is harmonically related to the reference signal the output of the phase detector is proportional to the sine of the difference in phase of the two signals. If the voltage controlled oscillator frequency is not harmonically related to the reference signal, the output of the phase detector is a beat note at the difference frequency.

Test Procedure 2

Test 2-a Disconnect the input to the sampler gate from the A4A5 voltage controlled oscillator and substitute a 1 MHz, 10 dBm signal from the test oscillator. Connect the oscilloscope to the phase error output (labeled ϕ on the circuit board). Varying the output level of the test oscillator should cause the oscilloscope display to follow the amplitude change.

If the oscilloscope is not as specified proceed to test 2-b.

If the display is correct and the display for test 1-b was correct, check the step-recovery diode and associated components.

Test 2-b With the oscilloscope connected as it was in test 2-a, inject the 1 MHz signal at Q4-G2. If the signal is now displayed on the oscilloscope and varies as the output of the test oscillator is varied, check the step-recovery diode, the sampler gate diodes and associated components.

If the signal is not displayed check Q4, Q5, Q6 and associated components.

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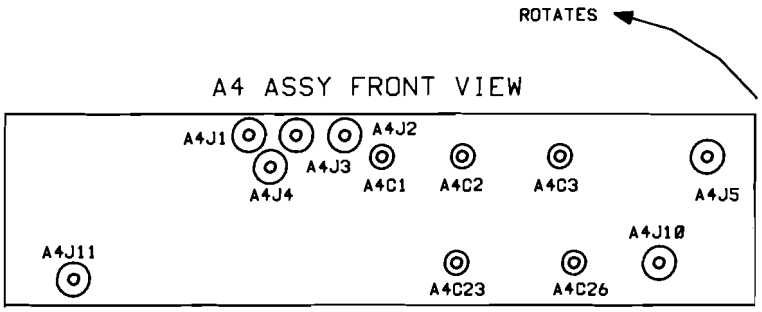
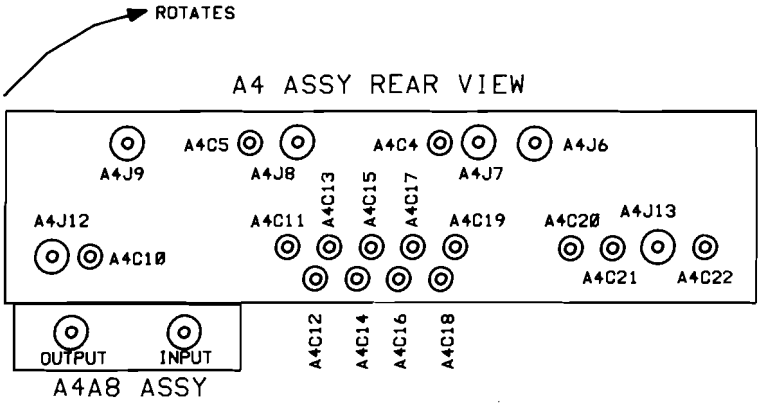
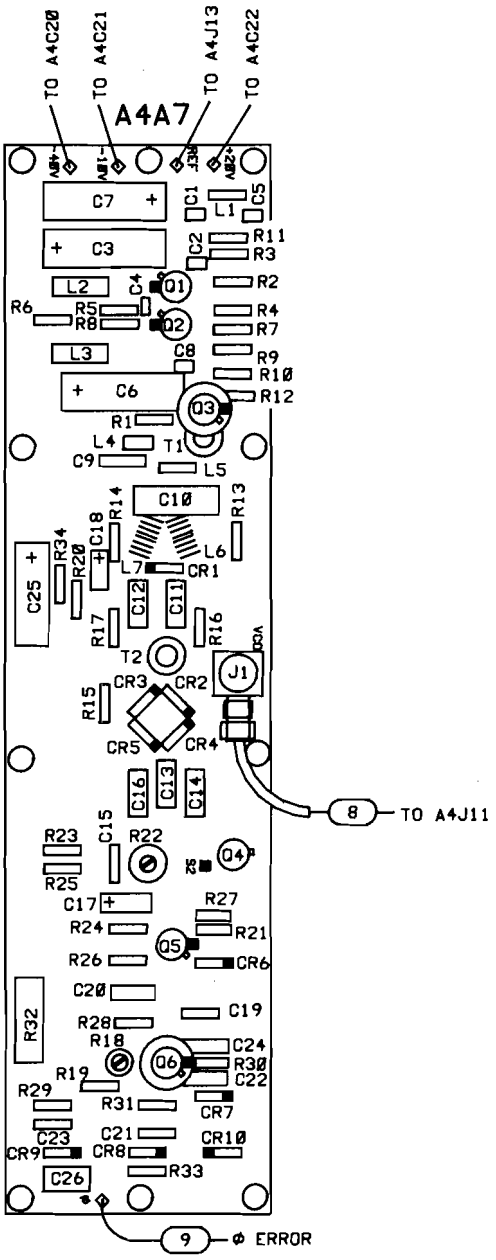
NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
2. P/O printed circuit board.







Component Locators

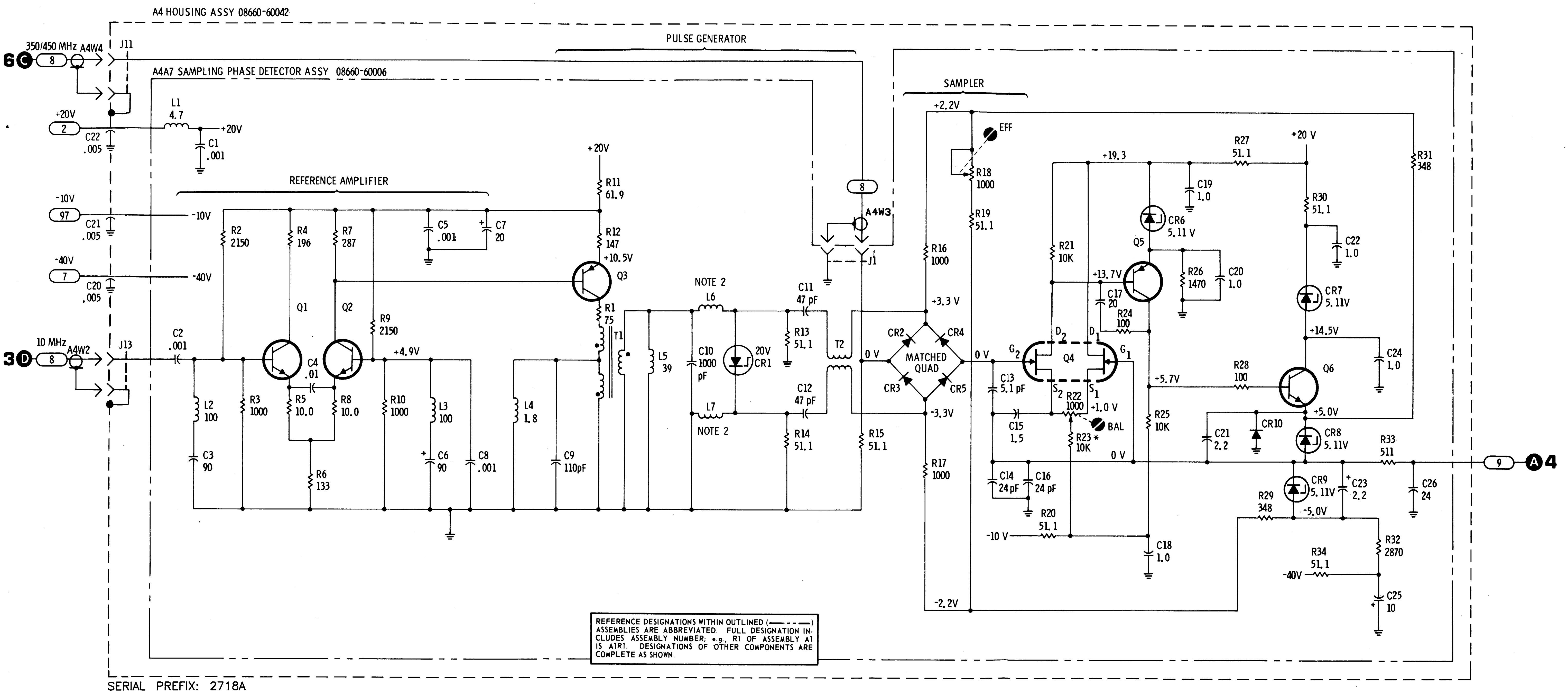


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Figure 8-6 Sampling Phase Detector

Service Sheet 6

ASSEMBLY

- **VCO and Amplifiers (A4A5)**

The A4A5 assembly, a part of the three-assembly High Frequency Loop, is shown schematically and described on this Service Sheet. The other two assemblies, A4A6 and A4A7, are shown schematically and described on Service Sheets 4 and 5.

NOTE

After making repairs to any part of the High Frequency Loop circuits, Adjustment 6 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Digital Voltmeter	HP 3478A
Spectrum Analyzer	HP 8590A
Frequency Counter	HP 5385A

HIGH FREQUENCY LOOP GENERAL INFORMATION

The purpose of the HF Loop is to provide a precise digitally controlled output frequency between 350 and 450 MHz in 10 MHz increments. This output is used in the Frequency Extension Module and in the plug-in RF Section to provide the desired output signal.

VCO and Amplifiers

Transistor Q4 and associated components comprise a voltage controlled oscillator. When the loop is phase locked, the output frequency is always a 10 MHz harmonic between 350 and 450 MHz. C3 is adjusted to set the high frequency end of the band. C1 is part of the loop filter in the control path and also provides an ac ground for the varactor at the bias point.

The oscillator output (about 0.5 Vrms) is coupled through an isolation transformer to two identical three-stage buffer amplifiers. The isolation transformer splits the power equally to the two amplifiers and also eliminates feedthrough of extraneous signals from one amplifier to the other. The amplifiers provide outputs that are about 1 Vrms into 50 ohms.

Additional isolation from extraneous signals is provided by separate power supply inputs to the two amplifiers, extensive decoupling between stages, multiple grounding points for individual stages and separation of ground planes for individual stages.

CR2 is a stabistor used for temperature compensation for the voltage controlled oscillator. The forward voltage drop of the stabistor changes with the voltage controlled oscillator temperature and controls a current source (A4A6Q14) in the pretuning assembly.

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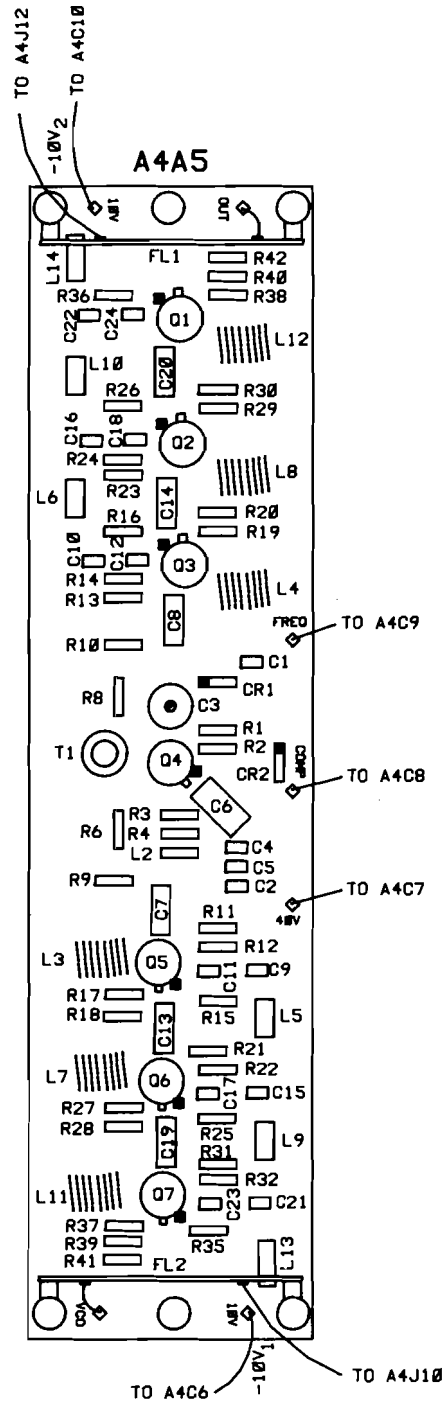
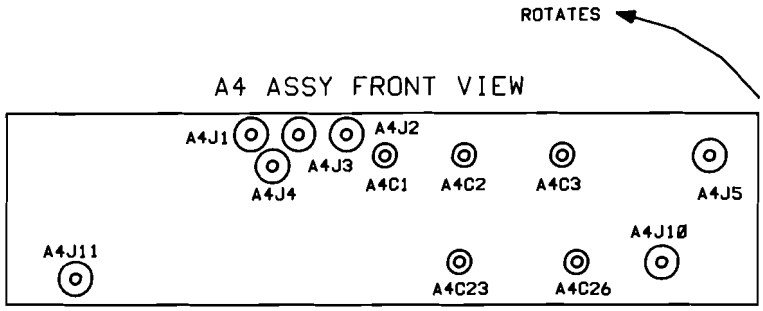
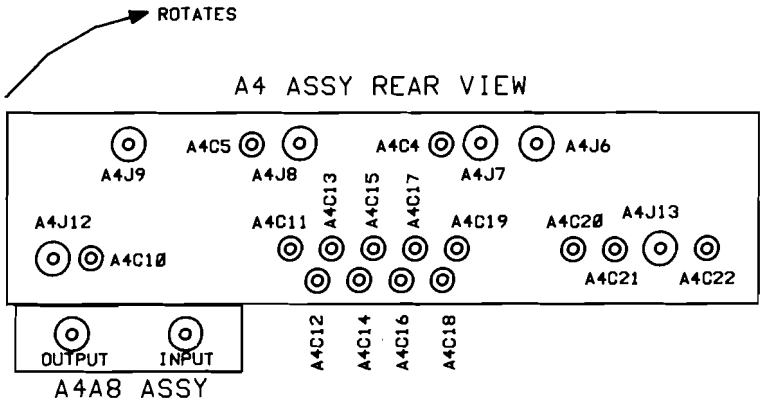
NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.







Component Locators

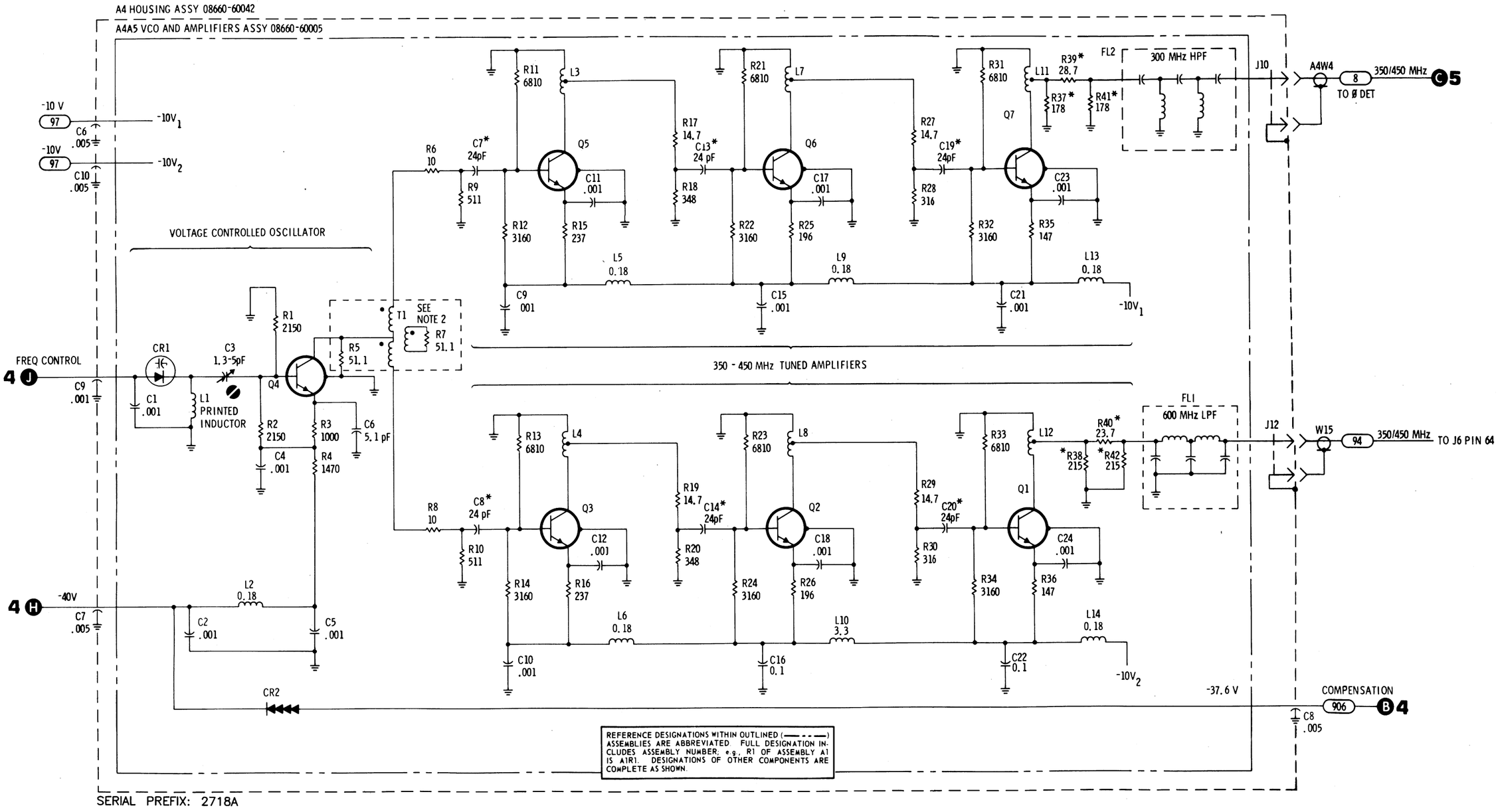


Figure 8–7 VCO and Amplifiers

Service Sheet 7

ASSEMBLY

- **N1 Phase Detector Assembly A16**

The A16 assembly, a part of the two-assembly N1 phase lock loop is shown schematically and described on this Service Sheet. The N1 Oscillator assembly, A17, is shown schematically and described on Service Sheet 8.

When trouble has been isolated to the A16 assembly it should be removed and reinstalled using two extender boards. This will provide easy access to test points and components.

NOTE

After making repairs in any part of the N1 loop circuits, Adjustment 7 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Oscilloscope (with 10:1 divider probes)	HP 54200A
Digital Voltmeter	HP 3478A
Frequency Counter	HP 5385A

N1 LOOP GENERAL INFORMATION

The purpose of the N1 loop is to generate digitally controlled RF signals in the range of 19.8 to 29.7 MHz in selectable 100 kHz increments. The voltage controlled oscillator is phase locked to a 400 kHz reference which is derived from the master oscillator in the reference section. The RF output from the N1 loop is applied to Summing Loop 1.

Programmable Divider Circuit

The integrated circuits in the A16 assembly, except for U1, are all used to count down the input from the N1 voltage controlled oscillator. When there is no BCD input (all inputs low) and the loop is locked, the input from the voltage controlled oscillator will be 29.7 MHz; the programmable divider will divide by 297 and provide a 100 kHz output at TP3. U5 and U6 are preset by CF digits 6 and 7 and programmed to vary between start counts of 00 to 99. Operation of the circuit is a follows:

Assume that initialy there are no BCD inputs to decade dividers U5 and U6 and they have been preset to zero. Assume also that U2A pin 6 $\overline{(Q)}$ and U2B pin 8 $\overline{(Q)}$ are both low. U4 pin 6 (Q), U3A pin 6 $\overline{(Q)}$ and U3B pin 8 $\overline{(Q)}$ are all high.

AND gate U7A functions as a Schmitt trigger to change the incoming positive half cycles of the sine wave from the voltage controlled oscillator to positive-going pulses. These pulses clock U5 when AND gate U7B is enabled. U5 pin 12 provides a divided-by-ten output to clock U6 and also provides A and B (BCD 1 and 2) outputs. The A and B outputs of U5 have no effect on U4 until AND gate U7C pin 8 goes high (AND gate U7C will be discussed later in this text).

U6 pin 12 provides a divide-by-one hundred output to clock U2A and also provides A and D (BCD 1 and 8) outputs to AND gate U7C. The A and D outputs have no effect on AND gate U7C until after U2B pin 8 $\overline{(Q)}$ goes high at the count of 200.

The D output of U6 (pin 12) goes high on the count of 8 (80 input pulses to U5). This output has no effect on U2A is clocked on negative-going pulses only.

The D output of U6 (pin 12) goes low at the count of 10 (100 input pulses to U5) and clocks U2A. This causes U2A pin 6 $\overline{(Q)}$ to go high. When the D output of U6 (pin 12) again goes low at the count of 10 (200 input pulses to U5), U2A is again clocked and the $\overline{Q}$ output goes low to clock U2B. When U2B pin 8 $\overline{(Q)}$ goes high it provides a high input to AND gate U7C pin 11.

Ninety input cycles after U2B pin 8 $\overline{(Q)}$ goes high (290 input cycles), U6 A and D outputs (BCD 1 and 8) go high and enable AND gate U7C and provide a high to J input 3 of U4, U4 still cannot be clocked because U4 J pins 4 and 5 are still low.

Three input cycles after U4 pin 3 goes high (293 input cycles), the A and B outputs of U5 (BCD 1 and 2) go high and enable the J input to J-K flip-flop U4.

The 294th input cycle will clock U4 at pin 12 because all J and K inputs are high. When clocked, U4 $\overline{Q}$ goes low and AND gate U7B is no longer enabled; the count, as far as U5, U6 and U2 are concerned, is ended. When U4 $\overline{Q}$ goes low it also sets U3A and U3B; the $\overline{Q}$ outputs go low and the Q outputs go high. When U3A in 6 $\overline{(Q)}$ goes low it is used to preset U5 and U6 to the start count programmed by CF digits 6 and 7 or by remote control; U2A and U2B $\overline{Q}$ outputs are set low. When U5, U6, U2A and U2B are preset the J input to U4 is no longer enabled since the count is no longer at the 'sense' count of 293.

When U3B pin 9 (Q) goes high the leading edge is used to generate the sampling pulse. The first pulse to the sampling phase detector is initiated by the 294th input cycle. Since three more cycles are required to restart the count cycle, following sampler pulses are 297 cycles apart.

The 295th input cycle will clock U4 and since U4 K is high, U4 $\overline{Q}$ will go high. This $\overline{Q}$ high is applied to K input of U3A (pin 2) and to pin 4 of AND gate U7B. AND gate U7B will not be enabled because U3B pin 8 $\overline{(Q)}$ is holding AND gate U7B pin 5 low.

The 296th input cycle will clock U3A because the K input is now high. U3A pin 6 $\overline{(Q)}$ will go high. This high $\overline{Q}$ output is applied to AND gate U7B pin 5 and the next count cycle is enabled through AND gate U7B.

When there is a preset input programmed into U5 and U6 pins 3, 4, 10 and 11 the terminal count is still 297. However, the count starts at the number programmed into the BCD inputs. As an example, if the BCD input into U5 and U6 is 99, the first cycle would cause the same digital circuit changes that the 100th cycle caused in the discussion above (U2A would be clocked). The frequency division would be 297 – 99, equal to division by 198. The phase lock loop operation would result in an input frequency to the programmable divider of 19.8 MHz. When divided by 198, the divider output at TP3 would again be 100 kHz.

The output from U3B at TP3 is always 100 kHz when the voltage controlled oscillator is phase locked to the reference signal.

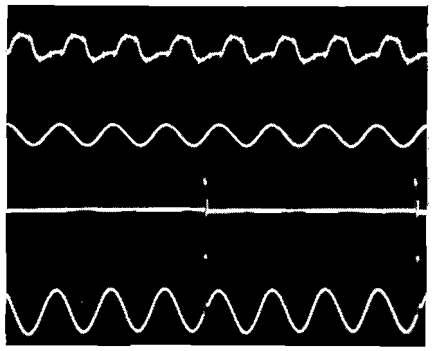
Q6 and CR1 provide Vcc to U3 to minimize the effect of power supply ac ripple and line variations.

Test Procedure 1

Composite waveform SS7-1 illustrates the proper timing relationship between the 400 kHz reference input, the pulse output from the pulse generator, and the sampling point on the 400 kHz reference signal when the loop is phase locked.

NOTE

In the following tests the CF is set to 0 unless otherwise noted.



Composite Waveform SS7-1

Test 1-a. Use the frequency counter to check for 400.000 kHz at TP5.

If the 400.000 kHz signal is displayed on the counter, verify that the sine wave at TP5 is as shown in trace 2 of composite waveform SS7-1. If the signal is as shown proceed to test 1-b.

If the 400 kHz signal cannot be counted or does not appear as shown on the composite waveform for TP5, check the reference input at XA16-1-2. The reference input signal should be about 4 Vpp and 400 kHz as shown in trace 1 of composite waveform SS7-1. If the correct waveform is observed, but was not observed at TP5, check Q1, Q2 and associated components. If the correct waveform is not present, check the cabling to the reference loop and, if necessary, the reference loop (See Service Sheet 3).

If trouble is found and corrected, perform the adjustment procedures specified in paragraph 5-16 to verify proper operation of the loop.

Test 1-b. Connect one oscilloscope channel and the counter to TP4 and the other oscilloscope channel to the junction of C20, R24 and T1. If the loop is locked the waveforms will be as shown in traces 3 and 4 of composite waveform SS7-1 and the counter will display 100.000 kHz.

Note that the waveform shown by trace 3 of the composite waveform may appear as shown even if the counter does not indicate 100.000 kHz. This is because the frequency sensitivity of the oscilloscope is not as exacting as the frequency sensitivity of the counter.

If the programmable divider and the pulse shaper are working properly but the loop is not locked, trace 4 as shown in composite waveform SS7-1 may still shown the pulses, but the signal between the pulses will be erratic.

Test 1-c. If the pulses are not present at TP4 or the junction of C20, R24 and T1 and the counter counts randomly or not at all, connect the oscilloscope to TP3. The oscilloscope should display a waveform similar to that shown in trace 3 of the composite waveform SS7-1 at about half the amplitude.

If the pulses are not present at TP3 proceed to test 1-b.

If the pulses are present at TP3 but were not present at TP4, check Q4, Q5, and associated components. After repairs are made recheck test procedure 1-b.

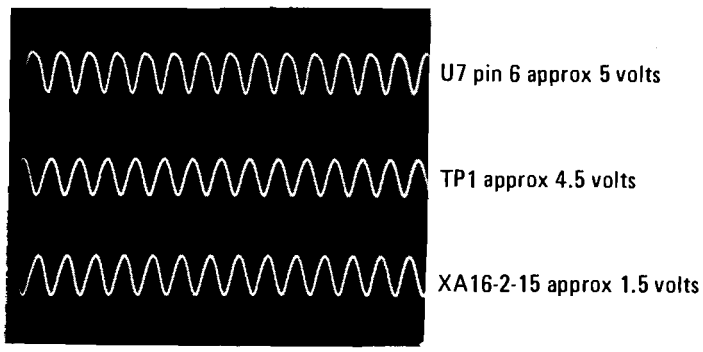
If the pulses are now present at TP4 and the junction of C20, R24 and T1, but the four-cycle sine wave is not present as shown in trace 4 of composite waveform SS7-1, rotate R38 through its range to see if the proper waveform can be obtained. If the frequency displayed on the counter does change as R38 is rotated but phase lock cannot be achieved; check Q3, the sampling diodes, and associated components.

Test 1-d. If the pulse is not present at TP3 in test 1-c connect the oscilloscope to AND gate U7B pin 6. The waveform should be as shown in the top trace of composite waveform SS7-2. If the correct signal is observed proceed to test 1-e.

If the correct signal is not observed connect the oscilloscope to TP1. The waveform should be as shown in the center trace of composite waveform SS7-2. If the signal is present, but was not present at AND gate U7B pin 6, use the digital voltmeter to check the voltage at pins 4 and 5 of AND gate U7B. The digital voltmeter should indicate about 4V. If the voltages are present AND gate U7B is defective.

If the voltages are not present at AND gate U7B pins 4 and 5, ground pin 2 of U4. If the signal now appears at AND gate U7B pin 6, U3 and U7B are functioning properly. The trouble is probably in the gating circuit to U4. Proceed to test 1-e.

If the signal is not present at TP1, use the oscilloscope to check the input from the voltage controlled oscillator at XA16-2-15. The signal should be as shown in the lower trace of composite waveform SS7-2.



Composite Waveform SS7-2

If the signal is present AND gate U7A is probably defective. If the signal is not present, the A17 assembly or interconnections are defective.

Test 1-e. It is assumed in this test that the signal from the N1 voltage controlled oscillator is present at U5 pin 8. Composite waveform SS7-3 illustrates the correct waveforms at the points shown. All signals are about 4.5V.

If none of the waveforms are present, U5 is probably defective.

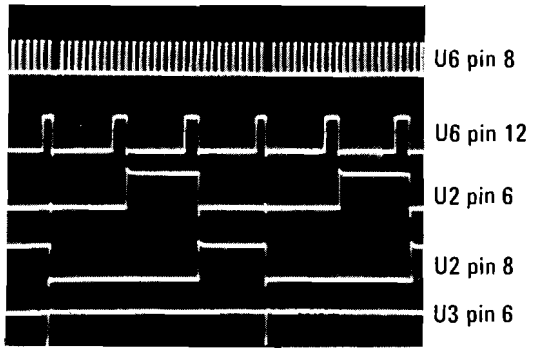
Note that the reset pulse in trace 5 is in time coincidence with the "missing" pulse in trace 1 and that the reset pulse resets traces 2 and 4.

Test 1-f. Composite waveform SS7-4 illustrates the correct waveforms at the points shown. All signals are about 4.5V in amplitude. Sync the oscilloscope to TP3 for this test.

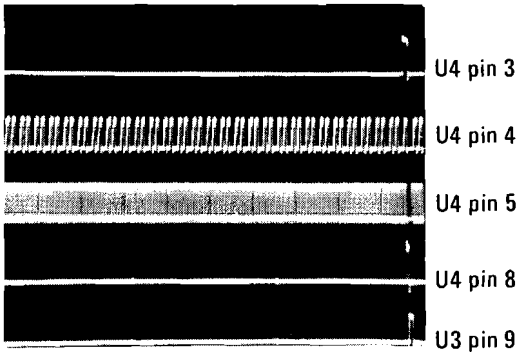
Note that U4 pin 8 goes high only when all of the J inputs (U4 pins 3, 4 and 5) are high.

If the waveforms for traces 2 and/or 3 are not present, U5 is probably defective.

If the waveforms for traces 1, 4 and 5 are not present, proceed to test1-g.

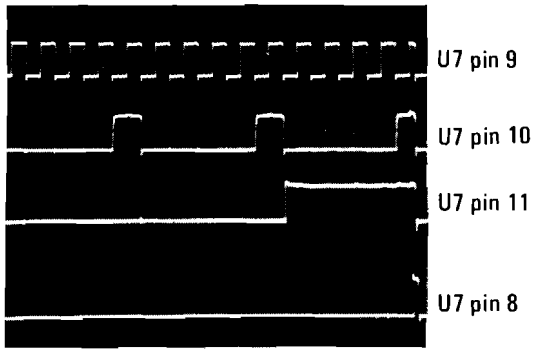


Composite Waveform SS7-3



Composite Waveform SS7-4

Test 1-g. Composite waveform SS7-5 illustrates the correct waveforms at the points shown. All signals are about 4.5V in amplitude. Sync the oscilloscope to TP3 for this test.



Composite Waveform SS7-5

If the inputs to AND gate U7C are not as shown, U6 or U2 may be defective.

If the inputs are as shown but there is no output at AND gate U7C pin 8, U7 is defective.

2 Pulse Amplifier

The positive-going output from U3B pin 9 is used to generate the pulse required to open the sampler gate. Common base amplifier Q5 and emitter follower Q4 amplifies and couples the pulse to T1. CR2 and CR3 are used to minimize flyback action. CR3 also bypasses the negative-going pulse around the transformer primary to ensure that only the positive-going pulse is coupled to the transformer secondary.

A 400 kHz signal from the reference loop is applied to the secondary center tap of T1. L5 and C8 (along with C7 in the reference loop A4A1 assembly) comprise a low pass filter with a cut off frequency of about 500 MHz. The TTL input from the reference loop is reshaped into a sine wave by the low pass filter. L6 and C13 comprise a tuned circuit which bypasses unwanted signals and further filters the sine wave.

Sampler diodes CR4 and CR5 are normally reverse biased. When the sampling pulse appears across the secondary of T1 it is coupled through C20 and C21 to forward bias CR4 and CR5. Since the gate pulses are equal in amplitude but opposite in polarity, they will cancel at TP6.

While CR4 and CR5 are forward biased the sampling gate is open and the 400 kHz reference signal is sampled.

This type of sampling phase detector may be phase locked at virtually any point on the sine wave curve. Ideally, the zero crossover point of the sine wave should be used to improve the lock and hold-in capability of the loop.

If the divided down output of the voltage controlled oscillator in the A17 assembly (100 kHz pulses) is not phase locked to the 400 kHz reference signal, an ac signal is developed at TP6. The polarity of the signal at any given time depends on the polarity of the 400 kHz reference signal at the time the last sample was taken. The amplitude of the signal at any given time depends on what portion of the sine wave the last sample was taken from. Each time CR4 and CR5 are forward biased the signal derived from the 400 kHz reference signal at T1 terminals 4 and 6 are coupled through the sampling gate to control the charge on C22.

When the sampling gate pulse ends, CR4 and CR5 are again reverse biased and the sampling gate is closed. Since Q3 is a high impedance device, the charge will remain on C22 until the next sampling pulse. The error signal from Q3 is applied to the summing amplifier in the A17 assembly through operational amplifier U1.

Test point 8 may be grounded to open the phase lock loop. Since the emitter of A17Q4 in the A17 assembly is also almost exactly at dc ground level, grounding this test point will not affect the pretuning circuit. With the loop open, both the pretuning and the error signal may be checked.

Test Procedure 2

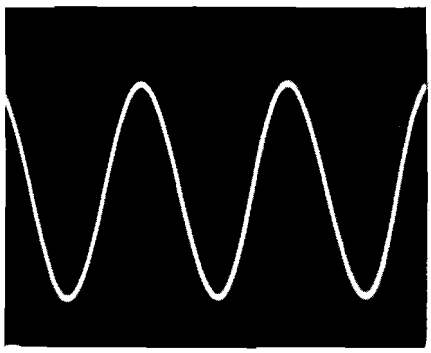
Test 2-a. Connect the oscilloscope to TP6. If the 400 kHz signal is present, one of the sampling gate diodes (CR4 or CR5) is probably shorted. If the gate pulses are present, one of the sampling gate diodes is probably open (negative-going pulses CR5, positive-going pulses, CR4). Proceed to test 2-b.

Test 2-b. With the oscilloscope connected to TP6, ground TP8. The signal displayed should be similar to that shown in waveform SS7-6, at about 3V. The frequency of the signal will be determined by the difference detected by the sampling gate (typically 200 to 400 Hz.).

If the signal is present at TP6, connect the oscilloscope to U1 pin 6. The sine wave should be about the same as that shown for TP6 except that the sampling points will not be as obvious.

If the signal is present at U1 pin 6 the error amplifier and the sampling circuits are functioning properly.

If the signal is not present at U1 pin 6, but was present at TP6, check U1 and associated components. After repairs are made repeat the test and remove the ground from TP8.



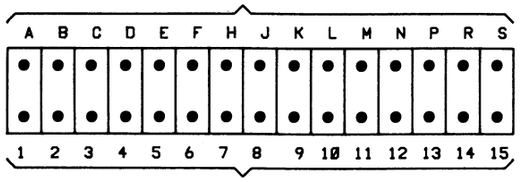
Composite Waveform SS7-6

NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
2. C31 may be omitted.

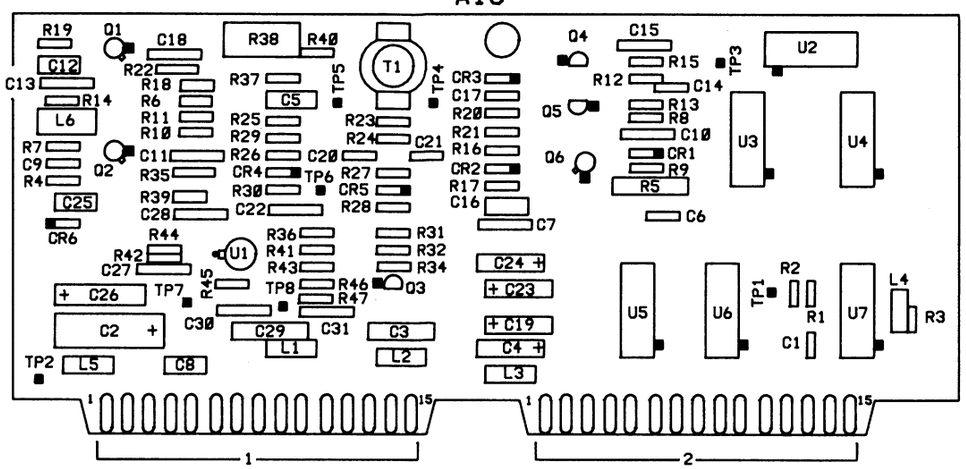
IC	VCC PIN#	GND PIN#
U1-U7	14	7

PIN IDENTIFICATION SOLDER SIDE OF PCB

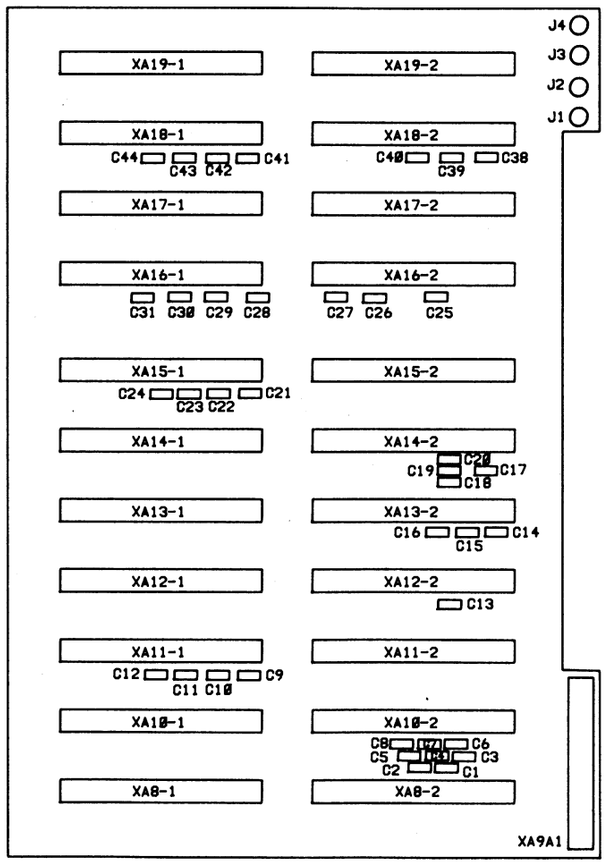


PIN IDENTIFICATION COMPONENT SIDE OF PCB

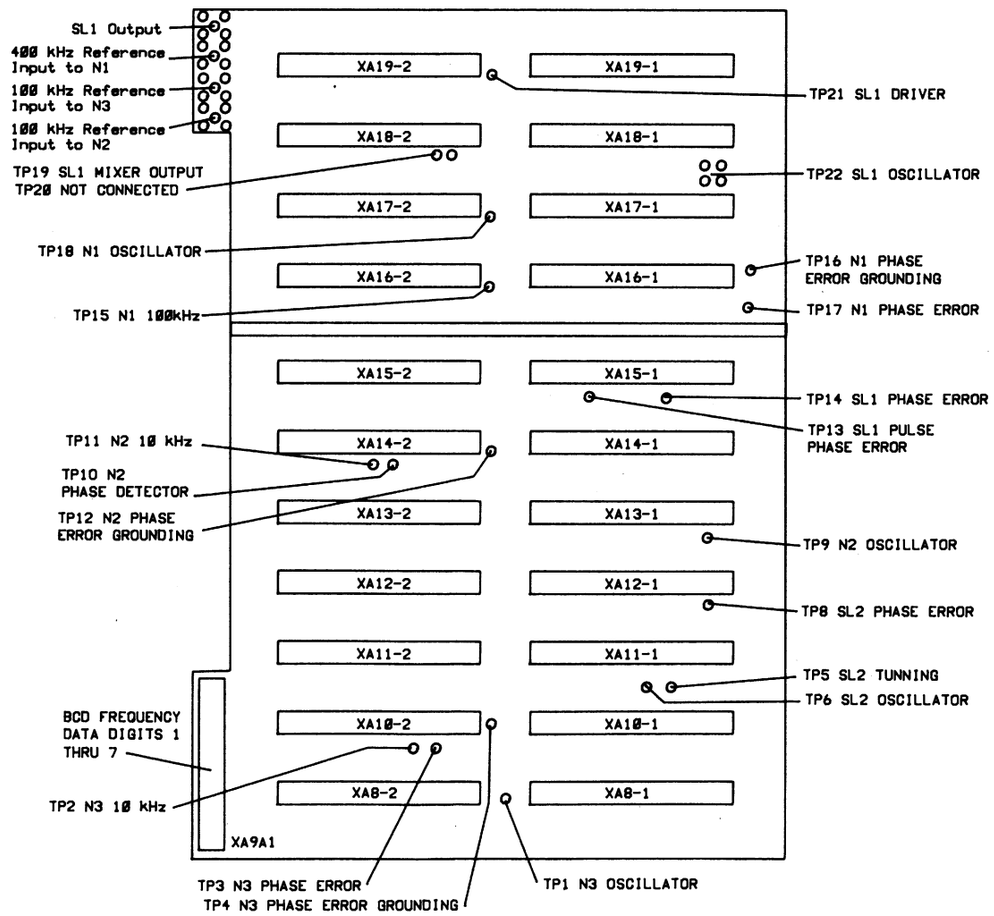
A16



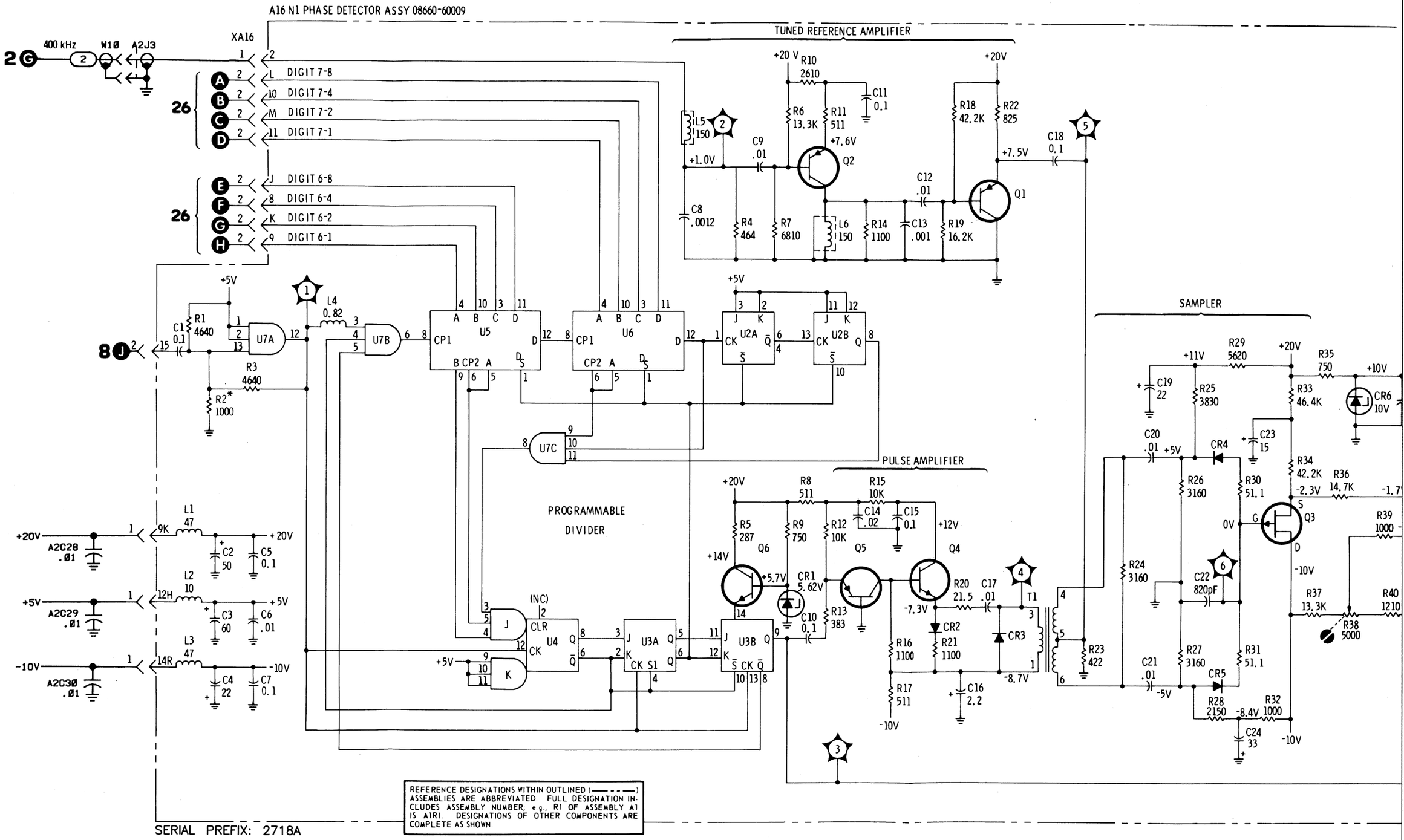
A2 COMPONENT SIDE



A2 SOLDER SIDE



Component Locators



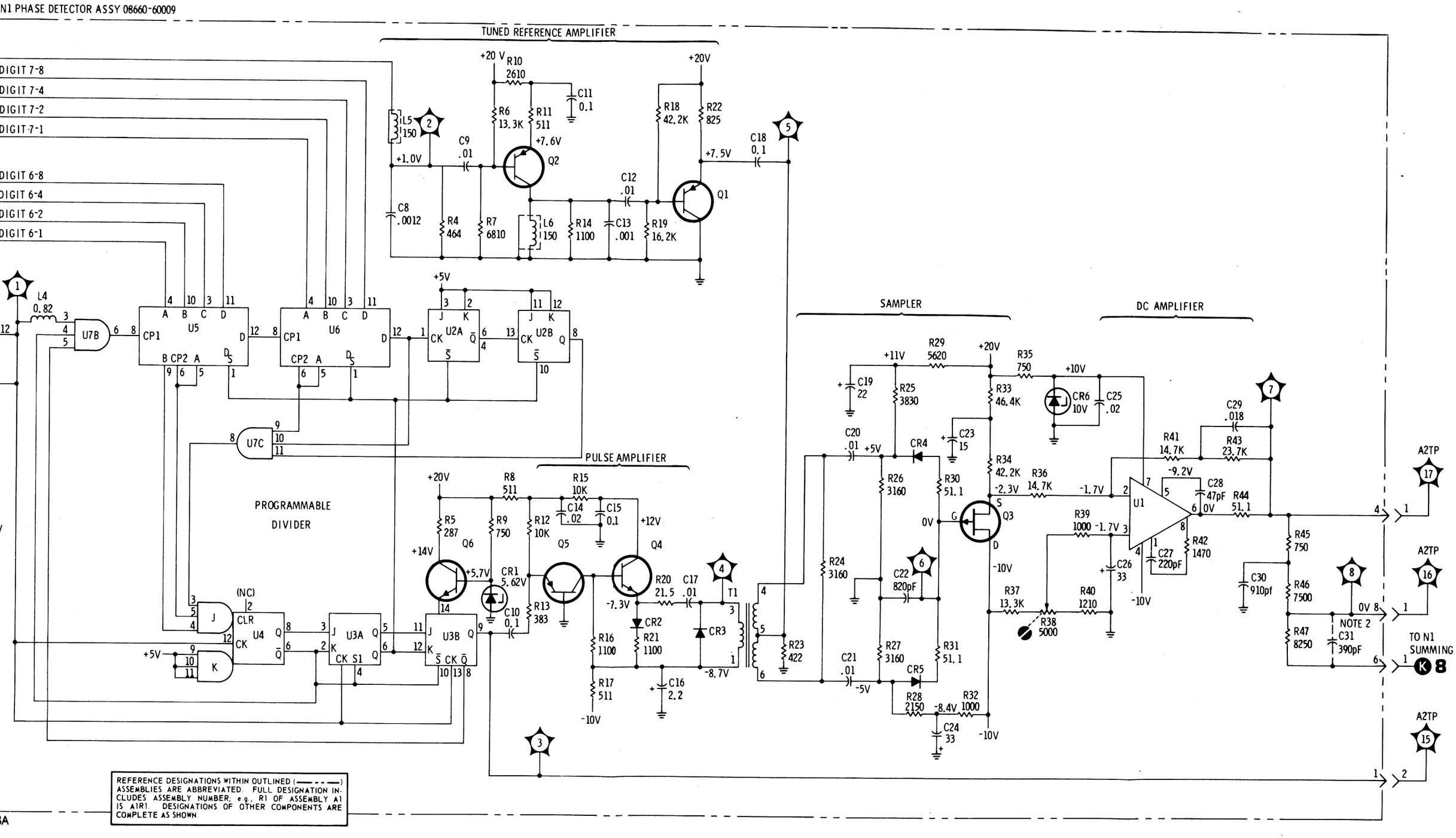


Figure 8–8 N1 Phase Detector

Service Sheet 8

ASSEMBLY

- **N1 Pretuning and Oscillator Assembly A17**

The A17 assembly, a part of the two-assembly N1 phase lock loop is shown schematically and described on this Service Sheet. The N1 Phase Detector Assembly, A16, is shown schematically and described on Service Sheet 7.

When trouble has been isolated to the A17 assembly it should be removed and reinstalled using two extender boards. This will provide easy access to test points and components.

NOTE

After making repairs to any part of the N1 loop circuits, Adjustment 7 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Oscilloscope (with 10:1 divider probes) ..... HP 54200A
Digital Voltmeter ..... HP 3478A
Frequency Counter ..... HP 5385A

N1 LOOP GENERAL INFORMATION

The purpose of the N1 loop is to generate digitally controlled RF signals in the range of 19.8 to 29.7 MHz in selectable 100 kHz increments. The voltage controlled oscillator is phase locked to a 400 kHz reference which is derived from the master oscillator in the reference section. The RF output from the N1 loop is applied to Summing Loop 1.

Voltage Controlled Oscillator

Q3, Q5, and associated components comprise a voltage controlled oscillator. Two varactors (CR6 and CR7) are used in parallel to provide a high Q as well as the wide capacitance range required.

FET Q5 acts as a source follower in the feedback circuit; it provides high impedance at the gate and a low impedance at the source. The gain of the FET is held at less than unity to minimize the Miller effect which might reflect capacitance back into the oscillator tank circuit.

Q1 amplifies the signal from the FET and applies it to two separate amplifiers. Q10 and Q15 provide the output to drive the SL1 mixer and Q8 drives the programmable divider in the A16 assembly.

Test Procedure 1

Test 1-a. Connect the frequency counter to XA17-1-2 and set CF as shown in Table 8-4. The counter readout should be as shown in the table. (Make allowances for counter accuracy).

If the counter does not display a frequency at, or close to, that specified, connect the oscilloscope to TP3. The oscilloscope should display a sine wave at about 0.3 Vpp. If the sine wave is present at TP3 but there is no signal at XA17-1-2, check Q10, Q15 and associated components.

If there is no signal at TP3 check the bias level at TP2. The bias level should be approximately as shown in Table 8-4 for the front panel frequency setting. If the bias level is within the range of approximately −3.4 to −30V, and there is no signal at TP3 check Q1, Q3, Q5 and associated components. If the bias voltage is not within the range shown, proceed to 2-b.

If the counter displays the correct readout for some, but not all, of the front panel settings, proceed to 2-a.

Pretuning Circuit

The frequency of the voltage controlled oscillator is roughly preset by the digital-to-analog converter (U1, U2, Q11 through Q14, and Q16 through Q19). The digital-to-analog converter cannot, by itself, set the oscillator frequency precisely; it does set the frequency within the capture range of the phase lock loop, The inputs to U1 and U2 are BCD bits coded 8, 4, 2 and 1. When any of the BCD inputs are high they cause the output of the NAND gate to which they are connected to go low; the transistor connected to the NAND gate output is switched on.

When all of the BCD inputs are low Q9 is biased to provide approximately −25V at TP1 (Q7-e). With this dc level at TP1 the oscillator is roughly preset to 29.7 MHz.

When any one or more of the BCD inputs go high the transistor associated with it saturates and the current through Q9 is reduced. The reduction in current flow through Q9 changes the bias on Q7 and causes the voltage at TP1 to go less negative (closer to dc ground level). Finally, when the BCD input is 99, the voltage at TP1 is approximately −5.2V and the oscillator frequency is roughly preset to 19.8 MHz.

Q4 is a summing amplifier which combines the output of the digital to analog converter and the signal from the N1 phase detector. The summing point (Q4-e) sums the current from three sources; a current source from the +20V supply through R31, R32 and R33, a negative source from the digital to analog converter (TP1) and the error signal from the N1 phase detector. The voltage at the summing point is always zero volts.

When TP1 is at approximately −25V (all inputs low), most of the current from the +20V source flows through Q7; very little current flows through Q4. Under these conditions the voltage at Q4-c is about −30V. As the voltage at TP1 decreases (gets closer to dc ground level), less current flows through Q7, more current flows through Q4, and the Q4 collector voltage goes less negative. CR3 through CR5, CR8 through CR15 and associated resistors are used to shape the voltage applied to the voltage controlled oscillator so that the frequency will be linear with the applied voltage. When all BCD inputs are low, Q4-c is at about −30V, the junction of R43 and R48 is about −27.5V and all of the diodes in the resistive network are reverse biased. As the voltage at TP1 decreases (gets closer to −5.2V), current through Q4 increases and the Q4 collector voltage goes less negative. As the Q4 collector voltage decreases, first CR3, then CR4 etc. are forward biased. As the diodes are forward biased resistors are added in parallel with R38 and R39 to shape the rate at which the voltage decreases at Q4-c.

Q2 and Q5 are emitter followers which couple the output of Q4 to the varactors. Q2 provides a high impedance for the output of the summing amplifier collector. R46, L7 and C14 comprise a 400 kHz trap to attenuate (15 to 20 dB) any 400 kHz ripple which may be present from the reference signal used in the phase detector. R51, L8, C20 and C21 comprise a low pass filter with a cutoff frequency of about 200 kHz.

Test Procedure 2

Table 8-4 represents typical voltage levels for test points 1 and 2 and exact frequencies at XA17-1-2 for given settings of CF digits 6 and 7 when the loop is locked.

NOTE

While the voltages shown for TP2 are typical (they will vary from instrument to instrument due to differences in varactor characteristics), they are representative of normal ratio of TP2 to TP1 voltages.

Test 2-a. With the digital voltmeter connected to TP1 select CF's shown in Table 8-4. The voltage level should approximately follow those shown in Table 8-4.

If the voltage at TP1 does not vary at all, first verify the presence of input digital information to the NAND gates, then check Q7, Q9 and associated components.

If the voltage at TP1 does not vary as shown, or some CF (or CF's) do not produce a change, first verify the presence of the input to the NAND gate/transistor combination affected, then check the NAND gate and the transistor.

If the voltages at TP1 are approximately as shown in Table 8-4 proceed to Test 2-b.

Test 2-b. Connect the digital voltmeter to TP2 and the counter to XA17-1-2. If the voltage at TP2 does not change approximately as shown in Table 8-4 for specified CF's, or does not change at all, check Q2, Q4, Q6 and associated components. If the voltage at TP2 varies approximately as shown in Table 8-4, but the Frequency at XA17-12 does not step (or there is no RF output), refer to Test Procedure 1 and check the oscillator circuits.

If the voltage at TP2 varies approximately as shown in Table 8-4 and the frequency readout of the counter approximately follows the table (± 20 to 30 kHz) check Q8 and associated components.

Table 8-4. *N1 Oscillator Test Point Measurement*

Center Frequency MHz	Frequency At TP3 kHz	Voltage at TP1	Voltage at TP2
0000.100000	29600.000	−25.2V	−29.2V
0000.100000	29600.000	−25.0V	−28.7V
0000.200000	29500.000	−24.8V	−28.2V
0000.300000	29400.000	−24.6V	−27.7V
0000.400000	29300.000	−24.4V	−27.1V
0000.500000	29200.000	−24.2V	−26.6V
0000.600000	29100.000	−24.0V	−26.2V
0000.700000	29000.000	−23.8V	−25.7V
0000.800000	28900.000	−23.6V	−25.2V
0000.900000	28800.000	−23.4V	−24.7V
0001.000000	28700.000	−23.2V	−24.3V
0002.000000	27700.000	−21.2V	−20.2V
0003.000000	26700.000	−19.2V	−16.6V
0004.000000	25700.000	−17.2V	−13.6V
0005.000000	24700.000	−15.2V	−11.9V
0006.000000	23700.000	−13.2V	−8.9V
0007.000000	22700.000	−11.2V	−7.1V
0008.000000	21700.000	−9.2V	−5.6V
0009.000000	20700.000	−7.1V	−4.3V
0009.900000	19800.000	−5.3V	−3.4V

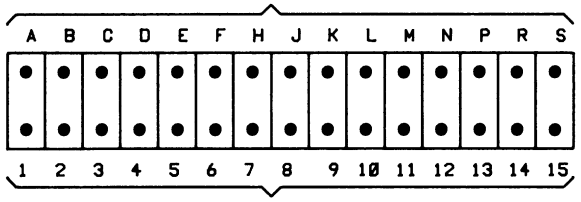
NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

⚠4 Q11-14, 16-19 BASE -7V TRUE -1.7 FALSE;

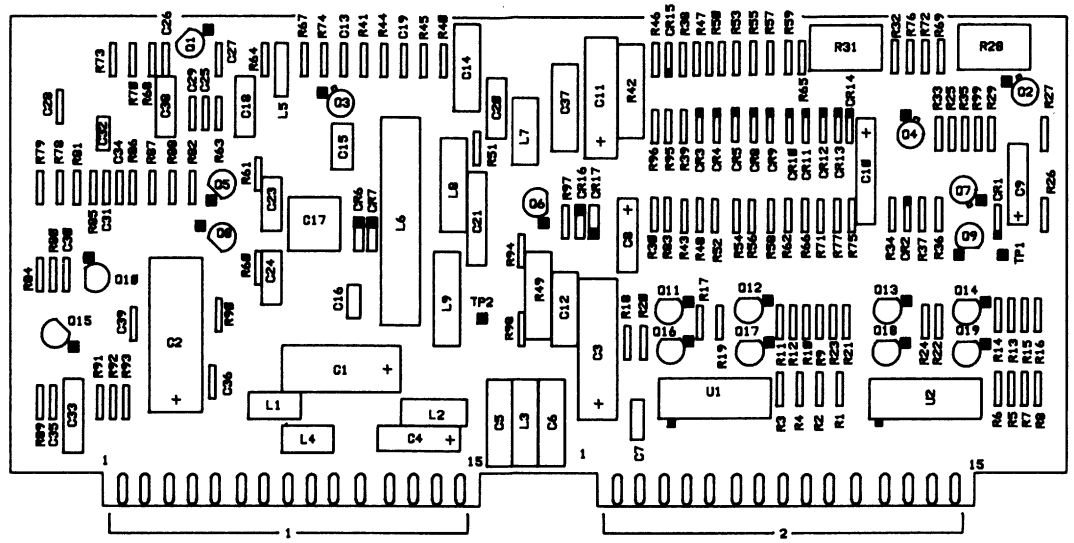
IC	VCC PIN#	GND PIN#
U1, U2	14	7

PIN IDENTIFICATION SOLDER SIDE OF PCB

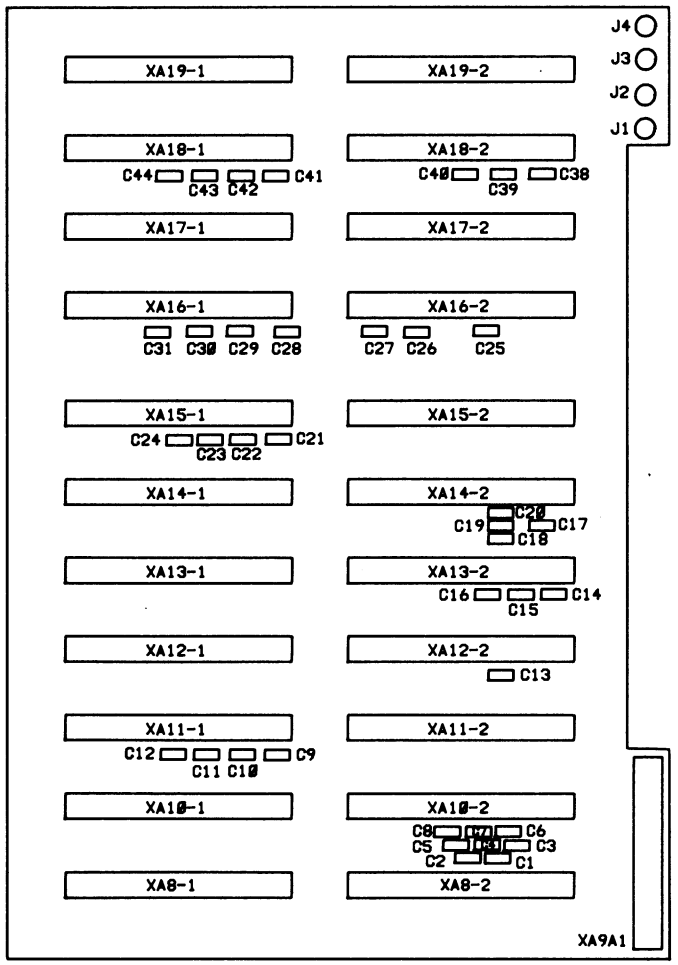


PIN IDENTIFICATION COMPONENT SIDE OF PCB

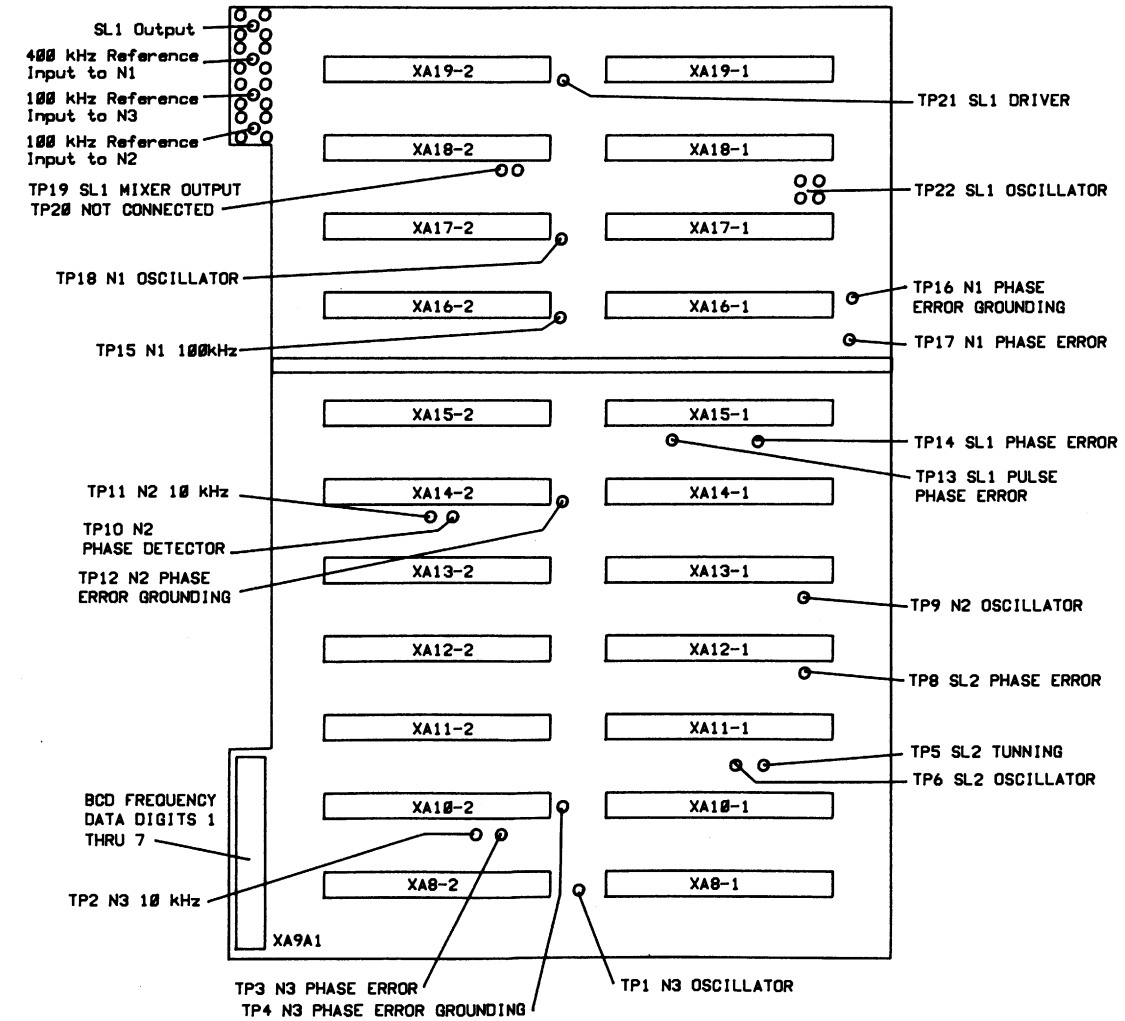
A17



A2 COMPONENT SIDE



A2 SOLDER SIDE



Component Locators

A17 N1 OSCILLATOR ASSY 08660-60010

DIGITAL TO ANALOG CONVERTER

VOLTAGE CONTROLLED OSCILLATOR

AMPLIFIERS

SUMMING CIRCUIT

SHAPER

XA17

26 H DIGIT 6-1
26 G K DIGIT 6-2
26 F DIGIT 6-4
26 E J DIGIT 6-8
26 D DIGIT 7-1
26 C M DIGIT 7-2
26 B DIGIT 7-4
26 A L DIGIT 7-8

+20 V — 9K — L1 47 — C1 50 — C5 0.1 — +20 V
-10 V — 14R — L2 100 — -10 VF1 — L5 22 — -10 VF2 — C2 170
-40V — A2C24 .01 — A2C31 .01 — 15S — L3 47 — C3 20 — C6 0.1 — -40 V
+5V — 12N — L4 47 — C4 47 — TO PIN 14 U1, U2 — C7 .01
FROM N1 Ø 7 K — C

U1C: R1 1620, R9 10K, Q12, R17 392K
U1D: R2 1620, R10 10K, Q11, R18 200K
U1B: R3 1620, R11 10K, Q17, R19 100K
U1A: R4 1620, R12 10K, Q16, R20 49.9K
U2A: R5 1620, R13 10K, Q18, R21 39.2K
U2B: R6 1620, R14 10K, Q19, R22 20K
U2D: R7 1620, R15 10K, Q13, R23 10K
U2C: R8 1620, R16 10K, Q14, R24 5000
-10 VF1

R25 10K, R35 2610, Q7, Q9, CR1
R26 215, R36 825, R27 2610, C9 22, R37 46.4
-40 V — *R29 14.7K — R28 5000
C8 33, R30 1210
R31 2000, +20V, R32 * 6190, C10 33, R33 5620
Q4, R38 46.4K, C11 10, CR2, R34 21.5K, R39 4640, -10 VF1, -40 V

R44 21.5K, C15 3.3pF, C23 3.3pF, C38 270, R63 196, R67 5620, R73 121
R40 8250, L6 0.6, C17 2-8pF, CR6 47pF, CR7 39pF, C24 3.3pF, R60 820K, C25 .01, C26 .01, R70 348
-4.3V, Q3, C16 .01, -8V, D, -1.0V, Q5, S, -6.0V, Q1, C27 .01
C13 .01, -7.6V, C18 100pF, R41 3160, R45 10K, R61 178K, R64 464, R68 4220, R74 316
C19 .01
-10 VF2

R42 5620, R46 215, R94 4220, Q6, Q2, R95 2150, CR16, R97 3830, R96 1000, CR17, L7 820, C14 3280 pF, C37 .022, -40 V, R99 215
R51 196, L8 270, L9 390, R49 6810, C21 1600 pF, C20 .012, R98 10K

R79 5620, R84 316, C30 .01, R80 1K, Q15, Q10, -3.6V, C35 .01, R91 28.7, R93 28.7, TO SL1 MXR 1 L16
-6.8V, C31 .01, R89 316, R92 26.1, R81 4220, R85 316, C32 0.1, -10 VF1, C33 .01
R90 316, -3.2V, C36 .01, TO N1 Ø DET 1 J7
C29 .01, R82 100, R86 5620, Q8, R87 4220, R88 316, 6.7V, C39 .01, -10 VF1, C34 .01, A2 TP 18

-27.5V, -23.2V, -19.2V, -16.0V, -13.3V, -10.8V, -9.1V, -7.4V, -5.9, -4.6V, 2.4V
C12 10, R43 1330, -40V
R48 464, R52 422, R54 348, R56 287, R58 261, R62 196, R66 178, R71 162, R75 133, R77 237, R83 261
CR3, CR4, CR5, CR8, CR9, CR10, CR11, CR12, CR13, CR14, CR15
R47 383K, R50 237K, R53 237K, R55 178K, R57 178K, R59 110K, R65 121K, R69 90.9K, R72 68.1K, R76 51.1K

REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - —) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

SERIAL PREFIX: 2718A

Figure 8-9 N1 Pretuning ar

08660-60010

DIGITAL TO ANALOG CONVERTER

VOLTAGE CONTROLLED OSCILLATOR

AMPLIFIERS

SUMMING CIRCUIT

SHAPER

TO SL1 MXR J16

TO N1 Ø DET J7

A2 TP 18

TO PIN 14 U1, U2

REFERENCE DESIGNATIONS WITHIN OUTLINED (— · · —) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

8A

8

Figure 8–9 N1 Pretuning and Oscillator

Service Sheet 9

ASSEMBLY

- **N2 Phase Detector Assembly A14**

The A14 assembly, a part of the two-assembly N2 phase lock loop is shown schematically and described on this Service Sheet. The N2 Phase Detector assembly, A13, is shown schematically and described on Service Sheet 10.

When trouble has been isolated to the A14 assembly it should be removed and reinstalled using two extender boards. This will provide easy access to test points and components.

NOTE

After making repairs to any part of the N2 loop circuits, Adjustment 8 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Oscilloscope (with 10:1 divider probes) ..... HP 54200A
Digital Voltmeter ..... HP 3478A
Frequency Counter ..... HP 5385A

N2 LOOP GENERAL INFORMATION

The purpose of the N2 loop is to generate digitally controlled RF signals in the range of 19.80 to 29.79 MHz in selectable 10 kHz increments. The voltage controlled oscillator is phase locked to a 100 kHz reference which is derived from the master oscillator in the reference section. The RF output of the N2 loop is applied to Summing Loop 2.

PROGRAMMABLE DIVIDER CIRCUIT

All of the integrated circuits in the A14 assembly are used to count down the input from the N2 voltage controlled oscillator.

When there is no BCD input to U5, U6 and U7 (all inputs low) the input from the oscillator will be 29.79 MHz; the programmable divider will divide by 2979 to provide a 10 kHz output. U5, U6 and U7 may be preset by CF digits 3, 4 and 5 and programmed to vary between counts of 1980 and 2979. Operation of the circuit is as follows:

Assume that initially there are no BCD inputs to U5, U6 and U7 (divide-by-ten decades) and they have all been preset to zero.

At the start of every count cycle, regardless of the BCD input, U1A pin 6 $\overline{(Q)}$ and U1B pin 8 $\overline{(Q)}$ are both low; U3 pin 6 $\overline{(Q)}$, U4A pin 6 $\overline{(Q)}$ and U4B pin 8 $\overline{(Q)}$ are all high.

NAND gate U8C functions as a Schmitt trigger and provides pulses derived from the N2 voltage controlled oscillator output to clock U7 when AND gate U2B is enabled. U7 provides a divide-by-ten output to clock U6 and also provides A and C (binary 1 and 4) outputs to J inputs of JK flip-flop U3. The A and C outputs have no effect on U3 until the count down reaches 2975.

U6 provides a divide-by-ten output to clock U5 and also provides A, B and C (binary 1, 2 and 4) outputs to AND gates U2A and U2C. The A, B and C outputs have no effect on the circuit until the count down of 2970 is reached.

U5 provides a divide-by-ten output to clock U1A and also provides A and D outputs to NAND gate U8A. The A and D (binary 1 and 8) outputs have no effect on the circuit until the count down has reached 2900.

The D output of U5 (pin 12) goes low on the 1000th pulse input to U7 pin 8 and clocks U1A. One thousand input cycles later U1A is again clocked and the negative-going $\overline{Q}$ output of U1A (pin 6) clocks U1B. When U1B $\overline{Q}$ goes high it provides a high to AND gate U2A. The count down has reached 2000.

When the count down reaches 2900, U5 A and D outputs are high. NAND gate U8A pin 3 goes low and NAND gate U8B pin 6 goes high.

When the count down reaches 2970, U6 A, B and C outputs are high. The B and C outputs are applied to AND gate U2C pins 10 and 11, and since U2C pin 9 has been high since U2C pin 9 has been high since the count of 2900, U2C pin 8 goes high. The U6A output is applied to AND gate U2A, and since the other two inputs to U2A are high, U2A pin 12 goes high and is applied to U3 J input pin 3.

When the count down reaches 2975, U7 A and C high outputs are applied to U3 J input pins 4 and 5. Since U3 J pin 3 is now held high the next input pulse from U8C will clock U3. Count coincidence at 2975 cycles has been achieved.

When the count down reaches 2976, U3 is clocked and the U3 $\overline{Q}$ output goes low. When U3 $\overline{Q}$ goes low, AND gate U2B is no longer enabled; the count, as far as U7, U6, U5 and U1 are concerned is ended. When U3 $\overline{Q}$ goes low it also sets U4A and U4B; the $\overline{Q}$ outputs go low and the Q outputs go high. When the $\overline{Q}$ output of U4B goes low it presets U7, U6, U5 and U1. When U7, U6, U5 and U1 are preset the J inputs to U3 are inhibited since the count is no longer at the coincident count of 2975.

When the U4B Q output goes high the leading edge of the pulse is used to generate the sampler pulse. The first pulse to the sampling phase detector is initiated by the 2976th input cycle. Since three more cycles are required to restart the count cycle, following sampler pulses will be 2979 cycles apart.

When the count down reaches 2977, U3 is again clocked and since the K input is high and the J input is low, $\overline{Q}$ will go high. This $\overline{Q}$ high is applied to the K input of U4A and to pin 4 of AND gate U2B. U2B will not be enabled because U4B $\overline{Q}$ is holding AND gate U2B pin 5 low.

When the count down reaches 2978 U4A is clocked because the K input is high. U4A $\overline{Q}$ goes high and is applied to the K input of U4B.

On the 2979th input cycle, U4B is clocked and the $\overline{Q}$ output goes high. When U4B $\overline{Q}$ goes high the preset pulse is ended and AND gate U2B is enabled. The next input cycle will initiate the count cycle.

When there is a preset input programmed into U7, U6 and U5, the terminal count is still 2979. However, the count down starts at the number programmed into the BCD inputs. As an example, if the binary input to U7, U6 and U5 is 999, the first input cycle would cause the same digital circuit changes that the 1000th input cycle caused in the discussion above (U1A would be clocked for the first time). The frequency division would be 2979 minus 999, equal to division by 1980. The phase lock loop operation would result in an input frequency to the programmable divider of 19.80 MHz. When the 19.80 MHz is divided by 1980 the divider output would again be 10 kHz.

The output from U4B is always 10 kHz when the oscillator is phase locked.

Test Procedure 1

Composite Waveform SS9-1 illustrates the proper timing relationship between the 100 kHz reference input, the pulse output from the pulse generator and the sampling point on the 100 kHz reference signal when the loop is phase locked.

NOTE

Center frequency is initially set to zero.

Test 1-a. Use the counter and the oscilloscope to check for a 100.000 kHz sine wave at approximately 5 Vpp at TP5. The display should be similar to that shown in the second trace from the top in composite waveform SS9-1.

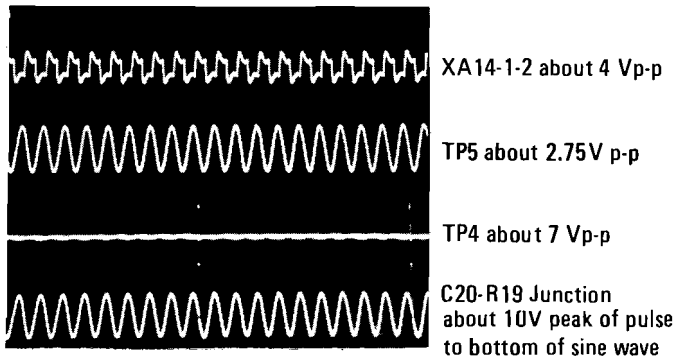
If the correct signal is present, proceed to test 1-b.

If the counter readout is 100.000 kHz but the sine wave is distorted, check Q1, Q2 and associated components.

If the signal is not present, connect the counter and the oscilloscope to XA14-1-2. The counter readout should be 100.000 kHz and the oscilloscope display should be similar to that shown in the top trace of composite waveform SS9-1.

If the correct signal is observed but was not observed at TP5, check Q1, Q2 and associated components.

If the signal is not present at XA14-1-2 check interconnections to the reference loop and, if necessary, the reference loop.



Composite Waveform SS9-1

Test 1-b. Connect the oscilloscope and the counter to TP4. The counter readout should be 10.000 kHz and the oscilloscope should display positive-going pulses as shown in composite waveform SS9-1 at about 7V amplitude.

If the signal is not present proceed to test 1-c. If the signal is present, connect the oscilloscope to the junction of R19 and C21. The oscilloscope display should be similar to that shown in the lower trace of composite waveform SS9-1.

If the programmable divider and the pulse generator are working properly but the loop is not phase locked, the oscilloscope may still show the signals, but the relationship between the pulses and the sine wave will not be the same as shown in composite waveform SS9-1. If the voltage controlled oscillator and the summing circuits in the A13 assembly are known to be functioning properly proceed to test procedure 2.

Test 1-c. If the pulses are not present at TP5, and the counter counts randomly or not at all, connect the oscilloscope to TP3. The oscilloscope should display pulses at approximately 10 kHz and about 3.5 Vpp.

If the pulses are present at TP3, but were not present at TP4, check Q6, Q7 and associated components.

If the pulses are not present at TP3, proceed to test 1-d.

Test 1-d. If the pulse is not present at TP3 connect the oscilloscope to U2B pin 6. The waveform should be similar to that shown in the top trace of composite waveform SS9-2. If the signal is as shown proceed to test 1-e.

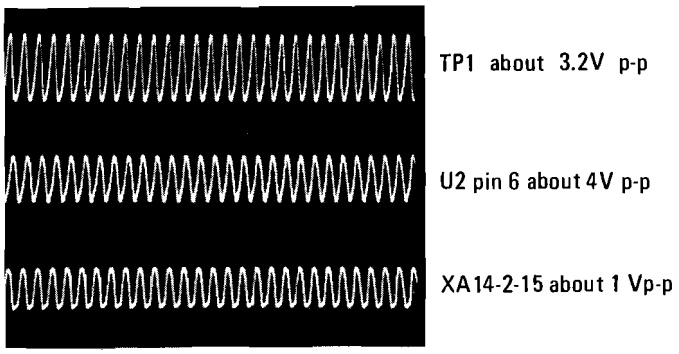
If there is no signal present at AND gate U2B pin 6, connect the oscilloscope to TP1. The waveform should be similar to that shown in the center trace of composite waveform SS9-2. If the signal is now present, use the digital voltmeter to check to check the voltage at AND gate U2B pins 4 and 5. The digital voltmeter should indicate about +3.7V; if it does, U2B is defective.

If the voltages are not present at AND gate U2B pins 4 and 5, ground U3B pin 2. If the voltages now appear at AND gate U2B pins 4 and 5 and the signal appears at U2B pin 6, U2B is functioning properly; the trouble is probably in the gating circuits to U3.

If the voltage is present at AND gate U2B pin 4 with U3 pin 2 grounded, but is not present U2B pin 5, U4 is probably defective.

If the voltages are not present at AND gate U2B pins 4 and 5 with U3 pin 2 grounded, U3 is probably defective.

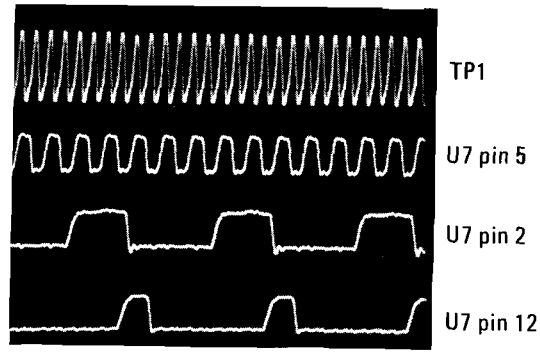
If the signal is not present at TP1, use the oscilloscope to check the voltage controlled oscillator input at XA14-2-15. The display should be similar to the lower trace in composite waveform SS9-2. If the signal is present, NAND gate U8C is probably defective. If the signal is not present, check interconnections to the A13 assembly and, if necessary, the A13 assembly.



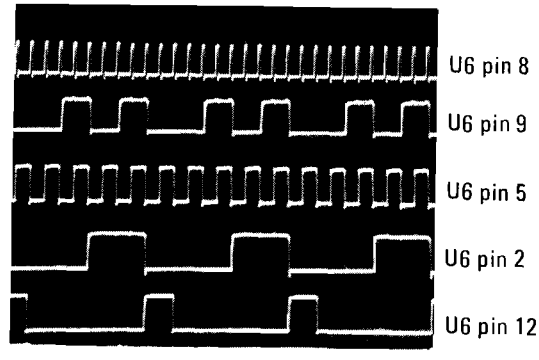
Composite Waveform SS9-2

Test 1-e. It is assumed in this test that the signal input is present at U7 pin 8 only because U3 pin 2 is grounded. Composite waveforms SS9-3 through SS9-7 illustrate the correct waveforms for the integrated circuits in the programmable divider loop. All waveforms are about 4.5V in amplitude. Follow the numerical sequence of the waveforms; when an IC output is missing the trouble is found. Replace the defective component, remove the ground from U3 pin 2, and repeat test 1-b.

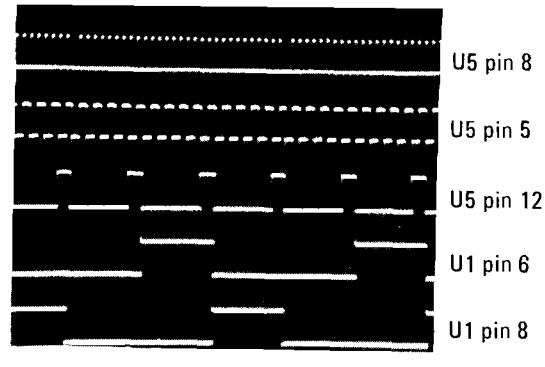
Composite waveform SS9-8 illustrates the proper waveforms for U3 under normal operating conditions.



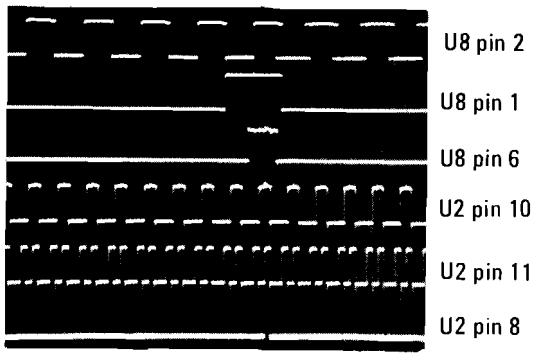
Composite Waveform SS9-3



Composite Waveform SS9-4



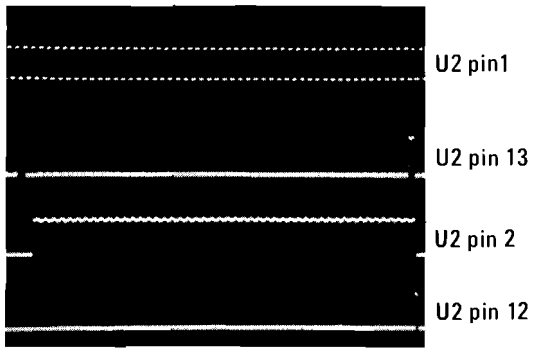
Composite Waveform SS9-5



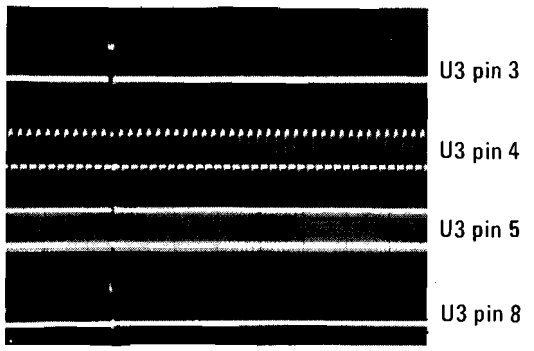
Composite Waveform SS9-6

NOTE

Composite waveforms SS9-7 and SS9-8 waveform pictures were taken with the oscilloscope being triggered from TP3 and the oscilloscope sweep magnified × 10.



Composite Waveform SS9-7



Composite Waveform SS9-8

Sampling Phase Detector

The positive-going output from U4B pin 9 is used to generate the pulse required to open the sampler gate. Common base amplifier Q6 and emitter follower Q7 amplifies and couples the pulse to T1. CR1 and CR2 are used to minimize transformer flyback action. CR2 also bypasses the negative-going pulse around the transformer primary to ensure that only the positive-going pulse is coupled to the transformer secondary.

A 100 kHz signal from the reference loop is applied to the secondary center tap of T1. L7 and C9 (along with C3 in the reference loop A4A1 assembly) comprise a low pass filter; it has an impedance of about 450 ohms and a cutoff frequency of about 150 kHz. The TTL input from the reference loop is reshaped into a sine wave by the low pass filter. L8 and C14 comprise a tuned circuit which bypasses unwanted high frequency signals and further filters the sine wave.

Sampler diodes CR3 and CR4 are normally reverse biased. When the sampling pulse appears across the secondary of T1 it is coupled through C20 and C21 to forward bias CR3 and CR4. Since the gate pulses are equal in amplitude but opposite in polarity, they will cancel at TP6.

While CR3 and CR4 are forward biased, the sampling gate is open and the 100 kHz reference signal is sampled.

This type of sampling phase detector may be phase locked at virtually any point on the sine wave curve. Ideally, the zero volt crossover point of the sine wave should be used to improve the lock and hold in capability of the loop.

If the divided down output of the voltage controlled oscillator in the A13 assembly (10 kHz pulses) is not phase locked to the 100 kHz reference signal an ac signal is developed at TP6. The polarity of the signal at any given time depends on the polarity of the 100 kHz sine wave at the time the last sample was taken. The amplitude of the signal at any given time depends on what portion of the sine wave the last sample was taken from. Each time CR3 and CR4 are forward biased the signal derived from the 100 kHz references signal at T1 terminals 4 and 6 are coupled through the sampling gate to control the charge on C22.

When the sampling gate pulse ends, CR3 and CR4 are again reverse biased and the sampling gate is closed. Since Q4 is a high input impedance device, the charge will remain in C22 until the next sampling pulse. The error signal from Q4 is applied to the summing amplifier in the A13 assembly through emitter followers Q3 and Q5.

TP8 may be grounded to open the phase lock loop. Since the emitter of A13Q12 in the A13 assembly is also exactly at dc ground level, grounding this test point will not affect the pretuning circuit. With the loop open, both the pretuning and the error signal may be checked.

Test Procedure 2

Test 2-a. Connect the oscilloscope to TP6. If the 100 kHz reference signal is present, one of the sampling gate diodes (CR3 and CR4) is probably shorted. If the gate pulses are present, one of the sampling gate diodes is probably open (Negative-going pulses CR4, positive going pulses CR3). Proceed to test 2-b.

Test 2-b. With the oscilloscope connected to TP6, ground TP8. The signal displayed should be similar to that shown in Composite Waveform SS9-9, at about 4V. The frequency of the signal will be determined by the frequency difference detected by the sampling gate (typically 200 to 400 Hz.)

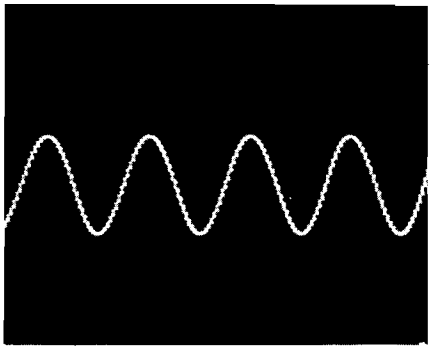
If the signal is present at TP6, connect the oscilloscope to Q5-e. The sine wave should be about the same as that shown for TP6 except that the sampling points will not be as obvious.

If the signal is present at Q5-e the error amplifier and the sampling circuits are functioning properly.

If the signal is not present at Q5-e, and was present at TP6, check Q3, Q4, Q5 and associated components. After repairs are made, repeat the test and remove the ground from TP8.

NOTE

Operation of the circuit shown on Service Sheet 9-a is essentially the same as that shown on Service Sheet 9. Reference designations differ. The count down is always 3000.



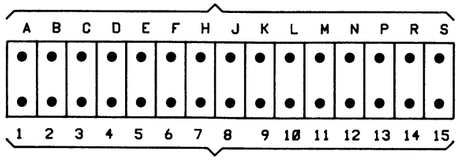
Waveform SS9-9

NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

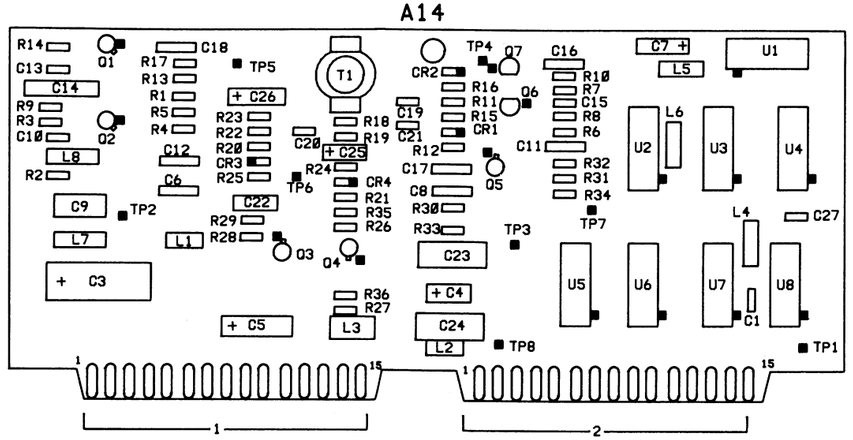
IC	VCC PIN#	GND PIN#
U1-U8	14	7

PIN IDENTIFICATION SOLDER SIDE OF PCB

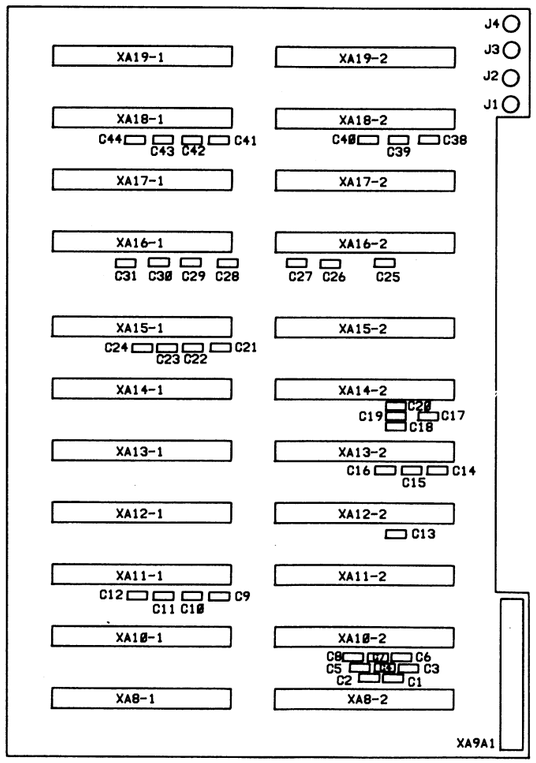


PIN IDENTIFICATION COMPONENT SIDE OF PCB

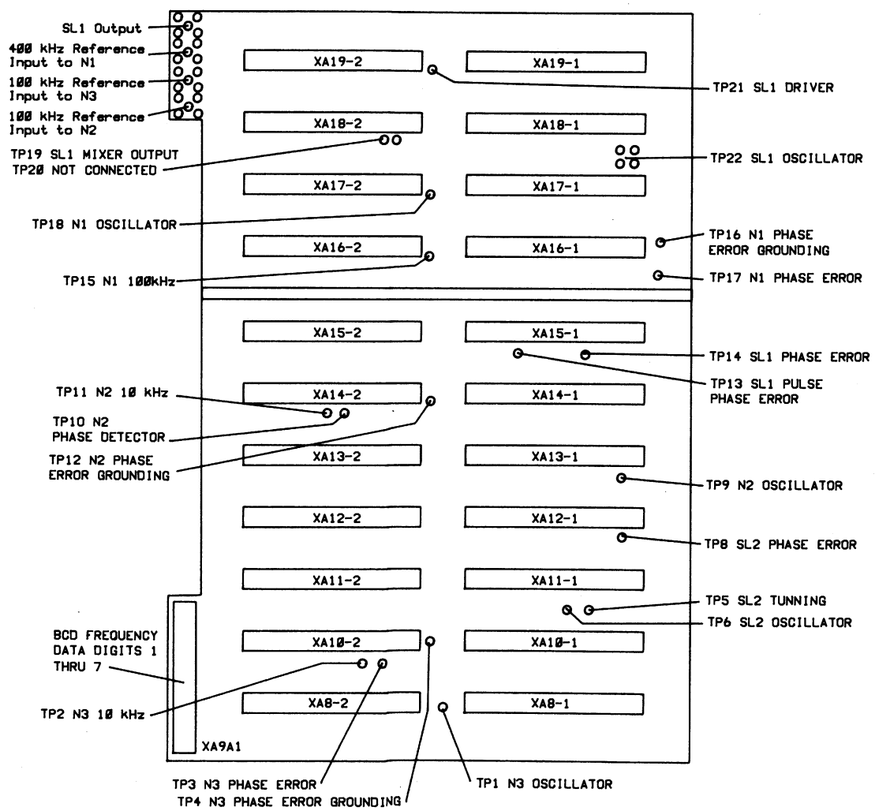
A14



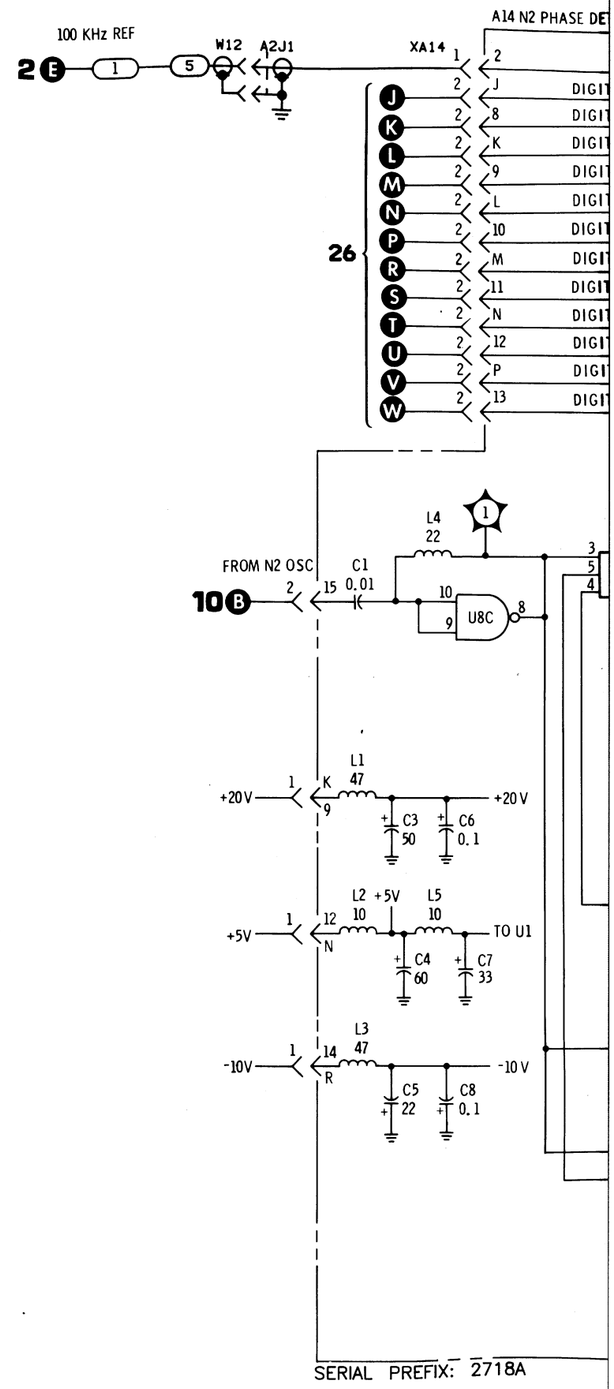
A2 COMPONENT SIDE



A2 SOLDER SIDE



Component Locators



SERIAL PREFIX: 2718A

A14 N2 PHASE DETECTOR ASSY (08660-60011)

100 KHz REF

TUNED REFERENCE AMPLIFIER

PROGRAMMABLE DIVIDER

PULSE AMPLIFIER

SAMPLER

DC AMPLIFIER

REFERENCE DESIGNATIONS WITHIN OUTLINED (—— - - ——) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

SERIAL PREFIX: 2718A

Figure 8-1

ASE DETECTOR ASSY (08660-60011)

DIGIT 5-8
DIGIT 5-4
DIGIT 5-2
DIGIT 5-1
DIGIT 4-8
DIGIT 4-4
DIGIT 4-2
DIGIT 4-1
DIGIT 3-8
DIGIT 3-4
DIGIT 3-2
DIGIT 3-1

TUNED REFERENCE AMPLIFIER

+20V
R1 13.3K
R4 2610
R5 511
C12 0.1
R13 42.2K
R17 825
L7 680
C10 0.01
+1.2V
+6.8V
Q2
C18 0.1
OV
+7.5V
Q1
C13 .01
C9 .0047
R2 464
R3 6810
L8 820
R9 1100
C14 0.003
R14 16.2K

TO C7

U2B U7 U6 U5 U1A U1B

PROGRAMMABLE DIVIDER
U2A U2C U8B U8A

PULSE AMPLIFIER
+20V
R6 511
R10 10K
+12.4V
R7 10K
C15 .01
C16 0.1
+.7V
-6.8V
Q7
R8 383
C11 0.1
Q6
C17 0.1
R11 1100
R15 21.5
C19 0.01
-8.7V
T1
CR1
R16 1100
CR2
R12 511
-10V
R18 422

SAMPLER
DC AMPLIFIER
+20V
R22 4640
C26 10
R23 6190
+4.5V
CR3
C20 0.01
R19 3160
R20 3160
R25 51.1
0V
C22 820pF
Q4
R36 511
-0.2V
Q3
R21 3160
R26 51.1
C21 0.01
-4.5V
CR4
-9.2V
R27 511
R24 2370
C25 33
R35 1470
-10V
R28 10K
R29 5620
Q5
R30 1100
C23 0.22
0V
R31 5110
R32 12.1K
C24 0.047
R33 12.1K
R34 1100
A2TP 12
A2TP 10
A2TP 11
ERROR TO N2 A10

L6 0.82
+5V

REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - —) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

Figure 8-10 N2 Phase Detector
8-65/8-66

Service Sheet 10

ASSEMBLY

- **N2 Oscillator Assembly A13**

The A13 assembly, a part of the two-assembly N2 phase lock loop is shown schematically and described on this Service Sheet. The N2 Phase Detector assembly, A14, is shown schematically and described on Service Sheet 9.

When trouble has been isolated to the A13 assembly it should be removed and reinstalled using two extender boards. This will provide easy access to test points and components.

NOTE

After making repairs to any part of the N2 loop circuits, Adjustment 8 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Digital Voltmeter ..... HP 3478A
Frequency Counter ..... HP 5385A

N2 LOOP GENERAL INFORMATION

The purpose of the N2 loop is to generate digitally controlled RF signals in the range of 19.80 to 29.79 MHz in selectable 10 kHz increments. The voltage controlled oscillator is phase locked to a 100 kHz reference which is derived from the master oscillator in the reference section. The RF output of the N2 loop is applied to Summing Loop 2.

Voltage Controlled Oscillator

Varactors CR8 and CR9, transistors Q2 and Q9 and associated components comprise a voltage controlled oscillator. Two varactors are used in parallel to provide high Q as well as the wide capacitance range required. C18 provides isolation for the dc levels required to bias the varactors. C17 provides the feedback required to sustain oscillation. The resonant tank circuit is coupled to Q9 by means of capacitive divider C22 and C23. The FET acts as a source follower in the feedback circuit; it provides a high impedance at the gate and a low impedance at the source. The gain of the FET amplifier for the output signal is less than one; this minimizes the Miller effect which might otherwise reflect capacitance back into the oscillator tank circuit.

Q1 amplifies the signal and applies it to U1A which functions as a Schmitt trigger. U1D inverts the output from U1A and applies it to the programmable divider in the A14 assembly. U1C inverts the output from U1A and applies it to the divide-by-one hundred circuit in Summing Loop 2.

Test Procedure 1

NOTE

Do not use long coax leads from the counter to TP3. The capacitive loading may attenuate the signal below a useable level.

Test 1-a. Connect the counter to TP3 and set Center Frequencies as shown in Table 8-5. The counter readout should be as shown in the table. (Make allowances for counter accuracy.)

NOTE

If the frequency readouts listed in Table 8-5 are not approximately as shown check the voltage levels shown for TP2 in Table 8-5. If the voltage levels are incorrect proceed to test procedure 2.

If the signal is present use the oscilloscope to check the outputs at XA13-1 pins 4 and 6 with center frequency set to zero. The signal at XA13-1-4 should be about 0.8 Vpp and the signal at XA13-1-6 should be about 0.3V.

If the signal is present at TP3 but is not present at XA13-1 pins 4 and 6 check U1.

Test 1-b. If the signal is not present at TP3 use the oscilloscope to check the signal at the collector of Q1. The signal should be about 1V in amplitude.

If the signal is not present at Q1-c use the oscilloscope to check the signal at the Q1 base. If the signal is now present (about 0.3V), Q1 is probably defective.

If the signal is not present at Q1 base, check Q2, Q9, and associated components.

Pretuning circuit

The frequency of the voltage controlled oscillator is roughly preset by the digital-to-analog converter (U2, U3, transistors connected to the outputs of the NAND gates, and associated components). The digital-to-analog converter cannot, by itself, set the oscillator frequency precisely; it does set the frequency within the capture range of the loop. The inputs to U2 and U3 are BCD bits coded 8, 4, 2 and 1. When any of the BCD inputs are high they cause the output of the NAND gate with which they are associated to go low; the transistor associated with the NAND gate is switched on.

When all of the BCD inputs are low Q4 is biased to provide approximately −25V at TP1 (Q3-e). With this dc level at TP1 the oscillator is roughly preset to 29.79 MHz.

When any one or more of the BCD inputs goes high, the transistor associated with it saturates and draws current through R34 and R35. The change in bias for Q4 causes the voltage at TP1 to go less negative (closer to ground level). Finally, when the binary input is 99, the voltage at TP1 is approximately −5.2V and the oscillator frequency is roughly preset to 19.80 MHz.

Q12 is a summing amplifier which combines the output of the digital to analog converter and the signal from the N2 phase detector. The summing point (Q12-e) sums the current from three sources; a current source from the +20V supply through R28, R30 and R37, a negative source from the digital-to-analog converter (TP1) and the signal from the N2 phase detector. The voltage at the summing point is always zero volts.

When TP1 is at approximately −25V (no BCD input), most of the current from the +20V supply flows through Q4 and Q3; very little flows through Q12. Under these conditions the voltage at Q12-c is about −30V. As the voltage at TP1 decreases (gets closer to ground level) less current flows through Q4 and Q3, more current flows through Q12, and the Q12 collector voltage decreases.

CR4 through CR7, CR11 and CR16 and associated resistors are used to shape the voltage applied to the varactors in the voltage controlled oscillator circuit so that the frequency will be linear with the voltage change. The voltage at the junction of R42 and R47 is about −27.5V. When there is no BCD input (Q12-c is about −30V) all of the diodes in the shaper are reverse biased. As the voltage at TP1 decreases (gets closer to −5.2V) current through Q12 increases and the Q12 collector voltage also decreases. As the Q12-c voltage decreases first CR4, then CR5, etc. are forward biased. As the diodes are forward biased resistors are added in parallel with R31 and R32 to shape the voltage curve to the varactors.

Q11 and Q10 are emitter followers which couple the output of Q12 to the varactors. Q11 provides a high impedance for the output of the summing amplifier, Q12.

Test Procedure 2

Test 2-a. Use the digital voltmeter to check the voltages at TP1 and TP2. These dc levels should be approximately as shown in Table 8-5 for the center frequencies shown.

If the voltages at TP1 are about right, but those at TP2 are not, check Q12, Q11, Q10 and associated components.

If the voltages at TP1 are not approximately as shown in Table 8-5, check the components in the digital to analog converter.

NOTE

Also check the BCD input lines for the correct levels. With CF digits 4 and 5 set to a zero all eight input lines should be low. With CF digits 4 and 5 set to a 1 inputs at XA13-2 pins 11 and 9 should be high, etc.

Table 8-5. *N2 Frequency Versus Voltage Chart*

Center Frequency	Counter Readout	TP1 Voltage	TP2 Voltage
00000 Hz	29.790000 MHz	−25V	−31V
11100 Hz	28.680000 MHz	−23V	−26V
22200 Hz	27.570000 MHz	−21V	−21V
33300 Hz	26.460000 MHz	−18.5V	−16.8V
44400 Hz	25.350000 MHz	−16.4V	−13.4V
55500 Hz	24.240000 MHz	−14.2V	−10.6V
66600 Hz	23.130000 MHz	−12V	−8.3V
77700 Hz	22.020000 MHz	−9.8V	−6.4V
88800 Hz	20.910000 MHz	−7.7V	−4.8V
99900 Hz	19.800000 MHz	−5.4V	−3.6V

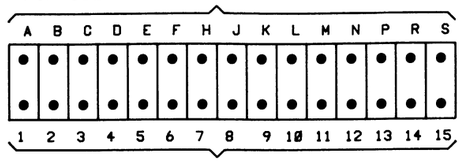
NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

⚠ 05-8, 12-16 BASE -0.7V TRUE -1.7 FALSE

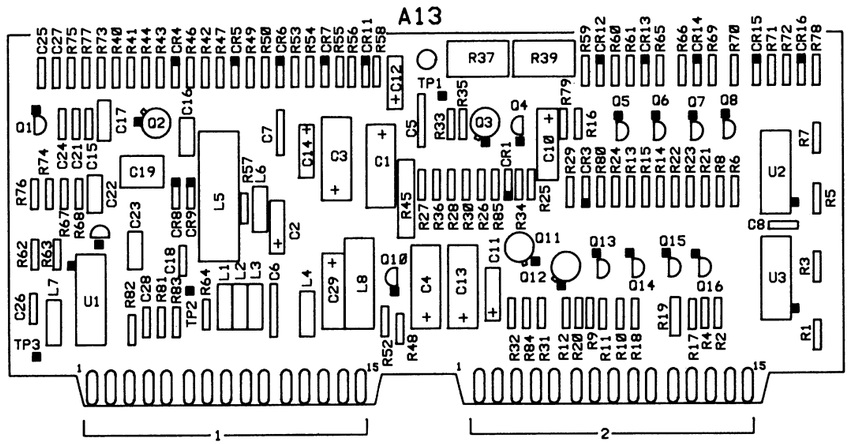
IC	VCC PIN#	GND PIN#
U1-U3	14	7

PIN IDENTIFICATION SOLDER SIDE OF PCB

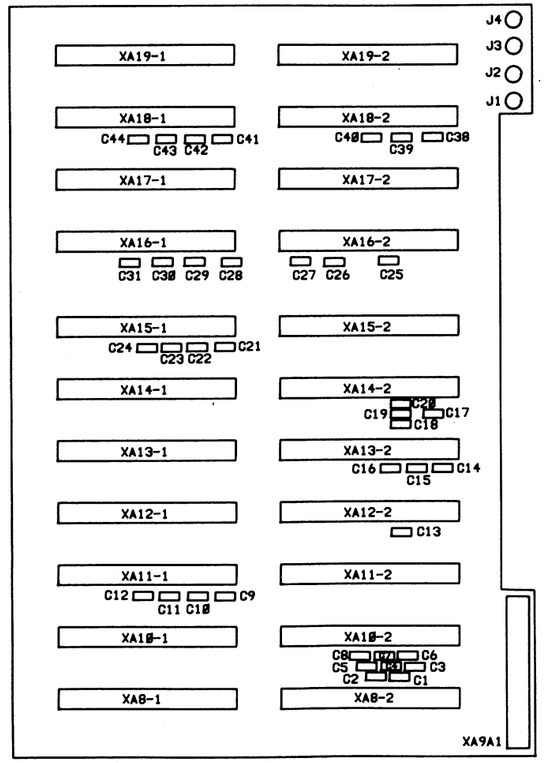


PIN IDENTIFICATION COMPONENT SIDE OF PCB

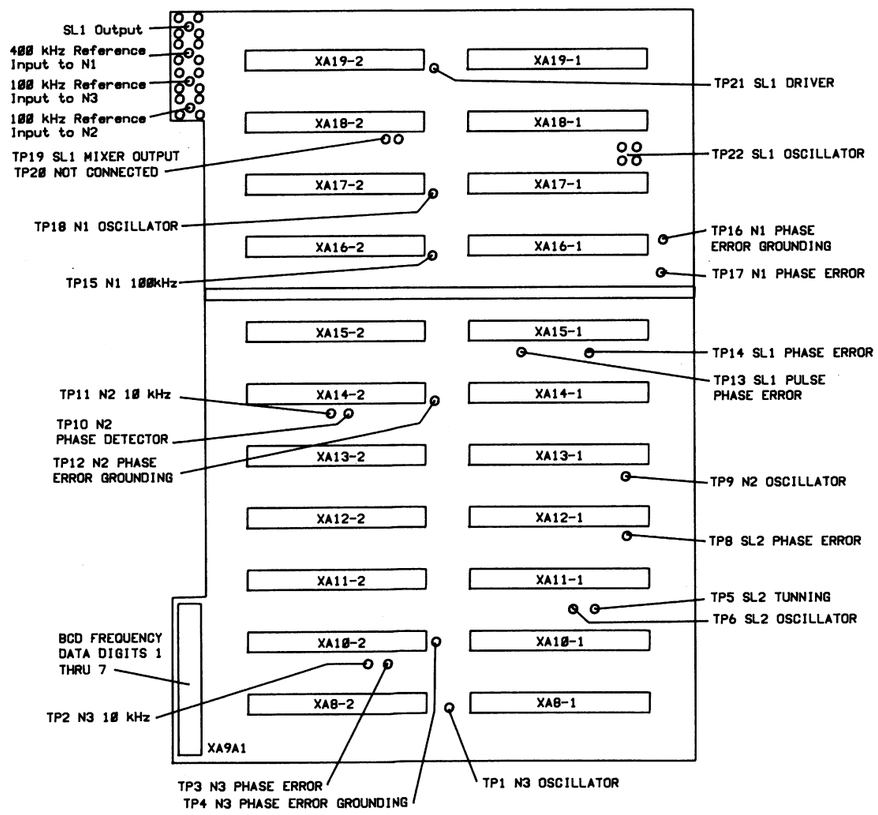
A13



A2 COMPONENT SIDE



A2 SOLDER SIDE



Component Locators

A13 N2 OSCILLATOR ASSY 08660-60012

DIGITAL TO ANALOG CONVERTER

VOLTAGE CONTROLLED OSCILLATOR

AMPLIFIER

SUMMING CIRCUIT

SHAPER

XA17

26

DIGIT 4-1
DIGIT 4-2
DIGIT 4-4
DIGIT 4-8
DIGIT 5-1
DIGIT 5-2
DIGIT 5-4
DIGIT 5-8

+20 V
-10 V
-40 V
+5 V

U3A U3D U3B U3C U2A U2D U2B U2C

Q16 Q14 Q15 Q13 Q8 Q6 Q7 Q5

Q3 Q4 Q12 Q11 Q10 Q2 Q1 Q9

CR1 CR3 CR4 CR5 CR6 CR7 CR11 CR12 CR13 CR14 CR15 CR16 CR8 CR9

U1A U1B U1D

TO N2 Ø DET B 9

TO SL2 C 13

TO PIN 14 U1

A2 TP 9

REFERENCE DESIGNATIONS WITHIN OUTLINED (——— - - ———) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

SERIAL PREFIX: 2718A

10

Figure 8-11 N2 Oscillator
8-71/8-72

Service Sheet 11

ASSEMBLY

- **N3 Phase Detector Assembly A10**

The A10 assembly, a part of the two-assembly N3 phase lock loop is shown schematically and described on this Service Sheet. The N3 Phase Detector assembly, A8, is shown schematically and described on Service Sheet 12.

When trouble has been isolated to the A10 assembly it should be removed and reinstalled using two extender boards. This will provide easy access to test points and components.

NOTE

After making repairs to any part of the N3 loop circuits, Adjustment 9 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Oscilloscope (with 10:1 divider probes)	HP 54200A
Digital Voltmeter	HP 3478A
Frequency Counter	HP 5385A

N3 LOOP GENERAL INFORMATION

The purpose of the N3 loop is to generate digitally controlled RF signals in the range of 20.01 to 21.00 MHz in selectable 10 kHz increments. The voltage controlled oscillator is phase locked to a 100 kHz reference which is derived from the master oscillator in the reference section.

The RF output of the N3 voltage controlled oscillator is divided by ten before being applied to the SL2 assembly. The output to SL2 is 2.001 to 2.100 MHz in 1 kHz increments.

N3 Programmable Divider Circuit

All of the integrated circuits in the A10 assembly are used to count down the input from the N3 voltage controlled oscillator.

When there are no BCD inputs to U5 and U6 (all inputs low), the input from the oscillator will be 21.00 MHz when the oscillator is phase locked; the programmable divider will divide by 2100 to provide a 10 kHz output at TP3. U5 and U6 are preset by CF digits 1 and 2 and programmed to vary between start counts of 00 and 99. Operation of the circuit is as follows:

Assume that initially all BCD inputs are low and U4, U5 and U6 have been preset to zero. Assume also that U2A pin 6 $\overline{(Q)}$ and U2B pin 8 $\overline{(Q)}$ are both low. U1B pin 8 $\overline{(Q)}$ and U1A pin 6 $\overline{(Q)}$ are both high.

NAND gate U7C couples the input from the N3 oscillator to the clock input of U5. U5 provides a divided-by-ten output to clock U6 and also provides A, B and C (BCD 1, 2 and 4) outputs. The A, B and C outputs are not used until the count of 2097 has been reached.

U6 provides a divided-by-ten output to clock U4 and also provides A and D (BCD 1 and 8) outputs to AND gates U3A and U3C. The A and D outputs are not used until the count has reached 2090.

U4 provides a divided-by-ten output to clock U2A. At the count of 1000 U4 clocks U2A and the U2A $\overline{Q}$ output at pin 6 goes high. At the count of 2000 U4 again clocks U2A and the negative-going $\overline{Q}$ output

at pin 6 clocks U2B. When U2B is clocked, $\overline{Q}$ at pin 8 goes high, and is applied to pins 2 and 13 of AND gate U3A.

At the count of 2090 the high A and D outputs of U6 are applied to AND gates U3A and U3C. Since U3A pins 2 and 13 are both high, U3A is enabled and it places a high on pin 11 of AND gate U3C.

At the count of 2097 the high A, B and C outputs of U5 are applied to AND gates U3B and U3C to provide a high at the J input of U1B at pin 11.

At the count of 2098 U1B is clocked, U1B $\overline{Q}$ (pin 8) goes low and sets U1A. U1A $\overline{Q}$ (pin 6) goes low and presets U2, U4, U5 and U6; they are held in preset until the count is completed.

When U1A is set $\overline{Q}$ (pin 5) goes high and initiates the sampling pulse. The first pulse to the sampling phase detector is initiated by the 2098th input cycle. Since two more cycles are required to restart the count cycle, following sampler pulses are 2100 cycles apart when there is no BCD input.

At the count of 2099 U1B is again clocked and $\overline{Q}$ (pin 8) goes high. The high at pin 8 is applied to the K input of U1A (pin 2).

At the count of 2100 U1A is clocked and pin 6 $\overline{Q}$ goes high to end the preset pulse. The next input to U5 initiates the next count cycle.

When there is a BCD input programmed into U5 and U6 pins 3, 4, 10 and 11 the terminal count is still 2100. However, the count starts at the number programmed into the BCD inputs. As an example, if the BCD input to U5 and U6 is 99, the first input cycle would cause the same digital circuit changes that the 100th input cycle caused in the discussion above (U4 would be clocked). The frequency division would be 2100-99, equal to division by 2001. The phase lock loop operation would result in an input frequency to the programmable divider of 20.01 MHz. When divided by 2001, the divider output at TP3 would again be 10 kHz.

The output from U1A pin 5 is always 10 kHz when the oscillator is phase locked regardless of the oscillator frequency.

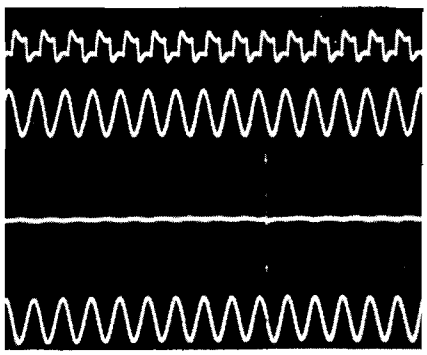
Test Procedure 1

Composite Waveform SS11-1 illustrates the proper timing relationship between the 100 kHz reference input, the pulse output from the pulse generator and the sampling point on the 100 kHz reference signal when the loop is locked.

NOTE

Center Frequency is initially set to zero.

Test 1-a. Use the counter and the oscilloscope to check for a 100.000 kHz sine wave at approximately 5 Vpp at TP5. The display should be similar to that shown in the second trace from the top of composite waveform SS11-1.



Composite Waveform SS11-1

If the counter readout is 100,000 kHz but the sine wave is distorted, check Q1, Q2 and associated components.

If the signal is not present, connect the counter and the oscilloscope to XA10-1-2. The counter readout should be 100.000 kHz and the oscilloscope display should be similar to that shown in the top trace of composite wave form SS11-1.

If the correct signal is present at XA10-1-2, but was not present at TP-5, check Q1, Q2 and associated components.

If the signal is not present at XA10-1-2 check interconnections to the reference loop and, if necessary, the reference loop.

Test 1-b. Connect the oscilloscope and the counter to TP4. The counter readout should be 100.000 kHz and the oscilloscope should display positive-going pulses as shown in composite waveform SS11-1 at about 7V amplitude. If the signal is not present, proceed to test 1-c.

If the signal is present, connect the oscilloscope to the junction of R19 and C20. The oscilloscope display should be similar to that shown in the lowest trace of composite waveform SS11-1.

If the programmable divider and the pulse generator are working properly but the loop is not phase locked, the oscilloscope may still display the signals at the junction of R19 and C20, but the relationship between the pulses and the sine wave will not be the same as shown in composite waveform SS11-1. If the voltage controlled oscillator and the summing circuit in the A8 assembly are known to be functioning properly, proceed to test procedure 2.

Test 1-c. If the pulses are not present at TP4, and the counter counts randomly or not at all, connect the oscilloscope to TP3. The oscilloscope display should be a series of pulses at approximately 10 kHz and about 4V in amplitude.

If the pulses are present at TP3, but were not present at TP4, check Q6, Q7 and associated components.

If the pulses are not present at TP3, proceed to test 1-d.

Test 1-d. If the pulse is not present at TP3 connect the oscilloscope to NAND gate U7C pin 8. The oscilloscope should display a slightly distorted sine wave at approximately 21 MHz and 3V in amplitude.

If the signal is not present at U7C pin 8, connect the oscilloscope to XA10-2-15. The 21 MHz signal should be about 0.06V in amplitude. If the signal is present, U7 is probably defective. If the signal is not present check interconnections to the A8 assembly and, if necessary, the A8 assembly.

Test 1-e. It is assumed in this test that the signal input is present at U5 pin 8. Composite waveforms SS11-2 through SS11-6 illustrate the correct waveforms for the integrated circuit points shown.

NOTE

These waveforms were taken with the oscilloscope triggered from TP3.

Follow the numerical sequence of the waveforms shown; when an IC output is missing the trouble is found. Replace the defective component and repeat test 1-b.

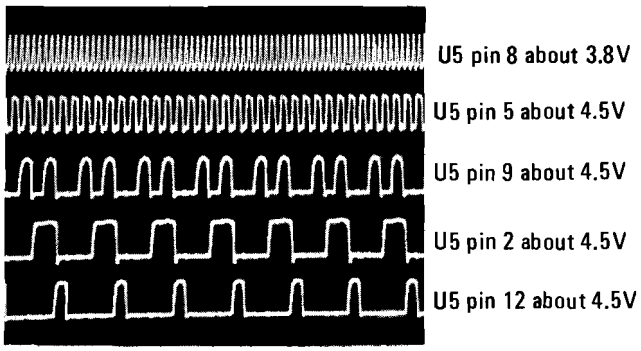
NOTE

If the output from U5 is not present proceed to test 1-f before replacing U5.

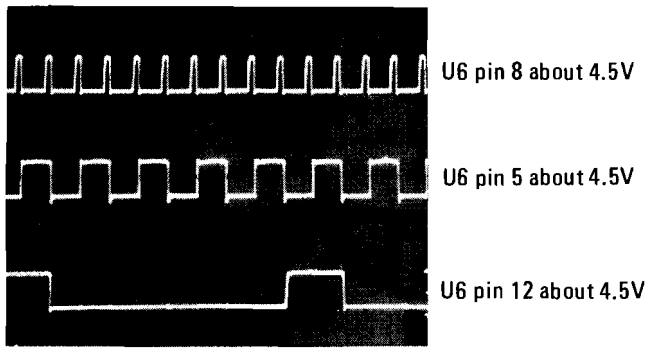
Test 1-f. Composite waveform SS11-7 illustrates correct waveforms for a properly operating U1. In this test the oscilloscope was again triggered by TP3 and the sweep delay of the oscilloscope was used to center the pulses shown.

If the waveforms in composite waveform SS11-7 cannot be observed (because an adequate oscilloscope is not available or other reasons) measure the voltage at U1 pin 6, it should be approximately +3.7V; U1 pin 5 should be at about +100 mV. If the voltages are not as specified, ground U1 pin 10. The voltages should then be; U1 pin 6 approximately +130 mV and U1 pin 5 approximately +3.8V. If the voltages are as specified in either case and there is no output from U5, U5 is probably defective.

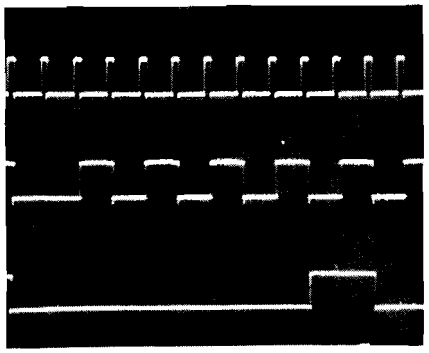
If there is no change in the dc levels at U1 pins 5 and 6 with U1 pin 10 grounded, U1 is probably defective.



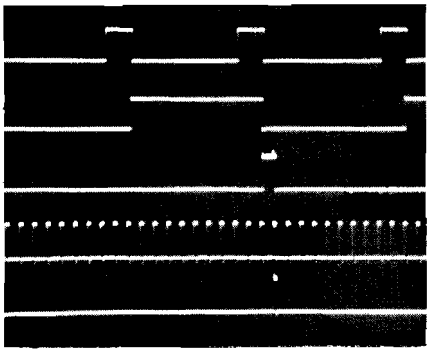
Composite Waveform SS11-2



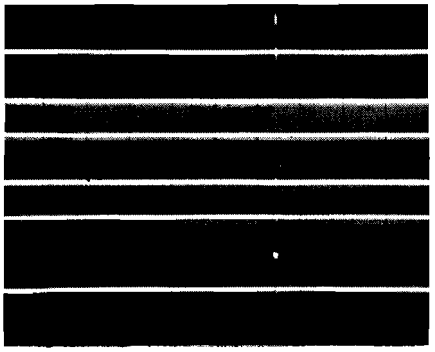
Composite Waveform SS11-3



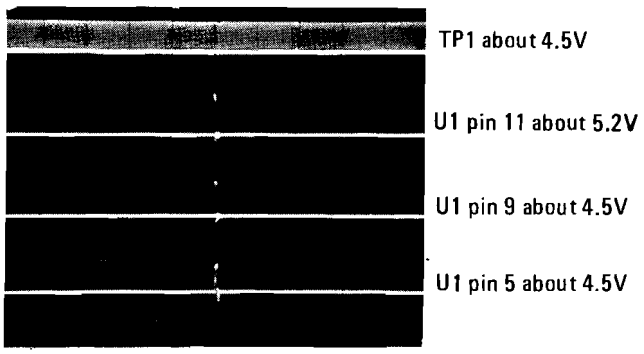
Composite Waveform SS11-4



Composite Waveform SS11-5



Composite Waveform SS11-6



Composite Waveform SS11-7

Sampling Phase Detector

The positive-going output from U1A (pin 5) is used to generate the pulse required to open the sampler gate. Common base amplifier Q6 and emitter follower Q7 amplifies and couples the pulse to T1. CR1 and CR2 are used to minimize transformer flyback action. CR2 also bypasses the negative-going pulse around the transformer primary to ensure that only the positive-going pulse is coupled to the transformer secondary.

A 100 kHz signal from the reference loop is applied through Q2 and Q1 to the secondary center tap of T1. L5 and C8 (along with C4 in the reference loop A4A1 assembly) comprise a low pass filter; it has an impedance of about 450 ohms and a cutoff frequency of about 150 kHz. The TTL input from the reference loop is reshaped into a sine wave by the low pass filter. Q2 and Q1 amplify the signal to the level required in the sampling phase detector. L7 and C13 comprise a tuned circuit which bypasses unwanted high frequency signals and further filters the sine wave.

Sampler diodes CR3 and CR4 are normally reverse biased. When the sampling pulse appears across the secondary of T1 it is coupled through C20 and C21 to forward bias CR3 and CR4. Since the gate pulses are equal in amplitude but opposite in polarity, they will cancel at TP6.

While CR3 and CR4 are forward biased the sampling gate is open and the 100 kHz reference input signal is sampled.

This type of sampling phase detector may be phase locked to virtually any point on the sine wave slope. Ideally, the zero crossover point of the sine wave should be used to improve the lock and lock hold capabilities of the loop.

If the divided down output of the voltage controlled oscillator (10 kHz pulses) is not phase locked to the 100 kHz reference signal an ac error signal will be developed at TP6. The polarity of the error signal at any given point in time depends on the polarity of the 100 kHz reference signal at the time the last sample was taken. The amplitude of the error signal at any given time depends on what part of the sine wave the last sample was taken from. Each time CR3 and CR4 are forward biased the 100 kHz reference signal at T1 terminals 4 and 6 are coupled through the sampling gate to control the charge on C22.

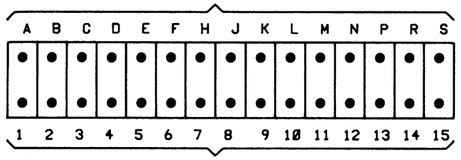
When the sampling gate pulse ends, CR3 and CR4 are again reverse biased and the sampling gate is closed. Since Q4 is a high impedance input device, the charge will remain on C22 until the next sampling pulse. The current through Q4 is controlled by the difference in gate-source voltage of the lower FET. Operation of the dual FET sets the output level at the lower FET drain to exactly the level at the upper FET gate. The output is coupled through two emitter followers to the summing amplifier in the A8 assembly.

NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

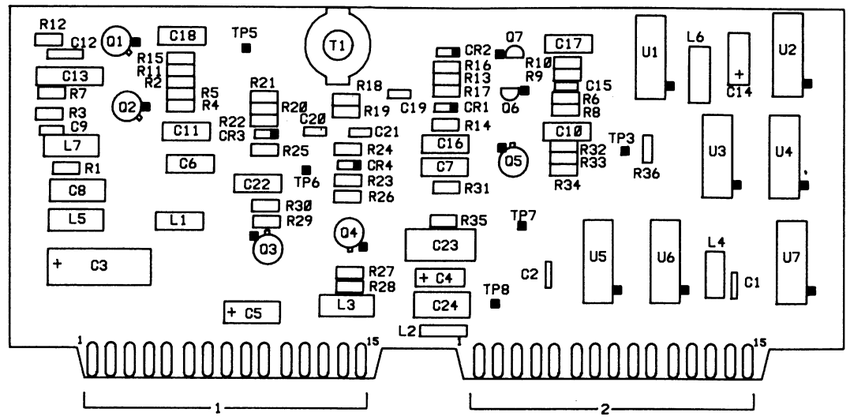
IC	VCC PIN#	GND PIN#
U1-U7	14	7

PIN IDENTIFICATION SOLDER SIDE OF PCB

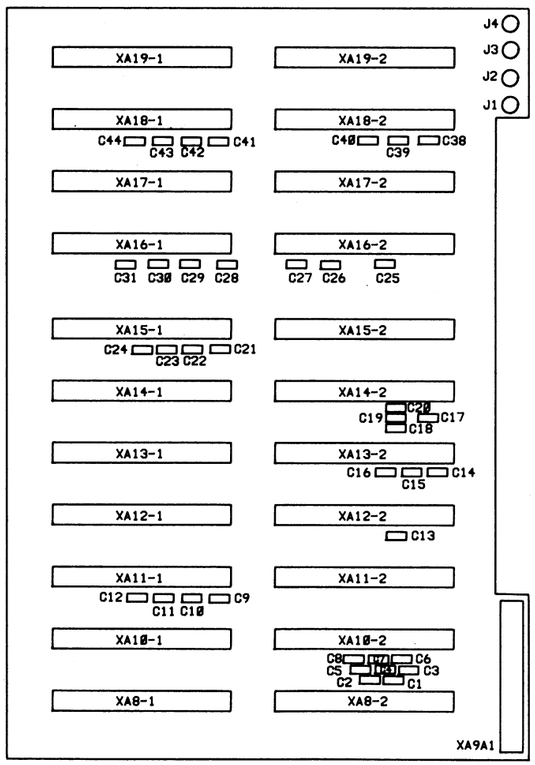


PIN IDENTIFICATION COMPONENT SIDE OF PCB

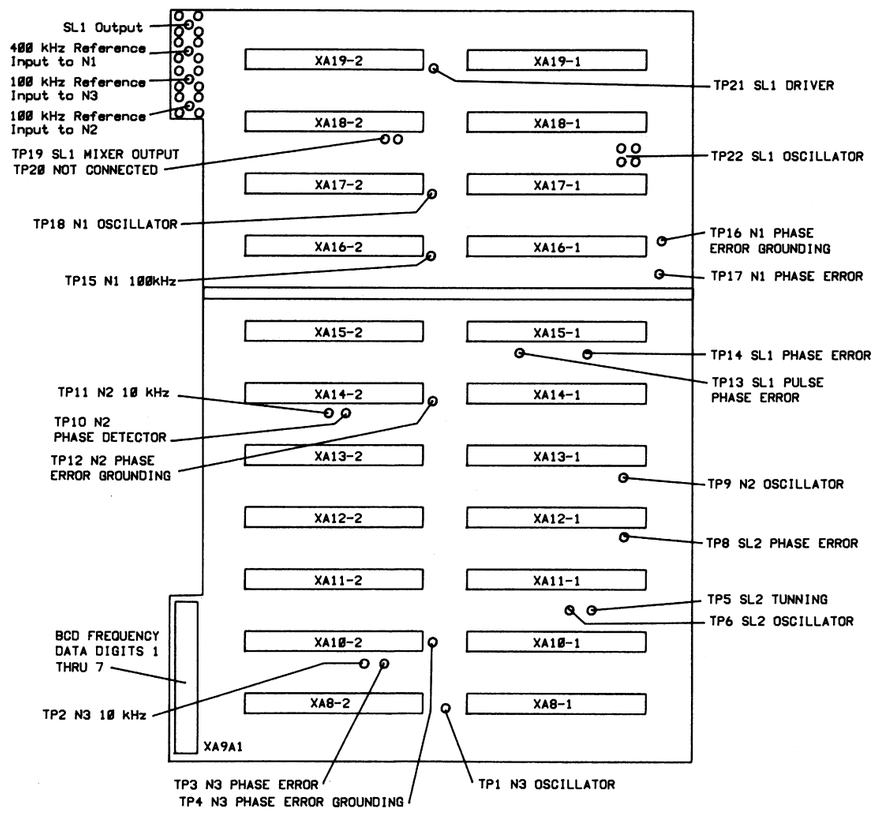
A10



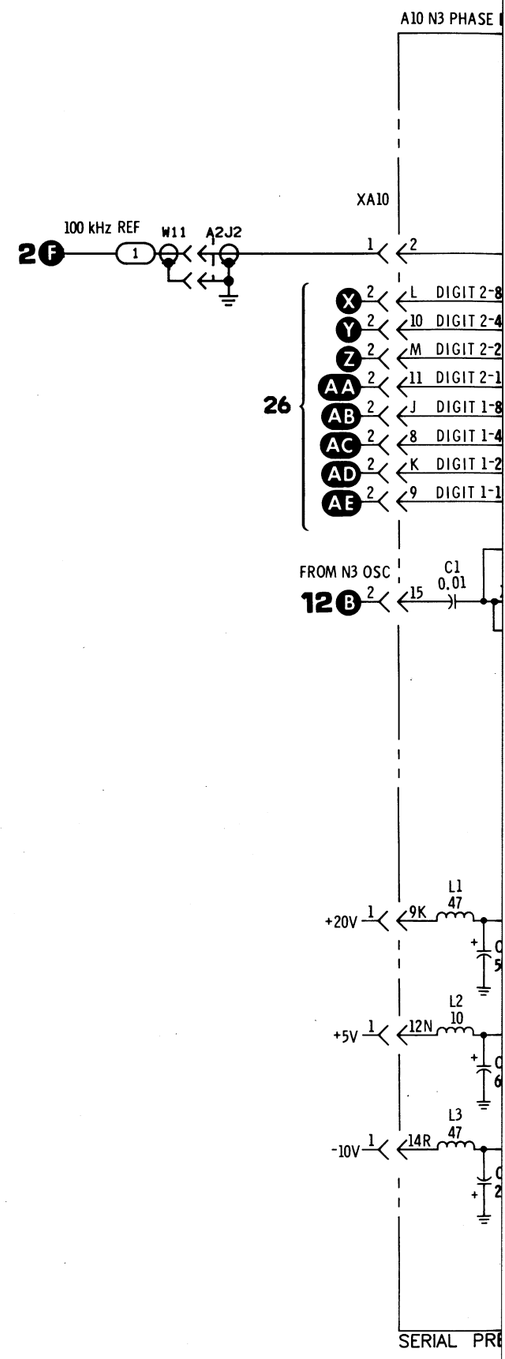
A2 COMPONENT SIDE



A2 SOLDER SIDE



Component Locators



A10 N3 PHASE DETECTOR ASSY (08660-60013)

TUNED REFERENCE AMPLIFIER

PROGRAMMABLE DIVIDER

PULSE AMPLIFIER

SAMPLER

DC AMPLIFIER

REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - -) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER: e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

SERIAL PREFIX: 2718A

11

Figure 8-12 N3 Phase Detector
8-79/8-80

Service Sheet 12

ASSEMBLY

- **N3 Oscillator Assembly A8**

The A8 assembly, a part of the two-assembly N3 phase lock loop is shown schematically and described on this Service Sheet. The N3 Phase Detector assembly, A10, is shown schematically and described on Service Sheet 11.

When trouble has been isolated to the A8 assembly it should be removed and reinstalled using two extender boards. This will provide easy access to test points and components.

NOTE

After making repairs to any part of the N3 loop circuits, Adjustment 9 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Digital Voltmeter ..... HP 3478A
Frequency Counter ..... HP 5385A

N3 LOOP GENERAL INFORMATION

The purpose of the N3 loop is to generate digitally controlled RF signals in the range of 20.01 to 21.00 MHz in selectable 10 kHz increments. The voltage controlled oscillator is phase locked to a 100 kHz reference which is derived from the master oscillator in the reference section. The RF output of the N3 voltage controlled oscillator is divided by ten before it is applied to Summing Loop 2. The output from the N3 assembly to SL2 is 2.001 to 2.100 MHz in selectable 1 kHz increments.

Voltage Controlled Oscillator

Q2, Q7, and associated components comprise a voltage controlled oscillator. C14 and C17 provide isolation for the dc levels required to bias the varactor. C13 provides the feedback required to sustain oscillation. The resonant tank is coupled to Q7 by capacitive divider C16 and C17. The FET acts as a source follower in the feedback circuit; it provides a high impedance at the gate and a low impedance at the source. The gain of the FET for the output signal at the drain is held at less than unity to minimize the Miller effect which might otherwise reflect capacitance back into the oscillator tank circuit.

Q1 amplifies the voltage controlled oscillator output and applies it to U1A which functions as a Schmitt trigger. U1D provides the output to the N3 programmable divider in the A10 assembly. U1B and U3 provide a divided-by-ten output to Summing Loop 2.

TEST PROCEDURE 1

NOTE

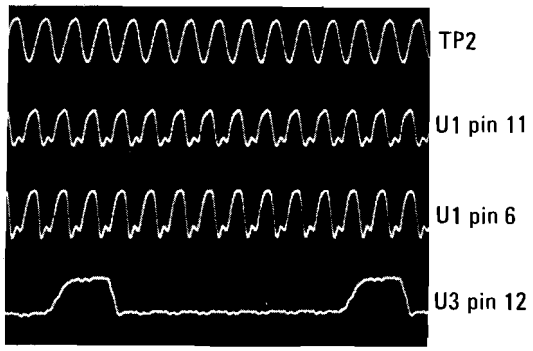
Do not use long coax leads from the counter to N3 test points. The capacitive loading may attenuate the signal below a useable level.

Test 1-a. Connect the counter to TP2. With the center frequency set to zero the counter readout should be 21.00 MHz. Set CF digits 1 and 2 to the settings specified in Table 8-6. Frequency readouts on the counter should follow those specified in the table. (Make allowances for counter accuracy).

NOTE

If the frequency readouts listed in Table 8-6 are not approximately as shown, check the voltage levels shown for TP3 in the table. If the voltage levels are incorrect proceed to test procedure 2.

If the signal is present use the oscilloscope to check the signal at points shown in composite waveform SS12-1. Signals shown are about 4V in amplitude.



Composite Waveform SS12-1

If the signal is present at TP2 but is not present at U1 pin 11, U1 is probably defective; if the signal is not present at U3 pin 12, U1 or U3 may be defective.

If the signal is not present at TP2 use the oscilloscope to check for the signal at Q1-b. If the signal is present at Q1-b check Q1 and NAND gate U1A. If the signal is not present check Q2, Q7 and associated components.

Pretuning Circuit

The frequency of the voltage controlled oscillator is roughly preset by the digital-to-analog converter (U2 and Q8 through Q11). The digital-to-analog converter cannot, by itself, set the oscillator frequency precisely; it does set the frequency within the capture range of the phase lock loop. The inputs to U2 are BCD bits coded 1, 2, 4, and 8. When any one of the BCD inputs are high they cause the output of the NAND gate to which they are connected to go low; the transistor connected to the NAND gate output is switched on.

When all of the BCD inputs are low Q6 is biased to provide ≈ -8.5V at TP1 (Q5-e). With this dc level at TP1 the oscillator is roughly preset to 21 MHz (how close depends on adjustment of R24 and R26).

When any one or more BCD inputs goes high the transistor associated with it saturates and the current through Q6 is reduced. The reduction of current through Q6 changes the bias on Q5 and causes the voltage at TP1 to go less negative (closer to dc ground level). Finally, when the BCD input is 9, the voltage at TP1 is ≈ -6.7V and the oscillator is roughly preset to 20.01 MHz (again depending on adjustment of R24 and R26).

Q3 is a summing amplifier which combines the output of the digital-to-analog converter and the error signal from the N3 Phase Detector. The summing point (Q3-e) sums the current from three sources; a current source from the +20V power supply through R9, R25, and R26, a negative source from the digital-to-analog converter (TP1), and the error signal from the phase detector. The voltage at the summing point is always zero volts when the loop is locked.

The output from Q3 is coupled through Q4 and Q12 to control the bias on varactor CR5 and the frequency of the voltage controlled oscillator.

Test Procedure 2

Test 2-a. Use the digital voltmeter to check the voltages at TP1 and TP3. These dc levels should be approximately as shown in Table 8-6 for the center frequencies shown.

NOTE

These voltages are typical. They will vary from instrument to instrument because of differences in individual varactor characteristics.

If the voltages at TP1 are about right, but those at TP3 are not, check Q3, Q4, Q12, and associated components.

If the voltages at TP1 are not approximately as shown in Table 8-6, check the components in the digital-to-analog converter.

NOTE

Also check the dc levels at the BCD input lines.

Table 8-6. *N3 Frequency Versus Voltage Chart*

Center Frequency	Counter Readout	TP1 Voltage	TP3 Voltage
00 Hz	21.000000 MHz	−8.5V	−3.7V
11 Hz	20.890000 MHz	−8.3V	−3.6V
22 Hz	20.780000 MHz	−8.1V	−3.5V
33 Hz	26.670000 MHz	−7.9V	−3.4V
44 Hz	20.560000 MHz	−7.7V	−3.3V
55 Hz	20.450000 MHz	−7.5V	−3.2V
66 Hz	20.340000 MHz	−7.3V	−3.1V
77 Hz	20.230000 MHz	−7.1V	−3.0V
88 Hz	20.120000 MHz	−6.9V	−2.9V
99 Hz	20.010000 MHz	−6.7V	−2.8V

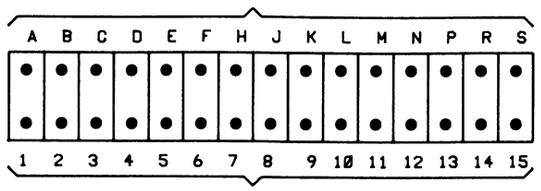
NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

△ Q8-11 BASE -Ø.7V TRUE +1.7 FALSE, COLL ØV TRUE -3ØV FALSE

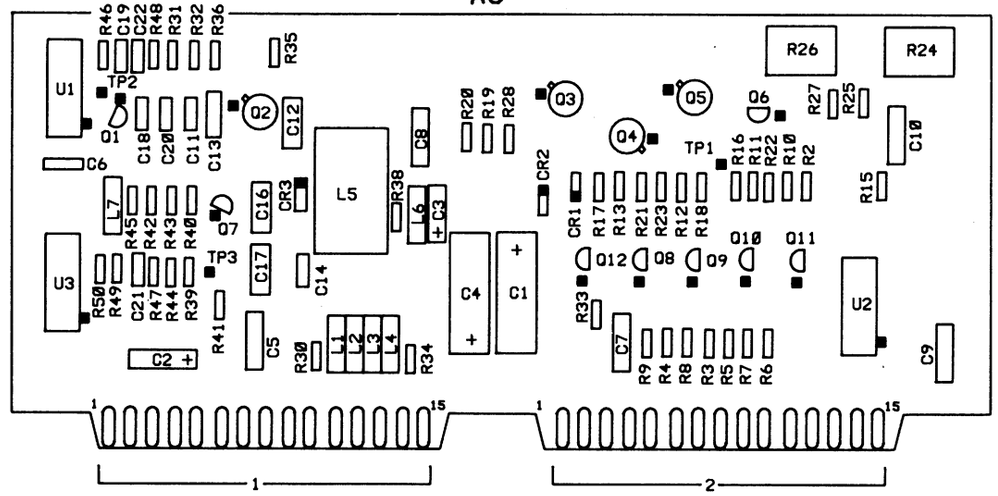
IC	VCC PIN#	GND PIN#
U1-U3	14	7

PIN IDENTIFICATION SOLDER SIDE OF PCB

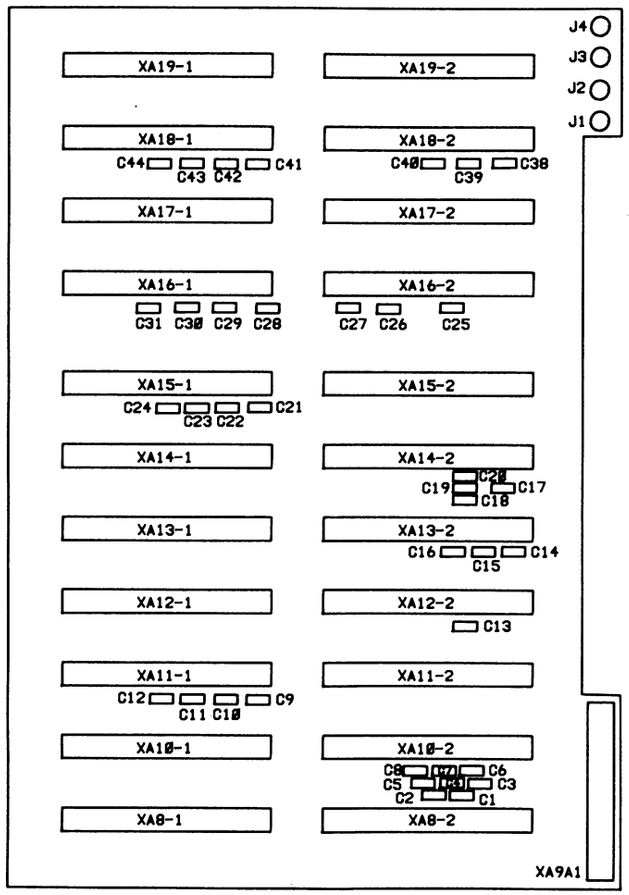


PIN IDENTIFICATION COMPONENT SIDE OF PCB

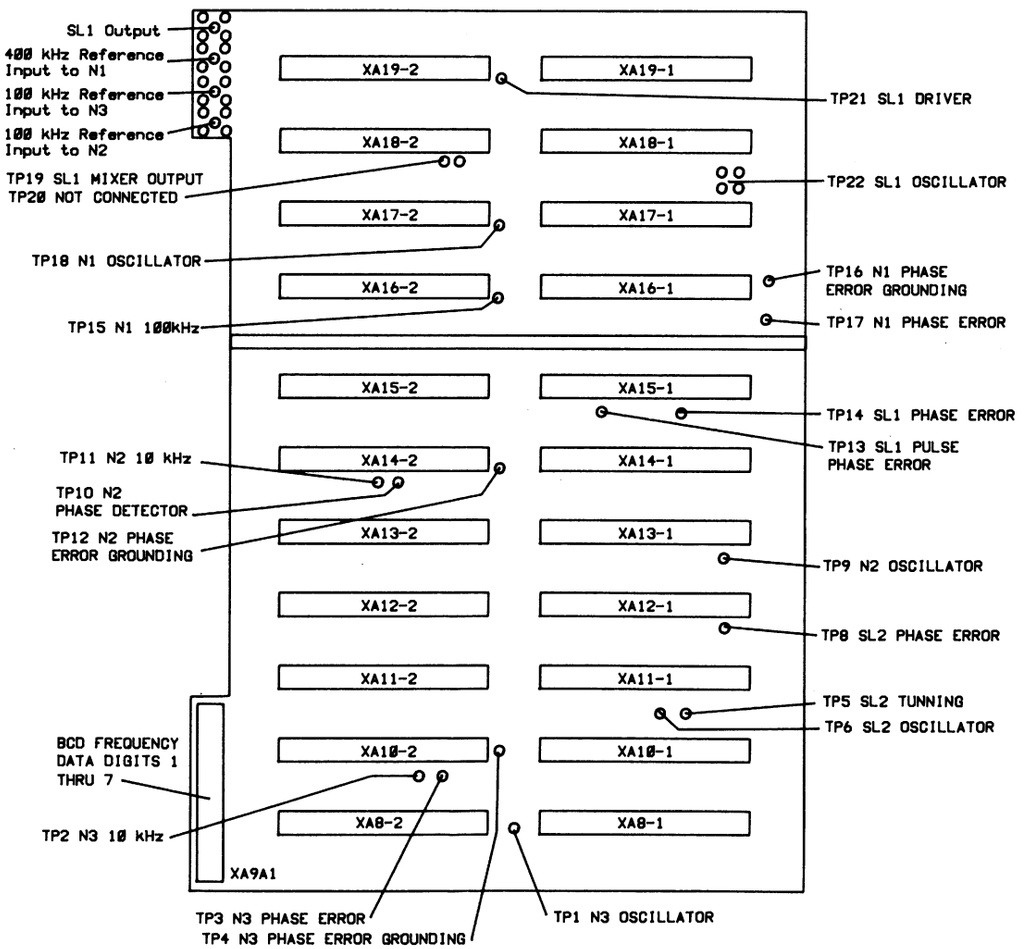
A8



A2 COMPONENT SIDE



A2 SOLDER SIDE



Component Locators

A8 N3 OSCILLATOR ASSY 08660-60014

DIGITAL TO ANALOG CONVERTER

VOLTAGE CONTROLLED OSCILLATOR

AMPLIFIER

XA8

+20V 1 9K L1 47 20V_F
C1 50 C5 0.10

+5V 1 12N L2 10 +5V_F
C2 47 C6 0.02 C9 .02

-10V 1 14R L3 47 -10V_F
C3 22 C7 0.1

-40V 1 15S L4 47 -40V_F
C4 20 C8 0.1

AA 2 11 2-1
Z 2 M 2-2
Y 2 10 2-4
X 2 L 2-8
26

FROM N3 ϕ DET
11 A 2 C

U2A U2D U2B U2C

R2 1620 R6 10K -10V_F
R3 1620 R7 10K -10V_F
R4 1620 R8 10K -10V_F
R5 1620 R9 10K -10V_F

Q11 Q10 Q9 Q8

R10 392K R11 200K R12 100K R13 49.9K R15 4640

R16 10K R17 2870 -40V_F
R18 19.6K * R24 5000
R19 5620 R25 5000 * R26 2000 +20V_F
C10 0.47

R21 2610 Q5 Q6 CR1 R22 825 R23 46.4

Q3 Q4 Q12 0V
R20 21.5K CR2 R27 19.6K -40V_F
R28 23.7K R34 11K
R30 14.7K R33 464 R38 100
-10V_F

SUMMING CIRCUIT

R31 8250 R35 21.5K -4.3V -7.2V Q2
C11 .01 C12 3.3 pF L5 0.6 C13 100 pF C14 0.01
CR3 82pF C16 3.3 pF C17 3.3 pF
R32 3160 R36 10K
R39 820K R40 178K -7.4V
R42 196 R43 464
L6 22 -10V
R41 10K

-1.0V D Q7 S -8.0V G
C18 .01

R44 5620 R47 121
C19 .01 R46 348
-1.2V -6.0V Q1
R45 4220 C20 .01 R48 316
C21 .01 C22 0.1μF

L7 22 2
U1A U1D U1B
R49 348 R50 147
XA8 TO N3 B 11
+5V_F U3 ÷ 10 TO SL2 C 13
A2TP 1

REFERENCE DESIGNATIONS WITHIN OUTLINED (—— - - —) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

SERIAL PREFIX: 2718A

Figure 8-13 N3 Oscillator

Service Sheet 13

ASSEMBLY

- **Summing Loop 2 Phase Detector A12**

The A12 assembly, a part of the two-assembly SL2, is shown schematically and described on this Service Sheet. The SL2 Oscillator Assembly (A11) is shown schematically and described on Service Sheet 14.

When trouble has been isolated to the A12 assembly it should be removed and reinstalled using two extender boards. This will provide easy access to test points and components.

NOTE

After making repairs to any part of the SL2 circuits, Adjustment 10 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Oscilloscope (with 10:1 divider probes)	HP 54200A
Digital Voltmeter	HP 3478A
Frequency Counter	HP 5385A

SUMMING LOOP 2 GENERAL

The purpose of Summing Loop 2 (SL2) is to generate digitally controlled RF signals in the range of 20.0001 to 30.0000 MHz in selectable 100 Hz increments. The difference frequency between the SL2 voltage controlled oscillator and the input from the N2 loop is phase locked to divided-by-ten output of the N3 assembly. The output of SL2 is applied to SL1.

The portion of the pretuning circuit that appears on Service Sheet 13 (U8 and Q8 through Q11) is explained in the text for Service Sheet 14.

Phase Detector

There are three signal inputs to the phase detector assembly. They are the output of the N2 voltage controlled oscillator, the divided-by-ten output of the N3 voltage controlled oscillator and the output of the SL2 voltage controlled oscillator.

The N2 and SL2 signals are mixed and the difference frequency is used as one input to the digital phase detector. The second input to the digital phase detector is the divided-by-ten input from the N3 assembly.

The output of the N3 voltage controlled oscillator is divided-by-ten in the N3 assembly and again divided-by-ten by U9. Q12 and NAND gate U7A shape the resulting pulses which vary in frequency (depending on programming to the N3 loop) from 0.2001 to 0.2100 MHz. The pulses at TP2 are negative-going.

The inputs from the N2 loop and the SL2 voltage controlled oscillator are applied to double balanced mixer E1 R and L ports. The difference signal from the X port is amplified by Q5 and Q4 and shaped by Q3, Q7 and NAND gates U4B and U4C. When the loop is phase locked the negative-going pulses at TP3 are at the same frequency as those at TP2. The pulses do not appear in time coincidence; they are received alternately.

U7B, U7D, U4A and U4D comprise a coincidence gate which inhibits signals that appear simultaneously at TP2 and TP3. Normally, when signals are not present, TP2 and TP3 are both high. When a

signal appears TP2, U7B pin 6 and U4D pin 13 go high. If there is no signal at TP3 U5D pin 12 is also high; U4D pin 11 goes low, and U1B pin 6 go high. The positive pulse at TP5 drives the clock generator and the sense circuit or phase detector. When a signal appears at TP3, U4A pin 3 and U7D pin 12 go high. If there is no signal at TP2, U7D pin 13 is also high; U7D pin 11 goes low, and U7C pin 8 goes high. The positive pulse at TP9 drives the clock generator and the sense circuit or the phase detector. When signals appear at TP2 and TP3 at the same time U7D pin 13 and U4D pin 12 go low, U7D pin 11 and U4D pin 11 remain high, and the signals cannot reach TP5 or TP9.

U1A, U1C, U1D and U5C comprise a clock generator which clocks U2A and U2B each time a signal appears at TP5 or TP9. With no signals present TP5 and TP9 are low. When a positive pulse appears at TP9 U1A pin 3 goes low, U1D pin 11 goes high and a negative-going pulse appears at TP6. When a positive pulse appears at TP5, operation of the circuit is the same except that U1C in 8 goes low (rather than U1A pin 3). Since a clock pulse is generated for each input, the pulse frequency at TP6 is the sum of the frequencies at TP5 and TP9.

Since the sense circuit does not function when the loop is locked, operation of the phase detector will be discussed first.

When the loop is phase locked U2A $\overline{Q}$ is held high to enable U3A and U3D. Assume that initially U2B $\overline{Q}$ is high, U3B pin 6 is low and U3C pin 8 is high. When a positive-going signal from TP9 appears at U3A pin 1, U3A pin 3 goes low and causes a change in state of flip-flop U3B/U3C; U3B pin 6 goes high and U3C pin 8 goes low. The high at U2B pin 12 sets the flip-flop and the positive-going trailing edge of the clock pulse causes U2B Q to go high. The following positive pulse from TP5 is applied to U3D pin 12, U3D pin 11 goes low and changes the state of flip-flop U3B/U3C. U3B pin 6 goes low and the clock pulse causes U2B $\overline{Q}$ to again go high. This sequence continues as long as the signals at TP5 and TP9 are received alternately.

The signals at TP5 and TP9 are applied to the sense circuit even when the loop is phase locked. They have no effect on the circuit because of the relationship of the Q and $\overline{Q}$ outputs of U2B to the incoming signals.

When U2B Q is high NAND gates U6A and U6C are enabled. When the signal from TP5 appears at U6C pin 9, U6C pin 8 goes low; flip-flop U5A/U5B does not change state because U5B pin 3 is low. The signal at U6B has no effect because U2B $\overline{Q}$ and U6B pin 4 are low.

When U2B $\overline{Q}$ is high, NAND gates U6B and U6D are enabled. When the signal at TP9 appears at U6D pin 13, U6D pin 11 goes low; flip-flop U5A/U5B does not change state because U5B pin 3 is low. The signal at pin 1 of U6A has no effect on the circuit because U2B $\overline{Q}$ and pin 2 of U6A are low.

When two or more consecutive pulses from either input (TP5 or TP9) occur between pulses from the other input, the sense circuit functions to disable the phase detector until the frequency error is corrected.

As an example of circuit operation, assume that two pulses from TP9 (SL2 signal) are received between two pulses from TP5 (N3 signal) indicating that the SL2 frequency is high. When the first pulse from TP9 is received U3A pin 3 goes low, U3B pin 6 goes high to set U2B and the clock pulse causes U2B $\overline{Q}$ to go high. When the second consecutive pulse is received from TP9, U6A has been enabled by the high $\overline{Q}$ output of U2B. U6A pin 3 goes low and causes flip-flop U5A/U5B to change state. When the D input of U2A goes low the clock pulse causes U2A $\overline{Q}$ to go low and inhibit U3A and U3D. If a third SL2 signal is received prior to receipt of an N3 signal, U6A pin 3 will again go low but will have no effect on flip-flop U5A/U5B because U5A pin 13 is low.

When an N3 pulse is received U2B Q is still high and U6C pin 8 will go low to change the state of flip-flop U5A/U5B. When the D input of U2A goes low the clock pulse causes U2A $\overline{Q}$ to go high and enable U3A and U3D. The propagation time of the signal through the sense circuit is long enough for the pulse from N3 (TP5) to have ended before U3D is enabled so the state of flip-flop U3B/U3C does not change.

The next pulse from SL2 will again cause U6A pin 3 to go low and change the state of flip-flop U5A/U5B. With the D input to U2A high again, the clock pulse again causes U2A $\overline{Q}$ to go low and

inhibit U3A and U3D. The signal applied to U3A has no effect on flip-flop U3B/U3C because U3B pin 5 is low.

The sense circuit continues operation in the manner described above until two consecutive N3 pulses are received between two SL2 signals. When this occurs the first pulse causes U6C pin 8 to go low and change the state of flip-flop U5A/U5B. With the D input to U2A low the clock pulse will cause U2A $\overline{Q}$ to go high and enable U3A and U3D. Again, because of propagation time through the sense circuit the pulse will have ended before U3D is enabled. The second consecutive N3 pulse again causes U6C pin 8 to go low but, because U5B pin 3 is low, no change in state occurs in flip-flop U5A/U5B. Since U3D is now enabled, U3D pin 11 goes low and causes flip-flop U3B/U3C to change state. With the D input to U2B low, the clock pulse causes U2B $\overline{Q}$ output to go high. Phase lock has been achieved and the loop will remain locked as long as pulses at the same frequency appear alternately at TP5 and TP9.

When the SL2 frequency is low U2B Q is low. When the SL2 frequency is high U2B Q is high.

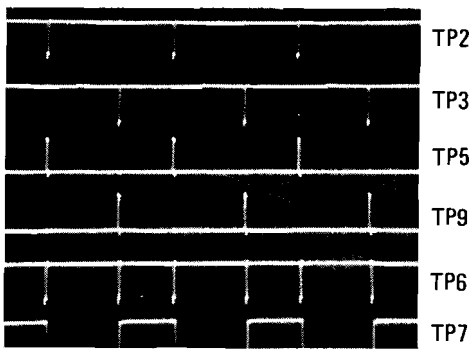
DC amplifier Q2, Q1, Q6 and associated components filter the Q output of U2B and applies it to a summing circuit in the A11 assembly to precisely control the voltage controlled oscillator.

Test Procedure 1

Test 1-a. Connect the oscilloscope input to test points shown by composite waveform SS13-1. This composite waveform illustrates correct waveforms and timing relationships for the points tested. All signals are about 4V in amplitude.

NOTE

The oscilloscope was triggered from TP1 for these tests.



Composite Waveform SS13-1

If the pulses are not present at TP2 proceed to test 1-b.

If the pulses are not present at TP3 proceed to test 1-c.

If the pulses are present at TP2 and TP3, but opposite polarity pulses are not present at TP5 and/or TP9, check the NAND gates between TP2 and TP5 or TP3 and TP9 as appropriate.

If the positive-going pulses are present at TP5 and TP9, but negative-going pulses are not present at TP6 for each of the pulses, check NAND gates U1A, U1C, U1D and U5C as appropriate.

If the pulses are approximately as shown in the top five traces of composite waveform SS13-1 but there is no square wave at TP7, use the oscilloscope to check the signal at NAND gate U3B pin 6. The display should be the same as that shown for TP7. If the signal is present, U2B is probably defective.

If the signal is not present at U3B pin 6 use the oscilloscope to check the signals at NAND gates U3D pin 11 and U3A pin 3. The signals should appear as they did at TP5 and TP9 except that they are

inverted. If the signals are present U3B or U3C may be defective. If the signal is present at one of the NAND gate outputs but not at the other, replace U3.

If the signal is not present at U3D pin 11 or U3A pin 3, use the digital voltmeter to check the dc level at U2A pin 6. The dc level should be approximately +4V. If U2A pin 6 is at about +4V, U3 is defective.

If the +4V is not present at U2A pin 6, ground U2A pin 1. If the voltage at U2A pin 6 does not go to approximately +4V, U2 is defective.

If the trouble still has not been found, connect the counter to TP3 and the digital voltmeter and the oscilloscope to NAND gate U5A pin 12. The counter readout should be about 210 kHz and U5A pin 12 should be low (about +60 mV). If the counter readout is lower or higher than 210 kHz and U5A pin 12 is high, slowly rotate A11R19 through its range while observing the counter and the oscilloscope. As the counter readout passes through the 210 kHz point the oscilloscope display should show a change in dc level; if it does not, U5 or U6 is probably defective.

Test 1-b. If there is no signal at TP2, or the signal is not approximately as shown in the top trace of composite waveform SS13-2, connect the oscilloscope first to TP1, then to U9 pin 8. TP1 and U9 pin 8 signals should be as shown in composite waveform SS13-2. All signal levels are about 4V. If the signal is as shown at TP1, U7A or Q12 may be defective.

If the signal is as shown at U9 pin 8 but does not appear at TP1, U9 is probably defective.

If the signal does not appear at U9 pin 8 check the interconnections to the N3 loop and, if necessary, the N3 loop.

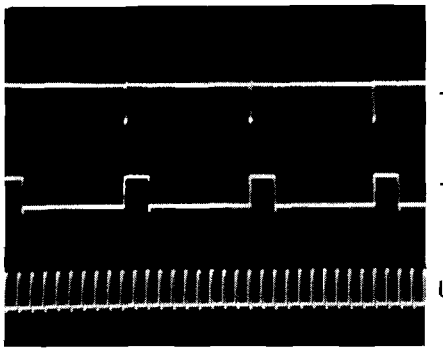
Test 1-c. If there is no signal at TP3, or the signal is not approximately as shown in the top trace of composite waveform SS13-3, connect the oscilloscope, in turn, to the points shown in composite waveform SS13-3.

If the signal shown in the second trace from the top of composite waveform SS13-3 is not as shown check Q3, Q7, U4B, U4C, and associated components.

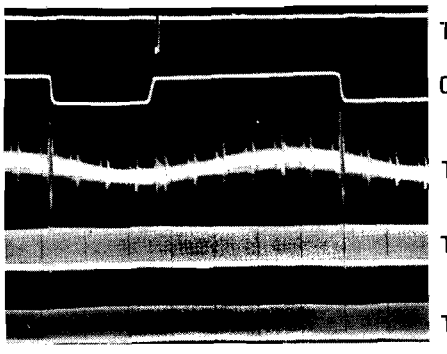
If the signal does not appear at Q4-c, but the signal at TP4 is present, check Q5, Q4, and associated components.

If the signal is not present at TP4 check for signals shown at TP10 and TP11. If both signals are present mixer E1 is probably defective. If either TP10 or TP11 signals are not present, the trouble is in the N2 Loop or the SL2 voltage controlled oscillator.

Test 1-d. To check operation of the dc amplifier connect the digital voltmeter to TP8 and rotate A11R19 through its range. The digital voltmeter readout should vary from about −1.5V to about +1.5V. If the voltage does not vary as A11R19 is adjusted, check Q2, Q1, Q6, and associated components.



Composite Waveform SS13-2



Composite Waveform SS13-3

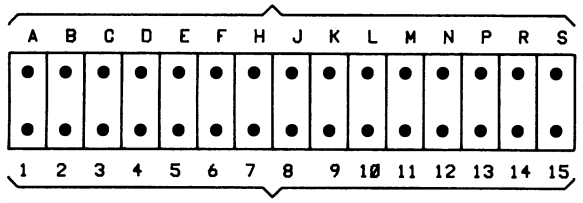
NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

△ 08-11 BASE -Ø.7 TRUE 1.4 FALSE, COLL ØV TRUE -24V

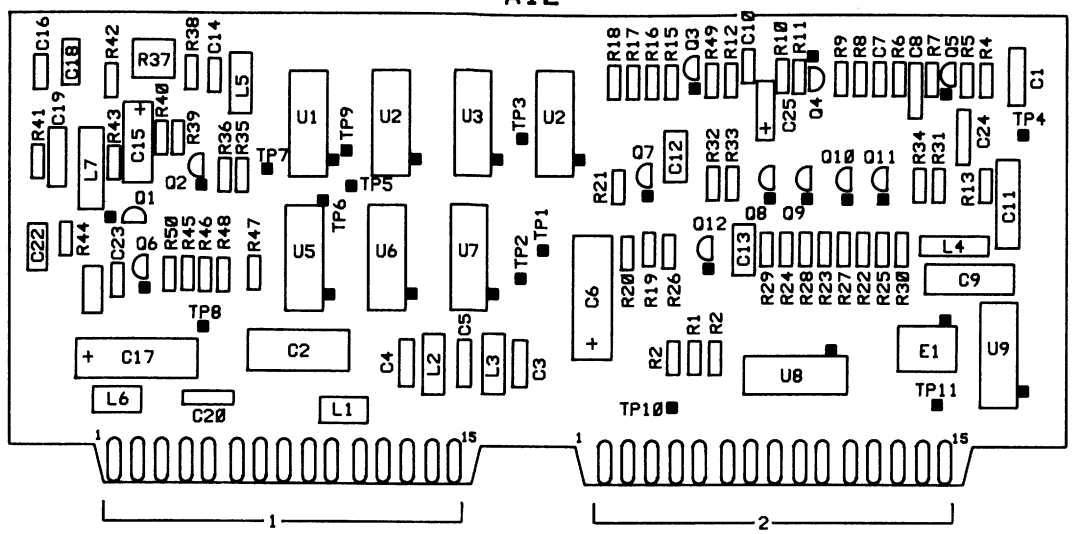
IC	VCC PIN#	GND PIN#
U1-U9	14	7

PIN IDENTIFICATION SOLDER SIDE OF PCB

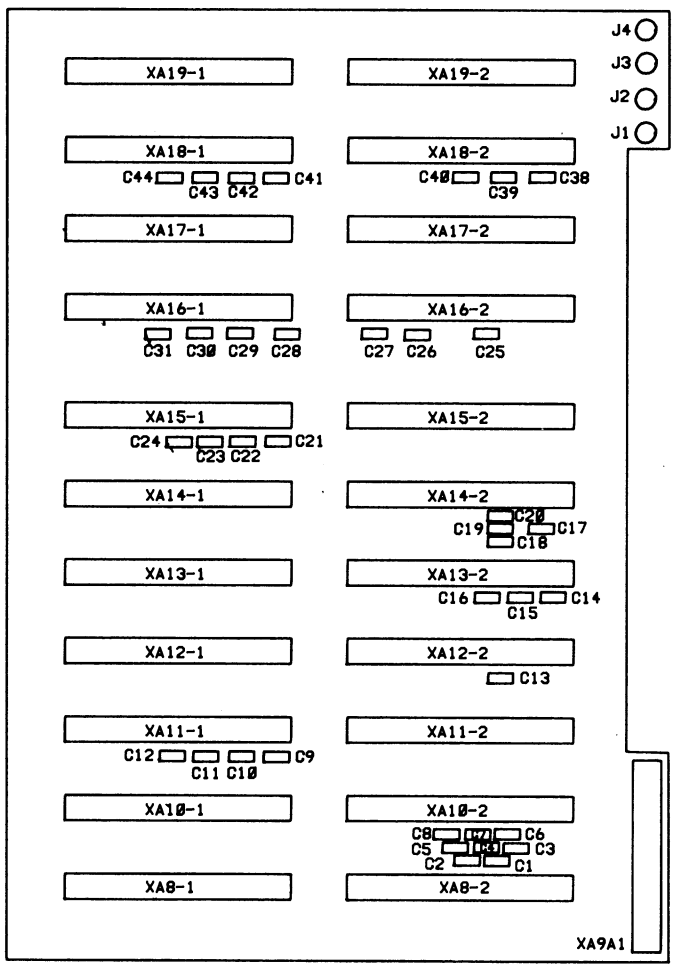


PIN IDENTIFICATION COMPONENT SIDE OF PCB

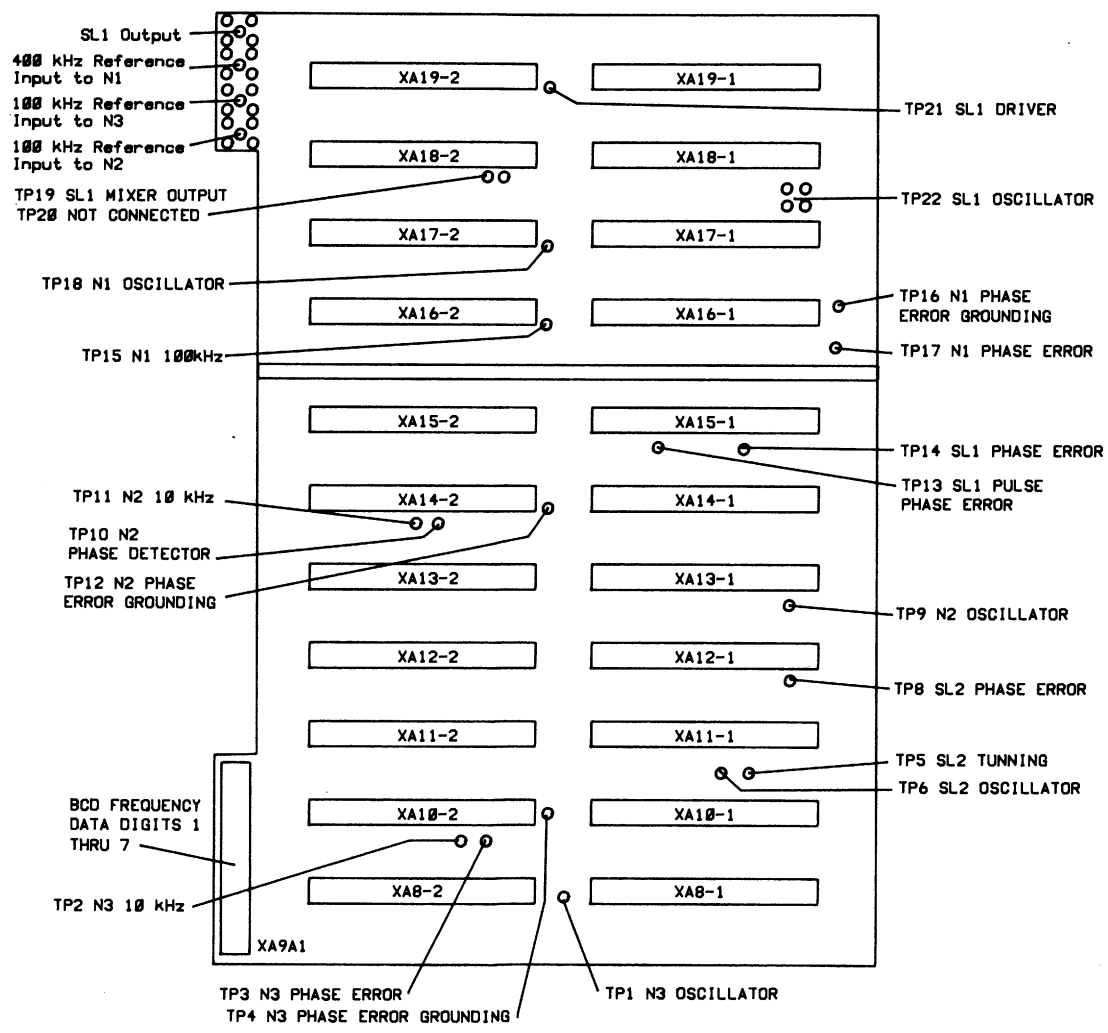
A12



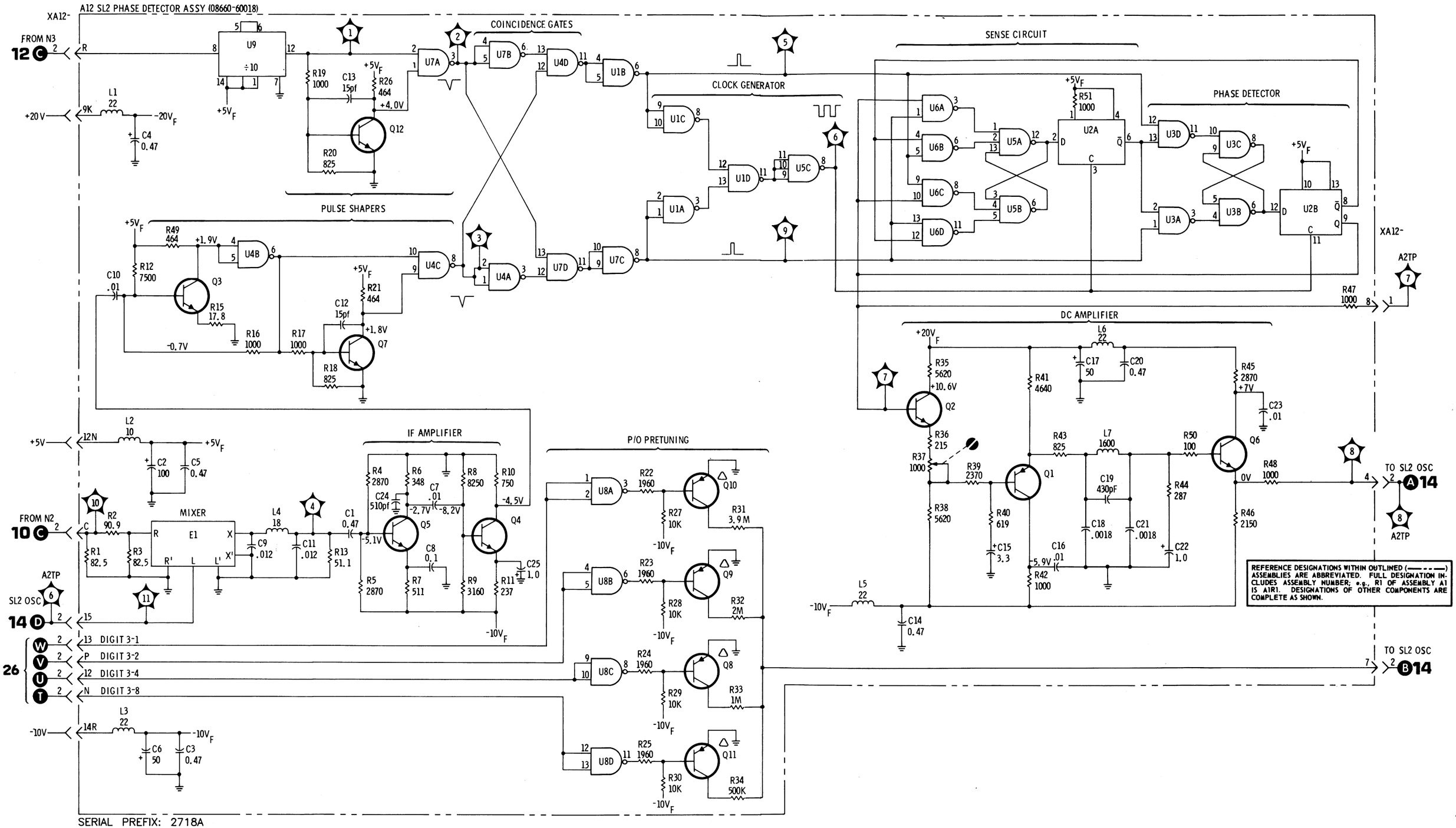
A2 COMPONENT SIDE



A2 SOLDER SIDE



Component Locators



SERIAL PREFIX: 2718A

Figure 8–14 Summing Loop 2 Phase Detector

Service Sheet 14

ASSEMBLY

- **Summing Loop 2 Oscillator A11**

The A11 assembly, a part of the two-assembly SL2, is shown schematically and described on this Service Sheet. The SL2 Phase Detector assembly (A12) is shown schematically and described on Service Sheet 13.

When trouble has been isolated to the A11 assembly it should be removed and reinstalled using two extender boards. This will provide easy access to test points and components.

NOTE

After making repairs to any part of the SL2 circuits, Adjustment 10 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Oscilloscope (with 10:1 divider probes) ..... HP 54200A
Digital Voltmeter ..... HP 3478A
Frequency Counter ..... HP 5385A

SUMMING LOOP 2 GENERAL

The purpose of Summing Loop 2 (SL2) is to generate digitally controlled RF signals in the range of 20.0001 to 30.0000 MHz in selectable 100 Hz increments. The difference frequency between the SL2 voltage controlled oscillator and the input from the N2 loop is phase locked to the divided-by-ten output of the N3 assembly. The output of SL2 is applied to SL1.

Pretuning And Oscillator

The A11 assembly contains a voltage controlled oscillator, a digital-to-analog converter and a circuit to combine the pretuning dc level with the output from the phase detector. The frequency of the voltage controlled oscillator is roughly preset by the pretuning signal from the digital-to-analog converter circuit. The pretuning signal cannot, by itself, set the oscillator precisely; it does set the frequency within the capture range of the phase lock loop.

U2 is a decoder which converts the BCD information from digit 5 to turn on one of nine transistors in a resistive network. Quad NAND gate U3 turns on one or more transistors (Q17 through Q20) when there is a BCD input from digit 4. Quad NAND gate U8 in the A12 assembly turns on one or more transistors (A12Q8 through A12Q11 also in the A12 assembly) when there is a BCD input from digit 3.

When there is no BCD input (all inputs low), the voltage at TP3 is approximately −25V and the oscillator is roughly preset to 30.0000 MHz. As the digital-to-analog transistors are switched on the voltage at TP3 decreases (becomes less negative). When the BCD inputs are at 999 the voltage at TP3 is about −5V and the oscillator is roughly preset to 20.0001 MHz.

Q4 is a summing amplifier which combines the output of the digital-to-analog converter and the signal from the SL2 phase detector. The summing point (Q4-e) sums the current from three sources; a current source from the +20V supply through R19, R20 and R21, a negative source from the digital-to-analog converter (TP3) and the signal from the SL2 phase detector. The voltage at the summing point is always zero volts.

When TP3 is at approximately −25V (all BCD inputs low), most of the current from the +20V source flows through Q5, very little flows through Q4. Under these conditions the voltage at Q4-c is about −30V. As the voltage at TP3 decreases (gets closer to dc ground level) less current flows through Q5, more flows through Q4 and the voltage at Q4-c decreases.

CR2 through CR11 and associated resistors are used to shape the voltage curve applied to the voltage controlled oscillator tuning varactors to ensure that the frequency change is linear with the applied voltage. The voltage at the junction of R52 and R53 is about −27.5V. When all BCD inputs are low (Q4-c is at about −30V) all of the diodes in the shaper are reverse biased. As the voltage at TP3 decreases (gets closer to −5V), current through Q4 increases and the Q4 collector voltage decreases. As the Q4-c voltage decreases first CR11, then CR10, etc. are forward biased. As the diodes are forward biased resistors are added in parallel with R37 and R38 to shape the voltage curve to the varactors. Q15 provides a low impedance output to drive the varactors.

Q1 drives U1A which functions as a Schmitt trigger. U1B inverts the signal and applies it to the SL1 phase detector. U1D also inverts the signal and applies it to the SL2 phase detector.

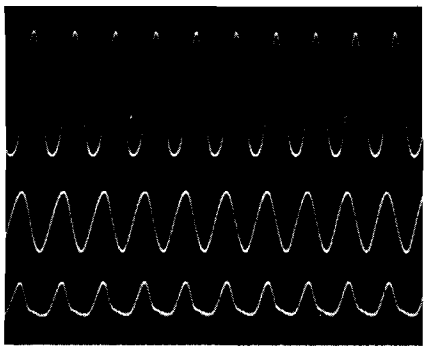
Test Procedure 1

Test 1-a. Connect the counter to TP4. With the center frequency set to zero the counter readout should be 30.000000 MHz. Set CF to the settings specified in Table 8-7. Frequency readouts should follow those specified in the table. (Make allowances for counter accuracy).

NOTE

If the frequency readouts listed in Table 8-7 are not as shown, check the voltage levels shown for TP5 in the table. If the voltages are incorrect proceed to test procedure 2.

If the signal is present use the oscilloscope to check the signals at points shown by composite waveform SS14-1.



Composite Waveform SS14-1

If the signal is present at TP4 but is not present at XA11-1-2 or XA11-1-6, U1 is probably defective.

If the signal is not present at TP4, use the oscilloscope to check for the signal at Q1-b. If the signal is present at Q1-b, check Q1 and NAND gate U1A. If the signal is not present at Q1-b check Q2, Q3, and associated components.

Test Procedure 2

Test 2-a. Use the digital voltmeter to check the voltages at TP3, TP2 and TP5. These dc levels should be approximately as shown in Table 8-7 for the center frequencies shown.

NOTE

These voltages are typical. They will vary from instrument to instrument because of differences in individual varactor characteristics.

If the voltage at TP3 does not change when CF digit 5 is changed to any position, U2 is probably defective (Verify presence of BCD inputs). If the voltage at TP3 reaches about −25V when any CF digit 5 position is set (other than 0) the transistor associated with that number is probably open.

When the voltage at TP3 does not change with a change of the setting of CF digit 4, U3 or the associated transistors may be defective.

When the voltage at TP3 does not change with a change in the setting of CF digit 3, A12U8 or associated transistors may be defective. (This portion of the digital-to-analog converter is located in the A12 assembly).

If the voltages are approximately correct at TP3 but are not correct at either TP2 or TP5, check Q4, Q15, and associated components.

The counter is connected to TP4 for readouts specified in Table 8-7.

Table 8-7. *SL2 Frequency Versus Voltage Chart*

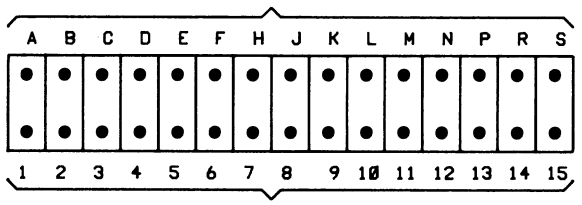
Center Frequency	Counter Readout	TP3	TP2	TP5
00000 Hz	30.000000 MHz	−25.1V	−31.6V	−30.9V
11100 Hz	28.890000 MHz	−22.8V	−25.5V	−24.8V
22200 Hz	27.780000 MHz	−20.5V	−20.5V	−19.9V
33300 Hz	26.670000 MHz	−18.3V	−16.4V	−15.7V
44400 Hz	25.560000 MHz	−16.0V	−13.0V	−12.4V
55500 Hz	24.450000 MHz	−13.8V	−10.3V	−9.6V
66600 Hz	23.340000 MHz	−11.7V	−8.0V	−7.3V
77700 Hz	22.230000 MHz	−9.5V	−6.2V	−5.5V
88800 Hz	21.120000 MHz	−7.3V	−4.6V	−4.0V
99900 Hz	20.010000 MHz	−5.3V	−3.4V	−2.8V

NOTES:

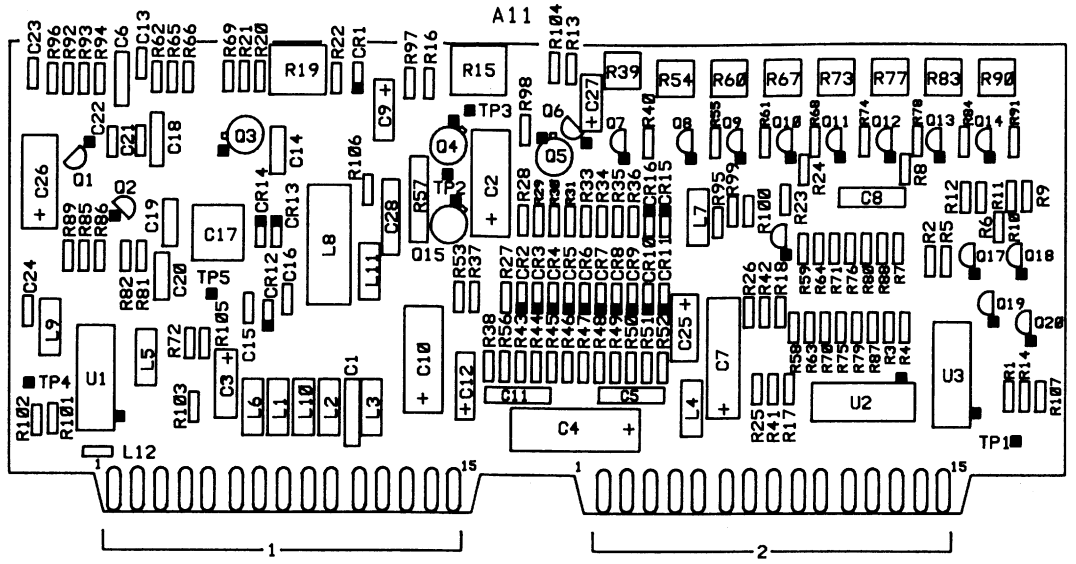
1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

IC	VCC PIN#	GND PIN#
U1, U3	14	7
U2	16	8

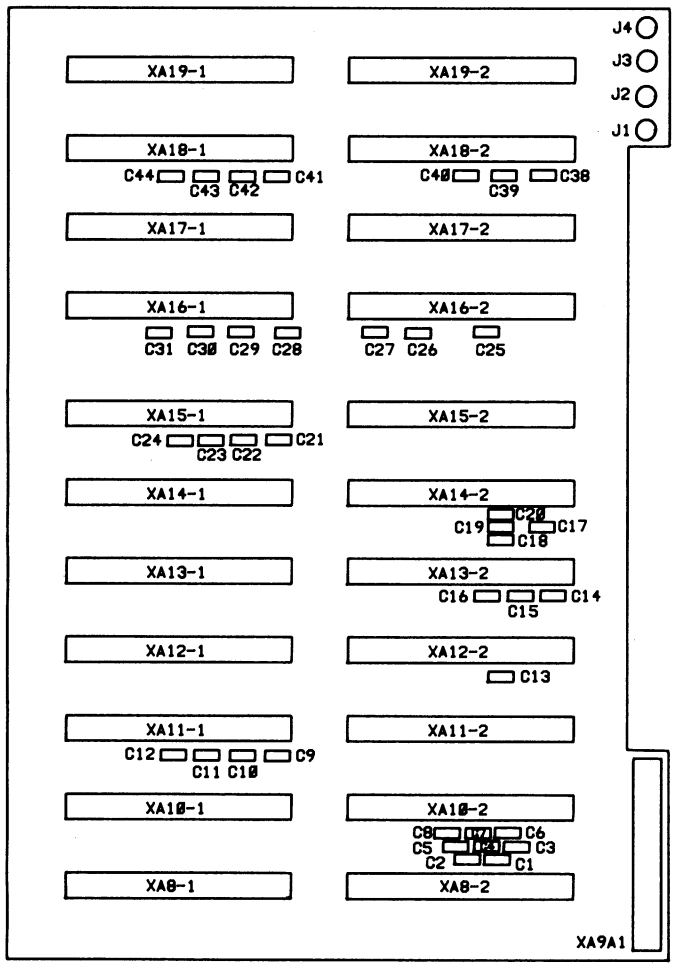
PIN IDENTIFICATION SOLDER SIDE OF PCB



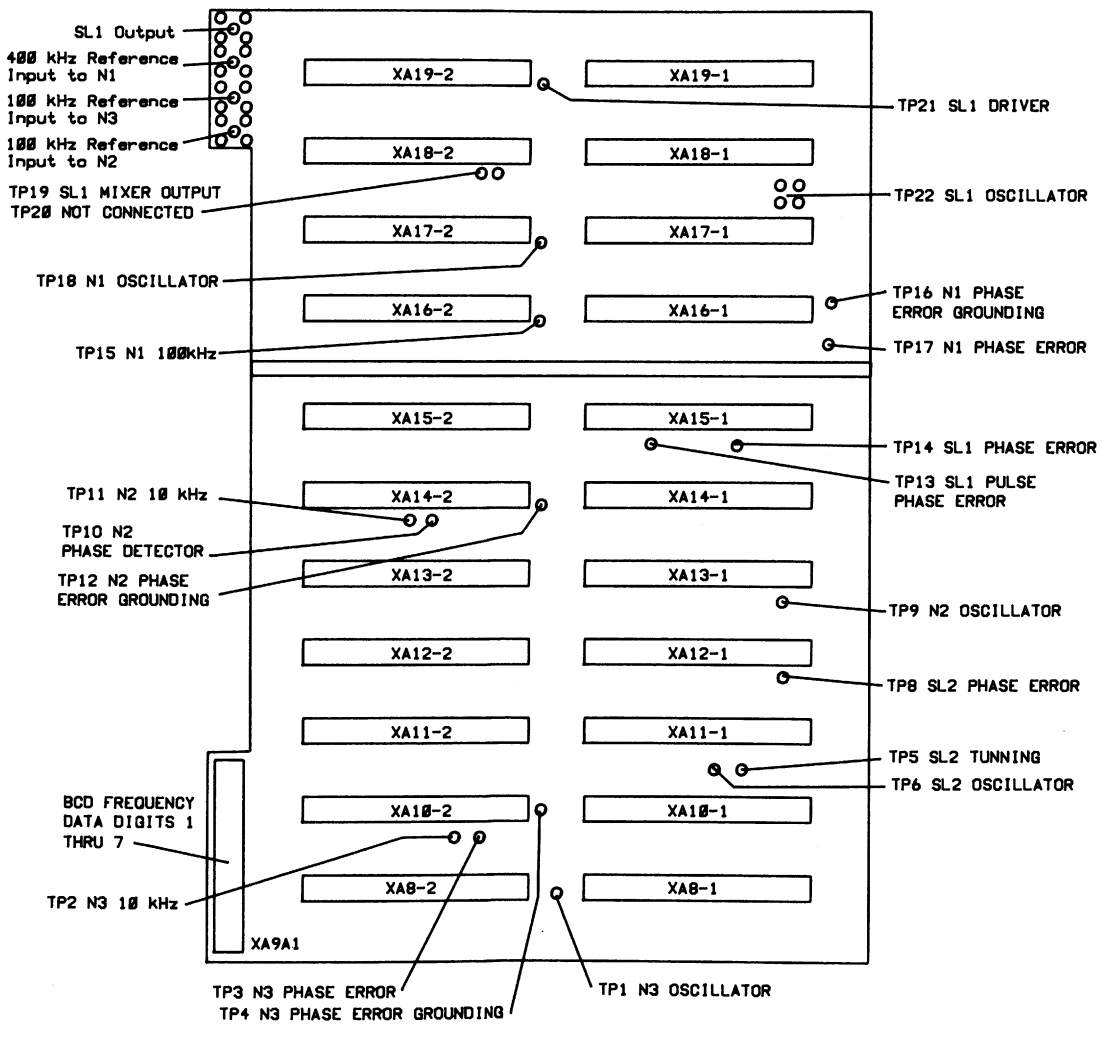
PIN IDENTIFICATION COMPONENT SIDE OF PCB



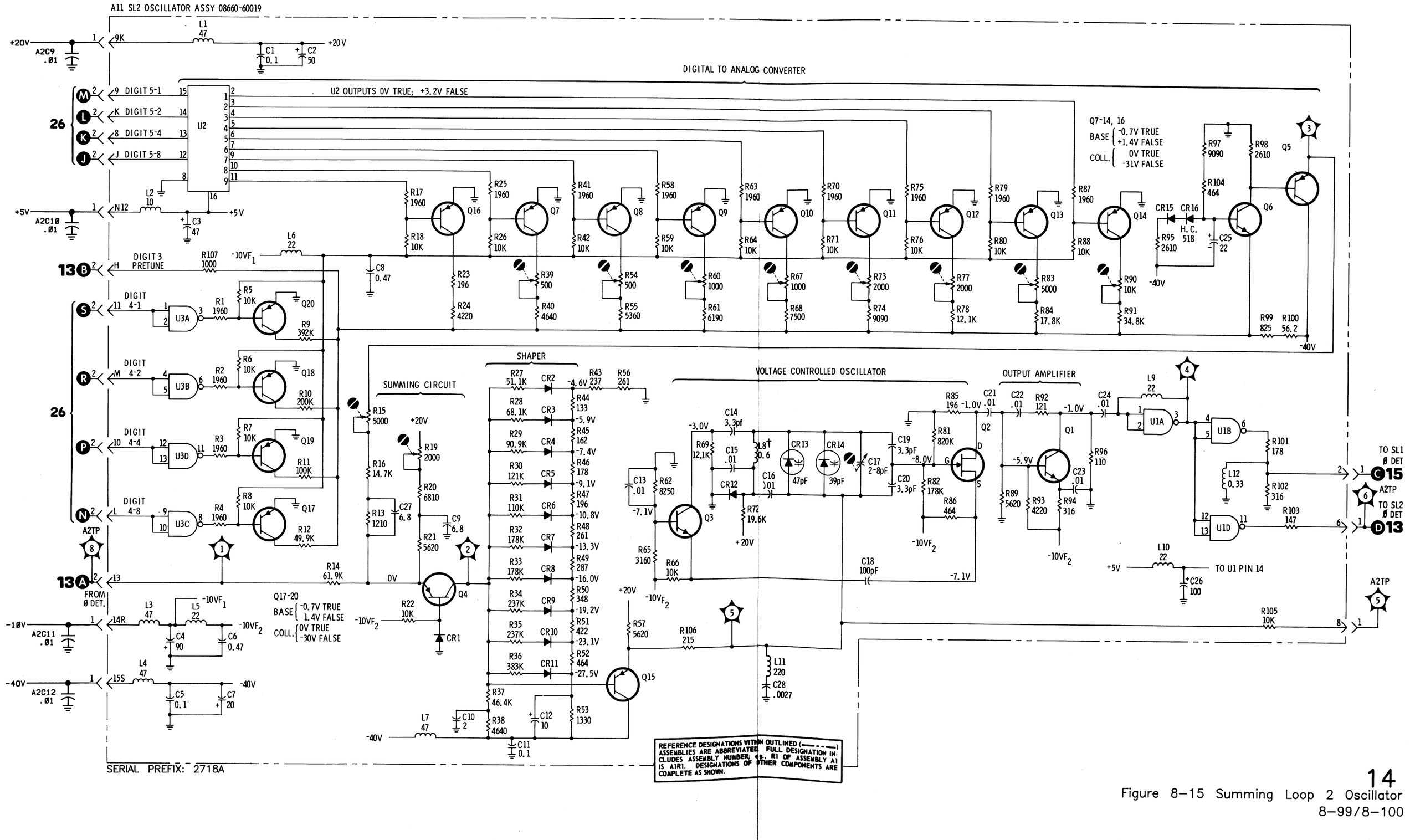
A2 COMPONENT SIDE



A2 SOLDER SIDE



Component Locators



14

Figure 8-15 Summing Loop 2 Oscillator

Service Sheet 15

ASSEMBLY

- **Summing Loop 1 Phase Detector A15**

The A15 assembly, a part of the three-assembly SL1, is shown schematically and described on this Service Sheet. The SL1 Oscillator Assembly (A19) is shown schematically and described on Service Sheet 17. The SL1 Mixer and D/A Converter Assembly (A18) is shown schematically and described on Service Sheet 16.

When trouble has been isolated to the A15 assembly it should be removed and reinstalled using two extender boards. This will provide easy access to test points and components.

NOTE

After making repairs to any part of the SL1 circuits, Adjustment 11 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Oscilloscope (with 10:1 divider probe) ..... HP 54200A
Digital Voltmeter ..... HP 3478A
Frequency Counter ..... HP 5385A

SUMMING LOOP 1 GENERAL

The purpose of Summing Loop 1 (SL1) is to generate digitally controlled RF signals in the range of 20.000001 to 30.000000 MHz in selectable increments as low as 1 Hz. The SL1 voltage controlled oscillator is phase locked to the divided-by-one-hundred output of the SL2 loop and the difference frequency of the N1 loop and the SL1 oscillator. The output of SL1 is applied to the RF Section plug-in.

Phase Detector Assembly A15

There are two signal inputs to the phase detector assembly. One is the input from the SL2 loop which is shaped by U10D and divided by 100, by U6 and U5. The output of U5 is again shaped by Q5 and U4A to provide negative-going pulses at TP2. The other input to the phase detector is from the SL1 mixer and is the difference frequency between the N1 oscillator and the SL1 voltage controlled oscillator. Q6, U4B, Q4 and U4C shape the signal and provide negative-going pulses at TP3.

The pulse frequency at TP2 and TP3 varies (depending on programming) from 0.200001 to 0.300000 MHz. When the phase lock loop is locked the pulse frequency is the same at TP2 and TP3. The sampling ratio is 1:1.

U9A, U3B, U4D and U9B comprise coincidence gates which inhibit signals which appear simultaneously at TP2 and TP3. Normally, when signals are not present, TP2 and TP3 are both high.

When a signal appears at TP2, U9A pin 3 and U3B pin 4 go high. If there is no signal at TP3, U3B pin 5 is also high; U3B pin 6 goes low and U3C pin 8 goes high. The positive pulse at TP4 drives the clock generator and the sense circuit or the phase detector.

When a signal appears at TP3, U4D pin 11 and U9B pin 5 go high. If there is no signal at TP2, U9B pin 4 is also high; U9B pin 6 goes low and U9D pin 11 goes high. The positive pulse at TP8 drives the clock generator and the sense circuit or the phase detector.

When signals appear simultaneously at TP2 and TP3, U9B pin 4 and U3B pin 5 go low: U9B pin 6 and U3B pin 6 remain high and the signals cannot reach TP4 or TP8.

U7C, U9C, U3D and U3A comprise a clock generator which clocks U2A and U2B each time a signal appears at TP4 or TP8. With no signals present, TP4 and TP8 are low. When a positive pulse appears at TP8, U9C pin 8 goes low, U3D pin 11 goes high, and a negative-going pulse appears at TP5. When a positive pulse appears at TP4, operation of the circuit is the same except that U7C pin 8 (rather that U9C pin 8 goes low). Since a clock pulse is generated for each input, the clock pulse frequency at TP5 is the sum of the pulse frequencies at TP4 and TP8. U2A and U2B are clocked by the positive-going trailing edge of the negative clock pulses.

Since the sense circuit does not function when the loop is locked, operation of the phase detector will be described first.

When the loop is phase locked U2A $\overline{Q}$ is held high to enable U1A and U1B. Assume that initially U2B $\overline{Q}$ is high, U1D pin 11 is low, and U1C pin 8 is high. When a positive pulse from TP8 appears at U1A pin 1, U1A pin 3 goes low and causes a change in state of flip-flop U1D/U1C: U1D pin 11 goes high and U1C pin 8 goes low. The high at U1D pin 11 sets the D input to U2B and the clock pulse causes U2B Q to go high. The following positive pulse at TP4 is applied to U1B pin 5, U1B pin 6 goes low and changes the state of flip-flop U1D/U1C. U1D pin 11 goes low and the clock pulse causes U2B $\overline{Q}$ to again go high. This sequence continues as long as the pulses at TP4 and TP8 alternate.

The signals at TP4 and TP8 are applied to the sense circuit even when the loop is phase locked. They have no effect on the circuit because of the relationship between the Q and $\overline{Q}$ outputs of U2B to the incoming signals.

When U2B is high, NAND gates U8A and U8C are enabled. When the signal from TP4 appears at U8C pin 9, U8C pin 8 goes low; flip-flop U7A/U7B does not change state because U7B pin 3 is low. The signal at U8B pin 4 has no effect because U2B $\overline{Q}$ and U8B pin 5 are low.

When two or more consecutive pulses from either input (TP4 or TP8) occur between pulses from the other input, the sense circuits function to disable the phase detector until the frequency error has been corrected.

As an example of circuit operation, assume that two pulses from TP8 are received between two pulses from TP4, indicating that the SL1 frequency is too high. When the first pulse from TP8 is received U1A pin 3 goes low, U1D pin 11 goes high to set the D input to U2B, and the clock pulse causes U2B Q to go high. When the second consecutive pulse is received from TP8, U8A has been enabled by the high Q output of U2B. U8A pin 3 goes low and causes flip-flop U7A/U7B to change state. When the D input to U2A goes high, the clock pulse causes U2A $\overline{Q}$ to go low and inhibit NAND gates U1A and U1B. If a third pulse from TP8 is received prior to receipt of a signal from TP4, U8A pin 3 will again go low but will not affect flip-flop U7A/U7B, because U7A pin 13 is low.

When a pulse is received from TP4, U2B Q is still high and U8C pin 8 will go low and change the state of flip-flop U7A/U7B. When the D input to U2A goes low the clock pulse will cause U2A $\overline{Q}$ to go high and enable U1A and U1B. The propagation time of the signal through the sense circuit is long enough for the pulse from TP 4 to have ended before U1B is enabled so the state of flip-flop U1D/U1C does not change.

The next pulse from TP8 will again cause U8A pin 3 to go low and change the state of flip-flop U7A/U7B. With the D input of U2A high again, the clock pulse causes U2A $\overline{Q}$ to go low and inhibit U1A and U1B. The signal applied to U1A has no effect on flip-flop U1D/U1C because U1D pin 12 is low.

The sense circuit continues operation in the manner described above until two consecutive pulses are received at TP4 between two pulses at TP8. When this occurs the first pulse causes U8C pin 8 to go low and change the state of flip-flop U7A/U7B. With the D input to U2A low the clock pulse will cause U2A $\overline{Q}$ to go high and enable NAND gates U1A and U1B. Because of the propagation time through the sense circuit, the pulse will have ended before U1B is enabled. The second consecutive pulse from TP4 again causes U8C pin 8 to go low, but because U7B pin 3 is now low, no change in state occurs in

flip-flop U7A/U7B. Since U1B is enabled, U1B pin 6 goes low and causes flip-flop U1D/U1C to change state. With the D input of U2B low, the clock pulse will cause the U2B $\overline{Q}$ output to go high.

Phase lock has been achieved and the loop will remain locked as long as pulses at the same frequency are received alternately at at TP4 and TP8.

When the SL1 frequency is too low, U2B Q is low. When the SL1 frequency is too high, U2B Q is high.

DC amplifier Q1, Q2, Q3 and associated components filter the Q output of U2B and apply it to a summing circuit in the A19 assembly to precisely control the voltage controlled oscillator.

Test Procedure 1

Test 1-a Connect the oscilloscope input to test points shown by composite waveform SS15-1. This composite waveform illustrates correct waveforms and timing relationships for the points tested. All signals are about 4V in amplitude.

NOTE

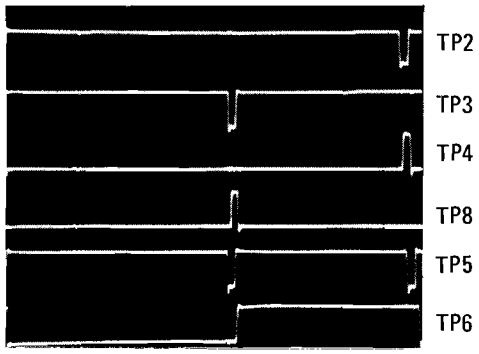
The oscilloscope was triggered from TP1 for all waveforms.

If the pulses are not present at TP2 proceed to test 1-b.

If the pulses are not present at TP3 proceed to test 1-c.

If the pulses are present at TP2 and TP3, but opposite polarity pulses are not present at TP4 and/or TP8, check the NAND gates between TP2 and TP4, or TP3 and TP8 as appropriate.

If the positive-going pulses are present at TP4 and TP8, but negative-going pulses are not present at TP5 for each of the pulses, check NAND gates U3A, U3D, U7C, and U9C as appropriate.



Composite Waveform SS15-1

If the pulses are approximately as shown in the top five traces of composite waveform SS-15, but there is no square wave at TP6, use the oscilloscope to check the signal at NAND gate U1D pin 11. The display should be the same as that shown for TP6. If the signal is present, U2B is probably defective.

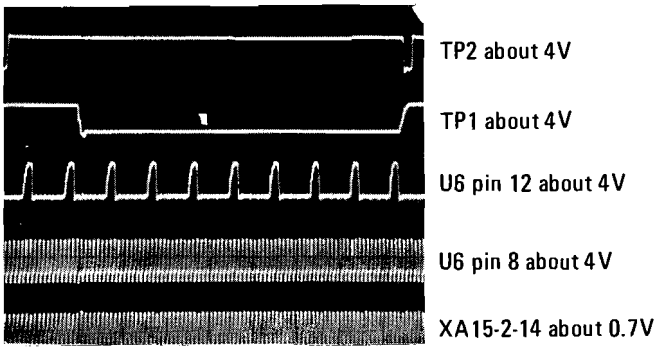
If the signal is not present at U1D pin 11 use the oscilloscope to check the signals at NAND gates U1A pin 3 and U1B pin 6. The signals should appear as they did at TP4 and TP8 except that they are inverted. If the signals are present, U1C or U1D may be defective. If the signal is present at one of the NAND gates but not at the other, replace U1.

If the signal is not present at U1A pin 3 or U1B pin 6, use the digital voltmeter to check the dc level at U2A pin 6. If U2A pin 6 is about +4V, U1 is defective.

If the +4V is not present at U2A pin 6, ground U2A pin 1. If the voltage at U2A pin 6 does not go to about +4V, U2 is defective.

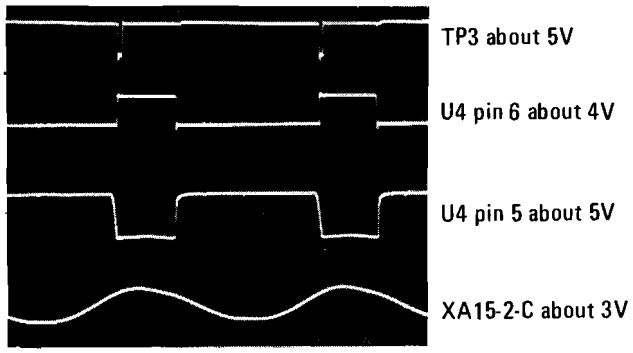
If the cause of trouble still has not been found, connect the counter to TP3 and the digital voltmeter and oscilloscope to NAND gate U7A pin 12. The counter readout should be about 300.000 kHz (center frequency set to zero) and U7A pin 12 should be low (about +70 mV). If the counter readout is lower or higher than 300 kHz and U5A pin 12 is high, slowly rotate A15R14 through its range while observing the counter and the oscilloscope. As the counter readout passes through the 300 kHz point the oscilloscope display should show a change in level; if it does not, U7 or U8 is probably defective.

Test 1-b. If there is no signal at TP2 or the signal is not approximately as shown in the top trace of composite waveform SS15-2, connect the oscilloscope first to TP2, then U6 pin 12, U6 pin 8 and finally to XA15-2-14. In making the checks in the order shown, the point at which the correct signal is first observed is followed by the defective circuit. If the signal is not present at XA15-2-14, check the interconnections to the SL2 loop.



Composite Waveform SS15-2

Test 1-c. If there is no signal at TP3 or the signal is not approximately as shown in the top trace of composite waveform SS15-3, connect the oscilloscope first to U4 pin 6, then to U4 pin 4 or 5 and finally to XA15-2-C.



Composite Waveform SS15-3

In making the checks in the order shown, the point at which the signal is first observed is followed by the defective circuit. If the signal is not present at XA15-2-C check the interconnections to the A18 assembly and, if necessary, the A18 assembly.

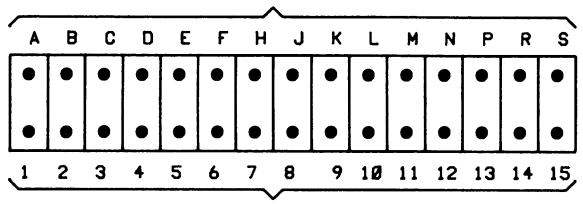
Test 1-d. To check operation of the dc amplifier connect the digital voltmeter to Q3-e, ground TP7, and rotate A15R14 through its range. The digital voltmeter readout should vary from approximately −1.5V to +1.5V. If the voltage does not vary as A15R14 is adjusted, check Q1, Q2, Q3 and associated components.

NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

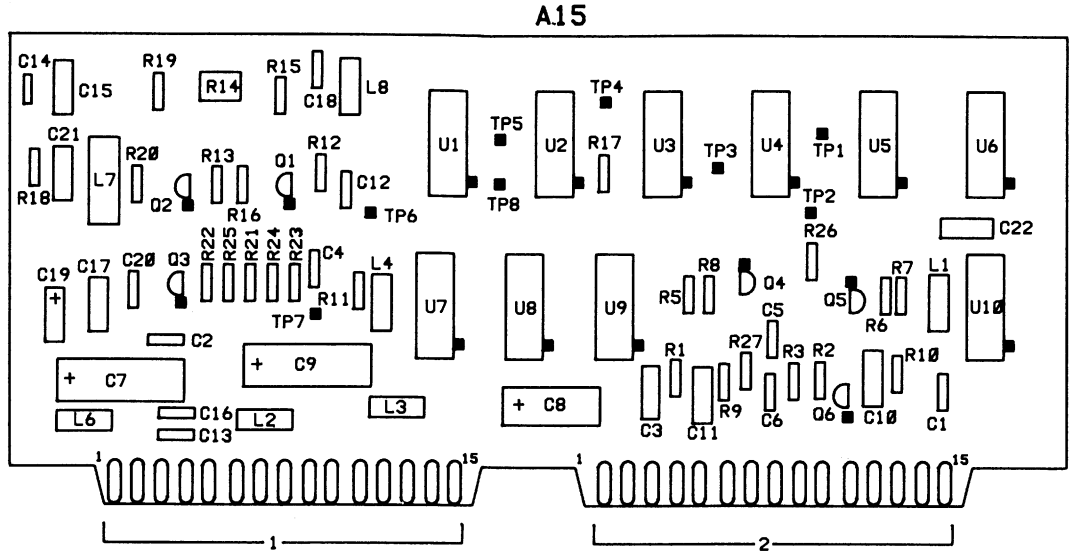
IC	VCC PIN#	GND PIN#
U1-U10	14	7

PIN IDENTIFICATION SOLDER SIDE OF PCB

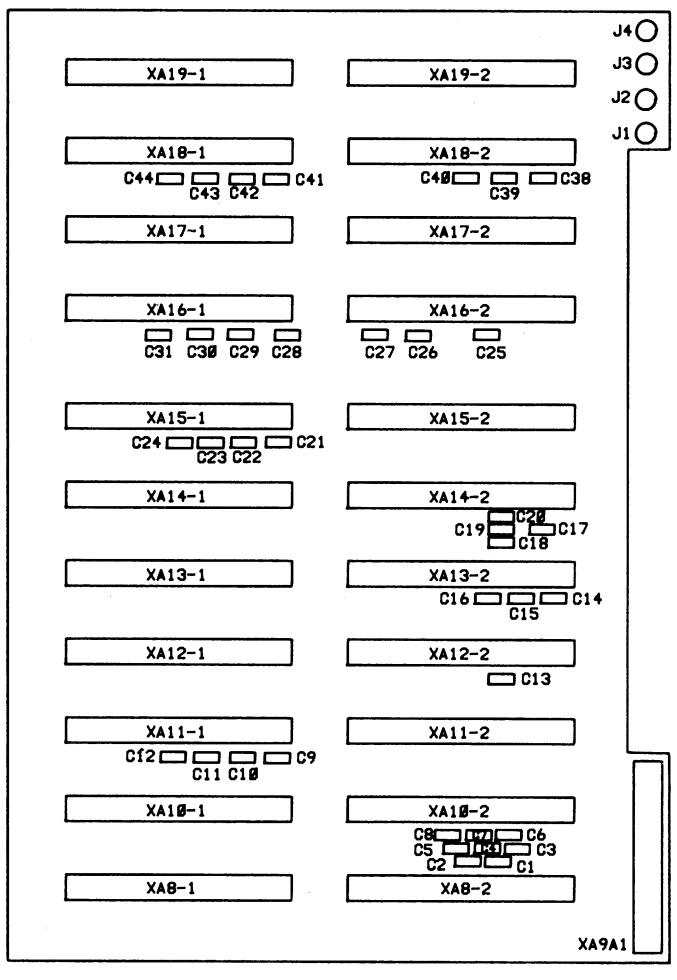


PIN IDENTIFICATION COMPONENT SIDE OF PCB

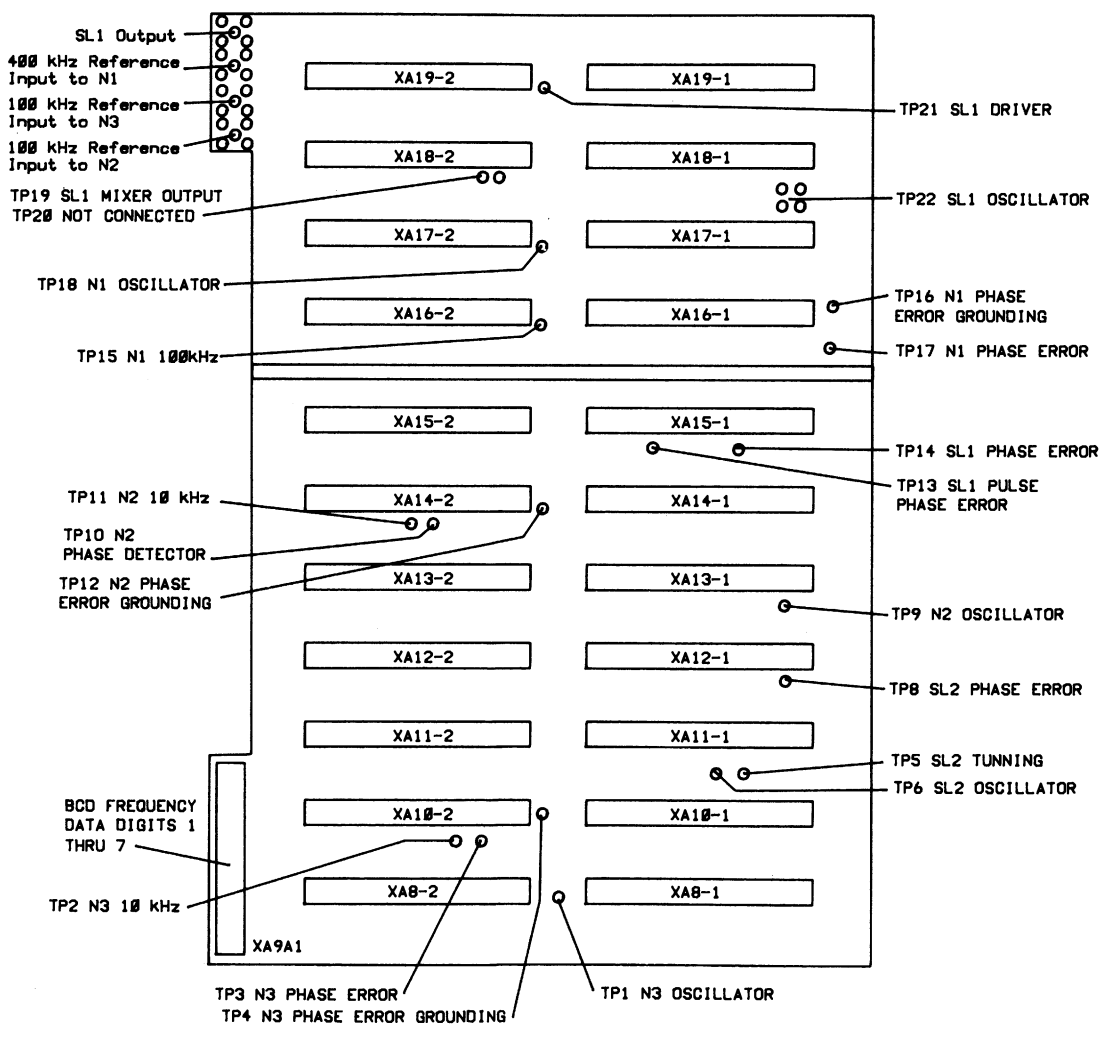
A15



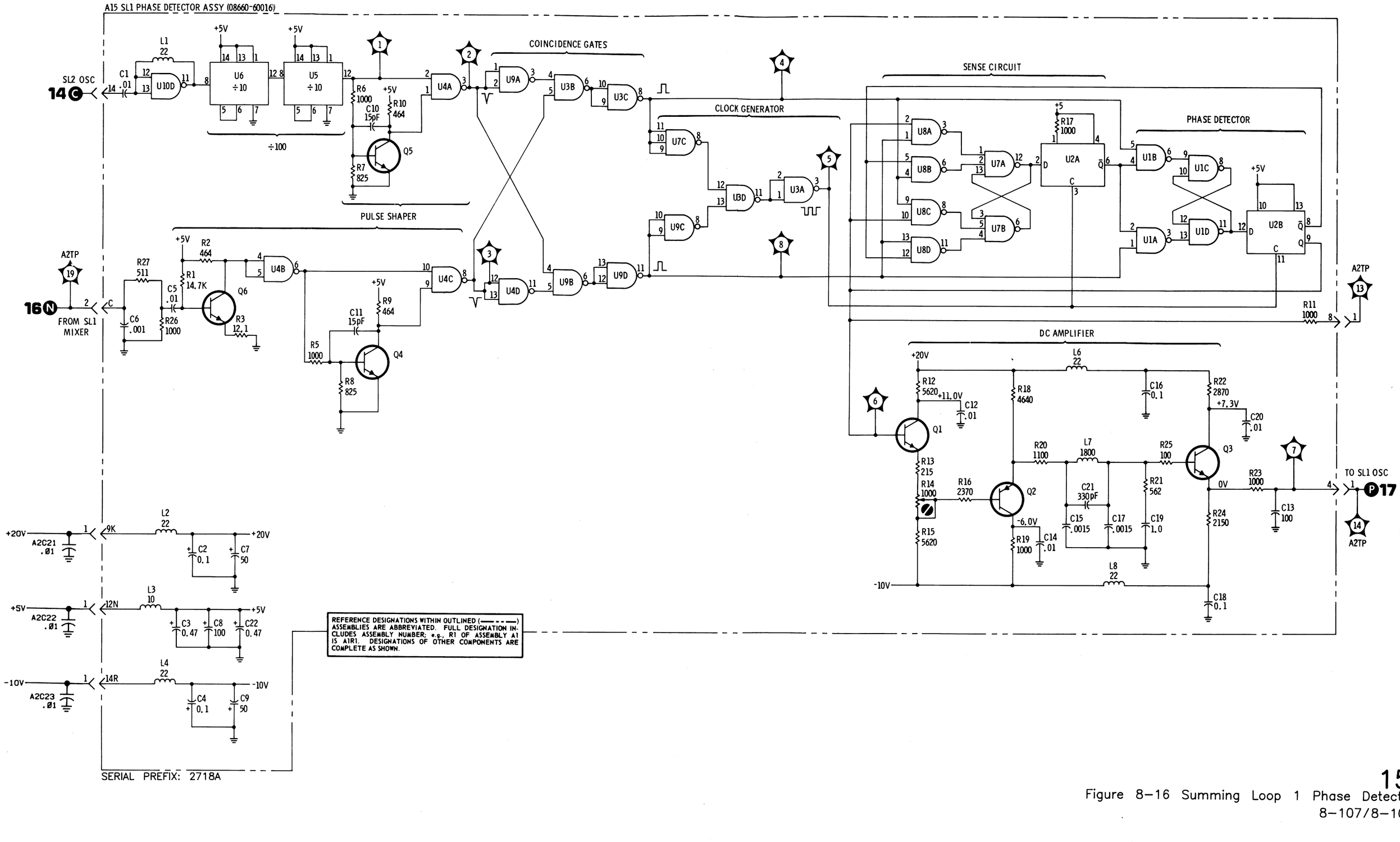
A2 COMPONENT SIDE



A2 SOLDER SIDE



Component Locators



15

Figure 8-16 Summing Loop 1 Phase Detector

Service Sheet 16

ASSEMBLY

- **Summing Loop 1 Mixer and D to A Converter A18**

The A18 assembly, a part of the three-assembly SL1, is shown schematically and described on this Service Sheet. The SL1 Phase Detector Assembly (A15) is shown schematically and described on Service Sheet 15. The SL1 Oscillator Assembly (A19) is shown schematically and described on Service Sheet 17.

When trouble has been isolated to the A18 assembly it should be removed and reinstalled using two extender boards. This will provide easy access to test points and components.

NOTE

After making repairs to any part of the SL1 circuits, Adjustment 11 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Oscilloscope (with 10:1 divider probes) ..... HP 54200A
Digital Voltmeter ..... HP 3478A
Frequency Counter ..... HP 5385A

SUMMING LOOP 1 GENERAL

The purpose of Summing Loop 1 (SL1) is to generate digitally controlled RF signals in the range of 20.000001 to 30.000000 MHz in selectable increments as low as 1 Hz. The SL1 voltage controlled oscillator is phase locked to the divided-by-one-hundred output of the SL2 loop and the difference frequency of the N1 loop and the SL1 oscillator. The output of SL1 is applied to the RF Section output plug-in.

Mixer And Amplifiers

E1 is a double balanced mixer which mixes the output of the SL1 voltage controlled oscillator with the output of the N1 loop and provides an output which is the difference frequency of the two inputs.

Q14 and Q1 amplify the input from the SL1 voltage controlled oscillator.

Q2, Q15, Q18, and associated components amplify the output from the mixer before applying it to the phase detector circuit in the A15 assembly.

Test Procedure 1

Test 1-a. With the center frequency set to zero, use the counter and the oscilloscope to check for the following (approximately sine wave) signals:

TP5 300.000 kHz at about 4 Vpp
TP4 (oscilloscope only) 300 kHz at about 0.1 Vpp
TP3 29.700000 MHz at about 0.5 Vpp
Q1-e 30.000000 MHz at about 1.1 Vpp
TP2 30.000000 MHz at about 0.5 Vpp

Digital To Analog Converter

U3 is a decoder which converts the BCD inputs from digit 7 to an output that will turn on one of nine transistors in a resistive network. Quad NAND gates U2 and U1 turn on one or more transistors connected to their outputs in a resistive network. U2 and U1 are controlled by digits 6 and 5 respectively.

The current flow through Q4 and the bias for Q3 is determined by which of the transistors in the resistive network are saturated. The dc level at TP1 is determined by which transistors are on. This dc level is applied to a summing circuit in the A19 assembly and used to roughly pretune the voltage controlled oscillator. When the BCD input is 000 the dc level at TP1 is about −25V. When the BCD input is 999 the dc level is about −5V.

Test Procedure 2

Test 2-a. Connect the digital voltmeter to TP1 and the counter to TP5. Refer to Table 8-8 for CF settings, counter readouts, and approximate voltage levels.

NOTE

The voltage readings are typical and may vary greatly from that shown due to differences in varactor characteristics. The important point to note is the ratio of change as the center frequency is changed.

If the voltage ratio changes approximately as shown, but the frequency requirements are not met, trouble is probably in the oscillator assembly or the phase detector assembly.

Table 8-8. *SL1 Frequency Versus Voltage Chart*

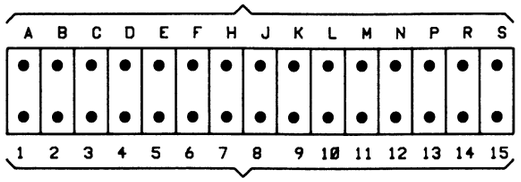
Center Frequency	Frequency TP5	Voltage TP1
0000000 Hz	300.000 kHz	−25.5V
1110000 Hz	290.000 kHz	−23.4V
2220000 Hz	280.000 kHz	−21.0V
3330000 Hz	270.000 kHz	−18.8V
4440000 Hz	260.000 kHz	−16.6V
5550000 Hz	250.000 kHz	−14.3V
6660000 Hz	240.000 kHz	−12.1V
7770000 Hz	230.000 kHz	−9.9V
8880000 Hz	220.000 kHz	−7.7V
9990000 Hz	210.000 kHz	−5.4V
9999999 Hz	200.000 kHz	−5.4V

NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

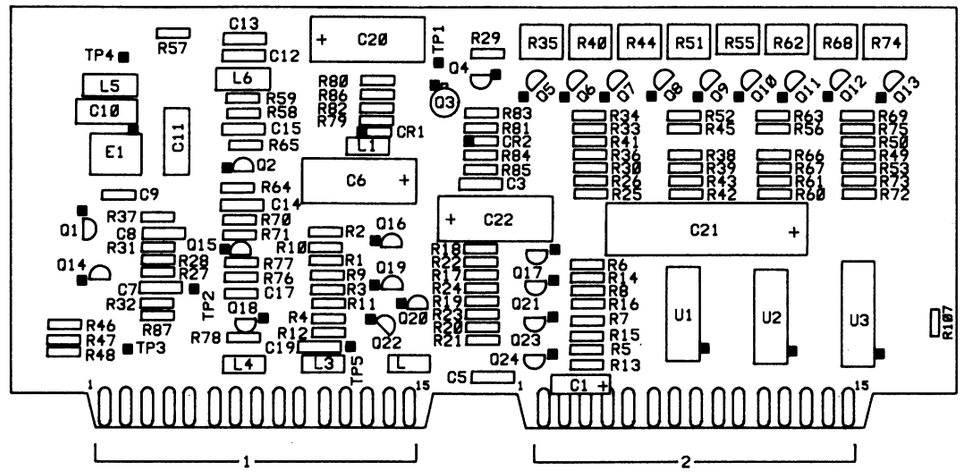
IC	VCC PIN#	GND PIN#
U1,U2	14	7
U3	16	8

PIN IDENTIFICATION SOLDER SIDE OF PCB

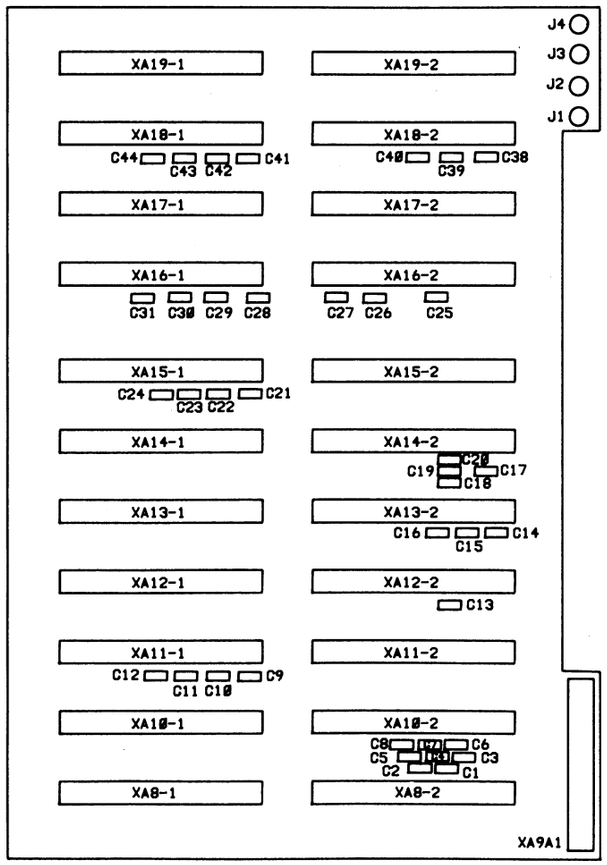


PIN IDENTIFICATION COMPONENT SIDE OF PCB

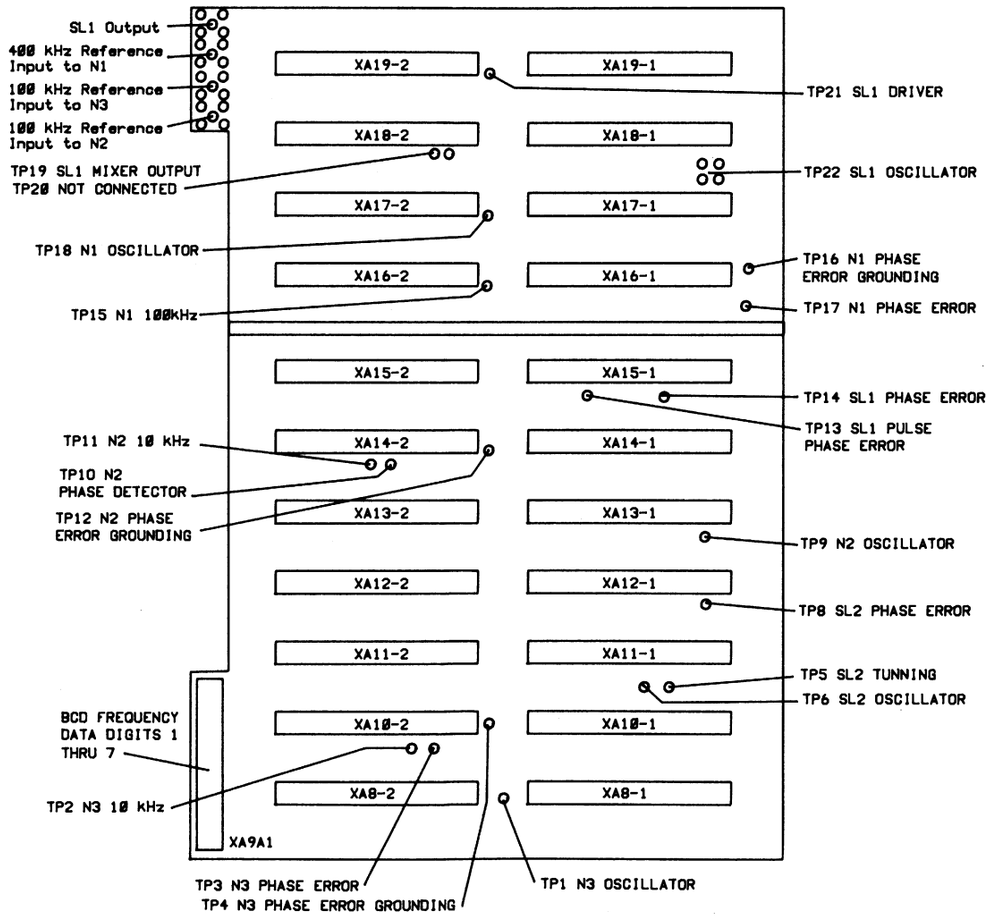
A18



A2 COMPONENT SIDE



A2 SOLDER SIDE



Component Locators

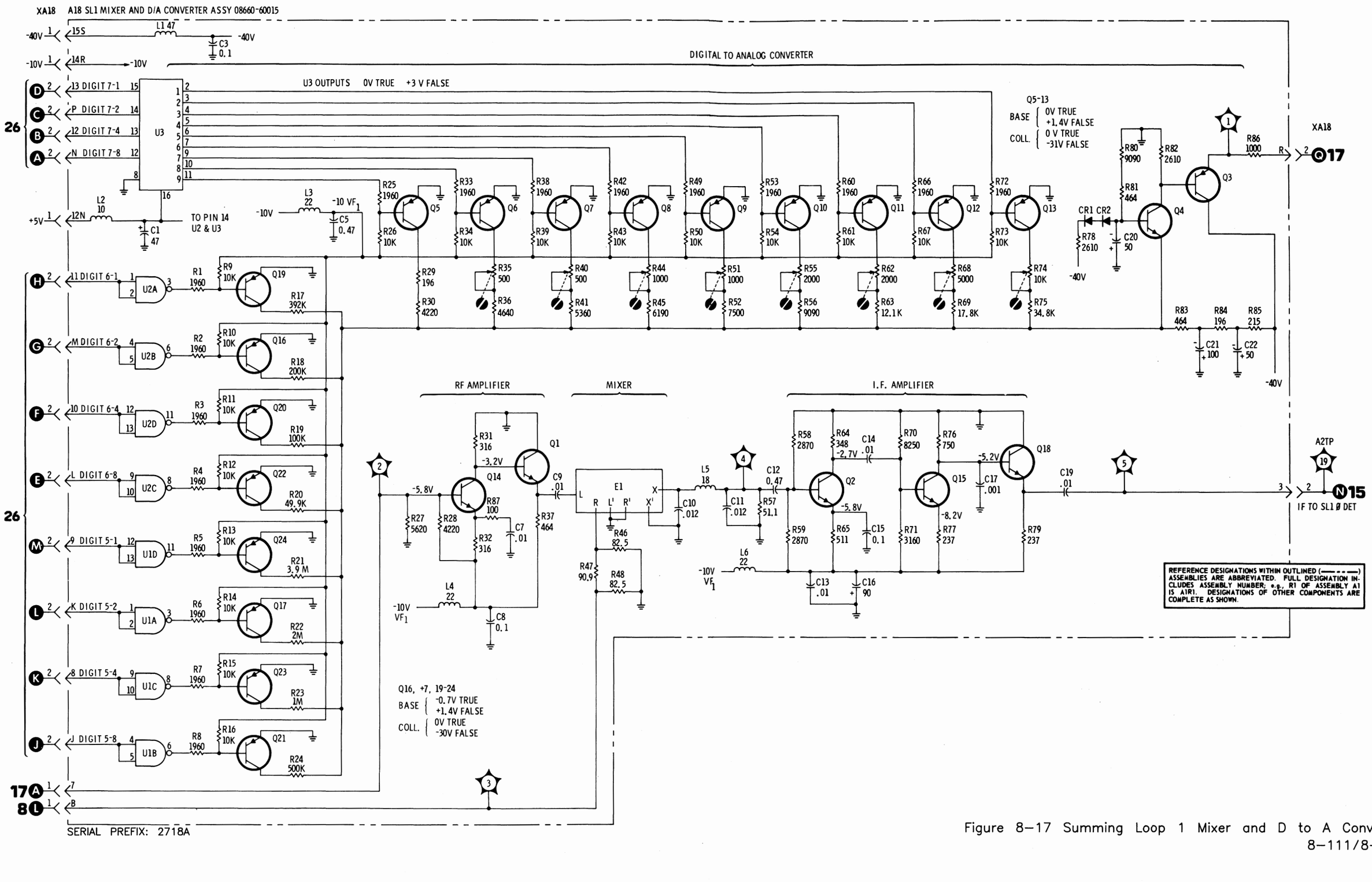


Figure 8–17 Summing Loop 1 Mixer and D to A Converter

Service Sheet 17

ASSEMBLY

- **Summing Loop 1 Oscillator A19**

The A19 assembly, a part of the three-assembly SL2, is shown schematically and described on this Service Sheet. The SL1 Mixer and D/A Converter Assembly (A18) is shown schematically and described on Service Sheet 16. The SL1 Phase Detector Assembly (A15) is shown schematically and described on Service Sheet 15.

When trouble has been isolated to the A19 assembly it should be removed and reinstalled using two extender boards. This will provide easy access to test points and components.

NOTE

After making repairs to any part of the SL1 circuits, Adjustment 9 in Section 5 of the HP 8660D Operation and Calibration Manual should be performed to ensure proper operation of the instrument.

TEST EQUIPMENT REQUIRED

Oscilloscope(with 10:1 divider probes)	HP 54200A
Digital Voltmeter	HP 3478A
Frequency Counter	HP5385A

SUMMING LOOP 1 GENERAL

The purpose of Summing Loop 1 (SL1) is to generate digitally controlled RF signals in the range of 20.000001 to 30.000000 MHz in selectable increments as low as 1 Hz. The SL1 voltage controlled oscillator is phase locked to the divided-by-one-hundred output of the SL2 loop and the difference frequency of the N1 loop and the SL1 oscillator. The output of SL1 is applied to the RF Section plug-in.

Summing Amplifier

Q6 is a summing amplifier which combines the output of the digital-to-analog converter and the signal from the SL1 phase detector. The summing point (Q6-e) sums the current from three sources through R9, R10, and R11, a negative source from the digital-to-analog converter through R3, R7 and R68, and the signal from the SL1 phase detector through R6. The dc level at the summing point is held at zero volts.

When the input at XA19-2-J is ≈ -25V (all BCD inputs to A18 low), most of the current from the +20V source flows through A18Q3; very little flows through Q6. Under these conditions the voltage at Q6-c is ≈ -30V. As the voltage at XA19-2-J decreases (becomes less negative), less current flows through A18Q3, more flows through Q6, and the voltage at Q6-c decreases (becomes less negative).

CR1 through CR10 and associated resistors are used to shape the voltage curve applied to the voltage controlled oscillator tuning varactors to ensure that frequency change is linear with voltage change. The voltage at the junction of R32 and R39 is about -27.5V. When all BCD inputs to the A18 assembly are low, Q6-c is about -30V and all of the diodes in the shaper are reverse biased. As the voltage from the digital-to-analog converter decreases (gets closer to -5V) current through Q6 increases and the Q6 collector voltage decreases. As the Q6-c voltage decreases first CR10, and CR9, etc. are forwarded biased. As the diodes are forward biased resistors are added in parallel with R35 and R38 to shape the voltage curve to the varactors. Q7 provides a low impedance output to drive the varactors.

Test Procedure 1

Test 1-a.

Connect the digital voltmeter to TP1 and set the center frequency as shown in Table 8-9.

NOTE

The voltage readings are typical and may vary greatly from the readings shown due to differences in varactor characteristics. The important point to note is the ratio of change as the center frequency is changed.

If the voltage at TP1 does not change as the CF is changed, check the input from the digital-to-analog converter (A18) at XA19-2-J. If the voltage levels at this point do not change as the CF is changed, trouble is probably in the A18 assembly.

If the voltage level from the digital-to-analog converter does change, but the level at TP1 does not, check Q6, Q7 and associated components.

Voltage Controlled Oscillator And Amplifiers

Q5, Q4 and associated components comprise a voltage controlled oscillator. C17, C20 and C21 provide isolation for the dc levels required to bias the varactors. C19 provides the feedback necessary to sustain oscillation. The resonant tank circuit is coupled to Q4 by capacitive divider C20 and C21. The FET acts as a source follower in the feedback circuit; it provides a high impedance at the gate and a low impedance at the source.

Q3 is a power splitter which drives two two-stage amplifiers. One amplifier output is applied to the RF Section plug-in and the other is applied to the mixer in the A18 assembly.

Test Procedure 2

Test 2-a. Connect the oscilloscope to TP3 then to TP4. The sine wave at both test points should be about 0.3 Vpp.

If the signal is not present at either TP3 or TP4 connect the oscilloscope to Q3-b. The signal level should be about 0.2 Vpp. If the signal is present at Q3-b but was not present at TP3 or TP4, Q3 is probably defective. If the signal is not present at Q3-b, check Q5, Q4 and associated components.

Test 2-b. Connect the counter to TP3 or TP4 and check for correct frequencies at the CF's shown in Table 8-9.

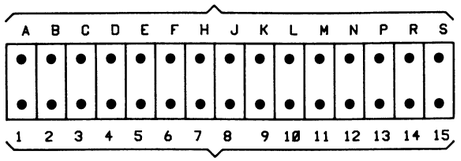
Table 8–9. *Varactor Bias Versus Frequency SL1*

Center Frequency	Frequency TP3 and TP4	Voltage TP1
0000000 Hz	30.000000 MHz	−30.7V
1110000 Hz	28.890000 MHz	−25.3V
2220000 Hz	27.780000 MHz	−21.2V
3330000 Hz	26.670000 MHz	−17.2V
4440000 Hz	25.560000 MHz	−13.4V
5550000 Hz	24.450000 MHz	−10.6V
6660000 Hz	23.340000 MHz	−8.2V
7770000 Hz	22.230000 MHz	−6.3V
8880000 Hz	21.120000 MHz	−4.7V
9990000 Hz	20.010000 MHz	−3.3V
9999999 Hz	20.000001 MHz	−3.2V

NOTES:

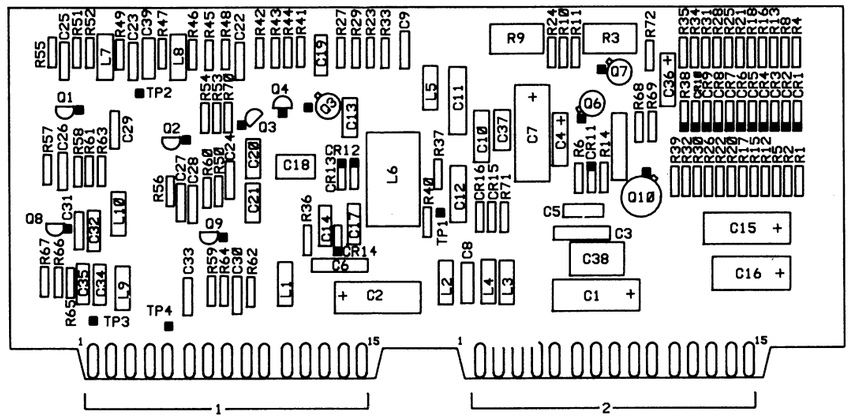
1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
2. C5 may be omitted.

PIN IDENTIFICATION SOLDER SIDE OF PCB

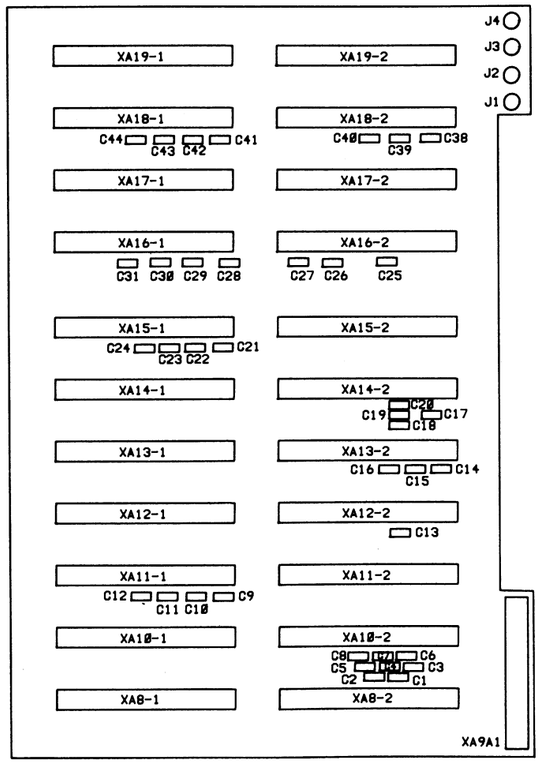


PIN IDENTIFICATION COMPONENT SIDE OF PCB

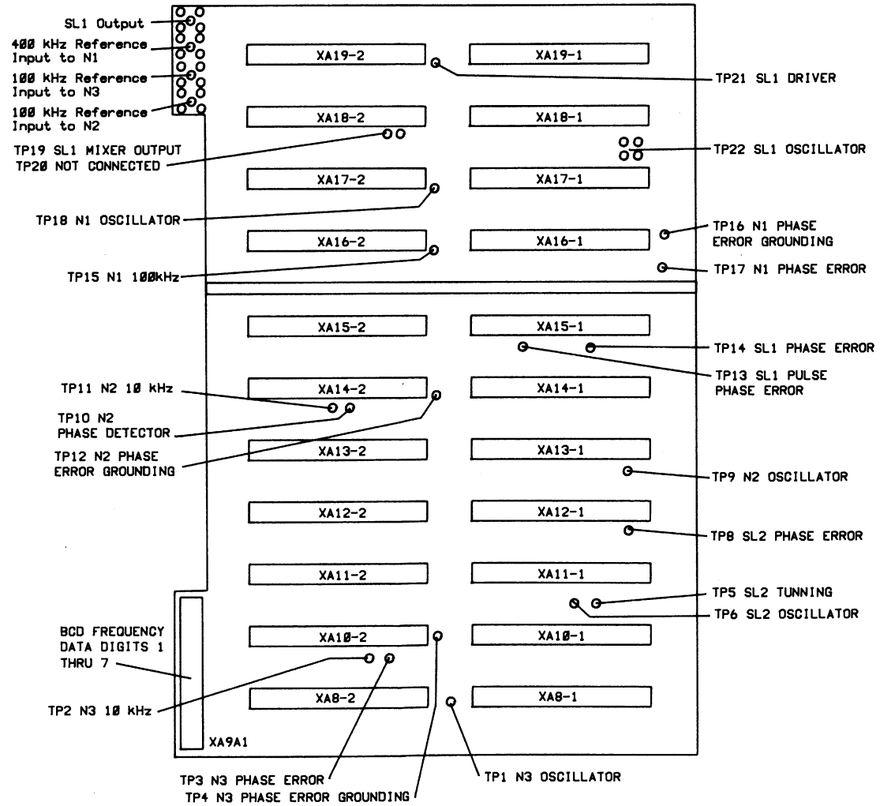
A19



A2 COMPONENT SIDE



A2 SOLDER SIDE



Component Locators

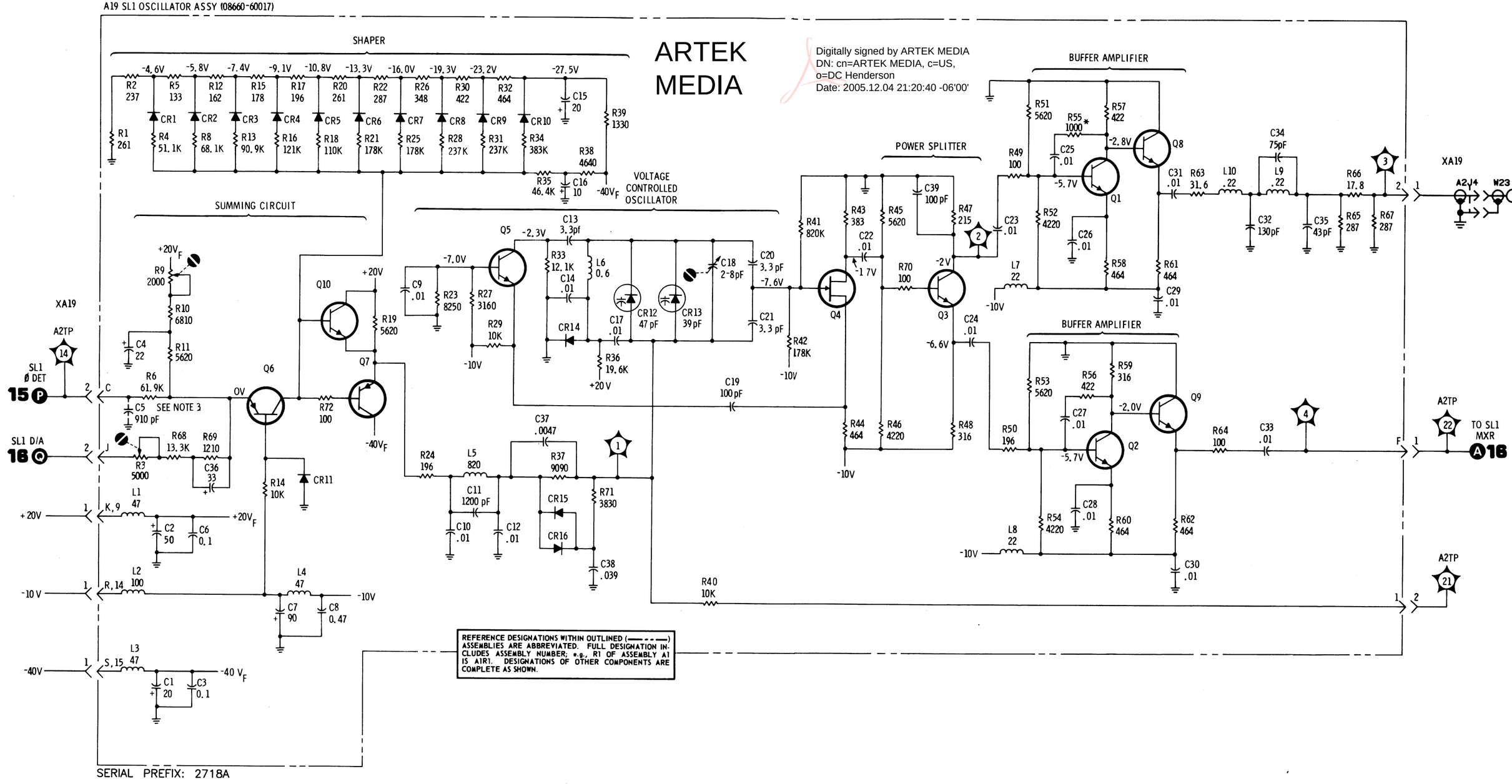


Figure 8–18 Summing Loop 1 Oscillator

Service Sheet 18

BLOCK DIAGRAM

- **Digital Control Unit (DCU) Block Diagram**

TROUBLESHOOTING

General Information

Signature analysis is a technique for troubleshooting digital circuitry. The HP 8660D Signal Generator contains programs to stimulate its digital circuitry and digital "signatures" are read by a separate instrument, the Signature Analyzer. The signatures read at every node in the digital circuitry can be compared to the correct signature for that node which is contained in a table included in the troubleshooting information with each schematic diagram. This provides a Go/No Go test.

The HP 8660D must be placed in one of its two "test modes" to provide the stimulus for signature analysis troubleshooting. The procedures below explain how to place the DCU into a "test mode". When the HP 8660D is in a "test mode" normal operation is not possible and the front panel keys are inactive. When in "test mode", the HP 8660D provides stop, start and clock signals to the Signature Analyzer and provides data to the assembly being tested to stimulate all nodes of the circuitry. The Signature Analyzer probe is placed on a node of the circuitry and the data on that node is clocked into the Signature Analyzer. Based on the data on that node and its relation to the time frame defined by the stop and start signals a unique four character signature is generated and displayed on the Signature Analyzer front panel.

The signature of the logic Vcc (+5 Vdc for the TTL logic in the HP 8660D) has special significance. When the signature analyzer probe is touching Vcc, the data clocked into the Signature Analyzer is a series of ones and the signature generated depends on the time frame defined by the stop and start signals and the connection and settings of the Signature Analyzer. Thus, the Vcc signature is a convenient check that the stimulus program in the HP 8660D is providing the correct stop, start and clock signals and the Signature Analyzer is set-up and connected correctly.

Test Equipment Required

Signature Analyzer ..... HP 5005A, 5005B, 5006A or 5004A
DCU Extender Board (2 Required) ..... HP 08660-60406

Set-Up Procedures

There are two test modes, Free-Run and Regular. There is a separate set-up procedure for each mode. The troubleshooting procedure for the assembly you are testing will explain which procedure to use.

FREE-RUN Signature Analysis Set-Up Procedure

Free-Run Signature Analysis is only used for the A1A3 Microprocessor Assembly.

1. Remove the DCU from the mainframe and set it upside-down on the top of the instrument directly behind the area from where the DCU was removed. Connect the ribbon cables and the power connector using the original cables. Remove the A1A3 Assembly from the DCU motherboard.
2. On A1A3 remove the jumper from J4 (NORM) and install it on J3 (SA).
3. Connect the Signature Analyzer pod leads to the A1A3 assembly as follows:

POD LEAD	A1A3
START/ST/SP	TP2 (ADD 15)
STOP/QUAL	TP2 (ADD 15)
CLOCK	TP1 (CLK)
Gnd	TP3 (GND)

4. If you are troubleshooting A1A3, then install it on an extender board. Otherwise, plug it back into the motherboard. Turn on the HP 8660D.

5. Set the Signature Analyzer's polarities as follows:

   Clock –

   Start +

   Stop +

6. Check that the GATE light on the Signature Analyzer is blinking. If it is not blinking, check the connections and settings specified in steps 3 and 5, above. If these are correct, and the gate light is still not blinking, there is most likely a problem with the signature analyzer or the A1A3 Microprocessor Assembly. Proceed to Signature Analysis Set-Up Problems found in Service Sheet 19 TROUBLESHOOTING.

7. Check the Vcc (+5V) signature by touching the Signature Analyzer probe to the Vcc pin of one of the ICs on the board being tested. The signature must be 0003. DO NOT continue if the Vcc signature is incorrect. Instead, check the connections and settings specified in steps 3 and 5, above. If these are correct, there is most likely a problem with the signature analyzer or the A1A3 assembly. Proceed to the troubleshooting procedure for Signature Analysis Set-Up Problems found in Service Sheet 19 TROUBLESHOOTING.

NOTE

For general troubleshooting of the A1A3 assembly refer to SS19, TROUBLESHOOTING.

8. If no problems were encountered, the set-up is complete.

REGULAR Signature Analysis Set-Up Procedure

1. Remove the DCU from the mainframe and set it upside-down on the top of the instrument directly behind the area from where the DCU was removed. Connect the ribbon cables and the power connector using the original cables. Remove the A1A3 Assembly from the DCU motherboard.

2. On A1A3 check that a jumper is installed on J4 (NORM) and NOT on J3 (SA); change if necessary. Using the Signature Analyzer probe, momentarily short A1A3J5 pins 1 and 2. The display should flash the message "SA".

3. Connect the Signature Analyzer pod leads to the A1A3 assembly as follows:

POD LEAD	A1A3
START/ST/SP	TP4 (SA TRIG)*
STOP/QUAL	TP4 (SA TRIG)*
CLOCK	TP1 (CLK)
Gnd	TP3 (GND)

* If TP4 is not on the A1A3 board the pod leads can be connected directly to U6 Pin 12.

4. Plug the A1A3 assembly into the DCU. If you are troubleshooting A1A3, then install it on an extender board. Otherwise, plug it back into the motherboard. Turn on the HP 8660D.
5. Set the Signature Analyzer's polarities as follows:

   Clock –

   Start +

   Stop –

1. Check that the GATE light on the Signature Analyzer is blinking. If it is not blinking, check the connections and settings specified in steps 3 and 5, above. If these are correct, and the gate light is still not blinking, there is most likely a problem with the signature analyzer or the A1A3 Microprocessor Assembly. Proceed to Signature Analysis Set-Up Problems found in Service Sheet 19 TROUBLESHOOTING.
2. Check the Vcc (+5V) signature by touching the Signature Analyzer probe to the Vcc pin of one of the ICs on the board being tested. The signature must be P389. DO NOT continue if the Vcc signature is incorrect. Instead, check the connections and settings specified in steps 3 and 5, above. If these are correct, there is most likely a problem with the signature analyzer or the A1A3 assembly. Proceed to the troubleshooting procedure for Signature Analysis Set-Up Problems found in Service Sheet 19 TROUBLESHOOTING.

NOTE

For general troubleshooting of the A1A3 assembly refer to SS19, TROUBLESHOOTING.

3. If no problems were encountered, the set-up is complete.

Other Information

1. Data Bus and Clock Signatures. The microprocessor data bus goes to all assemblies in the DCU. The signatures obtained on the data bus sometimes depend on assemblies other than the one being tested. Thus, signatures are sometimes not given for IC pins which connect directly to the data bus. The notation, '- - DX', where X is a digit from 0 to 7, is used for these pins. Check that the data on these lines is toggling. The microprocessor clock also appears on many DCU assemblies. This is the same clock the Signature Analyzer uses to clock data into itself so the signature obtained for this clock is not meaningful. IC pins which connect to this clock are marked, '- - - - CLK'. Check that the clock signal is toggling at a 2.0 MHz rate.
2. If an IC pin is marked '- - - -', no valid signature exists for that pin. Ignore pins marked this way when troubleshooting.
3. If an IC is not listed in the table of signatures, no valid signatures exist for that IC.

A1A5 INTERFACE LATCH ASSY

OUTPUT LATCHES
7 X 8

7

14

SWITHCH AND HP-IB
ADDRESS BUFFER

SELECT REMOTE INTERFACE

HP-IB INTERFACE
GPIA

REMOTE CONTROL

HP-IB

BCD

REMOTE DATA

BCD INTERFACE
PIA

SWEEP CLOCK
DIVIDERS

DATA BUS

ADDRESS BUS

CONTROL BUS

A1A3 MICROPROCESSOR ASSY

16K X 8 EPROM

2K X 8 RAM

LATCH DECODER

MICROPROCESSOR

KEYBOARD/DISPLAY
INTERFACE

RPG DECODER

INSTRUMENT
INTERFACE (PIA)

19,20

8

25

2

2

2

A1A2 KEYBOARD ASSY

10

14

21

A1A1 DISPLAY ASSY

22

A1A4 SWEEP COUNTER ASSY

3

2

25

A1W1

FRONT PANEL

SWEEP RAMP OUTPUT(0-8V)

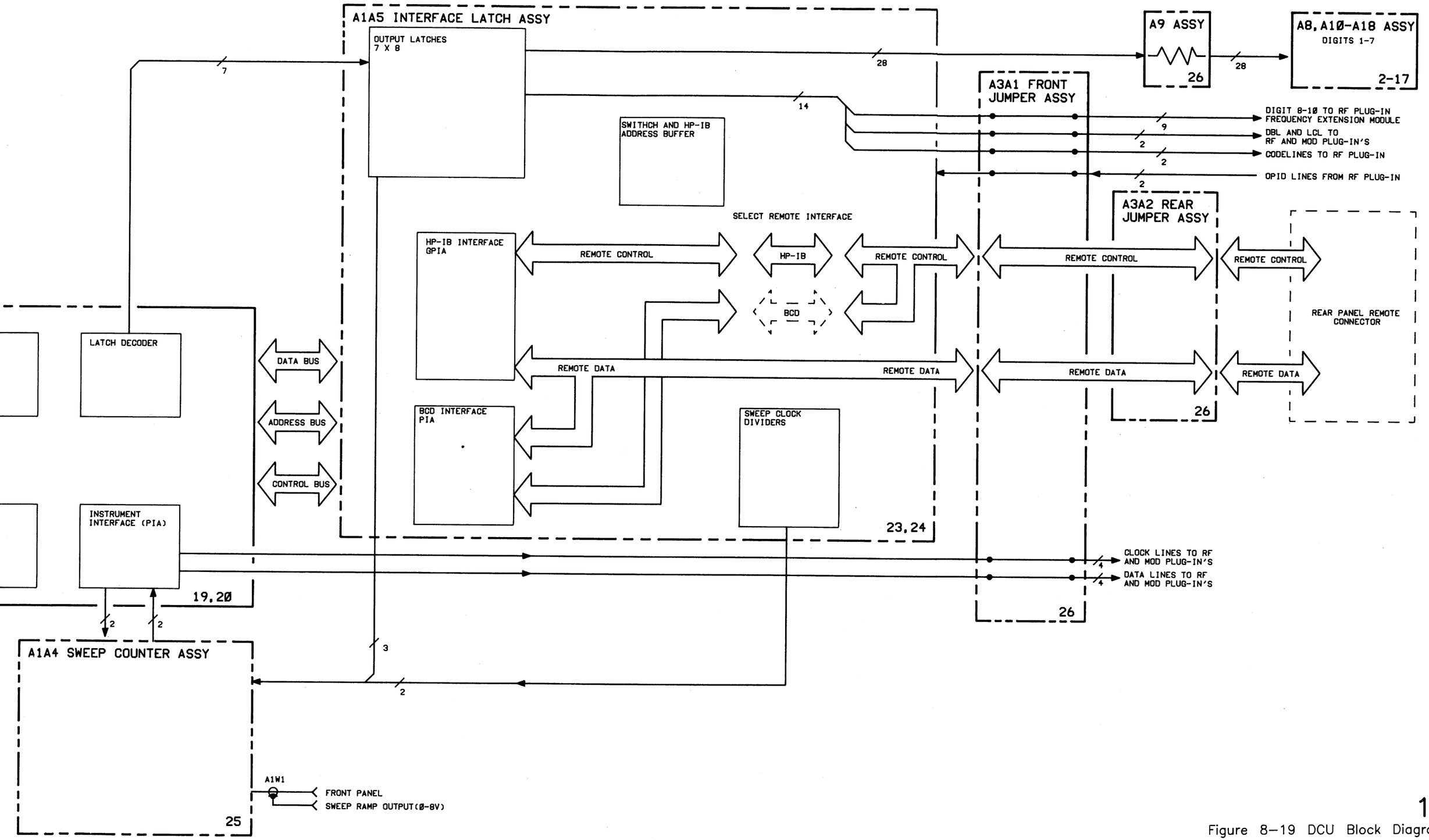


Figure 8-19 DCU Block Diagram
8-123/8-124

Service Sheet 19

ASSEMBLY

- **P/O A1A3 Microprocessor Assembly**

PRINCIPLES OF OPERATION

The Microprocessor Board A1A3 (SS19 and SS20) contains: all of the RAM and ROM memory, the Keyboard and Instrument Interface, the address decoding and the Microprocessor.

U1A is an oscillator with a TTL level output. Y1 is an 8 MHz crystal. Together they provide an 8 MHz TTL clock to the Microprocessor and memory holdoff circuit.

U2 is an 8 bit 68B02 microprocessor which is fully interrupt driven in this application.

U3 is an 8 bit buffer which is always enabled. U3A buffers the address lines ADD 0, ADD 1, and ADD 2. U3B buffers the control lines VMA, CLOCK, R/W, and RESET L.

U4 is a 16k × 8 EPROM which contains all of the ROM memory. The EPROM is addressed at memory locations OCOOOH - OFFFFH.

U5 is a 2k × 8 static RAM which contains all of the RAM memory. The RAM is addressed at memory locations 0000H - 07FFH.

U6 is a 3 to 8 line decoder which decodes the top 4 address lines (ADD 12 through ADD 15). ADD 15 and VMA are used as qualifiers. ADD 15, however, is used in its nonassertive state. U6 decodes addresses 0XXXH - 7XXXH (X = don't care).

U7 is another 3 to 8 line decoder used to select the output latches on the Interface/Latch Board (SS6). The address lines ADD 0, ADD 1, and ADD 2 are decoded while the E clock, R/W, and CE LATCH are used as qualifiers. U7 decodes addresses 7000H - 7007H.

U8 is a Perpheral Interface Adapter (PIA) that functions as the Instrument Interface. The PIA receives the sweep clock and control signals on pins 39, 40, and 19. When one of these inputs receives an active transition, the PIA activates the IRQ line of the MPU and sets a flag in an internal control register. This flag can be read by the MPU to determine which sweep condition generated the interrupt. The PIA generates the following lines: CUP H, CDN-L (which go to the Sweep Count board, A1A4), the plug-in clocks which are ATTEN-H, FMCAL, AM/FM %, and AM/FM FCTN. The PIA also generates the PLUG-IN data lines PI-1, PI-2, PI-3, and PI-4. The PIA address is at memory location 1000H-1003H.

U9 is an Open Collector Hex Inverter.

U10B is a two input NAND Gate which enables the CE input of the 16k X 8 EPROM (U4).

Service Sheet 20

ASSEMBLY

- **P/O A1A3 Microprocessor Assembly**

PRINCIPLES OF OPERATION

This part of the Microprocessor Board contains the Rotary Pulse Generator (RPG) Decoder, the Memory Holdoff, and Programmable Keyboard/Display Interface.

The RPG Decoder consists of flip-flop U12A and U12B, and AND gates U11C and U11D. When the RPG is rotated in the clockwise (CW) direction, the positive transition of the signal CCW leads the transition of the CW signal. CCW is ANDed with $\overline{Q}$ of U12A by the AND gate U11C and the result is applied to the D input of U12A. When CW makes a positive transition, it will clock the output of U11C through to U12A's Q output. If Q has been set on the previous transition of CW it will be cleared since $\overline{Q}$ will be low, driving the output of U11C low. Thus one pulse is produced on the Q output of U12A for every two CW pulses. When the RPG is rotated in the CCW direction, the positive transition of CW leads CCW. The Q output of U12A remains low since CCW will always be low during the CW transition. U12B and U11D operate the same as U12A and U11C. CW is ANDed with U12B's $\overline{Q}$ output, and the output of U11D is clocked through to U12B's Q output on the positive edge of CCW. This produces one pulse on the Q output of U12B for every two CCW pulses. When the RPG is rotated in the CW direction U12B's output remains low.

U13A and U13B are used to extend the respective CW and CCW pulses that are generated by U12A and U12B. This guarantees a longer pulse width and limits the frequency of the pulses generated.

When in the Manual Sweep Mode the signal QCTZ-H goes high, indicating that the lower sweep frequency limit has been reached. When the signal QCTM-H goes high it indicates that the upper sweep limit has been reached. The output of U10D will be high when QCTZ-H is true and QCTM-H is false. This result is then ANDed with QCTZ-H by AND gate U11A. When QCTZ-H is true and QCTM-H is false the output of U11A goes low, deselecting U13B and disabling the Sweep Down flip-flop (U13B). The SWEEP D input signal enables both U12A and U12B when the instrument is in any of the manual tuning modes.

The Power Up Reset consists of Q1, U14A, and U9A. Whenever the +5V supply is below 4.2 volts, Q1 is biased off and the collector of Q1 is pulled up by R13 to the supply voltage. When the +5V supply rises above 4.2 V, CR2 begins to conduct through the emitter of Q1 and R11, biasing Q1 on. The collector of Q1 is driven down to 0.2 volts as the transistor nears saturation. Thus a TTL low is applied to the low true trigger input of the one shot U14A, causing a reset pulse of approximately 150 μs to occur at the Q and $\overline{Q}$ outputs of U14A. During the reset pulse the $\overline{Q}$ output of U14A ensures that the memory holdoff flip-flop (U15A) powers up in the high (false) state. The Q output of U14A resets the Keyboard/Display Interface IC (U16) and is inverted by U9A to drive the reset for the other devices and the rest of the instrument.

The Memory Holdoff consists of U14B and U15A. This circuit provides a 300 ns pulse on the MR line of the MPU whenever the Programmable Keyboard/Display Interface IC (U16) is addressed. This allows for a 350 ns access time when U16 is being accessed.

U16 is a Programmable Keyboard/Display Interface IC which, in conjunction with U17 and U18, forms the Keyboard/Display Interface. U16 interfaces directly to the microprocessor. U16 output lines SL0-SL3 drive the 4-to-16 line decoder U17 and the 3-to-8 line decoder U18. U17 scans the 13 display addresses SCAN 0-SCAN 12. U18 scans the 4 × 8 keyboard matrix ROW 0-ROW 3. RL0-RL7 are the key return lines. U16 drives the IRQ line of the MPU whenever a keystroke is detected. The outputs A0-B3 provide the drive for the Quad PNP transistor drivers which select the displays and LEDs on the Display Board (A1A1), and the Keyboard (A1A2).

TROUBLESHOOTING FOR SERVICE SHEETS 19 AND 20

Troubleshooting of this assembly is done using Signature Analysis.

Procedures to troubleshoot Signature analysis set-up problems are provided below to check operation necessary for taking signatures. Unless you were directed here by the signature analysis set up procedures on Service Sheet 18, proceed to the Free Run Signature Analysis procedure. If no problems are found, perform the Regular Signature Analysis procedure.

Signature Analysis Set-Up Problems

If one of the following problems was encountered during the Signature Analysis set-up procedures, use this procedure to find the source of the problem.

- Signature Analyzer gate light does not blink (in Free Run mode),
- Vcc (+5V) signature is bad (in Free Run mode),
- Signature Analyzer gate light does not blink (in Regular mode),
- Vcc (+5V) signature is bad (in Regular mode)

1. If the problem was encountered in Free Run mode, jump to step 2.

   If the problem was encountered in Regular mode, perform the Free Run set up on Service Sheet 18, then, if a problem with the gate light or +5V signature still exists, proceed with step 2. If Free Run mode is as it should be, check A1A3U6 pin 12 (this pin drives the start and stop inputs to the signature analyzer).

2. Check the following inputs to the microprocessor with an oscilloscope. If any of these input signals are not as they should be, it will keep the microprocessor from running. Troubleshoot to find the cause of the bad input signal.

Check A1A3	Should Be
U2 pin 39	8 MHz clock (TTL)
U2 pin 2	High (TTL)
U2 pin 40	High (TTL)
U2 pin 3	High (TTL)

3. Check the following outputs of the microprocessor with an oscilloscope.

Check A1A3	Should Be
U2 pin 25	Square wave, period = 65.5 milliseconds, TTL Levels
U2 pin 37	Square wave, period = 0.5 microseconds, TTL Levels

4. If any of these signals are not as they should be, remove the A1A3U2 microprocessor from its socket and carefully bend U2 pins 25 and 37 out and then insert it back into the socket. If the pins listed above now produce a good signal, the problem is that another part is loading these pins.

   If these signals are good, the Signature Analyzer may be defective.

Free Run Signature Analysis of the A1A3 Microprocessor Assembly

1. Perform the FREE RUN Signature Analysis Set-Up Procedure included with Service Sheet 18.
2. Compare the signatures with the correct signatures in the tables below.

U2 Pin#	Function	Signature	U2 Pin#	Function	Signature
1	GND	0000	21	GND	0000
2	IN	0003	22	OUT	4FCA
3	IN	0003	23	OUT	4868
4	IN	0003	24	OUT	9UP1
5	OUT	0003	25	OUT	0002
6	IN	0003	26	IN	- -D7
7	OUT	- - - -	27	IN	- -D6
8	Vcc	0003	28	IN	- -D5
9	OUT	UUUU	29	IN	- -D4
10	OUT	FFFF	30	IN	- -D3
11	OUT	8484	31	IN	- -D2
12	OUT	P763	32	IN	- -D1
13	OUT	1U5P	33	IN	- -D0
14	OUT	0356	34	OUT	0003
15	OUT	U759	35	Vcc	0003
16	OUT	6F9A	36	IN	0000
17	OUT	7791	37	IN	- - - -CLK
18	OUT	6321	38	IN	0000
19	OUT	37C5	39	IN	- - - -
20	OUT	6U28	40	IN	0003

U3 Pin#	Function	Signature	U3 Pin#	Function	Signature
1	GND	0000	11	IN	0003
2	IN	- - - -	12	OUT	8484
3	OUT	0003	13	IN	- - - -
4	IN	UUUU	14	OUT	FFFF
5	OUT	0003	15	IN	0003
6	IN	FFFF	16	OUT	UUUU
7	OUT	- - - -	17	IN	0003
8	IN	8484	18	OUT	- - - -
9	OUT	0003	19	GND	0000
10	GND	0000	20	Vcc	0003

U4 Pin#	Function	Signature	U4 Pin#	Function	Signature
1	IN	0003	15	IN	- -D3
2	IN	4FCA	16	IN	- -D4
3	IN	6F9A	17	IN	- -D5
4	IN	U759	18	IN	- -D6
5	IN	0356	19	IN	- -D7
6	IN	1U5P	20	IN	PACH
7	IN	P763	21	IN	37C5
8	IN	8484	22	IN	0000
9	IN	FFFF	23	IN	6U28
10	IN	UUUU	24	IN	6321
11	IN	- -D0	25	IN	7791
12	IN	- -D1	26	IN	4868
13	IN	- -D2	27	IN	0003
14	GND	0000	28	IN	0003

U5 Pin#	Function	Signature	U5 Pin#	Function	Signature
1	IN	6F9A	13	IN	- -D3
2	IN	U759	14	IN	- -D4
3	IN	0356	15	IN	- -D5
4	IN	1U5P	16	IN	- -D6
5	IN	P763	17	IN	- -D7
6	IN	8484	18	IN	4P08
7	IN	FFFF	19	IN	37C5
8	IN	UUUU	20	IN	4P08
9	IN	- -D0	21	IN	0003
10	IN	- -D1	22	IN	6321
11	IN	- -D2	23	IN	7791
12	GND	0000	24	Vcc	0003

U6 Pin#	Function	Signature	U6 Pin#	Function	Signature
1	IN	4FCA	9	OUT	U3H7
2	IN	4868	10	OUT	0994
3	IN	9UP1	11	IN	6H4C
4	IN	0002	12	IN	F2A4
5	IN	0002	13	IN	PC03
6	IN	0003	14	IN	12U1
7	OUT	P257	15	IN	4P08
8	GND	0000	16	Vcc	0003

U7 Pin#	Function	Signature	U7 Pin#	Function	Signature
1	IN	UUUU	9	OUT	0003
2	IN	FFFF	10	OUT	0003
3	IN	8484	11	OUT	0003
4	IN	0003	12	OUT	0003
5	IN	P257	13	OUT	0003
6	IN	0000	14	OUT	0003
7	OUT	0003	15	OUT	0003
8	GND	0000	16	Vcc	0003

U8 Pin#	Function	Signature	U8 Pin#	Function	Signature
1	GND	0000	21	IN	0003
2	IN	- - - -	22	IN	0003
3	IN	- - - -	23	IN	12U1
4	IN	- - - -	24	IN	0003
5	IN	- - - -	25	IN	- - - -CLK
6	IN	- - - -	26	IN	- -D7
7	IN	- - - -	27	IN	- -D6
8	IN	- - - -	28	IN	- -D5
9	IN	- - - -	29	IN	- -D4
10	IN	- - - -	30	IN	- -D3
11	IN	- - - -	31	IN	- -D2
12	IN	- - - -	32	IN	- -D1
13	IN	- - - -	33	IN	- -D0
14	IN	- - - -	34	IN	0003
15	IN	- - - -	35	IN	FFFF
16	IN	- - - -	36	IN	UUUU
17	IN	- - - -	37	OUT	- - - -
18	IN	- - - -	38	OUT	- - - -
19	IN	- - - -	39	IN	- - - -
20	Vcc	0003	40	IN	- - - -

U10 Pin#	Function	Signature	U10 Pin#	Function	Signature
1	IN	0003	8	OUT	0000
2	IN	0003	9	IN	0003
3	OUT	0000	10	IN	0003
4	IN	9UP1	11	OUT	- - - -
5	IN	0002	12	IN	- - - -
6	OUT	PACH	13	IN	- - - -
7	GND	0000	14	Vcc	0003

U14 Pin#	Function	Signature	U14 Pin#	Function	Signature
1	IN	0000	9	IN	PC03
2	IN	0003	10	IN	0003
3	IN	0003	11	IN	0003
4	OUT	0003	12	OUT	- - - -
5	OUT	- - - -	13	OUT	0000
6	IN	0000	14	IN	0000
7	IN	- - - -	15	IN	- - - -
8	GND	0000	16	Vcc	0003

U16 Pin#	Function	Signature	U16 Pin#	Function	Signature
1	IN	0003	21	IN	UUUU
2	IN	0003	22	IN	PC03
3	IN	- - - -	23	OUT	- - - -
4	OUT	0000	24	OUT	- - - -
5	IN	0003	25	OUT	- - - -
6	IN	0003	26	OUT	- - - -
7	IN	0003	27	OUT	- - - -
8	IN	0003	28	OUT	- - - -
9	IN	0000	29	OUT	- - - -
10	IN	0000	30	OUT	- - - -
11	IN	0003	31	OUT	- - - -
12	IN	- -D0	32	OUT	- - - -
13	IN	- -D1	33	OUT	- - - -
14	IN	- -D2	34	OUT	- - - -
15	IN	- -D3	35	OUT	- - - -
16	IN	- -D4	36	IN	0003
17	IN	- -D5	37	IN	0003
18	IN	- -D6	38	IN	0003
19	IN	- -D7	39	IN	0003
20	GND	0000	40	Vcc	0003

Regular Signature Analysis of the A1A3 Microprocessor Assembly

3. Perform the REGULAR Signature Analysis Set-Up Procedure included with Service Sheet 18.
4. Compare the signatures taken with the Signature Analyzer with the correct signatures in the tables below.

U2 Pin#	Function	Signature	U2 Pin#	Function	Signature
1	GND	0000	21	GND	0000
2	IN	P389	22	OUT	- - - -
3	IN	- - - -	23	OUT	- - - -
4	IN	- - - -	24	OUT	- - - -
5	OUT	AU0P	25	OUT	- - - -
6	IN	- - - -	26	IN	3497
7	OUT	0000	27	IN	5900
8	Vcc	P389	28	IN	3HF6
9	OUT	- - - -	29	IN	P00U
10	OUT	- - - -	30	IN	54A1
11	OUT	- - - -	31	IN	6688
12	OUT	- - - -	32	IN	U57A
13	OUT	- - - -	33	IN	H8A4
14	OUT	- - - -	34	IN	2A1A
15	OUT	- - - -	35	Vcc	P389
16	OUT	- - - -	36	IN	0000
17	OUT	- - - -	37	OUT	- - - -CLK
18	OUT	- - - -	38	IN	0000
19	OUT	- - - -	39	IN	- - - -
20	OUT	- - - -	40	IN	P389

U3 Pin#	Function	Signature	U3 Pin#	Function	Signature
1	IN	0000	11	IN	AU0P
2	IN	- - - -	12	OUT	- - - -
3	OUT	P389	13	IN	- - - -
4	IN	- - - -	14	OUT	- - - -
5	OUT	2A1A	15	IN	2A1A
6	IN	- - - -	16	OUT	- - - -
7	OUT	- - - -	17	IN	P389
8	IN	- - - -	18	OUT	- - - -
9	OUT	AU0P	19	IN	0000
10	GND	0000	20	Vcc	P389

U4 Pin#	Function	Signature	U4 Pin#	Function	Signature
1	IN	P389	15	IN	54A1
2	IN	- - - -	16	IN	P00U
3	IN	- - - -	17	IN	3HF6
4	IN	- - - -	18	IN	5900
5	IN	- - - -	19	IN	3497
6	IN	- - - -	20	IN	- - - -
7	IN	- - - -	21	IN	- - - -
8	IN	- - - -	22	IN	8514
9	IN	- - - -	23	IN	- - - -
10	IN	- - - -	24	IN	- - - -
11	IN	H8A4	25	IN	- - - -
12	IN	U57A	26	IN	- - - -
13	IN	6688	27	IN	P389
14	GND	0000	28	Vcc	P389

U5 Pin#	Function	Signature	U5 Pin#	Function	Signature
1	IN	- - - -	13	IN	54A1
2	IN	- - - -	14	IN	P00U
3	IN	- - - -	15	IN	3HF6
4	IN	- - - -	16	IN	5900
5	IN	- - - -	17	IN	3497
6	IN	- - - -	18	IN	3CC0
7	IN	- - - -	19	IN	- - - -
8	IN	- - - -	20	IN	3CC0
9	IN	H8A4	21	IN	2A1A
10	IN	U57A	22	IN	- - - -
11	IN	6688	23	IN	- - - -
12	GND	0000	24	Vcc	P389

U6 Pin#	Function	Signature	U6 Pin#	Function	Signature
1	IN	- - - -	9	OUT	- - - -
2	IN	- - - -	10	OUT	135F
3	IN	- - - -	11	OUT	45CF
4	IN	- - - -	12	OUT	- - - -
5	IN	- - - -	13	OUT	016H
6	IN	AU0P	14	OUT	0A7F
7	IN	6UC8	15	OUT	3CC0
8	GND	0000	16	Vcc	P389

U7 Pin#	Function	Signature	U7 Pin#	Function	Signature
1	IN	- - - -	9	OUT	74FC
2	IN	- - - -	10	OUT	- - - -
3	IN	- - - -	11	OUT	362C
4	IN	2A1A	12	OUT	7UH5
5	IN	6UC8	13	OUT	3H04
6	IN	- - - -	14	OUT	CP41
7	OUT	7UCP	15	OUT	0FPF
8	GND	0000	16	Vcc	P389

U8 Pin#	Function	Signature	U8 Pin#	Function	Signature
1	GND	0000	21	IN	2A1A
2	OUT	U91A	22	IN	P389
3	OUT	57A9	23	IN	0A7F
4	OUT	1U92	24	IN	AU0P
5	OUT	7389	25	IN	- - - -CLK
6	OUT	- - - -	26	IN	3497
7	OUT	- - - -	27	IN	5900
8	OUT	- - - -	28	IN	3HF6
9	OUT	- - - -	29	IN	P00U
10	OUT	2597	30	IN	54A1
11	OUT	690U	31	IN	6688
12	OUT	- - - -	32	IN	U57A
13	OUT	- - - -	33	IN	H8A4
14	OUT	087H	34	IN	P389
15	OUT	H147	35	IN	- - - -
16	OUT	1A4H	36	IN	- - - -
17	OUT	U803	37	OUT	- - - -
18	IN	- - - -	38	OUT	- - - -
19	IN	- - - -	39	IN	05PU
20	Vcc	P389	40	IN	- - - -

U9 Pin#	Function	Signature	U9 Pin#	Function	Signature
1	IN	- - - -	8	OUT	- - - -
2	OUT	- - - -	9	IN	- - - -
3	IN	- - - -	10	OUT	8A86
4	OUT	- - - -	11	IN	690U
5	IN	- - - -	12	OUT	- - - -
6	OUT	- - - -	13	IN	- - - -
7	GND	0000	14	Vcc	P389

U10 Pin#	Function	Signature	U10 Pin#	Function	Signature
1	IN	2A1A	8	OUT	8514
2	IN	2A1A	9	IN	AU0P
3	IN	F993	10	IN	2A1A
4	IN	- - - -	11	OUT	H226
5	IN	- - - -	12	IN	05PU
6	OUT	- - - -	13	IN	- - - -
7	GND	0000	14	Vcc	P389

U11 Pin#	Function	Signature	U11 Pin#	Function	Signature
1	IN	H226	8	OUT	- - - -
2	IN	- - - -	9	IN	- - - -
3	OUT	- - - -	10	IN	- - - -
4	IN	- - - -	11	OUT	- - - -
5	IN	- - - -	12	IN	- - - -
6	OUT	- - - -	13	IN	- - - -
7	GND	0000	14	Vcc	P389

U16 Pin#	Function	Signature	U16 Pin#	Function	Signature
1	IN	P389	21	IN	- - - -
2	IN	P389	22	IN	016H
3	IN	- - - -	23	OUT	- - - -
4	OUT	- - - -	24	OUT	- - - -
5	IN	P389	25	IN	- - - -
6	IN	P389	26	IN	- - - -
7	IN	P389	27	IN	- - - -
8	IN	P389	28	IN	- - - -
9	IN	0000	29	IN	- - - -
10	IN	F993	30	IN	- - - -
11	IN	2A1A	31	IN	- - - -
12	IN	H8A4	32	IN	- - - -
13	IN	U57A	33	IN	- - - -
14	IN	6688	34	IN	- - - -
15	IN	54A1	35	IN	- - - -
16	IN	P00U	36	IN	P389
17	IN	3HF6	37	IN	P389
18	IN	5900	38	IN	P389
19	IN	3497	39	IN	P389
20	GND	0000	40	Vcc	P389

NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

A1A3

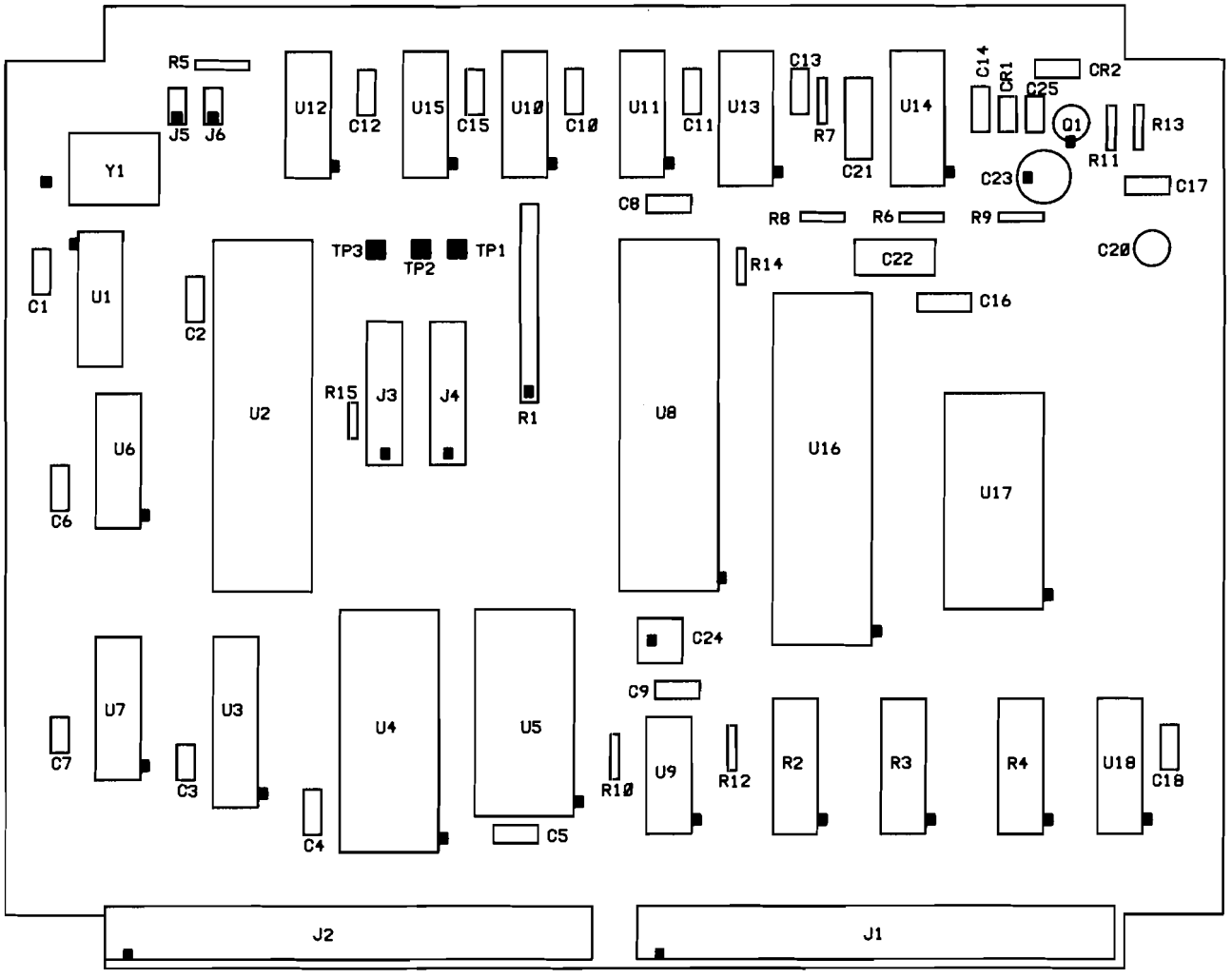


Figure 8-20. Service Sheet 19 Information.

P/O A1A6 MOTHERBD

P/O A1A3 MICROPROCESSOR BOARD ASSEMBLY (08660-60400)

QCTM-H 25 CD → J3(13)

FM-H 26 CB → J4(31)

IRQ 23 CC → J4(48)

J1(13) J2(31) J2(48)

QCTM-H BI 20

FM-H

IRQ 20 BA

IRQ

MR 20 BB

RESET_L 20 BD

8_MHz 8_MHz BC 20

+5 R5 2.15K

J5(1) J5(2)

+5 R1A 1K

+5 C3 0.01U

+5 C2 0.01U

+5 C4 0.01U

MICROPROCESSOR

U2 uPROC MC6802

RESET_L

RESET HALT NMI IRQ RE EXTAL XTAL MR STBY

Φ

ADDRESS BUS

A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15

BA VMA E R/W

NC

1, 21

DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7

D0 D1 D2 D3 D4 D5 D6 D7

CLOCK GENERATOR

U1A 5V (OSC)

RNG FC CX CX

IG

ØV (OSC)

Y1 C1 8.0000MHZ 10P

U3A EN

U3B EN

ADD_0 20 BE

ADD_0 ADD_1 ADD_2 ADD_3 ADD_4 ADD_5 ADD_6 ADD_7 ADD_8 ADD_9 ADD_10 ADD_11 ADD_12 ADD_13 ADD_14 ADD_15

TP2 ADD_15

U10B U10C

VMA CLOCK R/W RESET_L

TP1 CLK

FREE RUN TEST

JUMPER

R1C 1K +5

DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7

J3(1) J3(2) J3(3) J3(4) J3(5) J3(6) J3(7) J3(8)

J3(16) J3(15) J3(14) J3(13) J3(12) J3(11) J3(10) J3(9)

NORMAL OPERATION

A1A3W1 JUMPER

J4(1) J4(2) J4(3) J4(4) J4(5) J4(6) J4(7) J4(8)

J4(16) J4(15) J4(14) J4(13) J4(12) J4(11) J4(10) J4(9)

DATA_0 DATA_1 DATA_2 DATA_3 DATA_4 DATA_5 DATA_6 DATA_7

ADDRESS DECODE

+5 C5 0.01U

U6 DMUX

ADD_12 ADD_13 ADD_14 VMA ADD_15

CE_PIA CE_ADD CE_HPIB CE_BCD NC CE_LATCH

TP4 SA TRIG

CE_KYBD BL 20

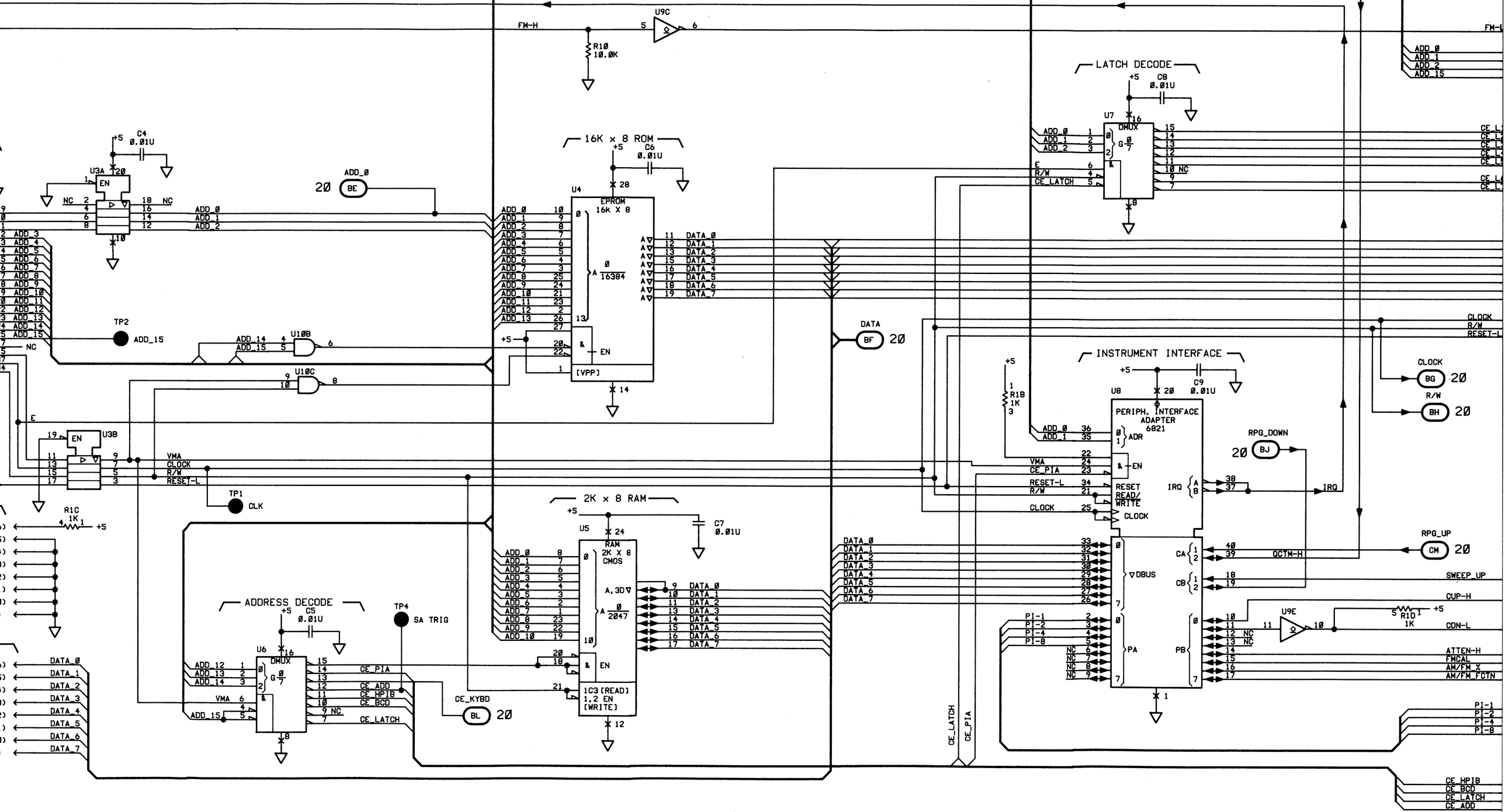
TP3 GND

20 KA +5 C20 10U

J4(2) J4(1) NC J4(6) J4(14) J4(19) J4(20) J4(29) J4(35) J4(45) J4(46) J4(49) NC J4(50)

J2(2) J2(1) NC J2(6) J2(14) J2(19) J2(20) J2(29) J2(35) J2(45) J2(46) J2(49) NC J2(50)

SERIAL PREFIX: 2718A



P/O A1A6 MOTHERBD

U9C

R10 10.0K

16K x 8 ROM

U4 EPROM 16k X 8

2K x 8 RAM

U5 RAM 2K X 8 CMOS

LATCH DECODE

U7 DMUX

INSTRUMENT INTERFACE

U8 PERIPH. INTERFACE ADAPTER 6821

U9E

R1B 1K

R1D 1K

C6 0.01U

C7 0.01U

C8 0.01U

C9 0.01U

DATA_0 DATA_1 DATA_2 DATA_3 DATA_4 DATA_5 DATA_6 DATA_7

ADD_0 ADD_1 ADD_2 ADD_15

CE_L1 CE_L2 CE_L3 CE_L4 CE_L5 CE_L6 CE_L7

E R/W CE_LATCH CE_PIA VMA RESET-L CLOCK

PI-1 PI-2 PI-4 PI-8

RPG_DOWN RPG_UP IRQ QCTM-H

SWEEP_UP CUP-H CDN-L

ATTEN-H FMCAL AM/FM_% AM/FM_FCTN

FM-L

DATA 20 BF

CLOCK 20 BG

R/W 20 BH

RPG_DOWN 20 BJ

RPG_UP 20 CM

FM-L AC 22

ADD AS 23

ADD_15 AT 23

CE AR 24

DATA0-7 AQ 23

CLOCK AU 23

R/W AX 23

RESET-L AW 23,26

SWEEP_UP CE 24

CUP-H CF 25

CDN-L CG 25

GROUP 4 CH 26

PI1-8 AP 26

CE_HPIB AV 23

CE_BCD AY 23

CE_LATCH AZ 24

CE_ADD CA 23

NOTES:
1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

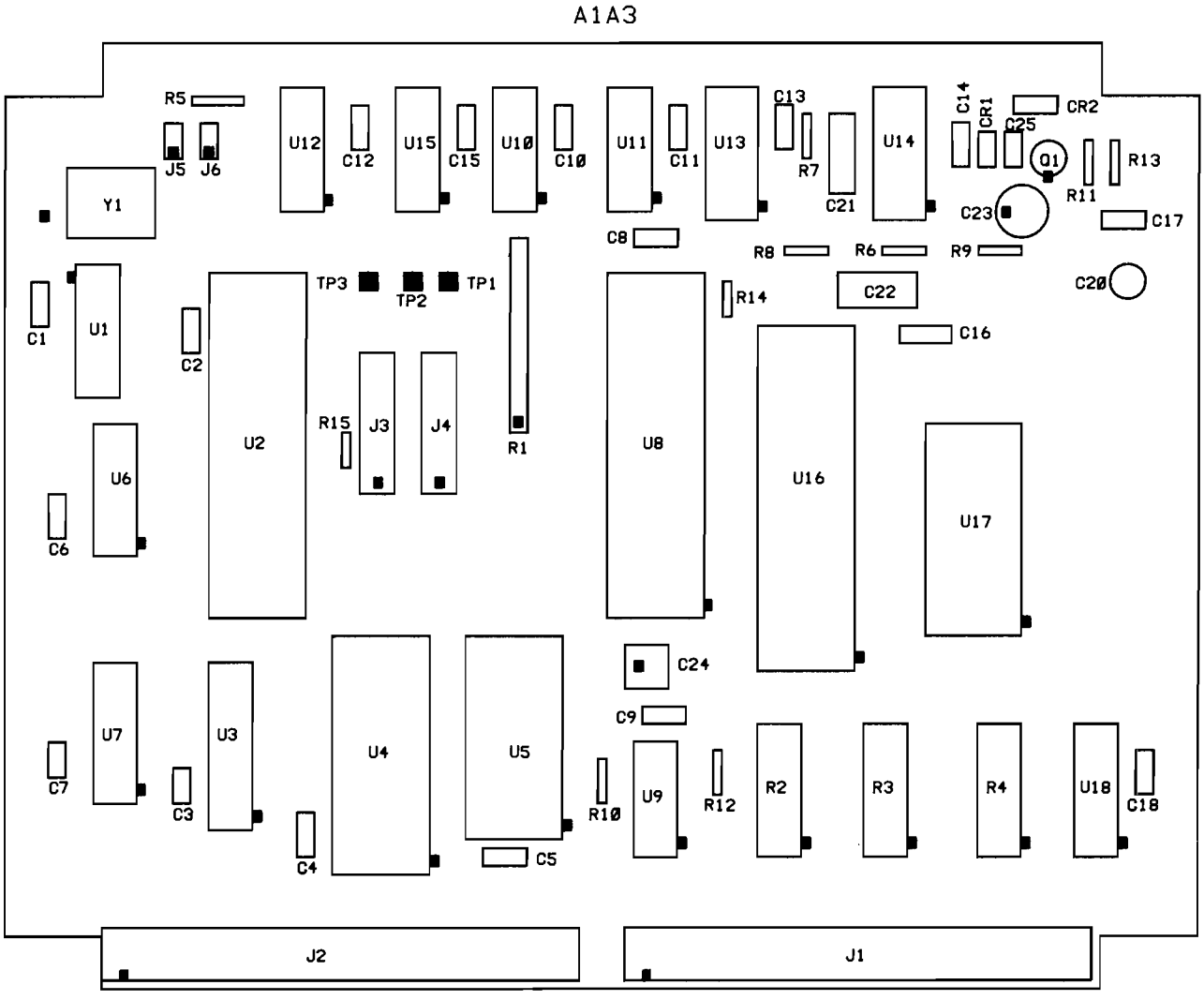


Figure 8-22. Service Sheet 20 Information.

P/O A1A6 MOTHERBD

SSEMBLY (08660-60400)

QCTZ-H 25 CI → J3(14) J1(14) QCTZ-H

QCTM-H 19 BI

SWEEP_D 24 CJ → J3(42) J1(42) SWEEP_D

RPG 22 AJ

CW → J3(44) J1(44) CW

CCW → J3(46) J1(46) CCW

RL0-RL7 22 AM

RL0 → J3(31) J1(31) RL0
RL1 → J3(33) J1(33) RL1
RL2 → J3(35) J1(35) RL2
RL3 → J3(37) J1(37) RL3
RL4 → J3(39) J1(39) RL4
RL5 → J3(41) J1(41) RL5
RL6 → J3(43) J1(43) RL6
RL7 → J3(45) J1(45) RL7

RNG-H 24 CK → J3(29) J1(29) RNG-H

CKA_B-H 25 ED

+5 → J3(2) J1(2) +5
+5 → J3(49) J1(49) +5
+5 → J3(50) J1(50) +5
NC → J3(1) J1(1) NC
NC → J3(27) J1(27) NC
NC → J3(32) J1(32) NC
NC → J3(47) J1(47) NC
NC → J3(48) J1(48) NC

U10D

U11A

C10 0.01U

RPG DECODER

U12A

U11C

U12B

U11D

C11 0.01U

R1F 1K

U13A

R7 10.0K

R1E 1K

C12 0.01U

C21 0.47U

RPG_UP CM 19

U13B

R8 10.0K

C22 0.47U

RPG_DOWN BJ 19

PROGRAMABLE KEYBOARD/ DISPLAY INTERFACE

U10A

C19 0.01U

C15 0.01U

R/W 19 BH

CE_KYBD 19 BL

DATA 19 BF

CLOCK 19 BG

U16

PROG. KEYBD/ DISPLAY INTERFACE 8279

CS
RESET
RD
WR
CLK
CNTL/STB
SHIFT
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
RL0
RL1
RL2
RL3
RL4
RL5
RL6
RL7
IRQ
BD
A0
SL0
SL1
SL2
SL3
OUT A0
OUT A1
OUT A2
OUT A3
OUT B0
OUT B1
OUT B2
OUT B3

DATA_0
DATA_1
DATA_2
DATA_3
DATA_4
DATA_5
DATA_6
DATA_7

U9B

R14 2.15K

IRQ BA 19

ADD_0 BE 19

POWER UP RESET

VR1

Q1

R13 3.16K

R11 2.87K

R9 10.0K

C23 33U

U14A

R1G 1K

C14 0.01U

U9D

R1I 1K

C24 10U

+5 KA 19

SERIAL PREFIX: 2718A

P/O A1A6 MOTHERBD

DISPLAY SCAN

KEY SCAN

POWER UP RESET

MEMORY HOLDOFF

RPG_UP

RPG_DOWN

RESET_L

8_MHz

SCAN

ROW

RANGE-L

A0-A3

B0-B3

MR

Figure 8-23 P/O Microprocessor Assembly

Service Sheet 21

ASSEMBLY

- **A1A2 Keyboard Assembly**

PRINCIPLES OF OPERATION

The key Matrix of S1-S25 is scanned in four rows (ROW_0-ROW_3). Whenever a key is depressed, one of the corresponding return lines (RLO-RL7) will be pulled low. These lines are sensed by the Keyboard Controller IC (U16) on the Microprocessor Board. A1A2DS1-DS11 are individual panel LED indicators. The LEDs are scanned in the same manner as the Displays and LED Indicators on the Display Board.

A1A2J3 connects to the front panel POWER switch. A1A2J2 connects to the front panel Rotary Pulse Generator (RPG).

NOTES:
1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

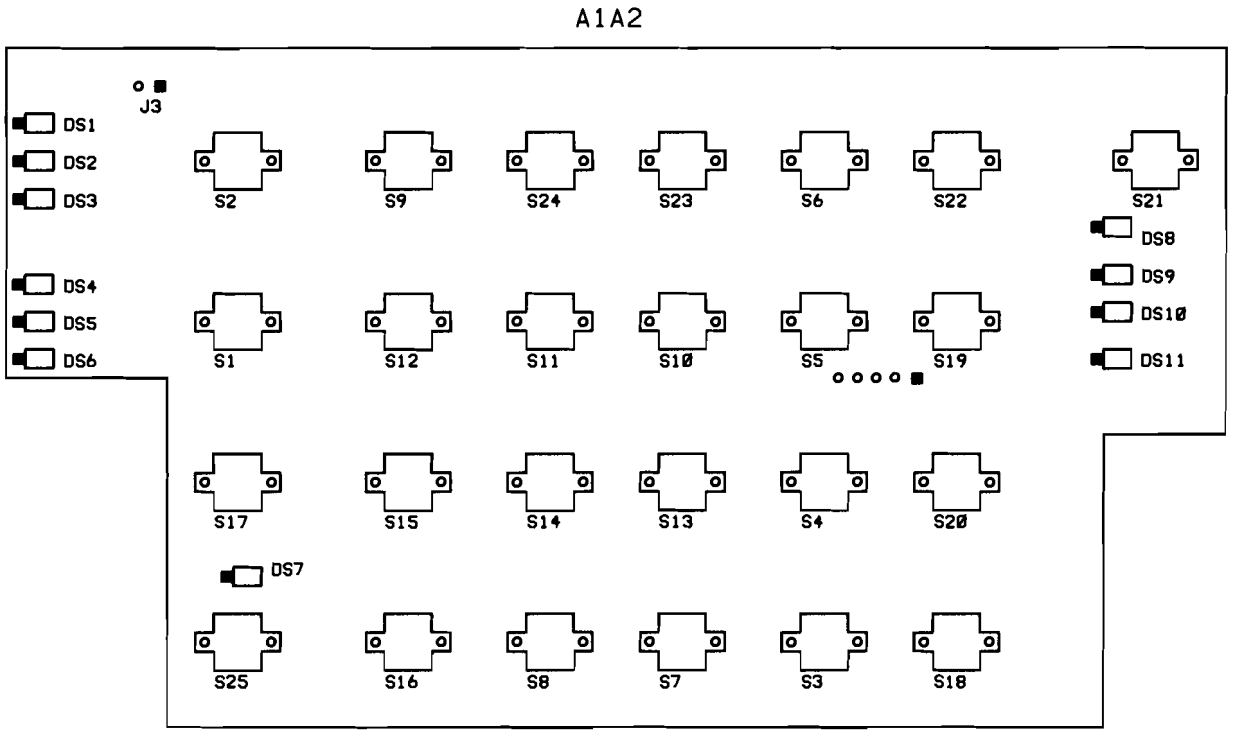


Figure 8-24. Service Sheet 21 Information.

A1A2 KEYBOARD ASSEMBLY (08660-60399)

ROW0-3 — 22 — A1

DISPLAY — 22 — A0

J1(14) ROW_3
J1(12) ROW_2
J1(10) ROW_1
J1(8) ROW_0

J1(2) DS_a
J1(4) DS_b
J1(6) DS_c
J1(7) DS_d
J1(9) DS_e
J1(11) DS_f
J1(13) DS_g
J1(15) DS_dp

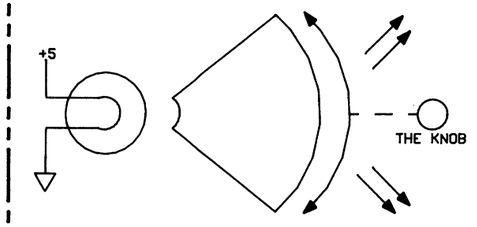
SLOW DS1
MED DS2
FAST DS3
AUTO DS4
SINGLE DS5
MANUAL DS6
SHIFT DS7
FINE DS8
MEDIUM DS9
COARSE DS10
STEP DS11

SC10-11 — 22 — AN
J1(5) SC_11
J1(3) SC_10

ON/STBY — 22 — AH
J1(1) ON/STBY

RL7	SWEEP MODE S1	7 S9	SINGLE SWEEP S17	
RL6	SWEEP RATE S2	6 S10	SWEEP WIDTH S18	
RL5	Hz S3	5 S11	STEP UP S19	
RL4	kHz S4	4 S12	STEP DOWN S20	
RL3	MHz S5	3 S13	MANUAL MODE S21	
RL2	GHz S6	2 S14	CENTER FREQ. S22	
RL1	BACK SPACE S7	1 S15	9 S23	
RL0	DEC. POINT S8	0 S16	8 S24	

A24 RPG



A OUTPUT W/BK/R — J2(3) CW
+5 W/R — J2(1) +5
BK — J2(6)
NC — J2(5) NC
B OUTPUT W/BK/BR — J2(4) CCW

SERIAL PREFIX: 2718A

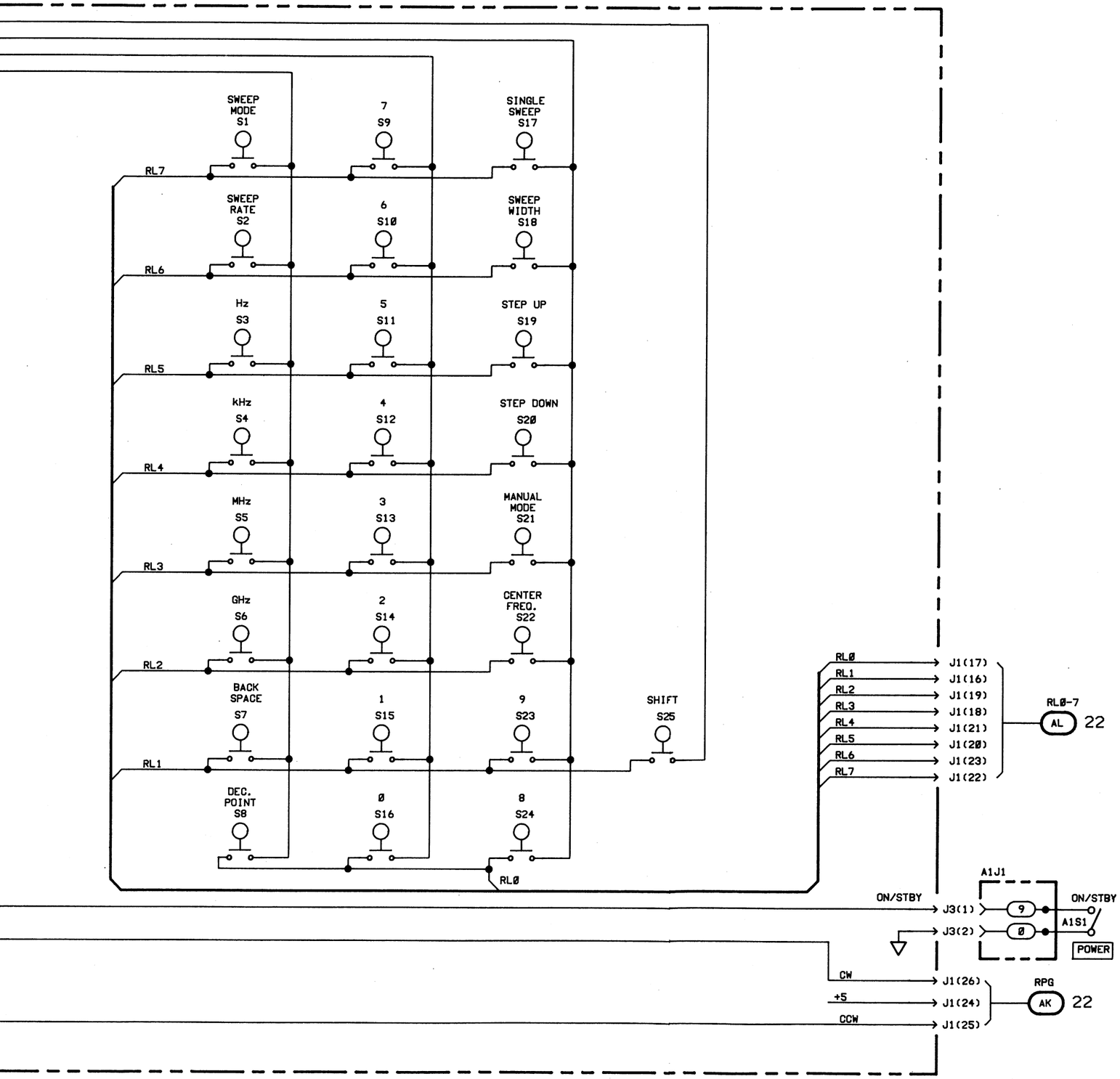


Figure 8-25 Keyboard Assembly
8-143/8-144

Service Sheet 22

ASSEMBLY

- **A1A1 Display Board**

PRINCIPLES OF OPERATION

U1-U10 are common cathode Seven Segment Displays.

U11 and U12 are quad PNP Transistors which drive the anodes of the Seven Segment Displays and the LEDs.

DS1 is a 2 × 4 LED Display Indicator. DS2-DS6 are quad LED Bar Indicators.

The Seven Segment Displays and the LEDs are scanned by the Programmable Keyboard/Display Interface (U16) on the Microprocessor Board A1A3.

NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

A1A1

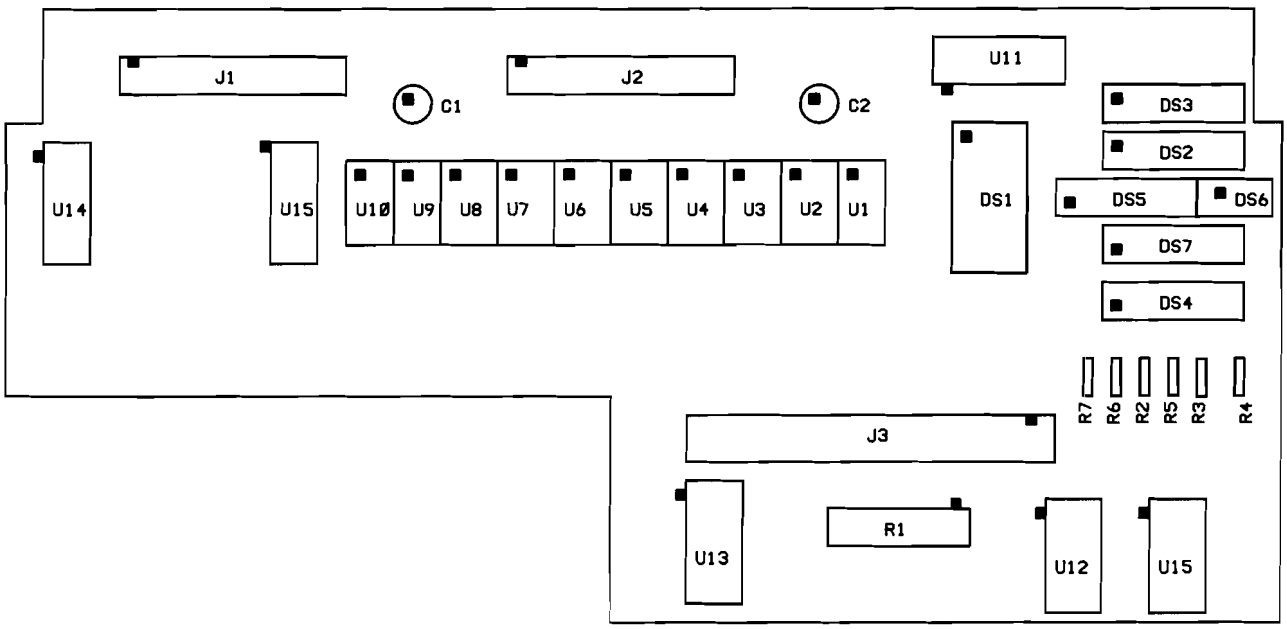


Figure 8-26. Service Sheet 22 Information.

P/O A1A6 MOTHERBD.

A1A1 DISPLAY BOARD ASSEMBLY (Ø8660-6Ø398)

26 H OVEN-L
RANGE-L 20 AB
FM-L 19 AC
SCAN 20 AD
A0-A3 20 AE
B0-B3 20 AF
ROW 20 AG
ROW0-3 21 AI
ON/STBY 27 KL
ON/STBY 21 AH
RPG 21 AK
RL0-7 21 AL
RPG 20 AJ
RL0-RL7 20 AM

C1 10U +5
C2 10U

R1A 22 DS_a
R1B 22 DS_b
R1C 22 DS_c
R1D 22 DS_d
R1E 22 DS_e
R1F 22 DS_f
R1G 22 DS_g
R1H 22 DS_dp

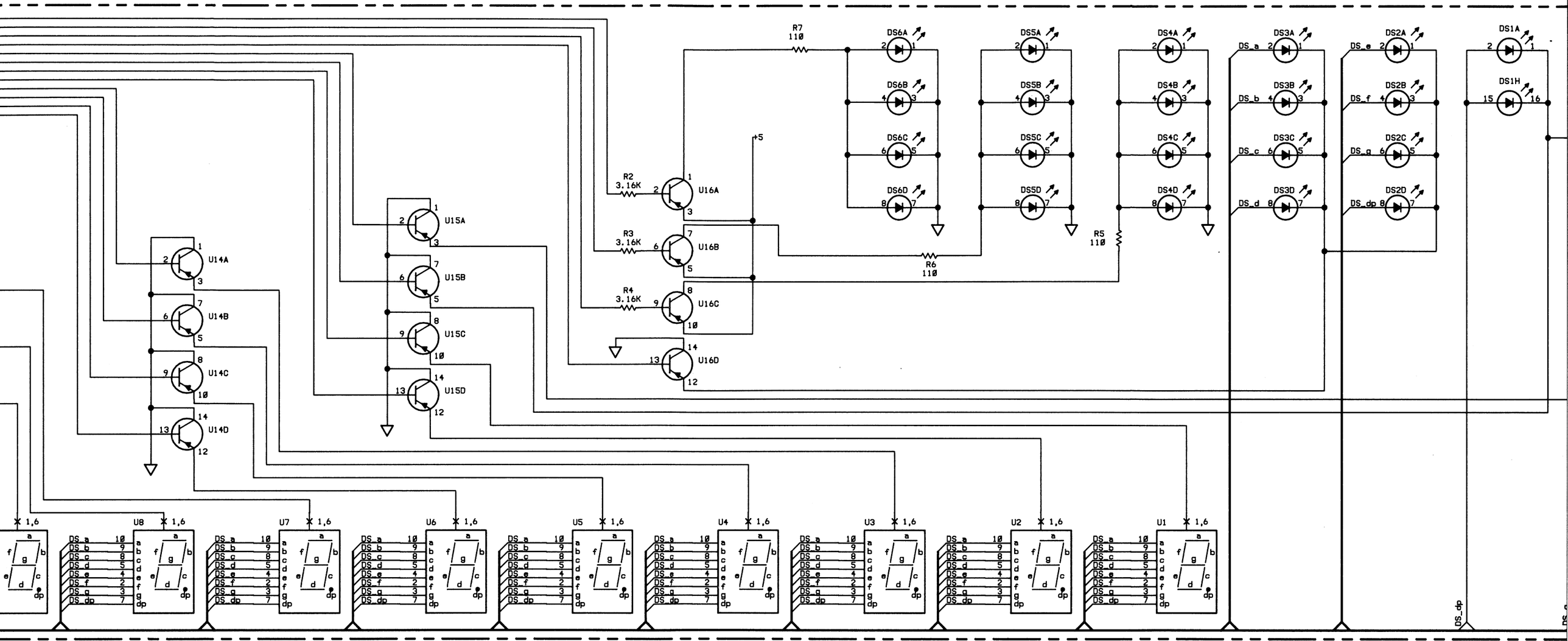
R2 3.16K
R3 3.16K
R4 3.16K

U11A U11B U11C U11D U12A U12B U12C U12D
U13A U13B U13C U13D
U14A U14B U14C U14D
U15A U15B U15C U15D
U10 U9 U8 U7 U6 U5 1,6

A1A6W1 P1 P2 P3

P/O A1A6 MOTHERBD.

SERIAL PREFIX: 2718A



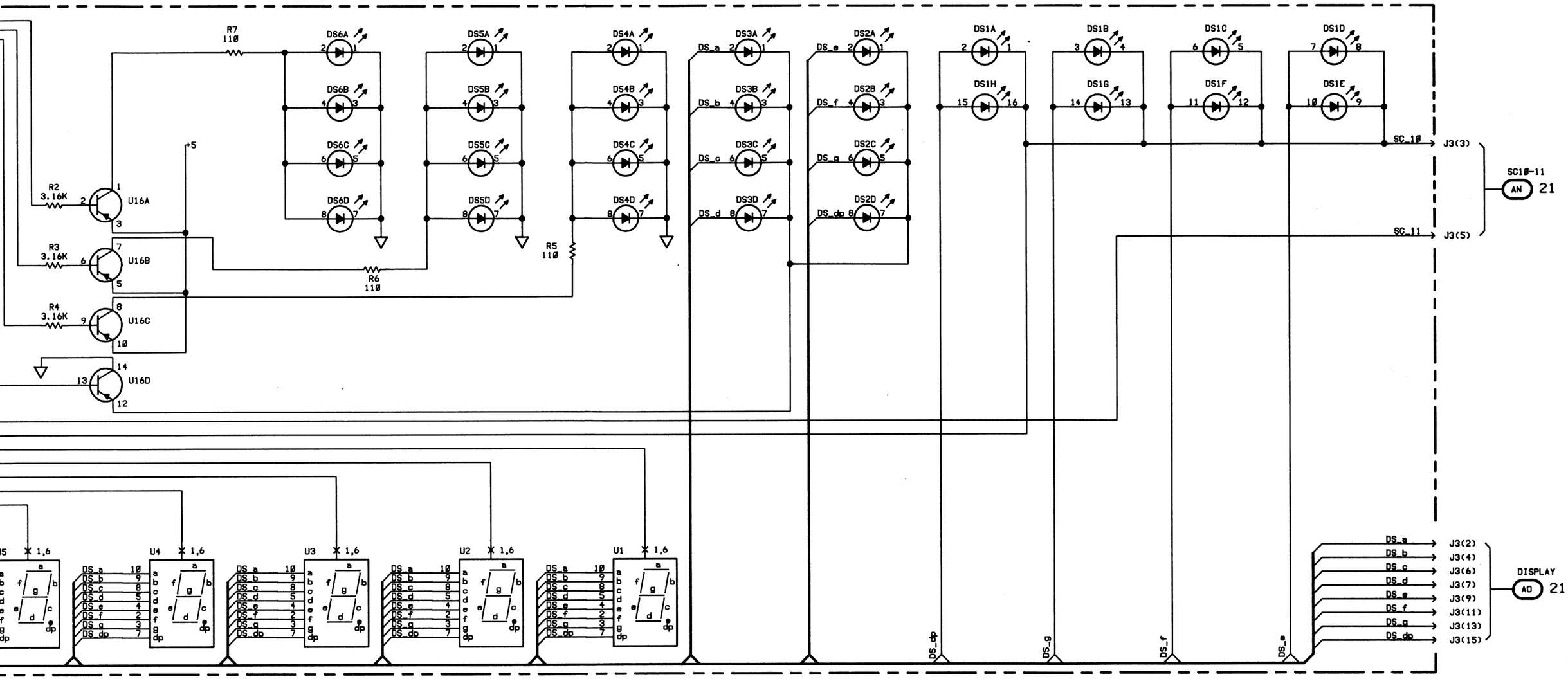


Figure 8–27 Display Board
8–147/8–148

Service Sheet 23

ASSEMBLY

- **P/O A1A5 Interface/Latch Assembly (A)**

PRINCIPLES OF OPERATION

The Interface/Latch Board contains all of the Remote Interface circuitry, output latches, and sweep-to-clock circuitry.

S1 is the Address Select switch. The binary value selected on the five switch positions is read by the MPU via buffer U5, and is written to U4, General Purpose Interface Adapter. This value then becomes the instrument's HP-IB remote address. This value is also stored in RAM for future reference. The input lines OPID-1, OPID-2, and BCD-L, are also read by the MPU through U5. The OPID-1, and OPID-2 lines indicate which type of RF Plug-In is presently installed in the instrument. The BCD-L line indicates to the MPU which position the 8 pair jumper is in (that is, J3 for HP-IB Remote Interface or J4 for BCD Interface). The MPU reads this bit to determine which remote interface to initialize at power-on.

CAUTION

The eight-pair jumper should never be moved while the instrument is turned on.

U1, U2, U3, and U4 comprise the HP-IB Remote Interface circuit. U4 interfaces directly with the MPU and activates the IRQ line whenever an HP-IB Remote Local Change (RLC), a Byte-In (BI) or a Device Clear (DCAS) interrupt occurs. U1 and U2 interface U4 to the IEEE GPIB.

U2, U6, U7, and U8 comprise the BCD Remote Interface circuit. The HP-IB and the BCD remote data lines run in parallel. Therefore, U2 buffers the BCD data lines to the BCD Interface Latch (U6). When a remote data byte is sent over the BCD data bus the COMM-L line will pulse low. The rising edge of this pulse will clock the remote data byte into U6. This edge also sets an interrupt status flag in the PIA (U7), and U7 generates an interrupt on the IRQ line to the MPU. The COMM-L line also sets the BCD Busy Flag (FLAG-L) on the Q output of flip-flop U8B. This flip-flop is reset via the PIA on Port B (PB0) when the MPU has finished servicing the remote interrupt. Upon a BCD remote COMM-L interrupt the MPU reads the data captured by U6 via Port A of the PIA (U7). This data byte is then interpeted by the MPU as either a command byte or data byte.

Service Sheet 24

ASSEMBLY

- **P/O A1A5 Interface/Latch Assembly (B)**

PRINCIPLES OF OPERATION

U9 is an 8-bit buffer which buffers the MPU data lines and outputs them to the Output Latches (U10-U16).

U10-U16 are the output latches. These latches are memory addressed as follows: U10=7000H, U11=7001H, U12=7002H, U13=7003H, U14=7004H, U15=7006H, and U16=7007H. U10 through U14 drive all of the frequency digit lines. Each latch drives two 4-bit BCD digits. U15 drives the out-of-range one-shot circuit, Double line, and the code lines CODE_1 and CODE_2. U16 drives the sweep clock select lines SWEEP_A through SWEEP_D, the sweep control lines Q100-H, IRS-L, ILD-L, and the instrument local line LCL-H.

SWEEP_A, SWEEP_B, and SWEEP_C select a sweep frequency on the multiplexer U21. SWEEP_D enables the RPG decode circuit (SS20). When the sweep reaches its upper limit QCTM-H goes high, disabling U21 to inhibit any further SWEEP_UP pulses.

U18, U19, and U20 comprise the sweep clock divide circuit. U8A divides the system clock of 2 MHz by 2 for the 1 MHz input to the sweep clock divide circuit. U18, U19, and U20 are bi-quinary counters which divide the 1 MHz input down to the sweep frequencies of 1 kHz, 100 Hz, 20 Hz, and 2 Hz.

U17A and U3B make up the out-of-range one-shot circuit. When the RANGE-H line is pulsed, the Q output of U17A is pulsed for an extended period of approximately 1 second. This drives the output of U3B high for the duration of the pulse. If RANGE-H is set high it takes U3B pin 4 high and causes the output of U3B to remain high (TRUE).

TROUBLESHOOTING FOR SERVICE SHEETS 23 AND 24

Troubleshooting of this assembly is done using REGULAR Signature Analysis.

Signature Analysis of the A1A5 Interface/Latch Assembly

1. Perform the REGULAR Signature Analysis Set-Up Procedure included with Service Sheet 18.
2. Compare the signatures taken with the Signature Analyzer with the correct signatures in the tables below.

U4 Pin#	Function	Signature	U4 Pin#	Function	Signature
1	IN	- - - -	21	IN	- - - -
2	Vcc	P389	22	OUT	- - - -
3	IN	45CF	23	IN	- - - -
4	IN	2A1A	24	IN	- - - -
5	IN	2A1A	25	IN	- - - -
6	IN	- - - -	26	IN	- - - -
7	IN	- - - -	27	IN	- - - -
8	IN	- - - -	28	IN	- - - -
9	IN	- - - -	29	IN	- - - -
10	IN	H8A4	30	IN	- - - -
11	IN	U57A	31	IN	- - - -
12	IN	6688	32	IN	- - - -
13	IN	54A1	33	IN	- - - -
14	IN	P00U	34	IN	- - - -
15	IN	3HF6	35	IN	- - - -
16	IN	5900	36	IN	- - - -
17	IN	3497	37	IN	- - - -
18	IN	- - - -CLK	38	IN	- - - -
19	IN	P389	39	IN	- - - -
20	GND	0000	40	Vcc	P389

U7 Pin#	Function	Signature	U7 Pin#	Function	Signature
1	GND	0000	21	IN	2A1A
2	IN	- - - -	22	Vcc	P389
3	IN	- - - -	23	IN	135F
4	IN	- - - -	24	Vcc	P389
5	IN	- - - -	25	IN	- - - -CLK
6	IN	- - - -	26	IN	3497
7	IN	- - - -	27	IN	5900
8	IN	- - - -	28	IN	3HF6
9	IN	- - - -	29	IN	P00U
10	IN	3079	30	IN	54A1
11	IN	CFH9	31	IN	6688
12	IN	- - - -	32	IN	U57A
13	IN	- - - -	33	IN	H8A4
14	IN	- - - -	34	IN	P389
15	IN	- - - -	35	IN	- - - -
16	IN	- - - -	36	IN	- - - -
17	IN	- - - -	37	IN	- - - -
18	IN	CFH9	38	IN	- - - -
19	IN	CFH9	39	IN	- - - -
20	Vcc	P389	40	Vcc	P389

U8 Pin#	Function	Signature	U8 Pin#	Function	Signature
1	IN	P389	8	OUT	P389
2	IN	- - - -	9	IN	- - - -
3	IN	- - - -CLK	10	IN	- - - -
4	IN	P389	11	GND	0000
5	IN	- - - -	12	GND	0000
6	IN	- - - -	13	IN	3079
7	GND	0000	14	Vcc	P389

U9 Pin#	Function	Signature	U9 Pin#	Function	Signature
1	IN	6UC8	11	IN	P00U
2	IN	H8A4	12	OUT	H32F
3	OUT	1628	13	IN	3HF6
4	IN	U57A	14	OUT	UH7A
5	OUT	C233	15	IN	5900
6	IN	6688	16	OUT	90U2
7	OUT	8534	17	IN	3497
8	IN	54A1	18	OUT	0926
9	OUT	C67A	19	IN	6UC8
10	IN	0000	20	Vcc	P389

U10 Pin#	Function	Signature	U10 Pin#	Function	Signature
1	IN	0000	11	IN	0FPF
2	IN	0926	12	OUT	9F03
3	IN	90U2	13	OUT	F839
4	IN	UH7A	14	OUT	968P
5	IN	H32F	15	OUT	FU78
6	IN	C67A	16	OUT	PHPU
7	IN	8534	17	OUT	AA4A
8	IN	C233	18	OUT	3PP6
9	IN	1628	19	Vcc	A523
10	GND	0000	20	IN	P389

U11 Pin#	Function	Signature	U11 Pin#	Function	Signature
1	IN	0000	11	IN	CP41
2	IN	0926	12	OUT	11FF
3	IN	90U2	13	OUT	61A1
4	IN	UH7A	14	OUT	A66C
5	IN	H32F	15	OUT	5U8H
6	IN	C67A	16	OUT	C5P3
7	IN	8534	17	OUT	A2F6
8	IN	C233	18	OUT	0A5F
9	IN	1628	19	OUT	34C8
10	GND	0000	20	Vcc	P389

U12 Pin#	Function	Signature	U12 Pin#	Function	Signature
1	IN	0000	11	IN	3H04
2	IN	0926	12	OUT	71HA
3	IN	90U2	13	OUT	C866
4	IN	UH7A	14	OUT	3982
5	IN	H32F	15	OUT	8HFA
6	IN	C67A	16	OUT	30FF
7	IN	8534	17	OUT	1H9U
8	IN	C233	18	OUT	1780
9	IN	1628	19	OUT	4A7C
10	GND	0000	20	Vcc	P389

U13 Pin#	Function	Signature	U13 Pin#	Function	Signature
1	IN	0000	11	IN	7UH5
2	IN	0926	12	OUT	9C81
3	IN	90U2	13	OUT	38UF
4	IN	UH7A	14	OUT	FA97
5	IN	H32F	15	OUT	P48A
6	IN	C67A	16	OUT	90HU
7	IN	8534	17	OUT	8P89
8	IN	C233	18	OUT	118C
9	IN	1628	19	OUT	7434
10	GND	0000	20	Vcc	P389

U14 Pin#	Function	Signature	U14 Pin#	Function	Signature
1	IN	0000	11	IN	362C
2	IN	0926	12	OUT	- - - -
3	IN	90U2	13	OUT	- - - -
4	IN	UH7A	14	OUT	- - - -
5	IN	H32F	15	OUT	C73A
6	IN	C67A	16	OUT	A105
7	IN	8534	17	OUT	FC5A
8	IN	C233	18	OUT	5617
9	IN	1628	19	OUT	C361
10	GND	0000	20	Vcc	P389

U15 Pin#	Function	Signature	U15 Pin#	Function	Signature
1	IN	0000	11	IN	74FC
2	IN	0926	12	OUT	- - - -
3	IN	90U2	13	OUT	- - - -
4	IN	UH7A	14	OUT	- - - -
5	IN	H32F	15	OUT	- - - -
6	IN	C67A	16	OUT	3C6A
7	IN	8534	17	OUT	18A5
8	IN	C233	18	OUT	1H83
9	IN	1628	19	OUT	72F1
10	GND	0000	20	Vcc	P389

U16 Pin#	Function	Signature	U16 Pin#	Function	Signature
1	IN	0000	11	IN	7UCP
2	IN	0926	12	IN	AA32
3	IN	90U2	13	IN	5HC5
4	IN	UH7A	14	IN	9046
5	IN	H32F	15	IN	9C4C
6	IN	C67A	16	IN	UC96
7	IN	8534	17	IN	82H2
8	IN	C233	18	IN	F265
9	IN	1628	19	IN	A304
10	GND	0000	20	Vcc	P389

U17 Pin#	Function	Signature	U17 Pin#	Function	Signature
1	GND	0000	9	IN	- - - -
2	IN	72F1	10	IN	- - - -
3	Vcc	P389	11	IN	- - - -
4	IN	- - - -	12	IN	- - - -
5	IN	- - - -	13	IN	- - - -
6	IN	- - - -	14	GND	0000
7	IN	- - - -	15	IN	- - - -
8	GND	0000	16	Vcc	P389

U21 Pin#	Function	Signature	U21 Pin#	Function	Signature
1	IN	0000	9	IN	F265
2	IN	0000	10	IN	82H2
3	IN	0000	11	IN	UC96
4	IN	0000	12	IN	- - - -
5	IN	- - - -	13	IN	- - - -
6	IN	- - - -	14	IN	- - - -
7	IN	05PU	15	IN	- - - -
8	GND	0000	16	Vcc	P389

NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

A1A5

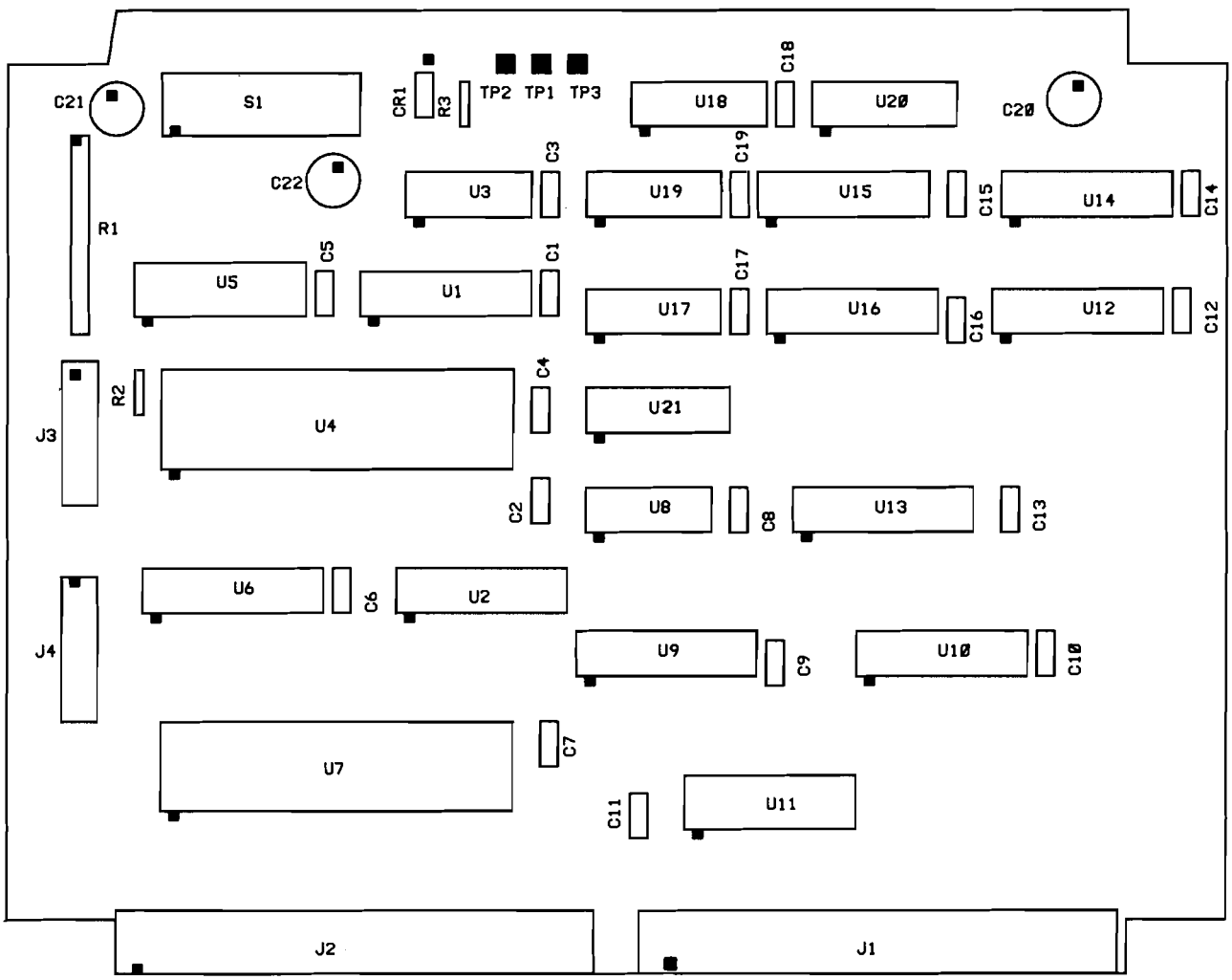
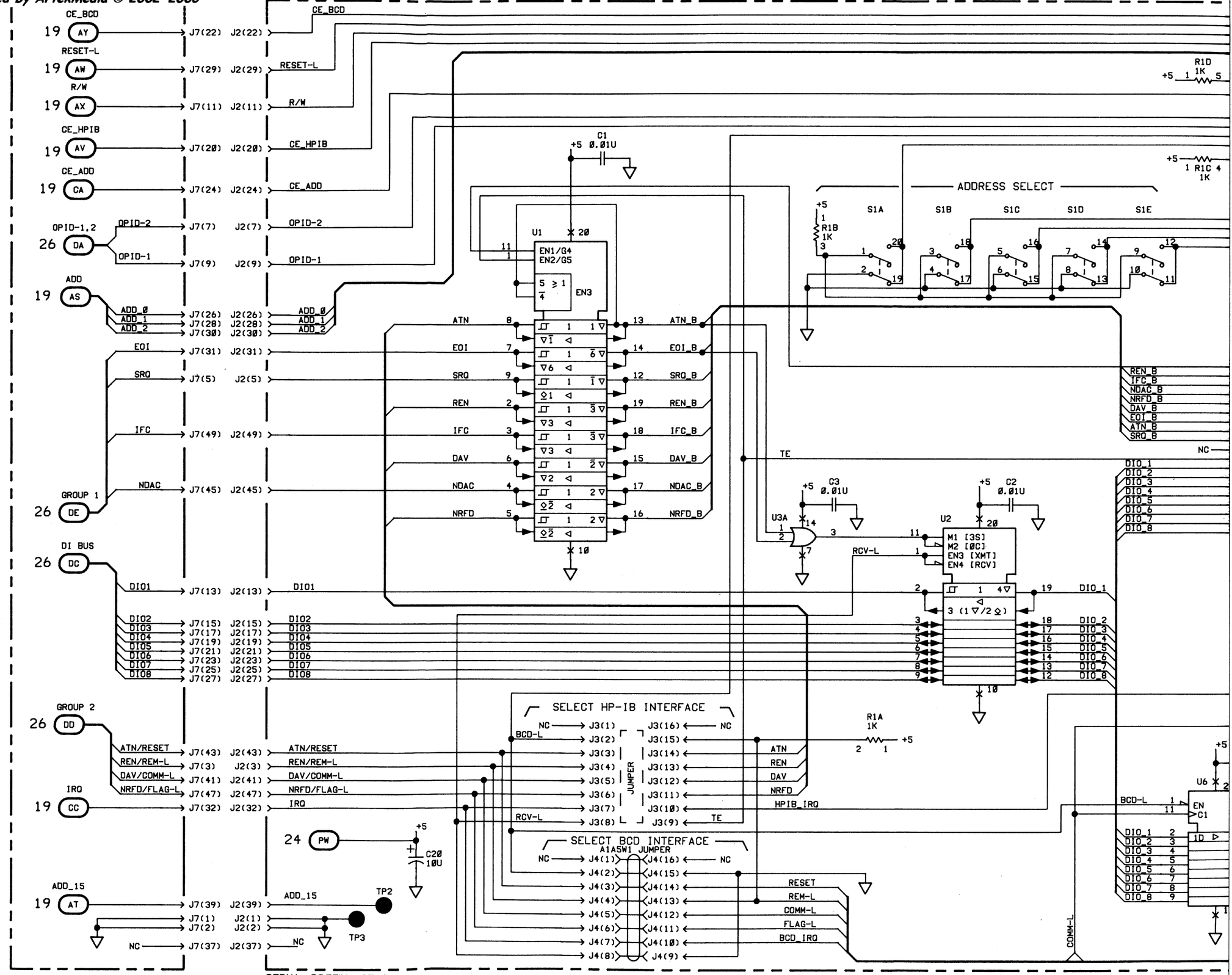


Figure 8-28. Service Sheet 23 Information.

P/O A1A5 INTERFACE AND LATCH BOARD ASSEMBLY (08660-60401)



SERIAL PREFIX: 2718A

ADDRESS SELECT
S1A S1B S1C S1D S1E
R1B 1K
R1C 4 1K
R1D 1K
R1E 1K
R1A 1K
R2 5.11K
C2 0.01U
C3 0.01U
C4 0.01U
C5 0.01U
C6 0.01U
C7 0.01U
U2
U3A
U4
U5A
U5B
U6
U7
U8B
M1 [3S]
M2 [0C]
EN3 [XMT]
EN4 [RCV]
3 (1▽/2◇)
HP-IB INTERFACE
GENERAL PURPOSE INTERFACE ADAPTER 9914
HP-IB INSTRUMENT INTERFACE
PERIPH. INTERFACE ADAPTER 6821
BCD INTERFACE
DATA BUS
CLOCK
TP1
BF 24
BZ 24
J2(48) J7(
J2(46) J7(
J2(44) J7(
J2(42) J7(
J2(40) J7(
J2(38) J7(
J2(36) J7(
J2(34) J7(
J2(4) J7
DATA_7
DATA_6
DATA_5
DATA_4
DATA_3
DATA_2
DATA_1
DATA_0
ADD_0
ADD_1
ADD_2
HPIB_IRQ
BCD_IRQ
COMM-L
RESET
REM-L
RES_FLAG
FLAG-L
REN_B
IFC_B
NDAC_B
NRFD_B
DAV_B
EOI_B
ATN_B
SRQ_B
DIO_1
DIO_2
DIO_3
DIO_4
DIO_5
DIO_6
DIO_7
DIO_8
RCV-L
BCD-L
TE
NC
ATN
REN
DAV
NRFD
HPIB_IRQ
RESET
REM-L
COMM-L
FLAG-L
BCD_IRQ

P/O A1A6 MOTHERBD

DATA0-7 AQ 20

CLOCK AU 19

J2(48) J7(48) DATA_7
J2(46) J7(46) DATA_6
J2(44) J7(44) DATA_5
J2(42) J7(42) DATA_4
J2(40) J7(40) DATA_3
J2(38) J7(38) DATA_2
J2(36) J7(36) DATA_1
J2(34) J7(34) DATA_0
J2(4) J7(4) CLOCK

HP-IB INTERFACE

U5A EN 20
U5B EN
C5 0.01U
C4 0.01U
DATA_7 DATA_6 DATA_5 DATA_4 DATA_3 DATA_2 DATA_1 DATA_0
DATA BUS BF 24
+5
R2 5.11K
U4 40
GENERAL PURPOSE INTERFACE ADAPTER 9914
CONT REN IFC NDAC NRFD DAV EOI ATN SRQ TRIG TE
DIO1 DIO2 DIO3 DIO4 DIO5 DIO6 DIO7 DIO8
HP-IB INTERFACE
INSTRUMENT INTERFACE
WE DBIN RS0 RS1 RS2 CE CLK INT RESET ACCRQ ACCGR
D0 D1 D2 D3 D4 D5 D6 D7
HPIB_IRQ
NC
ADD_0 ADD_1 ADD_2
CLOCK
TP1
CLOCK BZ 24
20

BCD INTERFACE

+5 C7 0.01U
U7 20
R1E 1K
PERIPH. INTERFACE ADAPTER 6821
ADR
EN
RESET
READ/ WRITE
CLOCK
IRQ
BCD_IRQ
DBUS
PA
PB
CA
CB
COMM-L
RESET
REM-L
RES_FLAG
NC
1

U8B
S C D R
NC
RES_FLAG
FLAG-L

Figure 8–29 P/O Interface/Latch Assembly

NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.

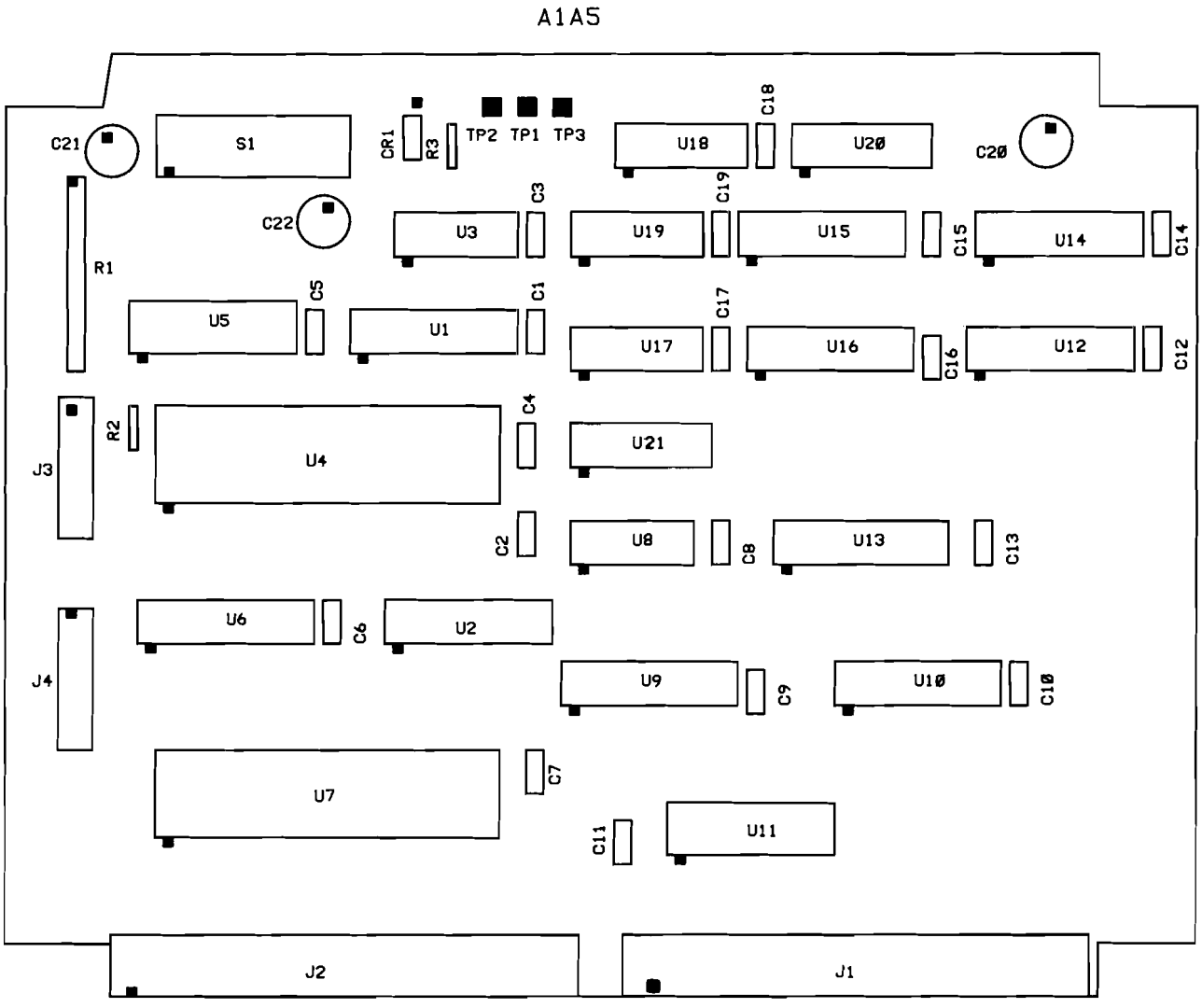


Figure 8-30. Service Sheet 24 Information.

RD ASSEMBLY (08660-60401)

P/O A1A6 MOTHERBD

BUFFER DATA BUS

CE_LATCH 20 AZ

CE 20 AR

DATA BUS 23 BF

CE_L1 CE_L2 CE_L3 CE_L4 CE_L5 CE_L6 CE_L7

J7(50) J7(6) J7(8) J7(10) J7(12) J7(14) J7(16) J7(18)

J2(50) J2(6) J2(8) J2(10) J2(12) J2(14) J2(16) J2(18)

C9 0.01U U9A U9B

C10 0.01U U10

C11 0.01U U11

C12 0.01U U12

C13 0.01U U13

DATA_0 DATA_1 DATA_2 DATA_3 DATA_4 DATA_5 DATA_6 DATA_7

DO_0 DO_1 DO_2 DO_3 DO_4 DO_5 DO_6 DO_7

DIGIT_1-1 DIGIT_1-2 DIGIT_1-4 DIGIT_1-8 DIGIT_2-1 DIGIT_2-2 DIGIT_2-4 DIGIT_2-8

DIGIT_3-1 DIGIT_3-2 DIGIT_3-4 DIGIT_3-8 DIGIT_4-1 DIGIT_4-2 DIGIT_4-4 DIGIT_4-8

DIGIT_5-1 DIGIT_5-2 DIGIT_5-4 DIGIT_5-8 DIGIT_6-1 DIGIT_6-2 DIGIT_6-4 DIGIT_6-8

SWEEP CLOCK DIVIDE

CLOCK 23 BZ

R1G 1K

C8 0.01U U8A

C18 0.01U

U18A U18B U19A U19B U20A U20B

CTR CT=0 DIV2 DIV5

QCTM-H 25 CD

NC

PW 23

C21 10U

SERIAL PREFIX: 2718A

OUTPUT LATCHES

C11 0.01U +5 — U11 74LS373 20 — EN 1 / C1 11 — 1D ▷ — 10
DO_0 2 — DIGIT_3-1 19
DO_1 3 — DIGIT_3-2 18
DO_2 4 — DIGIT_3-4 17
DO_3 5 — DIGIT_3-8 16
DO_4 6 — DIGIT_4-1 15
DO_5 7 — DIGIT_4-2 14
DO_6 8 — DIGIT_4-4 13
DO_7 9 — DIGIT_4-8 12

C12 0.01U +5 — U12 74LS373 20 — EN 1 / C1 11 — 1D ▷ — 10
DO_0 2 — DIGIT_5-1 19
DO_1 3 — DIGIT_5-2 18
DO_2 4 — DIGIT_5-4 17
DO_3 5 — DIGIT_5-8 16
DO_4 6 — DIGIT_6-1 15
DO_5 7 — DIGIT_6-2 14
DO_6 8 — DIGIT_6-4 13
DO_7 9 — DIGIT_6-8 12

C13 0.01U +5 — U13 74LS373 20 — EN 1 / C1 11 — 1D ▷ — 10
DO_0 2 — DIGIT_7-1 19
DO_1 3 — DIGIT_7-2 18
DO_2 4 — DIGIT_7-4 17
DO_3 5 — DIGIT_7-8 16
DO_4 6 — DIGIT_8-1 15
DO_5 7 — DIGIT_8-2 14
DO_6 8 — DIGIT_8-4 13
DO_7 9 — DIGIT_8-8 12

C14 0.01U +5 — U14 74LS373 20 — EN 1 / C1 11 — 1D ▷ — 10
DO_0 2 — DIGIT_9-1 19
DO_1 3 — DIGIT_9-2 18
DO_2 4 — DIGIT_9-4 17
DO_3 5 — DIGIT_9-8 16
DO_4 6 — DIGIT_10-1 15
DO_5 7 — NC 14
DO_6 8 — NC 13
DO_7 9 — NC 12

C15 0.01U +5 — U15 74LS373 20 — EN 1 / C1 11 — 1D ▷ — 10
DO_0 2 — 19
DO_1 3 — DBL-L 18
DO_2 4 — CODE_2 17
DO_3 5 — CODE_1 16
DO_4 6 — 15 NC
DO_5 7 — 14 NC
DO_6 8 — 13 NC
DO_7 9 — 12 NC

C16 0.01U +5 — U16 74LS373 20 — EN 1 / C1 11 — 1D ▷ — 10
DO_0 2
DO_1 3
DO_2 4
DO_3 5
DO_4 6
DO_5 7
DO_6 8
DO_7 9

CE_L3 — CE_L4 — CE_L5 — CE_L6 — CE_L7

C18 0.01U +5 — U19A 74LS390 16 — CTR, CT=0, DIV2, DIV5 (0, CT, 2) — 5 NC, 6 NC, 7 — 8

U19B 74LS390 — CTR, CT=0, DIV2, DIV5 (0, CT, 2) — 11 NC, 10 NC, 9

+5 — U20A 74LS390 16 — CTR, CT=0, DIV2, DIV5 (0, CT, 2) — 5 NC, 6 NC, 7 — 8

U20B 74LS390 — CTR, CT=0, DIV2, DIV5 (0, CT, 2) — 13 NC, 11 NC, 10 NC, 9

OUT OF RANGE ONE SHOT

+5 — R1F 1K 7

+5 C17 0.01U — U17A 74LS123 16 — 1 2 3 13 14 15 4 5 — R CX RX/CX — 4 NC — 8

R3 51.1K

C22 33U

SWEEP CLOC

U21 — 7 EN M — SWEEP_A 11 — SWEEP_B 10 — SWEEP_C 9 — 4 3 2 1 15 14 13 12 — 0 1 2 3 4 5 6 7 — 0 2 G

OUTPUT LATCHES

P/O A1A6 MOTHERBD

OUT OF RANGE ONE SHOT

SWEEP CLOCK SELECT

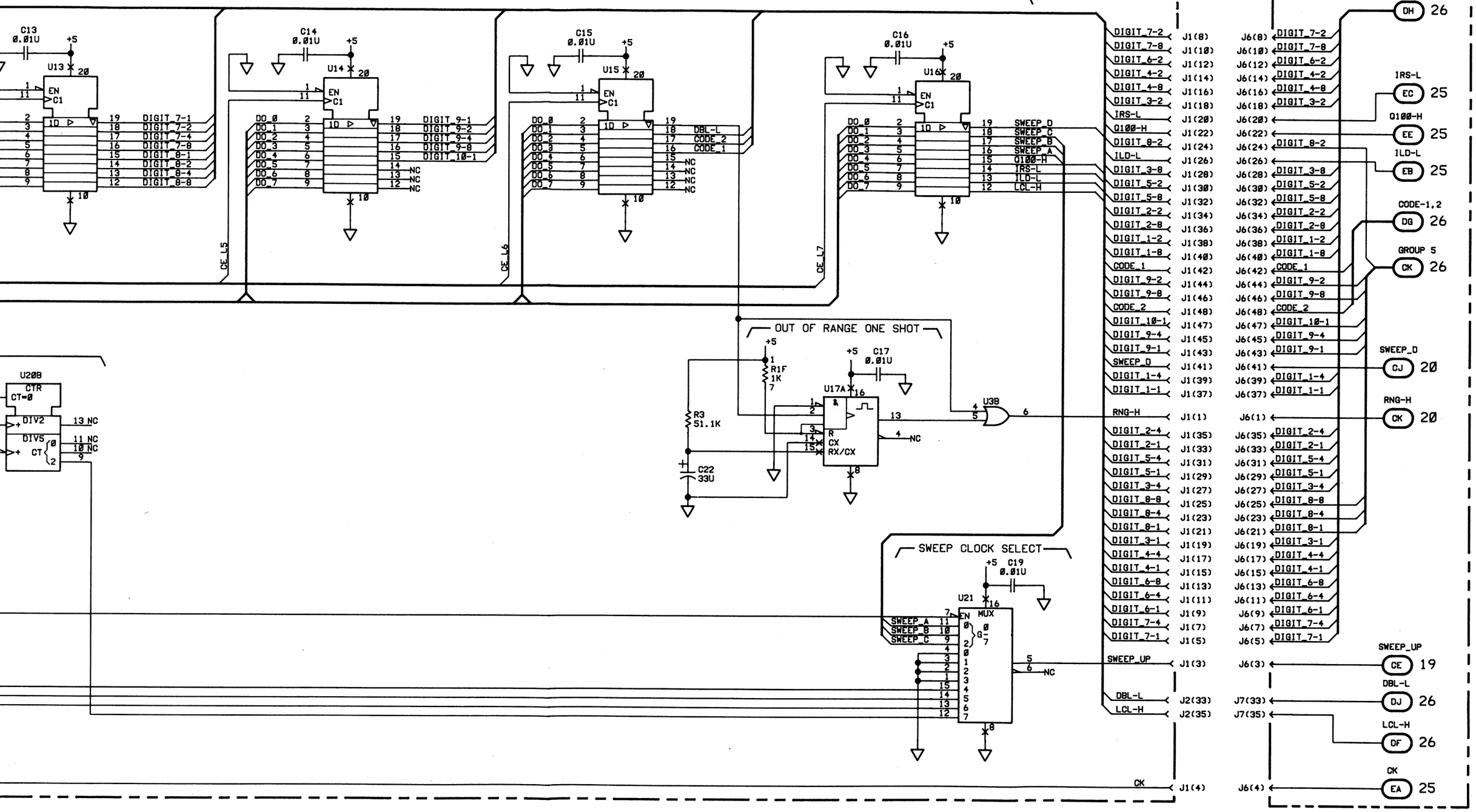


Figure 8–31 P/O Interface/Latch Assembly

Service Sheet 25

ASSEMBLY

- **A1A4 Sweep Count Assembly**

TROUBLESHOOTING

Troubleshooting of this assembly is done using Signature Analysis.

Signature Analysis of the A1A4 Sweep Count Assembly

1. Perform the REGULAR Signature Analysis Set-Up Procedure included with Service Sheet 18.
2. Compare the signatures taken with the Signature Analyzer with the correct signatures in the tables, below.

U2 Pin#	Function	Signature	U2 Pin#	Function	Signature
1	IN	9C4C	9	IN	- - - -
2	IN	F012	10	IN	- - - -
3	IN	8A86	11	IN	- - - -
4	OUT	F012	12	IN	- - - -
5	IN	P171	13	IN	- - - -
6	IN	F61P	14	IN	- - - -
7	OUT	P171	15	IN	0000
8	GND	0000	16	Vcc	P389

U3 Pin#	Function	Signature	U3 Pin#	Function	Signature
1	IN	- - - -	8	OUT	P666
2	IN	- - - -	9	IN	FF01 or CUFP
3	OUT	- - - -	10	IN	05PU
4	IN	P389	11	OUT	05PU
5	IN	P389	12	IN	H7F9
6	OUT	0000	13	IN	P666
7	GND	0000	14	Vcc	P389

U4 Pin#	Function	Signature	U4 Pin#	Function	Signature
1	IN	8472	8	OUT	45P4 or 7H88
2	IN	9FAU	9	IN	- - - -
3	IN	87F1	10	IN	- - - -
4	IN	F45C	11	IN	P389
5	IN	841H or FF71	12	IN	P389
6	IN	PFPA or H486	13	IN	- - - -
7	GND	0000	14	Vcc	P389

U5 Pin#	Function	Signature	U5 Pin#	Function	Signature
1	IN	0000	9	IN	0000
2	OUT	0088	10	IN	P389
3	OUT	- - - -	11	IN	- - - -
4	IN	4H77	12	OUT	H7F9
5	IN	8U57	13	OUT	9576
6	OUT	- - - -	14	IN	- - - -
7	OUT	6791	15	IN	P389
8	GND	0000	16	Vcc	P389

U6 Pin#	Function	Signature	U6 Pin#	Function	Signature
1	IN	P389	8	OUT	- - - -
2	IN	P389	9	IN	- - - -
3	IN	2597	10	IN	CP3F
4	IN	P389	11	IN	CP3F
5	IN	P389	12	OUT	8A86
6	OUT	F61P	13	IN	690U
7	GND	0000	14	Vcc	P389

U7 Pin#	Function	Signature	U7 Pin#	Function	Signature
1	IN	8A86	8	OUT	CP3F
2	OUT	690U	9	IN	5HC5
3	IN	08AA	10	OUT	- - - -
4	OUT	- - - -	11	IN	7P68
5	IN	6UPP	12	OUT	- - - -
6	OUT	- - - -	13	IN	014P
7	GND	0000	14	Vcc	P389

U8 Pin#	Function	Signature	U8 Pin#	Function	Signature
1	IN	0000	9	IN	0000
2	OUT	6UPP	10	IN	0000
3	OUT	08AA	11	IN	- - - -
4	IN	8A86	12	OUT	P171
5	IN	F61P	13	OUT	F012
6	OUT	014P	14	IN	9C4C
7	OUT	7P68	15	IN	0000
8	GND	0000	16	Vcc	P389

U9 Pin#	Function	Signature	U9 Pin#	Function	Signature
1	OUT	9FAU	8	IN	0U17
2	IN	7P68	9	IN	28F5
3	IN	014P	10	OUT	F45C
4	OUT	8472	11	IN	C383
5	IN	08AA	12	IN	5CF0
6	IN	6UPP	13	OUT	87F1
7	GND	0000	14	Vcc	P389

U10 Pin#	Function	Signature	U10 Pin#	Function	Signature
1	IN	0000	9	IN	0000
2	OUT	5CF0	10	IN	0000
3	OUT	C383	11	IN	- - - -
4	IN	F012	12	OUT	8U57
5	IN	P171	13	OUT	4H77
6	OUT	28F5	14	IN	- - - -
7	OUT	0U17	15	IN	0000
8	GND	0000	16	Vcc	P389

U11 Pin#	Function	Signature	U11 Pin#	Function	Signature
1	IN	- - - -	8	OUT	- - - -
2	OUT	- - - -	9	IN	- - - -
3	IN	- - - -	10	OUT	- - - -
4	OUT	- - - -	11	IN	- - - -
5	IN	6791	12	OUT	- - - -
6	OUT	- - - -	13	IN	0088
7	GND	0000	14	Vcc	P389

U12 Pin#	Function	Signature	U12 Pin#	Function	Signature
1	OUT	- - - -	8	IN	6791
2	IN	- - - -	9	IN	- - - -
3	IN	76UU	10	OUT	- - - -
4	OUT	- - - -	11	IN	- - - -
5	IN	- - - -	12	IN	0088
6	IN	9046	13	OUT	- - - -
7	GND	0000	14	Vcc	P389

U13 Pin#	Function	Signature	U13 Pin#	Function	Signature
1	IN	C383	8	OUT	- - - -
2	OUT	- - - -	9	IN	0U17
3	IN	5CF0	10	OUT	76UU
4	OUT	- - - -	11	IN	9576
5	IN	28F5	12	OUT	- - - -
6	OUT	- - - -	13	IN	- - - -
7	GND	0000	14	Vcc	P389

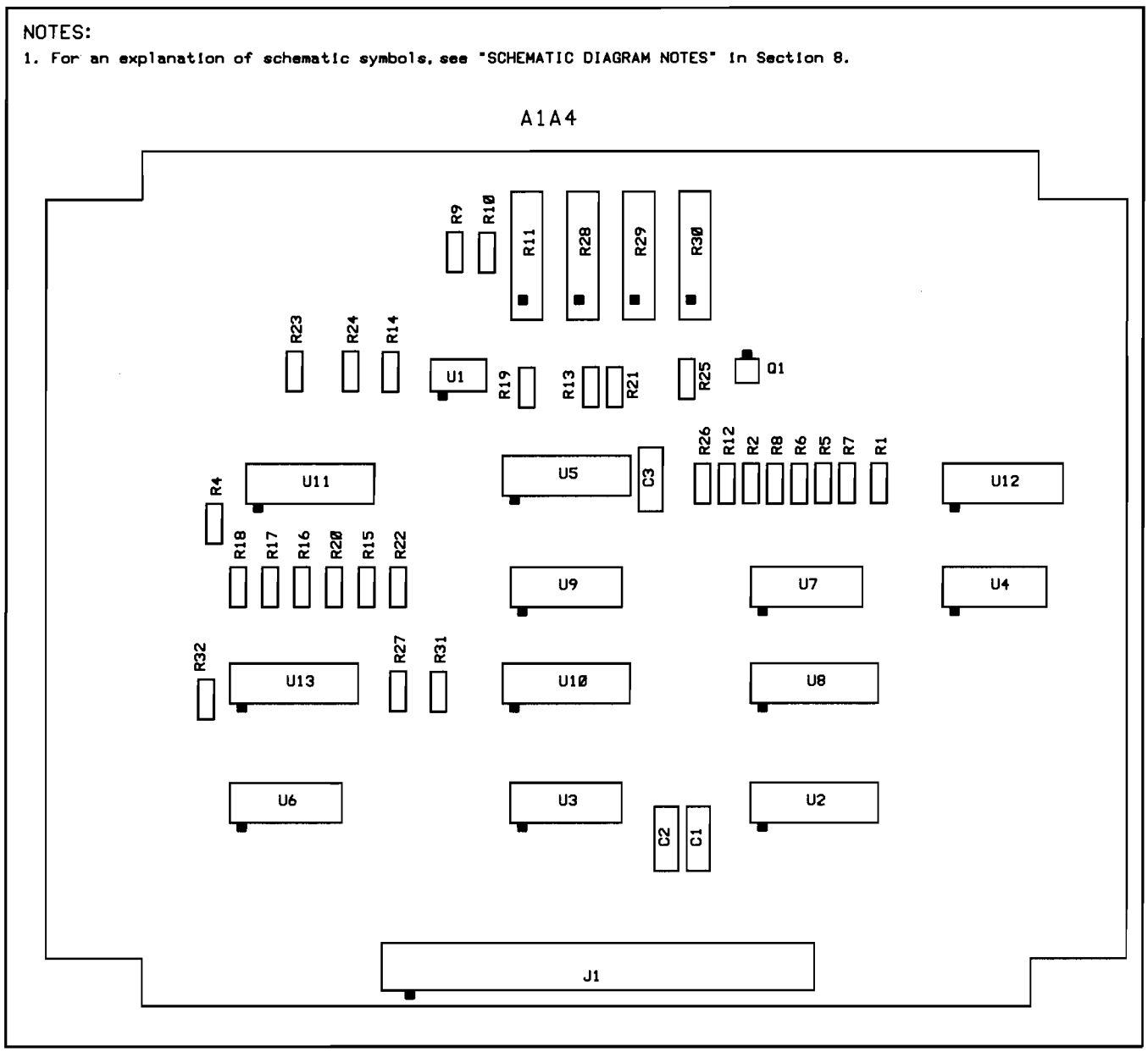


Figure 8-32. Service Sheet 25 Information.

P/O A9 COUNT ASSEMBLY (08860-60402)

CK 24 EA → J5(9)
ILD-L 23 EB → J5(15)
IRS-L 24 EC → J5(24)
CKA_B-H 20 ED → J5(10), J5(8)
CUP-H 23 CF → J5(6)
CDN-L 19 CG → J5(11)
Q100-H 24 EE → J5(19)
+20V → J5(7)
+5 → J5(29)
+5 → J5(30)
J5(33)
J5(34)
-10V → J5(5)
NC → J5(1), J5(2), J5(3), J5(4), J5(12), J5(13), J5(14), J5(16), J5(18), J5(20), J5(21), J5(22), J5(23), J5(25), J5(27), J5(31), J5(32), J5(35), J5(36), J5(37), J5(38), J5(39), J5(40), J5(41), J5(42), J5(43), J5(44), J5(45), J5(46), J5(47), J5(48), J5(49), J5(50)

J1(9), J1(15), J1(24), J1(10), J1(8), J1(6), J1(11), J1(19), J1(7), J1(29), J1(30), J1(33), J1(34), J1(5)
J1(1), J1(2), J1(3), J1(4), J1(12), J1(13), J1(14), J1(16), J1(18), J1(20), J1(21), J1(22), J1(23), J1(25), J1(27), J1(31), J1(32), J1(35), J1(36), J1(37), J1(38), J1(39), J1(40), J1(41), J1(42), J1(43), J1(44), J1(45), J1(46), J1(47), J1(48), J1(49), J1(50) → NC

U11A, U12B, U7D, U6C, U3B, U6B, U7A, U6A, R1 4.22K, R2 4.22K, R4 4.22K, C1 2.2U, C2 2.2U

U2 MUX, R32 1.00K, R31 1.00K

U8 CTRDIV10, U10 CTRDIV10

U7B, U7C, U7F, U7E, R8 400K, R12 400K, R7 400K, R6 200K, R5 100K

U13A, U13B, U13C, U13D

R13 750, R28 100 CW, R14 1.21K, R9 8.48K, R10 2.15K CW, R11 500, U1

SERIAL PREFIX: 2718A

U12B
U2
EN
G1
MUX
NC 11
NC 10
NC 14
NC 13
R32 1.00K
R31 1.00K
U10
CTRDIV10
CT=0
2+
G1
1-
G2
C3
ICT=9
ZCT=0
3D
[1]
[2]
[4]
[8]
U5
CTRDIV10
U13A
U13B
U13C
U13D
U13E
R18 80.0K
R17 40.0K
R16 20.0K
R15 10.0K
R20 4.22K
U12A
U3C
U3D
U7B
U7C
U7F
U7E
R8 400K
R12 400K
R7 400K
R6 200K
R5 100K
U11E
U11F
U11D
U11C
R24 8.00K
R23 4.00K
R22 2.00K
R21 909
R29 17TV100
R30 100
R25 750
Q1
R26 4.22K
J1(28)
J5(28)
J1(17)
J5(17)
R13 750
R28 100
R19 1.00K
C3 0.15U
+20
R14 1.21K
R9 3.48K
R10 2.15K
R11 500
U1
NC
-10
U12D
U12C
U9D
U9C
U9B
U9A
U4
U11B
R27 4.22K
J1(26)
J5(26)
CW
NC
+5

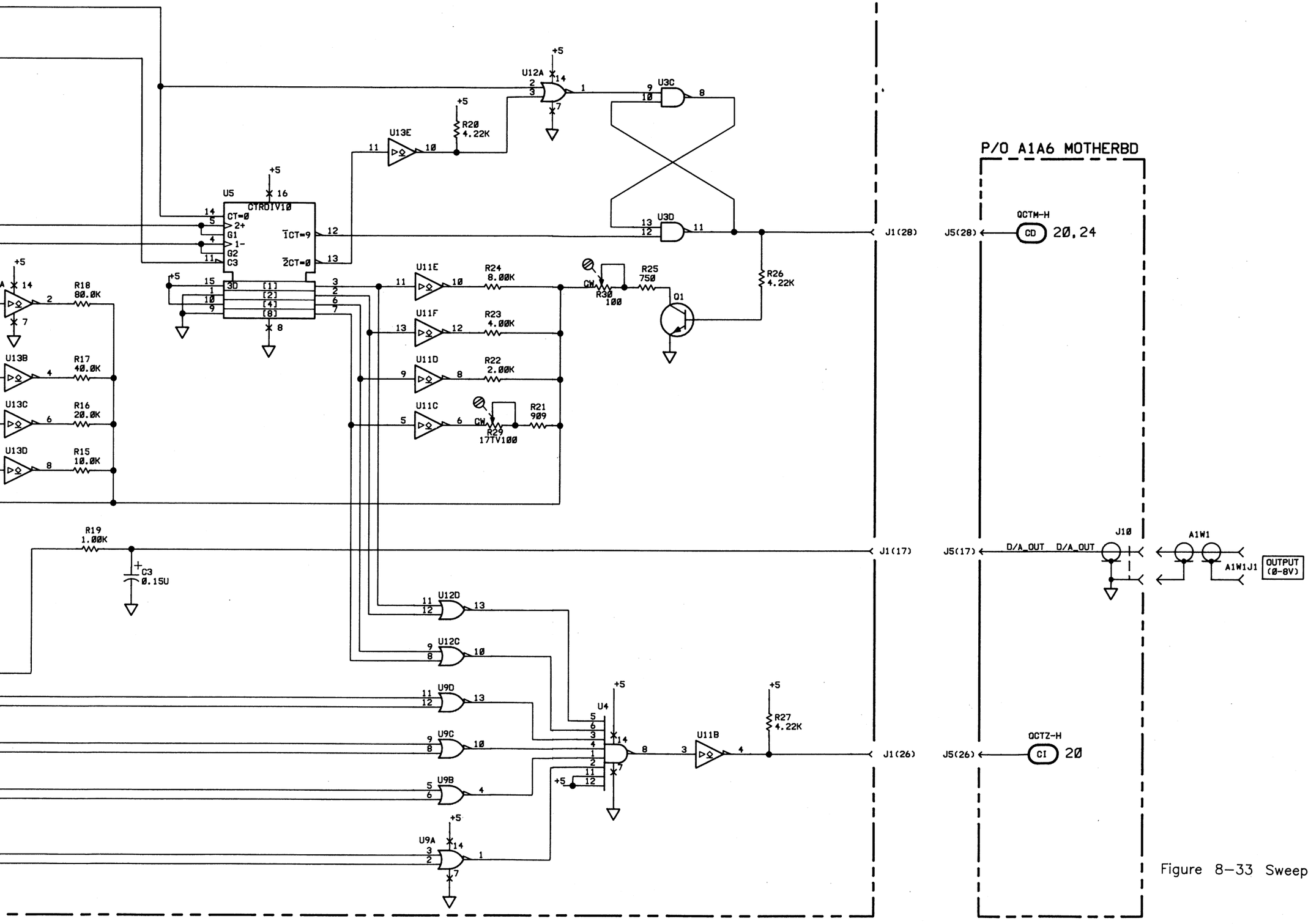


Figure 8-33 Sweep Count Assembly

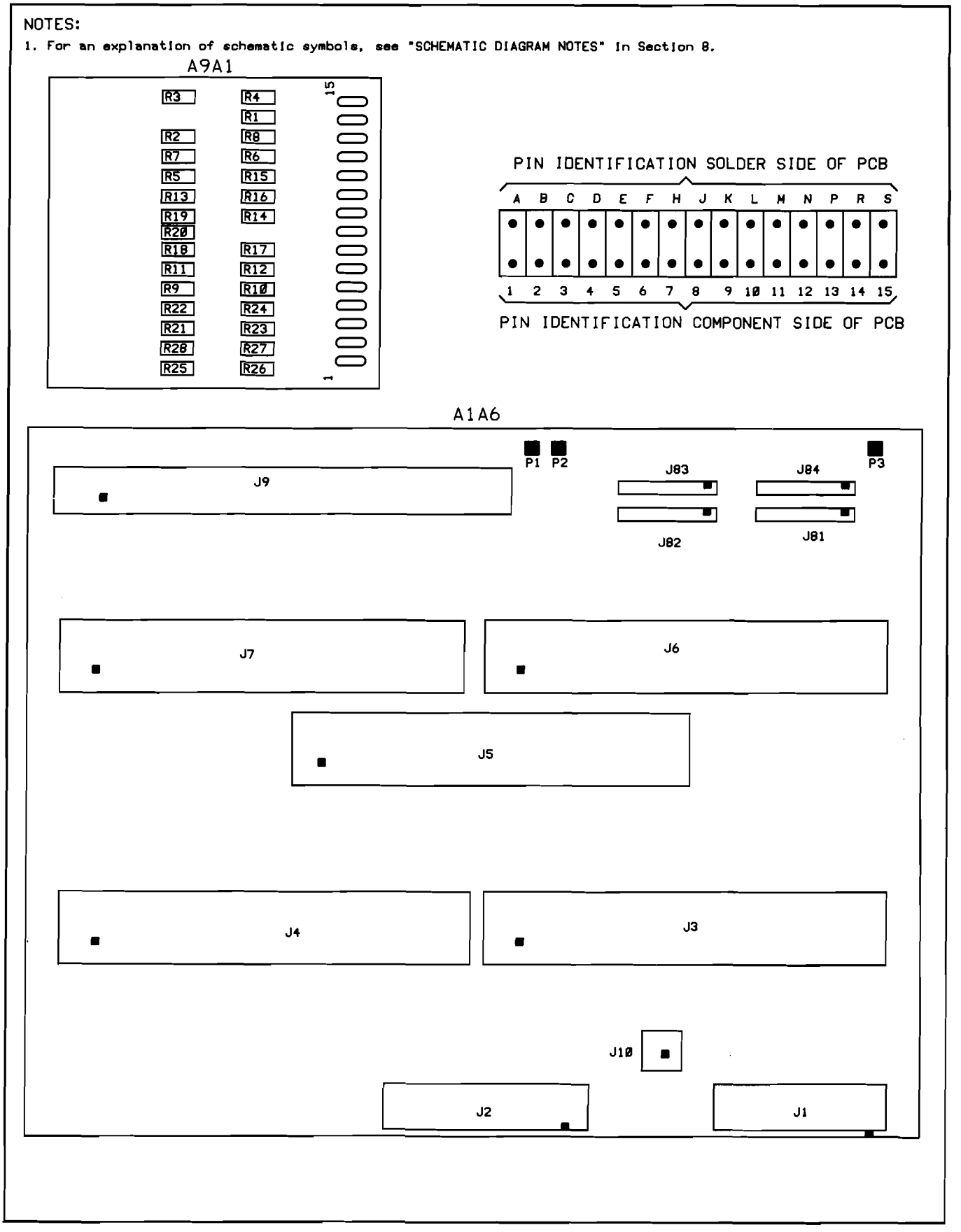


Figure 8-34. Service Sheet 26 Information.

P/O A1A6 MOTHERBD

A3A1 FRONT JUMPER ASSY
(08660-60403)

A3A2 REAR JUMPER ASSY
(8660-60404)

A3A3 INTERFACE MOTHERBD (08660-60025)

SERIAL PREFIX: 2718A

SERIAL PREFIX: 2718A

BCD/HP-IB ADAPT

RF SECTI

JUMPER THRU PLUG CONNECT

A3A2 RL
(8660-60404)

A3A2W1

P/O A3A3

P/O A3XA3A2

BCD/HP-IB ADAPTER

A23J2

P/O A23

SERIAL PREFIX: 2718A

P/O A1A6 MOTHERBD

GROUP 3

A9 CABLE LOOP ASSY
(08660-60045)

A9A1 DIGITAL PROGRAM
ASSY (08660-60037)

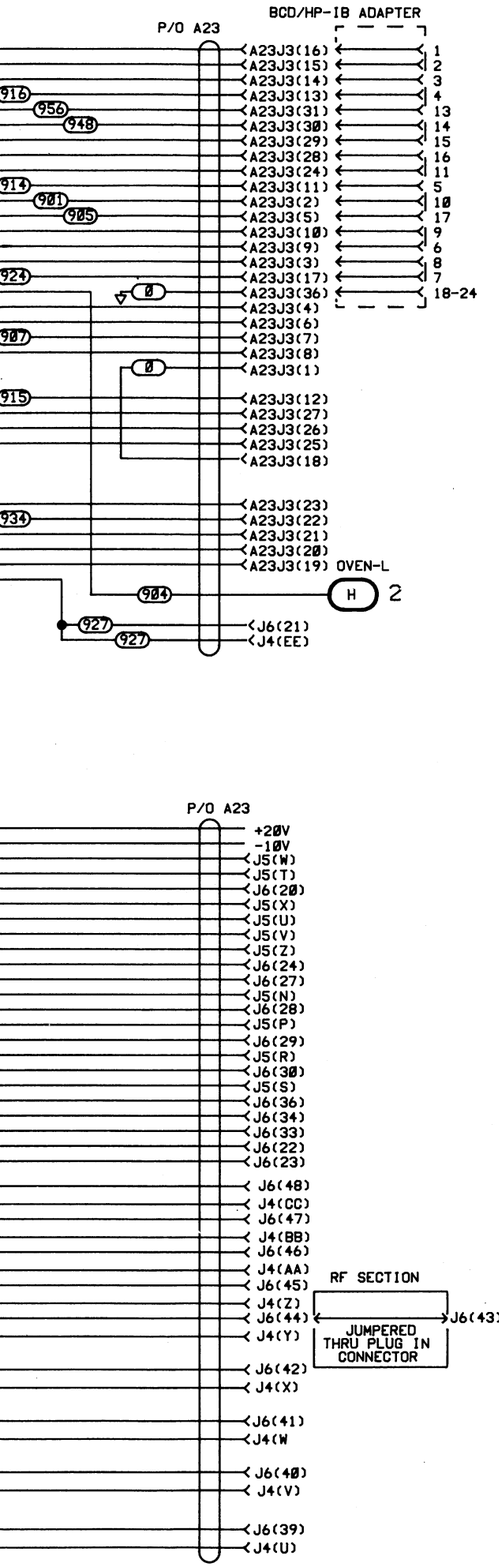
P/O A2 MOTHER

SERIAL PREFIX: 2718A

RF SECTION

JUMPERED THRU PLUG IN CONNECTOR

Figure 8-3



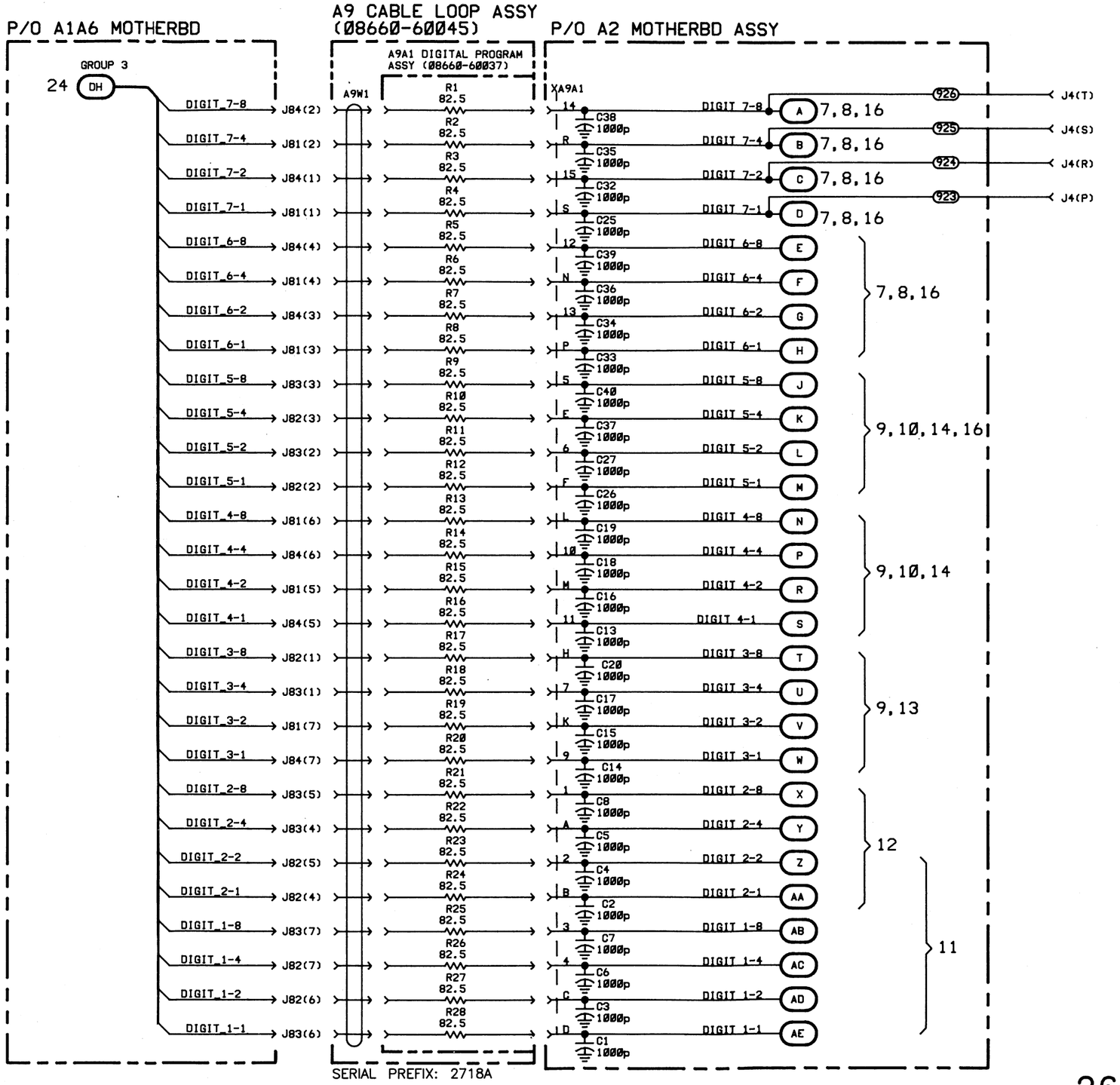
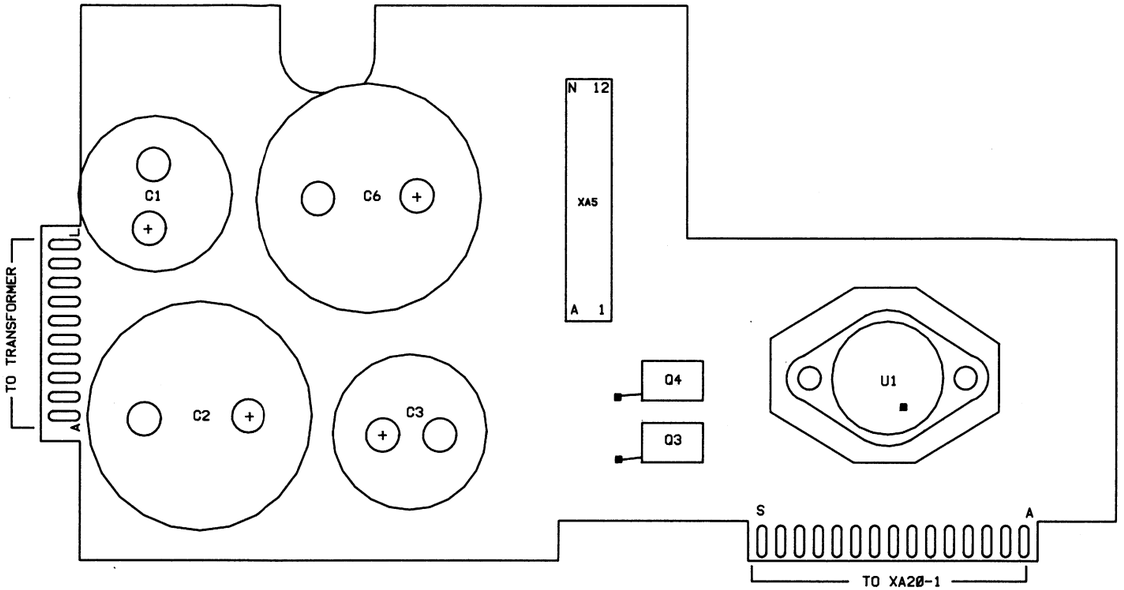
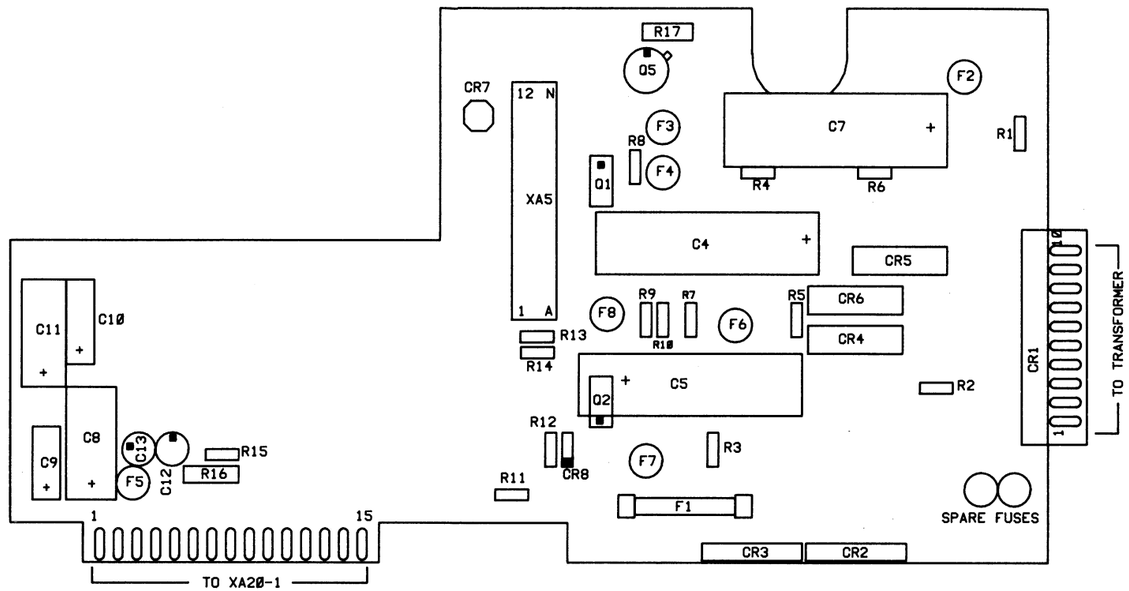


Figure 8-35 Front/Rear Jumpers, Cable Loop Assembly

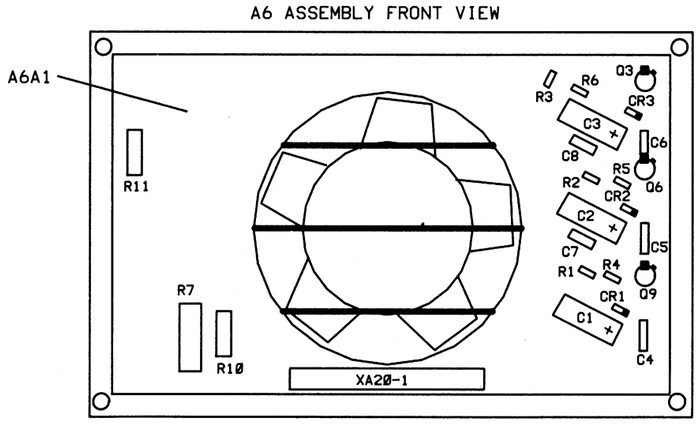


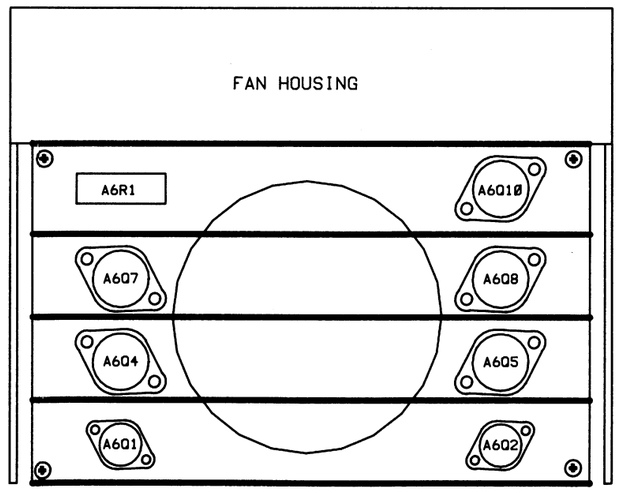
A20 TOP VIEW



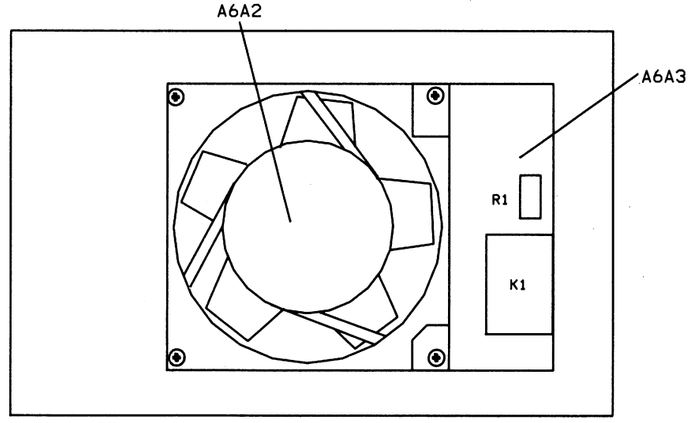
A20 BOTTOM VIEW

A6 INTERNAL VIEW





A6 INTERNAL VIEW



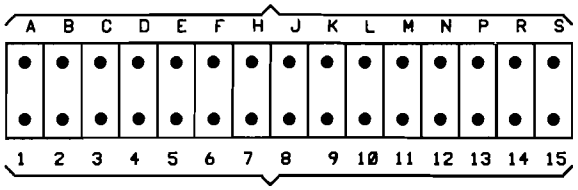
FRONT/REAR JUMPERS, SEE REVERSE SIDE CABLE LOOP ASSY

SS26

NOTES:

1. For an explanation of schematic symbols, see "SCHEMATIC DIAGRAM NOTES" in Section 8.
2. L1 is part of A22 assembly.

PIN IDENTIFICATION SOLDER SIDE OF PCB



PIN IDENTIFICATION COMPONENT SIDE OF PCB

A5

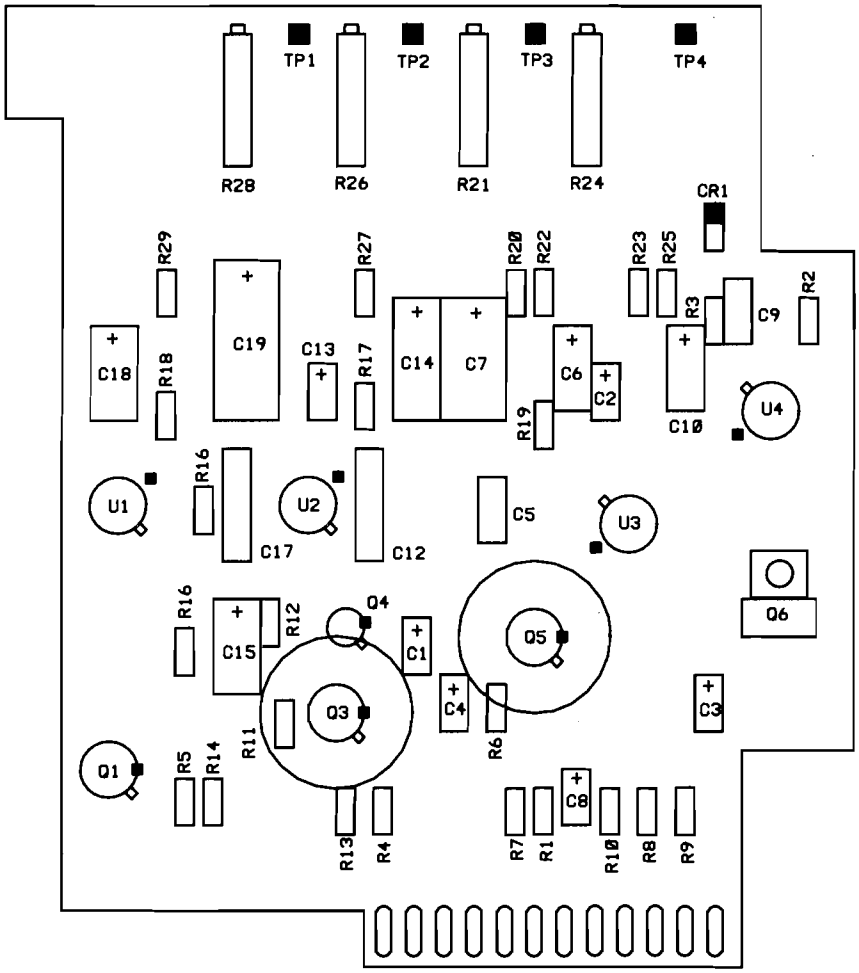


Figure 8-36. Service Sheet 27 Information.

A6A2
B1
P/O A6A3 FAN RELAY ASSY (08660-60388)
R1 270
P/O A6A1 ASSY
+30Vdc
THIS PAGE
P/O XA20-1
P/O A20 ASSY
NC
A7 LINE MODULE (0960-0443)
POWER CABLE
F1
RT1
C1 0.1
LINE VOLTAGE 100, 120,220,240 VAC +5% -10% 50-400 Hz
LINE VOLTAGE SELECTOR CARD
100 VAC
120 VAC
200 VAC
240 VAC

A20 RECTIFIER BOARD ASSEMBLY (08660-60390)
T1
R1 10K
C1 3900
CR2
F5 3A
U1
C13 1uF
R15 237
C12 1uF
R16 5.11K
+30V TO OVEN
J 2
CR1
F6 3A
+30V
J6(5)
R7 10K
Q1
R8 19.6K
R9 10K
R2 10K
C2 18K
CR3
F1 10A
Q2
R10 19.6K
Q3
THIS PAGE
F7 3A
R3 10K
C3 3600
R11 10K
R12 12.1K
CR8
F8 3A
Q4
CR5
R4 10K
C6 3900
R13 13.3K
R14 51.1K
CR4
F4 3A
R5 10K
C4 470
F3 3A
C5 470
F2 3A
R17 19.6K
CR6
R6 10K
C7 1900
Q5
+21V
J6(1)
-21V
J6(2)
A23J7
A1A6W1J1
+4V
ON/STBY
GND
+5.25V
KL 22
SERIAL PREFIX: 2718A

A6A1 PREREGULATOR ASSY (08660-60333)
P/O
+30Vdc
THIS PAGE
A608
TP1
A607
P/O XA20-1
R7 .5
Q9
TP4
R4 422
CR1 24.9V
+24.9V
C7 .1
C4 .1
R1 422
C1 50
A6Q10
A6R1 0.165
TP3
A605
A604
R10 .39
R2 261
Q6
TP6
R5 261
CR2 14.8V
-14.8V
C8 .1
C5 .1
C2 50
A6Q2
A6Q1
TP2
R11 2.2
R3 1210
Q3
TP5
R6 1210
CR3 46.4V
-48V
C9 .1
C6 .1
C3 10
SERIAL PREFIX: 2718A

A6A1 PREREGULATOR ASSY (08660-60333)

P/O A20

A5 REGULATOR ASSY (08660-60327)

+30Vdc

THIS PAGE

TP1

A6Q8

A6Q7

P/O XA20-1

P/O XA5

R7 .5

C8 50

+20V

+20.8V

+20.00V

TP3

R6 75

R1 68.1

R7 1000

C5 300p

C7 10

R19 17.8K

R20 1470

R21 200

R22 1780

+23.1V

+23.9V

+1.7V

U3

Q5

C2 1.0

C6 47

C4 1.0

Q9

TP4

R4 422

CR1 24.9V

C4 .1

+24.9V

C7 .1

R1 422

C1 50

THIS PAGE

+5.25V

TP4

A6Q10

92

A6R1 0.165

92

C9 33

CR7 12

+6.6V

R2 10

CR1 5.62V

R8 100

R9 68.1

R10 383

+4.0V

+9.6V

+10.5V

C9 330p

R23 3480

R24 500

R25 1620

U4

Q6

C3 1.0

C10 47

C8 1.0

TP3

A6Q5

A6Q4

R10 .39

R2 261

Q6

TP6

R5 261

CR2 14.8V

C5 .1

-14.8V

C8 .1

C2 50

THIS PAGE

N

L

R3 261

-10.00V

TP2

Q4

R11 10K

C1 1.0

R12 1000

-9.8V

-10.9V

Q3

R4 68.1

C10 22

-10V

C20 .047

R13 51.1

U2

R26 1000

-5.0V

C12 .022

R17 2370

C13 1.0

C14 100

R27 4640

-12.8V

-13.5V

A6Q2

A6Q1

R11 2.2

TP2

-40.00V

TP1

Q2

R14 38.3K

C15 1.0

R15 1100

-40.9V

Q1

R5 68.1

C11 20

-40V

C21 .047

R16 51.1

U1

R28 5000

-20V

C17 .001

R18 2370

C18 1.0

C19 50

R29 17.8K

-45.8V

-40.6V

R3 1210

TP5

Q3

R6 1210

CR3 46.4V

C6 .1

-48V

C9 .1

C3 10

SERIAL PREFIX: 2718A

27

Figure 8-37 Rectifier Board, Preregulator

Schematic Diagram Notes

Table 8-10 summarizes the symbology used in presenting many devices found in the instrument. The logic symbols used in this manual are based on the Institute of Electrical and Electronic Engineers (IEEE) in IEEE-STD 91-1984, *Graphic Symbols for Logic Functions*. This publication may be purchased from:

Institute of Electrical and Electronic Engineers
345 East 47th Street
New York, NY 10017

Table 8-10. *Schematic Diagram Notes (1 of 12)*

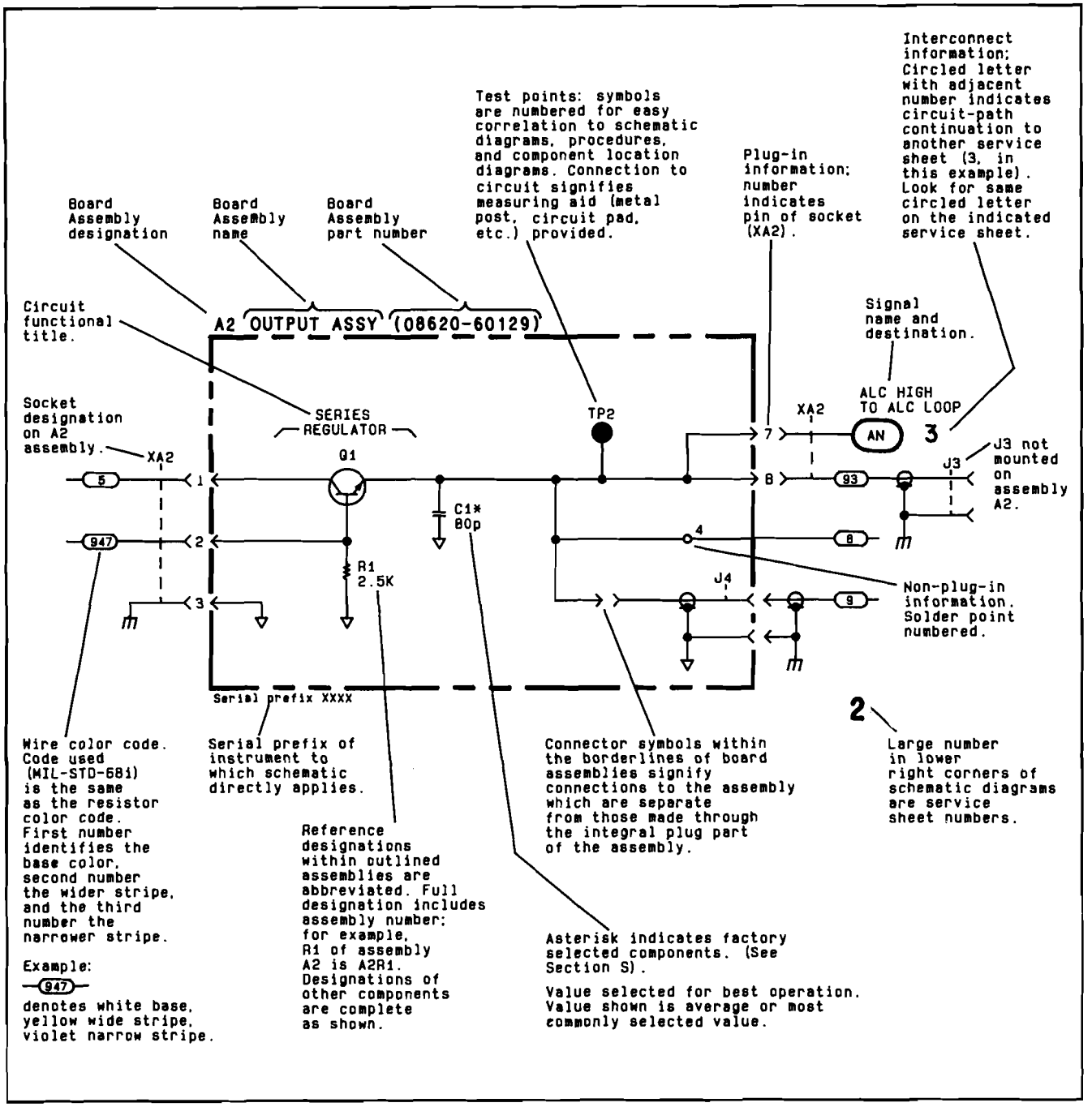


Table 8-10. *Schematic Diagram Notes (2 of 12)*

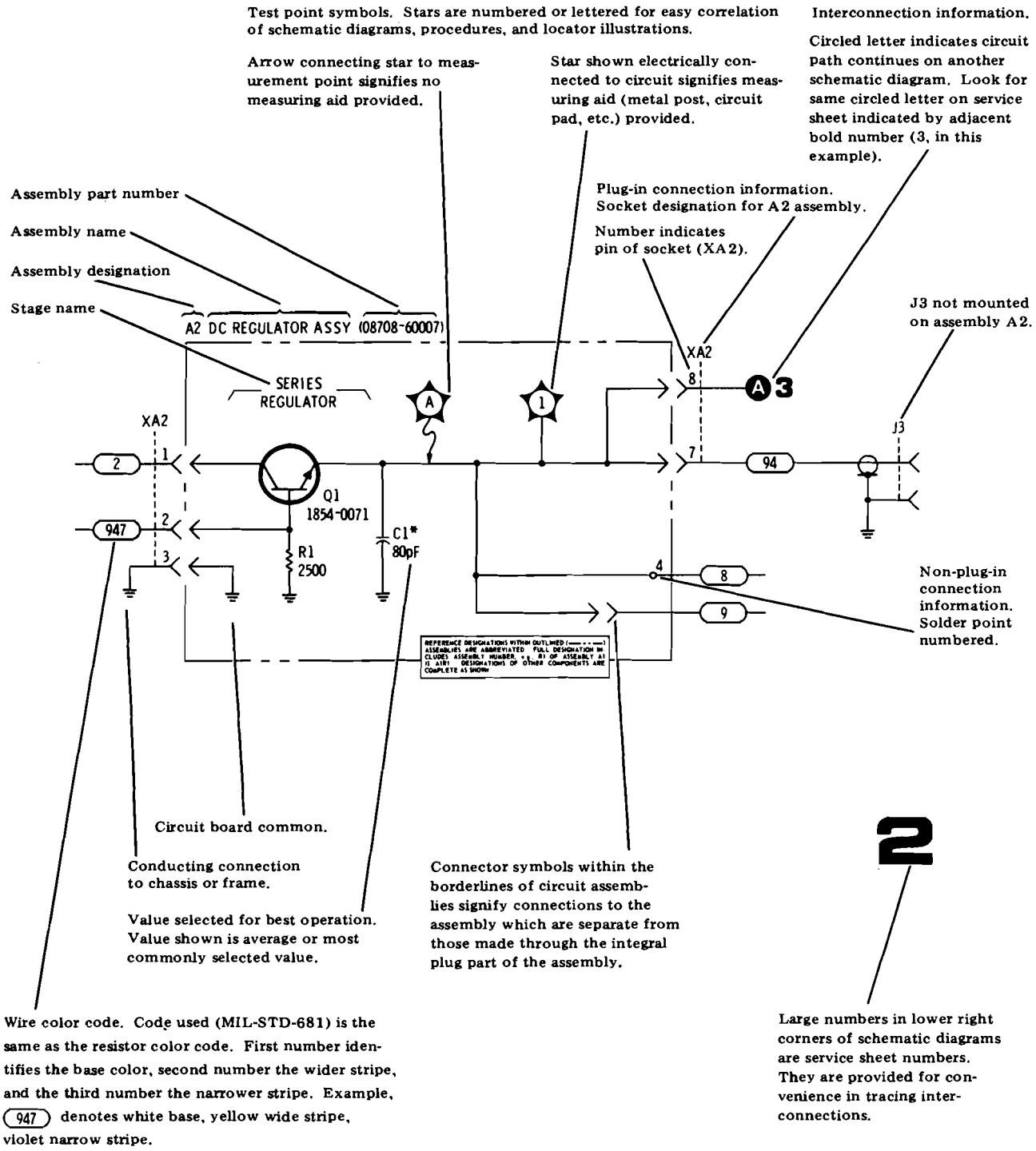


Table 8–10. *Schematic Diagram Notes (3 of 12)*

Values for all components are marked in units of farads, henries, and ohms unless otherwise specified.

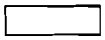
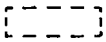
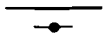
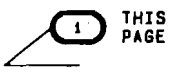
*	Asterisk denotes a factory-selected value. Value shown is typical. See Section V.
	Tool-aided adjustment.
	Encloses front-panel designation.
	Encloses rear-panel designation
	Circuit assembly borderline.
	Other assembly borderline.
	Heavy line with arrows indicates path and direction of main signal.
	Heavy dashed line with arrows indicates path and direction of main feedback.
	Indicates stripline (i.e., RF transmission line above ground).
	Wiper moves toward cw with clockwise rotation of control (as viewed from shaft or knob).
	Numbered Test Point measurement aid provided.
	Encloses wire or cable color code. Code used is the same as the resistor color code. First number identifies the base color, second number identifies the wider stripe, and the third number identifies the narrower stripe, e.g., (947) denotes white base, yellow wide stripe, violet narrow stripe.
	A direct conducting connection to earth, or a conducting connection to a structure that has a similar function (e.g., the frame of an air, sea, or land vehicle).
	A conducting connection to a chassis or frame.
	Common connections. All like-designation points are connected.
	Letter = off-page connection. Number = Service Sheet number for off-page connection. In the example, signal flow is continued on Service Sheet 12, at the point marked.
	Number (only) = on-page connection.

Table 8–10. *Schematic Diagram Notes (4 of 12)*

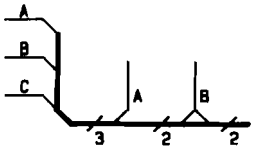
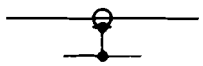
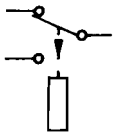
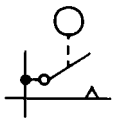
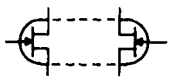
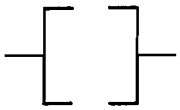
	Indicates multiple paths represented by only one line. Letters or names identify individual paths. Numbers indicate number of paths represented by the line.
	Coaxial or shielded cable.
	Ferrite bead. (Increases the self-inductance of the conductor passing through the bead.)
	Relay. Contact moves in direction of arrow when energized.
	Indicates a pushbutton switch with a momentary (ON) position.
	Feedthrough capacitor. (Acts as a feedthrough terminal when mounted on a chassis or a frame.)
	Indicates a PIN diode.
	Indicates a current regulation diode.
	Indicates a voltage regulation diode.
	Indicates a capacitive (varactor) diode.
	Indicates a Schottky (hot-carrier) diode.
	Light-emitting diode.
	Multiple transistors in a single package—physical location of the pins is shown in package outline on schematic.
	Identification of logic families as shown (in this case, ECL).

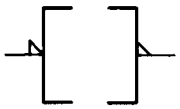
Table 8–10. Schematic Diagram Notes (5 of 12)

DIGITAL SYMBOLOGY REFERENCE INFORMATION

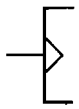
Input and Output Indicators



Implied Indicator—Absence of polarity indicator (see below) implies that the active state is a relative high voltage level. Absence of negation indicator (see below) implies that the active state is a relative high voltage level at the input or output.

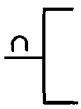


Polarity Indicator—The active state is a relatively low voltage level.



Dynamic Indicator—The active state is a transition from a relative low to a relative high voltage level.

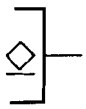
Inhibit Input—Input that, when active, inhibits (blocks) the active state outputs of a digital device.



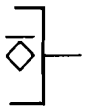
Analog Input—Input that is a continuous signal function (e.g., a sine wave).

Polarity Indicator used with Inhibit Indicator—Indicates that the relatively low level signal inhibits (blocks) the active state outputs of a digital device.

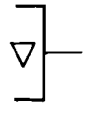
Output Delay—Binary output changes state only after the referenced input (m) returns to its inactive state (m should be replaced by appropriate dependency or function symbols).



Open Collector Output.



Open Emitter Output.



Three-state Output—Indicates outputs can have a high impedance (disconnect) state in addition to the normal binary logic states.

Table 8-10. Schematic Diagram Notes (6 of 12)

DIGITAL SYMBOLOGY REFERENCE INFORMATION

Combinational Logic Symbols and Functions

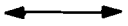
Σ	Summing Junction—Outputs added together at a common point.
&	AND—All inputs must be active for the output to be active.
≥1	OR—One or more inputs being active will cause the output to be active.
≥m	Logic Threshold—m or more inputs being active will cause the output to be active (replace m with a number).
=1	EXCLUSIVE OR—Output will be active when one (and only one) input is active.
=m	m and only m—Output will be active when m (and only m) inputs are active (replace m with a number).
=	Logic Identity—Output will be active only when all or none of the inputs are active (i.e., when all inputs are identical, output will be active).
	Amplifier—The output will be active only when the input is active (can be used with polarity or logic indicator at input or output to signify inversion).
X/Y	Signal Level Converter—Input level(s) are different than output level(s).
	Bilateral Switch—Binary controlled switch which acts as an on/off switch to analog or binary signals flowing in both directions. Dependency notation should be used to indicate affecting/affected inputs and outputs. Note: amplifier symbol (with dependency notation) should be read to indicate unilateral switching.
X→Y	Coder—Input code (X) is converted to output code (Y) per weighted values or a table.
(Functional Labels)	The following labels are to be used as necessary to ensure rapid identification of device function.
MUX	Multiplexer—The output is dependent only on the selected input.
DEMUX	Demultiplexer—Only the selected output is a function of the input.
CPU	Central Processing Unit

Table 8-10. *Schematic Diagram Notes (7 of 12)*

DIGITAL SYMBOLOGY REFERENCE INFORMATION

Sequential Logic Functions

1	Monostable—Single shot multivibrator. Output becomes active when the input becomes active. Output remains active (even if the input becomes inactive) for a period of time that is characteristic of the device and/or circuit.
G 	Oscillator—The output is a uniform repetitive signal which alternates between the high and low state values. If an input is shown, then the output will be active if an only if the input is in the active state.
FF	Flip-Flop—Binary element with two stable states, set and reset. When the flip-flop is set, its outputs will be in their active states. When the flip-flop is reset, its outputs will be in their inactive states.
T	Toggle Input—When active, causes the flip-flop to change states.
S	Set Input—When active, causes the flip-flop to set.
R	Reset Input—When active, causes the flip-flop to reset.
J	J Input—Analogous to set input.
K	K Input—Analogous to reset input.
D	Data Input—Always enabled by another input (generally a C input—see Dependency Notation). When the D input is dependency-enabled, a high level at D will set the flip-flop; a low level will reset the flip-flop. Note: strictly speaking, D inputs have no active or inactive states—they are just enabled or disabled.
+m	Count-Up Input—When active, increments the contents (count) of a counter by "m" counts (m is replaced with a number).
−m	Count-Down Input—When active, decrements the contents (count) of a counter by "m" counts (m is replaced with a number).
→m	Shift Right (Down) Input—When active, causes the contents of a shift register to shift to the right or down "m" places (m is replaced with a number).
←m	Shift Left (Up) Input—When active, causes the contents of a shift register to shift to the left or up "m" places (m is replaced with a number).

NOTE

For the four functions shown above, if m is one, it is omitted.

(Functional Labels)	The following functional labels are to be used as necessary in symbol build-ups to ensure rapid identification of device function.
mCNTR	Counter—Array of flip-flops connected to form a counter with modules m (m is replaced with a number that indicates the number of states: 5 CNTR, 10 CNTR, etc.).

Table 8–10. Schematic Diagram Notes (8 of 12)

DIGITAL SYMBOLOGY REFERENCE INFORMATION

Sequential Logic Functions (Cont'd)

REG	Register—Array of unconnected flip-flops that form a simple register or latch.
SREG	Shift Register—Array of flip-flops that form a register with internal connections that permit shifting the contents from flip-flop to flip-flop.
ROM	Read Only Memory—Addressable memory with read-out capability only.
RAM	Random Access Memory—Addressable memory with read-in and read-out capability.

Dependency Notation

Cm	Control Dependency—Binary affecting input used where more than a simple AND relationship exists between the C input and the affected inputs and outputs (used only with D-type flip-flops).
Gm	Gate (AND) Dependency—Binary affecting input with an AND relationship to those inputs or outputs labeled with the same identifier. The m is replaced with a number or letter (the identifier).
Vm	OR Dependency—Binary affecting input with an OR relationship to those inputs or outputs labeled with the same identifier. The m is replaced with a number or the letter (the identifier).
mAm	Address Dependency—Binary affecting inputs of affected outputs. The m prefix is replaced with a number that differentiates between several address inputs, indicates dependency, or indicates demultiplexing of address inputs and outputs. The m suffix indicates the number of cells that can be addressed.
ENm	Enable Dependency—Binary affecting input which, when active enables all outputs. When inactive open-collector and open-emitter outputs are off, and three-state outputs are at an external high impedance state. When the enable input affects only certain inputs and outputs, they will be numbered to indicate the logic connection.
Xm	Transmission Dependency—Binary affecting input which bidirectionally connects dependent inputs and outputs.
Mm	Mode Dependency—Binary affecting input used to indicate that the effects of particular inputs and outputs of an element depend on the mode in which the element is operating. The m is replaced with a number or letter (the identifier).
Zm	Interconnection Dependency—Indicates the existence of internal logic connections between inputs, outputs, internal inputs, and/or internal outputs. The m is replaced with a number (the identifier).
,	Comma—AND Function.
/	Slant—OR Function.

NOTE

The identifier (m) is omitted if it is one—that is, when there is only one dependency relationship of that kind in a particular device. When this is done, the dependency indicator itself (G, C, EN, or V) is used to prefix or suffix the affected (dependent) input or output.

Table 8-10. *Schematic Diagram Notes (9 of 12)*

DIGITAL SYMBOLOGY REFERENCE INFORMATION

Miscellaneous

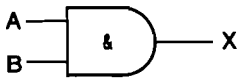
Schmitt Trigger—Input characterized by hysteresis; one threshold for positive going signals and a second threshold for negative going signals.

Active

Active State—A binary physical or logical state that corresponds to the true state of an input, an output, or a function. The opposite of the inactive state.

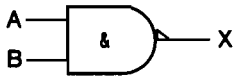
Table 8–10. *Schematic Diagram Notes (10 of 12)*

AND GATE



A	B	X
H	H	H
H	L	L
L	H	L
L	L	L

NAND GATE



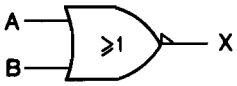
A	B	X
H	H	L
H	L	H
L	H	H
L	L	H

OR GATE WITH INVERTED INPUTS

OR GATE

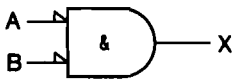
A	B	X
H	H	H
H	L	H
L	H	H
L	L	L

NOR GATE

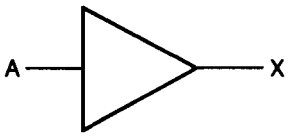


A	B	X
H	H	L
H	L	L
L	H	L
L	L	H

AND GATE WITH INVERTED INPUTS

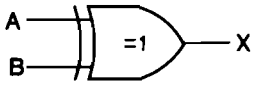


BUFFER

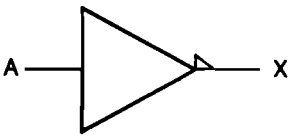


A	X
H	H
L	L

EXCLUSIVE-OR GATE



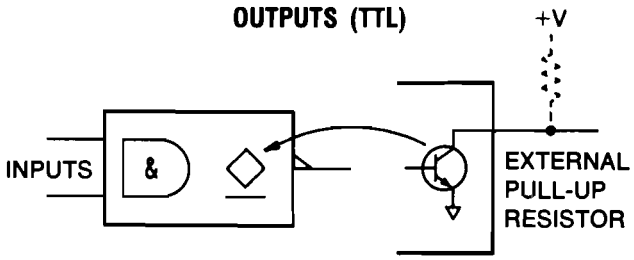
A	B	X
H	H	L
H	L	H
L	H	H
L	L	L



A	X
H	L
L	H

INVERTER

OPEN COLLECTOR OUTPUTS (TTL)



OPEN EMITTER OUTPUTS (ECL)

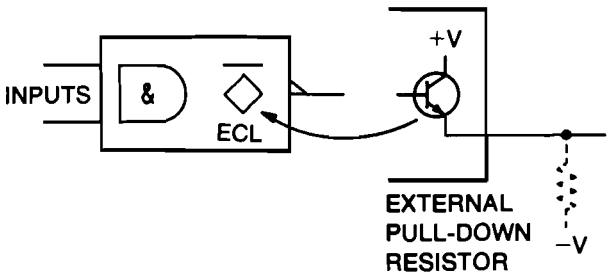
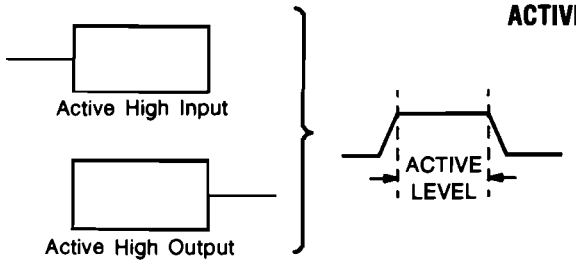
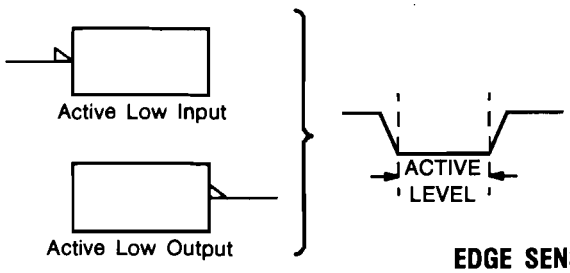


Table 8–10. Schematic Diagram Notes (11 of 12)

ACTIVE LEVELS

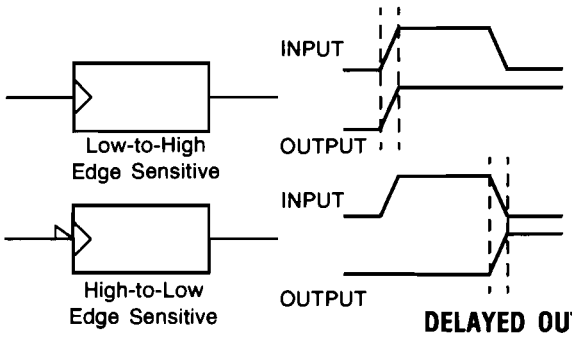


ACTIVE HIGH inputs and outputs are indicated by the absence of the polarity indicator symbol.



ACTIVE LOW inputs and outputs are indicated by the presence of the polarity indicator symbol (▷).

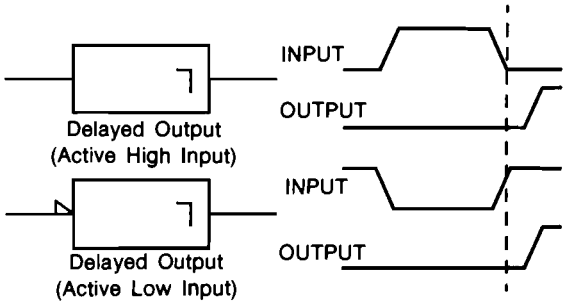
EDGE SENSITIVE INPUTS



EDGE SENSITIVE (low-to-high) inputs are indicated by the presence of the dynamic indicator symbol (—▷).

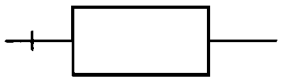
EDGE SENSITIVE (high-to-low) inputs are indicated by the presence of both the dynamic indicator and the polarity indicator symbols (—▷).

DELAYED OUTPUT RESPONSE



OUTPUT DELAY indicator symbol (⌐) shows that the output becomes effective *after* the input signal returns to its inactive state.

INHIBIT INPUTS

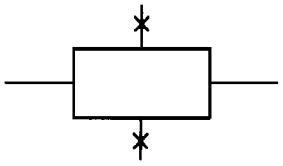


INHIBIT indicator symbol (+) indicates an input that, when active, inhibits (blocks) the output(s) from achieving their active states (the outputs remain inactive).

ANALOG LINES

ANALOG indicator symbol (∩) indicates a line that has an analog input or output.

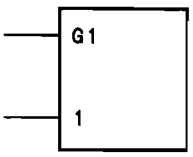
NONLOGIC CONNECTION



The Nonlogic Connection symbol (X) indicates a connection that does not carry any logic information.

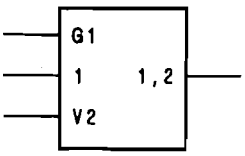
Table 8–10. *Schematic Diagram Notes (12 of 12)*

AND



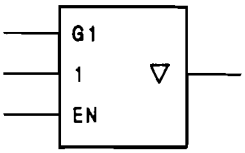
The input that controls or gates other inputs is labeled with a C or a G, followed by an identifying number.
The controlled or gated input or output is labeled with the same number. In this example, 1 is controlled by G1.

OR



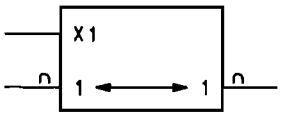
When a V input is active, the output will be in its active state. With the V input inactive, the device functions as if the V input doesn't exist.

ENABLE



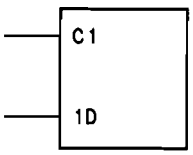
When the EN input is active, the output is enabled to function normally. When the EN input is inactive, the three-state output (▽), in this case, becomes a high impedance, effectively removing that device from the circuit.

TRANSMISSION

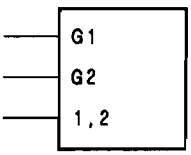


When the X1 input is active, the associated input-output pair are bi-directionally connected together. When X1 is inactive, the connection is broken.

CONTROL

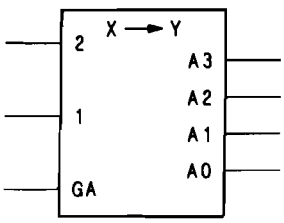


When the controlled or gated input or output already has a functional label (D is used here), that label will be prefixed by the identifying number.



If the input or output is affected by more than one gate or control input, then the identifying numbers of each gate or control input will appear separated by commas.

ADDRESS



When GA is active, the active address line (0 through 3) is the decoded value of the 1 and 2 binary inputs. When the controlled address lines have a functional value, that value will be prefixed by the identifying letter.