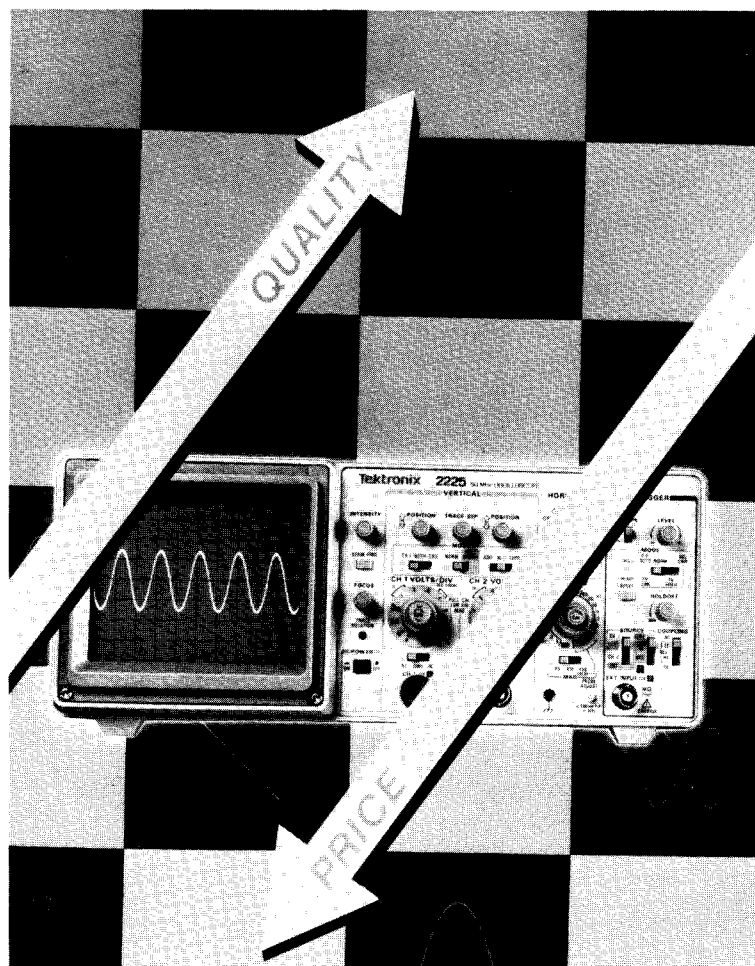


SERVICETEKNOTES

TEKTRONIX—EVER SEARCHING FOR NEW AND BETTER PRODUCTS TO SERVE YOUR NEEDS!

2225 SCOPE

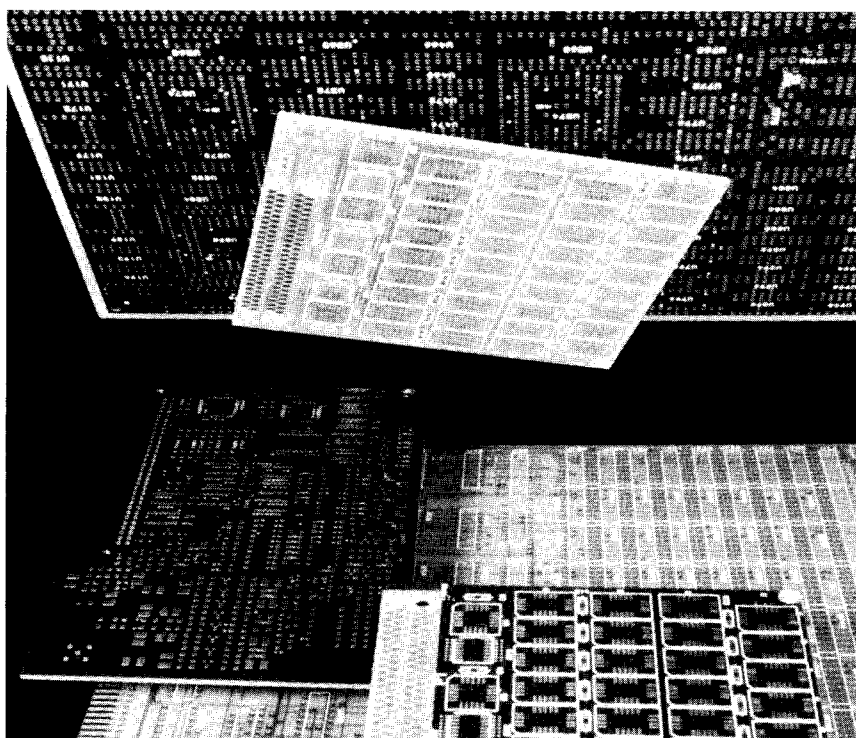
HIGH VALUE FEATURES
ON A LOW-COST SCOPE



665001
PG 506
7A16P
2465

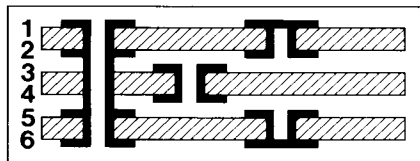
... AND BE SURE TO READ ABOUT TEKTRONIX' STATE-OF-THE-ART PRINTED CIRCUIT BOARD
MANUFACTURING FACILITY AT OUR FOREST GROVE, OREGON LOCATION. (See inside front cover.)

Circuit Board Manufacturing



Advanced Technology Quality Service

Tektronix circuit board manufacturing offers you a competitive advantage in bringing your high-technology products to market and keeping them there.



This illustration shows a 6-layer multilayer with conventional holes, a buried via connecting layers 3 and 4, and blind vias connecting layers 1 and 2, and layers 5 and 6. This process, available up to 8 layers, conserves circuit board real estate by allowing only necessary layers to be connected. This process, combined with surface mount technology, can reduce costs per interconnect up to 50% over conventional technology.

TECHNOLOGY

Blind and Buried Vias—These interconnecting vias conserve circuit board real estate by allowing only necessary layers to be connected, which frees space on other layers to be used for circuitry.

High Quality Multilayers—We specialize in high quality multilayers backed by a Tektronix warranty.

Fine-Line Circuits—Our tight tolerances and precise registration accuracy provide high quality fine-line circuits with track widths of 0.006" and greater.

Hot-Air Leveling—Our state-of-the-art horizontal hot-air leveling system eliminates process variability and ensures component solderability.

Electrical Characteristics—Fabrication and testing of circuitry with impedance control tolerances to $\pm 3\%$. Consultation in proper lay up and material selection for tightly toleranced 50 Ω and 75 Ω circuitry.

Laser Film Generation—We use customer supplied CAD and N.C. data bases to create tooling that provides ultimate feature and registration accuracy and maximum accuracy between laser generated artwork and N.C. drill programs.

Surface Mount—If you are ready to incorporate surface mount technology in your next product, we offer a wide range of technology and support services from design consultation to high quality fine-line or blind and buried via multilayers.

SERVICE

New Product Support—Design consultation, value engineering and prototype support are just some of the services provided by Tektronix circuit board manufacturing which can improve your time-to-market and the cost-effectiveness of your design.

Delivery—Our delivery performance is unequaled in the circuit board industry. Ours is the first Class "A" MRP certified circuit board plant in the world, an accomplishment which assures on-time delivery to our customers.

CAPABILITIES

Number of Layers—Two to ten plus

Standard Material—FR-4, CEM-3

Density—0.006" conductor width, 0.006" spacing. Minimum 0.0135" vias. Denser packaging negotiable on prototype basis.

Finishes—Bright-acid tin, gold, hot air leveled solder

Soldermasks—Screen printed, thermal cured epoxy, photographic dry film.

Panel Size—Maximum 18" x 24"

Finished Board Thickness—Maximum 0.125" Minimum 0.025"

Tooling—Computer aided laser generated film

Testing and Analysis—Complete in-house electrical, metallurgical and chemical testing

Customer Support

Circuit Board Manufacturing
Product Marketing Manager or
Customer Representative
Tektronix, Inc.
1521 Poplar Lane, D.S. F1-487
Forest Grove, OR 97116
(503) 640-2288

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Note: Until all WIZARDS' WORKSHOP articles can be entirely entered into the "desktop publishing" format, inconsistencies will occur with SERVICE TEKNOTES articles not quite matching type face or ink density. These articles are, as you are aware, reprints and "pasteups" from WIZARDS' publications. You will be seeing changes sometime in 1987. (The Editor).

NEW 2225 SCOPE FIRST MEMBER OF 2200 SERIES TO SELL FOR UNDER \$1,000

Tektronix has broken the \$1,000 dollar price barrier with the introduction of the newest member of the popular 2200 Series of portable oscilloscopes. The dual channel 2225 oscilloscope offers "unprecedented" features and performance for the price, including 50-MHz bandwidth alternate magnification, 500 microvolt sensitivity, peak-to-peak auto trigger mode, and high-frequency/low-frequency trigger filtering.

The new portable oscilloscope is targeted for use in field service applications, manufacturing and production test, and educational institutions such as vocational technical schools, colleges and universities. TV trigger comes standard with the capability of selective triggering on TV lines or TV fields, making the 2225 well suited for a variety of television and video applications. The new 2225 scope "offers an excellent performance-/price ratio, giving the customer a new high level of value for dollars spent. In doing so, it answers a crucial need in the U.S. and European markets for a low-priced, but high-quality portable oscilloscope."

The 2225 scope features three important new features which are useful capabilities that appear for the first time in a 2200 Series oscilloscope: alternative magnification, 500-microvolt sensitivity, and trigger filtering.

High-Value Features on a Low-Cost Scope

Because the 2225 is a member of the Tektronix' 2200 family, it has the same front panel layout, ease of operation, and many of the features and capabilities that made the 2200 Series an industry standard.

Key 2225 performance features include:

- 50-MHz, dual-channel inputs for comparative measurements
- 500-microvolt input sensitivity for low-level signals
- X1, X5, X10 and X50 horizontal alternate sweep magnifications for time measurement accuracy
- High- and low-frequency reject trigger coupling for triggering stability
- Normal, peak-to-peak auto, single sweep, and TV line and field triggering for versatility and ease-of-use

All of this is available in the new 2225 Portable Oscilloscope, with enhanced value provided by:

- A 3-year warranty
- A proven Tektronix design base that is already serving 75% of the world's portable scope market
- Use of established manufacturing lines and established 2000-series manufacturing expertise
- Aggressive sourcing policies that provide parts from the best sources worldwide while enhancing price stability

If this low-cost scope peaks your interest for any of your particular applications, please contact **Robert Galvin, 627-5493** or **Larry Johnson, (44) (0992) 467151**

AM502 MAIN BOARD REPLACEMENT

S/N Range: B010100 - B052349

Main circuit board, Tek P/N 670-2733-04, is no longer available and is replaced by Tek P/N 670-2733-06. When installing the new Main circuit board use modification kit 050-0844-04.

If the instrument serial number is greater than the above listed serial number range or, if this kit or kit, Tek P/N 050-0780-XX has been installed previously, then Tek P/N 670-2733-06 will be a direct replacement.

W2 Issue 17-1

AM503 SIDE PANEL SHORTENED TO PREVENT SHORTING TO FUSE

REF: Mod# 62902
S/N B071826

AM503's with a serial number between B070000 and B071826 have the potential of shorting the side panel to the fuse. To correct this, replace the side panel with Tektronix P/N 337-1399-12.

W2 Issue 17-4

AVC-20 0dB GAIN CALIBRATION

REF: AVC-20 INSTRUCTION MANUAL
P/N 070-5979-00

Mod 60357

Mod 60357 has been incorporated into the AVC-20 to assure sufficient gain for 0dB calibration with 150 ohm systems.

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A1R466 and A1R563 change from 30K ohms to 22K ohms (P/N 315-0223-00), and A1R562 is changed from 27K ohms to 18K ohms (P/N 315-0183-00).

Install this mod on an "as required" basis.

Mod 60357 is being installed in new instruments from the factory starting with S/N B010410.

W2 Issue 17-2

CG551AP/CG5001 POWER-UP ERRORS 83 AND 84

If errors 83 and 84 are displayed at power-up, it is possible that A7C1620 is shorted. If this capacitor develops internal low resistance, then these error codes will be displayed along with a decrease in the amplitude of the Lo Edge signal.

W2 Issue 17-1

CRT PIN CLEANER NOW AVAILABLE

Ever have the need to clean CRT pins due to build up of dirt and oxidation? A CRT pin cleaner is now available through Tektronix.

Order Tektronix P/N 003-0852-00

W2 Issue 17-1

GMA303 OPTION 23 BROKEN CRT NECK

REF: Corporate Mod #62325

GMA303 Service Manual, 070-5260-00

Corporate Mod #62325 has been approved to add one extra spacer, Tektronix P/N 361-1279-00, to each top CRT mounting stud (one spacer on each stud, two

(Article Continued on Next Page)

GMA303 Option 23 (continued)

spacers required). For spacer location, refer to item 160 of Figure 1, GMA303 Replaceable Mechanical Parts pullout in Section 8 of the GMA303 Service Manual.

Adding these spacers changes the CRT mounting by one-half degree and will prevent the possibility of the CRT neck from breaking during shipment of the instrument.

B010409 is the first GMA303 Option 23 serial number which incorporates this mod.

This mod only affects GMA303 with Option 23 cabinets.

Without the added spacers, the CRT socket board enclosure is close to the back part of the chassis, and excessive vibration during shipment can cause the CRT neck to break.

W2 Issue 17-1

M/4115B/4120/P SERIES POWER SUPPLY FUSES F143 AND F144 CHANGE

REF: Corporate Mod 61662

4115/4120 Series System Unit Service Manual, 070-5271-0X

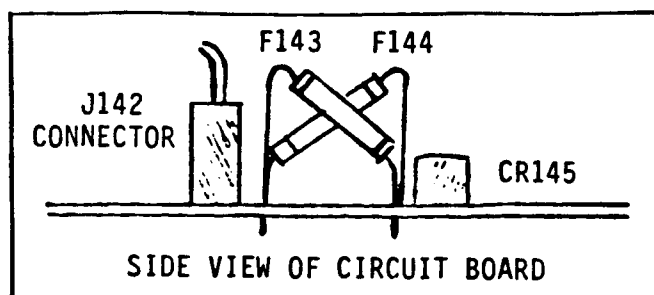
Corporate Mod 61662 has been approved to change fuses F143 and F144 on the power supply, Tektronix P/N 620-0311-0X. The fuse P/N is 159-0267-00 (2 each required), and after the mod, the power supply's P/N rolls to its next higher level.

These new fuses have a larger body than the original fuses and are rated at 2 Amps at 250 Vac, with longer blow time. These housekeeping fuses (F143 and F144) are changed because the old fuses may prematurely blow due to high

in-rush current at power supply start-up and when the power supply is operating at 220 to 240 Vac.

Since the 159-0267-00 fuse has a larger body, the following installation procedure should be used to prevent possible shorts.

1. After removal of the old fuses, bend one wire lead of each new fuse to form a 60 degree angle with respect to the fuse body. Bend the other lead until it's parallel to the first wire lead.
2. Insert leads in the appropriate circuit board holes and dress one fuse to slant above circuit board toward the left and the other fuse toward the right (refer to drawing).
3. Solder and trim as necessary.
4. Do not allow the metal parts of the fuses to touch anything except where the leads are soldered into the circuit board.



W2 Issue 17-1

MAG LATCH RELAY RETAINING SCREW CHANGE

Effective S/N's:

B064160-CG5001/CG551AP
B053531-DC5009/DC5009;01
B053531-DC509/DC509;01
B041762-FG5010
B010717-DP501
B041882-DC5010/DC510

The slot head screws, Tek P/N 213-0848-00, used to secure the Mag Latch Relays to the circuit board, are no longer available. The replacement

(Article Continued on Next Page)

MAG Latch Relay (continued)

screw is Tek P/N 213-1000-00, which is a torx head type. The required torx head tip which is used with the magnetic screwdrivers is Tek P/N 003-1413-00. The recommended torque spec. is 1.25 inch pounds.

W2 Issue 17-3

OF15X POWER SUPPLY ADJUSTMENT
IMPROVEMENT

REF: OF150 SERVICE MANUAL
P/N 070-3677-00

OF151 SERVICE MANUAL
P/N 070-5363-00

OF152 SERVICE MANUAL
P/N 070-5060-00

OF235 SERVICE MANUAL
P/N 070-5743-00

Occasionally, when adjusting 50kHz switching signal on the OF15X power supply (Steps 1j and 1k of the adjustment procedure), the signal does not appear to trigger easily. It may also trigger at a frequency higher than 50kHz and it will not adjust down to the correct level.

The cause of this appears to be some capacitance between two large runs on different layers of the circuit board. To remedy this, add a 100pf capacitor (P/N 283-0330-00) between pins two (2) and twelve (12) of Ckt. #A30A1U1030 (OF150) and Ckt. #A14A1U1030 (OF151, OF152, and OF235). This creates a capacitance divider that eliminates the effects of this problem.

W2 Issue 17-1

PG502 PERFORMANCE CHECK PROCEDURE
CORRECTION

REF: Instruction Manual, 070-1598-01

Effective date: 09-04-86

The PG502 Performance Check Procedure Step #4, "Check Pulse Amplitude" has been changed. See Pullout "A" for change information.

W2 Issue 17-1

PG506 STANDARD AMPLITUDE SPECIFICATION
CORRECTION

REF: Instruction Manual, 070-3383-00

The following information should be added to the specification information for Standard Amplitude Output Performance Requirements (Table 1-1 Electrical Characteristics, page 1-1).

Amplitude (dc)

Range ---- 200mV to 100V

Accuracy ---- Within 0.25% + 1 micro V

The manual will be changed accordingly.

W2 Issue 17-4

SC501 MOD DF DESCRIPTION

The SC501 Mod DF oscilloscopes have CRTs with P7 instead of the P31 phosphor. An amber CRT light filter is included in the accessory complement.

The calibration procedure is unchanged and the Tek part numbers are as follows:

CRT: 154-0699-53

Filter, Light Amber: 035-0192-00

W2 Issue 17-1

SPG12 TO SPG12A UPGRADE

REF: SPG12 INSTRUCTION MANUAL
P/N 070-2324-00

Mod 61466

The SPG12 Sync Generator Module of the 1411 has been upgraded to an SPG12A by Mod 61466. This change accomplishes the following:

- 1) Changes the Sync Lock Board, causing SCH Phase to remain constant with changes in the adjustment of the H Delay pot.
- 2) Improves SCH Phase Jitter and Time base errors to meet EBU D-25 requirements.
- 3) Provides a Field 1 Line 7 ID pulse on the Black Burst Output.
- 4) Improves Horizontal Unlock functional performance on the A26-1 Board.

The changes included in this mod affect the Sync Timing (A20-1) Board, the Generator Logic (A22-1) Board, and the Black Burst (A25-1) Board in small amounts. The Sync Lock (A21-A) Board, however, has received major changes and rearrangements in the circuits.

A manual insert has been written for this mod. It covers changes and additions to Specifications, Operating Instructions, Calibration/Performance Check Procedures, Circuit Theory, Parts Lists and Schematics. The insert is being included in all new SPG12 manuals.

The changes, although extensive, do not incorporate any new or unusual circuit topologies beyond those already familiar to the 1411 technician. Careful reading of the change information and study of the schematics should be sufficient to service this new unit.

There are no new requirements for test equipment for troubleshooting or calibration of the SPG12A.

Upgrading Older Instruments

Earlier SPG12's can receive some of the benefits of the SPG12A.

- The SCH Phase/H Delay problem can be addressed by ordering a kit, P/N 050-2209-00.
- The SCH Phase Jitter and Time Base concerns can be addressed by ordering kit, 050-2210-00.
- The addition of the Field 1 Line 7 ID pulse can be obtained by ordering a new Black Burst Board:

P/N 670-4918-07 for SPG12
P/N 670-8222-02 for SPG12 Opt. AA
- The improvement in the Horizontal Unlock function (A26-1) will be accomplished by ordering a new 670-8222-02.

W2 Issue 17-2

TDC1/TDC2 OSCILLATION FIX

REF: TDC1/2 INSTRUCTION MANUAL
P/N 070-2754-00

TDC1/2 OPT. 2, 12 INSTRUCTION
MANUAL, P/N 070-3719-00

Mod 60699

In order to insure stable 2nd L.O. operation and alleviate a spurious oscillation in the TDC1 and TDC2, Mod 60699 makes the following changes.

- C26, a 2.5-9 pfd cap has been changed to 1-3 pfd (P/N 281-0151-00) and C27, a tested selectable cap has been paralleled with C26.
- R25, a 100 ohm resistor (P/N 317-0101-00) has been added into the base circuit of Q25.

TDC1/TDC2 Oscillation Fix (continued)

The capacitor that has been added has the following nominal values.

TDC1

Opt. 11 & 14

Opt. 1	4.7 pfd	281-0618-00
Opt. 2	4.7 pfd	281-0618-00
Opt. 3	5.6 pfd	281-0612-00

Opt. 12	3.9 pfd	281-0615-00
---------	---------	-------------

TDC2

Opt. 11 & 14

Opt. 1	4.7 pfd	281-0618-00
Opt. 2	4.7 pfd	281-0618-00
Opt. 3	5.6 pfd	281-0612-00

Opt. 12	4.7 pfd	281-0618-00
---------	---------	-------------

The approximate selection range is 3.9 to 6pfd, and the capacitors are selected to cause the circuit to oscillate with C26 centered.

R25 is added by lifting the base leg of Q25 and adding the resistor in series with the base leg "teepee" fashion.

Install the capacitor change on an "as required" basis, and install the resistor on any unit returned for service.

Mod 60699 is being installed in new instruments from the factory starting with the following serial numbers:

TDC1 -- B010575

TDC2 -- B010408

TDC1/2 Opt. 2/12 -- B010408

W2 Issue 17-2

TSG170A POWER SUPPLY SWITCHING TRANSISTOR FAILURES

REF: TSG170A INSTRUCTION MANUAL
P/N 070-5680-00

On page 6-36 of the Instruction Manual, the Technician is requested to replace R750 and R751 if the power supply switching FET's (Q660 and Q661) fail.

It should be noted that recent failures of this circuit have indicated the advisability of having a Switching Regulator IC (U435, P/N 156-1585-02) available. This IC has been an additional required replacement in most failures of Q660 and Q661.

W2 Issue 17-5

TSG170A FALSE SYNC DETECTION WITH NO GENLOCK SOURCE

REF: TSG170A INSTRUCTION MANUAL
P/N 070-5680-00

Mod 63056

Mod 63056 has been implemented in the TSG170A to prevent false sync detections when a genlock source is not applied.

To address this problem, connect a new resistor (R426, P/N 315-0106-00, 10M ohm) in parallel with C425 on the A3 Analog Board.

Install this mod on any instrument returned for service.

Mod 63056 is being installed in new instruments from the factory starting with S/N B030738.

W2 Issue 17-6

TSG3, TSG13, TSG23 STEP
LINEARITY OUT OF SPEC

REF: TSG3 INSTRUCTION MANUAL
P/N 070-2108-01

TSG13 INSTRUCTION MANUAL
P/N 070-2330-00

TSG23 INSTRUCTION MANUAL
P/N 070-2334-00

Mod 62183

Due to the improvements in transistors being used in contemporary instruments, changing Q264 on the Linearity Logic Board may cause oscillations to occur.

Mod 62183 addresses this condition by adding a 10pf capacitor (P/N 283-0648-00) in parallel across R263.

Add the capacitor whenever Q264 is changed due to failure, or to address oscillations in this circuit that are causing step linearity to be out of spec.

Mod 62183 is being installed in new instruments from the factory starting with S/N B012861 (TSG3), B012303 (TSG13), and B010127 (TSG23).

W2 Issue 17-5

TSG5/TSG15 MODULATED PHASE
RANGE ABERRATION

REF: TSG5 INSTRUCTION MANUAL
P/N 070-2336-00

TSG15 INSTRUCTION MANUAL
P/N 070-2479-00

Mod 60712

Mod 60712 has been implemented in the TSG5 and TSG15 to eliminate a small amount of jitter that might be seen during adjustment of R169. This jit-

ter can be seen between the 350 and 360 degree point of the Phase adjustment.

The mod adds a shottky diode, P/N 152-0322-00, between the base and collector of Q135, anode to base.

Install this mod on an as required basis. Mod 60712 is being installed in new instruments from the factory starting with S/N B012028 (TSG5) and B011716 (TSG15).

W2 Issue 17-2

TSI 8150 POWER SUPPLY MODIFICATIONS

REF: M61964

EFFECTIVE S/N: B010138

The force that is exerted on the power supply AC power switch from the front panel on/off button will cause the switch to fail. To prevent this failure, remove the power supply circuit board (A1A1) and add two Tek P/N 213-0141-00 screws from the back side of the power supply circuit board through the power switch bracket.

CAUTION:

PRIOR TO ADDING THESE PARTS ALLOW SEVERAL MINUTES FOR THE INPUT CAPACITORS TO DISCHARGE.

Also install bleeder resistors R980, Tek P/N 301-0431-00, across filter capacitor C880 and R685, Tek P/N 301-0472-00, across C785. The circuit board mounting screw next to the power switch, which is a washered screw, should be replaced by Tek P/N 211-0510-00. The reason for this change is the washer interferes with the switch bracket.

W2 Issue 17-1

TV PRODUCTS SEMICONDUCTOR CHANGES

REF: 1420 SERIES INSTRUCTION MANUAL
P/N 070-2899-00

1480 SERIES INSTRUCTION MANUAL
P/N 070-2338-00

1710B SERIES INSTRUCTION MANUAL
P/N 070-5522-00

1720 SERIES INSTRUCTION MANUAL
P/N 070-5846-00

1730 SERIES INSTRUCTION MANUAL
P/N 070-4474-00

1740 SERIES INSTRUCTION MANUAL
P/N 070-4473-00

1750 SERIES INSTRUCTION MANUAL
P/N 070-5664-00

Mod 61250

The following part numbers have been changed to reflect increased reliability from our vendors and reduced costs.

151-0220-03 becomes 151-0220-00 in the following: **1710B/1711B** -- A3Q545

151-0223-04 becomes 151-0223-00 in the following:

1710B/1711B - A1Q462, A1Q565, A1Q731

1720/1721 - A1Q462, A1Q565, A3Q248, A3Q343, A3Q353, A3Q552, A3Q553, A3Q632, A3Q733, A3Q836

1730/1731 - A1Q462, A1Q565, A3Q776, A3Q777

1740/1741/1742 - A5Q430, A5Q432, A5Q456, A5Q457, A5Q594, A5Q638

1750/1751 - A5Q429, A5Q432, A5Q456, A5Q457, A5Q462, A5Q656, A5Q662

151-0301-02 becomes 151-0301-00 in the following:

1710B/1711B - A3Q144

1740/1741/1742 - A6Q116

1750/1751 - A6Q439, A6Q642, A6Q742

156-0067-13 becomes 156-0067-00 in the following:

1420/1421/1422 - U1223, U1820, U6535

1480 Series - U1235, U1548

1720/1721 - A3U380

1740/1741/1742 - A5U344

1750/1751 - A1U752, A5U344

156-0411-02 becomes 156-0411-00 in the following:

1720/1721 - A3U446

Use the new parts on an "as fails" basis.

Mod 61250 is being installed in new instruments from the factory starting with the following serial numbers:

1420 Series	B067239
1480C Series	B094396
1480R Series	B105568
1710B	B021134
1711B	B020239
1720	B010857
1721	B010405
1730	B010967
1731	B010431
1740	B013437
1741	B011192
1742	B010152
1750	B031509
1751	B030710

W2 Issue 17-2

WFM-300 ADJUSTMENT PROCEDURE CHANGES

REF: WFM-300 INSTRUCTION MANUAL
P/N 070-6039-00

Please make the following changes to the adjustment procedure in your WFM-300 Instruction Manual.

Page 5-16

Change: Steps 28 and 29 to read 29 and 30.

Add: Step 28: ADJUST MAGNIFIER REGISTRATION (R655).

Pages 5-27, 5-28

Change: Steps 28 and 29 to read 29 and 30.

Add: Step 28. ADJUST MAGNIFIER REGISTRATION (R655).

a. Apply a color bar signal to the WFM-300 CH 1 INPUT connector. Terminate this loop-through connector in 75ohms.

b. Set the WFM-300 front panel controls as follows:

MODE	WAVEFORM
SWEEP	2 FLD
CH 1	On
CH 2	Off
CH 3	Off

c. Set the HORIZONTAL MAG button to On.

d. Use the HORIZONTAL Position control to position the vertical blanking interval to the center of the screen.

e. Set the HORIZONTAL MAG button to Off.

f. Adjust R655 to position the display to the center of the screen.

g. It may be necessary to repeat steps c through f to achieve optimum magnifier registration.

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WFM-300 COMPONENT WAVEFORM MONITOR:
SERVICE MAINTENANCE INFORMATION

A Service Maintenance Information article regarding the WFM-300 Component Waveform Monitor is located in the pullout section of this issue. (See Pullout B".

W2 Issue 17-2

WFM-300 VECTOR TARGET, OPENING IN BOX

REF: WFM-300 Instruction Manual,
P/N 070-6039-00

MOD 62773

Mod 62773 has been implemented to close a small opening in the yellow vector target box (GBR Format). Integrated circuit A4U268 has been changed as follows:

<u>INST.</u>	<u>OLD P/N</u>	<u>NEW P/N</u>
WFM-300 (Std)	160-4196--00	160-4196-01
WFM-300 Opt. 10	160-4258-00	150-4258-01
WFM-300 Opt. 12	160-4259-00	160-4259-01

Install this change on an "as required" basis.

Mod 62773 will be incorporated in new instruments from the factory starting with S/N B010196.

W2 Issue 17-3

WFM300 MICROPROCESSOR CHANGE

REF: WFM300 INSTRUCTION MANUAL,
P/N 070-6039-00
MOD 62113

MOD 62113 changes the WFM300'S micro-processor from a programmable part to a masked part. The new part number for A4U343 is 160-4203-01.

Replace A4U343 with the new part upon failure.

MOD 62113 is being installed in new instruments from the factory starting with S/N B010227.

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WFM-300 VALID GAMUT SELECT/DESELECT

REF: WFM-300 INSTRUCTION MANUAL
P/N 070-6039-00

Mod 63158

In order to accommodate customer requests for an "OFF/ON" capability for the Valid Gamut strobe, Mod 63158 changes the microprocessor, A4U343, from P/N 160-4203-01 to 160-4203-02.

To use this function, the operator must deselect "Line Select". The front panel "Up" and "Down" pushbuttons can then be used to turn the strobe on and off, respectively.

Install this mod on an "as required" basis.

Mod 63158 is being installed in new instruments from the factory starting with S/N B010347.

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067-1039-00 AND 067-1039-01
OSCILLATION FIX

REF: 067-1039-00 INSTRUCTION MANUAL
P/N 070-3986-00

Mod 62882

A spurious oscillation of about 450MHz has been observed on the outputs of a high percentage of 067-1039-00 Pattern Generators.

Mod 62882 addresses this problem by changing R278 on the Horizontal Sync Generator board from 47 ohms to 100 ohms (P/N 315-0101-00).

Install Mod 62882 on an "as required" basis.

Mod 62882 will be installed on replacement Horizontal Sync Generator boards (P/N 670-7244-01) from the factory.

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7A16P MOD KIT NOW AVAILABLE FOR
REPLACEMENT OF U30630

REF: M43567, M43737

S/N Range: B010100 - B041353

U30630 the masked ROM, Tek P/N 156-0981-00, is no longer available. To replace this part for the indicated S/N range, use mod kit 050-1535-01. If the unit is above S/N B041353 the new part is a direct replacement.

The reason for the kit is to adapt the different pin configuration of the replacement part to the circuitry on the Logic circuit board.

The circuit designation changes from U30630 to U31630.

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118AS CIRCUIT BOARD ERROR

REF: 118AS PRELIMINARY INSTRUCTION
MANUAL, P/N 061-3076-00

Improper Common Mode operation of the Analog Board has recently been traced to an error in early board designs.

P/N 670-8453-00 has Pin 1 of A1T169 inadvertently connected to ground. This will cause the instrument's input to be unbalanced when used in the transformer-coupled mode.

To correct this problem, lift the leg of A1R174 that is nearest to the edge of the ECB. Also lift pin 1 of A1T169 (Black lead). Connect the two together "teepee" fashion.

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380/381 IMPROVEMENTS

REF: 380 INSTRUCTION MANUAL
P/N 070-3421-00

381 INSTRUCTION MANUAL
P/N 070-3422-00

Mod 56561

Mod 56561 has been implemented in the 380 and 381 to address the following problems:

- Lay down teepee parts onto ECB
- Improve position effect for Pulse-to-Bar Ratio
- Lower component costs
- Provide mechanical clearance for the power switch shaft

All of these are being addressed by circuit board re-layout and parts changes/additions to the Main Circuit Board. The new circuit boards are 670-6593-04 (380) and 670-6593-05 (381).

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410X WITH 50HZ HUM ON DISPLAY

Ref: Power Supply Part Numbers:
119-2012-00
119-2029-00

A problem has been encountered with the new power supply, 119-2012-00 (and 119-2029-00) when used with a line frequency of 50hz. When the Host RS-232 cable is attached there may be a noticeable 50hz hum on the display.

The hum can be removed by shorting C29 with a piece of wire soldered across its leads. It is recommended that this be done on an as-needed basis.

A mod is in process with completion expected by March 1987.

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468 POWER CORD WILL NOW FIT THE POWER CORD CLAMP

REF: MOD #62298

The power cord part number presently called out in the manual is incorrect and will not fit in the power cord clamp. The correct part number is 161-0104-11.

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520A SERIES APL CHANGE
CAUSING VIT OFFSET

REF: 520 INSTRUCTION MANUAL
P/N 070-1709-00

521A INSTRUCTION MANUAL
P/N 070-1794-00

522A INSTRUCTION MANUAL
P/N 070-1874-00

If, when viewing a VIT with the 520A, a change in Full Field APL causes the VIT to offset, make sure CR836 is present, and functional.

This diode was added at approximately S/N B430000 to decrease the turn-on time of the Vertical Deflection Output Amps. The diode is shown on schematic 7.

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650/650A/650HR SERIES LEFT FRONT PANEL REPLACEMENT ASSEMBLY

REF: 650 SERIES INSTRUCTION MANUAL
P/N 070-1161-00

650A SERIES INSTRUCTION MANUAL
P/N 070-2234-00

650HR SERIES INSTRUCTION MANUAL
P/N 070-2646-02

653A/656A SERIES INSTRUCTION
MANUAL, P/N 070-2337-00

653HR/656HR SERIES INSTRUCTION
MANUAL, P/N 070-2647-00

Mod 63053

The left front panel assembly of the 650 Series instruments will now be available as P/N 670-1604-00.

W2 Issue 17-6

760 GRATICULE HEAT DISTORTION

REF: 760 Instruction Manual,
P/N 070-5992-00

MOD 61934

In order to decrease the chance of damaging the 760's graticules, due to illumination bulb heat, A3R615 has been changed from a 10 ohm resistor to an 18.2 ohm 3 watt resistor, P/N 308-0344-00.

In addition, the material used to make the external graticules has been changed for increased temperature rating. The part numbers remain the same.

Install a new graticule where heat related distortion is observed, and install the new resistor on any unit returned for service.

Mod 61934 is being installed in new 760's from the factory starting with serial number B010371.

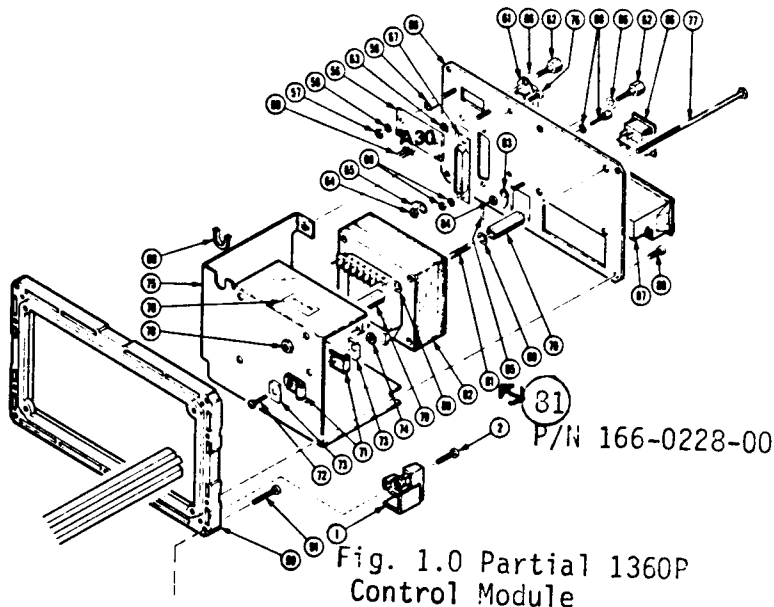
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1360P INSULATOR SLEEVE WRONG P/N CORRECTION

Ref: Instruction Manual 070-3476-00

Figure 1.0 is a partial mechanical exploded view of the 1360P Control Module. The correct Tek P/N for index #81 is 166-0228-00 as indicated.



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1410R OPT. AA/1411R OPT. AA/1412R OPT. AA SYNC & SCH PHASE IMPROVEMENT MODS

REF: 1410R OPT. AA INSTRUCTION MANUAL
P/N 070-4905-00

1411R OPT. AA INSTRUCTION MANUAL
P/N 070-4906-00

1412R OPT. AA INSTRUCTION MANUAL
P/N 070-4907-00

Mod 60797

Mod 60797 has been incorporated into the 141X Opt. AA Generator Series in order to address the following concerns:

- 1) Insure that the 1411R Opt. AA and 1412R Opt. AA can be adjusted for proper SCH Phase.

1410R OPT. AA/1411R OPT. AA/1412R OPT
AA SYNCH & SCH PHASE (continued)

2) Remove unnecessary parts.

3) Increase sync width in the 1410R
Opt. AA and 1411R Opt. AA.

Item 1 was implemented in the 1411R
Opt. AA by lifting pins 3 and 10 of
U122 (on board A26-1), strapping pin 3
to pin 4 and strapping pin 10 to pin
11. Item 1 was also implemented in
the 1412R Opt. AA by lifting pins 4
and 10 of U122 (on board A26-2) and
strapping them to adjacent pins 3 and
11. In addition, in the 1412, J122,
J432 and J429 were moved to their PAL
positions.

Item 2 removed extra parts in the
1411R Opt. AA and 1412R Opt. AA. The
parts removed are U322, U429 and R525.

Item 3, in the 1410R Opt. AA and 1411R
Opt. AA consisted of:

A) Adding a clamp diode, CR564, P/N
152-0322-00, from the +3 Volt end
of R564 to the Q572 end of R561
(Anode to +3V).

B) Adding a speed-up cap and current
limit resistor to the output of
U422D. The parts added are C561
(P/N 283-0220-00) and R560 (315-
0102-00). They are put together as
a parallel pair and inserted into
the circuit by lifting the cathode
of CR560 and putting the pair in
series between U422D and CR560
"Teepee" fashion.

Add mod 60797 to any Opt. AA returned
for service.

This mod is being installed in new in-
struments from the factory starting
with serial numbers B040886 (1410R
Opt. AA) B023151 (1411R Opt. AA) and
B020155 (1412R Opt. AA).

W2 Issue 17-2

1434 IMPROVEMENT MODIFICATIONS

REF: 1434 INSTRUCTION MANUAL
P/N 070-5658-00

Mod 61725

Mod 61725 has been implemented in the
1434 to address the following:

- A small amount of unwanted power
supply noise.
- Re-layout of the A1 Circuit Board.

The small amount of power supply noise
has been acceptably reduced by remov-
ing R311.

During the board re-layout process,
two circuit changes made additional
changes necessary. The new A1 board,
P/N 670-9007-01, will have a wire
strap from TP453 to U352-5, and R482
is 432 ohms, P/N 321-0158-00. These
two changes are not applicable to A1
boards, P/N 670-9007-00.

These changes are being installed in
new instruments from the factory
starting with S/N B010128.

W2 Issue 17-2

1441 REAR INTERFACE ASSEMBLY

REF: 1441 INSTRUCTION MANUAL
P/N 070-1499-00

The complete rear interface assembly
for a 1441 can be obtained by ordering
P/N 610-0584-00.

W2 Issue 17-4

1480 RELIABILITY/PERFORMANCE ENHANCEMENT MODS

REF: 1480 SERIES INSTRUCTION MANUAL
P/N 070-2338-00

Mod 61325

Mod 61325 has been implemented in the 1480 Series to address the following:

- 1) Less than desired reliability from A9C6446.
- 2) Improvements to the Sync Separator to alleviate IC selection.
- 3) Improvements to the Opt. 7 Input Amp to alleviate transistor selection.
- 4) Change the rear fuse holder to accommodate a 90 degree power cord plug.

Item 1 was addressed by changing A9C6446 from P/N 283-0057-00 to 283-0189-00, a 400 V part.

Item 2 was addressed by changing A6C3269 from .1ufd to .22ufd, P/N 283-0339-00.

Item 3 was addressed by adding a new capacitor, nomenclated A4C4909 (P/N 281-0819-00) across the emitter and collector of Q4910.

Item 4 was addressed by changing the rear fuse holder to P/N 204-0832-00.

Install these changes as required.

Mod 61325 is being installed in new instruments from the factory starting with S/N B105725 (1480 R Series) and S/N B094424 (1480 C Series).

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1700F10 EXCESSIVE NOISE WHEN USED WITH 1705

REF: 1700F10 INSTRUCTION MANUAL
P/N 070-5812-00

Mod 63114

The 1700F10 DC Power Supply Field Kit has been upgraded to reduce excessive noise that interfered with the 1705's operation.

The change involves adding four capacitors (C408, C410, C508, and C510), P/N 281-0775-00, to the back of the circuit board, and adding some additional ground strapping.

This article can be considered as "Information Only".

New 1700F10's from the factory, starting with S/N B010208, will have mod 63114 installed.

W2 Issue 17-6

1710B SERIES CHASSIS CHANGE

REF: 1710B SERIES INSTRUCTION MANUAL
P/N 070-5522-00

Mod 61227

Mod 61227 has been incorporated into the 1710B Series instruments to take advantage of a common chassis.

P/N 426-2103-00 changes to 426-2103-01. Install this mod when chassis replacement is required.

Mod 61227 is being installed in new instruments from the factory starting with S/N B021134 (1710B) and S/N B020250 (1711B).

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1710B SERIES SPEC & PROCEDURE CHANGES

REF: 1710B SERIES INSTRUCTION MANUAL
P/N 070-5522-00

Enclosed as pull-out supplement "C" are changes to the Specifications and Performance Check procedures for the 1710B Series Waveform Monitors.

W2 Issue 17-1

1710B/1720/1730/WFM-300 SERIES
POWER SUPPLY IMPROVEMENT

REF: 1710B SERIES INSTRUCTION MANUAL
P/N 070-5522-00

1720 SERIES INSTRUCTION MANUAL
P/N 070-5846-00

1730 SERIES INSTRUCTION MANUAL
P/N 070-4474-01

WFM-300 INSTRUCTION MANUAL
P/N 070-6039-00

Mod 62312

Mod 62312 provides a more reliable capacitor in the power supplies of the above listed instruments. A1C436 and A1C546 have been changed from P/N 290-0939-00 to P/N 290-0880-00.

Install the new cap on any instrument returned for service.

Mod 62312 is being installed in new instruments from the factory starting with the following serial numbers:

1710B	B021135
1711B	B020250
1720	B011048
1721	B010454
1730	B011047
1731	B010538
WFM-300	B010129

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1720 SERIES PHASE SHIFTER
ASSEMBLY MAINTENANCE NOTE

REF: 1720 Series Instruction Manual,
P/N 070-5846-00

Due to mechanical construction and assembly requirements for the 1720's Phase Shifter assembly, a few points need to be stressed for field repair concerns.

The Phase Shifter assembly is fastened together with four screws that self-tap into plastic pieces. These screws are tightened down with three general limitations.

1. The Rotor and Stator plates must be parallel.
2. They must be close enough to provide adequate signal coupling.
3. They must not jam or drag.

The spacing requirement is mostly limited by a compression ring. However, this ring only compresses once. It does not recover. Therein lies the potential problem.

If the self-tapping screws have loosened, the following steps are recommended.

o Tighten the screws carefully, insuring that the rotor and stator are as parallel as possible. This can best be observed by comparing the incremental rotation rate of the displayed waveform with the corresponding rotation rate of the Phase Shifter.

o If the screws become tight before the rotor starts to drag, you are done. If not, the assembly must be replaced.

Methods to improve the assembly process for this part are under investigation, and you will be informed of the results when available.

W2 Issue 17-3

**1730 SERIES MICROPROCESSOR
RELIABILITY IMPROVEMENT**

REF: 1730 SERIES INSTRUCTION MANUAL
P/N 070-4474-00

Mod 60691

The Microprocessor (A3U522) in the 1730 and 1731 has been changed from P/N 160-3304-00 to P/N 160-3304-01 in order to improve reliability and reduce cost.

Replace U522 with the new part on an "as fails" basis. **NOTE:** When P/N 160-3304-01 is installed, R526 is no longer necessary for proper operation, and can be removed.

Mod 60691 is being installed in new instruments from the factory starting with S/N B010893 (1730) and S/N B010378 (1731).

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**1740 SERIES CRYSTAL
OSCILLATOR START-UP FAILURE**

REF: 1740 SERIES INSTRUCTION MANUAL
P/N 070-4473-00

Mod 62762

Due to certain loading conditions, Y605 on the Vertical Circuit Board may not oscillate with C613 installed.

Mod 62762 addresses this problem by:

- removing C613, and
- cutting the ECB run between U613 pins 1 and 2, and strapping pin 2 to pin 13.

Install Mod 62762 in 1740's, 1741's, and 1742's on an "as required" basis.

Mod 62762 is being installed in new instruments from the factory starting with S/N B013850 (1740), B011376 (1741), and B010163 (1742).

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**1740/1750 SERIES CRT
CLAMP SCREW CHANGE**

REF: 1740 SERIES INSTRUCTION MANUAL
P/N 070-4473-00

1750 SERIES INSTRUCTION MANUAL
P/N 070-4472-00

1750 SERIES INSTRUCTION MANUAL
(B03 & UP) P/N 070-5664-00

Mod 61838

To prevent the possibility of over-tightening the CRT clamp and possible CRT breakage, the clamp screws in the 1740 Series and 1750 Series have been changed from P/N 213-0864-00 to P/N 212-0168-00 by Mod 61838.

These parts can be located in Figure 2-60 (1740 Manual) and Figure 1-10 (1750 Manual).

Install the new screws on an "as required" basis, and consider changing all four if one must be replaced.

Mod 61838 is being installed in new instruments from the factory starting with the following serial numbers:

1740	B013621
1741	B011291
1742	B010162
1750	B031688
1751	B030825

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1910 PROGRAMMING TIP

REF: 1910 OPERATORS MANUAL,
P/N 070-4466-00
1910 SERVICE MANUAL,
P/N 070-4523-00

When programming one of the many functions in the 1910, there is a hidden problem that may not allow the new settings to be saved.

For instance, you may go through the procedure of putting a different VIT

(Article Continued on Next Page)

1910 Programming Tip (continued)

signal on F1L17, execute a SAVE Command, and then power down/up only to find that your new signal did not "take".

One possible solution is to Initialize the EEPROM, and then try your new signal again. The EEPROM will not save anything unless it has been initialized at sometime. It must also be initialized after replacement.

The correct INIT procedure is explained on page 5-10 in the 1910 Service Manual.

W2 Issue 17-6

2230 10/VECTOR GENERATOR BOARD
ASSEMBLY (A11) PART NUMBER INCORRECT
IN MANUAL

The correct part number for the 2230 A11 assembly is 672-1194-01.

For instruments below S/N B022102, order 050-2228-00 which contains a 672-1194-01.

W2 Issue 17-3

2220/2230/2235/2236 VERTICAL GAIN
CHANGE WHEN CABINET IS INSTALLED

REF: Mod #61549

2220 S/N B020396
2230 S/N B022387
2235 S/N B028540
2236 S/N B023850

The vertical gain may change when the cabinet is installed. This is due to an oscillation in the delay line driver circuit.

To correct this, replace A1C210 with a Tektronix P/N 283-0853-00.

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2445/2445A/2455/2455A/2465/2465A/2467
OPTION CALIBRATION

The option buffer board has its own calibration routine that should be performed after buffer board/EAROM replacement (non-A) or NVRMM/Battery replacement (A and 2467). All options and the host must be calibrated before doing the buffer CAL F1.

The non-A buffer CAL F1 recalculates the checksum in the Buffer EAROM and initializes all options to off. The A and 2467 performs a similar task, but since all data is in the NVRAM, CAL F1 runs a checksum on the Control board NVRAM and initializes all options to off.

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2754/P, 2755/P: PART NUMBER FOR W340

REF: 2754/P SERVICE VOLUME 2
P/N 070-6098-00

2755/P SERVICE VOLUME 2
P/N 070-6033-00

The part number and item description for W340 has been incorrectly listed in the Electrical Parts Lists for both 275X/P manuals listed above. The correct part number is P/N 174-0389-00. A Manual Change Request has been submitted to correct new manuals.

(Article Continued on Next Page)

2754/P, 2755/P (continued)

W340 is the Calibrator Output signal interconnect cable, which connects from P340 on the A34 3rd Converter Assembly to the front panel Calibrator Output BNC connector. The cable is constructed from flexible 50 ohm coax and measures 20.52 inches long. The P/N 174-0389-00 has one female BNC connector and one female smb connector.

W2 Issue 17-5

4100F3A SUPPORT BRACKET/PART NUMBERS NOT DOCUMENTED

REF: 4115/4120 Series DMA Interface Service Manual, 070-5290-02

There are part numbers not documented in the 4115/4120 Series DMA Interface Service Manual.

In Figure 1, Exploded View of Section 4, Replaceable Mechanical Parts, item 15 is the support bracket for installation of the Option 3A U-Bracket assembly into a pedestal. Not shown is the support bracket for installation of the U-Bracket assembly into the rollabout unit (M4115B/4120 series). It's part number is 407-1519-00 and uses one screw, P/N 211-0507-00.

Also not documented are the following part numbers:

118-2997-00 MDB-LLTB Loopback Board
118-2998-00 MDB-BLL11 RS422 Long Line Driver
118-2999-00 MDB-DR11-B DMA Module
118-3000-00 Cable Assembly, Loopback Test, 40 pin
118-3275-00 Ribbon Cables, 40 pin, package of 2
These five part numbers make-up the MDB DR11-BLL interface, part number 119-0505-00.

Changes to Section 4 should be incorporated in the next revision of the 4115/4120 Series DMA Interface Service Manual.

W2 Issue 17-1

6130: 2.2, 4MB MEMORY AND LAN

Reason for Article

Reports have been received from several sources that describe critical failures of the Tektronix 6130. This article will explain the failure mode and give a method to correct the malfunction.

Failure Description

The failures of the 6130s are associated with Workstations that are running Level 2.2 or prior of the UTek Operating System Software, have over 3 MB of total memory and are accessing remote files over a Local Area Network (LAN). The failure will usually occur during times of high network activities, and at time of failure will display the message "panic: bus error" on the console terminal. The 6130 Workstation will then shut down. When powered back up, the Workstation will work normally until the next time there is high network activity and the user is trying to access the LAN.

Reason For Failure

The reason for the "panic" is a hardware design error of the Intel LAN controller in combination with some address decoding logic on the main compute board. This allows decoding of DMA operations into the bottom order 3 MByte address range. A request for DMA to a higher address may be requested in error; however the address decoding

(Article Continued on Next Page)

6130: 2.2, 4MB Memory & Lan (continued)

logic will map any address outside of the low order 3 MByte range into the top order 3 MByte range. If such a request is made, a bus error will result, as there is no physical memory within the top 3 MByte range.

Within the UTeK kernel are message buffers (mbufs) that are used by the network code for storing network data traffic. Mbufs are normally created in the systems' low order memory address space (addresses less than 3 MB) at boot time. While the kernel is running, the mbuf pool may get exhausted under high network load demands. When such an event occurs, the UTeK network code will attempt to borrow free physical memory from the area assigned to user processes and allocate it to additional mbufs. In a system with greater than 3 MBytes of physical memory it is possible under these circumstances to allocate memory for temporary mbuf usage at an address greater than 3 MByte (outside of the Intel controllers' addressing range).

Technical Resolution

Code has been put into the UTeK kernel which will avoid using mbufs at an address greater than 3 MByte. Current 4132 hardware design also implements the same 3 MByte limit.

The work-around is probabilistic in the following sense: If the network load is sufficiently high on the Workstation, such that the pre-allocated mbufs are exhausted, the process load is high, such that there is no free physical memory below the 3 MByte boundary, and a received interrupt from the net requires a buffer to be allocated, then the incoming data packet will be ignored. This condition will prevail until either a free block of memory becomes available in the right address

range or the appropriate protocol level detects a net failure. It will be a soft, controlled failure versus the present system failure.

Note that the majority of net traffic in our environment is based on the TCP/IP protocols. TCP/IP will attempt many retries before recognizing a link down or failure condition. With the work-around in place, what is a failure (panic) in UTeK 2.2 (and prior) will become one or more retries to the TCP/IP protocol levels. Under very abnormal conditions it may degenerate to link failure, but not a system critical failure.

Corrective Action

Users on 6130s running UTeK 2.2 and prior, who are experiencing this malfunction may correct it by either reconfiguring their Workstation so that its total memory is 3 MBytes or less, or upgrading their Workstation to run UTeK 2.3 Operating System Software.

A work-around to the reported deficiency is in place and is available in the new UTeK 2.3 kernel software release. Please see the TEK Marketing Sales Release, GWD-010, dated 10-27-86, for details for upgrading a 6130 Workstation.

Summary

In summary, if a 6130 Workstation is running the UTeK 2.2, or prior Operating System Software has 3 MBytes or more of memory, and accesses a heavily used Local Area Network, there is a good chance that the system may "panic" and "crash". Even though there is usually no permanent damage done, it is a very great inconvenience and is a system "bug".

To correct this malfunction, remove any memory over 3 MBytes or upgrade the Workstation to the 2.3 level of UTeK.

W2 Issue 17-2

7612D HIGH VOLTAGE SHUTDOWN PREVENTION MODIFICATION

Effective S/N: B051975
Reference: M62574

To prevent the 7612D high voltage oscillator from randomly shutting down at power-up and after power-up, perform the following modification to the Deflection Amp Circuit Board (A26).

- Remove resistor R900, Tek P/N 315-0271-00 and change to Tek P/N 301-0151-00 (150 ohm, 4%, 0.5W).
- Remove resistor R912, Tek P/N 308-0304-00 and change to Tek P/N 308-0077-00 (1K ohm, 5%, 3W).
- Remove capacitor C814, Tek P/N 283-0081-00 and change to Tek P/N 281-0812-00 (1000PF, 10%, 100v).
- Add heat sink, Tek P/N 214-0269-00, to transistor A26 Q906.

The new Tektronix part number for the A26 Deflection Amp Board is 670-4941-07.

W2 Issue 17-2

7612D QUESTION - ANSWER BRIEF

REF: Operator's Manual, 070-2386-00

This article will provide answers to frequently asked questions about the 7612D Digitizer.

See Pullout "D".

W2 Issue 17-4

7612D REVISED TRACEABLE CERTIFICATION PROCEDURE NOW AVAILABLE

REF: 7612D Instruction Manual
(070-2387-01)

The intent of this article is to provide the necessary information required to perform a traceable certification per the revised Calibration/Verification procedure for the 7612D.

The revised procedure is contained in the 7612D Instruction Manual, Tek P/N 070-2387-01. The procedure provides descriptions for the software Main tests; Bit Accuracy, Trigger, Time-base, Vertical, front-rear panels.

This certification process will verify that the instrument meets or exceeds all published specifications and has been calibrated using equipment, standards, and documented procedures traceable to NBS where applicable.

The major advertised specifications that are traceable to NBS are as follows:

Product Characteristic

1. Vertical Deflection System

- Bandwidth
- Deflection Factor

2. A and B Timebases

- Clock
Internal Rate

The Certificate of Traceable Calibration and the Calibration Data Report (Before-and-After report) are currently in place and available upon request from the Service Cal/Cert Lab located in Beaverton, Oregon.

W2 Issue 17-1

7912AD MAY RETURN INCOMPLETE DATA FROM PLUG-INS (REVISION)

Ref: 670-7642-00

It has been discovered that 7912ADs with the new 670-7642-00 MPU boards may return incomplete data from the plug-ins over the GPIB. Occasionally an entire byte is missing from a character string, such as BWFUL instead of BW FUL. It was discovered earlier that component selection could prevent the problem.

Manufacturing has developed a modification that eliminates the need for component selection. A wire should be soldered from A54U810 pin 1 to A54U800 pin 10. This connection was inadvertently omitted when the 670-7642-00 board was designed. For this reason, this wire should be added to every 670-7642-00 MPU board.

Future boards from manufacturing will have this modification installed, and will be part numbered 670-7642-01.

W2 Issue 17-6

Tektronix
 COMMITTED TO EXCELLENCE

MANUAL CHANGE INFORMATION

Date: 9/4/86Change Reference: C4/0986Product: PG 502Manual Part No.: 070-1598-01

DESCRIPTION

On page 4-3 replace step 4. Check Pulse Amplitude with the following corrected procedure.

4. Check Pulse Amplitude HIGH and LOW LEVELS

a. Set the PG 502 as follows:

PERIOD	EXT TRIG
PULSE DURATION	EXT DURATION
BACK TERM	IN
COMPLEMENT (—)	OUT (NORM)
HIGH LEVEL	Fully colckwise
LOW LEVEL	(0)

b. Connect the PG 502 OUTPUT through a precision bnc cable and a 50 Ω terminator to a digital voltmeter.

c. Check that the voltmeter reads $\pm .000$ volts within 500 mV (— .50 to +.50).

d. Rotate the PG 502 LOW LEVEL knob to —5 and the HIGH LEVEL control knob to 0.

e. Depress the MAN TRIG and hold in.

f. Check that the voltmeter reads $\pm .000$ volts within 500 mV (— .50 to +.50) when the MAN TRIG button is pushed in.

g. Adjust the PG 502 HIGH LEVEL and the LOW LEVEL controls fully cw.

h. Check for a voltmeter reading of +5 volts or greater.

i. Depress the MAN TRIG and hold in.

j. Check for a voltmeter reading of +5 volts or greater.

k. Adjust the PG 502 HIGH LEVEL and the LOW LEVEL controls fully ccw.

l. Check for a voltmeter reading of —5 volts or greater.

m. Depress the MAN TRIG and hold in.

n. Check for a voltmeter reading of —5 volts or greater.

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SERVICE MAINTENANCE INFORMATION

WFM-300

COMPONENT WAVEFORM MONITOR

INTENT: To provide supplementary or additional maintenance information not available in the Service Implementation Plan or Service Manual. Reference should be made to the published Service Implementation Plan, dated October 7, 1986.

ORIGINATOR: Bill Bean, Performance Assurance Engineer
Beaverton Service Support, 53-108, 642-8695
Issue 17-2

I. PRODUCT DESCRIPTION

The WFM-300 Component Waveform Monitor is one of several new products being introduced to address the needs of three-wire analog component television systems. The instrument is configured as a half-rack, CRT based monitor, using many mechanical and electrical parts and assemblies common to the 1700 Series Tektronix Television products.

The WFM-300 features standard waveform monitor and vector displays, plus some innovative displays developed for, and unique to, the analog component world. Display functions available include:

- WAVEFORM, a traditional time vs. amplitude display, with three sweep speeds and a MAG function.
- PARADE, a traditional display of the three input signals, chan 1-2-3 ordered, with overlay capability.
- VECTOR, a traditional phase vs. amplitude polar plot of the color signal.
- BOWTIE, a new display mode that allows a quick assessment of timing and gain matching any two of the three analog signals.
- LIGHTNING, a new display mode that provides simultaneous gain and timing measurement capability for all three analog inputs.
- and others.

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The WFM-300, in one or more of its options, addresses most of the Analog Component formats being presently used or tested. These include:

- GBR
- SMPTE
- BETACAM (Opt. 10)
- M (or YQI) (Opt. 12)

II. MANUALS

The WFM-300 Instruction Manual, P/N 070-6039-00, provides Operating and Service information in one volume. The manual can be ordered now.

III. DIAGNOSTICS

There are no built-in diagnostic capabilities within the WFM-300. Diagnosing instrument failures will depend upon a thorough understanding of the instrument's normal operating modes, and a detailed study of the circuit description and schematics contained within the Instruction Manual.

IV. TROUBLESHOOTING HINTS

As always, begin troubleshooting the WFM-300 with a thorough symptom analysis and a good visual inspection. Loose connectors, parts not fully seated in their sockets, and operator error can be very quickly repaired. Then check the power supplies.

The power supply provides +40V, +5V, +15V and -15V to the Main Board, and from there, +5V, +15V and -15V are also fed to the Control Board. +15V and -15V are post-regulated on the Main Board to +11.8V and -11.8V by U146 and U139 respectively. These voltages are used on the Main Board and also distributed to the Control Board. The GBR Board receives + and -11.8V from the Main Board, and +5V from the Control Board. One more voltage source exists on the Main Board that provides -3V and -3.6V to a few components on schematic 2.

Once the power supplies are determined to be functional, selection of a few of the operating modes and reference to the block diagram should help in further narrowing down the problem area. The block diagram has been drawn with signal paths indicated by heavy dark lines, and control paths indicated by light lines.

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By using the instrument in the familiar WAVEFORM mode, you should be able to quickly ascertain the basic operation of the vertical deflection system from the Input Amps, through the Variable Gain stage, the filters, the Mag Amps and the Vertical Deflection Amp. In addition, the G, B and R signals will be available through a set of transcoders and amps, and can be analyzed via the GBR rear-panel connectors.

While in the WAVEFORM mode, the Ramp Generator and Horizontal Deflection circuitry can be checked, as well as the EXT SYNC processing circuitry.

The VECTOR mode operates similar to a traditional vector-scope. The color difference signals (Pr and Pb) are applied to the Horizontal and Vertical Deflection circuits, after suitable filtering and clamping, to produce the familiar vector display.

The remainder of the instrument's functions serve to provide variations on these basic displays (filters, transcoders, switches, magnifiers, clamps, etc.), to generate the electronic graticules, and to provide the timing/controls for all of the above.

Schematic Diagrams 1, 2 and 3 contain the basic Vertical and Horizontal circuitry discussed so far. The circuitry is analog for the most part, and troubleshooting should present no new or unusual problems.

Schematic 4, TIMING, contains most of the circuitry that must respond to real-time events triggered by combinations of H or V. Troubleshooting this section should be straight-forward. The signal flow is in a left-to-right configuration with no feed back loops. The timing equation for the one-shots is given and the text provides the background for the signal flow requirements.

Schematic 5, PROCESSOR, can be broken up into a few basic blocks for troubleshooting. The microprocessor gives a priority to responding to the front panel, and provides feedback via LED's. U343 and U288 are the major blocks for this function, with U360 providing the chip select function. The next items to look at are the Static Registers, U463 and U475. Their output lines should reflect what was selected since it is from here that most of the non-real time functions are set.

These Dynamic Registers (U560 and U451) will be sending signals to circuitry continuously, depending on functions selected. The expected actions of these lines are explained in the text.

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Schematic 6, GRATICULE, contains the circuitry that generates the electronic graticules, CRT readouts, and other ancilliary lighting and control data. The data path for the electronic graticule is mostly a left-to-right flow. U152 does receive two feedback lines from the EPROM for sequence control. U160 and U260 will provide continuous address counts depending upon the graticule being implemented. This count, plus more address information, will cause various data streams to be sent from U268 to U283 and U275. The voltage outputs from these DAC's should be continuously moving when electronic graticules are being used.

Schematic 7 and 8 are the Low and High Volt power supplies. These are nearly identical to the supplies used in the 1720 and 1730 Series products. Review your maintenance information on these products for more detail.

V. MODIFICATIONS

The mods that have been implemented in the WFM-300 as of the printing of this article follow below.

Mod 62198 - starting S/N is #B010128.

The GBR to Color Difference resistor matrix has several value changes to insure meeting specs. (Opt. 12 only)

<u>CKT #</u>	<u>OLD P/N</u>	<u>NEW P/N</u>
A3R178	321-1709-01	321-0612-07
A3R179	321-0210-07	321-0619-00
A3R180B	321-0237-00	321-0238-00
A3R181	321-0431-00	315-0331-00
A3R182	321-1173-00	321-1739-07
A3R183	321-0221-00	321-0222-07
A3R277	321-0173-01	321-0612-07
A3R278	321-0226-00	321-0220-00
A3R279	321-0698-00	321-0214-00
A3R280	315-0751-00	315-0561-00
A3R285	321-0698-00	321-0222-07
A3R286	321-0199-03	321-0198-00

Install this mod, if not already done, on any Opt. 12 returned for Service.

Mod 62312 - starting S/N is #B010129.

The working voltage of A1C436 and A1C546 was increased for reliability. P/N 290-0939-00 is replaced by 290-0880-00.

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Install this mod on any unit returned for service where not already done.

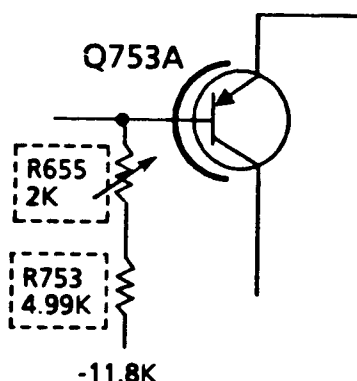
Mod 62419 - starting S/N is #B010155.

This change addresses the following items.

- 1-Backporch clamp to sync edge timing changed.
- 2-Horizontal Magnification registration improved.
- 3-Gamut Detector time constants decreased.
- 4-Changes to Channel input circuitry.

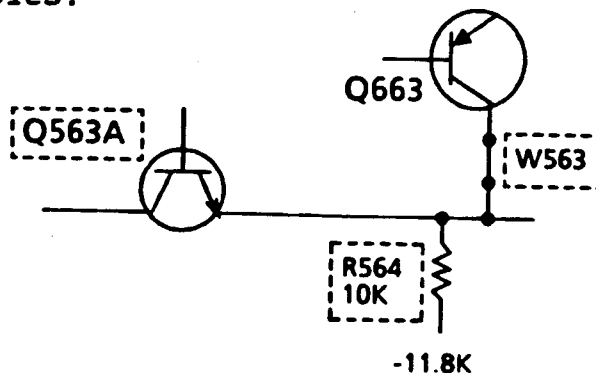
Item 1 was addressed by changing A4R322 from 9.76K ohms to 7.87K ohms (P/N 321-0279-00), and A4R321 from 11.8K ohms to 12.4K ohms (P/N 321-0298-00).

Item 2 was addressed by changing A3R753 from 6.19K ohms to 4.99K ohms and by adding A3R655, "teepee" fashion, in series with R753 and the base of Q753A (see drawing below).



Item 3 was addressed by changing A4R411 and A4R412 from 2K ohms to 8.2K ohms (P/N 315-0822-00).

Item 4 was addressed by replacing A3C564 with a 0 ohm resistor (P/N 131-0566-00), reversing Q563, and adding A3R564, a 10K ohm resistor (P/N 315-0103-00) from the emitter of Q563 to an 11.8 volt source (located at the left leg of A3R568). (See drawing below) Q563 can be most easily installed by inverting it and routing the leads to the appropriate holes.



Install these changes on any unit returned for service.

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VI. NEW TEST EQUIPMENT

A new item of test equipment is required to properly test and calibrate the WFM-300. The TSG-300 Component Test Signal Generator is specified, and will be used for a variety of new analog component devices in the future.

VII. TEST DATA

Before and After Calibration Data Sheets will be available from the Factory Service Cal/Cert. Lab. Contact Del Knapp, 56-125 or 642-8658.

7612D QUESTION - ANSWER BRIEF

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7612D QUESTIONS AND ANSWERS

The purpose of these notes is to provide answers to typical customer questions.

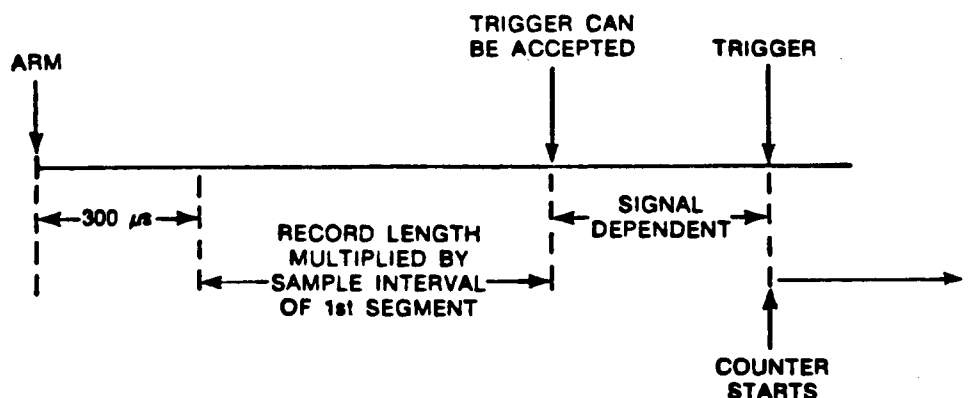
QUESTION 1 **The instrument ARMs but does not digitize now. What is wrong?**

ANSWER This and similar questions usually indicate that the customer does not understand PRE-TRIGGER operation. Often the customer has previously used the 7612D with a short sampling interval (5 ns), and has a new application requiring a long sampling interval (10 ms).

Pages 2-15 and 2-16 of the 7612D Operator's Manual, P/N 070-2386-00 provide a flow chart and explanation which may assist in your explanation of the ARMING process to the customer.

Essentially there is a minimum period of time between ARM and the time at which the circuits can accept a trigger. Typically, the time is 300 microseconds, unless the time base settings have been changed since the previous ARM. If they have been changed, the time would be 50 milliseconds.

In PRE-TRIGGER mode there is an additional period of time which is sampling interval and record length dependent. This is the time taken to fill the selected memory with samples. The trigger starts the counter which will terminate digitization. The count being Record Length minus the selected number of Pretrigger samples.



PRETRIGGER TIMING (NO SETTINGS CHANGED)

Consider a record of length 2048 points with no breakpoints. With a 5 ns sample interval it takes approximately 10 microseconds to fill the memory. This time must elapse before the required trigger event occurs. In the case where the sample interval is 10 ms, over 20 seconds must elapse between the ARM and the desired trigger event. Using MANUAL TRIGGER (front panel control) does not cause the counter to start and digitization to complete unless the time period has elapsed.

QUESTION 2

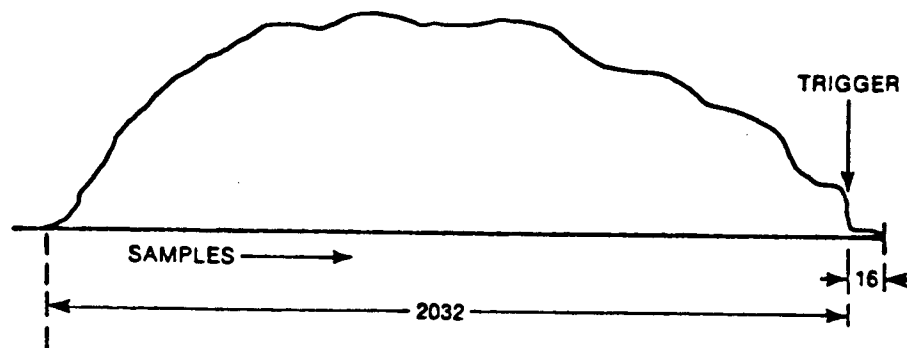
Can the pre-trigger arming period be eliminated?

ANSWER

No, but there are some ways in which its effect may be reduced:

- a) If the full record must be acquired at one sample interval setting, then arranging for the channel to be triggered at the end of the event can help.

RECORDS 1
 LENGTH 2048
 PRETRIGGER 2032

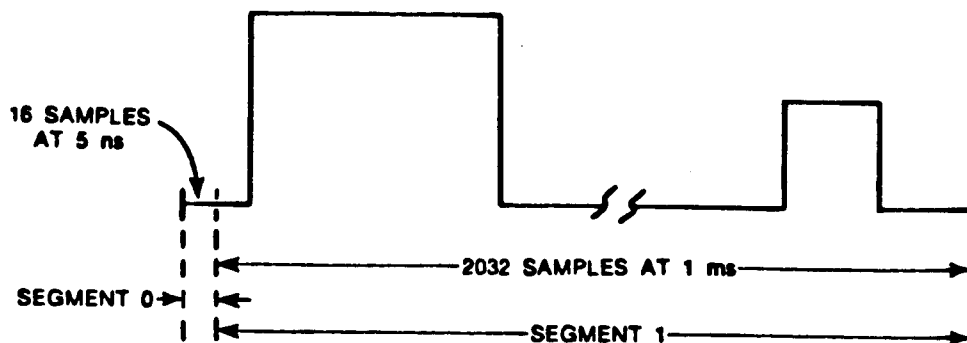


DATA ACQUISITION - PRETRIGGER

In the example shown above, if the PRE-TRIGGER setting is 2032, it would mean that the desired data was in fact digitized during the PRE-TRIGGER ARMING time, as only 16 samples would be taken after the trigger event.

- b) The ARMING time is a fixed period, plus Record Length times the Sample Interval, of the first Segment of record. Set a breakpoint at 16 with the desired sample interval, then arrange for the first segment (samples 0 to 15) to have a sample interval of 5 nsec. Even if the record length is 2048 points, 10.24 microseconds will be the only additional time taken before a trigger can be recognized.

PRETRIGGER 0000
 BREAKPOINT AT 0 S.I. 5 ns
 BREAKPOINT AT 16 S.I. 1 ms

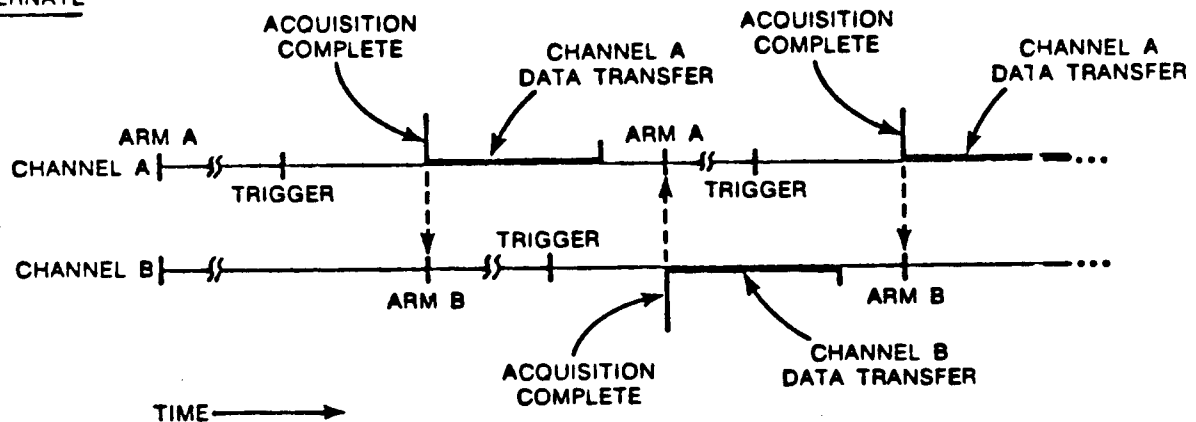


DATA ACQUISITION - PRETRIGGER

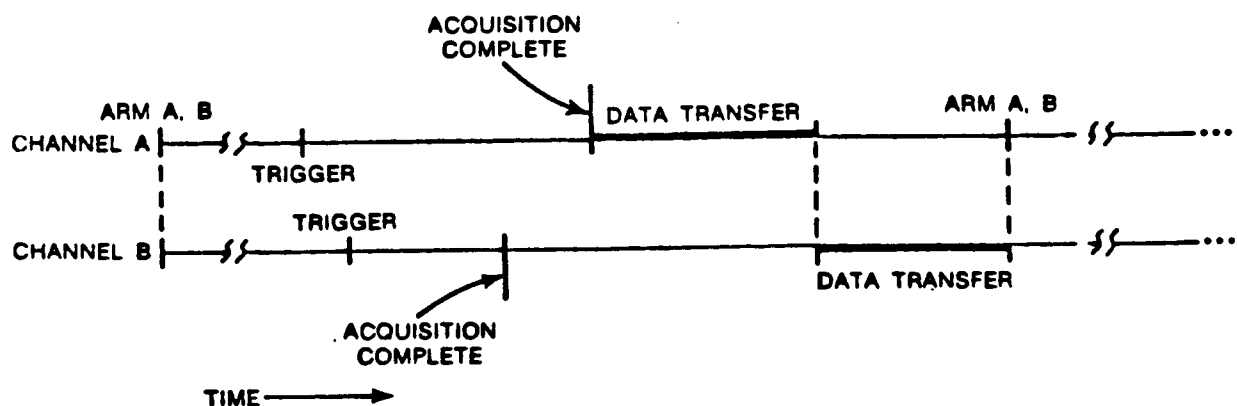
In subsequent data processing, the different sample interval times may need to be taken into account.

QUESTION 3**Can the 7612D function as a continuous digitizer?****ANSWER**

No, but it can very closely approach this mode under certain conditions where the time interval lost, when switching between channels; may be of no significance. The major condition to be satisfied is that data transmission time is shorter than data acquisition time.

ALTERNATE

In the ALT mode, as one channel completes acquisition, the other channel receives the ARM pulse. No more data will be acquired until that channel can accept a trigger (refer to question/answer numbers 1, 2 for an explanation of ARM timing). This time period can be made relatively short, and maybe ignored, if the application calls for long sample intervals.

REPEAT

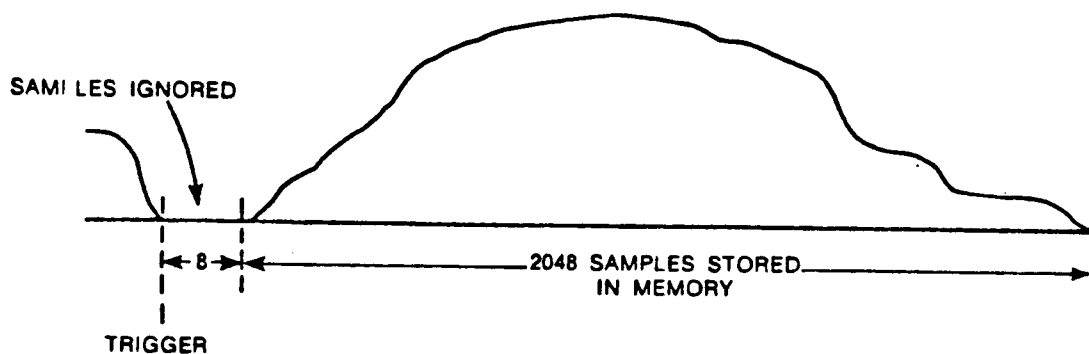
The REP A,B mode would have a longer time period without acquiring data. This is due to the fact that channel 'B' always has to be read after the acquisition completes, before the channels can be ARMed again.

The ALT mode is the best choice to approach continuous digitization.

QUESTION 4 Can continuous digitization be obtained using the POST-TRIGGER mode of operation?

ANSWER No, because the minimum setting for POST-TRIGGER is 8. This means that the first 8 clocks after trigger do not cause data to be stored in the memory.

RECORDS 1
 LENGTH 2048
 POST TRIGGER 8



QUESTION 5 Trigger ambiguity — The specifications state that there is ± 1 sample interval ambiguity in recognizing the trigger. Is there any way in which the event time and the sample time can be correlated?

ANSWER Yes, use the 200 MHz clock out signal to initiate the event. The timing relationships will then be preserved.

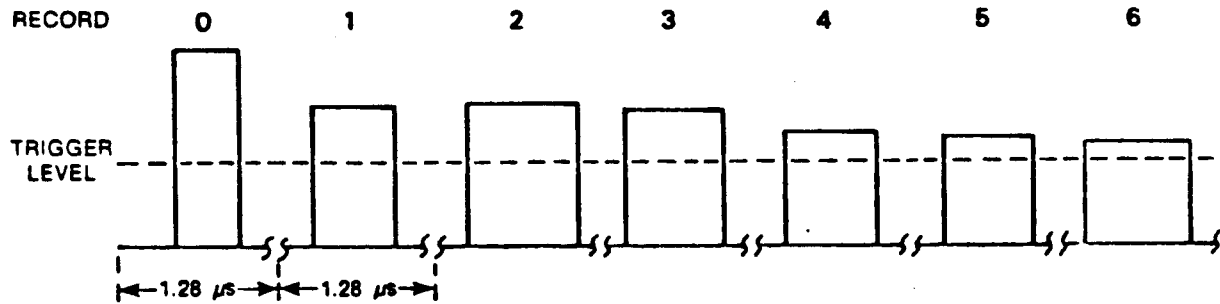
QUESTION 6 Multiple records — I have a series of 7 pulses of approximately one microsecond duration occurring in one-half millisecond. I would like to have a resolution of 5 ns during each pulse, and know pulse occurrence times to an accuracy of 1 microsecond. Is this possible?

ANSWER Yes, input the signal to both channels A and B and arrange for both channels to be triggered from the left (Channel A).

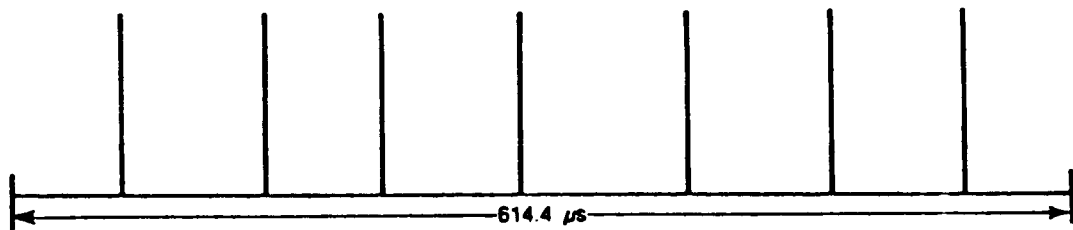
Ensure that the trigger level is set to trigger from the lowest amplitude pulse being input to Channel A. A trigger is required before each record can be digitized.

CHANNEL A

RECORDS 7
 LENGTH 256
 SI 5 ns

CHANNEL B

RECORDS 1
 LENGTH 2048
 SI 300 ns
 PRETRIGGER 0032



QUESTION 7

When using multiple records, what is the minimum time between records?

ANSWER

The minimum time between records is dependent on the ARM time in pre-trigger because an ARM sequence occurs after each record is acquired. See question/answer #1 for details.

POST-TRIGGER permits single record only.

QUESTION 8 Occasionally we need a record length of 4096. Can this be achieved using the 7612D?

ANSWER Yes, connect the desired signal to both A and B channels and arrange for both channels to be triggered from one source. Set Channel A to PRE-TRIGGER 0000, RECORDS 1, LENGTH 2048. Set Channel B to POST-TRIGGER 2048, RECORDS 1, LENGTH 2048. Set identical sample intervals on each channel.

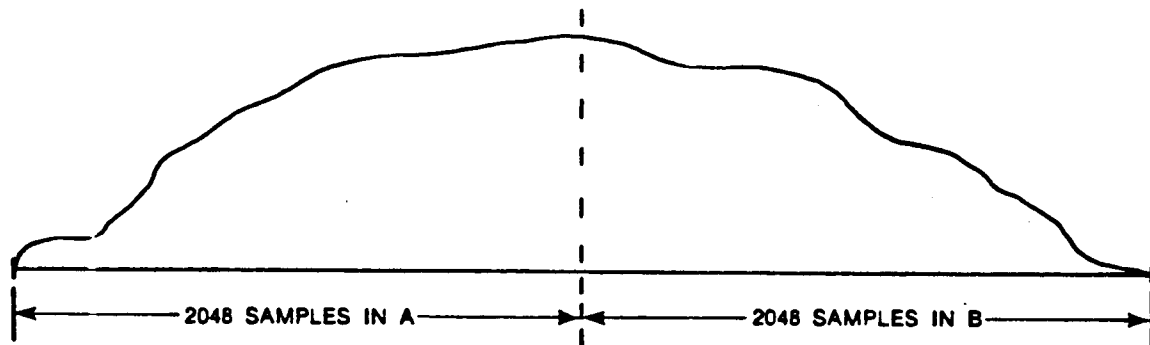
Allow sufficient time after ARM before the occurrence of the desired trigger signal. After trigger recognition, the first 2048 samples will be stored in Channel A, and the next 2048 samples stored in Channel B. There is a possibility of one sample interval time ambiguity between the two channels.

CHANNEL A

RECORDS 1
LENGTH 2048
PRETRIGGER 0000

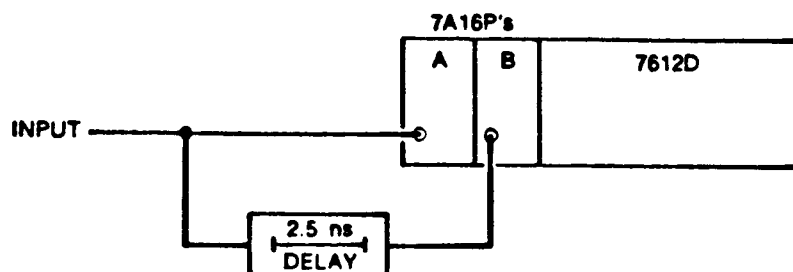
CHANNEL B

RECORDS 1
LENGTH 2048
POST-TRIGGER 2048



QUESTION 9 What are the specifications for 400 MHz sampling when using the two channels and a 2.5 nsec delay line?

ANSWER 400 MHz is not specified nor is it recommended.



Both channels would be set for 5 nsec sample interval. They are driven from a common clock. The 2.5 nanosecond time separation of A and B channel samples of the signal can be achieved by delay line adjustment. The contents of A and B memories could be combined in an external controller.

We do not advise this approach for two reasons. First, separate amplifiers are used in each signal path to condition the signal. Each amplifier would require to be completely characterized and necessary corrections made to the stored samples before attempting to merge the contents of the two memories. A further problem area is due to the trigger ambiguity specification. Steps would be necessary to estimate whether A or B channel received the first sample taken.

In A.E. Interface, Vol.3 No.8, Page 17 is an application entitled "How to Sample at 800 MHz with the 7612D." This article discusses a method of interpolation using FFT techniques. This technique utilizes samples taken at 5 nanosecond intervals and calculates the values for 2.5 nanoseconds or smaller intervals. Assumptions are made concerning the input signal.

QUESTION 10

When changing sample intervals during a record, is time coherency maintained?

ANSWER

Yes, on 7612D's serial numbers B031113 and above. Earlier instruments where timebase circuit boards P/N 670-4950-05 are installed (or P/N 670-4950-04 modified by Mod #52781) are also coherent.

Timebase boards with lower modification levels are not coherent when switching to/from 5 ns, but are coherent when switching between all other sample intervals.

QUESTION 11

How many waveforms per second can be digitized and read out from the 7612D?

ANSWER

The number is sample interval and external hardware dependent.

Assuming a 5 nanosecond sample interval, then the limitations are usually external to the 7612D, the 7612D GPIB interface being specified at 710K bytes per second into an infinitely fast controller.

As an example, using a PDP11/34A with a Tektronix GPIB interface, an RL01 hard disk, and TEK SPS BASIC software DLOG command.

More than 30 waveforms (2048 samples) per second, or more than 100 waveforms (256 samples) per second can be logged.

With discrete custom circuitry, customers have achieved higher transfer rates than quoted above.

QUESTION 12 I have two 7A16P's and they give me different responses to the "SET?". Why?

ANSWER 7A16P's S/N B010100 to B041353 in response to a SET?; delimited each field of the response with "<CR><LF>". This causes controllers like the 4050 series to terminate after the first "B/W XXXX". A new firmware release at S/N B041354 corrected the condition.

To upgrade 7A16P's S/N B010100 to B041353, use the following kits:

U630	P/N 050-1535-01
U830	P/N 050-1536-01

QUESTION 13 Can I get self-test to run without turning the 7612D off and using the power-up to initiate self-test sequence?

ANSWER Yes. The power-up sequence can be started by sending EXEC 486A over the bus. 486A is the starting address of the power-up sequence in HEX DIGITS.

QUESTION 14 What length of cable can I drive with the clock-out?

ANSWER The clock-out 200 MHz is an ECL level pulse provided to drive one additional 7612D. Its rise and fall time is less than or equal to 1 ns. It will drive 1 to 2 meters of low loss 50 Ohm coaxial cable. It is not intended to drive long lengths of cable.

QUESTION 15 **EXTERNAL CLOCK MODE** - My instrument exhibits an error when using an external clock frequency below 125 MHz, and the sample clock multiplier is X1. In Pre- or Post-trigger, occasionally there is an error of 8 samples in the start point of acquisition. This shows if one acquires, say 100 waveforms, of the same input signal and graphs them. If the error is present, you will observe two waveforms displaced by 8 samples. What is the solution?

ANSWER The clock requires ECL level drive within specifications. Deviations from this will cause 7612D problems. The external clock in signal is only gated on the clock buffer board and routed to the timebase board. It is not shaped. Timebase boards P/N 670-4950-04 (and later) introduced at S/N B030708 are more tolerant than earlier ones and will usually mask the above problem.

QUESTION 16 **POST-TRIGGER BREAKPOINTS** - In post-trigger mode, the sample interval does not change at the selected breakpoint. It changes 8 samples later. Why is this?

ANSWER It occurs on all instruments prior to S/N B041194. It was corrected by a change of firmware. The problem also caused the channel not to trigger if the displayed breakpoint was set to 8 less than the record length, for example, 2040 in a 2048 record.

The Tektronix Service Organization firmly supports a policy of assuring continued utility of products sold by Tektronix.

This publication is meant to provide technical information to the customer who has elected to maintain his own Tektronix products. It contains product servicing information and is written for the technician.

Articles are submitted primarily by Corporate Service Support & Planning personnel thoroughly familiar with the products they support. SERVICE TEKNOTES also encourages you, the customer, to submit articles for publication. If you have knowledge of a technique, procedure or idea that enables you to service your Tektronix product more effectively, write it up so others may benefit from your experience.


Articles for publication should be submitted directly to:

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P.O. Box 500, M/S 53-102
Beaverton, Oregon 97077

Attention: Mary Ellen Zander
SERVICE TEKNOTES Editor

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