



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

Published by Service Admin. Support
56-037 Ext. 8939 Merlo

July 3, 1981
Issue 11-12

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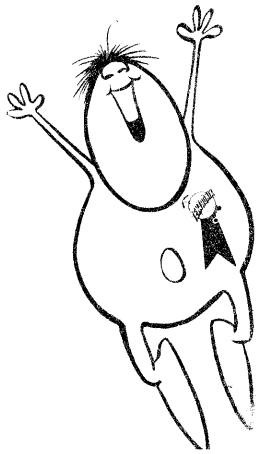
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you done
GOOD,

"YOU DONE GOOD" AWARDS THIS
WEEK GO TO THE FOLLOWING . . .

SANTA CLARA SERVICE CENTER

Congratulations go to the Santa Clara service center personnel for the high quality of service provided to one of our major customers. Recognition of our quality by customers is the most accurate measure we have.

Thanks for a job well done!

DAVE BUTLER
MYRON TSUN - Seattle

This statement sums up the appreciation expressed by a customer recently;

"Your saved the day for us". Keep up the good work!

GARLAND LEE - Denver

Garland recently spent one week at the customers site in Colorado Springs assisting a Beaverton Audit Team with a Video product audit. He received numerous letters of recognition for his efforts and a You Done Good.

Garland's performance demonstrated that teamwork between the Field and Beaverton strengthens the TEK image with our customers.

Here is another "You Done Good" for Garland and a thank you for both a job well done and his teamwork efforts. Keep up the good work!

JOHN MAYES
REX McGUIRE - Kansas City

The following is extracted from a customer letter of appreciation;
"Mr. John Mayes and Mr. Rex McGuire answered our call for help in a highly professional manner and were able to diagnose and repair our 4027 in record time. Tektronix's response to a short notice service call from an out of town customer with minimum red tape is truly outstanding. Many thanks . . ."

Our thanks for a job well done to both John and Rex!



PERSONNEL CHANGES

NEW HIRES

Please join us in welcoming the following people to Tek and the Service Organization:

JOSEPH IMPERIAL - Long Island

Joe begins with Tek as an ET II following four years in the Air Force gaining PMEL experience and as a job shotter in a number of Cal. Labs for five years. Welcome Joe!

JOY GAROFALO - Long Island

Joy has joined Tek as an ET I and comes to us with a two year A.A.S. degree in Electronic Instrumentation from Nassau Community College. Welcome Joy!

DANIEL FLOREZ - Long Island

Dan joins Tek as an ET I following four years in the Air Force as a PMEL specialist. Welcome Dan!

IRIS WYATT - Rockville

Iris comes to Tek from Mid-Atlantic Industries, Inc. and lives in the Silver Spring area with her son. She will be working in the capacity of Field Service Specialist with the Rockville South team. Welcome Iris!

RICHARD SLUSSER - Rockville

Richard comes to tek with 8½ years of electronics experience with the U.S. Army. He resides in Waynesboro, PA with his wife and son. Richard will also be working in the capacity of Field Service Specialist. Welcome Richard!

GARY HARVEY - Newport News

Gary served as a data systems technician in the Navy and most recently as a field service engineer for ICOT Corporation. He will be working with Tek as a Field Service Specialist. Gary resides in Virginia Beach, VA with his wife and son. Welcome Gary!

LEE HARSHALL - Houston

Lee has joined Tek as a Field Service Specialist I. He comes to us after successfully completing 20 years with the USAF with Air operations and computer experience. Welcome Lee!

NEW HIRES (CONTINUED)

GARTH BAY - Albuquerque

Garth comes to Tek following his discharge from the U.S. Air Force. He has joined the Albuquerque team as an ET I. Welcome Garth!

JAMES BUSH - Albuquerque

Jim has joined Tek as a Stockclerk/Driver and will be working in the Shipping/Receiving Department. Welcome Jim!

PROMOTIONS

MIKE OLIVERI - Long Island

Mike has been promoted to the Long Island Sales Force as an Applications Engineer for the T&M Group. Congratulations Mike!

HANK MOORE - Long Island

Hank has been promoted to Field Service Supervisor. Congratulations Hank!

DEBORAH BROWN - Rockville North

Deborah has been promoted from J.E.T. to Field Service Specialist I. Congratulations and best wishes for the future!

--Sharon Huetson
Editor

GENERAL
METEROLOGY

BASIC TRANSISTOR TROUBLESHOOTING REVISITED - ARTICLE #2

(Second article in a series of five.)

BASIC TROUBLESHOOTING TIPS

In troubleshooting transistor circuits, the most important area to examine is the base-emitter junction as this is the control point of the transistor.

If the base-emitter junction is forward biased, the transistor would normally be "on."

If the base-emitter junction has zero bias or reverse bias, it should be turned off. If it is not off under these conditions, it is either shorted or leaky.

TIP 1 — MEASURE THE BASE-EMITTER VOLTAGE. FROM THIS DECIDE HOW THE TRANSISTOR SHOULD BE BEHAVING. THEN LOOK AT THE COLLECTOR VOLTAGE AND SEE IF THE TRANSISTOR IS BEHAVING AS IT SHOULD BE.

For example, if the base-emitter voltage is 0.6 volts forward biased and the collector voltage is the same as the supply voltage, something is wrong. Probably the collector-base junction is open.

Expanding on the above idea leads to our second troubleshooting tip.

TIP 2 — MODIFY THE CONTROL SIGNALS PRESENT AND SEE IF THE CIRCUIT RESPONDS ACCORDINGLY.

For example, if the transistor is forward biased as shown in Figure 1, see if it is behaving as an amplifier. Short the emitter to the base to remove the forward bias as shown in Figure 3. The collector voltage should then rise to the approximate level of the supply voltage. (Any difference is caused by I_{CO} , the collector-to-base leakage current.) The higher the collector voltage rises, the lower I_{CO} , and the better the transistor.

If the collector voltage doesn't rise as expected, we've identified a bad transistor. This technique is perfectly safe in ac coupled circuits. However, in some dc coupled circuits, we could cause damage if base-emitter shorts are applied around high power levels (e.g., such as the output stage of a power amplifier).

Now back to I_{CO} , the collector-to-base leakage current mentioned previously. As we implied, if the transistor was perfect it would have no I_{CO} leakage current. Look at Figure 1a again. Note the collector voltage is more positive than the base voltage. In this "on" condition the base-collector diode junction is reverse biased. The reverse biased diodes should be off, but because we have never been able to make a perfect diode, there is a very small current leaking across it. This leakage current flows through the collector-base junction and part of it goes through the base-emitter (control point) junction.

Since leakage current is extremely temperature sensitive, we can use this to our advantage in troubleshooting. For example, in an amplifier stage, excessive leakage current can cause clipping distortion because of the shift in the quiescent operating point.

TIP 3 — IN AN AMPLIFIER WITH CLIPPING DISTORTION, TRY COOLING EACH TRANSISTOR WITH SPRAY COOLANT. QUITE LIKELY YOU WILL FIND THAT WHEN THE LEAKY TRANSISTOR IS COOLED THE CLIPPING DISTORTION DISAPPEARS. CONVERSELY, HEATING A LEAKY TRANSISTOR WILL MAKE THE PROBLEM MUCH WORSE BY GREATLY INCREASING THE I_{CO} LEAKAGE.

Reprinted from Bench Briefs

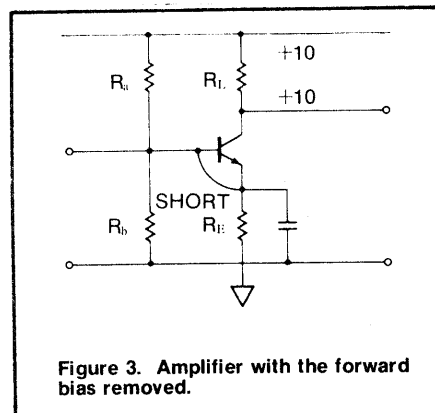


Figure 3. Amplifier with the forward bias removed.

Submitted by Dick Hornicak

MEDICAL (U.S. ONLY)

The following is the most current list of Medical Sales Representatives for Vitatek. PRO-MED, INC. replaces LEE INSTRUMENTS, effective July 1, 1981. This listing reflects that.

CARDIO CARE, INC.
285 Hakalau Place
Honolulu, Hawaii 96825
(808) 395-0581

Eugene Beltrame, President

COAST MEDICAL CORPORATION
2575 Stanwell Drive
Concord, California 94520
(415) 825-6500
(800) 642-0247 Inside California
(800) 227-0341 Outside California

Earl Lunceford, President
Cliff Knuckles, Vice-President, Sales
John Marciano, Sales Manager

HOWLAND ASSOCIATES
4620A S. W. Caldew Street
Portland, Oregon 97219
(503) 246-9950

Hal Howland

INTERNATIONAL BIOMEDICAL CORPORATION
512 South Freeway
Fort Worth, Texas 76104
(817) 338-0451
(800) 792-1090 Inside Texas
(800) 433-5615 Outside Texas

A. J. (Joe) Segars, President
John Segars, Vice-President
Dick Braun, Sales Manager

KOL BIO-MEDICAL INSTRUMENTS, INC.
7950-4 Woodruff Court
Springfield, Virginia 22151
(703) 323-7100

Roger Kolasinski, President
Tim McInerney, Sales Manager

LIFE INSTRUMENTS, INC.
16 West 129-83rd Street
Hinsdale, Illinois 60521
(312) 887-1240

Mike Dubisky, President
Patrick Smith, Sales Manager

MALKIN INSTRUMENT
962 Baxter Avenue
Louisville, Kentucky 40204
(502) 587-0776

Scott Malkin, President
Reagh Stubbs, Sales Manager

MED TEK SOUTEAST, INC.
201-62nd Avenue, North
St. Petersburg, Florida 33702
(813) 522-0554

Jim Carroll, President

MEDICAL ELECTRONICS CORPORATION
131 Clarendon Street
Boston, Massachusetts 02116
(617) 536-8300
(800) 225-7038 Outside Massachusetts

John Knight, President
Carl Wallman, Sales Manager

MEDICAL SPECIALIZED SYSTEMS
2300 Center Point Road
Birmingham, Alabama 35215
(205) 854-5599

Sherrel Smith, President

PRO-MED, INC.
2157 Avon Industrial Drive
Auburn Heights, Michigan 48057
(313) 852-6650

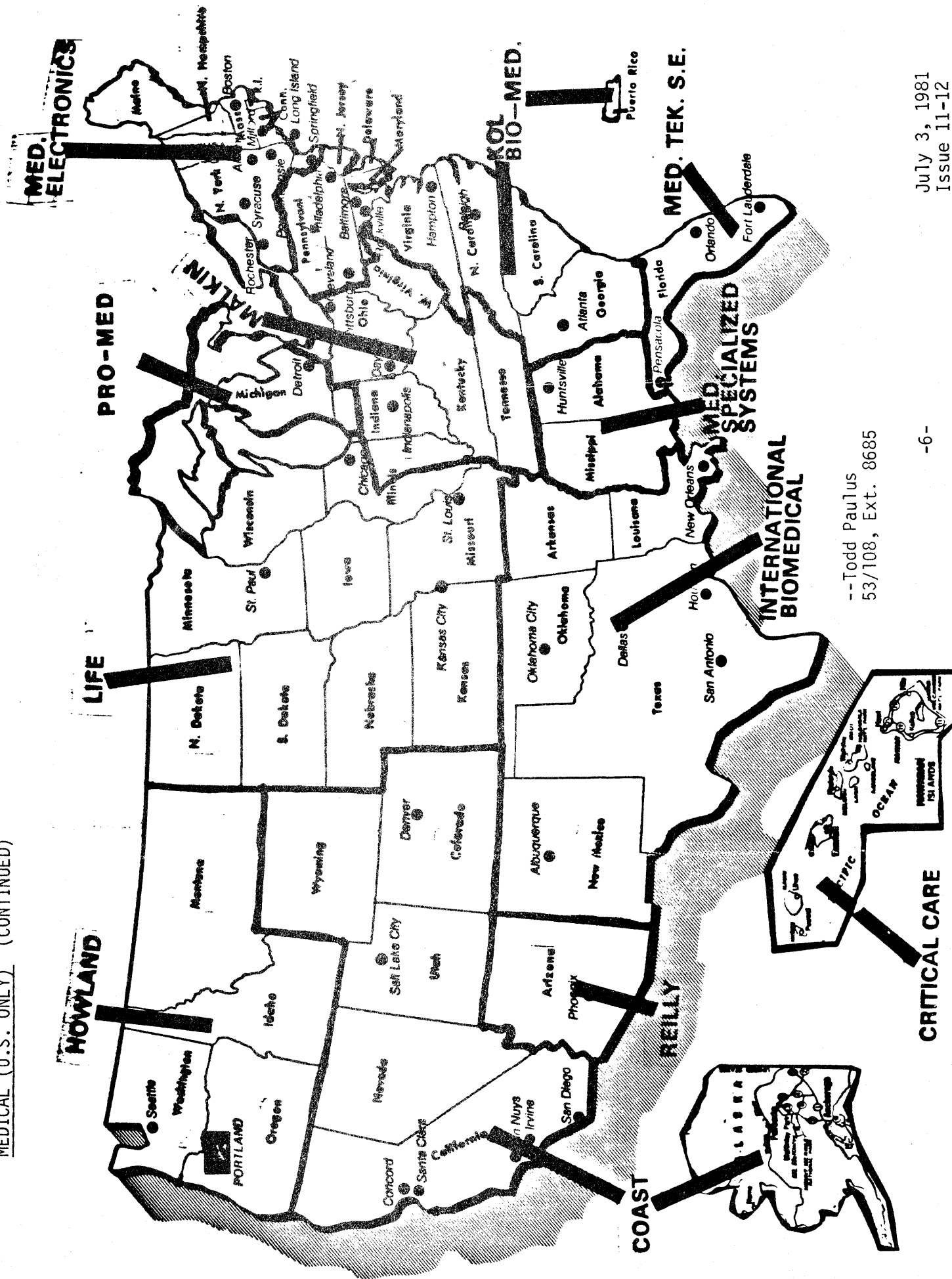
Conrad Chojnacki, President

REILLY MEDICAL SUPPLY
4535 West Van Buren
Phoenix, Arizona 85403
(602) 278-8541

Don Vollette

STERIMED
47 Baywood Road
Rexdale, Toronto
Ontario, Canada M9V 3Y9
(416) 749-6111

Mike Needham, President
Bob Ableman, Vice-President
Rick Green, Sales Manager



--Todd Paulus
53/108, Ext. 8685

REORGANIZATION WITHIN SERVICE ORGANIZATION

Due to the reorganization within the company we have had some changes in the Beaverton Service Organization.

Maintenance Training, managed by Dick Hornicak, is now reporting directly to Stan Kouba, Corporate Service Manager. Dick's group is responsible for providing training for the service organization and customers on all Tektronix products.

Reliability Information Services, formerly Reliability Engineering, managed by Clair Gruver, is now reporting to Bob Wruble, Manager, Service Operations. Clair's group handles product and component failure information from the manufacturing plants and field service. The information is computerized and reports are generated for responsible persons to effect corrective action.

Provisioning Documentation, managed by Don Nordone, is now reporting to Jim Baker, Factory Service Manager. Don's group is responsible for providing parts lists and drawings to support products ordered by major government accounts. They have recently relocated to building 56 with a new delivery station of 56-122. however, all telephone extensions remain the same.

--Sharon Huetson
Editor

TEST EQUIPMENT MAINTENANCE

The Tektronix service reporting system is designed to monitor problems concerning our products. In addition the Service Support groups will assist with any problems concerning serviceability. This leaves one area of test equipment without any focal point on service and servicing problems. That area is the non-Tek Test equipment calibration and servicing.

A recent problem with one non-Tek instrument has suggested that every Service Center could have an unusual problem obtaining quality, professional service from outside calibration labs. The problem could be small or large to you, but if ten other Service Centers have a similar problem, then your concern could actually represent the tip of the iceberg.

To prevent any long-term problems with non-Tek test equipment or unsatisfactory results, send any information concerning the instrument and the problem to Tom Fox, 53/108. I will monitor the problems, regardless of magnitude, and respond to your needs as appropriate.

--Tom Fox
53/108, Ext. 8697

TROUBLESHOOTING SYMPTOMS HANDBOOK - CORRECTION

Regarding the recently published TROUBLESHOOTING SYMPTOMS — RASTER SCAN PRODUCTS, some errors exist in the checksums and update kits for the 4025 and 4027. These errors pertain to the 2.2 standard and 1.7 optional firmware for the 4025 and 1.3 optional firmware for the 4027. A set of corrected pages is available from Training Publications, delivery station 54-031, ext. 8078(MR).

Submitted by--
Dave Nelson
Maintenance Training

Inserted by--
Editor

ADMINISTRATIVE SUPPORT

SERVICE RECORD PROCESSING

The Service Information System Copy, in both In-House and On-Site Service Records, and the Module Exchange Information Copy in the On-Site Service Record are used as source documents for the Service Record Data Base. The importance of these three pieces of paper cannot be over-emphasized.

The Service Record Data Base supplies product and component related failure data to all areas of the company. This data is used not only in correcting problems in existing products, but is also used in the design of future products.

The Service Record Data Base (SRDB) also supplies the data for the Turn-Around Time and Service Activity Reports used throughout the Service Organizations. These reports are becoming increasingly important and directly reflect the quality of data collected in the SRDB.

Data entering some 12,000 service records each AP is at best a tedious task requiring a great deal of interpretative skill. Training and quality of the data entry effort is a function controllable here in Beaverton; quality of the source document is controllable only in the field.

The source document must be accurate and legible. These requirements must be uppermost in the minds of everyone connected with the processing of the Service Record.

Please ensure service records are typed whenever possible. When they must be completed by hand; please use a hard tip (ball point) pen, please write on a hard surface, please press hard and please check the entries for accuracy and legibility.

-- Bill Duerden
56-037 EXT. 8938 MR

LABORATORY INSTRUMENT DIVISION

SAMPLING

1502 WARRANTY EXCEPTION FOR THE SAMPLING BRIDGE AND TUNNEL DIODE

When the sampling bridge and the tunnel diode have failed, it is due to customer abuse. If the instrument is under warranty, the customer should be charged for that portion of the repair. The 1502 manual, P/N 070-1792-01 Revision B, Feb. 1980, informs the customer of this exception to the warranty.

CONNECTING A TEST CABLE TO THE 1502

CAUTION

Do not connect live circuit cables to the input of the 1502. Voltages in excess of 5 V can damage the sampling gate or tunnel diode. If both the sampling bridge and tunnel diodes are destroyed at the same time, an improper use is indicated. If such simultaneous damage occurs, repair charges will be assessed to the customer regardless of the equipment warranty period.

Bleeding of cables before connecting them to the 1502 will remove static charge from them. The 50 Ω termination and BNC adapter supplied may be used to bleed any cable charge.

When testing antennas, be sure that you are not close to transmitters that can be keyed at the antennas receiving frequency. Keying of transmitters in close proximity can cause damage to the 1502.

--Rich Kuhns
53/108, Ext. 8693

5223, DISPLACED DOTS

5000 SERIES

There has been some misunderstanding as to what is good or bad as far as displaced dots on a display. There is no published specification, but here are some guidelines you can follow to determine whether a scope has a problem or not.

More than two adjacent missing dots or more than four missing dots over the entire sweep can be considered excessive. Use of the horizontal expansion to display 10 dots per division and the position control is useful in viewing.

This should tell the technician that some sort of problem exists and the troubleshooting flowcharts in the manual should be used.

--John Eaton
53/108, Ext. 8689

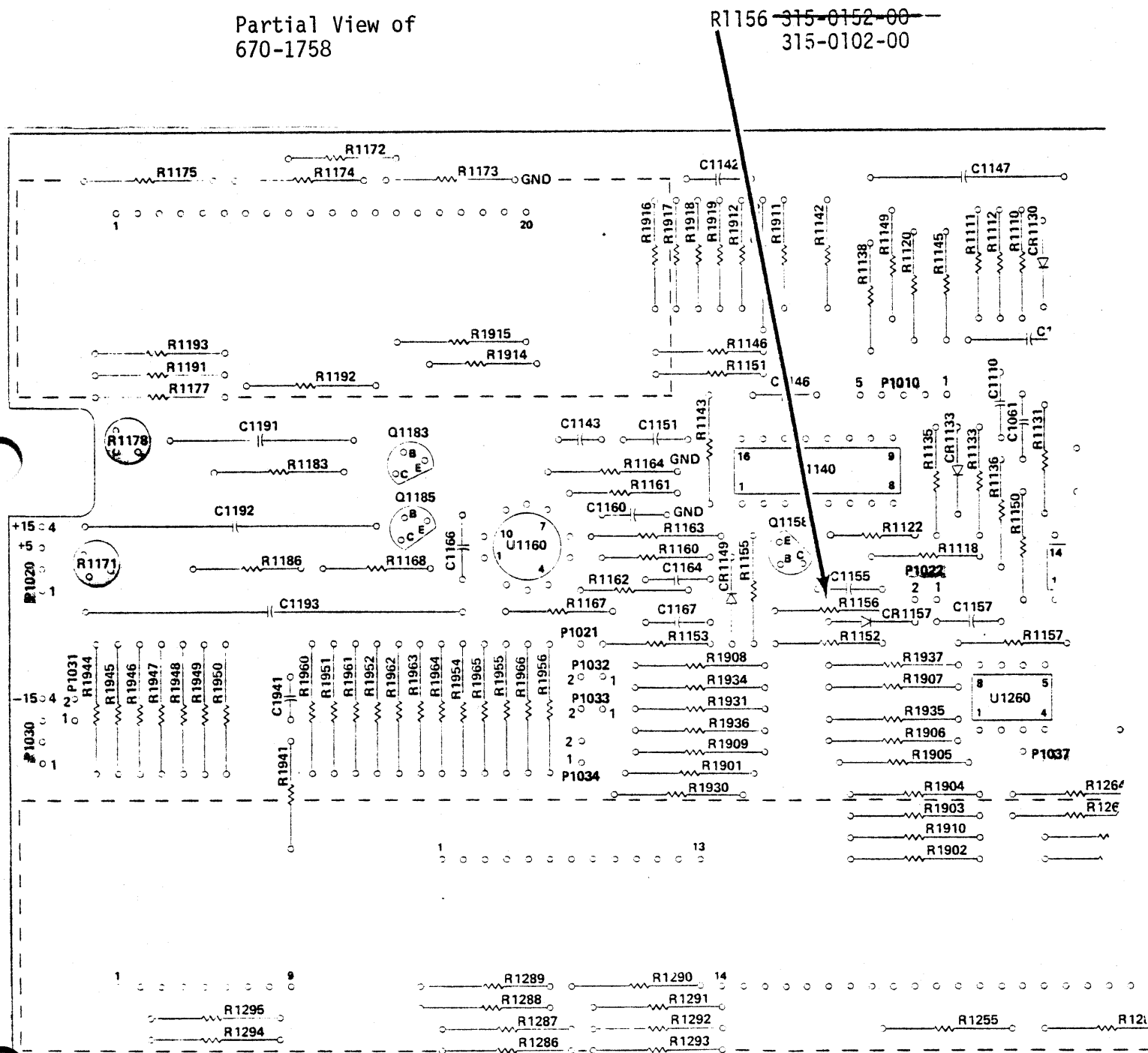
July 3, 1981
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SPECTRUM ANALYZERS

7L12 SWEEP GATE OUTPUT VOLTAGE TOO LOW

The sweep gate output doesn't conform to the 7000 Series interface standard. The output is too low at 2.5V, it should be 3.5V min. The sweep gate Voltage Level was corrected by replacing R1156, a 15K Ω resistor P/N 315-0152-00, with a 1K Ω resistor, P/N 315-0102-00 (see diagram). This mod rolled the part number of the Sweep Dispersion board from 670-1758-04 to 670-1758-05.

Partial View of
670-1758



R1156 ~~315-0152-00 1.5K~~
315-0102-00 1K



-12-

July 3, 1981
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SERVICE INSTRUMENT DIVISION

ACCESSORIES

P6451 CUSHIONING PADS

A new pad (P/N 348-0123-00) has been developed to cushion the circuit board/IC assembly, P/N 670-5025-00. I recommend that all P6451's repaired in a Service Center have these pads added (one on each side of the board). It will insure that the probe can survive a 500 gram Drop Test. This will add protection at a very small cost to the customer, with little to no extra repair time involved.

--Eilene Dickey
53/108, Ext. 8692

40 PIN LOW PROFILE DIP CLIPS

The new 40 pin DIP Clips allow convenient test probe access to dual in-line package (DIP) IC pins where component accessibility is a problem. Each cable assembly consists of a low-profile 40-pin DIP IC clip attached to a length of ribbon cable that is terminated in a standard double-row socket connector.

P/N 015-0339-00 - 300mm (11.8 inches)

P/N 015-0339-02 - 100mm (3.9 inches)

Male and Female square-pin adapters that plug into the double-row socket connectors can also be ordered.

P/N 380-0560-05 - Male

P/N 380-0647-01 - Female

--Eilene Dickey
53/108, Ext. 8692


DATA COMMUNICATIONS ANALYZERS

834 - IMPROVED REFERENCE CLOCK STABILITY

References: 834 Instruction Manual, P/N 070-3399-00
MOD #43604

Affected Serial Numbers: B041430 and below.

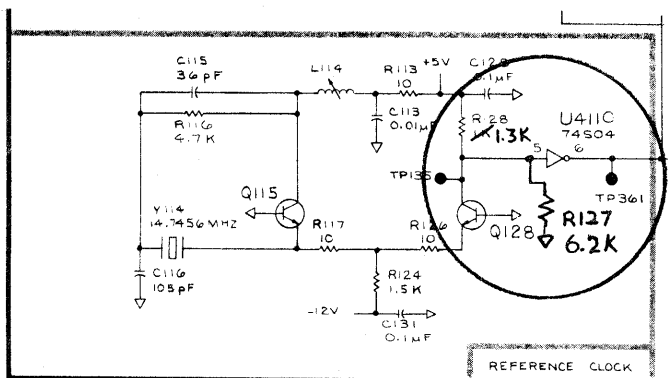
The reference clock circuitry in the 834 has shown signs of temperature instability. This instability causes failures which are indicated by "834 Malfuction" or "Dead CS" being displayed by the 834.

To improve this condition, MOD #43604 was implemented, effective at S/N B041430. This MOD changes R128 on Schematic  from a 1K Ω to a 1.3K Ω (P/N 315-0132-00) resistor and adds a 6.2K Ω (P/N 315-0622-00) resistor from U411C-5 to ground. This change allows the clock circuitry to reach the threshold levels required for U411C to operate most efficiently.

The 6.2K resistor is to be added on the component side of A1 between TP135 and the ground side of C131. Its circuit number will be A1R127. The part number for the A1 CPU board (670-6926-02) will be updated.

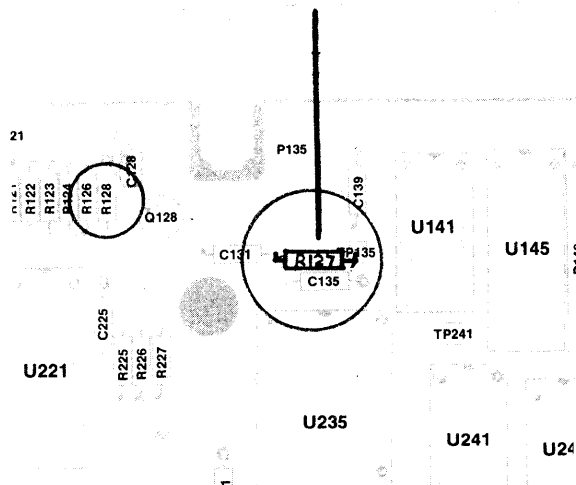
Refer to the following diagrams for schematic changes and parts locations.

Schematic  Grid 6,B



A1 CPU Board Grid 1,B

Install so that "TP135"
is readable.



834 - IMPROVED REFERENCE CLOCK STABILITY (CONTINUED)

There will also be a change in the 14.7 MHZ clock calibration procedure. The 834 instruction manual, page 6-4, steps d. and e. should read:

- d. Using a correct size nonmetallic alignment tool, back the slug (counterclockwise) out of A1L114 until the slug is protruding from the coil form.
- e. Now advance the slug clockwise 1/8 turn past the point where the negative peak has a significant increase in amplitude.

-Pat Wolfram
92-236, Ext. 1582

834 R01 "TRANSFER 30" CAUSING KEYBOARD LOCKUP

Ref: 834 R01 Manual, P/N 070-3534-00

Mod. # 43329

Wizards Workshop 10-17-80 - "Using the 834 Diagnostics".

Affected Serial Numbers: B020562 and Below

When a "Transfer 30" is programmed into an 834 with an R01 (B020562 and below) installed, it will cause the 834 to stop responding to the keyboard.

Mod. #43329 corrects this problem by updating the code in U1, which also changed its part number from 160-0967-02 to 160-0967-03.

To determine which version of U1 that you have in your 834 R01, refer to Wizard Workshop 10-17-80 - "Using the 834 Diagnostics". Put the 834 in the self-test mode, power up, scroll to "List X ROM 1", and press the "start" key. The version of U1 should now be displayed.

If any questions, please call:

--Pat Wolfram
92-236, Ext. 1582

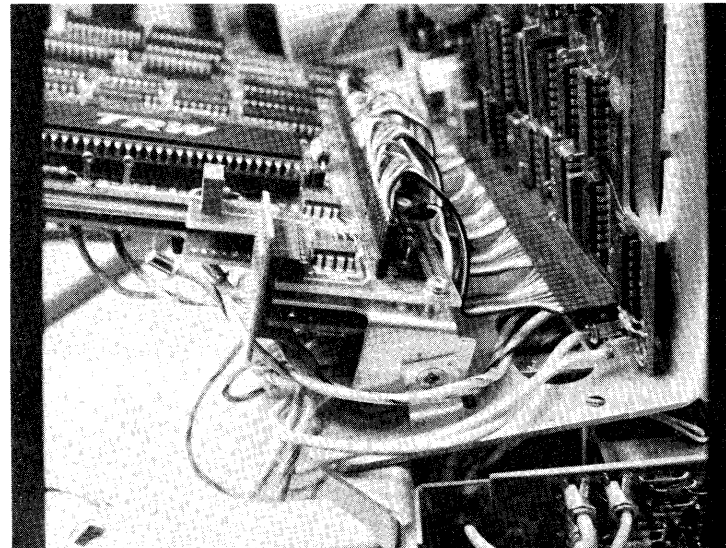
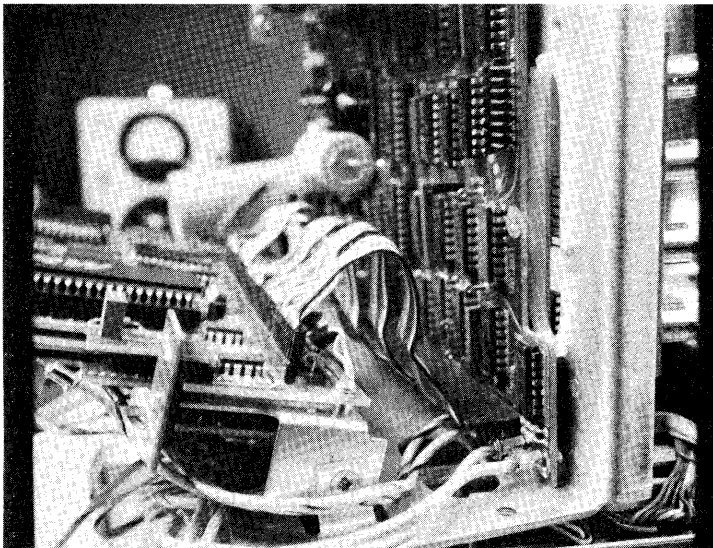
468 BREAKING CABLES

PORTABLES

Reference: A18 Memory Board P237, 246, 257, 266, 276

A19 Time Base Board P105, 115, 125, 135, 145

The field has complained of cables between the Memory Board (A18) and the Time Base Board (A19) breaking after opening the instrument up only a few times. Arranging the cables properly will eliminate this breakage. The pictures illustrate the right and wrong way of cable placement. If the cables correspond to the wrong picture, the cables will last only 3 to 5 openings. With the right placement, the cables will last indefinitely (about 200 plus openings).



--Mike Laurens
53/108, Ext. 8688

2335, 2336 DS900 PART NUMBER CHANGE

Serial Numbers: All

DS900, a green LED, changes from P/N 150-1054-00 (old) to P/N 150-1054-01 (new).
The new LED includes an added connector.

--Mike Laurens
53/108, Ext. 8688

2335, 2336 VERTICAL ABERRATIONS CHANGING 1 TO 2 MINOR DIVISIONS

Reference: M.P.L. Figure 4, Part #4, Spring Clip P/N 131-2661-00

In the 1, 2, and 5 Volt/Div position of the Vertical attenuators, the vertical aberrations may be intermittent, changing 1 to 2 minor divisions. The ground spring clip, P/N 131-2661-00, and it's attaching hardware, a screw and washer, are removed to eliminate these random changes.

--Mike Laurens
53/108, Ext. 8688

INFORMATION DISPLAY DIVISION

4052/4054 VERSION 4.3 FIRMWARE

Version 4.3 firmware is now being shipped in 4052s and 4054s. Listed below are the problems that were corrected to the 4.2 firmware that rolls the firmware level to 4.3.

1. System Error Message Writer

PROBLEM: The System Error Writer routine in the 4054 prints the same data on the screen no matter what the error was or what caused it. The routine works correctly in the 4052.

COMMENT: The system message is very useful in making a determination of a problem that causes "System Errors".

2. Memory Over-Write Problem

PROBLEM: Memory is being over-written. Picture composition Plot 50 software fails sometimes with system errors, line numbers with invalid error messages, or system hangs and line numbers with meaningless characters and a lot of parentheses in them.

3. Memory Compress

PROBLEM: A status bit was being lost during a memory compress.

COMMENT: This memory compress failure was difficult to program around. But if all forced memory compress functions were performed outside of the User Definable Keys, System Errors were usually avoided.

4. 4054 Random Vector on Break-Break

PROBLEM: A vector would be drawn if an immediate halt is forced by break-break while running a program.

5. 4052/54 Hang on Call Header

PROBLEM: The 4052 or 4054 will hang and lockup if header is called when the tape is at file 0 (rewound) or if no tape is present.

6. 4054 Emulating 4014 Inquiry Response

PROBLEM: When in Terminal Mode and prompted with ESC-ESC by the host, the 4054 responds too fast.

7. 4054 12 Bit Graphics in Terminal Mode

PROBLEM: The 4054 in Terminal Mode had graphic capabilities of 10 bit resolution only. This caused distortion in vectors when a host was sending 12 bit graphics.

8. 4054 Opt 30 Hardcopy Bloom

PROBLEM: The 4054 operating system processor advances to the next item for processing if the Opt 30 hand shakes the previous display command. This sequence was supposed to be preceded by a test to determine if the display controller or display is busy.

9. Print @40,31: Does Not Clear CR Count

PROBLEM: The CR count does not continue to decrement as data is pulled from the buffer after the buffer is disabled. It worked as long as the buffer was enabled.

10. Call BLKCHR, Wrong Numbers

PROBLEM: Call BLKCHR will allow 0 thru 127 ASCII to be entered as parameters. However, the functions only use 0 thru 31 ASCII. Call PRLIST displays 0 thru 31 ASCII if 0 thru 31 are entered, or 0 thru 31 ASCII if 32 thru 63 are entered, etc.

COMMENT: 4.3 firmware tests the numbers passed with the CALL, and sets an error code if the values are greater than ASCII 31.

Listed in Figure 1 is a table showing the ROM checksums using the Diagnostic ROM PACK for all firmware levels previously and currently shipped in 4052s and 4054s.

To check system ROM checksums without the patches, remove the even and odd FPLAs -- U485 and U863.

The serial number breaks for level 4.3 firmware are:

4052 -- B024078 and up
4054 -- B011753 and up

The MAS board changes from a 670-6030-04 to a 670-6030-06 with 32K RAM memory and from 672-0799-03 to 672-0799-05 with 64K RAM memory.

The part numbers for version 4.3 kits are:

050-1402-01 to upgrade from 4.1 or 4.2 to 4.3
050-1282-03 to upgrade from 2.1, 3.1, or 3.2 to 4.3

This is not a Service Update Program; customers that are on maintenance agreement, warranty or rental will not be charged for the upgrade. All other customers will be charged as follows:

If the MAS board is exchanged, the upgrade is included in the exchange price. If the customer wants the upgrade, the customer pays the 050 kit price plus labor and travel.

Fig. 1 to complete article is on the following page.

--Darrell McGiverin
63/503, Ext. 3786

IC	PART NUMBER	V2.1			V3.1			V3.2			V4.1			V4.2			V4.3		
		P/N LEVEL	WITH PATCH	WITHOUT PATCH	P/N LEVEL	WITH PATCH	WITHOUT PATCH	P/N LEVEL	WITH PATCH	WITHOUT PATCH	P/N LEVEL	WITH PATCH	WITHOUT PATCH	P/N LEVEL	WITH PATCH	WITHOUT PATCH	P/N LEVEL	WITH PATCH	WITHOUT PATCH
U810	160-0260	01	B883	B883	01	4A4E	B833	01	4A4E	B883	02	5867	2670	02	5867	2670	02	5B67	267D
U820A	160-0261	01	E396	E396	01	E396	E396	01	E396	E396	02	3EAB	3EAB	02	3EAB	3EAB	02	3EAB	3EAB
U820B	160-0261	01	8C00	D684	01	E306	D684	01	E306	D684	02	E708	988E	02	12A0	988E	02	00F1	988E
U825	160-0262	01	A091	1AF1	01	0468	1AF1	01	0468	1AF1	02	D098	88A8	02	D098	88A8	02	7403	88A8
U835	160-0263	01	75A8	00DE	02	E810	D515	02	E810	D515	03	0CA2	9254	03	2780	9254	03	241B	9254
U870A	160-0264	01	C1FA	C1FA	01	C1FA	C1FA	01	C1FA	C1FA	02	7132	7132	02	7132	7132	02	7132	7132
U870B	160-0264	01	1C8B	4383	01	C509	4383	01	C509	4383	02	04C8	4383	02	026A	4383	02	958C	4383
U880	160-0265	01	876A	9E7B	01	928B	9E7B	01	928B	9E7B	02	E7F0	AF39	02	E7F0	AF39	02	3FE5	AF39
U885	160-0266	01	641A	030C	02	1344	593F	02	1344	593F	03	2E15	7369	03	97C6	7369	03	026F	7369
U893	160-0267	01	FABF	FABF	01	0613	FABF	01	0613	FABF	02	CB18	CB18	02	1F38	CB18	02	1F38	CB18
U805A	160-0340	00	1152	XXXX	01	5107	XXXX	03	B9D1	XXXX	02	9407	XXXX	04	98AC	XXXX	05	68D3	XXXX
U805B	160-0340	00	XXXX	XXXX	01	XXXX	XXXX	03	XXXX	XXXX	02	XXXX	XXXX	04	XXXX	XXXX	05	XXXX	XXXX
U897A	160-0341	00	97F7	XXXX	01	B742	XXXX	01	B742	XXXX	02	F080	XXXX	03	C7CD	XXXX	04	4A20	XXXX
U897B	160-0341	00	XXXX	XXXX	01	XXXX	XXXX	01	XXXX	XXXX	02	XXXX	XXXX	03	XXXX	XXXX	04	XXXX	XXXX
U845	160-0379	00	XXXX	XXXX	01	XXXX	XXXX	01	XXXX	XXXX	02	XXXX	XXXX	03	XXXX	XXXX	04	XXXX	XXXX
U863	160-0360	00	XXXX	XXXX	01	XXXX	XXXX	01	XXXX	XXXX	02	XXXX	XXXX	03	XXXX	XXXX	04	XXXX	XXXX

XXXX NOT APPLICABLE

Editor ROMPAK 4052/54 R06	4052/54 Option 10	Printer Interface	(PROM)	Level 1.0
U1 160-0268-00 2D58	U100 160-0342-01	F578	(ROM)	Level 1.0
	U100 160-0342-01	IECA		
SPS ROMPAK #1 4052/54 R07	4042/54 Tapesend Enhancement ROMPAK			
U1 160-0278-00 B6B3	U100 160-0870-00 72FF			Level 1.0
SPS ROMPAK #2 4052/54 R08	4052/54 Diagnostic ROMPAK			
U1 160-0348-00 FF43	U101 160-0381-00			
	U111 160-0382-00 C08A	(ICRC for both)		Level 1.0
Real Time Clock ROMPAK 4052/54 R09	U101 160-0381-01			
U21 160-0762-00 B257	U111 160-0382-01 D4B6	(ICRC for both)		Level 1.4
U21 160-0762-01 968D				
4907 File Manager ROMPAK				
U1 160-0279-00 C5C4				

4662 FRONT PANEL EXTENDER CABLE

There is an extender cable available which can be used on the 4662 front panel for troubleshooting and joystick adjustments.

This extender cable, P/N 198-3848-00, can be ordered through Customer Service or obtained from the 4662 diagnostic test fixture, P/N 067-0831-00. Even though the cable is included in the items supplied with the 4662 diagnostic test fixture, it does not require this cable for any of its procedures. It might be advisable to transfer this cable from the test fixture's contents to the 4662 maintenance kit. This is because the cable is seldom used in conjunction with the diagnostic test fixture, and in contrast, is frequently needed for routine maintenance and calibration.

The extender cable is 12.5 inches long and has 20 pins. If desired, a picture of this cable can be found in the 4662 Diagnostic Test Fixture Manual on page vii, item A.

--Larry North
63-503, ext. 3926 (WI)

LABORATORY INSTRUMENT DIVISION

SEMICONDUCTOR TEST SYSTEMS

SECTOR CARD CHAINING MOD

If the Dbus is connected between all sector cards in the 1803 test table, there can be oscillations during MOVE statements. The 1804 and 1805 test tables have the Ansley jumper cut between connector board #1 and #4. This breaks the connection between sector card #1 and #64 preventing oscillations. Only the new 1803 tables had this modification made during manufacturing.

To check for this modification, ohm between sector card #64, pin 22 Sector card #1, Pin Z. It should be an open circuit.

Once this modification is installed in the table, data may not be parallel chained between sector cards #1 and #64.

If there are any questions, reference Mod #M32876.

--Joe Lipska
92-236, Ext. 1634

S-3200: POGO RING CLEANER

The Pogo Ring (354-0533-01) is manufactured from a plexiglass type lucite also called polystyrene. Clean all socket cards and pogo rings at monthly intervals or more frequently for heavily used socket cards. Use a freon degreaser; for example, Miller Stephenson MS-180 freon TF degreaser. Hold the socket card or pogo ring by the outer circumference and spray the contact areas liberally. Shake or let set on edge to dry. Do not wipe with hands, rags, or brush.

The MS-180 degreaser has Tektronix Part Number 006-1926-00. The same Tek part number would be used for CRC 2002. A freon degreaser supplied by another vendor. These cleaners are ideal for use on connectors throughout the S-3200 System.

--Jim Stubbs
92-236, Ext. 1287

S-3200 TYPE D SOCKET CARD PART NUMBER

The socket card shown in the 1804 Test Station manuals, 070-3331-01, Volume 2, Figure 2 can be ordered by component part numbers. Shown in the manual are five choices of assemblies with part numbers 018-0076-00 through 018-0080-00. If only the circuit board is desired, order Part Number 388-4291-01. The 020-0080-00 undersocket assembly, Figure 2, Index 4, can be also be ordered in an unassembled circuit board. Order Part Number 388-3361-00.

--Joe Lipska
92-236, Ext. 1634

S-3200: 1140 TYPE PROGRAMMABLE POWER SUPPLY, INTERMITTENTS

Reference Mod Number M34065

Intermittent problems occur in the 1140 Programmable Power Supplies due to socket and relay connectors. Reduction of these intermittents is possible when sockets and connectors are removed. Changing the plug-in relays to solder-in types will provide more reliable circuit operation.

"CAUTION"

Factory installation is highly recommended for this reliability improvement. Circuit board updates should be referred to the factory. Major rework is required for this update.

Circuit boards with soldered-in components require new replaceable parts. Sockets and spring clips have been removed and new reed relays are required. The following reed relay changes should be noted in the 1140A Programmable Power Supply Manual, 070-3108-00 and the 1140A 651F Manual, 070-3281-00. This will provide quick reference for replaceable parts.

148-0072-01 Reed Relay is replaced by 148-0125-00 solder-in type Reed Relay.

148-0041-01 Reed Relay is replaced by 148-0123-00 solder-in type Reed Relay.

The following circuit board part number changes must be observed when replacement circuit boards are installed.

The Programmable Current Limit Assembly, 670-1848-04, is a direct replacement for 670-1848-02.

The Programmable Current Limit Assembly, 670-1848-05, is a direct replacement for 670-1848-03.

The Auxiliary Program Assembly, 670-1294-02, is a direct replacement for 670-1294-01.

The Current Supply Amplifier Assembly, 670-1295-03, is a direct replacement for 670-1295-02.

The Current Supply Program Board, 670-1297-02, is a direct replacement for 670-1297-01.

The Auxiliary Program Assembly, 670-5831-01, is a direct replacement for 670-5831-00.

The circuit boards listed above are part of the 1140A, 1140A 651F, 1141, 1140A-03, and 1140A-04 Power Supplies. Programmable Instrument circuit boards should be inventoried for proper replacements prior to ordering new or spare circuit boards.

Submitted by: Dick Sherrard, Production Engineering.

--Ron Lang
92-236, Ext. 1015

DESCRIPTION

SECTION 3 ADJUSTMENT PROCEDURE

Page 3-49 through 3-56, Steps 5 and 6

REPLACE with the following:

5. Calibrate the 1st LO System and Center Frequency Control

An alternate procedure for the 492P is provided using program control. Before proceeding with this step, check sweep timing and amplitude accuracy.

a. Adjust Coarse Tuning Range

1) Test equipment setup is shown in Fig. 3-30. Set the front-panel controls as follows:

FREQUENCY RANGE 0—4.2 GHz (0—1.8 GHz Option 01 and activate EXTERNAL MIXER). If the 492/492P has Option 01 and Option 08 (External Mixer deleted), switch POWER off, remove Preselector Driver board, switch POWER on and select band 1

FREQ SPAN/DIV 200 MHz
TIME/DIV MNL
Triggering FREE RUN
MANUAL SCAN Midrange

2) Connect the digital voltmeter (DVM), set to the 20 V range, between TP1058 of the 1st LO Driver and chassis ground (Fig. 3-31), so the voltage at the test point can be monitored. Adjust FREQUENCY for a readout of 0 MHz as the FREQ SPAN/DIV is reduced to 5 MHz. Note the DVM reading.

3) Tune the FREQUENCY for a readout of 4.278 GHz (switch FREQ SPAN/DIV to 200 MHz to facilitate tuning, then reduce to 5 MHz.

4) Note the DVM setting.

5) If the differential between 0 MHz and 4.278 GHz is not 20.00 V, adjust Coarse Tune Range R1032 on the Center Frequency Control board (Fig. 3-31) until the voltage difference between the two frequency points is 20.00 V.

b. Calibrate 10 V Supply

1) Connect the DVM to TP1059, on the 1st LO Driver (Fig. 3-31A).

2) Adjust R1034 (Fig. 3-31A) for -10.00 V.

c. Adjust Sweep Offset

1) Connect a shorting strap from TP1035, on the Span Attenuator board, to chassis ground (Fig. 3-31). Monitor the voltage on TP1073 (Fig. 3-31) with the DVM.

2) Adjust Sweep Offset R1063 for 0.00 V.

3) Remove shorting strap and switch EXTERNAL MIXER off. If the Preselector Driver board was removed turn POWER off and replace the board. Turn POWER on.

d. Calibrate Frequency Span to Center Frequency Readout (This is followed by an alternate procedure for 492P only instruments.)

1) Apply the Calibrator output to the RF INPUT. Set the FREQ SPAN/DIV to 100 MHz, activate FREQUENCY CAL, then set the readout calibration at the center of the CAL range (range is about ± 15 MHz). Deactivate the FREQUENCY CAL function.

2) Initialize the front panel control settings by switching POWER off, then on. Set the FREQ SPAN/DIV to 200 MHz, TIME/DIV to AUTO, and REFERENCE LEVEL to -30 dBm (MIN RF ATTEN at 0 dB).

DESCRIPTION

3) Adjust the FREQUENCY to tune the 18th marker of the Calibrator signal to the center of the screen, then reduce the FREQ SPAN/DIV to 2 MHz, activate DEGAUSS, and set the FREQUENCY readout to 1.800 GHz.

4) Adjust the 1st LO Offset R1032 (Fig. 3-31) on the 1st LO Driver board to center the 1.8 GHz marker.

5) Tune the FREQUENCY for a readout of 100 MHz (switch the SPAN/DIV to a higher setting to facilitate tuning, then back to 2 MHz). Degauss by pressing DEGAUSS.

6) Adjust 1st LO Sensitivity R1031 (Fig. 3-31) on the 1st LO Driver board to center the 100 MHz marker.

7) Repeat these steps to correct for any interaction.

ALTERNATE PROCEDURE TO CALIBRATE FREQUENCY SPAN TO CENTER FREQUENCY READOUT, FOR 492P INSTRUMENTS

Instructions for the 4050 program are given in parentheses.

1. Send

```
"INIT;REF - 20;SPAN 2M;SIG"
"FREQ 100M;DEG;SIG;WAIT;FREQ 1.8G;DEG;-
SIG;WAIT; REP 1200"
```

This will give an adjustment sequence for about two minutes. If necessary, re-send the command to complete the adjustment.

(Press USER key 3 to start the sequence and press the BREAK key to stop.)

2. If the adjustments are fairly close, two signals will appear on screen on alternate sweeps: a large and a small signal. The small signal is 1.8 GHz, the large at 100 MHz. Proceed with the following adjustments:

a. Adjust the 1st LO Offset R1032 on the 1st LO Driver board, to bring the two signals to the same horizontal position. If one or no signals appear on screen, adjust R1031 until a signal comes on screen. Then adjust R1032 (1st LO Offset) until the second signal appears while alternately adjusting the 1st LO Sense R1031 to keep the first signal on screen;

b. Adjust 1st LO Sense R1031, on the 1st LO Driver board, to align the two signals with the vertical centerline of the graticule.

e. Adjust 1st LO Sweep (Applicable to both 492 and 492P instruments)

1) With the Calibrator output applied to the RF INPUT, set the FREQ SPAN/DIV to 100 MHz and tune the FREQUENCY to about 500 MHz.

2) Adjust Tune Coil Swp R1065 (Fig. 3-31) on the Span Attenuator board so the 100 MHz harmonics of the Calibrator are spaced at one division intervals over the center eight divisions of the graticule. Adjust the FREQUENCY as necessary to align the markers.

3) Remove the Calibrator signal.

4) Set the FREQ SPAN/DIV to 2 MHz, REF LEVEL to +10 dBm, FREQUENCY about 15 MHz, then apply 0.5 μ s markers from a time-mark generator to the RF INPUT.

5) Adjust the 1st LO FM Coil Swp R1071 (Fig. 3-31) for 1 marker/division over the center eight divisions of the display.

f. Adjust 2nd LO Sweep

1) Set the front panel controls as follows:

FREQUENCY RANGE	5.4—18 GHz (Band 4)
FREQUENCY	6.0 GHz
FREQ SPAN/DIV	20 MHz
AUTO RESOLUTION	Activated
Vertical Display	10 dB/DIV
REF LEVEL	-10 dBm
MIN RF ATTEN	20 dB

2) Connect the comb generator to the RF INPUT and apply 10 μ s markers from the time-mark generator to the FM Input of the comb generator. Adjust PEAKING (Option 1 instruments) to maximize the amplitude of the comb markers.

DESCRIPTION

NOTE

If a signal cannot be located at 6.0 GHz with Option 1 instruments, check preselector tracking, step 18.

3) Adjust REF LEVEL and FREQUENCY to display and center the 6.0 GHz comb line, then reduce FREQ SPAN/DIV progressively to 100 kHz while keeping the 6.0 GHz signal centered on the display.

4) Adjust the 2nd LO Swp, R1067, (Fig. 3-31) on the Span Attenuator circuit board, so the two comb lines near the graticule edges are 8 divisions (800 kHz) apart.

5) Disconnect and remove the comb generator and time-mark generator from the RF INPUT. Return the FREQUENCY RANGE to band 1.

6. Check 2nd LO Frequency and Adjust Tune Range

The procedure applies to both versions of the 2nd LO. An alternate procedure is also described for use with the programmable 492P over the GPIB bus.

a. Check the 2nd LO frequency as follows:

1) Set the FREQUENCY RANGE to band 1 and FREQ SPAN/DIV to MAX.

2) Connect a microwave frequency counter, such as Hewlett Packard 5342A, with a sensitivity of -20 dBm or better, to the 2nd LO Output connector.

3) Measure the 2nd LO frequency. Frequency should be $2182 \text{ MHz} \pm 1.0 \text{ MHz}$. If the frequency is not within this limit proceed as follows: Instruments that have the 2182 MHz Phaselocked 2nd LO (B040000 and up) refer to the Maintenance section for repair. If your instrument has the Cavity 2nd LO (B039999 and below) proceed with the following adjustments.

a) Using a 5/16 inch open-end wrench and a 5/64 inch Allen wrench, loosen the lock nut and adjust the Fine Tune slug in the cavity (Fig. 3-32B) for a counter reading of 2182.0 MHz.

CAUTION

Do not adjust the two slotted slugs. These are Varactor diode mounts.

b) Tighten the lock nut and recheck the oscillator frequency. If correct disconnect the counter and proceed with part b.

b. Adjust tuning range of the 2nd LO as follows:

1) On the Center Frequency Control circuit board, center the Fine Tune Range, R4040, and the Fine Tune Sensitivity, R3040, adjustments (see Fig. 3-33).

2) Set the FREQUENCY to 5 MHz, FREQ SPAN/DIV to 100 kHz, REF LEVEL to +10 dBm and MIN RF ATTEN to 10 dB. Apply 2 μ s markers from a time-mark generator to the RF INPUT.

3) Adjust the FREQUENCY to position a frequency marker 2.5 major divisions right of center then reduce the FREQ SPAN/DIV to 50 kHz. Markers should now appear at the graticule edge.

4) Turn the FREQUENCY control counterclockwise until the 2nd LO reaches the end of its tuning range (markers stop moving).

5) Note the position of the marker signal. If the instrument has digital storage, activate SAVE A to save the marker reference position.

6) Turn the FREQUENCY control clockwise and count the markers as they cross the reference signal location until the end of the tuning range is reached. The 9th marker should now be on screen close to the reference point. Note its position with respect to the reference established in part 5.

7) If the 9th marker is more than one major division from the reference, adjust Fine Tune Range R4040 so as to reduce this distance by one half.

8) The 492P, if used with an external controller, requires adjustment of the Fine Tune Sensitivity R3040. A controller is required to make this adjustment. See Alternate Procedure for 492P, otherwise R3040 should remain centered.

DESCRIPTION

c. Adjust Identify Offset as follows:

- 1) Apply 1 μ s markers to the RF INPUT and set the FREQ SPAN/DIV to 500 kHz;
- 2) Tune the FREQUENCY to 5 MHz then center one of the 1 μ s markers on screen.
- 3) Activate the IDENTIFY 500 kHz/ONLY mode;
- 4) Adjust Coarse Tune Sensitivity R1042 (Fig. 3-33) on the Center Frequency Control board so that, on alternate sweeps, the signals align horizontally with each other.

ALTERNATE PROCEDURE FOR 492P

NOTE

Instructions in parentheses refer to the 4040-Series program as listed at the end of step 7 (Adjust 1st Converter Bias). At the end of any programmed procedure press the RETURN TO LOCAL button.

a. Adjust the 1st LO Tune Sensitivity as follows:

- 1) Set the MIN RF ATTEN to 30 dB and apply 1 μ s markers to the RF INPUT from the time mark generator. Set the FREQ SPAN/DIV to 500 kHz and adjust FREQUENCY to center the 10 MHz marker on screen.
- 2) Send: 'INIT;FREQ 10M;SPAN 100k' to the 492P over the GPIB bus.
- 3) Adjust the FREQUENCY control to center the marker on screen, then send: 'TUNE 5M; SIG; WAIT;TUNE -5M;SIG;WAIT;RPT 1200'. This will repeat the adjustment sequence for about two minutes. Send the instruction again if necessary to complete the adjustment.

(Press USER DEFINABLE KEY #4 to start the sequence and press BREAK to stop the sequence.)

b. Adjust the Coarse Tune Sensitivity R1042 until the harmonics of alternate sweep are at the same horizontal position in the display as the regular sweep. It is not important where they are in the display, just so they are at the same horizontal location.

c. Adjust the 2nd LO range as follows:

- 1) Tune the FREQUENCY to about 10 MHz and center one of the 1 μ s markers on screen.
- 2) Decrease the FREQ SPAN/DIV to 50 kHz keeping the marker centered on screen with the FREQUENCY control.
- 3) Send: "TUNE 2M;SIG;WAIT;TUNE - 2M; SIG; WAIT; REP1200". This will repeat the adjustment sequence for about two minutes. Repeat the command if necessary.

(Press USER DEFINABLE KEY #5 to start the sequence and BREAK to stop the sequence.)

d. Adjust Fine Tune Range, R4040, until the displayed signals for alternate sweeps align horizontally with those on the initial sweep.

e. Adjust the 2nd LO Tune Sensitivity as follows:

- 1) Apply 0.5 ms markers to the RF INPUT, change the FREQ SPAN/DIV to 1 MHz, and tune FREQUENCY to about 0 MHz. Decrease the FREQ SPAN/DIV to 5 kHz and tune the zero spur to the left side of the display. Decrease the FREQ SPAN/DIV to 500 Hz;
- 2) Send: "TUNE 2K;SIG;WAIT;TUNE -2K; SIG; WAIT; REP 150". This will repeat the adjustment sequence for five minutes. Repeat the command if necessary.

(Press USER DEFINABLE KEY #6 to start the sequence and press BREAK to stop the sequence.)

- 3) Adjust Fine Tune Sensitivity R3040 until the harmonics displayed in alternate sweep have the same horizontal location as the even sweep. Note: This may take some time because of the long sweep time and drift.

DESCRIPTION

PROGRAM TO FACILITATE CALIBRATING THE 1st LO DRIVER AND THE CENTER FREQUENCY CONTROL BOARDS OF THE 492P, USING TEKTRONIX 4050-SERIES COMPUTER TERMINAL

```

1  ON SRQ THEN 700
2  GO TO 700
4  ON SRQ THEN 100
5  GO TO 210
8  ON SRQ THEN 100
9  GO TO 230
12 ON SRQ THEN 100
13 GO TO 300
16 ON SRQ THEN 100
17 GO TO 400
20 ON SRQ THEN 100
21 GO TO 500
24 ON SRQ THEN 100
25 GO TO 600
100 REM *** ERROR HANDLING ROUTINE ***
110 POLL Z8,Z9;A9
120 PRINT @A9:"ERR?"
130 INPUT @A9:Z$
140 PRINT @Z$
150 RETURN
200 REM *** ADJUST COARSE TUNE RANGE R1032 CEN FRE CONTROL BRD ***
210 PRINT @A9:"FRE 0"
220 RETURN
230 PRINT @A9:"FRE 4278M"
240 RETURN
300 REM *** ADJUST 1ST LO SENSE (GAIN) AND OFFSET ***
310 PRINT @A9:"FRE 100M;DEG;SIG;WAI"
320 PRINT @A9:"FRE 1.8G;DEG;SIG;WAI"
330 GO TO 310
400 REM *** ADJUST COARSE TUNE SENSITIVITY R1042 CEN FRE CON BRD ***
410 PRINT @A9:"TUN 5M;SIG;WAI"
420 PRINT @A9:"TUN -5M;SIG;WAI"
430 GO TO 410
500 REM *** ADJUST FINE TUNE RANGE R4040 CEN FRE CON BRD ***
510 PRINT @A9:"TUN 2M;SIG;WAI"
520 PRINT @A9:"TUN -2M;SIG;WAI"
530 GO TO 510
600 REM *** ADJUST FINE TUNE SENSITIVITY R3040 CEN FRE CON BRD ***
610 PRINT @A9:"TUN 2K;SIG;WAI"
620 PRINT @A9:"TUN -2K;SIG;WAI"
630 GO TO 610
700 REM *** START UP PROCEDURE ***
710 PAGE
720 PRINT @:"ENTER THE 492P'S GPIB PRIMARY ADDRESS";
730 INPUT A9
740 POLL Z8,Z9;A9
750 RETURN

```

DESCRIPTION

SECTION 5 THEORY OF OPERATION

Page 5-10 Following Cavity 2nd Local Oscillator, add the following:

2182 MHz PHASELOCKED 2ND LO

38A & 38B

General Description

The 2182 MHz Phaselocked 2nd LO assembly contains a tunable microwave oscillator, frequency reference circuitry, and phaselock circuitry, within a two-section housing. Microwave circuitry is packaged within the machined aluminum portion of the housing. Low frequency phaselock circuitry is within the mu-metal compartment.

In the microwave or LO portion of the assembly, the 2182 MHz Microstrip Oscillator generates 2182 MHz for the 2nd converters and the 2nd LO internal reference circuitry. The 2200 MHz Reference circuit receives a 100 MHz drive signal from the 3rd converter crystal oscillator and produces 100 MHz harmonics. The 22nd harmonic or 2200 MHz is mixed with 2182 MHz from the microstrip oscillator in the 2200 MHz Reference Mixer circuit. The difference frequency of 18 MHz is then fed to the phaselock side of the module.

A phase/frequency detector, on the 14-22 MHz Phaselock circuit board, compares the 18 MHz difference frequency with a signal from a linearized tuning 18 MHz voltage controlled oscillator. The detector output tunes the 2182 MHz Microstrip Oscillator such that the difference frequency exactly matches the frequency of the 18 MHz reference VCO.

Sweep and tune signals from the Span attenuator and Center Frequency Control circuits, tune the 18 MHz VCO. The output voltage from the phase/frequency detector forces the Microstrip Oscillator to tune the same amount.

2182 MICROSTRIP OSCILLATOR 38B

This oscillator consists of a printed 1/2 wavelength resonator driven by a common-emitter feedback amplifier (Q1021). The base of Q1021 is capacitively tapped into the resonator. The resonator serves as a tuned phase inverter and impedance transformer, connected between the base and collector of Q1021. Part of the base feedback capacitance is provided by a bendable tab (C1021). This allows fine adjustment of the total feedback. This feedback RF signal is detected, by the base-emitter junction of Q1021, to produce a change in bias voltage that is related to the amount of feedback. The base voltage can be monitored at TP1015 with a high impedance voltmeter without significantly disturbing the oscillator.

The dc collector voltage and current for Q1021 is regulated by an active feedback circuit containing transistor Q2021. Voltage at the junction of R2023 and L2023 is a function of Q1021 collector current. This voltage is sensed by Q2021 which alters the base current to Q1021 thereby regulating the collector current and maintaining +10V dc on the resonator. Decoupling and control of bias loop dynamics are provided by C2104. R2016 swamps the negative base resistance of Q1021 to provide stabilization. R2015 protects the base-emitter junction of Q1021 from excessive reverse bias in the event the +12 volt supply fails.

The oscillator is tuned by varactor diode (CR1028) connected to one end of the resonator. Decoupling for the varactor is provided by the low-pass elements in the tune line. Bendable tab C1022 can be used to fine tune the oscillator center frequency.

Three output taps are coupled to the resonator through printed capacitors under the resonator. One output supplies 2182 MHz through a 6 dB attenuator to the Harmonic Mixer in the 829 MHz 2nd Converter. The other two output taps couple LO power through 6 dB attenuators to buffer amplifiers (Q1031 and Q1011). The amplifiers provide about +10 dBm to the 2072 MHz 2nd Converter and +8 dBm to the Reference Mixer.

Since the two buffers are nearly identical, only the 2nd Converter buffer is described. Gain is provided by a single common-emitter transistor (Q1011). Printed elements provide input and output impedance matching. Out-of-band damping is provided by R1011 in series with a 1/4 wavelength shorted stub. Dc is blocked by C1014 and C1011. A 1/4 wavelength open stub is used at the output to reflect one of the 2nd Converters's image frequencies at 4254 MHz (the other buffer does not use nor need this stub). Collector bias for Q1011 is provided through R1012, L1011, the 1/4 wavelength shorted stub, and R1011. The 1/4 wavelength shorted stub is grounded through C2011. (C2011, C1013, and L1011 are also used for decoupling.) Collector voltage is determined by divider R1013 and R2013; this controls the dc feedback to the collector-base junction of Q1011. The bias network is decoupled from the RF path by L1014. CR2013 protects the base of Q1011 from excessive reverse bias if the +12 volt supply fails.

DESCRIPTION

2200 MHz Reference Board 38B

This circuit generates harmonics of the 100 MHz input. The 22nd harmonic or 2200 MHz is used by the Reference Mixer. The input 100 MHz signal is applied through a matching network (consisting of L1034, L1025, C1036, C1029, and C1025) to a differential amplifier (Q1024 and Q2024). The emitters of this amplifier are ac coupled through C2026, reducing low frequency gain and ensuring balanced operation. A snap-off diode (CR2014) is driven by the amplifier, via transformer T2015, to generate multiple harmonics of the 100 MHz signal including the 2200 MHz reference. The output passes through a 3 dB attenuator, for isolation, to the Reference Mixer circuit.

2200 MHz Reference Mixer 38B

Signals from the 2200 MHz Reference circuit are filtered by a printed 2200 MHz bandpass filter. Diodes CR1011 and CR1012 are the switching elements of a single-balanced mixer. The microstrip oscillator output is applied to CR1011 and through a 1/2 wavelength delay line to CR1012. The delay line shifts the oscillator signal 180 degrees so both diodes switch together. Mixing the 2200 MHz with the oscillator 2182 MHz signal, produces the difference frequency of 18 MHz. This 18 MHz signal is fed through a 37 MHz lowpass filter to the 14 to 22 MHz phaselock circuit. The lowpass filter prevents unwanted products, such as 82 MHz (product of 2100 MHz and 2182 MHz), from passing into the phaselock circuit.

14-22 MHz Phaselock Board 38A

This board contains regulated power supplies, a 14-22 MHz (18 MHz nominal) voltage controlled oscillator with linearizing circuitry, and a phase/frequency detector circuit. Its main function is control of the 2182 MHz Microstrip Oscillator. The entire circuit board is housed in a magnetic shield to reduce spurious effects of external ac fields. All power supply and control inputs enter the circuit board via feedthrough capacitors, C220-C227, in the housing wall. All connections with the microwave circuitry are through feedthrough capacitors, C2200-C2204, in the floor of the housing.

The +15V, -15V, and +9V inputs supply power to operational amplifier type regulators which produce +12V, -12V, and +5.2V outputs respectively. A zener diode (VR2021) serves as a stable -6.2V reference for U2014B which regulates the -12V supply through emitter-follower Q2021. The -12V supply in turn, provides bias current for VR2021. Diodes CR2015 and CR2018 protect the operational amplifier output and Q2021 during supply shutdown. Inverting amplifiers U2014A/Q1012 and U1015/Q1022 use the -12V supply as a reference to produce the +12V and +5.2V supplies respectively.

2nd LO sweep and tune inputs are summed by differential amplifier U2063. Ground potential of the Span Attenuator circuit is sensed through R2057 and subtracted from the sweep signal to reduce effects of ground potential variations. Provision is made for sensing the ground potential of the Center Frequency Control circuit board through R2059; however, the present interface requires that the Fine Tune ground input be grounded to the 2nd LO assembly through W2059. Sweep and tune sensitivities are set by selectable resistor R2063.

The combined sweep and tune signals, at the output of U2063, are applied to a non-linear shaping circuit, the gain of which varies as a function of input signal voltage. Output voltage from the shaper circuit controls the bias of varactor diode CR1075. This bias tunes the 14-22 MHz oscillator. Non-linear tuning characteristics of the oscillator are compensated by reciprocal non-linearity in the shaper. As the input voltage to non-inverting amplifier U1062B becomes more positive, it successively exceeds the tap-point voltages of a series of positive voltage dividers. Diodes in U2051, connected to the divider tap points, are successively forward biased to add increasing shunt conductance to the amplifiers's feedback path. Feedback progressively decreases and forward gain of the amplifier increases with positive excursions. A similar amplifier, U1062A, uses negative voltage dividers and the diodes in U1051 to increase the gain progressively with negative voltage excursions. Outputs of the two amplifiers are summed at R1068, which is selected to match the gain shaping requirements of the 14-22 MHz oscillator. One of the varactor bias resistors, R1070, is also selected as part of the linearity adjustment.

The 14-22 MHz Oscillator consists of a differential amplifier with transformer feedback. The emitters of the amplifier transistors Q2073 and Q2078 are ac coupled through C2077. T1077 serves as the amplifier feedback path and also as part of the oscillator resonator. Tuning varactor CR1075 provides virtually all of the resonator capacitance to allow a wide tuning range. T1077 and T1075 constitute the resonator inductance which may be selected by using different tap combinations to interconnect the two coils. Resonator inductance is adjusted to center the oscillator's tune range near 18 MHz, R2076 and R2079 enhance the amplifier high frequency stability.

A discrete two-stage amplifier provides an unsaturated voltage gain of approximately 43 dB for the difference frequency signal from the 2200 MHz Reference Mixer. The output of Q1036 drives a differential amplifier consisting of Q1037 and Q1038. The differential stage limits the output swing to ECL compatible levels. dc bias for the amplifier is provided by Q1036, which has dc collector-base feedback via voltage divider R1039 and R1041. ECL line receivers, U2036D and U2036B, buffer signals from the discrete amplifier and the 14-22 MHz oscillator respectively. Output signals from these amplifiers are applied to the phase/frequency detector for comparison.

DESCRIPTION

A pair of ECL D-type flip-flops (U2027A, U2027B) comprise the phase/frequency detector. The flip-flop outputs are wired and connected to the input of U2036C which serves as a common reset. The clock input to U2027B is the 14-22 MHz VCO signal, and the clock input to U2027A is the amplified difference signal from the Reference Mixer. If the two clock signals are of identical phase and frequency, both flip-flop sections set then reset together. If the phase of the Reference Mixer signal leads the 14-22 MHz signal, U2027A will remain set longer than U2027B. If the signal lags, U2027B will set first and remain set longer. The signal that leads in phase or has the higher frequency will cause the associated flip-flop to remain set a higher percentage of the time. The average differential output voltage of the two flip flops therefore indicates whether the Reference Mixer signal leads, lags, or differs in frequency from the 14-22 MHz VCO reference. Output of the detector is filtered by an RC lowpass filter, then applied to differential amplifier U1028 which tunes the 2182 MHz oscillator.

The phaselock circuit adjusts the Microstrip Oscillator frequency such that the Reference Mixer output always matches the frequency of the 14-22 MHz VCO. The Microstrip Oscillator is therefore locked to a frequency equal to that of the 2200 MHz reference minus that of the 14-22 MHz VCO. If the 14-22 MHz Oscillator is swept or tuned, the Microstrip Oscillator sweeps and tunes an equal amount. Within the control bandwidth of the lock loop, the Microstrip Oscillator FM noise is reduced to that of the reference circuitry. R1024, C10256, and R1025, C1023 control the phaselock loop bandwidth. Unity gain for the phaselock loop occurs near 200 kHz with a gain slope of -6 dB/octave. The gain slope breaks to -12 dB/octave for frequencies below 16 kHz. R1030 and R1031 divide and offset the output of U1028 so the Microstrip oscillator tune voltage ranges between 0 and -12.5 volts.

--Rich Kuhns
53/108, Ext. 8693

Date: 5-28-81Change Reference: C4/581Product: 2335 OSCILLOSCOPE

SERVICE

Manual Part No.: 070-4116-00**DESCRIPTION**

EFFECTIVE ALL SN

TEXT CHANGES

Page 1-3 Chop Frequency Performance Requirement

CHANGE TO: 275 kHz \pm 30%.

Page 3-9 Left column, third paragraph, 5th line

CHANGE TO:

...switched at the end of each trace. For CHOP Vertical Mode, the diode gates are switched at a rate of about 275 kHz. See the "Vertical...

Page 4-6

CHANGE TO:

Step 3, part d:

d. CHECK--Period of one cycle is 2.8 to 5.2 μ s (approximately 4 horizontal divisions).

Step 4, part d:

d. CHECK--Trace shift is 0.4 division or less when switching between normal (button out) and invert (button in).

Step 5, part d:

d. CHECK--For 0.2 division or less trace shift from the center horizontal graticule line.

Step 6, part d:

d. CHECK--For 0.2 division or less trace shift from the center horizontal graticule line.

Page 4-9

Step 16, part b.

CHANGE TO:

b. Connect a 100-kHz-fast-rise, positive-going, square-wave signal via a 50- Ω cable, a 10X attenuator, and a 50- Ω termination to the CH 2 OR Y input connector. Set the generator output for a 5-division vertical display. _

DESCRIPTION

REPLACE: Step 16, parts f, g, and h with the following new parts
f through j:

f. Disconnect the test signal from the CH 2 OR Y input connector. Re-connect the 10X attenuator (if previously removed) and reduce the generator amplitude to minimum.

g. Set VERTICAL MODE to CH 1 and connect the test signal to the CH 1 OR X input connector. Set the generator output amplitude for a 5-division vertical display.

h. Vertically center the display using the CH 1 POSITION control.

i. CHECK--Repeat parts d and e for CH 1.

j. Disconnect the test setup.

Page 4-10 Step 20, part d.

CHANGE TO: d. CHECK--Start of sweep is within ± 1 vertical division of the center horizontal graticule line.

Page 4-10 Step 21, part b, second line

CHANGE TO: ...to the A EXT input connector via a 50- Ω cable, a 10X...

Page 4-11 Step 22, part c, line 2

CHANGE TO: ...the generator output for a signal display of 2 vertical...

Page 4-11 Step 22, part d, line 2

CHANGE TO: ...off is less than 20% (1.6 to 2.4 divisions) while holding...

Page 4-11, Step 23, part b.

CHANGE TO:

b. Connect a 100-kHz fast-rise, positive-going square-wave signal via a 50- Ω cable, a 50- Ω termination, and a dual-input coupler to the CH 2 OR Y and A EXT input connectors.

Page 4-14 Step 2, part a

ADD: X10 MAG OFF (button out)

Page 4-16 Step 4, part i, third line

CHANGE TO: ...button is pressed in and released.

DESCRIPTION

Page 4-16

At the end of Step 4, ADD:

5. Check Trigger Level Control Range

a. Set:

CH 1 VOLTS/DIV	0.5
TRIGGER SLOPE	+
TRIGGER SOURCE	EXT
TRIGGER Mode	AUTO

b. Connect a 50-kHz sinewave signal to the CH 1 OR X and A EXT input connectors via a precision 50- Ω cable, a 50- Ω termination, and a dual-input coupler.

c. Set the generator output for a 4-division vertical display.

d. CHECK--Display is triggered along the entire positive slope of the waveform as the A TRIGGER LEVEL control is rotated.

e. CHECK--Display is not triggered (free runs) either extreme of rotation.

f. Set A TRIGGER SLOPE switch to -.

g. CHECK--Display is triggered along the entire negative slope of the waveform as the A TRIGGER LEVEL control is rotated.

h. CHECK--Display is not triggered (free runs) at either extreme of rotation.

i. Disconnect the test setup.

Page 4-19

Preceding Step 4

ADD:

Step 3, parts f and g:

f. Rotate the B DELAY TIME POSITION control to set every succeeding time marker to coincide with the center vertical graticule line and note the dial reading for each.

g. CHECK--Difference of dial readings between any two adjacent time markers is 1.000 ± 0.023 (0.977 to 1.023), see part e for ambient temperature qualification.

DESCRIPTION

Page 4-19 Step 4, between parts b and c.

ADD: NOTE

Exclude B DELAY TIME POSITION
control dial readings below
0.25 (000 to 0.25) for all
delay time measurements.

Page 4-19 Step 5, part a, B SEC/DIV

CHANGE TO: B SEC/DIV 0.5 μ s

Page 4-19 Step 5, part d, second and third line

DELETE: The parenthetical statement.

Page 4-19 Table 4-6, first line entry

DELETE: 0.2 μ s 0.05 μ s 0.2 μ s

Page 4-19 Step 6, part a, X10 MAG,
CHANGE TO: X10 MAG ON (button in)

ADD: HORIZ MODE A

Page 4-20 Step 6, part d, last line

CHANGE TO: ...Set from on (in) to off (out).

Page 4-20 Step 8

DELETE: Parts e through h.

Page 4-20 Step 9, part d

CHANGE TO:
d. Select 0.5 s time markers.

Page 4-21 Step 12, part a

CHANGE TO:
a. Connect a 50 kHz leveled sine-wave signal via
a precision 50- Ω cable, and a 50- Ω termination to
the CH 1 OR X input connector.

Page 4-21 Step 13, parts a and e

CHANGE TO:
a. Set both VOLTS/DIV switches to 10 mV.
e. Vertically center the display using the channel 2
POSITION control, and horizontally center the display
using the horizontal POSITION control.

Page 4-22 Step 2, part a, CH 1 VOLTS/DIV

CHANGE TO: CH 1 VOLTS/DIV 5 m

DESCRIPTION

Page 4-22 Step 2, part c, first line

CHANGE TO: c. CHECK--For a 4-division vertical display of the...

Page 5-3 Table 5-1

Blacken the squares at the following coordinates:

		DOWN		ACROSS
	X1 HORIZ GAIN	and		X-Y GAIN
	DELAY START	and		5 ns TIMING, X1 HORIZ GAIN, X10 HORIZ GAIN, X-Y GAIN, A HIGH SPEED TIMING.
	DELAY STOP	and		X -Y GAIN
	A SLOPE OFFSET	and		A HYSTERESIS
	CRT REPLACEMENT	and		VERTICAL BALANCE

Page 5-6 Step 1, part j, second line

CHANGE TO: ... varying the autotransformer output voltage between 100 V...

Page 5-6 Step 2, parts a, b, and c.

CHANGE TO:

a. Connect the digital voltmeter low lead to chassis ground and connect the volts lead to TP320 (+102 V supply). Set the autotransformer to zero output.

b. Connect a shorting strap between TP184 and TP185.

c. CHECK--While slowly increasing the autotransformer output, that the voltage level increases to $112\text{ V} \pm 4\text{ V}$, then drops to approximately 13 V. Note that a buzzing sound is heard just before the voltage drops. Reset the autotransformer for a 115 V output.

Page 5-8 Step 5, part b, Volts/Div

CHANGE TO: Volts/Div 0.2 V (with 10X probe)

Page 5-8 Step 5, part f.

CHANGE TO:

f. CHECK--The p-p aberration is less than $\pm 5\%$ (0.25 division).

Page 5-9 Immediately below "Equipment Required" box

CHANGE TO: See ADJUSTMENT LOCATIONS 1 and ADJUSTMENT LOCATIONS 4 at the back of this manual for test point and adjustment locations.

DESCRIPTION

Page 5-11 In part a of Step 6, ADD:

CH 1 AC-GND-DC GND

then INTERCHANGE: All of Steps 6 and 7

Page 5-11 Steps 8 and 9

In part a of Step 8, ADD:

CH 2 AC-GND-DC GND

then INTERCHANGE: All of Steps 8 and 9.

Page 5-12 Note between Step 10 parts d and e.

CHANGE TO:

NOTE

If the trace does not reach exactly
2 full divisions above the center
horizontal graticule line, set R44
to maximum or minimum to position
the trace as closely as possible to
2 divisions above the center horizontal
graticule line.

Page 5-12 Step 11, parts b and c.

REPLACE WITH:

b. Rotate the channel 2 POSITION control while
alternately pressing in and releasing the CH 2
INVERT button until a point is reached where there
is no trace movement.

c. CHECK/ADJUST--Vertical Balance (R18) to
vertically position the trace within ± 0.4
divisions of the center horizontal graticule
line.

d. Repeat parts b and c as necessary.

Pages 5-13 and 5-14

REPLACE: All of Steps 17 and 18 with the following new steps:

17. Check/Adjust CH 1 and CH 2 Low-Frequency Transient
Response and Compensation (R66, R73, R31 and R92)

a. Set:

VERTICAL MODE CHOP

AC-GND-DC (both) DC

VOLTS/DIV (both) 5 m

DESCRIPTION

A TRIGGER SOURCE	CH 1
A SEC/DIV	1 ms
A TRIGGER LEVEL	For a stable display

b. Connect a 1-kHz signal from the square-wave generator's fast-rise, positive-going output via a precision 50- Ω cable, a X10 attenuator, and a 50- Ω termination to the CH 1 OR X input connector.

c. Adjust the generator output to obtain a 5-division vertical display.

d. Position the CH 2 trace on the center horizontal graticule line, center the CH 1 display, and adjust the A TRIGGER LEVEL control for a stable display.

e. CHECK--Display overshoot or rounding is within $\pm 3\%$ (4.85 to 5.15 divisions) for each CH 1 VOLTS/DIV switch setting from 5 m to 0.2 and waveform flatness is within $\pm 2\%$ (0.1 division) at all settings. Adjust the generator output and/or remove the attenuator as necessary to maintain a 5-division vertical display throughout this step. If not within tolerance proceed to part f; if within tolerance skip to part j.

f. Set CH 1 and CH 2 VOLTS/DIV to 10 m and adjust the generator output for a 5-division vertical display.

g. Repeat part d.

h. ADJUST--Low-frequency Compensation (R66 and R73) for no vertical deflection on the CH 2 trace.

i. ADJUST--Low-frequency Compensation (R31) for the best flat-top square wave on the CH 1 display.

j. Set generator output to minimum amplitude and move the test signal to the CH 2 OR Y input connector.

k. Set:

VOLTS/DIV (CH 2)	5 m
VERTICAL MODE	CH 2
A TRIGGER SOURCE	CH 2
A TRIGGER LEVEL	For a stable display

DESCRIPTION

1. Vertically center the CH 2 display and repeat parts c and e for CH 2. If within tolerance skip to Step 18; if not, proceed to part m.

m. Reduce generator output to minimum, reinstall the attenuator, and set CH 2 VOLTS/DIV to 10 m.

n. ADJUST--Low-frequency compensation (R92) for the best flat-top square wave on the CH 2 display.

o. Repeat all of Step 17 as necessary, then proceed to Step 18.

18. Check/Adjust CH 1 and CH 2 20 Pf Compensation (C1 and C62 on A10 Board)

a. Reduce generator output to minimum and reinstall the attenuator.

b. Set:

VERTICAL MODE CH 2

VOLTS/DIV (both) 10 m

A TRIGGER SOURCE VERT MODE

A TRIGGER LEVEL For a stable display

c. Adjust generator output for a 5-division vertical display and set A TRIGGER LEVEL for a stable display.

d. Note shape of displayed waveform.

e. Set CH 2 VOLTS/DIV to .1 and readjust generator output for a 5-division vertical display (remove attenuator if necessary).

f. CHECK--Displayed waveform shape matches that noted in part d. If so skip to part h, if not proceed to part g.

g. ADJUST--C62 for waveform shape to match the waveform noted in part d.

h. Set CH 2 VOLTS/DIV to .2 and set generator for a 5-division display. Check that waveform shape matches that noted in part d. If not, repeat all of Steps 17 and 18. (If still not correct a circuit malfunction is indicated)

i. Set generator for minimum output.

j. Move the test signal to the CH 1 or X input connector.

k. Set VERTICAL MODE to CH 1.

DESCRIPTION

1. Repeat parts c through e for channel 1.
- m. CHECK--Displayed waveform shape matches the waveform noted in part d for channel 1. If so, skip to Step 19, if not, proceed to part n.
- n. ADJUST--C1 for waveform shape to match the waveform noted in part d for channel 1.
- o. Repeat part h for channel 1.

Page 5-14 Step 19 title, and parts a and b

CHANGE TO:

19. Check/Adjust Vertical Output High-Frequency Compensation (R29, R32, C33, C36, R39 and C39) and CH 1 and CH 2 preamplifier High-Frequency Compensation (R33, C33, C58, R95, and C95)

a. Set:

VERTICAL MODE	CH 1
VOLTS/DIV (both)	10 m
A TRIGGER SOURCE	VERT MODE
A SEC/DIV	1 μ s
BW LIMIT	Full Bandwidth (button out)

b. Set generator for minimum output amplitude and connect a fast-rise, positive-going 100 kHz signal from the square-wave generator output via a precision 50 Ω cable, a 10X attenuator and a 50- Ω termination to the CH 2 OR Y input connector.

Page 5-14 Step 19, part f.

CHANGE TO:

f. Set the A SEC/DIV switch to .2 μ s.

Page 5-14 Step 19, parts i, j and k

REPLACE WITH:

i. ADJUST--CH 2 Preamp HF Compensation (R95 and C95) and Vertical Output Amplifier HF Compensation (R39 and C39) for best front corner (see Figure 5-1).

j. Set VERTICAL MODE to CH 1 and move the test signal to the CH 1 OR X input connector.

k. ADJUST--CH 1 Preamp HF Compensation (R33, C33 and C58) for best front corner (see Figure 5-1) NOTE: C58

DESCRIPTION

affects the same area on the waveform as C33 and R33 do. C58 is located just to the right of Q57 (see ADJUSTMENT LOCATIONS 1 and Figure 9-6).

Page 5-15 Step 19, part 1, lines 2 and 3

CHANGE TO: ...the Vertical Output Amplifier and CH 1 Preamp adjustments made in part k to obtain...

Page 5-15 Step 20, parts a and c.

CHANGE: CH 2 to read CH 1

Page 5-15 Step 20, part g, lines 1 and 2

CHANGE TO: g. Repeat parts c and d for each of the following CH 1 VOLTS/DIV switch settings: 10 m, 20 m, 50 m, 0.1....

Page 5-15 Step 20, parts h and i

CHANGE TO: h. Set VERTICAL MODE to CH 2 and move the test signal to the CH 2 OR Y input connector.

i. Repeat parts b through g for CH 2.

Page 5-15 Step 20, parts k and l

CHANGE TO: k. Connect a 100 kHz fast-rise, negative-going square-wave signal from the generator via a precision 50- Ω cable, a 10X attenuator and a 50- Ω termination to the CH 2 OR Y input connector, and adjust the generator output for a 5-division vertical display.

l. Vertically center the display using the CH 2 POSITION control.

Page 5-15 Step 20, parts p and q.

CHANGE TO: p. Set VERTICAL MODE to CH 1 and move the test signal to the CH 1 OR X input connector.

q. Repeat parts 1 through 0 for CH 1.

Page 5-16 Step 23, part d

CHANGE TO: —
d. CHECK--Start of sweep is within ± 1 vertical division of the center horizontal graticule line.

DESCRIPTION

Page 5-16 Step 24, part a

ADD: A TRIG COUPLING DC

Page 5-17 Step 26, part b.

CHANGE TO:

b. Connect a 100-kHz fast-rise, positive-going square-wave signal via a 50-Ω cable, a 50-Ω termination and a dual-input coupler to the CH 2 OR Y input connector and the A EXT input connector.

Page 5-17 Step 26, part f, last line

CHANGE TO: ...horizontal graticule division).

Page 5-18 Step 28, part a, VOLTS/DIV

CHANGE TO: VOLTS/DIV (both) 10 m

Page 5-18 Step 29, part e

CHANGE TO:

e. CHECK--Generator output frequency is set to 20 MHz, ±5 MHz.

Page 5-19 Step 1, part g, line 1

CHANGE TO:

g. Repeat parts e through f until a stable display can be...

Page 5-19 Following Step 1, part i

ADD:

j. Repeat parts e through i until no improvement is noted.

Page 5-21 Step 4, part a

ADD: X10 MAG OFF (button out)

Page 5-26 Step 8, part f, last 2 lines

CHANGE TO: ...procedure of Step 9. then, perform Step 8 again to verify the adjustments

Page 5-28 Step 9 at the end of part n

ADD: o. Repeat Steps 8 and 9 as necessary until all timing ranges are within tolerance.

Page 5-30 Table 5-7 following last line

ADD: 50 ms to .5s 50 ms

e. Set A SEC/DIV to .5 ms and rotate VAR TRIG HOLDOFF fully counterclockwise.

f. CHECK--That holdoff time increases by a factor of at least 2.5.

DESCRIPTION

EFFECTIVE ALL SN

TEXT CHANGES

Page 1-3 Chop Frequency Performance Requirement

CHANGE TO: 275 kHz $\pm 30\%$.Page 3-9¹ Right column, second paragraph, 7th line

CHANGE TO: at a rate of about 275 kHz. See the "Vertical switching..."

Page 3-37 Left column, last paragraph

CHANGE TO: The circuit composed of Q222, Q213, and associated components shunts a small compensating current away from the voltage divider for sweep speeds from 5 $\mu\text{s}/$ division through 0.5 s/division. When the A SEC/DIV switch is set to .05 $\mu\text{s}/$ division through 2 $\mu\text{s}/$ division, +10 V is applied to the base of Q222 either through R223 or R224. Transistor Q222 becomes forward biased and -10 V is applied to the gate of Q213 to bias it off. This removes the shunting resistance of R212 from across R214 and improves the linearity for the faster time measurements.

Page 4-6

CHANGE TO:

Step 3, part d:

d. CHECK--Period of one cycle is 2.8 to 5.2 μs (approximately 4 horizontal divisions).

Step 4, part d:

d. CHECK--Trace shift is 0.4 division or less when switching between normal (button out) and invert (button in).

Step 5, part d:

d. CHECK--For 0.2 division or less trace shift from the center horizontal graticule line.

Step 6, part d:

d. CHECK--For 0.2 division or less trace shift from the center horizontal graticule line.

DESCRIPTION

Page 4-9 Step 16, part b.

CHANGE TO:

b. Connect a 100-kHz fast-rise, positive-going, square-wave signal via a 50- Ω cable, a 10X attenuator, and a 50- Ω termination to the CH 2 OR Y input connector. Set the generator output for a 5-division vertical display.

REPLACE: Step 16, parts f, g, and h with the following new parts f through j:

f. Disconnect the test signal from the CH 2 OR Y input connector. Re-connect the 10X attenuator (if previously removed) and reduce the generator amplitude to minimum.

g. Set VERTICAL MODE to CH 1 and connect the test signal to the CH 1 OR X input connector. Set the generator output amplitude for a 5-division vertical display.

h. Vertically center the display using the CH 1 POSITION control.

i. CHECK--Repeat parts d and e for CH 1.

j. Disconnect the test setup.

Page 4-10 Step 20, part d.

CHANGE TO:

d. CHECK--Start of sweep is within ± 1 vertical division of the center horizontal graticule line.

Page 4-10 Step 21, part b, second line

CHANGE TO:

...to the A EXT input connector via a 50- Ω cable, a 10X...

Page 4-11 Step 22, part c, line 2

CHANGE TO:

...the generator output for a signal display of 2 vertical...

Page 4-11 Step 22, part d, line 2

CHANGE TO:

...off is less than 20% (1.6 to 2.4 divisions) while holding...

DESCRIPTION

Page 4-11, Step 23, part b.

CHANGE TO: b. Connect a 100-kHz fast-rise, positive-going square-wave signal via a 50-Ω cable, a 50-Ω termination, and a dual-input coupler to the CH 2 OR Y and A EXT input connectors.

Page 4-17 Step 4, part i, third line

CHANGE TO: ... button is pressed in and released.

Page 4-21 Step 7

DELETE: Parts g through j.

RENUMBER: Part k to part g.

Page 4-21 Step 9, part a

CHANGE TO: a. Connect a 50 kHz leveled sine-wave signal via a precision 50-Ω cable, and a 50-Ω termination to the CH 1 OR X input connector.

Page 4-22 Step 10, part d

CHANGE TO: d. Vertically center the display using the channel 2 POSITION control, and horizontally center the display using the horizontal POSITION control.

Page 4-23 Step 2, part a, CH 1 VOLTS/DIV

CHANGE TO: CH 1 VOLTS/DIV 5 m

Page 4-23 Step 2, part c, first line

CHANGE TO: c. CHECK--For a 4-division vertical display of the...

Page 5-3 Table 5-1

Blacken the squares at the following coordinates:

<u>DOWN</u>		<u>ACROSS</u>
X1 HORIZ GAIN	and	X-Y GAIN
DELAY START	and	5 ns TIMING, X1 HORIZ GAIN, X10 HORIZ GAIN, X-Y GAIN, A HIGH SPEED TIMING.
DELAY STOP	and	X -Y GAIN
A SLOPE OFFSET	and	A HYSTERESIS
CRT REPLACEMENT	and	VERTICAL BALANCE

Page 5-6 Step 1, part j, second line

CHANGE TO: ... varying the autotransformer output voltage between 100 V...

DESCRIPTION

Page 5-6 Step 2, parts a, b, and c.

CHANGE TO:

a. Connect the digital voltmeter low lead to chassis ground and connect the volts lead to TP320 (+102 V supply). Set the autotransformer to zero output.

b. Connect a shorting strap between TP184 and TP185.

c. CHECK--While slowly increasing the autotransformer output, that the voltage level increases to $112\text{ V} \pm 4\text{ V}$, then drops to approximately 13 V. Note that a buzzing sound is heard just before the voltage drops. Reset the autotransformer for a 115 V output.

Page 5-8 Step 5, part b, Volts/Div

CHANGE TO: Volts/Div 0.2 V (with 10X probe)

Page 5-8 Step 5, part f.

CHANGE TO:

f. CHECK--The p-p aberration is less than $\pm 5\%$ (0.25 division).

Page 5-9 Immediately below "Equipment Required" box

CHANGE TO: See ADJUSTMENT LOCATIONS 1 and ADJUSTMENT LOCATIONS 4 at the back of this manual for test point and adjustment locations.

Page 5-11 In part a of Step 6, ADD:

CH 1 AC-GND-DC GND

then INTERCHANGE: All of Steps 6 and 7

Pages 5-11 & 5-12 Steps 8 and 9

In part a of Step 8, ADD:

CH 2 AC-GND-DC GND

then INTERCHANGE: All of Steps 8 and 9.

DESCRIPTION

Page 5-12 Note between Step 10 parts d and e.

CHANGE TO:

NOTE

If the trace does not reach exactly
2 full divisions above the center
horizontal graticule line, set R44
to maximum or minimum to position
the trace as closely as possible to
2 divisions above the center horizontal
graticule line.

Page 5-12 Step 11, parts b and c.

REPLACE WITH:

b. Rotate the channel 2 POSITION control while
alternately pressing in and releasing the CH 2
INVERT button until a point is reached where there
is no trace movement.

c. CHECK/ADJUST--Vertical Balance (R18) to
vertically position the trace within ± 0.4
division of the center horizontal graticule
line.

d. Repeat parts b and c as necessary.

Page 5-14

REPLACE: All of Steps 17 and 18 with the following new steps:

17. Check/Adjust CH 1 and CH 2 Low-Frequency Transient
Response and Compensation (R66, R73, R31 and R92)

a. Set:

VERTICAL MODE	CHOP
AC-GND-DC (both)	DC
VOLTS/DIV (both)	5 m
A TRIGGER SOURCE	CH 1
A SEC/DIV	1 ms
A TRIGGER LEVEL	For a stable display

DESCRIPTION

b. Connect a 1-kHz signal from the square-wave generator's fast-rise, positive-going output via a precision 50- Ω cable, a X10 attenuator, and a 50- Ω termination to the CH 1 OR X input connector.

c. Adjust the generator output to obtain a 5-division vertical display.

d. Position the CH 2 trace on the center horizontal graticule line, center the CH 1 display, and adjust the A TRIGGER LEVEL control for a stable display.

e. CHECK--Display overshoot or rounding is within $\pm 3\%$ (4.85 to 5.15 divisions) for each CH 1 VOLTS/DIV switch setting from 5 m to 0.2 and waveform flatness is within $\pm 2\%$ (0.1 division) at all settings. Adjust the generator output and/or remove the attenuator as necessary to maintain a 5-division vertical display throughout this step. If not within tolerance proceed to part f; if within tolerance skip to part j.

f. Set CH 1 and CH 2 VOLTS/DIV to 10 m and adjust the generator output for a 5-division vertical display.

g. Repeat part d.

h. ADJUST--Low-frequency Compensation (R66 and R73) for no vertical deflection on the CH 2 trace.

i. ADJUST--Low-frequency Compensation (R31) for the best flat-top square wave on the CH 1 display.

j. Set generator output to minimum amplitude and move the test signal to the CH 2 OR Y input connector.

k. Set:

VOLTS/DIV (CH 2)	5 m
VERTICAL MODE	CH 2
A TRIGGER SOURCE	CH 2
A TRIGGER LEVEL	For a stable display

l. Vertically center the CH 2 display and repeat parts c and e for CH 2. If within tolerance skip to Step 18; if not, proceed to part m.

m. Reduce generator output to minimum, reinstall the attenuator, and set CH 2 VOLTS/DIV to 10 m.

DESCRIPTION

n. ADJUST--Low-frequency compensation (R92) for the best flat-top square wave on the CH 2 display.

o. Repeat all of Step 17 as necessary, then proceed to Step 18.

18. Check/Adjust CH 1 and CH 2 20 Pf Compensation (C1 and C62 on A10 Board)

a. Reduce generator output to minimum and reinstall the attenuator.

b. Set:

VERTICAL MODE	CH 2
VOLTS/DIV (both)	10 m
A TRIGGER SOURCE	VERT MODE
A TRIGGER LEVEL	For a stable display

c. Adjust generator output for a 5-division vertical display and set A TRIGGER LEVEL for a stable display.

d. Note shape of displayed waveform.

e. Set CH 2 VOLTS/DIV to .1 and readjust generator output for a 5-division vertical display (remove attenuator if necessary).

f. CHECK--Displayed waveform shape matches that noted in part d. If so skip to part h, if not proceed to part g.

g. ADJUST--C62 for waveform shape to match the waveform noted in part d.

h. Set CH 2 VOLTS/DIV to .2 and set generator for a 5-division display. Check that waveform shape matches that noted in part d. If not, repeat all of Steps 17 and 18. (If still not correct a circuit malfunction is indicated)

i. Set generator for minimum output.

j. Move the test signal to the CH 1 or X input connector.

k. Set VERTICAL MODE to CH 1.

l. Repeat parts c through e for channel 1.

m. CHECK--Displayed waveform shape matches the waveform noted in part d for channel 1. If so, skip to Step 19, if not, proceed to part n.

DESCRIPTION

n. ADJUST--C1 for waveform shape to match the waveform noted in part d for channel 1.

o. Repeat part h for channel 1.

Page 5-14 Step 19 title, and parts a and b

CHANGE TO:

19. Check/Adjust Vertical Output High-Frequency Compensation (R29, R32, C33, C36, R39 and C39) and CH 1 and CH 2 preamplifier High-Frequency Compensation (R33, C33, C58, R95, and C95)

a. Set:

VERTICAL MODE	CH 1
VOLTS/DIV (both)	10 m
A TRIGGER SOURCE	VERT MODE
A SEC/DIV	1 μ s
BW LIMIT	Full Bandwidth (button out)

b. Set generator for minimum output amplitude and connect a fast-rise, positive-going 100 kHz signal from the square-wave generator output via a precision 50 Ω cable, a 10X attenuator and a 50- Ω termination to the CH 2 OR Y input connector.

Page 5-15 Step 19, part f.

CHANGE TO:

f. Set the A SEC/DIV switch to .2 μ s.

Page 5-15 Step 19, parts i, j and k

REPLACE WITH:

i. ADJUST--CH 2 Preamp HF Compensation (R95 and C95) and Vertical Output Amplifier HF Compensation (R39 and C39) for best front corner (see Figure 5-1).

j. Set VERTICAL MODE to CH 1 and move the test signal to the CH 1 OR X input connector.

k. ADJUST--CH 1 Preamp HF Compensation (R33, C33 and C58) for best front corner (see Figure 5-1) NOTE: C58 affects the same area on the waveform as C33 and R33 do. C58 is located just to the right of Q57 (see ADJUSTMENT LOCATIONS 1 and Figure 9-7).

DESCRIPTION

Page 5-15	Step 19, part 1, lines 2 and 3
CHANGE TO:	... Vertical Output Amplifier and CH 1 Preamp adjustments made in part k to obtain...
Page 5-15	Step 20, part a
CHANGE:	CH 2 to read CH 1
Page 5-15	Step 20, part c
CHANGE TO:	c. Vertically center the display using the channel 1 POSITION control.
Page 5-15	Step 20, part g, lines 1 and 2
CHANGE TO:	g. Repeat parts c and d for each of the following CH 1 VOLTS/DIV switch settings: 10 m, 20 m, 50 m, 0.1....
Page 5-15	Step 20, parts h and i.
CHANGE TO:	h. Reduce the generator output and set VERTICAL MODE to CH 2 then move the test signal to the CH 2 OR Y input connector. i. Repeat parts b through g for CH 2.
Page 5-15	Step 20, part k and l
CHANGE TO:	k. Connect a 100 kHz fast-rise, negative-going square-wave signal from the generator via a precision 50- Ω cable, a 10X attenuator and a 50- Ω termination to the CH 2 OR Y input connector, and adjust the generator output for a 5-division vertical display. l. Vertically center the display using the CH 2 POSITION control:
Page 5-16	Step 20, part p and q.
CHANGE TO:	p. Set VERTICAL MODE to CH 1 and move the test signal to the CH 1 OR X input connector. q. Repeat parts l through o for CH 1.
Page 5-16	Step 23, part d
CHANGE TO:	d. CHECK--Start of sweep is within ± 1 vertical division of the center horizontal graticule line.
Page 5-17	Step 24, part a
ADD:	A TRIG COUPLING DC

DESCRIPTION

Page 5-17 Step 26, part b.
CHANGE TO: b. Connect a 100-kHz fast-rise, positive-going square-wave signal via a 50- Ω cable, a 50- Ω termination and a dual-input coupler to the CH 2 OR Y input connector and the A EXT input connector.

Page 5-17 Step 26, part f, last line
CHANGE TO: ... horizontal graticule division).

Page 5-18 Step 29, part a, VOLTS/DIV
CHANGE TO: VOLTS/DIV (both) 10 m

Page 5-18 Step 30, part e
CHANGE TO: e. CHECK--Generator output frequency is set to 20 MHz, ± 5 MHz.

Page 5-20 Step 1, part g, line 1
CHANGE TO: g. Repeat parts e and f until a stable display can be...

Page 5-20 Following Step 1, part i
ADD: j. Repeat parts e through i until no improvement is noted.

Page 5-27 Step 3, part b
ADD: ...Set the B DELAY TIME POSITION control to place the intensified zone at the second graticule line. Set the Δ TIME POSITION control for a Δ TIME digital readout of 8.00 ms. Set HORIZ MODE to B and set the time-mark generator variable timing control to superimpose the displayed time marks. Do not change the time mark generator settings for the remainder of Step 3.

Page 5-27 Step 3, part c, first line
CHANGE TO: c. Set HORIZ MODE to A INTEN and align both intensified zones with the second vertical...

Page 5-28 Following Step 3, part t
ADD: n. Set the time-mark generator for calibrated time marks (set variable to off).

DESCRIPTION

Page 5-31 Step 9 at the end of part 1
ADD: o. Repeat Steps 8 and 9 as necessary until all
timing ranges are within tolerance.

Page 5-34 Table 5-10 following last line
ADD: 50 ms to .5s 50 ms

e. Set A SEC/DIV to .5 ms and rotate VAR TRIG
HOLDOFF fully counterclockwise.

f. CHECK--That holdoff time increases by a factor
of at least 2.5.

--Mike Laurens
53/108
Ext. 8688

