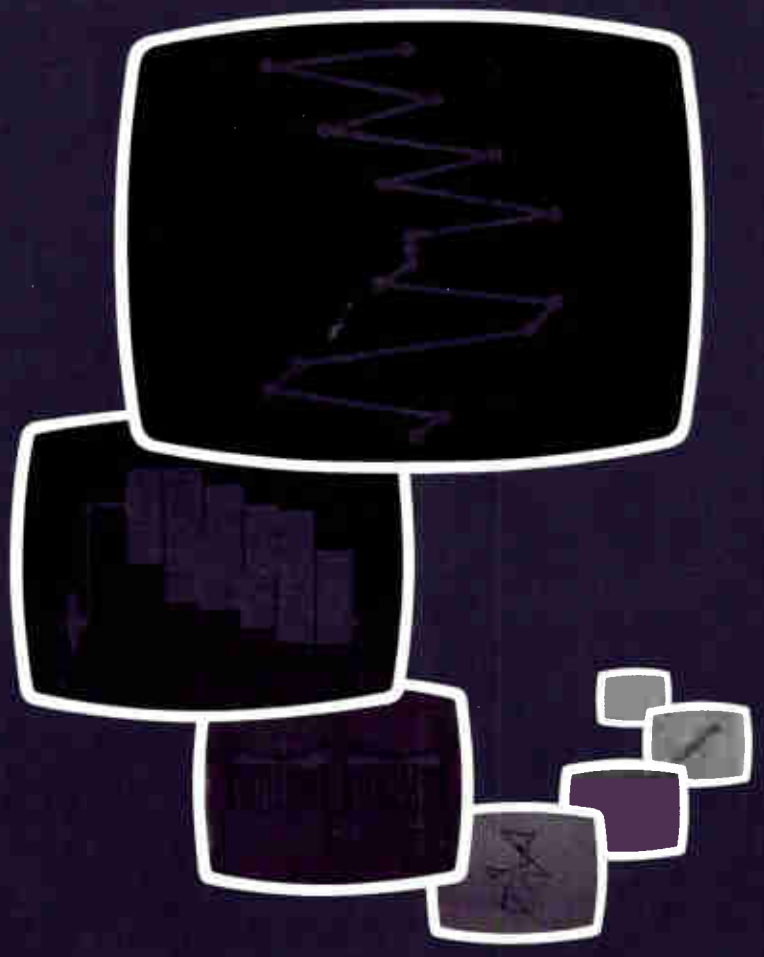
Television Products 1986-87



Tektronix

ON THE COVER

For more than 30 years, Tektronix has met the changing needs of the Television Industry. Tektronix offers test, measurement and monitoring equipment for component television and stereo audio. On the cover are some of our most familiar, and some of our newest television signals. From the waveform and vector displays to the new Bowtie and Lightning displays, Tektronix' tradition of offering the products you need when you need them, continues.

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Tektronix®
COMMITTED TO EXCELLENCE

TOM JORDAN
Region Sales Manager
Television Division

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Blue Bell, PA 19422
Phone: 215-825-6400, 609-541-2105

HARDWARE WARRANTY SUMMARY

Tektronix warrants to its Customers that the products that it manufactures and sells will be free from defects in materials and workmanship for the periods set forth in the table below. If any such product proves defective during the applicable warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Tektronix will provide such service at Customer's site for certain categories of products, as indicated in the table below, if Customer's site is within the normal on-site service area. Tektronix will provide on-site service outside the normal on-site service area only upon prior agreement and subject to payment of all travel expenses by Customer. In all other cases, Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the service center is located. Customer shall be responsible for paying all shipping charges, duties and taxes, if the product is returned to any other location. The locations at which the services will be provided for different categories of products or product groups are set forth below.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; or c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THE LISTED PRODUCTS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE A DEFECTIVE PRODUCT IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

PRODUCT CATEGORIES	WARRANTY PERIOD	SERVICE LOCATION
Oscilloscopes (except 2200, 2300, 2400 Series) and Plug-ins; TM 500/TM 5000 General Purpose Instruments; Communications Network Analyzers (except 834 Series); Logic Analyzers; Spectrum Analyzers (except 494 and 494P); Television Products (except 1980 and 650 Series); Waveform Digitizers; Curve Tracers; Photometers/ Radiometers; Cameras; Carts; Probes; CRTs; and Isolators	1 year from date of shipment	Service Center designated by Tektronix
Oscilloscopes: 2200, 2300, 2400 Series; Spectrum Analyzers: 494 and 494P; Monitors: 650 Series; Communications Network Analyzers: 834 Series and 067-0986-00	3 years from date of shipment	Service Center designated by Tektronix
Computer Graphics Products (except 4105, 4106, 4107, 4109); Intelligent Graphics Workstations; Monitors: 611, 613, 614, 616, 618, GMA 301, GMA 304; 1980 ANSWER; 4041 Controller; Microcomputer Development Products; Artificial Intelligence System 4404	3 months, except 1 year from date of shipment for CRT	Customer's site if within normal on-site service area
Service	3 months from date of shipment or date of completion if performed on-site	Location where original service was performed

U.S. GENERAL TERMS OF SALE

Credit and Payment Terms

Tektronix, Inc. offers many different terms of sale in order to meet varied purchasing objectives and to assist in financial planning.

Credit accommodations must be arranged with Tektronix' Credit Department. Orders and request for credit accommodations should be placed with your local Tektronix Sales Office, listed on page 91 of this catalog.

If, in the judgment of Tektronix, the financial condition or payment record of the Buyer at any time does not justify shipment of order on the payment terms requested, Tektronix may refuse to ship unless it receives payment in in advance, or at its option, payment upon delivery of equipment. Businesses established six months or less may not meet minimum requirements for extended and/or installment terms of sale.

The following terms may be arranged with a Tektronix Sales Office:

Net 30 Days Standard Terms

Standard terms of sale are Net 30 days following the date of invoice. There are no discounts for early payment.

60, 90 and 120 Days Extended Terms of Sale

Extended terms of 60 to 120 days are available on the same single payment basis as standard terms. Since the cost of extended terms is not included in catalog prices, a service chage is added to the invoice. The amount of the service charge depends upon the number of days the terms are extended. Request for extended terms must be made at the time of order placement.

Minimum Order

The minimum acceptable order is $25.00.

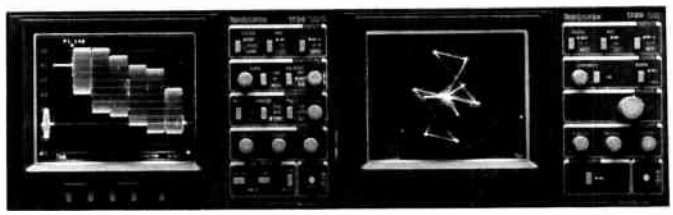
Shipment

All prices, quotations, and shipments are FOB Beaverton, Oregon, unless otherwise specified.

Unless otherwise specified, shipment will be made via most economical method and air shipments will be insured at full valuation unless your order instructs otherwise.

INTERNATIONAL — CONTACT YOUR LOCAL TEKTRONIX SUBSIDIARY OR DISTRIBUTOR.

Here's a look at our *NEW* Television Products. . .

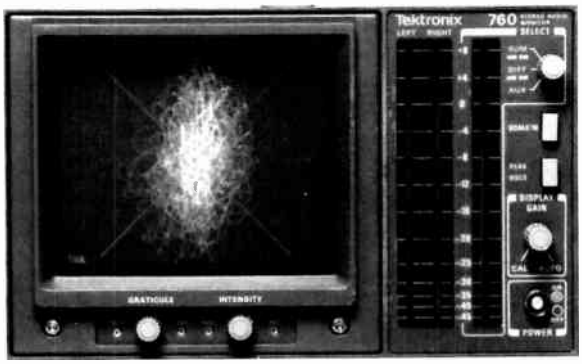


Tek's ***1730 Series Waveform Monitor*** and companion ***1720 Series Vectorscope*** are easy to operate and programmable. Together they offer new measurement capabilities at a surprisingly low price. ***(Page 8)***

With its unique "Lightning" display, the ***WFM-300 Analog Component Waveform Monitor*** provides new methods for measuring and monitoring inequalities in component amplitude and timing. ***(Page 21)***

The ***SPG-170A NTSC Sync Generator*** features RS-170A sync generation, a high stability color standard, digital genlock, and optional color bars with ID and audio tone. ***(Page 28)***

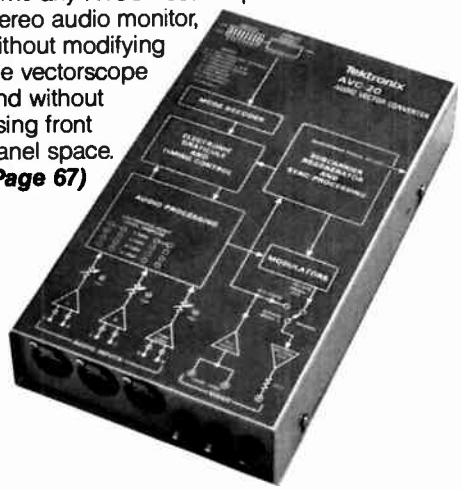
The ***ECO-170A Synchronous Changeover*** provides transparent, automatic selection of sync sources. ***(Page 30)***



The ***760 Stereo Audio Monitor*** is one of the best defenses against out of phase stereo sound. It is ideal for any audio mixing, sweetening, and master control or transmission location where monitoring the stereo audio signal is a must. ***(Page 65)***

With Tek's ***650HR-C Component Picture Monitor*** you can now display parallel component as well as NTSC signals. ***(Page 48)***

The ***AVC-20 Audio Vector Converter*** turns any NTSC Vectorsope into a stereo audio monitor, without modifying the vectorscope and without using front panel space. ***(Page 67)***



Designed for any North American facility broadcasting in stereo, the ***751 NTSC Aural Modulation Monitor/Decoder*** provides accurate modulation monitoring and decoding of the NTSC encoded TV sound channel in a single unit. ***(Page 66)***

1710B Waveform Monitor with carrying case and BP1 Battery Pack (carrying case & BP1 are optional accessories).

1710B

Series Waveform Monitors

Cost Effective

Easy Operation

Burst Phase Indicator

Dual Filter Display

Half Rack Width

Bright CRT Display

Internal Graticule

Light Weight

Low Power Consumption

DC Operation

Available in NTSC and PAL Standards

The 1710B Series waveform monitors provide all of the commonly used display modes. In addition, the 1710B Series adds relative burst phase indication and dual filter display. All of this in a cost effective package for the user who wants high quality at a low price. These new monitors are mechanically compatible and retrofit into an existing system that uses half rack width, 5¼ inch waveform monitors.

Because of its extreme light weight, low power consumption, and dc operation (field installable kit) the 1710B Series is ideal for field production, mobile operations, and any other application where space, power consumption and/or portability are prime considerations.

Easy Operation

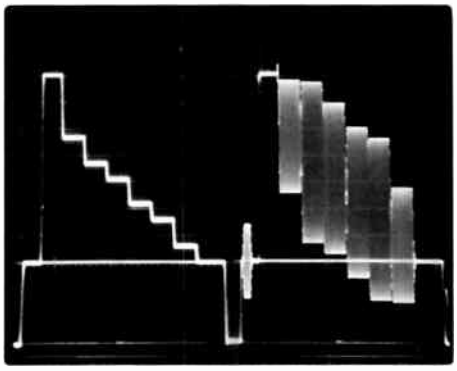
This monitor was also designed with the user in mind. Controls have clear nomenclature and are laid out in a logical order. This makes the operation of this powerful tool easier than one might expect.

Burst Phase Indication

The relative burst phase between inputs are displayed on the LED bar graph. The center green LEDs indicate the two signals are phase matched. The yellow ones warn the phase is slipping out of an acceptable range. Finally, the red LEDs flag an unacceptable amount of phasing error. This feature allows one instrument to do the complete job of timing and phasing in a basic television system.

Dual Filter Display

The dual filter display allows the user to view both the complete video signal and the luminance information at the same time using just one instrument. This eliminates the need for switching back and forth between filters and makes the instrument easier to operate. Ideal for camera setup.



1711B Waveform Monitor Dual Filter Display.

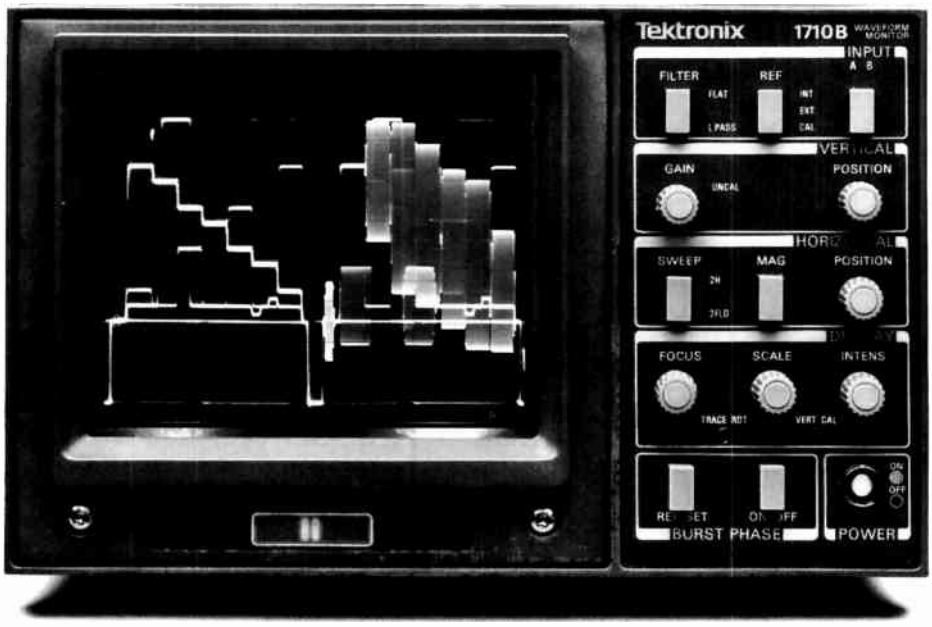
Bright CRT Display

The bright CRT display permits use of the 1710B Series in high ambient light conditions. Brightness remains high in the magnified sweep modes enhancing the 1710B's use in system timing applications. The internal graticule is parallax-free to reduce errors and improve its monitoring and measuring capabilities.

NTSC and PAL Standards

The 1710B Series waveform monitors are available in both NTSC and PAL versions.

1710B	NTSC
1711B	PAL



1710B Waveform Monitor Dual Filter Display

CHARACTERISTICS

ELECTRICAL SPECIFICATIONS

VERTICAL DEFLECTION SYSTEM

Frequency Response — Flat: Within 5% of the response at 50 kHz from 50 kHz to 6 MHz. The response at Fsc is within 2% of the response at 50 kHz. L PASS: At least 97% attenuation at Fsc.

Transient Response

Pulse to Bar Ratio — 0.99:1.00 to 1.01:1.00. Ringing: 2% or less. Overshoot: 2% or less. Tilt (Field Rate Square Wave, Vertical Window, or 25 μs Bar): 1% or less of active video.

Gain Range — Input signals between 0.25 V and 2.0 V can be adjusted to 140 IRE (NTSC) or 1 V (PAL) display.

Maximum Absolute Input Level — +2 V (dc + peak ac).

Deflection Accuracy

1710B: 1 V input for 140 IRE display within 2%.
1711B: 1 V input displays 1 V within 2%.

Dc Restoration — Dc Restorer Clamp Time: Back Porch. Low Frequency Response at 50 Hz: Attenuation of 50 Hz on Input Signal 20% or less. Blanking Level Shift with 10% to 90% APL Change: 1% or less of 100% video. Blanking Level Shift Due to Presence or Absence of Burst: 1% or less of 100% video.

HORIZONTAL DEFLECTION SYSTEM

Sweep — Sweep will occur in all Horizontal mode settings with or without synchronization.

Synchronization — Sweep will synchronize to composite video 0.5 V p-p to 2.0 V p-p or to composite sync 143 mV p-p to 8 V p-p.

2FLD Sweep Repetition Rate — Equal to frame rate of applied video or external sync.

2H Sweep Repetition Rate — Equal to half line-rate of applied video or external sync.

Timing Accuracy — 1 μs/div sweep within 2%.

Linearity (1 μs/Division) — Within 2%.

Differential Linearity (1 μs/Division) — Within 3% 0.1 div (0.5 minor div) or less compression or expansion of a center screen four division signal, when positioned anywhere horizontally.

POWER SOURCE

MAINS Voltage Ranges — 115 V (90 V to 132 V); 230 V (200 V to 250 V)

Power Consumption — 25 Watts (85.25 BTU/hour) maximum.

CALIBRATION SIGNAL

Frequency — 100 kHz ±1 kHz.

Amplitude — 1 V within 1%.

BURST PHASE INDICATOR

Phase of selected input (A or B) relative to the stored reference phase is displayed.

ENVIRONMENTAL

Temperature — Operating: 0°C to +50°C. Nonoperating: −55°C to +75°C.

Altitude — Operating: To 4500 m, (15,000 ft). Nonoperating: To 15,000 m, (50,000 ft).

CERITFICATION

Safety — UL-1244, CSA Bulletin 556B, IEC 348.

EMI Compatibility — FCC Rules Part 15 Subpart J, (Class A). VDE 0871.5 (Class B).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width	133	5.2
Height	214	8.4
Depth	429	16.9
Weight ≈	**kg**	**lb**
Net	3.6	8.0

ORDERING INFORMATION

When ordering please use exact nomenclature given here. The **Standard instruments are shipped without a case or handle.** If your application is for bench or portable use, please order the appropriate enclosure from the optional accessories list. The 1710B and 1711B are UL recognized components and meet the requirements for listing when used in the appropriate enclosure. These instruments are configured for rackmounting and are shipped without cases or covers. Order appropriate optional accessories to configure for bench, rackmount or portable use.

1710B Waveform Monitor (NTSC System Applications).
Includes: Power cable assembly, instruction manual.

1711B Waveform Monitor (PAL System Applications).
Includes: Same as 1710B.

OPTIONAL ACCESSORIES

Cabinet — Plain. Order 1700F00.

Cabinet — Portable. Order 1700F02.

Side-By-Side Rack Mount — For mounting two half-racks (1750, 1730, etc), in a standard 19 inch rack. Order 1700F05.

Blank Panel Adaptor — For the side-by-side rack mount. Order 1700F06.

Snap-On Front Cover — High impact plastic. Order 200-1566-00.

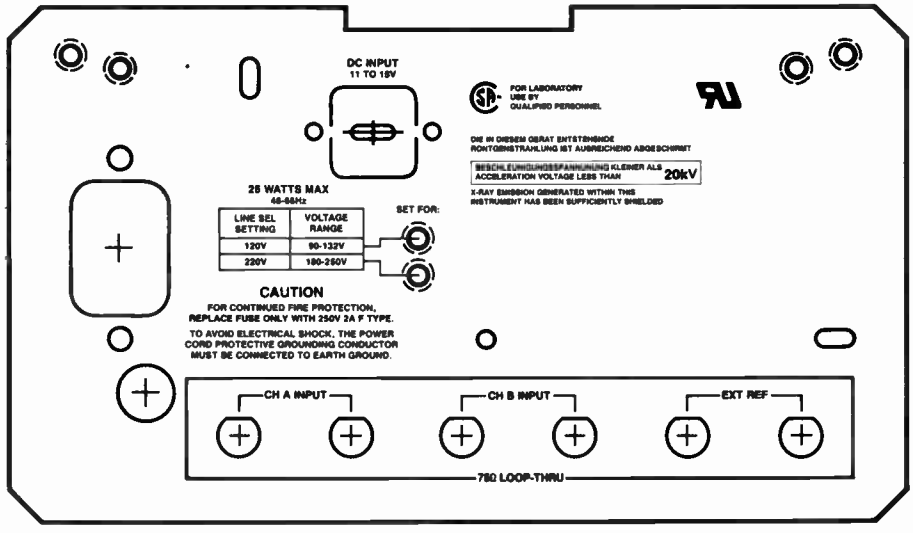
Viewing Hood — For high ambient light environments. Order 016-0475-00.

Dc Operation Kit — 12 VDC. Order 1700F10.

Camera — C-5C Option 02 (Regular). C7 Option 03 (Automatic).

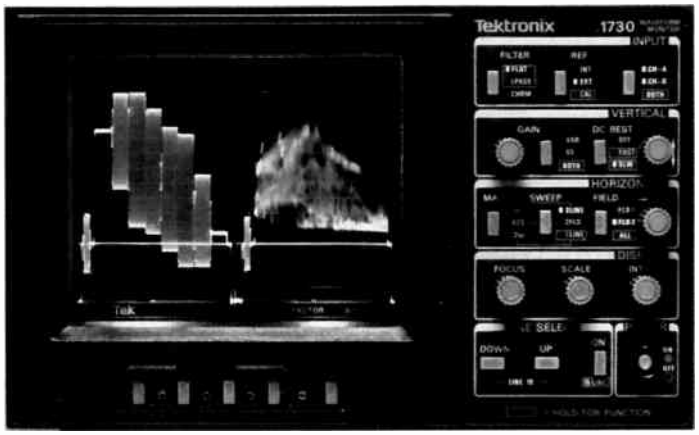
Battery Pack — Requires 1700F03 case to mount the BP1 to the 1710B or 1711B. Order BP1.

Snap Lock Power Cord Kit — North America. Order 040-1185-00. Universal Euro. Order 040-1186-00.

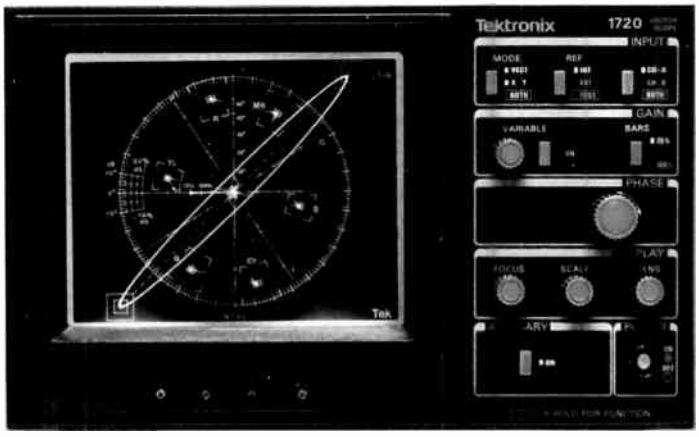


1710 Rear Panel.

TEK 1720 SERIES VECTORSCOPES 1730 SERIES WAVEFORM MONITORS



1730 Waveform Monitor — Simultaneous Channel A and B Display.



1720 Vectorscope — Vector and Stereo Audio Dual Display Mode.

1720 Series Vectorscopes
1730 Series Waveform Monitors

Performance and Economy

Complete Line Select

Simultaneous Channel A & B Display

Dual Filter Display

One-Button Front Panel Recall

Differential Phase and Gain Measurement

Stereo Audio Phase Measurement

RGB/YRGB Display Capability

Vector Center Dot Clamping

Parallax-Free Internal Graticules

Portable DC Power and Battery Available

Remote Control Capability

Available in NTSC and PAL Standards

The Tektronix 1730 Series Waveform Monitors and 1720 Series Vectorscopes provide a new dimension in television signal monitoring for both NTSC and PAL applications. These versatile new instruments are light weight, half-rack width, and have bright CRTs for comprehensive video signal monitoring. Both instruments exceed normal monitoring capabilities. Their unique features make them even more powerful when operated in tandem. Each monitor has its own advanced feature set and the proven 1700 Series family performance to provide more monitor for the money. These new monitors do the job faster, better and easier at a new low price.

Complete Line Select
The 1730 Series Waveform Monitor has full frame line select, with alpha-numeric readout that can be tracked by the 1720 Series Vectorscope when in Auxiliary mode. Any one or two lines of the entire frame can be selected and displayed, or the same line(s) in both fields can be viewed at one time. An intensified zone in the two-field sweep and on the picture monitor output signal indicates the location of the line selection. In addition, any successive 15 lines can be overlayed for camera and VTR adjustments.

Simultaneous Channel A and B Display
These new instruments have state-of-the-art microprocessor front panel control. They are operator-friendly and provide new features in half-rack waveform monitors or vectorscopes. Both the 1730 Series Waveform Monitor and the 1720 Series Vectorscope have dual channel display capability, allowing both input channels to be displayed on the CRT simultaneously.

Dual Filter Display
The 1730 (NTSC) and the 1731 (PAL) Waveform Monitor include dual filter display, which provides low pass and flat information in the same display. The 2-Field and 2-Line Display Modes have the Low Pass Filter applied to the left half of the trace. In the 1-Line Mode, the two signals are overlayed. These filter modes can also be used independently. Both versions of the 1730 Series have chroma filters centered around the subcarrier frequency.

One-Button Front Panel Recall
Once the front panel has been set up in a frequently used mode, the configuration can be stored for later, one-button recall. In addition, when the 1720 is used in tandem with the 1730, it will respond to this Store/Recall operation. Up to four operator-selected front panel configurations can be stored from the front panel. Four other front panel configurations are factory-programmed settings and are accessible from the Remote Control interface.

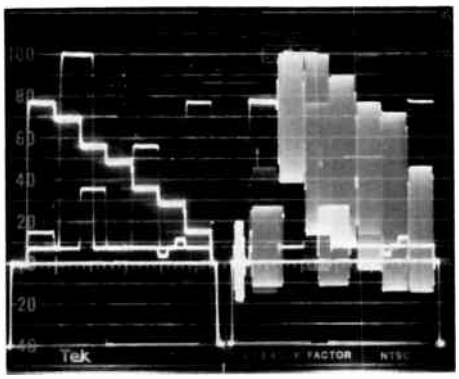
Differential Phase and Gain Measurements
The 1720 Series Vectorscope graticule has scales for measuring Differential Phase and Gain. The Differential Phase scale has markings at 2° intervals. The Differential Gain scale has markings at 5% intervals. For even greater precision, the 1720 and 1730 Series can be coupled for differential phase measurements using the field or line sweep on the 1730 Series Waveform Monitor. The Waveform Monitor Chroma filter can be used for differential gain measurements.

Stereo Audio Phase Measurements
Balanced inputs for the X Y mode are available on the 1720 Series Vectorscope through a separate input connector. This mode is particularly useful for evaluation of stereo audio with a special X Y graticule scale for both amplitude and phase measurements. X Y measurements can be displayed individually or in combination with a vector display. This input can also be used for other applications where X Y monitoring is useful.

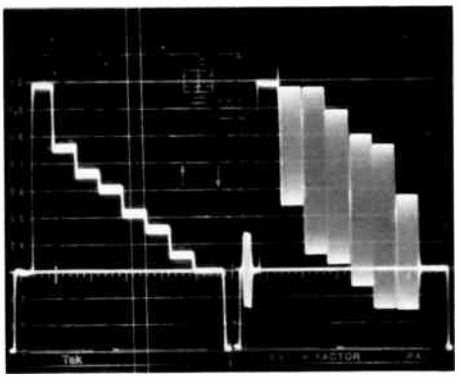
RGB-YRGB
The Waveform Monitor can display RGB or YRGB. The RGB/YRGB staircase input is through a rear panel connector.

Vector Center Dot Clamping
These new Vectorscopes employ center dot clamping in Vector mode for easy detection of residual subcarrier on the signal. In addition, with no signal present, the center dot automatically dims prolonging the CRT life.

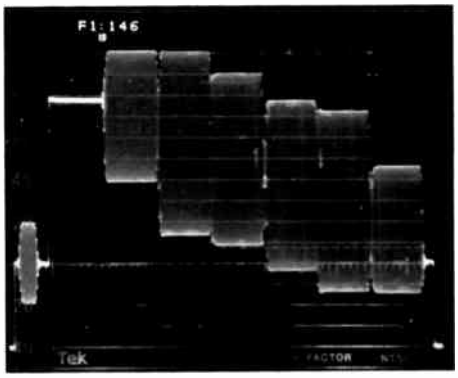
Parallax-Free Internal Graticules
Both instruments utilize post-accelerated, mesh-type CRTs equipped with internal graticules to provide parallax-free displays. Variable, evenly-illuminated scales, along with molded bezels, make waveform photography a snap.



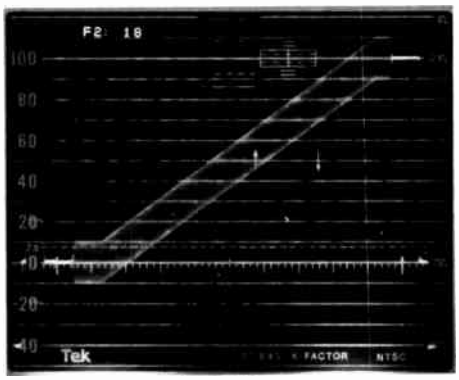
1730 NTSC Dual Filter Display.



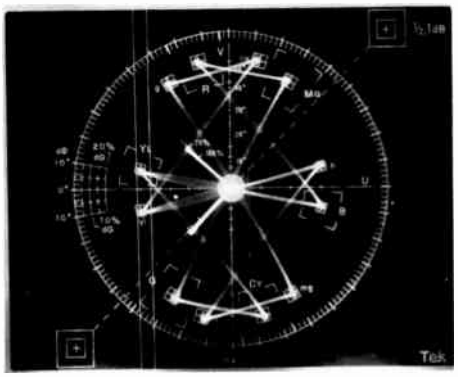
1731 PAL Dual Filter Dispaly.



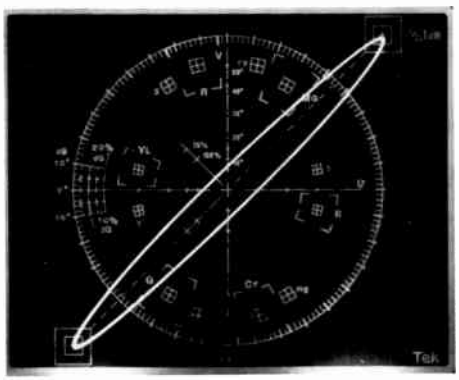
15 Line Display.



Line Select Test Signal Display.



1721 PAL Vector Display.



1721 Stereo Audio with ≈ 10° phase error.

Portable DC Power
In addition to being ideal for camera control units and video tape recorders, these instruments can be equipped with cabinet and field upgrades allowing them to operate from a 12 Vdc source for portable operation. They can be used with the Tektronix BP1 or other 12 V supply. Coupling this dc operation with their light weight (about 9 pounds, including cabinet), low power consumption, and compact size make these instruments well suited for use on a portable production cart.

Remote Control
Internal front panel presets, RGB/YRGB enable, along with front panel recall/setup can be accessed through the Waveform Monitor Remote connector.

Available in NTSC and PAL
Both the 1730 Series and the 1720 Series are available in either NTSC or PAL versions. The 1721 Vectorscope and the 1731 Waveform Monitor are the PAL versions.

1730 CHARACTERISTICS

1730 and 1731 WAVEFORM MONITOR

Signal input (video and external reference) — Return loss: >40 dB, 50 kHz to 6 MHz, power on or off. Maximum input: ±5 Vdc + peak ac. Loop-through isolation: >80 dB at F_{SC}. Channel isolation: >50 dB at F_{SC}. Impedance: >15 kΩ.

Vertical deflection — Deflection factor: Within 1% of 1 V. Gain range: Input signals between 0.8 V and 2 V can be adjusted to a 1 V display; (160 mV and 400 mV for X5 gain). Position range: 1 V signal can be positioned so that peak white and sync tip can be placed at blanking level regardless of gain range.

Frequency response — Flat: 50 kHz to 6 MHz within 2% (X1), within 5% (X5). Low pass: 40 dB attenuation at F_{SC}. Low pass response within 1% of flat response. Chroma: Nominal bandwidth 1 MHz. 2X F_{SC} attenuation >20 dB. Chroma response within 1% of flat response.

Transient response — Preshoot: <1%. Overshoot: <2%. Ringing: <2%. Tilt: <1%. Pulse-to-bar ratio: 0.99:1 to 1.01:1. Differential gain — <1%.

DC restoration — Clamp time: Back porch. Frequency response: Attenuation of 60 Hz on input signal, slow mode — <20%; fast mode — >90%. Blanking level shift: A 10% to 90% APL change will cause <1% of blanking level shift. Presence or absence of color burst will cause <1% of blanking level shift.

PIX MONitor OUTput — Frequency response: 50 kHz to 6 MHz within 3%. Differential gain: <1%. Differential phase: <1%. DC level on output: <0.5 V into 75 ohms load. Intensification (brightup): 180 mV dc offset on select lines. Output impedance: 75 ohms nominal. Return loss: >30 dB, 50 kHz to 6 MHz. Input to output (PIX MON) gain ratio luminance: 1:1 ±5% at 15 kHz.

Calibrator — Frequency: 100 kHz ±0.1 kHz. Timing accuracy: 10 μs, ±0.01 μs. Amplitude: 1 V, ±1%.

Horizontal deflection system — Sweep: Sweep will occur with or without input signal. 1-Line repetition rate: Equal to applied line rate, magnification equals 0.2 μs/div. 2-Line repetition rate: Equal to half applied line rate, magnification equals 1 μs/div. 2-Field repetition rate: Equal to applied frame rate, magnification equals approximately X25. Timing accuracy: 1 μs/div. within 2%. 0.2 μs/div. within 3%. Linearity: Within 2%. Differential linearity: Within 2%. Sweep magnification registration: Magnification occurs about the center of the screen. Position range: Any portion of a synchronized video sweep can be positioned on screen in all sweep modes.

Synchronization — Internal: Composite video or black burst with sync ±6 dB of nominal. External: Sync amplitude of 143 mV to 4 V. Remote sync: 2.0 to 5.0 V square wave or 4.0 V comp sync (sync polarity can be internally inverted). RGB/YRGB: Repetition rate: Field rate and line rate with magnification of X25 and X10, respectively. Sweep length: 3-Step (RGB) — 3.4 to 4.1 divs.; 4-Step (YRGB) — 2.5 to 3.1 divs.

1720 and 1721 Vectorscope

Signal input (video and external reference) — Return loss: >40 dB, 50 kHz to 6 MHz, power on or off. Maximum input: ±5 Vdc + peak ac. Loop-through isolation: >70 dB at F_{SC}. Channel isolation: >70 dB at F_{SC}. Impedance: >15 kohms.

Chrominance bandwidth — Upper: −3 dB point, F_{SC} +500 kHz, ±100 kHz. Lower: −3 dB point, F_{SC} −500 kHz, ±100 kHz. Vector phase accuracy: Within 1.25°. Vector gain accuracy: Within 2.5%, typical. Quadrature phasing: Within 0.5°, typical.

TEK 1720 SERIES VECTORSCOPES 1730 SERIES WAVEFORM MONITORS

Subcarrier regenerator — Pull-in range: F_{SC} ±50 Hz. Pull in time: Within 1 second. Phase shift with subcarrier frequency change: 2° ±50 Hz. Phase shift with burst amplitude change: <2° with ±6 dB change from nominal. Phase shift with input channel change: <0.5°. Phase change with variable gain control: ±1°. Phase control range: 360° continuous rotation. Burst jitter: <0.5°. Display differential phase and gain: ±1° and ±1%. Center dot clamp stability: <0.4 mm spot movement.

Synchronization — Internal: Composite video with sync ±6 dB of nominal. External reference: Composite video or CW subcarrier.

X Y mode — Input: Differential, dc coupled. Input amplitude: 2 to 9 V p-p, adjustable full scale deflection 0 dBm to +12 dBm for 600-Ohm system, factory set to 0 dBm. Maximum input: ±15 V peak signal + dc. Frequency response: Dc to 500 kHz (dc to 100 kHz high-gain mode). X and Y phase match: Less than a trace width separation at 20 kHz.

1720, 1721, 1730, and 1731

Specifications — CRT viewing area: 80 x 100 mm. Trace rotation: 8° range, typical. Graticule: Internal scale with variable illumination.

Power source — Mains voltage ranges: 115 V, 90-132 V. 230 V, 200-250 V. Mains frequency range: 48 Hz to 66 Hz. Power consumption: 25 watts (85 BTU/HR) maximum. Battery operation: 12 Vdc (when 1700F10 is field installed).

ENVIRONMENTAL

Temperature non-operating — −55°C to +75°C.

Temperature operating — 0°C to +50°C.

Altitude non-operating — To 18,000 M (50,000 feet).

Altitude operating — To 5,500 M (15,000 feet).

Shock — Non-operating: 30 g's, ½ sine, 11 ms duration, 3 shocks per surface (18 total).

Transportation — Qualified under NTSC Test Procedure 1A, Category II (30-inch drop).

Humidity — Meets Tektronix Standard 062-2847-00.

CERTIFICATION

Safety — UL-1244. Factory Mutual-3820. CSA Bulletin 556B. IEC 348.

EMI compatibility — FCC Rules, Part 15, Subpart J, Class A, VDE 0871.5 (Class B).

PHYSICAL CHARACTERISTICS

Dimensions	mm	In
Height	133.4	5.25
Width	215.9	8.5
Length	460.4	18.125
Weight (approximate)	**kg**	**lb**
Net	3.8	8.5

INCLUDED ACCESSORIES

Instruction manual; Power cable assembly; Spare fuse; Remote control mating connector; Auxiliary control cable (1720 series only).

OPTIONAL ACCESSORIES

Cabinets — Plain (painted silver grey) Order 1700F00

Cabinets — Portable (including handle and feet, painted silver grey) Order 1700F02.

Side-by-side rack adapter — Order 1700F05

Blank half-rack width panel — Order 1700F06

DC power converter (kit) — Order 1700F10

Battery pack — Order BP1

Cameras — Order C5C Opt. 02; C7 Opt. 03

Viewing hood — Order 016-0475-00

Snap-on Front Cover — Order 200-1566-00

ORDERING INFORMATION

The standard instruments are shipped without a case or handle. If your application is for bench or portable use, please order the appropriate enclosure from the optional accessories list. The 1720, 1721, 1730 and 1731 are UL-recognized components and meet the requirements for listing when used in the appropriate enclosure.

1720 Vectorscope (for NTSC system applications)

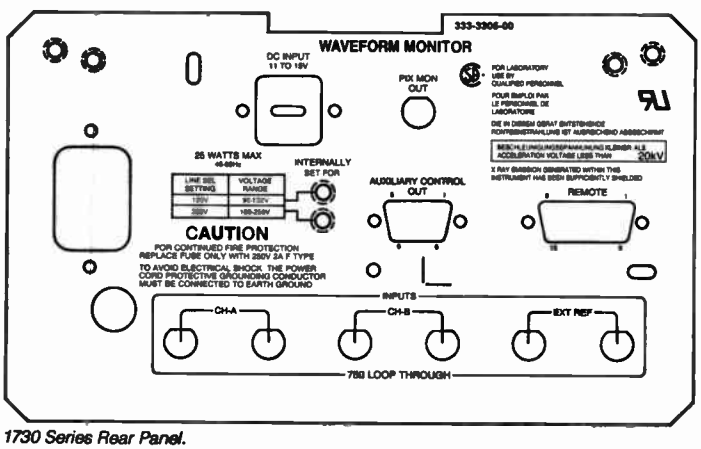
1721 Vectorscope (for PAL system applications)

1730 Waveform Monitor (for NTSC system applications)

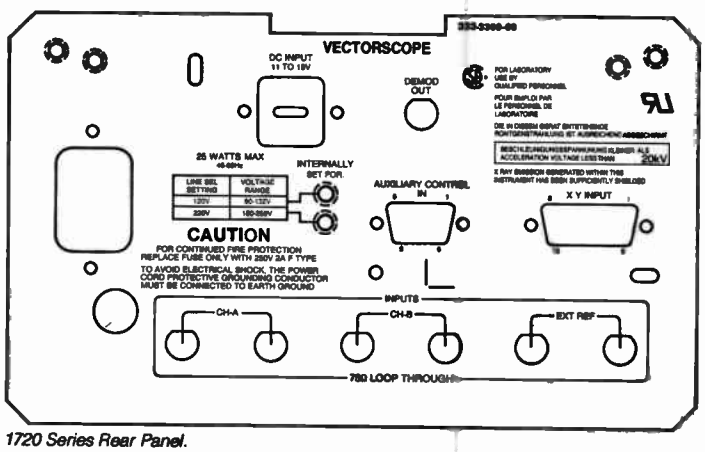
1731 Waveform Monitor (for PAL system applications)

PORTABLE DC POWERED APPLICATIONS

17XX (from above) plus 1700F10 DC Power Converter, 1700F02 Portable Cabinet and BP1 Battery Pack



1730 Series Rear Panel.



1720 Series Rear Panel.

NEW PRODUCT

1741 Waveform/Vector Monitor with optional carrying case and battery pack.

1740 Series Waveform/Vector Monitors

Two Instruments in One

Optional Dc Power Capability

Bright CRT Display

R-Y (V-Axis) Mode

VITS Monitoring

RGB/YRGB Display Capability

Remote Control Capability

Available in NTSC, PAL, and PAL-M

Similar to the 528A and 1420 Series products, the 1740 Series provides all the basic waveform monitoring and vectorscope functions, but in a single, compact package. In addition, the 1740 Series adds dc power operation (optionally), single line vertical interval display which is internally preset, an R-Y/sweep mode for differential phase measurements, and remote control of waveform/vector mode and most of the front panel sweep and vertical amplifier response functions.

The 1740's half rack width package allows easy installation where space and power requirements are important considerations. The 1740 is mechanically compatible with the 528A, 1710B, 1420 and 1750 Series instruments.

Typical applications include video signal monitoring in VTR bridges, camera control units, production switcher consoles, and in mobile vans and field productions.

Optional Dc Power Capability

Two instrument options provide a dc Input for powering the monitor from a 12 volt dc power source. Option 07 provides the dc capability. Option 11 provides the dc capability and includes a portable case and the BP1 Battery Pack as the power source. The BP1 quickly and securely mounts to the bottom of the portable case. Total package weight of the instrument with the BP1 mounted is approximately 13.6 kg (30 lb).

A 1740 Series instrument will operate from a BP1 for at least two hours before recharging is required. Spare BP1 Battery Packs are available as optional accessories.

Bright CRT Display

The bright CRT display permits use of the 1740 Series in high ambient light conditions, such as those encountered in field production applications. Brightness remains high in the 1 μs and 0.5 μs magnified sweep speeds, thus enhancing the 1740's use in system phasing applications. The internal waveform graticule and the external vector graticule are independently illuminated. A parallax free composite internal graticule, including both the waveform and vector features, is available (Option 06).

R-Y (V-Axis) Mode

The demodulated chrominance may be displayed with a horizontal sweep using the R-Y mode for NTSC signals or the V-axis mode for PAL or PAL-M signals. When the burst is phased properly in the vector mode, the R-Y mode displays the chrominance demodulated on the R-Y axis (V-axis in PAL systems). There are differential phase markings on the right side of the vector graticule that are calibrated for use in this mode. Different sweep speeds may be used to examine differential phase as a function of time.

VITS Monitoring

VITS (Vertical Interval Test Signals) or ITS (Insertion Test Signals) can be monitored in all modes. Each instrument model is internally set for a particular line. The 1740 is set to display line 19, usually occupied by the VIRS. The 1741 is set to line 17/330, and the 1742 to line 17/280. The 1740 may be reset for any line from 6 through 36, the 1741 from line 3/316 through 33/346, and the 1742 from line 3/266 through 33/296.

RGB/YRGB Display

Facilities for a parade display of camera RGB signals are included in all 1740 Series instruments. The monitor's REMOTE connector accepts the required enable and three-step staircase signals from the camera. An internal jumper change permits display of a YRGB parade signal.

Remote Control Capability

Remote control of input channel selection, mode, sweep speeds, and vertical amplifier filters is available through a rear panel connector. The remote function is useful for VTR applications.

CHARACTERISTICS

ELECTRICAL SPECIFICATIONS

VERTICAL WAVEFORM MODE

Deflection Factor
1740: 140 IRE display within 1% with 1 V input.
1741/1742: 1 V display within 1% with 1 V input.

Variable Gain Range
1740: Input signals between 0.7 V and 2 V can be adjusted to 140 IRE display.
1741/1742: Input signals between 0.7 V and 2 V can be adjusted to 1 V display.

Maximum Absolute Input Level — ±2 V (dc + peak ac).

Video Input Return Loss — At least 40 dB from 50 kHz to 6 MHz.

FREQUENCY RESPONSE

FLAT — ±2% from 50 kHz to 6 MHz. ±5% from 6 MHz to 8 MHz.

IRE — (1740) Conforms to IEEE Standard 205. Response at 15 kHz does not vary between FLAT and IRE by more than 1%.

LUM — (1741/1742) <3 dB down at 1 MHz, >40 dB down at 4.43 MHz, response at 15 kHz does not vary between FLAT and LUM by more than 1%.

CHROMA — (1740/1742) Response at 3.58 MHz does not vary between FLAT and CHROMA by more than 1%.
Lower: −3 dB point at 2.83 MHz to ±0.15 MHz.
Upper: −3 dB point at 4.33 MHz to ±0.15 MHz.
Attenuation at 7.2 MHz: >25 dB.

CHROMA (1741) — Response at 4.43 MHz does not vary between FLAT and CHROMA by more than 1%.
Lower: −3 dB point at 3.68 MHz to ±0.15 MHz.
Upper: −3 dB point at 5.18 MHz to ±0.15 MHz.
Attenuation at 8.9 MHz: >25 dB.

RESPONSE DISTORTIONS

Preshoot — 1% or less.

Pulse-to-Bar Ratio — 0.99:1 to 1.01:1.

Overshoot — 2% or less.

Ringing — 2% or less.

Tilt (Field Rate Squarewave, Vertical Window, or 25 μs Bar) — 1% or less.

Differential Gain — Displayed differential gain is 1% or less with 10% to 90% APL changes.

VIDEO OUTPUT

Frequency Response — 50 kHz to 6 MHz, within 3% of response at 50 kHz.

Dc Level on Output — 0.5 V or less into 75 Ω load.

Output Impedance — 75 Ω.

Return Loss — At least 30 dB, 50 kHz to 6 MHz.

DC RESTORATION

Dc Restorer Clamp Time — Back porch (internally selectable to sync tip).

Low-Frequency Response at 60 Hz — Attenuation of 60 Hz or input signal: 20% or less.

Blanking Level Shift with APL Change

1740: APL changes from 50% to either 10% or 90% will cause blanking level shift of 1 IRE unit or less.

1741/1742: APL changes from 50% to either 10% or 90% will cause blanking level shift of 7.2 mV or less.

CALIBRATOR SIGNAL

Frequency — 100 kHz, ±0.1 kHz. Synchronizes in 2H and 1H sweep, providing reference for sweep and magnifier calibration.

Amplitude — 1 V display within 0.5%.

HORIZONTAL DEFLECTION SYSTEM

Timing Accuracy — 1 μs/div sweep within 2%. 0.5 μs/div sweep within 3%.

Linearity — 1 μs/div and 0.5 μs/div within 2%.

SYNCHRONIZATION REQUIREMENTS

Internal References

1740: Composite video or black burst with sync and burst amplitudes 40 IRE to ±6 dB.

1741/1742: Composite video or black burst with sync and burst amplitudes 300 mV to ±6 dB.

External References — Waveform Mode: Sync amplitude between 143 mV and 4 V will synchronize sweeps.

Vector Mode

1740: Composite video or black burst with sync and burst amplitudes 40 IRE to ±6 dB.

1741/1742: Composite video or black burst with sync and burst amplitudes 300 mV to ±6 dB.

EXTERNAL REFERENCES INPUT

Dc Input Impedance — >15 kΩ.

Return Loss — At least 40 dB from 50 kHz to 6 MHz.

RGB/YRGB MODE

Will display either a 3-step or 4-step RGB/YRGB display.

Staircase Amplitude — A 10 V input will result in a horizontal display of 9 divisions ±1.4 major divisions.

Maximum Operating Staircase Signal Voltage — 12 V p-p ac component. Signal voltage not to exceed ±12 V dc + peak ac.

VECTOR MODE

Chrominance Bandwidth

Upper: −3 dB point Fsc +500 kHz ±100 kHz.
Lower: −3 dB point Fsc −500 kHz ±100 kHz.

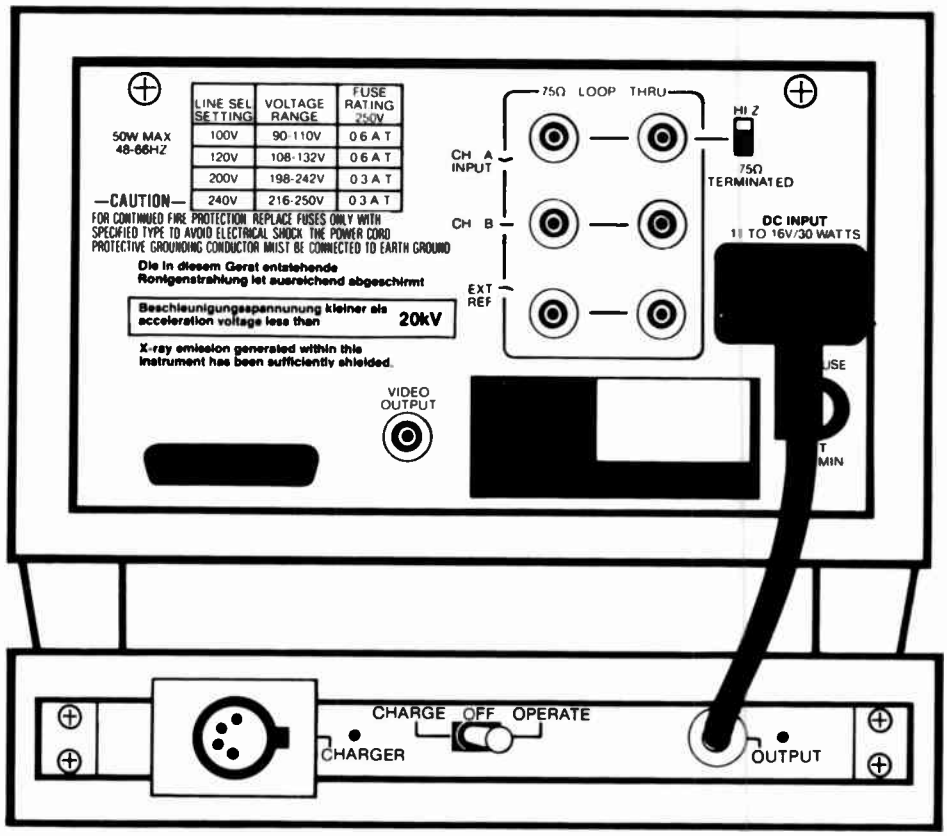
Vector Phase Accuracy — Within 1.25 degrees.

Vector Gain Accuracy — 1740: Within 1.25 IRE. 1741/1742: Within 1.25%.

Quadrature Phasing — Within 0.5 degrees.

SUBCARRIER REGENERATOR

Pull-In Range — 1740: Within 50 Hz of Fsc. 1741/1742: Within 10 Hz of Fsc.



1740 Rear Panel with Optional Battery Pack Attached.

Phase Shift with Subcarrier Frequency Change — 1740: Within 0.5 degrees from Fsc to (Fsc +50 Hz), or Fsc to (Fsc −50 Hz).
1741/1742: Within 0.5 degrees from Fsc to (Fsc +10 Hz), of Fsc to (Fsc −10 Hz).

Phase Shift with Burst Amplitude Change — Within 2 degrees from nominal burst amplitude to ±6 dB.

Phase Shift with Reference Switched Between Internal and External References — Within 0.5 degrees.

Phase Shift with Input Channel Change — Within 0.5 degrees.

Phase Shift with X5 Gain — Within 2 degrees.

Phase Shift with Variable Gain — Within 1 degrees as gain is varied from +3 dB to −6 dB.

Phase Control Range — 360 degrees continuous rotation.

DISPLAY CHARACTERISTICS

Differential Phase — Within 1 degree.

Differential Gain — Within 1%.

Variable Gain Range — 1740: Input subcarrier signals between 28 IRE and 140 IRE can be adjusted to normal burst vector length.
1741/1742: Input carrier signals between 210 mV and 1.0 V can be adjusted to normal burst vector length.

CRT DISPLAY

CRT Viewing Area — 80 mm x 100 mm.

Accelerating Potential — Nominally 15 kV.

GRATICULE

Waveform — Internal, variable illumination.

Vector — External, variable illumination. Illuminated with VECTOR or R-Y mode selected.

POWER SOURCE

Mains Voltage Ranges — 100 V (90 V to 100 V); 120 V (108 V to 132 V); 220 V (200 V to 242 V); 240 V (218 V to 250 V).

Mains Frequency Range — 48 Hz to 66 Hz.

Power Consumption — 50 W maximum in ac. 30 W nominal in dc.

DC BATTERY OPERATION (OPTION 07)

Voltage Input Range — 11 V to 16 V.

Over Voltage and Polarity Reversal Protection — Fuse blows if >20 V dc or opposite polarity is applied to the dc INPUT.

Under Voltage Protection — Instrument shuts down when battery voltage (under load) is below 9 V.

Battery Current — 3.5 A or less at 12 V.

ENVIRONMENTAL

Temperature — Operating: 0°C to +50°C. Nonoperating: −55°C to +75°C.

Altitude — Operating: 4500 m (15,000 ft). Nonoperating: 15 000 m (50,000 ft).

CERTIFICATION

Safety/EMC — UL 1244.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width	216	8.5
Height	133	5.3
Depth	460	18.1
Weight	**kg**	**lb**
Net	8.2	18.8
Battery Pack	13.6	30.0

ORDERING INFORMATION

These instruments are configured for rackmounting and are shipped without cases or covers. Order appropriate options or optional accessories to configure for bench or portable use. **Option 06 is recommended.**

1740 Option 01 Waveform/Vector Monitor (NTSC Applications).

1741 Option 01 Waveform/Vector Monitor (PAL Applications).

1742 Option 01 Waveform/Vector Monitor (PAL-M Applications).

OPTIONS

Option 06 — (Composite internal graticule, waveform and vector.)

Option 07 — (Adds dc power operation capability, must be installed during manufacture.)

Option 11 — (Portable carrying case, dc power operation, and a BP1 Battery Pack.)

OPTIONAL ACCESSORIES

Battery Pack — Requires 1700F03 case to mount the BP1 to the 1740 or 1741. Order BP1.

Cabinet — Aluminum, no handle or feet. Order 1700F00.

Cabinet — Painted, with handle and feet. Order 1700F02.

Side-By-Side Rack Mount — For mounting two half-racks (1750, 1730, etc) in a standard 19 inch rack. Order 1700F05.

Blank Panel — For one half of the side-by-side rack mount. Order 1700F06.

Snap-On Front Cover — High impact plastic. Order 200-1566-00.

Viewing Hood — For high ambient light environments. Order 016-0475-00.

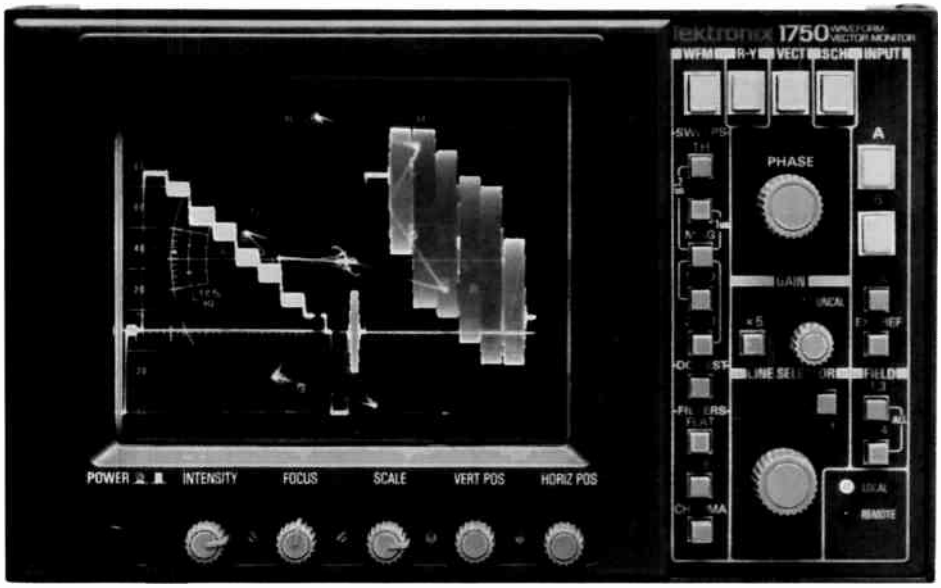
Camera — Use C-30 Option 01 with adaptor 016-0269-03, or C-5C Option 02 or 04, or standard C-4.

MAINTENANCE ACCESSORIES

Extender Board — 64 pin. Order 670-7980-00.

Extender Cable — Order 670-0709-00.

Deflecton Leads Extender Cables — (Order four each) Order 196-0939-00.



1750 Waveform/Vector Monitor—Dual Filter/Simultaneous Display.

1750 Series Waveform/Vector Monitors

Two Instruments in One

SCH Phase and Color Framing

R-Y (V-Axis) Mode

RGB/YRGB Mode

Remote Control Capability

The Tektronix 1750 Series offers comprehensive monitoring and measurement of television signals, including SCH phase and color framing, in one compact unit. While similar in appearance to the 1740 instruments, the 1750 has enhanced performance in each of its operating modes.

The unique SCH phase display presents horizontal sync timing relative to reference subcarrier (burst) for verification of signal format and color framing. This mode enables easy analysis and monitoring of these important characteristics of the television signal; a task which previously required complex techniques, highly skilled operators and/or additional instrumentation. The 1750's SCH phase and color frame displays are derived from the standard composite signals. No extra pulses or added signal details are required.

The 1750's SCH capability makes it particularly valuable in production and editing environments where maintenance of SCH phase and color frame are critical considerations. Applications include VTR bridges, camera control units, switcher consoles, master control, mobile and field production units, and in maintenance operations supporting any of these areas.

The 1750's half-rack package allows easy installation in environments where space and power requirements are important considerations. The 1750 is mechanically compatible with 528A, 1710B, 1420, and 1740 Series Tektronix instruments.

Waveform Mode

The waveform mode vertical response is controlled by selectable flat, chroma, and luminance (IRE) filters. A backporch slow clamp is controllable from the front panel. An internal jumper reprograms the clamp timing for sync tip operation.

The 1750 has pushbutton selection of H, 2H, V, and 2 V horizontal sweeps. A magnifier provides calibrated sweep speeds of 1 μs/div, and 0.2 μs/div at the line display rates, and about 20X magnification of the vertical rate display. The faster sweep speeds are useful for determination of horizontal blanking, pulse widths, risetimes, and other timing details of the signal, while the magnified vertical sweep allows viewing of the vertical blanking interval.

The internal calibrator signal in the 1750 is useful for verification of both video amplitude and sweep timing calibration. Crystal control of the calibrator waveform provides an accurate 1V p-p squarewave and 10 μs timing interval.

The sweeps may be locked to the selected signal (A or B input), or to a separate external reference input. The horizontal rate sweeps may be triggered by the selected source (which presents a stable display in the presence of sync jitter) or may be AFC controlled (which displays sync jitter for analysis). Use of the AFC sweep repositions the H sweep for more convenient timing measurements.

The 1750 Series has front panel line and field selection, LED readout of the selected line number, and a video output with a strobe pulse on the displayed line. The 1750 (NTSC) will display line 8 thru 23 of either monochrome field (color fields 1,3 or fields 2,4). The 1751 (PAL) will display lines 6 thru 21 or 319 thru 334. The line selection range may be extended to any line of the frame by the use of rear panel remote control input in conjunction with the front panel controls.

The line selection function is operational in waveform, R-Y, and vector modes. These features provide convenient in-service monitoring or measurement of field blanking interval test or data signals.

R-Y (V-Axis) Mode

In this mode the display is similar to a waveform display with the demodulated chrominance signal on the vertical axis and the selected sweep on the horizontal axis. Any demodulation axis may be set with the phase control; properly setting the display of burst in the vector mode will ensure R-Y-axis decoding when the R-Y mode is selected.

There are differential phase markings on the graticule for use in this mode. Resolution of differential phase error is about twice that of vector measurement techniques, and the displayed errors may be correlated with time and luminance amplitude by using modulated staircase or modulated ramp test signals.

SCH Phase Mode

This display is a combination of the burst vectors of the vector display and a bright dot on the outer degree circle of the vector graticule. The position of this "sync dot" around the circle represents the timing (phase) of the horizontal sync edges relative to the reference subcarrier. An individual signal may be analyzed for proper format (for proper SCH phase) without any additional reference.

Since it is possible for two signals to be properly formatted but not properly timed to each other (i.e., a color framing error exists), the 1750 has provision for using an external reference input for its subcarrier phase reference. When the external reference mode is used, the display shows the burst phase and sync timing of the selected signal relative to the burst of the reference signal, simultaneously indicating the SCH phase of the selected input signal and its color frame relative to the external reference signal.

System Timing

Complete system timing on one display is possible with the simultaneous display mode. The SCH, burst phase and horizontal sync are time shared for simultaneous viewing, making system timing a one step operation.

Dual Filter Display

The dual filter display mode allows both full bandwidth and IRE/LUM displays to be viewed simultaneously for live video level monitoring and camera set up.

CHARACTERISTICS

VERTICAL WAVEFORM MODE

Deflection Factor
1750: 1 V input for 140 IRE display within 1%. 1751: 1 V input displays 1 V within 1%.

Gain Ranges — Input signals between 0.7 V and 2 V can be adjusted to 140 IRE (NTSC) or 1 V (PAL) display.

Maximum Absolute Input Level — ±2 V (dc + peak ac).

FREQUENCY RESPONSE

Flat — ±2% from 50 kHz to 6 MHz. ±5% from 6 MHz to 8 MHz.

IRE — (1750) Conforms to IEEE Standard 205. Response at 15 kHz does not vary between FLAT and IRE by more than 1%.

LUM — (1751) <3 dB down at 1 MHz, >40 dB down at 4.43 MHz, response at 15 kHz does not vary between FLAT and LUM by more than 1%.

CHROMA — (1750) Response at 3.58 MHz does not vary between FLAT and CHROMA by more than 1%. Lower: −3 dB point at 2.83 MHz ±0.15 MHz. Upper: −3 dB point at 4.33 MHz ±0.15 MHz. Attenuation at 7.2 MHz >25 dB.

CHROMA — (1751) Response at 4.43 MHz does not vary between FLAT and CHROMA by more than 1%. Lower: −3 dB point at 3.68 MHz ±0.15 MHz. Upper: −3 dB point at 5.18 MHz ±0.15 MHz. Attenuation at 8.9 MHz >25 dB.

RESPONSE DISTORTION

Preshoot — 1% or less.

Pulse-to-Bar Ratio — 0.99:1 to 1.01:1.

Overshoot — 2% or less.

Ringing — 2% or less.

Tilt (Field Rate Squarewave, Vertical Window, or 25 μs Bar) — 1% or less.

Differential Gain — Displayed differential gain is 1% or less with 10% to 90% APL changes.

PIX MON OUTPUT

Frequency Response — 50 kHz to 6 MHz, within 3% of response at 50 kHz.

Dc Level on Output — 0.5 V or less into 75 Ω load.

Output Impedance — 75 Ω.

Return Loss — At least 30 dB, 50 kHz to 6 MHz.

DC RESTORATION

Dc Restorer Clamp Time — Back Porch (internally selectable to Sync Tip).

Low-Frequency Response at 60 Hz — Attenuation of 60 Hz on Input Signal: 20% or less.

Blanking Level Shift with 10% to 90% APL Change
1750: APL changes from 50% to either 10% or 90% will cause blanking level shift of 1 IRE unit (7 mV) or less. 1751: APL changes from 50% to either 10% or 90% will cause blanking level shift of 7.2 mV or less.

CALIBRATOR SIGNAL

Frequency — 100 kHz, ±0.1 kHz. Synchronizes in 2H and 1H sweep, providing reference for sweep and magnifier calibration.

Timing Accuracy — 10 μs, ±10 ns.

Amplitude — 1 V within 0.5%.

HORIZONTAL DEFLECTION SYSTEM

Sweep — Sweep will occur in all horizontal mode settings with or without synchronization.

Timing Accuracy — 1 μs/div sweep within 2%. 0.2 μs/div sweep within 2%.

Linearity — (1 μs/div and 0.2 μs/div) within 2%.

SYNCHRONIZATION REQUIREMENTS

Internal References — SCH Mode: Composite video or black burst with sync and burst amplitudes 286 mV, (300 mV) ±3 dB. Other Modes: Composite video or black burst with sync and burst amplitudes 286 mV, (300 mV) ±6 dB.

External References — Waveform Mode Sync amplitude between 143 mV and 4 V will synchronize sweeps.

Vector Mode — Composite video or black burst with sync and burst amplitudes 286 mV, (300 mV) ±6 dB.

External References Input — Dc Input Impedance: >15 kΩ. (Unterminated). Return Loss (75 Ω): >40 dB from 50 kHz to 6 MHz.

RGB/YRGB MODE

Will display either a 3-step or 4-step RGB/YRGB display.

Staircase Amplitude — A 10 V input will result in a horizontal display of 9 divisions ±1.4 major divisions.

Maximum Operating Staircase Signal Voltage — 12 V p-p ac component. Signal voltage not to exceed ±12 V Dc plus peak ac.

VECTOR MODE

Chrominance Bandwidth — Upper: −3 dB Point Fsc +500 kHz, ±100 kHz.
Lower: −3 dB Point Fsc −500 kHz, ±100 kHz.

Vector Phase Accuracy — Within 1.25°.

Vector Gain Accuracy — 1750: Within 1.25 IRE. 1751: Within 2.5%.

Quadrature Phasing — Within 0.5°.

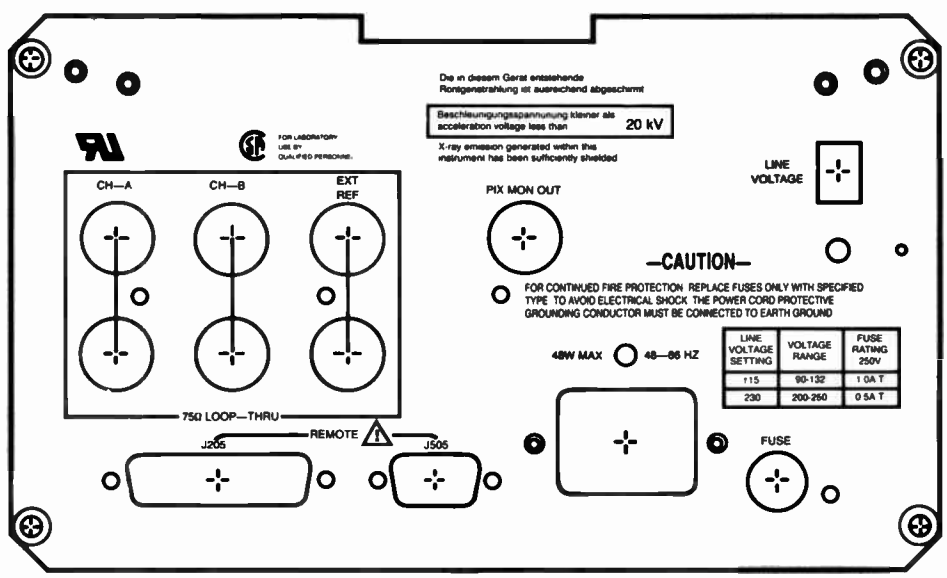
SCH MODE

Accuracy — Absolute: ±5° phase at 25° C. Relative: ±2°. Acquisition Time: <1 s.

SUBCARRIER REGENERATOR

Pull-In Range — 1750: Within 50 Hz of Fsc. 1751: Within 10 Hz of Fsc.

Phase Shift with Subcarrier Frequency Change — 1750: Within 0.5° from Fsc to (Fsc +50 Hz), or Fsc to (Fsc −50 Hz). 1751: Within 0.5° from Fsc to (Fsc +10 Hz), or Fsc to (Fsc −10 Hz).



1750 Rear Panel.

Phase Shift with Burst Amplitude Change — Within 2° from nominal burst amplitude to ±6 dB.

Phase Shift with Reference Switched Between Internal & External References — Within 0.5°.

Phase Shift with Input Channel Change — Within 0.5°.

Phase Shift with X5 Gain — Within 2°.

Phase Shift with Variable Gain — Within 1° as gain is varied from +3 dB to −6 dB.

Phase Control Range — 360° continuous rotation.

DISPLAY CHARACTERISTICS

Differential Phase — Within 1°.

Differential Gain — Within 1%.

Variable GAIN Range — Input subcarrier signals between 210 mV and 1.05 V can be adjusted to normal burst vector length (may be extended to 43 mV via X5 gain).

CRT DISPLAY

CRT Viewing Area — 80 mm x 100 mm.

Graticule — Dual internal, variable SCALE illumination.

POWER SOURCE

Mains Voltage Ranges — 115 V (90 V to 132 V); 230 V (200 V to 250 V).

Mains Frequency Range — 48 Hz to 66 Hz.

Power Consumption — 48 W (163 BTU/hr) maximum.

ENVIRONMENTAL

Temperature — Operating: 0° C to +75° C. Nonoperating: −55° C to +75° C.

Altitude — Operating: To 4500 m (15,000 ft). Nonoperating: To 15 000 m (50,000 ft).

CERTIFICATION

Safety/EMC — UL 1244. Factory Mutual-3820. CSA Bulletin 556B. IEC 348.

FCC EMC Compatibility — (FCC Rules Part 15 Subpart J, Class A). VDE 0871.5 (Class B).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width	216	8.5
Height	133	5.3
Depth	460	18.2
Weights	**kg**	**lb**
Net	8.0	18.0

ORDERING INFORMATION

These instruments are configured for rackmounting and are shipped without cases or covers. Order appropriate options or optional accessories to configure for bench or portable use.

1750 Waveform/Vector Monitor (NTSC Applications).

1751 Waveform/Vector Monitor (PAL Applications).

OPTIONAL ACCESSORIES

Cabinet — Aluminum, no handle or feet. Order 1700F00.

Cabinet — Painted, with handle and feet. Order 1700F02.

Side-By-Side Rack Mount — For mounting two half-racks (1750, 1730, etc) in a standard 19 inch rack. Order 1700F05.

Blank Panel — For one half of the side-by-side rack mount. Order 1700F06.

Snap-On Front Cover — High impact plastic. Order 200-1566-00.

Viewing Hood — For high ambient light environments. Order 016-0475-00.

Camera — Use C-30 Option 01 with adaptor 016-0269-03, or C-5C Option 02 or 04, or standard C-4.

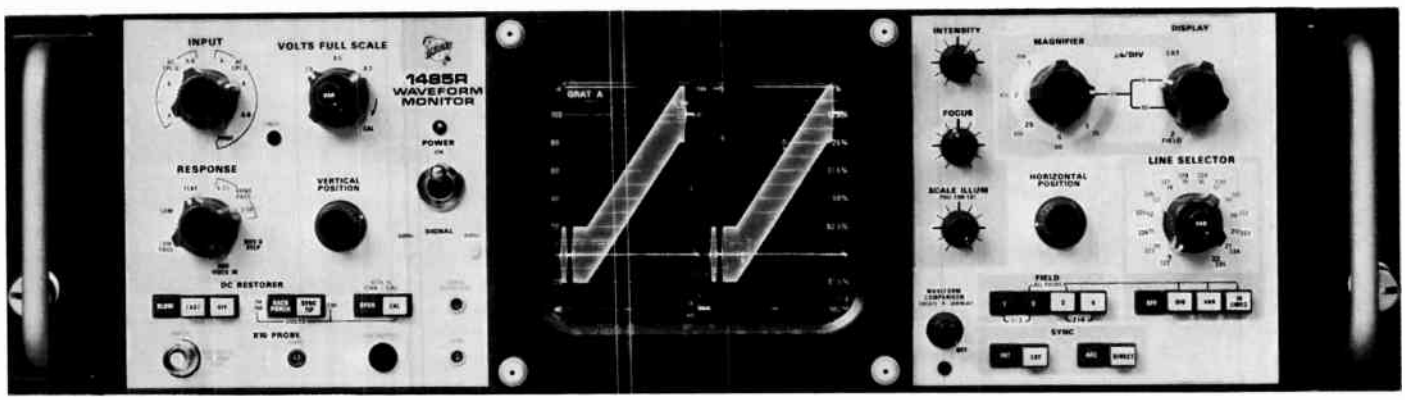
MAINTENANCE ACCESSORIES

Extender Board — 64 pin. Order 670-7980-00.

Extender Board — 32 pin. Order 670-7981-00.

Extender Cable — Order 670-0709-00.

Deflecton Leads Extender Cables — (Order four each) Order 196-0939-00.



1485R Option 01 PAL/NTSC Dual Standard Waveform Monitor (Rackmount)

1480 Series Waveform Monitors

Bright CRT Especially Suitable for Vertical Interval Testing

Advanced Measurement Modes

Amplitude Measurement Accuracy Approaching 0.2%

Digital Selection of Line and Field

Probe Input Option

15-Line Display for VTR Applications

Full Feature capability for demanding video measurements in a range of applications. The 1480 Series was designed to meet the monitoring needs of CCU, VTR, control room, transmission facilities, transmitter and special systems with optimum accuracy, precision and performance. It features a variety of advanced measurement modes, amplitude measurement accuracy approaching 0.2%, plus an exceptionally bright CRT that's especially suitable for vertical interval testing.

In addition to a 0.2% amplitude standard, the 1480 Series provides superior resolving power through calibrated five-times expansion of the vertical display, plus offset comparison and fine CRT spot size for making highly accurate amplitude measurements.

A unique overlay mode makes it possible to superimpose portions of waveform displays for exact, side-by-side comparison of levels.

Among many additional features are a probe input option, AFC sweep synchronization, selectable filters and 15-line display for VTR applications.

The 1480 Series is available in NTSC, PAL, PAL-M and NTSC/PAL Dual Standard versions.

The 1480 Series waveform monitors have excellent amplitude measuring accuracy and many unique operating modes which enable you to work more precisely and accurately. The monitoring needs of CCU, VTR, control room, transmission facilities, transmitter, and special systems are met by the use of 1480 Series waveform monitors. The 1485C and 1485R PAL/NTSC dual standard monitors (see photos) represent the essentials of all seven monitors in the 1480 Series. The differences between the monitors in the series are essentially confined to what lines in the vertical interval are selectable, what filters are selectable in the response mode, and in the field selection modes. Dual-Standard Monitors recognize the signal standard in use automatically and indicate that standard with front panel indicators.

Vertical Interval Testing
Two features are needed in a waveform monitor used for vertical interval testing: A bright CRT and line selection.

The CRT in the 1480 Series is bright enough that one VITS (Vertical Interval Test Signal) selected out of four fields can be seen with ease even in a well-lighted area.

Two modes of line selection are provided in the 1480 Series waveform monitors: digital and variable.

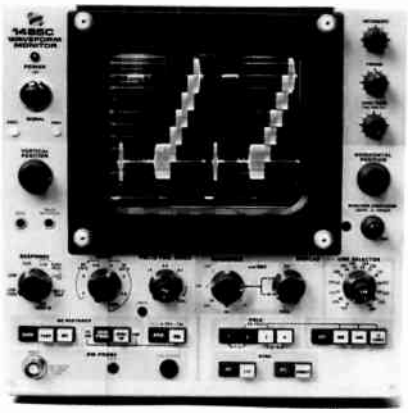
Digital selection of field and line assures positive identification of displayed information. For example when you select line 18 of field 2 it is certain what you will see is line 18, field 2. Digital techniques will not allow an incorrect selection.

Variable selection of other lines is provided for full field signal analysis. In all line selection modes a line intensifying strobe is provided with video for picture monitor displays. A second line strobe output is provided to strobe 520A Series vectorscopes, etc. Intensified two-field displays on the 1480 help you locate the line or lines selected.

High Amplitude Measurement Accuracy
In recognition of the need for more accuracy the 1480's give you the capability to make amplitude measurements with accuracy approaching 0.2% using a precision display offset. A proven video measurement technique, offsetting displays with an amplitude standard is an easy-to-use method which achieves accuracy by eliminating parallax and transfer errors. Transfer errors are eliminated because you compare your signal to a precise one volt standard rather than to graticule calibration. Measurements made with comparison techniques also have a high order of consistency and repeatability. When your signal precisely matches the standard your signal amplitude will be determined to the value and accuracy of the offset. The tolerance of the internal calibration signal used as the standard is 0.2%.

Trace Overlay
The 1480's can actually overlay a later segment of a display on the earlier segment. Superimposing waveforms over other waveforms allows exact comparison of levels. With overlay you can exactly compare the elements of complex vertical interval test signals.

Probe Option
The 1480's make convenient high impedance probing available with a probe option. This option provides an input accepting most Tektronix probes. As a part of this option a probe compensation waveform test point is provided (A ten-times amplifier keeps full screen sensitivities while using X10 attenuator probes.)



1485C PAL/NTSC Waveform Monitor (Cabinet)

CHARACTERISTICS

VERTICAL DEFLECTION

Inputs — Input A and B are 75 Ω high impedance loop-through. Return loss is ⩾40 dB from dc to 5 MHz in a 75 Ω system. Aux Video Input is internally terminated in 75 Ω. Return loss is ⩾34 dB from dc to 5 MHz.

Scale Factor — A and B input calibrated 1.0 V ±7 mV, 0.5 V ±15 mV, 0.2 V ±7 mV. (0.05 V ±2.5 mV Option 06) volts full scale. Variable: Range for each scale factor at least +40% to −50%. Aux Video Input 1.5 dB gain.

Maximum Input Voltage — 2 V p-p (ac coupled), ±1.5 V dc + peak ac (dc coupled).

Frequency Response
FLAT: 50 kHz to 5 MHz ±1% (1.0 V F.S., VAR in detent). 5 MHz to 8 MHz +2, −3%, 8 MHz to 10 MHz +2, −6%. Typically within +2, −15% to 18 MHz and typically −3 dB at 20 MHz.
Low Pass: Attenuation ⩾14 dB, 500 kHz and above. 3.58 MHz Bandpass: Amplitude within ±1% of amplitude in Flat response position. Bandpass ≈600 kHz. 4.43 MHz Bandpass: Amplitude within ±1% of amplitude in flat response position. Bandpass ≈800 kHz. IRE: Conforms to IEEE Standard 205, 1972.

Linear Waveform Distortion
Pulse/Bar Ratio: ±1%. For NTSC or PAL 2T Pulse or NTSC T Pulse.
Short Time: Preshoot, overshoot, ringing ⩽1% of NTSC or PAL T Pulse and Bar.
Line Time: Tilt or rounding ⩽1.0%. Field Time: (Ac coupled) ⩽1%.

Nonlinear Distortion — Differential Gain: ⩽0.5%.

Dc Restorer — Keyed type, may be turned off. Clamping point: Back Porch/Sync Tip. Time Constant: FAST reduces mains hum ⩾26 dB, SLOW reduces mains hum <0.9 dB.

Calibrator — Amplitude selected by dc Restorer switch. Sync Tip: 1 V ±0.2%. Back Porch: 714 mV or 700 mV ±0.5%.

HORIZONTAL DEFLECTION

Time Base — 5 μs and 10 μs timing accuracy ±2% (center 10 divisions); 5 μs and 10 μs linearity ±1% (center 10 division).

External Sync Input — Two loop-through high impedance, with ⩾46 dB return loss in a 75 Ω system. Inputs are slaved to A and B input or to A external sync input only.

External Sync Input Requirements — 400 mV to 2 V composite video or 200 mV to 8 V composite sync.

Field Selector — Positive selection of Field 1 or Field 2 in the NTSC system. Positive selection of 1, 2, 3, 4, or 1 & 3, 2 & 4 in the PAL systems.

Line Selector — Dig: Selects lines 9 to 22 NTSC, line 9/322 to line 22/335 PAL, line 9/272 to line 22/285 PAL-M. Var: Approx line 20 of the selected field to line 4 of the next related field. 15 lines: Identical to Var, except 15 successive lines are displayed.

Sync — AFC horizontal frequency range is 15.75 kHz ±200 Hz. Maximum Jitter with Respect to Input Sync: 10 ns with 4 V RMS hum (30 ns with the addition of −36 dB white noise). Direct horizontal frequency up to ⩽20 kHz. Maximum Jitter with Respect to Input Sync: 12 ns with 4 V RMS hum (90 ns with the addition of −36 dB white noise).

OUTPUTS

Line Strobe — TTL amplitude pulse. Pulse coincident with line or lines selected by VAR, 15 LINE or DIG modes of DISPLAY switch.

Picture Monitor — Output of incoming video with Line Strobe added. Output impedance is 75 Ω. Output gain adjusted to unity with respect to A and B video input.

Aux Video — Output of incoming video. 75 Ω output impedance. Gain adjustable to unity with respect to A and B video input.

OTHER CHARACTERISTICS

RGB/YRGB Staircase Input — ≈12 V for 12.7 divisions deflection. RGB sweep length internally selected for ⅓ normal sweep. YRGB sweep length internally selected for ¼ normal sweep length.

Mains Voltage — Ranges 100 V ac, 110 V ac, 120 V ac, 200 V ac, 220 V ac, 240 V ac ±10%. Frequency 48 Hz to 62 Hz, maximum power consumption 75 W. At factory, 1480, 1482 preset for 110 V ac. 1481, 1485 preset for 220 V ac.

CHARACTERISTICS (OPTION 01)

10X Probe Channel — Scale Factor: 1 V, 0.5 V, 0.2 V full screen with 10X attenuator probe. Gain Range: ±10%. Tilt: ⩽5% on 50 Hz. Squarewave High Frequency Response: ±3%, 25 Hz to 5 MHz. Referenced to 50 kHz. Input Resistance 1 MΩ, ±2%, not including probe. Input RC Product: 20 μs, ±1%, not including probe. BNC connector accepts most Tektronix probes.

10X Probe Calibrator — Output voltage 1.000 V ±0.005 V or 0.995 V to 1.005 V.

SLOW SWEEP CHARACTERISTICS (OPTION 07)

Duration — 4 to 12 s, variable with front panel control.

Linearity — ±5% of full-screen over the length of the sweep.

Indicator — Front panel indicator on when slow sweep is operating but sweep is not running.

Triggering Signal — APL change ⩽10% to 90% (Bump or Bounce), front panel selectable for either + or − level change.

Sensitivity — 400 mV to 2 V p-p composite video with APL change.

Rate — ⩾0.2 Hz, free-runs at rates <0.2 Hz or with no triggering signal.

Input — Internal or External.

50Hz/60 Hz Squarewave Triggering — Sensitivity: 400 mV p-p minimum to 3 V p-p maximum. Input Impedance: ≈10 kΩ ac coupled (Rear Panel loop-through connectors not return loss compensated.)

PHYSICAL CHARACTERISTICS

	1480C		1480R	
Dimensions	**mm**	**in**	**mm**	**in**
Width	216	8.5	482	19.0
Height	210	8.3	133	5.3
Depth	430	16.9	457	18.0
Weights ≈	**kg**	**lb**	**kg**	**lb**
Net	9.8	21.5	11.2	24.6
Shipping	24.1	53.1	24.1	53.1

ORDERING INFORMATION

1480C NTSC Waveform Monitor.

1480R NTSC Waveform Monitor.

1481C PAL Waveform Monitor*1.

1481R PAL Waveform Monitor*1.

1482R PAL-M Waveform Monitor.

1485C PAL/NTSC Dual Standard Waveform Monitor*1.

1485R PAL/NTSC Dual Standard Waveform Monitor*1.

Includes: Two BNC right angle adaptors (103-0031-00); one pair rackmount ext DWR slides (351-0195-01), various external graticules (see matrix below); manual.

External Graticules	1480R/C	1481R/C	1482R	1485R/C
Blank	x	x	x	x
NTSC				x
CCIR				
CCIR K (V)		x		x
CCIR K (P)		x		x
GRAT A (V)				x
GRAT B (V)	x			x
GRAT A (P)				x
GRAT B (P)	x			x

(V) Visual (P) Photo

OPTIONS

Option 01 — 1 MΩ, 20 pF Probe Input (not available with Option 06, probe not included).
Suggested Probe: P6108 10X Probe 2 m (010-6108-03); or 3 m (010-6108-05).

Option 06 — (1480R only) 124 Ω WECO Style Inputs.

Option 07 — Slow Sweep*2 (Option 07 performance included with Option 06. Do not order with Option 06).

Option 08 — (1481C, 1481R, 1485C and 1485R only) SECAM Field Identification.

*1 *1481C/R, 1485C/R meets European Broadcast Union Tech. 3221-E, Guiding Principles for design of Television Waveform Monitors.*

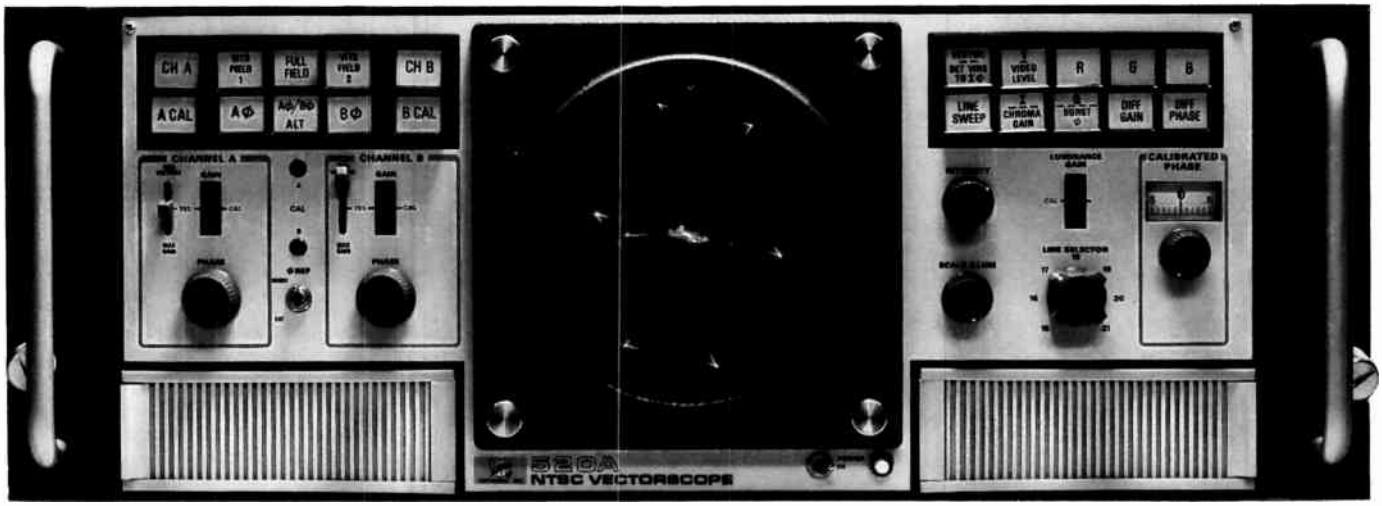
*2 *Option 07 satisfies EBA Tech 3321-E § 3.2.2.*

OPTIONAL ACCESSORIES

1480R Cradle Assembly — For mounting the 1480R in a WECO backless rack. Order 426-0309-00.

Field Case — (For cabinet versions only). Order 016-0084-00.

Trace Recording Cameras — Both the Tektronix C-53P and the C-59AP can be used.



R520A NTSC Vectorscope

R520A/R521A/R522A

Luminance Amplitude

Chrominance Amplitude and Phase

Precision Differential Gain and Phase

Outstanding accuracy and versatility in a video measurement vectorscope. The 520A Series offers advanced capability that enables measurements of the chrominance signal and distortions thereof to be made with a high degree of precision. It effectively complements the 1480 Series in applications requiring highly accurate measurements of luminance amplitude, chrominance amplitude and phase, differential gain, differential phase and other distortions.

The 520A Series provides polar coordinate displays which easily detect errors in color encoding, videotape recording and playback, or transmission processes that interfere with phase and/or amplitude relationships and lead to color errors in a television picture. Large phase shifts can be read from the parallax-free vector graticule, and a precision calibrated phase shifter is provided for measuring small phase shifts.

Differential gain and differential phase measurements can be made with accuracy to better than 1% or 1°. Using a trace overlay provides excellent resolution for measuring very small phase errors.

Other features include a voltage step-up termination option, VITS observation from front panel selected lines and dual vector display.

The 520A Series is available in NTSC, PAL and PAL-M versions.

The Tektronix R520A Series vectorscopes include three basic instruments. These are the R520A for NTSC, the R521A for PAL, and the R522A for PAL-M.

DISPLAYS

The vector display shows the relative phase and amplitude of the chrominance signal on polar coordinates. To help identify these coordinates, the graticule has points corresponding to the proper phase and amplitude of the primary and complementary colors: R (Red), B (Blue), G (Green), C_Y (Cyan), Y_L (Yellow), and M_G (Magenta).

Any errors in the color encoding, video-tape recording, or transmission processes that change these phase and/or amplitude relationships cause color errors in the television picture. Polar coordinate displays, such as those obtained on the R520A, R521A, and R522A CRT, have proven to be the best method for displaying these errors.

The polar display permits measurement of hue in terms of relative phase of the chrominance signal with respect to the color burst. Amplitude is expressed in terms of the displacement from center (radial length) toward the color point which corresponds to 75% (or 100%) amplitude of the particular color being measured.

The outer boxes around the color points correspond to phase and amplitude error limits (±10°, ±20%). For the R520A (NTSC) the inner boxes indicate ±2.5° and 2.5 IRE units, and correspond to phase and amplitude error limits per EIA specification RS-189, amended for 7.5% setup. For the R521A (PAL) and R522A (PAL-M), the inner boxes indicate ±3° phase angle and ±5% amplitude.

An internally generated test circle, used with the vector graticule, verifies quadrature accuracy, horizontal to vertical gain balance, and gain calibration for chrominance signal amplitude measurements. Two methods of measuring phase shifts are provided.

You can accurately read large phase shifts from the parallax-free vector graticule. A precision calibrated phase shifter with a range of 30°, spread over 30 inches of dial length, is provided for measuring small phase shifts.

Dual Vector Display

In dual-channel operation, successive samples of channels A and B are displayed on a time-shared basis. The switching rate is locked to horizontal sync, and switching transients are blanked. You can conveniently compare input/output signals from video equipment on Channel A or B for phase and/or amplitude distortion.

The subcarrier processing channel contains two uncalibrated 0° to 360° phase-shifters and one 30° calibrated phase shifter. While viewing Channel A or B, you can switch either of the uncalibrated phase-shifters, AØ or BØ into the subcarrier processing channel. Each phase shifter locks to its respective channel when A and B channels are time-shared, permitting independent phase control of the Channel A and B displays. Unequal signal paths causing phase shifts are easily cancelled, leaving only phase and amplitude distortion caused by equipment deficiencies.

Video cable lengths may be accurately matched for time delay at color subcarrier frequency to less than 0.5° phase difference.

You can make accurate amplitude measurements of chrominance and luminance from the CRT display. Use the internal one volt luminance amplitude calibration test signal to check the gain accuracy of Channel A and B amplifiers and the luminance channel.

Time Base Displays

The linear time base operates at the line rate. Color signals may be demodulated along any desired axis, I, Q, and R-Y (for NTSC), and U, and V (for PAL and PAL-M), and displayed at the line rate on a linear time base.

Luminance-Color Separation
A luminance channel permits the separation and display of the luminance (Y) component from the composite color signal. You can also combine the Y component with the output of the chrominance demodulators for R, G, and B displays at a line rate. Amplitude measurements of color signal components can be made with an accuracy of 3%.

Vertical Interval Test Signal Observation
You can display VITS (Vertical Interval Test Signals) from front-panel selected lines of either field 1 or 2 on the R520A Vectorscope. For the R521A (PAL) and the R522A (PAL-M), you can display ITS from either fields 1 and 3 or fields 2 and 4.

Differential Gain and Differential Phase Measurements
The two main chrominance signal distortions—differential gain and differential phase—can be measured on the R520A (NTSC), R521A (PAL), and R522A (PAL-M) Vectorscopes. Differential gain (Figure 1) is a change in color subcarrier amplitude as a function of luminance level. In the reproduced color picture, saturation will be distorted in the areas between the light and dark portions of the scene. The R520A, R521A, and R522A permit differential gain measurements with accuracy to better than 1%.

Differential phase (Figure 2) is a phase modulation of the chrominance signal caused by changes in the luminance signal level. The hue will vary with scene brightness in the reproduced color picture. Differential gain and differential phase occur separately or together. You can read differential phase errors from the precision calibrated phase shift control or directly from the differential phase markings on the graticule.

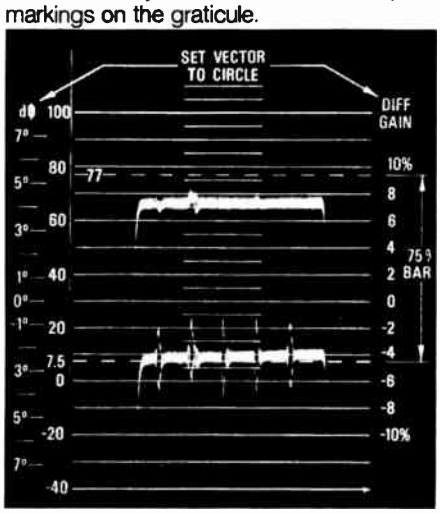


Figure 1. Differential Gain display from the R520A. Luminance is on in lower trace. On upper trace, luminance is off. Minor divisions of graticule indicate 1% differential gain. Double exposure.

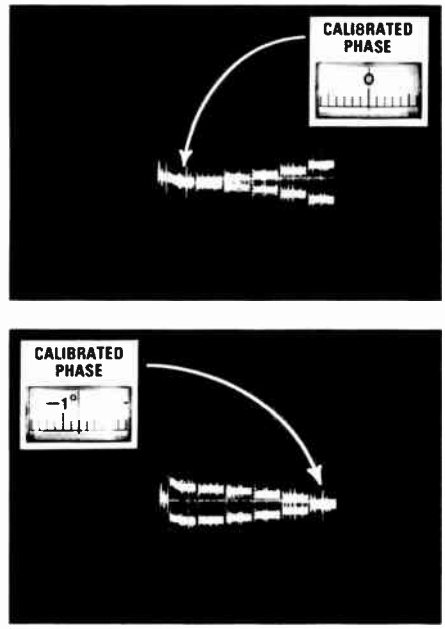


Figure 2. Differential Phase presentation from the R520A using a modulated staircase signal. Trace overlay technique provides excellent resolution for measuring small phase changes. The differential phase error from the reference point in top photo (first step of staircase signal overlayed) to point of measure in bottom photo (sixth step overlayed) is 1.2°.

CHARACTERISTICS

Graticule — Two separate graticules provide reference for vector and line sweep displays. The parallax-free vector graticule, or the luminance graticule, is automatically selected and edge-lighted concurrent with operating mode selection.

Z-Axis Input — The Z-Axis Input connector accepts external trace-brightening pulses for intensifying a portion of the display during the time of interest.

Video Inputs — Dual BNC input connectors for each channel permit 75 Ω loop-through operation with a return loss >46 dB to 5 MHz (exceeds CCIR recommendation 567, Part D and D.2). Amplitude range is 0.7 V to 1.4 V Video (sync tip to peak white).

AC POWER

Mains Voltage Range — 90 V ac to 136 V ac or 180 V ac to 272 V ac.

Mains Frequency — 47 Hz to 63 Hz.

Power Consumption — 95 W maximum at 115 V ac/60 Hz. (Rear panel selector provides rapid accommodation to six line-voltage ranges. Factory set at 115 V ac for the R520A and R522A and 230 V ac for the R521A.)

ENVIRONMENTAL

Operating Temperature Range — 0°C to +50°C ambient.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width	483	19.0
Height	178	7.0
Depth	483	19.8
Weights	**kg**	**lb**
Net	15.0	33.0
Shipping≈	27.7	61.0

ORDERING INFORMATION

R520A NTSC Vectorscope.
R521A PAL Vectorscope.
R522A PAL-M Vectorscope.
Includes: Manual.

OPTIONAL ACCESSORIES

75 Ω Voltage Step-Up Termination — When used with a Tektronix vectorscope, the 75 Ω Voltage Step-up Termination provides an X5 increase in chrominance amplitude and lets you make more accurate Differential Gain and Differential Phase measurements. Input impedance to the termination is a constant 75 Ω. Use of the termination requires a source of external sync to the vectorscope.

Voltage Step-up Termination — For use with R520A (NTSC), R522A (PAL-M) Vectorscopes. Order 011-0100-01.

Voltage Step-up Termination — For use with the R521A Vectorscope. Order 011-0109-00.

Single Sideband Chroma Amplitude Corrector — Designed for use with a Tektronix vectorscope in transmitter applications where a vestigial sideband signal is being demodulated with a detecting diode. The corrector provides an X2 increase in chrominance amplitude and passes luminance components with little or no attenuation. Input impedance is 75 Ω.

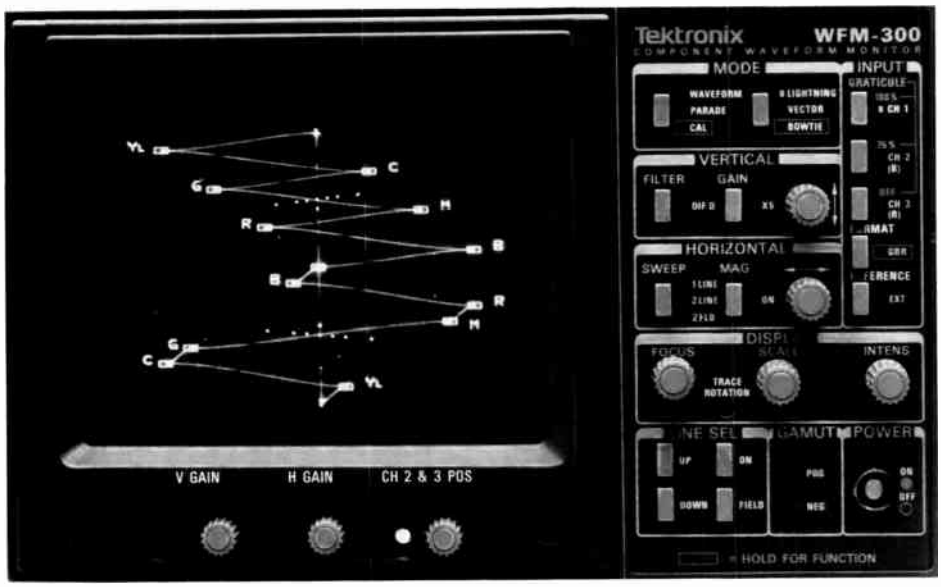
Chroma Amplitude Corrector — For use with R520A (NTSC), R522A (PAL-M) Vectorscopes. Order 011-0107-01.

Chroma Amplitude Corrector — For use with R521A Vectorscope. Order 011-0108-01.

Recommended Camera — For Display Photographs: C-59AP with mounting adaptor 016-0295-01.

R520A Cradle Assembly — For mounting the R520A in a WECO backless rack. Order 426-0667-00.

Rackmount to Cabinet Conversion Kit — Order 040-1153-00.



WFM-300 Component Television Waveform Monitor with Lightning Display.

WFM-300

Component Television Waveform Monitor

Electronic Graticule

Lightning Display

Waveform Display Parade & Overlay

Vector Display

Bowtie Timing Display

Color Gamut Limit Indication

Linearity Measurements

Input Selectable Between Y, B-Y, R-Y G,B,R Y,Q,I

625/50 and 525/60 Configurations

GBR Picture Monitor Output

The versatile WFM-300 Component Television Waveform Monitor provides a comprehensive set of signal monitoring capabilities designed specifically for the component television environment.

New component based television equipment produces signals quite different from the composite television signals, and the WFM-300 provides new monitoring capabilities to meet this challenge. An innovative new Lightning display provides amplitude and timing information for all three channels simultaneously, allowing the operator to set up equipment accurately and efficiently.

The traditional parade display of three signals provides side-by-side comparison of all signals. In addition, any combination of the three signals can be overlayed for accurate comparisons. Both horizontal and vertical magnification can be applied for detailed inspection of the signal being observed.

A vector display of the color difference signals provides the traditional color bar vector display. The new Bowtie display uses the special Bowtie timing test signal from the TSG-300 component television test signal generator, allowing precise timing of three wire component television systems.

The three channel input signals can be Y, B-Y, R-Y or G,B,R or Y,Q,I with internal accommodation for each signal type. All of these signal types are converted to G,B,R for a dedicated picture monitor output. The valid GBR gamut limit is monitored to ensure the operator is warned if a combination of signals is not valid. The WFM-300 can be configured for both 525/60 and 625/50 signal standards.

CHARACTERISTICS

Vertical Deflection System — Frequency Response: 1 V Full Scale; 50 kHz to 6 MHz within 2% of response at 50 kHz. X5 Gain; 50 kHz to 5 MHz within 2% of response at 50 kHz. Dif'd Step; Equal to greater than −20 dB at 14 kHz and 2 MHz. Transient Response: 1 V Full Scale; Pulse-to-bar 0.99:1.00 to 1.01:1.00. Ringing and Overshoot; 2% or less. Tilt: 1% or less; Variable Gain Range: 1 V Full Scale; Input signals between 0.7 V and 2 V can be adjusted to 1 V display. Deflection Accuracy: Within 2%.

DC Restoration — Attenuation of 50 Hz on Input Signal: Less than or equal to 20%. Blanking Level Shift with 10% to 90% APL Change: Less than or equal to 1%.

Inputs — CH 1, CH 2, CH 3, & External Reference: Return Loss (75 ohms) at least 40 dB from 50 kHz to 6 MHz. Cross Talk Between Channels: Greater than 46 dB isolation between channels. Loop-Through Isolation: Greater than 60 dB isolation between channels. Maximum Input Level for Normal Operation (CH 1, CH 2, CH 3) ±2 V (dc + peak ac). External Reference: +2 to −4 V peak ac (compatible with comp sync).

Horizontal Deflection System — (Waveform and Parade Mode) Sweep will occur in all sweep rate settings with or without a reference signal. Synchronization: Sweep will synchronize to sync amplitude of 0.3 V p-p ±6 dB. 2 FLD Sweep Repetition Rate: Equal to frame rate of selected reference. 2 FLD MAG (Magnification): Approximately X20. 1 LINE Sweep Repetition Rate: Equal to line rate of selected reference. 2 LINE Sweep Repetition Rate: Equal to half line rate of selected reference. Timing Accuracies: 1 μs/Div; within 2%. 0.2 μs/Div; within 2%. Linearity (1 μs/Div and 0.2μs/Div): within 2 %.

Parade Mode — Sweep Repetition Rate: Field or line rate of selected reference.

Vector Mode — Vertical Bandwidth: 900 kHz ±100 kHz. Horizontal to Vertical Bandwidth Matching: No eye opening at 500 kHz or 2 MHz. Vertical Gain Accuracy: ±1%. Horizontal Gain Accuracy: ±1%. Electronic Graticule Accuracy: ±1%.

Bowtie Mode — Common Mode Rejection Ratio: Greater than 40 dB.

Calibration — Calibrator accuracy within 1%.

Transcoder — Accuracy: Within 1%. GBR Outputs: Impedance 75 ohms nominal. Back porch clamped to 0 V. Gamut Limit: Preset threshold settings are nominally +735 mV and −35 mV within ±5 mV.

CRT Display — CRT Viewing Area: 80 × 100 mm. Horizontal = 12.5 div. Accelerating Potential: Nominally 13.75 kV. Trace Rotation Range: Greater than ±1 degree from horizontal.

Power Source — Mains Voltage Ranges: 110 V (88-132 V); 220 V (198-242 V). Mains Frequency Range: 48 Hz to 66 Hz. Power Consumption: 35 Watts maximum.

TEK WFM-300 COMPONENT TELEVISION WAVEFORM MONITOR

ENVIRONMENTAL

Temperature non-operating — −55 degrees C to +75 degrees C

Temperature operating — 0 degrees C to +50 degrees C

Altitude non-operating — to 50,000 feet

Altitude operating — to 15,000 feet

Vibration operating — 15 minutes each axis at 0.15 inch, frequency varied from 10-55-10 Hz in 1-minute cycles with instrument secured to vibration platform. Ten minutes each axis at any resonant point or at 55 Hz if no resonant point is found.

Shock non-operating — 30 g's, ½ sine, 11 ms duration, 3 shocks per surface (18 total).

Transportation — Qualified under NTSC Test Procedure 1A, Category II (24-inch drop).

Humidity — Meets Tektronix Standard 062-2847-00.

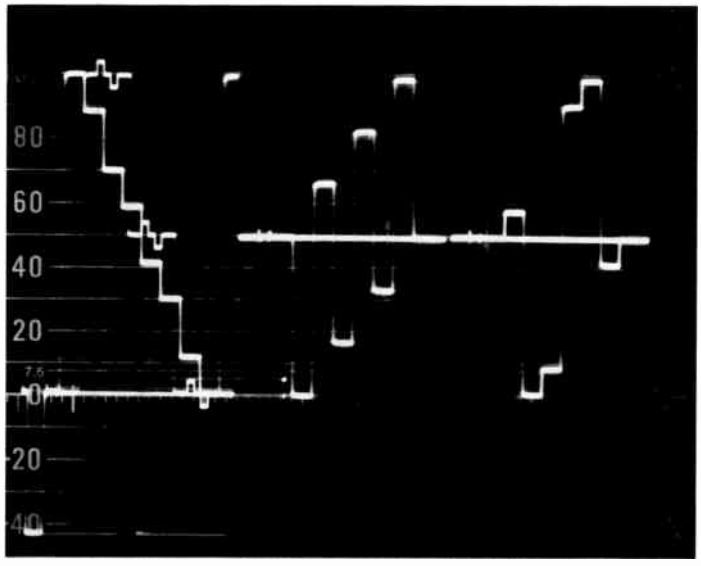
CERTIFICATION

Safety — UL-1244. ANSI C39.5. CSA Bulletin 556B. IEC 348.

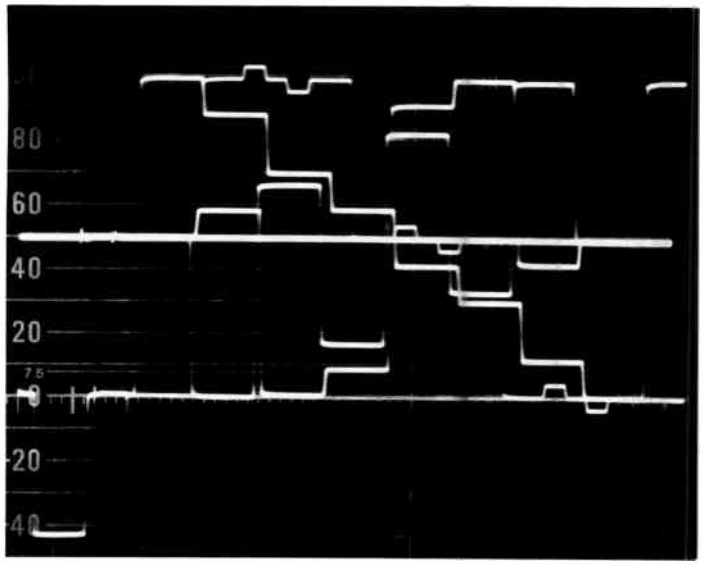
FCC EMI Compatibility — FCC Rules Port 15 Subpart J (Class A). VDE 0871.5 (Class B).

PHYSICAL CHARACTERISTICS

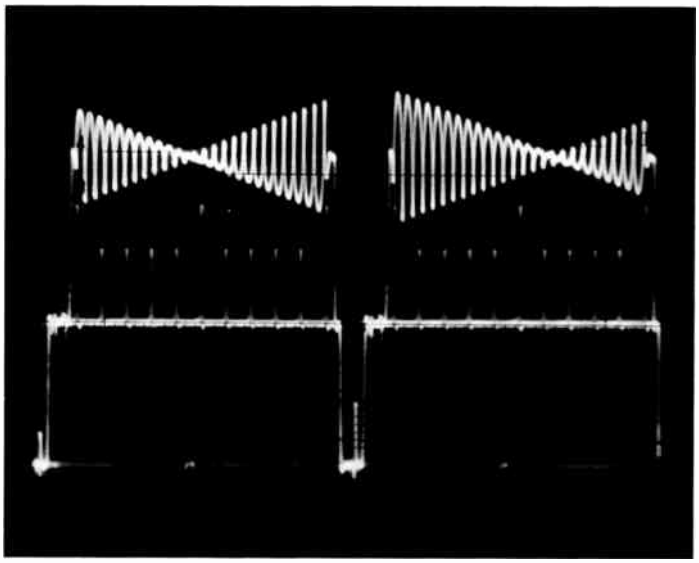
Dimensions	mm	in
Height	133	5.25
Width	214	8.424
Length	464	18.125
Weight (approximate)	**kg**	**lb**
Net	4	9



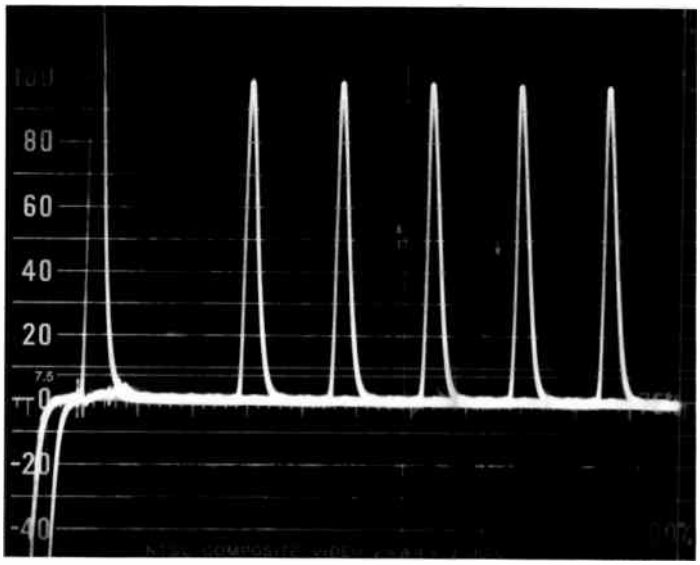
Parade Display.



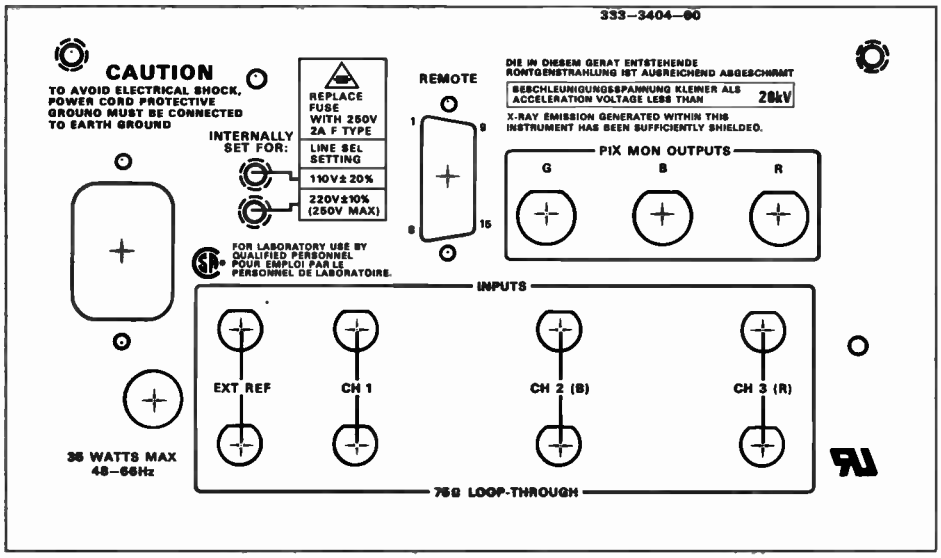
Waveform Overlay Display.



Bowtie Display.



Luminance Linearity Display.



WFM-300 Rear Panel.

INCLUDED ACCESSORIES

Instruction manual; Power cable assembly; Spare fuse; Remote control mating connector.

OPTIONAL ACCESSORIES

Cameras — Regular: Order C5C opt. 2. Automatic: Order C7 opt. 3.
Cabinets — Plain: Order 1700F00.
Cabinets — Portable: Order 1700F02.
Rack Adapter — Order 1700F05.
Blank Panel — Order 1700F06.
Viewing Hood — Order 016-0726-01.
Snap-on Front Cover — Order 200-1566-00.

ORDERING INFORMATION

The standard instruments are shipped without a case or handle. If your application is for bench or portable use, please order the appropriate enclosure from the option accessories list. The WFM-300 is a UL recognized component and meets the requirements for listing when used in the appropriate enclosure.

WFM-300 Component Television Waveform Monitor.

Option 01 for 625/50 operation (SMPTE transcoder).

Option 10 for BetaCam® transcoder.

Option 12 for YQI transcoder.

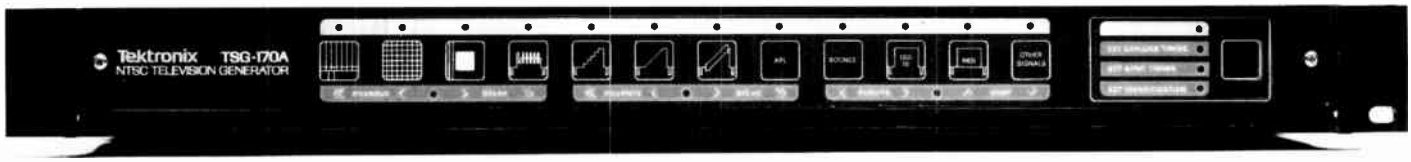
BetaCam® is a registered trademark of Sony Corporation.

NEW PRODUCT

TEK SIGNAL MONITOR SELECTION GUIDE

	1710B	1720	1730	1740	1750	1480	520A
HALF-RACK WIDTH	X	X	X	X	X		
INTERNAL GRATICULE	X	X	X	X	X	X	X
DC POWER	(4)	(4)	(4)	(5)			
BATTERY	(1)	(1)	(1)	(5)			
VITS MONITORING		(6)	X	(2)	X	X	X
R-Y/SWEEP MODE		(6)		X	X		X
DUAL FILTER MODE	X		X		X		
SIMULTANEOUS CH A & B DISPLAY		X	X			(7)	
REMOTE CONTROL		X	X	X	X		
RGB/YRGB DISPLAY			X	X	X	X	
X Y INPUT		X					
SCH MODE					X		
PROBE INPUT						(5)	
DIGITAL SELECTION OF LINE AND FIELD		(6)	X		X	X	X
TRACE OVERLAY						X	
15-LINE DISPLAY		(6)	X			X	
PRECISION AMPLITUDE MEASUREMENTS						X	
PRECISION PHASE MEASUREMENTS							X
NTSC	X	X	X	X	X	X	X
PAL	X	X	X	X	X	X	X
PAL-M				X	(3)	X	X
NTSC/PAL DUAL VERSION						X	
BURST PHASE DISPLAY	X						

(1) Order BP1, 1700F02 case and DC mod kit
(2) Limited capability
(3) Available as a modified product
(4) Available as a field mod kit (1700F10)
(5) Available as an ordered option
(6) When connected to a 1730/31
(7) A-B Display



TSG-170A NTSC Television Generator.

TSG-170A

NTSC Television Generator

Simple, Effective Test Signal Complement

RS-170A Sync Pulse Generator with Digital Genlock

Separate Timing Controls for Sync and Test Signals

Separate SMPTE Bars Output with Programmable ID (Option 01)

Audio Tone Output (Option 01)

Tape Leader Countdown

The Tektronix TSG-170A NTSC Television Generator offers you the test signals you need plus the advantages of master and genlock sync capability. It provides true 10 bit digital signal accuracy with a full complement of test signals and a stable RS-170A sync generator.

The rugged, compact TSG-170A is designed to support both operational and maintenance requirements. The TSG-170A Option 1 provides even more versatility by adding a separate SMPTE bar generator, programmable identification, and audio tone output.

Test Signal Generator

The accuracy and long term stability of the TSG-170A test signals are enhanced by its precision digital to analog converter. Each converter is automatically laser trimmed to 12 bit accuracy. The TSG-170A test signal generator's simple front panel controls provide selection of:

- SMPTE Bars
- Convergence
- Pulse & Bar with Window
- Multiburst
- 5-Step Luminance Staircase
- Luminance Ramp
- Modulated Ramp
- Selectable 10% or 90% APL
- Bounce
- 10 and 100 IRE Flat Fields
- Red Field
- Multibars
- NTC7 Composite
- System Test Matrix
- Monitor Setup Matrix
- 5 MHz Line Sweep
- Multipulse
- DAC Calibration Signals

Color bar blanking width is 10.6 μs to facilitate verification of proper blanking throughout your system.

RS-170A Sync Generator with Digital Genlock

The TSG-170A sync generator's stable color standard and unique digital genlock make it ideal for either master generator or slave operation. All outputs are correctly SC-H phased, even if the TSG-170A is locked to an improperly SC-H phased reference input. The digital genlock calculates sync timing and subcarrier phase to properly identify color framing of the input reference signal. The TSG-170A automatically senses composite video or 3.58 MHz subcarrier reference inputs and, in the absence of a reference input signal, automatically switches to its own internal reference. This high stability crystal oscillator, with its constant temperature oven, ensures long term frequency stability.

System Timing Control

Front panel controls are provided for phasing of all outputs relative to the genlock source. In addition, a separate set of timing controls is provided to move the pulse and subcarrier outputs relative to the black burst and test signal outputs. This simplifies system timing and eliminates delay lines. All timing settings are stored in nonvolatile memory to prevent loss in the event of a power failure. A front panel lockout feature prevents inadvertant changes to the front panel timing controls.

Flexible Pulse Output

The TSG-170A has eight sync generator outputs; four fixed and four programmable. The primary outputs for SUBCARRIER, SYNC, BLANKING, and BLACKBURST, are fixed. The secondary outputs, BURST FLAG, H DRIVE, V DRIVE, and COLOR FRAME PULSE, are programmable and can be changed to provide a second set of primary outputs. The BLANKING output may be set to 10.2, 10.7, or 10.9 μs.

SMPTE Bars with Programmable ID, Audio Tone and Tape Leader Countdown (Option 01)

Option 01 adds a separate SMPTE bar output for routine studio needs, such as tape leaders, freeing the front panel selected test signals for engineering and maintenance.

SMPTE Bars with Character ID (Option 01).

An ID of up to 12 alphanumeric characters may be inserted in the SMPTE bar output. This front panel programmable ID is ideal for identifying satellite feeds, and videotapes.

Option 01 also provides a 400 Hz audio tone output, useful for checking program line continuity and adjusting audio levels. The tone can be adjusted over a 0 dBm to +8 dBm range into 150 Ω or 600 Ω.

Also included in option 01 is a tape leader countdown. When initiated, the full time SMPTE Bars output goes to black and the audio tone is switched off. Simultaneously, a ten to two (in seconds) countdown is initiated and overlayed on the black background. The black background remains until the count down program is terminated. Control of the tape leader countdown is through the remote control connector.

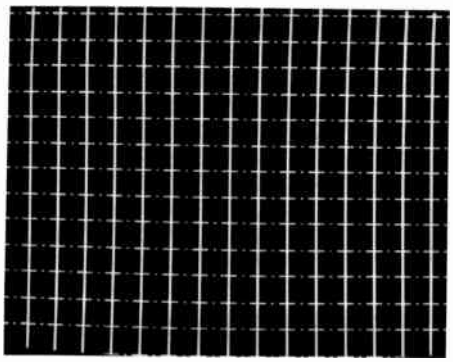
Remote Control

Remote selection of internal/external reference, ID preset, genlock and sync timing presets, and test signal is provided. Selection is made with ground closures through a rear panel connector.

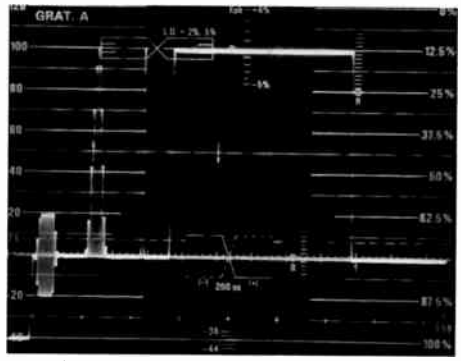
Packaging

The TSG-170A's rugged, 1¾ inch package makes it ideal for remote vans or anywhere space is at a premium.

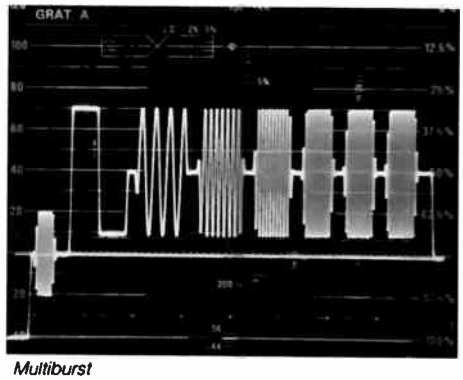
TEK TSG-170A



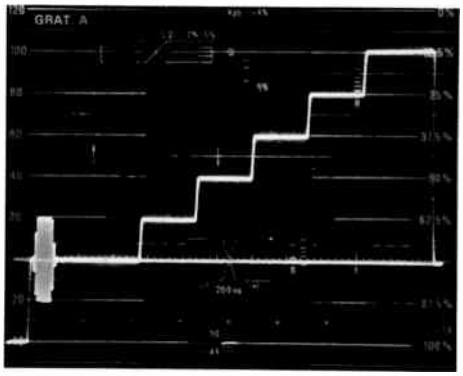
Convergence



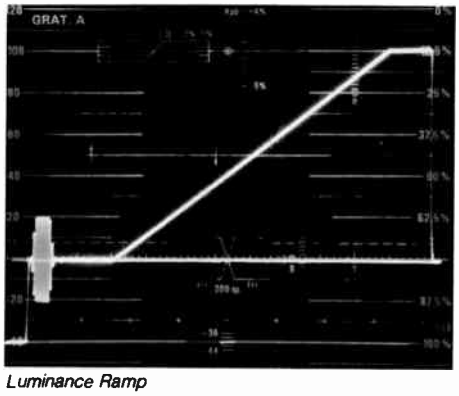
Pulse & Bar with Window



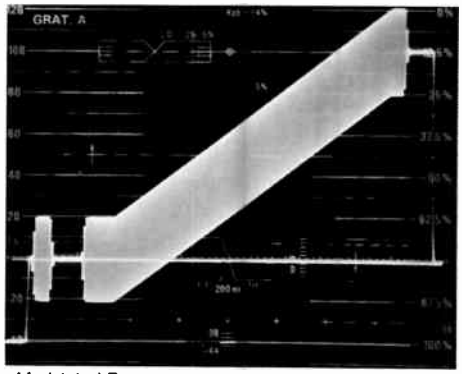
Multiburst



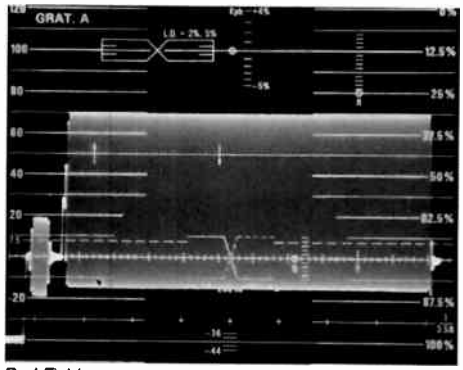
5-Step Luminance Staircase



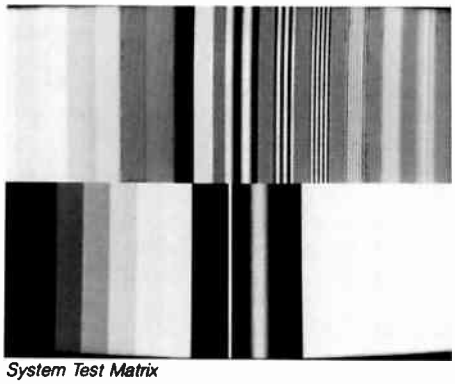
Luminance Ramp



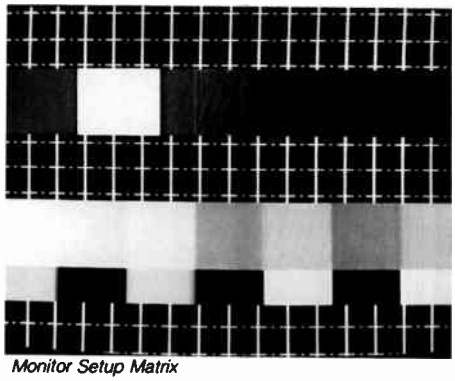
Modulated Ramp



Red Field

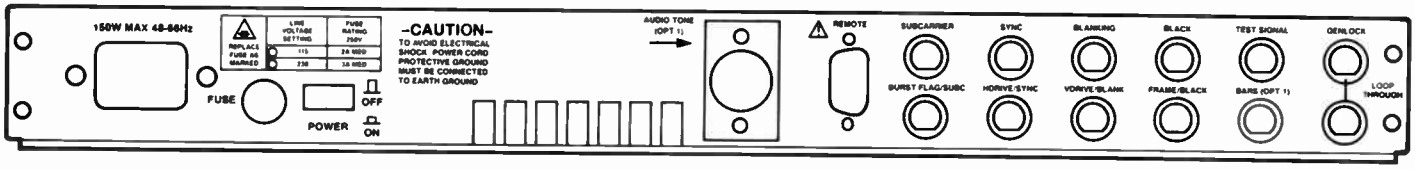


System Test Matrix



Monitor Setup Matrix

TSG-170A Rear Panel



TEST SIGNAL GENERATOR

Luminance Amplitude Accuracy	±1%
Chrominance-to-Luminance Gain	±1%
Output Impedance	75 ohm
Return Loss	36 dB to 4.2 MHz
TEST SIGNALS COLOR BARS	SMPTE Bars with 10.6 μs blanking
CONVERGENCE	14 lines per field, 17 lines per horizontal
PULSE & BAR WITH WINDOW 2T Pulse HAD	250 ns ±25 ns
White Bar Amplitude	100 IRE
Field Tilt	0.5%
Line Tilt	0.5%
MULTIBURST White Reference Bar Amplitude	428.6 mV (60 IRE)
Packet Amplitude	428.6 mV (60 IRE) p-p
Burst Frequencies	0.5, 1.0, 2.0, 3.0, 3.58 and 4.2 MHz
5-STEP STAIRCASE	714.3 mV (100 IRE)
LUMINANCE RAMP	0 to 714.3 mV (100 IRE)
MODULATED RAMP Chrominance Amplitude	285.7 mV (40 IRE)
Diff Gain	0.6%
Diff Phase	0.3°
APL	10% and 90%
AC BOUNCE Bounce Rate	1 second high, 1 second low
FLAT FIELDS	10 IRE, 100 IRE
RED FIELD Luminance Amplitude	202.2 mV (28.3 IRE)
MULTIBARS	Color bars and multiburst
NTC7 COMPOSITE	80 IRE, 5-step modulated staircase and pulse & bar
LINE SWEEP	714.3 mV p-p. Linear sweep from 500 kHz to 5 MHz
MULTIPULSE Amplitude	714.3 mV
Frequencies	0.5, 1.0, 2.0, 3.0, 3.58, and 4.2 MHz
SYSTEM TEST MATRIX	Multibars and NTC7
MONITOR SETUP MATRIX	Convergence, IWQB, convergence, color bars, reverse bars, and convergence
DAC TEST	500 kHz and 3.58 MHz
OPTION 01 COLOR BARS	SMPTE bars
IDENTIFICATION	12 characters, 7×9 matrix
AUDIO TONE	450 Hz (locked to vertical), distortion less than 0.01%, 0 to +8 dBu into 150Ω, 600Ω, or high impedance. Click ID adjustable 0.2 to 4 Hz.

SYNC GENERATOR

SUBCARRIER STABILITY	3.579545 MHz ±1Hz over temperature; typically less than 1 Hz drift over a year after initial aging
BLACK BURST OUTPUT Setup	7.5 IRE
Blanking	Less than 10.6 μs
PULSE OUTPUTS (GENERAL CHARACTERISTICS) Amplitude	4.0 ±0.1V
Impedance	75 ohm
Return Loss	30 dB to 4.2 MHz
Rise Time	140 ns ±20 ns
PULSE OUTPUTS (SIGNALS) COMPOSITE SYNC	
BLANKING Horizontal Blanking Duration	10.7 μs ±0.1 μs, jumper selectable for 10.2 μs or 10.9 μs
Vertical Blanking Duration	20 lines, jumper selectable for 19 or 20 lines
BURST FLAG	
HORIZONTAL DRIVE	
VERTICAL DRIVE	
COLOR FRAME PULSE	Field 1, Line 11
SUBCARRIER OUTPUT Amplitude	2 V p-p ±0.2V
PULSE AND SUB-CARRIER OUTPUTS Timing Range	4 μs advance, 4 μs delay relative to the test signal and black burst outputs

GENLOCK

GENLOCK SOURCE (COMP VIDEO) Input Configuration	75 ohm loop-through
Return Loss	At least 40 dB to 4.2 MHz
Burst Amplitude	286 mV +1 dB to −6 dB
Sync Amplitude	286 mV +3 dB to −6 dB
GENLOCK PERFORMANCE Horizontal Timing Range	8 μs advance, 8 μs delay
Vertical Timing Range	0, 1, or 2 lines advance or 1 line delay, jumper selectable
Burst Lock Range	3.579545 MHz ±20 Hz
Jitter	0.5°

PHYSICAL CHARACTERISTICS

Dimensions	mm	In
Width	483	19.0
Rackmount Height	44	1.734
Length	561	22.1

ENVIRONMENTAL

Power — 90-132 VAC or 180-250 VAC, 80 W max.

Temperature operating — 0° to 40°C.

Temperature non-operating — −40° to +65°C

ORDERING INFORMATION

TSG-170A NTSC Television Generator

TSG-170A Option 1: Adds a separate SMPTE Bars output with 12 character ID, Audio Tone Output and Tape Leader Countdown.

TEK SPG-170A NTSC SYNC GENERATOR

SPG-170A NTSC Sync Generator.

SPG-170A Sync Generator

Digitally Generated RS-170A Black Burst

Digital Genlock

High Stability Subcarrier

Flexible Pulse Outputs

Pulse Timing Independent of Black

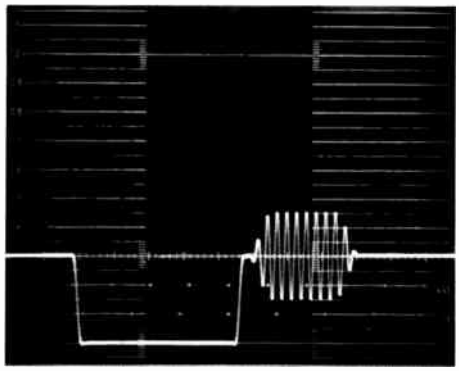
Remote-Control Timing Presets

Remote-Control ID Presets

Optional SMPTE Bars, ID, and Audio Tone

The SPG-170A sync generator offers all the features expected in a sync generator, plus the advantages of digital accuracy and system flexibility. Ideal for either master or slave generator operation, the SPG-170A features stable RS-170A performance and a rugged 1¾" package. The SPG-170A Option 1 provides even more versatility by adding SMPTE bars with programmable identification and audio tone.

Digital Accuracy



All SPG-170A signals are digitally generated to provide excellent SCH and timing accuracy. The SPG-170A also has a digital genlock to ensure consistent color framing and to eliminate timing drift inherent in other genlock systems. This microprocessor-based system calculates genlock input burst phase and sync timing to control output timing and color framing. All outputs are correctly SCH phased, even if the SPG-170A is locked to an improperly SCH phased input. When no input signal is present, it switches to an internal oscillator. This high stability crystal oscillator, enclosed in a constant temperature oven, ensures long term frequency accuracy.

System Flexibility

The flexibility of the SPG-170A's pulse outputs allows you to configure it to your specific system needs. The SPG-170A has eight sync generator outputs: SYNC, SUBCARRIER, BLANKING, BLACK BURST, and four selectable outputs. The selectable outputs can be used for BURST FLAG, H DRIVE, V DRIVE, and COLOR FRAME PULSE, or they can be used to provide an additional set of outputs for the pulses most commonly used in modern television facilities. Horizontal blanking can be set to 10.5, 10.7, or 10.9 μs and vertical blanking can be set to either 19 or 20 lines.

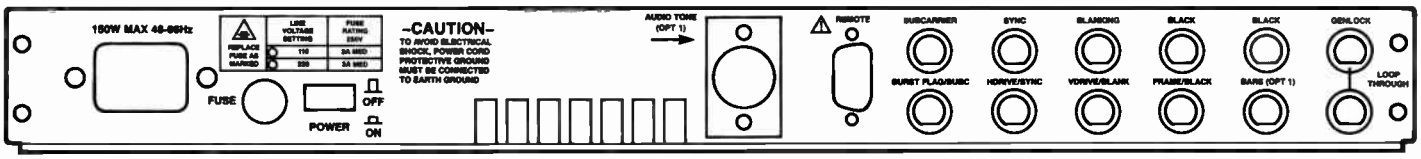
The SPG-170A sync timing controls allow you to advance or delay subcarrier and pulse outputs relative to the black burst output, eliminating the need for separate delay lines. Microprocessor control enables both genlock and sync timing settings to be stored in nonvolatile memory in case of power failure. To prevent inadvertant changes to critical timing settings, the front panel timing controls can be locked out by an internal jumper. Up to eight timing presets are selectable through the remote control to simplify timing of shared equipment.

SMPTE Bars with ID and Audio Tone (Option 1)

By specifying Option 1, basic video and audio test capabilities are added to the SPG-170A. Option 1 includes SMPTE bars and audio tone generators for setting program levels. Also, a preset ID of up to 12 characters can be added over the SMPTE bar output. This ID is stored in nonvolatile memory from the front panel, and up to four preset IDs can be recalled through the remote control. Additionally, the remote control allows the ID to be replaced by a countdown, providing a tape leader function. The vertically locked 450 Hz audio tone provides a unique method for checking audio edit quality. The audio tone can be combined with a variable rate click to distinguish various audio sources.

Total System Solution

Tektronix provides a cost-effective solution to your sync and test signal requirements. The SPG-170A NTSC Sync Generator is ideal in a master sync system with the ECO-170A Synchronous Changeover and TSG-170A NTSC Television Generator.



SPG-170A Rear Panel.

TEST SIGNAL AND BLACK BURST GENERATOR

Luminance Amplitude Accuracy	±1%
Chrominance-to-Luminance Gain	±1%
Output Impedance	75 ohm
Return Loss	36 dB to 4.2 MHz
OPTION 01 COLOR BARS	SMPTE bars
IDENTIFICATION	12 characters, 7×9 matrix
AUDIO TONE	450 Hz (locked to vertical), distortion less than 0.01%, 0 to +8 dBu into 150Ω, 600Ω, or high impedance. Click ID adjustable 0.2 to 4 Hz.

SYNC GENERATOR

SUBCARRIER STABILITY	3.579545 MHz ±1 Hz over temperature. Long term stability typically less than 1 Hz drift per year.
BLACK BURST OUTPUT Setup	7.5 IRE
Blanking	10.7 µs
PULSE OUTPUTS (GENERAL CHARACTERISTICS) Amplitude	4.0 ±0.2V
Impedance	75 ohm
Return Loss	30 dB to 4.2 MHz
Rise Time	140 ns ±20 ns
PULSE OUTPUTS (SIGNALS) COMPOSITE SYNC	
BLANKING Horizontal Blanking Duration	10.7 µs ±0.1 µs, jumper selectable for 10.5 µs or 10.9 µs
Vertical Blanking Duration	20 lines, jumper selectable for 19 or 20 lines
BURST FLAG	
HORIZONTAL DRIVE	
VERTICAL DRIVE	
COLOR FRAME PULSE	Field 1, line 11
SUBCARRIER OUTPUT Amplitude	2 Vp-p ±0.2V
SYNC TIMING RANGE	4 µs advance, 4 µs delay

GENLOCK

GENLOCK SOURCE (COMP VIDEO) Input Configuration	75 ohm loop-through
Return Loss	At least 40 dB to 4.2 MHz
Burst Amplitude	286 mV +1 to −6 dB
Sync Amplitude	286 mV +3 to −6 dB
GENLOCK PERFORMANCE Horizontal Timing Range	8 µs advance, 8 µs delay
Vertical Timing Range	0, 1, or 2 lines advance or 1 line delay, jumper selectable
Burst Lock Range	3.579545 MHz ±20 Hz
Jitter	0.5° maximum

PHYSICAL CHARACTERISTICS

DIMENSIONS	**mm**	**in**
Height (Rackmount)	44	1.734
Width	483	19.0
Length	561	22.1
WEIGHT	**kg**	**lb**
Net	6.14	13.5
Shipping	10.4	22.88

ENVIRONMENTAL

Power — 90-132 VAC or 180-250 VAC, 60 W max.
Temperature — Operating: 0° to 50°C. Storage: −40° to +65°C.

ORDERING INFORMATION

SPG-170A NTSC Sync Generator

SPG-170A Option 1: SMPTE Bars with ID and audio tone

NEW PRODUCT

TEK ECO-170A SYNCHRONOUS CHANGEOVER

ECO-170A Synchronous Changeover.

ECO-170A

Synchronous Changeover

Automatic Sync Changeover

Clean Electronic Switching

Unique Fault Detection System

8 Channels

Manual Override

Remote Control with Fault Indicators

Compatible with NTSC and PAL Systems

The ECO-170A Synchronous Changeover provides transparent, automatic selection of sync sources. Front panel controls allow simple access to changeover functions. A two level front panel lockout protects these controls in critical master sync systems.

Transparent Switching

The ECO-170A employs electronic sync transfer to ensure uninterrupted sync for critical production and on-air operations. Unlike other sync changeovers, the ECO-170A only uses relay transfer when a power or changeover circuit failure has disabled the electronic transfer function. This gives optimum sync system performance while ensuring maximum system reliability. Manual sync source selection provides a means for periodic verification of changeover and backup sync generator operation.

Fault Detection

By testing both pulse amplitude and pulse timing, the ECO-170A provides two methods of error checking for your sync system. Conventional amplitude detection finds missing pulses quickly, while the ECO-170A's additional timing detection identifies errors that would otherwise be undetected. When the ECO-170A detects a fault, it automatically switches to the backup generator, unless the backup generator also has a fault. Front panel indicators and outputs for remote indicators provide fault information for each generator. These indicators remain on until cleared by an operator.

Indicators also also provided for changeover status, source on line, switching mode, and alarm and front panel control status.

An audible internal alarm and an output to drive a remote alarm are provided.

System Configuration

The flexibility of the ECO-170A lets you configure it to your specific system needs. The ECO-170A has eight inputs for each sync generator: SYNC, SUBCARRIER, BLANKING, COMPOSITE VIDEO, and four selectable outputs. The selectable outputs can be used for BURST FLAG, H DRIVE, V DRIVE and COLOR FRAME PULSE, or they can be used to provide an additional set of outputs for the pulses most commonly used in modern television facilities. The composite video channels may be black burst or color bars.

Reliable Sync

With its clean switching and two level fault detection, the ECO-170A teams with your sync generators to provide a reliable master sync system.

ORDERING INFORMATION

ECO-170A Synchronous Changeover

NEW PRODUCT

TSG-300 Component Television Generator.

TSG-300

Component Television Generator

Multiple Formats and Standards
–Y,B-Y,R-Y (Y,Pb,Pr; SMPTE/EBU)
–GBR
–BetaCam™
–MII
–M
–525/60 and 625/50

10 Bit Digital Signal Generation

New Test Signals for Component Video
–Bowtie
–Coring
–Valid Ramp
–Shallow Ramp

User Configurable Controls

Digital Genlock

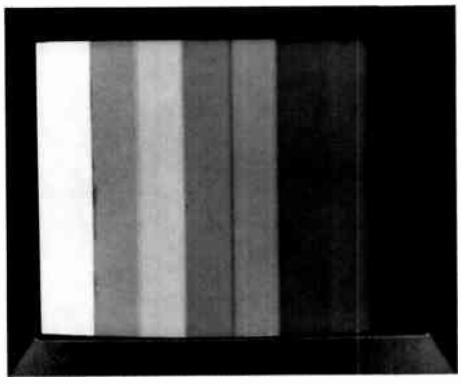


Figure 1a. Component Color Bars.

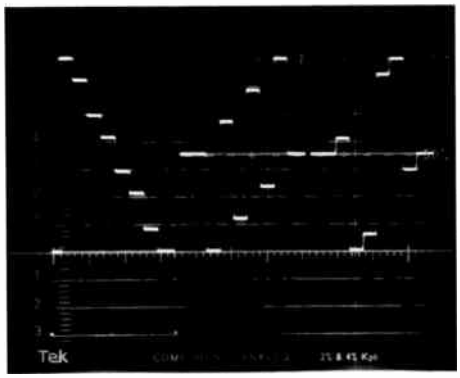


Figure 1b. Y, B-Y, R-Y Color Bars.

From news gathering to post-production, component television is providing new levels of image quality and operational flexibility. While component television solves many problems inherent in composite NTSC and PAL, it brings with it a new set of concerns. The TSG-300 Component Television Generator provides innovative solutions to the the measurement problems encountered in component television systems.

Multiple Formats and Standards

While the EBU and SMPTE are setting standards for component video, there is already a large base of installed component equipment using many different operating levels. The TSG-300 bridges this gap between formal and de-facto standards, providing signals in SMPTE/EBU standard formats as well as previously existing component formats. Signal formats supported by the TSG-300, using color bars as an example (Figure 1), are Y, B-Y, R-Y (Y,Pb,Pr; SMPTE/EBU), GBR, BetaCam, MII, and M. The TSG-300 also supports both 525/60 and 625/50 systems by either internal jumper selection or remote control.

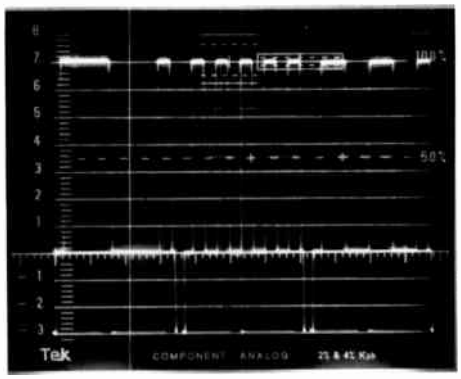


Figure 1c. GBR Color Bars.

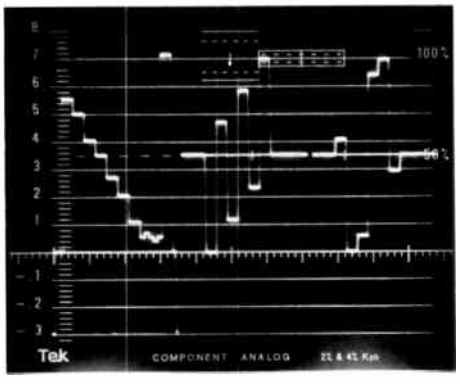


Figure 1d. BetaCam™ Color Bars.

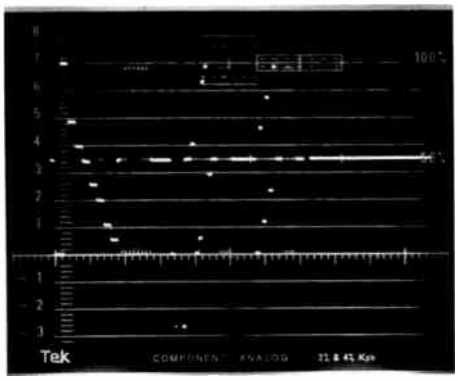


Figure 1e. BetaCam™ Y-CTM Color Bars.

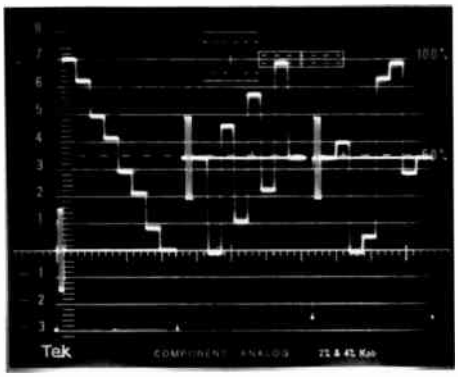


Figure 1f. MII Color Bars.

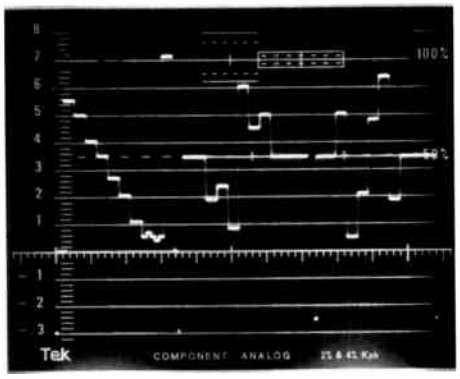


Figure 1g. M Color Bars.

Digital Signal Generation

Precision digital signal generation insures the accuracy and stability of the TSG-300 test signals. 10 bit digital to analog conversion at 13.5 MS/s, even in the color difference channels, allows full bandwidth testing of GBR systems. Digital generation of each individual format eliminates transcoding artifacts.

TEK TSG-300 COMPONENT TELEVISION GENERATOR

New Test Signals for Component Video
The TSG-300 provides unique solutions to component measurement problems with signals such as Bowtie, Coring, Valid Ramp, and Shallow Ramp, as well as a wide range of more conventional signals (Table 1).

Bowtie
Channel matching is critical in component systems. Timing mismatch causes color fringing on fine details, while amplitude mismatch causes color saturation and hue shifts. The Bowtie Signal simplifies channel timing and provides a quick check of gain matching.

The Bowtie signal is composed of 3 separate sine-wave packets, one for each channel. You can compare luminance and color difference channel delays by subtracting channels with the A-B display on a waveform monitor. The WFM-300 Component Waveform Monitor simultaneously compares channel 1 with both channel 2 and channel 3, forming the Bowtie display (Figure 2d).

Channel timing errors move the null off center (Figure 2c). Markers built into the Bowtie signal indicate 20 nS delay increments, with resolution to 5 nS. Channel amplitude mismatch will appear as an incomplete null of the Bowtie (Figure 2f).

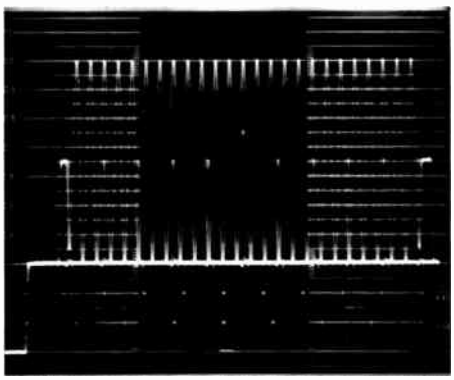


Figure 2a. Bowtie Luminance.

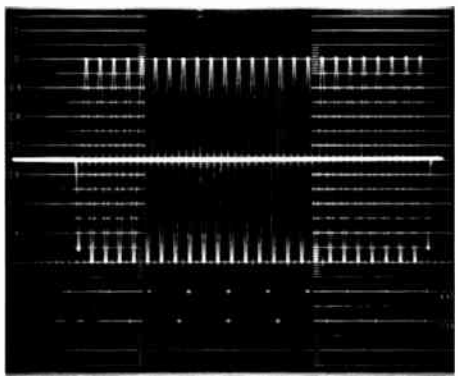


Figure 2b. Color Difference.

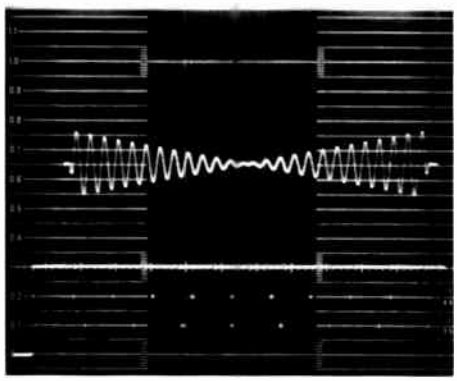


Figure 2c. Bowtie Display.

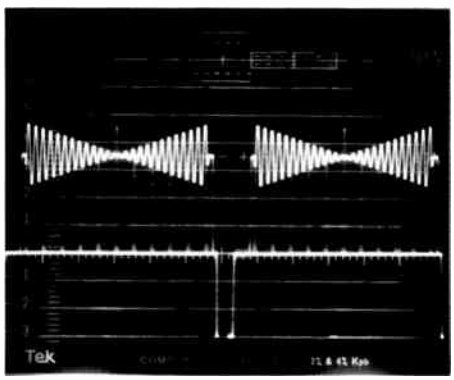


Figure 2d. Comparing Channel 1 with Channels 2 and 3.

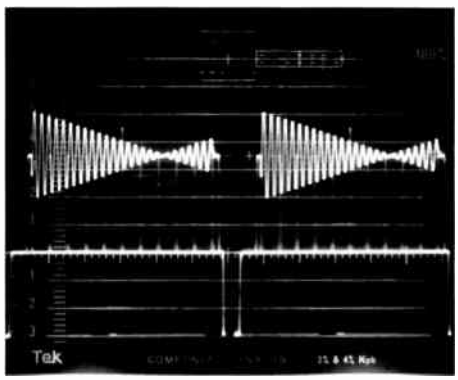


Figure 2e. Delay Error.

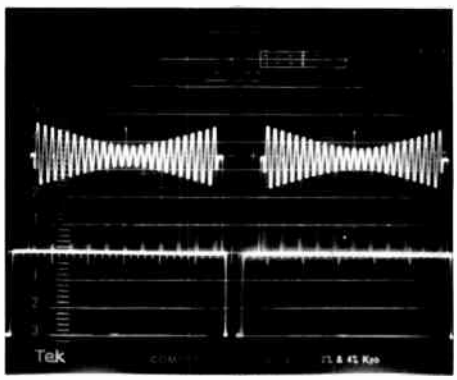


Figure 2f. Gain Error.

Coring
Coring is a technique used in some cameras and recorders to improve apparent signal-to-noise ratio. Coring circuits remove small high frequency noise, but unfortunately impair fine picture detail as well. Extreme application of coring can result in cartoon-like pictures after multiple tape generations (Figure 3a).

The TSG-300 Coring Test Signal consists of low amplitude sine waves at different frequencies. Each packet is tapered to zero amplitude and will have the lowest amplitudes removed where coring is applied. The Coring test aids in setting coring levels and identifying excessive use of coring.

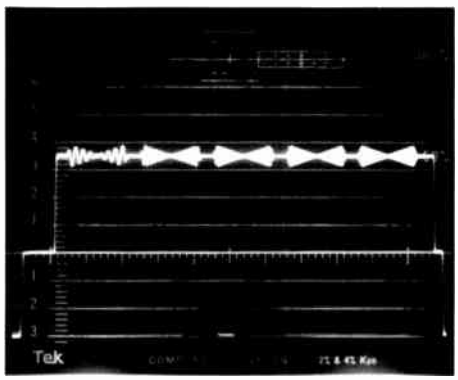


Figure 3a. Coring Test Signal.

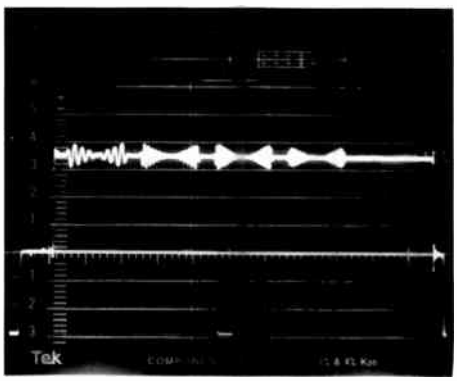


Figure 3b. Excessive Coring.

TEK

Valid Ramp

Component processing and switching equipment may transcode Y, B-Y, R-Y signals to GBR for internal processing. A linearity test in these mixed-format systems should not drive the GBR channels below zero or above maximum signal level. The Valid Ramp signal consists of 3 separate ramps in each of the 3 channels. Each ramp is optimized to test one channel and is accompanied by smaller ramps in the other channels to allow valid transcoding to GBR.

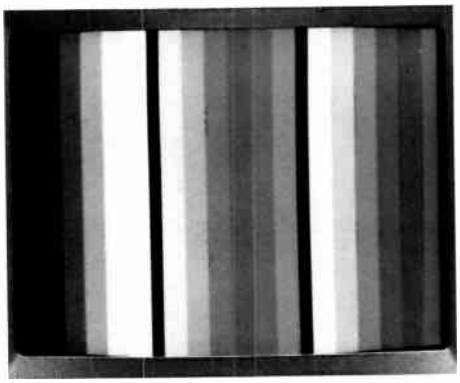


Figure 4a. Valid Staircase.

Figure 4b. Valid Ramp.

Shallow Ramp

Subtle linearity errors introduced by ADCs and DACs in video processors can accumulate on multiple generations. In the past, full scale ramps were used to test these converters but sometimes an error occurring at one specific digital word will be hidden when using conventional ramps. With full scale ramps (Figure 5a), single word errors last only a single clock cycle and are masked by the system anti-aliasing filters.

The TSG-300 Shallow Ramp (Figure 5b) extends the duration of these errors, making them easier to see. A digital system can be tested over its full dynamic range using the variable pedestal. The pedestal can be swept manually or automatically to move the Shallow Ramp from 0 to 700 mV in the luminance channel and −350 to +350 mV in the color difference channels.

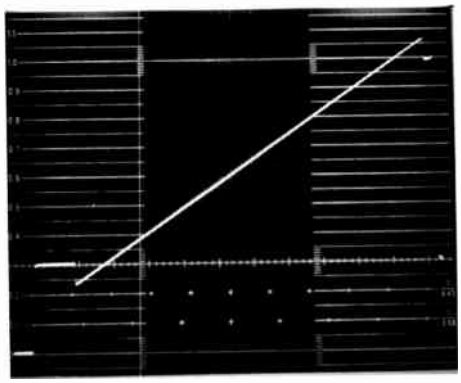


Figure 5a. Linearity Error on Conventional Ramp.

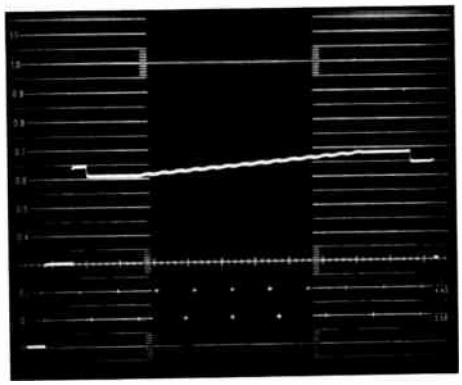


Figure 5b. Linearity Error on Shallow Ramp.

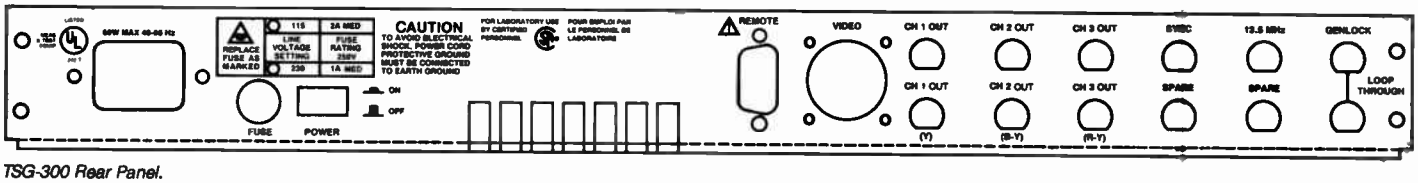
Table 1: TSG-300 Test Signals

Test Signal	GBR	Y,B-Y,R-Y (Y,Pb,Pr) (SMPTE/EBU) (MII)	YQI (M)	Y,CTDM BetaCam™
100% Color Bars	•	•		
75% Color Bars	•	•		
Color Bars with Bowtie				•
Luminance Reference and Pluge	•	•		
5 Step	•	•	•	
Valid 5 Step		•		
120% Ramp	•	•	•	
Valid Ramp		•		
Shallow Ramp	•	•	•	
2T & 3T Pulse and Bar		•	•	
2T & 3T Pulse and Window		•	•	
2T & 5T Pulse and Bar		•	•	

Test Signal	GBR	Y,B-Y, R-Y (Y, Pb, Pr) (SMPTE/BU) (MII)	YQI (M)	Y,CTDM BetaCam™
2T & 5T Pulse and Window		•	•	
2T Pulse and Bar with 20T Pulse	•	•	•	
2T Pulse and Window with 20T Pulse	•	•		
Field Square Wave	•	•	•	
Multipulse	•	•	•	
Wideband 60% Multiburst	•	•	•	
Narrowband 60% Multiburst		•	•	
Wideband 100% Line Sweep	•	•	•	
Wideband 60% Line Sweep	•			

Test Signal	GBR	Y,B-Y, R-Y (Y, Pb, Pr) (SMPTE/BU) (MII)	YQI (M)	Y,CTDM BetaCam™
Narrowband 60% Line Sweep		•	•	
Bowtie	•	•	•	
Convergence	•	•	•	
Coring	•	•	•	
Flat Field	•	•	•	
SMPTE Timing and Amplitude	•	•		
Variable Pedestal	•	•	•	
APL	•	•	•	
Bounce	•	•	•	
Switchable Channel On/Off	•	•	•	•
Selectable Sync On/Off	•	•	•	
Selectable MII Timing Bursts		•		

TEK TSG-300 COMPONENT TELEVISION GENERATOR



TSG-300 Rear Panel.

User Configurable Controls

Operation of the TSG-300 is simplified by its user configurable controls. Many of the test signal controls access a variety of similar signals. These signals are accessed by pressing the switch repeatedly. By simply specifying which signal you want to appear first, the problem of searching for a commonly used signal is eliminated.

Digital Genlock

The TSG-300's unique digital genlock and stable internal oscillator make it suitable for either slave or stand-alone operation. After the incoming signal is digitized, a processor analyzes timing to control the TSG-300's system clock. The digital genlock works with component video or composite NTSC, PAL, or SECAM sources operating in either 525/60 or 625/50 systems. The TSG-300 automatically switches to its internal oscillator in the absence of a reference input signal. This high stability crystal oscillator, with its constant temperature oven, ensures long term frequency stability.

Remote Control

Remote operation of test signal selection, system timing, and line and field rate selection is available by simple ground closure control through a rear panel connector.

Packaging

The TSG-300's rugged, 1¾ inch package makes it ideal for use anywhere space is at a premium.

TSG-300 Specifications

Signal Formats	Y, B-Y, R-Y (SMPTE; Y,Pb,Pr; EBU) GBR BetaCam™ (3 wire) Y-CTDM (BetaCam 2 channel) MII (SMPTE with timing bursts) YQI (M Format)
Systems	525/60 and 625/50 by jumper selection or remote control
Signal Generation	10 bit digital 13.5 MS/s Direct generation (no transcoders)
Outputs	Channel 1: 2 outputs Channel 2: 2 outputs Channel 3: 2 outputs Sync 13.5 MHz Reference Space for Betacam or MII Dub
Inputs	Genlock loop-through

TSG-300 Specifications (Continued)

Test Signals	(Unless otherwise specified)
Luminance Amplitude	700 mV for 100% luminance
Color Difference	±350 mV for 100% color difference
Sync Amplitude	−300 mV on luminance channel
Blanking level	0±50 mV
Amplitude Accuracy	1%
Channel Amplitude Match	0.5%
Channel Timing Match	5 nS
Frequency Response	1% to 5 MHz 2% to 5.5 MHz
Pulse Response	1% ringing on 2T pulse T=100 nS
Line Tilt	0.5%
Field Tilt	0.5%
Output Impedance	75 Ohm
Return Loss	36 dB to 5 MHz
Y, B-Y, R-Y (Y,Pb,Pr; SMPTE; EBU)	
100/0/100/0	700 mV luminance 350 mV color difference
75/0/75/0	525 mV luminance 262.5 mV color difference
GBR Bars	
100/0/100/0	700 mV all channels
75/0/75/0	525 mV all channels
BetaCam Bars	
100/7.5/75/7.5	714 mV luminance in 525/60 53.6 mV setup ±14.3 mV pluge ±350 mV color difference
100/0/75/0	700 mV luminance in 625/50 ±14 mV pluge ±350 mV color difference
Y,CTDM	
100/7.5/75/7.5	714 mV luminance in 525/60
100/0/75/0	700 mV luminance in 625/50 350 mV color difference
MII Bars	Same as SMPTE/EBU with 2.25 MHZ and 1.125 MHz timing bursts added
YQI Bars (M Format) 100/7.5/75/7.5	714 mV luminance 53.6 mV setup 259 mV Q channel 295 mV I channel
Luminance Reference with pluge	0, 175, 350, 525, and 700 mV Gray scale references with −70 and +770 mV clipping indicators ±14 mV pluge
5 Step Staircase	700 mV luminace ±350 mV color difference
120% Ramp	−70 mV to +770 mV
Valid Ramp	700 mV p-p
Shallow Ramp	±350 mV from Pedestal 0 to 700 mV Pedestal luminance ±350 mV pedestal color difference in 5.5 mV increments
Pulse and Bar	2T Pulse and 2T Bar luminance 3T or 5T Pulse and Bar color difference Includes 3 step or 5 step staircase to indicate pulse HAD
Pulse and Bar with 20T Pulse	2T pulse and 2T bar luminance 20T pulse on all channels codes to modulated pulse in composite signal
Window	Pulse and Bar signal gated on during lines 72-202 in 525/60 and lines 78-234 in 625/50

TSG-300 Specifications (Continued)

Field Square Wave	700 mV luminance 350 mV color difference Vertical timing same as window
Multipulse	420 mV 60% amplitude selectable 1, 2, 3, 4, and 5 MHz luminance -350 to +70 mV color difference 0.5, 1, 1.5, 2, and 2.5 MHz color difference
Wideband Multiburst	420 mV p-p 60% on 350 mV pedestal for luminance 1, 2, 3, 4, and 5 MHz all channels
Narrowband Multiburst	420 mV p-p 60% 1, 2, 3, 4, and 5 MHz luminance 0.5, 1, 1.5, 2, and 2.5 MHz color difference
Wideband 100% Line Sweep	700 mV p-p 200 kHz to 5.5 MHz all channels
Wideband 60% Line Sweep	420 mV p-p 200 kHz to 5.5 MHz GBR only
Narrowband 60% Sweep	420 mV p-p 200 kHz to 5.5 MHz luminace 100 kHz to 2.75 MHz color difference
Bowtie	500 kHz luminance 502 kHz color difference ±100 nS delay range with markers every 20 nS
Convergence	525 mV (75%) 4 horizontal lines; 5 vertical lines
Coring	70 mV p-p 0 to 700 mV pedestal luminance ±350 mV pedestal color difference 1, 2, 3, 4, and 5 MHz luminance 0.5, 1, 1.5, 2, and 2.5 MHz color difference
Flat Field	0 to 700 mV variable luminance ±350 mV variable color difference
Timing and Amplitude	Control VIT proposed by SMPTE 525 mV 6 bar colorbars
Sync Pulse Output	−4 V or −2 V selectable
13.5 MHz Output	1 V p-p
Genlock	Loop-through input Return loss 40 dB to 5.5 MHz Locks to NTSC, PAL, SECAM, or Component luminance
Genlock Timing	±8 μS delay range

PHYSICAL CHARACTERISTICS

DIMENSIONS	mm	In
Height	44	1.734
Width	483	19.0
Depth	561	22.1

ENVIRONMENTAL

Temperature operating — 0° to 50°C

Temperature non-operating — -40° to +65°C

ORDERING INFORMATION

TSG-300 Component Television Generator

1410R Option 04 Test Signal Generator.

1410R/1411R/1412R

NTSC/PAL/PAL-M

Five Test Signal Generators and One Switcher

Conforms to EIA Standard RS-170A (1410R)

Sync to Subcarrier Phasing Maintained or Corrected

Color Frame Reference Output

Genlock to Composite Video

Lock to External References

Adjustable Blanking Widths

Adjustable Sync Delays (H and V)

Parallel Test Signal Outputs

The 1410R Series sync and test signal generators are precision generators for use in studios, remote vans, maintenance facilities and anywhere high quality sync or test signals are required.

1410R SERIES PRODUCTS

	Color Standard		
Description	NTSC	PAL	PAL-M
Mainframe	1410R	1411R	1412R
Sync Pulse Generator	SPG2A	SPG12	SPG22
Color Bars Generator	TSG7	TSG11	TSG21
Convergence Generator	TSG2	TSG12	
Linearity Generator	TSG3	TSG13	TSG23
Pulse & Bar Generator	TSG5	TSG15	TSG25
Multiburst Generator	TSG6	TSG16	TSG26
Signal Switcher	TSP1	TSP11	TSP21

SPG2A/SPG12/SPG22

Sync Pulse Generators

The SPG2A, SPG12 and SPG22 are high quality sync generators designed for use in systems where accuracy, stable SCH (sync-to-subcarrier) phasing capability, and lockup mode versatility are of prime importance.

Two external synchronization modes, external reference and genlock, are available. In the genlock mode, line field, subcarrier and PAL pulse (SPG12, SPG22) timing are derived from the incoming composite video signal.

In the external reference mode, line, field, subcarrier, and PAL pulse timing is derived from individual reference signals applied to the generator.

The SCH phasing of the generator outputs can be set for zero error or offset to match the SCH phase of the incoming genlock signal.

A slow genlock mode is provided for those applications where fast-lock may upset the system. The slow-lock selector is located on the generator-card sets.

Internal adjustments permit some variation of burst and blanking widths on the burst flag, comp blanking, and black burst outputs.

TSG7/TSG11/TSG21

Color Bars Generator

Color Bars Signals

SMPTE Color Bars (TSG7)

EIA (TSG7)

Fixed Full Field (TSG11/TSG21)

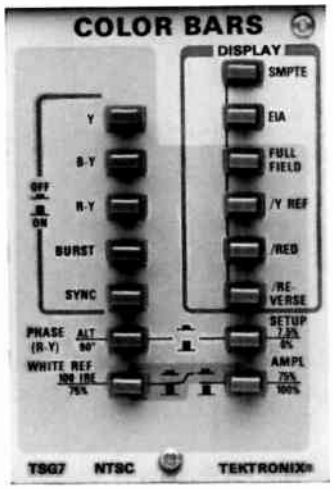
Full Field with Switchable Components

75% or 100% Amplitude

Split Field/Y Reference

Split Field/Red

Split Field Bars/Bars Reversed



The TSG7, TSG11 and TSG21 provide high-quality full field and split field color bars for the 1410R series signal generators. Fixed configuration signals are available for operational environments such as post production. For lab and maintenance facilities, front panel control of luminance and chrominance signal components provides the flexibility to meet most engineering and testing requirements.

The split field bars/Y reference signal provides a convenient means for simultaneous checking of picture monitor color performance and gray scale tracking.

The split field bars/red field signal is useful in detection of VTR noise and moire.

The SMPTE Bars signal provides an easy way to adjust picture monitor chroma, hue, and brightness.

TSG2/TSG12

Convergence Test Signal Generators

Dots and Crosshatch

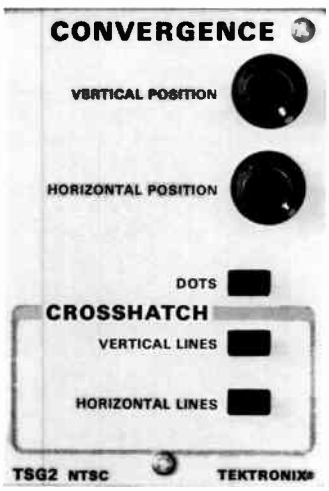
Dots Only

Vertical Lines Only

Horizontal Lines Only

Vertical and Horizontal Lines

Position Controls



The TSG2 and TSG12 provide high-quality convergence test signals for the 1410R Series signal generators. You can use them to determine picture monitor or camera scanning linearity, aspect ratio, and geometric distortion. Signals for the TSG2 conform to IEEE Standard 202.

Provision is made for on/off switching of the dots, vertical lines, and/or horizontal lines and for positioning vertical and horizontal lines.

TSG3/TSG13/TSG23

Linearity and Modulated Pedestal Test Generators

5 Step and 10 Step Staircase Signal
Ramp Signal
2 Modulation Amplitudes

One or Three Level Modulated Pedestal

Flat Field with 11 Fixed Levels

AC and DC Bounce

Variable APL

The TSG3, TSG13 and TSG23 provide high-quality linearity and modulated pedestal test signals for the 1410R Series signal generators.

You can select the 5 step and 10 step staircase signals and the ramp signal with or without 180° subcarrier modulation for NTSC, or U subcarrier modulation for PAL and PAL-M. Applications include measuring differential phase and gain, dynamic gain, luminance linearity, and burst phase errors.

On the ac Bounce signal, the active portion of each line (excluding sync) changes APL levels at a rate determined by the rate control (1 second to 30 second intervals). Blanking level remains fixed at 0 V. To check ac coupled circuitry use ac bounce.

On the dc bounce signal, ac bounce occurs as described above. In addition, the entire signal changed dc level in the opposite direction at the same rate resulting in no change in average dc level. Clamp circuits may be checked using dc bounce.

TSG5/TSG15/TSG25

Pulse and Bar Generators

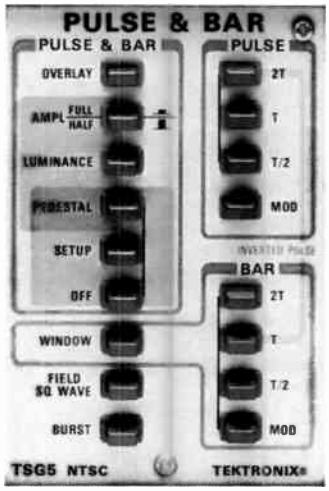
Pulse and Bar Overlay

Full and Half Amplitude Pulse and Bar

Field Squarewave and Window

Modulated Pulse and Modulated Bar

Front Panel Selection of 2T, T, and T/2 Pulse Width and Bar Risetime



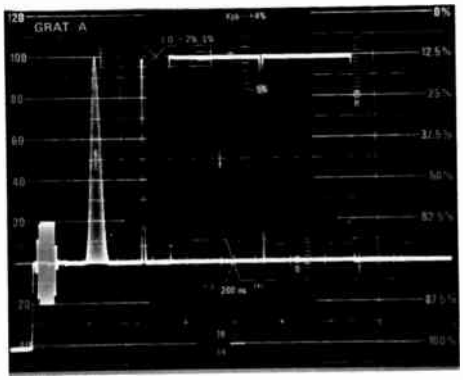
The TSG5, TSG15, and TSG25 are sin² pulse and bar television test signal generators designed for use with the 1410R Series signal generators.

The pulse and bar test signal consists of a sin² modulated pulse, a sin² pulse, and luminance bar. The pulse and bar overlay mode lets you conveniently compare pulse to bar ratio without manipulating waveform monitor controls.

The inverted and noninverted 2T pulses may be overlaid to compare shape and HAD (half amplitude duration). This capability is particularly useful in detecting quadrature distortion which results from envelope detection of the RF modulated video signal.

Front panel selection of pulse HAD and bar risetime is provided. In addition, half amplitude signals may be selected for testing in environments where non-linearities may affect measurement of linear parameters.

Other TSG5 applications include measurement of video gains; short time, line time, and field time distortion, and chrominance to luminance delay and gain.



Sin² Pulse and Bar with Inverted Pulse.

TSG6/TSG16/TSG26

Multiburst Signal Generators

Multiburst Signal

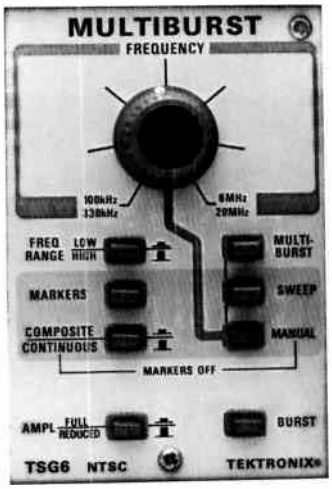
Controlled Risetime Burst Packets

Last Burst Frequency Variable

Manual and Field Swept Frequency Signals to 20 MHz

Markers for Both Frequency and Amplitude Reference

Full and Reduced Amplitude on all Signals



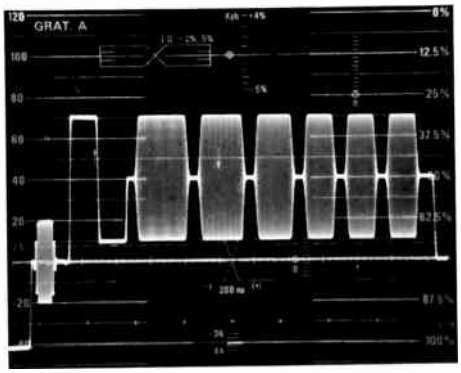
The TSG6, TSG16 and TSG26 are television multiburst and video sweep test signal generators designed for the 1410R Series signal generators.

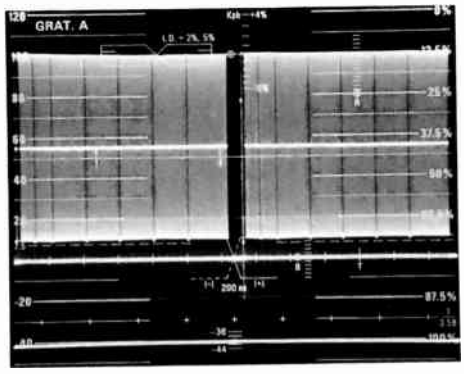
Performance advances include reduction in harmonic content of sinewave signals and skirt energy associated with gating burst packets. Phase modulation of the burst packets aids ease of measurement by filling in shape of packets. Two ranges of multiburst frequencies are available: the 500 kHz to 4.1 MHz (TSG6) range aids in testing television transmitters and common carrier links, while the 1.25 MHz to 12 MHz range is used in testing television studio equipment and cabling.

Use these generators where nonlinearities make reduced amplitude test signals desirable. The reduced amplitude multiburst signal allows accurate testing of video tape record/playback systems, since it is not subject to the false distortion of the full amplitude multiburst that often occurs in such applications.

High and low frequency bands are provided for both the multiburst and sweep signals. Amplitude and frequency markers may be added to the sweep signal.

Color burst and the horizontal and field sync signals may be removed when non-composite signals are required.





Field Rate Sweep showing amplitude and frequency markers.

TSP1/TSP11/TSP21

Switchers and Convergence Generators

Single Switchable Output for Two to Six Generated Signals

Blanking, Sync and Burst Insertion for External Signal

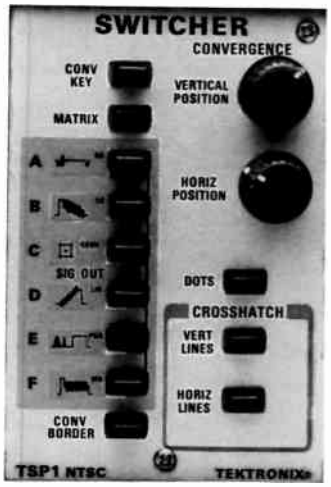
Matrixing — Eight Programmed Display Formats to up to Six Sequential Signals

Convergence Border

Convergence Key

Crosshatch or Dots

Combined Crosshatch and Dots



The TSP1, TSP11, and TSP21 combine the capabilities of a test signal switcher and convergence signal generator in a single unit. They simplify and expand the uses of the 1410R Series signal generators.

From a single, electronically switched output, you have access to all the test signals generated by the card sets in the mainframe. Meanwhile, you may continue to use the individual generator card sets' parallel outputs, so no restrictions are imposed on an established system. As an added feature, one of the input signals can be external (composite or non-composite). All of the switcher inputs are provided with clamp circuitry.

Eight different matrixes are stored in the PROM. This signal matrixing capability, combined with the full-field mode of the TSP1 presents several combinations of signals sharing the full field display.

Most of TSP1 switching functions can be remotely controlled through the mainframe's Remote connector.

CHARACTERISTICS

SYNC PULSE GENERATORS

1410R Subcarrier — Frequency (F_{SC}): 3.579545 MHz ± 1 Hz. Pull-in Range: F_{SC} ±20 Hz.

1411R Subcarrier — Frequency F_{SC}: 4.43361875 MHz ± 1 Hz. Drift ≤1 part in 10^7 per week. Pull-in Range: F_{SC} ±20 Hz.

1412R Subcarrier — Frequency F_{SC}: 3.57561149 MHz ± 1 Hz. Drift ≤1 part in 10^7 per week. Pull-in Range: F_{SC} ±20 Hz.

PULSE OUTPUTS

Output Level (Into 75 Ω) — 4 V (1410R), 1 V, 2 V, or 4 V (selectable, 1411R and 1412R) ±2 V.

Return Loss — ≥30 dB to 5 MHz.

Risetime and Falltime — 10% to 90% (Linear Ramp). 140 ns, (1410R, 1412R). 250 ns (1411R — Other values internally selectable).

Jitter — Linelock: ≤10 ns. Subcarrier Lock: ≤4 ns.

Outputs — Comp sync, comp blanking, burst flag, H drive, V drive, Field reference, 1411R/1412R only: PAL pulse, V/2, V/4, and 64H.

SUBCARRIER OUTPUT

Amplitude — 2 V p-p into 75 Ω. Return Loss: ≥30 dB to 5 MHz.

BLACK BURST OUTPUT

Amplitudes — Sync: 286 mV ±3.57 mV (1410R); −300 mV ±3 mV (1411R, 1412R) from blanking. Burst: 286 mV ±2.86 mV (1410R). Absolute: 300 mV ±9 mV. Setup: 53.57 mV ±3.57 mV (1410R), 0% (1411R), 50 mV ±2.5 mV (1412R).

VIR Signal — (1410R Only) Chrominance Amplitude (40 IRE); phase within 0.5° of burst; envelope risetime Sin^2 shaped 1 μs ±150 ns. Luminance: Setup level (7.5 IRE ±0.5 IRE); gray level (50 IRE ±0.5 IRE); chroma pedestal (70 IRE ±0.7 IRE); risetime and falltime Sin^2 shaped, 250 ns ±39 ns.

GENLOCK

Input Configuration — 75 Ω Loop-Through With Return Loss: ≥ −46 dB to 5 MHz (1410R); ≥40 dB to 7 MHz (1411R); ≥40 dB to 5 MHz (1412R).

Input Requirements — 1 V nominal composite video or black burst, sync negative. Sync Amplitude: Nominal ±6 dB. Burst Amplitude: Nominal ±12 dB. Burst Sync Ratio: Within 6 dB.

Subcarrier Phase Range — 360° via front panel goniometer.

Line Sync Delay Range — Adjustable to advance output sync ≥10 μs or delay ≥4 μs (internal adjustment). A front panel screwdriver adjustment provides a delay/advance range of ±0.5 μs.

Stability (Over Ambient Temperature Range 0°C to ±50°C) — Line Lock: Within 70 ns. Subcarrier Lock: Within 35 ns.

Field/Frame Sync — Fast Lock: Direct-acting in one field. Slow Lock: One line/field slew.

Loss of Lock — Indicated by front panel LED's (automatic switching to full or partial internal).

COLOR BAR GENERATORS (TSG7, TSG11, TSG21)

Luminance Signal Accuracy — Within 1% or 1.5 mV, whichever is greater.

Chrominance Accuracy — Absolute Amplitudes: Within 3% (all subcarrier components). Relative Amplitudes: Within 1% of the red chrominance bars or 1 mV plus p-p residual subcarrier amplitude, whichever is greater.

CONVERGENCE TEST SIGNAL GENERATOR (TSG2, TSG12)

Displays Available — Crosshatch, vertical lines only, horizontal lines only, dots only, and crosshatch plus dots (dots appear centered in the rectangles formed by the crosshatch pattern). Horizontal and vertical positioning.

Risetime and Falltime — Pulses and setup 135 ns ±15 ns (TSG2); 115 ns ±15 ns (TSG12).

Pulse Amplitude — 77 IRE ±3 IRE (TSG2); 525 mV ±25 mV (TSG12).

LINEARITY TEST SIGNAL GENERATOR (TSG3, TSG13, TSG23)

Luminance Risetime — 250 ns ±39 ns (TSG3); 250 ns ±50 ns (TSG13, TSG23).

Five-Step Signal — Step Amplitudes Nominal: 143 mV (TSG3); 140 mV (TSG13, TSG23).

Ten-Step Signal — Step Amplitudes Nominal: 71.5 mV (TSG3); 70 mV (TSG13, TSG23).

Ramp Signal — Linearity: ±1%.

Linearity Subcarrier — Absolute Amplitudes: ±3%. Relative Amplitudes: ±1%. 20 IRE: (TSG3); 140 mV (TSG13, TSG23). 40 IRE: (TSG3); 280 mV (TSG13, TSG23). Differential Gain: ≤0.5%. Phase: 180° ±1°. Differential Phase: 0.1°.

Subcarrier Envelope — Risetime: 400 ns ±60 ns (TSG3, TSG23); 350 ns ±50 ns (TSG13).

Modulated Pedestal — 90° Subcarrier. Amplitude: one level is 5 IRE to 20 IRE (TSG3); low level is internally adjustable (TSG13, TSG23). Three Levels: 20 IRE, 40 IRE and 80 IRE (TSG3); 140 mV, 420 mV and 700 mV (TSG13, TSG23).

Bounce Modes — Ac: Rate, 1/60 to 1/2 Hz. Dc: Rate, slow 1/60 to 1/2 Hz. Dc Rate, Fast Selectable: Line rate, field rate, or frame rate.

PULSE AND BAR GENERATOR (TSG5, TSG15, TSG25)

	Full Amplitude	Half Amplitude
Luminance Bar Amplitude Setup Off (TSG5)	714.3 mV ±7.1 mV	357.1 mV ±3.6 mV
(TSG15, TSG25)	700.0 mV ±7.0 mV	350.0 mV ±5.3 mV
Modulated Bar Amplitude Setup Off Luminance (TSG5)	357.1 mV ±3.6 mV	178.6 mV ±1.8 mV
(TSG15, TSG25)	350.0 mV ±3.5 mV	175.0 mV ±1.8 mV
P-P Chrominance (TSG5)	714.3 mV ±14.3 mV	357.1 mV ±7.1 mV
TSG15, TSG25)	700.0 mV ±14.0 mV	350.0 mV ±7.0 mV
Pulse Amplitude Setup Off		
2T (TSG5)	714.3 mV ±7.1 mV	357.1 mV ±5.4 mV
−2T, T	714.3 mV ±10.7 mV	357.1 mV ±7.1 mV
T/2	714.3 mV ±14.3 mV	347.1 mV ±14.3 mV
Modulated	714.3 mV ±7.1 mV	357.1 mV ±5.4 mV
2T (TSG15, TSG25)	700.0 mV ±7.0 mV	350.0 mV ±5.3 mV
−2T, T	700.0 mV ±10.5 mV	350.0 mV ±7.0 mV
T/2	700.0 mV ±14.0 mV	340.0 mV ±14.0 mV
Modulated	700.0 mV ±7.0 mV	350.0 mV ±5.3 mV
Pulse to Bar Ratio 2T	1:1 ±0.005	1:1 ±0.01
−2T, T	1:1 ±0.01	1:1 ±0.02
T/2	1:1 ±0.02	1:1 ±0.04
Modulated Pulse to Modulated Bar	1:1 ±0.01	1:1 ±0.02

Modulated Pulse and Bar — Chrominance-Luminance Gain: 3.6 mV (3.5 mV for TSG15, TSG25) maximum amplitude difference of peak chrominance and peak luminance. Delay Residual: 5 ns maximum.

Window — Line Timing: Bar Timing.

Field Timing: White lines from line 67 to line 218 (line 65 to line 270 for TSG15, line 64 to line 215 for TSG25) each field. Field Tilt: 0.5% maximum.

Field Squarewave — Field Timing: White line 75 to line 206 (line 65 to line 221 for TSG15, line 64 to line 215 for TSG25). Field Tilt: 0.5% maximum.

MULTIBURST SIGNAL GENERATOR (TSG6, TSG16, TSG26)

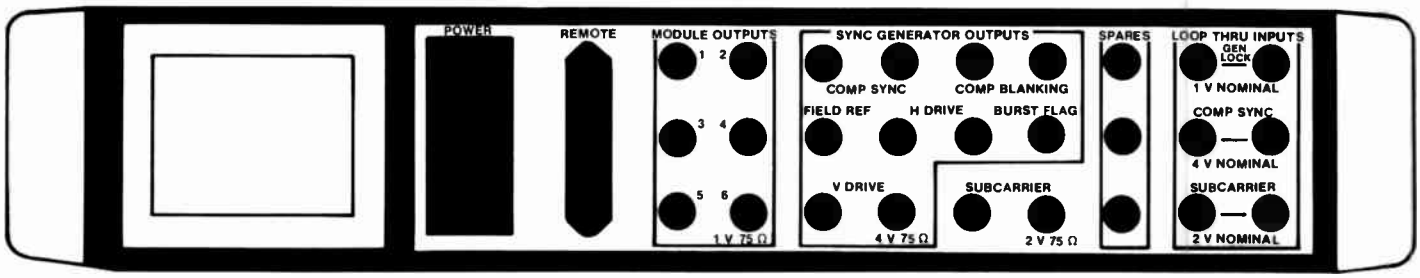
	Low Range	High Range
Multiburst Frequencies (TSG6)	500 kHz ±3% 1.25 MHz ±3% 2.00 MHz ±3% 3.00 MHz ±3% 3.58 MHz ±3% 4.10 MHz ±3%	1.25 MHz ±3% 3.50 MHz ±3% 5.50 MHz ±3% 8.00 MHz ±3% 10.0 MHz ±3% 12.0 MHz ±3%
(TSG16)	500 kHz ±3% 1.00 MHz ±3% 2.00 MHz ±3% 4.00 MHz ±3% 4.80 MHz ±3% 5.80 MHz ±3%	1.00 MHz ±3% 3.00 MHz ±3% 5.00 MHz ±3% 8.00 MHz ±3% 10.0 MHz ±3% 12.0 MHz ±3%
(TSG26)	500 kHz ±3% 1.00 MHz ±3% 2.00 MHz ±3% 3.00 MHz ±3% 3.58 MHz ±3% 4.20 MHz ±3%	1.00 MHz ±3% 3.00 MHz ±3% 5.50 MHz ±3% 8.00 MHz ±3% 10.0 MHz ±3% 12.0 MHz ±3%
Amplitude (First Multiburst Packet) Full (TSG6)	643 mV (90 IRE) ±20 mv	643 mV ±25 mV
(TSG16,, TSG26)	700 mV ±21 mV	700 mV ±28 mV
Reduced (TSG6)	428 mV (60 IRE) ±12 mV	428 mV ±16 mV
(TSG16, TSG26)	420 mV ±12 mV	420 mV 16 mV
Flatness, Reduced and full (TSG6)	10 mV or less	16 mV or less
(TSG16, TSG26)	10 mV or less	17.5 mV or less
Packet Envelope Risetime	400 ns ±60 ns	400 ns ±60 ns
Burst Phasing	Phase shifted at field rate to provide filled-in burst packets.	
Sweep/Manual Sinewave Frequencies Start	100 kHz minimum	330 kHz minimum
Stop	6 MHz ±10%	20 MHz ±10%
Markers Frequencies	500 kHz ±3%*1 1.0 MHz ±3%*1 2.0 MHz ±3%*1 3.0 MHz ±3%*1 4.0 MHz ±3%*1 5.0 MHz ±3%*1	1.0 MHz ±3%*1 2.0 MHz ±3%*1 2.0 MHz ±3%*1 4.0 MHz ±3%*1 8.0 MHz ±3%*1 10.0 MHz ±3%*1 12.0 MHz ±3%*2 14.0 MHz ±3%*2 16.0 MHz ±3%*2 18.0 MHz ±3%*2 20.0 MHz ±3%*2
Harmonic Distortion (Single Frequency Relative to Fundamental (TSG6, TSG26)	−44 dB, 0.3 to 4.2 MHz −40 dB, 0.1 to 0.3 MHz −40 dB, 4.2 to 6.0 MHz	−38 dB, 0.33 to 6.0 MHz −36 dB, >6 to 20 MHz
(TSG16)	43 dB, 300 kHz to 5.0 MHz −40 dB, 100 kHz to 300 kHz −40 dB, 5.0 MHz to 6.0 MHz	−38 dB, 330 kHz to 6.0 MHz −36 dB, 6 MHz to 20 MHz

*¹ *Within one television line either side of the marker*

*² *Above 10 MHz, difference frequency between markers is 2 MHz ±400 kHz.*

*³ *Maximum-minimum diode detected peak-to-peak voltages.*

TEK 1410R SERIES



Rear panel of the 1410R.

SIGNAL SWITCHER (TSP1, TSP11, TSP21)

Input Signal — Amplifier Limits: 1.4 V p-p. Input Return Loss: ≥30 dB, to 5 MHz.

Input Isolation: ≥50 dB, internal inputs. Input impedance: 75Ω.

Switcher Output Signal — Timing: Same as inputs, delayed by ±10 ns (10° to 20° of subcarrier). Amplitudes: Within 2% of inputs. Blanking dc Level: 0 V ±100 mV.

AC POWER

Mains Voltage Ranges — 90 V ac to 112 V ac. 106 V ac to 132 V ac, 180 V ac to 224 V ac and 212 V ac to 250 V ac. Factory set at 106 V ac to 132 V ac (1410R, 1412R), 212 V ac to 250 V ac (1411R).

Power Consumption — 130 W maximum.

Mains Frequency — 47 Hz to 63 Hz.

ENVIRONMENTAL

Temperature Range — Operating: 0°C to +50°C. Non-operating: −40°C to +65°C.

Altitude Range — Operating: Sea level to 4600 m (15,000 ft). Non-operating: Sea lvel to 15,000 m (50,000 ft).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width	483	19.0
Height	88	3.5
Depth	488	19.2
Weight (w/Plug-ins)	**kg**	**lb**
Net	9.7	21.2
Shipping	21.4	47.1

SAFETY CERTIFICATIONS

Underwriters Laboratories, Inc.: Listed, 242T; Canadian Standards Association: Certified, LR37158; International Electro-technical Commission (IEC 348): Certified by Tektronix, Inc.

ORDERING INFORMATION

1410R NTSC PACKAGES STANDARD CONFIGURATIONS

	Option 03	Option 04
TSG2 (Convergence)	x	
TSG3 (Linearity)	x	x
TSG5 (Pulse and Bar)		x
TSG6 (Multiburst)		x
TSG7 (Color Bars)	x	x
TSP1 (Switcher)		x

1410R NTSC Mainframe and SPG2A

Includes: Extender board (670-4441-02); 1.5 A fuse (159-0016-00); 0.75 A fuse (159-0042-00); rackmount hardware; instruction manual.

OPTIONS

Option 03*1 — NTSC Package Installed and Tested Together.

Option 04*1 — NTSC Package Installed and Tested Together.

Option 1B — Adds TSG7 Installed.

Option 1S — Adds TSP1 Installed.

Option 2C — Adds TSG2 Installed.

Option 3L — Adds TSG3 Installed.

Option 4M — Adds TSG6 Installed.

Option 4P — Adds TSG5 Installed.

**1 Cannot be combined with any other option.*

TSG2 Convergence Generator
TSG3 Linearity Generator
TSG5 Pulse and Bar Generator
TSG6 Multiburst Generator
TSG7 Color Bars Generator
TSP1 Switcher

1411R PAL PACKAGES STANDARD CONFIGURATIONS

	Option 03	Option 04
TSG11 (Color Bars)	x	x
TSG12 (Convergence)	x	
TSG13 (Linearity)	x	x
TSG15 (Pulse and Bar)		x
TSG16 (Multiburst)		x
TSP11 (Switcher)		x

1411R PAL Mainframe and SPG12

OPTIONS

Option 03*1 — PAL Package Installed and Tested Together.

Option 04*1 — PAL Package Installed and Tested Together.

Option 1B — Adds TSG11 Installed.

Option 1S — Adds TSP11 Installed.

Option 2C — Adds TSG12 Installed.

Option 3L — Adds TSG13 Installed.

Option 4M — Adds TSG16 Installed.

Option 4P — Adds TSG15 Installed.

**1 Cannot be combined with any other option.*

TSG11 Color Bars Generator
TSG12 Convergence Generator
TSG13 Linearity Generator
TSG15 Pulse and Bar Generator
TSG16 Multiburst Generator
TSP11 Switcher

1412R PAL-M PACKAGES

1412R PAL-M Mainframe and SPG22, TSG21

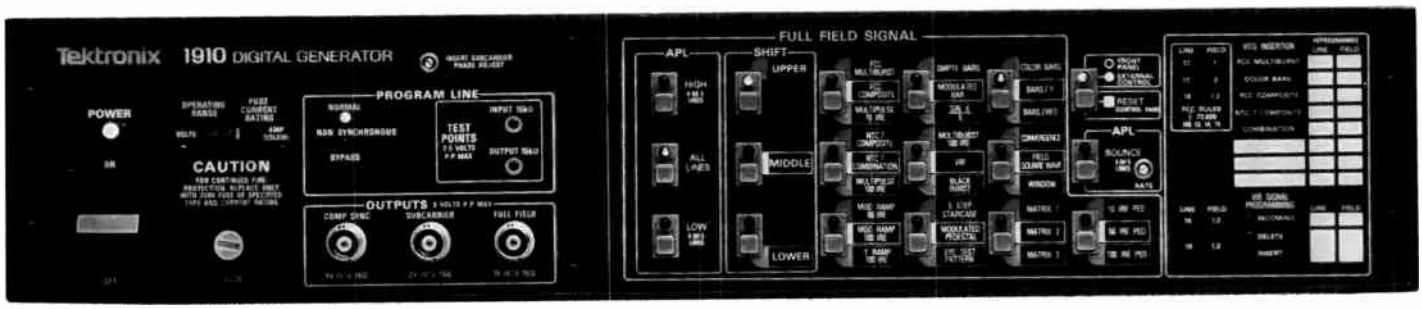
Option 05 — Adds TSG23/TSG25/TSG26/TSP21 Installed.

OPTIONAL ACCESSORIES (FOR ALL CONFIGURATIONS)

Single-Width Blank Panel — Order 333-2171-00

Conversion Kit for SMPTE Bars — For TSG1 Module. Order 040-1010-00

Rackmount to Cabinet Conversion Kit — Order 040-1152-00



1910 Digital Generator

Four External VITS Inputs for Insertion of Teletext, Closed Captioning, Source ID, etc.

Nonvolatile Memory to Maintain Selected VITS and Full Field Signal Configuration after Power Interruption

Signal Stored in Replaceable PROMs so Your 1910 won't Become Obsolete

The Accuracy and Stability of an all-Digital 10-Bit Sync and Signal Generation (RS-170A)

User Friendly RS-232C Control Port for Added Versatility

New Signals (Eye Test Pattern, Special Multipulse, Color Multipulse), New Functions (VITS Sequence, Field Sequence and More

The 1910 Digital Generator is a state-of-the-art test signal generator designed for performance testing of NTSC video systems and equipment. The 1910 is especially suited where high accuracy and stability are required. It is also a VITS inserter (internal and external) with a full complement of signals that allow testing in studio, transmitter, production or research environments.

External interfacing of the 1910 is controlled by an internal microprocessor and its nonvolatile memory. Test signals are stored as 10-bit digital words and converted to analog form by a 10-bit precision DAC to ensure signal accuracy as well as long term stability and repeatability.

Since all signals are stored in replaceable EPROMs, changing needs and industry standards will not cause obsolescence.

Control and versatility of the 1910 are greatly enhanced by the use of its RS-232 control port. Most functions of the 1910 can be controlled, reconfigured and saved. This includes VITS and full field signal selection, matrix signal creation, sequences and other features.

Program Line

The 1910 offers full VITS and VIRS insertion capabilities which can be controlled through the RS-232 control port or through ground closures with the remote control unit. The 1910 may be used to insert either internally or externally generated test signals or data patterns in any combination on lines 10 through 21. Full sync and burst insertion capabilities with accurate SCH phasing eliminate the need for proc amps. When used as VITS inserter, the program line is bypassed upon loss of incoming sync to prevent nonsynchronous VITS or sync insertion. The 1910 may be reconfigured so that transmitter protection may be enabled where the loss of incoming sync will automatically cause a test signal to be inserted on the program line to maintain sync continuity until normal operation is restored.

External VITS Inputs

Four terminated inputs are standard in the 1910. Externally generated VITS from another source such as teletext, source ID, closed captioning, etc. can be internally gated and inserted into the program. External VITS can be inserted on any field of lines 10 through 21 as selected by RS-232 control port or the remote control unit.

Pulse Out Feature

This included feature of the 1910 allows the user to change the four external VITS inputs to four pulse outputs for limited camera drive. The outputs available are H Drive, V Drive, Composite Blanking, and Burst Flag. Applications for pulse outputs are remote vans or standby sync generators. Composite sync and subcarrier outputs are always available.

The 1910 can also be used as a stand-alone signal source that will remain SCH phased and locked to an internal oven-controlled reference.

Remote Control

Remote control via a ground closure interface allows the user to control the full field signals, VITS insertion on lines 14 through 21 (VITS changes are saved in nonvolatile memory), VIR mode, bypass/operate, genlock source, control mode and reset to preprogrammed condition.

Programmability and RS-232 Control Port Features

The 1910 has a friendly command language that allows the user to program its features to meet specific applications. The user does not need to be a programming expert as the 1910 has a language that allows him to concentrate on the applications and not on programming.

The 1910 can be programmed and controlled using an RS-232 terminal. It can also be controlled or run under program control using an RS-232 host computer, including some handheld models or personal computers. The host computer could also be the Tektronix 1980 Automatic Measurement Set which would use the 1910 as a programmable signal source to stimulate television equipment or a transmission link.

The 1910 can also be controlled over telephone lines. An auto-answer modem connected to the 1910 will allow the user to take control of the 1910, observe or modify its status and subsequently release control. The control and reconfiguration can also be accomplished automatically by a host computer.

Some of the capabilities offered by the RS-232 port include the ability to redefine the signal selection on the front panels (1910 and remote control unit) to better meet particular user needs, such as placing frequently used signals in a preferred position or in a convenient sequence for calibration; production testing or other special uses.

Nonvolatile Memory

The 1910 has an EEPROM nonvolatile memory (no need for battery back up) where configurations different from the factory set can be saved even if the instrument is powered down or a power failure occurs (a nonvolatile memory retains the information stored in it even if the power has been turned off).

TEK 1910

These Special Features are also Available Through the Control Port:

Signal Sequencing

Commands allow the user to program the VITS or full field signals to be displayed for definable periods of time in specific sequences.

Signal Sequence Applications:
An example of color frame sequence would be to set field one to white and the other three fields to black. In this way it becomes simple to identify color field one for an accurate indication of SCH framing. This particular color frame sequence can also test the delay through frame synchronizers, effects generators, etc.

The VITS sequence can optimize the use of the vertical interval by specifying different signals (e.g., test signals, teletext, etc.) for each of the four color fields. One line of the vertical interval can be used to insert up to four signals. These signals may be programmed to change to new signals with the time sequence feature, thus multiplexing many signals onto one vertical interval line.

Sequencing full field or VITS signals provides for manual or automated testing without operator interaction and is useful in generating programmable duty-cycle signals.

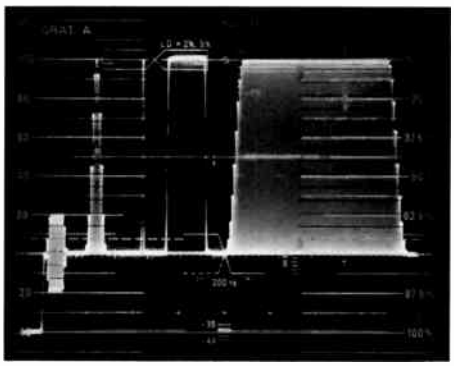
Digital Word Input and Output

The 1910 features a composite digital parallel data input and output. The digital data output provides a 10-bit digital word of the selected test signal. This accurate digital test signal may be used to evaluate and align DACs. It's a useful feature as the error incurred in digitizing an analog signal for this purpose is eliminated. The digital data is not modified to compensate for inadequacies in the analog reconstruction process.

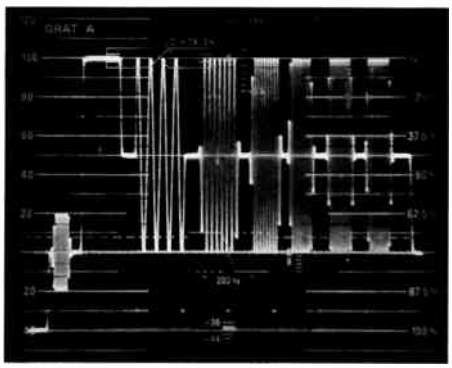
The digital data input will accept a user-generated digital word (up to 10 bits) for conversion to analog with the precision DAC in the 1910. The DAC, with its deglitching circuitry, will yield 10-bit accuracy, 0.6 % differential gain and 0.3° differential phase performance.

Diagnostics

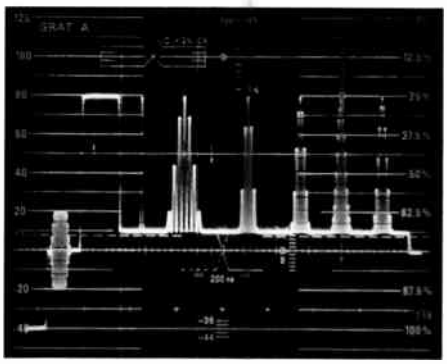
When powering up, the 1910 automatically performs a number of checks to determine if its microprocessor interface is working properly. More extensive internal diagnostics are available for further isolation of faults on an out-of-service basis.



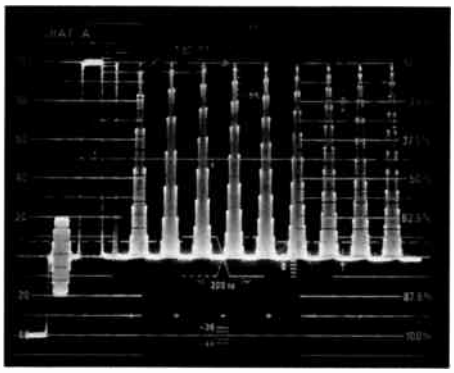
Modulated Bar



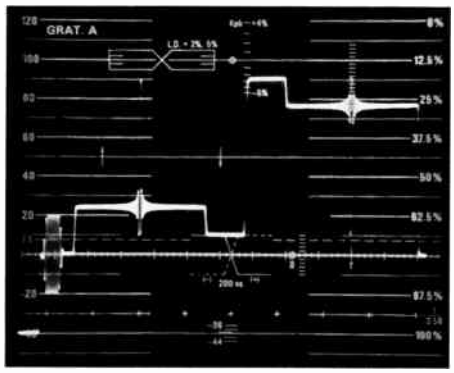
Multiburst 100 IRE



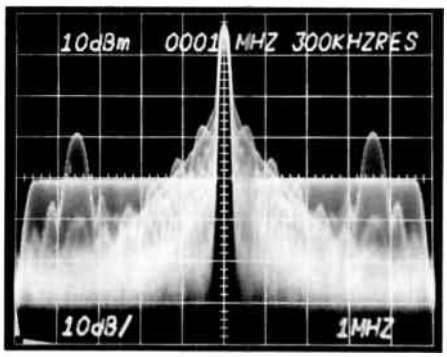
Multipulse 70 IRE



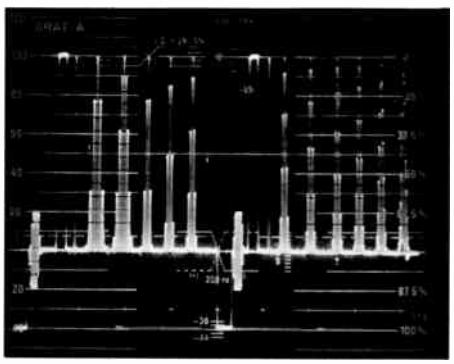
The Color Multipulse allows delay and amplitude measurements through chroma codecs.



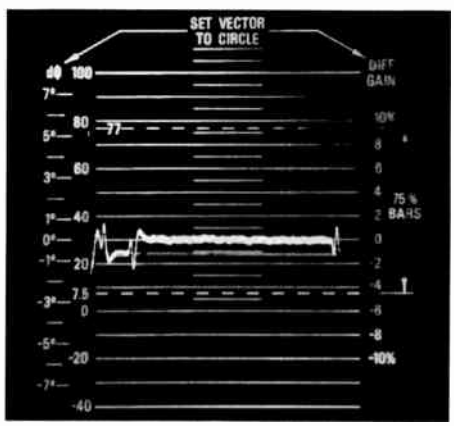
$\frac{\sin x}{x}$ *(Time Domain)*



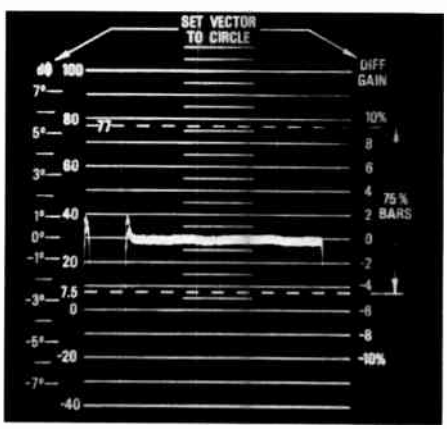
$\frac{\sin x}{x}$ *(Frequency Domain)*



The Special Multipulse has pulses which extend to 6 MHz allowing delay and amplitude measurements past the normal TV channel band edge.



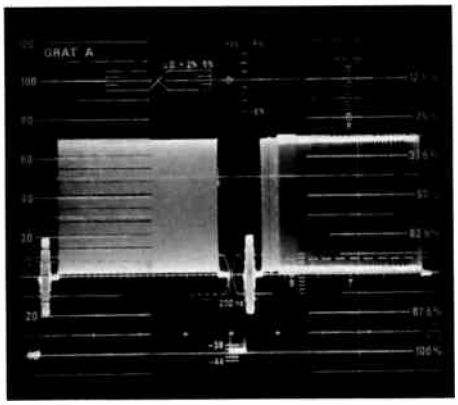
Modulated Ramp — Differential Phase



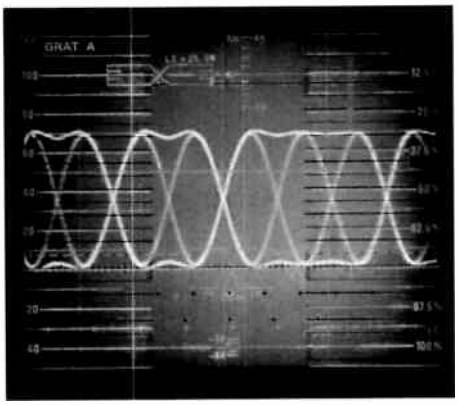
Modulated Ramp — Differential gain

EYE HEIGHT DATA TEST SIGNAL

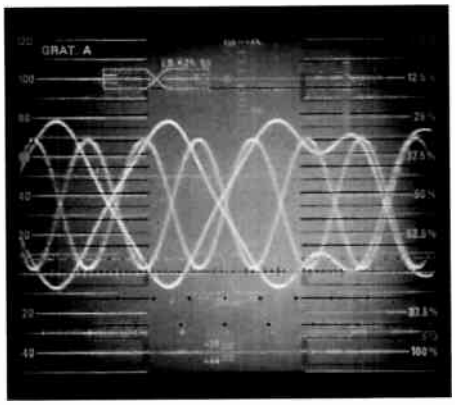
The eye test pattern signal indicates the capability of a system to pass teletext or similar data patterns. Programming the eye test pattern and the eye test reference signals into a VITS or a field sequence allows monitoring for the possibility of data errors. A standard waveform monitor can be used to observe the resulting zero crossings and data height relative to the clock reference.



Eye test data pattern



Data pattern and clock pattern overlaid with no distortion.



Same position in signal as last photo but through an uncompensated 4.2 MHz low pass filter. Note the time displacement and the amplitude error closing the data pulses' usable window area.

CHARACTERISTICS

PROGRAM CONTROL SYSTEM
VITS INSERTER

Program Line Input Level — 1 V ±3 dB (0.7 V to 1.4 V) into 75 Ω.

PROGRAM LINE/MONITOR OUT

Impedance — 75 Ω nominal.

Hum Rejection — ≥10 dB (≥20 dB user selectable), referenced to 1 V hum.

Keyboard (No Noise) — <0.25 IRE.

Video Gain — Unity gain ±0.5%.

Inserted Pedestal Offset — 0 V hum: ≤2 mV. 1 V hum: ≤10 mV.

Pulse to Bar Ratio — T/2 Pulse to Bar Ratio: 100% ±2%. 1T Pulse to Bar Ratio: 100% ±0.5%. 2T Pulse to Bar Ratio: 100% ±0.25%.

Frequency Response — 0.5% to 5 MHz; 1.0% to 10 MHz; 3.0% to 15 MHz.

Differential Phase (10 APL to 90 APL) — ≤0.15°.

Differential Gain (10 APL to 90 APL) — ≤0.2%.

Random Noise (Weighted) — ≥75 dB (RMS) down, referenced to 1 V.

Spurious Signals During Blanking — Up to 5 MHz (Insertion Transient): ≥40 dB down (≤10 mV). Above 5 MHz (Clock Noise): ≥46 dB down (≤5 mV).

Delete Mode Signal Attenuation — 2T Pulse: ≥70 dB down, referenced to 0.714 V. Subcarrier: ≥60 dB down, referenced to 0.714 V.

Crosstalk (Internal to Program Line) — 2T Pulse: ≥70 dB down, referenced to 0.714 V. Subcarrier: ≥60 dB down, referenced to 0.714 V.

EXTERNAL VITS INPUT

Insertion Gain — Unity: ±1% (into 75 Ω).

Insertion Level — Dc Coupled: ±2 mV.

Frequency Response — Flat within 1% to 5 MHz.

Pulse to Bar Ratio — 2T: 100% ±1%. 1T: 100% ±2%.

External Input Isolation — >60 dB to 5 MHz.

Switching Transients — <10 mV p-p to 5 MHz.

GENLOCK

Source — Program Input or Black Burst Input.

Sync or Burst Amplitude — 40 IRE ±6 dB.

Burst Lockup Range — 3.579545 MHz ±20 Hz (sync must be locked to burst).

Sync Lockup Range — 15.73426 kHz ±0.079 Hz.

Free Run Frequency — 3.579545 MHz ±10 Hz. Temperature controlled, four times subcarrier oscillator normally locked to burst, or sync when burst absent.

Jitter — <5 ns (free run and burst lock mode).

FULL FIELD OUTPUT TIMING

Line Blanking Width — 11.5 μs ±100 ns at 50% amplitude points (measured on 100 IRE Ped).

Front Porch Width — 1.8 μs ±100 ns at 50% amplitude points (measured on 100 IRE Ped).

GENERAL

Output Impedance — 75 Ω nominal.

Dc Level — 0 V ±2 mV (Clamp On); 0 V ±50 mV (Clamp Off).

Luminance Gain — Within ±1%. All luminance levels are digitally defined and will be within ±0.5 LSB (±1.3 mV or ±0.2 IRE) of the correct value relative to the calibrated 100 IRE level.

Chroma Amplitude Accuracy — Within ±0.72% (adjustment accuracy) plus quantizing error.

Definition of Quantizing error = $\frac{40 \text{ IRE} \times 0.6\%}{\text{chroma amplitude}}$

Relative Frequency Flatness — ±0.3% typical from 56 kHz to 5 MHz with 0.714 mV p-p (digital sweep generator and p-p detector). ±1% maximum using 50 IRE Multiburst (500 kHz to 4.2 MHz).

Differential Phase — ≤0.3° using 100 IRE Mod Ramp with 40 IRE p-p subcarrier.

Differential Gain — ≤0.6% using 100 IRE Mod Ramp with 40 IRE p-p subcarrier.

2T Pulse to Bar Ratio — 100% ±1%.

2T Pulse Ringing — ≤1 IRE p-p.

Group Delay Error — ≤10 ns, up to 5.0 MHz.

FULL FIELD AND VITS SIGNALS TEST SIGNAL SPECIFICATIONS

FCC Multiburst and Multiburst 100 IRE — Frequencies: 0.5 MHz, 1.25 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz and 4.1 MHz.

NTC 7 Combination — Frequencies: 0.5 MHz, 1.0 MHz, 2.0 MHz, 3.0 MHz, 3.58 MHz and 4.2 MHz. Chroma: 20 IRE, 40 IRE, 80 IRE at 90°.

Multipulse 100 IRE — Frequencies: Same as NTC 7 Combination without 0.5 MHz.

Multipulse 70 IRE — All pulses on a 10 IRE pedestal. Frequencies: Same as FCC Multiburst without 0.5 MHz.

Color Multipulse — Subcarrier frequency for center pulse. Pulses to the left are decreasing in frequency by 300 kHz increments while pulses to the right are increasing in frequency by 300 kHz.

Special Multipulse — Frequencies: 1 MHz through 6 MHz at 500 kHz increments.
NOTE: This signal uses two adjacent lines.

$\frac{\text{Sin x}}{\text{x}}$

Spectrum: −3 dB at 4.75 MHz. Positive and negative pulses.

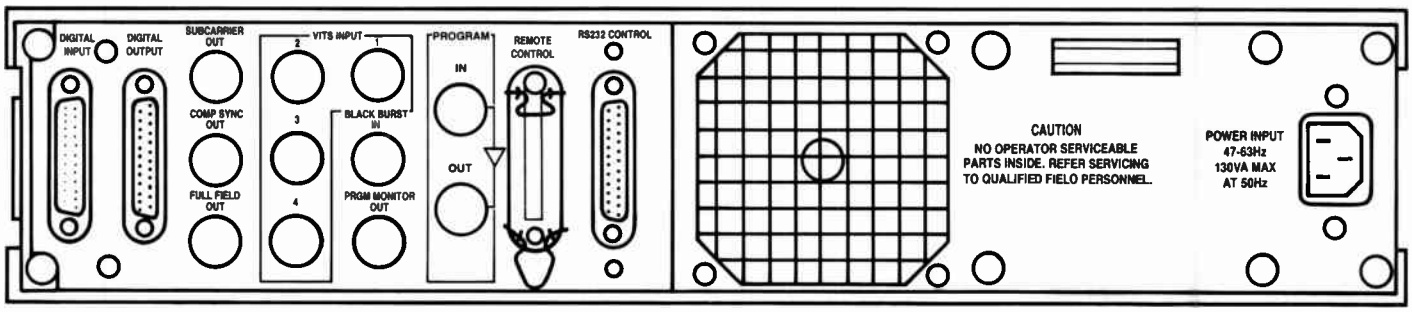
FCC Composite — 80 IRE staircase.

NTC 7 Composite — 90 IRE staircase.

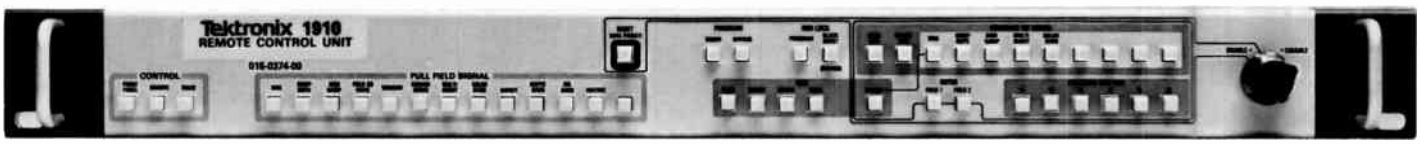
Ramp (100, 80) — Luminance: 100/80 IRE. Chroma: 40 IRE at 180°.

Staircase (5 Step, 10 Step) — Luminance: 100 IRE.
Chroma: 40 IRE at 180°.

TEK 1910



1910 Rear Panel



1910 Remote Control Unit

Inverted Pulse and Bar — Positive and negative 2T pulses.

Modulated Bar — Chroma: 100 IRE at 33°.

Modulated Pedestal — Chroma: 20 IRE, 40 IRE, 80 IRE at 90°.

Color Bars, Y Bars — 75% amplitude, 7.5% setup, 6.5 μs/bar (8 bars).

Red Field — 75% amplitude, 7.5% setup.

Bars/Y — Split field of Color Bars followed by Y Bars.

Bars/Red — Split field of Color Bars followed by Red Field.

EIA Bar — 75% amplitude, 7.5 setup, 7.5 μs/bar (7 bars). SMPTE compatible.

IYQB (with PLUGE) — SMPTE compatible.

Reverse Blue Bars — Blue component of EIA Bar. SMPTE compatible.

SMPTE Bars — Split field of EIA Bar, Reverse Blue Bars, and IYQB.

VIRS — Luminance: 70 IRE, 50 IRE, 7.5 IRE. Chroma: 40 IRE at 180°.

VICR*1 — Luminance: 50 IRE, 100 IRE, 7.5 IRE. Chroma: 100 IRE at 180°.

Convergence — 14 x 17 crosshatch with dots.

APL, Bounce, Black Burst (7.5), 10 IRE, 25 IRE, 50 IRE and 100 IRE Ped — Full line width.

Field Bar — 100 IRE. 18 μs wide.

Field Squarewave — Same as 100 IRE Pedestal.

Window — Same as Field Bar.

Eye Test Pattern — Test pattern at 5.7 Mbit/s. Risetime: 100 ns.

Eye Test Reference — Alternate "1", "0" pattern at 5.7 Mbit/s. Risetime: 100 ns.

Matrix (Factory Set, but User Redefinable) — Matrix 1: Mod 10 Step, Color Bars, Red Field. Matrix 2: Mod Ramp 100 IRE, EIA Bar, Reverse Blue Bar, Multipulse 100 IRE. Matrix 3: Convergence, EIA Bars, Reverse Blue Bar, Convergence, IYQB, Convergence.

*1 *Vertical interval color reference.*

SYNC AND SUBCARRIER OUTPUT

All pulse outputs have negative going output levels of 4 V ±10% into 75 Ω and have a risetime and falltime of 140 ns ±20 ns.

Composite Sync Timing — EIA RS-170A Specifications.

Subcarrier Output — Frequency: See Genlock. Amplitude: 2 V p-p ±10%.

The following optional outputs replace the external VITS input function of the 1910.

Composite Blanking — Horizontal Blanking Width: 10.7 μs ±100 ns. Field Blanking: Field 1=21 lines, Field 2=21 lines.

Horizontal Drive Timing — Start of line blanking to end of line sync, ±100 ns.

Vertical Drive Timing — Coincident with start of field. Duration: 9 lines.

Burst Flag — Duration: 2.5 μs ±100 ns. Delay from Line Sync: 5.3 μs ±100 ns.

RS-232C INTERFACE

Supports EIA Standard RS-232C format to the extent shown below.

Baud — 300 bit/s, 1200 bit/s, 2400 bit/s or 4800 bits/s.

Input/Output — ASCII, serial, asynchronous data. Full duplex input and output.

Character Length — Eleven bits/character, including a start and two stop bits.

Parity — Input: No parity required and, if present, is ignored. Output: No parity sent.

DIGITAL DATA INTERFACE

Parallel, 12 balanced, signal pairs consisting of 10 bits/sample, a clock, a timing reference signal.

Sampling Frequency — Four times color subcarrier. Nominally 14.3 MHz.

Sampling Phase Angle — Referenced to I axis and Q axis.

Dynamic Range — Ten bits/sample: Blanking level (0 IRE) is at digital word 240. Reference white (100 IRE) is at digital word 800 (5.6 LSB/IRE).

Input Logic Levels Terminated in 100 Ω — 10 k ECL compatible.

Output Logic Levels — 10 k ECL compatible.

Digital Input Timing — Setup and hold times are 10 ns before and after the 50% point of the negative transition of the clock.

Output Clock Timing — The 50% point of the leading edge of the clock pulse preceeds the data by 5 ns ±5 ns.

POWER SUPPLY

Line Voltage Range — 90 V ac to 132 V ac. 180 V ac to 250 V ac.

Maximum Power Consumption — 130 W.

Line Frequency — 47 Hz to 63 Hz.

PHYSICAL CHARACTERISTICS

	Cabinet		Rackmount	
Dimensions	**mm**	**in**	**mm**	**in**
Width	442	17.4	486	19.1
Height	96	3.8	88	3.5
Depth	525	20.6	525	20.6
Weight	**kg**	**lb**	**kg**	**lb**
Net	11.6	25.5	12.2	27.0
Shipping	16.7	37.0	16.7	37.0

ENVIRONMENTAL

Temperature — Operating: 0°C to +50°C. Nonoperating: −40°C to +65°C.

Altitude — Operating: To 4572 m (15,000 ft). Nonoperating: To 15 240 m (50,000 ft).

*1 *Vertical interval color reference*

ORDERING INFORMATION

1910 Digital Generator

Includes: Pair of rack slides (351-0636-00); pulse out board (670-8007-00); cabinet hardware (655-3231-00); rack hardware (351-0636-00); operator manual (070-4466-00); service manual (070-4523-00).

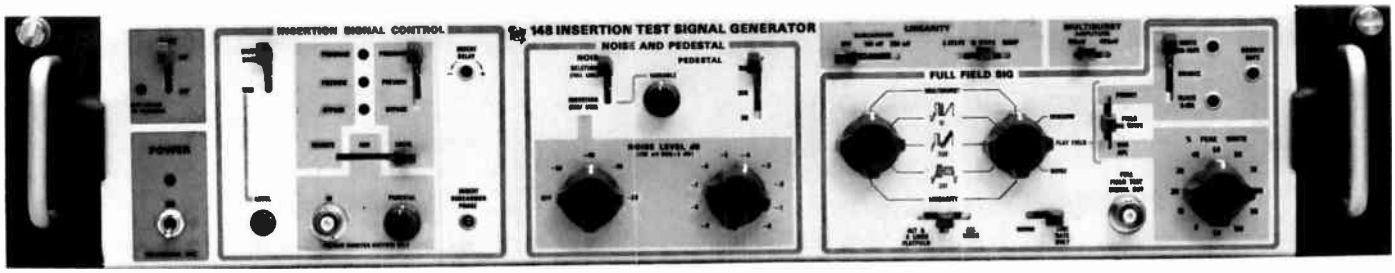
Option 03 — CBC Test Signals.

OPTIONAL ACCESSORIES

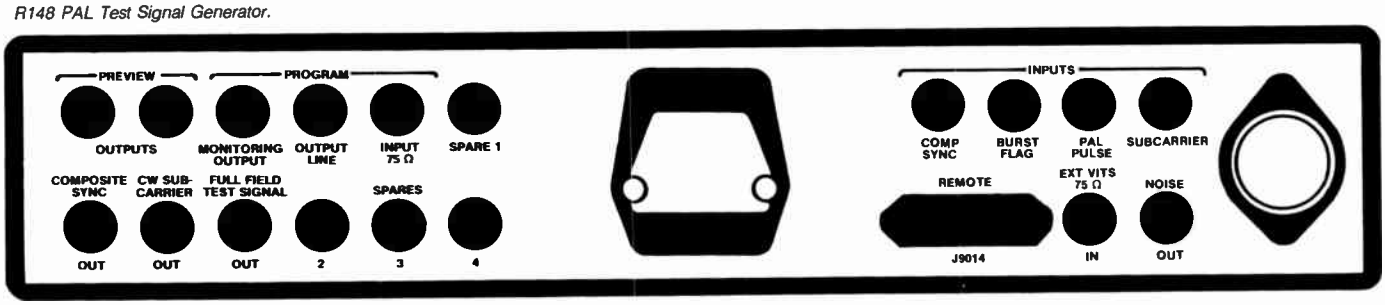
Remote Control Unit
Order 015-0374-00

Interconnecting Cable (6 ft).
Order 012-0108-00

Interconnecting Cable (22 ft).
Order 012-0251-00



R148 PAL Test Signal Generator.



R148 Rear Panel.

R148/R148-M

Test Signal Generators

Insertion Test Signals (Per EBU, CCIR Recommendation 473-2, Annex 1)

Full-Field Test Signals (Per CCIR Recommendation 567)

Easily Reprogrammable

Safe In-Service ITS Insertion (Per EBU Specifications)

Noise Measurement

APL Bounce Signal

Source Identification Code

Operates with Sound In Syncs

Locks with Mixed Sync (Per EBU Homologation Specifications for ITS Generators) Subcarrier, PAL Pulse, Burst Flag, Comp Sync

The Tektronix R148 (PAL) and R148-M (PAL-M) Insertion Test Signal (ITS) Generators provide all the test signals you need to test and measure PAL (or PAL-M) video transmission systems. Test signals are available as both full-field composite video and ITS inserted into the incoming program signal's vertical blanking interval. All timing information for ITS insertion is derived from the incoming composite video signal.

VERTICAL INTERVAL INSERTION/ DELETION AND PROGRAM CONTROL

The R148 and R148-M insert ITS only when gen-locked to an incoming composite video signal. Since ITS insertion/deletion involves active circuit elements in the program line, program line fail safe operation is provided in the event of instrument malfunction, loss of sync, or power failure. You also have access to local and remote control manual override capability.

A preview monitor output permits observation of the ITS deletion/insertion program before anything is actually done to the program signal. Preview/program operation can be locally or remotely controlled.

Provisions are made for adding an externally generated ITS to the program line.

INSERTION SIGNAL CONTROL FEATURES

Free Running Operation

A warning light indicates absence of incoming synchronizing information and ITS deletion and insertion is automatically discontinued.

Program Level

A front panel switch lets you select a preset gain, normally adjusted for unity gain between program input and program output. Or, you can use a front panel level adjustment to normalize the incoming program signal to provide 1 volt at the program output.

Local-Remote Control of Program and Preview

You can shift control of program or preview modes from the front panel (local) to a position remote from the generator. When operating under either local or remote control, front panel lights indicate program line status, since the front panel program status switch position may not correspond to the operating mode selected.

Auxiliary

A noncomposite video signal (such as a sweep generator) applied to the auxiliary input appears at the preview monitor output connector with composite blanking and sync added. A pedestal control provides a dc offset so the auxiliary signal excursion may be positioned between the black and white limits of the resulting composite video signal. Remote control is not available.

ITS Subcarrier Phase

A recessed front-panel control adjusts phase of color subcarrier on internally generated signals to be correct in relation to the phase of incoming burst.

Insertion Delay

A recessed front-panel control provides a fine horizontal timing adjustment for inserted signals.

TEST SIGNALS

The R148 provides the following PAL Insertion Test Signals which meet CCIR recommendation 569, 473-2, Annex 1. (These signals are also available full field):

Line 17
Line 330
Line 331

The R148 also provides these PAL Full Field Test Signals:

Field Square-wave
Flat Field
Linearity
Multiburst
Noise Measurement
Window

The R148-M provides these PAL-M Insertion Test Signals which are also available full field:

CCIR-I (Recommendation 473-2, Annex I)
CCIR-II (Recommendation 473-2, Annex II)
SIG-III (CCIR recommendation 567, Figure 27)

The R148-M also provides these PAL-M Full Field Test Signals:

Field Rate Sweep
Field Squarewave
Flat Field
Linearity
Modulated Pulse and Bar
Window

FULL-FIELD OPERATION

The Tektronix R148 and R148-M provide full-field test signals separate from program. These signals are generated with or without external synchronizing information and will be locked to the external synchronizing signal when a program signal or external synchronizing signals are present.

FLAT-FIELD SIGNAL

The flat-field signal with VITS inserted is used primarily for system testing at discrete average picture levels.

The flat-field signal is a composite video signal that, during the active portion of each field, has a constant luminance level. The luminance level is selectable in eleven increments from 0% to 100% of white. An alternate selection provides automatic change between black and white with a period variable from 1 s to 10 s.

When operating the R148 in the flat field mode, you may select a white level preset between 85% and 100% and a black level preset between 0% and 15%. Automatic change between white and black is available and occurs at a period adjustable from 1.0 s to 10.0 s.

FIELD SQUAREWAVE SIGNAL

The field squarewave signal is used to measure field time distortions. In this mode, the Tektronix R148 provides a composite video signal with 205 active lines at 700 mV, approximating a 50 Hz squarewave. The R148-M provides a composite video signal with 132 active lines at 700 mV, approximating a 60 Hz squarewave.

Use this signal to detect low frequency phase and gain distortions, even those passing through clamper amplifiers.

LINEARITY SIGNAL

You can select three Linearity Test Signals: 5 step, 10 step, or ramp (either modulated or unmodulated). The subcarrier component is phase-locked to color burst. Use this signal for measuring differential gain and phase, dynamic gain, luminance signal linearity, luminance signal distortion caused by chrominance signal nonlinearity, and burst phase and amplitude errors.

WINDOW SIGNAL

The window signal in the R148 consists of a modulated 20T pulse followed by a 2T pulse followed by a bar with 2T risetime. The bar portion of the signal occupies the center 205 lines of each field. The window signal in the R148-M consists of a 2T pulse followed by a bar with a 2T risetime. The bar portion of the signal occupies the center 152 lines of each field.

MULTIBURST SIGNAL (R148 ONLY)

The multiburst signal is generated by a function generator controlled by a digital programmer. This design eliminates the need for individual start/stop oscillators on each burst and individual amplitude and ac axis adjustments. Each burst start time is completely stable, and each burst packet consists of an exact number of cycles, regardless of the frequency. Each burst starts at 0° of the first cycle and ends at 360° of the last cycle. Location of the white flag with relation to the bursts is programmable and may be used for source identification.

NOISE SIGNAL (R148 ONLY)

When the noise signal is selected the active picture lines contain noise generated by an internal calibrated noise source.

FIELD RATE SWEEP (R148-M ONLY)

This signal consists of a sinewave that is swept in frequency from about 200 kHz to more than 6 MHz during each field period. Markers are spaced at about 1 MHz intervals. Composite sync and blanking are added to make the signal compatible with clamp circuits.

MOD PULSE AND BAR (R148-M ONLY)

This signal consists of a 12.5T modulated pulse and a modulated bar with 12.5T risetimes and falltimes.

CHARACTERISTICS

PROGRAM CHANNEL

Input Level — Adjusted to unity gain.

Variable Input Level — ±30%.

Inserted Signal Level — Within ±1% of nominal.

Output Dc Level — <50 mV (no signal).

Frequency Response, Program, and Preview Channels — ±1%, 50 kHz to 5 MHz.

Field Time Tilt — <0.5%.

Line Time Tilt — <0.25%.

Differential Phase Standard Input — Program Output: <0.15°. Preview Output: <0.3°.

Differential Gain Standard Input — Program Output: <0.2%. Preview Output: <0.4%.

Random Noise Output Program Channel — <−75 dB RMS.

Hum, Transients on Noninserted Lines — ≥60 dB down.

Spurious Signals During Blanking Time — Inactive line time ≥40 dB down. Active ITS lines ≥60 dB.

Signal Attenuation in "Delete" Mode — 2T Pulse: >−70 dB. Subcarrier (Color Bars): >−60 dB.

Crosstalk into Program Channel from Internal Signals — 2T Pulse: <−70 dB. Subcarrier (Color Bars): <−60 dB.

Unwanted Pedestal at Time of ITS Insertion — Program and Preview Channel: <5 mV.

Insert Delay Adjustment Range — ±0.5 μs front panel.

SOURCE IDENTIFICATION CODE (R148 ONLY)

The Tektronix R148 is a source identification code generator with up to 25 pulses available in any combination on line 16 or line 329.

Pulse Width — 1 μs.

One Level — 630 to 700 mV above blanking.

Zero Level — Within 25 mV of blanking.

OTHER CHARACTERISTICS

Power Requirements — 90 V ac to 136 V ac or 180 V ac to 272 V ac; 48 Hz to 66 Hz, 55 W maximum at 115 V ac and 60 Hz. Factory set at 230 V ac (R148) or 115 V ac (R148-M).

Ambient Temperature — Performance characteristics are valid over an ambient temperature range of 0°C to +50°C.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width	483	19.0
Height	88	3.5
Depth	499	19.7
Weights	**kg**	**lb**
Net	9.1	20.0
Shipping≈	16.3	36.0

ORDERING INFORMATION

R148 PAL Test Signal Generator
Includes: 75 Ω BNC termination (011-0103-02); two each BNC-T adaptors (103-0030-00); rackmounting hardware (351-0195-01); manual.

R148M PAL-M Test Signal Generator
Includes: Same as above.

OPTIONAL ACCESSORIES

Noise Measurement Filters — External filters are required with the R148 Generator when making noise measurements.

Low Pass 6.0 MHz 625/50 —
Order 015-0220-00

Noise Weighting 5.0 MHz 625/50 —
Order 015-0215-00

Low Pass 4.2 MHz 525/60 —
Order 015-0212-00

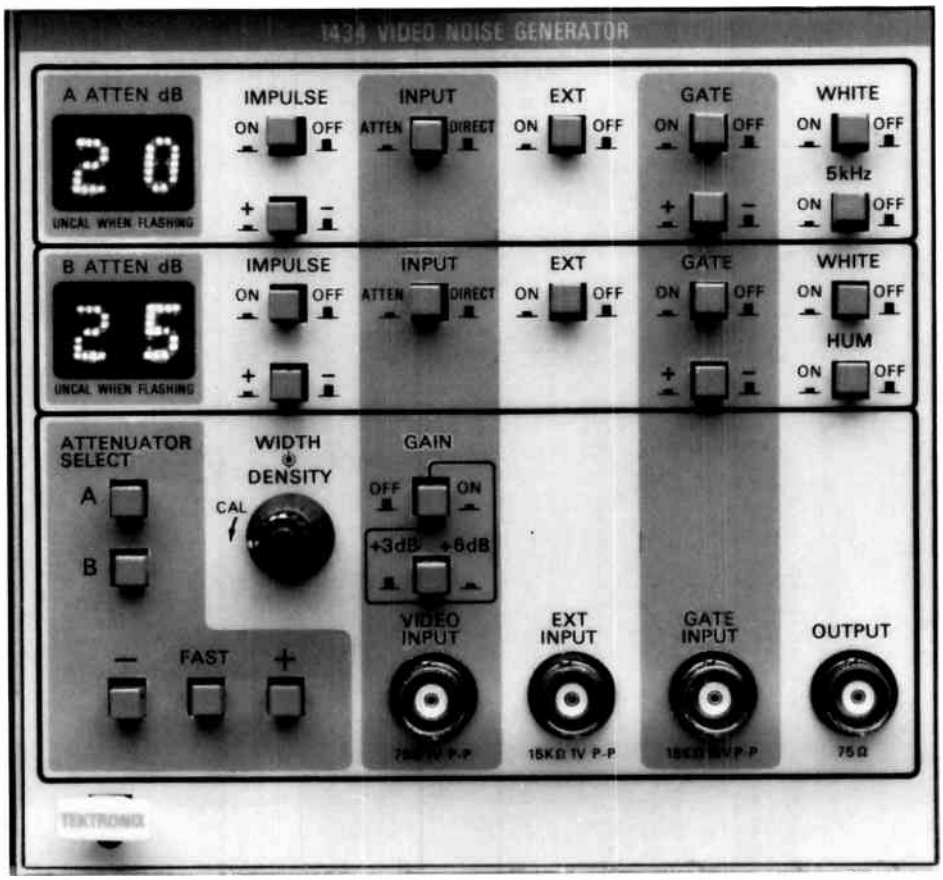
Noise Weighting 4.2 MHz 525/60 —
Order 015-0214-00

CCIR recommendation 568 provides for measuring signal-to-weighted random noise on all international transmissions (both 525/60 and 625/50) with a 5.0 MHz low pass filter and a unified noise weighting filter.

Low Pass 5.0 MHz — Order 015-0213-00

Unified Noise Weighting Network —
Order 015-0283-00

Rackmount to Cabinet Conversion Kit —
Order 040-0573-00



1434 Video Noise Generator.

1434 Video Noise Generator

Calibrated Noise Levels

White Noise

Impulse Noise with Selectable Polarity, and Variable Width and Density

Hum — 50 or 60 Hz

5 KHz Sine Wave

Noise Gating

Calibrated Video Attenuation

Works with NTSC, PAL, PAL-M, and SECAM

Video equipment must often deal with noisy input signals and until now there has been no easy way to evaluate equipment noise susceptibility. Tek's new 1434 Video Noise Generator provides an easy means for adding a known quantity of noise to a video signal. Noise types available in the 1434 include white, impulse, hum, and 5 KHz. White noise bandwidth is internally selectable.

In addition to its calibrated noise levels, the 1434 includes provisions for attenuating or boosting the gain of the input video signal, making it possible to obtain a wide range of signal to noise ratios with input signal amplitudes from −60 to +6 dB.

Noise gating is also provided in the 1434. This feature is useful when testing one parameter of a device without disturbing other circuitry. For example, gating noise onto just the video signal back porch would permit clamp testing without having the test affected by the device sync separator.

The 1434 also provides an external input for adding a user-created disturbance to the input video signal. If desired, the external input signal may be combined with the noise signals generated by the 1434.

Typical applications of the 1434 are clamp and sync separator testing in video equipment.

CHARACTERISTICS

Attenuator — Range: 0 to −60 dB. Resolution: 1 dB. Absolute accuracy: ±0.5 dB. Relative Step matching: ±0.25 dB.

Noise Sources — White Noise: Amplitude 700 mV RMS=0 dB. Bandwidth: Narrow: −6 dB @ 5 MHz. Wide: −6 dB @ 8 MHz.
Impulse: Amplitude 700 mV P-P=0 dB. Accuracy: ±1 dB. Width: Variable 0.5 μs to 200 μs typical. Density: Variable 10 μs to 10 ms typical. Polarity: Positive or Negative.
Hum: Amplitude 700 mV P-P=0 dB. Accuracy: ±1 dB.
Waveform: Sine wave at 50/60 Hz (Same as power line input).
5 KHz: Amplitude 700 mV P-P=0 dB. Accuracy: ±1 dB. Waveform: 5 kHz sine wave.

External Input — Input Range: ±1 V max. Input Impedance: 15 KΩ. Frequency Response: 5 MHz ±0.5 dB.

Gating Input — Input Range: 7.5 V P-P max. Input Impedance: 15 KΩ. Frequency: from 1 Hz to at least 250 KHz.

Video Input — Input Amplitude: ±1 V Peak. Input Impedance: 75 Ω, 40 dB Return Loss. Gain: +3 dB, +6 dB, or 0 to −60 dB. Frequency Response: Direct mode (attenuator bypassed) ±0.1 dB to 5 MHz; −3 dB @ 18 MHz (typical). Atten mode (through attenuator) ±0.5 dB to 5 MHz; −3 dB @ 14 MHz (typical).

Outputs — Adds Video Input, External In, and Noise. Impedance: 75 Ω, 30 dB Return Loss.

Packaging — Dual Width TM 500 Module (Compatible with TM 500 and TM 5000 Series Mainframes).

ORDERING INFORMATION

1434 Video Noise Generator

TEK COLOR PICTURE MONITORS

650HR-C Component/Composite Picture Monitor.

650HR Series Picture Monitors

High Resolution Display Plus Capability for Critical Signal Analysis

0.25 mm Triad Pitch High Resolution Trinitron® CRT

Variable Aperture Correction

Precise Color Tracking Over Full Signal Range

Two Video Inputs with Differential (A-B) Capability

Video Inputs Isolated from Ground for Hum Rejection

Optional Parallel Component Inputs — Internally Selected Format

NTSC, PAL and Multistandard Versions Available

Precise Decoders with Outputs to Provide Vector Display on External X-Y Monitor

Unique Monochrome (White) Display of Decoded Blue Signal for Critical Analysis of Color Noise

• Trinitron and BetaCam are registered trademarks of Sony Corporation.

The Tektronix 650HR Series color picture monitors are designed for exacting applications where picture quality and signal quality analysis are particularly important. The decoders have sufficient bandwidth to pass all the information in standard signals.

The unique blue only mode feeds the decoded blue video signal to the red, green, and blue channels simultaneously. This produces a monochrome display with a high subjective sensitivity to chroma noise, allowing better analysis of video quality.

The chrominance channel may be manually switched to either the monochrome or color modes, or activated automatically by the presence of burst.

Circuits in the Tektronix 650HR Series are designed for color stability and consistency. Outputs are provided from the precision decoders and may be used to drive an X-Y monitor for a vector display. The regulated EHT supply is not affected by extreme changes in APL even when calibrated brightness, at peak white, is set at 30 fL. Raster size is held within 1%, while excellent clamping maintains a stable black level with a 0% to 100% range of APL.

In 650HR Series color monitors, you can shift the picture either horizontally or vertically, or both (pulse cross). This lets you monitor sync, burst, blanking, vertical interval test, and reference signals. When the monitor is operating in any of these display modes, brightness is automatically advanced to permit observation of the sync pulses and burst. Expansion of the vertical scan is provided in the pulse cross and vertical delay modes, so you can view individual lines in the vertical blanking interval.

Versions are available for certain combinations of NTSC, PAL, and parallel components. (See ordering information chart.)

The optional "-C" versions directly display 3-wire parallel component signals. Internal selection for SMPTE Parallel (Y, Pb, Pr), BetaCam® (Y,B-Y, R-Y), M (Y, Q, I), or GBR formats offers a wide range of applications. Front panel switching between component and composite inputs allows easy comparison of non-encoded and encoded signals.

The 650HR Series monitors can be used in rack installations or separately in their own cabinets.

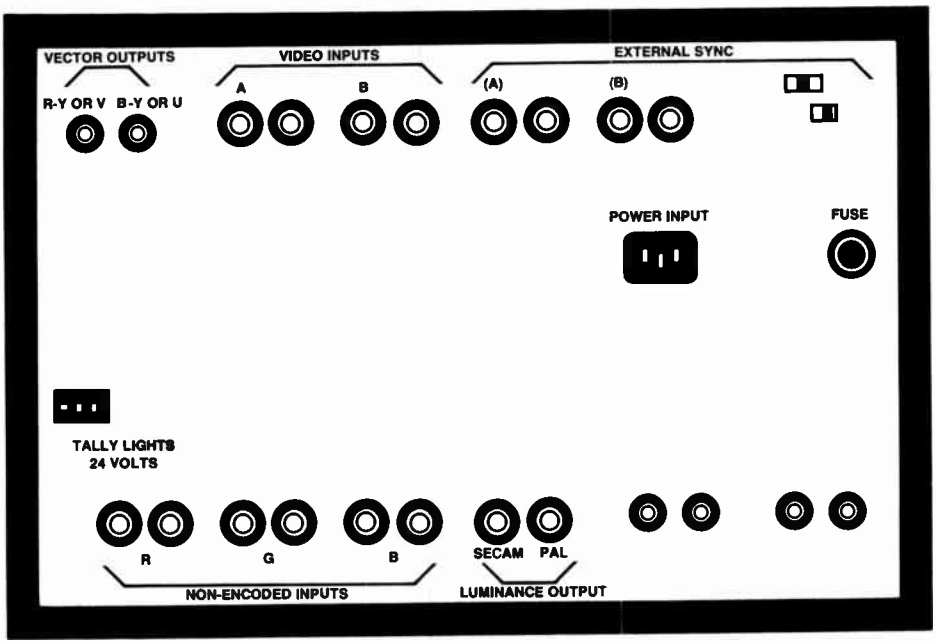
CHARACTERISTICS

Input Signal Level — 0.5 V p-p minimum composite video 2 V p-p maximum. (Exceeds CCIR recommendations 567, Part D and D.2.)

Impedance — Unterminated: High Z bridging inputs loop-through compensated for 75 Ω (not internally terminated). Return Loss: ≥46 dB to 5 MHz, power on or off, input in use or not.

Maximum Safe Input — Exceeds CCIR recommendation 451-2 (±5 V peak).

Hum Rejection — Hum is ≥50 dB down when 4 V maximum RMS common-mode mains hum signal is applied to the monitor in floating ground mode.



650HR Rear Panel.

NTSC Luminance Channel — Bandwidth (notch filter removed) ≈6 MHz. Subcarrier notch filter automatically removed when burst is not present and Mode switch is in Auto position. Subcarrier notch filter removed when Mode switch is in Monochrome positon. Dc Restoration: back porch type; not affected by burst. Mains hum reduction due to dc restorer is <6 dB. Amplitude Linearity: Within 2%.

NTSC Chrominance Channel — Demodulation Axis: R-Y, B-Y. Bandpass: 1.3 MHz equiband. Gain Range: Preset at 0 dB; adjustable from −6 dB to +10 db.

PAL Luminance Channel — Bandwidth (notch filter removed): ≈6 MHz. Subcarrier notch filter can be removed by changing internal jumper. Subcarrier notch filter normally left in circuit.

PAL Chrominance Channel — Demodulation Axis: U, V. Bandpass: ≈1.2 MHz. Gain Range: Preset at 0 dB; adjustable from −6 dB to +10 dB.

Residual Subcarrier Detection (On Applied Signal) — Color of displayed picture will shift due to any residual subcarrier. This feature can be inhibited by a jumper on the decoder board.

Chrominance/Luminance — Time Error: <30 ns. Gain Error: <3%.

Delay — Red to green to blue: <50 ns.

Subcarrier Regeneration — Phase Error: Within 1° with input burst variation of ±10 Hz from subcarrier nominal burst frequency. With Temperature Variation: Within 5° within ambient temperature variation from 0°C to +50°C; within 1° for any +10°C increment within the range 0°C to +50°C. With input Signal Variation: Within 1° with input signal variations of ±3 dB from 1.0 V, within 3° with variation of burst/sync ration of −6 dB to +10 dB. Breezeway Stability: ≤0.2° for burst timing errors including burst width variance (8 to 11 cycles), and breezeway variance ±0.28 μs. Phase Error Due to Noise: Within 1° with RMS white noise at −24 dB (0 dB = 700mV RMS).

Component Channels — Bandwidth: ≈6 MHz. Channel to Channel Delay Difference: <30 ns. Transcoding Error: <3 IRE.

PICTURE

Height — 184 mm (7.2 in).

Width — 244 mm (9.6 in).

Underscan — ≈20% reduction in both height and width.

Aspect Ratio — 4:3.

Deflection Linearity — Vertical and Horizontal: 1% of picture height within a central area bounded by a circle whose diameter equals picture height, ±2% of picture height outside of central area.

Convergence Error — <1 mm within the central area. Outside of the central area, color separation (misconvergence) is <2 mm.

Unblanking — All active picture elements are displayed. (Horizontal retrace is accomplished within 10 μs.)

Color Temperature — 6500°k. Easily adjustable to other standards.

Calibrated Contrast — 30 fL at peak white of standard 1 V signal.

Calibrated Brightness — Displayed black may be preset to a level appropriate for ambient conditions.

EHT (Extremely High Tension) — 19 kV nominal, regulated. Load variations cause <1% picture size variation. Monitor complies, as of date of manufacture, with applicable DHHS standards under Radiation Control for Health and Safety Act of 1968.

Kinescope Protection — Failure of horizontal or vertical scanning shuts off the EHT. Failure of HV Regulator circuit does not cause EHT to soar excessively. EHT supply is current limited.

Heater Voltage — Regulated dc.

SYNC AND TIMING

Signal Range — Composite sync 0.5 V p-p to 8 V p-p or composite video 0.5 V p-p to 2 V p-p.

Impedance — Unterminated: High Z bridging inputs loop-through compensated for 75 Ω (not internally terminated). Terminated: 75 Ω. Return Loss: ≥46 dB to 5 MHz with respect to 75 Ω.

Synchronization — Stable subcarrier regeneration, limited by line sync performance. Line sync white noise immunity is 20 dB. Field sync white noise immunity is 20 dB. Field sync stable with tilt equal to 100% of sync amplitude in vertical blanking. Stable with 20 IRE mains hum.

AFC (Two Loop AFC Type) — Phase Corrector: Corrects for phase errors due to side pincushion correction and other effects within the monitor. Slow AFC: Displays timing errors of incoming sync, particularly, 60 Hz or 240 Hz timing errors. Bandwidth is ≈25 Hz. Fast AFC: Largely corrects for incoming sync errors, ≈2 kHz bandwidth.

Scan Delay — Horizontal Delay: ≈¼ line; displays burst. Vertical Delay: Displays the vertical blanking interval of the input signal expanded ≈2.5 times unless underscan is activated. If the underscan button is depressed, vetical expand is inhibited.

AC POWER

Mains Voltage Range — 115 V: Within 10% (104 V ac to 126 V ac). 230 V: Within 10% (207 V ac to 250 V ac maximum). 650HR, 650HR-C are factory set for 115 V. 651HR, 651HR-C, 655HR-C and 652HR-1 are factory set for 230 V.

Crest Factor — ≥1.3

Mains Current — 1.5 A RMS maximum at 115 V, 60 Hz. 0.75 A maximum at 230 V, 50 Hz. Current is substantially higher during degaussing.

Degaussing Surge Current — 5 A RMS.

Power Consumption — 150 W maximum, 110 W typical.

Mains Frequency — 48 Hz to 66 Hz.

ENVIRONMENTAL

Temperature Range — Operating: 0°C to +50°C. Nonoperating: −40°C to +65°C.

Altitude Range — Operating: to 4.5 km (15,000 ft). Nonoperating: to 15 km (50,000 ft).

Shock — To 30 g's, ½ sine, 11 ms duration.

PHYSICAL CHARACTERISTICS

Dimensions	Cabinet		Rackmount	
	mm	in	mm	in
Width	426	16.8	483	19.0
Height	279	11.0	266	10.5
Depth	419	16.5	464*1	18.3*1
Weights	**kg**	**lb**	**kg**	**lb**
Net	22.7	50.0	23.5	52.0
Domestic Shipping	28.5	65.0	30.4	67.0
Export Shipping	36.3	80.0	37.2	82.0

*1 *With handles*

ORDERING INFORMATION

All 650HR Monitors are shipped with rackmounting hardware. Cabinet version hardware is also included.

MODEL NUMBER	NTSC	PAL	COMPONENT
650HR	•		
650HR-C	•		•
651HR		•	
651HR-C		•	•
652HR-1		M	•
655HR-C	•	•	•

* *GBR format only*

NEW PRODUCT

TEK COLOR PICTURE MONITOR

656HR-1 SECAM Picture Monitor

Color Sequencing from Field Identification Signals or Line Burst

Precision Decoding Allows Use of R-Y, B-Y Outputs for Vector Display Measurements

RGB Inputs with Vector Display Outputs

PAL/SECAM with Front Panel Control of Decoding Standard

Variable Aperture Correction

Vertical and Horizontal Delay Display Modes

Reduced Chrominance Line Crawl

Indicates Color Sequence Error

Rapid Retrace — Entire Picture Area is Displayed in Reduced Scan

Two Switchable Inputs Isolated from Ground for Hum Rejection

The Tektronix 656HR-1 SECAM color picture monitor is identical in function to the other 650HR Series monitors but is specifically designed for use in SECAM systems. It includes both PAL and SECAM decoders.

Color sequencing is front panel controlled by a three position mode switch. In the Field mode, field identification signals are used for color sequencing and a color display is enabled by the presence of detectable field identification signals. In the Line mode, line burst determines color sequence, and a color display is enabled whenever detectable SECAM subcarrier is present. Use of the Monochrome mode blanks the chrominance channel.

In the internally selectable Forced-Color mode, the very high limiting ratio of the chrominance channel lets you use the monitor to search for very small amounts of crosstalk or other unwanted signals. By displaying the chrominance portion of such signals on a brightened display, you can easily identify the source.

Two PROMs (Programmable Read Only Memories) are used in the monitor for generating accurate timing signals. Their use eliminates the need for many internal adjustments and possible drift related to the timing of internal signals. One of these PROMs is programmed with information corresponding to the lines containing subcarrier (including field identification lines) in 625/50 SECAM systems. The monitor then serves as a check on improper additions or deletions of lines that might possibly occur in improperly adjusted VTRs, processing amplifiers, and switchers.

Chrominance line crawl is greatly reduced by using separate acoustical delay lines; one for D'R and one for D'B. With front panel controls, you can turn off luminance or chrominance, and examine each one separately. Brightness is automatically advanced for easier viewing when luminance is turned off for examination of chrominance. For purity checks, you can set up the equivalent of a flat field display by switching luminance off in a monochrome mode (chrominance off).

The monitor's chroma control has two operating modes. When the control is in, the chrominance is independent of subcarrier amplitude. When the control is out, the chrominance is proportional to subcarrier amplitude. In the first mode, the saturation will vary with incoming video level. In the latter mode, correct saturation will be maintained for varying signal levels. In either mode, both a preset (detent) position and a variable range are available. Switching between the two modes in the preset position provides an indication of abnormal chrominance or luminance amplitude.

CHARACTERISTICS

SECAM PERFORMANCE-LUMINANCE CHANNEL

Bandpass Without Chrominance Trap — (Aperture Corrector set for 0 dB). Amplitude: ±0.5 dB to 5 MHz. Aperture Corrector Maximum Range: 8 dB; doubled peaked at 2.5 MHz and 7 MHz; ≤3 dB between 4.0 MHz and 5 MHz.

Chrominance Filter — Subcarrier Rejection: >25 dB at 4.250 MHz and 4.406 MHz, <−1 dB at 5.5 MHz. NOTE: The chrominance filter is removed from the luminance channel whenever the display is monochrome.

Pulse Distortion — <1% tilt on 50 Hz squarewave. <0.5% tilt on 15 kHz squarewave.

Dc Restoration — Back porch type, not affected by burst. Mains hum reduction due to dc restorer is <6 dB.

Amplitude Linearity — Within 2%.

Luminance Off Facility — Displays chrominance only and automatically advances brightness.

SECAM PERFORMANCE-CHROMINANCE CHANNEL

High Frequency De-emphasis — Matching to Encoder High Frequency Pre-emphasis: Error ≤0.5 dB over the range 3.9 MHz to 4.75 MHz; <3 dB at 2.85.

Drift (Center Frequency) — Within ±20 kHz.

Luminance Rejection — >46 dB at 15 kHz.

Limiting Ratio — >60 dB.

Ultrasonic Delay Line Error — <30 ns.

Crosstalk at Input to Discriminators — Between Direct and Delayed Chrominance Signals: Alternate line crawl on display is minimized through the use of separate delay lines for the D'R and D'B chrominance signals.

Discriminator Linearity — Overall: Within ±1%. Incremental: Within 1%.

Demodulator Center Frequency — Clamped to crystal reference stabilized within ±0.250 kHz.

Chrominance Sequence and Color Enable — Chrominance sequence and enable are statistically averaged with hysteresis for best performance under poor signal-to-noise conditions. Field Mode: Based upon field identification signals. Chrominance Amplitude: Disable when chrominance is more than 12 dB low, may be internally selected. Line Mode: normally based upon line burst with no chrominance amplitude disable. An internal jumper provides chrominance amplitude disable if required.

Chrominance Unblanking — Programmed internally according to 625 line 50 Hz SECAM standards. Field identification signals are displayed in vertical scan delay modes.

Saturation — Selectable to treat subcarrier as FM signal or to vary the saturation with incoming chrominance level. Independent of Subcarrier Amplitude: Gain Error <3%. Dependent on Subcarrier Amplitude: Tracking error <5% for signals within ±3 dB to −6 dB of normal amplitude. Chroma Control Separately Adjustable: ±6 dB.

Cross Talk — Between R-Y and B-Y >40 dB attenuation.

Chrominance/Luminance Time Error — <60 ns with properly adjusted bell filter and low frequency de-emphasis.

Sequence Error Indicator — When the front panel red light indicates that the incoming SECAM signal has a chrominance sequence opposite to that indicated by an externally applied 7.8 kHz signal. Also when the monitor is used in the Line mode the light will indicate when the field identification signals are reversed with respect to the Chrominance Sequence present during the active picture.

VECTORSCOPE OUTPUTS

Calibrated Modes (Dots in Boxes) — Selected by front-panel control for either 75% color bars or 25% color bars (SECAM and RGB only). Vector locations are within ±2% of vector magnitude.

Vectorscope Drive Capability — Suitable to drive 10 ft of 75 Ω coaxial cable (unterminated) to X-Y display.

Required X-Y Display Deflection Sensitivity — 0.05 V/cm on both X axis and Y axis.

Required X-Y Display Input Resistance — ≥100 kΩ.

RGB Vector Display — R, G, and B input signals are matrixed to form R-Y and B-Y signals which are switched to the rear-panel vector output connectors when the RGB inputs are selected.

RGB Matrix Error — R-Y and B-Y relative output signal amplitudes are within ±2% of desired values when equal R, G, and B signals are supplied.

RGB Centering — Black level is clamped to within ±9 mV which corresponds to ±1 mm in the 75% vector display.

Other Inputs and Outputs — 7.8 kHz input, 7.8 kHz output, and field 1 pulse output.

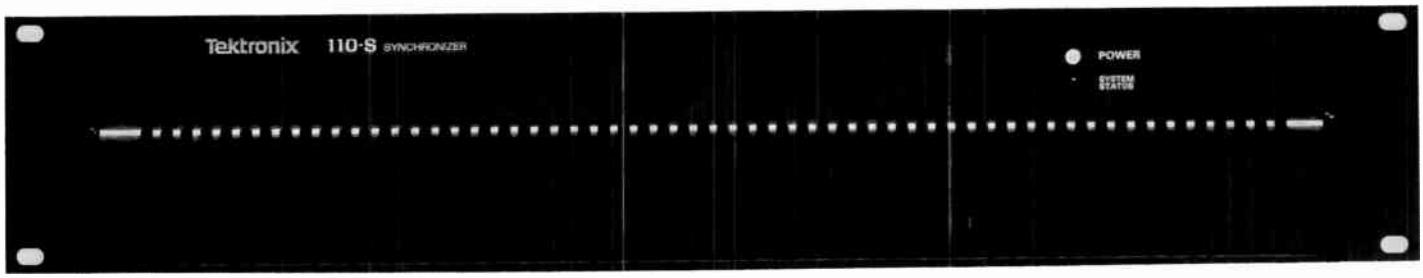
PHYSICAL CHARACTERISTICS

Dimensions	Cabinet		Rackmount	
	mm	in	mm	in
Width	426	16.8	483	19.0
Height	279	11.0	266	10.5
Depth	419	16.5	464*1	18.3*1
Weights	**kg**	**lb**	**kg**	**lb**
Net	22.7	50.0	23.5	52.0
Domestic Shipping	28.5	65.0	30.4	67.0
Export Shipping	36.3	80.0	37.2	82.0

*1 *With handles*

ORDERING INFORMATION

656HR-1 SECAM + PAL + RGB



110-S Video Synchronizer

True 10-Bit Accuracy and Resolution

Tracks Signals into the Noise

Optional Four-Field Memory for the Highest Picture Quality

Adaptive Decoding—Minimizes Picture Shifts while Preserving Horizontal and Vertical Detail, Provides Exceptionally High Quality Picture Freeze

Adaptive Clamping—Minimizes Streaking on Noisy Signals

Digitally Precise RS-170A Sync and Burst Insertion

Heterodyne Color Processing

Auto VTR Signal Recognition

Infinite Window Correction Range

Processing Amplifier

Passes the Vertical Interval

Precalibrated Boards in Modular Design

The 110-S Video Synchronizer is a high quality 10-bit, 4X fsc video synchronizer. The 10-bit architecture, adaptive decoding, and adaptive clamping combine to provide a synchronizer that performs well on noisy signals, minimizes horizontal picture shifts, and is virtually transparent to the processed signal.

10-Bit Precision

A Tektronix-designed 10-bit digitizer and a sampling rate of four times the subcarrier frequency result in negligible quantizing errors, low differential gain and phase, and a flat frequency response. Compared to 8-bit synchronizers, the 110-S has four times the accuracy and resolution. The resulting transparency to the video signal allows cascading of 110-S synchronizers in the signal path with minimum signal degradation.

Tracking Into Noise

When noise from a fading ENG microwave feed or static interference degrades the S/N ratio, the 110-S will continue to track the signal. If the original sync and burst are clean, they may be passed with the original signal. Noisy sync and burst are replaced with precise, digitally-generated RS-170A sync and burst. The 110-S can be configured to track into the noise, freeze field, or go to black upon loss of the incoming signal. As noise increases, the adaptive clamp slows down to prevent horizontal streaking while still responding quickly to hot switches.

Four-Field Memory (Optional)

Four-field memory allows display of full color-frames with correct SCH phase and without decoder artifacts. Four-field storage also enables accurate synchronization without the 140 ns horizontal shift caused by frame overlapping. Freeze frames of one, two, or for maximum resolution, four fields may be selected with the 110-S four-field option.

Adaptive Signal Decoding

Correct color framing on the standard, two-field memory 110-S is maintained with an adaptive comb/notch decoder. Vertical correlation of the picture information (for example a flag pole) allows chrominance/luminance separation to be done by a 3-line comb filter, thus preserving the fine detail in the picture. Absence of vertical correlation in the picture causes the notch decoder to be activated, thus preserving vertical chroma resolution.

TBC Option

The 110-S TBC option adds time base correction for heterodyne color VTR's to the 110-S Synchronizer.

The Auto VTR Signal recognition feature allows the 110-S Synchronizer/TBC to recognize a heterodyne color VTR signal and activate the TBC function. If automatic operation is not desired, the user can force the TBC to operate continuously. When the TBC mode is manually disabled or the input signal has no time base error, the 110-S functions as a standard synchronizer.

With a standard memory capacity of two fields, the 110-S Synchronizer/TBC provides time base correction without feedback to the VTR. This permits time base correction of remote location VTR feeds as well as backup TBC capability for studio VTR sources.

Processing Amplifier with Remote Control

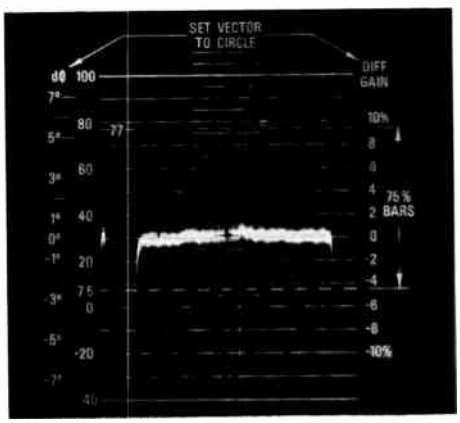
The 110-S processing amplifier provides adjustment of video gain, setup, chroma gain, and hue. Adjustment may be made with internal controls or via a rear panel remote control connector with externally supplied control voltages. The processing amplifier controls are located in the output circuitry and are active in both normal and freeze frame operation. The proc amp controls are included on the 110-RC Remote Control Unit.

Digital Test Ports

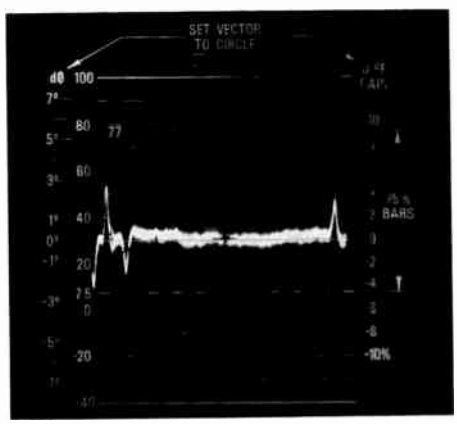
A Digital Test input port allows use of a digital signal from any of the Tektronix 1900 Series test signal generators to test the decoder and digital-to-analog converter. A Digital Output port enables analysis of the input video signal after it has been digitized by the analog-to-digital converter and processed through memory. This data can drive the DAC in a 1900 Series generator.

Reliable Operation

110-S reliability is assured by using high quality components, preconditioned IC's and two-piece connectors. Dual adaptive cooling fans provide overheating protection. The infrequent task of troubleshooting becomes fast and simple with modular, front-

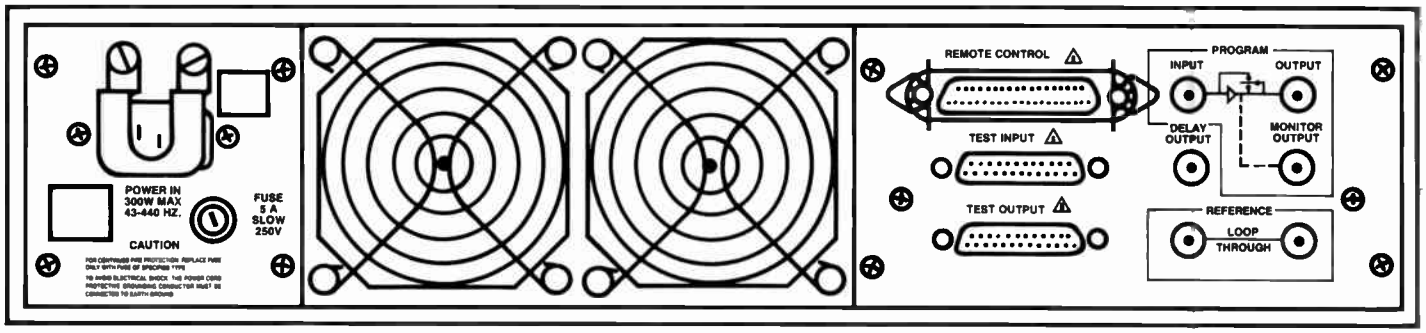


110-S Differential Gain



110-S Differential Phase

TEK 110-S



110-S Rear Panel

panel loaded circuitry designed so that the 110-S can be repaired without removing it from the rack. Factory precalibration of boards allows them to be replaced without disturbing the calibration of the synchronizer. Built-in diagnostics and input signal condition monitors continually check system status indicating possible problems. Memory error concealment allows in-service compensation of a memory fault, with remaining accuracy and resolution still better than 8-bit synchronizers. The 110-S automatically bypasses the signal when line power is lost.

Audio Delay

An Audio Delay control port allows automatic audio-video delay correction when used with a Tektronix 118-AS Audio Synchronizer.

Quantizing Error Included in Specifications

The industry has neglected the effects of quantizing error on synchronizer product specifications. The following 110-S specifications, however, include quantizing error for a modulated ramp with 40 IRE subcarrier.

CHARACTERISTICS

Digital Sampling — 10 bits at 14.3 MHz (1024 levels at four-times NTSC Subcarrier).

ELECTRICAL

PROGRAM CHANNEL

Gain — Program Output: Unity ± 1%.

Frequency Response — ± 1% to 4.2 MHz.

Signal to Noise Ratio — >60 dB unweighted.

Chrominance/Luminance Gain Error — <1%.

Chrominance/Luminance Delay Error — <10 ns.

Differential Gain — <1%.

Differential Phase — <1°.

2T Pulse K Factor — 0.5%.

2T Pulse to Bar Ratio Error — <1%.

Short Time Distortion — <1%.

Line Time Distortion — <0.5%.

Field Time Distortion — <0.5%.

PROGRAM CHANNEL (TBC OPERATING)

Meets all standard 110-S specifications except as listed below. Specifications reflect performance with a test signal generator input.

Frequency Response — Luminance: −3 dB at 2 MHz. Chrominance: −3 dB at ± 600 kHz from 3.58 MHz.

Signal to Noise Ratio — >52 dB unweighted.

Differential Gain — 2% maximum.

Differential Phase — 2° maximum.

2T Pulse K Factor — Symmetrical with 5% ringing.

Output Jitter — Luminance: 20 ns maximum. Chrominance: 2° maximum.

PROCESSING AMPLIFIER

Input Gain Range — ± 3 dB.

Output Gain Range — ± 3 dB.

Setup Range — ± 10 IRE.

Hue Adjustment Range — ± 20°.

Chrominance Gain Range — ± 3 dB.

Signal Correction Timing — Horizontal Blanking: 10.2 μs, 10.7 μs or 10.9 μs (selectable). Vertical Blanking: Start of field through line 21.

Sync and Burst Insertion Timing — Horizontal Insertion: 10.2 μs, 10.7 μs or 10.9 μs (selectable). Vertical Insertion: Start of field through line 9.

Sync and Burst Insertion Amplitude Accuracy — ± 1 IRE.

VITS Deletion Timing — Vertical Timing: Line 10 through line 14 (selectable).

ADAPTIVE CLAMP

The adaptive clamp has 32 dB hum rejection in the absence of noise other than hum, and reduces hum rejection in the presence of other noise in order to minimize clamp streaking.

Clamp Speed — Slow: (<20 dB S/N)*1. Settling Time: Within 5 IRE in 30 lines or more. Medium: (<35 dB S/N)*1. Settling Time: Within 5 IRE in 10 lines to 30 lines. Fast: (>35 dB S/N)*1. Settling Time: Within 5 IRE in 2 lines to 3 lines.

*1 *Approximate signal to noise ratio.*

CHROMINANCE DECODER

Video Signal Filtering Modes — Pass: Signal unaltered. Comb: Chrominance inverted using 3-line comb filter. Burst is comb decoded. Notch: Chrominance inverted using 9-point transversal notch filter. VITS are notch decoded. Adaptive: Chrominance inverted using combination of notch and comb filters.

SYNCHRONIZER TIMING

Output Timing Range — Horizontal: 13.41 μs advance to 4.40 μs delay. Vertical: Two lines advance to one line delay.

POWER SUPPLY

Line Voltage Range — 90 V ac to 132 V ac; 180 V ac to 250 V ac.

Peak Input Power — 300 W maximum.

Typical Power — 240 W.

ENVIRONMENTAL

Temperature — Operating: 0°C to +50°C. Nonoperating: −55°C to +75°C.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width	480	19.0
Height	89	3.5
Depth	510	20.1
Depth (Rackmount)	491	19.4
Weight	**kg**	**lb**
Net	32.7	14.8

Remote Control Interface Functions — Remote Bypass, Manual Freeze, Freeze Field or Frame, Freeze Four Field, Enable Auto Freeze, Inhibit Decode, Inhibit Sync and Burst Insertion, External Test Data Enable, (Digital Input Port), Status Indicator, Power LED, System Status LED, Proc Amp Active LED, Bypass LED, Hue Control, Setup Level, Chroma Level, Input Gain (ADC), Output Gain (DAC).

TBC Remote Control Interface Functions — TBC On/Off; Enable Auto VTR Signal Recognition; Forced Heterodyne Processing.

ORDERING INFORMATION

110-S Video Synchronizer.

Includes: Power cord (161-0066-00); remote plug 36-pin unwired connector with shell (131-0293-00); one set of rack slides (351-0636-00); circuit board extender (670-7754-00); operator manual, service manual.

OPTIONS

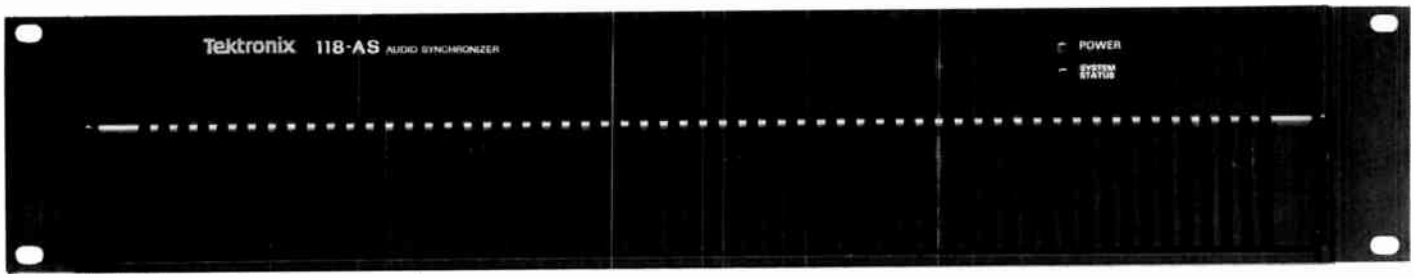
Option 10 — Four-Field Memory Adaptive Decoder.

Option 20 — Adds time base correction for heterodyne color VTR's.

110-RC Remote Control Unit.

OPTIONAL ACCESSORY

Spare Parts Kit — Order 020-0990-00.



118-AS Audio Synchronizer

Automatic or Manual Control of Audio to Video Timing

Simple One-Wire Interface to 110-S Video Synchronizer

118-F02 Option Provides Interface to Other Video Synchronizers

Expandable to Three Channels for Stereo and Auxilliary Channel

Compensates for up to Ten Fields of Video Delay

93.75 kHz Sampling Provides Accurate Stereo Phasing and Flat Frequency Response

18-Bit Floating Point Code for Wide Dynamic Range

Built-In Diagnostics and Easy Module Access for Service

Frame synchronizers, digital video effects, noise reducers, and other video delay devices in the television signal path necessitate delaying the audio signal to avoid annoying lip-sync errors. When a number of video synchronizers are cascaded, each with its inherent delay variations, fixed audio delays leave significant delay uncertainty. With four-field video synchronizers such as the Tektronix 110-S, video delay may be as great as 66 ms, making audio synchronization even more important. The Tektronix 118-AS Audio Synchronizer provides automatic and/or manual control of audio delay to maintain proper audio to video timing. With 18-Bit floating point code and 93.75 kHz sampling, the Tektronix 118-AS brings to audio synchronization the same high standards established for video synchronization by the Tektronix 110-S.

Automatic Audio Synchronization

The 118-AS Audio Synchronizer automatically tracks the 110-S Video Synchronizer using a simple one-wire digital interface. Additional audio delay may be added manually to compensate for audio to video timing errors present on an incoming signal. The standard 118-AS provides up to ten fields delay, with memory sockets for user expansion to 40 fields. An optional video interface board allows the 118-AS to be used with other video equipment.

118-AS Audio Synchronizer Configuration

The standard 118-AS is a single channel audio synchronizer, which may be expanded to two or three channels for stereo or second language applications. Each additional channel may be added by installing a 118-F01 kit, which consists of two fully calibrated plug-in circuit boards. The 118-AS mainframe is prewired to accept up to three channels. All channels may be controlled by a single video synchronizer or each channel may be operated independently using three 110-S synchronizers.

Remote Control

The 118-RC Audio Synchronizer Control allows remote adjustment and monitoring of delay for up to three channels. Automatic, manual, or total delay is displayed in either fields or milliseconds. System Status, Input Clip, and Bypass LEDs indicate abnormal operating conditions. The 118-AS can be bypassed from the Remote Control.

Transparent Delay Change

To minimize program audio discontinuities, the 118-AS provides a controlled rate of audio delay change. This allows color frame boundary crossings without introducing audible artifacts. Manual delay changes are also rate controlled to guarantee smooth transitions.

Wide Dynamic Range

Precision floating point coding makes high signal to noise ratio and low distortion available over a wide range of input signal levels. The 118-AS floating point code provides nearly constant 75 dB S/N and 0.05% distortion over a wide range of signal levels instead of optimizing performance for a specification at clip level. While conventional 16-Bit linear coding could provide 96 dB S/N and an impressive .002% distortion just below clipping (where most digital audio devices are specified), performance degrades substantially at lower, more realistic input signal levels, as illustrated in Figure 1. For example, if 16 dB headroom and 25 dB program dynamic range are allowed, a 16-Bit linear PCM system might have 50 dB S/N and 0.2% distortion.

TEK 118-AS

118-RC remote control unit

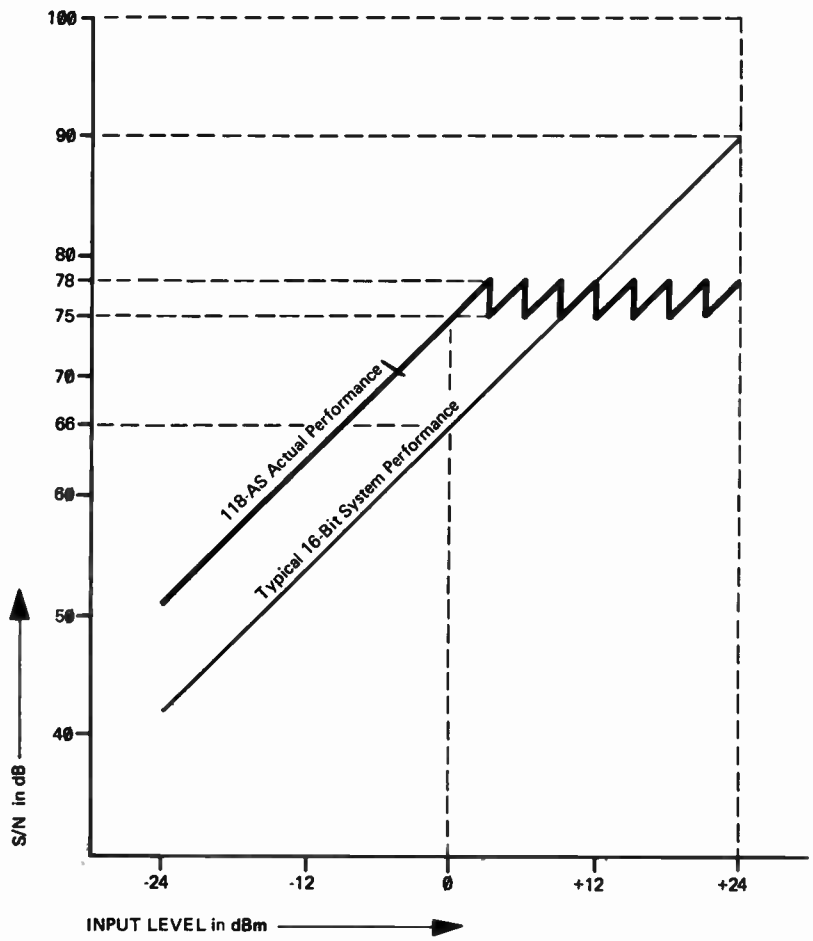


Figure 1: Signal-to-noise ratio in floating point and linear PCM systems.

Wide Bandwidth

A fundamental constraint of digitizing either audio or video is all frequencies above half the sample rate must be removed to avoid aliasing (see Figure 2). For example, with a typical 44 kHz sample rate and 20 kHz audio bandwidth only a 4 kHz transition band for the anti-aliasing filters is allowed. This necessitates performance trade-offs in frequency response and group delay. If compromises are made in filter design, aliasing may translate out-of-band energy, such as tape recorder bias frequencies, into the audio band.

With a sample rate of 93.75 kHz, the 118-AS filter transition band increases from 4 kHz to 53.75 kHz. As a result, wide frequency response, flat phase response, and accurate transient response is achieved without sacrificing attenuation of alias signals. The small delay through the wide transition band filters assures accurate matching of channel phasing for stereo applications.

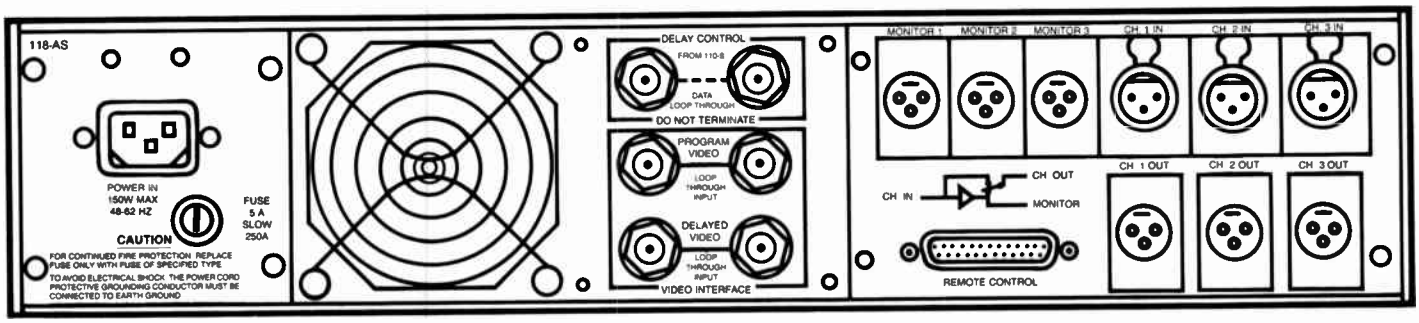
Diagnostics

118-AS operation is monitored by internal diagnostic circuits. Input signal level, A-D operation, memory, and power supplies are continuously checked. In addition, the microprocessor exercises an extensive set of digital power up diagnostics. Whenever a fault with the input signal or the 118-AS is detected, the front panel System Status LED flashes. For more detailed status information, diagnostic LEDs are provided on the circuit board modules.

Service

Repair of the 118-AS is simplified by modular construction. All modular assemblies are easily accessible without removing the 118-AS from the equipment rack.

In addition to the standard service programs, Priority Module Exchange Service is available for the 118-AS. This program provides quick response when downtime is critical.



Rear Panel

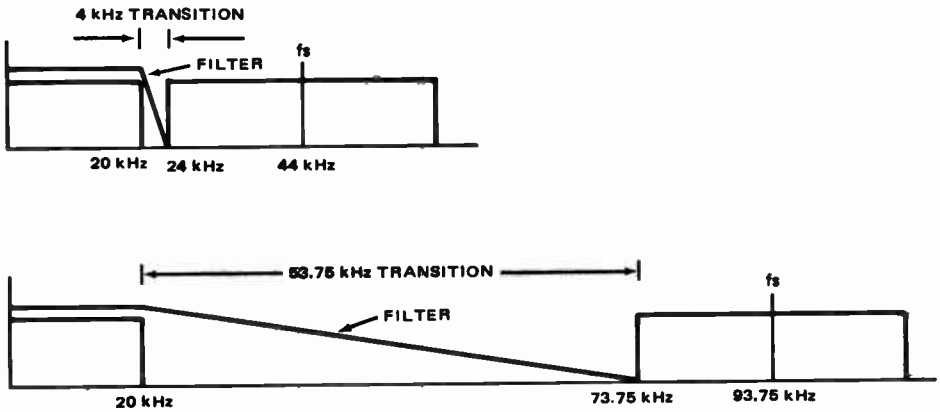


Figure 2. Anti-aliasing filter responses for low and high sampling frequencies.

CHARACTERISTICS

(For active balanced input)

Channels — 1 standard, expandable to 3 channels.

Delay — 10 fields total (user expandable to 40 fields). Automatic and manual delay control.

Encoding — 18-Bit floating point code.

Sample Rate — 93.75 kHz.

Total Dynamic Range — 100 dB.

Peak Input Signal — +24 dBm into 600 Ω, configurable to other levels.

Gain — Fixed at unity gain with provision for variable gain.

Gain Accuracy — ±0.2 dB at unity gain.

Frequency Response — ±0.2 dB, 50 Hz to 15 kHz, ±0.5 dB, 20 Hz to 20 kHz.

Phase Accuracy — Channels match within: ±1° at 1 kHz, ±10° at 10 kHz.

Harmonic Distortion — 0.05% maximum, 0 dBm to +24 dBm, 20 Hz to 20 kHz.

IM Distortion — 0.08% maximum, 0 dBm to +24 dBm, 20 Hz to 20 kHz.

Signal to Noise Ratio — 75 dB, 0 dBm to +24 dBm, 20 Hz to 20 kHz.

Channel Separation — 80 dB.

Input Impedance — High impedance balanced input, configurable to 150 Ω or 600 Ω.

Input Coupling — Active balanced input, can be configured for transformer coupling.

Output Impedance — Low impedance to drive 150 Ω or greater.

POWER REQUIREMENTS

90 V to 132 V or 180 V to 250 V switchable. Fused 1.6 A (0.8 A for 220 V) on power supply and 5 A on rear panel. 80 W typical power for 3 channels.

ENVIRONMENTAL

Temperature — Operating: 0°C to +50°C. Nonoperating: −40°C to +65°C.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width	483	19.0
Height	88	3.5
Depth	488	19.2
Weights	**kg**	**lb**
Net	11.6	25.6

Audio Synchronizer Control Functions — 118-AS Front Panel: Power LED; System Status LED.

Controls and Indicators Behind Front Panel — Power Switch; Fuse; Line Voltage Selector; Bypass Switch and LED; Input Clip LED; Dead Output LED; Digital Diagnostics; Manual Delay Switches; Zero Remote Delay Switches; Auto Delay Disable Switch; Processor Reset Switch.

Remote Control Functions — System Status LED; Input Clip LED; Bypass Switch and LED; Delay Readout; Fields or mS Switch and LEDs; Manual, Auto, or Total Switch and LEDs; Manual Delay Set Switches; Auto Delay Disable Switch and LED.

ORDERING INFORMATION

118-AS Single Channel Audio Synchronizer

Includes: Power cord; rack slides; remote control mating connector; instruction manual.

118-F01 Audio Channel Kit (adds one channel)

118-F02 Video Interface Kit

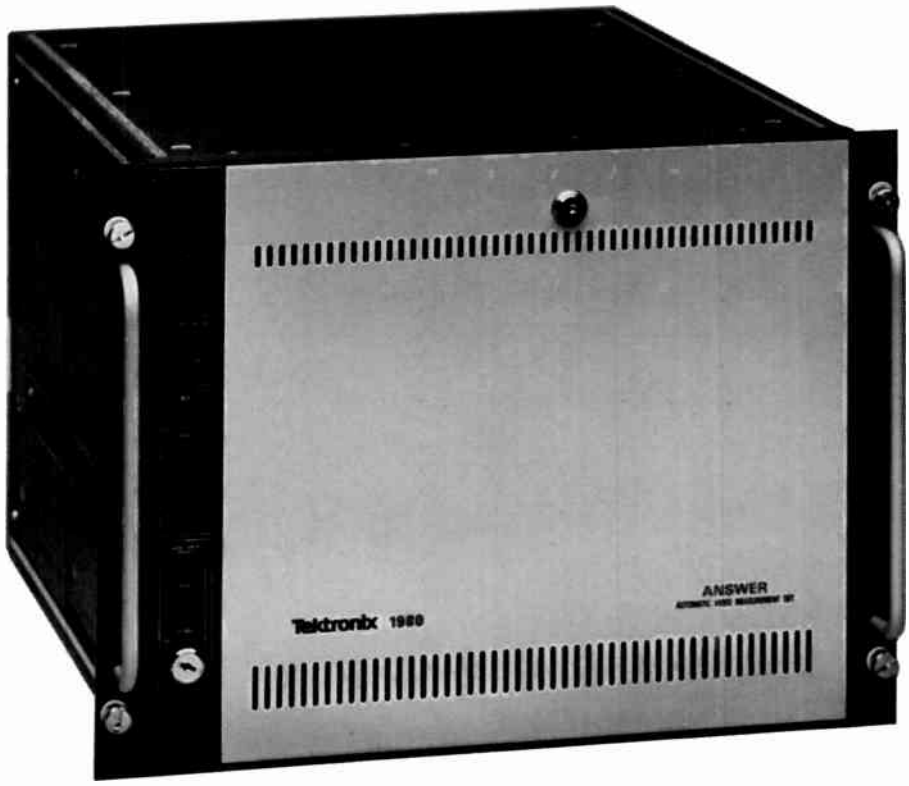
118-RC Remote Control Unit

Includes: Cable.

OPTIONAL ACCESSORY

Circuit Board Extender — (Same as 110-S Extender.) Order 670-7754-00

TEK AUTOMATIC VIDEO MEASUREMENT SET



1980

ANSWER with Measurement Software

Unattended Monitoring of Video Signals from Studios, STLs, Earth Stations, and Transmitters

Full Spectrum of Timing, Frequency Response, Amplitude, Phase, and Noise Measurements

Waveform Plots for Analysis and Documentation

Remote Operation

Automatic Logging

User Definable Measurement Limits

Operator Initiated Individual Measurement

Vertical Interval Scan for Test Signal Locations

User-Defined Measurement Groups

The 1980 ANSWER Automatic Video Measurement Set provides total video measurement capabilities and offers maximum versatility and testing power. Special features provide quality measurement performance for a wide variety of applications.

Programmability as Well as Comprehensive Software Packages.
The 1980 can be programmed using ANSWER BASIC to make specific measurements required for a wide range of video applications. Comprehensive software packages (Options 01, 04, 05 and 06) are available from Tektronix. The instrument can be tailored for a specific operation, automatically performing a single measurement or a group of measurements continuously, on operator demand, or at prescheduled times. The results can be returned in report format, with or without graphics, on a variety of terminals and printers. ANSWER's microprocessor control and ROM memory give you extensive flexibility. Format or standard changes can be made without the expensive modifications or recalibrations associated with analog test equipment.

High Measurement Accuracy
The 1980 provides consistent measurement accuracy with high repeatability. Special features like signal offset, gain control, dither generation, and signal averaging can be used to minimize possible errors. Using these features can significantly reduce noise on the incoming signal and provide an effective resolution of 11 bits. This means you can use the 1980 for the most stringent measurement problems and have fast accurate results.

Due to its digital nature ANSWER has very few internal adjustments, providing a high degree of reliability over long periods of time.

RS-232C Compatibility
ANSWER has five RS-232C (ASCII coding) Ports. This means the instrument can be adapted to a wide range of applications, including unattended and remote systems and computer control.

Remote Operation
The 1980 can also be operated from a remote terminal over telephone lines. With Option 12 (Autocall), it can even be programmed to automatically telephone a remote terminal under user specified conditions, e.g., an out-of-limits signal.

Display Terminal Allows Waveform Plots
ANSWER requires the use of a terminal for display. We offer several, including the 4105 and 4107 13 inch Color Graphics terminals. Standard RS-232C interfaces ensure compatibility with a wide range of other terminals and printers.

Waveforms can be plotted on local or remote graphic devices for further analysis. any portion of the waveform can be expanded to fill the screen and examine small distortions in detail. Hard copies of the waveform plots are useful for support documentation and trend analysis.

Applications Software Packages
With the Option 04 NTSC Video Signal Monitoring Software, ANSWER makes automatic or operator-initiated measurements on VITS and full field signals.

With the Option 05 PAL Video Signal Monitoring Software, ANSWER makes automatic or operator-initiated measurements on ITS and full field signals.

With the Option 06 Dual Standard Applications Software, ANSWER can make automatic or operator-initiated measurements on both PAL and NTSC video signals. The video standard in use on the incoming video signals is specified by the user, and thereafter Option 06 makes all measurements accordingly.

This program combines all features of Option 04 (NTSC Video Monitoring) and Option 05 (PAL Video Monitoring) into one program. The characteristics remain the same as in those programs.

Unattended Monitoring
ANSWERS Optional Applications Software will continuously monitor video signals, make user-selected standard measurements, compare them against user-defined limits, and print alarm messages should these limits be exceeded.

Signal Timing, Frequency Response, Amplitude, Phase, and Noise Measurements
Because of the broad spectrum of measurement capability provided by each option, ANSWER applications software allows ANSWER to be useful in many different video environments: at transmitters, in studios, at cable head-ends, at satellite earth stations and with TV equipment manufacturers.

Option 04 will make RS-170A and FCC timing measurements, as well as amplitude and phase measurements on both NTC-7 and FCC VITS. Amplitude measurements are reported as % of carrier, % of bar, or IRE units.

With Option 05, CCIR Rep. 624-1 timing measurements, as well as amplitude and phase measurements on CCIR Rec. 567 ITS, can be made with the amplitude measurement results reported as mV, % of bar, or % of carrier. Blanking level and baseline distortion can be measured and the amplitude/frequency response of various television circuits determined by measuring the amplitude of the first five multiburst frequency packets, referenced to the multiburst flag.

Scan the Vertical Interval for Test Signal Locations
NTC-7 or FCC VITS and VIRS can be located by using the Option 04 Program to scan the vertical interval and "memorize" the field and line locations of these well-defined waveforms. The locations found are used in subsequent sampling. Also, the waveforms on lines 10 through 21 can be plotted, enabling the operator to visually locate the zero carrier pulse, digital data, or a quiet line.

CCIR Rec. 567 ITS, EBU color bars, multiburst, Zero Carrier, teletext, or quiet lines can be located by using the Option 05 program to scan the vertical interval, and "memorize" the field and line locations of these well-defined waveforms. The locations found are used in subsequent sampling. Also, the waveforms on lines 9 through 23 and 322 through 336 can be plotted enabling the operator to visually locate the Zero-Carrier pulse, teletext, or a quiet line.

Remote Operation Optional Applications
Programs can be operated from a remote terminal over voice grade telephone lines. With Option 12 (Autocall) it will automatically dial up a remote terminal under user-specified conditions e.g., an out-of-limits signal.

Automatic Logging
A user-defined set of measurements will automatically be made and the results printed at operator-scheduled times.

User-Definable Measurement Limits
The user can specify inner (caution) and outer (alarm) limits for each measurement parameter and different sets of limits for the two 1980 video input channels.

Operator-Initiated Individual Measurements
Monitoring can be interrupted at any time to make one or more individual measurements, once or repeatedly. The numeric results are printed. Combined with the capability to plot waveforms, this makes ANSWER a powerful trouble-shooting instrument.

User-Specified Measurement Groups
New commands can be created, each of which "stands for" a sequence of Option 05 commands. This enables unique Option 05 command sequences to be developed which perform a measurement task that is tailor-made for the user's application. Thereafter, only the user-coined command name needs to be typed to initiate the series of measurements.

CHARACTERISTICS

SIGNAL HANDLING

Inputs — A and B (user selectable).

Impedance — 75 Ω.

Return Loss — Video: ≥46 dB to 5 MHz.

Signal Level — 0.5 V to 2 V p-p; sync negative.

Coupling — Dc or ac nonfloating (user selectable).

Clamp — Selection: Fast, slow, or off (user selectable). Level: Sync tip or back porch.

Hum Rejection — Fast: >36 dB. Slow: <1 dB.

Signal Averaging — Noise Reduction: 15 dB; with 32 line averaging and incoming signal-to-noise ratio of 46 dB or less. Dynamic Range: 2.5 V maximum; with 0 offset. Gain Range: 0 times to 15.5 times in 0.5 increments. Offset Range: 0 LSB to 248 LSB ±0.5 LSB (8 LSB increments); referred to input at unity gain. Noise Floor: −72 dB (0 dB = 714 mV).

Distortions — Differential Gain Error: ≤0.5%. Differential Phase Error: ≤0.4°. Luminance Nonlinearity Error: ≤1.0%. Amplitude/Frequency Error (0 MHz to 5 MHz): 0 dB ±0.25 dB; 7.16 MHz = ≥−46 dB. Delay/Frequency Error (0 MHz to 5 MHz): ≤20 ns.

SYNCHRONIZATION

Modes — Internal: Satisfactory operation with 26 dB signal-to-noise ratio (Sound-in-Syncs disabled). Channel A and B (user selectable). External: Channel A and B (user selectable).

Amplitudes — Internal Mode: 143 mV (20 IRE) minimum; negative going sync on incoming signal. External Mode: Minimum: 0.2 V p-p into 75 Ω, composite sync. Maximum: 8.0 V p-p into 75 Ω, composite sync.

ANALOG TO DIGITAL CONVERSION

Resolution — 8 bits; 11 bits effective with dither.

Accuracy — RMS: ±0.25 LSB (±0.1%). Peak: ±0.5 LSB (±0.2%).

Conversion Rate — 20 MHz maximum.

Monotonicity — All 256 codes present and in sequence with no polarity reversals.

Sampling Rate — NTSC: 910 x horizontal frequency. PAL: 1135 x horizontal frequency.

Note: User selectable means that the function is controlled from the keyboard.

DIGITAL PROCESSING

Signal Memory — Video Acquisition Memory Capacity: 32 k samples. Video Acquisition Memory Controller Sampling Modes: Line rate, field rate or block sampling between two points on signal. Save Value: Multiples of eight. Skip Value: Multiples of two. Picture Monitor Bright-Up Pulse Output: Amplitude: ≈240 mV. Termination: Internal in 75 Ω.

Real Time Clock — Internal Reference Stability: 10 P/M total over +10°C to +50°C; crystal controlled. External Input Frequency: 1 MHz. External Input Amplitude: 0.3 V to 4.0 V.

Microcomputer — User Memory: 32 k words. Nonvolatile Memory: 8 k words.

Software Control — TEK ANSWER BASIC.

DIGITAL INTERFACE

Access Ports — Interface: RS-232C; (ASCII code). Number: 5; 3 DCE*1 (full duplex). 2 DTE*2 (full duplex).

Baud Rate — Five Ports: Up to 9600; user programmable.

Automatic Call-Up — RS-366 (optional).

User Operation — Via keyboard (ASCII).

**1 DCE = Data Communication Equipment*
**2 DTE = Data Terminal Equipment*

ENVIRONMENTAL

Temperature Range — Operating: 0°C to +50°C. Nonoperating: −55°C to +75°C.

Altitude Range — Operating: Sea level to 4572 m (15,000 ft). Nonoperating: Sea level to 15 240 m (50,000 ft).

PHYSICAL CHARACTERISTICS

	Cabinet		Rackmount	
Dimensions	mm	in	mm	in
Width	429	16.9	483	19.0
Height	355	14.0	355	14.0
Depth	593	24.0	644	22.0
Weights≈	kg	lb	kg	lb
Net	25.0	55.0		

CHARACTERISTICS, OPTION 01

AMPLITUDE AND PHASE MEASUREMENTS

Measurement	Range	Accuracy
Bar Amplitude	30 IRE to 130 IRE units	±0.5 IRE
Sync Amplitude	20 IRE to 80 IRE units	±0.5 IRE
Burst Amplitude	10 IRE to 90 IRE units	±0.5 IRE
Average Picture Level	−20% +120% of 100 IRE	±3%
Reference Black Level	−20 IRE to 130 IRE units	±0.5 IRE
Line Time Distortion	0% to 40%	±0.5%
Pulse to Bar Ratio	10% to125%	±0.5%
2T Step Ringing	0% to 25%	±2%
Relative Chroma Gain	25% to 175%	±0.5%
Relative Chroma Time	±300 ns	±10 ns
Amplitude/ Frequency	0 IRE to 120 IRE	±1 IRE or ±2% whichever is greater
Luminance Nonlinearity	0% to 50%	±0.5%
Chrominance Nonlinear Gain	20 IRE Chroma 5 IRE to 35 IRE 80 IRE Chroma 45 IRE to 160/	±0.5 IRE
Chrominance Nonlinear Phase	0° to 160°	±1°
Differential Gain	0% to 160%	±0.4%
Differential Phase	0% to 100%	±0.5%
Chrominance Luminance Intermodulation	0 IRE to 50 IRE	±0.5 IRE
Signal to Noise Ratio	26 dB to 72 dB	within 1 dB
Low Frequency Periodic Noise	0 dB to 60 dB	within 1 dB
Relative Burst Gain	±50%	±0.5%
Relative Burst Phase	±180°	±0.4°

OUT-OF-SERVICE MEASUREMENTS

Measurement	Range	Accuracy
Field Time Distortion	0% to 40%	±0.5%
Long Time Distortion	Overshoot Range: 20 IRE to 100 IRE	±1.0 IRE
	0 IRE to 20 IRE	±0.5 IRE
	Settling Time: 0.1 s to 30 s	±2% of bounce rate
Dynamic Gain Distortion	Picture Gain: ±25% Sync Gain ±25%	±1.0 IRE ±1.0 IRE

WITH ZERO-CARRIER PULSE PRESENT

Measurement	Range	Accuracy
Blanking Level	65% to 85% of max carrier	±0.5%
Reference White Level	2.5% to 22.5% of max carrier	±0.5%

FCC AND RS-170A TIMING MEASUREMENTS

Measurement	Range	Accuracy
H Sync Width	1 μs to 8 μs	±25 ns
Front Porch Duration	0.5 μs to 2 μs	±25 ns
Sync to Start of Video Duration	8 μs to 15 μs	±25 ns
Sync to Burst Start Duration	4 to 30 cycles	±20°
Sync to End of Burst Duration	6 μs to 15 μs	±20 ns ±0.05 burst cycle
H Blanking Width	8 μs to 30 μs	±50 ns
Color Burst Width	6 to 13 cycles	±1 cycle amplitude detection ±0.5 IRE
Breezway Width	−2.0 μs to 3.5 μs	±25 ns ±0.5 burst cycle
H Sync Rise and Falltimes	0.14 μs to 0.3 μs 0.31 μs to 1.0 μs	±20 ns ±30 ns
Equalizing Pulse Width	1 μs to 20 μs	±25 ns
Serration Width	1 μs to 20 μs	±25 ns
Vertical Blanking Width	20 to 50 lines	±140 ns

The Option 01 program is stored in PROMS on two circuit boards which plug into the 1980 base unit.

CHARACTERISTICS, OPTION 04

HORIZONTAL INTERVAL TIMING MEASUREMENTS

Measurement	Range	Accuracy
Breezeway Width	0.2 μs to 3.5 μs	±25 ns
Color Burst Width	6 to 13 cycles	±0.1 cycle
Front Porch Duration	0.5 μs to 2 μs	±25 ns
Horizontal Blanking Width	6 μs to 30 μs	±50 ns
Horizontal Sync Risetime and Falltime	80 μs to 1 μs	±30 ns
Horizontal Sync Width	1 μs to 8 μs	±25 ns
SCH Phase	±90 °	±5 °
Sync to Setup	5 μs to 18 μs	±25 ns
Sync to Start-of-Burst	4 μs to 8 μs (i.e. 16 to 30 cycles)	±140 ns (0.5 cycles) ±20 ns
Sync to End of-Burst	6 μs to 15 μs	±20 ns

VERTICAL INTERVAL TIMING MEASUREMENTS

Measurement	Range	Accuracy
Equalizing Pulse Width	25% to 200% of nominal horizontal sync pulse width	±0.5%
Serration Width	1 μs to 20 μs	±25 ns
Vertical Blanking Width	19 to 29 lines	−0.1 lines to +0.2 lines

FCC COLOR BAR MEASUREMENTS

Measurement	Range	Accuracy
Color Bar Amplitude Errors	±100% of nominal	±1.0% or ±1.0 IRE, whichever is greater
Color Bar Phase Errors	±180° from nominal	±1°
Color Bar Chrominance-Luminance Gain Ratio	0% to 200% of nominal	±2%

AMPLITUDE AND PHASE MEASUREMENTS

Measurement	Range	Accuracy
Bar Amplitude Zero Carrier Pulse Present	0% to 90% of Carrier	±0.4%
Zero Carrier Not Present	0 IRE to 200 IRE	±0.5 IRE
Chrominance-Luminance Delay	±300 ns	±20 ns
Chrominance-Luminance Gain	0% to 160%	±1%
Differential Gain	0% to 100%	±0.5%
Differential Phase	0° to 360°	±0.4°
Luminance Non-linear Distortion	0% to 50%	±1%
Relative Burst Gain	±100%	±0.5%
Relative Burst Phase	±180°	±0.4°
Burst Amplitude % of Sync	25% to 200% of sync	±1.3% of sync or ±0.5 IRE, whichever is greater
% of Bar	10% to 80% of Bar	±0.5%
Bar Not Present	10 IRE to 80 IRE	±0.5 IRE
Sync Amplitude	20% to 80% of Bar	±0.5%
Bar Not Present	20 IRE to 80 IRE	±0.5 IRE
Blanking Level	0% to 90% of Max Carrier	±0.5%
Sync Variation	0% to 50% of Max Carrier	±0.5%
Zero Carrier Not Present	0% to 50% of Bar	±0.5%
Zero Carrier & Bar not present	0 IRE to 50 IRE	±0.5 IRE
Blanking Variation	0% to 50% of Max Carrier	±0.5%
Zero Carrier Not Present	0% to 50% of Bar	±0.5%
Zero Carrier & Bar not present	0 IRE to 50 IRE	±0.5 IRE
Vertical Interval White Level	0% to 90% of Max Carrier	±1.0%
Zero Carrier Not Present	0% to 100% of Bar	±1.0%
Zero Carrier & Bar not present	0 IRE to 100 IRE	±1.0 IRE
Maximum Picture White	0% to 90% of Max Carrier	±1.0%
Zero Carrier of Bar Not Present	0% to 100%	±1.0%
Zero Carrier & Bar Not Present	0 IRE to 100 IRE	±1.0 IRE
Minimum Picture Black	−40% to +100% of Bar	±1.0%
Bar Not Present	−40 IRE to +100 IRE	±1.0 IRE

FREQUENCY RESPONSE MEASUREMENTS

Measurement	Range	Accuracy
Multiburst Flag Amplitude	0% to 90% of max Carrier	±0.5%
Zero Carrier Not Present	20% to 130% of Bar	±0.5%
Zero Carrier & Bar Not Present	20 IRE to 130 IRE	±0.5 IRE
Multiburst Packet Amplitudes (6 Results)	0% to 100% of Flag	±3%

LINEAR WAVEFORM DISTORTION MEASUREMENTS

Measurement	Range	Accuracy
Line Time Distortion	0% to 40% of Bar	±0.5%
Pulse-to-Bar Ratio	10% to 125%	±1%
Short-Time Waveform Distortion	0% to 25%	±1%
Chrominance Nonlinear Gain Distortion	5 IRE to 35 IRE: 20 IRE chroma 45 IRE to 160 IRE: 80 IRE chroma	±0.5 IRE
Chrominance Nonlinear Phase Distortion	0° to 360°	±1.0°
Chrominance to Luminance Intermodulation	±50 IRE	±0.5 IRE

VIRS MEASUREMENTS

Measurement	Range	Accuracy
VIRS Setup Reference Black	−20% to 130% of Bar	±0.5%
Bar Not Present	−20 IRE to 130 IRE	±0.5 IRE
VIRS Chrominance Reference Amplitude	0% to 200% of burst amplitude	±1.0%
Burst Not Present	0% to 80% of Bar	±1.0%
Burst & Bar Not Present	0 IRE to 80 IRE	±1.0 IRE
VIRS Chrominance Phase Relative to Burst	±180°	±1.0°
VIRS Luminance Reference	30% to 100% of Bar	±1.0%
Bar Not Present	30 IRE to 100 IRE	±1.0 IRE

LOW FREQUENCY NOISE MEASUREMENT

Measurement	Range	Accuracy
Low Frequency SNR	26 dB to 60 dB	±1.0 dB

SIGNAL-TO-NOISE RATIO MEASUREMENTS

Measurement	Range	Accuracy
Unweighted SNR	26 dB to 65 dB 66 dB to 72 dB	±1.0 dB ±2.5 dB
Luminance Weight SNR	26 dB to 72 dB	±1.0 dB
Chrominance Weighted SNR	26 dB to 72 dB	±1.0 dB

The Option 04 program is stored in PROMS on two circuit boards which plug into the 1980 base unit.

CHARACTERISTICS, OPTION 05

LINE BLANKING TIMING MEASUREMENTS

Measurement	Range	Accuracy	
		at 46 dB	at 60 dB
Color Burst Duration	6 to 13 cycles	±0.2 cycle	±0.2 cycle
Front Porch Duration	0.5 μs to 3 μs	±30 ns	±25 ns
Line Blanking	9 μs to16 μs	±40 ns	±30 ns
Line Sync Rise and Falltimes	0.14 μs to 0.3 μs 0.3 μs to 0.8 μs	±20 ns ±40 ns	±15 ns ±30 ns
Line Sync	1.4 μs to 6.6 μs	±20 ns	±15 ns
Sync-to-Start of Burst	2.2 μs to 8.0 μs	±30 ns	±20 ns

FIELD BLANKING TIMING MEASUREMENTS

Measurement	Range	Accuracy	
		at 46 dB	at 60 dB
Equalizing Pulse Duration	1.4 μs to 20 μs	±25 ns	±20 ns
Broad Pulse Separation	1.4 μs to 20 μs	±25 ns	±20 ns

OTHER TIMING MEASUREMENTS

Measurement	Range	Accuracy	
		at 46 dB	at 60 dB
Bar Risetime	0.14 μs to 0.3 μs 0.3 μs to 1.0 μs	±25 ns ±60 ns	±15 ns ±20 ns

AMPLITUDE AND PHASE MEASUREMENTS

Measurement	Range	Accuracy	
		at 46 dB	at 60 dB
Sync Amplitude Error	+100% to −50%	±1.25%	±1.0%
Sync Amplitude Error (with Sound-in-Sync)	+100% to −50%	±1.25%	±1.0%
Burst Amplitude Error	+80% to −50%	±1.5%	±1.4%
Chrominance Reference Amplitude Error	−80% to +50%	±1.5%	±1.25%
Luminance Bar Amplitude Error	+30% to −70%	±0.75%	±0.6%
Luminance Bar Amplitude	200 to 900 mV	±5.5 mV	±4.5 mV
Bar Tilt Error	0% to 40%	±0.7%	±0.4%
Blanking Level	0% to 100% of Zero Carrier	±1%	±1%
2T Pulse K-factor	0% to 10% Kf	±0.7% Kf	±0.4% Kf
Chrominance-Luminance Gain Inequality	±75% of bar amplitude	±1.4%	±1.2%
Chrominance-Luminance Delay Inequality	±300 ns	±35 ns	±25 ns
Chrominance-Luminance Intermodulation	±50%	±0.5%	±0.3%
Differential Gain	0% to +50%	±1%	±0.3%
Differential Phase	0° to +180°	±0.6°	±0.3°
Luminance Nonlinear Distortion	0% to 50%	±0.7%	±0.35%

FREQUENCY RESPONSE MEASUREMENTS

Measurement	Range	Accuracy	
		at 46 dB	at 60 dB
Multiburst Flag Amplitude	15% to 125% of bar	±0.5%	±0.2%
Multiburst Amplitude (first five packets)	0% to 200% of flag	±3.0% (±3.5% on 4.8 MHz packet)	±2.5% (±3.5% 4.8 MHz packet)

LINEAR WAVEFORM DISTORTION MEASUREMENTS

Measurement	Range	Accuracy	
		at 46 dB	at 60 dB
Baseline Distortion	±50% of bar	±0.75%	±0.5%
2T Pulse/Bar Ratio Error	+25% to −90%	±1.5%	±1.25%

LOW FREQUENCY ERROR

Measurement	Range	Accuracy	
		at 46 dB	at 60 dB
Low Frequency Error	0% to 25%	±1.0%	±0.8%

NOISE MEASUREMENTS

Measurement	Range	Accuracy
Continuous Random Noise (weighted)	34 dB to 73 dB 74 dB to 80 dB	±2.0 dB ±2.5 dB
Signal-to-Unweighted Random Noise Ratio	26 dB to 65 dB 66 dB to 72 dB	±1.0 dB ±2.5 dB

ORDERING INFORMATION

For Base Unit Plus Software, Order:

1980 ANSWER with Option 01, NTSC Applications Software

Includes: Left rackmounting adaptor (367-0279-00); right rackmounting adaptor (367-0280-00); tracks (351-0104-03); 15 ft RS-232C modem connecting cable (012-0939-00); rubber cabinet feet (348-0068-00); power cord (161-0066-01); rack slides (351-0623-00); manual.

1980 ANSWER with Option 04, NTSC Monitoring Software

Includes: Same as above.

1980 ANSWER with Option 05, PAL Monitoring Software

Includes: Same as above.

1980 ANSWER Monitoring with Option 06, PAL/NTSC Software

Includes: Same as above.

Option 12 — Automatic Call Equipment Interface

For Software Only, Order:

1980 F04
1980 F05
1980 F06

TEK AUTOMATIC VIDEO CORRECTOR

1440 NTSC Automatic Video Corrector

Remote Control Unit

Remote Monitor Unit

1440 Automatic Video Corrector

Reduces Operating Costs

Extends Transmitter Tube Life and Reduces Maintenance Costs

Maintains Consistent High Quality Color Pictures

Automates Transmitter Modulation Level Control

Maintains Correct Sync-To-Video Ratios During Line Voltage Fluctuations

Automatic VIRS Referenced Correction of:
- **Overall Video Signal Amplitude**
- **Chrominance to Luminance Gain Ratio**
- **Black Level**
- **Chrominance Phase**
- **Burst Gain**
- **Sync Gain**

Optional Closed Loop Capabilities for Greater Efficiency and Economy in Transmitter and VTR Operations

The 1440 VIRS Automatic Video Corrector gives fully automatic correction of video gain, chrominance to luminance gain ratio, black level (set up), chroma phase, burst amplitude, and sync amplitude errors. With this corrector in your facility, the quality of the program signal is rigidly maintained. Ordinary changes and even many severe distortions are automatically corrected.

Auxiliary Units

In most applications, the usefulness of automatic correction is enhanced by a Tektronix Remote Control Unit. You can conveniently select corrector modes and manually correct six signal parameters with this unit. The remote unit allows easy adjustment of the parameter's preset values for operation in the absence of a reference signal. Automatic correction value adjustments are also provided.

The Tektronix Remote Monitoring Unit provides meter indications of the amount of correction applied to the signal.

CHARACTERISTICS

Input Impedance — 75 Ω nominal.

Video Delay — 145 ns.

Output Impedance — 75 Ω.

Linear Waveform Distortions (Maximum) — Field Time: 0.5%, Line Time: 0.5%. Short Time: T Pulse/Bar: 2%. 2T Pulse/Bar: 1%.

Nonlinear Waveform Distortions — Differential Gain (10% to 90% APL): 0.5%. Differential Phase (10% to 90% APL): 0.5%. Dynamic Gain (10% to 90% APL): Picture 0.5%, sync 0.5%. Chrominance/Luminance Intermodulation: 0.5%. Line Time Nonlinearity: 0.5%.

Unweighted Video Signal to Random Noise Ratio — ≥60 dB to 5 MHz.

Spurious Subcarrier — −60 dB.

Field Time Tilt Correction — 25% Tilt on Input Signal: Will be reduced to ≤1%.

Clamping Characteristics — 10% to 90% APL or 90% to 10% APL. Recovery within one line to within five IRE without overshoot. Slow clamp option provided to reduce keyboarding when used with noisy signals. Hum Reduction: 1 V hum on input signal can be reduced to ≤25 mV.

Maximum Correction Ranges — Video Level at Input: ±6 dB. Sync Level at Input: ±3 dB. Chrominance/Luminance Gain: ±3 dB. Burst Level: ±6 dB Burst/Chrominance Phase: ±25°. Black Level Set Up: ±10 IRE.

Reduced Correction Ranges — Video Level: ±2 dB. Sync Level: ±3 dB. Chrominance/Luminance Gain: ±3 dB. Burst/Chrominance Phase: ±25°. Black Level Set Up: ±5 IRE.

Dc Error-Signal Output — Source Impedance: 10 kΩ. Open Circuit Voltage: 10 V for remote metering and telemetry. Six Outputs: Video gain, sync gain, burst gain, relative chroma gain, burst phase, and set up.

POWER SUPPLY

Line Voltage Range — 115 V ac ±10% and 230 V ac ±10%.

Maximum Power Consumption — 35 W.

Line Frequency Range — 48 Hz to 66 Hz.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width	483	19.0
Height	881	3.5
Depth	412	16.2
Weight	**kg**	**lb**
Net	7.6	16.7
Domestic Shipping	11.0	24.1
Export Shipping	16.8	37.0

ORDERING INFORMATION

1440 NTSC Automatic Video Corrector.
Includes: Power cord (161-0066-00); rackmounting hardware (351-0394-01); manual (070-1498-02).

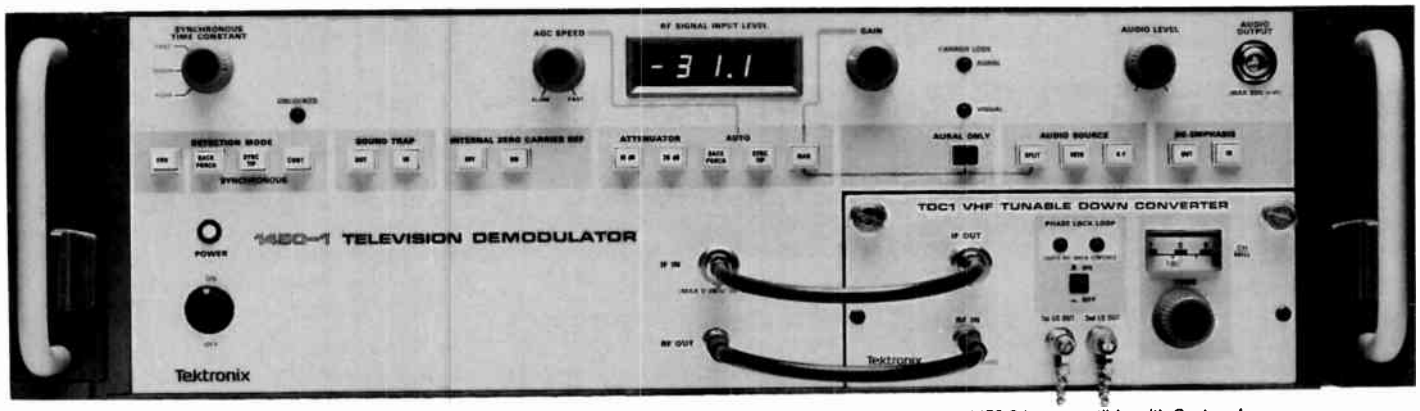
OPTIONAL ACCESSORIES

Remote Control Unit for 1440 — (Includes two connectors.) Order 015-0240-00.

Remote Monitor Unit for 1440 — (Includes one connector.) Order 015-0239-00.

Six Foot Extender Cable — With connectors for use between the 1440 and Remote Control Unit or Remote Monitor Unit.
Order 012-0131-00.

Three Foot Extender Cable — With connectors, for use between the 1440 chassis and the rear rackmounting section.
Order 012-0637-00.



The 1450-1 is compatible with System M Television Transmission, the 1450-2 is compatible with System B/G, and the 1450-3 is compatible with System I.

1450-1/1450-2/1450-3

Measurement-Quality Performance for Negligible Distortion

Synchronous Detection Eliminates Quadrature Distortion

Envelope Detection for Accurately Determined Differential Phase

Surface Acoustic Wave Filter Provides Precise Nyquist Slope; Excellent Long and Short-Term Stability

Digital Readout of Input Power Level for Easy, Accurate Field Strength Readings

Constant-Bandpass Characteristics Over Wide Dynamic Range

Any Single VHF or UHF Channel Operation

UHF and VHF Tunable Down Converters

Conforms to EIA Standard RS-462 (System M Only)

Wideband Audio Output for BTSC Multichannel Sound Applications (System M Only)

Wideband Audio Output Compatible with Japanese Stereo Sound with FAX Channel (System M Only).

The 1450-1 (System M), 1450-2 (System B/G) and 1450-3 (System I) demodulator mainframes are combined with a Tektronix Television Down Converter (TDC) to provide an accurate link between your transmitter's RF signals and video baseband measuring equipment. Unique components work together to identify and eliminate any possible demodulation distortion in reproduced signal characteristics. You see a transparent picture of your transmitter's performance and signal output.

High Performance Spectrum Analyzers for your RF measurements are described on pages 154-174 in the 1986 Corporate Catalog.

Tunable or Fixed-Channel Down Converters

For demodulating an RF signal at a TV channel frequency, the 1450 Series demodulator mainframes must be used with a Tektronix TDC. Three compatible TDCs are available for each system and provide a selection between tunable and fixed-channel performance. The TDC Fixed-Channel Down Converter supports your specified system channel number. Tunable Down Converters available for VHF and UHF channels are the TDC1 and TDC2 respectively.

Demodulation of the transmitter IF signal may be accomplished by using only the mainframe.

Synchronous and Envelope Detection

The 1450 Series demodulators allow you to select either synchronous or envelope detection. Each method has advantages, yet both are required for full measurement capability. For instance, synchronous detection is necessary for measurements that can be seriously affected by quadrature distortion.

The 1450 Series demodulators have two synchronous video detectors operating in phase quadrature. One detects the in-phase signal; the other detects the quadrature component of the video signal. (The quadrature component is a measure of change in visual carrier phase resulting from a change of video level.)

However, if incidental phase modulation is present on the picture carrier, the amount of differential phase measured on a synchronously detected signal will be erroneous. Because of this, an envelope detector is necessary to determine the actual differential phase present. The envelope detector has linear transfer characteristics down to 3% carrier and so provides optimum modulation depth indication.

ICPM (Incidental Carrier Phase Modulation)

This distortion can be easily measured with a Tektronix demodulator using synchronous detection and the quadrature signal output. It cannot be measured with envelope detection, nor can it be measured using a demodulator that is not equipped with two quadrature-phased synchronous detectors and having a quadrature output.

Because of the higher subcarrier frequencies used in BTSC multichannel sound and SAP (second audio program), accurate ICPM measurement is even more critical in these applications.

A special waveform monitor graticule and low pass filter are provided with each 1450-1 for the measurement of this distortion.

Quadrature Distortion

Quadrature distortion occurs when a single sideband signal is demodulated with an envelope detector.

Quadrature distortion most severely affects the chrominance signal, causing a loss of brightness in highly saturated colors, especially those at high luminance levels. Narrow white picture elements against the dark backgrounds are reproduced at reduced brightness.

Synchronous detection of the television RF signal eliminates quadrature distortion, allowing the true performance of the transmitter to be determined.

Tektronix-Developed Surface Acoustic Wave Filter

The 1450 Series demodulators feature a SAW (surface acoustic wave) filter developed by Tektronix. It provides more precise Nyquist slope characteristics without group delay distortion, improves long-term and short-term stability, and lowers maintenance costs compared to conventional filter network circuitry.

In conventional demodulators, the more precisely the bandpass characteristics approach an ideal Nyquist curve, the more complex the filter network required. In the 1450 Series demodulator mainframes however, the bandpass characteristics are determined by just a single component, the SAW filter. Precision is the result.

Conventional tuned IF circuitry must be meticulously adjusted and is subject to change with mechanical and thermal shock. But the SAW filter is in a sealed unit and accurately provides the critical selectivity characteristics of the demodulator—and requires no adjustments.

Constant-Bandpass Characteristics

The Tektronix 1450 Series demodulators offer constant-bandpass characteristics over the entire dynamic range of input signal level. Amplifiers in the mainframe operate at a constant gain, and pin-diode attenuators are used to adjust the overall gain of the demodulator. This more sophisticated approach to AGC (automatic gain control) is necessary to maintain constant-bandpass characteristics over the entire dynamic range of input power (−69 dBm to −3 dBm). Additional attenuation of 30 dB, available in 10 dB steps, can shift the range for higher input power levels. In addition to AGC, demodulator RF/IF gain control can be set for manual operation.

Digital Reading of Input Power

With the accurate (to 0.1 dB) digital readout you get measurements of input power you can depend on at transmitter sites, remote sites, or, for calibrated field strength measurements.

Split and Intercarrier Sound

For making measurements or adjustments on aural transmitters, the 1450 Series demodulators feature both split and intercarrier sound channels. The split carrier channel, which will operate without the presence of the visual carrier, may be used when making measurements on the aural transmitter only.

Four audio outputs give added measurement capability: a 600 Ω output, two low impedance outputs for driving a speaker or headphones, and a calibrated output for making deviation measurements with an ac voltmeter or an oscilloscope.

Multichannel Sound Compatible (System M Only)

The 1450-1 provides three aural detection modes—Intercarrier, Split and Quasi-Parallel. The split carrier mode will operate with or without the presence of the visual carrier. Quasi-Parallel detection substantially reduces the buzz that might otherwise be introduced on the detected signal due to the IF signal passing through the Nyquist filter of the demodulator when the intercarrier detection mode is used.

The 1450-1 has four audio outputs. The speaker and headphone outputs are 8 ohm impedance outputs and are filtered and deemphasized to provide only the monophonic main channel. A 15.734 kHz notch filter is provided to reduce the BTSC stereo pilot tone to an inaudible level.

The 600 ohm balanced output normally provides a full 150 kHz bandwidth output but can be restricted to 20 kHz by moving an internal jumper. The fourth output is a 75 ohm unbalanced output with a 150 kHz bandwidth and a calibrated level of 10 mV per kHz deviation of the aural carrier. This output can be used for accurate measurement and monitoring of the aural channel and can be used to drive a professional multichannel sound decoder, modulation monitor or spectrum analyzer.

CHARACTERISTICS

System RF Characteristics	Fixed Channel TDC	Tunable TDC1 or TDC2 (UHF)	System RF Characteristics	Tunable TDC1(VHF) Fixed Channel TDC	or TDC2 (UHF)
RF Input Impedance	50 Ω (N)*	50 Ω (N)*	Image Rejection Ratio, Second IF Image:		≥60 dB
Return Loss with 0 dB Attenuation	≥20 dB	≥10 dB	IF Rejection Ratio:	≥60 dB	(TDC1 First IF)
Return Loss with ≥20 dB Attenuation:	≥30 dB	≥30 dB			≥50 dB
Frequency:	Any System M, B, G, or I assigned carrier frequency ±20 kHz	(TDC1) All System M or B VHF assigned carrier frequencies, plus CATV Channels 14 through 36, ±27 kHz (TDC2) All System M, G or I UHF assigned carrier frequencies, ±27 kHz			(TDC2 First IF) ≥30 dB
			Adjacent Channel Cross Modulation:	≥60 dB	≥60 dB
			Alternate Channel Cross Modulation:	≥60 dB	≥60 dB
			Variation in System Frequency Response with AGC	(VHF) ≤0.1 dB (UHF) ≤0.15 dB	≤0.25 dB
Level Range*:					
0 dB Mainframe Attenuation	−69 to −3 dBm	−65 to +1 dBm	Variation in System Frequency Response, Channel to Channel:		≤0.3 dB across any 6 MHz channel bandpass
10 dB Mainframe Attenuation	−59 to +7 dBm	−55 to +11 dBm			
20 dB Mainframe Attenuation	−49 to +17 dBm	−45 to +21 dBm			
30 dB Mainframe Attenuation	−39 to +27 dBm	−35 to +31 dBm			
AGC Range:	66 dB	66 dB	Damage level at RF Input	1 watt	1 watt
VHF Noise Figure:	≤10 dB	(TDC1) ≤19 dB	Readout Accuracy:	±2 dB	±2 dB
UHF Noise Figure:	≤11 dB	(TDC2) ≤19 dB	Readout Resolution:	±0.1 dB	±0.1 dB
Image Rejection Ratio, First IF Image:	≥60 dB	(TDC1) ≥50 dB (TDC2) ≥40 dB			

* *In 50 Ω:* *+27 dBm = 5 V RMS* *+31 dBm = 8 V RMS* *−3 dBm = 158 mV RMS* *+1 dBm = 251 mV RMS* *−69 dBm = 80 μV RMS* *−65 dBm = 126 μV RMS*

IF

Input Impedance (Z_{in}) — 50 Ω (BNC).

Return Loss — >18 dB.

IF Level Range — −20 dBm to −64 dBm. (Signal to noise ratio deteriorates as signal level decreases.)

IF Frequency

1450-1: Visual is 37 MHz, 38.9 MHz, or 45.75 MHz ±127 kHz (as specified by the mainframe/TDC options). Aural is 4.5 MHz below visual.

1450-2: Visual is 38.9 MHz ±127 kHz. Aural is 5.5 MHz below visual.

1450-3: Visual is 38.9 MHz ±127 kHz. Aural is 6.0 MHz below visual.

VIDEO

Video Output — Z_0: 75 Ω (2 BNC). Return Loss: ≥34 dB. Level 1 V p-p sync tip to peak white.

Dc Level — Back Porch AGC: Blanking level at 0 V ±50 mV. Sync Tip AGC: Referenced to blanking level, sync tip is at −286 mV ±5.7 mV (1450-1), −300 mV ±6 mV (1450-2, 1450-3).

Line Time Distortion — ≤0.5%, wideband IF, synchronous detection. 1.0% in all other IF, detection mode combinations.

Field Time Distortion — ≤0.5%.

Line Time Nonlinearity — ≤1%.

Differential Gain — Synchronous: ≤1%. Envelope: ≤4%.

Differential Phase — ≤1°.

Chrominance/Luminance Delay — ≤±20 ns.

Chrominance/Aural/Visual Carrier Intermod — ≥50 dB down.

Aural Signal Rejection — ≥46 dB.

Video Signal to Noise Ratio — Low Frequency (p-p video/p-p hum): ≥60 dB. Mid Frequency Coherent (p-p video/p-p noise): ≥50 dB. White Noise (p-p video/RMS noise): ≥60 dB.

Quadrature Output — Z_0: 75Ω (BNC). Return Loss: ≥34 dB. Quadrature Phase: 90° ±2° (with respect to Video Out).

Zero Carrier Reference Gate

1450-1: Width is 30 μs ±10%. Delay is 20 μs ±10% from leading edge of sync. Carrier Cutoff is ≥50 dB. Zero Carrier is ±0.5 IRE. Timing is factory set to line 20 of both fields, internally selectable from line 10 through line 25 of both fields. 1450-2, 1450-3: Width is 30 μs ±10%. Carrier Cutoff is ≥50 dB. Zero Carrier is ±3.5 mV. Timing is factory set to line 16/329 of both fields, internally selectable from line 10/323 through line 25/338 of both fields.

EXT Zero Carrier Reference Drive Input — Z_{in}: ≈5 kΩ (BNC). Level Required: ≈±1 V.

AUDIO

Frequency Response — 1450-1: Deviation Output and 600 Ω Output ±0.1 dB (30 Hz to 50 kHz) ±0.5 dB (30 Hz to 150 kHz). 600 Ω Output can be limited to 20 kHz by jumper. Speaker and headphone Output ±0.4 dB (30 Hz to 20 kHz, 15.734 kHz Notch Filter jumper selecatble). 1450-2, 1450-3: All Outputs ±0.4 dB (30 Hz to 20 kHz).

De-emphasis — 1450-1: Follows standard 75 μs de-emphasis curve ±0.4 dB. 1450-2, 1450-3: Both follow standard 50 μs de-emphasis curve ±0.5 dB.

Harmonic Distortion — 1450-1: 0.1% for 30 Hz to 15 kHz inputs measured with 50 kHz band limiting, 0.5% for 16.5 kHz to 50 kHz inputs measured with 120 kHz band limiting (with ±25 kHz deviation). 1450-2, 1450-3: 0.2% (30 Hz to 15 kHz, with ±50 kHz deviation).

Audio Signal to Noise Ratio — 1450-1 wide band mode: ≥50 dB in all detection modes measured at the 75 Ω output, band limited to 130 kHz and modulation of visual carrier.

≥60 dB in all detection modes measured at the 75 Ω output, band limited to 50 kHz and no modulation of the visual carrier.

1450-1 narrow band mode, 1450-2, 1450-3: Intercarrier Mode: ≥55 dB. Split Carrier Mode: 1450-1, 1450-2 is ≥75 dB. 1450-3 is ≥70 dB. External Aural Intercarrier In: ≥75 dB. Aural Only Mode: ≥75 dB. All at 1 kHz modulation and ±25 kHz (±50 kHz for 1450-2 and 1450-3) deviation.

Deviation Output — 1450-1: 10 mV/kHz ±1% (75 Ω BNC). 1450-2, 1450-3: 50 mV/kHz ±1% (600 Ω BNC).

Aural Intercarier In — Z_{in}: 50 Ω (BNC). Return Loss: ≥20 dB. Level: −30 dBm ±5 dB.

Aural Intercarrier Output — Z_0: 50 Ω (BNC). Return Loss: ≥20 dB. Level Nominal: −6 dBm up to 0 dBm.

600 Ω Balanced Line Output — 1450-1 Wideband Mode: 50 mV/kHz ±3%; Narrowband Mode: 10 dBm at 25 kHz deviation. 1450-2: 10 dBm at 50 kHz deviation. 1450-3: 8 dBm at 50 kHz deviation. Connector XLR.

8 Ω Speaker Output — Level up to 5 W RMS, front panel adjustable. Connector Barrier block.

Headphone Output — Level up to 50 mW into 8 Ω headphone (stereo or mono style). Connector phone jack (monaural output only).

Remote Connector — Alarm output SPDT relay contact rated at 28 V, 3 A. External synchronous/envelope switch. Ground for envelope detection.

Damage Level at RF Input — 1 W maximum (any attenuator setting).

AC POWER

Line Voltage Ranges — 100 V ac ±10%. 120 V ac ±10%, 220 V ac ±10%. 216 V ac to 250 V ac.

Power Consumption — 100 W maximum.

Mains Frequency — 48 Hz to 62 Hz.

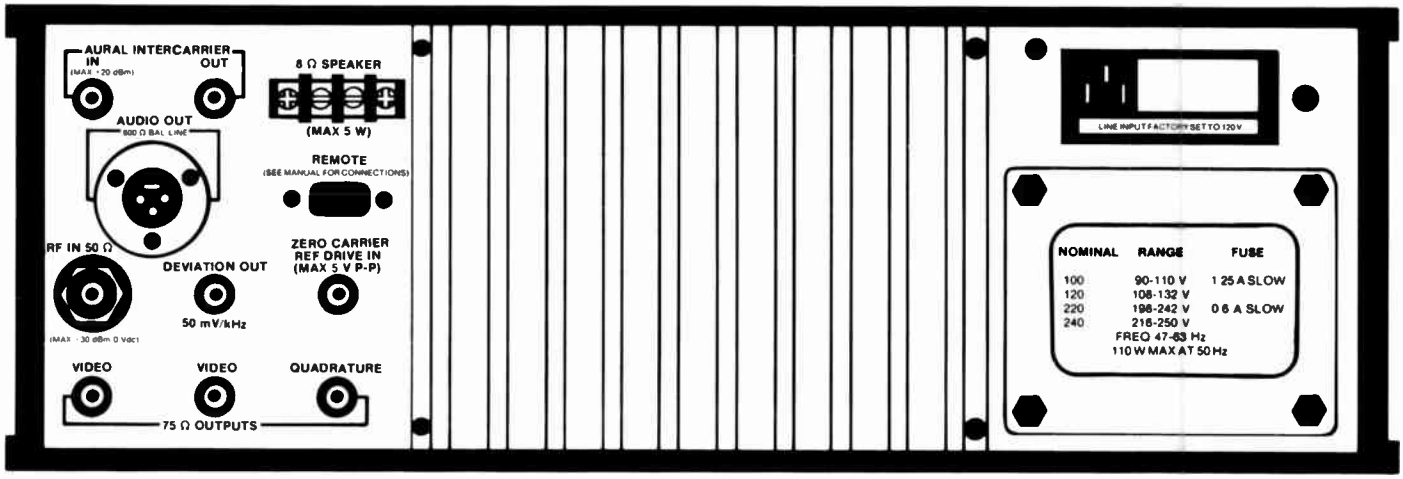
ENVIRONMENTAL

Temperature Range — Operating: 0°C to +50°C.

Altitude Range — Operating: Sea level to 4570 m (15,000 ft).

PHYSICAL CHARACTERISTICS

Dimensions	mm	In
Width	483	19.0
Height	133	5.3
Depth	486	19.1
Weight	**kg**	**lb**
Mainframe	16.3	36.0
Down Converter	2.3	5.0



1450 Rear Panel.

ORDERING INFORMATION SYSTEM M

1450-1 Television Demodulator
(Order one vision IF option)

Includes: Pair rackmount slide guide (351-0301-03); N to BNC coaxial adaptor (103-0045-00); extender circuit board (670-5034-00); 50 Ω BNC coax cable (012-0715-00); 50 Ω SMA double shield coax cable (012-0752-00); two BNC to square-pin adaptor cables (175-2140-00); BNC to Peltola adaptor cable (067-0709-00); TORX screwdriver (003-0816-00); male connector (131-1007-00); hood (200-1170-00); two screws (213-0260-00); low pass filter (015-0352-00). For 1450-1: ICPM graticule (331-0393-12); 0.6 A slow blow fuse (159-0043-00).

OPTIONS

Option 01 — 37 MHz Vision IF.

Option 02 — 38.9 MHz Vision IF.

Option 03 — 45.75 MHz Vision IF.

For demodulation of RF signals, one of the following three down converters must be plugged into the 1450-1 mainframe.

Order one vision IF option and either Option 11 or Option 14.

TDC Fixed Channel Down Converter —
(Stipulate channel number when ordering.)

TDC-1 — Tunable Down Converter VHF Band.

TDC-2 — Tunable Down Conveter UHF Band.

Option 01 — 37 MHz Vision IF.

Option 02 — 38.9 MHz Vision IF.

Option 03 — 45.75 MHz Vision IF.

Option 11 — System M Countries.

Option 14 — System M Countries.

For upgrading 1450-1 and 1450 (S/N BO 19999 and below) to provide a wide band audio output suitable for use with BTSC System multichannel sound in North America install:

1450F20 Field Upgrade Kit.

ORDERING INFORMATION SYSTEM B/G

1450-2 Television Demodulator
(Order both Option 02 and Option 09)

Includes: In addition to 1450-1; a ICPM graticule (331-0393-15); 1.25 A slow blow fues (159-0041-00); manual.

OPTIONS

Option 02 — 38.9 MHz Vision IF.

Option 09 — +90 ns/−170 ns Group Delay.

For demodulation of RF signals, one of the following three down converters must be plugged into the 1450-2 mainframe. Order both Option 02 and Option 12.

TDC Fixed Channel Down Converter —
(Stipulate channel number when ordering.)

TDC-1 — Tunable Down Converter VHF Band.

TDC-2 — Tunable Down Converter UHF Band.

Option 02 — 38.9 MHz Vision IF.

Option 12 — System B/G/I Countries.

OPTION 11 COUNTRIES: SYSTEM M
Antigua, Barbados, Bermuda, Brazil, Canada, Chile, Columbia, Costa Rica, Cuba, Curacao, Dominican Republic, Ecuador, El Salvador, Guam, Guatemala, Johnston Islands, Korea, Mexico, Micronesia, Netherlands Antilles Nicaragua, panama, Peru, Phillipines, Puerto Rico, Samoa, St. Kitts, Surinam, Taiwan, Trinidad/Tobago, uruguay, U.S.A., Venezuela, Virgin Islands.

OPTION 14 COUNTRIES: SYSTEM M
Japan and Okinawa.

OPTION 12 COUNTRIES: SYSTEM B/G/I
Algeria, Austria. Bahrain, Bangladesh, Belgium*1, Brunei, Cyprus, Denmark, East Germany, Egypt, Equatorial Guinea, Ethopia, Finland, Ghana, Gibraltar, Greece, Hong Kong, Iceland, india, Indonesia, iran, Iraq, Israel, Ireland (UHF)*1, Italy (UHF), Jordan, Kenya, Kuwait, Lebanon, Liberia, Libya, Malta, Mauritus, Netherlands, Nigeria, Norway, Oman, Pakistan, Portugal, Qatar, Rhodesia, Saudi Arabia*2, Sierra Leone, Singapore, South Africa (UHF)*1, Spain, Sudan, Sweden, Switzerland, Syria, Tanzania, Thailand*2, Tunisia, Turkey, Uganda, United Arab Emirates, United Kingdom (UHF)*1, West Germany, Yemen Arab Republic, Republic of Yemen, Yugoslavia, Zambia.

**1 System I.*
**2 System B only.*

ORDERING INFORMATION SYSTEM I

1450-3 Television Demodulator
(Order Option)

Includes: Same as for 1450-2.

OPTIONS

Option 02 — 38.9 MHz Vision IF.

For demodulation of RF signals, one of the following three down converters must be plugged into the 1450-3 mainframe. Order both Option 02 and Option 12.

TDC Fixed Channel Down Converter —
(Stipulate channel number when ordering.)

TDC-1 — Tunable Down Converter VHF Band.

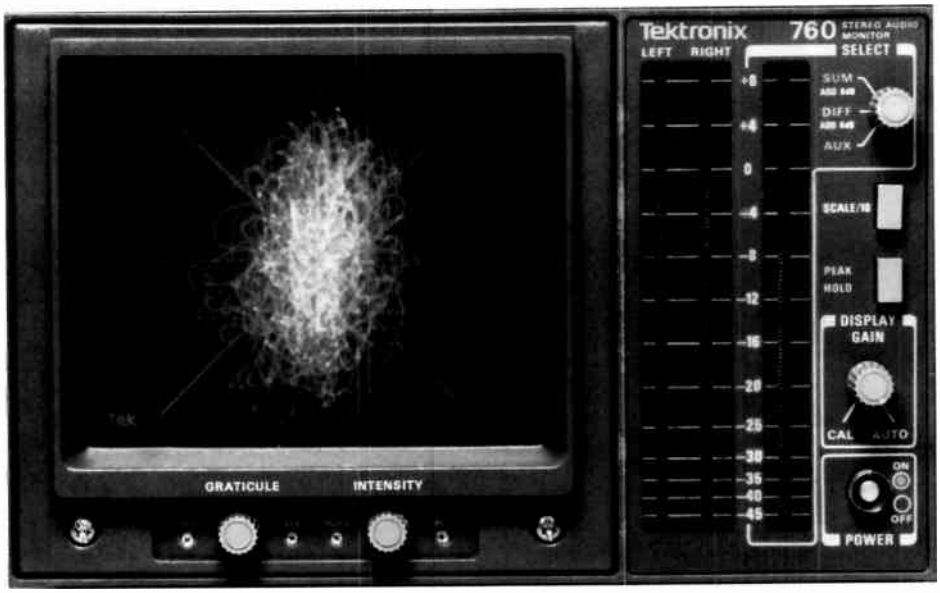
TDC-2 — Tunable Down Converter UHF Band.

Option 02 — 38.9 MHz Vision IF.

Option 12 — System B/G/I Countries.

ORDERING INFORMATION SYSTEMS D and K

1450 Series Television Demodulators and Down Conveters with modifications. Contact Tektronix to reques quote.



760 Stereo Audio Monitor.

760 Stereo Audio Monitor

Graphic CRT Display of Stereo Audio Signal

AGC for Continuously Viewable Pattern

Bar Graph for Quick Setups and Accurate Peak Indication

Third bar indicates mono compatability when set to SUM

Suitable for Phase and Amplitude Measurements

With Tektronix' new 760 Stereo Audio Monitor, the audio engineer can analyze a pattern display of the stereo audio signal. This display, along with a high resolution bar graph, provides accurate monitoring and measurement capabilities. Used in both operation and setup, the instrument provides immediate feed-back of the audio signal for creative or technical correction. With the appropriate test signals, the unit can also be used for accurate phase and amplitude measurements.

On the CRT and adjacent bar graph, you can observe amplitude information, stereo separation, and phase correlation between the Left and Right channels. Also of great importance, you can see monaural amplitudes resulting from the stereo channels.

Your choice of automatic or manual gain control provides flexible control of the pattern size. With no input signal, the display will dim to prolong CRT life.

Two calibrated bars are dedicated to the Left and Right channels. The input to a third bar is selectable from Sum, Difference (both internally derived), and an Auxiliary input on the rear panel. These bars give the operator even greater resolution for setting levels when the SCALE/10 push button is depressed. This increases resolution by a factor of 10 around the 0 dB point of the bars. A selectable three second PEAK HOLD control makes level monitoring easier than ever.

The 760 is ideally suited for use in editing suites, master control, transmission, and any other locations where monitoring the stereo audio signal is a must.

CHARACTERISTICS

Audio Inputs — Balanced Bridging: >10 kΩ/side. Termination: Selectable from >20 kΩ, 600 Ω, 150 Ω (internal jumper). Protection: Will withstand 50 V peak common-mode input, dc to 20 kHz, without damage. Sensitivity: Gain selectable for 0 dB bar indication for sine waves of 0, +4, +8, +12 and +16 dBu (internal jumper).

CRT Display — Graticule: L, R, L=R and L=−R lines. Major and minor tics for phase measurements at 10° and 5° respectively, on L axis. Automatic Gain Control (AGC): Control Range +8 dB to −20 dB (referenced to 0 dB on bar graph). Gain Match and Tracking (over AGC range): ±0.3 dB. Phase Match: ±1° at 0 dB. Frequency Response: ±0.5 dB, 20 Hz to 20 kHz from +8 dB to −20 dB. Z-Axis Dimming: With absence of signal.

Bar Graph — 100 Segment LED: Green to 0 dB, red above 0 dB. Display Range: +8 dB to −45 dB. Scale: dB linear from +8 to −20 dB. Resolution: 0.4 dB/segment. 0.04 dB/segment with SCALE/10 depressed (from +8 to −20 dB). Accuracy: ±0.3 dB at 0 dB and 1 kHz. Peak Hold: Approximately 3 seconds. Switchable On/Off. Attack/Decay Dynamics: PPM (Peak Program Meter) per DIN 45406. Frequency Response: ±0.5 dB, 20 Hz to 20 kHz from +8 to −20 dB. Gain Match: ±0.3 dB. Crosstalk: A +8 dB signal on any channel causes no indication on remaining bars.

Front Panel Controls — Power On/Off. For CRT Display: Intensity; Gain Auto/Man/Cal; Horizontal/Vertical Position; Focus; Trace Rotation. For Bar Graph: Third Bar Selector SUM, DIFF, AUX; Peak Hold On/Off; SCALE/10 (expander).

Rear Panel Connectors — XLR Inputs: Left, Right, Auxiliary. Power: Fuse

PHYSICAL CHARACTERISTICS

Dimensions	mm	In
Height	133	5.25
Width	214	8.424
Length	429	16.875
Weight (approximate)	**kg**	**lb**
Net	4.5	10

INCLUDED ACCESSORIES

Instruction Manual (070-5992-00), Power Cable Assembly (161-0066-00).

OPTIONAL ACCESSORIES

Cabinets — Plain: Order 1700F00.

Cabinets — Portable: Order 1700F02.

Rack Adaptor — Order 1700F05.

Blank Panel — Order 1700F06.

DC Operation Kit (12 Vdc) — Order 1700F10.

Battery Pack — Order BP1.

ORDERING INFORMATION

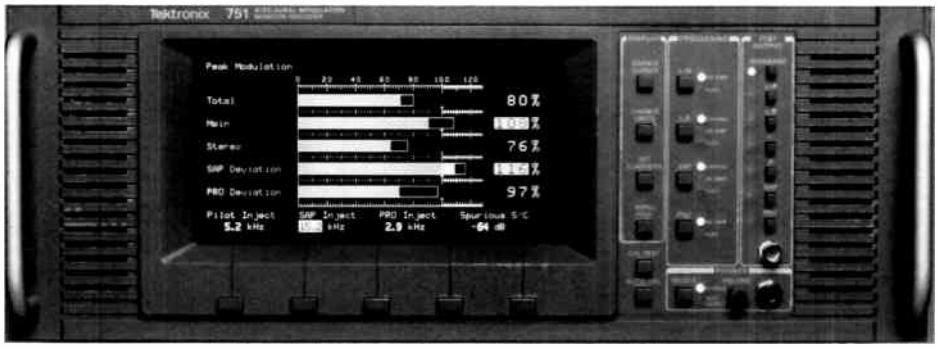
The standard instrument is shipped without a case or handle. If your application is for bench or portable use, please order the appropriate enclosure from the optional accessories list. The 760 is a UL recognized component and meets the requirements for listing when used in the appropriate enclosure.

760 Stereo Audio Monitor

Portable DC powered applications — 760 Stereo Audio Monitor plus 1700F10 DC Power Converter, 1700F02 Portable Cabinet, and BP1 Battery Pack

NEW PRODUCT

TEK 751 BTSC AURAL MODULATION MONITOR/DECODER



751 BTSC Aural Modulation Monitor/Decoder.

751 BTSC

Aural Modulation Monitor/Decoder

Precision Modulation Monitor for Entire BTSC Sound Channel

Simultaneously Displays all Components Necessary to Ensure Modulation Remains Within Legal Limits

Alternate Display of Processed Audio Levels for Left, Right, Sum, Difference, SAP and PRO

Electroluminescent Bar Graph with Precisely Controlled Dynamics

Bars Feature Peak Indicators with Timed Peak Hold and Easily Set Peak Limits

Digital Readout Accompanies Each Bar for Accurate Setups

Internal Auto-Calibrator Ensures Accurate Modulation Measurements

The new 751 BTSC Aural Modulation Monitor/Decoder provides accurate modulation monitoring and measurement of the BTSC encoded TV sound channel.

The 751 comes ready to monitor the entire BTSC sound channel, including SAP and PRO. Should the needs of your station change, a simple soft-key controlled menu can add or delete SAP or PRO from the display.

Two sets of parameters can be alternately displayed by a simple front-panel selection. Similarly, bar graph and digital readout units of measure can be changed from % of maximum, to kHz deviation and dB, with the simple push of a button.

Also displayed are injection levels for SAP, PRO, and Stereo Pilot, as well as Residual Stereo Subcarrier.

Instantaneous peak values as well as "held" peak values are displayed as calibrated bars. Each bar is accompanied by a digital readout that corresponds to the "held" peak value. The bar and readout both indicate when an easily set peak limit has been exceeded.

Processing is front-panel selected from Expand, De-emphasis, and Flat. A monitor output is provided on both the front- and rear-panels for external measurements of the Left and Right stereo channels, SUM, DIFF, SAP, PRO, and full baseband signal. A switchable headphone output is also located on the front panel.

Precisely decoded Left and Right stereo channels, SAP, and PRO 600Ω balanced line outputs are provided on the rear panel through XLR connectors.

Remote alarm contact closures for Pilot Unlocked (from horiz sync) and Stereo Channels Out of Phase are provided on the rear-panel through a 9 pin D connector. Alarm conditions are also indicated on the display. H sync for measuring Pilot Phase Lock is obtained via the rear panel Composite Video loop-through connector.

Automatic calibration of the display is accomplished by internally generating a calibration signal routed through the 1450-1, which provides a calibrated 1450-1 Deviation Out signal. This operation, as well as a calibration test, is software controlled.

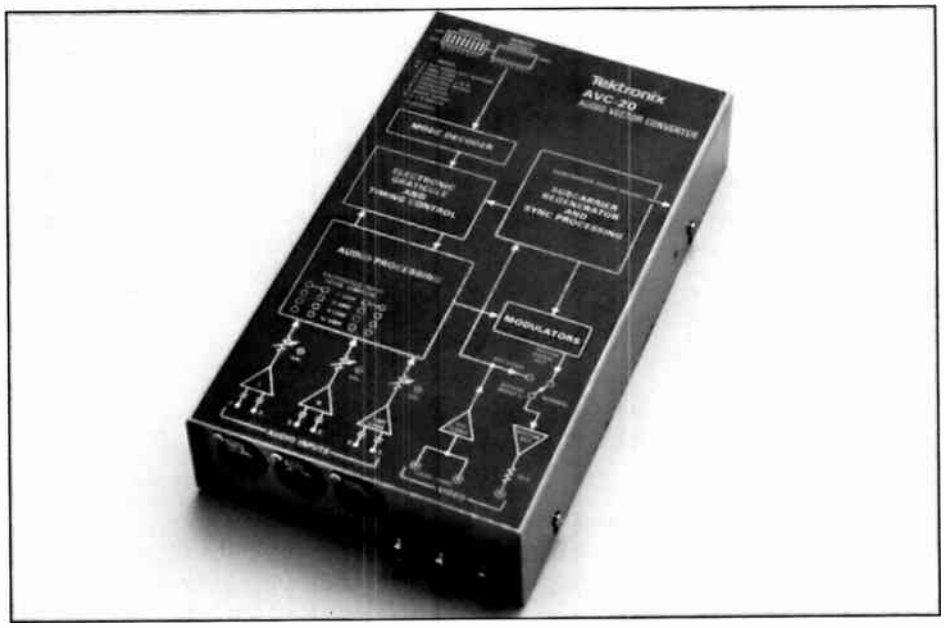
The 751 is a 7″ high, full rack width instrument that weighs ~ 30 lbs.

ORDERING INFORMATION

751 BTSC Aural Modulation Monitor/Decoder

Includes: Power cord; rackslides; circuit board extender; instruction manual.

NEW PRODUCT



AVC-20 Audio Vector Converter.

AVC-20 Audio Vector Converter

Use with Any NTSC Vectorscope

Balanced Line Level Inputs

User Selectable Display Formats
–Lissajous Pattern with Calibrated Amplitude
–Lissajous Pattern and Sweep Displays of Both Channels

Time Code or Third Channel Input
–Field Locked For Time Code Phase

Time Versus Amplitude Sweep Display
–Selectable Among All Three Inputs
–Left Plus Right Sweep

Low Power Consumption

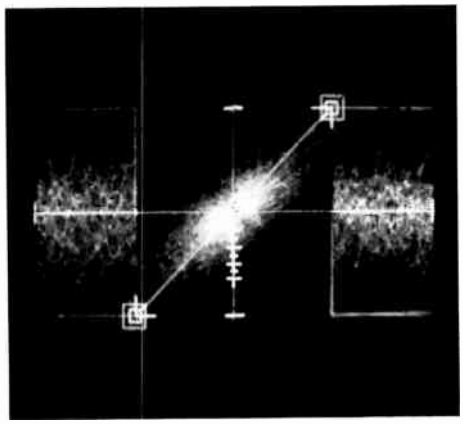
Cost Effective

No Front Panel Space Required

Simple Remote Control

The AVC-20 provides stereo audio monitoring capability when installed with an NTSC vectorscope. Complete audio monitoring can be added to VTR bridges, master control consoles and other locations requiring stereo audio monitoring without modifying the vectorscope and without using front panel space.

Stereo phase, individual signal amplitudes and audio distortions can be observed by simply using the B input to an existing vectorscope. A third audio input channel and a field locked sweep are available for monitoring time code or a second language program.



Live audio, left and right channels, time versus amplitude sweep display, and Lissajous pattern (center) with correct stereo phase.

The Tektronix AVC-20 is easy to operate, install and afford. It's an excellent choice for stereo television facilities.

Audio Monitoring

In an operational television facility, easy to use, reliable instrumentation is a necessity and the AVC-20 provides a multitude of selectable displays that fulfill many audio monitoring requirements. The most versatile display includes a left and right audio sweep displayed simultaneously with a Lissajous display for stereo phase at a glance (illus. A). A Lissajous only display is available for simple applications (illus. B). A time versus amplitude sweep display of the left channel, the right channel, or the left plus right channel are available for detailed inspection of each audio signal (illus. C).

A third input channel provides time code monitoring. It allows an operator to make sure the time code signal is locked to video, is adequately free of noise and of the correct amplitude. It also lets the operator see if the time code sync word is in phase with reference video (illus. D). Any of the eight display modes can be internally or remotely selected with a simple ground closure.

Stereo audio presents new challenges to maintaining audio quality in a television facility. The Tektronix AVC-20 employs an innovative concept allowing easy and inexpensive monitoring of a stereo audio signal without the need to use front panel space. Operators can set the audio level against the calibrated electronic graticule, while simultaneously checking for audio clipping, audio phase reversal, or measuring phase error. These observations can be made with this single display on an existing vectorscope.

The Tektronix AVC-20 brings unprecedented versatility at an affordable price to a stereo television facility.

Installation

The AVC-20 is designed for easy integration into an existing system. Starting with an NTSC vectorscope, audio capability can be added in a few minutes. The B input on many vectorscopes is not used and provides an ideal opportunity for fast and simple installation. As illustrated in Figure 1, the AVC-20 can be installed by looping the existing A signal through the AVC-20 and reconnecting it to the vectorscope A input. The AVC-20 vector output is then connected to vectorscope B input.

If the B input is being used, then the configuration in Figure 2 can be used by taking advantage of the Reference Video Out (Bypass) mode. A simple ground closure switch can be mounted at a convenient location and will select either the normal video signal or the AVC-20 vector signal.

The AVC-20 can be placed in several convenient locations within the VTR bridge or equipment rack. A mounting bracket and velcro strips are provided.

CHARACTERISTICS

Audio Inputs — Balanced Bridging >10K per side with >40dB common mode rejection.

Full Scale Input calibrated for 0, 4, 8, or 12dBm jumper selectable with range adjustable for levels from −6 to 12dBm (0dBm = 1mW).

Maximum Input is 18dBm.

Left or Right Phase Error <1 degree from 100Hz to 10KHz and <5 degrees from 20Hz to 20KHz.

Frequency Response from 20Hz to 20KHz within 0.2dB of response at 1KHz.

Time Code Input — Input is balanced bridging >10K Ohms with a bandwidth >100KHz.

Input level is adjustable for inputs from 0 to 12dBm while maintaining a 4cm deflection.

External Reference Loop-Thru — High Z input with >40dB return loss from 50KHz to 5MHz.

Input level from 0.75 to 1.5 volt composite video signal (black burst).

TEK AVC-20 AUDIO VECTOR CONVERTER

Subcarrier Genlock — Capture range within 50Hz of Fsc.

Quad phase error <= 1 degree.

Adjustable delay compensation of greater than 360 degrees.

Vector Output — Maximum output noncomposite (no sync) 1 volt peak to peak into 75 Ohms.

Return loss >26dB from 50 KHz to 5 MHz.

Power — Mains voltage range is 105 to 129 volts rms.

Power consumption is 10 Watts maximum (34 BTU/hour).

Mains frequency is 60Hz.

ENVIRONMENTAL

Temperature non-operating — −55 degrees C to +75 degrees C.

Temperature operating — 0 degrees C to +50 degrees C.

Altitude non-operating — to 50,000 feet.

Altitude operating — to 15,000 feet.

SAFETY/EMI

Designed to meet or exceed:
UL-1244
Factory Mutual-3820
CSA Bulletin 556B
IEC 348
FCC EMI Compatibility

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Height	510	2.0
Width	157	6.175
Length	273	10.75
Weight (approximate)	**kg**	**lb**
Net	1.82	4

ORDERING INFORMATION

AVC-20 AUDIO VECTOR CONVERTER

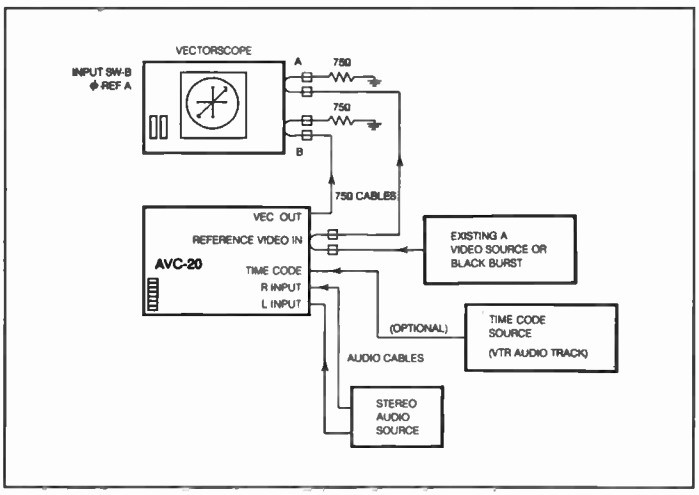


Figure 1.

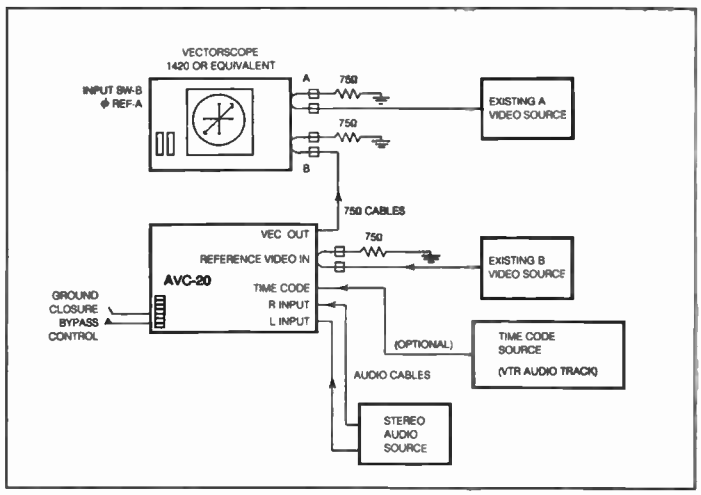


Figure 2.

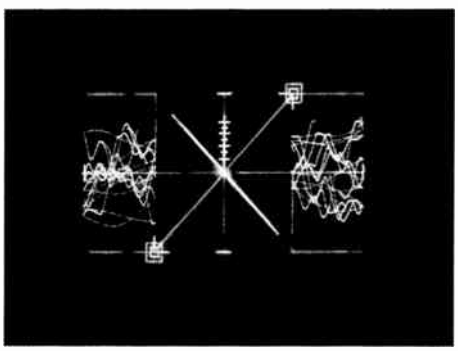


Illustration A. Live audio display with correct amplitude, 180 degree phase reversal.

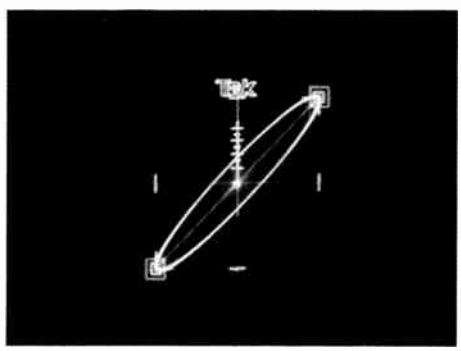


Illustration B. Lissajous pattern with 15-20 degrees of phase error, correct amplitude.

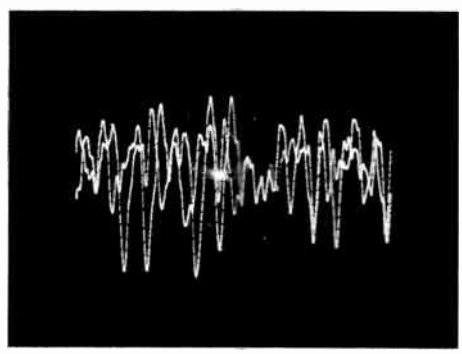


Illustration C. Time versus amplitude sweep display of an audio channel.

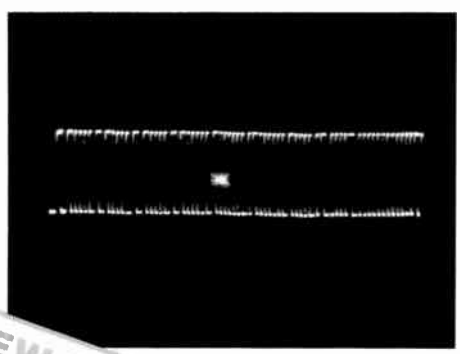
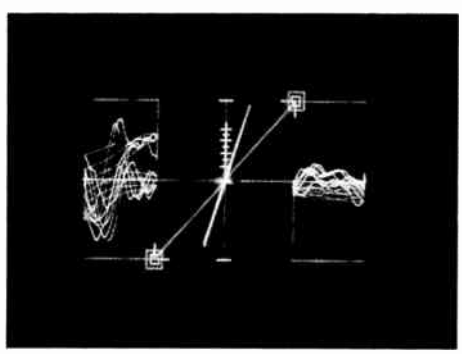
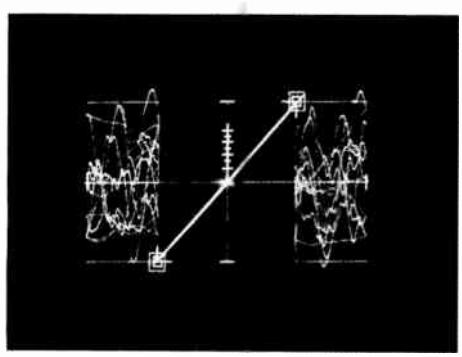


Illustration D. Time code display with correct sync word phase.



Live audio display with low amplitude, right channel.



Live audio display with correct amplitude, minimum phase error.

1430 Random Noise Measurement Set Front Panel

1430 Random Noise Measurement Set

Conforms to CCIR Recommendation 568

In-Service Testing

Out-of-Service Testing

Program Material Protected by Fail-Safe Provisions

525/60 or 625/50 Standards

The 1430 provides random noise measurement capabilities on an in-service basis using the spatially adjacent noise matching technique with a waveform monitor. A program channel allows deletion of VITS and/or noise on selected lines in the vertical blanking interval and a monitor channel is provided for making measurements in conjunction with a waveform monitor.

The 1430 has two sections. One section, permanently mounted in the rack, contains inputs and outputs and program protecting material. The second section, containing circuitry and controls, may be easily removed without cable disconnection.

Monitor Channel

The monitor channel has an output independent from program for waveform comparison of the noise on the incoming signal and noise from the internal noise generator. Front-panel controls determine monitor channel parameters with three operating modes: VITS, Full Field, and Out of Service.

In the VITS mode, any line between 10 and 21 in either or both fields may be selected for insertion of the reference noise. The Full Field mode provides insertion on all active lines.

The Out of Service mode is provided for measurements on sources that do not have composite sync. In particular, these include transmission circuits not carrying signals at the time testing is conducted. Horizontal sync is added for waveform monitor synchronization.

In all modes the insertion width is internally set at 26 μs. Delay between insertion and sync is controlled by the Delay adjustment. A switch and a potentiometer covering a range of 0 IRE to 100 IRE controls the insertion pedestal level.

Monitor channel gain control, with a ±3 dB range, allows normalizing the signal for a 1 V peak-to-peak signal so that noise measurement relative to 1 V may be made. The internal noise weighting filter may be switched in or out from the front panel for evaluation of the spectral content of the incoming noise. This filter is in for the monitor channel only and does not affect the program output.

The 1430 may be used on both 625/50 and 525/60 systems but is shipped equipped for 525/60. The 1430 Option 01 is equipped for 625/50. Both models use the unified weighting filter per CCIR Recommendation 568. Insertion loss characteristics are as follows:

Insertion Loss ≈	
1 MHz	5.9 dB
2 MHz	10.2 dB
3 MHz	12.0 dB
4 MHz	13.0 dB
5 MHz	13.6 dB

Program Channel

The Program Channel has a 75 Ω input impedance and unity gain and output impedance of 75 Ω. No program impairment is introduced. A relay provides program signal continuity if the 1430 loses power. Internal programming, readily changeable, controls all deletion parameters. Up to three lines between 10 and 21 in either or both fields may be deleted. The deletion may be varied between the first half, second half, or full active portion of the video line. A pedestal may be inserted in the deleted portion of a line at 10 IRE, 50 IRE, or 100 IRE levels.

CHARACTERISTICS

PROGRAM CHANNEL

Signal Input Level — 1 V nominal.

Input Impedance — 75 Ω nominal.

Input Return Loss — Power On: ≥46 dB to 5 MHz. Power Off or Bypass: ≥40 dB to 5 MHz.

Output Impedance (Operating) — 75 Ω nominal.

Output Return Loss (All) — ≥30 dB to 5 MHz.

Output Blanking, Dc Level — 0 V within 50 mV, for blanking pulses.

Inserted Pedestal Level — Adjustable to 100 IRE, 50 IRE, 10 IRE, or 0 IRE.

2T Pulse to Bar Amplitude — Within 0.25%.

Mod Sin² Pulse (Chrominance and Luminance) — 100% within 0.5%.

Waveform, Tilt — Field Rate Squarewave ≤0.5%, 26 μs Bar, ≤0.5%.

Differential Phase (10% to 90% APL, Standard Input) — Program Output: ≤0.15°.

Differential Gain (10% to 90% APL, Standard Input) — Program Output: ≤0.2%.

Line Time Amplitude Nonlinearity (10% to 90% APL, Standard Input) — ≤0.5%.

Random Noise — Program Output: ≥75 dB (RMS) down (using weighting and low pass filters, 5 MHz).

Hum or Transients on Noninserted Lines — ≥60 dB down, (using weighted and low pass filters, 5 MHz).

Spurious Signals During Blanking Lines — ≥40 dB down, low pass (5 MHz).

Signal Attenuation in Delete Mode — 2T Pulse: ≥70 dB down. Subcarrier (Color Bars): ≥60 dB down. Insertion pedestal: 10 IRE, 50 IRE, and 100 IRE, first half, second half, or entire line (up to 3; 10 to 21) or full field.

Unwanted Pedestal at Time of VITS Insertion — ≤0.7 IRE.

Time Jitter — ≤5 ns.

NOISE

Pedestal Level — Pedestal Amplitude: 10 IRE, 50 IRE, and 100 IRE.

Pedestal Position (Insertion Mode Only) — Delay: 10 μs to 50 μs.

Noise Amplitude — 20 dB to −59.5 dB (0 dB = 700 mV RMS).

Noise Attenuators — Absolute Amplitude: Within 1 dB.

Noise Spectrum — Energy/Unit Bandwidth: Flat within 6 dB, 15 kHz to 5 MHz.

Output Impedance — 75 Ω nominal.

Output Return Loss — ≥30 dB.

Noise Weighting and Low Pass Filter — Per CCIR recommendation 421-2.

AC POWER

Line Voltage Range — 115 V ac: 90 V to 132 V. 230 V ac: 180 V to 264 V. Standard 1430: Factory set at 115 V ac. 1430 Option 01: Factory set at 230 V ac.

Maximum Line Current — 0.25 A.

Maximum Power Consumption — 30 W.

Line Frequency Range — 48 Hz to 66 Hz.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in
Width	483	19.0
Height	44	1.7
Depth	429	16.9
Weights	**kg**	**lb**
Net	4.5	10.0
Shipping	7.2	16.0

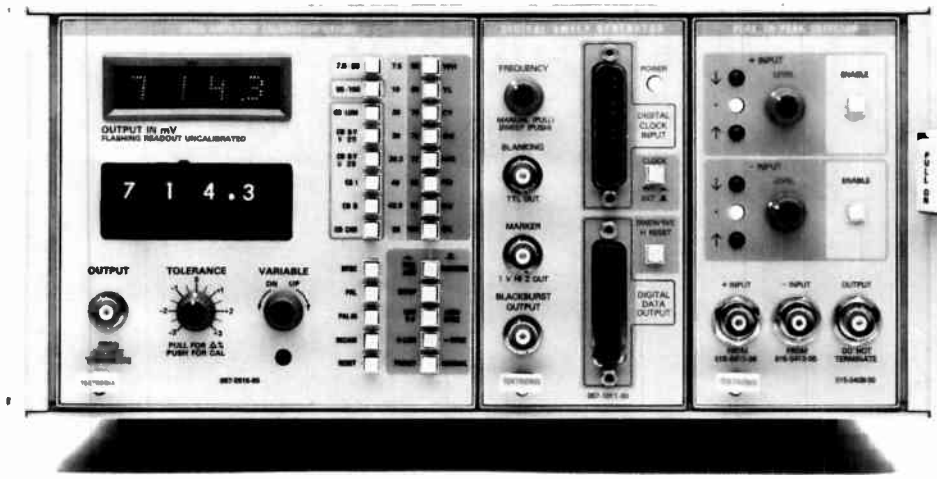
ORDERING INFORMATION

1430 Random Noise Measuring Set (525/60).

Includes: One pair slide guide (351-0331-03); cover program front panel (200-1481-00); manual.

Option 01 — Random Noise Measuring Set (625/50).

TEK DIGITAL SWEEP GENERATOR, PEAK-TO-PEAK DETECTOR AND VIDEO AMPLITUDE CALIBRATION FIXTURE



Video Amplitude Calibration Fixture, Digital Sweep Generator, and P-P Detector shown in a Tektronix TM 504 Mainframe.

Accurate calibration and verification of video equipment performance is essential for maintenance of optimum television system quality and thus signal quality.

New products, as well as calibration standards and procedures, have been developed to help provide accurate and NBS-traceable calibration and performance verification of Tektronix television products.

Video Amplitude Calibration Fixture

Provides a Standard Reference for Amplitude Calibration

Preset Values for Common Video Signals

NTSC, PAL, PAL-M, SECAM Compatible

The VAC (Video Amplitude Calibration Fixture) is a precision test fixture used in the measurement of common video signals and the calibration of video test signal generators and waveform monitors. It provides a simple means of measuring and calibrating luminance and chrominance amplitudes associated with most video signals.

The VAC provides a squarewave amplitude reference from 0.0 mV to 999.9 mV peak with a resolution of 0.1 mV and an accuracy of 0.05%. Signal amplitude may be selected using a four-digit front panel lever-switch or from over 500 preset values stored in EPROM. The VAC preset amplitudes are compatible with NTSC, PAL, PAL-M and SECAM television systems.

In the design of the VAC, careful attention was paid to thermal tilt to ensure accurate conversion from dc calibration to squarewave output. Unique choice of output impedance compensates loading effects when calibrating equipment with loop-through inputs.

The calibration of the VAC requires only a digital voltmeter with an accuracy of 0.01%.

The VAC operates in any of two compartments of the Tektronix TM 500 or TM 5000 Series power modules (except TM 501).

CHARACTERISTICS

Output Signal
Front Output Connector — 37.5 Ω; BNC connector located on front panel.
Rear Interconnect — 0.0 Ω; Rear edge connector pins 27A and 28A.
Amplitude Range (Tolerance Disabled) — 0 mV to 999.9 mV ±(0.05% +0.1 mV); p-p squarewave amplitude.
Amplitude Range (Tolerance Enabled) — 0 mV to 999.9 mV ±(0.5% +0.1 mV) + Tolerance reading; p-p squarewave amplitude.
Resolution — 0.1 mV.
Risetime — >1 μs.
Frequency — NTSC, PAL-M, 270 Hz nominal; PAL, SECAM, 275 Hz nominal.

ENVIRONMENTAL
Normal Operating Temperature — +15°C to +35°C.
Operating Temperature Range — 0°C to +50°C.
Weights — Net: 1.4 kg, (3.0 lb). Net Shipping: 4.5 kg, (10.0 lb).

ORDERING INFORMATION

Video Amplitude Calibration Fixture
Order 067-0916-00
Includes: (±0.025%) 75 Ω Terminator (011-0102-01); 0.06% attenuator (011-0134-00); subcarrier harmonic rejection filter (015-0407-00); manual.

OPTIONAL ACCESSORY
Low Loss Cable 72 inch 75 Ω —
Order 012-0159-01

Peak-To-Peak Detector

NBS-Traceable Frequency Response Standard

Ultra Flat Response

Detector Amplifier Corrects Detector Diode Gain and Offset Errors

The 015-0408-00 Detector Amplifier, combined with a 015-0413-00 Detector Head, comprise an NBS-traceable peak-to-peak detector system for baseband video frequency response testing. This system allows precise comparison of sinewave amplitudes at frequencies throughout the video spectrum. Typical response is accurate to as low as ±0.02% (±0.002 dB).

The frequency response of an analog generator may be calibrated using the peak-to-peak detector system as a transfer standard. The generator may then be used as a frequency response transfer standard to calibrate frequency response and chrominance-luminance gain of test equipment such as waveform monitors and vectorscopes.

A second detector head may be ordered for differential measurements.

CHARACTERISTICS

Input Signal Range — 0.25 V to 1.0 V p-p.
Envelope Gain Unit — ±0.1% for 1% signal change.
Input Impedance — 75 Ω.
Frequency Response

Frequency	Performance Requirements	Supplemental Information		
		Typical Response	Transfer Uncertainties	
			TEK	NBS
25 kHz	+0.1, −0.7%	+0, −0.25%	±0.05%	±0.01%
50 kHz	+0.1, −0.3%	+0, −0.1%	±0.05%	±0.02%
100 kHz	±0.1%	±0.05%	±0.05%	±0.02%
200 kHz	±0.1%	±0.02%	±0.05%	±0.05%
500 kHz	±0.1%	±0.02%	±0.05%	±0.05%
1 MHz	0.0% (Reference)	±0.02%	±0.05%	±0.05%
2 MHz	±0.1%	±0.02%	±0.05%	±0.1%
5 MHz	±0.1%	±0.02%	±0.05%	±0.1%
10 MHz	±0.15%	±0.05%	±0.05%	±0.1%
20 MHz	±0.2%	±0.1%	±0.05%	±0.2%
30 MHz	±0.5%	±0.2%	±0.1%	±0.2%
50 MHz	±2.0%	±1.0%	±0.2%	±0.5%

ORDERING INFORMATION

Peak-to-Peak Detector
Order 015-0408-00
Includes: Detector head and data sheet with NBS-traceability curves (015-0413-00); 72 inch low loss 75 Ω cable (012-0159-01); manual.

OPTIONAL ACCESSORY
Extra Detector Head — (For differential measurements). Order 015-0413-00

Digital Sweep Generator

Digitally Derived Sweep Signal

10-Bit Digital Data for Use with 1900-Series Digital Test Signal Generators to Reconstruct Analog Sweep

Frequency Range 55.9 kHz to 7.16 MHz Field Sweep or (Manually Adjustable) CW

The Digital Sweep Generator provides 10-bit, 14.31818 MHz, digital data words derived from a cosine lookup table. The output signal sweeps from 55.9 kHz to 7.16 MHz in each field with high spectral purity and amplitude accuracy when used with the DAC in a 1900 Series generator. A front panel connector provides SMPTE*[1] compatible balanced ecl data. Data is continuous through blanking so that it can be used with noncomposite video detectors. Sync and burst may be inserted by a 1900 Series generator using the blanking output on the DSG if desired. The Digital Sweep Generator may be locked to a 1900 Series generator using TRS and clock outputs from the 1900 Series generator. Alternatively, the 1900 Series generator may be genlocked to the black burst output from the sync generator in the Digital Sweep Generator. A separate marker output provides identification of 1 MHz intervals, as well as 3.58 MHz and 4.43 MHz, during the sweep.

The Digital Sweep Generator is enclosed in a single wide TM 500 package. The front panel includes an LED power indicator, two 25-pin digital data connectors, three BNC connectors for blanking, markers, and black burst outputs, and one variable control to manually set CW frequencies. Digital interfaces of the DSG conform to the signal levels, clock rate and pinout of the proposed SMPTE standard.

When the Digital Sweep Generator is used in conjunction with a 1900 and an 015-0408-00 peak-to-peak detector (included accessory), it will provide an NBS-traceable analog frequency response standard and completes an effort to provide NBS-traceable performance verification of Tektronix television generators, waveform monitors, and other television equipment.

*[1] *The proposed SMPTE standard "Digital Format for a Parallel Interface (System M/NTSC)," draft of July, 1979.*

CHARACTERISTICS

Digital Sweep Output

Frequency Range — 55.93 kHz to 7.159 MHz in 55.93 kHz increments; Field Sweep, or CW digital data.

Format — SMPTE Standard parallel 10-bit signal.

Sample Clock Frequency — 14.31818 MHz (4 fsc) ± 100 Hz; also accepts external 14.3 MHz clock from 1900.

Blanking — Vertical: 22 lines to 23 lines. Horizontal: 10.8 μs.

Markers

1 V at 1.006747 MHz.
1 V at 2.013494 MHz.
1 V at 3.020241 MHz.
0.5 V at 3.579545 MHz.
1 V at 4.026988 MHz.
0.5 V at 4.418501 MHz.
1 V at 4.977805 MHz.
1 V at 5.984552 MHz.

Marker frequencies are multiples of 55.93 kHz.

ENVIRONMENTAL

Temperature Range — Operating: 0°C to +50°C. Nonoperating: −40°C to +65°C.

Altitude — Operating: To 4752 m (15,000 feet). Nonoperating: To 15 240 m (50,000 feet).

Weights — Net:0.6 kg (1.3 lb). Net Shipping: 1.3 kg (2.8 lb).

ORDERING INFORMATION

Digital Sweep Generator
Order 067-1011-00
Includes: P-p detector (015-0408-00); ECL data cable assemblies (175-3671-00); 72 in low loss 75 Ω cable (012-0159-01); manual.

OPTIONAL ACCESSORY

Detector Head — Order 015-0407-00

Test Modulator

High Quality Double-Sideband Modulator

Available in Five Versions Covering Systems M, I, B, and G

RF Output is −25 dBm ±3 dB

IF Output is −24 dBm ±3 dB

Separate Video and Aural Carrier Level Controls

Group Delay Precorrection Systems M, B, and G

The 1450 Series Test Modulator is used to test a television demodulator plus down converter (system) or the television demodulator alone. Test modulators are available for four CCIR Systems and three visual IF Carrier Systems. The Test Modulator converts baseband video frequencies to a specified IF or RF. The aural carrier is below the visual carrier frequency at the IF output and above the visual carrier at the RF output.

Group delay pre-correction and sound pre-emphasis switches are front panel mounted. The RF and IF outputs provide double-sideband modulated signals of high quality. State-of-the-art circuitry is used to achieve high accuracy and stability. The test modulator needs very little maintenance or recalibration.

ORDERING INFORMATION

TEST MODULATORS

Test Modulator — 37 MHz for 1450-1.
Order 067-0886-01
Test Modulator — 38.9 MHz for 1450-1.
Order 067-0886-02
Test Modulator — 45.75 MHz for 1450-1.
Order 067-0886-03
Test Modulator — 38.9 MHz for 1450-2.
Order 067-0886-04
Test Modulator — 38.9 MHz for 1450-3.
Order 067-0886-05
Extender Cable — for TDC/14501,-2,-3.
Order 067-0899-00

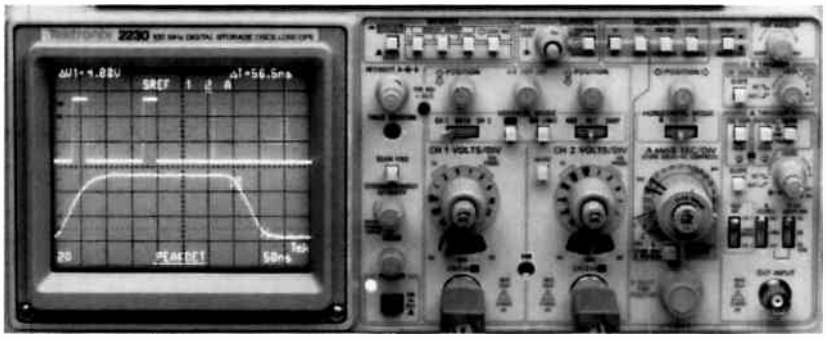
Other Calibration Fixtures for Tektronix Television Products.

ORDERING INFORMATION

Diagnostic Prom Order 067-0964-00
Pattern Generator — Order 067-1039-00

Tektronix Calibration Fixtures (067-XXXX-0X part numbers) are designed for calibration and verification of specific products. Some fixtures may not be supported at the same level as standard Tektronix products. Your local Tektronix sales office can advise you regarding availability and support.

TEK 100 MHz, 60 MHz DIGITAL STORAGE OSCILLOSCOPES



2230/2220

GPIB IEEE-488

The 2230 Option 10 and 2220 Option 10 comply with IEEE Standard 488-1978 and use Tektronix *Standard Codes and Formats*. The 2230 Option 12 and 2220 Option 12 features Standard RS-232C and use Tektronix *Standard Codes and Formats*.

100 MHz Digital Storage and Nonstorage (2230)

60 MHz Digital Storage and Nonstorage (2220)

100 ns Glitch Capture at Any Speed

Cursors for Time and Voltage Measurements (2230)

Point Selectable Pre/Posttriggering

4K Record Length

Post Acquisition Expansion, Compression, and Positioning

GPIB or RS-232C Optional

26K Battery-Backed Save Reference Memory (2230 Option 10 or 12)

TYPICAL APPLICATIONS

Medical Equipment Servicing
Digital Design and Troubleshooting
Power Supply Design and Troubleshooting
Electromechanical
Stress/Vibration Analysis

The 2230 and 2220 are the answer for general and special purpose storage needs. These high performance portable scopes have storage and nonstorage bandwidths of 100 MHz (2230) and 60 MHz (2220).

Both scopes have been designed with many features which enhance their usefulness in your applications. The 2230 offers cursors and CRT readout enabling you to measure time or voltage differences easily and accurately. The multiple Save Reference memories allow you to view both stored and current waveform acquisitions onscreen simultaneously. Weighted signal averaging can be used to remove random noise from a signal and improve measurement accuracy.

Peak detection makes 100 ns glitch capture possible at any sweep speed. This mode digitizes and stores, in acquisition memory as a data pair, the minimum and maximum levels of the input signal. The resulting display can be used to catch glitches, as narrow as 100 ns, view frequency drift and amplitude modulation, or detect aliasing.

Unlimited storage time; expandable, compressible, repositionable stored traces; save reference memory; pre/post trigger viewing; roll mode; standard X-Y plotter output; and optional interfaces make the 2230 and 2220 the most sensible digital storage oscilloscopes to own.

GPIB IEEE-488 Option 10 GPIB Interface
Option 12 RS-232C Interface

GPIB (Option 10) and RS-232C (Option 12) interfaces are available for the 2230 and 2220. Either interface can transmit and receive waveform data. Most front panel settings can be queried and any functions can be controlled via the interface.

2230 Option 10 or 12 interfaces also allow messages or computed results to be displayed on screen, and include a battery-backed reference memory (minimum lifetime 3 years) for storage of up to 26 additional waveform sets.

Option 10 GPIB Interface
The Option 10 GPIB interface conforms to IEEE Standard 488-1978. It is fully compatible with *Tektronix Standard Codes and Formats*. Primary address (0-30), message terminator (EOI or LF/EOI), and talk/listen mode are selected by a switch on the oscilloscope side panel. Maskable interrupts for RQS and OPC can be programmed.

Option 12 RS-232C Interface
The Option 12 RS-232C interface has both DCE and DTE connectors. It is compatible with an extension of *Tektronix Standard Codes and Formats*. Baud rate (50–9600), parity (Odd, Even, Mark, Space, or none), line termination (CR or CR-LF), and SRQ generation on parity error (ON or OFF) are selected by a switch on the oscilloscope side panel. Number of bits per character (7 or 8), number of stop bits (1 or 2), and CTRL-S/CTRL-Q handshaking (enable/disable) may be changed by remote commands. The interface automatically senses the presence of Clear to Send (CTS)/Request to Send (RTS) or Data Set Ready (DSR)/Data Terminal Ready (DTR) handshaking lines.

Option 12 for the 2230 also includes 26K of battery-backed reference memory for the storage of up to 26 waveform sets.

GPIB/RS-232C Printers and Plotters
A 2230 or 2220 equipped with either Option 10 or Option 12 interface is fully compatible with any X-Y plotter that uses Hewlett-Packard Graphics Language (HPGL). The GPIB interface also supports the HP ThinkJet 2225A printer. The RS-232C interface also supports any Epson FX-Series format printer or the HP Thinkjet 2225D printer. Plotter output is directed to the interface if its control switches are set for the appropriate plotter or printer. Otherwise, plotting is directed to the X-Y outputs.

IEEE Standard 488-1978 Interface Function Subsets Implemented — SHI, AHI, T6, L3, SRI, RL2, PP0, DCI, DT0, C0.

ORDERING INFORMATION

2230 100 MHz Dual Time Base Digital Storage Oscilloscope
Includes: Two P6121 10X voltage probes, front panel cover (200-2520-00), accessory pouch (016-0677-02), operator manual (070-4998-00), user's reference card (070-5370-00).

2220 60 MHz Single Time Base Digital Storage Oscilloscope
Includes: Two P6122 10X voltage probes, front panel cover (200-2520-00), accessory pouch (016-0677-02), operator manual (070-5301-00), user's reference card (070-5681-00).

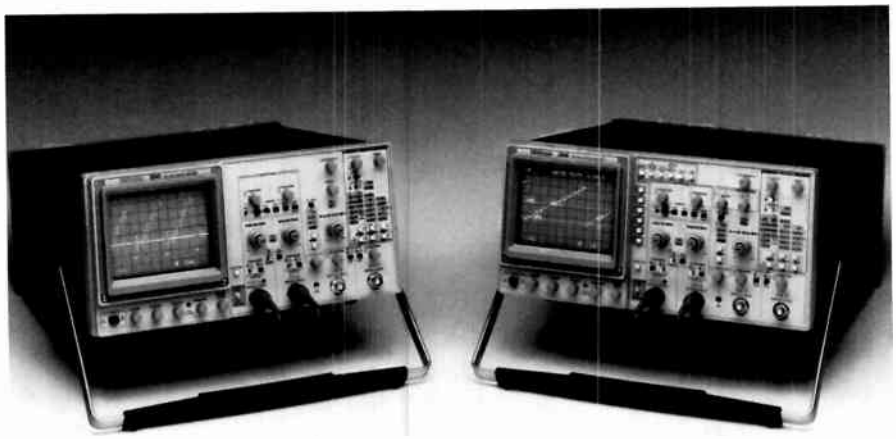
OPTIONS
Option 10 — (2230) GPIB IEEE-488 Interface.
Includes: 26K of Battery-Backed Reference Memory.
Option 12 — (2230) RS-232C Interface
Includes: 26K of Battery-Backed Reference Memory.
Option 10 — (2220) GPIB IEEE-488 Interface.
Option 12 — (2220) RS-232C Interface.
Option 33 — MKT'ING: needs description.

FIELD RETROFIT KITS
2230F10 — Field Retrofit Kit for Option 10.
2230F12 — Field Retrofit Kit for Option 12.
2220F10 — Field Retrofit Kit for Option 10.
2220F12 — Field Retrofit Kit for Option 12.

INTERNATIONAL POWER PLUG OPTIONS
Option A1 — Universal Euro 220 V/16 A, 50 Hz.
Order 020-0859-00.
Option A2 — UK 240 V/13 A, 50 Hz.
Order 020-0860-00.
Option A3 — Australian 240 V/10 A, 50 Hz.
Order 020-0862-00.
Option A4 — North American 240 V/15 A, 60 Hz.
Order 020-0862-00.
Option A5 — Switzerland 220 V/10 A, 50 Hz.
Order 020-0863-00.

***WARRANTY-PLUS* SERVICE PLANS**
SEE PAGE xxx
M1 — (2230) 2 Calibrations.
M1 — (2220) 2 Calibrations.
M2 — (2230) + 2 Years Service.
M2 — (2220) + 2 Years Service.
M3 — (2230) 4 Calibrations & 2 Years Service.
M3 — (2220) 4 Calibrations & 2 Years Service.
M4 — (2230) 5 Calibrations.
M4 — (2220) 5 Calibrations.
M5 — (2230) 9 Calibrations & 2 Years Service.
M5 — (2220) 9 Calibrations & 2 Years Service.

For more information, contact your nearest Tektronix sales engineer or call the Tektronix National Marketing Center at 1-800-426-2200.



2246/2245

Bright, Crisp Display With High Writing Rate

Four Independent Channels

100 MHz Bandwidth With 2 ns/Div Time Base

On-Screen Scale Factor Readouts

Flexible Triggering
Auto Level and Auto HF, LF, Noise Reject, TV Line and TV Field

Delayed Sweep

Control Status Lights

2% Vertical and Horizontal Accuracy

2 mV/Div Vertical Sensitivity at Full Bandwidth

New Specially Designed Probe

Simple, Rugged Construction

New Labeled Volts Cursors With Ground-Referenced Readings and On-Screen Readouts

New Hands-Off Voltmeter Measurements
+Peak and −Peak
Peak-to-Peak
Gates Peaks
Gated Peak-to-Peak
Dc

New SmartCursors™ Track Voltmeter Measurements

New SmartCursors™ Visually Indicate Trigger Level and Ground

Time Measurements with Cursors or Alternate Delayed Sweep Δ Time

Three Year Warranty — Five Year Optional

TYPICAL APPLICATIONS

Logic Design and Repair
Communications
Power Supply Design

Higher Performance, Lower Price

The performance/price ratio for portable oscilloscopes has been substantially upgraded. No other portable scope can offer the range of productivity enhancing features and performance characteristics at a comparably low price than the Tektronix *NEW* 2245 and 2246.

Features That Promote Productivity

Four independent channels speed troubleshooting and design tasks by allowing simultaneous observation of multiple test points. Front panel set-ups are simplified by pushbutton activated functions and on-screen scale factor readouts. And with buttons that light up, settings can be verified at a glance.

More Triggering Flexibility

Hands-free triggering, made possible by the Auto-level mode, automatically places a stable display of almost any waveform on screen. The LF, HF, and Noise Reject modes, together with a 10-to-1 holdoff range, deliver stable triggering on complex waveforms. The built-in TV Line and TV Field triggering capability extends measurements to most video-related applications.

Performance Plus

The *NEW* 2245 and 2246 oscilloscopes have low noise vertical systems that produce sharp, bright traces. Their 2 ns time base and 100 MHz bandwidth bring out the details on high speed signals and render measurements with good timing resolution.

Low level signal measurements are easily managed by the 2 mV/div vertical sensitivity, even at full bandwidth, and by trigger sensitivity that extends to 0.25 div at 50 MHz (0.5 div at 100 MHz).

Voltage Measurements With the Push of a Button

A pushbutton activated measurement system on the 2246 enhances productivity even more. This scope turns out virtually hands-off measurements quickly of +peak, −peak, peak-to-peak, dc, and gated volts, all with convenient on-screen readout of values.

If more visual indication is desired, the unique cursor system can provide feedback showing exactly where on the waveform an automatic measurement is being made. These feedback cursors, when selected, even show ground and trigger level locations.

There is also the ability to use cursors in the conventional manual mode for making point-to-point time and voltage measurements, including time interval measurements between a point on the reference waveform and a point on any of four other displayed waveforms.

Three Year Warranty

As with all of our high quality 2000 Series Oscilloscopes, the 2245 and 2246 (including the CRT) are covered by the Tektronix three year warranty, making ownership more cost effective than ever.

ORDERING INFORMATION

2245 100 MHz Oscilloscope
Includes: Two 10X, 1.3 m probes with accessories (P6109); clear accessories pouch with ziploc fastener (016-0537-00); blue plastic CRT filter (337-2775-00); 2A, 250 V fuse (159-0023-00); operator manual (070-6083-00); user reference guide (070-6082-00).

2246 100 MHz Oscilloscope with Voltmeter, ΔTime, and SmartCursors™
Includes: Same as 2245.

OPTIONS

Option 02 — Protective front panel cover and accessory pouch.
Option 1C — C-5C Option 02 Camera.
Option 1K — K212 Portable Instrument Cart.
Option 22 — Two additional P6109 probes.
Option 23 — Two 1X/10X P6062B, 6 ft probes.

INTERNATIONAL POWER OPTIONS

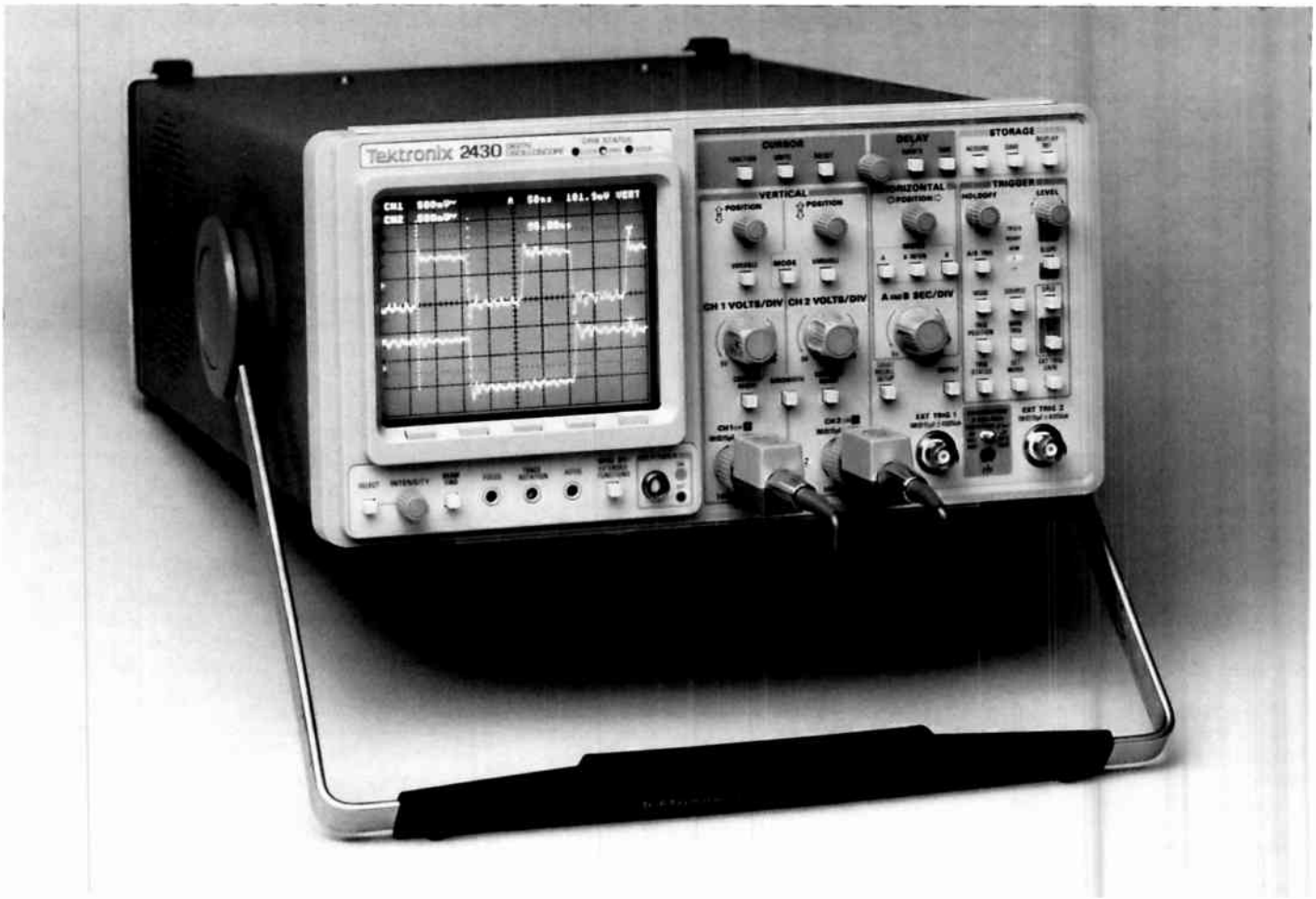
Option A1 — Universal Euro plug, 220 V, 16 A, 50 Hz.
Option A2 — UK plug, 240 V, 13 A, 50 Hz.
Option A3 — Australian plug, 240 V, 10 A, 50 Hz.
Option A4 — North American plug, 240 V, 15 A, 60 Hz.
Option A5 — Switzerland plug, 220 V, 10 A, 50 Hz.

***WARRANTY-PLUS* SERVICE PLANS**
SEE PAGE 497

M1 — 2 Calibrations.
M2 — 2 Years Service.
M3 — 2 Years Service and 4 Calibrations.
M4 — 5 Calibrations.
M5 — 9 Calibrations + 2 Years Service.

For more information, contact your nearest Tektronix sales engineer or call the Tektronix National Marketing Center at 1-800-426-2200.

TEK 2430 DIGITAL OSCILLOSCOPE



2430 Option 05 Digital Oscilloscope.

2430 Option 05 Digital Oscilloscope

GPIB IEEE-488

The 2430 with Option 05 complies with IEEE Standard 488-1978, and with Tektronix *Standard Codes and Formats.*

All of the High-Peformance Characteristics of the Standard 2430 Oscilloscope, plus Video Waveform Analysis Capabilities

150 MHz Bandwidth at Probe Tip

5 ns/Div Sweep Speed

100 MS/s Sample Rate

Simultaneous Acquisition of Two Channels

Envelope Mode with 2 ns Glitch Capture

8 Bit Resolution Over 10 Divisions

Save on Delta (Tek-Patented Feature) Provides Unattended Pass/Fail Testing and Babysitting Against a User-Defined Reference or Envelope

Save up to Six Waveforms for Later Display, Analysis and Comparison

Fully GPIB Programmable for Systems and Automated Test Applications

Selectable System-M and Nonsystem-M Protocols

Selectable Triggering on Any Line Within a Field, With Line-Number Readout

GPIB-Controllable Functions for Use in Automatic Measurement Systems

Compatible With Composite Video

Television Blanking-Level Clamp (Back-Porch)

Power and Flexibility in an Easy-To-Use Portable Digital Oscilloscope

With the Tek 2430 we've brought the best features of our industry standard 2400 Series into the digital world. Now you can capture and store complex wideband signals for research, design and test applications. On-screen readout, cursor functions, and a front panel layout similar to other Tek 2400-Series instruments make the 2430 an easy-to-use tool.

With its advanced feature set, the 2430 can meet your general purpose measurement needs while offering the advantages of a digitized waveform — including long term storage for future reference, data transfer, and waveform analysis — making the 2430 a powerful systems component.

Features of the 2430 include: 1024 point per channel record length, Average Mode for increased resolution and noise reduction on repetitive signals, Envelope Mode to capture events as fast as 2 ns at any sample rate, and Save on Delta to capture and save events that deviate from user-selected limits.

Option 05

Video Waveform Measurement System

CHARACTERISTICS

The set of characteristics is the same as specified for the standard 2430 Oscilloscope and includes the following additions:

VERTICAL SYSTEM (CHANNEL 1 AND CHANNEL 2)

Frequency Response — For Volts/Div switch settings between 5 mV and 0.2 V, with Var Volts/Div calibrated and using a five-division, 50 kHz reference signal from a 50 Ω system, with external 50 Ω termination on 1 MΩ input.

	Frequency Response	
Frequency Range	**With Full BW**	**With BW Limiting**
50 kHz to 5 MHz	±1%	+1%, −4%
>5 MHz to 10 MHz	+1%, −2%	—
>10 MHz to 30 MHz	+2%, −3%	—

Squarewave Flatness — ±1%, 1% p-p for both 60 Hz and 15 kHz squarewaves, using a 0.1 V input with Volts/Div settings between 5 mV and 20 mV and using a 1.0 V input with Volts/Div setting of 50 mV set up with 1 MΩ dc input coupling, external 50 Ω termination, Var Volts/Div in calibrated position and fast-rise input signal (risetime ≤1 ns). Exclude first 20 ns following step transition and exclude first 30 ns when 20 MHz BW LIMIT is set. For signals with rise times ≤10 ns, add 2% p-p between 155 ns and 165 ns after step transition.

Note: Although flatness and frequency response are verified using a 50 Ω system, similar performance can be expected when using 75 Ω systems.

Television Blanking-Level Clamp (Back-Porch) 60 Hz Rejection (Channel 2 Only) — ≥18 dB at 60 Hz, with Volts/Div settings between 5 mV and 0.2 V, Var Volts/Div control set to calibrated and a six-division reference signal.

Television Blanking-Level Clamp (Back-Porch) Reference — Within 1.0 division of ground reference.

TRIGGERING

Sync Separation — Stable sync separation from sync-positive or sync-negative compositive video on systems with 525 to 1280 lines per frame, 50 Hz or 60 Hz field rate, interlaced or non-interlaced scan.

Trigger Modes — LINES, FLD 1, FLD 2, AND ALT (FLD 1, FLD2) coupling.

Input Signal Amplitude for Stable Triggering Channel 1 and Channel 2 — 2.0 division for composite video and 0.6 division for composite sync signals (dc + peak video-signal amplituded must be within 18 divisions of input ground reference).

External 1 and External 2 — 60 mV for composite video and 30 mV for composite sync signals (dc + peak video-signal amplitude must be within nine divisions of input ground reference).

ORDERING INFORMATION

2430 150 MHz Digital Oscilloscope

OTHER OPTIONS

Option 1R — Configure oscilloscope for rack-mount.
Option 11 — Probe Power.
Option B1 — Service Manual.

POWER CORD OPTIONS

Power cords are available to meet international requirements.

WARRANTY-PLUS

Service plans are available to extend warranty coverage. Contact your Tektronix sales engineer.

OPTIONAL ACCESSORIES

Rackmount Conversion Kit — Order 016-0825-00.
Word Recognizer Probe — P6407. Order 010-6407-02.
ECL Probe — Order 010-6230-01.
Protective Cover — Blue vinyl. Order 016-0720-00.
Carrying Strap — Order 346-0058-00.

RECOMMENDED CAMERAS

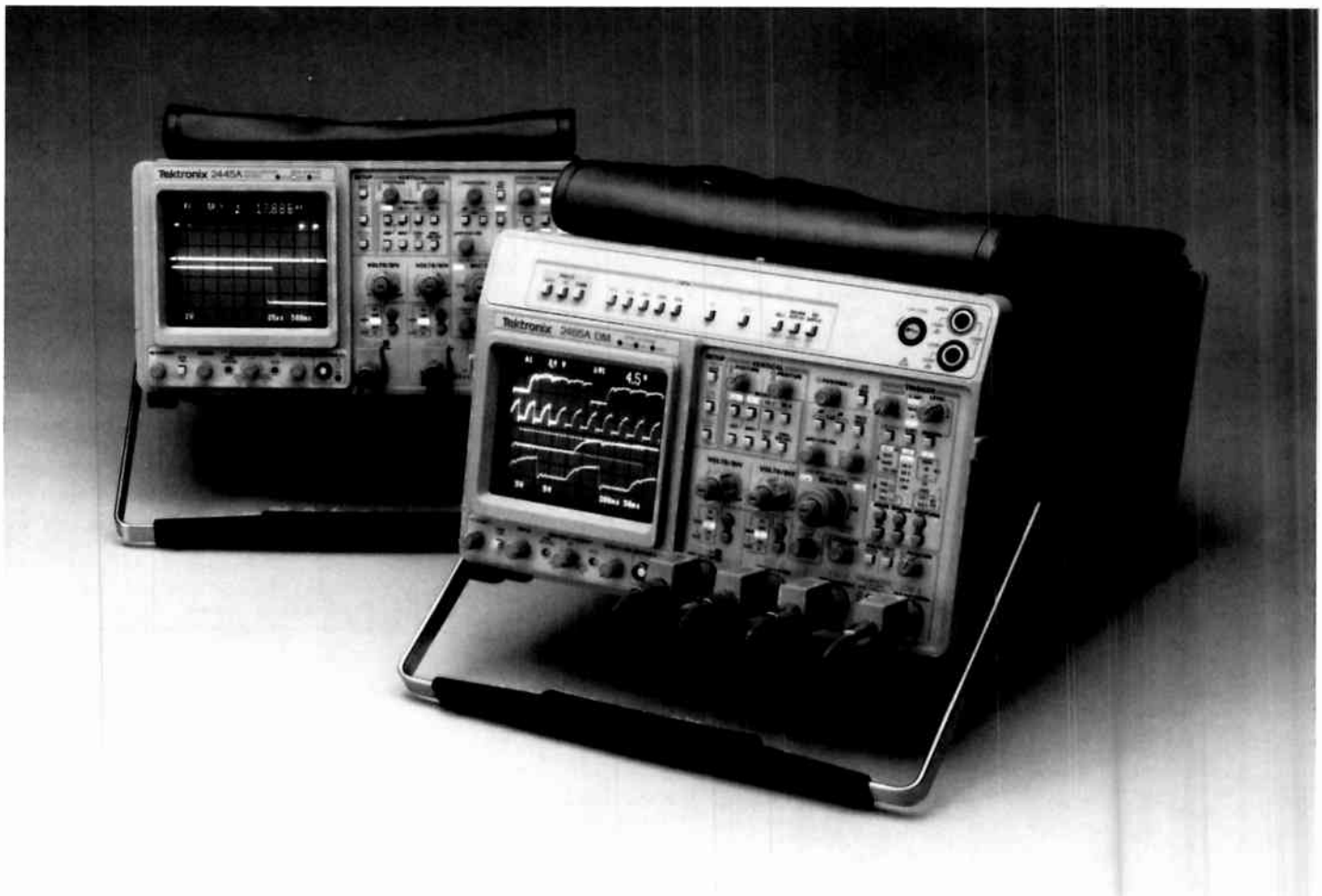
DCS01 — Digitizing Camera System.
C-53 — General Purpose.

RECOMMENDED CART

K212 — Portable Instrument Cart.

TRAINING

Customer training is available on this product. Contact your Tektronix sales engineer.



2465A/2445A Option 05.

2465A/2445A Option 05

All of the High-Performance Characteristics of Standard 2465A/2445A Oscilloscopes, plus Video Waveform Analysis Capabilities

Auto Setup

Save and Recall Setups

Setup Sequencing

1 ns/2.3 ns Rise Time

350 MHz/150 MHz Bandwidth

On-Screen Trigger Level Readout

Volts and Time Cursors With On-Screen Readout

Cursors After Delay

Switchable 1 MΩ and 50 Ω Inputs

20 ps Time Interval Resolution

2 mV/Div Vertical Sensitivity at 350 MHz/150 MHz

On-Screen Scale-Factor Readout

Lightweight and Rugged

500 MHz/250 MHz Trigger Bandwidth

Four Independent Channels

500 ps/1 ns per Div Time Base

Selectable System-M and Nonsystem-M Protocols

Selectable Triggering on Any Line within a Field, With Line-Number Readout

Compatible With Composite Video Having 13.1 kHz to 77 kHz Line Rates

TV Blanking-Level Clamp (Back-Porch)

Optimized Vertical Response Comparable to High Performance TV Waveform Monitors

Video measurement capabilities extend the 2465A/2445A's power and versatility to meet the challenges in broadcast and cable television, graphics displays and raster scan systems. The Video Waveform Measurement System (Option 05) makes quality measurements convenient during every stage of a product's life cycle: design, production, system calibration, quality assurance, maintenance and service.

With CRT readout of the line number and field selected for triggering, an operator knows precisely what the display represents. Any line can be selected from Field 1, Field 2, or Field 1 alternating with Field 2. The fourth video trigger selection is Lines, which superimposes all the lines in both fields. Systems with up to 1280 lines can be accommodated.

The back-porch clamp locks the video black level to a fixed point, so the display is stable and clean, even when the composite video contains low frequency hum or when the average picture level changes with AC coupling. Controls are provided for a wide variety of system protocols.

CHARACTERISTICS (OPTION 05)

The set of characteristics is the same as specified for standard 2465A/2445A oscilloscopes and includes the following additions:

VERTICAL SYSTEM (CHANNEL 1 AND CHANNEL 2)

Frequency Response — Applicable for Volt/Div settings between 5 mV and 0.2 V with Var Volt/Div control in calibrated detent and using a 5 div, 50 kHz reference signal from a 50 Ω or 75 Ω system.

Range	With Full BW	With BW Limiting
50 kHz to 5 MHz	±1%	+1%, −4%
>5 MHz to 10 MHz	+1%, −2%	*1
>10 MHz to 30 MHz	+2%, −3%	*1
>30 MHz	*1	*1

*1 Same as basic instrument.

Squarewave Flatness — 1% p-p for both 60 Hz and 15 kHz squarewaves, from a 50 Ω or 75 Ω system using a 1.0 V input with a 50 mV/Div setting and using a 0.1 V input at 20 mV/Div setting. 1.5% p-p using a 0.1 V input with 5 mV/Div and 10 mV/Div settings. Exclude first 50 ns following step transition. For signals with rise times ≤10 ns, add 2% p-p between 155 ns and 165 ns after step transition.

Television Blanking-Level Clamp (Back-Porch) 60 Hz Rejection (Channel 2 Only) — ≥18 dB at 60 Hz; with calibrated Volt/Div settings between 5 mV and 0.2 V, and a 6 div reference signal.

Television Blanking-Level Clamp (Back-Porch) Reference — Within 1.0 div of ground reference.

TRIGGERING

Sync Separation — Stable sync separation from sync-positive or sync-negative composite video on systems with 525 to 1280 lines/frame, 50 Hz or 60 Hz field rate, interlaced or noninterlaced scan.

Trigger Modes — LINES, FLD 1, FLD 2, and ALT (FLD 1-FLD 2).

Input Signal Amplitude for Stable Triggering — Channel 1 and Channel 2: 1.0 div for composite video and 0.3 div for composite sync signals (dc + peak video-signal amplitude must be within 18 div of input ground reference).

Channel 3 and Channel 4: 0.5 div for composite video and 0.25 div for composite sync signals (dc peak video-signal amplitude must be within 9 div of input ground reference).

GPIB Compatibility for Semiautomatic Measurement Systems — When combined with Option 10, the TV Waveform Measurement Systems (Option 05)/oscilloscope combination is fully programmable. Complies with Tektronix *Standard Codes and Formats.*

ORDERING INFORMATION

2465A 350 MHz Oscilloscope

2445A 150 MHz Oscilloscope

OTHER INSTRUMENT OPTIONS

Option 01[*3] — Digital Multimeter.

Option 06 — Counter/Timer/Trigger.

Option 09[*1*2] — Counter/Timer/Trigger and Word Recognizer.

Option 10 — IEEE-488 GPIB Interface.

Option 11[*1] — Rear Panel Probe Power.

Option 22 — Two additional Probes.

Option 1R[*3] — Configure Oscilloscope for Rackmount.

Option B1 — Service Manuals.

POWER CORD OPTIONS

Power cords are available to meet international requirements.

WARRANTY-PLUS

Service plans are available to extend warranty coverage. Contact your Tektronix sales engineer.

1 Option 11 may not be ordered with Option 09 or the 2445A.
2 Option 09 includes Option 06.
3 Option 1R may not be ordered with Option 01, 2465A DM, or 2465A DV. For rackmounting instruments equipped with Option 01, contact your Tektronix sales engineer.

Viewing Hoods —
(Polarized Collapsible) Order 016-0180-00
(Folding Light Shield) Order 016-0592-00
(Folding Binocular) Order 016-0566-00

Protective Waterproof Vinyl Cover —
Order 016-0720-00

Carrying Case — Order 016-0792-01

Carrying Strap — Order 346-0199-00

Dc Power — 1106/1105.

Dc Inverter — 1107.

OPTIONAL ACCESSORIES

Rackmount Conversion Kit — (Not compatible with Option 01.) Order 016-0691-02.

Probe Power Extender Cable for Rackmount 2445A/2465A Option 11 — Order 020-0104-00.

Word Recognizer Extender Cable for Rackmount 2445A/2465A Option 09 and 2465A CT — Order 020-0103-00.

GPIB Cables — Double shield, low EMC.
(1m) Order 012-0991-01.
(2m) Order 012-0991-00.
(4m) Order 012-0991-02.

RECOMMENDED CAMERAS

C-308P Option 01 — General Purpose.

C-5C Option 02 — Low Cost.

RECOMMENDED CART

K212 Portable Instrument Cart — For on-site mobility.

SOFTWARE

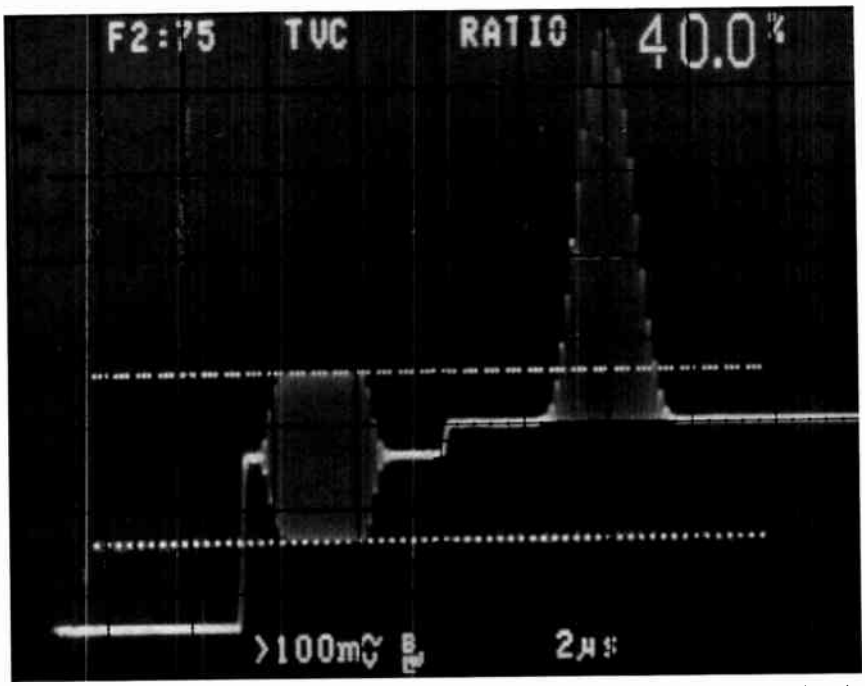
EZ-TEK 2400 Test Program Generator — For instruments with GPIB; used with 4041 controller. Order S49F101.

EZ-TEK 2400 PC Test Program Generator — For instruments with GPIB; used iwth IBM PC/XT/AT and compatibles. Requires GURU hardware. Order S49F103.

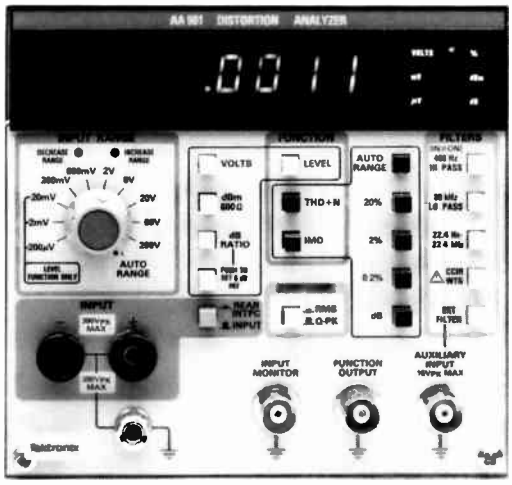
GPIB User's Resource Utility (GURU) — Includes GPIB-PC interface board, GPIB cable, software, and documentation. Order 021-0396-00.

TRAINING

Customer training is available on this product. Contact your Tektronix sales engineer.



This sample waveform and CRT readout show a 2445A's high-fidelity display and measurement of the color subcarrier amplitude on Line 75, Field 2 of an NTSC signal. The television blanking-level clamp (TVC) is engaged. The cursor readout of 40% is interpreted as 40 IRE units with appropriate adjustment of the vertical gain.



Distortion Analyzer

AA 501

Fully Automatic: No Level Setting, Tuning or Nulling

Level, Total Harmonic Distortion, and dB Ratio Measurements

Total System Harmonic Distortion Plus Noise (THD+N) <0.0025%

≤3.0 μV Residual Noise

Digital Readout Plus Analog-Like "Bar Graph" for Peaking and Nulling

IMD to SMPTE, DIN, and CCIF (Option 01)

The AA 501 Distortion Analyzer provides completely automatic measurement of level, total harmonic distortion plus noise (THD+N), and (with Option 01) Intermodulation Distortion. Automatic set level, automatic tuning, automatic nulling of the fundamental, and autoranging of the display all combine to permit completely hands-off operation once the mode is selected. Just apply the signal of interest and read the 3½-digit display. A novel analog-like bar graph simulates an analog meter to assist in peaking and nulling of applied signals.

With Option 01, intermodulation distortion measurements can be made to any of the three common standards: SMPTE, DIN, or CCIF. Internal circuitry automatically identifies the signal being used and selects the proper filtering circuits to perform the measurement.

DB ratio measurements can be referenced either to 774.6 millivolts (1 milliwatt in 600 ohms) or to a selected applied signal. The 0 dB reference memory remembers the selected level, and all subsequent measurements are referenced to that level.

The AA 501 allows readings to be expressed in true RMS or average response, RMS calibrated. Although true RMS is more accurate in most applications, the average response permits comparisons with measurements previously taken with older instrumentation.

The fundamental frequency range is 10 Hz to 100 kHz, with harmonics measured out to 300 kHz.

Any one of four built-in frequency-weighting filters can be switched into the signal paths for preconditioning of the signal to be measured. Provision is also made to permit the use of a user-selected filter.

A dc level, which is a function of the display readout, is available at the rear panel of the AA 501.

An Input Monitor connector and a Function Output connector are provided to permit oscilloscope display of the input signal or the result of the filter in the THD+N measurement.

The Option 02 version of the AA 501 is especially designed for use in accordance with CCIR recommendation 468-2 and DIN 45405 (typically used in Europe). In the Option 02 version, the 30 kHz filter and the "A" weighting filter of the standard unit are replaced by a 22.4-Hz-to-22.4-kHz filter and a CCIR-weighting filter, respectively, and the average responding detection circuit is replaced by a quasi-peak detection circuit. The Option 02 also contains the intermod measurement capability of the Option 01.

The AA 501 Distortion Analyzer and the SG 505 Oscillator were designed to be used together as the heart of a state-of-the-art audio analysis system. Used together, the two provide total system harmonic distortion of 0.0025% or less.

It should be noted that the automatic frequency tuning of the AA 501 does not depend upon the manual tuning of a companion oscillator. The AA 501 will automatically tune itself to its input signal whether the signal originates from an SG 505 alongside it in a TM 500 mainframe, or from some other signal source miles away.

CHARACTERISTICS

The following characteristics are common to the standard AA 501, Option 01 and Option 02 unless otherwise noted.

HARMONIC DISTORTION FUNCTION

Fundamental Frequency Range — 10 Hz to 100 kHz automatically tuned to input frequency.

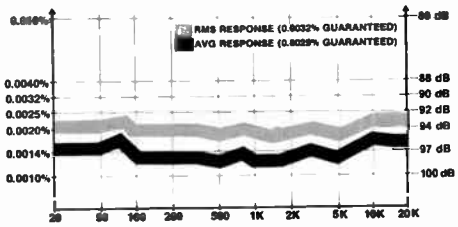
Distortion Ranges — Auto (100%), 20%, 2%, 0.2%, and dB (autoranging).

Accuracy (Readings ≥4% of Range) — 20 Hz to 20 kHz ±1 dB, 10 Hz to 100 kHz +1, −3 dB. (Accuracy is limited by residual THD+N and filter selection.)

THD — Complete Automatic Total Harmonic Distortion (THD) measurements to specified accuracy in seven seconds or less.

AA 501/SG 505 System Residual THD+N — Vin ≥250 mV, (all distortion, noise, and nulling error sources combined). 20 Hz to 20 kHz: ≤0.0025% (−92 dB) Average Response with 80 kHz filter (standard and Option 01 only). ≤0.0032% (−90 dB) RMS Response with 80 kHz filter. 10 Hz to 50 kHz: ≤0.0071% (−83 dB) RMS Response. 50 kHz to 100 kHz: ≤0.010% (−80 dB) RMS Response.

TYPICAL THD+N



Typical Fundamental Rejection — At least 10 dB below specified residual THD+N or actual signal THD, whichever is greater.

Minimum Input Level — 60 mV (−22 dBm).

NOISE (OPTION 02)

Noise measurements to CCIR recommendation 468-2 and DIN 45405. True RMS or quasi-peak response. Total system THD + N = 0.0032% (90 dB) RMS response. Balanced input.

LEVEL FUNCTION

Autoranging digital voltmeter displays input signal level in volts, dBm, or dB ratios.

Modes — Volts, dBm (600 Ω), or dB ratio with push to set 0 dB reference.

Level Ranges — 200 μV full scale to 200 V full scale in ten steps, manual or autoranging.

Accuracy[*1]

Frequency	Volts	dBm or dB Ratio
20 Hz to 20 kHz	±2%	±0.3 dB
10 Hz to 100 kHz[*2]	±4%	±0.5 dB

*[*1] V_{in} ≥ 100 μV, level ranging indicators extinguished.*
*[*2] On the 200 μV range, accuracy above 50 kHz is +4%, −6% (+0.5 dB, −0.7 dB).*

Bandwidth — ≥300 kHz.

Residual Noise — ≤3.0 μV (−108 dBm) with 80 kHz and 400 Hz filters. ≤1.5 μV (−114 dBm) with "A" weighting filter.

INTERMODULATION DISTORTION FUNCTION (OPTION 01/02)

Fully automatic SMPTE, DIN, and CCIF difference frequency test measurements.

SMPTE and DIN Tests — Lower Frequency Range: 50 Hz to 250 Hz. Upper Frequency Range: 3 kHz to 100 kHz. Level Ratio Range: 1:1 to 5:1 (lower:upper). Residual IMD: ≤0.0025% (−92 dB) for 60 Hz and 7 kHz or 250 Hz and 8 kHz, 4:1 level ratio.

CCIF Difference Frequency — Frequency Range: 4 kHz to 100 kHz. Difference Frequency Range: 50 Hz to 1 kHz. Residual IMD: ≤0.0018% (−95 dB) with 14 kHz and 15 kHz. Minimum Input Level: 60 mV (−22 dBm).

Accuracy — ±1 dB.

ALL FUNCTIONS

Detection — Average or true RMS for waveforms with crest factors ≤3.

Filters

400 Hz High Pass: −3 dB at 400 Hz ±5%; at least −40 dB rejection at 60 Hz.

80 kHz Low Pass: −3 dB at 80 kHz ±5%.

30 kHz Low Pass: −3 dB at 30 kHz ±5% (standard and Option 01 only). "A" Weighting: Meets specifications for Type 1 sound level meters (ANSI S 1.4, IEC Recommendation 179) (standard and Option 01 only). Ext: Allows connection of external filters. 22.4 Hz to 22.4 kHz: −3 dB ±5% (Option 02 only). CCIR WTG: CCIR Recommendation 468-2 and DIN 45405, functional only with Q-PK detector (Option 02 only).

Input Impedance — 100 kΩ ±2%, each side to ground, fully differential.

Maximum Input — 300 V peak, 200 V RMS either side to ground or differentially. Fully protected on all ranges.

Common Mode Rejection — ≥50 dB at 50 Hz or 60 Hz. Typically ≥40 dB to 300 kHz.

FRONT PANEL SIGNALS

Input Monitor — Provides constant amplitude version of signal applied to input. Output Voltage: 1 V RMS ±10% for input signals >50 mV. Source Impedance: 1 kΩ ±5%.

Function Output — Provides a scaled sample of selected function signal (1000 count display = 1 V RMS ±3%). Source Impedance: 1 kΩ ±5%.

Auxiliary Input — Provides input to detector circuit when Ext Filter button is depressed. Sensitivity: 1 V RMS ±3% = 1000 count display. Impedance: 100 kΩ ±5%, ac coupled.

REAR INTERFACE SIGNALS

Rear INTFC Input — Front panel selected. Same as main Input except, maximum signal input is limited to 42 V peak, 30 V RMS. (Potential crosstalk at rear interface may degrade noise and distortion on performance).

Monitor — Same as front panel Input Monitor.

Function Output — Same as front panel Function Output.

Auxiliary Input — Same as front panel Auxiliary Input.

Converter Output — Dc output of selected response converter. 1 V ±5% for 1000 count display. Source Z: 500 Ω ±5%.

dB Output — Dc output of logarithmic dB converter. 10 mV ±5% per 1 dB of display. Source Z: 1 kΩ ±5%.

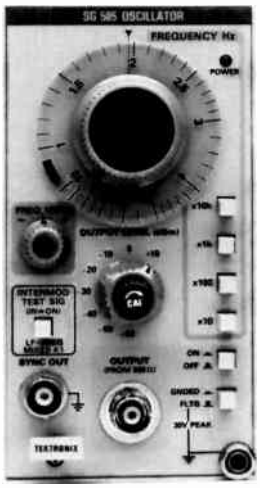
ORDERING INFORMATION

AA 501 Distortion Analyzer
Includes: Instruction manual (070-2958-00).

OPTIONS

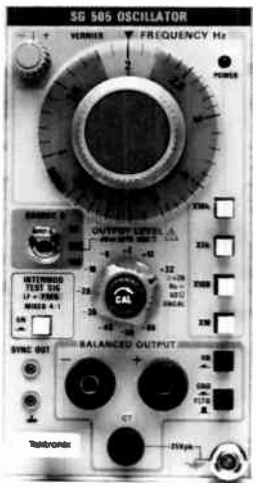
Option 01 — Intermodulation Distortion.
Option 02 — CCIR/DIN (Includes Option 01).

SG 505 Option 01



Oscillator

SG 505 Option 02



Oscillator

SG 505/Option 01/Option 02

10 Hz to 100 kHz Sinewave Output

Ultra-Low Distortion: <0.0008% THD (Typically 0.0003%)

Floating or Grounded Output

600 Ohm Source Impedance

Vernier Frequency Control

Fully Blanced Output (Option 02)

Uncalibrated Output to +28 dBm (Option 02)

Selectable Source Impedance (Option 02)

Intermodulation Test Signal (Option 01 & 02)

The SG 505 Oscillator generates an ultra-low distortion sinewave over the fequency range from 10 Hz to 100 kHz (<0.0008% THD, typically 0.0003% between 20 Hz and 20 kHz). In the standard and Option 01 units the output can be floated or referenced to chassis ground. In the Option 02 unit, the output is fully balanced and floating with a center tap which can be attached to system ground or to either side of the output signal. The oscillator also provides a fixed amplitude ground referenced sinewave at the Sync Out connector that is identical in frequency to the signal from the Output connector.

Option 01 adds an intermodulation test signal function. This signal consists of a selectable 60 Hz or 250 Hz sinewave mixed with the selected frequency in a 4:1 amplitude ratio.

For communications and broadcast applications, Option 02 provides a fully balanced output of +22 dBm to −68 dBm calibrated, into 600 ohms. A 10-position Output Level control provides 10 dB/step calibrated attenuation. Uncalibrated outputs can range from +28 dBm (into 600 ohms from a 50 ohm source) to −78 dBm.

Option 02 has a front panel switch that allows the selection of three different source resistances: 50 ohms for low impedance applications (improves measurement accuracies on long cable runs and reduces loading effects), 150 ohms for matching microphone circuits, and 600 ohms for complying with audio/communication industry standard and general purpose applications.

Option 02 also includedes the intermodulation test signal capability of the Option 01.

CHARACTERISTICS

MAIN OUTPUT

The following characteristics are common to the standard SG 505 and Option 01.

Frequency Range — 10 Hz to 100 kHz in four overlapping bands. Accurate within 3% of dual setting (with Vernier at center). Vernier Range is at least ±1% of frequency setting.

Calibrated Output — Selectable from +10 dBm to −60 dBm into 600 Ω in eight 10 dB steps. Accurate to within 0.2 dB at +10 dBm and 1 kHz. Step accuracy is ±0.1 dB/10 dB step. An uncalibrated control provides continuous variation from at least +2.2 dB to <−10 dB from calibrated position.

Amplitude Response — Level flatness ±0.1 dB from 10 Hz to 20 kHz (1 kHz ref); within 0.2 dB from 20 kHz to 100 kHz (excluding >50 kHz on −60 dB output level range).

Harmonic Distortion — <0.0008% (−102 dB) THD from 20 Hz to 20 kHz (typically 0.0003%); 0.0018% (−95 dB) THD from 10 Hz to 20 Hz, and from 20 kHz to 50 kHz; 0.0032% (−90 dB) THD from 50 kHz to 100 kHz (R_L ≥600 Ω).

Output Impedance — 600 Ω ±2%; floating or grounded through ≈30 Ω. Output impedance does not change with Output On/Off selection. Maximum floating voltage ±30 V peak.

Maximum Output Voltage — At least 6 V RMS open circuit, 3.16 V RMS (+10 dBV or +12.2 dBm) into 600 Ω.

SYNC OUTPUT

Signal — 200 mV RMS ±20% sinewave to 20 kHz, at least 120 mV RMS at 100 kHz.

Frequency — Same as main output.

Impedance — Nominally 1 kΩ, ground referenced and isolated from main output.

REAR INTERFACE SIGNALS

Buffered Main Output — Buffered version of actual output signals from front panel connector. ≈300 Ω Output impedance.

Sync Output — Same as front panel Sync Output except impedance is ≈50 Ω.

Option 01 IM Test Signal

Selecting the IM Test Signal causes a LF sinewave to be mixed with the normal oscillator signal in a 4:1 amplitude ratio.

LF Frequency — Internally selectable 60 Hz (±1 Hz) or 250 Hz (±3 Hz).

Main Output — Composite p-p output within 0.2 dB of normal oscillator mode output.

Residual IMD — Typically <0.0005% from 2.5 kHz to 10 kHz.

Sync Output — LF signal component only, 200 mV RMS ±20%.

Option 02 Oscillator

MAIN OUTPUT

Calibrated Output — Selectable from +22 dBm to −68 dBm into 600Ω in ten 10 dB steps. Accurate to within 0.2 dB at +22 dBm and 1 kHz. Step accuracy is ±0.1 dB/10 dB step or 20 dB step change. An uncalibrated control provides continuous variation from <−10 dB to +0.3 dB from calibrated position.

Harmonic Distortion — <0.0008% (−102 dB) THD from 20 Hz to 20 kHz (typically 0.0003%); 0.0018% (−95 dB) THD from 10 Hz to 20 Hz, and from 20 kHz to 50 kHz; 0.0056% (−85 dB) THD from 50 khz to 100 kHz (R_L ≥600 Ω).

Output Impedance — Selectable 600 Ω ±2%, 150 Ω ±2% or 50 Ω ±3% floating or grounded through ≈30 Ω. Output impedance does not change with Output On/Off selection. Impedance to CT is ½ the selected impedance. Maximum floating voltage ±25 V peak.

Maximum Output Voltage — At least 21 V RMS open circuit; 19.45 V RMS (+28 dBm) into 600 Ω from 50 Ω.

Balance — ≤0.5% mismatch of output open-circuit voltages referenced to CT for f ≤20 kHz with output grounded.

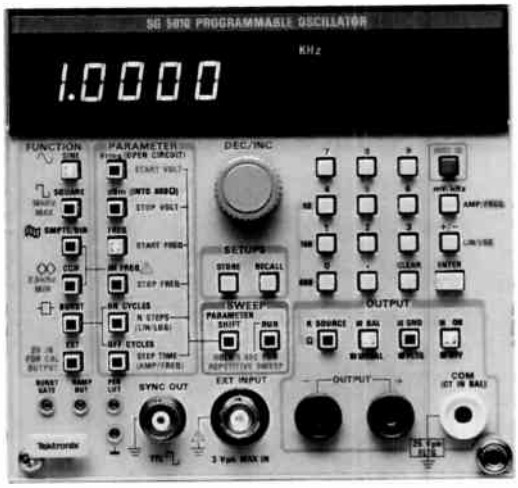
ORDERING INFORMATION

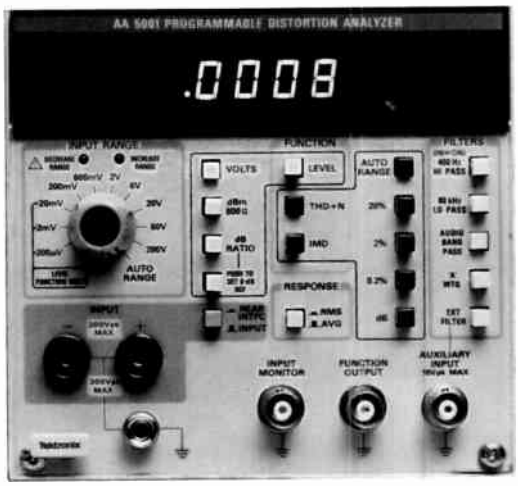
SG 505 Oscillator

Includes: Cable assembly for sync output (175-1178-00); instruction manual (070-2823-00).

Option 01 — IM Test Signal.

Option 02 — Oscillator (Includes Option 01).





SG 5010/AA 5001

GPIB IEEE-488

The SG 5010 and AA 5001 comply with IEEE Standard 488-1978, and with Tektronix *Standard Codes and Formats*.

Fast, Accurate, Repeatable Measurements

Easy to use, Minimized Training Nees

Automatic low-Cost Documentation of Test Results

Automated Audio Test System Advantages Tektronix SG 5010 and AA 5001 programmable instruments in a computer-controlled test system will make critical audio measurements consistently, accurately, and in two to four seconds each. Even complex tests can be made by technically unskilled operators since the procedures are controlled by software in the controller. And, permanent graphic or tabular records of test results can be produced at a very low cost.

An SG 5010/AA 5001 based system will automatically perform such industry-standard tests as harmonic distortion to IHF A202, intermodulation distortion to SMPTE TH 22.51, DIN 45403, IEC 268.3, and IHF A202, frequency response to IHF A202, and noise or signal-to-noise ratio to IHF A202 ("A" weighting filter complies with ANSI specification S1.4 and IEC specification 179 for sound level meters). With the Option 02 capability of the AA 5001, noise measurements can be made to CCIR 468-2 and DIN 45405 standards. The SG 5010 also generates the burst signal necessary for dynamic headroom tests per IHF A202.

A basic automated system consists of the SG 5010 Programmable Oscillator, the AA 5001 Programmable Distortion Analyzer, and an IEEE Standard 488 controller such as the Tektronix 4041 System Controller. Frequency counters, signal switchers, interface devices, disc storage, and hard copy units or plotters can be optionally added to the system.

Other Measurement Capabilities Features and flexibility of the SG 5010 and AA 5001 permit a variety of other measurements to be easily automated. SMPTE-like IMD measurements can be made at a variety of lower frequencies and any value of upper frequency, and at 1:1 amplitude ratios in addition to the standard 4:1 ratio. A CCIF test with the frequencies selected near the upper band limit of the device under test has been shown to be a very effective and simple-to-implement test for transient or dynamic intermodulation (TIM and DIM). Burst signals of any desired duty cycle can be generated for IHF dynamic headroom measurements and to test compressors and limiters; the between-bursts level can be selected as Off or 20 dB below the burst level. Power measurements are made by a controller computation from a voltage measurement across a known load resistance. SINAD measurements of sensitivity of FM communications receivers are a standard capability of the AA 5001 plus an appropriate RF signal generator. The SG 5010 features an amplifier mode in which an external signal can be converted to the high level, multiple impedance, balanced and floating capability of the SG 5010 output circuitry. Fully program-selectable filters in the AA 5001 allow various choices of bandwidth for distortion measurements and weighting for noise measurements, or rejection of interfering signals. Phase measurements can be added to the system by use of the DC 5009 or DC 5010 Universal Counter-Timer.

SYSTEM CHARACTERISTICS

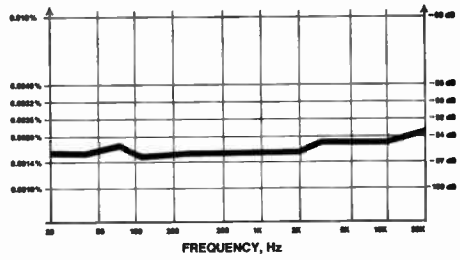
HARMONIC SYSTEM FUNCTION

Measurement Setting Time — Typically ≤2.5 s above 100 Hz, increasing by 1 s/octive below 100 Hz.

Residual THD+N — V_{in} ≥250 mV, RMS response, all distortion, noise, and nulling rescources combined. 20 Hz to 20 kHz ≤0.0032% (−90 dB) with 80 kHz filter. 10 Hz to 100 kHz ≤0.01% (−80 dB) no filters.

TYPICAL SYSTEM RESIDUAL THD+NOISE

V_{in} ≥250 mV with 80 kHz filter, RMS response.



INTERMODULATION DISTORTION FUNCTION

Measurement Settling Time — Typically ≤2 s.

Residual IMD — V_{in} ≥250 mV, RMS response.

SMPTE and DIN Tests — ≤0.032% (−90 dB) for 60 Hz and 7 kHz or 250 Hz and 8 kHz, 4:1 ratio.

CCIF Difference Frequency Test — ≤0.0018% (−95 dB) with 14 kHz and 15 kHz.

LEVEL FUNCTION

Measurement Settling Time — Typically ≤2 s.

Flatness — ±0.1 dB 20 Hz to 20 kHz.

SG 5010 CHARACTERISTICS

AVAILABLE FUNCTIONS

Sinewave, squarewave, SMPTE/DIN 4:1, SMPTE/DIN 1:1, CCIF, Sinewave Burst, IHF Burst (−20 dB or Off between bursts), External Input (Amplifier Mode).

FREQUENCY RANGE AND ACCURACY

Sinewave, Sinewave Burst — SMPTE/DIN: 10 Hz to 163.80 kHz ±0.01%. CCIF Center Frequency: 2.500 kHz to 163.80 kHz ±0.01%. Squarewave: 10 Hz to 16.380 kHz ±0.01%.

Resolution in Above Functions — 10.00 Hz to 163.80 Hz: 0.01 Hz. 163.9 Hz to 1.6380 kHz: 0.1 Hz. 1.693 kHz to 16.380 kHz: 1.0 Hz. 16.39 kHz to 163.80 kHz: 10.0 Hz.

SMPTE Lower Tone, CCIF Offset From Center Frequency — Selectable from: 40 Hz, 50 Hz, 60 Hz, 80 Hz, 100 Hz, 125 Hz, 250 Hz, 500 Hz, all ±2%.

Sine Distortion (Load ≥ 600 Ω, THD Including 2nd Through 5th Harmonics) — 20 Hz to 20 kHz: 0.001% (−100 dB). 20 kHz to 50 kHz: 0.0032% (−90 dB). 10 Hz to 20 Hz and 50 kHz to 100 kHz: 0.01% (−80 dB). 100 kHz to 163.8 kHz: 0.032% (−70 dB) any individual harmonic.

SMPTE, DIN or CCIF Distortion — See System Specifications.

Sine Flatness — 20 Hz to 20 kHz: ±0.05 dB. 10 Hz to 163.8 kHz: ±0.2 dB.

Squarewave Risetime — 1.5 μs ±10%.

Burst Range — 1 cycle to 65535 cycles On. 1 cycle to 65535 cycles Off. Off level either −20 dB or zero. All switching at sinewave zero crossing. Triggered, gated, or free-running burst modes available.

OUTPUT LEVEL RANGE AND ACCURACY

Balanced — Into Open Circuit: 200 μV to 21.2 V RMS. Into 600 Ω: −72.45 dBm to +22.05 dBm.[1]

Unbalanced — Into Open Circuit: 200 μV to 21.2 V RMS. Into 600 Ω: −72.45 dBm to +22.05 dBm.[1]

Resolution — 0.05 dB in dBm mode, 0.25% or better in volts mode.

Level Accuracy (Sinewave) — 20 Hz to 20 kHz ±2%. (0.2 dB). 10 Hz to 163.8 kHz ±3% (0.3 dB).

[1] *R_S = 50 Ω, for R_S = 150 Ω, subtract 1.25 dBm; for R_S = 600 Ω, subtract 5.35 dBm.*

OUTPUT IMPEDANCE AND CONFIGURATION

50 Ω ±3%, 150 Ω ±2%, or 600 Ω ±1%, balanced or unbalanced, floating or grounded.

EXTERNAL INPUT

A floating single-ended input is provided for accessing the variable gain stage and high level output amplifier, enabling the use of custom test signals. Input impedance is 20 kΩ; a 2 V RMS input (2.83 V peak maximum) provides a calibrated output.

SYNC OUTPUT

A ground referenced TTL-compatible signal is provided that allows stable oscilloscope display of all functions. In sine and squrewave modes the output is at the signal frequency. In the IM modes the sync output is at the lower of offset frequency. In both burst modes the sync signal follows the burst envelope.

SWEEP MODE

Linear or logarithmic sweep of amplitude or frequency in any function. Sweep is composed of discrete steps. The following sweep functions are programmable via GPIB or from the front panel: swept parameter (frequency or amplitude), linear or log sweep, number of steps up to 99, time per step from 0.1 s to 25 s, start frequency or voltage, and stop frequency or voltage. Start and stop frequencies or voltages can be anywhere within the range of the generator, and sweep direction can be upward or downward. Pen left and ramp outputs are available for interface to an analog piotter.

STORED SETUPS

Ten different complete front panel setups can be stored in the nonvolatile internal memory and recalled from front panel push buttons or via the GPIB. Additionally, the front panel settings at power down are retained and used at power up.

PROGRAMMABILITY

All functions, parameters, and modes may be controlled over the GPIB using simple English-like commands. All settings can be interrogated,, with the resulting response usable as a command to return the instrument to that setting (Learn mode). The GPIB address can be displayed and changed from the front panel.

GPIB Interface Function Subsets Implemented — SH1, AH1, T6, L4, SR1, RLI1, PP0, DC1, DT1, C0.

AA 5001 CHARACTERISTICS

HARMONIC DISTORTION FUNCTION

Fundamental Frequency Range — 10 Hz to 100 kHz, automatically tuned to input frequency.

Distortion Ranges — Auto (100%), 20 %, 2%, 0.2%, and dB (autoranging).

Accuracy — 20 Hz to 20 kHz is ±1 dB. 10 Hz to 100 kHz is +1, −2 dB. (Accuracy is limited by residual THD+N and filter selection.)

Fundamental Rejection — At least 10 dB below specified residual THD+N or actual signal THD, whichever is greater.

Minimum Input Level — 60 mV (−22 dBm).

LEVEL FUNCTION

Autoranging digital voltmeter displays input signal level in volts dBm, or dB ratios.

Modes — Volts, dBm (600 Ω), or dB ratio with push-to-set 0 dB reference.

Level Ranges — 200 μV full scale to 200 V full scale in ten steps, manual or autoranging.

Accuracy

Frequency	Volts	dBm or dB Ratio
20 Hz to 20 kHz	±2% ±1 count	±0.3 dB[1] +0.5% of reading
10 Hz to 100 kHz	±4% ±2 counts	±0.5 dB[1] +0.5% of reading

[1] *≥100 μV, level ranging indicators extinguished ±0.2 dB at 1 kHz only. Flatness is ±0.1 dB, 20 Hz to 20 kHz, and ±0.3 dB, 10 Hz to 100 kHz.*

Bandwidth — ≥300 kHz.

Residual Noise —
≤3 μV (−108 dBm with 80 kHz and 400 Hz filters, RMS response.
≤1.5 μV (−114 dBm) with "A" weighting filter, RMS response (standard instrument only).
≤5 μV (−104 dBm) with CCIR weighting filter, quasi-peak response (Option 02 instrument only).

INTERMODULATION DISTORTION FUNCTION

Fully automatic SMPTE, DIN, and CCIF difference tone measurements. Minimum input level 60 mV (−22 dBm). Accuracy ±1 dB.

SMPTE and DIN Tests — Lower Frequency Range: 50 Hz to 500 Hz. Upper Frequency Range: usable from 3 kHz to 163.8 kHz. Level Ratio Range: 1:1 to 4:1 (lower:upper). Residual IMD: See System Specifications.

CCIF Difference Frequency Test — Frequency Range: usable from 4 kHz to 163.8 kHz. Level Ratio Range: 1:1 to 4:1 (lower:upper). Residual IMD: See System Specifications.

ALL FUNCTIONS

Display — 3½ digits resolution at ≈ readings/s.

Detection — Average or true RMS for waveforms with crest factors ≤3. Option 02 replaces average detector with quasi-peak detector complying with CCIR Recommendation 468-2 and DIN 45405.

Filters —
400 Hz High Pass: −3 dB at 400 Hz ±5%; 18 dB octave slope, at least 40 dB rejection at 60 Hz.
80 kHz Low Pass: −3 dB at 80 kHz ±5%; 18 dB/octave slope.
Audio Bandpass: −3 dB at 22.4 Hz and 22.4 kHz, both ±5%. Complies with CCIR Recommendation 468-2 and DIN 45405.
"A" Weighting: Meets specifications for Type one sound level meters (ANSI S1.4, IEC Recommendation 179) Option 02 replaces "A" weighting filter with CCIR weighting filter complying with CCIR Recommendation 468-2 and DIN 45405.
Ext: Allows connection of external filters.

Input Type — Balanced (full differential).

Input Impedance — 100 kΩ ±2%, each side to ground.

Maximum Input — 300 V peak, 200 V RMS either side to ground or differentially. Fully protected on all ranges.

Common-Mode Rejection — ≥50 dB at 50 Hz or 60 Hz. Typically ≥40 dB to 300 kHz.

PROGRAMMABILITY

Function (Level or THD or IMD). Level Mode (Volts or dBm). Input Level and Distortion Ranges (Autorange or default to range selected by font panel switches).
Detector Type (RMS or AVG; or RMS or Q-PK on Option 02).
Filter Selection (400 Hz Hi Pass, 80 kHz Low Pass, 22.4 Hz to 22.4 kHz Band-Pass, "A" Weight (or CCIR WTG on Option 02, Ext Filter).

GPIB Interface Function Subsets Implemented — SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0.

FRONT PANEL SIGNALS

Input Monitor — Provides constant amplitude version of signal applied to input. Output Voltage: 1 V RMS ±10% for input signals >50 mV. Source impendance: 1 kΩ ±5%.

Function Output — Provides a scaled sample of selected function signal. Output Voltage: 1 V RMS ±3% for 1000 count display. Source impedance: 1 kΩ ±5%.

Auxiliary Input — Provides input to detector circuit when Ext Filter button is depressed. Sensitivity: 1 V RMS ±3% = 1000 count display. Impedance: 100 kΩ ±5%, ac coupled.

REAR INTERFACE SIGNALS

Duplicates of all front panel inputs and outputs are provided to allow external filter connections or oscilloscope monitoring within same mainframe without exposed cables. Detector outputs with specified scale factors also available to drive analog chart recorders, storage oscilloscopes, or similar devices.

ORDERING INFORMATION

SG 5010 Programmable Oscillator

Includes: Instrument interface guide (070-4790-00); instruction manual (070-4331-00); reference guide (070-4330-00)

AA 5001 Programmable Distortion Analyzer

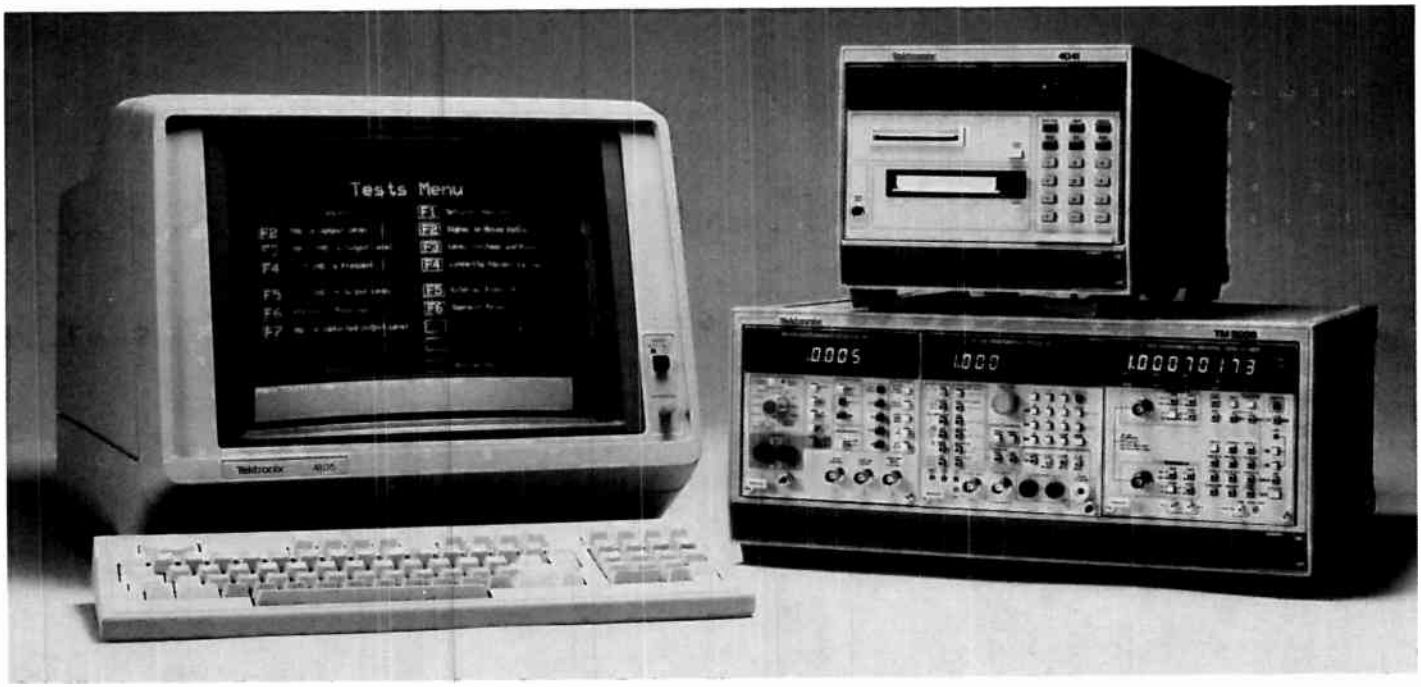
Includes: Instrument interface guide (070-4788-00); instruction manual (070-4598-01); reference guide (070-4597-00).

Option 02 — CCIR/DIN.

Audio Test Program Generator Software — Order S45F902.

Utility Software —
For TM 5000/4041 Order 062-6958-01

See page 297 of the 1986 General Catalog for description and ordering information



MP 2902 shown with Option 2H (DC 5010 Programmable Universal Counter/Timer).

MP 2902

GPIB IEEE-488 The MP 2902 complies with IEEE Standard 488-1978 and with Tektronix *Standard Codes and Formats.*

Eleven Comprehensive Audio Tests

Rapid, Error-Free Test Program Development by Nonprogrammers

State-of-the-Art Measurement Performance

Software Supports All IEEE Standard 488 Instruments and Provides for Unique Test Requirements

The MP 2902 Audio Measurements Package makes critical audio measurements consistently, accurately and quickly. The Tektronix Audio Test Program Generator (Audio TPG) produces automatied test procedure quickly and easily. This software development tool dramatically simplifies the process of converting manual tests into software. With the Audio TPG, menus guide nonprogrammers through test development. The result is error-free code written in 4041 BASIC. Tests supported in the Audio TPG include: THD vs Frequency, THD vs Output Level, IMD vs Output Level (SMPTE or CCIF), CCIF IMD vw Frequency, Frequency Response, Signal-to-Noise, Level (Voltage and Power), Linearity, and External Stimulus. Provisions are made for the user to add any unique testing requirements not directly supported in the Audio TPG.

Whether the environment is production or R & D and whether the test requirement is microphone characterization, broadcast station proof-of-performance, or measuring noise and and distortion of audiotype machines, the MP 2902 offers accuracy, speed and consistency.

CHARACTERISTICS

ENVIRONMENTAL

Operating Temperature — +10°C to +35°C (+50°F to +95°F).

Operating Altitude — 4600 m maximum (15,000 ft).

POWER REQUIREMENTS

Standard Operating Line Voltage — 115 V (nominal).

Line Frequency — 60 Hz.

Maximum Power Consumption — 970 W.

PHYSICAL CHARACTERISTICS

See individual component pages for dimensions.

ORDERING INFORMATION

MP 2902 Audio Measurements Package

Includes: 4041; 4105A; TM 5006; AA 5001; SG 5010; software.

OPTIONS

Option 1J — Substitute AA 5001. Option 02 (CCIR/DIN) for AA5001.

Option 10 — Substitute 4107A Color Graphics Terminal

Option 11 — Substitute 4106A Color Graphics Terminal for 4105A Color Graphics Terminal

Option 19 — Adds 4644 Dot Matrix Printer

Option 2H — Adds DC 5010 Programmable Universal Counter/Timer

Option 20 — Adds 4695 Color Hard Copy

Option 22 — Adds Option 01 to 4041 (Second GPIB Interface and second RS-232C Port). This option is not available with Option 23.

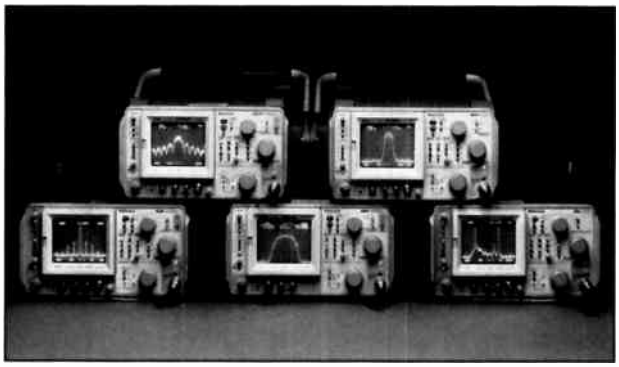
Option 23 — Adds Option 03 to 4041 (Disk Interface and second RS-232C Port). This option is not available with Option 22.

Option 26 — Adds 4041DDU (10 Mbyte hard disk and 5¼ in flexible disk). Requires Option 23

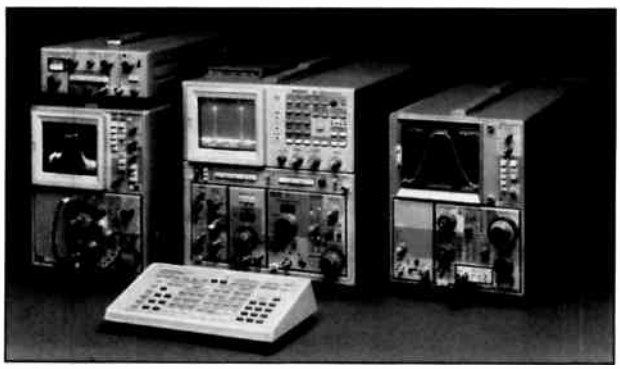
INTERNATIONAL POWER PLUG OPTIONS

Option A1 — Universal Euro 220 V/16 A, 50 Hz.
Option A2 — UK 240 V/13 A, 50 Hz.
Option A3 — Australian 240 V/10 A, 50 Hz.
Option A4 — North American 240 V/15 A, 60 Hz.
Option A5 — Switzerland 220 V/10 A, 50 Hz.

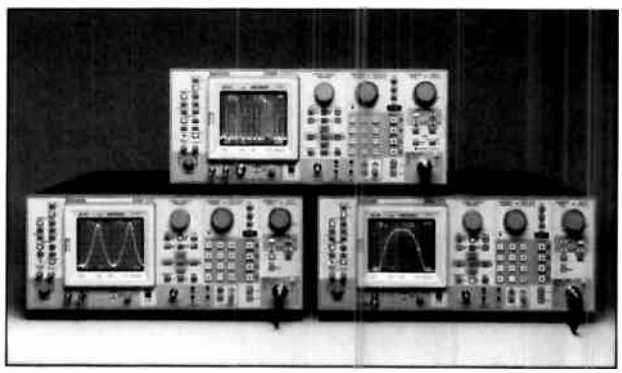
DEDICATED TO SPECTRUM ANALYZER SOLUTIONS FOR THE BROADCAST MARKET



490 Series Spectrum Analyzers.



7000 Series Plug-In Spectrum Analyzers.



2750 Series Spectrum Analyzers.

TEK

SPECTRUM ANALYZER PRODUCT SELECTION GUIDE

Choose among a large selection of capabilities: Top RF performance, portability and full programmability in the 490 Series; versatility and high performance economy in the 7000 Series plug-ins — from baseband through millimeter-wave.

Enhance your productivity, measurement repeatability and utility with TekSPANS — the *NEW* Family of Spectrum Analyzer Applications Software — available for IBM PC, Tek or HP controllers.

Model	Frequency Range	Minimum Resolution	Average Noise Level (Minimum BW)	Amplitude Measurement Range	GPIB Capability	Tracking Generator	Frequency Accuracy
2754	50 kHz to 21GHz	1 kHz	−115 dBm	+30 dBm to −115 dBm	Direct Plot	TR 503	±[(20% Span/Div or Resolution BW) + (Center or Marker Frequency) X10^{-5}] Hz
2754P	50 kHz to 21 GHz	1 kHz	−115 dBm	+30 dBm to −115 dBm	Full	TR503	
2755	50 kHz to 325 GHz	100 Hz	−125 dBm	+30 dBm to −125 dBm	Direct Plot	TR 503	±[(20% Span/Div or Resolution BW) + (Center or Marker Frequency) X10^{-5}] Hz
2755P	50 kHz to 325 GHz	100 Hz	−125 dBm	+30 dBm to −125 dBm	Full	TR 503	
492A	50 kHz to 325 GHz	100 Hz	−125 dBm	+30 dBm to −125 dBm	Direct Plot	TR503	±[(20% Span/Div or Resolution BW) + (Center or Marker Frequency) X10^{-5}] Hz
492AP	50 kHz to 325 GHz	100 Hz	−125 dBm	+30 dBm to −125 dBm	Full	TR 503	
494	10 kHz to 325 GHz	30 Hz	−121 dBm	+30 dBm to −121 dBm		TR 503	±[(2% Span or Res BW) + (CF X Ref Error + (2N + 25 Hz)]
494P	10 kHz to 325 GHz	30 Hz	−121 dBm	+30 dBm to −121 dBm	Full	TR 503	
495	100 Hz to 1.8 GHz	30 Hz	−130 dBm	+30 dBm to −130 dBm	Direct Plot	TR 503	±[(2% Span or Res BW) + (F × Ref Error) + 15 Hz] Where: F= Center or Marker Frequency Ref Error= 10^{-5} Standard 10^{-9} Option 05
495P	100 Hz to 1.8 GHz	30 Hz	−130 dBm	+30 dBm to −130 dBm	Full	TR 503	
7L5	20 Hz to 5 MHz	10 Hz	−148 dBV	+8 dBV to −148 dBV	Semiautomatic with 7854	Option 25	±(5 Hz + 2 × 10^{-6} Dot Freq)
7L12	100 kHz to 1.8 GHz	300 Hz	−115 dBm	+30 dBm to −115 dBm	Semiautomatic with 7854	TR502	±(8 MHz + 1% of Dial)
7L12 Option 39	100 kHz to 2.5 GHz	300 Hz	−115 dBm	+30 dBm to −115 dBm	Semiautomatic with 7854	TR 502 (to 1.8 GHz)	±(8 MHz + 1% of Dial)
7L14	10 kHz to 1.8 GHz	30 Hz	−130 dBm	+30 dBm to −130 dBm	Semiautomatic with 7854	TR 502	±(5 MHz + 2% Span)
7L14 Option 39	1 kHz to 2.5 GHz	30 Hz	−130 dBm	+30 dBm to −130 dBm	Semiautomatic with 7854	TR502 (to 1.8 GHz)	±(5 MHz + 2% Span)

For full specifications on Tektronix Spectrum Analyzer products, please refer to the Tek General Catalog.
For descriptive literature call

Tektronix®
COMMITTED TO EXCELLENCE

JOSEPH J. SKOWRONSKI
Sales Engineer
Frequency Domain Instrumentation

Tektronix, Inc.
450 Sentry Parkway
Blue Bell, PA 19422
Phone: 215-825-6400 609-541-2105

ORDERING INFORMATION

490 SERIES SPECTRUM ANALYZERS

492A Spectrum Analyzer
492AP programmable Spectrum Analyzer
Available Options: 01, 07, 08, 21, 22, 30, 31, 39, 41, 42, 52.

494 Spectrum Analyzer
494P programmable Spectrum Analyzer
Available Options: 08, 12, 13, 14, 20, 21, 22, 30, 31, 32, 41, 42.

495 Spectrum Analyzer
495P programmable Spectrum Analyzer
Available Options: 05 (495P only), 07, 30, 31, 39, 42, 52.

2750 SERIES SPECTRUM ANALYZERS

2754 Spectrum Analyzer
2754P programmable Spectrum Analyzer
Available Options: 01, 07, 30, 31, 52.

2755 Spectrum Analyzer
2755P programmable Spectrum Analyzer
Available Options: 01, 07, 08, 21, 22, 30, 31, 39, 41, 42, 52.

490 SERIES AND 2750 SERIES OPTIONS

Option 01 — Internal preselection. Eliminates spurious harmonic and image responses through automatic internally calibrated input preselection.

Option 07 — Adds 75 Ω input and dBmV calibrator to the normal 50 Ω input and dBm calibrator.

Options 07, 08, 20, 21 and 22 are not combinable in any form.

Option 08 — Delete coverage above 21 GHz.

Option 20 — General Purpose 12.4 to 40 GHz Waveguide Mixer Set. Includes three mixers (12.4 to 18 GHz, 18 to 26.5 GHz, and 26.5 to 40 GHz) and attaching hardware to extend the upper frequency.

Option 21 — Amplitude Calibrated high Performance 18 to 40 GHz Waveguide Mixer Set. Includes two mixers (18 to 26.5 GHz and 26.5 to 40 GHz) and attaching hardware to extend the upper frequency.

Option 22 — Amplitude Calibrated High Performance 18 to 60 GHz Waveguide Mixer Set. Includes three mixers (18 to 26.5 GHz, 26.5 to 40 GHz and 40 to 60 GHz) and attaching hardware to extend the upper frequency.

Option 30 — Rackmount.

Option 31 — Rackmount with all inputs through rear panel.

Option 32 — Benchmount (490 Series Only).

Option 39 — Non-Lithium (Silver) batteries for battery-powered memory.

Option 41 — Digital Radio Measurement Enhancement.

Option 42 — Wide Bandwidth IF Output.

Option 52 — North American 220 V configuration with standard power cord. Fuses are replaced with 2A slow blow.

SPECTRUM ANALYZER/CONTROLLER PACKAGES

When ordering packages, please use the model number and desired options of the spectrum analyzer plus one of the following package options. **Available in U.S. only.**

Option 23 — GRASP, PC2A, GPIB cable.

Option 24 — GRASP, PC2A, GPIB cable, IBM PC/XT-3, includes IBM computer components.

Option 25 — GRASP, PC2A, GPIB cable, IBM PC/XT-1, includes IBM computer components.

Option 26 — GRASP, PC2A, GPIB cable, IBM PC/AT Enhanced Model, includes IBM computer components.

Option 28 — GRASP, PC2A, GPIB cable, IBM PC/AT Entry Model, includes IBM computer components.

For a list of components request Data Sheet 26A-6216.

7000 SERIES PLUG-IN SPECTRUM ANALYZERS

7L5 SPECTRUM ANALYZER WITH STANDARD ACCESSORIES — (Requires L3 Plug-In Module).

L3 Plug-In Module — 1 MΩ, 50 Ω, 600 Ω. Includes: Instruction manual (070-2154-02).

L3 Option 01 — (L3 Only) 1 MΩ, 75 Ω, 600 Ω.

7L5 OPTIONS

Option 11 — L3 Option 01 Plug-In Module shipped with 7L5.

Option 20 — L3 Plug-In Module shipped with 7L5.

Option 25 — Built-in 10 Hz — 5 MHz Tracking Generator.

CONVERSION KIT

Tracking Generator — To add to existing 7L5. Order 040-0810-00.

7L12 SPECTRUM ANALYZER WITH STANDARD ACCESSORIES

7L12 OPTIONS

Option 39 — 100 kHz to 2.5 GHz Extended Frequency Range.

7L14 SPECTRUM ANALYZER WITH STANDARD ACCESSORIES

7L14 OPTIONS

Option 23 — Deletes input limiter.

Option 39 — 1 kHz to 2.5 GHz Extended Frequency Range.

RECOMMENDED MAINFRAMES

7613 — Storage Oscilloscope, 100 MHz (7L12).

7603 — Oscilloscope, 100 MHz (7L5, 7L14).

TV SIDEBAND ADAPTOR

1405 — TV Sideband Adaptor 525/60 Markers. Includes: Instruction manual (070-0728-00).

1405 OPTIONS

Option 01 — TV Sideband Adaptor (625/50 Markers).

Opton 02 — Dial Readout for use with 490 Series.

TRACKING GENERATORS

TR 502 — Tracking Generator with standard accessories (7L12, 7L14).

TR 503 — Tracking Generator with standard accessories (490 Series).

OPTIONAL ACCESSORIES

TM 503 — Power Module.

FREQUENCY COUNTER PACKAGE TO WORK WITH 7L14/TR502 ONLY

TM 504 — Power Module.

DC 509 Option 01 — Digital Counter with high stability time base.

DP 501 — Digital Prescaler.

Blank Panel — Order 016-0195-03.

10 dB, 3mm Attenuator — Used in the 2nd LO input line to improve TR 502/7L12 isolation. Order 307-0553-00.

ADAPTORS

BNC — From Left to Right
Male to UHF Female.
Order 103-0032-00

Male to GR. Order 017-0064-00

Male to N Female. Order 103-0058-00

Male to Binding Post. Order 103-0033-00

Male to Dual Binding Post.
Order 103-0035-00
Female to Dual Banana.
(Not shown) Order 103-0090-00

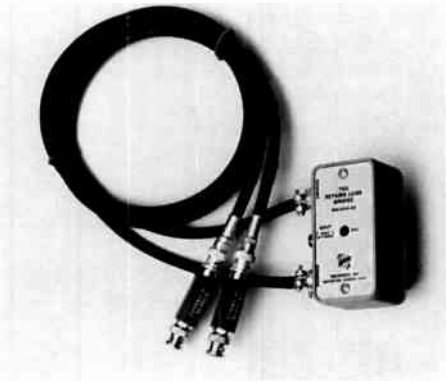
BNC — From Left to Right
Female to BNC Female.
Order 103-0028-00
Male to BNC Male. Order 103-0029-00
T. Order 103-0030-00
Elbow Male to Female.
Order 103-0031-00

BNC — From Left to Right
Female to UHF Male.
Order 103-0015-00
Female to GR. Order 017-0063-00
Female to N. Male. Order 103-0045-00
Female to Clip Leads.
Order 013-0076-00

BNC CABLES

Coaxial
50 Ω, 18 in. Order 012-0076-00
50 Ω, 42 in. Order 012-0057-01
75 Ω, RG 59, 42 in. Order 012-0074-00
93 Ω, 42 in. Order 012-0075-00
75 Ω, 300 in (25 ft). Order 012-0157-00
75 Ω, Belden 8281, (6 ft).
Order 012-0159-01
75 Ω, Belden 8281, (42 in).
Order 012-0159-00

75 Ω RETURN LOSS BRIDGE



This Return Loss Bridge is compact and rugged. It features passive components and simple construction. It is designed to measure impedance errors in a 75 Ω system in terms of return loss, using a wide-band, high-gain differential amplifier and oscilloscope (Tektronix 7A13/7000 Series) as the error detector. The Tektronix 011-0103-00 and 011-0103-01 are 75 Ω, 0.2% double-ended termination resistors supplied as removable bridge arms. Two matched coax cables extend the bridge arms and are permanently attached to the bridge. Either or both bridge arms can be disconnected for maximum flexibility, during calibration and in making measurements.

The bridge can be driven by a number of different sources such as TV test signals, squarewaves, sinewaves, $\sin^2$ pulses, multiburst, swept frequency sinewaves. With the Return Loss Bridge coupled to the differential amplifier and oscilloscope, a television test signal such as the multi-burst can be used to measure impedance errors over the complete video spectrum with a single measurement.

CHARACTERISTICS

Return Loss — ≥54 dB, dc to 10 MHz.

Maximum Input Voltage — 6 V RMS (6 V RMS, dc to 1.2 MHz decreasing to 0.7 V RMS at 10 MHz when used with 7A13).

Return Loss Bridge — Order 015-0149-00

TERMINATIONS

75 Ω termination. 75 Ω within 0.2% (at dc). Return loss is ≥52 dB, dc to 10 MHz, maximum input voltage is 5 V RMS, center conductor to ground.

BNC — Order 011-0102-00.

75 Ω feedthrough termination. 75 Ω within 0.2% (at dc). Return loss is ≥52 dB, dc to 10 MHz maximum input voltage is 3 V RMS, center conductor to ground.

BNC — Order 011-0103-02.

CAMERAS

C-4 Camera
Includes: Body, Pistol Grip (122-0901-00); hood (122-0894-01); operator manual (070-5000-01).

C-5C Camera
Includes: Adaptor hood (016-0357-01); flash unit (016-0642-02); instruction manual (070-2824-00).

C-7 Camera with Flash
Includes: Adaptor hood (016-0357-01); print holding chamber (122-1039-00); circuit board covers for 0.67 mag (200-3074-00); for 0.87 mag (200-3031-00); operator manual (070-5127-00).

C-30BP Camera
Includes: Polaroid pack film back (122-0752-02); split-image focus plate (387-0893-02); mounting adaptor (016-0306-01); instruction manual (070-2825-00).

Option 01 — Expanded Field of View
Includes: Same as C-30BP except it comes with 016-0269-03 mounting adaptor instead, plus corrector lens (352-0341-01).

C-53P Camera
Includes; Mounting adaptor for all 7000, 5000, and small 600 Series (016-0249-06); camera visor (337-0411-02); Polaroid film back (122-0926-02) with a focus plate (387-0893-02); instruction manual (070-1011-03).

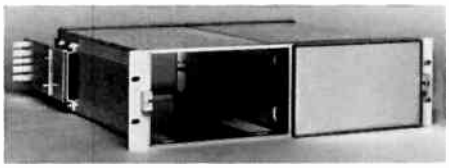
C-59AP Camera
Includes: Mounting adaptor for all 7000, 5000, and small 600 Series (016-0249-06); camera visor (337-0411-02); Graflock film back (122-0931-01) with integral focusing screen; instruction manual (070-3632-00).

("P" denotes that the camera has a 3 in. x 4 in. pack film back. All models include Polaroid pack film back.)

FOR USE WITH HALF RACK WIDTH SIGNAL MONITORS, VECTORSCOPES, AND WAVEFORM/VECTOR MONITORS

Plain Metal Case — Order 1700F00.

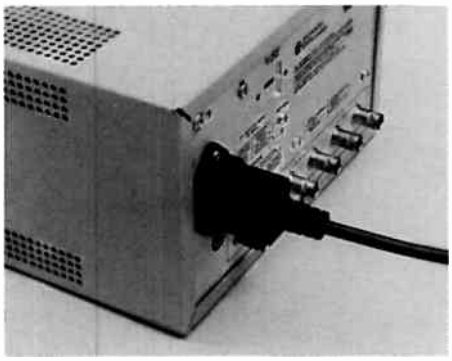
Plain Carrying Case — Portable case with handle and feet. Order 1700F02.



Rack Adapter — For side-by-side mounting of half rack width instruments. Order 1700F05.

Blank Panel Assembly — For one half of the side-by-side rackmount. Order 1700F06.

Snap-On Front Cover — High impact plastic. *Use with 1700 Series only.* Order 200-1566-00.



Snap-Lock Power Cord Kit — *Use iwth 1710 Series only.* North America Order 010-1185-00.

CONVERSION KITS

TSG1 to TSG7 — For SMPTE Bars. Order 040-1010-00.

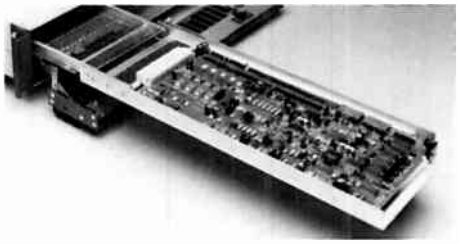
1480C/1480R Option 01 X 10 Probe — Order 040-0769-00.

R520A Rack-to-Cabinet Conversion — Order 040-1153-00.

1410R/1411 Rack-to-Cabinet Conversion — Order 040-1152-00.

R148/R148M Rack-to-Cabinet Conversion — Order 040-0573-00

FOR USE WITH 118-AS/110-S SYNCHRONIZERS



Circuit Board Extender — Order 670-7754-00.

Interconnecting Cable — With connectors for use between the 110-S and Remote Control Unit (110-RC) Interconnecting Cable. Order 012-0131-00.

FOR USE WITH 1410R SYNC AND TEST SIGNAL GENERATOR

Blank Panel — Single-Width. Order 333-2171-00.

FOR USE WITH R148 TEST SIGNAL GENERATOR

Noise Measurement Filters — External filters are required with the R148 Generator when making noise measurements.

Low Pass 6.0 MHz — 625/50. Order 015-0220-00.

Noise Weighting — 5.0 MHz 625/50. Order 015-0215-00.

Low Pass 4.2 MHz — 525/60. Order 015-0212-00.

Noise Weighting 4.2 MHz — 525/60. Order 015-0214-00.

CCIR recommendation 568 provides for measuring signal-to-weighted random noise on all international transmissions (both 525/60 and 625/50) with a 5.0 MHz low pass filter and a unified noise weighting filter.

Low Pass 5.0 MHz — Order 015-0213-00.

Unified Noise Weighting Network — Order 015-0283-00.

Rackmount to Cabinet Conversion Kit — Order 040-0573-00.

FOR USE WITH 1440 AUTOMATIC VIDEO CORRECTOR

Remote Control Unit — For 1440 (includes two connectors) Order 015-0240-00.

Remote Monitor Unit — For 1440 (includes one connector). Order 015-0239-00.

Extender Cable — Six foot with connectors for use between the 1440 and remote control unit or remote monitor unit. Order 012-0131-00.

Extender Cable — Three foot with connectors, for use between the 1440 chassis and the rear rackmounting section. Order 012-0637-00.

FOR USE WITH 1910 DIGITAL GENERATOR

Remote Control Unit — Order 015-0374-00.

Interconnecting Cable — (6 ft). Order 012-0108-00.

Interconnecting Cable — 22 ft). Order 012-0251-00.

ACTIVE VIDEO LINES

All video lines not occurring in the vertical blanking signal.

APL

The average signal level, with respect to blanking level, during the active picture scanning time expressed as a percentage of difference between blanking and reference white (IEEE Def).

BACK PORCH

That portion of the composite video signal lying between the trailing edge of the horizontal sync pulse and the trailing edge of the horizontal blanking pulse.

BLANKING LEVEL

The level of the composite picture signal separating the range containing picture information from the range containing synchronizing information (IEEE Def).

BREEZEWAY

The portion of the back porch between the trailing edge of the sync pulse and the start of the color burst.

BTSC MULTICHANNEL SOUND

Multichannel (stereo) television system used in the United States (Broadcast Television Systems Committee).

BURST FLAG

A keying or gating signal used in forming the color burst from a chrominance subcarrier source (IEEE Def).

B-Y

A color difference signal obtained by subtracting the luminance signal from the blue camera signal. It is ploted on the 0° to 180° axis of a vector diagram.

CHROMINANCE SIGNAL

That portion of the color television signal containing the color information (STOC Def).

COLOR BAR

A test signal, typically containing six basic colors: yellow, cyan, green, magenta, red, and blue — used to check the chrominance functions of color TV systems.

COLOR BURST

In color systems, a burst of subcarrier frequency located on the back porch of the composite video signal. This serves as a color synchronizing signal to establish a frequency and phase reference for the chrominance signal.

COLOR GAMUT

The entire range of values a component signal or combination of component signals may take on that are reproducible at the display device. Some component formats are interdependent (Y, R-Y, and B-Y) and the valid color gamut cannot be evaluated by looking at a single component alone.

COLOR SUBCARRIER

In color systems, the carrier signal whose modulation sidebands are added to the monochrome signals to convey color information.

COMPONENT

The fundamental electrical signal for producing video images. Three of these signals are needed for color video and the term component is used to indicate one considered alone. The signals may be in digital or analog form. They may be in the combination of Red, Green and Blue or they may be in some other form such as Luminance, R-Y, and B-Y. In general the RBG signals can be arithmetically combined into any three components and decoded at the display device into the RGB components necessary to make the color picture.

COMPOSITE BLANKING

The complete television blanking signal, composed of both line rate and field rate blanking signals (see also Line Blanking and Field Blanking).

COMPOSITE SYNC

The combined line and field rate synchronizing pulses (including field equalizing pulses).

COMPOSITE VIDEO

The color picture signal plus blanking and all synchronizing signals (STOC Def).

CONVERGENCE

In color television, the meeting or crossing of the three electron beams at the phosphor screen.

CROSSHATCH

A test pattern consisting of vertical and horizontal lines used for converging color monitors and cameras.

DIFFERENTIAL GAIN

The difference in output amplitude (expressed in percent or dB) of a small high frequency sinewave signal at two stated levels of a low frequency signal on which it is superimposed (IEEE Def).

DIFFERENTIAL PHASE

The difference in output phase of a small high frequency sinewave signal at two stated levels of a low frequency signal on which it is superimposed (IEEE Def).

EIA

An abbreviation for Electronic Industries Association.

EQUALIZING PULSES

Pulses of one half the width of the horizontal sync pulses transmitted at twice the rate of the horizontal sync pulses during the portions of the vertical blanking interval immediately preceding and following the vertical sync pulse. These pulses cause the vertical deflection to start at the same time in each interval, and also keep the horziontal sweep circuits in step during the portions of the vertical blanking interval immediately preceding and following the vertical sync pulse.

FIELD

One of the two (or more) equal parts of information in which a frame is divided in interface scanning.

FIELD BLANKING

The blanking signals occurring at the end of each field used to make the vertical retrace invisible. Also called vertical blanking.

FIELD FREQUENCY

The number of complete fields scanned per second.

FRAME

One complete picture consisting of two (or more) fields of interlaced scanning lines.

FRONT PORCH

That portion of the composite picture signal lying between the leading edge of the horizontal blanking pulse and the leading edge of the corresponding horizontal sync pulse.

H RATE

The number of complete horizontal lines, including trace and retrace, scanned per second.

HORIZONTAL DRIVE

A pulse at horizontal rate used in TV cameras. Its leading edge is coincident with the leading edge of the horizontal blanking pulse, and the trailing edge is coincident with the trailing edge of the horziontal sync pulse (NTSC only).

HUE

The attribute of color perception that determines whether the color is red, yellow, green, blue, etc.

IRE

An abbreviation for Institute of Radio Engineers. An "IRE" unit is 1% of the voltage from blanking to peak white in the video signal.

IRE SCALE

An oscilloscope scale that applies to composite video levels. Typically there are 140 IRE units in one volt (1 IRE = 7.14 mV).

–I, W, Q, B

An NTSC test signal used to check television broadcast equipment. It consists of a –I signal followed by a white bar, then a Q signal and a black level on each line.

LINE BLANKING

The blanking signal at the end of each horizontal scanning line. Used to make the horizontal retrace invisible. Also called horizontal blanking.

LINE FREQUENCY

The number of horizontal scans per second, normally 15,734.26 times per second for NTSC color systems.

LISSAJOUS PATTERN

The looping patterns generated by a CRT spot when the horizontal (X) and vertical (Y) deflection are sinusoids. These patterns are very useful for evaluating the delay or phase of two sinusoids of the same frequency. A more general definition would allow XY deflection with more complex signals such as video components. The resulting Lissajous patterns would then be very useful for evaluating the interdependence of the signals as required for color gamut measurements.

LUMINANCE

The amount of light intensity perceived by the eye as brightness (referred to as "Y").

NTSC

National Television Systems Committee. An industry-wide engineering group which, during 1950-1953, developed the color television specifications now established in the United States.

PRO

Professional channel in the BTSC system used for data or voice communications.

QUADRATURE COMPONENT

The measure of change in visual carrier phase resulting from a change in video level.

R-Y

A color difference signal obtained by subtracting the luminance signal from the red camera signal. It is plotted on the 90° to 270° axis of a vector diagram.

SAP

Second Audio Program channel in the BTSC system. Normally used for a second language.

SATURATION

Indicates to what degree a color is not diluted by white light.

SETUP

The separation in level between blanking and reference black levels.

STAIRCASE

A video test signal containing several steps at increasing luminance levels. The staircase signal is usually amplitude modulated by a subcarrier frequency and is useful for checking amplitude and phase linearities in video systems.

SYNC

An abbreviation for "synchronization," "synchronizing," etc. Applies to synchronization signals, or timing pulses, which lock the electron beam of the picture monitors in step, both horizontally and vertically, with the electron beam of the pick up tube. The color sync signal (NTSC) is known as the color burst.

TIME CODE

A digital or binary code used to label each frame of a video signal. This is very useful for editing the video since the time code is in the form of hours, minutes, seconds and frames.

TIME CODE SYNC WORD

A binary word that is used to synchronize the time code decoder or reader for proper identification of the data words. This sync word is visible on an oscilloscope display of audio time code as a fine structure band about 5 μsec in duration at the end of the video frame.

VERTICAL BLANKING INTERVAL

The blanking portion at the beginning of each field. It contains the equalizing pulses, the vertical sync pulses and VITS (if desired).

VITS

Vertical Interval Test Signal. A signal that may be included during the vertical blanking interval to permit on-the-air testing of the video system.

ALABAMA

Huntsville 35805
4900 Corporate Drive
Suite H
Phone: (205) 830-9212

ARIZONA

(Phoenix)
3015 S. 48th Street, Suite 100
Tempe 85282
Phone: (602) 438-1011
Tucson Area: (602) 790-3099
Mailing Address:
P.O. Box 29540
Phoenix 85038

CALIFORNIA

(Concord)
3451 Vincent Road
Pleasant Hill 94523
Phone: (415) 932-4949
From Oakland/San Francisco: (415) 254-5353
From Sacramento: (916) 447-5072
From Fremont/Milpitas: (415) 490-7067
From Livermore: (415) 449-5176
Mailing Address:
P.O. Box 4040
Concord 94524-2040

Irvine 92714
17052 Jamboree Blvd.
Mailing Address:
P.O. Box 19523
Irvine 92713
Phone: (714) 660-8080
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