Pocket Guide to Watthour Meters

POWERMETRIX

Steve Hudson, P.E.
VP of Hardware Engineering

10737 Lexington Drive
Knoxville, TN 37932
Phone: (865) 966-5856

www.powermetrix.com

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Overview of the Pocket Guide

- Chapter 1 – Electricity and Metering Concepts
  - Voltage, Current, Phase
  - Power and Energy
  - Useful Triangles
  - The Electricity Meter
  - Vectors
  - Full Load Current
  - Meter Sockets
  - Instrument Transformers

Overview of the Pocket Guide

- Chapter 2 – Meter Connection Diagrams
  - Service Types
  - Meter Form Selection
  - Meter Connection Diagrams

Overview of the Pocket Guide

- Chapter 3 – Installing Meters
  - Meter Checks

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Page 1 – Units, Power, & Energy

UNITS OF ELECTRICITY MEASUREMENT

	Unit	×1,000	×1,000,000
Current	ampere (A)	kA	–
Potential difference	volt (V or E)	kV	–
Real power	watt (W)	kW	MW
Energy	watthour (Wh)	kWh	MWh
Reactive power	VAR (volt-ampere reactive)	kVAR	MVAR
Apparent power	volt-ampere (VA)	kVA	MVA

POWER VS. ENERGY

Power Instantaneous rate at which work is done.
1 watt = the power expended when 1 ampere flows through 1 ohm.
Measured by: watt meter. (Comparable to a speedometer.)

Energy Average rate at which work is done multiplied by how long the power has been consumed.
1 watthour = the energy expended in one hour when the power is 1 watt.
Measured by: watthour meter. (Comparable to an odometer.)

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AC vs DC

- **Direct Current (DC)** – an electric current that flows in one direction.(IEEE100)

- **Alternating Current (AC)** – an electric current that reverses direction at regularly recurring intervals of time. (IEEE100)

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Ohm’s Law

Georg Simon Ohm
1789 - 1854

Ohm’s Law:

Voltage = Resistance x Current

V (or E) = I x R   OR   I = V / R

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Power Law

<u>Power Law for DC</u>

Power (Watts) = Voltage x Current

P = V x I

<u>Power Law for AC</u>

Power = Voltage x Current x Power Factor

P = V x I x PF

More on PF in a few minutes!

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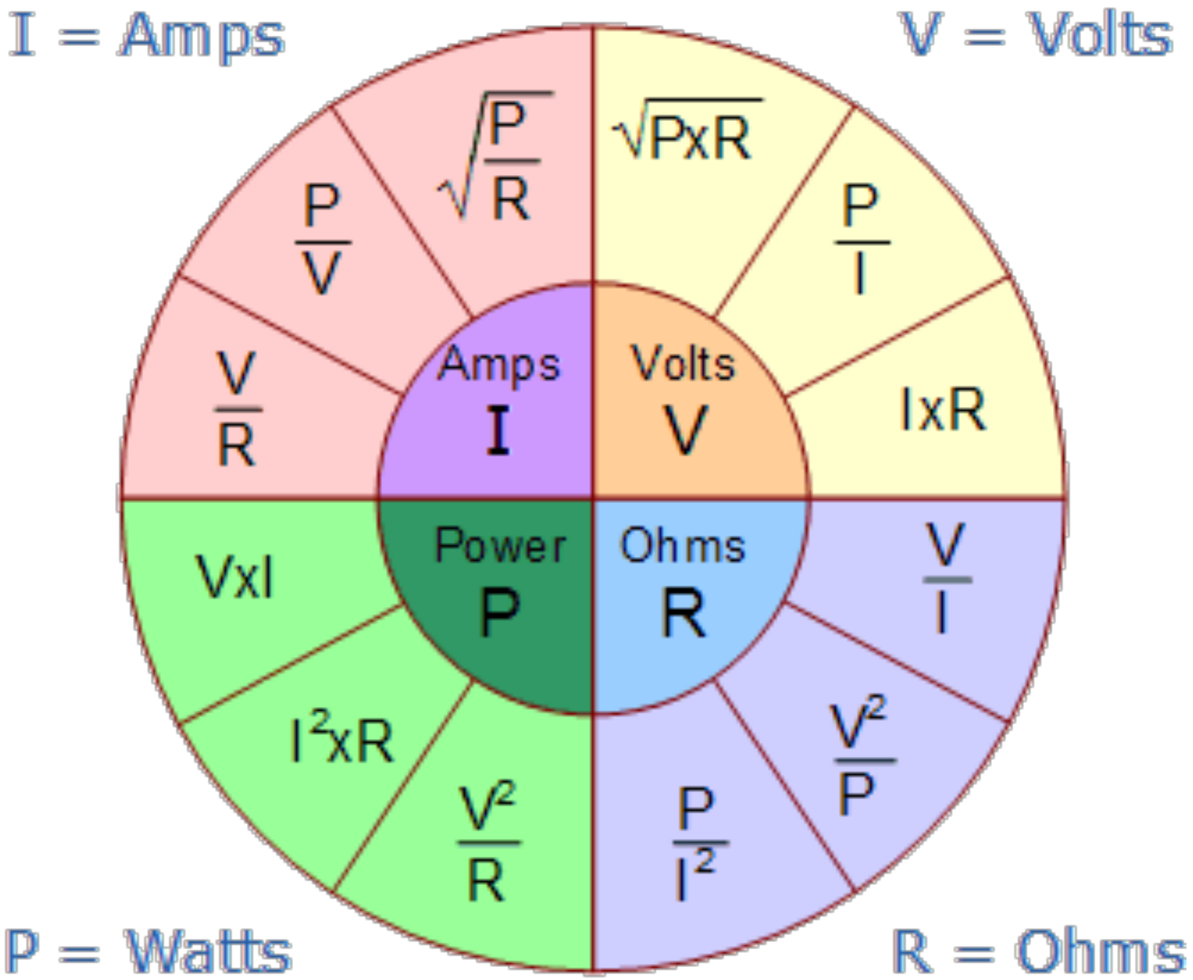
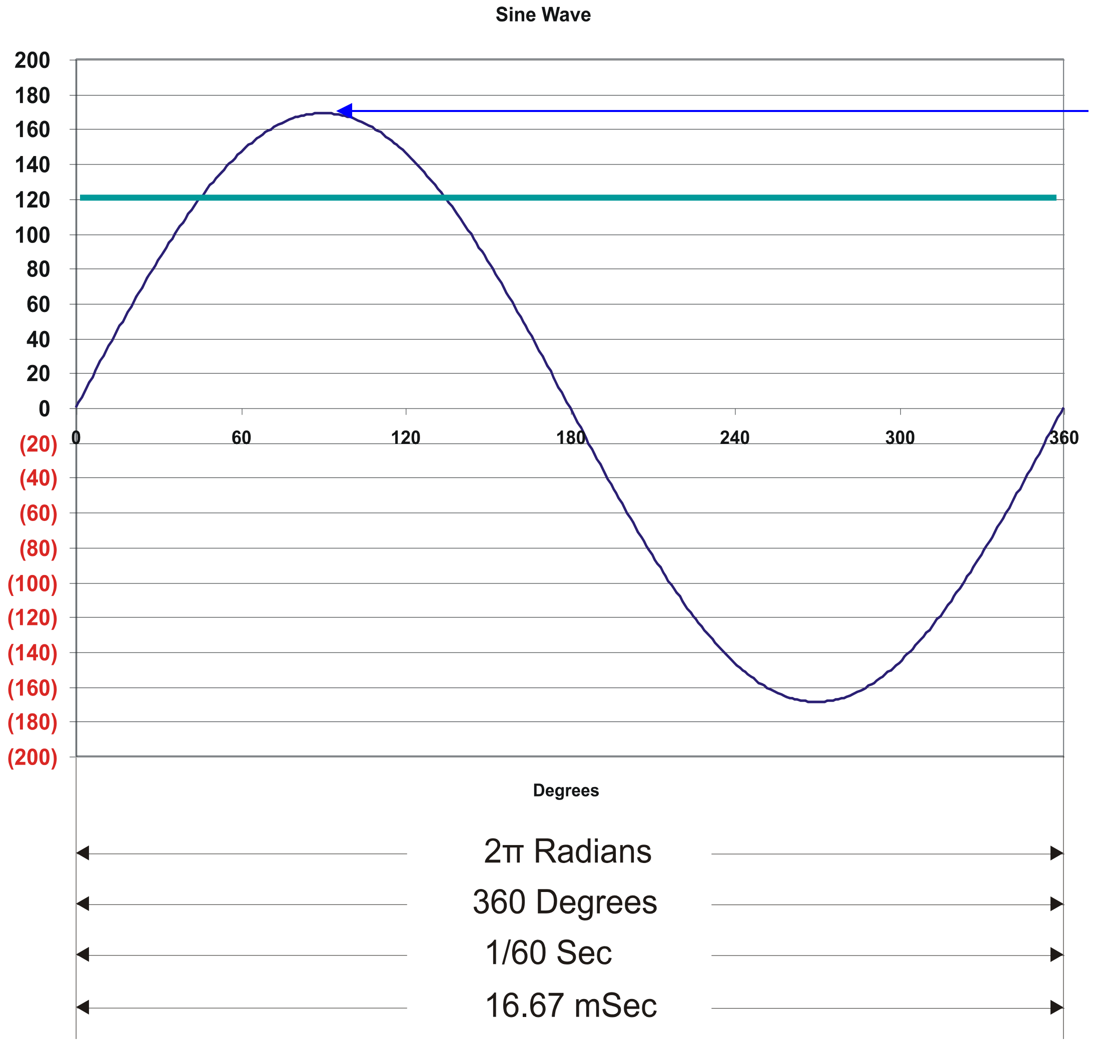
Ohm's Law Wheel



AC Theory Review – Sine Wave



$$V = V_{pk} Sin(2\pi ft - \theta)$$

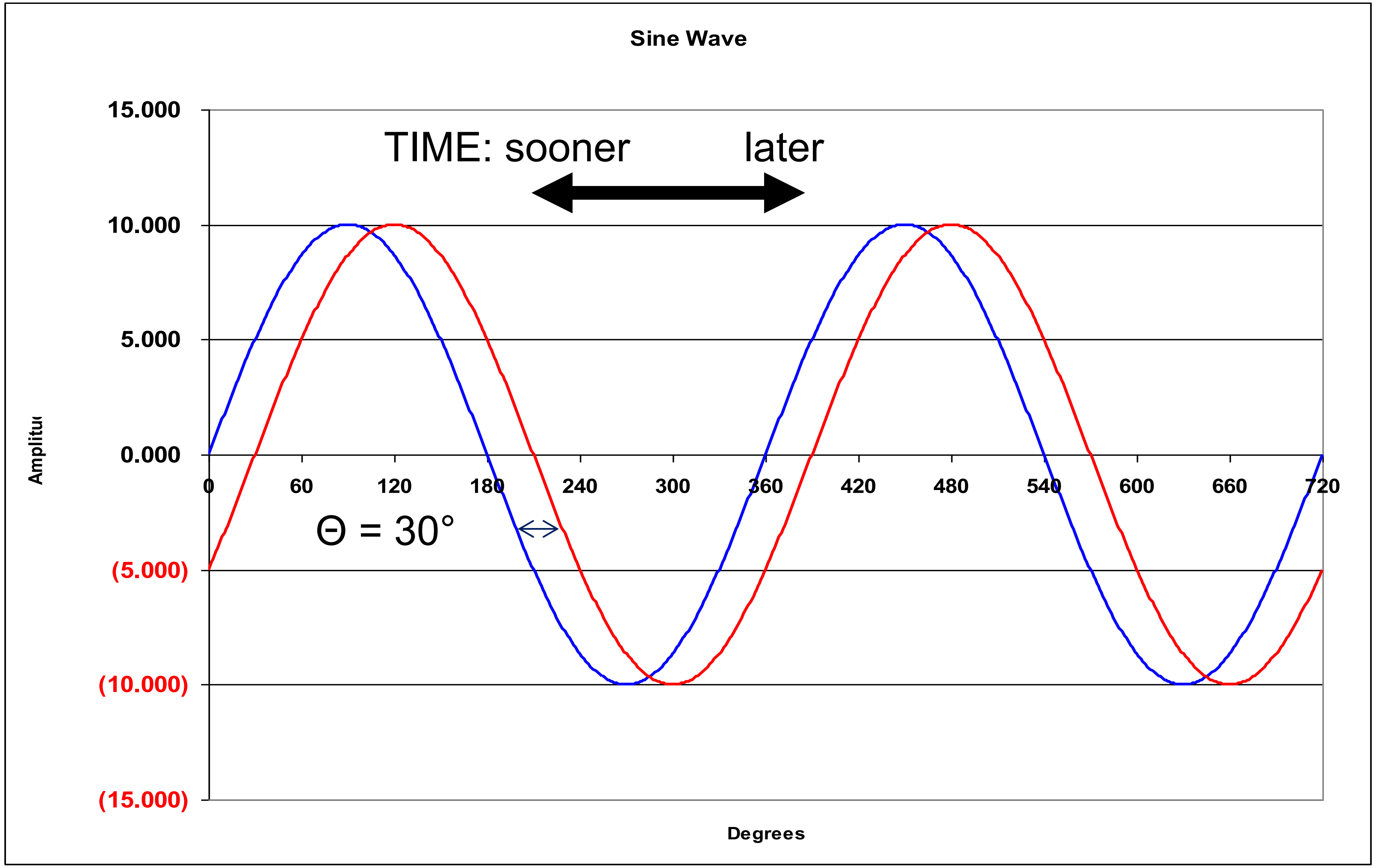
$$V_{pk} = \sqrt{2} V_{rms}$$

$$V_{rms} = 120V$$

$$V_{pk} = 169V$$

$$\theta = 0°$$

Basic AC Theory - Phase



Current is lagging Voltage by 30˚

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Basic AC Theory

Power – The Simple View

V = Voltage (RMS)

I = Current (RMS)

PF = Power Factor

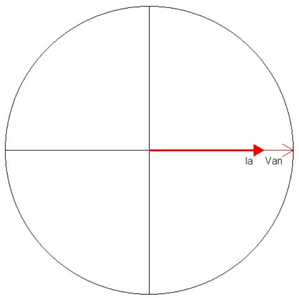
Power = Watts = V x I x PF

Power is sometimes referred to as Demand

Sinusoidal Waveforms Only

NO Harmonics

For a 120 Volt service drawing 13 Amps at Unity (1.0) PF, how much power is being drawn?



Power = 120 x 13 x 1.0 = 1560 Watts

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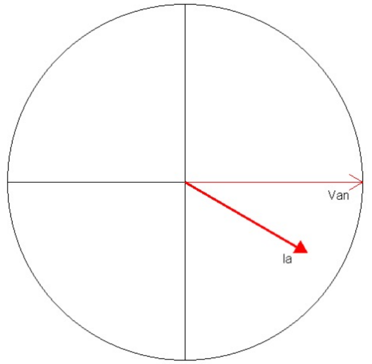
Basic Meter Math

Power – The Simple View

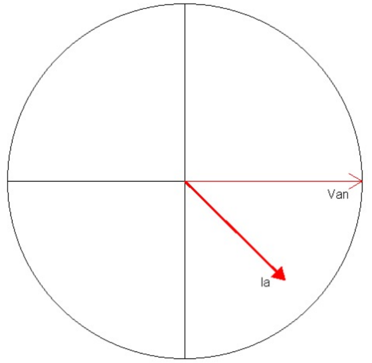
For a 120 Volt service drawing
13 Amps at 0.866 PF (ϴ=30˚),
how much power is being drawn?



Power = V x I x PF

Power = 120 x 13 x 0.866 = 1351 Watts

For a 120 Volt service drawing
13 Amps at 0.5 PF (ϴ=60˚),
how much power is being drawn?



Power = 120 x 13 x 0.5 = 780 Watts

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Basic AC Theory

Power – The Simple View

In the previous example we had:

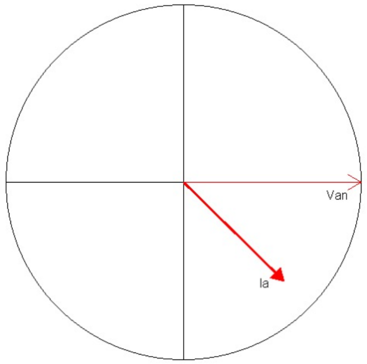
Power = 120 x 13 x 0.866 = 1351 Watts

Normally we don't talk about Watts, we speak in Kilowatts

1000 Watts = 1 Kilowatt = 1 kW

Watts / 1000 = Kilowatts

For a 120 Volt service drawing
13 Amps at 0.866 PF,
how many Kilowatts are being drawn?



Power = 120 x 13 x 0.866 / 1000 = 1.351 kW

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Basic AC Theory

Energy – What We Sell

If power is how fast water flows from a pipe,
then energy is how much water we have in a bucket
after the water has been flowing for a specified time.

Energy = Power x Time

1 kW for 1 Hour = 1 Kilowatt-Hour = 1 kWh

Energy (Wh) = V x I x PF x T

where T = time in hours

Energy (kWh) = (V x I x PF / 1000) x T

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Basic Meter Math

Energy – What We Sell

For a 120 Volt service drawing 45 Amps at a Power Factor of 0.9 for 1 day, how much Energy (kWh) has been used?

Energy (kWh) = (V x I x PF / 1000) x T

Energy = (120 x 45 x 0.9 / 1000) x 24 = 116.64 kWh

For a 240 Volt service drawing 60 Amps at a Power Factor of 1.0 for 5.5 hours, how much Energy (kWh) has been used?

Energy = (240 x 60 x 1.0 / 1000) x 5.5 = 79.2 kWh

Basic AC Theory

What is VA?

Power was measured in Watts. Power does useful work. The power that does useful work is referred to as "Active Power".

VA is measured in Volt-Amperes. It is the capacity required to deliver the Power. It is also referred to as the "Apparent Power".

Power Factor = Active Power / Apparent Power

VA = V x I

PF = W / VA

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Basic Meter Math

Power – VA

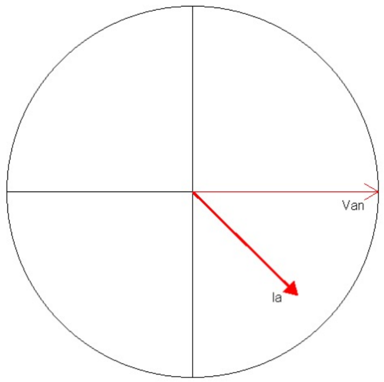
For a 120 Volt service drawing 13 Amps at 0.5 PF (60°)

How much power is being drawn?

Power = 120 x 13 x 0.5 = 780 Watts

How many VA are being drawn?

VA = 120 x 13 = 1560 Volt-Amperes



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Basic Meter Math

Power – VA

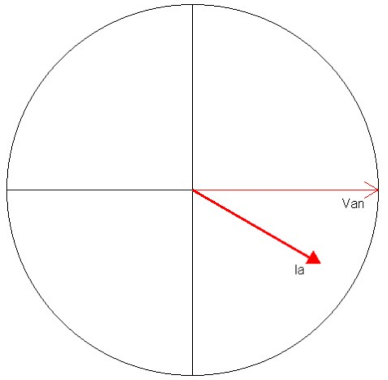
For a 120 Volt service drawing 13 Amps at 0.866 PF (30°)

How much power is being drawn?

Power = 120 x 13 x 0.866 = 1351 Watts

How many VA are being drawn?

VA = 120 x 13 = 1560 Volt-Amperes



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Basic Meter Math

Power – VA

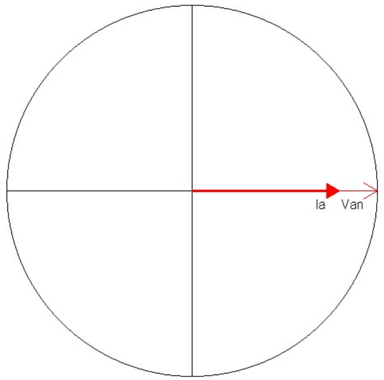
For a 120 Volt service drawing 13 Amps at 1.0 PF (0°)

How much power is being drawn?

Power = 120 x 13 x 1.0 = 1560 Watts

How many VA are being drawn?

VA = 120 x 13 = 1560 Volt-Amperes



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Power Factor, Watts, and VA

For our 120V, 13A system

Phase Angle	PF	Watts	VA
0	1.0	1560 W	1560 VA
30	0.866	1351 W	1560 VA
60	0.5	780 W	1560 VA

As PF get closer to 1, the Watt value gets closer to the VA value! This means more real power is being consumed!

A table of PF vs phase angle values is on pages 18-19

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Watt, VAR, and VA

Watt - useful power that does real work at the load – light a bulb or turn a motor

VAR – non-useful power that is required to drive the inductance or capacitance of a power line

VA – the total power in the system; the **vector sum** of Watts and VARs

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Watt, VAR, and VA

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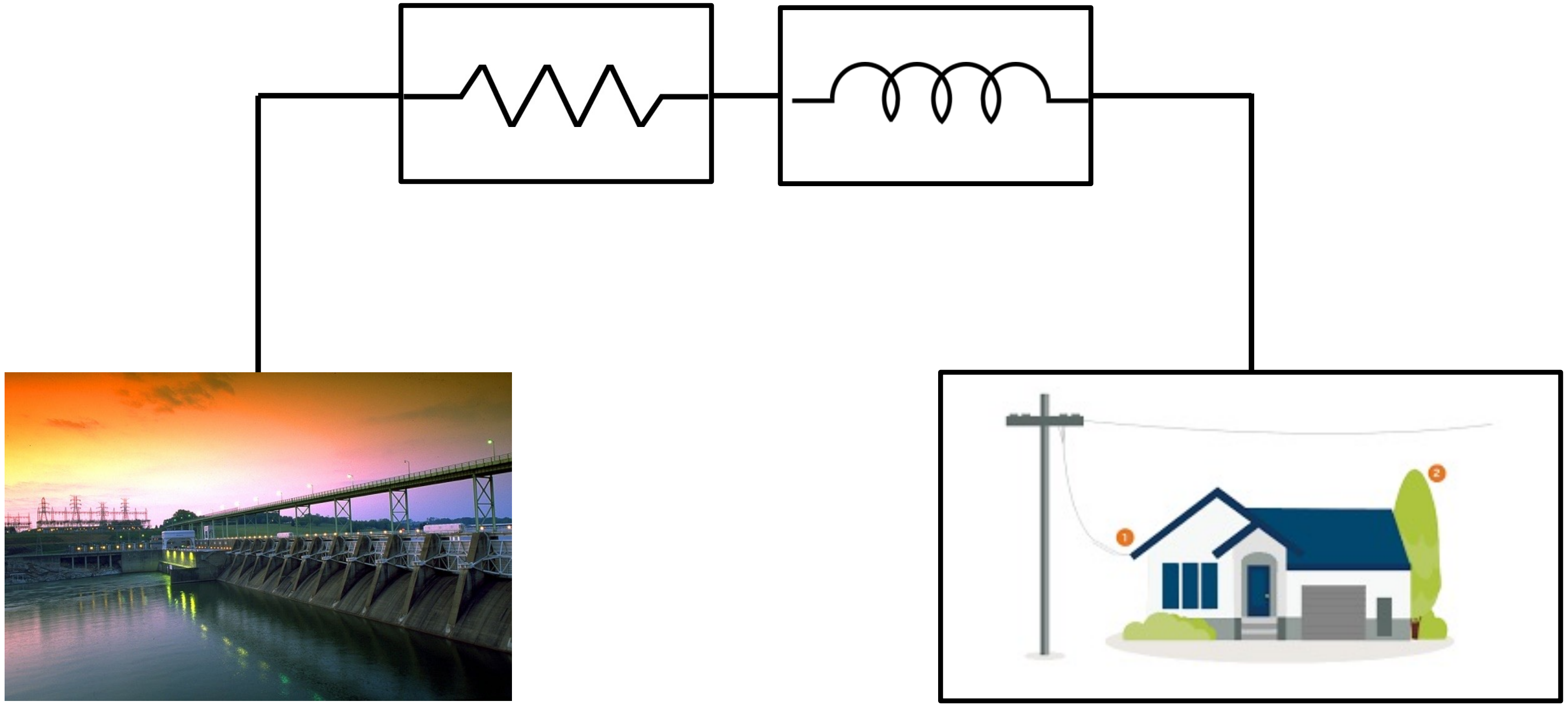
Where do VARs come from?



Inductance in the power transmission line lower power factor and increases VARs!

Power Factor Definition:

Power Factor represents the ratio of active power (Watts) to the total power (VA) in a system.

It is a representation of the percentage of useful work being done.

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Power Factor, Watts, and VARs

For a 120V, 13A System

Phase Angle	PF	Watts	VAR	VA
0	1	1560 W	0 VAR	1560 VA
30	0.866	1351 W	780 VAR	1560 VA
60	0.5	780 W	1351 VAR	1560 VA

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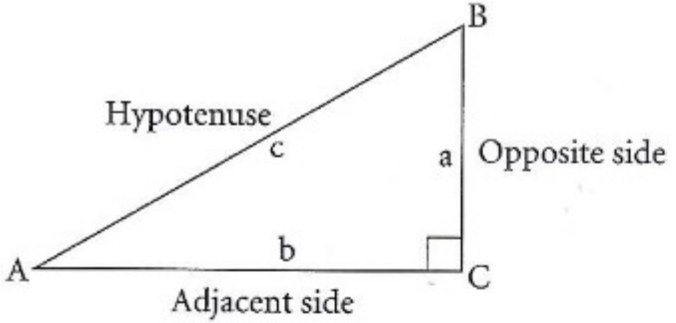
Page 8 - Useful Triangles

THE RIGHT TRIANGLE



A right triangle is a triangle having one right angle (90°).

A relationship exists between the sides of every right triangle. Mathematically, this formula is:

$$c^2 = a^2 + b^2$$

Fixed relationships also exist between two sides and one angle. These standard relationships, useful when solving AC circuit problems, are called trigonometric functions:

$$\text{Sine A} = \frac{\text{opposite side}}{\text{hypotenuse}} = \frac{a}{c}$$

$$\text{Cosine A} = \frac{\text{adjacent side}}{\text{hypotenuse}} = \frac{b}{c}$$

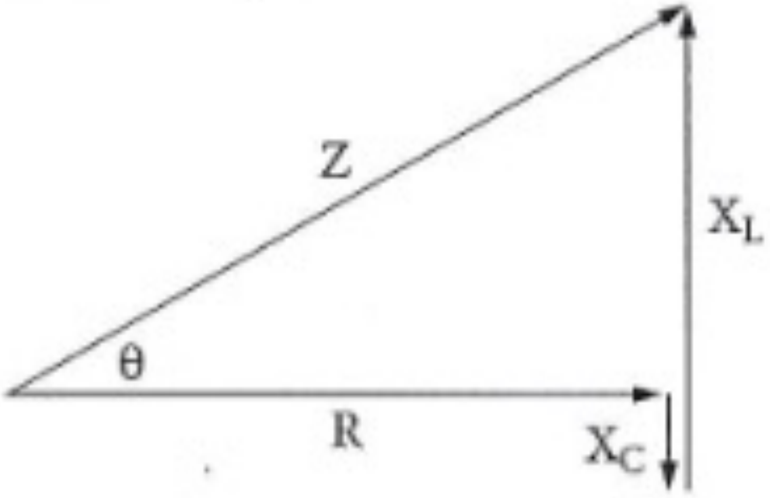
$$\text{Tangent A} = \frac{\text{opposite side}}{\text{adjacent side}} = \frac{a}{b}$$

Page 9 - Useful Triangles

IMPEDANCE TRIANGLE

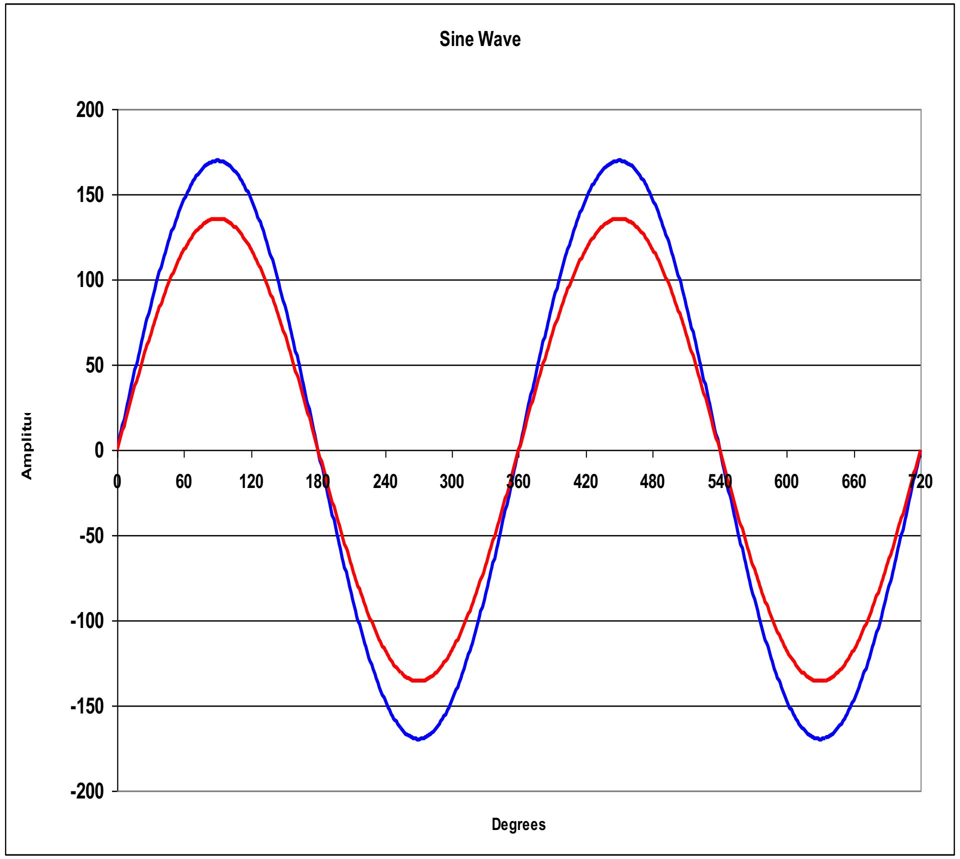
In AC circuits, three quantities limit the flow of current:

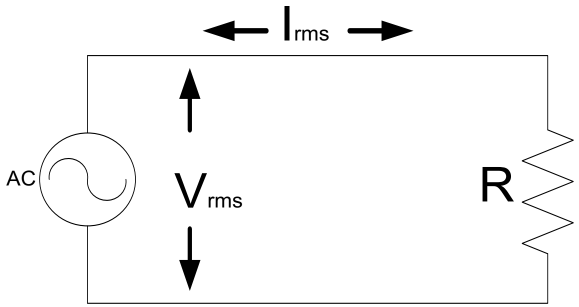
- Resistance R
- Inductive reactance X_L
- Capacitive reactance X_C

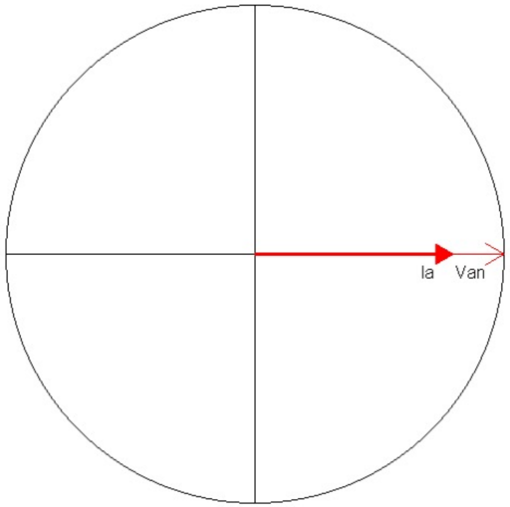


where $Z = \sqrt{R^2 + (X_L - X_C)^2}$

Resistive Load

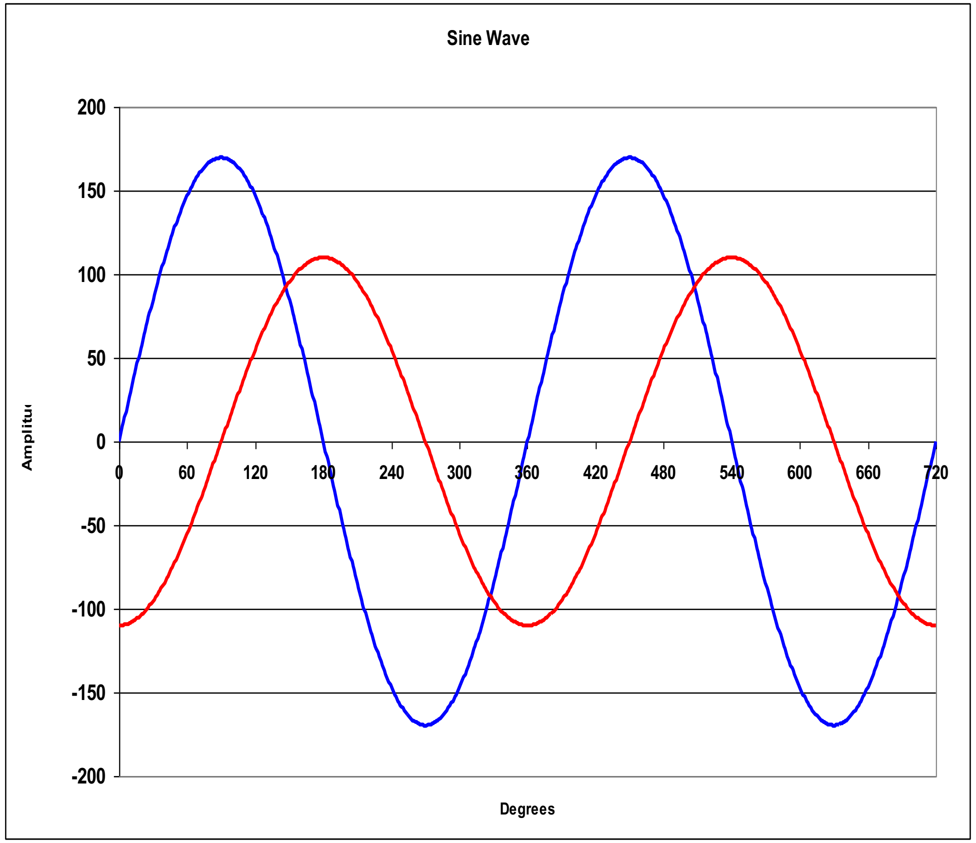


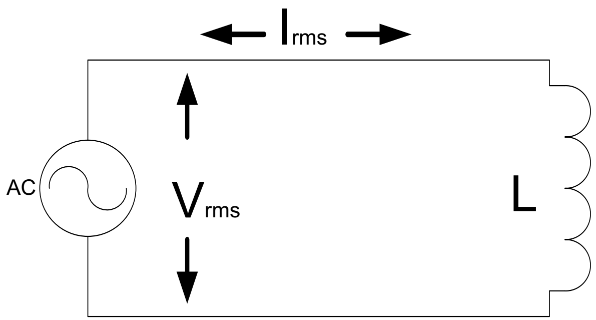


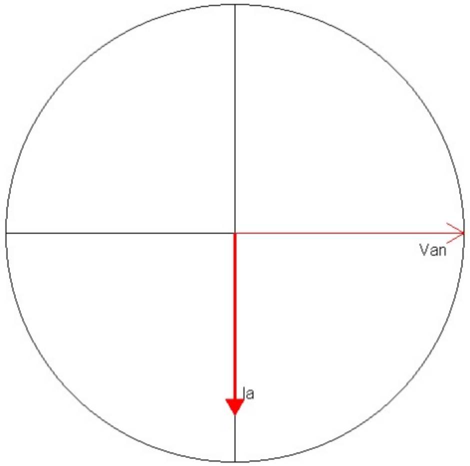


Resistors are measured in Ohms. When an AC voltage is applied to a resistor, the current is in degrees. A resistive load is considered a “linear” load because when the voltage is sinusoidal the current is sinusoidal.

Inductive Load

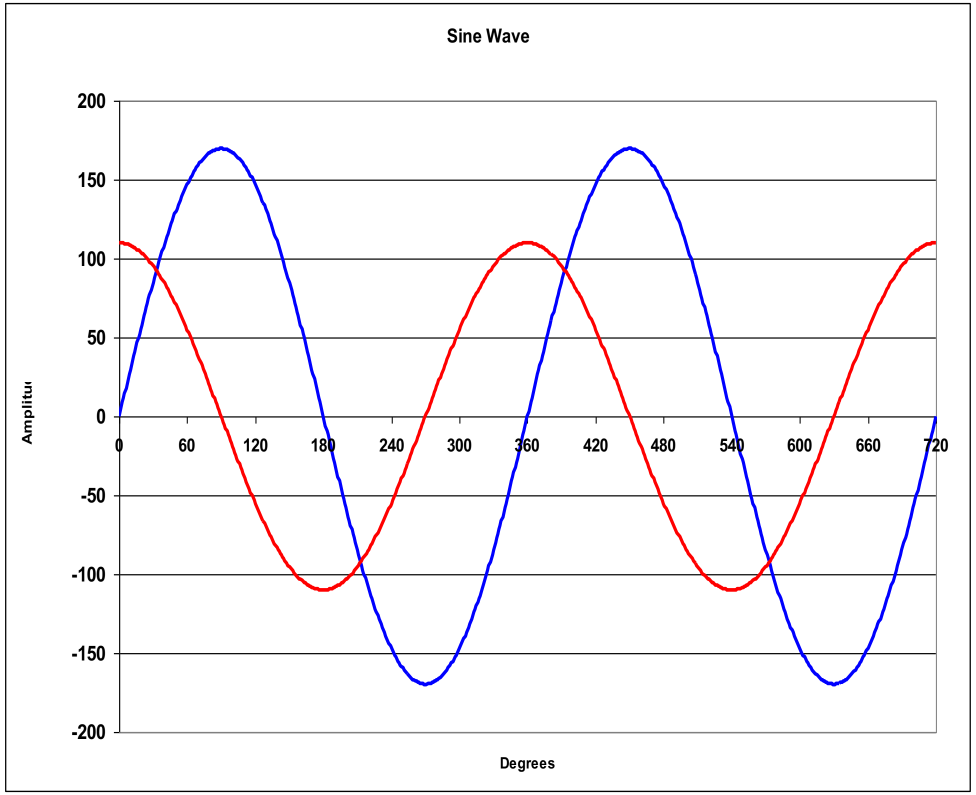


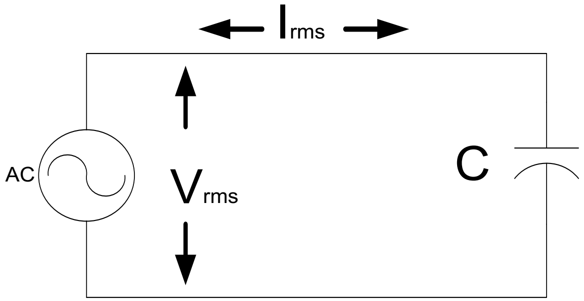


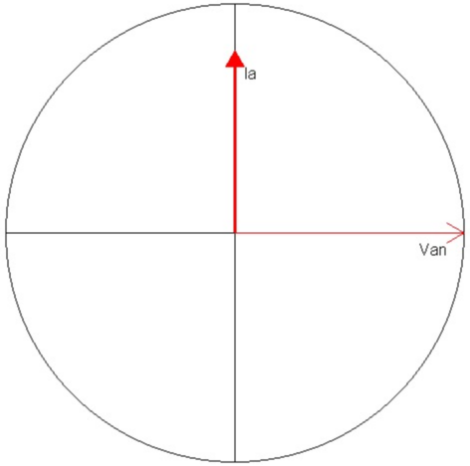


Inductors are measured in Henries. When an AC voltage is applied to an inductor, the current is 90 degrees out of phase. We say the current “lags” the voltage. A inductive load is considered a “linear” load because when the voltage is sinusoidal the current is sinusoidal.

Capacitive Load





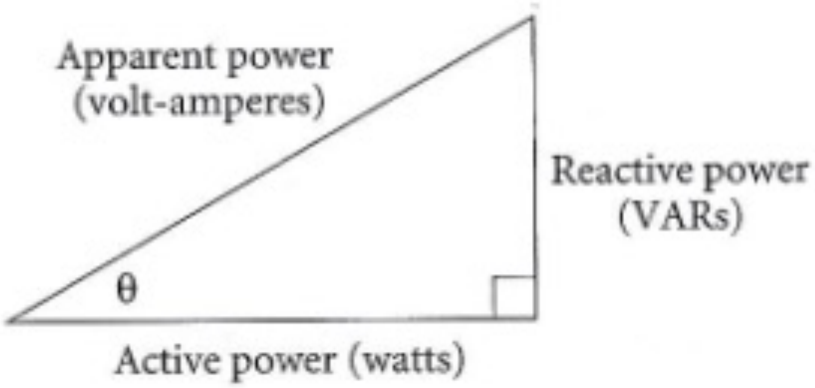


Capacitors are measured in Farads. When an AC voltage is applied to a capacitor, the current is 90 degrees out of phase. We say the current “leads” the voltage. A capacitive load is considered a “linear” load because when the voltage is sinusoidal the current is sinusoidal.

Page 10 - Power Triangle

(Sinusoidal Waveforms)

POWER TRIANGLE



Active power, also called working power or true power, is what wattmeters measure and is what most customers are billed for.

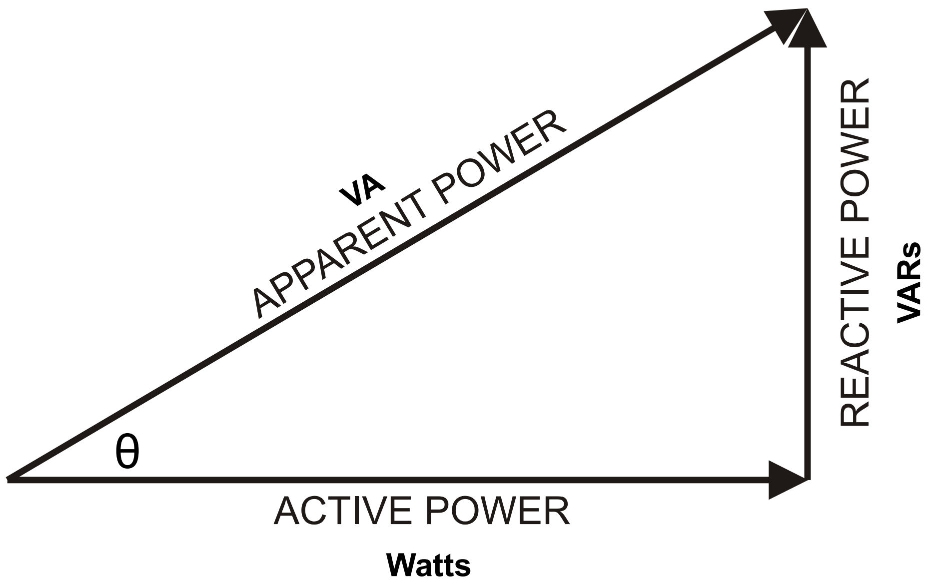
Apparent power is the total power generated by the utility.

Reactive power circulates in the wires, alternating between magnetic fields in inductive motor windings and transformers, and electrostatic fields in capacitors.

Active power divided by apparent power is the power factor of the circuit. It is also the cosine of the angle θ in the power triangle.

Page 10 - Power Triangle

(Sinusoidal Waveforms)



If V = Sin(ωt) and I = Sin(ωt - θ) (the load is linear)
then

Active Power =	$VI\,Cos(\theta)$	Watts
Reactive Power =	$VI\,Sin(\theta)$	Volt-Amp Reactive (VAR)
Apparent Power =	VI	Volt-Amp (VA)

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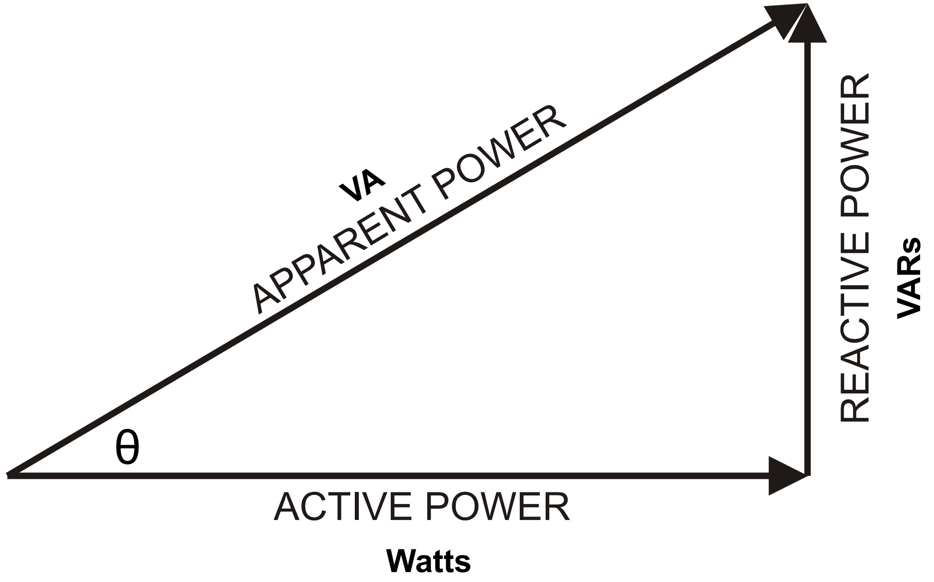
Power Factor Definition



Power Factor = Active / Apparent Power

= Watts / VA

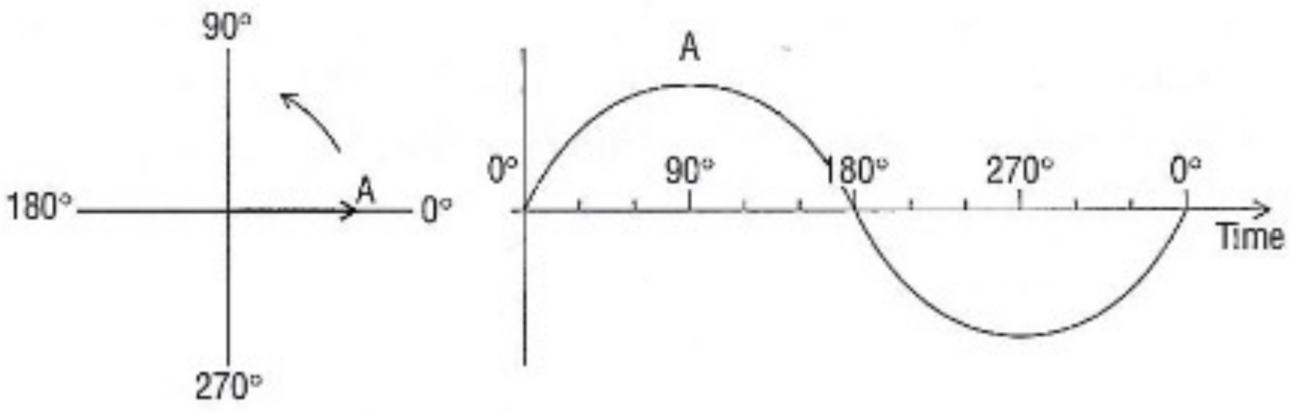
= *Cos*(θ)

Power Factor can range from 1 to 0

Page 14 – Vector (Phasor) Diagrams

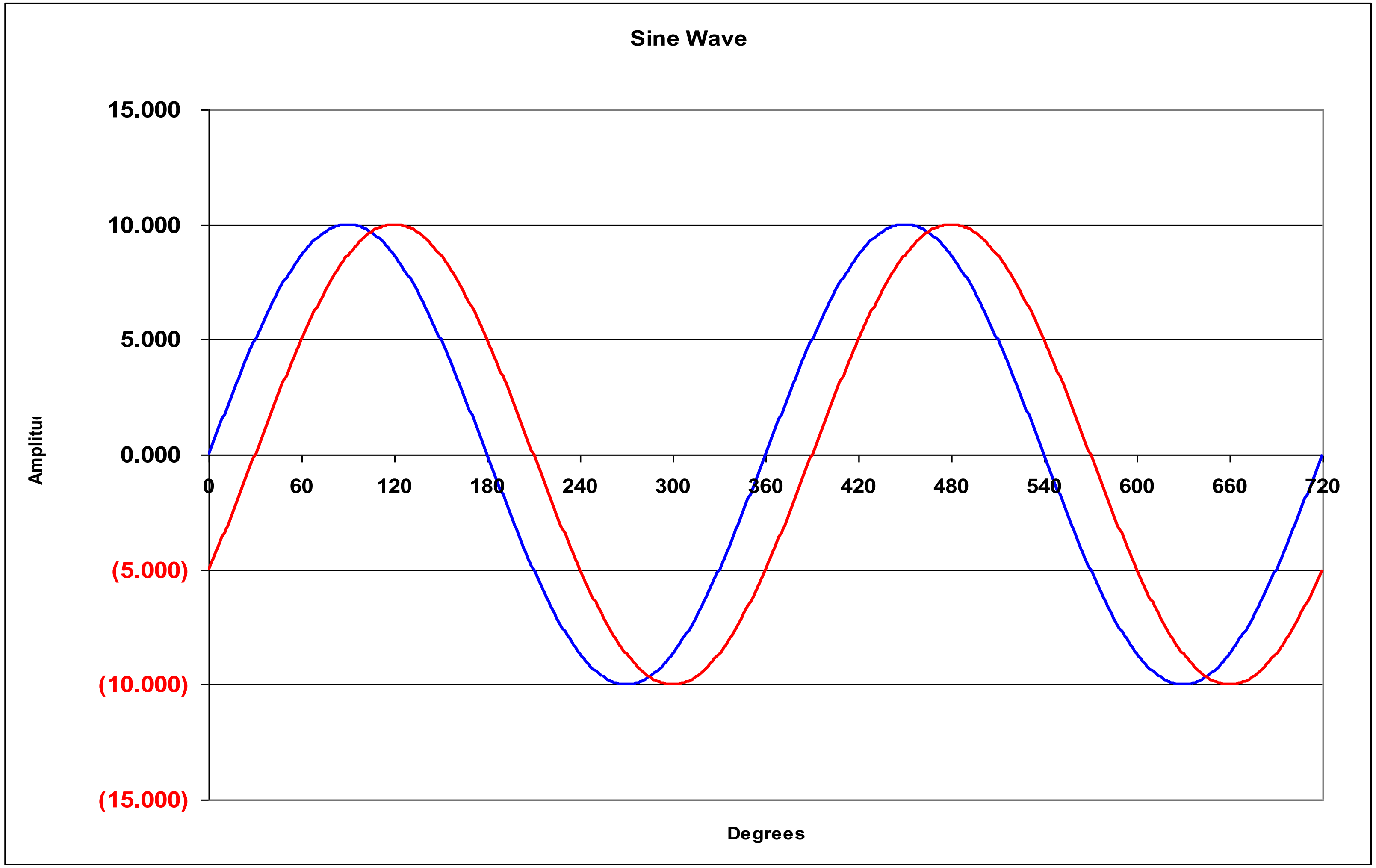
VECTORS

Sine waves can represent AC voltages and currents, but except for the most simple circuits, they make circuit analysis messy and confusing. Vectors are usually used instead of sine waves. The length of the vector (arrow) illustrates the value of the electrical quantity – for example, how many volts. The angle of each vector shows its relationship, relative to other vectors in the circuit.



Vectors and Phasors are the same thing!

Vector Diagrams



$$V = 10Sin(2\pi ft)$$

$$V = 10Sin(2\pi ft - 30)$$

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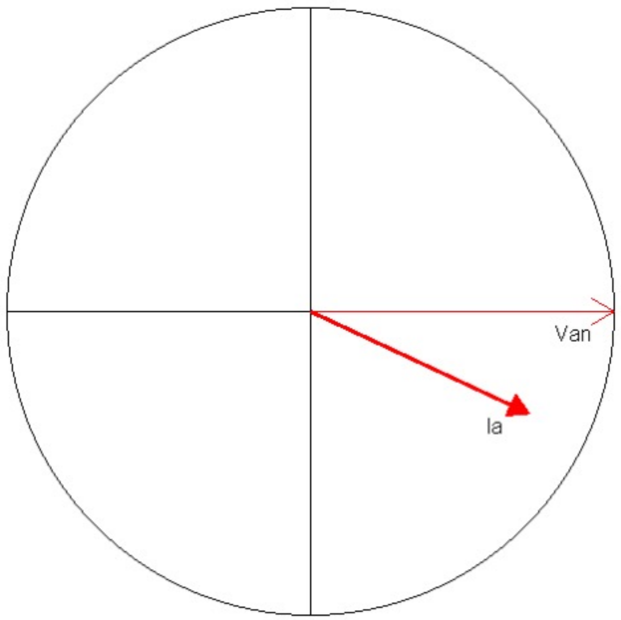
Vector Diagrams

- The length of the vector is proportional to the value of the quantity
- The angle of the vector (by convention phase A is drawn as horizontal) shows the phase of the quantity relative to phase A voltage.
- Here the current “lags” the voltage by 30 degrees.



$$V = 120\sqrt{2}Sin(2\pi f t - 0)$$

$$I = 2.5\sqrt{2}Sin(2\pi f t - 30)$$

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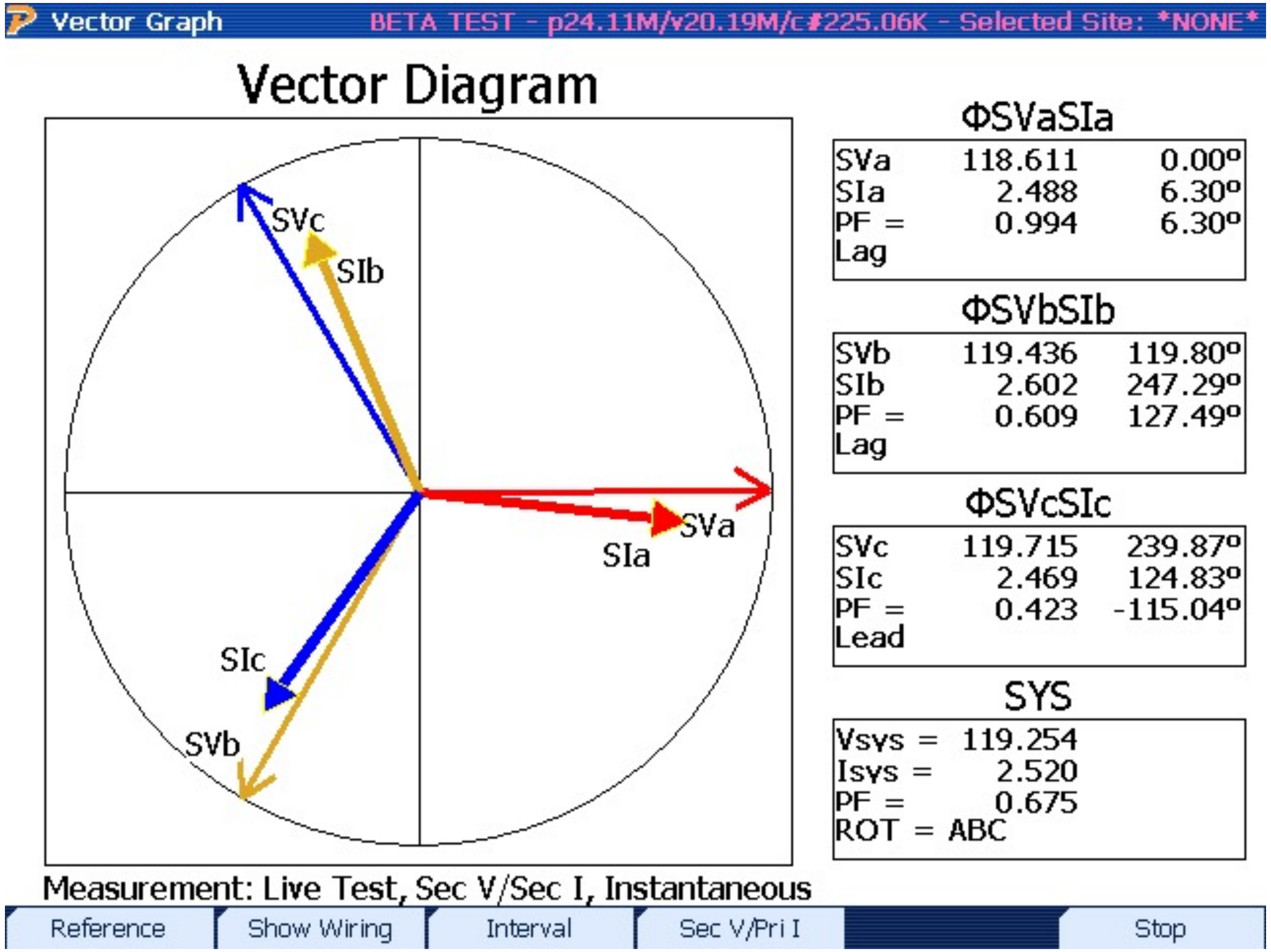
Vector Diagrams

- Vectors are particularly useful in poly-phase situations



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Pages 20 – 21
Full Load Current

$$Single\ Phase\ Full\ Load\ Current = \frac{circuit\ kVA\ x\ 10000}{circuit\ voltage}$$

$$3\ Phase\ Full\ Load\ Current = \frac{kVA\ x\ 10000}{1.732\ x\ voltage\ (L-L)}$$

Full load Current Tables are given for standard size distribution transformers on pages 20 - 21

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Page 85 – Allowable Ampacity

Conductor Size (AWG)	(kcmil)	Diameter (in.)	Copper (A)	Aluminum or Copper-Clad Aluminum (A)
6		0.162	75	55
4		0.204	95	75
3		0.229	115	85
2		0.258	130	100
1		0.289	145	115
0 (1/0)		0.325	170	135
00 (2/0)		0.365	195	150
000 (3/0)		0.410	225	175
0000 (4/0)		0.460	260	205
	250	0.500	290	230
	300	0.548	320	260
	350	0.592	350	280
	400	0.632	380	305
	500	0.707	430	350

Maximum current-carrying capacity of conductors at 194°F (90°C) with THNN insulation. See also NEC Table 310.15(B)(16).

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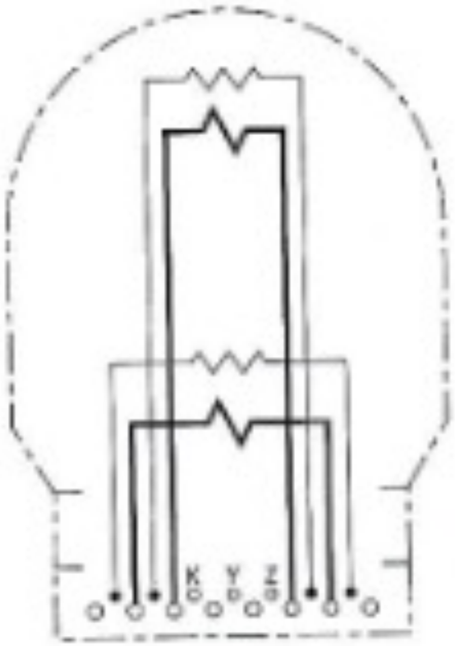
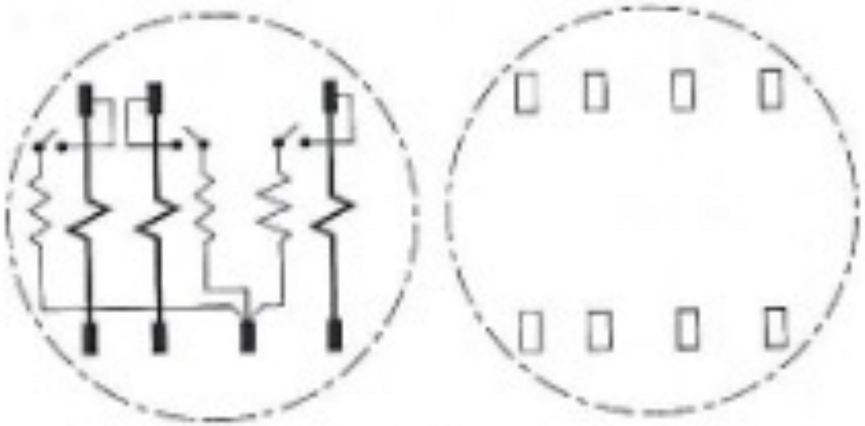
Page 22 – Meter Bases



A-base meter



S-base meter and meter socket

Page 23 – Meter Sockets

Socket	Voltage	Current	Comment
For single-phase circuits:			
	120/240V, 3-wire	Up to 200 amps	Direct-connect socket
	120/208V, 3-wire	Up to 200 amps	Direct-connect socket
	120/240V, 3-wire	201-320 amps	Direct-connect 320A socket
	120/240V, 3-wire	Above 200 amps	With CTs

Page 23 – Meter Sockets

For three-phase circuits:

	120/208V, 4-wire 120/240V, 4-wire 277/480V, 4-wire	Up to 200 amps	Direct-connect socket
	120/208V, 4-wire 120/240V, 4-wire 277/480V, 4-wire	Above 200 amps	With CTs

Page 25 – Meter Class

METER CLASS

The meter Class (CL) designates the upper limit of the load current, in amperes.

Test current for meter classes is defined in ANSI C12.1.

Class	Maximum Current	Meter Type	Test Current (TA)		
			Full Load	Light Load	50% PF
10	10A	Instrument-rated	2.5A	0.25A	2.5A
20	20A	Instrument-rated	2.5A	0.25A	2.5A
100	100A	Self-contained	15.0A	1.50A	15.0A
200	200A	Self-contained	30.0A	3.00A	30.0A
320	320A	Self-contained	50.0A	5.00A	50.0A

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Page 25 – Meter Voltages

METER VOLTAGE, FREQUENCY

Standard voltage ratings assigned to meters are:

72 volts
120 volts
240 volts
277 volts
480 volts
600 volts

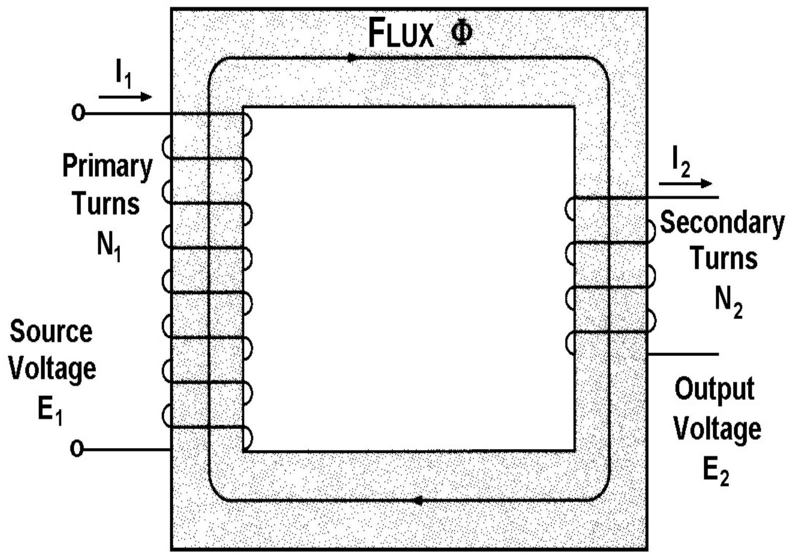
The use of 600-volt meters is limited for safety considerations. Meters for 72 volts are used only for special applications.

Some electronic meters can operate over a broad range of voltages, for example: from 120V to 277V or from 120V to 480V.

Meters manufactured for installation in North America are rated for use at 60 hertz.

What is a Transformer?

- A TRANSFORMER is a device used to change the voltage levels of electricity to facilitate the transfer of electricity from generating stations to customers. A step-up transformer increases the voltage while a step-down transformer decreases it.
  www.duquesnelight.com/understandingelectricityupdate/electricterms.html



Basic Transformer Theory

- Vp = primary voltage
- Ip = primary current
- Np = primary turns
- Pp = primary power
- Vs = secondary voltage
- Is = secondary current
- Ns = secondary turns
- Ps = secondary power

$$Vs = \frac{Ns}{Np} Vp$$

$$Is = \frac{Np}{Ns} Ip$$

$$Pp = Vp \bullet Ip = Ps = Vs \bullet Is$$

This is true for an IDEAL transformer!

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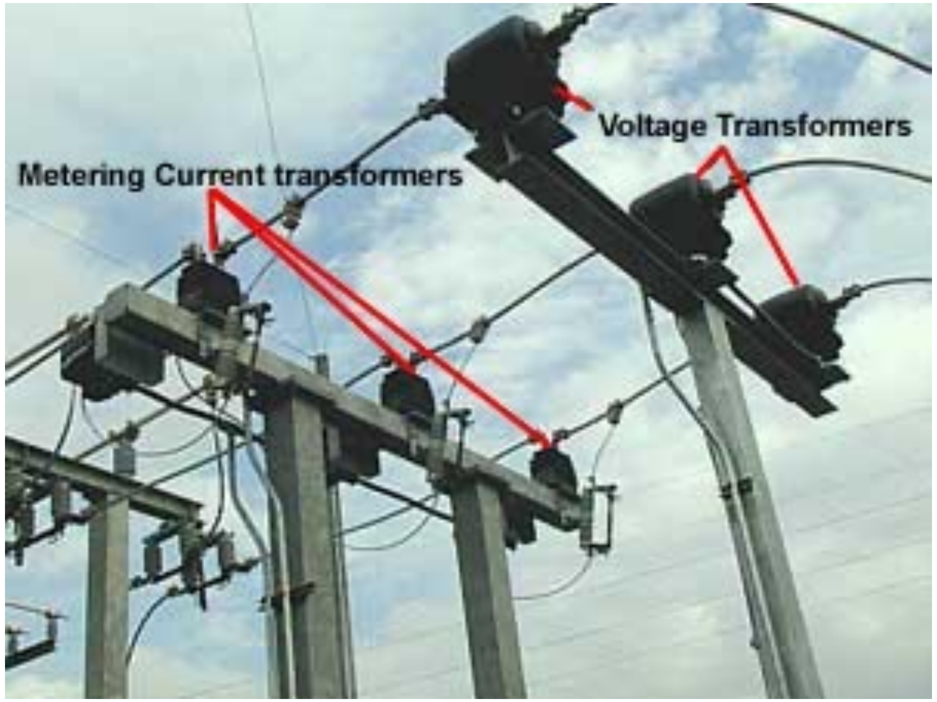
What is an Instrument Transformer?

Instrument Transformers convert signal levels from dangerous (high voltage) or inconvenient (high current, or current at high voltage) to levels appropriate for metering.

There are two fundamental types:

CTs (Current Transformers)

PTs (Potential Transformers)



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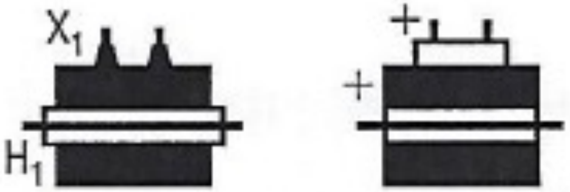
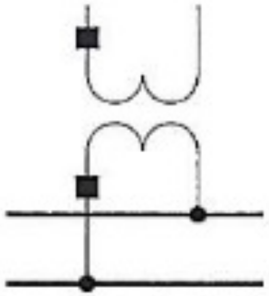
Page 26 & 27
CTs and PTs (VTs)

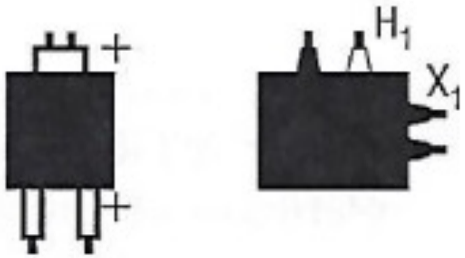
IEEE/ANSI symbol



Other symbols used for CTs

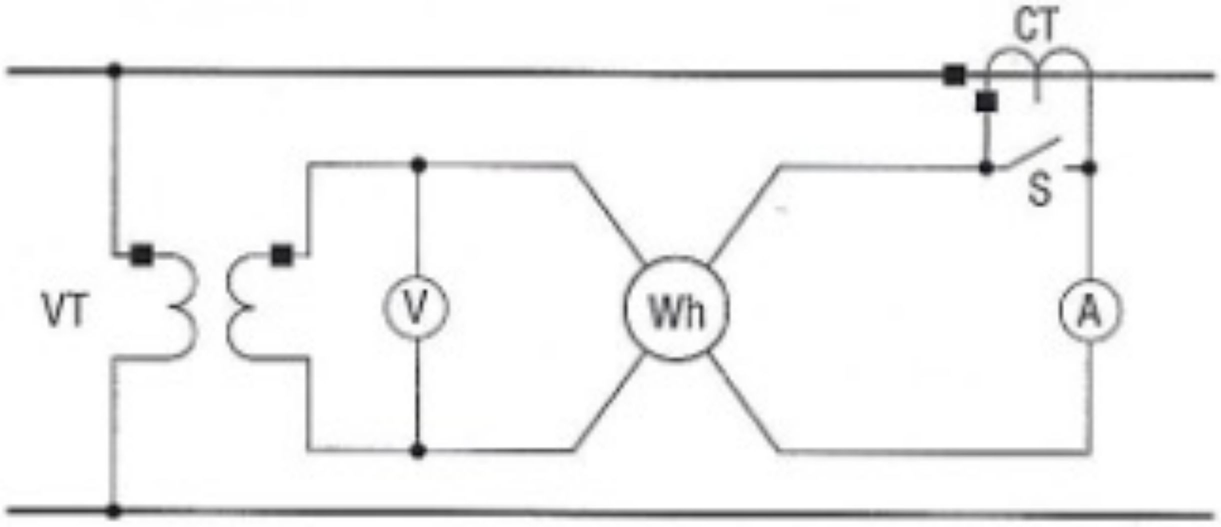


IEEE/ANSI symbol



Other symbols used for VTs

Page 28
Transformer Rated Site



Watthours = register reading × CTR × VTR × Dial K

Example: A CT with a ratio of 400:5 and a VT with a ratio of 20:1 are installed with a watthour meter with a Dial K of 1. The meter reading is 96 kilowatt-hours.

$$\text{Energy} = 96 \times \frac{400}{5} \times \frac{20}{1} \times 1 = 153{,}600 \text{ kWh}$$

POWERMETRIX

Page 29
Safety Tips

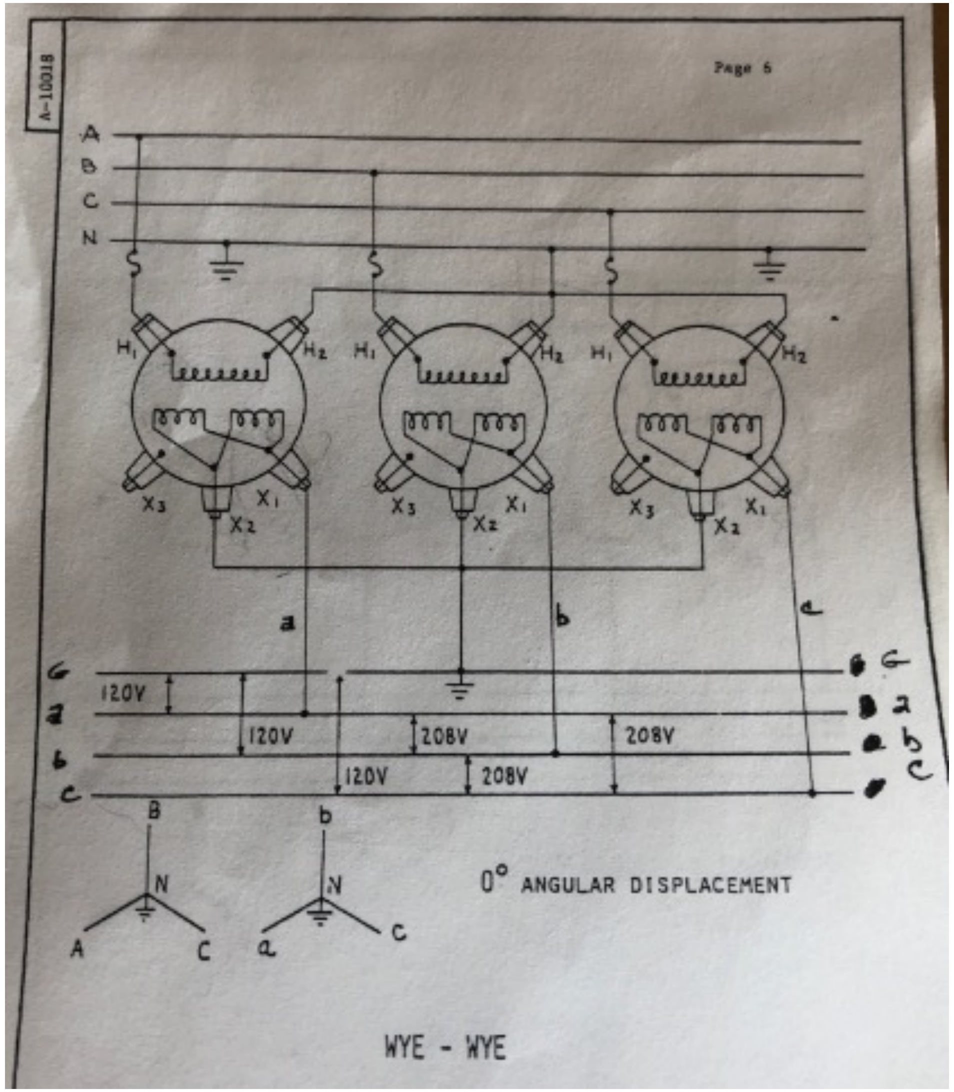
- Measure for hazardous voltage before installing a jumper between any two points.
- When conditions present hazards, do not work alone. When servicing or adjusting meters, have a partner nearby in case assistance is needed.
- If a meter falls, do not attempt to catch it. Trying to catch a glass-covered meter can result in cuts to hands or arms.
- When working with current transformers and voltage transformers:
  - Do not open the secondary circuit of a CT if current may be flowing in the primary. The voltage across the secondary will increase rapidly toward infinity, risking serious personal injury, and the CT might explode.
  - Do not short the secondary circuit of a VT. The resulting electric flash can cause serious injury.
  - Wire to ground, the proper secondary terminals of CTs and VTs.

POWERMETRIX

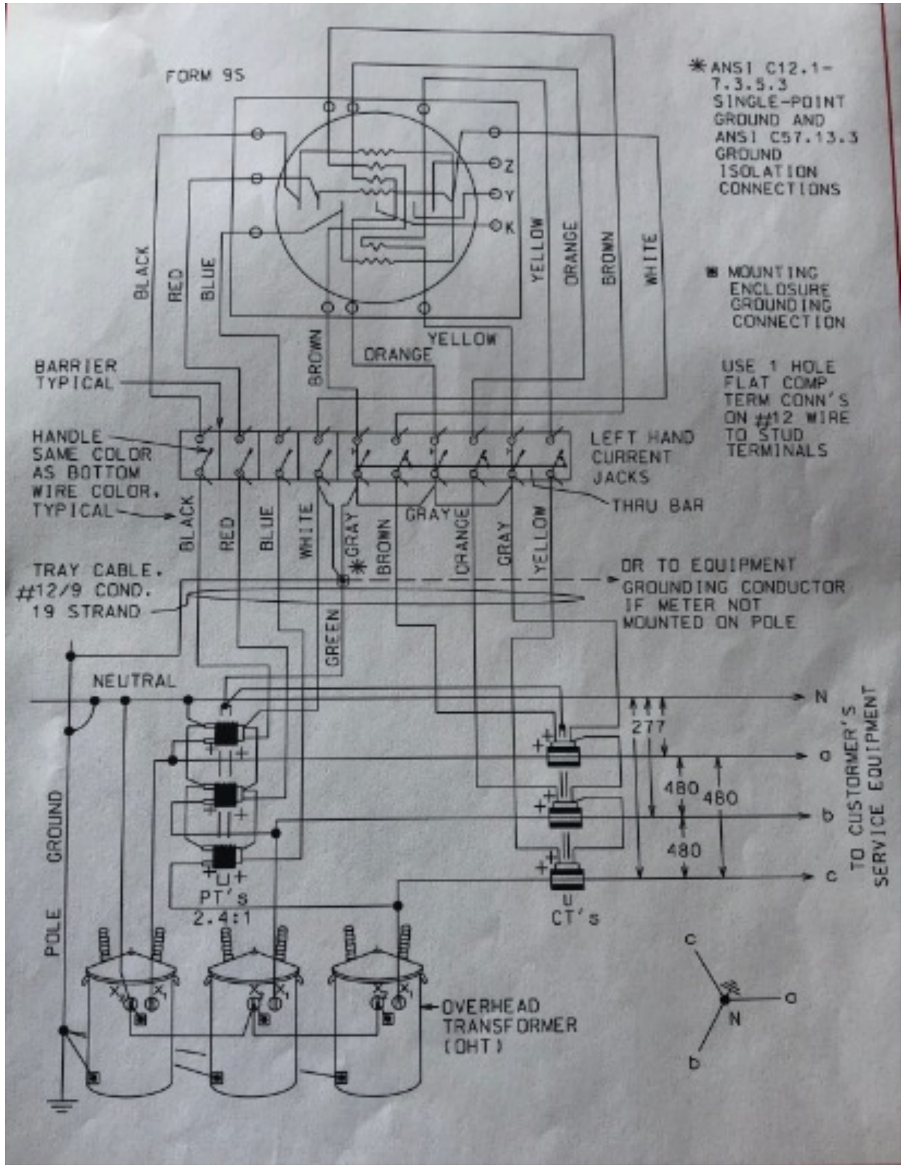
Page 29
Safety Tips

- Wear gloves and eye protection, goggles, or a face shield when setting or removing a meter. Keep co-workers clear.
- Do not use an air hose to clean clothing, hair, hands, or areas of the shop.
- Keep work areas neat and tidy.
- Use tongs, not fingers, to dip parts in cleaning fluids.
- When conducting high-potential (high-pot) tests on insulation:
  - One person per test set; all others stand clear.
  - Wear 10 kV rubber gloves.
  - Use one hand only to avoid a possible electrical path through your heart.
- Above all, follow all your company's established operating and safety procedures.

Meter Form Selection



Meter Form Selection

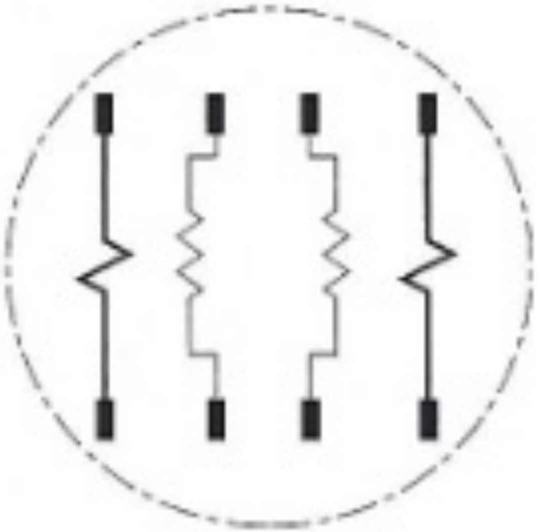


Page 30
Meter Form Designation

FORM DESIGNATION

Meter forms are defined in ANSI standard C12.10. As an example, Form 5S is illustrated below. Meters from different manufacturers with the same form and rating voltage are interchangeable.
The meter form:

- Specifies the internal meter wiring, terminals.



Page 31
Meter Form Designation

Form Designation	No. of Stators	No. of Current Circuits Inside Meter	No. of External Current Wires Connected To Meter
Socket Meters			
1S	1	1	2
2S	1	2	3
3S	1	1	2
4S	1	2	3
5S	2	2	3 (or 4)
6S	2	3	4 wye
8S	2	3	4 delta
9S	3	3	4 wye
12S	2	2	3
14S	2	3	4 wye
15S	2	3	4 delta
16S	3	3	4 wye
36S	2	2	3
45S	2	2	4 wye

POWERMETRIX

Common Meter Forms

Self Contained

Meter Form	# Wires	# Elements	# Phases	Delta / Wye	Class
1S	2	1	1	N/A	200
2S	3	1	1	N/A	200/320
12S	3	2	2	Delta	200/320
16S	4	3	3	Wye	200/320
16S	4	3	3	Delta	200/320

POWERMETRIX

Common Meter Forms

Transformer Rated

Meter Form	# Wires	# Elements	# Phases	Delta / Wye	Class
3S	2	1	1	N/A	20
5S	3 or 4	2	3	Delta	20
6S	4	2.5	2	Wye	20
9S	4	3	3	Wye	20

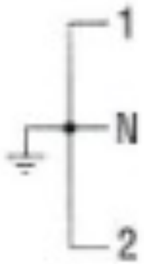
POWERMETRIX

Page 32
Distribution Circuit Symbols

Single-phase
two wire

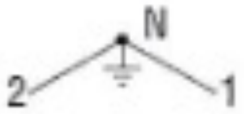
120 volts

Single-phase
three wire



120 volts line-to-neutral
240 volts line-to-line
or
240 volts line-to-neutral
480 volts line-to-line

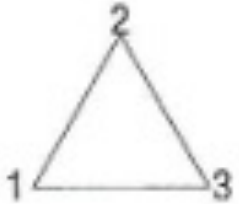
Three-wire
network



120 volts line-to-neutral
208 volts line-to-line

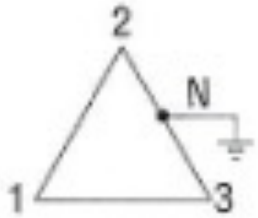
Page 32
Distribution Circuit Symbols

Three-wire
Three-phase delta



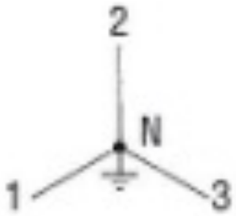
240 volts line-to-line
or
480 volts line-to-line

Four-wire
Three-phase delta



240 volts line-to-line
120 volts adjacent-line to neutral
208 volts opposite-line to neutral

Four-wire
Three-phase wye



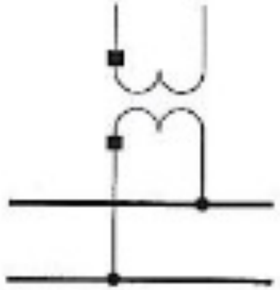
208 volts line-to-line
120 volts line-to-neutral
or
480 volts line-to-line
277 volts line-to-neutral

POWERMETRIX

Pages 33-34
Meter Diagram Symbols

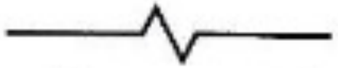
Current transformer, 2-wire with polarity marks

Current transformer, 3-wire with polarity marks

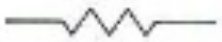


Voltage transformer with polarity marks

Meter



Current coil



Voltage coil

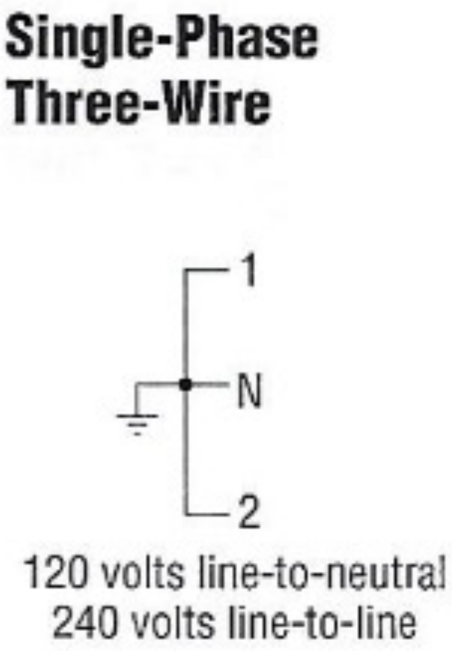
POWERMETRIX

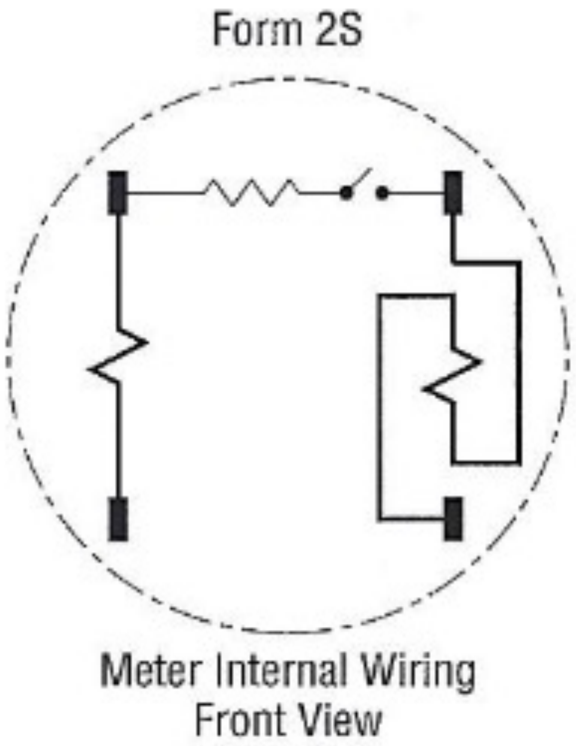
Page 35
Meter Diagram Index

	Circuit	Voltage	Current Connections	Meter Form	Page
Single-Phase	2-wire, 1-phase	120	Self-contained	1S	34
	3-wire, 1-phase	120/240	Self-contained	2S	35
			With CTs	3S, 4S, 4A	36-38
Network	3-wire network	120/208	Self-contained	12S	39
			With CTs	5S, 5A	40-41
Poly phase	3-wire delta	240/480/120	Self-contained	12S	46
			With CTs	5S, 5A	42-43
		With VTs	With CTs	5S, 5A	44-45
	4-wire delta	240/120/208	Self-contained	15S, 15A	47-48
			With CTs	5S, 5A, 8S, 8A	49-52
				9S, 45S	53-54
	4-wire wye	208/120, 480/277	Self-contained	14S, 14A, 16S, 16A	67-70
			With CTs	5S, 5A, 6S, 6A, 9S	55-58 61,64
		With VTs	With CTs	5S, 5A	59-60
				6S, 6A	62-63
				9S, 9A	65-66
				36S, 45S	71-72

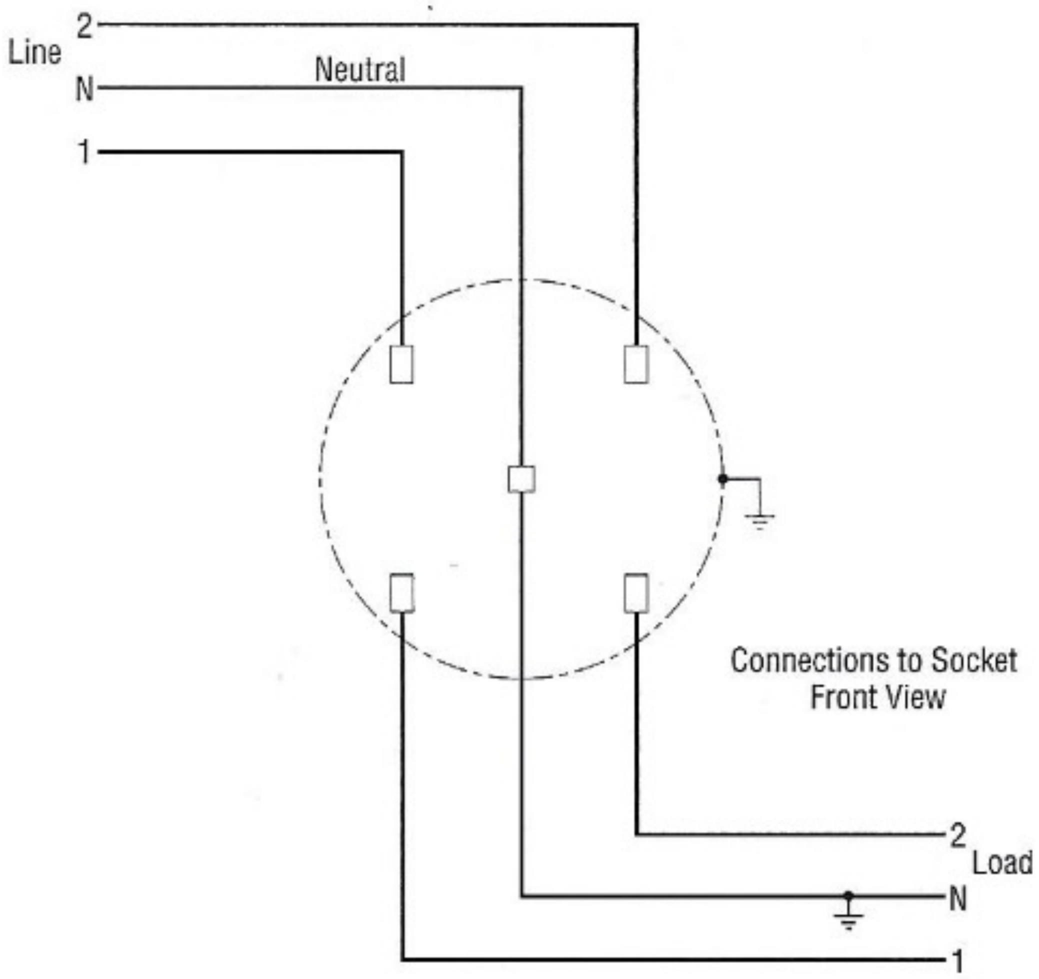
POWERMETRIX

Page 37
Form 2S – SC Single Phase 3W

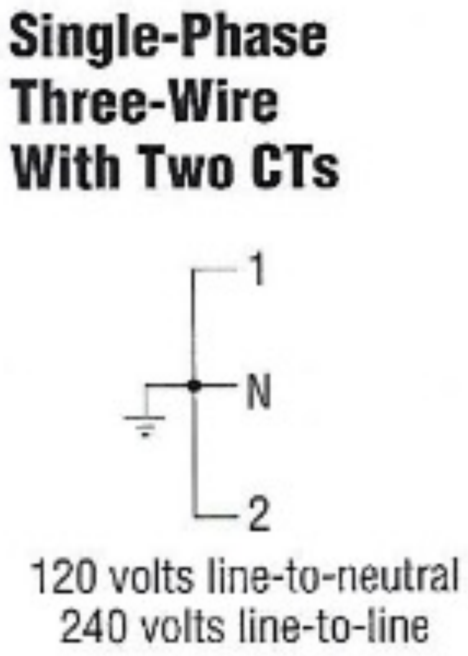


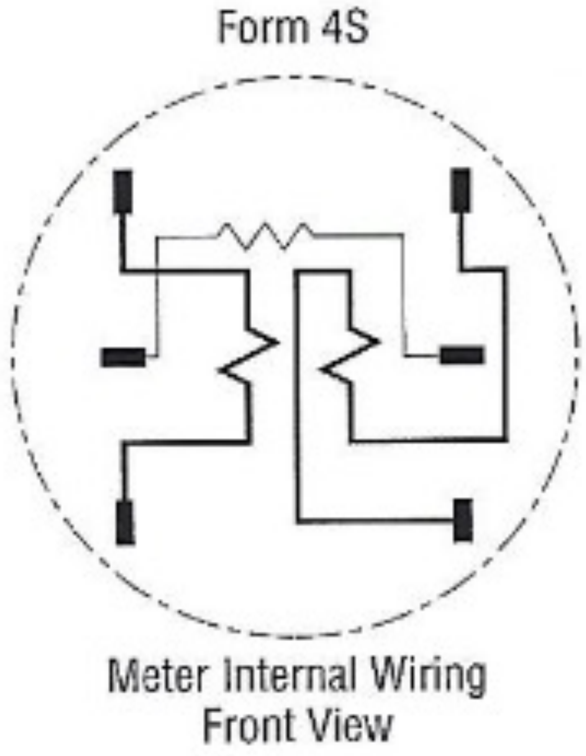


Page 37
Form 2S – SC Single Phase 3W

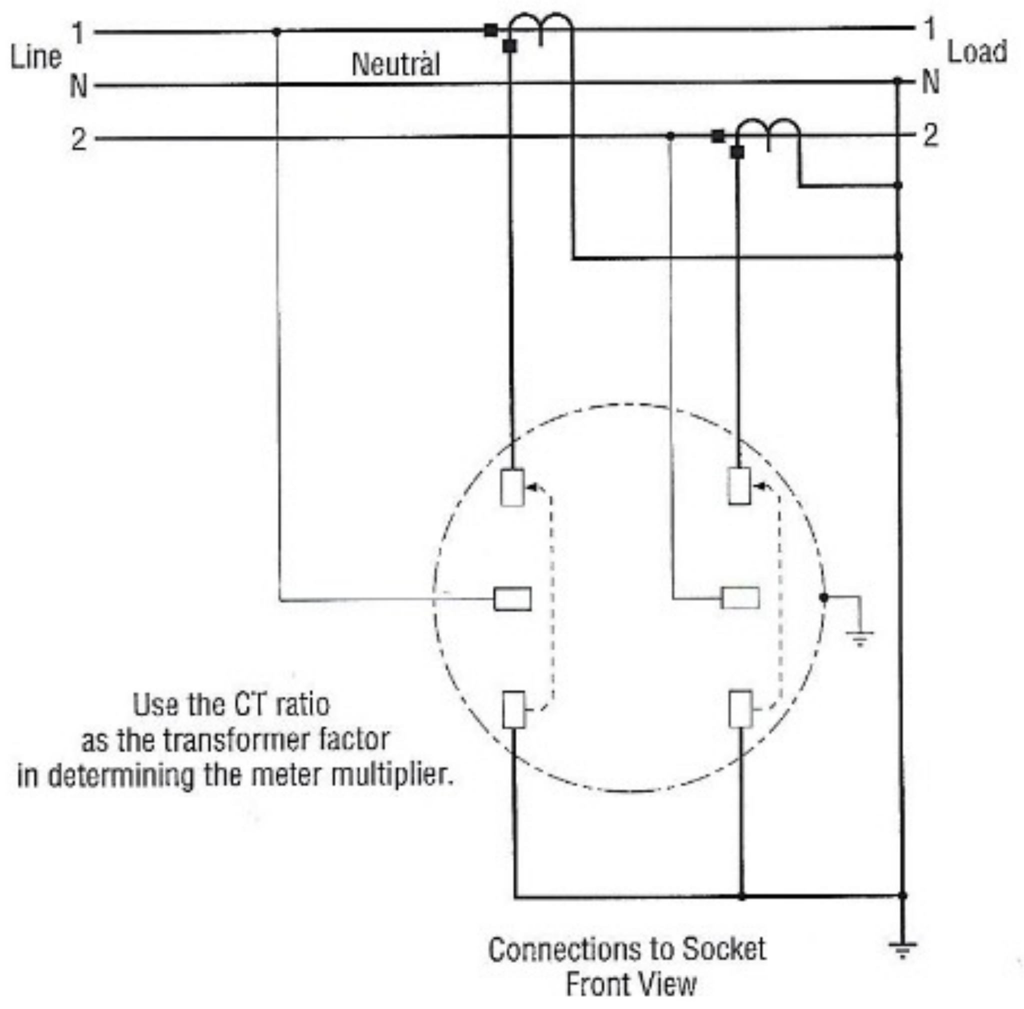


Page 39
Form 4S – TR Single Phase 3W





Page 39
Form 4S – TR Single Phase 3W

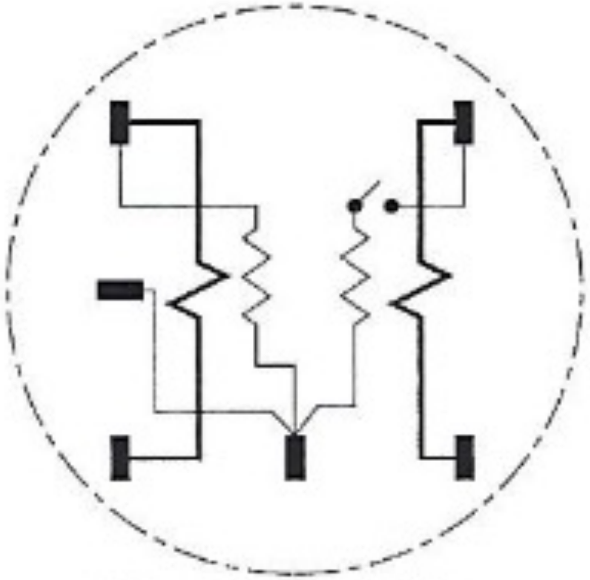


Page 41
Form 12S – SC 3W Network

Three-Wire Network

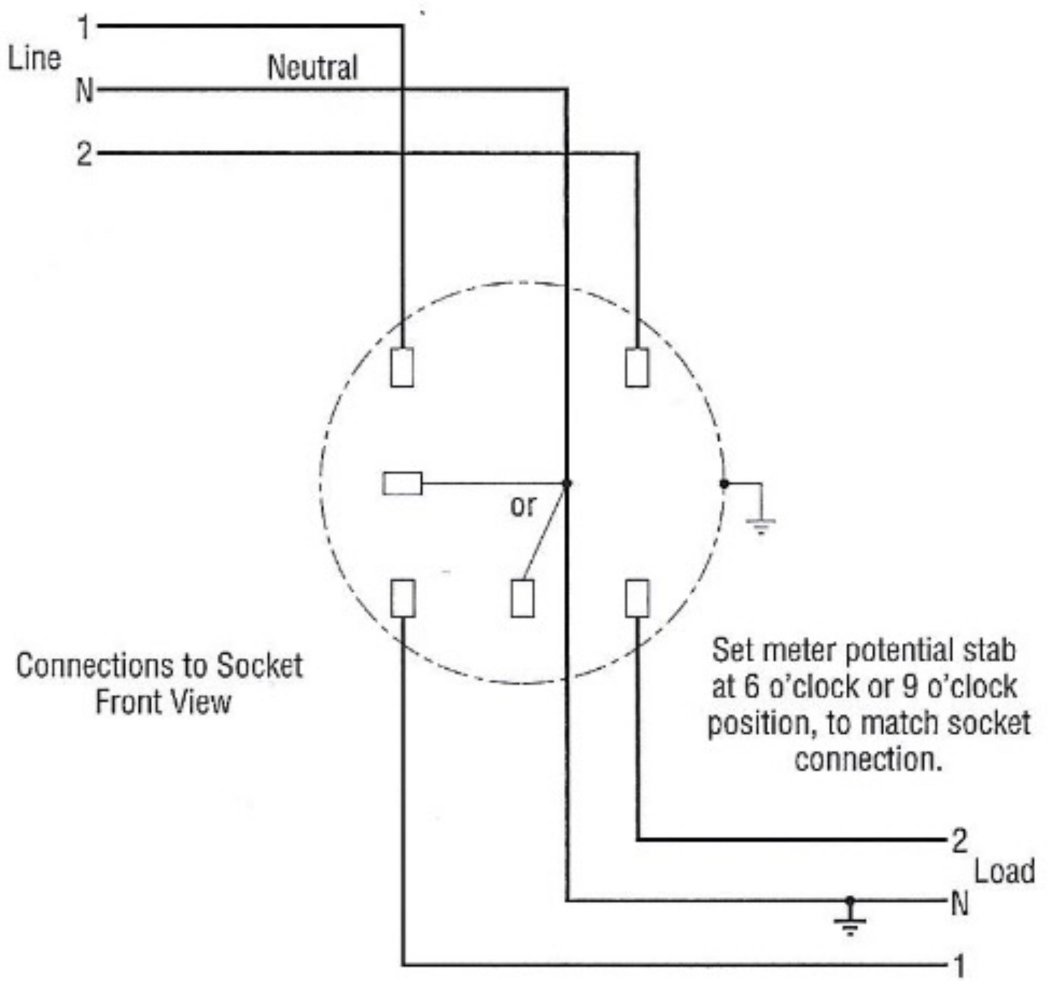
120 volts line-to-neutral
208 volts line-to-line

Form 12S



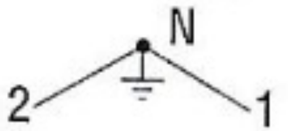
Meter Internal Wiring
Front View

Page 41
Form 12S – SC 3W Network



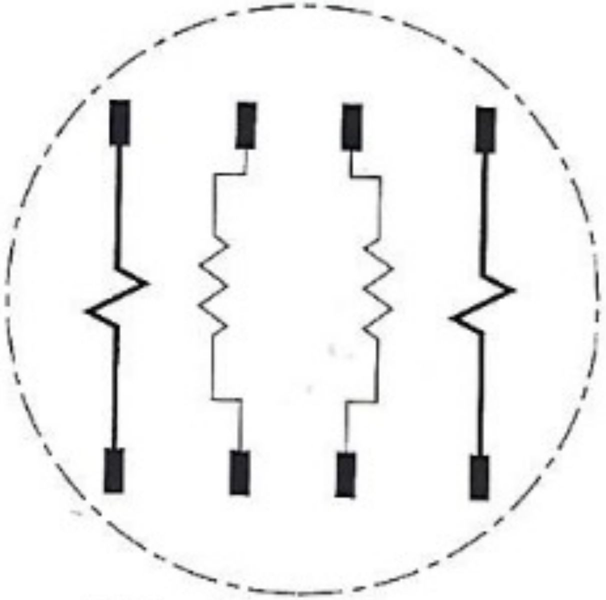
Page 42
Form 5S – TR 3W Network

Three-Wire Network With Two CTs



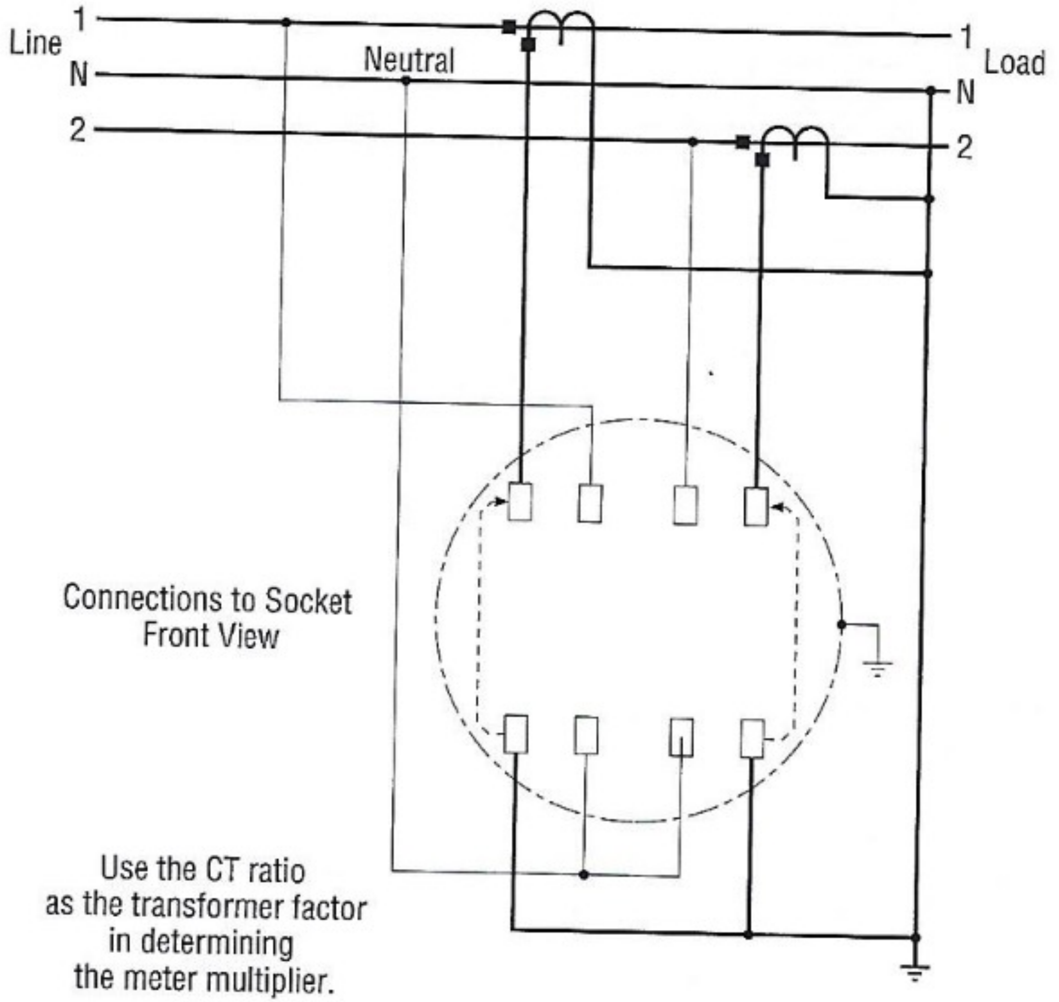
120 volts line-to-neutral
208 volts line-to-line

Form 5S



Meter Internal Wiring
Front View

Page 42
Form 5S – TR 3W Network



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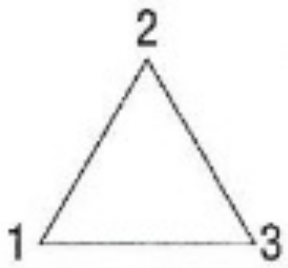
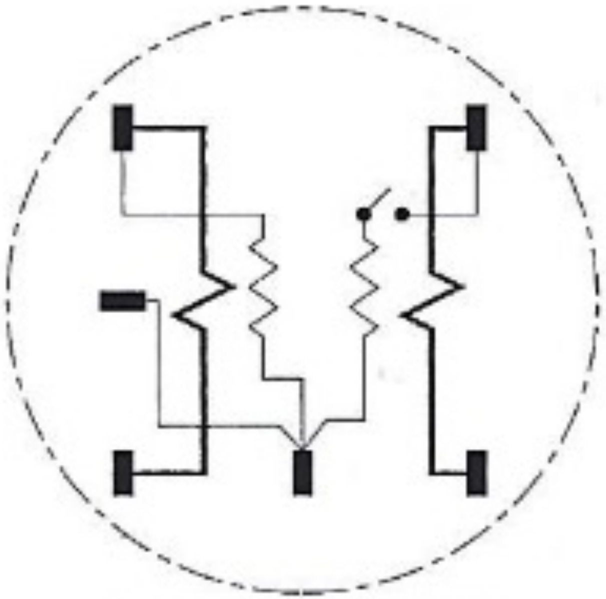
Page 48
Form 12S – SC 3WD

Three-Phase
Three-Wire Delta



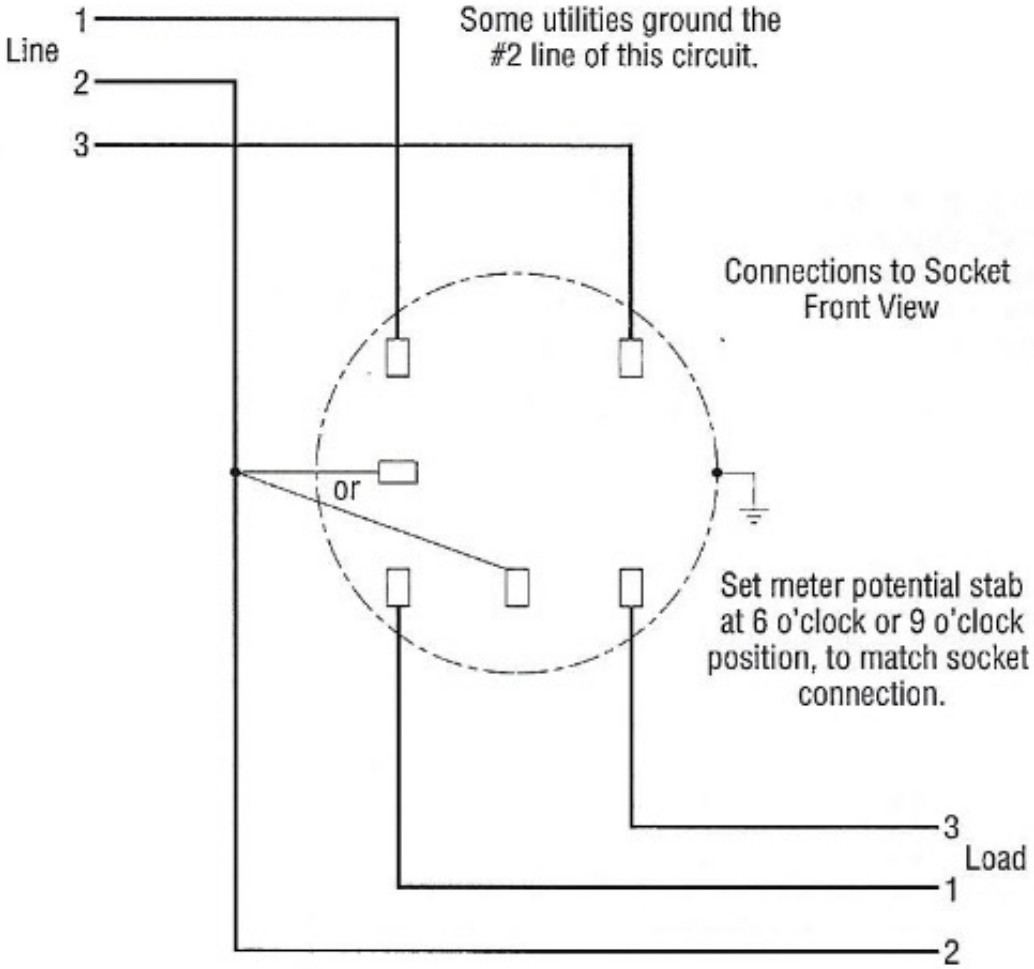
240 volts line-to-line
or 480 volts line-to-line
or 120 volts line-to-line

Form 12S



Meter Internal Wiring
Front View

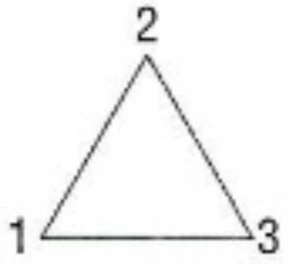
Page 48
Form 12S – SC 3WD



POWERMETRIX

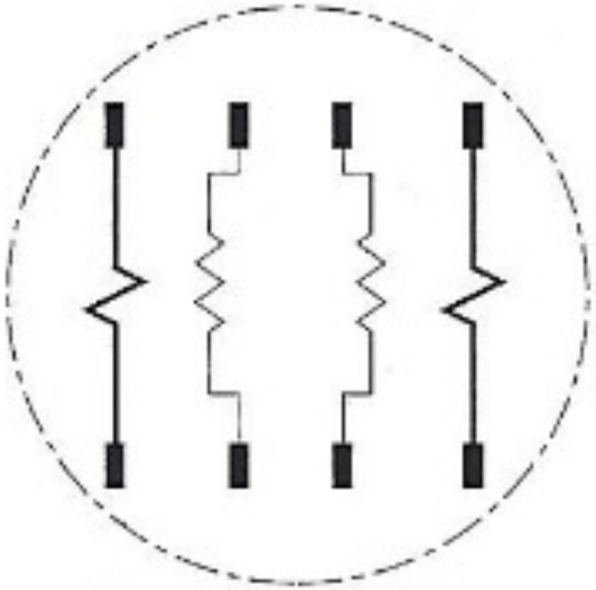
Page 44
Form 5S – TR 3WD

Three-Phase
Three-Wire Delta
With Two CTs



240 volts line-to-line
or 480 volts line-to-line
or 120 volts line-to-line

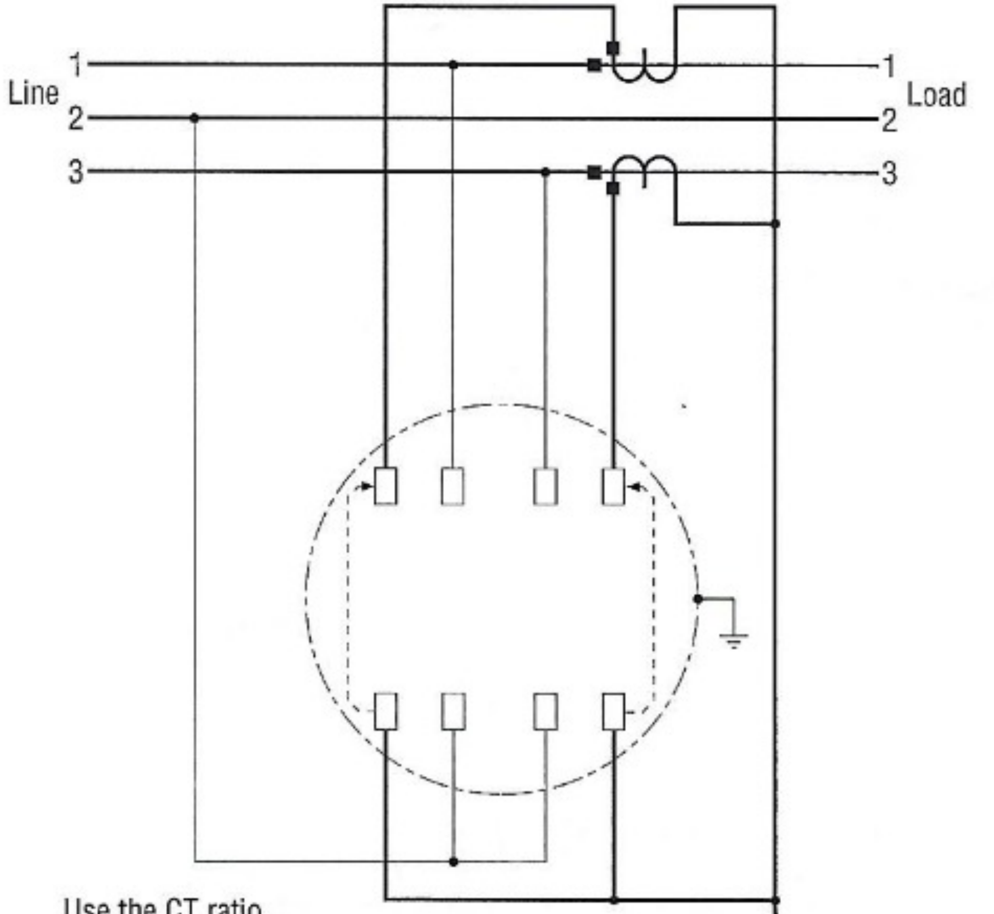
Form 5S



Meter Internal Wiring
Front View

POWERMETRIX

Page 44
Form 5S – TR 3WD



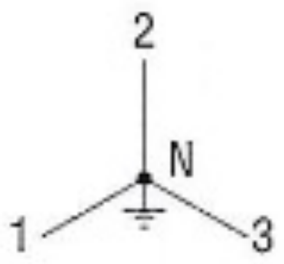
Use the CT ratio
as the transformer factor
in determining
the meter multiplier.

Connections to Socket
Front View

POWERMETRIX

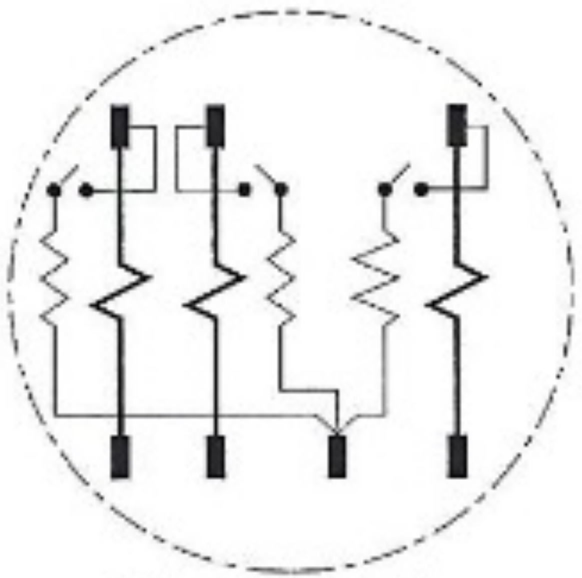
Page 71
Form 16S – SC 4WY

Three-Phase
Four-Wire Wye



208 volts line-to-line
120 volts line-to-neutral
or
480 volts line-to-line
277 volts line-to-neutral

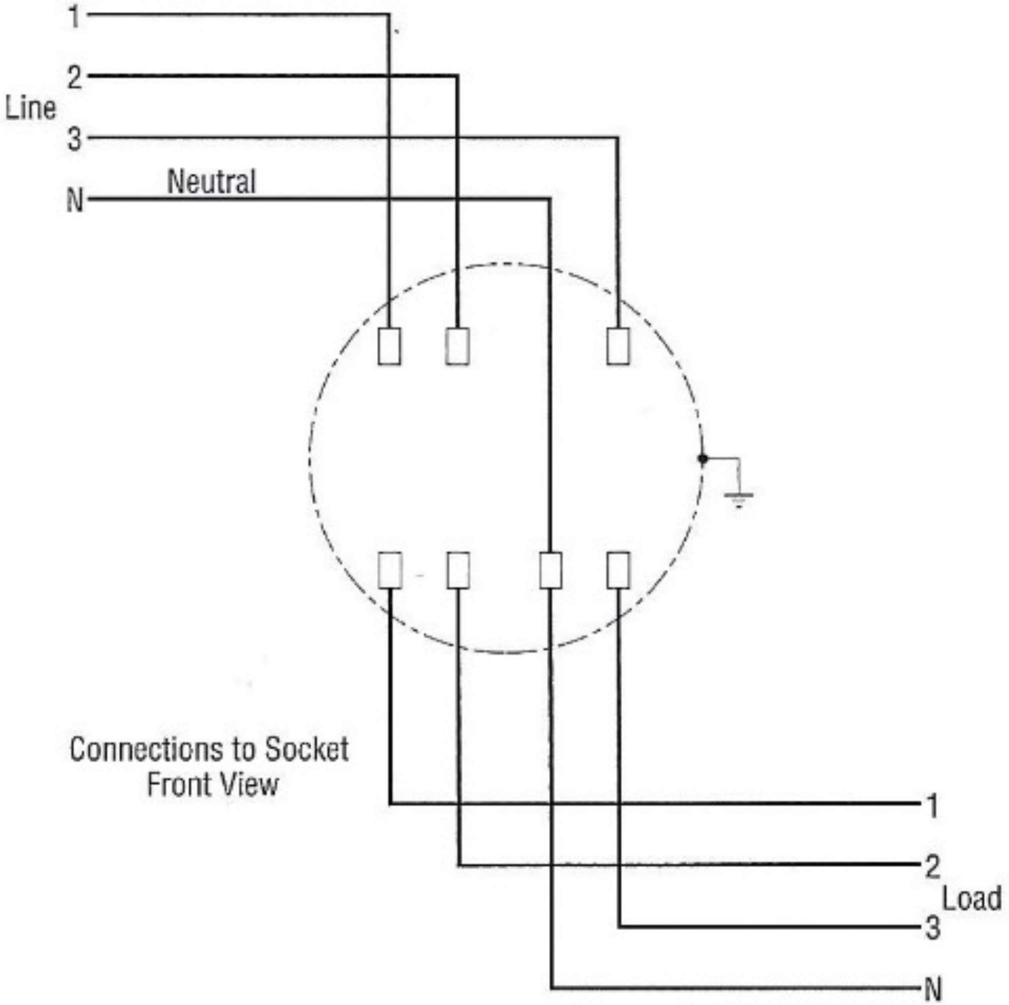
Form 16S



Meter Internal Wiring
Front View

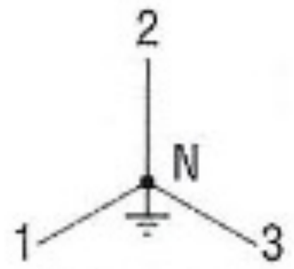
POWERMETRIX

Page 71
Form 16S – SC 4WY



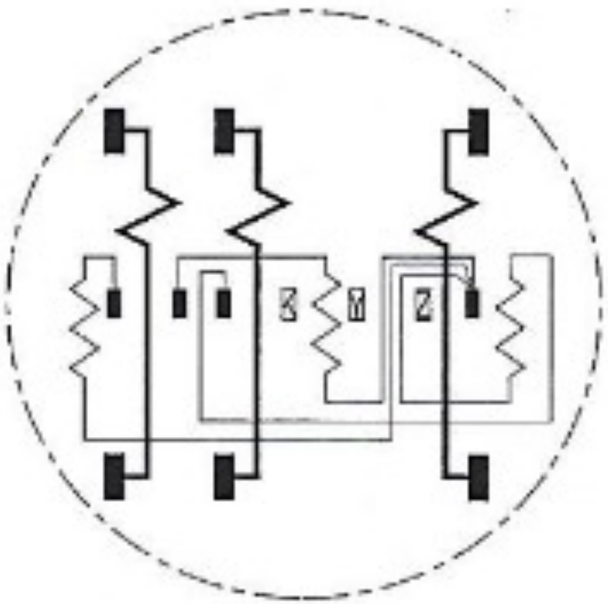
Page 67
Form 9S – TR 4WY

Three-Phase
Four-Wire Wye
With Three VTs and Three CTs



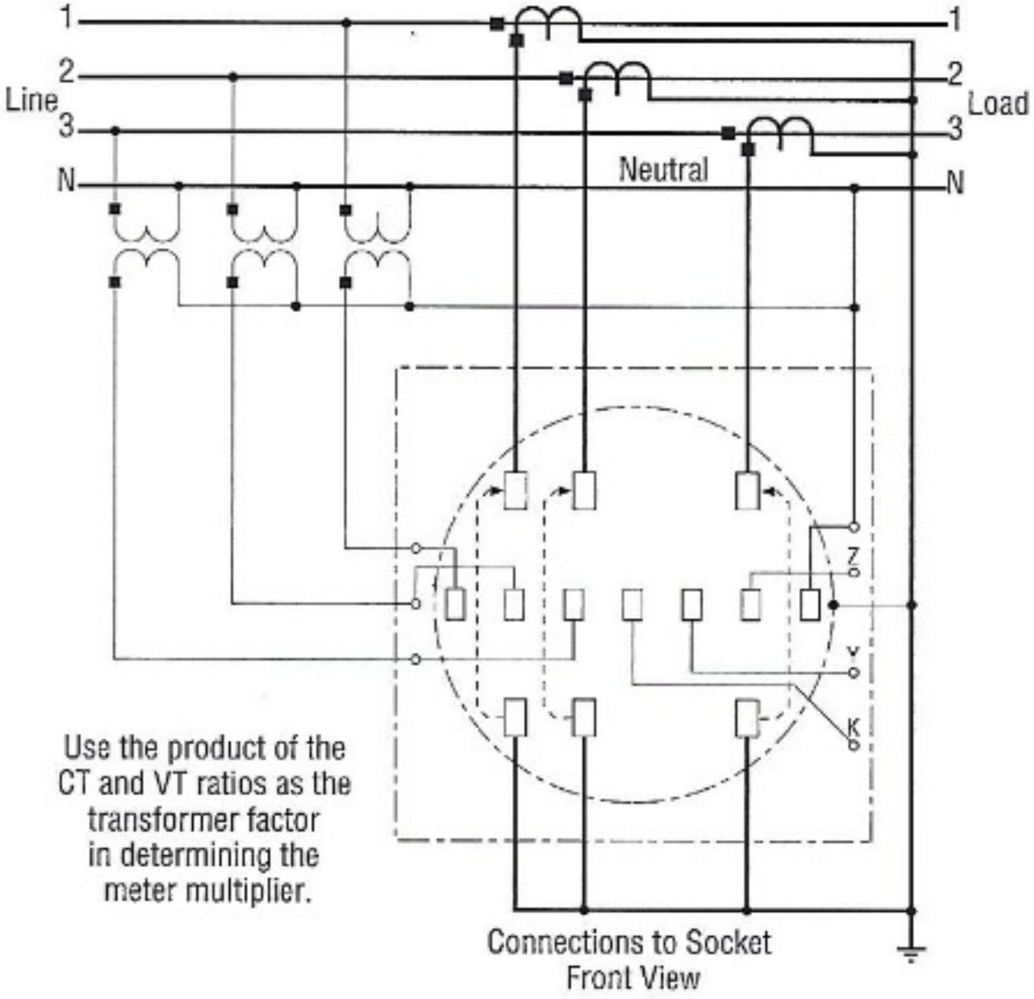
For high voltages.
The VTs apply reduced
voltages to the meter.

Form 9S



Meter Internal Wiring
Front View

Page 67
Form 9S – TR 4WY



Use the product of the CT and VT ratios as the transformer factor in determining the meter multiplier.

Page 87
Meter Socket Checks

The checks on pages 87 through 94 will determine if the socket is wired correctly, or if conditions must be corrected before setting the meter.

Use a fused jumper when making socket meter checks. If accidental contact is made with a voltage, the fuse will blow. To make a fused jumper, install a 1-amp fuse in series with the jumper wires.

Be alert for backfeed. If line voltage is on a load-side terminal, backfeed exists. Check for temporary power still connected, in-feed from solar panels or other generators, and energy diversion. Note: "Green" power makes backfeed more likely.

Use extra caution when 480 volts or higher might be present.

Page 87
Meter Socket Checks

Visual Checks

Before making electrical checks, make these visual checks:

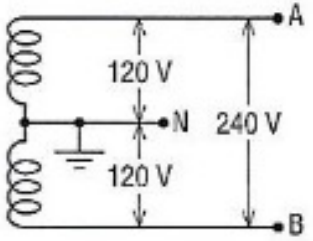
- Socket is firmly mounted and vertical.
- Jaws and terminals are secure.
- Socket jaws are not sprung.
- Conductors are not under undue strain at their terminals.
- Strands have not been removed to squeeze conductors into under-sized terminals.
- Electrical connections are tight.
- There is no possibility of shorting or grounding when the meter is installed.
- Voltmeter leads and clips are in first-class condition.

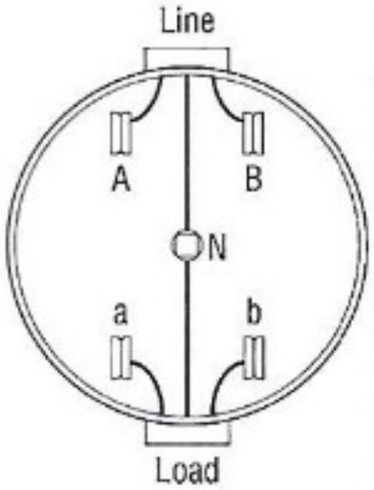
POWERMETRIX

Page 89
Single Phase 3W Meter Check

Single-Phase, Three-Wire

For 240/480V services, double the voltage readings in these checks.





Check 1. Line-side voltage

A to B = 240 volts
A to Neutral = 120 volts
B to Neutral = 120 volts

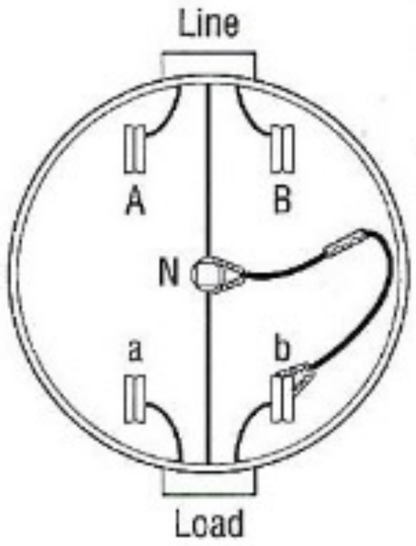
Check 2. Backfeed

a to Neutral = 0 volts
b to Neutral = 0 volts

Voltage reading other than 0 indicates backfeed from the load side.
Do not continue until condition is corrected.

Page 89
Single Phase 3W Meter Check

Use a fused jumper when making socket meter checks.



Check 3. Load-side fault

A to a = 0 volts
B to b = 0 volts

Voltage reading other than 0 indicates a fault from a to N, or b to N. Do not set meter until condition is corrected.

Add temporary jumper - Neutral to b
A to b = 120 volts

Checks the jumper connections before proceeding.

A to a = 0 volts

Voltage reading other than 0 indicates a fault from a to b. Do not set meter until condition is corrected.

Remove jumper.

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