The Model 6125A provides in one compact, easy-to-use package, all facilities for the most accurate calibrations of oscilloscope parameters possible, outside of the standards laboratory. It comprises three precision instruments: a voltage calibrator; a sweep-time and delay-time calibrator; and a rise-time calibrator. Not to be confused with less accurate instruments of limited range, the Model 6125A approaches secondary-standard accuracy and stability in all calibrating-signal parameters... yet it costs less than the 3 individual instruments it replaces.

It is simple to use. The operator sets the amplitude or time control to the value required, depresses the appropriate function and multiplier buttons and observes the waveform on the oscilloscope. If the trace does not coincide with the appropriate graticule, the deviation control is adjusted until it does, when the error can be read directly off the meter as a percentage.

**SPECIFICATIONS — MODEL 6125A**

**VOLTAGE CALIBRATOR**

<table>
<thead>
<tr>
<th>Range</th>
<th>(a) Volts/Division: 10 μV to 20 V</th>
<th>20 ranges in 1, 2, 5 sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(b) Number of divisions multiplier: X3, 4, 5, 6, 8, 10</td>
<td>Absolute Range: 27 μV to 220 volts</td>
</tr>
<tr>
<td></td>
<td>Deviation ranges: ±3 μV, and ±10 μV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output Modes: AC 1 kHz, 50.01% positive going square wave (Crystal Controlled Frequency)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC-positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC-negative</td>
<td></td>
</tr>
</tbody>
</table>

| Accuracy: Better than ±0.25% into open circuit |
| Offset: Less than 3.5 μV below 50 mV. (After use on ranges above 50 mV, a five minute settling time is required to avoid thermal effects) Less than 250 μV above 50 mV |
| Note: The same offset is obtained on all output modes including zero, |
| Ripple and Hum: Better than 0.1% ±2 μV p-p |
| Square wave risetime: Less than 5 μs |
| Square wave overshoot: Less than 0.5% |
| Regulation (for 1 MΩ load): Varies between 0 and 0.27% depending on setting. |
| Deviation Accuracy: ±1% FSD ±2.5% of reading |

**BALLANTINE LABORATORIES, INC.**

**FOUR DECADES OF INNOVATION IN ELECTRONIC INSTRUMENTATION**
SPECIFICATIONS - MODEL 6125A

Overload Protection: Protected against overload of short duration
Reference: High quality meter diode,
(Temperature coefficient 0.002% per °C)
Temperature Coefficient of Output (10-30°C): Better than
±0.01% per °C (±100 ppm/°C)
Line Regulation for ±10% change: ±0.02% max
Stability: ±0.10% per year (maximum)

TIME CALIBRATOR
Range: 10 nsec to 5 second intervals
(a) Time/Division: 10 nsec to 0.5 sec/div – 21 ranges in
1, 2, 4 sections.
(b) Multiplier (Number of Divisions): X 1, 2, 5, 10 (on
100 nsec to 0.5 sec/div only)
Deviation Ranges (for 100 nsec/div to 0.5 sec/div): ±3% and ±10%
Accuracy
(a) Crystal controlled: ±0.01% of setting
(b) Deviation 3% range: ±0.1%
(c) Deviation 10% range: ±0.2%
Amplitude
(a) 100 nsec/div to 0.5 sec/div: 1.0 V (typical) into 50 Ω
(1.4 V min into open circuit)
(b) Less than 100 nsec/div: 1.0 V p-p (typical) into 50 Ω
Pulse shape and width
(a) 100 nsec/div to 0.5 sec/div:
Spikes, width at base 10% of pulse interval
(b) below 100 nsec/div:
Square wave

RISETIME CALIBRATOR & TRIGGER OUTPUT
Amplitude: 200 mV to 250 mV continuously variable into
50 Ω (±400 mV, 500 mV open circuit)
Rise time: Less than 1 nsec going into 50 Ω
Period: 1 microsec to 1 second in 7 decade steps
Waveform: Square Wave
Overloads: Less than 2%
Accuracy: Same as Time Calibrator

LINE FREQUENCY SYNC OUTPUT
Amplitude: Continuously variable from 0 to 1 volt peak-to-peak
from 2 kHz source max.
Waveform: Follows powerline sine wave

GENERAL INFORMATION
Power Requirements: 100/125 or 200/250 volts r.m.s., 17W,
50/60 Hz
Operating temperature: 0°C to +50°C ambient.
Storage temperature: -40°C to +70°C ambient.
Humidity: to 90% RH for full accuracy; to 95% RH operating
Dimensions: 16 3/8" wide, 5 1/4" high x 12" deep overall.
(415.6 mm x 133.5 mm x 304.8 mm). Weight: 15 lbs 4 oz (7.07 kg.)
Shipping weight: 31 lbs 8 oz (14.2 kg) shipping weight.

PRICE: $1875.00
Note: All accuracies specified at 23°C ±1°C with full compensation
for output loading and referenced to a standard traceable to NBS
with uncertainty of ±0.01%.

Ballantine Laboratories, Inc.
P. O. Box 97, Boonton, New Jersey 07005, Phone (201) 335-0900, TWX (710) 987-8380

Four Decades of Innovation in Electronic Instrumentation
U.S. Sales Prices F.O.B. Boonton, New Jersey
Specifications and prices subject to change without notice.

3/72 Printed in U.S.A.
This unique new instrument "captures" signals (transient or repetitive) by recording them on a small tape loop, and then provides a versatile, stable, linear, essentially noise-free reproduction interface that permits the captured signal to be analyzed at leisure. The Ballantine Electronic Signal Recorder (ESR) may be coupled to any waveform/spectrum instrument, from conventional oscilloscopes to spectrum, waveform, or vibration analyzers and Fourier plotters. The ESR converts any scope into a storage scope — with the important advantages of much greater signal-analysis flexibility, higher contrast, faster effective writing rate, and (with 2 ESRs) two-channel signal-comparison capabilities. The inexpensive tape loops may be safely stored indefinitely, yet are instantly and automatically erased for re-recording.

### Features

- **Conversts**
  - any scope
  - into a
  - high-contrast
  - fast-writing
  - storage scope!

- **Provides**
  - high-resolution
  - “instant replay”
  - (and total electronic recall)
  - of one-shot
  - or repetitive
  - signals!

- adds unique
  - transient-analysis
  - capability to
  - spectrum analyzers
  - waveform analyzers
  - fourier plotters
  - vibration analyzers
  — and many other instruments!

- **Permits**
  - remote field recording
  — without viewing
  — for later
  — display and analysis
HOW IT'S USED...

Because the ESR can be used to provide "instant replay" of captured signals with so many different instruments, the simple steps described here may vary slightly from application to application. These procedures are given for use with an oscilloscope. NOTE: See next page for variations in these procedures.

1 Slip tape loop on spindles—ingenious tapered design automatically draws tape into correct position.

2 Interconnect signal ESR, and scope as shown on page 1, and set scope sensitivity to 100mV/cm and trigger control to EXT. (ESR provides both plus and minus trigger-slope selection.)

3 Set ESR sensitivity control to appropriate level for signal. (If you don't know correct level, simply switch ESR to "THRU" Mode, and check the signal, as you ordinarily would, directly on scope.) Press the Playback button. Now you're ready.

4 Press the RECORD button. The next 20 milliseconds of signal (of adequate level, as set in step 3) will be recorded, after which the RECORD light will go out, and the PLAYBACK light will go on, indicating signal capture. Now the tape is being read repeatedly, and the captured signal is being displayed on the scope. (You may have to set the trigger level of the scope, but this is only done once, for all recordings.)

5 Now you can observe, analyze, and even photograph, the captured signal, at your leisure. Using the horizontal-position control (output trigger delay) on the ESR, in combination with the scope's sweep-rate control, you can "zero in" on any small part of the waveform without significant jitter you or can look at the whole 20 milliseconds of recording. You can't lose any of the leading edge, either — there's a built-in delay after the sweep starts. On the rear of the ESR is a pulse that can be used for Z-axis blanking or brightening, to identify the start of the recording. (With two ESR's, you can compare an old tape with a new one, too! You can also copy tapes from one ESR to another.

APPLICATIONS include almost any requirement for capturing and/or storing time-domain signals... transient or repetitive, DC or AC coupled, with frequency components up to 250kHz. Here is a partial list:

- "Instant Replay" of transients or repetitive signals on a conventional CRO.
- Analysis of the frequency/energy components of a spectrum, in conjunction with any swept-spectrum (or stepped-frequency) device — e.g., microwave, RF, LF, AF, subsonic, noise, and shock/vibration spectra, from spectrum analyzers, swept-frequency receivers, telemetry-channel scanners, etc.
- Detailed analysis of the impedance/transfer-function vs. frequency characteristic of a device, circuit, or component, in conjunction with network or impedance analyzers, triggered sweep-frequency oscillators, etc. (With two ESR's, comparison of these characteristics with standards.)
- Analysis of the harmonic (Fourier) content of a captured waveform, in conjunction with waveform analyzers, Fourier plotters, sampled-data/computer processed analyzers, etc.
The 7050A operates in two modes: "RECORD," and "PLAYBACK." Mode switching ("TRANSFER") is accomplished automatically, by an internally or externally generated trigger signal, or manually by front panel pushbutton. The transfer may be delayed from 0 to 16 milliseconds after the trigger.

In the RECORD mode, the instrument continuously records input signals on a small endless loop of computer-grade magnetic tape, which is capstan driven by a brushless, constant-speed DC Hall-effect motor, at one revolution of the loop every 20 milliseconds. An erase head, positioned 16 milliseconds behind the recording head, continually erases the recorded signals after each revolution.

When a "TRANSFER" command is received, both recording and erasure cease, and the previous 20 milliseconds of recorded signals are read out as a continuously repeated, analog voltage signal. The recorded Read trigger signal is usable, as explained below, as a synchronization signal for the associated oscilloscope.

As the block diagram below indicates, the input signal is amplified, and used to FM modulate a 750kHz carrier. The resultant signal is fed through a Write amplifier to the recording head. Application of a TRANSFER signal, which may be derived from the input signal, from an external source, or by actuation of the PLAYBACK pushbutton, disconnects the erase head and switches the recording head to the playback amplifier. The recorded signals are fed through the playback amplifier to the demodulator, which removes the FM carrier, recovering the original signal.

In the PLAYBACK mode, a trigger output is available, for triggering the scope sweep. A unique feature of the ESR is its ability to transfer, manually or automatically, from RECORD to PLAYBACK, with an adjustable delay period, selected by front panel controls. A second adjustable delay of the sweep-trigger output permits precise examination of any small segment of the recorded waveform, by sweep expansion of the recorded signal. No other signal-storage medium — storage scope or photograph — has this capability.

The sweep trigger can thus be adjusted in phase with respect to the recorded signal... similar to a scope delayed sweep. Thus, the scope time base trigger may be advanced or delayed with respect to the ESR's zero-reference signal.

![Block diagram of the 7050A](image)
**SPECIFICATIONS**

**RECORDING:**
- **Frequency Range:** DC–100kHz (3dB), usable beyond 200kHz.
- **Rise Time:** 3.6 μsec.
- **Storage Time Period:** 20 mS maximum.
- **Input Sensitivity:** 9 ranges in 1, 2, 5 sequence (for an oscilloscope 4/10/40/100 mV/cm deflection coefficient 0.2/0.4/1/2V/cm of 100mV/cm).
- **Input Signal for Full Recording Level:** 10 x input sensitivity.
- **Maximum Input Voltage:** 400 volts (DC plus peak AC).
- **Input Impedance:** 1 MΩ ±5%, 36pF ±2pF, compensated on all ranges for use with attenuator probe.
- **Distortion:** < 1.5% at 1kHz.

**TRANSFER COMMAND:**
- Automatic, from input signal.
- External, by control pulse.
- Transfer Trigger Level Range: ±5 x input sensitivity (internal).
- Transfer Level Range: ±5 x input sensitivity (internal).
- Transfer Slope: positive or negative.
- External Transfer Trigger Sensitivity: > 50 mV, > 100 nsec.
- Input Impedance, External Transfer Trigger Input: 1MΩ, 36pF.
- Transfer Delay: adjustable 4 to 20msec.

**TAPE STORAGE**
Captured signals may be stored indefinitely, provided they are not exposed to very high magnetic fields, or high temperatures. The all-steel storage capsule shown here provides adequate magnetic shielding for all ordinary environments, and provides a label for identification and dating of the signal stored. Order as Model 70502A Tape Storage Capsule, $5.00 for a package of ten. (Quantity discounts are obtainable on request, from factory.)

**PLAYBACK:**
- **Output Level for Full Modulation:** ±0.5V (1V p-p).
- **Signal to Noise Ratio During Full Level Recording:** > 34 dB dynamic range, referenced to full scale.
- **Signal Output Source Impedance:** < 50 Ω.
- **Repetition Frequency of Recording:** 50 Hz (approx.).
- **Ground Reference:** Short-duration reference level pulse recorded on tape at instant of transfer.
- **Ground Reference Adjustment:** permits offsetting recorded signal ±3 x input sensitivity setting, via front-panel control.

**PULSE OUTPUTS:**
- **Trigger for Oscilloscope:** amplitude, > 13V into open circuit.
- **Trigger Delay:** 4 to 17 mS — continuously adjustable.
- **Signal Blanking for Oscilloscope:** amplitude, > 13V into 0pen circuit.

**PHYSICAL, ENVIRONMENTAL:**
- **Dimensions:** Width — 11.25" (300mm), Height — 4.3 " (110mm), Depth — 9.5 " (240mm).
- **Weight:** 66 pounds approx. 2.95 kg approx.
- **Power Requirements:** 115/230V, ±10%, 50 to 60 Hz, 35 Watts.
- **Ambient Temperature Range:** 0°C to +40°C operating, -30°C to +75°C storage.
- **Price:** $985.00 f.o.b. Boonton, New Jersey. U.S.A.

**TAPE KITS**
Each Model 7050A Electronic Signal Recorder is furnished with one complete Tape Kit, as shown here. The kit contains five recording loops (each usable for more than eight hours of continuous operation) and one cleaning loop (used for cleaning the tape heads, about every eight hours of continuous operation). Order as Model 70501A Tape Kit, $10.00 each. (Quantity discounts are obtainable on kits or on bulk quantities of tape loops on request, from factory.)

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