# SECTION 1
# CHARACTERISTICS

Change information, if any, affecting this section is found at the rear of the manual.

## Introduction

The Type 556 Oscilloscope—is a versatile dual-beam laboratory type instrument providing accurate voltage and time measurements in the DC to 50 MHz frequency range. Two complete horizontal and vertical deflection systems permit completely indepentent operation of the two beams.

The Upper Beam can display the signal from either the left or right vertical plug-in unit and may be controlled by either the A or B time base or an external signal. The Lower Beam displays the signal from the right plug-in and the sweep is controlled by the B time base or an external signal. The left and right plug-in compartments accept all letter series and 1-series plug-ins.

Special circuits within the oscilloscope provide selection of an accurate, continuously-variable delay when using the B sweep. The B sweep may be delayed by the A sweep from 0.1 μs to 50 s (calibrated) after application of a trigger pulse. This feature permits the delayed B sweep to expand a selected portion of the undelayed A sweep, thereby providing precise time measurements and detailed observation of the signal. Both the delayed and undelayed sweeps can be presented simultaneously on the oscilloscope screen. The Upper Beam trace has an intensified zone indicating the portion of the signal being displayed by the B sweep and Lower Beam.

The instrument is designed to operate over an ambient temperature range of 0° C to +50° C. Performance specifications that are given in the center column apply over this temperature range after a warmup time of 20 minutes. Supplemental information describing a characteristic or a feature is also included in this portion of the manual.

### VERTICAL AMPLIFIERS

| Characteristics | Performance Specification | Supplemental Information |
|---|---|---|
| Frequency Response | DC to ≥50 MHz at 3 dB down with a 1-series plug-in unit having a risetime of 3.12 ns or less. | |
| Risetime | | ≤6.25 ns. Indicated risetime of 6.93 ns with a Test Load Plug-In Unit (Tektronix Part No. 067-0521-00) having a risetime of 3 ns. |
| Transient Response on Screen | ≤2.25% peak overshoot, rounding, ringing or tilt. | Applies to all three vertical modes with Test Load Plug-In Units. |
| Gain Change with Line Voltage Change | ≤1% from 147 VAC peak to 178 VAC peak. | |
| Trace Drift with Line Voltage Change | ±2 mm from 147 VAC peak to 178 VAC peak. | |

### A & B SWEEP GENERATORS

| | | |
|---|---|---|
| Calibration Accuracy<br>5 s/cm to 0.1 μs/cm | ±3% of displayed time between two points displayed within the middle 8 cm. | |
| ×10 Magnified Display | ±5% of displayed time between any two points ≥1 cm apart displayed within the middle 8 cm. | Calibrated from 4 cm to 70 cm from sweep start. Extends fastest sweep rate to 10 ns/cm. |
| Variable Time/Cm Range | ≥2.5:1. | Extends slowest sweep to approximately 12.5 s/cm. |
| Sweep Length | 10.5 cm ±0.5 cm | At 1 ms/cm. |

### VARIABLE TIME DELAY

| | | |
|---|---|---|
| Delay Time Accuracy<br>5 s/cm to 1 μs/cm | ±1% of indicated delay time ±2% of A TIME/CM setting + fixed delay of ≤150 ns in system. | 1% of A TIME/CM setting corresponds to 1 minor division on the DELAY-TIME MULTIPLIER dial. |
| 0.5 μs/cm to 0.1 μs/cm | ±1% of indicated delay time ±5% of A TIME/CM setting + fixed delay of ≤150 ns in system. | For additional information refer to Fig. 2-10 in the Operation Instructions. |

| Characteristics | Performance Specification | Supplemental Information |
|---|---|---|
| Incremental Delay Time Accuracy | | |
| 5 s/cm to 1 μs/cm | ±1% of indicated incremental delay time ±4% of A TIME/CM setting. | Incremental Delay Time is the difference between two delay time readings. |
| 0.5 μs/cm to 0.1 μs/cm | ±1% of indicated incremental delay time ±7% of A TIME/CM setting. | For additional information refer to Page 2-24 in the Operating Instructions. |
| Short Term Jitter | ≤1 part in 20,000 of the available delay time. | |

## EXTERNAL HORIZONTAL AMPLIFIERS

| | | |
|---|---|---|
| Ext. Horizontal Deflection Factor | ≤0.1 V/cm with DISPLAY MAG in ×10 position. | |
| Transient Response | ±3% peak overshoot, rounding, ringing or tilt. | |
| Variable Range | ≥10:1 | |
| Frequency Response | DC to ≥400 kHz at 3 dB down. VARIABLE control set fully cw. | |
| Maximum Input Voltage | 50 V combined DC + peak AC. | With DISPLAY MAG in ×10 position. |
| Input C | | Approximately 65 pF. |

## A & B TRIGGERING FEATURES

| Characteristic | Feature |
|---|---|
| Source | Internal Normal (from left or right trigger pick-off circuit within the vertical amplifier), Internal Plug-In (from one of the channels in the left or right Type 1A1 or 1A2 Plug-In Unit), Line and External. |
| Coupling | Capacitive (AC), low-frequency reject (AC LF REJ), high-frequency reject (AC HF REJ) or direct (DC). |
| Slope | Triggering on positive-or-negative-going portion of triggering signal. |
| Mode: | |
| Auto Stability | Free runs sweep in absence of a triggering signal; instrument can be triggered on signals ≥30 Hz. |
| Triggered | Triggered at an adjustable level. |
| Jitter | ≤2 ns. |
| LEVEL Control Range: | |
| Normal | ≥ ±2 V. |
| ×10 Increase | ≥ ±20 V. |
| External Trigger Input: | |
| R & C | Approximately 1 megohm paralleled by approximately 35 pF. |
| Volts | 50 V maximum (DC plus peak AC). |

## A & B TRIGGERING SENSITIVITY

| Trigger Coupling/Source | | To 10 MHz | To 50 MHz |
|---|---|---|---|
| AC: | | | |
| INT NORM | | ≤ 2 mm display amplitude above 60 Hz. | ≤ 1 cm display amplitude. |
| EXT | | ≤ 0.2 V above 60 Hz. | ≤ 0.4 V. |
| AC LF REJ: | | | |
| INT NORM | ≥ 3 cm display amplitude at 30 Hz. | ≤ 2 mm display amplitude above 2.5 kHz. | ≤ 1 cm display amplitude. |
| EXT | ≥ 3 V at 30 Hz. | ≤ 0.2 V above 2.5 kHz. | ≤ 0.4 V. |
| AC HF REJ: | | | |
| INT NORM | ≤2 mm display amplitude from 60 Hz to 60 kHz, ≥1 cm at 6 MHz. | | |
| EXT | ≤0.2 V from 60 Hz to 60 kHz, ≥1 V at 6 MHz. | | |
| DC | | | |
| INT NORM | | ≤ 3.5 mm display amplitude. | ≤ 2 cm display amplitude. |
| EXT | | ≤ 0.2 V. | ≤ 0.4 V. |
| INT PLUG IN | Characteristics that apply for the EXT trigger input also apply to the Int Plug-In interconnection (pin 5 of plug-in connectors J11 and J12). | | |

## AMPLITUDE CALIBRATOR

| Characteristic | Performance Specification | Supplemental Information |
|---|---|---|
| Voltage Accuracy | ±2%. | |
| 5 mA Current Loop Accuracy | ±2%. | |
| Repetition Rate | 1 kHz ±25% | |
| Duty Cycle | 45% to 55%. | |
| Risetime | ≤ 1.5 μs. | 70 pF load. |
| Terminated Voltage Accuracy | One-half indicated voltage ±2% when terminated into 50 ohms ±0.1%. | Applies to AMPLITUDE CALIBRATOR switch positions from 0.2 mV to 0.2 V only. |

## Z AXIS INPUTS

| | | |
|---|---|---|
| Sensitivity | | 10 V P to P causes noticeable modulation intensity. |
| Input R at DC | | 1 megohm ±10%. |

## FRONT-PANEL OUTPUT SIGNALS

| | | |
|---|---|---|
| A GATE | ≥ 8 V positive-going pulse. | With baseline at zero volts. Time coincident with the A sweep. Maximum current is 10 mA. Recommended load resistance ≥1 kΩ. |
| B GATE | ≥ 8 V positive-going pulse. | With baseline at zero volts. Time coincident with the B sweep. Maximum current is 10 mA. Recommended load resistance ≥1 kΩ. |
| DLY'D TRIG | ≥ 7 V positive-going pulse into a ≥1 kΩ load. | Pulse occurs at the end of the A sweep delay period. |
| A SAWTOOTH | ≥ 9 V/cm. | Has the same time duration as the A sweep. Recommended load resistance ≥30 kΩ. |
| B SAWTOOTH | ≥ 9 V/cm. | Has the same time duration as the B sweep. Recommended load resistance ≥30 kΩ. |
| Line Frequency | 50 Hz to 60 Hz | 400 Hz with special fan modification. |
| Power Consumption | | ≈840 W maximum. ≈1 kVA maximum. |
| Thermal Protection | | An automatic resetting thermal cutout interrupts instrument power if internal temperature exceeds safe operating level. |

## POWER SOURCE REQUIREMENTS

| For serial numbers 2000 and up | | | |
|---|---|---|---|
| Regulating Range Selection: | AC RMS Operating Range (≤2% harmonic distortion of the input power waveform) | AC Peak Operating Range (>2% harmonic distortion[1]) | |
| 115 Volts | | | A Line Voltage Selector assembly facilities selection of a regulating range compatible with the actual line voltage. |
| LO | 90 to 110 V | 127 to 156 V | |
| M | 104 to 126 V | 147 to 178 V | |
| HI | 112 to 136 V | 158 to 192 V | |
| 230 Volts | | | |
| LO | 180 to 220 V | 254 to 311 V | |
| M | 208 to 252 V | 294 to 356 V | |
| HI | 224 to 272 V | 316 to 384 V | |

[1]**Crest Factor** = $\frac{\text{Peak V}}{\text{RMS V}}$ = **between 1.30 and 1.414.**

| Characteristic | Performance Specification | | Supplemental Infromation |
|---|---|---|---|
| For serial numbers 100-1999 | | | |
| Normal Line: | AC RMS Operating Range (≤2% harmonic distortion of the input power waveform) | AC Peak Operating Range (>2% harmonic distortion[1]) | |
| 115 VAC Nominal | 100 to 130 V | 142 to 183 V | Normally wired at the factory for this voltage unless directed otherwise. |
| 230 VAC Nominal | 200 to 260 V | 284 to 366 V | |
| Low Line: | | | |
| 104 VAC Nominal | 90 to 117 V | 127 to 165 V | |
| 208 VAC Nominal | 180 to 234 V | 254 to 330 V | |

## CRT AND DISPLAY

| Characteristic | Information |
|---|---|
| Tube Type | T5560-31-1. Dual-Beam, round, glass envelope. Tektronix Part No. 154-0500-00. |
| Phosphor | P31 standard. Others available on special order. |
| Accelerating Potential | Approximately 10 kV; gun potential is 2 kV. |
| Scan Area | ≥6 cm vertical by 10 cm horizontal per beam. Beams can be overlapped in a 4 cm area. |
| Graticule Type | Internal. 8 cm vertical by 10 cm horizontal. Each major division is 1 cm; four corners are omitted. |
| Graticule Illumination | Variable edge lighting. |
| Internal Unblanking | DC-coupled to CRT control grids from the Sweep Generators. |
| Orthogonality | Within ±1%. |
| Trace Rotation Range | Sufficient to align traces with their respective graticule lines. |
| Beam Finder | Limits traces within graticule area. |

## ELECTROMAGNETIC INTERFERENCE

| | |
|---|---|
| Electromagnetic Interference | Meets interference specifications of MIL-I-6181D over the following frequency ranges: Radiated (with CRT mesh filter, cabinet covers and BNC connector covers installed)—150 kHz to 1 GHz; conducted (power line)—150 kHz to 25 MHz. |

## MECHANICAL CHARACTERISTICS

| | |
|---|---|
| Construction | Aluminum alloy chassis, panel and cabinet. Glass laminate etched circuit boards. |
| Finish | Anodized front panel. Blue vinyl-finished cabinet and rear panel. |
| Overall Dimensions: | Measured at maximum points; 15 inches high, 16-7/8 inches wide, 24 inches deep. |

[2]**Crest Factor** $= \frac{\text{Peak V}}{\text{RMS V}} =$ **between 1.30 and 1.414.**

## ENVIRONMENTAL CHARACTERISTICS

The Type 556 has been designed to operate over a temperature range of 0° C to +50° C, altitude up to 15,000 feet. The non-operating storage temperature range is —40° C to +65° C, altitude up to 50,000 feet. After storage at either extreme, the instrument must be allowed at least 4 hours time for all components to return to the ambient temperature range 0° C to +50° C before operating.

Further information on environmental test procedures may be obtained by contacting your local Tektronix Field Office or representative.

## ACCESSORIES

Standard accessories supplied with the Type 556 can be found on the last pullo-ut page of the Mechanical Parts List Illustrations. For optional accessories see the Tektronix, Inc. catalog.