

---

**CMA-100**  
**Counter Measures Amplifier**  
**Owner's Guide**

---



---

**Research Electronics, Intl.**  
**455 Security Place**  
**Algood, TN 38506**  
**931-537-3359**  
**[www.research-electronics.com](http://www.research-electronics.com)**

---



Thank you for purchasing the CMA-100 Countermeasures Amplifier. When doing a Counter-surveillance investigation, it is important to analyze all of the wiring in the environment to ensure that building wiring is not being utilized to transport audio or video information. This wiring may include but is not limited to telephone wiring, LAN wiring, security system or access control wiring, intercom speaker wiring, heating and cooling wiring, etc... The main reason for analyzing suspect wiring is that a microphone that is well shielded is very difficult to detect with an ORION. Also, an OSCOR will not detect a hard-wired microphone because there is no radiated signal. The CMA-100 is an ideal tool to analyze miscellaneous wiring for audio content. Some scenarios of problems that can be discovered with a CMA are:

1. Utilizing an unused pair of telephone wires or LAN wiring to connect directly to a shielded microphone in the suspect environment
2. A phone set with a hot microphone or hot earpiece used as a microphone.
3. Microphones can easily be installed in miscellaneous wiring such as motion detectors, Intercom speakers, etc...
4. Many digital phone systems have audio leakage that occurs on the lines due to cross talk within the phone set. A CMA can be used to expose this type of vulnerability.
5. Conference call mikes are sometimes kept active without the user knowing it.

The CMA-100 can be connected to wiring (assuming that the AC voltage does not exceed 40 VAC or 250 VDC) and the audio content can be accessed. Furthermore, if there is video content on the wiring, the video synchronization pulses can be heard and identified through the CMA.

The CMA-100 is a high gain audio amplifier that is used to detect and identify certain types of surveillance devices connected to building wiring including telephone wiring, LAN, Server systems, de-energized AC power, left over wiring that is no longer being used, etc....

This multi-functional amplifier has a built in AC/DC digital voltmeter, selectable audio filters, and an extremely wide dynamic range.

Balanced and unbalanced high impedance input provides connectivity to a wide variety of suspect wiring.

The CMA-100 also provides a bias voltage adjustable between -14.5V to +14.5V DC that is used to possibly activate devices that are voltage or current sensitive.

All of these functions employ a sophisticated automatic gain control circuitry that is unmatched by any other audio amplifier.

This instruction manual covers the operation and specifications of the CMA-100.

---

**PRECAUTIONS:**

---

REI

1. Although the maximum input voltage rating indicates that connection to power lines would not be detrimental to the equipment or user, it is **NOT** recommend maintaining connection to such circuits. Extreme care should be taken when connecting the CMA-100 to an unknown electrical source. Always check line voltage with a multimeter first to determine the risk.
2. Although the maximum input voltage is 250 volts, the meter will only be able to read 199.9 volts.

**CONTROLS:**

REI

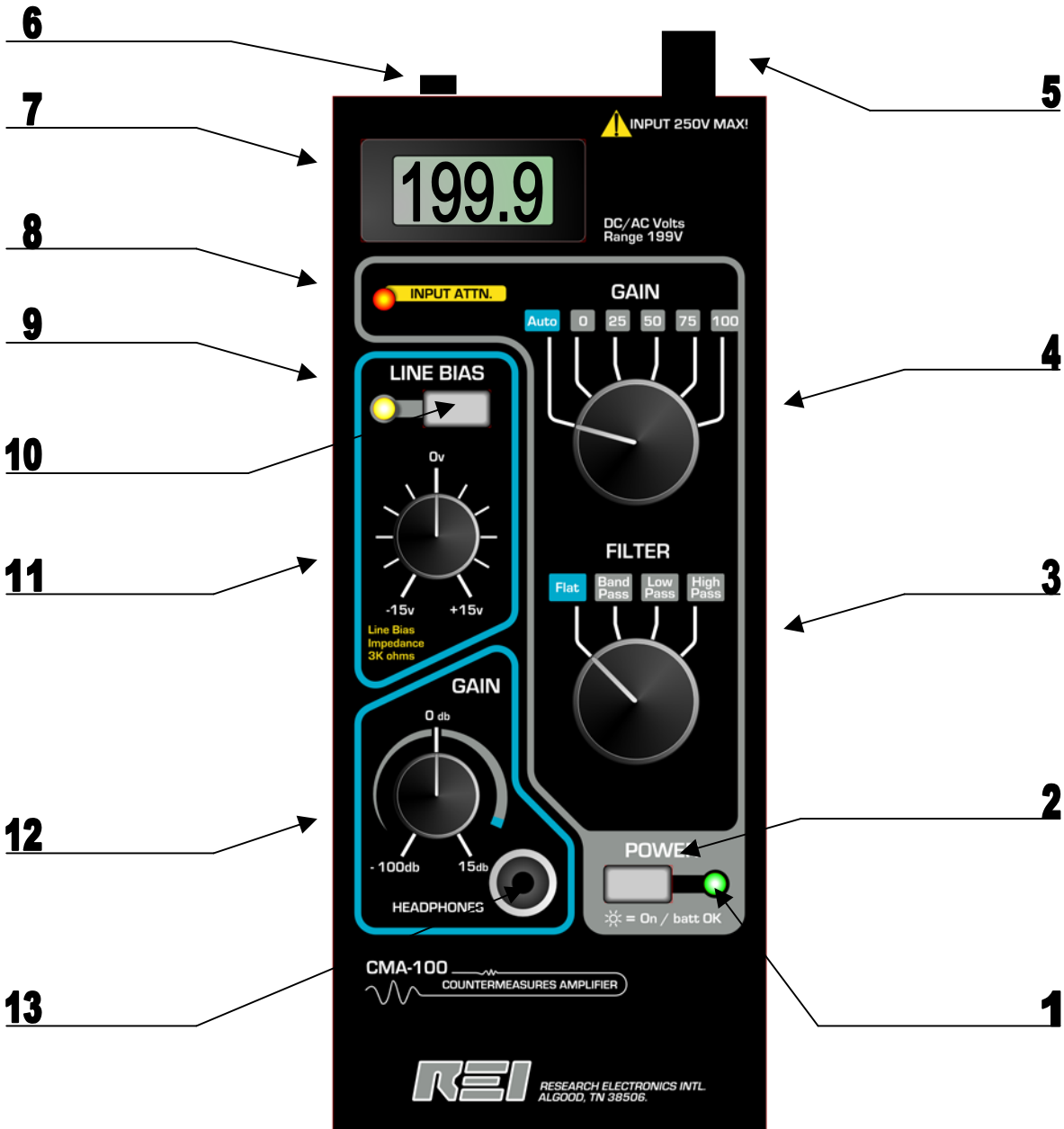


Figure 1

- |                              |                               |
|------------------------------|-------------------------------|
| 1. On/Low Battery Indicator  | 8. Input Attenuator Indicator |
| 2. Power Switch              | 9. Line Bias Indicator        |
| 3. Filter Selector           | 10. Line Bias Switch          |
| 4. Gain Selector             | 11. Line Bias Voltage Adjust  |
| 5. Test Lead Cable Connector | 12. Headphone Gain            |
| 6. Line Out Jack - 3.5mm     | 13. Headphone Jack - 3.5mm    |
| 7. Meter                     |                               |

---

**IDENTIFICATION**

---

Please refer to Figure 1 for the following function descriptions.

1. The Power On Indicator is used to identify when the unit is turned on. If the battery voltage falls below 6.9V, then the LED will extinguish and the battery should be replaced.
2. The Power Switch turns the unit on and off.
3. The Filter Selector is a 4 position rotary switch, provides different options of filtering the input audio signal.
  - A. Flat - Does not filter the input signal, providing a full bandwidth inspection between 25 and 44kHz.
  - B. Bandpass - Combines the Lowpass and Highpass in series to create a 3dB bandpass from 320Hz to 3.2kHz.
  - C. Low Pass - Allows the passage of frequencies below 3.2kHz and attenuation of higher frequencies. The effect of this filter is to remove high frequency noise such as machinery noise, etc...
  - D. High Pass - Allows the passage of frequencies above 320Hz and attenuation of lower frequencies. The effect of this filter is to remove low frequency noise such as AC power line noise.
4. The Gain Selector gives the user two operation modes.
  - A. Auto - This is automatic gain control (AGC) provides up to 105dB of gain. The AGC circuit increases the gain during low input signal conditions and decreases the gain for high input signal conditions. This circuit adapts to provide a proper audio listening level regardless of the change in input audio level.
  - B. Manual
    - 1.) Fixed gain setting of 0(unity), 25, 50, 75, and 100dB.
    - 2.) Useful for situations where signal level has large dynamic range that the user wants to utilize.
  - C. In either case, the Input Attenuator will automatically initiate if the input level exceeds 300 millivolts peak-peak. This will provide up to 30dB of attenuation.
5. The Test Lead Cable Connector is a three-pin keyed connector that insures proper polarity of the test leads.
6. The Line Out Jack provides a signal out, controlled by the "Headphone Gain ", and has an output impedance of 600 ohms.

---

**CONTROLS:**

---

REI

7. When the Line Bias Generator is turned off, the voltage meter can measure both AC and DC volts (Note: AC volts are read as RMS values).  
Note: When the Line Bias Generator is turned on, the voltage meter will measure a combination of the voltage in the circuit that the test leads are connected to and the voltage presented from the Bias Generator. To read only the Bias Generator, remove the Test Leads from any circuit.
8. The red LED Input Attenuation Indicator will indicate that the input signal is of sufficiently high level to automatically initiate the input attenuation circuit. This important function provides attenuation to a high power audio signal so that the gain circuit will not distort the signal. This automatic attenuator circuit provides attenuation for audio levels between 300 millivolts and 31 volts. For signals that exceed 31 volts peak-to-peak, distortion will occur.
9. A yellow Line Bias Indicator will indicate the Bias Generator is turned on.
10. The Line Bias Switch will turn the Bias Generator on or off.
11. The Line Bias Voltage Adjust will control the magnitude of the bias voltage. The mid-position will generate 0V. Turn to the left to generate a negative voltage and turn to the right to generate a positive voltage. This function is provided specifically to provide DC voltage to power a potential threat such as an electret microphone or wiretap device that may be connected to a line. By activating a potential threat, it is much easier to identify.
12. The Headphone Gain is a volume level control for both the Headphones and the Line Out. This level control provides up to 15 dB of additional gain.
13. The Headphone Jack is for use with the included headphones.

---

**USING THE CMA:**

---

REI

Testing for Voltage levels

Unknown wiring should first be evaluated using a voltmeter to ensure that the voltage does not exceed the ability of the CMA. However, if the wiring is known to be low-voltage wiring such as Telephone, LAN system, or security system wiring, then the CMA can be connected directly to the wiring using the CMA test leads and voltage levels will be displayed directly on the CMA.

### Single Line and Balanced Line Connections

The CMA provides for connections to either single line systems (typically a single line with a ground such as coax) or a balanced pair line such as telephone or LAN wiring.

For Single Line systems:

- Connect the Green grounding connector to the Black connector.
- Connect the Black connector to wiring shield or ground.
- Connect the Red connector to the single line to be tested.

For Balanced Pair systems:

- Connect the Green grounding connector to earth ground if available (if not available, do not connect to anything).
- Connect the Black connect one of the wires to be tested.
- Connect the Red connector to the other wire to be tested.

### Signal Power Levels

Signal power levels may vary dramatically. The CMA has two systems that allow the unit to respond automatically to a wide range of audio levels. The automatic input attenuator prevents distortion for situations when the input voltage levels exceed 0.3 volts.

But, more importantly the Automatic Gain Control Function has a dynamic range of 105dB. In basic terms, this means that that the unit can automatically adjust to audio signals ranging from 2 microvolts to 0.3 volts.

### Strong Signal Interference

If the input is attached to an AC voltage greater than 40 volts, the audio content will be masked.

### Signal Frequency Interference - Audio Band

Wiring in a building is very susceptible to interference from ambient electromagnetic noise sources. The most common type of audio interference is from the AC power lines. This noise is typically either 50 or 60Hz fundamental frequency; however, there are harmonic frequency components that also cause interference at 100/120Hz, 150/180Hz, and possible up to 200/240Hz. For this reason, the CMA has a built-in High Pass filter that filters out audio noise below 320Hz.

Also, high frequency electromagnetic noise can interfere with audio signals. This type of higher frequency noise can be generated from industrial machinery, computers, fax machines, and digital phone systems. Hence, the CMA has a built-in High Pass filter that filters out audio noise above 3,200Hz.

### Providing DC Bias

It is a common practice to utilize electret type microphones for audio surveillance, and electret microphones require a voltage supply in order to function. Therefore, when evaluating suspect wiring, if the wiring does not have any voltage on the line, it is recommended to apply a DC bias voltage to activate any potential microphones. The DC Bias Voltage should only be used after ensuring that the line does not have an active



voltage supply. Then, the DC Bias voltage can be switched on and the control knob slowly turned to both negative and positive directions while listening with the headphones to see if a microphone is activated.

#### Using the CMA with other probes

The CMA can be connected to a variety of other probes.

- Inductive coil - for coupling to an audio signal without making a metallic connection.
- Contact microphone - for detecting sound within physical structures.

#### Over voltage protection

If the CMA's input voltage limit is exceeded, then damage will most likely occur that will make the CMA require repairs. The CMA case is isolated from an input up to 500V. Therefore, if the input is allowed to exceed 500 volts then a shock hazard will exist.

#### Over current protection

When connected to an AC power line, the BIAS GENERATOR should not be activated. In the event that it is, there are input current limiting devices that will protect the delicate parts of the CMA. After disconnecting the input, it will take several seconds for the CMA to work properly again.

---

## SPECIFICATIONS

REI

---

INPUT IMPEDANCE: 50k ohm balanced  
COMMON MODE REJECTION: >75 dB  
MAXIMUM USABLE INPUT: 31 Vp-p  
PREAMP AUTO ATTENUATOR: 0 to -40 dB (with Input Atten LED)  
DYNAMIC RANGE: 145 dB min.  
MANUAL GAIN CONTROL: 0,25,50,75,100 dB  
HEADPHONE GAIN CONTROL: 0 to 15 dB  
MAXIMUM SYSTEM GAIN: 115 dB  
FREQUENCY RESPONSE: 25 Hz to 44 kHz  
HIGH PASS FILTER: 320 Hz to 44 kHz  
LOW PASS FILTER: 25 Hz to 3.2 kHz  
BAND PASS FILTER: 320 Hz to 3.2 kHz  
HEADPHONE AUDIO OUTPUT: 16 ohm, 105dB SPL limited  
LINEOUT AUDIO OUTPUT: 600 ohm  
BIAS CONTROL: 0 to +/-14.5 VDC, 5 mA max (Over current protected, input Impedance is reduced to 3.6k ohms when bias is active)  
DIGITAL VOLTMETER: 3.5 digit, auto zero, auto polarity, +/-199.9V AC or DC  
POWER ON/LOW BATTERY LED (LED off @ 6.9V)  
BATTERY: 9 V ALKALINE (5-30 Hrs typical run time)  
MAXIMUM INPUT VOLTAGE: 250 AC/DC  
LEAKAGE RESISTANCE TO CASE: >10M ohms  
SIZE: 7.3" (185.4mm) x 2.75" (69.8mm) x 1.75" (44.5 mm)  
WEIGHT: 12.1-oz (343g)