

ORTEC[®]

**Model 4006
Minibin and Power Supply
Operating Manual**

Advanced Measurement Technology, Inc.

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

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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.

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.

SAFETY WARNINGS AND CLEANING INSTRUCTIONS

DANGER The mains plug for this instrument shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous.

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.

CAUTION Before switching on this instrument, make sure that the line voltage selector is set to the voltage of the power source and the correct fuse is installed.

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 MODEL 4006 MINIBIN AND POWER SUPPLY

1. DESCRIPTION

The compact Model 4006 Minibin and Power Supply is the ideal solution where a small number of NIM modules must be located close to the action in a measurement system. Its slim 24-cm x 32-cm footprint minimizes the space required on a table top. It can operate at full power while sitting on a solid surface because rear intake and exhaust of cooling air eliminates the need to provide free air flow from below. The Model 4006 accommodates up to 6 standard, single-width NIM modules, or a proportionately smaller number of double-width modules. In addition to the standard ± 24 -V and ± 12 -V dc power, ± 6 V is provided to serve the high-current demands of TTL and ECL logic used extensively in newer NIM modules. The full load of 0.75 A on both of the 24-V supplies, 1.5 A on both of the 12-V supplies, and 4 A on both of the 6-V supplies can be drawn at room temperature (23°C) for a total of 120 W dc power. A total load of 80 W dc can be driven at ambient temperatures up to 50°C. The standard 60 VA of 120 V ac is also available on the module power connectors, independent of the actual ac voltage applied to the main power cord. Two 9-pin D connectors on the rear panel provide a convenient source of ± 6 -V, ± 12 -V and ± 24 -V power for preamplifiers via the industry-standard preamplifier power plug.

Extensive protection is designed into the Model 4006 power supply. Crowbar circuits are included on the ± 6 -V power lines to protect TTL and ECL integrated circuits against overvoltage. All six of the dc power lines incorporate protective fold-back circuits that automatically reduce the output voltage in case of an excessive load current or a short circuit. Green LED indicators turn red when the supply voltage is reduced by an overload. The LEDs extinguish if the voltage is reduced to zero by a low-impedance short circuit. Thermal cut-out switches protect the power supply against excessive temperature. When the heat sink temperature is within 15°C of the maximum safe temperature, the red TEMP warning indicator turns on. When the maximum safe temperature is exceeded, all power to the unit is automatically turned off. Power is recovered automatically when the temperature is reduced below the safe limit. There are no hot, external heat sinks that can be accidentally touched. All heat sinks are internal to the unit and cooled by forced air. The ac power input is protected with a fuse, and the unit meets all CE requirements.

A power input module with the standard IEC connector and selectable 100, 120, 220 and 240 ac input voltages at 50 or 60 Hz makes the Model 4006 compatible with power cords and ac power outlets in virtually all countries.

2. SPECIFICATIONS

2.1. BIN

MECHANICAL TOLERANCES in accordance with DOE/ER-0457T,¹ providing for interchangeability of all NIM standard modules.

MODULE CONNECTORS AND WIRING Six NIM module connectors wired in parallel for +6 V, -6 V, +12 V, -12 V, +24 V, -24 V, power return, high-quality ground return, and 117 V ac, in accordance with DOE/ER-0457T pin assignments (see Table 1).

PREAMPLIFIER POWER CONNECTORS Two industry-standard, female, 9-pin, D connectors on the rear panel provide power for up to two preamplifiers.

Connectors mate with power cords on all standard ORTEC preamplifiers. Compatible with preamplifier power cables of most other NIM manufacturers. Pin assignments are as follows.

Pin	Voltage	Pin	Voltage
1	Ground	6	-24 V
2	Ground	7	+24 V
3	+6 V	8	No connection
4	+12 V	9	-12 V
5	-6 V		

CONSTRUCTION Painted aluminum enclosure with cadmium-plated steel perforated top/bottom module-retainer plates and connector mounting plate. Plastic front bezel and guide-rail inserts. Rubber feet for table-top protection. All heat sinks are internal and cooled by a forced-air fan. Cooling air flows from the

¹Standard NIM Instrumentation System, U.S. NIM Committee, May 1990, DOE/ER-0457T, NTIS, U.S. Department of Commerce, Springfield, Virginia 22161.

lower rear intake, through the power supply and modules to exhaust at the top rear.

2.2. POWER SUPPLY

INPUT 100, 120, 220, 240 V ac, 50 or 60 Hz, 400 VA max., EMI filtered per IEC 801. Overvoltage category II, Pollution degree 2. Voltage regulation allows a range of +10% to -12% of the nominal voltage. Input current at 120 V ac is typically 3 A rms for a 120-W dc load. The rear-panel power-entry module provides a standard IEC plug for connecting power cords that are compatible with local ac voltage outlets. The power-entry module lets you select the required input voltage, and contains the input fuse. Fuse ratings are 4 A, 250 V (SLO-BLO) size 3AG for 100 or 120 V ac, and 2 A, 250 V (T) size 5 × 20 mm for 220 or 240 V ac.

DC OUTPUT Maximum rated currents for each voltage supplied to the 6 module power connectors and 2 preamplifier power connectors are:

DC Voltage (V)	Maximum Current (A)	DC Voltage (V)	Maximum Current (A)
+6	4	-6	4
+12	1.5	-12	1.5
+24	0.75	-24	0.75

Maximum total dc output power: 120 W at 23°C, 80 W up to 50°C ambient air temperature.

120 V AC OUTPUT Limited only by the power supply fuse when operating from 120 V ac. Limited to 60 VA when dc load is 80 W when operating from 100, 120, 220, or 240 V ac.

DC REGULATION <±0.1% (typically ±0.05%) for ±12 V and ±24 V, and <±0.2% (typically ±0.1%) for ±6 V over the combined range of zero to full load with the specified input voltage range for measurements made within a 1-minute period. Regulation <±0.3% for ±12 V and ±24 V, and <±0.6% for ±6 V over any 24-hour period at constant ambient temperature for the same load and input ranges after a 60-minute warm-up.

OUTPUT IMPEDANCE <0.3 Ω at any frequency to 100 kHz.

TEMPERATURE COEFFICIENT <0.02%/°C over a range of 0–50°C.

LONG-TERM STABILITY <±0.5% after a 24-h warmup at constant load, line voltage, and ambient temperature over a 6-month period.

NOISE AND RIPPLE <3 mV peak-to-peak as observed on an oscilloscope with a 50-MHz bandwidth.

VOLTAGE ADJUSTMENT ±5% minimum range, resettability <±0.05% of power supply voltage.

RECOVERY TIME <100 μs to return to within ±0.1% of the rated voltage for all dc outputs for any voltage change within the rated range or for a change of load current from 10% to 100% of full load.

CIRCUIT PROTECTION The input power line includes a fuse. The power supply is automatically turned off by an internal switch if the temperature of the internal heat sink exceeds 110°C. Recovery is automatic when the temperature decreases to a safe value. A red light on the front panel turns on when the heat sink temperature exceeds 95°C to warn that the maximum temperature is being approached. All dc outputs include a current foldback circuit to limit the output current to nominally 120% of the rated value. This feature provides short-circuit and overload protection. Recovery is automatic after the overload is removed. Over-voltage protection for the ±6-V outputs prevents these outputs from exceeding ±7.5 V, respectively, to protect the integrated circuits that are commonly powered by these supply voltages.

COOLING Rear-panel fan forces cooling air over the internal power supply heat sinks and up through any installed NIM modules to exhaust at the top rear. Consequently, no hot heat sinks are exposed to accidental contact.

ENVIRONMENTAL Temperature 0 to 50°C. Indoor use. 95% maximum relative humidity, non-condensing. Altitude up to 2,000 meters. Installation category II. Pollution degree 2. Meets all CE requirements.

2.3. CONTROLS AND INDICATORS

POWER Front-panel rocker switch interrupts both sides of the input power line.

AC Front-panel green LED lights when the ac mains power is supplied to the power transformer primary. If this light goes out during operation, check for a blown fuse or a temperature exceeding the 110°C cutout.

TEMP Front-panel red LED turns on when the internal heat-sink temperature exceeds 95°C to warn that the shut-down temperature limit is being approached. The TEMP light turns off if power has been shut off by exceeding the heat-sink temperature limit.

STATUS Six, front-panel LEDs indicate when the respective dc voltage is out of regulation because of a current overload or short circuit. Green indicates normal operation (within $\pm 5\%$ of the nominal voltage), while red indicates an out-of-regulation fault. A light turned off implies zero voltage due to a short circuit or lack of ac input power. The lights are labeled with the supply voltage (-6 V, +6 V, -12 V, +12 V, -24 V, and +24V) and the maximum rated load current for each supply voltage.

CALIBRATION Six potentiometers mounted inside on the printed wiring board permit precise adjustment of the six dc output voltages.

2.4. ELECTRICAL AND MECHANICAL

WEIGHT Net 12 kg (26 lb); shipping 14 kg (31 lb).

DIMENSIONS 24.0 cm W x 32.0 cm D x 32.5 cm H (9.4 in. W x 12.6 in. D x 12.8 in. H).

3. INSTALLATION

3.1. UNPACKING

Unpack the 4006, being careful to retain all packing materials until the unit has been checked for damage. Attach the mains power cord to the connector on the rear of the power supply.

3.2. SELECTING THE LINE VOLTAGE

Before connecting any system components to the ac mains source, consult the corresponding hardware manuals and make sure each component is configured for your ac line voltage.

CAUTION Your equipment can be destroyed if it is not set to the proper power line voltage!

The 4006 has a Corcom™ Power Entry Module on the rear panel. This module (Fig. 1) contains the power connector; a small, removable drum for setting the line voltage; and a line fuse. The removable drum lets you configure the instrument for a nominal 100, 120, 220, or 240 V ac. The module door has a small window that shows the line voltage setting now in use.

3.2.1. Selecting a Different AC Input Voltage

To change the ac input voltage:

1. Disconnect the power cord from the 4006.
2. Use a small flat-blade screwdriver or similar tool to pop open the module door.
3. Remove the plastic drum (pinch the sides of the drum with your fingernails and pull, or insert a flat-blade screwdriver in the slot between the **120Vac** and **240Vac** settings and *gently* pry the drum loose, one end at a time).

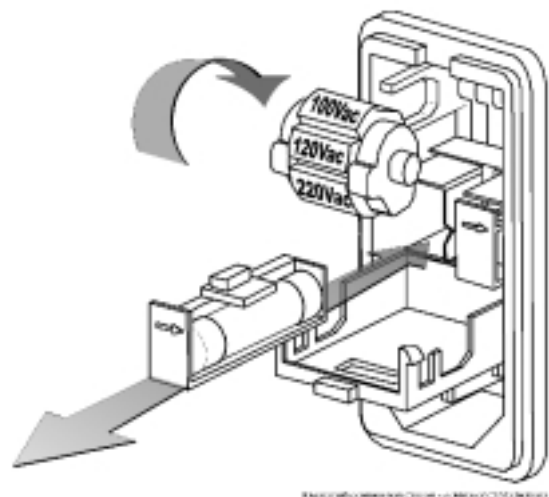


Fig. 1. Setting the Line Voltage and Replacing the Fuses.

4. Rotate the drum until the desired line voltage setting will show in the door window, and firmly press the drum back into the holder.

NOTE The spindles on each side of the drum are octagonal, not round. This gives each of the 4 settings a definite detent. To avoid eroding these detents, always remove the drum before rotating it.

5. Close the module door. You are now ready to connect the power cord to the 4006.

3.2.2. Replacing the Fuses

The 4006 requires the following fuses:

- For 100 or 120 V ac line voltage, a 4-A slow-blow fuse (Littelfuse® 3AG or equivalent)

- For 220 or 240 V ac line voltage, a 2 A(T) fuse (Littelfuse type 213, 5 × 20 mm or equivalent).

The 3AG fuse requires a Corcom LA200 fuseholder; the 5 × 200 mm fuse requires a Corcom LA201 fuseholder. (We supply the appropriate fuse and fuseholder based on your order specifications.)

CAUTION Do not use makeshift fuses or short-circuit the fuse holders.

To replace a fuse:

1. Disconnect the power cord from the 4006.
2. Use a small flat-blade screwdriver or similar tool to pop open the module door.

4. OPERATING INSTRUCTIONS

4.1. POWER SUPPLY LIMITATIONS

The 4006's maximum power output is 80 W at 50°C. Make sure that your combination of NIM modules does not exceed this limit.


If any of the dc power supplies is overloaded, the status light for that voltage changes to red for a moderate overload or turns off for a hard short to ground. Check the exact voltage on the pins of one of the preamplifier power plugs on the rear panel.

DANGER *Do not probe the pins on the module power connectors inside the bin* — 120 V ac is present on pins 33 and 41.

4.2. INSERTING AND REMOVING MODULES

Modules can be inserted or removed from the bin while the mains power is on without damaging the power

CAUTION Virtually all NIM manufacturers have adopted the preamplifier pin assignments for ± 12 V and ± 24 V. However, some manufacturers use the pins assigned to ± 6 V for other purposes. Before connecting a preamplifier, check that the preamplifier pin assignments are compatible with the pin assignments on the 4006 preamplifier power outputs.

3. Each line fuse has its own plastic fuseholder "drawer" marked with an arrow (). Gently pull the fuseholder out, remove the old fuse, and press in the replacement.
4. Slide the fuseholder back into the module, and close the module door. You are now ready to connect the power cord to the 4006.

3.3. LOCATION

The ORTEC 4006 Minibin and Power Supply is designed for tabletop installation. The bin is vented for fan cooling; be sure to position it so cooling air can enter through the rear-panel fan and can freely exhaust at the top rear. Also, avoid locating the unit near or above heat-producing equipment without taking the temperature rise into account.

supply. However, the sequence of power application to the set of modules cannot be determined if the bin is on when a module is inserted.

After inserting a module, check that the power supplies are not overloaded. All lights should be green. In addition, ***you should measure the voltages at the rear-panel preamplifier power plugs and ensure the measurements are within specifications.*** If these conditions are not true, remove the module and eliminate the cause of the overload.

4.3. CONNECTING PREAMPLIFIER POWER

Each preamp power output connector can be expanded to four output connectors by using the optional Model 4002P-C1 Preamp Power Fan-Out Cable. Using four of the Model 4002P-C1 cables allows the 4002P to supply power to 14 preamplifiers.

5. CIRCUIT DESCRIPTION

5.1. OVERVIEW

The bin circuit consists only of passive power-distribution wiring. The power supply produces six dc output voltages. A power transformer transforms the input ac line voltage into six separate low-voltage sources. The sources or windings are full-wave-rectified, capacitor-filtered, and regulated by electronic series regulator circuits. The regulator circuits provide short-circuit, current-limiting, and reverse-current protection.

The six series regulator circuits are identical in operation. Physically, they differ only in component values for each supply. The regulator can operate in two modes:

- Normal voltage-regulation mode
- Current-foldback or current-limiting protection mode

In voltage-regulation mode, the regulator will operate at any current output up to and including the full rated output of a particular dc output voltage.

The regulator automatically converts to current-foldback mode when current output beyond ~120% of the rated output (which includes a direct short across the output terminals) is required. This limits power and protects the regulator's circuitry and components. When excess current demand drops to a normal value, the regulator switches back to voltage-regulation mode.

6. CALIBRATION AND MAINTENANCE

6.1. POWER SUPPLY DISASSEMBLY AND TROUBLESHOOTING

The 4006 Minibin and Power Supply needs no routine maintenance or adjustment. If a problem develops and troubleshooting becomes necessary, the upper portion of the minibin should be removed to provide access to the components.

6.2. DC OUTPUT VOLTAGE LEVEL ADJUSTMENTS

Under normal conditions, none of the six dc voltage levels should need adjustment. However, after a long period of use, a slight readjustment might become necessary due to component aging. When any of the six dc voltage levels, as monitored at the preamp power connectors, are not within the prescribed tolerances listed under **DC OUTPUT** in Section 2.2, you can adjust their six corresponding calibration potentiometers mounted on the printed wiring board. To do this:

1. Turn the minibin power switch OFF and disconnect the ac power cord.
2. Remove the four screws (two each on the left and right side panels) just below the joint between the top and bottom sections of the minibin.

3. Slide the top section of the bin forward approximately 4 cm until the NIM connectors at the rear of the upper section have cleared the connector shield. Now gently lift the top section up and forward (see Fig. 3) until it clears the bottom section. **As you lift the top section, do not stress the wires that connect the two halves of the unit.**

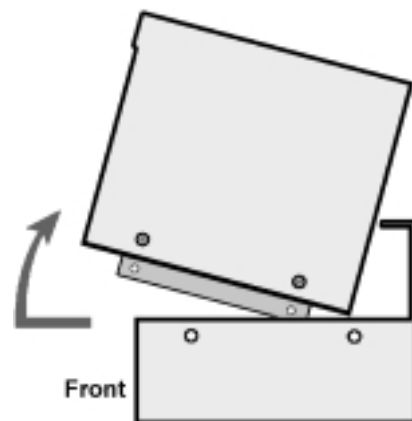


Fig. 3. Pull the Top Section Forward Then Rotate Up.

4. Lay the top section beside the bottom section (you may find it most convenient to place it to the left of the bottom section).

DANGER Before reaching inside the bottom section, use Figs. 4 and 5 to locate the two **thermal switches** on top of the heat sinks in the center of the board; the **ac power connection** on the inside rear panel; and the **capacitors** on the front half of the board. Dangerous voltages are present on these switches, connections, and capacitors. **Be sure not to touch them** as you adjust the dc-voltage calibration potentiometers! Check the voltage *outside the unit only*, on the pins of one of the rear-panel, preamplifier power plugs. (Remember, too, that the heat sinks may be very hot.)

5. The printed wiring board is located on the left of the bottom section (Fig. 4). The six dc-voltage calibration potentiometers are on the rear one-third of the board (Fig. 5), closest to the fan.
6. Carefully connect the ac power cord and turn on the ac power.
7. Use a small flat-blade screwdriver to adjust the calibration potentiometers.

Potentiometer	Voltage
R11	+24V
R28	+12V
R42	+6V
R58	-24V
R71	-12V
R86	-6V

8. Turn off the ac power and disconnect the ac power cord.
9. Replace the top section, making sure not to pinch or kink any of the wire bundles that connect the two sections.
10. Replace the four screws (two each on the left and right side panels) below the joint between the top and bottom sections of the minibin.
11. Reconnect the ac power cord.

6.3. FACTORY REPAIR

This instrument can be returned to the ORTEC factory for service and repair at a nominal cost. Our standard repair procedures ensure the same quality control and checkout that are used for a new instrument. Before returning an instrument for repair, *always* contact the ORTEC Customer Service Department at (865) 482-4411 to obtain shipping instructions and the required Return Authorization Number. Write this authorization number on both the address label and package to ensure proper handling when the instrument reaches the factory.

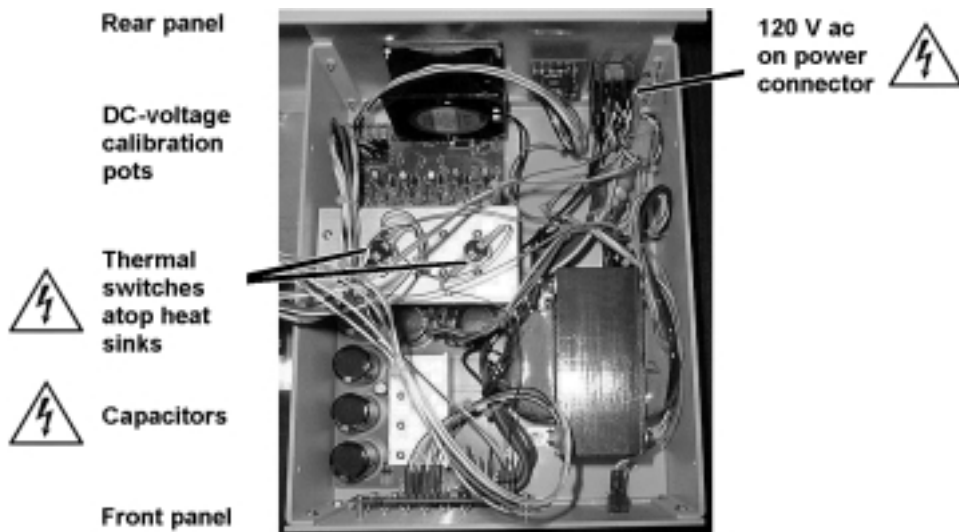


Fig. 4. Do Not Touch the Thermal Switches, AC Power Connector, or Capacitors.

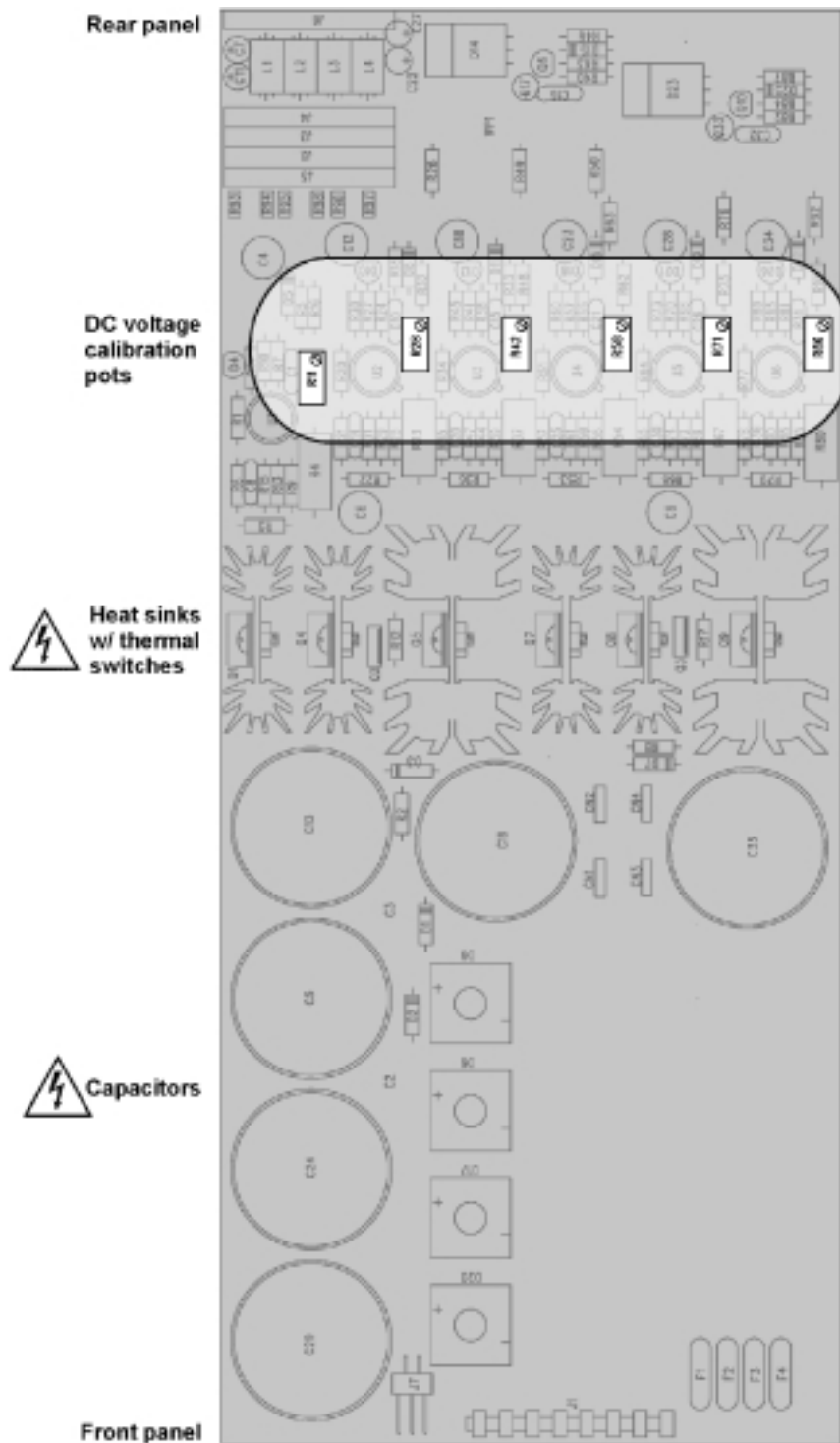


Fig. 5. The Six DC-Voltage Calibration Potentiometers — R11, R28, R42, R58, R71, and R86 — Located on the Rear Third of the Board.

Table 1. Bin/Module Connector Pin Assignments For Standard Nuclear Instrument Modules per DOE/ER-0457T.

Pin	Function	Pin	Function
1	+3 V	23	Reserved
2	-3 V	24	Reserved
3	Spare bus	25	Reserved
4	Reserved bus	26	Spare
5	Coaxial	27	Spare
6	Coaxial	*28	+24 V
7	Coaxial	*29	-24 V
8	200 V dc	30	Spare bus
9	Spare	31	Spare
10	+6 V	32	Spare
11	-6 V	*33	117 V ac (hot)
12	Reserved bus	*34	Power return ground
13	Spare	35	Reset (Scaler)
14	Spare	36	Gate
15	Reserved	37	Reset (Auxiliary)
*16	+12 V	38	Coaxial
*17	-12 V	39	Coaxial
18	Spare bus	40	Coaxial
19	Reserved bus	*41	117 V ac (neutral)
20	Spare	*42	High-quality ground
21	Spare	G	Ground guide pin
22	Reserved		

Pins marked (*) are installed and wired in the Model 4006.