Analyzer Repair Inc.

Test Equipment Repair & Calibration

HP 8568A-B

HP 85680B Service Manual Vol1 85680-90137

Need this instrument repaired or calibrated?

Analyzer Repair services spectrum analyzers, network analyzers, signal generators and other RF/microwave test equipment.

Free estimates - visit our website or email us to get started.

www.analyzerrepair.com **manager@analyzerrepair.com**

This manual is provided free as a reference by Analyzer Repair, Inc. All original content remains the property of its original manufacturer. Not for resale.

If you are the rights holder and object to this document being hosted here, email manager@analyzerrepair.com and it will be removed promptly.

Troubleshooting and Repair Manual
Volume 1

HP 85680B and HP 85670A
Spectrum Analyzer RF Section



HP Part No. 85680-90137 Microfiche Part No. 85680-90138
Printed in USA May 1991

Notice

Hewlett-Packard to Agilent Technologies Transition

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. To reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product name/number was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP8648 is now model number Agilent 8648.

The material contained in this document is provided "as is," and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Agilent disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

To contact Agilent Technologies please use the information below;

Online assistance: http://www.agilent.com/find/assist

Americas

Canada 1 877 894 4414	Latin America (305) 269 7500	United States 1 800 829 4444

Asia Pacific

Australia 1 800 629 485	China 800 810 0189	Hong Kong 800 938 693
India 1 800 112 929	Japan 0 120 (421) 345	Korea 080 769 0800
Malaysia 1 800 888 848	Singapore 1 800 375 8100	Taiwan 0800 047 866
Thailand 1 800226 008		

Europe & Middle East

Austria 43 (0) 1 360 277 1571	Belgium 32 (0) 2 404 93 40	Denmark 45 70 13 15 15
Finland 358 (0) 10 855 2100	France 0825 010 700* *0.125 Euros/minute	Germany 49 (0) 7031 464 6333
Ireland 1890 924 204	Israel 972-3-9288-504/544	Italy 39 02 92 60 8484
Netherlands 31 (0) 20 547 2111	Spain 34 (91) 631 3300	Sweden 0200-88 22 55
Switzerland 0800 80 53 53	United Kingdom 44 (0) 118 9276201	

Other European Countries: http://www.agilent.com/find/contactus



Agilent Technologies

Part Number 5969-5831
Printed in USA December 2011

©Copyright Hewlett-Packard Company 1991
All Rights Reserved. Reproduction, adaptation, or translation without prior written permission is prohibited, except as allowed under the copyright laws.
1212 Valley House Drive, Rohnert Park, CA 94928-4999, USA

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Exclusive Remedies

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

Safety Symbols

The following safety symbols are used throughout this manual. Familiarize yourself with each of the symbols and its meaning before operating this instrument.

Caution



The *caution* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a *caution* sign until the indicated conditions are fully understood and met.

Warning



The *warning* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a *warning* sign until the indicated conditions are fully understood and met.

General Safety Considerations

Warning



***Before this instrument is switched on*, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.**

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

Warning



There are many points in the instrument which can, if contacted, cause personal injury. Be extremely careful.

Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

Caution



Before this instrument is switched on, make sure its primary power circuitry has been adapted to the voltage of the ac power source.

Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

Contents

Volume 1

RF Section General Information	General information on the contents of the manual, including storage, shipment, and packaging.
Spectrum Analyzer Overall Troubleshooting	Troubleshooting index, special messages, diagnostic functions, error correction routine, sweep system block diagram and troubleshooting, mnemonics listing, and Spectrum Analyzer Overall Block Diagram.
RF Section Analog Troubleshooting	Phase lock loop operation, start frequency tuning equations, and phase lock troubleshooting.
RF Section Digital Troubleshooting	Instrument preset checks, digital storage verification, and RF Digital Troubleshooting Block Diagram.
A5 Front Panel through A18 275 MHz Phase Lock Oscillator	Service sheets containing circuit descriptions, troubleshooting information, replacement procedures, replaceable parts lists, parts identification, signature analysis troubleshooting diagrams, block diagrams, component locations, and schematic diagrams.

Volume 2

A19 Second IF Amplifier through A27 10 MHz Frequency Standard	Service sheets containing circuit descriptions, troubleshooting information, replacement procedures, replaceable parts lists, parts identification, signature analysis troubleshooting diagrams, block diagrams, component locations, and schematic diagrams.
General Parts Listing	Replaceable parts information and parts identification figures.
Major Assembly and Component Locations	Major assembly and component locations.

General Information

Introduction

This Troubleshooting and Repair Manual contains information for the troubleshooting and repair of the RF Section of the instrument. This information is combined in service sheets and indexed with tabs for quick reference. Also contained in this manual are overall troubleshooting information and illustrations of the instrument that are useful in isolating failures to the RF or IF-Display Section.

Instruments Covered by Manual

This Troubleshooting and Repair manual contains information for the servicing of all HP 85680B RF Sections and all HP 85670A RF Sections. The assemblies of the HP 8568AB Retrofit Kit (HP 8568A to HP 8568B Retrofit Kit) are also covered in this manual. The following HP 85680B RF Sections Options are covered in this manual.

- Option 001 (75Ω Input)
- Option 400 (400 Hz operation)
- Option 462 (Impulse Bandwidths)
- Option H96 (30 Hz-1 MHz Resolution Bandwidths)
- Option H44 (30 Hz-1 MHz Resolution Bandwidths)

The following HP 85670A RF Section Options are covered in this manual.

- Option 001 (75Ω Input)
- Option 400 (400 Hz operation)

How They're Used

- The HP 85680B RF Section is used with the HP 85662A IF-Display Section as the HP 8568B Spectrum Analyzer
- The HP 85670A RF Section is used with the HP 85662A Option 067 IF- Display Section as the HP 8567A Spectrum Analyzer.
- The HP 85680B RF Section is used with the HP 85662A Option 462 IF- Display Section as the HP 8568B Option 462 Spectrum Analyzer
- The HP 85680B Option H96 RF Section is used with the HP 85662A Option H96 IF-Display Section as the HP 8568B Option E96 Spectrum Analyzer
- The HP 85680B Option H44 RF Section is used with the HP 85662A Option H96 IF-Display Section as the HP 8568B Option E44 Spectrum Analyzer

Service Sheets

The service sheets in each volume of this manual are organized in alphanumeric order and are indexed with tabs to make it easy to locate a specific service sheet. Each of the service sheets contain the following information:

- Circuit Description (where practical)
- Troubleshooting Hints (where practical)
- Replaceable Parts List
- Component Location Illustration
- Block Diagram (where practical)
- Schematic Diagram

Repair Procedures

Repair procedures are included for use in removing and replacing assemblies for repair. They are located in the following sections:

- Front-Panel LED Replacement

  Tab: A5

- Front Panel Removal and Repair

  Tab: A5

- SIGNAL INPUT 1 Fuse Replacement Procedure

  Tab: A5

- RF Section Internal Fuse Replacement

  Tab: A25/A26

Major Assembly and Component Locations

Major assembly and component location illustrations for the RF Section are located at the rear of this manual.

Troubleshooting

Troubleshooting information for the RF Section is divided into three levels as follows:

- Instrument Level

  Spectrum Analyzer Overall Troubleshooting

- Section Level

  RF Section Analog Troubleshooting
  RF Section Digital Troubleshooting
  Pilot Third Local Oscillator Block Diagram

- Assembly Level

  Most assemblies have troubleshooting hints immediately following circuit descriptions. Troubleshooting information is also located on assembly level block diagrams, notes, and schematics.

All assemblies are indexed by tab except for the ones listed below. The index tab they can be found under is also listed.

Assembly	Location
A13	Not Assigned
A14	HP 85670A and Option Tabs
A28	Not Assigned
A29 HP-IB Ground	A15 Tab

Printed Circuit Board Edge Connector Contact Cleaning

Materials

- Lint-free cloth or equivalent (HP Part Number 9310-0039, Check Digit 3).
- Solution of 80% electronics-grade isopropyl alcohol and 20% water.
- Static-free work station.

Procedure

1. Dampen the cloth with the alcohol and water solution and scrub the edge connector contacts vigorously, using a circular motion. Polish one side of the board at a time until the contacts shine, keeping the cloth damp to dissolve contaminants and reduce static electricity.
2. Using a clean cloth, dry the contacts by wiping from their inside to outside edge. This prevents particles from building up on the contact edges.

Caution



Do not use erasers to clean the edge connectors. They cause microscopic damage to the contact surface, removing the thin gold plating and exposing the nickel underplating, which eventually corrodes. Erasers also leave a film on the contact and generate static electricity.

Do not use paper of any kind to clean the edge connector contacts. Paper or lint particles left on the edge contact surface can cause intermittent electrical connections.

Do not touch contact or trace surfaces with bare hands. Always handle the board by its edges.

HP-IB Address Selection

The HP-IB address for the HP 8568B is preset at the factory by means of a five-segment binary switch located on the A15 Controller Assembly. This switch is set to the binary number 11111 which corresponds to a decimal equivalent of 31. The number 31 is a special instruction code that commands the instrument to use the last input address stored in memory. This stored HP-IB address is ASCII 2R (decimal 18) and determines the address to be used on "power up."

The HP-IB address may be changed to any of the addresses listed in Table 2 by resetting the HP-IB address switch to correspond to the binary equivalent of the desired ASCII character or decimal value as indicated in the table. The five-segment switch is illustrated in Figure 1 and is shown in its preset position (decimal 31).

Table 1. Cross-Reference Between ASCII, Decimal, and Binary Address Codes

ASCII Character		Decimal Value	5-Bit Binary Equivalent
@	SP	00	00000
A	!	01	00001
B	"	02	00010
C	#	03	00011
D	$	04	00100
E	%	05	00101
F	&	06	00110
G	'	07	00111
H	(	08	01000
I	)	09	01001
J	*	10	01010
K	+	11	01011
L	,	12	01100
M	–	13	01101
N	.	14	01110
O	/	15	01111
P	0	16	10000
Q	1	17	10001
R	2	18	10010
S	3	19	10011
T	4	20	10100
U	5	21	10101
V	6	22	10110
W	7	23	10111
X	8	24	11000
Y	9	25	11001
Z	:	26	11010
[	;	27	11011
\	<	28	11100
]	=	29	11101
⌒	>	30	11110

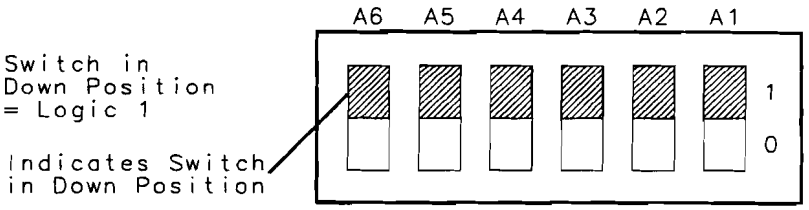


Figure 1. HP-IB Address Switch (Shown in Factory Preset Position)

The HP-IB address may also be changed from the front panel or programmed via a controller using a special shift key function (KSP). This address remains in effect as long as the instrument memory has power from either the ac line or the internal battery. However, if this stored address is lost, the default address is the factory preset decimal 18 (ASCII 2R). For additional information on the HP-IB address, refer to the Operating and Programming Manual.

Storage and Shipment

Environment

The instrument may be stored or shipped in environments within the following limits:

Temperature ..... −40°C to +75°C
Humidity .....5% to 90% at 0° to 40°C
Altitude .....Up to 15,240 meters (50,000 feet)

The instrument should be protected from temperature extremes which might cause condensation within the instrument.

Original Packaging

It is recommended that the original factory packaging materials be retained for use when shipping the instrument. If original packaging material cannot be retained, packaging materials identical to those used in factory packaging are available through Hewlett-Packard offices. Part numbers and descriptions of the packaging materials are listed in Figure 3.

The combined weight of the two instrument sections is approximately 50 kg (112 lbs). Because of the weight involved, do not package the instrument sections fastened together as one unit. The instrument sections must be separated and packaged in separate containers. The quantity of packaging materials in Figure 3 is for only one instrument section.

If the instrument is being returned to Hewlett-Packard for servicing, attach a tag to each carton indicating the type of service required, return address, model number, and full serial number. For your convenience, a supply of tags is included at the end of this section. Also, mark each container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

Other Packaging

If it is necessary to use packaging materials other than the type used in original factory packaging, the following general instructions should be followed.

1. Separate the two instrument sections and wrap each in heavy paper or plastic.

2. Place the instrument sections in separate containers with 8 to 10 cm (3 to 4 inches) of shock-absorbing material around all sides to provide firm cushioning and prevent movement inside the container. Protect front panels with cardboard. Double-wall corrugated cartons of 125 kg (275 lb) bursting strength are sufficient for shipping containers.
3. Seal each container securely and, if shipping to a Hewlett-Packard office or service center, attach a tag to each container indicating the type of service required, return address, model number, and full serial number. For your convenience, a supply of tags is included at the end of this section.
4. Mark each container FRAGILE to assure careful handling.

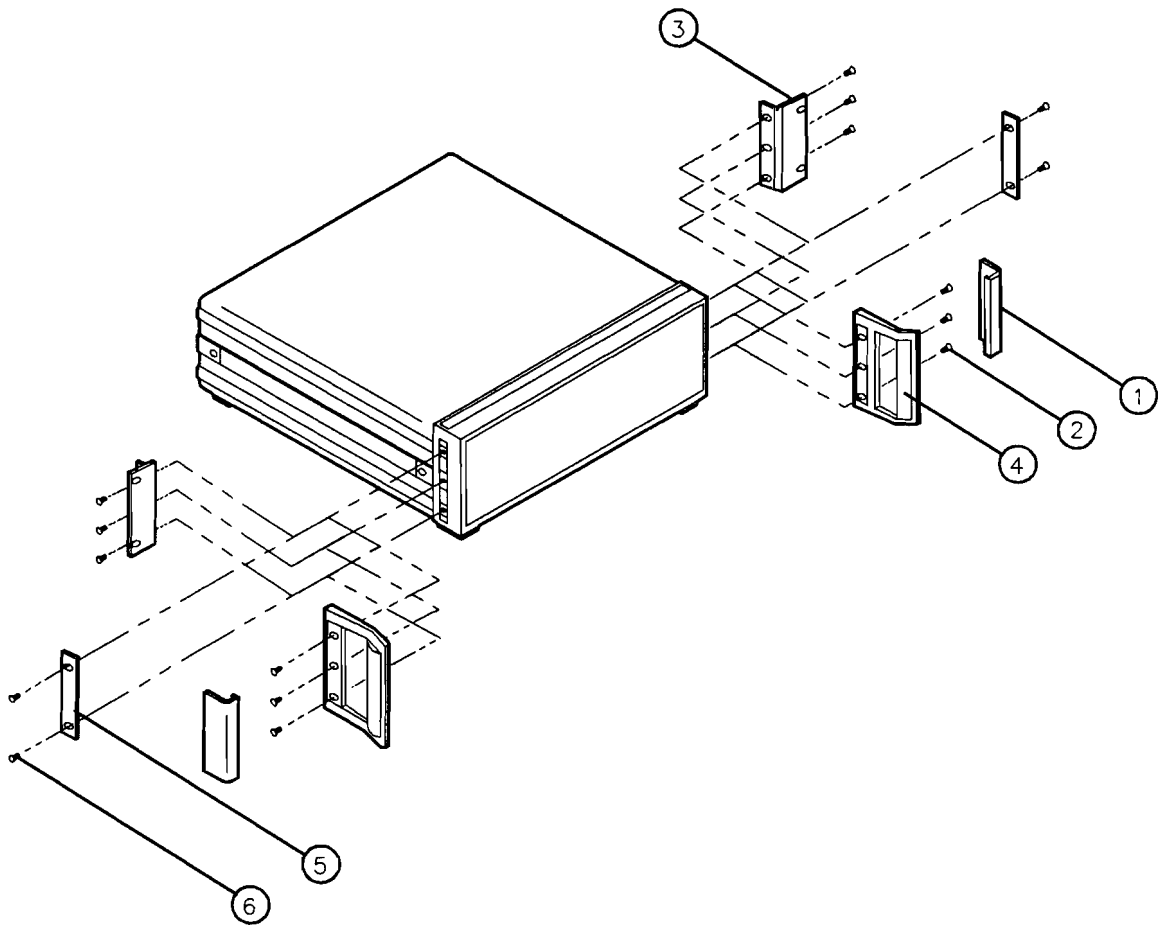
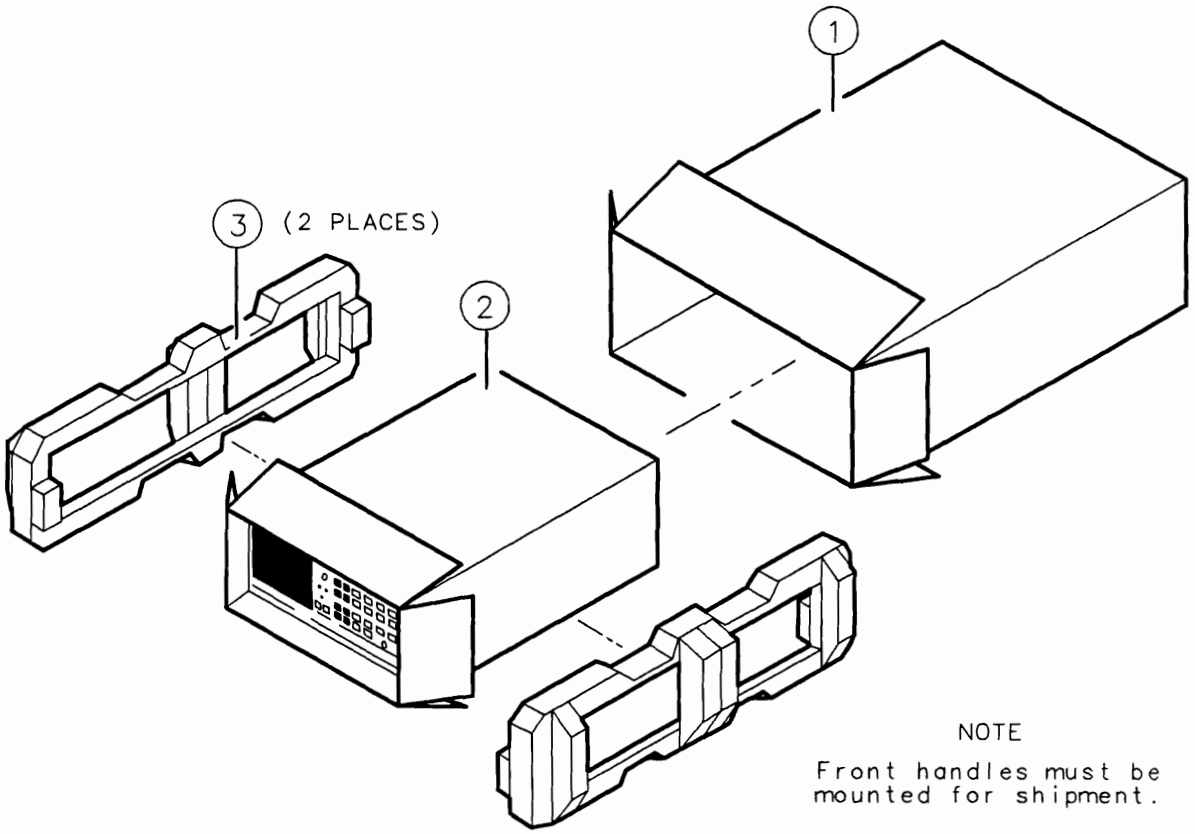


Figure 2. Preparing Instrument Section for Shipment

1. If front handles are installed, remove trim ①.
2. Remove screw ②, thus removing rack mount flanges ③ or front handles ④.
3. Attach shipping bars ⑤ using screws ⑥.



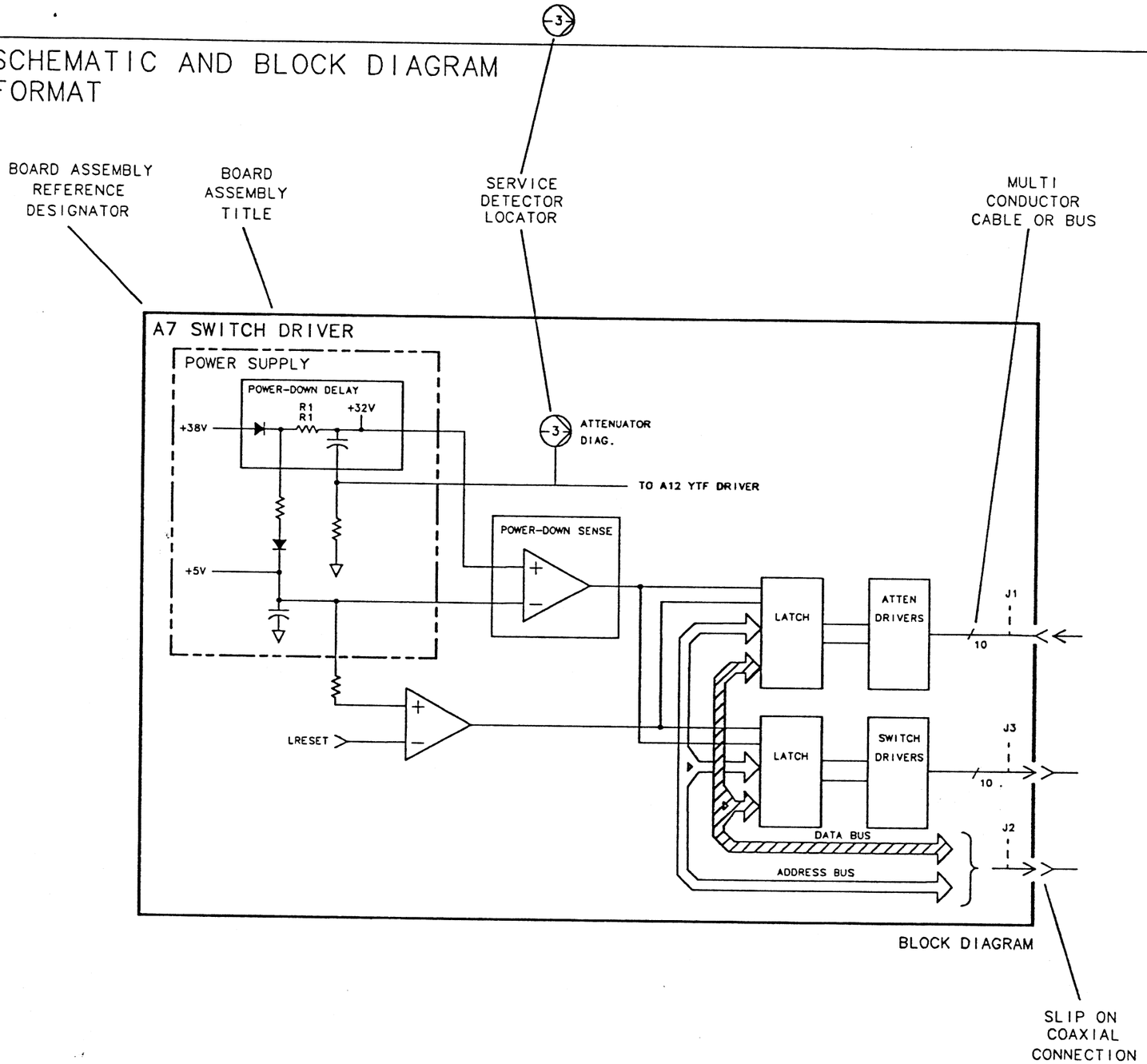
Item	HP Part Number	CD	Qty	Description
1	9211-4487	3	1	OUTER BOX
2	5180-2320	8	1	INNER BOX
3	5180-2319	5	2	INNER FOAM PAD

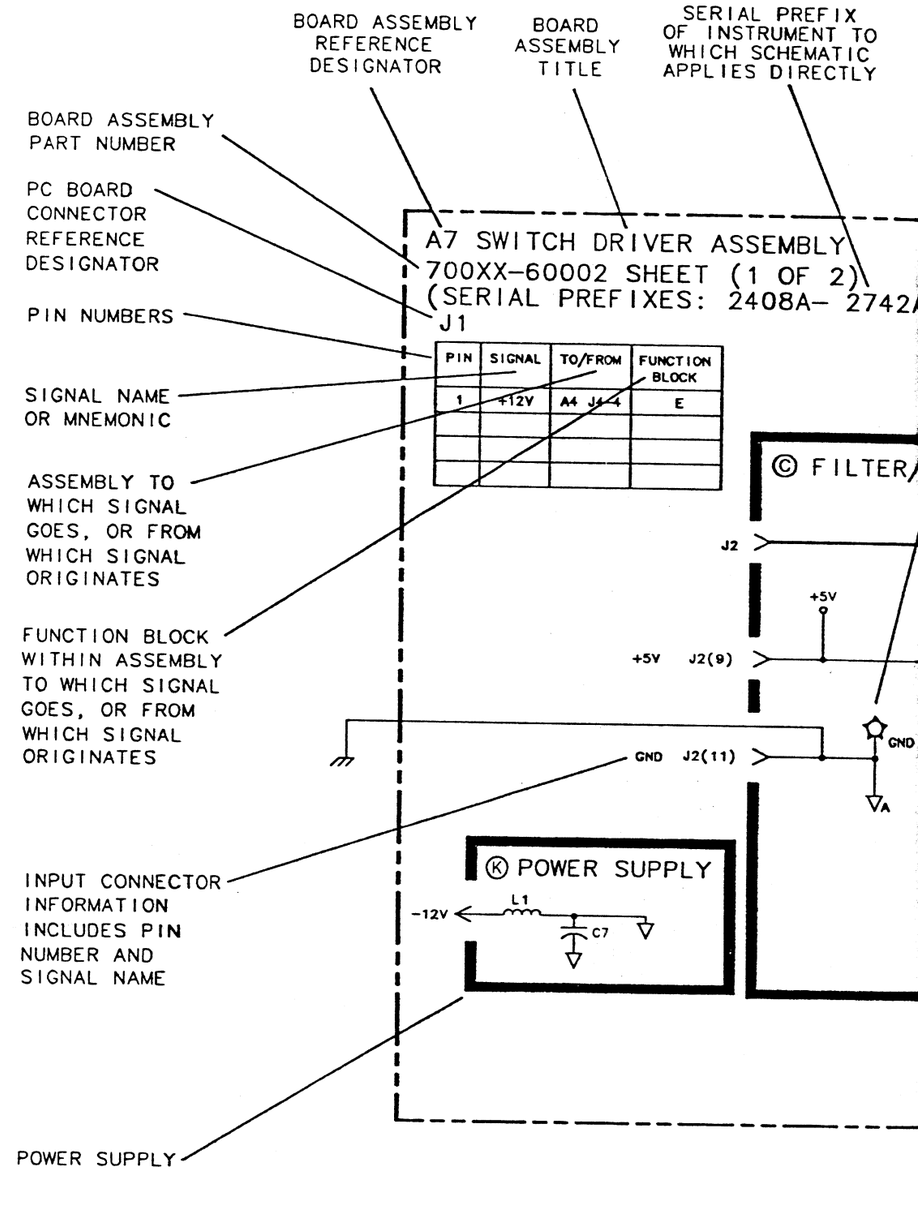
Figure 3. Packaging for Shipment Using Factory Packaging Materials

Recommended Test Equipment

A list of recommended test equipment is contained in the HP 8568B Performance Tests and Adjustments Manual (HP Part Number 08568- 90105). This list includes all of the equipment that is necessary to perform the adjustments and performance tests on the HP 8568B Spectrum Analyzer. The List of Recommended Test Equipment recommends a model number for each piece of equipment and contains minimum specifications so that other equipment may be substituted for the recommended model.

SCHEMATIC AND BLOCK DIAGRAM FORMAT





TEST POINT PROVIDED ON ASSEMBLY

CIRCUIT TITLE

FUNCTION BLOCK DESIGNATOR

FUNCTION BLOCK TITLE

PRIMARY FEEDBACK PATH

NOTES: GENERAL INFORMATION PERTINENT TO SCHEMATIC

PANEL CONNECTOR

SIGNAL NAME AND DESTINATION OR ORIGIN

PRIMARY SIGNAL PATH

CABLE DESIGNATOR

CABLE COLOR CODE

BOARD ASSEMBLY REFERENCE DESIGNATOR

SCHEMATIC DIAGRAM

FORMAT ONLY

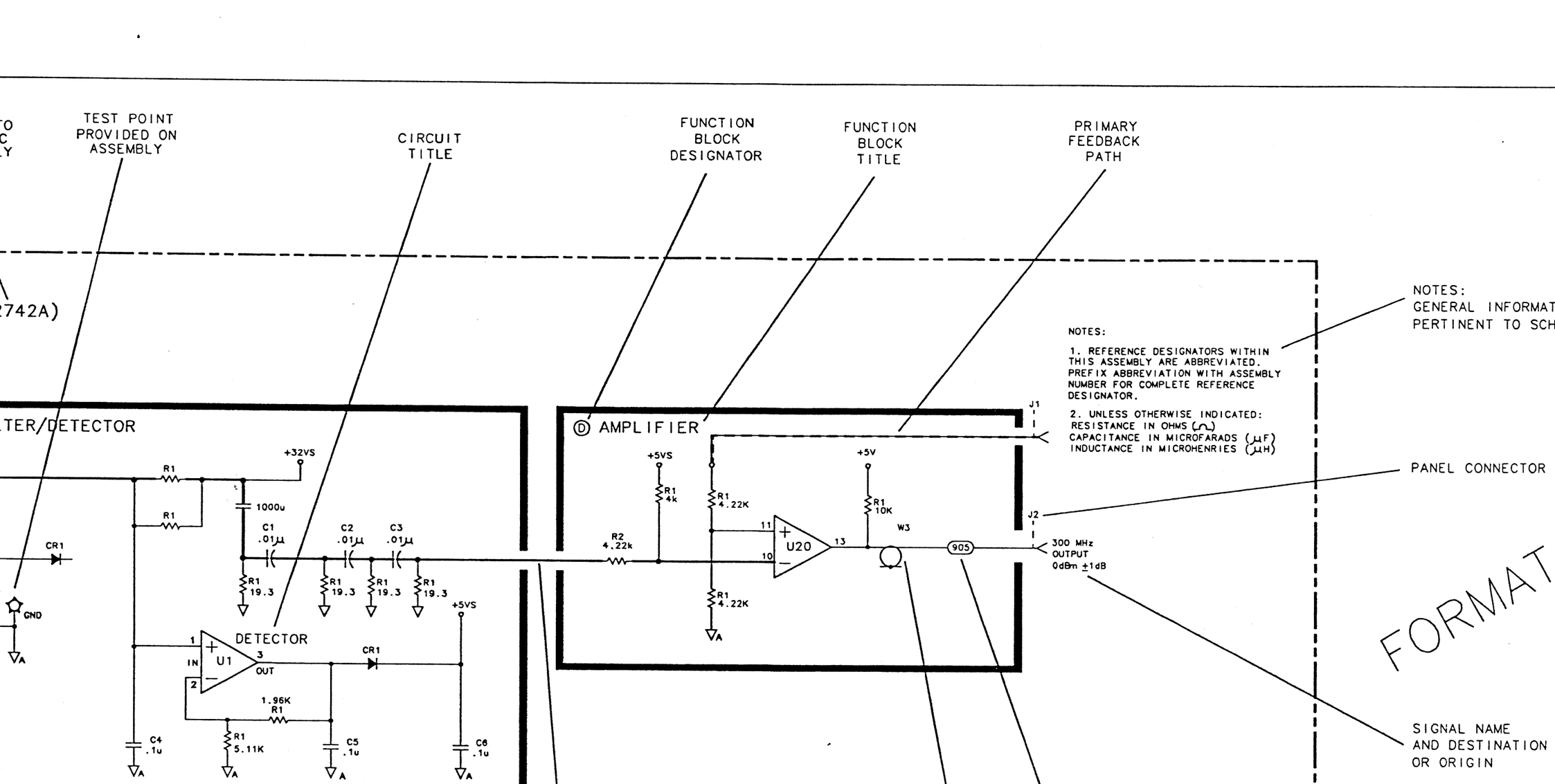


FIGURE 4. SCHEMATIC AND BLOCK DIAGRAM FORMAT

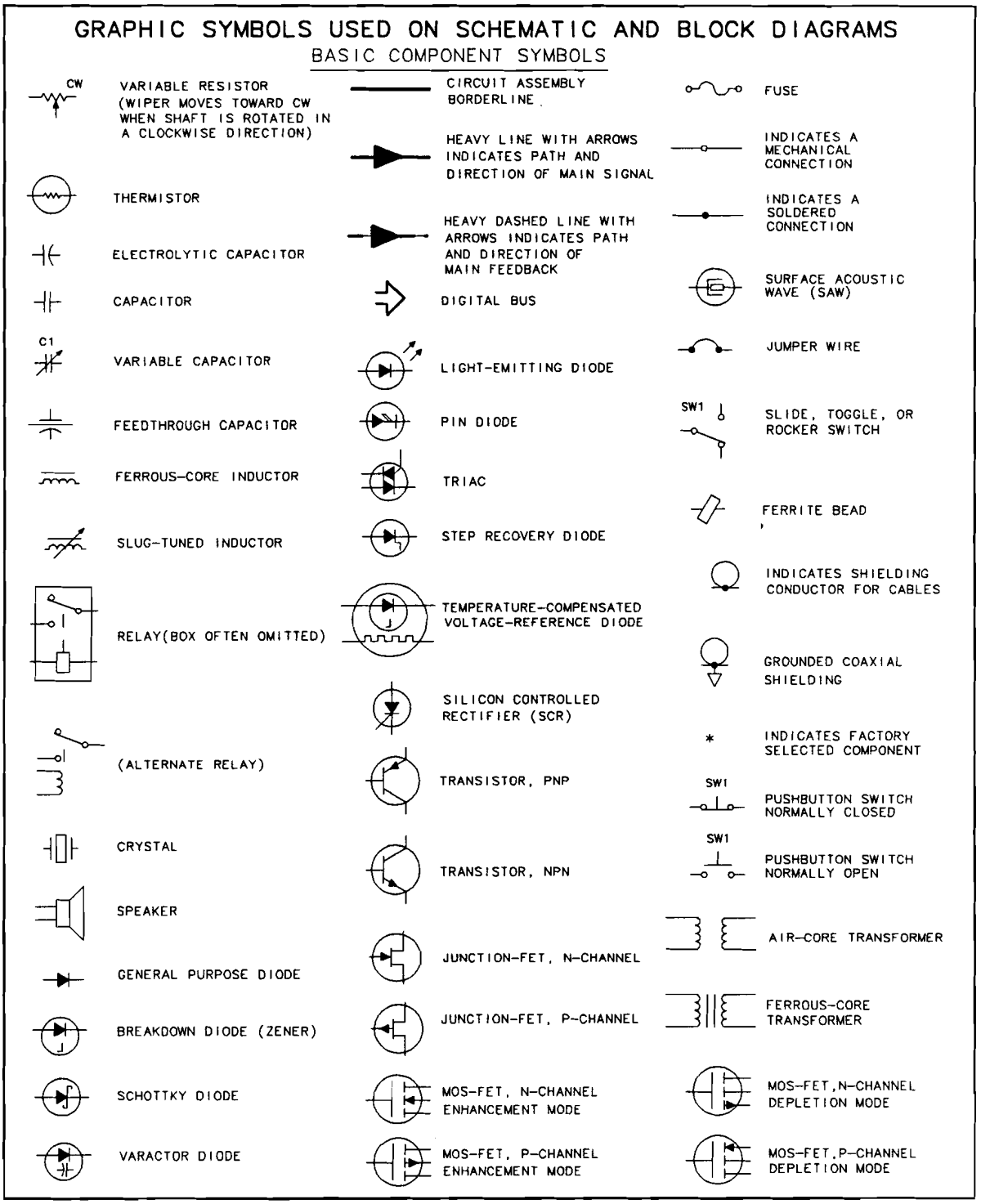


Figure 5. Graphic Symbols (1 of 2)

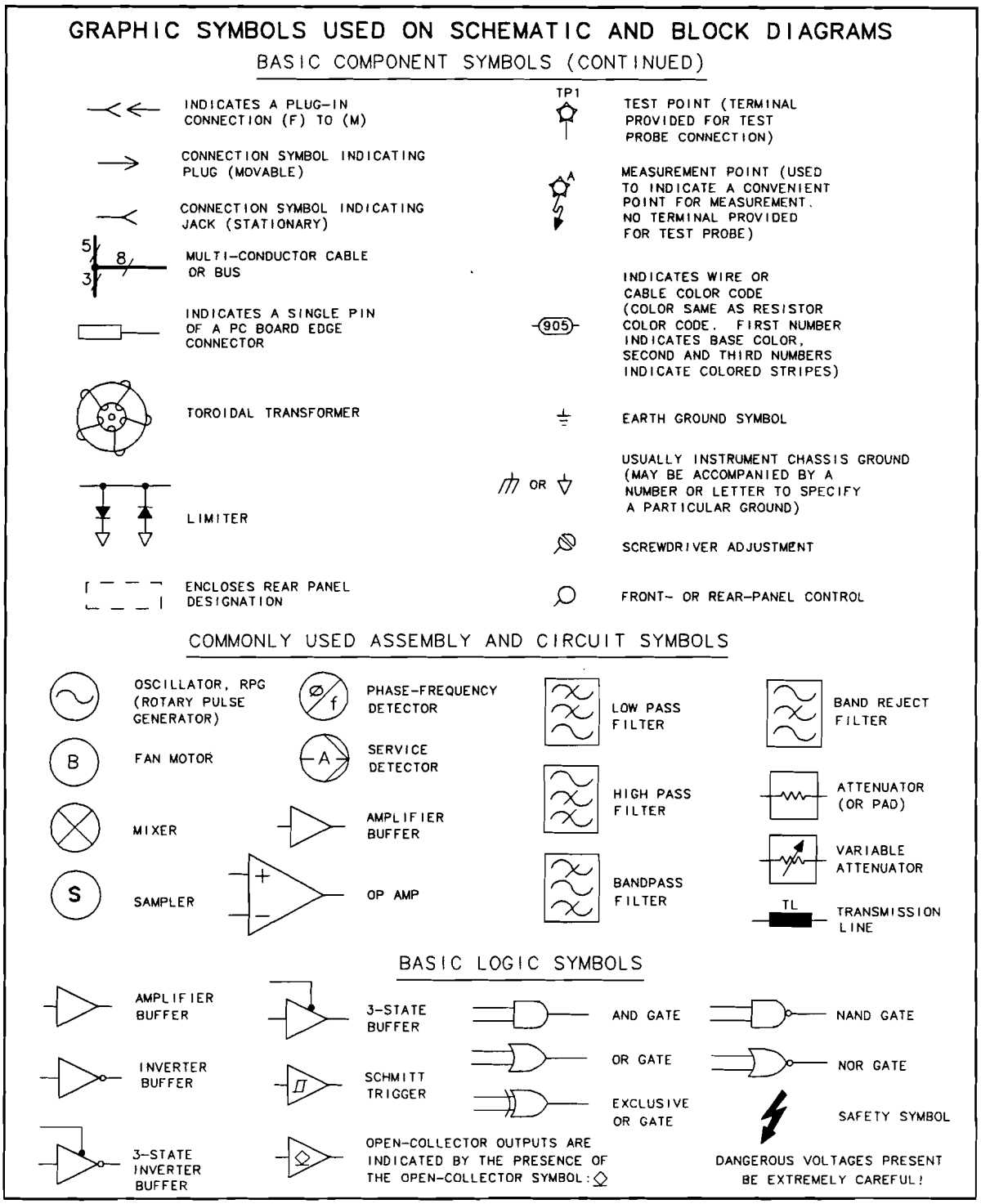


Figure 5. Graphic Symbols (2 of 2)

Schematic Symbols for Digital Integrated Circuits

The following is a guide to the symbols used for digital or logic ICs in this manual. The symbology is based upon American National Standard ANSI Y32.14, *Graphic Symbols for Logic Diagrams (Two-State Devices)*, but does not strictly follow the standard. Figure 6 should be consulted for the explanation of digital IC symbols used in Sections VIII and IX.

Definitions

Logic Element. The part or parts of a logic device symbol having a well-defined logic function (OR, AND, FLIP-FLOP, and so on) and one or more outputs. The inputs of a logic element may be data or control inputs; the outputs are data outputs.

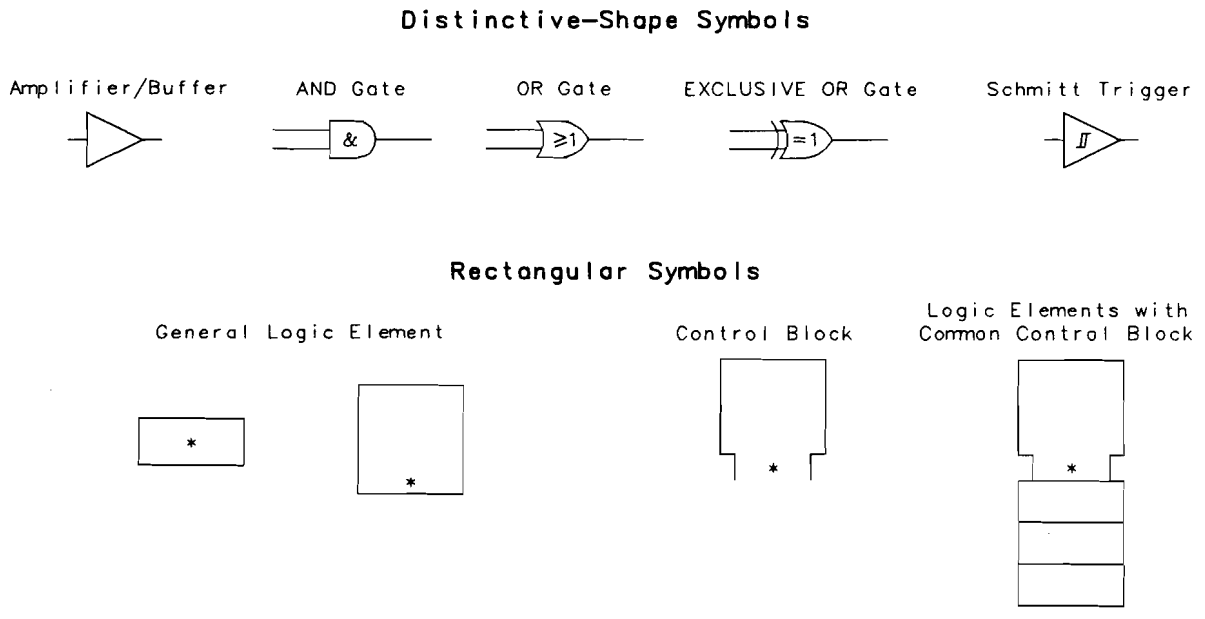
Control Block. The part of a logic device symbol to which all logic lines common to a group of logic elements are connected. Lines connected to a control block are control lines.

Function Label. The notation within a logic device symbol that denotes its overall logic function (counter, shift register, multiplexer, and so on)

Line Label. The symbol or abbreviation associated with an output or input line that defines the action of the line.

Indicator Symbol. A symbol associated with an input or output line which defines the active state or special characteristics of the line.

Basic Logic Symbols



NOTE: An asterisk indicates the location of the function label. If elements sharing control lines are widely separated, each element will have a separate control block.

Figure 6. Schematic Symbols for Digital Integrated Circuits (1 of 7)

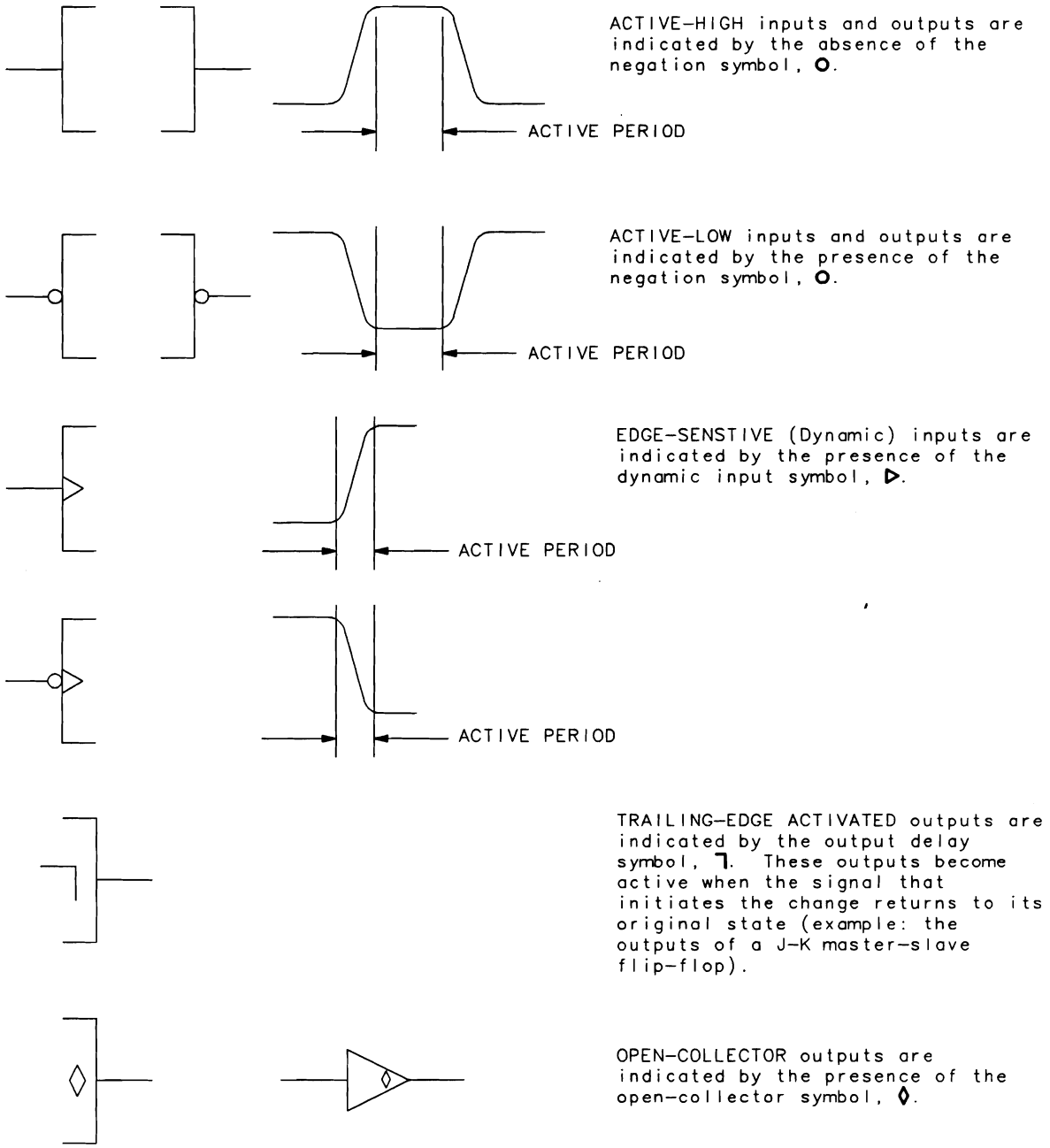


Figure 6. Schematic Symbols for Digital Integrated Circuits (2 of 7)

Note:

The logic negation symbol (O) alone gives no information about the actual voltage levels used in a digital circuit. For this reason the type of logic system (positive or negative) must be specified. In this manual, unless otherwise noted on the schematic, the logic system is positive; that is, the more positive voltage level is the HIGH or 1-state and the less positive level is the LOW or 0-state.

Function Labels

Σ	Adder
▷	Amplifier/Buffer
1 ⊓⊔	Monostable Multivibrator (One-Shot)
&	And Gate
≥1	Or Gate
=1	Exclusive or Gate
X→Y	Encoder, Decoder
XMAX→Y	Priority Encoder
ALU	Arithmetic and Logic Unit
CTR	Counter
DEMUX	Demultiplexer
FF	Flip-Flop
MUX	Multiplexer
RAM	Random Access Memory
REG	Register
ROM	Read Only Memory
SAR	Successive Approximation Register
SR	Shift Register

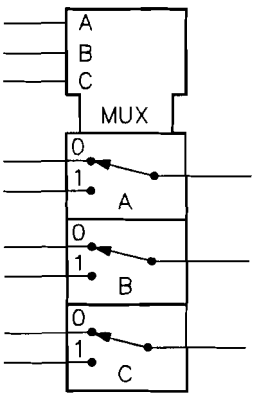
Figure 6. Schematic Symbols for Digital Integrated Circuits (3 of 7)

Line Labels	
←	Shift Left (or up)
→	Shift Right (or down)
+1	Count Up
−1	Count Down
=0,−1	Borrow Output
=9,+1	Carry Output (Decimal Counter)
=15,+1	Carry Output (Binary Counter)
An	nth Address Bit (ROM, RAM)
C	Clock Input
D	Data or Delay Input (Flip-Flop)
Dn	nth Data Bit Input
EN	Enable
F	3-State Enable Input (See "Dependency")
G	Gating Input (See "Dependency")
J	J-K Flip-Flop J Input
K	J-K Flip-Flop K Input
LD	Load Enable Input (Synchronous)
PS	Preset Input (Asynchronous)
R	Reset or Clear Input
RD	Read Enable Input (RAM, ROM)
S	Set Input
SEL	Line or Function Select Input
SER	Serial Data Input (Shift Register)
T	Trigger Input (Monostable)
WR	Write Enable Input (RAM)
Yn	nth Data Bit Output or I/O
3-ST (placed by function label)	3-State

Figure 6. Schematic Symbols for Digital Integrated Circuits (4 of 7)

Notes

1. The suffix or subscript 0 denotes the least significant bit (LSB) of a data or address word.
2. Letters may be used to identify a line or logic element without indicating a specific logic function. For example:

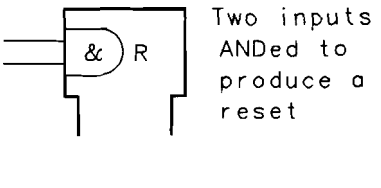


Triple 2-Channel Multiplexer

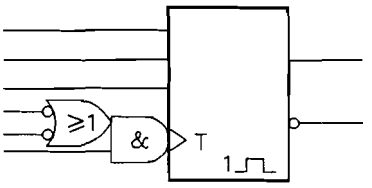
Letters are used to relate control inputs to logic elements. The numerals 0 and 1 indicate 0-state and 1-state, respectively, and relate the position of a "switch" to the logic state of the corresponding control line.

DEPENDENCY (G and F)

The dependency of inputs or outputs on an input is indicated with gate symbols or the G line label. Gate symbols are often used when the dependency exists between inputs. Two examples are:



Two inputs ANDed to produce a reset



Three inputs gated to produce a trigger

Figure 6. Schematic Symbols for Digital Integrated Circuits (5 of 7)

When the G label is used, the gating input is labelled with a G followed by a numeral or letter. The line labels of the gated inputs or outputs are prefixed with the same numeral or letter. Two examples are:

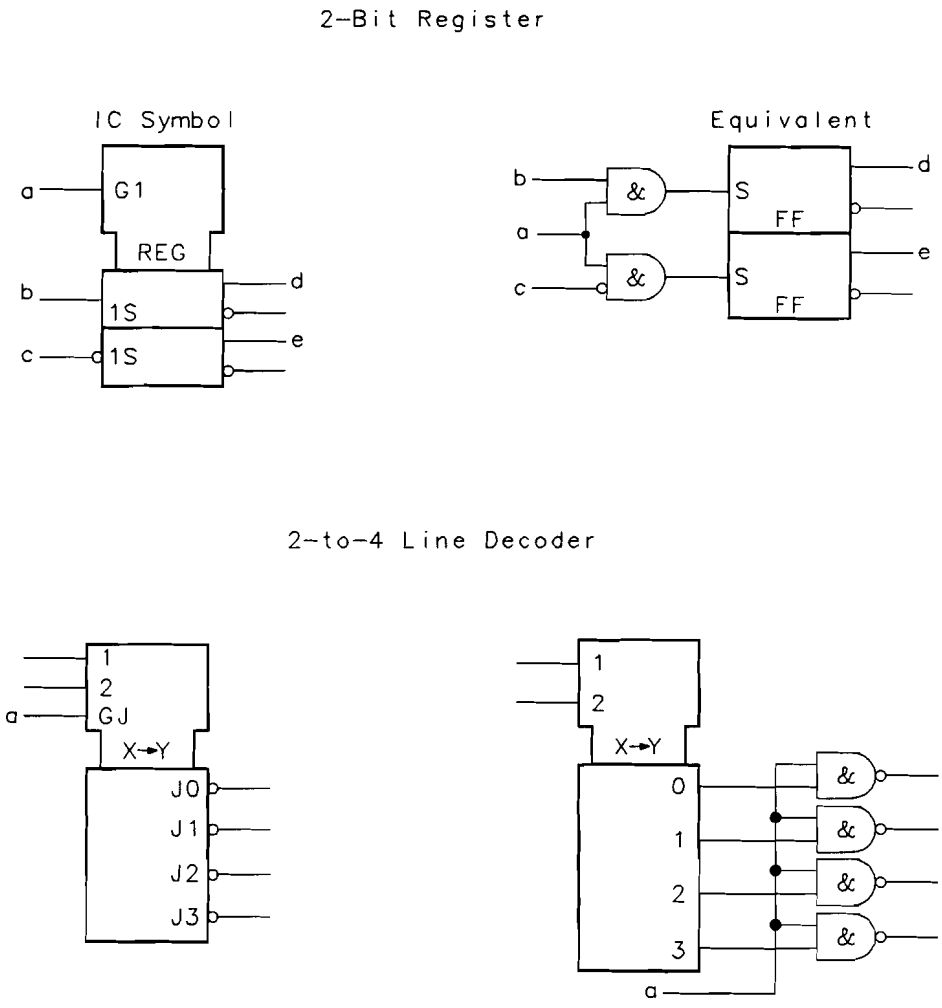


Figure 6. Schematic Symbols for Digital Integrated Circuits (6 of 7)

The F line label is used to indicate 3-state logic. The 3-state enable input is labelled with an F and numerals or letters are used as with the G label:

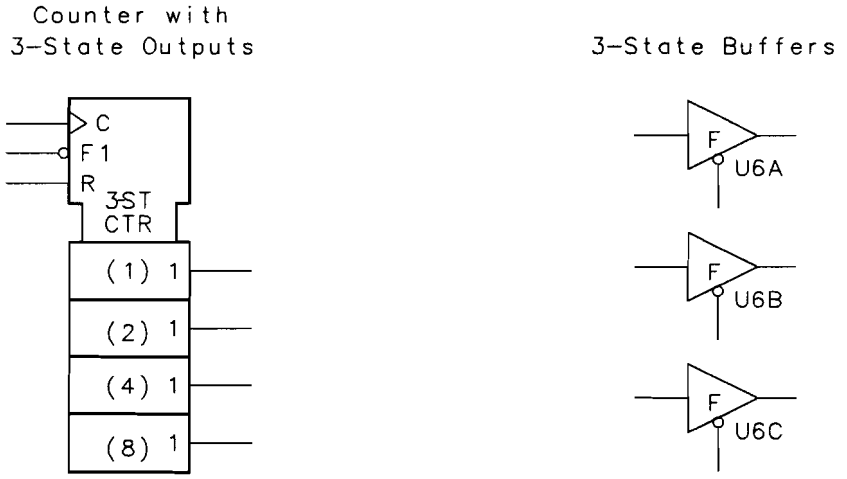


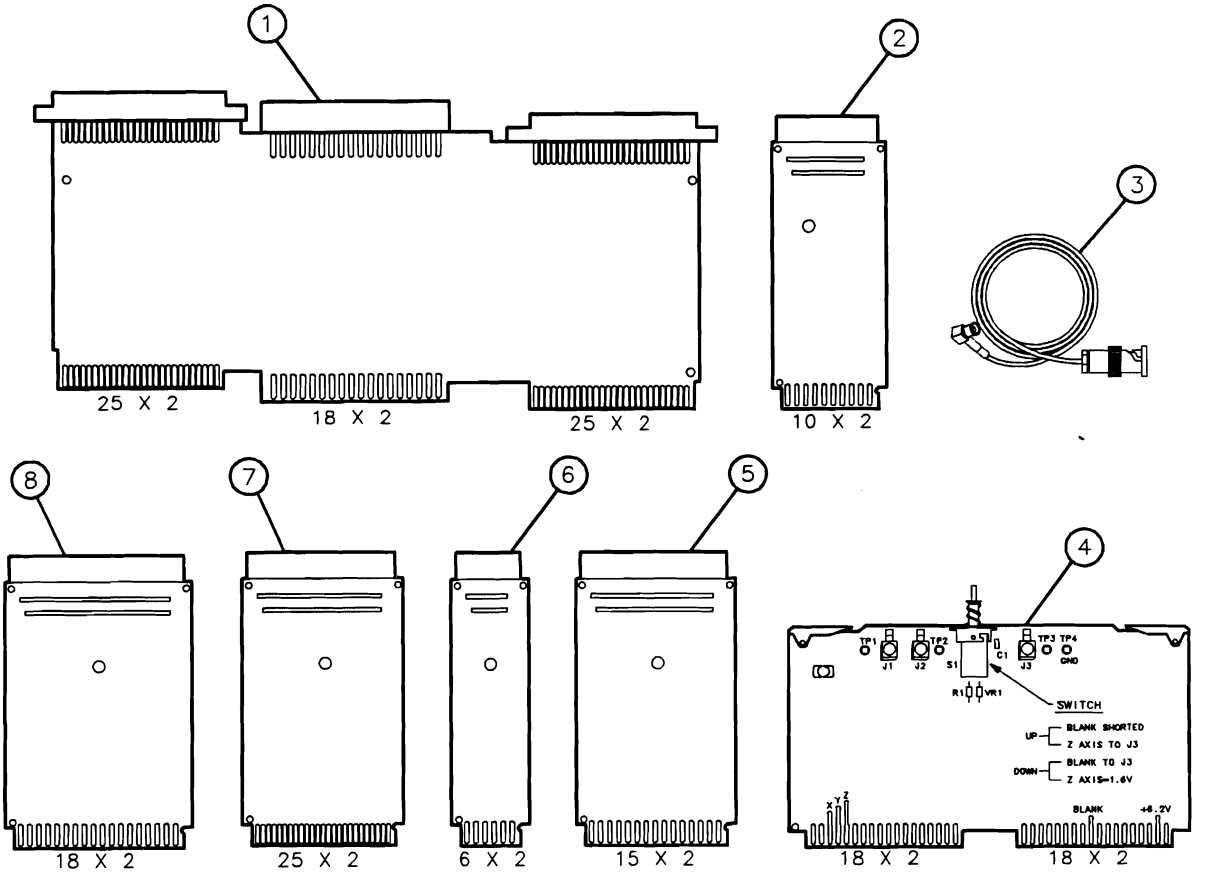
Figure 6. Schematic Symbols for Digital Integrated Circuits (7 of 7)

Weighting of Input and Output Lines

The coding of multiplexers, demultiplexers, encoders, and decoders is shown by decimal weighting. An example is the 2-to-4-line decoder shown on the previous page.

Weighting of Flip-Flops

When the position of a flip-flop in an array is significant (as in counters and shift registers), the flip-flop is labelled with its decimal weight. An example is the "Counter with 3-State Outputs" shown above.



Item	HP Part Number	CD	Qty	Description
1	85680-60035	3	1	EXTENDER BOARD: A12 RF SECTION INTERFACE
2	85680-60028	4	1	EXTENDER BOARD: 20 CONTACTS; 2 ROWS OF 10
3	85680-60093	3	2	CABLE: 4-FOOT LONG; BNC TO SMB SNAP-ON
4	85662-60088	4	1	PC BOARD; DISPLAY ADJUSTMENT TEST
5	08505-60041	7	1	EXTENDER BOARD; 30 CONTACTS; 2 ROWS OF 15
6	08505-60109	8	2	EXTENDER BOARD; 12 CONTACTS; 2 ROWS OF 6
7	85680-60034	2	2	EXTENDER BOARD; 50 CONTACTS; 2 ROWS OF 25
8	08505-60042	8	2	EXTENDER BOARD; 36 CONTACTS; 2 ROWS OF 18

Figure 7. Service Accessories

Spectrum Analyzer Overall Troubleshooting

This chapter contains information that will help to identify the system of the spectrum analyzer that is not operating correctly. Table 1, "Troubleshooting Index," may be used to locate troubleshooting information in the RF and IF-Display Troubleshooting and Repair Manuals. This chapter also describes the Special Messages that may be displayed on the CRT and the Diagnostic Functions that are accessible from the front panel. The Error Correction Routine and the Sweep System are also described in this chapter. The overall block diagram of the HP 8566B is located at the end of this chapter.

Table 1. Troubleshooting Index

Troubleshooting Information	Tab Title or Location	Volume
Center Frequency Tuning Equations and Phase Lock	RF Section Analog Troubleshooting Block Diagram	RF
Diagnostic Functions	Spectrum Analyzer Overall Troubleshooting	RF
Digital Storage	A3 Digital Storage	IF
Display System	Spectrum Analyzer Overall Troubleshooting	RF
	A1 Display Section Block Diagram	IF
Error Correction Routine	Spectrum Analyzer Overall Troubleshooting	RF
RF Section Digital (includes INSTR CHECK LEDs)	A3 Digital Storage	IF
	RF Section Digital Troubleshooting	RF
	A15 Controller	RF
Special Messages	Spectrum Analyzer Overall Troubleshooting	RF
Sweep System	Spectrum Analyzer Overall Troubleshooting	RF
A1A1 Keyboard	A12 RF Section Interface	RF
A3 Digital Storage	Spectrum Analyzer Overall Troubleshooting	RF
	A3 Digital Storage	IF
A3A1 Trigger*	Spectrum Analyzer Overall Troubleshooting (Sweep System)	RF
	A3 Digital Storage	IF
A3A2 Intensity Control*	A1 Display Section	IF
	A3 Digital Storage	IF
A3A3 Line Generator*	A1 Display Section	IF
	A3 Digital Storage	IF
A3A4 Memory*	A1 Display Section	IF
	A3 Digital Storage	IF
A3A5 Data Manipulator* A3A6 Main Control* A3A7 Interface*	A3 Digital Storage	IF
A3A8 Analog-Digital Converter*	Spectrum Analyzer Overall Troubleshooting (Sweep System)	RF
	A1 Display Section	IF
	A3 Digital Storage	IF
A3A9 Track and Hold*	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions)	RF
	A1 Display Section	IF
	A3 Digital Storage	IF

Table 1. Troubleshooting Index (continued)

Troubleshooting Information	Tab Title or Location	Volume
A4A1 Video Processor* A4A2 Log Amplifier-Detector* A4A3 Log Amplifier-Filter* A4A4 Bandwidth Filter A4A5 Step Gain* A4A6 Down/Up Converter* A4A7 3 MHz Bandwidth Filter A4A8 Attenuator-Bandwidth Filter* A4A9 IF Control*	Spectrum Analyzer Overall Troubleshooting (Error Correction Routine)	RF
A5 Front Panel	A12 RF Section Interface A15 Controller	RF RF
A6 YTO Phase Lock* A8 249 MHz Phase Lock* A11 50 MHz Voltage-Tuned Oscillator	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions)	RF
A12 RF Section Interface*	Spectrum Analyzer Overall Troubleshooting (Sweep System) A15 Controller	RF RF
A14 TCXO Buffer	HP 85670A	RF
A15 Controller*	Spectrum Analyzer Overall Troubleshooting (Sweep System)	RF
A17 Frequency Counter*	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions) RF Section Digital Troubleshooting	RF RF
A22 Frequency Control*	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions, Sweep System)	RF
A23 RF Converter	Spectrum Analyzer Overall Troubleshooting (Diagnostic Functions, Error Correction Routine)	RF
* Troubleshooting information is also located behind the tab having the same title as that listed in this table.		

Special Messages

As a convenience to the operator and an aid in servicing, ten messages can appear in the upper right corner of the CRT display. (Seven of these messages are shown in Figure 1.) Five of the messages inform the operator of possible erroneous data from improper instrument operation. The other five provide warnings of instrument malfunctions that must be repaired for proper instrument operation.

A brief description of each message follows. The troubleshooting information listed is not meant to be exhaustive. Refer to the appropriate Troubleshooting tab and Troubleshooting Hints for more detailed information.

Ext Ref

Indication to operator that the external frequency reference is selected. (When the external reference is selected on the rear panel, the external 10 MHz signal must be present before any front panel, display, or HP-IB functions will operate.)

Meas Uncal

A warning to the operator that the amplitude/frequency data on the CRT is invalid because the analyzer's sweep speed is too fast for the selected bandwidth.

*

A warning to the operator that the analyzer settings displayed on the CRT have been changed but the trace data has not been updated. This would occur, for example, when Trace A view is selected and then Center Frequency is changed.

Oven Cold (HP 85680B only)

Indication that the frequency reference oven temperature is too low. There will be an oven cold indication normally for about 10 minutes after the line power is initially applied to the instrument. (The oven is powered and should stay warm as long as the instrument is in standby.) The time base Oven Mtr output is detected on A24 and the HOVC (High Oven Cold) signal is routed to the A12 RF Section Interface.

Battery

A warning to the operator that the CMOS memory on A15 Controller has probably lost its stored instrument states. The warning can only appear at instrument turn-on. If it appears, the instrument will automatically reinitialize all the instrument states to the instrument preset condition. Removing the A15 Controller assembly or performing the "long POP" instrument check (see RF Section Digital Troubleshooting) will erase the stored instrument states and cause a battery warning to appear at instrument turn-on. If the HP-IB address has been changed from the front panel, the HP-IB address is also lost.

275 Unlock

The 275 MHz phase lock loop is unlocked. Items to check are:

- 275 MHz mixer, phase detector, amplifier, and lock detector on A21 275 MHz Phase Lock (275 MHz TUNE voltage on A18TP1)
- A18 275 MHz Phase Lock Oscillator output at A18J3
- 5 MHz input (A11J1) from A11 50 MHz Voltage-Tuned Oscillator

  (VTO) (VTO operation can be verified from the front panel by using [SHIFT] [MKR → CF] (KSN) which directly counts and displays the VTO frequency.)
- 280 MHz input (A20J3) from A20 Third Converter

249 Unlock

The 249 MHz phase lock loop is unlocked. Items to check are:

- Frequency divider, phase detector, amplifier, and lock detector on A8 249 MHz Phase Lock (249 MHz TUNE voltage on A7TP1)
- A7 249 MHz Phase Lock Oscillator output at A7J2
- A18 275 MHz Phase Lock Oscillator output at A18J1 Oscillator

VTO Uncal

The analyzer was unable to tune the A11 50 MHz VTO to the required frequency. Items to check are:

VTO tune DACs on A22 Frequency Control (50 MHz TUNE voltage on A22TP9)

A11 50 MHz VTO output at A11J2

VTO amplifier/multiplexer on A17 Frequency Counter (See front-panel Diagnostic Function keys to directly set the VTO DACs and to monitor the VTO frequency.)

YTO Error

The YIG-Tune Oscillator (YTO) did not tune close enough to the required center frequency. The A15 Controller had to offset the YTO DAC on A22 by more than 9 MHz from its proper setting. Items to check are:

- YTO tune DAC and drivers on A22 Frequency Control (YTO Tune voltage at A22TP6)
- A23A1 YTO output. (Output can be monitored at rear-panel connector J2, 1st LO OUT, Tune DAC can be set using [SHIFT] [CF STEP SIZE] (KSJ).)
- Pilot RF to IF converter A23
- A9 Pilot Second IF Amplifier and A10 Pilot Third Converter
- A6 YTO Phase Lock, Pilot IF output to A17 Frequency Counter [SHIFT] [PEAK SEARCH] (KSK)
- A7 249 MHz Phase Lock Oscillator

YTO Unlock

The YTO Phase lock loop did not phase lock. Items to check are:

- A6 YTO Phase Lock (YTO LOCK voltage at A6TP4)
- Pilot converter chain and comb generator (A23, A9, and A10)
- A7 249 MHz Phase Lock Oscillator output at A7J2

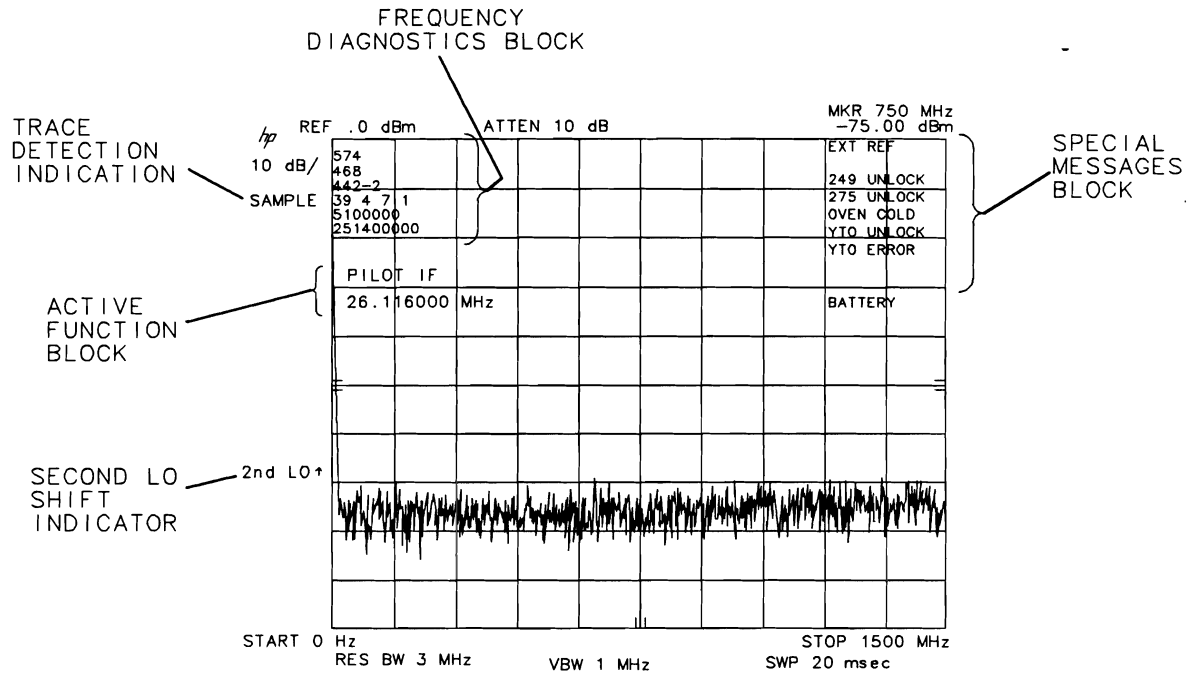


Figure 1. CRT Locations of Special Messages and Diagnostic Function Indicators

Diagnostic Functions

The Diagnostic Functions are accessible through the blue [SHIFT] key on the front panel. Through their use it is possible to trace many instrument malfunctions back to the functional block without removing any assemblies. A summary of the Diagnostic Functions follows. More information on their use can be found in the troubleshooting procedures.

Frequency Diagnostics [SHIFT] [MKR → REF LVL] (KSR)

This function displays many of the internal frequency control parameters in the upper left corner of the CRT display. (See Figure 1.) These parameters are the programmed values determined by the A15 Controller. For example, following an [INSTR PRESET], a [SHIFT] [MKR → REF LVL] (KSR) might display the following values:

1. 387
2. 438
3. 439 – 2
4. 39 4 7 0
5. 5100000
6. 251400000

Line 1 is the setting of the least significant 50 MHz VTO Tune DAC A22U6. The setting varies from 0 to 1023.

Line 2 is the setting of the most significant 50 MHz VTO Tune DAC A22U9. The setting varies from 0 to 1023.

Line 3 contains two different numbers. The first is the programmed setting of the YTO Tune DAC A22U4. The setting varies from 0 for 0 Hz Center Frequency to 1023 for a 1739 MHz Center Frequency. The second number is the difference between the calculated YTO Tune DAC setting and the actual one needed to program the Center Frequency. A number larger than ±4 would indicate that the A22 Frequency Control circuitry may need adjustment.

Line 4 contains four different numbers. The first number represents N, the harmonic of 20 MHz to which the analyzer's center frequency is locked. This number varies from 2 at a center frequency of 0 Hz to 89 at a center frequency of 1739 MHz. The next two numbers are the M and P numbers of the Variable Modulus Frequency Divider on the A8 249 MHz Phase Lock assembly. M varies from 0 to 5 and corresponds to 4 MHz steps in center frequency. P varies from 0 to 7 and corresponds to 500 kHz steps in center frequency. The last number is either a 0 or a 1; 1 indicates that the 2nd LO is shifted up 5 MHz in frequency (1753.6 MHz), and 0 indicates no 2nd LO shift (1748.6 MHz).

Line 5 indicates the frequency to which the A11 50 MHz VTO output has been programmed to be at center frequency. This is not a counted frequency. This frequency varies from 4.75 MHz to 5.25 MHz for frequency spans greater than 100 kHz and from 2.25 to 2.75 MHz for frequency spans less than 100 kHz.

Line 6 shows the frequency to which the processor has programmed the Pilot 3rd LO, the output of the A7 249 MHz Phase Lock Oscillator. This is not a counted frequency; the processor assumes that the 3rd LO frequency is exactly 280 MHz, so the actual Pilot 3rd LO frequency is exactly 280 MHz, so the actual Pilot 3rd LO frequency may vary at center frequency by up to 70 kHz—the accuracy of the 280 MHz oscillator. The displayed frequency for the Pilot 3rd LO varies from 238.75 MHz to 259.25 MHz.

Inhibit Phase Lock Flags (SHIFT) (FREE RUN) (KSv) or ST Jumpered T1 on A15 Controller

This function permits the analyzer to sweep at normal sweep rates, ignoring any phase lock flag indications. For example, if a YTO UNLOCK problem exists, the analyzer might only sweep once every 30 seconds, since it spends most of its time trying to lock up the YTO at center frequency during retrace. By performing the phase lock inhibit function, the analyzer does not waste time trying to lock the YTO, so that the front-panel keys and display can be used as in normal operation. Note, of course, that the displayed frequencies will probably not be accurate. In addition, when the phase lock inhibit function is implemented, a list of the special messages are displayed in the upper right corner of the display. (See Figure 1.)

Sometimes a YTO lock problem at turn-on will prevent the operator from performing a (SHIFT) (FREE RUN) (KSv) for about the first three minutes. In this case, a jumper can be placed from A15TP1-9 (ST) to A15TP1-6 (T1). On early versions of the A15 Controller, A15TP4 (STS) must be jumpered to A15TP1-4 (T1) instead. When (INSTR PRESET) is then pushed, the inhibit phase lock flags function is automatically implemented, and in addition the A17 Frequency Counter output is ignored. As long as the jumper is in place, the processor will substitute 20 MHz for all frequency counts instead of reading the actual counter output. To enable the Frequency Counter readings, the jumper is removed after (INSTR PRESET) is pushed. If the analyzer then stops sweeping, troubleshoot A17 Frequency Counter.

Manual DAC Control (SHIFT) (CF STEP SIZE) (KSJ)

This function permits direct control of the frequency control DACs on A22 Frequency Control in the analyzer. This permits verification of these DACs that is easier and faster than trying to set them indirectly by varying the center frequency and span. When (SHIFT) (CF STEP SIZE) (KSJ) is first pushed, all the DAC settings (YTO Tune DAC, 2 VTO Tune DACs, and Sweep Attenuator DAC) are set to 0. They can then be changed by turning the RPG to vary them continuously, using the step up and step down keys to vary them in a binary 1, 2, 3, 4, 8, 16, 32, ... sequence, or by keying in numbers directly on the keyboard. When using numeric keyboard, the GHz units key updates only the Sweep Attenuator DAC, MHz units updates only the YTO Tune DAC, kHz updates the most significant VTO Tune DAC, Hz updates the least significant VTO Tune DAC. Note that after a units key is pressed, the DAC function reads out the most significant VTO Tune DAC. The DAC settings can be monitored by simultaneously displaying the Frequency Diagnostics using KSR.

Frequency Count at Marker

The A17 Frequency Counter can count the frequency of three different inputs: the Pilot IF, the Signal IF, and the 50 MHz VTO.

Normally, these counts at the Marker are used to calculate the RF input signal frequency, but by using the following shift functions, the actual frequencies can also be displayed.

Count Pilot IF [SHIFT] [PEAK SEARCH] (KSK)

Counts and displays the Pilot IF frequency. In non-phase-locked modes (spans greater than 1 MHz), it will vary from approximately 8 MHz to 32 MHz. In phase-locked modes (spans less than or equal to 1 MHz), it should always be 20 MHz. This signal comes to A17 from A6 YTO Phase Lock assembly.

Count Signal IF [SHIFT] [MARKER/Δ→ STP SIZE] (KSQ)

Counts and displays the Signal IF frequency. This signal is from the output of the log amplifiers in the IF-Display Section. At the peak of a signal, this frequency should be 21.4 MHz, and will vary as the marker is moved away from the peak.

Count VTO [SHIFT] [MKR → CF] (KSN)

Counts and displays the A11 50 MHz VTO output. This frequency should be 25 MHz ±3.8 MHz. At center frequency, it will be either 5 or 10 times higher than the final VTO output frequency as displayed on line 5 of the Frequency Diagnostics. For spans greater than 1 MHz, its frequency remains constant across the sweep; for spans less than 1 MHz, its frequency varies with the marker position.

As an example, this can be used to check the tuning range of the VTO oscillator as follows:

Use [SHIFT] [CF STEP SIZE] (KSJ) to set the VTO Tune DACs to 0 kHz

Use [SHIFT] [MKR → CF] (KSN) to verify the high-end frequency of the VTO

Use [SHIFT] [CF STEP SIZE] (KSJ) and set VTO Tune DACs to 1012 kHz

Use [SHIFT] [MKR → CF] (KSN) to verify the low-end frequency of the VTO

Sweep Time Measure [SHIFT] [RES BW] (KSF)

This function is used to measure the sweep times (less than 75 s) of the analyzer. By using KSF to display the sweep generator time, it can be determined if the A22 Sweep Generator is properly responding to its control settings. A small amount of start-up time (1 to 5%) is included in this measurement, and it must be subtracted to determine the exact sweep times. This function is also useful in troubleshooting the A17 Frequency Counter. By setting a 1500 s sweep time and pushing [SHIFT] [RES BW] (KSF), the counter will count a fixed 1 MHz clock for 25 minutes. This enables a straightforward checking of the mulitplexer, counters, and bus drivers on A17.

Second LO Shift Control [SHIFT] [↑] [↓] (KSU)(KST)

Three functions can be used to control the 5 MHz Second LO shift, which normally is automatically switched by the controller depending on center frequency and span. The state is indicated on the left side of the CRT display. (See Figure 1) The 2nd LO output can be monitored at A23A3J3.

[SHIFT] [↑] (KSU) forces the 2nd LO to shift up (1753.6 MHz)

[SHIFT] [↓] (KSU) forces the 2nd LO to shift down (1748.6 MHz)

[SHIFT] [SIGNAL TRACK] (KSS) forces the control back to auto and removes the CRT indication

Note that spurious responses may appear on the display when the LO shift is being controlled by [SHIFT] [↑] (KSU) or [SHIFT] [↓] (KST).

Trace Detection

Three different sampling modes are used by the analyzer in converting the video signal; these are positive peak, negative peak, and sample. Normally the analyzer selects the proper mode for each measurement, but these can be manually selected to verify proper operation. The mode selected is indicated on the upper left side of the CRT display when under manual control. (See Figure 1.)

For example, a signal could be expanded to 2 dB/div to eliminate the noise floor, and then, by comparing a positive peak trace measurement, it can be determined if the gains and offsets of the three modes are properly aligned. All three should appear the same on a stable, noise-free signal. When in the noise, the positive peak should display the highest noise peaks, negative peak mode should display the lowest noise levels, and sample mode should display values between the positive and negative peaks.

[SHIFT] Trace A [MAX HOLD] (KSb) displays positive peaks

[SHIFT] Trace A [VIEW] (KSd) displays negative peaks

[SHIFT] Trace A [BLANK] (KSe) displays sampled data

[SHIFT] Trace A [CLEAR-WRITE] (KSa) returns to the normal automatic detection modes and removes the CRT indication.

Error Correction Routine

The internal Error Correction Routine available by pressing [SHIFT] [FREQUENCY SPAN] (KSW) is also useful as a diagnostic aid. If a malfunction causes it to stop, restart it and note the control settings (RES BW, ATTN, REF LEVEL, LOG/LIN, etc.) when the failure occurred. If the routine runs, the correction factors can be displayed by pressing [SHIFT] [LINE] (KSw). Figure 2 displays the data for a typical instrument. Table 2 gives the parametric information, specifications, and a place to start the troubleshooting procedure.

Caution must be exercised in interpreting the correction factor data. Wrong conclusions can be reached by not understanding how the internal program runs. The program assumes that the input signal level is −10 dBm. Any error in this level will translate to the correction factors. Thus the Amplitude Accuracy test [RECALL] [8] should be performed first. The internal program runs in the LIN mode while [RECALL] [8] is in 1 dB/LOG mode. Thus large offsets in LOG/LIN offset (lines 1 and 14) will cause errors in the data.

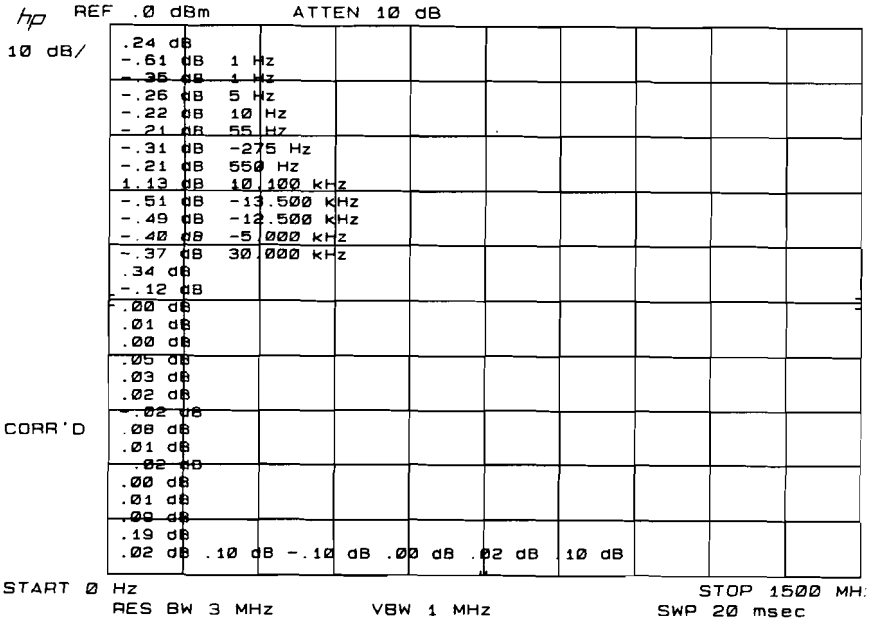


Figure 2. Error Correction Routine Data

Table 2. Error Correction Routine Parameters

Line	Parameter	Specification	Troubleshooting Information
1	LOG and LIN scale, BW <100 kHz	±1 dB typical	A4A3/A4A2
2	RES BW = 10 Hz**	±1 dB*	
3	30 Hz**		
4	100 Hz**		A4A7/A4A6/A4A5
5	300 Hz**		
6	1 kHz		
7	3 kHz	± 0.5 dB*	
8	10 kHz		
9	30 kHz		
10	100 kHz		A4A8/A4A4/A4A6
11	300 kHz		
12	1 MHz	*	
13	3 MHz	±1 dB*	
14	LOG and LIN scale, BW ≥ 100 kHz	±1 dB typical	A4A3/A4A2
15	2nd local oscillator frequency shift	±1.0 dB	A23
16	30 dB Gain		A4A3/A4A2
17	20 dB Gain LIN operation only	±1 dB	A4A2
18	10 dB Gain		A4A3
19	50 dB step gain errors		
20	40 dB step gain errors		
21	30 dB step gain errors		
22	20 dB step gain errors	±0.6 dB	A4A5
23	10 dB step gain errors		
24	0 dB step gain errors		
25	−10 dB step gain errors		A4A8
26	−20 dB step gain errors		
27	offset error 2 dB/LOG	±0.5 dB	
28	offset error 5 dB/LOG	±0.5 dB	A4A1
29	offset error 10 dB/LOG	±0.5 dB	
30	RF attenuator correction factor		A5AT1

* Specifications for all Resolution Bandwidths are referenced to the 1 MHz Resolution Bandwidth. The frequency error terms are for error correction only.
**These parameters are not used by the HP 8567A.

Sweep System Circuit Description

The HP 8568B and the HP 8567A Spectrum Analyzers' sweep systems consist of the following modes:

Continuous Sweep; Free Run Trigger

Several different assemblies are involved in the sweep system. A sweep generator portion of the A22 Frequency Control generates the 0 V to 10 V sweep ramp. The ramp converter on the A3A8 Digital Analog Converter and the Digital Storage Processor digitize this ramp into a 10-bit sweep address. When the sweep address reaches the marker address, the Digital Storage Processor outputs a RSHS (Low = Reset High Sweep) pulse. This signal resets the High Sweep flip-flop on the A3 A1 Trigger assembly. HSWP (High Sweep) goes low and the current source charging the sweep capacitor on A22 is shunted to ground, stopping the sweep ramp at its present value.

The negative transition on the HSWP line generates a service request on A12 RF Section Interface, forcing LSRQ low which sets LSTP (Low Stop) high. This "wakes up" the A15 Controller. The Controller then reads the sweep address from the Digital Storage Processor. If it corresponds to the end of the sweep, the A15 Controller outputs a sweep reset command to the sweep generator on A22, resetting the sweep ramp to 0 V. After all service requests have been handled (LSRQ is high), the A15 Controller starts the sweep by issuing a set HSWP command to the A3A1 Trigger. The A15 Controller then issues a stop command to the A12 RF Section Interface assembly that forces LSTP low, stopping the Controller. After a 500 μs delay on A3A1, HSWP goes high, the sweep ramp starts, the Digital Storage assembly starts digitizing the ramp, and the front-panel SWEEP LED turns on, indicating that a sweep is in progress.

Frequency Count at Marker

If the Frequency Counter is on, the Digital Storage Processor will stop the sweep, as described above, when the sweep address reaches the marker address. When the A15 Controller wakes up and reads the sweep address, it recognizes that it is not at the end of the sweep (Address <1000), so it does not reset the sweep generator. Instead, it determines the input signal frequency, resets the Digital Storage marker address to the end of sweep, and then restarts the sweep by issuing the same set HSWP command and stopping itself as before. See Figure 3 for an example of the sweep system timing.

Sweep System Troubleshooting

The following procedure is an aid to rapidly isolate sweep system malfunctions. When the malfunction has been traced to a single assembly, check the service sheets for that assembly for a more thorough troubleshooting procedure.

Isolate the Sweep Generator

Disconnect the ramp from A3A8J1 and jumper A3A8TP1 to A3A8TP2. This forces the ramp comparator output high. The Digital Storage should continue to process data and increment the sweep address. The HSWP light should be flashing and HSWP should have an approximately 16 ms pulse width. (Note that the instrument preset state may appear to be functioning properly but will become distorted as the sweep time is slowed down.) If this works, the Digital Storage and A15 Controller, A12 RF Section Interface, and A3A1 Trigger assemblies are operating properly. Suspect the sweep generator on A22 Frequency Control or ramp converter on the A3A8 Analog Digital Converter. To further isolate the sweep generator, reconnect the sweep ramp to A3A8J1 and remove the jumper. Set the sweep time to 1 s and press the single sweep key. The ramp waveform will start at greater than 10 V, go to 0 V when single sweep key is pressed, and ramp back up to greater than 10 V. If the ramp waveform is correct, check the A3A8 ramp converter. Otherwise, check the sweep generator on A22.

Isolate the Phase Lock Service Requests and Frequency Counter

Jumper A15TP1-9 (ST) to A15TP1-5 (T1) and push (INSTR PRESET). This causes the A15 Controller to gate out all phase lock errors and to ignore the A17 Frequency Counter output. (20 MHz is substituted for all frequency counts.) The system should now sweep repetitively, although the frequency will not be accurate. If the system stops sweeping when the jumper is removed, troubleshoot A17.

See Diagnostic Functions for a more detailed description of this function.

Isolate Digital Storage Processor if HSWP Stays High (SWEEP LED ON)

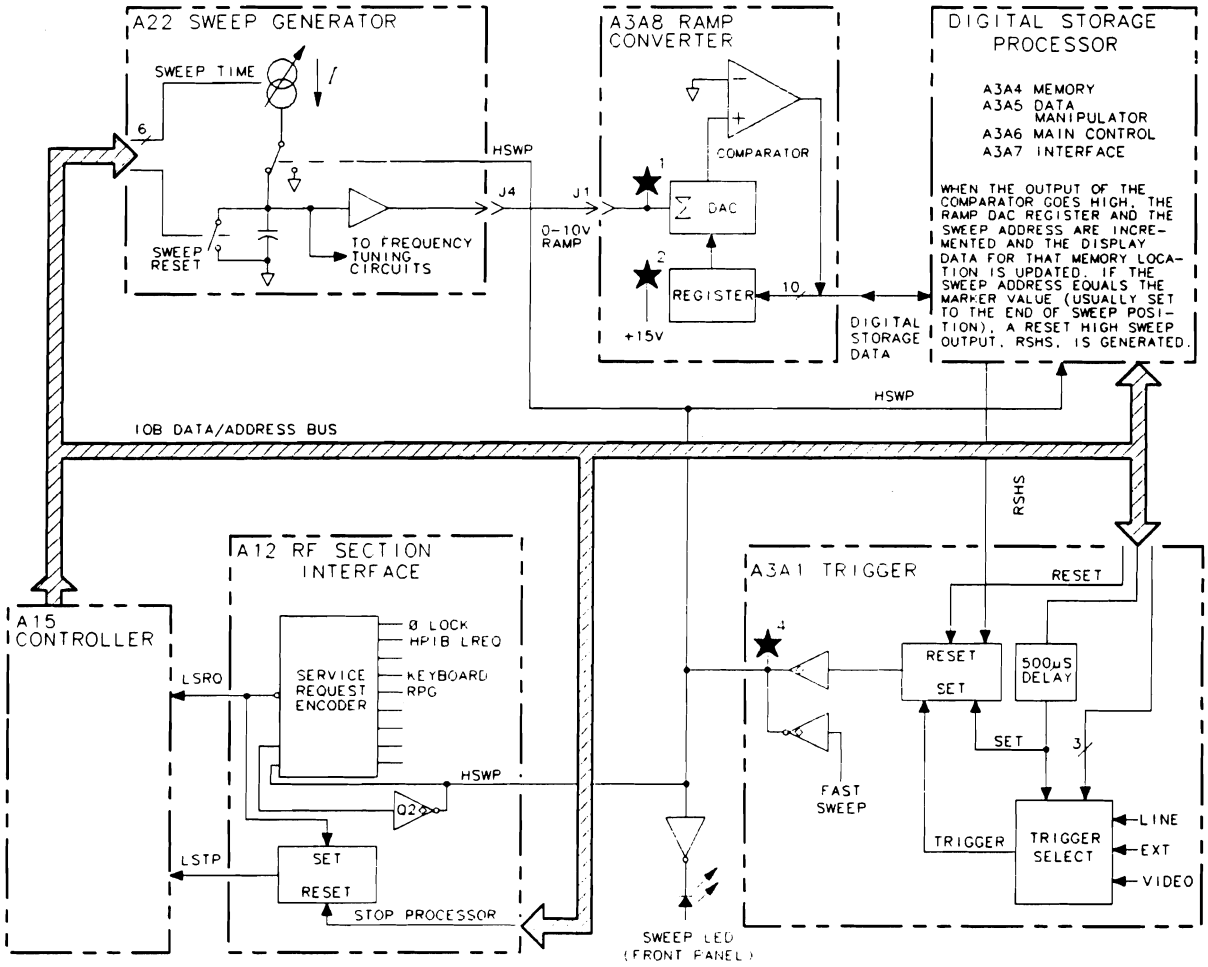
With the sweep ramp disconnected from A3A8J1 and A3A8TP1 jumpered to A3A8TP2, check RSHS output for the presence of a 60 ns low pulses. If present, check A3A1. If not, check the Digital Storage Processor.

Isolate A12 RF Section Interface if HSWP Stays Low (SWEEP LED OFF)

With the A15TP1-9 to A15TP1-5 jumper in place, check the LSRQ output. It should be high. If it is not, find out which input is requesting service.

See A3A1 Trigger Troubleshooting Procedure

Note that the A3A1 assembly also generates and controls the fast sweep timing (sweeps less than 10 ms).



Sweep System Block Diagram

(SEE NOTE2)

HP 85670A

A5 FRONT PANEL

INPUT 10kHz–1.5GHz

A5J3

AT1 70dB ATTEN

W3

TO A23

AMPTD CAL

REF LEVEL CAL (TO A22)

A1 KEYBOARD

A5J1

CAL OUT 20 MHz –10 dBm

W31

50

W38

20MHz CAL OUT (FROM A16)

TO/FROM A12

(SEE NOTE2)

HP 85680B OPTION H44 AND OPTIONH96

A5 FRONT PANEL

INPUT 100Hz–1.5GHz

A5J3

A3 DC INPUT CONNECTOR

AT1 70dB ATTEN

W3

TO A23

AMPTD CAL

REF LEVEL CAL (TO A22)

A1 KEYBOARD

A5J1

CAL OUT 20 MHz –10 dBm

W31

50

W38

20MHz CAL OUT (FROM A16)

TO/FROM A12

(SEE NOTE3)

HP 85680B OPTION H44 AND OPTION H96 AND HP 85670A

A14 TCXO BUFFER

10MHz

10MHz

W32

2

TO A16

OSC PWR

FROM A24

RF SECTION

A5 FRONT PANEL

INPUT 2 100 kHz–1.5GHz (SEE NOTE 2)

A5J3 (SEE NOTE 2)

A4 BLOCKING CAPACITOR (SEE NOTE 2)

K1 INPUT RELAY (SEE NOTE 2)

AT1 10dB ATTEN

INPUT 1 100 Hz–1.5 GHz (SEE NOTE 2)

A5J4 (SEE NOTE 2)

A3 DC INPUT CONNECTOR (SEE NOTE 2)

A1 KEYBOARD

A5J1

AMPTD CAL

REF LEVEL CAL (TO A22)

CAL OUT 20 MHz –10 dBm

W31

W3

20MHz –10dBm CAL OUT

50

W38

A12 RF SECTION INTERFACE

INT

EXT

SI

HINT

INTRUMENT BUS

LSRQ

3 PHASE LOCK FLAG

TIME BASE OUT:10MHz –4dBm TYP IN:5,10,20MHz –5dBm MIN

W37

10MHz IN/OUT

A16 20 MHz REF

X2

W15

W23

TO AB

W26

TO AC

10MHz (TO A17)

A27 10 MHz FREQUENCY STANDARD

(SEE NOTE3)

10 MHz

10MHz +3dBm

W32

A24 VOLTAGE REGULATOR

OSC PWR

OVN PWR

OVN MON

A25 RECTIFIER

+20V

+15V

+12V

+5V

–5V

–15V

FAN RELAY AND FAN

LINE IN

LINE MODULE AND TRANSFORMER

A23 RF CONVERTER

100Hz–1.5GHz

RF INPUT

AT1 LIMITER

A2 FIRST CONVERTER

AT2 ATTENUATOR

FL1 LOW-PASS FILTER 3.8GHz

2050MHz –.23dBm

A3 SECOND CONVERTER

301.4MHz –27dBm

W16

92

A19 SECOND IF AMPLIFIER

2.05–3.55GHz +12dBm TO +18dBm

A1 YIG OSCILLATOR

MAIN COIL

M COIL

W5

A4 FIRST LO DISTRIBUTION

(FROM A22)

W7 2.05 TO 3.55 GHz >+9dBm

SHIFT

904

W10 >+10dBm

1748.6 MHz OR 1753.6 MHz

A6 COMB GENERATOR

20MHz +12dBm

W9

–26 TO –40dBm (EACH COMB LINE)

A5 PILOT FIRST CONVERTER

W11

FL1 LOW-PASS FILTER 4.5GHz

2012.5MHz TO 2017.5MHz OR 2022.5MHz TO 2027.5MHz –34dBm TO –48dBm

269±10MHz –37 TO –51dBm

W17

80

A9 PILOT IF AMPLIFIER

A22 FREQUENCY CONTROL

YTO FM COIL DRIVER

YTO MAIN COIL TUNE DRIVER

FREQ ANALOG VOLTAGE

AMPTD CAL (TO A20)

REF LEVEL CAL (FROM A5)

1MHz<SPAN≤20MHz

SPAN>20MHz

SPAN≤1MHz

SWEEP ATTEN

–5V TO +5V SWEEP

YTO TUNE DAC

YTO TUNE DACS

20MHz >–15dBm (FROM A16)

W26

A6 YTO PH

50 MHz SWEEP

50 MHz TUNE

AUX SWEEP 0 TO 10V

SWEEP 0 TO 10V

1080–15, A0R0–5

LSRQ

10MHz (TTL)

A15 CONTROLLER

RF CONVERTER

RF INPUT

AT1 LIMITER

A2 FIRST CONVERTER

AT2 ATTENUATOR

FL1 LOW-PASS FILTER 3.8GHz

2050MHz
-.23dBm

A3 SECOND CONVERTER

2.05 – 3.55GHz
+6 TO +12dBm

301.4MHz
-27dBm
W16
92

A19 SECOND IF AMPLIFIER

301.4MHz
-11dBm
96
W30

A20 THIRD CONVERTER

280MHz

AMPTD CAL
(FROM A20)

97
W36

21.4MHz (-5dBm FOR -10dBm AT FIRST CONVERTER)

83
W28

PILOT THIRD LOCAL OSCILLATOR

280MHz 0dBm ±2dB

A11 50 MHz VOLTAGE TU

A21 275 PHASE LOCK

5MHz ±750KHz
OR
2.5MHz ±300KHz
(ECL)
85
W19

÷2

SPAN ≤100KHz

SPAN >100KHz

275MHz ±750KHz
OR
277.5MHz ±300KHz
+5dBm±2dB
W29
84

A18 275 MHz PLO

A8 249 MHz PHASE LOCK

÷N

4 ≤N ≤9.625

4MHz

÷5

W23

2.05-3.55GHz
+12dBm TO
+18dBm

W7
2.05 TO 3.55 GHz
>+9dBm

A4 FIRST LO DISTRIBUTION

W5

(FROM A22)

SHIFT
904

1748.6 MHz OR
1753.6 MHz

W10
>+10dBm

A6 COMB GENERATOR

W9
-26 TO
-40dBm
(EACH
COMB
LINE)

A5
PILOT FIRST CONVERTER

W11

FL1 LOW-PASS FILTER 4.5GHz

2012.5MHz TO 2017.5MHz OR
2022.5MHz TO 2027.5MHz
-34dBm TO -48dBm

269±10MHz
-37 TO
-51dBm
W17
80

A9 PILOT SECOND IF AMPLIFIER

269±10MHz
-23 TO
-37dBm
W20
81

A10 PILOT THIRD CONVERTER

249±10MHz
±5dBm±2dB
W21
89

A7 249 MHz PLO

249±10MHz
+2dBm±2dB
87
W25

16-36.5MHz
>-10dBm
86
W24

82
W22
20MHz±10MHz

FREQUENCY CONTROL

A6 YTO PHASE LOCK

SAMPLER/HOLD

BPF

W27
9

20MHz ±10MHz
>-25dBm

10 TO 30MHz FILTERED
PILOT THIRD IF

20MHz
>-15dBm
(FROM A16)
3
W26

10MHz
(TTL)
(FROM A16)

-5V TO +5V
SWEEP

SWEEP ATTEN

1MHz<SPAN≤20MHz

SPAN>20MHz

SPAN≤1MHz

50 MHz SWEEP

50 MHz TUNE

AUX SWEEP 0 TO 10V

SWEEP 0 TO 10V

YTO TUNE DAC

YTO TUNE DACS

1080-15, ADRO-5

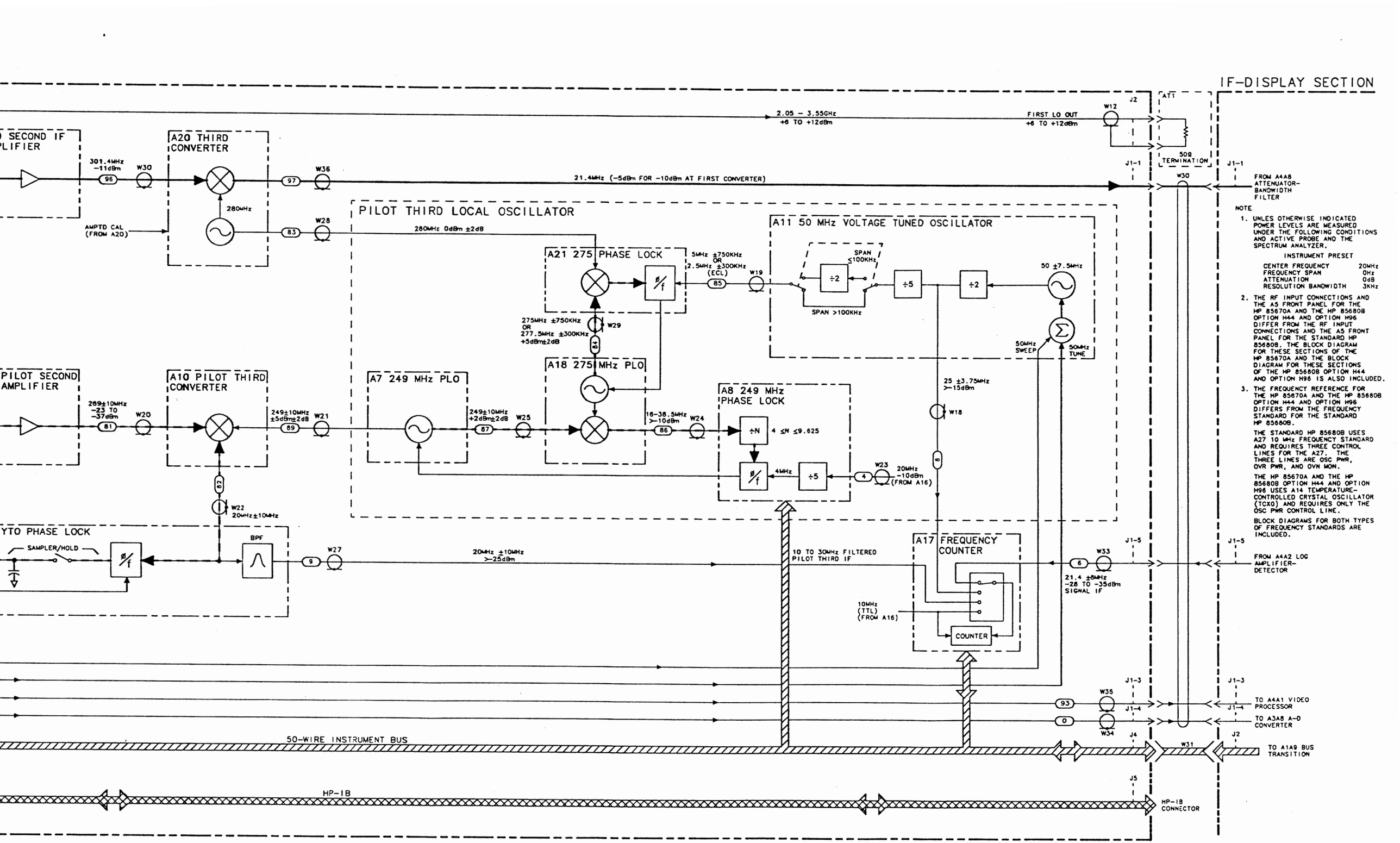
50-WIRE INSTRUMENT BUS

LSRQ

10MHz(TTL)

A15 CONTROLLER

HP-IB



SPECTRUM ANALYZER OVERALL, BLOCK DIAGRAM (1 OF 3)

RF SECTION

IF-DISPLAY SECTION

VIDEO INPUT/OUTPUT
VIDEO IN
W38
VIDEO OUT
96 W36 VIDEO TO A3A9 TRACK AND HOLD
7 W35

IF INPUT/OUTPUT
IF INP
W37
IF OUT
89 W33
87 W34

RECORDER OUTPUTS
PENLIFT 14 W25 PENLIFT (FROM A31)
VIDEO 1 W13 RECORDER VIDEO OUTPUT 0 TO 1V
SWEEP 3 W14 RECORDER SWEEP OUTPUT 0 TO 10V
21.4 MHz IF OUTPUT 2 W15 21.4 MHz IF OUTPUT

21.4 MHZ IF J1-1 W30 J1-1 97 W19

A4A8 ATTENUATOR BANDWIDTH FILTER
<-5dBm> 50
-20→0 dB Δ=10dB
LC POLES (2)
XTAL POLES (2)
<+5 dBm> OR <-15 dBm>

A4A6A2 DOWN CONVERTER
50
<-1dBm>
RES BW >1kHz
RES BW ≤1kHz
SEE NOTE 2
3 MHz
18.4 MHz
<-15dBm>

A4A7 3MHz BANDWIDTH FILTER
5 POLES
4

A4A6A1 UP CONVERTER
50
RES BW >1kHz
RES BW ≤1kHz
SEE NOTE 2
<+4dBm>
18.4 MHz
21.4 MHz
1 POLE
<+5dBm>

A4A5 STEP GAIN
0→50dB Δ=10dB
-15.9→0dB Δ=0.1dB
<-3dBm>
SEE NOTE 2
18.4 MHz
FREQ ZERO (FROM A1A1)
3 STEP GAIN CONTROL
4

ATTENUATION CONTROL 2 3

21.4 MHZ IF J1-5 6 W18 IF OUTPUT TO FREQUENCY COUNTER
SWEEP
J1-4 93 W17 AUX SWEEP 0 TO 10 VOLTS
J1-3 0 W16 SWEEP INPUT 0 TO 10 VOLTS
BANDWIDTH CONTROL

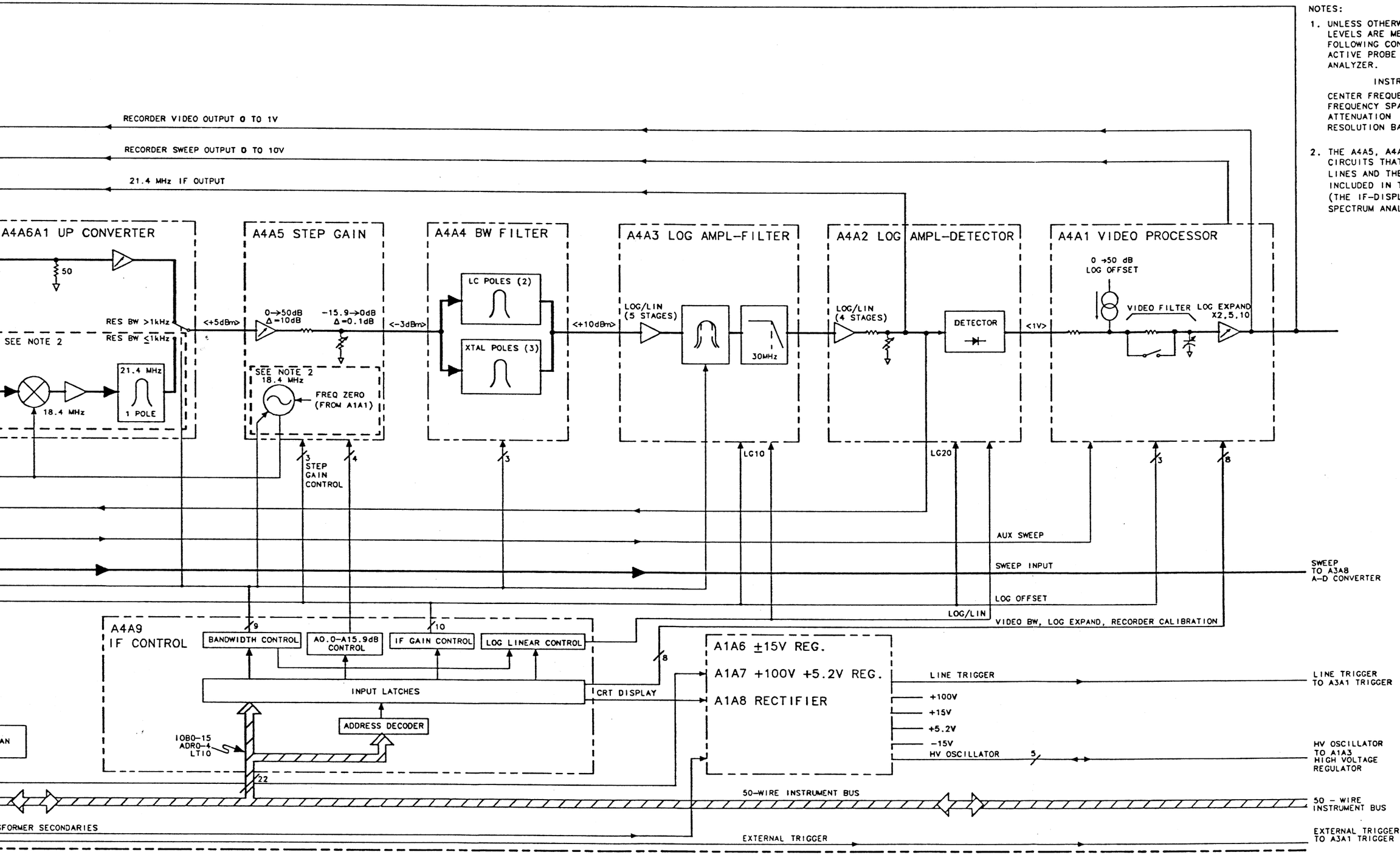
DISPLAY OUTPUTS
X 83 W28 AUX X (FROM A1A4)
Y 81 W29 AUX Y (FROM A1A5)
Z 82 W27 AUX Z (FROM A3A2)
BLANK 86 W32 AUX BLANK (FROM A3A2)

A4A9 IF CONTROL
9
BANDWIDTH CONTROL
A0.0-A15.9dB CONTROL
IF GAIN C
INPUT LATCHES
ADDRESS DECODER
IOBO-15
ADRO-4
LTIO
22

LINE IN 3
EXTERNAL TRIGGER INPUT 85 W26

LINE MODULE TRANSFORMER
A1A9 BUS TRANSITION
FAN RELAY
FAN
HPON
W8
9 TRANSFORMER SECONDARIES

50-WIRE INSTRUMENT BUS TO A15 CONTROLLER
J4 W31 50 J2
50-WIRE INSTRUMENT BUS



NOTES:

1. UNLESS OTHERWISE INDICATED, POWER LEVELS ARE MEASURED UNDER THE FOLLOWING CONDITIONS USING AN ACTIVE PROBE AND THE SPECTRUM ANALYZER.

   INSTRUMENT PRESET

CENTER FREQUENCY	20 MHz
FREQUENCY SPAN	0 Hz
ATTENUATION	0 dB
RESOLUTION BANDWIDTH	3 kHz

2. THE A4A5, A4A6A1, AND A4A6A2, CIRCUITS THAT ARE ENCLOSED IN DOTTED LINES AND THE A4A7 ASSEMBLY ARE NOT INCLUDED IN THE HP 85662 OPTION 067 (THE IF-DISPLAY SECTION FOR THE 8567A SPECTRUM ANALYZER).

SPECTRUM ANALYZER OVERALL, BLOCK DIAGRAM (2 OF 3)

RF SECTION

DISPLAY SECTION

W11 8 VIDEO

A3A9 TRACK AND HOLD

POS PEAK DETECTOR

NEG PEAK DETECTOR

POS PEAK

NEG PEAK

SAMPLE

HOLD

TRACK

HOLD (FROM A3A6)

A3A8 A-D CONVERTER

ADC

RAMP CONVERTER

DAC

COMPARATOR

A3A4 MEMORY

CHARACTER STROKE MEMORY (2K X 8)

RAM (4K X 12)

BUFFER

MEMORY DATA REGISTER

MEMORY ADDRESS REGISTER

A3A3 LINE GENERATOR

Y REGISTER

Y DAC

Y SAMPLE AND HOLD

Y INTEGRAT

EXPAND REGISTER

REFERENCE

X REGISTER

X DAC

X SAMPLE AND HOLD

X INTEGRAT

VIDEO FROM A4A1 VIDEO PROCESSOR

INPUT SELECT (FROM A3A6)

SWEEP FROM A22 FREQUENCY CONTROL

CONSTANT SELECTION

WRITE CONTROL

CHIP ENABLE

CONSTANT SELECTION

DIGITAL STORAGE B

FROM SHEET 2

LINE TRIGGER FROM A1A8 RECTIFIER

A3A6 MAIN CONTROL

RAM CE GENERATOR

ROM ENABLE

TEST ROM

PROGRAM ROM (512-WORD X 32 BIT)

STATE REGISTER

LINK REGISTER

BRANCH LENGTH ADDER

STATE MACHINE CONTROL

PIPELINE REGISTER

PIPELINE REGISTER

ADDRESSABLE FLIP-FLOPS

CONTROL PULSES

DUAL TIMER

HOLD (TO A3A8 AND A3A9)

INPUT SELECT (TO A3A9)

INTENSITY CONTROL (TO A3A2)

I/O SELECTION

TO A3A7

QUALIFIER SELECTION

RAM REGISTER SELECTION, FUNCTION SELECTION

BLOCK SWITCH CONTROL

A3A5 DATA MANIPULATOR

MULTIPLEXER BUS DRIVER

BUFFER

CONSTANT ROM

ACCUMU-LATOR

REGISTER RAM

ALU

A3A7 INTER

DATA TRANSFER REGISTER

TRANSFER

BUS DRIVERS

ADR0-4
IOB0-11
LTIO

LINE TRIGGER

50-WIRE INSTRUMENT BUS

50-WIRE INSTRUMENT BUS

EXTERNAL TRIGGER FROM REAR PANEL

EXT TRIGGER

HV OSCILLATOR FROM A1A6 ±15V REGULATOR

HV OSCILLATOR

NOTE:
UNLESS OTHERWISE INDICATED, POWER LEVELS ARE MEASURED UNDER THE FOLLOWING CONDITIONS USING AN ACTIVE PROBE AND THE SPECTRUM ANALYZER:

INSTRUMENT PRESET

CENTER FREQUENCY	20 MHz
FREQUENCY SPAN	0 Hz
ATTENUATION	0 dB
RESOLUTION BW	3 kHz

SERIAL PREFIXES 3004A AND ABOVE, A1A2, A1A4 AND A1A5 ARE COMBINED ONTO A SINGLE ASSEMBLY (A1A2 XYZ DRIVER AMP).

A3A2 INTENSITY CONTROL

A1A5 Y DEFLECTION AMPL

A1A4 X DEFLECTION AMPL

A1A2 Z-AXIS AMPL

A1A1 KEYBOARD

A1V1 CRT

VERTICAL DEFLECTION PLATES

HORIZONTAL DEFLECTION PLATES

POST ACCELERATOR

CATHODE AND GRIDS

A1A3 HIGH VOLTAGE REG

CONTROL GATE

FOCUS GATE

INTENSITY LIMIT

HV OSCILLATOR

A1A11 HIGH VOLTAGE MULTIPLIER

Y INTEGRATOR

Y FILTER

X INTEGRATOR

X FILTER

SWEEP TIME < 20 ms

SWEEP TIME ≥ 20 ms

LINE GENERATOR Z AXIS 1ΔX1+1ΔY1

INPUT REGISTER

BUS BUFFER

BLANKING LOGIC

AUX Z

AUX BLANK

INTENSITY CONTROL (FROM A3A6)

VIDEO

W24

W29 AUX Y

W27 AUX Z

W32 AUX BLANK

W23

W28 AUX X

W21

INTENSITY LIMIT CRT ADJUST

DIGITAL STORAGE BUS (B0–B11)

QUALIFIER SELECTION (FROM A3A6)

INTERFACE

DATA TRANSFER REGISTER

DIGITAL STORAGE BUS DRIVER

QUALIFIER SELECT

TRANSFER BUS

I/O CONTROL (TO A3A3, A3A4 A3A6, A3A8)

BUS DRIVERS

ADDRESS DECODER

I/O PORT DECODER

I/O SELECTION (FROM A3A6)

A3A1 TRIGGER

FAST SWEEP GENERATOR AND CONTROL

SWEEP TRIGGER

W25

PENLIFT (TO REAR PANEL)

TIMING GENERATOR

16 MHz

÷2

÷10

÷5

8 MHz (DIGITAL STORAGE CLOCK)

1 MHz

200 kHz (LINE GEN CLOCK)

ADR0–4
10B11–15
LT10
HSWP

LINE TRIGGER

EXT TRIGGER

VIDEO TRIGGER LEVEL

KR8–11
10B0–15
KC0–7
HSWP

FREQ ZERO (TO A4A5)

CRT CONTROLS

STATUS INDICATORS

KEY SWITCHES

SPECTRUM ANALYZER OVERALL, BLOCK DIAGRAM (3 OF 3)

RF Section Analog Troubleshooting

Center Frequency Tuning Equations and Phase Lock Troubleshooting

Troubleshooting of the phase lock loops is much easier with an understanding of how the center frequency and the counts at marker are derived. Phase lock troubleshooting is also simplified by the use of the Diagnostic Functions.

Figure 1 shows a simplified block diagram of the assemblies involved in setting the center frequency. The HP 8568B and HP 8567A have two tuning modes. For frequency spans greater than 1 MHz, a method called lock and roll is used. Basically, this involves phase locking the analyzer at the center frequency only during the retrace period of a sweep. A more thorough description of this technique is included in the A6 YTO Phase Lock Troubleshooting. For frequency spans of 1 MHz and less, the analyzer is phase locked during all of a sweep.

The equation for center frequency is

$$f_{CF} = 20\,\text{MHz} \cdot \text{N} + \text{f}_{\text{PILOT}} - \text{f}_{\text{VTO}} - (9 - \text{M} + .125\text{P}) \cdot \text{f}_{\text{REF}} - \text{f}_{\text{IF}}$$

where

f_{CF} = Center Frequency
f_{PILOT} = Pilot IF-frequency. Use KSK to count. Range is approximately 8 MHz to 32 MHz.
f_{VTO} = 50 MHz VTO frequency divided by either 20 (for frequency spans of 100 kHz or less), or 10 (for spans greater than 100 kHz). KSN counts the 50 MHz VTO frequency divided by 2. The range is 25 MHz ±3.75 MHz.
f_{REF} = 4 MHz
f_{IF} = Signal IF frequency. Use KSQ to count.
N = Harmonic for 20 MHz comb to which analyzer is locked. KSR displays value of N which varies from 2 to 89.
M, P = Divide number used by A8 Phase Lock assembly. KSR displays values. M varies from 0 to 5 while P varies from 0 to 7.

As an example, these values are used following an (INSTR PRESET).

f_{PILOT} = 20 MHz
f_{VTO} = 5.1 MHz
N = 39, M = 4, P = 7

Substituting these values into the equation:

$$f_{CF} = 20\,\text{MHz} \cdot 39 + 20\,\text{MHz} - 5.1\,\text{MHz} - (9 - 4 + .125 \cdot 7) \cdot 4\,\text{MHz} - 21.4\,\text{MHz} = 750\,\text{MHz}$$

The same equation is used in the (FREQ COUNT) mode except that the frequencies are counted at the marker. The Marker mode readout method will be described later. Note that the YTO,

Second LO and 280 MHz oscillators do not affect the center frequency equation, as all are both the signal path and pilot path.

Lock and Roll Tuning

In the lock and roll mode, the sweep is applied to either the YTO Main Coil or the FM Coil as indicated in Figure 1. The Second LO is set at 1748.6 MHz. The 275 MHz PLO is not swept and thus the 249 MHz loop frequency is constant. (The programmed frequency for this loop can be read with KSR.) The Pilot IF frequency is approximately 20 MHz at the center frequency of the analyzer. The Pilot IF is counted by A17 when the Controller is determining if the YTO is actually tuned to the correct frequency.

Phase Locked Tuning

In the phase locked mode, the sweep is derived from the 50 MHz VTO.

This causes the 249 MHz loop to sweep. Because the Pilot IF is exactly 20 MHz, the 269 MHz (loop) and the 249 MHz loop are always 20 MHz apart. The Second LO is switched between 1748.6 MHz and 1753.6 MHz to eliminate crossing spurs. For center frequency of 0 to 2.49 MHz, it is 1753.6 MHz, it is 1753.6 MHz. It goes to 1748.6 MHz for center frequency from 2.50 MHz to 7.49 MHz. This pattern of switching every 5 MHz is repeated to the highest center frequency of 1500 MHz. The state of the Second LO is indicated by the last digit in row 4 of KSR.

Marker Modes

(NORMAL)

When the Marker (NORMAL) mode is selected, the analyzer does the following: first, the center frequency is determined. In the (NORMAL) mode, the Signal IF is not counted but 21.4 MHz is assumed by the Controller. Because the (NORMAL) Marker is a display marker, the position of the marker on the display is determined after the center frequency is calculated. By knowing that the display consists of 1000 points and the programmed frequency span, the Controller calculates the offset between the center frequency and the marker. The frequency span accuracy is the major cause of error in the readout accuracy of the Marker (NORMAL) mode.

(FREQ COUNT)

When the (FREQ COUNT) Marker mode is selected, the analyzer counts the 50 MHz VTO, Signal IF and the Pilot IF frequencies at the marker. If the analyzer is phase locked, the Pilot IF is not counted but is assumed to be 20 MHz. This implies that the accuracy is determined by the time base.

Frequency Readout Errors

A malfunction in one or more of the RF assemblies often leads to an offset in the center frequency. The most common offsets are:

a. 20 MHz

This may be caused by a maladjusted Comb Generator, A23A6; or on the A22 Frequency Control, a maladjustment of the START/STOP circuitry, or a Sweep Attenuator that is not sweeping over the correct range.

b. 4 MHz, 500 kHz, or their multiples

Check the A8 Phase Lock assembly for proper operation.

c. 21.4 MHz

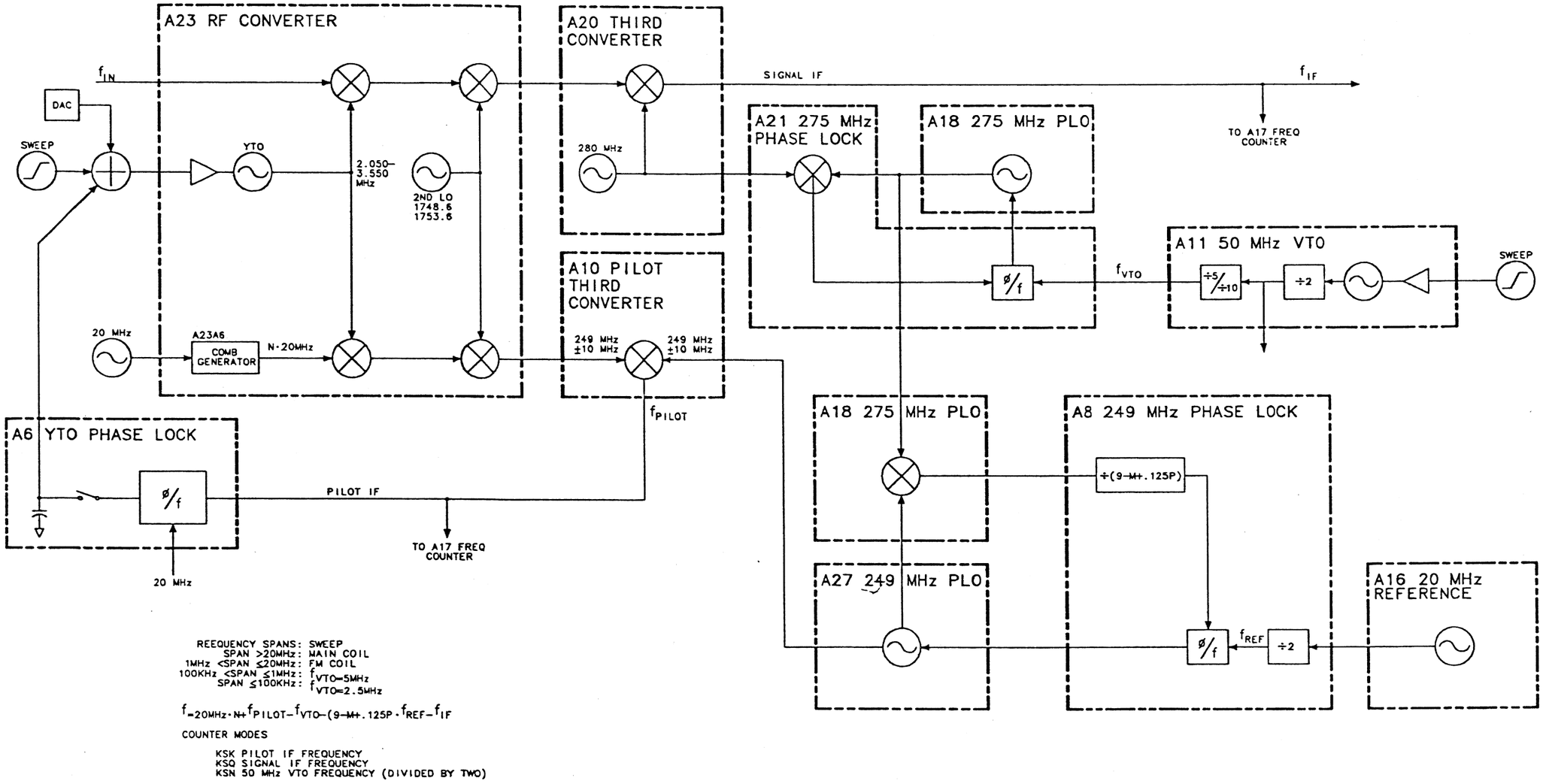
This occurs in [FREQ COUNT] mode if the Signal IF frequency is not read by A17. Check coaxial interconnect cable, A4A2 Log Amplifier-Detector in the IF-Display Section, and A17.

Phase Lock Loop Troubleshooting

If one of the phase lock error messages appears, a loop has failed.

Start the troubleshooting procedure by determining if the malfunction is dependent on center frequency, frequency span, etc. Next, break the suspected loop and measure the power levels as indicated on the RF Section Analog Block Diagram. Even with the oscillators at the extremes of their ranges, the power levels must be within the limits indicated. The loop frequencies can be counted and compared with the programmed frequencies listed by KSR by inserting a Tee connector into the loop.

The Phase Lock Inhibit jumper (see RF Section Digital Troubleshooting) may be necessary if the keyboard is locked out. Use the information from the Diagnostic Function and the Center Frequency Tuning Equations to narrow the fault to a single assembly.



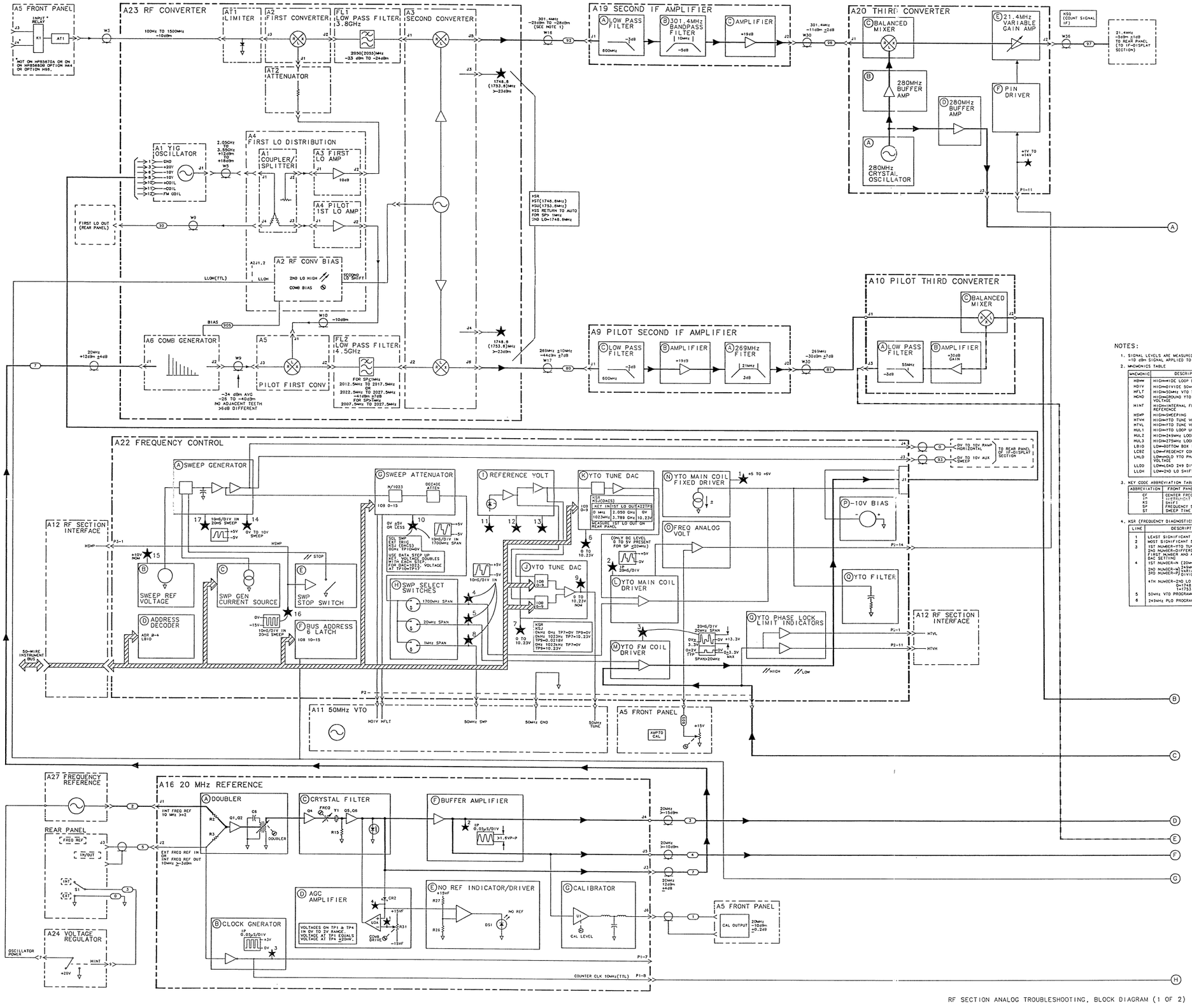
REEQUENCY SPANS: SWEEP
SPAN >20MHz: MAIN COIL
1MHz <SPAN ≤20MHz: FM COIL
100KHz <SPAN ≤1MHz: f_{VTO}=5MHz
SPAN ≤100KHz: f_{VTO}=2.5MHz

f=20MHz·N+f_{PILOT}–f_{VTO}–(9–M+.125P·f_{REF}–f_{IF}

COUNTER MODES

KSK PILOT IF FREQUENCY
KSQ SIGNAL IF FREQUENCY
KSN 50 MHz VTO FREQUENCY (DIVIDED BY TWO)

SIMPLIFIED RF, BLOCK DIAGRAM



RF SECTION ANALOG TROUBLESHOOTING, BLOCK DIAGRAM (1 OF 2)

NOTES:

1. SIGNAL LEVELS ARE MEASURED WITH −10 dBm SIGNAL APPLIED TO A13A2J3.
2. MNEMONICS TABLE

MNEMONIC	DESCRIPTION
HDMW	HIGH=WIDE LOOP BANDWIDTH
HDIV	HIGH=DIVIDE 50MHz VTO BY 2
HFLT	HIGH=50MHz VTO TUNE FILTER ON
HGND	HIGH=GROUND YTO PHASE-LOCK VOLTAGE
HINT	HIGH=INTERNAL FREQUENCY REFERENCE
HSWP	HIGH=SWEEPING
HTVH	HIGH=TO TUNE VOLTAGE HIGH
HTVL	HIGH=TO TUNE VOLTAGE LOW
HUL1	HIGH=TO LOOP UNLOCKED
HUL2	HIGH=2.5GHz LOOP UNLOCKED
HUL3	HIGH=275MHz LOOP UNLOCKED
LBI0	LOW=BOTTOM BOX I/O STROBE
LCBZ	LOW=FREQUENCY COUNTER BUSY
LHLD	LOW=HOLD YTO PHASE-LOCK VOLTAGE
LLOD	LOW=LOAD 249 DIVIDER NUMBERS
LLOH	LOW=2ND LO SHIFTED HIGH

3. KEY CODE ABBREVIATION TABLE

ABBREVIATION	FRONT PANEL KEY
CF	CENTER FREQUENCY
IP	INSTRUMENT PRESET
KS	SHIFT
SP	FREQUENCY SPAN
ST	SWEEP TIME

4. KSR (FREQUENCY DIAGNOSTICS)

LINE	DESCRIPTION
1	LEAST SIGNIFICANT 50MHz TUNE DAC
2	MOST SIGNIFICANT 50MHz TUNE DAC
3	1ST NUMBER=YTO TUNE DAC 2ND NUMBER=DIFFERENCE BETWEEN FIRST NUMBER AND ACTUAL YTO DAC SETTING
4	1ST NUMBER=N (20MHz HARMONIC) 2ND NUMBER=M (VARIABLE MODULO) 3RD NUMBER=P (DIVIDER NUMBERS 4TH NUMBER=2ND LO SHIFT 0=1745.5MHz 1=1753.5MHz
5	50MHz VTO PROGRAMMED FREQUENCY
6	249MHz PLO PROGRAMMED FREQUENCY

RF Section Digital Troubleshooting

Preliminary Checks

Instrument Preset Check

The two red INSTR CHECK LEDs are forced on whenever the instrument is turned on or [INSTR PRESET] is pushed. The A15 Controller then performs a self check of itself, a checksum verification of all the ROMs on the A15 Controller assembly, a partial check of the Instrument Bus, and a read-write check of the RAMs in the A3 Digital Storage. If all the checks pass, both INSTR CHECKS LEDs go out.

If the checks fail, one or more of the INSTR CHECK LEDs remain on.

a. Both LEDs on indicates an A15 Controller problem. First check to see that A15 is pushed completely into its edge connectors.

b. LED I on indicates a failure occurred when checking Digital Storage memory. First check to see that the Analyzer Bus Interconnect Cable, W31, is connected properly.

c. LED II on indicates a failure during the partial interface check.

The partial interface check reads the key column lines from the A5 front panel. If any key, except [LCL], is pressed when the [INSTR PRESET] is pressed, the right INSTR CHECK LED should stay on. This can be used to verify that the check routine is working and that a particular key is working.

Use the A15 Controller Self Test Fail indicators Table (in the A15 tab) to further isolate the source of the failure.

"Long Pop" Instrument Preset Check (Jumper A15TP1-9 [ST] to A15TP1-8 [T3])

This check is very similar to the normal INSTR PRESET check; an additional A15 Controller check is performed, all of the RAM locations in Digital Storage are checked, and the memory (RAM) on A15 is verified. On early versions of A15 Controller, jumper A15TP8 [STS] to A15TP1-7 [T3] instead of A15TP1-9 to A15TP1-8.

HP-IB Verification

When the instrument is turned on, keep the [INSTR PRESET] key pressed. the ADRS'D LED should flash until the [INSTR PRESET] key is released and the A15 Controller acknowledges the HP-IB request. If it doesn't flash, the A15 Controller is malfunctioning. All cables must be removed from the HP-IB connector, J5. This verification is only accurate for early versions of A15 Controller.

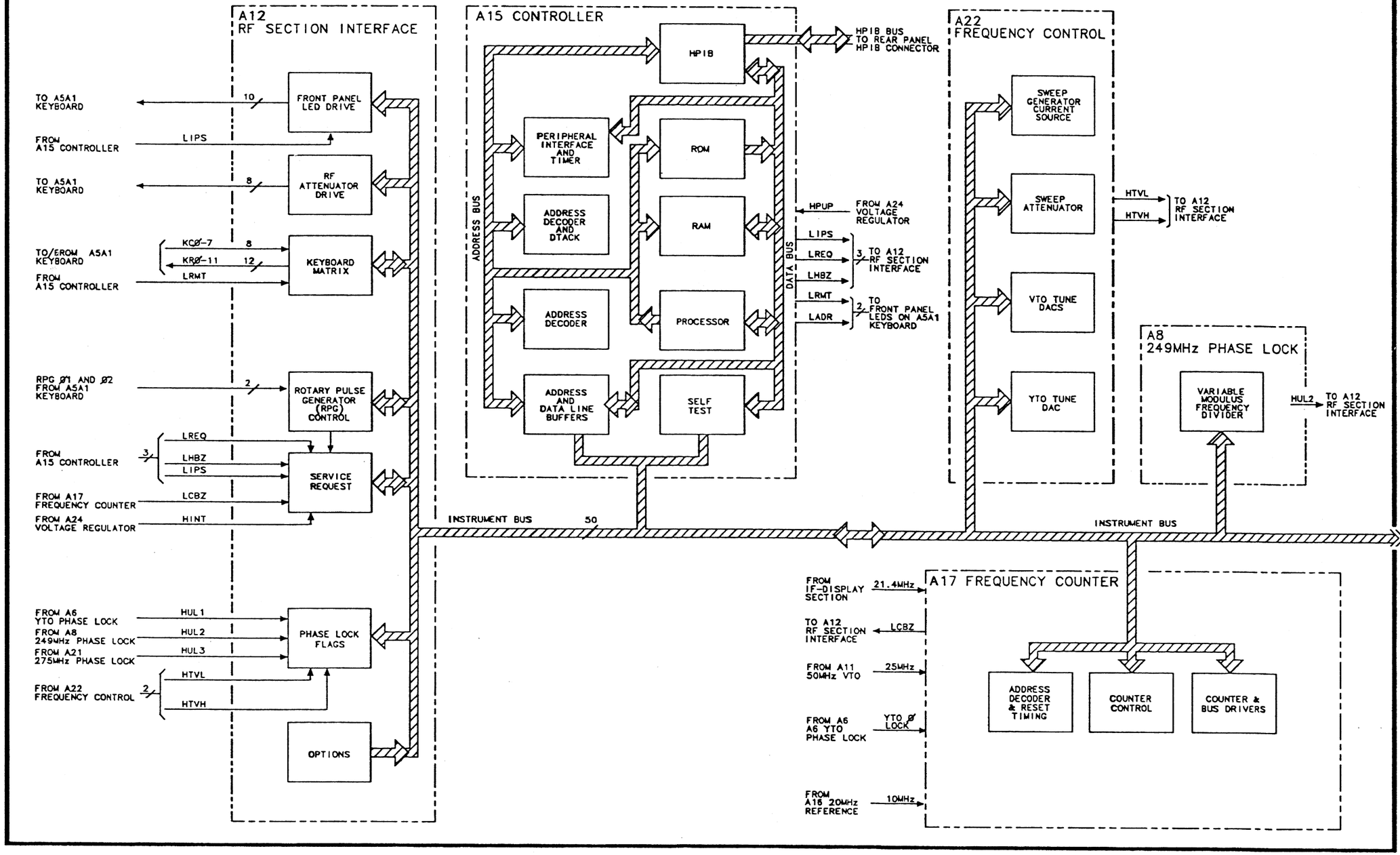
Phase Lock and Counter Inhibit (Jumper A15TP1-9 [ST] to A15TP1-6 [T1])

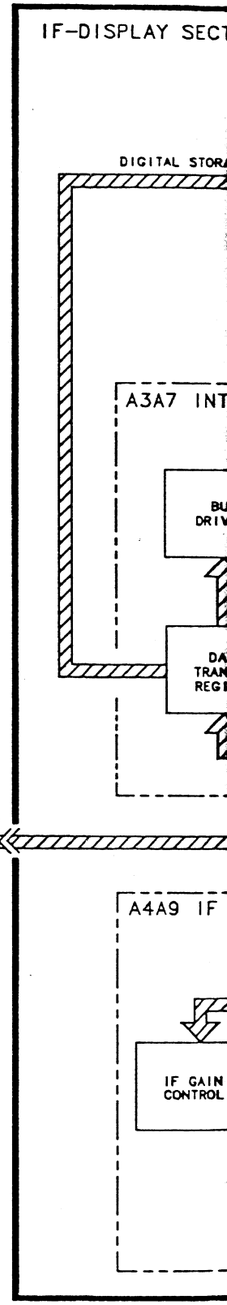
Following INSTR PRESET, the processor performs the phase lock inhibit function and ignores the A17 Frequency Counter. (20 MHz is substituted for all frequency counts.) Removing the jumper re-enables the counter. If the analyzer stops sweeping immediately after the jumper is removed, the A17 Frequency counter is malfunctioning. On early versions of A15 Controller, jumper A15TP4 [STS] to A15TP1-4 [T1] instead of A15TP1-9 and A15TP1-6

Digital Storage Verification

The above INSTR PRESET check does a fairly complete verification of the Digital Storage controller and Memory. An additional check can be done, independent from the RF section, by jumpering A3A6TP3 to A3A6TP6 and pushing A3A7S1 momentarily. A test pattern should appear on the display. See the Digital Storage Troubleshooting notes for more detail. Note that when the jumper is connected, the left check LED always stays on following an INSTR PRESET, since in the test pattern mode, Digital Storage ignores all instructions from A15 Controller.

RF SECTION INSTRUMENT BUS STRUCTURE





ONTROLLER

HP1B

HP1B BUS TO REAR PANEL HP1B CONNECTOR

PERIPHERAL INTERFACE AND TIMER

ROM

ADDRESS DECODER AND DTACK

RAM

ADDRESS DECODER

PROCESSOR

ADDRESS AND DATA LINE BUFFERS

SELF TEST

DATA BUS

HPUP — FROM A24 VOLTAGE REGULATOR

LIPS, LREQ, LHBZ — 3 TO A12 RF SECTION INTERFACE

LRMT, LADR — 2 TO FRONT PANEL LEDS ON A5A1 KEYBOARD

BUS 50

A22
FREQUENCY CONTROL

SWEEP GENERATOR CURRENT SOURCE

SWEEP ATTENUATOR

HTVL, HTVH — TO A12 RF SECTION INTERFACE

VTO TUNE DACS

YTO TUNE DAC

A8
249MHz PHASE LOCK

VARIABLE MODULUS FREQUENCY DIVIDER

HUL2 — TO A12 RF SECTION INTERFACE

INSTRUMENT BUS

W31

FROM IF-DISPLAY SECTION — 21.4MHz

TO A12 RF SECTION INTERFACE — LCBZ

FROM A11 50MHz VTO — 25MHz

FROM A6 A6 YTO PHASE LOCK — YTO LOCK

FROM A18 20MHz REFERENCE — 10MHz

A17 FREQUENCY COUNTER

ADDRESS DECODER & RESET TIMING

COUNTER CONTROL

COUNTER & BUS DRIVERS

IF-DISPLAY SECTION INSTRUMENT BUS STRUCTURE

DIGITAL STORAGE BUS — 12 — DIGITAL STORAGE BUS TO REMAINDER OF A3 DIGITAL STORAGE

A3A7 INTERFACE

BUS DRIVERS

DIGITAL STORAGE BUS DRIVERS

TRANSFER BUS

DATA TRANSFER REGISTER

ADDRESS DECODER

A1A1 KEYBOARD

STATUS INDICATORS

KEYBOARD SWITCHES

INSTRUMENT BUS 50

A4A9 IF CONTROL

IF GAIN CONTROL

LOG/LINEAR CONTROL

BANDWIDTH CONTROL

A3A1 TRIGGER

FAST SWEEP TIME CONTROL

HIGH SWEEP CONTROL

SWEEP TRIGGER

Pilot Third Local Oscillator, Circuit Description

The purpose of the Pilot Third Local Oscillator is to produce the precise frequency in the range of 238.5 MHz to 259.5 MHz that will allow the analyzer to be tuned to frequencies between the 20 MHz reference combs.

The Pilot Third Local Oscillator is comprised of the following assemblies:

- A7 249 MHz Phase Lock Oscillator
- A8 249 MHz Phase Lock
- A18 275 MHz Phase Lock Oscillator
- A21 275 MHz Phase Lock
- A11 50 MHz Voltage-Tune Oscillator

A7 249 MHz Phase Lock Oscillator

The control voltage from A8 249 MHz Phase Lock allows A7 249 MHz Phase Lock Oscillator to generate two signals:

- A Signal to A10 Pilot Third Converter which can be continuously tuned over a range of 239 MHz to 259 MHz and can be swept up to ±500 kHz about any point in that range.
- Another signal to A18 275 MHz Oscillator. (Refer to the description of that assembly.)

A8 249 MHz Phase Lock

The frequency from A18 (16 MHz to 38.5 MHz) is divided in A8 249 MHz Phase Lock to produce one of the two frequency inputs to a Phase/Frequency Detector. The other input is a 4 MHz reference signal (20 MHz divided by 5) from A16 20 MHz Reference. If the two inputs to the Phase/Frequency Detector are out of phase, a control voltage is generated to force a change in the frequency of A7 249 MHz Phase Lock Oscillator until the inputs are in phase.

A18 275 MHz Phase Lock Oscillator

A 249 (±10) MHz signal from A7 249 MHz Phase Lock Oscillator is mixed with the output of the 275 MHz Phase Lock Oscillator to produce a signal to A8 249 MHz Phase Lock that is in the range of 16 MHz to 38.5 MHz. A18 also sends 275 MHz to A21, where it is mixed with 280 MHz from A20 Third Converter.

A21 275 MHz Phase Lock

In A21 275 MHz Phase Lock, the signal from the 275 MHz oscillator in A18 is mixed with 280 MHz from A20 Third Converter, and the difference frequency is sent to the Phase/Frequency Detector for comparison with the reference frequency from A11. If the two input frequencies are out of phase, a correction voltage from the Phase/Frequency Detector will force a change in the 275 MHz oscillator frequency until the inputs are in phase.

A11 50 MHz Voltage-Tuned Oscillator (VTO)

The 50 MHz VTO is used to tune the Pilot Third Local Oscillator ±250 kHz corresponding to the spacing between the lock points in A7 249 MHz Phase Lock Oscillator. This is accomplished by providing a reference frequency to the Phase/Frequency Detector of A21 275 MHz Phase Lock. The reference frequency is either 5 (±0.75) MHz or 2.5 (±0.300) MHz, depending on the selected frequency span. For spans >100 kHz but ≤1 MHz, the 50 (±7.5) MHz oscillator frequency is divided by 10; for spans of 100 kHz or less, the frequency is divided by 20. For spans greater than 1 MHz, the VTO is not swept; the sweep is applied to A23A1 YIG-Tuned Oscillator (the first LO).

The frequency to which the 50 MHz oscillator is tuned is determined by the output of the Summing Amplifier, whose inputs are the 50 MHz SWEEP and the 50 MHz TUNE signals from A22 Frequency Control. For sweep times of 10 s or longer, the Slow Sweep Filter is switched into the circuit to filter off low-frequency components (on the 50 MHz SWEEP and 50 MHz TUNE lines) which in the most narrow bandwidths (30 Hz and 10 Hz) might cause spurious responses.

RF SECTION

FREQUENCY REF
A27 or A14
10 MHz
W32
2
20 MHz REF
A16
J1
X 2
J5
20 MHz
>-10 dBm
4
W23
16 MHz 38.5 MHz
>-10 dBm
86
W24
CONTROLLER
A15
I0B
10-15
MOTHERBOARD
A26
XA15P2
XA8P2
RF SECTION INTERFACE
A12
LLDD
HUL 2
XA12P2

A8 249 MHz PHASE LOCK

J1
J2
Ⓐ VARIABLE MODULO FREQUENCY DIVIDER
40 MHz LPF
L1
C24
C25
50Ω TO ECL BUFFER
Q3, Q4
TTL TO ECL LEVEL SHIFT
R5-R10
PRESET PULSE COUNT U5
DIVIDE RATIO SELECT U10, U13C
SIGNAL GATE U8
END OF COUNT DETECTOR U11, U13A, U13B
ECL TO TTL BUFFER
U6B
LLDD
DATA LATCH U15
DIVIDE RATIO CONTROL U14
Ⓑ REFERENCE ÷5
ECL CONV
÷ 5
4 MHz ECL
Ⓒ Ø FREQUENCY DETECTOR
Ⓓ LOCK INDICATOR
249 MHz UNLOCKED
HUL2
Ⓔ LOOP AMPLIFIER

A11 50 MHz VOLTAGE-TUNED OSCILLATOR

Ⓐ SLOW SWEEP FILTER +1V TO +18V
FILTER DRIVER
FILTER
R64
SWITCH
C24
+ 0.2 V — FILTER ON
+ 20 V — FILTER OFF
NOTE: GROUND TP6 TO FORCE SLOW SWEEP FILTER ON.
GROUND TP7 TO FORCE SLOW SWEEP FILTER OFF.
Ⓒ 50 MHz OSCILLATOR
50 MHz
±7.5 MHz
+0.6V
BUFFER AMPL
Ⓓ DIVIDE BY TWO
ECL AMPL
÷ 2
Ⓔ DIVIDE BY FIVE OR TEN
÷ 2
SWITCH
÷ 5
HDIV (TTL)
HFLT(TTL)
Ⓑ SHAPING NETWORK
SUMMING AMPL
50 MHz TUNE
0 V TO +10.23 V
(SENSITIVITY, REFERRED TO 50 MHz: 1.5 MHz/V)
50 MHz SWEEP
-5 V TO +5 V
(SENSITIVITY, REFERRED TO 50 MHz: 1 MHz/V)
R9 GAIN
COVER TEST POINT
-13V TO +18V
R42 SHAPING ATTEN
R17 SHAPING OFFSET
R10 OFFSET
SHAPING ATTEN
HDIV (TTL)

FREQUENCY COUNTER
A17
25 MHz
J2
8
W18
25 MHz ±3.75 MHz
>-15 dBm

FREQUENCY CONTROL
A22
MOTHERBOARD
A26
XA22P2
XA11P2
HFLT 9 12
50 MHz TUNE 4 7
50 MHz SWEEP 6 9
50 MHz GND 5 8
HDIV 8 11

A21 275
J1
W19
85
5 MHz ±50 KHz OR
OR
2.5 MHz ±300 KHz
(ECL)
THRID CONVERTER
A20
J3
280 MHz
W28
83
280 MHz
0 dBm ±3 dBm
AUX VTO
5.0 MHz ± 750 KHz
OR
2.5 MHz ± 300 KHz
(ECL)

MOTHERBOARD
A26
XA8P1 XA7P1
249 MHz TUNE
+4 TO +18 V
6 12

A7 249 MHz PHASE LOCK OSCILLATOR
4V TO 18V
Ⓐ TUNE VOLTAGE FILTER
PLL COMPENSATION
L17 L15
500 KHz TRAPS
Ⓑ 249 MHz Ø LOCK
C3 PLO ADJUST
0 dBm
Ⓒ BUFFER AMPL 1
2.5dB PAD
9dB AMPL
-2.5dBm +6.5dBm
Q3
2.5dB PAD
J1
Ⓓ BUFFER AMPL 2
5dB PAD
12dB AMPL
-5dBm +7dBm
Q2
5dB PAD
J2
0 dBm

W21
89
249 MHz ±10 MHz
+5dBm ± 2dBm
PILOT THIRD CONVERTER
A10
J2
249 MHz

W25
87
249 MHz ±10 MHz
+2dBM ±2dB

W24
86

A18 275 MHz PHASE LOCK OSCILLATOR
J1
Ⓔ 30dB PAD
Ⓐ 60 MHz LOW PASS FILTER
60 MHz
Ⓒ IF AMPLIFIER
Ⓕ MIXER
J2
Ⓘ BUFFER AMPL 2
Ⓚ 6 dB PAD
Ⓑ TUNE FILTER
1.5 MHz
Ⓓ 275 MHz PLO
PLO ADJUST
Ⓗ BUFFER AMPL 1
Ⓖ 3 dB PAD 1
Ⓙ 3 dB PAD 2
J3

21 275 MHz PHASE LOCK

Ⓑ LOCK DETECTOR
HUL3 (TTL)
MOTHERBOARD
A26
XA21P1 XA12P2
1
RF SECTION INTERFACE
A12
10
HUL3

1
Ⓐ PHASE DETECTOR
2
3
Ⓒ LOOP AMPL AND FILTERS
4
Ⓓ HIGH AND LOW CLAMPS
5
LOW CLAMP
HIGH CLAMP
XA21P2
275 MHz TUNE
+4 V TO +13 V
XA18P1
2
8

A21A1 275 MHz MIXER
Ⓔ FILTER AND 20 dB
433 MHz LPF
20 dB PAD
Ⓕ MIXER
Ⓖ 50 MHz LPF
Ⓗ LOW NOISE AMPL
3
Ⓘ BUFFER AMPL
15 MHz LPF
J2
W39
83
J3
W40
84
J3
W29
84
J3
275 MHz ±750 KHz
OR
277.5 MHz ±300 MHz +5 dBm ±2 dB
W29
84

PILOT THIRD LOCAL OSCILLATOR, BLOCK DIAGRAM

A5

A5 Front Panel, Circuit Description

(Refer to HP 85670A and HP 85680B Option H44/H96 tabs for A5 circuit descriptions for these versions.)

A5 Front Panel includes the following subassemblies:

- A5A1 Keyboard
- A5A2 Rotary Pulse Generator
- A5A3 DC Input Connector
- A5A4 Blocking Capacitor
- A5A5 Input Select

Also included are K1 Input Relay and AT1 Step Attenuator (0 to 70 dB in 10-dB steps).

A5A1 Keyboard

A5A1 Keyboard includes all the front-panel pushbutton key-switches and indicator LEDs. (Refer to A12 RF Section Interface for a description of the key-switch circuitry.) The LEDs, which are driven by A12, indicate the status of pushbuttons, except for INSTR CHECK indicators I (DS2) and II (DS3).

The INSTR CHECK indicators are used with a self-test routine that is run whenever the LINE switch is placed ON or the (INSTR PRESET) key is pressed. The self-test routine checks the digital circuitry in the A15 Controller, portions of A12 RF Section Interface, and A3 Digital Storage in the IF-Display Section. Both LEDs are lit until the self-test routine is completed. If both LEDs remain on, the trouble is probably in A15, INSTR CHECK II indicates probable trouble in A12 or the Instrument Bus, and INSTR CHECK I indicates probable trouble in the A3 Digital Storage section of the IF-Display Section.

A5A2 Rotary Pulse Generator

A5A2 Rotary Pulse Generator (RPG) is operated by the DATA knob on the front panel. The rate and direction of rotation of the knob are transmitted to A12 RF Section Interface on the 01 and the 02 lines.

A5A3 DC Input Connector

A5A3 DC Input Connector is normally used for signals which have no DC component. It is selected when the SIGNAL INPUT 1 pushbutton is pressed, energizing K1 Input Relay. This circuit is protected by fuse A5A3F1.

A5A4 Blocking Capacitor

A5A4 Blocking Capacitor prevents any dc component (up to ±50 VDC) of the input signal from getting into the Step Attenuator or Input Mixer. It has a frequency response of 100 kHz to 1.5 GHz.

A5A5 Input Select

The Input Select circuit includes two pushbutton switches, each with an indicator LED in its center. SIGNAL INPUT 1 selects the input through the DC Input Connector (Input Relay energized) for frequencies from 100 Hz to 1.5 GHz. SIGNAL INPUT 2 selects the input through the Blocking Capacitor for frequencies from 100 kHz to 1.5 GHz (Input Relay de-energized). The signal, in either case, is sent through AT1, the 0—70 dB Attenuator, to A23A2 First Converter.

When SIGNAL INPUT 1 is selected, the Input Relay is energized (refer to A12 RF Section Interface) and LED indicator DS11 is lit by +15 V through R1, since a Darlington Pair in A12 conducts, grounding its cathode. (DS12 is off because its anode is grounded.) When SIGNAL INPUT 2 is selected, the Input Relay is de-energized, turning off DS11 and applying +15 V to DS12 through the relay coil to light the SIGNAL INPUT 2 indicator LED.

ON/STANDBY Control

When the LINE switch is in STANDBY, a circuit is completed to A26 Motherboard to light STANDBY indicator LED DS1. The LED is lit when the instrument is in STANDBY or when regulated power to the instrument is removed during thermal shutdown.

PROBE POWER

The PROBE POWER connector provides power for active RF probes such as HP 1121A or HP 1120A Active probes. Three diodes on A26 Motherboard are in the −15 V line from A24 Regulator, resulting in about −13.4 V to the connector.

Reference Level Amplitude Calibration

AMPTD CAL screwdriver adjustment R3 provides a REF LEVEL CAL voltage to A22 Frequency Control.

CAL OUTPUT

The CAL OUTPUT connector provides a 20 MHz, −10 dBm signal from A16 20 MHz Reference.

Front Panel Removal and Repair

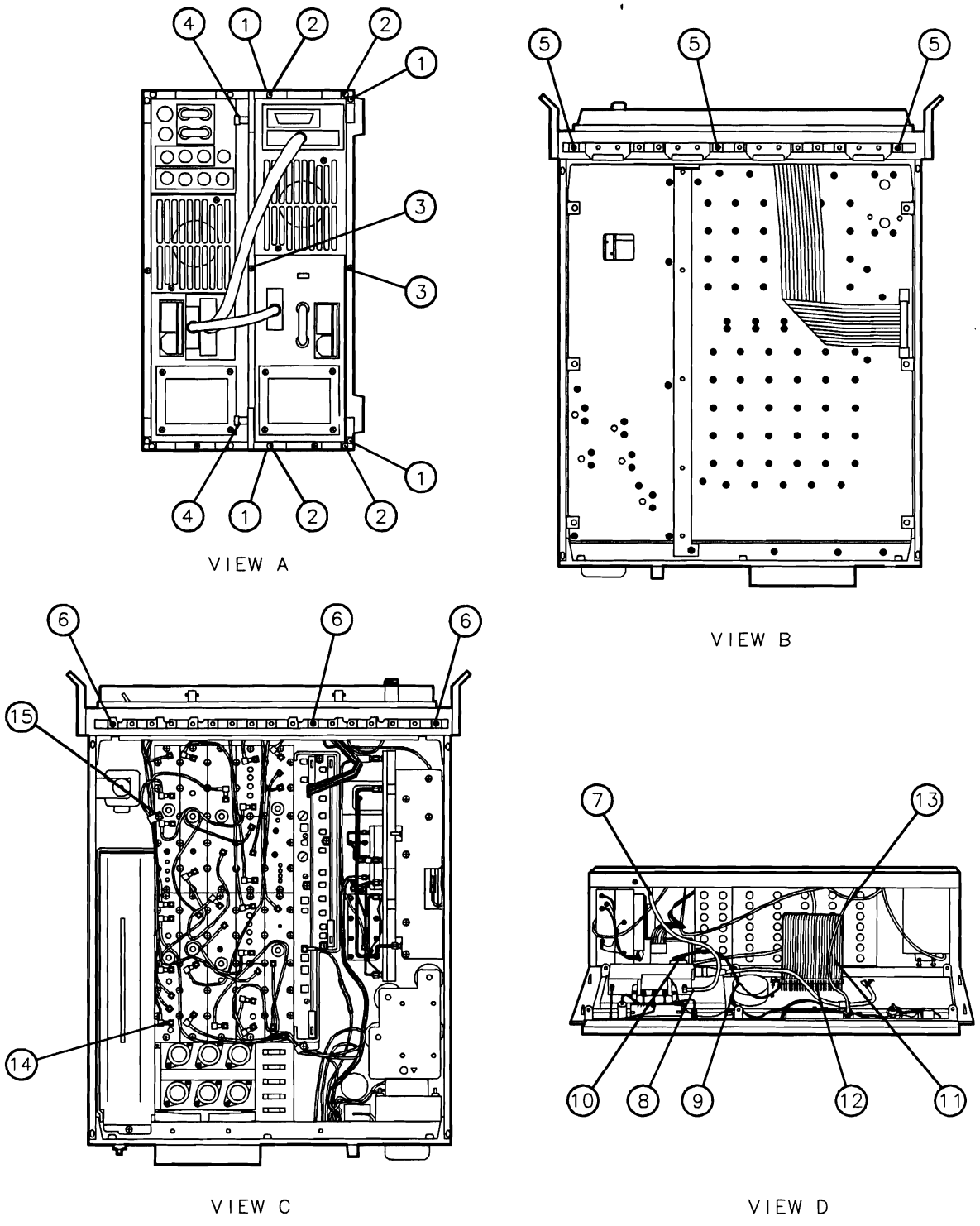


Figure 1. Front Panel Removal and Repair

1. Remove ac line cords from both instruments and remove interconnecting cables between instruments.
2. Position instrument on right side as shown in View A of Figure 1.
3. Loosen thumbscrews ④.
4. Separate instruments by holding IF-Display Section in place while pushing the RF Section at the front panel.
5. Remove feet ① by removing screws ②.
6. Remove covers from top and bottom of RF section by loosening screws ③.
7. Slide RF Section away from IF-Display Section far enough to remove screws ⑤ holding front panel to frame. (Refer to View B of Figure 1.)
8. Remove screws ⑥ from other side of instrument. (Refer to View C of Figure 1.)
9. Pull front panel out of frame, as shown in View D of Figure 1.
10. Disconnect cable ⑦ at connector ⑧. Disconnect cable ⑨ at connector ①⓪. Disconnect cable ①① at connector ①②. Disconnect cable ①③ at connector A16J6 ①④. It will be necessary to remove screw from cable clamp ①⑤ to remove cable ①③ from instrument. (Refer to View D.)

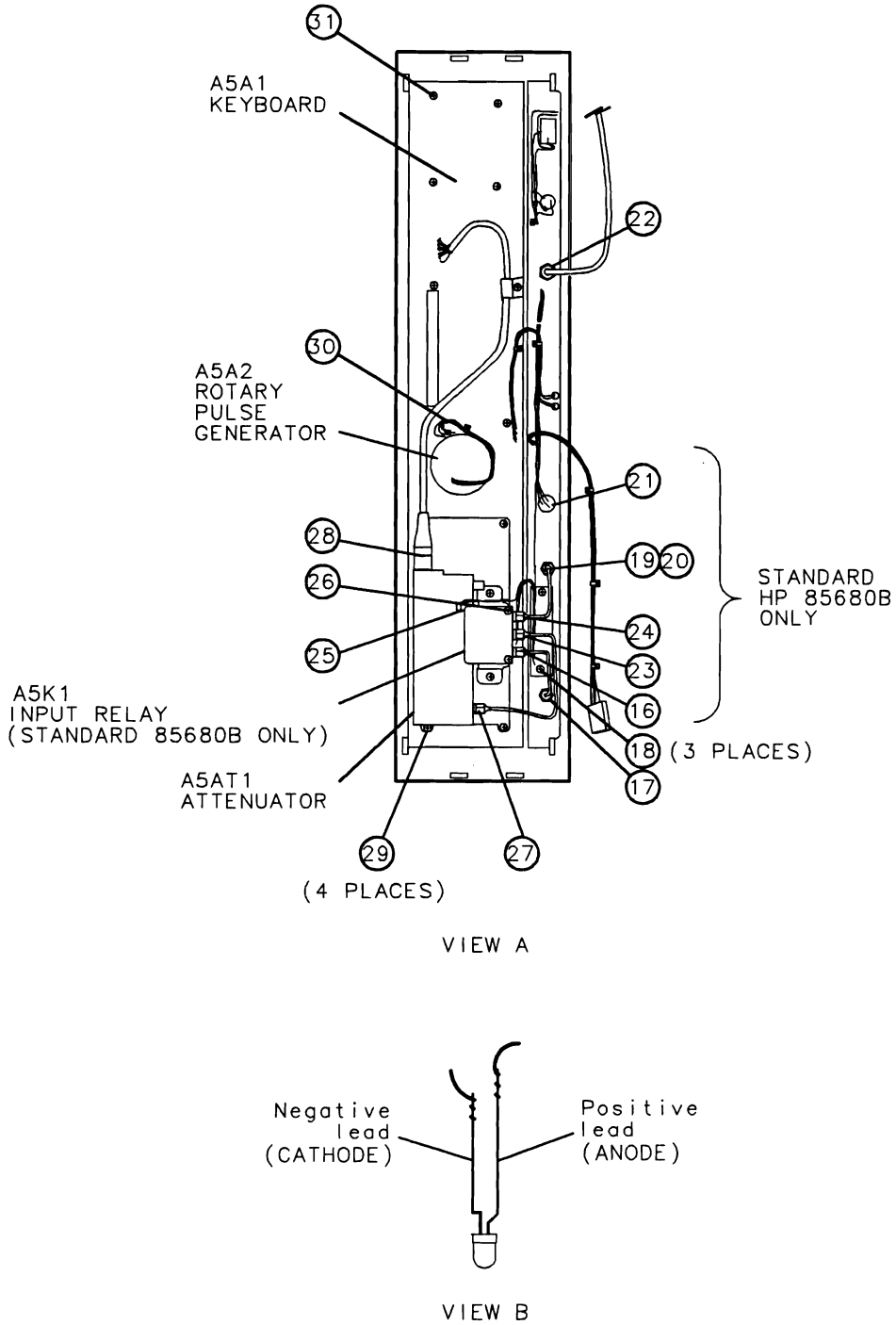


Figure 2. Front Panel Removal and Repair (Continued)

11. To replace INSTR CHECK and STANDBY LEDs, proceed as follows (Refer to View A of Figure 2.)

    a. For HP 85680B, disconnect cable at connector ①⑥. For HP 85670A and HP 85680B Options H44 and H96, disconnect cable at connector ②⑦.

    b. Remove nut ①⑦ and remove connector from front panel.

c. Remove three screws ①⑧.

d. Disconnect connector ①⑨, remove nut ②⓪, and remove SIGNAL INPUT 1 connector from front panel. (For Standard HP 85680B only.)

e. Remove nut and washer from PROBE POWER connector ②①. (Standard HP 85680B only.)

f. Remove knurl-nut (located on front panel) from CAL OUTPUT connector ②② and remove connector from front panel.

g. Lower front panel should now separate from front panel assembly. It may be necessary to cut the cable wraps on the cable to allow the connector to be removed from the panel far enough to replace the defective LEDs.

h. To replace the defective LEDs, unsolder the wires from the LED leads and push on the leads with a soldering aid to force the LED out of the socket through the front panel. Insert a new LED and resolder the wires to the LED leads as follows:

LEDs	Wire to Anode	Wire to Cathode
STANDBY LED	905	0
INST CHECK I LED	94	95
INST CHECK II LED	93	96

Trim excess lead length. (Refer to View B of Figure 2.)

i. Reassemble lower front panel.

12. For standard HP 85680B only, to replace SIGNAL INPUT LEDs, switches, or keys, proceed as follows. (Refer to View A of Figure 2.)

a. Disconnect connectors ①⑥, ②③, and ②④ and move cables from over printed circuit board where LEDs, switches, and keys are located.

b. Remove three screws ①⑧ and lift printed circuit board away from front panel.

c. To remove defective LED, remove key from front of switch, unsolder LED leads from printed circuit board, free leads with a soldering aid, and push leads through printed circuit board so that LED is forced out of switch.

d. To replace defective LED, insert a new LED through switch so that leads extend through printed circuit board. Negative (cathode) lead goes to square pad on PC Board. (Refer to View B of Figure 2.) Pull leads with fingers or needlenose pliers to ensure that LED is far enough into switch to allow room for reinstalling key. Solder leads to rear of printed circuit board and reinstall key on switch.

e. To remove defective switch, remove key from a switch, melt plastic pins holding switch to printed circuit board using a soldering iron, and remove switch from printed circuit board.

f. To replace switch, insert plastic pins of new switch through printed circuit board and melt the pins with a soldering iron on the rear of the printed circuit board enough to secure switch. Replace key.

g. Reassemble printed circuit board to front panel and reconnect cables.

13. For standard HP 85680 only, to replace input relay, proceed as follows. (Refer to View A of Figure 2.)
    a. Disconnect connectors ①⑥, ②③, and ②④, unsolder wires ②⑤, and remove screws ②⑥.
    b. Secure a new input relay to the mounting bracket with screws ②⑥, solder wires to new relay, and connect cables ①⑥, ②③, and ②④.
14. To replace input attenuator, proceed as follows. Refer to View A of Figure 2.
    a. For standard HP 85680B only, disconnect connectors ①⑥, ②③, and ②④ from input relay.
    b. Disconnect connectors ②⑦ and ②⑧ from input attenuator. Remove four screws ②⑨ from mounting bracket, turn mounting bracket over and remove two screws from rear of bracket used to secure input attenuator.
    c. Position new input attenuator on mounting bracket and install two screws. Position mounting bracket on A5A1 Keyboard and reinstall four screws ②⑨. Reconnect cables ②⑦ and ②⑧.
    d. For standard HP 85680B only, reconnect cables ①⑥, ②③, and ②④.
    e. Remove A12 RF Section Interface Board and replace A12U17 with new error correction ROM. Refer to A12 tab for location of A12U17.
15. To replace Rotary Pulse Generator (RPG), proceed as follows. (Refer to View A of Figure 2.)
    a. Disconnect DATA control (RPG) knob and nut from front panel. Refer to Figure 3 for procedure to remove knob and nut.
    b. Disconnect wires ③⓪ from A5A1 Keyboard and remove RPG.
    c. Insert a new RPG through the A5A1 Keyboard so that shaft protrudes through front panel.
    d. Reinstall nut and knob on RPG shaft. Refer to Figure 3.
    e. Reconnect wires ③⓪ to A5A1 Keyboard.
16. To replace switches on A5A1 Keyboard, refer to Figure 3 for front panel removal and refer to steps 12e and 12f of this procedure for switch replacement.
17. The A5A1 Keyboard may be removed by first removing the input attenuator and mounting bracket as described in step 14 of this procedure, and then removing screws securing Keyboard to front panel frame. Callout ③① shows typical location of screws.

Front Panel LED Replacement

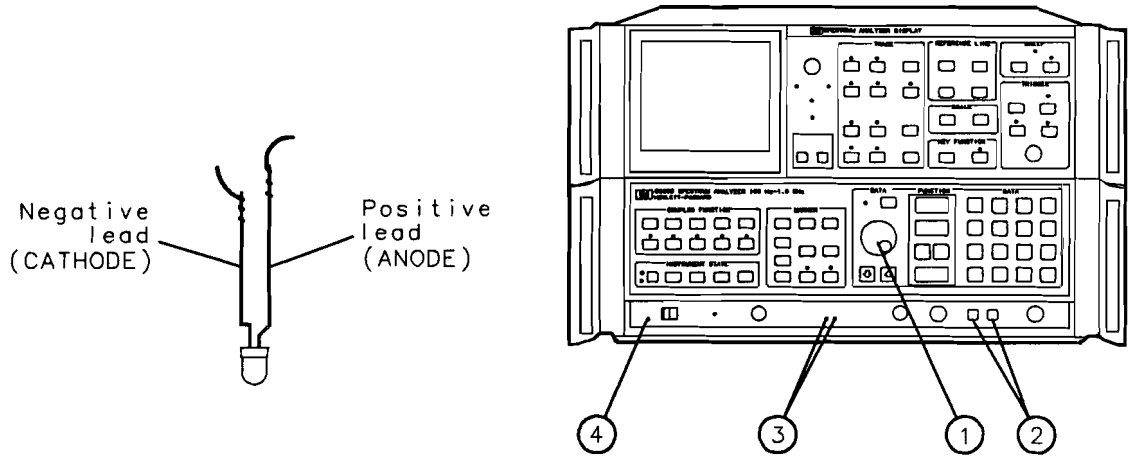


Figure 3. Front Panel LED Replacement

Note This procedure does not cover replacement of SIGNAL INPUT ②, INSTR CHECK ③, or STANDBY LEDs ④. Refer to front panel removal and repair procedure for these LEDs.

1. Remove front panel from RF Section. Refer to front panel removal and repair procedure.
2. Loosen set screws in DATA control knob (RPG) ① using a No. 4 allen wrench (HP part number 8710-0857) and remove knob.
3. Remove nut from DATA control using a 7/16-inch wrench.
4. The front panel is fastened to the sub-panel by four (4) studs with snap fasteners. These fasteners may be removed using needle-nose pliers to allow removal of front dress panel. After front dress panel is removed, front panel LEDs may be replaced as specified in Step 5.
5. Pull defective LED out of socket with fingers (it may be necessary to pry slightly with a pointed instrument such as a soldering aid), trim both leads on new LED to 3/8-inch (1 cm), and insert new LED in socket with negative (cathode) lead to square pad on printed circuit board. Refer to LED lead identification illustration above.
6. Reassemble front panel and reinstall in instrument.

Signal Input 1 Fuse Replacement (All HP 85680B Versions Only)

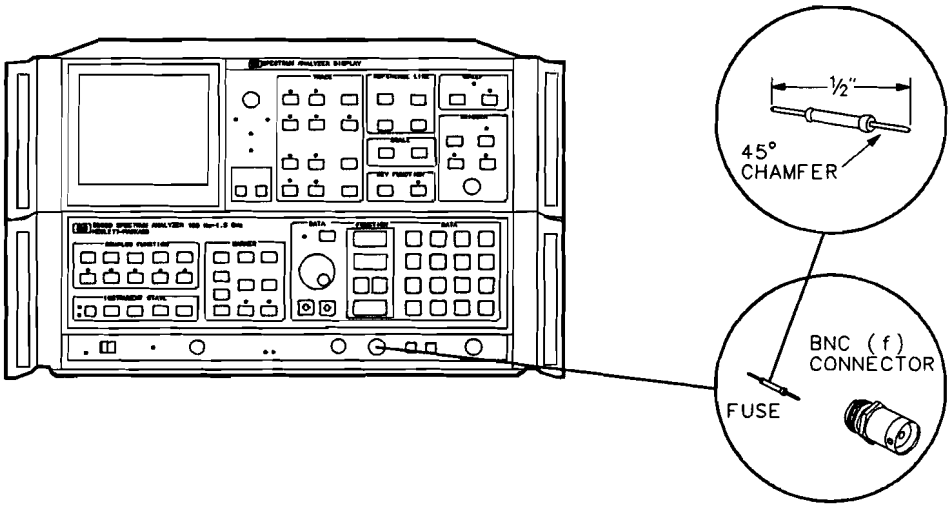


Figure 4. Signal Input 1 Fuse Replacement

1. Remove SIGNAL INPUT 1 BNC connector using a 7/16-inch open end wrench. (See Figure 4.)
2. Remove blown fuse, using long nose pliers if necessary.

Note Avoid confusion as to which is the good fuse after the new fuse has been properly clipped. One method is to mark the blown fuse using a felt-tip marker or the like before cutting the leads of the new fuse.

---

3. Clip leads of new fuse (HP part number 2110-0301 or 1535-3716) to the same length as the blown fuse which was removed. Overall length should be approximately 1/2 inch.
4. Using a small file, chamfer the ends of both leads at about a 45 degree angle.
5. Carefully insert one end of fuse into the small hole in threaded end of BNC connector. When fuse is properly seated into the center conductor, about half of the fuse should extend beyond the BNC connector body.
6. Carefully replace BNC connector (with new fuse) on SIGNAL INPUT 1.

Caution Do not over tighten BNC connector on SIGNAL INPUT 1.

---

7. Tighten snugly with 7/16-inch open end wrench (should not exceed 45 inch-pounds of torque).

A5 Front Panel Assembly for HP 85680B

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5				HP 85680B FRONT PANEL ASSEMBLY (NOT AVAILABLE FOR FIELD REPLACEMENT)		
A5A1	85680-60019	3	1	KEYBOARD ASSEMBLY	28480	85680-60019
A5A2	0960-0684	2	1	ROTARY PULSE GENERATOR	28480	0960-0684
A5A3	85680-60059	1	1	DC INPUT CONNECTOR ASSEMBLY (INCLUDES A5A3F1, A5A3J3 AND A5A3W4)	28480	85680-60059
A5A3	85680-60116	1	1	75-OHM INPUT ASSEMBLY (OPTION 001)	28480	85680-60116
A5A3F1	1535-3716	7	1	OEM FUSE; 1/8 AMP	28480	1535-3716
A5A3J3	1250-1557	6	1	ADAPTER-COAX, STR. F-BNC M-SMC	28480	1250-1557
A5A3W4	85680-20101	0	1	RIGID CABLE	28480	85680-20101
A5A4	85680-60053	5	1	BLOCKING CAPACITOR ASSEMBLY (INCLUDES RIGID CABLE)	28480	85680-60053
A5A5	85680-60117	2	1	INPUT SELECT SWITCHES (INCLUDES WIRING HARNESS)	28480	85680-60117
A5A5DS11	1990-0670	0	1	LED	28480	1990-0670
A5A5DS12	1990-0670	0	1	LED	28480	1990-0670
A5A5R1	0757-1094	9	1	RESISTOR 1.47K +-1% .125W	24546	C4-1/8-T0-1471-F
A5A5R2	0757-1094	9	1	RESISTOR 1.47K +-1% .125W	24546	C4-1/8-T0-1471-F
A5A5S50	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5060-9436
A5A5S51	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5060-9436
A5AT1	5086-7815	6	1	INPUT ATTENUATOR (INCLUDES PROM FOR A12U17)	28480	5086-7815
A5DS1	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A5DS2	1990-0486	6	1	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	HLMP-1301
A5DS3	1990-0486	6	1	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	HLMP-1301
A5J2	5060-0467	6	1	CONNECTOR, MALE PROBE	28480	5060-0467
A5K1	3106-0024	7	1	COAXIAL MICROWAVE SWITCH, 2GHZ MAX.	28480	3106-0024
A5MP1	0370-3069	2	1	RPG KNOB	28480	0370-3069
A5MP2	85680-00013	1	1	ATTENUATOR BRACKET	28480	85680-00013
A5MP3	85680-00018	6	1	RF SWITCH BRACKET	28480	85680-00018
A5MP4	85680-40004	4	1	LED MOUNT	28480	85680-40004
A5MP5	5021-8699	0	1	FRONT PANEL BEZEL	28480	5021-8699
A5MP6	85680-00009	5	1	LOWER SUB PANEL	28480	85680-00009
A5MP7	85680-00011	9	1	KEYBOARD SUB PANEL	28480	85680-00011
A5MP8	85680-00106	3	1	KEYBOARD DRESS PANEL	28480	85680-00106
A5MP9	85680-00103	0	1	LOWER DRESS PANEL	28480	85680-00103
A5R3	2100-2488	8	1	RESISTOR-VAR CONTROL 10K 10% LIN	28480	2100-2488
A5SW1	3101-2193	5	1	SWITCH-TGL PRI-SW SPDT 2A 250VAC SLDR-LU	09353	U11J60ZG W/7868-14 W/5310
A5W1	85680-20100	9	1	RIGID COAX CABLE	28480	85680-20100
A5W2	85680-60243	5	1	WIRING HARNESS	28480	85680-60243
A5W3	85680-60101	4	1	COAX CABLE	28480	85680-60101
A5W31	85680-60065	9	1	CONNECTOR, BNC-F (INCLUDES COAX CABLE)	28480	85680-60065
A5W42	5062-0704	8	1	WIRING HARNESS	28480	5062-0704

**Indicates factory-selected value*

HP Part Number 85680-60019

A5A1 Keyboard

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5A1	85680-60019	3	1	BOARD ASSEMBLY KEYBOARD (INCLUDES A5A5 INPUT SELECT BOARD) (FOR INDIVIDUAL A5A5 PARTS, REFER TO A5 PARTS LIST)	28480	85680-60019
A5A1DS1	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A5A1DS2	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A5A1DS3	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A5A1DS4	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A5A1DS5	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A5A1DS6	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A5A1DS7	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A5A1DS8	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A5A1DS9	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A5A1DS10	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A5A1E1	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E2	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E3	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E4	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E5	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E6	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E7	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E8	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E9	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E10	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E11	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E12	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E13	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E14	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E15	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E16	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E17	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E18	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E19	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1E20	1251-0600	0	1	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5A1J1	1251-5549	6	1	CONN-POST TYPE .100-PIN-SPCG 50-CONT	18873	68025-650
A5A1MP1				NOT ASSIGNED		
A5A1MP3	5041-3929	1	1	SPACER LED .450	28480	5041-3929
A5A1MP4	5041-3929	1	1	SPACER LED .450	28480	5041-3929
A5A1MP5	5041-3929	1	1	SPACER LED .450	28480	5041-3929
A5A1MP6	5041-3929	1	1	SPACER LED .450	28480	5041-3929
A5A1MP7	5041-3929	1	1	SPACER LED .450	28480	5041-3929
A5A1MP8	5041-3929	1	1	SPACER LED .450	28480	5041-3929
A5A1MP9	5041-3929	1	1	SPACER LED .450	28480	5041-3929
A5A1MP10	5041-3929	1	1	SPACER LED .450	28480	5041-3929
A5A1MP11	5041-3929	1	1	SPACER LED .450	28480	5041-3929
A5A1MP12	5041-3929	1	1	SPACER LED .450	28480	5041-3929
A5A1S1	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S2	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436

**Indicates factory-selected value*

HP Part Number 85680-60019
A5A1 Keyboard

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5A1S3	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S4	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S5	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S6	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S7	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S8	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S9	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S10	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S11	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S12	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S13	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S14	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S15	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S16	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S17	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S18	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S19	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S20	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S21	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S22	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S23	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S24	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S25	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S26	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S27	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S28	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S29	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S30	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S31	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S32	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S33	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S34	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S35	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S36	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S37	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S38	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S39	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S40	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S41	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S42	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S43	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S44	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S45	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S46	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S47	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S48	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436
A5A1S49	5060-9436	7	1	SWITCH-PB SPST-NO MOM	71468	5560-9436

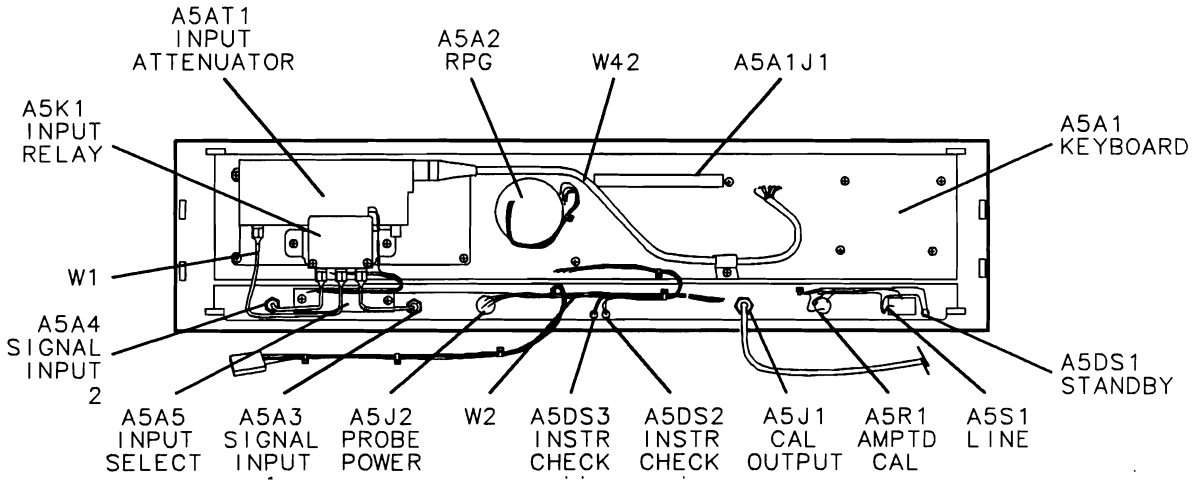
**Indicates factory-selected value*

HP Part Number 85680-60019

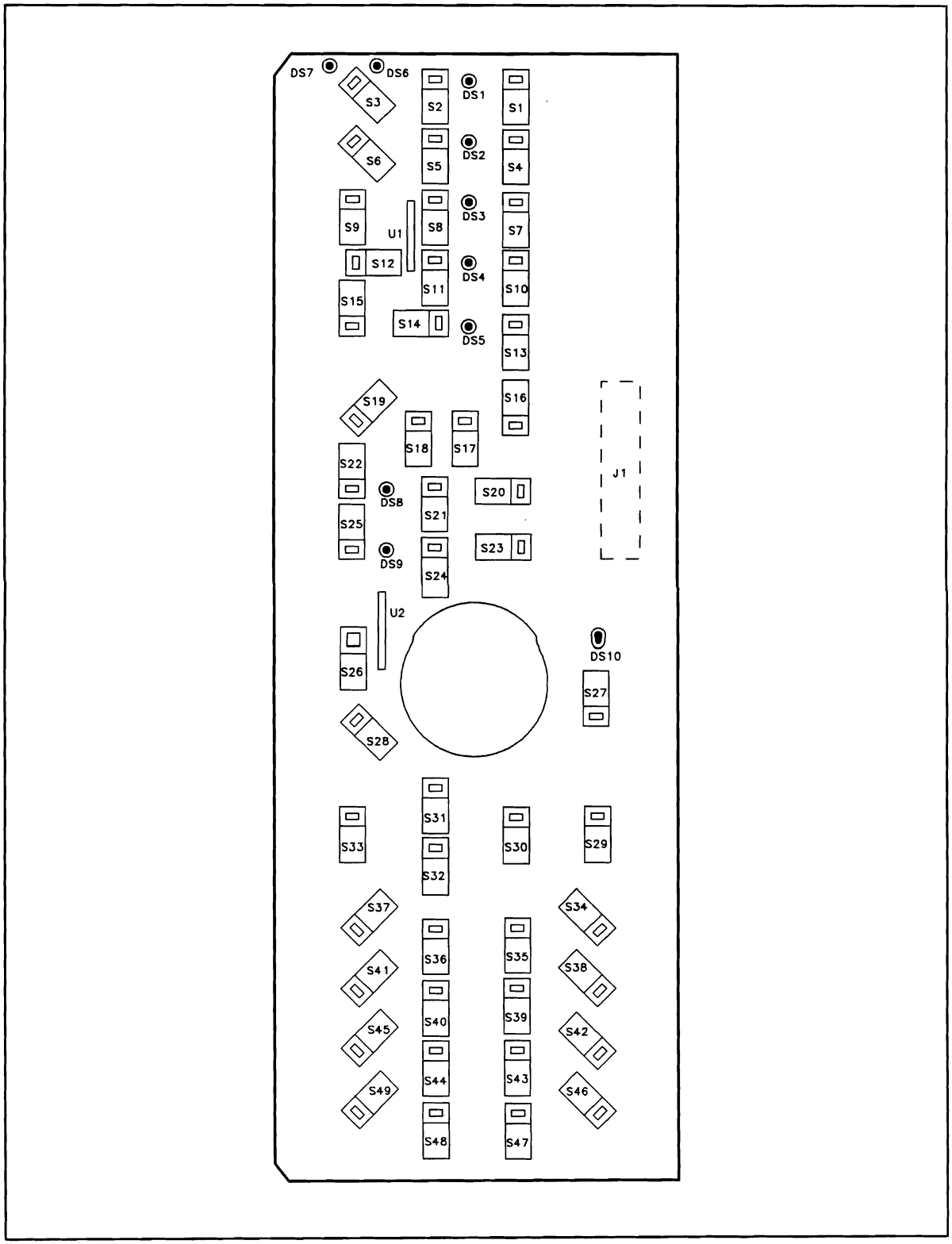
A5A1 Keyboard

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5A1U1	1810-0203	5	1	NETWORK-RES 8-SIP 470.0 OHM X 7	11236	750-81
A5A1U2	1810-0203	5	1	NETWORK-RES 8-SIP 470.0 OHM X 7	11236	750-81

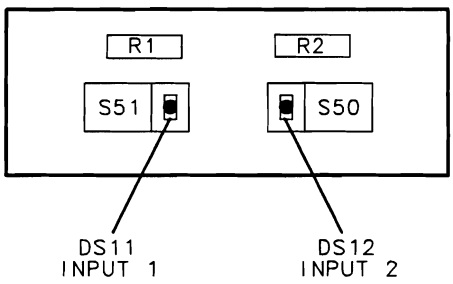
**Indicates factory-selected value*



A5 Front Panel, Assembly and Component Locations



A5A1 Keyboard Assembly Component Locations, 85680-60019 and 85670-60019



A5A5 Input Select Board Assembly Component Locations, 85680-60117

A5 FRONT PANEL
85680B
(SERIAL PREFIX: 2408A)

A1 KEYBOARD
85680-60019

FRONT PANEL KEYS (EXCEPT: LCL, INS

AUTO S1
RES BW S2
AUTO S4
VIDEO BW S5
SAVE S6
AUTO S7
SWEEP TIME S8
RECALL S9
AUTO S10
ATTEN S11
0-1.5 GHz S12
AUTO S13
CF STEP SIZE S14
PEAK SEARCH S16
MKR → CF S17
MKR/Δ → STP SIZE S18
MKR → REF LVL S19
OFF S20
Δ S21
FREQ COUNT S22
NORMAL S23
ZOOM S24

W42

CAL OUT 20 MHz -10 dBm ±0.2dB J1 W31 1

FROM A16 20 MHz REF J11

A5 INPUT SELECT

INPUT 1 S50
INPUT 2 S51

R2 1470
DS12 INPUT 2
DS11 INPUT 1
R1 1470

A4 BLOCKING CAPACITOR

TYPE N INPUT 2 J4

K1 INPUT RELAY

J10 J8

A3 DC INPUT CONNECTOR ASSEMBLY

BNC INPUT 1 J3 F1 1/8 A A3W4 J9

AT1 70dB ATTENUATOR 10 dB STEPS

W1 J7 J6 J5 W3 TO A23A2 FIRST CONVERTER

A3 75Ω INPUT CONNECTOR ASSEMBLY (OPTION 001)

BNC INPUT 1 J3 43.3 (~5.7dB LOSS) 86.6 J9

AMPLITUDE CAL

PROBE POWER J2 92 0 97
R3
AMPTD CAL

P1 W2
97 -12.6V
0 GND
92 +15V
TO XA5P1 A26 MOTHERBD 904 AMPTD CAL
905 STBY LED
903 STBY SW

ON/STANDBY CONTROL

S1 ON STANDBY
DS1 STANDBY

A2

, INSTR PRESET & INPUT SELECT)

+20V → 15
10dB THRU → 5
10dB PAD → 3
20dB THRU → 9
20dB PAD → 7
40dB THRU → 13
40dB PAD → 11

KR0 → 36
KR1 → 35
KR2 → 38
KR3 → 37
KR4 → 40
KR5 → 39
KR6 → 42
KR7 → 41

HOLD S27
CENTER FREQUENCY S29
FREQUENCY SPAN S30
START FREQ S31
REFERENCE LEVEL S33
STOP FREQ S32
7 S34
4 S35
1 S36
0 S37
8 S38
5 S39
2 S40
. S41
9 S42
6 S43
3 S44
BACK SPACE S45
GHz +dBm dB S46
MHz -dBm sec S47
kHz mV msec S48
Hz µV µsec S49
SIGNAL TRACK S25
S26
S28

KC0 → 44
KC1 → 43
KC2 → 46
KC3 → 45
KC4 → 48
KC5 → 47
KC6 → 50
KC7 → 49

W43 RIBBON CABLE FROM A12 RF SECTION INTERFACE

INDICATOR LEDS

INST PRESET & LOCAL

GND → 1,2
RPG 01 → 33
RPG 02 → 31
+5V → 4
INPUT RELAY → 17

INSTR PRESET S15
LCL S3
LRTL → 32
→ 34
LRWT → 30
LADR → 8

A2 ROTARY PULSE GENERATOR

GND 0 → 0
RPG1 902 → 902
RPG2 901 → 901
+5V 92 → 92

U1 (470Ω)

R3 4 DS7 REM
R4 5 DS6 ADRS'D
R7 8 DS1 RES BW
R6 7 DS2 VIDEO BW
R5 6 DS3 SWEEP TIME
R2 3 DS4 ATTEN
R1 2 DS5 CF STEP SIZE

→ 10
→ 12
→ 14
→ 16
→ 18

INST CHECK INDICATORS

U2 (470Ω)

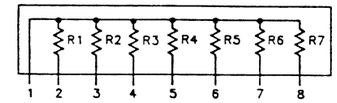
94 → 94 → R5 6 1
93 → 93 → R3 4
R6 7 DS8 FREQ COUNT → 24
R7 8 DS9 SIGNAL TRACK → 26
R1 2 DS10 ENABLED → 28
96 → 96 → 20
95 → 95 → 22

DS2 I
DS3 II

ROL
N
STANDBY

NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN MICROFARADS(µF) INDUCTANCE IS IN MICROHENRIES(µH)
3. U1 AND U2 PIN CONFIGURATION: U_(470Ω)



4. MNEUMONIC TABLE

MNEUMONIC	DESCRIPTION
KR0-7	KEY ROWS 0-7
KC0-7	KEY COLUMNS 0-7
LRTL	LOW-RETURN TO LOCAL
LRMT	LOW-REMOTE
LADR	LOW-ADDRESS LED ON

A5

A5 FRONT PANEL, SCHEMATIC DIAGRAM

A6

A6 YIG-Tuned Oscillator Phase Lock, Circuit Description

A6 YIG-Tuned Oscillator (YTO) Phase Lock consists of circuitry to phase lock the YTO to a reference voltage from A16 20 MHz Reference. A lock indication is provided, and a filtered output of the Pilot Third IF Amplifier circuit is routed to A17 Frequency Counter. For wide sweeps, A Sample/Hold circuit retains the output voltage.

20 MHz Reference Amplifier (A)

The 20 MHz Reference Amplifier uses C2, C3 and L2 to match the 20 MHz 50Ω input from A16 20 MHz Reference to the ECL-driving differential amplifier (Q5, Q6). R1 and R3 set current levels, and R2 sets the voltage swing to drive and ECL input.

Pilot Third IF Amplifier (F)

The Pilot Third IF Amplifier uses a voltage feedback pair (Q1, Q2), which provides about 20 dB gain and two outputs. VR2, C6 and R9 provide bias and feedback. R8 serves to match the amplifier input to 50Ω and (with R9) to set gain. R12 and R13 set current in Q2. C8 is a dc block to the 15—25 MHz Bandpass Filter (BPF), C11, L3, C12, L4, C13, and L5. R7 stabilizes the impedance at the filter output. Q3 and Q4 are an ECL-driving differential amplifier.

Phase Frequency Detector (B)

The Phase Frequency Detector is a dual D flip-flop, 4-pi-radian type detector consisting of U1A and U1B. If signal at pins 6 and 11 are in phase, outputs at 2 and 14 will cancel when summed. If the signals are out of phase, outputs 2 and 14 will sum to an offset. When both flip-flops become set with active high (Q outputs at logic high), U2C pin 14 resets both U1A and U1B. R21, R22 and C15 provide a dc level to the Loop Amplifier that is midway between logic high and logic low, while R19, R20, R23, R24, and R25 pull down outputs. R4 sets the D input of U1B high while U3A allows the D input of U1A to be high or low. A logic low at U3 pin 1 disables the Phase Frequency Detector.

Loop Amplifier (C)

The Loop Amplifier uses a high-speed, high-gain, monolithic op amp, U4. It is configured as an integrator with a zero at 1 kHz because of C22 and R35. R31 through R34, C17, and C18 set gain at 6 dB and sum and filter the outputs of the Phase Frequency Detector. U3C shorts the integrator to disable it.

Loop Filter Sample/Hold (D)

The Loop Filter Sample/Hold circuit can be switched to several configurations:

- 10 kHz break point, 9 dB attenuation using R36, U3D, Q12, C24, and R44
- Loop grounded using U3B and Q12
- Sample and hold using Q12, R44, and C24

Q7 and Q8 switch the sample and hold, and C47 balances the charge on Q12. VR1 is a level-shift zener diode. Other resistors provide bias and voltage levels as needed.

Buffer Amplifier (E)

The Buffer Amplifier consists of high input impedance dual FETS (Q13A and Q13B) in a differential stage whose unity gain is due to feedback. Q11 improved loop gain and gives a level shift. R48 sets source current, and R49 biases Q11. R51 and C46 protect the YTO lock voltage from external loading.

Phase Lock Indicator (H)

The Phase Lock Indicator circuit (using U2A, U2B, and R27) senses when either pins 2 and 15 (noninverting outputs) or pins 3 and 14 (inverting outputs) from U1A and U1B are high. This conditions signifies UNLOCK. Because of the 20-MHz pulse train at U2A pins 4 and 5 and U2B pins 6 and 7, the signal must be filtered (CR26, C16) to provide a signal of less than −953 mV to turn on U6A.

U6A lights LED indicator DS2 and produces a TTL logic high when the loop is unlocked.

11-29 MHz Bandpass Filter Ⓖ (A6 YTO Phase Lock, HP Part Number 85680-60152 only)

A 10-30 MHz Signal at J1 (from A10 Pilot Third Converter) is fed through an 11-29 MHz bandpass filter, and then is fed via J3 to A17 Frequency Counter.

Switched Filter and Amplifier Ⓖ Ⓙ (A6 YTO Phase Lock, HP Part Number 85680-60011 only)

A 10-30 MHz signal at J1 from A10 Pilot Third Converter is fed through the Switched Filter and the Amplifier, where it goes through J3 to A17 Frequency Counter. The Switched Filter consists of two bandpass filters (one at 10-20 MHz and one at 20-30 MHz) and diodes to provide switching of the signal through the bandpass filters. L12, L13, C26, C23, R62, and R63 provides isolation for the switching voltage.

The Amplifier is a voltage-feedback pair (Q9 and Q10) with a 3-dB pad on the output.

Filter Control Ⓘ (A6 YTO Phase Lock, HP Part Number 85680-60011 only)

The Filter Control detects the signal at the collector of Q10 in the Amplifier using CR2 and its associated bias resistors (R70 and R71) and C42 and R72 as a filter. U6C senses when the signal is too low and toggles JK flip-flop U7A, which switches filter driver U6B in search of a larger signal in the other passband of the Switched Filter circuit.

A6 YIG-Tuned Oscillator Phase Lock, Troubleshooting

Lock and Roll Theory

To aid in troubleshooting this assembly, an understanding of a phase locking technique called "lock and roll" is needed. For frequency spans greater than 1 MHz, the center frequency is phase locked only during the retrace period. The waveforms in Figure 1 and in the schematic for this assembly should be consulted.

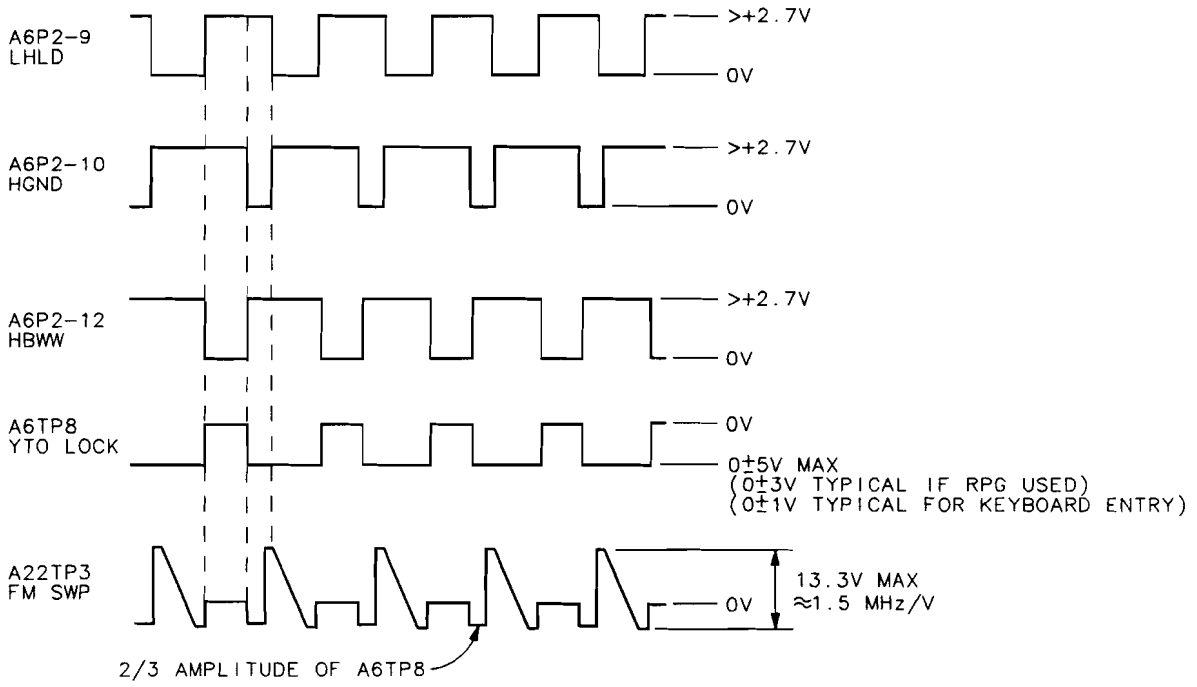


Figure 1. A6 YTO Phase Lock Timing Waveforms

Please note the following information about the waveforms. No timing information or voltage levels are given. The timing is controlled by the Sweep Time and the time needed for the A15 Controller to do certain tasks. The transitions are important and must occur as shown. The voltages of the first three waveforms are TTL levels. The voltage levels on the last two waveforms will vary depending on the center frequency and the frequency span that is selected.

The lock and roll sequence begins with LHLD (A6P2-9) going high. It is assumed that the center frequency is not being tuned.

The YTO loop is closed when LHLD goes high. The sweep lines on A22 Sweep Generator are grounded. The YTO LOCK (A6TP8) voltage is set to 0 V by the following:

a. HGND (A6P2-10), which is high, shorts the Loop-Amplifier **(C)** and the Loop Filter **(D)**.

b. HBWW (A6P2-12), which is low, opens JFET switch U3D further ensuring that the loop filter input is 0 V. This is necessary as the Phase Frequency Detector **(B)** is on.

The A15 Controller counts the Pilot IF and calculates whether the YTO DAC needs to be readjusted.

When HGND goes low, HBWW goes high. This turns on the Loop Amplifier (**C**) and the Loop Filter Sample/Hold (**D**). A YTO Lock voltage proportional to the phase error between the 20 MHz Reference and the Pilot IF is derived and sent to the YTO FM Coil Driver on the A22 Frequency Control.

LHLD goes low, turning off the phase detector, and HGND now goes high, shorting out the loop integrator and loop filter. This insures that the YTO LOCK voltage does not change. The A15 Controller then starts the sweep on the A22 Frequency Control. Several milliseconds after the sweep has been completed, LHLD goes high and the procedure is started over again.

Troubleshooting

For frequency spans greater than 1 MHz, the YTO loop CLOSED and YTO UNLOCKED LEDs should be flashing. This is an indication that the lock and roll is working. In the lock and roll mode, the PILOT IF (KSK, [SHIFT] [PEAK SEARCH]) should be very close to 20 MHz when the marker is placed at mid-screen. The smaller the frequency span, the closer it will be to 20 MHz. (For 1500 MHz SPAN, ±3 MHz is typical; for 2 MHz span, ± 3 kHz is typical.)

If the Sample and Hold (**D**) circuitry is defective, the displayed signals will often appear to be drifting when in spans greater than 1 MHz. This is especially true in the [SIGNAL TRACK] mode. This causes an offset in the marker readout of the signal frequency.

If either the YTO UNLOCK or the YTO ERROR messages appear, the sweep rate will be very slow as the A15 Controller spends most of its time trying to lock the system. A jumper from A15TP1-9 (ST) to A15TP1-6 (T1) followed by [INSTR PRESET] will start the analyzer sweeping. (For earlier versions of the A15 Controller, jumper A15TP4 (STS) to A15TP1-4 (T1).) If the jumper is then removed, the A17 Frequency Counter can be used for troubleshooting.

First check to see if signals are present at TP1 and TP2. Use KSK to count the Pilot IF signal. A signal in the 10—30 MHz range indicates A23, A7, A9, and A10 are working properly. If a signal outside of this range is present, (often less than 1 MHz), either the loop is broken or the A17 Frequency counter is defective. A Tee connector can be inserted into the loop at any point to measure the frequencies present. The overall RF Section Analog Block diagram indicates the signal levels that are present.

In the phase locked spans of 1 MHz or less, the YTO Loop CLOSED LED remains on. The PILOT IF should always be 20 MHz. HBWW and LHLD will be high and HGND will be low. the ramp waveforms at TP3 and TP8 are indicated on the schematic. The ramp is caused by the phase voltage tracking the frequency sweep of the 50 MHz VTO.

HP Part Number 85680-60011

A6 YTO Phase Lock

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	85680-60011	5	1	BOARD ASSEMBLY, YIG-TUNED OSCILLATOR (YTO) PHASE LOCK (SERIAL PREFIXES: 2408A-2714A)	28480	85680-60011
A6C1	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C2	0160-2203	9	1	CAPACITOR-FXD 91PF +-5% 300VDC MICA 0+70	28480	0160-2203
A6C3	0160-2202	8	1	CAPACITOR-FXD 75PF +-5% 300VDC MICA	28480	0160-2202
A6C4	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C5	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C6	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C7	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C8	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C9	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C10	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C11	0140-0193	0	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C12	0160-2255	1	1	CAPACITOR-FXD 8.2PF +-.25PF 500VDC CER	28480	0160-2255
A6C13	0140-0193	0	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C14	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C15	0160-4084	8	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C16	0140-0196	3	1	CAPACITOR-FXD 150PF +-5% 300VDC MICA	72136	DM15F151J0300WV1CR
A6C17	0140-0194	1	1	CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A6C18	0140-0194	1	1	CAPACITOR-FXD 110PF +-5% 300VDC MICA	72136	DM15F111J0300WV1CR
A6C19	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C20	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C22	0160-0301	4	1	CAPACITOR-FXD .012UF +-10% 200VDC POLYE	28480	0160-0301
A6C24	0160-0163	6	1	CAPACITOR-FXD .033UF +-10% 200VDC POLYE	28480	0160-0163
A6C25	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A6C26	0160-0945	2	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A6C27	0140-0193	0	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C28	0140-0192	9	1	CAPACITOR-FXD 68PF +-5% 300VDC MICA	72136	DM15E680J0300WV1CR
A6C29	0160-2264	2	1	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A6C30	0160-2254	0	1	CAPACITOR-FXD 7.5PF +-.25PF 500VDC CER	28480	0160-2254
A6C31	0140-0193	0	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	72136	DM15E820J0300WV1CR
A6C32	0140-0192	9	1	CAPACITOR-FXD 68PF +-5% 300VDC MICA	72136	DMA5E680J0300WV1CR
A6C33	0160-0945	2	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A6C34	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C35	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C36	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C37	0160-4084	8	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C38	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C39	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C40	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C41	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C42	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A6C43	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A6C46	0160-2437	1	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A6C47	0160-2199	2	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A6CR1	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR2	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040

**Indicates factory-selected value*

HP Part Number 85680-60011
A6 YTO Phase Lock

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6CR3	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR14	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR15	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR16	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6CR17	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6DS1	1990-0487	7	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0487
A6DS2	1990-0487	7	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0487
A6DS3	1990-0487	7	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0487
A6J1	85680-60076	2	1	CABLE ASSEMBLY, COAX 82	28480	85680-60076
A6J2	1250-0690	6	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A6J3	1250-0690	6	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A6L2	9100-2257	6	1	INDUCTOR RF-CH-MLD 820NH 10% .105DX.26LG	28480	9100-2257
A6L3	9100-3319	3	1	INDUCTOR RF-CH-MLD 740NH 2% .166DX.385LG	28480	9100-3319
A6L4	9100-1619	2	1	INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A6L5	9100-3319	3	1	INDUCTOR RF-CH-MLD 740NH 2% .166DX.385LG	28480	9100-3319
A6L6	9100-2259	8	1	INDUCTOR RF-CH-MLD 1.5UH 10% .105DX.26LG	28480	9100-2259
A6L7	9100-2256	5	1	INDUCTOR RF-CH-MLD 560NH 10% .105DX.26LG	28480	9100-2256
A6L8	9100-1619	2	1	INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A6L9	9100-1618	1	1	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A6L10	9100-2259	8	1	INDUCTOR RF-CH-MLD 1.5UH 10% .105DX.26LG	28480	9100-2259
A6L11	9100-2256	5	1	INDUCTOR RF-CH-MLD 560NH 10% .105DX.26LG	28480	9100-2256
A6L12	9100-1620	5	1	INDUCTOR RF-CH-MLD 15UH 10% .166DX.385LG	28480	9100-1620
A6L13	9100-1620	5	1	INDUCTOR RF-CH-MLD 15UH 10% .166DX.385LG	28480	9100-1620
A6L14	9140-0096	1	1	INDUCTOR RF-CH-MLD 1UH 10% .166DX.385LG	28480	9140-0096
A6L15	9140-0096	1	1	INDUCTOR RF-CH-MLD 1UH 10% .166DX.385LG	28480	9140-0096
A6L16	9140-0096	1	1	INDUCTOR RF-CH-MLD 1UH 10% .166DX.385LG	28480	9140-0096
A6MP1	85680-20071	3	1	LID YTO LOCK	28480	85680-20071
A6MP2	86701-40001	9	1	EXTRACTOR PC	28480	86701-40001
A6MP3	2190-0009	4	1	WASHER-LK INTL T NO. 8 .168-IN-ID	0G791	820-BC
A6MP4	2580-0002	4	1	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	80120	
A6MP5	2950-0078	9	3	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A6MP6	2190-0057	7	3	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A6MP7	2200-0101	0	6	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	
A6MP8				NOT ASSIGNED		
A6MP9	8151-0014	5	1	WIRE 24AWG 1X24	94130	
A6MP10	0890-0324	8	1	TUBING-FLEX 0.32 ID		
A6MP11	6960-0016	0	1	PLUG-HOLE .125D		
A6Q1	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360W	28480	1854-0019
A6Q2	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360W	28480	1854-0019
A6Q3	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360W	04713	2N3251
A6Q4	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360W	04713	2N3251
A6Q5	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360W	04713	2N3251
A6Q6	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360W	04713	2N3251
A6Q7	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q8	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q9	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A6Q10	1854-0809	9	1	TRANSISTOR NPN SI PD=300MW FT=600MHZ	04713	2N709

**Indicates factory-selected value*

HP Part Number 85680-60011
A6 YTO Phase Lock

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6Q11	1853-0451	5	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A6Q12	1855-0020	8	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0020
A6Q13	1855-0049	1	1	TRANSISTOR-J-FET DUAL N-CHAN D-MODE SI	28480	1855-0049
A6R1	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R2	0698-3437	2	1	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-TO-133R-F
A6R3	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-TO-316R-F
A6R4	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R5	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	CR-1/8-TO-2610-F
A6R6	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R7	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-TO-215R-F
A6R8	0757-0316	6	1	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-TO-42R2-F
A6R9	0757-0418	9	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-TO-619R-F
A6R10	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-TO-750R-F
A6R11	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-TO-215R-F
A6R12	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-TO-215R-F
A6R13	0757-0398	4	1	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-TO-75R0-F
A6R14	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-TO-383R-F
A6R15	0757-0316	6	1	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-TO-42R2-F
A6R16	0698-3439	4	1	RESISTOR 178 1% .125W F TC=0+-100	24546	C4-1/8-TO-178R-F
A6R17	0698-3437	2	1	RESISTOR 133 1% .125W F TC=0+-100	24546	C4-1/8-TO-133R-F
A6R18	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	24546	C4-1/8-TO-316R-F
A6R19	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R20	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R21	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A6R22	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A6R23	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R24	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R25	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R26	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A6R27	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R28	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1101-F
A6R29	0757-0447	4	1	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1662-F
A6R30	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3481-F
A6R31	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R32	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R33	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R34	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A6R35	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A6R36	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2871-F
A6R39	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2611-F
A6R40	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A6R41	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A6R42	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2151-F
A6R43	0757-0289	2	1	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-1332-F
A6R44	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-TO-511R-F
A6R45	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A6R48	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4642-F
A6R49	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4221-F

**Indicates factory-selected value*

HP Part Number 85680-60011
A6 YTO Phase Lock

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R51	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R52	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R53	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R54	0683-1055	5	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A6R55	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R56	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R57	0757-0294	9	1	RESISTOR 17.8 1% .125W F TC=0+-100	19701	MF4C1/8-T0-17R8-F
A6R58	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A6R59	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-750R-F
A6R60	0757-0274	5	1	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1211-F
A6R62	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A6R63	0757-0290	5	1	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A6R64	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6R65	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R66	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R67	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A6R68	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A6R69	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A6R70	0757-0123	3	1	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A6R71	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	CR-1/8-T0-1001-F
A6R72	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R73	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A6R74	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A6R75	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6TP1	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP2	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP3	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP4				REFER TO A6C46		
A6TP5	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP6	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP7	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6TP8	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6U1	1820-0817	8	1	IC FF ECL D-M/S DUAL	04713	MC10131P
A6U2	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A6U3	1826-0416	5	1	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A6U4	1826-1007	2	1	IC OP AMP PRCN 8-T0-99	28480	1826-0007
A6U6	1826-0161	7	1	IC OP AMP GP QUAD 14-DIP-P PKG	04713	MLM324P
A6U7	1820-1212	9	1	IC FF TTL LS J-K NEG-EDGE-TRIG	01295	SN74LS112AN
A6VR1	1902-3234	3	1	DIODE-ZNR 19.6V 5% DO-35 PD=.4W	28480	1902-3234
A6VR2	1902-0049	2	1	DIODE-ZNR 6.19V 5% DO-35 PD=.4W	28480	1902-0049
A6VR3	1902-3059	0	1	DIODE-ZNR 3.83V 5% DO-35 PD=.4W	28480	1902-3059
A6VR5	1902-0126	6	1	DIODE-ZNR 2.61V 5% DO-7 PD=.4W	28480	1902-0126
A6VR7	1902-3082	9	1	DIODE-ZNR 4.64V 5% DO-35 PD=.4W	28480	1902-3082

**Indicates factory-selected value*

HP Part Number 85680-60152

A6 YTO Phase Lock

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	85680-60152	5	1	BOARD ASSEMBLY, YIG-TUNED OSCILLATOR (YTO) PHASE LOCK (SERIAL PREFIX: 2718A)	28480	85680-60152
A6C1	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C2	0160-4802	8	1	CAPACITOR-FXD 82PF +-5% 100VDC CER	04222	SA102A820JAAH
A6C3	0160-4802	8	1	CAPACITOR-FXD 82PF +-5% 100VDC CER	04222	SA102A820JAAH
A6C4	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C5	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C6	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C7	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C8	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C9	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C11	0160-4802	8	1	CAPACITOR-FXD 82PF +-5% 100VDC CER	04222	SA102A820JAAH
A6C12	0160-4792	5	1	CAPACITOR-FXD 8.2PF +-.5PF 100VDC CER	04222	SA102A8R2DAAH
A6C13	0160-4802	8	1	CAPACITOR-FXD 82PF +-5% 100VDC CER	04222	SA102A820JAAH
A6C14	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C15	0160-4835	7	1	CAPACITOR-FXD .1UF +-10% 50VDC CER	04222	SA115C104KAAH
A6C16	0160-4835	7	1	CAPACITOR-FXD .1UF +-10% 50VDC CER	04222	SA115C104KAAH
A6C17	0160-4800	6	1	CAP-FXD 120pF 100 V	04222	SA102A121JAAH
A6C18	0160-4800	6	1	CAP-FXD 120pF 100 V	04222	SA102A121JAAH
A6C19	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C20	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C22	0160-0301	4	1	CAPACITOR-FXD .012UF +-10% 200VDC POLYE	84411	HEW-238M
A6C24	0160-0163	6	1	CAPACITOR-FXD .033UF +-10% 200VDC POLYE	84411	HEW-238M
A6C25	0160-4835	7	1	CAPACITOR-FXD .1UF +-10% 50VDC CER	04222	SA115C104KAAH
A6C26	0160-4809	5	1	CAPACITOR-FXD 390PF +-5% 100VDC CER	04222	SA101A391JAAH
A6C27	0160-4813	1	1	CAP-FXD 180pF 100 V	04222	SA101A181JAAH
A6C28	0160-4825	5	1	CAPACITOR-FXD 560PF +-5% 100VDC CER	04222	SA101A561JAAH
A6C29	0160-4813	1	1	CAP-FXD 180pF 100 V	04222	SA101A181JAAH
A6C30	0160-4825	5	1	CAPACITOR-FXD 560PF +-5% 100VDC CER	04222	SA101A561JAAH
A6C31	0160-4813	1	1	CAP-FXD 180pF 100 V	04222	SA101A181JAAH
A6C32	0160-4809	5	1	CAPACITOR-FXD 390PF +-5% 100VDC CER	04222	SA101A391JAAH
A6C33	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C38	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C39	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C41	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C43	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A6C46	0160-2437	1	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	33095	54-713-033-X5V-502Z
A6C47	0160-4807	3	1	CAPACITOR-FXD 33PF +-5% 100VDC CER	04222	SA102A330JAAH
A6DS2	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A6DS3	1990-0487	7	1	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A6J1	85680-60076	2	1	CABLE ASSEMBLY, COAX 82 (INCLUDES W22)	28480	85680-60076
A6J2	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A6J3	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A6L2	9100-2257	6	1	INDUCTOR RF-CH-MLD 820NH +-10% .105D	32159	1A 8203M +-10%
A6L3	9100-3319	3	1	INDUCTOR RF-CH-MLD 740NH +-2% .166D	24226	15M740G-1
A6L4	9100-1619	2	1	INDUCTOR RF-CH-MLD 6.8UH +-10% .166D	99800	1537-32
A6L5	9100-3319	3	1	INDUCTOR RF-CH-MLD 740NH +-2% .166D	24226	15M740G-1

**Indicates factory-selected value*

HP Part Number 85680-60152
A6 YTO Phase Lock

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6L6	9100-3911	1	1	INDUCTOR RF-CH-MLD 220NH +-5% .166D	24226	15M220J
A6L7	9100-3548	0	1	INDUCTOR RF-CH-MLD 470NH +-5% .166D	24226	15M470J
A6L8	9100-3314	8	1	INDUCTOR RF-CH-MLD 150NH +-5% .166D	24226	15M150J
A6L9	9100-3548	0	1	INDUCTOR RF-CH-MLD 470NH +-5% .166D	24226	15M470J
A6L10	9100-3314	8	1	INDUCTOR RF-CH-MLD 150NH +-5% .166D	24226	15M150J
A6L11	9100-3548	0	1	INDUCTOR RF-CH-MLD 470NH +-5% .166D	24226	15M470J
A6L12	9100-3911	1	1	INDUCTOR RF-CH-MLD 220NH +-5% .166D	24226	15M220J
A6L14	9140-0096	1	1	INDUCTOR RF-CH-MLD 1UH +-10% .166D	99800	1537-12
A6L15	9140-0096	1	1	INDUCTOR RF-CH-MLD 1UH +-10% .166D	99800	1537-12
A6L16	9140-0096	1	1	INDUCTOR RF-CH-MLD 1UH +-10% .166D	99800	1537-12
A6MP1	85680-20071	3	1	LID YTO LOCK	28480	85680-20071
A6MP2	86701-40001	9	1	EXTRACTOR PC	28480	86701-40001
A6MP3	2190-0009	4	1	WASHER-LK INTL T NO. 8 .168-IN-ID	0G791	820-BC
A6MP4	2580-0002	4	1	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	80120	
A6MP5	2950-0078	9	3	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A6MP6	2190-0557	7	3	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A6MP7	2200-0101	0	6	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	
A6MP8				NOT ASSIGNED		
A6MP9	8151-0014	5	1	WIRE 24AWG 1X24	94130	
A6MP10	0890-0324	8	1	TUBING-FLEX 0.32 ID		
A6MP11	6960-0016	0	1	PLUG-HOLE .125 D		
A6Q1	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A6Q2	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A6Q3	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q4	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q5	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q6	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A6Q7	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A6Q8	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A6Q11	1853-0451	5	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	04713	
A6Q12	1855-0020	8	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	04713	SFE793
A6Q13	1855-0049	1	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	34677	
A6R1	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R2	0698-3437	2	1	RESISTOR 133 1% .125W TF TC=0+-100	19701	SFR25H
A6R3	0698-3444	1	1	RESISTOR 316 1% .125W TF TC=0+-100	19701	SFR25H
A6R4	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R5	0698-3132	4	1	RESISTOR 261 1% .125W TF TC=0+-100	19701	SFR25H
A6R6	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R7	0698-3441	8	1	RESISTOR 215 1% .125W TF TC=0+-100	19701	SFR25H
A6R8	0757-0316	6	1	RESISTOR 42.2 +-1% .125W TF TC=0+-100	19701	SFR25H
A6R9	0757-0418	9	1	RESISTOR 619 +-1% .125W TF TC=0+-100	19701	SFR25H
A6R10	0757-0420	3	1	RESISTOR 750 +-1% .125W TF TC=0+-100	19701	SFR25H
A6R11	0698-3441	8	1	RESISTOR 215 1% .125W TF TC=0+-100	19701	SFR25H
A6R12	0698-3441	8	1	RESISTOR 215 1% .125W TF TC=0+-100	19701	SFR25H
A6R13	0757-0398	4	1	RESISTOR 75 +-1% .125W TF TC=0+-100	19701	SFR25H
A6R14	0698-3442	9	1	RESISTOR 237 1% .125W TF TC=0+-100	19701	SFR25H
A6R15	0757-0276	7	1	RESISTOR 61.9 +-1% .125W TF TC=0+-100	19701	SFR25H
A6R17	0698-3437	2	1	RESISTOR 133 1% .125W TF TC=0+-100	19701	SFR25H

**Indicates factory-selected value*

HP Part Number 85680-60152
A6 YTO Phase Lock

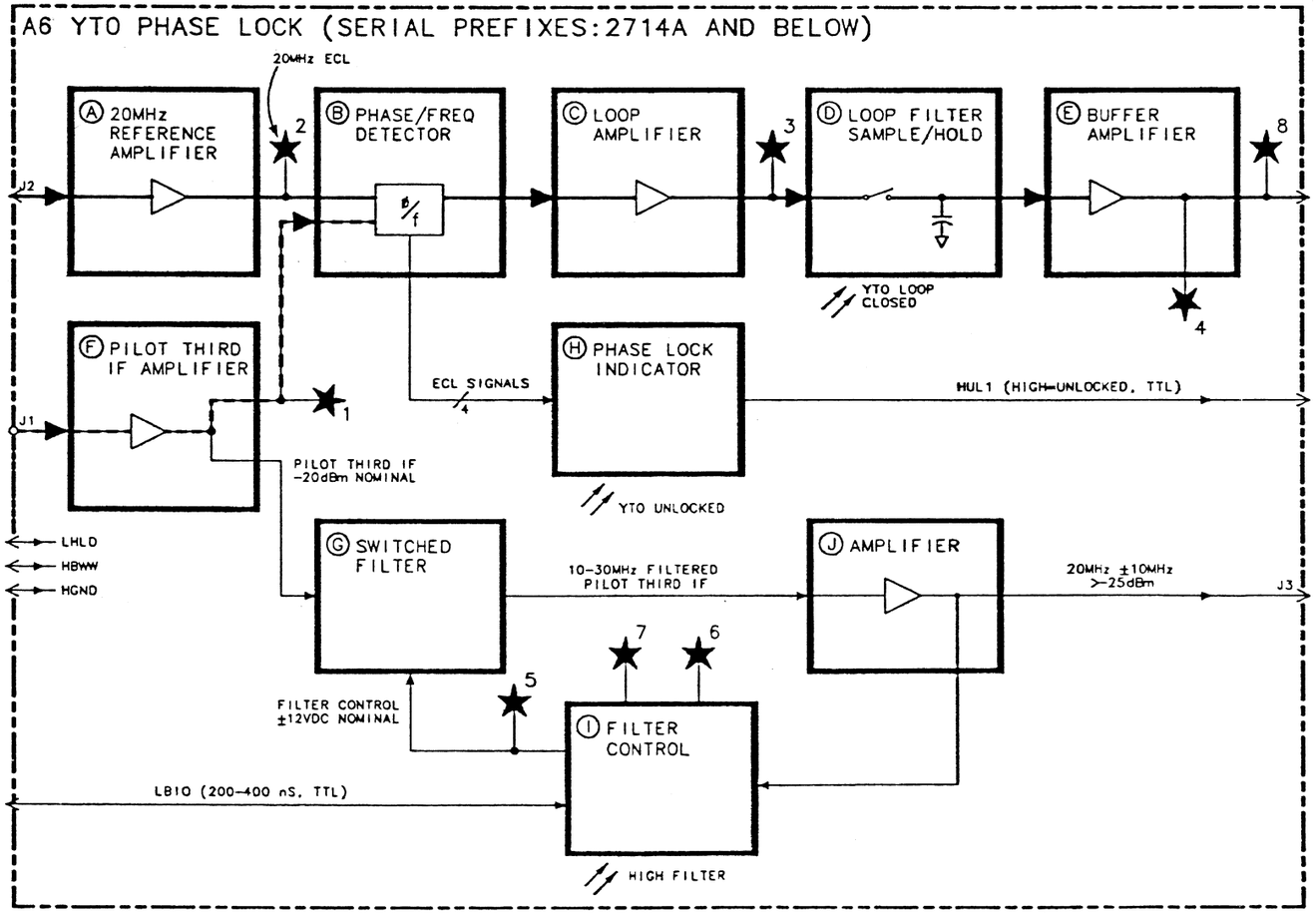
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R18	0698-3444	1	1	RESISTOR 316 1% .125W TF TC=0+-100	19701	SFR25H
A6R19	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R20	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R21	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R22	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R23	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R24	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R25	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R26	0757-0123	3	1	RESISTOR 34.8K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R27	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R28	0757-0424	7	1	RESISTOR 1.1K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R29	0757-0447	4	1	RESISTOR 16.2K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R30	0698-3152	8	1	RESISTOR 3.48K 1% .125W TF TC=0+-100	19701	SFR25H
A6R31	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R32	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R33	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R34	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R35	0757-0444	1	1	RESISTOR 12.1K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R36	0698-3151	7	1	RESISTOR 2.87K 1% .125W TF TC=0+-100	19701	SFR25H
A6R39	0698-0085	0	1	RESISTOR 2.61K 1% .125W TF TC=0+-100	19701	SFR25H
A6R40	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R41	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R44	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H
A6R45	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R48	0698-3162	0	1	RESISTOR 46.4K 1% .125W TF TC=0+-100	19701	SFR25H
A6R49	0698-3154	0	1	RESISTOR 4.22K 1% .125W TF TC=0+-100	19701	SFR25H
A6R51	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R52	0698-3132	4	1	RESISTOR 261 1% .125W TF TC=0+-100	19701	SFR25H
A6R53	0698-0084	9	1	RESISTOR 2.15K 1% .125W TF TC=0+-100	19701	SFR25H
A6R54	0683-1055	5	1	RESISTOR 1M 5% .25W CF TC=0-800	2M627	R-25J
A6R55	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A6R56	0698-3132	4	1	RESISTOR 261 1% .125W TF TC=0+-100	19701	SFR25H
A6R57	0757-0294	9	1	RESISTOR 17.8 +-1% .125W TF TC=0+-100	19701	SFR25H
A6R58	0698-3132	4	1	RESISTOR 261 1% .125W TF TC=0+-100	19701	SFR25H
A6R59	0757-0398	4	1	RESISTOR 75 +-1% .125W TF TC=0+-100	19701	SFR25H
A6TP1	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A6TP2	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A6TP3	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A6TP4	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A6TP5	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A6U1	1820-0817	8	1	IC FF ECL D-M/S DUAL	04713	MC10131P
A6U2	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A6U3	1826-0416	5	1	ANALOG SWITCH 4 SPST 16 -CBRZ/SDR	27014	LF13331D
A6U4	1826-1007	2	1	IC OP AMP PRCN 8-TO-99 PKG	06665	OP-27GJ
A6U6	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	27014	LM311H
A6VR1	1902-3234	3	1	DIODE-ZNR 19.6V 5% DO-35 PD=.4W	04713	
A6VR2	1902-0049	2	1	DIODE-ZNR 6.19V 5% DO-35 PD=.4W	04713	

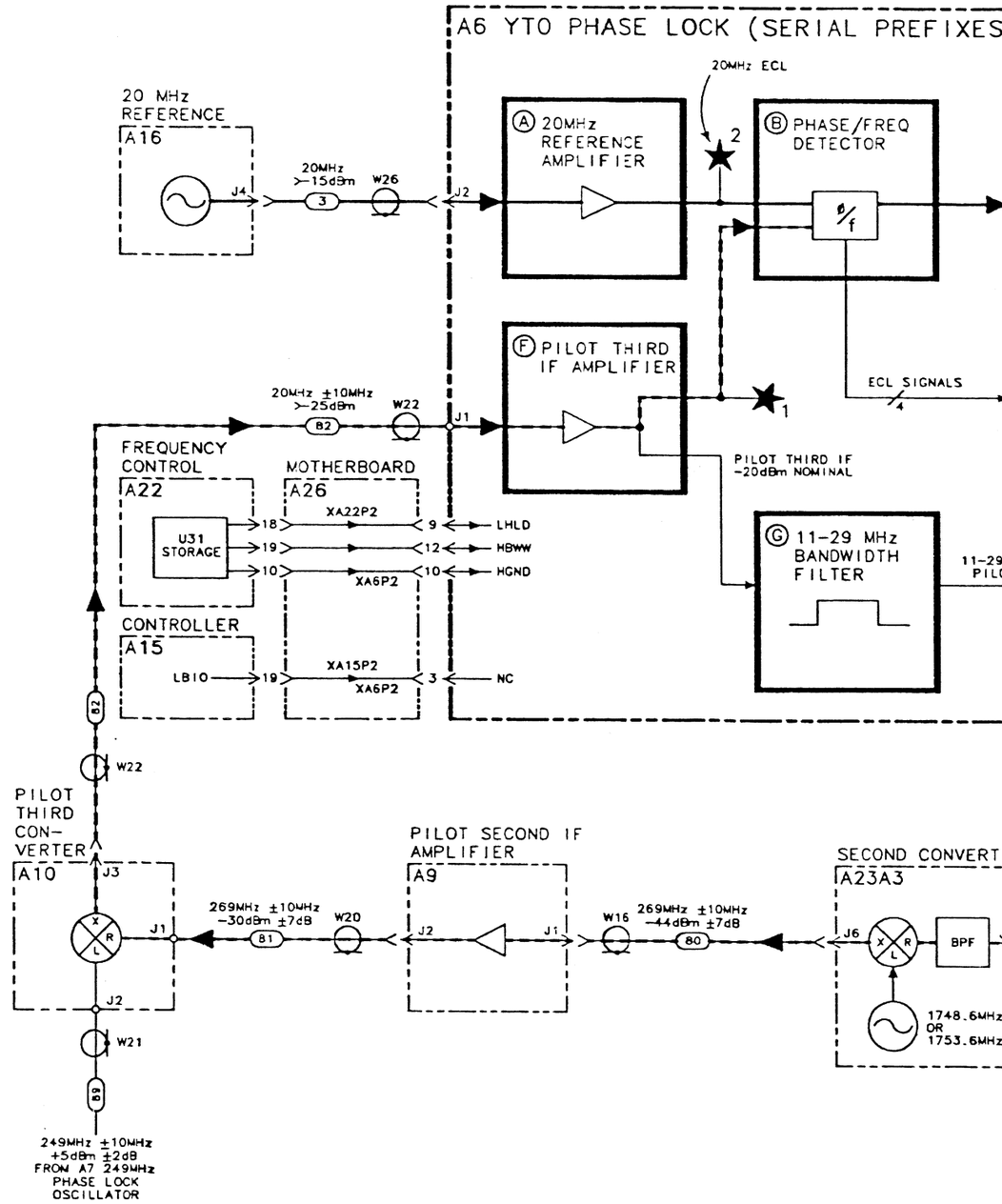
**Indicates factory-selected value*

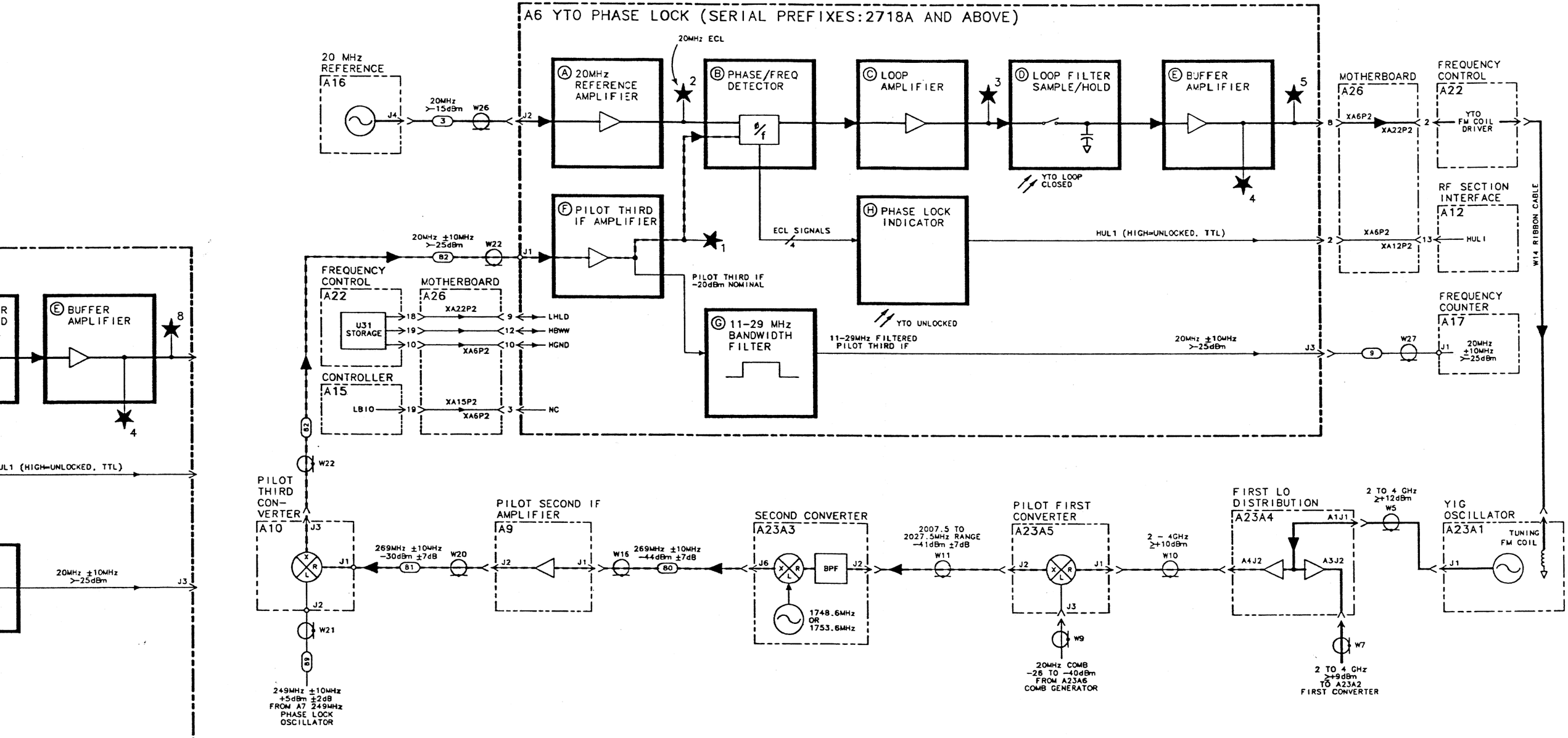
HP Part Number 85680-60152
A6 YTO Phase Lock

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6VR5	1902-0126	6	1	DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.072%	04713	

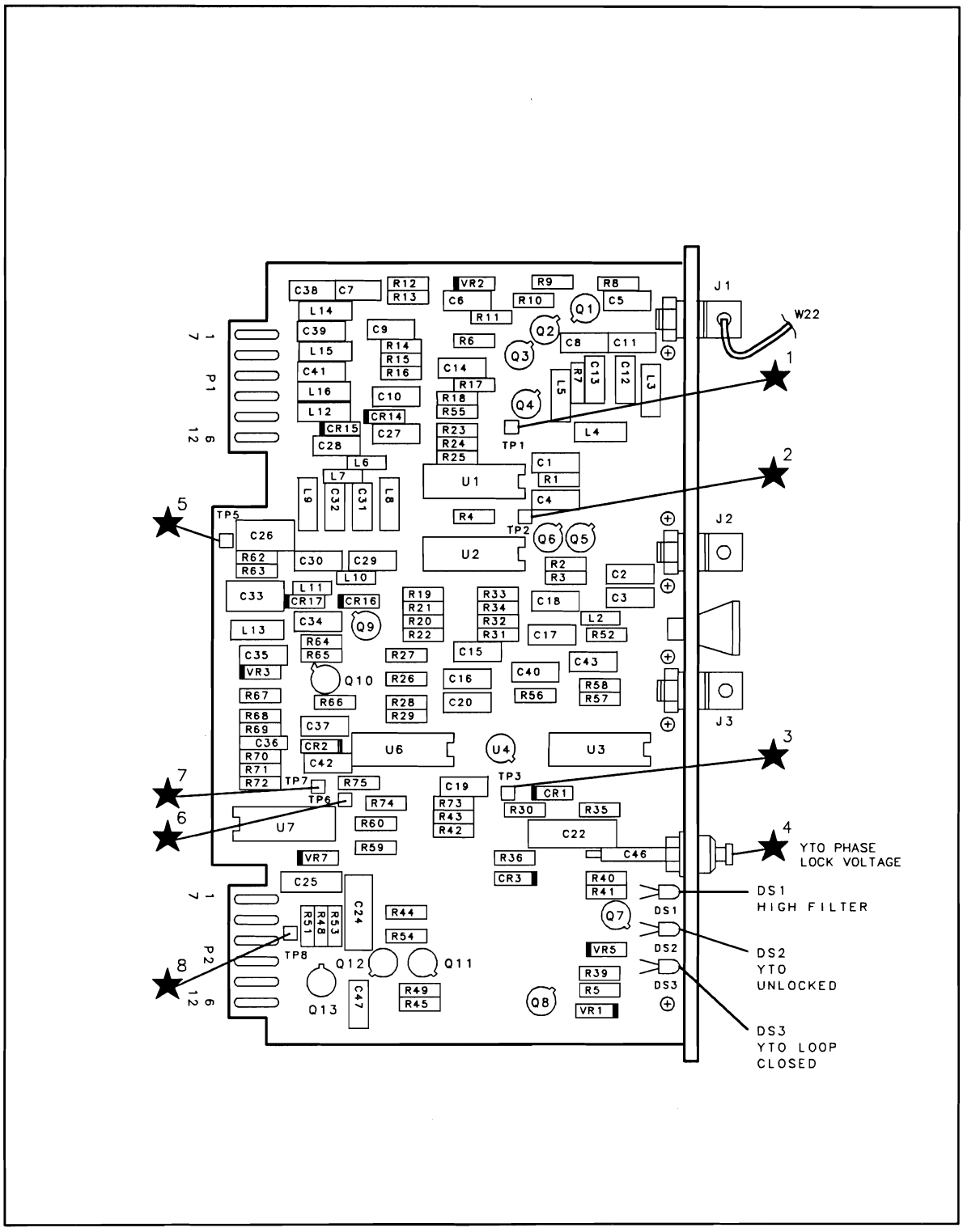
**Indicates factory-selected value*


A6 YTO PHASE LOCK (SERIAL PREFIXES:2714A AND BELOW)
20MHz ECL
Ⓐ 20MHz REFERENCE AMPLIFIER
Ⓑ PHASE/FREQ DETECTOR
Ⓒ LOOP AMPLIFIER
Ⓓ LOOP FILTER SAMPLE/HOLD
Ⓔ BUFFER AMPLIFIER
J2
2
3
8
4
YTO LOOP CLOSED
Ⓕ PILOT THIRD IF AMPLIFIER
J1
1
PILOT THIRD IF -20dBm NOMINAL
ECL SIGNALS
4
Ⓗ PHASE LOCK INDICATOR
HUL1 (HIGH=UNLOCKED, TTL)
YTO UNLOCKED
LHLD
HBWW
HGND
Ⓖ SWITCHED FILTER
10-30MHz FILTERED PILOT THIRD IF
Ⓙ AMPLIFIER
20MHz ±10MHz >-25dBm
J3
7
6
5
FILTER CONTROL ±12VDC NOMINAL
Ⓘ FILTER CONTROL
LB10 (200-400 nS, TTL)
HIGH FILTER

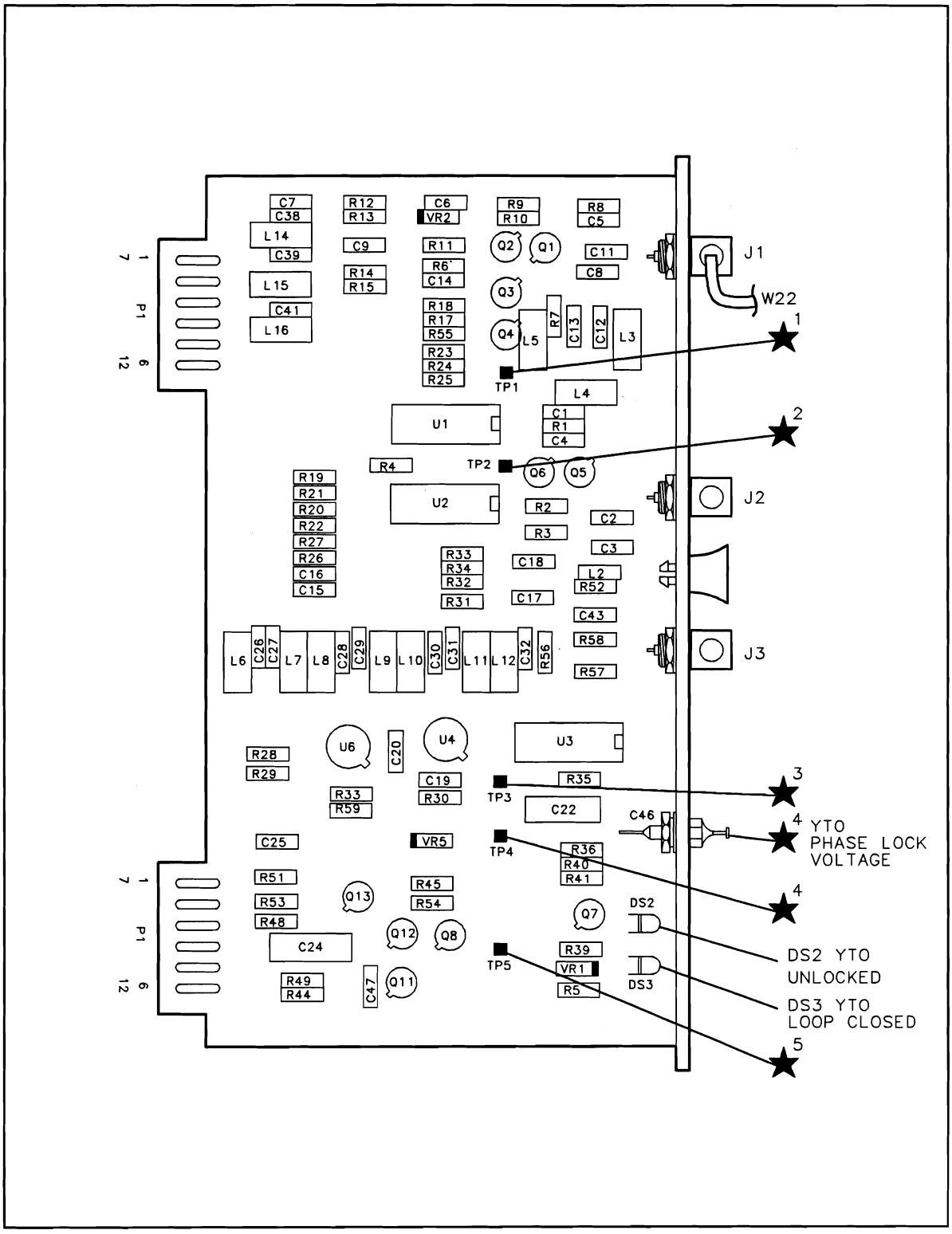

A6 YTO PHASE LOCK (SERIAL PREFIXES
20 MHz REFERENCE A16
J4
20MHz >-15dBm
3
W26
J2
20MHz ECL
Ⓐ 20MHz REFERENCE AMPLIFIER
2
Ⓑ PHASE/FREQ DETECTOR
Ø/f
Ⓕ PILOT THIRD IF AMPLIFIER
ECL SIGNALS
4
1
20MHz ±10MHz >-25dBm
82
W22
J1
PILOT THIRD IF -20dBm NOMINAL
FREQUENCY CONTROL A22
U31 STORAGE
MOTHERBOARD A26
XA22P2
18
19
10
9
12
10
LHLD
HBWW
HGND
XA6P2
Ⓖ 11-29 MHz BANDWIDTH FILTER
CONTROLLER A15
LB10
19
XA15P2
XA6P2
3
NC
82
W22
PILOT THIRD CON-VERTER A10
J3
J1
J2
W21
89
249MHz ±10MHz +5dBm ±2dB FROM A7 249MHz PHASE LOCK OSCILLATOR
PILOT SECOND IF AMPLIFIER A9
269MHz ±10MHz -30dBm ±7dB
81
W20
J2
J1
W16
269MHz ±10MHz -44dBm ±7dB
80
SECOND CONVERT A23A3
J6
BPF
1748.6MHz OR 1753.6MHz



A6 YIG-TUNED OSCILLATOR PHASE LOCK, BLOCK DIAGRAM



A6 YIG-Tuned Oscillator Phase Lock Component Locations, 85680-60011



A6 YIG-Tuned Oscillator Phase Lock Component Locations, 85680-60152

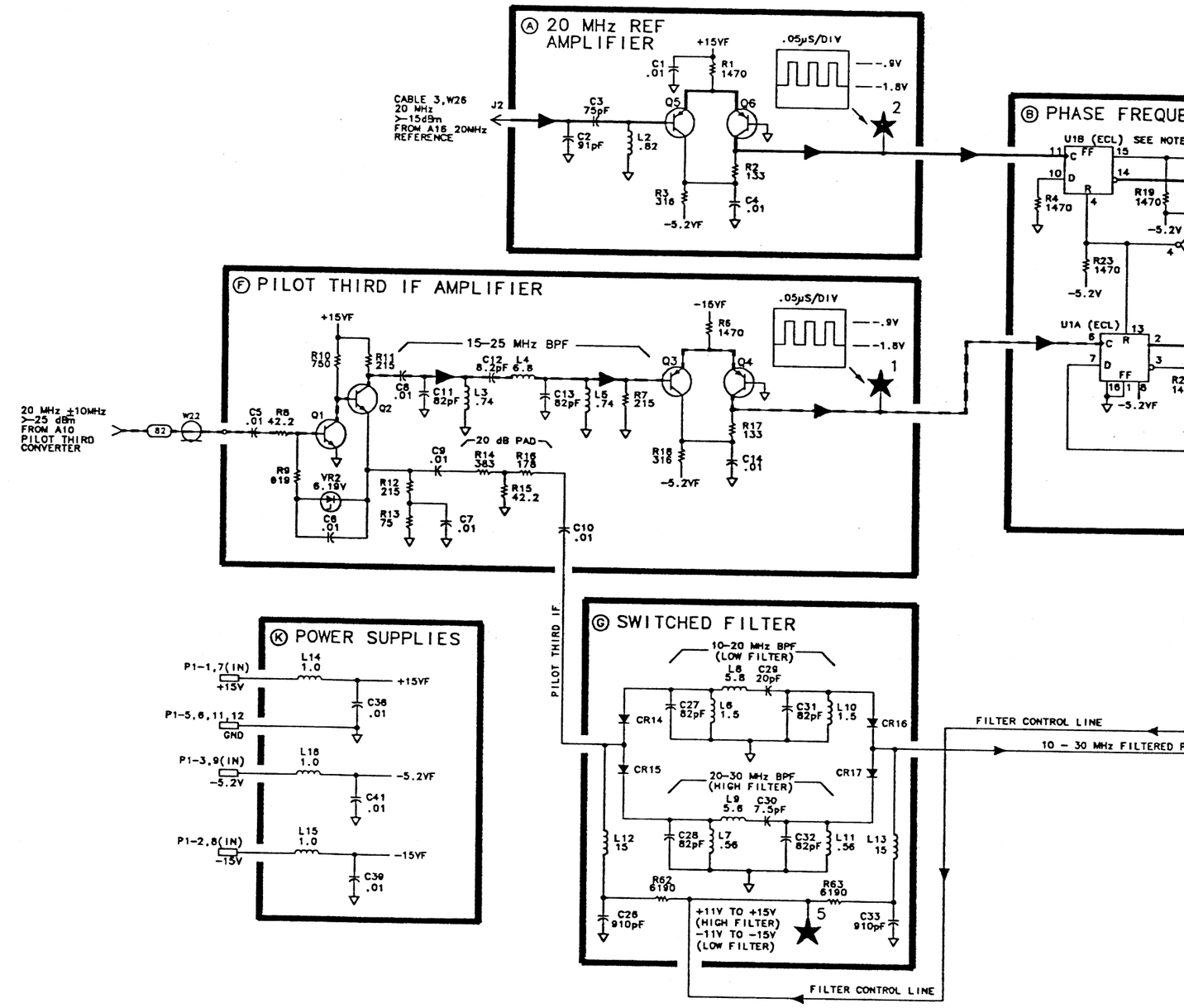
A6 YTO PHASE LOCK
85680-60011
(SERIAL PREFIXES: 2408A-2714A)

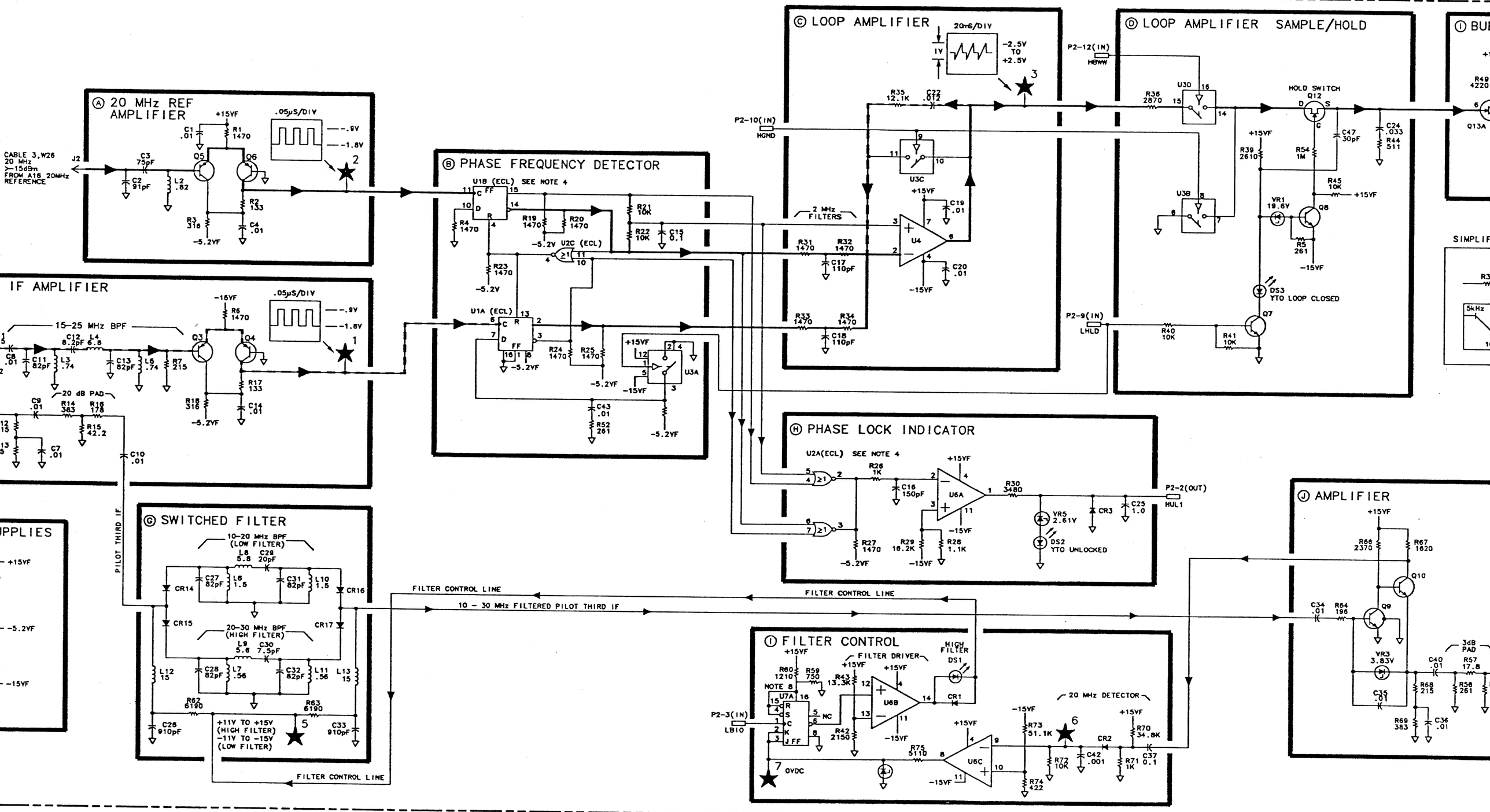
P1

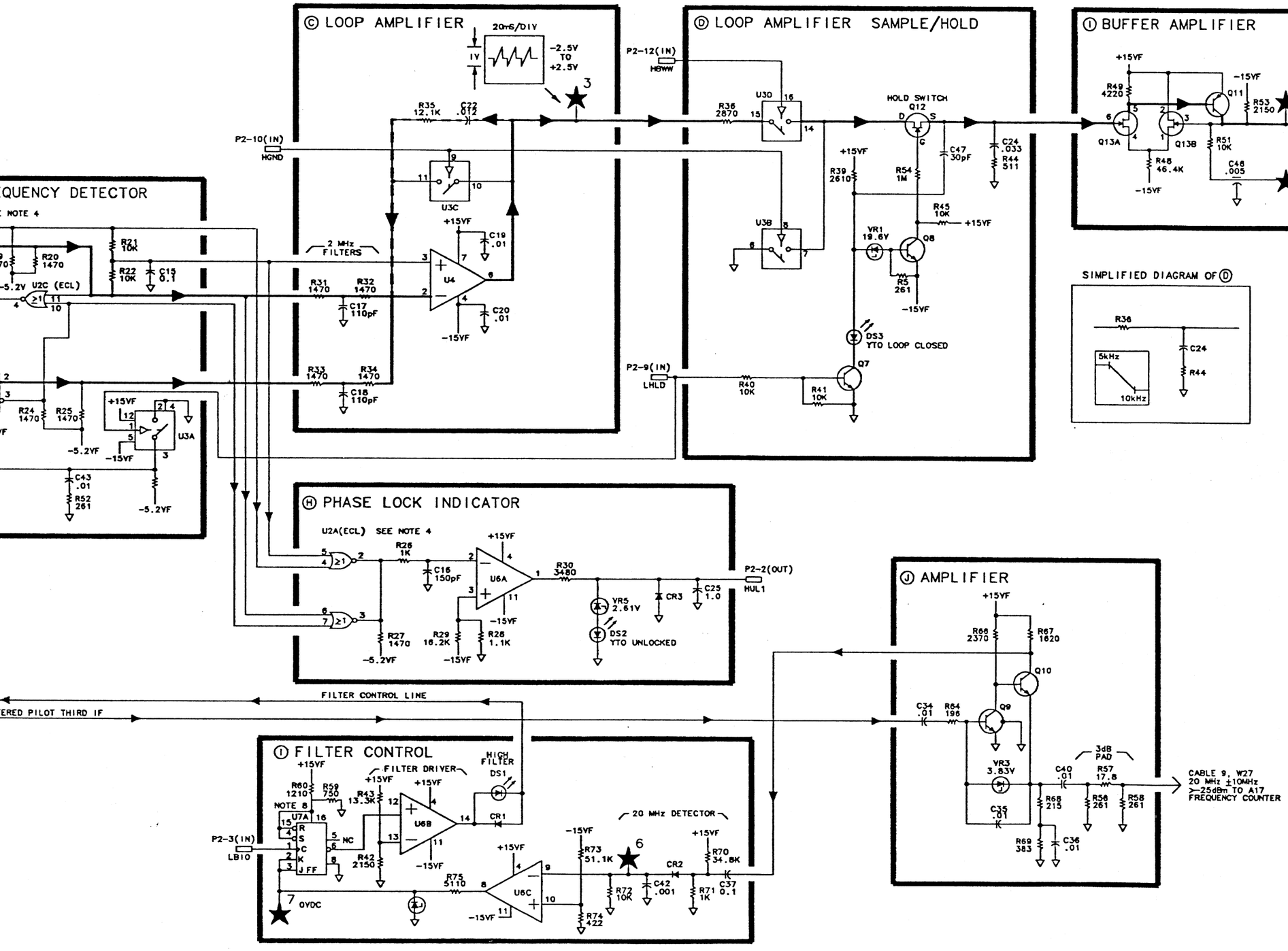
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 7	+15V +15V		K K
2 8	+15V +15V		K K
3 9	-5.2V -5.2V		K K
4 10	NC NC		
5 11	GND GND		K K
6 12	GND GND		K K

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1 7	NC NC		
2 8	HUL1 YTO LOCK	A12P2-13 A22P2-2	H E
3 9	LBIO LHLD	A15P2-19 A22P2-18	I D
4 10	NC HGND	A22P2-10	C
5 11	NC NC		
6 12	NC HBWW	A22P2-19	D




Ⓐ 20 MHz REF AMPLIFIER
CABLE 3,W26 20 MHz >-15dBm FROM A16 20MHz REFERENCE
J2
C1 .01
+15VF
R1 1470
.05µS/DIV
-.9V
-1.8V
C3 75pF
Q5
Q6
C2 91pF
L2 .82
R2 133
R3 316
C4 .01
-5.2VF
2
Ⓑ PHASE FREQUENCY DETECTOR
U1B (ECL) SEE NOTE 4
R4 1470
R19 1470
R20 1470
R21 10K
R22 10K
C15 0.1
-5.2V U2C (ECL)
R23 1470
-5.2V
U1A (ECL)
R24 1470
R25 1470
-5.2VF
+15VF
U3A
-15VF
C43 .01
R52 261
-5.2VF
Ⓒ LOOP AMPLIFIER
20mS/DIV
1V
-2.5V TO +2.5V
3
R35 12.1K
C22 .012
P2-10(IN)
HGND
U3C
2 MHz FILTERS
+15VF
C19 .01
R31 1470
R32 1470
U4
C17 110pF
C20 .01
-15VF
R33 1470
R34 1470
C18 110pF
Ⓓ LOOP AMPLIFIER SAMPLE/HOLD
P2-12(IN)
HSWW
U30
R36 2870
HOLD SWITCH Q12
C47 30pF
C24 .033
R44 511
U3B
+15VF
R39 2610
R54 1M
R45 10K
+15VF
VR1 19.6V
Q8
R5 261
-15VF
DS3 YTO LOOP CLOSED
Q7
P2-9(IN)
LHLD
R40 10K
R41 10K
Ⓘ BU
R49 4220
Q13A
SIMPLIF
5kHz
IF AMPLIFIER
-15VF
R6 1470
.05µS/DIV
-.9V
-1.8V
15-25 MHz BPF
C12 8.2pF
L4 6.8
Q3
Q4
1
C8 .01
C11 82pF
L3 .74
C13 82pF
L5 .74
R7 215
R17 133
20 dB PAD
C9 .01
R14 383
R16 178
R18 316
C14 .01
-5.2VF
R15 42.2
C7 .01
C10 .01
PILOT THIRD IF
UPPLIES
+15VF
-5.2VF
-15VF
Ⓖ SWITCHED FILTER
10-20 MHz BPF (LOW FILTER)
L8 5.8
C29 20pF
CR14
C27 82pF
L6 1.5
C31 82pF
L10 1.5
CR16
CR15
20-30 MHz BPF (HIGH FILTER)
CR17
L9 5.6
C30 7.5pF
L12 15
C28 82pF
L7 .56
C32 82pF
L11 .56
L13 15
R62 6190
R63 6190
C26 910pF
+11V TO +15V (HIGH FILTER)
-11V TO -15V (LOW FILTER)
5
C33 910pF
FILTER CONTROL LINE
10 - 30 MHz FILTERED PILOT THIRD IF
FILTER CONTROL LINE
FILTER CONTROL LINE
Ⓗ PHASE LOCK INDICATOR
U2A(ECL) SEE NOTE 4
R26 1K
C16 150pF
U6A
R30 3480
P2-2(OUT)
HUL1
VR5 2.61V
CR3
C25 1.0
DS2 YTO UNLOCKED
R27 1470
R29 16.2K
R26 1.1K
-5.2VF
-15VF
Ⓙ AMPLIFIER
+15VF
R66 2370
R67 1620
Q10
C34 .01
R64 196
Q9
3dB PAD
VR3 3.83V
C40 .01
R57 17.8
C35 .01
R68 215
R58 261
R69 383
C36 .01
Ⓘ FILTER CONTROL
+15VF
HIGH FILTER
DS1
FILTER DRIVER
R60 1210
R59 750
R43 13.3K
U6B
CR1
NOTE 8
U7A
NC
P2-3(IN)
LB10
R42 2150
J FF
20 MHz DETECTOR
-15VF
R73 51.1K
6
+15VF
R70 34.8K
CR2
R72 10K
C42 .001
R71 1K
C37 0.1
R75 5110
U6C
R74 422
7
0VDC

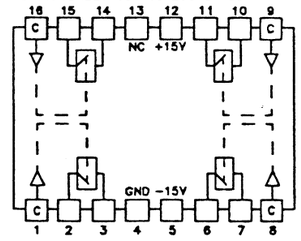


NOTES:

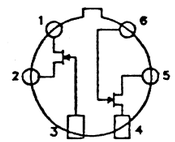
1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN MICROFARADS (μF) INDUCTANCE IS IN MICROHENRIES (μH)
3. TEST POINT VOLTAGES ASSUME 1MHz SCAN; ALL OTHER SETTINGS AUTO UNLESS NOTED.
4. ECL LOGIC LEVELS ARE TYPICALLY:
   HIGH = -0.9V
   LOW = -1.8V
5. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
HUL1	HIGH INDICATES UNLOCKED YTO LOOP
LB10	LOW=BOTTOM BOX I/O STROBE
LHLD	LOW=HOLD PHASE LOCK VOLTAGE
HGND	HIGH GROUNDS OUTPUT OF PHASE DETECTOR
HGND	HIGH=WIDE (100kHz) LOOP BW

6. U3 IS A SET OF FOUR JFET ANALOG SWITCHES WHICH ARE OPEN WHEN THE INPUTS (TTL) ARE LOW AND CLOSED WHEN THE INPUTS ARE HIGH. CLOSED RESISTANCE FROM INPUT TO OUTPUT ID TYPICALLY 150 TO 200 OHMS.



7. TOP VIEW OF Q13.



8. U7B IS NOT USED. PINS 14 AND 10 ARE CONNECTED TO PIN 16.
9. U2D AND U6D ARE NOT USED.

A6

A6 YIG-TUNED OSCILLATOR PHASE LOCK, SCHEMATIC DIAGRAM

A6 YTO PHASE LOCK
85680-60152
(SERIAL PREFIX: 2718A)

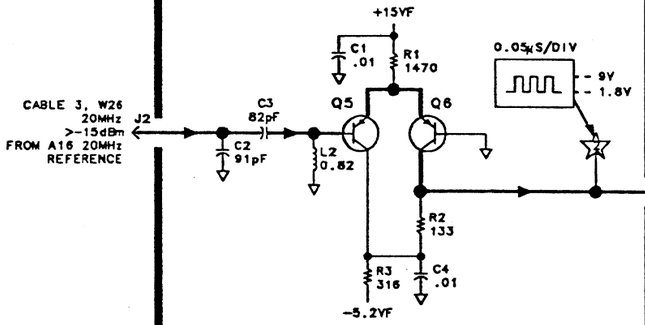
P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+15V		K
7	+15V		K
2	-15V		K
8	-15V		K
3	-5.2V		K
9	-5.2V		K
4	NC		
10	NC		
5	GND		K
11	GND		K
6	GND		K
12	GND		K

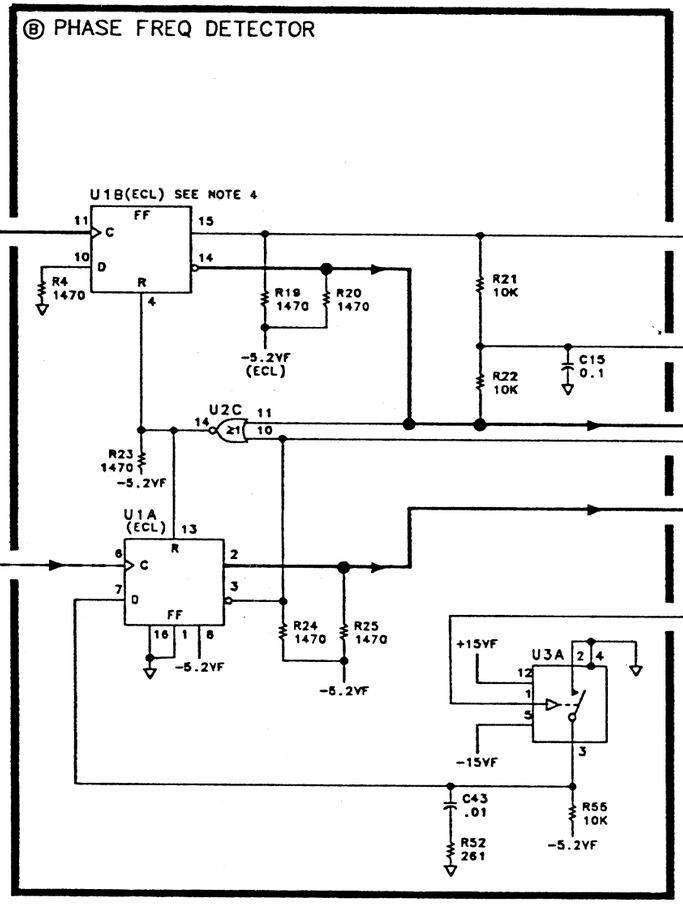
P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
7	NC		
2	HUL1	A12,P2-13	H
8	YTO LOCK	A22,P2-2	E
3	LBIO	A15,P2-19	NC
9	LHLD	A22,P2-18	D
4	NC		
10	HGND	A22,P2-10	C
5	NC		
11	NC		
6	NC		
12	HBWW	A22,P2-19	D

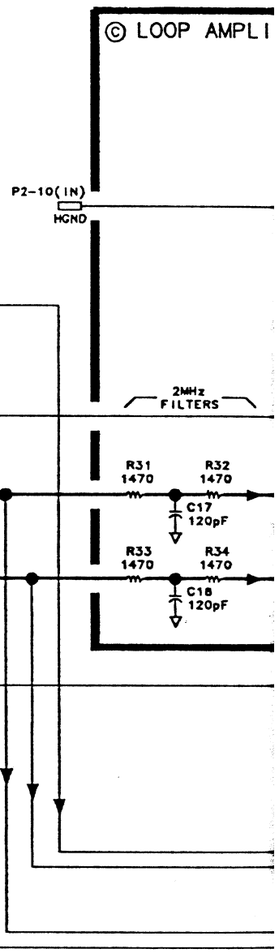
Ⓐ 20 MHz REF AMPL



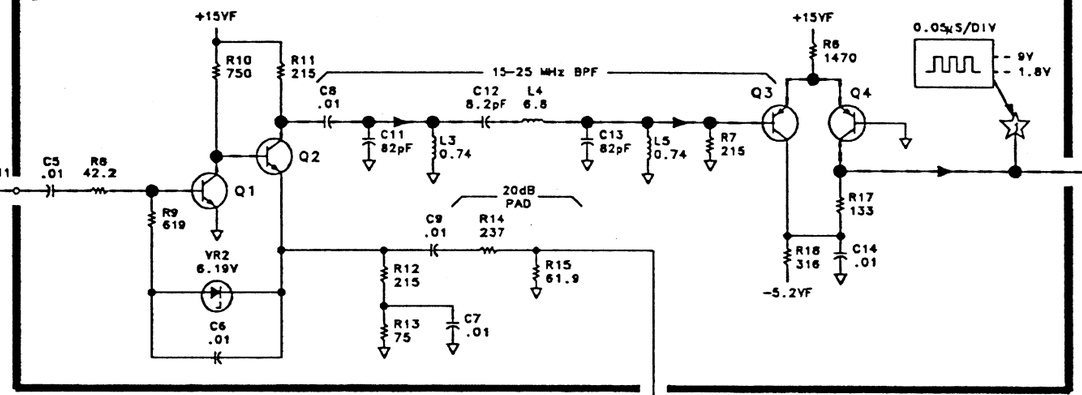
Ⓑ PHASE FREQ DETECTOR



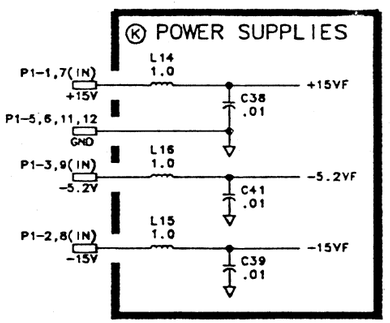
Ⓒ LOOP AMPLI



Ⓕ PILOT THIRD IF AMPLIFIER

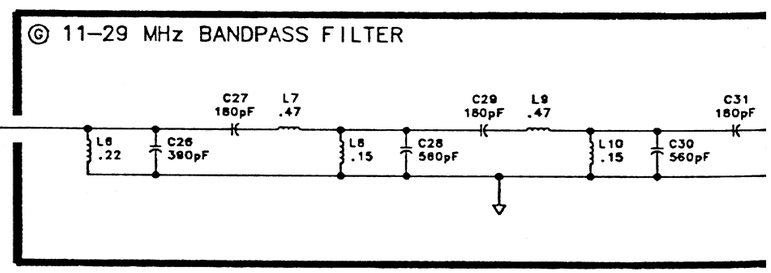


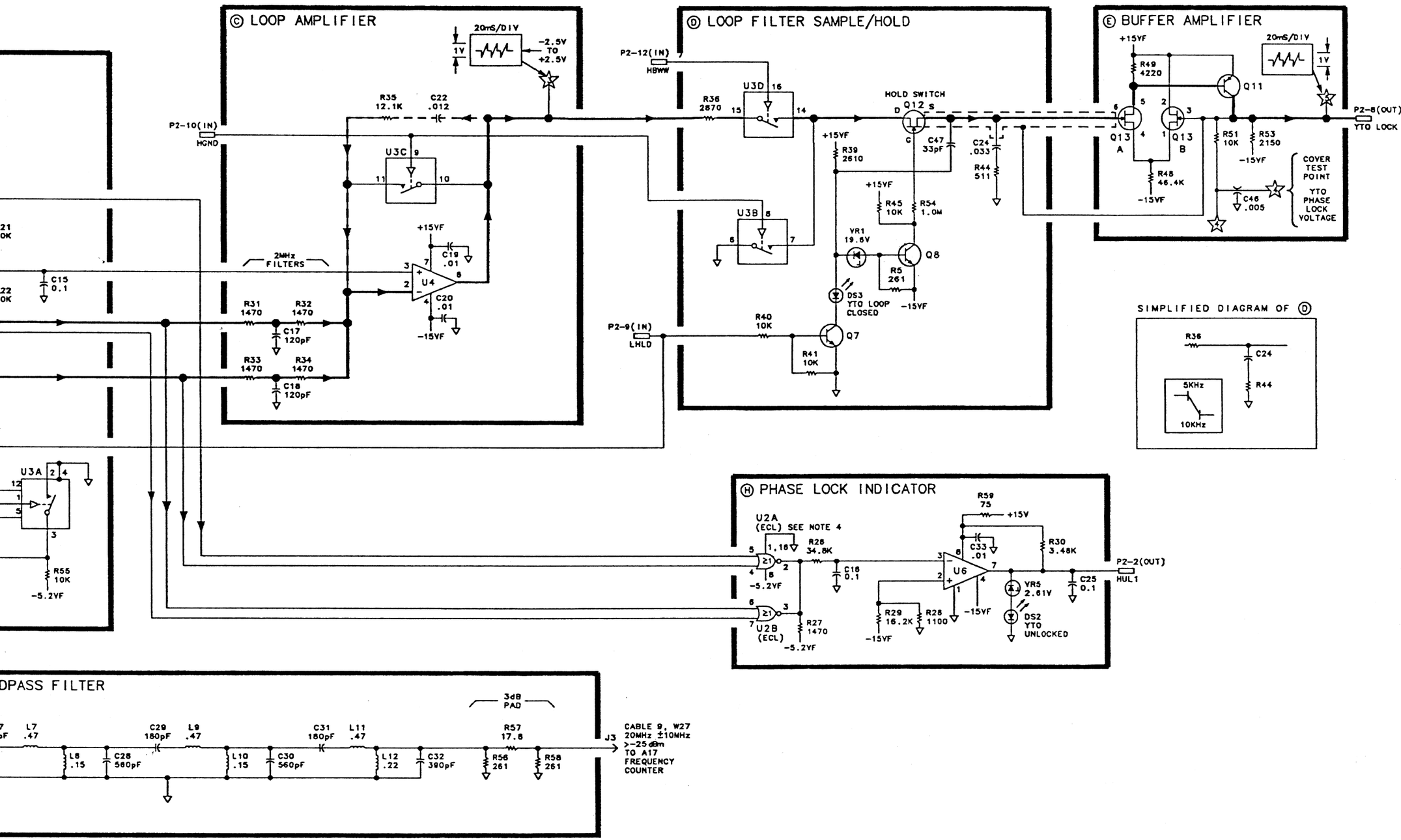
Ⓚ POWER SUPPLIES



PILOT THIRD IF

Ⓖ 11-29 MHz BANDPASS FILTER



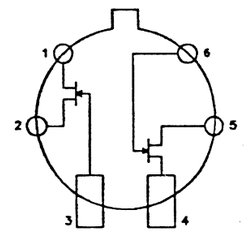


NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IS IN OHMS (Ω)
   CAPACITANCE IS IN MICROFARADS (μF)
   INDUCTANCE IS IN MICROHENRIES (μH)
3. TEST POINT VOLTAGES ASSUME 1MHz SCAN; ALL OTHER SETTINGS AUTO UNLESS NOTED.
4. ECL LOGIC LEVELS ARE TYPICALLY:
   HIGH = -0.9V
   LOW = -1.8V
   AN UNCONNECTED ECL INPUT IS LOW.
5. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
HUL1	HIGH INDICATES UNLOCKED YTO LOOP
LHLD	LOW=HOLD PHASE LOCK VOLTAGE
HGND	HIGH GROUNDS OUTPUT OF PHASE DETECTOR
HBWW	HIGH=WIDE (100KHz) LOOP BW

6. U3 IS A SET OF FOUR JFET ANALOG SWITCHES SWITCHES WHICH ARE OPEN WHEN THE LOGIC INPUTS (TTL) ARE LOW AND CLOSED WHEN THE INPUTS ARE HIGH. CLOSED RESISTANCE FROM INPUT TO OUTPUT IS TYPICALLY 150-200 OHMS.
7. TOP VIEW OF Q13.



8. U2D IS NOT USED.

A7

249 MHz Phase Lock Oscillator, Circuit Description

A7 249 MHz Phase Lock Oscillator has two outputs in the range 239 MHz to 259 MHz. One output goes to A10 Pilot Third Converter. The other goes to A18 275 MHz Phase Lock Oscillator, where it is mixed with 275 MHz to provide a 16 MHz to 38.5 MHz signal (variable in 500-kHz steps) to A8 249 MHz Phase Lock. A7 consists of the 249 MHz Phase Lock Oscillator, a Tune Voltage Filter (which also provides phase lock loop compensation), and two common-emitter Buffer Amplifiers.

249 MHz Phase Lock Oscillator (B)

Transistor Q1 and its associated circuitry form a modified Colpitts oscillator with C21 through C23 providing the feedback signal. The tank circuit capacitance is provided by the feedback capacitors and by PLO ADJUST C3, C2, and varactor diode CR1. The tank circuit inductance is provided by PLO ADJUST L2 and L11. R1 and R2 set the operating bias for Q1. L1, L3, L4, C1, C5 and C8 are high frequency bypass elements.

Tune Voltage Filter (A)

The Tune Voltage Filter receives a +4 V to +18 V signal (called 249 MHz TUNE) from A8 249 Phase Lock. This tune voltage is derived in A8 by the Phase/Frequency Detector. The amount of frequency offset is determined by the Variable Module Frequency Divider, which operates at a 500 kHz rate. The 500 kHz component of the tune voltage is filtered out before it is sent to the 249 MHz Phase Lock Oscillator. The tune voltage may be measured at TP1.

The Tune Voltage Filter consists of L12, L13, L14, L15, L16, L17, L18, C25, C26, and C27. The 500 kHz TRAP inductors L17 and L15 are adjusted to shunt 500 kHz to ground. R23, R22, and C24 provide phase lock loop compensation.

Buffer Amplifier 1 (C)

Buffer Amplifier 1 provides isolation for the 249 MHz (±10 MHz) signal to A10 Pilot Third Converter. Q3 is a common-emitter amplifier with a gain of approximately 9 dB. The bias for Q3 is set by R8, R19, and R13. The amplifier has a 2 dB resistive pad on both the input and the output for additional isolation.

Buffer Amplifier 2 (D)

Buffer Amplifier 2 provides isolation for the 249 MHz (±10 MHz) signal to A18 275 MHz Phase Lock Oscillator. Q2 is a common-emitter amplifier with a gain of approximately 12 dB. R17, R18, and R25 provide dc bias for Q2. The amplifier has a 5 dB resistive pad on the input and an 8 dB resistive pad on the output for additional isolation. The output signal then passes through a 300-MHz low-pass filter (L5, L7, and C6) to eliminate crossing spurs in A8 249 MHz Phase Lock.

HP Part Number 85680-60013

A7 249 MHz Phase Lock Oscillator

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7	85680-60013	7	1	BOARD ASSEMBLY, 249MHZ PHASE LOCK OSCILLATOR	28480	85680-60013
A7C1	0160-3466	8	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER		838-546 X5E 101K
A7C2	0160-2262	0	1	CAP-FXD 16pF 500 V	52763	
A7C3	0121-0457	9	1	CAPACITOR-V TRMR-PSTN .8-8.5PF 750V PC-M	18736	TP9
A7C5	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A7C6	0160-2259	5	1	CAPACITOR-FXD 12PF +-5% 500VDC CER	52763	2RDPLX05012RNP0
A7C8	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A7C9	0160-4084	8	1	CAP-FXD 0.1uF 50 V	56289	1C20X7R104M050B
A7C10	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	04222	SR201C103MAAH
A7C11	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A7C12	0160-4084	8	1	CAP-FXD 0.1uF 50 V	56289	1C20X7R104M050B
A7C13	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	04222	SR201C103MAAH
A7C14	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	04222	SR201C103MAAH
A7C15	0160-4084	8	1	CAP-FXD 0.1uF 50 V	56289	1C20X7R104M050B
A7C16	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A7C17	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	04222	SR201C103MAAH
A7C18	0160-4084	8	1	CAP-FXD 0.1uF 50 V	56289	1C20X7R104M050B
A7C19	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2-DYS
A7C20	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2-DYS
A7C21	0160-2266	4	1	CAPACITOR-FXD 24PF +-5% 500VDC CER	52763	2RDPLX05024RNP0
A7C22	0160-2247	1	1	CAPACITOR-FXD 3.9PF +-.25PF 500VDC CER	52763	2RDPLX0503R9NP0
A7C23	0150-0059	8	1	CAP-FXD 3.3pF 500 V	52763	
A7C24	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2-DYS
A7C25	0160-2224	4	1	CAPACITOR-FXD 1800PF +-5% 300VDC MICA	09023	CD19FD182J03
A7C26	0160-2221	1	1	CAPACITOR-FXD 1300PF +-5% 300VDC MICA	09023	CD19FD132J03
A7C27	0160-2227	7	1	CAP-FXD 2400pF 300 V MICA	09023	CD19FD242J03
A7C28	0160-2437	1	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	33095	54-713-033-X5V-502Z
A7CR1	0122-0085	1	1	DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	S0545	1S2208(B)
A7E1	4330-0145	9	1	INSULATOR-BEAD GLASS		
A7E2	4330-0145	9	1	INSULATOR-BEAD GLASS		
A7E3	4330-0145	9	1	INSULATOR-BEAD GLASS		
A7E4	4330-0145	9	1	INSULATOR-BEAD GLASS		
A7E5	4330-0145	9	1	INSULATOR-BEAD GLASS		
A7E6	4330-0145	9	1	INSULATOR-BEAD GLASS		
A7E7	4330-0145	9	1	INSULATOR-BEAD GLASS		
A7E8	4330-0145	9	1	INSULATOR-BEAD GLASS		
A7E9	4330-0145	9	1	INSULATOR-BEAD GLASS		
A7E10	4330-0145	9	1	INSULATOR-BEAD GLASS		
A7J1	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A7J2	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A7L1	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH +-10% .105D	32159	1A1002M +-10%
A7L2	85680-80005	9	1	COIL-OSCILLATOR-VARIABLE	28480	85680-80005
A7L3	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH +-10% .105D	32159	1A1002M +-10%
A7L4	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH +-10% .105D	32159	1A1002M +-10%
A7L5	9100-2891	4	1	INDUCTOR RF-CH-MLD 50NH +-10% .105D	24226	10M050K-1
A7L6	9100-2247	4	1	INDUCTOR RF-CH-MLD 100NH +-10% .105D	24226	10M100K

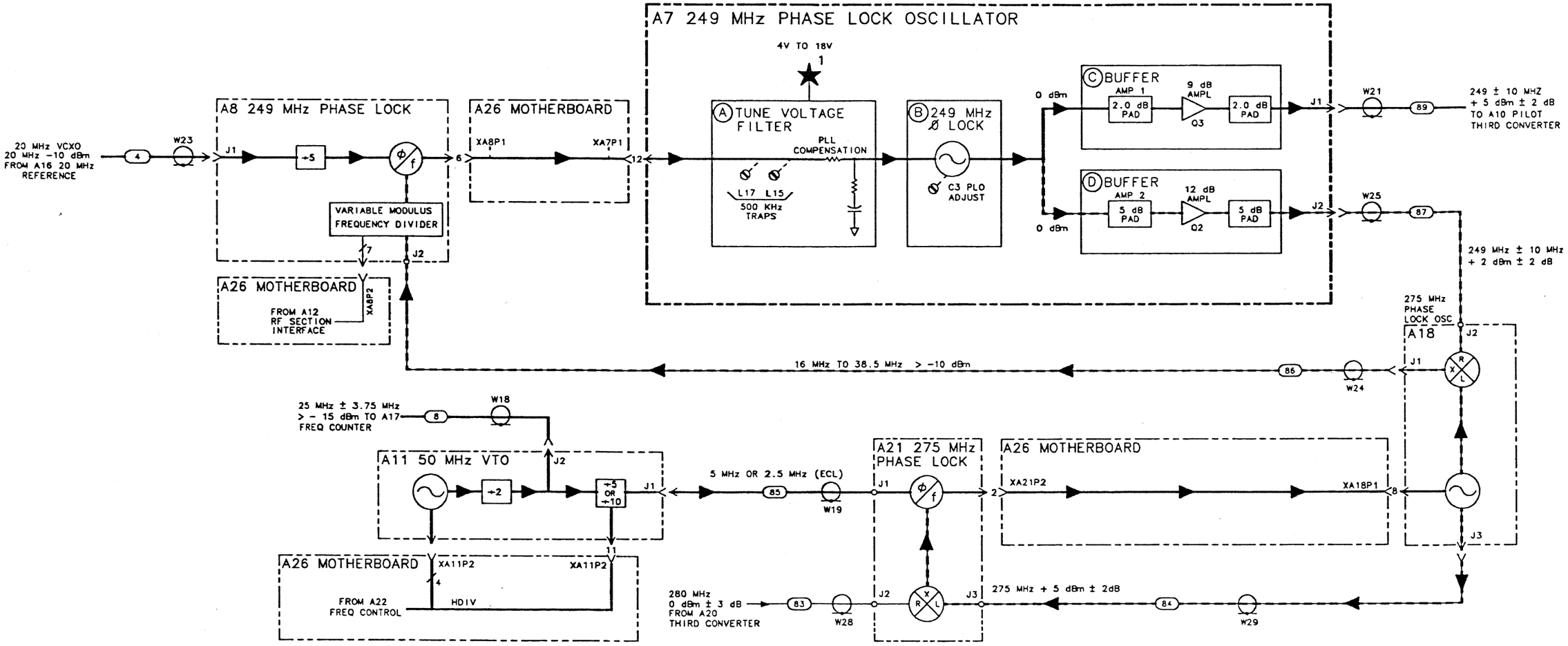
**Indicates factory-selected value*

HP Part Number 85680-60013

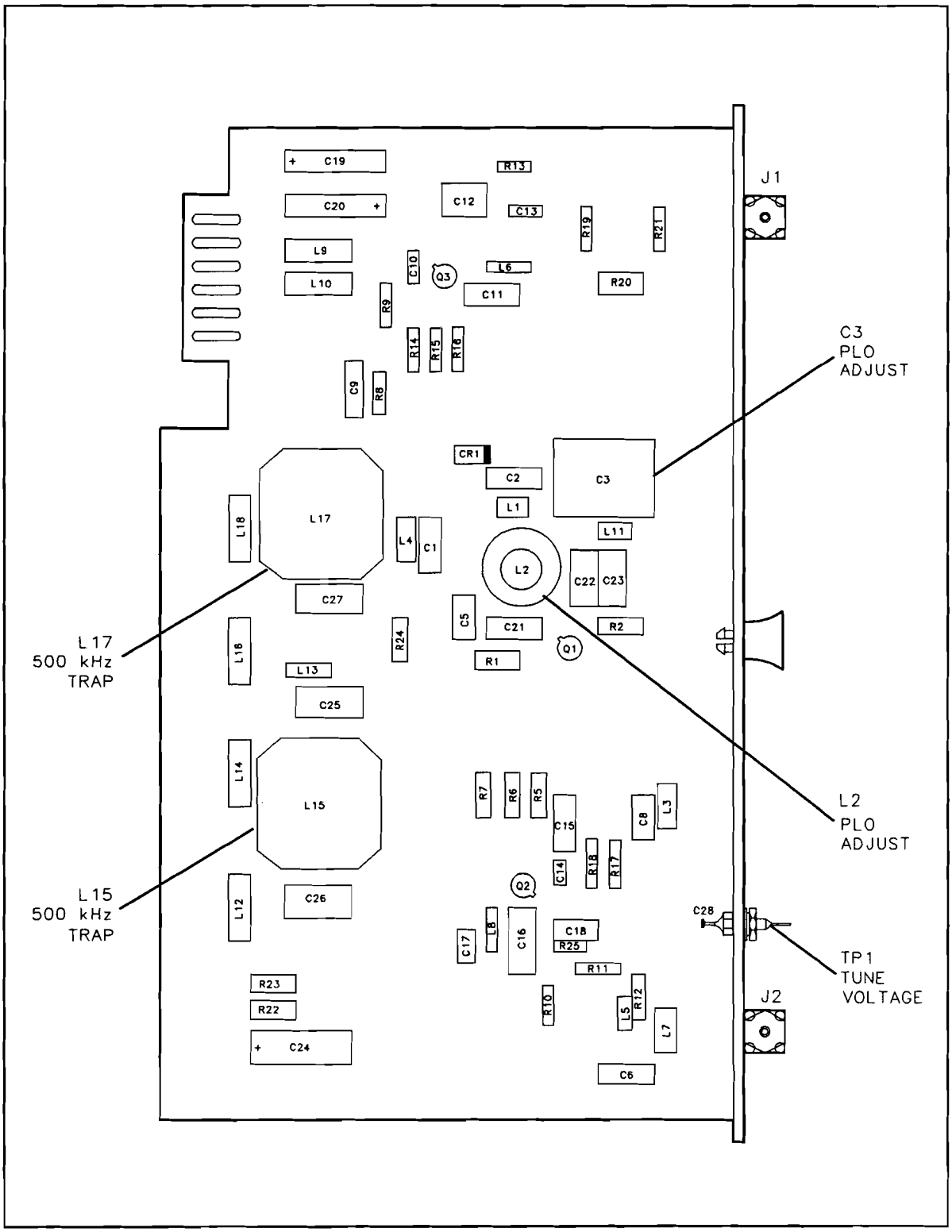
A7 249 MHz Phase Lock Oscillator

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7L7	9100-2891	4	1	INDUCTOR RF-CH-MLD 50NH +-10% .105D	24226	10M050K-1
A7L8	9100-2247	4	1	INDUCTOR RF-CH-MLD 100NH +-10% .105D	24226	10M100K
A7L9	9140-0129	1	1	INDUCTOR RF-CH-MLD 220UH +-5% .166D	99800	1537-92
A7L10	9140-0129	1	1	INDUCTOR RF-CH-MLD 220UH +-5% .166D	99800	1537-92
A7L11	9100-2251	0	1	INDUCTOR RF-CH-MLD 220NH +-10% .105D	24226	10M220K
A7L12	9100-1634	1	1	INDUCTOR RF-CH-MLD 75UH +-5% .166D	99800	1537-70
A7L13	9100-1620	5	1	INDUCTOR RF-CH-MLD 15UH +-10% .166D	99800	1537-40
A7L14	9100-1635	2	1	INDUCTOR RF-CH-MLD 91UH +-5% .166D	99800	1537-74
A7L15	85680-80007	1	1	INDUCTOR-VARIABLE 77UH	28480	85680-80007
A7L16	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH +-5% .166D	99800	1537-76
A7L17	85680-80006	0	1	INDUCTOR-VARIABLE 42UH	28480	85680-80006
A7L18	9100-1635	2	1	INDUCTOR RF-CH-MLD 91UH +-5% .166D	99800	1537-74
A7MP1				NOT ASSIGNED		
A7MP2	85680-20073	5	1	LID, 249 MHZ PLO	28480	85680-20073
A7MP3	2190-0009	4	1	WASHER-LK INTL T NO. 8 .168-IN-ID	0G791	820-BC
A7MP4	2190-0557	7	2	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A7MP5	2200-0101	0	4	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	
A7MP6	2580-0002	4	1	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	80120	
A7MP7	86701-40001	9	1	EXTRACTOR, PC	28480	86701-40001
A7MP8	2950-0078	9	2	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A7MP9	85660-20068	4	2	GROUND LUG	28480	85660-20068
A7Q1	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A7Q2	1854-0686	0	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	25403	
A7Q3	1854-0686	0	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	25403	
A7R1	0757-0424	7	1	RESISTOR 1.1K +-1% .125W TF TC=0+-100	19701	SFR25H
A7R2	0698-3447	4	1	RESISTOR 422 1% .125W TF TC=0+-100	19701	SFR25H
A7R5	0698-3439	4	1	RESISTOR 178 1% .125W TF TC=0+-100	19701	SFR25H
A7R6	0757-0180	2	1	RESISTOR 31.6 +-1% .125W TF TC=0+-100	19701	SFR25H
A7R7	0698-3439	4	1	RESISTOR 178 1% .125W TF TC=0+-100	19701	SFR25H
A7R8	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	19701	SFR25H
A7R9	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A7R10	0698-3437	2	1	RESISTOR 133 1% .125W TF TC=0+-100	19701	SFR25H
A7R11	0757-0398	2	1	RESISTOR 75 +-1% .125W TF TC=0+-100	19701	SFR25H
A7R12	0698-3437	2	1	RESISTOR 133 1% .125W TF TC=0+-100	19701	SFR25H
A7R13	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H
A7R14	0698-3447	4	1	RESISTOR 422 1% .125W TF TC=0+-100	19701	SFR25H
A7R15	0757-0378	0	1	RESISTOR 11 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A7R16	0698-3447	4	1	RESISTOR 422 1% .125W TF TC=0+-100	19701	SFR25H
A7R17	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	19701	SFR25H
A7R18	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A7R19	0698-3447	4	1	RESISTOR 422 1% .125W TF TC=0+-100	19701	SFR25H
A7R20	0757-0378	0	1	RESISTOR 11 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A7R21	0698-3447	4	1	RESISTOR 422 1% .125W TF TC=0+-100	19701	SFR25H
A7R22	0757-0394	0	1	RESISTOR 51.1 +-1% .125W TF TC=0+-100	19701	SFR25H
A7R23	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	19701	SFR25H
A7R24	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A7R25	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H

**Indicates factory-selectea value*



A7 249 MHz PHASE LOCK OSCILLATOR, BLOCK DIAGRAM

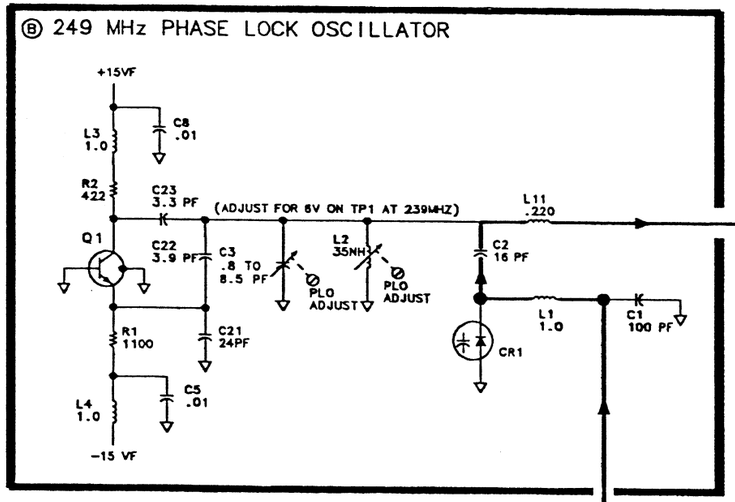


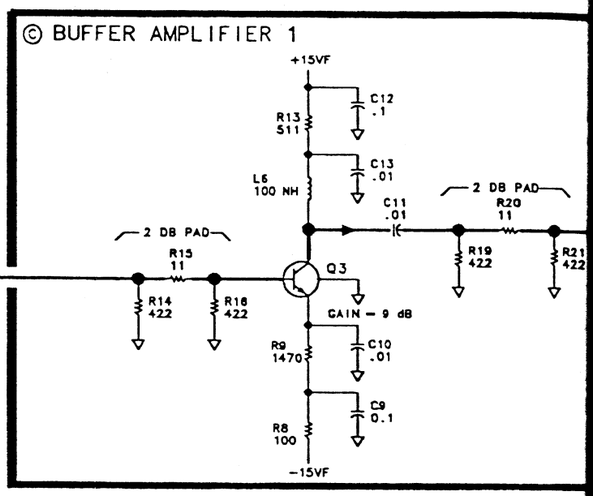
A7 249 MHz Phase Lock Oscillator Component Locations, 85680-60013

A7 249 MHz PHASE LOCK OSCILLATOR
85680-60013
(SERIAL PREFIX: 2408A)

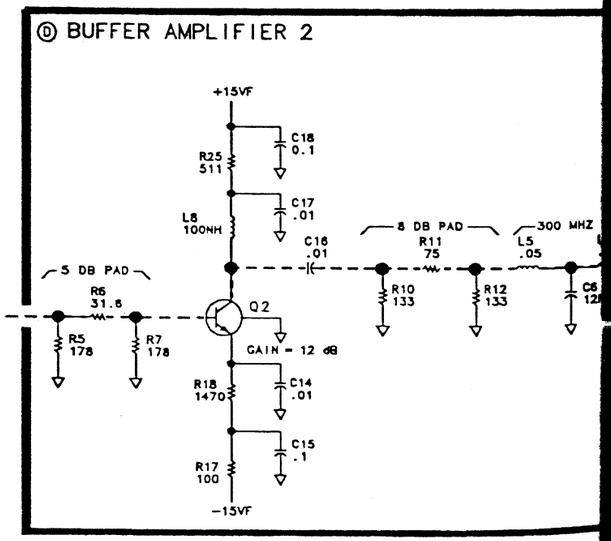
P1

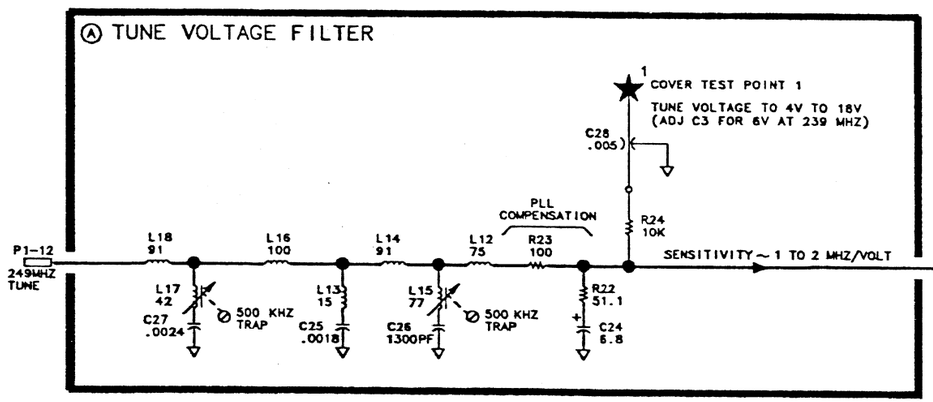
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
7	NC		
2	+15V		E
8	+15V		E
3	−15V		E
9	−15V		E
4	GND		E
10	GND		E
5	GND		E
11	GND		E
6	GND		E
12	249MHz TUNE	A8P1-6	A

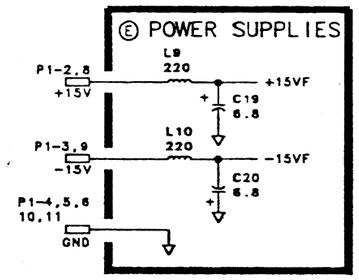




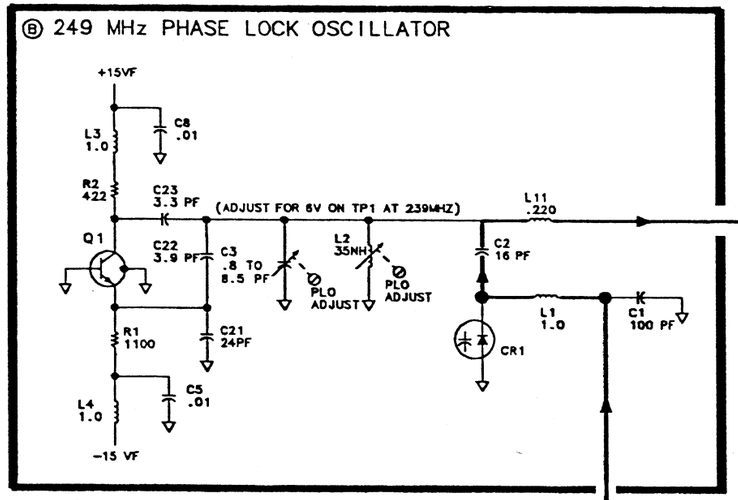
≈ 0 DBM



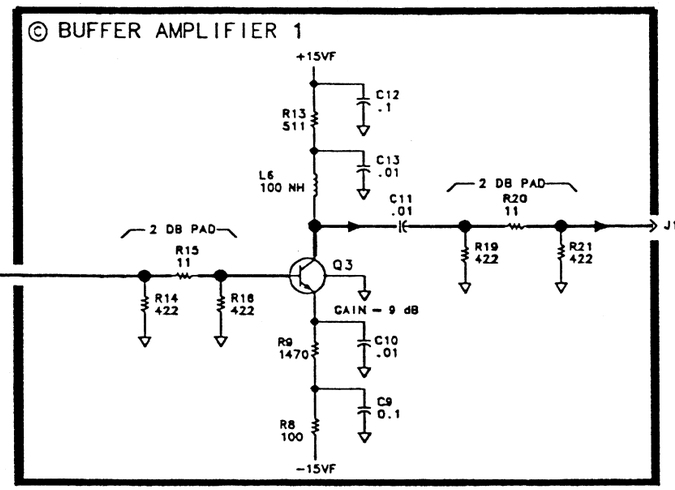


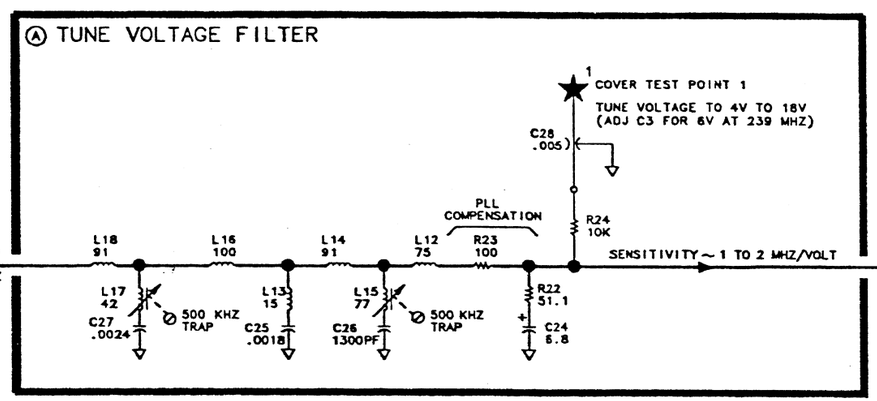


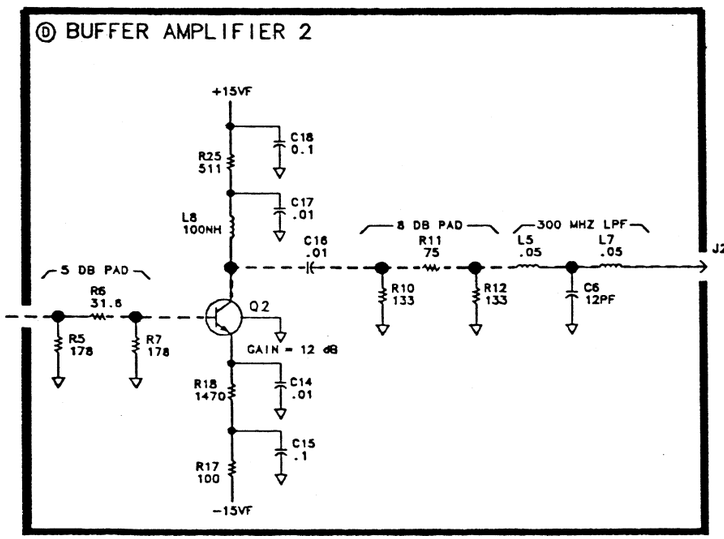
LATOR



≈ 0 DBM







NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IS IN OHMS (Ω)
   CAPACITANCE IS IN MICROFARADS (μF)
   INDUCTANCE IS IN MICROHENRIES (μH)
3. UNLESS OTHERWISE INDICATED:
   SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.

A7

A7 249 MHz PHASE LOCK OSCILLATOR, SCHEMATIC DIAGRAM

A8

249 MHz Phase Lock, Circuit Description

The frequency from A18 275 MHz Phase Lock Oscillator (16 MHz to 38.5 MHz) is divided in A8 249 MHz Phase Lock to produce one of the two frequency inputs to a Phase/Frequency Detector. The other input is a 4 MHz reference signal (20 MHz divided by 5) from A16 20 MHz Reference. If the two inputs to the Phase/Frequency Detector are out of phase, a control voltage is generated to force a change in the frequency of A7 249 MHz Phase Lock Oscillator until the inputs are in phase.

Reference ÷ 5 (B)

A 20 MHz, −10 dBm signal from A16 20 MHz Reference is amplified by Q1, Q2, and associated circuitry, and the level is shifted to ECL at the collector of Q2 (TP5). The ECL 20 MHz signal goes to the divider U4 pin 7 and is divided by 5. The ECL 4 MHz signal at U4 pin 2 is the reference (REF) signal to the Phase/Frequency Detector.

Variable Modulo Frequency Divider (A)

The Variable Modulo Frequency Divider provides a means to divide by numbers that are not integers (for example, 3.125, 5.875, and so forth). This results in a better signal-to-noise ratio in the phase-locked oscillator, since the signal-to-noise ratio is directly proportional to the divide number in phase lock circuits.

The 16—38.5 MHz, −10 dBm input to the Variable Modulo Frequency Divider is the result of mixing the signal from A7 249 MHz Phase Lock Oscillator with 275 MHz in A18 275 MHz Phase Lock Oscillator, where the lower sideband, 16—38.5 MHz, is filtered off and sent to A8. C24, C25, and L1 provide further low-pass filtering. Q3 and associated circuitry buffer the 16—38.5 MHz to ECL level on the collector of Q3 (TP6), providing clock pulses to binary counter U5 pin 13 and D flip-flop U8B pin 11.

Hex D flip-flop U15 is connected to the Instrument Bus and latches data bits 10 through 15 from A15 Controller when the LLDD line is pulled low. Data bits 13 through 15 are latched and go through the TTL to ECL Level Shift (R5 through R10 and R14 through R16) to the three low-order D inputs of U5. The high-order D input is always at ground (high). Data bits 10, 11, and 12 are latched and go to binary rate multiplier U14 inputs D_3, D_4, and D_5. D_0, D_1, and D_2 are tied to ground (low).

At the start of the count cycle, U5 is loaded from the Data Latch U15 and counts up (SEL1 low, SEL2 high). When the count reaches 1110, U13A pin 3 and U13B pin 14 (which are wired OR) go low, driving U6B, which is used as an ECL-to-TTL buffer. U6B pin 15 drives the CLK input at U14 pin 9. At count 1111, U5 pin 4 (carry out) goes low and the carry out is connected to NOR gate U10C pin 10. If U5 is allowed to continue counting, it will cause NOR gate U10D pin 12 to go low. Therefore, one of the following events will occur: (1) U5 starts at its pre-load number and counts to 1111 (U10C pin 10 goes low); or (2) U5 starts at

its pre-load number and counts one past 1111 to 0000 (U10D pin 12 goes low). U14 selects the signal (U10C pin 10 or U10D pin 12) that will be used to reset U5 and start over through U13C. U14 pin 5 will pulse n times for every 8 of its clock pulses, where $n = (D_5 \times 2^2) + (D_4 \times 2^1) + D_3$. If U14 pin 5 is high, the carry out from U5 will reset U5. If this pin is low, 0000 (carry out plus 1) will rest U5. U13C, U10C, and U10D are arranged so that the selected reset signal is at U10A pin 2. The signal goes to the D input (pin 10) of flip-flop U8 and is clocked through on the next pulse of the main clock. The divided signal out is then at U8 pin 14, and U5 is reset because SEL2 (U5 pin 7) is low.

The 16 to 38.5 MHz input from A18 275 MHz Phase Lock Oscillator is divided in the Variable Modulo Frequency Divider to provide one of the frequency inputs to the Phase/Frequency Detector. (The other input is 4 MHz from the Reference ÷ 5 circuit.) The signal is divided according to the following equation:

$$N = 9 - M + 0.125P$$

where N is the divide number, M is the number obtained by the M0, M1, and M2 outputs of U15, and P is the number obtained by the P0, P1 and P2 outputs of U15. M0 through M2 are inputs to U5, and P0 through P2 are inputs to U14. For the frequency range 16 to 38.5 MHz, M is never 6 or 7.

Table 1 gives N, M, and P for some selected frequencies:

Table 1. N, M, and P Numbers for Selected A18 275 MHz PLO Frequencies

Frequency (MHz)	N	M	P
16.0	4.000	5	0
19.5	4.875	5	7
23.0	5.750	4	6
36.0	9.000	0	0
38.5	9.625	0	5

The M and P numbers for a specific frequency of the 249 MHz Phase Lock Oscillator may be displayed on the CRT. Pres (SHIFT) (MKR --> REF LVL). The diagnostic data is displayed in the upper left-hand corner of the CRT as shown in Figure 1. A description of each number is given in Table 2.

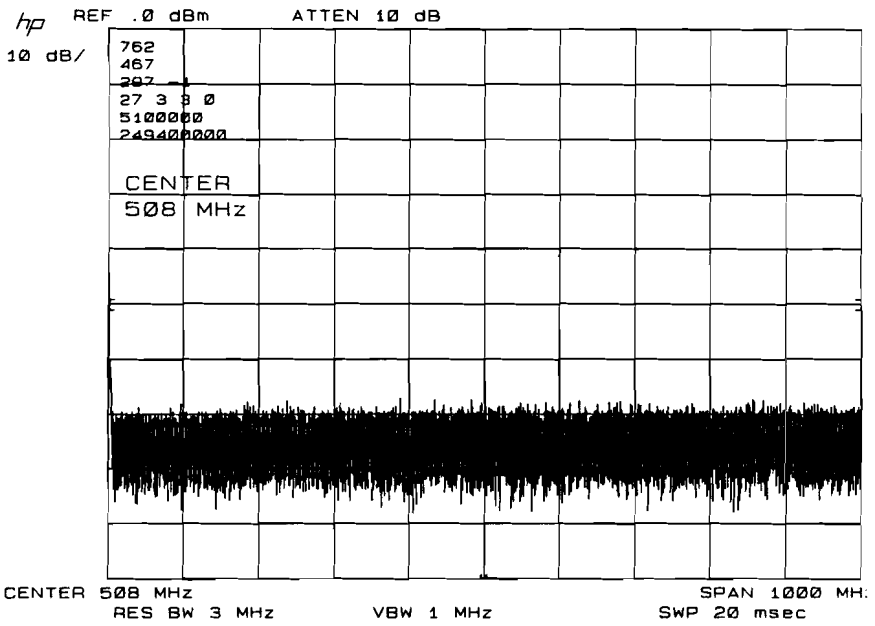


Figure 1. CRT Display Showing Location of Diagnostic Data

Table 2. Explanation of Diagnostic Numbers

Number	Description
762	LSB, 50 MHz VTO DAC
467	MSB, 50 MHz VTO DAC
297	YTO DAC
27	Harmonic, 20 MHz Reference
3	M number
3	P number
0	No Second LO shift
5100000	50 MHz VTO reference frequency (5.1 MHz)
249400000	249 MHz PLO frequency (248.9 MHz)

Phase/Frequency Detector (C)

The divided signal from the Variable Modulo Frequency Divider goes to the clock input of U3A. The divided REF signal from the Reference ÷ 5 goes to the clock input of U3B. The D inputs of the flip-flops are tied to ground through R21 and are held high. The active low (LQ) outputs of the flip flops are tied to the inputs (pins 7 and 8) of NOR gate U1A, and the resets are tied to the output, U1A pin 3. The first low-to-high transition to either the flip-flop U3A or the REF flip-flop U3B sets the active high (Q) output of that flip-flop high. The active low output remains low until the second flip-flop is set; then NOR gate U1A resets both flip-flops. Thus, the signal that leads in phase will have a pulse on the active high and active low outputs of its flip-flop, and the pulse length will be proportional to the amount of phase lead.

Lock Indicator (D)

The active low output (pin 3) of U3A and the active low output (pin 14) of U3B are inputs to NOR gate U1C. The remaining outputs (U3A pin 2 and U3B pin 15) are inputs to NOR gate U1B. When the loop is locked, the PILOT divided signal and the REF divided signal are in phase, the active high outputs of the flip-flops are in phase, and the active low outputs are in phase (but opposite in state to the active high outputs). The outputs of U1B and U1C are wired OR, so when the loop is locked, one or the other of the gates is high. When the loop is unlocked, the gates are no longer in phase, so the output goes low an average of half the time. This output goes to U6A pins 5, 6, and 7. A low on the inputs to U6A causes pin 1 to go high, and a TTL high on the base of Q5 lights LED indicator DS1 to give a 249 MHz UNLOCKED indication. A low on pins 5, 6, and 7 of U6A gives a corresponding low on output pins 2, 3, and 4, activating the positive feedback circuit R24, R23, and C9 to increase the high-to-low transition speed. When the loop is unlocked, the HUL2 signal is sent to A12 RF Section Interface.

Loop Amplifier (E)

The active high or active low outputs of U3A and U3B are summed at the bases of differential pair Q6, Q7. The amplified signals are connected to comparator U7 to produce the 249 MHz TUNE signal to A7 MHz Phase Lock Oscillator.

249 MHz Phase Lock, Troubleshooting

The 249 MHz PHase Lock assembly is used to produce steps of either 500 kHz or 4 MHz in the Center Frequency of the analyzer.

If the 249 UNLOCK message is flashing or a constant center frequency offset of a multiple of 500 kHz or 4 MHz exists, start the troubleshooting procedure with this assembly.

First, turn on the Diagnostic function by keying in KSR ([SHIFT] [MKR --> REF LVL]). The last line is the programmed frequency of the 249 MHz PLO. A Tee connector can be placed in the 249 MHz loop and the actual frequency can be counted. The second and third numbers in the fourth row are the M and P numbers used in the Variable Modulo Frequency Divider (**A**).

Verify the waveforms shown on the schematic. The following procedure simplifies troubleshooting of the Variable Modulo Frequency Divider. Jumper A15TP1-9 (ST) to A15TP1-6 (T1) and push [INSTR PRESET]. (On earlier versions of A15 Controller, jumper A15TP4 (STS) to A15TP1-4 (T1).) Remove cable 1 from A16J6 and connect cable 86 from A8J2 to A16J6. This inputs a constant 20 MHz signal to the Variable Modulo Frequency Divider.

Table 3 lists the instrument settings necessary to exercise the circuitry on this assembly. Verify that the M and P inputs are the same as those shown by KSR. The frequency readings at TP1, 2, and 4 are taken by using a 10:1 oscilloscope probe into the high impedance input of a frequency counter. A 1:1 probe causes excessive loading of the ECL circuitry. The frequency at TP4 is 20 MHz divided by N, where $N = 9 - M + .125P$. During this test, the Loop Amplifier (**E**) output, TP7, is at its extremes. It is +4 V when TP4 is less than 4 MHz, and +18 V when TP4 is greater than 4 MHz.

Table 3. M and P Numbers for Variable Modulo Frequency Divider

Center Frequency (MHz)	Frequency Span (MHz)	M	P	TP1, 2, 4 (MHz)	TP7 (V)
1.6	50	1	0	2.500	+4
5.6	50	2	0	2.857	+4
13.6	50	4	0	4.000	—
17.6	50	0	0	2.222	+4
14.1	50	5	7	4.103	+18
18.0	100 kHz	0	4	2.105	+4
19.0	100 kHz	0	2	2.162	+4
19.5	100 kHz	0	1	2.192	+4

HP Part Number 85680-60123

A8 249 MHz Phase Lock

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8	85680-60123	0	1	BOARD ASSEMBLY, 249 MHz PHASE LOCK	28480	85680-60123
A8C1	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C2	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C3	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C4	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C5	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C6	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C7	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C8	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C9	0160-0127	2	1	CAP-FXD 1uF 50 V	04222	SR835E105MAAH
A8C10	0140-0198	5	1	CAPACITOR-FXD 200PF +-5% 300VDC MICA	09023	CD15FD201J03
A8C11	0140-0198	5	1	CAPACITOR-FXD 200PF +-5% 300VDC MICA	09023	CD15FD201J03
A8C12	0140-0198	5	1	CAPACITOR-FXD 200PF +-5% 300VDC MICA	09023	CD15FD201J03
A8C13	0140-0198	5	1	CAPACITOR-FXD 200PF +-5% 300VDC MICA	09023	CD15FD201J03
A8C14	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C15	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C16	0160-2201	7	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	09023	CD15ED510J03
A8C17	0160-0161	4	1	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	84411	HEW-238M
A8C18	0180-0100	3	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2-DYS
A8C19	0180-0229	7	1	CAP-FXD 33uF 10 V TA	56289	150D336X9010B2-DYS
A8C20	0180-0229	7	1	CAP-FXD 33uF 10 V TA	56289	150D336X9010B2-DYS
A8C21	0180-0100	3	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2-DYS
A8C22	0160-2201	7	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	09023	CD15ED510J03
A8C23	0160-0161	4	1	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	84411	HEW-238M
A8C24	0160-2201	7	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	09023	CD15ED510J03
A8C25	0160-2201	7	1	CAPACITOR-FXD 51PF +-5% 300VDC MICA	09023	CD15ED510J03
A8C26	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C27	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	04222	SR201C103MAAH
A8C28	0160-5413	9	1	CAPACITOR-FXD 160PF +-5% 100VDC CER		DA12C0G2A161J
A8C29	0160-5413	9	1	CAPACITOR-FXD 160PF +-5% 100VDC CER		DA12C0G2A161J
A8C30	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A8C31	0160-5413	9	1	CAPACITOR-FXD 160PF +-5% 100VDC CER		DA12C0G2A161J
A8CR1	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A8CR2	1901-0179	7	1	DIODE-SWITCHING 15V 50MA 750PS DO-7	27014	FD777
A8CR3	1901-0179	7	1	DIODE-SWITCHING 15V 50MA 750PS DO-7	27014	FD777
A8DS1	1990-0486	6	1	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	HLMP-1301
A8J1	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A8J2	85680-60080	8	1	CABLE ASSEMBLY COAX 86 (INCLUDES W24)	28480	85680-60080
A8L1	9100-2247	4	1	INDUCTOR RF-CH-MLD 100NH +-10% .105D	24226	10M100K
A8L2	9100-2254	3	1	INDUCTOR RF-CH-MLD 390NH +-10% .105D	24226	10M390K
A8L3	9100-1618	1	1	INDUCTOR RF-CH-MLD 5.6UH +-10% .166D	99800	1537-30
A8L4	08558-80011	6	1	FILTER COIL BLUE	28480	08558-80011
A8L5	08558-80011	6	1	FILTER COIL BLUE	28480	08558-80011
A8L6	9100-1618	1	1	INDUCTOR RF-CH-MLD 5.6UH +-10% .166D	99800	1537-30
A8L7	9140-0144	0	1	INDUCTOR RF-CH-MLD 4.7UH +-10% .105D	99800	1025-36
A8L8	9100-2254	3	1	INDUCTOR RF-CH-MLD 390NH +-10% .105D	24226	10M390K
A8MP1				NOT ASSIGNED		

**Indicates factory-selected value*

HP Part Number 85680-60123

A8 249 MHz Phase Lock

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8MP2	2190-0112	0	4	WASHER-LK HLCL NO. 2 .088-IN-ID	77339	
A8MP3	0520-0129	8	4	SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	77250	
A8MP4	0590-0533	5	4	THREADED INSERT-NUT 2-56 .06-IN-LG SST	46384	KFS2-256
A8MP5	1205-0285	0	2	HEAT SINK SGL DIP	13103	6007A-TOP
A8MP7	2190-0557	7	2	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A8MP8	2200-0101	0	5	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	
A8MP9	2200-0105	4	2	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	77250	
A8MP10	2950-0078	9	2	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A8MP11	6040-0454	0	1	HEAT SINK COMPOUND SYNTH/REFRC	92895	52022IJ
A8MP12	85680-00027	7	2	HEAT SINK, IC	28480	85680-00027
A8MP13	85680-20074	6	1	LID, 249 MHz PHASE LOCK	28480	85680-20074
A8MP14	86701-40001	9	1	EXTRACTOR, PC	28480	86701-40001
A8Q1	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A8Q2	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A8Q3	1853-0018	0	1	TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	04713	
A8Q5	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A8Q6	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	25403	
A8Q7	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	25403	
A8R1	0698-3447	4	1	RESISTOR 422 1% .125W TF TC=0+-100	19701	SFR25H
A8R2	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H
A8R3	0757-0428	1	1	RESISTOR 1.62K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R4	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R5	0757-0288	1	1	RESISTOR 9.09K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R6	0757-0288	1	1	RESISTOR 9.09K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R7	0757-0288	1	1	RESISTOR 9.09K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R8	0757-0289	2	1	RESISTOR 13.3K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R9	0757-0289	2	1	RESISTOR 13.3K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R10	0757-0289	2	1	RESISTOR 13.3K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R11	0698-3437	2	1	RESISTOR 133 1% .125W TF TC=0+-100	19701	SFR25H
A8R12	0757-0399	5	1	RESISTOR 82.5 +-1% .125W TF TC=0+-100	19701	SFR25H
A8R13	0698-3443	0	1	RESISTOR 287 1% .125W TF TC=0+-100	19701	SFR25H
A8R14	0757-0418	9	1	RESISTOR 619 +-1% .125W TF TC=0+-100	19701	SFR25H
A8R15	0757-0418	9	1	RESISTOR 619 +-1% .125W TF TC=0+-100	19701	SFR25H
A8R16	0757-0422	5	1	RESISTOR 909 +-1% .125W TF TC=0+-100	19701	SFR25H
A8R17	0698-3444	1	1	RESISTOR 316 1% .125W TF TC=0+-100	19701	SFR25H
A8R18	0698-3437	2	1	RESISTOR 133 1% .125W TF TC=0+-100	19701	SFR25H
A8R19	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A8R20	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R21	0757-0438	3	1	RESISTOR 5.11K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R22	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	19701	SFR25H
A8R23	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R24	0698-3444	1	1	RESISTOR 316 1% .125W TF TC=0+-100	19701	SFR25H
A8R25	0698-3443	0	1	RESISTOR 287 1% .125W TF TC=0+-100	19701	SFR25H
A8R26	0757-0274	5	1	RESISTOR 1.21K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R27	0698-3437	2	1	RESISTOR 133 1% .125W TF TC=0+-100	19701	SFR25H
A8R28	0757-0399	5	1	RESISTOR 82.5 +-1% .125W TF TC=0+-100	19701	SFR25H
A8R29	0698-3443	0	1	RESISTOR 287 1% .125W TF TC=0+-100	19701	SFR25H
A8R30	0757-0276	7	1	RESISTOR 61.9 +-1% .125W TF TC=0+-100	19701	SFR25H

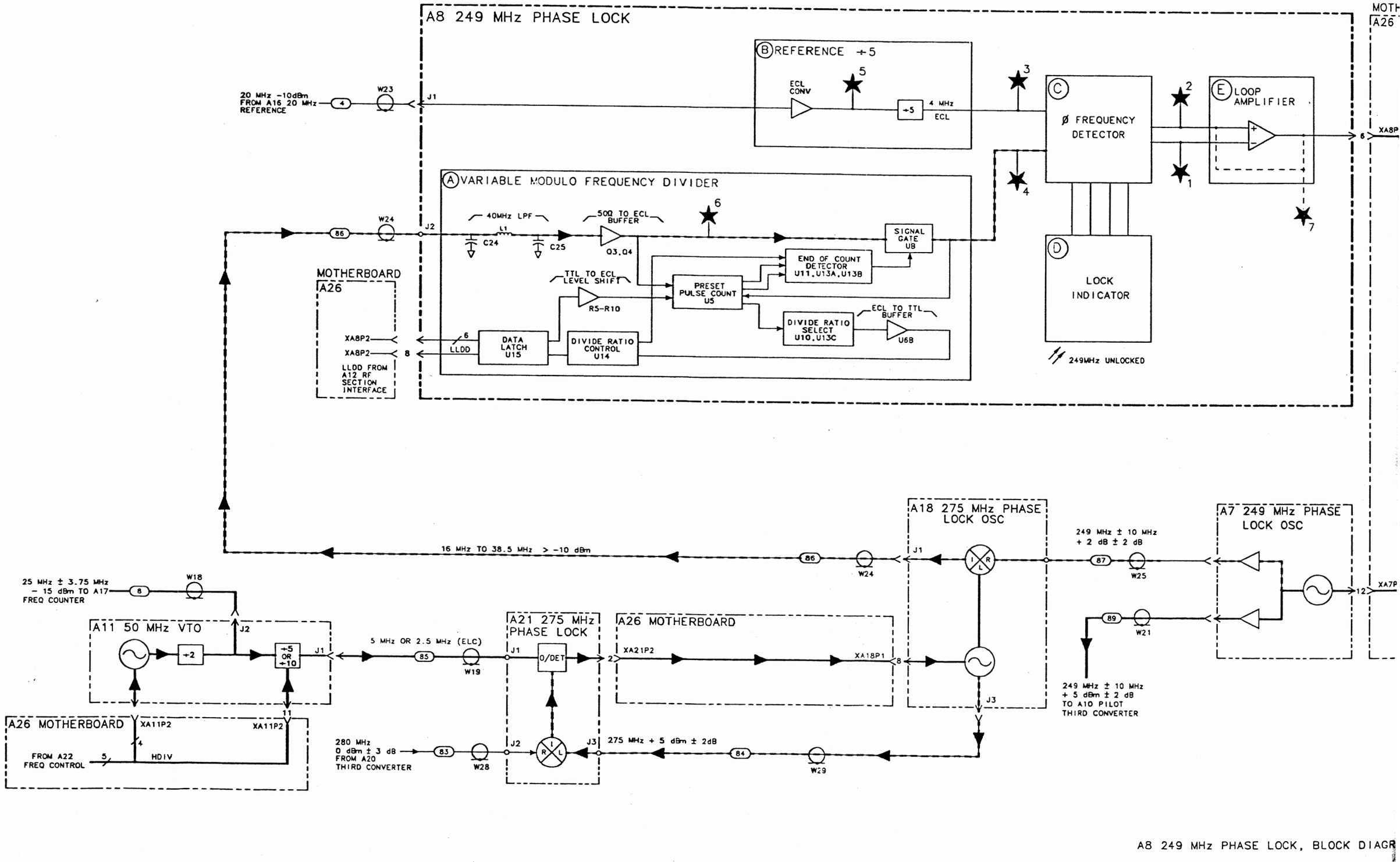
**Indicates factory-selected value*

HP Part Number 85680-60123

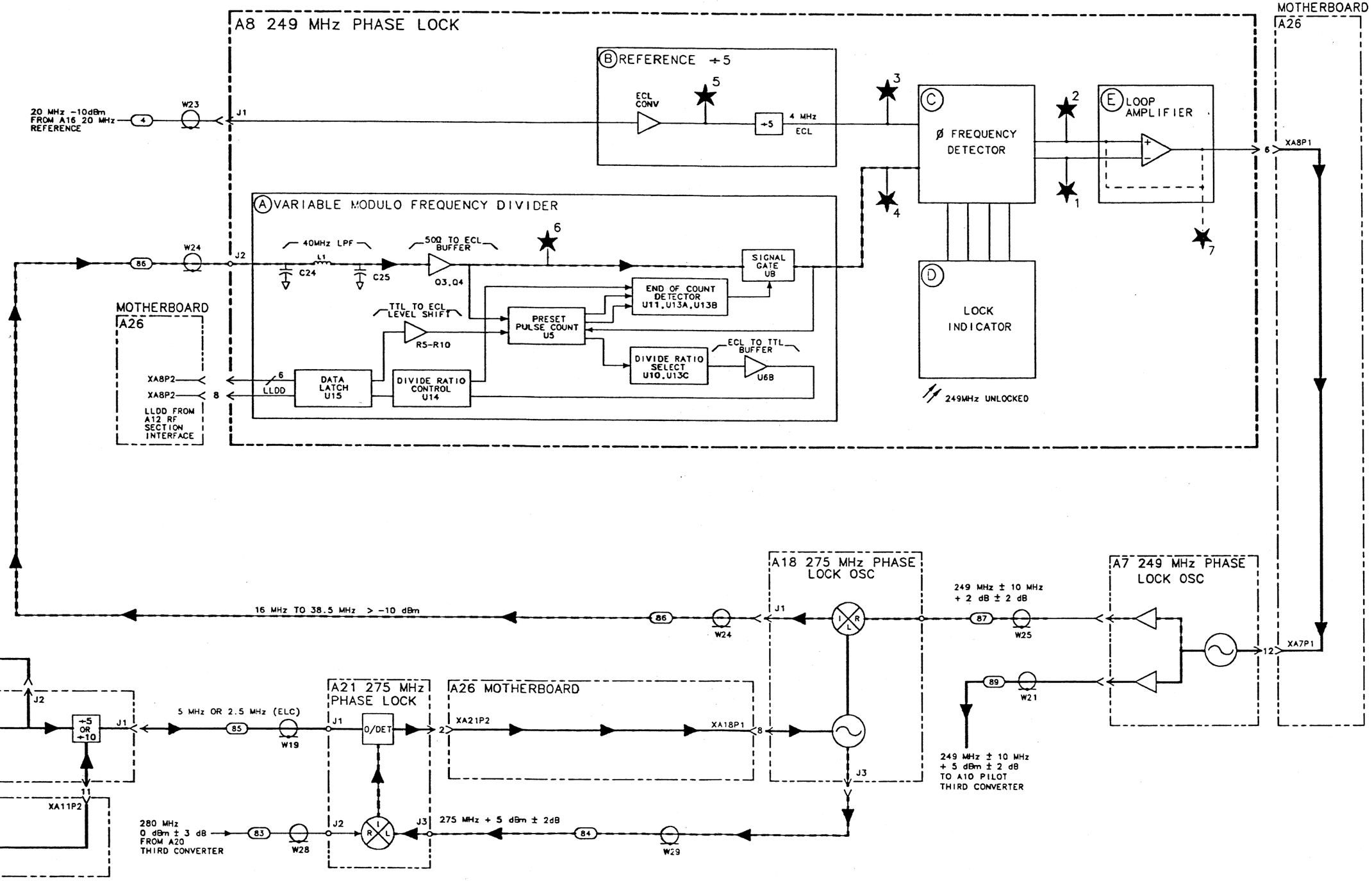
A8 249 MHz Phase Lock

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8R31	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R32	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R33	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R34	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R35	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R36	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R37	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R38	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R39	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R40	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A8R41	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	19701	SFR25H
A8R42	0698-3156	2	1	RESISTOR 14.7K 1% .125W TF TC=0+-100	19701	SFR25H
A8R43	0698-3154	0	1	RESISTOR 4.22K 1% .125W TF TC=0+-100	19701	SFR25H
A8R44	0698-3154	0	1	RESISTOR 4.22K 1% .125W TF TC=0+-100	19701	SFR25H
A8R45	0698-3438	3	1	RESISTOR 147 1% .125W TF TC=0+-100	19701	SFR25H
A8R48	0698-7205	0	1	RESISTOR 51.1 +-1% .05W TF TC=0+-100	19701	5063J
A8R49	0698-7205	0	1	RESISTOR 51.1 +-1% .05W TF TC=0+-100	19701	5063J
A8TP1	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A8TP2	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A8TP3	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A8TP4	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A8TP5	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A8TP6	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A8TP7	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A8U1	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A8U2	1810-0204	6	1	NETWORK-RES 8-SIP 1.0K OHM X 7	11236	750-81
A8U3	1820-0817	8	1	IC FF ECL D-M/S DUAL	04713	MC10131P
A8U4	1820-1383	5	1	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A8U5	1820-0821	4	1	IC CNTR ECL BIN UP/DOWN SYNCHRO POS-EDGE	04713	MC10136L
A8U6	1820-0807	6	1	IC GATE ECL OR DUAL 3-INP	04713	MC10110P
A8U7	1826-1007	2	1	IC OP AMP PRCN 8-TO-99 PKG	06665	OP-27GJ
A8U8	1820-0817	8	1	IC FF ECL D-M/S DUAL	04713	MC10131P
A8U9	1810-0204	6	1	NETWORK-RES 8-SIP 1.0K OHM X 7	11236	750-81
A8U10	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A8U11	1820-0801	0	1	IC GATE ECL OR-NOR QUAD 2-INP	04713	MC10101P
A8U12	1810-0204	6	1	NETWORK-RES 8-SIP 1.0K OHM X 7	11236	750-81
A8U13	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A8U14	1820-0744	0	1	IC CNTR TTL BIN SYNCHRO POS-EDGE-TRIG 6-	01295	SN7497N
A8U15	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N
A8W24				REFER TO A8J2		

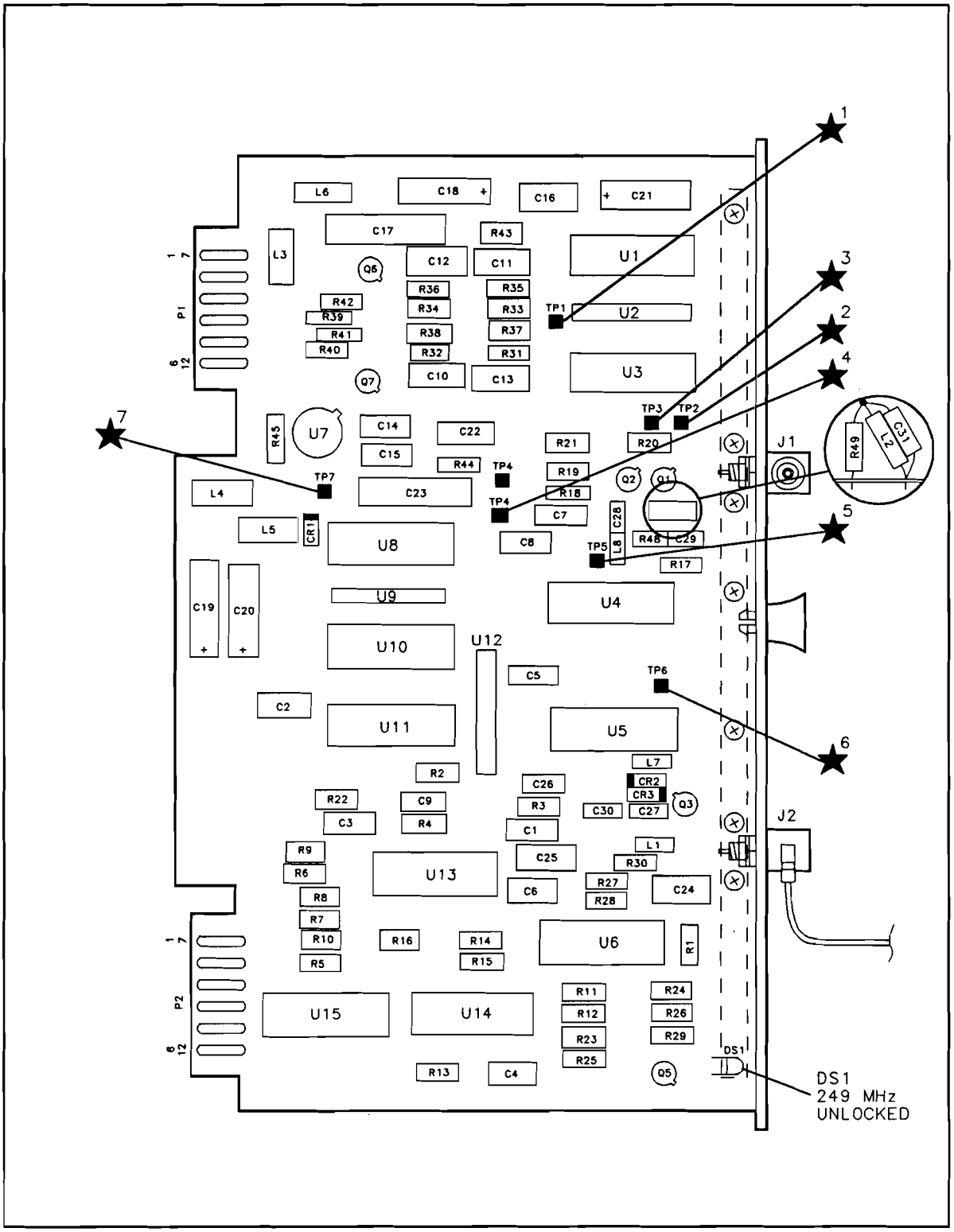
Indicates factory-selected value



A8 249 MHz PHASE LOCK, BLOCK DIAGR



A8 249 MHz PHASE LOCK, BLOCK DIAGRAM



A8 249 MHz Phase Lock Component Locations, 85680-60123

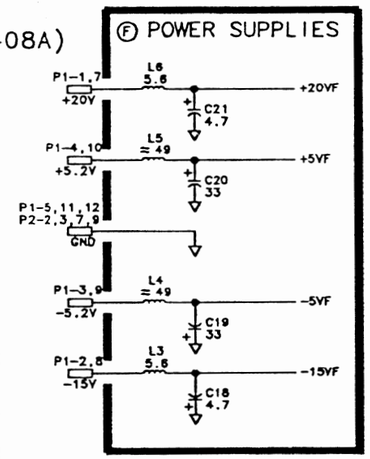
A8 249 MHZ PHASE LOCK
85680-60123
(SERIAL PREFIX: 2408A)

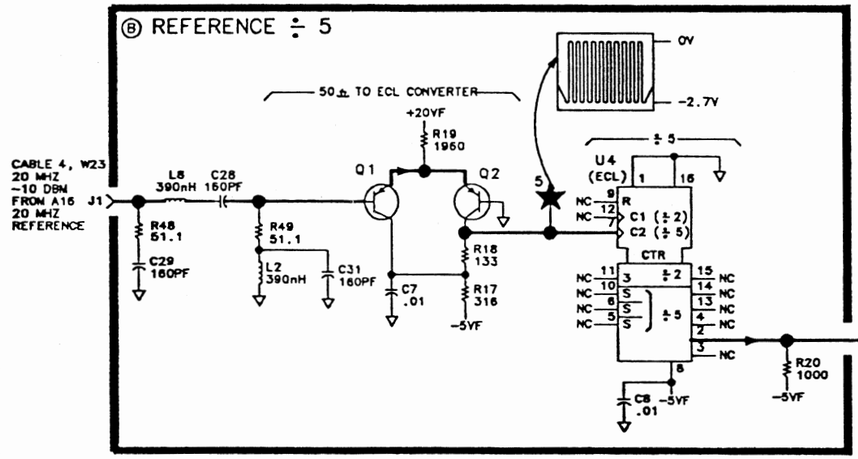
P1

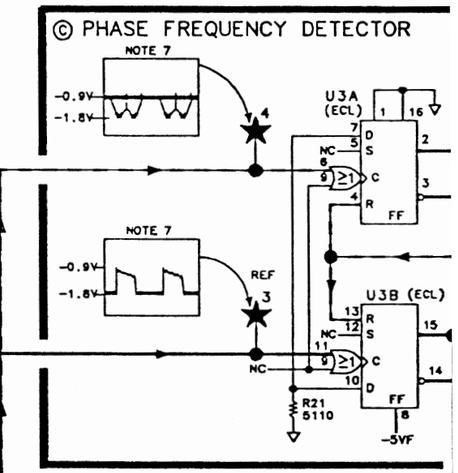
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+20V		F
7	+20V		F
2	-15V		F
8	-15V		F
3	-5.2V		F
9	-5.2V		F
4	+5.2V		F
10	+5.2V		F
5	GND		F
11	GND		F
6	249 MHZ TUNE	A7P1-12	E
12	GND		F

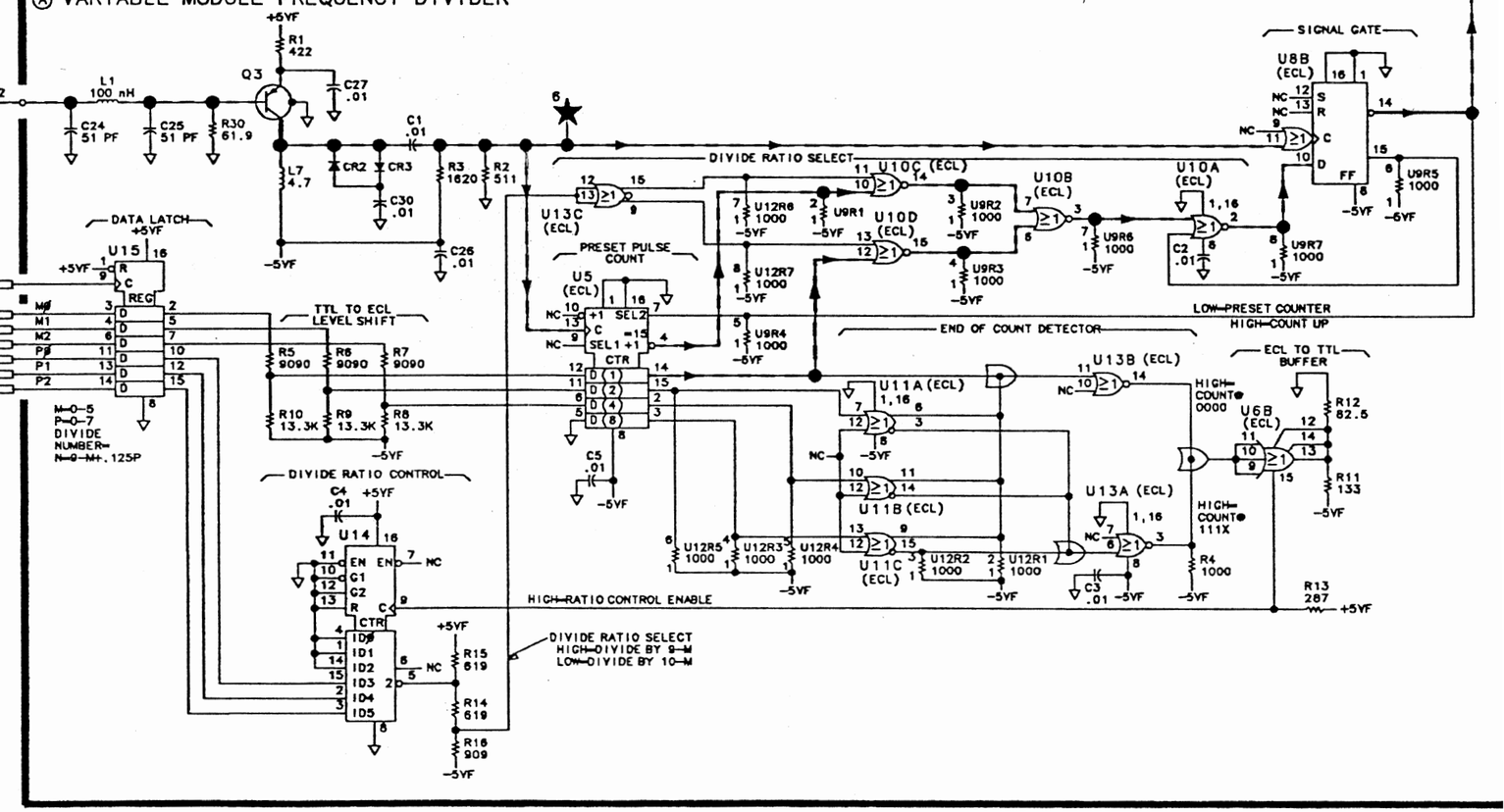
P2

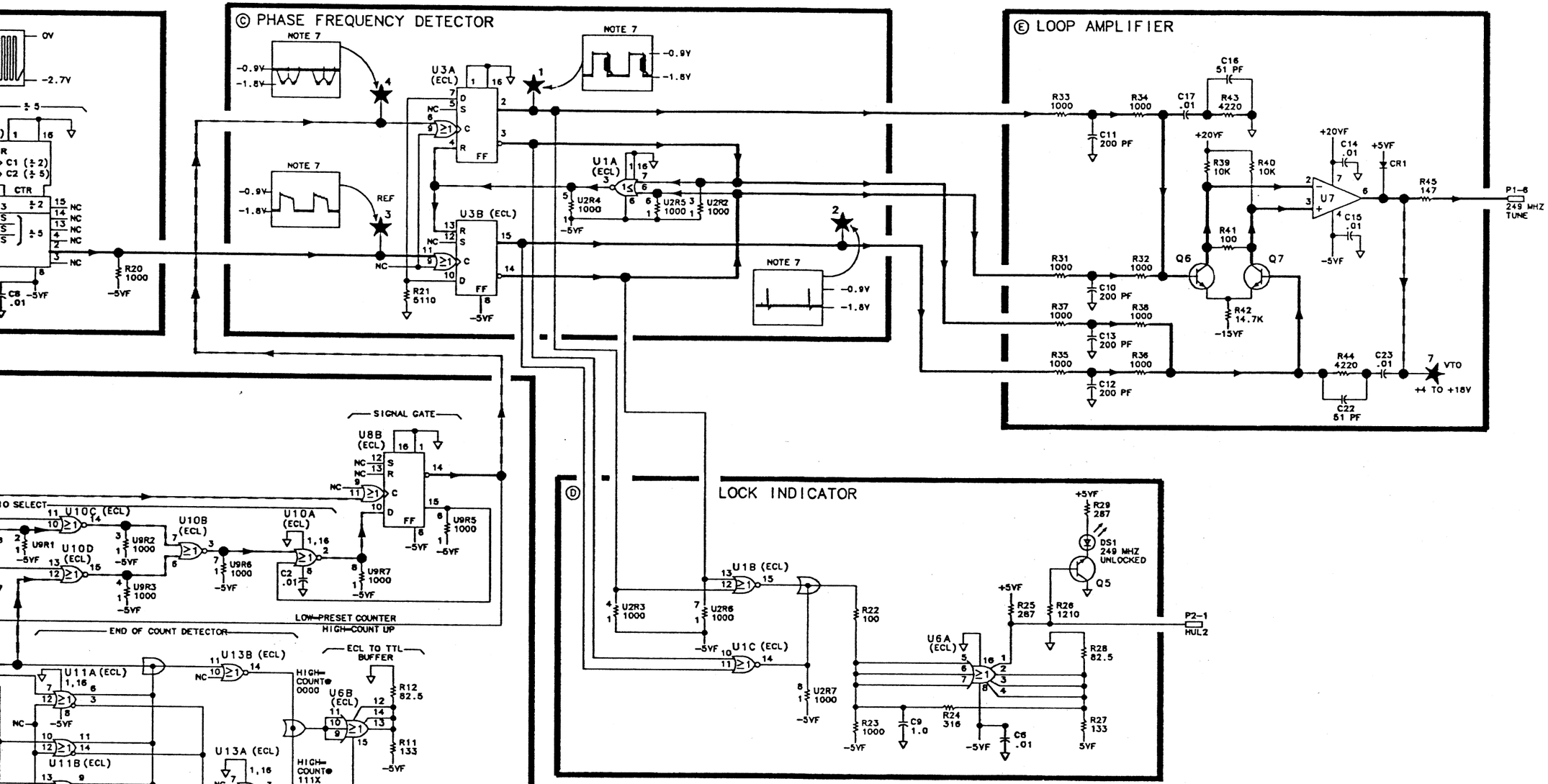
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	HUL2	A12P2-6	D
7	GND		F
2	GND		F
8	LLDD	A12P2-5	A
3	GND		F
9	GND		F
4	10815	A15P2-30	A
10	10814	A15P2-12	A
5	10813	A15P2-29	A
11	10812	A15P2-11	A
6	10811	A15P2-28	A
12	10810	A15P2-10	A





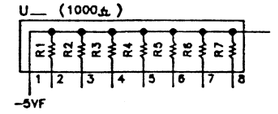






NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN MICROFARADS(μF) INDUCTANCE IS IN MICROHENRIES(μH)
3. UNLESS OTHERWISE INDICATED: SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.
4. ECL LOGIC LEVELS ARE TYPICALLY: -0.8V=LOGIC 1 -1.8V=LOGIC 0
5. U2, U9, AND U12 ARE 1000Ω 8-PIN RESISTOR NETWORKS:



6. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
LLDD	LOW-LOAD 249 DIVIDER NUMBERS
1081β-15	INSTRUMENT BUS DATA, BITS 10 THRU 15 (HIGH-TRUE)
HUL2	HIGH-249 MHZ LOOP UNLOCKED

7. CONTROL SETTINGS FOR WAVEFORMS:
   8568:
   INSTRUMENT PRESET
   OSCILLOSCOPE:
   0.1 μS/DIV
8. U1D, U2R1, U8A, U11D, AND U13D ARE NOT USED.

A8

A8 249 MHZ PHASE LOCK, SCHEMATIC DIAGRAM

A9 and A10

A9 Pilot Second IF Amplifier, Circuit Description

A9 Pilot Second IF Amplifier contains a Low-Pass Filter, a common-emitter Amplifier, and a 269 MHz Bandpass Filter. The Low-Pass Filter has a cutoff of approximately 500 MHz and gives less than 1 dB loss at 269 MHz. The amplifier has a gain of 19 dB and the Bandpass Filter has an insertion loss of 5 dB, giving the assembly an overall gain of 14 dB.

Amplifier (B)

The common-emitter amplifier consists of Q1 as the amplifier and Q2 for active bias. Capacitors C6, C8, C13 and C14 serve as high frequency bypass elements. Inductor L3 and capacitor C7 transform the output impedance of Q1 to 50Ω, which couples into the 269 MHz Bandpass Filter through the tapped inductor L4.

269 MHz Bandpass Filter (A)

The 269 MHz Bandpass Filter has a 3 dB bandwidth of approximately 23 MHz. The filter is made of L4, C9, L5, C10, L6, C11, L7, C12, and coupling capacitors made of traces on the printed circuit board. The shielding strips between the resonators serve to reduce inductive coupling from one section to another. The tapped inductors L4 and L7 transform the impedance to 50Ω for the filter.

A10 Pilot Third Converter, Circuit Description

A10 Pilot Third Converter consists of a Balanced Mixer, two transistor amplifiers, and a Low-Pass Filter. The signal from A7 249 MHz Phase Lock Oscillator is mixed with the signal from A9 Pilot Second IF Amplifier to produce the 20 MHz signal to the A6 YIG-Tuned Oscillator Phase Lock. The Balanced Mixer has a conversion loss of 8 dB and the gain of the two-stage amplifier is 30 dB, which yields an overall gain of 22 dB.

Balanced Mixer (C)

The 249 MHz signal from A7 is applied to the LO port of the Balanced Mixer at a level of approximately +5 dBm. The level of the 269 MHz signal from A9 is between −42 dBm and −32 dBm. The output from the Balanced Mixer is the difference frequency, 20 MHz. The Balanced Mixer has a conversion loss of approximately 8 dB.

Amplifier +30 dB Gain (B)

The 20 MHz amplifier consists of transistors Q1 and Q2 as cascaded, common-emitter amplifiers. The first stage has a voltage gain of about 8, which is determined by R4, L3, and Q1. Capacitors C2 and C3 are bypass elements. The second stage has a voltage gain of approximately 4, which is determined by R9, R10, and Q2. Capacitors C5 and C7 are bypass elements.

Low-Pass Filter (A)

C8, L1, C9, L2, and C10 form the output Low-Pass filter. The filter has a cutoff frequency of approximately 55 MHz and less than 1 dB loss at 30 MHz. The filter attenuates the 269 MHz Second IF signal and the 249 MHz LO signal from the desired 20 MHz signal being sent to A6.

HP Part Number 85680-60140

A9 Pilot Second IF Amplifier

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9	85680-60140	1	1	BOARD ASSEMBLY-PILOT SECOND IF AMPLIFIER (SERIAL PREFIXES: 2408A-2541A)	28480	85680-60140
A9C1	0160-3873	1	1	CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER 0+		FD12C0G2D4R7D
A9C2	0160-3874	2	1	CAPACITOR-FXD 10PF +-.5PF 200VDC CER 0+-		FD12C0G2D100D
A9C3	0160-3873	1	1	CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER 0+		FD12C0G2D4R7D
A9C4	0160-3873	1	1	CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER 0+		FD12C0G2D4R7D
A9C5	0160-3466	8	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER		838-546 X5E 101K
A9C6	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A9C7	0160-2261	9	1	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	52763	2RDPLX05015RNP0
A9C8	0160-3466	8	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER		838-546 X5E 101K
A9C9	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V PC-MT	74970	187-0306-125
A9C10	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V PC-MT	74970	187-0306-125
A9C11	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V PC-MT	74970	187-0306-125
A9C12	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V PC-MT	74970	187-0306-125
A9C13	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A9C14	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER		808-542 X5E 102K
A9J1	1250-0690	6	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A9J2	1250-0690	6	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	28480	1250-0690
A9L1	85680-80009	3	1	INDUCTOR-35NH	28480	85680-80009
A9L2	85680-80009	3	1	INDUCTOR-35NH	28480	85680-80009
A9L3	9100-2891	4	1	INDUCTOR RF-CH-MLD 50NH +-10% .105D-INX.	24226	10M050K-1
A9L4	85680-80015	1	1	TRANSFORMER	28480	85680-80015
A9L5	85680-80008	2	1	INDUCTOR-50NH	28480	85680-80008
A9L6	85680-80008	2	1	INDUCTOR-50NH	28480	85680-80008
A9L7	85680-80015	1	1	TRANSFORMER	28480	85680-80015
A9L8	9100-2247	4	1	INDUCTOR RF-CH-MLD 100NH +-10% .105D-INX	24226	10M100K
A9MP1				NOT ASSIGNED		
A9MP2	85680-00038	0	4	STRIP SHIELDING	28480	85680-00038
A9MP3	2950-0078	9	2	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A9MP4	2200-0101	0	3	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	
A9MP5	2190-0557	7	2	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A9MP6	85680-20069	9	1	LID-PILOT 2ND IF AMPLIFIER	28480	85680-20069
A9Q1	1854-0686	0	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	25403	
A9Q2	1853-0451	5	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	04713	
A9R1	0757-0200	7	1	RESISTOR 5.62K +-1% .125W TF TC=0+-100	19701	SFR25H
A9R2	0757-0288	1	1	RESISTOR 9.09K +-1% .125W TF TC=0+-100	19701	SFR25H
A9R3	0757-0200	7	1	RESISTOR 5.62K +-1% .125W TF TC=0+-100	19701	SFR25H
A9R4	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H

**Indicates factory-selected value*

HP Part Number 85680-60210

A9 Pilot Second IF Amplifier

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9	85680-60210	6	1	BOARD ASSEMBLY-PILOT SECOND IF AMPLIFIER (SERIAL PREFIX: 2601A)	28480	85680-60210
A9C1	0160-3873	1	1	CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER 0+		FD12C0G2D4R7D
A9C2	0160-3874	2	1	CAPACITOR-FXD 10PF +-.5PF 200VDC CER 0+-		FD12C0G2D100D
A9C3	0160-3873	1	1	CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER 0+		FD12C0G2D4R7D
A9C4	0160-3873	1	1	CAPACITOR-FXD 4.7PF +-.5PF 200VDC CER 0+		FD12C0G2D4R7D
A9C5	0160-3466	8	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER		838-546 X5E 101K
A9C6	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A9C7	0160-2261	9	1	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	52763	2RDPLX05015RNP0
A9C8	0160-3466	8	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER		838-546 X5E 101K
A9C9	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V PC-MT	74970	187-0306-125
A9C10	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V PC-MT	74970	187-0306-125
A9C11	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V PC-MT	74970	187-0306-125
A9C12	0121-0493	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V PC-MT	74970	187-0306-125
A9C13	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A9C14	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER		808-542 X5E 102K
A9J1	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A9J2	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A9L1	85680-80009	3	1	INDUCTOR-35NH	28480	85680-80009
A9L2	85680-80009	3	1	INDUCTOR-35NH	28480	85680-80009
A9L3	9100-2891	4	1	INDUCTOR RF-CH-MLD 50NH +-10% .105D-INX.	24226	10M050K-1
A9L4	85680-80015	1	1	TRANSFORMER	28480	85680-80015
A9L5	85680-80008	2	1	INDUCTOR-50NH	28480	85680-80008
A9L6	85680-80008	2	1	INDUCTOR-50NH	28480	85680-80008
A9L7	85680-80015	1	1	TRANSFORMER	28480	85680-80015
A9L8	9100-2247	4	1	INDUCTOR RF-CH-MLD 100NH +-10% .105D-INX	24226	10M100K
A9MP1				NOT ASSIGNED		
A9MP2	85680-00038	0	3	STRIP SHIELDING	28480	85680-00038
A9MP3	2950-0078	9	2	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A9MP4	2200-0101	0	3	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	
A9MP5	2190-0557	7	2	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A9MP6	85680-20069	9	1	LID-PILOT 2ND IF AMPLIFIER	28480	85680-20069
A9MP7	7100-1304	0	1	CAN-RECT .421-IN-DP-OUT .368-IN-WD-OUT	02875	HU-5069-.421-BR
A9MP8	8160-0387	4	1	RFI STRIP-FINGERS BE-CU SN-PL .5-IN-WD	30817	786-D-0092
A9MP9	8160-0387	4	1	RFI STRIP-FINGERS BE-CU SN-PL .5-IN-WD	30817	786-D-0092
A9Q1	1854-0686	0	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	25403	
A9Q2	1853-0451	5	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	04713	
A9R1	0757-0200	7	1	RESISTOR 5.62K +-1% .125W TF TC=0+-100	19701	SFR25H
A9R2	0757-0288	1	1	RESISTOR 9.09K +-1% .125W TF TC=0+-100	19701	SFR25H
A9R3	0757-0200	7	1	RESISTOR 5.62K +-1% .125W TF TC=0+-100	19701	SFR25H
A9R4	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H

**Indicates factory-selected value*

HP Part Number 85680-60010

A10 Pilot Third Converter

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A10	85680-60010	4	1	BOARD ASSEMBLY PILOT THIRD CONVERTER (SERIAL PREFIXES: 2408A-2541A)	28480	85680-60010
A10C1	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER		808-542 X5E 102K
A10C2	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C3	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C4	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C5	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C6	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER		808-542 X5E 102K
A10C7	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C8	0140-0190	7	1	CAPACITOR-FXD 39PF +-5% 300VDC MICA	09023	CD15ED390J03
A10C9	0140-0195	2	1	CAPACITOR-FXD 130PF +-5% 300VDC MICA	09023	CD15FD131J03
A10C11	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C12	0180-0197	8	1	CAPACITOR-FXD 2.2UF 20V TA	56289	150D225X9020A2
A10J1	85680-60075	1	1	CABLE ASSEMBLY COAX 81 (INCLUDES W20)	28480	85680-60075
A10J2	85680-60082	0	1	CABLE ASSEMBLY COAX 89 (INCLUDES W21)	28480	85680-60082
A10J3	1250-0690	6	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	51-047-4610
A10L1	9100-2252	1	1	INDUCTOR RF-CH-MLD 270NH +-10% .105D	24226	10M270K
A10L2	9100-2252	1	1	INDUCTOR RF-CH-MLD 270NH +-10% .105D	24226	10M270K
A10L3	9100-2250	9	1	INDUCTOR RF-CH-MLD 180NH +-10%	28480	9100-2250
A10L4	9140-0179	1	1	INDUCTOR-22UH +-10%	28480	9140-0179
A10MP2	85680-20070	2	1	LID-PILOT 3RD CONVERTER	28480	85680-20070
A10MP3	2950-0078	9	3	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A10MP4	2200-0101	0	4	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	
A10MP5	2190-0557	7	3	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A10Q1	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	04713	
A10Q2	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A10R1	0757-0416	7	1	RESISTOR 511 +-1% .125W	24546	C4-1/8-TO-511R-F
A10R2	0757-0280	3	1	RESISTOR 1K +-1% .125W	24546	C4-1/8-TO-1001-F
A10R3	0698-3439	4	1	RESISTOR 178 +-1% .125W	24546	C4-1/8-TO-178R-F
A10R4	0757-0346	2	1	RESISTOR 10 +-1% .125W	24546	C4-1/8-TO-10R0-F
A10R5	0698-3438	3	1	RESISTOR 147 +-1% .125W	24546	C4-1/8-TO-147R-F
A10R6	0757-0280	3	1	RESISTOR 1K +-1% .125W	24546	C4-1/8-TO-1001-F
A10R7	0757-0280	3	1	RESISTOR 1K +-1% .125W	24546	C4-1/8-TO-1001-F
A10R8	0757-0416	7	1	RESISTOR 511 +-1% .125W	24546	C4-1/8-TO-511R-F
A10R9*	0757-0346	2	1	RESISTOR 10 +-1% .125W	24546	C4-1/8-TO-10R0-F
A10R10	0757-3494	0	1	RESISTOR 51.1 +-1% .125W	24546	C4-1/8-TO-51R1-F
A10U1	0955-0063	0	1	U-WAVE MIXER 500 MHZ MAX	15542	SRA-1-32

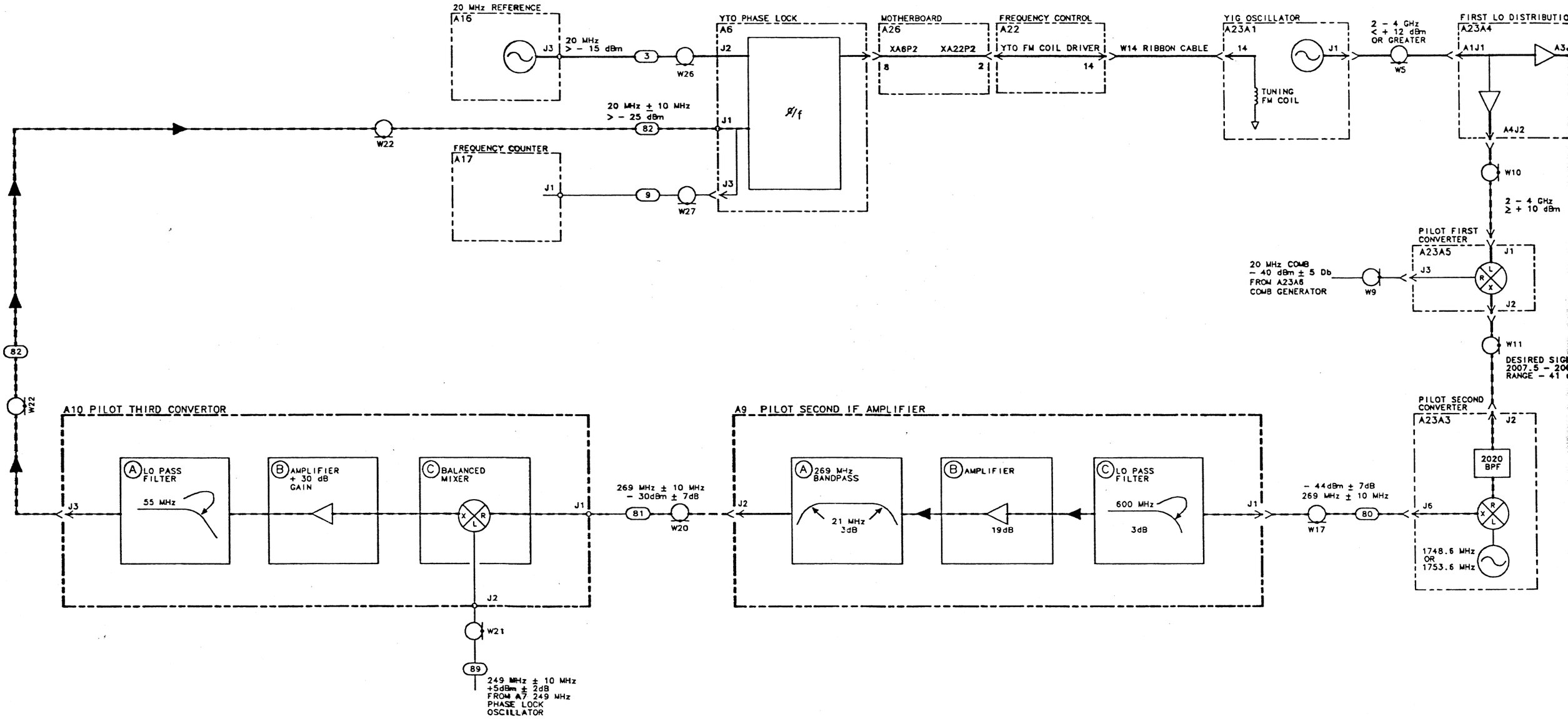
**Indicates factory-selected value*

HP Part Number 85680-60211

A10 Pilot Third Converter

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A10	85680-60211	7	1	BOARD ASSEMBLY, PILOT THIRD CONVERTER (SERIAL PREFIX: 2601A)	28480	85680-60211
A10C1	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER		808-542 X5E 102K
A10C2	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C3	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C4	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C5	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C6	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER		808-542 X5E 102K
A10C7	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C8	0140-0190	7	1	CAPACITOR-FXD 39PF +-5% 300VDC MICA	09023	CD15ED390J03
A10C9	0140-0195	2	1	CAPACITOR-FXD 130PF +-5% 300VDC MICA	09023	CD15FD131J03
A10C11	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A10C12	0180-0197	8	1	CAPACITOR-FXD 2.2UF 20V TA	56289	150D225X9020A2
A10C13	0160-3874	2	1	CAPACITOR-FXD 10PF +-.5PF 200VDC CER		FD12C0G2D100D
A10C14	0160-3874	2	1	CAPACITOR-FXD 10PF +-.5PF 200VDC CER		FD12C0G2D100D
A10J1	85680-60075	1	1	CABLE ASSEMBLY COAX 81 (INCLUDES W20)	28480	85680-60075
A10J2	85680-60082	0	1	CABLE ASSEMBLY COAX 89 (INCLUDES W21)	28480	85680-60082
A10J3	1250-0690	6	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	51-047-4610
A10L1	9100-2252	1	1	INDUCTOR RF-CH-MLD 270NH +-10% .105D	28480	9100-2252
A10L2	9100-2252	1	1	INDUCTOR RF-CH-MLD 270NH +-10% .105D	24226	10M270K
A10L3	9100-2250	9	1	INDUCTOR-RF-CH-MLD 180NH +-10%	28480	9100-2250
A10L4	9140-0179	1	1	INDUCTOR-22UH +-10%	28480	9140-0179
A10MP2	85680-20070	2	1	LID-PILOT 3RD CONVERTER	28480	85680-20070
A10MP3	2950-0078	9	3	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A10MP4	2200-0101	0	4	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	
A10MP5	2190-0557	7	3	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A10Q1	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	04713	
A10Q2	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A10R1	0757-0416	7	1	RESISTOR-511 +-1% .125W	24546	C4-1/8-TO-511R-F
A10R2	0757-0280	3	1	RESISTOR-1K +-1% .125W	24546	C4-1/8-TO-1001-F
A10R3	0698-3439	4	1	RESISTOR-178 +-1% .125W	24546	C4-1/8-TO-178R-F
A10R4	0757-0346	2	1	RESISTOR-10 +-1% .125W	24546	C4-1/8-TO-10R0-F
A10R5	0698-3438	3	1	RESISTOR-147 +-1% .125W	24546	C4-1/8-TO-147R-F
A10R6	0757-0280	3	1	RESISTOR-1K +-1% .125W	24546	C4-1/8-TO-1001-F
A10R7	0757-0280	3	1	RESISTOR-1K +-1% .125W	24546	C4-1/8-TO-1001-F
A10R8	0757-0416	7	1	RESISTOR 511 +-1% .125W	24546	C4-1/8-TO-511R-F
A10R9*	0757-0346	2	1	RESISTOR 10 +-1% .125W	24546	C4-1/8-TO-10R0-F
A10R10	0757-0394	0	1	RESISTOR 51.1 +-1% .125W	24546	C4-1/8-TO-51R1-F
A10U1	0955-0063	0	1	U-WAVE MIXER 500 MHZ MAX	15542	SRA-1-32

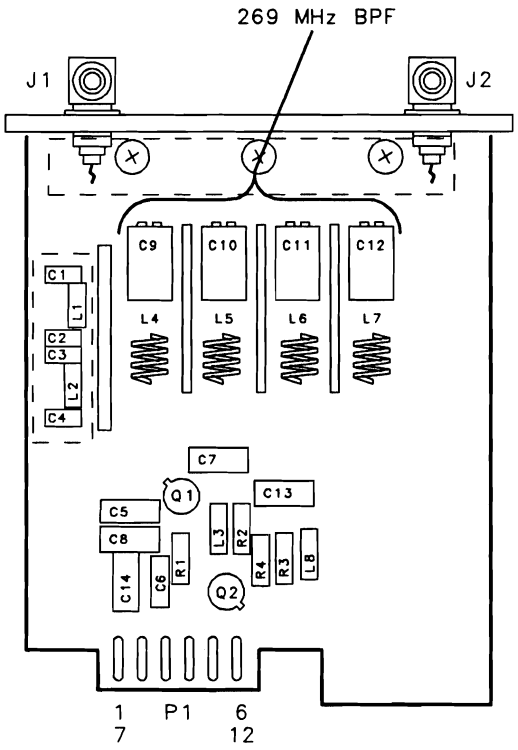
**Indicates factory-selected value*



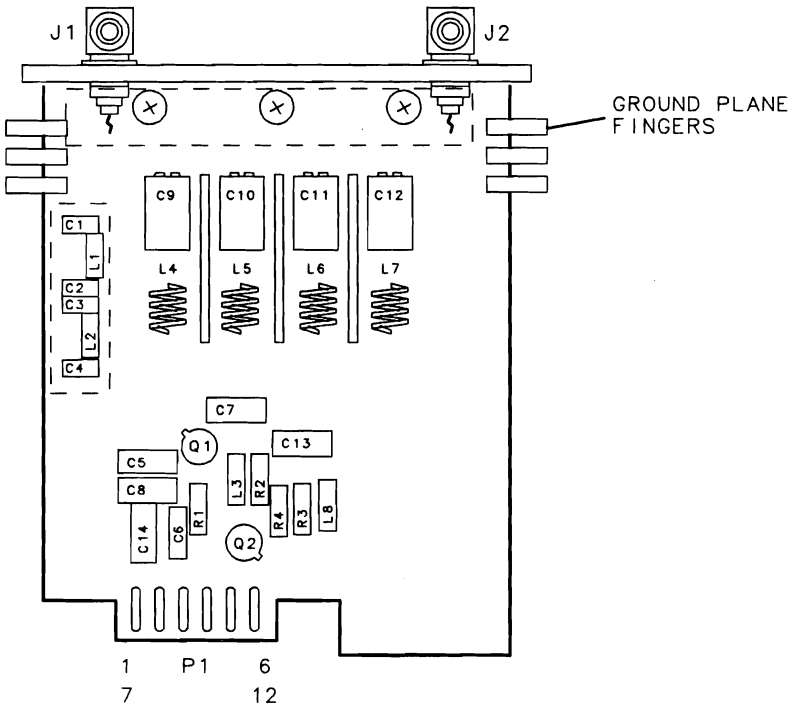
A9 PILOT SECOND IF AMPLIFIER AND A10 PILOT THIRD C

20 MHz REFERENCE
A16
J3
20 MHz
> - 15 dBm
3
W26
YTO PHASE LOCK
A6
J2
MOTHERBOARD
A26
XA6P2 XA22P2
8 2
FREQUENCY CONTROL
A22
YTO FM COIL DRIVER
14
W14 RIBBON CABLE
YIG OSCILLATOR
A23A1
14
J1
TUNING
FM COIL
2 - 4 GHz
< + 12 dBm
OR GREATER
W5
FIRST LO DISTRIBUTION
A23A4
A1J1
A3J3
W7
FIRST
CONVERTER
20 MHz ± 10 MHz
> - 25 dBm
82
J1
W22
FREQUENCY COUNTER
A17
J1
9
W27
J3
A4J2
W10
2 - 4 GHz
≥ + 10 dBm
PILOT FIRST
CONVERTER
A23A5
J1
J3
R
L
X
J2
20 MHz COMB
- 40 dBm ± 5 Db
FROM A23A6
COMB GENERATOR
W9
W11
DESIRED SIGNAL IN:
2007.5 - 20027.5 MHz
RANGE - 41 dBm ± 7 dB
PILOT SECOND
CONVERTER
A23A3
J2
2020
BPF
J6
1748.6 MHz
OR
1753.6 MHz
- 44dBm ± 7dB
269 MHz ± 10 MHz
80
W17
CONVERTOR
AMPLIFIER
+ 30 dB
GAIN
BALANCED
MIXER
J1
269 MHz ± 10 MHz
- 30dBm ± 7dB
81
W20
A9 PILOT SECOND IF AMPLIFIER
J2
269 MHz
BANDPASS
21 MHz
3dB
AMPLIFIER
19dB
LO PASS
FILTER
600 MHz
3dB
J1
J2
W21
89
249 MHz ± 10 MHz
+5dBm ± 2dB
FROM A7 249 MHz
PHASE LOCK
OSCILLATOR

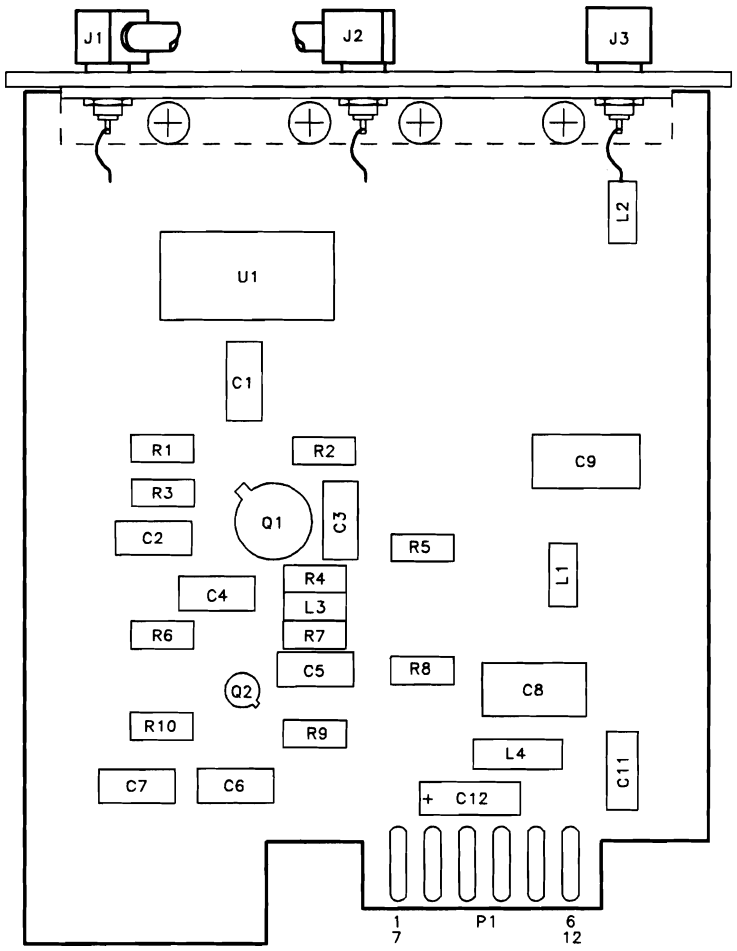
A9 PILOT SECOND IF AMPLIFIER AND A10 PILOT THIRD CONVERTER, BLOCK DIAGRAM



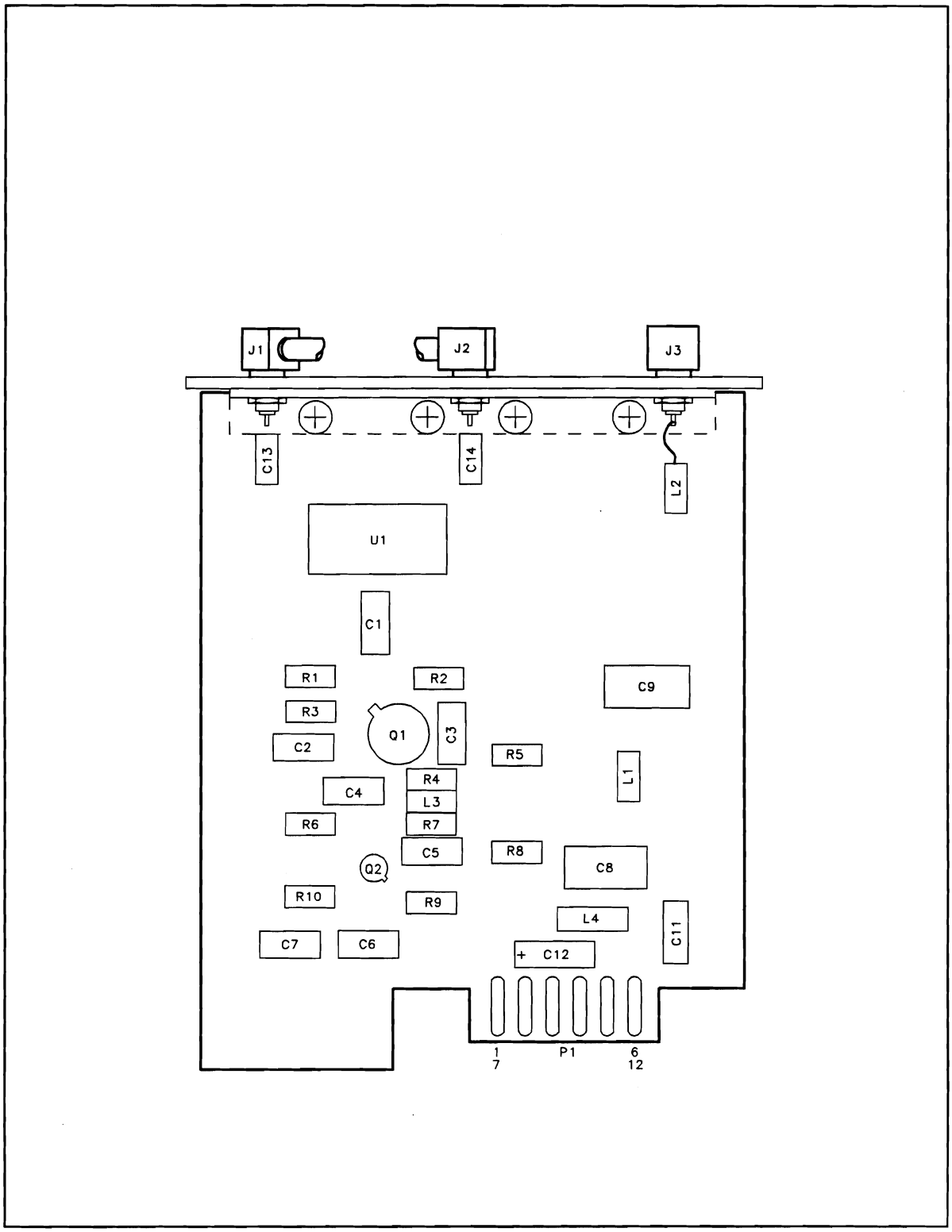
A9 Pilot Second IF Amplifier Component Locations, 85680-60140



A9 Pilot Second IF Amplifier Component Locations, 85680-60210



A10 Pilot Third Converter Component Locations, 85680-60010

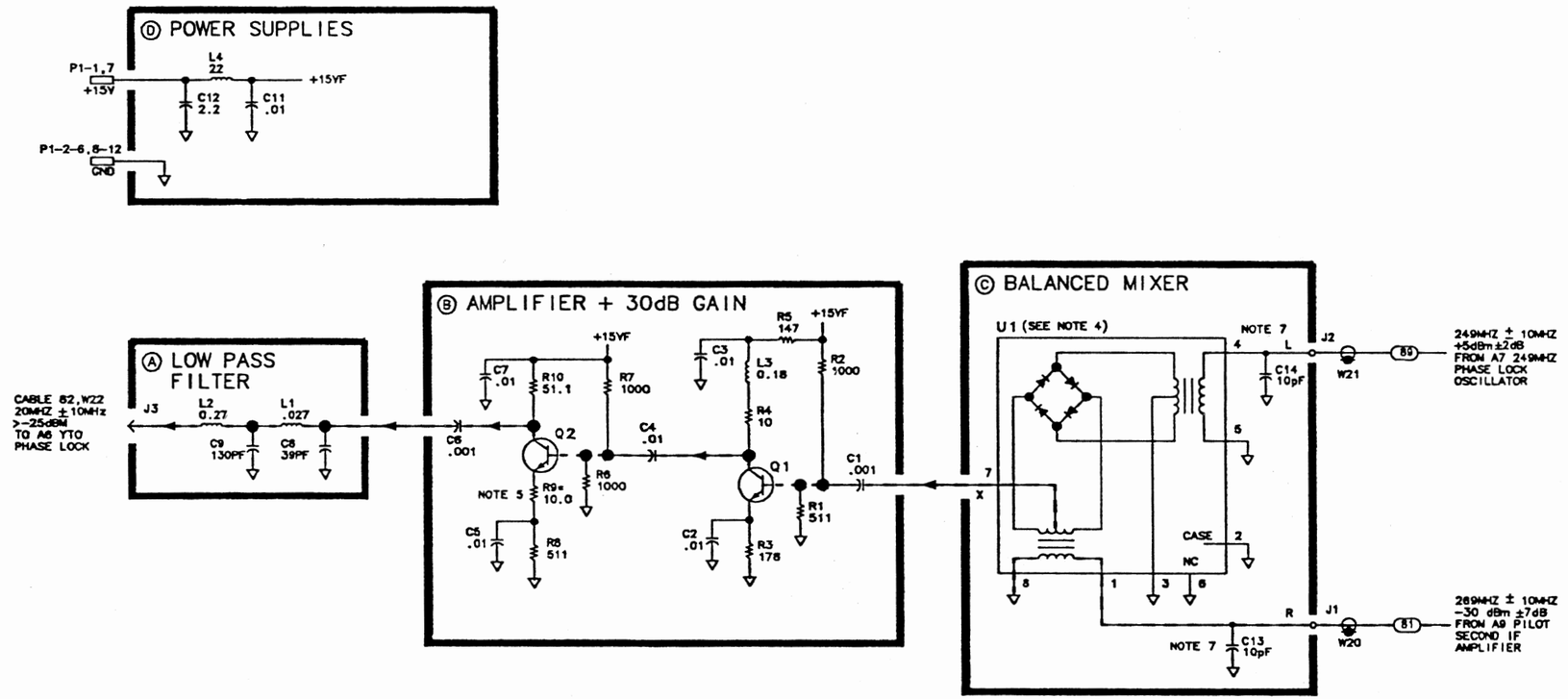


A10 Pilot Third Converter Component Locations, 85680-60211

A10 PILOT THIRD CONVERTOR
85680-60010
(SERIAL PREFIXES: 2408A-2541A)
85680-60211
(SERIAL PREFIX: 2601A)

P

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+15V		D
7	+15V		D
2	GND		D
8	GND		D
3	GND		D
9	GND		D
4	GND		D
10	GND		D
5	GND		D
11	GND		D
6	GND		D
12	GND		D



A9 PILOT SECOND
85680-60140
(SERIAL PREFIXES
85680-60210
(SERIAL PREFIX: 2

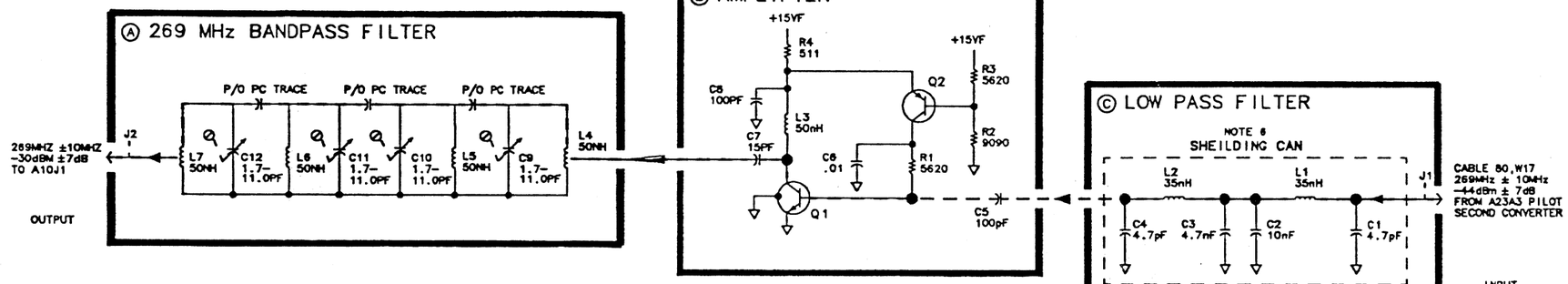
P1

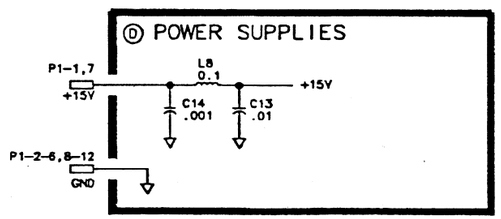
PIN	SIGNAL	TO/FROM	FUNCTIO BLOCK
1	+15V		D
7	+15V		D
2	GND		D
8	GND		D
3	GND		D
9	GND		D
4	GND		D
10	GND		D
5	GND		D
11	GND		D
6	GND		D
12	GND		D

A9 PILOT SECOND IF AMPLIFIER
85680-60140
(SERIAL PREFIXES: 2408A-2541A)
85680-60210
(SERIAL PREFIX: 2601A)

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+15V		D
7	+15V		D
2	GND		D
8	GND		D
3	GND		D
9	GND		D
4	GND		D
10	GND		D
5	GND		D
11	GND		D
6	GND		D
12	GND		D





NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IS IN OHMS (Ω)
   CAPACITANCE IS IN MICROFARADS (μF)
   INDUCTANCE IS IN MICROHENRIES (μH)
3. UNLESS OTHERWISE INDICATED:
   SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.
4. A10U1 PIN CONFIGURATION:

   1 2 3 4
   □ ○ ○ ○
   ○ ○ ○ ○
   8 7 6 5

5. A10R9* IS A FACTORY SELECTED COMPONENT. THE FOLLOWING ALTERNATE HP PART NUMBER AND VALUE MAY BE USED.

HP PART NUMBER	VALUE
0698-7192	14.7Ω

6. A9 PILOT 2ND IF AMPLIFIER WAS WAS UPGRADED FROM HP PART NUMBER 85680-60140 TO 85680-60210 BY THE ADDITION OF A SHEILDING CAN TO SHEILD THE LOW PASS FILTER CIRCUIT OF THE BOARD. THE LOW PASS FILTER SHEILDING CAN IS NOT INCLUDED ON 85680-60140.
7. A10 PILOT THIRD CONVERTER WAS UPGRADED FROM HP PART NUMBER 85680-60010 TO 85680-60211 BY THE ADDITION OF TWO CAPACITORS, C13 AND C14, TO THE BALANCED MIXER CIRCUIT OF THE BOARD. C13 AND C14 ARE NOT INCLUDED ON 85680-60010.

A9
A10

A9 PILOT SECOND IF AMPLIFIER AND A10 THIRD CONVERTER, SCHEMATIC DIAGRAM

A11

A11 50 MHz Voltage-Tuned Oscillator, Circuit Description

A11 50 MHz Voltage-Tuned Oscillator (VTO) is used to tune the Pilot Third Local Oscillator ±250 kHz corresponding to the spacing between the lock points in A7 249 MHz Phase Lock Oscillator. This is accomplished by providing a reference frequency to the Phase/Frequency Detector of A21 275 MHz Phase Lock. The reference frequency is either 5 (±0.75)MHz or 2.5 (±0.300) MHz, depending on the selected frequency span. For spans >100 kHz but ≤1 MHz, the 50(±7.5)MHz oscillator frequency is divided by 10; for spans of 100 kHz or less, the frequency is divided by 20. For spans greater than 1 MHz, the VTO is not swept; the sweep is applied to A23A1 YIG-Tuned Oscillator (the first LO).

The frequency to which the 50 MHz oscillator is tuned is determined by the output of the Summing Amplifier, whose inputs are the 50 MHz SWEEP and 50 MHz TUNE signals from A22 Frequency Control. For sweep times of 10 sec or longer, the Slow Sweep Filter is switched into the circuit to filter off low-frequency components (on the 50 MHz SWEEP and 50 MHz TUNE lines) which in the most narrow bandwidths (30 Hz and 10 Hz) might cause spurious responses.

Shaping Network (B)

The Shaping Network is composed of a Summing Amplifier and a Shaping Attenuator. The 50 MHz TUNE and 50 MHz SWEEP lines, received from A22 Frequency control, are summed through R43 and R46. The ratio of these resistors is such that the frequency of the 50 MHz oscillator varies at the rate of 1.1 MHz per volt on the 50 MHz TUNE line and at the rate of 1.0 MHz per volt on the 50 MHz SWEEP line when the shaping network is properly adjusted. The gain around U6 is set by R45 and GAIN adjustment R9. The output is offset by the action of R47, R48, and OFFSET adjustment R10. C14 heavily filters the offset voltage. R9 sets the overall sensitivity of the oscillator, and R10 offsets its frequency.

The output of the Summing Amplifier is shaped by the Shaping Attenuator to fit the characteristics of the 50 MHz Oscillator Tuning diodes CR15 and CR16. R18 through R28, R71, R17 and CR2 form a voltage divider setting the voltages at which diodes CR3 through CR14 and CR18 turn on. When the output of U6 is at its high end, corresponding to the 50 MHz Oscillator being tuned to its upper end around 57.5 MHz, all these diodes are turned off and the signal passes unattenuated through the Shaping Attenuator. As the oscillator is swept down in frequency, the voltage from U6 is swept down and successive diodes turn on, starting with CR14. As diodes are successively turned on, the attenuating action of R29 through R40 and R72 against R41 and R42 tends to pull back on the downward movement of the output voltage. As the Shaping Attenuator begins to act, the gain through it is controlled by SHAPING ATTN adjustment R42. The points at which the diodes turn on are adjusted by SHAPING OFFSET adjustment R17 and POSITIVE SUPPLY adjustment R6 in the Power Supplies. CR2 is always on and compensates the remaining diodes for temperature variations.

Slow Sweep Filter (A)

The output of the Shaping Network passes through the Slow Sweep Filter. This filter is turned on for instrument sweep times of 10 seconds or greater. Q4 is a unity gain amplifier. When the filter is off, Q4 shorts out R64 so that U5 drives C24 directly, and no filtering takes place. When the filter is on, Q4 is open, and the action of R64 and C24 filters the signal. The filter is controlled by the HFLT line from A22 Frequency Control. To turn the filter on, HFLT goes high. This puts current through R14 to saturate Q6, which pulls current through R16 to saturate Q7. Q7, in turn, puts current through R61 to saturate Q5. This pulls the gate of Q4 to −15 V, turning it off and allowing R64 and C24 to act as a filter. The filter is turned off by a low signal on HFLT, which turns off Q6, Q7, and Q5, allowing R59 to pull the gate of Q4 to the voltage of the source. This turns Q4 on, thus shorting out R64 and disabling the filter.

50 MHz Oscillator (C)

The 50 MHz Oscillator frequency is set by the tank circuit made of L4 and tuning diodes CR15 and CR16. As the voltage on the line to the diodes is lowered, their capacitance is increased, thus lowering the frequency of oscillation. The range of the oscillator is 50 (± 7.5) MHz. L6 and C23 isolate the tank from the tuning circuitry at the frequency of oscillation. C18 couples the tank to the transistor Q3. Q3 operates in common-base configuration with its collector driving the tank and C19 and C20 forming a voltage divider to feed back some of the signal to the emitter. This signal also goes to the Buffer Amplifier composed of Q2, R49, and R50. R8, C6, C16, L3, R52, and R55 properly bias Q3. R51, R57, C7, and C17 properly bias Q2. R56 biases CR17, which compensates CR15 and CR16 for temperature variations.

Divide By Two (D)

The Divide By Two circuit receives the signal from the 50 MHz Oscillator. ECL NOR gate U2C acts as a limiting amplifier, producing ECL output levels to drive the flip-flop U3A, which divides the frequency by 2. R65, R66, and C26 feed back a voltage to bias the amplifier to the center of the ECL voltage range (approximately −1.3 V). R68 and R69 attenuate the divided signal as it is sent to A17 Frequency Counter. R67, R70, R68, and R69 properly bias the ECL outputs.

Divide By Five or Ten (E)

The Divide by Five Or Ten circuit contains a Divide by Two circuit (U1A) and a Divide By Five circuit (U1B). The Divide by Two circuit is connected to an output of the previous Divide By Two circuit. U1A is either bypassed or used, as selected by the switch composed of NOR gates U2A, U2B, and U2D. The signal selected by the switch is then divided by 5 and sent to A21 275 MHz Phase lock, which locks onto it as its reference. The net result of all the divisions is to divide the 50 MHz Oscillator output frequency by 10 or 20. Division by 10 is used for spans greater than 100 kHz, and division by 20 for spans of 100 kHz or less. This gives frequencies centered about 5 MHz or about 2.5 MHz. The division used is controlled by the HDIV line from A22 Frequency Control. R11, R12, and R13 translate the TTL levels to ECL levels to control U2D. When HDIV is high, U2D disables U2B and enables U2A, thus selecting the output of Divide By Two circuit, U1A. When HDIV is low, U2D disables U2A and enables U2B, thus bypassing this Divide By Two circuit and directly selecting the output of the first Divide By Two circuit, U3A. R4, R44, R58, R60, R63, and R73 properly bias the ECL outputs used.

Power Supplies (F)

The Power Supplies circuit supplies regulated current to both the Shaping Network and the 50 MHz Oscillator. R1 supplies current to reference diode VR1, whose voltage is filtered by R2 and C3 and fed to U4. The output voltage is set by R7, R5, and the POSITIVE SUPPLY adjustment R6. C5 provides further filtering, and CR1 compensates for temperature variation of the diodes in the shaping network. Q1 increases the current capability of the supply, and R3 limits the current for momentary short circuits.

HP Part Number 85680-60017

A11 50 MHz Voltage-Tuned Oscillator

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11	85680-60017	1	1	BOARD ASSEMBLY-50MHZ VOLTAGE-TUNED OSCILLATOR	28480	85680-60017
A11C1	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C2	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2-DYS
A11C3	0180-0229	7	1	CAP-FXD 33uF 10 V TA	56289	150D336X9010B2-DYS
A11C4	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C6	0180-1746	5	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2-DYS
A11C7	0180-0229	7	1	CAP-FXD 33uF 10 V TA	56289	150D336X9010B2-DYS
A11C8	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C9	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C10	0180-1746	5	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2-DYS
A11C11	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C12	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C13	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C14	0160-3787	6	1	CAPACITOR-FXD 1UF +-10% 50VDC MET-POLYC	84411	HEW-249
A11C15	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C16	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C17	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C18	0160-2261	9	1	CAPACITOR-FXD 15PF +-5% 500VDC CER	52763	2RDPLX05015RNP0
A11C19	0160-0949	6	1	CAPACITOR-FXD 68PF +-5% 300VDC MICA	09023	CD15ED680J03
A11C20	0160-2016	2	1	CAPACITOR-FXD 62PF +-5% 500VDC MICA	09023	CD15ED620J03
A11C21	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C22	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C23	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER		808-542 X5E 102K
A11C24	0160-3402	2	1	CAP-FXD 1uF 50 V POLYC-MET	84411	HEW-249
A11C25	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C26	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C27	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C28	0160-4084	8	1	CAP-FXD 0.1uF 50 V	56289	1C20X7R104M050B
A11C29	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C30	0160-4084	8	1	CAP-FXD 0.1uF 50 V	56289	1C20X7R104M050B
A11C31	0180-0229	7	1	CAP-FXD 33uF 10 V TA	56289	150D336X9010B2-DYS
A11C32	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A11C33	0160-2437	1	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	33095	54-713-033-X5V-502Z
A11C34	0160-2437	1	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	33095	54-713-033-X5V-502Z
A11CR1	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR2	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR3	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR4	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR5	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR6	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR7	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR8	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR9	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR10	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR11	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR12	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	

**Indicates factory-selected value*

HP Part Number 85680-60017

A11 50 MHz Voltage-Tuned Oscillator

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11CR13	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR14	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR15	0122-0300	3	1	DIODE-VVC 100PF 5% C2/C20-MIN=2 BVR=20V	04713	
A11CR16	0122-0300	3	1	DIODE-VVC 100PF 5% C2/C20-MIN=2 BVR=20V	04713	
A11CR17	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11CR18	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A11J1	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A11J2	85680-60072	8	1	CABLE ASSEMBLY COAX 8 (INCLUDES W18)	28480	85680-60072
A11J3	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A11L1	9100-1618	1	1	INDUCTOR RF-CH-MLD 5.6UH +-10% .166D	99800	1537-30
A11L2	9100-1618	1	1	INDUCTOR RF-CH-MLD 5.6UH +-10% .166D	99800	1537-30
A11L3	9100-1621	6	1	INDUCTOR RF-CH-MLD 18UH +-10% .166D	99800	1537-42
A11L4	9100-2811	8	1	INDUCTOR 200NH +-10% .312D-INX1.016LG	52763	5087-0288-0
A11L5	9100-1618	1	1	INDUCTOR RF-CH-MLD 5.6UH +-10% .166D	99800	1537-30
A11L6	9140-0114	4	1	INDUCTOR RF-CH-MLD 10UH +-10% .166D	99800	1537-36
A11MP1	0590-0533	5	4	THREADED INSERT-NUT 2-56 .06-IN-LG SST	46384	KFS2-256
A11MP3	0520-0129	8	4	SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	77250	
A11MP4	1205-0285	0	2	HEAT SINK SGL DIP	13103	6007A-TOP
A11MP6	2190-0009	4	2	WASHER-LK INTL T NO. 8 .168-IN-ID	0G791	820-BC
A11MP7	2190-0557	7	3	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A11MP8	2200-0101	0	3	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	
A11MP9	2200-0105	4	2	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	77250	
A11MP10	2580-0002	4	2	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	80120	
A11MP11	2950-0078	9	3	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A11MP12	85680-00027	7	2	HEAT SINK, IC	28480	85680-00027
A11MP13	85680-00068	6	1	COVER-50MHZ SHIELD	28480	85680-00068
A11MP14	85680-20077	9	1	LID-50MHZ VTO	28480	85680-20077
A11MP15	85680-20103	2	1	SHIELD-50MHZ VTO	28480	85680-20103
A11MP16	85680-20104	3	1	COVER-50MHZ BOTTOM	28480	85680-20104
A11MP17	86701-40001	9	1	EXTRACTOR, PC	28480	86701-40001
A11MP19	2190-0112	0	4	WASHER-LK HLCL NO. 2 .088-IN-ID	77339	
A11MP20				NOT ASSIGNED		
A11MP22	0520-0139	0	8	SCREW-MACH 2-56 .875-IN-LG PAN-HD-POZI	77250	
A11MP23	85680-00069	7	1	SHIELD-MAG 50MHZ	28480	85680-00069
A11MP24	0460-0114	3	1	TAPE-INDL 1.25-IN-W .25-IN-T POLYU-FM	87730	TESA 761-4763
A11MP25	2190-0112	0	8	WASHER-LK HLCL NO. 2 .088-IN-ID	77339	
A11Q1	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A11Q2	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A11Q3	1853-0018	0	1	TRANSISTOR PNP SI TO-72 PD=200MW FT=1GHZ	04713	
A11Q4	1855-0020	8	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	04713	SFE793
A11Q5	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A11Q6	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	25403	
A11Q7	1853-0451	5	1	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	04713	
A11R1	0757-0278	9	1	RESISTOR 1.78K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R2	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R3	0757-0316	6	1	RESISTOR 42.2 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R4	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R5	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H

**Indicates factory-selected value*

HP Part Number 85680-60017

A11 50 MHz Voltage-Tuned Oscillator

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11R6	2100-1739	0	1	RESISTOR-TRMR 5K 10% WW SIDE-ADJ 20-TRN	32997	3005P-DM3-502
A11R7*	0757-0288	1	1	RESISTOR 9.09K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R8	0757-0317	7	1	RESISTOR 1.33K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R9	2100-1972	3	1	RESISTOR-TRMR 20K 10% WW SIDE-ADJ 20-TRN	32997	3005P-DM3-203
A11R10	2100-2850	8	1	RESISTOR-TRMR 10K 10% WW SIDE-ADJ 20-TRN	32997	3005P-DM3-103
A11R11	0757-0439	4	1	RESISTOR 6.81K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R12	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A11R13	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A11R14	0698-3160	8	1	RESISTOR 31.6K 1% .125W TF TC=0+-100	19701	SFR25H
A11R15	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R16	0698-3160	8	1	RESISTOR 31.6K 1% .125W TF TC=0+-100	19701	SFR25H
A11R17	2100-1799	2	1	RESISTOR-TRMR 500 10% WW SIDE-ADJ 20-TRN	32997	3005P-DM3-501
A11R18	0757-0394	0	1	RESISTOR 51.1 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R19	0757-0395	1	1	RESISTOR 56.2 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R20	0757-0276	7	1	RESISTOR 61.9 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R21	0757-0397	3	1	RESISTOR 68.1 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R22	0757-0398	4	1	RESISTOR 75 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R23	0757-0399	5	1	RESISTOR 82.5 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R24	0757-0400	9	1	RESISTOR 90.9 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R25	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R26	0757-0402	1	1	RESISTOR 110 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R27	0757-0403	2	1	RESISTOR 121 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R28	0698-3437	2	1	RESISTOR 133 1% .125W TF TC=0+-100	19701	SFR25H
A11R29	0757-0443	0	1	RESISTOR 11K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R30	0757-0289	2	1	RESISTOR 13.3K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R31	0698-3136	8	1	RESISTOR 17.8K 1% .125W TF TC=0+-100	19701	SFR25H
A11R32	0757-0199	3	1	RESISTOR 21.5K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R33	0698-3159	5	1	RESISTOR 26.1K +-1% .125W		
A11R34	0698-3160	8	1	RESISTOR 31.6K 1% .125W TF TC=0+-100	19701	SFR25H
A11R35	0698-3161	9	1	RESISTOR 38.3K 1% .125W TF TC=0+-100	19701	SFR25H
A11R36	0698-3162	0	1	RESISTOR 46.4K 1% .125W TF TC=0+-100	19701	SFR25H
A11R37	0757-0458	7	1	RESISTOR 51.1K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R38	0757-0460	1	1	RESISTOR 61.9K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R39	0757-0461	2	1	RESISTOR 68.1K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R40	0757-0462	3	1	RESISTOR 75K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R41	0757-0438	3	1	RESISTOR 5.11K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R42	2100-2850	8	1	RESISTOR-TRMR 10K 10% WW SIDE-ADJ 20-TRN	32997	3005P-DM3-103
A11R43	0698-6630	3	1	RESISTOR 20K +-0.1% .125W TF TC=0+-25	19701	5033R
A11R44	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R45	0698-3450	9	1	RESISTOR 42.2K 1% .125W TF TC=0+-100	19701	SFR25H
A11R46	0698-6977	1	1	RESISTOR 30K +-0.1% .125W TF TC=0+-25	19701	5033R
A11R47	0698-3158	4	1	RESISTOR 23.7K 1% .125W TF TC=0+-100	19701	SFR25H
A11R48	0698-3157	3	1	RESISTOR 19.6K 1% .125W TF TC=0+-100	19701	SFR25H
A11R49	0698-7236	7	1	RESISTOR 1K +-1% .05W TF TC=0+-100	19701	5063J
A11R50	0699-1903	5	1	RESISTOR 51.1 +-1% .05W TF TC=0+-100	91637	CMF-50-21
A11R51	0698-3151	7	1	RESISTOR 2.87K 1% .125W TF TC=0+-100	19701	SFR25H
A11R52	0698-7239	0	1	RESISTOR 1.33K +-1% .05W TF TC=0+-100	19701	5063J

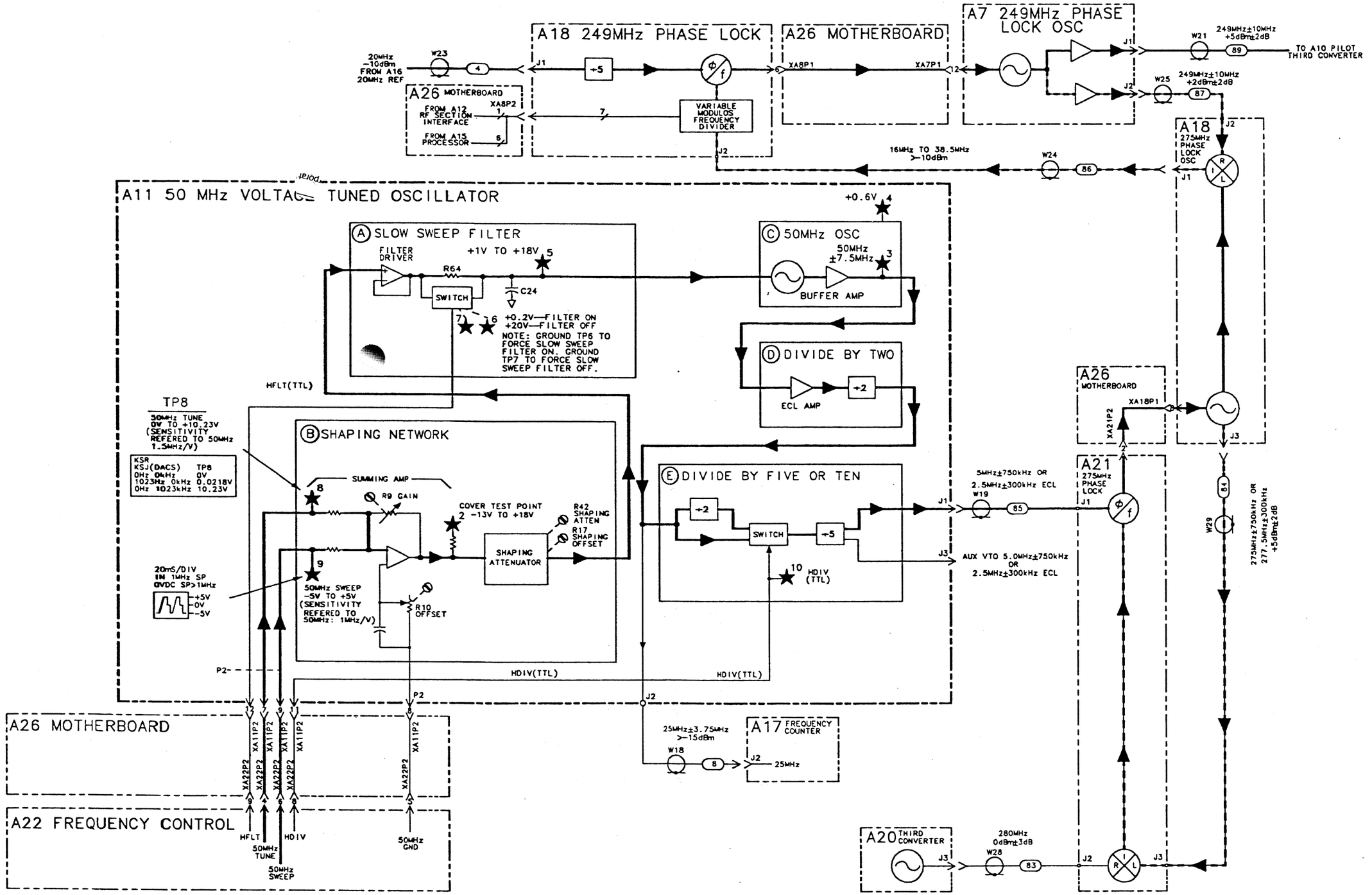
**Indicates factory-selected value*

HP Part Number 85680-60017

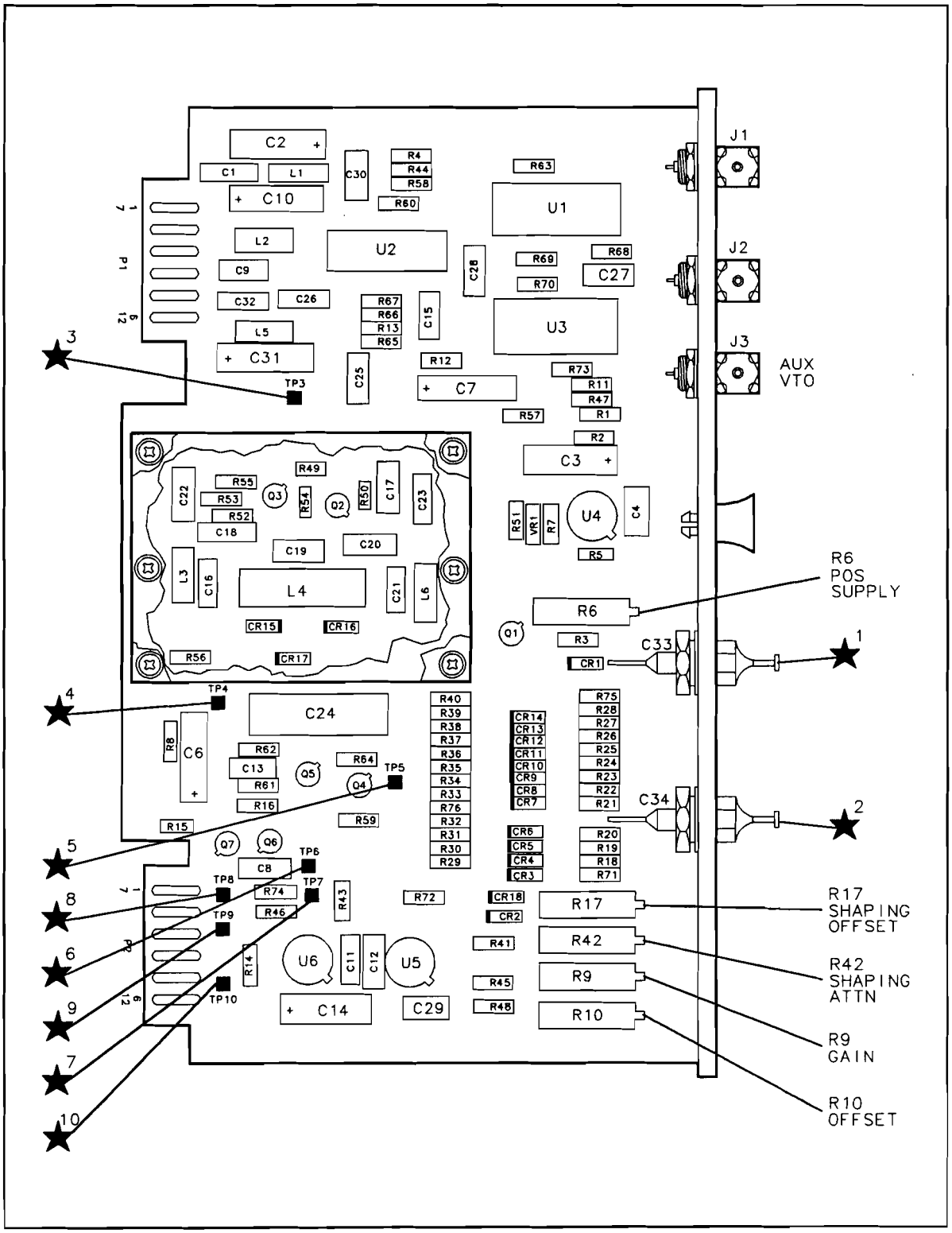
A11 50 MHz Voltage-Tuned Oscillator

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11R53	0698-7188	8	1	RESISTOR 10 +-1% .05W TF TC=0+-100	19701	5063J
A11R54	0698-7201	6	1	RESISTOR 34.8 +-1% .05W TF TC=0+-100	19701	5063J
A11R55	0698-7252	7	1	RESISTOR 4.64K +-1% .05W TF TC=0+-100	19701	5063J
A11R56	0757-0443	0	1	RESISTOR 11K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R57	0698-3151	7	1	RESISTOR 2.87K 1% .125W TF TC=0+-100	19701	SFR25H
A11R58	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R59	0698-3260	9	1	RESISTOR 464K 1% .125W TF TC=0+-100	19701	SFR25H
A11R60	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R61	0757-0458	7	1	RESISTOR 51.1K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R62	0757-0199	3	1	RESISTOR 21.5K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R63	0698-0084	9	1	RESISTOR 2.15K 1% .125W TF TC=0+-100	19701	SFR25H
A11R64	0757-0458	7	1	RESISTOR 51.1K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R65	0698-3441	8	1	RESISTOR 215 1% .125W TF TC=0+-100	19701	SFR25H
A11R66	0698-3441	8	1	RESISTOR 215 1% .125W TF TC=0+-100	19701	SFR25H
A11R67	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R68	0698-0082	7	1	RESISTOR 464 1% .125W TF TC=0+-100	19701	SFR25H
A11R69	0698-0082	7	1	RESISTOR 464 1% .125W TF TC=0+-100	19701	SFR25H
A11R70	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R71	0698-4037	0	1	RESISTOR 46.4 1% .125W TF TC=0+-100	19701	SFR25H
A11R72	0757-0288	1	1	RESISTOR 9.09K +-1% .125W TF TC=0+-100	19701	SFR25H
A11R73	0698-0084	9	1	RESISTOR 2.15K 1% .125W TF TC=0+-100	19701	SFR25H
A11R74	0757-0402	1	1	RESISTOR 110 +-1% .125W TF TC=0+-100	19701	SFR25H
A11R75	0698-3151	7	1	RESISTOR 2.87K 1% .125W TF TC=0+-100	19701	SFR25H
A11R76	0698-3151	7	1	RESISTOR 2.87K 1% .125W TF TC=0+-100	19701	SFR25H
A11TP3	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A11TP4	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A11TP5	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A11TP6	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A11TP7	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A11TP8	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A11TP9	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A11TP10	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A11U1	1820-1383	5	1	IC CNTR ECL BCD POS-EDGE-TRIG DUAL	04713	MC10138L
A11U2	1820-0802	1	1	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A11U3	1820-0820	3	1	IC FF ECL J-BAR K-BAR COM CLOCK DUAL	04713	MC10135L
A11U4	1826-1058	3	1	IC OP AMP GP 8-TO-99 PKG	06665	OP-02CJ
A11U5	5180-2315	1	1	IC 05C M1 OPAMP	28480	5180-2315
A11U5	5180-2314	0	0	IC 05C M1 OPAMP-SCREENED 1826-0229 NOTE: USE AS ALTERNATE FOR 5180-2315		
A11U6	5180-2315	1	1	IC 05C M1 OPAMP	28480	5180-2315
A11U6	5180-2314	0	0	IC 05C MI OPAMP-SCREENED 1826-0229 NOTE: USE AS ALTERNATE FOR 5180-2315		
A11VR1	1902-0680	7	1	DIODE-ZNR 1N827 6.2V 5% DO-7 PD=.4W	04713	1N827

**Indicates factory-selected value*



A11 VOLTAGE-TUNED OSCILLATOR, BLOCK DIAGRAM



A11 50 MHz Voltage-Tuned Oscillator Component Locations, 85680-60017

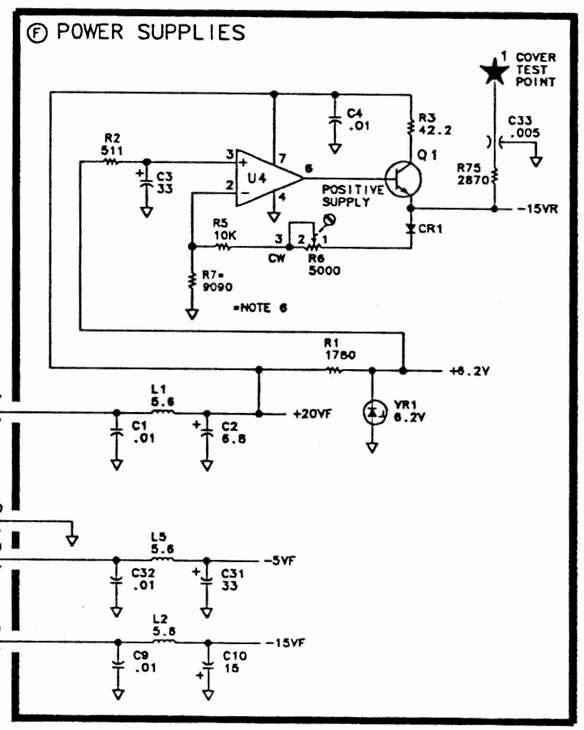
A11 50 MHz VOLTAGE-TUNED OSCILLATOR
85680-60017
(SERIAL PREFIX:2408A)

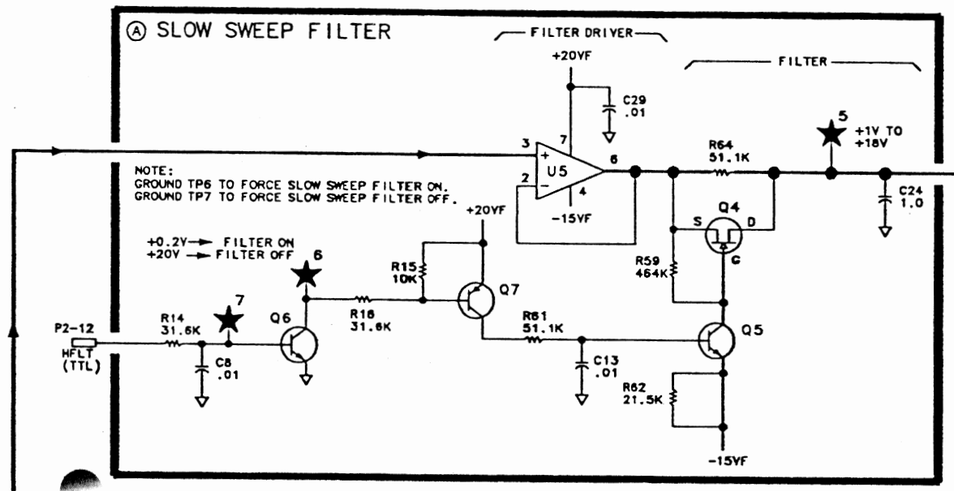
P1

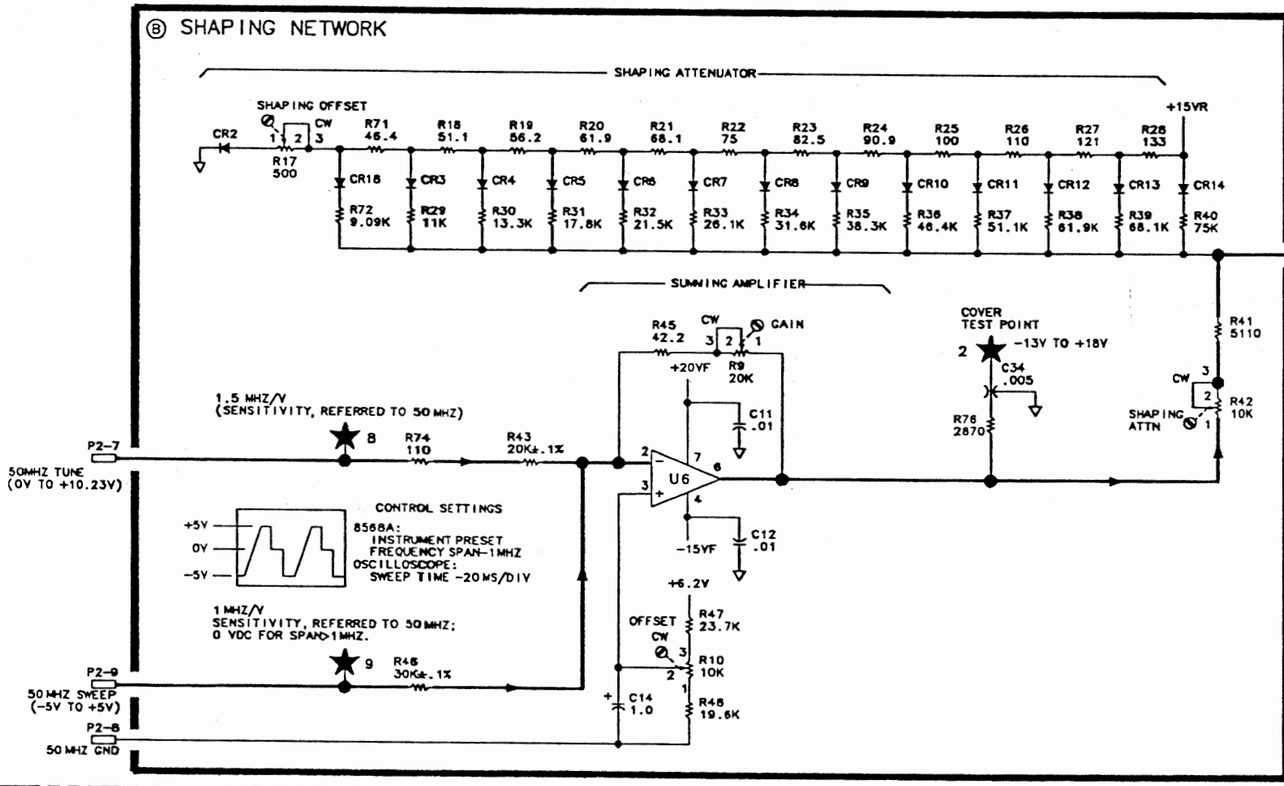
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	+20V		F
7	+20V		F
2	GND		F
8	GND		F
3	-15V		F
9	-15V		F
4	-5.2V		F
10	-5.2V		F
5	GND		F
11	GND		F
6	GND		F
12	GND		F

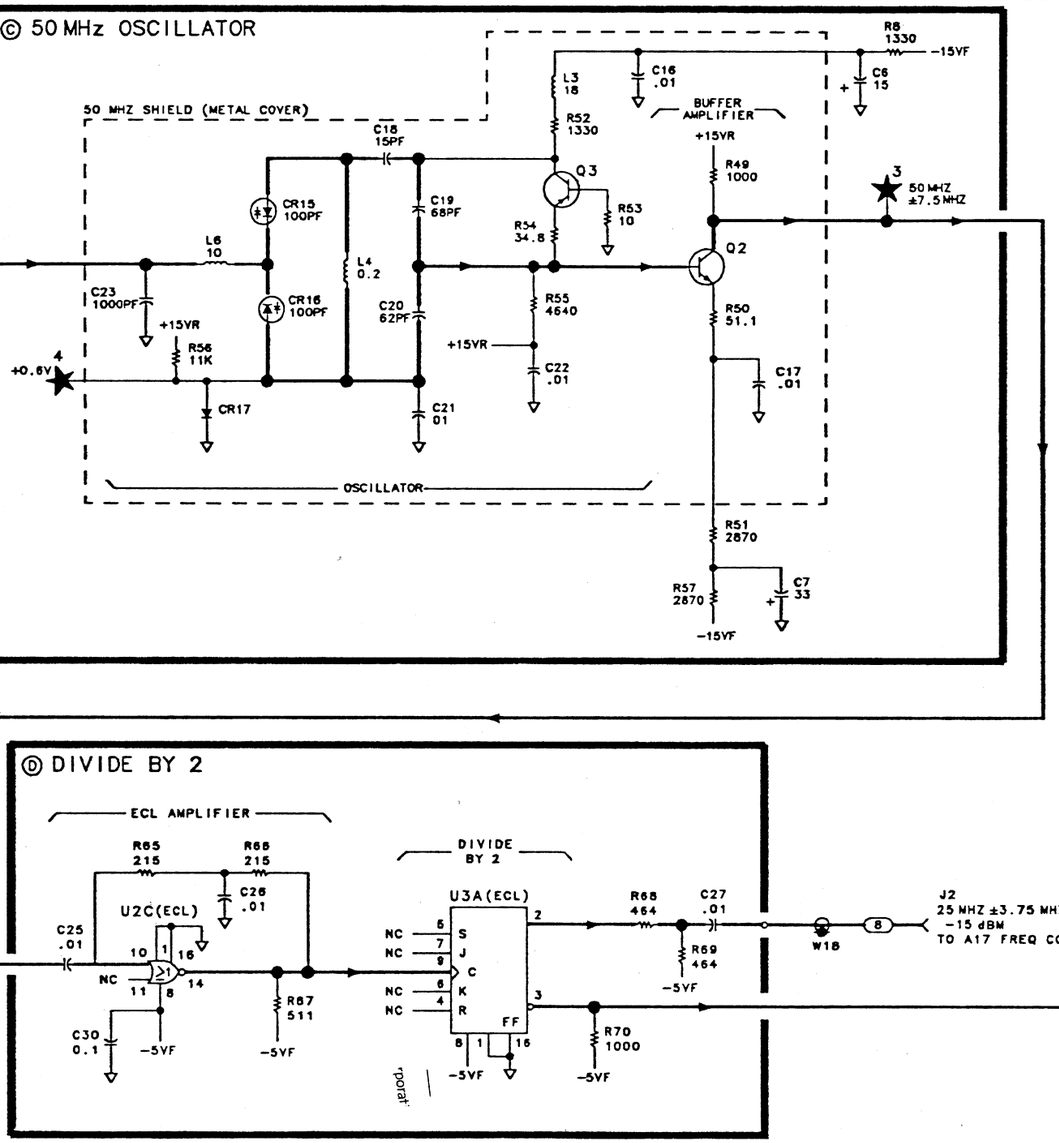
P2

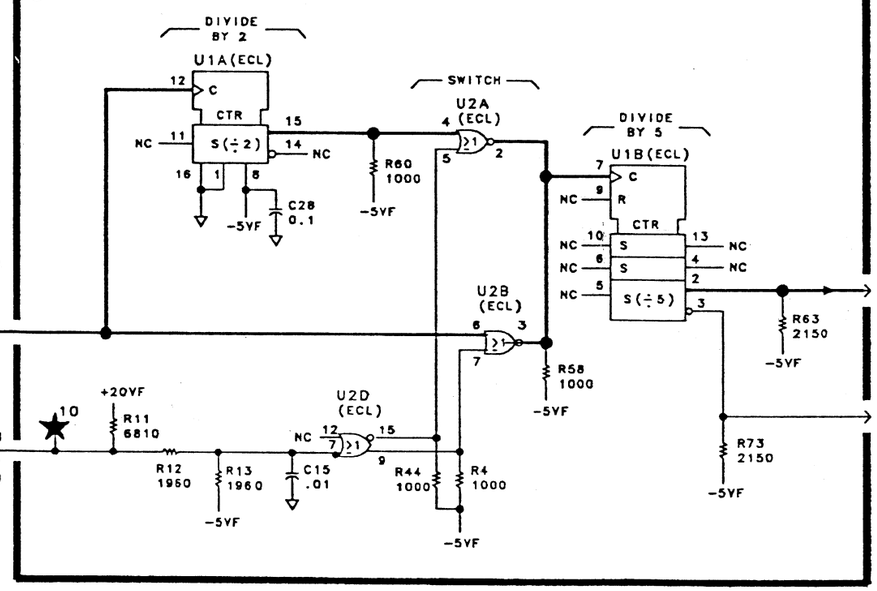
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		F
7	50 MHz TUNE	A22,P2-4	B
2	GND		F
8	50MHz GND	A22,P2-5	B
3	GND		F
9	50MHz SWEEP	A22,P2-6	B
4	GND		F
10	GND		F
5	GND		F
11	HDIV	A22,P2-8	E
6	GND		F
12	HFLT	A22,P2-9	A











NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IS IN OHMS (Ω)
   CAPACITANCE IS IN MICROFARADS (μF)
   INDUCTANCE IS IN MICROHENRIES (μH)
3. ECL LOGIC LEVELS ARE TYPICALLY:
   -0.9V = LOGIC '1' = HIGH
   -1.8V = LOGIC '0' = LOW
   AN UNCONNECTED ECL INPUT IS LOW
4. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
HFLT	HIGH = SLOW SWEEP FILTER ON
HDIV	HIGH = TOTAL DIVIDE BY 20 LOW = TOTAL DIVIDE BY 10

5. U38 IS NOT USED.
6. R7* IS A FACTORY-SELECTED COMPONENT. THE FOLLOWING HP PART NUMBERS AND VALUES MAY BE USED.

HP PART NUMBER	VALUE
0757-0442	10KΩ
0757-0443	11KΩ
0757-0444	12KΩ

A11

A11 50 MHz VOLTAGE-TUNED OSCILLATOR, SCHEMATIC DIAGRAM

A12

A12 RF Section Interface, Circuit Description

The A12 RF Section Interface Assembly contains digital functions that allow the front-panel controls to interface with the A15 Controller assembly.

Keyboard Matrix Ⓐ

The main processor in the A15 Controller assembly polls the keyboard by selectively enabling the key rows. The keyboard is organized as a matrix (rows and columns) of normally-open SPST switches. The rows are driven by U19 and U30. U16 and U34 gate the columns to the Data Bus. U23 detects when any key is in the down position (closed). Q12 and associated circuitry debounce the key switches.

Rotary Pulse Generator (RPG) Control Ⓓ

The front panel knob is rotary pulse generator (RPG) that generates pulses proportional to the speed and direction of its rotation. The RPG has two outputs: RPG phase 1, and RPG phase 2. When the knob is turned, the outputs are square waves that are 90 degrees out of phase.

The rate and direction of rotation determines the frequency and phase of the square waves. When the knob is turned clockwise, RPG phase 1 leads RPG phase 2 by 90 degrees. Conversely, when the knob is turned counterclockwise, RPG phase 1 lags RPG phase 2 by 90 degrees.

The RPG control circuitry is enabled when U4B is set. The logic high output of U4B is ANDed (with inversion) with RPG phase 1 by U5C, providing a clock signal for the RPG control circuitry.

The main processor senses clockwise RPG rotation as follows: When the trailing edge of RPG phase 1 occurs, the output of U5C is rising; the value of RPG phase 2 is clocked into U6A. RPG phase 1 is leading RPG phase 2, so the value of RPG phase 2 is high. The output of U6A, a high, tells the main processor that the rotation is clockwise.

If RPG rotation is counterclockwise, RPG phase 1 lags RPG phase 2. The output of U6A is now low, because RPG phase 2 is low during the trailing edge of RPG phase 1, telling the main processor that RPG rotation is counterclockwise.

RPG clock signal (U5C output) is counted by U13 and U12. The main processor determines how much the RPG knob was turned by reading the count. After each reading, the processor resets the counters through U5B.

When the count reaches 255, the counters are disabled by the U12 overflow signal (pin 7), inverted by U5A.

The RPG clock signal also clocks U6B. when the RPG circuit is reset, the output of monostable multivibrator U14 is high for about 90 msec. After this period, the output returns

low, and a clock to U6B resets the flip-flop, providing the active low RPG request output. The RPG reset signal sets U6B, driving the active low RPG request to a high state.

Service Request ©

The Service Request block includes several functions. Flip-flop U10A controls the execution of the main processor in the A15 Controller assembly. After the main processor initiates the sweep, but before a sweep can start, U10A is reset, driving Q1 to saturation and placing the main processor in an idle mode. The processor is activated when the low service request signal (LSRO) sets U10A.

U3 and U2 latch the internal or external frequency reference, and local or remote (HP-IB) status of the spectrum analyzer. C5 and C4 form RC delaying networks with R10 and R9. The outputs of U3C or U3D are high until the voltages at C5 or C4 have stabilized. U3B and U3A act as inverters that provide a negative pulse which resets the corresponding flip-flop in U2.

U5D and U4A are an end-of-sweep detector for the main processor. The high sweep signal (HSWP), after inversion by U5D, clocks and sets U4A. This produces an interrupt signal (through the priority encoder) that alerts the main processor of impending processing.

The priority encoder, U1, collects the outputs of all interface functions, such as keyboard, RPG, sweep, HP-IB, phase lock errors, and so on. When any input is active (low), the priority encoder:

1. stops the sweep
2. alerts the main processor with the high state of LSTP (via LSRQ, U10A, and Q1).
3. requests system service via LSRQ
4. prioritizes multiple request
5. encodes the function "number" that the main processor reads to determine which function to service.

The phase lock function has the highest priority. Of second priority is LREQ. The sweep function has the lowest priority.

The third highest priority, LTGR, is not used, but sometimes is a source of instrument failure. This line goes to the 50-wire bus and the interconnect cable between the HP 85680B and the HP 85662A.

A pinched wire in the cable may interfere with proper instrument operation. The priority encoder is a common focal point during instrument failure diagnosis.

RF Attenuator (ATTEN) Drive Ⓕ

This circuit switches input attenuator and input selection relay, A5K1. The HPUP signal resets U7. When the instrument is set to standby mode, the power supply voltages decrease, and HPUP goes low. This resets U7, enabling all three pads—10dB, 20 dB, and 40 dB—producing 70 dB of input attenuation. On A12, HP part number 85680-60168, switching transients are suppressed by U24, U25, and U26.

Phase Lock Flags ⓖ

This circuit monitors the reference oscillator oven temperature sensor, the YTO tuning voltage comparators, and various unlock error signals for phase lock. Any input(s) to the circuit can be disabled from the main processor by the input AND gates and flip-flops in U21. Eventually, any inputs not disabled are ORed together by U31B, inverted by U20D, and applied to the priority encoder. The main processor determines which error message(s) are active. Note that the YTO TUNE voltage comparator inputs are disabled when the YTO is unlocked. (See U20B.)

Address Decoder ⓗ

Primary address decoding is done by U18. The decoder is enabled when U18 pin 6 is high, and pins 5 and 4 are low. The outputs, pins 7, 9—15, go low singly, according to the inputs at pins 1—3. Note that output 4(pin 11) enables address decoder U9 of the Service Request circuit.

Options ⓘ

The jumpers are set to represent the instrument configurations. For example, the Input 1 jumper is set for 50Ω. The main processor corrects the displayed information according to the jumper settings.

The correction data for input attenuation is stored in ROM U17. This data is unique for each attenuator. Thus, U17 must be replaced whenever the attenuator is replaced.

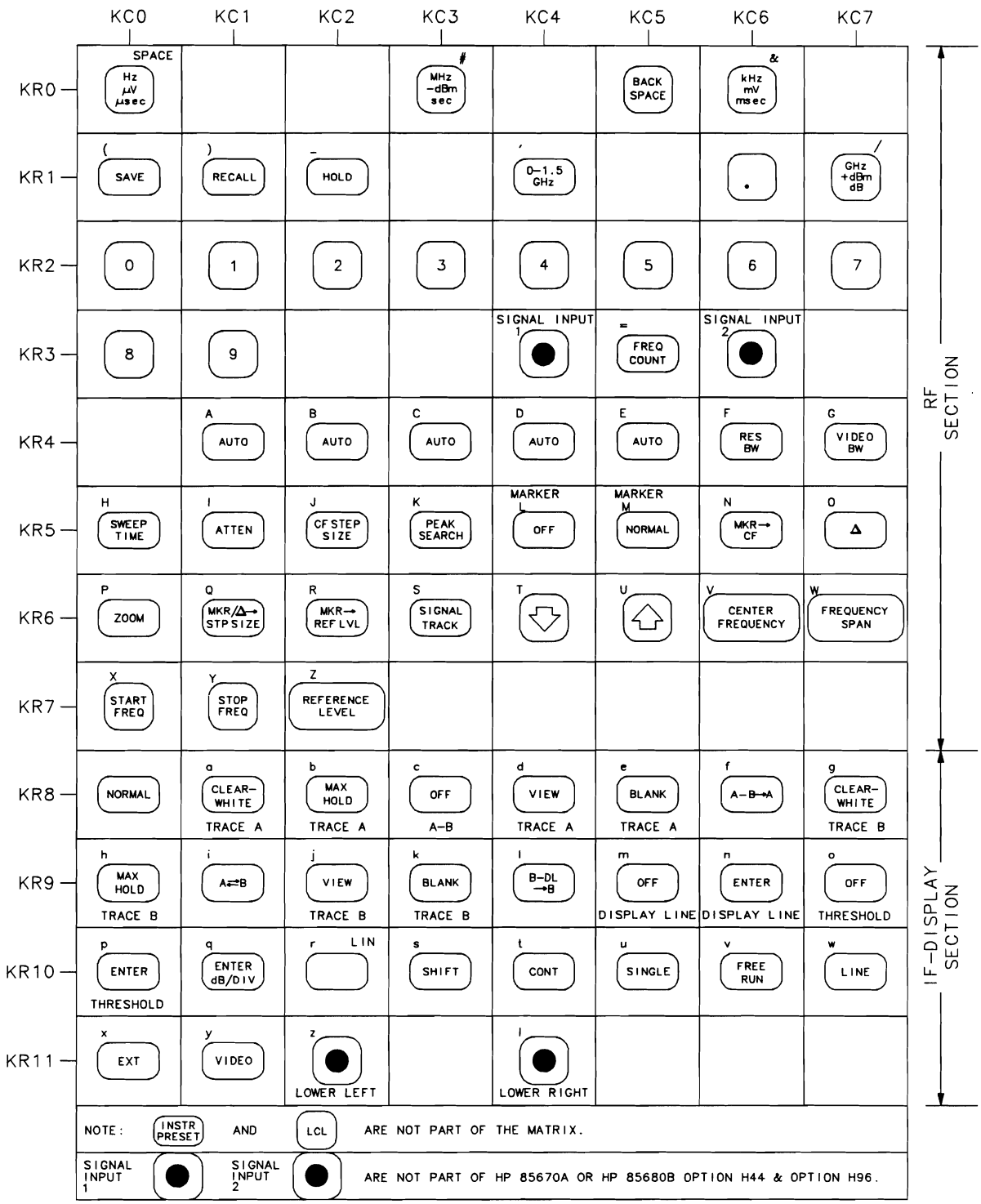


Figure 1. Keyboard Matrix

HP Part Number 85680-60168

A12 RF Section Interface

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12	85680-60168	3	1	BOARD ASSEMBLY RF SECTION INTERFACE (SERIAL PREFIXES: 2408A-2431A)	28480	85680-60168
A12C1	0180-0100	3	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2-DYS
A12C2	0160-0161	4	1	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	84411	HEW-238M
A12C3	0160-2291	5	1	CAPACITOR-FXD .18UF +-10% 80VDC POLYE	84411	HEW-238T
A12C4	0160-0153	4	1	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	84411	HEW-238M
A12C5	0160-0153	4	1	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	84411	HEW-238M
A12C6	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2-DYS
A12C8	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C9	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C10	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C11	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C12	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C13	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C15	0180-0229	7	1	CAPACITOR-FXD 33uF 10 V TA	56289	150D336X9010B2-DYS
A12C16	0160-3454	4	1	CAPACITOR-FXD 220pF +-5% 100VDC CER	04222	SA102A101JAAH
A12CR1	1901-0028	5	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A12CR2	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12CR3	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12CR4	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12CR5	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12CR6	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12CR7	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12L1	08558-80011	6	1	INDUCTOR-FILTER COIL-BLUE	28480	08558-80011
A12L2	08558-80011	6	1	INDUCTOR-FILTER COIL-BLUE	28480	08558-80011
A12MP1				NOT ASSIGNED		
A12MP2	4040-0750	7	1	EXTR-PC BD RED POLYC .062-IN-BD-THKNS		
A12MP3	4040-0749	4	1	EXTR-PC BD BRN POLYC .062-IN-BD-THKNS		
A12MP4	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72962	99-012-062-0250
A12MP5	1200-0607	0	1	SOCKET-IC 16-CONT DIP DIP-SLDR	09922	DILB16P-308T
A12Q1	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A12Q2	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A12Q3	1854-0367	4	1	TRANSISTOR NPN 2N2219A	01295	2N2219A
A12Q4	1853-0281	9	1	TRANSISTOR PNP 2N2907A	04713	2N2907A
A12Q5	1854-0477	7	1	TRANSISTOR NPN 2N2222A	04713	2N2222A
A12Q6	1854-0477	7	1	TRANSISTOR NPN 2N2222A	04713	2N2222A
A12Q7	1854-0477	7	1	TRANSISTOR PNP 2N2222A	04713	2N2222A
A12Q8	1854-0477	7	1	TRANSISTOR NPN 2N2222A	04713	2N2222A
A12Q9	1854-0477	7	1	TRANSISTOR NPN 2N2222A	04713	2N2222A
A12Q10	1854-0477	7	1	TRANSISTOR NPN 2N2222A	04713	2N2222A
A12Q11	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A12Q12	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A12R2	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A12R3	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A12R4	0698-3157	3	1	RESISTOR 19.6K 1% .125W TF TC=0+-100	19701	SFR25H
A12R5	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A12R6	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H

**Indicates factory-selected value*

HP Part Number 85680-60168

A12 RF Section Interface

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12R7	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A12R8	0698-3260	9	1	RESISTOR 464K 1% .125W TF TC=0+-100	19701	SFR25H
A12R9	0698-0083	8	1	RESISTOR 1.96K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R10	0698-0083	8	1	RESISTOR 1.96K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R11	0757-0442	2	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R12	0698-0083	8	1	RESISTOR 1.96K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R13	0698-0083	8	1	RESISTOR 1.96K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R14	0698-0083	8	1	RESISTOR 1.96K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R15	0698-0083	8	1	RESISTOR 1.96K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R16	0698-0083	8	1	RESISTOR 1.96K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R17	0698-0083	8	1	RESISTOR 1.96K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R18	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R19	0698-0083	8	1	RESISTOR 1.96K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R20	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R21	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R22	0698-3441	8	1	RESISTOR 215 +-1% .125W	24546	C4-1/8-TO-215R-F
A12R25	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R26	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R32	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R33	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R34	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R35	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R36	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R37	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R38	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R39	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R40	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R41	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R42	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R43	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R44	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R45	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12TP1	1251-5177	6	1	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ		460-2984-02-03-00
A12TP2	1251-5177	6	1	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ		460-2984-02-03-00
A12TP3	1251-5177	6	1	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ		460-2984-02-03-00
A12TP4	1251-5177	6	1	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ		460-2984-02-03-00
A12U1	1820-1851	2	1	IC ENCDR TTL LS	01295	SN74LS148N
A12U2	1820-1440	5	1	IC LCH TTL LS QUAD	01295	SN74LS279AN
A12U3	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86AN
A12U4	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRESET	01295	SN74LS74AN
A12U5	1820-1425	6	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
A12U6	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRESET	01295	SN74LS74AN
A12U7	1820-1195	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS175N
A12U8	1820-1438	1	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS257BN
A12U9	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A12U10	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRESET	01295	SN74LS74AN
A12U11	1820-1492	7	1	IC BFR TTL LS INV HEX 1-INP	01295	SN74LS368AN
A12U12	1820-2270	1	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO POS-E	34335	AM25LS2569DC

**Indicates factory-selected value*

HP Part Number 85680-60168
A12 RF Section Interface

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12U13	1820-2270	1	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO POS-E	34335	AM25LS2569DC
A12U14	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	18324	NE555N
A12U15	1810-0206	8	1	NETWORK-RES 8-SIP 10.0K OHMX7	56289	ULN-2003A
A12U16	1820-1491	6	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A12U17				PROM (P/O A5AT1 INPUT ATTENUATOR) (NOT SEPARATELY REPLACEABLE)		
A12U18	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A12U19	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N
A12U20	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A12U21	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N
A12U22	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N
A12U23	1820-1207	2	1	IC GATE TTL LS NAND 8-INP	01295	SN74LS30N
A12U24	1901-0367	5	1	DIODE FWB 600V 1A	28480	1901-0364
A12U25	1901-0367	5	1	DIODE FWB 600V 1A	28480	1901-0364
A12U26	1901-0367	5	1	DIODE FWB 600V 1A	28480	1901-0364
A12U27	1810-0206	8	1	NETWORK-RES 8-SIP 10.0K OHM X 7	11236	750-81
A12U28	1810-0206	8	1	NETWORK-RES 8-SIP 10.0K OHM X 7	11236	750-81
A12U29	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A12U30	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N
A12U31	1820-1210	7	1	IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN74LS51N
A12U32	1820-1210	7	1	IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN74LS51N
A12U33	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N
A12U34	1820-1491	6	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A12U35	1810-0398	9	1	NETWORK-RES 10-SIP 22.0K OHM X 9	11236	750-101
A12W2	0757-0346	2	1	RESISTOR 10 +-1% .125W	24546	C4-1/8-TO-10R0-F
A12W3	0757-0346	2	1	RESISTOR 10 +-1% .125W	24546	C4-1/8-TO-10R0-F
A12W4	0757-0346	2	1	RESISTOR 10 +-1% .125W	24546	C4-1/8-TO-10R0-F

**Indicates factory-selected value*

HP Part Number 85680-60181

A12 RF Section Interface

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12	85680-60181	0	1	BOARD ASSEMBLY RF SECTION INTERFACE (SERIAL PREFIX: 2445A)	28480	85680-60181
A12C1	0180-0100	3	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2-DYS
A12C2	0160-0161	4	1	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	84411	HEW-238M
A12C3	0160-2291	5	1	CAPACITOR-FXD .18UF +-10% 80VDC POLYE	84411	HEW-238T
A12C4	0160-0153	4	1	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	84411	HEW-238M
A12C5	0160-0153	4	1	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	84411	HEW-238M
A12C6	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2-DYS
A12C8	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C9	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C10	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C11	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C12	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C13	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C14	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A12C15	0180-0229	7	1	CAPACITOR-FXD 33uF 10 V TA	56289	150D336X9010B2-DYS
A12C16	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER	04222	SA102A101JAAH
A12C17	0160-4574	1	1	CAPACITOR-FXD 1000PF +-10% 100VDC CER	04222	SA101C102KAAH
A12C18	0160-4574	1	1	CAPACITOR-FXD 1000PF +-10% 100VDC CER	04222	SA101C102KAAH
A12C19	0160-4574	1	1	CAPACITOR-FXD 1000PF +-10% 100VDC CER	04222	SA101C102KAAH
A12CR1	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A12CR2	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12CR3	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12CR4	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12CR5	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12CR6	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12CR7	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A12L1	08558-80011	6	1	INDUCTOR-FILTER COIL-BLUE	28480	08558-80011
A12L2	08558-80011	6	1	INDUCTOR-FILTER COIL-BLUE	28480	08558-80011
A12MP1				NOT ASSIGNED		
A12MP2	4040-0750	7	1	EXTR-PC BD RED POLYC .062-IN-BD-THKNS		
A12MP3	4040-0749	4	1	EXTR-PC BD BRN POLYC .062-IN-BD-THKNS		
A12MP4	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72962	99-012-062-0250
A12MP5	1200-0607	0	1	SOCKET-IC 16-CONT DIP DIP-SLDR	09922	DILB16P-308T
A12Q2	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A12Q11	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A12Q12	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A12R2	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A12R3	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A12R4	0698-3157	3	1	RESISTOR 19.6K 1% .125W TF TC=0+-100	19701	SFR25H
A12R5	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A12R6	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A12R7	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A12R8	0698-3260	9	1	RESISTOR 464K 1% .125W TF TC=0+-100	19701	SFR25H
A12R9	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H
A12R10	0698-0083	8	1	RESISTOR 1.96K 1% .125W TF TC=0+-100	19701	SFR25H
A12R11	0757-0180	2	1	RESISTOR 31.6 +-1% .125W TF TC=0+-100	19701	SFR25H

**Indicates factory-selected value*

HP Part Number 85680-60181

A12 RF Section Interface

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12R12	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R18	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R20	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R21	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R25	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R26	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R32	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R33	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R34	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R35	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R36	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R37	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A12R38	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R39	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R40	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R41	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R42	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R43	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R44	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R45	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A12R46	0757-0405	4	1	RESISTOR 162 +-1% .125W TF TC=0+-100	19701	SFR25H
A12TP1	1251-5177	6	1	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ		460-2984-02-03-00
A12TP2	1251-5177	6	1	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ		460-2984-02-03-00
A12TP3	1251-5177	6	1	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ		460-2984-02-03-00
A12TP4	1251-5177	6	1	CONNECTOR-SGL CONT PIN .031-IN-BSC-SZ		460-2984-02-03-00
A12U1	1820-1851	2	1	IC ENCDR TTL LS	01295	SN74LS148N
A12U2	1820-1440	5	1	IC LCH TTL LS QUAD	01295	SN74LS279AN
A12U3	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86AN
A12U4	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRESET	01295	SN74LS74AN
A12U5	1820-1425	6	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
A12U6	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRESET	01295	SN74LS74AN
A12U7	1820-1195	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS175N
A12U8	1820-1438	1	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS257BN
A12U9	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A12U10	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRESET	01295	SN74LS74AN
A12U11	1820-1492	7	1	IC BFR TTL LS INV HEX 1-INP	01295	SN74LS368AN
A12U12	1820-2270	1	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO POS-E	34335	AM25LS2569DC
A12U13	1820-2270	1	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO POS-E	34335	AM25LS2569DC
A12U14	1826-0180	0	1	IC TIMER TTL MONO/ASTBL	18324	NE555N
A12U15	1858-0047	5	1	TRANSISTOR ARRAY 16-PIN PLSTC DIP	56289	ULN-2003A
A12U16	1820-1491	6	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A12U17				PROM (P/O A5AT1 INPUT ATTENUATOR) (NOT SEPARATELY REPLACEABLE)		
A12U18	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A12U19	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N
A12U20	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A12U21	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N
A12U22	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N

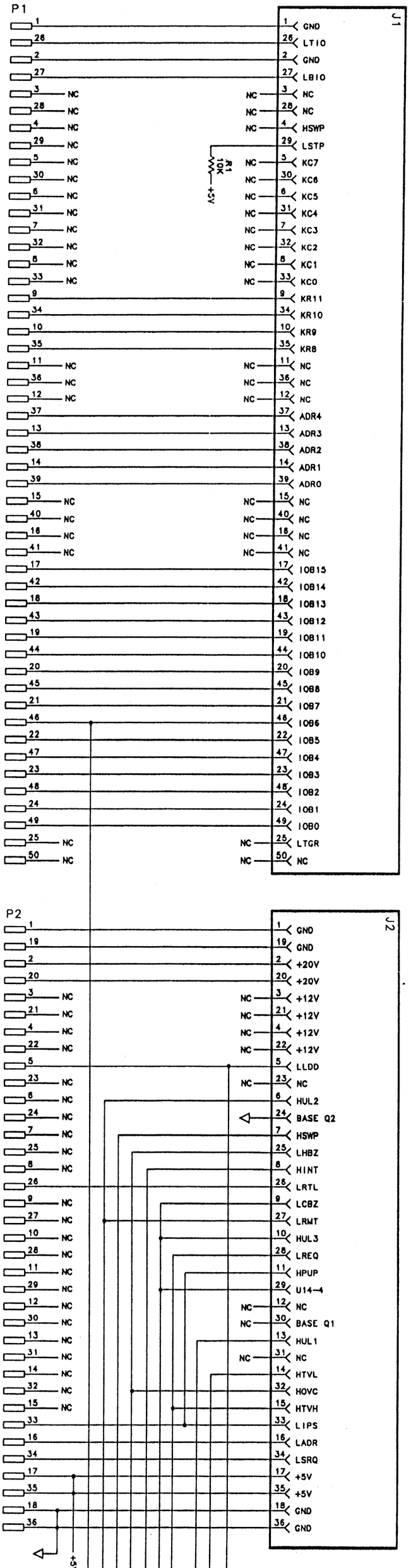
**Indicates factory-selected value*

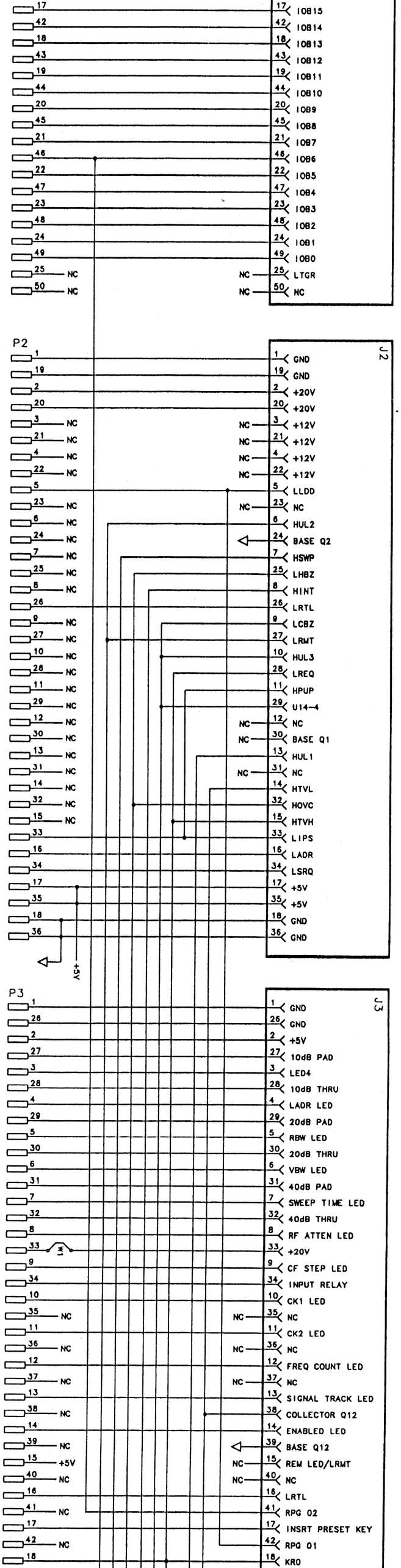
HP Part Number 85680-60181

A12 RF Section Interface

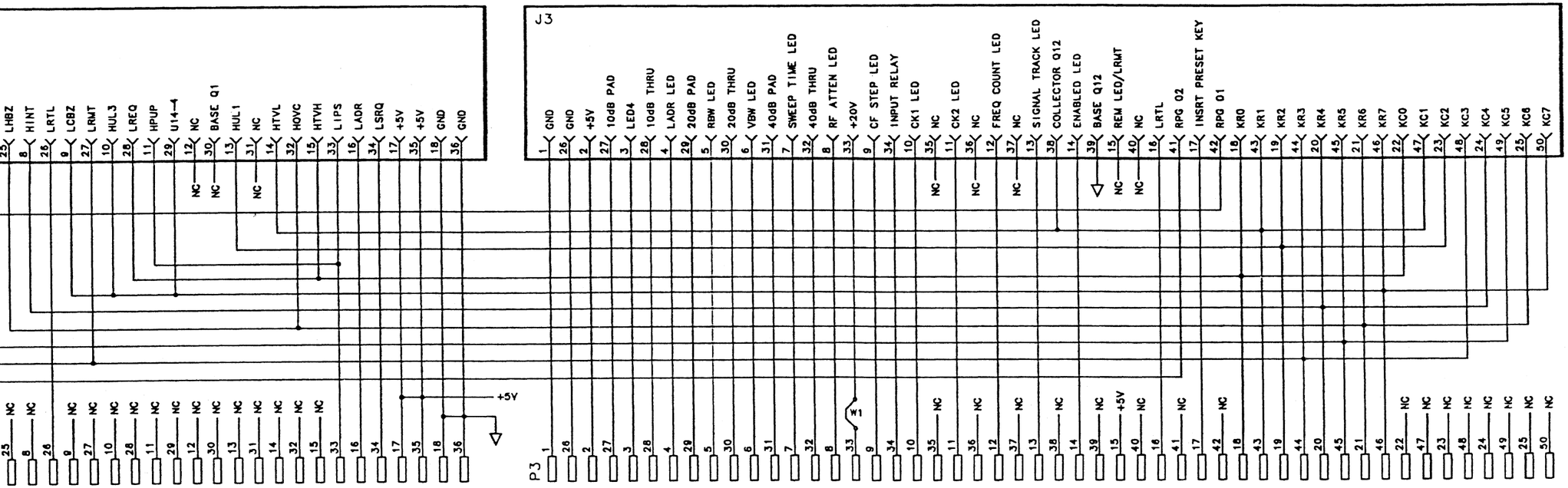
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12U23	1820-1207	2	1	IC GATE TTL LS NAND 8-INP	01295	SN74LS30N
A12U27	1810-0206	8	1	NETWORK-RES 8-SIP 10.0K OHM X 7	11236	750-81
A12U28	1810-0206	8	1	NETWORK-RES 8-SIP 10.0K OHM X 7	11236	750-81
A12U29	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A12U30	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N
A12U31	1820-1210	7	1	IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN74LS51N
A12U32	1820-1210	7	1	IC GATE TTL LS AND-OR-INV DUAL 2-INP	01295	SN74LS51N
A12U33	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N
A12U34	1820-1491	6	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A12U35	1810-0398	9	1	NETWORK-RES 10-SIP 22.0K OHM X 9	11236	750-101

**Indicates factory-selected value*


P1
J1
1 GND
26 LTIO
2 GND
27 LBIO
3 NC
28 NC
4 NC
29 NC
5 NC
30 NC
6 NC
31 NC
7 NC
32 NC
8 NC
33 NC
9 KR11
34 KR10
10 KR9
35 KR8
11 NC
36 NC
12 NC
37 ADR4
13 ADR3
38 ADR2
14 ADR1
39 ADR0
15 NC
40 NC
16 NC
41 NC
17 IOB15
42 IOB14
18 IOB13
43 IOB12
19 IOB11
44 IOB10
20 IOB9
45 IOB8
21 IOB7
46 IOB6
22 IOB5
47 IOB4
23 IOB3
48 IOB2
24 IOB1
49 IOB0
25 NC
50 NC
R1
10K
+5V
NC 3 NC
NC 28 NC
NC 4 HSWP
29 LSTP
NC 5 KC7
NC 30 KC6
NC 6 KC5
NC 31 KC4
NC 7 KC3
NC 32 KC2
NC 8 KC1
NC 33 KC0
NC 11 NC
NC 36 NC
NC 12 NC
NC 15 NC
NC 40 NC
NC 16 NC
NC 41 NC
NC 25 LTGR
NC 50 NC
P2
J2
1 GND
19 GND
2 +20V
20 +20V
3 NC
21 NC
4 NC
22 NC
5
23 NC
6 NC
24 NC
7 NC
25 NC
8 NC
26
9 NC
27 NC
10 NC
28 NC
11 NC
29 NC
12 NC
30 NC
13 NC
31 NC
14 NC
32 NC
15 NC
33
16
34
17
35
18
36
+5V
NC 3 +12V
NC 21 +12V
NC 4 +12V
NC 22 +12V
5 LLDD
NC 23 NC
6 HUL2
24 BASE Q2
7 HSWP
25 LHBZ
8 HINT
26 LRTL
9 LCBZ
27 LRMT
10 HUL3
28 LREQ
11 HPUP
29 U14-4
NC 12 NC
NC 30 BASE Q1
13 HUL1
NC 31 NC
14 HTVL
32 HOVC
15 HTVH
33 LIPS
16 LADR
34 LSRQ
17 +5V
35 +5V
18 GND
36 GND



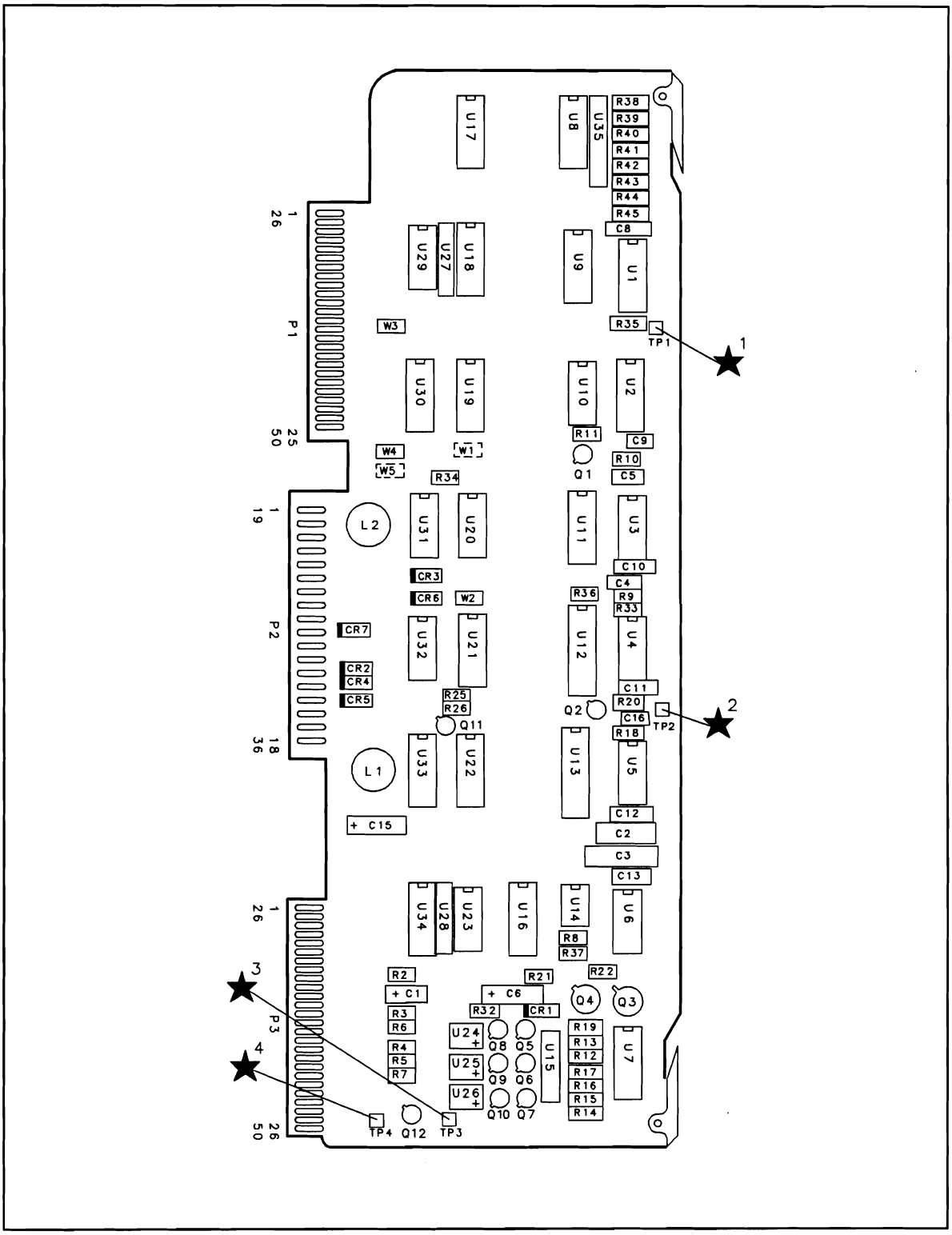
NOTE:
1. W1 IS OPENED TO DISABLE THE ATTENUATOR DRIVERS.
2. FOR HP 85670A, J3 PIN 34 IS NOT CONNECTED, AND THE TRACE ON THE EXTENDER BOARD IS OPEN.



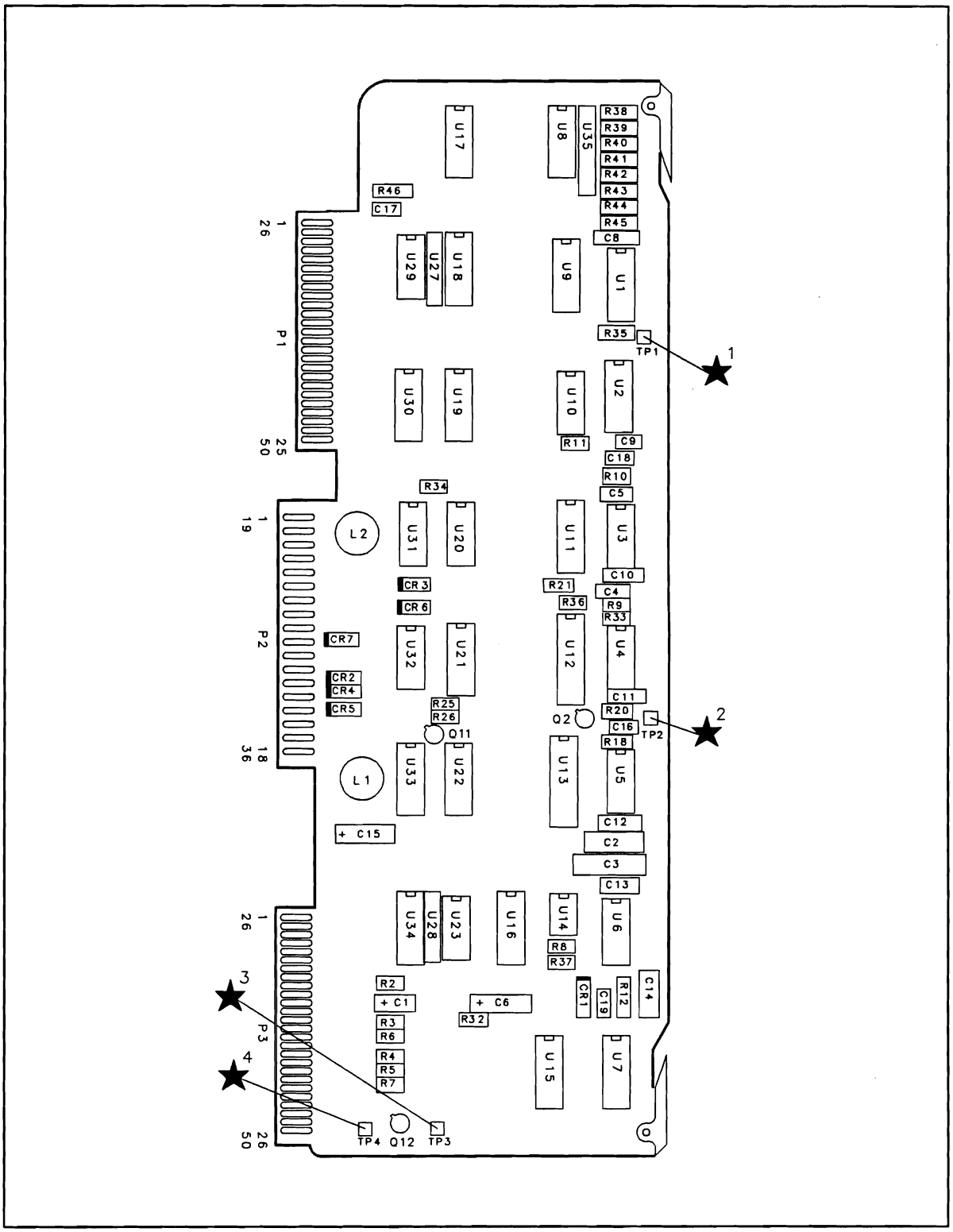
NOTE:
1. W1 IS OPENED TO DISABLE THE ATTENUATOR DRIVERS.
2. FOR HP 85670A, J3 PIN 34 IS NOT CONNECTED AND THE TRACE ON THE EXTENDER BOARD IS OPEN.

A12

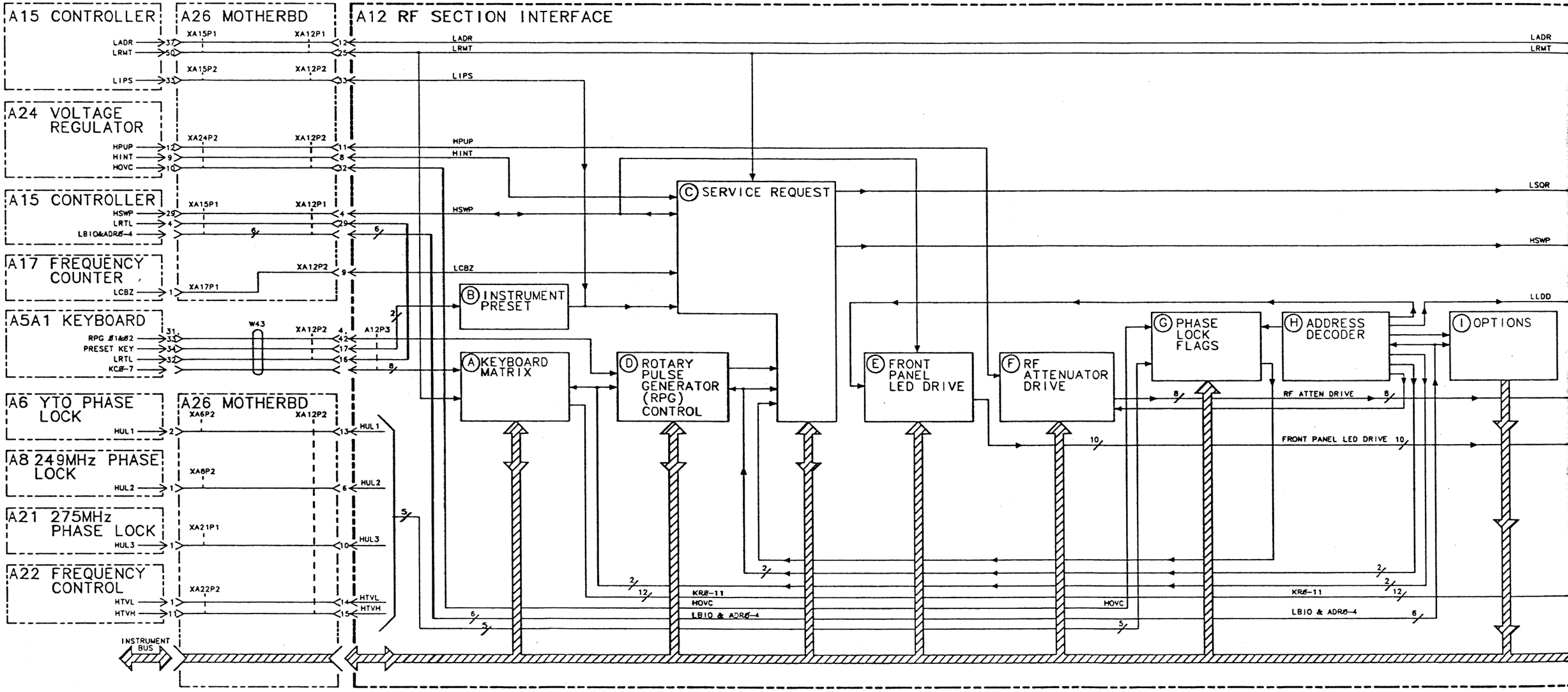
RF SECTION INTERFACE, EXTENDER BOARD, INTERCONNECT DIAGRAM



A12 RF Section Interface Component Locations, 85680-60168



A12 RF Section Interface Component Locations, 85680-60181


A15 CONTROLLER
A26 MOTHERBD
A12 RF SECTION INTERFACE
LADR
LRMT
LIPS
XA15P1
XA12P1
XA15P2
XA12P2
A24 VOLTAGE REGULATOR
HPUP
HINT
HOVC
XA24P2
A15 CONTROLLER
HSWP
LRTL
LB10&ADRØ-4
A17 FREQUENCY COUNTER
LCBZ
XA17P1
A5A1 KEYBOARD
RPG Ø1&Ø2
PRESET KEY
KCØ-7
W43
A12P3
A6 YTO PHASE LOCK
HUL1
XA6P2
A8 249MHz PHASE LOCK
HUL2
A21 275MHz PHASE LOCK
HUL3
XA21P1
A22 FREQUENCY CONTROL
HTVL
HTVH
XA22P2
INSTRUMENT BUS
C SERVICE REQUEST
B INSTRUMENT PRESET
A KEYBOARD MATRIX
D ROTARY PULSE GENERATOR (RPG) CONTROL
E FRONT PANEL LED DRIVE
F RF ATTENUATOR DRIVE
G PHASE LOCK FLAGS
H ADDRESS DECODER
I OPTIONS
LSQR
LLDD
RF ATTEN DRIVE
FRONT PANEL LED DRIVE
KRØ-11

A12 RF SECTION INTERFACE

LADR
LRWT
LIPS
HPUP
HINT
HSWP
LCBZ
A12P3
UL1
UL2
UL3
TVL
TVH

Ⓑ INSTRUMENT PRESET
Ⓐ KEYBOARD MATRIX
Ⓓ ROTARY PULSE GENERATOR (RPG) CONTROL
Ⓒ SERVICE REQUEST
Ⓔ FRONT PANEL LED DRIVE
Ⓕ RF ATTENUATOR DRIVE
Ⓖ PHASE LOCK FLAGS
Ⓗ ADDRESS DECODER
Ⓘ OPTIONS

KR0-11
HOVC
LB10 & ADR0-4
RF ATTEN DRIVE
FRONT PANEL LED DRIVE

A26 MOTHERBD
XA12P2
XA15P2
XA22P3
XA8P2
LSQR
HSWP
LLDD

A15 CONTROLLER
A22 FREQUENCY CONTROL
A8 249MHz PHASE LOCK

XA12P3
W43

A5A1 KEYBOARD
A5A1J1
TO INPUT SELECT
LADR (ADRS'D LED)
LRWT (REM LED)
TO LED INDICATORS
KR0-11

A26 MOTHERBD
INSTRUMENT BUS

A12 RF SECTION INTERFACE, BLOCK DIAGRAM

A12 RF SECTION INTERFACE (SHEET 1 OF 2)
85680-60168
(SERIAL PREFIX: 2408A-2431A)

P1

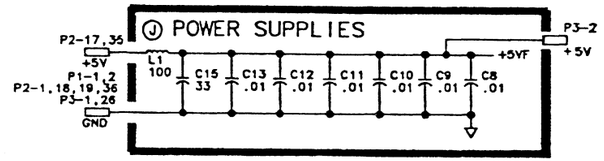
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		J
26	LTIØ	A15P1-1	NC
2	GND		J
27	LBIØ	A15P1-2	H
3	NC		
28	NC		
4	HSWP	A15P1-29	C
29	LRTL	A15P1-4	C
5	KC7	A15P1-30	A
30	KCØ	A15P1-5	A
6	KC5	A15P1-31	A
31	KC4	A15P1-6	A
7	KC3	A15P1-32	A
32	KC2	A15P1-7	A
8	KC1	A15P1-33	A
33	KCØ	A15P1-8	A
9	KR11	A15P1-34	A
34	KR1Ø	A15P1-9	A
10	KR9	A15P1-35	A
35	KR8	A15P1-10	A
11	NC		
36	NC		
12	LADR	A15P1-37	A
37	ADR4	A15P1-12	H
13	ADR3	A15P1-38	H
38	ADR2	A15P1-13	H
14	ADR1	A15P1-39	H
39	ADRØ	A15P1-14	H
15	NC		
40	NC		
16	NC		
41	NC		
17	10B15	A15P1-42	D
42	10B14	A15P1-17	A, D
18	10B13	A15P1-43	A, D
43	10B12	A15P1-18	A, D
19	10B11	A15P1-44	A, D
44	10B10	A15P1-19	A, D
20	10B9	A15P1-45	A, D
45	10B8	A15P1-20	A, D
21	10B7	A15P1-46	A
46	10B6	A15P1-21	A
22	10B5	A15P1-47	A, C
47	10B4	A15P1-22	A, C
23	10B3	A15P1-48	A, C
48	10B2	A15P1-23	A, C
24	10B1	A15P1-49	A, C
49	10BØ	A15P1-24	A, C
25	LRMT	A15P1-50	A, C
50	NC		

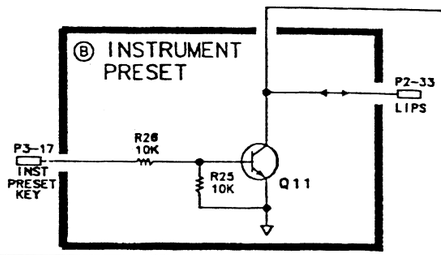
P2

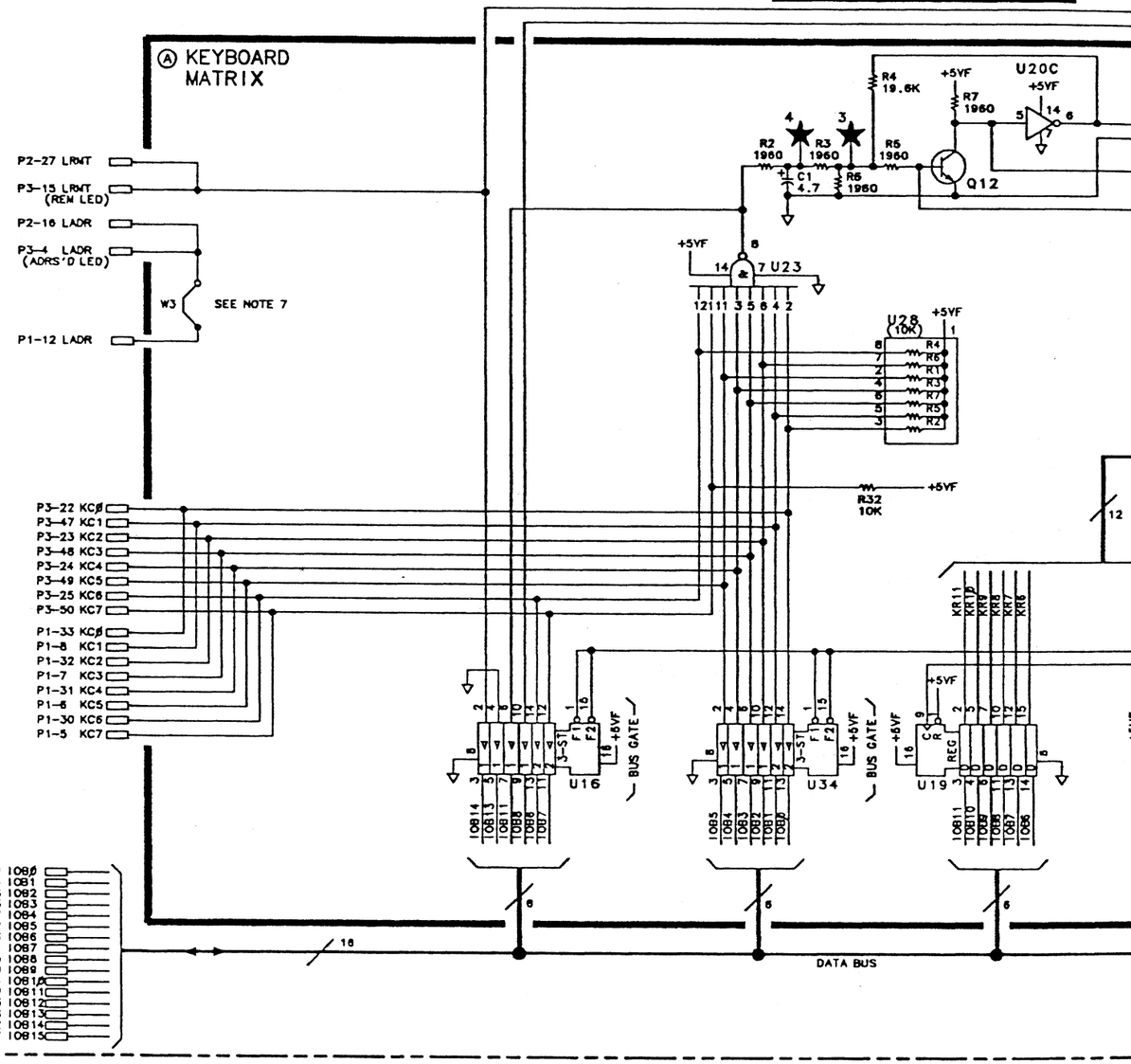
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		J
19	GND		J
2	+20V		F
20	+20V		F
3	+12V		NC
21	+12V		NC
4	+12V		NC
22	+12V		NC
5	LLDD	A8P2-8	H
23	NC		
6	HUL2	A8P2-1	G
24	BASE Q2	NC	C
7	HSWP	A22P3-1,16	C
25	LHBZ	NC	C
8	HINT	A24P2-9	C
26	LRTL	NC	C
9	LCBZ	A17P1-1	C
27	LRMT	NC	A
10	HUL3	A21P1-1	G
28	LREQ	NC	C
11	HPUP	A24P2-12	F
29	U14-4	NC	D
12	NC		
30	BASE Q1	NC	C
13	HUL1	A8P2-2	G
31	NC		
14	HTYL	A22P2-1	G
32	HOVC	A24P2-10	G
15	HTYH	A22P2-11	G
33	LIPS	A15P2-33	B
16	LADR	NC	A
34	LSRQ	A15P2-34	C
17	+5V		J
35	+5V		J
18	GND		J
36	GND		J

P3

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND	A5A1J1-2	J
26	GND	A5A1J1-2	J
2	+5V	A5A1J1-4	J
27	10 dB PAD	A5A1J1-3	F
3	LED 4		E
28	10 dB THRU	A5A1J1-5	F
4	LADR (ADRS'D LED)	A5A1J1-6	A
29	20 dB PAD	A5A1J1-7	F
5	RES BW LED	A5A1J1-10	E
30	20 dB THRU	A5A1J1-9	F
6	VIDEO BW LED	A5A1J1-12	E
31	40 dB PAD	A5A1J1-11	F
7	SWEEP TIME LED	A5A1J1-14	E
32	40 dB THRU	A5A1J1-13	F
8	ATTEN LED	A5A1J1-16	E
33	+20V	A5A1J1-15	F
9	CF STEP SIZE LED	A5A1J1-18	E
34	INPUT RELAY	A5A1J1-17	F
10	CKII	A5A1J1-20	E
35	NC		
11	CKI LED	A5A1J1-22	E
36	NC		
12	FREQ COUNT LED	A5A1J1-24	E
37	NC		
13	SIGNAL TRACK LED	A5A1J1-26	E
38	COLLECTOR Q12		A
14	ENABLED LED	A5A1J1-28	E
39	BASE Q12		A
15	LRMT (REM LED)	A5A1J1-30	A
40	NC		
16	LRTL	A5A1J1-32	C
41	RPG ØZ2	A5A1J1-31	D
17	INST PRESET KEY	A5A1J1-34	B
42	RPG Ø1	A5A1J1-33	D
18	KRØ	A5A1J1-36	A
43	KR1	A5A1J1-35	A
19	KR2	A5A1J1-38	A
44	KR3	A5A1J1-37	A
20	KR4	A5A1J1-40	A
45	KR5	A5A1J1-39	A
21	KR6	A5A1J1-42	A
46	KR7	A5A1J1-41	A
22	KCØ	A5A1J1-44	A
47	KC1	A5A1J1-43	A
23	KC2	A5A1J1-46	A
48	KC3	A5A1J1-45	A
24	KC4	A5A1J1-48	A
49	KC5	A5A1J1-47	A
25	KC6	A5A1J1-50	A
50	KC7	A5A1J1-49	A







R SUPPLIES

P3-2 +5V

+5VF

C13 .01 C12 .01 C11 .01 C10 .01 C9 .01 C8 .01

YBOARD TRIX

SEE NOTE 7

Ⓑ INSTRUMENT PRESET

P3-17 INST PRESET KEY

R28 10K

R25 10K

Q11

P2-33 LIPS

LIPS

Ⓒ SERVICE REQUEST

P3-16 LRTL

P2-26 LRTL

P1-29 LRTL

P1-25 LRMT

SEE NOTE 7

W4

W5

NOTE 7 W1

W2 NOTE 7

+5VF

U27R7 10K

R33 10K

U3C

U3B

U3A

U3D

R10 1960

C5 .001

R9 1960

C4 .001

R20 10K

HSWP

U5D

P1-4 HSWP

LIPS

P2-8 HINT

HINT

INT FREQ REF

R4 19.6K

R7 1960

U20C

R2 1960

R3 1960

R5 1960

R6 1960

C1 4.7

Q12

U10B

NC

P3-38 COLLECTOR Q12

P3-39 BASE Q12

U23

U28 (10K)

R32 10K

P3-18 KRØ

P3-43 KR1

P3-19 KR2

P3-44 KR3

P3-20 KR4

P3-45 KR5

P3-21 KR6

P3-46 KR7

P1-35 KR8

P1-10 KR9

P1-34 KR1Ø

P1-9 KR11

12

Ⓓ ROTARY PULSE GENERATOR (RPG) CONTROL

P2-29 U14-4

P2-28 LREQ

P2-9 LC8Z

P2-25 LHBZ

RPG SIGN

U6A

U14

RPG REQUEST

U6B

R37 10K

R8 464K

C3 0.18

C2 .01

EXT TMC

GND

RPG RESET

P3-41 RPG Ø2

P3-42 RPG Ø1

C16 220 pF

U5C

U5A

R18 10K

RPG COUNTER

RPG ENABLE

U4B

U16

U34

U19

U30

U13

U12

BUS GATE

COUNTER

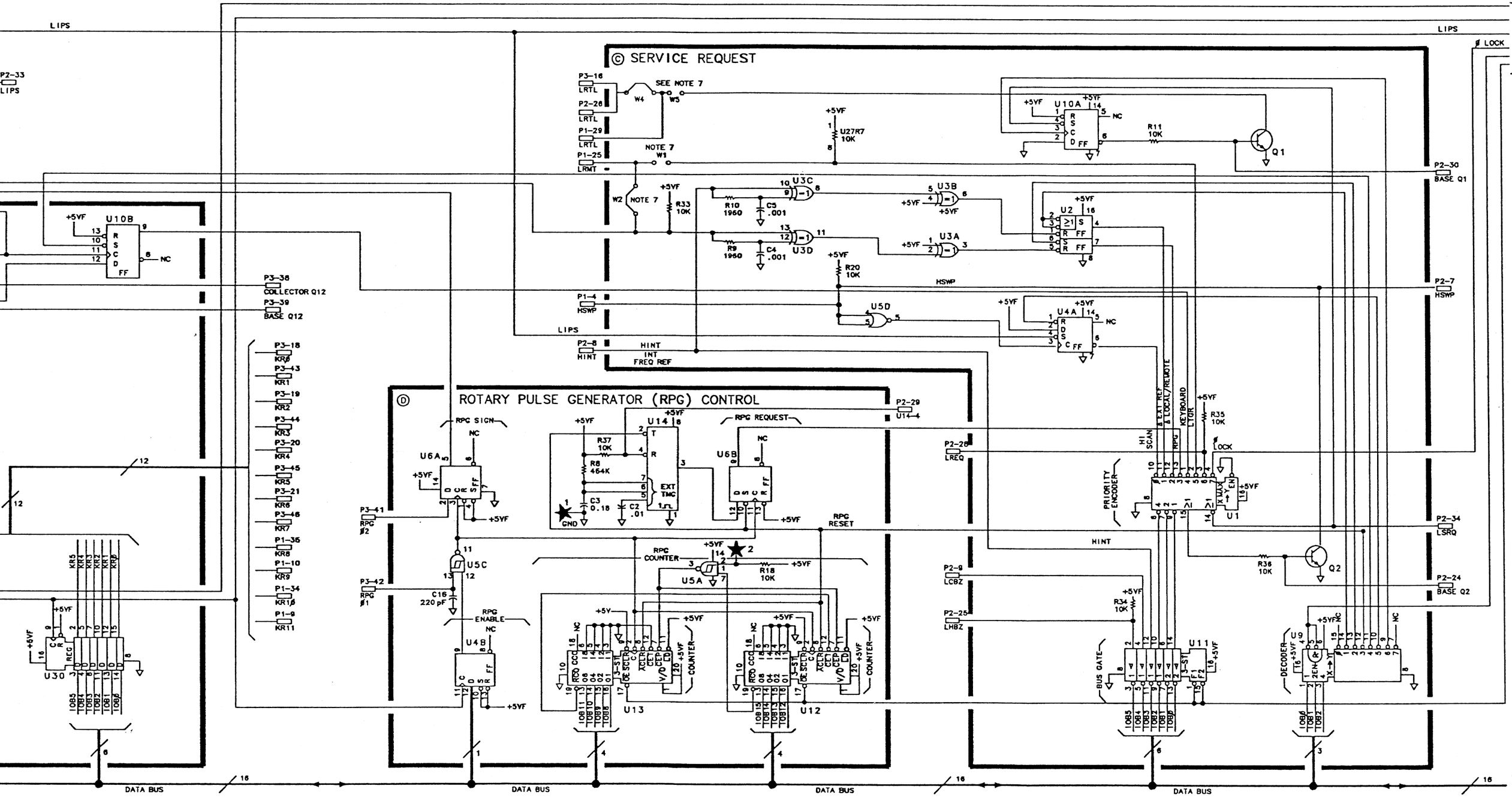
DATA BUS

16

6

1

4

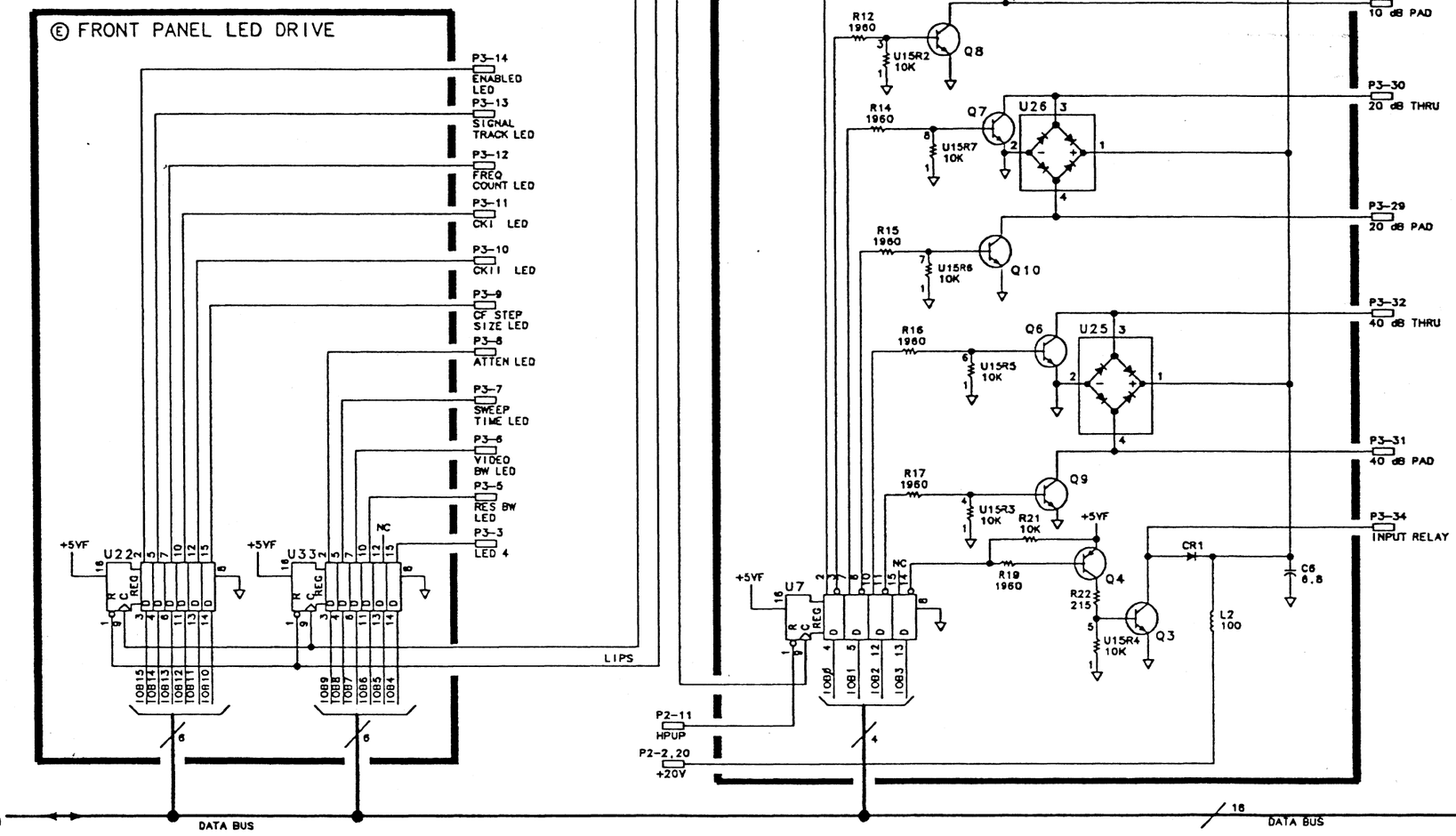


A12

A12 RF SECTION INTERFACE, SCHEMATIC DIAGRAM (1 OF 2)

A12 RF SECTION INTERFACE 85680-60168 (SERIAL PREFIXES: 2408A-2431A) (SHEET 2 OF 2)

FROM SHEET 1
LIPS
⌀ LOCK



LOCK

P3-28
10 dB THRU

P3-33
+20V

P3-27
10 dB PAD

P3-30
20 dB THRU

P3-29
20 dB PAD

P3-32
40 dB THRU

P3-31
40 dB PAD

P3-34
INPUT RELAY

ⓖ PHASE LOCK FLAGS

P2-13 HUL1 — YTO UNLOCKED — CR2
P2-6 HUL2 — 249 MHz LOOP UNLOCKED — CR3
P2-14 HTVL — YTO TUNE VOLTAGE LOW — CR4
P2-15 HTVH — YTO TUNE VOLTAGE HIGH — CR5
P2-10 HUL3 — 275 MHz LOOP UNLOCKED — CR6
P2-32 HOVC — OVEN COLD — CR7

+5VF

U20B

U31A

U32B

U31B

U20D

U32A

U21 — 74LS273 — R C REG

IO8I5 IO8I4 IO8I3 IO8I2 IO8I1 IO8I0

8

16 DATA BUS

ⓗ ADDRESS DECODER

P2-5 LLDD (249 LOAD)

U18 — 74LS138 — EN

U29B

U29A

P1-39 ADR0
P1-14 ADR1
P1-38 ADR2
P1-27 LB10
P1-37 ADR4
P1-13 ADR3

DATA BUS

ⓘ OPTIONS

INPUT 1	REMO
50Ω	NON
75Ω	D (
INPUT 1 ABSENT	D &

PREAMP PRESENT	REMO
NO	NON
YES	A (F

+5VF U35 (22K)

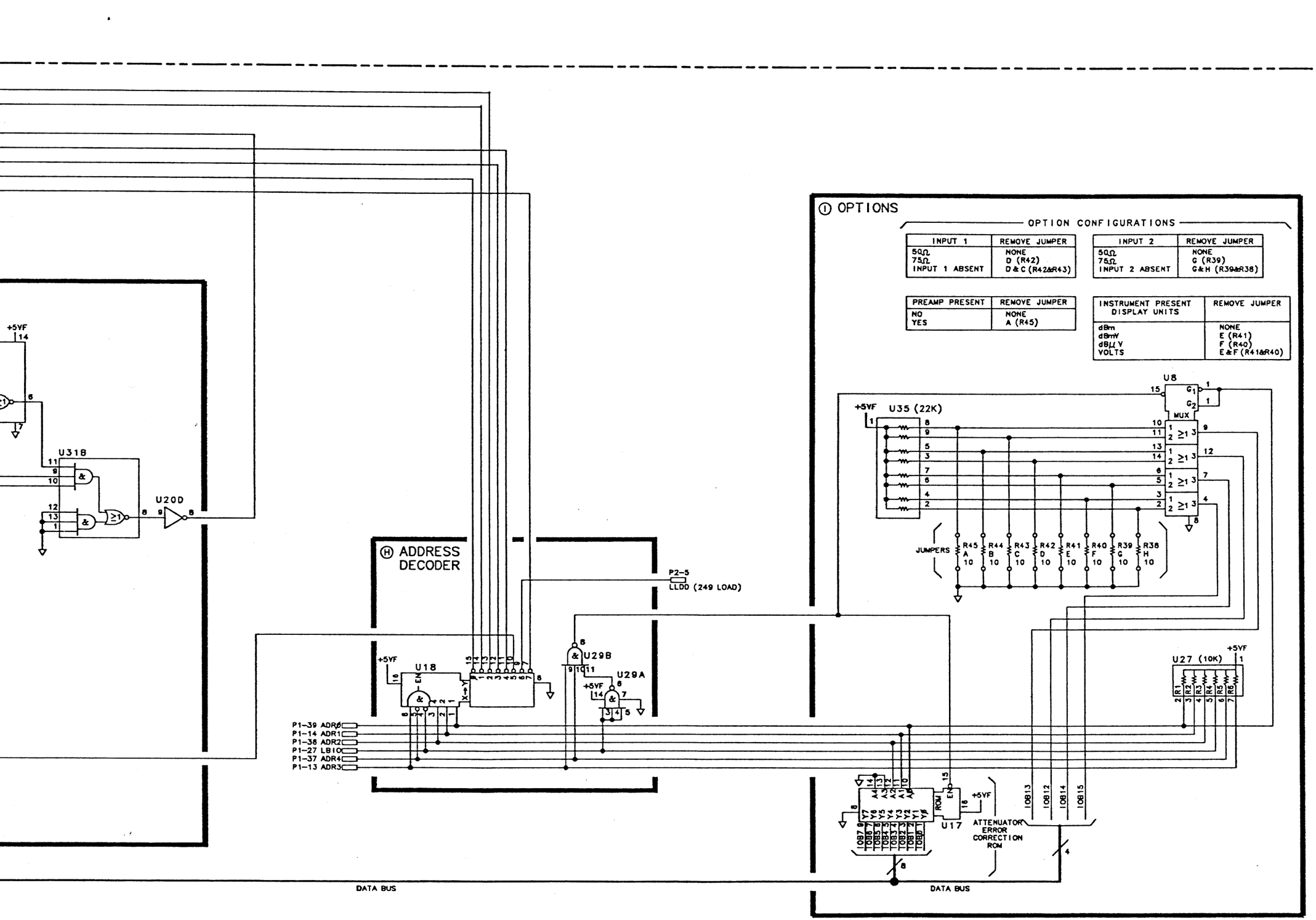
JUMPERS R45 A 10 R44 B 10

U17 — 74LS471 — ROM

IO87 IO86 IO85 IO84 IO83 IO82 IO81 IO80

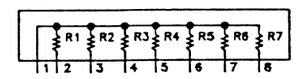
ATTENUATOR ERROR CORRECTION ROM

DATA BUS

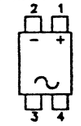


NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IS IN OHMS (Ω)
   CAPACITANCE IS IN MICROFARADS(µF)
   INDUCTANCE IS IN MICROHENRIES(µH)
3. UNLESS OTHERWISE INDICATED:
   LOGIC LEVELS ARE TTL:
   2.0V TO +5.0V = LOGIC 1 = HIGH
   0V TO +0.8V = LOGIC 0 = LOW
4. PIN CONFIGURATION FOR U15,27,28 (10K)



5. U24,25,26: FULL WAVE RECTIFIER PACKAGES



TOP VIEW

6. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
LBIO	LOW=BOTTOM BOX I/O STROBE
HPUP	HIGH=POWER UP
HUL1	HIGH=YTO LOOP UNLOCKED
HUL2	HIGH=249 MHz LOOP UNLOCKED
HUL3	HIGH=275 MHz LOOP UNLOCKED
HTVL	HIGH=YTO TUNE VOLTAGE LOW
HTVH	HIGH=YTO TUNE VOLTAGE HIGH
HINT	HIGH=INTERNAL FREQ REF
HOVC	HIGH=FREQ REF OVEN COLD
LLDD	LOW=LOAD 249 DIVIDER NUMBERS
LRTL	LOW=RETURN TO LOCAL
LTGR	LOW=TRACKING GENERATOR REQUEST
HSWP	HIGH=SWEEPING
CKI	CHECK ONE } FRONT PANEL
CKII	CHECK TWO } CHECK LEDS
VBW	VIDEO BANDWIDTH
RBW	RESOLUTION BANDWIDTH
RPG Ø1	ROTARY PULSE GENERATOR ONE } FRONT PANEL
RPG Ø2	ROTARY PULSE GENERATOR TWO } DATA CONTROL
LSTP	LOW=STOP PROCESSOR

7. JUMPERS W1-W5 MAY BE CHANGED TO CONVERT THE 85680B RF SECTION INTERFACE BOARD (85680-60168) TO THE 85680A RF SECTION INTERFACE BOARD (85680-60170). FOR THE FOR THE 85680-60170, W1 AND W5 ARE INSTALLED; W2, W3, AND W4 ARE REMOVED. THESE JUMPERS ARE LOCATED IN FUNCTION BLOCKS A AND C.
8. U58 AND U20A ARE NOT USED.

A 12

A12 RF SECTION INTERFACE, SCHEMATIC DIAGRAM (2 OF 2)

A12 RF SECTION INTERFACE (SHEET 1 OF 2)

85680-6018[illegible]

(SERIAL PR[illegible]IX: 2445A)

P1

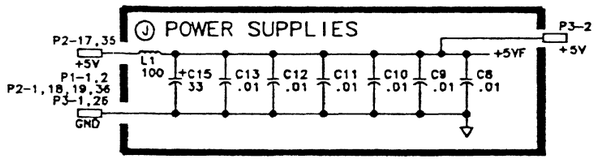
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		J
26	LTIØ	A15P1-1	NC
2	GND		J
27	LBIØ	A15P1-2	H
3	NC		
28	NC		
4	HSWP	A15P1-29	C
29	LRTL	A15P1-4	C
5	KC7	A15P1-30	A
30	KC6	A15P1-5	A
6	KC5	A15P1-31	A
31	KC4	A15P1-6	A
7	KC3	A15P1-32	A
32	KC2	A15P1-7	A
8	KC1	A15P1-33	A
33	KCØ	A15P1-8	A
9	KR11	A15P1-34	A
34	KR1Ø	A15P1-9	A
10	KR9	A15P1-35	A
35	KR8	A15P1-10	A
11	NC		
36	NC		
12	LADR	A15P1-37	A
37	ADR4	A15P1-12	H
13	ADR3	A15P1-38	H
38	ADR2	A15P1-13	H
14	ADR1	A15P1-39	H
39	ADRØ	A15P1-14	H
15	NC		
40	NC		
16	NC		
41	NC		
17	10B15	A15P1-42	D
42	10B14	A15P1-17	A, D
18	10B13	A15P1-43	A, D
43	10B12	A15P1-18	A, D
19	10B11	A15P1-44	A, D
44	10B10	A15P1-19	A, D
20	10B9	A15P1-45	A, D
45	10B8	A15P1-20	A, D
21	10B7	A15P1-46	A
46	10B6	A15P1-21	A
22	10B5	A15P1-47	A, C
47	10B4	A15P1-22	A, C
23	10B3	A15P1-48	A, C
48	10B2	A15P1-23	A, C
24	10B1	A15P1-49	A, C
49	10BØ	A15P1-24	A, C
25	LRMT	A15P1-50	A, C
50	NC		

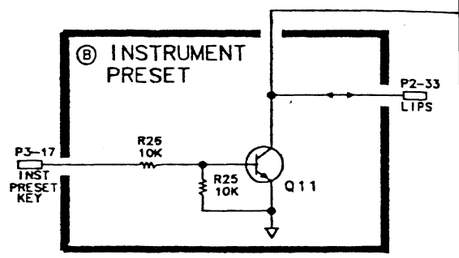
P2

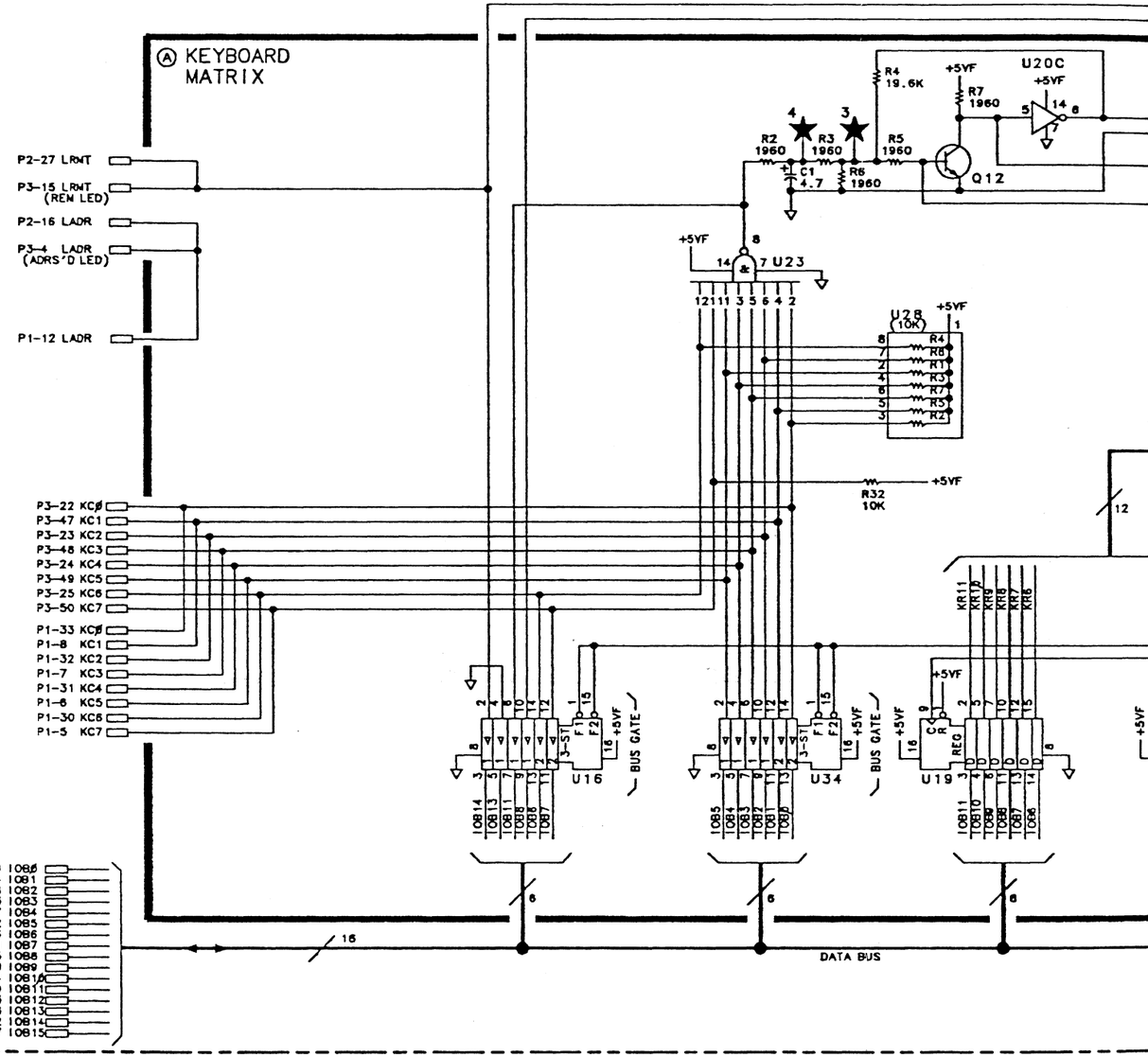
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		J
19	GND		J
2	+20V		F
20	+20V		F
3	+12V		NC
21	+12V		NC
4	+12V		NC
22	+12V		NC
5	LLDO	A8P2-8	H
23	NC		
6	HUL2	A8P2-1	G
24	BASE Q2	NC	C
7	HSWP	A22P3-1,16	C
25	LHBZ	NC	C
8	HINT	A24P2-9	C
26	LRTL	NC	C
9	LCBZ	A17P1-1	C
27	LRMT	NC	A
10	HUL3	A21P1-1	G
28	LREQ	NC	C
11	HPUP	A24P2-12	F
29	U14-4	NC	D
12	NC		
30	BASE Q1	NC	NC
13	HUL1	A6P2-2	G
31	NC		
14	HTVL	A22P2-1	G
32	HOVC	A24P2-10	G
15	HTVH	A22P2-11	G
33	LIPS	A15P2-33	B
16	LADR	NC	A
34	LSRQ	A15P2-34	C
17	+5V		J
35	+5V		J
18	GND		J
36	GND		J

P3

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND	A5A1J1-2	J
26	GND	A5A1J1-2	J
2	+6V	A5A1J1-4	J
27	10 dB PAD	A5A1J1-3	F
3	LED 4		E
28	10 dB THRU	A5A1J1-5	F
4	LADR (ADRS'D LED)	A5A1J1-8	A
29	20 dB PAD	A5A1J1-7	F
5	RES BW LED	A5A1J1-10	E
30	20 dB THRU	A5A1J1-9	F
6	VIDEO BW LED	A5A1J1-12	E
31	40 dB PAD	A5A1J1-11	F
7	SWEEP TIME LED	A5A1J1-14	E
32	40 dB THRU	A5A1J1-13	F
8	ATTEN LED	A5A1J1-16	E
33	+20V	A5A1J1-15	F
9	CF STEP SIZE LED	A5A1J1-18	E
34	INPUT RELAY	A5A1J1-17	F
10	CK11	A5A1J1-20	E
36	NC		
11	CKI LED	A5A1J1-22	E
36	NC		
12	FREQ COUNT LED	A5A1J1-24	E
37	NC		
13	SIGNAL TRACK LED	A5A1J1-26	E
38	COLLECTOR Q12		A
14	ENABLED LED	A5A1J1-28	E
39	BASE Q12		A
15	LRMT (REM LED)	A5A1J1-30	A
40	NC		
16	LRTL	A5A1J1-32	C
41	RPG Ø2	A5A1J1-31	D
17	INST PRESET KEY	A5A1J1-34	B
42	RPG Ø1	A5A1J1-33	D
18	KRØ	A5A1J1-36	A
43	KR1	A5A1J1-36	A
19	KR2	A5A1J1-38	A
44	KR3	A5A1J1-37	A
20	KR4	A5A1J1-40	A
45	KR5	A5A1J1-39	A
21	KR6	A5A1J1-42	A
46	KR7	A5A1J1-41	A
22	KCØ	A5A1J1-44	A
47	KC1	A5A1J1-43	A
23	KC2	A5A1J1-46	A
48	KC3	A5A1J1-45	A
24	KC4	A5A1J1-48	A
49	KC5	A5A1J1-47	A
25	KC6	A5A1J1-50	A
50	KC7	A5A1J1-49	A







SUPPLIES

P3-2 +5V

+5VF

C13 .01 C12 .01 C11 .01 C10 .01 C9 .01 C8 .01

LIPS

Ⓑ INSTRUMENT PRESET

P3-17 INST PRESET KEY

R26 10K

R25 10K

Q11

P2-33 LIPS

Ⓒ SERVICE REQUEST

P3-16 LRTL

P2-26 LRTL

P1-29 LRTL

P1-25 LRMT

+5VF

R33 10K

R11 31.6

C18 .001

U3C

R10 1960

C5 .001

U3B

R9 511

C4 .001

U3D

U3A

R20 10K

HSWP

U5D

P1-4 HSWP

LIPS

P2-8 HINT

HINT INT FREQ REF

DARD IX

R4 19.6K

R7 1960

U20C

U10B

R2 1960

R3 1960

R5 1960

C1 4.7

R6 1960

Q12

P3-38 COLLECTOR Q12

P3-39 BASE Q12

U23

P3-18 KR0

P3-43 KR1

P3-19 KR2

P3-44 KR3

P3-20 KR4

P3-45 KR5

P3-21 KR6

P3-46 KR7

P1-35 KR8

P1-10 KR9

P1-34 KR10

P1-9 KR11

U28 (10K)

R32 10K

12

Ⓓ ROTARY PULSE GENERATOR (RPG) CONTROL

RPG SIGN

U6A

U14

RPG REQUEST

P2-29 U14-4

P2-28 LREQ

R37 10K

R8 464K

C3 0.18

C2 .01

EXT TMC

U6B

RPG RESET

P3-41 RPG Ø2

P3-42 RPG Ø1

U5C

C16 100 pF

RPG ENABLE

U4B

RPG COUNTER

U5A

R18 10K

P2-9 LCBZ

P2-25 LHBZ

U16

U34

U19

U30

U13

U12

BUS GATE

COUNTER

DATA BUS

16

LIPS

LIPS

TO SHEET 2

ϕ LOCK

© SERVICE REQUEST

P3-16 LRTL
P2-26 LRTL
P1-29 LRTL
P1-25 LRMT

+5VF R33 10K
R11 31.6 C18 .001
R10 1960 C5 .001
R9 511 C4 .001
U3C U3D U3B U3A

+5VF R20 10K
HSWP
P1-4 HSWP
P2-7 HSWP

U5D

LIPS
P2-8 HINT
HINT
INT FREQ REF

U10B U10A U2 U4A

+5VF U27R7 10K

P3-38 COLLECTOR Q12
P3-39 BASE Q12

P3-18 KR0
P3-43 KR1
P3-19 KR2
P3-44 KR3
P3-20 KR4
P3-45 KR5
P3-21 KR6
P3-46 KR7
P1-35 KR8
P1-10 KR9
P1-34 KR10
P1-9 KR11

12

KR5 KR4 KR3 KR2 KR1 KR0

U30 REG

1085 1084 1083 1082 1081 1080

6

Ⓓ ROTARY PULSE GENERATOR (RPG) CONTROL

RPG SIGN
U6A
P3-41 RPG Ø2
P3-42 RPG Ø1
C16 100 pF
RPG ENABLE
U4B
U5C

U14
R37 10K
R8 464K
C3 0.18
C2 .01
EXT TMG
GND

RPG REQUEST
U6B

RPG COUNTER
U5A
R18 10K
RPG RESET

P2-29 U14-4
P2-28 LREQ

U13 U12

1 4 4

DATA BUS 16

HI SCAN
A EXT REF
A LOCAL/REMOTE
KEYBOARD
LTGR

R35 10K
LOCK

PRIORITY ENCODER
U1

HINT
P2-9 LCBZ
P2-25 LHBZ

R36 10K
R21 10K
Q2

P2-34 LSRQ
P2-24 BASE Q2

R34 10K

BUS GATE
U11

U9 DECODER

1085 1084 1083 1082 1081 1080
1086 1083 1082

6 3

DATA BUS 16

TO SHEET 2

A12

A12 RF SECTION INTERFACE, SCHEMATOC DIAGRAM (1 OF 2)

A12 RF SECTION INTERFACE 85680-60181 (SERIAL PREFIX: 2445A) (SHEET 2 OF 2)

FROM SHEET 1
- LIPS
- ∮ LOCK

∮ LOCK

Ⓔ FRONT PANEL LED DRIVE

- P3-14 ENABLED LED
- P3-13 SIGNAL TRACK LED
- P3-12 FREQ COUNT LED
- P3-11 CKI LED
- P3-10 CKII LED
- P3-9 CF STEP SIZE LED
- P3-8 ATTEN LED
- P3-7 SWEEP TIME LED
- P3-6 VIDEO BW LED
- P3-5 RES BW LED
- P3-3 LED 4

U22, U33: 74LS374 (+5VF, REG, NC)

LIPS

Ⓕ RF ATTENUATOR (ATTEN) DRIVE

U15: 74LS244 (+20V)

- P3-33 +20V
- P3-28 10 dB THRU
- P3-27 10 dB PAD
- P3-30 20 dB THRU
- P3-29 20 dB PAD
- P3-32 40 dB THRU
- P3-31 40 dB PAD
- P3-34 INPUT RELAY

U7: 74LS374 (+5VF, NC)

- C14 .01
- R12 10K
- P2-11 HPUP
- CR1
- C19 .001
- P2-2,20 +20V
- C6 6.8
- L2 100

Ⓖ PHASE LOCK FLAGS

- P2-13 HUL1 — YTO UNLOCKED — CR2
- P2-6 HUL2 — 249 MHz LOOP UNLOCKED — CR3
- P2-14 HTVL — YTO TUNE VOLTAGE LOW — CR4
- P2-15 HTVH — YTO TUNE VOLTAGE HIGH — CR5
- P2-10 HUL3 — 275 MHz LOOP UNLOCKED — CR6
- P2-32 HOVC — OVEN COLD — CR7

+5VF, U20B, U31A, U32B, U32A

U21: 74LS374 (+5VF)

FROM SHEET 1 — 16 DATA BUS

16 DATA BUS

16 DATA BUS

LOCK

P3-33 +20V

P3-28 10 dB THRU

P3-27 10 dB PAD

P3-30 20 dB THRU

P3-29 20 dB PAD

P3-32 40 dB THRU

P3-31 40 dB PAD

P3-34 INPUT RELAY

© PHASE LOCK FLAGS

P2-13 HUL1 — YTO UNLOCKED — CR2

P2-6 HUL2 — 249 MHz LOOP UNLOCKED — CR3

P2-14 HTVL — YTO TUNE VOLTAGE LOW — CR4

P2-15 HTVH — YTO TUNE VOLTAGE HIGH — CR5

P2-10 HUL3 — 275 MHz LOOP UNLOCKED — CR6

P2-32 HOVC — OVEN COLD — CR7

+5VF

U20B

U31A

U32B

U31B

U20D

U32A

U21 — 74LS374 — REG

T0B15 T0B14 T0B13 T0B12 T0B11 T0B10

16

DATA BUS

Ⓗ ADDRESS DECODER

P2-5 LLDO (249 LOAD)

U18 — 74LS138

U29B — 74LS08

U29A — 74LS08

P1-39 ADR0
P1-14 ADR1
P1-38 ADR2
P1-27 LB10
P1-37 ADR4
P1-13 ADR3

C17 .001

R46 162

DATA BUS

① OPTIONS

INPUT 1	REMOVE
50Ω	NONE
75Ω	D (R42
INPUT 1 ABSENT	D&C (

PREAMP PRESENT	REMOVE
NO	NONE
YES	A (R45

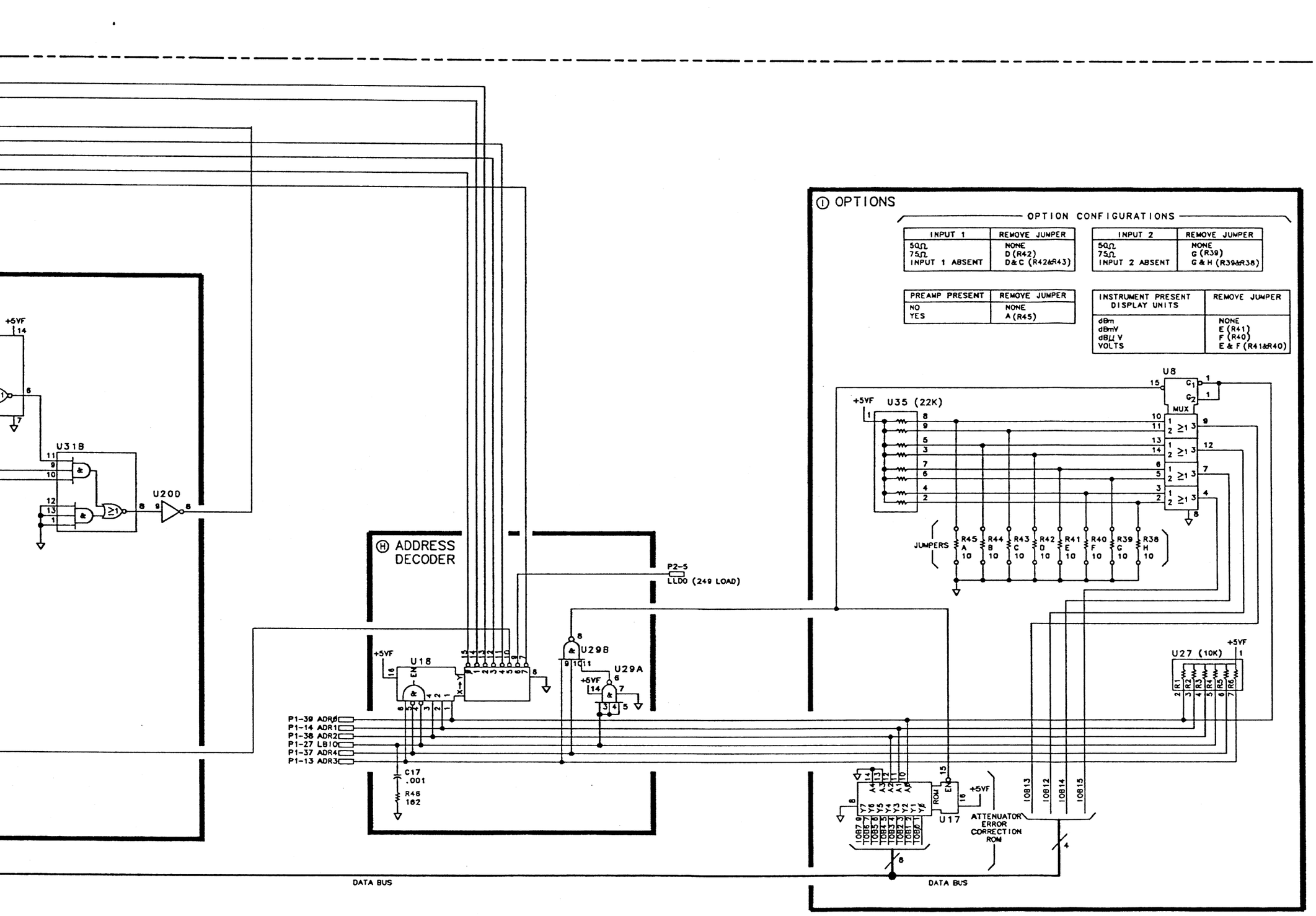
+5VF U35 (22K)

JUMPERS R45 A 10 R44 B 10 R43 C 10

U17 — ATTENUATOR ERROR CORRECTION ROM

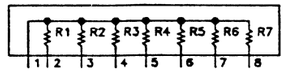
T0B7 T0B6 T0B5 T0B4 T0B3 T0B2 T0B1 T0B0

DATA BUS



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IS IN OHMS (Ω)
   CAPACITANCE IS IN MICROFARADS(µF)
   INDUCTANCE IS IN MICROHENRIES(µH)
3. UNLESS OTHERWISE INDICATED:
   LOGIC LEVELS ARE TTL:
   2.0V TO +5.0V = LOGIC '1' = HIGH
   0V TO +0.8V = LOGIC '0' = LOW
4. PIN CONFIGURATION FOR U27 AND U28 (10K)



5. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
LBIO	LOW=BOTTOMBOX I/O STROBE
HPUP	HIGH=POWER UP
HUL1	HIGH=YTO LOOP UNLOCKED
HUL2	HIGH=249 MHz LOOP UNLOCKED
HUL3	HIGH=275 MHz LOOP UNLOCKED
HTVL	HIGH=YTO TUNE VOLTAGE LOW
HTVH	HIGH=YTO TUNE VOLTAGE HIGH
HINT	HIGH=INTERNAL FREQ REF
HOVC	HIGH=FREQ REF OVEN COLD
LLDO	LOW=LOAD 249 DIVIDER NUMBERS
LRTL	LOW=RETURN TO LOCAL
LTGR	LOW=TRACKING GENERATOR REQUEST
HSWP	HIGH=SWEEPING
CKI	CHECK ONE } FRONT PANEL
CKII	CHECK TWO } CHECK LEDS
VBW	VIDEO BANDWIDTH
RBW	RESOLUTION BANDWIDTH
RPG ø1	ROTARY PULSE GENERATOR ONE } FRONT PANEL
RPG ø2	ROTARY PULSE GENERATOR TWO } DATA CONTROL
LSTP	LOW=STOP PROCESSOR

6. U20A AND U5B ARE NOT USED.

A 12

A12 RF SECTION INTERFACE, SCHEMATIC DIAGRAM (2 OF 2)

A15

A15 Controller, Circuit Description

The A15 Controller Assembly performs the main control functions of the spectrum analyzer. The board includes a 16-bit microprocessor (the instrument's main processor), read-only memory (ROM's), random-access memory (RAMs), and HP-IB circuitry.

The schematic shows how the main processor, memory, HP-IB, and other circuits on the A15 Controller assembly are interconnected via the microprocessor's 23-bit address bus and the 16-bit data bus. To control signal flow on these buses, various signals must be derived from the address bus signals and the microprocessor's remaining output signals. These control signals are generated by two programmable-array-logic integrated circuits (PALs) and other discrete logic (R/W DECODE, ADDRESS DECODER AND DTACK, ADDRESS DECODE, and LTI0/LPIO blocks). The signals are used by the microprocessor to control data flow and address decoding on the A15 Controller assembly and to control signal flow over the Instrument Bus.

The 16-bit, 8 MHz MC68000 microprocessor is the main processor used to control the spectrum analyzer. It receives input through the front-panel keyboard or from HP-IB, performs the necessary decoding and calculations, and outputs the proper control signals to execute a specific spectrum analyzer operation. Typical main processor tasks include phase-locking the YTO, selecting the correct sweep time and frequency span, setting the IF-Display Section resolution bandwidth and sensitivity, and displaying the current control settings on the CRT through the A3 Digital Storage section. Instructions that tell the microprocessor how to accomplish these tasks, the firmware, are stored in ROMs located on the A15 Controller assembly. In addition, custom commands and programming can be down-loaded into RAM, permitting specialized operation without requiring a dedicated controller.

The microprocessor performs a brief power-on pretest (POP) at instrument turn-on, verifying operation of critical circuits and lighting front-panel check LEDs I and II. In addition, LEDs located on the top edge of the A15 Controller assembly provide information to help identify particular faulty circuit components should a failure occur.

The instrument's main memory consists of read-only memory (ROM) and random-access memory (RAM), which are located on the A15 Controller assembly. Each 16-bit word in memory is composed of two 8-bit bytes. The ROM, used to provide permanent storage of the firmware, is composed of four 32K-byte erasable programmable read-only memories (EPROMs). This provides a total of 64K-words of ROM. The RAM, used for erasable storage of custom instructions and programs, is composed of four 8K-byte static CMOS memory integrated circuits for a total of 16K-words of RAM. A lithium battery located on the A15 Controller assembly provides battery back-up power to the CMOS RAM to preserve the contents of memory when power is removed from the instrument. The typical in-circuit life expectancy of the non-rechargeable battery is at least 3 years.

The HP-IB allows the spectrum analyzer to communicate with external devices. It is implemented using four ICs: A data latch, an HP-IB processor, and two bus transceivers.

The A15 Controller clock circuit generates an 8-MHz clock signal for the 16-bit microprocessor and a synchronous 4-MHz clock signal for the HP-IB processor. The appropriate clock frequency is derived from division of the output signal of a 14.7456 MHz hybrid crystal clock oscillator.

The A15 Controller assembly firmware includes extensive diagnostics, which are executed whenever the instrument is powered up or INSTR PRESET is pressed; the microprocessor executes a self-test routine and indicates the results via LEDs. A memory failure, microprocessor failure, or Instrument Bus failure can usually be pinpointed to the failed component using these indicators.

HP-IB Address Switch

The position of the address switch on the A15 Controller (A15SW1) determines what read/write address is used by the analyzer when the line power is turned on.

The address switch is preset to 31 (switches A1 through A5 pressed up) at the factory. If the CMOS backup battery is not discharged, the last read/write address used by the analyzer is active with power on. If the backup battery is discharged, the analyzer will default to a read/write address of 18 with power on.

If the address switch is set to any address from 0 to 30, this address will be used as the read/write address by the analyzer with power on.

Switch A6 is also set in the "up" position (logic 1) at the factory. A6 in this position does a checksum verification of the two pairs of ROMs on the A15 Controller as part of the self-test routine with power on.

HP-IB Signal Ground (A29)

The A29 assembly provides chassis ground for the HP-IB shield. Pins 12 and 18 through 24 of the HP-IB connector J2 are immediately grounded to the chassis upon entering the instrument.

HP-IB Address Labels

HP-IB address labels are available by ordering HP Part Number 7120-6853. (See Figure 1). These labels allow easy reference to the HP- IB address of each system component.

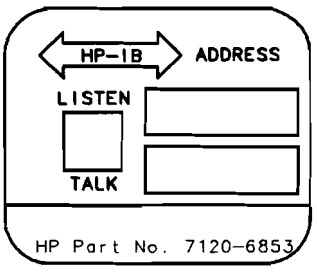


Figure 1. HP-IB Address Label

A15 Controller, Troubleshooting

Troubleshooting the A15 Controller is divided into two levels:

Level 1 is Self Test which uses the built-in diagnostics of the spectrum analyzer to isolate the failure. No external test equipment is required.

Level 2 is Manual Tests which require the use of general troubleshooting equipment, such as digital voltmeter and oscilloscope. This level is required when the Self Test can't isolate the failure.

Level 1 Self Test

The Self Test is run on power-up and after pushing INSTR PRESET. Two front-panel LEDs, INSTR CHECK I and II, give an indication of Self Test results (without removing any covers from the instrument). There are also 15 LEDs on the A15 Controller assembly (DS1 through DS15) that will help isolate a problem.

Front Panel INSTR I and II LEDs

The two red INSTR CHECK LEDs are forced on whenever the instrument is turned on or INSTR PRESET is pushed. The main processor then performs a check of itself, a checksum verification of all ROMs on the A15 Controller, a partial check of the Instrument Bus (50-wire bus), and a read-write check of the RAMs and A34A Memory in the IF-Display Section.

If all the checks pass, both INSTR CHECK LEDs are turned off. If all the checks fail, one or both INSTR CHECK LEDs remain on.

a. **Both INSTR CHECK LEDs** on indicates a problem on the A15 Controller. First remove the A15 Controller and make sure that the 50-wire ribbon cable and HP-IB ribbon cable are pressed all the way onto A15J1 and A15J2 connectors. Reinstall A15 Controller. If both front panel INSTR CHECK LEDs still remain on when instrument is turned on, follow procedure under A15 Controller Self Test.

b. **Left LED (INSTR CHECK I)** on indicates a failure occurred when checking Digital Storage Memory (A3A4). First check to ensure that a LINE power cord is connected to the IF-Display Section. Also check to see that the rear-panel Analyzer Bus Interconnect Cable, W31, is properly connected. If INSTR CHECK I still remains on when instrument is turned on, troubleshoot the A3 Digital Storage in the IF-Display Section.

c. **Right LED (INSTR CHECK II)** on indicates a failure occurred during the partial check of the Instrument Bus.

Note



The partial interface check reads the key column lines (KC0 through KC7) from the A1 and A5 front panels. If any front panel key is shorted or stuck closed, INSTR CHECK II LED should remain on after the Self Test is completed. This part of the Self Test can easily be verified by pushing any key, except LCL, and holding the key in while pushing INSTR PRESET. If the I/O interface check routine is working, INSTR CHECK II LED will stay on.

d. Suspected digital failure but no INSTR CHECK LEDs on may indicate a RAM or I/O bus failure which is not checked in the normal Self Check or "POP" (Power on Preset). If the two front-panel INSTR CHECK LEDs turn on when LINE switch is set to ON, and within

a few seconds turn off (indicating no digital problems), but symptoms (such as improper CRT display or improper response to particular commands) indicate that the problem is in the digital area, a "LONG POP" can be performed. LONG POP is very similar to the normal POP except an additional processor check is performed, all of the RAM locations in Digital Storage (A3A4 Memory) are checked, and the memory (RAM) on the A15 Controller is verified.

Since these more extensive checks require altering information that has been stored in RAM, LONG POP requires an internal jumper. To perform a LONG POP, set LINE switch to STANDBY and jumper A15TP1-9 (ST) to A15TP1-7 (T3). For early versions of A15 Controller, jumper A15TP4 (STS) to A15TP1-7 (T3). (Refer to A15 component locations diagram for location of test points). When LINE switch is then set to ON, the two red INSTR CHECK LEDs are forced on and the main processor steps through the Self Test routine, expanding the normal POP by the additional tests mentioned. The expected results for a LONG POP are exactly the same as for the normal POP of INSTR PRESET as described in paragraphs a, b, and c under "Front Panel INSTR CHECK I and II LEDs".

Because LONG POP is a "destructive test" (it alters any information that has been stored in RAM), it should be performed only as a last resort effort in troubleshooting what appears to be a memory- or processor-related problem.

A15 Controller Self Test

The A15 Controller Self Test is run on power-up and after pushing INSTR PRESET. Fourteen LEDs (A15DS1 through A15DS14) on the A15 Controller Assembly give an indication of the self test results. All fourteen LEDs are forced on whenever the instrument is turned on or INSTR PRESET is pushed. The main processor (A15U26) then performs a check of itself, a check of the Peripheral Interface and Timer chip, a checksum verification of all the ROMs on the A15 Controller, a read-write check of the RAMs on the A15 Controller, and an Instrument Bus check that checks the I/O Bus, and Data Bus for stuck lines.

If all the checks pass, the fourteen LEDs are turned off serially as each check is completed. If the checks fail, one or more LEDs remain on. Refer to Self Test Fail Indicators Table at the end of this troubleshooting section.

Other failure modes to look for are:

a. The fourteen LEDs do not turn on when the spectrum analyzer is turned on or INSTR PRESET is pushed.

b. The fourteen LEDs turn on but are all turned off at the same time (instead of sequentially). The Peripheral Interface and Timer chip has most likely failed.

c. When an I/O failure is indicated (DS3, DS4, or a combination of these LEDs remain on), it may become necessary to use an oscilloscope to locate a stuck line. Hint: Try replacing U20 and U42 PALs first, then try replacing U39 and U40 ROMs. If I/O failure still occurs, probe I/O lines with oscilloscope.

Level 2 Manual Tests

If the Self Test does not lead to a failed component, it will be necessary to use a DVM and/or oscilloscope. The following procedure may help locate the failed component:

a. Check all power supply voltages that supply power to the A15 Controller.

b. Check processor clock by connecting oscilloscope to A15TP2-4 (CK). The clock frequency should be approximately 7.36 MHz. The amplitude should be approximately +5 V (HIGH) and 0 V (LOW). Also check for LCLK at pin 7 of A15U27B.

c. Check HP-IB clock at pin 5 of A15U27A. The HP-IB clock frequency should be approximately 3.68 MHz. The amplitude should be approximately +5 V (HIGH) and 0 V (LOW).

d. Some intermittent failures may require the use of heat (hair dryer) or cold (freeze mist) to isolate the failure.

Caution



Care should be exercised to avoid getting components too hot. Excessive heat may cause permanent damage of good components. Also, avoid spraying freeze mist directly on PC boards. Failures due to high-resistance paths between traces on PC boards have been caused by spraying the boards with freeze mist.

Table 1-1. A15 Controller Self Test Fail Indicators

A15 LED On	Affected Circuitry	Probable Failure
DS1	Processor	A15U26
DS2	Top Box Address	Use oscilloscope to isolate failure.
DS3	Bottom Box Address	Use oscilloscope to isolate failure.
DS4	I/O, Data Bus	Use oscilloscope to isolate failure
DS5	RAM	A15U18
DS6	RAM	A15U15
DS7	RAM	A15U17
DS8	RAM	A15U14
*DS9	ROM	A15U19
*DS10	ROM	A15U16
DS11	ROM	A15U39
DS12	ROM	A15U37
DS13	ROM	A15U40
DS14	ROM	A15U38
†DS15	RAM	Power Supply (VRAM)

* A15U16 and A15U19 are loaded when 128K ROMs (set of 6) are installed.
A15U16 and A15U19 are not loaded when 256K ROMs (set of 4) are used.
†DS15 should normally stay on. If SD15 is not on, suspect power supply that supplies VRAM.

Table 1-2. Table of Firmware History for HP 85680B

Revision	Instrument Serial Numbers	EPROM	HP Part Number	Date Code
A	2408A00101	U16	85680-80052	28.3.84
	through	U19	85680-80053	
	2415A00484a	U37	85680-80054	
		U38	85680-80056	
		U39	85680-80055	
		U40	85680-80057	
B	2415A00485	U16	85680-80077	16.7.84
	through	U19	85680-80078	
	2445A00970	U37	85680-80079	
		U38	85680-80081	
		U39	85680-80080	
		U40	85680-80082	
C	2503A00971	U37	85680-80071	14.1.85
	through	U38	85680-80069	
	2601A02671	U39	85680-80072	
		U40	85680-80070	
D	2634A02672	U37	85680-80094	9.9.86
	through	U38	85680-80096	
	2714A03282	U39	85680-80095	
		U40	85680-80097	
E	2718A03283	U37	85680-80113	7.4.87
	and Above	U38	85680-80115	
		U39	85680-80114	
		U40	85680-80116	

HP Part Number 85680-60174

A15 Controller

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15	85680-60174	1	1	BOARD ASSEMBLY, CONTROLLER (SERIAL PREFIX: 2408A)	28480	85680-60174
A15BT1	1420-0331	3	1	BATTERY 3.6V 1.75A-HR LITHIUM THIONYL		15-51-04-410-000
A15C1	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C2	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C3	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C4	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C5	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C6	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C7	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C8	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C10	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C11	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C12	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C13	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C15	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C17	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C18	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C19	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C20	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C22	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C23	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C24	0160-4574	1	1	CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A15C25	0160-4535	4	1	CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4554
A15C29	0180-0100	2	1	CAPACITOR-FXD 4.7UF +-10% 100VDC CER	28480	0180-0100
A15C30	0180-0500	7	1	CAPACITOR-FXD 47UF +-20% 20VDC TA	28480	0180-0500
A15C31	0180-0197	8	2	CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A15C32	0180-0552	9	1	CAPACITOR-FXD 220UF +-20% 10VDC TA	28480	0180-0552
A15C33	0180-0197	8	1	CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A15C34	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A15CR1	1901-0620	3	1	DIODE-SWITCHING 60V 400MA DO-35	9N171	NDP250
A15CR2	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A15CR3	1901-0518	8	1	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A15CR4	1901-0620	3	1	DIODE-SWITCHING 60V 400MA DO-35	9N171	NDP250
A15DS1	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS2	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A14DS3	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS4	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS5	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A14DS6	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS7	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A14DS8	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS9	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS10	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A14DS11	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS12	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A14DS13	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958

**Indicates factory-selected value*

HP Part Number 85680-60174

A15 Controller

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15DS14	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A14DS15	1990-0957	6	1	LED-LAMP LUM-INT=1MCD IF=7MA-MAX BVR=5V	28480	1990-0957
A15E1	1251-4787	2	1	SHUNT-DIP 8-POSITION	28480	1251-4787
A15J1	1251-5926	3	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-5926
A15J2	1251-5905	8	1	CONNECTOR 24-PIN M POST TYPE	28480	1251-5905
A15J5	1251-5619	1	1	CONNECTOR 4-PIN M POST TYPE	28480	1251-5619
A15L1	9100-1788	6	1	CHOKE-WIDE BAND ZMAX=680/180MHZ	02114	VK200 20/48
A15L2	9100-1788	6	1	CHOKE-WIDE BAND ZMAX=680/180MHZ	02114	VK200 20/48
A15MP1	1251-8616	4	1	CONN-POST TYPE .150-PIN-SPACING 4-CONT	28480	1251-8616
A15MP3	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A15MP4	4040-0749	4	1	EXTR-PC BD BRN POLYC .062-BD-THKNS	28480	4040-0749
A15MP5	4040-0753	0	1	EXTR-PC BD GRN POLYC .062-BD-THKNS	28480	4040-0753
A15MP6				NOT ASSIGNED		
A15MP7	2200-0139	4	1	SCREW-MACH 4-40 .25-IN-LG PAN-HD POZI	28480	2200-0139
A15MP8	3050-0105	6	1	WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
A15MP9	2190-0003	8	1	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0003
A15MP10	2260-0001	5	1	NUT-HEX-DBL-CHAM 4-40-THD .094-IN-THK	28480	2260-0001
A15Q1	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A15R2	0757-0289	2	1	RESISTOR 13.3K 1% .05W F TC=0+-100	24546	C3-1/8-TO-3162-F
A15R3	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1962-F
A15R4	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1962-F
A15R5	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3481-F
A15R6	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A15R7	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A15R8	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1003-F
A15R9	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A15R10	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A15R11	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A15R12	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A15R13	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-TO-196R-F
A15R14	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A15R15	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-TO-825R-F
A15R16	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2871-F
A15R17	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1621-F
A15R18	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A15R19	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4641-F
A15R20	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3481-F
A15SW1	3101-2197	9	1	SWITCH-RKR DIP-RKR-ASSY 6-1A .05A 30VDC	28480	3101-2197
A15TP1	1251-8096	4	1	HEADER ASSY 7PIN	28480	1251-8096
A15TP2	1251-8616	4	1	HEADER ASSY 4PIN	28480	1251-8616
A15TP3	0360-1682	0	1	TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A15TP4	0360-1682	0	1	TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A15U1	1810-0446	8	1	NETWORK-RES 8-SIP 1.5K OHM X 7	11236	750-81-1.5K
A15U2	1810-0446	8	1	NETWORK-RES 8-SIP 1.5K OHM X 7	11236	750-81-1.5K
A15U3	1810-0446	8	1	NETWORK-RES 8-SIP 1.5K OHM X 7	11236	750-81-1.5K
A15U4	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A15U5	1820-3401	2	1	IC BFR TTL ALS OR QUAD 2-INP	28480	1820-3401
A15U6	1820-2551	1	1	IC-GENERAL PURPOSE INTERFACE BUS ADAPTER	28480	1820-2551

**Indicates factory-selected value*

HP Part Number 85680-60174
A15 Controller

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15U7	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A15U8	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A15U9	1820-3449	8	1	IC-PARALLEL INTERFACE/TIMER/8MHZ/MC68000	28480	1820-3449
A15U10	1820-2102	8	1	IC LCH TTL LS D-TYPE OCTL	01295	SN74LS373N
A15U11	1820-1997	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A15U12	1820-1208	3	1	IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A15U13	1820-1203	8	1	IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A15U14	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U14	1818-3305	0	0	ALTERNATE - IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U15	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U15	1818-3305	0	0	ALTERNATE - IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U16	85680-80077	5	1	EPROM-PROGRAMMED	28480	85680-80077
A15U17	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U17	1818-3305	0	0	ALTERNATE-IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U18	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U18	1818-3305	0	0	ALTERNATE-IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U19	85680-80078	6	1	EPROM-PROGRAMMED	28480	85680-80078
A15U20	5180-2330	0	1	IC16R4 PAL PRGMD	28480	5180-2330
A15U21	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U22	1820-2024	3	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A15U23	1810-0394	5	1	NETWORK-RES 8-SIP6.8K OHM X 7	01121	208A682
A15U24	1820-1851	2	1	IC ENCDR TTL LS	01295	SN74LS148N
A15U25	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U26	1820-2505	5	1	IC-MPU; CLK FREQ=8MHZ, INSTRUCTION	28480	1820-2505
A15U27	1820-3173	5	1	IC FF CMOS/74HC J-K NEG-EDGE-TRIG	28480	1820-3173
A15U28	1820-1281	2	1	IC DCDR TTL LS 2-TO-4-LINE DUAL 2-INP	01295	SN74LS139N
A15U29	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U30	1820-2483	8	1	IC RCVR TTL LS BUS OCTL	01295	SN75161N
A15U31	1820-3431	8	1	IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	28480	1820-3431
A15U32	1820-2675	0	1	IC RCVR TTL LS BUS OCTL	01295	SN74LS646N
A15U33	1810-0279	5	1	NETWORK-RES 10-SIP 4.7K OHM X 9	01121	210A472
A15U34	1820-1997	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A15U35	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A15U36	1820-2675	0	1	IC RCVR TTL LS BUS OCTL	01295	SN74LS646N
A15U37	85680-80079	7	1	EPROM PRGMD U37	28480	85680-80079
A15U38	85680-80081	1	1	EPROM PRGMD U38	28480	85680-80081
A15U39	85680-80080	0	1	EPROM PROG U39	28480	85680-80080
A15U40	85680-80082	2	1	EPROM PRGMD U40	28480	85680-80082
A15U41	1810-0344	5	1	NETWORK-RES 10-SIP6.8K OHM X 9	01121	210A682
A15U42	85680-80068	4	1	IC1618 PAL PRGMD	28480	85680-80068
A15U43	1826-0759	9	1	IC COMPARATOR GP QUAD 14-DIP-C PKG	04713	LM339J
A15U44	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U45	1820-3562	6	1	IC BFR TTL ALS INV HEX	28480	1820-3562
A15U46	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U47	1820-1208	3	1	IC GATE TTL L8 OR QUAD 2-INP	01295	SN74LS32N
A15U48	1826-0393	7	1	IC V RGLTR-ADJ-POS 1.2/37V TO-220 PKG	27014	LM317T
A15W1*	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005

**Indicates factory-selected value*

HP Part Number 85680-60174

A15 Controller

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15Y1	1813-0196	1	1	XTAL-CLOCK-OSCILLATOR 14.7456-MHZ	28480	1813-0196
A15Y1	1813-0129	0	0	XTAL-CLOCK-OSCILLATOR 14.7456-MHZ 0.01% (ALTERNATE PART FOR 1813-0196)	00815	HS-100(14.7456 MHZ)

**Indicates factory-selected value*

HP Part Number 85680-60180

A15 Controller

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15	85680-60180	9	1	BOARD ASSEMBLY, CONTROLLER (SERIAL PREFIXES: 2413A - 2445A)	28480	85680-60180
A15BT1	1420-0331	3	1	BATTERY 3.6V 1.75A-HR LITHIUM THIONYL		15-51-04-410-000
A15C1	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C2	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C3	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C4	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C5	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C6	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C7	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C8	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C10	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C11	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C12	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C13	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C15	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C17	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C18	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C19	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C20	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C22	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C23	0160-4554	7	1	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A15C24	0160-4574	1	1	CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A15C25	0160-4535	4	1	CAPACITOR-FXD 1UF +-10% 50VDC CER	28480	0160-4554
A15C29	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	28480	0160-4832
A15C30	0180-0500	7	1	CAPACITOR-FXD 47UF +-20% 20VDC TA	28480	0180-0500
A15C31	0180-0197	8	1	CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A15C32	0180-0552	9	1	CAPACITOR-FXD 220UF +-20% 10VDC TA	28480	0180-0552
A15C33	0180-0197	8	1	CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A15C34	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER	28480	0160-4801
A15C35	0160-4833	5	1	CAPACITOR-FXD .022UF +-10% 100VDC CER	28480	0160-4833
A15CR1	1901-0620	3	1	DIODE-SWITCHING 60V 400MA DO-35	9N171	NDP250
A15CR2	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A15CR3	1901-0518	8	1	DIODE-SM SIG SCHOTTKY	28480	1901-0518
A15CR4	1901-0620	3	1	DIODE-SWITCHING 60V 400MA DO-35	9N171	NDP250
A15DS1	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS2	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A14DS3	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS4	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS5	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A14DS6	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS7	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A14DS8	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS9	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS10	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A14DS11	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS12	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958

**Indicates factory-selected value*

HP Part Number 85680-60180
A15 Controller

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A14DS13	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A15DS14	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	1990-0958
A14DS15	1990-0957	6	1	LED-LAMP LUM-INT=1MCD IF=7MA-MAX BVR=5V	28480	1990-0957
A15E1	1251-4787	2	1	SHUNT-DIP 8-POSITION	28480	1251-4787
A15J1	1251-5926	3	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-5926
A15J2	1251-5905	8	1	CONNECTOR 24-PIN M POST TYPE	28480	1251-5905
A15J5	1251-5619	1	1	CONNECTOR 4-PIN M POST TYPE	28480	1251-5619
A15L1	9100-1788	6	1	CHOKE-WIDE BAND ZMAX=6800HM/180MHZ	02114	VK200 20/48
A15L2	08558-80011	6	1	INDUCTOR BLUE COIL	28480	08558-80011
A15MP1	1251-8616	4	1	CONN-POST TYPE .150-PIN-SPACING 4-CONT	28480	1251-8616
A15MP3	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	28480	1480-0073
A15MP4	4040-0749	4	1	EXTR-PC BD BRN POLYC .062-BD-THKNS	28480	4040-0749
A15MP5	4040-0753	0	1	EXTR-PC BD GRN POLYC .062-BD-THKNS	28480	4040-0753
A15MP6				NOT ASSIGNED		
A15MP7	2200-0139	4	1	SCREW-MACH 4-40 .25-IN-LG PAN-HD POZI	28480	2200-0139
A15MP8	3050-0105	6	1	WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
A15MP9	2190-0003	8	1	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0003
A15MP10	2260-0001	5	1	NUT-HEX-DBL-CHAM 4-40-THD .094-IN-THK	28480	2260-0001
A15Q1	1853-0281	9	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A15R2	0698-7272	1	1	RESISTOR 31.6K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3162-F
A15R4	0698-3156	2	1	RESISTOR 14.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1472-F
A15R5	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A15R6	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A15R7	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R8	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A15R9	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R10	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A15R11	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A15R12	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A15R13	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A15R14	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A15R15	0757-0421	4	1	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A15R16	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A15R17	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A15R18	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A15R19	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A15R20	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A15SW1	3101-2197	9	1	SWITCH-RKR DIP-RKR-ASSY 6-1A .05A 30VDC	28480	3101-2197
A15TP1	1251-8096	4	1	HEADER ASSY 7PIN	28480	1251-8096
A15TP2	1251-8616	4	1	HEADER ASSY 4PIN	28480	1251-8616
A15TP3	0360-1682	0	1	TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A15TP4	0360-1682	0	1	TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A15U1	1810-0446	8	1	NETWORK-RES 8-SIP 1.5K OHM X 7	11236	750-81-1.5K
A15U2	1810-0446	8	1	NETWORK-RES 8-SIP 1.5K OHM X 7	11236	750-81-1.5K
A15U3	1810-0446	8	1	NETWORK-RES 8-SIP 1.5K OHM X 7	11236	750-81-1.5K
A15U4	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A15U5	1820-3401	2	1	IC BFR TTL ALS OR QUAD 2-INP	28480	1820-3401
A15U6	1820-2551	1	1	IC-GENERAL PURPOSE INTERFACE BUS ADAPTER	28480	1820-2551

**Indicates factory-selected value*

HP Part Number 85680-60180

A15 Controller

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15U7	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A15U8	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A15U9	1820-3449	8	1	IC-PARALLEL INTERFACE/TIMER/8MHZ/MC68000	28480	1820-3449
A15U10	1820-2102	8	1	IC LCH TTL LS D-TYPE OCTL	01295	SN74LS373N
A15U11	1820-1997	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A15U12	1820-1208	3	1	IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A15U13	1820-1203	8	1	IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A15U14	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U14	1818-3305	0	0	ALTERNATE - IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U15	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U15	1818-3305	0	0	ALTERNATE - IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U16	85680-80077	5	1	EPROM-PROGRAMMED	28480	85680-80077
A15U17	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U17	1818-3305	0	0	ALTERNATE-IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U18	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U18	1818-3305	0	0	ALTERNATE-IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U19	85680-80078	6	1	EPROM-PROGRAMMED	28480	85680-80078
A15U20	5180-2330	0	1	IC16R4 PAL PRGMD	28480	5180-2330
A15U21	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U22	1820-2024	3	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A15U23	1810-0394	5	1	NETWORK-RES 8-SIP6.8K OHM X 7	01121	208A682
A15U24	1820-1851	2	1	IC ENCDR TTL LS	01295	SN74LS148N
A15U25	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U26	1820-2505	5	1	IC-MPU; CLK FREQ=8MHZ, INSTRUCTION	28480	1820-2505
A15U27	1820-3173	5	1	IC FF CMOS/74HC J-K NEG-EDGE-TRIG	28480	1820-3173
A15U28	1820-1281	2	1	IC DCDR TTL LS 2-TO-4-LINE DUAL 2-INP	01295	SN74LS139N
A15U29	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U30	1820-2483	8	1	IC RCVR TTL LS BUS OCTL	01295	SN75161N
A15U31	1820-3431	8	1	IC TRANSCEIVER TTL S INSTR-BUS IEEE-488	28480	1820-3431
A15U32	1820-2675	0	1	IC RCVR TTL LS BUS OCTL	01295	SN74LS646N
A15U33	1810-0279	5	1	NETWORK-RES 10-SIP 4.7K OHM X 9	01121	210A472
A15U34	1820-1997	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A15U35	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A15U36	1820-2675	0	1	IC RCVR TTL LS BUS OCTL	01295	SN74LS646N
A15U37	85680-80079	7	1	EPROM PRGMD U37	28480	85680-80079
A15U38	85680-80081	1	1	EPROM PRGMD U38	28480	85680-80081
A15U39	85680-80080	0	1	EPROM PROG U39	28480	85680-80080
A15U40	85680-80082	2	1	EPROM PRGMD U40	28480	85680-80082
A15U41	1810-0344	5	1	NETWORK-RES 10-SIP6.8K OHM X 9	01121	210A682
A15U42	85680-80068	4	1	IC1618 PAL PRGMD	28480	85680-80068
A15U43	1826-0759	9	1	IC COMPARATOR GP QUAD 14-DIP-C PKG	04713	LM339J
A15U44	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U45	1820-3562	6	1	IC BFR TTL ALS INV HEX	28480	1820-3562
A15U46	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A15U47	1820-1208	3	1	IC GATE TTL L8 OR QUAD 2-INP	01295	SN74LS32N
A15U48	1826-0393	7	1	IC V RGLTR-ADJ-POS 1.2/37V TO-220 PKG	27014	LM317T
A15W1*	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005

**Indicates factory-selected value*

HP Part Number 85680-60180

A15 Controller

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15Y1	1813-0196	1	1	XTAL-CLOCK-OSCILLATOR 14.7456-MHZ	28480	1813-0196
A15Y1	1813-0129	0	0	XTAL-CLOCK-OSCILLATOR 14.7456-MHZ 0.01% (ALTERNATE PART FOR 1813-0196)	00815	HS-100 (14.7456 MHZ)

**Indicates factory-selected value*

HP Part Number 85680-60182

A15 Controller

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15	85680-60182	1	1	BOARD ASSEMBLY, CONTROLLER (SERIAL PREFIX: 2503A)	28480	85680-60182
A15BT1	1420-0331	3	1	BATTERY 3.68V 1.75A-HR LITHIUM THIONYL		15-51-04-410-000
A15C1	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C2	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C3	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C4	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C5	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C6	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C7	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C8	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C10	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C11	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C12	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C13	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C15	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C17	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C18	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C19	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C20	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C22	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C23	0160-4554	7	1	FXD 0.01uF 50 VDC +-20% CER	04222	SA105C103MAAH
A15C24	0160-4574	1	1	CAPACITOR-FXD 1000PF +-10% 100VDC CER	04222	SA101C102KAAH
A15C25	0160-4535	4	1	CAPACITOR-FXD 1UF +-10% 50VDC CER	04222	SR305C105KAAH
A15C29	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER 0+-3	04222	SA102A101JAAH
A15C30	0160-4832	4	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SA101C103KAAH
A15C31	0160-4808	4	1	CAPACITOR-FXD 470PF +-5% 100VDC CER 0+-3	04222	SA101A471JAAH
A15C32	0180-2207	5	1	CAPACITOR-FXD 100UF+-10% 10VDC TA	56289	150D107X9010R2-DYS
A15C34	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER 0+-3	04222	SA102A101JAAH
A15CR3	1901-0518	8	1	DIODE-SCHOTTKY SM SIG	28480	
A15DS1	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS2	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS3	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS4	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS5	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS6	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS7	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS8	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS9	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS10	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS11	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS12	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS13	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15DS14	1990-0958	7	1	LED-LAMP IF=7MA-MAX BVR=5V	28480	HLMP-1700
A15E1	1251-4787	2	1	SHUNT-DIP 8 POSITION DUAL INLINE PKG	00779	435704-8
A15J1	1251-5926	3	1	CONN-POST TYPE .100-PIN-SPCG 50-CONT	18873	67997-650
A15J2	1251-5905	8	1	CONN-POST TYPE .100-PIN-SPCG 24-CONT	18873	67997-624

**Indicates factory-selected value*

HP Part Number 85680-60182
A15 Controller

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15J3	1200-0607	0	1	16-PIN IC SOCKET	00779	641600-1/TUBED 2-641600
A15J5	1251-5619	1	1	CONN-POST TYPE .100-PIN-SPCG 4-CONT	18873	68000-604
A15L1	9140-0875	4	1	INDUCTOR 80uH 10%	28480	9140-0875
A15MP1	1400-1267	4	1	HOLDER-BAT .531-.656-DIA FOR AA CELLS	91833	91
A15MP3	1480-0073	6	2	PIN-ROLL .062-IN-DIA .25-IN-LG BE-CU	72962	99-012-062-0250
A15MP4	4040-0749	4	1	EXTR-PC BD BRN POLYC .062-IN-BD-THKNS 1-		
A15MP5	4040-0753	0	1	EXTR-PC BD GRN POLYC .062-IN-BD-THKNS 1-		
A15MP6	0361-0026	6	1	RIVET-SEMITUB OVH .089DIA .125LG	12014	R-4008-1/8
A15MP11	1200-0567	1	1	SOCKET-IC 28-CONT DIP DIP-SLDR	00779	2-641605-1
A15Q1	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A15Q2	1853-0213	7	1	TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A15R2	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R3	0698-3157	3	1	RESISTOR 19.6K 1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R4	0698-3260	9	1	RESISTOR 464K 1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R5	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R6	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R7	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R8	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R9	0698-3260	9	1	RESISTOR 464K 1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R10	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R11	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R12	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R13	0698-3440	7	1	RESISTOR 196 1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R14	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R18	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R19	0698-3155	1	1	RESISTOR 4.64K 1% .125W TF TC=0+-100	2M627	CRB14 OR CRB25
A15R21	0698-7212	9	1	RESISTOR 100 +-1% .05W TF TC=0+-100	19701	5063J
A15SW1	3101-2197	9	1	SWITCH-DIP RKR 6-1A 0.05A 30VDC	81073	76YY2346S
A15TP1	1252-0569	2	1	CONN-POST TYPE .150-PIN-SPCG 9-CONT	00779	87221-8
A15TP2	1251-8427	5	1	CONN-POST TYPE .150-PIN-SPCG 5-CONT	00779	87221-4
A15U1	1810-0446	8	1	NETWORK-RES 8-SIP 1.5K OHM X 7	11236	750-81
A15U2	1810-0446	8	1	NETWORK-RES 8-SIP 1.5K OHM X 7	11236	750-81
A15U3	1810-0446	8	1	NETWORK-RES 8-SIP 1.5K OHM X 7	11236	750-81
A15U4	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A15U5	1820-3401	2	1	IC BFR TTL ALS OR QUAD 2-INP	01295	SN74ALS1032AN
A15U6	1820-2548	6	1	IC-GENERAL PURPOSE INTERFACE BUS ADAPTER	01295	TMS9914ANL
A15U7	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A15U8	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A15U9	1820-3449	8	1	IC-PARALLEL INTERFACE/TIMER/8MHZ/MC68000	04713	MC68230L8
A15U10	1820-2102	8	1	IC LCH TTL LS D-TYPE OCTL	01295	SN74LS373N
A15U11	1820-1997	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A15U12	1820-1208	3	1	IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A15U13	1820-1203	8	1	IC GATE TTL LS AND TPL 3-INP	01295	SN74LS11N
A15U14	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U14	1818-3305	0	0	ALTERNATE-IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U15	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U15	1818-3305	0	0	ALTERNATE-IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U16	85680-80077	5	1	EPROM-PROGRAMMED	28480	85680-80077

**Indicates factory-selected value*

HP Part Number 85680-60182
A15 Controller

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15U17	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U17	1818-3305	0	0	ALTERNATE-IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U18	1818-3183	2	1	IC CMOS 65536 (64K) STAT RAM 150-NS 3-S	28480	1818-3183
A15U18	1818-3305	0	0	ALTERNATE-IC CMOS 65536 (64K) STAT RAM	28480	1818-3305
A15U20	5180-2330	0	1	IC 16R4 PAL PRGMD	28480	5180-2330
A15U21	1810-0205	7	1	NETWORK-RES 8-SIP 4.7K OHM X 7	11236	750-81
A15U22	1820-2024	3	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A15U23	1810-0394	5	1	NETWORK-RES 8-SIP 6.8K OHM X 7	11236	750-81
A15U24	1820-1851	2	1	IC ENCDR TTL LS	01295	SN74LS148N
A15U25	1810-0205	7	1	NETWORK-RES 8-SIP 4.7K OHM X 7	11236	750-81
A15U26	1820-3532	0	1	IC-16 BIT MICROPROCESSOR /8 MHZ	04713	MC68000P8
A15U27	1820-3173	5	1	IC FF CMOS/74HC J-K NEG-EDGE-TRIG PRESET	04713	MC74HC112N
A15U28	1820-1281	2	1	IC DCDR TTL LS 2-TO-4-LINE DUAL	01295	SN74LS139AN
A15U29	1810-0205	7	1	NETWORK-RES 8-SIP 4.7K OHM X 7	11236	750-81
A15U30	1820-3513	7	1	IC-INTERFACE XCVR BCD UP/DOWN INSTRUMENT	27014	DS75161AN
A15U31	1820-3431	8	1	IC-INTERFACE XCVR BCD UP/DOWN INSTRUMENT	27014	DS75160AN
A15U32	1820-2675	0	1	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS646NT
A15U33	1810-0279	5	1	NETWORK-RES 10-SIP 4.7K OHM X 9	11236	750-101
A15U34	1820-1997	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
A15U35	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRESET	01295	SN74LS74AN
A15U36	1820-2675	0	1	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN74LS646NT
A15U37	85680-80113	0	1	EPROM PRGMD	28480	85680-80113
A15U38	85680-80115	2	1	EPROM PRGMD	28480	85680-80115
A15U39	85680-80114	1	1	EPROM PRGMD	28480	85680-80114
A15U40	85680-80116	3	1	EPROM PRGMD	28480	85680-80116
A15U41	1810-0344	5	1	NETWORK-RES 10-SIP 6.8K OHM X 9	11236	750-101
A15U42	85660-80070	4	1	IC 1618 PAL PRGMD	28480	85660-80070
A15U43	1826-0759	9	1	IC COMPARATOR GP QUAD 14-DIP-C PKG	04713	LM339J
A15U44	1810-0205	7	1	NETWORK-RES 8-SIP 4.7K OHM X 7	11236	750-81
A15U45	1820-3562	6	1	IC BFR TTL ALS INV HEX	01295	SN74ALS1005N
A15U46	1810-0205	7	1	NETWORK-RES 8-SIP 4.7K OHM X 7	11236	750-81
A15U47	1820-1208	3	1	IC GATE TTL LS OR QUAD 2-INP	01295	SN74LS32N
A15Y1	1813-0196	1	1	CLOCK-OSCILLATOR-CRYSTAL 14.7456 MHZ	28480	1813-0196
A15Y1	1813-0129	0	0	CLOCK-OSCILLATOR-XTAL 14.7456-MHZ 0.01% (ALTERNATE PART FOR 1813-0196)	00815	HS-100(14.7456MHZ)

**Indicates factory-selected value*

RF INTERFACE A12

MOTHERBOARD A26

CONTROLLER A15

LADR → 12 → XA12P1 → XA15P1 → 37 → P1 → LADR

LRMT → 25 → 50 → LRMT

LRTL → 29 → 4 → LRTL

LIPS → 33 → XA12P2 → XA15P2 → 33 → P2 → LIPS

VOLTAGE REGULATOR A24

HPUP → 12 → XA24P2 → 32 → HPUP

DATA BUS

Ⓚ INTERRUPT

LSRQ

Ⓑ RESET

LRESET

Ⓘ PERIPHERAL INTERFACE AND TIMER

CLK

LPIT

R/W

LRESET

HPUP

LSRQ

Ⓓ ADDRESS DECODER AND DTACK

LBUS

BIO

TIO

ADDRESS BUS

LBUS

ADDRESS BUS

ADDRESS BUS

Ⓔ ADDRESS DECODER

LHP-IBSW

LOE

LHI-WE

BIO

TIO

TRIGGER A3A1

LTIO → 19

DIGITAL STORAGE MOTHERBOARD A3A10

A3XA1P1 → J2

INSTRUMENT BUS → W44 → 50 → P1 → LTIO

INSTRUMENT BUS → 49 → LBIO

INSTRUMENT BUS → 48 → LSRQ

Ⓕ LBIO/LTIO

LTIO

LBIO

ADDRESS BUS

CLK

RF INTERFACE A12

MOTHERBOARD A26

LSRQ → 34 → XA12P2 → XA15P2 → 34 → P2 → LSRQ

LBIO → 27 → XA12P1 → XA15P1 → 2 → P1 → LBIO

LTIO → 26 → 1 → LTIO

Ⓗ BUFFERS

LATCH

DATA BUS

DATA BUS

DATA BUS

Ⓛ SELF TEST

LBIO

LTIO

INSTRUMENT BUS

INSTRUMENT BUS

INSTRUMENT BUS

INSTRUMENT BUS

DATA BUS

Ⓚ INTERRUPT

LSRQ

Ⓙ HP-IB

HP-IB

J2

HP-IB GND

A29

J5

HP-IB

Ⓐ CLOCK

HP-IB CLK

CLK

LHP-IB

LHP-IBSW

R/W

LLO-WE

LRESET

Ⓓ ADDRESS DECODER AND DTACK

LBUS

BIO

TIO

LHP-IB

LROM

3

LRAM

ADDRESS BUS

ADDRESS BUS

Ⓟ ROM

HPUP

LRAM

2

HPUP

Ⓠ RAM

LOE

LHI-WE

LLO-WE

TIO

LBIO/LTIO

Ⓒ R/W DECODE

R/LW

R/LW

LAS

LLDS

LUDS

LDTACK

CLK

LRESET

Ⓜ PROCESSOR

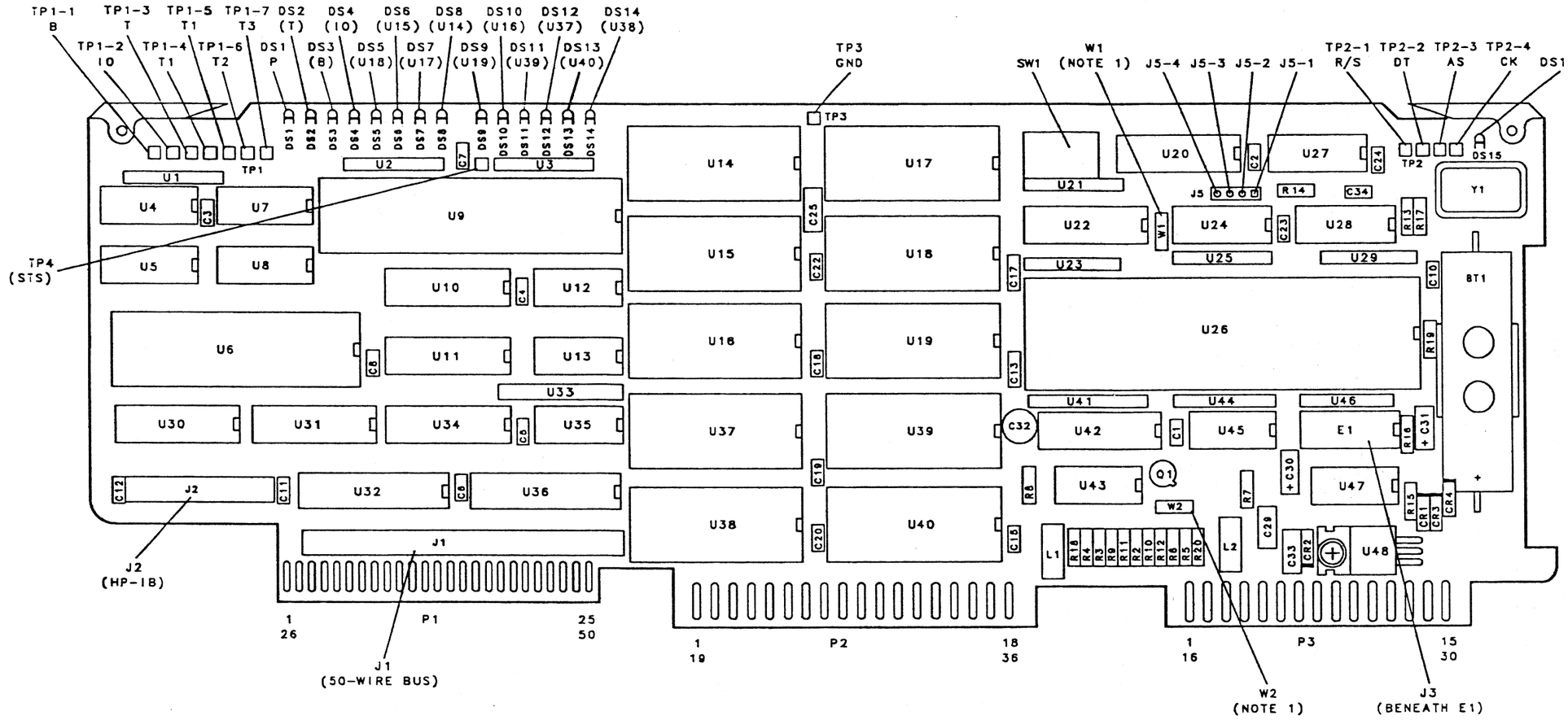
CLK

DATA BUS

J1

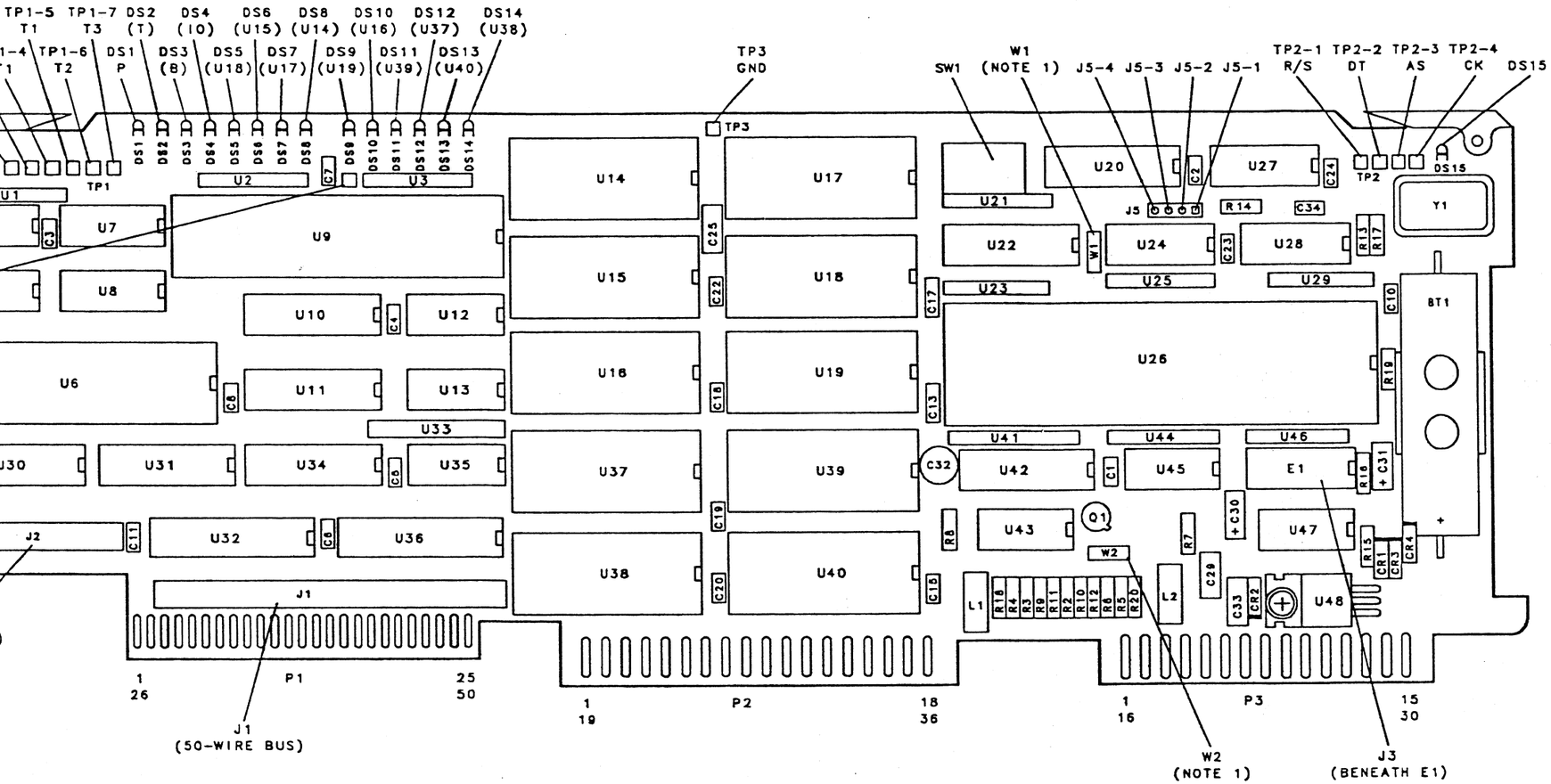
J4 INSTRUMENT BUS

A15 CONTROLLER, BLOCK DIAGRAM



NOTES:

1. JUMPER W1 IS LOADED WHEN 128K ROMS (SET OF SIX) ARE INSTALLED; W2 IS LOADED WHEN 256K ROMS (SET OF FOUR) ARE INSTALLED.



NOTES:
1. JUMPER W1 IS LOADED WHEN 128K ROMS (SET OF SIX) ARE INSTALLED; W2 IS LOADED WHEN 256K ROMS (SET OF FOUR) ARE INSTALLED.

A15 CONTROLLER, COMPONENT LOCATIONS: 85680-60174

A15 CONTROLLER 85680-60174 SERIAL PREFIX: 2408A) (SHEET 1 OF 4)

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	LTIO	A12P1-26	F
26	GND		R
2	LBIO	A12P1-27	F
27	GND		R
3	NC		
28	NC		
4	LRTL	A12P1-29	I
29	HSWP	A12P1-4	S
5	KC6	A12P1-30	S
30	KC7	A12P1-5	S
6	KC4	A12P1-31	S
31	KC5	A12P1-6	S
7	KC2	A12P1-32	S
32	KC3	A12P1-7	S
8	KCØ	A12P1-33	S
33	KC1	A12P1-8	S
9	KR1Ø	A12P1-34	S
34	KR11	A12P1-9	S
10	KR8	A12P1-35	S
35	KR9	A12P1-10	S
11	NC		
36	NC		
12	ADR4	A12P1-37	H
37	LADR	A12P1-12	I
13	ADR2	A12P1-38	H
38	ADR3	A12P1-13	H
14	ADRØ	A12P1-39	H
39	ADR1	A12P1-14	H
15	NC		
40	NC		
16	NC		
41	NC		
17	IOB14	A12P1-42	H
42	IOB15	A12P1-17	H
18	IOB12	A12P1-43	H
43	IOB13	A12P1-18	H
19	IOB1Ø	A12P1-44	H
44	IOB11	A12P1-19	H
20	IOB8	A12P1-45	H
45	IOB9	A12P1-20	H
21	IOB6	A12P1-46	H
46	IOB7	A12P1-21	H
22	IOB4	A12P1-47	H
47	IOB5	A12P1-22	H
23	IOB2	A12P1-48	H
48	IOB3	A12P1-23	H
24	IOBØ	A12P1-49	H
49	IOB1	A12P1-24	H
25	GND		R
50	LRMT	A12P1-25	I

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND	INSTRUMENT BUS	R
19	LBIO		F
2	ADRØ		H
20	ADR1		H
3	ADR2		H
21	ADR3		H
4	ADR4		H
22	NC		H
5	IOBØ		H
23	IOB1		H
6	IOB2		H
24	IOB3		H
7	IOB4		H
25	IOB5		H
8	IOB6		H
26	IOB7		H
9	IOB8		H
27	IOB9		H
10	IOB1Ø		H
28	IOB11		H
11	IOB12		H
29	IOB13		H
12	IOB14		H
30	IOB15		H
13	NC		
31	NC		
14	GND		R
32	HPUP	A24P2-12	B
15	NC		
33	LIPS	A12P2-33	I
16	NC		
34	LSRQ	A12P2-34	J
17	+5.2V		R
35	+5.2V		R
18	GND		R
36	GND		R

P3

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
16	NC		
2	GND		R
17	GND		R
3	+12V		R
18	+12V		R
4	-5.2V	NC	
19	-5.2V	NC	
5	NC		
20	NC		
6	NC		
21	NC		
7	NC		
22	NC		
8	NC		
23	NC		
9	NC		
24	NC		
10	NC		
25	NC		
11	NC		
26	NC		
12	NC		
27	NC		
13	NC		
28	NC		
14	NC		
29	NC		
15	GND		R
30	GND		R

A15

A15 Controller Schematic Diagram, 85680-60174 (1 of 4)

A15 CONTROLLER
85680-60174
(SERIAL PREFIX: 2408A)
(SHEET 2 OF 4)

J1

PIN	SIGNAL	TO FROM	FUNCTION BLOCK
1	NC		
2	IOB1	A4A10J1-4	H
3	IOB3	A4A10J1-6	H
4	IOB5	A4A10J1-8	H
5	IOB7	A4A10J1-10	H
6	IOB9	A4A10J1-12	H
7	IOB11	A4A10J1-14	H
8	IOB13	A4A10J1-16	H
9	IOB15	A4A10J1-18	H
10	LADR	NC	I
11	HPON	A1A9J1-22	R
12	ADR1	A4A10J1-24	H
13	ADR3	A4A10J1-26	H
14	NC		
15	NC		
16	KR9	A1A1J1-33	S
17	KR11	A1A1J1-31	S
18	KC1	A1A1J1-41	S
19	KC3	A1A1J1-39	S
20	KC5	A1A1J1-37	S
21	KC7	A1A1J1-35	S
22	HSWP	A3A1P1-21	S
23	LDSR	A3A10J1-46	J
24	GND		R
25	GND		R
26	GND		R
27	IOBØ	A4A10J1-3	H
28	IOB2	A4A10J1-5	H
29	IOB4	A4A10J1-7	H
30	IOB6	A4A10J1-9	H
31	IOB8	A4A10J1-11	H
32	IOB1Ø	A4A10J1-13	H
33	IOB12	A4A10J1-15	H
34	IOB14	A4A10J1-17	H
35	NC		
36	NC		
37	ADRØ	A4A10J1-23	H
38	ADR2	A4A10J1-25	H
39	ADR4	A4A10J1-27	H
40	NC		
41	KR8	A1A1J1-34	S
42	KR1Ø	A1A1J1-32	S
43	KCØ	A1A1J1-42	S
44	KC2	A1A1J1-40	S
45	KC4	A1A1J1-38	S
46	KC6	A1A1J1-36	S
47	NC		
48	LSRQ	A1A9J1-45	J
49	LBIO	A1A9J1-47	F
50	LTIO	A3A10J2-49	F

J2

PIN	SIGNAL	TO FROM	FUNCTION BLOCK
1	DIO1	J5-1	J
2	DIO2	J5-2	J
3	DIO3	J5-3	J
4	DIO4	J5-4	J
5	EOI	J5-5	J
6	DAV	J5-6	J
7	NRFD	J5-7	J
8	NDAC	J5-8	J
9	IFC	J5-9	J
10	SRQ	J5-10	J
11	ATN	J5-11	J
12	NC	SEE NOTE 5	
13	DIO5	J5-13	J
14	DIO6	J5-14	J
15	DIO7	J5-15	J
16	DIO8	J5-16	J
17	REN	J5-17	J
18	NC	SEE NOTE 5	
19	NC	SEE NOTE 5	
20	NC	SEE NOTE 5	
21	NC	SEE NOTE 5	
22	NC	SEE NOTE 5	
23	NC	SEE NOTE 5	
24	NC	SEE NOTE 5	

NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN MICROFARADS (μF) INDUCTANCE IS IN MICROHENRIES (μH)
3. UNLESS OTHERWISE INDICATED: SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.
4. JUMPER W1 IS LOADED WHEN 128K ROMS (SET OF SIX) ARE INSTALLED: W2 IS LOADED WHEN 256K ROMS (SET OF FOUR) ARE INSTALLED.
5. PINS 12,18-24 ARE CHASSIS GROUNDED THRU A29.

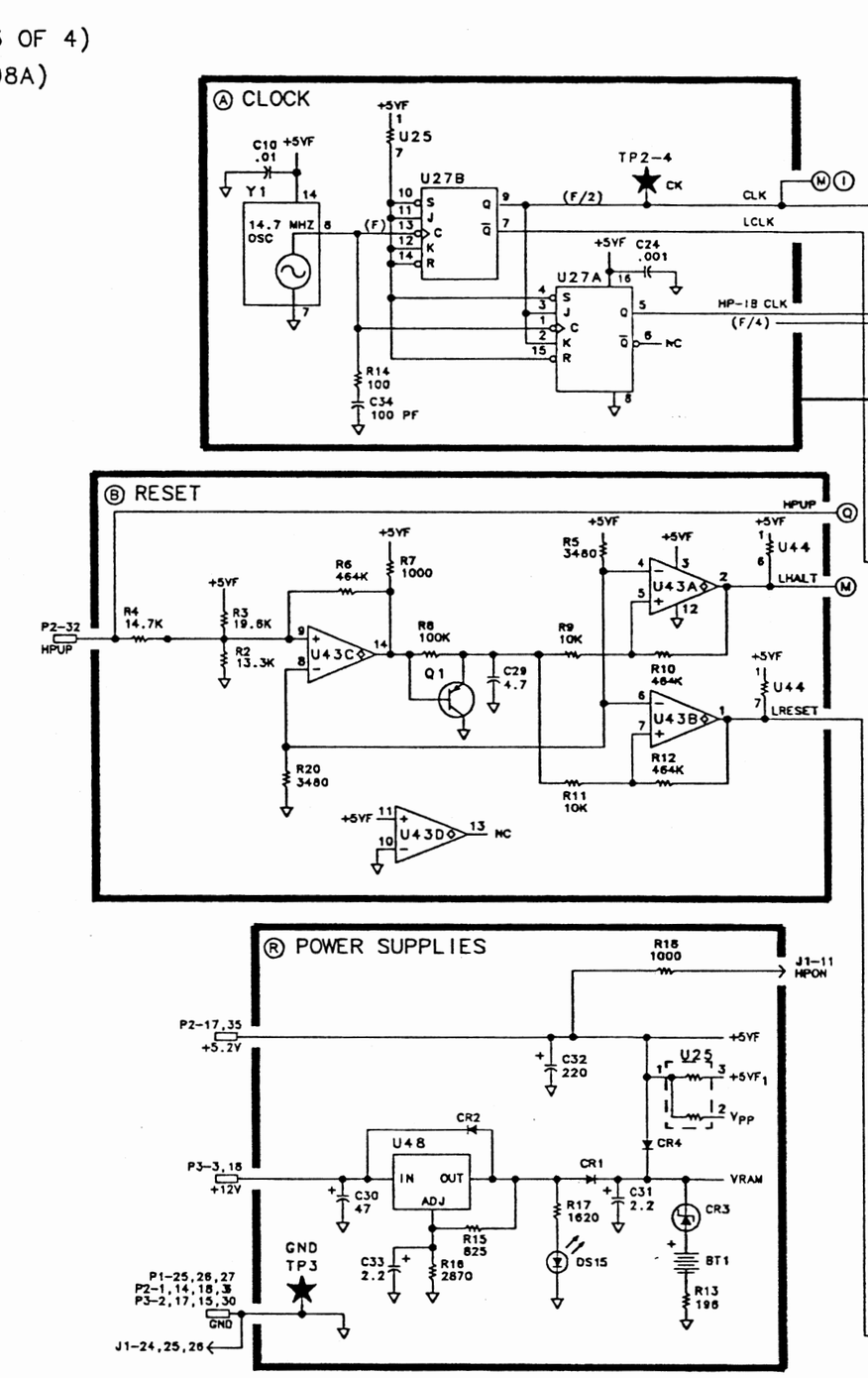
6. MNEMONIC TABLE:

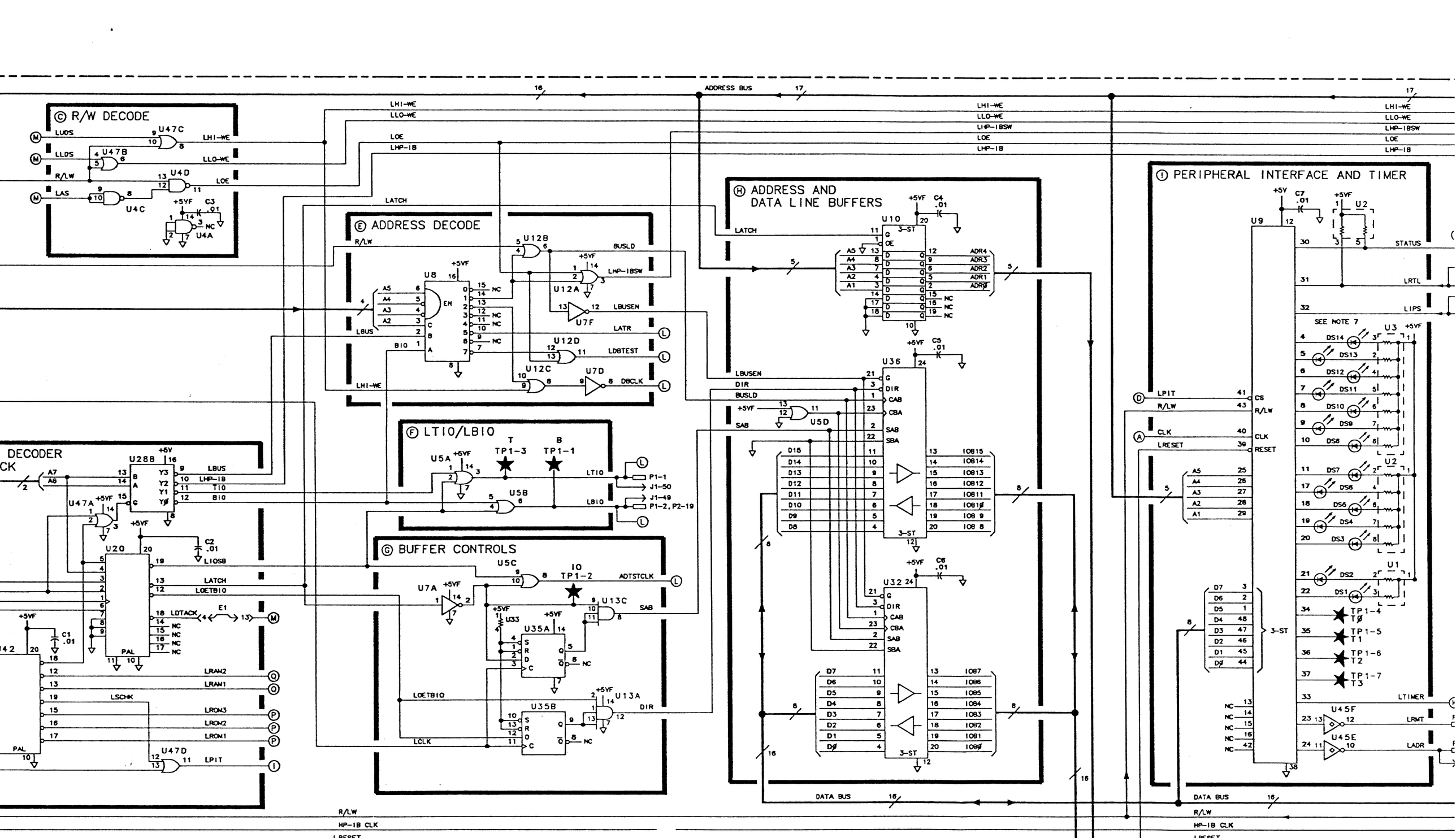
MNEMONIC	DESCRIPTION
ADRØ	INSTRUMENT BUS ADDRESS BIT Ø
ADR1	INSTRUMENT BUS ADDRESS BIT 1
ADR2	INSTRUMENT BUS ADDRESS BIT 2
ADR3	INSTRUMENT BUS ADDRESS BIT 3
ADR4	INSTRUMENT BUS ADDRESS BIT 4
ATN	HP-IB CONTROL
DAV	HP-IB CONTROL
DIO1	DATA INPUT/OUTPUT
DIO2	DATA INPUT/OUTPUT
DIO3	DATA INPUT/OUTPUT
DIO4	DATA INPUT/OUTPUT
DIO5	DATA INPUT/OUTPUT
DIO6	DATA INPUT/OUTPUT
DIO7	DATA INPUT/OUTPUT
DIO8	DATA INPUT/OUTPUT
EOI	HP-IB CONTROL
HPON	HIGH=IF-DISPLAY SECTION POWER ON
HPUP	HIGH=POWER ON
IFC	HP-IB CONTROL
IOBØ	INSTRUMENT BUS DATA BIT Ø
IOB1	INSTRUMENT BUS DATA BIT 1
IOB2	INSTRUMENT BUS DATA BIT 2
IOB3	INSTRUMENT BUS DATA BIT 3
IOB4	INSTRUMENT BUS DATA BIT 4
IOB5	INSTRUMENT BUS DATA BIT 5
IOB6	INSTRUMENT BUS DATA BIT 6
IOB7	INSTRUMENT BUS DATA BIT 7
IOB8	INSTRUMENT BUS DATA BIT 8
IOB9	INSTRUMENT BUS DATA BIT 9
IOB1Ø	INSTRUMENT BUS DATA BIT 1Ø
IOB11	INSTRUMENT BUS DATA BIT 11
IOB12	INSTRUMENT BUS DATA BIT 12
IOB13	INSTRUMENT BUS DATA BIT 13
IOB14	INSTRUMENT BUS DATA BIT 14
IOB15	INSTRUMENT BUS DATA BIT 15
LADR	LOW=ADDRESS LED ON
LBIO	LOW=BOTTOM BOX INPUT/OUTPUT
LDSR	LOW=DIGITAL STORAGE READY
LIPS	LOW=INSTRUMENT PRESET
LRMT	LOW=REMOTE
LRTL	LOW=RETURN TO LOCAL
LSRQ	LOW=SERVICE REQUEST
LTIO	LOW=TOP BOX I/O
NDAC	HP-IB CONTROL
NRFD	HP-IB CONTROL
REN	HP-IB CONTROL
SRQ	HP-IB CONTROL

A15

A15 Controller Schematic Diagram, 85680-60174 (2 of 4)

A15 CONTROLLER
85680-60174 (SHEET 3 OF 4)
(SERIAL PREFIX: 2408A)




ADDRESS BUS
LHI-WE
LLO-WE
LOE
LHP-IB
LHP-IBSW
LATCH
R/LW
LBUS
BIO
LBUSEN
DIR
BUSLD
SAB
SBA
DATA BUS
LRESET
HP-IB CLK
ADR BUS (P/O INSTRUMENT BUS)
I/O BUS (P/O INSTRUMENT BUS)
Ⓒ R/W DECODE
LUDS
LLDS
LAS
U47C
U47B
U4D
U4C
U4A
Ⓔ ADDRESS DECODE
U8
U12B
U12A
U12C
U12D
U7F
U7D
BUSLD
LHP-IBSW
LBUSEN
LATR
LDBTEST
DBCLK
Ⓕ LTIO/LBIO
U5A
U5B
T
TP1-3
B
TP1-1
LTIO
LBIO
P1-1
J1-50
J1-49
P1-2, P2-19
Ⓖ BUFFER CONTROLS
U5C
IO
TP1-2
ADTSTCLK
U7A
U13C
SAB
U33
U35A
U35B
U13A
DIR
LOETBIO
LCLK
Ⓗ ADDRESS AND DATA LINE BUFFERS
U10
3-ST
ADR4
ADR3
ADR2
ADR1
ADR0
U36
U5D
U32
10815
10814
10813
10812
10811
10810
10809
10808
1087
1086
1085
1084
1083
1082
1081
1080
Ⓘ PERIPHERAL INTERFACE AND TIMER
U9
U2
U3
U1
STATUS
LRTL
LIPS
SEE NOTE 7
DS14
DS13
DS12
DS11
DS10
DS9
DS8
DS7
DS6
DS5
DS4
DS3
DS2
DS1
TP1-4
TØ
TP1-5
T1
TP1-6
T2
TP1-7
T3
LTIMER
LRMT
LADR
U45F
U45E
LPIT
CLK
RESET
DECODER
U28B
U47A
U20
PAL
U47D
LRAM2
LRAM1
LSCHK
LROM3
LROM2
LROM1
LIOSB
LDTACK
E1
LATCH
LOETBIO
C1
C2
C3
C4
C5
C6
C7
.01

ADDRESS BUS 16 17

LHI-WE
LLO-WE
LHP-IBSW
LOE
LHP-IB

TO SHEET 4

H ADDRESS AND DATA LINE BUFFERS

U10 3-ST — +5VF, C4 .01
LATCH → G, OE
A5 A4 A3 A2 A1 → D
ADR4 ADR3 ADR2 ADR1 ADR0 ← Q
NC NC NC

U36 — +5VF, C5 .01
LBUSEN → G
DIR → DIR
BUSLD → CAB
+5VF → U5D → CBA
SAB → SAB, SBA
D15 D14 D13 D12 D11 D10 D9 D8 → D
IOB15 IOB14 IOB13 IOB12 IOB11 IOB10 IOB9 IOB8 ← Q
3-ST

U32 24 — +5VF, C6 .01
G, DIR, CAB, CBA, SAB, SBA
D7 D6 D5 D4 D3 D2 D1 D0 → D
IOB7 IOB6 IOB5 IOB4 IOB3 IOB2 IOB1 IOB0 ← Q
3-ST

U12B BUSLD
+5VF, U12A LHP-IBSW
U7F LBUSEN
LATR
U12D, U7D LDBTEST
U12C, U7D DBCLK

T TP1-3 — P1-1, J1-50
B TP1-1 — J1-49, P1-2, P2-19
U5B LTIO, LBIO

S
5C, IO TP1-2 ADTSTCLK
U13C SAB
U35A
U35B
+5VF, U13A DIR

DATA BUS 16

I PERIPHERAL INTERFACE AND TIMER

U9 — +5V, C7 .01
LPIT → CS
R/LW → R/LW
CLK → CLK
LRESET → RESET
A5 A4 A3 A2 A1 → A
D7 D6 D5 D4 D3 D2 D1 D0 → D
3-ST

+5VF, U2
STATUS → TP4 (STS)
LRTL → P1-4
LIPS → P2-33

SEE NOTE 7
U3 +5VF
DS14 DS13 DS12 DS11 DS10 DS9 DS8
U2
DS7 DS6 DS5 DS4 DS3
U1
DS2 DS1

TP1-4 T0
TP1-5 T1
TP1-6 T2
TP1-7 T3

LTIMER
U45F → LRMT → P1-50
U45E → LADR → P1-37 → J1-10

NC NC NC NC NC

DATA BUS 16
R/LW
HP-IB CLK
LRESET
ADR BUS (P/O INSTRUMENT BUS) 5
I/O BUS (P/O INSTRUMENT BUS) 16

J HP-IB

LHP-IBSW
+5VF, U22 — EN EN
+5VF, U21, SW1
LSRQ → J1-48, P2-34
LDSR → J1-23
D0 D1 D2 D3 D4 D5 D6 D7
3-ST

+5VF C8 .01, U33 — U6 — +5VF C11 .01, U31 — J2
A3 A2 A1 → RS2 RS1 RS0
D7 D6 D5 D4 D3 D2 D1 D0 → D
3-ST
DIO1 DIO2 DIO3 DIO4 DIO5 DIO6 DIO7 DIO8
TE 3-ST

+5VF, U1
LHP-IB → ACCRG
R/LW → CE
LLO-WE → DBIN, WE
HP-IB CLK → CLK
LRESET → R
NC NC → ACCRQ TR
CONT INT

+5VF C12 .01, U30
REN IFC NDAC NRFD DAV EOI ATN SRQ
DC 3-ST
LHPINT

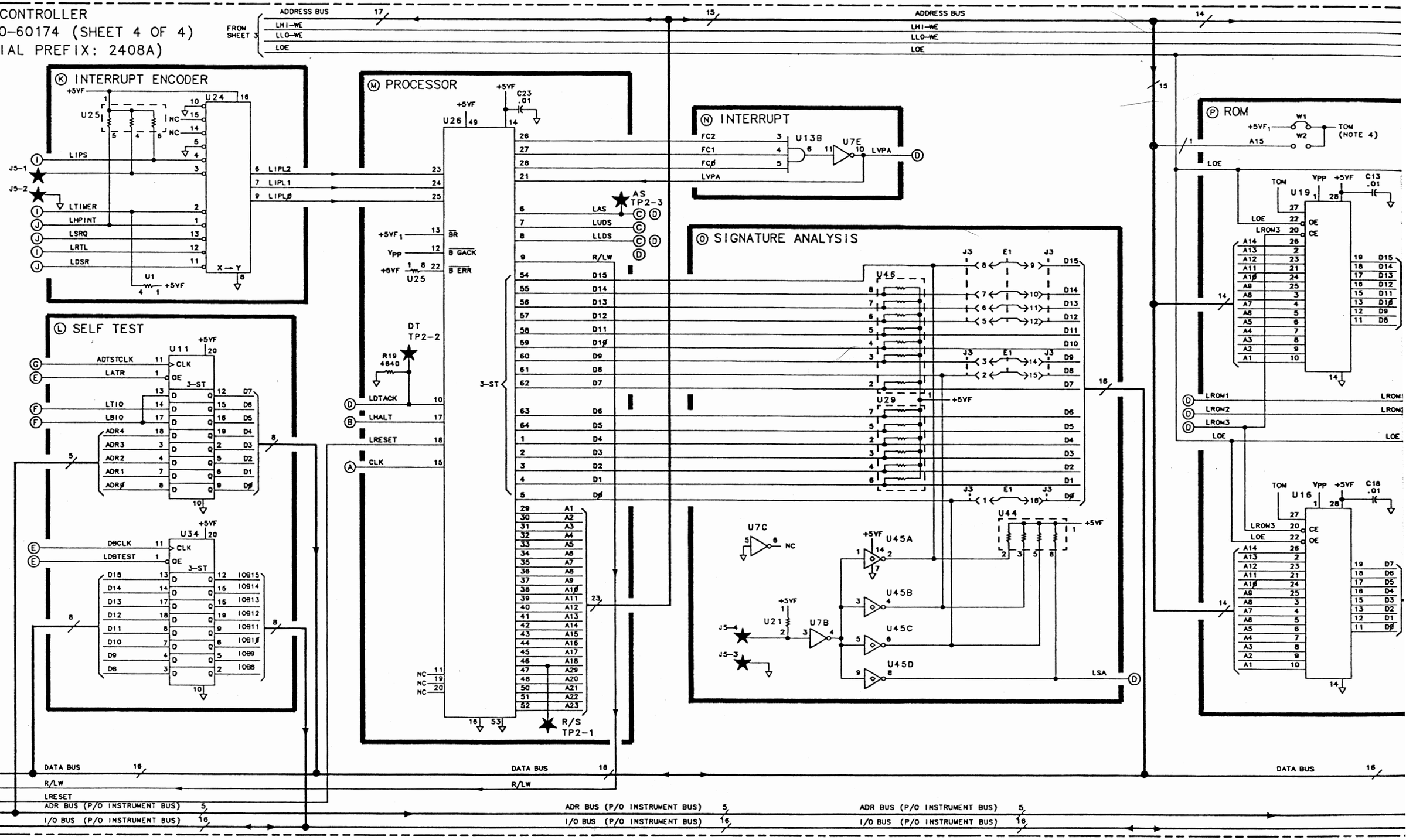
TO SHEET 4

DATA BUS 16
R/LW
LRESET
ADR BUS (P/O INSTRUMENT BUS) 5
I/O BUS (P/O INSTRUMENT BUS) 16

A15

A15 CONTROLLER, SCHEMATIC DIAGRAM (3 OF 4)

A15 CONTROLLER
85680-60174 (SHEET 4 OF 4)
(SERIAL PREFIX: 2408A)



ADDRESS BUS 14
LHI-WE
LLO-WE
LOE

U7E 11 10 LVPA (D)

LYSIS

U46
J3 E1 J3
8 9 D15
7 10 D14
6 11 D13
5 12 D12
D11
D10
3 14 D9
2 15 D8
D7
D6
D5
D4
D3
D2
D1
D0

U29 +5VF
16

U44 +5VF
1 2 3 5 8

+5VF U45A 1 14 2 7
U45B 3 4
U45C 5 6
U45D 9 8

7B 4

LSA (D)

DATA BUS 16

ADR BUS (P/O INSTRUMENT BUS) 5
I/O BUS (P/O INSTRUMENT BUS) 16

(P) ROM

+5VF W1 W2 A15 TOM (NOTE 4)

LOE

U19 U39 U40
TOM VPP +5VF C13 .01 (U19) C15 .01 (U40)
LOE 22 OE
LROM3 (U19) LROM2 (U39) LROM1 (U40) 20 CE
A14 26 A13 2 A12 23 A11 21 A10 24 A9 25 A8 3 A7 4 A6 5 A5 6 A4 7 A3 8 A2 9 A1 10
19 D15 18 D14 17 D13 16 D12 15 D11 13 D10 12 D9 11 D8
8

(D) LROM1
(D) LROM2
(D) LROM3
LOE

U16 U37 U38
TOM VPP +5VF C18 .01 (U16) C19 .01 (U37) C20 .01 (U38)
LROM3 (U16) LROM2 (U37) LROM1 (U38) 20 CE
LOE 22 OE
A14 26 A13 2 A12 23 A11 21 A10 24 A9 25 A8 3 A7 4 A6 5 A5 6 A4 7 A3 8 A2 9 A1 10
19 D7 18 D6 17 D5 16 D4 15 D3 13 D2 12 D1 11 D0
8

DATA BUS 16

ADR BUS (P/O INSTRUMENT BUS) 5
I/O BUS (P/O INSTRUMENT BUS) 16

(Q) RAM

(D) LRAM 1
(D) LRAM 2
LOE
(B) HPUP
LHI-WE
LLO-WE

U17 U14
20 CS1
LOE 22 OE
HPUP 26 CS2
LHI-WE (U17) LLO-WE (U14) 27 W
A13 2 A12 23 A11 21 A10 24 A9 25 A8 3 A7 4 A6 5 A5 6 A4 7 A3 8 A2 9 A1 10

U23
5 A1 6 A2 7 A3 8 A4 4

U41
10 A5 9 A6 8 A7 7 A9 6 A10 5 A11 4 A12 3 A13 2 A14 9

DATA BUS 16

ADDRESS BUS 14

LHI-WE 13

LLO-WE

LOE

14

14

4)

C13 .01

LOE

TOM VPP +5VF

U39 1 28

27

LOE 22 OE

LROM2 20 CE

A14 26
A13 2
A12 23
A11 21
A10 24
A9 25
A8 3
A7 4
A6 5
A5 6
A4 7
A3 8
A2 9
A1 10

19 D15
18 D14
17 D13
16 D12
15 D11
13 D10
12 D9
11 D8

14 8

D15 D14 D13 D12 D11 D10 D9 D8

U40 1 28 C15 .01

TOM VPP +5VF

27

LOE 22 OE

LROM1 20 CE

A14 26
A13 2
A12 23
A11 21
A10 24
A9 25
A8 3
A7 4
A6 5
A5 6
A4 7
A3 8
A2 9
A1 10

19 D15
18 D14
17 D13
16 D12
15 D11
13 D10
12 D9
11 D8

14 8

LROM1

LROM2

LOE

C18 .01

U37 1 28 C19 .01

TOM VPP +5VF

27

LROM2 20 CE

LOE 22 OE

A14 26
A13 2
A12 23
A11 21
A10 24
A9 25
A8 3
A7 4
A6 5
A5 6
A4 7
A3 8
A2 9
A1 10

19 D7
18 D6
17 D5
16 D4
15 D3
13 D2
12 D1
11 D0

14 8

D7 D6 D5 D4 D3 D2 D1 D0

U38 1 28 C20 .01

TOM VPP +5VF

27

LROM1 20 CE

LOE 22 OE

A14 26
A13 2
A12 23
A11 21
A10 24
A9 25
A8 3
A7 4
A6 5
A5 6
A4 7
A3 8
A2 9
A1 10

19 D7
18 D6
17 D5
16 D4
15 D3
13 D2
12 D1
11 D0

14 8

16 16

DATA BUS 16

ADR BUS (P/O INSTRUMENT BUS) 5

I/O BUS (P/O INSTRUMENT BUS) 16

Q RAM

D LRAM 1

D LRAM 2

LOE

B HPUP

LHI-WE

LOE

LLO-WE

13

U23

5 A1
6 A2
7 A3
8 A4
4

1

U41

10 A5
9 A6
8 A7
7 A9
6 A10
5 A11
4 A12
3 A13
2 A14
9

1

VRAM

U17 28

20 CS1
LOE 22 OE
HPUP 26 CS2
LHI-WE 27 W

A13 2
A12 23
A11 21
A10 24
A9 25
A8 3
A7 4
A6 5
A5 6
A4 7
A3 8
A2 9
A1 10

19 D15
18 D14
17 D13
16 D12
15 D11
13 D10
12 D9
11 D8

1 14 8

13

VRAM C17 .01

U18 28

20 CS1
LOE 22 OE
HPUP 26 CS2
LHI-WE 27 W

A13 2
A12 23
A11 21
A10 24
A9 25
A8 3
A7 4
A6 5
A5 6
A4 7
A3 8
A2 9
A1 10

19 D15
18 D14
17 D13
16 D12
15 D11
13 D10
12 D9
11 D8

1 14 8

13

LOE

HPUP

LLO-WE

13

8

VRAM C25 1.0

U14 28

20 CS1
LOE 22 OE
HPUP 26 CS2
LLO-WE 27 W

A13 2
A12 23
A11 21
A10 24
A9 25
A8 3
A7 4
A6 5
A5 6
A4 7
A3 8
A2 9
A1 10

19 D7
18 D6
17 D5
16 D4
15 D3
13 D2
12 D1
11 D0

1 14 8

13

VRAM C22 .01

U15 28

20 CS1
LOE 22 OE
HPUP 26 CS2
LLO-WE 27 W

A13 2
A12 23
A11 21
A10 24
A9 25
A8 3
A7 4
A6 5
A5 6
A4 7
A3 8
A2 9
A1 10

19 D7
18 D6
17 D5
16 D4
15 D3
13 D2
12 D1
11 D0

1 14 8

13

Ⓢ JUMPER CONNECTIONS

J1-22	HSWP	P1-29
J1-41	KR8	P1-10
J1-16	KR9	P1-35
J1-42	KR10	P1-9
J1-17	KR11	P1-34
J1-43	KC0	P1-8
J1-18	KC1	P1-33
J1-44	KC2	P1-7
J1-19	KC3	P1-32
J1-45	KC4	P1-6
J1-20	KC5	P1-31
J1-46	KC6	P1-5
J1-21	KC7	P1-30

ADR0	P1-14, P2-2, J1-37
ADR1	P1-39, P2-20, J1-12
ADR2	P1-13, P2-3, J1-38
ADR3	P1-38, P2-21, J1-13
ADR4	P1-12, P2-4, J1-39

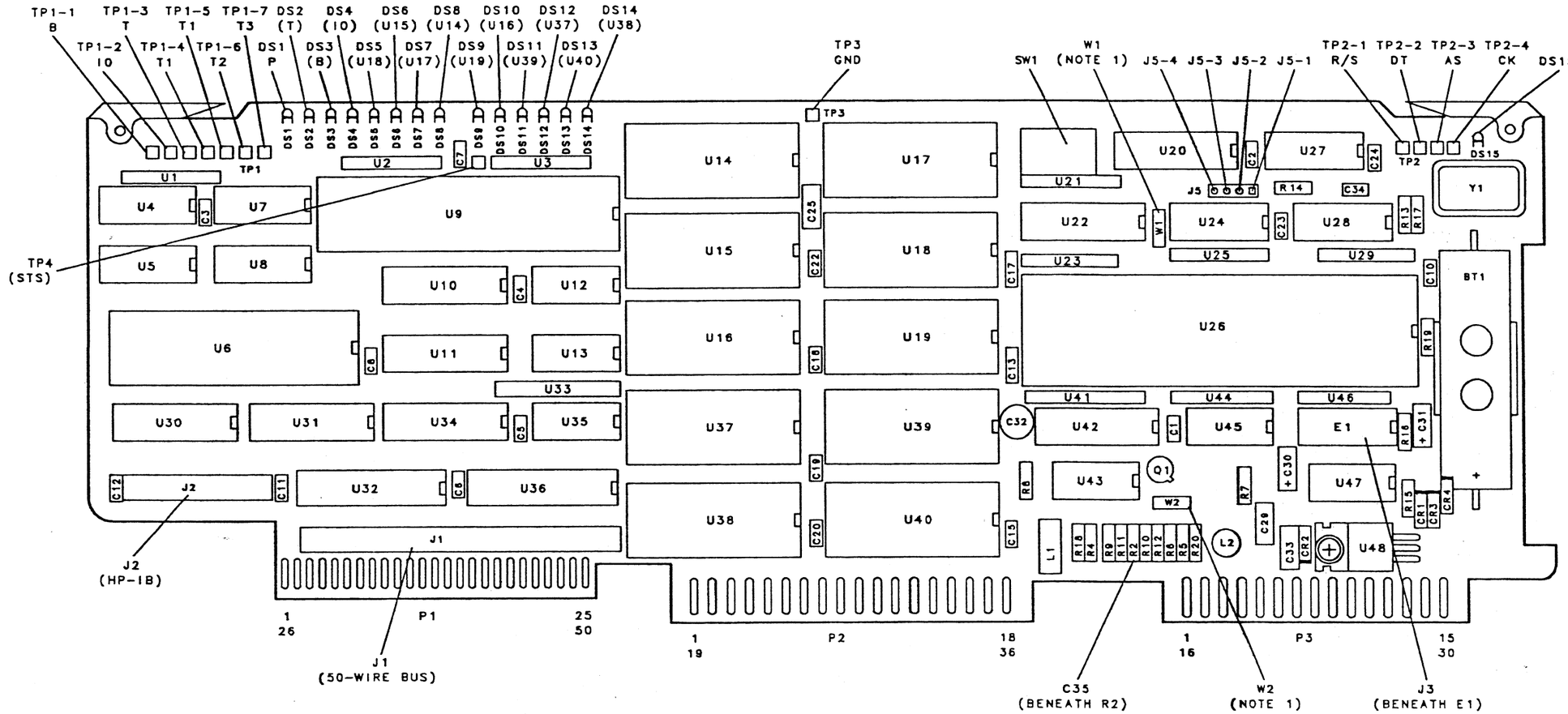
IOB0	P1-24, P2-5, J1-27
IOB1	P1-49, P2-23, J1-2
IOB2	P1-23, P2-6, J1-28
IOB3	P1-48, P2-24, J1-3
IOB4	P1-22, P2-7, J1-29
IOB5	P1-47, P2-25, J1-4
IOB6	P1-21, P2-8, J1-30
IOB7	P1-46, P2-26, J1-5
IOB8	P1-20, P2-9, J1-31
IOB9	P1-45, P2-27, J1-6
IOB10	P1-19, P2-10, J1-32
IOB11	P1-44, P2-28, J1-7
IOB12	P1-18, P2-11, J1-33
IOB13	P1-43, P2-29, J1-8
IOB14	P1-17, P2-12, J1-34
IOB15	P1-42, P2-30, J1-9

ADR BUS (P/O INSTRUMENT BUS) 5

I/O BUS (P/O INSTRUMENT BUS) 16

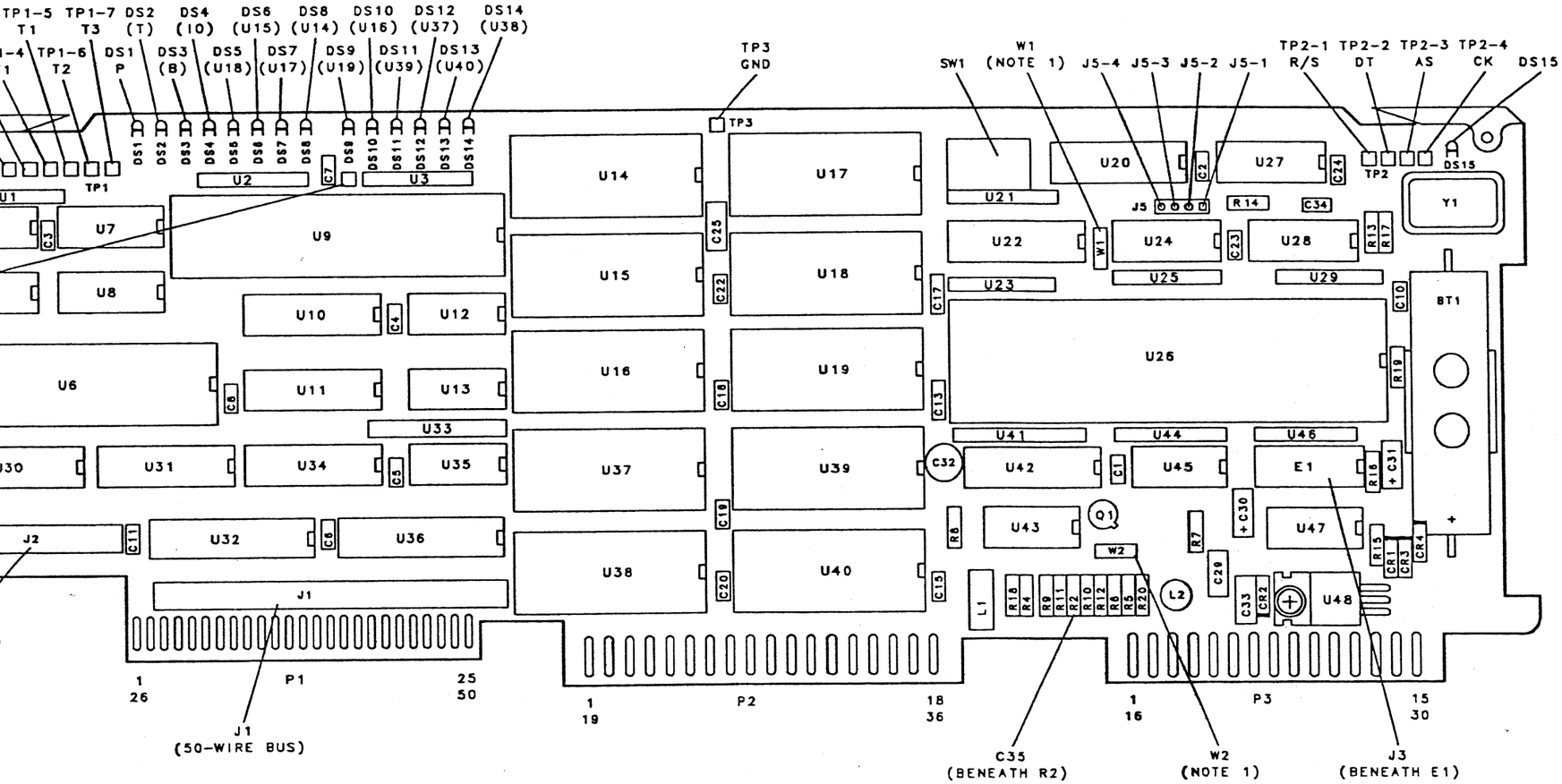
A15

A15 CONTROLLER, SCHEMATIC DIAGRAM (4 OF 4)



NOTES:

1. JUMPER W1 IS LOADED WHEN 128K ROMS (SET OF SIX) ARE INSTALLED; W2 IS LOADED WHEN 256K ROMS (SET OF FOUR) ARE INSTALLED.



NOTES:

1. JUMPER W1 IS LOADED WHEN 128K ROMS (SET OF SIX) ARE INSTALLED; W2 IS LOADED WHEN 256K ROMS (SET OF FOUR) ARE INSTALLED.

A15 CONTROLLER, COMPONENT LOCATIONS: 85680-60180

A15 CONTROLLER
85680-60180
SERIAL PREFIXES: 2413A-2445A)

(SHEET 1 OF 4)

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	LTIO	A12P1-26	F
26	GND		R
2	LBIO	A12P1-27	F
27	GND		R
3	NC		
28	NC		
4	LRTL	A12P1-29	I
29	HSWP	A12P1-4	S
5	KC6	A12P1-30	S
30	KC7	A12P1-5	S
6	KC4	A12P1-31	S
31	KC5	A12P1-6	S
7	KC2	A12P1-32	S
32	KC3	A12P1-7	S
8	KCØ	A12P1-33	S
33	KC1	A12P1-8	S
9	KR1Ø	A12P1-34	S
34	KR11	A12P1-9	S
10	KR8	A12P1-35	S
35	KR9	A12P1-10	S
11	NC		
36	NC		
12	ADR4	A12P1-37	H
37	LADR	A12P1-12	I
13	ADR2	A12P1-38	H
38	ADR3	A12P1-13	H
14	ADRØ	A12P1-39	H
39	ADR1	A12P1-14	H
15	NC		
40	NC		
16	NC		
41	NC		
17	IOB14	A12P1-42	H
42	IOB15	A12P1-17	H
18	IOB12	A12P1-43	H
43	IOB13	A12P1-18	H
19	IOB1Ø	A12P1-44	H
44	IOB11	A12P1-19	H
20	IOB8	A12P1-45	H
45	IOB9	A12P1-20	H
21	IOB6	A12P1-46	H
46	IOB7	A12P1-21	H
22	IOB4	A12P1-47	H
47	IOB5	A12P1-22	H
23	IOB2	A12P1-48	H
48	IOB3	A12P1-23	H
24	IOBØ	A12P1-49	H
49	IOB1	A12P1-24	H
25	GND	.	R
50	LRMT	A12P1-25	I

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND	INSTRUMENT BUS	R
19	LBIO		F
2	ADRØ		H
20	ADR1		H
3	ADR2		H
21	ADR3		H
4	ADR4		H
22	NC		H
5	IOBØ		H
23	IOB1		H
6	IOB2		H
24	IOB3		H
7	IOB4		H
25	IOB5		H
8	IOB6		H
26	IOB7		H
9	IOB8		H
27	IOB9		H
10	IOB1Ø		H
28	IOB11		H
11	IOB12		H
29	IOB13		H
12	IOB14		H
30	IOB15		H
13	NC		
31	NC		
14	GND		R
32	HPUP	A24P2-12	B
15	NC		
33	LIPS	A12P2-33	I
16	NC		
34	LSRQ	A12P2-34	J
17	+5.2V		R
35	+5.2V		R
18	GND		R
36	GND		R

P3

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
16	NC		
2	GND		R
17	GND		R
3	+12V		R
18	+12V		R
4	-5.2V		NC
19	-5.2V		NC
5	NC		
20	NC		
6	NC		
21	NC		
7	NC		
22	NC		
8	NC		
23	NC		
9	NC		
24	NC		
10	NC		
25	NC		
11	NC		
26	NC		
12	NC		
27	NC		
13	NC		
28	NC		
14	NC		
29	NC		
15	GND		R
30	GND		R

A15

A15 Controller Schematic Diagram, 85680-60180 (1 of 4)

A15 CONTROLLER
85680-60180
(SERIAL PREFIXES: 2413A-2445A)
(SHEET 2 OF 4)

J1

PIN	SIGNAL	TO FROM	FUNCTION BLOCK
1	NC		
2	IOB1	A4A10J1-4	H
3	IOB3	A4A10J1-6	H
4	IOB5	A4A10J1-8	H
5	IOB7	A4A10J1-10	H
6	IOB9	A4A10J1-12	H
7	IOB11	A4A10J1-14	H
8	IOB13	A4A10J1-16	H
9	IOB15	A4A10J1-18	H
10	LADR	NC	I
11	HPON	A1A9J1-22	R
12	ADR1	A4A10J1-24	H
13	ADR3	A4A10J1-26	H
14	NC		
15	NC		
16	KR9	A1A1J1-33	S
17	KR11	A1A1J1-31	S
18	KC1	A1A1J1-41	S
19	KC3	A1A1J1-39	S
20	KC5	A1A1J1-37	S
21	KC7	A1A1J1-35	S
22	HSWP	A3A1P1-21	S
23	LDSR	A3A10J1-46	J
24	GND		R
25	GND		R
26	GND		R
27	IOBØ	A4A10J1-3	H
28	IOB2	A4A10J1-5	H
29	IOB4	A4A10J1-7	H
30	IOB6	A4A10J1-9	H
31	IOB8	A4A10J1-11	H
32	IOB1Ø	A4A10J1-13	H
33	IOB12	A4A10J1-15	H
34	IOB14	A4A10J1-17	H
35	NC		
36	NC		
37	ADRØ	A4A10J1-23	H
38	ADR2	A4A10J1-25	H
39	ADR4	A4A10J1-27	H
40	NC		
41	KR8	A1A1J1-34	S
42	KR1Ø	A1A1J1-32	S
43	KCØ	A1A1J1-42	S
44	KC2	A1A1J1-40	S
45	KC4	A1A1J1-38	S
46	KC6	A1A1J1-36	S
47	NC		
48	LSRQ	A1A9J1-45	J
49	LBIO	A1A9J1-47	F
50	LTIO	A3A10J2-49	F

J2

PIN	SIGNAL	TO FROM	FUNCTION BLOCK
1	DIO1	J5-1	J
2	DIO2	J5-2	J
3	DIO3	J5-3	J
4	DIO4	J5-4	J
5	EOI	J5-5	J
6	DAV	J5-6	J
7	NRFD	J5-7	J
8	NDAC	J5-8	J
9	IFC	J5-9	J
10	SRQ	J5-10	J
11	ATN	J5-11	J
12	NC	SEE NOTE 5	
13	DIO5	J5-13	J
14	DIO6	J5-14	J
15	DIO7	J5-15	J
16	DIO8	J5-16	J
17	REN	J5-17	J
18	NC	SEE NOTE 5	
19	NC	SEE NOTE 5	
20	NC	SEE NOTE 5	
21	NC	SEE NOTE 5	
22	NC	SEE NOTE 5	
23	NC	SEE NOTE 5	
24	NC	SEE NOTE 5	

NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN MICROFARADS (μF) INDUCTANCE IS IN MICROHENRIES (μH)
3. UNLESS OTHERWISE INDICATED: SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.
4. JUMPER W1 IS LOADED WHEN 128K ROMS (SET OF SIX) ARE INSTALLED: W2 IS LOADED WHEN 256K ROMS (SET OF FOUR) ARE INSTALLED.
5. PINS 12,18-24 ARE CHASSIS GROUNDED THRU A29.

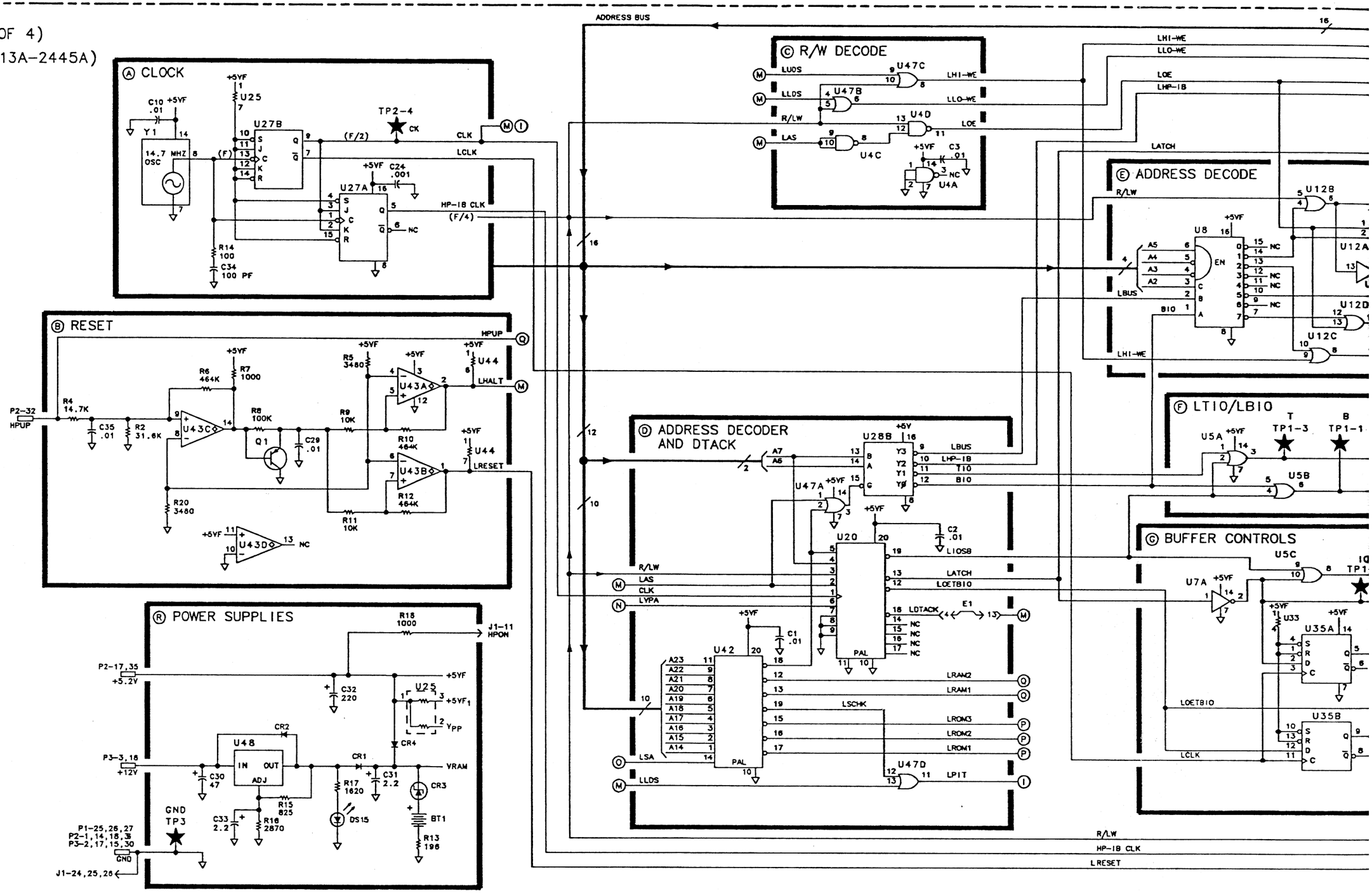
6. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
ADRØ	INSTRUMENT BUS ADDRESS BIT Ø
ADR1	INSTRUMENT BUS ADDRESS BIT 1
ADR2	INSTRUMENT BUS ADDRESS BIT 2
ADR3	INSTRUMENT BUS ADDRESS BIT 3
ADR4	INSTRUMENT BUS ADDRESS BIT 4
ATN	HP-IB CONTROL
DAV	HP-IB CONTROL
DIO1	DATA INPUT/OUTPUT
DIO2	DATA INPUT/OUTPUT
DIO3	DATA INPUT/OUTPUT
DIO4	DATA INPUT/OUTPUT
DIO5	DATA INPUT/OUTPUT
DIO6	DATA INPUT/OUTPUT
DIO7	DATA INPUT/OUTPUT
DIO8	DATA INPUT/OUTPUT
EOI	HP-IB CONTROL
HPON	HIGH=IF-DISPLAY SECTION POWER ON
HPUP	HIGH=POWER ON
IFC	HP-IB CONTROL
IOBØ	INSTRUMENT BUS DATA BIT Ø
IOB1	INSTRUMENT BUS DATA BIT 1
IOB2	INSTRUMENT BUS DATA BIT 2
IOB3	INSTRUMENT BUS DATA BIT 3
IOB4	INSTRUMENT BUS DATA BIT 4
IOB5	INSTRUMENT BUS DATA BIT 5
IOB6	INSTRUMENT BUS DATA BIT 6
IOB7	INSTRUMENT BUS DATA BIT 7
IOB8	INSTRUMENT BUS DATA BIT 8
IOB9	INSTRUMENT BUS DATA BIT 9
IOB1Ø	INSTRUMENT BUS DATA BIT 1Ø
IOB11	INSTRUMENT BUS DATA BIT 11
IOB12	INSTRUMENT BUS DATA BIT 12
IOB13	INSTRUMENT BUS DATA BIT 13
IOB14	INSTRUMENT BUS DATA BIT 14
IOB15	INSTRUMENT BUS DATA BIT 15
LADR	LOW=ADDRESS LED ON
LBIO	LOW=BOTTOM BOX INPUT/OUTPUT
LDSR	LOW=DIGITAL STORAGE READY
LIPS	LOW=INSTRUMENT PRESET
LRMT	LOW=REMOTE
LRTL	LOW=RETURN TO LOCAL
LSRQ	LOW=SERVICE REQUEST
LTIO	LOW=TOP BOX I/O
NDAC	HP-IB CONTROL
NRFD	HP-IB CONTROL
REN	HP-IB CONTROL
SRQ	HP-IB CONTROL

A15

A15 Controller Schematic Diagram, 85680-60180 (2 of 4)

A15 CONTROLLER
85680-60180 (SHEET 3 OF 4)
(SERIAL PREFIXES: 2413A-2445A)



© R/W DECODE

LUDS, LLDS, R/LW, LAS (M)
U47C, U47B, U4D, U4C, U4A
+5VF, C3 .01, NC
LHI-WE, LLO-WE, LOE

Ⓔ ADDRESS DECODE

R/LW, LBUS, BIO
U8 (EN), U12B, U12A, U7F, U12D, U12C, U7D
BUSLD, LHP-IBSW, LBUSEN, LATR, LDBTEST, DBCLK

Ⓕ LTIO/LBIO

T TP1-3, B TP1-1
U5A, U5B
LTIO, LBIO → P1-1, J1-50, J1-49, P1-2, P2-19

© BUFFER CONTROLS

U5C, IO TP1-2, ADTSTCLK
U7A, U13C, SAB
U33, U35A, U35B, U13A, DIR
LOETBIO, LCLK

DECODER

U288, U47A, U47D
A7, A6, LBUS, LHP-IB, TIO, BIO, LPIT
U20 PAL, C2 .01, LIOSB, LATCH, LOETBIO, LDTACK, E1
U42 PAL, C1 .01, LRAM2, LRAM1, LSCHK, LROM3, LROM2, LROM1

Ⓗ ADDRESS AND DATA LINE BUFFERS

LATCH, ADDRESS BUS 17
U10 3-ST, C4 .01, A5 A4 A3 A2 A1 → ADR4 ADR3 ADR2 ADR1 ADR0
U36, C5 .01, U32, C6 .01
LBUSEN, DIR, BUSLD, SAB, SBA
U5D
D15 D14 D13 D12 D11 D10 D9 D8 → IOB15 IOB14 IOB13 IOB12 IOB11 IOB10 IOB9 IOB8
D7 D6 D5 D4 D3 D2 D1 D0 → IOB7 IOB6 IOB5 IOB4 IOB3 IOB2 IOB1 IOB0
DATA BUS 16

Ⓘ PERIPHERAL INTERFACE AND TIMER

+5V, C7 .01, U9, U2, U3, U1
STATUS, LRTL, LIPS, LTIMER, LRXT, LADR
SEE NOTE 7
DS14 DS13 DS12 DS11 DS10 DS9 DS8 DS7 DS6 DS5 DS4 DS3 DS2 DS1
TP1-4 T0, TP1-5 T1, TP1-6 T2, TP1-7 T3
U45F, U45E
LPIT, R/LW, CLK, LRESET, CS, RESET
A5 A4 A3 A2 A1, D7 D6 D5 D4 D3 D2 D1 D0, 3-ST
DATA BUS 16, R/LW, HP-IB CLK, LRESET
ADR BUS (P/O INSTRUMENT BUS) 5
I/O BUS (P/O INSTRUMENT BUS) 16

16 ADDRESS BUS 17 | 17 ADDRESS BUS 17 | 17 ADDRESS BUS

LHI-WE | LHI-WE | LHI-WE

LLO-WE | LLO-WE | LLO-WE

LHP-IBSW | LHP-IBSW

LOE | LOE | LOE

LHP-IB | LHP-IB

TO SHEET 4

Ⓗ ADDRESS AND DATA LINE BUFFERS

LATCH

U10 3-ST — +5VF, C4 .01

A5 A4 A3 A2 A1 → ADR4 ADR3 ADR2 ADR1 ADR0

NC NC NC

U36 — +5VF, C3 .01

LBUSEN, DIR, BUSLD, SAB

U5D

D15 D14 D13 D12 D11 D10 D9 D8 → IOB15 IOB14 IOB13 IOB12 IOB11 IOB10 IOB9 IOB8

U32 24 — +5VF, C6 .01

D7 D6 D5 D4 D3 D2 D1 D0 → IOB7 IOB6 IOB5 IOB4 IOB3 IOB2 IOB1 IOB0

DATA BUS 16

Ⓘ PERIPHERAL INTERFACE AND TIMER

U9 — +5V, C7 .01

U2 — +5VF

STATUS → TP4 (STS)

LRTL → P1-4

LIPS → P2-33

SEE NOTE 7

U3 — +5VF

DS14 DS13 DS12 DS11 DS10 DS9 DS8

U2

DS7 DS6 DS5 DS4 DS3

U1

DS2 DS1

TP1-4 TØ

TP1-5 T1

TP1-6 T2

TP1-7 T3

LTIMER

U45F — LRMT → P1-50

U45E — LADR → P1-37 → J1-10

LPIT, R/LW, CLK, LRESET

A5 A4 A3 A2 A1

D7 D6 D5 D4 D3 D2 D1 D0 — 3-ST

NC NC NC NC NC

DATA BUS 16

R/LW

HP-IB CLK

LRESET

ADR BUS (P/O INSTRUMENT BUS) 5

I/O BUS (P/O INSTRUMENT BUS) 16

Ⓙ HP-IB

LHP-IBSW

U22 — +5VF

U21 — +5VF — SW1

J1-48, P2-34, LSRQ, J1-23, LDSR

D0 D1 D2 D3 D4 D5 D6 D7 — 3-ST

U6 — +5VF, C8 .01

A3 A2 A1 → RS2 RS1 RS0

D7 D6 D5 D4 D3 D2 D1 D0 — 3-ST

U31 — +5VF, C11 .01

DIO1 DIO2 DIO3 DIO4 DIO5 DIO6 DIO7 DIO8 — J2

U33 — +5VF, C12 .01

U30

REN IFC NDAC NRFD DAV EOI ATN SRQ

U17 — +5VF

LHP-IB, R/LW, LLO-WE → ACCRG, CE, DBIN, WE

HP-IB CLK, LRESET → CLK, R

NC NC → ACCRQ, TR

CONT, INT

DC 3-ST

LHPINT

DATA BUS 16

R/LW

LRESET

TO SHEET 4

ADR BUS (P/O INSTRUMENT BUS) 5

I/O BUS (P/O INSTRUMENT BUS) 16

B

TP1-1

LT10 → P1-1 → J1-50

LB10 → J1-49 → P1-2, P2-19

I0

TP1-2 ADTSTCLK

U13C — SAB

U13A — DIR

U35A, U35B

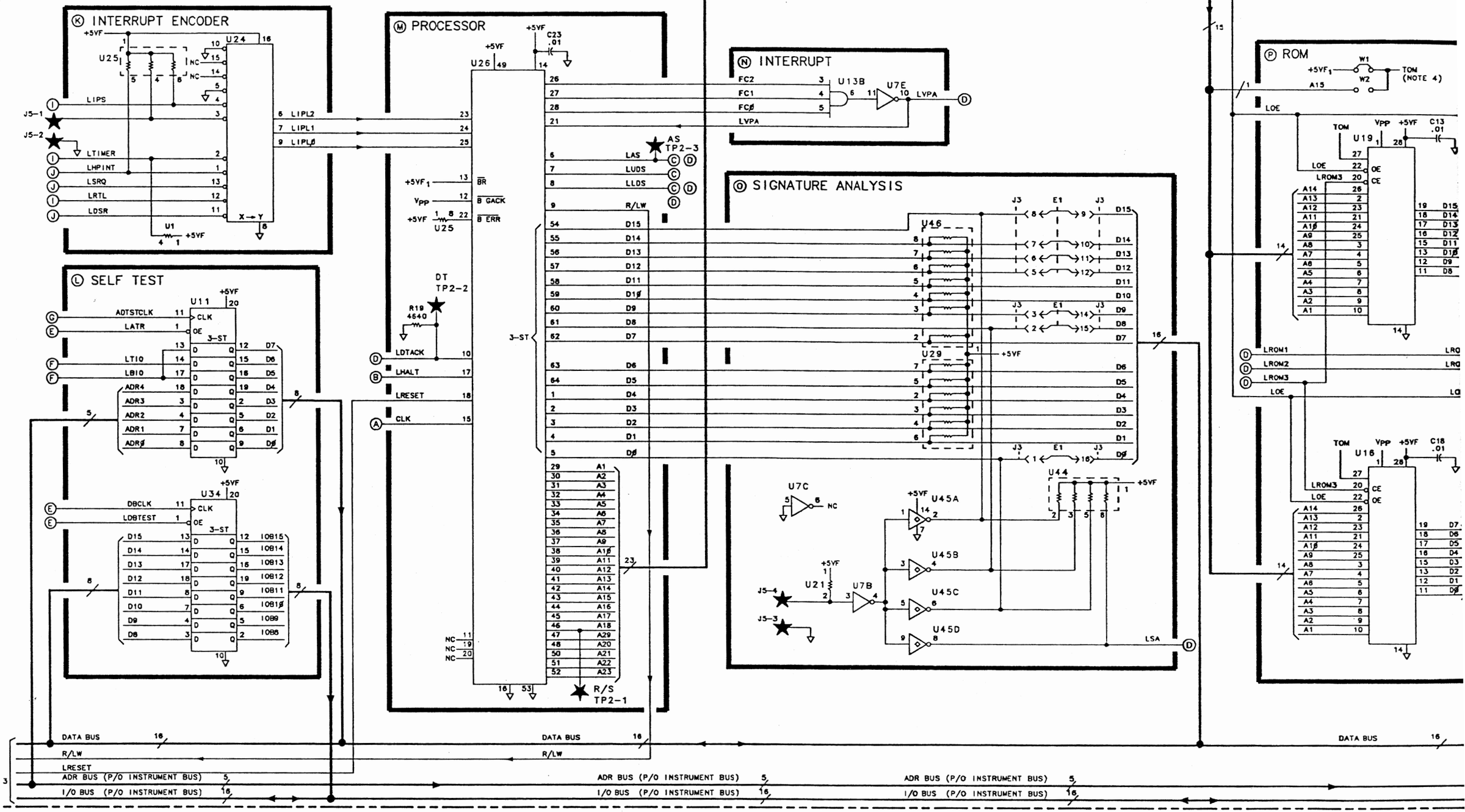
A15

A15 CONTROLLER, SCHEMATIC DIAGRAM (3 OF 4)

A15 CONTROLLER
85680-60180 (SHEET 4 OF 4)
(SERIAL PREFIXES: 2413A-2445A)

FROM SHEET 3

ADDRESS BUS 17
LHI-WE
LLO-WE
LOE



DATA BUS 16
R/LW
LRESET
ADR BUS (P/O INSTRUMENT BUS) 5
I/O BUS (P/O INSTRUMENT BUS) 16

FROM SHEET 3

ADDRESS BUS
LHI-WE
LLO-WE
LOE

U13B
U7E
LVPA
(D)

ANALYSIS

U46
J3 E1 J3
D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0

U29
+5VF

U44
+5VF

U45A
U45B
U45C
U45D
U7B
LSA

(P) ROM
+5VF1 W1 W2 A15
TOM (NOTE 4)

U19 U39 U40
TOM VPP +5VF C13 C15 .01
LROM3 LROM2 LROM1
A14 A13 A12 A11 A10 A9 A8 A7 A6 A5 A4 A3 A2 A1
OE CE
D15 D14 D13 D12 D11 D10 D9 D8

LROM1
LROM2
LROM3
LOE
DATA BUS 16

U16 U37 U38
TOM VPP +5VF C18 C19 C20 .01
LROM3 LROM2 LROM1
CE OE
D7 D6 D5 D4 D3 D2 D1 D0

(Q) RAM
(D) LRAM 1
(D) LRAM 2
LOE
(B) HPUP
LHI-WE
LLO-WE

U17 U14
CS1 OE CS2 W
HPUP LHI-WE LLO-WE

U23
U41
A1 A2 A3 A4 A5 A6 A7 A9 A10 A11 A12 A13 A14

ADR BUS (P/O INSTRUMENT BUS) 5
I/O BUS (P/O INSTRUMENT BUS) 16

ADDRESS BUS 14
LHI-WE
LLO-WE
LOE

(NOTE 4)

LOE
TOM
VPP
+5VF
C13 .01
C15 .01
C18 .01
C19 .01
C20 .01

U39 U40 U37 U38

LROM2
LROM1
LOE

A14 A13 A12 A11 A10 A9 A8 A7 A6 A5 A4 A3 A2 A1

19 D15 18 D14 17 D13 16 D12 15 D11 13 D10 12 D9 11 D8
19 D7 18 D6 17 D5 16 D4 15 D3 13 D2 12 D1 11 D0

LROM1
LROM2
LOE

ADDRESS BUS 13
LHI-WE
LLO-WE
LOE

Q RAM

D LRAM 1
D LRAM 2
LOE
B HPUP
LHI-WE

U17 U18 U14 U15

VRAM
C25 1.0
C17 .01
C22 .01

CS1 OE CS2 W

HPUP
LHI-WE
LLO-WE

U23 U41

A1 A2 A3 A4
A5 A6 A7 A9 A10 A11 A12 A13 A14

DATA BUS 16

ADR BUS (P/O INSTRUMENT BUS) 5
I/O BUS (P/O INSTRUMENT BUS) 16

S JUMPER CONNECTIONS

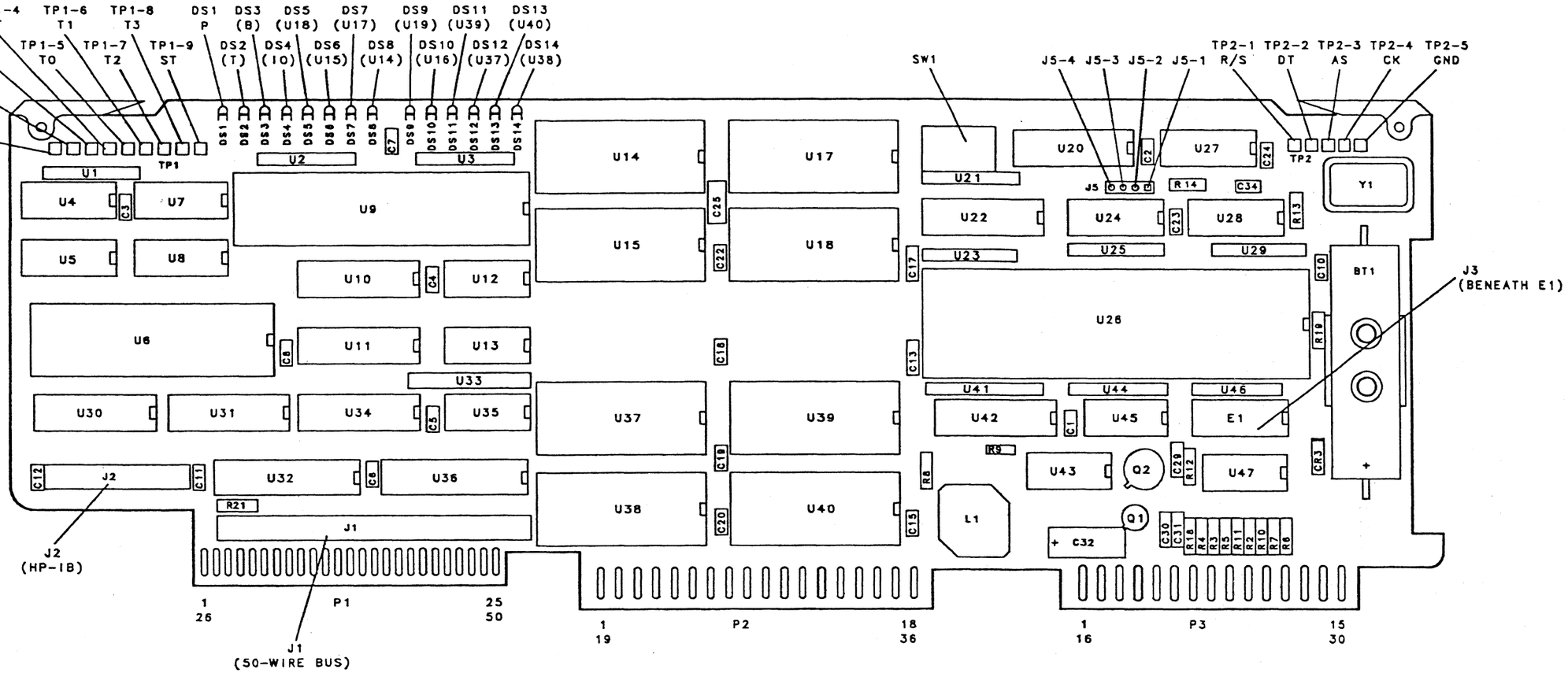
J1-22	HSWP	P1-29
J1-41	KR8	P1-10
J1-16	KR9	P1-35
J1-42	KR10	P1-9
J1-17	KR11	P1-34
J1-43	KC0	P1-8
J1-18	KC1	P1-33
J1-44	KC2	P1-7
J1-19	KC3	P1-32
J1-45	KC4	P1-6
J1-20	KC5	P1-31
J1-46	KC6	P1-5
J1-21	KC7	P1-30

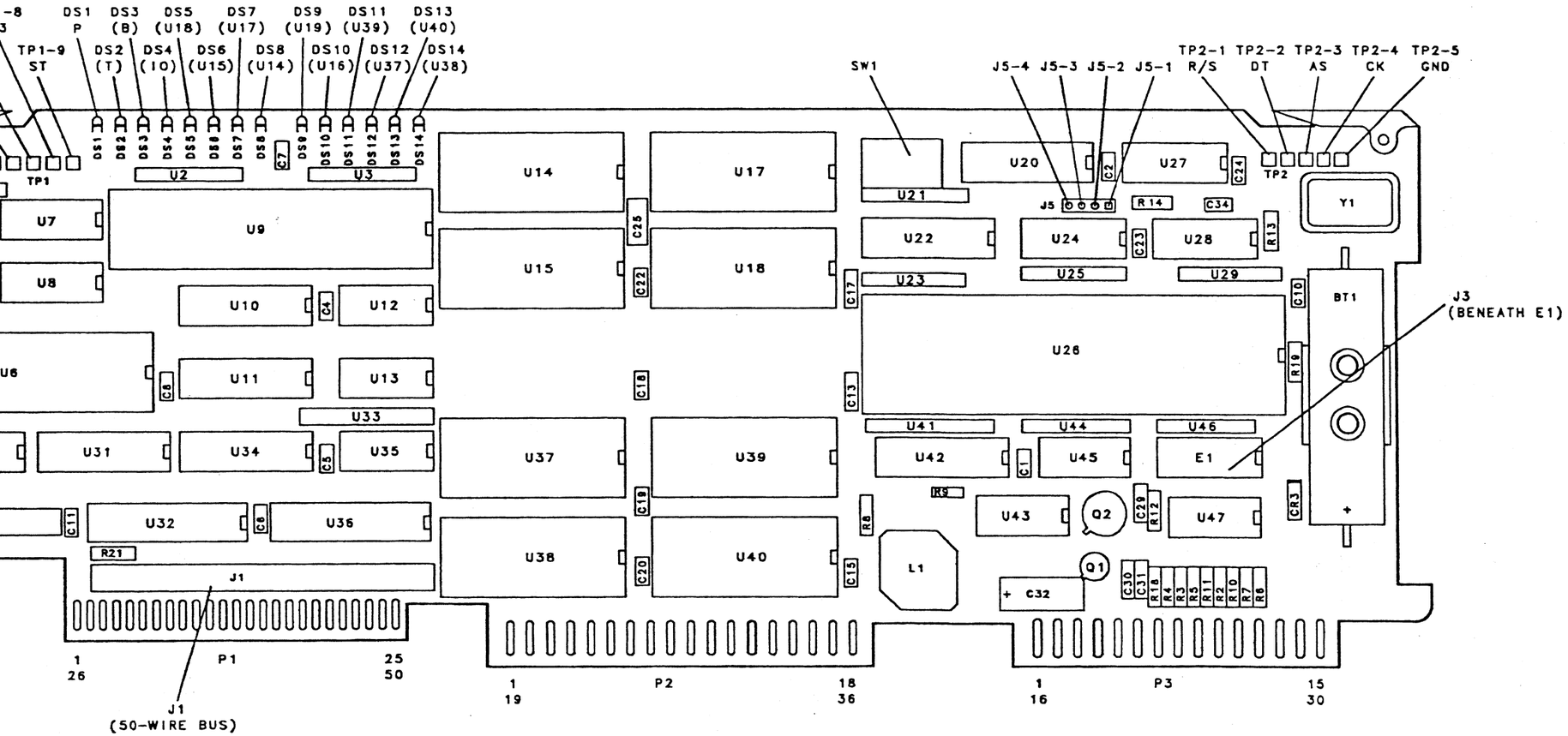
ADR0	P1-14, P2-2, J1-37
ADR1	P1-39, P2-20, J1-12
ADR2	P1-13, P2-3, J1-38
ADR3	P1-38, P2-21, J1-13
ADR4	P1-12, P2-4, J1-39

1080	P1-24, P2-5, J1-27
1081	P1-49, P2-23, J1-2
1082	P1-23, P2-6, J1-28
1083	P1-48, P2-24, J1-3
1084	P1-22, P2-7, J1-29
1085	P1-47, P2-25, J1-4
1086	P1-21, P2-8, J1-30
1087	P1-46, P2-26, J1-5
1088	P1-20, P2-9, J1-31
1089	P1-45, P2-27, J1-6
1081	P1-19, P2-10, J1-32
10811	P1-44, P2-28, J1-7
10812	P1-18, P2-11, J1-33
10813	P1-43, P2-29, J1-8
10814	P1-17, P2-12, J1-34
10815	P1-42, P2-30, J1-9

A15

A15 CONTROLLER, SCHEMATIC DIAGRAM (4 OF 4)


TP1-4 T
TP1-6 T1
TP1-8 T3
DS1 P
DS3 (B)
DS5 (U18)
DS7 (U17)
DS9 (U19)
DS11 (U39)
DS13 (U40)
TP1-3 IO
TP1-5 TO
TP1-7 T2
TP1-9 ST
DS2 (T)
DS4 (IO)
DS6 (U15)
DS8 (U14)
DS10 (U16)
DS12 (U37)
DS14 (U38)
TP1-2 B
TP1-1 GND
TP1
SW1
J5-4 J5-3 J5-2 J5-1
TP2-1 R/S
TP2-2 DT
TP2-3 AS
TP2-4 CK
TP2-5 GND
TP2
J5
Y1
BT1
J3 (BENEATH E1)
E1
J2 (HP-IB)
J1 (50-WIRE BUS)
1 26
P1
25 50
1 19
P2
18 36
1 16
P3
15 30
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U17
U18
U20
U21
U22
U23
U24
U25
U26
U27
U28
U29
U30
U31
U32
U33
U34
U35
U36
U37
U38
U39
U40
U41
U42
U43
U44
U45
U46
U47
L1
Q1
Q2
+ C32
R21
R14
R13
R19
R9
R8
C1
C2
C3
C4
C5
C6
C7
C8
C10
C11
C12
C13
C15
C16
C17
C18
C19
C20
C22
C23
C24
C25
C29
C30
C31
C34
CR3
R12
R16
R4
R3
R5
R11
R2
R10
R7
R6



A15 CONTROLLER, COMPONENT LOCATIONS: 85680-60182, 85680-60202, 85680-60217, 85670-60002.

A15 CONTROLLER
85680-60182 (SERIAL PREFIX: 2503A)
85670-60002 (SERIAL PREFIX: 2541A)
85680-60202 (OPTION H96)(SERIAL PREFIX: 2517A)
85680-60217 (OPTION H44)(SERIAL PREFIX: 2634A)
(SHEET 1 OF 4)

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	LTIO	A12P1-26	F
26	GND		R
2	LBIO	A12P1-27	F
27	GND		R
3	NC		
28	NC		
4	LRTL	A12P1-29	I
29	HSWP	A12P1-4	S
5	KC6	A12P1-30	S
30	KC7	A12P1-5	S
6	KC4	A12P1-31	S
31	KC5	A12P1-6	S
7	KC2	A12P1-32	S
32	KC3	A12P1-7	S
8	KCØ	A12P1-33	S
33	KC1	A12P1-8	S
9	KR1Ø	A12P1-34	S
34	KR11	A12P1-9	S
10	KR8	A12P1-35	S
35	KR9	A12P1-10	S
11	NC		
36	NC		
12	ADR4	A12P1-37	H
37	LADR	A12P1-12	I
13	ADR2	A12P1-38	H
38	ADR3	A12P1-13	H
14	ADRØ	A12P1-39	H
39	ADR1	A12P1-14	H
15	NC		
40	NC		
16	NC		
41	NC		
17	IOB14	A12P1-42	H
42	IOB15	A12P1-17	H
18	IOB12	A12P1-43	H
43	IOB13	A12P1-18	H
19	IOB1Ø	A12P1-44	H
44	IOB11	A12P1-19	H
20	IOB8	A12P1-45	H
45	IOB9	A12P1-20	H
21	IOB6	A12P1-46	H
46	IOB7	A12P1-21	H
22	IOB4	A12P1-47	H
47	IOB5	A12P1-22	H
23	IOB2	A12P1-48	H
48	IOB3	A12P1-23	H
24	IOBØ	A12P1-49	H
49	IOB1	A12P1-24	H
25	GND		R
50	LRMT	A12P1-25	I

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND	INSTRUMENT BUS	R
19	LBIO		F
2	ADRØ		H
20	ADR1		H
3	ADR2		H
21	ADR3		H
4	ADR4		H
22	NC		H
5	IOBØ		H
23	IOB1		H
6	IOB2		H
24	IOB3		H
7	IOB4		H
25	IOB5		H
8	IOB6		H
26	IOB7		H
9	IOB8		H
27	IOB9		H
10	IOB1Ø		H
28	IOB11		H
11	IOB12		H
29	IOB13		H
12	IOB14		H
30	IOB15		H
13	NC		
31	NC		
14	GND		R
32	HPUP	A24P2-12	B
15	NC		
33	LIPS	A12P2-33	I
16	NC		
34	LSRQ	A12P2-34	J
17	+5.2V		R
35	+5.2V		R
18	GND		R
36	GND		R

P3

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	NC		
16	NC		
2	GND		R
17	GND		R
3	+12V		R
18	+12V		R
4	-5.2V		NC
19	-5.2V		NC
5	NC		
20	NC		
6	NC		
21	NC		
7	NC		
22	NC		
8	NC		
23	NC		
9	NC		
24	NC		
10	NC		
25	NC		
11	NC		
26	NC		
12	NC		
27	NC		
13	NC		
28	NC		
14	NC		
29	NC		
15	GND		R
30	GND		R

A15

A15 Controller Schematic Diagram, 85680-60182 (1 of 4)

A15 CONTROLLER
85680-60182 (SERIAL PREFIX:2503A)
85670-60002 (SERIAL PREFIX: 2541A)
85680-60202 (OPTION H96) (SERIAL PREFIX:2517A)
85680-60217 (OPTION H44) (SERIAL PREFIX:2634A)
(SHEET 2 OF 4)

J1

PIN	SIGNAL	TO FROM	FUNCTION BLOCK
1	NC		
2	IOB1	A4A10J1-4	H
3	IOB3	A4A10J1-6	H
4	IOB5	A4A10J1-8	H
5	IOB7	A4A10J1-10	H
6	IOB9	A4A10J1-12	H
7	IOB11	A4A10J1-14	H
8	IOB13	A4A10J1-16	H
9	IOB15	A4A10J1-18	H
10	LADR	NC	I
11	HPON	A1A9J1-22	R
12	ADR1	A4A10J1-24	H
13	ADR3	A4A10J1-26	H
14	NC		
15	NC		
16	KR9	A1A1J1-33	S
17	KR11	A1A1J1-31	S
18	KC1	A1A1J1-41	S
19	KC3	A1A1J1-39	S
20	KC5	A1A1J1-37	S
21	KC7	A1A1J1-35	S
22	HSWP	A3A1P1-21	S
23	LDSR	A3A10J1-46	J
24	GND		R
25	GND		R
26	GND		R
27	IOBØ	A4A10J1-3	H
28	IOB2	A4A10J1-5	H
29	IOB4	A4A10J1-7	H
30	IOB6	A4A10J1-9	H
31	IOB8	A4A10J1-11	H
32	IOB1Ø	A4A10J1-13	H
33	IOB12	A4A10J1-15	H
34	IOB14	A4A10J1-17	H
35	NC		
36	NC		
37	ADRØ	A4A10J1-23	H
38	ADR2	A4A10J1-25	H
39	ADR4	A4A10J1-27	H
40	NC		
41	KR8	A1A1J1-34	S
42	KR1Ø	A1A1J1-32	S
43	KCØ	A1A1J1-42	S
44	KC2	A1A1J1-40	S
45	KC4	A1A1J1-38	S
46	KC6	A1A1J1-36	S
47	NC		
48	LSRQ	A1A9J1-45	J
49	LBIO	A1A9J1-47	F
50	LTIO	A3A10J2-49	F

J2

PIN	SIGNAL	TO FROM	FUNCTION BLOCK
1	DIO1	J5-1	J
2	DIO2	J5-2	J
3	DIO3	J5-3	J
4	DIO4	J5-4	J
5	EOI	J5-5	J
6	DAV	J5-6	J
7	NRFD	J5-7	J
8	NDAC	J5-8	J
9	IFC	J5-9	J
10	SRQ	J5-10	J
11	ATN	J5-11	J
12	NC	SEE NOTE 5	
13	DIO5	J5-13	J
14	DIO6	J5-14	J
15	DIO7	J5-15	J
16	DIO8	J5-16	J
17	REN	J5-17	J
18	NC	SEE NOTE 5	
19	NC	SEE NOTE 5	
20	NC	SEE NOTE 5	
21	NC	SEE NOTE 5	
22	NC	SEE NOTE 5	
23	NC	SEE NOTE 5	
24	NC	SEE NOTE 5	

NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IS IN OHMS (Ω)
   CAPACITANCE IS IN MICROFARADS (μF)
   INDUCTANCE IS IN MICROHENRIES (μH)
3. UNLESS OTHERWISE INDICATED:
   SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.
4. ON EARLIER VERSIONS OF THESE CONTROLLER BOARDS (85680-60182, 85670-60002, 85680-60202, AND 85680-60217), R21 IS NOT INSTALLED. REFER TO FUNCTION BLOCK F.
5. PINS 12,18-24 ARE CHASSIS GROUNDED THRU A29.

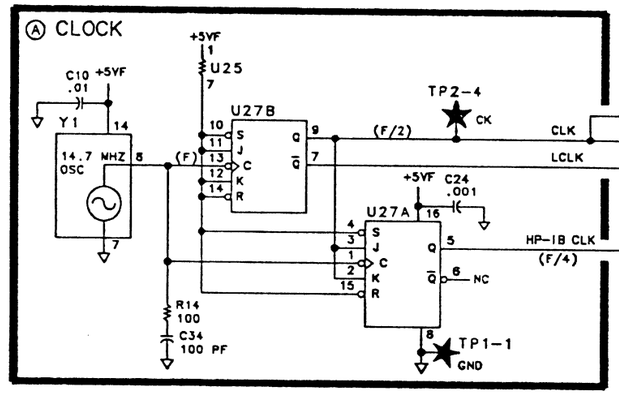
6. MNEMONIC TABLE:

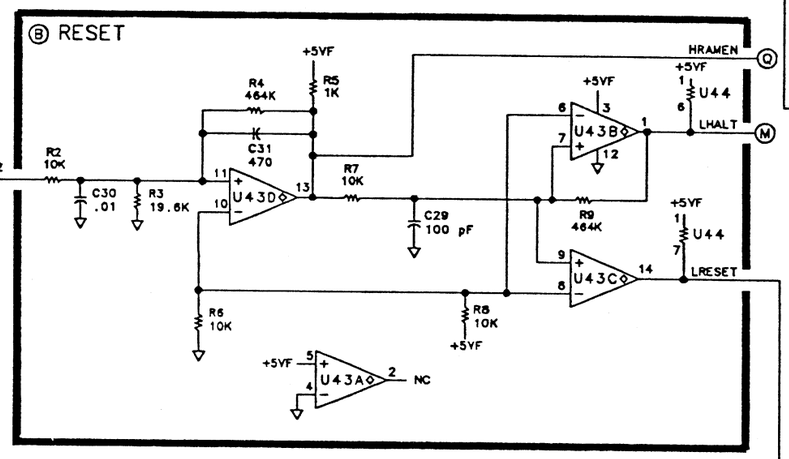
MNEMONIC	DESCRIPTION
ADRØ	INSTRUMENT BUS ADDRESS BIT Ø
ADR1	INSTRUMENT BUS ADDRESS BIT 1
ADR2	INSTRUMENT BUS ADDRESS BIT 2
ADR3	INSTRUMENT BUS ADDRESS BIT 3
ADR4	INSTRUMENT BUS ADDRESS BIT 4
ATN	HP-IB CONTROL
DAV	HP-IB CONTROL
DIO1	DATA INPUT/OUTPUT
DIO2	DATA INPUT/OUTPUT
DIO3	DATA INPUT/OUTPUT
DIO4	DATA INPUT/OUTPUT
DIO5	DATA INPUT/OUTPUT
DIO6	DATA INPUT/OUTPUT
DIO7	DATA INPUT/OUTPUT
DIO8	DATA INPUT/OUTPUT
EOI	HP-IB CONTROL
HPON	HIGH=IF-DISPLAY SECTION POWER ON
HPUP	HIGH=POWER ON
IFC	HP-IB CONTROL
IOBØ	INSTRUMENT BUS DATA BIT Ø
IOB1	INSTRUMENT BUS DATA BIT 1
IOB2	INSTRUMENT BUS DATA BIT 2
IOB3	INSTRUMENT BUS DATA BIT 3
IOB4	INSTRUMENT BUS DATA BIT 4
IOB5	INSTRUMENT BUS DATA BIT 5
IOB6	INSTRUMENT BUS DATA BIT 6
IOB7	INSTRUMENT BUS DATA BIT 7
IOB8	INSTRUMENT BUS DATA BIT 8
IOB9	INSTRUMENT BUS DATA BIT 9
IOB1Ø	INSTRUMENT BUS DATA BIT 1Ø
IOB11	INSTRUMENT BUS DATA BIT 11
IOB12	INSTRUMENT BUS DATA BIT 12
IOB13	INSTRUMENT BUS DATA BIT 13
IOB14	INSTRUMENT BUS DATA BIT 14
IOB15	INSTRUMENT BUS DATA BIT 15
LADR	LOW=ADDRESS LED ON
LBIO	LOW=BOTTOM BOX INPUT/OUTPUT
LDSR	LOW=DIGITAL STORAGE READY
LIPS	LOW=INSTRUMENT PRESET
LRMT	LOW=REMOTE
LRTL	LOW=RETURN TO LOCAL
LSRQ	LOW=SERVICE REQUEST
LTIO	LOW=TOP BOX I/O
NDAC	HP-IB CONTROL
NRFD	HP-IB CONTROL
REN	HP-IB CONTROL
SRQ	HP-IB CONTROL

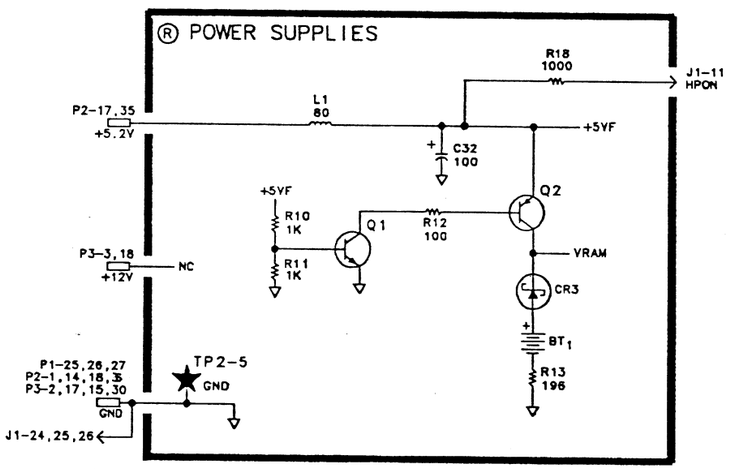
A15

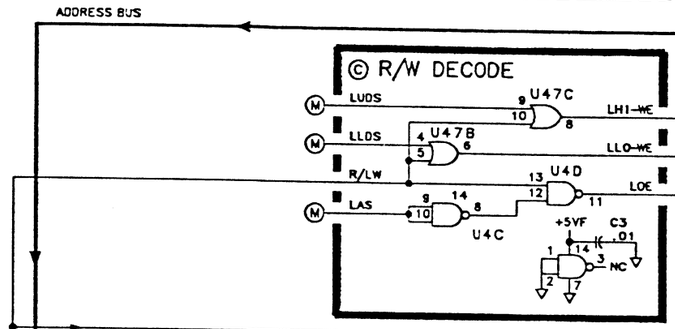
A15 Controller Schematic Diagram, 85680-60182 (2 of 4)

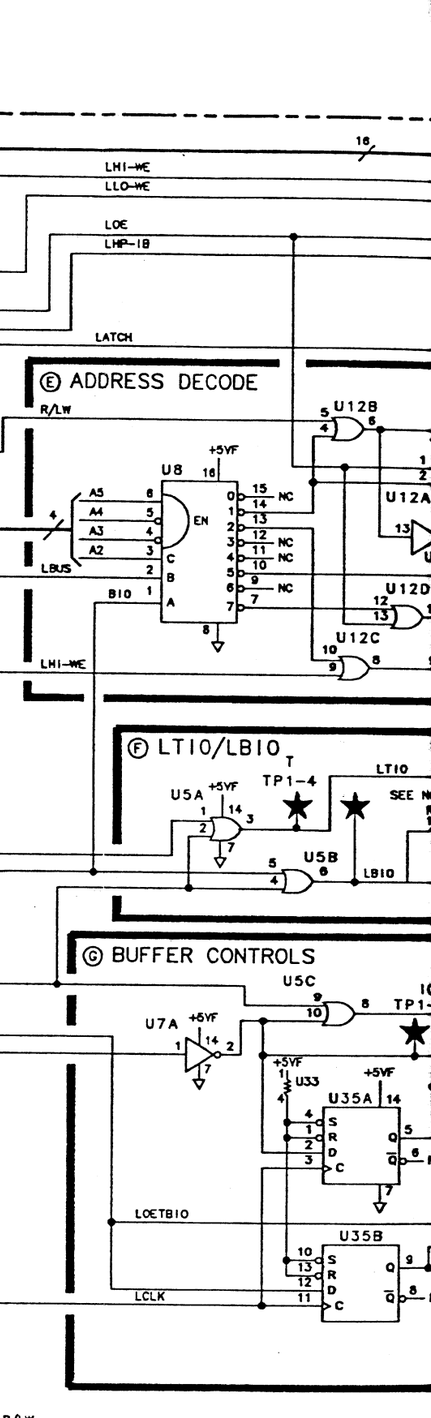
A15 CONTROLLER (SHEET 3 OF 4)
85680-60182
(SERIAL PREFIX: 2503A)
85670-60002
(SERIAL PREFIX: 2541A)
85680-60202 (OPTION H96)
(SERIAL PREFIX: 2517A)
85680-60217 (OPTION H44)
(SERIAL PREFIX: 2634A)



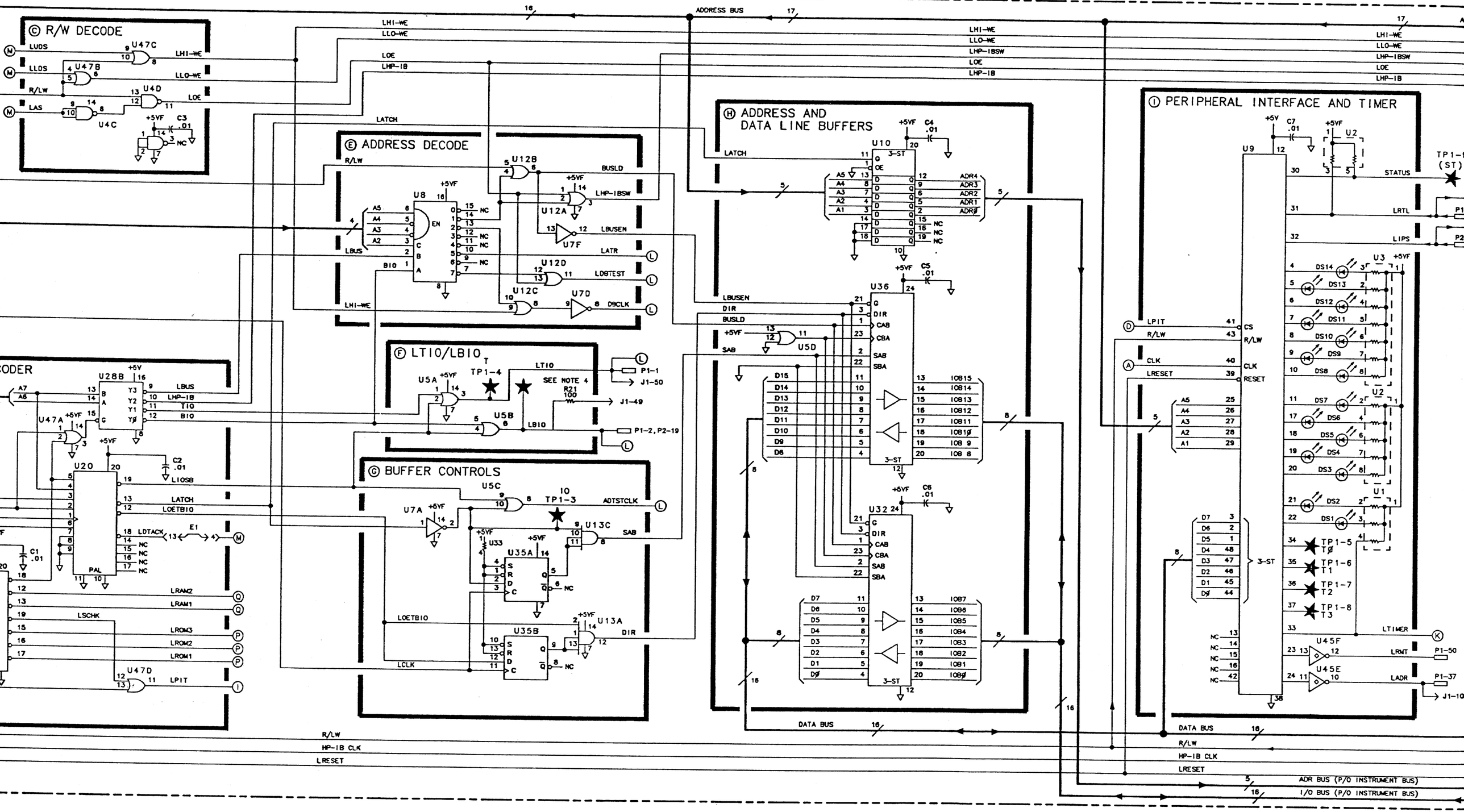








R/LW
HP-IB CLK
LRESET


© R/W DECODE
LUDS
LLDS
R/LW
LAS
U47C
U47B
U4D
U4C
LHI-WE
LLO-WE
LOE
LHP-IB
+5VF
C3 .01
NC
LATCH
ADDRESS BUS
16
17
LHI-WE
LLO-WE
LHP-IBSW
LOE
LHP-IB
Ⓔ ADDRESS DECODE
R/LW
U8
EN
A5
A4
A3
A2
LBUS
BIO
U12B
U12A
U7F
U12D
U12C
U7D
BUSLD
LHP-IBSW
LBUSEN
LATR
LDBTEST
DBCLK
LHI-WE
Ⓕ LTIO/LBIO
TP1-4
U5A
U5B
LTIO
LBIO
SEE NOTE 4
R21
100
J1-49
P1-1
J1-50
P1-2, P2-19
Ⓖ BUFFER CONTROLS
U5C
IO
TP1-3
ADTSTCLK
U7A
U13C
SAB
U33
U35A
U35B
U13A
DIR
LOETBIO
LCLK
Ⓗ ADDRESS AND
DATA LINE BUFFERS
U10
3-ST
LATCH
ADR4
ADR3
ADR2
ADR1
ADR0
C4 .01
U36
C5 .01
LBUSEN
DIR
BUSLD
SAB
SBA
U5D
D15
D14
D13
D12
D11
D10
D9
D8
10B15
10B14
10B13
10B12
10B11
10B10
10B9
10B8
C6 .01
U32
D7
D6
D5
D4
D3
D2
D1
D0
10B7
10B6
10B5
10B4
10B3
10B2
10B1
10B0
DATA BUS
16
Ⓘ PERIPHERAL INTERFACE AND TIMER
U9
U2
C7 .01
STATUS
LRTL
LIPS
TP1-5
TP1-6
TP1-7
TP1-8
LTIMER
U45F
LRNT
U45E
LADR
P1-37
J1-10
U3
U1
DS14
DS13
DS12
DS11
DS10
DS9
DS8
DS7
DS6
DS5
DS4
DS3
DS2
DS1
LPIT
R/LW
CLK
LRESET
CS
RESET
3-ST
ADR BUS (P/O INSTRUMENT BUS)
I/O BUS (P/O INSTRUMENT BUS)
CODER
U28B
U47A
U20
PAL
C2 .01
LIOSB
LDTACK
E1
C1 .01
LRAM2
LRAM1
LSCHK
LROM3
LROM2
LROM1
U47D
LPIT
LBUS
LHP-IB
TIO
BIO
LATCH
LOETBIO
NC
R/LW
HP-IB CLK
LRESET

ADDRESS BUS 17
LHI-WE
LLO-WE
LHP-IBSW
LOE
LHP-IB

TO SHEET 4

H ADDRESS AND DATA LINE BUFFERS

U10 3-ST
LATCH
A5 A4 A3 A2 A1 → ADR4 ADR3 ADR2 ADR1 ADRØ
NC NC NC
+5VF C4 .01

U36
LBUSEN
DIR
BUSLD
SAB
U5D
D15 D14 D13 D12 D11 D10 D9 D8
10815 10814 10813 10812 10811 10810 10809 10808
+5VF C5 .01

U32
D7 D6 D5 D4 D3 D2 D1 DØ
10807 10806 10805 10804 10803 10802 10801 10800
+5VF C6 .01

BUSLD
LHP-IBSW
U12A
U7F
LBUSEN
U12D
LATR
LDBTEST
U7D
DSCLK

LTIO
SEE NOTE 4
R21 100
P1-1
J1-50
J1-49
P1-2, P2-19

IO
TP1-3
ADTSTCLK
U13C
SAB
U13A
DIR

I PERIPHERAL INTERFACE AND TIMER

U9
+5V C7 .01
U2
TP1-9 (ST)
STATUS
LRTL → P1-4
LIPS → P2-33
U3
DS14 DS13 DS12 DS11 DS10 DS9 DS8
DS7 DS6 DS5 DS4 DS3
DS2 DS1
U1
TP1-5 TØ
TP1-6 T1
TP1-7 T2
TP1-8 T3
LTIMER
U45F
LRNT → P1-50
U45E
LADR → P1-37 → J1-10
LPIT
R/LW
CLK
LRESET
A5 A4 A3 A2 A1
D7 D6 D5 D4 D3 D2 D1 DØ
NC NC NC NC NC

J HP-IB

U22
LHP-IBSW
U21
S1
LSRQ
LDSR
J1-48
P2-34
J1-23
D8 D1 D2 D3 D4 D5 D6 D7

U6
RS2 RS1 RSØ
D7 D6 D5 D4 D3 D2 D1 DØ
ACCRG
CE
DBIN
WE
CLK
R
ACCRQ
TR
CONT
INT
HP-IB CLK
LRESET
LHP-IB
R/LW
LLO-WE

U31
U33
C8 .01
C11 .01
J2
DIO1 DIO2 DIO3 DIO4 DIO5 DIO6 DIO7 DIO8

U30
C12 .01
REN IFC NDAC NRFD DAV EOI ATN SRQ
LHPINT

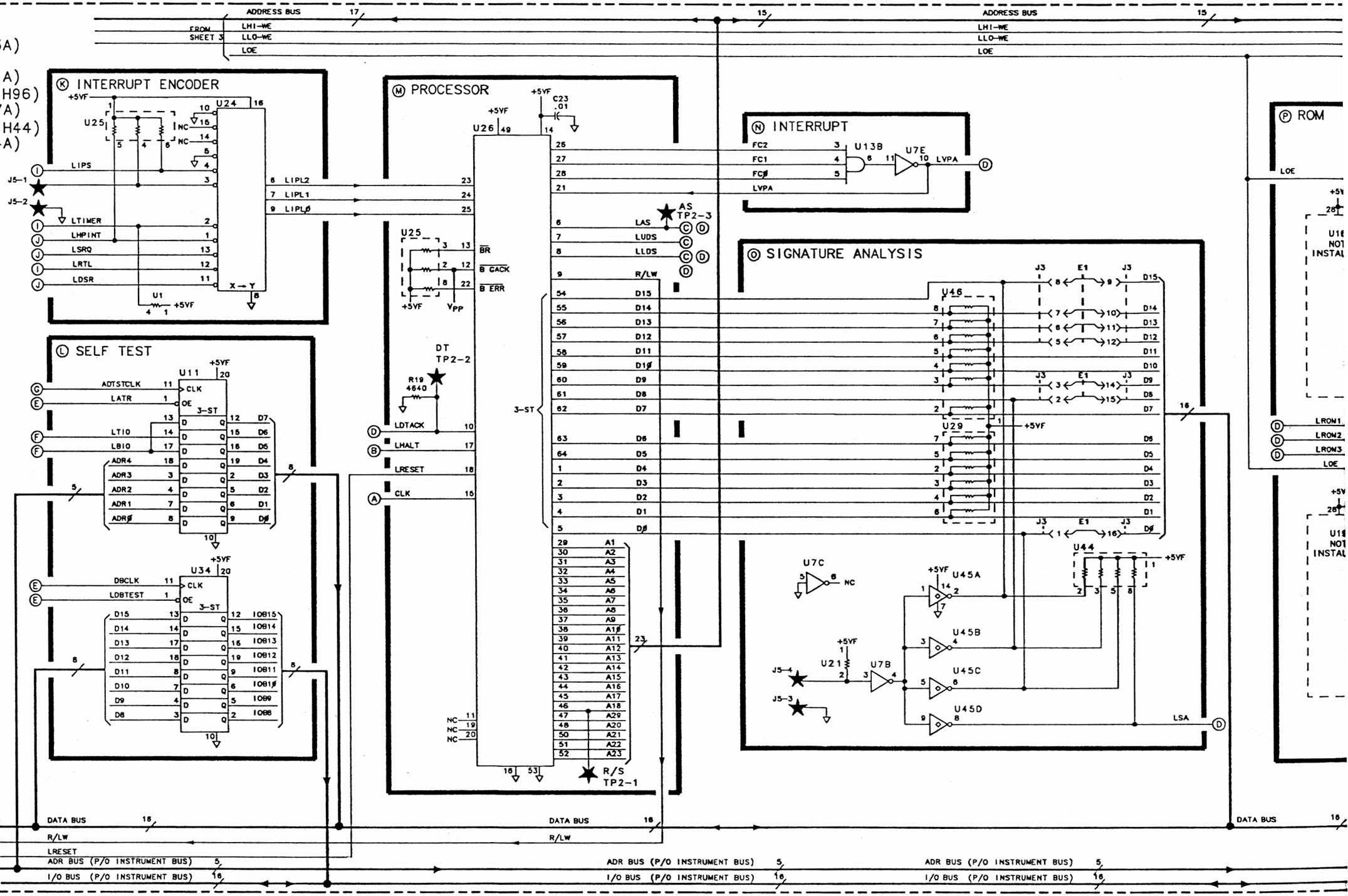
DATA BUS 16
R/LW
HP-IB CLK
LRESET
ADR BUS (P/O INSTRUMENT BUS) 5
I/O BUS (P/O INSTRUMENT BUS) 16

TO SHEET 4

A15

A15 CONTROLLER, SCHEMATIC DIAGRAM (3 OF 4)

A15 CONTROLLER
85680-60182
(SERIAL PREFIX: 2503A)
85670-60002
(SERIAL PREFIX: 2541A)
85680-60202 (OPTION H96)
(SERIAL PREFIX: 2517A)
85680-60217 (OPTION H44)
(SERIAL PREFIX: 2634A)
(SHEET 4 OF 4)



ADDRESS BUS 15
LHI-WE
LLO-WE
LOE

N INTERRUPT

FC2 3
FC1 4
FC0 5
LVPA
U138 6 11
U7E 10 LVPA → D

O SIGNATURE ANALYSIS

U46 J3 E1 J3 D15 D14 D13 D12 D11 D10 D9 D8 D7
U29 +5VF D6 D5 D4 D3 D2 D1 D0
J3 E1 J3 16
U44 +5VF
U7C NC
U45A U45B U45C U45D +5VF
U21 +5VF
U7B
J5-4 J5-3
LSA → D

P ROM

LOE
+5VF C18 .01
U16 NOT INSTALLED
U39 Vpp +5VF
LROM2 20 CE
LOE 22 OE
A15 27 A14 26 A13 2 A12 23 A11 21 A10 24 A9 25 A8 3 A7 4 A6 5 A5 6 A4 7 A3 8 A2 9 A1 10
19 D15 18 D14 17 D13 16 D12 15 D11 13 D10 12 D9 11 D8
U40 Vpp +5VF C15 .01
LROM1 20 CE
LOE 22 OE
A15 27 A14 26 A13 2 A12 23 A11 21 A10 24 A9 25 A8 3 A7 4 A6 5 A5 6 A4 7 A3 8 A2 9 A1 10
19 D15 18 D14 17 D13 16 D12 15 D11 13 D10 12 D9 11 D8
LROM1 → D
LROM2 → D
LROM3 NC → D
LOE
+5VF C13 .01
U19 NOT INSTALLED
U37 Vpp +5VF C19 .01
LROM2 20 CE
LOE 22 OE
A15 27 A14 26 A13 2 A12 23 A11 21 A10 24 A9 25 A8 3 A7 4 A6 5 A5 6 A4 7 A3 8 A2 9 A1 10
19 D7 18 D6 17 D5 16 D4 15 D3 13 D2 12 D1 11 D0
U38 Vpp +5VF C20 .01
LROM1 20 CE
LOE 22 OE
A15 27 A14 26 A13 2 A12 23 A11 21 A10 24 A9 25 A8 3 A7 4 A6 5 A5 6 A4 7 A3 8 A2 9 A1 10
19 D7 18 D6 17 D5 16 D4 15 D3 13 D2 12 D1 11 D0

DATA BUS 16

Q RAM

LRAM 1 → D
LRAM 2 → D
LOE
HRAMEN → B
LHI-WE
LOE
LLO-WE
U17 CS1 OE CS2 W
U14 CS1 OE CS2 W
A13 2 A12 23 A11 21 A10 24 A9 25 A8 3 A7 4 A6 5 A5 6 A4 7 A3 8 A2 9 A1 10
U23 5 A1 6 A2 7 A3 8 A4 4
U41 10 A5 9 A6 8 A7 7 A8 6 A9 5 A10 4 A11 3 A12 2 A13 9

DATA BUS 16

ADR BUS (P/O INSTRUMENT BUS) 5
I/O BUS (P/O INSTRUMENT BUS) 16

ADDRESS BUS 15

LHI-WE

LLO-WE

LOE

ROM

U16 NOT INSTALLED

U19 NOT INSTALLED

+5VF C18 .01

+5VF C13 .01

U39 VPP +5VF

U40 VPP +5VF C15 .01

U37 VPP +5VF C19 .01

U38 VPP +5VF C20 .01

LROM1

LROM2

LROM3 NC

LOE

A15 A14 A13 A12 A11 A10 A9 A8 A7 A6 A5 A4 A3 A2 A1

D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0

RAM

LRAM 1

LRAM 2

LOE

HRAMEN

LHI-WE

LLO-WE

U17 VRAM

U18 VRAM C17 .01

U14 VRAM C25 1.0

U15 VRAM C22 .01

CS1 OE CS2 W

U23

U41

DATA BUS 16

ADR BUS (P/O INSTRUMENT BUS) 5

I/O BUS (P/O INSTRUMENT BUS) 16

JUMPER CONNECTIONS

J1-22	HSWP	P1-29
J1-41	KR8	P1-10
J1-16	KR9	P1-35
J1-42	KR10	P1-9
J1-17	KR11	P1-34
J1-43	KC0	P1-8
J1-18	KC1	P1-33
J1-44	KC2	P1-7
J1-19	KC3	P1-32
J1-45	KC4	P1-6
J1-20	KC5	P1-31
J1-46	KC6	P1-5
J1-21	KC7	P1-30

ADR0	P1-14, P2-2, J1-37
ADR1	P1-39, P2-20, J1-12
ADR2	P1-13, P2-3, J1-38
ADR3	P1-38, P2-21, J1-13
ADR4	P1-12, P2-4, J1-39

IOB0	P1-24, P2-5, J1-27
IOB1	P1-49, P2-23, J1-2
IOB2	P1-23, P2-6, J1-28
IOB3	P1-48, P2-24, J1-3
IOB4	P1-22, P2-7, J1-29
IOB5	P1-47, P2-25, J1-4
IOB6	P1-21, P2-8, J1-30
IOB7	P1-46, P2-26, J1-5
IOB8	P1-20, P2-9, J1-31
IOB9	P1-45, P2-27, J1-6
IOB10	P1-19, P2-10, J1-32
IOB11	P1-44, P2-28, J1-7
IOB12	P1-18, P2-11, J1-33
IOB13	P1-43, P2-29, J1-8
IOB14	P1-17, P2-12, J1-34
IOB15	P1-42, P2-30, J1-9

A15

A15 CONTROLLER, SCHEMATIC DIAGRAM (4 OF 4)

A16

A16 20 MHz Reference, Circuit Description

A16 20 MHz Reference takes a 10 MHz signal from A27 10 MHz Frequency Standard and processes it into 20 MHz reference signals to A5 Front Panel, A6 YIG-Tuned Oscillator Phase Lock, A8 249 MHz Phase Lock, and A23A6 Comb Generator.

Reference Selection

During internal time base operation of the instrument, a 10 MHz signal at $\approx$ +3 dBm is applied to the Doubler from A27 10 MHz Frequency Standard. This signal is split by the resistor network of R1 through R5. The power is applied to the Clock Generator, to the Doubler buffer amplifier Q1, and to the rear panel, where it is available as INT TIME BASE OUT. When EXT TIME BASE operation is selected on the rear panel, A27 is shut off and the 10 MHz, 0 dBm EXT TIME BASE signal is applied to the Doubler. This power is split between the Doubler buffer amp and the Clock Generator.

Doubler (A)

A 10 MHz signal to the Doubler is amplified by buffer Q1 and then drives Q2 through the impedance-matching network Q2 through C4 and L1. The pulse output from Q2 is coupled into the 20 MHz resonator T1 and C6 to produce a 20 MHz output from the Doubler.

Clock Generator (B)

The 10 MHz signal from the Time Base is applied through C33 to the isolation amplifier Q3. The amplified signal is converted to TTL levels by Q7, which drives the NOR gate U2, which in turn drives the 10 MHz TTL bus to clock A15 Controller and A17 Frequency Counter.

Crystal Filter (C)

The output of the Doubler drives the emitter follower Q4, which provides a low output impedance driver for the Crystal Filter. CENTER FREQ adjustment C11 varies the center frequency of the filter. Some of the 20 MHz signal is fed back through the inverting transformer T2 to cancel the case capacitance of Y1. The 20.34 MHz NULL adjustment C12 adjusts the proper amount of feedback. The filtered signal is amplified by Q5. L16 and C16 match the impedance to PIN diode CR1. The current through CR1 sets the attenuation for the desired comb drive level at J3, which is applied to A23A6 Comb Generator.

AGC Amplifier (D)

A small amount of the comb drive signal is fed through R24, C18, and L4 to the detector diode CR2. The rectified voltage across R25 is proportional to the comb drive power. Op amp U3A compares the drive level to a reference set by COMB DRIVE adjustment R31. The output from U3A is then set to bias CR1 for a value of attenuation that will cause the rectified drive voltage to equal the reference voltage.

NO REFERENCE Indicator/Driver (E)

Comparator U3B compares the rectified drive voltage from CR2 with a fixed voltage. If the drive drops too low, U3B turns on the NO REF indicator LED DS1.

Buffer Amplifier (F)

A small amount of 20 MHz comb drive signal is fed through R35 to Q6. L5 and C22 match the impedances and R37 is a feedback element to stabilize the gain of Q6. R40 through R47 and R54 form an aggregate network of splitters and pads to provide a 20 MHz, −15 dBm reference signal to A6 YIG-Tuned Oscillator Phase Lock, a 20 MHz, −10 dBm signal to A8 249 MHz Phase Lock, and drive for the Calibrator.

Calibrator (G)

The 20 MHz signal from the Buffer Amplifier is amplified by an emitter-coupled pair, U1A. This signal is clipped by U1B to set a precise level. The output goes through a low-pass filter L8, L9, L10, C29, and C30 to reduce the harmonic content. CAL LEVEL adjustment R51 varies the amount of emitter current, U1C provides temperature compensation.

HP Part Number 85680-60005

A16 20 MHz Reference

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A16	85680-60005	7	1	BOARD ASSEMBLY 20MHZ REFERENCE	28480	85680-60005
A16C1	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C2	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C3	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C4	0140-0193	0	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	09023	CD15ED820J03
A16C5	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C6	0140-0205	5	1	CAPACITOR-FXD 62PF +-5% 300VDC MICA	09023	CD15ED620J03
A16C7	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C8	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C9	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C10	0160-2264	2	1	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	52763	2RDPLX05020RNP0
A16C11	0121-0457	9	1	CAPACITOR-V TRMR-PSTN .8-8.5PF 750V	18736	TP9
A16C12	0121-0451	3	1	CAPACITOR-V TRMR-AIR 1.7-11PF 175V	74970	187-0106-028
A16C13	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C14	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C15	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C16	0160-2202	8	1	CAPACITOR-FXD 75PF +-5% 300VDC MICA	09023	CD15ED750J03
A16C17	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C18	0160-2260	8	1	CAP-FXD 13pF 500 V	52763	
A16C19	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C20	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2-DYS
A16C21	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2-DYS
A16C22	0140-0198	5	1	CAPACITOR-FXD 200PF +-5% 300VDC MICA	09023	CD15FD201J03
A16C23	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2-DYS
A16C24	0140-0210	2	1	CAPACITOR-FXD 270PF +-5% 300VDC MICA 0+7	09023	CD15FD271J03
A16C25	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C26	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C27	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C28	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C29	0160-2204	0	1	CAPACITOR-FXD 100PF +-5% 300VDC MICA 0+7	09023	CD15FD101J03
A16C30	0160-2204	0	1	CAPACITOR-FXD 100PF +-5% 300VDC MICA 0+7	09023	CD15FD101J03
A16C31	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C32	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C33	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C34	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C35	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C36	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C37	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C38	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C39	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2-DYS
A16C40	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	04222	SR201C103MAAH
A16C41	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	04222	SR201C103MAAH
A16C42	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	04222	SR201C103MAAH
A16C43	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C44	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C45	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A16C46	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z

**Indicates factory-selected value*

HP Part Number 85680-60005

A16 20 MHz Reference

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A16C47	0160-2247	1	1	CAPACITOR-FXD 3.9PF +-.25PF 500VDC CER	52763	2RDPLX0503R9NP0
A16CR1	1901-0639	4	1	DIODE-PIN	28480	
A16CR2	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A16CR3	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A16CR4	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	71468	
A16DS1	1990-0486	6	1	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	HLMP-1301
A16E1	9170-0029	3	1	CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A16E2	9170-0029	3	1	CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A16J1	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A16J2	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A16J3	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A16J4	85680-60067	1	1	CABLE ASSEMBLY COAX 3 (INCLUDES W26)	28480	85680-60067
A16J5	85680-60068	2	1	CABLE ASSEMBLY COAX 4 (INCLUDES W23)	28480	85680-60068
A16J6	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A16L1	9140-0143	9	1	INDUCTOR RF-CH-MLD 3.3UH +-10% .105D-INX	99800	1025-32
A16L2	9140-0179	1	1	INDUCTOR RF-CH-MLD 22UH +-10% .166D-INX.	99800	1537-44
A16L3	9140-0142	8	1	INDUCTOR RF-CH-MLD 2.2UH +-10% .105D-INX	99800	1025-28
A16L4	9140-0114	4	1	INDUCTOR RF-CH-MLD 10UH +-10% .166D-INX.	99800	1537-36
A16L5	9100-2250	9	1	INDUCTOR RF-CH-MLD 180NH +-10% .105D-INX	24226	10M180K
A16L6	9140-0179	1	1	INDUCTOR RF-CH-MLD 22UH +-10% .166D-INX.	99800	1537-44
A16L7	9140-0179	1	1	INDUCTOR RF-CH-MLD 22UH +-10% .166D-INX.	99800	1537-44
A16L8	9100-2256	5	1	INDUCTOR RF-CH-MLD 560NH +-10% .105D-INX	24226	10M560K
A16L9	9100-2259	8	1	INDUCTOR RF-CH-MLD 1.5UH +-10% .105D-INX	99800	1025-24
A16L10	9100-2256	5	1	INDUCTOR RF-CH-MLD 560NH +-10% .105D-INX	24226	10M560K
A16L11	9140-0179	1	1	INDUCTOR RF-CH-MLD 22UH +-10% .166D-INX.	99800	1537-44
A16L12	9140-0179	1	1	INDUCTOR RF-CH-MLD 22UH +-10% .166D-INX.	99800	1537-44
A16L13	9140-0179	1	1	INDUCTOR RF-CH-MLD 22UH +-10% .166D-INX.	99800	1537-44
A16L14	9140-0179	1	1	INDUCTOR RF-CH-MLD 22UH +-10% .166D-INX.	99800	1537-44
A16L15	9140-0179	1	1	INDUCTOR RF-CH-MLD 22UH +-10% .166D-INX.	99800	1537-44
A16L16	9100-2257	6	1	INDUCTOR RF-CH-MLD 820NH +-10% .105D-INX	32159	1A 8203M +-10%
A16MP1				NOT ASSIGNED		
A16MP2	86701-40001	9	1	EXTRACTOR, PC	28480	86701-40001
A16MP3	85680-20065	5	1	LID, 20MHZ REFERENCE	28480	85680-20065
A16MP4	2950-0078	9	6	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A16MP5	2190-0557	7	6	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A16MP6	1200-0173	5	1	INSULATOR-XSTR TO-5 NOTE: USED UNDER Y1 20 MHZ CRYSTAL		
A16MP7	2200-0101	0	5	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	
A16Q1	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	25403	
A16Q2	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	25403	
A16Q3	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	25403	
A16Q4	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	04713	
A16Q5	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	04713	
A16Q6	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	04713	
A16Q7	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A16Q8	1853-0007	7	1	TRANSISTOR PNP 2N3251		
A16R1	0757-0398	4	1	RESISTOR 75 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R2	0757-0378	0	1	RESISTOR 11 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1

**Indicates factory-selected value*

HP Part Number 85680-60005

A16 20 MHz Reference

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A16R3	0757-0378	0	1	RESISTOR 11 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A16R4	0698-3443	0	1	RESISTOR 287 1% .125W TF TC=0+-100	19701	SFR25H
A16R5	0757-0422	5	1	RESISTOR 909 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R6	0698-3157	3	1	RESISTOR 19.6K 1% .125W TF TC=0+-100	19701	SFR25H
A16R7	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A16R8	0698-3443	0	1	RESISTOR 287 1% .125W TF TC=0+-100	19701	SFR25H
A16R9	0757-0422	5	1	RESISTOR 909 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R10	0757-0398	4	1	RESISTOR 75 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R11	0757-0394	0	1	RESISTOR 51.1 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R12*	0698-3443	0	1	RESISTOR 287 1% .125W TF TC=0+-100	19701	SFR25H
A16R13	0698-3404	3	1	RESISTOR 383 1% .5W TF TC=0+-100	19701	5053R
A16R14	0698-3439	4	1	RESISTOR 178 1% .125W TF TC=0+-100	19701	SFR25H
A16R15	0757-0395	1	1	RESISTOR 56.2 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R16	0757-0200	7	1	RESISTOR 5.62K +-1% .125W TF TC=0+-100	19701	SFR25H
A16R17	0757-0449	6	1	RESISTOR 20K +-1% .125W TF TC=0+-100	19701	SFR25H
A16R18	0757-0422	5	1	RESISTOR 909 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R19	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R20	0698-3446	3	1	RESISTOR 383 1% .125W TF TC=0+-100	19701	SFR25H
A16R21	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A16R22	0757-0378	0	1	RESISTOR 11 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A16R23	0698-0082	7	1	RESISTOR 464 1% .125W TF TC=0+-100	19701	SFR25H
A16R24	0757-0274	5	1	RESISTOR 1.21K +-1% .125W TF TC=0+-100	19701	SFR25H
A16R25	0757-0465	6	1	RESISTOR 100K +-1% .125W TF TC=0+-100	19701	SFR25H
A16R26	0698-3157	3	1	RESISTOR 19.6K 1% .125W TF TC=0+-100	19701	SFR25H
A16R27	0698-3260	9	1	RESISTOR 464K 1% .125W TF TC=0+-100	19701	SFR25H
A16R28	0698-3150	6	1	RESISTOR 2.37K 1% .125W TF TC=0+-100	19701	SFR25H
A16R29	0757-0274	5	1	RESISTOR 1.21K +-1% .125W TF TC=0+-100	19701	SFR25H
A16R30	0757-0459	8	1	RESISTOR 56.2K +-1% .125W TF TC=0+-100	19701	SFR25H
A16R31	2100-3161	6	1	RESISTOR-TRMR 20K 10% TKF SIDE-ADJ 17-TR	73138	89PR20K
A16R32	0757-0462	3	1	RESISTOR 75K +-1% .125W TF TC=0+-100	19701	SFR25H
A16R33	0698-3157	3	1	RESISTOR 19.6K 1% .125W TF TC=0+-100	19701	SFR25H
A16R34	0757-0274	5	1	RESISTOR 1.21K +-1% .125W TF TC=0+-100	19701	SFR25H
A16R35	0698-3443	0	1	RESISTOR 287 1% .125W TF TC=0+-100	19701	SFR25H
A16R36	0757-0398	4	1	RESISTOR 75 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R37	0757-0422	5	1	RESISTOR 909 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R38	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R39	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R40	0698-7196	8	1	RESISTOR 21.5 +-1% .05W TF TC=0+-100	19701	5063J
A16R41	0698-7207	2	1	RESISTOR 61.9 +-1% .05W TF TC=0+-100	19701	5063J
A16R42	0698-7201	6	1	RESISTOR 34.8 +-1% .05W TF TC=0+-100	19701	5063J
A16R43	0698-7196	8	1	RESISTOR 21.5 +-1% .05W TF TC=0+-100	19701	5063J
A16R44	0698-7203	8	1	RESISTOR 42.2 +-1% .05W TF TC=0+-100	19701	5063J
A16R45	0698-7201	6	1	RESISTOR 34.8 +-1% .05W TF TC=0+-100	19701	5063J
A16R46	0698-7196	8	1	RESISTOR 21.5 +-1% .05W TF TC=0+-100	19701	5063J
A16R47	0757-0397	3	1	RESISTOR 68.1 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R48	0698-3151	7	1	RESISTOR 2.87K 1% .125W TF TC=0+-100	19701	SFR25H
A16R49	0698-3441	8	1	RESISTOR 215 1% .125W TF TC=0+-100	19701	SFR25H

**Indicates factory-selected value*

HP Part Number 85680-60005

A16 20 MHz Reference

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A16R50	0698-3437	2	1	RESISTOR 133 1% .125W TF TC=0+-100	19701	SFR25H
A16R51	2100-3123	0	1	RESISTOR-TRMR 500 10% TKF SIDE-ADJ 17-TR	73138	89PR500
A16R52	0757-0419	0	1	RESISTOR 681 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R53	0698-3437	2	1	RESISTOR 133 1% .125W TF TC=0+-100	19701	SFR25H
A16R54	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R55	0757-0401	0	1	RESISTOR 100 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R56	0757-0276	7	1	RESISTOR 61.9 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R57	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A16R58	0698-3443	0	1	RESISTOR 287 1% .125W TF TC=0+-100	19701	SFR25H
A16R59	0757-0422	5	1	RESISTOR 909 +-1% .125W TF TC=0+-100	19701	SFR25H
A16R60	0698-3157	3	1	RESISTOR 19.6K 1% .125W TF TC=0+-100	19701	SFR25H
A16R61	0698-3160	8	1	RESISTOR 31.6K 1% .125W TF TC=0+-100	19701	SFR25H
A16R62	0757-0422	5	1	RESISTOR 909 +-1% .125W TF TC=0+-100	19701	SFR25H
A16T1	85680-80004	8	1	TRANSFORMER RF	28480	85680-80004
A16T2	85662-80002	4	1	COIL ASSEMBLY-TRANSFER	28480	85662-80002
A16TP1	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A16TP2	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A16TP3	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A16TP4	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A16U1	1858-0032	8	1	TRANSISTOR ARRAY 14-PIN PLSTC DIP	27014	LM3146
A16U2	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A16U3	5081-8117	3	1	SCREEN 1826-0092	28480	5081-8117
A16VR1	1902-0048	1	1	DIODE-ZNR 6.81V 5% DO-35 PD=.4W	04713	
A16Y1	0410-1293	6	1	CRYSTAL 20MHZ		

**Indicates factory-selected value*

(HP85670A AND HP85680B OPTION H44 AND OPTION H69 ONLY)

TCXO BUFFER
A14
J1

VOLTAGE REGULATOR
A24
+20V
HINT
OSCILLATOR POWER

MOTHERBOARD
A26
XA27P1
XA24P2
OSCILLATOR POWER
XA24P2

10 MHz FREQUENCY STANDARD
A27
J1

REAR PANEL
FREQ REF
IN/OUT
J3
W37
INT
EXT
S1
HINT

W32
J1
J2

A16 20 MHz REFERENCE

INT FREQ REF 10 MHz, >+2dBm
EXT FREQ REF IN 10 MHz, >-3dBm OR
INT FREQ REF OUT 10MHz, >-3dBm OR

(A) DOUBLER
R2
R3
Q1,Q2
DOUBLER
C6
T1

(C) XTAL FILTER
FREQ
C11
Y1
Q5,Q8
R15
CR1

(F) BUFFER AMPLIFIER
Q6
2

(D) AGC AMPLIFIER
CR2
4
U3A
1
+15VF
R31
-15VF
COMB DRIVE

(E) NO REFERENCE INDICATOR/ DRIVER
+15VF
R27
U3B
R28
NO REF
DS1

(G) CALIBRATOR
U1
CAL LEVEL

(B) CLOCK GENERATOR
Q3,Q7,U2
3

ND HP85680B OPTION
PTION H69 ONLY)

D BUFFER

J1

10 MHz
FREQUENCY
STANDARD
A27

J1

W32

2

EAR PANEL

FREQ REF

J3

W37

5

IN/
OUT

INT

S1

HINT

EXT

0

3

A16 20 MHz REFERENCE

INT FREQ REF
10 MHz,
>+2dBm

J1

J2

EXT FREQ REF IN
10 MHz,
≥-3dBm OR
INT FREQ REF OUT
10MHz,
>-3dBm OR

Ⓐ DOUBLER

R2

R3

Q1,Q2

C6

DOUBLER

T1

Ⓒ XTAL FILTER

FREQ

C11

Y1

Q5,Q8

R15

CR1

Ⓕ BUFFER
AMPLIFIER

Q6

2

J4

J5

J3

J6

3

4

7

1

YTO
PHASE LOCK
A6
20MHz
>-15dBm

W26

249 MHz
PHASE LOCK
A8
20MHz
>-10dBm

W23

COMB
GENERATOR
A23A6
20MHz
±12dBm
+4dB

W15

FRONT PANEL
A5

W31

J1

CAL
OUTPUT

20MHz
-10dBm
±0.2dB

Ⓓ AGC
AMPLIFIER

CR2

4

U3A

1

+15VF

R31

-15VF

COMB
DRIVE

Ⓔ NO REFERENCE
INDICATOR/
DRIVER

+15VF

R27

U3B

NO
REF

R28

DS1

Ⓖ CALIBRATOR

U1

CAL
LEVEL

Ⓑ CLOCK
GENERATOR

Q3,Q7,U2

3

MOTHERBOARD
A26

XA16P1

XA15P2

XA16P1

XA17P1

CONTROLLER
A15
CONTROLLER
CLK 10MHz
(TTL)

FREQUENCY
COUNTER
A17
COUNTER
CLK 10MHz
(TTL)

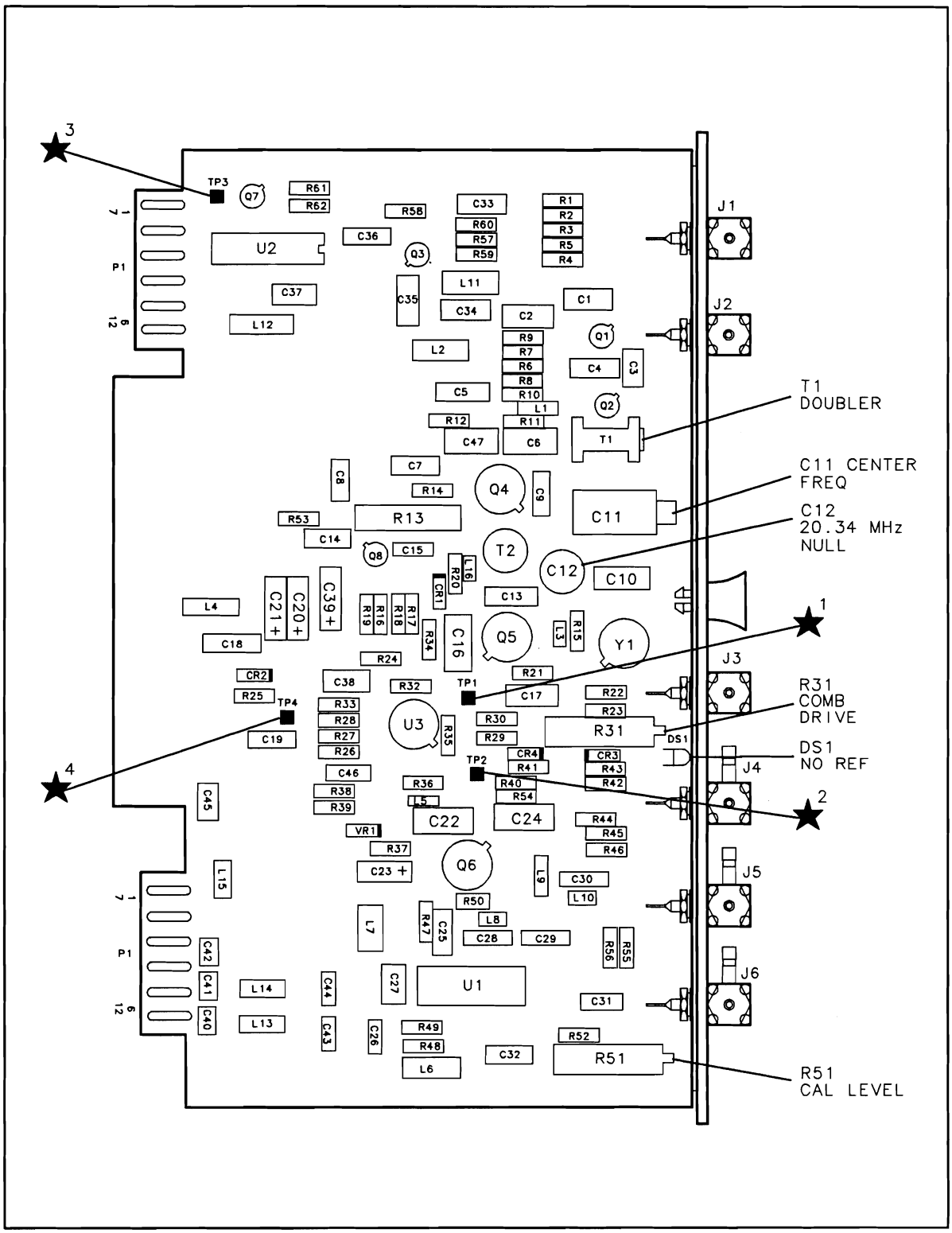
7

15

8

6

A16 20 MHz REFERENCE, BLOCK DIAGRAM



A16 20 MHz Reference Component Locations, 80680-60005 and 85670-60008

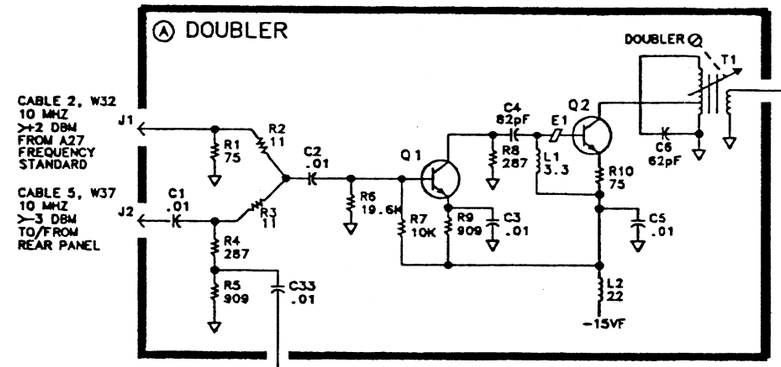
A16 20 MHZ REFERENCE
85680-60005
(SERIAL PREFIX: 2408A)
85670-60008
(SERIAL PREFIX: 2541A) (SEE NOTE 9)

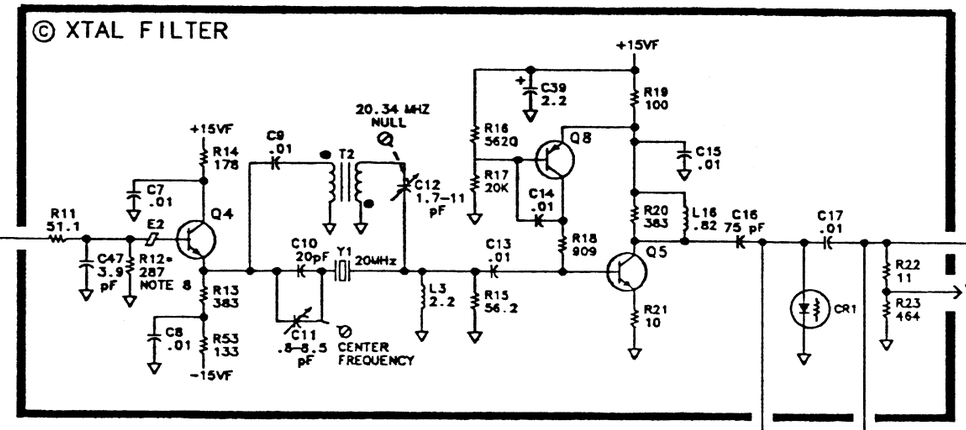
P1

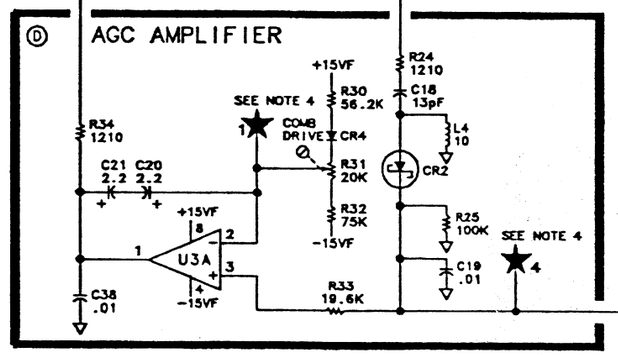
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		H
7	CONTROLLER CLK	A15P2-15	B
2	GND		H
8	COUNTER CLK	A17P1-6	B
3	GND		H
9	GND		H
4	GND		H
10	GND		H
5	GND		H
11	HOVC	A24P2-10	NC
6	GND		H
12	GND		H

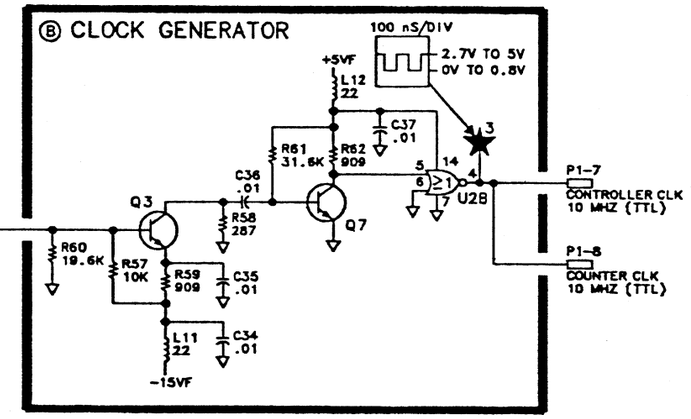
P2

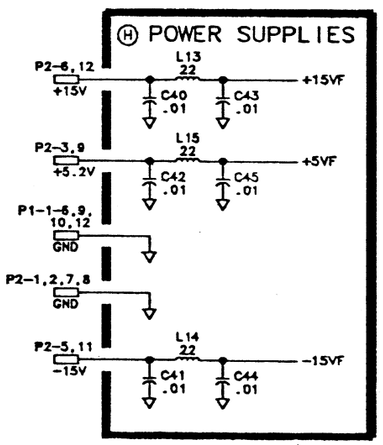
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		H
7	GND		H
2	GND		H
8	GND		H
3	+5.2V		H
9	+5.2V		H
4	-5.2V		NC
10	-5.2V		NC
5	-15V		H
11	-15V		H
6	+15V		H
12	+15V		H

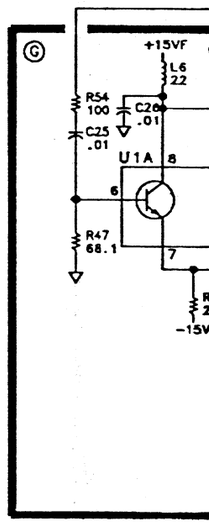


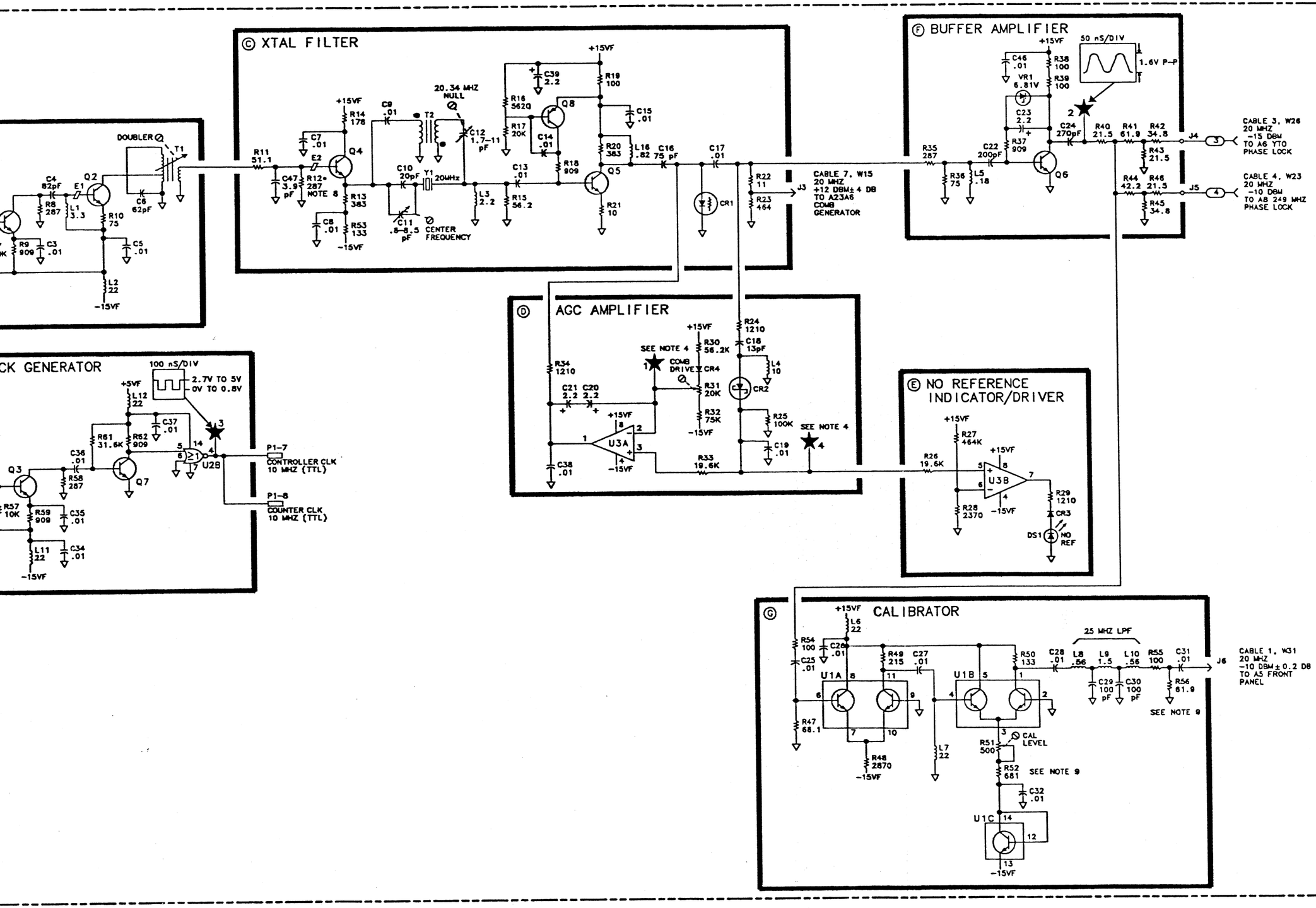












NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IS IN OHMS (Ω)
   CAPACITANCE IS IN MICROFARADS(μF)
   INDUCTANCE IS IN MICROHENRIES(μH)
3. UNLESS OTHERWISE INDICATED:
   SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.
4. VOLTAGES AT TP1 AND TP4 VARY BETWEEN 0V AND 2V DEPENDING UPON THE SETTING OF R31. DURING NORMAL AGC OPERATION THE VOLTAGE OF TP1 EQUALS THAT OF TP4 ± 20 MV. TO DISABLE AGC, GROUND TP4.
5. WHEN INT IS SELECTED AT REAR PANEL, 10 MHZ AT -3 DBM MINIMUM IS PRESENT AT A16J2. WHEN EXT IS SELECTED, A27 TIME BASE IS DISABLED AND A16J2 BECOMES AN INPUT REQUIRING 10 MHZ AT -3 DBM MINIMUM.
6. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
HOVC	HIGH=OVEN COLD
HINT	HIGH=INTERNAL TIME BASE

   LANR LOW: ANALYZER RESET
7. U2A, U2C, AND U2D ARE NOT USED.
8. R12* IS A FACTORY SELECTED COMPONENT. THE FOLLOWING ALTERNATE HP PART NUMBERS AND VALUES MAY BE USED.

HP PART NUMBERS	VALUES
0698-3132	261
0698-3444	316

9. A16 20 MHz REFERENCE BOARDS: HP PART NUMBER 85670-60008 HAS TWO PARTS THAT DIFFER FROM HP PART NUMBER 85680-60005. THE SCHEMATIC DIAGRAM INDICATES THE PARTS FOR 85680-60005. IN FUNCTION BLOCK C ON 85670-60008, R52 IS 1000Ω AND R56 IS 1100. REFER TO PARTS LIST FOR ADDITIONAL INFORMATION.

A17

A17 Frequency Counter, Circuit Description

A17 Frequency Counter counts the following frequencies:

- 50 MHz VTO (nominal 25 MHz after division by 2)
- Signal IF (nominal 21.4 MHz)
- Pilot IF (nominal 20 MHz)

A17 consists of three input buffer amplifiers, a multiplexer, an eight-decade counter, and control circuitry. The 10 MHz reference frequency for the counter comes from the Clock Generator in A16 20 MHz Reference. The counter can be used as a timer by causing it to count its clock. In all cases, the outputs are buffered to the Instrument Bus.

Signal IF Amplifier (A)

The Signal IF Amplifier consists of a simple cascade transistor (Q11, Q12) driving a differential amplifier (Q13, Q14) which provides TTL voltage levels to the digital multiplexer U1. R3, R4, R28, C4, and C5 provide the bias, and with Q11, 50Ω input impedance. R1, C1, and C6 decouple the +5 V supply from the amplifier, and R2, L1, C2, L2, R31, and C29 provide a bandpass filter and matching network between Q12 and Q13. CR1 and CR2 inhibit doubling of frequency of large input signals. For isolation when the counter is not used, the entire amplifier is turned off by Q9, Q10, and their associated circuitry. The amplifier is sensitive to −35 dBm or lower over 21.4 ±8 MHz.

VTP Amplifier (B)

The VTO Amplifier uses a differential pair (Q5 and Q6) to convert an attenuated ECL signal at about 200Ω impedance to a TTL signal. Its sensitivity is about −15 dBm in the range of 25 ± 3.75 MHz.

Pilot IF Amplifier (C)

The Pilot IF Amplifier is almost identical to the Signal IF Amplifier, but the frequency range is 20 ± 10 MHz, sensitivity is approximately −28 dBm, and additional decoupling is provided by R18 and C15, since the amplifier is not turned off.

Multiplexer (F)

The Multiplexer U1 brings all three inputs and the 10 MHz internal reference to the counter string. Depending upon which bits on the data bus have been held in latch U6, one of these four inputs is selected. When the enable line is low to U1 pins 1 and 15, the signal at the selected input is routed through U7C to U12, the least significant digit counter.

Counter Control and Address Decoder (D) (E)

Dual JK flip-flop U4 sets the state of the counter. The receipt of an octal address 24 and a strobe resets both U4A and U4B to zero, triggers the one-shot multivibrator (Q7/Q8), and loads data into latch U6. Notice that U4 pin 9 goes low and indicates counter busy, and U4 pin 7 goes high to gate on the 10 MHz reference, which is divided by 10 by U14.

U8, U13, and U18 serve as internal start/stop counters. they are reset to all 9 by octal address 24 through the one-shot multivibrator (Q7/Q8). The reference 1 MHz then clocks the counters and the falling edge of the bit selected by multiplexer U1. U2 clocks U4A to signify the start and stop of the count interval. U4 pin 6 then goes high to disable multiplexer U1, U4B is clocked by U4 pin 5, the busy line (LCBZ) goes high, and the reference is gated off. Normally, state of U4A will be 0 and that of U4B will be 1 when the counter is not being used but has been addressed.

Counter and Bus Driver (G)

This circuit is composed of an eight-decade counter and 32 bits of 3-state bus driver. U11 and U12 are low power Schottky counters, while U3, U5, and U10 are CMOS counters. All are reset by the address 24 strobe signal. Address 25 causes the high order 4 digits to be read, while address 26 gates the low order 4 digits to the bus.

A17 Frequency Counter, Troubleshooting

Five front panel diagnostic functions are available as an aid in troubleshooting A17. These same functions are useful when trying to determine the cause of constant frequency offsets and phase locking problems. The key functions are:

KSF [SHIFT] [RES BW] ..... Sweep Generator Time
KSK [SHIFT] [PEAK SEARCH] ..... Count pilot IF at Marker
KSN [SHIFT] [MKR → CF] ..... Count 50 MHz VTO at Marker
KSQ [SHIFT] [MARKER/Δ → STP SIZE] ..... Count Signal IF at Marker
KS = [SHIFT] [FREQ COUNT] .....Set Counter Resolution (1 Hz to 100 kHz)

If the analyzer is not sweeping due to a phase lock problem, the counter could be at fault. To determine this, jumper A15TP8 to A14 TP11, push [INSTR PRESET], and then remove the jumper. If the sweep stops, A17 is probably faulty.

The input amplifiers can be checked with the following conditions:

[INSTR PRESET]
[SWEEP TIME] ..... 1500 seconds
[SHIFT] [RES BW] (KSF)

With these conditions, TP3 is low and signal activity should exist at the multiplexer U1 inputs. When the RES BW [AUTO] key is pressed, U1 pin 4 goes high, turning off the Signal IF Amplifier.

The Counter Control and Multiplexer can be verified by using the [FREQ COUNT] mode. Key in the following:

[INSTR PRESET]
[SWEEP TIME] ..... 1 s
[SHIFT] [FREQ COUNT] (KS =) ..... 1 Hz
[FREQ COUNT]

Four signals will now be multiplexing at TP2. The order is 1 MHz time base, signal IF, pilot IF, and 50 MHz VTO. Figure 1 shows the corresponding waveform at TP1. TTL activity will be present at TP3.

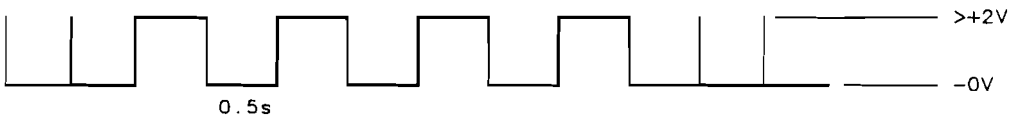


Figure 1. Time Base Waveform

If one of the signals is missing, use the [SHIFT] functions in the first paragraph to trace the problem. The Marker should be turned off before activating each function.

Proper operation of the Counter and Bus Drivers can be determined with the following procedure.

[INSTR PRESET]
[SWEEP TIME] .....1500 seconds
[SHIFT] [RES BW] (KSF

First, check for a 1 MHz signal at U1 pin 7 and TP2. Check the MSB at the output of each decade counter in the string for 100 kHz at U12 pin 12 to 0.01 Hz at U3 pin 6.

Next, short U19 pin 10 to ground. This simulates an octal address of 25 and enables the bus drivers for the 16 high order bits. A 10 Hz signal is present at P2-7. The other IOB lines are then checked for the appropriate TTL activity.

Finally, short U19 pin 9 to ground. This simulates an octal address of 26 and enables the bus drivers for the 16 low order bits. A 100 kHz signal is present at P2-7.

HP Part Number 85680-60131

A17 Frequency Counter

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A17	85680-60131	0	1	BOARD ASSEMBLY, FREQUENCY COUNTER	28480	85680-60131
A17C1	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C2	0160-2199	2	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA -20/	09023	CD15ED300J03
A17C3	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C4	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C5	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C6	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C7	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C8	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C9	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C10	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C11	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C12	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C13	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C14	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C15	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C16	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C17	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C18	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C19	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C21	0160-0945	2	1	CAPACITOR-FXD 910pF 100 V MICA	09023	CD15FA911J03
A17C22	0160-4084	8	1	CAPACITOR-FXD 0.1uF 50 V	56289	1C20X7R104M050B
A17C23	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2-DYS
A17C24	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C25	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C26	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C28	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A17C29	0160-2308	5	1	CAPACITOR-FXD 36PF +-5% 300VDC MICA -20/	09023	CD15ED360J03
A17C30	0160-2257	3	1	CAPACITOR-FXD 10PF +-5% 500VDC CER 0+-60	52763	2RDPLXD501RNP0
A17C31	0140-0205	5	1	CAPACITOR-FXD 62PF +-5% 300VDC MICA -20/	09023	CD15ED620J03
A17CR1	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A17CR2	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A17CR3	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A17CR4	1901-0535	9	1	DIODE-SCHOTTKY SM SIG		
A17J1	85680-60073	9	1	CABLE ASSEMBLY COAX 9 (INCLUDES W27)	28480	85680-60073
A17J2	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A17J3	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A17L1	9100-2261	2	1	INDUCTOR RF-CH-MLD 2.7UH +-10% .105D-INX	99800	1025-30
A17L2	9100-2258	7	1	INDUCTOR RF-CH-MLD 1.2UH +-10% .105D-INX	99800	1025-22
A17L4	9100-1617	0	1	INDUCTOR RF-CH-MLD 3.9UH +-10% .166D-INX	99800	1537-26
A17L5	9100-2261	2	1	INDUCTOR RF-CH-MLD 2.7UH +-10% .105D-INX	99800	1025-30
A17L6	9100-2258	7	1	INDUCTOR RF-CH-MLD 1.2UH +-10% .105D-INX	99800	1025-22
A17L7	9140-0114	4	1	INDUCTOR RF-CH-MLD 10UH +-10% .166D-INX.	99800	1537-36
A17L8	9140-0114	4	1	INDUCTOR RF-CH-MLD 10UH +-10% .166D-INX.	99800	1537-36
A17MP1	2190-0557	7	3	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A17MP2	2950-0078	9	3	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A17MP3	2200-0101	0	6	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	

**Indicates factory-selected value*

HP Part Number 85680-60131

A17 Frequency Counter

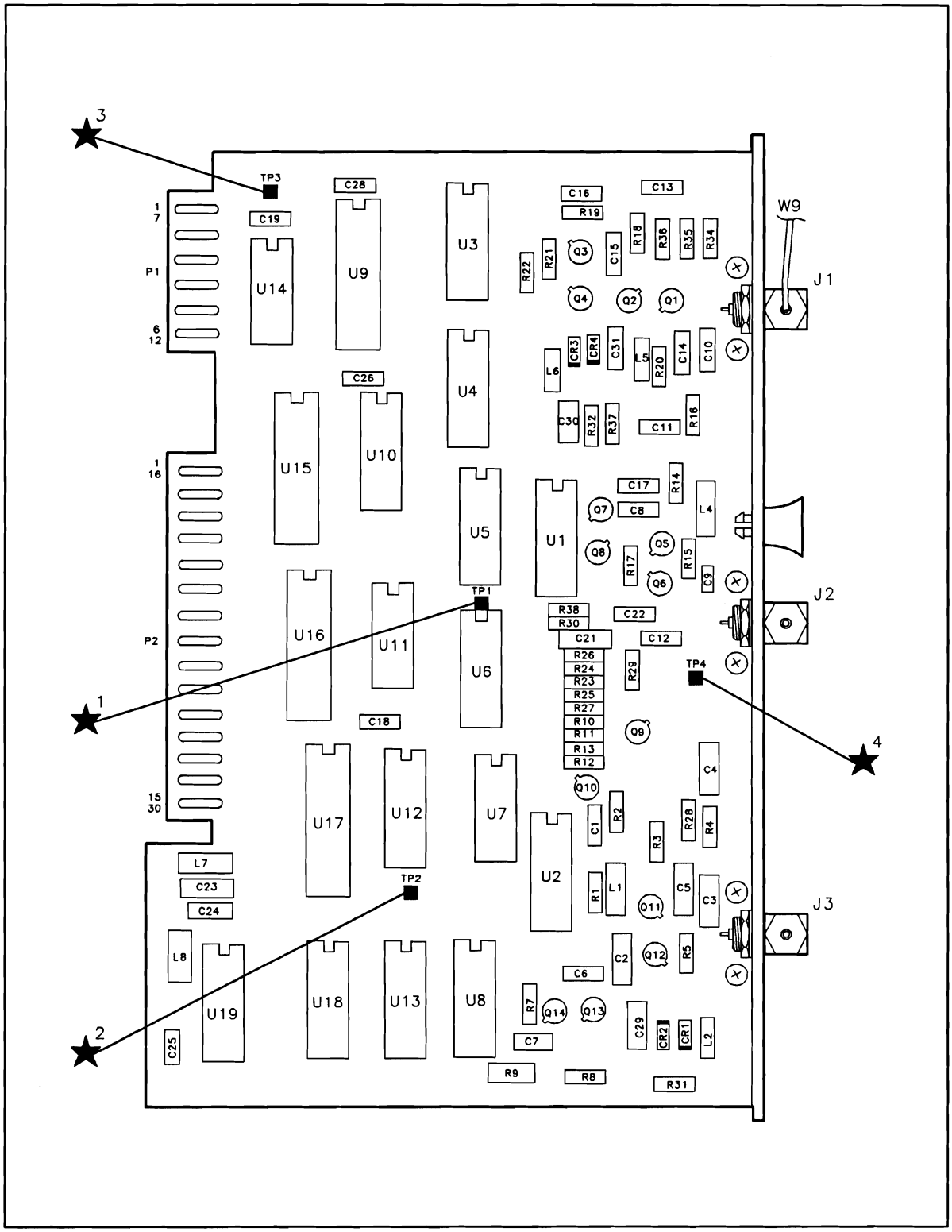
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A17MP4	85680-20078	0	1	LID, FREQUENCY COUNTER	28480	85680-20078
A17MP5	86701-40001	9	1	EXTRACTOR PC	28480	86701-40001
A17Q1	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	25403	
A17Q2	1854-0023	9	1	TRANSISTOR NPN SI TO-18 PD=360MW	25403	
A17Q3	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A17Q4	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A17Q5	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A17Q6	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A17Q7	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A17Q8	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A17Q9	1854-0404	0	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A17Q10	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A17Q11	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A17Q12	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A17Q13	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A17Q14	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	04713	
A17R1	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A17R2	0757-0395	1	1	RESISTOR 56.2 +-1% .125W TF TC=0+-100	19701	SFR25H
A17R3	0698-3152	8	1	RESISTOR 3.48K 1% .125W TF TC=0+-100	19701	SFR25H
A17R4	0757-0276	7	1	RESISTOR 61.9 +-1% .125W TF TC=0+-100	19701	SFR25H
A17R5	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H
A17R7	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A17R8	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A17R9	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A17R10	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A17R11	0757-0438	3	1	RESISTOR 5.11K +-1% .125W TF TC=0+-100	19701	SFR25H
A17R12	0757-0418	9	1	RESISTOR 619 +-1% .125W TF TC=0+-100	19701	SFR25H
A17R13	0698-3152	8	1	RESISTOR 3.48K 1% .125W TF TC=0+-100	19701	SFR25H
A17R14	0698-3440	7	1	RESISTOR 196 1% .125W TF TC=0+-100	19701	SFR25H
A17R15	0698-3445	2	1	RESISTOR 348 1% .125W TF TC=0+-100	19701	SFR25H
A17R16	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A17R17	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A17R18	0698-3440	7	1	RESISTOR 196 1% .125W TF TC=0+-100	19701	SFR25H
A17R19	0698-3445	2	1	RESISTOR 348 1% .125W TF TC=0+-100	19701	SFR25H
A17R20	0757-0395	1	1	RESISTOR 56.2 +-1% .125W TF TC=0+-100	19701	SFR25H
A17R21	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A17R22	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A17R23	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A17R24	0698-3157	3	1	RESISTOR 19.6K 1% .125W TF TC=0+-100	19701	SFR25H
A17R25	0698-3447	4	1	RESISTOR 422 1% .125W TF TC=0+-100	19701	SFR25H
A17R26	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A17R27	0698-3457	6	1	RESISTOR 316K 1% .125W TF TC=0+-100	19701	SFR25H
A17R28	0757-0278	9	1	RESISTOR 1.78K +-1% .125W TF TC=0+-100	19701	SFR25H
A17R29	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A17R30	0698-3157	3	1	RESISTOR 19.6K 1% .125W TF TC=0+-100	19701	SFR25H
A17R31	0757-0294	9	1	RESISTOR 17.8 +-1% .125W TF TC=0+-100	19701	SFR25H
A17R32	0757-0294	9	1	RESISTOR 17.8 +-1% .125W TF TC=0+-100	19701	SFR25H
A17R34	0698-3157	3	1	RESISTOR 19.6K 1% .125W TF TC=0+-100	19701	SFR25H

**Indicates factory-selected value*

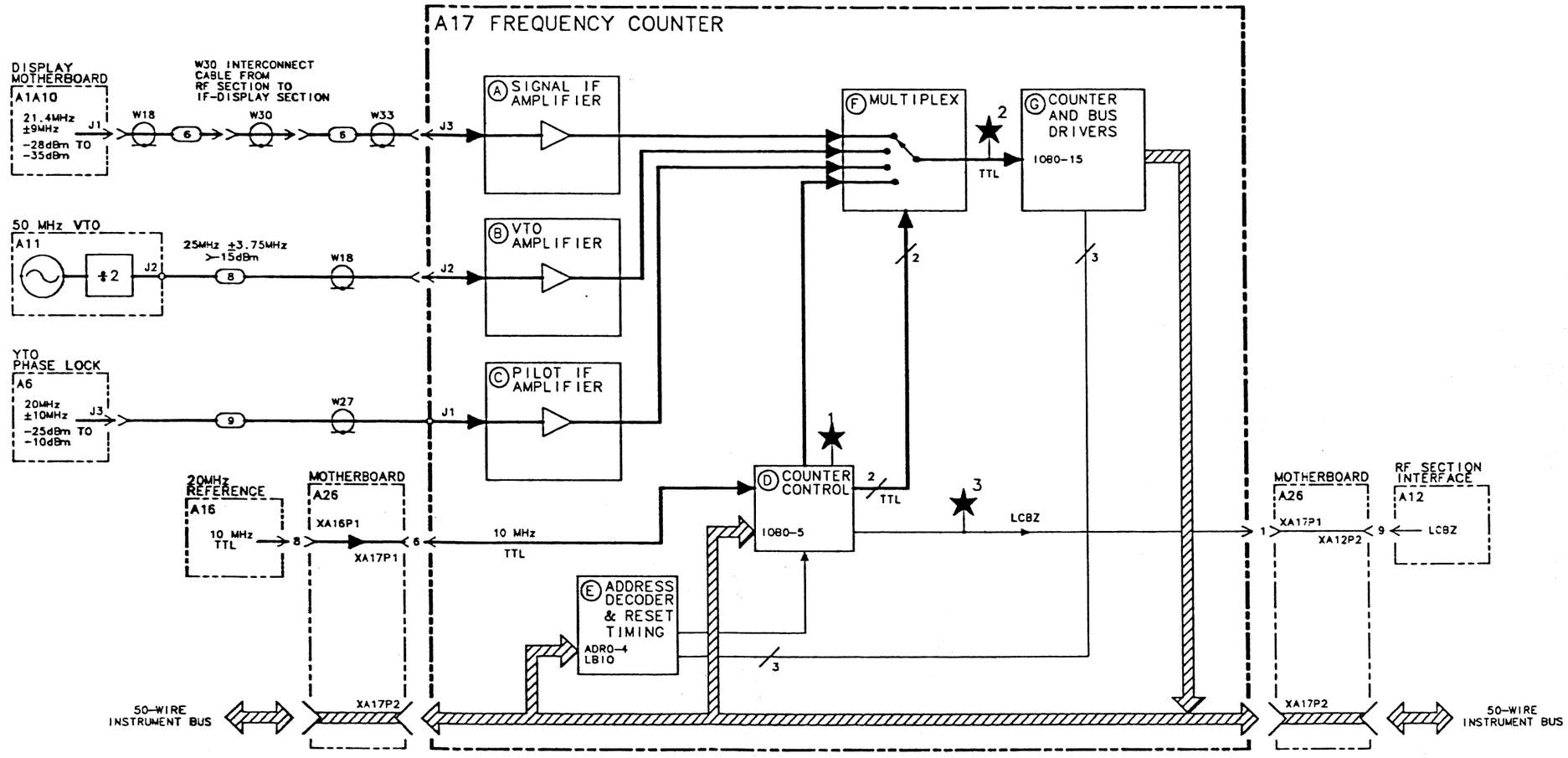
HP Part Number 85680-60131
A17 Frequency Counter

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A17R35	0757-0276	7	1	RESISTOR 61.9 +-1% .125W TF TC=0+-100	19701	SFR25H
A17R36	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A17R37	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H
A17R38	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A17TP1	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A17TP2	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A17TP3	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A17TP4	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A17U1	1820-1244	7	1	IC MUXR/DATA-SEL TTL LS 4-TO-1-LINE DUAL	01295	SN74LS153N
A17U2	1820-1217	4	1	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE 8-IN	01295	SN74LS151N
A17U3	1820-1122	0	1	IC CNTR CMOS BCD SYNCHRO DUAL	04713	MC14518BCP
A17U4	1820-1212	9	1	IC FF TTL LS J-K NEG-EDGE-TRIG PRESET/CL	01295	SN74LS112AN
A17U5	1820-1122	0	1	IC CNTR CMOS BCD SYNCHRO DUAL	04713	MC14518BCP
A17U6	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM CL	01295	SN74LS174N
A17U7	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A17U8	1820-2078	7	1	IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS490N
A17U9	1820-1759	9	1	IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U10	1820-1122	0	1	IC CNTR CMOS BCD SYNCHRO DUAL	04713	MC14518BCP
A17U11	1820-1251	6	1	IC CNTR TTL LS DECD ASYNCHRO NEG-EDGE-TR	01295	SN74LS196N
A17U12	1820-1251	6	1	IC CNTR TTL LS DECD ASYNCHRO NEG-EDGE-TR	01295	SN74LS196N
A17U13	1820-2078	7	1	IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS490N
A17U14	1820-1251	6	1	IC CNTR TTL LS DECD ASYNCHRO NEG-EDGE-TR	01295	SN74LS196N
A17U15	1820-1759	9	1	IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U16	1820-1759	9	1	IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U17	1820-1759	9	1	IC BFR TTL LS NON-INV OCTL	27014	DM81LS97N
A17U18	1820-2078	7	1	IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS490N
A17U19	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N

**Indicates factory-selected value*



A17 Frequency Counter Component Locations, 85680-60131



A17 FREQUENCY COUNTER, BLOCK DIAGRAM

A17 FREQUENCY COUNTER
85680-60131
(SERIAL PREFIX: 2408A)

P1

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	LCBZ	A12P2-9	D
7	GND		H
2	NC		
8	GND		H
3	NC		
9	GND		H
4	NC		
10	GND		H
5	GND		H
11	GND		H
6	10 MHZ	A16,P1-8	D
12	GND		H

CABLE 6, W33
21.4 MHZ ± 9 MHZ
-28 DBM TO -35 DBM
FROM A4A2
LOG AMPLIFIER
DETECTOR

P2

PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	10815	A15,P2-30	G
16	10814	A15,P2-12	G
2	10813	A15,P2-29	G
17	10812	A15,P2-11	G
3	10811	A15,P2-28	G
18	10810	A15,P2-10	G
4	1089	A15,P2-27	G
19	1088	A15,P2-9	G
5	1087	A15,P2-26	G
20	1086	A15,P2-8	G
6	1085	A15,P2-25	G
21	1084	A15,P2-7	G
7	1083	A15,P2-24	G
22	1082	A15,P2-6	G
8	1081	A15,P2-23	G
23	108Ø	A15,P2-5	G
9	NC		
24	ADR4	A15,P2-4	E
10	ADR3	A15,P2-21	E
25	ADR2	A15,P2-3	E
11	ADR1	A15,P2-20	E
26	ADRØ	A15,P2-2	E
12	LB1O	A15,P2-19	E
27	LB1O	A15,P2-19	E
13	GND		H
28	GND		H
14	+5.2V		H
29	+5.2V		H
15	-15V		H
30	-15V		H

CABLE 8, W18
25 MHZ ± 3.75 MHZ
-15 DBM
FROM A11
50 MHZ VOLTAGE
TUNED OSCILLATOR

20 MHZ ±10 MHZ
-10 DBM TO -25 DBM
FROM A6 YTO
PHASE LOCK

Ⓐ SIGNAL IF AMPLIFIER

Ⓑ VTO AMPLIFIER

Ⓒ PILOT IF AMPLIFIER

Ⓗ POWER SUPPLIES

Ⓓ COUNTER CONTROL

Ⓔ ADDRESS DECODER AND RESET TIMING

3 TO 8 DECODER

DECADE DIVIDER

MONOSTABLE -10 TO 20 μS

HIGH-PRESET TO 9

OCTAL ADDRESS 24
OCTAL ADDRESS 25
OCTAL ADDRESS 26

LATCH

INSTRUMENT BUS

6

Ⓓ COUNTER CONTROL

+5VF

U6

+5VF 1 9 R C

16

REG

1080 11 D 10
1081 13 D 12
1082 14 D 15
1083 3 D 2
1084 6 D 7
1085 4 D 5

8

LATCH

6

DECADE COUNTERS

10μ SEC
100μ SEC
1 mS
10 mS
100 mS
1 SEC

+5VF

U18A 16 C PS (SET-TO-9) R CTR A B C D 8
U18B 15 C PS (SET-TO-9) R CTR A B C D 8
U13A 16 C PS (SET-TO-9) R CTR A B C D 8
U13B 15 C PS (SET-TO-9) R CTR A B C D 8
U8A 16 C PS (SET-TO-9) R CTR A B C D 8
U8B 15 C PS (SET-TO-9) R CTR A B C D 8

NC 3 5 6 7

U2 16 G2 G7 G1 8 MUX

NC 4 3 2 1 15 14 13 12 NC

1

U4A +5VF S J C K R FF 8

LOGIC ZERO WHEN COUNTING

3

U4B +5VF S J C K R FF 8

P1-1 LCBZ

HIGH—PRESET TO 9

DECADE DIVIDER

C19 .01 +5VF

U14 14 C2 (÷ 5) R 13 +5VF 8
PS C1 (÷ 2) 1
CTR
4 D (÷ 2) 5 9 NC
10 D 3 D (÷ 5) 2 NC
11 D 12
7

P1-6 TTL 6
10 MHZ

+5VF R25 422

R23 1000 R24 19.6K C22 0.1 C26 1000
C21 910 PF R38 10K
Q7 Q8
R30 19.6K
R27 316K
-15VF

MONOSTABLE -10 TO 20 μS

Ⓕ MULTIPLEXER

C17 .01 +5VF

U1 16 GY G2 MUX 8

0 1 2 3 Y 7
0 1 2 3 Z 9

U7C +5VF 8 9 14 7 10

2

MUX

.05μS/DIV

(SEE NOTE 3)

+3V TO +5V
0V

Ⓖ COUNTER

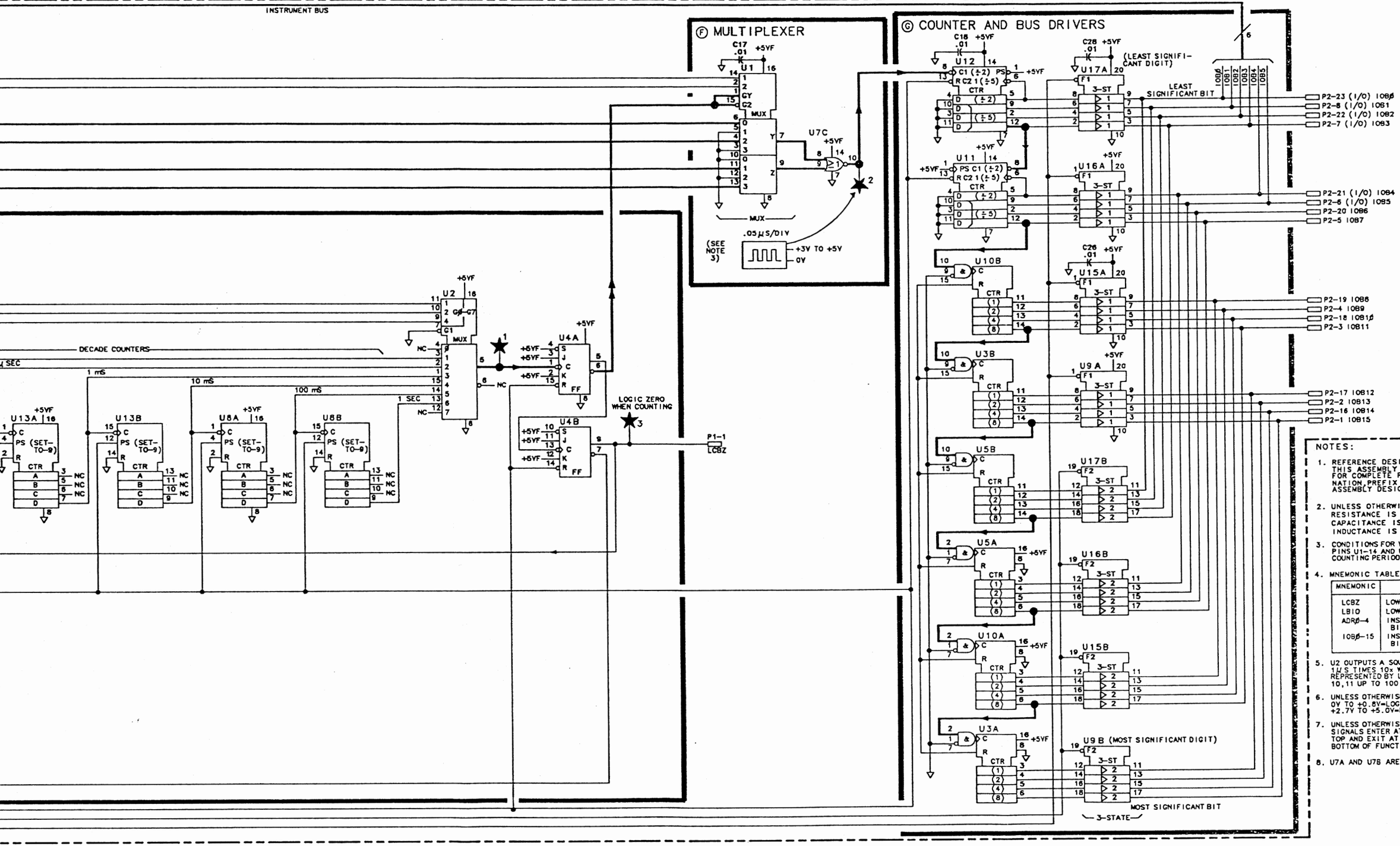
C18 .01

U12 8 C1 (÷ R C2 1 CT 4 D 10 D 3 D 11 D

U11 +5VF 1 PS C R C2 1 CT 4 D 10 D 3 D 11 D

10 9 15 2 1 7

SS 24
SS 25
SS 26



NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IS IN OHMS (Ω)
   CAPACITANCE IS IN MICROFARADS (µF)
   INDUCTANCE IS IN MICROHENRIES (µH)
3. CONDITIONS FOR WAVEFORM AT TP2 ARE: PINS U1-14 AND U1-2 LOW, 1 SECOND COUNTING PERIOD, (KSF).
4. MNEMONIC TABLE:

MNEMONIC	DESCRIPTION
LCBZ	LOW=COUNTER BUSY
LBIO	LOW=BOTTOM BOX I/O STROBE
ADRØ–4	INSTRUMENT BUS ADDRESS BITS Ø–4
10BØ–15	INSTRUMENT BUS DATA BITS Ø–15

5. U2 OUTPUTS A SQUARE PULSE OF PERIOD 1µS TIMES 10x WHERE X IS THE NUMBER REPRESENTED BY LOGIC LEVELS AT PINS 9, 10, 11 UP TO 100 SECONDS.
6. UNLESS OTHERWISE INDICATED, LOGIC LEVELS
   0V TO +0.8V=LOGIC 0
   +2.7V TO +5.0V=LOGIC 1
7. UNLESS OTHERWISE INDICATED: SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.
8. U7A AND U7B ARE NOT USED.

A17

A17 FREQUENCY COUNTER, SCHEMATIC DIAGRAM

A18

A18 275 MHz Phase Lock Oscillator, Circuit Description

A18 275 Phase Lock Oscillator provides a variable offset from the nominal 280 MHz supplied by A20 Third Converter. The amount of the offset is equal to the signal supplied by A11 50 MHz Voltage-Tuned Oscillator to A21 275 MHz Phase Lock. This signal is either 2.5 MHz (±375 kHz) for frequency spans of 100 kHz or less or 5.0 MHz (±750 kHz) for frequency spans greater than 100 kHz.

A18 also sends a 16 MHz to 38.5 MHz signal to A8 249 MHz Phase Lock. The frequency is determined by the divide number (4.0 through 9.625 in steps of 0.125) used by the Variable Modulo Frequency Divider circuit in A8.

275 MHz Phase Lock Oscillator (D)

Transistor Q5 and its associated circuitry form a modified Colpitts oscillator with C9 through C11 providing the feedback signal. The tank circuit capacitance is provided by the feedback capacitors and by PLO ADJUST C8, C7, and varactor diode CR1. The tank circuit inductance is provided by L4 and L27. R4 and R5 set the operating bias for Q5. L5, L6, C14, C15, C12, and C13 are high-frequency bypass elements.

Tune Filter (B)

The Tune Filter receives a +5 V to +13 V signal (called 275 MHz TUNE) from A21 275 MHz Phase Lock. This voltage controls the frequency of the 275 MHz Phase Lock Oscillator. The Tune Filter is a 1.5 MHz low-pass filter that eliminates any 2.5 MHz or 5.0 MHz component that might be impressed on the output of the Phase/Frequency Detector in A21. The tune voltage may be measured at TP1.

Buffer Amplifier 1 (H)

Buffer Amplifier 1 provides isolation for the 275 MHz signal to A21, R29 and R28 set the operation bias for Q2. The gain of the stage, determined by Q2, L14, and C31, is approximately 11 dB. The amplifier has a 3 dB resistive pad on both the input and the output for additional isolation. The output pad also incorporates a low-pass filter to further attenuate 275 MHz harmonics.

Buffer Amplifier 2

Buffer Amplifier 2 provides isolation for the 275 MHz signal to the Mixer. A 6 dB resistive pad on the input provides additional isolation. R11 and R12 set the operating bias for Q1. The gain of the stage, determined by Q2, L8, and C19, is approximately 11 dB. The output of Q1 drives the LO port of the Balanced Mixer U1.

Balanced Mixer (F)

The Balanced Mixer U1 receives (through a 30 dB pad) the 249 MHz signal from A7 249 Phase Lock Oscillator, mixes it with the signal from the 275 MHz Phase Lock Oscillator, and sends the difference to the IF Amplifier.

IF Amplifier (C)

The IF Amplifier has two stages, Q4 and Q3, with a gain of approximately 30 dB. It receives a 16 MHz to 38.5 MHz signal from the Balanced Mixer and sends it through the 60 MHz Low-Pass Filter to A8 249 MHz Phase Lock.

R15, R14, R13, and R17 provide dc bias for Q4. The voltage gain of the first stage, approximately 10, is determined by Q4, R16, and L10.

R35, R34, R33, and R38 set the bias for the second stage transistor, Q3. The voltage gain of about 3 is determined by Q3, R37, and R36.

60 MHz Low-Pass Filter (A)

The 60 MHz Low-Pass Filter eliminates the 249 MHz and 275 MHz signals, which cause crossing spurs in A8 249 MHz Phase Lock.

HP Part Number 85680-60015

A18 275 MHz Phase Lock Oscillator

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A18	85680-60015	9	1	BOARD ASSEMBLY, 275 MHz PHASE LOCK OSCILLATOR	28480	85680-60015
A18C1	0140-0199	6	1	CAPACITOR-FXD 240PF +-5% 300VDC MICA	09023	CD15FD241J03
A18C2	0140-0191	8	1	CAP-FXD 56pF 300 V MICA	09023	CD15ED560J03
A18C3	0160-2207	3	1	CAP-FXD 300pF 300 V MICA	09023	CD15FD301J03
A18C4	0160-2206	2	1	CAPACITOR-FXD 160PF +-5% 300VDC MICA 0+7	09023	CD15FD161J03
A18C5	0140-0196	3	1	CAPACITOR-FXD 150PF +-5% 300VDC MICA 0+7	09023	CD15FD151J03
A18C6	0160-3466	8	1	CAPACITOR-FXD 100PF +-10% 1KVDC CER		838-546 X5E 101K
A18C7	0160-2248	2	1	CAP-FXD 4.3pF 500 V	52763	
A18C8	0121-0457	9	1	CAPACITOR-V TRMR-PSTN .8-8.5PF 750V PC-M	18736	TP9
A18C9	0160-2266	4	1	CAPACITOR-FXD 24PF +-5% 500VDC CER 0+-30	52763	2RDPLX05024RNP0
A18C10	0160-2247	1	1	CAPACITOR-FXD 3.9PF +-.25PF 500VDC CER	52763	2RDPLX0503R9NP0
A18C11	0150-0059	8	1	CAP-FXD 3.3pF 500 V	52763	
A18C12	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C14	0160-2259	5	1	CAPACITOR-FXD 12PF +-5% 500VDC CER 0+-30	52763	2RDPLX05012RNP0
A18C15	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C16	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C17	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C18	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C19	0160-2261	9	1	CAPACITOR-FXD 15PF +-5% 500VDC CER 0+-30	52763	2RDPLX05015RNP0
A18C20	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C21	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C22	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C23	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C24	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C25	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C26	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C27	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C28	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C29	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C30	0160-2055	9	1	CAPACITOR-FXD .01UF +80-20% 100VDC CER		805-504 Y5V 103Z
A18C31	0160-2247	1	1	CAPACITOR-FXD 3.9PF +-.25PF 500VDC CER	52763	2RDPLX0503R9NP0
A18C32	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2-DYS
A18C33	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2-DYS
A18C34	0160-3876	4	1	CAPACITOR-FXD 47PF +-20% 200VDC CER	04222	SR202C470MAAH
A18C35	0140-0193	0	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA -20/	09023	CD15ED820J03
A18C36	0140-0193	0	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA -20/	09023	CD15ED820J03
A18C38	0160-2437	1	1	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	33095	54-713-033-X5V-502Z
A18C39	0160-4790	3	1	CAP-FXD 12pF 100 V	04222	SA102A120JAAH
A18CR1	0122-0085	1	1	DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	S0545	1S2208(B)
A18E1	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A18E2	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A18J1	1250-0690	6	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	51-047-4610
A18J2	85680-60081	9	1	CABLE ASSEMBLY COAX 87 (INCLUDES W25)	28480	85680-60081
A18J3	1250-2112	1	1	CONNECTOR-RF SMB M SGL-HOLE-FR 50-OHM	98291	051-047-0259-220
A18L1	9140-0129	1	1	INDUCTOR RF-CH-MLD 220UH +-5% .166D-INX.	99800	1537-92
A18L2	9100-1639	6	1	INDUCTOR RF-CH-MLD 150UH +-5% .166D-INX.	99800	1537-84

**Indicates factory-selected value*

HP Part Number 85680-60015

A18 275 MHz Phase Lock Oscillator

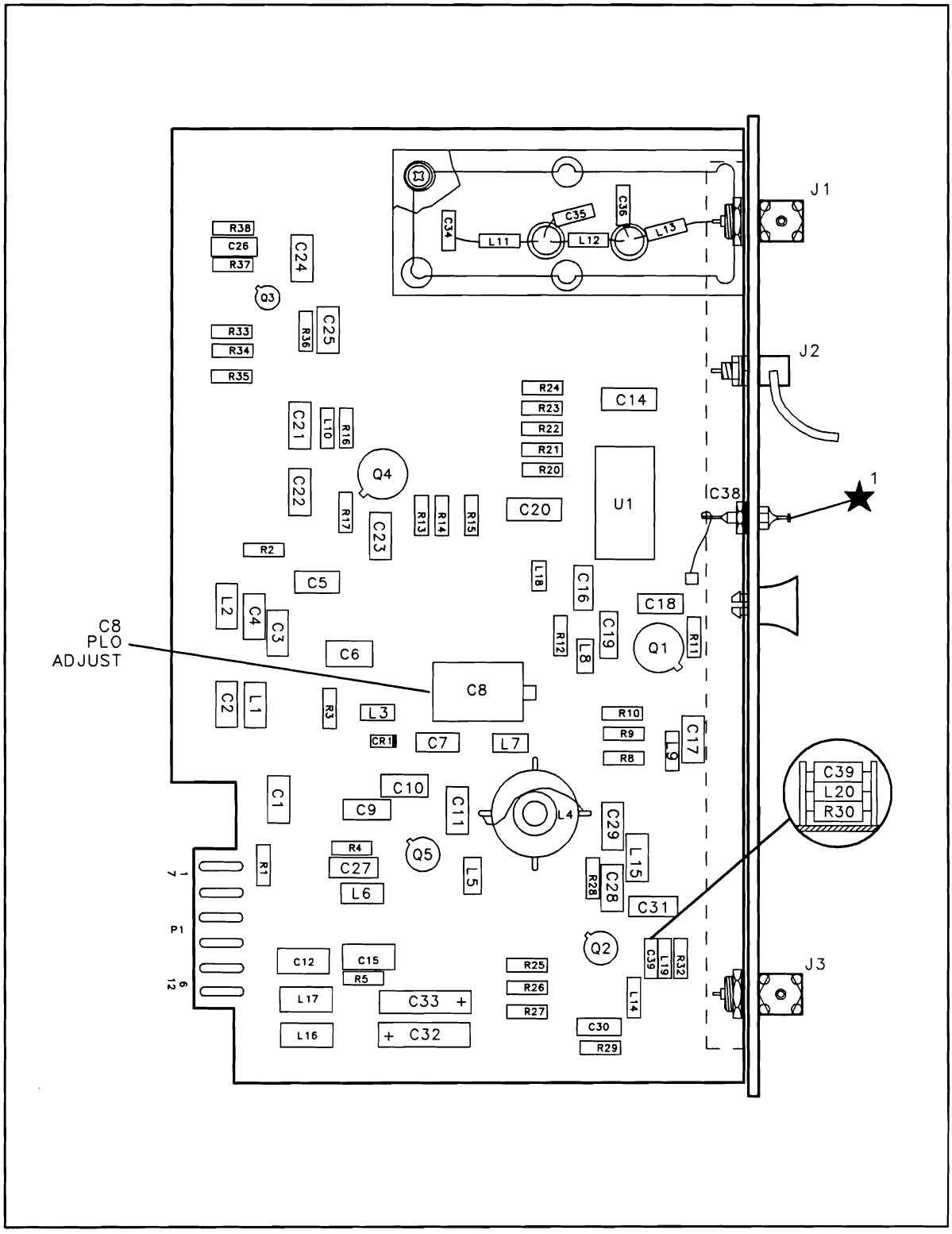
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A18L3	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH +-10% .105D-INX.2	32159	1A1002M +-10%
A18L4	85680-80005	9	1	INDUCTOR, COIL-OSCILLATOR	28480	85680-80005
A18L5	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH +-10% .105D-INX.2	32159	1A1002M +-10%
A18L6	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH +-10% .105D-INX.2	32159	1A1002M +-10%
A18L7	9100-2252	1	1	INDUCTOR RF-CH-MLD 270NH +-10% .105D-INX	24226	10M270K
A18L8	9100-0346	0	1	INDUCTOR RF-CH-MLD 50NH +-20% .105D-INX.	32159	1A5004M 20%
A18L9	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH +-10% .105D-INX.2	32159	1A1002M +-10%
A18L10	9100-2251	0	1	INDUCTOR RF-CH-MLD 220NH +-10% .105D-INX	24226	10M220K
A18L11	9100-2249	6	1	INDUCTOR RF-CH-MLD 150NH +-10% .105D-INX	24226	10M150K
A18L12	9100-2249	6	1	INDUCTOR RF-CH-MLD 150NH +-10% .105D-INX	24226	10M150K
A18L13	9100-2249	6	1	INDUCTOR RF-CH-MLD 150NH +-10% .105D-INX	24226	10M150K
A18L14	9100-0346	0	1	INDUCTOR RF-CH-MLD 50NH +-20% .105D-INX.	32159	1A5004M 20%
A18L15	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH +-10% .105D-INX.2	32159	1A1002M +-10%
A18L16	9100-1788	6	1	CORE-FERRITE CHOKE-WIDEBAND IMP:680	02114	VK200 20/4B
A18L17	9100-1788	6	1	CORE-FERRITE CHOKE-WIDEBAND IMP:680	02114	VK200 20/4B
A18L18	9100-2256	5	1	INDUCTOR RF-CH-MLD 560NH +-10% .105D-INX	24226	10M560K
A18L19	9100-0346	0	1	INDUCTOR RF-CH-MLD 50NH +-20% .105D-INX.	32159	1A5004M 20%
A18L20	9100-0346	0	1	INDUCTOR RF-CH-MLD 50NH +-20% .105D-INX.	32159	1A5004M 20%
A18MP1	85680-20079	1	1	SHIELD, 16-40MHz	28480	85680-20079
A18MP2	85680-00040	4	1	COVER, 16-40MHz	28480	85680-00040
A18MP3	0360-1031	3	1	TERMINAL-STUD FKD-TUR INT-THD-MTG	01364	
A18MP4	0360-1031	3	1	TERMINAL-STUD FKD-TUR INT-THD-MTG	01364	
A18MP5	2190-0009	4	1	WASHER-LK INTL T NO. 8 .168-IN-ID	0G791	820-BC
A18MP6	2190-0557	7	3	WASHER-LK INTL T NO. 10 .195-IN-ID	78189	1210-06-00-0551
A18MP7	2200-0101	0	3	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	77250	
A18MP8	2200-0564	9	6	SCREW-MACH 4-40 .812-IN-LG PAN-HD-POZI	4F517	
A18MP9	2580-0002	4	1	NUT-HEX-DBL-CHAM 8-32-THD .085-IN-THK	80120	
A18MP10	2950-0078	9	3	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	74163	500220
A18MP11	86701-40001	9	1	EXTRACTOR PC	28480	86701-40001
A18MP12				NOT ASSIGNED		
A18MP13	85680-20075	7	1	LID, 275MHz PLO	28480	85680-20075
A18MP14	0590-0526	6	6	THREADED INSERT-NUT 4-40 .065-IN-LG SST	46384	KFS2-440
A18Q1	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A18Q2	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A18Q3	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A18Q4	1854-0247	9	1	TRANSISTOR NPN SI TO-39 PD=1W FT=800MHZ	04713	
A18Q5	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A18R1	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A18R2	0757-0442	9	1	RESISTOR 10K +-1% .125W TF TC=0+-100	19701	SFR25H
A18R3	0757-0394	0	1	RESISTOR 51.1 +-1% .125W TF TC=0+-100	19701	SFR25H
A18R4	0757-0424	7	1	RESISTOR 1.1K +-1% .125W TF TC=0+-100	19701	SFR25H
A18R5	0698-3446	3	1	RESISTOR 383 1% .125W TF TC=0+-100	19701	SFR25H
A18R8	0698-3438	3	1	RESISTOR 147 1% .125W TF TC=0+-100	19701	SFR25H
A18R9	0757-0180	2	1	RESISTOR 31.6 +-1% .125W TF TC=0+-100	19701	SFR25H
A18R10	0698-3438	3	1	RESISTOR 147 1% .125W TF TC=0+-100	19701	SFR25H
A18R11	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A18R12	0698-0082	7	1	RESISTOR 464 1% .125W TF TC=0+-100	19701	SFR25H
A18R13	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H

**Indicates factory-selected value*

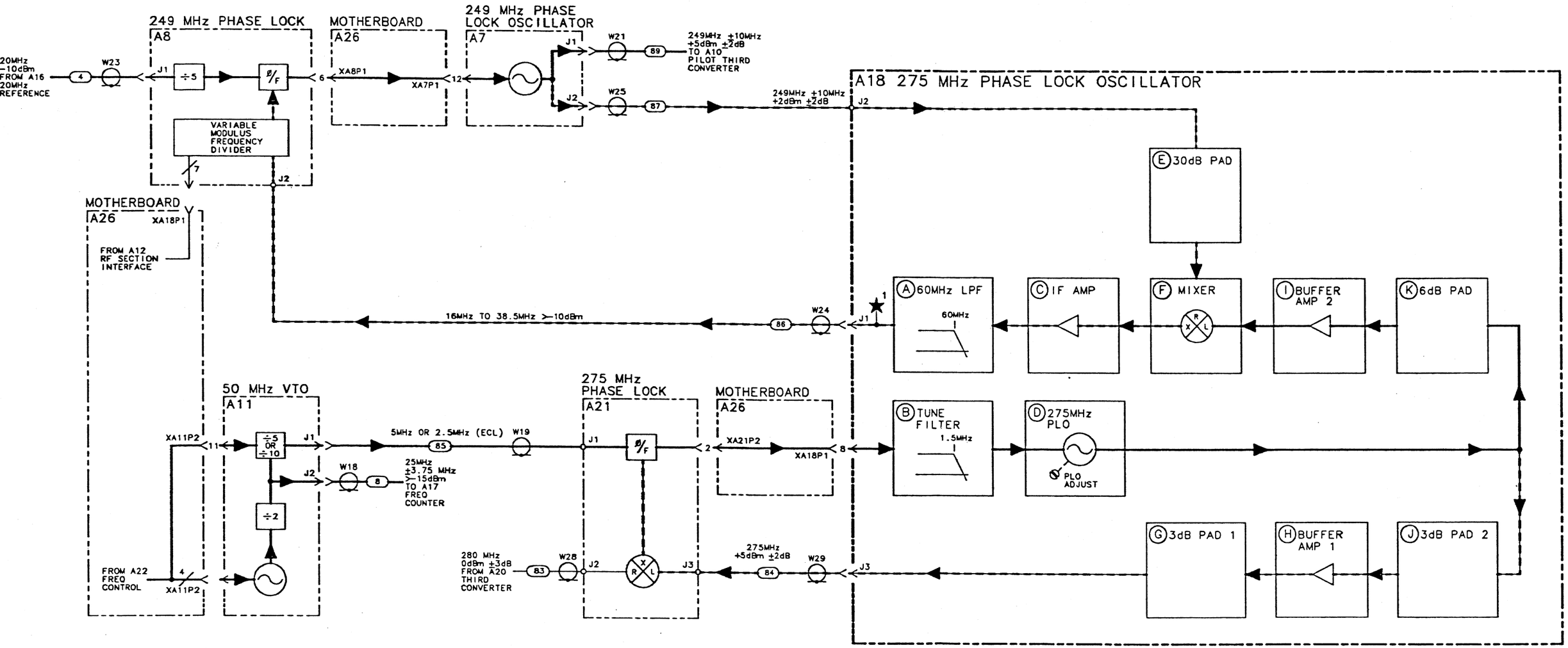
HP Part Number 85680-60015
A18 275 MHz Phase Lock Oscillator

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A18R14	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A18R15	0698-3438	3	1	RESISTOR 147 1% .125W TF TC=0+-100	19701	SFR25H
A18R16	0757-0346	2	1	RESISTOR 10 +-1% .125W TF TC=0+-100	91637	CMF-55-1, T-1
A18R17	0698-3439	4	1	RESISTOR 178 1% .125W TF TC=0+-100	19701	SFR25H
A18R20	0757-0398	4	1	RESISTOR 75 +-1% .125W TF TC=0+-100	19701	SFR25H
A18R21	0698-3438	3	1	RESISTOR 147 1% .125W TF TC=0+-100	19701	SFR25H
A18R22	0698-3434	9	1	RESISTOR 34.8 1% .125W TF TC=0+-100	19701	SFR25H
A18R23	0698-3438	3	1	RESISTOR 147 1% .125W TF TC=0+-100	19701	SFR25H
A18R24	0757-0398	4	1	RESISTOR 75 +-1% .125W TF TC=0+-100	19701	SFR25H
A18R25	0698-3443	0	1	RESISTOR 287 1% .125W TF TC=0+-100	19701	SFR25H
A18R26	0757-0294	9	1	RESISTOR 17.8 +-1% .125W TF TC=0+-100	19701	SFR25H
A18R27	0698-3443	0	1	RESISTOR 287 1% .125W TF TC=0+-100	19701	SFR25H
A18R28	0757-1094	9	1	RESISTOR 1.47K +-1% .125W TF TC=0+-100	19701	SFR25H
A18R29	0698-0082	7	1	RESISTOR 464 1% .125W TF TC=0+-100	19701	SFR25H
A18R30	0757-0400	9	1	RESISTOR 90.9 +-1% .125W TF TC=0+-100	19701	SFR25H
A18R32	0757-0400	9	1	RESISTOR 90.9 +-1% .125W TF TC=0+-100	19701	SFR25H
A18R33	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A18R34	0757-0280	3	1	RESISTOR 1K +-1% .125W TF TC=0+-100	19701	SFR25H
A18R35	0698-3438	3	1	RESISTOR 147 1% .125W TF TC=0+-100	19701	SFR25H
A18R36	0757-0394	0	1	RESISTOR 51.1 +-1% .125W TF TC=0+-100	19701	SFR25H
A18R37	0698-8822	9	1	RESISTOR 6.81 +-1% .125W TF TC=0+-100	91637	CMF-55-1
A18R38	0757-0416	7	1	RESISTOR 511 +-1% .125W TF TC=0+-100	19701	SFR25H
A18U1	0955-0063	0	1	U-WAVE MIXER 500 MHZ MAX	15542	SRA-1-32

**Indicates factory-selected value*



A18 275 MHz Phase Lock Oscillator Component Locations, 85680-60015

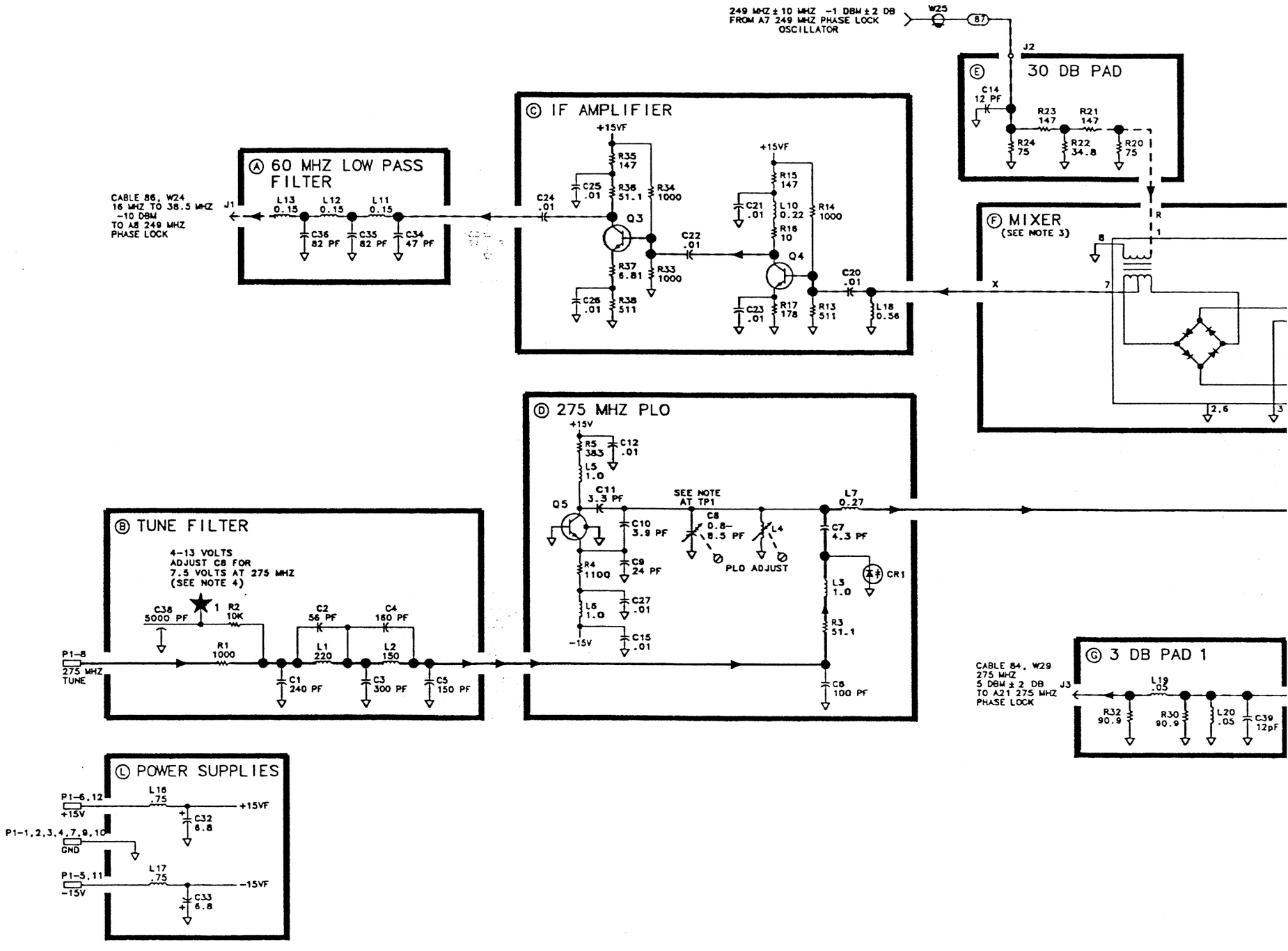


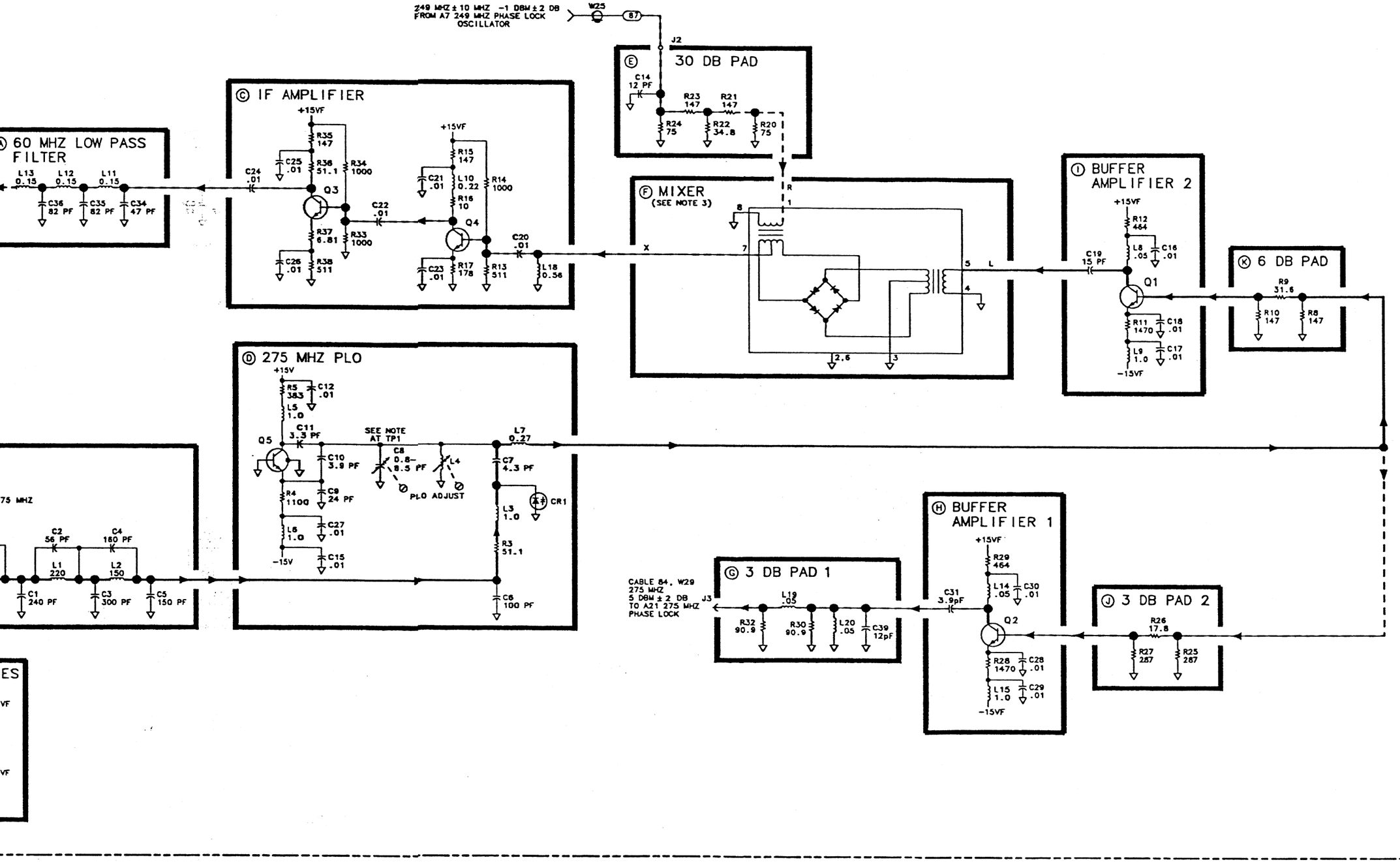
A18 275 MHz PHASE LOCK OSCILLATOR, BLOCK DIAGRAM

A18 275 MHZ PHASE LOCK OSCILLATOR
85680-60015
(SERIAL PREFIX: 2408A)

P1

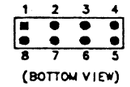
PIN	SIGNAL	TO/FROM	FUNCTION BLOCK
1	GND		L
7	GND		L
2	GND		L
8	275 MHZ TUNE	A21P2-2	B
3	GND		L
9	GND		L
4	GND		L
10	GND		L
5	-15V		L
11	-15V		L
6	+15V		L
12	+15V		L





NOTES:

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IS IN OHMS (Ω)
   CAPACITANCE IS IN MICROFARADS (μF)
   INDUCTANCE IS IN MICROHENRIES (μH)
3. U1 PIN CONFIGURATION:



(BOTTOM VIEW)

4. INSTRUMENT CONTROL SETTINGS:
   INSTRUMENT PRESET
   CENTER FREQUENCY-17.1 MHZ
5. UNLESS OTHERWISE INDICATED:
   SIGNALS ENTER AT LEFT SIDE OR TOP AND EXIT AT RIGHT SIDE OR BOTTOM OF FUNCTION BLOCKS.

A18

A18 275 MHz PHASE LOCK OSCILLATOR, SCHEMATIC DIAGRAM