Review of Ohio Semitronics Wiring Diagrams

By Cory Forler, 04/10/2014

Some of the most common questions concerning connection diagrams from the transducer specification sheet or from the label attached to the unit involve OSI AC current, voltage and power transducers. The term “Power Transducers” in this discussion represents Watts, Watt-Hours, VAR, VA, Power Factor and Phase Angle transducers. With the exception of a 4-20mAdc output, power transducers are designed to indicate forward (consumption) and reverse (generation) of power with their bi-directional analog outputs (±). VAR transducers indicate Lead/Lag with their output sign. VA and Power Factor outputs are always absolute (+). Current and Voltage transducers that are *Average Measuring* and *RMS Measuring* have analog outputs that are always absolute (+) regardless of input polarity.

Caution: Never install OSI transducers using live voltage or current. Never connect or disconnect a current or potential transformer on a transducer with primary current or voltage present.

Connection diagrams indicate numeric and/or alphanumeric marked terminals that represent electrical input parameters. The diagrams discussed here also reflect a transducers DC output analog signal. Other outputs can be reflected as a relay or digital signal connection.

Diagrams that show direct current connected to the transducer are typically shown with wide lines to reflect a robust ampacity upwards of 20 amps with some models. Use the correct wire gauge size for the specified current range with power and current transducers. OSI transducer terminal strips are rated for maximum of 20A direct current inputs.
A few models in the power measuring category have a 25A direct rated terminal strip.

Voltage inputs shown for voltage and power transducers are shown with thin lines to reflect the low milliamp current produced by these connections. A wire of 16AWG or smaller is sufficient. It is the wires insulation factor that is important with voltage connections and make sure that the insulation value is higher than the system voltage being applied. OSI manufactured transducers use terminal strips that are rated up to 600Vac max. Figure 1 reflects ACT and AVT series transducers with a direct connection from each current or voltage input respectively.

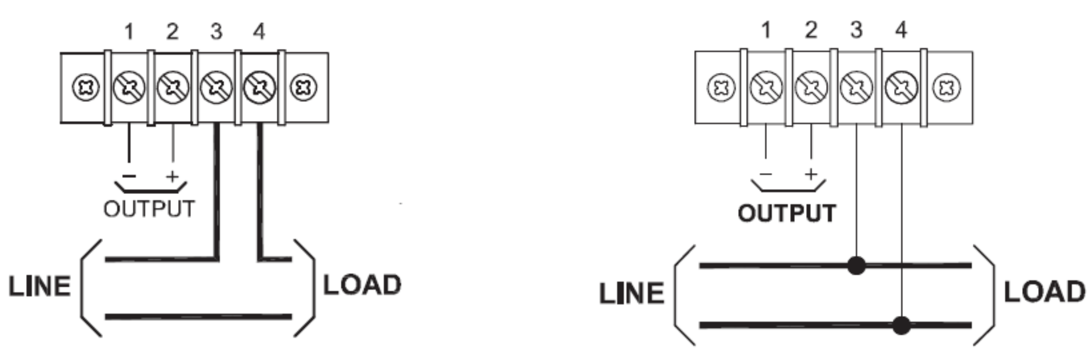

Figure 1. Single input Current and Voltage Transducer.

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AC Current Transformers (CTs) are used to step down high current to a lower value in order to meet the limited input current range of the transducer's terminal strips. CTs are polarity marked H1, H2 for primary and X1, X2 for secondary. OSI diagrams are marked with a black dot to represent H1 and another dot on the CT secondary X1. Current transformer polarity is only important when used with power transducers requiring voltage and current inputs and must be wired exactly as marked in order to produce the correct output result.

AC Potential Transformers (PTs) are used to step down high voltage to a low voltage value in order to meet the restricted input voltage range of the transducer's terminal strips. PT's are polarity marked H1, H2 for primary and X1, X2 for secondary.

OSI diagrams throughout the catalog will show a dot to represent H1 and another dot on the secondary X1. Potential Transformer polarity is only important when used with power transducers requiring voltage and current inputs and must be wired exactly as marked in order to produce the correct output result.

Figure 2 shows a typical 3-phase 4-wire GW5 series power transducer.

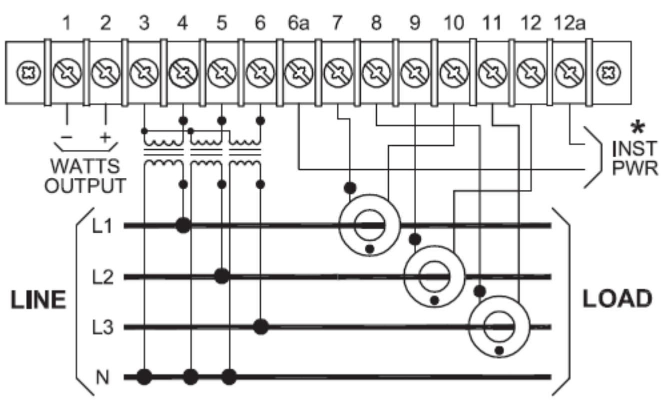

Figure 2. Watt transducer using external Current and Potential transformers.

Inst Power (Instrument Power) indicates the auxiliary voltage connection that is needed to operate the transducer and does not contribute to making the electrical measurement.

OSI product catalog and on-line specification data sheets may indicate a variety of instrument power voltage options to choose from and is reflected in the individual model number of the transducer. This voltage is often reflected at the bottom text of the unit's side connection label.

Power transducer diagrams that show *Inst Power at the connection terminals is a reference to see notes at the bottom of the connection label or connection diagram on the spec sheet. The notes refer the installer to determine the model of the unit being installed and the instrument power voltage rating. Based on a few listings at the bottom of the connection diagram, each marked with * and depending on the model number sequence, it may indicate that the unit is

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"self-powered" and does not require a connection at these terminals. Note: Instrument power for self powered models is derived internally from the input measuring voltage connection and the *Inst Power marked terminals remain empty.

Reading a power transducer connection diagram involves the conventional thinking of Line (source) always starting at the left side of the diagram. This is not the case with all OSI diagrams. Some select PC5 and W series power system diagrams show the Line side of the power flow ON THE RIGHT SIDE (with the load on the left). This was done to provide clarity of the wires drawn with minimal jump-over points. The effect is an occasional CT reversal on the install due to an assumed direction of power flow of Line/Left to Load/Right.

Figure 3 shows a typical 3-phase 3-wire W series power transducer (designated for optional Edison system hookup).

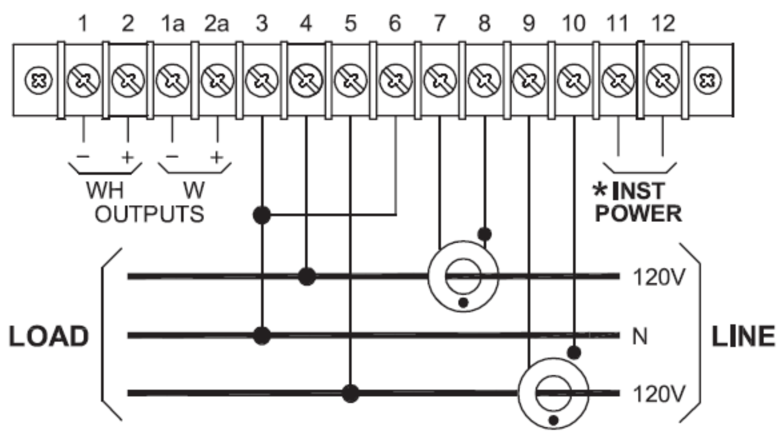

Figure 3. Watt and Watt-Hour 2 element transducer.

Edison systems are prevalent in the US and require a 2 element transducer. This is considered to be a 1-phase 3-wire system. The transducer model number will be listed as a 3-phase 3-wire transducer on the product selection chart (datasheet). The same transducer category works for both 1-phase 3-wire and 3-phase 3-wire. Not all power transducer groups are consistent in the indication of the Neutral reference when using a 3-phase 3-wire transducer on an Edison system.

Figure 4 shows a typical 3-phase 3-wire GWV5 series power transducer.

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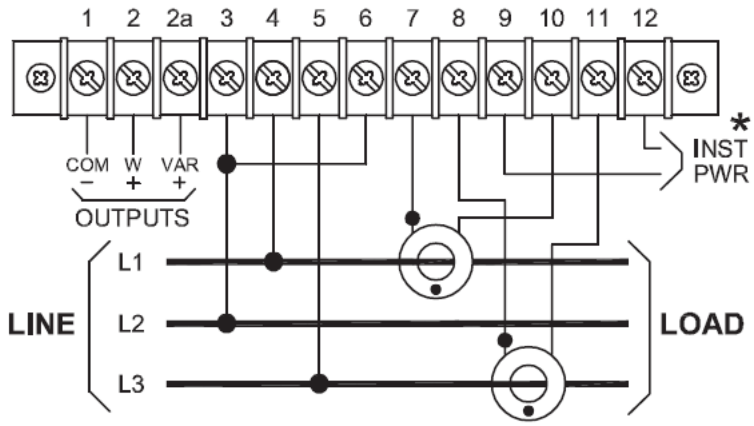

Figure 4. 3 phase 3 wire Watt-VAR transducer.

When using a 3-phase 3-wire transducer on Edison the rule is to wire Neutral voltage input from the line without a current input. In this GWV5 example L2 shown is now Neutral (to terminals 3, 6). L1 stays as L1. L3 shown is now L2 Edison system input and wires into terminal 5 with Edison L2 current wiring into terminals 8 and 11.

COMMON RECOMMENDATIONS BASED ON HISTORIC WIRING ISSUES:
Review the product specification sheet that comes with the transducer order. Don't have one?
Go to www.ohiosemitronics.com and enter the standard part number to download a .PDF spec sheet.
If the search results do not find a match for your model, call the factory for the correct .PDF to match.
There are many OSI special transducer part numbers that are not available on the internet such as X, Y, Z suffix, 4-digit suffix, private label transducers or discontinued models.

Use the correct wire gauge for the input current ampacity. Do not try to extent current transformer secondary leads too far (see Bulletin #133, Determine Maximum CT Lead Length) Long lead extensions can cause too much burden on the CT and cause the transducer output to become inaccurate.

Analog output wires should be shielded twisted pair with the shield tied to ground at the receiving equipment end (particularly with noisy environments). Observe transducer output loading specification on datasheet. The receiving device (DAQ, PLC, Logger, Controller,…) has an input impedance (resistance) specification that must conform to the OSI transducer output loading limits. Any mismatch here can give an incorrect analog output that sends the electrician chasing the problem through the input wiring. Disconnect the analog output from the input device and measure the OSI transducer output with a multi-meter. Does the output change?

No analog output? Sometimes the answer here is to ***turn on*** the instrument power to the transducer.

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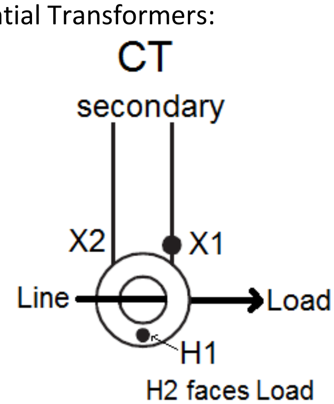
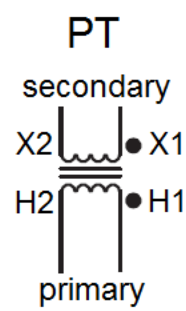
Power transducers with inputs that are wired incorrectly will affect the analog output reading. This reading can help pinpoint the issue. The most common mistake is a CT that is wired reverse. A CT that has a double reversal (Primary facing wrong direction & secondary wired to the transducer in reverse polarity) is considered to be wired ***correctly***. Power Transducers with 4-20mAdc output with input reversal will drive the 4mAdc signal downwards until it locks at 0.000mAdc, thus giving the appearance of a "defective" transducer. Other analog output models will indicate a negative output with incorrect input reversals. These analog examples do not cover all of the conditions and they depend on the particular model and number of elements/AC system used.

Power transducer cross phasing is another possible mistake where a specific line current or voltage connection (OSI input terminal number) does not originate from the correct system line designated on the diagram.
EX: Transducer L1 voltage input terminal is wired with L2 system voltage source (rewire with L1 volts to this terminal).

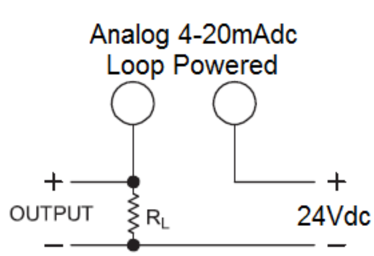
Average measuring and RMS measuring Current transducer diagrams with current transformers shown may have polarity markings on the diagram (for consistency). It is not necessary to follow these polarities to obtain analog (+). The same concept applies with Potential transformers with Avg./RMS Voltage transducers.

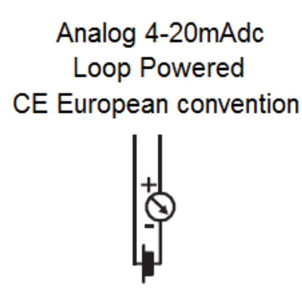
SYMBOLS AND MEANINGS USED IN OHIO SEMITRONICS DIAGRAMS, SPECIFICATIONS AND OPERATION MANUALS:
Current Transformers and Potential Transformers:





Typical model groups with E2 suffix requiring an external 24Vdc voltage source. R_L represents a resistor or other I/O device such as a PLC, DAQ, Logger or Display Meter.





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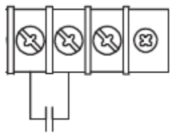
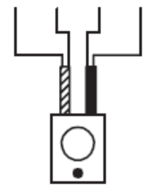
Watt-Hour Relay Output SPST



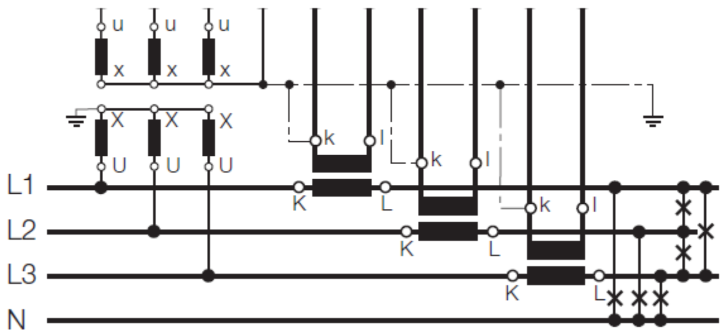
Earth Ground Connection

Hall-Effect Current Sensor



CE European conventions:

3 phase 4 wire Power Transducer with PT and CT inputs



Current, Voltage and Power Transducers