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Transconductance Amplifier Model 8100

- **HIGHLY ACCURATE**
- **7 VOLT COMPLIANCE**
- **100 AMPERES to 100 kHz**

- **200 μA to 100A in six ranges**
- **100% over range capability**
- **40ppm short term stability**
- **0.04% dc and 0.10% ac accuracy**
- **Accuracy independent of load**
- **Distortion below -60dB**
- **Complete Front Panel Calibration**
- **IEEE-488.2 Interface standard**
- **Stable with inductive loads**
- **High output impedance**
- **Power Factor corrected supplies (PF>0.98 at 100A output)**

WIDE CURRENT RANGE / EXTREMELY BROADBAND

The Model 8100 Transconductance Amplifier is a precision, high stability, high accuracy instrument which produces an output current which is directly proportional to the input voltage over the frequency range from dc to 100kHz. Six overlapping ranges, with full scale values of 2mA, 20mA, 0.2A, 2A, 20A and 100A, provide low distortion output currents from 200uA to 100A. With the exception of the 100A range, for which a 1 V rms input produces the 100 Arms output current, the transconductance of the other ranges is set such that a 2Vrms input produces the full scale output current. With the exception of the 100A range, all of the other ranges may be operated to twice their full scale value without any deterioration in performance.

LOW TOTAL HARMONIC DISTORTION

The total harmonic distortion introduced by the transconductance amplifier is less than -60dB up to 10 kHz (typically 20kHz) and less than -40dB to 100kHz for all current ranges.

AMPLE COMPLIANCE VOLTAGE

The maximum compliance voltage (the maximum permissible voltage which can be developed across a load connected across the output) is at least 7Vrms (7V for dc) for all ranges and all frequencies. This high voltage limit permits a large variety of loads to be driven from the transconductance amplifier. These loads may be resistive or resistive with capacitive or inductive components without causing any instability in the output current. An OVERCOMPLIANCE indicator is illuminated when the 7V has been exceeded.

FREQUENCY AND COMPLIANCE VOLTAGE DISPLAYED

Both the compliance voltage (0.00V - 7.00V) and the frequency of the input voltage drive (10Hz - 500kHz) are continuously displayed by bright seven-segment LED displays.

HIGHER FREQUENCY OUTPUTS AVAILABLE

With the exception of the 20A range and the 100A range which are internally limited to 110kHz, the Model 8100 Transconductance Amplifier will normally supply full scale currents up to at least 500kHz into suitable loads.

WIDE RANGE OF APPLICATIONS

The Model 8100 Transconductance Amplifier is ideally suited for calibration of any device that requires a precision current excitation. High current and high frequency combinations are available that have heretofore been difficult to obtain. The Model 8100 may be used to calibrate (or to develop) current transformers, shunts, ammeters and V-A-W meters. Whenever the compliance voltage limits will allow it, units may be paralleled to obtain even higher currents.

EASY TO CALIBRATE

The Model 8100 Transconductance Amplifier has a CALIBRATION PANEL on the front panel which allows the unit to be calibrated without having to remove either the top or bottom cover. The Calibration Mode is activated by breaking the seal over the CAL key and then depressing it with a small, narrow screwdriver. When the CAL key is again depressed, the new calibration points are stored in an internal non-volatile memory.

COAXIAL OUTPUT FOR HIGH CURRENTS

To minimize the output inductance, the current output for both the 20A and the 100A range is supplied through a coaxial LC connector. The output current for the lower current ranges, where inductance is not as much of a problem, is supplied through a set of recessed safety terminals.

IEEE-488.2 BUS CONTROL

The Model 8100 Transconductance Amplifier is equipped with an IEEE-488.2 interface which incorporates all of the common commands and queries. Any function which can be entered manually can be sent by a bus controller to the Transconductance Amplifier over the IEEE interface. In addition, the frequency and the compliance voltage, which are displayed on the front panel, can be queried by the controller and returned to it over the bus. The status and states (e.g. current range, standby, etc.) of the Transconductance Amplifier can also be queried by the controller and returned over the bus. The bus address is set from the front panel and is displayed both at turn on and when the LOCAL key is pressed. A REMOTE lamp indicates that the Model 8100 has been placed in its Remote state by the controller.

SPECIFICATIONS

RANGES AND TRANSCONDUCTANCE

Range (Full Scale)	Output Current	Transconductance
100A	0 to 100A	100 Siemens
20A	0 to 40A	10 Siemens
2A	0 to 4A	1 Siemens
0.2A	0 to 0.4A	100 Millisiemens

20mA	0 to 40mA	10 Millisiemens
2mA	0 to 4mA	1 Millisiemens

TRANSCONDUCTANCE STABILITY (10 MINUTE INTERVAL)

	0% - 100% of Full Scale	100% - 200% FS
Frequency	±(% of Reading+% of Range)	±% of Reading
dc	±(0.002 + 0.002)	±0.004
10Hz - 10kHz	±(0.005 + 0.005)	±0.010
10kHz - 100kHz	±(0.010 + 0.010)	±0.020

The stability specification is valid after the Model 8100 has been in a particular configuration for at least 5 minutes. Measurement system must have a stability which is better by at least a factor of four.

TRANSCONDUCTANCE UNCERTAINTY (1 YEAR)

	0% - 100% of Full Scale	100% - 200% FS
Frequency	±(% of Reading+% of Range)	±% of Reading
dc	±(0.02 + 0.02)	±0.04
10Hz - 10kHz	±(0.05 + 0.05)	±0.10
10kHz - 20kHz	±(0.10 + 0.10)	±0.20
20kHz - 50kHz	±(0.15 + 0.15)	±0.30
50kHz - 100kHz	±(0.30 + 0.30)	±0.60

The dc uncertainty is based on the average of the transconductance obtained with a positive and a negative input. The uncertainties pertain to the transconductance and do not include any variations in the output current induced by the output capacitance and the reactance of the device under test. These high frequency effects must be corrected for separately as outlined in sub-section 1-7 of the instruction manual.

OUTPUT OFFSET Less than ±0.05% of Range.

COMPLIANCE VOLTAGE 7Vrms for ac and 7V for dc. The accuracy of the display is ±0.10V

TOTAL HARMONIC DISTORTION
-60dB from 10Hz to 10kHz
-50dB from 10kHz to 40kHz
-40db from 40kHz to 100kHz

NOISE 0.05% of current range in a band from dc to 100kHz

INDUCTIVE LOADS Free from oscillations for inductive loads up to 1mH. The quality factor of the inductor (Q) at 200kHz should be less than 15.

INPUT IMPEDANCE 500kΩ from each input terminal to chassis ground.

FREQUENCY DISPLAY UNCERTAINTY 0.01% of reading.

DISPLAYS Three LED (10.9mm/.43 inch high) Displays. One five digit display for Input Frequency, one three digit display for Compliance Voltage and one two digit display for Calibration Mode. The display is updated 10 times a second.

IEEE-488.2 INTERFACE SUBSETS	SH1, AH1, T6, L4, SR1, RL1, PP0, DT0, DC1
TEMPERATURE RANGE	Operating: 10°C to 35°C Within Specifications: 18°C to 28°C Storage: -20°C to 60°C
RELATIVE HUMIDITY	Less than 80%
WARMUP TIME	Thirty minutes for all specifications
POWER REQUIREMENTS	207V to 253V, 50Hz to 60Hz, 12A Max. Input Power Factor Corrected
PHYSICAL	Weight 36.4 kilograms (80 pounds) Size 43.2cm x 40.0cm x 55.9cm (17" x 15.75" x 22")
ACCESSORIES	Included: L-C connector to screw terminal adapter Optional: 100 Ampere cable pair terminated in high current lugs. (1/4" mounting hole in lugs to connect to adapter and device under test) 1, 2 or 3 foot lengths

APPLICATIONS

The following papers describe in more detail the properties and applications of the Model 8100 Transconductance Amplifier

- Evaluation of 100 Ampere, 100 kHz Transconductance Amplifiers by Donald T. Hess and Kenneth K. Clarke

- Measurements of Impressive dc Gain Accuracy and Stability

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