

Description

Introduction

The DIN Power Supply (DPS) is an off-line switch-mode power supply that provides a 24Vdc output at a maximum rated load of 525mA. The output has a minimum adjustability of $\pm 5\%$.

The DPS has continuous short circuit and overload protection. When a short circuit or overload is detected, the unit shuts down. The DPS attempts to recover (at approximately a 1 Hz rate) by raising the output voltage following shutdown. During these attempts, the OUTPUT ON indicator may flash, depending on how high the voltage rises. When the overload condition is removed or the short circuit is fixed, full recovery occurs.

The DPS power supply has input/output isolation, is convection cooled, and features a derated circuit design for added dependability.

The standard DPS comes with two removable terminal blocks: a 3-position terminal block for input power, and a 2-position terminal block for 24Vdc output. Additional 2-position terminal blocks are optionally available to power additional loops. (Note: RTBs are required to make connections to outputs). The removable terminal blocks allow the user to isolate individual loops for troubleshooting or general maintenance, without disturbing field wiring.

The -CS option provides an end panel connector for interconnecting the power supply to adjacent data communication modules.

The DPS is enclosed in the narrow-rail DIN-style housing. Any number can be snapped on a rail, and the rail can be mounted anywhere, on a wall, in a rack, or in a NEMA enclosure.

Installation

Introduction

This section provides information for mechanical installation and electrical installation of the power supply. Observe applicable notes and cautions given with the illustrations and text.

Mechanical Installation

Although each unit is designed for convection cooling, it is advisable to mount the unit on a surface made of material that can serve as a heat sink. The unit should be located in an area that is protected from dust, moisture, and corrosive atmospheres.

To connect the DPS to other data communication modules via the end panel connector, align the 15-pin connectors mounted on the sides of the units, press firmly together, and then mount to the DIN-style rail.

To install the unit on the DIN-rail, insert the spring clip under the short flange of the rail and press in and down on the unit until it snaps into position. See figure 1 for installation dimensions. To remove the unit, pull out and up to clear the rail.

Electrical Connections

Electrical connections are made to the removable terminal blocks on the front of the power supply. See table 1 for terminal designations. To connect wiring to the DPS, use 14 to 22 AWG insulated copper hookup wire. Strip 5/16" to 3/8" of insulation from the end of the wire and tin with 60/40 rosin core solder. Loosen the clamp screw and insert the tinned wire into the terminal while tightening the screw. To avoid transients and stray pickups, it is recommended that twisted conductors be used when they run close to other services.

To remove the wire, loosen the clamp screw and pull the wire straight out. Tag all wires for proper identification before removing them.

The removable terminal blocks allow individual loops to be disconnected, without tools, while not affecting the remaining loops.

Table 1. DPS Terminal Designations

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
GND	AC	ACC	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-

Key to Abbreviations

GND	Chassis ground
AC	Ac power input
ACC	Ac power return
+	+24Vdc output
-	+24Vdc return

The DPS power supply operates from an AC source. The unit requires 117Vac, $\pm 10\%$, 50/60 Hz of nominal power. The AC power input terminal (AC) should be connected to the ungrounded or "hot" side of the supply. The AC power return terminal (ACC) should be connected to common or neutral. The chassis ground terminal (GND) is the mechanical case connection.

Important Note: This document is complete as of the printing date; however, subsequent product changes may be reflected in companion documents.

Specifications

Characteristics		Output Regulation	Ordering Specifications
Front Panel Adjustments VOLTAGE ADJUST Control: adjustable multiturn potentiometer VOLTAGE ON Indicator: flashing red LED indicates recovery procedure in process +T/-T: input and output signal terminals for connecting test equipment	Performance Temperature: 0°C to +70°C (+32°F to +158°F) Temperature Effect: 0.05%/°C, maximum Efficiency: 65%, minimum rated at full load Hi-Pot Isolation: 1100Vrms between case, input, and output Switching Frequency: 125kHz, nominal Input Frequency: 47 to 63 Hz	Ac input: 0.5%, maximum low line to high line Load: 1%, maximum no load to full load Hold-up Time: 16 ms, minimum Ripple: 50mV, maximum (100kHz) 200mV, maximum (10mHz) Transient Recovery: 2ms, maximum, ±10%, maximum output change for no load to full load change Start Time: 2 seconds, maximum	Unit DPS Output Voltage 24DC 24Vdc, adjustable ±5%, minimum Output Current 525MA 525mA, maximum Power 117AC 117Vac, ±10% Options -CS End panel D-subminiature connector (to mate to data communication modules) -RTB4 Provides a total of four removable terminal blocks for additional 24Vdc output loops. -RTB8 Provides a total of eight removable terminal blocks for additional 24Vdc output loops. Housing DIN DIN-style rail-mount housing
		Weight 2.4 lbs. (1.05kgs) nominal	
Model number description: Unit / Output Voltage / Output Current / Power / Options [Housing]			

Accessories

Removable terminal blocks can be ordered as accessory items, without the power supply. They are available as replacement parts, or to provide the capability of powering additional output loops.

To order Removable Terminal Blocks only, specify:
 800-951-27 (3-position terminal block for power input)
 800-950-27 (2-position terminal block for 24Vdc output)

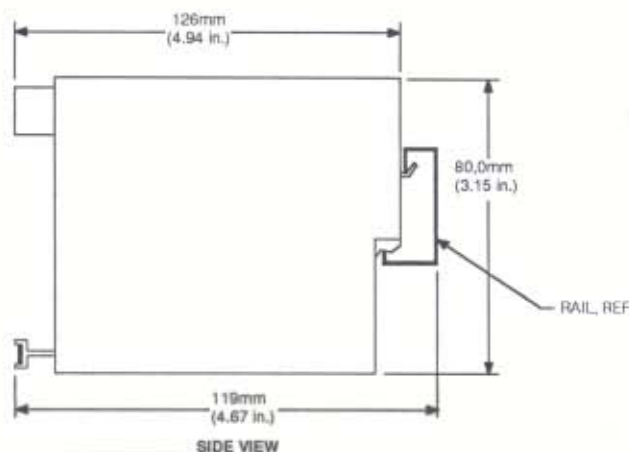
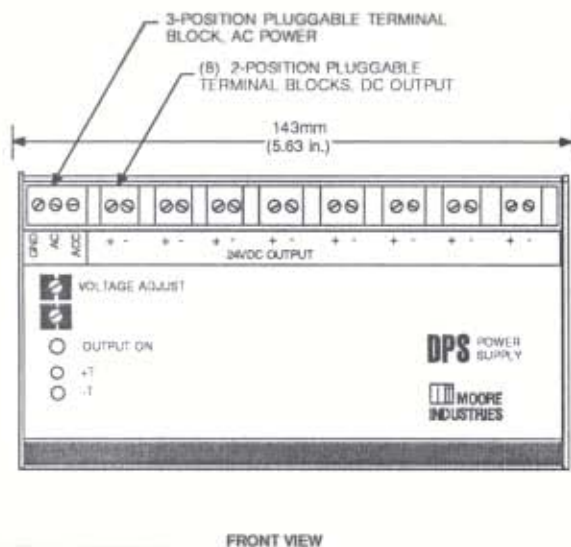


Figure 1. Installation Dimensions

Calibration

Introduction

Once adjusted and installed, the power supply operates unattended. Because each unit uses highly reliable solid-state components, the power supply operates maintenance free for extended periods of time.

A power supply may become warm during operation, especially where the ambient temperature is above normal. This is acceptable and should not cause alarm unless a malfunction is also observed.

After a power supply is unpacked, general operating level checks are recommended. The DPS has only one front panel adjustment: the voltage adjust control. This multiturn potentiometer can be adjusted with a blade screwdriver.

Caution

Screwdriver blade should not be more than 0.1 inch (2.54 mm) wide. A wider blade may permanently damage the potentiometer mounting.

The potentiometer is equipped with a slip clutch at each end to prevent wiper damage if the control is turned beyond the wiper stop. Turning the control clockwise increases the voltage, turning the control counterclockwise decreases the voltage.

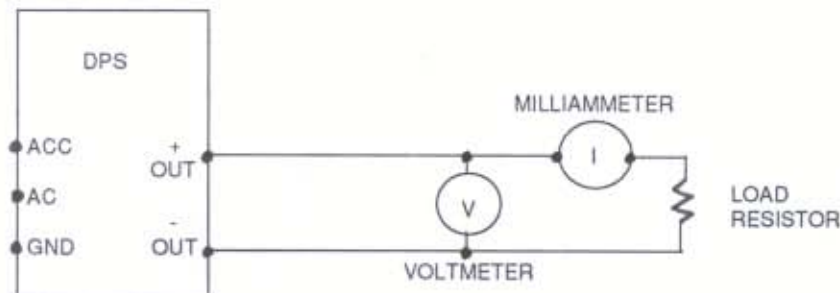
Test equipment must be provided by the user. A voltmeter, milliammeter, and load resistor are required for the general set-up configuration shown in figure 2. Input and output signal terminals (+T and -T) are provided on the front panel for connecting test equipment.

During normal operation the Voltage On indicator remains in an ON condition. If a short circuit or overload condition occurs, the unit shuts down. The unit attempts to recover at approximately a 1 Hz rate. When the overload condition or short circuit is removed, full recovery occurs.

Adjustment Procedure

Adjustment consists of applying ac power to the DPS unit, monitoring the output, and moving the VOLTAGE ADJUST control to obtain the desired value. The test equipment must be provided by the user. A voltmeter, milliammeter and load resistor are required. To adjust a unit proceed as follows:

1. Connect the DPS as shown in figure 2.
2. Apply power to the unit.
3. With a 45Ω load resistor across the circuit, adjust the voltmeter to read 24Vdc.
4. Turn off the power and disconnect the test equipment.



VOLTAGE	CURRENT	LOAD
24Vdc	525mA	45Ω (15 watts)

Figure 2. Test Setup

Theory of Operation

Introduction

This section briefly describes how the DPS operates. A simplified block diagram of the unit is provided to help in understanding the circuit description. Figure 3 shows the DPS block diagram. A detailed schematic and assembly drawing are shown in figures 4 and 5.

The DPS compensates for extremely wide input voltage variations while maintaining constant output voltage. The basic power supply accepts ac power input signals and generates output voltages (24Vdc @ 525mA).

The DPS uses a switching circuit that monitors and varies the amount of energy transferred through the high frequency transformer to the output circuit. The energy is stored within the primary of the current transformer is defined by:

$$\text{Energy-per-cycle (En)} = 1/2 LI_{PK}^2,$$

where I_{PK} is the instantaneous peak current flowing when the switching circuit turns off, and L is the inductance of the primary winding. Since energy-per-cycle times frequency equals the power transferred by the transformer, by simply varying the the stored energy each cycle, the output voltage can be regulated for various load demands.

The controller section regulates the amount of energy transferred through transformer T1. It provides on-time control for the converter transistor and also initial starting. (Note: an opto-isolator path provides feedback from the output to the controller circuit for output voltage regulation.)

The primary output of the high frequency transformer is regulated within the control loop and is coupled through the current sensing circuit, which triggers when the current reaches a preset level. This

level is factory preset. This effectively limits the output current, thereby protecting the power supply from damage due to excessive output current.

When the over-current-sensing circuit triggers, it causes the controller to shut down, which stops the switching.

The over-current-sensing delay circuit tries to restart the power supply. The current starts building back up and if the over-current-sensing circuit does not re-trigger, full recovery occurs.

Maintenance

Introduction

The design of the DPS power supply limits maintenance primarily to keeping the input and output terminals and conductors clean and tight while maintaining a heat conduction path to a suitable heat sink. A thorough cleaning of the terminal block requires complete disassembly of the unit and should only be done at the factory. It is recommended that the user check the terminations every six months of service to verify that they are secure and free of oxidation.

Troubleshooting

1. Verify that all electrical connections are clean and tight.
2. Verify that the measuring instrument used for checking the output voltage is of the proper range and accuracy.
3. Disconnect the output load connections and measure the output from the power supply. If the output is within specifications, check the load for shorts.

If a problem still exists, the unit should be returned to the factory .

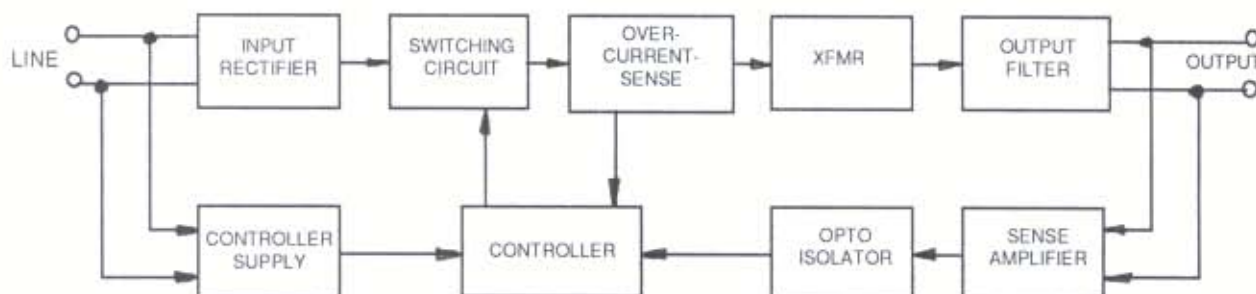


Figure 3. Simplified Block Diagram

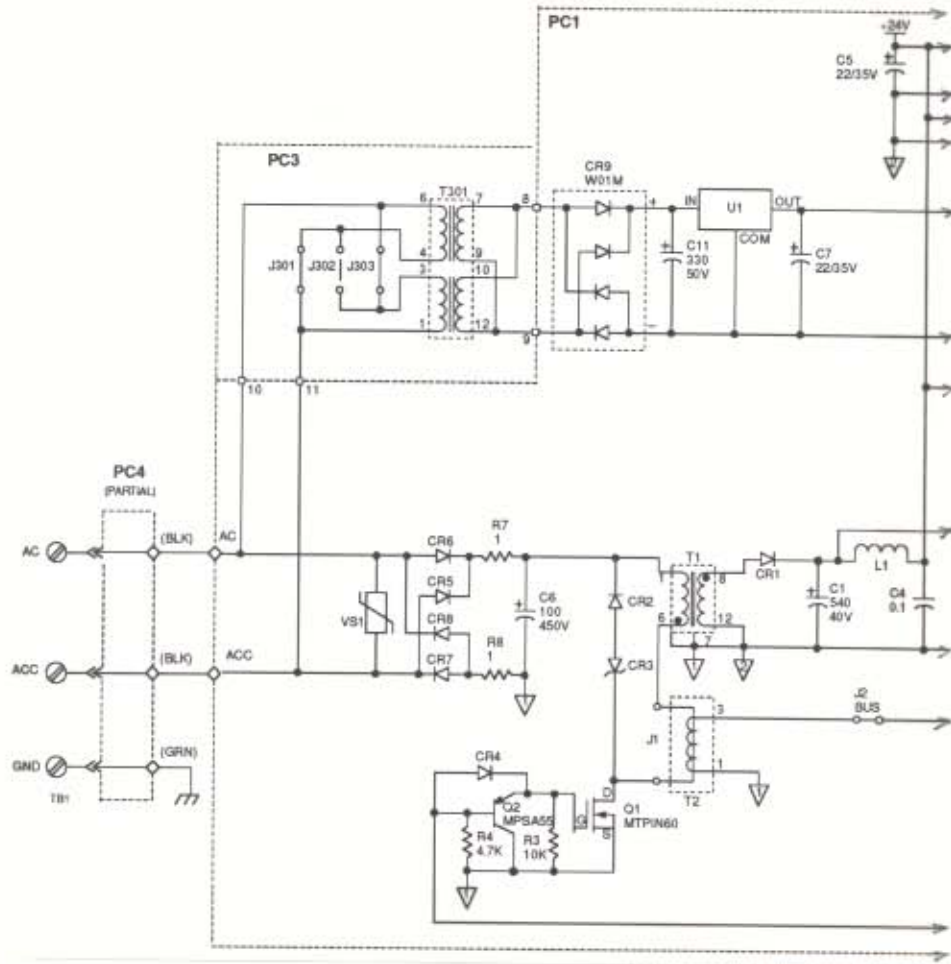
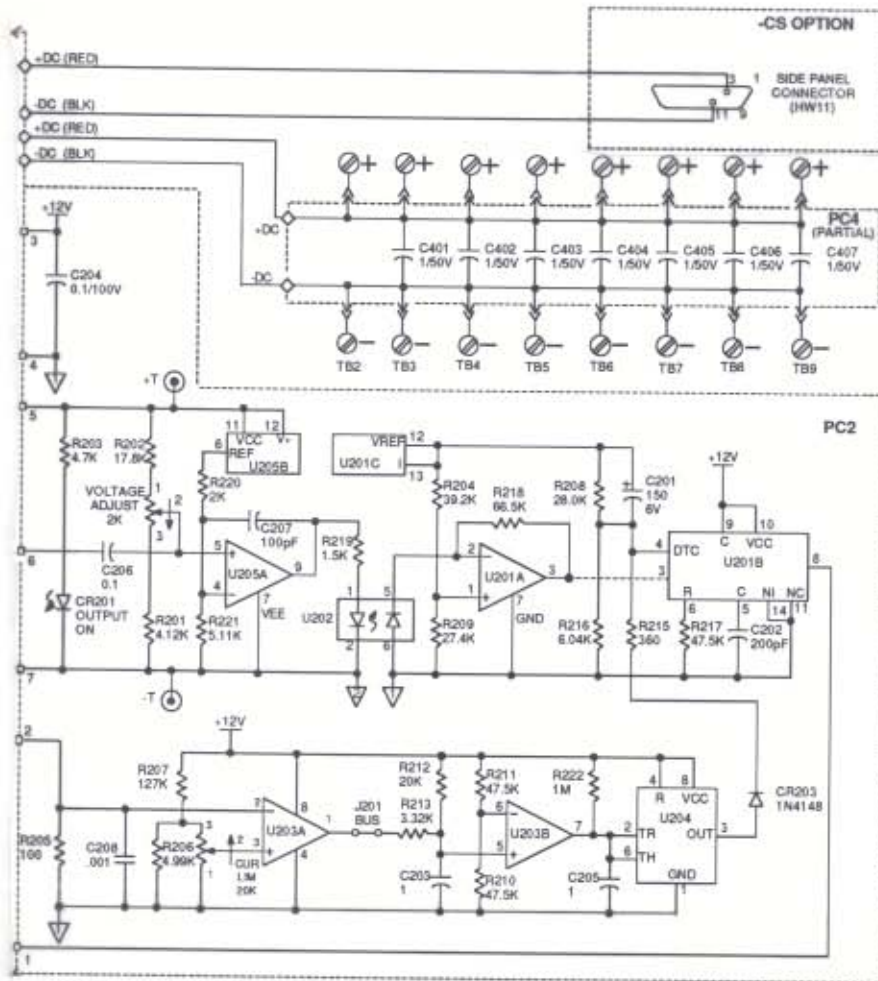


Figure 4. DPS Schematic



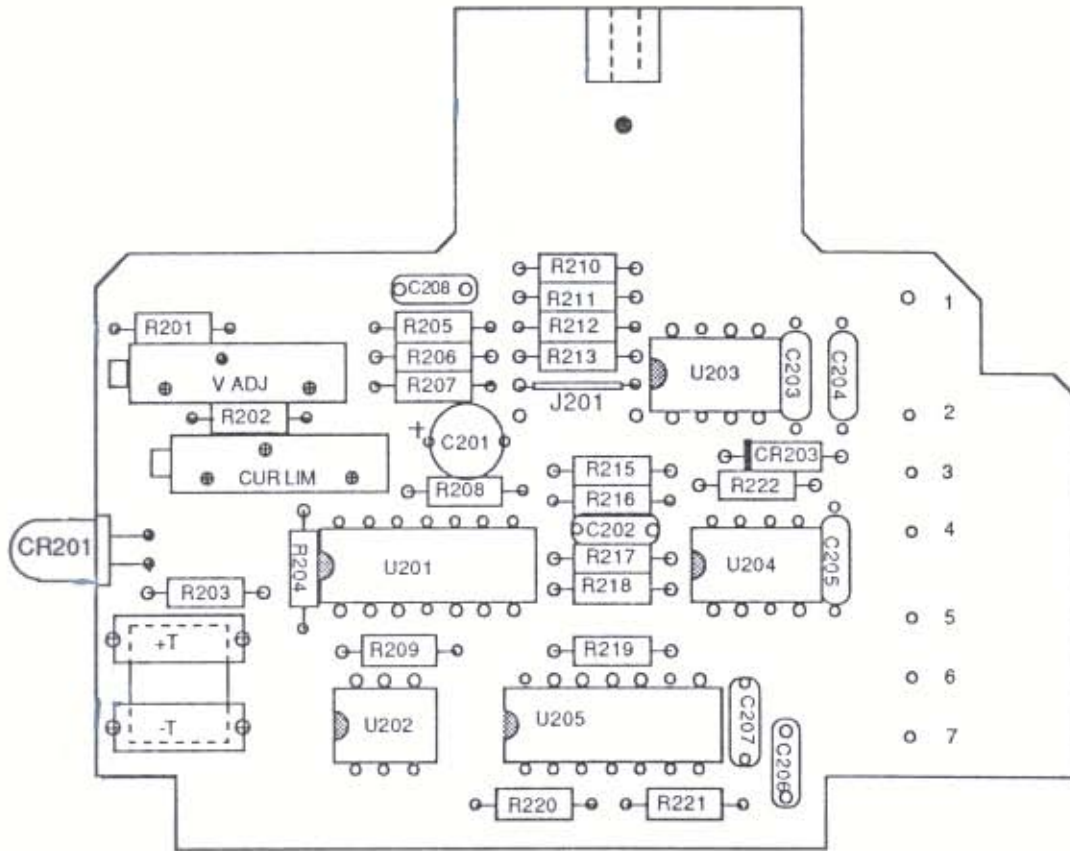


Figure 6. DPS Assembly PC2

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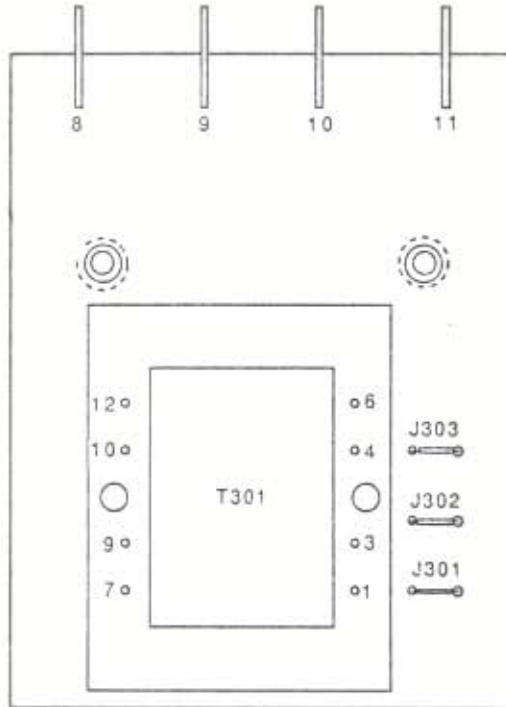


Figure 7. DPS Assembly PC3

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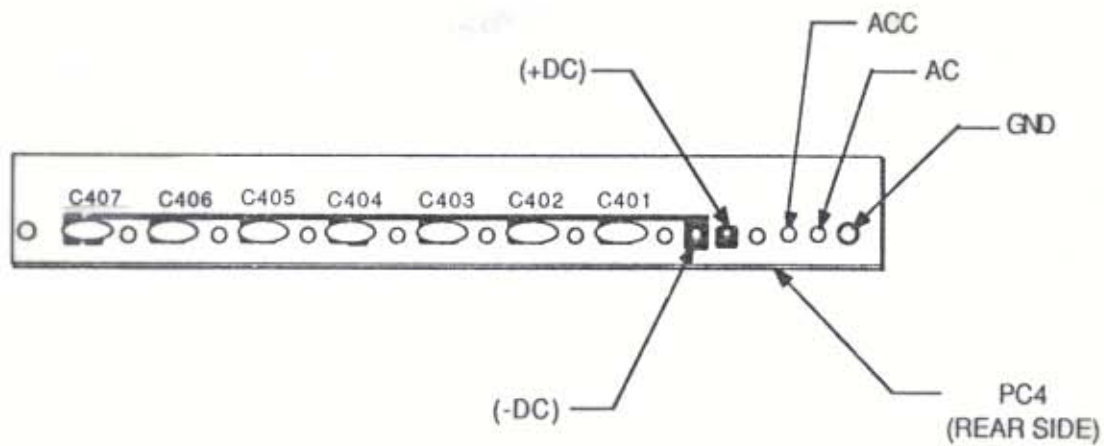


Figure 8. DPS Assembly PC4

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RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

Warranty Repair –

If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

Non-Warranty Repair –

If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
 - a) A note listing the symptoms that indicate the unit needs repair
 - b) Complete shipping information for return of the equipment after repair
 - c) The name and phone number of the person to contact if questions arise at the factory
3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.
4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

WARRANTY DISCLAIMER

THE COMPANY MAKES NO EXPRESS, IMPLIED OR STATUTORY WARRANTIES (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY GOODS OR SERVICES SOLD BY THE COMPANY. THE COMPANY DISCLAIMS ALL WARRANTIES ARISING FROM ANY COURSE OF DEALING OR TRADE USAGE, AND ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY ACKNOWLEDGES THAT THERE ARE NO WARRANTIES IMPLIED BY CUSTOM OR USAGE IN THE TRADE OF THE BUYER AND OF THE COMPANY, AND THAT ANY PRIOR DEALINGS OF THE BUYER WITH THE COMPANY DO NOT IMPLY THAT THE COMPANY WARRANTS THE GOODS OR SERVICES IN ANY WAY.

ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY AGREES WITH THE COMPANY THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS OR SERVICES SHALL BE FOR THE COMPANY, AT ITS OPTION, TO REPAIR OR REPLACE THE GOODS OR SERVICES OR REFUND THE PURCHASE PRICE. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES EVEN IF THE COMPANY FAILS IN ANY ATTEMPT TO REMEDY DEFECTS IN THE GOODS OR SERVICES, BUT IN SUCH CASE THE BUYER SHALL BE ENTITLED TO NO MORE THAN A REFUND OF ALL MONIES PAID TO THE COMPANY BY THE BUYER FOR PURCHASE OF THE GOODS OR SERVICES.

ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.



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