



USER'S MANUAL
PDC
DC Voltage Transducer

No. 325-701-00 B

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Table of Contents

Introduction	1
Description	1
Calibration	1
Installation	6
Maintenance	7
Drawings	7

Introduction

This manual contains calibration and installation information for the Moore Industries' DC Voltage Transducer and Ground Fault Detector (PDC). Along with a description of the PDC, this manual contains calibration and installation information. Related tables and illustrations are provided for reference purposes.

The PDC is a compact instrument that provides an analog output proportional to the dc input. The unit is available in three configurations: DG, which consists of the dc voltage transducer and ground fault detector; PD, which consists of the dc voltage transducer only; and PG, which consists of the ground fault detector only.

This manual may contain notes, cautions and warnings that must be observed to prevent personal injury, equipment damage or minor inconveniences during calibration or installation of the PDC. The following definitions describe these captions:

A **NOTE** shall contain technical or literary information of a helpful nature. This information is intended to aid the reader's understanding of the subject being discussed and/or minimize inconveniences while performing technical tasks.

A **CAUTION** shall contain technical information of a serious nature that if ignored may cause equipment damage.

A **WARNING** shall contain safety information of a grave nature that if ignored may cause injury to personnel, including fatal injuries.

Description

The PDC is primarily intended for monitoring dc voltage and/or leakage to ground in a floating battery system. The ground fault detector circuit can sense a momentary ground short as high as 300K ohms, while the dc voltage transducer circuit provides a highly accurate dc output proportional to the dc input (battery voltage).

The dc voltage transducer portion uses operational amplifiers that have ultra-high input impedance and an opto-coupler between the input and output. This differential input technique provides a high degree of input/output isolation, and a very low battery burden.

The ground fault detector portion has a dry contact output (normally open, standard), which remains energized only as long as the alarm condition exists. Two LEDs located on the front of the unit indicate whether the fault is positive or negative. This data remains until the RESET button is pressed.

The PDC is enclosed in an extruded aluminum housing. The mounting plate features keyhole cutouts, which allow the entire housing to be removed by just loosening the screws. Alternatively, the front panel and electrical circuitry may be pulled out by removing screws on the front panel without dismantling the housing from its panel.

Table 1 contains the PDC specifications, including complete information on input ranges, output options and performance characteristics.

Model Number. Moore Industries' model numbers identify the type of instrument, functional characteristics, operating parameters, options ordered and housing. If all accompanying documentation of a unit is missing, the model number can be used to obtain technical information. The model number for the PDC is located on a label adhered to the side of the unit.

Serial Number. A complete history is kept on every Moore Industries' unit. This information is keyed to the serial number. Whenever service data is required on a unit, it is necessary to provide the factory with the serial number. This information is engraved on the printed circuit board of the unit.

Calibration

This section contains information necessary for unit calibration. Each unit is calibrated and checked for proper performance at the factory before shipping.

Table 1. PDC Specifications

Characteristics	Specifications
Input Voltage	24Vdc, 48Vdc, 125Vdc, 250Vdc, or 600Vdc
Output	0-1mA, 4-20mA, or Contact Closure
Power	Self-powered (SP), 120Vac, or 240Vac
Performance	<p>Accuracy @ 25°C, ±2°C: 0.2% of reading, ±0.01% of full scale</p> <p>Output Ripple (peak): less than 0.5% of full scale</p> <p>Overload: 1.2 x full scale</p> <p>Dielectric Test: 2500Vdc for one minute (PD only)</p> <p>Response Time: to 90% less than 200ms to 99% less than 400ms</p> <p>Burden: 5.5VA typical for AC powered unit 3-7 Watts for self-powered unit (depending on input voltage)</p> <p>Contact Rating (ground fault output): 1A @ 120Vac, P.F. = 1: 600,000 operations; 0.8A @ 240Vac, P.F. = 0.4: 100,000 operations</p>
Adjustments	<p>SPAN: 22-turn potentiometer, ±10% of rated output</p> <p>ZERO: 22-turn potentiometer, ±2% of rated output span</p> <p>SETPOINT: adjustable from 5K to 300K ohms</p>
Features	<p>RESET: momentary pushbutton switch</p> <p>+FAULT, - FAULT: Two LEDs indicate whether a fault is positive or negative, display remains until RESET is pressed</p>
Operating Temperature	<p>Range: -20°C to +70°C</p> <p>Coefficient: 0.010% / °C, typical</p> <p>Humidity: 0-95%, non-condensing</p>
<p>Note: See Installation Section for physical dimensions.</p>	

Adjustments

The PDC has ZERO, SPAN and SETPOINT adjustments located on the front of the unit. Each of these adjustments has a multiturn potentiometer that is adjustable with a slotted screwdriver.

Calibration Equipment

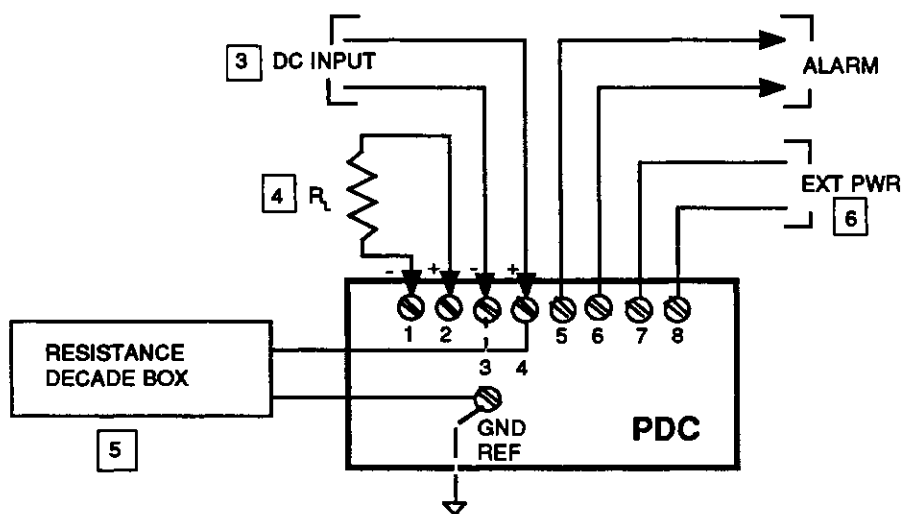
Calibration equipment is listed in table 2. This equipment is not supplied with the unit and must be provided by the user.

Calibration Setup

The calibration setup is generally the same for all units regardless of options specified. However, for clarity, each configuration is shown separately. The PDC-DG requires hookup to a resistance decade box and the Ground Reference (GND REF) terminal, which is not located on the terminal block. See figure 1. The PDC-PG also requires hookup to a resistance decade box, but the GND REF terminal is located at position 1 on the terminal block. See figure 2. The calibration setup for the PDC-PD is shown in figure 3.

Table 2. PDC Calibration Equipment

Equipment	Description
Screwdriver (slotted)	Head width no greater than 0.1 inch (2.54mm)
Adjustable DC Signal Source	Capable of producing signal ranges defined by input level requirements
Resistance Decade Box	0-10M Ω , Heathkit or equivalent
DC Milliammeter (optional)	Fluke 8600A or equivalent, accuracy of $\pm 0.05\%$ or better
DC Voltmeter (optional)	Fluke 8800 or equivalent, accuracy of $\pm 0.05\%$ or better
Resistor	10K Ω for 0-1mA output; 250 Ω for 4-20mA output
Power Supply	120Vac or 240Vac (externally powered units only)

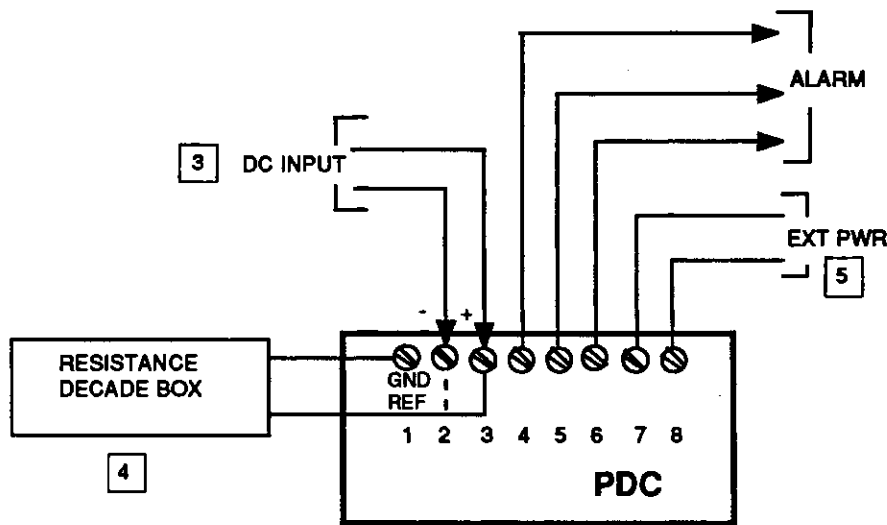


NOTES:

1. POWER IS APPLIED TO TERMINALS 3 AND 4 FOR UNITS WITH SP OPTION.
2. WHEN CALIBRATING UNITS WITH SP OPTION, POWER SUPPLY MUST BE ABLE TO DELIVER AT LEAST 500MA, AT RATED VOLTAGE.
3. DC INPUTS ARE EITHER 24VDC, 48VDC, 125VDC, 250VDC, OR 600VDC. SELF-POWERED (SP) UNITS HAVE EITHER 48 VOLT OR 125 VOLT INPUT, ONLY.
4. RESISTANCE LOAD (R_L) IS 10K Ω FOR 0-1MA OUTPUT; 250 Ω FOR 4-20MA OUTPUT.
5. GROUND FAULT DETECTOR CALIBRATION: FIRST CONNECT RESISTANCE DECADE BOX BETWEEN (+) INPUT AND GND REF TERMINAL, AND SET PER STEP 1, PAGE 5. THEN CONNECT BETWEEN (-) INPUT AND GND REF, AND SET PER STEP 8, PAGE 5. VERIFY INPUTS AND GROUND ARE DISCONNECTED PRIOR TO CALIBRATION.
6. EXTERNALLY POWERED UNITS ARE EITHER 120VAC OR 240VAC.

Figure 1. PDC-DG Calibration Setup Diagram

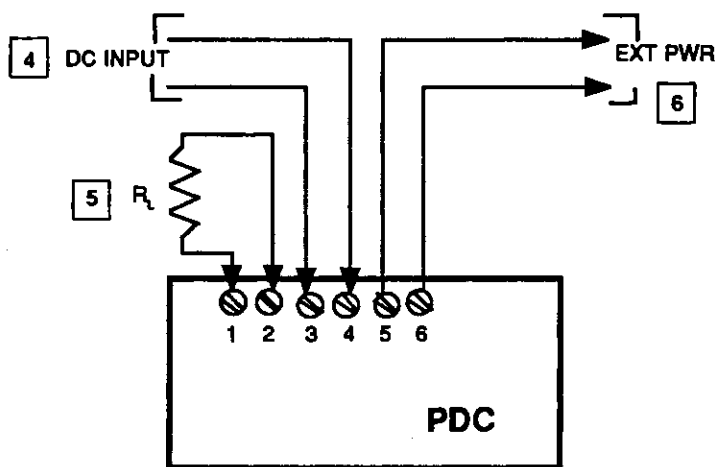
PDC



NOTES:

1. POWER IS APPLIED TO TERMINALS 2 AND 3 FOR UNITS WITH SP OPTION.
2. WHEN CALIBRATING UNITS WITH SP OPTION, POWER SUPPLY MUST BE ABLE TO DELIVER AT LEAST 500MA, AT RATED VOLTAGE.
- 3 DC INPUTS ARE EITHER 24VDC, 48VDC, 125VDC, 250VDC, OR 600VDC. SELF-POWERED (SP) UNITS HAVE EITHER 48 VOLT OR 125 VOLT INPUT, ONLY.
- 4 GROUND FAULT DETECTOR CALIBRATION: FIRST CONNECT RESISTANCE DECADE BOX BETWEEN (+) INPUT AND GND REF TERMINAL, AND SET PER STEP 1, PAGE 5. THEN CONNECT BETWEEN (-) INPUT AND GND REF, AND SET PER STEP 8, PAGE 5. VERIFY INPUTS AND GROUND ARE DISCONNECTED PRIOR TO CALIBRATION.
- 5 EXTERNALLY POWERED UNITS ARE EITHER 120VAC OR 240VAC.

Figure 2. PDC-PG Calibration Setup Diagram



NOTES:

1. POWER IS APPLIED TO TERMINALS 3 AND 4 FOR UNITS WITH SP OPTION.
2. WHEN CALIBRATING UNITS WITH SP OPTION, POWER SUPPLY MUST BE ABLE TO DELIVER AT LEAST 500MA, AT RATED VOLTAGE.
- 3 DC INPUTS ARE EITHER 24VDC, 48VDC, 125VDC, 250VDC, OR 600VDC. SELF-POWERED (SP) UNITS HAVE EITHER 48 VOLT OR 125 VOLT INPUT, ONLY.
- 4 RESISTANCE LOAD (R_L) IS 10KΩ FOR 0-1MA OUTPUT; 250Ω FOR 4-20MA OUTPUT.
- 5 EXTERNALLY POWERED UNITS ARE EITHER 120VAC OR 240VAC.

Figure 3. PDC-PD Calibration Setup Diagram

Calibration Procedure

Calibration consists of simulating an input signal and adjusting the unit to obtain the specified output. A dc voltage signal source provides the input and a voltmeter or a milliammeter monitor the output signal and load resistance. A decade box simulates a leakage to ground, which defines the alarm trip resistance level.

1. Connect the PDC to the calibration equipment as shown in figure 1. If the unit has the PG configuration (ground fault only), connect the PDC to the calibration equipment as shown in figure 2.
2. Apply power to the unit. Allow a five minute warm up time for the unit to stabilize.
3. Adjust the input signal source to zero volts.
4. Adjust the ZERO potentiometer to obtain 0 percent output.
5. Adjust the input signal source to the value of the maximum input signal that will be applied to the unit for that input range.
6. Adjust the SPAN potentiometer to obtain 100 percent output with the maximum input signal applied.
7. Repeat steps 3-6 until no further adjustment of either the SPAN or ZERO potentiometer is required.
8. Apply 0 percent input plus 25 percent, 50 percent and 75 percent of the span successively and check that the output is linearly proportional to within $\pm 0.1\%$ of the span.

Ground Fault Detector Calibration (DG and PG Options)

The ground fault alarm is calibrated for desired alarm trip resistance.

1. Adjust the resistance decade box to desired resistance (adjustable from 5K Ω to 300K Ω on PDC-DG unit). Connect the decade box between the + DC INPUT terminal and the GND REF terminal.
2. Turn the SETPOINT potentiometer fully counter-clockwise.
3. Apply power input and nominal dc voltage input to the unit. Allow a five minute warm up time for the unit to stabilize.
4. Check that the +FAULT and -FAULT LEDs turn on during initial power up.
5. Press and release the RESET button.
6. The +FAULT and -FAULT LEDs should turn off.
7. The contact closure terminals should be open (in a non-alarm condition).
8. Turn the SETPOINT potentiometer slowly clockwise until the -FAULT LED turns on.
9. Check that the contact closure terminals are shorted.
10. Turn off the power input and dc voltage input and connect the decade box to the -DC INPUT terminal and the GND REF terminal.
11. Apply power.
12. Press and release the RESET button.
13. Check that the -FAULT LED turns on, and that the contact closure terminals are shorted at the desired resistance.

PDC

Installation

This section contains physical mounting dimensions, installation procedures, electrical and power connections. Although the unit is designed to operate in free air at a high ambient temperature, it is recommended that the PDC be mounted on a surface that serves as a heat sink. In addition, input and output values should be checked on-site, before the unit is placed into service.

Mounting

The PDC is enclosed in an extruded aluminum housing. The mounting plates feature keyhole cut-outs, which allow the entire housing to be removed by loosening four screws. See figure 4 for the mounting dimensions.

Electrical Connections

All electrical connections are made to the terminals on the front of the PDC. See table 3 for terminal designations.

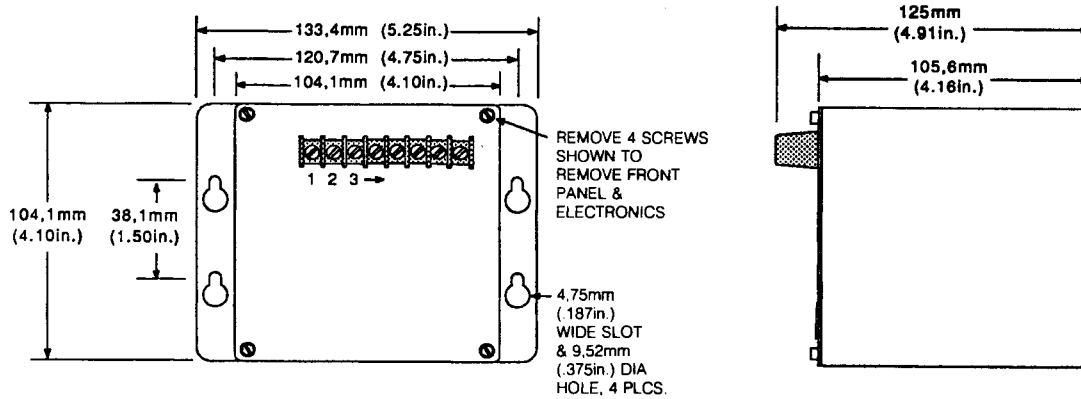


Figure 4. PDC Mounting Dimensions

Table 3. Terminal Positions

Unit	Terminal Position						
	1	2	3	4	5	6	7&8
PDC-DG (DC Volts and Ground Fault) *	(-) Output	(+) Output	(-) DC Input	(+) DC Input	Alarm Output	Alarm Output	Ext. Power
PDC-PD (DC Voltage Only)	(-) Output	(+) Output	(-) DC Input	(+) DC Input	Ext. Power	Ext. Power	N/A
PDC-PG (Ground Fault Only)	Gnd. Ref.	(-) DC Input	(+) DC Input	Alarm Output	Alarm Output	Alarm Output	Ext. Power

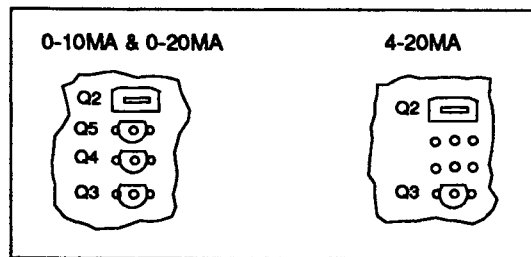
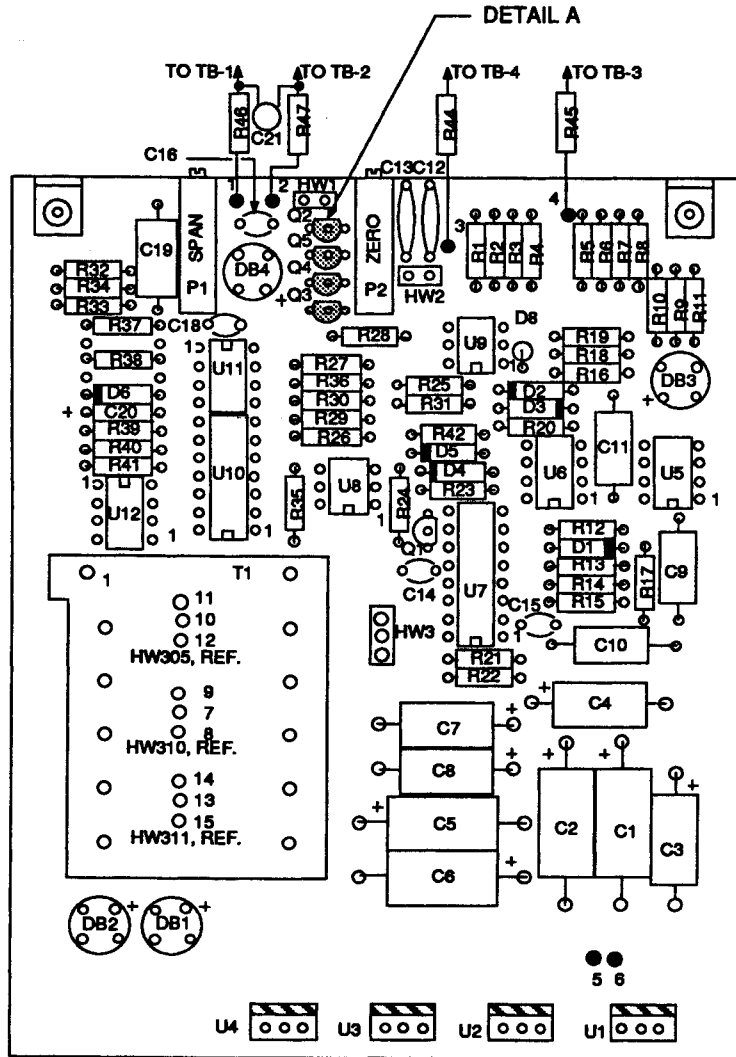
* NOTE: The Ground Reference (GND REF) terminal is not located on the terminal block.

Maintenance

Maintenance of the PDC is limited to keeping the input and output terminals clean and tight, and ensuring there is adequate ventilation or heat dissipation for the unit. It is recommended that the user check the terminals every six months. Calibration should be checked once a year.

Drawings

Figures 5 through 10 are the schematic and assembly drawings for the PDC.



NOTE: R44, R45, R46, AND R47 ARE SHOWN FOR PDC-PD CONFIGURATION; ON PDC-DG, COMPONENTS ARE SOLDERED TO PC2.

Figure 5. PC1 Assembly

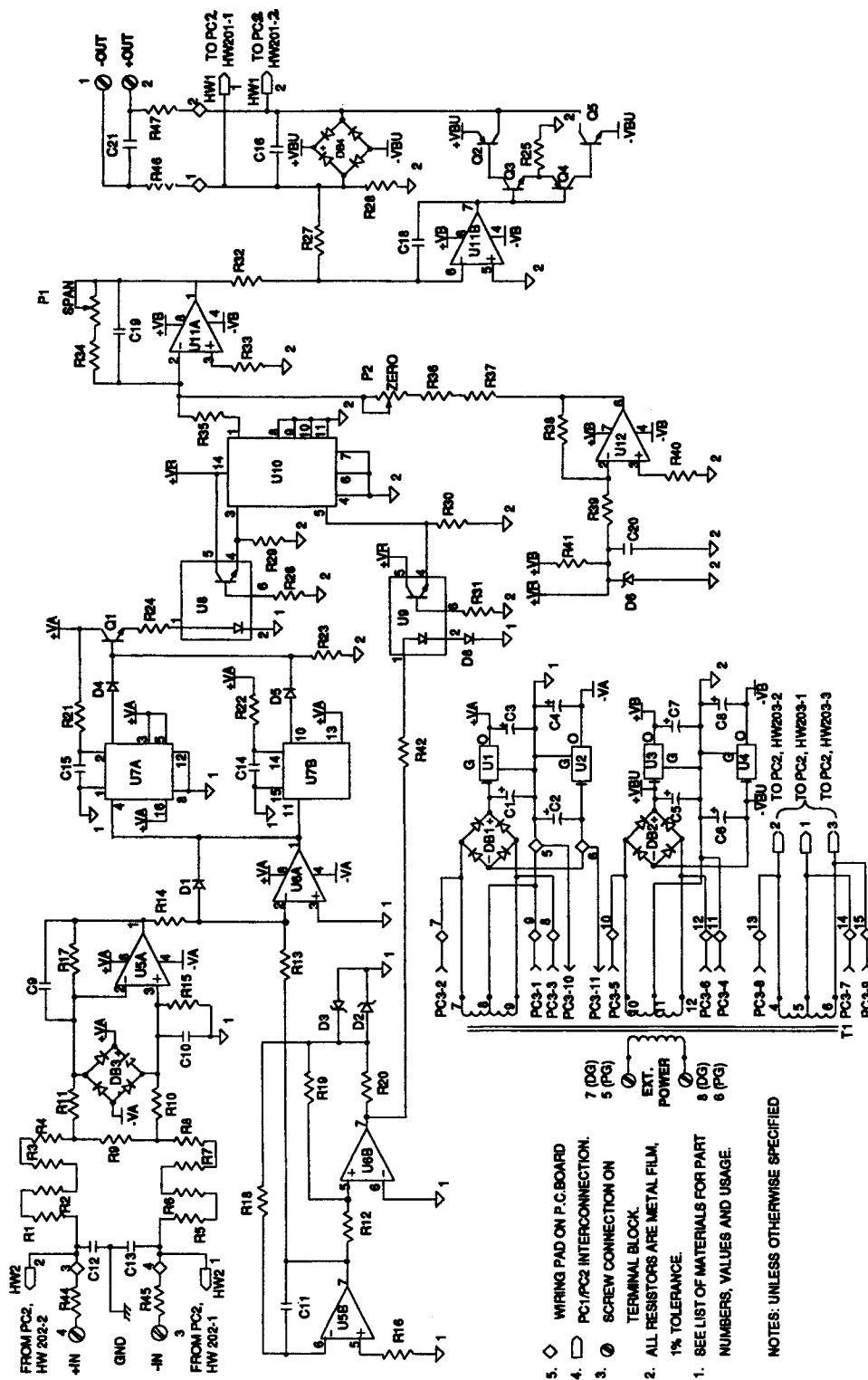
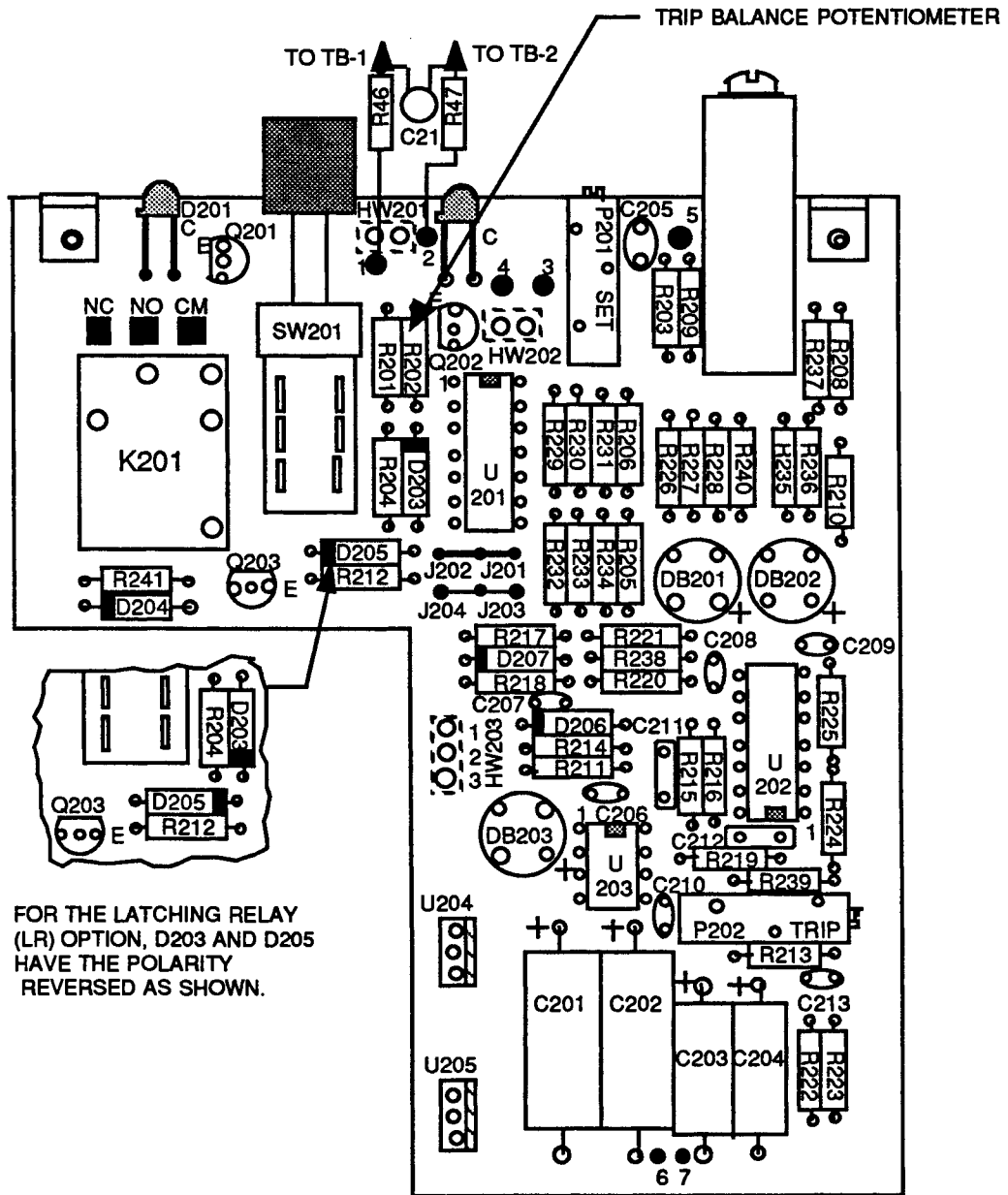


Figure 6. PC1 Schematic, Dc Voltage Transducer



NOTE: R46, R47 ARE SHOWN FOR THE PDC-DG CONFIGURATION, ONLY.

Figure 7. PC2 Assembly

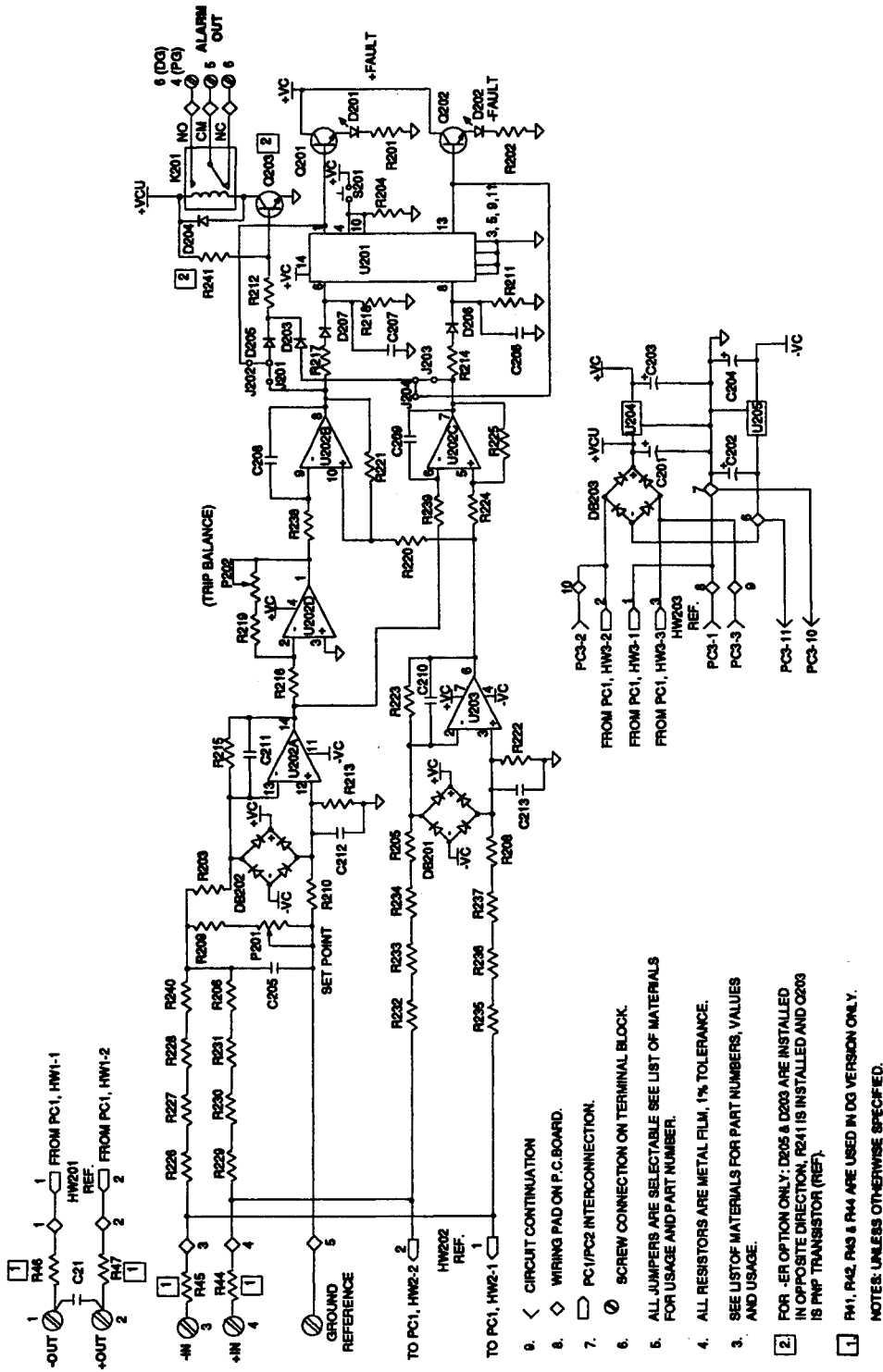
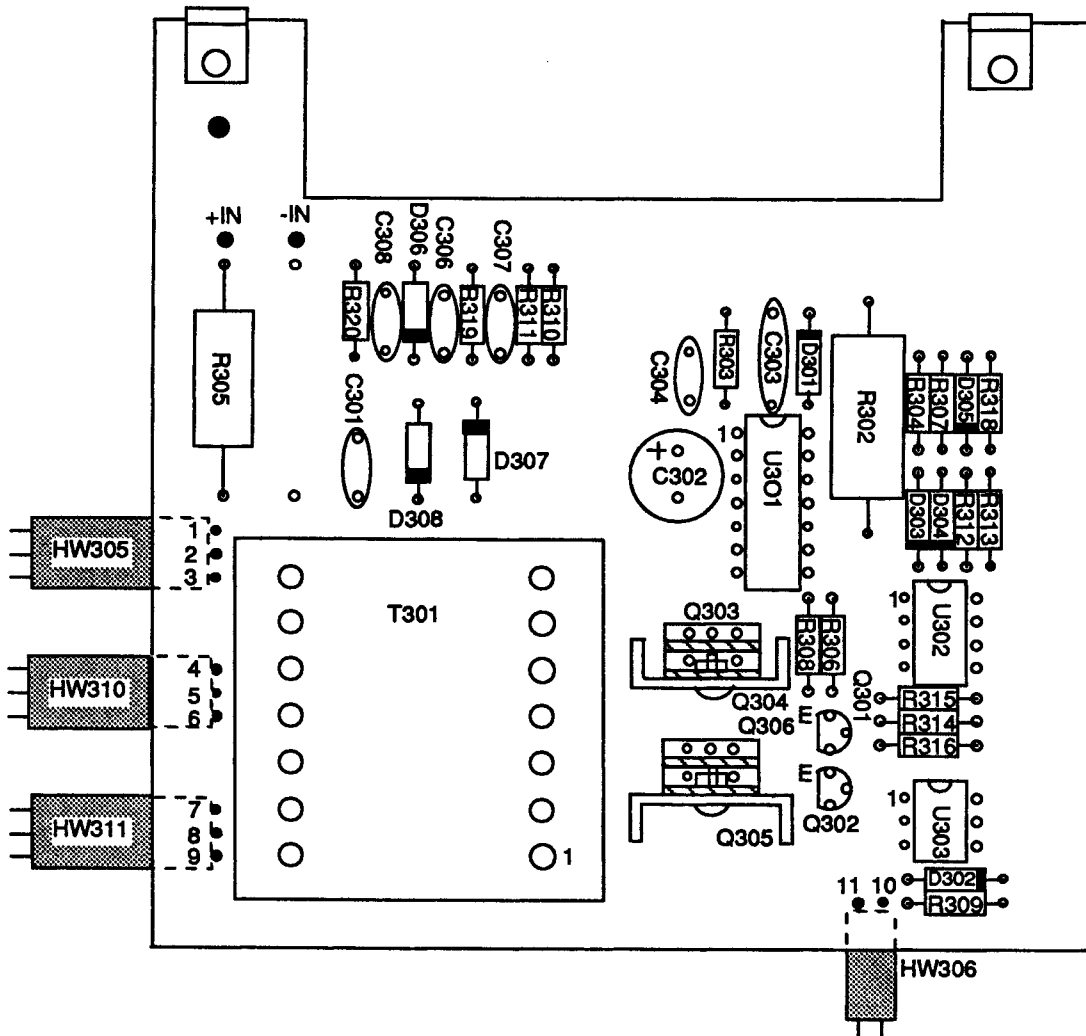
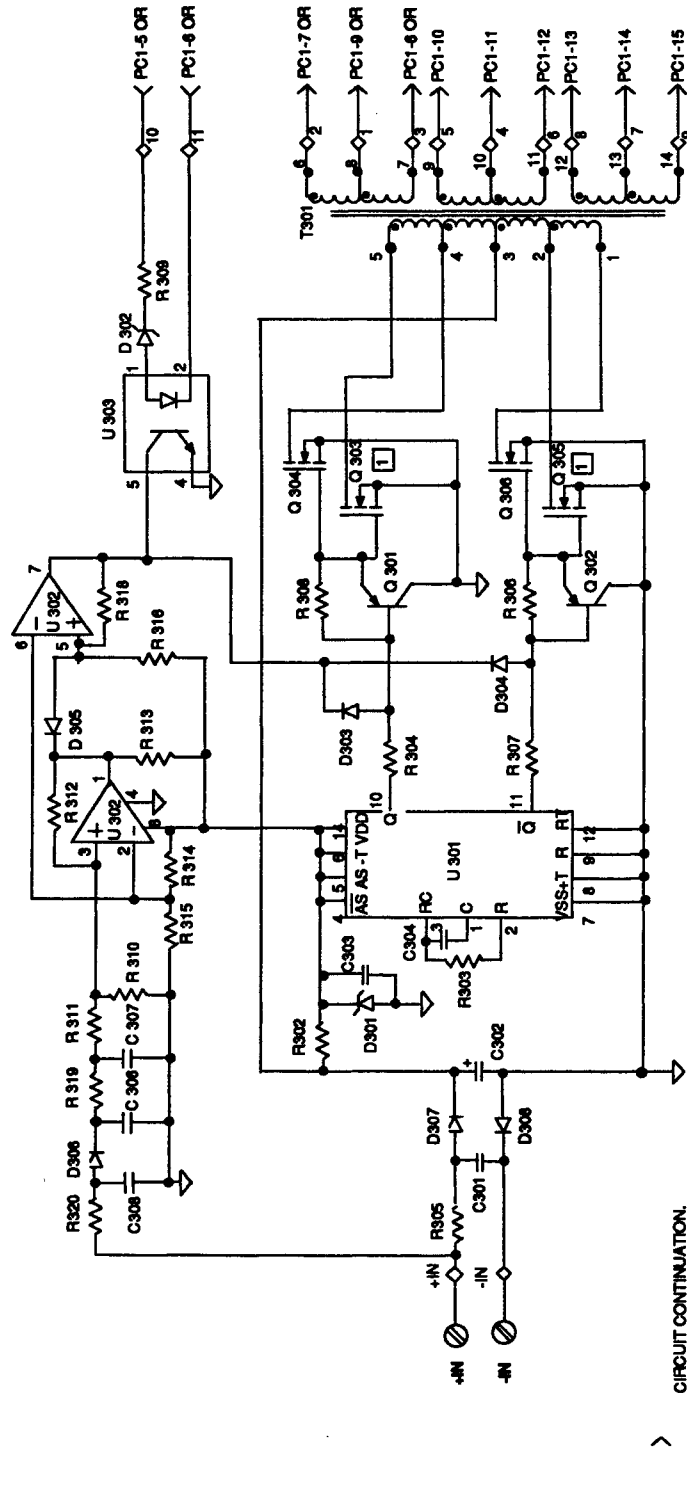


Figure 8. PC2 Schematic, Ground Fault Alarm



NOTE: EITHER Q303 AND Q306 ARE USED, OR Q304 AND Q305 ARE USED.

Figure 9. PC3 Assembly, AC/DC Power Supply



- > CIRCUIT CONTINUATION.
 3. Ⓞ SCREW CONNECTION ON TERMINAL BLOCK
 2. ◊ IDENTIFIED WIRING PAD ON PCB BOARD.
 ◻ EITHER Q303 & Q306 ARE INSTALLED OR Q304 & Q305 ARE INSTALLED, NOT BOTH.
 NOTES : UNLESS OTHERWISE SPECIFIED.

Figure 10. PC3 Schematic, AC/DC Power Supply

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

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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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