

# 1720 Series Vectorscopes

# 1730 Series Waveform

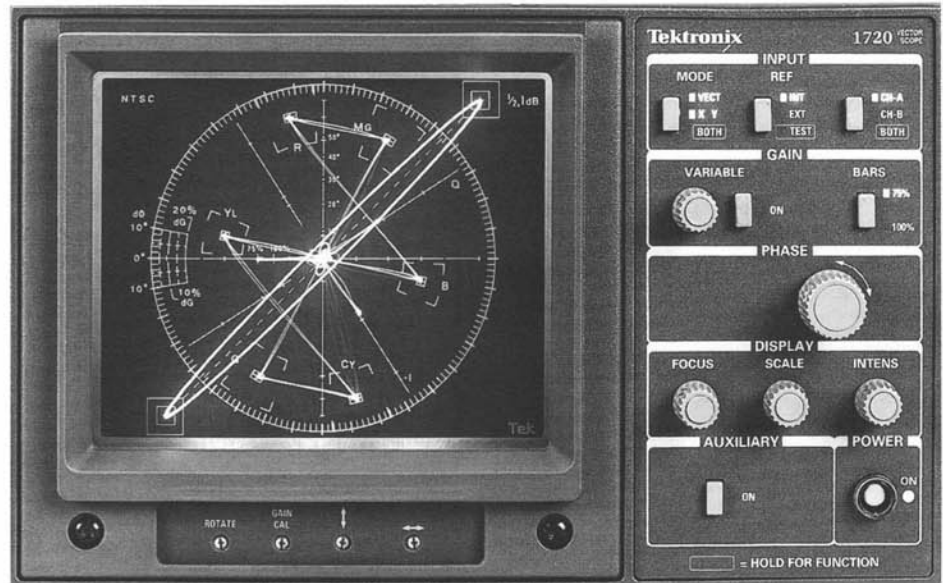
# Monitors

- Performance and economy
- Full frame line select
- Simultaneous Channel A & B display
- Dual filter display
- One-button front panel recall
- RGB/YRGB display capability
- 1730 Series displays D-2 servo waveforms
- Parallax-free internal graticules
- Differential phase and gain measurement
- Stereo audio phase measurement
- Vector center dot clamping
- Portable DC power input available
- Remote control capability
- Available in NTSC and PAL standards as well as dual standard
- White phosphor available
- SCH monitoring available with 1720 SCH Series Vectorscopes
- Composite serial and parallel monitoring is available with 1730 D Series

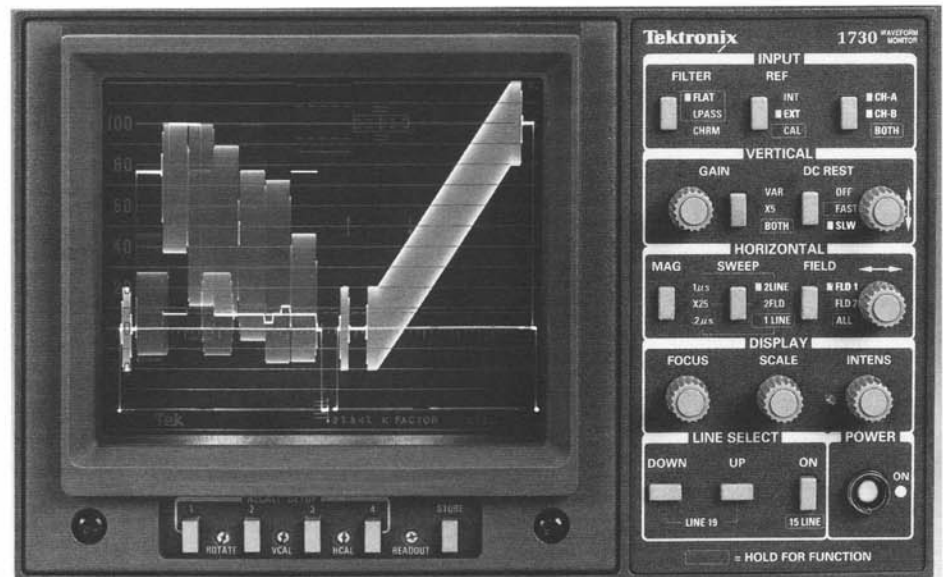
The Tektronix 1730 Series Waveform Monitors and 1720 Series Vectorscopes provide comprehensive television signal monitoring for both NTSC and PAL applications. These versatile instruments are light weight, half-rack width, and have bright CRTs for video signal monitoring. Both instruments exceed normal monitoring capabilities, and 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 monitors do the job faster, better and easier at an economical price.

The 1720 Series and 1730 Series family cover a wide variety of video testing needs. For typical composite monitoring in the NTSC and PAL realm, the 1720 Series and 1730 Series more than handle the job. If there is a need for Dual Standard testing (PAL and NTSC), the 1735 Waveform Monitor and 1725 Vectorscope can be used. For SCH capability the 1720 SCH Series of vectorscopes are an economical solution. Digital testing of both Composite Parallel and Composite Serial can be accomplished with the 1730 D Series of Digital Waveform Monitors. Whatever the individual video testing application, the 1720 and 1730 Series family provide an easy to use, economical solution.

**Complete line select.** The 1730 Series Waveform Monitor has full frame line select,



1720 Vectorscope — Vector and Stereo Audio Dual display mode.



1730 Waveform Monitor — Simultaneous Channel A and B display.

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 overlaid for camera and VTR adjustments.

**Simultaneous Channel A and B display.** These instruments have state-of-the-art microprocessor front panel control. They are operator-friendly and provide outstanding 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 overlaid. These filter modes can also be used independently. Both versions of the 1730 Series have chroma filters centered around the subcarrier frequency.

# 1720 Series Vectorscopes 1730 Series Waveform Monitors

**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.

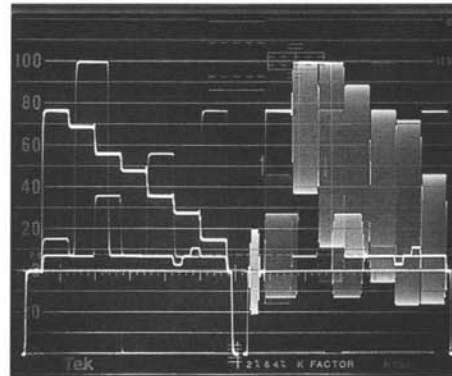
**Stereo audio phase measurements.** Balanced inputs for the X Y mode are available on the 1720 Series Vectorscope through a separate input connector. This mode is particularly useful for evaluation of stereo audio with a special X Y graticule scale for both amplitude and phase measurements. X Y measurements 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.

**Polar display of relative and absolute SCH phase (1720SCH series only).** The absolute and relative SCH polar displays makes the 1720SCH series ideal for the editing suite. In the two dot absolute SCH mode, the 1720SCH series accurately display the subcarrier to horizontal phase relationship of the input signal. In the one dot relative mode, the SCH relationship is measured against an external reference signal. This makes matched frame editing sequences easy to verify.

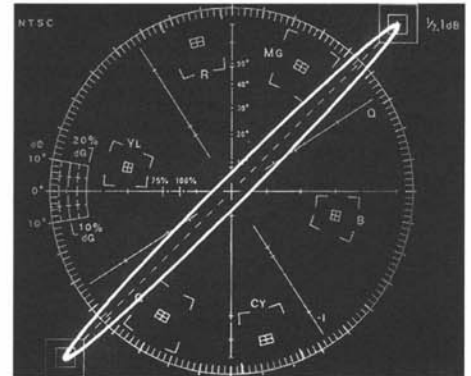
**RGB-YRGB.** The Waveform Monitor can display RGB or YRGB. The RGB/YRGB staircase input is through a rear panel connector.

**Vector center dot clamping.** The 1720 Series Vectorscopes employ center dot clamping in Vector mode for easy detection of residual sub-carrier 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.



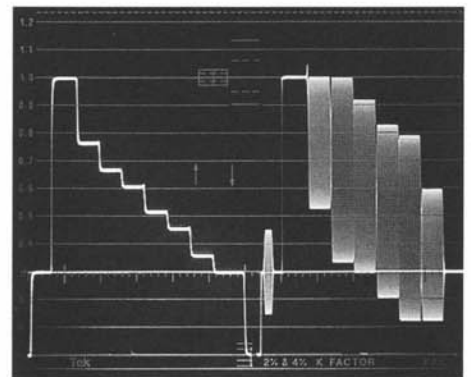
1730 NTSC Dual Filter display.



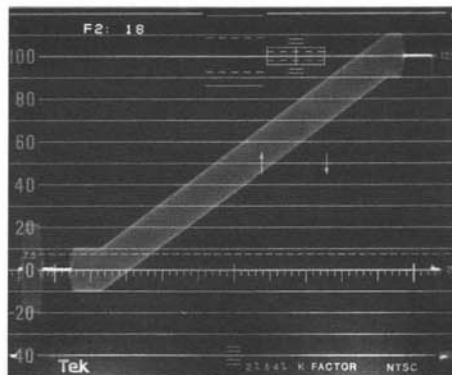
1720 Stereo Audio display with phase error.



1721 PAL Vector display.



1731 PAL Dual Filter display.



Line Select Test Signal display.



1720 NTSC Vector display.

**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. 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. 12 Vdc power is not available on 1730 D and 1720 SCH Series products.

**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, PAL and Dual Standard.** 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. The 1735 Waveform Monitor and 1725 Vectorscope provide PAL/NTSC Dual Standard Monitoring. PAL-M and PAL-N instruments are available as a modified product.

# 1720 Series Vectorscopes 1730 Series Waveform Monitors

1720/1730

SIGNAL MONITORS

## 1730 SERIES WAVEFORM MONITORS CHARACTERISTICS

### 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 FSC
Channel Isolation	>50 dB at FSC
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

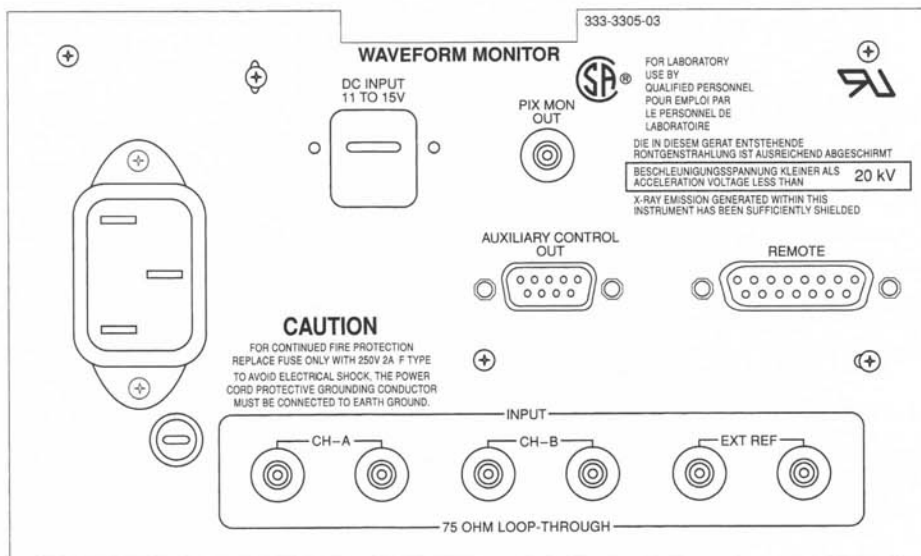
Flat	50 kHz to 6 MHz within 2% (X1), within 5% (X5)
Low Pass	40 dB attenuation at FSC Low pass response within 1% of flat response (1735: 30 dB)
Chroma	Nominal bandwidth 1 MHz 2X FSC attenuation >20 dB Chroma response within 1% of flat response.

### TRANSIENT RESPONSE

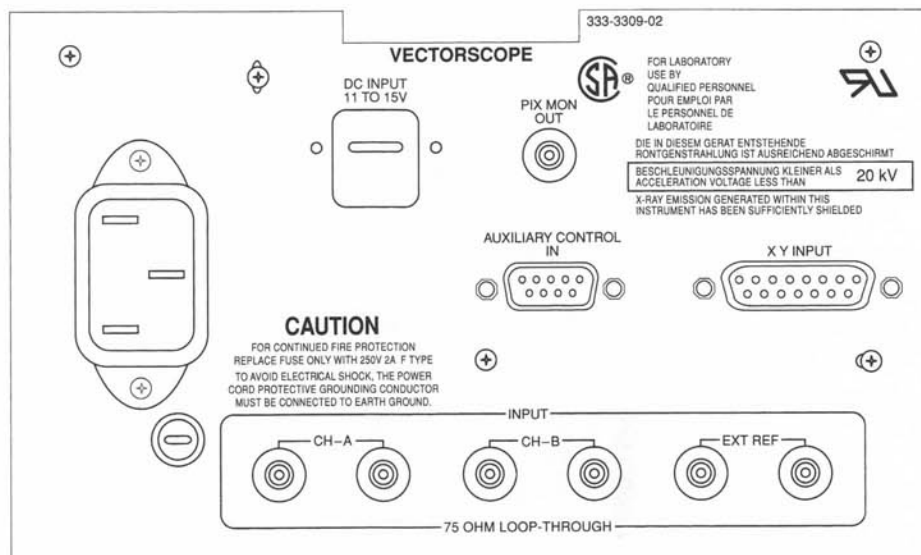
Preshoot	<1%
Overshoot	<2%
Ringing	<2%
Tilt	<1%
Pulse-to-Bar Ratio	0.99:1 to 1.01:1
Differential Gain	<1%

### 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 shift



1730 Series rear panel.



1720 Series rear panel.

### 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 ms/div
2-Line Repetition Rate	Equal to half applied line rate, magnification equals 1 ms/div
2-Field Repetition Rate	Equal to applied frame rate, magnification equals approximately X25
Timing Accuracy	
1 ms/div.	within 2%
0.2 ms/div.	within 3%
Linearity	within 2%
Differential Linearity	within 2%



1720/1730

# 1720 Series Vectorscopes 1730 Series Waveform Monitors

## HORIZONTAL DEFLECTION SYSTEM (CONTINUED)

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 $\pm 6$ 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).

## HORIZONTAL DEFLECTION SYSTEM (CONTINUED)

<b>RGB/YRGB</b>	
Repetition rate	Field rate and line rate with magnification of X25 and X10, respectively.
<b>Sweep length</b>	
3-Step (RGB)	3.4 to 4.1 divs
4-Step (YRGB)	2.5 to 3.1 divs

## 1720 SERIES VECTORSCOPES CHARACTERISTICS

### SIGNAL INPUT (VIDEO AND EXTERNAL REFERENCE)

Return Loss	>40 dB, 50 kHz to 6 MHz, power on or off
Maximum Input	$\pm 5$ Vdc + peak ac
Loop-through Isolation	>70 dB at $F_{sc}$
Channel Isolation	>70 dB at $F_{sc}$
Impedance	>15 k $\Omega$

### CHROMINANCE BANDWIDTH

Upper	-3 dB point, $F_{sc} + 500$ kHz, $\pm 100$ kHz
Lower	-3 dB point, $F_{sc} - 500$ kHz, $\pm 100$ kHz
Vector Phase Accuracy	Within 1.25°
Vector Gain Accuracy	within 2.5%, typical
Quadrature Phasing	within 0.5°, typical

### SUBCARRIER REGENERATOR

Pull-in Range	$F_{sc} \pm 50$ Hz
Pull in Time	within 1 second
Phase Shift with Subcarrier Frequency Change	2° $\pm 50$ Hz
Phase Shift with Burst Amplitude Change	<2° with $\pm 6$ dB change from nominal
Phase Shift with Input Channel Change	<0.5°
Phase Change with Variable Gain Control	$\pm 1$ °
Phase Control Range	360° continuous rotation
Burst Jitter	<0.5°
Display Differential Phase and Gain	$\pm 1$ ° and $\pm 1$ %
Center Dot Clamp Stability	<0.4 mm spot movement

## SYNCHRONIZATION

Internal	Composite video with sync $\pm 6$ 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 to 600-Ohm system, factory set to 0 dBm
Maximum Input	$\pm 15$ 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

## SCH MODE (1720SCH AND 1721SCH ONLY)

<b>Accuracy</b>	
Absolute	$\pm 5$ degrees phase at 25°C
Relative	$\pm 2$ degrees
Acquisition Time	Less than 1 second

## 1720 AND 1730 SERIES PRODUCTS COMMON CHARACTERISTICS

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). Not available on 1730 D and 1720 SCH Series products

## ENVIRONMENTAL

<b>Temperature</b>	
Nonoperating	-55°C to +75°C
Operating	0°C to +50°C
<b>Altitude</b>	
Nonoperating	To 18,000 M (50,000 feet)
Operating	To 5,500 M (15,000 feet)
<b>Shock</b>	
Nonoperating	30 g's, 1/2 sine, 11 ms duration, 3 shocks per surface (18 total)
Transportation	Qualified under NATA Test Procedure 1A, Category II (30-inch drop)
<b>Humidity</b>	
Meets Tektronix Standard 062-2847-00	
<b>Certification</b>	
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

<b>Dimensions</b>	<b>mm</b>	<b>in</b>
Height	133.4	5.25
Width	215.9	8.5
Length	460.4	8.125
<b>Weight</b>	<b>kg</b>	<b>lb</b>
Approximately	3.8	8.5

## 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 1720, 1720 SCH, 1721, 1721 SCH, 1725, 1730, 1731, and 1735 are UL-recognized components and meet the requirements for listing when used in the appropriate enclosure.

**1720** — Vectorscope (for NTSC System Applications)

**1720SCH** — Vectorscope with SCH (NTSC)

**1721** — Vectorscope (for PAL System Applications)

**1721SCH** — Vectorscope with SCH (PAL)

**1725** — Vectorscope (for PAL/NTSC Dual Standard Applications)

**1730** — Waveform Monitor (for NTSC System Applications)

**1731** — Waveform Monitor (for PAL System Applications)

**1735** — Waveform Monitor (for PAL/NTSC Dual Standard Applications)

PAL-M instruments are available as a modified product.

## INCLUDED ACCESSORIES

Instruction manual, power cable assembly, spare fuse, auxiliary control cable (1720 Series only).

## OPTIONS

**Option 74** — Substitute P4 (white) phosphor on CRT

**Option M2** — Remedial Service Support

**Option M8** — Calibration Service

## OPTIONAL ACCESSORIES

**1700F00** — Cabinets Plain (painted silver grey)

**1700F02** — Portable (including handle, feet and front cover, painted silver grey)

**1700F05** — Side-by-side Rack Adapter

**1700F06** — Blank Half-rack Width Panel

**1700F10** — DC Power Converter (kit). Not available on 1730 D or 1720 SCH Series.

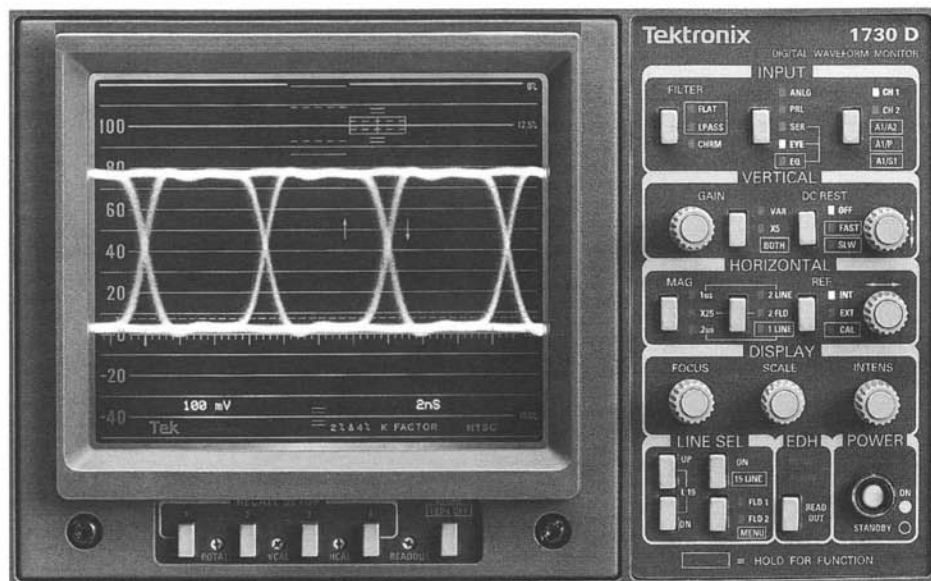
**C9 Option 20** — Camera

**016-0475-00** — Viewing Hood

**200-3897-01** — Snap-on Front Cover

# 1730 D Series Digital Composite Waveform Monitor

- Two analog composite inputs
- Two serial digital composite inputs
- One parallel digital composite input
- Passive loop-through for serial inputs
- Precision analog display of digital input
- Full time DAC output
- Serial digital bit stream EYE Pattern display
- Error Detection and Handling display mode (EDH)
- Displays VTR servo waveforms
- Available in PAL (1731 D) and NTSC (1730 D) versions
- Menu screens for instrument setups and error read-outs



1730 D Digital Composite Waveform Monitor with EYE Pattern display.

As the video environment moves toward digital video signal distribution, the need for signal monitoring is still prevalent. The 1730 D Series of digital waveform monitors meets this challenge with a variety of flexible digital and analog monitoring modes.

The 1730 D Series functions as a standard waveform monitor, with direct digital inputs for serial and parallel composite signals. Additionally it has two analog inputs for composite video signals, and input for an external reference.

#### Active composite parallel loop through

The 1730 D Series provides a composite parallel input. This is a buffered, regenerating loop-thru.

#### Full time DAC output

The 1730 D Series also offers an analog output derived from a precision 10-bit D to A Converter (DAC). This full time DAC output operates for the serial or parallel digital inputs.

#### Serial digital inputs with EYE Pattern display

The 1730 D Series offers the additional benefit of digital video testing via serial composite digital inputs. These wideband, high return loss loop-throughs allow the instrument to "tap" and monitor a 143 Mb/s (177 Mb/s PAL) Serial Composite Digital link. The 1730 D Series also offers an EYE Pattern display of the serial input. This provides an indication of the analog performance of the digital channel. The EYE display is formed by equivalent time sampling. A wideband sample-and-hold takes "snap shots" of the data stream's voltage at particular instants in time and displays these values against a calibrated time axis. This allows observation of the amplitude, rise time, and jitter of the serial bit stream. InterSymbol Interference (ISI) caused by bandwidth loss and improper cable termination is clearly seen, a useful tool when installing and troubleshooting serial systems.

#### Error Detection and Handling display (EDH).

The 1730 D Series includes a unique method for checking serial path integrity. This mode provides an error detection scheme when used with the Tektronix TSG-170D digital video generator. The Error Detection and Handling (EDH) operation is based on the instrument calculating a check-word for the received digital video, then comparing this with the check-word sent from the generator. Further, in-service error rate monitoring is possible when used with picture sources that comply with SMPTE RP165.

#### Simultaneous input flexibility

Parallel digital or serial digital inputs can be paraded side by side with an analog input on the CRT's display.

The 1730 D Series, when used with a 1720 Series Vectorscope, offers a complete solution to digital and analog video system testing and monitoring.

### CHARACTERISTICS

#### SERIAL INPUTS

Input Type	Passive loop-through 75 $\Omega$ compensated
Return Loss	>25 dB, 50 kHz to 200 MHz
Insertion Loss	<1%
Transmission Bandwidth	50 kHz to 350 MHz, $\pm 3\%$

#### SERIAL RECEIVER

Input Signal	143 Mb/s (NTSC) 177 Mb/s (PAL) scrambled NRZI
Equalization	Automatic
Maximum Range	>250 meters using Belden 8281 coax

#### EYE PATTERN DISPLAY

Type	Equivalent time sampler
Input Signal	Selected serial input, with or without equalization
Bandwidth	>350 MHz
Risetime	<1 ns
Deflection Factor	
Vertical	100 mV/10 IRE
Horizontal	2 ns/div

#### PARALLEL DIGITAL INPUT

Type	Differential ECL (10 K family)
Input Impedance	110 $\Omega$ nominal

#### PARALLEL DIGITAL OUTPUT

Type	Differential ECL (10 K family)
Load Impedance	110 $\Omega$ nominal

#### DAC OUTPUT

Frequency Response	
50 kHz to 4.2 MHz (NTSC)	$\pm 1\%$ ( $\pm 0.09$ dB)
4.2 MHz to 5.5 MHz (NTSC)	$\pm 5\%$ ( $\pm 0.5$ dB)
50 kHz to 5.5 MHz (PAL)	$\pm 1\%$ ( $\pm 0.09$ dB)
5.5 MHz to 6 MHz (PAL)	$\pm 2\%$ ( $\pm 0.18$ dB)
Differential Gain	<0.6%
Differential Phase	<0.3°
Luminance Amplitude Accuracy	$\pm 1\%$
Luminance Nonlinearity	<1%
2T Pulse Preshoot and Overshoot	<1%
2T Pulse-to-Bar Ratio	$\pm 1\%$
Chrominance-to-Luminance Gain	$\pm 1\%$
Chrominance-to-Luminance Delay	<10 ns
SCH Phase Error	<10°
Output Impedance	75 $\Omega$ nominal
Return Loss	>36 dB 50 kHz to 4.2 MHz

# 1730 D Series Digital Composite Waveform Monitor

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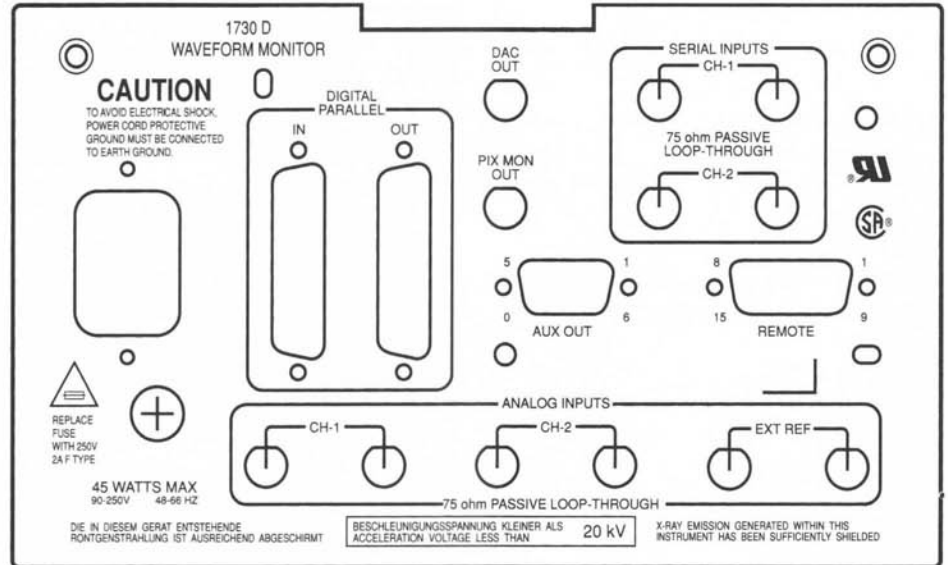
- 1730 D NTSC Digital Waveform Monitor
- 1731 D PAL Digital Waveform Monitor

### OPTIONS

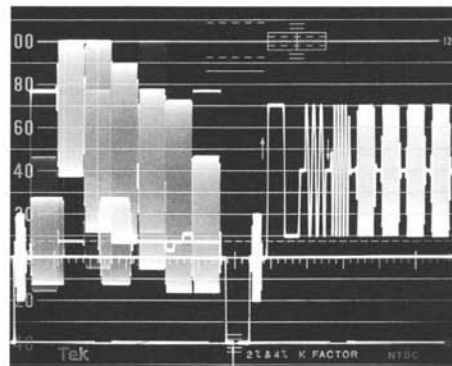
- Option 74 — Substitute P4 (white) phosphor on CRT
- Option M2 — Remedial Service Support
- Option M8 — Calibration Service

### OPTIONAL ACCESSORIES

- 1700F00 — Plain cabinet (painted silver grey)
- 1700F02 — Portable cabinet (including handle, feet, and front cover)
- 1700F05 — Side-by-side Rack Adapter
- 1700F06 — Blank Half-rack Width Panel
- 1700F07 — Utility Drawer
- C9 Option 20 — Camera
- 016-0475-00 — Viewing Hood
- 200-3897-01 — Snap-on Front Cover



1730 D Series rear panel.



Simultaneous analog and serial inputs displayed on 1730 D.

```

EDH CONFIGURE
-----
ALARM LIGHT           : ENABLE
REMOTE ERROR FLAG     : OFF
REPORT ACTIVE PIX ERR : YES
..... FULL FLD ERR   : YES
..... FORMAT ERR     : YES
..... ESP FLAGS       : YES
..... NO SIGNAL       : YES
FREEZE ON ERROR       : YES
> EXIT

USE UP/DWN KEYS TO MOVE CURSOR,
PRESS FLD KEY TO SELECT
    
```

1730 D Series EDH configure menu screen.

```

EDH DETECTED          AUDIO: 1 2
                      OTHER ANC DATA

TRS ERROR

ACTIVE PIX ERROR :
    002 ERRORED SEC IN,
    01:10:22:36
TIME SINCE LAST ERROR
    00:15:44:19

PRESS FLD FOR FULL FLD STATS.
PRESS CH TO RESET ERROR CTR.
    
```

EDH error screen for active picture data errors.

```

FF EDH VALID
ZERO VALUE APCRC

FULL FIELD ERROR :
    000 ERRORED SEC IN,
    00 DAY,00:19:00
TIME SINCE ERROR
    -- DAY,--:--:--

PRESS FLD FOR AP STATS
PRESS CH TO RESET ERROR CTR.
    
```

EDH error screen for full field data errors.