OPERATION & CALIBRATION MANUAL

PC5 SERIES WATT TRANSDUCERS

This manual applies to both PC5 (50 and 60 Hertz) and PC4 (400 Hertz) Watt Transducers.

By David W. MILLER
Edited and revised by William D. Walden September, 1998

OHIO SEMITRONICS, INC.
4242 Reynolds Drive
Hilliard, Ohio 43026
Phone: 614-777-1005
Fax: 614-777-4511
E-mail: sales@ohiosemitronics.com
http://www.ohiosemitronics.com

PC5-MANUAL
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Preface to the PC5 Operation and Calibration Manual

By William D. Walden
Ohio Semitronics, Inc.

The PC5 Transducers

The PC5 series of transducers are true four quadrant multipliers for calculating electric power in watts. The output signals are bi-directional. If the direction of power flow reverses as it may in a facility that has co-generation, the sign of the output reverses. All PC5 watt transducers are calibrated at Ohio Semitronics, Inc. using standards that are traceable to the National Institute of Standards and Technology (NIST).

The PC5 series watt transducers are unique in that these Hall effect watt transducers do an excellent job calculating power where severe distortion or chopped current and voltage wave shapes exist.

Watt transducers are available from Ohio Semitronics, Inc. in 1, 2, 2 ½, and 3 element versions and with output signals of 0 to ±1 mADC, 0 to ±5 volts, 0 to ±10 volts DC, 4 to 20 mADC, or 4 to 12 to 20 mADC, where 4 mADC represents negative full scale, 12 mADC represents 0, and 20 mADC represents positive full scale. We are very flexible with this series. If you have special requirements, please contact us.

Mr. David W. Miller

David W. Miller is Vice President of Ohio Semitronics, Inc. He has been with the company since its founding in 1964. Mr. Miller personally designed most of the transducers that Ohio Semitronics, Inc. is presently manufacturing.

CONTENTS

WATT TRANSDUCER
PC5 SERIES

1. OPERATING PRINCIPLES

The power in an AC circuit is the product of the voltage, current, and power factor expressed as $P = EI \cos \theta$ where θ is the angle by which the current lags (inductive) or leads (capacitive) the voltage. Power is a measure of the rate at which work is being done. Watt (or power) transducers provide a means of measuring this and provide a signal proportional to the rate at which work is being done. The unit of electric power is the watt. Some convenient power conversions: 1 horsepower=746 watts, 1 watt = 3.41 BTU/hour, 1 watt = 1 DC ampere X 1 DC volt.

The PC5 Watt Transducers utilize Hall Effect multipliers to provide an output signal proportional to the electric power consumed in a load. The multipliers provide instantaneous multiplication of the voltage and the current on a continuous basis.

2. TYPES

PC5 Watt Transducers come in four types.

A Single Phase (One Element)

This type has one current sensor and one voltage transformer. This measures total power in a two-wire circuit.

B Polyphase (Two Element)

This type has two current sensors and two voltage transformers. This transducer will measure total power in a 1Ø 3W or 3Ø 3W Delta circuits without voltage or load restrictions.

C Polyphase (2½ Element)

This type has three current sensors and two voltage transformers. This transducer will measure total power in a 3Ø 4W circuit with balanced voltage and unrestricted load.

D Polyphase (Three Elements)

This type has three current sensors and three voltage transformers. This transducer will measure total power in a 3Ø 4W circuit without voltage or load restrictions.

3. RATING

3.1 STANDARD PC5 OUTPUT

The base unit PC5 Watt Transducer has an analog signal output of 50 millivolts for single phase, 100 millivolts for 3Ø 3W, 1Ø 3W or 3Ø 4W, 2 1/2 element, or 150 millivolts for 3Ø 4W. In each case output loading should be greater than 100K Ω. Figure 1 shows the output of the base PC5 Watt Transducer. The sine wave shown is at twice the source frequency. The "average dc" shown by the dashed line in the figures below is proportional to the true power and the sine wave shown as solid lines is proportional to the apparent power.

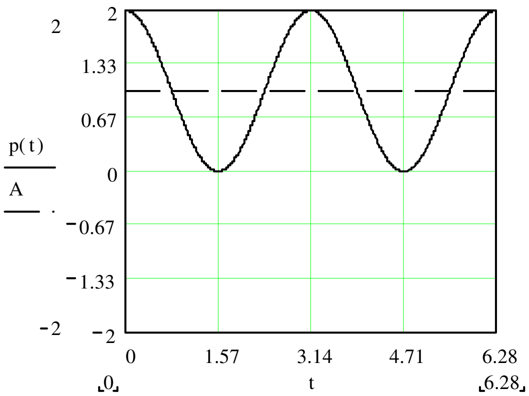

Figure 1a

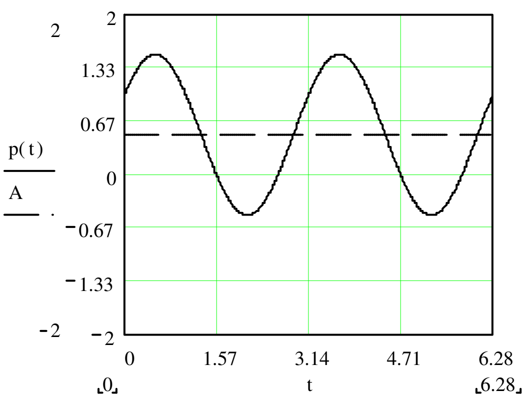

Figure 1b

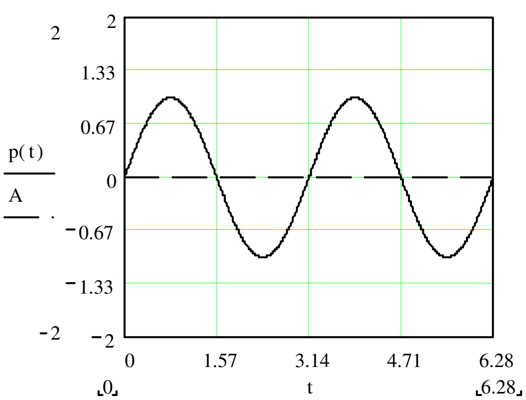

Figure 1c

The Graphs at the left illustrate loads with the following characteristics:

- Top Figure 1a – Load at unity power factor.
- Middle Figure 1b – Inductive load at 0.5 power factor.
- Bottom Figure 1c – Pure inductive load or 0 power factor.

In all three cases the dashed line represents the real average power or the work being done by the load.

The AC ripple, which represents apparent power, is eliminated using the simple filter circuit shown below.

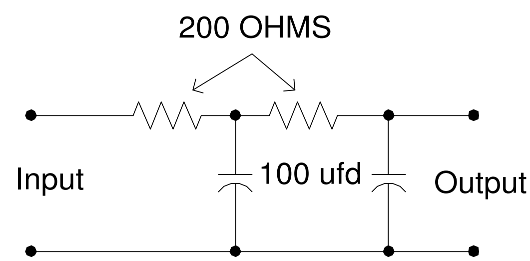

Figure 2

In all cases the base outputs are filtered and amplified to provide 0 to 1mA, 0 to 5 volts, 0 to 10 volts or 4 to 20mA's by adding the option letter to the end of the model number when ordering the transducer. Base models (models with non-amplified outputs) are no longer available from Ohio Semitronics, Inc. except by special request.

OUTPUT OPTION Suffix Letter	OUTPUT
A	0 to ±1 mADC Self powered.
B	0 to ± 1 mADC Requires 120 volts AC instrument power.
C	0 to ± 10 Volts DC Self powered.
D	0 to ±10 Volts DC Requires 120 volts AC instrument power.
E	4 to 20 mADC Requires 120 volts AC instrument power.
E2	4 to 20 mADC Requires 24 volts DC in the external loop.
X5	0 to ±5 volts DC Requires 120 volts AC instrument power.
CX5	0 to ±5 volts DC Self powered.

Options A , C, & CX5 the self powered models should maintain the voltage within:

120 volt models: 85 to 135 volts AC
240 volt models: 200 to 280 volts AC
480 volt models: 380 to 550 volts AC

The standard specification sheets show the Effective Range of the voltage and current. These inputs indicate the ranges over which the transducer will be within its specified accuracy. The rated output "RO" is the calibration point at which the 1mA, 5V, 10V or 20mA is obtained. All transducer outputs will over range by 20% as long as the voltage and current are in their effective range.

3.2 VOLTAGE INPUTS

PC5 Watt Transducers are designed for nominal inputs of 120, 240/277 or 480 VAC. The effective range at the specified accuracy is 0 to 150, 0 to 300, or 0 to 600 VAC. These wide ranges do not apply to Options A or C, which are limited as follows: 85 to 135 V for 0 to 150 V models, 200 to 280 V for 0 to 300 V models, and 380 to 550 V for 0 to 600 models.

3.3 CURRENT INPUTS

Standard models are rated from 1 through 1000 amperes. Models with input current up to 20 amperes connect direct to the terminal strips. Models above 20 amperes use a current transformer. Current connections are made through the window of the current transformer.

(A) Current Transformers

Current transformers step the current down to 5 amperes. When specified by model number these current transformers are calibrated as part of the watt transducer and should not be interchanged among different watt transducers. Extending the leads of the current transformers is permissible as long as 12-gauge wire is used and the VA rating of the transformer is not exceeded. See Page 18 Technical Bulletin 101 for wire sizes.

CAUTION

Only qualified personnel should install the current transformer. Do not apply line current through the window of the current transformer with the secondary leads open. A SEVERE SHOCK TO THE INSTALLER OR DAMAGE TO THE CURRENT TRANSFORMER MAY RESULT.

If necessary to operate the current transformer without the watt transducer, bolt the two secondary leads together and mark with a CAUTION tag.

4. POWER FACTOR

All PC5 watt transducers are corrected for power factors from 0 lead to unity to 0 lag (0° to ±90°) and are within the specified accuracy listed.

5. FREQUENCY RANGE

The PC5 Watt Transducers are designed to operate from 50 to 70 Hz. However, good results can be obtained from 40 to 400 Hz. See specification sheet for PC4 Models when 400 Hz is required.

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6. SIGNAL SOURCE

A Options A & B, 0 to 1 mADC constant current output, may be used to drive a 1 milliampere analog meter directly..

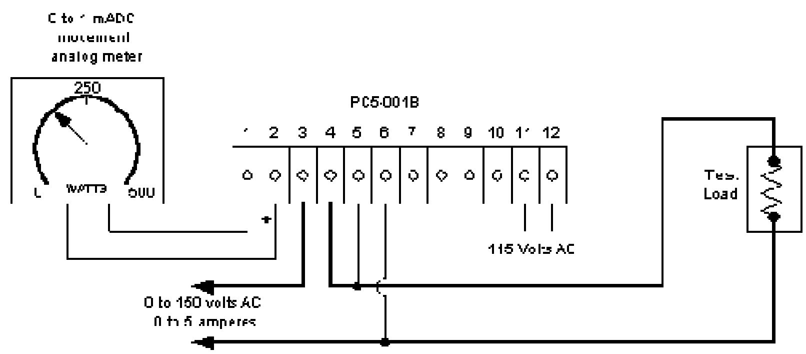


Figure 3

Or, may be scaled for a digital meter using a load resistor.

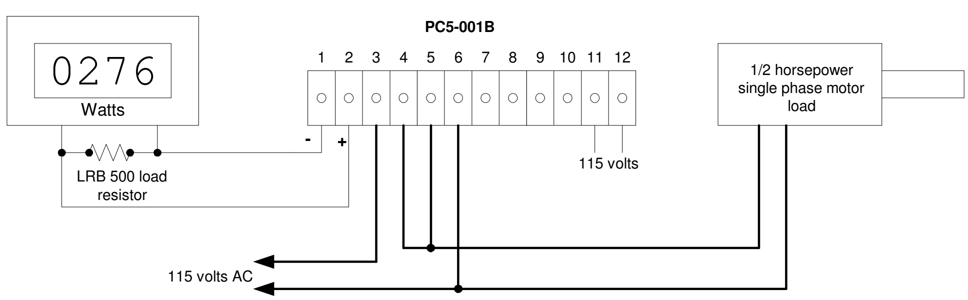


Figure 4

The value of the load resistor may be calculated using Ohm's Law:

R = E/I Where E is the desired voltage and I is 0.001 (1 mADC).

B Option C & D, 0 to 10 VDC constant voltage output, supply up to 5 mA into a 2000 Ω load.

C Option E, 4 to 20 mADC output for industrial controls, has its own power source and may be used for loads from 0 to 1500 Ω.

D Option E2, 4 to 20 mADC output requires 16 to 40 volts DC in the external loop.

7. READOUT INSTRUMENT

Analog instruments, which accept a 0 to 1mADC input, may be directly connected to the output terminals of the watt transducer with option A or B, to provide a direct reading in power. Watt Transducers may be used to supply signals for recorders, analog to digital converters, computers, digital panel meters, etc.

8. SCALING

8.1

OSI has a complete line of watt transducers for various applications. These are designed for a particular voltage and current range, and are calibrated as a package. If a watt transducer is to be used with user supplied current and potential transformers; the following information will be helpful.

MODEL	PHASE	ELEMENTS	REQUIRED PT's	REQUIRED CT's	CALIBRATED WATTS AT 1mADC
PC5-001B	1∅ 2W	1	1	1	500
PC5-004B	1∅ 3W	2	* DIRECT	2	1000
PC5-004B	3∅ 3W	2	2	2	1000
PC5-7.5B	3∅ 4W	2½	2	3	1500
PC5-007B	3∅ 4W	3	3	3	1500

* Direct Connections for 120 V line to neutral. Refer to drawings A902-082 and A902-076, PG. 23 & PG. 23 for PT's & CT's connections.

The power measured in a circuit in which current and potential transformers are used is equal to the power rating of the watt transducer multiplied by both the current transformer and potential transformer ratios. If only current transformers are used, then multiply by the current transformer ratio.

Consider a PC5-004B rated at 5 amperes, 120 V, 3Ø, 3W transducer calibrated for 1000 watts at 1 mADC. It is connected to a 480 VOLT, 200 ampere three phase power system. The potential transformer ratio is 480 to 120 or 4. The current transformer ratio is 200 to 5 amperes or 40. The full-scale power will equal 1000 X 4 X 40 or 160 kW. 0 to 1mA is proportional to 0 to 160 kilowatts.

8.2 AMPERE TURNS

Adding turns through the window of the sensor can change current transformers primary ratios. Consider a 100-ampere transformer that you would like to use in a 25-ampere circuit. Wind four turns through the transformer window. The net result on a PC5-058B which has a normal full scale of 10 kilowatts and is supplied with a 100:5 current transformer, will be a watt transducer set up to give a full scale of 1 mA output at 2.5KW. The maximum current rating for the transformer or transducer will be 25 amperes. The picture below is shown with 4 amp turns. Count only the turns that pass through the window of the transformer.

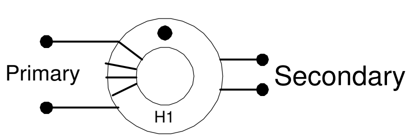


Figure 5

9. CALIBRATION

All PC5 Watt Transducers are factory calibrated and checked 100% for voltage and current linearity, power factor, and initial set point. Temperature is checked on random samples. Instrumentation used for calibration is traceable to N.I.S.T. (National Institute of Standards and Technology)

All PC5 Watt Transducers are calibrated on single-phase with the current coils or current sensors in series and voltage transformers in parallel. Polarities are chosen to produce a positive output on terminal 2 of the watt transducer. Ideally, the transducer is energized from a precision instrument calibrator but adequate results are obtained by using commercial power and a single-phase 0.1% Wattmeter standard. The Wattmeter standard current circuit is connected in series with the current coils or sensor of the watt transducer under test. The voltage transformers are connected in parallel. Refer to Figure 11 (A) & (B), PG. 21.

9.1 GENERAL

A The Wattmeter standard must be capable of the desired range of input voltage and current required calibrating the particular PC5 Watt Transducer.

Since all PC5 Watt Transducers will be calibrated using a single phase source, the actual wattmeter standard reading will be half of the total specified output on 2 elements and 1/3 of the total specified output on 3 elements PC5 Watt Transducers.

First Example: PC5-004B, 3Ø 3W has a specified output of 1mA proportional to 1KW. Using the single-phase calibration method, the Wattmeter standard would be set at 500 watts full scale and the PC5 would be calibrated for a 1mA output at the 500-watt point on the wattmeter.

Second Example: PC5-007B, 3Ø 4W has a specified output of 1mA proportional to 1.5KW. Using the single-phase calibration method, the Wattmeter standard would be set at 500 watts and the PC5-007B would be set to 1 mA at the 500-watt point on the Wattmeter standard. In each case, each element of PC5-007B is measuring the full-scale current & voltage.

B A digital meter capable of 10-microvolt resolution for the base watt transducer with outputs of 50, 100, or 150 millivolts is required and digital meter capable of 1-millivolt resolution for all others.

C A precision load resistor of 1K Ω, 0.05% should be used for the 1mA-output units, option A & B and a precision resistor of 500 Ω, 0.05% should be used for option E.

D If the full-scale line current required is not available; amp-turns through the current transformer or transducer window may be used. The windings must be distributed uniformly around the current transformer or transducer and not pulled tightly against the unit.

E If current transformers are not calibrated with the PC5 the following additional errors may be expected:

3%	50 and 100 ampere range.
1.5%	200 ampere range.
0.75%	400 & 600 ampere range.
0.3%	1000 ampere range and up.

F Apply power to all voltage potential circuits for 20 minutes, (this includes 115 VAC instrument power if you have PC5 with option B, D, or E) before calibration is attempted.

G Calibration of the watt transducer should be made at or as close to unity power as possible.

H Calibration of all standard PC5 Watt Transducers is scaled for standard power levels such as 100, 500, 1000, 2000 Watts, etc. Refer to the PC5 specifications for the "Watts at Rated Output".

9.2 ADJUSTMENTS

Overall calibration and zero adjustments are located through the lid underneath the plastic caps. If the lid has a black plastic cap over the zero opening, do not remove, this is not an adjustment. Balance adjustments for 2, 2½, and 3 elements are located inside the can. Refer to Figure 6 for location.

A Zero Offset:

Energize only the voltage coils of the watt transducer. Adjust the output at terminal 1 & 2 within ±1 millivolts. This applies for PC5's with option A, B, C, and D. Option A and B must be loaded with a 1K Ω precision resistor. For E option, load the output with a 500 Ω precision resistor and adjust the "Zero" adjustment for 4mA or 2VDC ±2 millivolts.

B Balance

This adjustment sets the internal calibration to provide a balanced output among elements. Balance of PC5 Watt Transducers is not required on 1-element units, and is usually not necessary on 2, 2½, or 3 element units unless a part is replaced or the trimpot has been changed. Refer to page 8, Section 9.3 if balancing is not required. If adjustments are necessary, refer to Figure 6 for internal circuit board locations of the balanced trimpots. (See Figure 6 on page 14.)

2 & 2½ Element Watt Transducers

After the test connections are made as shown in Figures 8A and 8B or Figure 9A, reverse the polarity of the voltage on terminals 5 and 6 by switching the leads.. (See pages 15 & 16 for figures 7, 8 & 9.)

Energize the voltage and current and adjust the power source for a full scale Standard Wattmeter reading. Now, adjust the internal balance trimpot for a zero output reading at terminals 1 and 2.

3 Element 3Ø 4W

After the test connections are made as shown in Figure 9B or 9C, disconnect the lead from terminal 12 and connect it to terminal 11, shorting them together. Reverse leads going to terminals 9 & 10.

Energize the AC power source and adjust the Standard Wattmeter for a full-scale output. Adjust L2 balance trimpot for a zero output at terminals 1 and 2.

Turn off the power source and change the connections. Remove terminals 9 and short to terminal 10. Reverse terminals 11 and 12.

Energize the AC power source and adjust the Standard Wattmeter for a full-scale output. Adjust L3 balance trimpot for a zero output at terminals 1 and 2.

9.3 FINAL CALIBRATION

Before attempting the final calibration, read the section on calibration. Figure 7, 8 and 9 provide all the various standard test connection diagrams for the PC5 Watt Transducers. As you can see, the voltage circuits are in watts, parallel and the current circuits are in series.

All standard watt transducers are calibrated at even power levels, such as 100, 500, 1000, etc. Refer to "Rated Output" on the specification sheet for the calibration point.

The best method of calibration is to use a Precision Wattmeter Calibrator, if this instrument is not available, the set up shown in Figure 10A on page 17 will do if the Standard Wattmeter is used.

Two variacs are used in Figure 10A to give independent adjustment between the voltage and current circuits. The voltage input, which is represented with the letter "E", requires a low current 1 ampere variac with a voltage range of 0 to 150, 0 to 300 or 0 to 600 VAC depending on the PC5 input voltage under test. The variac for the current sensors must be capable of the current required by the PC5 under test and the load should be resistive, such as cone heaters.

The following are examples of calibration of 4 types of PC5 Watt Transducers. They are 1Ø 2W (1 element) and 3Ø 3W (2 elements), 3Ø 4W (2½ elements) and 3Ø 4W (3 elements).

A particular model number will be picked from each of the 4 types to show the standard procedure for calibration. Only the voltage, current and rated output change from model to model for that type of unit. Balance and zeroing adjustments must have been made previous to the final calibration. See 9.2A and 9.2B on page 8.

(A) Example: 1Ø 2W, 1 Element

Model	PC5-010B
Voltage	120 VAC
Current	10 A AC
Rated Output	1 mA @ 1 kW
Load on Output Required	1 K Ω ± 0.05% Resistor
External Sensor Required	None
Test Connections Drawing	Figure 7A
Standard Wattmeter Set-Up	120 V - 10 A FS 1000 W
Accuracy	± 0.5% FS

Refer to Figure 10A or 10B Calibration Test Set-Ups on page 17, make the required connections between the calibrator and the direct connections in Figure 7A on page15.

Energize the voltage and apply 120 VAC, not energize the current and apply the necessary current to obtain a 1000-watt reading on the Standard Wattmeter. Adjust the "CAL" trimpot (located in the PC5-010B lid) for a 1 V ± 0.001V reading at terminals 1 and 2.

With the voltage maintained at 120 VAC, change the current such that the power reading goes from 0 to 1000 watts on the Standard Wattmeter. The output should not vary more than ±0.005V from the Standard

Wattmeter reading. Likewise, hold the current potential at 10 amperes and change the voltage such that the power reading goes from 0 to 1000 watts on the Standard Wattmeter from 0 to 1000 watts.

Next, with the voltage at 120 VAC and the current adjusted for a 1000 W reading, change the power factor from unity to 0 for both lead and lag. Current, voltage, and linearity should be within ± 0.5% FS.

B Example: 1Ø 3W, 3Ø 3W, 2 Elements)

Model	PC5-062D
Voltage	240 VAC
Current	100 A AC
Rated Output	10 V @ 40 kW
External Sensor Required	2 (Factory Supplied 100:5 current transformers)
Test Connections Drawing	Figure 8B
Standard Wattmeter Set-Up	240 V, 100 A FS @ 20 kW or 240 V, 10 A FS @ 2 kW
Accuracy	± 0.50% FS

Refer to Figure 10A or 10 B on page 17 Calibration Test Set-Ups, make the necessary connections between the calibration and Figure 8B on page 15.

Please note if the AC current source will not supply the 100 amperes, ampere-turns may be used. For instance 10 turns through the window of each current sensor will produce a 100-ampere current signal when 10 amperes are applied.

Energize the voltage and apply the necessary current to obtain either 20 kW or the 2kW reading if 10 ampere turns are used in the Standard Wattmeter.

Adjust the "CAL" trimpot, (located on the PC5-062D) for a 10 V ± 0.50% FS. Likewise, hold the current at 100 amperes and change the voltage such that the power reading goes from 0 to 20 kW. Next, with the voltage potential at 240 VAC and current adjusted for a 20 kW reading, change the voltage linearity should be within ± 0.50% FS.

C Example: 3Ø 4W, 2½ Element)

Model	PC5-7 .5D
Voltage	120 VAC
Current	5 A AC
Rated Output	10 V @ 1500 kW
External Sensor Required	None
Test Connections Drawing	Figure 9A
Standard Wattmeter Set-Up	120 V, 5 A FS 500 W
Accuracy	± 0.5% FS

Refer to Figure 10A or 10B on page 17 Calibration Test Set-Up, make the required connections between the calibration and the direct connections in Figure 9A on page 16.

Energize the voltage and apply 120 VAC, now energize the current and apply the necessary current or obtain a reading of 375 watts on the Standard Wattmeter. Adjust the "CAL" trimpot (located on the PC5-7.5D lid) for a 10 VDC ±0.001 V reading at terminals 1 & 2.

With the voltage maintained at 120 VAC, change the current such that the power reading goes from 0 to 375 watts or 75% full scale. The output should not change more than ±0.005V from the Standard Wattmeter reading or ±0.5% FS. Likewise, hold the current at 3.75 amperes and change the voltage such that the power reading goes from 0 to 375 watts. Next, with the voltage potential at 120 V and current adjusted for a power reading of 375 watts, change the power factor from unity to zero for both lead and lag. Both current and voltage linearity should be within ±0.5% FS.

D Example: (3Ø 4W, 3 Element)

Model	PC5-007A
Voltage	120 VAC
Current	5 A AC
Rated Output	1 mA @ 1500 Watts
Load On Output Required	10 K Ω ± 0.05%
External Sensor Required	None
Test Connections Drawing	Figure 9B
Standard Wattmeter Set-Up	120 V, 5 A FS @ 500 W
Accuracy	± 0.5% FS

Refer to Figure 10A or 10B Calibration Test Set-Up on page 17, make the required connections between the calibration and the direct connections in Figure 9B on page16.

Energize the voltage and apply 120 VAC, now energize the current and then apply the necessary current to obtain the 500-watt reading on the Standard Wattmeter.

Adjust the "CAL" trimpot (located in the PC5-007A lid) for a 1 VDC ±0.001 V reading at terminals 1 & 2.

With the voltage maintained at 120 VAC, change the current from 0 to 500 watts. The output should not change more than ±0.005 V from the standard wattmeter reading of ±0.5% FS.

Since the PC5 has option A, the voltage should be between 85 to 135 VAC because

the amplifier power supply uses the input voltage. Voltage linearity can not be checked. Adjust the current back to 500 watts and change the power factor from unity to zero for both lead and lag. The output should be within ±0.005 V or ± 0.5% FS.

10. INSTALLATION

The PC5 may be installed in any position and in an environment of not more than +60° C or less than -10° C.

For best accuracy the current carrying cable should be centered in the window of the transducer.

Caution must be observed when installing the current transformers. See section 3.3A.

11. TROUBLESHOOTING

The majority of the problems can usually be traced to improper connections. The following list gives some common problems and solutions.

PROBLEM: No Output

SOLUTION:

1 115 VAC Instrument power not connected. This applies only to Options B, X5, D, or E.

2 Voltage not connected.

3 Defective readout.

4 On 3Ø 3W or 1Ø3W units, could have reverse polarity either on voltage or current circuit.

PROBLEM: ½ Output

SOLUTION: All 50-ampere Watt Transducers require two turns through the window of the current transformers.

PROBLEM: 1/3 Output

SOLUTION: 3Ø 4W units, polarity of one phase reversed.

PROBLEM: Doesn't Seem Calibrated

SOLUTION:

1 Calibration point is at the "Rated Output" not Effective Watts or Full-Scale range.

2 "CAL" adjustment has been changed.

3 Customer relies on voltage and current for power measurement. This method is only accurate in a resistive load.

4 Most industrial loads are either inductive or capacitive. This causes a phase shift in the current relative to the voltage. For instance with a phase shift of 30°, the true power would be 86.6% of E X I. This is derived by P = E X I X COS(30°) The cosine of 30° is 0.866, so one can see that 86.6% of E X I is the maximum power obtainable.

Note that an unloaded induction motor will run at very low power factor. What this means is that very little power (compared to the rated motor power) is required to keep the motor running at constant speed. In other words, **the motor is not doing any work.** Power in watts is the measure of the rate at which work is being done.

Electric motors often have a power factor rating. This rating is for the fully loaded motor only and will not apply to an unloaded or partially loaded motor.

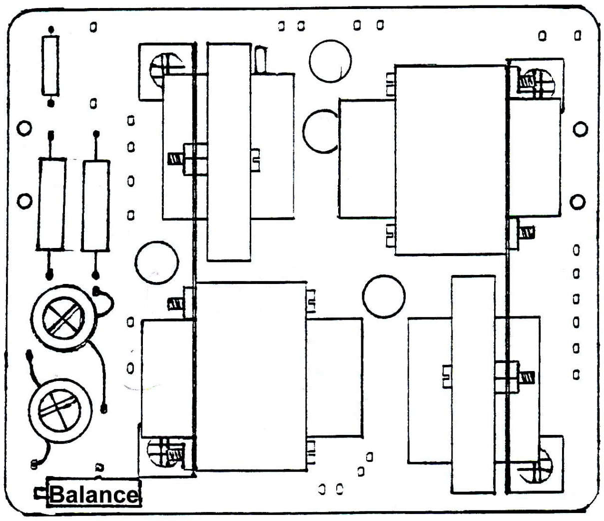


Figure 6a 2 and 2 ½ element models except those with option E.

Figure 6 showing the position of the balance control on the boards of the PC5 series watt transducers.

From upper left clockwise around the page. Figure 6a is used for 2 and 2 ½ element models with output options A, B, C, D, CX5, and X5. Figure 6b is used for 2 and 2 ½ element models with option E. Figure 6c is used for all 3 element models.

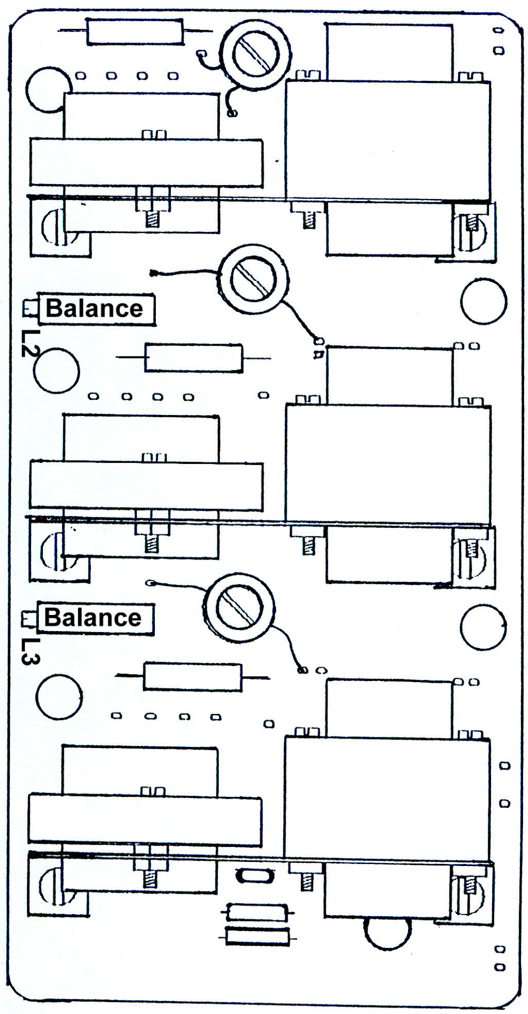


Figure 6c All 3 element models.

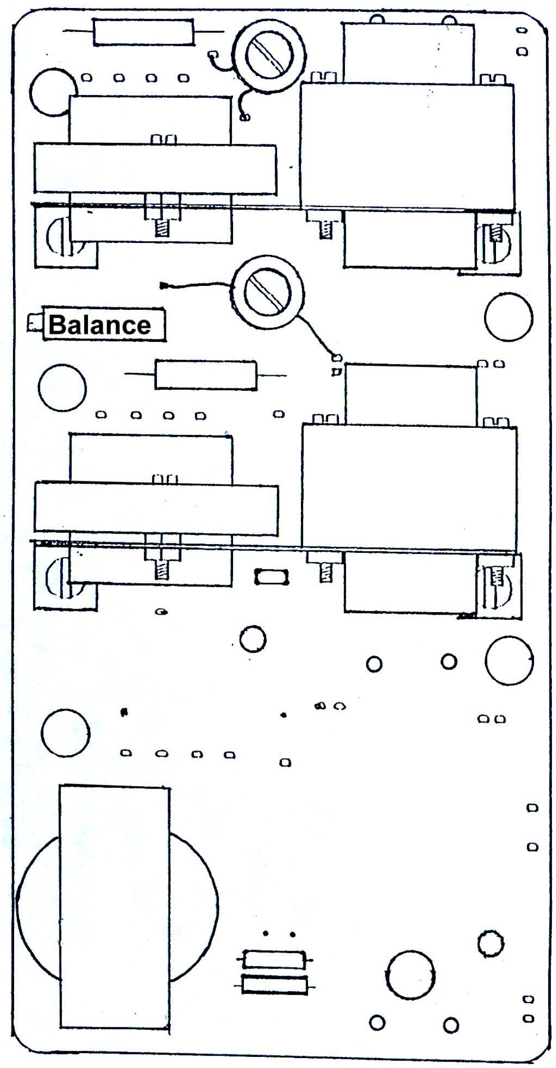
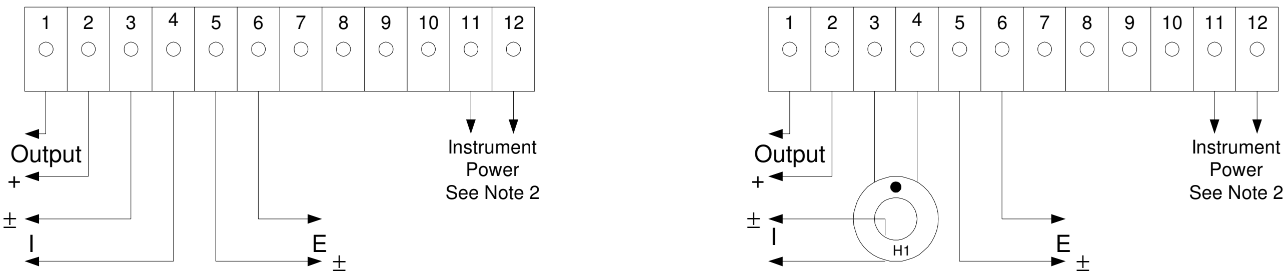


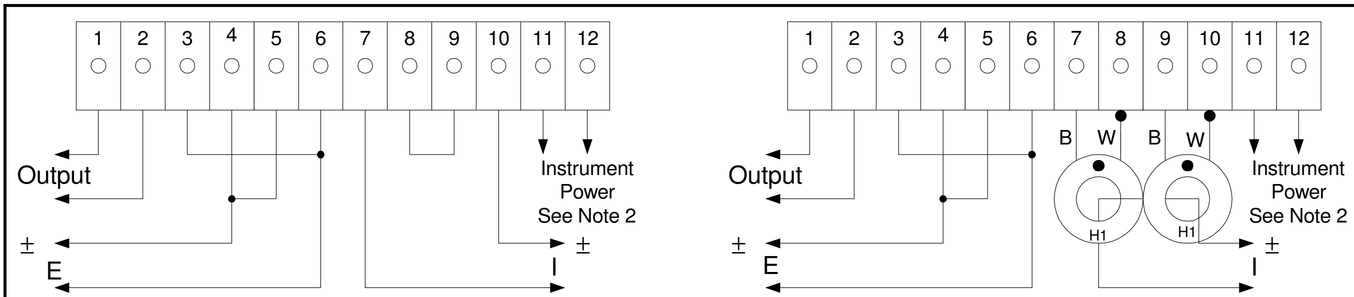
Figure 6b 2 and 2 1/2 element models with option E, the 4 to 20 ADC output.



(a) Using direct connections

(b) Using a current transformer

Figure 7
Test Connection for 1 phase, 2 wire, 1 Element Watt Transducer.



(a) Direct connections

(b) Using current transformers

Figure 8
Test connections for 1 phase, 3 wire & 3 phase, 3 wire, 2 Element Watt Transducers

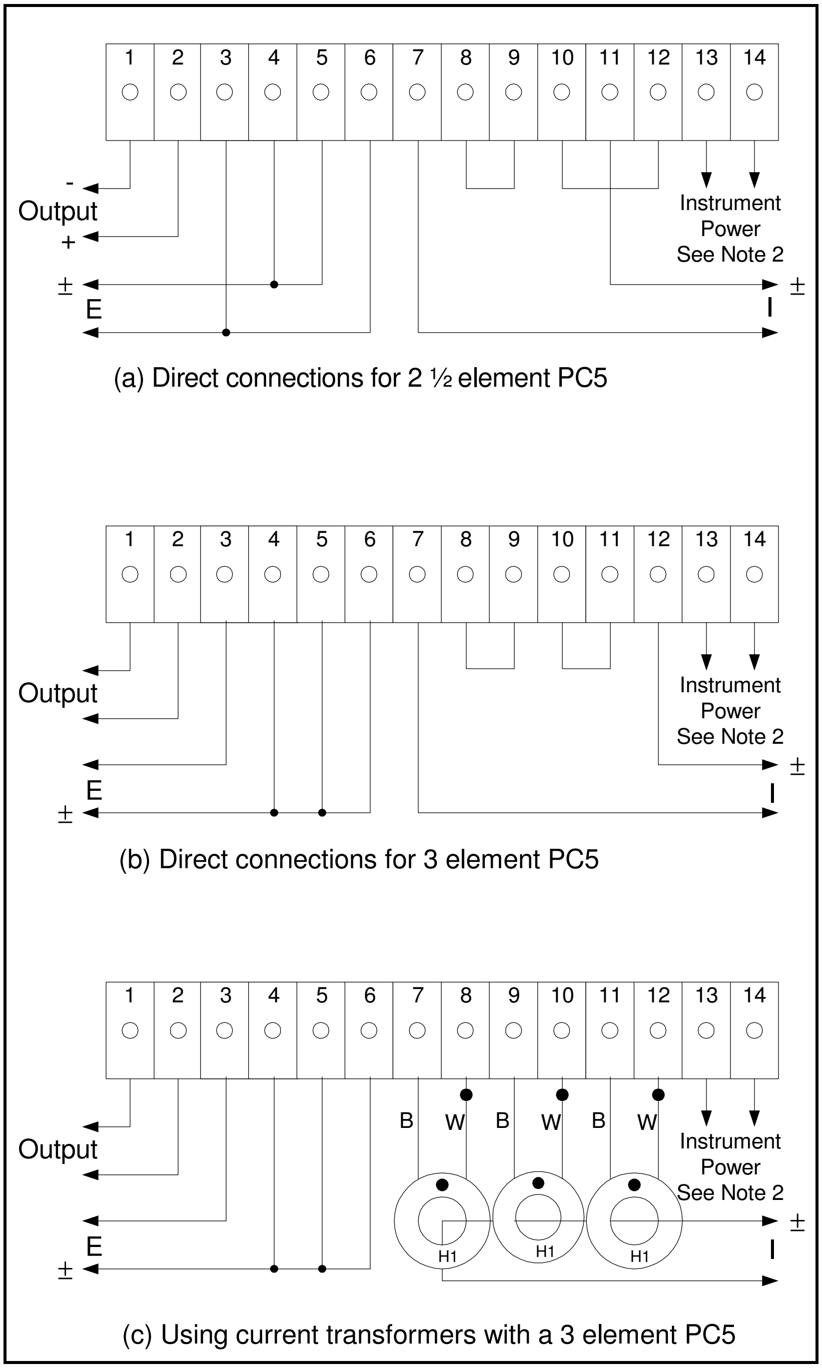


Figure 9

a) 3 Phase, 4 Wire 2 ½ element Watt Transducer Connections.

b) 3 Phase, 4 wire 3 Element Watt Transducer Connections.

c) 3 Phase, 4 wire 3 Element Watt Transducer Connections.

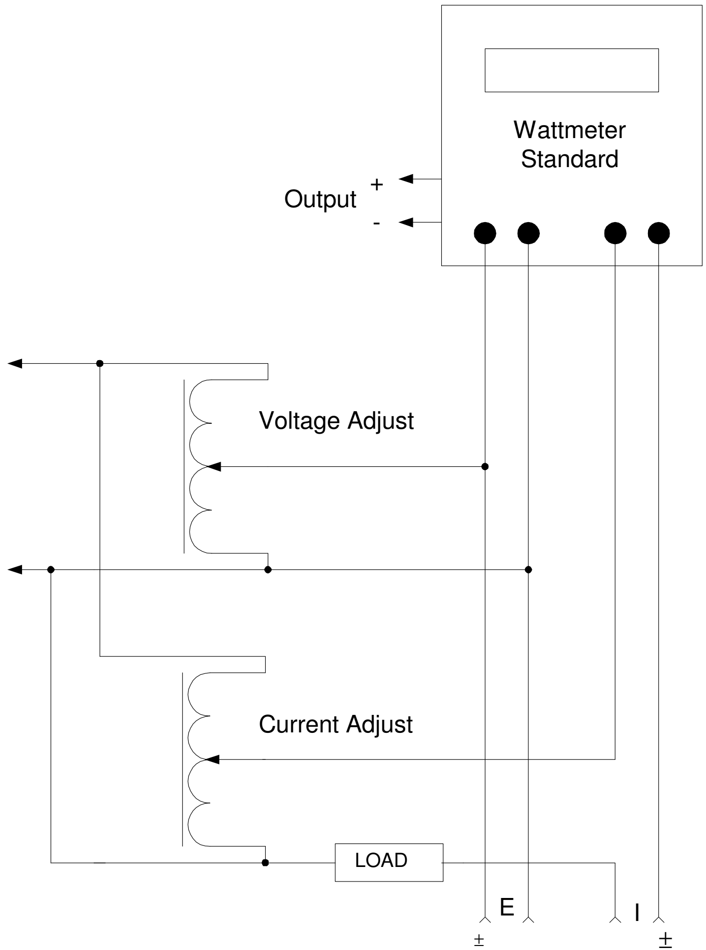
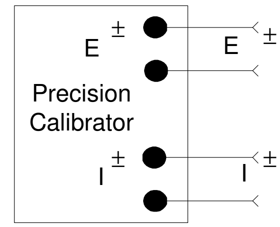


Figure 10a



Using a precision Calibrator such as the Rotek 800A or 811A is the prefered method of calibration.

Rotek Instruments Corp.
390 Main St.
Waltham, MA 02254
781-899-4611

Figure 10b

Notes:

1) 50-ampere models require two (2) primary turns through the current transformer window.
2) PC5 models with the suffix B, D, E, or X5 require 120 volts AC instrument power.
3) The following indicates a connection between the PC5 watt transducer and the calibrator.

Transducer ——►›—— Calibrator

USING CURRENT AND POTENTIAL TRANSFORMERS WITH WATT TRANSDUCERS

TECHNICAL BULLETIN NO. 101

CONNECTIONS

One of the most commonly overlooked connections is that between the watt transducer and the current transformers. Power measuring transducers and meters are polarity sensitive.

Current transformers are marked with both primary and secondary polarity marks. The "H1" on the body of the current transformer is for the primary current through the opening. The "H1" must face the line or the source of the current. The secondary leads or terminals are labeled with an "X1" and an "X2." The "X1" corresponds to the polarity "H1" of the primary.

Current transformers supplied as part of OSI watt transducers have white and black secondary leads. The white lead is the X1 lead and the Black is the X2 lead.

In OSI connection diagrams the dots in the diagrams refer to the H1 for the primary and the X1 for the secondary.

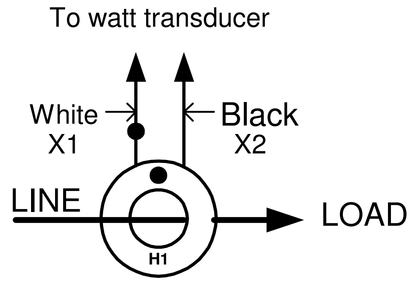


Figure 1 Current Transformer with Polarity Marks.

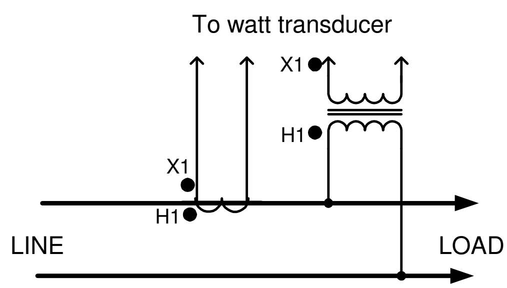


Figure 2 Current Transformer and Potential Transformer with Polarity Marks.

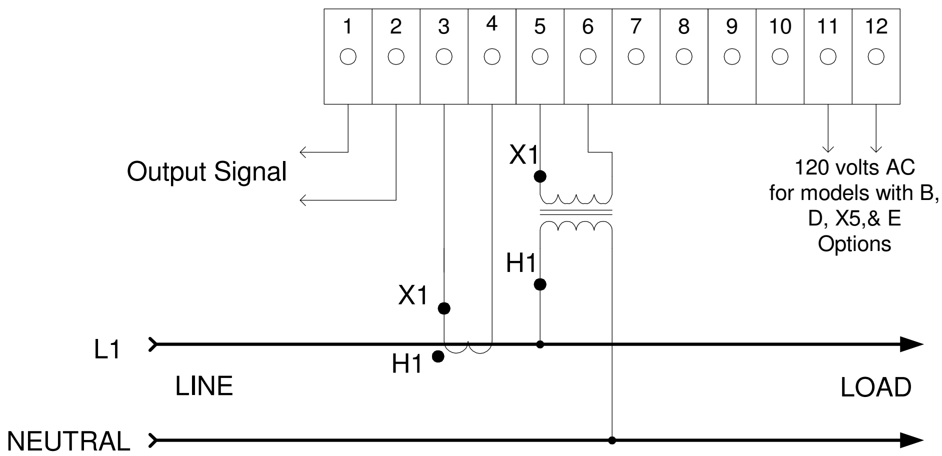
EXTENDING SECONDARY LEADS OF CURRENT TRANSFORMERS

It is very important to keep the electrical resistance in the secondary circuit of current transformers to a minimum. The following chart gives the maximum secondary lead length for typical current transformers.

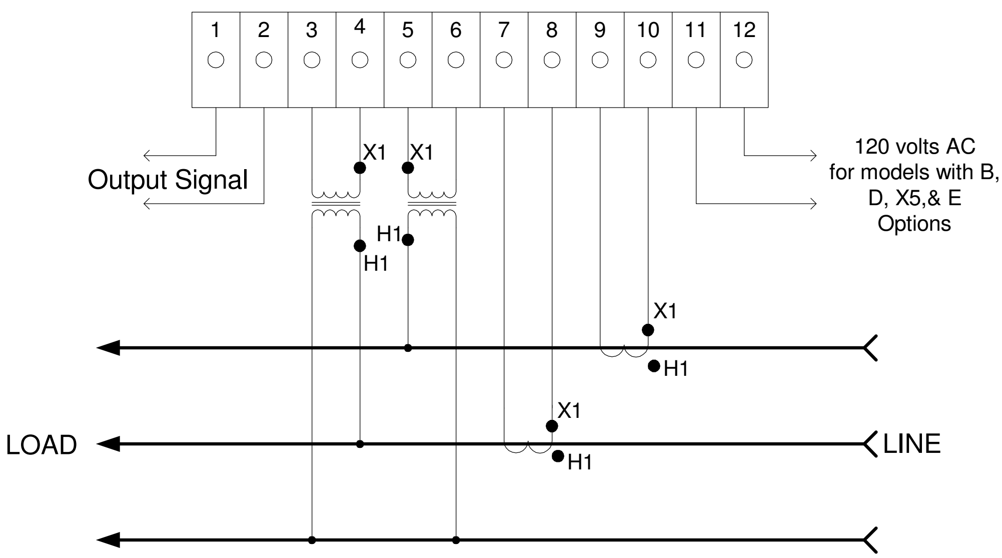
CT CURRENT RATIO	10 GAUGE WIRE	12 GAUGE WIRE	14 GAUGE WIRE
100:5	20 feet	15 feet	10 feet
200:5 through 400:5	40 feet	30 feet	20 feet
600:5 and higher	80 feet	60 feet	40 feet

TB101.12.98

PC5 CONNECTION DIAGRAMS FOR USE WITH BOTH CURRENT AND POTENTIAL TRANSFORMERS



1-element connection for a single phase, 2-wire load.



2-element connection for a 3-phase, 3-wire connection.
Load may be unbalanced, voltage may be unbalanced.

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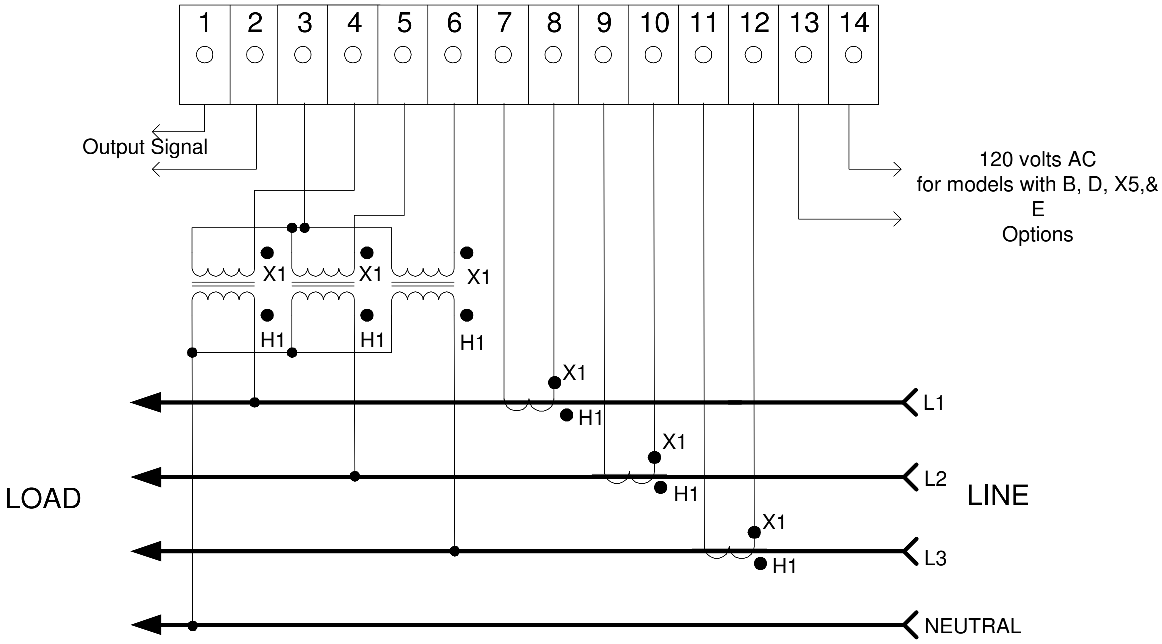
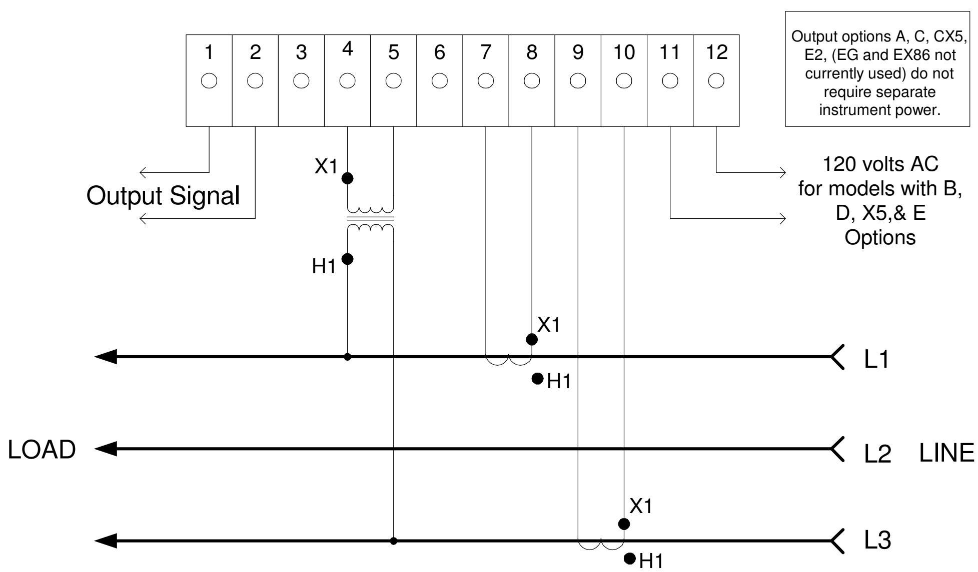


3-element connections for a 3-phase, 4-wire load.



1 ½-element connections for a balanced 3-phase, 3-wire load.

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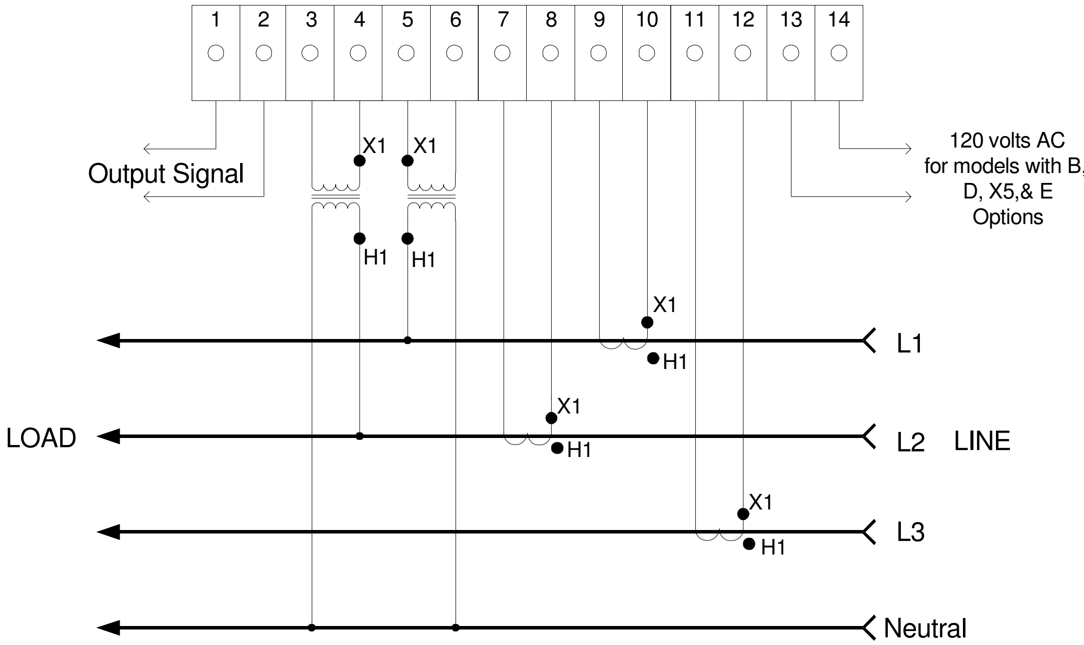

2 1/2 element connections for a 3-phase, 4-wire load.

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