Electricity Metering

Byram's
Metering
Manual

WATTHOUR METERS

A3 ALPHA DEMAND

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BYRAM EST. 1910 Electricity Metering

Valued Customers and Installers

Thank you for buying one of the most popular meters in the US. ABB is the market leader in Revenue Grade, Electricity Metering. Byram is the Exclusive East Coast Meter Center of Excellence for ABB watthour meters.

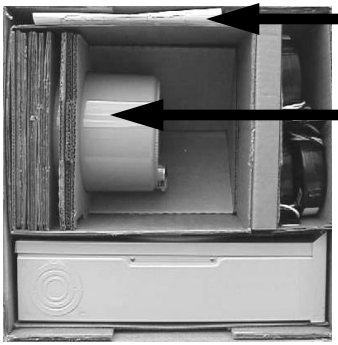
Please read this manual to understand how to install your watthour meter. If you have any questions you can call Byram at 1-800-766-1212, or fax your questions and comments to 908-252-0822. You may also visit Byram's web-site for KWH wiring information, www.byramlabs.com.

If you are the installer, please make sure that the owner receives this instruction manual.

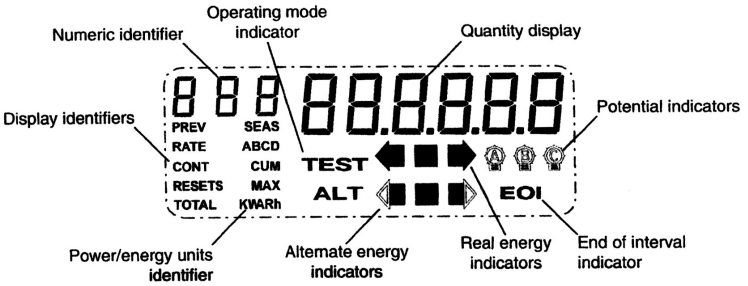
INDEX of topics

Electricity Metering Package

Your meter package will arrive in one box. All components necessary for your meter installation will be included in the meter package.



LCD Display



PREV - indicates the previous billing period or previous season.
RATE - indicates the rate period [TOU only]; used with ABCD
CONT - indicates a continuous demand reading; used with CUM
RESETS - indicates the number of demand resets
TOTAL - indicates total energy value; used with KWARh
SEAS - indicates the previous season information [TOU only]; used with PREV to form PREV SEAS
ABCD - indicates the rate period A, B, C, or D of the displayed data [TOU only]; the active rate blinks when displayed
CUM - indicated cumulative demand value; used with kWARh
MAX - indicates the maximum demand value; used with kWARh
KWARh - indicates power or energy as follows; kW, kWh, kVA, kVAh, kVAR, kVARh

READING THE ALPHA METER

When your Alpha Meter is powered up, an LCD display test and an alternative display test takes place. All Alpha Meters come with a default program in the following sequence. Unless you requested a specific program, your Alpha Meter will display the default program sequence and quantities.

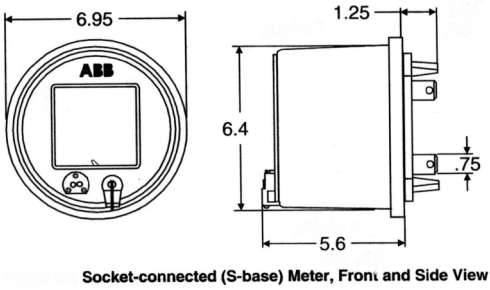
ID	Displayed Quantity	Definition
001	*Subinterval and Interval*	Length of demand interval and subinterval in minutes. Default program is a 15 minute demand interval, without a subinterval. The display will be15-15.
002	*Total kWh – Del*	Total energy accumulated in kWh from the metered load. This is the total kilowatthours consumed by the metered load. This is an accumulation of energy over time and does not reset. To measure a months energy one would have to sub tract the previous month's reading from the current month's reading.
003	*Max kW – Del*	Maximum kW used in the demand interval. This value represents the highest kilowatts consumed during the 15 minute interval. This value resets to zero when the demand reset button is pressed.
004	*Cum kW – Del*	This is a cumulative value of all previous max values. The previous Max value is a added to the Cum value when the demand reset button is pressed. This is a control feature to notify when a demand reset has been performed. Example: First month maximum kW-del is 5, the Cum would become 5 after reset. The second month maximum kW-del is 10, the Cum becomes 15 after reset, and so on.
888	*Complete LCD test*	All segments are turned on to verify the LCD is functioning properly.

ID: The Numeric Identifier is a three-digit field that uniquely identifies the displayed quantity.

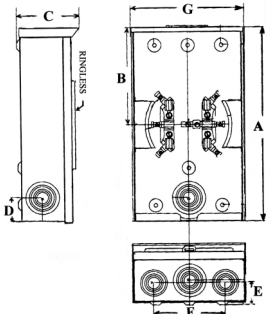
DISPLAYED QUANTITY: This contains the numeric value for the displayed quantity. The types of displayed quantities are defined at the time of programming. The definition of each quantity is noted above.

INSTALLING AND REMOVING THE A3 ALPHA METER - Direct connect to socket no CTs

The meters are calibrated and tested before shipping , and are ready for installation. The Alpha meter fits all standard socket connected (S type) services. With the optional S type to A type adapter it will fit all standard bottom connected services.



Socket-connected (S-base) Meter, Front and Side View



Dimensional data subject to change. Typical socket

Installing a S type socket connected unit

1. Check the socket to make sure the wiring of the service matches the base form of the unit
2. Remove any paint from the socket rim at the point of contact with the ground strap of the Alpha+ lightning arrester, to insure the meter is grounded.
3. Align the meter blades and the socket jaws on the base of the unit with the service socket
4. Plug the unit into the socket by grasping each side of the meter and push it into the socket until it is firmly in place.
5. After the meter is plugged in, apply power.
6. Record any information you need about the meter like location, & serial number, and then verify the following:

- The system service test [if enabled] shows the valid service for this location. The phase rotation, service voltage, and service type should be indicated on the LCD.
- All potential indicators are present and not flashing. The potential indicators are located on the left side of the LCD in the diagram on page 3. If an indicator is blinking that phase voltage is missing or below minimum level.
- The real energy indicators should be flashing, and arrows indicate the correct direction of energy flow.
- The meter is NOT in the test mode.
- Required meter seals are installed.

WARRANTY

- Byram Labs will replace or repair (at it's option) any ABB metering product purchased through Byram Labs which contains defects in material or workmanship.
- The product has a limited warranty of 18 months from the date of shipment or 12 months from date of installation. Additional warranties are available.
- The limited warranty does not include the cost of removal or reinstallation or any associated labor costs, or transportation (freight) costs.
- The warranty does not include misapplication of the metering product, alteration of the metering product from it's intended configuration, use of the metering product with other products not recommended by ABB, or abuse.
- Byram must be notified within 30 days of the assumed defect.
- No warranties, expressed or implied, including warranties or fitness for a particular purpose or merchantability, or warnings arising from the course of dealing or usage of trade, are made regarding the information, recommendations, descriptions, warnings, and cautions contained herein.
- In no event will Byram Labs or ABB be responsible to the user on contract, in tort, (including negligence), strict liability or otherwise for any special indirect, incidental, or consequential damage or loss whatsoever, including but not limited to, damage to or loss of use of equipment; cost of capital; loss of profits or revenues; or claims against the user by its customers resulting from the use of the information, recommendations, descriptions, and safety notices contained herein.

SAFETY

- The installer should follow all appropriate and applicable OSHA, and local safety requirements.
- Caution - make sure the meter you are installing matches the service type (form), current class, and capacity required. Installing a mismatched meter can cause serious damage to the installer and the equipment. Do not use with phase shifting transformers.
- **Warning** Circuit closing devices must be used on current transformer secondaries. Dangerous currents and voltages are present when secondaries are open circuited. Personal injury, death, and/or equipment damage can result if circuit closing devices are not used.
- Use authorized utility procedures to install ground connections before wiring meter.

Removing the S-type meter from service

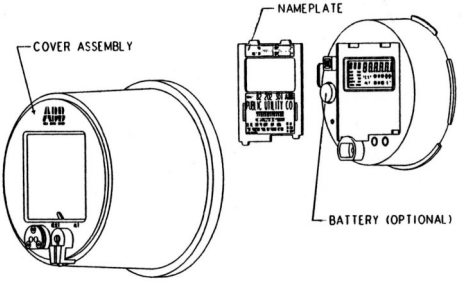
Warning - Use authorized utility procedures to remove metering equipment. Dangerous voltages are present, and personal injury, death, or equipment damage can result if safety precautions are not followed.

Warning - When you remove a socket connected S-type meter that will not immediately be replaced, always install a cover plate over the socket hole. Failure to do so will expose dangerous voltages causing personal injury, death, or damage to equipment.

To remove a socket –connected S-type unit, follow these steps:

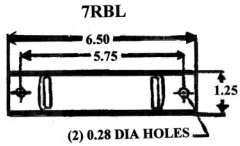
1. Prior to disconnecting the unit, make sure you have recorded the register data either optically, via software or at least manually writing down all data on the LCD.
2. Remove power from the unit.
3. Break the seal holding the unit in place.
4. Remove the seal, and collar [or other security /locking device]
5. Remove the unit from the socket firmly grasp each side of the unit, and gently pull it out from the socket. If the unit resists being pulled, gently rock the meter from top to bottom as you pull. DO NOT try to force it off with a screw driver or crow bar.

Internal Battery



If your meter has an optional battery please call us before trying to change the battery

INSTALLING TRANSFORMER TYPE METERS



How to Install-

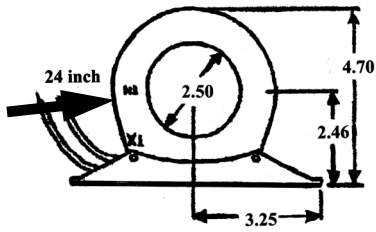
1. Use authorized Utility procedures to make sure that the power to the Socket is turned off. To be sure that the power is off, always use a quality multimeter to check for both AC and DC voltages that might be present.
2. Make sure to use the correct transformer for the maximum amps and voltage of the supply from the utility.
3. Install the current transformers to each wire to be measured. Make sure that the transformers are installed in the correct direction per the below diagram. This will involve breaking the circuit, placing the wire through the transformer, and reconnecting the wire. If you are using split core transformers you do not need to break the circuit.
4. Make sure that all transformers have the same rating.
5. Make sure that the meter is the correct form to use with the socket [example - 5S meter with a 5S socket]
6. Wire the transformer leads to the socket making sure to use the correct wiring diagram. Some of the circuits diagrams are on the following pages.
7. Make your voltage connections.
8. Carefully push the meter into the socket, making sure that there is a firm connection.
9. Restore power to the socket using Utility procedures.
10. Test the meter to make sure that it is energized.
11. Now follow the procedures from page 5 item 6.

Package transformer

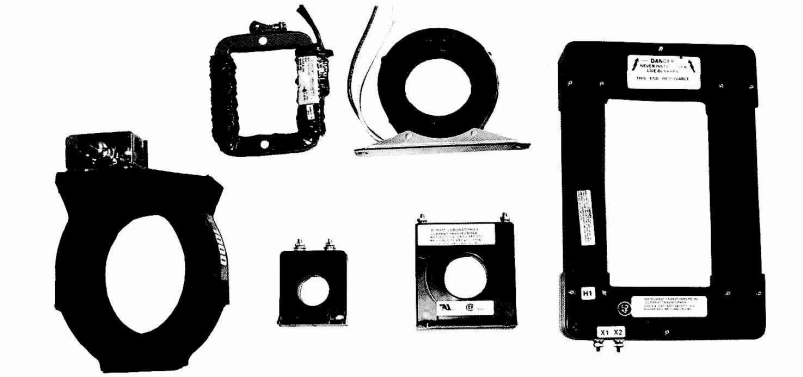
H1 Marking on transformer
Should be on supply side.

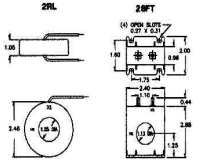
X1 White lead

X2 Black lead



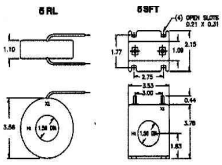
Current Transformers





Series 2SFT
Series 2RL

Catalog #	Current Ratio	Accuracy @ 60 Hz	Burden VA @ 60 Hz	Price
INS2SFT-500	50:5	3%	2.0	$32
INS2SFT-101	100:5	1%	2.0	$32
INS2SFT-201	200:5	1%	4.0	$32
INS2SFT-301	300:5	1%	8.0	$32
INS2AL-500	50:5	3%	2.0	$32
INS2AL-101	100:5	1%	2.0	$32
INS2AL-201	200:5	1%	4.0	$32
INS2AL-301	300:5	1%	8.0	$32



Series 5SFT
Series 5RL

Catalog #	Current ratio	Accuracy @ 60 Hz	Burden VA @ 60 Hz	Price
INS5SFT-500	50:5	2%	2.0	$32
INS5SFT-101	100:5	2%	2.0	$32
INS5SFT-201	200:5	1%	4.0	$32
INS5SFT-301	300:5	1%	8.0	$32
INS5RL-500	50:5	2%	2.0	$32
INS5RL-101	100:5	2%	2.0	$32
INS5RL-201	200:5	1%	4.0	$32
INS5RL-301	300:5	1%	8.0	$32

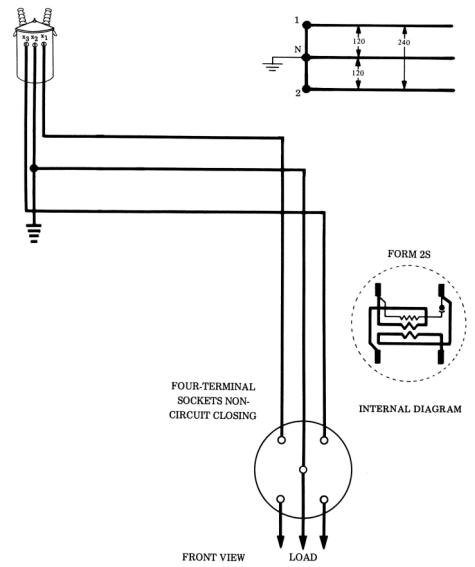
WICC Split Core Current Transformers
3SP Window size 2.19" X 3.25"
5SP Window size 2.88" X 4.25"

Catalog #	Ratio	Price
WIC 3SP-100-00	100:5	$80
WIC 3SP-200-00	200:5	$80
WIC 3SP-400-00	400:5	$80
WIC 3SP-600-00	600:5	$87
WIC 3SP-800-00	800:5	$87
WIC 5SP-200-00	200:5	$101
WIC 5SP-400-00	400:5	$101
WIC 5SP-600-00	600:5	$101
WIC 5SP-800-00	800:5	$115

Type CMV Current Transformers
For 600V Systems, 200-4000A
25-60 Hz, Indoor or outdoor
Tapered bottom style

Part #	Primary amp rating	Price
7883A44G25	200	$152
7883A44G26	300	$152
7883A44G28	600	$152
7883A44G29	800	$152
7883A44G30	1000	$152
7883A44G33	2000	$168

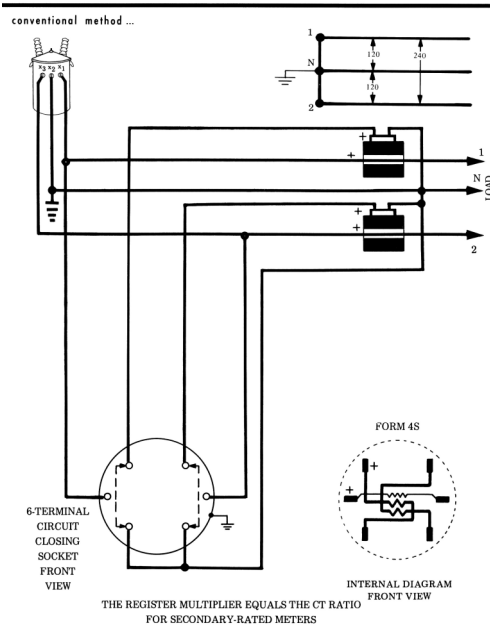
Measurement of energy from a grounded neutral - 120/240 volt single-phase, three-wire supply, 3-wire service



Form 2S

Single-Phase, Three-Wire

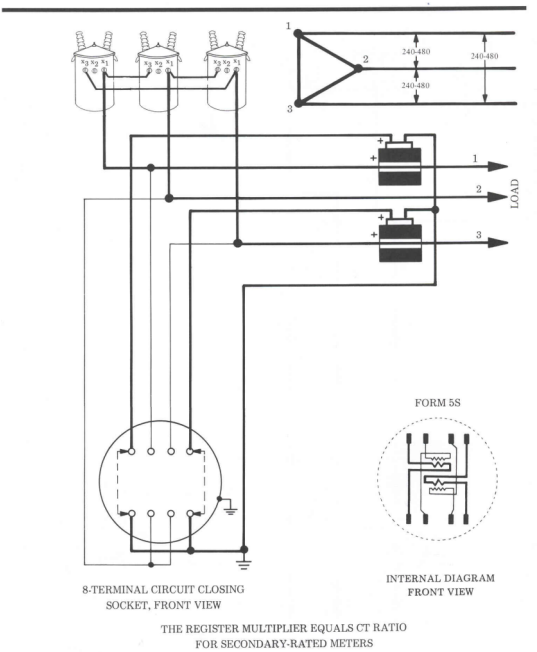
Measurement of energy on a single-phase, three-wire service with 2 CT's and a three-wire single-phase meter



Form 4S

Single-Phase with two window type transformers

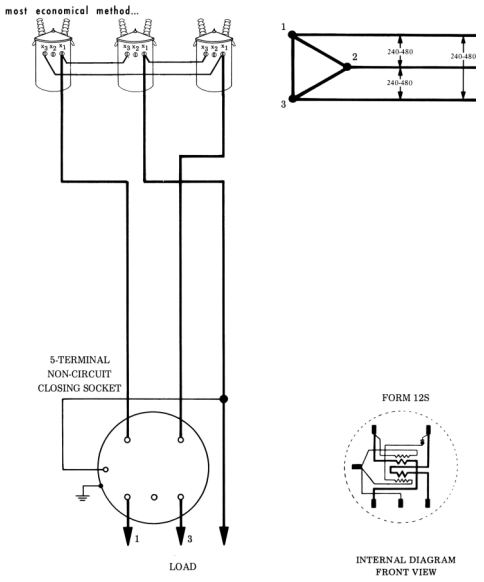
Measurement of energy on a three-phase, three-wire Delta service with 2 CT's and a 2-stator meter



Form 5S

Three-Phase,
Three-Wire Delta

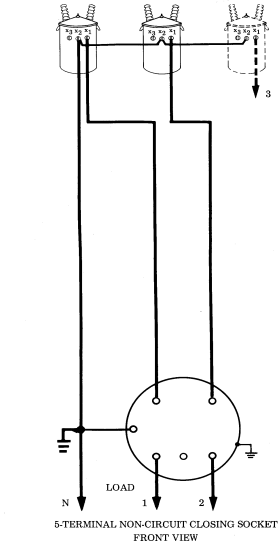
Measurement of energy on a three-phase, three-wire Delta service with a 2-stator meter

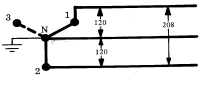


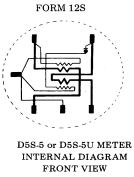
Form 12S

Three-Phase,
Three-Wire Delta

Measurement of energy on a network, three-wire, 120/208-volt service with a 2-stator meter



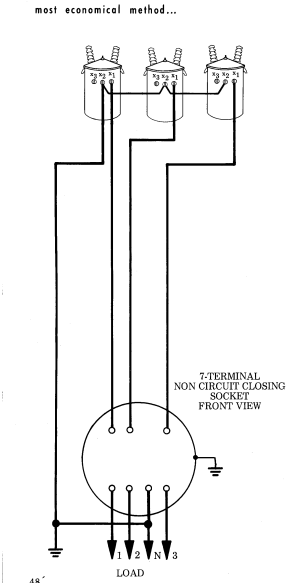


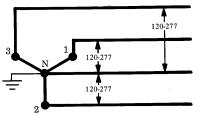


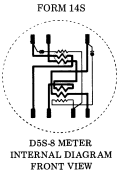
Form 12S

Network,
Three-Wire

Measurement of energy on a three-phase, four-wire Wye service with a 2-1/2-stator meter



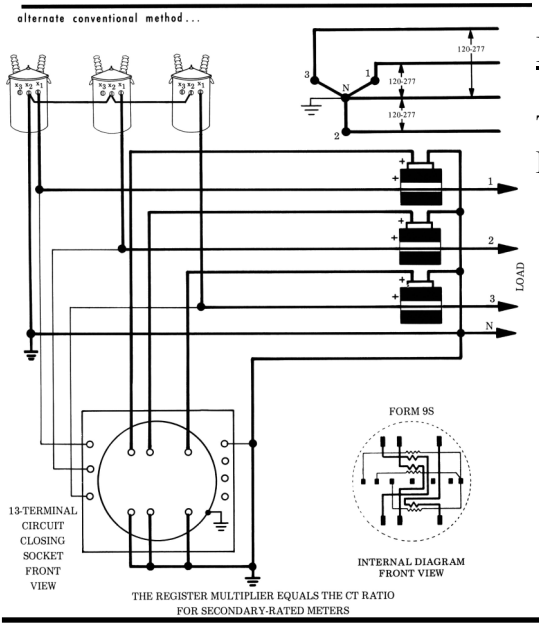




Form 14S

Three-Phase,
Four-Wire Wye

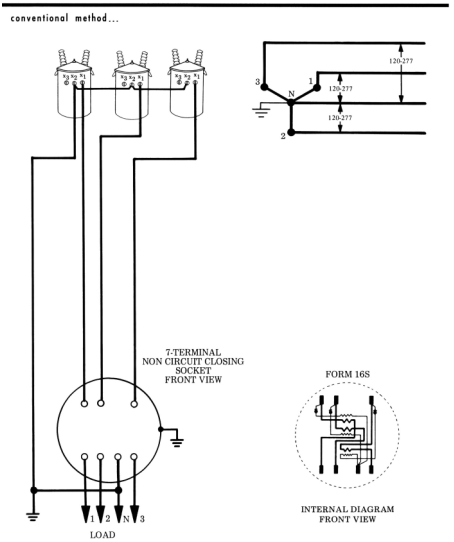
Measurement of energy on a three-phase, four-wire Wye service with 3 CT's and a 3-stator meter



Form 9S

Three-Phase,
Four-Wire Wye

Measurement of energy on a three-phase, four-wire Wye service with a 3-stator meter



Form 16S

Three-Phase,
Four-Wire Wye

If the diagram you need is not here call 1-800-766-1212

Specifications of the A3 Alpha Meter

Absolute maximums

- Continuous voltage - 528VAC
- Surge voltage ANSI C37.90.1 Oscillatory 2.5 kV, 2500 strikes
  Fast transient 5 kV, 2500 strikes
  ANSI C62.41: 6 kV@ 1.2/50 us, 10 strikes
  IEC 61000-4-4: 4 kV, 2.5 kHZ repetitive burst for 1 min.
  Dielectric [ANSI C12.16]: 2.5 kV @ 60 HZ, 60 sec.
- Current - continuous : 120 % class of meter
- Temporary - [1 sec]: 200% of meter class
- Humidity range 0 to 100 % RH [non condensing]

Operating Ranges

- 120 - 480V nameplate has operating range 96V to 528V
- Current - 0 to maximum amperes
- Frequency - nominal+/- 5%
- Temperature—40 to 85 Celsius [inside meter cover]

Operating Characteristics

- Burden - Power supply [phase A] lass than 34watts
- Per phase current burden 0.1 milliohms typical at 25 Celsius
- Per phase voltage burden 0.008 watts @ 120 VAC
  0.03 watts @240 VAC
  0.04 watts @ 277 VAC
- Accuracy - with load: +/- {0.2 + .001[class/l][1 + Tan0)]}%
- Voltage coefficient: +/-0.01% change in voltage from nominal
- Temperature coefficient: +/- 0.01% per degree Celsius
  Starting current:
  form 1S an 3S = 10ma class20, 100ma class 200, 160ma class 320
  all other forms = 5ma class 20, 50 ma class 200, 80ma class 320
- Start up delay: 3 sec from power application to accumulation.
- Creep @ 0.000 amps: no more that one pulse per quantity ANSI C12.1
- Outage carryover - 6 hours at 25C. Supercapacitor rated @ 0.1 F, 5.5V
- Communications - optical port 9600 baud nom., option 1200 to 19,200 BPS
- Optional LiSOC12 battery: 800 mAhr, 3.6V: 5 years @ 25 Celsius projected life > 20 years typical

HANDY TABLES AND FORMULAS

Formulas for determining amperes, hp, kw, and kva

to find	direct current	alternating current		
		single phase	two phase-4 wire*	three phase
amperes when horsepower is known	$\frac{hp \times 746}{E \times \% \text{ eff}}$	$\frac{hp \times 746}{E \times \% \text{ eff} \times p\text{-}f}$	$\frac{hp \times 746}{2 \times E \times \% \text{ eff} \times p\text{-}f}$	$\frac{hp \times 746}{1.73 \times E \times \% \text{ eff} \times p\text{-}f}$
amperes when kilwatts is known	$\frac{kw \times 1000}{E}$	$\frac{kw \times 1000}{E \times p\text{-}f}$	$\frac{kw \times 1000}{2 \times E \times p\text{-}f}$	$\frac{kw \times 1000}{1.73 \times E \times p\text{-}f}$
amperes when kva is known		$\frac{kva \times 1000}{E}$	$\frac{kva \times 1000}{2 \times E}$	$\frac{kva \times 1000}{1.73 \times E}$
kilowatts	$\frac{I \times E}{1000}$	$\frac{I \times E \times p\text{-}f}{1000}$	$\frac{I \times E \times 2 \times p\text{-}f}{1000}$	$\frac{I \times E \times 1.73 \times p\text{-}f}{1000}$
kva		$\frac{I \times E}{1000}$	$\frac{I \times E \times 2}{1000}$	$\frac{I \times E \times 1.73}{1000}$
horsepower (output)	$\frac{I \times E \times \% \text{ eff}}{746}$	$\frac{I \times E \times \% \text{ eff} \times p\text{-}f}{746}$	$\frac{I \times E \times 2 \times \% \text{ eff} \times p\text{-}f}{746}$	$\frac{I \times E \times 1.73 \times \% \text{ eff} \times p\text{-}f}{746}$

*For 3-wire, 2-phase circuits the current in the common conductor is 1.41 times that in either of the two other conductors.

Common electrical terms

ampere (I) = unit of current or rate of flow of electricity
volt (E) = unit of electromotive force
ohm (R) = unit of resistance
ohms law—$I=\frac{E}{R}$ (d-c or 100% p-f)
megohm = 1,000,000 ohms
volt amperes (va) = unit of apparent power
= EI (single phase)
= E x I x 1.73 (3-phase)
kilovolt amperes (kva) = 1000 volt-amperes
watt (w) = unit of true power
= va x p-f
= .00134 hp
kilowatt (kw) = 1000 watts
power factor (p-f) = ratio of true to apparent power
$= \frac{w}{va}$ or $\frac{kw}{kva}$
watthour (whr) = unit of electrical work
= one watt for one hour
= 3.413 Btu
= 2,655 ft lbs
kilowatthour (kwhr) = 1000 watthours
horsepower (hp) = measure of time rate of doing work
= equivalent of raising 33,000 lbs, one ft in one minute
= 746 watts
demand factor = ratio of maximum demand to the total connected load
diversity factor = ratio of the sum of individual maximum demands of the various subdividions of a system to the maximum demand of the whole system
load factor = ratio of the average load over a designated period of time to the peak load occurring in that period

How to compute power factor

Determining watts: $p\text{-}f = \frac{\text{watts}}{\text{volts x amperes}}$

1. From watthour meter.
watts = rpm of disc x 60 x kh
Where kh is meter constant printed on face or nameplate of meter.
If metering transformers are used, above must be multiplied by the transformer ratios.

2. Directly from wattmeter reading.
where:
volts = line-to-line voltage as measured by voltmeter
amps = current measured in line wire (not neutral) by ammeter.

Conversion factors

$C° = \frac{5}{9} \times (F° - 32°)$ $F° = \frac{9}{5}C° + 32°$

C°	–15	–10	–5	0	5	10	15	20
F°	5	14	23	32	41	50	59	68
C°	25	30	35	40	45	50	55	60
F°	77	86	95	104	113	122	131	140
C°	65	70	75	80	85	90	95	100
F°	149	158	167	176	185	194	203	212

1 inch = 2.54 centimeters
1 kilogram = 2.20 lbs
1 square inch = 1,273,200 circular mills
1 circular mill = .785 square mill
1 btu = 778 ft lbs
= 252 calories
1 year = 8,760 hours

Byram Labs, located in Branchburg NJ, is a world class distributor, manufacturer, modification center, and calibration facility, serving the electrical, electronics, and process markets with products that include test equipment, calibrators, analog and digital panel meters, and electrical

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