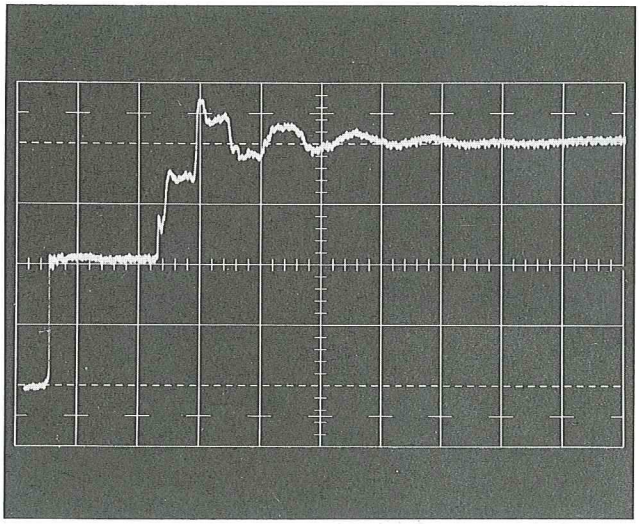
1 - S2 50Ω SMA Head
1 - S3 Low Imp 350Ω Head
1 - 564 Scope
1 - 352 Dual Time Sampling Plug-In
1 - 3T2 Random Sampling Sweep
1 - 3S3 Delayed Sweep Plug-In
1 - 3H6 Dual Trace Plug-In

# TEKTRONIX SAMPLING INSTRUMENTS



TEKTRONIX®

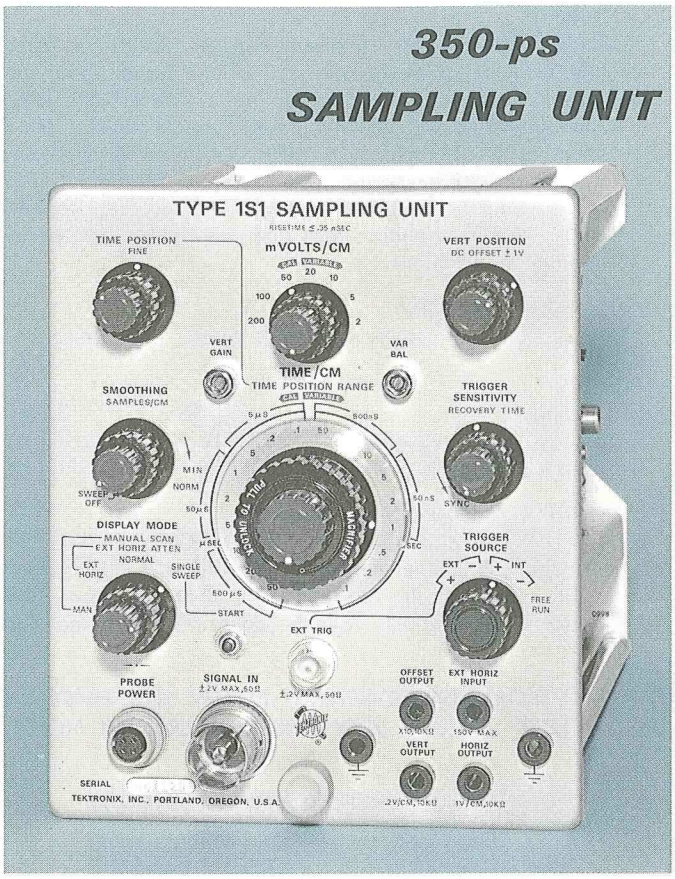
**The instruments included in this packet are only a portion of those described in the current catalog. For information on the entire product line, consult the catalog or your Tektronix Field Engineer, Representative or Distributor.**

A-2330
Printed in U. S. A.

# TYPE 1S1

## 350-ps SAMPLING UNIT

- **DC-to-1 GHz BANDWIDTH**
- **2 mV/CM to 200 mV/CM DEFLECTION FACTOR**
- **INTERNAL TRIGGERING**
- **100 ps/CM to 50 μs/CM CALIBRATED TIME BASE**




Used with any of the Type 530, 540, 550 or 580*-Series Oscilloscopes, the Type 1S1 Sampling Unit extends the measuring capabilities to 1 gigahertz. Operation is like a conventional oscilloscope—but with a combination of bandwidth and sensitivity possible only through sampling.

The Type 1S1 features internal triggering with a built-in delay line—no need for pretriggers or external delay lines. The tunnel-diode trigger circuit assures stable triggering through 1 gigahertz. Calibrated sweep range is from 100 ps/cm to 50 μs/cm. A single control is used to select the sweep range and magnify the display up to X100 when desired. This single-control feature allows direct read-out of the sweep time/cm even when magnified.

Calibrated vertical deflection factors range from 2 mV/cm to 200 mV/cm. Noise in the display is less than 1 mV, and can be reduced by a smoothing control. A DC-offset control permits observation of millivolt signals in the presence of up to ±1 volt input levels. Output signals are available at the front panel for driving chart recorders.

## VERTICAL SYSTEM

### RISETIME
Less than or equal to 350 ps.

### BANDWIDTH
Equivalent to DC-to-1 GHz at 3-dB down.

### DEFLECTION FACTOR
2 mV/cm to 200 mV/cm in 7 calibrated steps, 1-2-5 sequence. Each step accurate within 3%. Variable between steps, extending to 500 μV/cm, uncalibrated.

### RANDOM NOISE
Equivalent to an input signal of 1 mV or less, unsmoothed; 500 μV, smoothed (tangentially-measured).

### INPUT CHARACTERISTICS
Nominally 50 Ω. Safe overload is ±5 V. GR874 input connectors. Trigger input is BNC, nominally 50 Ω.

### DC OFFSET RANGE
+1 V to −1 V. Allows signals between +1 V and −1 V limits to be displayed at 2 mV/cm. Signals between +2 V and −2 V limits may be displayed at 200 mV/cm. Monitor jacks provide 10X actual DC offset through 10 kΩ.

### VERTICAL OUTPUT
200 mV for each centimeter of displayed signal through 10 kΩ.

### PROBE POWER
Available at front-panel connector for cathode-follower probe, Type 281 TDR Pulser, and Type 282 Adapter for high-impedance probes.

*A Type 81A Adapter is required.

## HORIZONTAL SYSTEM

### TIME BASE
50 μs/cm to 100 ps/cm in 18 calibrated steps, 1-2-5 sequence. Each step accurate within 3%. Variable between steps.

### MAGNIFIER
Displays at sweep rates from 1 ns/cm to 50 μs/cm can be magnified up to X100 (depending on sweep rate) while maintaining a constant number of samples/cm and the same Time Position Range. Magnification occurs from a fixed time-reference point at the left end of the trace.

### TIME POSITION RANGE
500 μs, 50 μs, 5 μs, 500 ns and 50 ns, depending on unmagnified TIME/CM setting. Coarse and fine TIME POSITION controls position start of the display through a time interval equal to the TIME POSITION RANGE setting.

### SAMPLES/CM
Continuously variable adjustment of samples displayed per centimeter horizontally from approximately 5 samples/cm to an immeasurable number. Allows optimum adjustment of display rate and dot density.

### DISPLAY MODES
Repetitive, single display, manual scan, or external scan. Front-panel START button for single-display operation.

### INTERNAL DELAY LINE
Permits viewing the leading edge of the input waveform.

## TRIGGERING

SOURCE (AC-Coupled): Internal, trigger pickoff in signal channel delivers approximately 1/7 of the input signal amplitude; External, 50-Ω terminated input. AMPLITUDE (EXT): Sinewaves, 10 mV to 400 mV, peak-to-peak; Pulses, 5 mV, either polarity. 2 V max DC. REPETITION RATE: Sinewave triggering or synchronizing from 100 kHz through 1 GHz. Pulse triggering from 10 Hz through 1 GHz. JITTER: Depends on signal shape, repetition rate and amplitude; ≤40 ps under optimum conditions.

## HORIZONTAL OUTPUT

1 V per displayed centimeter; 10 kΩ source impedance.

## WEIGHTS

| | | |
|---|---|---|
| Net weight | 7¾ lb | 3.5 kg |
| Domestic shipping weight | ≈17 lb | ≈ 7.7 kg |
| Export-packed weight | ≈25 lb | ≈11.4 kg |

## INCLUDED STANDARD ACCESSORIES

5-ns 50-Ω RG58 cable, GR connectors (017-0512-00); 5-ns 50-Ω RG58 cable, BNC connectors (012-0057-01); 10X 50-Ω attenuator, GR connectors (017-0078-00); 10X 50-Ω attenuator, BNC connectors (011-0059-00); 18-inch patch cord, banana connectors (012-0039-00); 18-inch patch cord, BNC-banana plugs (012-0090-00); GR-to-BNC female adapter (017-0063-00); GR-to-BNC male adapter (017-0064-00); two instruction manuals (070-0475-00).

**TYPE 1S1 SAMPLING UNIT ..... $1175**

## OPTIONAL ACCESSORIES

TYPE 281 TDR PULSER, order 015-0060-00 ..... $95
TYPE 282 PROBE ADAPTER, order 015-0074-00 ..... $95
P6034 10X Probe, order 010-0110-00 ..... $38
P6035 100X Probe, order 010-0111-00 ..... $38
P6040/CT-1 CURRENT PROBE, order 015-0041-00 ..... $33
VP-1 VOLTAGE PICKOFF, order 017-0073-00 ..... $25
POWER DIVIDER GR 874-TPD, order 017-0082-00 ... $70.00
COUPLING CAPACITOR, GR 874-K, order 017-0028-00 $10.50

This represents only a partial listing of the many useful items available for sampling systems. Please refer to the catalog accessory section for a more complete listing.

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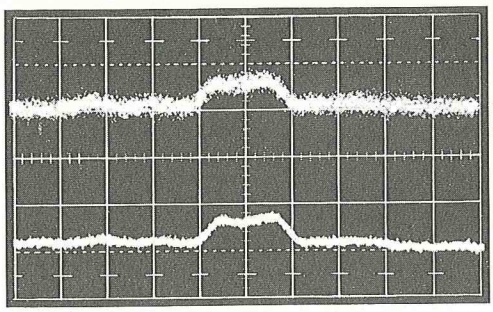
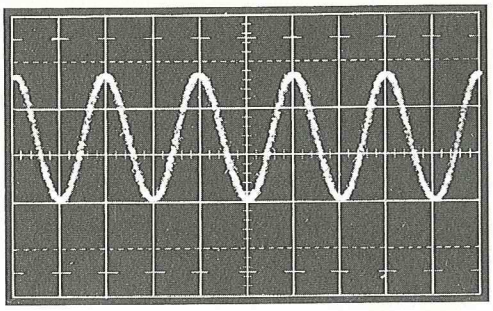
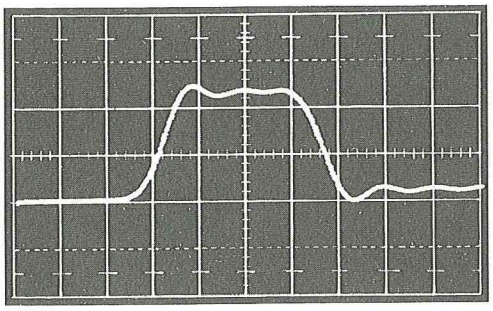
***THE WAVEFORM PHOTOGRAPHS BELOW ILLUSTRATE THE PERFORMANCE CAPABILITIES OF THE TYPE 1S1 SAMPLING UNIT. THESE INCLUDE LOW INHERENT DISPLAY NOISE, STABLE TRIGGERING AND REAL-TIME SAMPLING.***



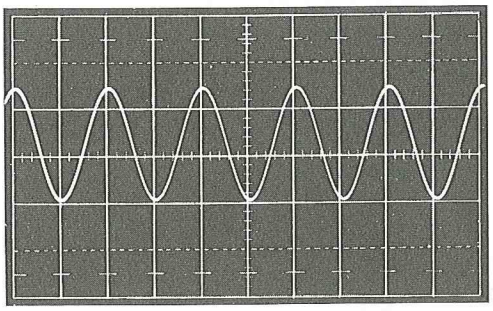
*TANGENTIAL NOISE—A 1-mV, 2-ns wide pulse externally triggered. Upper waveform is unsmoothed. The lower is smoothed. Vert: 2 mV/cm. Horiz: 1 ns/cm.*



*TRIGGERING AT 1 GHz—A 1-GHz sinewave; internally triggered. Vert: 100 mV/cm. Horiz: 0.5 ns/cm.*



*PULSE TRIGGERING—A 50-mV, 2-ns wide pulse; internally triggered. Vert: 20 mV/cm. Horiz: 0.5 ns/cm.*



*REAL-TIME SAMPLING DISPLAY—A 1-kHz sinewave; Internal Main Frame triggering. Vert: 100 mV/cm (free running sampler). Horiz: 0.5 ms/cm (realtime—main frame).*



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# TYPE 1S2

# REFLECTOMETER & SAMPLING UNIT

- ***140-ps TDR SYSTEM RISETIME***
- ***90-ps SAMPLING RISETIME***
- ***RHO AND VOLTAGE CALIBRATION***
- ***TWO INTERNAL PULSE SOURCES***

The Type 1S2 Sampling Plug-in converts any Tektronix 530, 540, or 550-series oscilloscope to a time-domain reflectometry measurement system. As a TDR, the Type 1S2 has a system risetime of 140 ps and is calibrated in rho ($\rho$) from 0.005 $\rho$/div to 0.5 $\rho$/div. The horizontal is calibrated from 1 cm/div to 100 m/div for dielectrics of air, TFE and polyethylene. Two pulse outputs provide either 50 ps $t_r$, 250 mV into 50 Ω, or 1 ns $t_r$, 1 V into 50 Ω.

The 90-ps risetime, 5 mV/div deflection factor, 100 ps/div sweep and built-in triggering capability make the Type 1S2 useful for many other sampling measurements.

## SYSTEM PERFORMANCE AS REFLECTOMETER

### VERTICAL

**SYSTEM RISETIME**
Less than or equal to 140 ps, for the displayed reflection from a short-circuited 20-cm air line.

**VERTICAL SCALE**
Calibrated in $\rho$ (rho) and volts: 0.005 $\rho$/div to 0.5 $\rho$/div or 5 mV/div to 500 mV/div in 7 calibrated steps (1-2-5 sequence), accurate within 3%. Continuous variation between steps, uncalibrated.

**RESOLUTION**
Reflection coefficients as small as 0.001 can be observed.

**INPUT CHARACTERISTICS**
Nominal 50-Ω feed-through signal channel, (termination supplied). GR874 connectors.

**DC OFFSET RANGE**
+2 $\rho$ to −2 $\rho$ (or +2 V to −2 V). Allows open-circuit reflections to be displayed at full sensitivity. Actual DC offset may be monitored at 1 $\rho$/V through 10 kΩ.

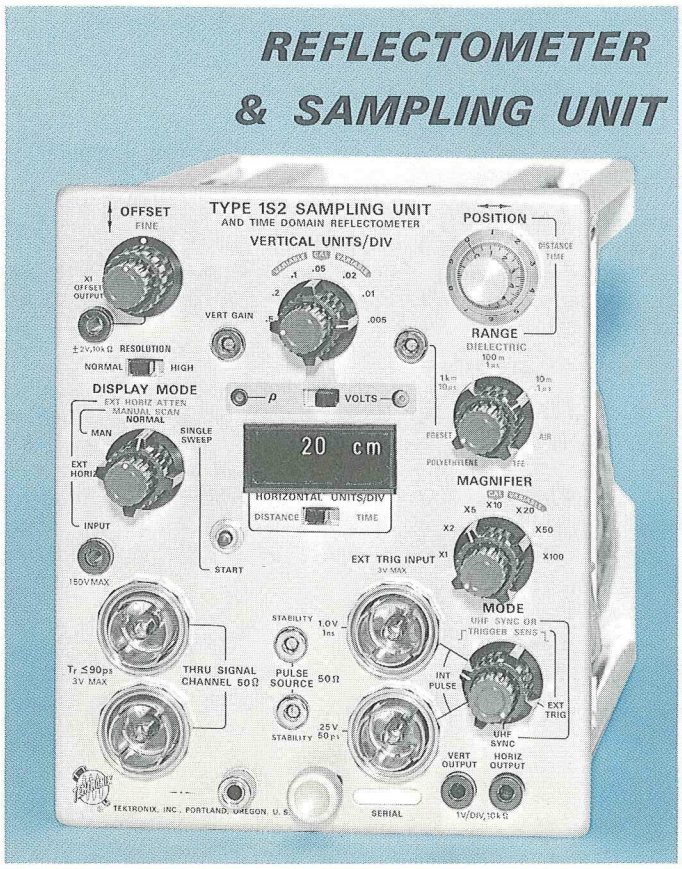
**VERTICAL OUTPUT**
1 V for each division of displayed signal through 10 kΩ.

### HORIZONTAL

**HORIZONTAL SCALE**
Calibrated in distance and time: full-scale, 10-div display (without magnification) of 10 m, 100 m, or 1 km; 100 ns, 1 μs, or 10 μs. Accuracy is ±3% with or without magnification.

**MAGNIFIER**
X1 to X100 in 7 calibrated steps (1-2-5 sequence). Continuously variable between steps. Allows display to be magnified from a fixed on-screen reference point, 1 major division from the left edge of the graticule.

**UNITS/DIV READOUT**
Horizontal scale factor (combination of horizontal range and magnification settings) readout, directly at front panel, indicates either distance or time/div.




**DISTANCE OR TIME POSITION**
Ten-turn dial directly reads one-way distance or round-trip time to test-line discontinuity. Round-trip time readings are accurate to within ±1%. Range of 10-turn dial is the same as the full-scale, 10-div display without magnification.

**JITTER**
Less than or equal to 20 ps with internal pulse sources.

**DIELECTRIC**
Calibrated for air, tfe and polyethylene lines. Preset mode adjustable for lines with velocity of propagation from 0.6 to 1.0X velocity of light.

**DISPLAY MODES**
Repetitive or single sweep, manual or external scan.

**HORIZONTAL OUTPUT**
1 V for each division of displayed signal through 10 kΩ.

### PULSE SOURCES

**FAST-RISE OUTPUT**
Approximately 50-ps risetime, 250 mV. 50-Ω source (reverse terminated).

**LARGE-AMPLITUDE OUTPUT**
Approximately 1-ns risetime, 1 V. 50-Ω source (reverse terminated).

## PERFORMANCE AS SAMPLER

**RISETIME**
Less than or equal to 90 ps.

**BANDWIDTH**
Equivalent to DC-to-3.9 GHz at 3-dB down.

DEFLECTION FACTOR

5 mV/div to 500 mV/div in 7 calibrated steps, 1-2-5 sequence, accurate within 3%. Continuous variation between steps, uncalibrated.

RANDOM NOISE

Equivalent to an input signal of 2 mV or less (tangentially-measured).

SIGNAL RANGE

Signals between +2 V and −2 V limits may be displayed at any deflection-factor setting. Safe overload is ±3 V if signal channel is coupled directly into EXT TRIG INPUT, ±5 V if not.

TRIGGERING

SOURCE: External only, AC coupled—may serve as termination for signal channel. AMPLITUDE: Sinewaves, 100 mV to 2 V, peak-to-peak; Pulses, 50 mV to 1 V either polarity. 3 V max DC. REPETITION RATE: Sinewave triggering or synchronizing from 100 kHz through 5 GHz. Pulse triggering from 10 Hz through 5 GHz. JITTER: Depends on signal shape, repetition rate and amplitude; ≤30 ps under optimum conditions.

WEIGHTS

| | | |
|---|---|---|
| Net weight | 7½ lb | 3.3 kg |
| Domestic shipping weight | ≈18 lb | ≈ 8.2 kg |
| Export-packed weight | ≈28 lb | ≈12.7 kg |

INCLUDED STANDARD ACCESSORIES

Two GR elbows (017-0070-00); 5X attenuator (017-0079-00); 2X attenuator (017-0080-00); 50-Ω termination (017-0081-00); 20-cm air line (017-0084-00); 50-Ω termination, short circuit (017-0087-00); 5-ns cable, RG 8/213 (017-0502-00); 18-inch patch cord (012-0039-00); 18-inch BNC-to-banana plug patch cord (012-0090-00); two instruction manuals (070-0543-00).

**TYPE 1S2 SAMPLING UNIT ..... $1375**

## OPTIONAL ACCESSORIES

Type 113 Delay Cable ..... $260

Type P6034 10X Probe Package, order 010-0110-00 ... $ 38

Type P6035 100X Probe Package, order 010-0111-00 .. $ 38

Power Divider, GR 874-TPD, order 017-0082-00 ..... $ 70

Coupling Capacitor, GR 874-K, order 017-0028-00 .. $10.50

This listing covers only a few of the more commonly useful items for sampling instruments. A more complete listing can be found in the accessory section of this catalog.

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# TYPE 3S2 DUAL-TRACE SAMPLING UNIT

- **PLUG-IN SAMPLING HEADS**
- **2 mV/DIV TO 200 mV/DIV CALIBRATED DEFLECTION FACTOR**
- **VARIABLE INTER-CHANNEL DELAY**
- **NEW PERFORMANCE WITH RANDOM SAMPLING**


The Type 3S2 Dual-Trace Sampling Unit is designed for use in the Type 561A, 564, 567 or 568 Oscilloscope. The unit can be used with sampling sweep units, including the Type 3T2 Random Sampling Sweep, or with real-time time base units to allow sweep rates to 5 s/div.

The Type 3S2 accepts two Sampling Heads that can be inserted directly or located remotely with an optional extender. Sampling Heads feature a choice of measurement capabilities and may be mixed or matched to meet specific measurement needs. A front panel control allows adjustment of the inter-channel time relationship to compensate for signal cables or other external delays.

Five display modes provide for a variety of single-trace, dual-trace or X-Y displays. The 3S2 can also be operated with only one head, for applications not presently requiring dual-trace displays.

## CHARACTERISTICS

### SAMPLING HEADS

May be plugged into the Type 3S2 or located remotely on the optional 3-ft or 6-ft Sampling-Head extenders.

| SAMPLING HEAD | RISETIME | INPUT | MINIMUM DEFLECTION FACTOR | RANDOM NOISE | PRICE |
|---|---|---|---|---|---|
| Type S-1 | 350 ps | 50 Ω, GR874 | 2 mV/div | 2 mV | $250 |
| Type S-2 | 50 ps | 50 Ω, GR874 | 2 mV/div | 6 mV | $300 |
| Type S-3 | 350 ps | 2.3 pF, 100 kΩ | 2 mV/div | 3 mV | $375 |
| Type S-4 | 25 ps | 50 Ω, 3 mm | 2 mV/div | 10 mV | $750 |
| Type S-50 | 25-ps Pulse Generator Head | | | | $450 |
| Type S-51 | 1-to-18 GHz Trigger Countdown Head | | | | $425 |

### DEFLECTION FACTOR

2 mV/div to 200 mV/div in 7 calibrated steps, 1-2-5 sequence. Each step accurate within 3%. Variable between steps, extending to approximately 0.8 mV/cm, uncalibrated.

### DC OFFSET RANGE

+1 V to −1 V. Allows signals between 1 V and −1 V limits to be displayed at 2 mV/div. Signals between +2 V and −2 V limits can be displayed at 200 mV/div. Monitor jacks provide 10X actual DC offset through 10 kΩ.

### TRIGGERING

Trigger pickoff within Sampling Heads permits triggering on either input signal. 50-Ω Trigger Out connector at the front panel.

### B-DELAY RANGE

Channel B display can be continuously positioned in time from +5 ns to −5 ns with respect to Channel A. Accommodates 3 feet difference in signal or sampling-head cables.

### DISPLAY MODES

A only, B only, Dual Trace, Algebraic Addition of A and B signals, and X-Y display of A-vertically and B-horizontally, (for observation of hysteresis loops, phase shift, and similar displays). Independent controls for each channel permit positioning and inverting displays as desired.

### VERTICAL OUTPUT

200 mV for each division of displayed signal through 10 kΩ.

### WEIGHTS

| | | |
|---|---|---|
| Net weight | 5½ lb | 2.5 kg |
| Domestic shipping weight | ≈ 8½ lb | ≈3.9 kg |
| Export-packed weight | ≈12 lb | ≈5.5 kg |

### INCLUDED STANDARD ACCESSORIES

7-inch trigger cable with RG58 BNC/BSM connectors (012-0128-00); 18-inch trigger cable with RG58 BNC/BSM connectors (012-0127-00); two instruction manuals (070-0759-00).

**TYPE 3S2 DUAL-TRACE SAMPLING UNIT,** without sampling heads ..... **$800**

## OPTIONAL ACCESSORIES

3-ft Sampling-Head extender, order 012-0124-00 ..... $58

6-ft Sampling-Head extender, order 012-0125-00 ..... $60

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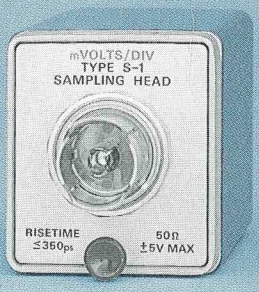
# TYPE S-1

## 350-ps SAMPLING HEAD




- ***DC-TO-1 GHz BANDWIDTH***
- ***RANDOM NOISE LESS THAN 2 mV (unsmoothed)***

The Type S-1 Sampling Head is a low-noise, 350-ps risetime unit with a 50-Ω input impedance. It is designed for use with the Type 3S2, 3S5 and 3S6 Dual-Trace Sampling Units, and can be plugged in or attached by a cable for remote use. A trigger pickoff within the Type S-1 provides a trigger signal output from the plug-in unit. When used with the Type 3T2 Random Sampling Sweep Unit, the triggering event may be displayed on the screen without the use of delay lines or a pretrigger.

RISETIME
Less than or equal to 350 ps.

BANDWIDTH
Equivalent to DC to 1 GHz at 3-dB down.

TRANSIENT RESPONSE
Aberrations as observed with the Type 284 Pulse Generator are +0.5%, —3% or less, total of 3.5% or less P-P, first 5 ns following the step transition; +0.5%, —0.5% or less, total of 1% or less P-P after 5 ns.

RANDOM NOISE
Equivalent to an input signal of 2 mV or less, unsmoothed; 1 mV, smoothed (tangentially measured).

SIGNAL RANGE
Variable DC offset allows signals between +1 V and —1 V limits to be displayed at 2 mV/div. Signals between +2 V and —2 V limits may be displayed at 200 mV/div. For best dot-transient response with random-sampling sweep unit, signal amplitude should be less than 500 mV P-P.

INPUT CHARACTERISTICS
Nominally 50 Ω. Safe overload is ±5 V. GR 874 input connectors.

WEIGHTS

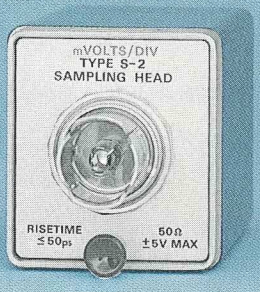
| | | |
|---|---|---|
| Net weight | ¾ lb | 0.34 kg |
| Domestic shipping weight | ≈1½ lb | ≈0.68 kg |

INCLUDED STANDARD ACCESSORIES
5-ns, RG58 cable with GR connectors (017-0512-00); 10X, 50 Ω, GR attenuator (017-0078-00); instruction manual (070-0763-00).

**TYPE S-1 SAMPLING HEAD ..... $250**

# TYPE S-2

## 50-ps SAMPLING HEAD




- ***DC-TO-7 GHz BANDWIDTH***
- ***RANDOM NOISE LESS THAN 6 mV (unsmoothed)***

The Type S-2 Sampling Head is a 50-ps risetime unit with a 50-Ω input impedance. It is designed for use with the Type 3S2, 3S5 and 3S6 Dual-Trace Sampling Units, and can be plugged in or attached by a cable for remote use. A trigger pickoff within the Type S-2 provides a trigger signal output from the plug-in unit. When used with the Type 3T2 Random Sampling Sweep Unit, the triggering event may be displayed on the screen without the use of delay lines or a pretrigger.

RISETIME
Less than or equal to 50 ps.

BANDWIDTH
Equivalent to DC to 7 GHz at 3-dB down.

TRANSIENT RESPONSE
Aberrations as observed with the Type 284 Pulse Generator are +5%, —5% or less, total of 10% or less P-P, first 2.5 ns following a step transition; +2%, —2% or less, total of 4% or less P-P after 2.5 ns.

RANDOM NOISE
Equivalent to an input signal of 6 mV or less, unsmoothed; 3 mV, smoothed (tangentially measured).

SIGNAL RANGE
Variable DC offset allows signals between +1 V and —1 V limits to be displayed at 2 mV/div. Signals between +2 V and —2 V limits may be displayed at 200 mV/div. For best dot-transient response with random-sampling sweep unit, signal amplitude should be less than 200 mV P-P.

INPUT CHARACTERISTICS
Nominally 50 Ω. Safe overload is ±5 V. GR 874 input connectors.

WEIGHTS

| | | |
|---|---|---|
| Net weight | ¾ lb | 0.34 kg |
| Domestic shipping weight | ≈1½ lb | ≈0.68 kg |

INCLUDED STANDARD ACCESSORIES
5-ns, RG213 cable with GR connectors (017-0502-00); 10X, 50-Ω, GR attenuator (017-0078-00); instruction manual (070-0764-00).

**TYPE S-2 SAMPLING HEAD ..... $300**

## OPTIONAL ACCESSORIES

P6040/CT-1 Current Probe, order 015-0041-00 ..... $33.00
CT-3 Signal Pickoff, order 017-0061-00 ..... 35.00
VP-1 Voltage Pickoff, order 017-0073-00 ..... 25.00
P6034 10X Passive Probe, order 010-0110-00 ..... 38.00
P6035 100X Passive Probe, order 010-0111-00 ..... 38.00
Power Divider GR 874-TPD, order 017-0082-00 ..... 70.00
Coupling Capacitor, GR 874-K, order 017-0028-00 .... 10.50

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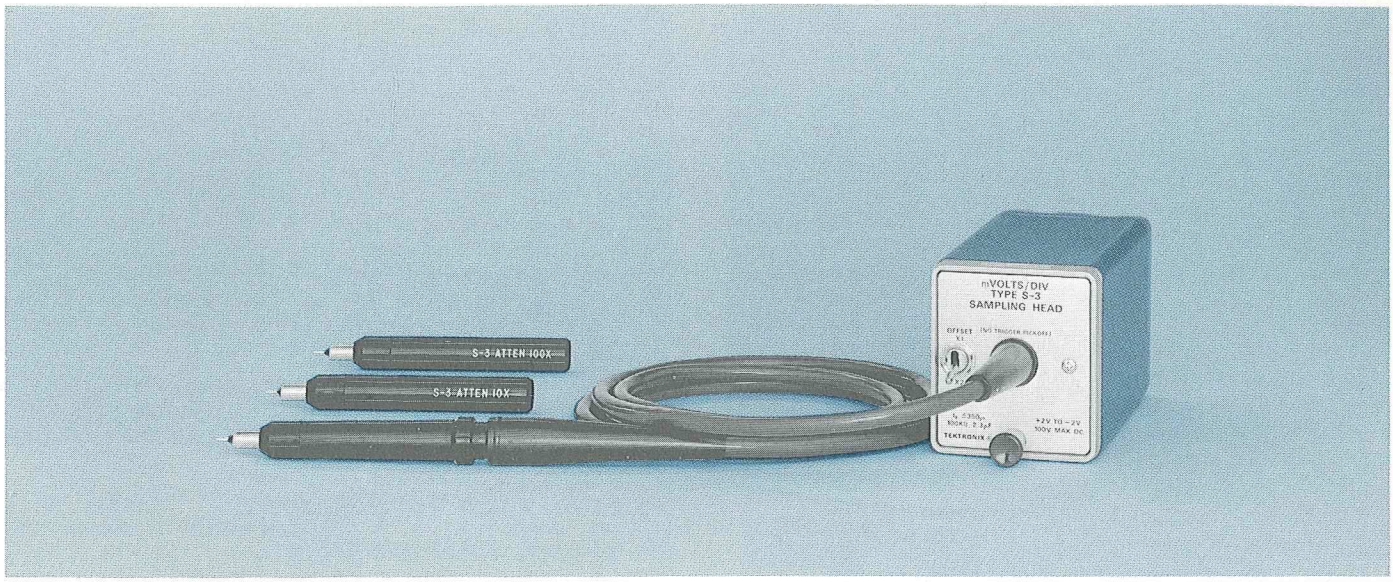
# TYPE S-3 350-ps SAMPLING HEAD




- ***COMPACT PROBES***
- ***100 kΩ, 2.3-pF INPUT RC***
- ***DC-to-1 GHz BANDWIDTH***
- ***DISPLAYED NOISE LESS THAN 3 mV (unsmoothed)***

The Type S-3 Sampling Head is a low-noise, 350-ps risetime, sampling-probe unit with a 100-kΩ, 2.3-pF input impedance. A switch on the Sampling Head selects a DC offset of X1 or X2 while maintaining a 2 mV/div deflection factor.

The Type S-3 Sampling Head is designed for use with the Type 3S2, 3S5 and 3S6 Dual-Trace Sampling Units and can be plugged in or attached by an optional Sampling-Head extender for remote use. When used with the Type 3T2 Random Sampling Sweep Unit, the triggering event may be displayed on the screen without the use of delay lines or a pretrigger.

## CHARACTERISTICS

### RISETIME

Probe only, 350 ps or less.
With 10X attenuator, 400 ps or less.
With 100X attenuator, 500 ps or less.

### BANDWIDTH

Probe only is equivalent to DC-to-1 GHz at 3-dB down.

### TRANSIENT RESPONSE

(As observed with Type 284 Pulse Generator)
Probe only: aberrations in the first 2 ns following a step are +8%, —2% or less, total of 10% or less P-P; +1%, —1% or less, total of 2% or less P-P after 2 ns.

With 10X attenuator: aberrations in first 5 ns following a step transition are +2%, —5% or less, total of 7% or less P-P; +1%, —1% or less, total of 2% or less P-P after 5 ns.

With 100X attenuator: aberrations in the first 5 ns following a step transition are +5%, —8% or less, total of 13% or less P-P; +2%, —5% or less, total of 7% or less P-P from 5 ns to 30 ns; +1%, —1% or less, total of 2% or less P-P after 30 ns.

### DISPLAYED NOISE

Probe only, 3 mV or less, measured tangentially, referred to the probe tip.

### SIGNAL RANGE

Variable DC offset allows signals between +1 V and —1 V, X1 range; or +2 V and —2 V, X2 range to be displayed at 2 mV/div. For best dot-transient response with random-sampling sweep unit, signal amplitude should be less than 1 V P-P. The signal range may be increased X10 or X100 with the use of the probe attenuators.

### PROBE AND ATTENUATOR ACCURACY

Accuracy is within 0.5% probe only, within 1.75% with 10X attenuator, within 2.5% with 100X attenuator, in addition to the accuracy of the vertical plug-in unit.

### INPUT CHARACTERISTICS

Probe only is 100 kΩ paralleled by 2.3 pF.
With 10X attenuator, 1 MΩ paralleled by 2 pF.
With 100X attenuator, 1 MΩ paralleled by 1.75 pF.
With coupling capacitor 4.5 pF; probe only and coupling capacitor time constant is approx 100 μs.

### WEIGHT

| | | |
|---|---|---|
| Net weight | ¾ lb | 0.34 kg |

### INCLUDED STANDARD ACCESSORIES

10X attenuator (010-0364-00), 100X attenuator (010-0365-00), coupling capacitor (011-0098-00), probe tip (206-0114-00), bayonet-ground adapter (013-0085-00), two test-point jacks (131-0258-00), 5½-inch ground lead (175-1017-00); 12½-inch ground lead (175-1018-00); 3-inch cable assembly (175-0249-00); three probe clips (344-0046-00); end cap (200-0834-00); two end caps (200-0835-00); probe holder (352-0090-00); retractable hook tip (013-0097-00); 50-Ω voltage pickoff (017-0077-01), carrying case (016-0121-00), manual (070-0765-00).

**TYPE S-3 SAMPLING HEAD** ..... **$375**

## OPTIONAL ACCESSORIES

Probe tip-to-BNC adapter, order 013-0084-00 ..... $ 4.75
Probe tip-to-GR adapter, order 017-0076-00 ..... $ 6.00

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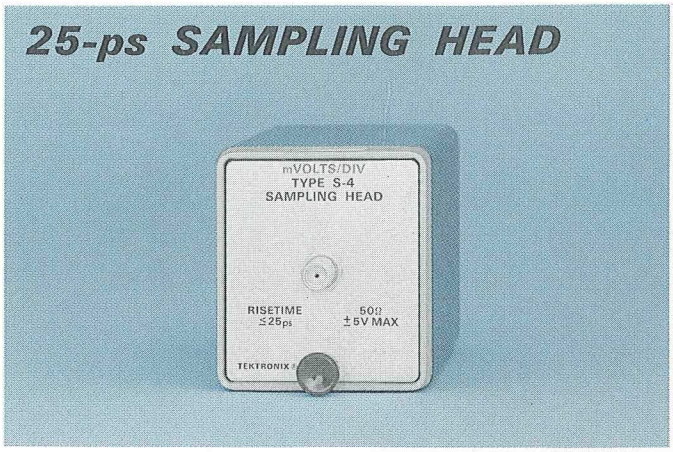
# TYPE S-4

## 25-ps SAMPLING HEAD




- ***25-ps SAMPLING HEAD***
- ***DC-to-14 GHz BANDWIDTH***
- ***RANDOM NOISE LESS THAN 10 mV (unsmoothed)***

The Type S-4 Sampling Head is a 25-ps risetime unit with a 50-Ω input impedance. It is designed for use with the Type 3S2, 3S5 and 3S6 Dual-Trace Sampling Units. The Type S-4 can be plugged into the sampling unit or attached by a Sampling-Head extender for remote use. When used with the Type 3T2 Random Sampling Sweep Unit, the triggering event may be displayed on screen without the use of delay lines or a pretrigger.

### CHARACTERISTICS

**RISETIME**
Less than or equal to 25 ps.

**BANDWIDTH**
Equivalent to DC-to-14 GHz at 3-dB down.

**TRANSIENT RESPONSE**
Aberrations as observed with the Type S-50 Pulse Generator are +10%, —10% or less.

**RANDOM NOISE**
Equivalent to an input signal of 10 mV or less, unsmoothed; 5 mV, smoothed (tangentially measured).

**SIGNAL RANGE**
Variable DC offset allows signals between +1 V and —1 V limits to be displayed at 2 mV/div. For best dot-transient response with random-sampling sweep unit, signal amplitude should be less than 500 mV P-P.

**INPUT CHARACTERISTICS**
Nominally 50 Ω. Safe overload ±5 V. 3-mm input connector.

**WEIGHTS**

| | | |
|---|---|---|
| Net weight | ¾ lb | 0.34 kg |
| Domestic shipping weight | ≈1½ lb | ≈0.68 kg |

**INCLUDED STANDARD ACCESSORIES**
2-ns cable with 3-mm connectors (015-1005-00); 10X 50-Ω 3-mm attenuator (015-1003-00); GR874 to 3-mm male adapter (015-1007-00); 3-mm male-to-male adapter (015-1011-00); instruction manual (070-0896-00).

**TYPE S-4 SAMPLING HEAD . . . . . $750**

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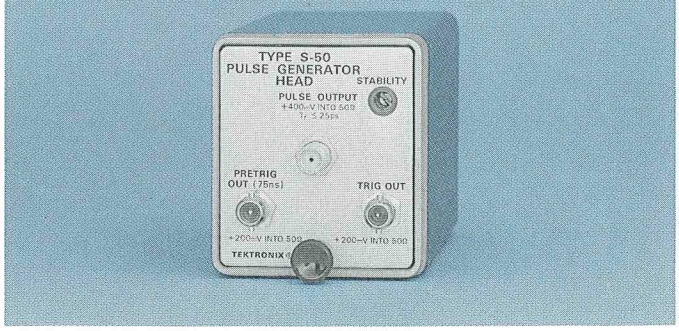
# TYPE S-50

## 25-ps PULSE GENERATOR




- ***25-ps PULSE RISETIME***
- ***400-mV PULSE AMPLITUDE***
- ***100-ns PULSE WIDTH***

The Type S-50 Pulse Generator Head is a high-speed, tunnel-diode step generator designed for use in the Type 3S2, 3S5 and 3S6 Sampling Unit or in the Type 285 Power Supply Unit. The Type S-50 when used with the Type S-4 Sampling Head provides high-resolution 35-ps TDR measurements. The Type S-50 is also used for verification of sampling system risetimes. A pretrigger output allows operation with sequential sampling systems.

### CHARACTERISTICS

**PULSE OUTPUT**
Risetime is 25 ps or less. Amplitude into 50 Ω is at least 400 mV, positive going. Pulse duration is 100 ns, pulse repetition rate is 25 kHz. Pulse aberrations are +10%, —10%, or less as observed with the Type S-4 Sampling Head.

**PRETRIGGER OUTPUT**
Risetime is 400 ps or less. Amplitude into 50 Ω is at least 180 mV, positive going. Pretrigger pulse duration is 3 ns. Pretrigger occurs 75 ns (±5 ns) before the pulse output. Pretrigger to pulse output jitter is 10 ps or less.

**TRIGGER OUTPUT**
Risetime is 200 ps or less. Amplitude into 50 Ω is at least 200 mV, positive going. Trigger pulse duration is 100 ns. The trigger output occurs in time coincidence with the pulse output.

**POWER REQUIREMENTS**
The necessary power is provided from the Type 3S2, 3S5, 3S6 or Type 285 Power Supply.

**OUTPUT CONNECTORS**
Pulse output uses a 3-mm connector. Pretrigger output and trigger output use BSM connectors. A pretrigger output from the rear of the Type S-50 provides a pretrigger pulse for internal triggering of the sampling sweep unit.

**WEIGHTS**

| | | |
|---|---|---|
| Net weight | ¾ lb | 0.34 kg |
| Domestic shipping weight | ≈1½ lb | ≈0.68 kg |

**INCLUDED STANDARD ACCESSORIES**
Instruction manual (070-0897-00).

**TYPE S-50 PULSE GENERATOR HEAD . . . . . $450**

U.S. Sales Price FOB Beaverton, Oregon

# TYPE S-51

## 1-to-18 GHz TRIGGER COUNTDOWN HEAD


The Type S-51 Trigger Countdown Head is a free-running tunnel-diode oscillator designed to provide stable sampling displays of signals up to 18 GHz. The Type S-51 may be used with the Type 3S2, 3S5 and 3S6 Sampling Units in place of one of the Sampling Heads, or it may be operated separately with the Type 285 Power Supply. The Type S-51 has a front-panel synchronizing control that syncs the oscillator frequency to a sub-harmonic of the input signal. The output from the Type S-51 is available at a front-panel trigger output connector or through a rear-panel connector for internal triggering. The output signal is a direct countdown from the input display and permits triggering by a standard sampling time-base unit.

## CHARACTERISTICS

**INPUT SIGNAL**

Frequency range is 1 GHz to 18 GHz. Stable synchronizing on signals 100 mV or less P-P, 5 V, P-P maximum.

**INPUT CHARACTERISTICS**

50-Ω 3-mm connector. Open termination paralleled by 1 pF.

**TRIGGER OUTPUT**

At front panel trigger output is at least 200 mV into 50 Ω, Type BSM connector. Internal trigger output is at least 100 mV into 50 Ω, internally connected to sampling sweep unit. Jitter is 10 ps or less, with signals from 5 GHz to 18 GHz; 15 ps or less with signals from 1 GHz to 5 GHz. Trigger kickout at signal input connector is 400 mV or less, kickout occurs between successive samples.

**POWER REQUIREMENTS**

The necessary power is provided from the Type 3S2, 3S5, 3S6 or Type 285 Power Supply.

**WEIGHT**

| | | |
|---|---|---|
| Net weight | ¾ lb | 0.34 kg |
| Domestic shipping weight | 1½ lb | 0.68 kg |

**INCLUDED STANDARD ACCESSORIES**

Instruction manual (070-0898-00).

**TYPE S-51 TRIGGER COUNTDOWN HEAD ..... $425**

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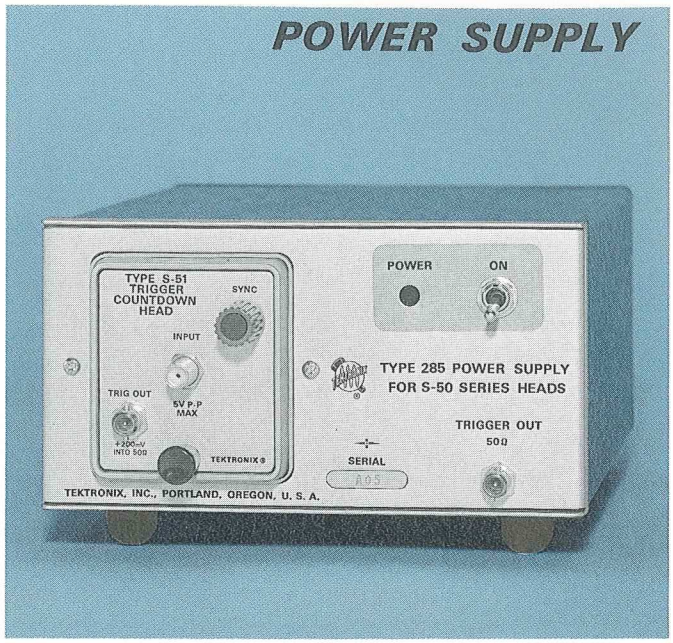
# TYPE 285

## POWER SUPPLY




- ***ACCEPTS ONE TYPE S-50 SERIES HEAD***
  ***TYPE S-50 PULSE GENERATOR HEAD***
  ***TYPE S-51 TRIGGER COUNTDOWN HEAD***

The Type 285 Power Supply is designed for use with either the Type S-50 Pulse Generator Head or the Type S-51 Trigger Countdown Head. The Type 285 provides the regulated power supplies necessary to power one Type S-50 Series Head. It also provides a front panel trigger output jack. The trigger output jack provides the internal trigger pulse from the plug-in Head to the front panel of the Type 285.

## CHARACTERISTICS

**POWER REQUIREMENTS**

90 V to 136 V or 180 V to 272 V, 50 Hz to 400 Hz, 10 watts at 115 V and 60 Hz. Slide switch on rear panel selects high or low voltage operation.

**TRIGGER OUTPUT**

BSM Connector provides internal trigger output of Type S-50 Series Heads to the front panel.

**DIMENSIONS AND WEIGHTS**

| | | |
|---|---|---|
| Height | 3⅛ in | 5.1 cm |
| Width | 5 in | 12.7 cm |
| Depth | 8 in | 20.3 cm |
| Net weight | 3⅛ lb | 1.4 kg |

**INCLUDED STANDARD ACCESSORIES**

3-to-2 wire adapter (103-0013-00); two instruction manuals (070-0903-00).

**TYPE 285 POWER SUPPLY**, without Heads ..... **$150**

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## OPTIONAL ACCESSORIES WITH 3-mm CONNECTORS

| | |
|---|---|
| 10X 50-Ω attenuator, order 015-1003-00 | $65 |
| 5X 50-Ω attenuator, order 015-1002-00 | $70 |
| 2X 50-Ω attenuator, order 015-1001-00 | $60 |
| 2-ns 50-Ω signal cable, order 015-1005-00 | $35 |
| 5-ns 50-Ω signal cable, order 015-1006-00 | $35 |
| 50-Ω termination, order 015-1004-00 | $38 |
| Male-to-male adapter, order 015-1011-00 | $ 8 |
| Female-to-female adapter, order 015-1012-00 | $ 6 |
| Male-to-GR874 adapter, order 015-1007-00 | $18 |
| Female-to-GR874 adapter, order 015-1008-00 | $18 |
| Male-to-7-mm adapter, order 015-1010-00 | $95 |
| Male-to-N female adapter, order 015-1009-00 | $30 |

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# TYPE 3T2

# RANDOM SAMPLING SWEEP UNIT

- **RANDOM OR SEQUENTIAL SAMPLING**
- **NO PRETRIGGER REQUIRED**
- **20 ps/div TO 100 μs/div SWEEP RANGE**
- **WIDE RANGE TIME POSITION**


The Type 3T2 Random Sampling Sweep Unit provides a unique, state-of-the-art advancement in measurement capabilities. This unit may be used in a Type 561A, 564, 567, or 568 Oscilloscope, in conjunction with a Vertical Dual-Trace Sampling Unit.

Random sampling permits observation of the leading edge (or other portions) of signals even when used with vertical units that have no delay lines and without a pretrigger. Random sampling is especially useful with sampling units such as the Type 3S2 with S1 or S2 Sampling Heads or the Type 3S3 with high-impedance sampling probes.

A front-panel switch (START POINT) selects either conventional, sequentially-stepped sampling or random sampling modes of operation.

### SWEEP TIME/DIV

100 μs/div to 200 ps/div, 1-2-5 sequence extending to 20 ps/div with X10 DISPLAY MAGNIFIER. Accurate within 3% from 100 μs/div to 2 ns/div, within 5% from 1 ns/div to 200 ps/div. TIME/DIV is a resultant of the combined settings of TIME POSITION RANGE, TIME MAGNIFIER, and DISPLAY MAG. The sweep rate is displayed (digitally) in the TIME/DIV "window" for all combinations of these controls.

### DISPLAY MAG

X1 or X10 magnification of the display. Display magnifier accurate within 2%, in addition to specified sweep time/div accuracy.

### TIME POSITION RANGE

100 ns, 1 μs, 10 μs, 100 μs, and 1 ms. TIME POSITION and FINE variable controls position start of the display through a interval equal to TIME POSITION RANGE setting.

### SAMPLES/DIV

Continuously variable adjustment of samples displayed per horizontal division from approx 5 samples/div to an immeasurable number of samples/div. Allows optimum adjustment of display rate and dot density.

### DISPLAY MODES

Normal (repetitive), Single Sweep, Manual, or Ext. Horiz. For external input, deflection factor is adjustable from 1.5 V/div to 15 V/div. Front-panel START button for single-sweep operation.

### PULSE OUTPUT

Approximately 150 mV into 50 Ω, negative going. Coincides with trigger recognition.

### TRIGGERING

SOURCES (AC-coupled): Internal—if Sampling Unit contains a trigger pickoff. External, both 1-MΩ (for hi-Z probes) and 50-Ω terminated inputs.

JITTER: Depends on signal shape, repetition rate and amplitude; Less than or equal to 30 ps under optimum conditions.

| PULSE TRIGGERING | | |
|---|---|---|
| SOURCE | REPETITION RATE | AMPLITUDE* |
| EXTERNAL 1-MΩ/UHF Sync input | 10 Hz to 100 MHz<br>600 MHz to 3 GHz | 10 mV to 500 mV (100 V max DC) |
| EXTERNAL 50-Ω input | 10 Hz to 600 MHz | 5 mV to 250 mV (5 V max DC) |

*Either polarity. Minimum rise rate is 150 mV/μs.

| SINEWAVE TRIGGERING | | |
|---|---|---|
| SOURCE | FREQUENCY | AMPLITUDE |
| EXTERNAL 1-MΩ/UHF Sync input | 10 kHz to 100 MHz (+ polarity) | 10 mV to 500 mV peak-to-peak |
| | 100 kHz to 100 MHz<br>500 MHz to 3 GHz<br>(— polarity) | |
| EXTERNAL 50-Ω input | 100 kHz to 600 MHz | 10 mV to 250 mV peak-to-peak |

### HORIZONTAL OUTPUT

1 V for each division of displayed signal through 10 kΩ.

### WEIGHTS

| | | |
|---|---|---|
| Net weight | 6½ lb | 3 kg |
| Domestic shipping weight | ≈11 lb | ≈5 kg |
| Export-packed weight | ≈17 lb | ≈7.7 kg |

### INCLUDED STANDARD ACCESSORIES

5-ns cable, RG58 with BNC connectors (012-0057-01); 10X 50-Ω attenuator, BNC (011-0059-00); GR-to-BNC female adapter (017-0063-00); GR-to-BNC male adapter (017-0064-00); two instruction manuals (070-0631-00).

**TYPE 3T2 RANDOM SAMPLING SWEEP UNIT . . . . $990**

U.S. Sales Prices FOB Beaverton, Oregon

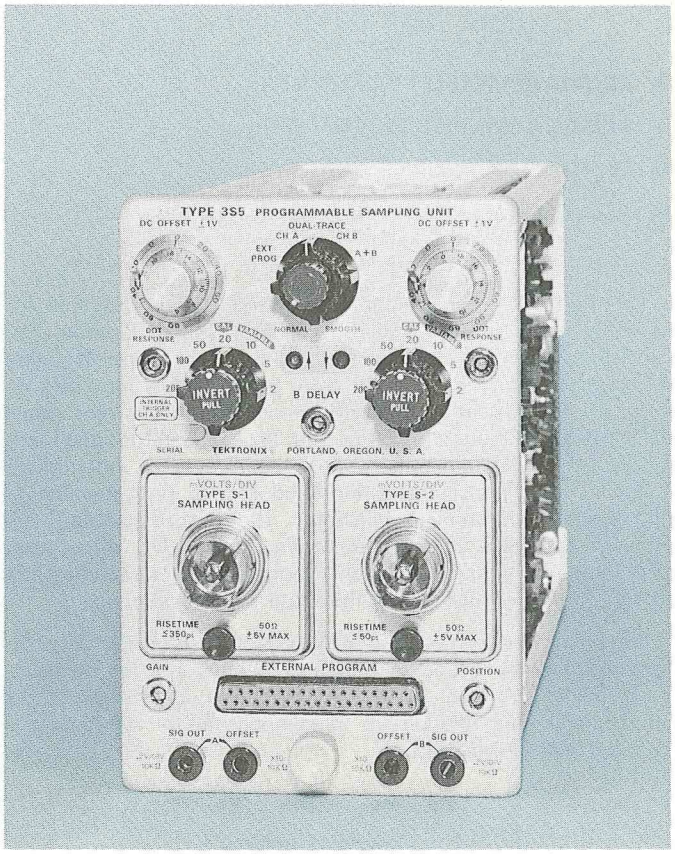
# TYPE 3S5 PROGRAMMABLE SAMPLING UNIT

- ***PROGRAMMABLE VOLTS/DIV***
- ***PROGRAMMABLE DC OFFSET***
- ***PLUG-IN SAMPLING HEADS***
- ***FRONT AND REAR PANEL PROGRAM CONNECTORS***

The Type 3S5 Programmable Sampling Unit extends the automated measurement capabilities of the Type 567 or Type 568 Digital Readout Oscilloscopes by allowing remote programming of the vertical plug-in measurement functions. The Type 3S5 can also be used in the Type 561A and 564 Oscilloscopes where it may be operated manually from the front panel or externally programmed.

The Type 3S5 is a dual-trace programmable vertical unit featuring Sampling Heads that plug-in directly or are located remotely with the optional Sampling-Head extenders. Most of the measurement functions of the Type 3S5 are externally programmable through use of parallel multi-pin connectors on the front panel of the plug-in and the rear panel of the Type 568 Oscilloscope. Programmable functions include deflection factor, DC offset and smoothing.

Sampling Heads feature a choice of measurement capabilities and may be mixed or matched to meet specific measurement needs. A front panel control allows adjustment of the interchannel time relationship to compensate for signal cables or other external delays.




## CHARACTERISTICS

### SAMPLING HEADS

May be plugged into the Type 3S5 or located remotely on the optional 3-ft or 6-ft Sampling-Head extenders.

| SAMPLING HEAD | RISETIME | INPUT | MINIMUM DEFLECTION FACTOR | RANDOM NOISE | PRICE |
|---|---|---|---|---|---|
| Type S-1 | 350 ps | 50 Ω, GR874 | 2 mV/div | 2 mV | $250 |
| Type S-2 | 50 ps | 50 Ω, GR874 | 2 mV/div | 6 mV | $300 |
| Type S-3 | 350 ps | 2.3 pF, 100 kΩ | 2 mV/div | 3 mV | $375 |
| Type S-4 | 25 ps | 50 Ω, 3 mm | 2 mV/div | 10 mV | $750 |

### DEFLECTION FACTOR

2 mV/div to 200 mV/div in 7 calibrated steps, 1-2-5 sequence. Each step accurate within 2% in normal mode, within 3% smoothed. Each channel may be programmed with 3 program lines or by manual front panel controls.

### DC OFFSET RANGE

+1 V to −1 V. Allows signals between +1 V and −1 V limits to be displayed at 2 mV/div. Continuously variable and calibrated with front panel controls between +1 V and −1 V, accurate within 10 mV of same offset voltage obtained in the external program mode. Programmable between +995 mV and −995 mV in 5-mV steps. The programmable accuracy is within 2% or 5 mV (whichever is greater) of the programmed value. Programming is accomplished with 9 program lines per channel in BCD code plus one program line per channel for + or − polarity.

### B-DELAY RANGE

Channel B display can be continuously positioned in time from +5 ns to −5 ns with respect to Channel A. Accommodates up to 3-foot difference in signal cable or Sampling-Head extenders.

### PROGRAMMING

The Type 3S5 uses negative logic with true being ground or <2 V, and false being open or >6 V. The units/div range is programmed with 3 lines per channel. DC offset is programmed with 9 lines per channel in BCD code plus one line per channel for + or − polarity. One line is used to program smoothed or normal operation. A total of 27 program lines is required to externally program all the measurement functions of the Type 3S5.

### DISPLAY MODES

A only, B only, dual trace, algebraic addition of A and B signals. In the external program mode, dual-trace operation is automatically provided. Independent controls for each channel permit positioning and inverting displays as desired.

### INCLUDED STANDARD ACCESSORIES

Connector (131-0422-00); connector cover (200-0660-00); circuit board connector (388-0805-00); two instruction manuals (070-0788-00).

**TYPE 3S5 PROGRAMMABLE SAMPLING UNIT,** without Sampling Heads ..... **$1450**

## OPTIONAL ACCESSORIES

3-ft Sampling-Head extender, order 012-0124-00 ..... $58

6-ft Sampling-Head extender, order 012-0125-00 ..... $60

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# TYPE 3S6 PROGRAMMABLE SAMPLING UNIT

- ***PROGRAMMABLE VOLTS/DIV***
- ***PROGRAMMABLE DC OFFSET***
- ***REMOTE SAMPLING HEADS***
- ***ALL CONNECTIONS ON REAR PANEL***


The Type 3S6 Programmable Sampling Unit is designed for use only in the Type 568 and Type R568 Digital Readout Oscilloscopes. The measurement functions of the Type 3S6 may be operated manually from the front panel or they may be controlled externally from connectors mounted on the rear panel of the Type 568 Oscilloscope. The Type 3S6 is designed primarily for use in automated measurement systems that require minimum front panel connections and remote programming of all vertical measurement functions. The programmable functions of the Type 3S6 are deflection factor, DC offset, and smoothing. Sampling Heads and program cables are attached to rear panel connectors on the Type 568 Oscilloscope.

Sampling Heads feature a choice of measurement capabilities and may be mixed or matched to meet specific measurements needs. A front panel control allows adjustment of the interchannel time relationship to compensate for signal cables or other external delays.

## CHARACTERISTICS

### SAMPLING HEADS

Located remotely on included 6-ft Sampling-Head extender that connects on the rear of the Type 568 Oscilloscope. Type 568 Oscilloscopes below serial number B110000 require a modification. Please consult your Field Engineer, Representative or Distributor.

| SAMPLING HEAD | RISETIME | INPUT | MINIMUM DEFLECTION FACTOR | RANDOM NOISE | PRICE |
|---|---|---|---|---|---|
| Type S-1 | 350 ps | 50 Ω, GR874 | 2 mV/div | 2 mV | $250 |
| Type S-2 | 50 ps | 50 Ω, GR874 | 2 mV/div | 6 mV | $300 |
| Type S-3 | 350 ps | 2.3 pF, 100 kΩ | 2 mV/div | 3 mV | $375 |
| Type S-4 | 25 ps | 50 Ω, 3 mm | 2 mV/div | 10 mV | $750 |

### DEFLECTION FACTOR

2 mV/div to 200 mV/div in 7 calibrated steps, 1-2-5 sequence. Each step accurate within 2% in normal mode, within 3% smoothed. Each channel is programmed with 3 program lines or by manual front panel controls.

### DC OFFSET RANGE

+1 V to −1 V. Allows signals between +1 V and −1 V limits to be displayed at 2 mV/div. Continuously variable and calibrated with front panel controls between +1 V and −1 V, accurate within 10 mV of same offset voltage obtained in the external program mode. Programmable between +995 mV and −995 mV in 5-mV steps. The programmable accuracy is within 2% or 5 mV (whichever is greater) of the programmed value. Programming is accomplished with 9 program lines per channel in BCD code, plus one program line per channel for + or − polarity.

### B-DELAY RANGE

Channel B display can be continuously positioned in time from +5 ns to −5 ns with respect to Channel A. Accommodates up to 3-foot difference in signal cables.

### PROGRAMMING

The Type 3S6 uses negative logic with true being ground or <2 V and false being open or >6 V. The units/div range is programmed with 3 lines per channel. DC offset is programmed with 9 lines per channel in BCD code plus one line per channel for + or − polarity. One line is used to program smoothed or normal operation. A total of 27 program lines is required to externally program all the measurement functions of the Type 3S6.

### DISPLAY MODES

A only, B only, dual trace, and algebraic addition of A and B signals. In the external program mode, dual-trace operation is automatically provided. Independent controls for each channel permit positioning and inverting displays as desired.

### INCLUDED STANDARD ACCESSORIES

6-ft Sampling-Head extender (012-0130-00); two circuit board connectors (388-0805-00); two instruction manuals (070-0789-00).

**TYPE 3S6 PROGRAMMABLE SAMPLING UNIT,** without Sampling Heads . . . . . **$1450**

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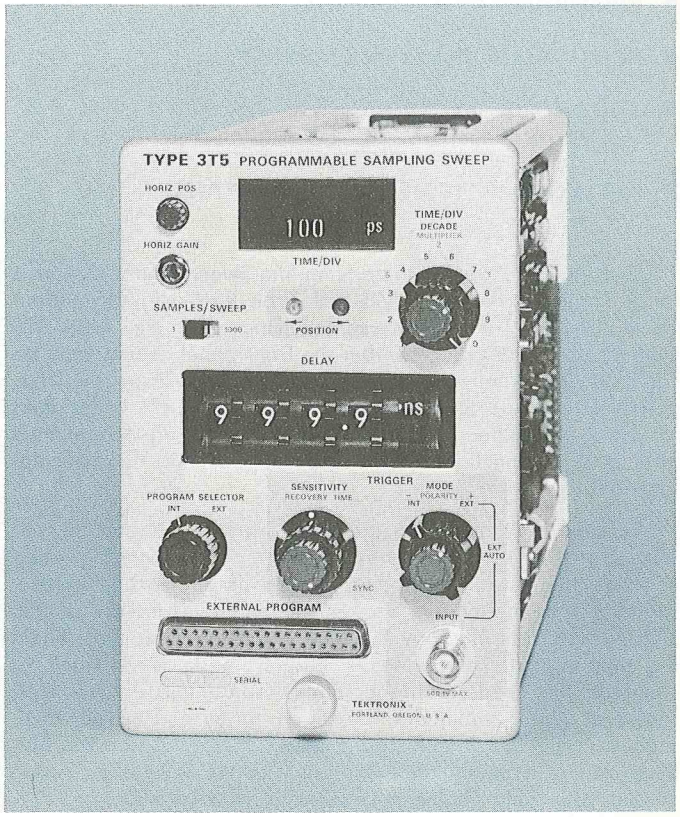
# TYPE 3T5 PROGRAMMABLE SAMPLING SWEEP

- **PROGRAMMABLE TIME/DIV**
- **PROGRAMMABLE SWEEP DELAY**
- **100 ps/DIV to 500 ms/DIV CALIBRATED SWEEP RANGE**
- **FRONT AND REAR PANEL PROGRAM CONNECTORS**




The Type 3T5 Programmable Sampling Sweep Unit extends the automatic measurement capabilities of the Type 567 or the Type 568 Digital Readout Oscilloscopes, by allowing remote programming of the sampling sweep unit. The Type 3T5 can also be used in the Type 561A and Type 564 Oscilloscopes where it may be operated manually from the front panel, or externally programmed with the front panel program connector.

The time/div range, delay time range and samples/sweep of the Type 3T5 are externally programmed by means of parallel multipin connectors located on the front panel of the Type 3T5 and the rear panel of the Type 568 Oscilloscope (Serial Number B110000 and above). Digital delay and real-time sampling (1 ms/div to 500 ms/div) are controlled by a clock and digital counter within the plug-in unit. An automatic trigger mode is provided to eliminate the need for trigger adjustments over a wide range of trigger amplitudes, repetition rates, risetimes and pulse widths.

## CHARACTERISTICS

### SWEEP TIME/DIV

Remotely programmable or front panel operation from 100 ps/div to 500 ms/div in 30 calibrated steps, 1-2-5 sequence. TIME/DIV "window" provides digital readout of all sweep time/div settings in both programmable and manual modes of operation. Programming is accomplished with 7 program lines. Accuracy is within 3%, except for non-linearities at the beginning of the sweep, that can be programmed off screen.

### SAMPLES/SWEEP

1 sample/sweep or 1000 samples/sweep are available in the manual mode of operation; 1000 samples/sweep or 100 samples/sweep are available in the external programming mode of operation. In the external program modes, the Type 230 Digital Unit can program the sweep unit to scan quickly (100 samples/sweep) when not making a measurement, but provides maximum measurement resolution (1000 samples/sweep) when making the measurement. The Type 230 will also reset the sweep immediately after the completion of a measurement. These functions are obtained by externally programming the high speed program line on the Type 230.

### DELAY RANGE

Digital delay is obtained with a clock and a digital counter within the Type 3T5. The digital delay is remotely programmable or selectable from the front panel. The delay range is from 0 to 999.9 ns in 100-ps increments from 100 ps/div to 500 ps/div; 0 to 9.999 $\mu$s in 1-ns increments from 1 ns/div to 1 $\mu$s/div; 0 to 999.9 $\mu$s in 100-ns increments from 2 $\mu$s/div to 500 $\mu$s/div. Programming is accomplished with 16 program lines.

### TRIGGERING

SOURCES: Internal, if sampling unit contains a trigger pick-off; External, 50-Ω terminated input.

JITTER: External automatic, pulse, 30 ps or less with 300-mV pulse, 2 ns or less wide; sinewave, 200 ps or less with 300-mV P-P signal at 30 MHz.

| PULSE TRIGGERING | | |
|---|---|---|
| SOURCE | FREQUENCY | AMPLITUDE |
| Internal | DC to 100 MHz | 100 mV to 2 V |
| External | DC to 100 MHz | 5 mV to 250 mV |
| External Automatic | DC to 100 MHz | 100 mV to 500 mV |

| SINEWAVE TRIGGERING | | |
|---|---|---|
| SOURCE | FREQUENCY | AMPLITUDE peak-to-peak |
| Internal | 100 kHz to 100 MHz | 100 mV to 2 V |
| External | 1 Hz to 100 MHz | 10 mV to 500 mV |
| External Sync | 100 MHz to 1 GHz | 10 mV to 500 mV |
| External Automatic | DC to 100 MHz | 100 mV to 500 mV |

### INCLUDED STANDARD ACCESSORIES

5-ns, 50-Ω RG58 cable with BNC connectors (012-0057-01); 10X 50-Ω BNC attenuator (011-0059-00); GR-to-BNC female adapter (017-0063-00); GR-to-BNC male adapter (017-0064-00); electrical connector (131-0422-00); electrical connector cover (200-0660-00); circuit board connector (388-0805-00); two instruction manuals (070-0760-00).

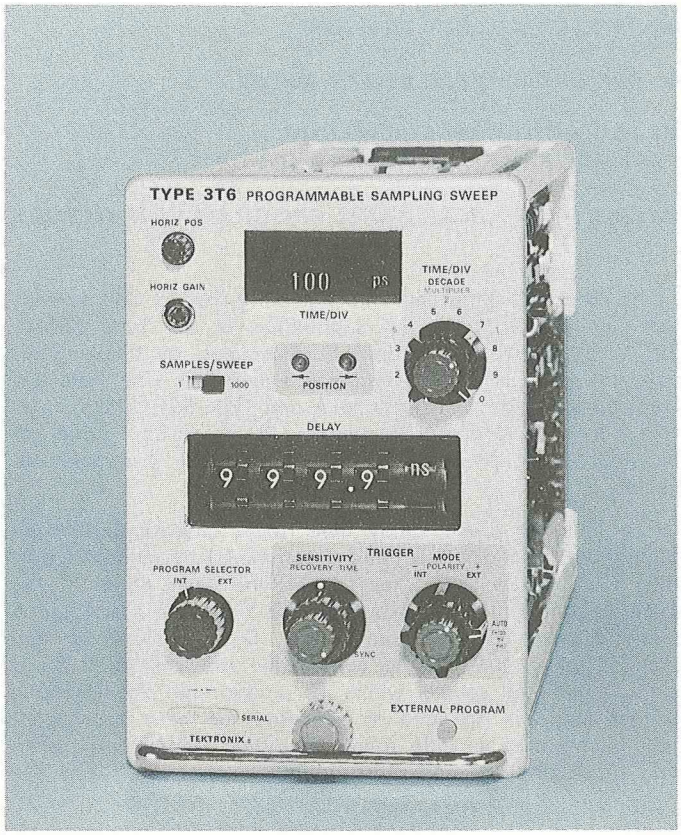
**TYPE 3T5 SAMPLING UNIT . . . . . $1550**

U.S. Sales Price FOB Beaverton, Oregon

**Tektronix, Inc.** / *P. O. BOX 500 · BEAVERTON, OREGON 97005 · Phone: (Area Code 503) 644-0161 · Telex: 036-691*
*TWX: 503-291-6805 · Cable: TEKTRONIX · OVERSEAS DISTRIBUTORS IN OVER 30 COUNTRIES*
*TEKTRONIX FIELD OFFICES in principal cities in United States. Consult Telephone Directory*

# TYPE 3T6 PROGRAMMABLE SAMPLING SWEEP

- **PROGRAMMABLE TIME/DIV**
- **PROGRAMMABLE SWEEP DELAY**
- **100 ps/DIV to 500 ms/DIV CALIBRATED SWEEP RANGE**
- **ALL CONNECTIONS ON REAR PANEL**




The Type 3T6 Programmable Sampling Sweep Unit is designed for use only in the Type 568 and Type R568 Digital Readout Oscilloscopes. The measurement functions of the Type 3T6 may be operated manually from the front panel or they may be controlled externally from connectors mounted on the rear panel of the Type 568 Oscilloscope. The Type 3T6 is designed for use in automated measurement systems that require minimum front panel connections and remote programming of horizontal functions.

The time/div range, sweep delay range and sample per sweep of the Type 3T6 are externally programmable using negative logic, with true being ground and false being open. Digital sweep delay and real-time sampling (1 ms/div to 500 ms/div) are controlled by a clock and digital counter within the plug-in unit. An automatic trigger mode is provided to eliminate the need for trigger circuit adjustment over a wide range of pulse amplitudes, repetition rates, and pulse waveshapes. Type 568 Oscilloscopes below the serial number B11-0000 require a modification for use with the Type 3T6. Please consult your Field Engineer, Representative, or Distributor.

## CHARACTERISTICS

### SWEEP TIME/DIV

Remotely programmable or front panel operation from 100 ps/div to 500 ms/div in 30 calibrated steps, 1-2-5 sequence. TIME/DIV "window" provides digital readout of all sweep time/div settings in both programmable and manual modes of operation. Programming is accomplished with 7 program lines. Accuracy is within 3%, except for non-linearities at the beginning of the sweep, that can be programmed off screen.

### SAMPLES/SWEEP

1 sample/sweep or 1000 samples/sweep are available in the manual mode of operation; 1000 samples/sweep or 100 samples/sweep are available in the external programming mode of operation. In the external program modes, the Type 230 Digital Unit can program the sweep unit to scan quickly (100 samples/sweep) when not making a measurement, but provides maximum measurement resolution (1000 samples/sweep) when making the measurement. The Type 230 will also reset the sweep immediately after the completion of a masurement. These functions are obtained by externally programming the high speed program line on the Type 230.

### DELAY RANGE

Digital delay is obtained with a clock and a digital counter within the Type 3T6. The digital delay is remotely programmable or selectable from the front panel. The delay range is from 0 to 999.9 ns in 100-ps increments from 100 ps/div to 500 ps/div; 0 to 9.999 μs in 1-ns increments from 1 ns/div to 1 μs/div; 0 to 999.9 μs in 100-ns increments from 2 μs/div to 500 μs/div. Programming is accomplished with 16 program lines.

### TRIGGERING

SOURCES: Internal, if sampling unit contains a trigger pickoff; External, 50-Ω terminated input.

JITTER: External automatic, pulse, 30 ps or less with 300-mV pulse, 2 ns or less wide; sinewave, 200 ps or less with with 300-mV P-P signal at 30 MHz.

| PULSE TRIGGERING | | |
|---|---|---|
| SOURCE | FREQUENCY | AMPLITUDE |
| Internal | DC to 100 MHz | 100 mV to 2 V |
| External | DC to 100 MHz | 5 mV to 250 mV |
| External Automatic | DC to 100 MHz | 100 mV to 500 mV |

| SINEWAVE TRIGGERING | | |
|---|---|---|
| SOURCE | FREQUENCY | AMPLITUDE peak-to-peak |
| Internal | 100 kHz to 100 MHz | 100 mV to 2 V |
| External | 1 Hz to 100 MHz | 10 mV to 500 mV |
| External Sync | 100 MHz to 1 GHz | 10 mV to 500 mV |
| External Automatic | DC to 100 MHz | 100 mV to 500 mV |

### INCLUDED STANDARD ACCESSORIES

Circuit board connector (388-0805-00); two instruction manuals (070-0761-00).

**TYPE 3T6 SAMPLING SWEEP UNIT ..... $1550**

U.S. Sales Price FOB Beaverton, Oregon

**Tektronix, Inc.** / *P. O. BOX 500 · BEAVERTON, OREGON 97005 · Phone: (Area Code 503) 644-0161 · Telex: 036-691*
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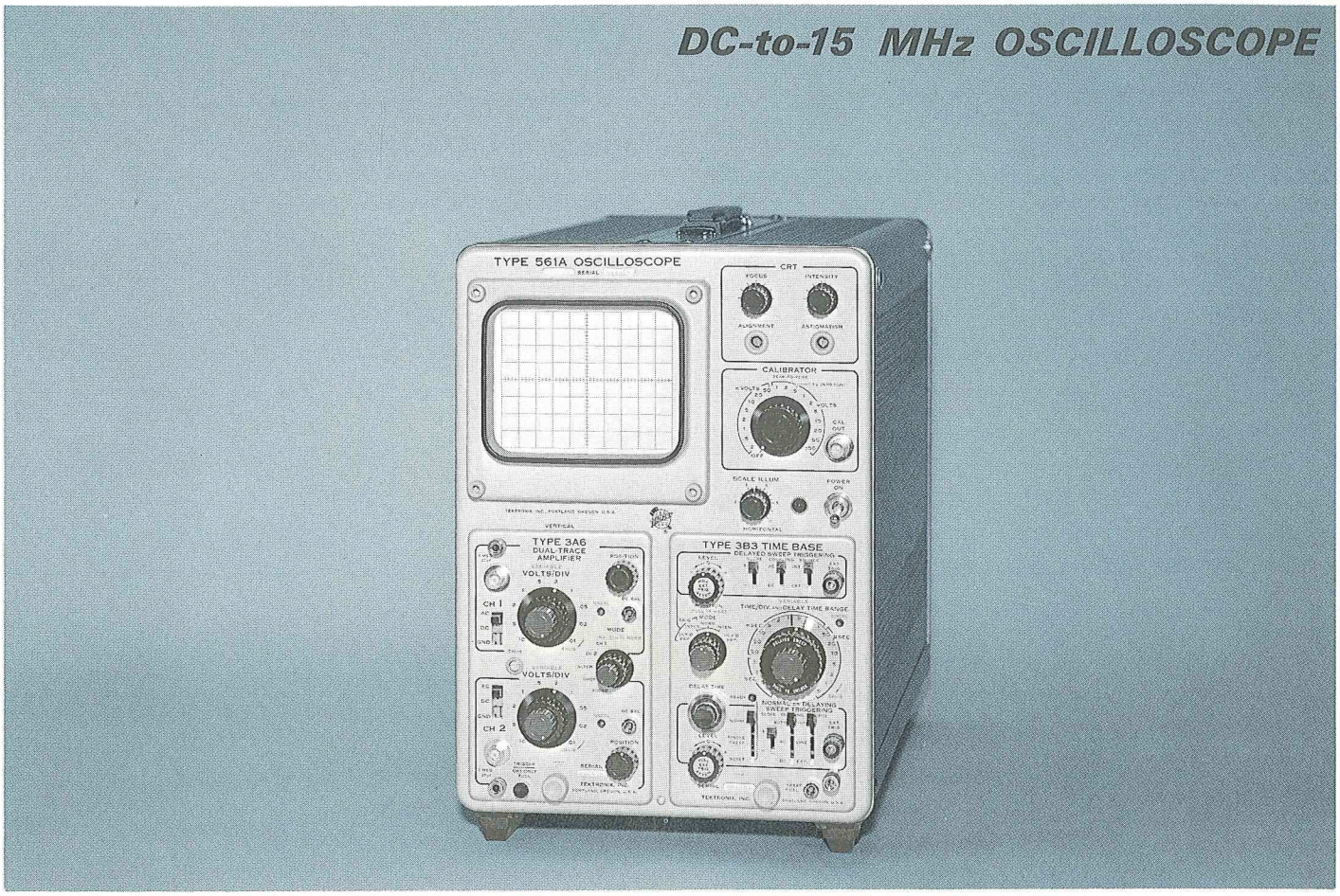
# TYPE 561A / RM561A

## DC-to-15 MHz OSCILLOSCOPE




- ***ACCEPTS MULTI-TRACE, DIFFERENTIAL, SAMPLING AND SPECTRUM ANALYZER PLUG-IN UNITS***
- ***8 x 10-CM DISPLAY***
- ***ILLUMINATED PARALLAX-FREE GRATICULE***
- ***X-Y DISPLAYS***

The Tektronix Type 561A and Type RM561A Oscilloscopes have a complete selection of plug-ins, permitting changing measurement capabilities to meet changing measurement needs. Amplifier plug-ins offer a wide range of measurement capabilities with 10-MHz dual-trace plug-ins, 10 $\mu$V/div differential plug-ins, 50-ps sampling plug-ins and spectrum analyzer plug-ins covering the spectrum from 50 Hz to 36 MHz. Time-base plug-ins include delayed sweep, X50 magnifier, single time-bases or sampling time-bases. Two amplifier plug-ins may be used for X-Y or multiple X-Y displays. An automatic seeking amplifier and time base are also available.

Both the Type 561A and the Type RM561A use a 8 by 10-cm cathode-ray tube that features an internal graticule with controllable illumination. Thus, you can take photographs with the same ease, but without the parallax of the external graticule.

Occupying only 7 inches of rack height, the Type RM561A bolts directly to the rack but may be ordered with optional slide-out tracks at additional cost.

## CHARACTERISTIC SUMMARY

### VERTICAL

Vertical deflection characteristics are extremely flexible through use of 2-Series and 3-Series Amplifier Plug-In Units.

### HORIZONTAL

Horizontal deflection characteristics are extremely flexible through use of 2-Series and 3-Series Amplifier and Time-Base Units.

### CRT

DISPLAY AREA—8 x 10 cm.

ACCELERATING VOLTAGE—3.5 kV.

PHOSPHOR—P31

### OTHER

AMPLITUDE CALIBRATOR—0.2 mV to 100 V (561A), 1 mV to 100 V (RM561A), and 0.1 V into 50 Ω, power line-frequency.

POWER REQUIREMENTS—105 to 125 V or 210 to 250 V, 50 to 400 Hz (561A), 50 to 60 Hz (RM561A), 240 watts maximum.

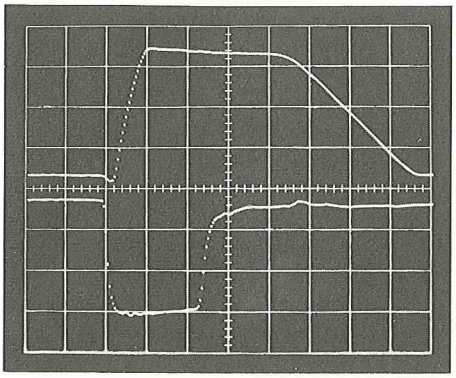
## PARALLAX-FREE MEASUREMENTS—CONVENIENT PHOTOGRAPHY

The internal graticule eliminates parallax, a common cause of erroneous readings. Parallax is an apparent displacement of the trace in relationship to the graticule. It occurs when the trace is on a different plane than the graticule, and is not viewed from exactly the same angle for all parts of the display.

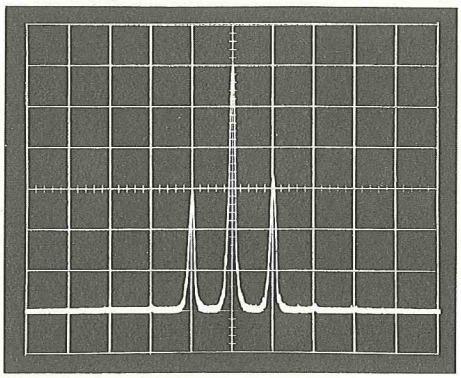
When the trace and graticule are on the same plane, as on the cathode-ray tube of the Type 561A and RM561A Oscilloscope, parallax is eliminated.

Controllable illumination of the internal graticule enables you to easily take waveform photographs in which the graticule rulings are sharply delineated. This was formerly possible only with oscilloscopes using external graticules.

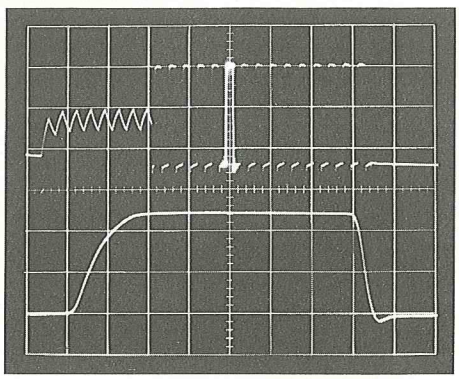
Adding to the convenience of operation the Type RM561A has numbered settings of the illumination control that serve as an approximate exposure guide.



SAMPLING
Transistor turn-on and turn-off (upper trace). Driving pulse (lower trace).



SPECTRUM ANALYZER
Waveform showing center frequency and two sidebands.



DELAYING SWEEP (Double exposure)
Intensified portion of waveform (upper trace) expanded (lower trace) by means of delayed sweep.

### PLUG-IN UNITS

| PLUG-IN UNIT | MINIMUM DEFLECTION FACTOR | BANDWIDTH (−3 dB) | $T_R$ | PRICE |
|---|---|---|---|---|
| **MULTIPLE TRACE** | | | | |
| 3A1 Dual-Trace | 10 mV/div | DC to 10 MHz | 35 ns | $500 |
| 3A3 Dual-Trace | 100 μV/div | DC to 500 kHz | 0.7 μs | 825 |
| 3A6 Dual-Trace | 10 mV/div | DC to 10 MHz | 35 ns | 525 |
| 3A72 Dual-Trace | 10 mV/div | DC to 650 kHz | 0.54 μs | 295 |
| 3A74 Four-Trace | 20 mV/div | DC to 2 MHz | 0.18 μs | 625 |
| **DIFFERENTIAL** | | | | |
| 2A61 High-Gain | 10 μV/div | 0.06 Hz to 300 kHz | 1.2 μs | $400 |
| 2A63 | 1 mV/div | DC to 300 kHz | 1.2 μs | 165 |
| 3A3 | 100 μV/div | DC to 500 kHz | 0.7 μs | 825 |
| 3A7 Comparator | 1 mV/div | DC to 10 MHz | 35 ns | 660 |
| **SPECTRUM ANALYZERS** | | | | |
| 3L5 | 10 μV/div | 10 Hz to 1 MHz | | $1100 |
| 3L10 | −100 dBm | 1 MHz to 36 MHz Center Freq. | | 1260 |
| **SAMPLING** | | | | |
| 3S1 Dual-Trace | 2 mV/div | DC to 1 GHz | 350 ps | $1150 |
| 3S2 Dual-Trace | 2 mV/div | | | 800 |
| S1 | | DC to 1 GHz | 350 ps | 250 |
| S2 | | DC to 7 GHz | 50 ps | 300 |
| 3S3 Dual-Trace | 5 mV/div | DC to 1 GHz | 350 ps | 1575 |

| PLUG-IN UNIT | MINIMUM DEFLECTION FACTOR | BANDWIDTH (−3 dB) | $T_R$ | PRICE |
|---|---|---|---|---|
| **SPECIAL PURPOSE** | | | | |
| 3A8 Operational | 20 mV/div | DC to 3.5 MHz | 100 ns | $625 |
| 3C66 Carrier Amp. | 10 μstrain /div | DC to 5 kHz | 70 μs | 425 |
| **SINGLE TRACE** | | | | |
| 2A60 | 50 mV/div | DC to 1 MHz | 0.35 μs | $110 |
| 3A5 Automatic/Prog. | 10 mV/div<br>1 mV/div | DC to 15 MHz<br>DC to 5 MHz | 23 ns | 790 |
| 3A75 | 50 mV/div | DC to 4 MHz | 90 ns | 190 |

### TIME-BASE UNITS

| TYPE | FASTEST TIME-BASE RATE | MAGNIFIER | FEATURES | PRICE |
|---|---|---|---|---|
| 2B67 | 1 μs/div | X5 | single sweep | $ 225 |
| 3B3 | 0.5 μs/div | X5 | calib sweep delay; single sweep | 625 |
| 3B4 | 0.2 μs/div | X1 to X50 | single sweep | 425 |
| 3B5 Automatic/ Programmable | 0.1 μs/div | X10<br>X100 | calib delay mag; auto-seek programmable | 925 |
| **SAMPLING** | | | | |
| 3T2 | 20 ps/div | X10 | random sampling | $ 990 |
| 3T4 Programmable Sampling | 1 ns/div | X10 | single sweep; manual scan; calib sweep delay | 1380 |
| 3T77A Sampling | 0.2 ns/div | X10 | single sweep; manual scan sweep delay | 690 |

### CONVENTIONAL DISPLAYS

A wide range of non-sampling bandwidths and deflection factors are available in the selection of 2-Series and 3-Series Amplifier Plug-In Units. These include both single-trace and multi-trace units. The Types 2A61, 2A63, 3A3, and 3A7 are differential amplifier units while the Type 3C66 is useful for strain-gage and similar transducer operations.

Normal sweep, single sweep, magnified or delayed sweep is available with the group of 2-Series and 3-Series time-base plug-in units.

### AUTOMATIC SEEKING

The Types 3A5 Amplifier (DC to 15 MHz) and 3B5 Time-Base are automatic-seeking plug-in units. These units, when commanded, have the ability to sense voltage levels and time changes and adjust their deflection factors to present calibrated on-screen displays. The control settings are read out on the front panels in large, lighted digits.

### SAMPLING DISPLAYS

The Type 3T77A, 3T2 and 3T4 Sampling Sweep Units with the Type 3S1, Type 3S2 and Type 3S3 Amplifier Units give a dual-trace sampling system with risetimes in the subnanosecond region.

### SPECTRUM ANALYSIS

The Type 3L10 Spectrum Analyzer Plug-In Unit covers the 1-36 MHz range. This plug-in unit with a sensitivity of —100 dBm and calibrated dispersion allows the display of RF signals with a resolution of 10 Hz to 1 kHz.

The Type 3L5 Spectrum Analyzer Plug-In Unit provides both spectral and time-based displays from 10 Hz to 1 MHz. Calibrated dispersion is 10 Hz/div to 100 kHz/div. Sensitivity is 10 $\mu$V/div RMS for spectral displays, 1 mV/div peak to peak for time-based displays

### X-Y DISPLAYS

The Types 2A60, 2A61, 2A63, 3A3, 3A72, 3A74, and 3A75 Amplifier Plug-In Units operate equally well in the vertical and horizontal compartments of the Type 561A and RM561A permitting X-Y displays using any combination of these plug-in units. Plug-In units other than these listed above are not recommended for X-Y displays.

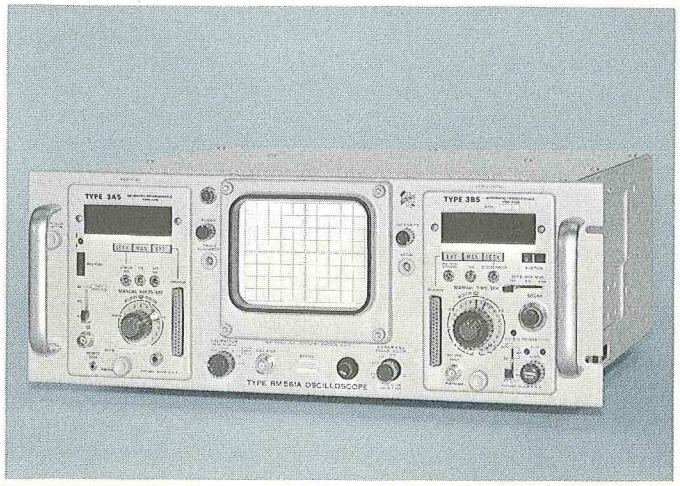
For medium and high-frequency X-Y operation, use of two units of the same type is recommended. Deflection-circuit capacitances of the Type 561A and RM561A are carefully standardized to minimize high frequency phase-shift between two plug-ins of the same type when operated X-Y.

### MULTIPLE X-Y DISPLAYS

Using two Type 3A72 or two Type 3A74 Plug-In Units, both synchronization and automatic pairing are provided. With two 3A72's operated X-Y in the dual-trace mode, Channel 1 of the left-hand plug-in is always plotted against Channel 1 of the right-hand plug-in. With two Type 3A74's, two, three, or four independent displays may be obtained, properly paired: Channel 4 versus Channel 4, Channel 3 versus Channel 3, etc. . . .

Using two Type 3A1 or two Type 3A6 Plug-In Units, dual-trace switching is not synchronized. Dual X-Y displays within the center 8 cm x 8 cm area of the graticule may be obtained, but one plug-in or the other must usually be limited to single-trace operation unless four displays are wanted.

Using two Type 3A3 Plug-In Units, dual-trace switching is synchronized, so one Y Channel remains plotted against the same X Channel once the display is set up. There is no provision for consistent pairing each time the system is operated.




As with single X-Y displays, two plug-ins of the same type should always be used where X-Y phase relationships are to be preserved.

### RASTER GENERATION

A raster display can be presented by using two time-base plug-in units, one in each compartment. Signal modulation can be achieved through the Z-axis of the CRT.

## TYPE 561A CHARACTERISTICS

### PLUG-IN COMPARTMENTS

Accepts all 2-Series and 3-Series Amplifier and Time-Base Units.

### TEKTRONIX CRT

Flat-faced rectangular 5-in tube with internal "no parallax" graticule, controllable edge-lighting, 3.5-kV monoaccelerator, beam-deflection unblanking. A P31 Phosphor is normally supplied.

### ILLUMINATED INTERNAL GRATICULE

Edge lighted graticule marked in 8 vertical and 10 horizontal cm divisions. The centerlines are marked every 2 mm. Illumination is controlled by a front-panel knob.

### DISPLAY CONTROLS

Front-panel controls include Focus, Intensity, and Scale Illumination (of the 8-cm by 10-cm display area), in addition to screwdriver adjustments for Astigmatism and Trace Alignment.

### Z-AXIS INPUT

Accessible through a terminal at the rear of the instrument permits external modulation of the CRT cathode.

### AMPLITUDE CALIBRATOR

18 squarewave voltages from 0.2 mV to 100 V, peak to peak, accurate within 3%; approximately 5-$\mu$s risetime, at line frequency. For 50 $\Omega$ systems the 0.5 V position provides 0.1 V into 50 ohms for convenient amplitude calibration of sampling units.

### ELECTRONICALLY-REGULATED SUPPLIES

All voltages required for proper operation of the indicator and the plug-in units are regulated. DC-supply provides 85 watts for powering the 2-Series and 3-Series Plug-In Units. Supplies operate normally with or without plug-ins.

### POWER REQUIREMENTS

240 watts maximum, 50 to 400 Hz. Instrument factory wired for 105 V to 125 V (117 V nominal) operation. Transformer taps permit operation at 210 V to 250 V (234 V nominal). Instrument can be ordered factory wired for 210 V to 250 V operation.

DIMENSIONS AND WEIGHTS

| | | |
|---|---|---|
| Height | 14½ in | 36.8 cm |
| Width | 10 in | 25.4 cm |
| Depth | 21⅛ in | 53.7 cm |
| Net weight | 32 lb | 14.6 kg |
| Domestic shipping weight | ≈40 lb | ≈18.2 kg |
| Export-packed weight | ≈50 lb | ≈22.7 kg |

INCLUDED STANDARD ACCESSORIES

3 to 2-wire adapter (103-0013-00); 3-conductor power cord (161-0010-03); CRT protector plate (387-0935-00); smoke gray filter (installed) (378-0560-00); 18-inch red patch cord, BNC-to-BNC (012-0087-00); 18-inch red patch cord, BNC-to-banana plug (012-0091-00); red post jack, BNC (012-0092-00); two instruction manuals (070-0342-00).

**TYPE 561A OSCILLOSCOPE**, without plug-in units . . **$530**

## TYPE RM561A RACKMOUNT

Electrically identical to the Type 561A except the calibrator range is 1 mV to 100 V and the line-frequency range is 50 to 60 Hz. Instrument mounts to a standard 19-inch rack. (Additional mounting information on Catalog Instrument Dimensions page).

DIMENSIONS AND WEIGHTS

| | | |
|---|---|---|
| Height | 7 in | 17.8 cm |
| Width | 19 in | 48.3 cm |
| Rack depth | 18⅜ in | 46.7 cm |
| Net weight | 32¼ lb | 14.7 kg |
| Domestic shipping weight | ≈55 lb | ≈25.0 kg |
| Export-packed weight | ≈74 lb | ≈33.6 kg |

INCLUDED STANDARD ACCESSORIES

Same as Type 561A, but includes mounting hardware; power cord (161-0024-00); and two instruction manuals (070-0352-01).

**TYPE RM561A OSCILLOSCOPE**, without plug-in units **$580**

## TYPE RM561A WITH SLIDE-OUT TRACKS

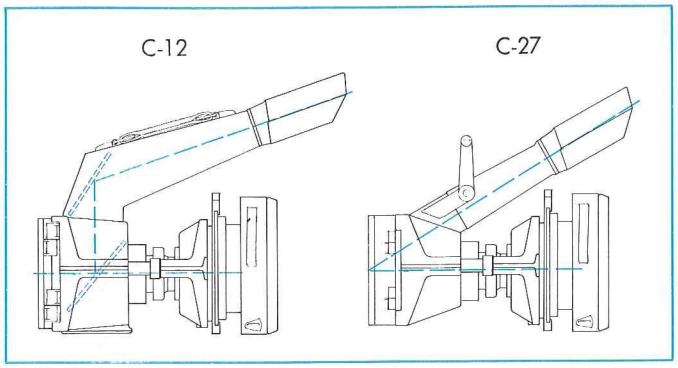
Type RM561A MOD 171A mounts to a standard 19-inch rack on slide-out tracks. It can be pulled out, tilted, and locked in any one of seven positions for convenient servicing. Instrument has same standard accessories as the Type RM561A, but also includes one pair of mounting tracks (351-0084-00).

**TYPE RM561A MOD 171A OSCILLOSCOPE**, without plug-in units . . . . . **$630**

## OPTIONAL ACCESSORIES

Optional accessories increase measurement capability and provide added convenience. The probes recommended for use with these instruments are covered on the 2- and 3-series plug-in unit pages. Additional probes are available that may be better suited for a particular application, including current and high-voltage measurements. See the catalog accessory pages for information on these and other items.

CAMERAS




Standard C-12 with beam-splitting mirror for straight-on viewing and use of optional projected graticule; f/1.9—1:0.85 lens, Polaroid Land* Pack Film back, order C-12 . . . . . $460

Type 561A or RM561A to C-12 Camera adapter, order 016-0217-00 . . . . . $15

Standard C-27 has rotating and removable viewing hood allowing mounting on adjacent Type RM561A's, f/1.9—1:0.85 lens. Polaroid Land* Pack Film back, order C-27 . . . . $430

Type 561A or RM561A to C-27 Camera adapter, order 016-0224-00 . . . . . $15

SCOPE-MOBILE® CART

Model 201-2 for Type 561A: two plug-in carrier, 9-position tilt-lock oscilloscope tray, order 201-2 . . . . . $135

SLIDE-OUT TRACKS

Converts standard Type RM561A for easy withdrawal and tilt of instrument, order 351-0050-00 . . . . . $45

CRADLE ASSEMBLY

Provides rear slide support when RM561A with slide-out tracks is mounted in a backless rack, order 040-0344-00 . . . . . $12

*Registered Trade-Mark Polaroid Corporation

U.S. Sales Prices FOB Beaverton, Oregon

**Tektronix, Inc.** *P. O. BOX 500 · BEAVERTON, OREGON 97005 · Phone: (Area Code 503) 644-0161 · Telex: 036-691*
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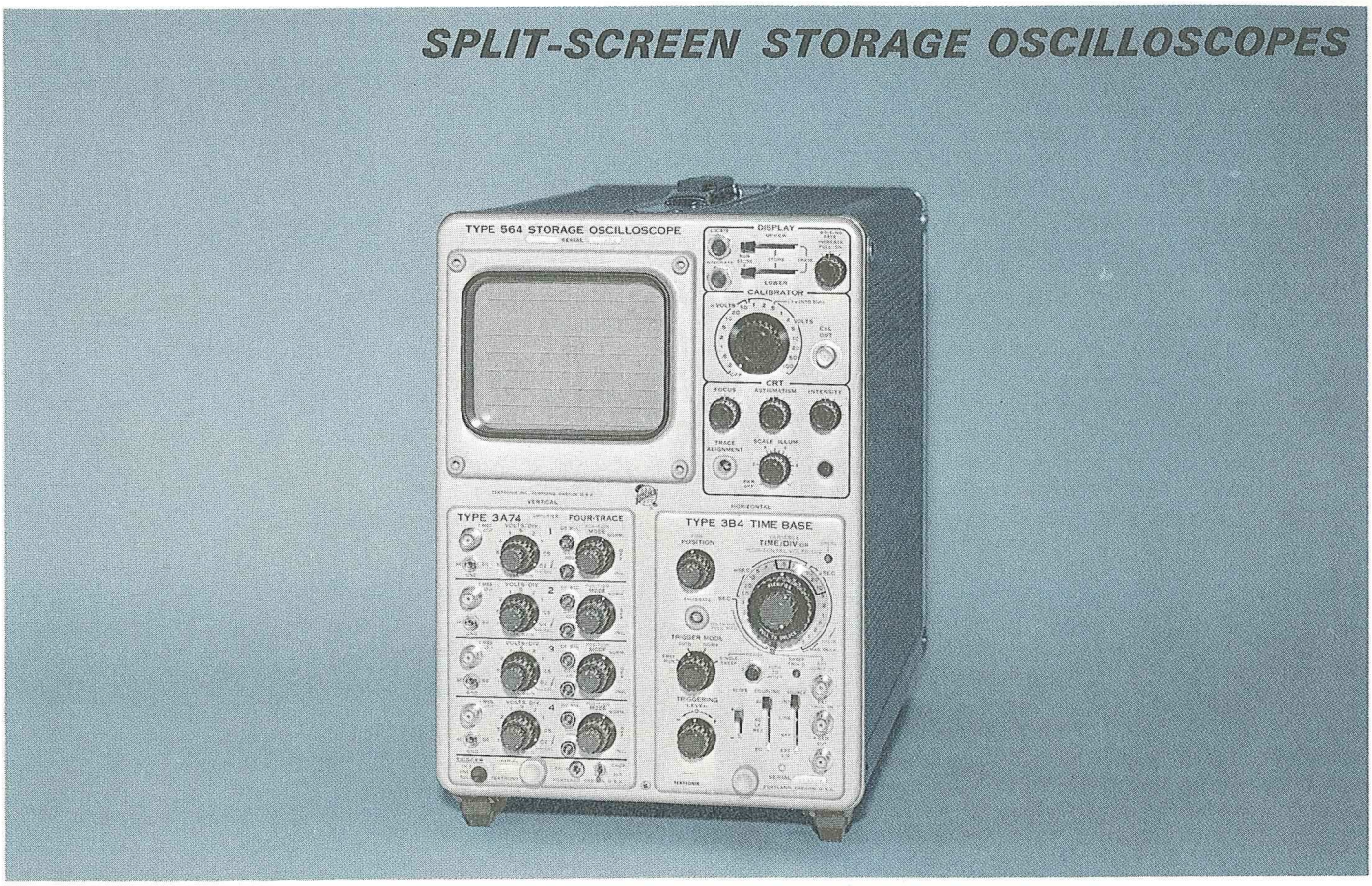
**Tektronix International A.G.,** *Zug, Switzerland* · **Tektronix Ltd.,** *Guernsey, C.I.* · **Tektronix U.K. Ltd.,** *Harpenden, Herts*


# split-screen displays

**Type 564**
**Storage Oscilloscope**

# SPLIT-SCREEN STORAGE OSCILLOSCOPES




- ***BISTABLE SPLIT-SCREEN STORAGE***
- ***UP TO 500 cm/ms WRITING SPEED***
- ***ACCEPTS MULTI-TRACE, DIFFERENTIAL, SAMPLING AND SPECTRUM ANALYZER PLUG-IN UNITS***
- ***X-Y DISPLAYS***

The Types 564 and RM564 Storage Oscilloscopes are virtually two instruments in one, offering all the advantages of a split-screen storage oscilloscope, plus those of a conventional plug-in oscilloscope. A complete selection of plug-ins permits changing the oscilloscope's performance to meet changing measurement needs.

With the split-screen storage feature, either half of the 8 x 10-cm display can be independently controlled, thus allowing stored or conventional displays on either the upper or lower half. The contrast ratio and brightness of the stored displays are constant and independent of viewing time, writing and sweep rates, or signal repetition rates.

The Type 564 and RM564 have dual plug-in flexibility with vertical and horizontal plug-in units. Amplifier plug-ins offer a wide range of measurement capabilities with 10-MHz multi-trace, 10-$\mu$V differential, 50-ps sampling and spectrum analyzer plug-ins. Time-base plug-ins include delayed sweep, X50 magnifier, single time-bases and sampling time-bases. Amplifier plug-ins may be placed in the horizontal position for X-Y or multiple X-Y displays and automatic seeking plug-ins are available.

## CHARACTERISTIC SUMMARY

### VERTICAL

Vertical deflection characteristics are extremely flexible through use of 2-Series and 3-Series Amplifier Plug-In Units (see chart).

### HORIZONTAL

Horizontal deflection characteristics are extremely flexible through use of versatile 2-Series and 3-Series Amplifier and Time-Base Units (see chart).

### STORAGE CRT

**DISPLAY AREA**—8 x 10 cm.

**ACCELERATING VOLTAGE**—3.5 kV.

**SPLIT SCREEN STORAGE**—Store on either upper or lower half of screen with non-storage on other half; store on entire screen; or non-store on entire screen.

**VIEWING TIME**—Up to one hour.

**ERASE TIME**—Approximately 0.25 second.

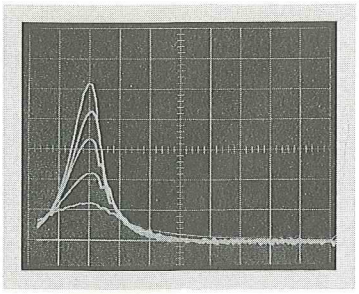
**WRITING SPEED**—Up to 500 cm/ms.

**PHOSPHOR**—P1

### OTHER

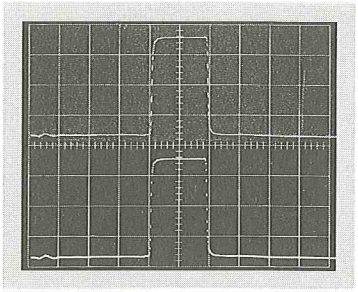
**AMPLITUDE CALIBRATOR**—0.2 mV to 100 V (564), 1 mV to 100 V (RM564), and 0.1 V into 50 Ω, power line-frequency.

**POWER REQUIREMENTS**—105 to 125 V or 210 to 250 V.



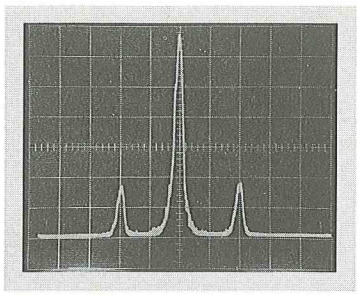
*SHOCK TEST*

*Display shows ability of the Type 564 to store consecutive events for comparison or photography. Waveforms indicate shock imparted by dropping sub-table weight of 5 lbs from different heights.*



*LOW-REPETITION RATE SAMPLING*

*Display shows ability of the Type 564 (with sampling plug-in units) to record complete sampling waveforms at low repetition rates. Upper trace is stored. Lower trace is not stored. This capability for storing low-repetition-rate waveforms allows observation and analysis of the entire sampled display at one time.*



*STORED SPECTRAL DISPLAY*

*Stored waveform showing center frequency with two sidebands. Using single-sweep and storage allows measurement of frequency drift with spectrum analyzer unit.*

## PLUG-IN UNITS

| PLUG-IN UNIT | MINIMUM DEFLECTION FACTOR | BANDWIDTH (—3 dB) | $T_R$ | PRICE |
|---|---|---|---|---|
| **MULTIPLE TRACE** | | | | |
| 3A1 Dual-Trace | 10 mV/div | DC to 10 MHz | 35 ns | $ 500 |
| 3A3 Dual-Trace | 100 μV/div | DC to 500 kHz | 0.7 μs | 825 |
| 3A6 Dual-Trace | 10 mV/div | DC to 10 MHz | 35 ns | 525 |
| 3A72 Dual-Trace | 10 mV/div | DC to 650 kHz | 0.54 μs | 295 |
| 3A74 Four-Trace | 20 mV/div | DC to 2 MHz | 0.18 μs | 625 |
| **DIFFERENTIAL** | | | | |
| 2A61 High-Gain | 10 μV/div | 0.06 Hz to 300 kHz | 1.2 μs | $ 400 |
| 2A63 | 1 mV/div | DC to 300 kHz | 1.2 μs | 165 |
| 3A3 | 100 μV/div | DC to 500 kHz | 0.7 μs | 825 |
| 3A7 Comparator | 1 mV/div | DC to 10 MHz | 35 ns | 660 |
| **SPECTRUM ANALYZERS** | | | | |
| 3L5 | 10 μV/div | 10 Hz to 1 MHz | | $1100 |
| 3L10 | —100 dBm | 1 MHz to 36 MHz Center Freq. | | 1260 |

| PLUG-IN UNIT | MINIMUM DEFLECTION FACTOR | BANDWIDTH (—3 dB) | $T_R$ | PRICE |
|---|---|---|---|---|
| **SPECIAL PURPOSE** | | | | |
| 3A8 Operational | 20 mV/div | DC to 3.5 MHz | 100 ns | $ 625 |
| 3C66 Carrier Amp. | 10 μstrain /div | DC to 5 kHz | 70 μs | 425 |
| **SINGLE TRACE** | | | | |
| 2A60 | 50 mV/div | DC to 1 MHz | 0.35 μs | $ 110 |
| 3A5 Automatic/Prog. | 10 mV/div<br>1 mV/div | DC to 15 MHz<br>DC to 5 MHz | 23 ns | 790 |
| 3A75 | 50 mV/div | DC to 4 MHz | 90 ns | 190 |

**TIME-BASE UNITS**

| TYPE | FASTEST TIME-BASE RATE | MAGNIFIER | FEATURES | PRICE |
|---|---|---|---|---|
| 2B67 | 1 μs/div | X5 | single sweep | $ 225 |
| 3B1 | 0.5 μs/div | X5 | sweep delay | 575 |
| 3B3 | 0.5 μs/div | X5 | calib sweep delay; single sweep | 625 |
| 3B4 | 0.2 μs/div | X1 to X50 | single sweep | 425 |
| 3B5 Automatic/ Programmable | 0.1 μs/div | X10<br>X100 | calib delay mag; auto-seek programmable | 925 |

**SAMPLING**

| | | | | |
|---|---|---|---|---|
| 3S1 Dual-Trace | 2 mV/div | DC to 1 GHz | 350 ps | $1150 |
| 3S2 Dual-Trace | 2 mV/div | | | 800 |
| S1 | | DC to 1 GHz | 350 ps | 250 |
| S2 | | DC to 7 GHz | 50 ps | 300 |
| 3S3 Dual-Trace | 5 mV/div | DC to 1 GHz | 350 ps | 1575 |

| | | | | |
|---|---|---|---|---|
| 3T2 | 20 ps/div | X10 | random sampling | $ 990 |
| 3T4 Programmable Sampling | 1 ns/div | X10 | single sweep; manual scan; calib. sweep delay | 1380 |
| 3T77A Sampling | 0.2 ns/div | X10 | single sweep; manual scan sweep delay | 690 |

## STORAGE OPERATION

*Features of the Type 564 as a storage oscilloscope include—*
*Long-term storage with short-time erasure.*
*Storage of single shot signals.*
*Split-screen with individual controls for each half.*

### *SOME THINGS YOU CAN DO WITH TYPE 564 STORED DISPLAYS*

1. *Observe single-shot phenomena.*
2. *Study, for long periods of time, a waveform without having to photograph it. (Stored brightness and contrast remain essentially constant for up to an hour.)*
3. *Photograph only those stored waveforms you want.*
4. *Compare changing waveforms to a stored waveform, each displayed on half of the CRT face.*
5. *Change the stored standard while viewing other waveforms on the non-stored half.*
6. *Photograph a multi-event stored display with only one exposure.*
7. *Store fast recurrent phenomena by using the integrate feature.*
8. *Store X-Y displays.*

## AVAILABLE DISPLAYS

With the wide-range sensitivity and bandwidth of the Type 564, several storage and conventional operation displays are obtainable. The range of signals which may be stored is limited by stored-mode writing characteristics of the CRT.

### SINGLE-TRACE AND MULTI-TRACE

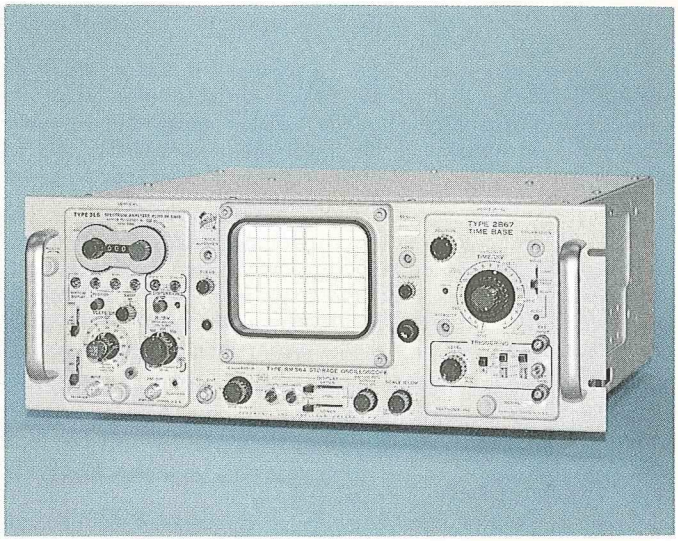
These displays are obtained by selecting either sampling or non-sampling amplifier plug-in units. Selection of the Type 2A61, 2A63, or 3A3, gives differential amplifier operation, while strain gage and other transducer operations are available with the Type 3C66.

### SAMPLING

Risetimes in the sub-nanosecond region are obtained by using Type 3T77A, 3T2, or 3T4 Sampling Sweep Unit with either a Type 3S1, Type 3S2 or Type 3S3 Amplifier Unit. These combinations will provide a dual-trace display or a single display.

### SPECTRUM ANALYSIS

The Type 3L10 Spectrum Analyzer Plug-In Unit covers the 1 —36 MHz range. This plug-in unit, with a sensitivity of —100 dBm and calibrated dispersion, allows the display of RF signals with a resolution of 10 Hz to 1 kHz.



The Type 3L5 Spectrum Analyzer Plug-In Unit provides both spectral and time-based displays from 10 Hz to 1 MHz. Calibrated dispersion is 10 Hz/div to 100 kHz/div. Sensitivity is 10 $\mu$V/div RMS for spectral displays, 1 mV/div peak to peak for time-based displays.

### SINGLE X-Y

X-Y display can be obtained by using any combination of the Type 2A60, 2A63, 3A3, 3A72, 3A74, and 3A75 Units in both the vertical and horizontal compartments of the Type 564.

For medium and high-frequency X-Y operation, however, use two units of the same type. Careful standardization of deflection-circuit capacitance in the Type 564, minimizes high frequency phase-shift between two of the same type plug-in units when operated X-Y.

### MULTIPLE X-Y

Using two Type 3A72 or two Type 3A74 Plug-In Units, both synchronization and automatic pairings are provided. With two 3A72's operated X-Y in the dual trace mode, Channel 1 of the left-hand plug-in is always plotted against Channel 1 of the right-hand plug-in. With two Type 3A74's, two, three, or four independent displays may be obtained, properly paired: Channel 4 versus Channel 4, Channel 3 versus Channel 3, etc. . . .

Using two Type 3A1 or two Type 3A6 Plug-In Units, dual-trace switching is not synchronized. Dual X-Y displays within the center 8 cm x 8 cm area of the graticule may be obtained, but one plug-in or the other must usually be limited to single-trace operation unless four displays are wanted.

Using two Type 3A3 Plug-In Units, dual-trace switching is synchronized, so one Y Channel remains plotted against the same X Channel once the display is set up. There is no provision for consistent pairing each time the system is operated.

As with single X-Y displays, two plug-ins of the same type should always be used where X-Y phase relationships are to be preserved.

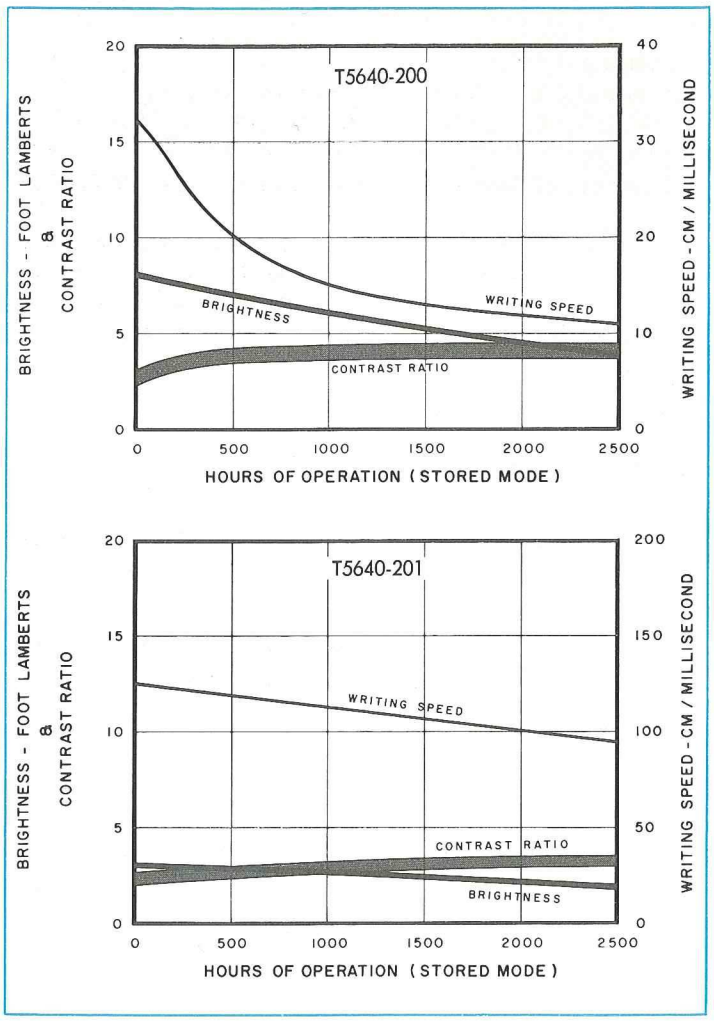
## CRT PERFORMANCE

There are two storage tubes available for use in the Type 564 Oscilloscope. Both tubes exhibit characteristics of a conventional CRT when used in the non-stored mode. The standard tube, the Type T5640-200, has the brighter stored display. The other tube, the Type T5640-201, has the faster writing speed.

By selecting the proper tube, you can obtain optimum oscilloscope performance for your particular application. Such selection is important because each tube has its own maximum writing speed and brightness for stored-mode operation. The brightness of a stored display for an individual tube is one value regardless of the intensity of the beam that generated it.

The hours shown are the actual hours the CRT is used in the stored mode with repetitive writing, storing, and erasing. It should be noted that non-storage operation of the CRT has little effect on the age characteristics shown. Therefore to obtain maximum CRT performance and service, the oscilloscope should be in the non-stored mode when stored displays are not needed.

## TYPICAL LIFE CHARACTERISTICS




### TEKTRONIX STORAGE CRT

The CRT is a Tektronix Type T5640, flat-faced bistable storage tube with beam-deflection blanking and an accelerating voltage of 3.5 kV. It has an 8 x 10 cm storage target divided into two 4 x 10 cm areas, individually controllable for storage and erasure.

| WARRANTED MINIMUM CHARACTERISTICS | | |
|---|---|---|
| **Characteristics** Minimum Initial Brightness | T5640-200* 6 foot-lamberts | T5640-201† 2 foot-lamberts |
| Typical Brightness at 1000 hours (% of initial) | 70% | 80% |
| Writing Speed, Initial Minimum | 25 cm/ms†† | 100 cm/ms†† |
| Writing Speed at 1000 hours, (% of initial) | 25% | 90% |

*Supplied with Type 564
†Supplied with Type 564 MOD 08
††Specification holds true for middle 7 x 9 cm area.

## STORAGE CHARACTERISTICS

### VIEWING TIME

Displays can be stored for viewing up to 1 hour. Longer times may be obtained but tend to reduce target sensitivity in the stored areas.

### ERASURE TIME

Approximately 0.25 second.

### STORED WRITING-SPEED ENHANCEMENT

This feature controls the single-sweep storage capabilities of the storage CRT. Through adjustment of the front-panel Writing-Rate Increase control, single-trace spot velocities up to 250 cm/ms using the T5640-200 CRT or up to 500 cm/ms using the T5640-201 CRT can be stored with minimal loss of resolution and contrast in the center 7 x 9 cm.

### SINGLE SHOT SIGNALS

At slow or medium speeds, single-shot signals are easily stored for extended viewing time (within writing-speed capabilities of CRT selected).

### INTEGRATE MODE

Increases the effective writing speed for repetitive fast signals with repetition rates that are too low for effective storage, but which may be too fast for satisfactory single-shot storage with enhancement.

## TYPE 564 CHARACTERISTICS

### PLUG-IN COMPARTMENTS

The instrument accepts 2-Series and 3-Series Amplifier and Time-Base Units.

### LOCATE BUTTON

This button, when depressed, causes a spot or spots to appear at the left of the CRT screen at the vertical position of the next sweep.

### EXTERNAL GRATICULE

The graticule is edge lighted and is marked in 8 vertical and 10 horizontal cm divisions. The centerline is marked every 2 mm. Illumination is controlled by a front-panel knob.

### Z-AXIS INPUT

Accessible through a terminal at the rear of the instrument permits external modulation of the CRT cathode.

### AMPLITUDE CALIBRATOR

18 squarewave voltages from 0.2 mV to 100 V peak to peak, accurate within 3%; approximately 5-μs risetime, at line frequency. For 50-Ω systems, the 0.5-V switch position provides 0.1 V (peak to peak) into 50 ohms, for convenient calibration of sampling units.

### ELECTRONICALLY REGULATED SUPPLIES

Regulated power supplies furnish all voltages required for proper operation of the Indicator and the plug-in units.

### POWER REQUIREMENTS

240 watts maximum, 50 to 400 Hz. Instrument factory wired for 105 V to 125 V (117 V nominal) operation. Transformer taps permit operation at 210 V to 250 V (234 V nominal). Instrument can be ordered factory wired for 210 V to 250 V operation.

### DIMENSIONS AND WEIGHTS

| | | |
|---|---|---|
| Height | 14 11/16 in | 37.3 cm |
| Width | 9 3/4 in | 24.8 cm |
| Depth | 21 1/8 in | 53.7 cm |
| Net weight | 33 1/4 lb | 15.2 kg |
| Domestic shipping weight | ≈43 lb | ≈19.5 kg |
| Export-packed weight | ≈54 lb | ≈24.6 kg |

### INCLUDED STANDARD ACCESSORIES

Polarized viewer (016-0039-00); 3 to 2-wire adapter (103-0013-00); 3-conductor power cord (161-0010-03); patch cord, BNC-to-BNC, 18 inch (012-0087-00); patch cord, BNC-to-banana plug, 18 inch (012-0091-00); post jack, BNC (012-0092-00); two instruction manuals, (070-0351-00).

**TYPE 564 OSCILLOSCOPE,** without plug-in units . . . **$925**
(with CRT for stored display of highest intensity).

**TYPE 564 MOD 08 OSCILLOSCOPE,** without plug-in units . . . . . **$925**
(with CRT for fastest stored writing speed).

## TYPE RM564 RACKMOUNT

Similar to the Type 564 except the calibrator range is 1 mV to 100 V and the line-frequency range is 50 to 60 Hz. In addition, the RM564 has a connector on the rear panel for remote erase of the stored waveform on either or both halves of the split-screen storage tube. Instrument mounts to a standard 19-inch rack. (Additional mounting information on Catalog Instrument Dimensions page).

### DIMENSIONS AND WEIGHTS

| | | |
|---|---|---|
| Height | 7 in | 17.8 cm |
| Width | 19 in | 48.3 cm |
| Rack depth | 18 7/16 in | 46.9 cm |
| Net weight | 33 3/4 lb | 15.3 kg |
| Domestic shipping weight | ≈57 lb | ≈26.0 kg |
| Export-packed weight | ≈79 lb | ≈35.9 kg |

### INCLUDED STANDARD ACCESSORIES

Same as Type 564, but includes mounting hardware; power cord (161-0024-00); and two instruction manuals (070-0415-00).

**TYPE RM564 OSCILLOSCOPE,** without plug-in units **$1025**
(with CRT for stored display of highest intensity).

**TYPE RM564 MOD 08 OSCILLOSCOPE,** without plug-in units . . . . . **$1025**
(with CRT for fastest stored writing speed).

## TYPE RM564 WITH SLIDE-OUT TRACKS

Type RM564 MOD 171A or Type RM564 MOD 08, MOD 171A mounts to a standard 19-inch rack on slide-out tracks. It can be pulled out, tilted, and locked in any one of seven positions for convenient servicing. Instrument has same standard accessories as the Type RM564, but also includes one pair of mounting tracks (351-0084-00).

**TYPE RM564 MOD 171A OSCILLOSCOPE,** without plug-in units . . . . . **$1075**
(with CRT for stored display of highest intensity).

**TYPE RM564 MOD 08, MOD 171A OSCILLOSCOPE,** without plug-in units . . . . . **$1075**
(with CRT for fastest stored writing speed).

## OPTIONAL ACCESSORIES

Optional accessories increase measurement capability and provide added convenience. The probes recommended for use with these instruments are covered on the 2- and 3-series plug-in unit pages. Additional probes are available that may be better suited for a particular application, including current and high-voltage measurements. See the catalog accessory pages for information on these and other items.

### CAMERAS

Standard C-12 with beam-splitting mirror for straight-on viewing and use of optional projected graticule; f/1.9—1:0.85 lens, Polaroid Land* Pack Film back, order C-12 . . . . . $460

Type 564 or RM564 to C-12 Camera adapter, order 016-0217-00 . . . . . $ 15

Standard C-27 has rotating and removable viewing hood allowing mounting on adjacent Type RM564's f/1.9—1:0.85 lens, Polaroid Land* Pack Film back, order C-27 . . . . $430

Type 564 or RM564 to C-27 Camera adapter, order 016-0224-00 . . . . . $ 15

### SCOPE-MOBILE® CART

Model 201-2 for Type 564: two plug-in carrier, 9-position tilt-lock oscilloscope tray, order 201-2 . . . . . $135

### SLIDE-OUT TRACKS

Converts standard Type RM564 or RM564 MOD 08 for easy withdrawal and tilt of instrument, order 351-0050-00 . . $ 45

### CRADLE ASSEMBLY

Provides rear slide support when RM564 with slide-out tracks is mounted in a backless rack, order 040-0344-00 . . . $ 12

### REMOTE-ERASE CONNECTOR

Mates with 9-pin connector on the rear panel of RM564, supplied without cable, order 134-0049-00 . . . . . $4.25

### REPLACEMENT CATHODE-RAY TUBES

For optimum stored brightness, order 154-0410-00 . . $325

For optimum writing speed, order 154-0418-00 . . . . . $325

*Registered Trade-Mark Polaroid Corporation

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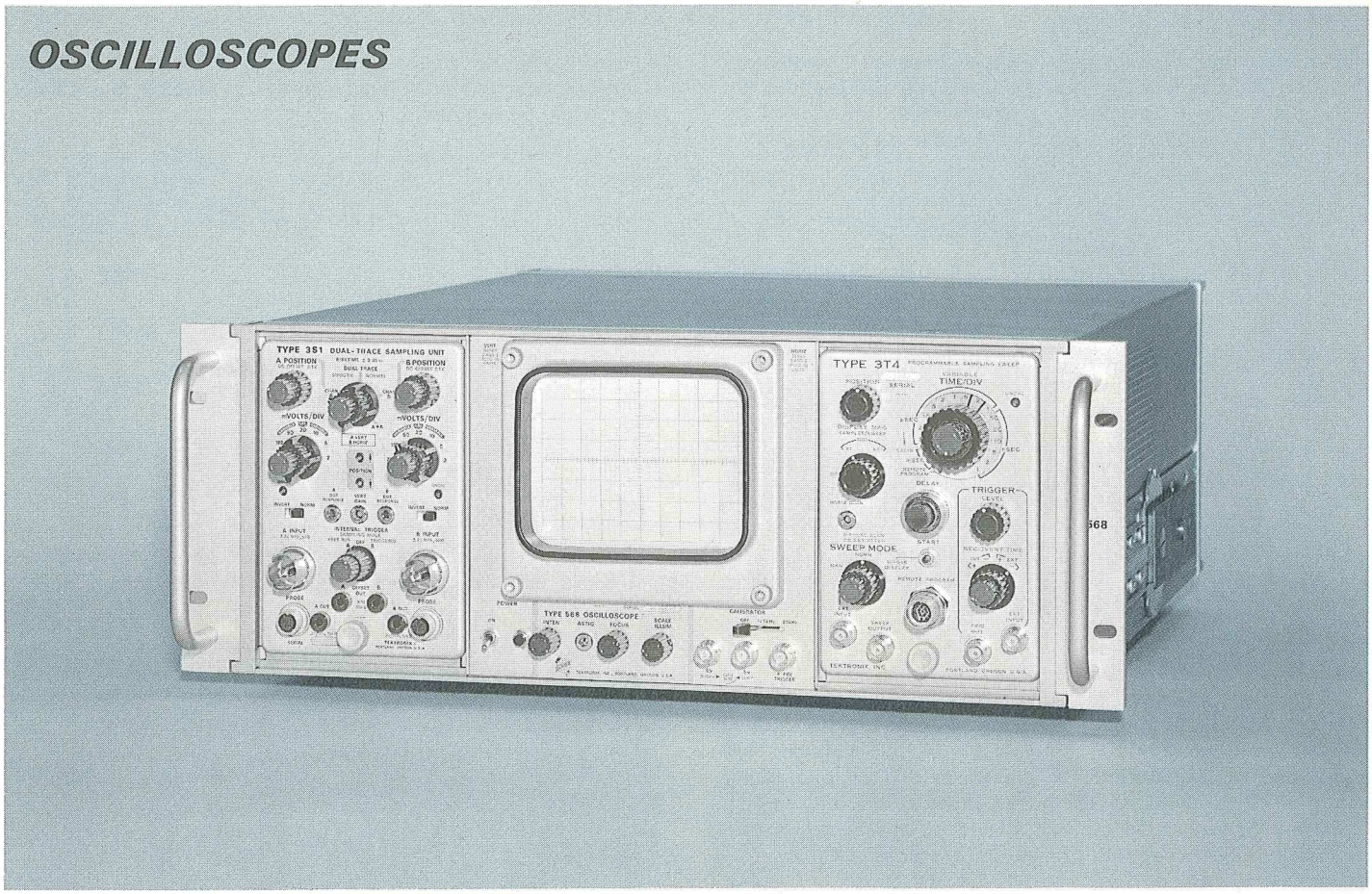
# OSCILLOSCOPES




- ***ANALOG DISPLAYS OF ANALOG/DIGITAL MEASUREMENT SYSTEM***
- ***PROVIDES MEASUREMENT INFORMATION FOR TYPE 230 DIGITAL UNIT***
- ***ILLUMINATED NO-PARALLAX GRATICULE***
- ***SOLID-STATE DESIGN***

Type 568 and Type R568 Readout Oscilloscopes are designed for use with 2- and 3-series plug-in units in both the vertical and horizontal deflection systems. When used together with the Type 230 Digital Unit, digital readout of measurements (in addition to the analog display on the CRT) makes the measurements faster, more convenient, and more accurate.

Connectors on the rear provide measurement information for the Type 230 Digital Unit and couple trace-brightening information from the Type 230 to the Type 568.

The Types 568/R568 are designed mainly for use in digital measurement systems, but they are also quite useful in laboratory applications through use of amplifier, spectrum analysis, and time-base plug-in units.

Through use of solid state components, the Types 568/R568 offer reliable operation with low heat dissipation.

Both cabinet-style Type 568 and rack-mount Type R568 use the same mechanical construction. A quick conversion from one style to the other is possible by means of a few mechanical changes. The R568 requires only 7 inches of rack height and is constructed for convenient stacking with the Type R230 Digital Unit.

## CHARACTERISTIC SUMMARY

### VERTICAL

Vertical deflection characteristics are extremely flexible through use of 2-series and 3-series Amplifier Plug-In Units. See chart for plug-in units that provide digital readout when used with a Type 230 Digital Unit.

### HORIZONTAL

Horizontal deflection characteristics are extremely flexible through use of 2-Series and 3-Series Amplifier and Time-Base Units. See chart for plug-in units that provide digital readout when used with a Type 230 Digital Unit.

### CRT

DISPLAY AREA—8 x 10 div. (Each major div = 1 cm.)

ACCELERATING VOLTAGE—3.5 kV.

PHOSPHOR—P2.

### OTHER

AMPLITUDE CALIBRATOR—5 V and 0.5 V into $\geq$100 kΩ or 500 mV and 50 mV into 50 Ω. Repetition rate is 20 kHz or 1 kHz.

POWER REQUIREMENTS—Quick-change line-voltage taps permit operation from 90 to 110 V, 104 to 126 V, 112 to 136 V; or 180 to 220 V, 208 to 252 V, 224 to 272 V. Line frequency is 48 to 66 Hz. Power consumption is 210 watts maximum.

## DIGITAL READOUT COMBINATIONS

Digital and analog displays are simultaneously presented on the Type 568 Readout Oscilloscope and Type 230 Digital Unit. A Digital Readout Combination consists of a Type 568, Type 230, and any of the following combinations of amplifier and time-base Plug-In Units. Other 2-Series and 3-Series Plug-In Units can be used for normal analog CRT display, but do not provide digital readout.

**PLUG-IN UNITS**

| VERTICAL | | | | | TIME BASE | | |
|---|---|---|---|---|---|---|---|
| TYPE | MINIMUM DEFLECTION FACTOR | $T_R$ | BANDWIDTH | PRICE | TYPE | CALIBRATED SWEEP RANGE | PRICE |
| 3S1 | 2 mV/div | 350 ps | DC to 1 GHz | $1150 | 3T2 | 200 ps/div to 100 μs/div plus X10 magnifier | $ 990 |
| 3S2 | 2 mV/div | | | 800 | | | |
| S1 | | 350 ps | DC to 1 GHz | 250 | 3T4* | Programmable 1 ns/div to 200 μs/div | 1380 |
| S2 | | 50 ps | DC to 7 GHz | 300 | | | |
| 3S3 | 5 mV/div | 350 ps | DC to 1 GHz | 1575 | 3T77A | 200 ps/div to 100 μs/div plus X10 magnifier | 690 |
| 3A2 | 10 mV/div | 700 ns | DC to 500 kHz | 520 | 3B2 | 2 μs/div to 1 s/div | 675 |

*Type 3T4, when used with Type 283 Real Time Adapter has an additional range of CALIBRATED SWEEP from 1 ms/div to 1 s/div, but no TIME POSITION in "REAL TIME" operation. Type 3T4 can also be programmed through a front panel connector. (See Type 3T4 catalog page.)

### AMPLITUDE CALIBRATOR

Front-panel selection of squarewave outputs of 20 kHz, crystal-controlled, with an accuracy of ±0.05% or approx 1 kHz, RC time-constant controlled. Output voltages are 5 V and 0.5 V into 1 MΩ or greater or 500 mV and 50 mV into 50 Ω. + PRETRIGGER output provides a positive-going pulse that occurs ≈¼ cycle ahead of the rising portion of the calibrator signal. Connectors are BNC.

### TEKTRONIX CRT

5-inch rectangular CRT with 3.5-kV accelerating potential. A P2 phosphor is normally supplied.

### ILLUMINATED INTERNAL GRATICULE

Edge lighted graticule is marked in 8 vertical and 10 horizontal divisions (centimeters). Centerlines are also marked in 2-mm increments. Scale illumination is adjustable with a front-panel control.

### DC-VOLTAGE SUPPLIES

Electronically regulated to compensate for widely varying line conditions. Separate regulated heater supply is included. The Type 568 has an additional 25 watts of regulated power available at the rear connector for system use.

### POWER REQUIREMENTS

Quick-change line-voltage selection permits operation from any of the following line voltages:

| | |
|---|---|
| 90 V to 110 V | 180 V to 220 V |
| 104 V to 126 V | 208 V to 252 V |
| 112 V to 136 V | 224 V to 272 V |

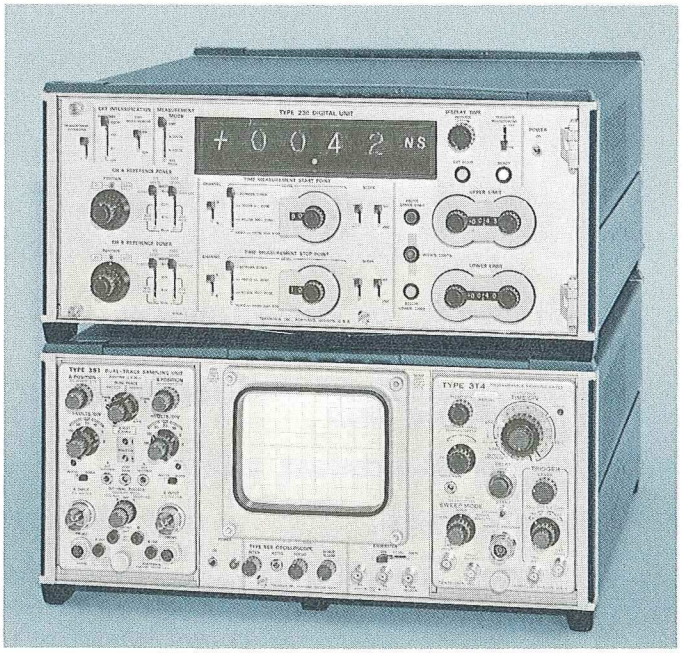
The Type 568 will operate over a line frequency from 48 to 66 Hz, and its power consumption is 210 watts maximum.

### TYPE 568 DIMENSIONS AND WEIGHTS

| | | |
|---|---|---|
| Height | 8 in | 20.3 cm |
| Width | 16 13/16 in | 42.7 cm |
| Depth | 21 7/8 in | 55.5 cm |
| Net weight | 40 lb | 18.2 kg |
| Domestic shipping weight | ≈52 lb | ≈23.6 kg |
| Export-packed weight | ≈72 lb | ≈32.7 kg |

### TYPE R568 DIMENSIONS AND WEIGHTS

| | | |
|---|---|---|
| Height | 7 in | 17.8 cm |
| Width | 19 in | 48.3 cm |
| Rack depth | 22 3/4 in | 57.8 cm |
| Net weight | 41 lb | 18.6 kg |
| Domestic shipping weight | ≈56 lb | ≈25.5 kg |
| Export-packed weight | ≈76 lb | ≈34.5 kg |




### INCLUDED STANDARD ACCESSORIES

3 to 2-wire adapter (103-0013-00); CRT protector plate (387-0935-00); 18-inch patch cord, BNC-to-BNC (012-0087-00); 18-inch patch cord, BNC-to-banana plug (012-0091-00); patch cord, post jack-to-BNC (012-0092-00); two instruction manuals (070-0596-00). Type R568 also includes mounting tracks (351-0085-00) and mounting hardware.

**TYPE 568 OSCILLOSCOPE,** without plug-in units . . **$875**

**TYPE R568 OSCILLOSCOPE,** without plug-in units . **$925**

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**Tektronix, Inc.**

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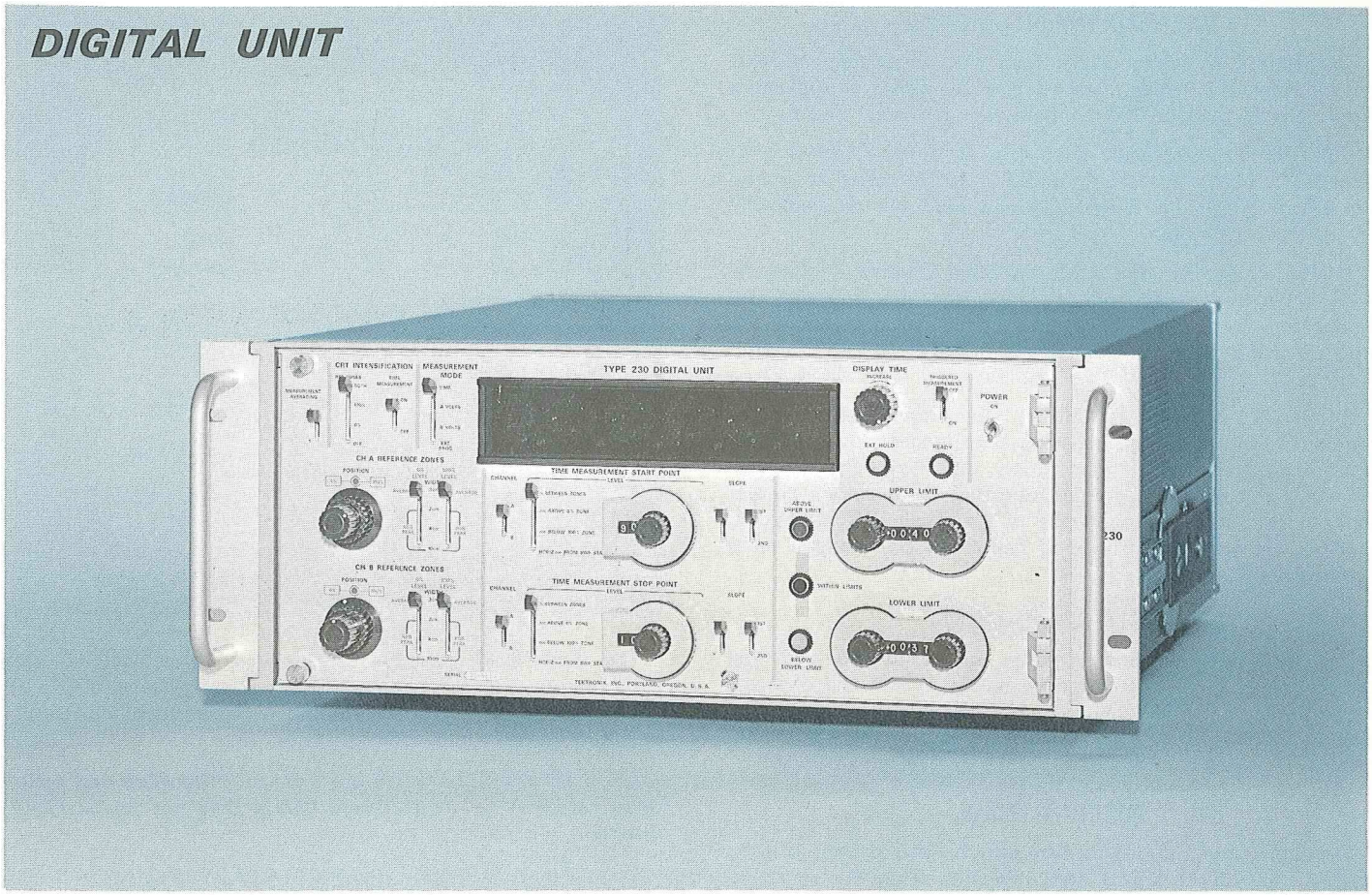
# TYPE 230 / R230

# DIGITAL UNIT




- ***PRESENTS OSCILLOSCOPE MEASUREMENTS IN DIGITAL FORM***
- ***DIGITAL READOUT PARAMETERS***
  - ***PULSE AMPLITUDE***
  - ***PULSE RISE AND FALL TIME***
  - ***PULSE WIDTH***
  - ***TIME INTERVAL***
- ***UP TO 50 MEASUREMENTS PER SECOND***
- ***PARALLEL GROUND-CLOSURE BCD PROGRAMMING***
- ***BCD DATA OUTPUT (1 2 4 8)***
- ***ALL SOLID STATE—EXTENSIVE USE OF INTEGRATED CIRCUITS***

The Type 230 and Type R230 Digital Units are new high-speed solid-state units that provide digital measurements of signals displayed on the Type 568 Oscilloscope. The Type 230 has flexible measurement capabilities with up to 50 measurements per second, easy programming, BCD data outputs, and solid-state circuitry with extensive use of integrated circuits. The Type 230 Digital Unit can make a wide variety of repetitive pulse measurements on the signals displayed on the Type 568. The digital presentations can designate voltage measurements, time-difference measurements between similar pulses, and time-difference measurements between percentages or voltages of pulse amplitudes. The Type 230 can be externally programmed for use in high-speed automatic measurement systems and data output connectors provide measurement results in convenient BCD code.

## MEASUREMENT MODES

The Type 230 Digital Unit's four basic measurement functions (Channel A volts, Channel B volts, Time, and External Program) are selected by the Measurement Mode switch.

VOLTAGE measurements are made on either Channel A or Channel B between the 0% and the 100% reference zones. The signal polarity is determined and read out automatically on the digital readout.

TIME measurements are made on either Channel A, Channel B or between the two channels. The time measurements are made from a pre-determined start point to a pre-determined stop point that can be referenced to the 0% and 100% reference zones or to the start of the sweep.

EXTERNAL PROGRAM: All of the front-panel functions required to make voltage and time measurements can be easily programmed externally. The variety and flexibility of measurements possible with external programming are even greater than those possible through use of the Type 230 front-panel controls, and measurements and limits can be changed more rapidly.

## DIGITAL READOUT

The measurements made by the Type 230 are read out directly on four Nixie* tubes. Decimal point and unit of measure (ns, $\mu$s, ms, s, mV, V) are automatically presented. The polarity of the measurement (+ or —) is also read out automatically.

## DISPLAY TIME

The digital readout display time may be varied from $\approx$10 ms to 10 s. EXTERNAL HOLD light indicates when the measured data is being held until the recording device has had sufficient time to record the measurement. External hold does not prevent the next measurement from being made. In TRIGGERED MEASUREMENT operation, a measurement is started after a receipt of a trigger (+ or —) and after DISPLAY TIME has been completed. The READY light indicates a ready condition for a trigger.

## REFERENCE ZONES

To make any digital voltage or time measurement of the waveforms displayed on the Type 568 Oscilloscope, the Reference Zones must be properly set. The 0% and the 100% zones establish the reference points from which all measurements are made. The reference zones can be brightened on the oscilloscope by means of the CRT Intensification Reference Zone switch. The switch brightens both zones, 100% zone only, 0% zone only or disables the zone intensification.

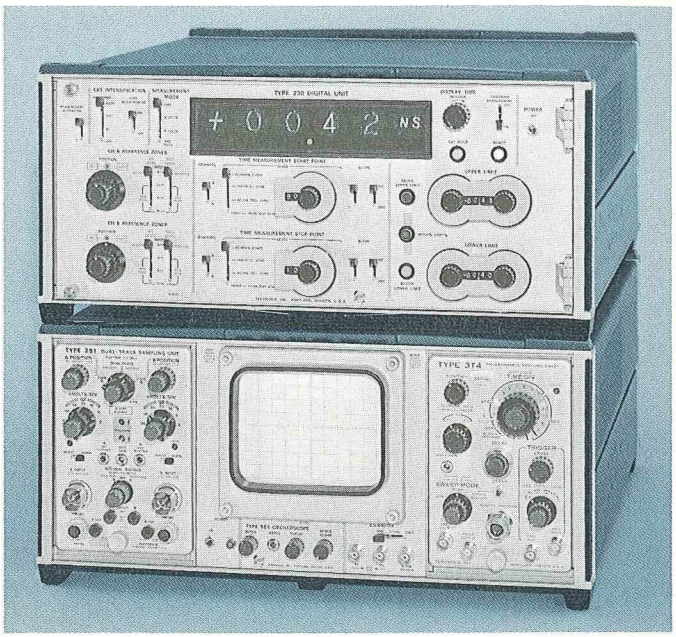
### CHANNEL A REFERENCE ZONE

The 0% POSITION and 100% POSITION controls determine the start position of the 0% and 100% zones to any $\frac{1}{2}$-cm point from the start of the sweep by means of a 20-position switch. Five external program lines are required for each position control.

LEVEL WIDTH controls select the width of the reference zone and select the type of voltage reading, average or peak.

The AVERAGE 0.3-cm WIDTH position of the control is normally used for average voltage and most time measurements.

*Trade-Mark Burroughs Corporation




The three PEAK positions (2-cm, 4-cm, 10-cm WIDTH) are used for average to peak, or peak to peak voltage measurements. Two program lines are required for each 0% LEVEL or 100% LEVEL width controls.

CH B REFERENCE ZONES are identical in function and operation as Ch A Reference Zones except they are set on Ch B display.

## TIME MEASUREMENT START POINT

The start of the time measurement is selected to start on either Channel A or Channel B and on the first or second positive-going or negative-going slope. The time measurement starts when the signal reaches one of the 99 pre-determined levels. Four different modes of start point level selection are available: (1) % between 0% and 100% zones, (2) mm above 0% zone, (3) mm below 100% zone, and (4) Horizontal mm from sweep start. Eleven BCD program lines are required for externally programming the time measurement start point. There are 159 pre-determined levels available in the external programming mode.

CRT intensification during the time measurement portion of the sweep is selected by means of the CRT Intensification Time Measurement On-Off switch.

## TIME MEASUREMENT STOP POINT

All functions of the Time Measurement Stop Point are identical to the previously explained Time Measurement Start Point. It stops the count on the selected point on Ch A or Ch B. If the Stop Point occurs before the Start Point, a negative reading is indicated.

## LIMIT CONTROLS

The Limit Controls select the UPPER and LOWER measurement Limits. Measurement limit results can be quickly determined on the front-panel by means of three lights (ABOVE UPPER LIMIT, WITHIN LIMITS, BELOW LOWER LIMIT) and the information is available on the rear panel for stopping automatic measurement sequences or for automatic sorting. Fifteen BCD lines are required for programming each limit control.

## RESOLUTION

DOTS/MEASUREMENT Time measurements are performed by gating and counting clock-pulses during the measurement interval. If a measurement interval occupied 2.5 div and the sweep speed was 10 ns/div with 100 samples/div, then 250 samples would be registered in the digital readout counter and reading would be 25.0-ns. For sweep speeds with multipliers of 2, the count is doubled and the decimal is shifted to maintain maximum resolution. For multiples of 5 the count is divided by 2 providing 50 samples/div.

The TIME MEASUREMENT START and STOP comparators have ±0.1 mm pick-off resolution capabilities. This gives the Type 230 the ability to scale a 1-cm display in 1% steps.

MEASUREMENT AVERAGING permits selection of measurements to be a statistical average of eight sweeps or to be a measurement of only one sweep. One program line is required for Measurement Averaging selection.

## EXTERNAL READOUT

Data outputs are available on the rear-panel of the Type 230 that permit the recording of measurement polarity, displayed digits, units of measure, decimal point, and measurement limit results. The information is in BCD code (1 2 4 8; true . . . ground, false . . . +12 Volts) and the Type 230 can be synchronized to the data recorder.

Regulated power is available for use in systems applications.

## EXTERNAL PROGRAMMING

The Type 230 Digital Unit is designed to be externally programmed for use in high-speed measurement systems, up to 100 measurements per second with proper programming techniques. All of its measurement functions can be programmed by means of ground closures or logic levels. The programming is achieved with 104 program lines using negative logic with true being ground or <2 V and false being open or >6 V. Suitable programming devices include card readers, block readers, computers, etc.

## HIGH SPEED PROGRAMMED MEASUREMENTS

When using the Type 3T4 Programmable Sampling Sweep for the oscilloscope time base, the Type 230 Digital Unit can program the Type 3T4 to provide increased measurement speeds. The time-base can be made to run fast (10 dots/div) during the non-measurement part of the sweep and then run at normal speeds (100 dots/div) for maximum resolution during the measurement. The Type 3T4 is also set for Single-Sweep operation and the sweep is started by the Type 230 so that no time is lost waiting for an unwanted sweep to finish. This function is obtained by externally programming the high speed program line.

Measurement speed can be increased by externally programming the position of the 0% and/or 100% Reference Zones start point to 12 cm. This puts the reference zones into a memory hold position of up to 10 seconds and permits several different measurements to be made without a zone charging sweep. This gives an additional feature of permitting measurements referenced to reference zones that are not on the CRT display.

## OTHER CHARACTERISTICS

### POWER REQUIREMENTS

90 to 136 VAC or 180 to 272 VAC, 48 to 66 Hz, 130 watts maximum at 115 V and 60 Hz. Rear panel selector provides rapid accomodations for six line-voltage ranges.

### TYPE 230 DIMENSIONS AND WEIGHTS

| | | |
|---|---|---|
| Height | 8 in | 20.3 cm |
| Width | $16\frac{13}{16}$ in | 42.7 cm |
| Depth | $21\frac{7}{8}$ in | 55.5 cm |
| Net weight | 38 lb | 17.3 kg |
| Domestic shipping weight | ≈50 lb | ≈22.7 kg |
| Export-packed weight | ≈73 lb | ≈33.2 kg |

### TYPE R230 DIMENSIONS AND WEIGHTS

| | | |
|---|---|---|
| Height | 7 in | 17.8 cm |
| Width | 19 in | 48.3 cm |
| Depth | $22\frac{3}{4}$ in | 57.8 cm |
| Net weight | 40 lb | 18.2 kg |
| Domestic shipping weight | ≈52 lb | ≈23.6 kg |
| Export-packed weight | ≈75 lb | ≈34.1 kg |

### INCLUDED STANDARD ACCESSORIES

Type 230 to Type 568 48-inch interconnecting cable (012-0119-00); 3 to 2-wire adapter (103-0013-00); two instruction manuals (070-0635-00). Type R230 also includes mounting tracks (351-0085-00) and mounting hardware.

**TYPE 230 DIGITAL UNIT . . . . . $2965**

**TYPE R230 DIGITAL UNIT . . . . . $3015**

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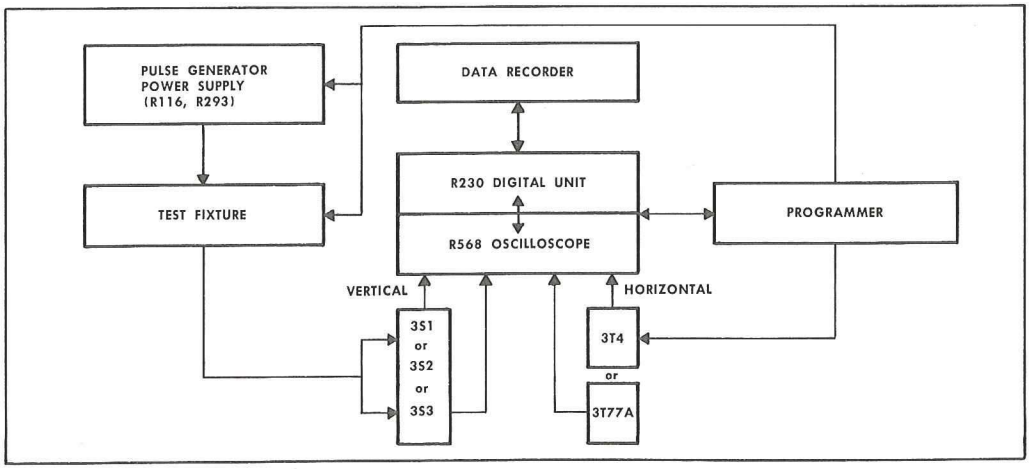
## TYPICAL AUTOMATIC MEASUREMENT SYSTEM

(For further information, consult your Field Engineer)



# THE RANDOM SAMPLING OSCILLOSCOPE

by AL ZIMMERMAN
Tektronix, Inc.
Project Manager, Sampling
Instrument Design

The Random Sampling Oscilloscope represents a break-through in electronic instrumentation. Although the principles of *random sampling* as they apply to the oscilloscope have been known for years [1,2], a workable instrument has been generally considered too complex to be practical in the past. Recent advances on many fronts have now made it possible to reverse this situation, resulting in an instrument that is both easy to use and reasonably priced.

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[1]J. G. McQueen, **Electronic Engineering** (British), "The Monitoring of High-Speed Waveforms", 1952.

[2]G. J. Frye and N. S. Nahman, **IEEE Transactions on Instrumentation and Measurement**, "Random Sampling Oscillography", 1964.

## WHAT DOES IT DO?

The random sampler constructs a display of a repetitive waveform in a manner much like a conventional sampling oscilloscope but with a very significant difference for the user—no delay line or *pretrigger* is required for *lead time* in the display. The benefits thus afforded are numerous:

1. The inherent distortions and risetime limitation of bulky signal delay lines are eliminated.
2. It is no longer necessary to work into the 50-Ω characteristic impedance of a delay line.
3. Direct sampling probes may be used for convenient high-impedance, in-circuit signal pickup.
4. Triggers may occur prior to, coincident with, or AFTER the displayed signal without sacrificing lead time in the display.
5. Display jitter caused by pretrigger-to-signal jitter or by signal period uncertainty is eliminated.
6. Signals with no convenient source of pretrigger can be observed.

## HOW DOES IT WORK?

The operating process of a random sampler is easily divided into two separate parts: (1) timing the samples to fall somewhere within the *time window* and (2) constructing the display from a series of such samples placed at random.

Figure 1 illustrates how samples may be distributed across the time window. It is clearly desirable to limit the number of samples falling outside the time window since these samples are unusable and will not contribute to the display.

### GLOSSARY OF TERMS RELATING TO THE RANDOM SAMPLING OSCILLOSCOPE

*random-sampling oscilloscope*—an oscilloscope employing the *random sampling* process together with means for constructing a *coherent display* from the samples taken at random.

*random sampling*—a sampling process involving significant time uncertainty between the signal being sampled and the sample-taking operation.

*coherent display*—a plot of a set of samples in which the time-sequence of signal events thus indicated is preserved.

*pretrigger*—a trigger which occurs or arrives before a related signal event.

*lead time*—in the display, the interval represented which occurs just prior to trigger recognition.

*time window*—the displayed portion of the signal period.

*sampling distribution*—a function which describes how the density of a large number of randomly placed samples varies across the signal period.

*equivalent time*—the time scale associated with the display of signal events.

*real time*—the time scale associated with the signal events themselves.

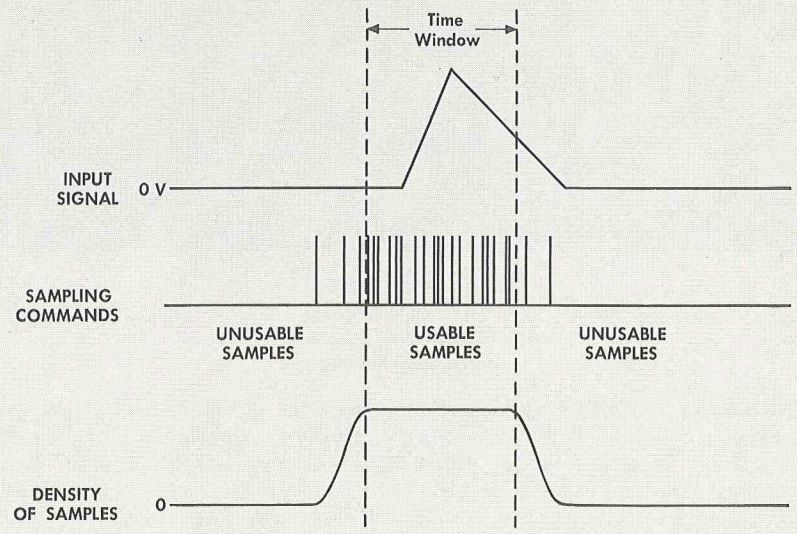
*trigger recognition*—the process of responding to a suitably applied trigger. Such response as time-reference for the *time window*.

*slewing*—the process of incrementally delaying successive samples or a set of samples with respect to the signal being sampled.

*usable samples*—those samples which fall within the *time window*.

*unusable samples*—those samples which do not fall within the *time window*.

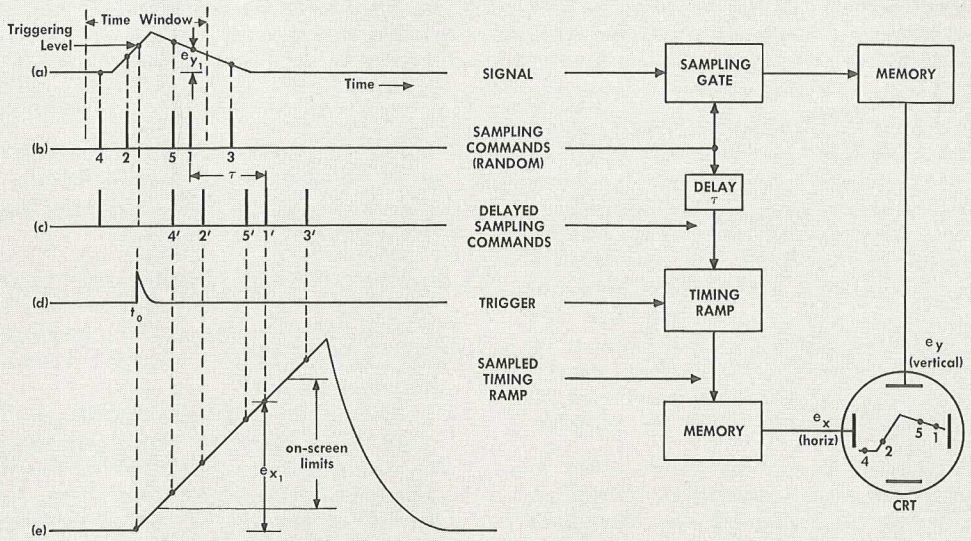
Fig. 1 Distribution of random samples across the time window.




Somehow arriving at such a *sampling distribution* is the first part of the process. The second part involves the derivation of two analog signals $e_x$ and $e_y$, representing the "x" and "y" coordinates of a particular sample.

The "y" or vertical coordinate of a sample is obtained by the same sample-and-hold process used in a conventional sampling oscilloscope. The "x", or horizontal, coordinate of the sample is obtained differently, however, and this process is illustrated in Figure 2.

## Fig. 2 Derivation of "X" and "Y" Deflection Signals.




As shown, five randomly placed samples are taken of the signal. It must be kept in mind that these five samples are taken on SUCCESSIVE repetitions of the signal in a random *equivalent-time* sampler which we are discussing.*

The y-component, $e_y$, of the first sample is held and subsequently used to position the CRT spot vertically. The sampling command which took the first sample is then delayed by a fixed interval $\tau$, as indicated in Figure 2c. This delayed sampling command 1′ is used to sample a timing ramp which was started by *trigger recognition* along the input signal at $t_0$. The resulting sample $e_x$ is held and subsequently used to position the CRT spot horizontally.

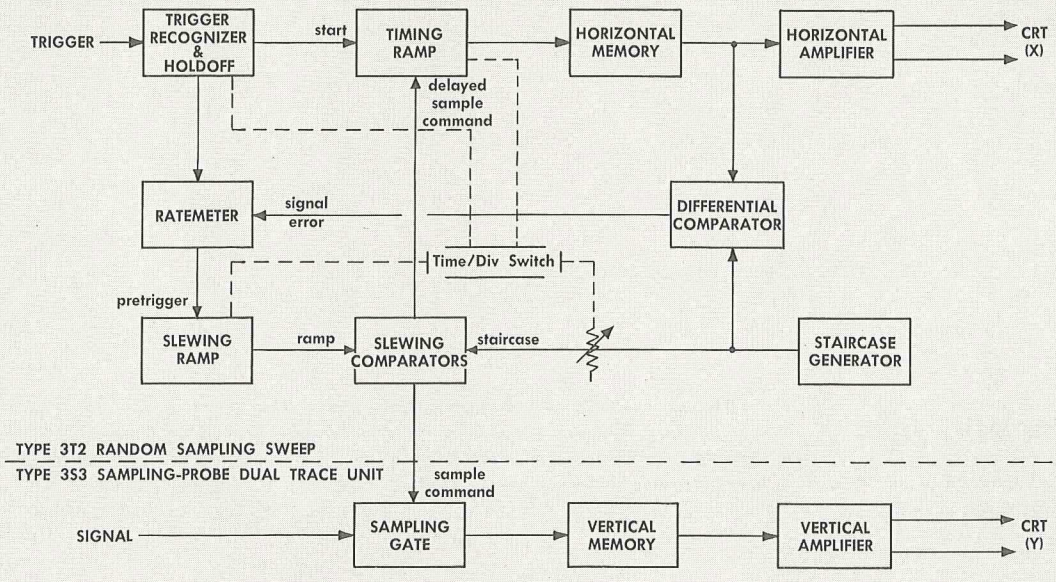
By this same process subsequent samples supply both vertical and horizontal information to deflect the CRT beam from dot to dot thus constructing a display of the signal from those samples which fall within the time window.

Some reflection will show that as the interval $\tau$ is increased, more lead time will appear in the display. It should be clear that such an increase in $\tau$ for more lead time will also require a time shift of the sampling distribution to the left in Figure 2b (i.e. earlier in time) in order that the required information be collected for the display.

Figure 3 is a complete operational block diagram of the random sampling oscilloscope including those portions which control the distribution of samples across the time window.

*The random **real-time** mode of the Tektronix Type 5T3 Timing Unit (used in the Type 661 Oscilloscope), in contrast, permits **many** randomly placed samples to occur during a single relatively slow signal occurrence.

## Fig. 3 Random Sampling Oscilloscope.



The TRIGGER RECOGNIZER & HOLDOFF block responds to the presence of a suitable trigger and immediately starts the timing ramp. The holdoff function prohibits restarting the timing ramp until it has had sufficient time to complete its previous cycle.

The RATEMETER block also receives word that a trigger has been recognized, and proceeds to measure the repetition rate of such recognitions over an extremely wide range of trigger repetition rates. On the basis of this measurement and an error signal supplied by the differential comparator, the ratemeter then supplies the *slewing* ramp with a pretrigger. This pretrigger is the ratemeter's "best guess" as to when to start the slewing ramp and may contain considerable time uncertainty on a sample-to-sample basis. If a number of successive samples is taken later than desired, an appropriate error signal arrives to cause the ratemeter to start the slewing ramp earlier for the next few samples.

The SLEWING RAMP is a linear ramp which is started upon command from the ratemeter. The slope of the slewing ramp is controlled by the Time/Div switch.

The SLEWING COMPARATORS provide both the sampling commands and the delayed sampling commands shown in Figure 2b, c. Such a command is issued when the relatively fast slewing ramp reaches the voltage level of the staircase. Successive excursions of the slewing ramp find the staircase at slightly higher levels; hence, the resulting comparisons and sampling commands are successively delayed or slewed in time. The delayed sampling commands are generated in a similar fashion from the slewing ramp and staircase, but a DC offset added to the staircase causes these comparisons to occur later by the fixed interval $\tau$.

The TIMING RAMP is a linear ramp whose slope is also controlled by the Time/Div switch. The starting and subsequent sampling of this ramp is shown in Figure 2e.

The sampled and stored levels of the timing ramp are available at the output of the HORIZONTAL MEMORY where they supply the horizontal, or x-axis, information to the display.

The DIFFERENTIAL COMPARATOR receives both this horizontal signal and the staircase and generates an error signal when the horizontal signal does not track along with the staircase on the basis of an average of many samples.

Thus a closed loop is established which causes a random sampling distribution to slew across the time window under control of the STAIRCASE GENERATOR. The resulting sampling distribution is shown in Figure 1. If the uncertainty of the pretrigger generated by the ratemeter block is purely random, the skirts of this distribution will have the familiar gaussian shape and the central portion within the time window will be covered by a uniform distribution of samples.

By this means, the sampling density is made constant over the time window despite trigger repetition rate jitter or ratemeter uncertainty. Construction of a display which puts the triggering signal in the center of the screen without the need for a signal delay line then proceeds as described earlier.

---

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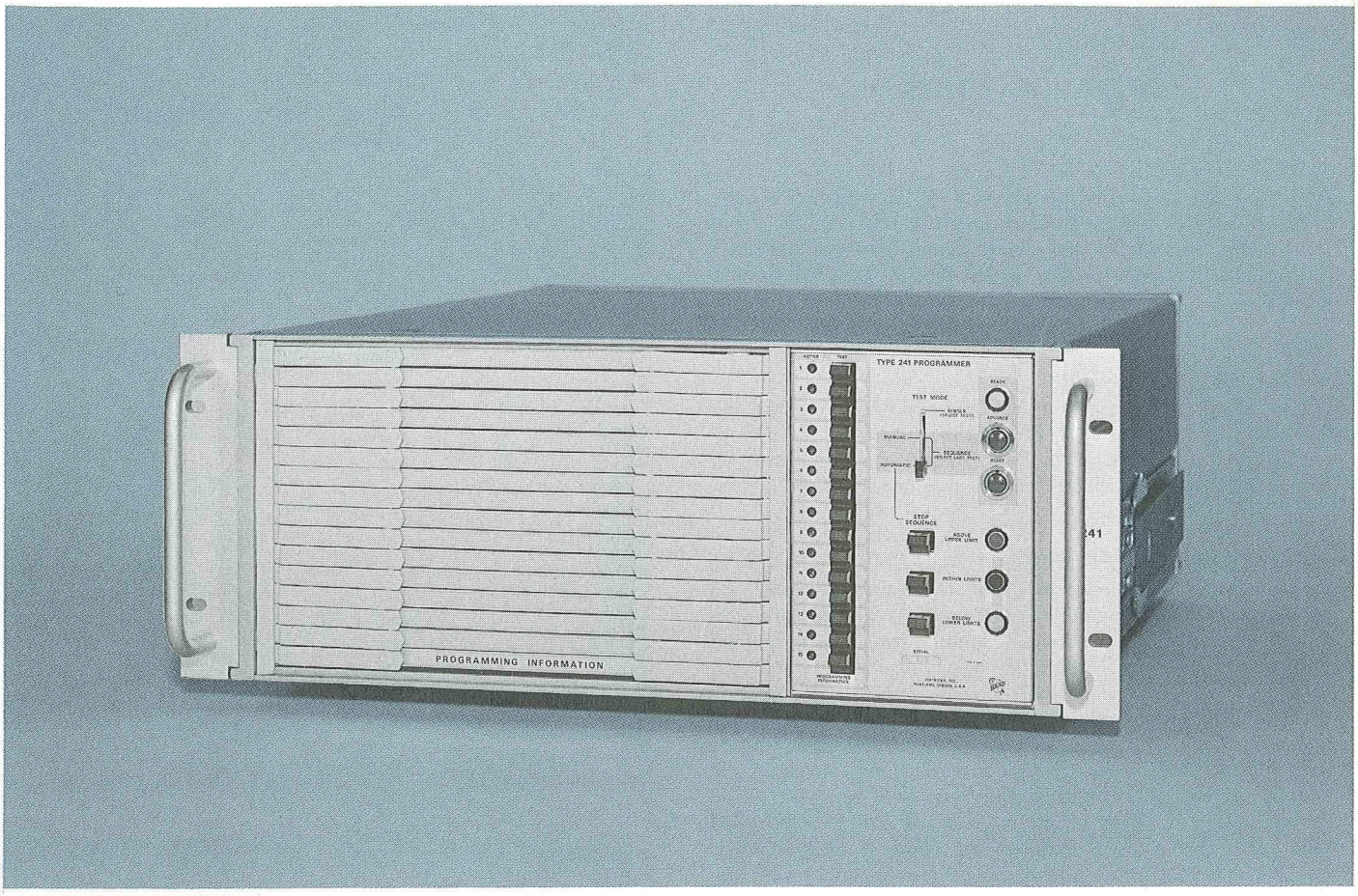
A-2337 Printed in U.S.A. 3/67

# TYPE 241 / R241 PROGRAMMER




- ***PROGRAMS TYPE 568/230 DIGITAL OSCILLOSCOPE***
- ***UP TO 15 MEASUREMENTS***
- ***MANUAL OR REMOTE SELECTION***
- ***AUTOMATIC OR MANUAL SEQUENCE***
- ***AUTOMATIC STOP SEQUENCE***
  - ***ABOVE UPPER LIMITS***
  - ***WITHIN LIMITS***
  - ***BELOW LOWER LIMITS***
- ***14 ADDITIONAL PROGRAM LINES***

The Type 241 Program Unit is designed for use with the Type 568 Oscilloscope, Type 3T5 or 3T6, Type 3S5 or 3S6 Programmable Plug-In Units, and the Type 230 Digital Unit. The Type 241 programs all the programmable functions of the Type 568/230 and has an additional 14 lines available for programming other equipment.

The Type 241 provides up to 15 programmed measurements that can be selected manually by front panel push buttons or by external control lines. Automatic or manual sequence of up to 15 measurements is provided with front panel or external control. In the automatic sequence mode, out-of-limit conditions can stop the measurement sequence if desired.

Each program board controls one measurement and has 159-bit capacity, enough to control the Type 568/230 with the Type 3T5 or 3T6 and Type 3S5 or 3S6 Programmable Plug-In Units and an additional 14 bits for external equipment.

Programs are easy to setup. A special tool is supplied to make insertion and removal of diodes quick and easy. Diode clips are labeled to permit a person having minimum training to program the boards. Typically only 15 to 20 diodes need to be inserted for a particular measurement.

The Type 241 program boards are accessible from the front panel and may be easily removed, rearranged or exchanged with others that are intended for different tests. A storage area in the rear of the Type 241 provides storage for up to 15 additional program boards. A storage drawer holds extra diodes and the diode inserting tool.

## OPERATING MODES

### SINGLE TEST MODE

Any program board/measurement can be selected in any order by a row of numbered push buttons on the front panel. 15 external control lines permit external selection of any measurement in any order by an external ground closure.

### MANUAL SEQUENCE MODE

Up to 15 measurements may be stepped through manually with the front panel ADVANCE push button or by an external ground closure. Less than 15 measurements can be manually sequenced without including the undesired tests.

### AUTOMATIC SEQUENCE MODE

In the automatic sequence mode up to 15 measurements can be sequenced through at a rate in excess of 100 measurements per second. Measurement limits may be programmed and out-of-limit conditions can stop the measurement sequence if desired. Limit lights on the front panel indicate the status of each test, and the condition which may have interrupted the automatic sequence. The ADVANCE button will advance the Type 241 to the next measurement in the sequence. The RESET button will reset the Type 241 to a ready condition. Both of these functions can be controlled externally by a ground closure. Less than 15 measurements can be automatically sequenced without including the undesired tests.

## OTHER CHARACTERISTICS

### POWER REQUIREMENTS

The power required to operate the Type 241 is obtained from the Type 230 Digital Unit.

### TYPE 241 DIMENSIONS

| | | |
|---|---|---|
| Height | 8 in | 20.3 cm |
| Width | 16¾ in | 42.7 cm |
| Depth | 21⅞ in | 55.5 cm |

### TYPE R241 DIMENSIONS

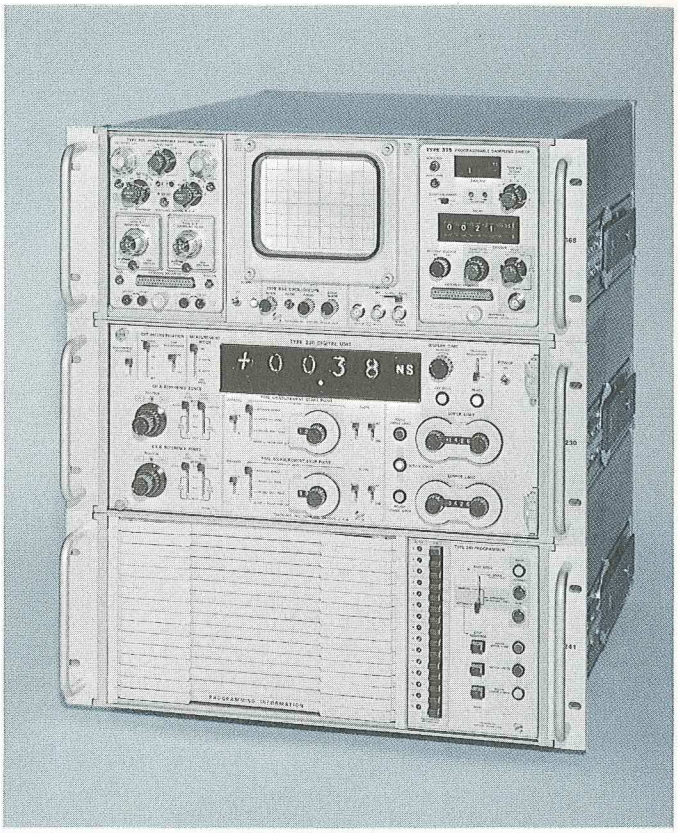
| | | |
|---|---|---|
| Height | 7 in | 17.8 cm |
| Width | 19 in | 48.3 cm |
| Depth | 22¾ in | 57.8 cm |

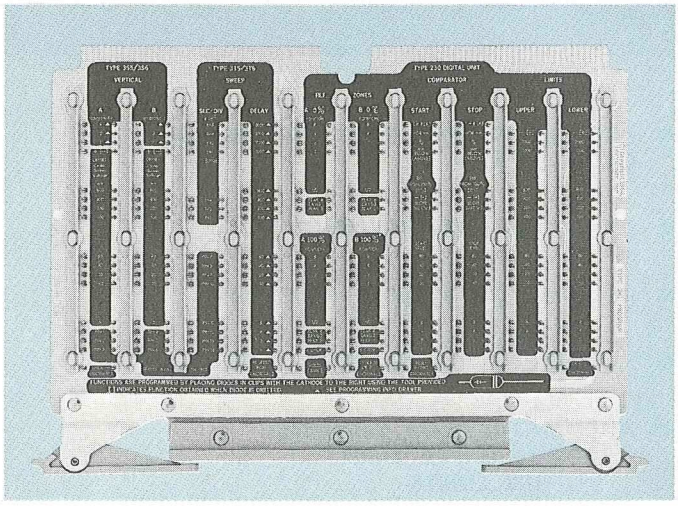
### INCLUDED STANDARD ACCESSORIES

15 program boards (670-0285-00); 6 interconnecting cables (012-0131-00); 450 diodes (152-0143-03); diode insertion tool (003-0611-00); 2 instruction manuals (070-0809-00).

**TYPE 241 PROGRAM UNIT** ..... **$1950**

**TYPE R241 PROGRAM UNIT** ..... **$2000**



## OPTIONAL ACCESSORIES

### PROGRAM BOARDS

Up to 15 additional program boards may be stored in the rear of the Type 241. Program boards may be easily removed, rearranged or exchanged with others that are intended for different tests, order 670-0285-00 ..... $40

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