



Ballantine Laboratories, Inc.

# 1620A Transconductance Amplifier



## Product Summary

The BLI 1620A Transconductance Amplifier is designed to provide calibration and test departments a highly accurate, highly precise, high current calibration source.

The 1620A provides high accuracy current levels from dc to over 10 kHz for calibrating ammeters, current transformers and shunts. It also provides output current up to 100 Amperes. and as such may also be used as a high accuracy power supply, and as a power source in welding and bonding applications.

The 1620A converts a signal voltage applied to its input, into a high resolution output current whose value is directly proportional to the input signal level. As a example, if an input of 2 Volts is applied on the 20 Ampere range, a current of 20 Amperes will be produced at the output terminals. With dc input voltages, the output current provides the same polarity as the driving signal, and with ac inputs the output will faithfully reproduce the frequency, phase, waveshape, symmetry and dc offset of the input source. A wide range of currents can be produced with seven switchable ranges from 200 microamperes to 100 Amperes rated for positive or negative dc and ac sinusoidal rms at crest factor to 1.45 maximum. Signal inputs can be up to 100 Volts above or below the earth grounded enclosure.

The 1620A can be driven by commercially available manual or programmable, precision ac or dc voltage calibrators and sources, and when equipped with the IEEE-488 option a fully automated current calibration system can be configured to optimize throughput in calibration procedures.

## Definitions

### *Transconductance Amplifier*

An amplifier, or voltage-to-current converter, that supplies an output current proportional to its input voltage. Source impedance of the amplifier is much greater than the impedance of the output load and the device has the characteristics of constant current source until its "Compliance Voltage" is exceeded.

### *Siemens*

The unit of transconductance that is described by the ratio of voltage input to current output of a voltage-to-current converter, or transconductance amplifier.

Siemens = Amperes/Volts

### *Compliance Voltage*

Compliance Voltage is the output voltage produced by a transconductance amplifier as it delivers a given constant current over a range of load resistance. Compliance voltage is calculated as the product of load impedance and current out. The amplifier will sustain the desired current until the Compliance Voltage rating is exceeded.

## Product Features

- 16201 Current Coil accessory
- 200 Amp Capability in Pulsed Mode
- Paralleled Operation for High Current Capability
- Improved linearity and reduced Temperature Coefficients
- Calibrates AC or DC ammeters, shunts, and current transformers
- High accuracy of  $\pm 0.02\%$  of DC range;  $\pm 0.15\%$  of AC range
- Output current bandwidth DC to over 10kHz. 1kHz at 100A RMS
- Low distortion of less than 0.1% of fundamental
- IEEE-488 Programmable
- Full overload protection



## Product Specifications

### AC Mode

#### Ranges

- o to 100A rms, at 100 Siemens
- o to 20A rms, at 10 Siemens
- o to 2A rms, at 1 Siemens
- o to 200mA rms, at 100 milliSiemens
- o to 20mA rms, at 10 milliSiemens
- o to 2mA rms, at 1 milliSiemens
- o to 200mA rms, at 100 microSiemens

#### Ratio of Input Voltage to Output Current

All ranges: 2 Volts input for full range current output, except 100A range which is 1 Volt for 100A rms output current. AC rms is rated for sinusoidal inputs with a maximum crest factor of 1.45 at full range current output, and greater than 3 at midrange.

#### Resolution (Referred to input voltage)

1mA on the 200mA range.  
±0.01% of range on the 2mA to 20A ranges.

#### Compliance Voltage

100A range:  $\pm 3$  3 Volts rms ( $\pm 4.2$  Volts peak)  
20A range:  $\pm 3$  4 Volts rms ( $\pm 5.6$  Volts peak)  
:All other ranges:  $\pm 3$  5.5 Volts rms ( $\pm 7.7$  Volts peak)

#### Open Circuit Compliance Voltage

Not greater than ±15 Volts peak.

#### Accuracy of Output Current

Allowable deviation of range output current input voltage:  
±(0.15% of output current +0.1% of range) to 1 kHz.

#### Bandwidth (Sinusoidal input)

100A range: DC to 20 Hz to 100 Amps peak  
20 Hz to 1 kHz to 100 Amps rms  
20A range: DC to 1 kHz  
2A range DC to 5 kHz  
All other ranges: DC to > 10 kHz

#### Load Regulation/Transient Recovery Rime

Output Current settles within ±0.01% of initial value in ≤5 seconds with any change in load.

#### Total Harmonic Distortion

< 0.1% of the fundamental at 100A rms and 1 kHz sinewave.

#### Load Requirements

The current output will supply resistive and capacitive loads as well as inductive loads to 2 millihenries at full specified currents and frequencies which permit operation within the rated compliance voltage.

### DC Mode

#### Ranges and Transconductance

- o to ± 100A at 100 Siemens
- o to ± 20A at 10 Siemens
- o to ± 2A at 1 Siemens
- o to ± 200mA at 100 milliSiemens
- o to ± 20 mA at 10 milliSiemens
- o to ± 2 mA at 1 milliSiemens
- o to ± 200mA at 100 microSiemens

#### Ratio of Input Voltage to Output Current

All ranges ±2 Volts input for ± full range current output; except 100A range which is ± 1 Volt for ± 100A output current.

#### Resolution (Referred to input voltage)

1mA on the ± 200mA range.  
0.01% of range from ±2mA to ±20A ranges.

#### Compliance Voltage

± 4 Volts minimum on the ± 20A and ±100A ranges. ±7.5 volts minimum on all other ranges.

#### Open Circuit Compliance Voltage

Not greater than ±15 Volts peak.

#### Accuracy of Output Current

Provides accuracy of ± (0.02% of output current +0.02% of range) on all the ranges.

#### Load Regulation

to ±10%; 50 to 400 Hz

#### Transient Recovery Time

Output current settles within ± 0.01% of initial value in ≤ 5 seconds with any change in load.



## General

### Input Terminals and Impedance

Gold plated universal binding posts. 10 Megohm input resistance.

### Output Terminals

Gold plated, universal binding posts on all ranges except 100A range which uses Superior Model RS 100G high current female terminals.

### Rear Input

Front or rear input selectable by front panel switch.

### Off ground Operation

Instrument is capable of operating input LO and output LO to  $\pm 100V$  dc with respect to case ground input. LO to case resistance: 0.5 Megohm

### Isolation

Input voltage LO may be separated by  $\pm 10$  volts common mode voltage with respect to output current HI and LO terminals.

### Environmental Characteristics

Designed to comply with MIL-T-28800, Class 5.

Temperature:

Storage: -40 to +750 C

Operation: 0 to 500 C

Humidity:

Full Accuracy: 20% to 80% RH to 40 0 C

Usable: 10% to 100% RH without condensation

Altitude:

Storage: 0 to 15 Km (50,000 ft.)

Operating: 0 to 3 Km (10, 000 ft.)

## Controls and Indicators

ON-OFF Power Switch

FRONT/REAR Input Switch - Selects front or rear panel input voltage terminals

RANGE - 6 push-button switches select one of seven ranges.

OVERCOMPLIANCE Indicator - Lights when load compliance voltage is exceeded.

INPUT OVERDRIVE Indicator - Lights when input drive voltages are exceeded.

OPERATE/STANDBY Switch - Disables output current drive.

REMOTE Indicator - Lights when remote operation is selected.

## Protection

Input Protection: to 200 Vrms.

Output Protection: Open circuit or short circuit protection and output compliance voltage limited to  $\pm 15$  volts peak across current output terminals.

Sensitive components protected by high temperature cut out with auto reset and "standby" indicator.

Ventilation: Forced air ventilation is provided whenever interior temperature rises above 50 Degrees Celsius.

## Size

Height: 267 mm (10 1/2")

Width: 19" standard EIA rack mount configuration

Depth: 416 mm (16 3/4") behind panel, 457 mm (18") overall

Weight: 50 kg (80 lbs.)

64 kg (110 lbs.) shipping

## Power Requirements

100V or 120V or 220V or 240V  $\pm 10\%$ . Single phase, 50 to 60 Hz 2 KVA. Fully protected with 20A magnetic circuit breaker.