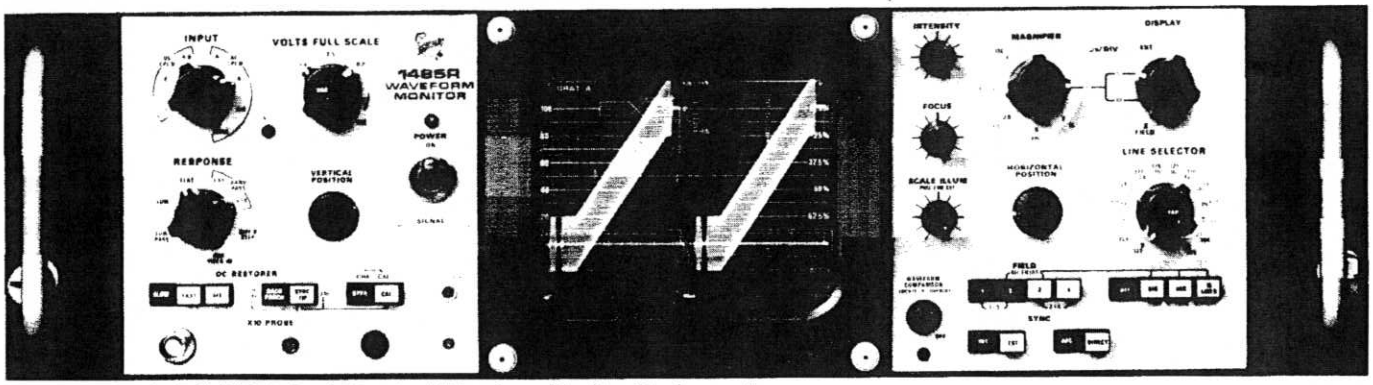
1480 SERIES WAVEFORM MONITORS



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

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

THE 1480 SERIES OF WAVEFORM MONITORS

There are 1480 Series Monitors for PAL, PAL-M, NTSC, and SECAM. Dual standard units are also available. The differences between the monitors in the series are essentially confined to what lines in the vertical interval are selectable, what vertical amplifier response modes are available, and to the field selection modes. Dual-Standard Monitors automatically recognize the signal standard in use and indicate that standard on the front panel.

VERTICAL INTERVAL TESTING

The bright CRT of the 1480 Series eliminates many of the VITS monitoring difficulties associated with previous waveform monitors. CRT brightness is sufficient to allow you to easily see one Vertical Interval Test Signal selected out of four fields, even in a well-lighted area. This solution to VITS display problems required the design of a very high light-output CRT — only one of the unique features of the 1480 Series.

MORE ACCURACY, GREATER RESOLUTION

The 1480's provide several advanced measurements modes for more accuracy. These allow you to make amplitude measurements to an accuracy approaching 0.2%. In one mode, a precision display offset is used. A proven video measurement technique, offsetting displays with an amplitude standard is an easy-to-use method that achieves accuracy by eliminating parallax and transfer errors. Transfer errors are eliminated because the signal is compared to a precise 1 V standard rather than to graticule calibration. Measurements made with comparison techniques also are highly consistent and repeatable. When the signal precisely matches the standard, 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%.

Resolving power is important in achieving precise amplitude measurements. The 1480's provide great resolving power through calibrated X5 expansion of the vertical display. Expansion means that signal and standard comparison is more precise and the differences (errors) between signal and standard are easier to see and measure.

A vernier position control facilitates greater resolution of the X5 expansion. With this control, you can position any portion of a standard amplitude signal on screen and then examine it in detail. A 0.2% amplitude standard, X5 expansion offset comparison, and fine CRT spot size are a few of the many factors that make the 1480's very accurate video signal monitoring instruments.

A MODE FOR SIDE-BY-SIDE COMPARISON

We call this mode overlay or sweep foldback. The 1480's can actually overlay a later segment of a display on an earlier segment. Superimposing waveforms over other waveforms allows exact comparison of levels. Overlay allows exact comparison of the elements of complex vertical interval test signals. Add the extra resolving power of X5 vertical expansion with precision offset and the overlay mode reaches its full potential.

SURE LINE SELECTION, POSITIVE FIELD IDENTIFICATION

The overlay mode is just one of the advances in 1480 time-base functions. Digital selection of field and line assures positive identification of displayed information. For example, selection of line 18 of field 2 assures display of line 18, field 2. Digital techniques will not allow an incorrect selection.

Variable selection of other lines is provided for full-field signal analysis. The 15-line mode is provided for working with quadruplex VTRs. 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 520 Series Vectorscopes, etc. Intensified two-field displays on the 1480 help to locate the line or lines selected.

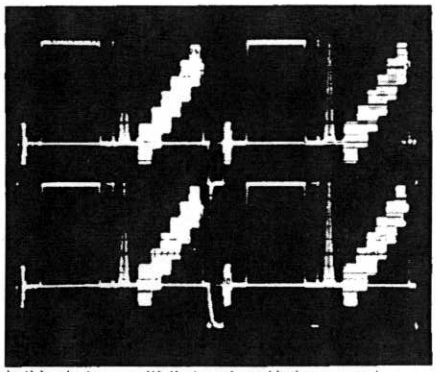
15-LINE DISPLAY FOR VTR APPLICATIONS

With the 15-line mode, the 1480's are particularly well suited for examining head by head performance of a quadruplex videotape recorder. Without the conflicting pattern of signals from other heads, the 1480 easily displays time base instability, jitter, distorted sync pulses, missing sync pulses, and field time distortions. Also, the 1480 line strobe is very useful in selecting only the output from an individual head for measurement by a Tektronix 520 Series Vectorscope. That makes it possible to measure chrominance phasing, differential phase, and differential gain.

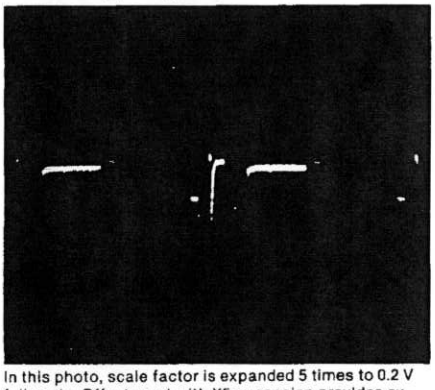
RESPONSE SELECTION AND A UNIQUE AUXILIARY MODE

Many television measurements require the filtering of some components from the composite signal. For example, luminance signal rejection by 3.58 MHz or 4.43 MHz subcarrier filters for differential gain measurements. A selection of appropriate filters is provided in the 1480's, including low pass, IRE, subcarrier, and one for staircase linearity measurements called differentiated staircase. When specialized or unique measurements require a special filter, you may insert that filter between the auxillary video output and auxiliary input. The auxillary video input mode, selected by the response control, allows you to add a filter or other device without breaking into the program line. The auxiliary video input and output are buffered by amplifiers to provide a precise 75 Ω source and load.

DISPLAY OFFSET
. . . compare the signal to a precise 1 V standard for accurate results.

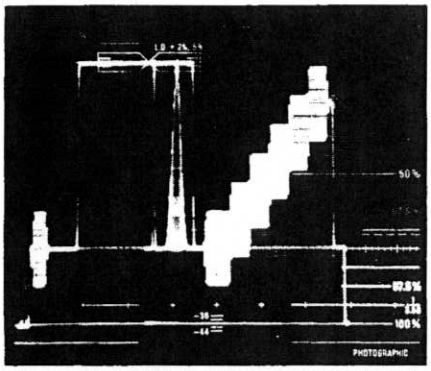


In this photo, sensitivity is reduced below normal operating values to show how OFFSET places the top of one display on the same level as the bottom of another display of the same signal. Since the top and bottom line up, the signal equals the offset standard.



In this photo, scale factor is expanded 5 times to 0.2 V full scale. Offset used with X5 expansion provides exceptional resolving power plus comparison accuracy. The signal shown is 10% high.

OVERLAY (SWEEP FOLDBACK)
. . . overlay signal elements for side-by-side comparison.



Pulse and Bar overlaid for precise comparison. Use expansion for more resolution. TV Application Notes fully detail Offset and Overlay Techniques.

GRATICULES, FOCUS AND INTENSITY, AND FACTORS AFFECTING DISPLAYS

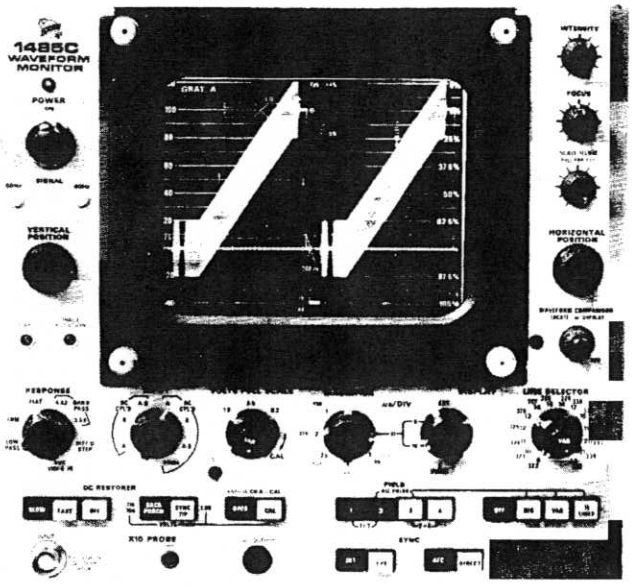
Two graticules are provided. One, internal and illuminated, is used for most applications. An internal graticule has no parallax. The other graticule is external and can be easily changed, a feature useful for special applications. The external graticule is illuminated by a separate system. The internal graticule is not visible when external graticule illumination is selected.

In the 1480 Series, monitor focus and brightness levels are automatically compensated for when switching from a two field setting to a faster time base.

The fastest sweep time is 0.1 μs per division, fast enough and bright enough to examine T pulses. The 1480's are calibrated in μs with a basic 1% time base accuracy (2% when using the magnifier). X50 is the greatest range of magnification with steps of 10, 5, 2 and 1.

The sync recognizer has two modes: AFC and Direct. This provides a way to display jitter or to stabilize a jittery display.

Other improvements provided by the 1480's include slow dc restoration, which will display any hum present, or a fast mode to filter out hum so you can make measurements more accurately. Also selectable are backporch or sync tip dc restoration. A dc coupled input mode is provided for measuring diode demodulator output and other applications.



1485C Option 01 PAL/NTSC Dual Standard Waveform Monitor (Cabinet).

WORKING IMPEDANCES OTHER THAN 75 Ω . . . A PROBE OPTION (OPTION 01)

A Probe Option for the 1480's makes convenient high impedance probing available. This option provides an input that accepts most Tektronix Probes. With this option, a probe compensation waveform test point is provided. A X10 amplifier keeps full screen sensitivities at 1.0 V, 0.5 V, and 0.2 V while you use X10 attenuator probes.

OPTION 06

The 1480R Option 06 is a high-performance television waveform monitor designed for use in a television operating center. Option 06 is especially designed for measurements in long distance video transmission systems using 124 Ω balanced lines. Self-normalizing WECO-style input jacks allow this monitor to operate in a 75 Ω system without externally terminating the ring input.

OPTION 07 SLOW SWEEP

In the 1480 Series Option 07 Waveform Monitor, random sampling techniques are employed to display long time distortions. Sampling maintains display intensity at a level suitable for viewing and photography. Long time distortions occur over a longer period of time than the field rate, generally one-half to several seconds. The signal most often used for long time distortion testing is a flat field video signal with a changing Average Picture Level (APL). This method, called "Bump" or "Bounce" testing, requires a signal level change at selected intervals, usually 1 to 10 seconds. The effect is then viewed on a waveform monitor with a sweep speed of 5 to 10 seconds per sweep. When the waveform monitor is triggered by the change in APL, you can track the effect of the change for up to 10 seconds after the change has occurred.

A 1480 Series Option 07 in the slow sweep mode is triggered from APL change. You may select either + polarity, starting the slow sweep on the transition from at or near black level to peak or near peak white, or – polarity, white to black. In addition, you can choose either internal (stripped from incoming video) or external (through the External Sync Inputs) trigger sources. If insufficient or no trigger is present, the slow sweep will operate in a free-run mode, which has a noticeably reduced repetition rate. The sweep duration and linearity are unchanged.

The sweep duration is controlled by a variable front-panel control, located on the display switch. Range of control over the duration of the sweep is approximately 4 to 15 seconds.

You can easily determine the status of the sweep by observing the waveform comparison indicator light. In the slow sweep mode, the lamp is lit during the intervals between sweeps and goes out during actual sweep time. This feature is valuable for either waveform photography or for determining sweep timing.

1480 SERIES WAVEFORM MONITORS

1480 Series instruments with Option 07 can be triggered by a 50-60 Hz square wave that has no field sync and filtered line sync. This mode of operation has its own loop-through rear panel input. You can activate this mode by simultaneously depressing both Internal and External Sync pushbuttons. Display duration is two fields.

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, 0.5, 0.2 V full scale. Variable — range for each scale factor ≥ +40% to −50%. Aux Video Input 1.5 dB gain.

Max Input Voltage — 2 V peak-to-peak (ac coupled).

Frequency Response — Flat — Flat to 5 MHz ±2%; 5 MHz to 10 MHz + 2%, −5%. Low Pass — Attenuation ≥ 14 dB, 500 kHz and above. 3.58 MHz Band Pass — Amplitude within ± 1% of amplitude in Flat response position. **Bandpass** ≈ 600 kHz. 4.43 MHz Band Pass — Amplitude within ±1% of amplitude in Flat response position. Bandpass ≈ 600 kHz. IRE — Conforms to IRE Standard 23S-1 1958 amended.

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 < 1 dB.

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

Nonlinear Distortion — Differential gain ≤ 0.5%.

Linear Waveform Distortion — Pulse/bar ratio ± 1%. SHORT TIME: preshoot, overshoot, ringing ≤ 0.5% on 100 ns sin² pulse. LINE TIME: Tilt or rounding ≤ 0.5%. FIELD TIME: (ac coupled) ≤ 1%.

HORIZONTAL DEFLECTION

Time-Base — 5 μs and 10 μs/div; ± 1% over center 10 divisions. 1 μs, 0.5 μs, 0.25 μs, 0.2 μs, and 0.1 μs/div: ± 2% over center 10 divisions. 2 FIELD ≈ 12.7 divisions.

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 video inputs or to A external sync only.

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

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 — ≈ line 20 of the selected field through the next field and to line 8 of the following vertical blanking interval. 15 lines — Identical to VAR, except 15 successive lines are displayed.

Sync — AFC: Horizontal frequency range is 15.75 kHz ± 200 Hz. Max jitter with respect to input sync 10 ns (30 ns with 4 V rms hum plus −36 dB white noise). Direct: Horizontal frequency ≤ 20 kHz. Max jitter with respect to input sync 12 ns (90 ns with 4 V rms hum plus — 36 dB white noise).

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

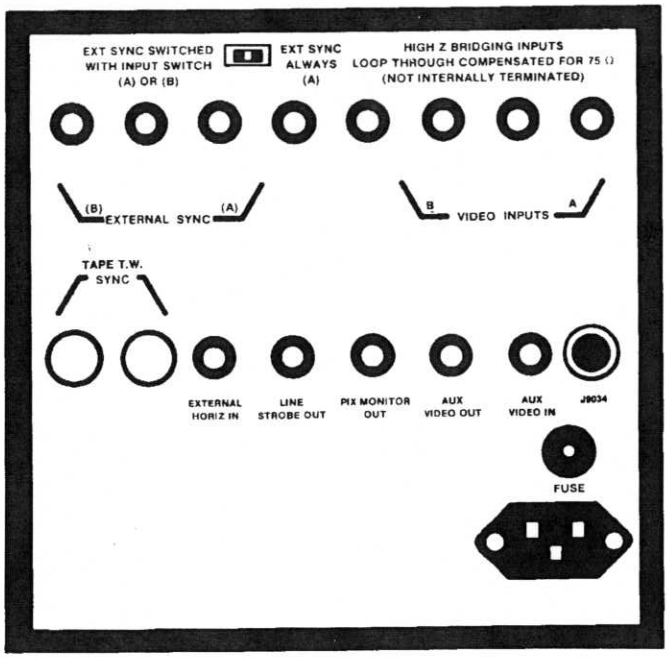
OPTION 08 (SECAM field identification)

Field Reference Pulse Input — Amplitude: 2.4 V min, 4.5 V max p-p. Input impedance: ≈ 1 kΩ ac coupled. Pulse timing: Positive going transition must occur between line 9 of field 4 and end of line 7 of field one. Pulse width: 3 μs min. Pulse rise time: 1 μs max.

The 12.5 Hz output of the 143 and the Field One Reference Pulse output of the 653HR and 656HR are compatible with this input.

OUTPUTS

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



1485C Rear Panel

Rear Panel Inputs BNC
- Video A Loop-Through
- Video B Loop-Through
- External Sync A Loop-Through
- External Sync B Loop-Through
- External Horizontal
- Auxiliary Video

Rear Panel Outputs BNC
- Line Strobe
- Pix Monitor
- Auxiliary Video

Picture Monitor — Output of incoming video with LINE STROBE added. Output impedance is 75 Ω. Output 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 1/3 normal sweep. YRGB sweep length internally selected for 1/4 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. Max power consumption 75 W. At factory, 1480 preset for 110 V ac. 1481, 1485 preset 220 V ac. 1482 preset for 115 V ac.

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 square wave. High frequency response ±2%, 25 Hz to 5 MHz. +3%, −5%, 5 MHz to 10 MHz. Referenced to 50 kHz. Input resistance 1 MΩ, ± 2%, not including probe. Input RC Product 20 μs, ± 0.5%, not including probe. BNC connector accepts most Tektronix probes.

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

SLOW SWEEP (Option 07)

Duration — 4 to 15 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. 50/60 Hz Square wave Triggering — Sensitivity: 400 mV p-p min 3 V p-p max. Input Impedance: 10 kΩ ac coupled (Rear Panel loop-through connectors not return loss compensated.)

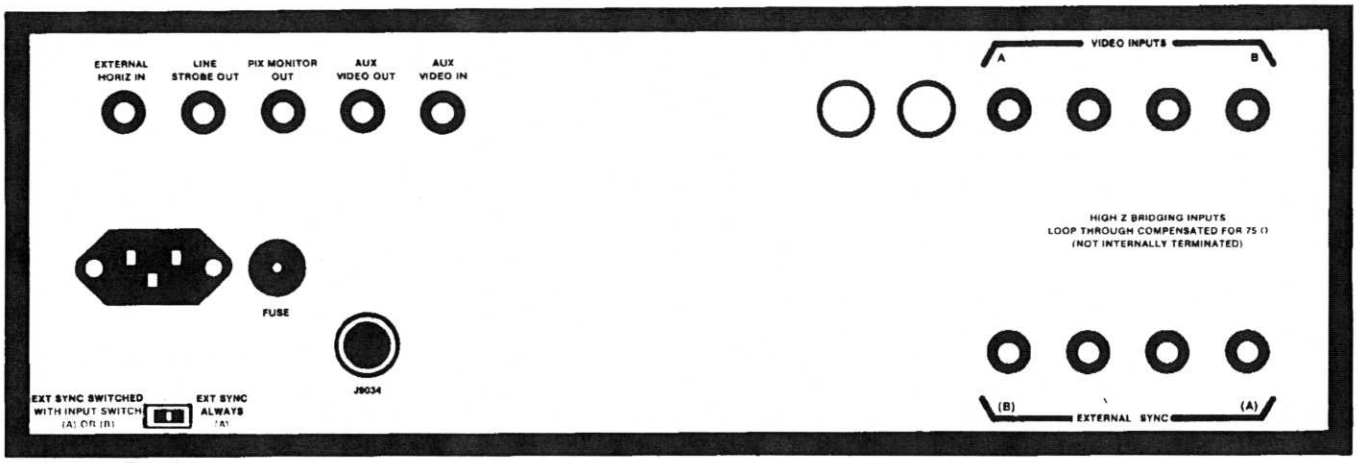
DIMENSIONS AND WEIGHTS

	Cabinet		Rackmount	
	in	cm	in	cm
Height	8.25	21.0	5.25	13.3
Width	8.50	21.6	19.0	48.2
Depth	16.95	43.0	18.0	45.7
	lb	kg	lb	kg
Net	21.5	9.8	24.6	11.2
Shipping	28.5	12.9	53.1	24.1

Included Accessories — 351-0195-00 Slide, SWR, Ext Slide Pair (Rackmount Only). 103-0031-00 (2 each) Adapter, Right Angle BNC.

A BNC to multi-pin connector adapter is provided as a standard accessory for connecting the incoming reference signal to the 1481/1485 when Option 08 is ordered.

1480 SERIES WAVEFORM MONITORS



1485R Rear Panel

ORDERING INFORMATION

When ordering, please use the exact nomenclature given here.

1480C NTSC Waveform Monitor

1480R NTSC Waveform Monitor

1481C PAL Waveform Monitor *

1481R PAL Waveform Monitor *

1482C PAL-M Waveform Monitor

1482R PAL-M Waveform Monitor

1485C PAL/NTSC Dual Standard Waveform Monitor *

1485R PAL/NTSC Dual Standard Waveform Monitor *

Option 01 1 MΩ, 20 pF Probe Input (probe not included) Suggested Probe: P6108 10X Probe, 2 m order **010-6108-03,** 3 m order **010-6108-05.**

Option 02 With Carrying Case (Cabinet Version Only).

Option 03 With Blank CRT.

Option 04 Tone Wheel Sync (1480C, 1481C, 1482C, and 1485C only. Replaces 529 or T04 in some RCA VTRs — Check with RCA for retrofit compatibility).

Option 05 Tone Wheel Sync (1485C only — check with RCA for retrofit compatibility).

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

Option 07 Slow Sweep. **

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

*1481C/R, 1485C/R meets European Broadcast Union Tech. 3221-E, Guiding Principles for design of Television Waveform Monitors.
**Option 07 satisfies EBU Tech. 3221-E §3.2.2.

OPTIONAL ACCESSORIES

Mounting Cradles — A cradle assembly, with associated bezel, lets you mount the 1480C Waveform Monitor alongside a 9 in. Conrac Picture Monitor in a standard 19 in. rack. A cradle and bezel are also available for mounting two 1480s side-by-side.

For mounting 9 in. SNA-9 Picture Monitor (Requires 8¾ in. rack space).

Cradle Assembly **014-0020-00**

Bezel, for mounting 1480C on operator's left . **014-0023-00**

Bezel, for mounting 1480C on operator's right **014-0024-00**

For mounting two 1480C Waveform Monitors side-by-side (requires 8¾ in. rack space)

Cradle Assembly **014-0020-00**

Bezel **014-0022-00**

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

C-59P recommended for display photos. See Camera section of the Tektronix Products Catalog.