

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 - 10⁹ 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) ^①	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.) ^①	9
Special	X

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

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

^① 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.