

**Model 556H
High Voltage Power Supply
Operating and Service Manual**

Advanced Measurement Technology, Inc.

a/k/a/ ORTEC[®], a subsidiary of AMETEK[®], Inc.

WARRANTY

ORTEC* warrants that the items will be delivered free from defects in material or workmanship. ORTEC makes no other warranties, express or implied, and specifically NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

ORTEC's exclusive liability is limited to repairing or replacing at ORTEC's option, items found by ORTEC to be defective in workmanship or materials within one year from the date of delivery. ORTEC's liability on any claim of any kind, including negligence, loss, or damages arising out of, connected with, or from the performance or breach thereof, or from the manufacture, sale, delivery, resale, repair, or use of any item or services covered by this agreement or purchase order, shall in no case exceed the price allocable to the item or service furnished or any part thereof that gives rise to the claim. In the event ORTEC fails to manufacture or deliver items called for in this agreement or purchase order, ORTEC's exclusive liability and buyer's exclusive remedy shall be release of the buyer from the obligation to pay the purchase price. In no event shall ORTEC be liable for special or consequential damages.

Quality Control

Before being approved for shipment, each ORTEC instrument must pass a stringent set of quality control tests designed to expose any flaws in materials or workmanship. Permanent records of these tests are maintained for use in warranty repair and as a source of statistical information for design improvements.

Repair Service

If it becomes necessary to return this instrument for repair, it is essential that Customer Services be contacted in advance of its return so that a Return Authorization Number can be assigned to the unit. Also, ORTEC must be informed, either in writing, by telephone [(865) 482-4411] or by facsimile transmission [(865) 483-2133], of the nature of the fault of the instrument being returned and of the model, serial, and revision ("Rev" on rear panel) numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. The ORTEC standard procedure requires that instruments returned for repair pass the same quality control tests that are used for new-production instruments. Instruments that are returned should be packed so that they will withstand normal transit handling and must be shipped PREPAID via Air Parcel Post or United Parcel Service to the designated ORTEC repair center. The address label and the package should include the Return Authorization Number assigned. Instruments being returned that are damaged in transit due to inadequate packing will be repaired at the sender's expense, and it will be the sender's responsibility to make claim with the shipper. Instruments not in warranty should follow the same procedure and ORTEC will provide a quotation.

Damage in Transit

Shipments should be examined immediately upon receipt for evidence of external or concealed damage. The carrier making delivery should be notified immediately of any such damage, since the carrier is normally liable for damage in shipment. Packing materials, waybills, and other such documentation should be preserved in order to establish claims. After such notification to the carrier, please notify ORTEC of the circumstances so that assistance can be provided in making damage claims and in providing replacement equipment, if necessary.

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SAFETY INSTRUCTIONS AND SYMBOLS

This manual contains up to three levels of safety instructions that must be observed in order to avoid personal injury and/or damage to equipment or other property. These are:

DANGER Indicates a hazard that could result in death or serious bodily harm if the safety instruction is not observed.

WARNING Indicates a hazard that could result in bodily harm if the safety instruction is not observed.

CAUTION Indicates a hazard that could result in property damage if the safety instruction is not observed.

Please read all safety instructions carefully and make sure you understand them fully before attempting to use this product.

In addition, the following symbol may appear on the product:



ATTENTION – Refer to Manual



DANGER – High Voltage

Please read all safety instructions carefully and make sure you understand them fully before attempting to use this product.

- II. Section 1. - Add symbol DANGER - High Voltage next to the 'WARNING'.
- III. Section 2. - Remove word "toggle".
- IV. In Section 2.3 change the last sentence to:
Fuse rating: 1.5A (FAST) (250V) size 3AG for 115V or 0.75A(F) (250V) size 5X20 mm for 230V ac operation.
- V. Section 3.2, change last sentence of the first paragraph to:
On 115 V ac operation a 1.5A (FAST)(250V) size 3AG fuse should be used; on 230 V ac operation a **0.75A(F) (250V) size 5X20 mm fuse should be used.**
- VI. Section 3.3 Change as follows:
 - 3. Install 1.5 A(FAST) (250V) size 3AG for 115V in gray topped fuse knob or a 0.75A(F) (250V) size 5X20 mm for 230V in black topped fuse knob.
 - 7. Remove word "toggle".
- VII. Make Section 5.3, 5.4 and add Section 5.3 as follows:
5.1. Cleaning Instructions

To clean the instrument exterior, do the following:

1. Remove loose dust on the outside of the instrument with a lint free cloth.
2. Remove remaining dirt with a lint free cloth dampened in a general purpose detergent and water solution. Do not use abrasive cleaners.

CAUTION: To prevent getting moisture inside of the instrument during external cleaning, use only enough liquid to dampen the cloth or applicator.

SAFETY WARNINGS AND CLEANING INSTRUCTIONS

DANGER Opening the cover of this instrument is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.

WARNING Using this instrument in a manner not specified by the manufacturer may impair the protection provided by the instrument.

Cleaning Instructions

To clean the instrument exterior:

- Unplug the instrument from the ac power supply.
- Remove loose dust on the outside of the instrument with a lint-free cloth.
- Remove remaining dirt with a lint-free cloth dampened in a general-purpose detergent and water solution. Do not use abrasive cleaners.

CAUTION To prevent moisture inside of the instrument during external cleaning, use only enough liquid to dampen the cloth or applicator.

- Allow the instrument to dry completely before reconnecting it to the power source.



ORTEC 556H HIGH VOLTAGE POWER SUPPLY

1. DESCRIPTION

The ORTEC 556H High Voltage Power Supply provides either polarity of output voltage from 50 to 3000 V, 0 to 10 mA. The adjusted output voltage of the selected polarity is available simultaneously through two SHV rear-panel connectors. A rear-panel slide switch permits operation on either 115- or 230-V ac input power, furnished through a removable power line cord and connector.

The 556H features a front-panel LCD meter which can be programmed via a front-panel toggle switch to display either output voltage or load current. The output voltage can be programmed by an external control via a rear panel BNC connector.

The 556H provides the extremely stable, low-noise, high voltage that is required for proper bias of photomultiplier tubes, ionization chambers, and semiconductor detectors.

WARNING

THIS INSTRUMENT PRODUCES EXTREMELY HAZARDOUS VOLTAGES AT A POTENTIALLY LETHAL CURRENT LEVEL. NEVER CONNECT OR DISCONNECT THE HIGH VOLTAGE OUTPUT CONNECTOR WITH THE POWER SWITCH ON. NEVER CHANGE THE OUTPUT POLARITY SWITCH WITH THE POWER SWITCH ON. ALWAYS SWITCH POWER OFF AND WAIT AT LEAST 30 SECONDS BEFORE CONNECTING OR DISCONNECTING CABLES AND BEFORE CHANGING THE OUTPUT POLARITY.

2. SPECIFICATIONS

2.1. PERFORMANCE

OUTPUT POLARITY Positive or negative, selected by switch on rear panel.

OUTPUT RANGE 50 to 3000 V; minimum usable voltage 10 V.

OUTPUT LOAD CAPACITY 0 to 10 mA.

REGULATION $\leq 0.0025\%$ variation in output voltage for combined line and load variations within operating range at constant ambient temperature.

TEMPERATURE INSTABILITY $\leq \pm 50$ ppm/ $^{\circ}\text{C}$ after 30 minute warmup; operating range 0 to 50 $^{\circ}\text{C}$.

LONG-TERM DRIFT $< 0.01\%$ /hour and $< 0.03\%$ /24-hour variation in output voltage at constant input line voltage, load, and ambient temperature after 30 minute warmup.

OUTPUT RIPPLE < 10 mV peak-to-peak, 20 Hz to 20 MHz.

OVERLOAD PROTECTION Internal circuitry protects against overloads including short circuits.

RESETTABILITY Output voltage can be reset to within 0.1%.

2.2. CONTROLS

POWER Front-panel toggle switch energizes unit when power cord is connected to appropriate source, and an adjacent red LED lamp indicates when power is applied.

OUTPUT LEVEL One 6-position switch, one 5-position switch, and one 10-turn precision potentiometer; output level is the sum of the 3 settings.

METER Front panel toggle switch selects display of output voltage in kV or load current in mA.

POLARITY Rear-panel switch selects either positive or negative output polarity.

CONTROL Rear-panel locking toggle switch selects the reference source for the output voltage.

Int Selects the internal reference source; the front-panel controls select the output amplitude.

Ext Selects the external reference source; output voltage is proportional to magnitude of reference input.

AC VOLTAGE Rear-panel slide switch selects either 115 V or 230 V ac-input voltage.

2.3. INPUTS

AC POWER 103-129 V or 206-258 V, 47-63 Hz, 70 W nominal at full output power; supplied through international standard IEC power connector on rear panel Fuse rating: 1.5 A, 250 V fuse for 115 V ac operation or 0.75, 250 V fuse for 230 V ac operation.

EXTERNAL CONTROL Full range of output voltage can be based on an external dc reference level furnished through a rear-panel BNC connector; control voltage range is 0 through ± 6.9 V dc; control voltage polarity must be the same polarity as that selected by the rear-panel Polarity switch; this input protected against over-voltages $> \pm 7$ V. Input impedance > 45 k Ω .

2.4. OUTPUTS

REGULATED DC OUTPUT The adjusted and regulated voltage, with selected polarity, is furnished simultaneously to the two SHV connectors on the rear panel.

2.5. INDICATOR

METER Front panel LCD display indicates output voltage in kV ± 10 v or load current in mA \pm μ A. Load current is sum of external load current and internal load current. Internal load resistance is ~ 5 M Ω .

2.6. ELECTRICAL AND MECHANICAL

POWER REQUIREMENTS 115 or 230 V ac, 47-63 Hz, 70 W nominally.

WEIGHT

Net 5.7 kg (12.6 lb).

Shipping 6.6 kg (14.6 lb).

DIMENSIONS 11.43 x 22.35 x 29.21 cm (4.5 x 8.8 x 11.5 in.)

2.7. ACCESSORIES AVAILABLE

Two 3.66 cm (12 ft) long adapter cables are available from ORTEC for connecting to the Model 556H SHV output connectors:

1. ORTEC C-34-12 cable assembly: RG-59 A/U (75 Ω) cable with one C-37 SHV female plug and one C-26 MHV male plug.
2. ORTEC C-36-12 cable assembly: RG-59 A/U (75 Ω) cable with two C-37 SHV female plugs.

2.8. RELATED EQUIPMENT

Each of the two outputs of the 556H can be used as a power source for any application that is within the operating limits of the power supply. Both output levels are identical and of the same polarity. The load on the 556H output circuit is the sum of the individual loads connected to the output connectors, and the load current can be monitored by the front panel LDC meter.

This power supply is ideal for use with either one detector or a pair of detectors where the voltage level requirements are the same for both detectors. The appropriate types of detectors for which the 556H is designed include photomultiplier tubes, ionization chambers, and semiconductor detectors.

3. INSTALLATION

3.1. CONNECTION TO POWER

The 556H requires a grounded ac-power source of nominal 115 V or 230 V ac. A rear panel international-standard IEC connector allows the connection of many different types of line cords between the ac outlet and the 556H. A rear panel slide switch allows the choice of 115-V or 230-V ac input voltages. The unit is shipped with a choice of two fuse holder caps to accommodate either 3AG or 5 x 20 mm size fuses. On 115 V ac operation a 1.5 A, 250 V-rated fuse should be used; on 230 V ac operation a 0.75 A, 250 V rated fuse should be used.

3.2. CONNECTING INTO A SYSTEM

1. Check to see that the power switch is in the Off position.
2. Check rear panel 115/230 V ac switch and set to appropriate position.
3. Install a 1.5 A, 250 V fuse for 115 V ac setting or a 0.75 A, 250 V fuse for 230 V ac setting in the rear-panel-mounted fuse holder.
4. Check the polarity switch on the rear panel and set it for either positive or negative output polarity as required for the application.
5. Connect a high-voltage cable from either output connector on the 556H to instrument to be powered. Use the other output connector if a second instrument is to be operated at the same output voltage.

6. Set the front-panel selector switches and potentiometer for the desired voltage level. This is normally specified for the instruments to which the voltage is to be applied. The adjusted output voltage will be the sum of the setting of all three controls.
7. Turn on the power with the toggle switch on the front panel. The indicator lamp next to the switch will light to show that input power is being applied. The indicating meter at the top of the front panel will also indicate the polarity and amplitude of either the 556H output voltage or load current, depending on the setting of the meter switch.

3.3. CONNECTING AN EXTERNAL REFERENCE INPUT

The 556H output voltage level can be controlled by an external reference level that is furnished through the rear-panel BNC connector when the Control locking toggle switch is set at Ext. The range of input voltage is 0 to 6.9 V to provide an output from 0 to 3000 V. The front-panel voltage level controls are ineffective for external reference operation.

For positive output the polarity selector switch on the rear panel is set at Pos. And the external reference should be positive. For negative output the polarity switch is set at Neg and the external reference should be negative. The external reference voltage should be stable and filtered since the output is linearly proportional to the reference. The external reference should be capable of driving the 45-k Ω input impedance.

4. CORRECTIVE MAINTENANCE

4.1. GENERAL

The 556H should not require maintenance other than cleaning to prevent leakage paths from being created by dust collection. If an apparent malfunction is noted. It is important to determine if it is within the 556H power supply by disconnecting it from its load and performing routine diagnostic tests. The unit is short-circuit protected and with a short-circuit load the output voltage will drop to zero. If an external short circuit must be removed before the 556H will again produce its adjusted voltage.

4.2. TROUBLESHOOTING SUGGESTIONS

Only service technicians trained and experienced in the service of high-voltage circuitry should attempt trouble shooting this unit. **EXTREMELY DANGEROUS VOLTAGE LEVELS ARE PRESENT INSIDE THE 556H CHASSIS! OBSERVE GREAT CAUTION WHEN ANY PROTECTIVE COVERS ARE REMOVED WITH POWER APPLIED!**

To troubleshoot the 556H, check the internal $\pm 12V$ supplies first, then check for symmetrical conduction times for oscillator output MOSFETs Q10 and Q11. With the 556 set for positive polarity, the voltages at U1(2 and 3) should be nearly identical and equal to the reference voltage setting. If this is not the case, check components through the two regulating feedback loops described in Section 4.2.

4.3. FACTORY REPAIR

The 556H, or any other standard ORTEC product, may be returned to the factory for repair service at a nominal cost. Our standard procedure for repair ensures the same quality control and checkout that are used for a new instrument. Always contact Customer Services at ORTEC (865) 482-4411, before sending in an instrument for repair to obtain shipping instructions and so that the required Return Authorization Number can be assigned to the unit. Write this number on the address label and on the package to ensure prompt attention when it reaches the factory.