92-515

MICHAEL A MIHALIK

COMBINATION WIZARDS

COMBINATION EDITION

Wizards Workshop

****
* ALL SERVICE QUESTIONS FROM EUROPE, MIDDLE EAST, *
* AND AFRICA SHOULD BE ADDRESSED TO THE EUROPEAN *
* MARKETING CENTER SERVICE GROUP IN THE NETHERLANDS. *
****

TEKTRONIX INTERNAL USE ONLY

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1980

REFERENCE PULL-OUTS

GENERAL

PERSONNEL CHANGES

NEW HIRES

Please welcome the following individuals to Tektronix:

Andrew Koval - FSII, IDD
Ft. Lauderdale

Andrew "Tony" came to Tek from Tele-Acoustics, Inc., where he was their service manager.

Kathryn Ott - Denver

Kathy came to Tek upon completion of training at E.T.I. with a great amount of experience in the service environment. Her hobbies include reading, roller skating and travelling.

Jay Mendoza - FET I
Irvine Night Team

Jay comes to Tek from Cox Hobbies where he was a Product Technician on radio control systems. His previous experience includes three years with the U.S. Army as a Radio Communications Specialist.

Gary Clure - Stock Department Field Clerk
Irvine

Gary comes to Tek from high school and operates the entire stock area while also attending college. Gary's career plan is to get into the computer programming field.

Eric Morton - Jr. ET
Irvine Night Team

Eric comes to Tek from Racal Dana where he was a Calibration Technician on the DVM line. He is a college student during the day, working towards his AA and Electronic Technician certificate.

Ron Roberts - Field Clerk/Driver
Irvine

Ron is Irvine's new Field Clerk/Driver and helps in the shipping and receiving area. He also drives the shuttle to the Los Angeles Field Office and makes pick-ups and deliveries along the way. Ron's plans include school and possibly a sales or management career with Tek.

PROMOTIONS

Please join us in congratulating the following on their recent promotions in the Santa Clara Service Center IDD group:

Bill Tucker	to Field Service Specialist II
Chris Martinez	to Field Service Specialist III
Ron Phillips	to Field Service Specialist III
Lou Shultz	to Field Service Specialist III

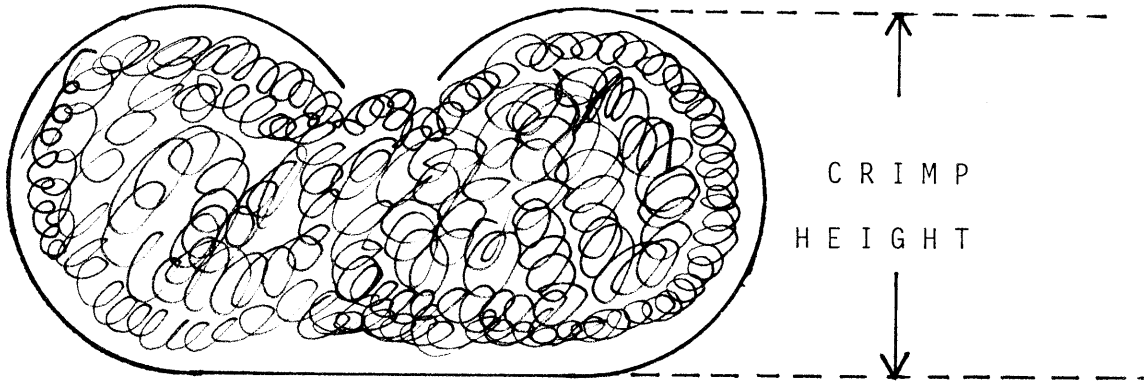
WELCOME TO OUR NEW HIRES AND CONGRATULATIONS TO THOSE RECEIVING PROMOTIONS!!!!

BERG CONNECTOR CRIMP TOOLS

Over 100 different types or sizes of Berg connectors are used in Tektronix products. Fortunately, however, only one connector is replaced with regularity and that is P/N 131-0707-00. The crimp tool Berg manufactures for this connector also crimps P/N 131-0708-00 allowing double use in one tool. The following table matches Berg tools to connectors:

TOOL	CONNECTOR BY P/N
HT-73	131-2428-00
HT-95	131-0707-00
HT-95	131-0708-00
HT-49	131-0792-00
HT-48	131-0621-00
HT-47	131-0622-00

When crimping a wire it is important to observe and insure that the crimp height is within the following tolerances: (Continued on the next page)



BERG CONNECTOR CRIMP TOOLS (CONTINUED)

CONNECTOR P/N	WIRE SIZE (AWG)	CRIMP HEIGHT (INCHES)
131-0707-00	22	.035 - .039
131-0707-00	24	.033 - .037
131-0707-00	26	.031 - .035
131-0708-00	28	.026 - .028
131-0708-00	30	.026 - .028
131-0708-00	32	.026 - .028
131-0621-00	22	.038 - .042
131-0621-00	24	.036 - .040
131-0622-00	26	.034 - .038
131-0622-00	28	.032 - .034
131-0622-00	30	.030 - .032
131-0622-00	32	.028 - .030

Present Customer Service connector demand indicates that only the HT-95 and possibly the HT-48 would be useful and appropriate at this time. You may order from your local Berg representative or from CSG in about 2 months.

--Tom Fox
58/511, Ext. 7349

STOLEN INSTRUMENTS (INTERNATIONAL)

The following instrument has been reported by EMC as missing.

Product	Serial Number	Location Missing From
466DM	700119	Norwegian PTT reported this instrument missing from Central Laboratory.

--Editor

UNIVERSAL LOAD UNIT - PRODUCTION ERROR

Since the release of the article in the October 21 edition, additional input has shed light upon a production error on the 067-0883-99 (Universal Load Unit). It is undetermined at this writing how many ULU's were shipped with this problem; however, all instruments in service should be checked. The problem is the result of a misinterpretation of a poorly documented B-Phase change order.

The error was an incorrect routing of a 26 ga. (black) ground wire. This wire, when properly routed, provides the channel 13 (passive) H. V. return. Without this ground properly in place, channel 13 is floating and, therefore, prevents the test supply that is connected to it from coming up properly.

In the B-Phase change order, the addition of 2 ground wires was called out. Both wires are 26 gauge black wires and are grounded together at the thermal switch on the main heatsink. The other end of one wire was to be connected to pins 35 and 36 on the rear panel sense connector (P3). The end of the other wire was to be connected to pins 31 and 32 of P3. Instead, both wires were inadvertently routed together from ground to pins 35 and 36, leaving pins 31 and 32 open. It is necessary to move one of the ground wires from pins 35 and 36 on P3 to pin 32 of P3 and jumper pin 32 to pin 31. It will also be necessary to add a jumper between pins 35 and 36 of P3 if there isn't one already in place.

It should be noted that it is necessary to move one the black wires, as channel 13 needs its own dedicated ground return for optimum performance.

Written by--
Craig O'Hara
SPECS Prod. Eng'g

Inserted by--
EDITOR

WIZARDS WORKSHOP MASTER INDEX

Due to many unforseen problems the six month update of the Master Index was not published. Look for a new one the second week in January 1981 which will include all 1980 articles. The publication cycle will then be on an every six month schedule. Your editor apologizes for the inconvenience this may have caused you.

Also, for anyone interested we do have a chronological set of Wizards Workshop on microfiche. This is updated every three months. The set now covers September of 1973 thru October 17, 1980. If you would like this fiche and all future updates just call me on Ext. 8939 Merlo Road or drop me a note at Delivery Station 56-037. It's free!.

--Sharon Huetson
Editor

ADMINISTRATIVE SUPPORT

MAINTENANCE AGREEMENT ADMINISTRATION

An increasing number of maintenance agreements are being written using IDD Schedule B prices with an effective period of one year.

Schedule B prices are to be used for new products with CRT warranty in effect. The maximum term for such an agreement is nine (9) months, coinciding with the period from expiration of product warranty (90 days) to expiration of CRT Warranty (1 year).

--Bill Duerden
56-037, Ext. 8938
Ext. 8938 MR

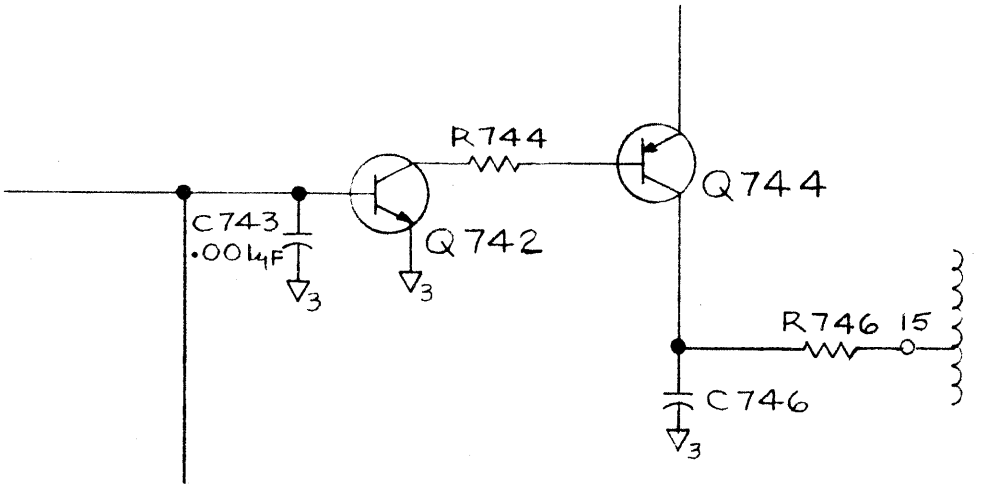
408, 414 POWER SUPPLY CHANGE

408 Manual P/N 070-1525-00
414 Manual P/N 070-2042-01

At the below listed serial numbers, the power supply circuitry was changed as shown in the picture below. In this case, the problem was fixed before the new circuit board was ever shipped.

Effective Serial Number 408 B203715
Effective Serial Number 414 B097215

Add: C743 P/N 281-0812-00 0.001µF, 10%, 100v
R746 Moved location as shown below.



POWER SUPPLY

--Dave McKinney
58/511, Ext. 7072

LEVELING OF HEWLETT PACKARD HP 8620C SYSTEM

Leveling of the HP 8620C system with the HP435A will not always work properly. Hewlett Packard has suggested that we use the crystal detector method of leveling the 8620C (see Application Note 150-13 which is attached). The crystal detector that will be needed is the HP 8470B, Opt. 12. I suggest that you order a HP8470B, Opt. 12 to enable your technicians to level their systems.

--Rich Kuhns
58-511, Ext. 6782

REMAINDER OF THIS ARTICLE IS ON THE FOLLOWING PAGES.

STIMULUS-RESPONSE MEASUREMENTS . . . Using the HP 8565A Spectrum Analyzer from 2-18 GHz

INTRODUCTION

A stimulus/response measurement technique for the 2 to 18 GHz frequency range is described in this note. This application will be of specific interest to those who have an HP 8565A Spectrum Analyzer and an HP 8620C/86290B Sweep Oscillator, and have a need to make scalar network measurements. The implementation described here includes the analyzer and sweeper mentioned along with an HP 8709A-H10 Synchronizer.

Microwave devices such as attenuators, filters, amplifiers, directional couplers, and power splitters are characterized through measurements of insertion loss, gain, frequency response, and return loss. To make these measurements with a spectrum analyzer, a swept signal source is desirable. A wide dynamic range can be achieved by forcing this swept signal to track or follow the frequency of the spectrum analyzer input tuning. If this requirement is met, the spectrum analyzer will not detect source harmonics or spurious products generated in its first mixer as it is always tuned to the fundamental. At RF frequencies up to 1300 MHz a suitable tracking signal can be obtained with an HP 8444A Tracking Generator. Further details on the operation and use of tracking generators can be found in HP Application Note 150-3, "Spectrum Analysis . . . Swept Frequency Measurements and Selective Frequency Counting with a Tracking Generator."

A tracking signal at microwave frequencies can be obtained in conjunction with the HP 8565A Spectrum Analyzer by externally phase-locking a sweep generator to the spectrum analyzer tuning. This is accomplished using an HP 8709A-H10 Synchronizer functioning as the phase comparator in a phase-lock loop. The frequency range depends upon the choice of sweep generators; here we have used an HP 8620C/86290B Sweep Oscillator which operates from 2 to 18 GHz.

PERFORMANCE

The characteristics of an actual system are summarized as follows and should be regarded as typical:

Frequency Range	Dynamic Range
2 - 4 GHz	76 dB
3.8 - 8.5 GHz	76 dB
5.8 - 12.9 GHz	66 dB
8.5 - 18 GHz	60 dB

Table 1. Typical Performance

The indicated frequency ranges correspond to available bands on the HP 8565A with the exception of the first (2 - 4 GHz). Any center frequency and frequency span may be selected on the analyzer so long as that range is available from the sweeper.

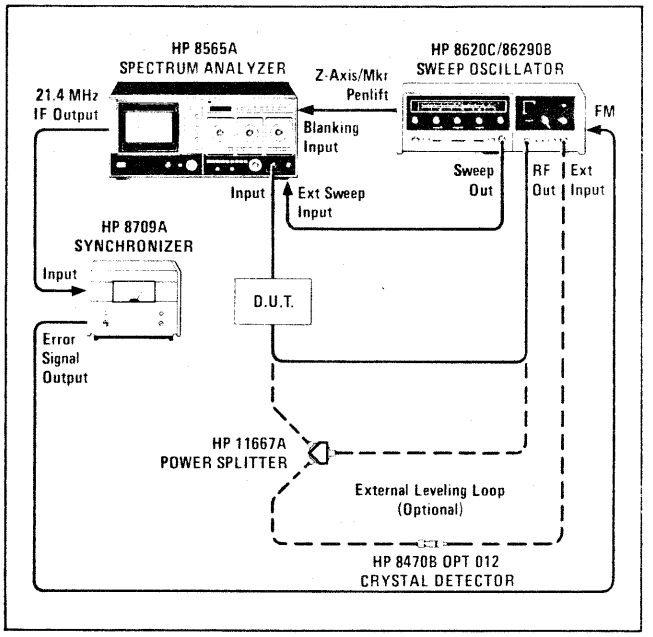


Figure 1. Test Set-Up

OPERATION

The required interconnections for the signal tracking system are shown in the figure above.

Basically, a phase-lock loop is set up so that the output of the sweeper, which is down-converted within the analyzer to an IF frequency, is compared to a fixed oscillator in the HP 8709A-H10 Synchronizer. This reference frequency is 21.4 MHz—chosen to be the same as the analyzer's final IF. The phase comparison yields an error voltage which frequency modulates the sweeper, keeping its output tuned to the center of the analyzer's passband.

Certain operating characteristics of this phase-lock loop are worth noting. The limiting loop bandwidth is the analyzer's 3 MHz IF bandwidth; using narrower bandwidths (<3 MHz) tends to decrease the loop stability to the point that oscillations can occur. For this reason, bandwidths less than 3 MHz are generally not usable.

If the DUT exhibits large out-of-band rejection, only a very low-level signal will reach the analyzer and, in turn, the synchronizer may receive insufficient signal to function. The HP 8709A-H10 in the test set-up required a minimum input level of −76 dBm (−65 dBm specified). This corresponds to a CRT display range of 6.6 divisions, measured down from the top. So long as the analyzer's noise is below this threshold level, the dynamic range lower limit is determined by the minimum IF signal required to drive the synchronizer; this is the case for the first two frequency bands listed in Table 1. For the other two ranges, the analyzer's internal noise sets the overall system sensitivity and thus determines the available dynamic range.

INITIAL SET-UP

Connect equipment as shown in Figure 1, replacing the device under test (DUT) with a "through" cable for calibration. As an illustration, the system will be set up for an analyzer full band, 5.8 to 12.9 GHz. Alternatively, any combination of center frequency and span may be used.

8565A:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz .....5.8 - 12.9
INPUT ATTEN .....10 dB
REF LEVEL .....+10 dBm
REF LEVEL FINE 0
FREQUENCY SPAN MODE .....FULL BAND
SWEEP SOURCE .....EXT
PRESELECTOR PEAK .....Centered in Green

8620C/86290B:

(Front Panel)

BAND .....Band 4 (2 - 18.6 GHz)
MARKER SWEEP pushbutton .....Depress
START MARKER pointer .....5.8 GHz
STOP MARKER pointer .....12.9 GHz
SWEEP TIME-SECONDS .....1 - .01
SWEEP TIME-SECONDS vernier .....
Fully Counterclockwise
RF OFF-ON .....ON
ALC SWITCH .....INT
POWER LEVEL .....Midrange

(Rear Panel)

RF BLANKING/OFF .....RF BLANKING
DISPLAY BLANKING/OFF..DISPLAY BLANKING
FM-NORM-PL .....PL

8709A:

MOD. SENS .....6 MHz/Volt
ERROR SIGNAL .....+
(use "+" for bands 1.7 - 4.1, 3.8 - 8.5 GHz, and "—" for 8.5 - 18 GHz)

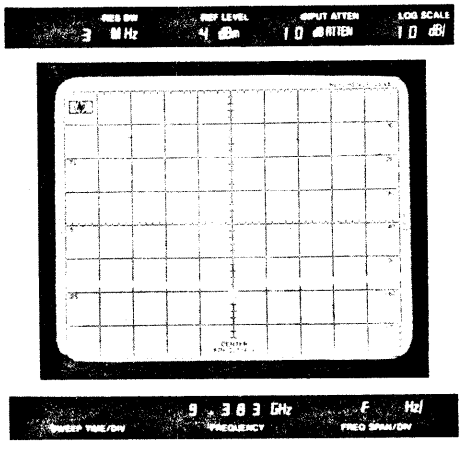
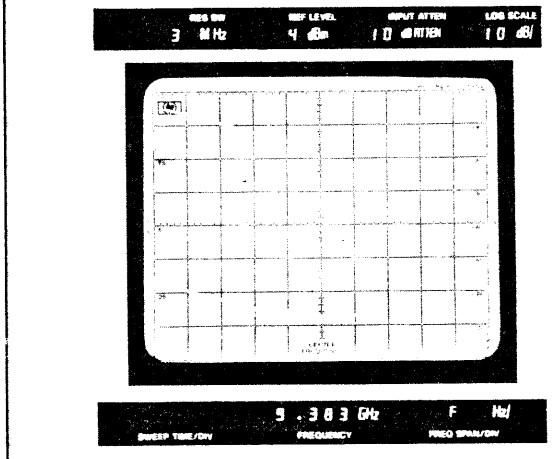


Figure 2. Sweeping Without Phase-Lock

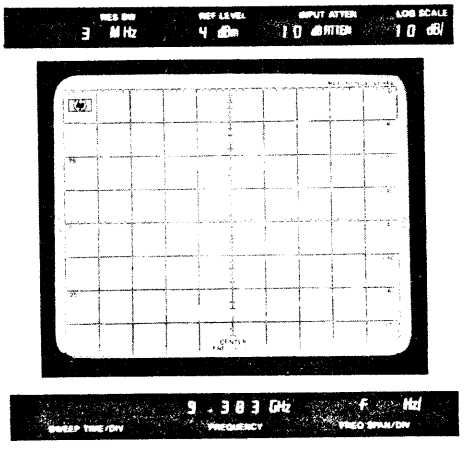
TRACKING PROCEDURE

Starting with the system out-of-lock (Figure 2), phase-lock sweep oscillator as follows:

1. Set sweep oscillator to manual sweep mode with manual sweep control fully counterclockwise.
2. Set sweep oscillator start marker to low frequency of selected spectrum analyzer FREQUENCY BAND and adjust start marker for synchronizer phase-lock (minimum phase-error). (Figure 3a.)
3. Set sweep oscillator manual sweep control fully clockwise.
4. Set stop marker to high frequency of selected spectrum analyzer FREQUENCY BAND. Adjust stop marker for synchronizer phase-lock (minimum phase-error). (Figure 3b.)
5. Set sweep oscillator to automatic sweep mode and check for phase-locked spectrum analyzer CRT display. If the system is breaking phase-lock, repeat steps 1 through 3. Phase-lock drop-outs will be minimized by using slower sweep speeds.



A. Start Frequency (Manual Sweep CCW)



B. Stop Frequency (Manual Sweep CW)

Figure 3. Adjusting for Phase-Lock At Start and Stop Frequencies

MEASUREMENT PROCEDURE

The sweeper is now generating a signal that tracks the tuning of the analyzer. For passive device testing, adjust POWER LEVEL on the sweeper to obtain the maximum leveled RF output (i.e., insure that the UNLEVELED indicator remains off during the entire sweep.) Adjust RF OUTPUT-PEAK and ALC SLOPE on the sweeper together with PRESELECTOR PEAK on the analyzer to achieve as flat a trace as possible on the CRT screen. Set REF LEVEL on the HP 8565A to position the trace at the top of the screen (Figure 4). This serves as the calibration

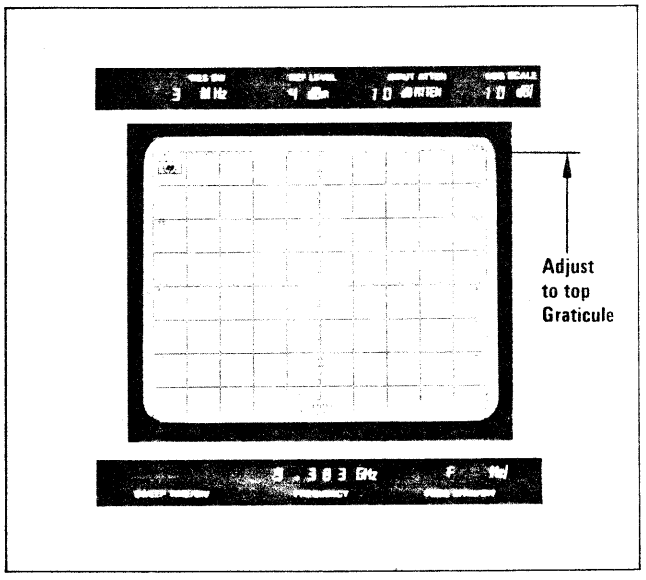


Figure 4. Phase-Locked Sweep

reference level. Replace the "through" cable with the test device to measure its swept response relative to the calibration level (Figure 5).

The display range for this analyzer band is 5.6 divisions, measured down from the top graticule line (i.e., from +10 dBm to −46 dBm). To obtain the full dynamic range listed in Table 1, shift the trace 10 dB off the top of the screen

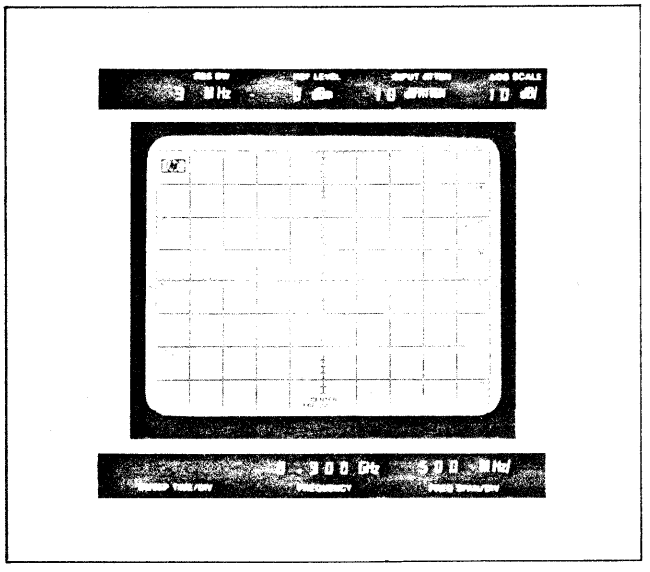


Figure 5. Frequency Response of 6 to 8 GHz Bandpass Filter

(reduce INPUT ATT to 0 dB). 5.6 divisions are again available but now the range is from 0 dBm to −56 dBm. In Figure 6, the full dynamic range of 66 dB is displayed in a composite photograph. Switching the attenuator is necessary because during "through" calibration, the reference line cannot be positioned above the 1 dB gain compression input level of 0 dBm with 0 dB attenuation. Adding 10 dB input padding raises the effective input gain compression level to +10 dBm, thereby permitting a calibration level which utilizes the maximum power available from the HP 8620C/86290B Sweeper. Thus, the usable dynamic range is as shown in Table 1 provided the operator switches the input attenuator from 10 dB to 0 dB to alter the limits of the displayed range.

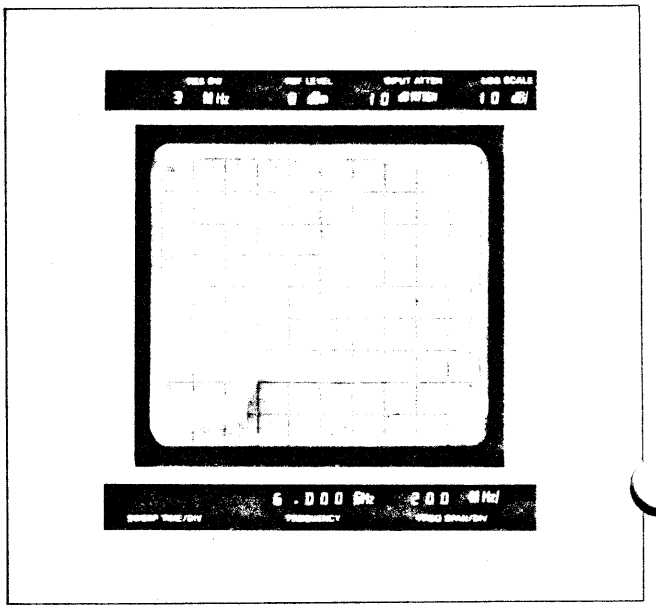


Figure 6. Composite Photo of Filter Response Showing 66 dB Dynamic Range

For test devices with gain, set the calibration level low enough on the display such that the trace remains on screen when the gain is inserted. In a log mode (such as 10 dB/div), be certain the reference line is not set below the seventh graticule so that trace calibration is retained.

To measure return loss, a directional coupler, a short and a 50 ohm termination are required, connected as shown below.

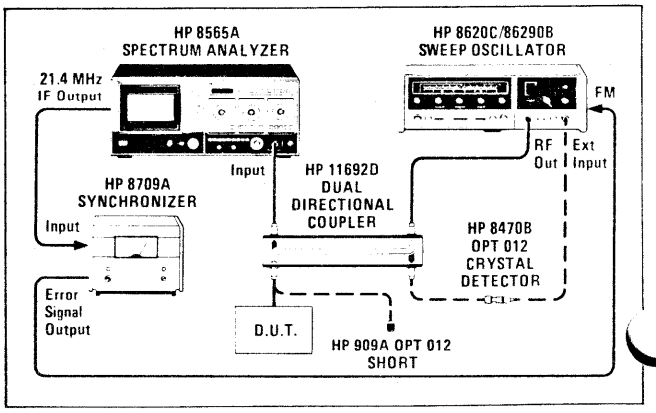


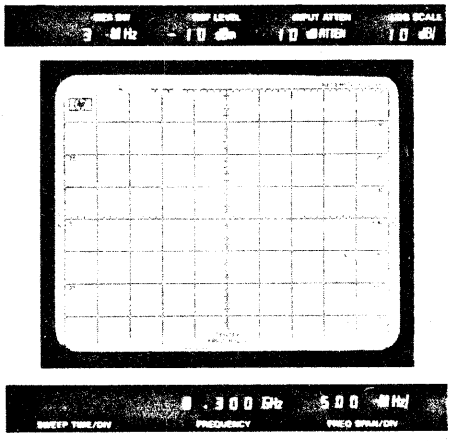
Figure 7. Return Loss Measurement Test Set-Up

First, calibrate the system with the short (total reflection, or 0 dB return loss) in place of the DUT. Then replace the short with the DUT—properly terminated in 50 ohms—and measure return loss relative to the calibration level (Figure 8).

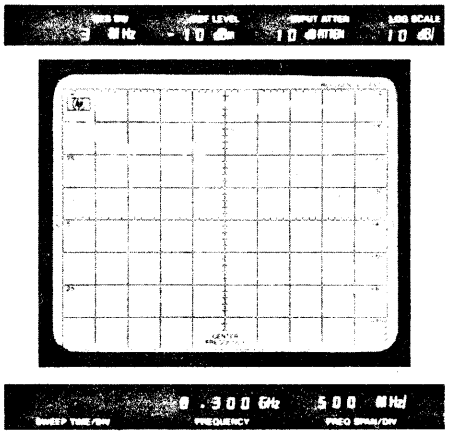
Whichever type of stimulus/response measurement is undertaken, special care should be used when testing narrowband devices, as they may serve to limit the response time of the system and thus require the use of long sweep times. The fastest usable sweep speed should be determined by first increasing the rate of sweep until the display clearly changes (i.e., distorts), and then reducing the rate until the trace ceases to change.

IMPROVED FLATNESS

There are two ways to improve the frequency response (flatness) of this tracking system. The set-up may be configured with an external leveling loop as shown in Figure 1 with the addition of a power splitter (or coupler) and a detector. This technique reduces the effects of mismatch errors between the DUT and the loop components. An effective method to improve the spectrum analyzer's flatness uncertainty is to normalize it out of the measurement by incorporating the HP 8750A Storage Normalizer. The return loss measurement shown in Figure 8 is repeated in Figure 9 using the HP 8750A. Note the flatness achieved by normalizing during calibration.

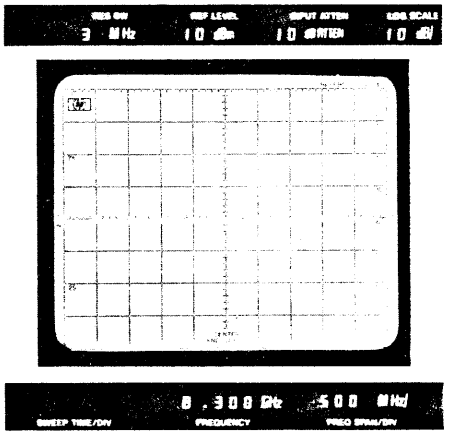


A. Calibration

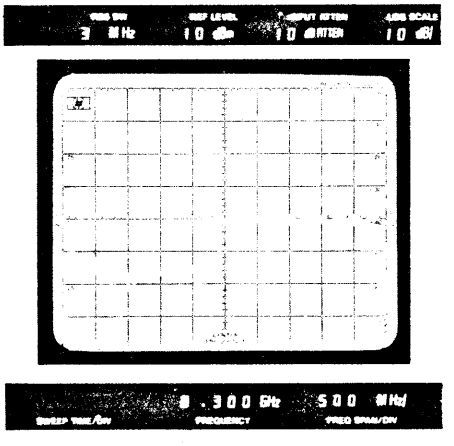


B. Measurement

Figure 8. Return Loss of 6 to 8 GHz Bandpass Filter



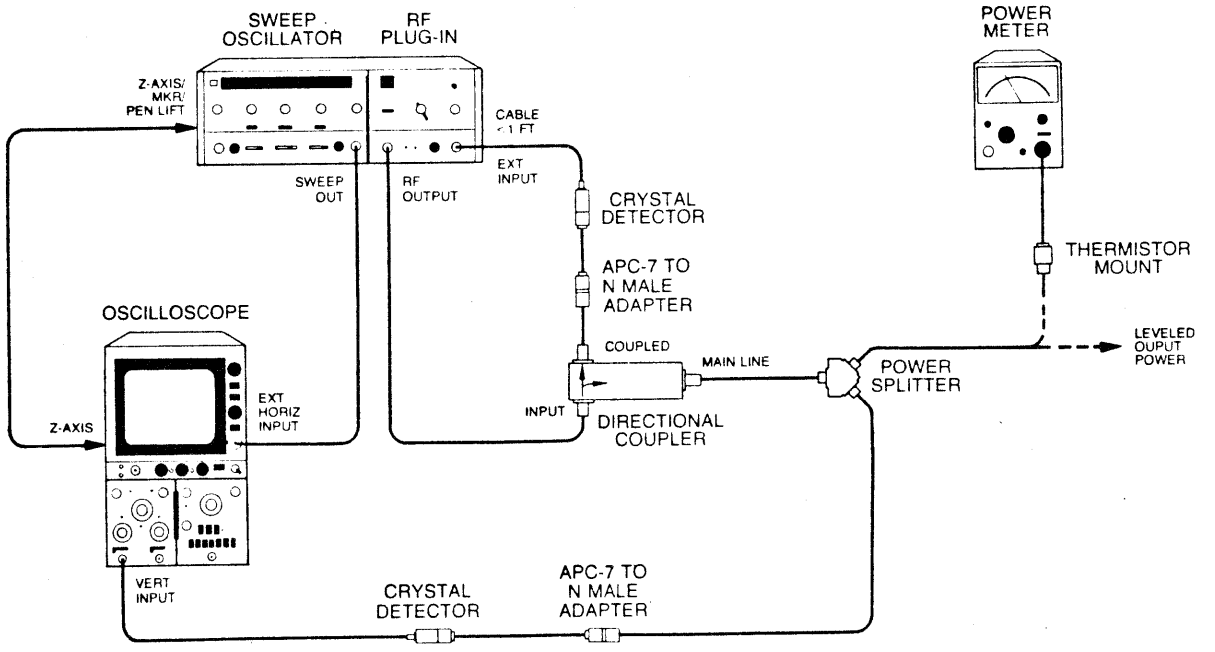
A. Calibration and Normalization



B. Measurement

Figure 9. Return Loss of 6 to 8 GHz Bandpass Filter Using HP 8750A Storage Normalizer

EXTERNAL CRYSTAL DETECTOR LEVELING



NOTE

Cables in the ALC loop must be kept <1 foot in length for best ALC response.

EQUIPMENT:

Sweep Oscillator	HP 8620C
RF Plug-in	HP 86290A
Oscilloscope	HP 182C/1801A/1820C
Power Meter	HP 432A
Crystal Detector (2 required)	HP 8470A
Power Splitter	HP 11667A
Directional Coupler	HP 11691D, Option CO-1
Thermistor Mount	HP 8478B
APC-7 to N Male Adapter (2 required)	HP 11525A

PROCEDURE:

1. Connect equipment as shown in test setup.

NOTE

Crystal Detector output must be between 25 mVdc and 350 mVdc.

Figure 3-11. External Crystal Detector Leveling (1 of 2)

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This operating section explains the function of the controls and indicators of the Model 86290A RF Plug-in. It describes typical operating modes in a measurement system and covers operator maintenance for replacing the indicator lamps. Figure 3-13 shows the positions of the ALC Function switch A1S1 that the operator will set for each application.

3-3. PANEL FEATURES

3-4. Front and rear panel features are described in Figures 3-2 and 3-3. Description numbers match the numbers on the illustration.

3-5. OPERATOR'S CHECKS

3-6. The Operator's Checks (Figure 3-4) allow the operator to make quick evaluation of the instrument's main functions prior to use. These checks assume that the 86290A RF Plug-in is installed in an 8620C Sweep Oscillator mainframe. The checks cover the RF Plug-in and mainframe; therefore, if the correct indications are not obtained, trouble may be in either of the units. If the RF Plug-in is suspected, perform applicable performance tests in Section IV of this manual, and if necessary, the related adjustments in Seciton V. If correct indications are still not obtained, refer to the troubleshooting chart in Section VIII to isolate the problem.

3-7. OPERATING INSTRUCTIONS

WARNING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal could make this instrument dangerous.

3-8. Internal Leveling

3-9. The most convenient method of RF output leveling is internal leveling. A portion of the RF output is coupled from a Directional Coupler DC1 to a Detector CR1. A proportional dc-voltage is applied to an operational amplifier in the 86290A ALC Amplifier Assembly A1. The Operator's Checks in Figure 3-4 are performed in the internal leveling mode.

3-10. External Power Meter Leveling

3-11. Power leveling can be obtained with a power meter and power splitting tee or directional coupler as shown in Figure 3-10. A sample of the RF output signal is routed to a power meter to produce a dc voltage proportional to the RF signal level. The dc voltage is applied to the 86290A ALC circuits and compared with an internal reference voltage. A difference voltage is produced and amplified by the ALC amplifier before being applied, as modulator drive, to the Coupler/Modulator assembly A10. The modulator drive controls the output of the Coupler/Modulator to maintain a constant power level.

3-12. External Crystal Detector Leveling

3-13. Power may be leveled externally using a power splitting tee (or directional coupler) and crystal detector. This leveling system uses a power splitting tee to sample the RF output signal and a crystal detector to produce a dc voltage proportional to RF signal level. The detector voltage is compared with an internal reference voltyage, and the difference voltage changes the output power level to keep it constant at the output. Instead of a power splitting tee, a directional coupler may be used to sample the RF signal for the leveling loop. Directional couplers are usually narrow band, whereas the power splitting tee is flat over a wide frequency range. The advantage of a directional coupler is that it does not have a 6-dB loss like the power splitting tee, therefore a higher maximum leveled power output may be obtained. To place the crystal detector leveling loop in operation, use the test setup and procedures in Figure 3-11.

EXTERNAL CRYSTAL DETECTOR LEVELING

2. Set controls as follows:

8620C:

BAND	BAND 4, 2.0 — 18.0 GHz
MARKER	OFF
MODE	AUTO
TRIGGER	INT
TIME/SECONDS Vernier	Fully clockwise
1 kHz SQ WAVE/OFF (rear panel)	OFF
DISPLAY BLANKING/OFF (rear panel)	.DISPLAY BLANKING

86290A:

RF OUTPUT	ON
POWER LEVEL	Fully clockwise
ALC	EXT
ALC GAIN	Fully clockwise
FM-NORM-PL (rear panel)	NORM (Normal)

3. Press 8620C LINE pushbutton to ON; LINE, and FULL SWEEP pushbuttons should light, indicating FULL SWEEP mode is selected. The 2. — 18.0 GHz lamp should light on 86290A.

4. Adjust ALC GAIN and POWER LEVEL controls fully clockwise for maximum RF power OUTPUT and maximum ALC Loop gain. Adjust PEAK control for maximum RF power. One of the conditions shown in Figures 3-5 through 3-9 should be displayed on oscilloscope. If trace is unleveled as shown in Figures 3-5 or 3-7 (or partially leveled) and UNLEVELED lamp is on, turn POWER LEVEL control counterclockwise until trace is level. (See Figures 3-6 and 3-8). If ALC loop gain is too high, oscillations may occur as shown in Figure 3-9. To remove oscillations, reduce ALC loop gain by turning ALC GAIN control counterclockwise.

5. To use leveled RF power output for testing external equipment, make connection at point marked "Leveled Power Output."

Figure 3-11. External Crystal Detector Leveling (2 of 2)

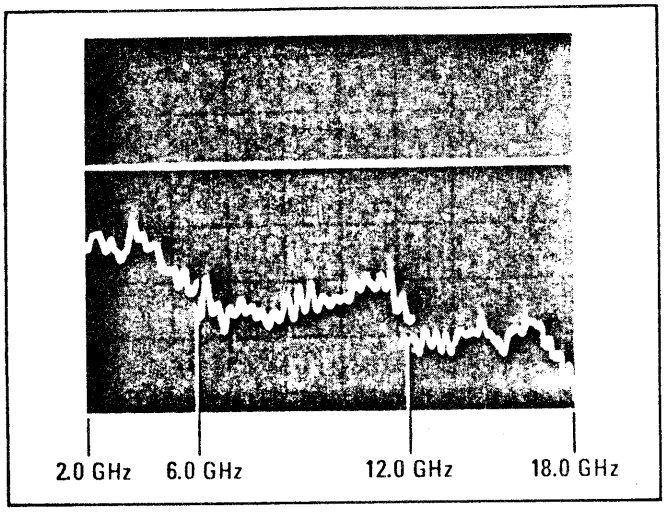


Figure 3-5. Unleveled Rf Power Output for Sequential Sweep

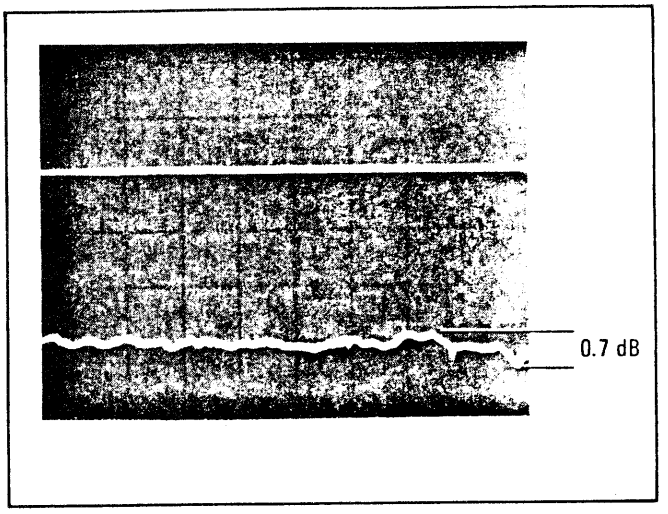


Figure 3-6. Leveled RF Power Output for Sequential Sweep

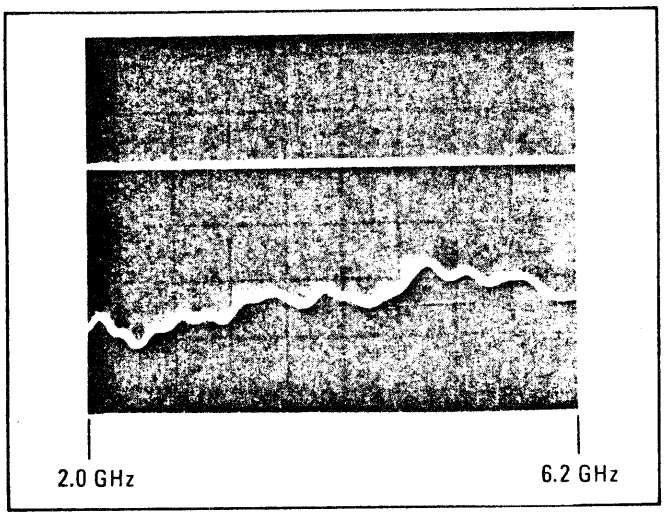


Figure 3-7. Unleveled RF Power Output for Single Band

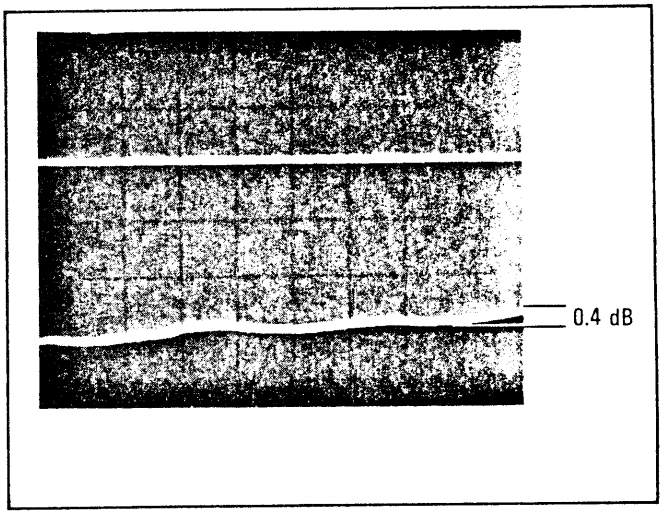


Figure 3-8. Leveled RF Power Output for Single Band

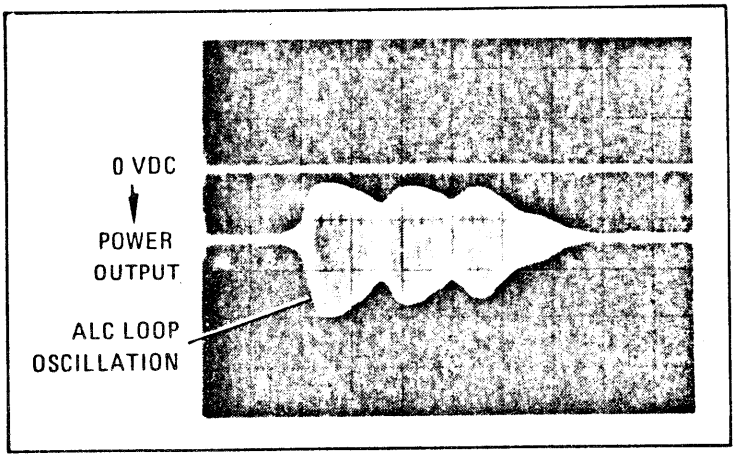


Figure 3-9. Oscillations with ALC Loop Gain Too High

492/492P SERVICE POINTS

There still seems to be some confusion as to where to send a 492/492P for repairs. Some Service Centers are automatically shipping instruments to Factory Service. *DO NOT SHIP INSTRUMENTS TO FACTORY SERVICE FOR REPAIRS UNLESS IT IS YOUR LOCAL 492/492P SERVICE CENTER.* Please send units to the Service Center designated for your area. The following is a list of 492/492P Service Centers:

BOSTON	ROCKVILLE
CHICAGO	SANTA CLARA

FACTORY SERVICE

If you have any questions, please contact me.

--Rich Andrusco
58/511, Ext. 5609

1502/1503 FUSED BATTERY PACKS

The battery pack for the 1502 and 1503 was modified to include a 3 amp fuse, P/N 159-0124-00, and a fuse protection plate, P/N 337-2762-00. During calibration or repair of the 1502/1503, the battery pack is inserted into the instrument without the cover on the instrument. The fuse protection plate on the battery pack may possibly cut the cable harness in the 1502/1503. To prevent cutting the cable harness, I suggest extending the battery pack during repair and calibration. You can do this with the following parts:

BNC male to dual binding post adapter	P/N 103-0035-00
BNC female to BNC female adapter	P/N 103-0028-00
50Ω coaxial cable, 42 in.	P/N 012-0057-01
BNC female to dual banana adapter	P/N 103-0090-00

--Rich Kuhns
58-511, Ext. 6782

520 SERIES DIFF GAIN TRACE NOISE

Reference: 520A Instruction Manual, P/N 070-1709-00

When used in the DIFF GAIN mode, a situation can occur that appears as "noise" on the CRT trace. The reason for this noise is that transistor, Q836, is driven hard into saturation during the vertical interval. During the vertical interval, the clamp Amp samples during each horizontal sync pulse. When Q836 is slow coming out of saturation, the clamp level changes and appears as "noise" on the signal.

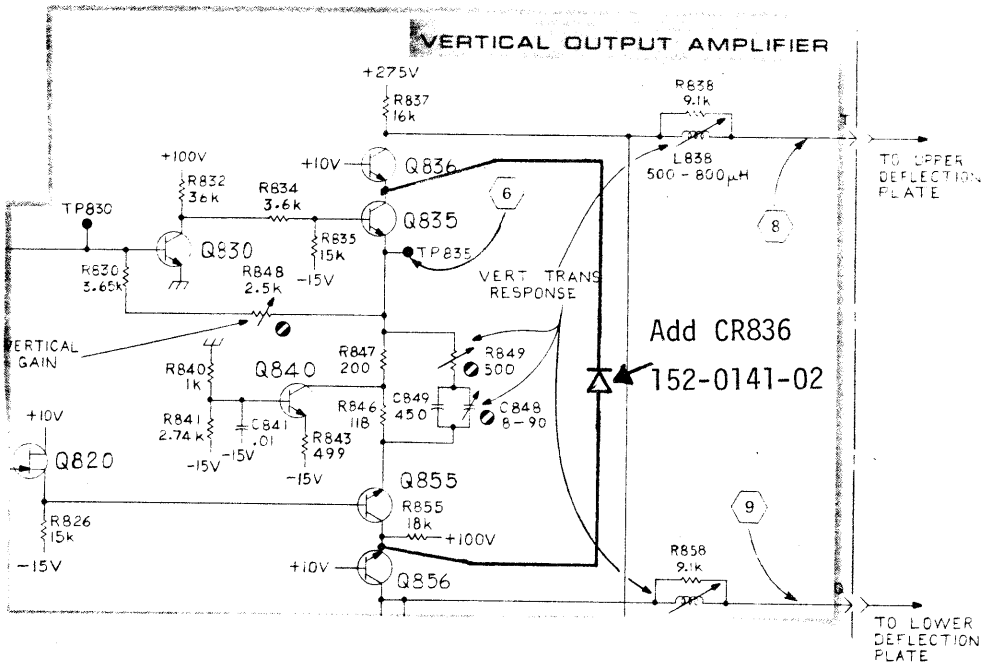
To improve circuit operation, a diode (P/N 152-0141-02) is added to the back of the board between the emitter of Q836 and the emitter of Q856, the cathode end going to Q836. This switches the extra current through R855 and Q856 to Q835, thereby relieving Q836 of the extra charge dissipation. The addition of the diode also protects Q856 from being reverse biased into zener break down. Another diode (P/N 152-0141-02) is also added to Q956 (cathode to Q956 emitter) and Q976 (anode to Q976 emitter) on the back of the circuit board, again for reverse break down protection.

Refer to the following diagrams for the additions required.

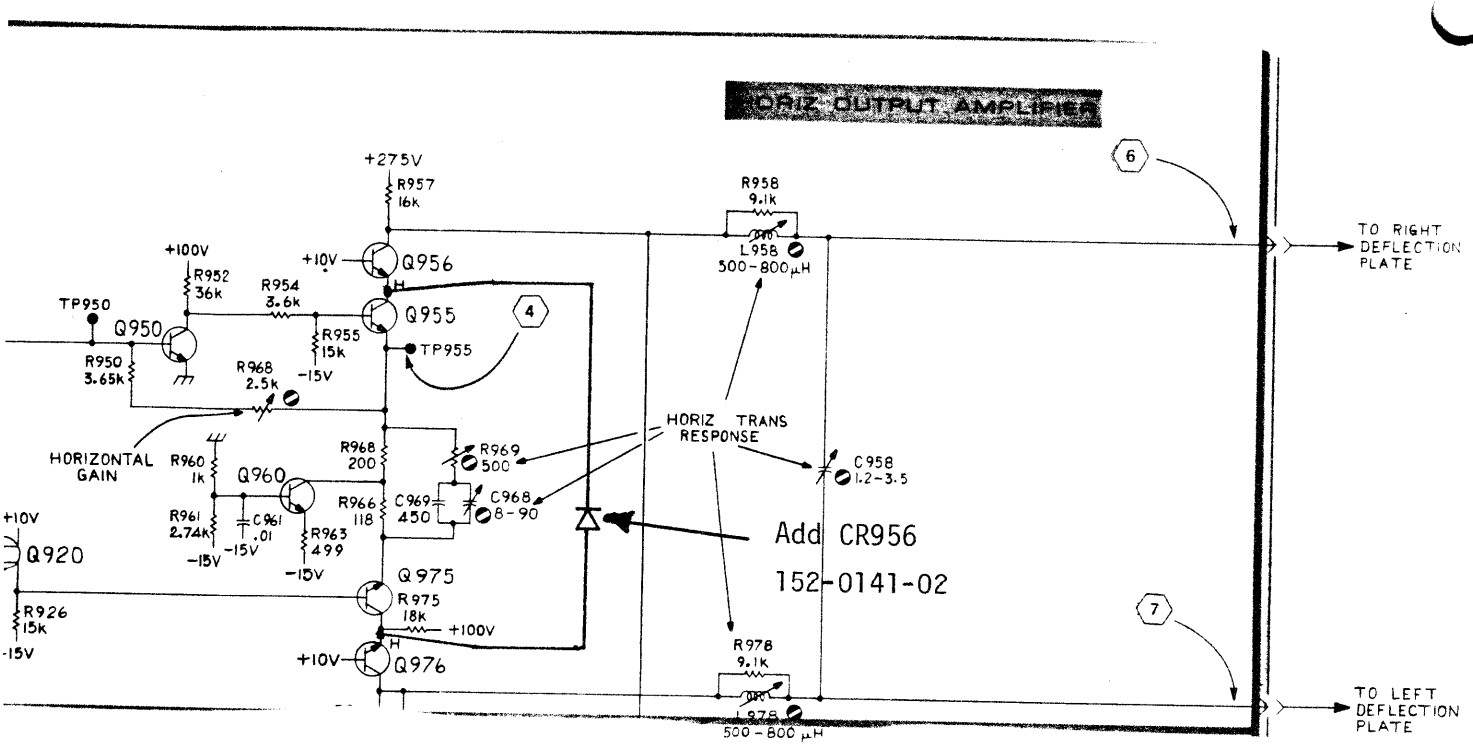
CONCLUSION OF ARTICLE IS ON THE FOLLOWING PAGE.

--Bill Bean
58/511
Ext. 6507

Parts of 670-0537-00 (B333000-B399999)/
670-0537-04 (B400000 & Up)



VERTICAL AMPLIFIER 7



HORIZONTAL AMPLIFIER 8

528 VERTICAL, NOISE ON TRACE

Reference: Mod #41688, Instruction Manual P/N 070-0800-00
Diagram ◇1◇

Zener diodes D172 and D152 have been contributing excessive noise to the vertical sweep due to operation in a low current mode. To reduce the noise, the current is increased through these diodes by resistor value changes. R154 and R174 are to be changed from 300K ohm resistors to 174K ohm, (P/N 323-0408-00), ½ watt resistors.

MAIN BOARD

670-0588-06

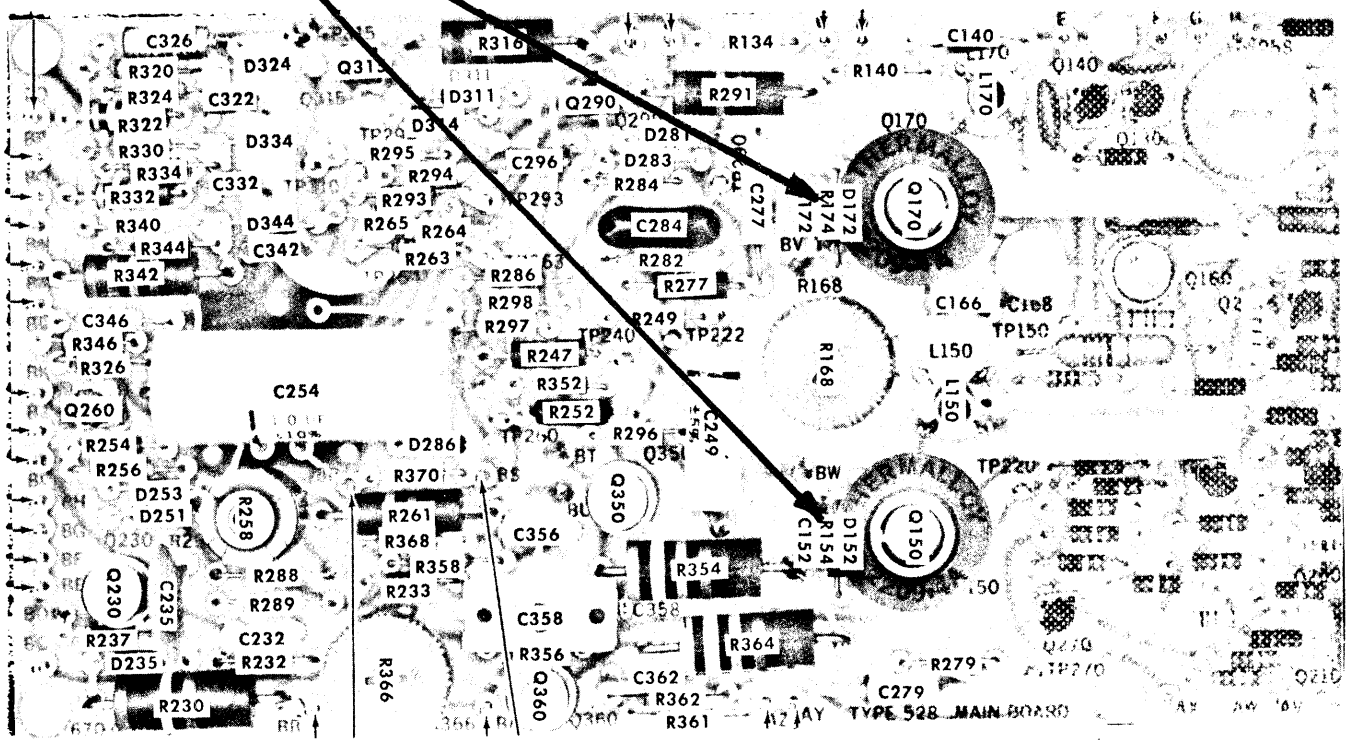
(528)

(partial view)

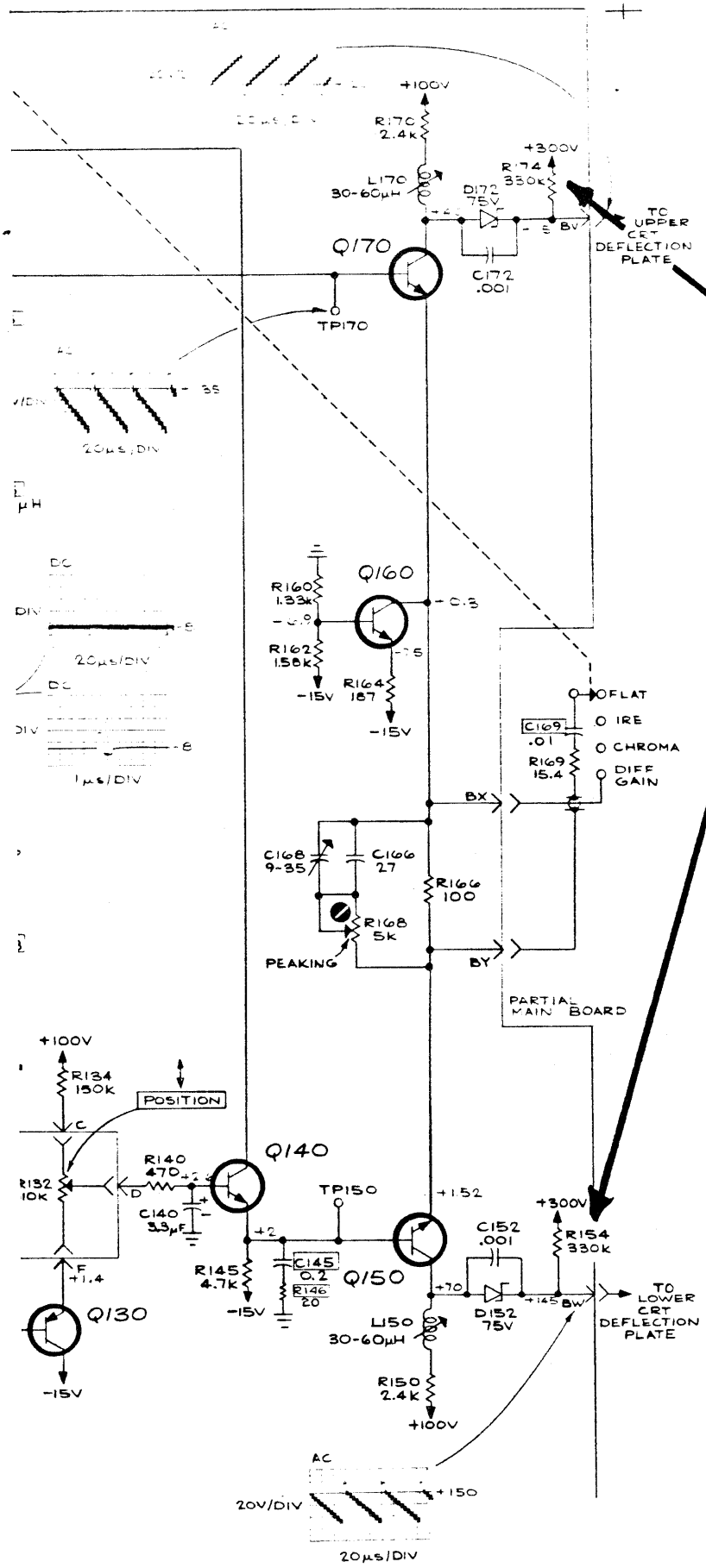
REMOVE 315-0334-00

ADD 323-0408-00

R154, R174



(continued)



670-0588-06
(528)
(partial view)

R154, R174

REMOVE 315-0334-00
ADD 323-0408-00

--Bill Bean
58/511, Ext. 6507

1071

INPUT & VERTICAL AMPLIFIER ①

November 21, 1980
Issue 10-23

650A/650HR SERIES, PARTS KITS AVAILABLE TO PREVENT SPOT BURNING OF CRT

Reference: 650 Manual P/N 070-2234-00
650HR Manual P/N 070-2246-00
Modification 37966
WIZARD'S WORKSHOP Issue 10-11, Pg. 19

The article in Issue 10-11 titled "Modification to Prevent Spot Burning of the CRT Phosphor" outlined a procedure to install components to eliminate spot burning of the CRT at turn-off. A kit (P/N 050-0741-01) is available which contains a blanking circuit board with the piggy-back board already installed. When available the new corrected blanking board will be put in this 050 kit. While more expensive than adding individual components, the availability of this kit reduces labor required to implement the modification. Service Centers should use their own discretion when deciding which method to use.

--Steve Schmelzer
58/511, Ext. 6507

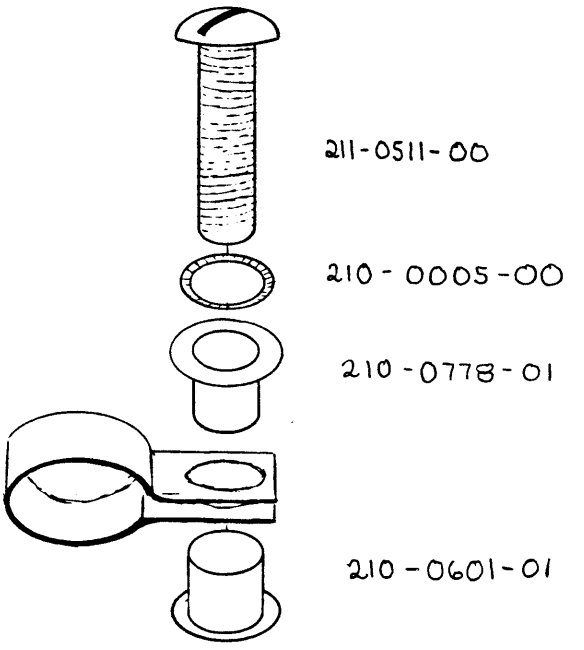
1450 CABLE CLAMP LOOSENESS PROBLEM

Cable clamps and associated hardware in the 1450 have been showing signs of loosening up after exposure to heat over a long period of time. This is generally caused by the tendency of the plastic, in the cable clamp, to move away from areas of mechanical pressure. Heat makes the plastic a little softer and exaggerates the problem.

If you are experiencing this problem, the solution is as follows:

Remove--211-0507-00 Screw
210-0863-00 Washer

Replace With--
211-0511-00 Screw
210-0005-00 Lock Washer
210-0778-01 Eyelet
210-0601-01 Eyelet



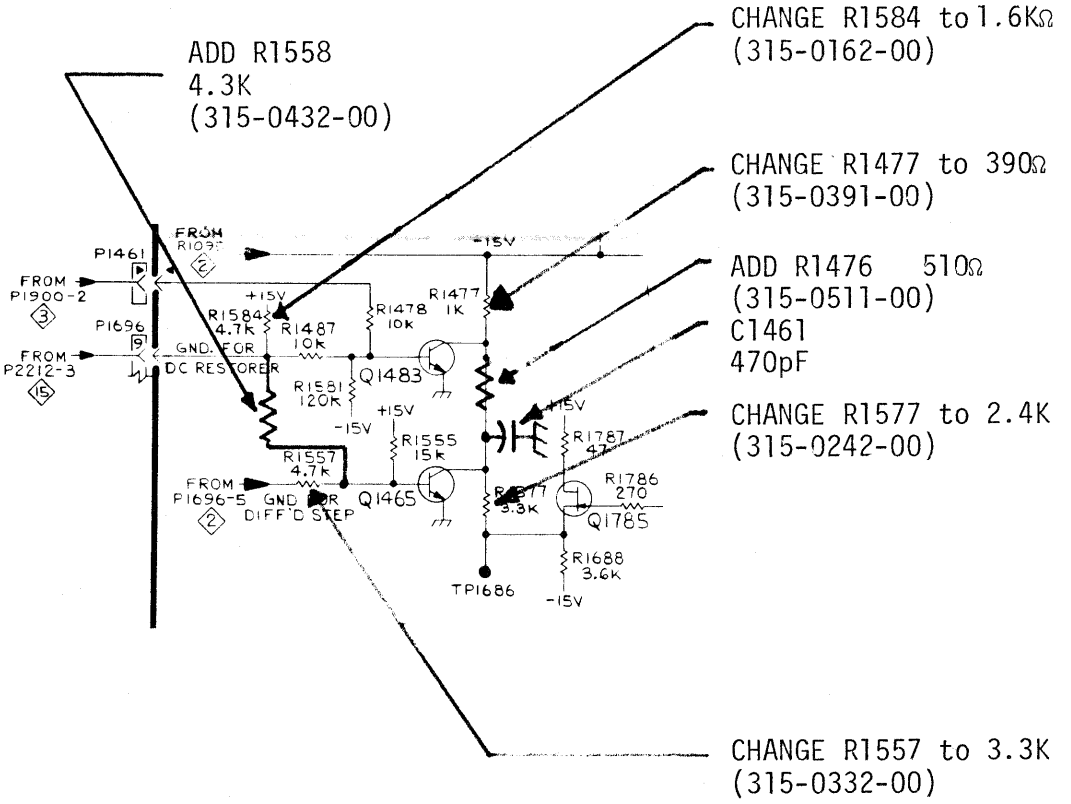
These parts are all current part numbers and should be readily available.

--Bill Bean
58/511, Ext. 6507

1480 SERIES, D.C. RESTORER, *WIZARD CORRECTION*

This material is provided to correct an article published in WIZARD'S WORKSHOP, Issue 10-8, April 18, 1980.

The text in the article concerning a modification to improve incomplete D.C. restorer turn-off was correct. The partial schematic that was provided is in error. The proper schematic is illustrated below. The nomeclature is also correct as it is illustrated below:



DC RESTORATION & GAIN CONTROL

SCHEMATIC ◇3◇

--Bill Bean
58/511, Ext. 6507

1980 POWER-UP DIAGNOSTICS

Reference: Video Data Converter A-24, P/N 670-5695-00
Video Data Converter Board, S/N B010010100 - B010010180 (S/N on the Board)

The 1980 will show a power-up diagnostic error in the "VID:" section of the diagnostics if a signal is connected to EXTB SYNC. This is due to an error in the circuit board. All video data converters will have the following modification installed before leaving the factory. Units with S/NB010010180 and below should be modified as they are returned for repair service, or they can be modified on-site on an "as needed" basis.

To determine whether or not power-up errors are a result solely of this problem, disconnecting any input signal from both EXT B SYNC input connectors should clear the error condition.

An example of power-up errors with a signal applied to EXT B SYNC is as follows:

1980 SELF TEST

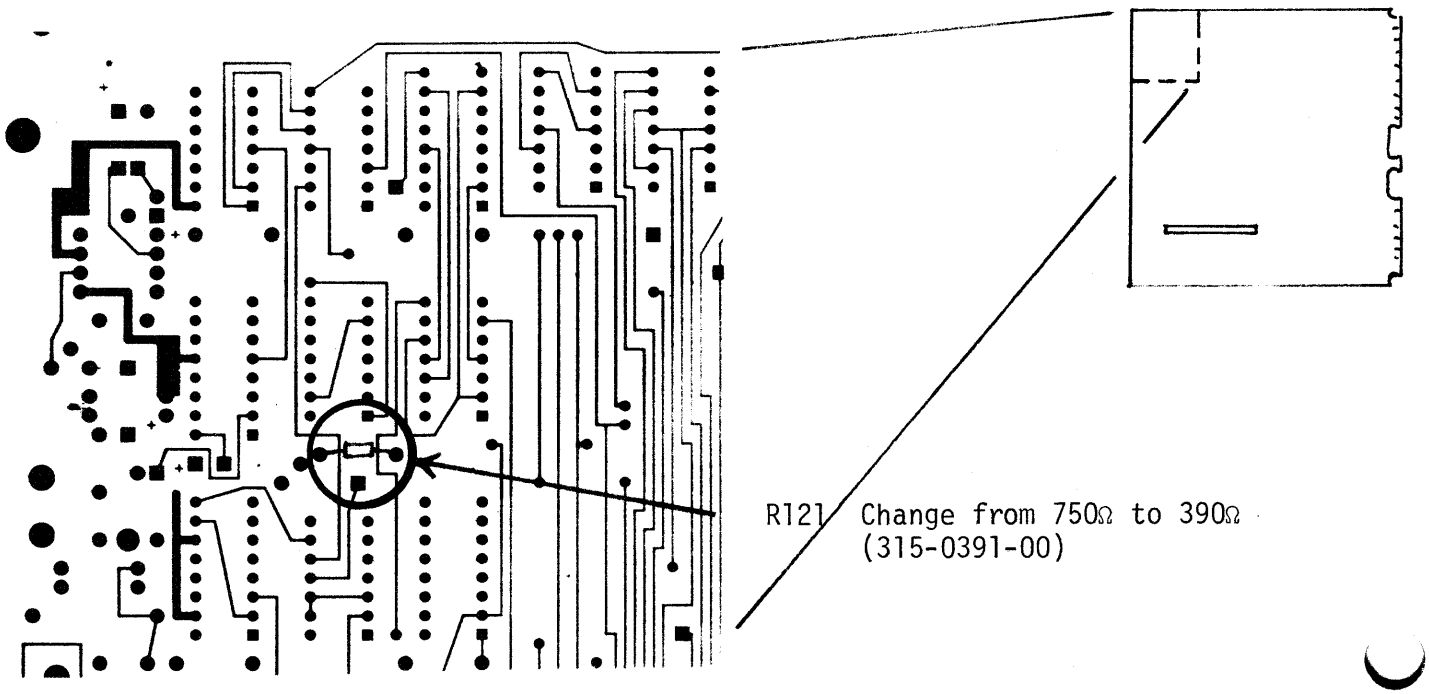
```
CPU:     DONE
RAM:     DONE
FIRM:    DONE
ROM:     DONE
TT:
         DONE
NVM:     DONE
VID: FPULSE F
     FBINCR F
     DVMVAL F
     CSAVE  F
     CSKIP  F
     CINSTR F
TEST COMPLETE
```

(continued)

The modification goes as follows:

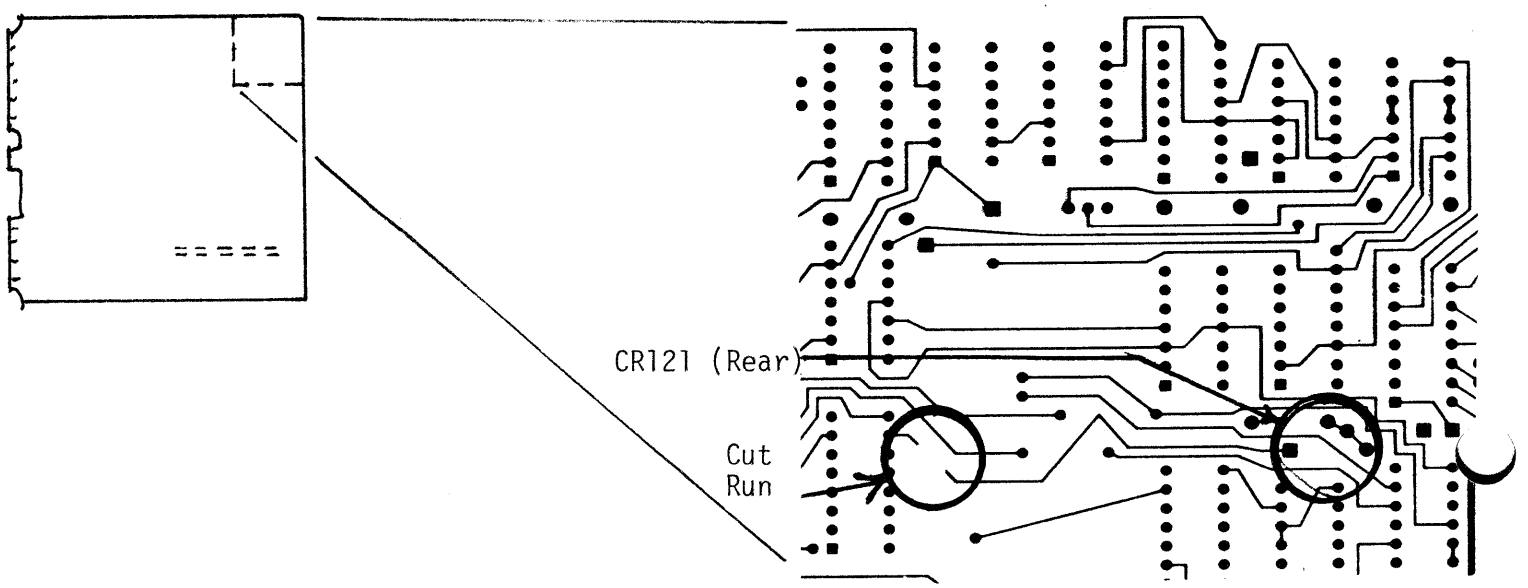
1. Change R121 from 750Ω to 390Ω (315-0391-00).

Front of 670-5695-00
(Partial)



2. Cut ECB run on rear of circuit board that goes from cathode of CR121 to pin 10 of U420.

Rear of 670-5695-00
(Partial)

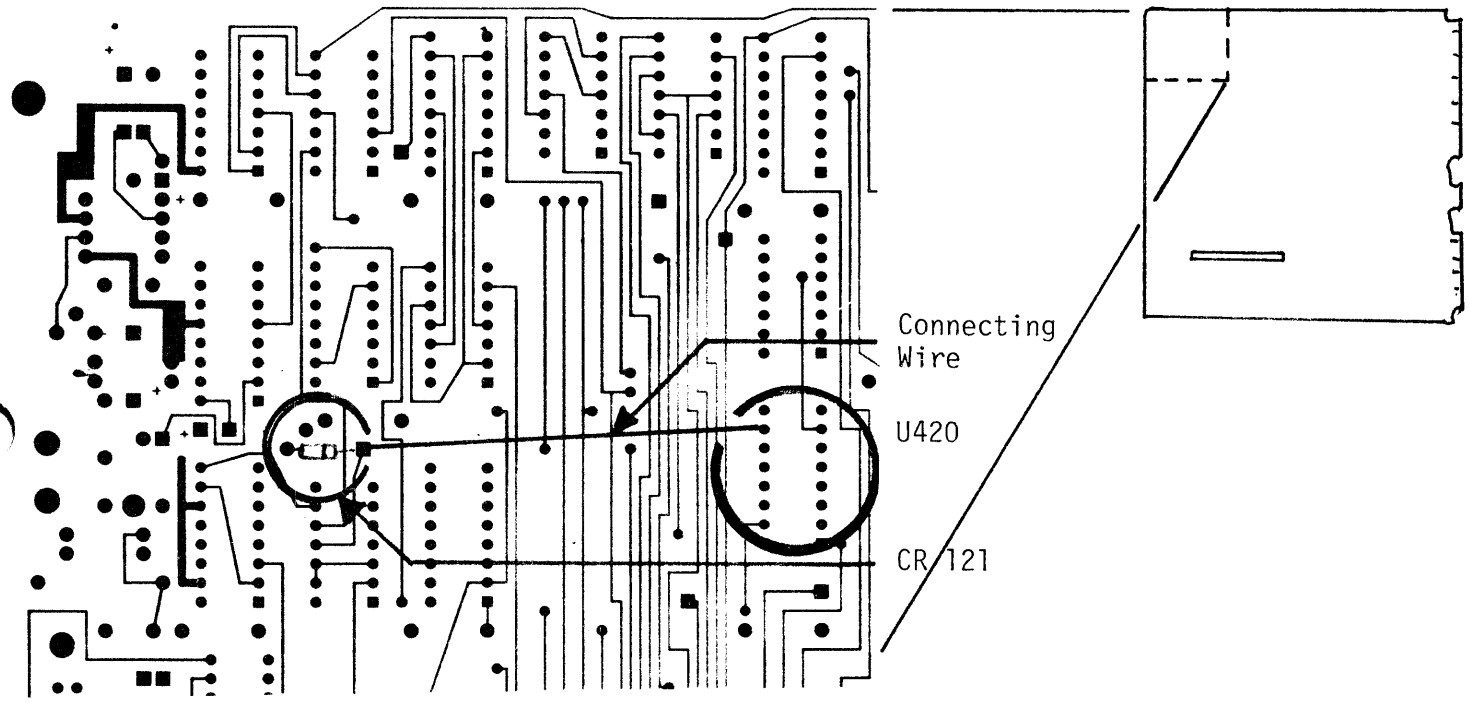


3. Clip pin 10 of U420 close to board and CAREFULLY bend the leg of the IC up to clear the board.

4. Connect an insulated piece of wire (3" of #20) from bent up pin (10) of U420 to cathode end of CR121.

Front of 670-5695-00

(Partial)



If the mod has been installed correctly and power-up diagnostic errors still exist, another malfunction exists and should be troubleshot as required. Mod installation in the factory started at board serial number B010010181.

--Bill Bean
58/511, Ext. 6507

602 PHASING ADJUSTMENT

The phase setting as described in the 602 instruction manual (P/N 070-0799-00, page 5-7) may sometimes be difficult to attain. If this is the case, it may be necessary to "dress" the feedback capacitors, C20, C29, C70 and C79.

"Dressing the caps" consists of bending them toward or away from their associated parallel resistors, R20, R29, R70 and R79. This is done while observing the elipse on the CRT face to obtain minimal phase difference.

--George Kusiowski
63/503, ext. 3928

608: CRT REPLACEMENT IN EARLY INSTRUMENTS

The earliest 608 monitors were shipped with a wire connection for grounding the CRT funnel. A few of these also had an oversized faceplate. This was due to a limited supply of funnels.

When replacing one of these CRTs it may be necessary to install a spring contact (P/N 131-2187-00) to ground the funnel.

In addition, those instruments with large faceplates on original CRTs must have the one-piece CRT front support replaced by two 386-3824-00 supports.

My thanks to K. Takahashi, of Sony/Tek, for bringing this to our attention.

George Kusiowski
63/503, ext. 3928 (WI)

611: U450 LAYOUT MISLEADING

The layout for the Z-axis and high voltage board (p/n 670-0837-0X) in the 611 Storage Display Unit is misleading as to the orientation of U450. The flag indicating pin #1 rests, instead, on pad #8.

A correction to this error is not expected due to the advanced age of the 611.

My thanks to Bill Stevenson and Pat Morrison of Dallas for sharing this observation.

--George Kusiowski
63/503, ext. 3928

634 ARCING CRT DETECTION

The recent implementation of MOD #37777 in the 634 monitor has helped minimize the damage done to circuitry in the event of a CRT arc. One component, however, is still vulnerable.

Diode CR184 in the video interface's output characteristically fails if the CRT arcs. Repeated failure of CR184 is therefore a strong indication of an arcing CRT.

--George Kusiowski
63/503, Ext. 3928

613 CG, 613-1 CG, 613 JA; MODIFICATION 35391 APPLIES

References: "613 High Voltage Board Resistor Changes, MOD #35391" Wizard Workshop February 16, 1979, issue 9-3, page 14

"Correction to 613 High Voltage Board Article" Wizard Workshop January 25, 1980, issue 10-2, page 21.

The modification described in the above mentioned articles has been applied to the high voltage boards in the 613 CG, 613-1 CG and 613 JA custom modified products. Installation changes the part number of the high voltage board from CM 670-2308-50 to CM 670-2308-51.

This article is for your information only.

--George Kusiowski
63/503, Ext. 3928

634: MODIFICATION #36364

Modification 36364 changed the part number and rating of fuse F406 as reported in "634 High Voltage Fuse Change," Wizards Workshop issue 9-6 (April 6, 1979), page 41. In addition, a number of U.L. concerns were addressed to facilitate production of Options 6 and 9.

To prevent the bottom cover from being pushed in and contacting the interface circuit board, a nylon spacer (P/N 129-0143-00) and a 6 X 32 screw (P/N 211-0040-00) were added to the board. The part number of the interface board then changed from 670-5592-01 to 670-5592-02 and is now 670-5592-03.

To preclude the possibility of leakage or arcing between runs on the low voltage power supply board, an insulating coating was applied to the 670-5595-01 circuit board assembly. However, to avoid requiring the use of a coating, a new circuit foil pattern was made up. This new layout pattern was implemented in the 670-5595-02 board which is a direct replacement for the -01 low voltage power supply board.

Finally, a possibility existed that the sliding cabinet top panel could abrade against the deflection yoke wiring harness. To correct this, a fiber insulator (P/N 342-0483-00) was added to protect the harness. Initially, there was some difficulty in obtaining this item.

At the time of this writing, the 342-0483-00 insulator is readily available.

Modification #36364 became effective in 634 number B010821.

This article is for your information only. No field update is intended.

--George Kusiowski
63/503, ext. 3928

7D02 FAILURE TO POWER UP

All 7D02's above Serial Number B010100 and below B010410 may experience intermittent power up. The symptoms are: C.P.U. lockup with random numbers on the display.

This condition is caused by the display board +5 Volt supply coming up slightly before the C.P.U. Board +5 Volt Supply. This in turn, sometimes causes the ready line to go low while the C.P.U. is trying to exercise power up routines. A low READY line will inhibit the 8085 from writing to and reading from memory.

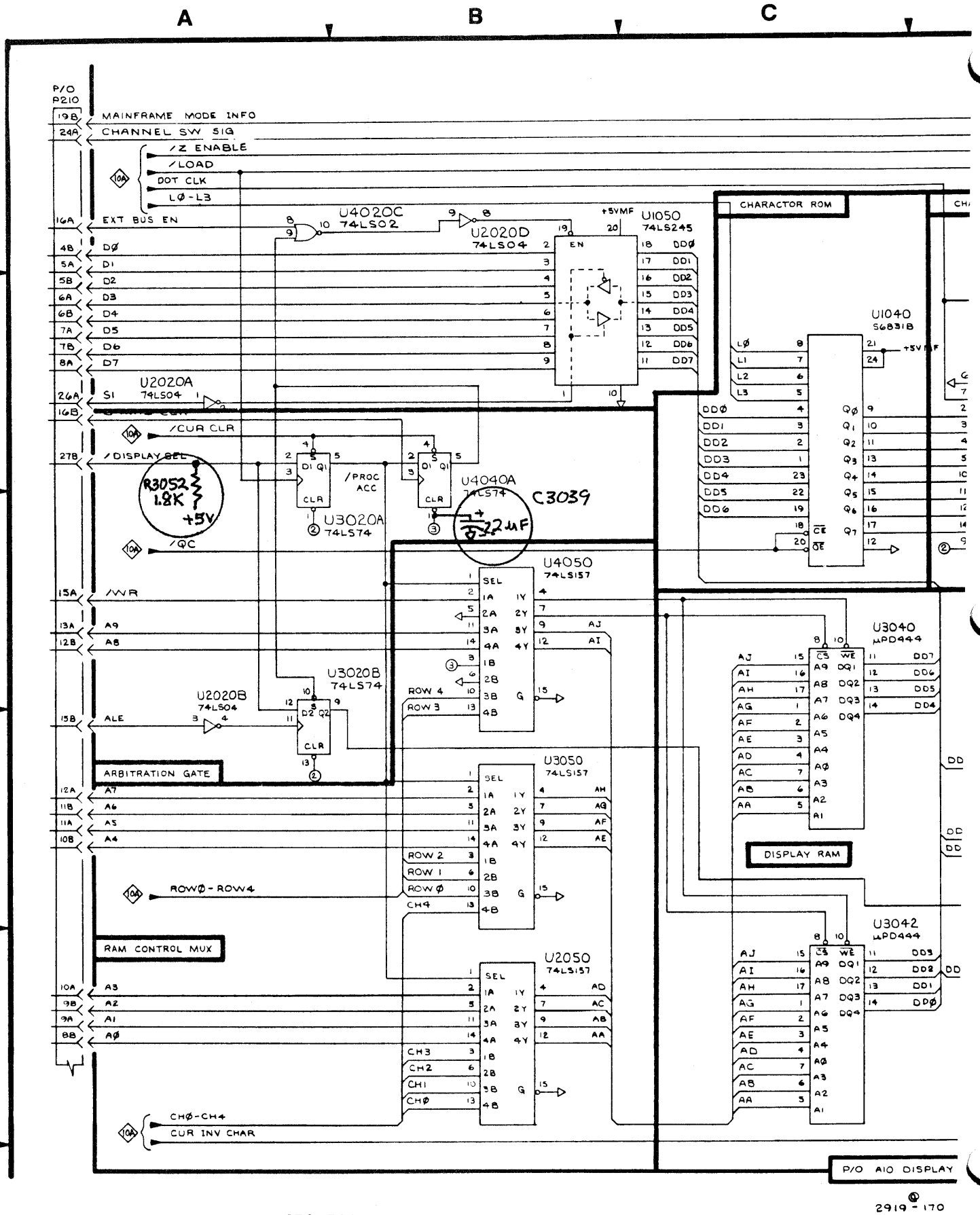
The fix is to add a 4.7K resistor R3076 (315-0472-00) to the C.P.U. Board (670-5984-00), from U4080 Pin 1 to +5 Volts. Also, add to the display board (670-5983-00), a 1.8K resistor R3052 (315-0182-00), from U3020B Pin 12 to +5 Volts, and add a 2.2 microfarad capacitor C3039 (290-0523-00), from U4040A Pin 1 to ground.

Refer to the following schematics.

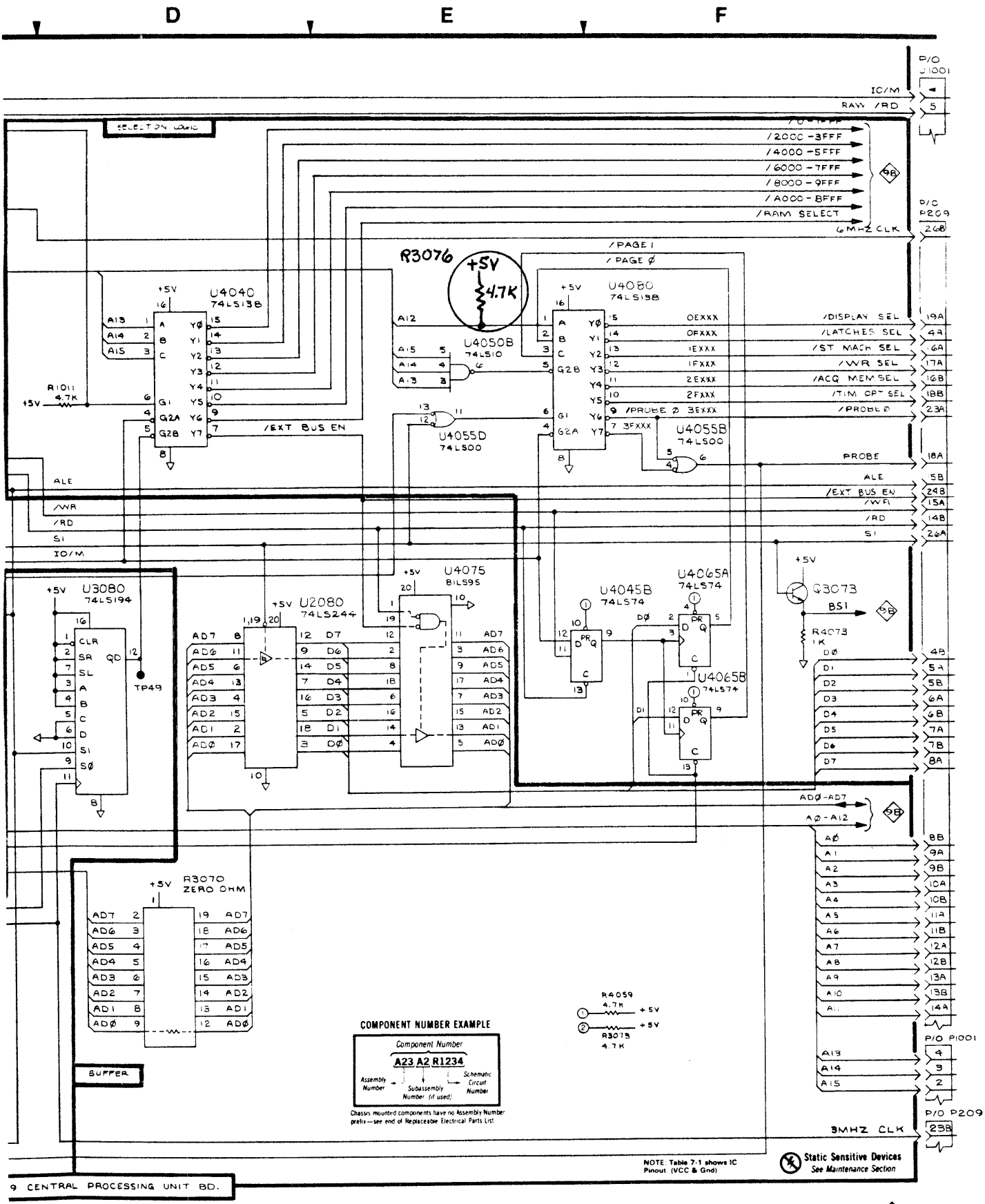
If any questions, please call.

--Craig Wasson
92-236, Ext. 1564

ARTICLE CONTINUED ON NEXT TWO PAGES


A
B
C
1
2
3
4
5
P/O P210
19B MAINFRAME MODE INFO
24A CHANNEL SW SIG
/Z ENABLE
/LOAD
DOT CLK
LØ-L3
16A EXT BUS EN
U4020C 74LS02
U2020D 74LS04
+5VMF
U1050 74LS245
EN
4B DØ
5A D1
5B D2
6A D3
6B D4
7A D5
7B D6
8A D7
DD0 DD1 DD2 DD3 DD4 DD5 DD6 DD7
CHARACTOR ROM
U1040 S68318
LØ L1 L2 L3
DDØ DD1 DD2 DD3 DD4 DD5 DD6
ØØ Ø1 Ø2 Ø3 Ø4 Ø5 Ø6 Ø7
U2020A 74LS04
26A SI
16B
/CUR CLR
27B /DISPLAY SEL
R3052 1.8K +5V
/PROC ACC
U4040A 74LS74
C3039 22 µF
U3020A 74LS74
/QC
U4050 74LS157
15A /WR
13A A9
12B A8
AJ AI
U3020B 74LS74
U2020B 74LS04
15B ALE
ROW 4 ROW 3
U3040 µPD444
AJ AI AH AG AF AE AD AC AB AA
A9 A8 A7 A6 A5 A4 AØ A3 A2 A1
CS WE DQ1 DQ2 DQ3 DQ4
ARBITRATION GATE
U3050 74LS157
12A A7
11B A6
11A A5
10B A4
ROW 2 ROW 1 ROWØ CH4
ROWØ-ROW4
DISPLAY RAM
RAM CONTROL MUX
U2050 74LS157
10A A3
9B A2
9A A1
8B AØ
CH3 CH2 CH1 CHØ
U3042 µPD444
CHØ-CH4
CUR INV CHAR
P/O A10 DISPLAY
2919-170

670-5983-00



2919-167

670-5984-00

P/O A09 CENTRAL PROCESSING UNIT 9A

7D02 PERSONALITY MODULE LOOPBACK

When making the 7D02 self-test stimulus connections on the PM101 personality module, it is important that all loopback connections be in the correct positions. If any signal lines are not connected or on wrong pins, failures will result in the personality module diagnostic tests.

Figure 1 shows the colors of all the PM101 signal and ground pins. Note that the address and data lines start with black through white, then start over with black. The second black being line ten. Be sure to connect the P6451 probe when running the extended diagnostics. Without the P6451, Timing Option Test will fail test 3 with a 2E807-7 error (no trigger error).

With any other personality module with the onboard data generator, be sure the S.U.T. (System under test) plug is plugged into the diagnostic loop back socket and insure that no microprocessor is inserted in the Z.I.F. (zero insertion force) socket. If a microprocessor is inserted, the personality module will fail the diagnostics. Also, damage may result to the microprocessor.

If any questions, please call.

--Craig Wasson
92-236, Ext. 1564

DIAGRAM TO COMPLETE ARTICLE IS ON THE FOLLOWING PAGE

PM101 - LOOPBACK

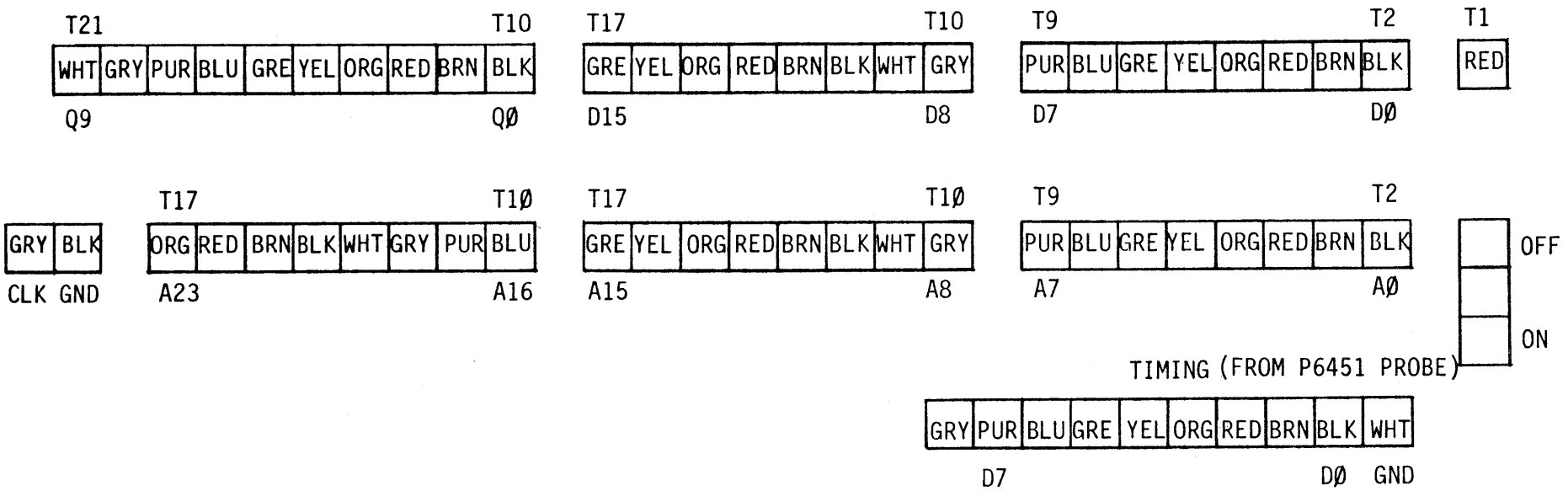


FIGURE 1

T900 SLOW TURN ON TIME OF H.V.

Reference: CRT & Vertical Amplifier Schematic
Serial Numbers:

T912	B016760 to B016789
T922	B022950 to B030859
T922R	B013880 to B013919
T932A	B022410 to B022489
T935A	B024020 to B024059
442	B024432 to B024521

In some instruments listed above, Q458, the H.V. oscillator transistor, may have P/N 151-0423-00 in the circuit instead of the correct P/N 151-0423-01. With the -00 part in the circuit, the H.V. may take up to 30 seconds to turn on. In some extreme cases the H.V. may not turn on at all and load down the other power supplies. The correct transistor P/N 151-0423-01 is selected from P/N 151-0358-00. Either of these transistors will work properly in the circuit, however, P/N 151-0423-01 has been stressed and prechecked which makes for a more reliable part in the circuit.

To check for the wrong transistor in the instrument, P/N 151-0423-00 has a black case whereas the correct part, P/N 151-0423-01, has a red case.

--Mike Laurens
58/511, Ext. 6246

465B DTM JITTER

One possible source of DTM jitter is caused by wires coming from P6015 on the timing board, going to P7052 on the trigger board. If these wires run parallel and touch the CH2 trigger coax, it can cause crosstalk between CH2 trig coax and the input to the "B" delayed pick off comparator, thus causing jitter. To determine whether CH2 coax is causing the problem, simply unplug the CH2 coax from the trigger board and the jitter should reduce.

To prevent the crosstalk, dress the wires away from the CH2 coax. The wires may cross each other but they should not be touching along the entire length.

--Written by
465B Manufacturing

--Submitted by
Mike Laurens
58/511, Ext. 6246

468 SWITCHING FROM *NORM STORAGE TO SAVE* CAUSES A VERTICAL POSITION SHIFT

Reference: Manual--Volume I P/N 070-3515-00
Volume II P/N 070-3516-00
Schematic ◇16◇ Storage Display X and Y Axis

In the storage display circuit U359, U365, U373, U374, U377, and U385 are used to set the vertical position in SAVE. However, because of the feedback loop of the circuit, an error in one part will cause erroneous voltages elsewhere in the circuit. (See Theory of Operation, Vol. I, Page 3-61.) This feedback loop makes the circuit difficult to troubleshoot.

To break the feedback loop so the circuit can be diagnosed, a shorting strap can be placed across R386 (CH2-R461) which places the +5v to pin 6 of U377 (U365). This produces an output of 1111 1111 from U377 (U365) which is read by the D.A.C. U385 (U359). The current output of U385 (U359) is fed into pin 13 of U374D (pin 6 of U374B) which produces a voltage output of -7.5v at pin 14 of U374D (pin 7 of U374B). By shorting pin 6 of U377 to ground the output of that chip will be 0000 0000 which produces 0v at pin 14 of U374D. Normal circuit operation produces a voltage of 0 to +7.5v at pin 8 of U374C (pin 1 of U374A) and an equal but opposite voltage at pin 14 of U374D (pin 7 of U374B) which nulls to 0v at pin 5 of U373B (pin 3 of U373A). However, by shorting across or grounding the resistor this null voltage will not be there.

By using this technique two known outputs can be expected which should help in isolating the trouble area.

(NOTE: All these measurements are made when the instrument has sampled in NORM STORAGE and then switched to SAVE.)

--Mike Laurens
58/511, Ext. 6246

TELEQUIPMENT

TECHNICAL SUPPORT ON TELEQUIPMENT

Please direct all technical Telequipment questions to:

TOM HERD
56-103
Ext. 8616 Merlo Road.

--Editor

GMA102A MANUAL FOR SERIAL NUMBER B060000 AND UP

A new instruction manual is available for the major mod GMA102A which has serial numbers of B060000 and up. Part number of the new manual is 070-3635-00, title of manual is GMA102A (B060000 and up) STORAGE DISPLAY MONITOR Instruction Manual.

--Dennis Painter
63/503, ext. 3597

4052/54 MAG TAPE ERROR - COM CLOCK MODIFICATION #M40828

Some 4052's and 4054's have indicated read errors during a read operation of the magnetic tape. The source of these read errors are actually due to a improperly formatted header written on a file or data on the magnetic tape written incorrectly. The result is the magnetic tape cannot be read by the 4052/54. The circuitry that causes the error is on the 4052/54 I/O Boards. Modification #M40828 addresses the write error.

There are two different procedures to Modification #M40828, the first addressing the 4052 I/O Board, the second, the 4054 I/O Board.

The first procedure addressing the 4052 I/O Board 670-5632-01 is as follows.

Parts Needed: 1 283-0107-00 51pf capacitor
1 317-0101-00 100ohm resistor

Procedure: (refer to figure 1)

1) Clip and lift pin 1 of U505
2) Add 100ohm resistor (317-0101-00) circuit number R405, between U505 pin 1 and the pad of where pin 1 of U505 was clipped from.
3) Add a 51pf capacitor, circuit number C405 (283-0107-00), between U505 pin 1 and ground.
4) The 670-5632-01 will roll to a -03.

(CONTINUED)

Procedure to MOD the 670-5666-01 4054 I/O Board.

Parts Needed: 1 283-0107-00 51pf capacitor
1 317-0101-00 100ohm resistor

Procedure: (refer to figure 2)

1) Clip and lift U120 pin 1
2) Add 100 ohm resistor circuit number R121 (317-0101-00), between U120 pin 1 and the pad of where pin 1 of U120 was clipped from.
3) Add a 51pf capacitor, circuit number C121 (283-0107-00), be tween U120 pin 1 and ground.
4) The 670-5666-01 rolls to a -02.

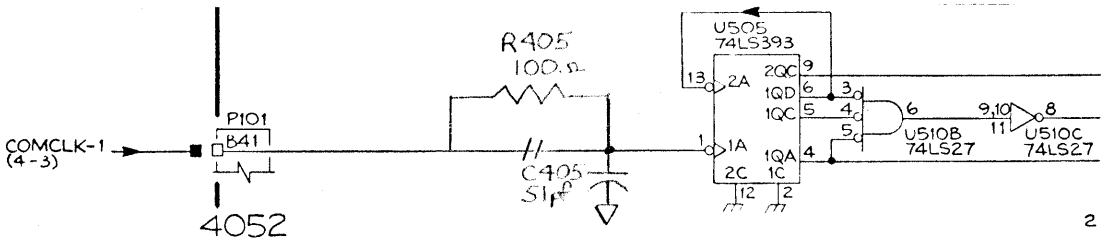


Figure 1 4052 Manual Schematic 5-2

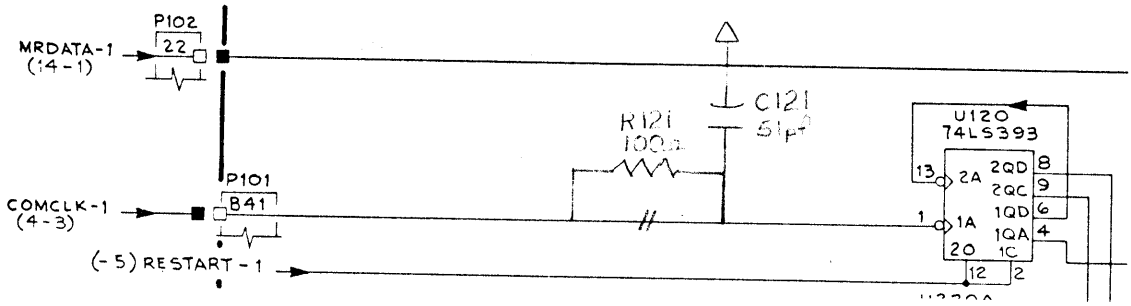


Figure 2 4054 Manual Schematic 5-2

--Darrell McGiverin
63/503, Ext. 3786 (W1)

4054 VECTOR GENERATOR AND DISPLAY CONTROLLER MODIFICATIONS, #M41262 & M41404

Some 4054's with Option 30 installed have demonstrated an undesirable problem when operating in a refresh mode. The symptom of this problem occurs as follows: The 4054 may draw some unwanted vectors and hang busy. In addition, when the product hangs busy, the Z axis may remain on causing the CRT to be damaged. This problem is caused by interaction between the Vector Generator (670-5667-02) and Display Controller (670-5672-03), and is only apparent with Option 30 installed. There are two modifications addressing this problem. Both modifications have to be implemented together.

The first mod is #M41626 and addresses the Display Controller (670-5672-03). The procedure is as follows:

1. Clip pin 1 of U20.
2. Run an insulated wire from pin 1 of U20 to pin 11 of U630.
3. Roll 670-5672-03 to a -04 level board.

The second mod is #M41404 and addresses the Vector Generator (670-5667-02). The procedure is as follows:

1. Remove U155 (156-0382-01, 74LS00)
2. Replace U155 with a 156-0030-00 (7400).
3. Roll board level from 670-5667-02 to a -03.

--Darrell McGiverin
63/503, ext. 3786 (W1)

4631 Y-AXIS DEFLECTION MODIFICATION #40282

Calls have been received concerning the appearance of a faint Z-Axis dot on the bottom righthand side of the CRT faceplate in the 4631. This dot will cause a black blemish to appear on the hardcopy if the instrument is left to idle for a period of time.

The cause of the dot is the CRT's unusually high "electrical center." The electrical center of a CRT is the location of the Z-Axis trace with no deflection applied.

To correct this situation, MOD #40282 calls for changing some resistor values on the standard and Option 31 timing boards. Identical changes are made to both boards as follow:

CIRCUIT NO.	OLD VALUE	NEW VALUE	NEW PART NUMBER
R3	15KΩ	13KΩ	321-0300-00
R233	200Ω	100Ω	308-0075-00
R336	1.5KΩ	330Ω	315-0331-00

As a result, the standard 4631 timing board changes from P/N 670-3661-07 to 670-3661-08. The Option 31 board changes from 670-5740-00 to 670-5740-01.

This modification should be made in any 4631 suspected of having a CRT with a high electrical center.

--George Kusiowski
63/503, ext. 3928

CURRENT MANUAL PART NUMBERS

This MDP Manuals List supersedes all previous manual lists to date.

8002A USER'S MANUALS	PART NUMBER	PRICE
8002A uProcessor Lab TEKDOS System User's Manual	070-2701-02	25.00
---Supplement for 6800/6802 Emulator Processor	070-2714-00	2.00
---Supplement for 8048/etc. Emulator Processor	070-2856-00	2.00
---Supplement for 6500/1 Emulator Processor	070-3433-00	2.00
8002A uProcessor Lab MDL/u Compiler User's Manual	070-2584-01	25.00
8002A uProcessor Lab TEKDOS Editor Version 3.X	070-3441-00	25.00
8001/8002A uProcessor Lab Real-Time Prototype Analyzer User's Guide	070-2785-00	25.00
Simplifying Microprocessor-Based Product Design	062-3771-00	20.00
8002A uProcessor Lab 8086 Prototype Debug User Manual	070-3455-00	.....
8002A uProcessor Lab Z8000 Prototype Dbug User Manual	070-3507-00	.....
8002A uProcessor Lab 8080A/8085A Assembler & Emulator User's Manual	070-2702-01	25.00
8002A uProcessor Lab 6800/6802 Assembler & Emulator User's Manual	070-2703-02	25.00
8002A uProcessor Lab 9900 Assembler & Emulator User's Manual	070-2704-01	25.00
8002A uProcessor Lab Z80 Assembler & Emulator User's Manual	070-2705-01	25.00
8002A uProcessor Lab F8/3870/3872 Assembler & Emulator User's Manual	070-2615-00	25.00
8002A uProcessor Lab 1802 Assembler & Emulator User's Manual	070-2627-00	25.00
8002A uProcessor Lab 8048/8021/8041A/8022 Assembler & Emulator User's Manual	070-2611-00	25.00
8002A uProcessor Lab Assembler User's Manual	070-3454-00	25.00
---Supplement for 6500/1 Assembler	070-2790-00	2.00
---Supplement for 8086 Assembler	070-3505-00	2.00
---Supplement for Z8000 Assembler	070-3509-00	2.00
8002A REFERENCE CARDS		
8002A uProcessor Lab System Reference Booklet (TEKDOS Version 3)	070-2706-01	3.00
8002A uProcessor Lab MDL/u Compiler Reference Booklet	070-2629-01	3.00
8002A uProcessor Lab TEKDOS Editor Version 3.X Reference Card	070-3442-00	1.00
8002A uProcessor Lab 8086 Prototype Debug Ref Card	070-3504-00	1.00
8002A uProcessor Lab Z8000 Prototype Debug Ref Card	070-3508-00	.....
8002A uProcessor Lab 8080A/8085A Assembler & Emulator Reference Card	070-2707-01	1.00

(CONTINUED)

CURRENT MANUAL PART NUMBERS (CONT.)

8002A uProcessor Lab 6800/6802 Assembler & Emulator Reference Card	070-2708-02	1.00
8002A uProcessor Lab 9900 Assembler & Emulator Reference Card	070-2709-01	1.00
8002A uProcessor Lab Z80 Assembler & Emulator Reference Card	070-2710-01	1.00
8002A uProcessor Lab F8/3870/3872 Assembler & Emulator Reference Card	070-2616-00	1.00
8002A uProcessor Lab 1802 Assembler & Emulator Reference Card	070-2628-00	1.00
8002A uProcessor Lab 8048/8021/8041A/8022 Assembler Reference Card	070-2612-01	1.00
8002A uProcessor Lab 6500/1 Assembler Reference Card	070-2784-00	1.00
8002A uProcessor Lab 8086 Assembler Reference Card	070-3506-00	1.00
8002A uProcessor Lab Z8000 Assembler Reference Card	070-3510-00	1.00

8001 USER'S DOCUMENTATION	PART NUMBER	PRICE
8001 uProcessor Lab System User's Manual	070-2464-00	25.00
---Supplement for F8/3870/3872 Emulator Processor	070-2822-00	2.00
---Supplement for 1802 Emulator Processor	070-2854-00	2.00
---Supplement for 6800/6802 Emulator Processor	070-2713-00	2.00
---Supplement for 8048/etc. Emulator Processor	070-2855-00	2.00
---Supplement for 6500/1 Emulator Processor	070-3432-00	2.00
8001 uProcessor Lab System Reference Card (TEKOPS Version 2)	070-2471-01	1.00
8001/8002A uProcessor Lab Real-Time Prototype Analyzer User's Guide	070-2785-00	25.00

8001/8002A SERVICE MANUALS	PART NUMBER	PRICE
8001/8002A uProcessor Lab Service Manual	070-2711-00	50.00
8001/8002/8002A uProcessor Lab 8080A Emulator Processor Service Manual	070-2353-02	10.00
8001/8002/8002A uProcessor Lab 6800/6802 Emulator Processor Service Manual	070-2354-02	10.00
8001/8002A uProcessor Lab Z80 Emulator Processor Service Manual	070-2715-00	10.00
8001/8002A uProcessor Lab 9900 Emulator Processor Service Manual	070-2712-00	10.00
8001/8002A uProcessor Lab 8085 Emulator Processor Service Manual	070-2716-00	10.00
8001/8002A uProcessor Lab F8/3870/3872 Emulator Processor Service Manual	070-2634-00	10.00
8001/8002A uProcessor Lab 1802 Emulator Processor Service Manual	070-2631-00	10.00
8001/8002A uProcessor Lab 6500/1 Emulator Processor Service Manual	070-2887-00	10.00
8001/8002A uProcessor Lab 8048/etc. Emulator Processor Service Manual	070-2632-00	10.00

CURRENT MANUAL PART NUMBERS (CONT.)

8001/8002/8002A uProcessor Lab Installation Guide	070-2717-01	10.00
---Supplement for 8080A Emulator Processor	070-3380-00	1.00
---Supplement for 6800/6802 Emulator Processor	070-2951-00	1.00
---Supplement for Z80 Emulator Processor	070-3382-00	1.00
---Supplement for 9900 Emulator Processor	070-3381-00	1.00
---Supplement for 8085 Emulator Processor	070-2871-01	1.00
---Supplement for F8/3870/3872 Emulator Processor	070-2872-01	1.00
---Supplement for 1802 Emulator Processor	070-2882-01	1.00
---Supplement for 8048/etc. Emulator Processor	070-2473-00	1.00
---Supplement for 6500/1 Emulator Processor	070-3475-00	1.00
8001/8002A uProcessor Lab 1702A PROM Programmer Service Manual	070-2722-00	10.00
8001/8002A uProcessor Lab 2704/2708 PROM Programmer Service Manual	070-2723-00	10.00
8001/8002A uProcessor Lab Real-Time Prototype Analyzer Service Manual	070-2724-00	10.00
8001/8002A uProcessor Lab Maintenance Front Panel Service Manual	070-2725-00	10.00
8002A uProcessor Lab Flexi. Disc Unit Service Manual	070-2587-00	25.00
118-0195-00 Flexible Disc Drive Service Manual	070-2786-00	25.00
MicroLab I Instruction Manual	070-2827-01	10.00
---Supplement for 3870 Personality Card	070-2862-01	5.00
---Supplement for F8 Personality Card	070-2864-01	5.00
---Supplement for 1802 Personality Card	070-2866-01	5.00
---Supplement for 6802 Personality Card	070-2939-01	5.00
---Supplement for 6500/1 Personality Card	070-2941-01	5.00
---Supplement for MCS-48 Personality Card	070-2937-00	5.00
---Supplement for 8085A Personality Card	070-2860-00	5.00
---Supplement for Z80A Personality Card	070-2861-00	5.00

8001/8002A PERIPHERAL SERVICE & USER'S MANUALS	PART NUMBER	PRICE
CT8100 CRT Terminal Service Manual (4023)	070-2362-00	50.00
CT8100 CRT Terminal User's Manual (4023)	070-2359-00	10.00
CT8101 Printing Terminal Service Manual	070-2363-00	50.00
CT8101 Printing Terminal User's Manual	070-2360-00	25.00
LP8200 Line Printer Service Manual	070-2364-00	50.00
LP8200 Line Printer User's Manual	070-2361-00	10.00
4025 Computer Display Terminal Operator's Manual	070-2401-02	7.00
4025 Computer Display Terminal Programmer's Reference Manual	070-2402-00	15.00
4025 Computer Display Terminal Programmer's Reference Card	070-2437-02	1.00
4024/4025 Computer Display Terminal Service Manual		
.....volume 1	070-2830-00	25.00
.....volume 2	070-2831-00	25.00

--Brad Griffin/Kevin King
92-236, Ext. 1608/1636

VERSION 3.X EDITOR RESTRICTION

The Upgraded Editor (Version 3.X) doesn't function correctly with the LEARN keys on the 4024 and 4025 terminals. This is a known restriction with the Editor interface to TEKDOS. The restriction can't be fixed without sacrificing other editing capabilities. The following is an example of the restrictions; suppose the Editor is invoked and you are trying to use a LEARNED key such as GET 100. The results of GET 100 will be G which is get one line instead of 100. The system only had time to process the first character of the command. The rest of the command line is lost.

At this time there is no intention of implementating a modification to correct the problem.

Brad Griffin/Kevin King
92-236, Ext. 1608/1636

S3200: FLUKE OPTION, TYPE D FIXTURING RESISTANCE MEASUREMENTS

REFERENCE MOD #M41000

The S3200 Test Systems with the Fluke DVM and Type D Fixturing cannot perform resistance measurements.

A similar problem existed in 1976 with Type J Fixturing on S3260 systems. The Type J Fixturing created a thermal electric offset in the matrix path for the optional DVM of approximately 300 microvolts, which was too high. This problem was resolved by modifying the 1803 card nest, changing the Type J Load Board (1881/1882), and designing a new interconnect cable. These changes allowed the DVM meter leads to be connected to the load board for resistance measurements. A 20 microvolt offset was achieved with these modifications. Present documentation for Type J Fixturing should reflect these changes.

The Type D Fixturing for 1804, 1804A, 1803F, and 1804B test stations with the Fluke DVM option cannot make accurate resistance measurements. This is because the high and low currents on the DC Load Circuit board are tied together.

The DC Load Circuit board (670-2831-03) must have the runs cut between J503 Pins One and Two. The runs between Pins Three and Four must also be cut. These connections are shown in 070-3291-00 manual "Program Controlling the Fluke 8500A DVM" Figure Diamond 2, cabling, DVM to 1803.

The new DC load circuit board 670-2831-04 directly replaces the 670-2831-03.

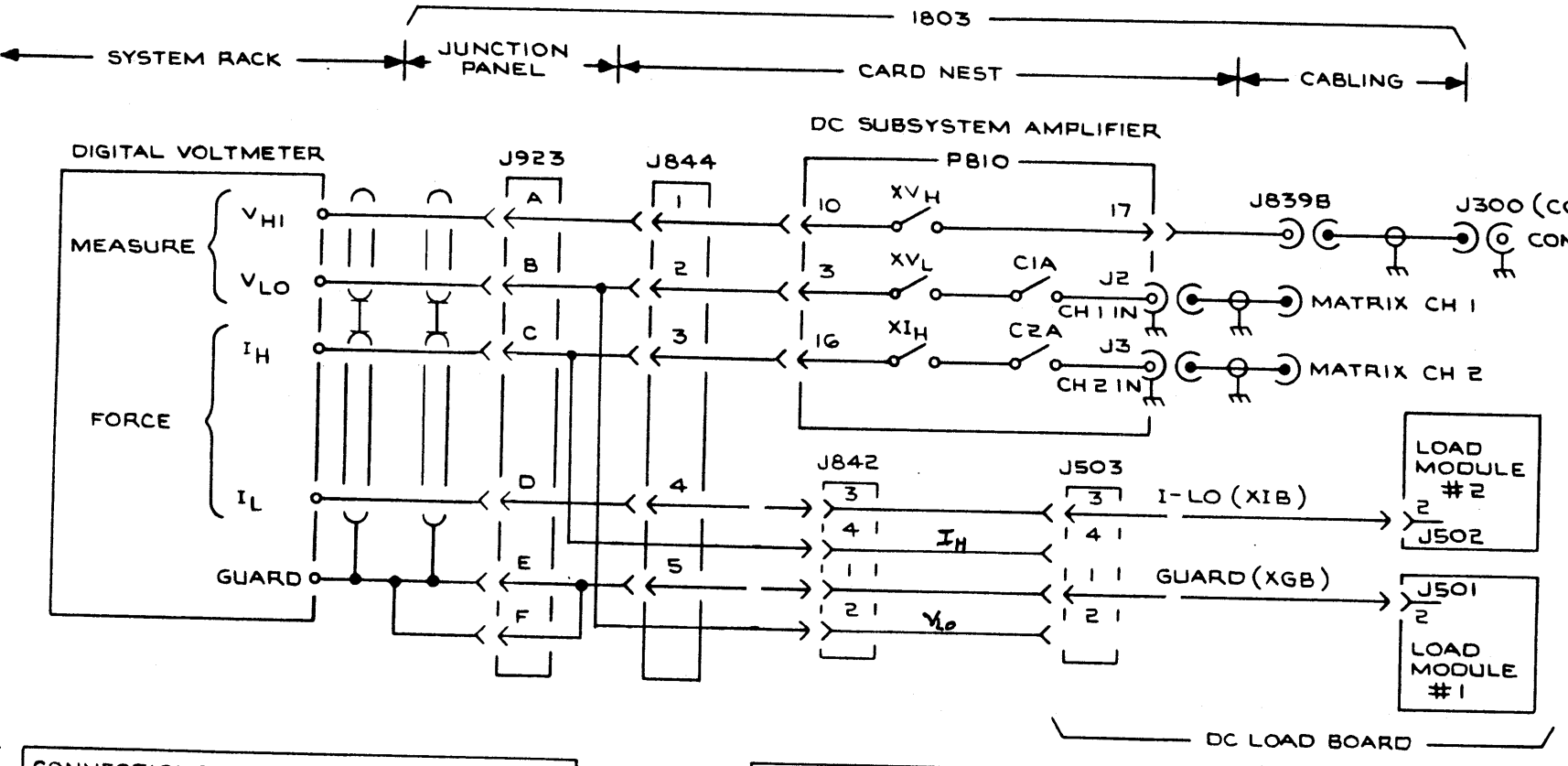
The attached drawing details the new signal paths for the Fluke DVM. Note the new signal paths for Ih and Vlo from Junction Panel J923 to cardnest J842 for the 1803 Test Station. Cable part number 179-2087-02 is necessary for these signal paths to be complete when used with the 670-2831-04 DC Load Board. This cable is also used with Type J Fixturing.

Implementation of these changes will allow S3200 Systems with the Fluke Options to make accurate resistance measurements.

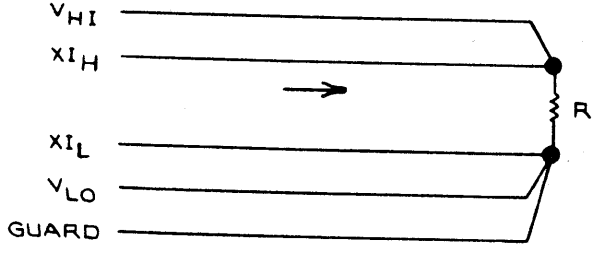
Information supplied by Steve Mishler, Production Engineering.

Inserted by--
Ron Lang
92-236, Ext. 1015

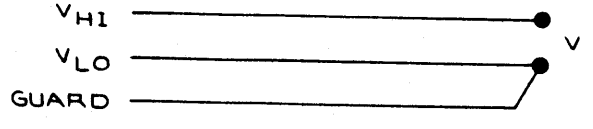
DIAGRAMS TO COMPLETE THIS ARTICLE ARE ON THE FOLLOWING TWO PAGES.

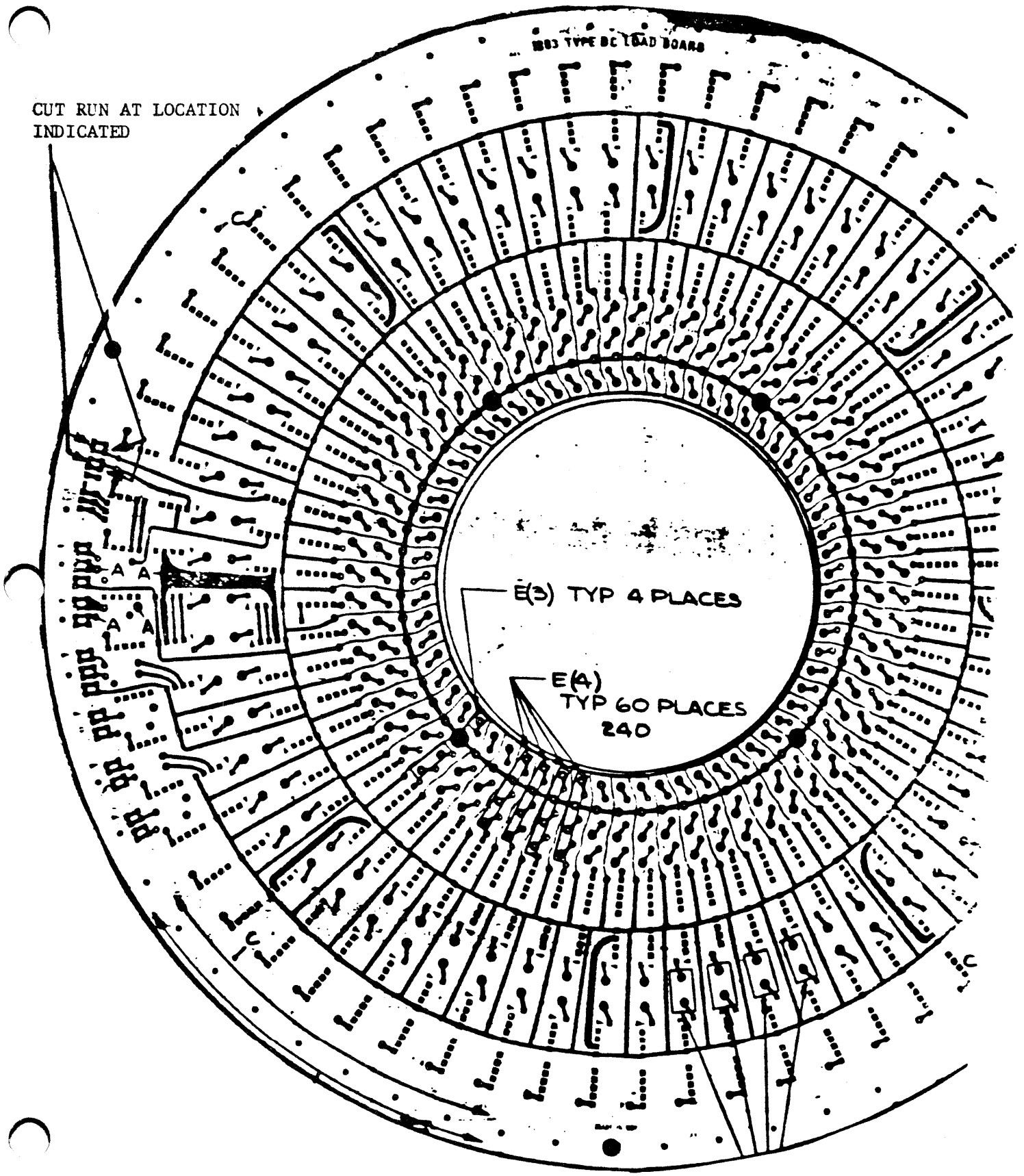


CONNECTIONS TO MEASURE RESISTANCE



CONNECTIONS TO MEASURE VOLTAGE





PARTIAL VIEW DC LOAD CIRCUIT BOARD
ASSEMBLY 670-2831-04.

S3200: 1140 CURRENT SUPPLIES: MIXED STOCK

When ordering an 1140 current supply from Board Exchange, be aware that presently you may receive either export or domestic versions.

621-0458-01 indicates the domestic current supply which is strapped for 115V. The Export version is numbered 621-0458-02 and is strapped for 220V operation.

The procedure for converting from 115V to 220V operation and the reverse is located on Page 2-1 of the 1140A manual, part number 070-3108-01. Observe that you change the straps on the transformer as well as the circuit protection fuses. No recalibration should be required.

Check your spares for proper strapping and fuses for your particular application. Also, check the fuses for proper ratings on the instruments already installed. The possibility exists that the unit could be operating with inadequate circuit protection.

If you discover your instruments are strapped wrong, rework them accordingly. It is not necessary to return them for exchange. Insure the part numbers are corrected for the intended usage.

If you convert any of these current supplies from Export to Domestic or vice-versa, please contact Ron Powell in Board Exchange, 56-103, Ext. 8928 to insure an accurate count of the exchange stock is maintained.

--Jim Stubbs
92-236, Ext. 1287

1980 - 1900 COMPATIBILITY (Answer Service Bulletin #10)

When using the 1900 Digital Generator with the 1980, it is important that the EIA Color Bars VIT NOT be located in Field 1. The 1980 confuses these color bars with the NTC-7 Composite VITS Test Signal. Locating the EIA Color Bars in Field 2 (preferably line 17) "hides" that signal "behind" the Composite signal in Field 1. This method allows the Composite signal to be properly located by the 1980.

Thanks to Dave Meyers, Irvine, for bringing this to our attention.

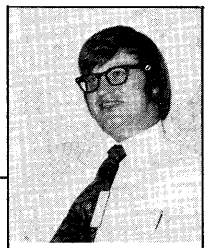
--Bill Bean
58/511, Ext. 6507

TODD PAULUS
Service Programs Manager
Ext. 7092

BRENDA MOHR
Secretary
Ext. 6918

DIANE OLMSHEID
Secretary
Ext. 6918

PATTI VILLAREAL
Secretary
Ext. 6918

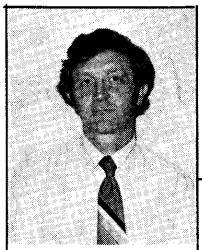


SPS
STEVE SCHMELZER
TV
Ext. 5927

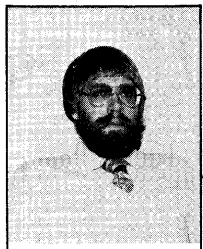
SPS
RICH ANDRUSCO
FDI
Ext. 5609

SPS
ROY LINDLEY
PORTABLES/T900 OPERATIONS
Ext. 7173

SPS
DICK FRESHOUR
5000, 7000 SERIES
Ext. 6810



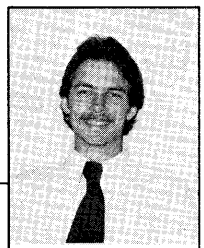
SPS
GARY ELLSWORTH
MEDICAL, ACCESSORIES
Ext. 6454



SPS
TOM FOX
METROLOGY
Ext. 7349

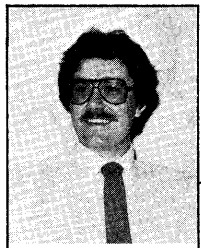
PAE
BILL BEAN
TV
Ext. 6507

PAE
RICH KUHNS
FDI
Ext. 6782

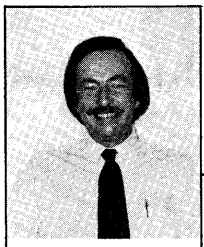


PAE
MIKE LAURENS
PORTABLES/T900
Ext. 6246

PAE
LYNN SPERLEY
7000 SERIES
Ext. 6902



PAE
DAVE MCKINNEY
MEDICAL, ACCESSORIES
Ext. 7072



PAE
JOHN EATON
5000 SERIES
Ext. 5222

SPS = Service Program Specialist
(New Product Introduction Support)

PAE = Performance Assurance Engineer
(Current Product Support)

SYSTEMS SERVICE SUPPORT

WALKER ROAD

DELIVERY STATION 92-236

1285	Wally Karstad	Service Programs Manager
1565	Marianne Hamilton	Secretary
1290	Mary Feeken	Secretary
1291	Debbie Zukerman	Systems Notification/DEC
1286	Frank Tucker	SPS: TM500
1288	Terry Turner	PAE: TM500
1292	Roger Lee	SPS: S-3200, S-3455, S-3100
1287	Jim Stubbs	PAE: S-3200
1015	Ron Lang	PAE: S-3200
1634	Joe Lipska	Applications Support for S-3455
1611	Doug Comstock	SPS: LA, DCA, BST
1564	Craig Wasson	PAE: LA, DCA,
1582	Pat Wolfram	PAE: LA, DCA, TM500
1284	Dean Hager	Operations/SPS: SPS, Sampling
1635	Randy Newton	PAE: SPS
1289	Vern Johnson	SPS: MDL
1608	Brad Griffin	PAE: MDL
1636	Kevin King	PAE: MDL

PRODUCT RESPONSIBILITY LIST FOR WALKER ROAD SERVICE SUPPORT

Includes: S-3000 Series, SPS Products, 8000 Series, TM500, BST, Logic Analyzers, TM500, 800 Series, Telequipment, Sampling,

STS PRODUCTS

Product	Description	Technical Questions Repair/Troubleshoot Perf. Assur. Eng.	Service Plan Business Serv. Prog. Spec.
S-3000	Series Test Systems	STS Staff	Roger Lee
S-3100	Series Test Systems	STS Staff	Roger Lee
S-3200	Series Test Systems	Jim Stubbs/Ron Lang	Roger Lee
S-3455	Test System	Joe Lipska	Roger Lee

BST PRODUCTS

172	Programmable Test Fixture	Factory Service	Doug Comstock
176	High Current Fixture	Factory Service	Doug Comstock
177	Standard Test Fixture	Factory Service	Doug Comstock
178	Linear IC Test Fixture	Factory Service	Doug Comstock
576	Curve Tracer	Factory Service	Doug Comstock
577D1	Storage Curve Tracer	Factory Service	Doug Comstock
577D2	Nonstorage Curve Tracer	Factory Service	Doug Comstock

MICROCOMPUTER DEVELOPMENT PRODUCTS

8001/8002 8002A	Microcomputer Development Products	Brad Griffin/Kevin King	Vern Johnson
CT8101	Printer/Terminal	Brad Griffin/Kevin King	Vern Johnson
CT8100	TEK 4023-CRT Terminal	Brad Griffin/Kevin King	Vern Johnson
LP8200	DEC Line Printer	Brad Griffin/Kevin King	Vern Johnson
8301	Microcomputer Development Unit	Brad Griffin/Kevin King	Vern Johnson
8501	Data Management Unit	Brad Griffin/Kevin King	Vern Johnson
CT8500	CRT Terminal	Brad Griffin/Kevin King	Vern Johnson
Microlab	067-0892-0X	Brad Griffin/Kevin King	Vern Johnson
8000	Series Options	Brad Griffin/Kevin King	Vern Johnson

SIGNAL PROCESSING SYSTEMS PRODUCTS

Product	Description	Technical Questions Repair/Troubleshoot Perf. Assur. Eng.	Service Plan Business Serv. Prog. Spec.
P7001	Digitizer	Randy Newton	Dean Hager
P7912	Digitizer	Factory Service	Dean Hager
R7912R	Digitizer	Factory Service	Dean Hager
7612D	Digitizer	Randy Newton	Dean Hager
7912AD	Digitizer	Randy Newton	Dean Hager
7A16P	Programmable Vertical Plug-in	Randy Newton	Dean Hager
7B90P	Programmable Horizontal Plug-in	Randy Newton	Dean Hager
CP4165	Controller	Randy Newton	Dean Hager
1350	DDC	Factory Service	Dean Hager
016-0397-00	TV MUX (Custom)	Randy Newton	Dean Hager
021-XXXX-XX	Interfaces	Randy Newton	Dean Hager
CP112	DEC Floppy	Randy Newton	Dean Hager
CP115	Data Systems Floppy	Randy Newton	Dean Hager
WP1000	Series - DPO System	Randy Newton	Dean Hager
WP2000	Series - Transient Digitizer System	Randy Newton	Dean Hager
WP3XXX	Dual Channel Digitizer Systems	Randy Newton	Dean Hager
WP11000AC	Custom Product	Randy Newton	Dean Hager
WP1000AF	Mod Product	Randy Newton	Dean Hager
All previous WPXXX			

LOGIC ANALYZER PRODUCTS

7D01	Logic Analyzer	Factory Service	Doug Comstock
7D01-DF1	Logic Analyzer	Factory Service	Doug Comstock
7D02	Logic Analyzer	Craig Wasson/P. Wolfram	Doug Comstock
PM1XX	Personality Module Series	Pat Wolfram/C. Wasson	Doug Comstock
DF1	Logic Analyzer	Factory Service	Doug Comstock
DF2	Logic Analyzer	Factory Service	Doug Comstock
DL2	Logic Analyzer	Factory Service	Doug Comstock
DL502	Logic Analyzer	Factory Service	Doug Comstock
LA501	Logic Analyzer	Factory Service	Doug Comstock
WR501	Logic Analyzer	Factory Service	Doug Comstock

DIGITAL SERVICE INSTRUMENTS

Product	Description	Technical Questions Repair/Troubleshoot Perf. Assur. Eng.	Service Plan Business Serv. Prog. Spec.
821	Word Recognizer	Factory Service	Doug Comstock
832	Data Comm Tester	Pat Wolfram	Doug Comstock
833	Data Comm Tester	Pat Wolfram	Doug Comstock
834	Programmable Data Comm Tester	Craig Wasson	Doug Comstock
851	Digital Tester	Craig Wasson	Doug Comstock

TM500 PRODUCTS

AA501	Distortion Analyzer	Terry Turner/P. Wolfram	Frank Tucker
AF/AM5XX[1]	Amplifiers	Terry Turner/P. Wolfram	Frank Tucker
DD501	Digital Delay	Terry Turner/P. Wolfram	Frank Tucker
DM5XX	Digital Multimeters	Terry Turner/P. Wolfram	Frank Tucker
MR5XX	X-Y Display Monitor	Terry Turner/P. Wolfram	Frank Tucker
PS5XX	Power Supplies	Terry Turner/P. Wolfram	Frank Tucker
RG5XX	Ramp Generator	Terry Turner/P. Wolfram	Frank Tucker
FG5XX	Function Generator	Pat Wolfram/T. Turner	Frank Tucker
SG5XX	Sine-wave Generators	Pat Wolfram/T. Turner	Frank Tucker
TG5XX	Time Mark Generators	Pat Wolfram/T. Turner	Frank Tucker
SC5XX	Oscilloscopes	Terry Turner/P. Wolfram	Frank Tucker
TM5XX	Power Modules	Terry Turner/P. Wolfram	Frank Tucker
PG5XX	Pulse Generators	Terry Turner/P. Wolfram	Frank Tucker
DC5XX	Digital Counters	Terry Turner/P. Wolfram	Frank Tucker

[1]Except AM503 and AM511 (T & M, Building 58 Service Support)

Other products not covered: DL502 and LA501,W (Craig Wasson, Doug Comstock)
SW503 and TR501,502 (Building 58 Service Support)

TELEQUIPMENT PRODUCTS

All Service related calls should be referred to Tom Herd,
Factory Service, Ext. 8616 Merlo Road.

SAMPLING

Product	Description	Technical Questions Repair/Troubleshoot Perf. Assur. Eng.	Service Plan Business Serv. Prog. Spec.
S Series	Sampling Head	Factory Service	Dean Hager
S50	Pulse Head	Factory Service	Dean Hager
S51,S52	Trigger Count Down	Factory Service	Dean Hager
S53	Trigger Recognizer	Factory Service	Dean Hager
S54	Pulse Head	Factory Service	Dean Hager
284	Pulse Generator	Factory Service	Dean Hager
5S14	Two Channel Sampler	Factory Service	Dean Hager
7K Series	Sampling	Factory Service	Dean Hager

IDD SERVICE SUPPORT

WILSONVILLE

DELIVERY STATION 63-503

3885	Gary Cooper	Service Program Manager
3591	Jeannie Keller	Lead Secretary
3951	Mary Ann O'Shea	Secretary
3594	OPEN	Secretary
3931	Dick Schilling	Service Program Manager: Technical Support
3927	Marty DeVall	PAE: 4020 Series & Options, 495X, Remote Diagnostics
3787	Bill Hatch	PAE: 4080 Series, Meg Series & Options, 619
3928	George Kusiowski	PAE: 600 Series, HCU's.
3929	Frank Lees	PAE: Data Communications, Interfaces, Graphic Computing Systems
3786	Darrell McGiverin	PAE: 4050 Series & Options, 492X, 4907
3599	Duane Moore	PAE: Diagnostician, Remote Diagnostic Center
3926	Larry North	PAE: 464X, 466X
3597	Dennis Painter	PAE: 4010 Series, Interfaces & Options, Displays
3595	Ed Sawicki	PAE: Internal Diagnostics, Copiers, Plotters, & Image Forming Systems
3598	Kent Barnard	SPS: Terminals & Displays, 4020 & 4010 Series, 600 Series,
3313	Dan Harris	SPS: Graphic Computing Systems, Data Storage Products
3788	Dennis McGary	SPS: Terminals & Displays, 408X, Meg Series
3930	Del Moore	SPS: Graphic Computing Systems: 4050 Series & Options
3596	Hank Piatek	SPS: Copiers, Plotters, & Image Forming Systems, 463X, 464X
3593	Steve Prunty	SPS: Copiers, Plotters, & Image Forming Systems, 466X
3701	Jim Tiano	SPS: OEM, Custom Mods, & International

PRODUCT RESPONSIBILITY LIST FOR IDD SERVICE SUPPORT

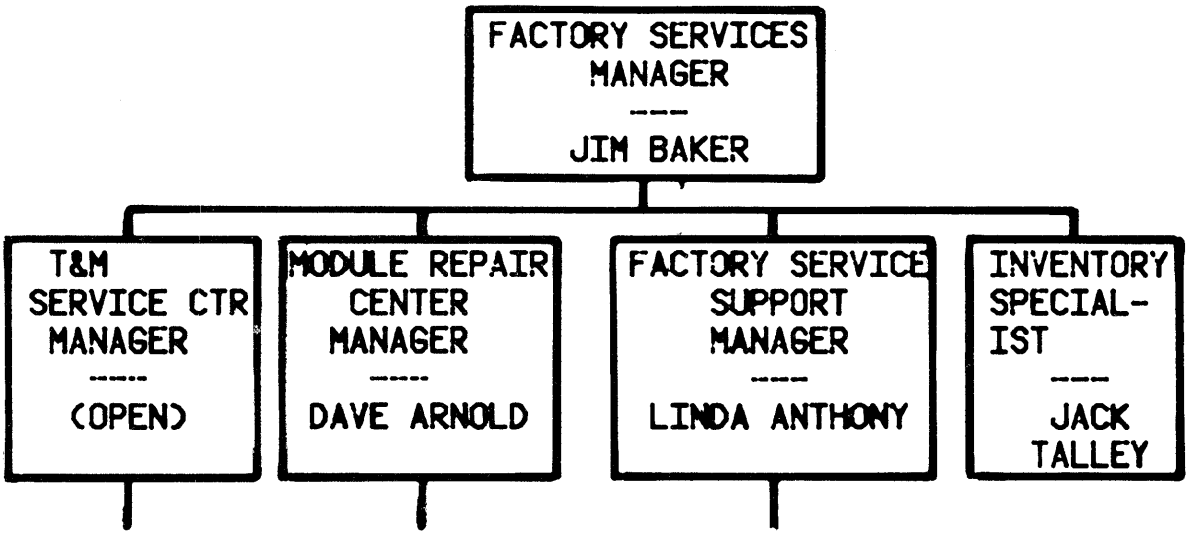
PRODUCT	DESCRIPTION	TECHNICAL QUESTIONS REPAIR/TROUBLESHOOT PERF. ASSUR. ENG.	SERVICE PLAN BUSINESS SER. PROG. SPEC.
	MODIFIED PROD., OEM ACCOUNTS, INTERNATIONAL		JIM TIANO
	REMOTE DIAGNOSTIC CENTER	DUANE MOORE	
	DATA COMMUNICATIONS	FRANK LEES	
	REMOTE DIAGNOSTICS	MARTY DEVALL	
	INTERNAL DIAGNOSTICS	ED SAWICKI	
E31	LOW COST TEK 31	FACTORY SERVICE	DEL MOORE
FEM181	4081 & PERIPHERALS & S/W PACKAGE	BILL HATCH	DENNIS MCGARY
GMA101A	19" STORAGE DISPLAY MONITOR	DENNIS PAINTER	DENNIS MCGARY
GMA102A	19" STORAGE DISPLAY MONITOR	DENNIS PAINTER	DENNIS MCGARY
GMA125	25" STORAGE DISPLAY MONITOR	DENNIS PAINTER	KENT BARNARD
MEG121	MECHNICAL ENGINEERING WORK ST.	BILL HATCH	DENNIS MCGARY
MEG121/131	OPT. 35 FUNCTION KEYBOARD	BILL HATCH	DENNIS MCGARY
MEG121/131	OPT. 36, 25" DISPLAY	BILL HATCH	DENNIS MCGARY
MEG121/4904	OPT. 10 READER/PUNCH I/F	BILL HATCH	DENNIS MCGARY
MEG121/4904	OPT. 11 READER/PUNCH I/F FOR 4081	BILL HATCH	DENNIS MCGARY
MEG121/4904	OPT. 30 REMEX TAPE READER	BILL HATCH	DENNIS MCGARY
MEG121/4904	OPT. 31 REMEX PAPER TAPE PUNCH	BILL HATCH	DENNIS MCGARY
MEG131	MECHANICAL ENGINEERING DEVELOPMENT STATION (INCLUDES PDP 11/34)	BILL HATCH	DENNIS MCGARY
RE4012	RUGGEDIZED MIL SPEC RACK MT. 4012	DENNIS PAINTER	KENT BARNARD
SURVEY 31	SURVEYING CALCULATOR	FACTORY SERVICE	JIM TIANO
T4002	11" CRT STORAGE TERMINAL	FACTORY SERVICE	KENT BARNARD
TEK 21	LOW COST CALCULATOR (DESK TOP)	FACTORY SERVICE	DEL MOORE
TEK 31	DESK TOP CALCULATOR	FACTORY SERVICE	DEL MOORE
152	TEK 31 INTERFACE	FACTORY SERVICE	DEL MOORE
153	TEK 31 INTERFACE TO TM503	FACTORY SERVICE	DEL MOORE
154	TEK 31 INTERFACE	FACTORY SERVICE	DEL MOORE
3110	TEK 31 & 4010 TERMINAL	FACTORY SERVICE	DEL MOORE
3153	TEK 31 & 153 INTERFACE	FACTORY SERVICE	DEL MOORE
4002A	11" STORAGE TERMINAL	FACTORY SERVICE	KENT BARNARD
4006	11" STORAGE TERMINAL-LOW COST	DENNIS PAINTER	KENT BARNARD
4010	11" STORAGE TERMINAL-PEDESTAL	FACTORY SERVICE	KENT BARNARD
4012	11" STORAGE TERMINAL-PEDESTAL	FACTORY SERVICE	KENT BARNARD
4013	4012 WITH APL CHARACTER SET	FACTORY SERVICE	KENT BARNARD
4014	19" DVST TERMINAL	FACTORY SERVICE	KENT BARNARD
4015	19" DVST TERMINAL & APL CHARACTER SET	FACTORY SERVICE	KENT BARNARD
4016	25" STORAGE TERMINAL-PEDESTAL	DENNIS PAINTER	KENT BARNARD

4023	RASTER SCAN TERMINAL	FACTORY SERVICE	KENT BARNARD
4024	RASTER SCAN TERMINAL	MARTY DEVALL	KENT BARNARD
4025	RASTER SCAN TERMINAL	MARTY DEVALL	KENT BARNARD
4027	COLOR RASTER SCAN TERMINAL	MARTY DEVALL	KENT BARNARD
4051	11" CRT GRAPHIC COMPUTING SYSTEM	DARRELL MCGIVERIN	DEL MOORE
4051C01	SYNC. INTERFACE	DARRELL MCGIVERIN	DEL MOORE
4051E01	ROM EXPANDER BACK PACK	DARRELL MCGIVERIN	DEL MOORE
4051R0X	ROM PACKS	DARRELL MCGIVERIN	DEL MOORE
4052	GRAPHIC COMPUTING SYSTEM	DARRELL MCGIVERIN	DEL MOORE
4052R0X	ROM PACKS	DARRELL MCGIVERIN	DEL MOORE
4054	GRAPHIC COMPUTING SYSTEM	DARRELL MCGIVERIN	DEL MOORE
4054R0X	ROM PACKS	DARRELL MCGIVERIN	DEL MOORE
4081	MINI-COMPUTER SYSTEM	BILL HATCH	DENNIS MCGARY
4501	SCAN CONVERTER	FACTORY SERVICE	HANK PIATEK
4551	LIGHT PEN FOR VIDEO TERMINAL	FACTORY SERVICE	HANK PIATEK
4601	HARD COPY (611 AND 4002)	FACTORY SERVICE	HANK PIATEK
4602	VIDEO HARD COPY	FACTORY SERVICE	HANK PIATEK
4610	HARD COPY TO 4010 FAMILY	FACTORY SERVICE	HANK PIATEK
4620	DIGITAL VIDEO HARD COPY	FACTORY SERVICE	HANK PIATEK
4623	VIDEO HARD COPY	FACTORY SERVICE	HANK PIATEK
4631	HARD COPY TO 4010 FAMILY	FACTORY SERVICE	HANK PIATEK
4632	VIDEO HARD COPY	FACTORY SERVICE	HANK PIATEK
4633	CONTINUOUS RECORDER	GEORGE KUSIOWSKI	HANK PIATEK
4633A	CONTINUOUS RECORDER	GEORGE KUSIOWSKI	HANK PIATEK
4634	IMAGE FORMING MODULE	GEORGE KUSIOWSKI	HANK PIATEK
4641	LINE PRINTER (DEC LA180)	LARRY NORTH	HANK PIATEK
4642	LINE PRINTER (CENTRONICS)	LARRY NORTH	HANK PIATEK
4661	PLOTTER "B" SIZE	FACTORY SERVICE	STEVE PRUNTY
4662	PLOTTER "B" SIZE	LARRY NORTH	STEVE PRUNTY
4663	PLOTTER "C" SIZE	LARRY NOTH	STEVE PRUNTY
4701	8 CHANNEL ANALOG MUX	FACTORY SERVICE	KENT BARNARD
4801	INTERFACE FOR T4002	FACTORY SERVICE	KENT BARNARD
4802	INTERFACE FOR T4002	FACTORY SERVICE	KENT BARNARD
4803	INTERFACE FOR T4002	FACTORY SERVICE	KENT BARNARD
4804	INTERFACE FOR T4002	FACTORY SERVICE	KENT BARNARD
4901	INTERFACE FOR T4002A	FACTORY SERVICE	KENT BARNARD
4902	INTERFACE FOR T4002A	FACTORY SERVICE	KENT BARNARD
4903	INTERFACE FOR T4002A	FACTORY SERVICE	KENT BARNARD
4905	MASS STORAGE MODULE	BILL HATCH	DENNIS MCGARY
4907	FLOPPY DISC STORAGE MODULE	DARRELL MCGIVERIN	DAN HARRIS
4911	REMEX READER PUNCH FOR 4010 FAMILY	FACTORY SERVICE	KENT BARNARD
4912	CASSETTE RECORDER (DIGITAL) (SYKES) FOR 4010 FAMILY	FACTORY SERVICE	KENT BARNARD
4921	SINGLE FLOPPY DISC TO 4010 FAMILY	FACTORY SERVICE	KENT BARNARD
4922	DUAL F.D. TO 4010 FAMILY	FACTORY SERVICE	KENT BARNARD
4923	CASSETTE TAPE RS-232, 401X BUS	DARRELL MCGIVERIN	DAN HARRIS
4924	CASSETTE TAPE GPIB	DARRELL MCGIVERIN	DAN HARRIS
4931	MODEM FOR 4010 FAMILY	FRANK LEES	KENT BARNARD
4951	JOY STICK FOR 4002A	FACTORY SERVICE	KENT BARNARD
4952	JOY STICK FOR 4010 FAMILY AND 4051	DARRELL MCGIVERIN	KENT BARNARD
4953	SUMMAGRAPHICS GRAPHIC TABLET 11"X11"	MARTY DEVALL	KENT BARNARD
4954	SUMMAGRAPHICS GRAPHIC TABLET 40"X30"	MARTY DEVALL	KENT BARNARD
4956	SUMMAGRAPHICS GRAPHIC TABLET GPIB INTERFACE TO 4051 20"X20"	DARRELL MCGIVERIN	KENT BARNARD
601	DISPLAY MONITOR	FACTORY SERVICE	KENT BARNARD
602	8X10 CM DISPLAY MONITOR	FACTORY SERVICE	KENT BARNARD

603	10.2X12.7 CM STORAGE DISPLAY MONITOR	FACTORY SERVICE	KENT BARNARD
603A	10.2X12.7 CM STORAGE DISPLAY MONITOR	GEORGE KUSIOWSKI	KENT BARNARD
604	10.2X12.7 CM DISPLAY MONITOR	FACTORY SERVICE	KENT BARNARD
604A	10.2X12.7 CM DISPLAY MONITOR	GEORGE KUSIOWSKI	KENT BARNARD
605	7.2X9 CM STORAGE DISPLAY MONITOR	FACTORY SERVICE	KENT BARNARD
606	8X10 CM DISPLAY MONITOR	FACTORY SERVICE	KENT BARNARD
606A	8X10 CM HIGH RESOLUTION DISPLAY MON.	GEORGE KUSIOWSKI	KENT BARNARD
606B	8X10 CM HIGH RESOLUTION DISPLAY MON.	GEORGE KUSIOWSKI	KENT BARNARD
607	7.2X9 CM VARIABLE PERSISTANCE DISPLAY MONITOR	FACTORY SERVICE	KENT BARNARD
607A	7.2X9 CM VARIABLE PERSISTANCE DISPLAY MONITOR	GEORGE KUSIOWSKI	KENT BARNARD
608	9.8X12.2 CM HIGH BRIGHTNESS DIS. MON.	GEORGE KUSIOWSKI	KENT BARNARD
611	11" DISPLAY	FACTORY SERVICE	KENT BARNARD
613	11" HIGH CONTRAST DISPLAY	FACTORY SERVICE	KENT BARNARD
618	19" STORAGE DISPLAY	DENNIS PAINTER	DENNIS MCGARY
619	19" STORAGE DISPLAY	DENNIS PAINTER	DENNIS MCGARY
620	10X12 CM DISPLAY MONITOR	GEORGE KUSIOWSKI	KENT BARNARD
624	9.8X12.2 CM DISPLAY MONITOR	GEORGE KUSIOWSKI	KENT BARNARD
634	9X12 CM RASTER SCAN DISPLAY MONITOR	GEORGE KUSIOWSKI	KENT BARNARD

FACTORY SERVICE CENTER

DELIVERY STATION 56-103



REPAIR & TECHNICAL SUPPORT FOR T&M PRODUCTS

MODULE REPAIR FOR: IDG & SYSTEMS

MODULE MOD-PROGRAM

IDG FIELD SVC.

SHIPPING & RECEIVING

CLERICAL SUPPORT

EXCHANGE PROGRAM ADMINISTRATION

DISCRETE PARTS INVENTORY

TELEPHONE LISTING

Jim Baker	8639
Dave Arnold	8641
Linda Anthony	8640
Jack Talley	8638

GENERAL

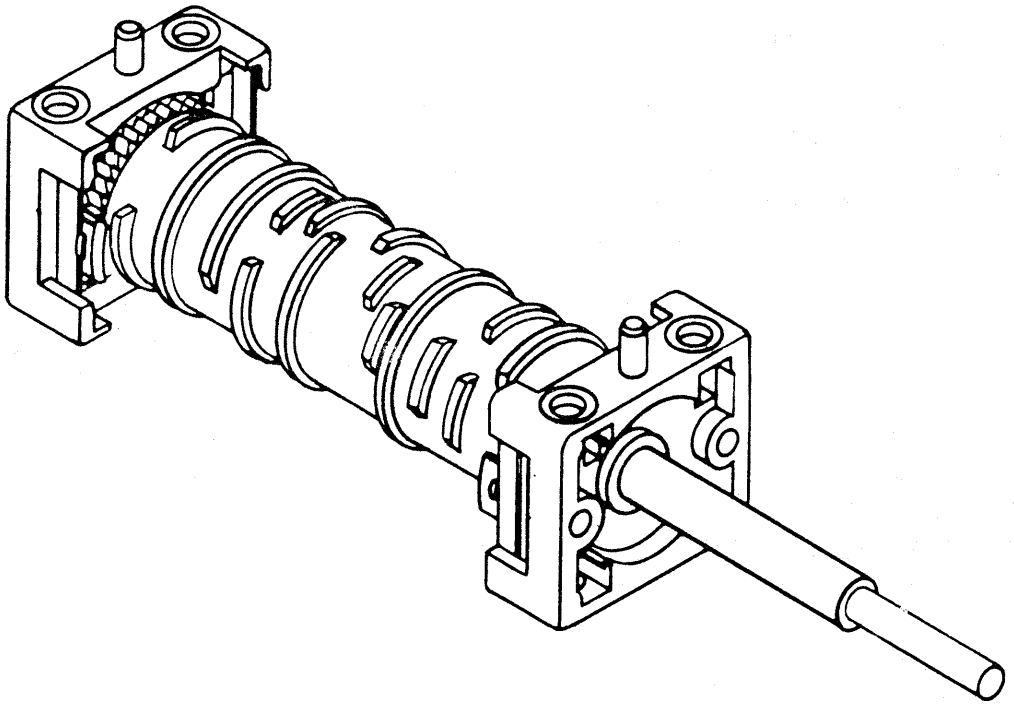
CAM SWITCH REPAIR MANUAL

The Electromechanical Design group has prepared a cam switch repair manual detailing operation, cleaning and maintenance of cam switches. The manual will be part numbered and made available in the near future. The part number will be published when the manual is available. The manual is included as a reference pull-out in this issue.

Submitted by Virgil Hanes

Inserted by Lynn Sperley
58/511, Ext. 6902

ARTICLE CONTINUED ON THE NEXT FIVE PAGES



cam switch repair manual

November 21, 1980
Issue 10-23

1. INTRODUCTION

This manual has been prepared to assist field personnel in troubleshooting and repairing cam switches. Use it as a supplement to service manuals for instruments that have cam switches.

The information herein is presented in the most logical inspection/repair order normally followed by technicians, starting with knob/shaft misalignment and progressing through contact contamination and cleaning, contact pressure and alignment problems, contact and actuator replacement.

Causes of failure are also presented in the most probable sequence of occurrence based upon service record reports and failure analysis of parts returned to Beaverton.

2. FRONT PANEL PROBLEMS KNOB/SHAFT MISALIGNMENT

Only knob/shaft misalignment can be checked from the front panel.

1. First check tightness of knob set screws. If after tightening, the misalignment problem still exists, remove the set screws and examine for damaged threads. If threads are damaged, replace the entire knob.

2. Two basic knob configurations are used for mating with the shaft. One is a metal insert molded into the plastic knob. If the inner diameter of this insert is scored, replace the entire knob.

   The second configuration uses a split bushing that can be pushed out with a pencil. If this bushing is fractured or scored, install a new bushing.

3. Check the knurl of the shaft for wear and damage. Its surface should feel rough when rotated between thumb and forefinger. If the knurl is damaged, replace the entire actuator assembly (see section 5).

3. SWITCH/CIRCUIT BOARD PROBLEMS

Some switch/ECB assemblies can be inspected while in the instrument by simply removing the switch cam cover; others require removal of the actuator assembly. If this is the case, leave the cam cover in place to keep the switch intact during removal.

For removal instructions, consult the service manual for that instrument.

Also, do not restrict your inspection to the cam switch alone. Board problems such as component drift, damaged runs and defective solder joints can underlie what is thought to be strictly a switch problem.

CONTACT CONTAMINATION/CLEANING

Contacts require cleaning: (1) when visual inspection shows contamination on the contacts or pads; (2) after solder work has been done on the ECB [flux fumes may leave a thin film deposit on contact surfaces] (3) after board wash, which can trap contaminants around closed contacts.

Two cleaning procedures are recommended. Procedure A is preferred. Use procedure B only if A proves inadequate.

WARNING: Do not use No-Noise or other contact lubricants on cam switches. They are designed to operate dry, and lubricants tend to trap dust particles.

Cleaning procedure A

1. Remove the cam cover.

2. Clean contact pads and fingers with isopropanol (isopropyl alcohol) or fotocol (ethyl alcohol) using a soft brush and alcohol on cotton swabs. Be very gentle around the contact fingers. Rotate the switch shaft during cleaning and drying to prevent dissolved contaminants from collecting around closed contacts.

3. Allow switch to air dry for 60 seconds.

4. Blow out remaining residue with an air hose while rotating the shaft to prevent trapping of particles.

5. If contacts are clean, proceed with checking for contact pressure and damage. If contamination persists and cannot be removed with this procedure, use procedure B.

Cleaning procedure B — Removing hard films

This procedure is to be used only on films not removeable by procedure A.

CAUTION: There is only about 0.0001 inch of gold on the contact pad surface. *Any* abrasive material will remove some of this gold, thus increasing risk of corrosion and decreasing the life of the switch.

1. Rotate the switch shaft to open contacts to be cleaned.

2. Cut an Eberhard Faber 'Pink Pearl' eraser into the shape of a screwdriver tip small enough so that it can be inserted between the contact fingers and pad. Note: do not use typewriter- or fiberglass-type erasers because they are too abrasive.

3. Use light strokes to remove contamination. Use only enough pressure and strokes to change the gold pads to a more satiny, yellow finish.

4. Follow up with the alcohol cleaning procedure A to remove residue.

CONTACT PRESSURE

Improper contact pressure on a pad can either cause or contribute to switch failure. Contact pressure is determined by visually inspecting cam-to-contact arm height and contact arm shape.

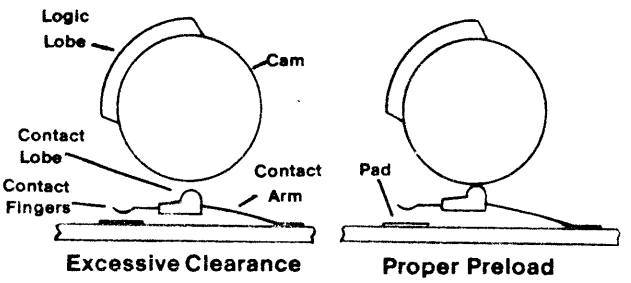
Sometimes a "defective" switch will operate satisfactorily after being installed on either a new or freshly cleaned circuit board.

Make your visual checks with the cam cover removed. Rotate the switch shaft to check all contacts in both open and closed positions.

With contacts open:

1. Lobe on contact arm should ride on the cam. A gap means either a defective contact arm or excessive cam clearance.

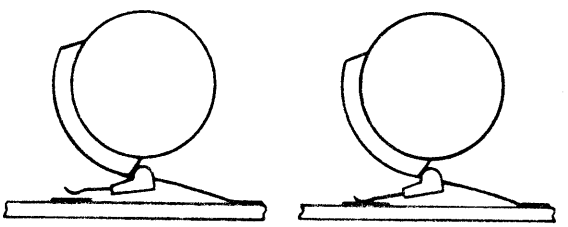
2. Contact-to-board gap should be even. Variations may indicate defective contacts, actuator problems, or cam cover problems



As contacts close:

1. Contact should be made while the contact lobe is still on the cam ramp (before logic lobe is over the contact lobe). Failure means excessive cam clearance or defective contact arm.

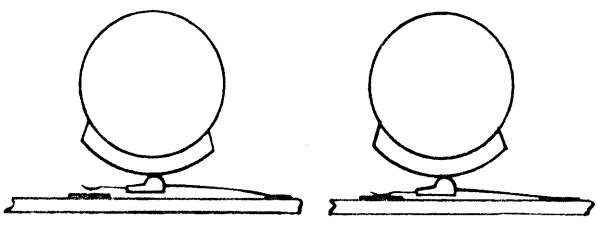
2. All fingers on any arm should touch the pad at the same time. Failure means defective contact arm or fingers.

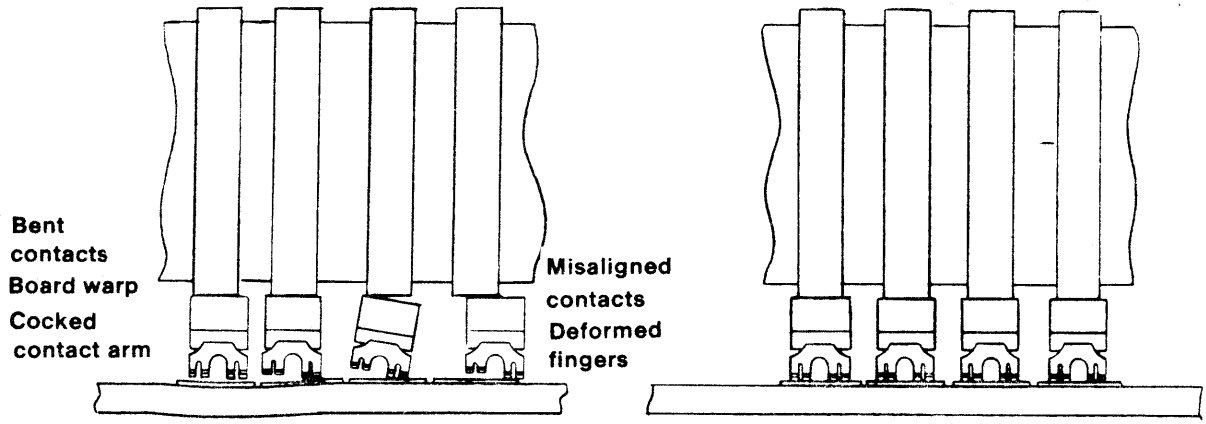


With contacts closed:

1. Contact fingers should be centered squarely on the pad. Failure means defective contact arm or fingers.

2. Contact arm should be deflected toward ECB. Failure of contact arm to deflect means that inadequate pressure is being exerted on the pad. This may mean either a defective contact arm or actuator problems.





Typical Misalignment **Proper Alignment**

For normally closed attenuator contacts: Sight along board. All contacts should be in line and set squarely on their pads. Failure means defective contacts, which must be replaced.

4. CONTACT REPLACEMENT

All defective contacts should be replaced. Do not attempt to adjust or repair defective contacts because optimum realignment is not possible.

For standard contacts use replacement kit 040-0541-00. For high-frequency (attenuator) contacts use kit 003-0708-00, and for T900 Series instruments install a whole new contact strip.

Other factors can also affect contact pressure although they rarely occur, and are found primarily on long, single-cam switches. These include:

1. Board warpage, which causes uneven height variations between cam and board. Check for this condition by visual inspection.

2. Repeated switch failures with no indication of physical damage may mean a tolerance buildup somewhere. Installing a new actuator assembly and cam cover may help.

5. ACTUATOR REPLACEMENT

Mechanical failure of the actuator is usually easy to identify. The cam won't turn, it may be scored, etc.

To remove an actuator, first reinstall its cam cover. This will hold the actuator in alignment. Removal must be done carefully to avoid risk of damaging the contacts.

When installing a new actuator, include a new cam cover as well.

6. DEFECTIVE PARTS/SPECIAL PROBLEMS

The Switch Design Group does failure analysis on all returned parts. If actuators are returned with covers on, it is easier to identify the cause of failure. Any helpful additional information should be sent along with the part.

If questions arise about a specific instrument, write or phone Irv Sherbeck, manager, Electromechanical Design Support, or Virgil Hanes, switch and relay reliability engineer, at delivery station 58-021, ext. 7909 (Beaverton GTE).