CALIBRATION MANUAL FOR THE PF5 SERIES OF POWER FACTOR TRANSDUCERS

SUBJECT

Calibration of the PF5 series of power factor transducers.

DESCRIPTION

The PF5 series of power factor transducers provide a DC output that is linearly proportional to the phase angel difference between voltage and current of an AC power system. The polarity of the bipolar output indicates leading or lagging conditions.

The suffix letter indicates the type analog output that these transducers have. The letter designations are:

Option	Output	Instrument Power
A	0 to ±1 mADC	None required
C	0 to ±10 volts DC	None required
E*	4 to 20 mADC	120 volts AC
EM**	4 to 12 to 20 mADC	120 volts AC

* Unidirectional. 4 to 20 mADC represents unity to 0.5 lagging power factor.
** Bi-directional. 4 to 12 to 20 mADC represents 0.5 leading to unity to 0.5 lagging power factor.

Ohio Semitronics, Inc. recommends checking calibration for critical applications annually.

TEST EQUIPMENT REQUIRED

1. Sourcing meter calibrator such as the Rotek 800 or 8000 or the Arbiter Systems model 1040C meter calibrator.

2. DC milliampere meter or voltmeter to measure the output with an accuracy of ±0.5% or better.

3. A precision resistor may be substituted to measure transducers with a milliampere output. Recommended values are:

   - For 0 to 1 mADC use a 1000-ohm, 1/4 watt resistor.
   - For 4 to 20 mADC use a 250-ohm, 1/2 watt resistor.
   - Resistor tolerances must be ±0.05% or better.

4. Dielectric test of 1500 volts AC @ 60 hertz.
   - Install the transducer in the metal can with the fisch paper supplied.
   - Jumper terminals 1 and 2 together.
   - Hi Pot between:
     Input terminals to case.
     Input terminals to output terminals
     Output terminals to case.

   - The 1500 volts AC must be applied for one minute.

CONNECTIONS AND ADJUSTMENTS

Test points and trimpot locations are shown on page 4.

Make the connections with the voltage applied to terminals •5 and 6 and current applied to terminals 7 and •8. Terminals 5 and 8 are the polarity marked terminals. Refer to the drawing on page 5.

All calibrations are done using a single-phase source.

CALIBRATION (There are 18 steps)

1. Connect the power factor transducer being calibrated to the Rotek or other sourcing calibrator. Program in the voltage and power (watts) at 60 hertz. For example for a model PF5-001*, set the voltage for 120 volts and the power for 600 watts.

2. If you are calibrating a 3-phase, 3-wire or 4-wire model, **defeat** the 90°-phase shift circuit by changing the shunt clip to PL1 pins 1 and 2.

3. Apply power to the PF5.

4. Set the power factor to unity (1) on the calibrator. Connect the voltmeter to TP-3 and Com. The voltmeter should read between 30 and 100 millivolts DC. Repeat step 4 except move the test lead to TP-4. If this voltage reads in the millivolt range, continue to step 5.

5. Connect the voltmeter to TP-1 and COM. Adjust the zero trimpot P5 for a ±0.000 output. Connect the voltmeter to TP-2 and COM. Adjust the zero trimpot P5 for a ±0.000 output.

6. Change the calibrator to 0.5 lag power factor and connect the voltmeter or milliampere meter to terminals 1 and 2. Adjust the CAL trimpot (through the lid) for a full-scale output at 0.5 lagging power factor. Switch the calibrator to 0.5 lead and adjust the balance trimpot P3 to read the same output value, except negative. Repeat step 6. Until the output is of equal magnitude for both lead and lag 0.5 power factor.

7. Repeat step 5. The voltage measured between TP-1 and COM and TP-2 and COM should be 0.000.

8. Change the power factor setting back to unity (1) and adjust the zero trimpot (through the lid) to the zero point. (±0.000 volts or milliamperes, 4 mADC (1.000 volts with load resistor) for the E version, or 12 mADC (3.000 volts with the load resistor) for the EM version.

9. Check the transducer over the complete range as shown in the chart below. Use the balance trimpot P3 to adjust between lead and lag measurements. Note: Balance adjust may cause a zero offset at TP-1. Repeat step 5 if necessary.

Table I giving the expected outputs from the PF5 power factor transducers at different power factor settings on the sourcing calibrator -- Rotek or Arbiter. The letters "B", "D", "E", or "EM" refer to the output option (suffix letter) that the transducer has. See page one for explanation.

POWER FACTOR SETTING	"B" models - output in mA or volts with 1000 ohm resistor	"D" models - output in volts.	"E" models with 4 to 20 mADC output loaded with 250-ohm resistor.	"EM" models with 4 to 12 to 20 mADC output loaded with 250-ohm resistor.
UNITY 1.0	0.000	0.000	1.000	3.000
Lag 0.9	+0.4307	+4.307	2.723	3.861
Lead 0.9	-0.4307	-4.307	Not applicable	2.139
Lag 0.8	+0.6145	+6.145	4.458	4.229
Lead 0.8	-0.6145	-6.145	Not applicable	1.771
Lag 0.7	+0.7596	+7.596	4.038	4.519
Lead 0.7	-0.7596	-7.596	Not applicable	1.481
Lag 0.6	+0.8855	+8.855	4.542	4.771
Lead 0.6	-0.8855	-8.855	Not applicable	1.229
Lag 0.5	+1.0000	+10.000	5.000	5.000
Lead 0.5	-1.0000	+10.000	Not applicable	1.000
Tolerance	±0.005	±0.05	±0.02	±0.01

10. Reduce the input current to 0.2 amperes by setting the sourcing calibrator (Rotek or Arbiter) for 120 volts, 0.2 amperes, and 24 watts. Other models will be proportional. For example 240 volts, 0.2 amperes, and 48 watts or 480 volts, 0.2 amperes, and 96 watts. Use Table I for the calibration values.

11. This completes the single-phase calibration. Wrap the circuit boards in fisch paper and mount into the can using four (4) #6-32 X 1/4 inch screws. Add top and side labels.

12. Continue for three phase models only.

13. Connect the shunt clips back to the proper sockets for the 90° phase shift circuit. Connect PL1 pin 1 to PL2 pin 1 and PL1 pin 2 to PL2 pin 2.

14. Final Test -- Adjust the sourcing calibrator (Rotek or Arbiter) to unity power factor and apply power. The PF5 output should go to maximum output (lock up). Change the calibrator to zero (0) leading power factor. The output should go to 0.000 for "A" and "C" models, 4 mADC (1.000 volts with 250 ohm resistor) for "E" models, and 12 mADC (3 volts with 250 ohm resistor) for "EM" models. Tweak if necessary (Lid zero adjust trimpot).

15. Set the calibrator to 0.5 leading power factor. The output should be as shown in Table II. Next set the calibrator to 0.9 leading power factor. The output should be as shown in Table II.

16. Set the power factor to zero (0) lag. **Reverse the voltage input from the calibrator.** The output should go to 0.000 for "A" and "C" models, 4.000 mADC (1.000 volt if using a 250 ohm resistor) for "E" models, or 12.000 mADC (3.000 volts if using a 250 ohm resistor).

17. Switch the calibrator to 0.5 lagging power factor. The output should be as shown in Table III. Next set the calibrator to 0.9 lagging power factor. The output should be as shown in Table III.

18. If the power factor transducers reads correctly and within the tolerance given, this completes the calibration. Wrap the circuit boards in fisch paper and mount into the can using four (4) #6-32 X 1/4 inch screws. Add top and side labels.

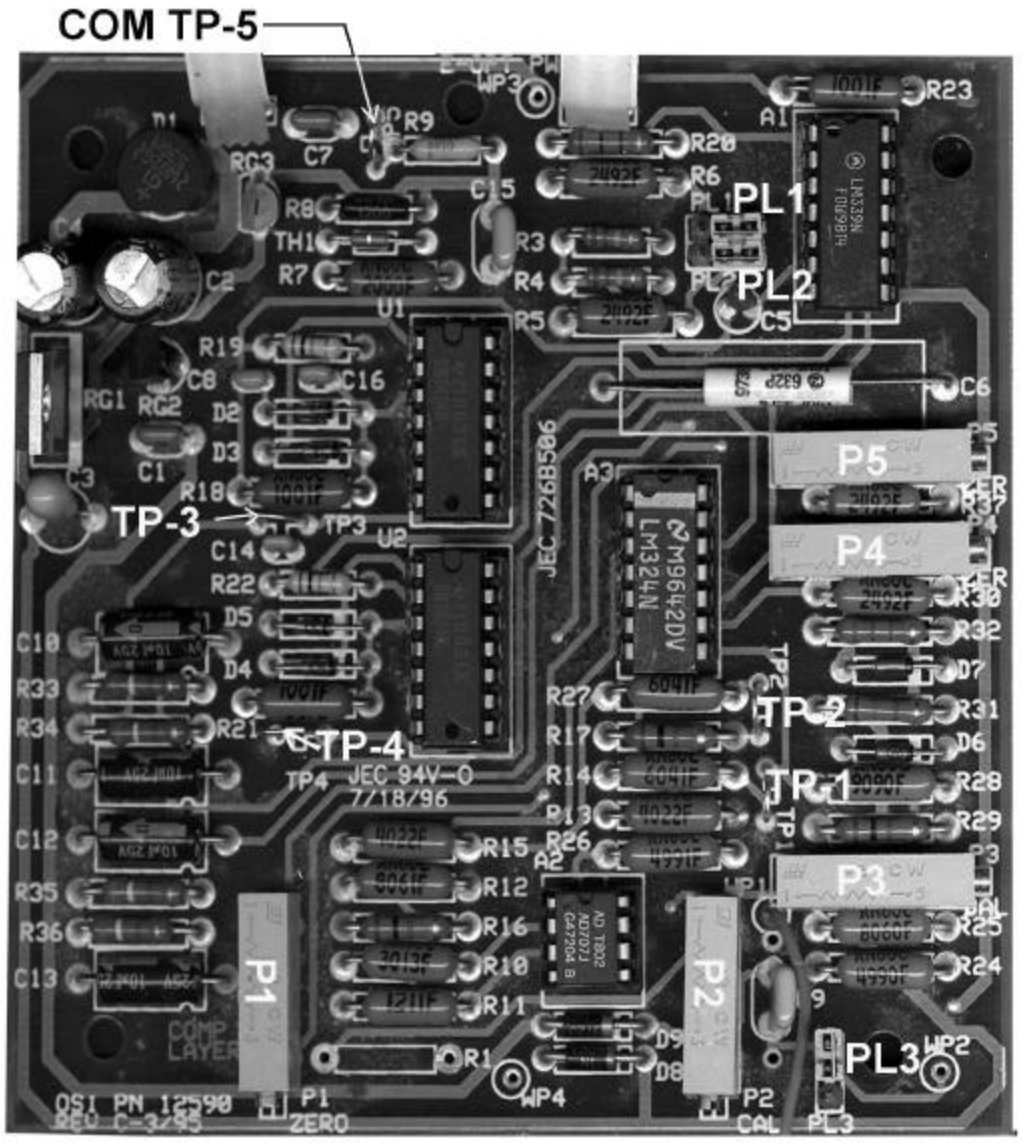
Table II

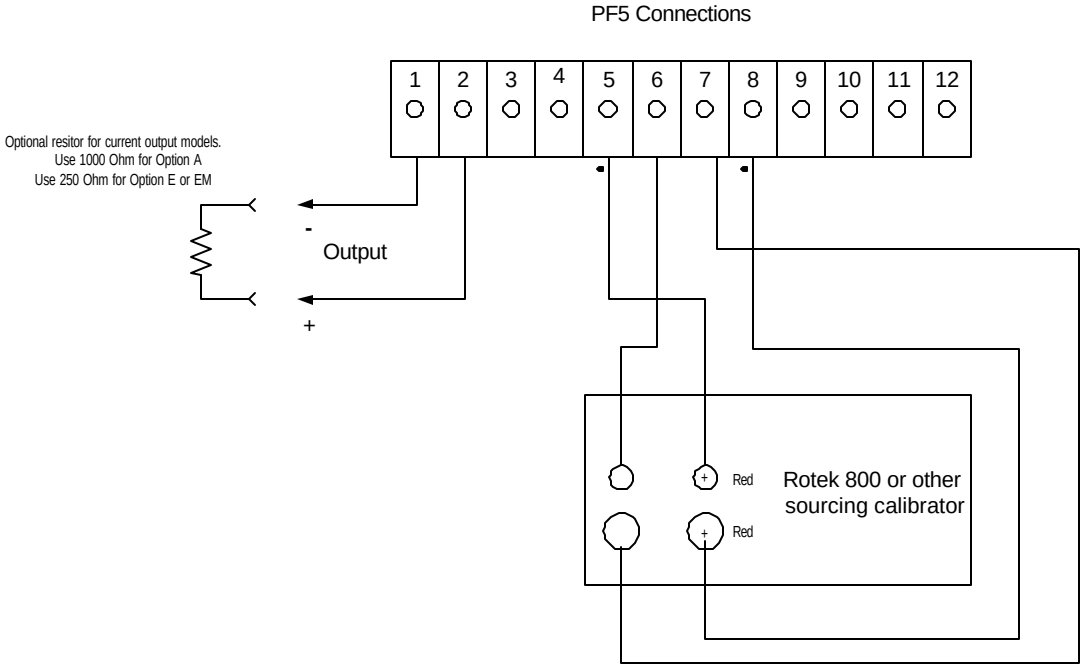
POWER FACTOR SETTING	"B" models - output in mA or volts with 1000 ohm resistor	"D" models - output in volts.	"E" models with 4 to 20 mADC output loaded with 250-ohm resistor.	"EM" models with 4 to 12 to 20 mADC output loaded with 250-ohm resistor.
Lead 0.5	+0.5000	+5.000	3.000	4.000
Lead 0.9	+1.069	+10.690	5.276	5.138
Tolerance	±0.005	±0.05	±0.02	±0.01

Table III

POWER FACTOR SETTING	"B" models - output in mA or volts with 1000 ohm resistor	"D" models - output in volts.	"E" models with 4 to 20 mADC output loaded with 250-ohm resistor.	"EM" models with 4 to 12 to 20 mADC output loaded with 250-ohm resistor.
Lag 0.5	-0.5000	-5.000	0	2.000
Lag 0.9	-1.069	-10.690	0	0.862
Tolerance	±0.005	±0.05	Not Applicable	±0.01

PF5 Board with trimpots, test points and jumpers identified.





Connections for all PF5 Models

PF5 Manual 042199
Drawing #A-7004-34
Price $15.00