

DC Current Amplifier

Model No.: BEM-5004



Read this manual thoroughly before use.

Version B

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DC Current Amplifier

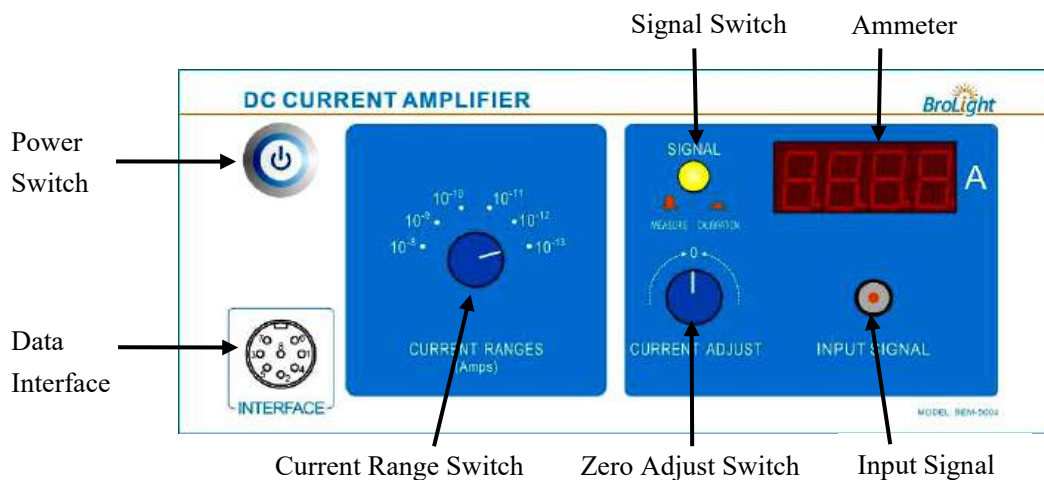
Model No. : BEM-5004

Equipment List



No	Part Description	Model	Quantity
1	DC Current Amplifier	BEM-5004	1
2	Power cord	BC-105075	1
3	User's Manual	CD-M-BEM-5004	1

DC Current Amplifier Panel Description



- **Power Switch:** Turns the power to the instrument ON or OFF.
- **Current Range Switch:** Sets the amplification range for the current measurement (from 10^{-8} A to 10^{-13} A).
- **Signal switch:** Sets the operational mode between "Measurement" and "Zero Adjustment".
- **Zero Adjust Switch:** Sets the current through the instrument to zero.
- **Ammeter:** Displays the value of the input signal current.
- **Signal Input:** Input the current signal to be measured.
- **Data Interface:** Provides an analog voltage output that is proportional to the measured current, used for connecting to data acquisition equipment.

Limited Warranty and Limitation of Liability

This Brolight product is free from defects in material and workmanship for one year from the date of purchase. This warranty does not cover fuses, or damage from accident, neglect, misuse, alteration, contamination, or abnormal conditions of operation or handling. Resellers are not authorized to extend any other warranty on Brolight's behalf. To obtain service during the warranty period, return the unit to point of purchase with a description of the problem.

THIS WARRANTY IS YOUR ONLY REMEDY. NO OTHER WARRANTIES, SUCH AS FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSED OR IMPLIED. BROLIGHT IS NOT LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, ARISING FROM ANY CAUSE OR THEORY. Since some states or countries do not allow the exclusion or limitation of an implied warranty or of incidental or consequential damages, this limitation of liability may not apply to you.

Safety Information



Warning:

The following general safety precautions must be observed during all phases of operation, service and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Brolight Technologies, Inc. assumes no liability for the customer's failure to comply with these requirements.

BEFORE APPLYING POWER.

Verify that the product is set to match the available line voltage and the correct fuse is installed.

GROUND THE INSTRUMENT.

This product is a Safety Class 1 instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument must be connected to the ac power supply mains through a three conductor power cable, with the third wire firmly connected to an electrical ground (safety ground) at the power outlet. For instruments designed to be hard wired to the ac power lines (supply mains), connect the protective earth terminal to a protective conductor before any other connection is made. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury. If the instrument is to be energized via an external autotransformer for voltage reduction, be certain that the autotransformer common terminal is connected to the neutral (earth pole) of the ac power lines (supply mains).

INPUT POWER MUST BE SWITCH CONNECTED.

For instruments without a built-in line switch, the input power lines must contain a switch or another adequate means for disconnecting the instrument from the ac power lines.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

Do not operate the instrument in the presence of flammable gases or fumes.

KEEP AWAY FROM LIVE CIRCUITS.

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified service personnel. Do not replace components with power

cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power, discharge circuits and remove external voltage sources before touching components.

DO NOT SERVICE OR ADJUST ALONE.

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT EXCEED INPUT RATINGS.

This instrument may be equipped with a line filter to reduce electromagnetic interference and must be connected to a properly grounded receptacle to minimize electric shock hazard. Operation at the line voltage or frequencies in excess of those stated on the data plate may cause leakage currents in excess of 5.0mA peak.















DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Agilent Technologies, Inc. Sales and Service Office for service and repair to ensure that safety features are maintained.

- Do not clean the equipments with the wet rag.
- Before use, verify that the apparatus is not damaged.
- Do not defeat power cord safety ground feature.
- Plug in to a grounded (earthed) outlet.
- Do not use product in any manner not specified by the manufacturer.
- Do not install substitute parts or perform any unauthorized modification to the product.
- Line and Current Protection Fuses: For continued protection against fire, replace the line fuse and the current-protection fuse only with fuses of the specified type and rating.
- Main Power and Test Input Disconnect: Unplug instrument from wall outlet, remove power cord, and remove all probes from all terminals before servicing. Only qualified, service-trained personnel should remove the cover from the instrument.
- Do not use the equipment if it is damaged. Before you use the equipment, inspect the case. Pay particular attention to the insulation surrounding the connectors.
- Do not use the equipment if it operates abnormally. Protection may be impaired. When in doubt, have the equipment serviced.
- Do not operate the equipment where explosive gas, vapor, or dust is present. Don't use it under wet condition.
- Do not apply more than the rated voltage, as marked on the apparatus, between terminals or between any terminal and earth ground.
- When servicing the equipment, use only specified replacement parts.
- Use caution when working with voltage above 30V ac rms, 42V peak, or 60V dc. Such voltages pose a shock hazard.
- To avoid electric shock, do not touch any naked conductor with hand or skin.
- Adhere to local and national safety codes. Individual protective equipment must be used to prevent shock and arc blast injury where hazardous live conductors are exposed.
- Remaining endangerment:

When an input terminal is connected to dangerous live potential it is to be noted that this potential at all other terminals can occur!

Electrical Symbols

	Alternating Current
	Direct Current
	Caution, risk of danger, refer to the operating manual before use.
	Caution, possibility of electric shock
	Earth (ground) Terminal
	Protective Conductor Terminal
	Chassis Ground
	Conforms to European Union directives.
	WEEE, waste electric and electronic equipment
	Fuse
	On (Power)
	Off (Power)
	In position of a bi-stable push control
	Out position of a bi-stable push control

Introduction

Scope

This manual contains information for troubleshooting the Brolight Models BEM-5004 to the component level. Wherever applicable, the service instructions given in this manual refer to pertinent information provided in the Operation Manual.

System Description

BEM-5004 DC Current Amplifier is a current-to-voltage conversion amplifier. It is primarily designed for amplifying minute currents from photodiodes or photomultiplier tubes, maintaining extremely low noise levels. Additionally, it functions as a two-stage, low-noise, and highly stable transimpedance amplifier. It features six adjustable gain settings (ranging from 10^{-8} A to 10^{-13} A), adjustable offset current, and a switchable Measure/Calibrate button.

The device utilizes a BNC port for signal input, enabling it to form a microcurrent measurement setup when combined with compatible detectors. Additionally, it is equipped with an 8-pin interface for outputting analog voltage signals, which can be acquired in real time via a data acquisition interface and displayed on a computer. Its BNC compatibility allows for straightforward design and construction of photoelectric test systems using detectors with BNC interfaces.

Operation Verification Tests

1. Connect the power cord, ensuring the correct voltage is selected (110-120V~ or 220-240V~).
2. Turn on the power switch and allow the amplifier to warm up for at least 20 minutes.
3. Select the appropriate current range. If the approximate current level is unknown, use the maximum range (10^{-8} A) initially.
4. Press the "SIGNAL" button. The amplifier will enter the zero-adjustment mode, internally disconnecting the external input signal. Rotate the "Zero Adjust" knob until the ammeter displays "0".
5. Connect the device under test to the "Signal Input" terminal using a BNC cable. Ensure the input current does not exceed 20 μ A.
6. Press the "SIGNAL" button again to pop it out. The amplifier now enters the measurement mode, and the ammeter will display the current reading.

Reading the current value: Displayed numeric value \times Selected current range = Actual measured current.

Example: If the range is set to 10^{-10} A and the display shows 256, the measured current is 256×10^{-10} A.

7. The data interface outputs an analog voltage signal corresponding to the measured current value for data acquisition. This voltage output is linearly proportional to the ammeter reading and is independent of the selected current range.

Example 1: A current of 256×10^{-10} A corresponds to a 0.256 V output.

Example 2: A current of 1980×10^{-12} A corresponds to a 1.980 V output.

Example 3: A current of -1375×10^{-11} A corresponds to a -1.375 V output.

Note: The maximum analog voltage output range is ± 2 V.

Precautions for Use

1. Do not exceed the current measurement range, as this may damage the equipment.
2. Reset the instrument to zero each time, when the current range is changed.
3. Since the measured current is extremely weak, to ensure testing stability and accuracy, the test leads and test environment should be shielded from external interference. Avoid moving or shaking the device or any connected leads during testing. When measuring currents at the nanoampere level or above, a shielded box should be used to enclose the device under test (DUT).
4. **Measurement Stability:** The conductivity of many materials is not strictly like that of a standard resistor, which provides a very stable current for a given voltage. Many materials have conductive characteristics that do not obey Ohm's law, which can lead to unstable readings. This is not an instrument malfunction but is caused by the inherent instability of the current being measured. Furthermore, inadequate shielding can also cause unstable readings due to interference from external electromagnetic signals. To verify the instrument's stability: Disconnect the input current signal leads. If the displayed current value remains stable and does not fluctuate, the amplifier is stable. Any instability in the current value therefore originates from the input signal itself or external electromagnetic interference.

Maintenance and repair



WARNING:

Maintenance described herein is performed with power supplied to the instrument, and protective covers removed. Such maintenance should be performed only by service trained personnel who are aware of the hazards involved (for example, fire and electrical shock). Turn off ac power before making or removing connections to the power supply. Where maintenance can be performed without power applied, the power should be removed.

Introduction

Before attempting to troubleshoot this instrument, ensure that the fault is with the instrument itself and not with an associated circuit. The performance test enables this to be determined without having to remove the covers from the supply.

Troubleshooting Procedures

If a problem occurs, follow the steps below in sequence:

- a) Check that input power is available, and check the power cord and fuse.
- b) Check that the settings of input power (110-120V~/220-240V~) are correct for the desired mode of operation.
- c) Check that all connections to the power supply are secure and that circuits between the supply and external devices are not interrupted.
- d) If the power supply fails turn-on or gives any other indication of malfunction, remove the unit from the operating system before proceeding with further testing.

Repair and Replacement

Repair and replacement of most components in the power supply require only standard techniques that should be apparent to the technician. The following paragraphs provide instructions for removing certain assemblies and components for which the procedure may not be obvious upon inspection.



WARNING:

To avoid the possibility of personal injury, remove the power supply from operation before opening the cabinet. Turn off ac power and disconnect the line cord, load before attempting any repair or replacement.

Fuse Replacement



Open cover to remove fuse.

Fuse type: 250V T1A



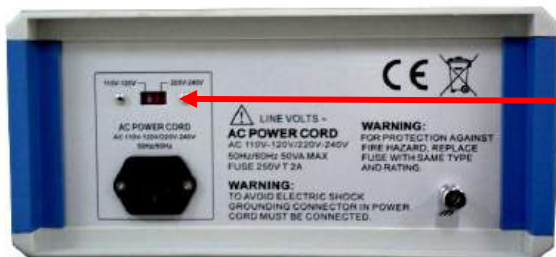
WARNING:

To reduce the risk of electric shock or damage to the instrument, turn the power switch off and disconnect the power cord before replacing a fuse.

- Disconnect the power cord from the instrument
- Open the fuse cover and remove the fuse.
- Replace the fuse(s). Use the same type fuses.
- Reconnect the power cord and turn on the instrument.
- If the problem persists, contact Brolight Corporation for service.

Note: Replace the burned fuses with new fuses of the same type, or buy them from the manufacturer.

Connect Cords and Cables



110-120V~/220-240~

Please make sure you select the right setting according to your AC voltage level.

Note: Before connecting any cords or cables, be sure that both switches on the Power Supply are in the OFF position and all voltage controls are turned fully to the left.

Note: The input power connector can be operated at 115VAC or 230VAC. The product is shipped with the setting on 230V. Please make sure you select the right setting according to your AC voltage level.

Appendix A: General Specifications

- Supply voltage:** 110-120V~/220-240V~
- Mains supply voltage fluctuations:** ±10%
- Frequency:** 50/60Hz
- Fuse Protection for inputs:** 250 V T1A
- Using site:** In door use
- Temperature:** Operating: 0°C to 40 °C, Storage: -20 °C to 50 °C
- Operating Altitude:** 0 to 2000 meters
- Relative Humidity:** Noncondensing < 10 °C, 90% from 10 °C to 30 °C; 75% from 30 °C to 40 °C
- Pollution degree:** 2
- Safety Compliance:** IEC/EN 61010-1
- Overvoltage category:** II
- Degree of protection:** IP20

Item	Description
DC Current Amplifier	Current range: 10 ⁻⁸ A~10 ⁻¹³ A, in six ranges ; 3.5 Digit Display; Zero drift: ≤ ±0.2% of full range reading in 30 minutes at the range of 10 ⁻¹³ A (after a 20 minute warm-up)

Appendix B: Product End of Life Disposal Instructions

Product End of Life Disposal Instructions:

This electronic product is subject to disposal and recycling regulations that vary by country and region. It is your responsibility to recycle your electronic equipment per your local environmental laws and regulations to ensure that it will be recycled in a manner that protects human health and the environment. To find out where you can drop off your waste equipment for recycling, please contact your local waste recycle/disposal service, or the place where you purchased the product.



The European Union WEEE (Waste Electronic and Electrical Equipment) symbol (above) and on the product or on its packaging indicates that this product must not be disposed of in a standard waste container.