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BENCH BRIEFS

SERVICE INFORMATION FROM HEWLETT-PACKARD

JANUARY-FEBRUARY 1974

CLUES TO HELP DETERMINE THE HP PART NUMBER OF A REPLACEMENT PART

by Rod Dinkins

Have you ever searched through the parts list in an Operating and Service Manual trying to determine the HP part number of a needed replacement? If so, there have probably been times when it was difficult to determine the desired number. It is not uncommon to find several part descriptions that seem to apply to the part that you need.

How do you determine which is the correct number? One way is to call your local HP office. An even faster method, though, is to use the clues given by the part number of each part.

If you frequently use HP parts lists, you have probably noticed that similar parts have similar part numbers. That is, there appears to be some pattern in the numbering system. Although there are variations and exceptions, the organization of the part numbering system can be broken down into three major classifications: (1) Components and materials, (2) General usage parts, and (3) Specific instrument parts. A knowledge of the basic structure of the part numbering system simplifies identification of part types or part numbers. In this article, we'll examine each classification and show some typical examples.

Component Parts and Materials

These are items that you might expect to find stocked at a local electronics distributor; items that might be used by *any* electronics manufacturer. For example, transistors, ICs, transformers, capacitors, resistors, nuts screws, grommets, tubes, switches connectors, batteries, etc. For components parts and materials, eight digit part numbers are used, where the four-digit prefix identifies the type of component, part, or material and the four-digit suffix indicates the unique part. Table 1 is a list of some of the more commonly used prefixes for component parts.

The tips in this article will help you to determine needed part numbers. If you need assistance, identification experts such as Paul Goblin are available to help. Please contact your local HP office.

Knowing this system has two benefits; first having information about the part will give you clues about its part number. For example, if the part you are replacing is an electrolytic capacitor, you know that the HP part number must begin with 0180-. Second, knowing the part number gives you helpful information about the part. For example, if you are working on a circuit with a transistor with part number 1854-0037, you know that this transistor is an NPN made out of silicon. Therefore you can expect to see about 0.6V across a forward-biased base-emitter junction. A transistor with an 1850- or 1851- prefix is germanium and therefore you should expect about 0.2V drop across its B-E junction.

IN THIS ISSUE

Table 1

PREFIX	COMPONENT/PART/ MATERIAL	PREFIX	COMPONENT/PART/ MATERIAL
0121-	Capacitors, Variable (mechanical)	1251-	Connectors (non RF and related parts)
0122-	Capacitors, Voltage Variable (semiconductor)	1410-	Bearings and Bushings
0140-	Capacitors, Fixed } Non-	1420-	Batteries
0150-	Capacitors, Fixed } Electrolytic	1820-	Monolithic Digital Integrated Circuits
0160-	Capacitors, Fixed }	1826-	Monolithic Linear Integrated Circuits
0180	Capacitors, Fixed Electrolytic	1850-	Transistors, Germanium PNP
0330-	Insulating Materials	1851-	Transistors, Germanium NPN
0340-	Insulators, Formed	1853-	Transistors, Silicon PNP
0370-	Knobs, Control	1854-	Transistors, Silicon NPN
0380-	Spacers and Standoffs	1855-	Field-Effect-Transistors
0410-	Crystals	1884-	Thyristors and SCR's
0470-	Adhesives	1900- thru 1912	Diodes
0490-	Relays	1920- thru 1952-	Vacuum Tubes
0510-	Fasteners	1990-	Semiconductor Photosensitive and Light-Emitting Diodes
0674 thru 0778-	Resistors, Fixed (non-wire wound)	2110-	Fuses
0811 thru 0831-	Resistors (wire wound)	2140-	Lamps
1200-	Sockets for components	3100- thru 3106-	Switches
1205-	Heat Sinks	8120-	Cables
1250-	Connectors (RF and related parts)	9100-	Filters and Transformers

General Usage Parts

There are quite a few parts that are built by HP to be used in many different HP instruments. The main characteristic of this category is that you would *not* expect to find any of these parts used in a competitor's product, unlike the previous category discussed. These include such items as covers, side frames, rack mounting hardware, etc. An example of this is side frame 5060-0732; this is an assembly used in the 5245L, 5244L, 5242L, 5065A, and others. Table 2 gives the prefixes for general usage HP manufactured parts.

Table 2

TYPE OF PART	PREFIX
Sheet Metal	5000- to 5019-
Machined	5020- to 5039-
Molded	5040- to 5059-
Assemblies	5060- to 5079-
Components	5080- to 5099-

As an example of use, assume you have a broken guide used for printed circuit board support. Upon examining the part, you determine that it's likely to be used in many instruments and that it is a plastic molded part. From this and the previous listing, it's very likely that the PC guide will have the prefix of 5040- to 5059-. This will help to locate the correct part in the table of replaceable parts. The part number for a commonly used PC guide is 5040-0170. An example of a component used in several instruments is power splitter 5088-7003. Thus if the part to be replaced appears to be one made by HP and used in *many* HP products, the part number probably has eight digits and the first digit is a 5. The third digit will indicate additional information about the item.

Specific Instrument Parts

These are parts manufactured by HP for use in a particular HP instrument or series of instruments. These parts have ten digit part numbers; the prefix is the model number of the instrument and the suffix indicates the type of part. Table 3 is a list of suffixes commonly used.

As an example, assume that you are looking for the part number for the main chassis for Model 5340A. Since this is likely to be used only in the 5340A and because it's a sheet metal part, you will conclude the number will most likely be 05340-0NNNN. After scanning the parts list under chassis parts, you would find the part number is 05340-00003.

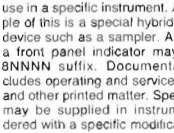
Some clarification of the above categories may be appropriate. "Sheet Metal" includes items that are stamped out of sheet metal, folded if necessary and perhaps painted. Many front panel parts fall into this category. Also included are items made out of sheets of other material, such as an insulator made from a sheet of bakelite.

A part is assigned a -2NNNN suffix when the last operation performed is a machining operation, such as drilling a

Table 3

TYPE OF PART	P/N SUFFIX (N=Any Number)
Sheet Metal	-0NNNN
Machined	-2NNNN
Molded	-4NNNN
Assembly	-6NNNN
Component	-8NNNN
Documentation and special parts	-9NNNN

hole. Other machining operations include milling, threading and lathing. A molded part can be recognized by the unique shape that results from a mold. A part is considered an assembly if one or more parts were combined to make the part. Did someone put together the desired part? A switch purchased from a supplier would have a number such as this: 3100-NNNN. If someone soldered wires or components on the switch, it would then be considered an assembly and assigned an appropriate number. Component numbers are used when a particular component was designed for use in a specific instrument. An example of this is a special hybrid circuit or device such as a sampler. A mask for a front panel indicator may have a 8NNNN suffix. Documentation includes operating and service manuals and other printed matter. Special parts may be supplied in instruments ordered with a specific modification. For example, if you are repairing a board with p/n 05326-90002, the 9 indicates that this board is "special" and therefore is different from the board normally supplied in the instrument.



Parts manufactured for many HP instruments have eight digit part numbers beginning with a 5.

Here's a short quiz to further illustrate the point. Let's say you are working on an HP 5055A Digital Recorder and after repairs you notice the paper tray is damaged. What is the HP part number? Instead of randomly searching through the parts list, we first determine a great deal by examining the part.

1) Is this a component (that is, is this a part that might be stocked at a local electronics distributor?) If so, it has an eight digit number.

2) Is this part manufactured by HP for use in hundreds of HP products? If so, it will probably have an eight digit part number beginning with a 5.

3) Is this part manufactured by HP for use in one or a few HP products? If so, it will probably have a ten digit part number and the first five digits are related to the product's model number.

If the second or third category is chosen, we next ask if the part is:

a) made out of sheet metal
b) machined
c) molded
d) an assembly
e) a component

What can you determine about the desired part number? _____

_____

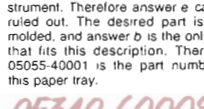
_____

An examination of the paper tray for this instrument leads us to the conclusion that the part is unique enough that it probably was designed by HP for only this HP product. Therefore it has a ten digit part number and the first five digits will be the product model number: 05055-NNNNN. Further examination reveals a curved shape indicating that the item is molded. Therefore the first digit in the suffix is a 4, so our number is narrowed to 05055-4NNNN.

Let's assume that the service manual lists five parts with descriptions that might be what we want (such as paper holder, paper support, etc.). These are:

a) 05055-00005
b) 05055-40001
c) 05055-00004
d) 05055-20005
e) 5060-0099

Which part is the one desired? We concluded our part was used only in this instrument. Therefore answer e can be ruled out. The desired part is also molded, and answer b is the only one that fits this description. Therefore 05055-40001 is the part number of this paper tray.



Instrument-related part numbers have ten digits. The first five digits indicate the model number.

Some variations on this part number system may be noticed in some divisions and in some countries. Also previous part numbering methods were used that did not incorporate the features of the present system. The previous system used numbers such as 560A-37AK. Also some firms acquired by HP had their own methods of assigning numbers. Many of these numbers are still in use today. Therefore the techniques presented above will not help you 100% of the time, but a great amount. Investing a few minutes learning the system pays big rewards. Try it; it works!

Rod Dinkins is a writing supervisor at the Santa Clara (California) Division of HP. His responsibilities include all the Operating and Service Manuals for instruments manufactured there.

His outside interests are many, including photography, bridge, and building model cars. He is married and has two boys.

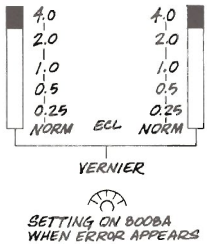
PULSE GENERATOR WAVEFORM ERROR?

by Gunter Schade

If you work with pulse generators or repair them you may have noted a special effect on some instruments which raises the question to service people and customers: is this an error or not?

This apparent error appears as a bend in the middle of the leading edge on the 8008A Pulse Generator. Similar symptoms may appear with other models.

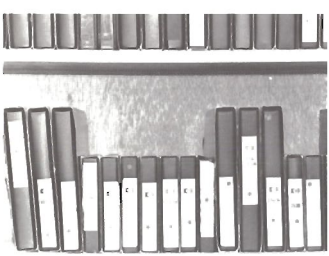
This strange behavior is caused by an incorrect impedance match and appears when each channel is set to full amplitude of about 4V but when only one channel is used (and therefore, terminated by 50Ω) while the other unused channel is not terminated. Since the output stage is a difference amplifier and both collectors are connected to the output connectors, the difference amplifier is not able to work correctly with different loads (different current) when the generator is used as described above. To avoid this bend in the waveform, either use a 50Ω load for each channel or switch the attenuator of the unused (open) channel down to a lower range.



In conclusion, if you ever use a pulse generator, watch for correct termination. This may save a lot of time looking for the problem.

Guenter Schade has been with HP for six years and is currently a Customer Service Engineer at the HP factory in Boeblingen, West Germany. This job entails solving service related problems for electronic products. Previously Guenter designed some of the unique electronic fixtures and tools used in the manufacturing of HP products at Boeblingen. In addition to spending a lot of time skiing, he enjoys table tennis.

NEW SERVICE-ORIENTED VIDEO TAPES AVAILABLE



Two new service-oriented video tapes are available which should be especially valuable to service personnel. The programs cover the mechanical and electrical aspects of the 1700A Oscilloscope Series.

1) 1700 OSCILLOSCOPE SERIES (SERVICE 3)—1710A MECHANICAL

The significant mechanical aspects of the Model 1710A Oscilloscope are reviewed, with emphasis on control groupings and how to remove most of the assemblies and the CRT. Personnel who have to service the vertical attenuators or remove the horizontal module or CRT of the 1710A will find this program very useful. HP stock number 90030__#797. (Time: 14 minutes).

2) 1700 OSCILLOSCOPE SERIES (SERVICE 4)—1710A ELECTRICAL

Block diagrams and simplified schematics are used in this program to clarify the operation of the low voltage power supply, the bright scan mode and the logic-controlled trigger circuit of the 1710A Oscilloscope. Major electrical aspects are examined, and the troubleshooting tips offered will be of great practical help to service personnel. HP stock number 90030__#798. (Time: 14 minutes).

These two tapes are part of a four-part series on the 1700A Oscilloscope series. Operation was covered in tape 90030__#673. Power supplies are reviewed in tape 90030__#674.

To order these tapes, or for more details, contact your local HP Office.

CAN YOU SOLVE THIS?

Since service work requires a very logical procedure to get optimum results, here's a challenging exercise to test your logic. It may be ideal to try this one when you are relaxed and away from the noise of the shop because this puzzle may require deep concentration. It can be solved with the clues given so don't give up easily. Good Luck!

One day five young aspiring HP technicians were finishing a day of repair work. One was Japanese, another was Italian, another was German, another was English and another was American. (If you think that that is strange, read on.) They decided to have a race to the local bar to share a drink and extend their best wishes for a prosperous New Year.

Now this was not an ordinary group of service personnel because their cars were a Datsun 240Z, Volkswagen Superbug, Fiat 850, Triumph TR4 and a '56 Chev with one bald tire. One of the above cars was marked #1, another marked #2, another #3, another #4 and another was #5. (It also seems that they were racing enthusiasts).

From the information in the clues below, answer these questions:

1. Who finished first in the race?
2. What car was he driving?
3. What number was labeled on it?

Similarly determine the same for the second, third, fourth and last place people. That is, fill in the table.

Here's what you need to solve the problem:

a. No driver had the same nationality as the country of manufacture of his car. (Japanese did not drive the Datsun, Italian did not drive the Fiat, etc.)

b The Datsun finished behind the Fiat (not necessarily directly behind).

c. The driver of the Chev had to stop to change a flat tire.

d. The Italian won the race.

e. Car #3 did not finish in the first two places.

f The Triumph had a broken windshield wiper

g. No car finished the race in a place that corresponds to its number.

(Car #1 did not finish 1st, Car #2 did not finish 2nd, etc.

h. The driver in Car #3 worked for HP two years longer than the driver of the Fiat.

i. The American is 6 feet tall and weighs 270 pounds.

j. The driver that finished in 4th place has a mother-in-law who is bigger than the American.

k The Volkswagen was painted green

l. The Chev finished last.

m. The driver of #2 was older than the American but younger than the driver of the Volkswagen.

n. The American was not driving Car #4.

o. The Englishman finished ahead of these three different cars: the Fiat, the Chevrolet and the car labeled #1.

	Make of Car	Number labeled on Car	Nationality of Driver
Winner			
2nd Place			
3rd Place			
4th Place			
Last			

MAGNETIC TAPE DISCONTINUED

by Vern Hudson

Some versions of the 3960A Instrumentation Tape Recorders, such as the 3960G-E14, are equalized for 3M Type 203 Audio Tape. Others, such as the 3960G-E51 are equalized for 3M Type 150 Audio Tape. 3M has recently announced the discontinuance of Types 150 and 203 tapes. Also, they do not have a direct replacement for these two audio tapes which would meet all specifications of these special versions. Extensive testing at San Diego Division has verified that a direct replacement for the 203 tape is the Ampex Type 641 tape. The 3960A series recorders equalized for the 203 tape will meet all specifications when using the 641 tape, and in fact, the 641 is being supplied with the 3960's which previously used 203 tapes. For replacement purposes, the 641 is available under HP P/N 9162-0060. A replacement for the 150 tape is being tested and the replacement will be announced as soon as it is available. All other standard versions of the 3960A series require 3M 951 tape, HP P/N 9162-0006.

Vern Hudson is a Service Engineer for Recorders and Plotters at the San Diego California) Division of HP. Service Engineers are product experts that provide technical assistance to the HP Field Service Organization. Vern also contributed an article on tape recorders that may be of interest in the November-December 1973 issue of Bench Briefs.

IS THIS NORMAL???

by Brent Helland

Should this screw be this long? Is this normal?

It is in poor taste these days to speak of "normal". Anthropologists, sociologists and psychologists have about given up trying to define normal. It is even harder than it may seem to define "normal" as it applies to machines. On the other hand, one of the virtues of a deeply experienced serviceman is an almost instinctive feel for deviations from normal operation in a circuit. So, it's to your great advantage to devise a strategy that helps you to better determine what is normal for any particular instrument.

How does "normal" apply to electronic gear? Let's examine some practical definitions of normality.

"Normal" could be thought of as "within specifications". It is possible, however, to find deviations from normal within specifications. For instance, an instrument that functions properly may show some indication of possible failure six months hence. Such indications may be minor, yet stem from major causes. A drop of oil on the chassis of an instrument could be from a defective capacitor that will explode within weeks, or perhaps hours. The drop of oil and similar, even more subtle indications can be caught if you will prepare a checklist of things to look for. Add to the list as you think of new entries, such as a drop of oil, a cracked p.c. board, a loose ground, etc. The list will ultimately cover a page or so, but will still require only a few moments to check out.

"Normal" could be thought of as usual or mean performance.[1] Is a tiny amount of jerk in the transmission of a recorder acceptable? The paper moves at the specified speed, but from experience, you know that the paper should move smoothly. Inspection will reveal a jerking clutch. Had it locked, it could have done hundreds of dollars worth of damage. Smooth performance is usual, but not specified.

Take a moment every so often, while troubleshooting or testing, to deliberately try to sense how the machine is running. Touch the paper feed roller, does it move smoothly? Look at the display, is an LED too dim? Listen for a whine or clunk or rattle.

"Normal" could be thought of as being efficient enough and not requiring remedial action.[1] For example, a radio operator may continue to take messages from his receiver despite noise or poor fidelity, and say that the receiver operates normally until it requires remedial action because of a total failure (no reception at all).

One user's oscillographic recorder yielded more power line frequency interference when grounded than when floating. The user considered this peculiarity to be normal for this instrument so he left it floating and tolerated the smaller amount of hum. Investigation revealed that this "ground" was an ungrounded window grating that was twenty feet from a high voltage power line. Recordings became free of perceptible hum when the recorder chassis was properly grounded.

When an operator claims that his gear worked normally until its recent malfunction, ask a few questions. Find out just what he means by "normal". His answer may save valuable troubleshooting time.

"Normal" could be thought of as an unspecified condition that is necessary for proper instrument function. If 2½ milliwatts of R.F. power into the regulator is necessary to produce

Should this recorder have such a wide trace? Is this normal?

a levelled output, 2¼ won't do. The 2½ milliwatts is not specified but the 1 milliwatt of levelled output is specified. Common sense might dictate that 2¼ times the output should be more than enough power to ensure levelling. Any serviceman would be helpless to repair this instrument until he knew what the normal input power should be.

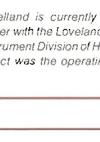
If you are stuck in a circuit that displays unreasonable symptoms, it is possible that you have made invalid assumptions about what is normal for the circuit. Many times it will clear things up to make careful measurements throughout the circuit, note them, then call the nearest specialist to find out which measurements are abnormal.

To summarize, it appears that "within specifications" is a good start at defining normal operation for electronic gear. Our definition, however, needs expansion to include "usual performance" and "unspecified conditions for operation" to make it really useful.

An orderly approach to mechanical inspection, deliberate sensitivity to the peculiarities of an instrument, and a readiness to seek help will reduce down-time and minimize re-repairs.

One of the most important of maintenance procedures is to take notes (preferably in the instrument service manual) that describe normal operation for the instrument at hand. Any description of normal operation will help you work more efficiently, since any divergence from normal (however subtle) provides a valuable tool for troubleshooting.

[1]Abercrombie, M.L. Johnson, The Anatomy of Judgment, London, 1960, pp 94-108.



Brent Helland is currently a technical writer with the Loveland (Colorado) Instrument Division of HP. His latest project was the operating manual for the miniature Probe Voltmeter. Brent previously spent 8 years at the HP Englewood, Colorado sales and Service Office working both on the service bench and as part of the on-site service force.

The streams and wooded areas of Colorado fit well with Brent's interests of fishing and hiking. He is active in church work and also enjoys reading. Brent is married and has two children.

THE ORIGIN OF -114 dBm

by George Stanley

Many of you who work in radar, communications or receiver testing are familiar with the expression -114 dBm as the residual background noise level that is present when using a 1 MHz bandwidth. This noise level is derived from the expression: KTB where K is Boltzman's constant (which is $1.38 \times 10^{-23} \frac{\text{joules}}{^\circ\text{K}}$)

T is the noise temperature (in degrees Kelvin) of the device being measured.

B is the bandwidth of the system (in Hz)

For a 20°C environment K is 273° + 20° = 293°K. If bandwidth is 1 MHz then KTB =

$$1.38 \times 10^{-23} \frac{\text{joules}}{^\circ\text{K}} \times 293^\circ\text{K} \times 10^{6} \frac{\text{cy}}{\text{sec}}$$

$$= 1.38 \times 293 \times 10^{-17} \frac{\text{joules}}{\text{sec}}$$

But 1 joule equals 1 watt-sec

Therefore KTB =

$$1.38 \times 293 \times 10^{-17} \frac{\text{watt-sec}}{\text{sec}}$$

$$= 4.04 \times 10^{-15} \text{ watts}$$

$$= 4.04 \times 10^{-12} \text{ m watts}$$

The decibel (dB) is often used to express the ratio of a power level P_X to some reference power. The term dBm is used when the reference power level is 1mw. Thus,

$$\text{dBm} = 10 \log_{10} \left(\frac{P_X}{1\text{mw}} \right)$$

(See the April 1973 issue of Bench Briefs). Let us convert KTB to dBm.

Absolute Power Level

$$= 10 \log_{10} \left(\frac{4.04 \times 10^{-12}\text{mw}}{1\text{mw}} \right)$$

$$= 10 \left[\log_{10} (4.04) + \log_{10} \{10^{-12}\} \right]$$

$$= 10 \left[\log_{10} (4.04) - 12 \log_{10} (10) \right]$$

$$= 10 \left[0.6 - 12(1) \right]$$

$$= 10 \left[-11.4 \right]$$

$$= -114 \text{ dBm}$$

For a 10 KHz bandwidth the theoretical background noise would be -134 dBm.

For a 100 Hz bandwidth the theoretical background noise would be -154 dBm.

For a 1 Hz bandwidth the theoretical background noise would be -174 dBm.

One practical implication of the above is that if you use a very narrow bandwidth and digital coding (high or low signal) you can pass intelligence over long distances such as deep space with very low power (battery operated) transmitters. This is just another reason why so much of our electronics is going digital. Not only do we use digital techniques for deep space communications, but then we use "digital enhancement" techniques to integrate out some of the noise which is random in nature and enhance the digital signal which is repetitive in nature.

George Stanley, who is probably familiar to many readers as the author of a book and videotape series on transistor basics is a regular contributor to Bench Briefs. He is the Group Training Manager for HP's instrument producing divisions.

HIGH FREQUENCY OVERLOAD PROTECTION

A limiter is available that provides input protection for a variety of instruments. Many times the input circuits of spectrum analyzers, samplers or amplifiers can be damaged by excessive input signal levels. These could be either transients or short duration overloads.

Model 11693A Limiter protects inputs from up to a 75W peak or 1 Watt continuous power. Also signal generators can be protected from application of reverse power.

A typical application, shown in Figure 1, is the protection of a spectrum analyzer input from inadvertent overload due to high level signals from an antenna.

The Limiter has Type N connectors and an insertion loss of less than 2dB. For more information call your local HP Office.

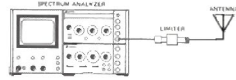


Figure 1.

supplement to BENCH BRIEFS SERVICE NOTE INDEX

Here's the latest listing of Service Notes available for Hewlett-Packard products. Service Notes contain information that will help you get the most out of your purchases.

Many times design changes or other improvements are made in products currently being manufactured. HP often recommends including these changes in products previously sold; this is done by writing a Service Note for the product.

Service Notes for your instruments can be obtained by using the Service Note Order Form. Remove the order form and mail it to the HP distribution center nearest you. European customers should mail it to this address:

Hewlett-Packard S.A.
Central Mailing Department
P.O. Box 7550
Freeport Building
SCHIPHOL–Centrum
The Netherlands

For the U.S. and elsewhere, mail it to:
Hewlett-Packard Company
195 Page Mill Road
Palo Alto, California 94306

GENERAL

M50 Autogrip Installation and cleaning procedure. (supersedes M48 and autogrip).

M51 All X-Y Recorders and graphic plotters. Mylar test grids not recommended.

M53 Equipment necessary to Calibrate and check performance of HP Real Time Oscilloscopes. (supersedes erroneously numbered S.N. M-51).

141A STORAGE OSCILLOSCOPE

141A/S-19 All serial prefixes. CRT Neck Pin Location

141T SPECTRUM ANALYZER-DISPLAY SECTION

141T-3 All serial prefixes. Fast and Standard Mode Adjustments using spectrum analyzer plug-ins

141T-4 All serial prefixes. Cooling fan modification

236A TELEPHONE TEST OSCILLATOR

236A/AH-1 Telephone Test Oscillator (Model 236A serials 1107A04460 and below; Model 236AH serials 1107A04565 and below; Model KS-19353-L4 all serials). Modification to improve amplitude flatness above 100 kHz

403B AC VOLTMETER

403B-5 Serials 523-05300 and below. Modification to replace germanium transistors with silicon transistors.

435A POWER METER

435A-1 Serial prefix 1234A and below. Modification for long input cables.

489A MICROWAVE AMPLIFIER

489A-6 All serial prefixes. Installation of improved TWT and general updating. Supersedes all previous service notes.

491C MICROWAVE AMPLIFIER

491C-6 All serial prefixes. Installation of improved TWT and general updating. Supersedes all previous service notes.

651B TEST OSCILLATOR

651B-U-1000 Serials 1201U00925 and below. Power Transistor Replacement.

741B DIFFERENTIAL VOLTMETER

741B-7 All serials. Replacement of resistor in AC probe.

741B-8 All serials. Padding capacitors used for AC probe replacement.

1106A TUNNEL DIODE

1106A-1A All serial prefixes. Repair Policy (supersedes 1106A-1).

1200A SERIES OSCILLOSCOPE

1200A/B-5 All serial prefixes. Preferred replacement for A6Q4

1200A/B-6 All serial prefixes. Nut adapter for Intensity Pot.

1201A/B-5 All serial prefixes. Preferred replacement for A6Q4

1201A/B-6 All serial prefixes. Nut adapter for Intensity Pot.

1202A/B-2 All serial prefixes. Preferred replacement for A6Q4

1202A/B-3 All serial prefixes. Nut adapter for Intensity Pot.

1205A/B-2 All serial prefixes. Preferred replacement for A6Q4

1205A/B-3 All serial prefixes. Nut adapter for Intensity Pot.

1206A/B-2 All serial prefixes. Preferred replacement for A6Q4

1206A/B-3 All serial prefixes. Nut adapter for Intensity Pot.

1207A/B-5 All serial prefixes. Preferred replacement for A6Q4

1207A/B-6 All serial prefixes. Nut adapter for Intensity Pot.

1208A/H11-4 Serial prefix 1306A and below. High voltage oscillator double-modingand preferred replacement for A6Q4.

1208A/H11-5 Serial prefix 1330A and below. Potential trace shorting problem.

1208A/H11-6 All serial prefixes. Tips for recognizing and identifying storage CRT symptoms.

1215A/B-1 All serial prefixes. Preferred replacement for A6Q4.

1215A/B-2 All serial prefixes. Nut adapter for Intensity Pot

1217A/B-2 All serial prefixes. Preferred replacement for A6Q4

1217A/B-3 All serial prefixes. Nut adapter for Intensity Pot

1300A X-Y DISPLAY MONITOR

1300A-9 All serial prefixes. Preferred replacement for H.V. Oscillator Transistor.

1300A/H82-2A Serial prefix 1254A and below. Preferred replacement for A5. Recommended Modification to A5.

1300A/H82-3 Serial prefix 1204A and below. Preferred replacements for A6, A6F1 and A6F4

1308A EIGHT CHANNEL MONITOR

1308A-7 Serial prefix 1222A and below. Preferred replacement for A9, A9F1 and A9F4.

1308A-8 All serial prefixes. Preferred replacement for H.V. Oscillator Transistor.

1309A X-Y MONITOR

1309A-7 Serial prefix 1252A and below. Preferred replacements for A9, A9F1 and A9F4.

1309A-8 All serial prefixes. Preferred replacement for H.V. Oscillator Transistor.

1310A COMPUTER GRAPHIC DISPLAY

1310A-9 Serial prefix 1316A only. Preferred replacement for A5.

1310A-10 All serial prefixes. Stock numbers for ordering mask assemblies.

1310A-11 Serial prefix 1316A and below. Possibility of insufficient gain range after replacing A1U2 or A3U2.

1311A COMPUTER GRAPHIC DISPLAY

1311A-9 Serial prefix 1316A only. Preferred replacement for A5.

1311A-10 All serial prefixes. Stock numbers for ordering mask assemblies.

1311A-11 Serial prefix 1316A and below. Possibility of insufficient gain range after replacing A1U2 or A3U2.

1331A/C DISPLAY

1331A/C-3 1331A serial prefix 1319A and below. 1331C serial prefix 1318A and below. H.V. Oscillator double-modingand preferred replacement for Q5

1331A/C-4 All serial prefixes. Tips for recognizing and identifying storage CRT symptoms.

1420A TIME BASE

1420A-6 Serial prefix 964 and below. Preferred replacement for Q101.

1601A LOGIC STATE DISPLAY

1601A-1 Serial prefix 1338A and below. Transformer replacement

1601A-2 All serial prefixes. Field repair kit

1703A OSCILLOSCOPE

1703A-3 Serial prefix 1232A and below. Improved low frequency triggering

1707B OSCILLOSCOPE

1707B-2 Serial prefix 1234A and below. Improved low frequency triggering

1710A OSCILLOSCOPE

1710A-1 Serial prefix 1302A and below. Vertical Amplifier Protection Modification

1710A-2 Serial prefix 1316A and below. CRT Burn Protection Modification

1820A TIME BASE

1820A-7 All serial prefixes. Preferred replacement for R249.

1820B TIME BASE PLUG-IN

1820B-3 All serial prefixes. Improved sweep length

1821A TIME BASE/DELAY GENERATOR

1821A-9 (For 1821A and 1821F) All serial prefixes Preferred replacement for R223 and R444.

1822A TIME BASE PLUG-IN

1822A-3 All serial prefixes. Preferred replacement for A1R59 and A1R105.

1915A VARIABLE TRANSITION TIME OUTPUT

1915A-12 Serial prefix 1207A and below. Preferred replacement for A5Q33.

1922A NEGATIVE OUTPUT PLUG-IN

1922A-1 Serial prefix 1209A and below. Increased risetime capability.

1925A WORD GENERATOR

1925A-3 Serial prefix 1232A and below. Word count errors

2761 OPTICAL MARK READER

2761A-12/2761B-6 2761A prefix 1214 and below. 2761B prefix 1216 and below. All Options. Prevention of high failure rate of front idle wheels.

2930A LOW LEVEL MULTIPLEXER

2930A-4 Serials 1118A00141 to 1118A00160. Modification to prevent erroneous overload.

3310A FUNCTION GENERATOR

3310A-4 Serial numbers 820-00651 and below. Replacement of A1CR21 and A1CR22

3403C TRUE RMS VOLTMETER

3403C-1 All serials. Improving light emitting diode annunciator.

3459A DIGITAL VOLTMETER

3459A-11A All serials. Replacement oven assembly

3460A/B DIGITAL VOLTMETER

3460A-10/3460B-10 All serials. Replacement oven assembly.

3462A DIGITAL VOLTMETER

3462A-3 All serials. Replacement oven assembly.

3524A TRANSPORT

3524A-3 All serials. Replacement of dashpot 1520-0073.

3525A TRANSPORT

3525A-3 All serials. Replacement of dashpot 1520-0073.

3526A TRANSPORT

3526A-3 All serials. Replacement of dashpot 1520-0073.

3527A TRANSPORT

3527A-3 All serials. Replacement of dashpot 1520-0073.

3701Z TRANSMITTER

3701Z-1 All serials. Field Replacement of fan.

3701Z-2 Serials below 1145U01451. Reduction of drop in B.B. level from B.B. + Sweep output under certain environmental conditions.

3702B IF/B.B. RECEIVER

3702B-1 Serials below 1136U00124. Removal of crosstalk between Y and YZ traces.

3702B-2 All serials. Elimination of noise on upper trace when B.B. calibration is on.

3702B-3 All serials. Preferred replacement for A4 CR3, CR4, CR5, CR6, and CR7.

3702B-4 Serials below 1242U00251. Improvement in Marker Display.

3702B-5 All serials. Preferred replacement for A2 C35.

3702B-6 All serials. Preferred replacement for R11.

3702B-7 All serials. Preferred replacement for I.F. Attenuator.

3702B-8 All serials. Preferred replacement of A6Q1 and A6Q2.

3702B-9 Serials below 1205U00191. Field replacement of A4 Assembly.

3702B-10 Serials below I205U00191. Field replacement of A2 Assembly.

3702B-11 Serials below I205U00191. Reduction of X-position offset when changing X-gain.

3702B-12 Serials 1205U00239, 1205U00240, 1205U00248, 1245U00256, 1245U00258, 1245U00260. 1245U00262, 1245U00263 and above. Field replacement of A6 Assembly.

3702Z DEMODULATOR DISPLAY

3702Z-1 All serials. Field replacement fan.

3702Z-2 All serials. Preferred replacement for transistors A3Q3, A4Q5 and A4Q6.

3703B GROUP DELAY DETECTOR

3703B-1A All serials. Preferred replacement for A1MC1, MC2, MC3, MC4 & MC5.

3705A DIFFERENTIAL PHASE DETECTOR

3705A-1 All serials. Preferred replacement for A1MC1, MC2, MC3, MC4 & MC5.

3716A B.B. GENERATOR

3716A-1 Serials below 1136U00136. Reduction of phase ripple on differential phase display.

3721A CORRELATOR

3721A-7 All serials. Installation of the tape punch interface options 021 and 022.

3721A-8 Serials 1103U00310 and below except 00297 thru 00305. Improved interpolation facility.

3721A-9 Serial prefix 1123U and below. Serial numbers 1112A00135 and below. Installation of 3720A Interface Modification kit (03721-7009B)

3730A UP DOWN CONVERTER

3730A-1 Serials below 122U00131. Reduction of spurious signals at I.F. Output.

3960 SERIES INSTRUMENTATION TAPE RECORDERS

3960-9B All serial prefixes. Recommended spare parts

3960-10A All serial prefixes. Operator maintenance routine.

3960-11A All serial prefixes. Preventative maintenance routine

3960-14A All serial prefixes. Procedure for replacement of Capstan Motor Tachometer Lamp Assembly

3960-15A All serial prefixes. Replacement of Capstan Motor Assemblies

3960-17 Serial prefix 1332A and above. Improved reel cover hinges.

3960-18 All serial prefixes. Optional rewiring of E-O-T switches to series

3960-19 Serial prefix 1330A and above. Improved brake adjustment procedure.

3960-20 Serial prefix 1344A and above (supersedes 3960-13A). New configuration cross reference

3960A-21 All serial prefixes. Access door adjustment procedure

3960A-22 All serial prefixes. Record/reproduce head adjustment procedure.

3960A-23 Serial prefix 1330A and below. Improved low speed flutter performance.

4204A DIGITAL OSCILLATOR

4204A-1 Serials 1240J03140 and below. Recommended replacement for Q3.

4270A CAPACITANCE BRIDGE

4270A-7 Serial prefix with J. Solution for oscillation on 1 MHz range.

5306A MULTIMETER

5306A-1 Serials below 1248A00560. Auto zero stability.

5306A-2 Serials below 1324A00160. Improvement of linearity

5340A FREQUENCY COUNTER

5340A-5 All serials. Recommended replacement for IC 1820-0753 is 1820-1179

5340A-6 All serials. Adjustment to correct intermittent display of all zeros or prolonged acquisition time with high level (0dbm) 6 to 11 GHz input signal.

5354A FREQUENCY CONVERTER

5354A-1 Serials 1332A00051 through 1332A00068 Mandatory test point for adjustment of Schmitt Trigger Assy (A15).

5360A COMPUTING COUNTER

5360A-5 Serials 1136A00900 and below. Recommended new A8 board to increase reliability.

5379A TIME INTERVAL PLUG-IN

5379A-1 Serials below 1232A00900. Improved arming stability.

5505A LASER DISPLAY

5505A-1 Serial prefix 1312A and below. Modification to eliminate unstable display.

6130A DIGITAL VOLTAGE SOURCE

6130A-4 All serials. Modification to remove noise susceptibility on programming lines.

6130B DIGITAL VOLTAGE SOURCE

6130B-6 All serials. Modification to remove noise susceptibility on programming lines.

6131B DIGITAL VOLTAGE SOURCE

6131B-5 All serials. Modification to remove noise susceptibility on programming lines.

6450 SERIES POWER SUPPLIES

6450A-1/6453A-1/6456B-1/6459A-1 Units produced before October 1973. Modification to operate from unbalanced delta source.

7004A/B X-Y RECORDERS

7004B-5 All serials. Change of overload circuit thyristor.

7004B-6 Serial prefix 928A through 1240A. Change of overload circuit zener.

7034A X-Y RECORDERS

7034A-6 All serials. Change of overload circuit thyristor.

7034A-7 Serial prefix 1332A and below. Change of overload circuit zener.

7100 SERIES STRIP CHART RECORDERS

7123A/B-7A Serial prefix prior to 1319A. Disposable Pen Kits. (Supersedes 7123A/B-4, 6, 7).

7130A/B-1,7131A/B-1 Serial prefix 1312A and below. Improve reliability of instrument grounding

7143A/B-3A Disposable Pen Kits. (Supersedes 7143A/B-1,-2,-3).

7260 SERIES OPTICAL MARK READER

7260A-1 All serials. Recommended spare parts.

7260A-2 All serials. Improved read head sensitivity.

7261A-2 All serials. Improved read head sensitivity

7402A OSCILLOGRAPHIC RECORDER

7402A-2 Serial numbers 1342A00558 through 1342A00600. Preventing a possible short in the power supply regulator PCB.

7414A, 7418A THERMAL RECORDERS

7414A-2 All serial prefixes. Installation of additional channels

7418A-2 All serial prefixes. Installation of additional channels.

7754A, 7758A THERMAL RECORDERS

7754A-2 All serial prefixes. Installation of additional channels.

7758A-2 All serial prefixes. Installation of additional channels

8000A SERIES PULSE GENERATORS

8003A-3 Serial prefix 1233A and below. Line interference in the Gates mode.

8007A/B-2 All serial prefixes. Rate jitter.

8012A-3 Serial prefix 1228A and below. Preferred replacement for A2R21-A2R22.

8407 NETWORK ANALYZER

8407A-5 Serial prefix 1144A and below. Modification for improved operation when used on 220v line voltage.

8654A SIGNAL GENERATOR

8654A-2 Serial prefix 1327A and below. Elimination of fine tuning creep.

8660A SYNTHESIZED SIGNAL GENERATOR

8660A-7A Serial prefixes 1246A and below. Modification to improve HF Section adjustment range

8660A-15 Serial prefixes 1317A and below. Improved interface connection bracket.

8660A-16 All serials. Internal crystal oscillator installation

8660A-17 Serial prefixes 1339A and below. N3 oscillator adjustment improvement.

8660B SYNTHESIZED SIGNAL GENERATOR

8660B-12 All serials. Internal crystal oscillator installation.

8660B-13 Serial prefixes 1310A and below. Improved HF section adjustment range

8660B-14 Serial prefixes 1339A and below. N3 oscillator adjustment improvement.

8660B-15 Serial prefixes 1318A and below. Improved interface connection bracket

9400B-001 MODULAR SWITCH

9400B-001-1 All serials. Fuse connection for 230 Vac operation

AMC-1000 PROGRAMMABLE WAVEFORM ANALYZER (OEM-9500 SYSTEM)

AMC-1000-1A All serials. Modification for improved reliability of the A-S2 high voltage board

WAVETEK MODEL 157-S-140 PROGRAMMABLE WAVEFORM SYNTHESIZER(OEM-9500 SYSTEM)

Wavetek 157-S-140-1 All serials. Modification to allow adjustability to the unattenuated output

9540D TRANSCEIVER TEST SYSTEM

9540B/D-1 All serials. Recommended spare parts for three levels of system repair.

9551D INSTRUMENT CALIBRATION SYSTEM

9551B/D-1 All serials. Recommended spare parts for three levels of system repair

9862A CALCULATOR X-Y PLOTTER

9862A-2 Serial prefix 1308. Options 20 and 36. Modification to prevent improper calculator operation caused by Plotter turn-off

9869A I/O EXPANDER

9869A-1 Serial prefixes 1321 through 1406. Modification to prevent intermittent Diagnostic Test Program failures.

10525T LOGIC PROBE

10525T-1 Series 1120A. Solution for "D" latching and first pulse non-detection.

11146A INTERFACE KIT

11146A-1 All serials. Improvements in program tapes.

12722A MINIVERTER SERVICE KIT

12722A-1B All serials. List of kit components for servicing the 2310C and 2312A Subsystems.

12770A COUPLER SERIAL I/O KIT

12770A-1 All serials. Modification to prevent system lock-up when used with an HP 3480B and HP 2570A coupler with Pin Board Programmer.

12772A COUPLER MODEM I/O KIT

12770A-1 All serials. Modification to prevent system lock-up when used with an HP 3480B and HP 2570A coupler with Pin Board Programmer.

28023 POWER METER SUBSYSTEM

28023B-1A All serials. Recommended spare parts for three levels of system repair.

28037A DIGITAL VOLTMETER SUBSYSTEM

28037A-1 All serials. Recommended spare parts for three levels of system repair.

28038A FREQUENCY COUNTER SUBSYSTEM

28038A-1 All serials. Recommended spare parts for three levels of system repair.

28048A SYNTHESIZER SUBSYSTEM

28048A-1 All serials. Recommended spare parts for three levels of system repair.

28084A WAVEFORM ANALYZER SUBSYSTEM

28084A-1 All serials. AMC 1010/1011 Calibration and maintenance procedures.

28084A-2 All serials. Recommended spare parts for modular and component repair.

34740A DISPLAY SYSTEM

34740A-U-1000 Serials 1250U00340. To ease calibration of Display Assembly.

86242A, 86250A/B RF PLUG-INS

86242A-1, 86250A/B-1, 86342A-1, 86350A-2, 86351A-1, 86352A-1 All serials. YIG oscillator replacement assemblies.

86342A, 86350A, 86351A, 86352A OSCILLATOR MODULES

86242A-1, 86250A/B-1, 86342-1, 86350A-2, 86351A-1, 86352A-1 All serials. YIG oscillator replacement assemblies.

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- ☐ 7123A/B-7A
- ☐ 7130A/B-1/7131A/B-1
- ☐ 7143A/B-3A
- ☐ 7260A-1
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- ☐ 28084A-1
- ☐ 28084A-2
- ☐ 34740A-U-1000
- ☐ 86242A-1, 86250A/B-1, 86342A-1, 86350A-2, 86351A-1, 86352A-1

Would you take a moment to answer a few questions?

If you repair HP products we would like your opinion. (Please leave blank if you do not repair HP products).

Hewlett-Packard attempts to provide service manuals that are the best available. One area of the service manual that generally gets a lot of emphasis is the Troubleshooting Procedure. We would appreciate your comments on the various approaches used.

1. *Do you use the Troubleshooting Procedure in HP Manuals?*
   ☐ *Always* ☐ *Usually* ☐ *Sometimes* ☐ *Seldom* ☐ *Never*
2. *Of the time you spend each month repairing all makes of electronic instruments (HP repairs plus all other repairs), what percentage is spent repairing HP products?*
   ☐ *10% or less* ☐ *10-40%* ☐ *40-70%* ☐ *70-100%*
3. *Have you ever used a Troubleshooting Tree in an HP manual?*
   ☐ *Yes* ☐ *No*
4. *Have you ever used a Troubleshooting Chart in an HP manual?*
   ☐ *Yes* ☐ *No*

(questions continued on back cover)

5. *Have you ever used a "Talking Schematic" in an HP manual?*
☐ *Yes* ☐ *No*

6. *Which of these do you prefer?*
☐ *Troubleshooting Tree* ☐ *Troubleshooting Chart* ☐ *Talking Schematic*

Any comments? _____

7. *On the average, how would you rate the quality of HP Troubleshooting Procedures?*
☐ *Extremely Good* ☐ *Very Good* ☐ *Good* ☐ *Equally Good & Bad* ☐ *Bad* ☐ *Very Bad* ☐ *Extremely Bad*

Thanks for your cooperation

HP-35/80/45 CALCULATOR REPAIRS

Owners of miniature calculators in the U.S. may be interested to know that there are now six additional HP repair offices that handle minicalculator repairs. They are:

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5500 W. Howard Street
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Mountain View, CA 94040
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Phone: (214) 231-6101

1430 E. Orangethorpe
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Should service be required, please fill out the service card provided in the back of your operating manual and send the calculator to the nearest repair center.

For minicalculator repair in countries other than the U.S., please contact your nearest HP office.

Want to test your logic???

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HEWLETT-PACKARD COMPANY
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