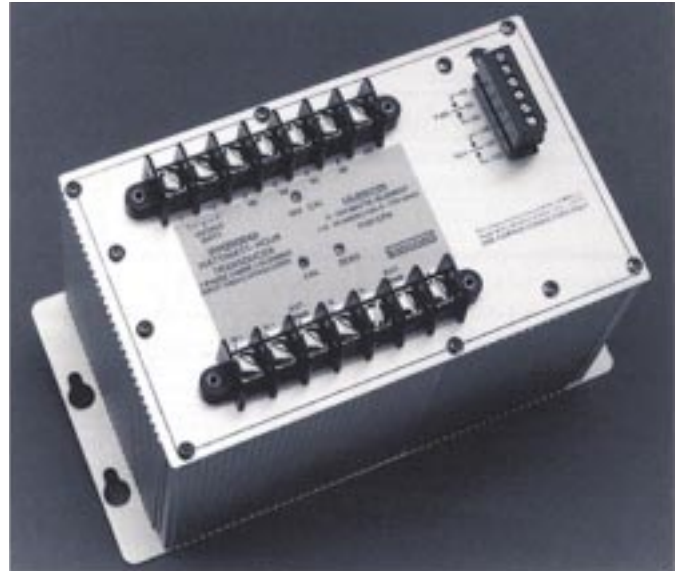


# AC Energy Transducers

## Watt/Watt-hour • VAR/VAR-hour Q/Q-hour • Combined Watt/Watt- hour and VAR/VAR-hour or Watt/Watt-hour and Q/Q-hour Uni-directional or Bi-directional

All these transducers are high accuracy electronic multiplying devices for measuring consumed energy. Mercury-wetted contacts provide isolated bounce-free output for driving electromechanical counters; a solid-state output is included for electronic counters and controllers.



### Standard Features

- 0.2% of reading accuracy
- Voltage, current, and process outputs
- Low temperature coefficient
- No zero adjustment ever required
- Low burdens
- Exceptional long-term stability
- Self-powered or externally powered
- Standardized wiring and mounting
- Metal surface mount cases

### Specifications

#### Accuracy (@ 25°C ±2°C)

**Watt/Watt-hour:**  $\frac{0.19\% \text{ of reading}}{\text{Cos}\theta} \pm 0.01\% \text{ of full scale}$

**VAR/VAR-hour:**  $\frac{0.19\% \text{ of reading}}{\text{Sin}\theta} \pm 0.01\% \text{ of full scale}$

**Q/Q-hour:**  $\frac{0.19\% \text{ of reading}}{\text{Cos}(\theta-60^\circ)} \pm 0.01\% \text{ of full scale}$

**Temperature Range:** -20°C to +70°C

**Temperature Coefficient:** 0.005%/°C, 50 ppm typical

**Operating Humidity:** 0-95% non-condensing

**Output Ripple Peak:** 0.5% of full scale

**Power Factor Range:** Watt or VAR, any; Q, 0.866 lead to 0 lag

**Operating Frequency:** Nominal ±10% in accordance with IEC 688

**Dielectric Test:** 2,000 Vrms for 1 minute; 2,400 Vrms for 1 second (for solid state output); 1,200 Vrms for 1 minute; 1,600 Vrms for 1 second (for mercury wetted relay)

**Surge Withstand:** ANSI C37.90a (IEEE 472); BEAMA 219; special 5 kV

**Response Time:** 200 msec to 90%, 400 msec to 99%

**Calibration Adjustment:** ±10% standard

**Zero Adjustment:** ±2% standard

**Pulse Frequency:** ±2% standard

**Output, Contacts:** SPDT (Form C) Mercury wetted; 100 W, 500 V maximum; contact resistance - 50 mOhms max; expected life - 10<sup>9</sup> operations

**Output, Solid-state:** Dual open collector transistors; 1.5 W, 300 V maximum

**Full scale Counts/Hour:** Uni-directional, 10 to 20,000 CPH; Bi-directional, 500 to 20,000 CPH

## Potential Table

| OPTION | NOMINAL INPUT | POTENTIAL RANGE WITH ACCURACY (SELF-POWERED) | POTENTIAL RANGE WITH ACCURACY (EXTERNAL-POWERED) | MAXIMUM BURDEN | POTENTIAL OVERLOAD |
|--------|---------------|--|--|----------------|--------------------|
| 0      | 120 V         | 85 - 150 V                                   | 0 - 150 V  | 0.02 VA        | 180 V              |
| 1      | 69 V          | 50 - 90 V                                    | 0 - 90 V   | 0.02 VA        | 100 V              |
| 2      | 230 V         | 170 - 300 V                                  | 0 - 300 V  | 0.02 VA        | 350 V              |
| 3      | 460 V         | 325 - 575 V                                  | 0 - 575 V  | 0.02 VA        | 680 V              |
| 4      | 600 V         | 425 - 750 V                                  | 0 - 750 V  | 0.02 VA        | 750 V              |

Note: Self-powered units have a potential burden of less than 4.5 VA on terminals 3 and 4.

## Current Table

| OPTION | INPUT    | OVER-RANGE WITH ACCURACY | MAXIMUM BURDEN | OVERLOAD CONTINUOUS | OVERLOAD 10 SEC/HOUR | OVERLOAD 1 SEC/HOUR |
|--------|----------|--------------------------|----------------|---------------------|----------------------|---------------------|
| 0      | 0 - 5 A  | 10 A                     | 0.5 VA         | 15 A                | 30 A                 | 250 A               |
| 1      | 0 - 1 A  | 2 A                      | 0.5 VA         | 3 A                 | 6 A                  | 100 A               |
| 2      | 0 - 2 A  | 4 A                      | 0.5 VA         | 6 A                 | 12 A                 | 150 A               |
| 3      | 0 - 10 A | 20 A                     | 0.5 VA         | 30 A                | 50 A                 | 300 A               |
| 4      | 0 - 25 A | 35 A                     | 0.5 VA         | 35 A                | 75 A                 | 300 A               |

## Output Table

| OPTION | RANGE FULL SCALE | OUTPUT LOADING  | COMPLIANCE OR MAXIMUM CURRENT |
|--------|------------------|-----------------|-------------------------------|
| 0      | 0 ± 1 mA         | 0 - 10,000 Ohms | ± 11 V                        |
| 1      | 0 ± 3 mA         | 0 - 3,300 Ohms  | ± 11 V                        |
| 2      | 0 ± 5 mA         | 0 - 2,000 Ohms  | ± 11 V                        |
| 3      | 0 ± 10 mA        | 0 - 1,000 Ohms  | ± 11 V                        |
| 4      | 4 - 20 mA        | 0 - 750 Ohms    | 15 V                          |
| 5      | 0 ± 100 mV       | 20 Ohms - ∞     | 5 mA                          |
| 6      | 0 ± 1 V          | 200 Ohms - ∞    | 5 mA                          |
| 7      | 0 ± 5 V          | 1,000 Ohms - ∞  | 5 mA                          |
| 8      | 0 ± 10 V         | 2,000 Ohms - ∞  | 5 mA                          |
| 9      | 1 - 5 V          | 1,000 Ohms - ∞  | 5 mA                          |

## Analog Full Scale Calibration (Watt/VAR/Q Per Element)

| POTENTIAL \ CURRENT | 0 - 5 A | 0 - 1 A | 0 - 2 A | 0 - 10 A | 0 - 25 A |
|---------------------|---------|---------|---------|----------|----------|
| 120 V               | 500     | 100     | 200     | 1,000    | 2,500    |
| 69 V                | 325     | 65      | 130     | 650      | 1,625    |
| 230 V               | 1,000   | 200     | 400     | 2,000    | 5,000    |
| 460 V               | 2,000   | 400     | 800     | 4,000    | 10,000   |
| 600 V               | 2,500   | 500     | 1,000   | 5,000    | 12,500   |

Note: 1½ Element Transducers are calibrated as 2 element. 2½ Element Transducers are calibrated as 3 element.

## Application Table

| CONNECTION  | MODEL NUMBER |      |      |          |        | RESTRICTIONS |          |
|-------------|--------------|------|------|----------|--------|--------------|----------|
|             | WATT         | VAR  | Q    | WATT/VAR | WATT/Q | VOLTAGE      | LOAD     |
| 1 PHASE     | WH10         | RH10 | QH10 | WRH10    | WQH10  | NONE         | NONE     |
| 3 PHASE 3 W | WH15         | RH15 | QH15 | WRH15    | WQH15  | BALANCED     | BALANCED |
| 3 PHASE 3 W | WH20         | RH20 | QH20 | WRH20    | WQH20  | NONE         | NONE     |
| 3 PHASE 4 W | WH25         | RH25 | QH25 | WRH25    | WQH25  | BALANCED     | NONE     |
| 3 PHASE 4 W | WH30         | RH30 | QH30 | WRH30    | WQH30  | NONE         | NONE     |

# Available Models – AC Energy Transducers

## To Order, Specify:

### A. MODEL

|                              |     |
|------------------------------|-----|
| Watt/Watt-hour               | WH  |
| VAR/VAR-hour                 | RH  |
| Q/Q-hour                     | QH  |
| Watt/Watt-hour, VAR/VAR-hour | WRH |
| Watt/Watt-hour, Q-Q-hour     | WQH |

### B. CONFIGURATION

|               |    |
|---------------|----|
| 1 Element     | 10 |
| 1-1/2 Element | 15 |
| 2 Element     | 20 |
| 2-1/2 Element | 25 |
| 3 Element     | 30 |

### C. INPUT NOMINAL VOLTAGE (Reference Potential Table)

|         |   |
|---------|---|
| 120 V   | 0 |
| 69 V    | 1 |
| 230 V   | 2 |
| 460 V   | 3 |
| 600 V   | 4 |
| Special | X |

### D. INPUT NOMINAL CURRENT (Reference Current Table)

|          |   |
|----------|---|
| 0 - 5 A  | 0 |
| 0 - 1 A  | 1 |
| 0 - 2 A  | 2 |
| 0 - 10 A | 3 |
| 0 - 25 A | 4 |
| Special  | X |

### E. OUTPUT

#### (Reference Output Table)

|  |   |
|--|---|
| 0 ± 1 mA (0-10,000 Ohms)               | 0 |
| 0 ± 3 mA (0-3,300 Ohms)                | 1 |
| 0 ± 5 mA (0-2,000 Ohms)                | 2 |
| 0 ± 10 mA (0-1,000 Ohms)               | 3 |
| 4 - 20 mA (0-750 Ohms) <sup>①</sup>    | 4 |
| 0 ± 100 mV (2,000 Ohms min.)           | 5 |
| 0 ± 1 V (2,000 Ohms min.)              | 6 |
| 0 ± 5 V (2,000 Ohms min.)              | 7 |
| 0 ± 10 V (2,000 Ohms min.)             | 8 |
| 1 - 5 V (2,000 Ohms min.) <sup>①</sup> | 9 |
| Special                                | X |

NOTE: 4-20 mA units are uni-directional.

If a bi-directional unit is required, use output designator X and state.

<sup>①</sup> Auxiliary power supply required.

### F. PULSE OUTPUT

|   |   |
|---|---|
| Solid-state, uni-directional            | 0 |
| Hg wetted relay, uni-directional        | 1 |
| Solid-state, bi-directional, WH, RH     | 2 |
| Hg wetted relay, bi-directional, WH, RH | 3 |
| Solid-state, bi-directional, WRH        | 4 |
| Hg wetted relay, bi-directional, WRH    | 5 |
| Special                                 | X |

### G. SUFFIX (If Applicable)

|                                  |   |
|----------------------------------|---|
| 25 - 125% Calibration Adjustment | A |
| 50 Hz                            | C |
| 400 Hz                           | D |
| External Power, 120 VAC          | E |
| External Power, 230 VAC          | F |
| Case ground terminal             | G |
| DC Aux Power (Please Specify)    | K |
| Special                          | X |

### PULSE CALIBRATION INSTRUCTIONS

Full scale counts per hour must be stated.

$$\text{CPH} = \frac{\text{CT Ratio} \times \text{PT Ratio} \times \text{FS Calibrating Power of Transducer}}{\text{Desired Primary Watt-hours Per Pulse}}$$

**EXAMPLE: WH-15-3-1-2-1-C is the ordering code for a Watt/Watt-hour Transducer in a metal surface mount case, 1-1/2 element, 460 V input voltage, 0-1 A input current, 0 ± 5 mA, Hg wetted output relay, uni-directional, 50 Hz power.**

See pages 34 - 35 for connections.