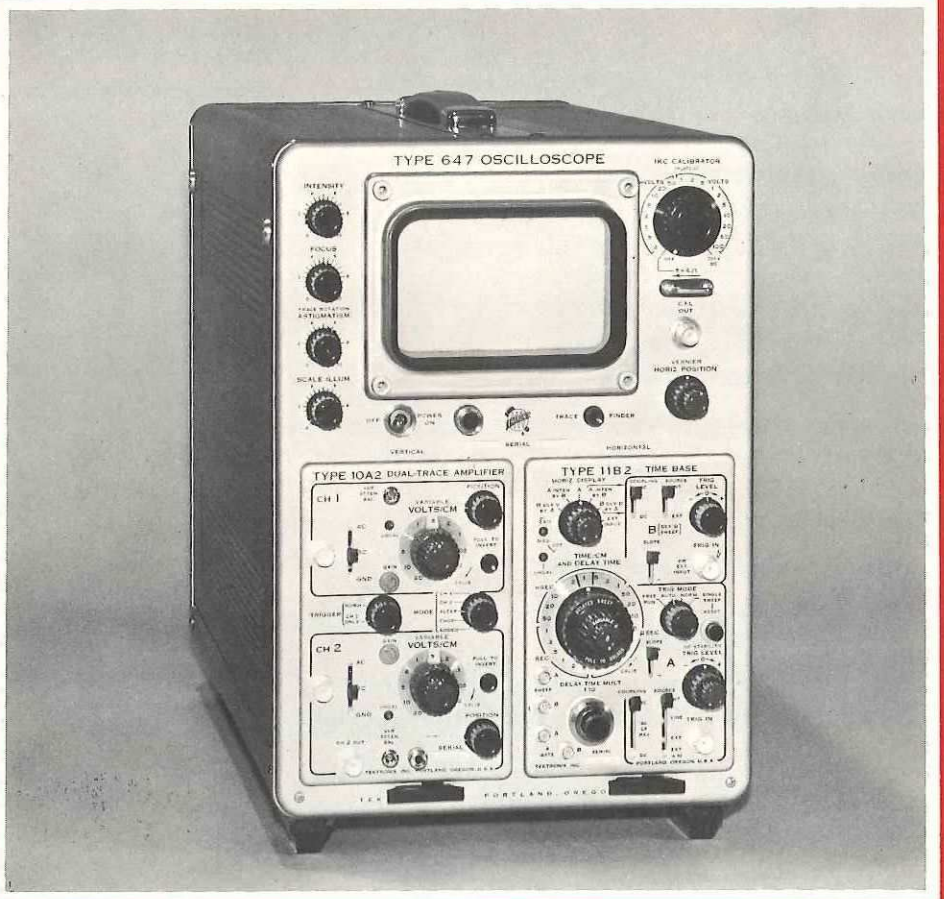
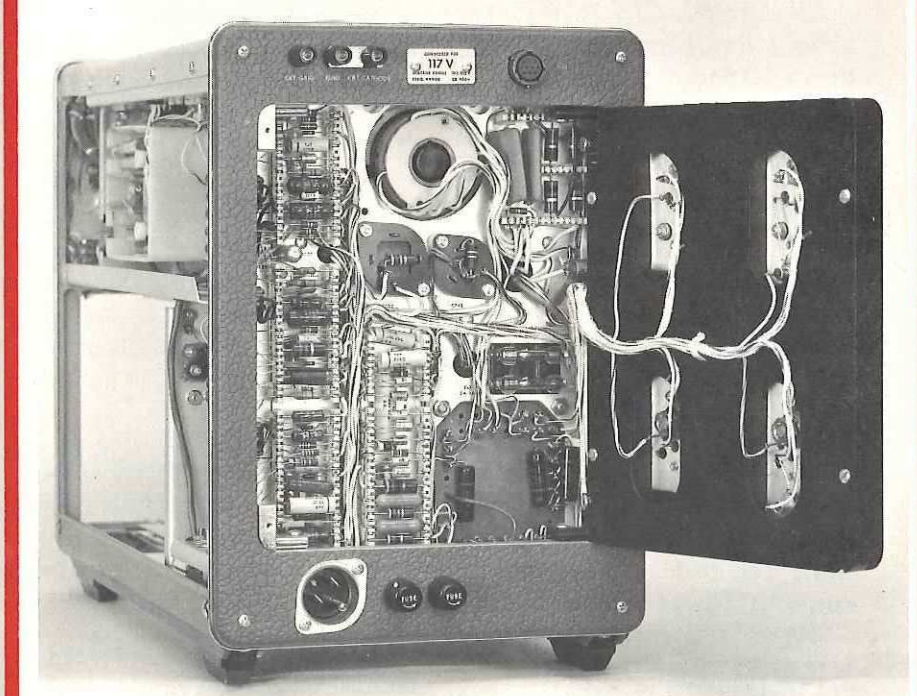


TEKTRONIX

TYPE 647 OSCILLOSCOPE

TENTATIVE SPECIFICATIONS

- *DC-to-50 MC*
- *ENVIRONMENTALIZED*
- *CALIBRATED SWEEP DELAY*
- *6 x 10-CM DISPLAY*
- *PARALLAX-FREE INTERNAL GRATICULE*
- *AMPLIFIER & TIME BASE PLUG-IN-UNITS*
- *14-KV ACCELERATING POTENTIAL*



TRANSITION FROM ENGINEERING MODEL TO PRODUCTION MODEL MAY REQUIRE MINOR SPECIFICATION CHANGES. FINAL SPECIFICATIONS WILL BE RELEASED LATER.

The Type 647 Oscilloscope with 10 Series and 11 Series Plug-In Units comprises a complete high-performance system built to withstand extreme operating and storage conditions. This system is compact, yet easy to maintain, due to its solid-state design, rear-panel swing-away heat sink, and easily-accessible adjustments.

VERTICAL DEFLECTION

VERTICAL SYSTEM accepts a 10-Series Plug-In Unit.

SIGNAL DELAY permits observation of the leading edge of the waveform that triggers the sweep. The 140 nsec (approx) delay line requires no tuning.

HORIZONTAL DEFLECTION

HORIZONTAL SYSTEM accepts an 11-Series Plug-In Unit.

CRT AND DISPLAY FEATURES

TEKTRONIX CRT is a new ceramic tube with parallel-ground glass faceplate. Accelerating potential is 14 kv. A P31 phosphor is normally supplied.

INTERNAL GRATICULE with variable edge lighting is accurately ruled in centimeter squares. Viewing area is 6 by 10 cm. Vertical and horizontal centerlines are marked in 2-mm divisions.

TRACE FINDER attenuates both horizontal and vertical voltages to aid in positioning the display.

UNBLANKING is dc coupled to the crt grid. This assures uniform beam intensity for all sweep speeds and repetition rates at any setting of the intensity control.

EXTERNAL CRT INPUTS are located at the rear of the oscilloscope. Grid Z-axis input has 22-kΩ input resistance. Unblanking amplifier passband is dc to 10 Mc. Gain is 1.5. Cathode Z-axis input is ac coupled (0.015 μfd and 22 kΩ).

OTHER CHARACTERISTICS

1 KC CALIBRATOR provides 18 square-wave voltages from 0.2 mv to 100 v, 1-2-5 sequence. Frequency is crystal controlled, and is accurate within ±0.1%. Output resistance is 50 ohms from 0.2 mv to 0.2 v. Square-wave symmetry is accurate within ±0.1%. Risetime and falltime are approximately 2 μsec. The calibrator also provides a 100 v dc output. A 5-ma square-wave output is available through a front panel loop.

ELECTRONICALLY-REGULATED DC SUPPLIES insure stable, low-drift operation. All supplies are protected against accidental short circuit. Supply voltages are available at the rear panel for external application. 50 to 400-cps line frequency can be used with either 100 to 130 v ac, or 200 to 260 v ac line. A multi-tap transformer provides a selection of operating voltages within these ranges. Power consumption is approximately 185 watts at 117 v ac.

CONVECTION COOLING provides adequate ventilation to +65° C, when the instrument is not tipped by more than 20° on any axis from the normal position. A thermal cutout protects the instrument from overheating.

DIMENSIONS are 14-1/2" high by 10" wide by 23" deep. Net indicator weight is 40-1/2 pounds. Net weight with Type 10A2 and 11B2 Plug-In Units is 52 pounds.

ENVIRONMENTAL

TEMPERATURE

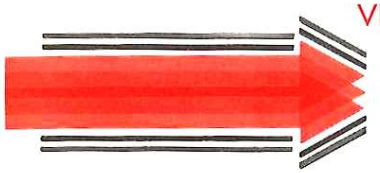
OPERATING

-30°C to +65°C, continuous, when the instrument is not tipped more than 20° in any direction from level position. Other positions require a decrease in maximum temperature. If simultaneously operated at maximum altitude and maximum line voltage in a particular operating voltage range, maximum operating temperature must be limited to +55°C. A self-resetting thermal cutout disrupts instrument power if internal temperature becomes excessive.

NON-OPERATING

-55° C to +75° C.

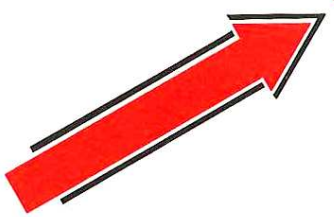
VIBRATION



OPERATING and NON-OPERATING

0.025 inch peak-to-peak, 10 to 55 to 10 cps in 1 minute sweeps (4G's) for 15 minutes on each axis. 3 minute vibration at resonance or 55 cps (each axis).

ALTITUDE



OPERATING

15,000 feet maximum. Maximum operating temperature at 130 v line reduced to 55°C.

NON-OPERATING

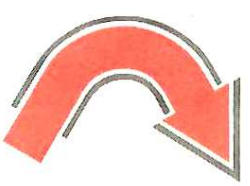
50,000 feet, maximum.

SHOCK

OPERATING and NON-OPERATING

20 G's, one-half sine, 11-millisecond duration. Two shocks each direction along each of the three major axes; total of 12 shocks.

HUMIDITY



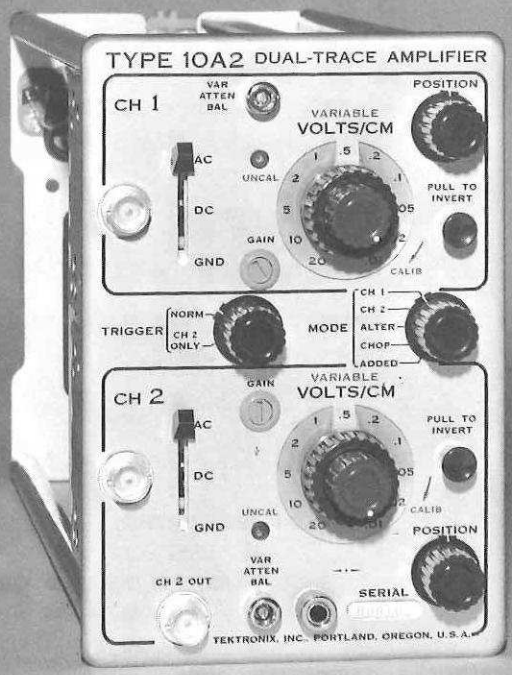
NON-OPERATING

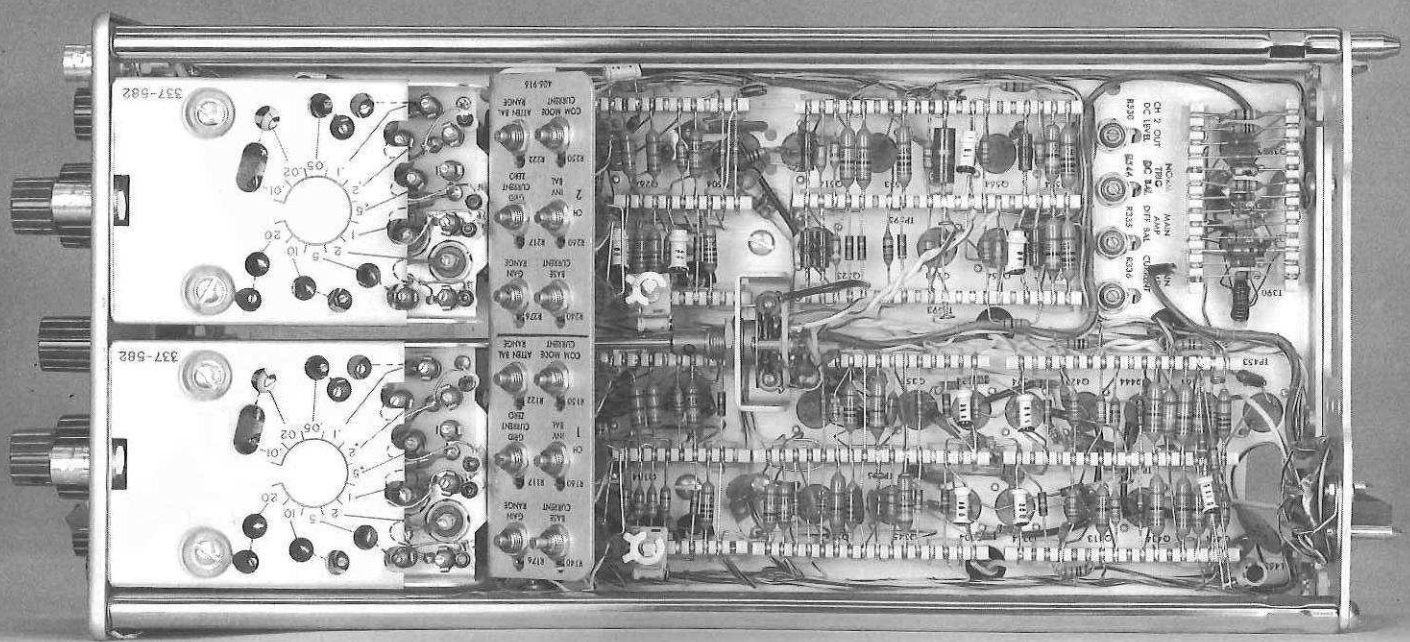
Meets Mil-Std-202B, method 106A (except freezing and vibration) through 5 cycles (120 hours).

TRANSIT

NON-OPERATING

Meets National Safe Transit test when factory-packaged:
Vibration for one hour at slightly greater than one G.
30 inch drops on corners, edges, and flat surfaces, total of 10 drops.


TYPE 10A2 DUAL-TRACE AMPLIFIER
CH 1
VAR ATTEN BAL
VARIABLE VOLTS/CM
POSITION
AC
DC
GND
UNCAL
GAIN
PULL TO INVERT
CALIB
TRIGGER
NORM
CH 2 ONLY
MODE
CH 1
CH 2
ALTER
CHOP
ADDED
CH 2
VARIABLE VOLTS/CM
CH 2 OUT
SERIAL
TEKTRONIX, INC., PORTLAND, OREGON, U.S.A.


337-582
337-582

DUAL-TRACE AMPLIFIER TYPE 10A2

TENTATIVE SPECIFICATIONS

The Type 10A2 Amplifier is a ruggedized, dual-trace plug-in unit, giving the Type 647 Oscilloscope a dc-to-50 Mc passband. Solid-state design has made possible the construction of this compact high performance unit. The Type 10A2 is environmentalized to operate under adverse extremes, and provides even greater reliability under normal operating conditions.

IDENTICAL CHANNELS can be added algebraically, operated singly with either polarity, or dual-trace with either alternate or chopped switching. In alternate operation, electronic switching occurs at the end of each sweep. In chopped operation, electronic switching occurs at a 1 Mc rate (±20%) to show successive 500-nsec samples of each trace.

FREQUENCY RESPONSE with the Type 647 Oscilloscope is dc to at least 50 Mc (3-db down).

RISETIME with the Type 647 Oscilloscope is less than 7 nsec.

SENSITIVITY from 10 mv/cm to 20 v/cm is in 11 calibrated steps with 1-2-5 sequence, and is accurate within ±2% from -30° C to +65° C. Sensitivity can be adjusted to 0% error with the front-panel gain adjustment. A variable control permits continuous adjustment uncalibrated from 10 mv/cm to 50 v/cm.

POLARITY INVERSION for both channels can be used to compare signals 180° out of phase.

CHANNEL ISOLATION is 80-db up to 20 Mc.

COMMON-MODE REJECTION in the added-algebraically mode is at least 20:1 throughout the passband for common-mode signals up to 10 cm.

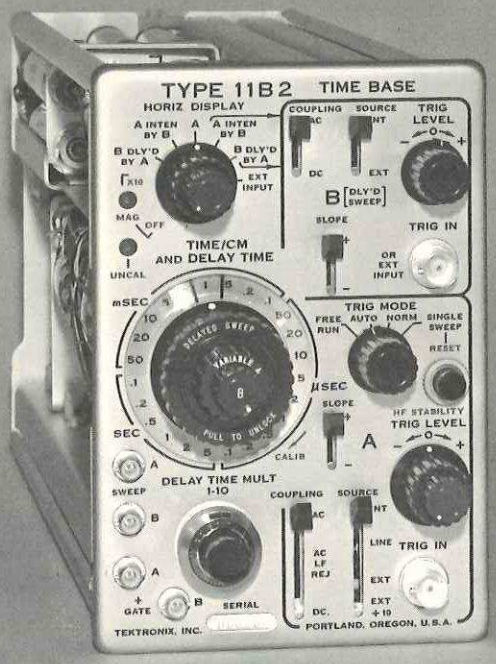
INTERNAL TRIGGER is obtained from the common output amplifier, or can be switched to Channel 2 only. Triggering from Channel 2 provides the correct time relationship between channels in Alternate and Chopped operation.

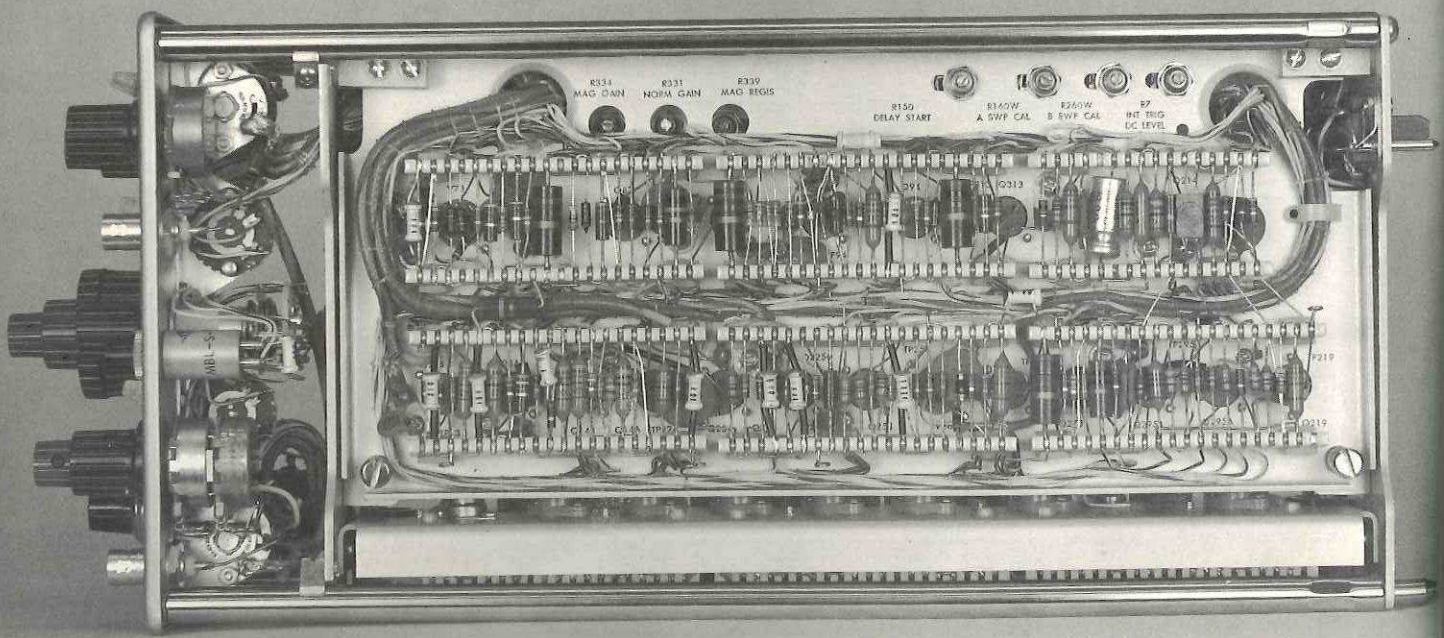
CHANNEL 2 OUTPUT is available at the front panel for external triggering or driving other equipment. This 10X output, when fed into Channel 1, provides 1 mv/cm sensitivity at a dc-to-20 Mc bandwidth.

AC or DC COUPLING or grounding of the input is controlled from the front panel. With ac coupling, the low-frequency 3-db point is 2 cps.

MAXIMUM INPUT is 600 volts (dc + peak ac).

INPUT IMPEDANCE is 1 megohm paralleled by 20 pf.


TYPE 11B2 TIME BASE
HORIZ DISPLAY
A INTEN BY B
A
A INTEN BY B
B DLY'D BY A
B DLY'D BY A
EXT INPUT
X10
MAG
OFF
UNCAL
TIME/CM AND DELAY TIME
mSEC
SEC
μSEC
DELAYED SWEEP
VARIABLE
PULL TO UNLOCK
CALIB
SWEEP
A
B
DELAY TIME MULT 1-10
+ GATE
SERIAL
TEKTRONIX, INC.
COUPLING
SOURCE
TRIG LEVEL
AC
DC
INT
EXT
B [DLY'D SWEEP]
SLOPE
TRIG IN
OR EXT INPUT
TRIG MODE
FREE RUN
AUTO
NORM
SINGLE SWEEP
RESET
HF STABILITY
TRIG LEVEL
A
AC LF REJ
LINE
EXT
EXT ÷10
PORTLAND, OREGON, U.S.A.


R334 MAG GAIN
R331 NORM GAIN
R339 MAG REGIS
R150 DELAY START
R340W A SWP CAL
R260W B SWP CAL
R7 INT TRIG DC LEVEL

TIME-BASE UNIT TYPE 11B2

TENTATIVE SPECIFICATIONS

The Type 11B2 is a ruggedized time-base unit for the Type 647 Oscilloscope. Two separate time-base generators provide for calibrated sweep delay. Time Base A is the normal sweep and is also used to delay the start of Time Base B. This high performance unit is designed for severe operating and storage conditions.

TIME BASE A and B SWEEP RANGE from 0.1 μsec/cm to 5 sec/cm is in 24 calibrated steps with 1-2-5 sequence. Sweep speed is continuously variable uncalibrated from 0.1 μsec/cm to approximately 12 sec/cm. A front-panel lamp indicates uncalibrated sweep rates.

10X SWEEP MAGNIFIER expands the center portion of the normal display to fill 10 cm. It can be used to extend the calibrated sweep time to 10 nsec/cm.

ACCURACIES	0°C to +40° C	-30°C to +65°C
5 sec/cm to 0.1 sec/cm	±3%	+4, -6%
50 msec/cm to 0.1 μsec/cm	±1.5%	±2.5%
10X Magnifier additional:		
Up to 50 nsec/cm	±1%	±1.5%
20, 10 nsec/cm	±2%	±2.5%

DISPLAY MODES include Time Base A only, A intensified by B, or B delayed by A. In the 2 latter modes, B can be started automatically at the end of the delay period, or is triggerable at the end of the delay period.

SINGLE SWEEP OPERATION facilitates photographic recording of waveforms displayed on Time Base A. A RESET pushbutton arms the sweep to fire on the next received trigger. The sweep can also be remotely reset, through a rear-panel jack on the Type 647 Oscilloscope. After firing once, the sweep is locked out until rearmed by pressing the RESET button. The button lights to indicate when the sweep is armed to fire on the next received trigger.

+GATE and SAWTOOTH OUTPUTS from each time base are available at the front panel. Output is +15 v from A and B gate, and +10 v from A and B sweep.

EXTERNAL HORIZONTAL INPUT provides for horizontal beam deflection with an external source. Horizontal sensitivity is 1 v/cm without magnification or 0.1 v/cm with 10X magnifier. Passband is dc to at least 3 Mc (3-db down). With ac coupling, the low-frequency 3-db point is approximately 16 cps. Input impedance is 1 megohm paralleled by approximately 30 pf.

TRIGGER

TRIGGER MODE selects free-running, normal, single-sweep, or automatic operation.

AUTOMATIC TRIGGERING provides a bright reference trace (regardless of sweep speed) when no input signal is applied, or when the input signal repetition rate is less than 20 cps. Above 20 cps, Time Base A is triggered at the repetition rate of the incoming trigger signal to achieve jitter-free displays to beyond 50 Mc.

TRIGGER LEVEL adjusts to allow sweep triggering at any selected point on either the rising or falling portion of the waveform, and up to ±5 or ±50 v (Time Base A), or ±10 v (Time Base B) external.

TRIGGER SOURCE can be internal or external (Time Base B), internal, external, external ÷10, or line (Time Base A). Time Base B is ac or dc coupled. Time Base A has ac or dc coupling plus ac low-frequency reject.

LOW-FREQUENCY REJECT (-3 db at 17 kc) prevents low-frequency components, such as 60-cps hum, from interfering with stable operation.

HIGH-FREQUENCY STABILITY changes Time Base A recovery time to reduce high-frequency jitter.

TIME BASE A and B TRIGGER REQUIREMENT for internal triggering is 2-mm deflection to 50 kc, 1-cm deflection at 50 Mc. External triggering requires 125 mv to 50 kc, 250 mv to 50 Mc.

SWEEP DELAY

CALIBRATED DELAY RANGE from Time Base A is continuously variable, 1 μsec to 50 sec. A ten-turn precision potentiometer permits accurate delay time multiplication of the Time Base A delay steps. The 3 fastest Time Base A rates are not normally used for delay generation.

DELAY ACCURACIES	0°C to +40°C	-40°C to +65°C
5 sec/cm to 0.1 sec/cm	±2.5%	+3%, -6%
50 msec/cm to 1.0 μsec/cm	±1.0%	±2%
Multiplier Incremental Linearity	±0.15%	±0.2%
Jitter, Parts in 10^5 of Max. Available Delay Period	5	5

TRIGGERED OPERATION holds off the start of the delayed sweep until the arrival of the first trigger signal following the selected delay time. Because the delayed sweep is actually triggered by the signal under observation, the display is completely jitter free. A steady display is thus provided for time-modulated pulses and signals with inherent jitter.

CONVENTIONAL OPERATION holds off the start of the delayed sweep for the precise amount of the selected delay time. Any time-modulation or jitter on the signal will be magnified in proportion to the amount of sweep expansion. The time jitter in the delayed trigger or delayed sweep will not exceed one part in 20,000 of the maximum available delay interval (where this interval is 10 times the Time/Cm or Delay-Time setting).

WIDE-RANGE MAGNIFICATION is readily accomplished when Time Base B is operated at a faster rate than Time Base A. For example, if TIME BASE B is operating at 1 μsec/cm and TIME BASE A is operating at 50 μsec/cm, the magnification is 50 times.

TRACE BRIGHTENING indicates the exact portion that will appear on the magnified display, and shows the point-in-time relationship of the magnified display to the original display.

Tektronix, Inc. / P. O. BOX 500 · BEAVERTON, OREGON 97005 / Phone: (Area Code 503) Mitchell 4-0161 · Telex: 036-691 · TWX: 503-291-6805 · Cable: TEKTRONIX · OVERSEAS DISTRIBUTORS IN 27 COUNTRIES

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