



# PWH

Watt/Watt-hour Transducer

## USER'S MANUAL

No. 317-701-00 B

January 1992

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## Introduction

This manual contains calibration and installation information for Moore Industries' Watt/Watt-hour Transducer (PWH). A description of the PWH and user maintenance information are also contained in this manual. Associated tables and illustrations are provided for reference purposes.

The PWH is designed to accurately measure the true root-mean-square (rms) power consumed by electrical equipment or systems. It electronically computes this consumption and produces an analog and a pulse output, which are proportional to the input. The output of the PWH can be directly input to counters and controllers.

The PWH is a highly accurate multiplying device that offers excellent long term stability. It requires minor periodic maintenance and operates virtually unattended.

This manual contains notes that must be observed to avoid minor inconveniences during calibration or installation of the PWH. The following definition describes 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.

## Description

The PWH is an AC energy transducer that produces a watt (analog) and a watt-hour (pulse) output from voltage and current inputs. This watt/watt-hour transducer is factory-configured as a 1-, 1.5-, 2-, 2.5-, or 3-element (inputs) device.

A 1-element device accepts one voltage input and one current input. A 1.5-element device accepts one voltage input and two current inputs. A 2-element device accepts two voltage inputs and two current inputs. A 2.5-element device accepts two voltage inputs and three current inputs. A 3-element device accepts three voltage inputs and three current inputs. The combination of voltage and current inputs are summed together to produce the analog and pulse outputs.

The PWH is factory-configured to predetermined specifications from a variety of available input and output ranges (see table 1). Its outputs are configured to meet a number of applications where remote indication and/or automatic control functions are required.

The PWH is powered by one of two means: an external 120/240Vac source or an internally generated voltage obtained from the voltage input.

The PWH is packaged in an extruded aluminum enclosure, and is available in either a surface-mount (SM) or DIN-rail-mount (DM) housing. Depending on the type output required (relay or solid-state), SM and DM housings are either horizontally or vertically mounted on a vertical plane.

Each PWH is individually configured to meet the application needs of the user. This manual does not cover all possible configurations individually. However, the following is a list of options available with the PWH:

- 50 Hz input frequency (option 50H)
- 400 Hz input frequency (option 400H)
- 85-150 Vac external power (option 120AC)
- 170-300 Vac external power (option 240AC)
- 25-125% calibration range (option CAL)
- Case ground terminal (option CG, SM units only)

Table 1 contains the PWH equipment specifications; including input and output options, power requirements, and performance characteristics.

For information about input or output ranges not shown in table 1, the user should contact Moore Industries or their local representative.

*Table 1. PWH Operational and Performance Specifications*

Characteristics	Specifications
Input	<p>Manufactured as 1-, 1.5-, 2-, 2.5-, and 3-element configurations.</p> <p><b>Voltage (In Vac):</b> 69, 120, 240, 460, 600 (Refer to table 2 for data on potential and burden)</p> <p><b>Full-Scale Current (In Amps):</b> 0-1, 0-2, 0-5, 0-10, 0-25 (Refer to table 3 for data on maximum overrange and burden)</p>
Output	<p><b>Analog:</b> 0, <math>\pm 1</math> mA, 0-1 mA, 4-20 mA, and 4-20 mA bidirectional.</p> <p><b>Pulse:</b> Compute counts per hour (CPH) at full-scale.</p> <p><b>Full-scale CPH:</b> 2-20,000 for both unidirectional and bidirectional output.</p> <p><b>Pulse Type:</b> Solid-state, bidirectional (PRB) and unidirectional (RMU). Open-collector transistors rated for 1.5 W, 50 V, maximum; or Mercury-wetted, bidirectional (RMB) and unidirectional (RMU). SPDT (form C) contacts rated for 100 W, 500 V, maximum. Maximum contact resistance, 50 m<math>\Omega</math></p> <p><b>Pulse Frequency:</b> <math>\pm 0.2\%</math>, standard</p>
Power	<p>Factory-configured, 120 Vac or 240 Vac</p>
Controls	<p><b>WATT CAL:</b> Adjustment for full-scale analog output <b>WATT ZERO:</b> Adjustment for minimum analog output <b>WATT-H CAL:</b> Fine adjustment for pulse output rate</p>
Performance	<p><b>Accuracy:</b> At 25 °C, <math>\pm 2</math> °C (74 °F, <math>\pm 4</math> °F), Watt: 0.19% of Reading + Cos <math>\theta</math>, <math>\pm 0.01\%</math> of full-scale <b>Output Frequency:</b> 60 Hz <b>Response Time:</b> Less than 200 milliseconds (ms) up to 90% of rated range. Less than 400 ms between 90 and 99% of rated range <b>Output Ripple (peak):</b> Less than 0.5% of full-scale <b>Surge Immunity:</b> 5 kV; ANSI-C37.90a-1974 (IEEE 472), BEAMA 219</p>
Environmental Ratings	<p><b>Recommended Ambient Temperature Operating Range:</b> -20 to 70 °C (-4 to 158 °F) <b>Recommend Ambient Humidity Operating Range:</b> 0 to 90%, non-condensing</p>
<p><b>NOTE:</b> Refer to Installation Section of this manual for PWH outline dimensions.</p>	

*Table 2. Typical Input Voltages*

Nominal Input (In V)	Potential Range w/Accuracy, Self-Powered* (in V)	Potential Range w/Accuracy, Externally Powered (In V)	Maximum Burden @ Nominal (in VA)	Potential Overload, Continuous (In V)
69	50-90	0-90	0.02	100
120	85-150	0-150	0.02	180
240	170-300	0-300	0.02	350
460	325-575	0-575	0.02	660
600	425-750	0-750	0.02	750

\* Self-powered units have a potential burden of less than 5 VA on terminals 3 and 4.

*Table 3. Typical Input Current*

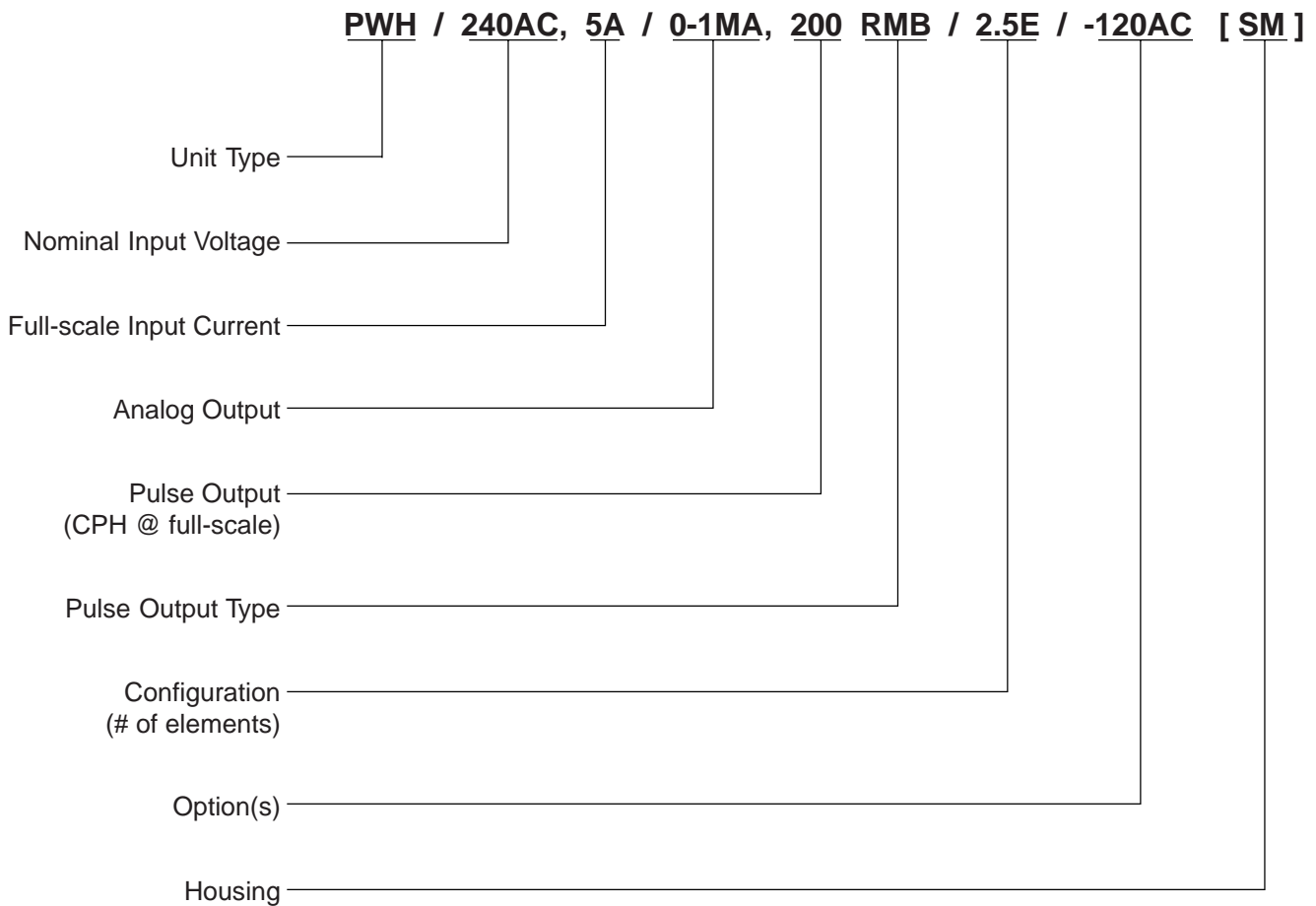
Input (In Amps)	Overrange w/Accuracy (In Amps)	Maximum Burden (In VA)	Overload, Continuous (In Amps)	Overload, 10 sec/hour (In Amps)	Overload, 1 sec/hour (In Amps)
0-1	2	0.5	3	6	100
0-2	4	0.5	6	12	150
0-5	10	0.5	15	30	250
0-10	20	0.5	35	75	300
0-25	35	0.5	35	75	300

# PWH

**Model Number.** The PWH model number describes the equipment type, functional characteristics, operating parameters, and configuration options. If all other documentation is missing, this number can be used to identify equipment characteristics. The model number is printed on a label that is attached to the right side of the unit.

**Serial Number.** Moore Industries maintains a complete history on every unit it sells and services. This information is keyed to the serial number. When service information about the PWH is required, it is necessary to provide the factory with this number. The serial number is printed on the same label as the unit model number.

**EXAMPLE**



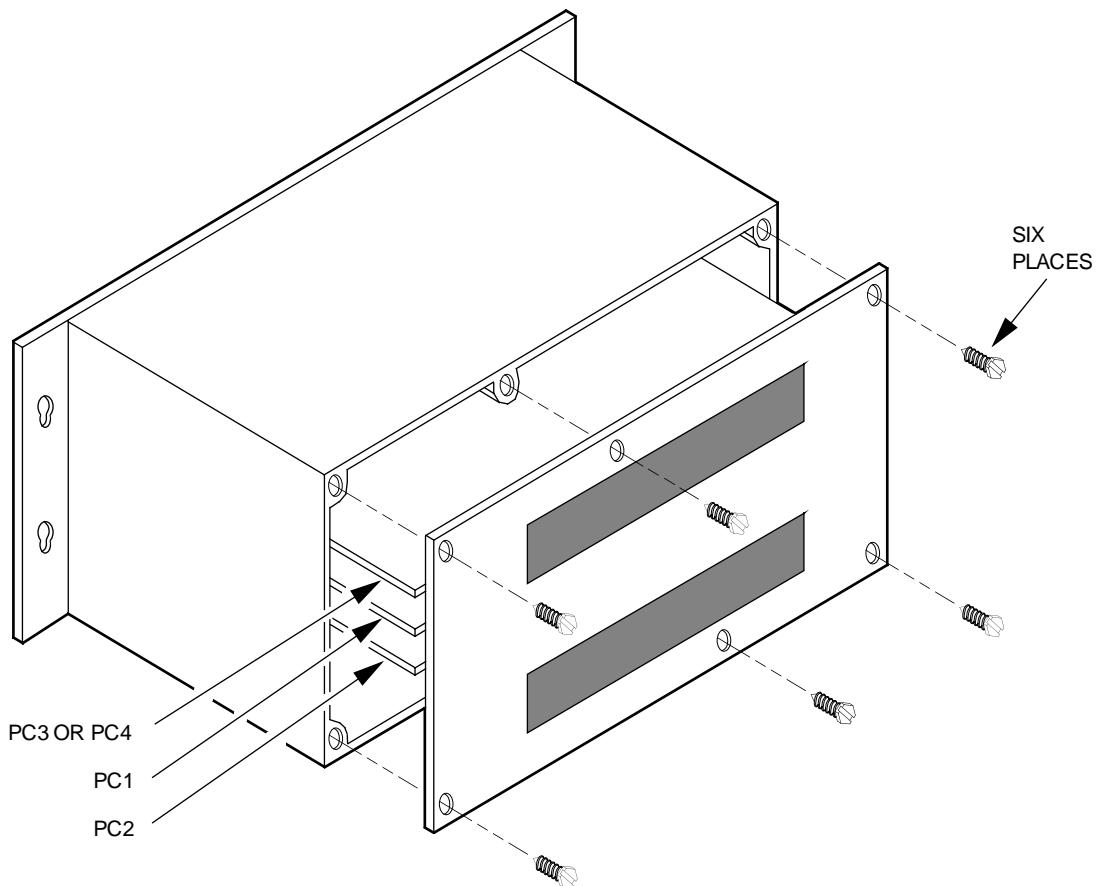
## Calibration

Every PWH is factory-calibrated to user specifications prior to shipment. This calibration ensures that every unit meets the user's performance requirements before it leaves the factory.

Moore Industries uses sophisticated equipment to calibrate the PWH. However, should the need arise to check out or calibrate the PWH in the field, the user should read this section carefully before making any adjustments to the unit. If questions arise, the user is advised to contact Moore Industries' Customer Service Department for assistance.

In determining the need for calibration, the unit's analog and pulse outputs must be checked closely. The desired outputs must be attainable from correct jumper settings and potentiometer adjustments. Also, the unit must be supplied inputs which have known values.

**Jumpers.** Solderless jumpers are used for coarse setting of the pulse output rate. To verify or change jumper settings in the field, partial disassembly of the unit is required. Six slotted screws along the outer edge of the front panel secure it to the housing. To access the jumpers, these six outer screws must be removed and the front panel pulled away from the housing (see figure 1).



**Figure 1.** PWH Disassembly/PCB Access

# PWH

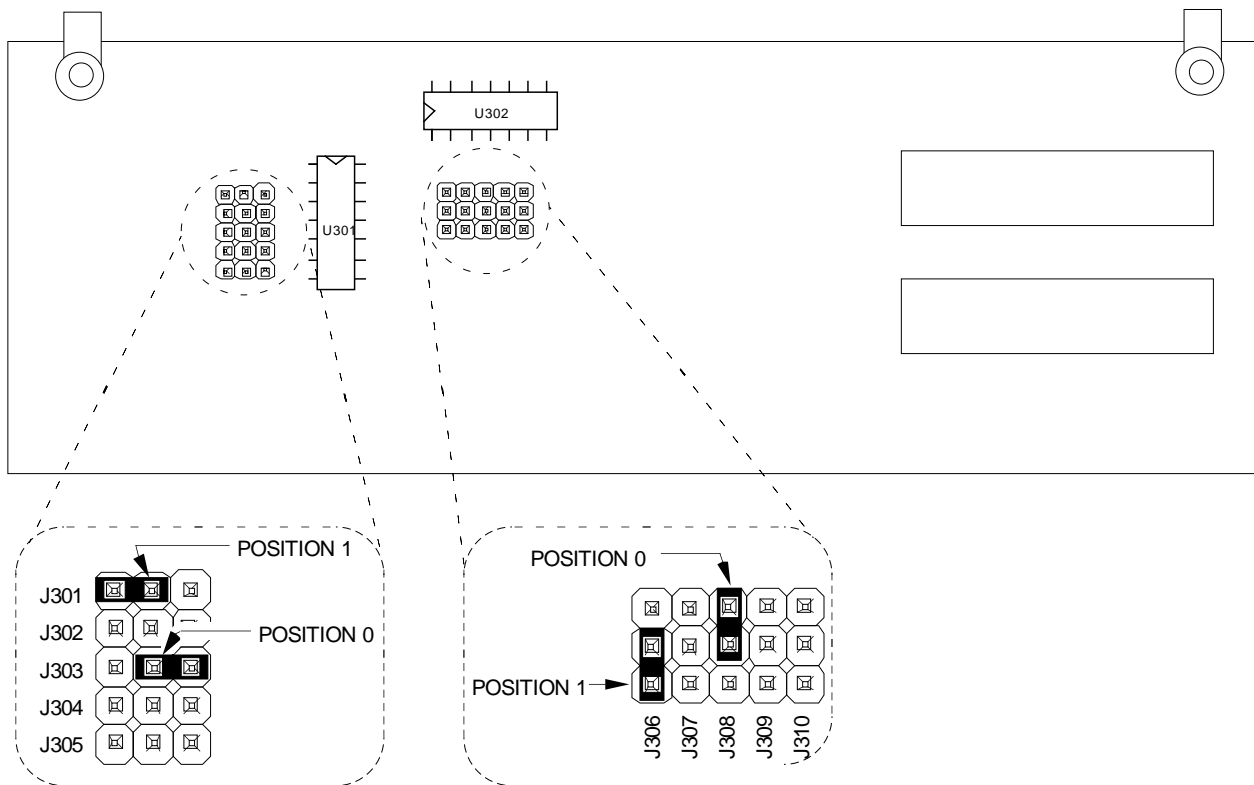
Attached to the inside of the front panel are three printed circuit (PC) boards. The first set of jumpers are located on the component side of PC3 or PC4, and the second set are on the left side of PC1.

Units configured with mercury-wetted relays (options RMB or RMU) are vertical-mount units. These units use PC3. Figure 2 shows the jumper locations and designations for PC3. Table 4 contains the output-rate jumper settings for PC3. The first column of table 4 lists the coarse pulse output rate achieved by setting the corresponding jumpers.

Units configured with solid-state outputs (options PRB or PRU) are horizontal-mount units. These units use PC4. Figure 3 shows the jumper locations and designations for PC4. Table 5 contains the output rate jumper settings for PC4. The first column of table 5 lists the coarse pulse output rate achieved by setting the corresponding jumpers.

**NOTE**

*PC3 and PC4 are the smallest circuit boards of the three boards contained in a unit. Either PC3 or PC4 are used in the PWH, but not both.*



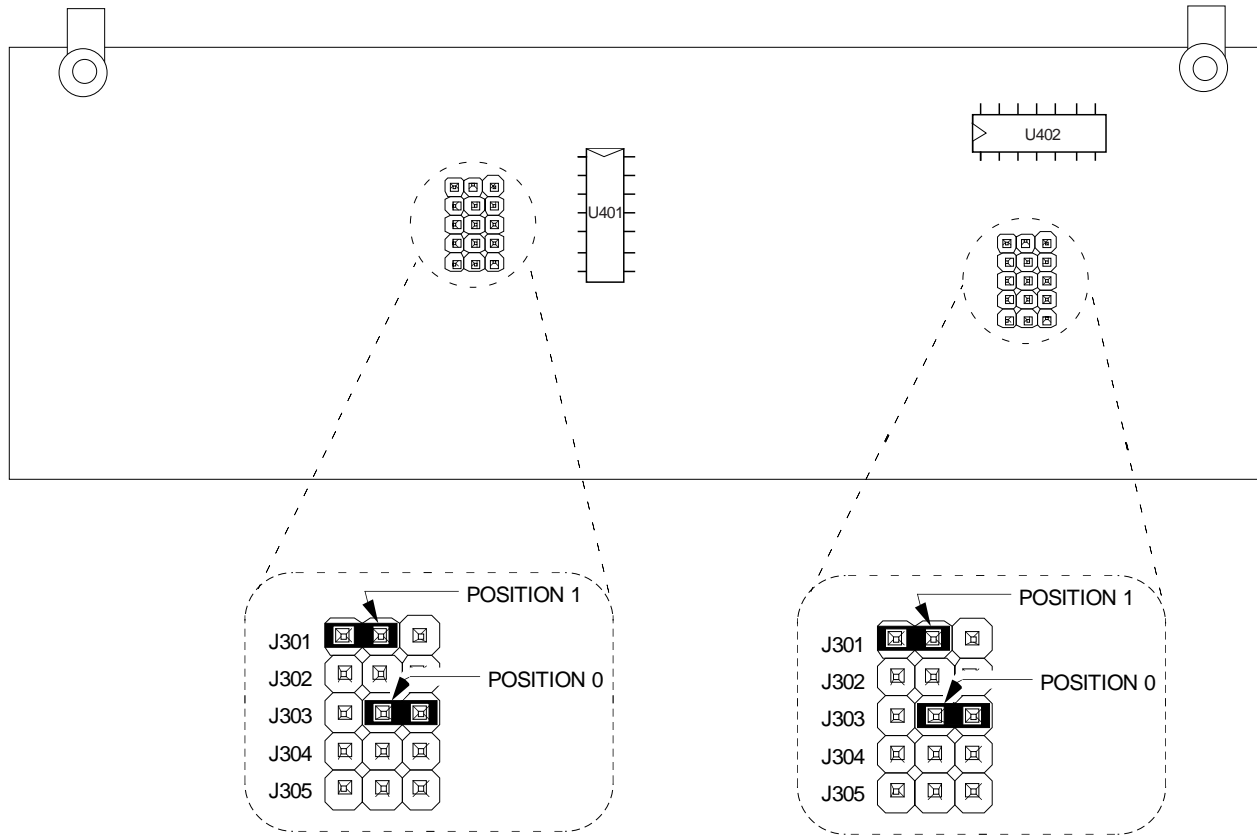
**Figure 2. PC3 Jumper Locations**



*Table 4. PC3 Jumper Locations*

Pulse Output Rate RMB/RMU Option	Jumper Positions*				
	J301 J306	J302 J307	J303 J308	J304 J309	J305 J310
56250	1	0	1	1	1
28125	0	1	1	1	1
14062	0	0	0	0	0
7031	1	0	0	0	0
3515	0	1	0	0	0
1758	1	1	0	0	0
879	0	0	1	0	0
439	1	0	1	0	0
220	0	1	1	0	0
110	1	1	1	0	0
55	0	0	0	1	0
27	1	0	0	1	0
14	0	1	0	1	0
7	1	1	0	1	0
3	0	0	1	1	0

\* Unidirectional output units require jumpers J301 through J305 only.



**Figure 3. PC4 Jumper Locations**

Jumpers on PC3 and PC4 are set based on the desired output. After determining a suitable pulse output rate, locate the next highest number in the first column of table 4 or 5. Jumper positions listed across that row are the required settings to generate the coarse pulse output listed. All jumpers must be used except on unidirectional units.

Figure 4 shows the location of the second set of coarse output-rate jumpers. The jumpers on PC1 bring the output rate, set by the jumpers on PC3 or PC4, to within 5-percent of the desired pulse rate.

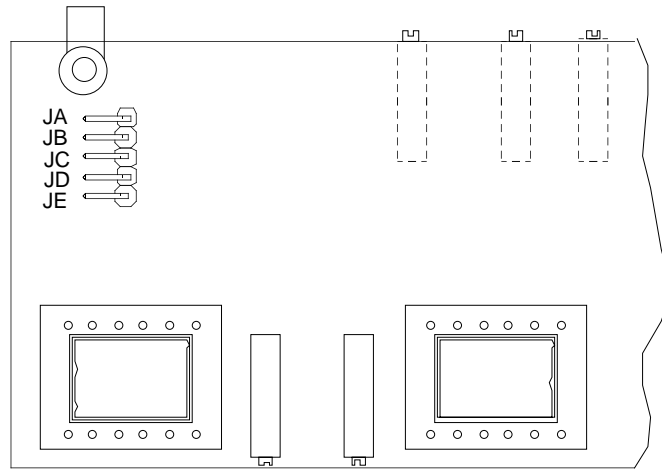
To determine which jumpers to set, the desired output rate is divided by the output rate listed in table 4 or 5. The percentage derived from this is matched with the nearest number (listed in percent) in the first column of table 6. Jumpers listed across that row are the required settings to bring the pulse rate to within 5-percent of the desired output rate.

Refer to the calibration procedures in this manual for step-by-step instructions in setting these jumpers.

*Table 5. PC4 Jumpers Settings*

Pulse Output Rate PRB/PRU Option	Jumper Positions*				
	J401 J406	J402 J407	J403 J408	J404 J409	J405 J410
28125	1	0	1	1	1
14062	0	1	1	1	1
7031	0	0	0	0	0
3515	1	0	0	0	0
1758	0	1	0	0	0
879	1	1	0	0	0
439	0	0	1	0	0
220	1	0	1	0	0
110	0	1	1	0	0
55	1	1	1	0	0
27	0	0	0	1	0
14	1	0	0	1	0
7	0	1	0	1	0
3	1	1	0	1	0
1.5	0	0	1	1	0

\* Unidirectional output units require jumpers J401 through J405 only.



**Figure 4. PC1 Jumper Locations**

**Table 6. PC1 Jumper Settings**

Percent of Required Input	Set Jumper(s)
100	JA
95	JA, JD
90	JA, JE
88	JB, JC, JD
86	JA, JD, JE
80	JB, JD
77	JB, JC, JE
76	JC, JD
70	JB, JC, JD, JE
66	JB, JE
60	JC, JE
57	JB, JD, JE
51	JC, JD, JE

**Adjustments.** There are three potentiometer adjustments used during calibration. These three adjustments are accessible on the front panel and are labeled “WATT CAL”, “WATT ZERO” and “WATT-H CAL”.

The WATT CAL and WATT ZERO potentiometers affect the analog output, while the WATT-H CAL potentiometer fine adjusts the pulse output.

**Inputs.** For calibration, full-scale inputs are required. Each unit has been individually set at the factory for predetermined inputs and outputs. A label attached to the unit identifies what the full-scale inputs are for that unit. These full-scale inputs must be supplied to the PWH for proper calibration.

### Calibration Setup

Table 7 lists the equipment required to check out or calibrate the PWH. This equipment is not supplied with the unit and must be furnished by the user. The user should ensure that equipment used for these procedures meets the minimum specifications listed in table 7 .

**Table 7. PWH Calibration Equipment**

Equipment	Characteristics
Wattmeter	600 W full-scale. Accuracy of $\pm 0.1\%$
AC Voltmeter	Range: 0-150 Vac
DC Power Source	15 V, capable of driving 10 mA
Frequency Counter	Four-digit Display, minimum
ON/OFF Switch	AC current rating surpassing current supplied to PWH under test
Test Load	1000 W
Resistor	10 k $\Omega$ , $\pm 5\%$

Figures 5 through 9 are the calibration setup diagrams for the 1-, 1.5- 2-, 2.5-, and 3-element PWH's. Refer to the applicable illustration for the type unit being calibrated.

## Calibration Procedures

The following calibration procedures pertain to all five PWH configurations. These procedures are written for a PWH configured for 120 Vac, 5 A input (500 W per element) and 0-1 mA output. In the case of 1.5-element units, the input power must be 250 W instead of 500 W. For 2.5-element units, the input power must be 374 W. Make appropriate adjustments to input and output values if the unit being calibrated is configured differently than described here.

Although the analog output and the pulse output procedures are separate, the same illustration is used for both.

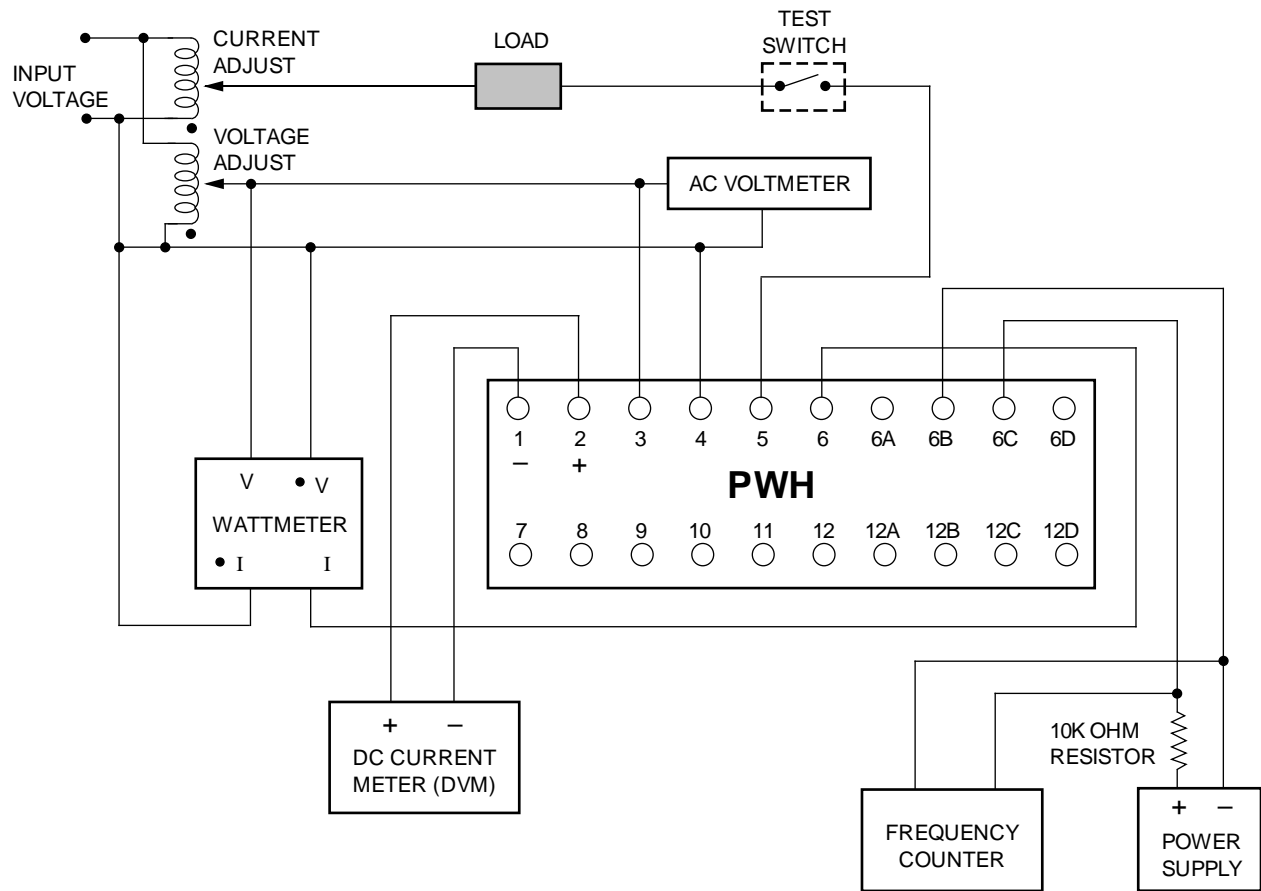
### **NOTE**

*It is assumed that a full-scale input source of the proper characteristics is available and connected as shown in the corresponding illustration.*

### Analog Output:

1. Set AC test switch to open (off).
2. Monitor AC voltmeter and adjust input voltage for 120 Vac reading.
3. Check DC current meter; if a reading other than zero is detected, adjust WATT ZERO potentiometer on PWH for a zero reading (minimum output).
4. Set AC test switch to closed (on).
5. Monitor wattmeter and adjust input current until meter reads 500 W (full-scale input).
6. Monitor DC current meter and adjust WATT CAL potentiometer on PWH for 1.000mA reading (maximum specified output).
7. Check linearity by adjusting current up and down within specified range, and compare readings on wattmeter and DC current meter. Readings should be proportional.

# PWH



**Figure 5.** Calibration Setup, 1-Element PWH

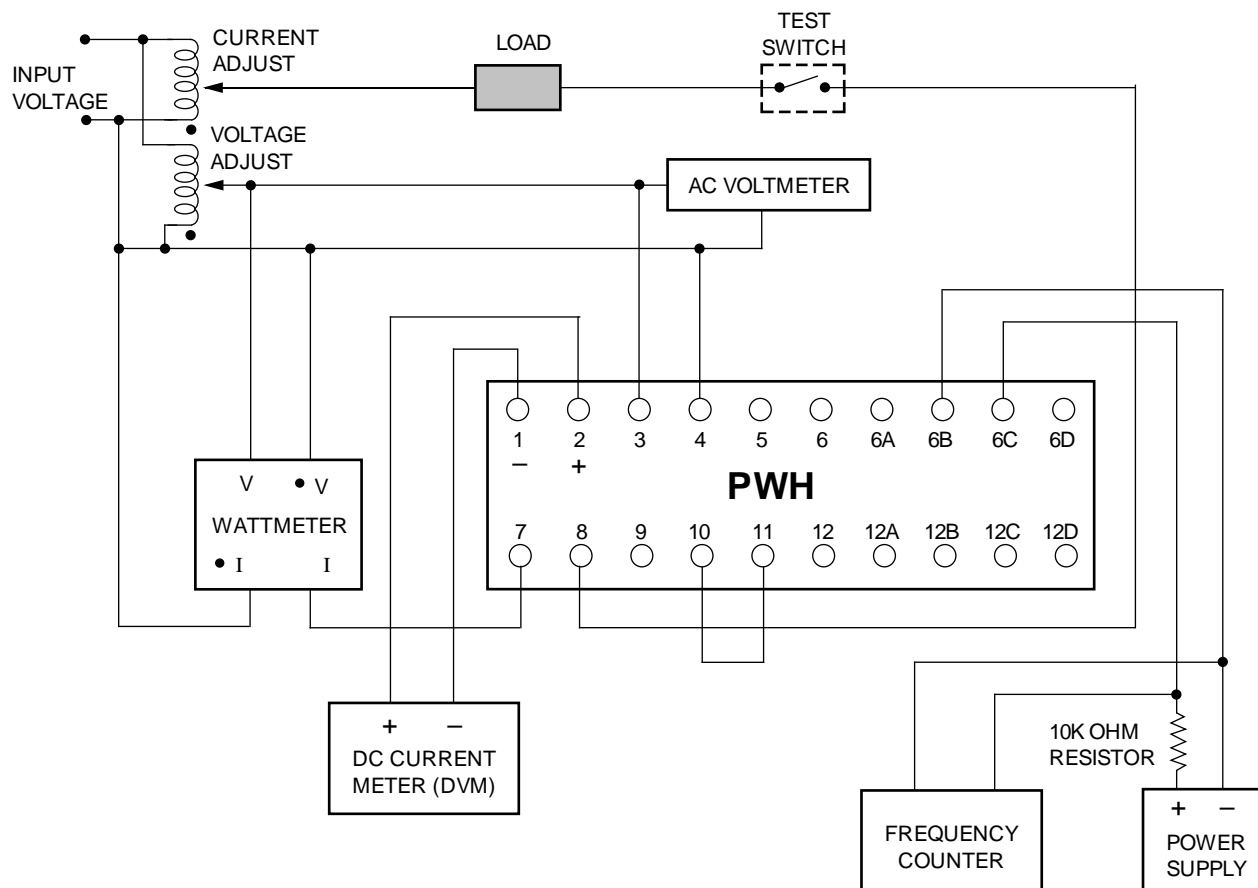
**Pulse Output:**

1. Calculate number of counts-per-hour (pulse rate) output for full-scale input as follows:
  - a. Determine what the pulse output represents (e.g., 1 pulse per watt-hour (Wh), 1 pulse per 2 Wh, etc.)
  - b. Identify the number of elements on unit and amount of full-scale power to be input per element (e.g., 3-element, 500 W)

**NOTE**

Use "2" for 1.5-element units and "3" for 2.5-element units in step 1.b.

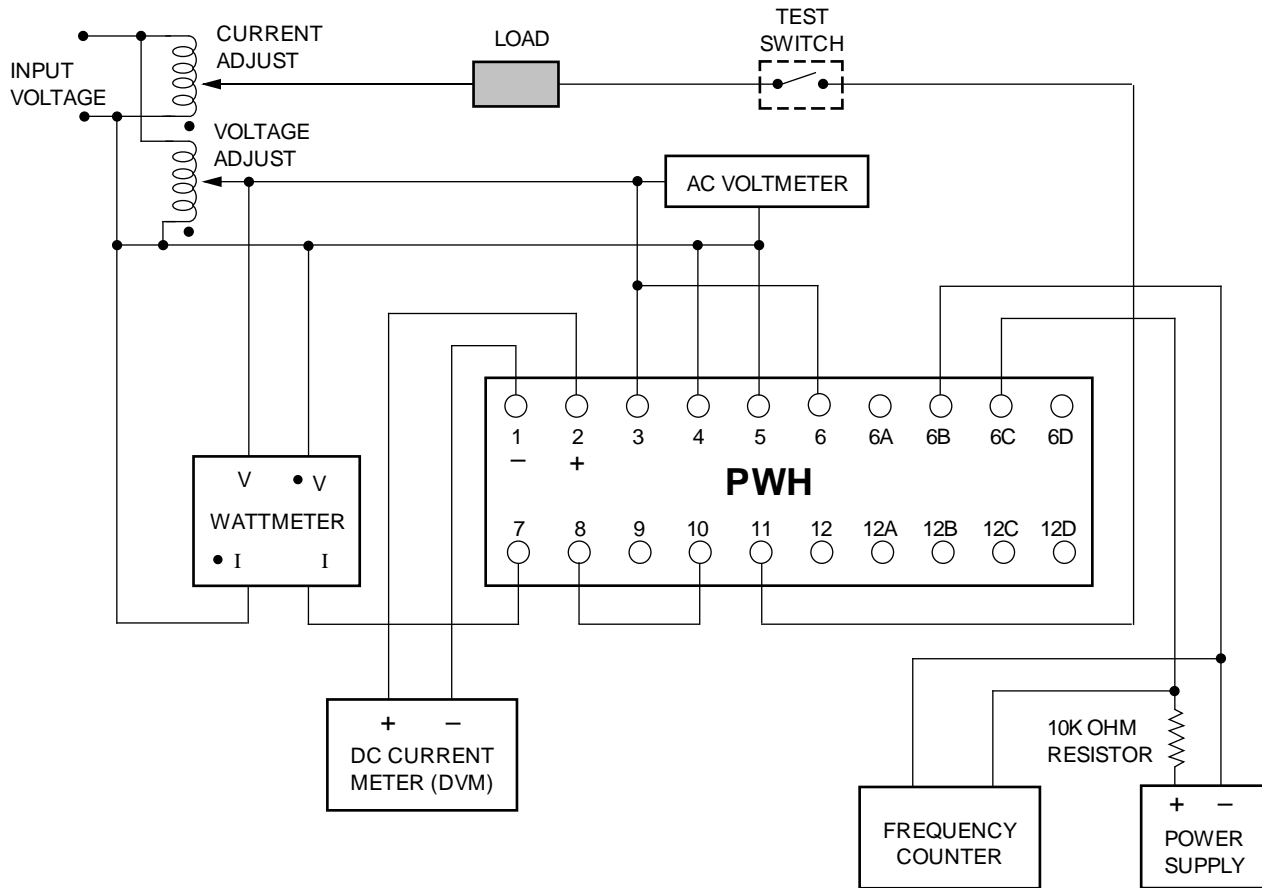
- c. Multiply full-scale input power by number of elements on unit (e.g.,  $500 \times 3 = 1500 \text{ W}$ )
- d. Divide total full-scale input by amount of desired time between each pulse (e.g.,  $1500 \text{ W}/1 \text{ Wh} = 1500 \text{ counts per hour (CPH)}$ ,  $1500 \text{ W}/2 \text{ Wh} = 750 \text{ CPH}$ , etc.)



**Figure 6.** Calibration Setup, 1.5-Element PWH

2. Calculate time between each pulse by dividing 1 hour (3600 seconds) by number of output pulses derived in step 1.d.  
(e.g., 3600 seconds/1500 CPH = 2.4 seconds)
3. Monitor frequency counter and record time displayed. If this time is within 5% of required time (calculated in step 2), adjust WATT-H CAL potentiometer on front panel of PWH to set time as required.
4. If frequency counter reading has more than a 5% difference from that required, remove AC input and/or AC power from unit.
5. Remove and retain six slotted screws from outer edge of PWH front panel (see figure 1).
6. Pull front panel, with PC's attached, away from PWH housing.
7. Set jumpers on PC3 or PC4 as called out in tables 4 or 5 for the type output option for which PWH is configured. See figures 2 or 3.

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**Figure 7.** Calibration Setup, 2-Element PWH

**Example:**

Desired CPH: **1500**

Type output: **PRB**

Next highest number in table 4: **1750**

**SET JUMPERS:**

J401, J406 to position 0

J402, J407 to position 1

J403, J408 to position 0

J404, J409 to position 0

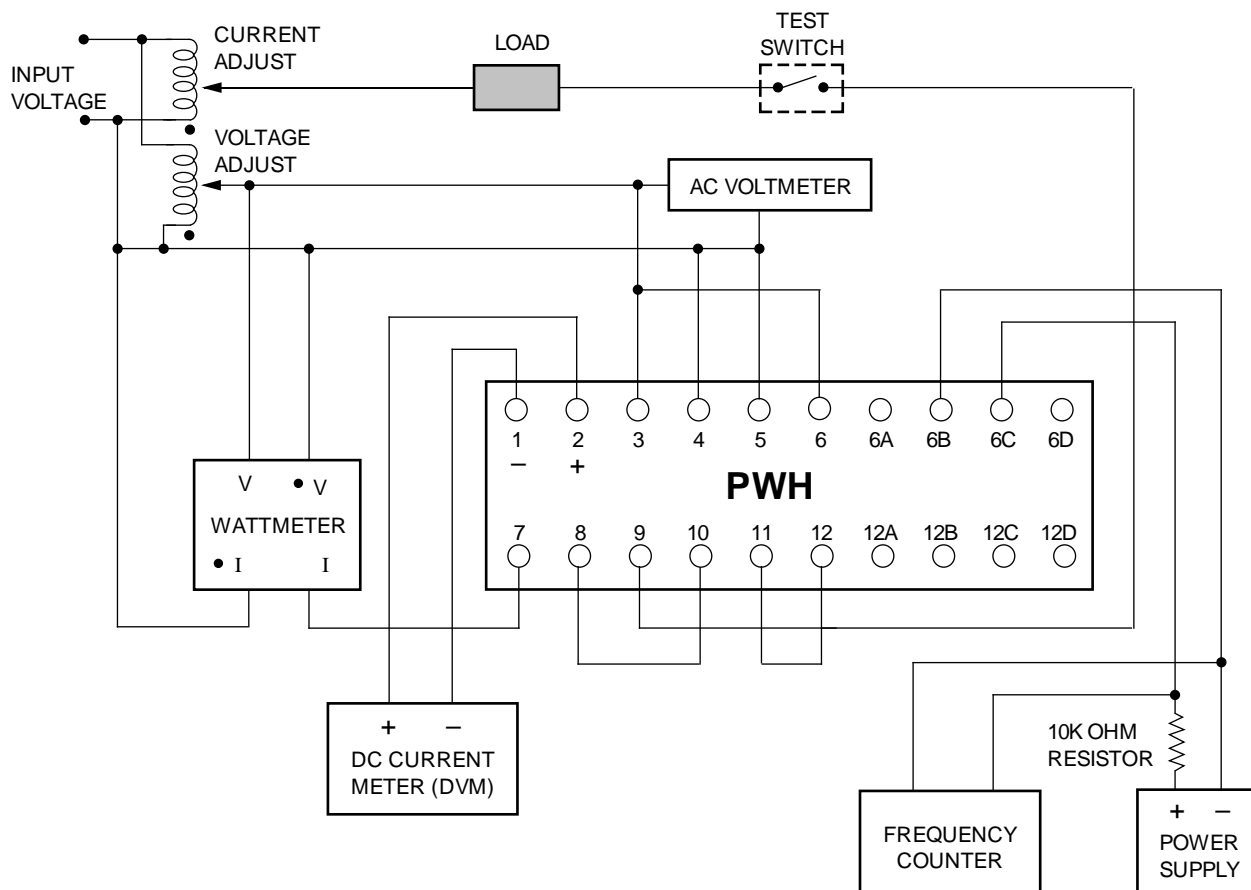
J405, J410 to position 0

**NOTE**

*Unidirectional outputs use only J301 through J305, or J401 through J405.*

8. Calculate the percentage of output by dividing number of CPH by number used from table 4.





**Figure 8.** Calibration Setup, 2.5-Element PWH

**Example:**

$$1500 \div 1750 = 85.7\%$$

9. Set jumpers on PC1 as called out in table 5 to the nearest percent number listed in the first column. See figures 1 and 4.

**NOTE**

*Install only the jumpers listed. Remove unused jumpers from PC1.*

**Example:**

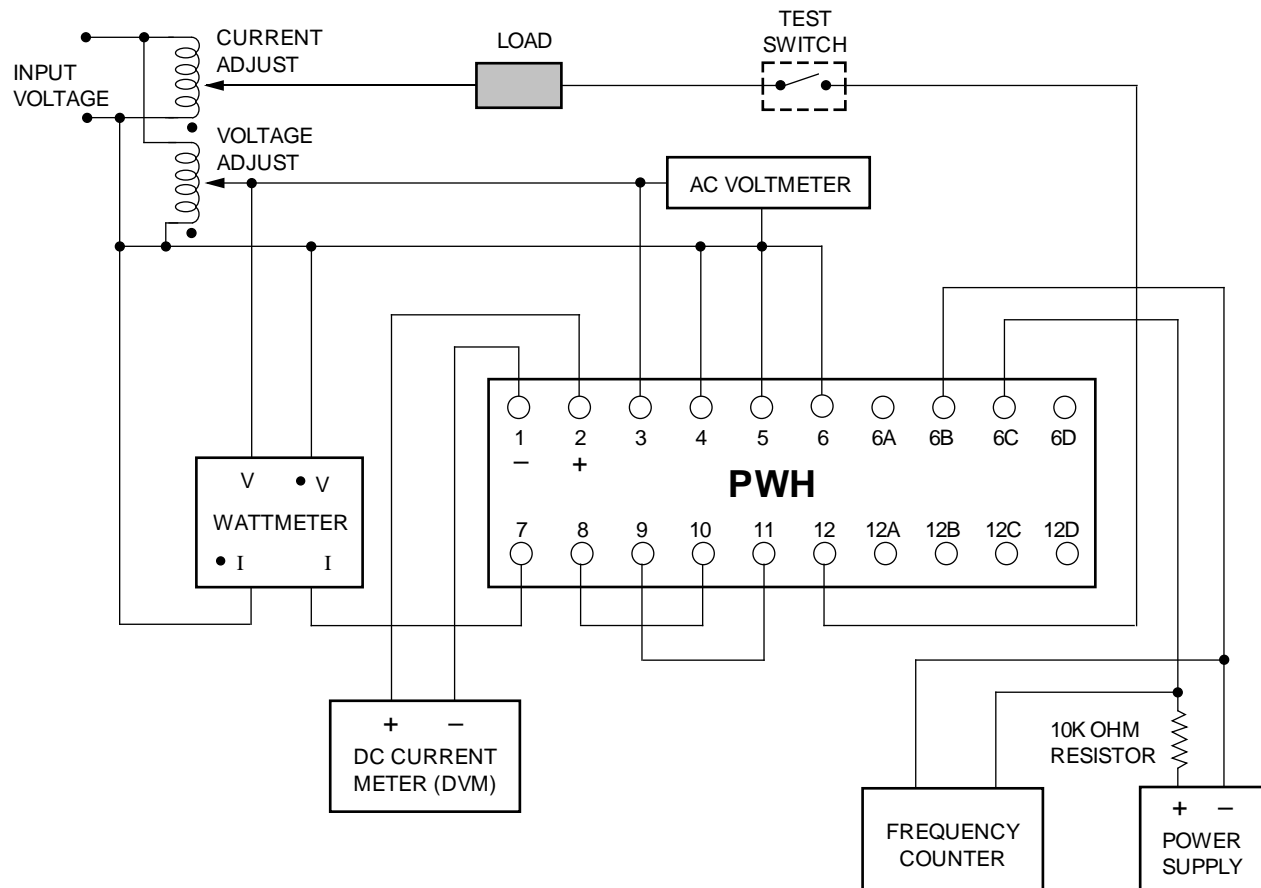
Actual percentage: **85.7%**

Nearest percentage listed in table 5: **86%**

**SET JUMPERS:** JA, JD and JE

**REMOVE JUMPERS:** JB and JC

10. Assemble PWH and connect 500 W input (full-scale).



**Figure 9.** Calibration Setup, 3-Element PWH

11. Check frequency counter reading; reading should be within  $\pm 3\%$  of the required time (e.g., 2.4 seconds  $\pm 0.072$  second).
12. Adjust WATT-H CAL potentiometer on front panel of PWH to bring frequency counter reading to within  $\pm 0.1\%$  of required time (e.g., 2.4 seconds  $\pm 0.0024$  second).
13. If unit cannot be adjusted to required time, disconnect input and/or AC power and repeat steps 1 through 12. Ensure all jumper settings are correct.

## Installation

Installation of the PWH is divided into two phases: mounting and electrical connections. In most cases, it is easier to mount the PWH before completing the electrical connections.

## Mounting

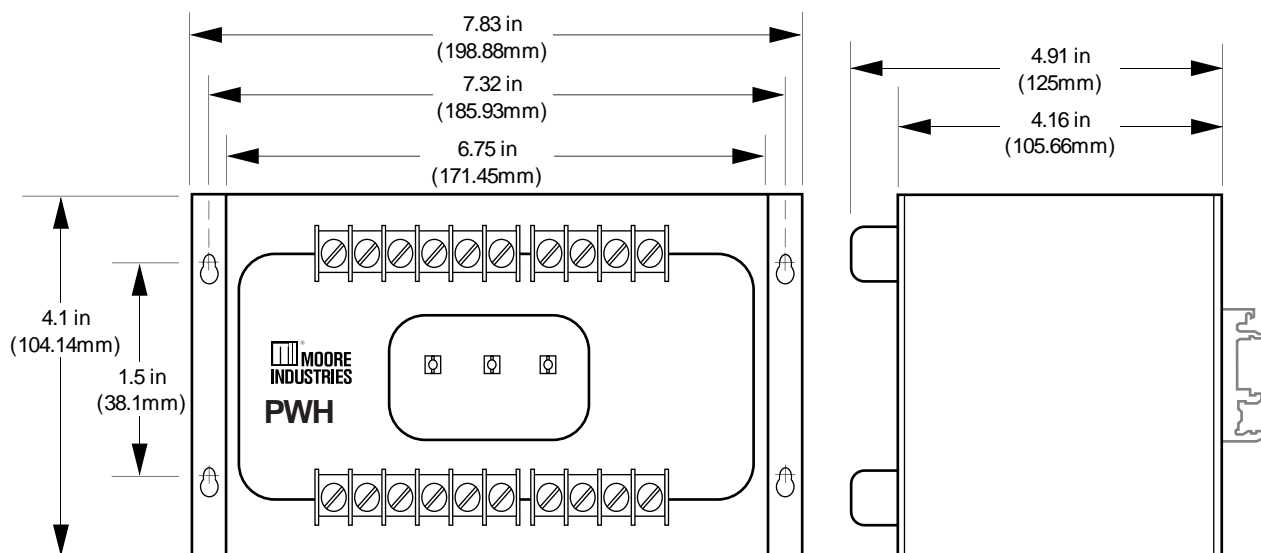
Depending on the housing style and options ordered, the PWH is either surface mounted (SM) or DIN-rail mounted (DM). Figure 10 contains the mounting dimensions for both these housing styles. When mounting the PWH, ensure it is mounted on a vertical plane in an area free of dust, moisture and corrosive elements.

PWHs ordered with the RMB or RMU output option must be mounted on a vertical plane with their length extended vertically. This positioning is necessary for proper operation of the mercury-wetted relay inside the PWH. The correct upright position is identified by the layout of the unit's front panel.

The mounting dimensions for vertical-mount units are the same as those given in figure 10. Figure 11 illustrates a 3-element, vertical-mount front panel for reference purposes. Vertical-mount units are packaged in either an SM or DM housing.

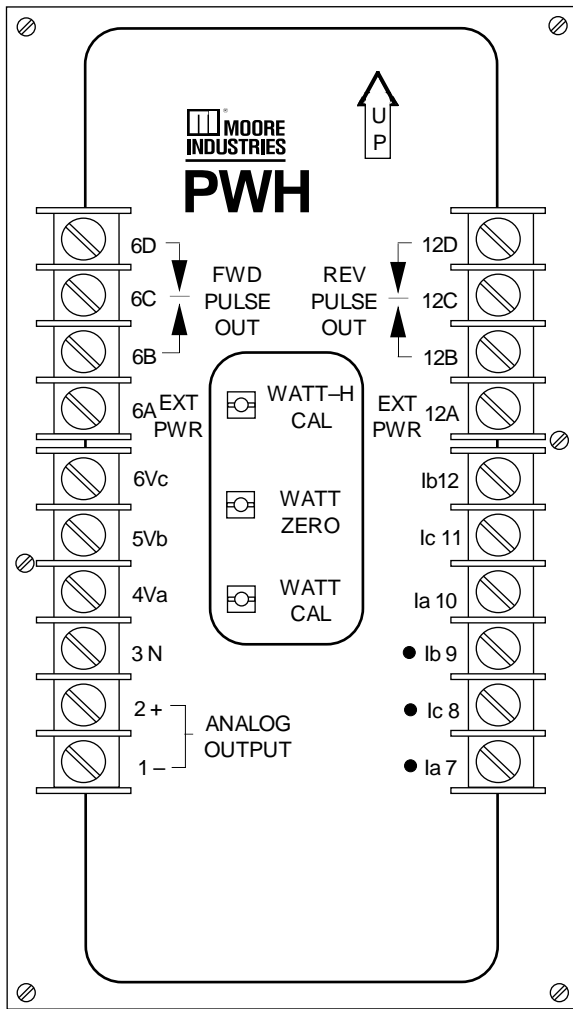
Surface-mount (SM) units may be mounted on any vertical plane. However, it is recommended that the PWH be mounted on a surface that helps dissipate heat, especially if the ambient temperature is unusually high. Surface-mount units have four keyhole cutouts in their mounting plate for easy mounting and removal (see figure 10).

The DM housing is designed for mounting on standard DIN rails. The rear of the unit is equipped with two mounting clips (see figure 10), which attach the unit to the rails; either 32 mm (1.26 in) or 35 mm (1.38 in) rails.



**Figure 10.** PWH Outline Dimensions

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**Figure 11.** Vertical-Mount PWH Front Panel (Example)

Terminal connections are made in the same relative positions for horizontal- and vertical-mount units. A vertical-mount unit is basically a horizontal unit that has been rotated 90 degrees to its left. Figure 11 illustrates the front panel of a 3-element, vertical-mount PWH. Vertically mounted units have relay outputs. The FWD PULSE OUT terminals 6B, 6C and 6D are all used for the relay output. Horizontally mounted units only use terminals 6B and 6C for the solid-state output.

## Operation

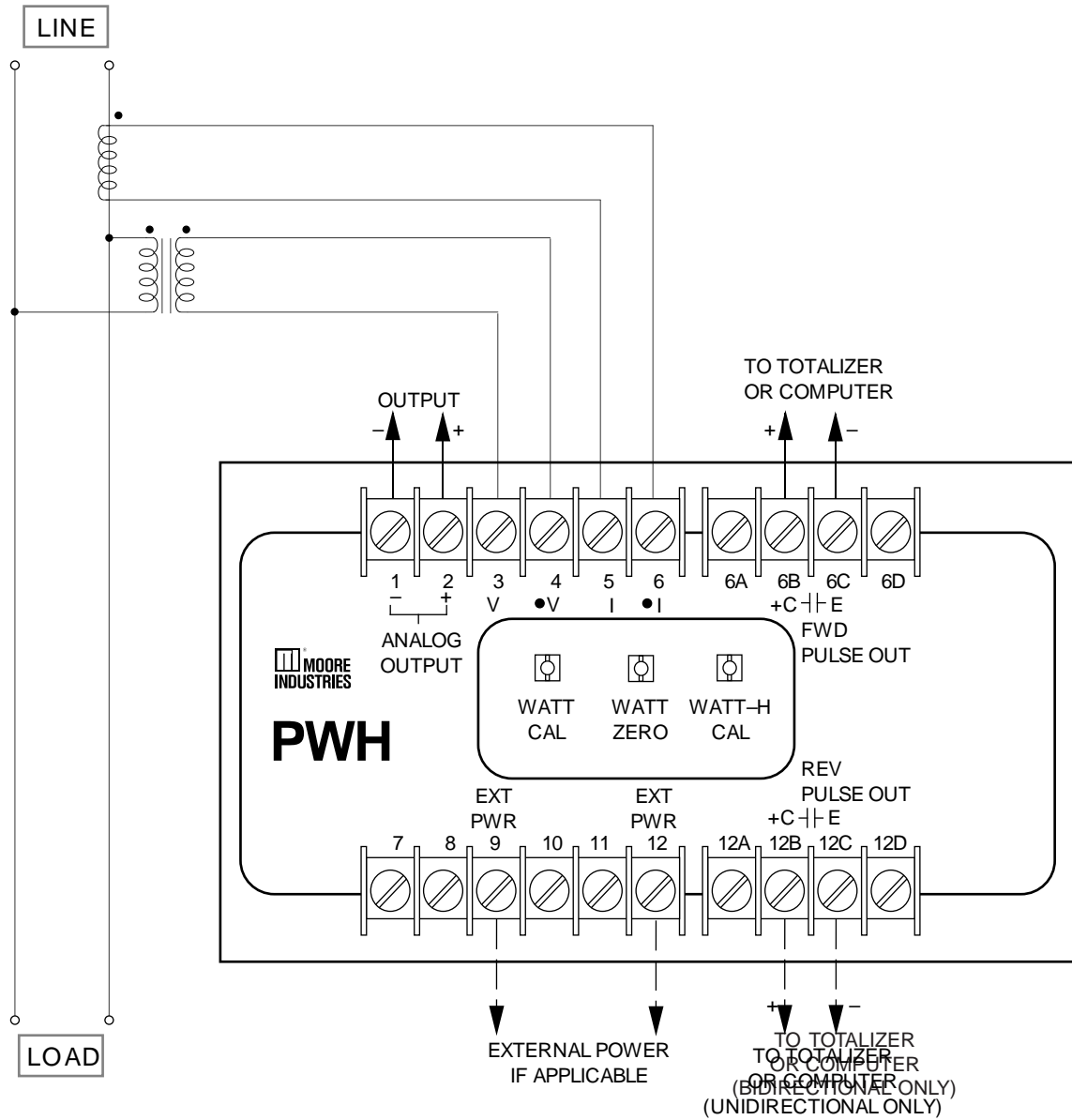
Since there are no LED's or digital displays to monitor on the PWH, it operates unattended. However, the PWH may become warm during normal operation, especially if the ambient temperature is unusually high. This operating condition is normal for power transducers and should not cause alarm, unless a malfunction is also detected.

## Maintenance

The PWH is built with highly reliable components, which allows this device to operate unattended for extended periods of time. Because of this high reliability, field maintenance is limited to ensuring that wire terminals on the unit are clean and tight. It is recommended that the PWH be inspected for mounting security, terminal corrosion and general cleanliness at least once every six months.

## Electrical Connections

Every PWH is equipped with the same number of terminals. The number of elements a PWH is configured for determines which terminals are used for installation. Terminal designations are clearly marked on the front label of each unit. Figures 12 through 16 are installation hookup diagrams for the five PWH configurations.



**Figure 12.** Installation Hookup, 1-Element PWH

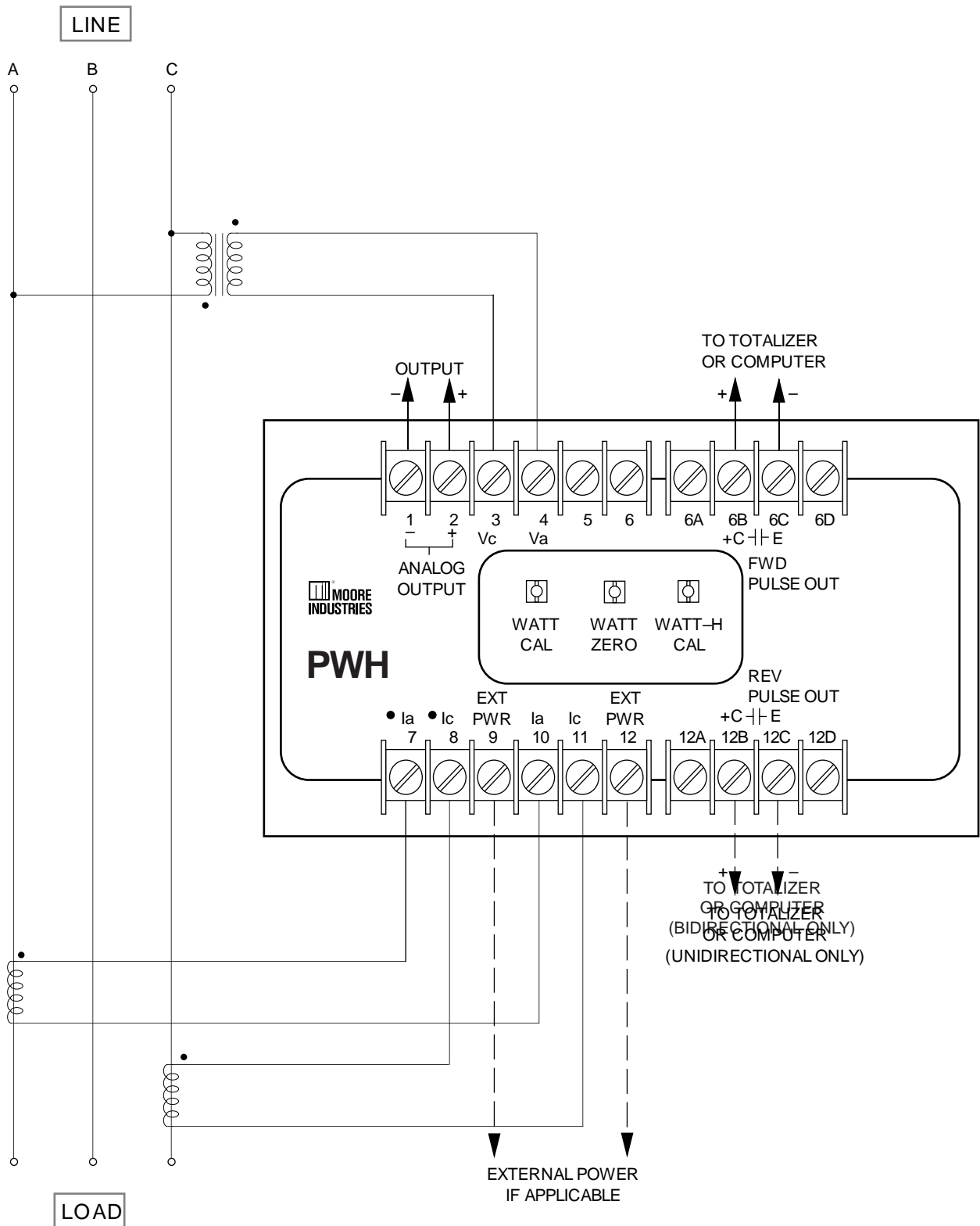


Figure 13. Installation Hookup, 1.5-Element PWH

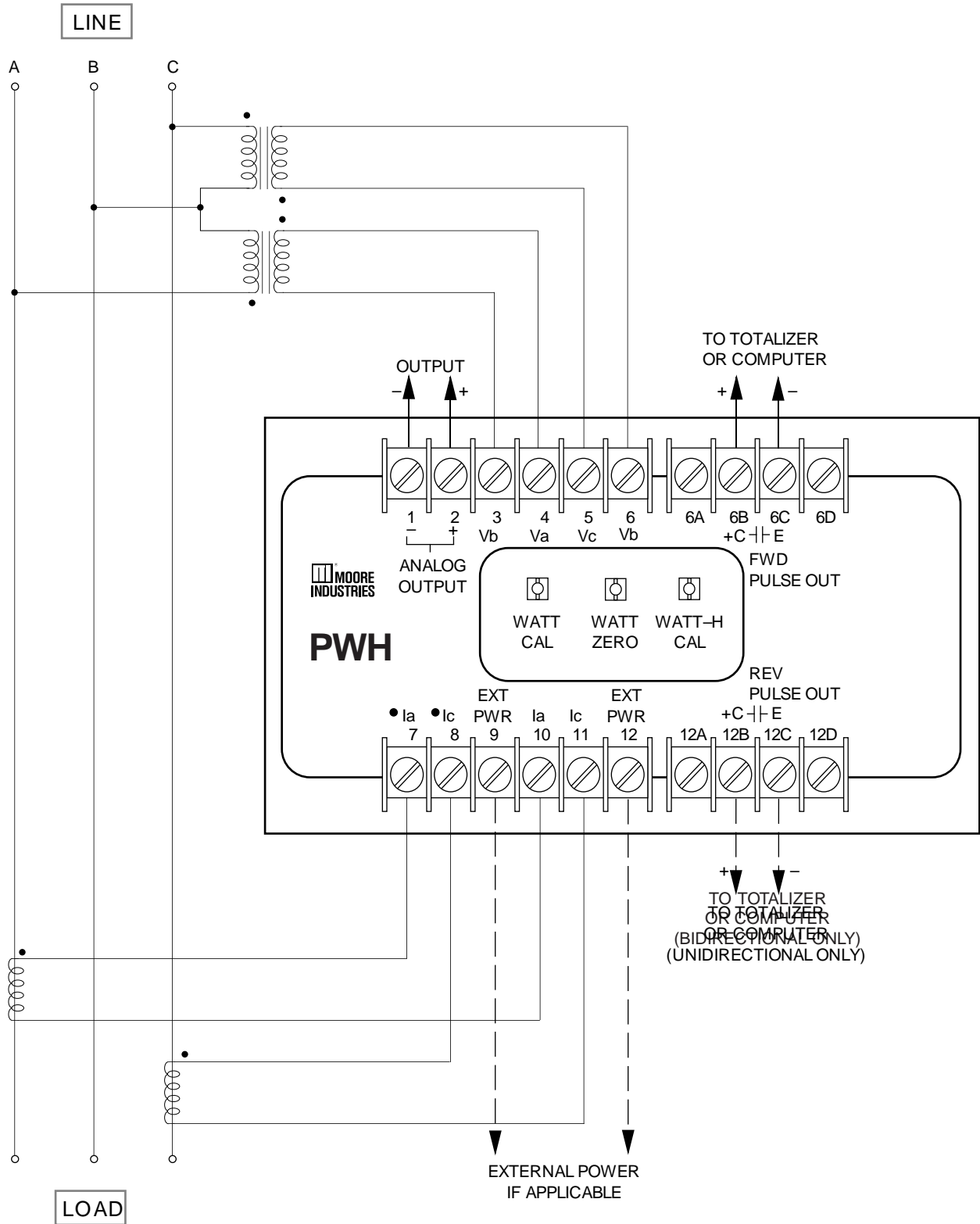


Figure 14. Installation Hookup, 2-Element PWH

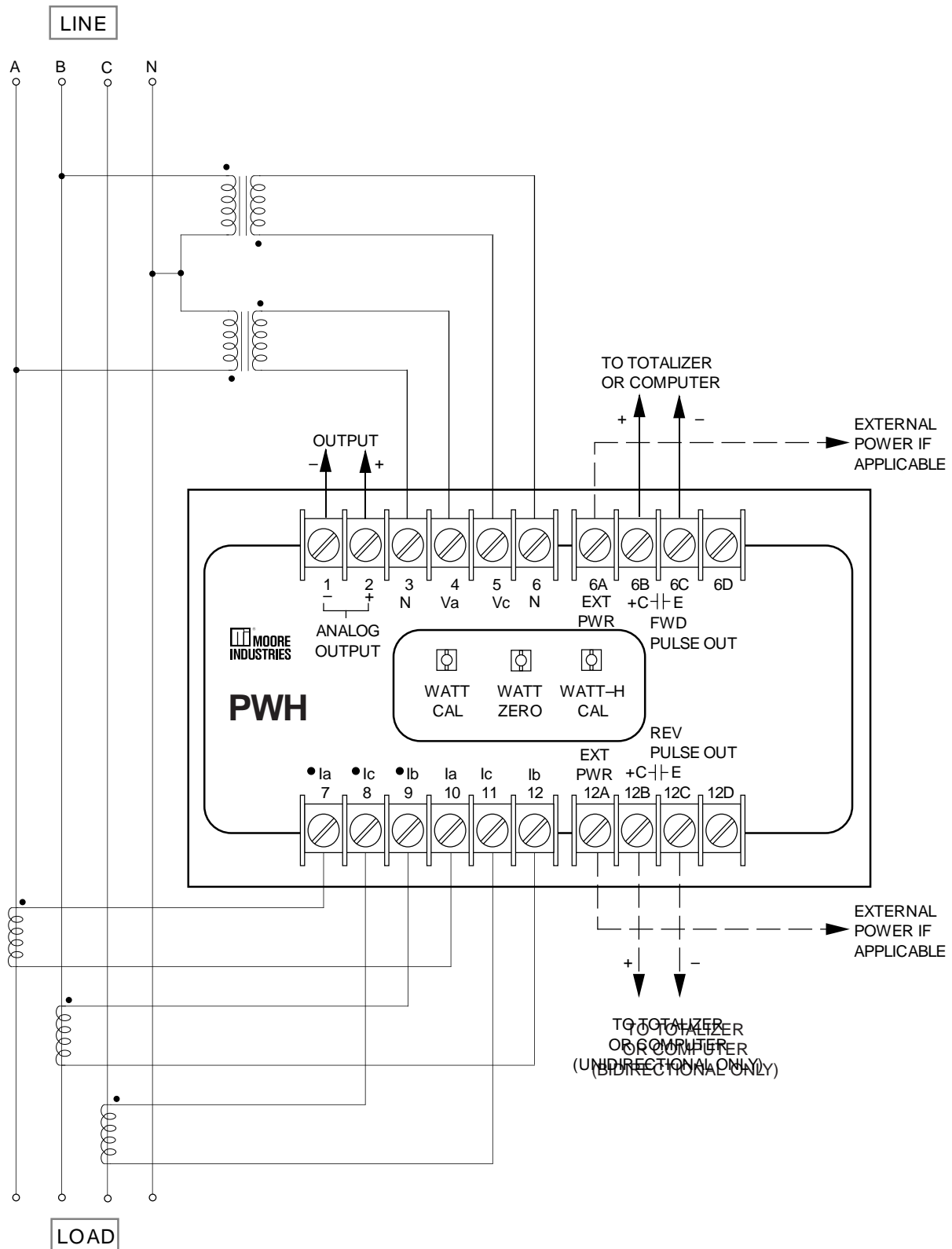


Figure 15. Installation Hookup, 2.5-Element PWH



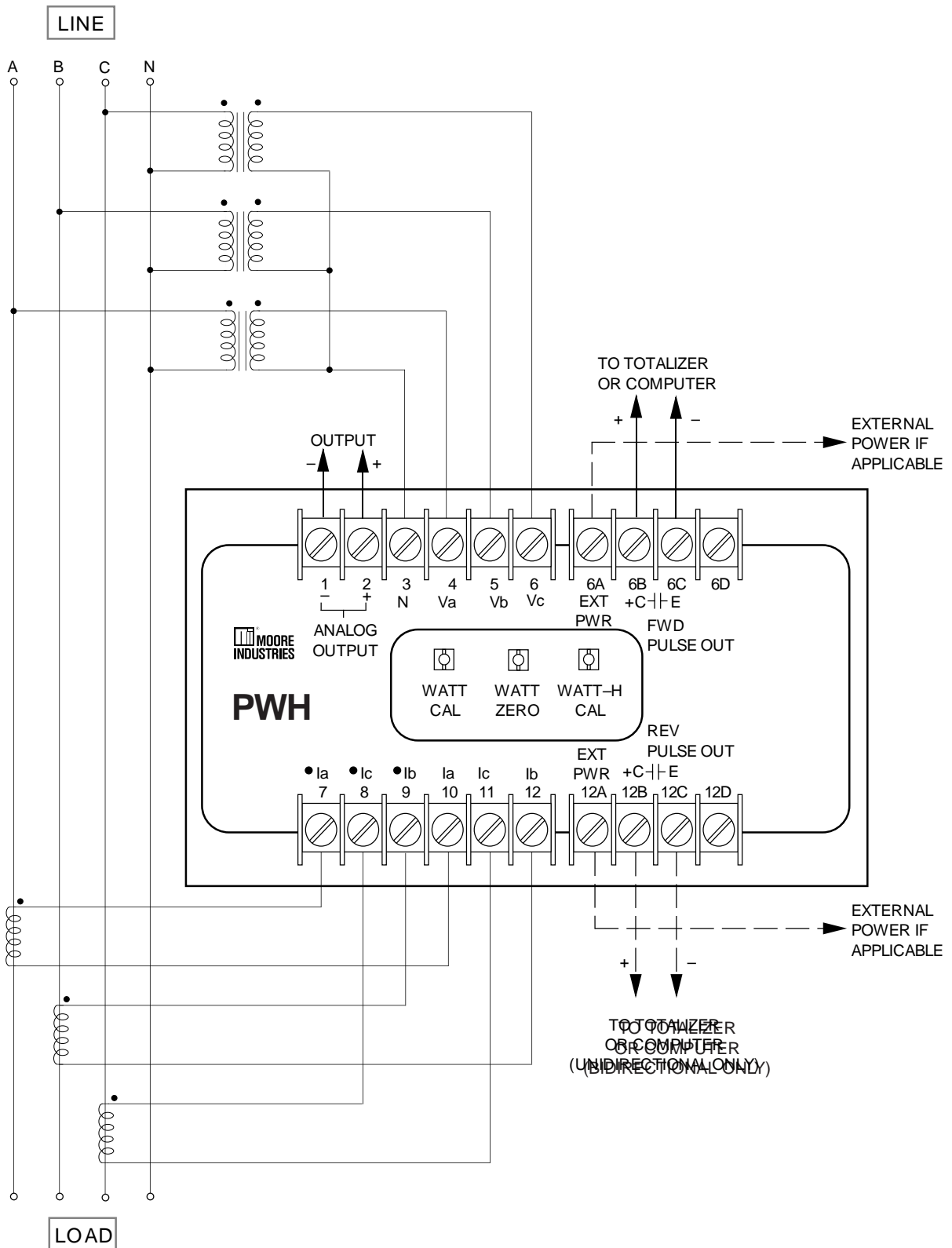


Figure 16. Installation Hookup, 3-Element PWH

# Supplement

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March 1993

This supplement applies to the following manuals:

- **PCV, 320-701-00 B, October 1989**
- **PVH, 318-701-00 A, March 1989**
- **PWH, 317-701-00 A, February 1989**

This supplement corrects an error in the 2.5 element hookup diagrams in each of these manuals. Please note the model type, replacement page and figure number on each of the attached 3 pages.

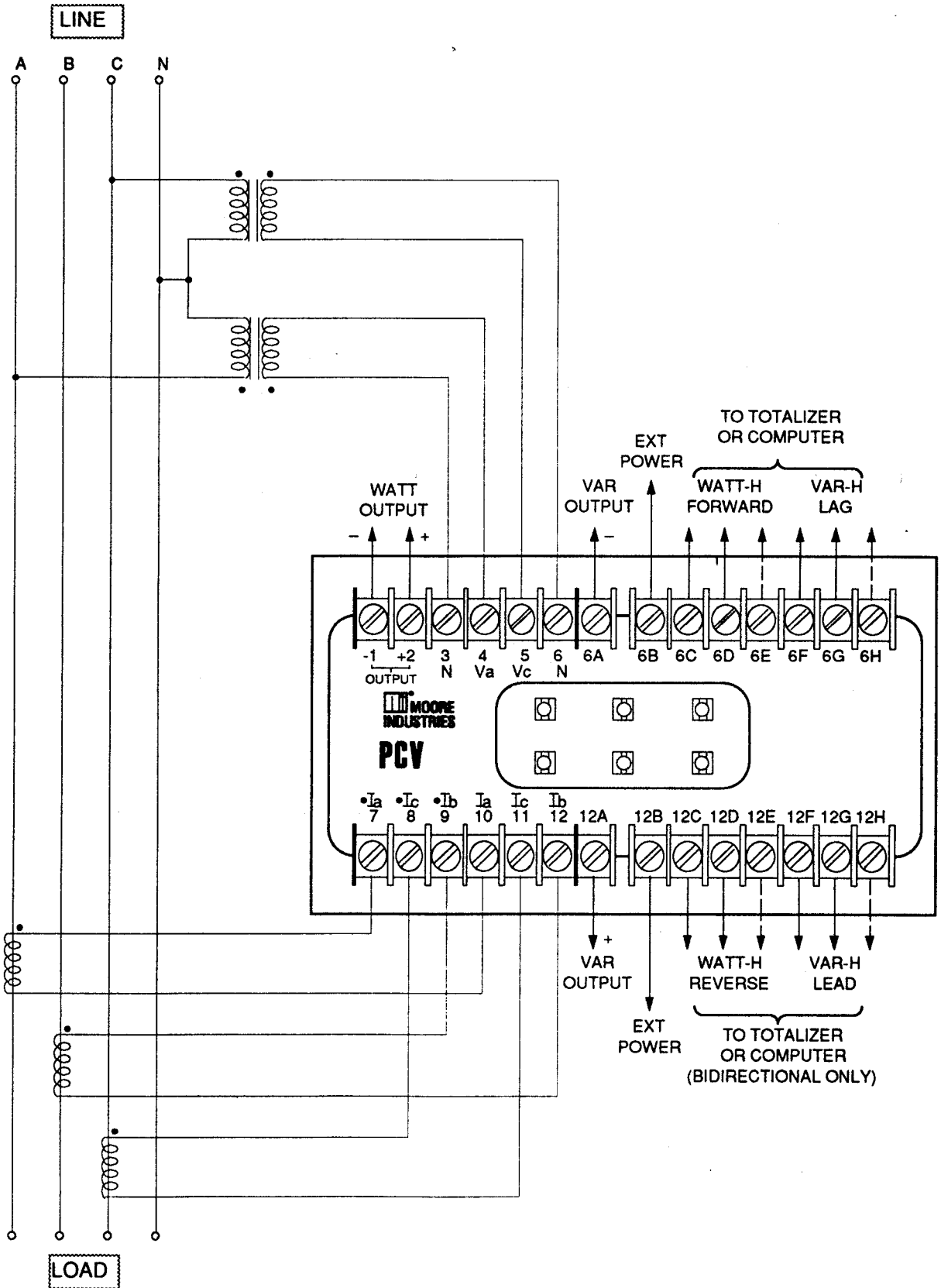


Figure 16. Installation Hookup, 2.5-element PCV

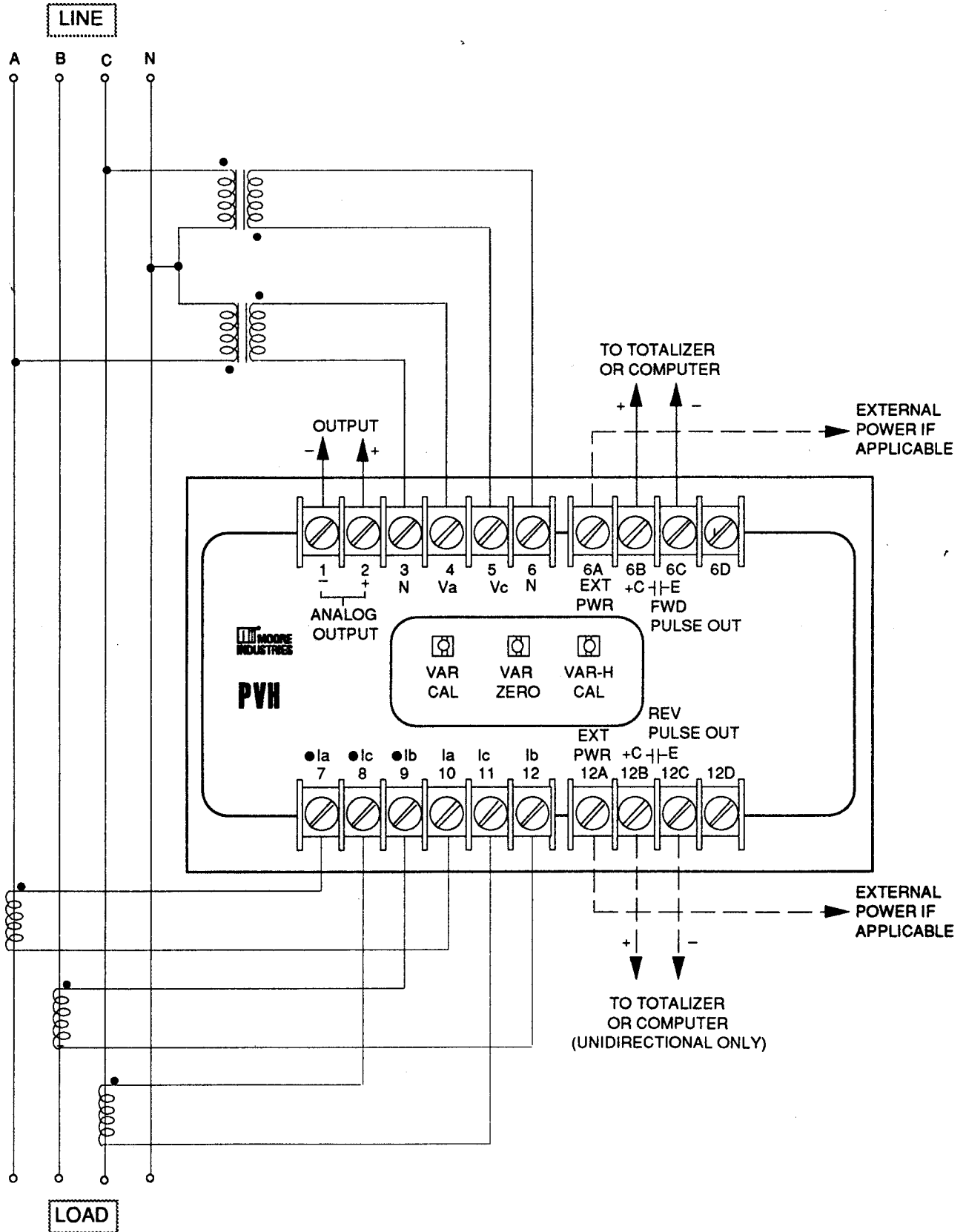


Figure 15. Installation Hookup, 2.5-element PVH

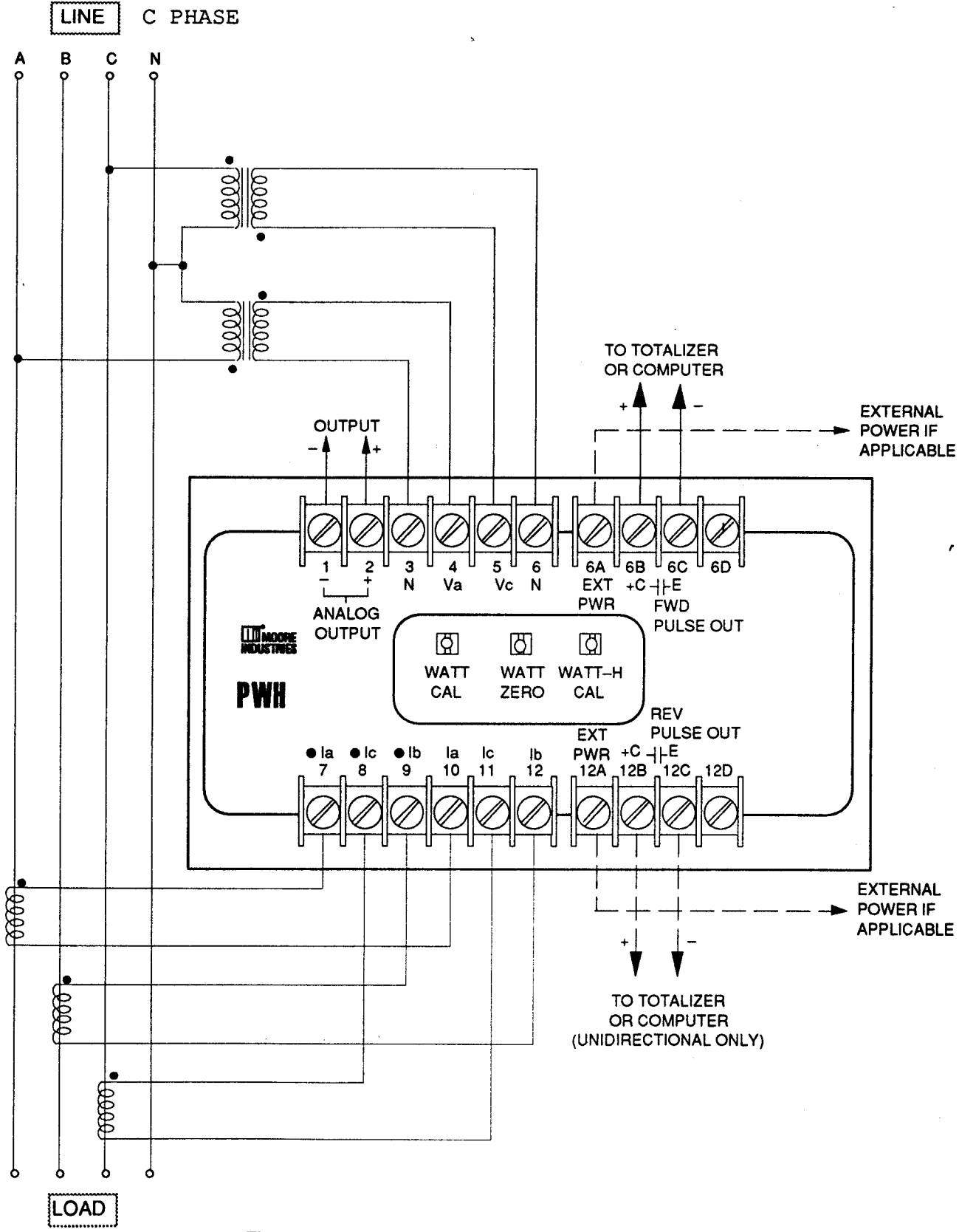


Figure 15. Installation Hookup, 2.5-element PWH

## 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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