Ballantine
Electronic
Instruments
1972

CONDENSED CATALOG 142

BALLANTINE LABORATORIES, INC.
FOUR DECADES OF INNOVATION IN ELECTRONIC INSTRUMENTATION
The Name
Ballantine

... has been associated with
the most advanced thinking
in electronic instrumentation
for forty years. That has
never been more true than
it is today, as modern Ballantine
designs reach into the most
advanced technologies, providing new
metrological and analytical capabilities
with greater convenience and certainty.
The record of consistent achievement
set down here speaks for itself.

Ballantine
Four Decades of
Innovation in
Electronic
Instrumentation

1932 Stuart Ballantine develops the first practical vacuum-
tube voltmeter, for use in audio-frequency research on
microphones.
1935 Stuart Ballantine applies for patents on the first
logarithmic-scale VTVM, based on his earlier invention of the variable-μ vacuum tube.
1938 Ballantine introduces the first commercial logarithmic
voltage-scale VTVM — the classic Model 300. Over 30,000
of these instruments had been sold when the design was
finally discontinued, in 1966! Serial number 4 of the Model
300 is on permanent display at the Smithsonian Institution,
in Washington, D.C.
1942 Ballantine produces the first commercial VTVM to pro-
vide sub-millivolt sensitivity over the audio-frequency and
low radio-frequency bands.
1943 Ballantine introduces the first commercial instrument
capable of reading peak and peak-to-peak voltages in the
0.01Hz–20Hz infrasonic region.
1948 Ballantine introduces the first logarithmic-scale RF/HF
VTVM — submillivolt sensitivity and high accuracy up to
5MHz.
1953 Ballantine develops the first commercial direct-reading
True-RMS VTVM, combining the sensitivity and the auto-
matic-current-limiting characteristics of the electronic ampli-
fier with the RMS accuracy of the vacuum thermocouple.
1957 Ballantine produces the first AC instruments with
selectable response — peak/peak-to-peak/average/RMS.
1960 Ballantine introduces the first commercial instrumen-
tation for measuring true-RMS values of broadband noise,
pulses, and other harmonic-rich waveforms.
1962 Ballantine produces the first commercial Attenuator-
Thermoelement (A-T) Voltmeter, (Selby-Behrent NBS type),
thereby extending accurate AC measurement and calibration
to 1000MHz.
1963 Ballantine produces the first commercial UHF Micro-
potentiometer (Selby NBS type) thereby extending the
accurate calibration of signal generators, AC Voltmeters, and
oscilloscopes up to 900MHz.
1965 Ballantine develops the first commercial AC/DC
direct-reading digital AC instrumentation.
1966 Ballantine introduces the first automatically-balanced
AC/DC transfer standard — primary-standard AC measure-
ments with the direct-reading convenience of general-purpose
laboratory equipment.
1969 Ballantine introduces the first commercial broadband
direct-reading digital AC instrumentation.
1970 Ballantine introduces the first commercial broadband
digital AC instruments with 1 microvolt resolution and four-
digit accuracies.
1970 Ballantine introduces the first completely self-protect-
ed auto-balance AC/DC transfer standard, NBS traceable to
±0.005PPM (the present limit of the state of the art).
## Computer-Compatible Digital

### AC Instrumentation

<table>
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<tr>
<th>Model</th>
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<td>Model 3571 A True Average AC Converter</td>
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### True RMS Wideband AC Voltmeter/Amplifiers

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<tr>
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<tr>
<td>323 (Wideband, 10Hz-20MHz)</td>
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<td>321A (True RMS-Average-Peak)</td>
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<td>320A (Medium bandwidth)</td>
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<td>340 (RF Millivoltmeter)</td>
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### Logarithmic Voltmeter/Amplifiers

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<td>303 (Wideband, High Accuracy)</td>
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<td>310B (Wideband, High Accuracy)</td>
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<td>314A (Wideband, High Accuracy)</td>
<td>14</td>
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<tr>
<td>300H (Low cost)</td>
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### Limited-Production "Classics"

<table>
<thead>
<tr>
<th>Model</th>
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<tr>
<td>300E (300mV-300V)</td>
<td>15</td>
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<tr>
<td>300G (High Accuracy)</td>
<td>15</td>
</tr>
<tr>
<td>302C (100mV-1kV)</td>
<td>15</td>
</tr>
<tr>
<td>305A (Peak Response)</td>
<td>15</td>
</tr>
<tr>
<td>316 (Peak Infra sonic)</td>
<td>15</td>
</tr>
<tr>
<td>317 (Wideband, 100mV)</td>
<td>15</td>
</tr>
<tr>
<td>345 (AC/DC/Ohms)</td>
<td>15</td>
</tr>
</tbody>
</table>

## Wideband Portable Oscilloscopes & Cameras

<table>
<thead>
<tr>
<th>Model</th>
<th>PAGE</th>
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<tbody>
<tr>
<td>1066A Dual-trace, Portable Oscilloscope</td>
<td>10-11</td>
</tr>
<tr>
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<td>11</td>
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<td>11</td>
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</table>

### Oscilloscope Calibrators

<table>
<thead>
<tr>
<th>Model</th>
<th>PAGE</th>
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<tbody>
<tr>
<td>6125A</td>
<td>12</td>
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</tbody>
</table>

### AC/DC Precision High-Voltage Calibrators

<table>
<thead>
<tr>
<th>Model</th>
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<tbody>
<tr>
<td>Series 421</td>
<td>13</td>
</tr>
</tbody>
</table>

### Primary AC/DC Transfer Standards & Accessories

<table>
<thead>
<tr>
<th>Model</th>
<th>PAGE</th>
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</thead>
<tbody>
<tr>
<td>1600A ATS Auto-Balance AC-DC Transfer Standard</td>
<td>8</td>
</tr>
<tr>
<td>440 Micropotentiometers</td>
<td>9</td>
</tr>
<tr>
<td>Series 1394 Coaxial Thermal Converters</td>
<td>9</td>
</tr>
<tr>
<td>Series 1395A Thermal Converters</td>
<td>9</td>
</tr>
<tr>
<td>Model 390 Laboratory Voltage Standard</td>
<td>9</td>
</tr>
</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Model</th>
<th>PAGE</th>
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<tbody>
<tr>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

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**The Ballantine Product Line**

... is today the broadest and most diversified in the company's long history. As this summary indicates, the main emphasis of Ballantine Laboratories' design and production continues to be directed toward more and more sophisticated AC and Waveform measurement. A fair balance has been maintained between frequency-domain and time-domain instrumentation.

Ballantine's leadership in these fields is perhaps best reflected by the fact that seven of the instruments listed here are true "state-of-the-art" designs, and five of them are unique in their respective classes.

Many of the designs described in this catalog are new — introduced within the past 12 months. Others are third- and fourth-generation refinements of well-established instruments. In 1972, at least four more Ballantine instruments, now in the final stages of development and field evaluation, will be introduced. Watch for them — they are sure to expand your measurement capabilities.

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**Note:** All specifications and prices subject to change without notice. All prices are domestic U.S. prices, f.o.b. Boonton, New Jersey.
Series 3500
Computer-Compatible Precision AC/DC Modular Digital Instrumentation

This modular, computer-programmable measurement system attains the highest accuracy and the greatest sensitivity, over the broadest bandwidth of any digital AC measurement system available — by an order of magnitude in most respects! The Model 3600 Digital-Readout/DC-DVM module is designed to be combined with the Model 3571A True-Average AC Converter module to provide a complete direct-reading AC/DC voltage measurement system of unusually high resolution, accuracy, and convenience.

All ranges of this system are remotely programmable, and BCD outputs are standard. This high-performance equipment is the logical first choice for programmable and computer-compatible automated AC measurement systems requiring the highest accuracy and dependability. Its moderate price also recommends it for use in manual laboratory and production-test applications.

The Model 3571A True-Average Converter module has a bandwidth of 30Hz to 10MHz — a significant contribution to the state of the art in digital broadband-average systems. Its sensitivity is 10mV full scale, which provides 1 microvolt resolution. Its mid-range accuracy is ±0.2% rdg ±0.01% f.s. over 50Hz to 100kHz, higher than any other average-responding device in this class.

The Model 3600 Digital Display/DC-DVM module is more than a compatible digital voltmeter for displaying the DC output of the AC converters. It presents a complete data and control interface to any remote digital programming/computing device. Without the converter, it provides four ranges of precise, stable, digital DC voltage measurement, with 4½-digit resolution (±9999 full-range). Its most sensitive range is 1.9999 Volts, which provides 100μV resolution. Internal self-calibration, against a 100 PPM standard, is an available option. Excellent CMRR and NMRR ensure freedom from errors due to ground loops, noise, etc.
<table>
<thead>
<tr>
<th><strong>Model 3571A</strong></th>
<th><strong>Model 3600</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ranges</strong></td>
<td>10mV, 100mV, 1V, 10V, 100V, 300V</td>
</tr>
<tr>
<td><strong>Overrange</strong></td>
<td>10% on all ranges</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>±0.01% of range, 1 µV on 10mV range (with Model 3600)</td>
</tr>
<tr>
<td><strong>Digits</strong></td>
<td>4 plus 1</td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>30Hz to 10MHz</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±0.01% of range + 0.1% f.s. ±(0.01% rdg + 0.01% f.s. + 1 digit)</td>
</tr>
<tr>
<td><strong>Temperature Coefficient</strong></td>
<td>±0.005% rdg + 0.002% of range/°C midband</td>
</tr>
<tr>
<td><strong>Crest Factor</strong></td>
<td>Approximately 1:1 full scale, Approximately 2:1 downscale.</td>
</tr>
<tr>
<td><strong>Polarity</strong></td>
<td>Automatic</td>
</tr>
<tr>
<td><strong>CMRR</strong></td>
<td>&gt;60 dB at 60 Hz</td>
</tr>
<tr>
<td><strong>Input Impedance</strong></td>
<td>2 Megohms shunted by 25 pF</td>
</tr>
<tr>
<td><strong>Response Time</strong></td>
<td>0.5, 1, or 3 sec. front-panel selected, to within 0.2% of full scale accuracy.</td>
</tr>
<tr>
<td><strong>Reading Speed</strong></td>
<td>200 msec (50 or 33 msec available on request)</td>
</tr>
<tr>
<td><strong>DC output</strong></td>
<td>±10% for 100% f.s. input, 10 kilohm source impedance, accuracy as above.</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>Supplied by either Model 3600 DVM or Model 3579 Power Module. Self-powered. Requires 115/230 Volts ±10%, 50–600Hz</td>
</tr>
<tr>
<td><strong>Warm up</strong></td>
<td>30 minutes to full specifications.</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Temperature: -4°C to +40°C, Operating: 0 to 90% (75% for 3600)</td>
</tr>
<tr>
<td><strong>BCD Output</strong></td>
<td>BCD outputs of AC measurement are available at the rear panel of the 3600. They are 1-2-4-8 positive, DTL &amp; TTL compatible.</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>3½&quot; high x 8¾&quot; wide x 12&quot; deep (9 cm x 22 cm x 31 cm).</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>6 pounds (2.8 Kilograms)</td>
</tr>
<tr>
<td><strong>Options</strong></td>
<td>Manual or programmable ranging. Time constants actuated by contact closure.</td>
</tr>
</tbody>
</table>

**PRICES:** Model 3571A $800; Model 3600 $445; Model 3579 $245.
Wideband True RMS Voltmeters Series 323

- Meaningful RMS Measurements — Including Harmonics and High Crest Factors.
- True Portability — Line/Recharge-Battery Operation.
- Highest Readability — Logarithmic Voltage Scales for Consistently High Resolution; Linear dB Scales.
- Greatest Versatility — 10 Hz to 20 MHz; 100 μV Sensitivity; 1% Basic Accuracy.
- High Reliability — no vulnerable thermocouples; 500 V overvoltage protection, all ranges.

Series 323 True-RMS Wideband analog AC voltmeters are the most sophisticated, widest bandwidth instruments of their kind. They feature the world-famous Ballantine logarithmic voltage scale (linear dB scale) providing constant reading accuracy, end to end, and they employ the most advanced broadband, high-crest-factor, true-RMS measurement circuit ever provided in this class of instrumentation. (This circuit actually measures the RMS value, and is not to be confused with "RMS calibrated," average-responding devices.)

The all-solid-state Series 323 Voltmeter/Amplifiers have a bandwidth of 2 Hz to 20 MHz (usable to beyond 50 MHz at reduced accuracy) — widest bandwidth in the field. The accuracy from 50 Hz to 2 MHz is ±1% f.s. or ±2% rdg, with gradually broadened tolerances above and below that band. Its high sensitivity and logarithmic scale permits readings as low as 100 μV to full accuracy! The wide bandwidth and high crest-factor ratio ensures valid RMS readings even for noise waveforms, pulses, and other signals rich in harmonics.

Models 323, 323L, and 323-06 may be operated from line power or rechargeable battery; Models 323-01, 323L-01, and 323-07 from line only. Models 323-06/07 provide dBm scales, referenced to 1 milliwatt into 600 ohms as 0 dBm.

Optional accessories include the Model 1301 High-voltage, 80 dB Attenuator Probe for measurement to 10,000 Volts (up to 1 MHz). Series 600 plug-in Shunt Resistors for current measurement; and the Model 800 rack mounting kit for installing one (or two) 323 voltmeters in a 19" rack.

The Model 1301 High-voltage, 80 dB Attenuator Probe for measurement to 10,000 Volts (up to 1 MHz). Series 600 plug-in Shunt Resistors for current measurement; and the Model 800 rack mounting kit for installing one (or two) 323 voltmeters in a 19" rack.

Other features include: rechargeable battery option; adjustable time constant; isolated signal ground; and positive overvoltage protection. Series 323 Voltmeters are the instruments of choice for modern laboratory, production, and field measurements of true-RMS AC ... acknowledged standards of the industry.

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**MODELS**

<table>
<thead>
<tr>
<th>Series</th>
<th>Voltage Range</th>
<th>Decibel Range</th>
<th>Frequency Range</th>
<th>Accuracy</th>
<th>Input Impedance</th>
<th>Crest Factor</th>
<th>Scales Logarithmic</th>
<th>Decibels</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>323-01</td>
<td>300μV to 300V</td>
<td>-70 dB to +50dB, referred to 1 V</td>
<td>10 Hz to 20 MHz</td>
<td>100 Hz</td>
<td>2 megohms shunted by 15 pF, 125 pF, 1-30 mV f.s. ranges</td>
<td>5:1 at full scale</td>
<td>1-3 and 3-10V</td>
<td>0-0.1 dB</td>
<td>Series 600 Shunt resistors for current measurements; 100 μA to 10A.</td>
</tr>
<tr>
<td>323-06</td>
<td>100 μV to 330V, 12 ranges plus &quot;METER on top&quot; mode</td>
<td>-78 dBm to +52dBm, 608 μV - 1 mW, 690 μV</td>
<td>±10 Hz to 20 MHz</td>
<td>100 Hz</td>
<td>12% rdg whichever is better, increasing to 15% at 20 MHz</td>
<td>0-10 dB</td>
<td>0-0.1 dB</td>
<td>-8.2 to +2.6 dB</td>
<td>Model 1301 HV Probe for measurements to 10A.</td>
</tr>
<tr>
<td>323-07</td>
<td>330 μV to 300V</td>
<td>-70 dB to +50dB, referred to 1 V</td>
<td>2 Hz to 20 MHz</td>
<td>100 Hz</td>
<td>2 megohms shunted by 15 pF, 125 pF, 1-30 mV f.s. ranges</td>
<td>5:1 at full scale</td>
<td>1-3 and 3-10V</td>
<td>0-0.1 dB</td>
<td>Model 800 Rack Mounting Kit. Accommodates one or two Series 323 instruments in a 19&quot; rack (7 1/4&quot; high).</td>
</tr>
</tbody>
</table>

**Other Features**

- Ratios of the industry.
- 300 μV to 300 V.
- -79 dBm to +52 dBm.
- 608 μV to 1 mW.
- 1 mW.
- ±10 Hz to 20 MHz.
- 12% rdg whichever is better, increasing to 15% at 20 MHz.
- 0-10 dB.
- -8.2 to +2.6 dB.
- -0.1 V to 1.0 V, ±1 dB.
- ±10 Hz to 20 MHz.
- ±10 Hz to 20 MHz.
- 0-10 dB.
- -8.2 to +2.6 dB.
- -0.1 V to 1.0 V, ±1 dB.
- ±10 Hz to 20 MHz.
- ±10 Hz to 20 MHz.
- 0-10 dB.
- -8.2 to +2.6 dB.
- -0.1 V to 1.0 V, ±1 dB.
- ±10 Hz to 20 MHz.
- ±10 Hz to 20 MHz.
- 0-10 dB.
- -8.2 to +2.6 dB.
- -0.1 V to 1.0 V, ±1 dB.
- ±10 Hz to 20 MHz.
- ±10 Hz to 20 MHz.
- 0-10 dB.
- -8.2 to +2.6 dB.
- -0.1 V to 1.0 V, ±1 dB.
- ±10 Hz to 20 MHz.
- ±10 Hz to 20 MHz.
- 0-10 dB.
- -8.2 to +2.6 dB.
- -0.1 V to 1.0 V, ±1 dB.
**Logarithmic AC Voltmeter/Amplifiers**

**Series 303**

- **Highest Readability** — Logarithmic Voltage Scales for Consistently High Resolution; Linear dB Scales.
- **True Portability** — Line/Rechargeable-Battery Operation.
- **Greatest Versatility in Its Class** — 2Hz-6MHz; 300µV to 10kV Ranges; 1% Basic Accuracy.

Series 303 instruments provide not only high-accuracy, broadband AC measurements (average-responding, RMS-calibrated) but also function as precise-gain broadband AC amplifiers of excellent linearity and stability. Despite their moderate price, they provide performance that is unsurpassed in this class of analog AC instruments. The unique Ballantine logarithmic-voltage display (linear-dB scale) ensures uniform resolution and highest usable accuracy over the entire extent of every range.

The solid-state Model 303 has a range of 100µV to 350 Volts (to 1000 or 10,000 Volts with optional probes) over a frequency range from 2Hz to 6MHz and is usable with reduced accuracy to beyond 12MHz. All ranges are protected to 350 Volts. The midband accuracy is 2% of reading from 30Hz to 1MHz, with broader tolerances above and below that band. The amplifier mode provides ±0.5dB of gain, over 2Hz to 6MHz, with a linearity of better than ±0.5dB, up to 100mV output. Low or rechargeable-battery operation - Model 303 (Model 303-01, line only). Optional Model 600 shunt resistors for current-measurement (10µA to 1A).

Half-rack packaging allows one or two 303 voltmeters to be mounted in a 19" rack with the Model 800 Rack Mounting Kit.

Thousands of Series 303 instruments are in service in leading electronics facilities all over the world... proof of their great value and versatility.

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**MODELS**

<table>
<thead>
<tr>
<th>Voltage Range</th>
<th>Frequency Range</th>
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</thead>
<tbody>
<tr>
<td>300µV-350V</td>
<td>2Hz-6MHz</td>
</tr>
<tr>
<td>12 ranges, 1mV FS to 350V</td>
<td>1Hz-10MHz (3dB bandwidth)</td>
</tr>
<tr>
<td>10µV - 1000V</td>
<td>10µV - 1000V</td>
</tr>
<tr>
<td>11 ranges, 10mV FS to 1kV</td>
<td>10µV - 1000V</td>
</tr>
</tbody>
</table>

**Accuracy** (±% of reading)

- 30Hz-1MHz: ±1%
- 20Hz-20MHz: ±2%
- >20MHz: ±5%

**Input Impedance**

- 10 MΩ (15-25pF)
- 15-25pF (without probe)

**Amplifier Mode**

Gain 40dB: 0.5dB, 2Hz-6MHz. Full scale output 6.1V RMS. AC coupled. Source resistance 150Ω. Input noise < 30 µV. Model 303-09 has DC as well as AC input.

**Power Requirements**

120V/24V, 50-60Hz, 3W, or rechargeable nickel cadmium battery. (Model 303-01 and 303-09, line power supply only).

**Dimensions**

6.1" high x 7.8" wide x 10.2" deep (155.5 cm x 198 cm x 25.8 cm.)

**Weight**

303 and 303-50: 8 lbs. (3.6 kg nett, 12 lbs. (5.4 kg shipping).
303-01 and 303-51: 7 lbs. (3.2 kg nett, 11 lbs. (5.0 kg shipping).

**Rack Mounting**

Model 600 Rack Mounting Kit accommodates one or two Series 303 instruments in a 19" rack.

**Prices**

- 303: $315
- 303-01: $315
- 303-09: $325
- 303-50: $445
- 303-51: $385

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Note 1: Model 303-09 is an environmentalized, 48Hz version of 303-01, 100µV-350 Volts (1mV FS to 350V FS).

Note 2: Accuracy in "Meter + 10dB" Mode is ±0.5% ±10Hz-100k; ±2% ±100k-200k; ±3% ±1M-500kHz; ±5% ±1M-10MHz.

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**PRICES**

Model 303: $395; Model 303-01: $315; Model 303-09: $425; Model 303-50: $445; Model 303-51: $385;
**Auto-Balance AC/DC Transfer Standard**

**Model 1600A ATS**

- Automatic Direct-Reading True-RMS measurements.
- Primary-Standard Accuracy and Stability; NBS-Referenced Calibration.
- Minimum Operator Manipulation — eliminates Error.
- Saves Time — eliminates multi-step procedures.
- Simplified Operation — no calibration adjustments.

Model 1600A ATS is a unique Ballantine development. It provides all of the primary-standard accuracy and stability of the finest manual AC/DC transfer standards, including traceability to NBS ultimate references — yet does not require the laborious and error-provoking manual-balancing manipulations otherwise required for primary-level AC measurements.

In essence, the Model 1600A ATS automatically compares the heating effect of an internally servoed DC voltage with that of the AC input, and at balance, generates a DC voltage having the same heating value as the AC input, over broad ranges of frequency and crest factor. The DC may then be read on an external primary-standard potentiometer, or a DVM of appropriate accuracy and resolution. The realizable absolute accuracy of the 1600A ATS, with reference to the NBS AC/DC difference standard, is better than ±100PPM, over a frequency range of 20Hz to 20kHz. At somewhat increased uncertainty, the bandwidth is 3Hz to 30MHz. The system is usable to beyond 100MHz.

The same thermoelement and coaxial attenuators are used for sensing both the applied AC and the internally developed DC balancing voltage. Both attenuators and thermoelement are housed in a Transfer Assembly (Model 11600A) that may be easily removed for use as a conventional AC/DC transfer standard or for shipment to the National Bureau of Standards for calibration and certification.

This unique instrument makes possible, for the first time, automatic and direct-reading True-RMS AC measurements at the limit of the state of the art . . . without operator error, in seconds. Every standards laboratory and central calibration facility should investigate the advantages of this unique modern automated instrument.

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### Input Voltage Ranges (12 Ranges)

<table>
<thead>
<tr>
<th>Input Voltage Range</th>
<th>0.25 – 0.5/1/2/4/8/16/32/64/125/250/500/1000 volts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Sensitivity</td>
<td>200 ohms/volt ± 5% (0.25V – 32V ranges) ±5% (32V – 1000V ranges)</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>DC and 5 Hz to 30 MHz, usable 2 Hz to 100 MHz.</td>
</tr>
<tr>
<td>Calibration Accuracy</td>
<td>Manual mode, referenced to NBS certified standard</td>
</tr>
<tr>
<td>NBS certified standard</td>
<td>DC, 6 Hz to 20 Hz, ±0.05%</td>
</tr>
<tr>
<td>Auto Transfer Mode</td>
<td>DC, 20 Hz to 1 MHz, ±0.05%</td>
</tr>
<tr>
<td>Auto Transfer Mode</td>
<td>DC, 1 MHz to 10 MHz, ±0.2%</td>
</tr>
<tr>
<td>Auto Transfer Mode</td>
<td>DC, 10 MHz to 30 MHz, ±0.5%</td>
</tr>
<tr>
<td>Balance time</td>
<td>Special calibration to uncertainty of 0.005% available at additional cost.</td>
</tr>
<tr>
<td>(auto balance modes)</td>
<td>Manual-mode accuracy plus 0.005% of range.</td>
</tr>
<tr>
<td>DC Output Voltage</td>
<td>10 to 15 sec typical (depends on thermocouple output constant).</td>
</tr>
<tr>
<td>DC Output Resistance</td>
<td>Equal to True-RMS value of input voltage (0.25 to 1000 volts @ up to 2 mA).</td>
</tr>
<tr>
<td>DC Output Resistance</td>
<td>0.1 ohm to 10 volts, 1.0 ohm to 100 volts, 10 ohms to 1000 volts.</td>
</tr>
<tr>
<td>DC Output Stability</td>
<td>±50PPM Short term (1 to 3 sec at constant ambient temp.).</td>
</tr>
<tr>
<td>DC output ripple &amp; noise (rms)</td>
<td>90dB below full scale or 100 JF, whichever is greater.</td>
</tr>
<tr>
<td>DC meter accuracy</td>
<td>±5% if –1–0 scale with front panel multiplier indicator.</td>
</tr>
<tr>
<td>Null resolution</td>
<td>0.005% minimum per minor scale division for 5 divisions either side of zero.</td>
</tr>
<tr>
<td>Overload protection</td>
<td>Peak-sensing circuit trips at approximately 125% of selected range for sinusoidal input signals.</td>
</tr>
<tr>
<td>Overload protection</td>
<td>Protects each range 1000% overload or 1500 volts, whichever is less.</td>
</tr>
<tr>
<td>Overload protection</td>
<td>DC, 10 MHz to 30 MHz, ±0.2%</td>
</tr>
<tr>
<td>Overload protection</td>
<td>DC, 100 MHz to 1000 MHz, ±0.5%</td>
</tr>
<tr>
<td>Overload protection</td>
<td>DC, 10 MHz to 30 MHz, ±0.5%</td>
</tr>
<tr>
<td>Overload protection</td>
<td>DC, 10 MHz to 30 MHz, ±0.5%</td>
</tr>
<tr>
<td>Overload protection</td>
<td>DC, 10 MHz to 30 MHz, ±0.5%</td>
</tr>
<tr>
<td>Overload protection</td>
<td>DC, 1 MHz to 10 MHz, ±1%</td>
</tr>
<tr>
<td>Overload protection</td>
<td>DC, 10 MHz to 30 MHz, ±1%</td>
</tr>
<tr>
<td>Overload protection</td>
<td>DC, 10 MHz to 30 MHz, ±1%</td>
</tr>
<tr>
<td>Overload protection</td>
<td>DC, 1 MHz to 10 MHz, ±1%</td>
</tr>
<tr>
<td>Credibility</td>
<td>Greater than 10:1 with overload protection circuitry disabled 2:1 in normal mode.</td>
</tr>
<tr>
<td>Remote operation of</td>
<td>By external contact closure through rear connections.</td>
</tr>
<tr>
<td>AC–DC transfer</td>
<td>Power requirements 115 or 230 VAC (switch selectable), 50 or 60 Hz, 0.45 amps @ 115 V.</td>
</tr>
<tr>
<td>Warmup time</td>
<td>Nominally 20 minutes.</td>
</tr>
<tr>
<td>Output temperature</td>
<td>±10°C to ±40°C.</td>
</tr>
<tr>
<td>Size</td>
<td>17&quot; wide x 17&quot; deep x 7&quot; high (43.2cm x 13.2cm x 17.8cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>40 lbs. (18kg) net; 56 lbs. (25.2kg) shipping.</td>
</tr>
</tbody>
</table>

**NOTES:** Accuracies of the 1600A are referenced to the midpoint of a General Radio 874 T-coaxial connector, and a Ballantine 11600A Transfer Assembly, certified by NBS to have an AC/DC difference uncertainty of less than ±0.005% to 20 kHz.

Correction data are available from Ballantine for the 25 to 8 V ranges to provide accuracies within ±1% from 10 MHz to 30 MHz. This is an extra-cost option. Correspondence is invited on other correction data, on use beyond 30 MHz, and on remote programmability of attenuators.

NBS Test Reports can be obtained on the 11601A ATS Transfer Assembly with an uncertainty on AC–DC difference of less than ±0.005% up to 20 kHz.

**PRICES:** Model 1600A, $3950; Model 11600A, $2495. NBS Test Report on 11601A, $250.
Model 440 Micropotentiometers

The Model 440 Micropotentiometers are the only commercially available devices capable of developing accurately known NBS-traceable millivolt-level signals from DC to 900MHz. Based on the Selby National Bureau of Standards design, the Model 440 consists of a UHF thermocouple in series with a special thick-film radial resistor. When the combination is connected to an external signal source, the voltage drop across the resistor, which constitutes the coupling-resistor combination selected of 17μV and 1AV RMS. Ideal for calibration of AC voltmeters, oscilloscopes and signal generators. Calibration to various frequencies and voltages. Calibrated by NBS is required, but not included in the base price. Design is based on that of Myron C. Selby and L.F. Behrent of NBS.

These primary-standard devices belong in every calibration and standards facility concerned with RF-UHF measurement. They are widely accepted as ultimate transfer standards, throughout the world.

Series 1394 Coaxial Thermal Converters

Using AC/DC transfer techniques, these wide range RMS voltage standards provide voltage measurements accurate to ±0.02% as well as precise frequency influence tests. Based on design and development by F. L. Hermach of the National Bureau of Standards.

<table>
<thead>
<tr>
<th>Model</th>
<th>Nominal Voltage</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1394-0.5</td>
<td>0.5 volts</td>
<td>0.1 to 0.67 volts</td>
</tr>
<tr>
<td>1394-1</td>
<td>1.0 volts</td>
<td>0.2 to 1.35 volts</td>
</tr>
<tr>
<td>1394-2</td>
<td>2.0 volts</td>
<td>0.4 to 2.7 volts</td>
</tr>
<tr>
<td>1394-5</td>
<td>5.0 volts</td>
<td>1 to 6.7 volts</td>
</tr>
<tr>
<td>1394-10</td>
<td>10.0 volts</td>
<td>2 to 13.5 volts</td>
</tr>
<tr>
<td>1394-20</td>
<td>20.0 volts</td>
<td>4 to 27 volts</td>
</tr>
<tr>
<td>1394-50*</td>
<td>50.0 volts</td>
<td>10 to 67 volts</td>
</tr>
<tr>
<td>1394-100*</td>
<td>100.0 volts</td>
<td>20 to 135 volts</td>
</tr>
</tbody>
</table>

*Models 1394-50/100 calibrated to ±10MHz, usable to 100MHz.

Uncertainty of AC/DC Transfer Difference—
as referenced to NBS certified converter:
DC, 20Hz—50kHz, ±0.01%
DC, 6Hz—10MHz, ±0.05%
DC, 10MHz—30MHz, ±0.2%
DC, 30MHz—60MHz, ±0.5%
DC, 60MHz—100MHz, ±1.0%

Series 1395A Thermal Converters.

Broadband primary-standard true-RMS-to-DC converters feature essentially constant input impedance and extremely high accuracy over wide frequency response. They provide fundamental, low-cost, NBS-traceable means for RMS calibration of AC and RF voltmeters, secondary-standard AC sources, signal generators, amplifiers, detectors etc.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>With Reference to Standard</th>
<th>Max. Uncert.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20Hz—1MHz</td>
<td>Within ±0.01%</td>
<td>±0.06%</td>
</tr>
<tr>
<td>5Hz—10MHz</td>
<td>Within ±0.05%</td>
<td>±0.12%</td>
</tr>
</tbody>
</table>

Voltage Ranges:
Model 1395A-3: 3 Volts RMS max input.
Model 1395A-1: 1 Volt RMS max input.
Model 1395A-0.45: 0.45 Volt RMS max input.
Model 1395A-6: 6 Volts RMS max input.
Input Impedance: 55Ω to 15Ω, to 10MHz
Output Impedance: Less than 1Ω.
Open Circuit Output Voltage (full-scale input): 7.0mV ±12%
Max AC/DC Reversal Error: 0.05%
Dimensions: 1.5 in. Deep x 1.44 in. High x Long (exclusive of connectors)
Weight: 2.2 ounces.
Connectors: Male BNC, input; 2 bayonet lugs, output.
OPTIONS: NBS-traceable calibration report to 60MHz (Option 01), to 100MHz (Option 02). Include individual correction chart covering frequency range specified.

UHF Calibration Standards

PRICE: Model 440 Micropotentiometer, includes one housing with thermocouple and resistor (less NBS calibration), $395.
Each additional resistor: standard value, $175; special value, $195.
Model 440-01 Micropotentiometer Kit: 3 resistors, 3 thermocouples, housings in mahogany case (less NBS calibration), $1160.
Model 390 A-T Voltmeter, $195.
Model 2390 Tere Adapter, $300.
Series 1394 Coaxial Thermal Converters: 0.5 to 10V nominal voltage, $165: 50 and 100V, $195.
Series 1395A Thermal Converters: $120 each (except 1395A-6, $150).
Wideband Portable Dual-Channel Oscilloscope Model 1066A

- Easy to Use — Greatly Simplified Panel Layout.
- Lowest Cost in this Class of Instruments.
- Truly Portable — Small, Light, Rugged, Designed for Dependable Operation in Adverse Environments.

The Model 1066A dual-channel portable CRO has all the features normally found only in instruments costing twice as much. This solid-state professional oscilloscope incorporates a 4kV CRT supply for bright display on even the fastest sweeps — to 50 nanoseconds/cm, for precise fast-rise pulse work. It is designed around a premium cathode-ray tube of advanced design, providing exceptional linearity and resolution.

### SPECIFICATIONS

**CATHODE RAY TUBE**

- 5-inch rectangular CRT. Illuminated graticule with 6 x 10cm display area. 4kV accelerating potential.
- P31 phosphor standard, P7 optional. Removable bezel permits attachment of oscilloscope cameras and viewing hoods as well as interchange of graticules.

**VERTICAL DELFECTION**

Dual Channels (identical): Y1 and Y2.
- Bandwidth (at 3dB down): DC to 15MHz; 5Hz to 5MHz in cascaded mode. 2Hz to 5MHz with AC coupling (less than 0.2Hz with attenuator probe).
- Rise Time: 24nsec; 70nsec in cascade.
- Deflection Factor: 5mV/cm to 20V/cm in 12 calibrated steps, 1:2:5 sequence. Extended to 1mV/cm in cascaded mode, and to <50V/cm with 2.5:1 vernier range.
- Accuracy: within 3% (within 6% in cascade).
- DC Drift: <2mm/hour after 30 min. warmup (constant line voltage and constant ambient temp. in 20°C to 30°C range). <1mm/minute within 1st hour after 30 min. warmup (constant ambient temp. and line voltage).
- Input RC: 1MΩ ±2%/28pF (AC/DC/Ground coupling).

Maximum Input: 400V (DC and AC peak).
- Delay Line: Permits viewing leading edge of triggering waveform. PC type; introduces non-distorting, balanced signal delay of approx. 150nsec.

**Display Modes:**

- Single Trace: Y1 or Y2.
- Cascaded: Y2 and Y1.
- Dual Trace: Chopped mode, selected automatically on 1msec/cm to 1 sec/cm time base ranges; 250kHz rate; Alternate mode from 0.5 msec/cm to 0.5μsec/cm. Z-axis blanking provided.
- X-Y: via Y1 and Y2 identical channels.
- External: X against Y1 or Y2, Y1 and Y2 dual trace, or cascaded Y2 and Y1.

**HORIZONTAL DEFLECTION**

- Time Base: 0.5μsec/cm to 1/sec/cm in 20 calibrated steps, 1:2:5 sequence. Accuracy, within 3% over center 8cm of CRT scale. 2.5:1 vernier extends range to 2.5sec/cm and 25 sec. full scale.
- x10 Magnifier: Extends range to 50nsec/cm. Accuracy within 5% over center 8cm of CRT scale. Permits full screen 10cm display of any 1cm segment of normal time base. Expands normal time base around center (±1.5cm) scale.
Other salient characteristics include:

Protected-FET input circuitry for minimum drift, fast stabilization time, and low power consumption; single trace, dual trace, and X-Y display modes; built-in signal delay; DC to 15MHz bandwidth and ±3% accuracy; 5mV/cm sensitivity; amplifiers may be cascaded for 1mV/cm max. sensitivity (5Hz-5MHz); wide time-base ranges, from 1 second to 50ms/cm; internal calibrator; comprehensive trigger controls, including TV Sync., will trigger positively on as little as 2mm peak-to-peak.

The Model 1066A is especially well suited to such demanding applications as field maintenance of computers, peripherals, data terminals, and other digital equipment; communications equipment maintenance, on modems, telemetry, and pulsed-carrier data links; maintenance of process servos, aircraft control and guidance devices, and other A/D/A closed-loop systems; and field and studio maintenance of closed-circuit and broadcast TV equipment.

The Model 1066A may be ordered with a full range of accessories, including probes, viewing hoods, and compatible CRO cameras. Its compact design (only 7" x 11\(\frac{1}{4}\)" x 17"), its light weight (only 20 pounds), and its high-strength construction recommend it for every field and bench application compatible with its high sensitivity and bandwidth.

**Model 7000A Oscilloscope Camera**

For all standard oscilloscopes with 6 x 10cm screens. (Other sizes optional.) Controls reduced to minimum. Preamplified, lens aperture preset. Polaroid Land Type 20C "Coaterless" ASA-3000 film provides prints in 30 seconds, requires no coating for permanence, at lowest cost for any quick-process 'scope camera. Hooded viewing port provides convenient viewing of CRT and graticule before exposure. High-quality Dallmeyer f 4.5, 2.4-inch lens. Object/image ratio is 1:0.65 (nominal). Three shutter speeds: 1/25 sec (fixed), time, and bulb. Adaptors are available for a wide range of oscilloscopes — or the Model 7000A camera may simply be hand-held in position during exposure.

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**Model 7000A Oscilloscope Camera Specifications**

- **Amplifier Calibrator:** Square wave, line frequency, 1V p-p ampl. 5%. Rise time approx. 20nsec.
- **Channel Y2 Output:** 25mV/cm of Y2 display (0.25V max). AC coupled, 5Hz to 5MHz.
- **Gate Output:** Positive-going nominal 10V rectangular pulse with same duration as time base. Flat top and fast rise time for probe adjustment.
- **Ramp Output:** Time base frequency ramp, positive-going nominal 50V p-p.
- **External Modulation:** Via rear-panel jack, AC coupled. Visible modulation at normal intensity with 2V p-p input. Blanking voltage, 60V p-p.
- **Power:** 95-130V, 190-260V, 45 to 440Hz, approx. 28W (35VA).
- **Dimensions:** Case: 7"H x 11\(\frac{1}{4}\)" W x 15\(\frac{1}{4}\)" D (17.8 x 28.5 x 39.4cm). Including knobs, feet, handles — 7.625" x 12.5" x 17.5" (19.6 x 31.8 x 43.7cm).
- **Weight:** 14 lb. (6.5kg); shipping, 30 lb. (13.5kg).
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.

**VOLTAGE CALIBRATOR**

An accurate DC voltage, positive, negative, or zero, and a 1kHz positive-going square wave are provided for amplitude calibration. The main output voltage control switch is designed to correspond with that on most oscilloscopes. Pushbutton switching, plus a deviation control, combine to allow the deviation meter to indicate percentage error directly. The 1kHz square wave is crystal controlled.

**TIME CALIBRATOR**

A high-stability quartz-crystal controlled time-mark generator provides time-calibration pulses. The section is split into two ranges, each with its own output. The time per division switch corresponds to that on most oscilloscopes. Pushbutton switching, plus a deviation control, combine to allow the percentage error to be read directly from the deviation meter.

**RISETIME CALIBRATOR**

A 1Hz-1MHz squarewave having faster than 1 nanosecond risetime is provided for risetime measurements. Both the risetime and the bandwidth of the amplifier can be checked, using this fast pulse. The time base of the oscilloscope is first calibrated with the Model 6125A and then the risetime of the calibration pulse is measured on the screen.

The ultra-high speed capabilities of the Model 6125A, permit precise calibration of realtime scopes with 100MHz bandwidths, and it is usable up to 500MHz bandwidth.

**SYNCHRONIZATION TRIGGER CHECK**

A 50/60Hz sinewave output of variable amplitude is available for the checking of trigger circuits at line frequency.

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**SPECIFICATIONS**

**VOLTAGE CALIBRATION**

- Ranges: (a) Volts/division 10mV to 20V in 1, 2, 5 steps.
- (b) Multiplier X 3, 4, 5, 6, 8, 10.
- Output Modes: AC 1kHz positive-going square wave (crystal controlled).
- DC Positive or Negative.
- Zero.
- Accuracy (with 1MΩ load): Less than 0.25% if <10mV below 50mV. Less than 0.25% ±0.1% at 50mV and above.
- Ripple and hum: Less than 0.1% ±2µV peak to peak.
- Square wave risetime: less than 5µsec.
- Square wave overshoot: Less than 0.5%.
- Regulation (for 1MΩ load): Variation between 0 and 0.25% depending on setting.
- Deviation ranges: 12% and 71%. Analog meter with indicator light.
- Deviation accuracy: ±1% FS + 2.5% of reading.
- Reference: High quality zener diode.
- Temperature coefficients: Reference ±0.002%/C.
- Output better than 0.01%/C.
- Stability: ±0.1%/year non-commutative.

**TIME CALIBRATOR**

1. **Time Output**
   - Ranges: (a) 100ns/division - 0.5sec/division in 1, 2, 5 steps.
   - (b) Multiplier X 1, 2, 5, 10.
   - Amplitude: 1 Vp.p into 50Ω.
   - Pulse Shape: Spike, width at base generally 20% of pulse interval.
   - Accuracy: Crystal locked 0.01%.
   - Deviation ranges: 12% and 71%. Analog meter with indicator light.
   - Deviation Accuracy: 3% range, ±0.1%; 10% range, ±0.2%.

2. **H.F. Output**
   - Ranges: 10, 20, 50 nsec.
   - Amplitude: 1 Vp.p into 50Ω.
   - Pulse shape: Sinewave.
   - Accuracy: Crystal locked 0.01%.

**RISETIME CALIBRATOR**

- Amplitude: Continuously variable squarewave between 200 and 250mV p.p into 50Ω.
- Risetime: 1 nanosecond positive-going.
- Period: 1 pulse to base in decade steps.
- Over shoot: less than 2%.

**LINE FREQUENCY SYNCHRONIZATION/TRIGGER CHECK**

- Amplitude: Continuously variable sinewave 0-1V p.p from 2kHz source.
- Frequency: 50 or 60Hz as line.
- Waveform: As line.

**GENERAL**

- Power: 100/125V or 200/240V, 50/60Hz, 17 Watts.
- Temperature range: Operating +10°C to +50°C; Storage -10°C to +70°C.
- Dimensions: 1/5/4 x 1/5/4 x 1/1/5/7/27 cm.
- Weight: 15 pounds (7 kilograms).

**PRICE:** Model 6125A, $1875.
Precision AC/DC
High Voltage Calibrators
Series 421

MODEL 421A

SPECIFICATIONS — Series 421

Output Modes
AC: 400Hz or 1000Hz, RMS or Peak-to-Peak.
DC: Positive or Negative.

Voltage Ranges
AC: 1.11mV to 111V, 400Hz or 1000Hz; 100 to 1110V, 400Hz only.
DC: 1.11mV to ±111V (421 A); 1.11mV to ±300V (421 B).

Accuracy (Output EMF, full range)
AC/DC to ±11V: ±0.1%.
AC 100V to 1000V, 400Hz: ±0.3%.
DC 100V to 300V: ±0.15% (421 B).

Linearity of Controls
AC modes: ±0.05% of setting
DC modes: ±0.1% of setting (1/10 full to full range).

Source Resistance
AC (all models): ±100mΩ (1kV range) to 0.6Ω ±30% (1V) and 2.2Ω ±10% (1mV).
DC (421 A): 1000mΩ ±5% (100V range) to 1Ω ±5% (100mV) and 0.22Ω ±20% (1mV).
DC (421 B): 22Ω ±10% (1kV range) to 100mΩ ±2% (1V) and 0.22Ω ±20% (1mV).

Stability: ±0.01% (1 hour), short time.

Calibration: Certificate supplied. Recommended calibration period: 1000 hours operation or 6 months.

Waveform: Distortion: ±0.15% max. Frequency: ±2%, nominal. Hum and noise: ±0.05% of full range max. Ripple (rms) on DC: 0.1% of full range ±50uV.

Warm-up Time: To 0.05% of final value in 20 minutes.

Power Requirements: 120/240V, 50-420Hz, 40W.

Error Computer: Error range: ±5.3%. Accuracy of setting: ±0.05% ±0.1 of setting.

NOTE: Error computer may be used externally with Model 421 A or may be mounted in the same rack panel with it (421 A-S3). It is built into Model 421 B.

Dimensions
Model 421 A, Portable: 13 5/8" H x 7 5/8" W x 10 1/2" D. (34.3 cm x 19 cm x 26.7 cm).
Model 421 A-S2/S3 Rack: 7" H x 19" W x 10" D. (17.8 cm x 48.25 cm x 26.7 cm).
Model 421 B, Portable: 7" H x 13" W x 10 1/2" D. (17.8 cm x 33 cm x 26.7 cm).
Model 421B-S2, Rack: 7" H x 19" W x 10" D. (17.8 cm x 48.25 cm x 26.7 cm).

Weight
Model 421 A, Portable: 19 lb. (8.6 kg); shipping — 25 lb. (11.3 kg).
Model 421 A-S2, Rack: 20 lb. (9.1 kg); shipping — 26 lb. (11.8 kg).
Model 421 A-S3, Rack: 21 lb. (9.6 kg); shipping — 27 lb. (12.3 kg).
Model 421 B, Portable: 21 lb. (9.5 kg); shipping — 26 lb. (11.8 kg).
Model 421B-S2, Rack: 21 lb. (9.6 kg); shipping — 27 lb. (12.3 kg).

- Saves Time — speeds calibrations by simplifying procedures, eliminating intermediate self-checking, obviating result interpretation.
- Simplifies Operation and Training — eliminates error calculations, prevents reading or interpretation errors.
- Convenient — fast warmup, high long-term stability eliminates need for frequent verifications.
- Flexible — wide ranges, high resolution, low source impedance, both AC and DC.

Series 421 Precision Calibrators, despite their moderate prices, provide every facility for rapid, high-confidence calibration and standardization of a wide range of AC and DC instruments. Oscilloscopes, analog voltmeters, attenuators, DPM's, and DVM's can be checked over a wide range of voltage levels, on both AC and DC scales. The 421 A provides 0 to ±111.0 Volts DC, 0 to 111.0 Volts AC at 400Hz and 1kHz, and an additional range of 100 to 1000 Volts at 400Hz. Distortion on AC is less than 0.15%, and both RMS and peak-to-peak modes are provided. The Model 421 B has an extended DC voltage range, to ±300V.

A unique development of Ballantine Laboratories, the Model 2421 Error Computing Accessory, provides quick, easy readings directly in percent of absolute error, tracking error, or tracking error in the presence of range error. Model 421 B has the error-computing facility built in.

These calibrators are the first choice of cost-conscious laboratory, production, and quality-control supervisors throughout the industry.

PRICES
Model 421 A, AC/DC HV Calibrator, $795.
Model 421 A-S2, rack mounted version, $855.
Model 2421 Error Computer, $95. Optional Voltage Standard, Model 1250B, $100.
Special-Purpose AC Voltmeter/Amplifiers

**MODEL** 2318, 314A

**Voltage Range**
- 100mV to 100V
- 10mV to 100V
- 100V to 1000V
- 100mV to 1000V (Input/Outup)
- 100V to 1000V (Input/Final)

**Frequency Range**
- 10mS to 3MHz

**Accuracy**
- 0.1% to 0.2%
- 0.1% to 0.2%
- 0.1% to 0.2%
- 0.1% to 0.2%

**Noise Distortion**
- Max. 0.001% (100V to 1000V)
- Max. 0.001% (100V to 1000V)

**Response**
- 0.1 to 10000Hz
- 0.1 to 10000Hz

**Cabinet**
- Rack: 21" (1U) X 15" X 8"
- 24" (1U) X 15" X 8"

**Price**
- $540

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**Accessories**

Note: Special accessories for particular instruments are listed on this page. Listed below are accessories available with a number of different instruments, as well as special accessories for the Ballantine instruments listed on this page.

**Shunt Resistors, Series 600**

For current measurements up to 30 amperes; shunt resistors with a variety of wattage — as little as 1/4A with Models 310B, 314A, and 320A. Six models from 0.01 to 1000 ohms.

**Prices:**
- Portable: $845
- Rack Mounting Kit: Model 300, for mounting one or two half-rack instruments such as the 303 and 323 Series
- Rack Mounting Kit, Model 300, for mounting one or two half-rack instruments such as the 303 and 323 Series
- Probes: Capacitive 80dB attenuator probes for measurements to 100K. Model 1301, with plug-in capacitive binding posts. Model 1311, with binders for UHF testing.
- For Model 314A AC Voltmeter: Model 3514 20dB probe, Model 6314 Adapter (to N/BNC male).
- For Model 317 AC Voltmeter: Model 3217A Cathode Follower Probe for measurements up to 350mV. Model 3137 30dB Attenuator for use with 317A for measurements from 300mV to 350V.

For Model 340 True-RMS Voltmeter: 40dB Attenuators: Models 1340 and 6340 (HV). Model 3440 Probe Tip Adapter; Model 5340 Tee Adapter.

For Model 345 DC/AC Volt/Ohm/meter: Set of Probes with cable assemblies: P/N300, AC/P/N301, DC/P/N302; ohms/P/N303; common. Model 1345 Tee Adapter, 015Line. Model 3345 HV Probe, to 10kV DC.

Cables, Tee and Terminal Adapters, Ballantine provides at modest prices, every kind of adapter and cable accessory required by standard laboratory and production test procedures. Consult factory or local field representative.
Ballantine Instrumentation Classics

It has proved next to impossible to discontinue a Ballantine instrument. Indeed, the very first Ballantine commercial-production design, the Model 300, was finally removed from active production in 1966 (28 years after its introduction), and requests for it continue to arrive regularly. For the convenience of engineers who have standardized on these "classics" of the measurement art, intermittent small-scale production is maintained on the models listed below ... all of which have been superseded by more modern, more capable, and generally lower priced, designs. Please inquire before ordering.

SPECIFICATIONS

Model 300E Voltmeter/Amplifier, for systems use, 30Hz to 200kHz, 300µV to 300V, Linear dB: -10 to +10. Mechanically programmable. Half-rack.

Model 300G Voltmeter/Amplifier, 10Hz to 250kHz. 1mV to 1000V. High accuracy: 1% rdg, 20Hz to 20kHz.

Model 302C Battery operated Voltmeter, 2Hz to 150kHz. 100µV to 1kV. Linear dB: 0 to 10.

Model 305A Peak/Peak-to-Peak Voltmeter/Amplifier, 5Hz to 500kHz (harmonics up to 2MHz). 1mV to 1kV. Linear dB: 0 to 10.

Model 316 Peak-to-Peak Infrasonic Voltmeter. 0.01Hz to 30kHz, 20mV to 200V. Linear dB: 0 to 20.

Model 317 Wideband Voltmeter, 10Hz to 11MHz (30MHz as null detector), 300µV to 350V (up to 10kV with optional probe).

Model 345 High Accuracy AC/DC VOM, 20Hz to 1GHz. DC range: 0 to 1100V (10kV with optional multiplier). AC range: 0-350V. Ohms: 0-500MΩ. Logarithmic scales; auxiliary scale for low level measurements. Accuracies (in % rdg): 1% DC, 2% AC, 3% Ohms.

Ballantine Quality-Assurance and Calibration-Traceability Procedures.

This chart describes the validation procedures by which all instruments used for the calibration of all Ballantine products are standardized, by systematic reference to NBS-traceable primary transfer standards. Complete details are available on request from the Applications Engineering Department.

Warranty

All Ballantine Laboratories, Inc. products are warranted against defects in materials and workmanship. This warranty applies for one year from date of delivery, except for vacuum tubes or batteries, or, in the case of certain major components listed in the instruction manual for the specified period. Ballantine will repair or replace products which prove to be defective during the warranty period. No other warranty is expressed or implied. We are not liable for consequential damages.

Ballantine Technical Literature

Your local Ballantine field engineering representative can furnish a variety of technical publications to assist you in your selection of the best instrumentation and the best technique for your requirements. These include technical data bulletins on individual Ballantine instruments, reprints of "landmark" technical articles by Ballantine engineers, and complete instruction/application manuals on Ballantine instruments and accessories. Tell him your measurement interests, and he will select pertinent publications for you.

PRICES:

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