



WATLOW® SCR POWER CONTROLLERS AND OHIO SEMITRONICS WATT TRANSDUCERS

The Ohio Semitronics PC5 category of transducers measures True Power (Watts) in an AC single phase or three phase power system, and provides an isolated DC analog output that is proportional to the electrical power being consumed in a load. There are thousands of PC5's being used worldwide, with many different industrial applications occurring, including the control of heaters, ovens and furnaces that incorporate Watlow® power control equipment.



Watlow® model DC20-24S0-0000 with Ohio Semitronics model PC5-063EY25.

When specifying a PC5 model to use with a Watlow DIN-A-MITE® SCR (Silicon Controlled Rectifier), there are questions to consider in order to arrive at the appropriate and most effective watt transducer model number. These questions go as follows:

Controller output, control (use) type?

- 1) Phase Angle fired
- 2) Zero-Crossing.

Controller output configuration?

- 1) Single phase
- 2) Three phase three wire
- 3) Three phase four wire.



100% Full-On maximum RMS voltage range?

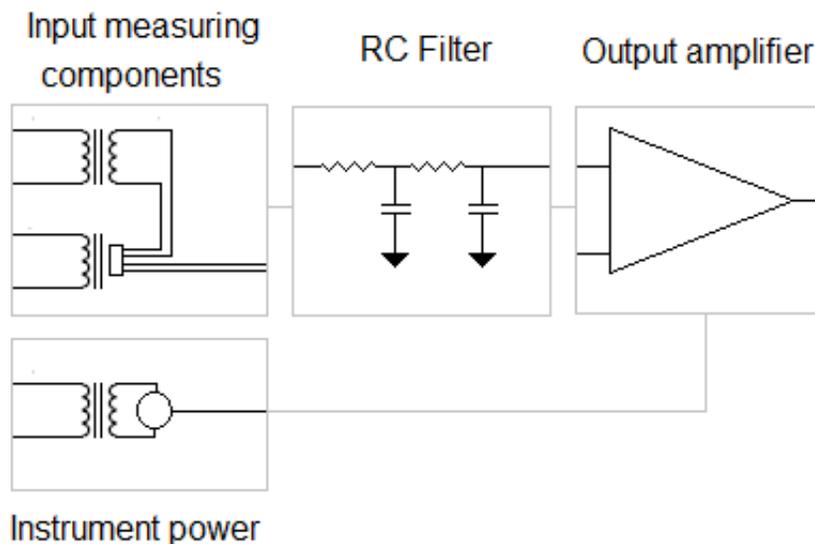
100% Full-On maximum RMS current range?

Analog output signal required (feedback)?

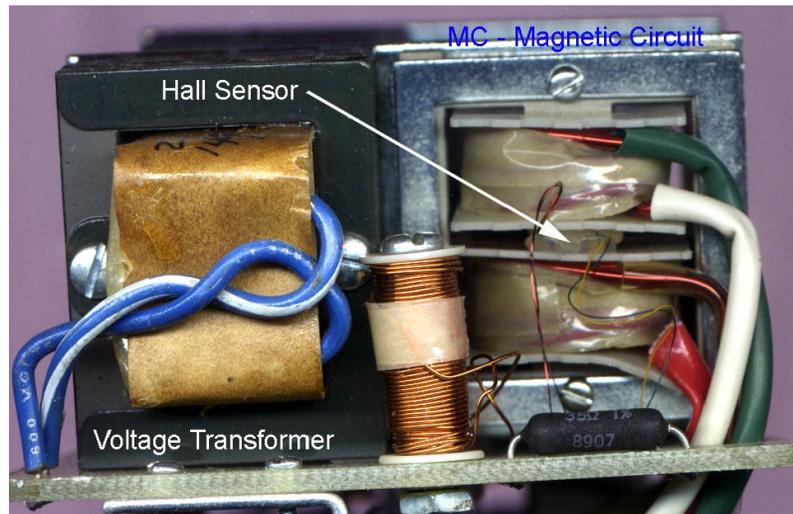
Available Instrument power voltage for PC5?

1) 120Vac 2) 230Vac 3) 24Vdc “loop power”.

STAGES OF PC5 OPERATION



A closer look at the block diagram shows the four sections representing the basic functionality of all PC5 series watt transducers. The internal input measuring components include a voltage transformer and a current coil (referred to as a Magnetic Circuit) that make up a single element transducer. Single element transducers (as shown) measure a single phase two wire system input. Two element transducers measure a three phase three wire “Delta” system input and include two sets of voltage transformers and two sets of current magnetic circuits. Three element transducers measure a three phase four wire “Wye” system input and include three voltage transformers and three current magnetic circuits. Each element with approximately 50mV is summed and balanced before it enters the filter and output amplifier. The summed milli-volt level at this mid-stage circuit represents the instantaneous power measurement that is the combination of a DC level with an unfiltered AC ripple at 120Hz. The filter and output amp complete the calibrated analog circuit for feedback control.



PC5 series watt transducer instantaneous input measuring circuit.

The internal RC filter is designed to average the AC portion of the signal and provide a smooth DC analog output through the output amplifier. The filter components dictate how much time it takes for the output to reach 90% with full input. Standard PC5 models include an output response time of 250 milliseconds which operates well with standard sine wave inputs or with an SCR Phase Angle Fired Controller. SCR Zero Crossing controller models are available as A) Variable Time, B) Time Proportioning, or C) Burst firing, and it is recommended that the PC5 filter contain a 5 second output response to 90%. This long response time allows for a smooth DC averaging that accurately measures the fast changing on-off periods of Zero Crossing signals. With Zero Crossing Control, the PC5 requires a suffix number, Y25, indicating that a 5 second output response is implemented.

There are 3 options to choose from in regards to supplying the PC5 with “instrument power” voltage.

- 1) Auxiliary connected. (Separate from measuring the load voltage input, sinusoidal, 120Vac or “-22” option for 230Vac instrument power).
- 2) Externally connected “Loop-Power”. Requires 24Vdc voltage applied in series with the output terminals of the 4-20mAdc model suffix “E2”. (No other power voltages are required).
- 3) Self power. (NOT recommended). The “self power” PC5 option derives instrument power from the same voltage source (controller output) that is connected to the measuring heater load. The internal PC5 power supply circuitry will not function correctly with a chopped or time controlled self power voltage input, leaving the end result of an erratic performing transducer. Always use separate auxiliary power (sine voltage) for PC5 models with SCR power controllers.

PC5's are available as direct current input models up to 25A (input current wires connect directly to the terminals). With currents above 25A, the PC5 series is available and calibrated with 1, 2 or 3 externally connected current transformers. The number of current transducers, and the current transducer ratio, will be selected to match the Watlow DIN-A-MITE® controller output system type.



An end use application that contains further wave-form alterations such as, rectified *half-wave or full-wave* signals to the load cannot be monitored correctly with a PC5 that incorporates a current transformer. Current transformers do not operate well with rectified altered wave forms. Direct-terminal-connected PC5 models, at 25A and below, will operate correctly with quasi-DC signals, due to the PC5 input magnetic circuit performance, and connecting the measured voltage input from the input side of the controller where the AC voltage is not rectified.

Ohio Semitronics is not limited to the PC5 watt transducer series when **monitoring** SCR controllers:

- Voltage Measuring Transducer series AVTR, VTR, VT8.
- Current Measuring Transducer series CT8, CTL with (rms)CTA, ACTR, CTR.
- Power Measuring Transducer series (with analog for watts & pulse contact output for watt-hours), P, PC8, PC20 and PTB.

Standard OSI models (above) work well with Phase Angle Fired SCR's. Special 5 second filters are required on the above model groups for Zero Crossing Controllers.

Contact Watlow® at 1-800-928-5692 to discuss your heater or heater control application.

www.watlow.com

Contact Ohio Semitronics at 1-800-537-6732 to discuss your DIN-A-MITE® monitoring and analog feedback application.

www.ohiosemitronics.com

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Watlow® model DC20-24S0-0000 with
Ohio Semitronics model PC5-063EY25