



Model 4002D
160-W
NIM Bin Power Supply
Operating and Service Manual

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4002D Manual Updates
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- I. Add the following text in the front of the manual on page ii:

WARNING: 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.

WARNING: 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: 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.

The following symbols may appear on the product:



ATTENTION - Refer to Manual



DANGER - High Voltage

- II. Modify Section 2.2, CIRCUIT PROTECTION as follows:
Replace; "The input line to the power supply is fused." with: Fuse Rating: 8 A (SB) size 3AG fuse for 100 V or 120 V operation; 5 A (T) size 5X20 mm fuse for 220 V or 240 V operation
- III. Modify Section 3.2 as follows:
- A. Add section following Step %3.2. to:
Install a 8 A (SB) (250V) size 3AG fuse for 100V or 120V operation. Install a 5 A (T) (250V) size 5X20 mm fuse in the fuse holder supplied with the power supply for 200V or 220V operation.
- IV. Insert Section 6.2 as follows:

6.2. 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.

CONTENTS

	Page
WARRANTY	ii
PHOTOGRAPHS	iv
1. DESCRIPTION	1
2. SPECIFICATIONS	2
3. INSTALLATION	2
3.1. Unpacking	2
3.2. Selecting the Mains Voltage	2
3.3. Connection of the 4002D to a NIM Bin	2
4. OPERATING INSTRUCTIONS	4
5. CIRCUIT DESCRIPTION	5
6. MAINTENANCE	5
6.1. Factory Repair	6
Schematic 743300	

ILLUSTRATIONS

Fig. 1. Bin to Power Supply Block Adapter Installation	3
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EG&G ORTEC 4002D POWER SUPPLY

1. DESCRIPTION

The EG&G ORTEC Model 4002D Power Supply is designed to supply dc power to a NIM Bin when the application requires ± 6 V, ± 12 V and ± 24 V power. The 4002D Power Supply can be purchased separately for use with existing NIM Bins, or it can be ordered attached to either a 4001A NIM Bin or a 4001C NIM Bin. Mounting hardware is supplied to make the Model 4002D compatible with all EG&G ORTEC NIM Bins. With minor mounting modifications the 4002D can be used with most standard NIM Bins. The EG&G ORTEC 4001C NIM Bin is recommended for use with the 4002D because the 4001C distributes the power with copper bus bars to minimize the voltage drop at each module's power plug. The 4002D Power Supply is designed to exceed recommended power supply specifications for Type V-H supplies as defined in DOE/ER-0457T.

Regulated dc power supplied to the attached bin by the 4002D is conservatively rated at +6 V @ 10 A, -6 V @ 10 A, +12 V @ 3 A, -12 V @ 3 A, +24 V @ 1.5 A, and -24 V @ 1.5 A. These maximum output currents can be delivered in any combination provided the total output dc power does not exceed 160 W at ambient temperatures up to 50° C. In addition, 115 V ac is available up to 0.5 A.

Protection against overload is provided in several ways. When the heat sink temperature exceeds 95° C,

the red warning indicator is illuminated on the attached bin control panel. When the heat sink temperature exceeds 110° C, the power supply is automatically shut down, causing both the power and temperature indicator lights to turn off. Recovery from thermal overload is automatic when the thermal load is reduced. Output currents from the dc supplies are internally limited to 120% of their rated values by foldback circuits. This provides overload and short-circuit protection. On the +6 V and -6 V dc supplies, crowbar circuits limit the output voltage to 7.5 V to protect integrated circuits. Fuses protect the ac inputs to the power supply.

An external slide switch allows selection of either 115 or 220 V ac as the power input. By changing pins on an internal connector, this selection can be altered to 100 and 200 V ac. An international standard IEC power connector permits power cords and plugs that meet local electrical standards to be used for the input power. Control of the primary power is provided by the On/Off switch on the NIM Bin control panel.

Connection of power and control lines to the NIM Bin is provided by the standard interface connector specified in DOE/ER-0457T. Mechanical mounting of the power supply to the bin is with brackets utilizing the standard bolt pattern specified in DOE/ER-0457T.

2. SPECIFICATIONS

INPUT 103-129 or 200-258 V ac, 47-63 Hz. An external slide switch selects nominal input voltages of 115 or 220 V ac. Changing pins on an internal connector allows operation at 88-110 V or 191-239 V ac, 47-63 Hz, with the external slide switch selecting nominal voltages of 100 or 200 V ac. Input current at 115 V ac is nominally 4 A for a 160-W dc output simultaneous with a 0.5-A, 115-V ac output. Dual fuse input uses 8-A SB U.S.A. standard fuses for 100 or 115 V ac, 60 Hz and 5-A SB metric fuses for 200 and 220 V ac, 50 Hz operation.

DC OUTPUTS Maximum rated output currents are:

DC Voltage	Maximum Current	DC Voltage	Maximum Current
+6 V	10 A	-6 V	10 A
+12 V	3 A	-12 V	3 A
+24 V	1.5 A	-24 V	1.5 A

Maximum dc output power from 0 to 50° C is 160 W. Derate 3%/° C for 50 to 60° C.

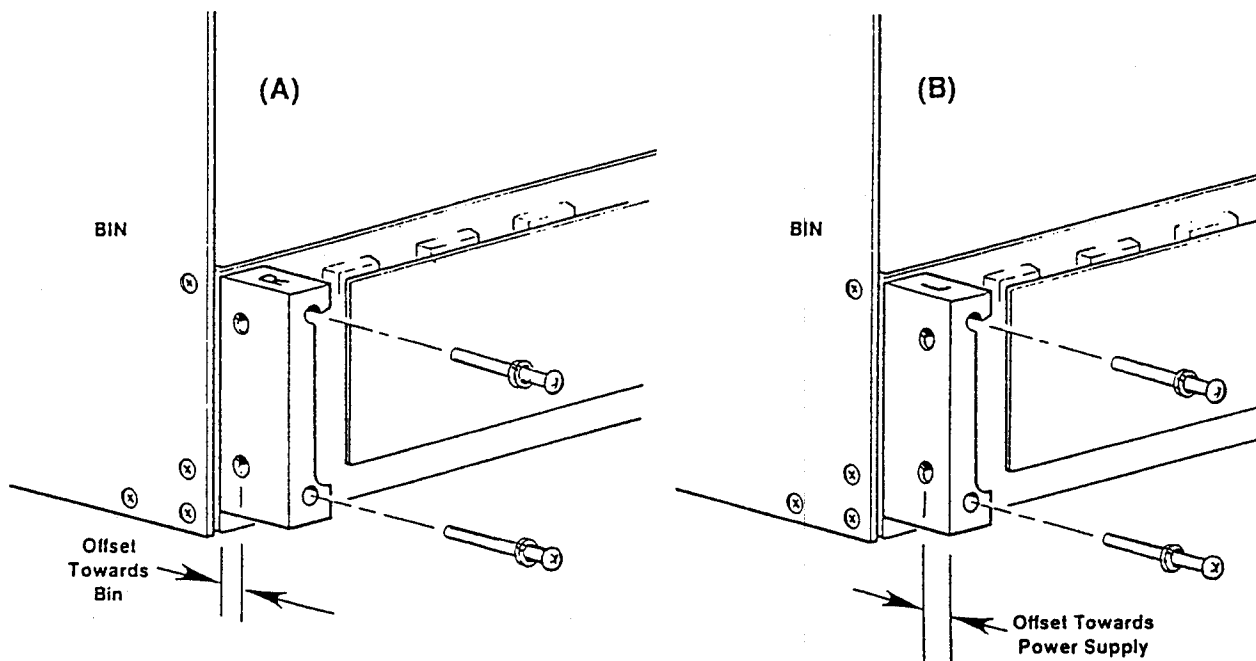


Fig. 1. Bin to Power Supply Block Adapter provides simple installation of bins and power supplies. (A) Illustrates Adapter used with EG&G ORTEC 4001A/C Bins. (B) Shows Adapter repositioned for use with earlier EG&G ORTEC bins. These conversions are accomplished by exchanging the positions of the two Adapter Blocks on the NIM bin.

having three wires. (This is the only unused wire on the primary section of the transformer.)

2. Using the proper tool (Part No. 635690), extract the black wire from position 3 of the primary connector wiring housing. NOTE: this black wire must be connected to the same primary section as the black/white wire.
3. Install the black/white wire into position 3 of the primary connector wiring housing.
4. Cover exposed pin of the black wire removed from the primary connector wiring housing with shrink tubing for safety.
5. Install the 100/200 V ac operation label to the chassis near the ac voltage select switch.

3.3. CONNECTION OF THE 4002D TO A NIM BIN

The 4002D Power Supply is normally attached to an EG&G ORTEC 4001C Modular System Bin. However, the 4002D is designed to DOE/ER-0457T specifications and may be attached, in the space provided, to any bin manufactured to those specifications.

3.3.1. Requirements for Attached Bin

The 4002D Power Supply is designed to provide very high currents to NIM modules that contain heavy

loads. The NIM Bin used with this power supply must be capable of handling the large currents demanded by those loads. The power On/Off switch mounted on the bin and its associated primary circuit wiring must be rated to handle 5 A.

The bin wiring distributing the dc voltages must also have an impedance low enough to yield negligible voltage drops at the rated currents for the supply. Although the EG&G ORTEC Model 4001A NIM Bin will function acceptably with the 4002D power supply, the Model 4001C Bin is strongly recommended as the more desirable choice. The EG&G ORTEC Model 4001C Bin employs copper bus bars for power distribution. This typically results in more than a factor of 10 lower voltage drop at maximum current.

3.3.2. Instructions for Attaching Bin

For attachment to a bin other than an EG&G ORTEC bin, please refer to the appropriate instruction manual. The On/Off switch and other controls necessary to operate the Power Supply are part of the bin and not furnished with the Power Supply.

For attachment to the EG&G ORTEC bin, the following steps are advised:

5. CIRCUIT DESCRIPTION

The 4002D Power Supply produces six dc output voltages. A power transformer changes 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 and current limiting protection.

Each of the six series regulator circuits are nearly identical in operation; they are physically different only in component values for each supply and in the pass element for the ± 6 V supply. The regulator can operate in two modes: first and normal is the voltage regulation mode; second is the current-foldback or current-limiting protection mode.

The regulator will operate in the voltage regulation mode at any current output up to and including the full rated output of a particular supply. When current output beyond $\sim 150\%$ of the rated output is required, which includes a direct short across the output terminals, the regulator automatically converts to a current-foldback mode. This provides power limiting and protection of the regulator's circuitry and components. When excessive current demands are removed, the regulator resumes the voltage regulation mode.

For a description of the regulator, refer to the schematic at the back of this manual. For convenience, only the $+24$ V regulator will be discussed. An

explanation of the regulation in the normal voltage regulation mode is given.

A 6.9-V reference voltage is set by the precision reference, D5. This reference voltage is divided by R3 and R4 and fed to pin 3 of the controller, U1. Simultaneously the output is divided by R10, R11, and R12, fed to pin 2 of U1, and compared with the voltage at pin 3 to produce an error signal at pin 6. Pin 6 of U1 drives the Darlington transistor, Q1, to maintain the same voltage at pins 2 and 3. Line regulation is improved by the Zener regulator, D4, which receives its unregulated voltage from a voltage-doubler circuit consisting of C1, C3, D1, and D3.

Current flow to the output is monitored by sensing the voltage drop across R9. When the potential between pins 10 and 1 of U1 exceeds ~ 80 mV, the output current and voltage will decrease, limiting the power dissipated in Q1.

Capacitors C5 and C6 tailor the frequency response of the system to provide excellent recovery time and output impedance characteristics. D6 provides reverse-current protection for the power supply and load in the event that a voltage source of the wrong polarity is connected to the output terminal. If loss of the sense lead should occur (pin 5 of J2 or pin 13 of PG14) R13 provides continued operation with some loss of regulation.

6. MAINTENANCE

The 4002D Power Supply needs no routine maintenance or adjustment. If a problem develops and troubleshooting becomes necessary, the top and bottom screen covers should be removed to provide access to the components. **While probing inside the 4002D Power Supply chassis, use extreme caution. There are two shock-hazard locations to regard: the wiring side of the input line cord connector block and the four thermal switches (S1, S2, S3, and S4) mounted against the heat sink. These two locations contain exposed primary circuit conductors.**

A test point (TP7) is provided on the circuit board to connect the reference lead of any probe. Table 6.1 shows typical dc voltages measured with respect to ground reference potential (TP7). These voltage levels are typical of a circuit that is operating properly; the precise values will vary between individual units.

Most of the components mounted on the heat sink can be replaced fairly easily. If replacement is required, remove power cord and then remove the four mounting screws that hold the inner chassis. Proceed by removing all wire connections associated with the

**BIN/MODULE CONNECTOR PIN ASSIGNMENTS
FOR STANDARD NUCLEAR INSTRUMENT
MODULES PER DOE/ER-0457T**

Pin	Function	Pin	Function
1	+3 volts	23	Reserved
2	-3 volts	24	Reserved
3	Spare Bus	25	Reserved
4	Reserved Bus	26	Spare
5	Coaxial	27	Spare
6	Coaxial	*28	+24 volts
7	Coaxial	*29	-24 volts
8	200 volts dc	30	Spare Bus
9	Spare	31	Spare
*10	+6 volts	32	Spare
*11	-6 volts	*33	117 volts 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 volts	38	Coaxial
*17	-12 volts	39	Coaxial
18	Spare Bus	40	Coaxial
19	Reserved Bus	*41	117 volts ac (Neut.)
20	Spare	*42	High Quality Ground
21	Spare	G	Ground Guide Pin
22	Reserved		

Pins marked (*) are installed and wired in EG&G ORTEC's 4001A and 4001C Modular System Bins.

