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Photodiode Current Amplifiers

Large-Dynamic-Range Amplifiers

- Nine gain settings from 10 Ω to 1 GΩ ensure accurate detection from 1 pA to 100 mA.
- The amplifiers operate for eight hours from a set of fully charged NiCd batteries.
- A 3½-digit backlit LCD gives direct readout of photocurrent, range setting, and battery status.

The 13 AMP 003 large-dynamic-range amplifier is a general purpose current amplifier for use with photodiodes and other detectors in applications requiring the transimpedance configuration. The compact unit converts current signals from a detector to a voltage while maintaining a constant zero bias across the detector independent of the signal amplitude.

There are nine gain settings available ranging from 1 G Ω to 10 Ω. This permits accurate detection of signals from as low as 1 pA to 100 mA. The amplifier contains a 3½-digit backlit LCD, providing direct readout of the photocurrent as well as range setting and battery status.

Additional features of the amplifier include offset adjustment to null background readings, a BNC signal monitor for utility purposes, and a rear-panel banana jack connection allowing the amplifier to be connected to earth ground. Rechargeable AA-size nickel-cadmium batteries provide a minimum of eight hours of portable operation. The unit can also be operated from a wall-mounted plug-in power supply which simultaneously charges the internal battery pack.

Large-Dynamic-Range Amplifiers

Description	PRODUCT NUMBER
for 110 Vac	13 AMP 003
for 220 Vac	13 AMP 003/A

SPECIFICATIONS: LARGE-DYNAMIC-RANGE AMPLIFIERS

Input/Output:
- **Accuracy:** ±1% all ranges
- **Input Current Range:** 1 pA–100 mA
- **Input Connector Type:** BNC
- **Range Selection:** 9-position switch, 2 nA–100 mA
- **Monitor Out:** −2 V to + 2 V full scale
- **Output Connector Type:** BNC

Offset Current Range: −2 mA to +2 mA

Display: 3½-digit LCD with backlighting

Power Requirements:
- **Voltage:** 115 Vac, 230 Vac, or 8 AA-size nickel-cadmium rechargeable batteries
- **Frequency:** 50–60 Hz

Temperature:
- **Operating Temperature:** +10°C to +35°C
- **Storage Temperature:** −20°C to +55°C

Dimensions (W × H × D):
133 × 83 × 140 mm (5.25 × 3.25 × 5.5 in.)

Performance Variation with Range

Range	Resolution	Transimpedance Gain (V/A)	Maximum Frequency Response (kHz)	Full Bandwidth Current Noise (A rms)
100 mA	0.1 mA	10^1	45.0	900 nA
20 mA	0.01 mA	10^2	45.0	90 nA
2 mA	0.001 mA	10^3	45.0	20 nA
200 μA	0.1 μA	10^4	45.0	2 nA
20 μA	0.01 μA	10^5	45.0	300 pA
2 μA	0.001 μA	10^6	35.0	70 pA
200 nA	0.1 nA	10^7	10.0	20 pA
20 nA	0.01 nA	10^8	1.0	3 pA
2 nA	0.001 nA	10^9	0.1	0.5 pA

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Wide-Bandwidth Amplifier

- Frequency response: dc to 5 MHz, maximum
- Accurate photocurrent detection from 100 pA to 2 mA
- Variable bias, ± 10 V adjustable in 1-V increments
- 3½-digit backlit LCD to display photocurrent and range setting
- Front-panel offset adjustment to null background readings
- BNC signal monitor and switch-selectable 115/230 Vac operation

The 13 AMP 005 wide-bandwidth amplifier is a general-purpose current amplifier used for operating photodiodes in both the photovoltaic and photoconductive modes. The portable unit provides a variable ± 10 V biasing adjustment which can be set in 1-V increments.

The transimpedance gain may be varied over five decades from 103 to 107 V/A. This permits accurate detection of photocurrents from as low as 100 pA to 2 mA with ± 1% accuracy. The maximum frequency response in the 103 V/A gain setting is dc to 5 MHz. A 3½-digit backlit LCD is provided for directly displaying the photocurrent and range setting. Additional features include a front-panel offset adjustment to null background readings, a BNC signal monitor for utility purposes, and a rear-panel banana jack connection which allows the unit to be connected to ground.

SPECIFICATIONS: WIDE-BANDWIDTH AMPLIFIER

Input/Output:
Accuracy: ± 1% all ranges
Input Current Range: 100 pA–2 mA
Input Connector Type: BNC
Range Selection: 5-position switch, 200 nA–2 mA
Monitor Out:
− 2 V to + 2 V, with 50-Ω termination
− 4 V to + 4 V unterminated
Output Impedance: 50 Ω
Output Connector Type: BNC
Offset Current Range:
High: − 50 μA to + 50 μA
Low: − 5 μA to + 5 μA
Display: 3½-digit LCD with backlighting
Power Requirements:
Voltage:
115 Vac + 10/ − 20% and 230 Vac ± 10%
rear-panel switch selectable
Frequency: 50–60 Hz
Temperature:
Operating Temperature: + 10°C to + 35°C
Storage Temperature: − 40°C to + 55°C
Dimensions (W × H × D):
133 × 83 × 140 mm (5.25 × 3.25 × 5.5 in.)

Wide-Bandwidth Amplifier

	PRODUCT NUMBER
Wide-Bandwidth Amplifier	13 AMP 005

Performance Variation with Range

Range	Resolution	Transimpedance Gain (V/A)	Maximum Frequency Response (kHz)	Full Bandwidth Current Noise (A rms)
2 mA	0.001 mA	10^3	5000	100 nA
200 μA	0.1 μA	10^4	1000	12 nA
20 μA	0.01 μA	10^5	300	1.5 nA
2 μA	0.001 μA	10^6	75	180 pA
200 nA	0.1 nA	10^7	15	32 pA

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High-Frequency Amplifier

The 13 AMP 007 is a low-noise ac-coupled high-frequency voltage or current amplifier.

- High-frequency response ranges from 4 kHz to >300 MHz.
- The amplifier accepts input currents up to 160 mA and input voltages up to 8 mV.

SPECIFICATIONS:
HIGH-FREQUENCY AMPLIFIER

Frequency Response: 4 kHz to >350 MHz (−3dB)
Maximum Output Voltage: 1 V p-p into 50 Ω
Input and Output Connector type: BNC
Input and Output Impedance: 50 Ω
Transimpedance Mode:
Transimpedance Gain: 6250 V/A
Maximum Input Current: 160 μA
Output Noise: 3.2 mV rms
Input-Referred Noise: 24 pA/Hz$^{1/2}$
Bias Adjustment: −20 V to +20 V
Voltage Amplification Mode:
Voltage Gain: 125
Maximum Input Voltage: 8 mV
Output Noise: 3.2 mV rms
Input Referred Noise: 1.2 nV/Hz$^{1/2}$
Power Requirements:
Voltage:
115 Vac +10/−20% and 230 Vac ±10%
rear panel switch selectable
Frequency: 50–60 Hz
Power: 3 W
Temperature:
Operating Temperature: +10°C to +35°C
Storage Temperature: −40°C to +55°C
Dimensions (W × H × D):
91 × 48.3 × 143 mm (3.6 × 1.9 × 5.6 in.)

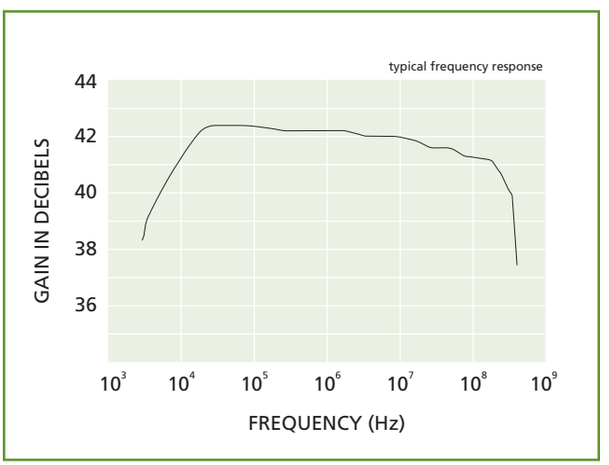
High-Frequency Amplifier

	PRODUCT NUMBER
High-Frequency Amplifier	13 AMP 007

Performance Variation with Detector Type[1]

Rise Time[2] at −9 Vdc (nsec)	NEP[2] at −9 Vdc (nsec)	DETECTOR PRODUCT NUMBER
1.0	48×10^{-12}	13 DAH 001
1.25	48×10^{-12}	13 DAH 003
1.5	48×10^{-12}	13 DAH 005

1 Combined performance for Melles Griot high-speed silicon photodiodes and the 13 AMP 007.
2 Rise-time and noise equivalent power values are for a transimpedance gain of 6250 V/A and a detector responsivity of 0.5 A/W.



Typical frequency response of the 13 AMP 007 high-frequency amplifier

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