GE kV2c™ Encompass Electronic Meter

Product Description,
Operating Instructions,
Maintenance Instructions,
Upgrading,
Site Analysis Guides,
Diagrams.

Price: $ 30.00

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1. Product Description

GE's kV2c Multifunction Meter represents a new level of functionality in revenue grade electricity meters. By building on the foundation of the GE kV2 Vector Electricity Meter and the addition of a wide range of powerful new meter functions, GE has created a new standard for meter capability.

Figure 1-1: The kV2c Meter

The kV2c meter retains the familiar characteristics of the kV2 meter, including:

Fitzall™ operation and consolidated forms, 57 to 120 or 120 to 480 Volt measurement capability, service installation analysis (Site Genie™), , event logging and power quality monitoring, accurate measurement in the presence of DC currents, and standardized meter reading (ANSI C12.18) and programming (ANSI C12.19).

The kV2c meter also provides a wide range of new features, making it the most powerful meter of its kind anywhere. These include an extended range of software configurable features (soft switches), alphanumeric display, enhanced energy, demand, and time of use

billing measures, new power quality analysis tools, measurement correction features, powerful logging and recording functions, built in totalization, and much more.

1.1 General Information

The kV2c Meter is similar to the kV2 Meter in physical construction and in its measurement principles:

- Dependable apparent power measurements for unbalanced loads and asymmetrical services. IEEE-defined vector calculations of polyphase quantities.
- Accurate measurement in the presence of DC currents.
- Fundamental only or fundamental plus harmonics measurements
- Distortion power and distortion power factor measurements
- Elimination of P/I ratios and meter measurement constants
- Demand meter with Load Profile recording in addition to flexible energy, demand, and TOU modes
- All nonvolatile data storage including Load Profile data
- Support for ANSI Reading and Programming Standards C12.18 and C12.19
- Fitzall™ operation for reduction of stocked form variations
- Wide voltage range operation
- Optional internal telephone modem
- Optional RS 232 / 485 communications interface
- Optional output pulse initiators

The kV2c meter additionally incorporates many new physical and functional features substantially enhancing its capability.

- Alphanumeric display
- Optocom communications up to 56k baud
- Optional battery hatch for battery replacement through the cover
- Optional high precision oscillator for accurate timekeeping in installations with unstable line frequency
- Optional Multifunction I/O board for up to 8 pulse outputs and 4 inputs, plus real time pricing input
- Capability for future firmware upgrades in the field
- Expanded set of soft switched features for easy field enabling of powerful new features
- Built in load profile and event logging features (under soft switch control), no option board required. Load profile of up to 20 data channels.
- Energy, demand, and TOU metering including real and reactive, bi-directional, 4 quadrant, per phase, and coincident quantities, more displayables, bigger tables, and more.

- Power Quality monitoring features including voltage sag and swell detection with programmable magnitude and duration down to 1 cycle, total Demand Distortion calculation, waveform capture and harmonic analysis
- Pulse inputs from up to 4 other meters with flexible totalization and processing options
- Correction of VT and CT error factors
- Transformer and line loss compensation

The features of the meter are described more fully in book GEH-7285A, “kV2C Meter Features and Applications”.

1.1.1 Physical Description

The kV2c meter uses a clear Lexan™ cover. The cover is molded in one piece and has an integrated Optocom communications port and demand reset mechanism. An optional battery port can be ordered in the cover to enable changing the battery without removing the meter cover.

The meter base assembly provides provision for connection of the meter to the electrical service to be metered, the basic physical structure, and current scaling devices. All common S base and A base (bottom connected) configurations are provided.

The electronics module contains the circuit power supply, all circuits for measurement, calculation, and display of meter data, and the connector for attachment of option boards.

The nameplate is removable and contains information not found on conventional meters. All the markings on the meter face are identified in Chapter 2, Operating Instructions.

The liquid crystal display indicates energy consumption and various other data. The display is covered in detail in Chapter 2, Operating Instructions. The 6 large characters of the display can display either numeric or alphabetic information.

The alternate display switch is located on the right side of the meter face slightly below the 3 o’clock position and is activated by a magnet. The switch and its use is also described in detail in Chapter 2, Operating Instructions.

The demand reset and test switches are located at the 5 o’clock position of the meter face. The test switch has no external access. The cover must be removed to operate the switch.

An optical (OPTOCOM™) port is located in the 7 o’clock position of the meter face. The optical port allows a computer to communicate with the meter for reading and programming using Standard Tables (ANSI C12.19) and PSEM (Protocol Specification for Electricity Meters [ANSI C12.18]). The kV2c Optocom™ port can operate at speeds from 9600 to 56k baud.

The battery for the time-of-use option is visible at the 9 o’clock position. It is the industry-standard battery.

1.1.2 Meter Forms

The ANSI Standard S Base (socketed) and A Base (bottom connected) Meter Forms are shown in Table 1-1.

Table 1-1. ANSI Standard Meter Forms

Form	Wires	Circuit	Elements	SC/TR	Class
1S	2	1Ø	1	SC	200, or 320
2S	3	1Ø	1	SC	200, or 320
3S	2	1Ø	1	TR	20
4S	3	1Ø	1	TR	20
9S, 10A, 48A	4	3Ø Y or Δ	3	TR	20
12S	3	Network or 3ØΔ	2	SC	200, or 320
13A	3	Network or 3ØΔ	2	SC	150
16S	4	3Ø Y or Δ	3	SC	200, or 320
16A	4	3Ø Y or Δ	3	SC	150
36S[1,3] 36A[1,3,4]	4	3Ø Y	2½	TR	20
45S[2,3] 56S[5] 45A[2, 3]	3,4,5	1Ø, 2Ø, Network, 3Ø Y or Δ	2	TR	20
9S	4	3Ø			200, or 320

Form	Wires	Circuit	Elements	SC/TR	Class
10A (No KYZ)	4	3Ø		TR	20
45A (No KYZ)	3	3Ø		TR	20
2S		1Ø		SC	200
16S		3Ø		SC	200
16SB	4	3Ø		SC	20
12SB	3	3Ø			20
3CS	2	1Ø	1	TR	20

Notes:

[3]. These forms are the traditional 2 ½-and 2-element solution for metering 4-wire circuits in the United States. However, 2 ½- and 2-element meters in 4-wire circuits do not produce a Blondel solution. Without a Blondel solution, systematic errors may occur when a voltage imbalance exists.

1.1.2.1 Fitzall™ Operation

The GE Fitzall™ feature, combined with wide voltage range operation, allows users to meter a wide variety of service types with only 2 basic meter types. A basic form 9S (or 10A, 48A) meter is used for transformer rated applications and form 16S (or 16A) is used for self contained applications. By using the MeterMate™ software to convert the meter for a different service type and providing an appropriately wired socket, any service can be metered. See Fitzall™ instruction book GEI-52590 for details.

1.1.3 Physical variants available

The basic physical description of the meter and available S base and A base forms have been described above. Switchboard configurations will also be available.

1.1.3.1 Voltage ratings

The standard meter voltage rating is 120V to 480 V, +10% / -20%. A low voltage version is also available for 57V to 120V applications. Choices of these variants must be made when the meter is ordered.

1.1.3.2 Timebase

The standard meter keeps time from the line frequency. A special version is available with a high precision crystal oscillator for use where line frequency does not provide adequate stability for line based time keeping. Choices of these variants must be made when the meter is ordered.

1.1.4 Hardware Options

Each of the features described in this section is a hardware option that can be added to the meter. Note that option boards are generally NOT INTERCHANGABLE between the kV and kV2c meters but can be changed between a kV2 and kV2C meter. However, the kV modem and RSX boards may be used in either the kV or kV2 or kV2c. No other common usage is permitted.

1.1.4.1 Battery port

The kV2c meter offers a cover battery port enabling changing of the meter (TOU) battery without removing the meter cover. This battery is used for time keeping during power outages. Covers with battery ports may be ordered with the meter or retrofitted in the field.

1.1.4.2 Communications option boards

Two communications options boards are offered for the kV2c. One is an internal 2400 baud telephone modem circuit board (type T-2). The second is the RSX board (type RSX-2), which is used to connect the meter to an external modem via a RS-232 interface or to provide for data connection to a RS-485 system. Either the internal modem or RSX board may be installed, but not both at the same time. These communications options may be ordered with the meter or installed in the field.

1.1.4.3 Input / Output option boards

Two types of I/O option boards are available for the kV2c meter.

The Simple I/O board (type S I/O-1) provides two form C outputs, one form A output, and one Real Time Pricing input to the meter. The outputs are programmable to provide a variety of functions including energy pulses, alerts, or End of Interval indication.

The Multiple I/O board (type M I/O-1) provides two form C outputs (with a common K connection), six form A outputs (with one common connection), one Real Time Pricing input, and four pulse inputs to the meter which may be used as either 3 wire (form C) or 2 wire (form A) inputs. Pulse inputs are used as data inputs to the meter. Processing of this data is very flexible, including most processes used for internal measurements and totalization. Either of the I/O boards may be installed, but not both at the same time. These options may be ordered with the meter or installed in the field.

Note that throughout this document when we refer to Form A pulse initiator outputs we are technically referring to two-wire, bi-stable outputs. Every contact change of state represents the programmed value of wh/varh/Qh/VAh. Strictly speaking, a traditional Form A output represents a normally open, momentary closure type of output where one cycle (from open to closed to open again) represented the desired output value. Most modern solid state metering products, including the kV and kV2c meters, have adopted the revised definition of Form A outputs where each change of state (from open to closed, or from closed to open) represents the desired output value. Similarly, every change of state is counted as a pulse for the external inputs (Form A or Form C).

1.1.5 Demand operating mode

The basic kV2c meter has several operating modes. It is not necessary to buy different versions of the meter to get these features, all modes are built into every meter.

Demand mode is the most basic mode of operation. Demand mode does not require a battery. The basic meter in demand mode provides:

- Energy measurement (5 quantities)
- Demand (5 quantities - block, or rolling demand, maximum, cumulative, and continuously cumulative displays). Alternatively, a 5 thermal demand measures is also available.
- Coincident values at the time of maximum demand (2 quantities for each demand)
- Fundamental only and fundamental plus harmonics measurements (both are available simultaneously)
- Bi-directional energy measurements with various detenting choices
- Self-monitoring of meter operation for 7-meter error conditions, and 5 meter caution conditions.
- Site GEnie™ site analysis information including 8 installation diagnostics
- Power Guard System – Power Quality information – many useful measurements
- Alternate display scroll
- Test mode to test meter operation and site characteristics without effect on billing quantities or load profile data.
- Input/Output board support for pulse outputs, alert outputs, pulse inputs, and real time pricing input
- Programming Seal function for enhanced security
- Security Table of key meter events

1.1.5.1 Site GEnie™ System

The Site Genie Monitoring System displays circuit information used by the kV2c Meter to determine service type. Diagnostic information & counters are also displayed. The information in the Site Genie™ display scroll can be used to help determine why an installation error or diagnostic error has occurred. Voltages and currents displayed in the Site GEnie mode are fundamental frequency only measurements.

The 26 displays that make up the Site Genie display scroll can be grouped as follows:

- Service type
- Voltage phase angles, A, B, C
- Voltages, A, B, C
- Current phase angles A, B, C
- Currents, A, B, C
- Power factor (kW/kVA)

- Distortion Power Factor
- Diagnostic counters 1 – 8

The Site GEnie ™ system is described in detail in “Operating Instructions”, section 2 of this manual.

1.1.5.2 Power Guard System

The Power Guard system provides measurements valuable in monitoring and evaluating power quality and system characteristics. Many quantities are available for meter display and table reading via local or remote communication. Some quantities can be defined by the user, where some definitions may require soft switches to access these measures.

- Line frequency
- Phase sequence – ABC or CBA
- Phase voltages – line to line and line to neutral, either fundamental only or fundamental plus harmonics – RMS
- Phase voltage phase angles (display or table reading only)
- Phase currents - fundamental only or fundamental plus harmonics – RMS
- Phase current phase angles (display or table reading only)
- Neutral current
- Power – active, per phase (fundamental frequency only, or fundamental plus harmonics)
- Power – reactive, per phase (fundamental frequency only, or fundamental plus harmonics)
- Apparent power (kVA) per phase
- Power factor (user defined)
- Displacement power factor (fundamental frequency)
- Outage counter
- Date and time of last outage (TOU and demand LP)
- Cumulative power outage time (TOU and demand LP)
- Site GEnie diagnostics
  - ❖ Distortion diagnostic with counter (user defined)
  - ❖ High neutral current diagnostic with counter
  - ❖ Over voltage diagnostic with counter
  - ❖ Under voltage diagnostic with counter
- Distortion kVA per phase
- Distortion Power Factor (DPF) – total and per phase
- Total Harmonic Distortion (THD) per voltage phase
- Total Harmonic Distortion (THD) per current phase
- Total Demand Distortion (TDD) per phase

Other conditions are monitored for control of alert outputs.

- Low power factor alert (user defined)
- High demand alert (user defined)
- Diagnostics 1~8
- Meter Cautions
- Demand Overload
- End-Of-Interval alert
- TOU Rate alert
- Real Time Pricing (RTP) alert

1.1.6 On site user features

1.1.6.1 Operation

The kV2c meter has many features for ease of use on site.

- Nameplate and label information
- Alphanumeric display with key annunciators
- Several display modes including normal, alternate, test
- Site GEnie™ mode with information on the installation voltages, currents, phase angles, and several installation diagnostic functions

These features are described in detail in “Operating Instructions”, section 2 of this manual.

1.1.6.2 Maintenance

The kV2c meter is designed for unattended operation over a long life. When attention is required by the meter or the site, the meter has features to facilitate these tasks.

- Many modes of operation and enhanced functions are built into the meter software and may be enabled without physical change to the meter.
- Upgrading from Demand to Demand Load Profile or Time of Use operation requires no added hardware, aside from the battery that supports timekeeping during power outages.
- Software changes and feature additions may be done in the field.
- Disk analog on the display for field calibration testing.
- Test mode for convenient calibration testing without affecting billing data.
- Self test of meter operation and diagnostics of installation characteristics
- Flexible control of display for meter diagnostic error conditions and cautions of meter and installation operating conditions.

Maintenance instructions are covered in section 3 of this manual.

1.1.7 Advanced features and soft switches

Many advanced features of the kV2c meter can be enabled by turning on “soft switches”. Soft switches are logical controls which enable related groups of meter features. Without activation of a soft switch, operation of the controlled features is suppressed. Soft switches may be enabled in the meter as shipped from the factory, or may be turned on at any time by the use of Meter Mate software.

The following soft switches are available in the kV2c meter:

- B Switch By quadrant measurements
- C Switch Call In on Outage (Modem)
- E Switch Event Log
- I Switch Instrument Transformer Correction
- K Switch kVA - Power Factor, Kvar and kVA measures
- L Switch Transformer Loss Compensation
- M Switch Expanded Measures - per phase measurement
- Q Switch Power Quality Measures
- R Switch Basic Recording (Four-channel)
- T Switch Time of Use
- V Switch Fast Voltage Event Monitor and Log
- W Switch Waveform capture

- X Switch Expanded Recording (20-channel)
- Z Switch Totalization
- N Switch Billing Demands

Operating features controlled by soft switches are described in section 4, Upgrading.

1.2 Programming and Reading Software

The meter is supported by the MeterMate™ software suite. This software facilitates setting up and using many meter features:

- Creation of custom meter programs
- Loading programs into the meter
- Setting site specific meter parameters
- Viewing Site Genie™ data
- Viewing real time data
- Waveform capture and harmonic analysis
- Reading meter data
- Load Profile data analysis and reporting
- Meter program and meter data reporting
- Batched meter communications
- Meter mode conversion and soft switch upgrading

Refer to Reading and Programming Instruction manual for Metermate (GEH-5084I Metermate MMCOMM Instructions book)

1.3 Technical Information

This section contains the theory of operation and general circuit configuration of the GE kV2c Meter.

1.3.1 Theory of Operation

The theory of operation of the kV2c Vector Electricity Meter is described in conjunction with the block diagram shown in Figure 1-2.

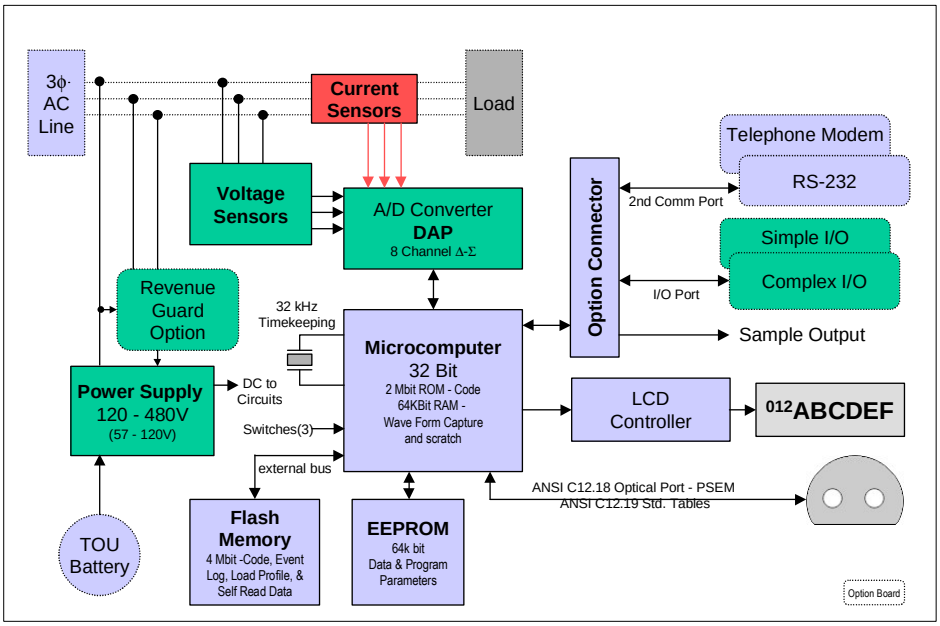

Figure 1-2 kV2c Meter Block Diagram

1.3.1.1 Sensing Devices

Voltages are sensed by three separate high impedance resistive voltage dividers. Currents are sensed by up to three separate Current Transformers, each feeding to the current signal sampling circuit. The sensors provide scaled signals to the Data Acquisition Platform (DAP) chip.

1.3.1.2 Data Acquisition

The Data Acquisition Platform (DAP) chip contains six independent, fully integrated analog to digital converters, one for each current and voltage signal. The converters are continuous time, delta-sigma analog to digital converters digitizing each signal 1.68 million times per second. Each input signal has a dedicated converter, multiplexing is not used. The converter over sampling rate of 512 provides approximately 3280 complete sets of decimated samples per second. For a full three element meter, 6 sets of 16-bit samples are processed, providing more than 54 decimated sample sets per line cycle.

1.3.1.3 Microcomputer

The microcomputer is a 32-bit expandable single chip microcomputer. It receives 16 bit data samples from the DAP chip. The microcomputer provides all data processing functions, including sample processing and digital filtering, accumulations, products and calculation of advanced quantities. It does time keeping and provides all register and display functions of the meter. It uses non volatile memories on the circuit board for storage of metered data

and program parameters. It communicates through the OPTOCOM port for reading and programming.

1.3.1.4 Nonvolatile Memory

The kV2c meter is equipped with two nonvolatile memory devices. All data values and program parameters are stored in semiconductor nonvolatile memory, battery is not required for data storage. EEPROM memory stores programmed operating parameters and meter data. Flash memory is used for special program provisions and memory intensive data requirements. Meter data quantities are updated at each power fail event. Stored data is constantly checked to prevent errors.

1.3.1.5 Power Supply

The kV2c meter is powered from the A phase voltage line. It has a wide range solid-state switching type power supply. The standard voltage range is 120V to 480V, the optional low voltage range is 69(57) to 120V. Both versions have an extended operating range of -20% to +10% of rating. The supply operates for either 50Hz or 60Hz line frequency.

Warning: Do not exceed 575(144) Volts on the power supply voltage input terminals for the 57-120V, or 575(850) Volts for the 120-480V supply.

1.3.1.6 Time Keeping Battery

A standard 3.6V, half-size AA, lithium battery maintains the meter clock when the meter is programmed as a time-of-use meter or demand meter with Load Profile recorder. Since all billing and programming information is stored in nonvolatile memory, the battery is primarily used for maintaining date and time information during a power outage. Under normal conditions, the battery should provide more than 1 year of service during outage conditions (time on battery backup) and more than 10 years of service during storage conditions (disconnected from terminals) or when properly installed in an energized meter.

1.3.1.7 Option boards

The basic meter provides connections, signals, and power for one or two other snap in option boards. One is a communications board, either 2400 baud telephone modem or RS – 232 or 485 communications interface board. The second is a pulse Input/Output interface board. It is available as either a Simple I/O or Multiple I/O version.

2. Operating Instructions

2.1 Nameplate Information and Labels

See Figure 2-1 for a graphic representation of the meter nameplate. The meter nameplate is found on the front of the meter.

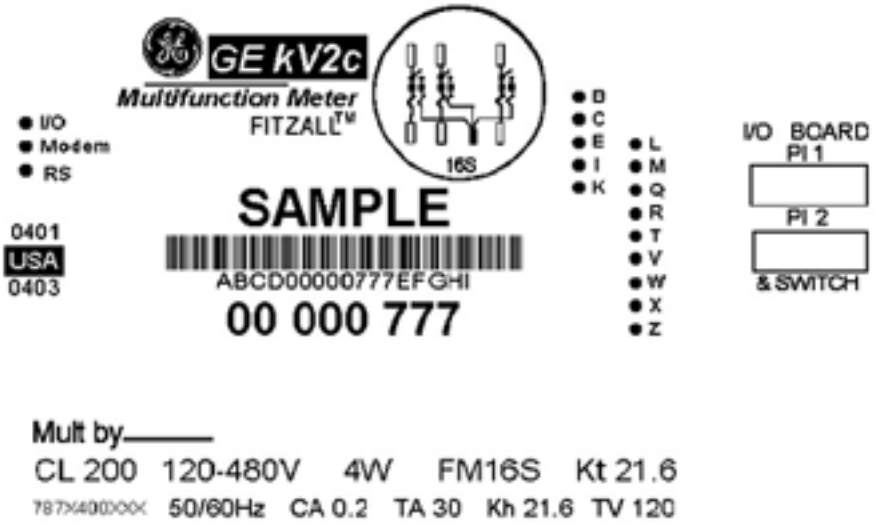

Figure 2-1. Meter Nameplate

2.1.1 Upper Nameplate Information

The upper nameplate information is shown in Figure 2-2. The following numbered list coincides with the numbers in the figure.

1. Meter type
2. ANSI C12.10 diagram of meter internal connections
3. Filled circle indicates that softswitch has been enabled
4. Utility information and bar code area
5. Firmware revision (2 digit)
6. Month and Year of manufacture (MMYY)
7. Hardware revision (2 digit)
8. Installed option boards
9. Meter Serial number

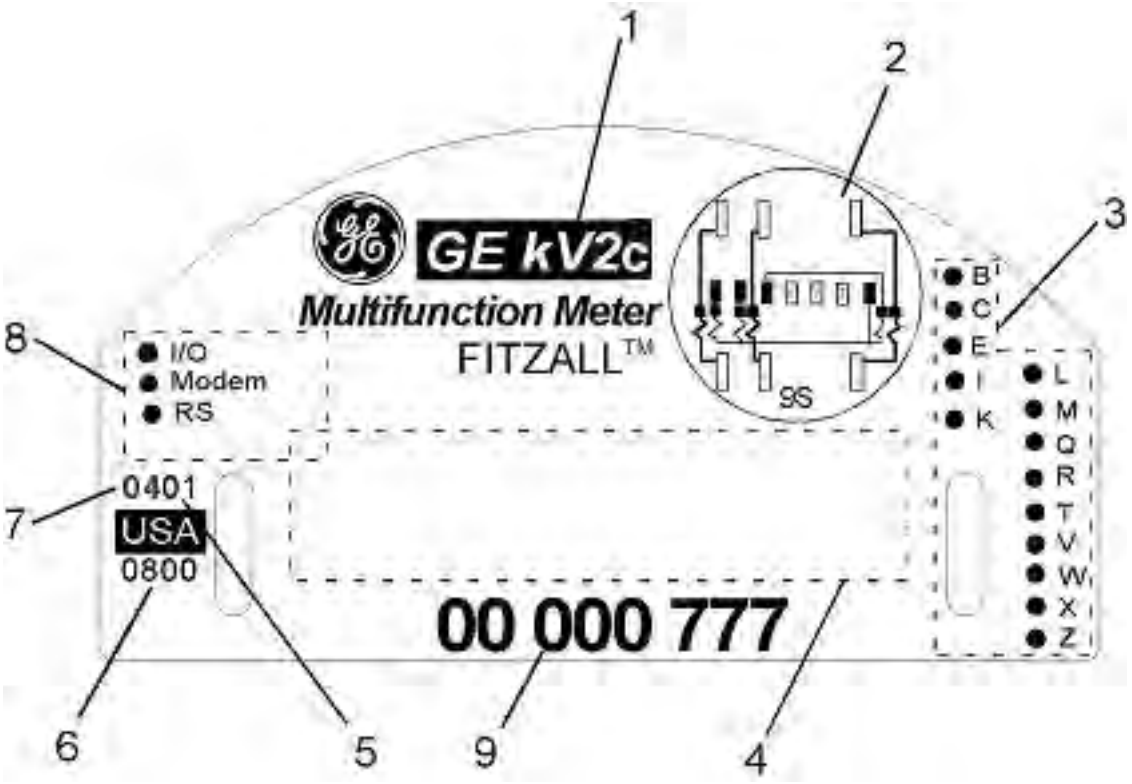

Figure 2-2. Upper Nameplate Information

2.1.2 Lower Nameplate Information

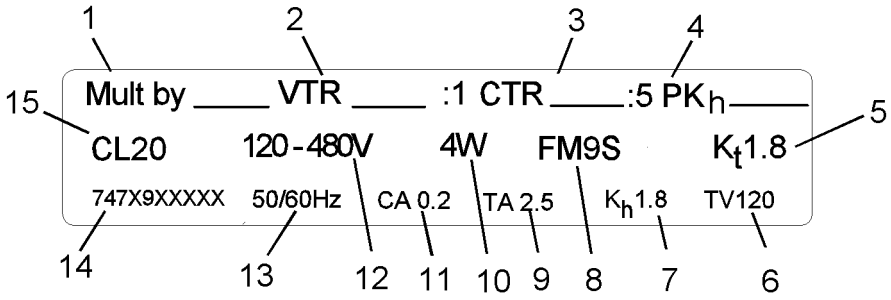

Figure 2-3: Lower Nameplate

The numbered list below coincides with the numbers in Figure 2-3.

1. Multiply by constant
2. Voltage transformer ratio
3. Current transformer ratio
4. Primary Watthour constant
5. Watthour test constant
6. Test voltage
7. Watthour meter constant

8. ANSI C12.10 Form Number
9. Test amperes
10. Number of wires for the metered service
11. ANSI C12.20 Accuracy Class — S-base CA 0.2, A-base CA 0.5
12. Nominal Voltage operating range
13. Nominal Frequency
14. Catalog number
15. Current Class

2.1.3 Labels

Additional labels found on the kV2c meter are the warning label, softswitch label, load profile label and I/O label.

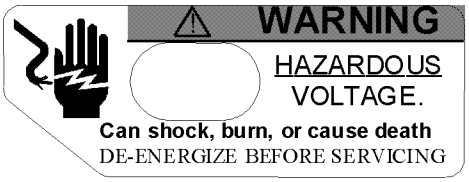

Figure 2-4: Warning Label

The warning label is shown in Figure 2-4. It is found on the front of the meter on the lower left corner of the bezel. The warning label advises to disconnect the meter from any external circuits before servicing since the meter operates at lethal voltages. The warning label is obscured by meter cover frosting when the cover is in place.

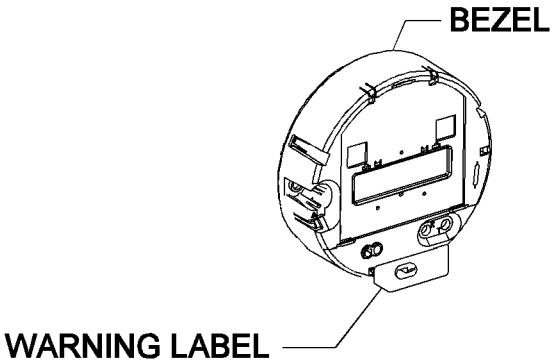

Figure 2-5: Location of warning label

Figure 2-6: Softswitch Label and Load Profile Label

The softswitch and load profile labels can be seen in Figure 2-6. Both of these labels are found on the side of the bezel as seen in Figure 2-7 and are present on every kV2c meter. The softswitch label provides the names associated with the one letter softswitch identifiers. The load profile label provides a place to mark quantities recorded in each of up to 20 load profile channels.

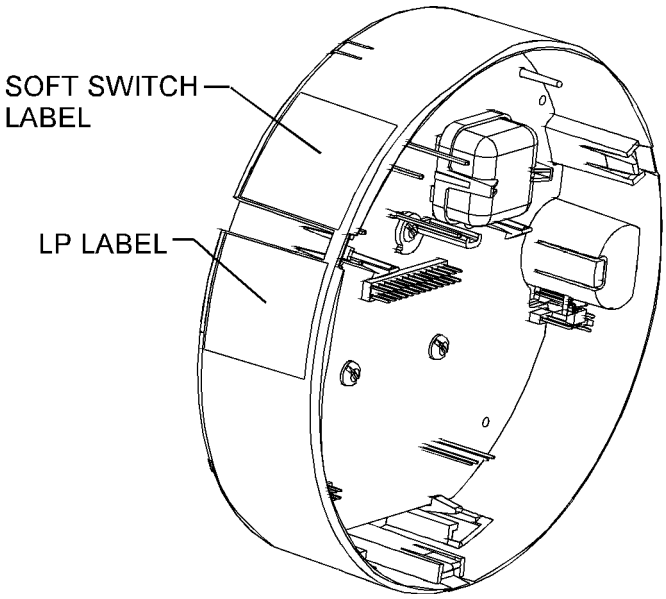

Figure 2-7 Location of Soft switch Label and Load Profile Label

I/O Cable		
Signal Name	*Wire Color*	*Measure*
Y1_OUT	Yellow	
Z1_OUT	Black	
Y2_OUT	Grey	
Z2_OUT	Blue	
K1/K2_OUT	Red	
Z3_OUT	Orange	
K3_OUT	Brown	
RTP+	Violet	
RTP-	Green	

kV2 M I/O Cable		
Signal Name	*Wire Color*	*Measure*
Y1_OUT	Yellow	
Z1_OUT	Black	
Y2_OUT	Grey	
Z2_OUT	Blue	
K1/K2_OUT	Red	
Z3_OUT	Orange	
K3/K8_OUT	Brown	
RTP+	Violet	
RTP-	Green	
Z4_OUT	White	
Z5_OUT	White/Black	
Z6_OUT	White/Brown	
Z7_OUT	White/Red	
Z8_OUT	White/Orange	
Y1_IN	White/Yellow	
K1_IN	White/Green	
Z1_IN	White/Blue	
Y2_IN	White/Violet	
K2_IN	White/Grey	
Z2_IN	White/Black/Brown	
Y3_IN	White/Black/Red	
K3_IN	White/Black/Orange	
Z3_IN	White/Black/Yellow	
Y4_IN	White/Black/Green	
K4_IN	White/Black/Blue	
Z4_IN	White/Black/Violet	

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Figure 2-8: S I/O Label and M I/O Label

There are two I/O labels depending on whether an S I/O board or an M I/O board is present in the meter. Both labels can be seen in Figure 2-8. The I/O label can be found on the side of the shroud in Figure 2-9.

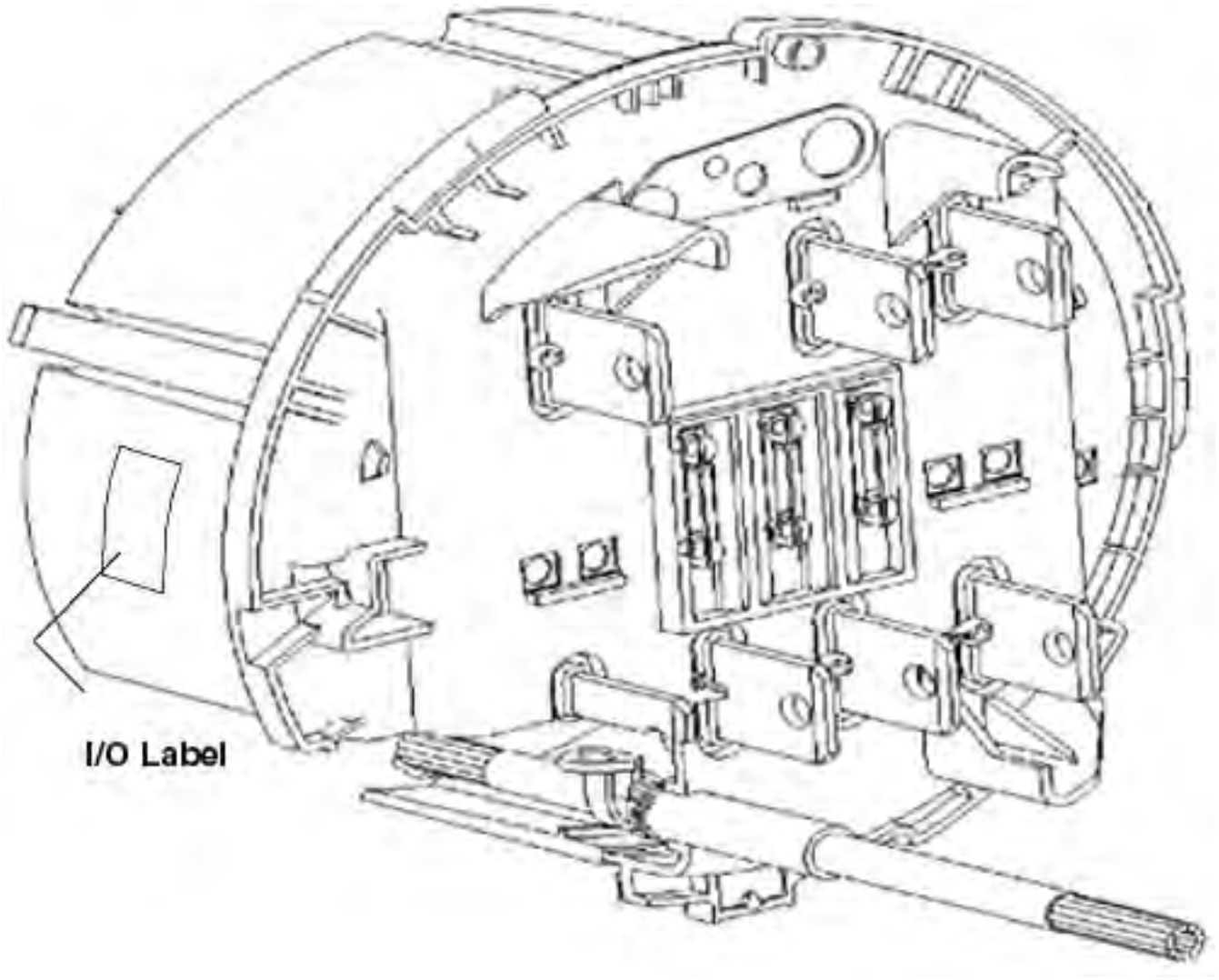


Figure 2-9: Location of I/O Label

2.2 Display Information

A total of 977 different user selectable quantities are available for display. As the meter is very flexible, a wide range of quantities can be defined for mapping to meter calculations and display. In the table below “UOM” refers to “Unit of Measure”, a general term for a range of measurements which can be displayed, as defined by the meter program. UOM quantities can be kWh or other integrating volt-amp quantities (such as kVA), currents, voltages, or numeric (pulse count) values.

Display Item	Operational Modes Available
Current Season	

Display Item	Operational Modes Available
Maximum 1,2,3,4,5 UOM:	
Maximum Demand	All
Maximum Demand Date	TOU
Maximum Demand Time	TOU
Maximum Demand Coincident 1	All
Maximum Demand Coincident 2	All
Maximum Demand Rate A,B,C,D	TOU
Maximum Demand Rate A,B,C,D Date	TOU
Maximum Demand Rate A,B,C,D Time	TOU
Maximum Demand A,B,C,D Coincident 1	TOU
Maximum Demand A,B,C,D Coincident 2	TOU
Cumulative 1,2,3,4,5 UOM:	
Cumulative Demand	All
Cumulative Demand Rate A,B,C,D	TOU
Continuously Cumulative 1,2,3,4,5 UOM:	
Continuously Cumulative Demand	All
Continuously Cumulative Demand Rate A,B,C,D	TOU
Summations 1,2,3,4,5 UOM:	
Total Summation	All
Summation Rate A,B,C,D	TOU
Instantaneous:	
Momentary Interval Demand	All
Momentary Interval Power Factor	All
Momentary Interval kW element A,B,C fundamental plus harmonics	All
Momentary Interval kW element A,B,C fundamental only	All
Momentary Interval kvar element A,B,C fundamental plus harmonics	All
Momentary Interval kvar element A,B,C fundamental only	All
Momentary Interval distortion kVA element A,B,C	All
Momentary Interval apparent kVA element A,B,C	All
Power Factor:	
Average Power Factor	All
Previous Interval 1,2,3,4,5 UOM:	
Previous Interval Demand	All
Previous Season	
Maximum 1,2,3,4,5 UOM:	
Maximum Demand	TOU
Maximum Demand Date	TOU
Maximum Demand Time	TOU
Maximum Demand Coincident 1	TOU
Maximum Demand Coincident 2	TOU
Maximum Demand Rate A,B,C,D	TOU
Maximum Demand Rate A,B,C,D Date	TOU
Maximum Demand Rate A,B,C,D Time	TOU
Maximum Demand A,B,C,D Coincident 1	TOU
Maximum Demand A,B,C,D Coincident 2	TOU
Cumulative 1,2,3,4,5 UOM:	
Cumulative Demand	TOU
Cumulative Demand Rate A,B,C,D	TOU

Display Item	Operational Modes Available
Continuously Cumulative 1,2,3,4,5 UOM:	
Continuously Cumulative Demand	TOU
Continuously Cumulative Demand Rate A,B,C,D	TOU
Summations 1,2,3,4,5 UOM:	
Total Summation	TOU
Summation Rate A,B,C,D	TOU
Power Factor:	
Previous Season Average Power Factor	TOU
Last Reset	
Maximum 1,2,3,4,5 UOM:	
Maximum Demand	All
Maximum Demand Date	TOU
Maximum Demand Time	TOU
Maximum Demand Coincident 1	All
Maximum Demand Coincident 2	All
Maximum Demand Rate A,B,C,D	TOU
Maximum Demand Rate A,B,C,D Date	TOU
Maximum Demand Rate A,B,C,D Time	TOU
Maximum Demand A,B,C,D Coincident 1	TOU
Maximum Demand A,B,C,D Coincident 2	TOU
Cumulative 1,2,3,4,5 UOM:	
Cumulative Demand	All
Cumulative Demand Rate A,B,C,D	TOU
Continuously Cumulative 1,2,3,4,5 UOM:	
Continuously Cumulative Demand	All
Continuously Cumulative Demand Rate A,B,C,D	TOU
Summations 1,2,3,4,5 UOM:	
Total Summation	All
Summation Rate A,B,C,D	TOU
Power Factor:	
Last Reset Average Power Factor	All
REAL-TIME PRICING (RTP) 1,2,3,4,5 UOM	
RTP Maximum Demand	Dmd/ DmdLP
RTP Cumulative Demand	Dmd/ DmdLP
RTP Continuously Cumulative Demand	Dmd/ DmdLP
RTP Summation	Dmd/ DmdLP
RTP Maximum Demand coincident 1	Dmd/ DmdLP
RTP Maximum Demand coincident 2	Dmd/ DmdLP
Last Reset	
Last Reset RTP Maximum Demand	Dmd/ DmdLP
Last Reset RTP Cumulative Demand	Dmd/ DmdLP
Last Reset RTP Continuously Cumulative Demand	Dmd/ DmdLP
Last Reset RTP Summation	Dmd/ DmdLP
Last Reset RTP Maximum Demand coincident 1	Dmd/ DmdLP
Last Reset RTP Maximum Demand coincident 2	Dmd/ DmdLP
ACCUMULATIONS	
Data accumulation 1 thru 20, UOM	All
SECURITY LOG	
Number of Bad Passwords	All

Display Item	Operational Modes Available
Number of Demand Resets	All
Number of EEPROM Writes	All
Number of OPTOCOM Communications	All
Number of Power Outages	All
Number of Times Programmed	All
Number of Times for Real-Time Pricing Entries	All
Cumulative Power Outage Duration in seconds	TOU/DmdLP
Date of Last Calibration	All
Time of Last Calibration	All
Date of Last Demand Reset	TOU
Time of Last Demand Reset	TOU
Date of Last OPTOCOM Comm.	TOU
Time of Last OPTOCOM Comm.	TOU
Date of Last Power Outage	TOU/ DmdLP
Time of Last Power Outage	TOU/DmdLP
Date of Last Programming	All
Time of Last Programming	All
Date of Last Real-Time Pricing Entry	TOU
Time of Last Real-Time Pricing Entry	TOU
Date of Last Time Change	TOU
Time of Last Time Change	TOU
Date of Last Transformer Loss Compensation Update	TOU
Time of Last Transformer Loss Compensation Update	TOU
Date of Last Transformer Inaccuracy Adjustment	TOU
Time of Last Transformer Inaccuracy Adjustment	TOU

DIAGNOSTIC TOOLS

Distortion

Distortion Power Factor element A,B,C (D/U)	All
Total Demand Distortion element A,B,C	All
Current Total Harmonic Distortion element A,B,C	All
Voltage Total Harmonic Distortion element A,B,C	All
Total Distortion Power Factor	All

Voltage

RMS Volts (fundamental plus harmonics), Phases A,B,C	All
RMS Volts (fundamental frequency), Phases A,B,C	All
RMS Volts (fundamental plus harmonics), Line to Line	All
RMS Volts (fundamental frequency), Line to Line	All
Frequency	All

Current

RMS Amps (fundamental plus harmonics), Phases A,B,C	All
RMS Amps (fundamental frequency), Phases A,B,C	All
RMS Amps imputed neutral current	All

Site Genie Voltage

RMS Volts (fundamental frequency), Phases A,B,C	All
Current Phase Angle (degrees), Phases A,B,C	All

Site Genie Current

RMS Amps (fundamental frequency), Phases A,B,C	All
Current Phase Angle (degrees), Phases A,B,C	All

Diagnostic Counters (number of occurrences)

d1 [Polarity, etc.]	All
d2 [Voltage Imbalance]	All
d3 [Inactive Current]	All
d4 [Current Phase Angle Imbalance]	All
d5-A [Distortion]	All
d5-B [Distortion]	All
d5-C [Distortion]	All

Display Item	Operational Modes Available
d5 Total [Distortion]	All
d6 [Under Voltage]	All
d7 [Over Voltage]	All
d8 [High Neutral]	All
TEST MODE	
Test Mode Demand Interval length in minutes (block)	All
Test Mode Demand No of Subintervals. (rolling only)	All
Test Mode Demand Subint. length in minutes (rolling)	All
Test Mode Maximum Demand 1,2,3,4,5 UOM	All
Test Mode Data Accumulation 1 thru 20 UOM	All
Test Mode Time Out Length in minutes	All
Test Mode Thermal Interval Type: “0”=15 min., “1”=1 min.	All
Test Mode Accumulating Demand 1,2,3,4,5 UOM	All
Test Mode Time Remaining in Subint (not valid for thermal demands)	All
Test Mode Power Factor	All
Time Remaining in Test Mode (Sub)interval in min. & sec. (Not valid for thermal demands)	All
CONSTANTS	
Demand Interval Length in minutes (block only)	All
Demand No. of Subintervals (rolling only)	All
Demand Subinterval Length in minutes (rolling only)	All
Demand Alert Threshold in UOM per “Display Demand Units” below	All
Demand Delay Length in minutes	All
Minimum Outage for Demand Delay in seconds	TOU
Display Demand Units (“0”=kW,kVA, etc.;”1”=W,VA,etc.)	All
Display Scalar: (for GE internal use)	All
Display Primary Volts/Amps Flag: “0”= Sec, “1”= Pri.	All
Display Multiplier (Scaled): (for GE internal use)	All
Electrical Service	All
Meter ID 1	All
Meter ID 2	All
Program ID	All
Transformer Ratio – Current: X:5	All
Transformer Ratio – Voltage: X:1	All
EOI Duration in seconds: contact closure and annunciator	All
Power Factor Threshold	All
Power Factor Demand Threshold	All
Load Profile # Channels	TOU/ DmdLP
Load Profile Interval Length in minutes	TOU/ DmdLP
Real-Time Pricing State: “0”= Disabled, “1”= Enabled	All
Seal Flag State: “0”= Unsealed, “1”= Sealed Official Government Metrology Control	All
Blank Data Display	All
All Segments	All
Firmware Version No. = 1, 2,…	All
Hardware Version No. = 1, 2,…	All
User defined label 1,2,3,4,5	All
Transformer Factor	All
VARIABLES	
Current Season	TOU
Current Date	TOU/ DmdLP
Current Day Of Week (1-7 means Sun-Sat)	TOU/DmdLP
Current Time	TOU/ DmdLP
Time Remaining in Demand (Sub)interval in minutes (Not valid for thermal demands)	All

Display Item	Operational Modes Available
Load Control ON (“0”= OFF, “1”= ON)	TOU
Real-Time Pricing time remaining until activation in min.	All
PREVIOUS SELF READS 1,2,3,4,5	
Date	TOU
Time	TOU
Total Summation 1,2,3,4,5	All
Max Demand 1,2,3,4,5	All
Max Demand Date 1,2,3,4,5	TOU
Max Demand Time 1,2,3,4,5	TOU

2.2.1 Display Modes

There are five display modes:

- Normal
- Alternate
- Site Genie
- Test
- Frozen

The user can switch between display modes using the Display Switch and the Test Switch.

2.2.1.1 Display Switch Actions

The Display Switch is actuated using a magnet as shown in Figure 2-10. Holding a magnet next to the Display Switch for varying lengths of time causes the meter to change display modes:

Less than 3 seconds:	Restarts the Normal Display scroll or produces one Normal Display scroll if an Error, Caution or Diagnostic is frozen on the display.
3 to 6 seconds:	Enters the Alternate Display mode for one scroll then returns to the Normal Display mode.
More than 6 seconds:	Enters the Site Genie Display mode for one scroll then returns to the Normal Display mode.

TIP The magnetic end of the SMARTCOUPLER will activate the Display Switch.

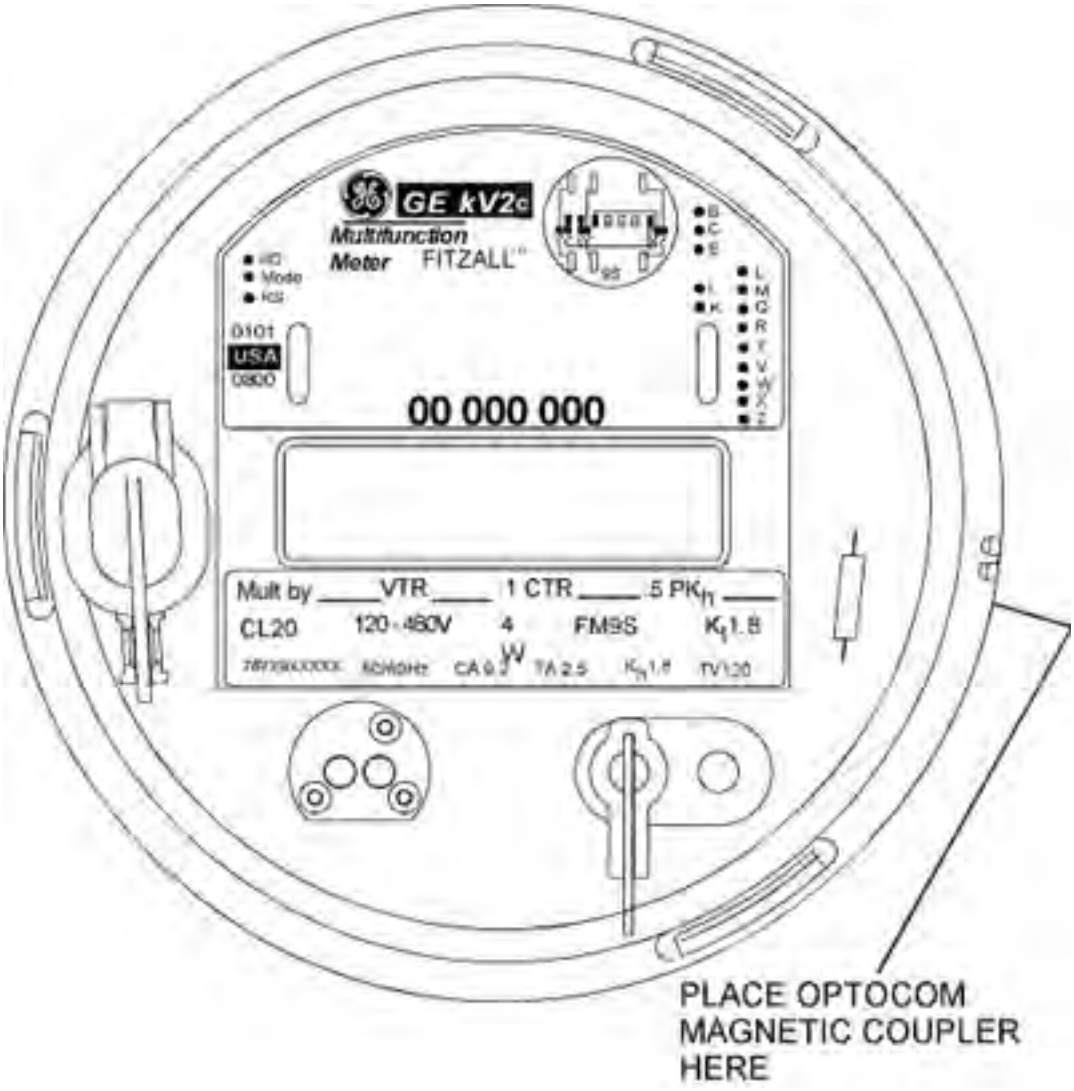


Figure 2-10: Alternate Display Mode Switch

2.2.1.2 Normal Display Mode

In Normal Display mode, the meter display scrolls continually through the Normal Display items until one of the following occurs:

- Demand reset is invoked.
- Display switch is actuated.
- Communication is initiated.
- Test mode is invoked.
- A frozen Error, Caution, or Diagnostic message is triggered.

Note the test mode push button is not accessible with the cover in place.

Normal Display items are selected during program development using MeterMate software. The meter returns to the Normal Display mode when other display modes have completed or timed-out.

TIP While the meter is communicating, the data annunciators are off and the LCD displays "BUSY".

2.2.1.3 Alternate Display Mode

The Alternate Display is used to display information for the meter technician that is not contained in the Normal Display.

- Display Items: selected during Meter Mate program development.
- Initiate: actuate the Display Switch for 3 to 6 seconds.
- Scroll: the meter automatically scrolls through the Alternate Display items.
- Exit: the meter automatically returns to the Normal Display mode after the last Alternate Display item.

2.2.1.4 Site Genie Display Mode

The Site Genie Display is used to display service type, phasor information, and the status of the diagnostic counters.

- Display Items: fixed (see Table 2-3)
- Initiate: actuate the Display Switch for more than 6 seconds.
- Scroll: the meter automatically scrolls through the Site Genie Display items.
- Exit: the meter automatically returns to the Normal Display mode after the last Site Genie Display item is displayed if the Display Switch is not actuated. If the Display Switch is actuated after the last item is displayed, the meter will start another Site Genie display scroll.

2.2.1.5 Test Mode

The Test Mode is used to display data for testing the meter. Normal accumulation of billing data is suspended in the test mode.

- ***Display Items***: selected during MeterMate program development.
- ***Initiate***: hold the Test (T) Switch for 1 second.
- ***Scroll***: momentarily actuate the Display Switch to advance to the next item in the Test Display scroll.
- ***Reset Accumulators***: hold the Reset (R) Switch to zero all accumulators and light all display segments. Test mode processing resumes when the Reset Switch is released. Pressing the Reset Switch does not affect billing data.
- ***Exit***: hold the Test Switch for 1 second or wait for the programmable Test Mode Timeout period.

2.2.1.6 Frozen Display Mode

The Frozen Display mode stops the Normal Display to draw attention to an Error, Caution, or Diagnostic in the meter.

- ***Display Items***: select Errors, Cautions and Diagnostics to freeze the display during MeterMate program development.
- ***Initiate***: automatic when the meter detects a frozen Error, Caution or Diagnostic.
- ***Scroll***: use a magnet to activate the Display Switch. The meter will perform one Normal Display scroll and then return to the Frozen Display.
- ***Exit***: clear the condition that caused the error, caution or diagnostic to return to the Normal Display mode.

2.2.2 Liquid Crystal Display Information

The liquid crystal display (LCD) is shown. The numbered list coincides with the numbers in the figure 2-11.

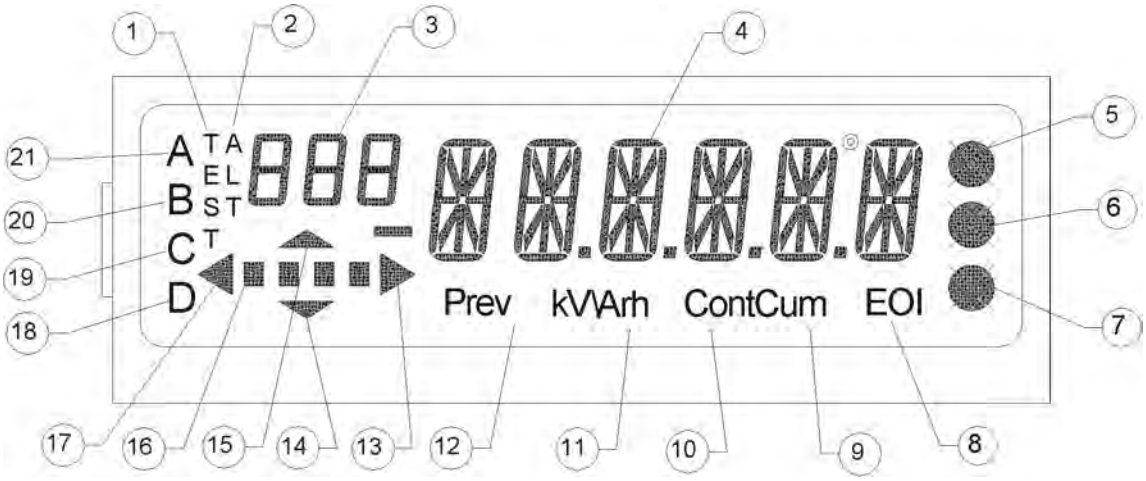


Figure 2-11 Liquid Crystal Display Information

1. The “TEST” annunciator indicates the meter is in Test mode.
2. The “ALT” annunciator indicates the meter is in Alternate Display mode.
3. The three small digits are used to display the current display label or code. “CA” or “Er” appearing in this location indicates a Caution or Error message in the display.
4. These characters display alphanumeric quantities.
   - The open O between the rightmost character and the character to its left is a degree symbol for fundamental lagging phase angles.
   - The short bar to the left of the first large digit indicates a minus sign.
   - There are four possible decimal point positions located between the five rightmost digits.
5. When displayed, the “A” annunciator indicates the “A” voltage is present at the meter. If blinking, “A” voltage is low.
6. When displayed, the “B” annunciator indicates the “B” voltage is present at the meter. If blinking, “B” voltage is low.

TIP ***If a voltage annunciator letter is not displayed, that voltage is not expected to be present at the meter for this combination of service and meter form. A voltage that should be present, but isn’t, is treated as a low voltage. Its annunciator blinks.***

7. When displayed, the “C” annunciator indicates the “C” voltage is present at the meter. If blinking, “C” voltage is low.
8. This display indicates an end of interval (EOI) condition.
9. CUM is displayed when the meter is displaying cumulative demand measurements.
10. When CONT and CUM are displayed, it indicates that the meter is displaying continuously cumulative demand measurements.
11. These letters are used to display the units of measure for the quantity currently being displayed. For example, energy displays will have a “kWh” annunciator and Apparent Power will have a “kVA” annunciator. Qhour displays will have no annunciators.
12. This part of the display indicates the previous season or billing period data is being shown.
13. When displayed, this arrow indicates energy is being delivered to the load.
14. When displayed, this arrow indicates VArh are leading.
15. When displayed, this arrow indicates VArh are lagging.
16. The four blocks simulate a disk revolution and are used to display energy flow. One through four blocks indicates 60, 70, 80 and 90% of K_t Watthours respectively. When all four blocks go blank, it indicates a complete cycle (i.e. K_t Watthours).

17. When displayed, this arrow indicates energy is being received from the load.
18. ~21. The letters A through D indicate the Time-Of-Use (TOU) rate that is in effect. Only one letter is displayed at a time when operating in a TOU Mode. If no letters are lit, the meter is in a non-TOU rate.

2.2.3 Display Examples

The following three figures show examples of possible kV2c Meter displays.

2.2.3.1 kWh Display

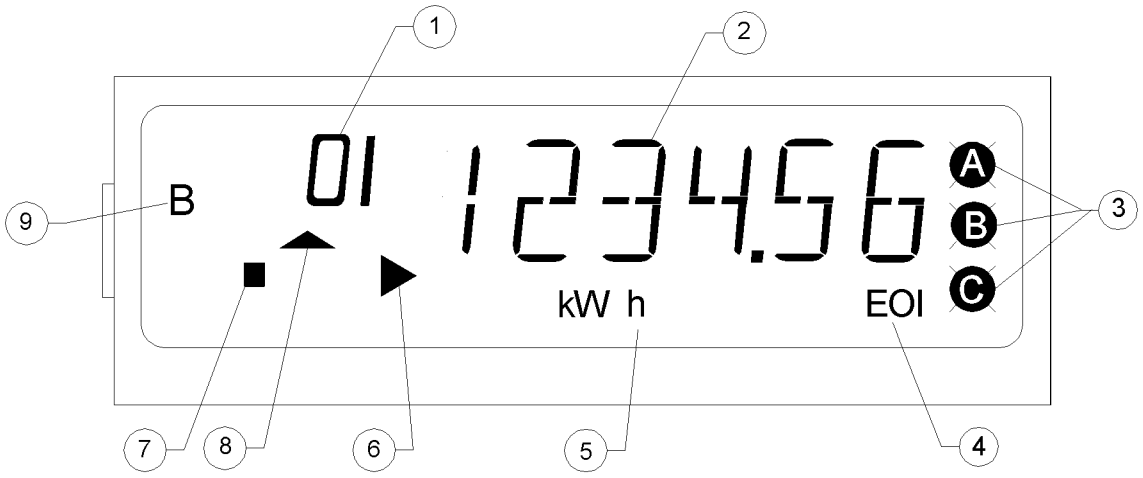


Figure 2-12 kWh Display

Figure 2-12 shows the following conditions:

1. The Display Label is “01”.
2. Six-digit display of energy (kWh).
3. All phases (A, B, C) are present and voltage exceeds the low voltage threshold.
4. End of demand interval indication. This indicator is lit at the end of each demand subinterval**.**
5. Displayed quantity is measured in kilowatt hours.
6. Energy is being delivered to the load.
7. The one block indicates 60% of K_t Watt hours.
8. Quadergy (kVArh) is lagging.
9. TOU rate B is in effect.

2.2.3.2 Alternate Display Mode

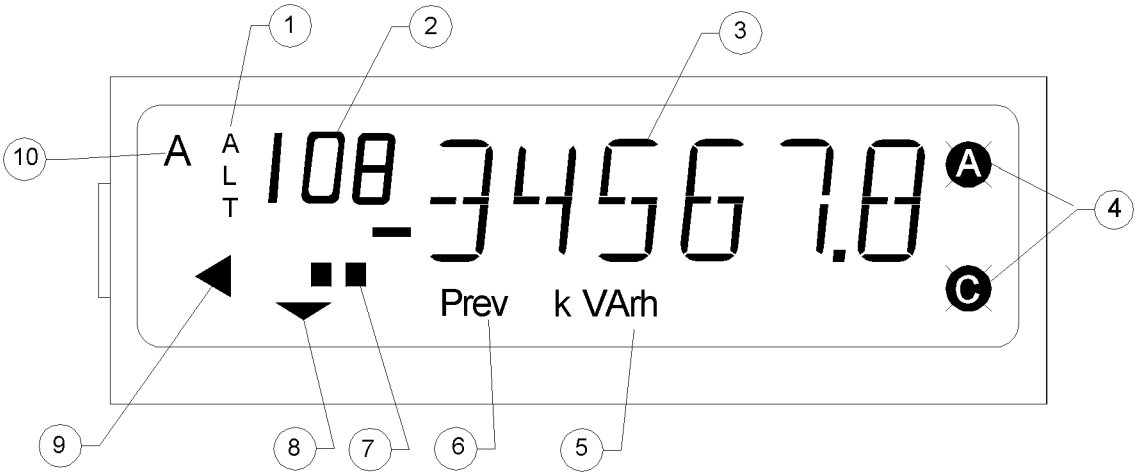


Figure 2-13 Alternate Display

Figure 2-13 shows the following conditions**:**

1. Meter is in Alternate Display mode.
2. Display label “108” is displayed
3. Six-digit previous billing period or season kvarh
4. Phase B voltage is not expected.
5. Displayed quantity is measured in kVArh.
6. Meter is displaying previous billing period or season data.
7. The two blocks indicate 70% of K_t Watt-hours.
8. Quadergy (kVArh) is leading.
9. Energy is being received from the load.
10. TOU rate A is in effect.

2.2.3.3 Test Mode Display

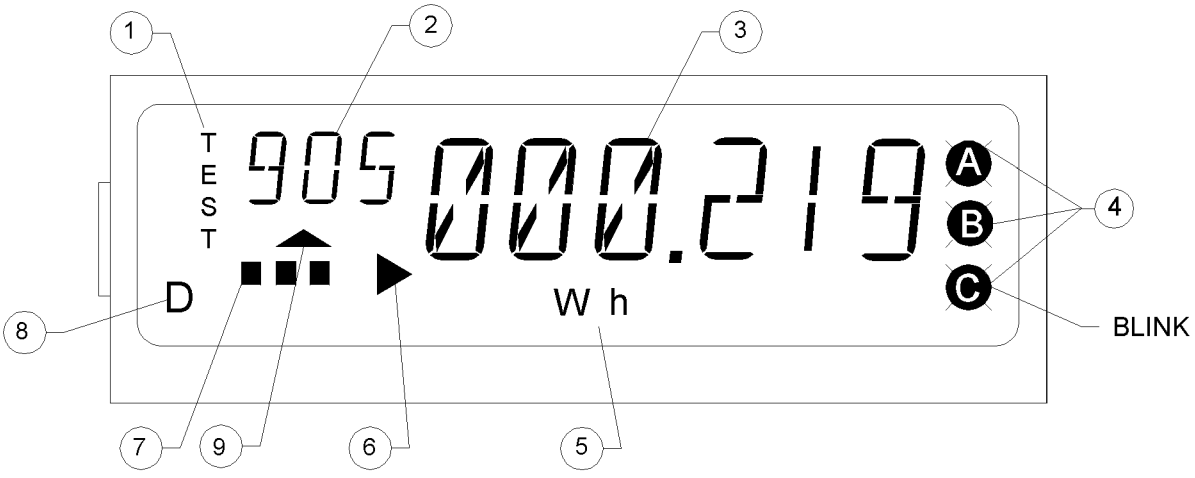


Figure 2-14 Test Mode Display

Figure 2-14 shows the following conditions:

1. Meter is in TEST mode.
2. Display label is “905”.
3. Meter display is a six-digit energy display (Wh) with three digits to the right of the decimal point.

4. A and B phase voltages are present. When a voltage indicator is blinking (C in the figure), it indicates that voltage is low or missing.
5. Meter display is in Watt-hours.
6. Energy is being delivered to the load.
7. The three blocks indicate 60%, 70%, and 80% of K_t Watthours respectively.
8. Time-of-use metering rate D is in effect.
9. Quadergy (kVArh) is lagging**.**

2.3 Site Genie Monitoring System

The Site Genie Monitor checks the installation, monitors the service after installation, and displays information to alert and diagnose problems.

At power-up, the kV2c meter automatically determines the metered service by examining the phase voltages and the phase angles between the voltages every second. The meter must obtain the same service result from three consecutive tests before selecting the service.

Tip ***The service type must be one that can be metered by this meter form for the meter to call it a valid service type. For example, a 36S meter will not consider a four wire delta service a valid service because it is not capable of metering that service. See Table 2-1 for valid service types.***

After the service is determined, it becomes part of the Site Genie display scroll. If the meter does not get three consecutive service results during the first one minute of operation, a service error diagnostic is added to the Site Genie scroll.

The Site Genie Monitoring System automatically identifies the metered service after every power outage. Table 2-1 shows the allowed services for each ANSI S-base and A-base meter form.

As an alternative to automatic service determination, the meter may be programmed for a specific service type. In this case, the meter will always use the programmed service type as the basis for operations. Refer to GEH-7285A, section 10.2.1.1 for more details regarding automatic service determination.

2.3.1 Service Display

As soon as the Site Genie System determines the service, the metered service can be displayed.

Tip ***If the meter has not yet determined the service type, it will display 'in progress" (INPROG).***

Tip ***Use the Site Genie display scroll to make sure the meter has correctly determined the service type. If the meter cannot determine the service type, diagnostic checks are disabled.***

Table 2-2 lists the meter's service displays.

Any attempt to read the service from the meter before the Site Genie Monitor has determined the service causes **INPROG** to be displayed. A service display for a 4-wire Wye service is shown in Figure 2-15 below.

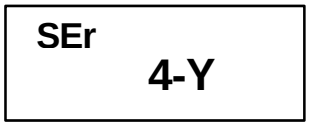


Figure 2-15 Typical Service Display

Table 2-1. Expected Service Types

Meter Form	Meter Construction	Service	Symmetrical Service	Blondel Solution
2S,4S	1 element, 3 wire	1 phase, 3 wire	Yes	No
1S,3S	1 element, 2 wire	1 phase, 2 wire		Yes
9S, 10A, 48A	3 element, 4 wire	3 phase, 4 wire (Wye) 3 phase, 4 wire (Delta)	Yes No	Yes Yes
12S, 13A	2 element, 3 wire	3 phase, 3 wire (Delta) 1 phase, 3 wire network	Yes Yes No	Yes Yes Yes
16S, 16A	3 element, 4 wire	3 phase, 4 wire (Wye) 3 phase, 4 wire (Delta)	Yes No	Yes Yes
36S, 36A	2½ element, 4 wire	3 phase, 4 wire (Wye)	Yes	No
45S, 45A	2 element, 3 wire	3 phase, 3 wire (Delta) 3 phase, 4 wire (Wye) 3 phase, 4 wire (Delta) 1 phase, 3 wire 2 phase, 5 wire	Yes No No Yes No	Yes No No Yes Yes

If the service type display has not been added to the display scrolls, a service error at installation is seen in the Site Genie Display scroll only. If the meter cannot determine the service type, diagnostic errors are disabled.

Table 2-2. Service Displays

Display	Electrical Service
_2-1PH	Single phase, 2 wire
_3-1PH	Single phase, 3 wire
_5-2PH	Two phase, 5 wire
_3-D_	Polyphase, 3 wire(delta)
_4-D_	Polyphase, 4 wire(delta)
_4-Y_	Polyphase, 4 wire(Wye)
_3-N_	Network
INPROG	In Progress
SER_ER	Service Error

A service error display, shown in Figure 2-16 indicates that the meter did not find a stable set of phase voltages that matched any of the expected voltage sets for that meter form. A review of the Site Genie Monitor display of phasor information should explain why the service error occurred.

Figure 2-16: Service Error Display

WARNING ***Before leaving the installation, always verify that the service identified by the meter is the type of service desired and that a service error has not occurred.***

2.3.2 Display of Phasor Information

The Site Genie Monitoring System displays circuit information used by the kV2 Meter for individual phase measurements and to determine service type. This information is also used for some of the diagnostic displays and counters. The information in the Site Genie Display scroll can often be used to determine why an installation error or diagnostic error has occurred.

The 26 displays that make up the Site Genie display scroll can be grouped as follows:

- Service type
- Voltage phase angles, A, B, C
- Voltages, A, B, C
- Current phase angles A, B ,C

- Currents, A, B, C
- Power Factors (active and distortion)
- Diagnostic counters 1 – 8

2.3.2.1 Starting the Site Genie Display Scroll

The Site Genie Display scroll is started by holding a magnet to the right of the alternate display switch indicator on the bezel of the meter. Holding the magnet to the bezel for at least 3 but less than 6 seconds causes the meter to enter the Alternate Display mode. Holding the magnet to the bezel for more than 6 seconds causes the meter to enter the Site Genie Display scroll. See Figure 2-10.

2.3.2.2 Site Genie Display Scroll

Table 2-3 lists the items displayed in the Site Genie Display scroll. The table shows the order of the displayed items and the label used with each display. Table 2-4 defines the displayed service label Phase notations.

Table 2-3. Site Genie Display Scroll

Label	Value
SER	**Service Label**
PhA	**Voltage Angle A**
PhA	**Voltage Magnitude A**
PhA	**Current Angle Phase A**
PhA	**Current Magnitude Phase A**
PhB	**Voltage Angle Phase B**
PhB	**Voltage Magnitude Phase B**
PhB	**Current Angle Phase B**
PhB	**Current Magnitude Phase B**
PhC	**Voltage Angle Phase C**
PhC	**Voltage Magnitude Phase C**
PhC	**Current Angle Phase C**
PhC	**Current Magnitude Phase C**
PF_	**Power Factor**
dPF	**Distortion Power Factor**
d1_	**Diagnostic Counter 1**

Label	Value
d2_	**Diagnostic Counter 2**
d3_	**Diagnostic Counter 3**
d4_	**Diagnostic Counter 4**
d5_	**Diagnostic Counter 5**
d5A	**Diagnostic Counter 5 Phase A**
d5B	**Diagnostic Counter 5 Phase B**
d5C	**Diagnostic Counter 5 Phase C**
d6_	**Diagnostic Counter 6**
d7_	**Diagnostic Counter 7**
d8_	**Diagnostic Counter 8**

2.3.2.3 Phase Voltage and Current Conventions

The per-phase information displayed by the Site Genie Monitor is referenced to the internal voltage and current sensors of the meter, filtered to the fundamental frequency component. The meter defines each phase in terms of meter elements.

2.3.2.3.1 Phase Notation

Table 2-4. kV2c Meter Phase Notation shows the convention used by the Site Genie Monitoring System and within this book to describe service phases and meter elements.

Table 2-4. kV2c Meter Phase Notation

Display Label	Defined Phase	Meter Element
PhA	**Phase A**	**Left-hand element**
PhB	**Phase B**	**Center element**
PhC	**Phase C**	**Right-hand element**

Figure 2-17 shows two typical examples of how the phase labeling convention is used. The drawings assume that you are looking at the face of the meters as they sit in a socket.

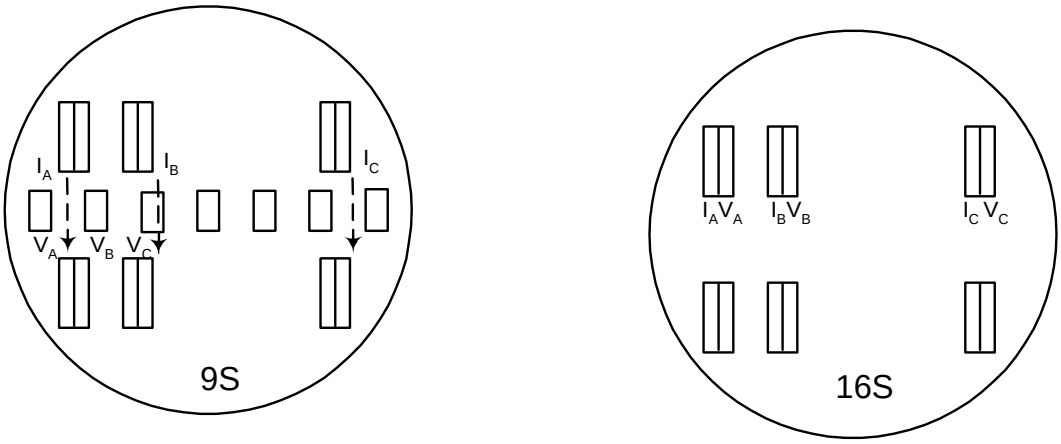


Figure 2-17 Phase Notation

2.3.2.3.2 Angle and Rotation Conventions

The Phase A voltage is the reference for angular measurements. All angles are measured as lagging from the Phase A voltage. Unless shown otherwise, phase rotation is counterclockwise; therefore, positive angles measure the amount of lag from the Phase A voltage. Figure 2-18 illustrates these conventions.

TIP ***The Site Genie Monitor uses the Phase A voltage as a reference point; therefore, the Phase A voltage angle is always 0.0 degrees.***

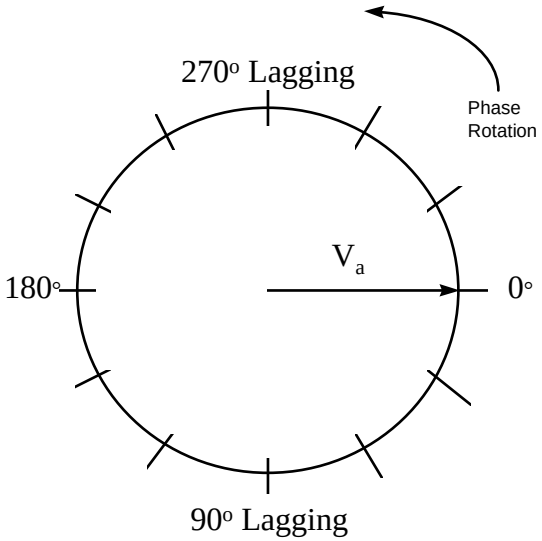


Figure 2-18: Phase Angle Conventions

2.3.2.4 Phase Voltage and Current Displays

Figure 2-19 shows typical Site Genie Phasor information for a form 16S meter installation as it appears on the display of a kV2c Meter.

	Phase A, Left Element	Phase B, Center Element	Phase C Right Element
Voltage Phase Angle	PhA 0.0° V	Phb 120.2° V	PhC 240.1° V
Phase Voltage	PhA 120.8 V	Phb 120.1 V	PhC 121.2 V
Current Phase Angle	PhA 9.8 ° A	Phb 126.0 ° A	PhC 243.8 ° A
Phase Current	PhA 36.7 A	Phb 42.2 A	PhC 29.2 A

Figure 2-19: Phasor Display Examples

The phasor information is most easily analyzed by plotting on a phasor diagram. Comparing the actual phasor diagram with the expected diagram for the service shows phase sequence and the sources of service wiring errors. Typical errors, such as polarity errors on transformers or mismatching currents and voltages, are easily diagnosed using the phasor diagram.

Phase sequence is determined by rotating the phasors counterclockwise and observing the order they would rotate through zero. In Figure 2-20, if the phasors are stationary, A is at zero. Rotating V_B and V_C counterclockwise, phase B next moves through zero followed by C. This indicates ABC phase sequence.

TIP ***For CBA rotation, A is at zero, but when the phasors are rotated counterclockwise, A is followed by C and then B.***

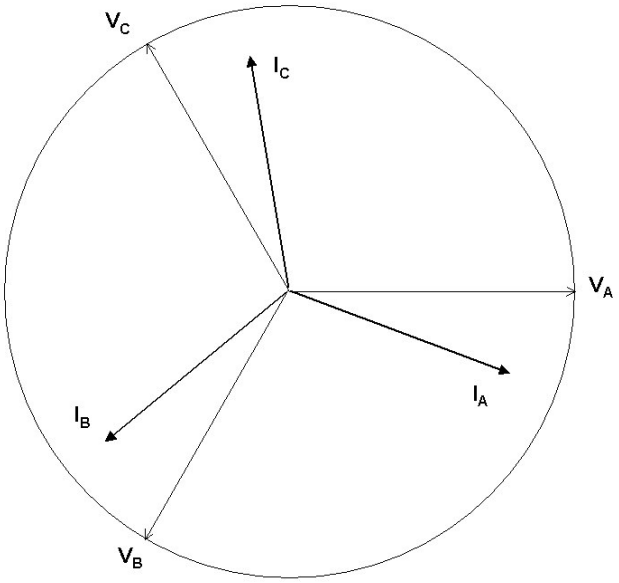


Figure 2-20: Phasor Diagram

Looking at the Figure 2-20, we can make the following observations about the circuit and installation:

- All phase currents are lagging.
- Phase voltage and current angles are as expected for a Wye installation; therefore, there are no apparent wiring errors.

2.3.3 Diagnostic Displays

Site Genie diagnostics provide continuous monitoring of the meter installation. They report on, and keep a count of, unexpected operating conditions (unless disabled by the meter's program). Diagnostic checks are performed every five seconds, except for Diagnostics 6 & 7, which are checked every second. If a diagnostic check fails a programmable number of consecutive tests (minimum of 3), the diagnostic display is added to the normal display scroll and the counter in the Site Genie scroll is incremented. Refer to Table 2-5 for a list of diagnostic displays and the meaning of the display.

Table 2-5. Site Genie Diagnostics

Diagnostic Test	Display
Polarity, Cross-Phase & Energy Flow Phasors must agree with service type.	**Diag 1**
Voltage Imbalance (%) Phase voltages must maintain acceptable agreement.	**Diag 2**
Inactive Phase Current All required phase currents must be above or below the defined threshold.	**Diag 3**
Imbalance (degrees) Phase angles between phase voltages and currents must not exceed limit.	**Diag 4**
Distortion (Total and per phase) (max. %) and DC Detection Distortion measurements must be below defined maximum.	**Diag 5** **A, B, C**
Under voltage (% below nominal) Phase A voltage must be above defined minimum.	**Diag 6**
Over voltage (% above nominal) Phase A voltage must be below defined maximum.	**Diag 7**
High Neutral Current Calculated neutral current must be below defined maximum.	**Diag 8**

MeterMate software provides several options for handling diagnostic errors. Each diagnostic may be enabled or disabled. If the diagnostic is enabled, then it may be added to the normal display scroll or suppressed. When added to the display scroll, the diagnostic may become part of the normal scroll or may freeze the display.

2.3.3.1 Diagnostic Limits

The limits for the diagnostic tests are set as part of the meter program. Specific voltage levels and services need not be set in the program. The Site Genie Monitor senses the service type and voltage. Diagnostic limits are set as variances (usually in percentages) from the nominal values.

TIP ***Diagnostic tests are disabled during series testing and Test Mode operation. This is done to allow normal testing of the meter without generating diagnostic displays and counts.***

2.3.3.2 Setting and Clearing of Diagnostics

Diagnostic conditions are checked every 5 seconds except for over- and under- voltage diagnostics, which are checked every second. The condition must remain out-of-limits for a programmed period of time (15 seconds to 30 minutes in 5-second increments) before a diagnostic condition is set in the meter. After the diagnostic condition is set, the meter displays the diagnostic and increments the diagnostic counter. The diagnostic is not armed again until two consecutive tests indicate conditions are within limits. Diagnostics

programmed to be part of the display scroll will be displayed as long as the condition is present.

The counters freeze at 255 until reset. Diagnostic counters may be reset using the Master Reset command in MeterMate DOS (answer NO to the first prompt, respond appropriately to subsequent prompts).

Extended diagnostic conditions are counted only once. For example, at an industrial plant, the voltage drops below limits at 8 a.m. and stays low until 3 p.m. Later the voltage goes above limit from 7 p.m. until 6 a.m. Only one under voltage and one over voltage diagnostic count is recorded.

2.3.3.3 Problem Detection

Table 2-6 lists the typical problems detected by each of the diagnostic tests. A detailed description of each test follows immediately after the table.

Table 2-6. Problem Detection with Diagnostic Tests

Diagnostic Test		Typical problems detected
d1	Polarity, Cross-phase, and Energy Flow Check	▪ Cross-phasing of a voltage or current circuit ▪ Incorrect polarity of voltage or current circuit ▪ Reverse energy flow ▪ Wiring error
d2	Voltage Imbalance	▪ Loss of a phase voltage ▪ Incorrect voltage transformer ratio ▪ Blown fuse - voltage transformer ▪ Incorrect phase voltage ▪ Wiring error
d3	Inactive Phase Current	▪ Shorted current transformer ▪ Wiring error ▪ Tampering or current diversion ▪ Shorting bar or by-pass closed in socket
d4	Current Imbalance or Displacement	▪ Poor power factor ▪ Imbalanced load

d5	Distortion	▪ DC current
		▪ Non-linear load created distortion
		  ▪ SCR and TRIAC motor controls
		  ▪ Switching power supplies
		  ▪ Reciprocating pumps

d6	Under Voltage	▪ High load ▪ Voltage regulation ▪ High system impedance ▪ Blown fuse ▪ Wrong VT ratio
d7	Over Voltage	▪ Capacitor banks ▪ Voltage regulation ▪ Blown fuse ▪ Wrong VT ratio
d8	High Neutral Current	▪ Third harmonic distortion adding in neutral ▪ Switching power supplies in PCs, copiers, fax machines ▪ Large single phase loading.

2.3.3.4 Description of Diagnostic Tests

There are eight diagnostic tests performed by the Site Genie Monitor. Each is described in the following paragraphs.

2.3.3.4.1 Automatically Determined Reference Voltage

The reference voltage used for the under and over voltage diagnostics and the voltage annunciators in the display is determined at power-up. This is accomplished by measuring the Phase A voltage and classifying the service as 120V, 277V, or 346V Wye, or 120, 240, or 480V Delta or Single Phase. The reference voltage may be overridden by programming a specific reference voltage.

2.3.3.4.2 Diagnostic Test 1—Polarity, Cross-phase, and Energy flow

Purpose:	Tests the phase angle relationships of the voltage and current phasors for each element against what is expected for the service.
Frequency:	Every 5 seconds using the data from the previous second.
Test:	Voltage phase angles must be within ±10° of the expected phase angle. Current phase angles must be within ±120° of the expected phase angle at unity PF (assuming a 3-phase load on polyphase meters).
Set:	Fails all tests during the programmed time period (15 seconds to 30 minutes in 5-second increments)
Clear:	Passes 2 consecutive tests.
Exceptions:	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test Mode.

TIP ***The diagnostic counter freezes at 255. Use the MeterMate DOS Master Reset command to clear the counter (answer NO to the first prompt, respond appropriately to subsequent prompts).***

2.3.3.4.3 Diagnostic Test 2—Voltage Imbalance

Purpose:	Verifies that the magnitude of the phase B & C voltages are within tolerance of the magnitude of the phase A (reference) voltage, taking into account the meter form and service.
Frequency:	Every 5 seconds using the data from the previous second.
Test:	Voltage magnitudes must be within ± the programmed tolerance of the expected voltage magnitude. Normal differences, such as the high leg on a 4-wire delta, are automatically accounted for by the test (V_C is expected to be 1.732 times V_A).
Tolerance:	User specified, 0% - 100% in 1 percent increments.
Set:	Fails all tests during the programmed time period (15 seconds to 30 minutes in 5-second increments)
Clear:	Passes 2 consecutive tests.
Exceptions:	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test Mode.

TIP ***The diagnostic counter freezes at 255. Use the MeterMate DOS Master Reset command to clear the counter (answer NO to the first prompt, respond appropriately to subsequent prompts).***

TIP ***The high and low voltage diagnostics (D6 and D7) monitor range of the service voltage based on the Phase A voltage input. D2 monitors voltage imbalance. D2 tells you if phase B and phase C are out of limit relative to the phase A service detect voltage.. If V_B or V_C are changing and move more than T% (T = tolerance) away from the phase A service detect voltage, then a Diagnostic 2 alert occurs.***

2.3.3.4.4 Diagnostic Test 3—Inactive Phase Current

This test should be used only for situations where continuous polyphase currents are expected. Circuits with only single-phase loads may generate diagnostics.

Purpose:	Catch shorted current circuits or unbalanced loading.
Frequency:	Every 5 seconds using the data from the previous second.
Test:	Checks the magnitude of the phase currents for any fall below the minimum threshold (at least one other phase must be above the threshold).
Tolerance:	0.1 – Class Amps in 0.1 Amp increments.
Set:	Fails all tests during the programmed time period (15 seconds to 30 minutes in 5-second increments)
Clear:	Passes 2 consecutive tests.
Exceptions:	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test Mode.

TIP ***The diagnostic counter freezes at 255. Use the MeterMate DOS Master Reset command to clear the counter (answer NO to the first prompt, respond appropriately to subsequent prompts).***

2.3.3.4.5 Diagnostic Test 4—Current Phase Angle

Purpose:	Apply tighter tolerances on current phase angles than the limits used in Diagnostic 1. It verifies that the current phase angles fall within the specified range of the expected value for the service.
Frequency:	Every 5 seconds using the data from the previous second.
Test:	Checks that the current phase angle is within (+/-) the programmed tolerance of the expected phase angle at unity PF (assuming a 3-phase load on a polyphase meter).
Tolerance:	0° to 120° in 1° increments
Set:	Fails all tests during the programmed time period (15 seconds to 30 minutes in 5-second increments)
Clear:	Passes 2 consecutive tests.
Exceptions:	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test Mode. Diagnostic 1 must pass and the measured current must be greater than 0.5% of class for the test to be performed.

TIP ***The diagnostic counter freezes at 255. Use the MeterMate DOS Master Reset command to clear the counter (answer NO to the first prompt, respond appropriately to subsequent prompts).***

2.3.3.4.6 Diagnostic Test 5—Total, A, B, C Distortion and DC Detection

Purpose:	Identify loads that generate excessive distortion or DC currents.
Frequency:	Every 5 seconds using the data from the previous second.
Test:	The meter will perform one of the following distortion measurements: Distortion Power Factor (DPF) Total Harmonic Voltage Distortion (VTHD) per element only Total Harmonic Current Distortion (ITHD) per element only Total Demand Distortion (TDD) per element only DC Detection Checks that the total (DPF only) and per phase distortion does not exceed the programmed tolerance. DC presence is sensed by measurement of the second harmonic content in the measured current waveform. Detection of this condition causes the meter diagnostic condition, d5, distortion, to be set. D5 is set when the total current level and second harmonic level are high enough for saturation to be possible, and the ratio of second harmonic current to total current exceeds programmed tolerance.
Tolerance:	0% to 100% in 1% increments.
Set:	Fails all tests during the programmed time period (15 seconds to 30 minutes in 5-second increments)
Clear:	Passes 2 consecutive tests.
Exceptions:	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test Mode. The diagnostic is not performed if the previous momentary interval demand (programmable choice of kW / kvar / kVA / kQ) does not exceed the programmed threshold.

TIP ***The diagnostic counter freezes at 255. Use the MeterMate DOS or MMCOMM Master Reset command to clear the counter (answer NO to the first prompt, respond appropriately to subsequent prompts).***

2.3.3.4.6.1 Distortion Power Factor

Distortion Power Factor is very good at identifying distortion sources and avoids penalizing others because distortion power is usually a result of non-linear loads. Linear loads typically do not have any distortion power even when harmonics are present.

Distortion Power Factor is the ratio of distortion power to apparent power. Distortion Power Factor tells us how much of the apparent power is explained by distortion power. Active Power Factor (PF) plus Reactive Power Factor (RF) and Distortion Power Factor (DPF) completely explain apparent power. Because these power factors are vector quantities, they add as shown in Equation 2-1.

$$\sqrt{PF^2 + RF^2 + DPF^2} = 1$$

Equation 2-1. Power factor Relationships

This is true because of the way the power vectors are defined. By definition, the square of apparent power is equal to the sum of the squares of active power, reactive power, and distortion power as shown in Equation 2-2. In the equation, U = Apparent Power, P = Active Power, Q = Reactive Power and D = Distortion Power.

$$U^2 \equiv P^2 + Q^2 + D^2$$

Equation 2-2. Apparent Power Definition

Typically, the limit used for this test is the same limit used by your power quality group for Current THD. Typical limits are between 15 and 30 percent. Distortion Power Factor usually closely follows current THD through the usable part of current THD's range (5% to 80%). This is because current distortion is usually much larger than voltage distortion and overwhelms the effects of voltage distortion.

2.3.3.4.7 Diagnostic Test 6—Under Voltage Test

Purpose:	Monitors the value of the phase A voltage.
Frequency:	Every 1 second.
Test:	Checks that the magnitude of the phase A voltage is above the reference voltage minus the programmed tolerance. The meter automatically determines the reference voltage based on the service type and input voltage magnitude (120V, 240V, 277V, 346V or 480V) unless a reference voltage is programmed into the meter.
Tolerance:	0% to 100% in 1% increments
Set:	Fails all tests during the programmed time period (3 seconds to 30 minutes in 1-second increments)
Clear:	Passes 2 consecutive tests.
Exceptions:	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test Mode.

TIP ***The diagnostic counter freezes at 255. Use the MeterMate DOS Master Reset command to clear the counter (answer NO to the first prompt, respond appropriately to subsequent prompts).***

TIP ***The high and low voltage diagnostics (D6 and D7) monitor range of the service voltage based on the Phase A voltage input. D2 monitors voltage imbalance. D2 tells you if phase B and phase C are out of limit relative to the phase A voltage.. If V_B or V_C are changing and move more than T% (T = tolerance) away from the phase A voltage, then a Diagnostic 2 alert occurs.***

2.3.3.4.8 Diagnostic Test 7—Over Voltage Test

Purpose:	Monitors the value of the phase A voltage.
Frequency:	Every 1 second.
Test:	Checks that the magnitude of the phase A voltage is below the reference voltage plus the programmed tolerance. The meter automatically determines the reference voltage based on the service type and input voltage magnitude (120V, 240V, 277V, 346V or 480V) unless a reference voltage is programmed into the meter.
Tolerance:	0% to 100% in 1% increments
Set:	Fails all tests during the programmed time period (3 seconds to 30 minutes in 1-second increments)
Clear:	Passes 2 consecutive tests.
Exceptions:	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test Mode.

TIP ***The diagnostic counter freezes at 255. Use the MeterMate DOS Master Reset command to clear the counter (answer NO to the first prompt, respond appropriately to subsequent prompts).***

TIP ***The high and low voltage diagnostics (D6 and D7) monitor range of the service voltage based on the Phase A voltage input. D2 monitors voltage imbalance. D2 tells you if phase B and phase C are out of limit relative to the phase A voltage.. If V_B or V_C are changing and move more than T% (T = tolerance) away from the phase A voltage, then a Diagnostic 2 alert occurs.***

2.3.3.4.9 Diagnostic Test 8—High Imputed Neutral Current

The meter does not measure the actual neutral current. It calculates the neutral current from the measured currents.

Purpose:	Monitors the imputed neutral current.
Frequency:	Every 5 seconds using the data from the previous second.
Test:	Checks that the magnitude of the imputed neutral current is below the programmed tolerance.
Tolerance:	0 – Class Amps in 0.1 Amp increments.
Set:	Fails all tests during the programmed time period (15 seconds to 30 minutes in 5-second increments)
Clear:	Passes 2 consecutive tests.

Exceptions:	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test Mode. Disabled for Form 45 and 56 meters used in a 4-wire wye or 4-wire delta service.

TIP ***Triplen currents add in the neutral. The triplens are the harmonics that are simply multiples of three times the fundamental. The third, sixth, and ninth harmonics are examples of triplens. For example, if there are large third harmonic currents in the phases, the neutral current can be higher than the individual phase currents.***

2.3.3.5 Diagnostic Output

The Site Genie diagnostics can also be used to control switches on a meter's I/O board. All diagnostics are supported and can drive several (any or all) solid- state relay (SSR) outputs on the I/O board. The outputs may be a Form A or Form C outputs. (See the I/O board specifications for ratings.)

MeterMate programming software allows the user to select which diagnostics will control which outputs. Any or all of the diagnostics can be selected to activate any or several outputs. If any of the selected diagnostic conditions which are mapped to a specific output occur, then that output is activated.

TIP ***Diagnostic events can also be recorded using the optional Event Recorder, enabled with the E soft switch, to determine the date/time when diagnostics occur. The meter must be operating in a Demand/LP or TOU mode for date/time information to be captured.***

3. Maintenance Instructions

WARNING: The information contained within this document is intended to be an aid to qualified metering personnel. It is not intended to replace the extensive training necessary to install or remove meters from service. Any work on or near energized meters, meter sockets, or other metering equipment presents the danger of electrical shock. All work on these products must be performed by qualified industrial electricians and metering specialists only. All work must be done in accordance with local utility safety practices and the procedures outlined in the current edition of the Handbook for Electricity Metering. The handbook is available from the Edison Electric Institute, 701 Pennsylvania Avenue N.W., Washington D.C. 20004-2696.

3.1 Recommended Procedures

The procedures described on the following pages are those recommended by the General Electric Company. Any procedures not described herein or referenced herein are not recommended.

3.1.1 Meter Testing Tools

The meter is equipped with a light-emitting diode (LED) for calibration and a liquid crystal display with disk analog and test displays. The calibration LED is part of the OPTOCOM port as shown in Figure 3-1.

3.1.1.1 Calibration LED

The OPTOCOM LED emits calibration pulses (infrared light) until the meter detects the presence of OPTOCOM communications. This LED is the source of Watthour and VArhour calibration pulses. Each calibration pulse is equal to the value assigned to Kt (Watthours or VArhours). The duration of each output pulse is approximately 25 milliseconds.

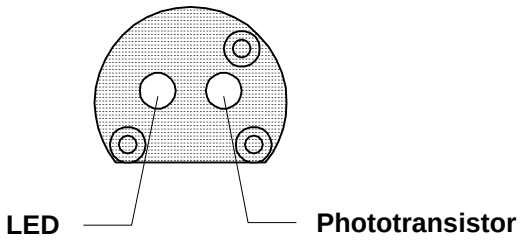


Figure 3-1: OPTOCOM Port

The default unit for the calibration pulses is Watthours. The meter may be switched to VArh calibration pulses using MeterMate software.

3.1.1.2 LCD Display

The meter display has annunciators for quadrant, phase voltage, and energy flow indication as shown in Figure 3-2. The annunciators provide valuable information during the testing process.

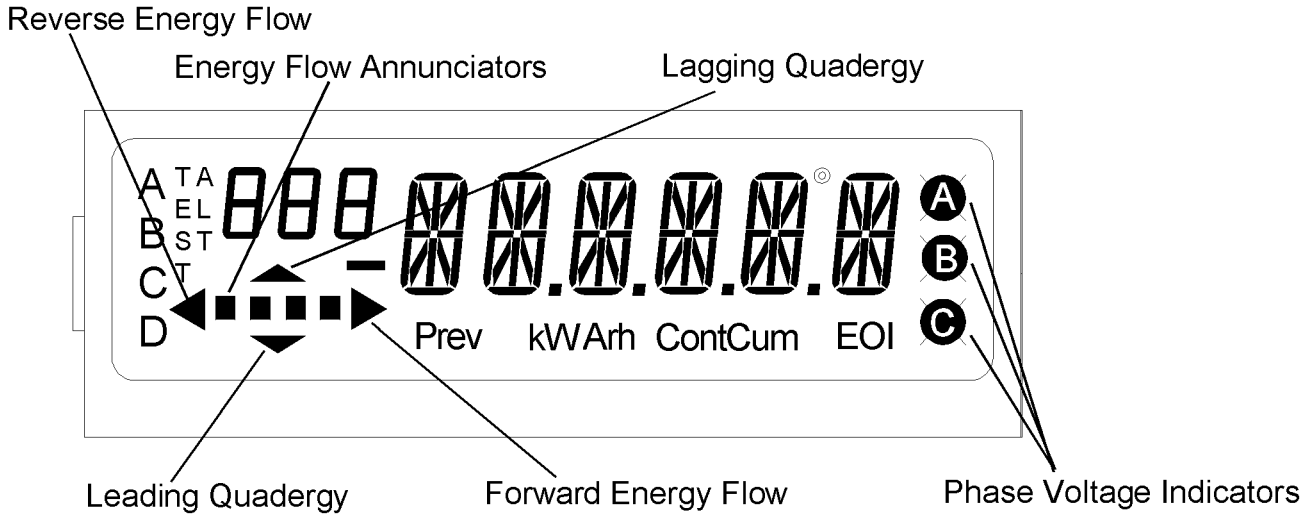


Figure 3-2: Liquid Crystal Display

Quadrant annunciators—The left and right arrows indicate reverse and forward energy flow, respectively. An up arrow indicates lagging quadergy (varh), and a down arrow indicates leading quadergy (varh). These arrows can be used to determine the quadrant in which the meter is currently operating.

Phase voltage—Three annunciators labeled A, B, and C are used to indicate the presence of voltage on their respective phases. If the annunciator is not displayed, there is no meter element in that phase or no phase voltage is expected for the metered service. For example, a 2 or 2½ element meter will show only A and C phases. If an expected voltage is low (below the value programmed into the meter [see Diagnostic Test 6 and Diagnostic Test 2]), the phase indicator blinks.

Energy flow annunciators—A series of four display segments are used to indicate the direction and relative quantity of energy flow (Disk analog). As energy flows from the line to the load, the segments will be energized, sequentially, from left to right. The segments are lighted respectively when accumulated energy equals 60%, 70%, 80%, and 90% of Kt watthours. All segments turn off when 100% of Kt watthours are accumulated. Conversely, as energy flows from the load to the line, they will be sequenced from right to left. The rate at which the segments are energized is inversely proportional to Kt. One complete cycle of four segments indicates that Kt Watthours of energy have been measured.

3.2 Test Mode

Test mode allows the meter to be tested without disturbing billing data or setting a new maximum demand. The Test Mode performs the same function as setting the pointers back on an electromechanical meter after testing.

The Test mode may be entered by pressing the test switch for 1 second or by using MeterMate software commands. The test mode switch is operated by removing the Lexan cover and pushing the test switch (switch marked T on the bezel).

3.2.1 Starting the Test Mode

To enter the test mode: use the test switch on the face of the meter or MeterMate Meter Comm. (MMDOS or MMCOMM in Metermate 5.00) commands.

Upon entering the test mode, several actions occur:

- The current demand interval is terminated.
- All outputs programmed to be active remain active.
- All test accumulators are set to zero.
- The subinterval countdown timer starts.
- LP recording is suspended, and LP interval status bits reflect test mode was in effect during affected interval(s).

When the test mode begins, the test annunciator is lit and the first item programmed for display is displayed.

3.2.2 While in Test Mode

The same selected measurement profile quantities (data accumulations) that are calculated during normal operation are calculated in test mode. The selection of which quantities are to be displayed in test mode is fully programmable in the MeterMate™ software. However, watthour, varhour, volt-ampere-hour, and q-hour quantities are displayed in units rather than kilo-units; i.e. the data is displayed as Wh, VArh, Vah and Qh rather than kWh, kVArh, kVAh and kQh. The same demand values calculated during normal operation are also calculated in test mode. The display formats for the demands are the same in test mode as they are in normal mode.

3.2.2.1 Energy Calculations

If the metering constants are not programmed, default values are used. Table 3-1 contains the default test mode values.

Table 3-1. Default Test Mode Values

Constant	Default Value
Demand decimal position	Same as non-test mode
Demand interval length	15 minutes
Demand subinterval length	5 minutes
Energy display format	XXX.XXX
Number of demand subintervals	3
Power line frequency	60

The display does not scroll while in test mode. Each item remains displayed until the display switch is activated with a magnet. At that time, the next item in the display program is shown. The quantity displayed is updated every second.

The test mode display is fully programmable. Table 3-2 lists the default test mode display items for an unprogrammed meter. Items can be added or deleted using MeterMate software.

Table 3-2. Test Mode Default Display

Display ID	Display Quantity
94	Accumulating Wh
95	Previous interval kW demand
91	Time remaining in subinterval (MM SS)
92	Momentary interval demand
93	Maximum test kW demand

3.2.2.1 Displays Available in Test Mode Only

The following display items are available for display only in the test mode:

- Test mode maximum demands
- Time remaining in test demand interval in block demand only
- Time remaining in test demand subinterval in rolling demand only
- Test mode data accumulations
- Test mode accumulating demand

3.2.2.2 Test Reset

A test reset is initiated by pressing the reset switch while in the test mode. A test mode reset causes all test quantities to be reset to zero and a new subinterval to be started. An all-segments display is shown until the reset switch is released. The item displayed when the reset occurred remains in the display, but the value will be initialized.

In the event of a power outage, data for test mode energy, demand, and power factor are not saved. These data are reset when power returns. Upon power up, the meter remains in test mode and the item displayed when the outage occurs, remains on the display. In a TOU meter or demand meter with load profiling, there may be a slight delay before re-entering test mode on power up. During the delay, the meter is performing its catch-up tasks.

3.2.2.3 Exiting Test Mode

Test mode is exited in one of three ways:

1. By pressing and holding the test switch for more than 1 second
2. By an MMDOS or MMCOMM command
3. By the test mode time-out timer

All test mode data is lost when test mode is exited. Upon exiting test mode in a meter programmed for rolling demand, a new, possibly partial, subinterval is started. The past subinterval as well as the current subinterval is zeroed. Upon returning to the normal operating mode, a TOU meter or demand meter with load profiling will complete the time remaining in the current partial subinterval such that subsequent subintervals will be synchronized with the midnight boundary. The new subinterval in the demand only mode is the number of minutes that was remaining in the subinterval prior to entering test mode.

For meters that are programmed for thermal emulation, the thermal demand reading is set to zero immediately after test mode is exited.

The meter will automatically exit the Test Mode when the time in the Test Mode Time has exceeded its programmed limit. This Test Mode time limit prevents accidentally leaving the

meter in the test mode and losing billing information. The test mode time-out function is programmable from 1 minute to 99 hours.

Note: ***Normal billing & LP data accumulation is suspended during test mode operation. Upon exiting test mode accumulation of billing & LP quantities will resume from the values in place when test mode was entered.***

3.3 Field Accuracy Test

The test mode allows the meter to be accuracy tested in the field without disturbing any billing data.

3.3.1 Field Testing With Test Mode

Testing the meter in the field can be accomplished three ways in the test mode by using the:

1. Maximum demand reading in the display
2. Disk analog display
3. Instantaneous demand feature of the kV2c

3.3.2 Maximum Demand Reading Testing

This is the most accurate of the three test methods. For this test, you need a portable standard with a start/stop switch and a phantom load.

1. Make sure that the voltage coils are in parallel and the current coils are in series.
2. Connect the phantom load and the portable standard to the meter to be tested.
3. Apply voltage to the meter and the standard and wait 20 seconds for settling time.
4. Put the meter into test mode.
5. Change the display to maximum demand (display ID 93 using the default display items).
6. Switch on the desired current.
7. Check the flow indicator on the meter to make sure that the polarity is correct.
8. Reset the standard.
9. Simultaneously reset the meter and start the standard. The test reset takes effect when switch is released.
10. Turn the current off when the end-of-interval (EOI) annunciator comes on.
11. Compare the meter readings with the standard's readings. EOI comes at the end of every subinterval; numbers won't match before interval is completed and display is updated. Where rolling demand is used (n sub intervals making up a complete demand interval) the display value needs to be multiplied by n for comparison to the standard value.

3.4 Disk Analog Testing

The disk analog provides a precise means of checking the calibration of the meter. There are some practical limits to this method of testing. For example, if the load on the meter is very low, the test may take a long time. Conversely, if the load is high, it may be difficult to accurately time the switching of the standard.

The disk analog in the kV2c works as follows:

- The first segment is lit when 60% of Kt Watt hours have accumulated.
- The second segment is lit (with the first segment remaining lit) when 70% of Kt Watt hours have accumulated.
- The third segment is lit (with the first and second segment remaining lit) when 80% of Kt Watt hours have accumulated.
- All segments are lit when 90% of Kt Watt hours have accumulated.
- All segments are turned off when 100% of Kt Watt hours have accumulated.
- The cycle then restarts, with the first segment being lit when another 60% of Kt Wh has accumulated.

For this test you need a portable standard with a start/stop switch. Field testing using the disk analog allows you to check the calibration of the meter without having to install a phantom load.

1. Make sure the voltage coils are in parallel and the current coils are in series.
2. Connect the portable standard to the meter.
3. Reset the standard.
4. Observe the disk analog. Each cycle of the disk analog represents K t Watt hours of accumulation. (The Kt value is printed on the meter nameplate.)
5. When the disk analog transitions from all segments on to all segments off, start the standard.
6. Let the disk analog scroll through a predetermined number of times (10, for example).
7. Stop the standard when the disk analog transitions from all segments on to all segments off for the desired number of times.
8. Calculate the accumulated Watt hours as shown in Equation 3-1.

$$\textit{Accumulated Energy} = (Kt) \times (\textit{the number of complete disk analog cycles})$$

Equation 3-1. Accumulated Watt-hours Calculation

For example: if Kt equals 3 and 10 complete cycles were counted, then:

3 Wh x 10 complete scrolls = 30 Wh.

9. Compare the results of the calculation to the reading on the standard.

3.5 Shop Test

Shop testing consists of verifying the meter's accuracy.

Caution POLYPHASE TESTING OF kV2c METER

The kV2c meter is designed to meter conventional services with nominal line-to line voltages up to 480 Volts for meters rated 120-480 Volts or line-to-line voltages up to 208 Volts for meters rated 69(57)-120V. Operation at voltages more than 10% above these ratings can lead to shortened life or failure.

Do not apply polyphase test voltages, using "Wye" test conditions, at voltages higher than 305 Volts line-to-neutral (277V + 10%) for 120-480V rating; no higher than 132 Volts line-to-neutral (120V +10%) for 57-120V rating
Meter forms 9S, 10A, 36S, 48A, 16S or 16A rated 120-480V without Revenue Guard Boards may be applied in 600/345V "Wye" services. Polyphase "Wye" test voltages applied to these meters must not exceed 380V line-to-neutral (345V +10%)

For example, polyphase testing with 480 Volt "Wye" line-to-neutral conditions will result in voltages in excess of 800 Volts being applied to the meter. Stresses of this magnitude can result in immediate failure of the meter and/ or shorten meter life.

3.5.1 Meter Shop Equipment

The meter loading equipment must be capable of maintaining accuracy while supplying energy to the meter's broad range switching power supply. Otherwise, meters may be tested in any shop that meets the requirements outlined in the current editions of the ***Handbook for Electricity Metering*** published by the Edison Electric Institute and the American National Standard Code for Electricity Metering.

3.5.1.1 Equipment Setup

The meter mounting equipment and its electrical connections must be used as required for the meter form number on the meter nameplate. If required for the test equipment used, the test link(s) must be opened.

3.5.1.2 Testing

The Watthour constant (Kh) of a meter is defined as ***Watthours per disk revolution***. Because electronic meters do not rely on disk revolutions to measure energy, Kh is not a meaningful unit of measure in the GE kV2c Meter. Kh is printed on the meter label as a reference to an equivalent electromechanical meter as required by applicable meter standards. ***It has no practical application in the operation of the kV2c Meter***.

3.5.2 Test Constant

The meter test constant (Kt) is the number of Watthours per calibration pulse. Typically the kV2c Meter is tested like an electromechanical meter, using a Kt value equal to a standard Kh value as printed on the meter label.

To simplify and speed up testing, you may want to use Kt values different from the traditional Kh values used with electromechanical meters. For example, a Kt of 0.3 for transformer-rated meters and 3.0 for self-contained meters would significantly speed up testing and

dramatically reduce the number of test constants used. These values (0.3 and 3.0) are the smallest values that test the complete operating range of the meter (up to 480V and class load). However, smaller values are possible if you are willing to restrict the test range. The test pulse duration of 25 milliseconds limits the minimum Kt value to a value large enough that the Test LED is not lit continuously at the maximum test load.

NOTE: ***Changing the value of Kt does not affect meter readings or measurements. Changing Kt affects only the speed at which test pulses are generated. Smaller Kt values produce more test pulses and reduce test time. Test times shorter than 30 seconds are not recommended as shorter times can cause significant variability in test system results.***

The wide voltage range capability of the kV2c meter let's you replace several ratings of traditional electromechanical meters with one 120 Volt to 480 Voltmeter. Each of these traditional voltage rating had a separate Kh. This means that we have several choices for Kt when testing a kV2c meter like a traditional electromechanical meter. The following recommendations should be kept in mind when selecting Kt.

1. Select the smallest practical Kt. Larger Kt values only slow down testing and do not increase test accuracy or change the test range.
2. If testing like an electromechanical meter use a Kt that matches the 120 Volt Kh for that meter. The meter can still be tested over the complete voltage range and will test faster than if the 480 Volt Kh is chosen.

Table 3-3 Allowable Kt Range of Values

	57-120V	120-480V
CL 20	**0.15 — 1.6**	**0.3 — 4.0**
CL 150, or 200	**1.5 — 16**	**3.0 — 40**
CL 320	**2.1 — 24**	**4.5 — 60**

Note: The maximum Kt values shown in Table 3-3 ***should not be exceeded. Exceeding these values may produce testing errors.***

3.5.3 Watthour Test Procedure

To test the meter, proceed as follows:

1. Note the meter Kt value listed on the nameplate.
2. Select the desired voltage and current level(s) on the test equipment. (Test voltage of 120V is assumed.)
3. Install the meter in the test socket, making certain that the socket is wired and/or configured for the appropriate meter form.
4. Align the optical pickup of the test equipment with the calibration LED.
5. Begin testing according to standard test procedures. Allow 15 seconds of settling time after applying voltage before making accuracy measurements (20 seconds if modem installed).
6. Check the meter calibration under three load conditions: full load, light load, and full load with lagging power factor. A minimum test time of 30 seconds is needed to reduce test uncertainty to a level compatible with the accuracy of the kV2c meter. (Check the instruction book for

your test board or standard to determine the actual minimum test time. Standards with heavily filtered inputs may require longer test times.)

3.5.4 VArhour Testing

GE kV2c meters are digital sampling meters. All quantities are derived mathematically from the same set of voltage and current sampled data used to compute Watthours. Therefore, it is only necessary to check Watthour calibration to ensure that all revenue quantities are accurate. However, some utilities are required by their Public Utilities Commissions to verify the accuracy of VArhour data as well as Watthour data.

1. Use MeterMate software to put the meter calibration LED into VArhour pulse output mode.
2. Set up the meter for testing as described above in Watthour Test Procedure. The test pulse value is now Kt VArhours per pulse.
3. Begin testing according to your standard VArhour test procedures. Allow 15 seconds of settling time after applying voltage before making accuracy measurements (20 seconds if modem installed).

NOTE: ***Test conditions with high power factors require very long VArh test times. Typically VArh testing is done at 120V and 0.5 PF.***

3.6 Battery Replacement

Lithium Inorganic 3.6 Volt Battery (Safety Precautions)

- Do not expose battery to temperatures above 100 degrees C. Do not incinerate, puncture, crush, recharge, short circuit and over-discharge battery.
- The contents are water reactive and the battery contents can form HCL (hydrochloric acid), SO_2 (sulfur dioxide) and H_2 (hydrogen), upon contact with water (only when forced open). Do not expose contents of battery to water. Do not expose contents to high humidity for extended periods of time.
    - Dispose of batteries in accordance with local, state and federal hazardous waste regulations.

To obtain an MSDS (Material Safety Data Sheet) , contact your local GE supplier.

3.6.1 Replacing the Battery

Note: ***The battery should be replaced within 30 seconds of de-energizing the meter to avoid losing date/time information and forcing the meter into an Er 000002 state.***

3.6.1.1 Replacing the Battery when a Battery Port is not Present on Meter Cover

CAUTION - Battery installation must be done with NO power applied to the meter.

1. Remove power from the meter.
2. Remove the meter cover.
3. Remove the old battery and disconnect its wire from the bezel battery connector.
4. Place the new battery in the battery compartment.
5. Connect the battery wire to the bezel battery connector.
6. Replace the meter cover.
7. Energize the meter.
8. Reset the Accumulated Outage Duration (time on battery backup) value using MMDOS or MMCOMM commands (Reset, Battery).

3.6.1.2 Replacing the Battery when a Battery Port is Present on Meter Cover

CAUTION –Do not need to remove meter cover but should install battery with NO power applied to the meter.

1. Remove power from the meter.
2. Open the battery port hatch on the meter cover. (It may be necessary to use the edge of a tool to pry the battery port hatch open.)
3. Reach fingers into the battery port and disconnect the old battery.
4. Remove the old battery.
5. Connect the battery wire to the connector in the battery compartment of the bezel.
6. Slide new battery into battery compartment.
7. Close battery port hatch and replace seal.
8. Energize the meter.
9. Reset the Accumulated Outage Duration (time on battery backup) value using MMDOS commands (Reset, Battery).

3.7 Service

The GE kV2c Meter is factory calibrated and requires no routine or scheduled service by the user.

3.8 Repair

Factory repair or replacement service is offered when you cannot fix a problem. Because of the high density and integrated design, the repair of on-board components is not recommended. Instead, return the whole meter to General Electric as described in the following paragraph.

3.9 Returning a Meter

If you wish to return a meter, call your General Electric sales representative for a Return Authorization. The entire meter should be returned with the GE supplied Return Authorization information form completed. Key information includes quantity, catalog

number, serial number(s) and a complete description of the problem. Return instructions will be provided by your General Electric sales representative.

3.10 Cleaning

CAUTION	***Care must be taken during cleaning not to damage or contaminate any gold-plated contacts of the connectors.***
CAUTION	***Do not immerse the meter in any liquid.*** ***Do not use abrasive cleaners on the Lexan covers.*** ***Do not use chlorinated hydrocarbon or ketone solvents on the covers.***

3.11 Storage

The kV2c Meter is a durable device; however, it should be handled and stored with care. The temperature and humidity levels in storage are not critical; but extremes of either factor should be avoided.

3.12 Troubleshooting Guide

The meter displays two types of codes:

Error codes begin with Er and are shown in

- **Table 3-4**.
- Caution codes begin with CA and are shown in Table 3-5.
- Problems that do not display any codes are listed in Table 3-6.

3.13 Errors and Cautions

The GE kV2c Meter continually checks for internal errors, hardware failures, and cautions. These events are reported in coded form on the LCD.

3.13.1 Error Reporting

The meter continuously checks its hardware components — ROM, EEPROM, flash, battery, DAP, microprocessor — to ensure that they are operating properly. When the meter detects that a hardware component is not operating properly, an error is reported. Error codes are displayed as soon as they are detected. The meter can be programmed to freeze error codes in the display when an error is detected. Refer to

Table 3-4 for a list of errors. If subsequent tests indicate that the hardware component is operating properly, the meter will clear the error automatically.

Errors are serious events and usually indicate a condition has occurred that may have compromised the meter data. Unless GE has issued a service advisory indicating that other actions should be taken, ***you should remove the meter from service and contact your GE sales representative***. The only exception to this rule is the Battery Failure & Power Loss error display, Er 000 002. ***Do not return meters displaying Er 000 002***.

The Er 000 002 display indicates that the meter lost time during a power outage because of a weak, missing, disconnected, or defective battery. Replace the battery and reprogram the meter to eliminate the problem.

TIP: ***When the meter is read through the OPTOCOM port, error and caution conditions are returned with the meter data regardless of what display options are chosen in the meter program.***

Table 3-4. Error Code Display

Error Display	Probable Cause	Remedy
Er 000 002	Power outage occurred, and: a. Battery disconnected. b. Battery defective.	Reprogram meter, and: a. Connect battery. b. Replace battery.
Er 000 020	Hardware failure.	Replace meter.
Er 000 200	Non-volatile data error: a. EEPROM error. b. Flash error.	Replace meter.
Er 001 000	Firmware code error: a. ROM code error. b. Flash code error.	Replace meter.
Er 100 000	Voltage reference error.	Replace meter.
Er 200 000	DSP error.	Replace meter.
Er 300 000	Both Voltage Reference and DSP errors.	Replace meter.

3.13.1.1 Er 000002—Battery Failure & Power Outage

The Battery Failure & Power Outage error indicates that the battery failed to maintain power during an outage. The meter has reverted to a Demand mode of operation. The meter will increment only Data Accumulation, Billing Summation, & maximum Demand values upon energizing the meter after loss of date/time information. TOU and LP operations are suspended. TOU and LP data accumulated prior to the loss of date/time information is stored in NV RAM and is available for reading via the optical port or remote communication link. The battery should be replaced and, after reading the meter electronically to extract the NV RAM data, the meter fully reprogrammed to ensure proper operation. Prior LP data will be lost when the meter is reprogrammed, so make sure you read it before reprogramming the meter. The meter can stay in service.

Date & Time:	Lost
Load Profile recording:	Stopped
Register Function:	Demand Only
Program:	OK
TOU schedule:	Stopped
TOU calendar:	Stopped
Billing Data:	Total accumulations and max. demands

	are OK

3.13.1.2 Er 000020—Hardware Failure

The Hardware Failure error indicates that the meter detected an internal hardware failure. The meter should be taken out of service and returned to GE.

Date & Time:	Stopped
Load Profile recording:	Stopped
Register Function:	Demand Only
Program:	OK
TOU schedule:	Stopped
TOU calendar:	Stopped
Billing Data:	May be corrupt

3.13.1.3 Er 000200—Non-Volatile Data Error

The Non-Volatile Data error indicates a failure in either the EEPROM used to store configuration information and billing data or the flash used to store self-reads, event logs and load profile data. When the meter is not communicating, it continually tests the integrity of the data stored in non-volatile memory. If the meter detects an error in the non-volatile data, it sets the Non-Volatile Data error. If subsequent tests pass, the error is cleared. A meter with a Non-Volatile Data error should be removed from service and returned to GE.

Date & Time:	OK
Load Profile recording:	May be corrupt
Register Function:	Unchanged
Program:	May be corrupt
TOU schedule:	May be corrupt
TOU calendar:	May be corrupt
Billing Data:	May be corrupt

3.13.1.4 Er 001000—Firmware Code Error

The Firmware Code error indicates a failure in either the masked ROM used to store firmware or the flash used to store functional enhancements and user defined calculations. When the meter is not communicating, it continually tests the integrity of the firmware stored in masked ROM and flash. If the meter detects an error in the firmware, the meter sets Firmware Code error. If subsequent tests pass, the error is cleared. A meter with a Firmware Code error should be removed from service and returned to GE.

Date & Time:	OK?
Load Profile recording:	OK?
Register Function:	Unchanged
Program:	OK?
TOU schedule:	OK?
TOU calendar:	OK?
Billing Data:	OK?

3.13.1.5 Er 100000—Voltage Reference Error

The Voltage Reference error indicates a problem in the analog to digital conversions for voltages and currents. If the meter detects a problem with the voltage reference, the meter sets the Voltage Reference error. If subsequent tests pass, the error is cleared. A meter with a Voltage Reference error should be taken out of service and returned to GE.

Date & Time:	OK

Load Profile recording:	Corrupt data
Register Function:	Unchanged
Program:	OK
TOU schedule:	OK
TOU calendar:	OK
Billing Data:	Corrupt data

3.13.1.6 Er 200000—DSP Error

The DSP error indicates a problem with the digital signal processing of the voltage and current samples. If the meter cannot read and process valid voltage and current samples, the meter sets the DSP error. If subsequent tests pass, the error is cleared. A meter with a DSP error should be taken out of service and returned to GE.

Date & Time:	Stopped
Load Profile recording:	Stopped
Register Function:	Unchanged
Program:	OK
TOU schedule:	Stopped
TOU calendar:	Stopped
Billing Data:	Stop accumulating

3.13.2 Caution Reporting

The meter also checks other conditions, which are of concern, but do not indicate a problem with the meter hardware. The meter reports these as cautions. Individual cautions may be enabled or disabled selectively. If a caution is enabled, it can be configured to be displayed and optionally freeze the display.

Low battery, loss of program and unprogrammed cautions are used to remind the user of actions that are required. Any meter with a low battery caution may lose time if the battery is not replaced before the next power outage.

Other caution codes report unusual operation such as receiving energy from the load, leading power factor, very high current flow, or low voltage.

TIP: ***When multiple cautions occur they are combined. For example, CA040400 indicates leading quadergy and low potential.***

Table 3-5. Caution Code Display

Caution Display	Probable Cause	Remedy
CA 000 001	Low battery. Battery failed test.	Replace battery.
CA 000 010	Meter unprogrammed. Using default values.	Program the meter.
CA 000 040	Loss of program. Programming interrupted. Using previous values.	Program the meter.
CA 000 400	Low potential on indicated phase.	Check circuit voltages.

Caution Display	Probable Cause	Remedy
CA 004 000	Demand overload warning has exceeded programmed threshold.	Check for service overload conditions. Check programming threshold value.
CA 040 000	Leading kVArh warning.	a. Disable the warning. b. Check system operating parameters if leading kVArh is unexpected.
CA 400 000	Received kWh warning. a. CT polarity is incorrect. b. Energy is flowing from load to line. c. Meter's internal wiring defective	a. Check meter socket and CT wiring. b. Disable caution. Check system operating parameters if reverse energy flow is unexpected. c. Check that sensor connector is properly seated.

3.13.2.1 CA 000001—Low Battery

The Low Battery caution indicates a weak or missing battery. The meter periodically tests the battery. To test the battery, the meter applies a load to the battery, waits, and samples the battery voltage. The meter sets the Low Battery caution if the resulting battery voltage is low. The Low Battery caution is cleared when the battery test passes. The meter tests the battery under the following conditions:

- Power up
- 1st of each month (00:16)
- Activate the Display Switch (not in Test Mode)
- MeterMate Meter Comm. command

3.13.2.2 CA 000010—Unprogrammed

The Unprogrammed caution indicates that the meter is not programmed and is functioning in a "Default Demand" mode. The meter is shipped "unprogrammed" unless ordered "factory programmed". The MeterMate Meter Comm "unprogram" command will put the meter into the "Default Demand" mode and set the Unprogrammed caution. Programming the meter clears the Unprogrammed caution.

3.13.2.3 CA 000040—Loss of Program

The Loss of Program caution indicates that a programming session was interrupted. The meter sets the Loss of Program caution when a programming session is terminated abnormally. The meter will "roll back" to the last good program and operate from it. If a meter has a Loss of Program caution, reprogram the meter and the Loss of Program caution will be cleared.

3.13.2.4 CA 000400—Low Potential

The Low Potential caution indicates that the voltage for one or more phases fell below the reference voltage minus the tolerance (uses Diagnostic 6 threshold). All active phases are tested every 5 seconds using the phase voltages from the previous second. The meter sets

the Low Potential caution when the test fails 3 consecutive times. The meter automatically clears the Low Potential caution when all active phases exceed the minimum threshold for 2 consecutive tests.

3.13.2.5 CA 004000—Demand Overload

The Demand Overload caution indicates that the load demand of the user –selected quantity exceeded the programmed threshold. The meter compares the value of the user-selected "instantaneous" demand quantity to the programmed threshold every 5 seconds using the demand from the previous second. The meter sets the Demand Overload caution when the user-selected demand exceeds its threshold for 3 consecutive tests. The meter does not automatically clear the Demand Overload caution. The Demand Overload caution is cleared by a demand reset.

3.13.2.6 CA 040000—Leading kvarh

The Leading kvarh caution indicates that the current leads the voltage instead of lagging it. The meter tests the direction of the quadergy every 5 seconds using the kvarh from the previous second. The meter sets the Leading kvarh caution when the direction of the quadergy is leading for 3 consecutive tests. The meter does not automatically clear the Leading kvarh caution. The Leading kvarh caution is cleared by a demand reset.

3.13.2.7 CA 400000—Received kWh

The Received kWh caution indicates that active energy was received from the load. The meter tests the direction of the active energy every 5 seconds using the kWh from the previous second. The meter sets the Received kWh caution when the direction of the active energy is received for 3 consecutive tests. The meter does not automatically clear the Received kWh caution. The Received kWh caution is cleared by a demand reset.

Table 3-6 Fault Symptoms Without Codes

Symptom	Probable Cause	Remedy
High/low demand registration	a. Socket wiring error. b. Meter internal wiring defective. c. Defective sensor.	a. Rewire according to applicable diagram. b. Check that voltage and current connectors are seated properly. Check the leads for damage. c. Replace meter.
Meter overheats	a. Meter socket has insufficient capacity or is not adequately wired. b. Meter is overloaded. c. Poor connection at socket terminal.	a. Replace mounting with a heavy duty model. b. Use transformer rated installation. c. Replace socket terminal.
Meter runs slow	a. Socket wiring error. b. Meter internal wiring defective. c. Defective sensor.	a. Rewire according to applicable diagram. b. Check that voltage and current connectors are seated properly. Check the leads for damage. c. Replace meter.
No display	a. Circuit de-energized. b. Test link(s) open. c. Meter internal wiring defective.	a. Check circuit voltages. b. Close test links. c. Check that the voltage and current sensors are properly connected. Also check the wires for damage.
Option board malfunctioning	a. Option board improperly installed. b. Output cables defective. c. Defective option board. d. Wrong program values	a. Check option board installation. b. Check output cables for loose or damaged leads. c. Replace option board. d. Reprogram meter

4. Upgrading

4.1 General

WARNING: The GE kV2c meter contains lethal voltages. The meter must be completely disconnected from any external circuits before disassembly is attempted. Failure to observe this practice can result in serious injury or death.

Refer to the MeterMate software manuals (GEH-5082I, GEH-5084I) for instructions on how to install and enable software options.

4.2 Softswitches

The basic kV2c meter provides a powerful platform for advanced metering. Features may be added to the basic meter through "Softswitches", which enable built-in capabilities. Softswitches may be ordered at the time the meter is purchased, or added in the field. Softswitches may be removed from one meter and installed in another meter.

The following table lists the Softswitches available in the kV2c:

Switch	Description
A[2]	Alternate Communication
B	By Quadrant measurements
C[1,4]	Call In on Outage (Modem)
D[2]	DSP Sample Output
E[1]	Event Log
G	Revenue Guard Plus
I	Instrument Transformer Correction
K[1]	kVA - Power Factor, kvar and kVA measures
L	Transformer Loss Compensation
M	Expanded Measures - per element measurements
N[5]	Billing Demand
P[2]	Pulse Initiator Output
Q	Power Quality Measures
R[3]	Basic Recording (Four-channel)
T[1]	Time of Use
V	Fast Voltage Event Monitor and Log (Sag and swell, 1 to 65k cycles)
W	Waveform capture (for harmonic analysis) (70 sample sets - 6 measures per set - V & I per phase)
X	Expanded Recording (20-channel)
Z	Totalization

Table 4-1 kV2c Softswitches

[1] Works in kV , kV2. and kV2C.

5

[2] Same as kV—not sold as an upgrade— factory set in all meters.

[3] R switch factory set in all kV's but must be set (optionally) in kV2.

[4] Set in Comm Board, not meter, and cannot be downgraded (removed) from meter.

[5] An Upgradeable switch in KV2c

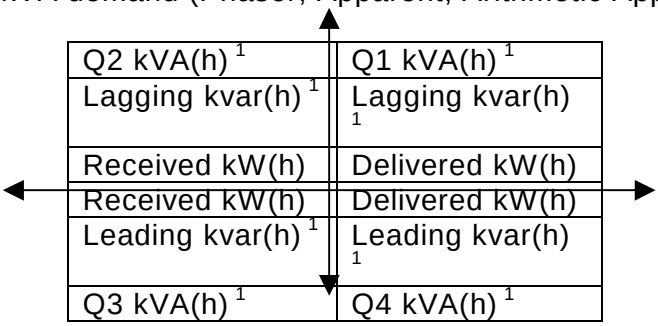
4.2.1 Alternate Communication—A Softswitch

The Alternate Communication Softswitch allows communication option boards to communicate with the meter. It is set in all meters.

4.2.2 By Quadrant Measurements—B Softswitch

The By Quadrant Measurements Softswitch allows the enabled measurements to be tracked by quadrant:

- kWh and kW demand
- kvarh and kvar demand[1]
- kVAh and kVA demand (Phasor, Apparent, Arithmetic Apparent) [1]



[1] Requires K Softswitch to be enabled.

4.2.3 Call In on Outage—C Softswitch

The Call In on Outage Softswitch allows the meter to call in during an outage to report the outage. It must be used in conjunction with a communication option board such as the Internal Modem or the RSX board in the external modem mode. The communications option board must have the call-in-on-outage battery pack. The Soft switch is stored in the option board, not in the meter. Softswitches cannot be removed from the communication option boards.

4.2.4 DSP Sample Output—D Softswitch

The DSP Sample Output Softswitch enables the output of voltage and current samples after the gain and phase corrections and DSP case has been applied.

4.2.5 Event Log—E Softswitch

The Event Log Softswitch allows the meter to track the most recent 500 "events". Use MMProg to select which event types should be logged and how many occurrences should be tracked - up to 500 occurrences max. Date & time stamps are included on logged events for Demand/LP or TOU meters. Logged Events include:

- Diagnostics 1~8: when set & when cleared (d5 by phase & total)

- Cautions: Under voltage, Demand overload, leading kvarh, reverse energy flow -- when set & when cleared
- Real Time Pricing activation and deactivation
- Test Mode activation and deactivation
- Externally initiated meter reading (local or remote)
- Programming sessions
- Power up, power down
- Demand resets
- Self Reads

4.2.6 Instrument Transformer Correction—I Softswitch

The Instrument Transformer Correction Softswitch allows users to create and optionally use an alternate set of calibration constants. Use MMDOS to input the CT and VT ratio and phase angle correction factors for the instrument transformers used at that installation. MMDOS uses those factors, plus the original factory calibration constants, to calculate new calibration constants. The adjusted calibration constants are stored separately from the original factory constants. MMDOS allows users choose whether to apply the alternate set of calibration constants or not (makes calibration testing easier). All measurements, including the Test LED output, are affected.

4.2.7 kVA, kvar and Power Factor Measurements—K Softswitch

The kVA, kvar and Power Factor Measurements Softswitch adds kVA(h), kvar(h), kQ(h) and PF measurement capability.

- kvar(h) may be IEEE defined or “Fuzzy vars”.
- kVA(h) may be Phasor, Apparent, or Arithmetic Apparent.
- PF may be user defined as one of the choices below:
  - Traditional (kWh / Phasor or Apparent kVA)
  - Alternative (kWh / Arithmetic Apparent kVA)
  - Displacement PF (filtered to the fundamental frequency)

The kV2c can have up to 20 quantities defined in the measurement profile, with 5 of these used for summations and demands. Each demand can have two coincident measurements. Coincident Demand/PF capability in every kV2c makes the K switch an even more powerful feature.

4.2.8 Transformer Loss Compensation—L Softswitch

The Transformer Loss Compensation Softswitch allows users to create and optionally use a set of transformer and line loss coefficients to compensate the metered values. Losses may be added to, or subtracted from, the metered values. Use MMDOS to input the no-load and load loss data for the power transformers and conductors used at that installation. MMDOS translates the data into compensation factors to be optionally used by the meter. The original factory calibration constants are unaffected. MMDOS allows users to choose whether to apply the loss compensation factors or not (makes field calibration testing easier). The Test LED output is unaffected by the loss compensation. All other data (except Distortion kVAh) is affected when the factors are applied.

4.2.9 Expanded Measurements—M Softswitch

The Expanded Measurements Softswitch allows the accumulation or Load Profile Recording of these “per element” values:

- kWh & kW Demand
- kvarh & kvar Demand
- Apparent kVAh & kVA Demand

Measured values with this softswitch include by element, by quadrant. Measurements for summing all elements by quadrant require the B switch. Measurements for summing all elements of reactive or apparent measures to a total for the meter require the K switch.

Note: ***These values are always available for "real time" displays, but cannot be accumulated or recorded without the M soft switch.***

4.2.10 Demand—N Softswitch

Demand (N) soft switch is used to calculate billing demands. If the N switch is not present. Meter will not calculate billing demands and will set demands to 0. Meter will always calculate non-billing demands for cautions, diagnostics, etc.

4.2.11 Pulse Initiator Output—P Softswitch

The Pulse initiator Output enables pulse outputs to the I/O board. It is factory set in all meters.

4.2.12 Power Quality Measurements—Q Softswitch

The Power Quality Measurements Softswitch enables the accumulation or Load Profile Recording of these power quality related values:

- Distortion kVA(h) (total and per element)
- Distortion PF (total and per element)
- Total Demand Distortion (TDD)
  TDD = Total Harmonic Current / Max. Current Per Phase
- Total Harmonic Distortion (THD): I_{THD} & V_{THD} per element
- Line Currents: I_A, I_B, I_C, I_N, (max, min, store); I_A^2h, I_B^2h, I_C^2h, I_N^2h
- Voltages (L-L, L-N): V_A, V_B, V_C, (max, min, store); V_A^2h, V_B^2h, V_C^2h

Note: ***These values are always available for "real time" displays, but cannot be accumulated or recorded without the Q soft switch.***

4.2.13 Basic Recording—R Softswitch

The Basic Recording Softswitch enables up to 4 channels of load profile recording in 64KB of on-board memory and up to 12 Self-Read entries in a separate memory space. The number of active channels and days of LP data are configurable using the MMProg Recorder Option editor.

4.2.14 Time Of Use—T Softswitch

The Time Of Use Softswitch enables TOU operation. The meter supports:

- Up to 4 TOU periods & 4 Seasons
- Up to 3 daily rate schedule types, plus one holiday schedule
- Up to 80 TOU Schedule set points
- Up to 150 programmable dates
  - Holidays, Season Change, Daylight Savings Time (DST), Self Read, Demand

Reset
- Perpetual calendar handles most dates

- Up to 5 billing & 5 demand measures per TOU period
  Each demand measure capable of 2 coincident values
- Future activation of TOU Schedule & Calendar possible
- Enables load control output switch capabilities
- Enables Self Read actions on specified dates -- with or without a Demand Reset

4.2.15 Fast Voltage Event Monitor & Log—V Softswitch

The Fast Voltage Event Monitor & Log Softswitch enable monitoring all phases for voltage sags and swells.

- Independently set magnitude threshold for sags and swells
  0~100% of Reference Voltage in 1% increments
- Duration threshold from 1 to 65,535 cycles (18.2 min. @ 60Hz)
- Event ends when all phase voltages are within tolerance
- Voltage Event log is separate from regular Event Log (E switch)
- Separate sag and swell event counters (65,535 events max.)
- For each of the most recent 200 events, the Log captures :
  - Event type (sag or swell)
  - Max (swell) or Min (sag) RMS cycle voltage for each phase
  - RMS current coincident with voltage max/min
  - Duration of the event (in cycles -- up to 65,535)
  - Date/Time recorded if meter is in Demand/LP or TOU mode

4.2.16 Waveform Capture—W Softswitch

The Waveform Capture Softswitch enables the capture of sample data from the kV2c. The meter captures 6 sets of 70 samples each (3 voltages, 3 currents). There are approximately 54.7 samples per cycle, per phase, @ 60 Hz. An MMDOS command triggers the data capture. MMDOS can then generate a harmonic analysis report for each voltage and current input. A Power Analysis report is also generated.

4.2.17 Expanded Recording—X Softswitch

The Expanded Recording Softswitch enables up to 20 channels of load profile recording in 192KB of on-board memory and up to 12 Self Read entries in a separate memory location. Number of active channels and days of LP data are configurable in the MMProg Recorder Option editor. The number of days of storage depends on number of active channels and LP interval length.

4.2.18 Totalization—Z Softswitch

The Totalization Softswitch enables combining data from up to 5 meters—4 external meter inputs plus the internal kV2c metered data. External inputs require use of the Multiple I/O option board. Up to 8 data combinations are allowed—"totalization maps"— which add or subtract inputs with the same engineering units. One totalization channel may be used as input to a second totalization channel. The Totalization Softswitch also enables the scaling of external pulse inputs. External inputs may be recorded and displayed as unscaled raw pulse counts without the Z soft switch installed.

4.3 Converting from Demand to Demand LP or TOU Mode

The kV2c is four meters in one: Demand, Demand Load Profile, TOU and TOU Load Profile. The Load Profile recording and Time-Of-Use options require Softswitches to extend the functionality of the basic Demand meter.

The following items are required to enable Demand LP, TOU or TOU LP operation:

- Computer with MeterMate Software
- Softswitch holder with T, and R or X switches
- SMARTCOUPLER device
- Time Keeping Battery

If at any time you are unsure if the meter has been upgraded, select **Check Meter** on the MeterMate **Upgrade** screen. The screen will display the capabilities of the meter. To enable the TOU function, proceed as follows:

CAUTION - Battery installation must be done with NO power applied to the meter.

1. Plug the Softswitch holder into the parallel port of the computer.
2. Install and connect the battery. See section 3.6, battery replacement.
3. Apply power to the meter.
4. Connect the SMARTCOUPLER device to the serial port of the computer and the OPTOCOM port on the kV2c Meter.
5. Using **MeterMate** software, go to the **Main Menu**.
6. On the **Main Menu**, select **Program**.
7. On the **Program** menu, select **Upgrade**.
8. On the **Upgrade** menu, select **TOU**.
9. This enables the TOU function in the meter. When completed, the screen reverts to the Upgrade menu.
10. Mark the TOU box on the nameplate.
11. Repeat steps 8 through 10 for the Basic Recording, R, or Extended Recording, X, Softswitch.

TIP: ***If you are not ready to install the TOU program, the meter may still be used as a Demand meter after the TOU switch is enabled. The battery may be put in place in the battery holder, but must not be connected until the meter has been programmed for TOU operation.***

To avoid rapid discharging of the battery, energize the meter within 10 minutes of connecting the battery and program the meter for Demand/LP or TOU operation.

4.4 Meter Disassembly

WARNING: The GE kV2c meter contains lethal voltages. The meter must be completely disconnected from any external circuits before disassembly is attempted. Failure to observe this practice can result in serious injury or death.

CAUTION: ***Do not interchange base and electronics module assemblies between meters. Calibration data stored in the meter is particular to a set of current sensors and electronics module. Interchanging these components causes the meter to lose calibration.***

The meter is disassembled in steps. First, remove the meter cover. Second, remove the electronics module from the base.

4.4.1 Removing the Meter Cover

Remove the meter cover as follows from S-base meters:

1. Remove the seal from the right side of the meter. If there is no seal, proceed to the next step.
2. Turn the cover counterclockwise approximately 30 degrees.
3. Lift the cover straight up.

Remove the meter cover as follows from A-base meters:

1. Unseal and remove the terminal cover.
2. Remove the seal from the right side of the meter. If there is no seal, proceed to the next step.
3. Turn the cover counterclockwise approximately 30 degrees.
4. Lift the cover straight up.

4.4.2 Removing the Electronics Module

To remove the electronics module, use a small flat-bladed screwdriver. There are three snap retainers located at the 2, 6 and 10 o'clock positions looking at the face of the meter. Figure 4-1 shows a meter in exploded view. Remove the module as follows:

1. Insert the small screwdriver under one of the snap retainers. Twist the screwdriver and pry up on the snap retainer until it releases. Repeat the procedure with the remaining snaps.
2. Gently remove the module. Take care not to put significant strain on the wires.
3. If any option boards are installed, begin by disconnecting the option leads before proceeding. Some connectors have latches which must be released before disconnecting.
4. Disconnect the remainder of the leads from the module.
5. Place the module on a flat, clean, cloth-covered surface with meter face down.

CAUTION:	**Do not pull on the wires to disengage the connectors. Pull only on the connectors.**

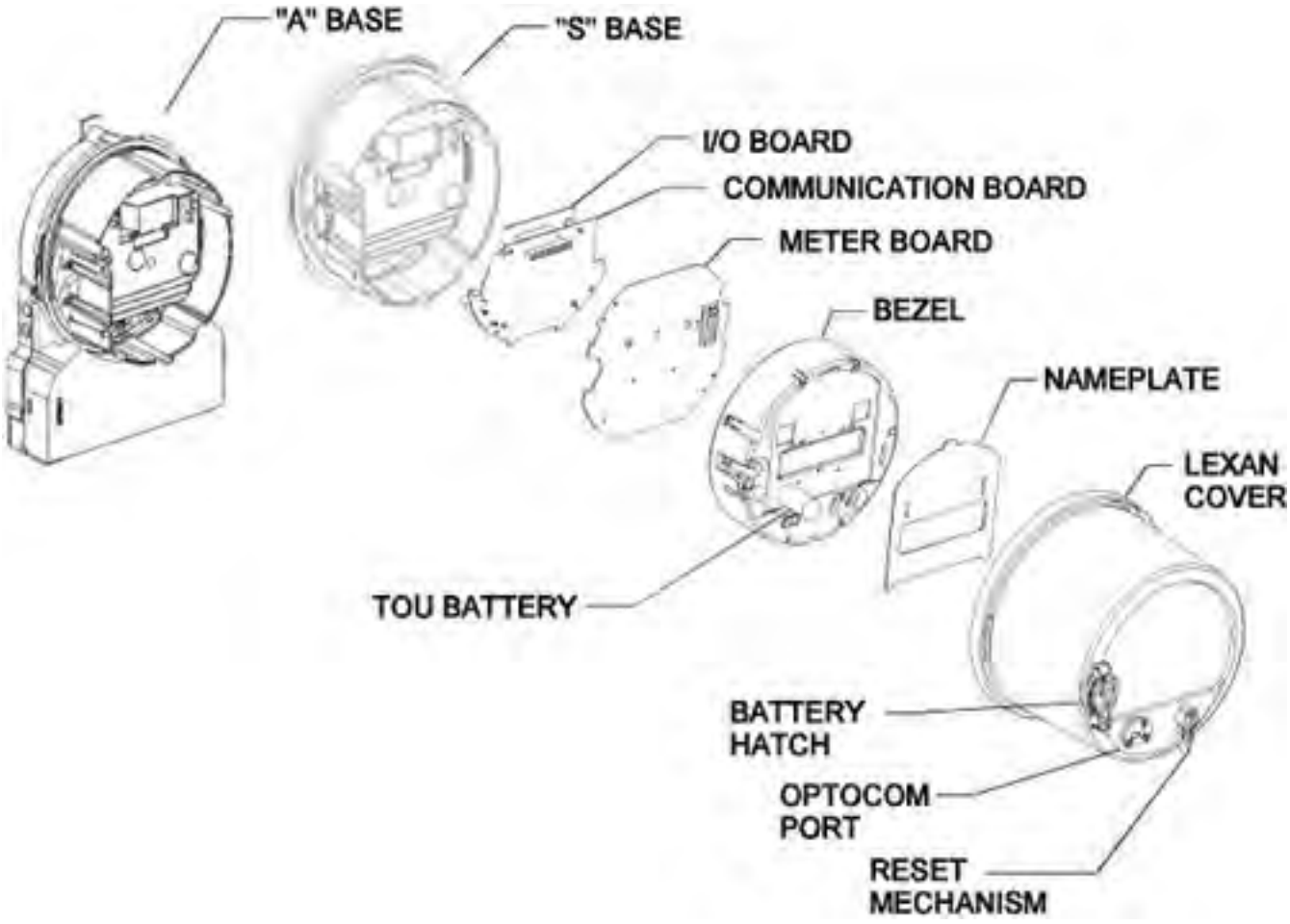


Figure 4-1. Exploded View of kV2c Meter

4.4.3 Removing an Option Board

The following procedure is performed if you are:

- Adding a communication board and an I/O board is installed
- Replacing an option board

To remove the option board, refer to Figure 4-2 and proceed as follows:

1. Disconnect the battery if present.
2. Orient the module so that the warning label is toward you but facing down. The timekeeping battery should be located on the right hand side.
3. Place the module on a flat, clean, cloth-covered surface with the face down.
4. If both communication and I/O boards are present: Hold the I/O board with the thumb and index finger. Use a pair of needle-nose pliers to squeeze the tabs at the end of each spacer while pulling straight up on the board. Lift the board out of the module.
5. If a single option board is present: Hold the option board with the thumb and index finger of each hand near the two board latches. Using your thumbs to push the latches away from the board, tilt the board upward toward yourself.
6. Continue tilting the board until the tabs on the module and the tabs on the board are disengaged.

7. Lift the board out of the module.

4.5 Option Board Installation

Caution INTERCHANGING OPTION BOARDS

Do not interchange option boards between the KV and KV2c meters.

The revenue guard option board for the KV meter won't assemble into a KV2c meter.

The modem and the RSX communication option board for the KV will not function properly in a KV2c meter. However, the kV2c modem and RSX communication option boards may be used in Comm Ready kV meters.

The load profile option board found in a KV meter is not required in the KV2c meter. The load profile options have been included in the main board.

Most importantly, interchanging I/O option boards between the KV and the KV2c meter could cause meter failure.

4.5.1 Installing Option Boards

See Figure 4-2 for a graphic description of board installation.

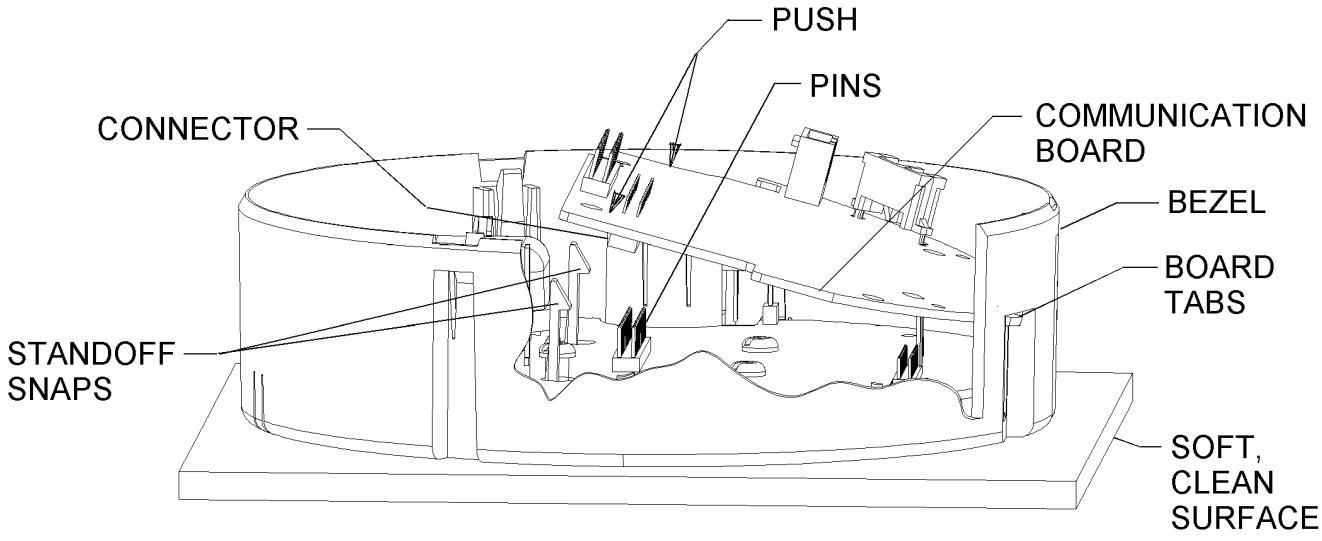


Figure 4-2. Installing a Communication Option Board

4.5.1.1 Installing a Communication Option Board

1. If the meter is not disassembled, follow the disassembly instructions described earlier in this chapter.

2. Place the module face down on a soft, clean surface to protect the nameplate and the liquid crystal display.
3. Check the pins on the meter board. Align any pin that is out of alignment.
4. With the 30-pin connector on the underside of the communication board, insert the tabs on the board into the slots on the bezel.
5. Gently move the board until the communication board connector engages the meter board pins.
6. Push straight down on the option board near the connector. Push gently until the standoffs snap firmly on the edge of the option board.
7. See Section 4.6 for meter reassembly.

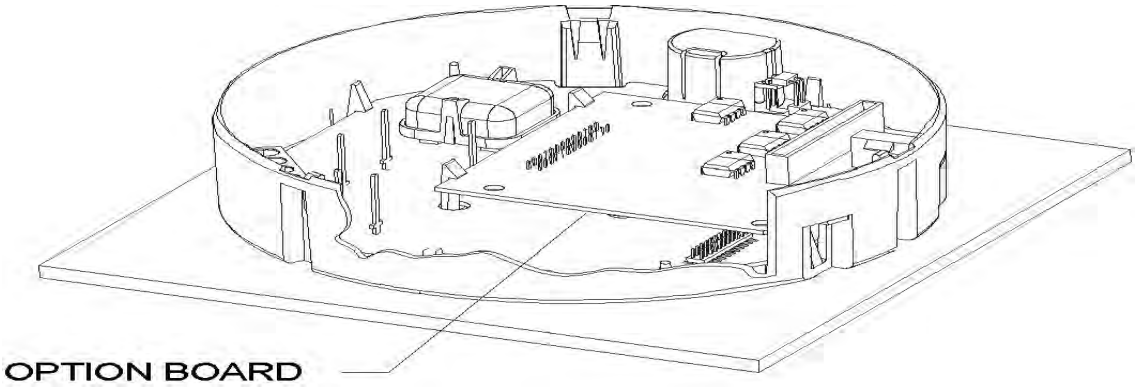


Figure 4-3: Installing the I/O Option Board

4.5.1.2 Installing the I/O Option Board

The I/O board is installed as follows:

1. If the meter is not disassembled, follow the disassembly instructions described earlier in this chapter.
2. Place the module face down on a soft, clean surface to protect the nameplate and the liquid crystal display.
3. Check the pins on the meter board. Align any pin that is out of alignment.
4. With the 30-pin connector on the underside of the board, insert the tabs on the board into the slots on the bezel.
5. Gently move the board until the I/O board connector engages the meter board pins.
6. Push straight down on the option board near the connector. Push gently until the standoffs snap firmly on the edge of the option board.
7. See Section 4.5.1.4 and 4.5.1.5 for installing the I/O cable into the meter base.

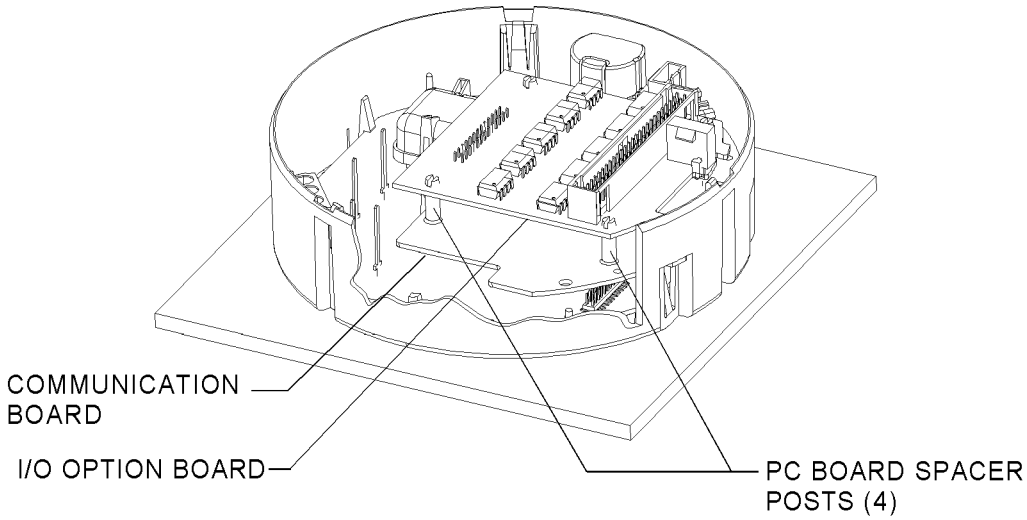


Figure 4-4: Installing the I/O Option Board

NOTE:The I/O board is always the outer option board. This position provides adequate clearance around the board to connect the I/O cable to the board.

4.5.1.3 Installing the I/O Option Board when a Communication Option Board is Present

1. If the meter is not disassembled, follow the disassembly instructions described earlier in this chapter.
2. Place the module face down on a soft, clean surface to protect the nameplate and the liquid crystal display.
3. On topside of communication board, insert the four PC board spacer posts into the four holes shown in Figure 4-4.
4. Place I/O board on top of communication board and align 30-pin connector to 30-pin header.
5. Gently press connector and header together until the four posts are aligned with the four holes in the I/O board.
6. Press boards together until all four posts have snapped securely in place. Test by trying to pull boards apart with moderate force.
7. See Section 4.5.1.4 and 4.5.1.5 for installing the I/O cable into the meter base.

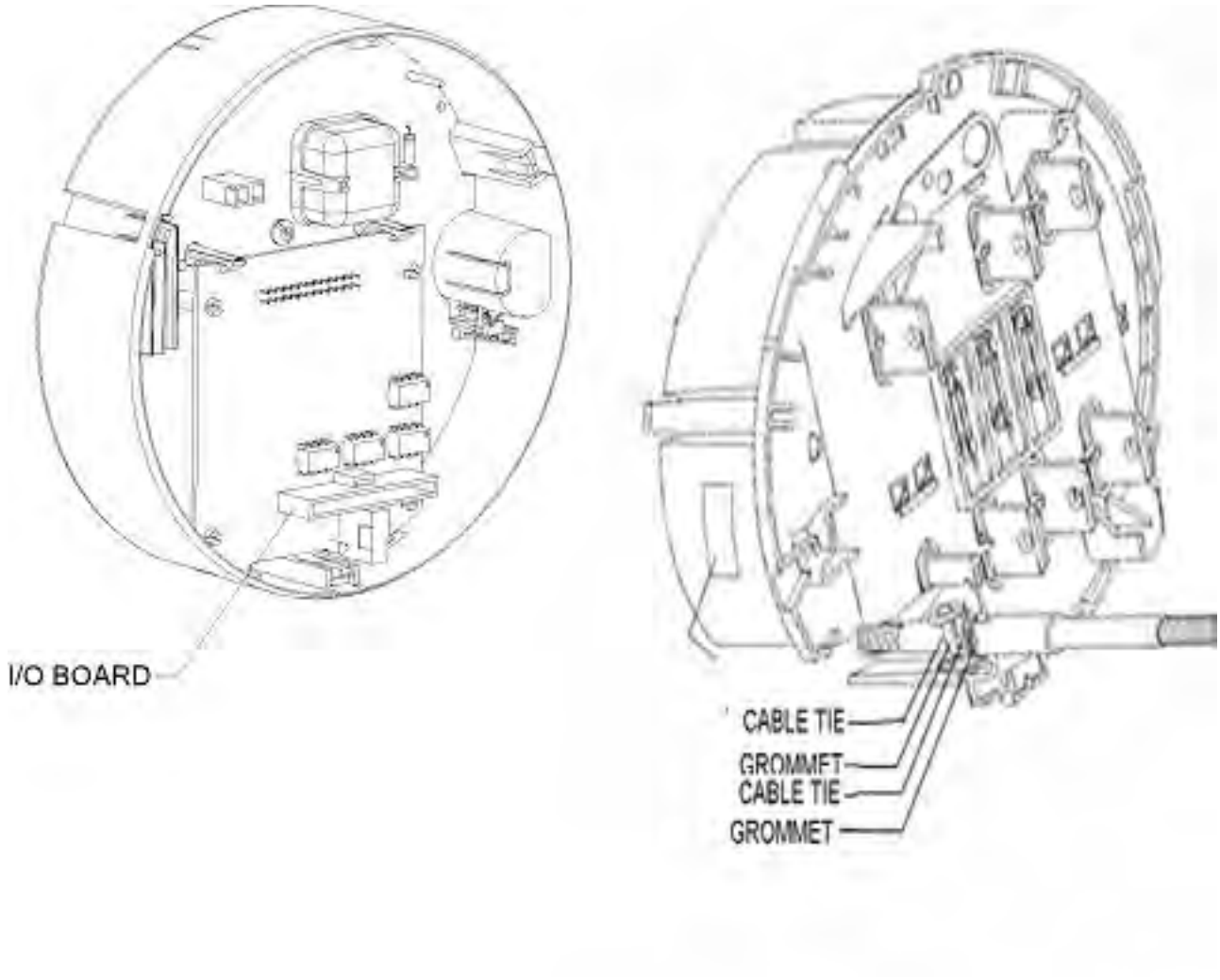


Figure 4-5: A Base I/O Cable Installation

4.5.1.4. S-base I/O Cable Installation

NOTE: ***If the output cable and the KYZ connector are both attached to the I/O board, then the KYZ output is connected in parallel to both the base terminals and the output cable.***

1. Remove the plastic hole plug from the meter base.
2. Push the free end of the I/O cable through the hole from inside the base where the plug had been; then, pull cable until cable grommet is firmly seated against base.
3. Install another grommet on the free end of the cable. Move the grommet up to and against the outside of the base.
4. Secure the grommet with a cable tie.
5. Place I/O label on shroud. (See Figure 2-9)
6. Before replacing the electronics module, plug the cable connector into the mating header on the I/O board.
7. If meter has KYZ terminals in the base, plug the 3-position connector into the mating header on the I/O board.

8. See Section 4.6 for meter reassembly.

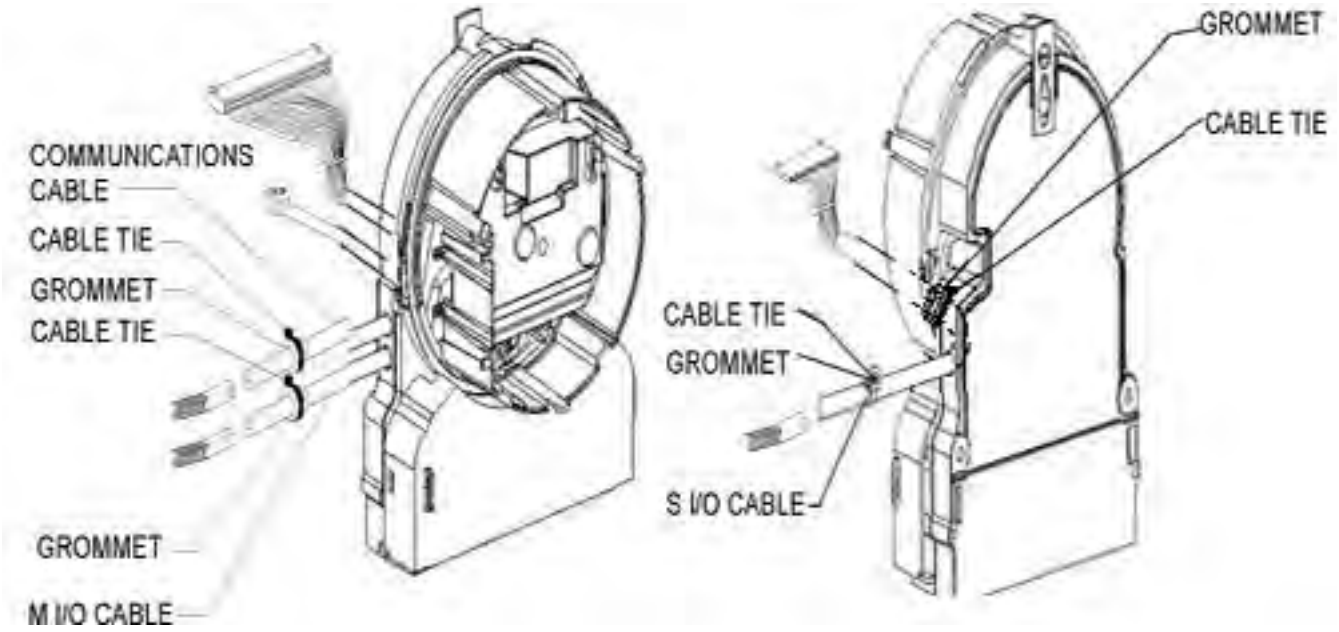


Figure 4-6: A Base I/O Cable Installation

4.5.1.5 A-base I/O Cable Installation

Note: ***Installation of I/O cables in an A base meter requires removal and reassembly of the base barrier.***

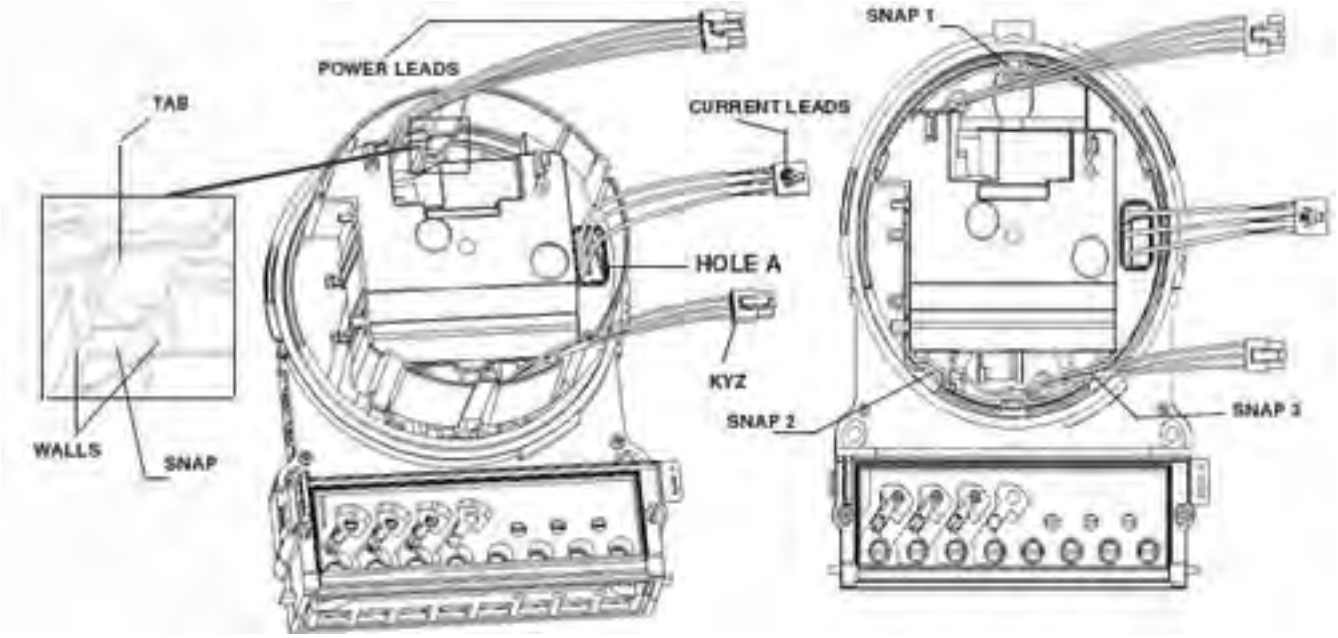


Figure 4-7 Disassembly and Reassembly of Shroud

Removal of Shroud:

1. Orient meter with the meter terminals facing toward you.
2. Using a thin flat bladed screwdriver, depress the tabs indicated “1” in Figure 4-7 until the tab clears the snaps in the base assembly.
3. Repeat this process for the 2 and 3 in Figure 4-7
4. Gently pull the Shroud straight up until it is free from the meter.
5. Gently place Shroud over the side of the Base assembly. This will provide you with access to install I/O cable.

Installation of an I/O cable:

1. Remove and clean the round knockout located on the side of meter base.
2. Cut and remove the existing cable tie from the I/O cable assembly, leaving the grommet free to slide on the cable.
3. Reposition the existing grommet on the cable assembly until it is approximately 7 inches from the connector.
4. Add a new cable tie on the connector side of the grommet to secure it in position.
5. Push the free end of I/O cable through knockout hole and draw cable through base until the existing grommet contacts the inside wall.
6. Slide another grommet over free end of cable (flat end outward) until it comes in contact with the hole in the base.

7. Push the outside grommet into the hole in the base until fully seated, securing the grommet with a cable tie.
8. Place I/O label on shroud.

Note: The S I/O cable exits the meter base on the right side, the M I/O cable on the left. Only one I/O board and cable can be installed in a meter at the time.

Reassembling Shroud:

1. Orient meter with the terminals of the meter facing toward you and the Shroud as shown in Figure 4-7.
2. Align the shroud so the tabs of the shroud are aligned with the guiding walls beside the snaps in the base assembly. Indicated as Tabs 1, 2, 3 in Figure 4-7
3. Press the Shroud top edges gently to snap the tabs of the shroud in the base assembly.
4. Make sure that shroud is fully seated all around on the edge of the base assembly

Note: Current sensor leads need to be put through Hole A on the shroud as indicated in Figure 4-7 located at 3 o'clock. Ensure that leads are not tangled. KYZ, if present, and I/O cable should be taken out through the bottom opening of the shroud as indicated in Figure 4-7. and be accessible for connection to the I/O board mounted in the electronics module. Power Leads should be taken out through the top opening of the shroud as indicated in Figure 4-7

Installation of I/O cable to bezel:

1. Before replacing the electronics module, plug the cable connector into the mating header on the I/O board.
2. If meter uses KYZ output through the base, plug the 3-position connector into the mating header on the I/O board.
3. See Section 4.6 for meter re-assembly.

See Table 4-2 and Table 4-3, I/O Cable Wiring for color coding of I/O cable wires.

NOTE: If the output cable and the KYZ connector are both attached to the I/O board, then the KYZ output is connected in parallel to both the base KYZ terminals and the output cable.

kV2c S I/O Cable		
Signal Name	**Wire Color**	**Pin Number**
Y1_OUT	Yellow	4
Z1_OUT	Black	6
Y2_OUT	Grey	10
Z2_OUT	Blue	12
K1/K2_OUT	Red	8
Z3_OUT	Orange	14
K3_OUT	Brown	16
RTP+	Violet	2
RTP-	Green	1

Table 4-2 S I/O Cable Wiring

kV2c M I/O Cable		
Signal Name	**Wire Color**	**Pin Number**
Y1_OUT	Yellow	8
Z1_OUT	Black	12
Y2_OUT	Grey	20
Z2_OUT	Blue	24
K1/K2_OUT	Red	16
Z3_OUT	Orange	28
K3_OUT	Brown	32
RTP+	Violet	4
RTP-	Green	2
Z4_OUT	White	36
Z5_OUT	White/Black	40
Z6_OUT	White/Brown	44
Z7_OUT	White/Red	48
Z8_OUT	White/Orange	52
Y1_IN	White/Yellow	5
K1_IN	White/Green	9
Z1_IN	White/Blue	13
Y2_IN	White/Violet	17
K2_IN	White/Grey	21
Z2_IN	White/Black/Brown	25
Y3_IN	White/Black/Red	29
K3_IN	White/Black/Orange	33
Z3_IN	White/Black/Yellow	37
Y4_IN	White/Black/Green	41
K4_IN	White/Black/Blue	45
Z4_IN	White/Black/Violet	49

Table 4-3 M I/O Cable Wiring

Caution POLYPHASE TESTING OF kV2c METER

The kV2c meter is designed to meter conventional services with nominal line-to line voltages up to 480 Volts for meters rated 120-480 Volts or line-to-line voltages up to 208 Volts for meters rated 57-120V. Operation at voltages more than 10% above these ratings can lead to shortened life or failure.

Do not apply polyphase test voltages, using "Wye" test conditions, at voltages higher than 305 Volts line-to-neutral (277V + 10%) for 120-480V rating; no higher than 132 Volts line-to-neutral (120V +10%) for 57-120V rating

Meter forms 9S, 10A, 36S, 48A, 16S or 16A rated 120-480V may be applied in 600/345V "Wye" services. Polyphase "Wye" test voltages applied to these meters must not exceed 380V line-to-neutral (345V +10%)

For example, polyphase testing with 480 Volt "Wye" line-to-neutral conditions will result in voltages in excess of 800 Volts being applied to the meter. Stresses of this magnitude can result in immediate failure of the meter and/ or shorten meter life.

4.6 Meter Reassembly

1. connect the power lead assembly into the four pin connector on the meter board.
2. Reconnect the current sensor leads to the meter board. The current sensor leads are located at 3 o'clock with a 15-position connector and connects to a 15-pin header on the meter board. Push the connectors together until fully seated.
3. If meter has an I/O option board installed, plug the I/O cable into the mating header on the I/O board.
4. If meter uses KYZ output through the base, plug the 3-position connector into the mating connector on the I/O board.
5. Fold the electronics module onto the base. Align the notches on the bezel with the locks on the base. Push the module onto the base until the locks snap into place.
6. Replace the cover by aligning it with the openings in the base and rotating it clockwise approximately 30 degrees.
7. Install security seals as required.

5. Site Analysis Guides

NOTICE:

These site analyses include rudimentary connection diagrams for identification of metering installation. ***These diagrams are not metering installation guides.***

Table 5-1 Site Analyses

Site Analyses pages to See **(Blondel solutions are in *bold type*)**

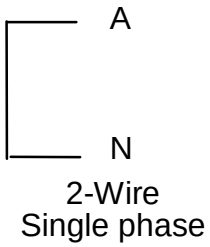
	2W-1ϕ	3W-1 ϕ	3W-Network	3W-Δ	4W-Δ	4W-Y	5W-2 ϕ
1S	***5-2***						
2S		5-3					
3S	***5-4***	5-5					
4S		5-6					
9S					***5-7***	***5-8***	
12S		***5-9***	***5-10***	***5-11***			
16S					***5-12***	***5-13***	
36S						5-14	
45S		***5-15***		***5-16***	5-17, 5-18	5-19, 5-20	5-21
56S		***5-22***		***5-23***	5-24, 5-25	5-26, 5-27	5-28
10A					***5-29***	***5-30***	
13A		***5-31***	***5-32***	***5-33***			
16A					***5-34***	***5-35***	
36A						5-36	
45A		***5-37***		***5-38***	5-39, 5-40	5-41, 5-42	5-43
48A					***5-44***	***5-45***	

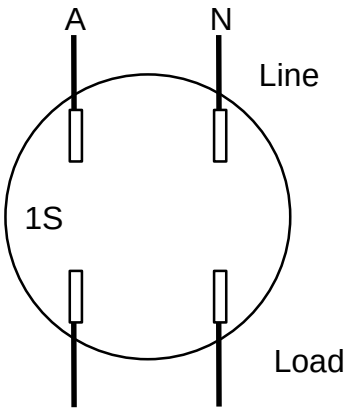
Traditional metering schemes not satisfying Blondel's theorem have demonstrated acceptable commercial accuracy. ***To fully realize the superior accuracy of electronic electricity meters, use Blondel metering solutions everywhere practical*. Keep electrical energy the most accurately measured common commodity**.

See Figure 5-1, The Site Genie™ Worksheet.

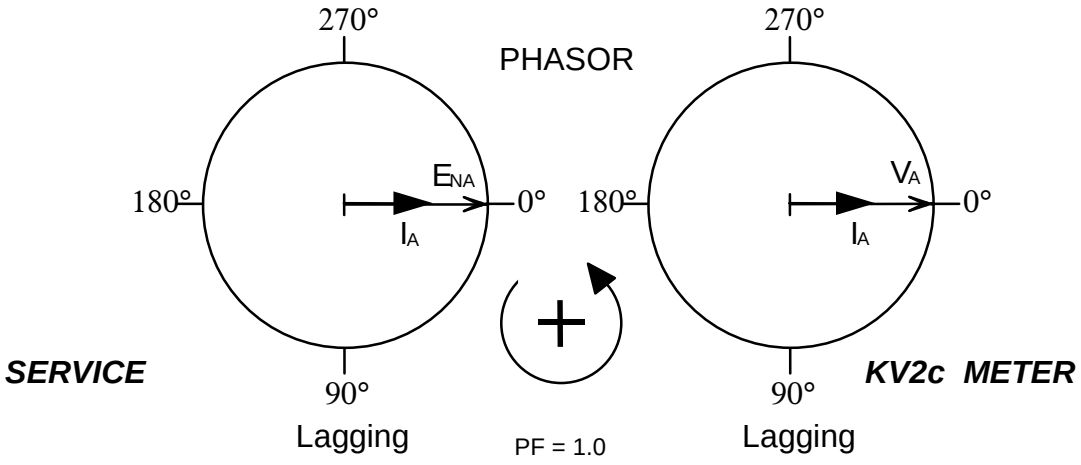
KV2c Site Analysis

Form 1S ***(Self-Contained)***





B LONDE solution L



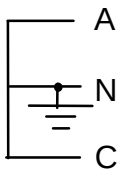
Actual installation procedures, equipment, and connections must to applicable codes and standards

2-wire, 1-phase, 1-element

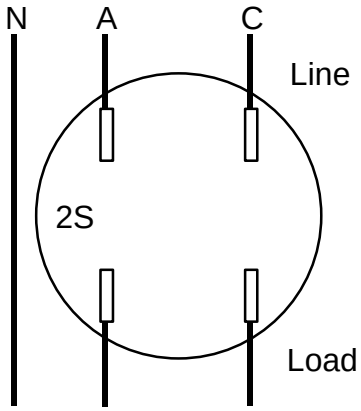
MO 3–5

kV2c Site Analysis

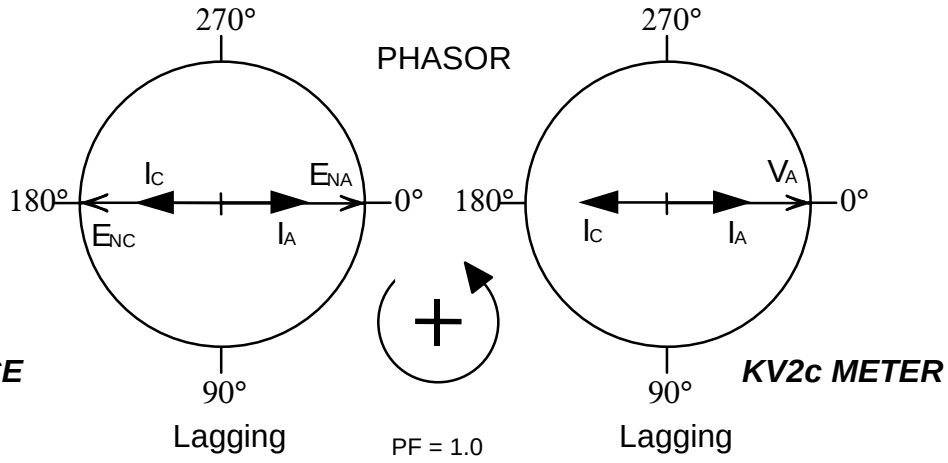
Form 2S ***(Self-Contained)***



3-
Singlephase



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.



SERVICE ***KV2c METER***

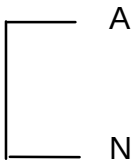
Actual installation procedures, equipment, and connections must to applicable codes and

3-wire, 1-phase, 1-element

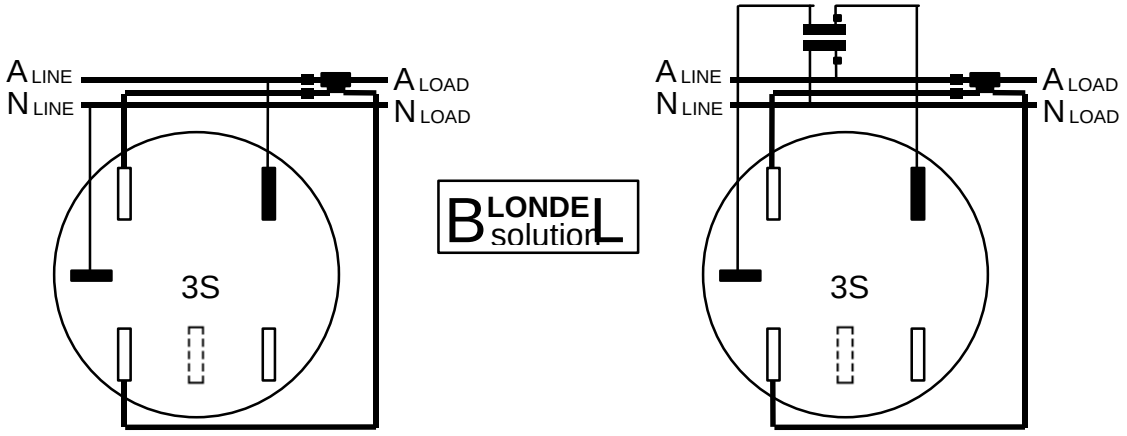
MO 2–1

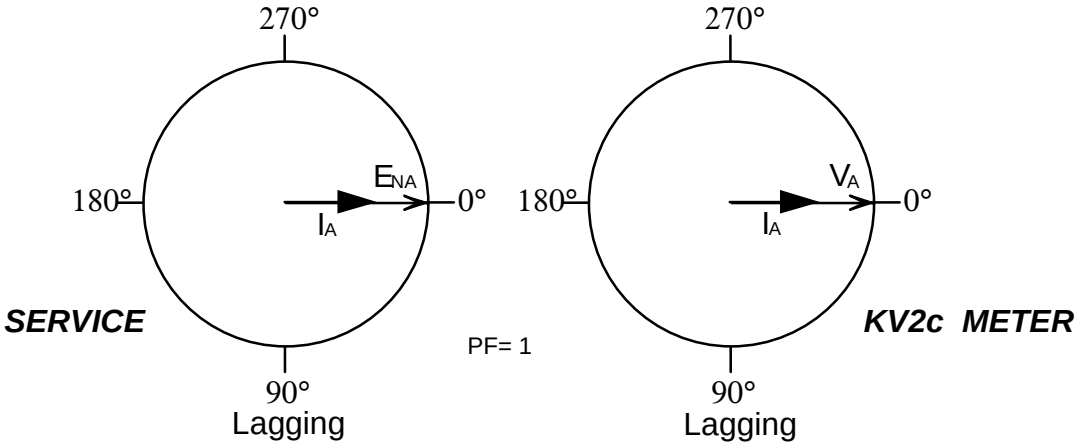
KV2c Site Analysis

Form 3S ***(Transformer Rated)***



2-
Single phase





Actual installation procedures, equipment, and connections must to applicable codes and standards

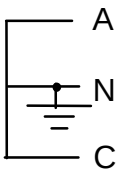
2-wire, 1-phase, 1-element

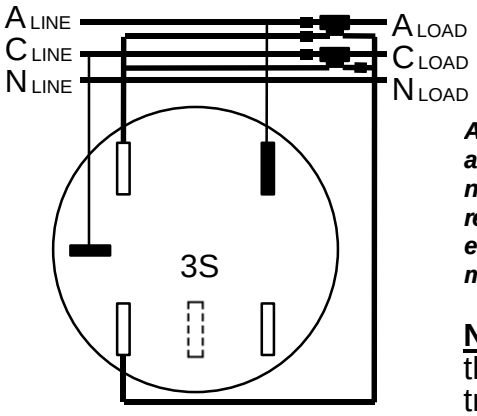
MO 3-5

KV2c Site Analysis

Form 3S ***(Transformer Rated)***

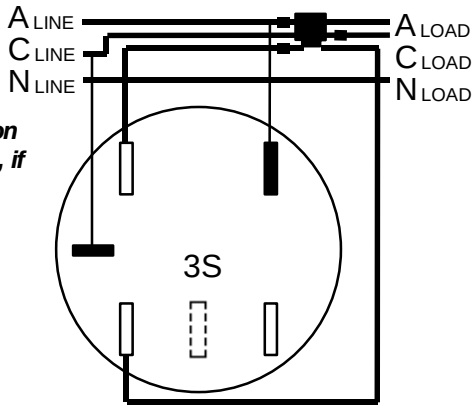
3-Singlephase

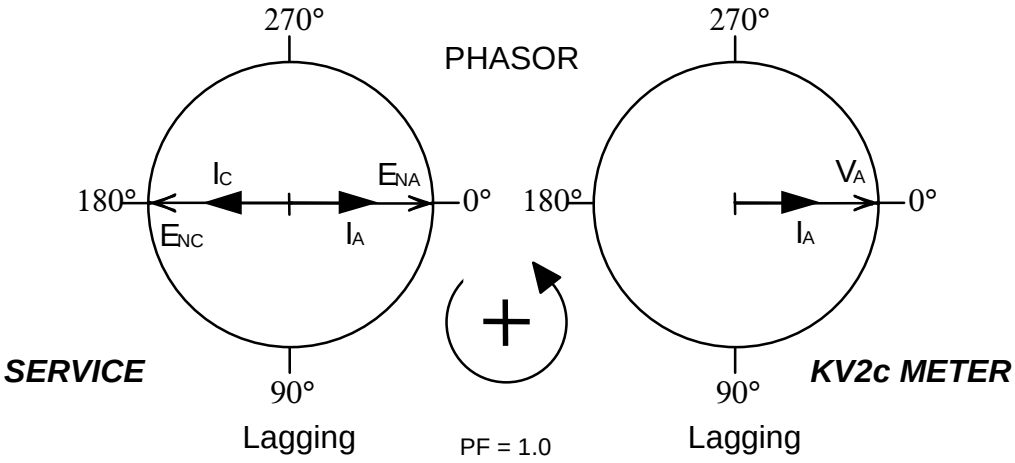




Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.

NOT: Use the CTs' ratio transformer in meter except for–wire CTs.





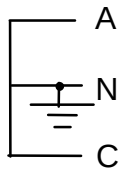
Actual installation procedures, equipment, and connections must to applicable codes and standards

3-wire, 1-phase, 1-element

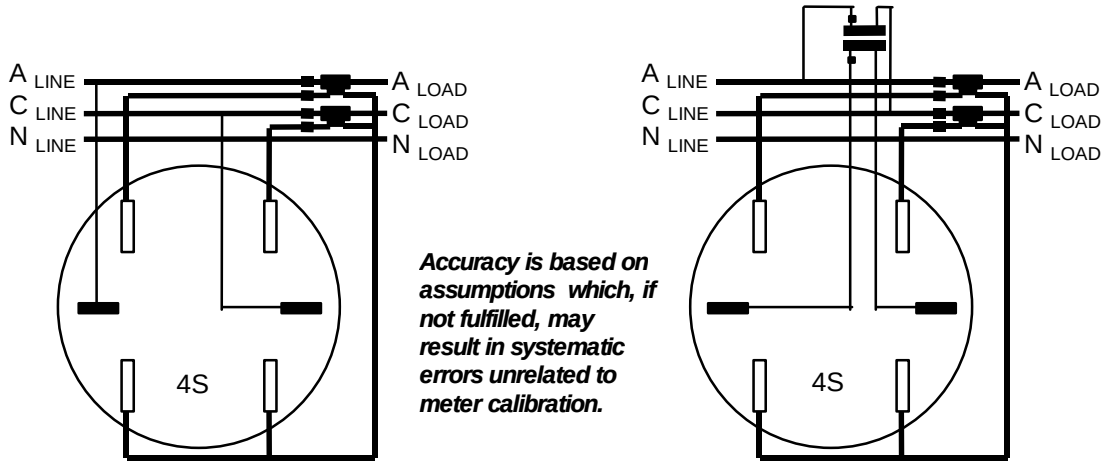
MO 3–5

KV2c Site Analysis

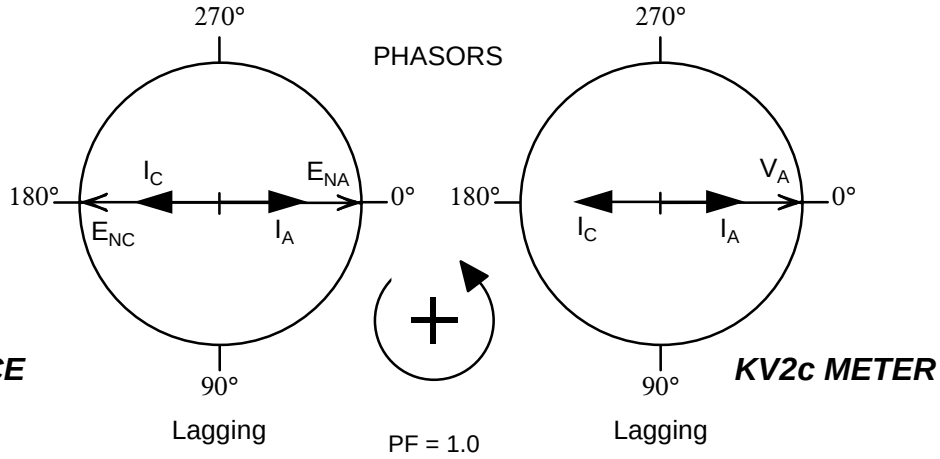
Form 4S ***(Transformer Rated)***



3-Wire
Singlephase



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.



SERVICE ***KV2c METER***

Lagging PF = 1.0 Lagging

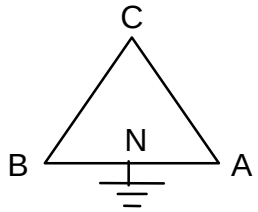
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

3-wire, 1-phase, 1-element

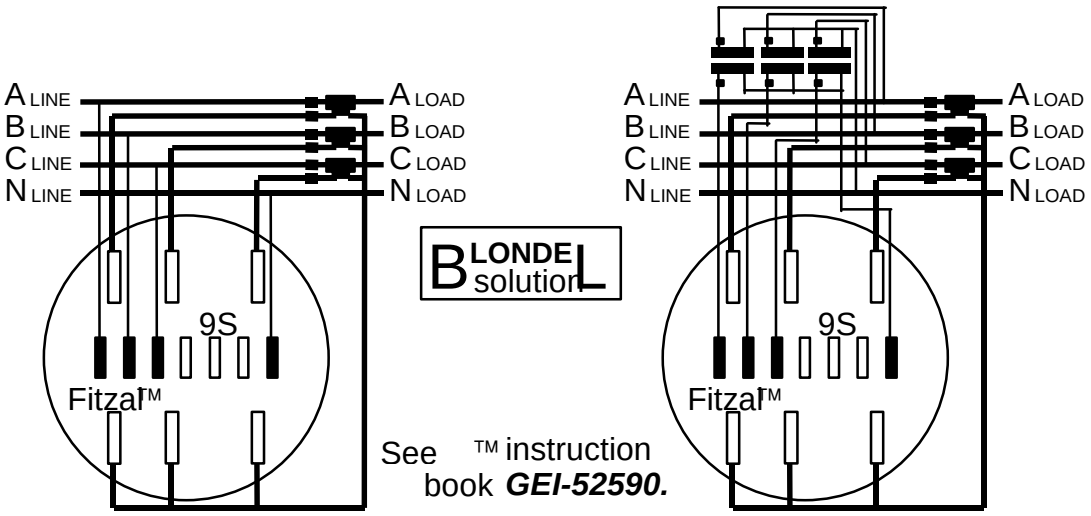
MO 2–1

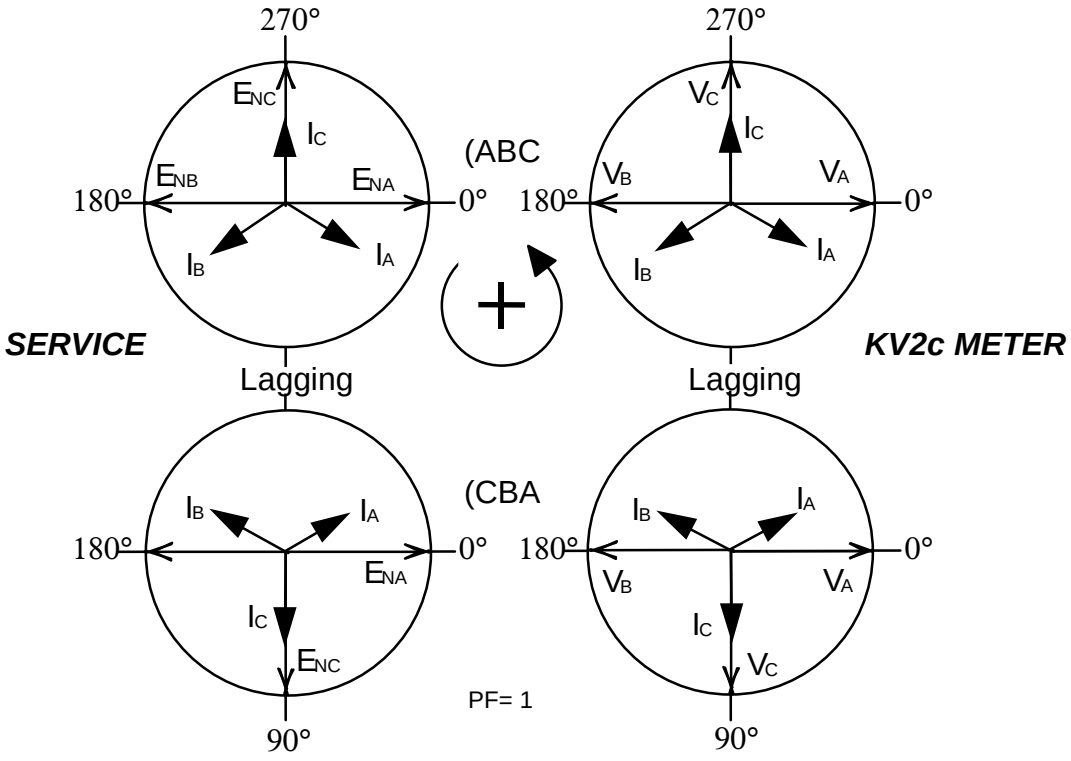
KV2c Site Analysis

Form 9S ***(Transformer Rated)***



4-Wire, Delta





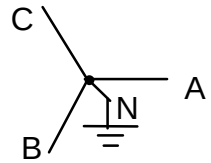
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, 3-Element

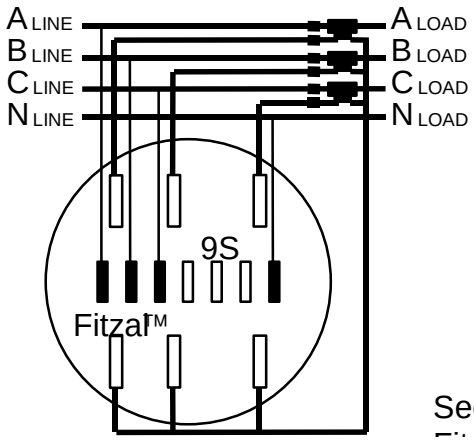
MO 9-6

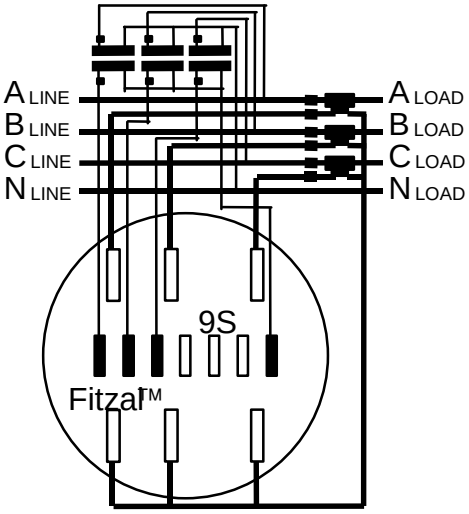
KV2c Site Analysis

Form 9S ***(Transformer Rated)***



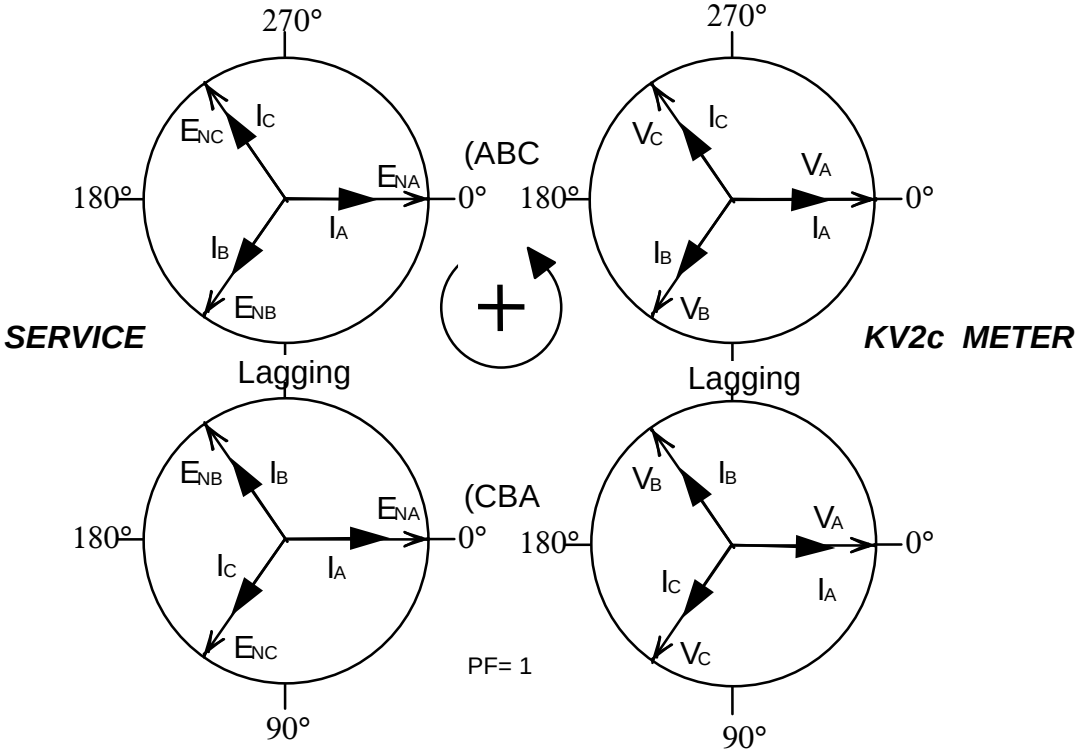
4-Wire, Wye





BLONDEL solution

See ™ instruction book ***GEI-52590.***



SERVICE ***KV2c METER***

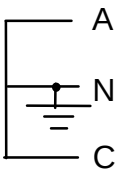
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, 3-Element

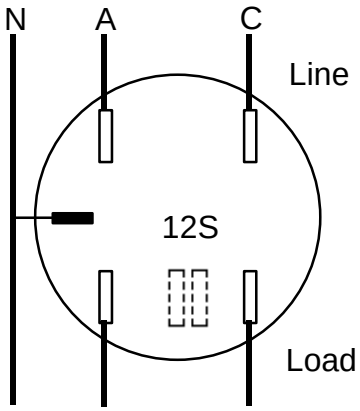
MO 9-6

KV2c Site Analysis

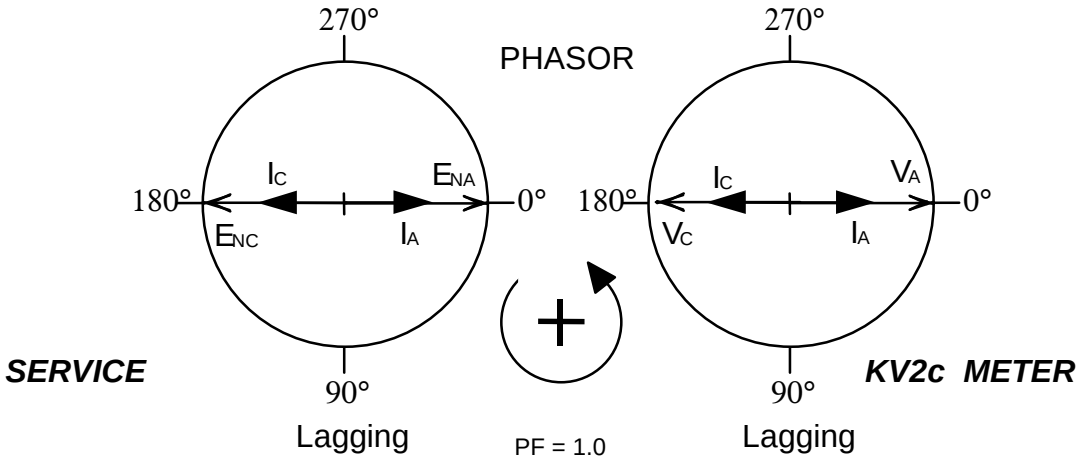
Form 12S ***(Self-Contained)***



3-Wire Singlephase



BLONDEL solution



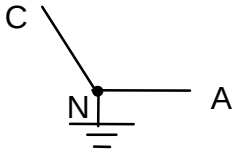
Actual installation procedures, equipment, and connections must to applicable codes and standards

3-wire, 1-phase, 2-element

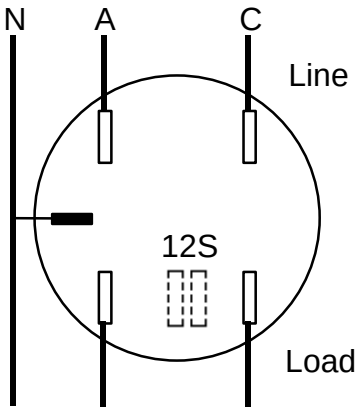
MO 12-4

KV2c Site Analysis

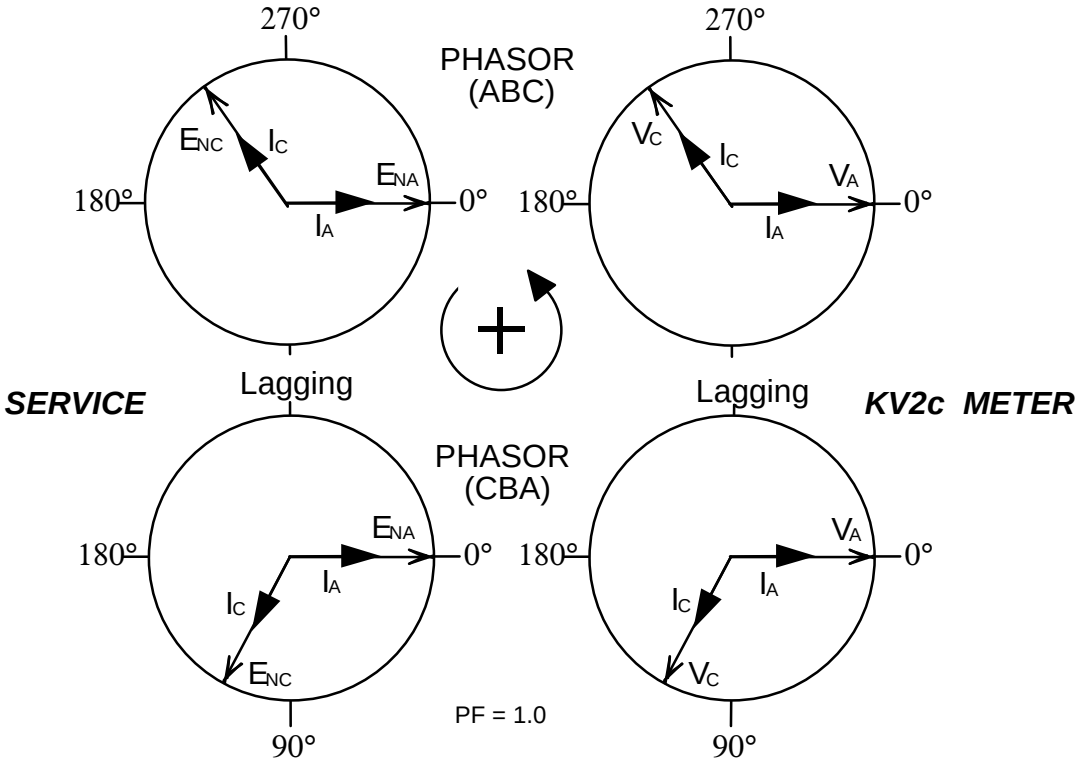
Form 12S ***(Self-Contained)***



Network



BLONDEL solution



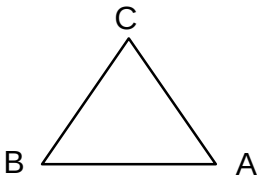
Actual installation procedures, equipment, and connections must to applicable codes and standards

3-wire, Network, 2-element

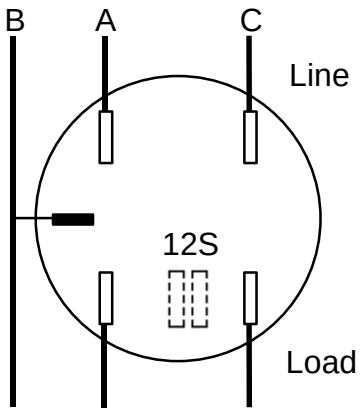
MO 12-4

KV2c Site Analysis

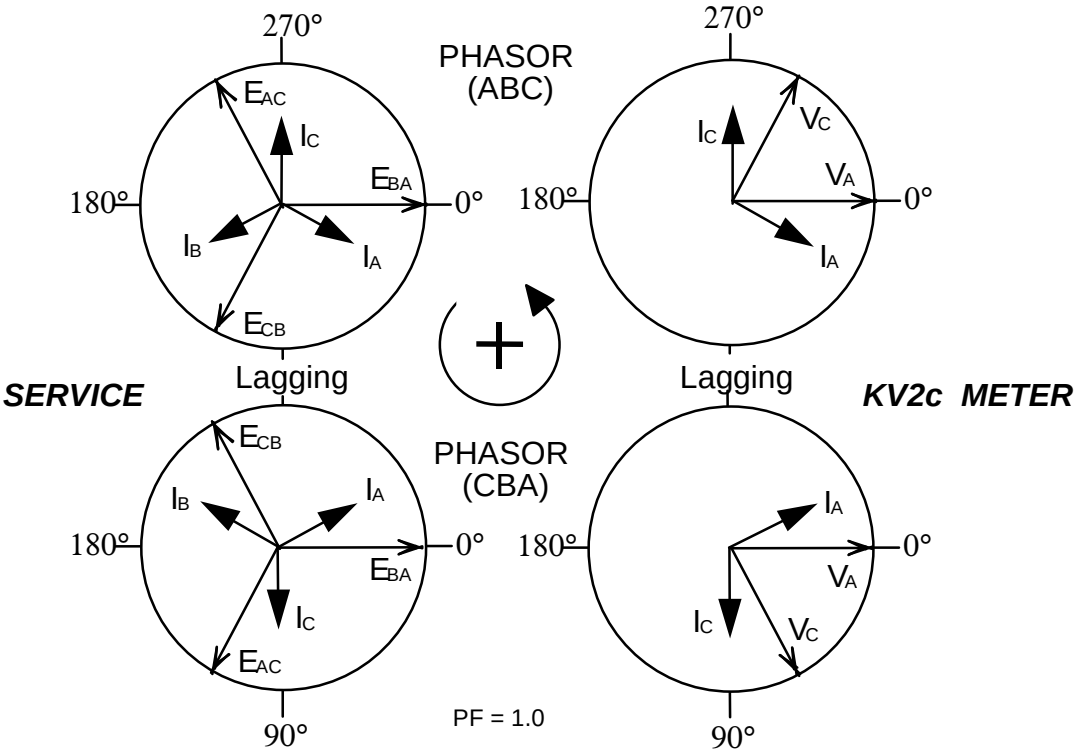
Form 12S ***(Self-Contained)***



3-Wire, Delta



BLONDEL solution



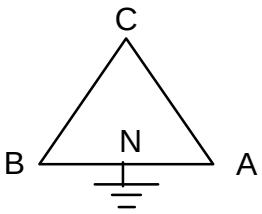
Actual installation procedures, equipment, and connections must to applicable codes and standards

3-wire, 3-phase, 2-element

MO 12-0

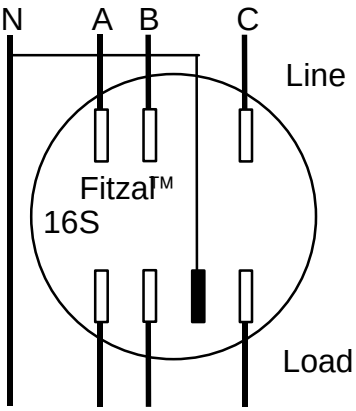
KV2c Site Analysis

Form 16S ***(Self-Contained)***

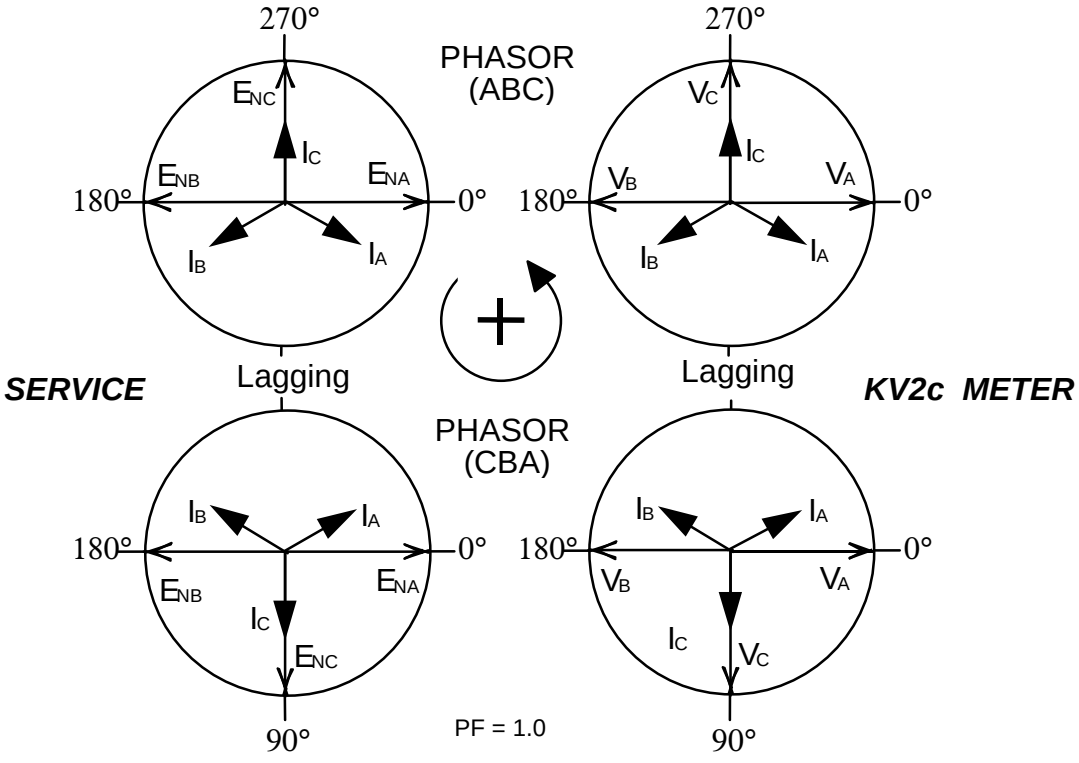


4-Wire, Delta

See ™instruction book ***GEI-52590.***



BLONDEL solution



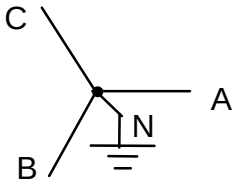
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, 3-Element

MO 16-6

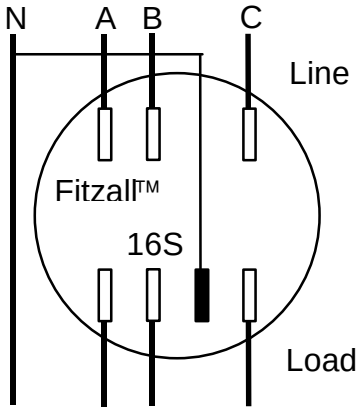
KV2c Site Analysis

Form 16S ***(Self-Contained)***

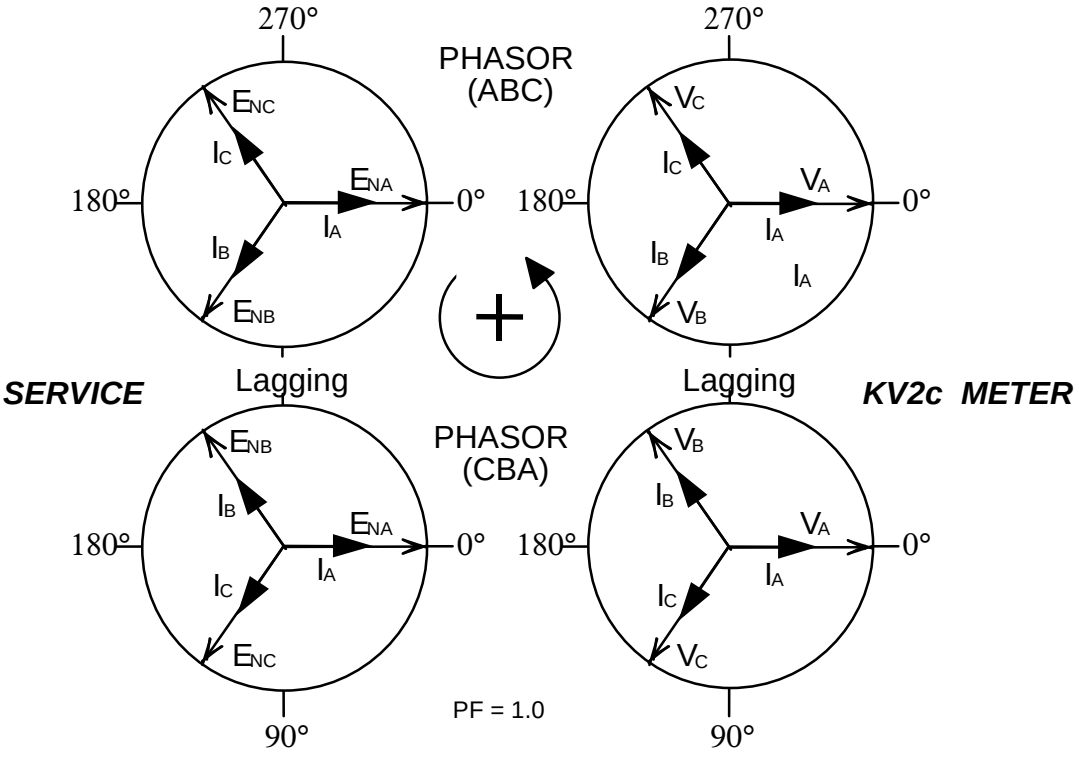


4-Wire, Wye

See instruction book ***GEI-52590***™



BLONDEL solution



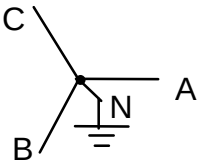
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, 3-Element

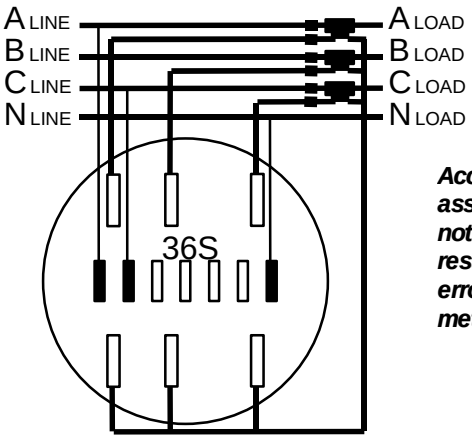
MO 16-6

KV2c Site Analysis

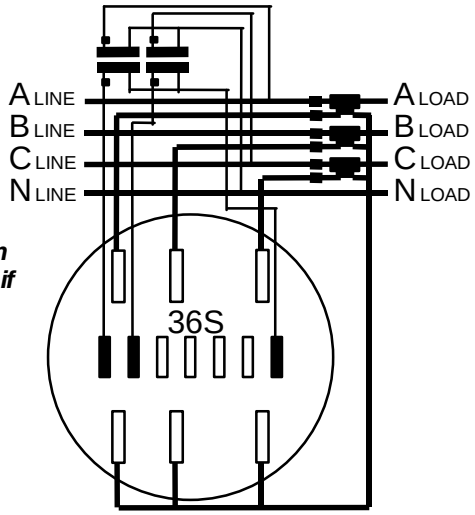
Form 36S ***(Transformer Rated)***

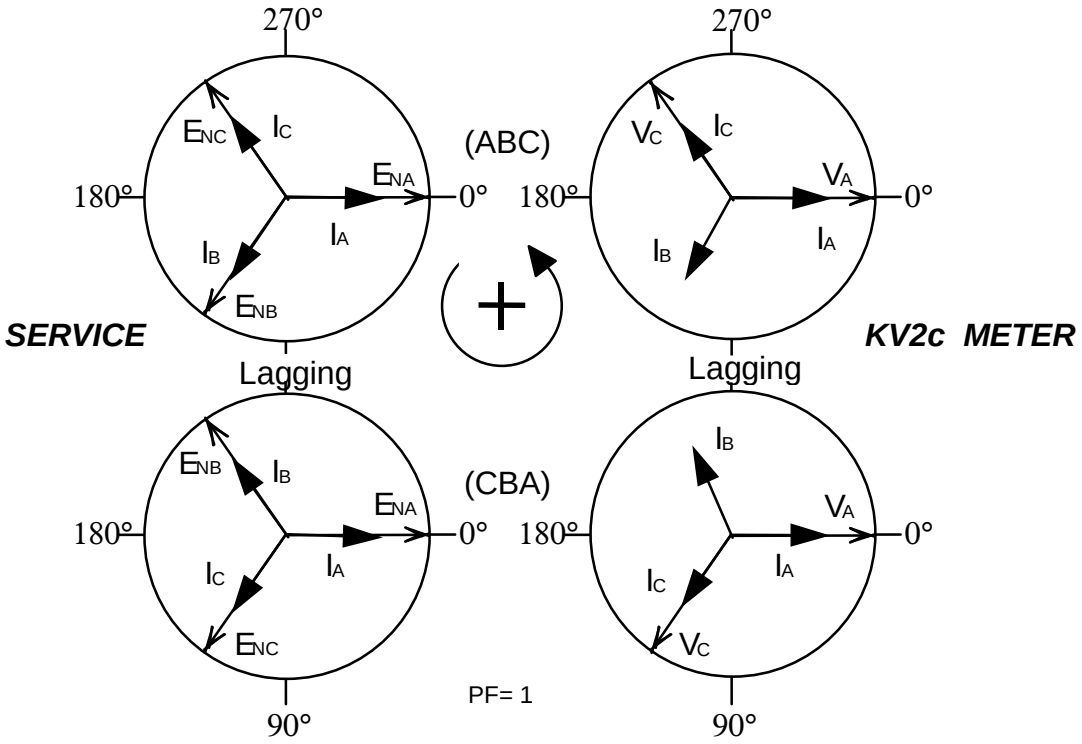


4-Wire, Wye



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.





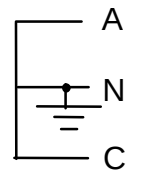
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, wye, 2-1/2-element

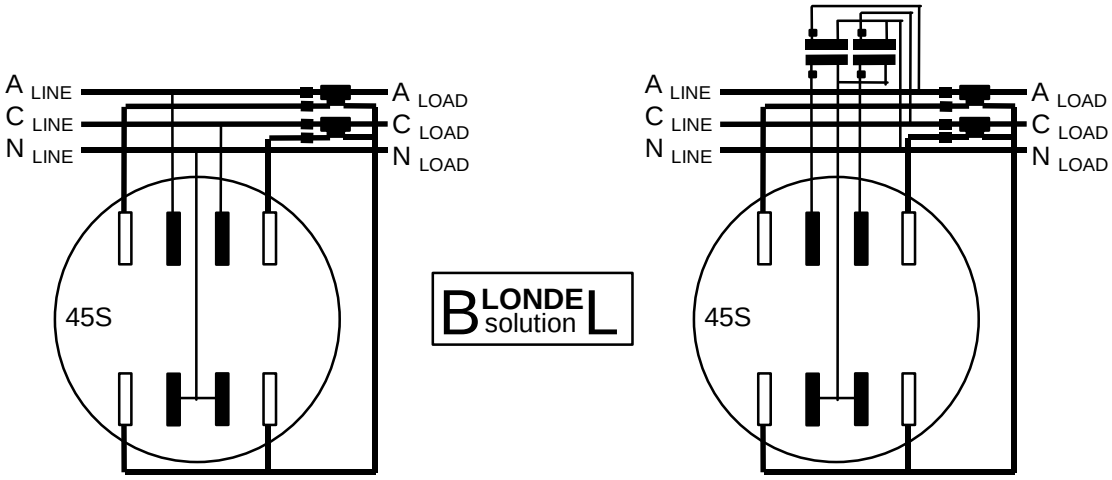
MO 36-2

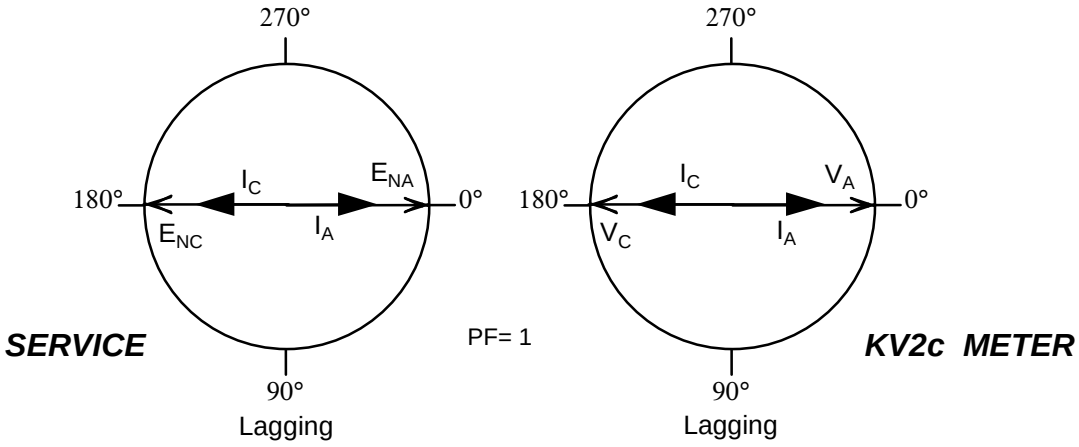
KV2c Site Analysis

Form 45S ***(Transformer Rated)***



3-Wire
Singlephase





SERVICE

PF= 1

KV2c METER

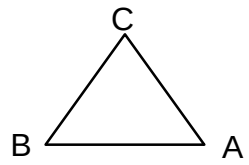
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

3-wire, 1-phase, 2-element

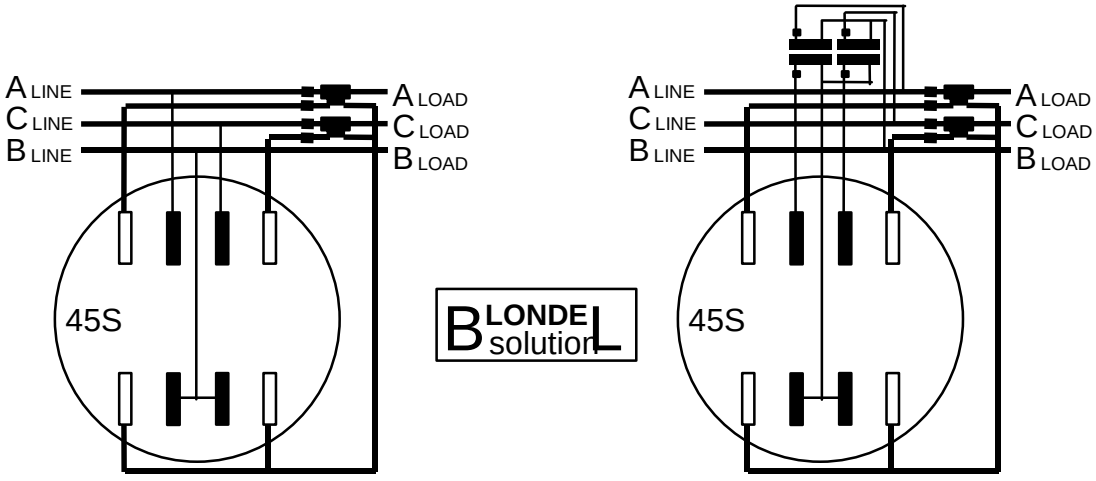
MO 45-3

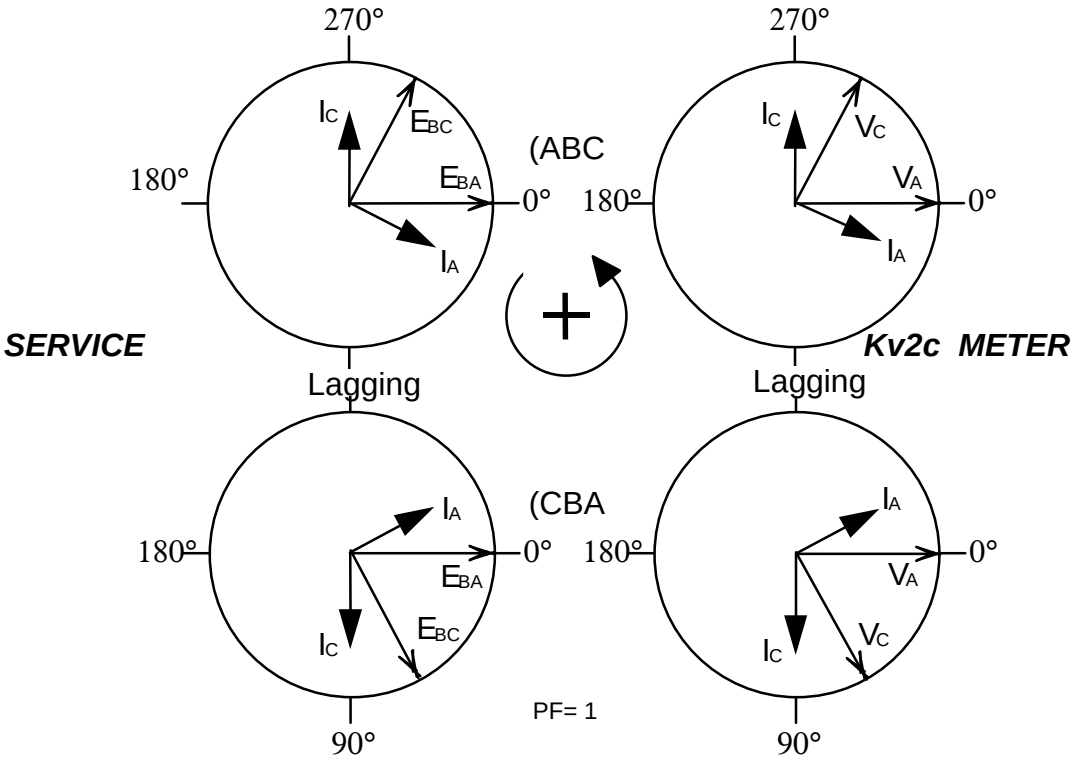
KV2c Site Analysis

Form 45S ***(Transformer Rated)***



3-Wire, Delta





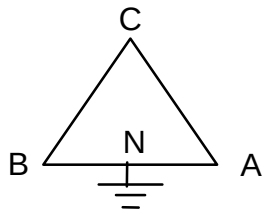
Actual installation procedures, equipment, and connections must to applicable codes and standards

3-wire, 3-phase, 2-element

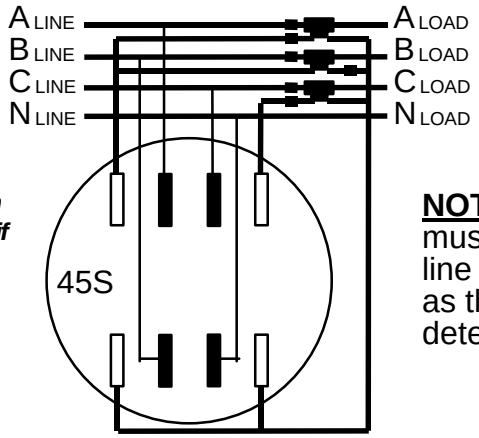
MO 45-0

KV2c Site Analysis

Form 45S ***(Transformer Rated)***

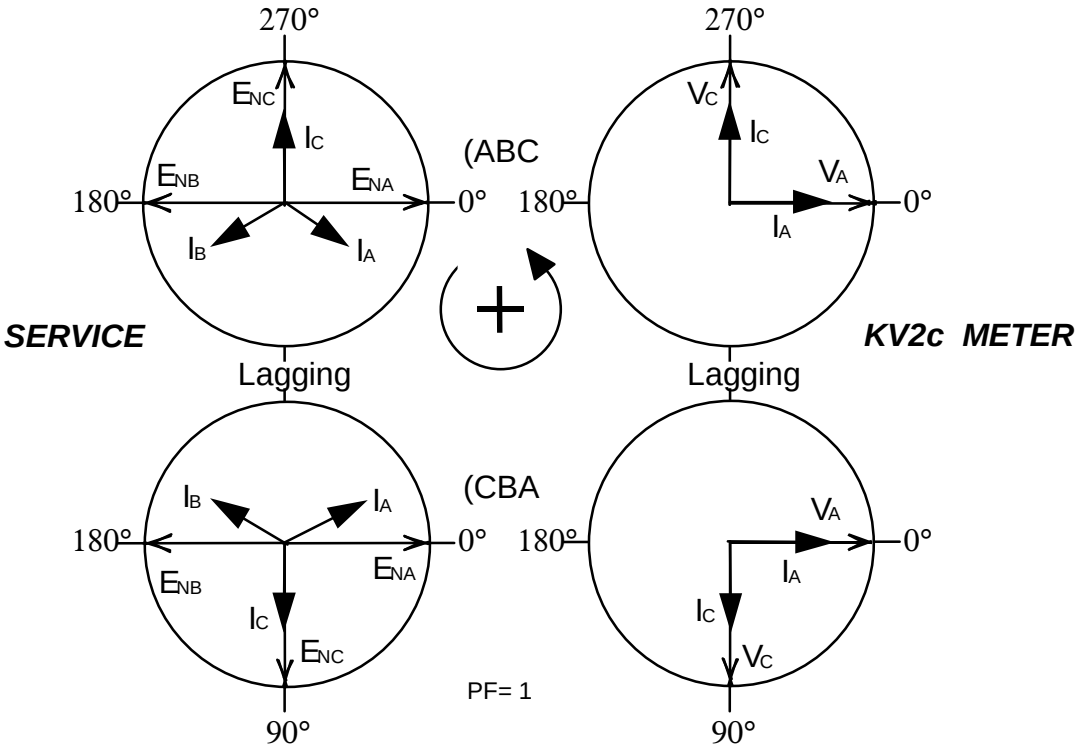


4-Wire, Delta



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.

NOT: The CTs in lines A must be twice the ratio of the line C. Use the ratio of CT in as the transformer determining the multiplier.



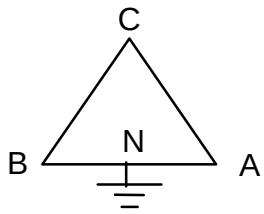
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, delta, 2-element

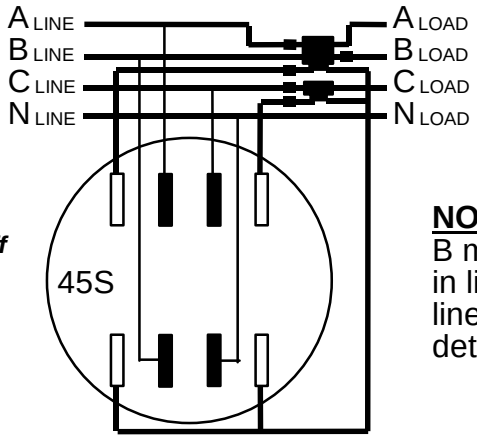
MO 45-3

KV2c Site Analysis

Form 45S ***(Transformer Rated)***

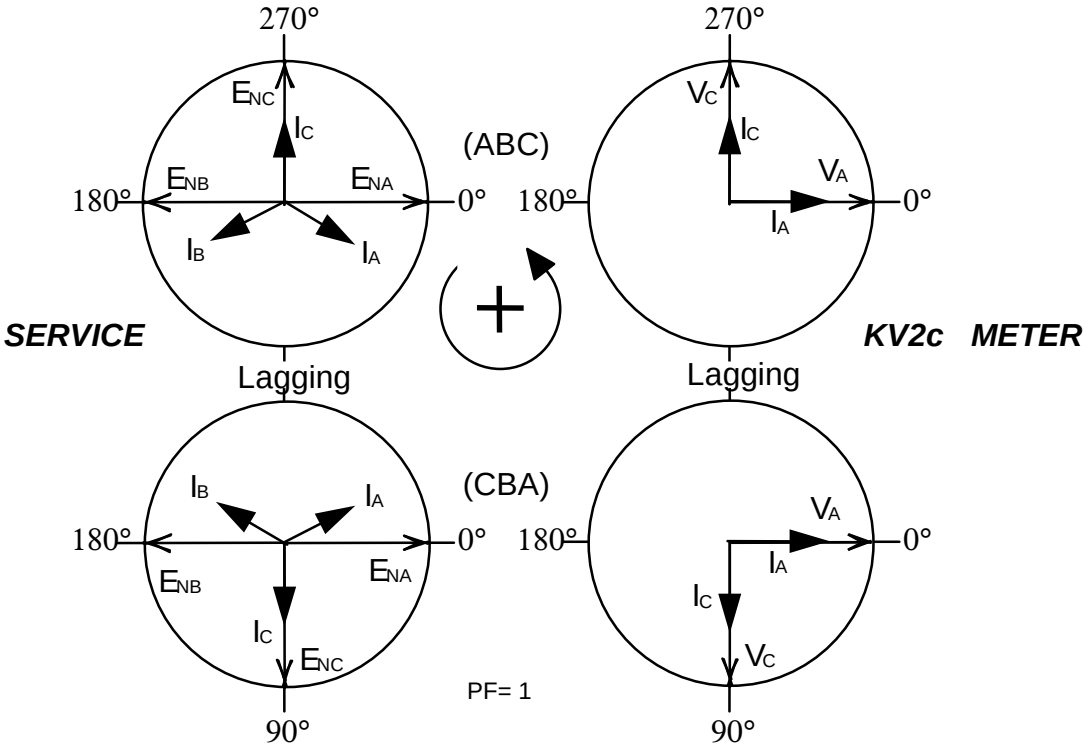


4-Wire, Delta



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.

NOT : A window CT in lines B must be twice the ratio of in line C. Use the ratio of line C as the transformer determining the multiplier.



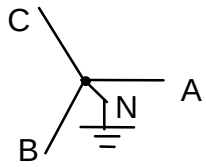
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, delta, 2-element

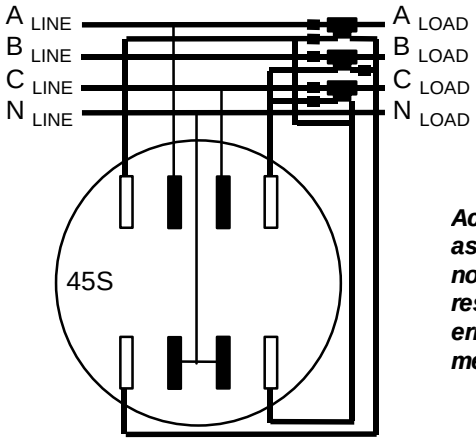
MO 45-3

KV2c Site Analysis

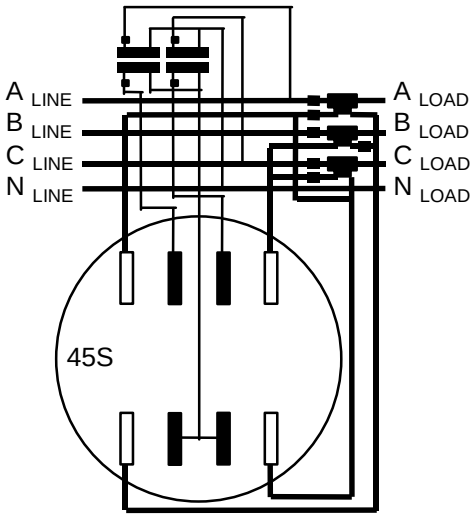
Form 45S ***(Transformer Rated)***

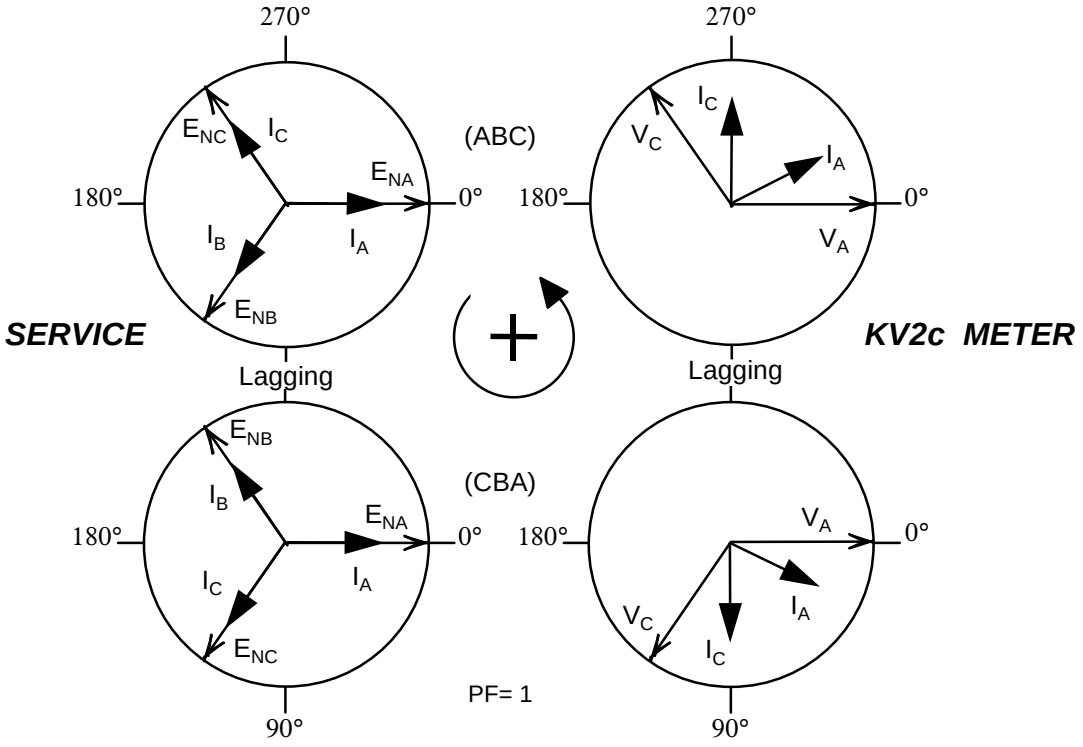


4-Wire, Wye



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.





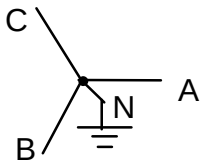
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

4-wire, wye, 2-element

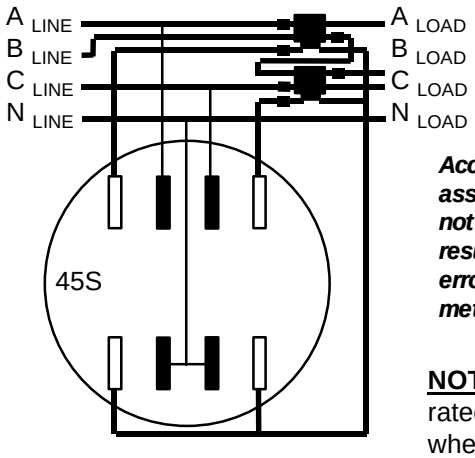
MO 45-3

KV2c Site Analysis

Form 45S ***(Transformer Rated)***

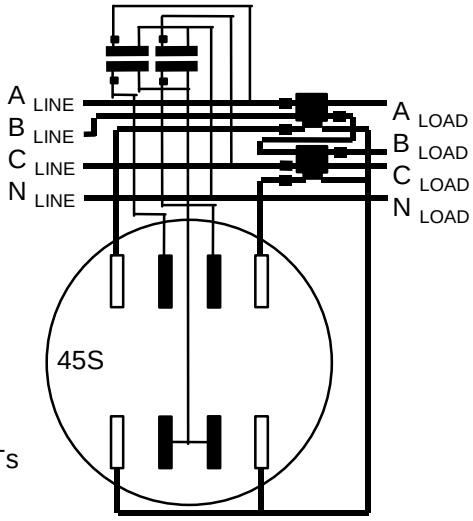


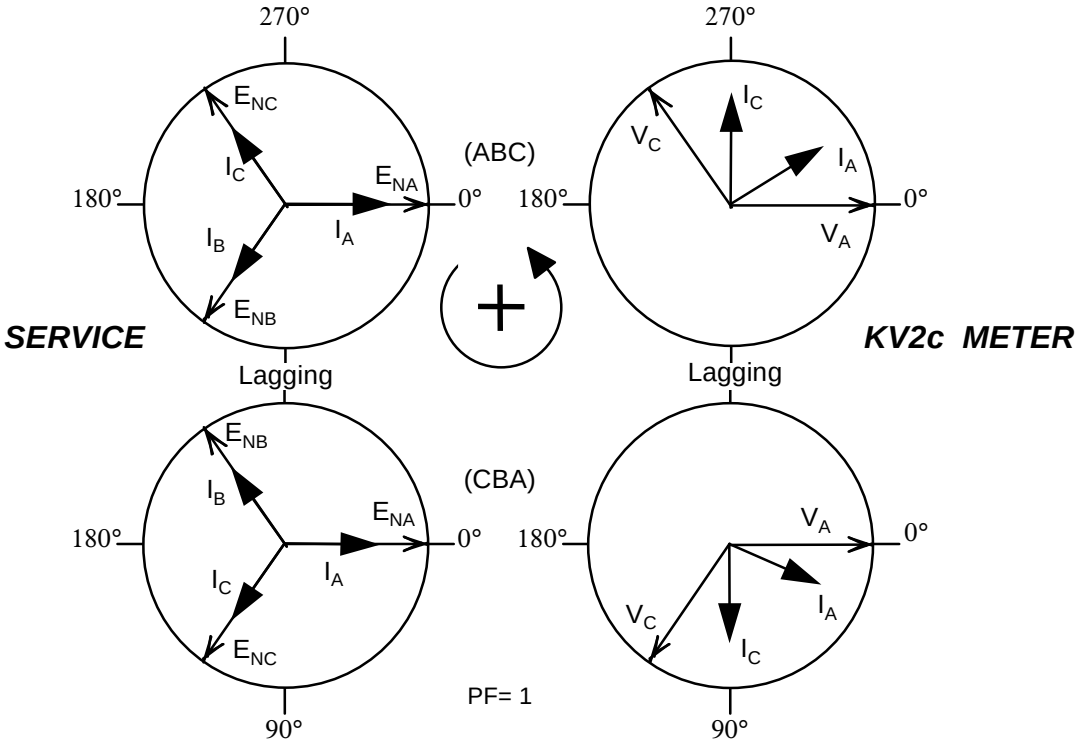
4-Wire, Wye



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.

NOTE: For 3–wire CTs rated x&x:5, use 2x:5 when calculating TF.





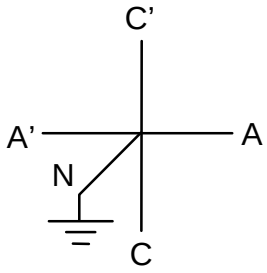
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

4-wire, wye, 2-element

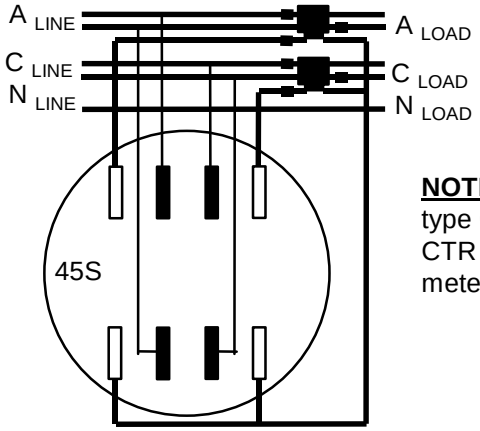
MO 45-3

KV2c Site Analysis

Form 45S ***(Transformer Rated)***

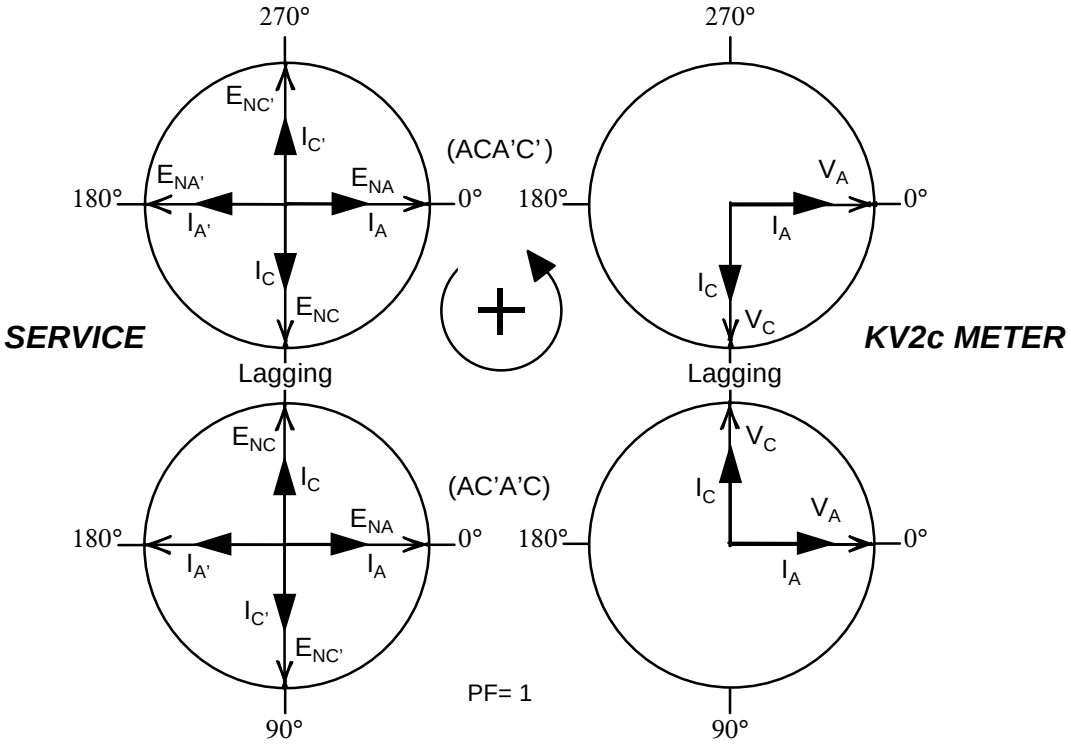


5-Wire, 2-Phase



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.

NOTE: For window type CTs, use half the CTR in determining meter multiplier.



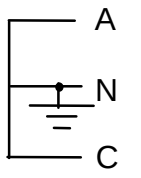
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

5-wire, 2-phase, 2-element

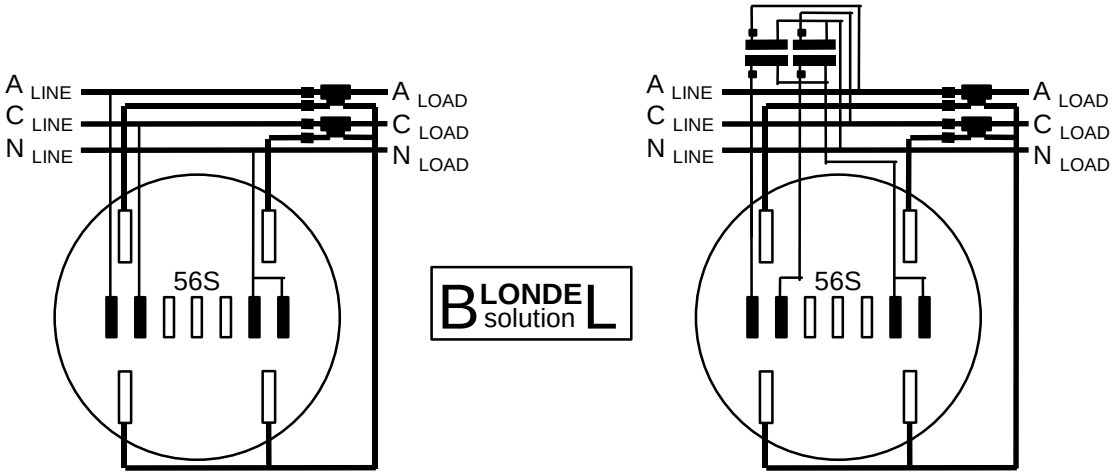
MO 45-3

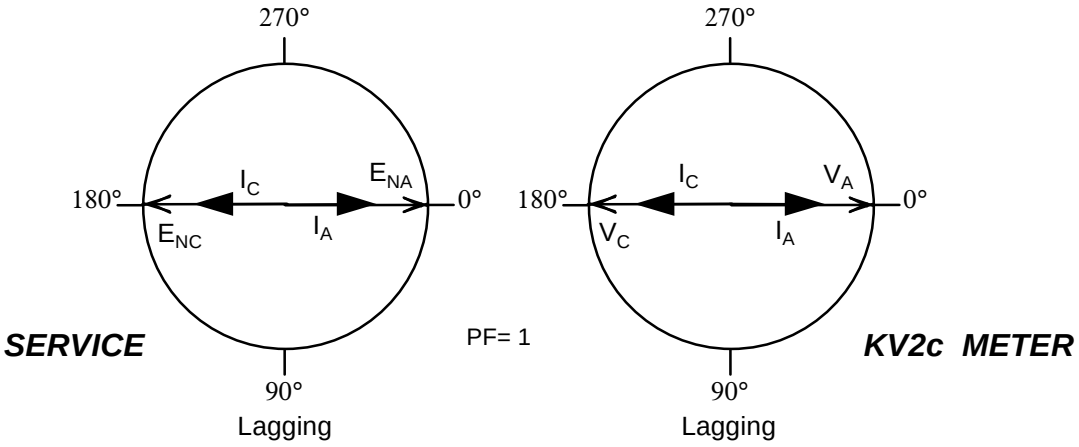
KV2c Site Analysis

Form 56S ***(Transformer Rated)***



3-Wire
Singlephase





SERVICE

PF= 1

KV2c METER

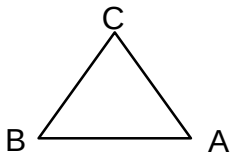
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

3-wire, 1-phase, 2-element

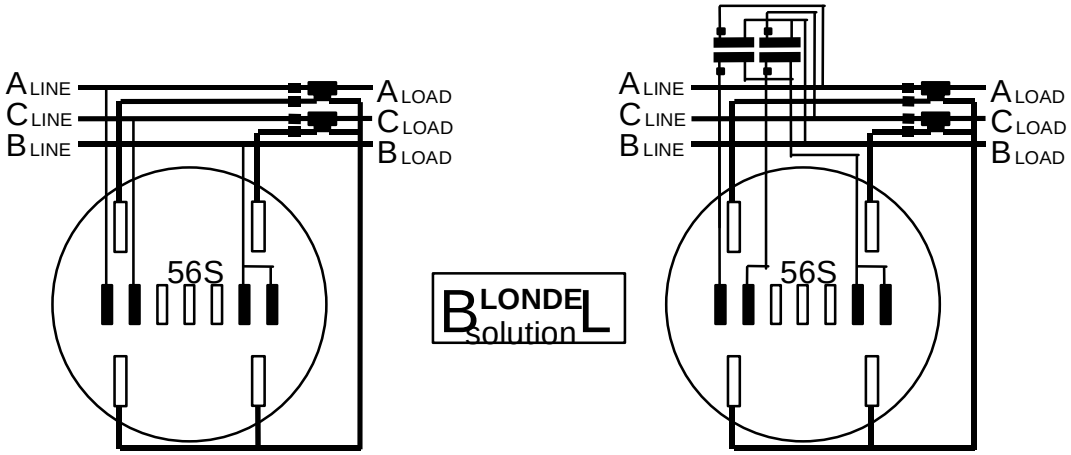
MO 45-3

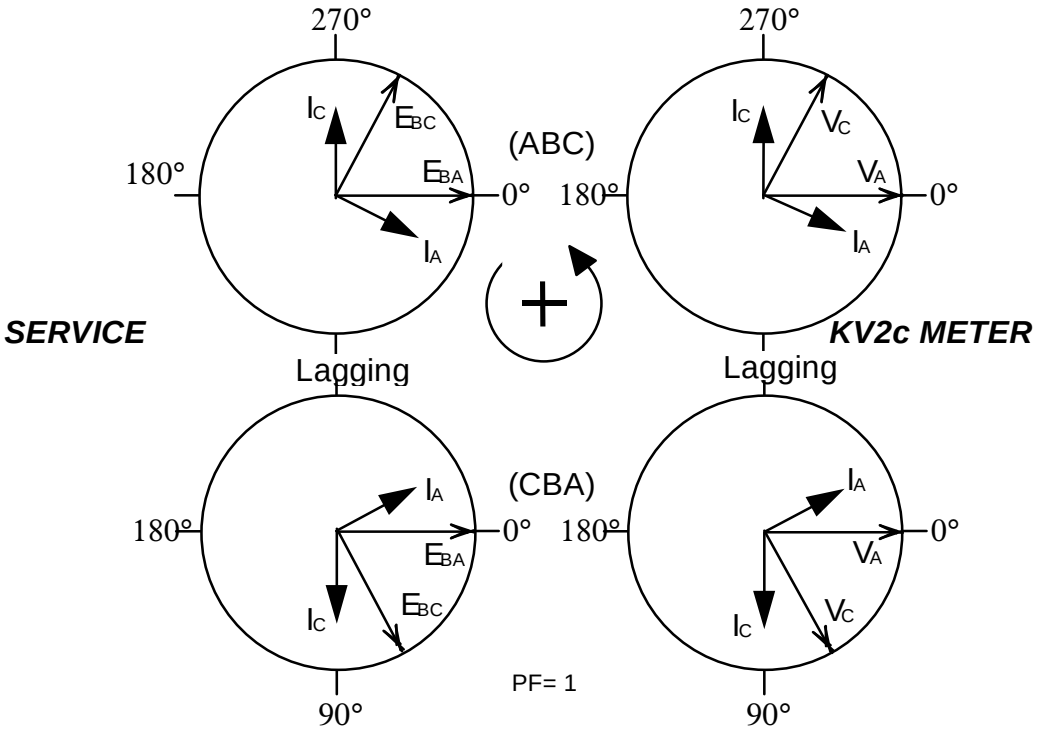
KV2c Site Analysis

Form 56S ***(Transformer Rated)***



3-Wire, Delta





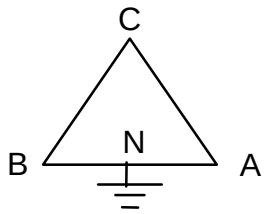
Actual installation procedures, equipment, and connections must to applicable codes and standards

3-wire, 3-phase, 2-element

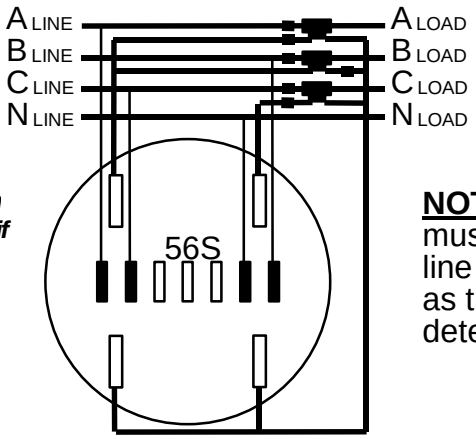
MO 45-0

KV2c Site Analysis

Form 56S ***(Transformer Rated)***

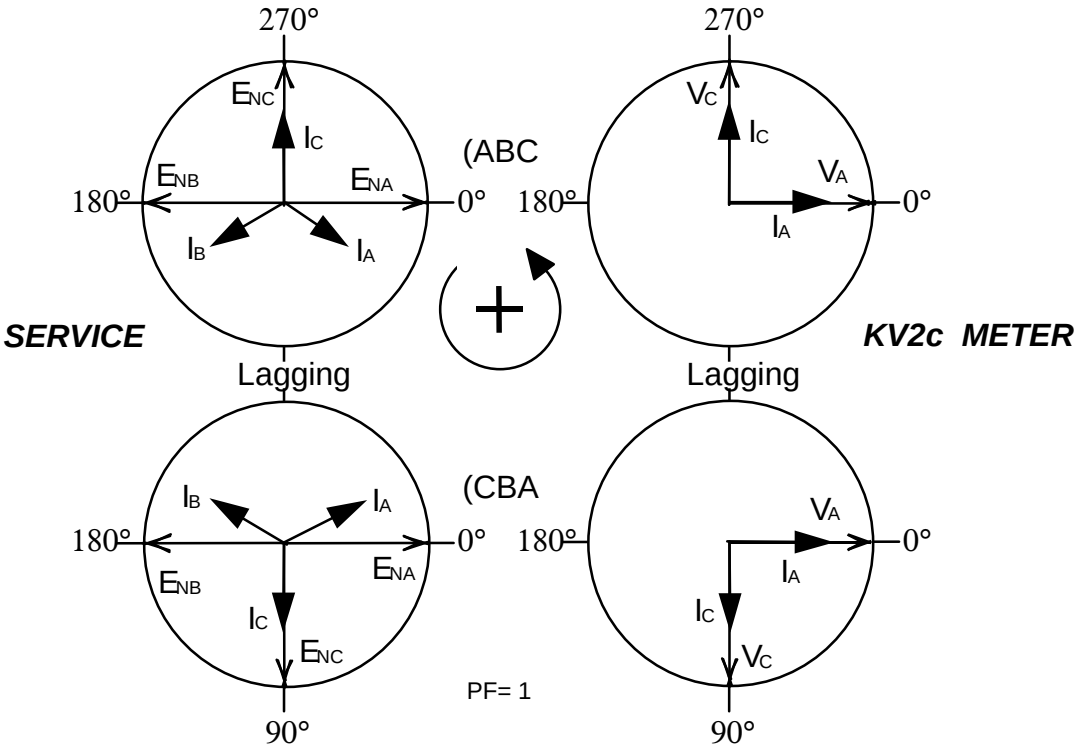


4-Wire, Delta



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.

NOT : The CTs in lines A must be twice the ratio of the line C. Use the ratio of CT in as the transformer determining the multiplier.



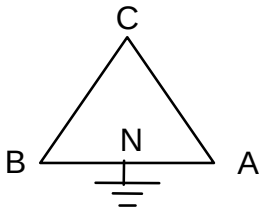
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, delta, 2-element

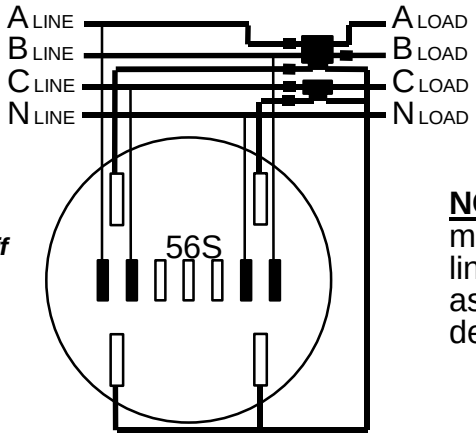
MO 45-3

KV2c Site Analysis

Form 56S ***(Transformer Rated)***

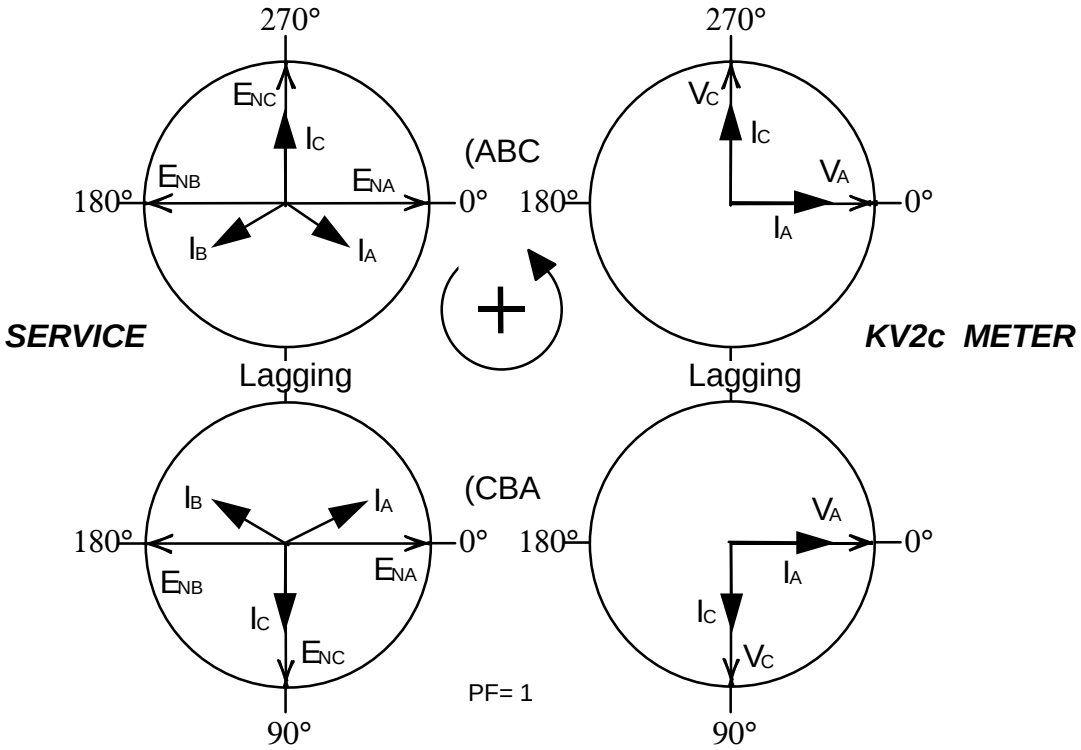


4-Wire, Delta



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.

NOT : A window CT in lines A must be twice the ratio of the line C. Use the ratio of CT in as the transformer determining the multiplier.



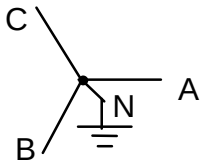
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, delta, 2-element

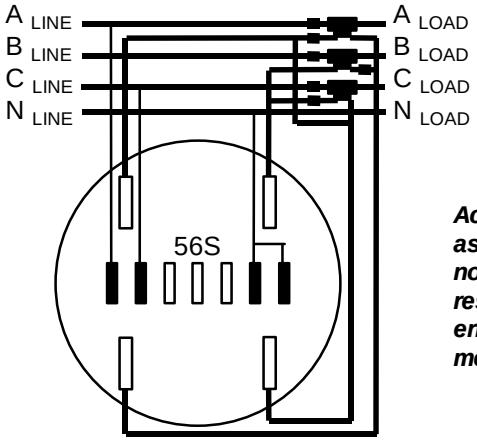
MO 45-3

KV2c Site Analysis

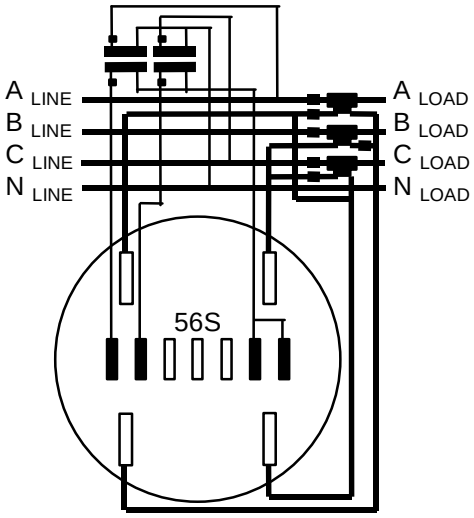
Form 56S ***(Transformer Rated)***

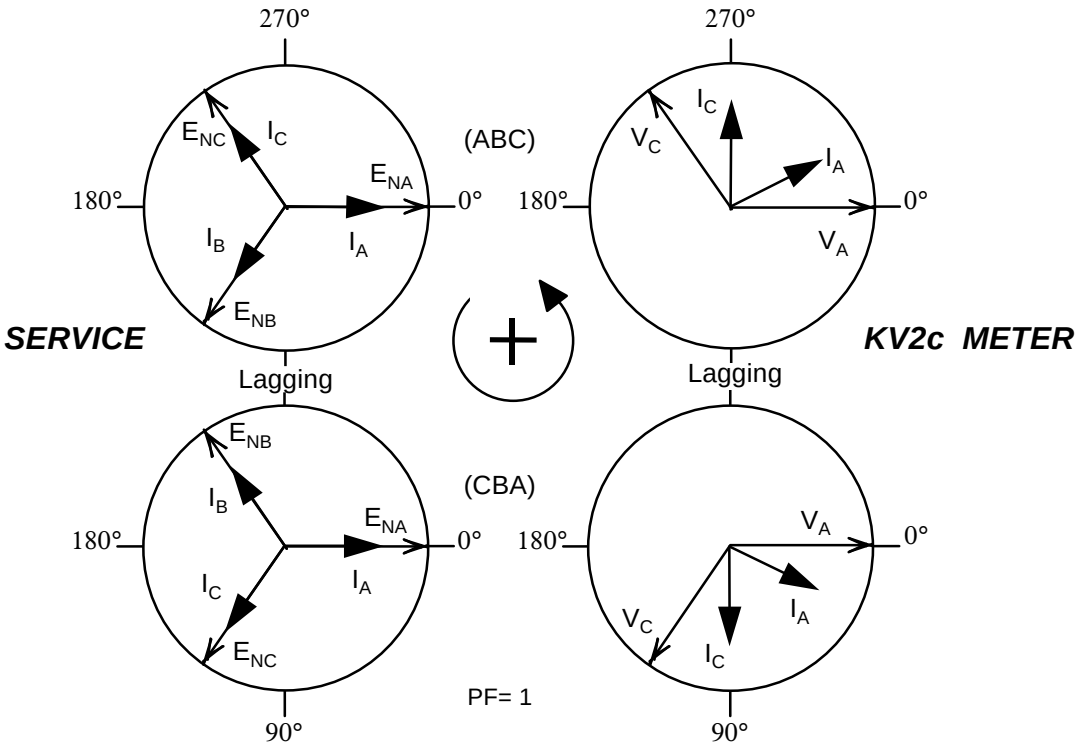


4-Wire, Wye



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.





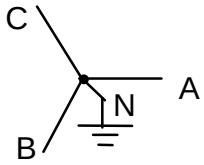
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

4-wire, wye, 2-element

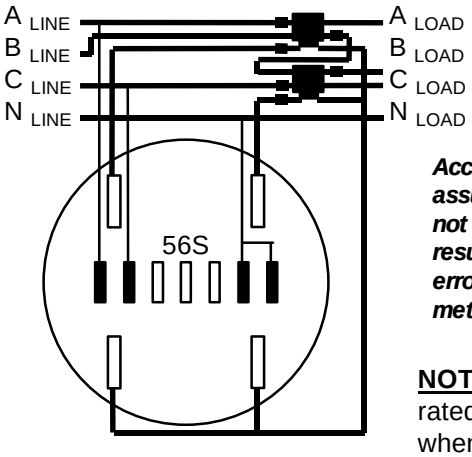
MO 45-3

KV2c Site Analysis

Form 56S ***(Transformer Rated)***

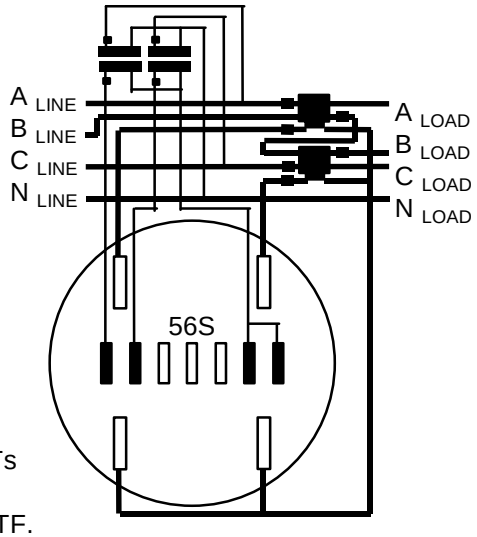


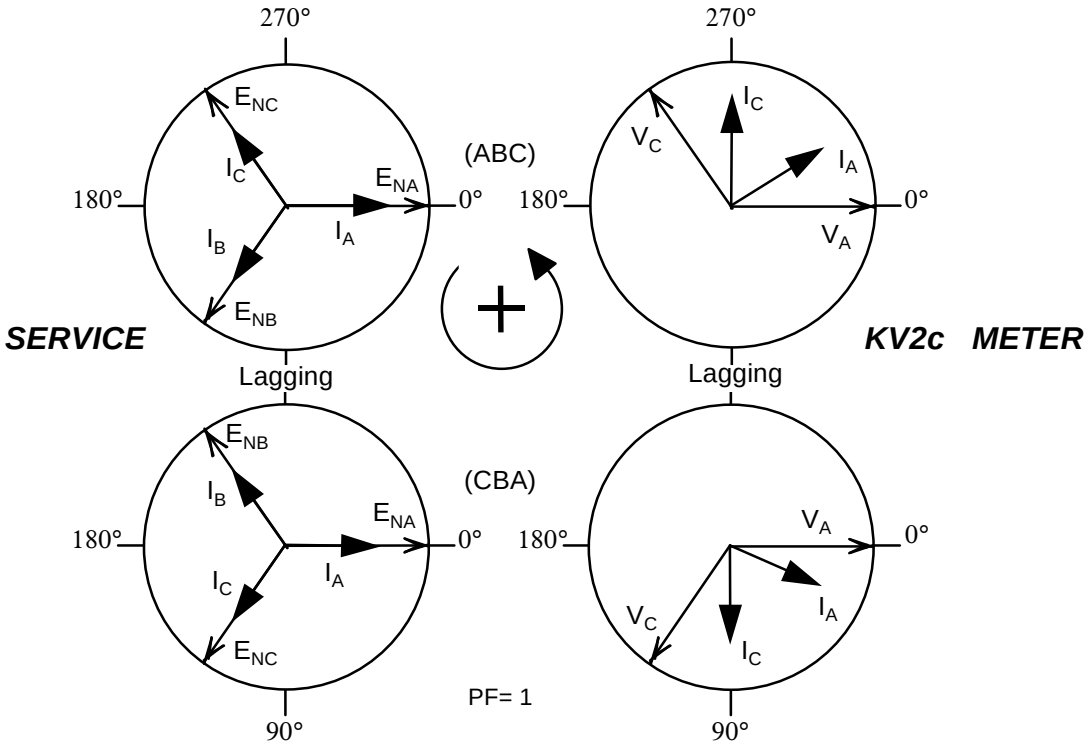
4-Wire, Wye



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.

NOTE: For 3–wire CTs rated x&x:5, use 2x:5 when calculating the TF.





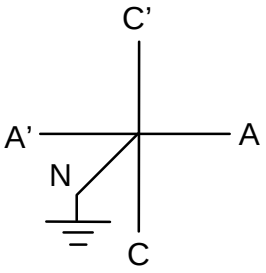
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

4-wire, wye, 2-element

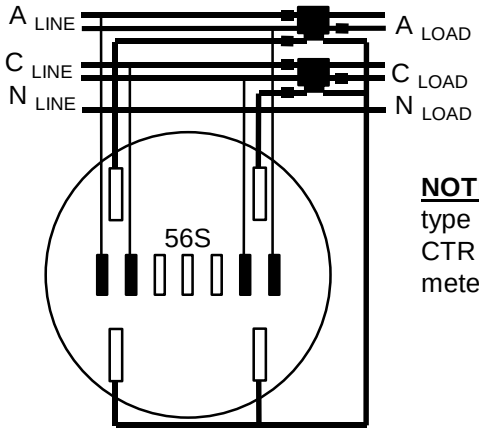
MO 45-3

KV2c Site Analysis

Form 56S ***(Transformer Rated)***

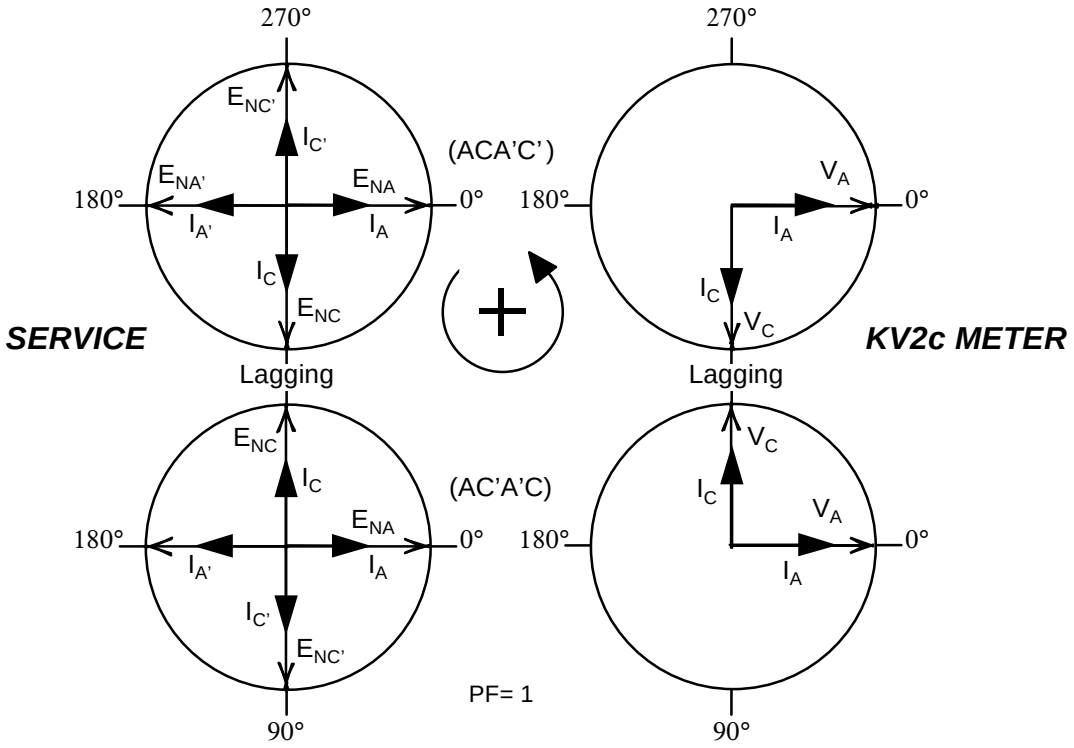


5-Wire, 2-Phase



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.

NOTE: For window type CTs use half the CTR in determining meter multiplier.



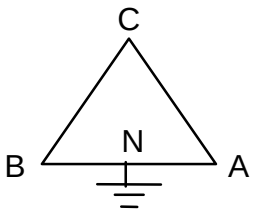
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

5-wire, 2-phase, 2-element

MO 45-3

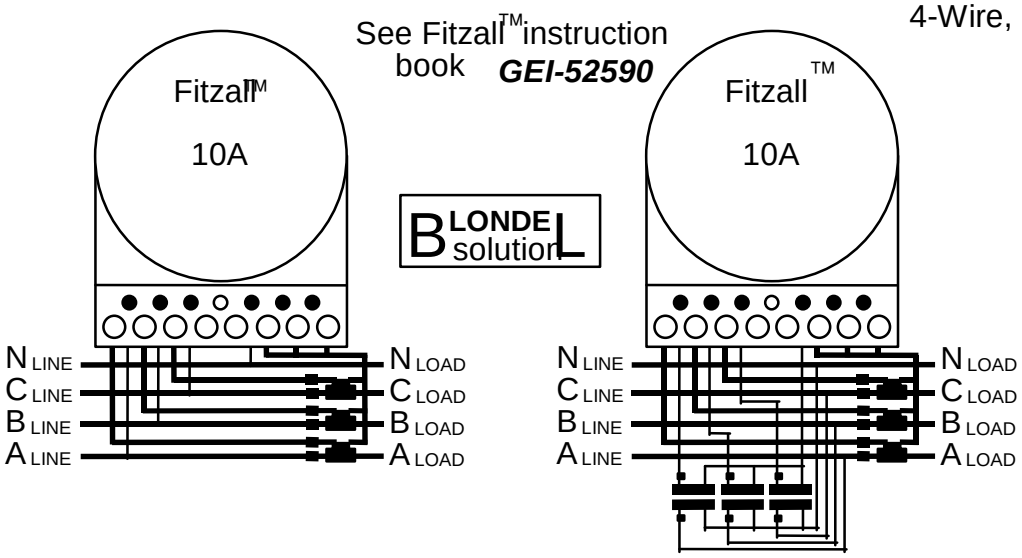
KV2c Site Analysis

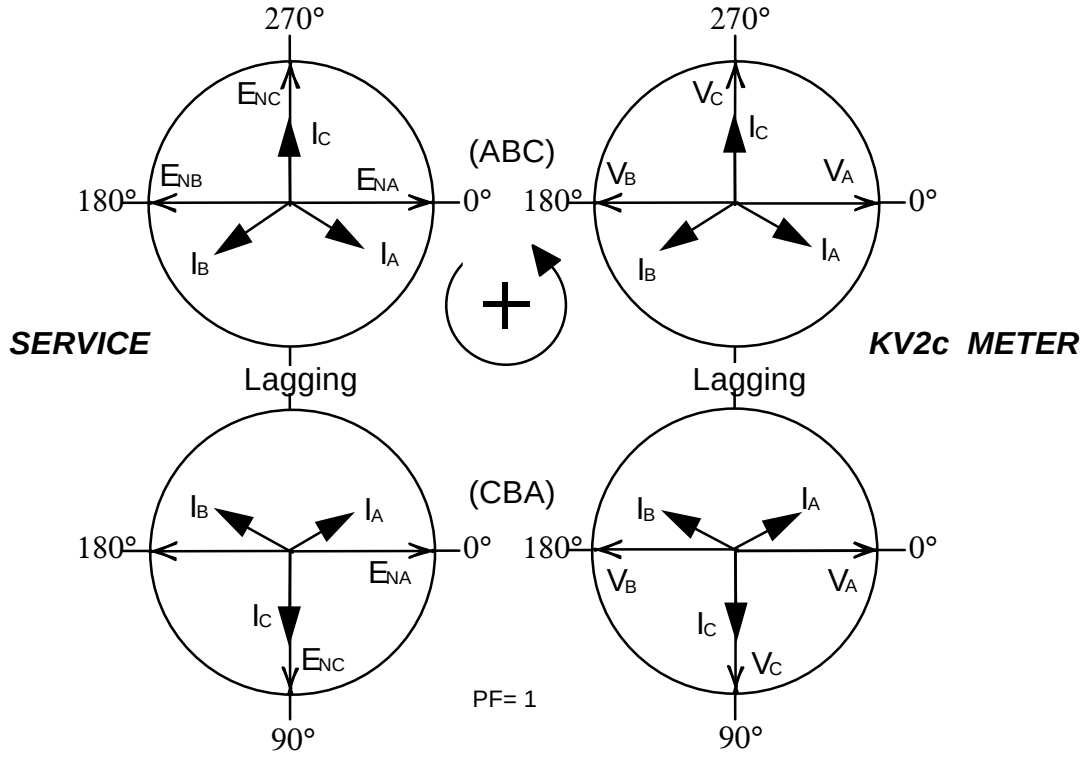
Form 10A ***(Transformer Rated)***



4-Wire, Delta

See Fitzall™ instruction book ***GEI-52590***





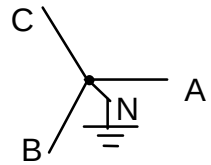
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, 3-Element

MO 9-6

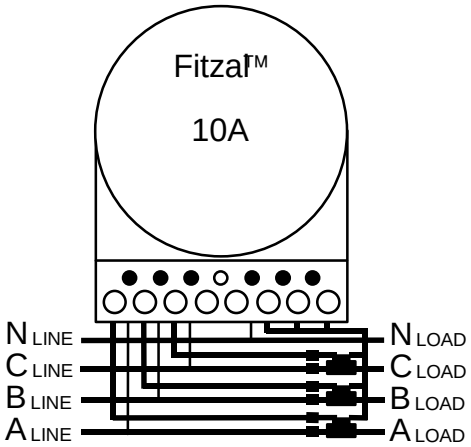
KV2c Site Analysis

Form 10A ***(Transformer Rated)***

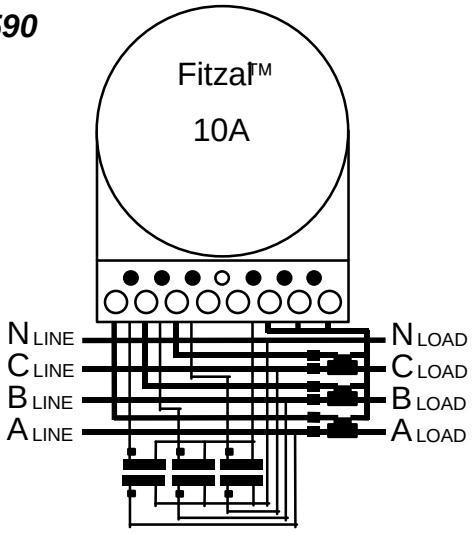


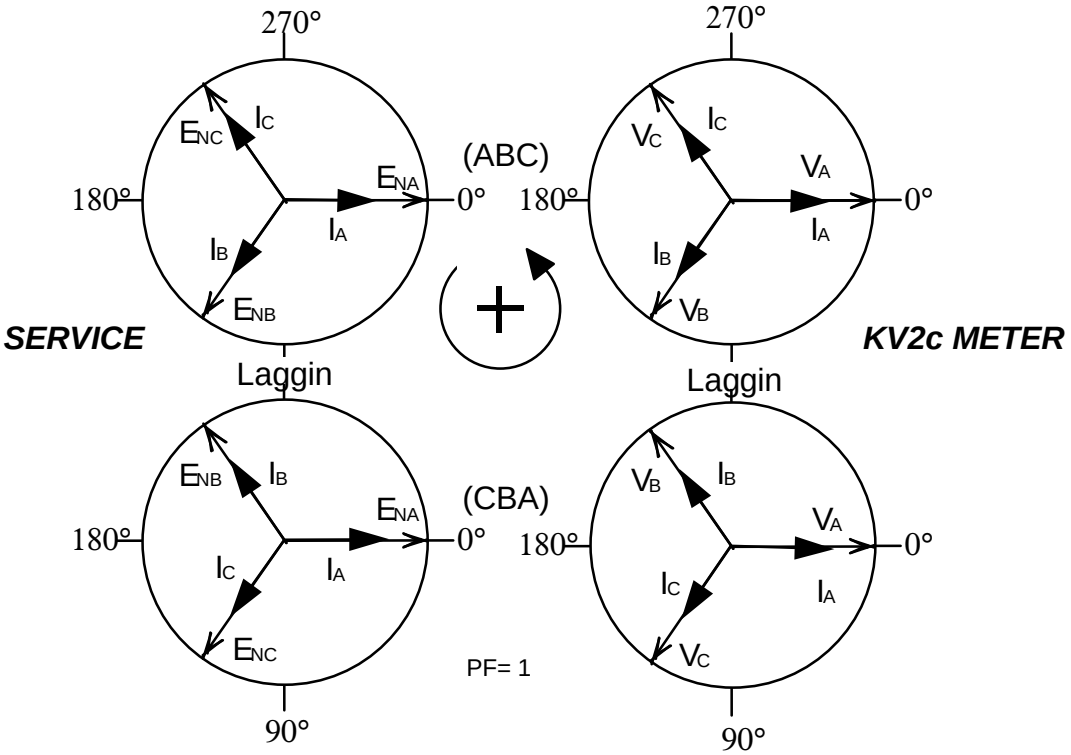
4-Wire, Wye

See ™ instruction book ***GEI-52590***



BLONDEL solution





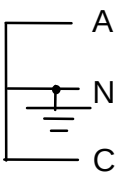
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, 3-Element

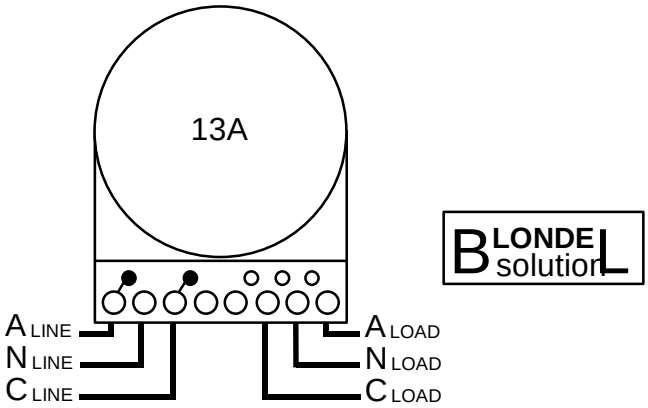
MO 9-6

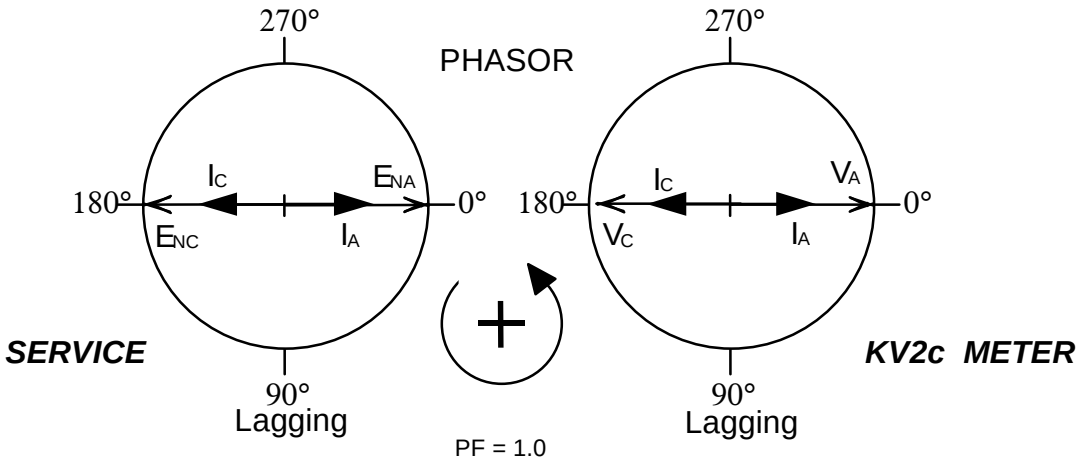
KV2c Site Analysis

Form 13A ***(Self-Contained)***



3-Wire Singlephase





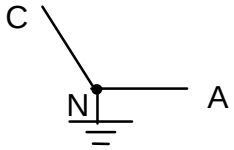
Actual installation procedures, equipment, and connections must to applicable codes and standards

3-wire, 1-phase, 2-element

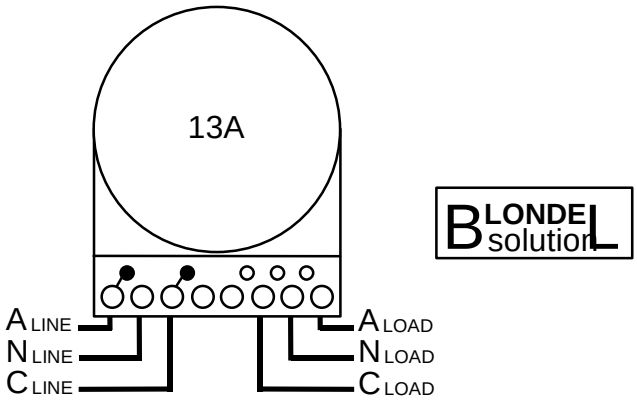
MO 12-4

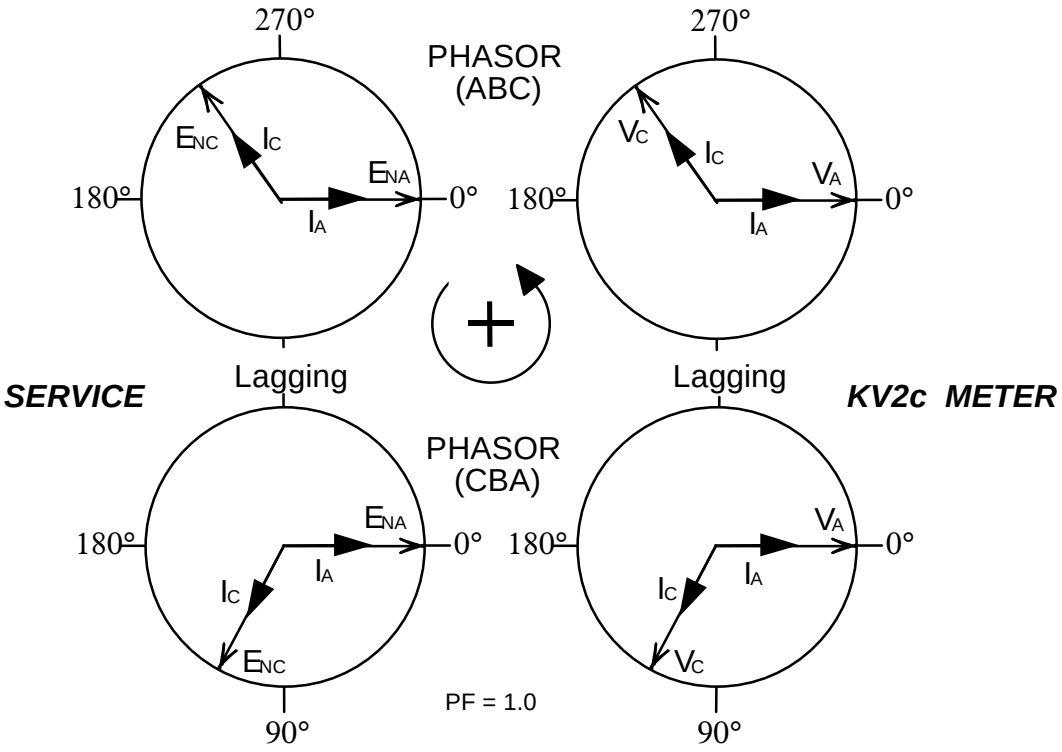
KV2c Site Analysis

Form 13A ***(Self-Contained)***



Network





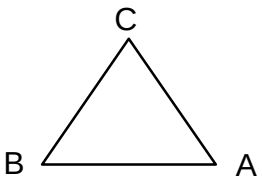
Actual installation procedures, equipment, and connections must to applicable codes and standards

3-wire, Network, 2-element

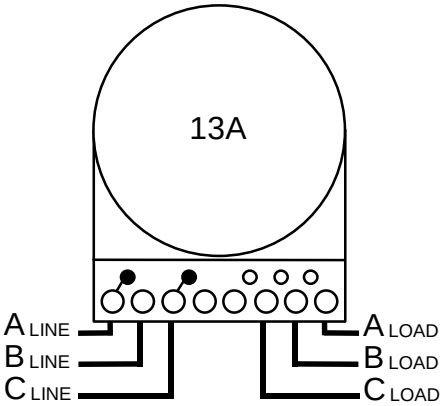
MO 12-4

KV2c Site Analysis

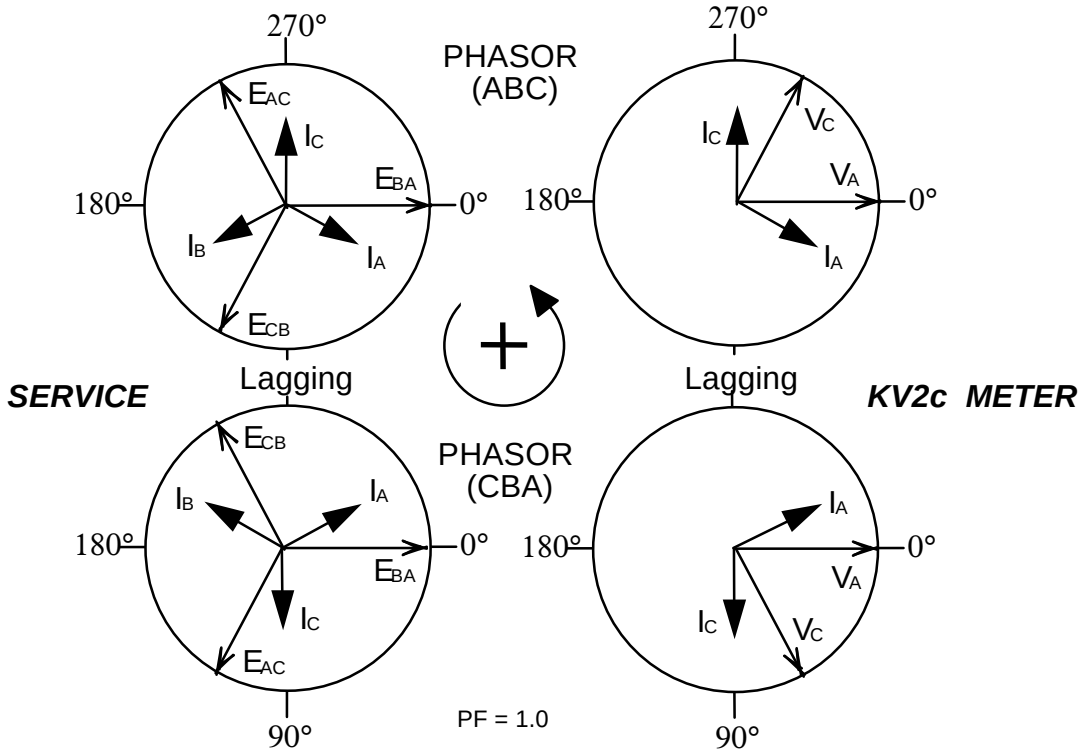
Form 13A ***(Self-Contained)***



3-Wire, Delta



BLONDEL solution



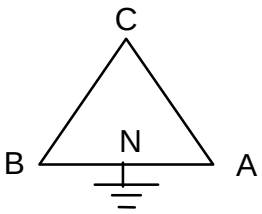
Actual installation procedures, equipment, and connections must to applicable codes and standards

3-wire, 3-phase, 2-element

MO 12-0

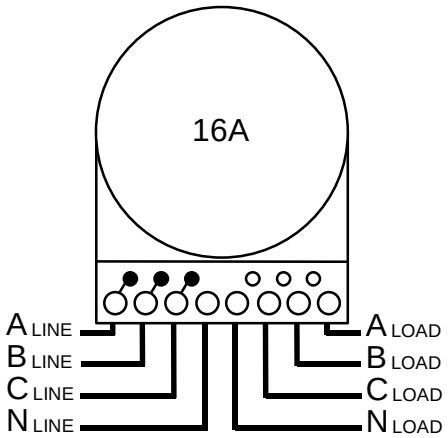
KV2c Site Analysis

Form 16A ***(Self-Contained)***

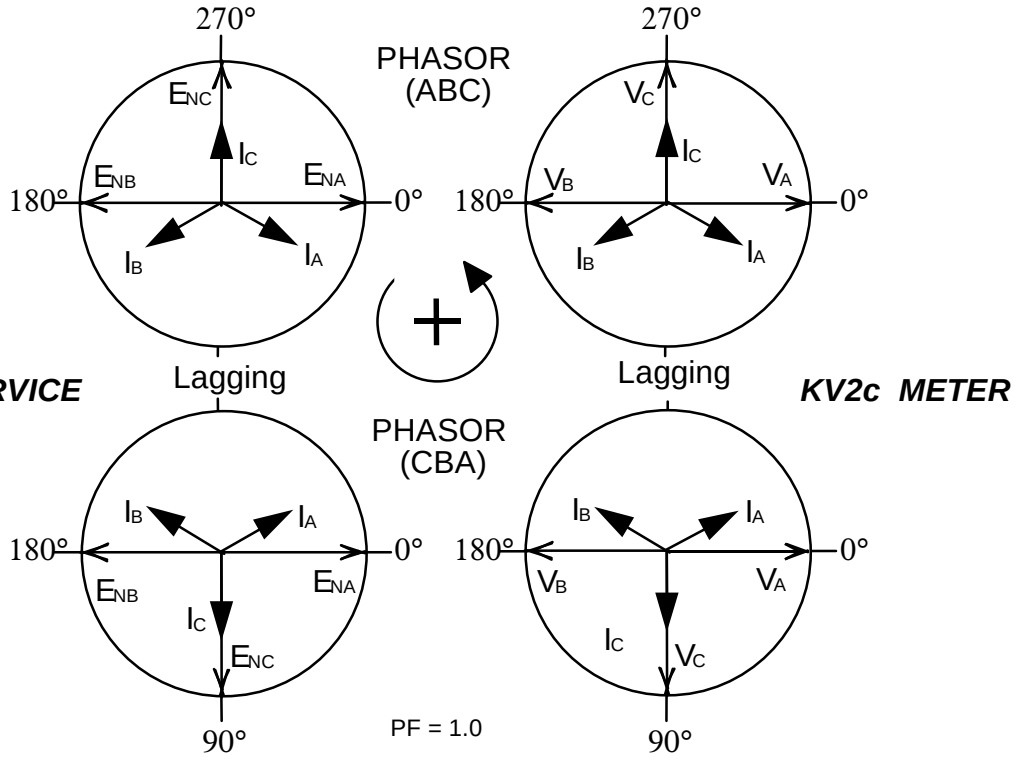


4-Wire, Delta

See ™ instruction book ***GEI-52590***



BLONDEL solution



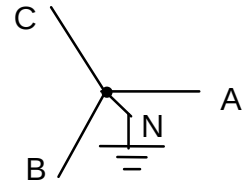
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, 3-Element

MO 16-6

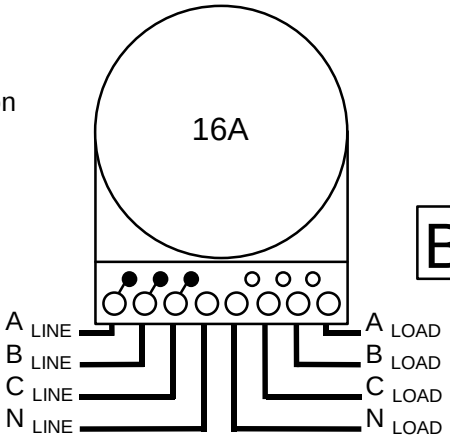
KV2c Site Analysis

Form 16A ***(Self-Contained)***

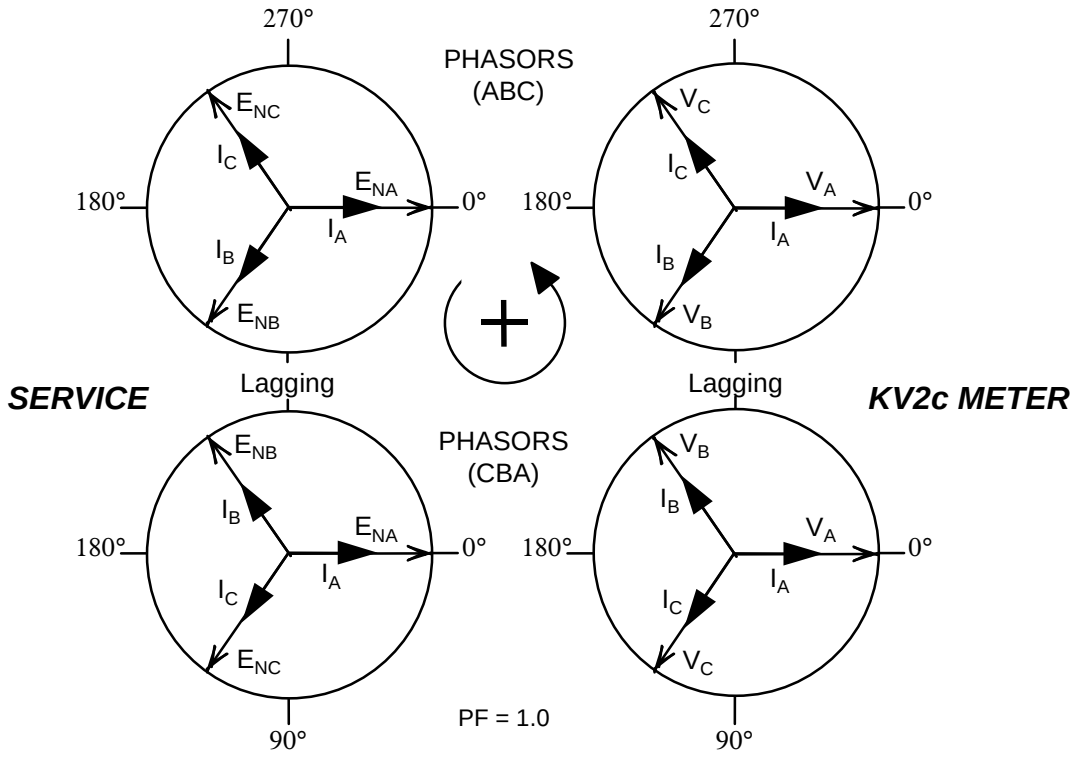


4-Wire, Wye

See Fitzall™ instruction book ***GEI-52590***.



BLONDEL solution



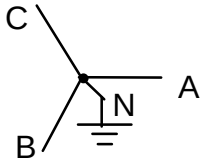
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

4-wire, 3-Element

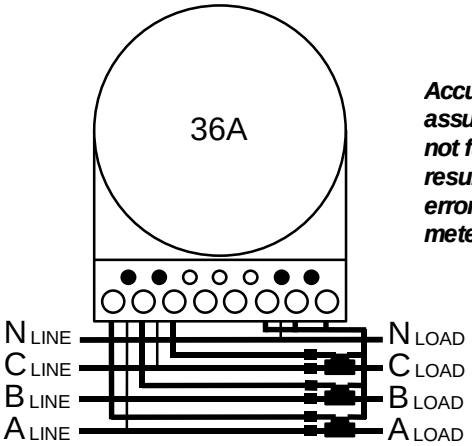
MO 16-6

KV2c Site Analysis

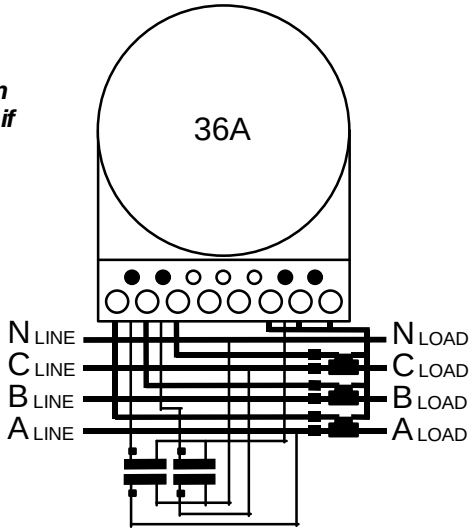
Form 36A ***(Transformer Rated)***

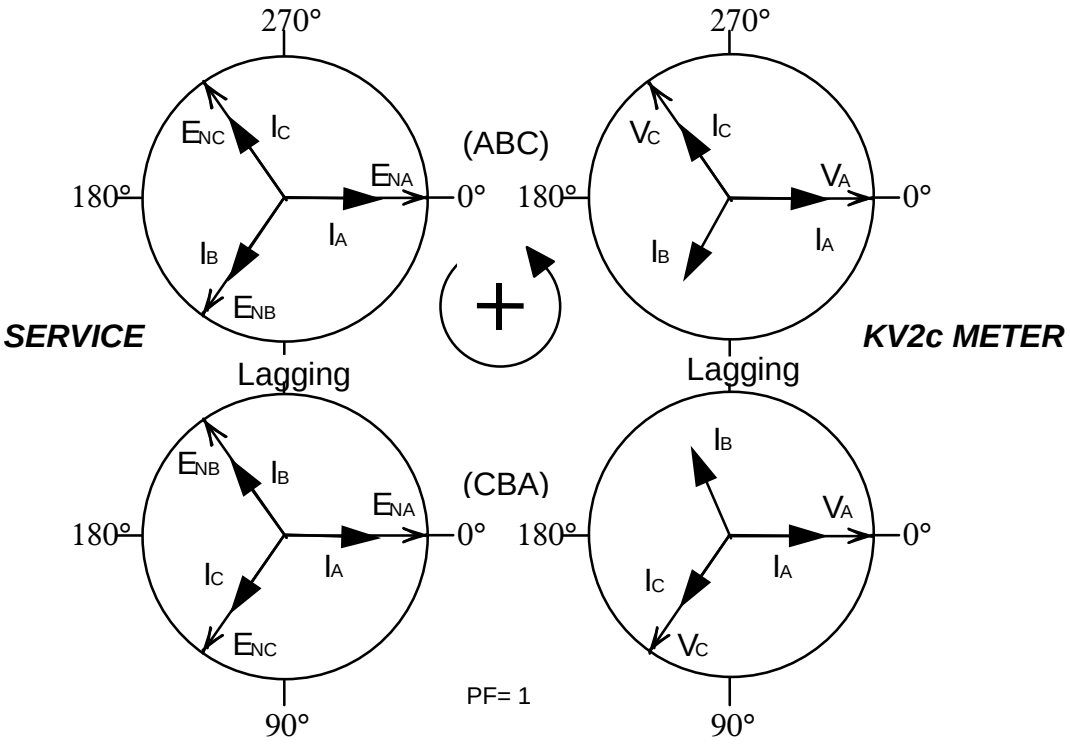


4-Wire, Wye



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.





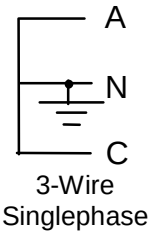
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, wye, 2-1/2-element

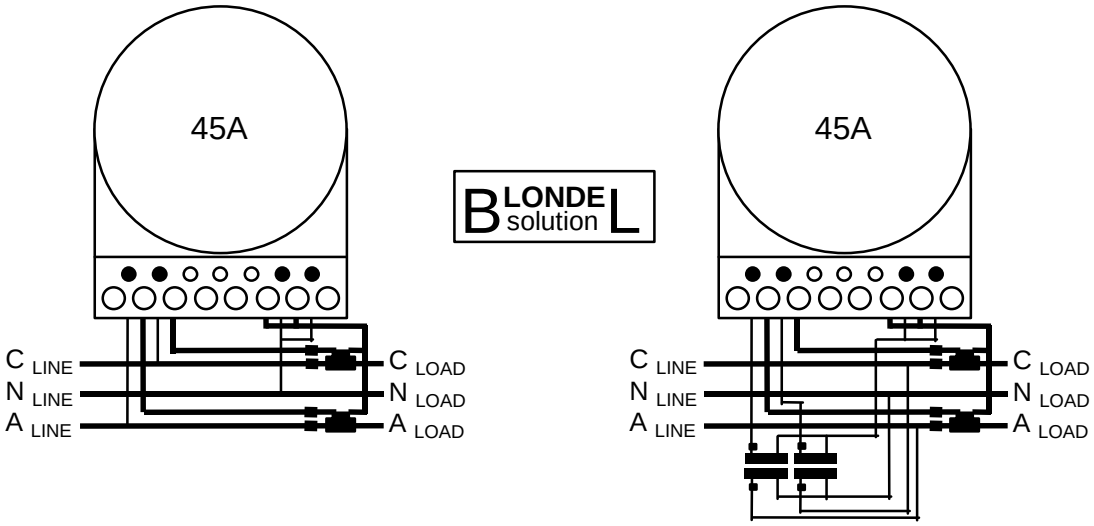
MO 36-2

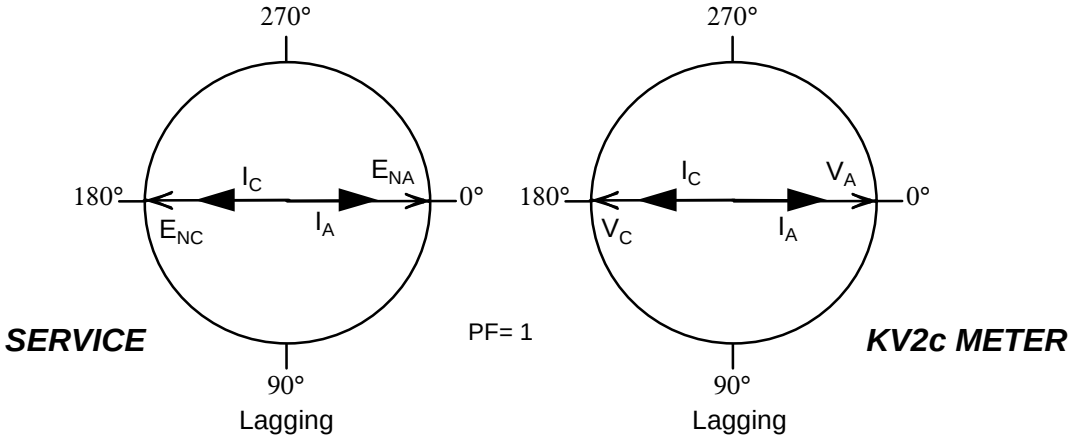
KV2c Site Analysis

Form 45A ***(Transformer Rated)***



3-Wire
Singlephase





SERVICE ***KV2c METER***

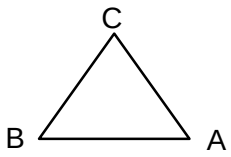
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

3-wire, 1-phase, 2-element

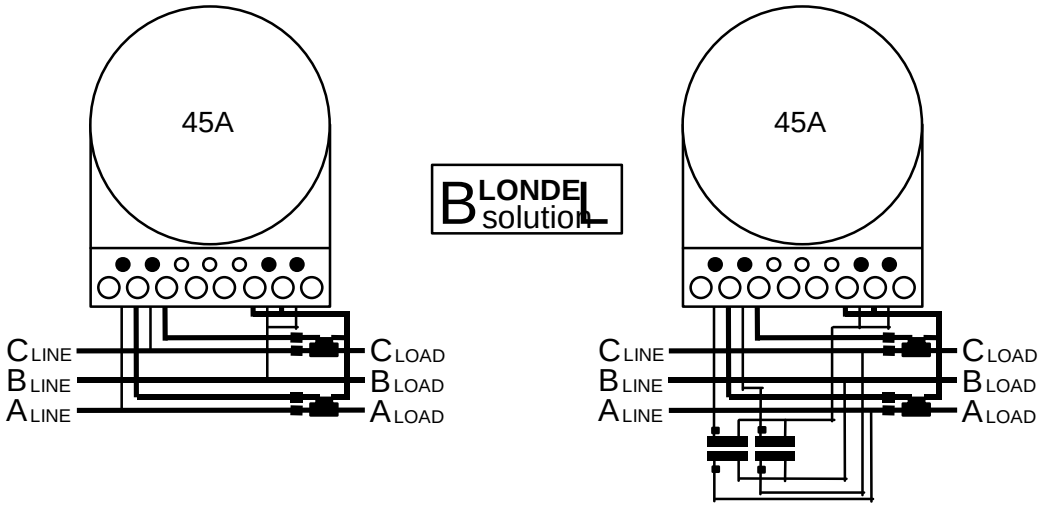
MO 45-3

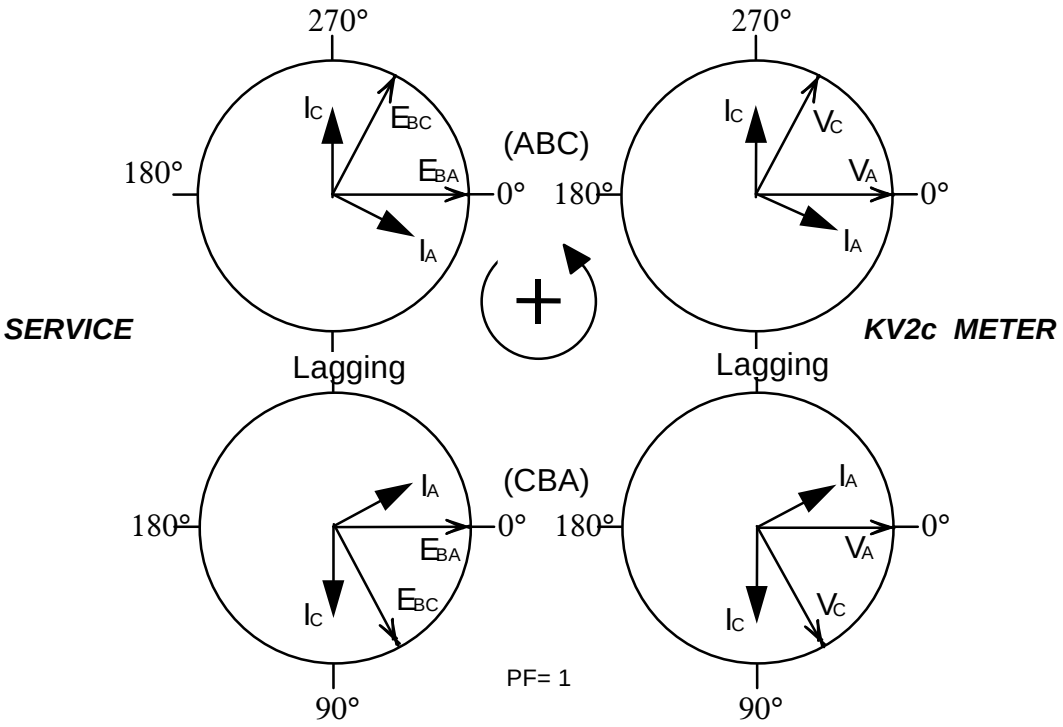
KV2c Site Analysis

Form 45A ***(Transformer Rated)***



3-Wire, Delta





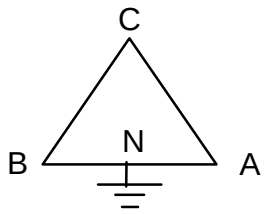
Actual installation procedures, equipment, and connections must to applicable codes and standards

3-wire, 3-phase, 2-element

MO 45-0

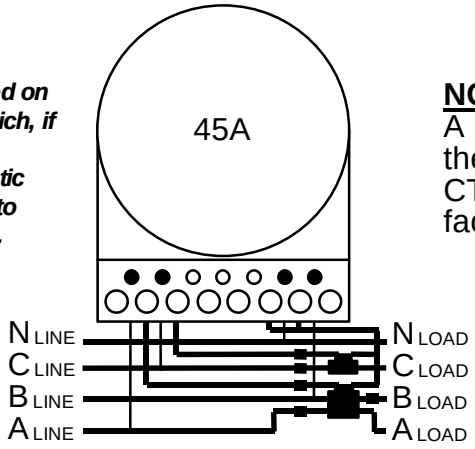
KV2c Site Analysis

Form 45A ***(Transformer Rated)***

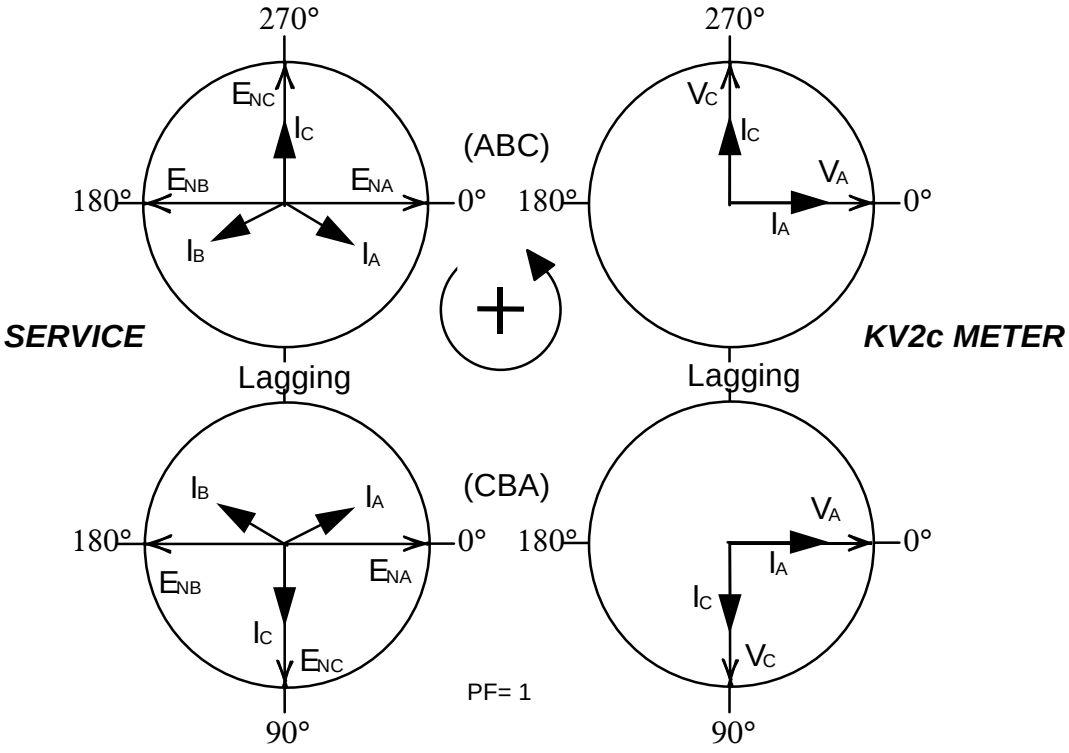


4-Wire, Delta

Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.



NOTE A window type CT in A & B must have twice the the CT in line C. Use the ratio CT in line C as the factor in determining the multiplier.



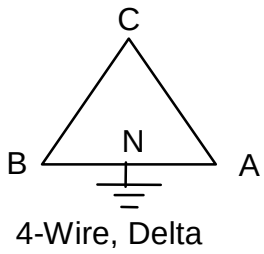
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, delta, 2-element

MO 45-3

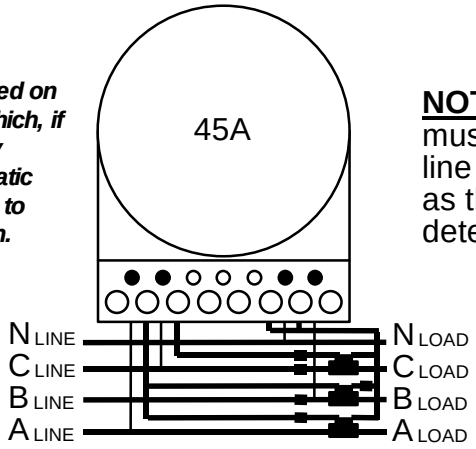
KV2c Site Analysis

Form 45A ***(Transformer Rated)***

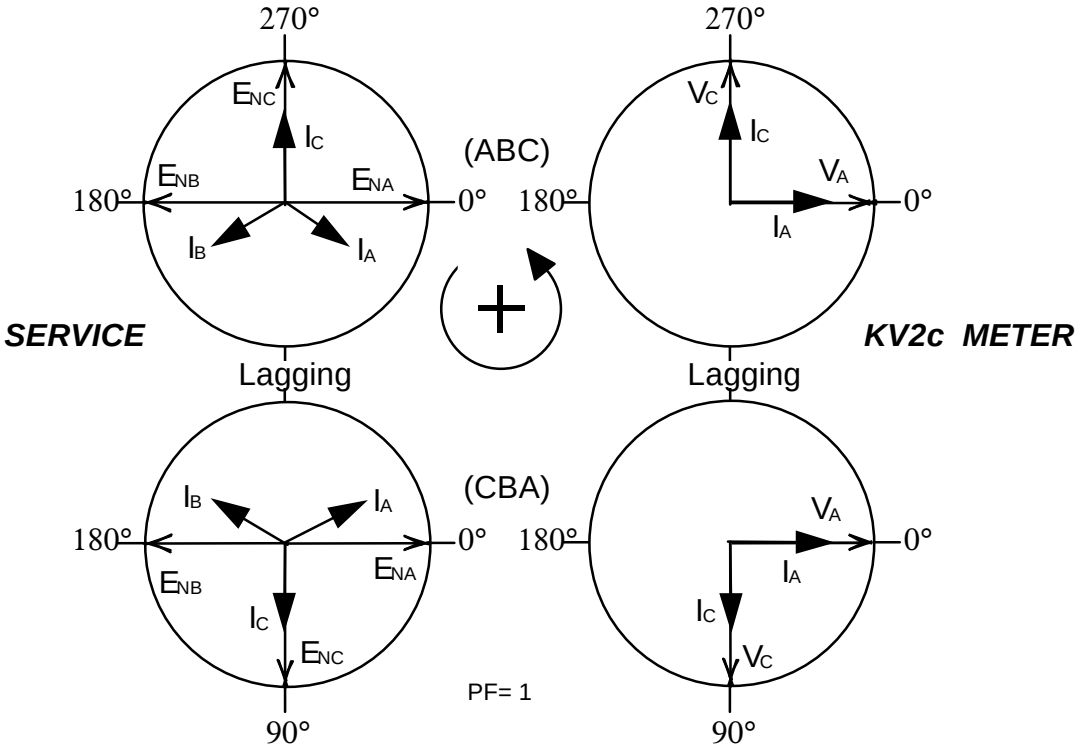


4-Wire, Delta

Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.



NOTE The CTs in lines A & must be twice the ratio of the CT line C. Use the ratio of CT in line as the transformer factor determining the multiplier.



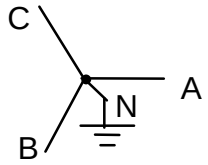
Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, delta, 2-element

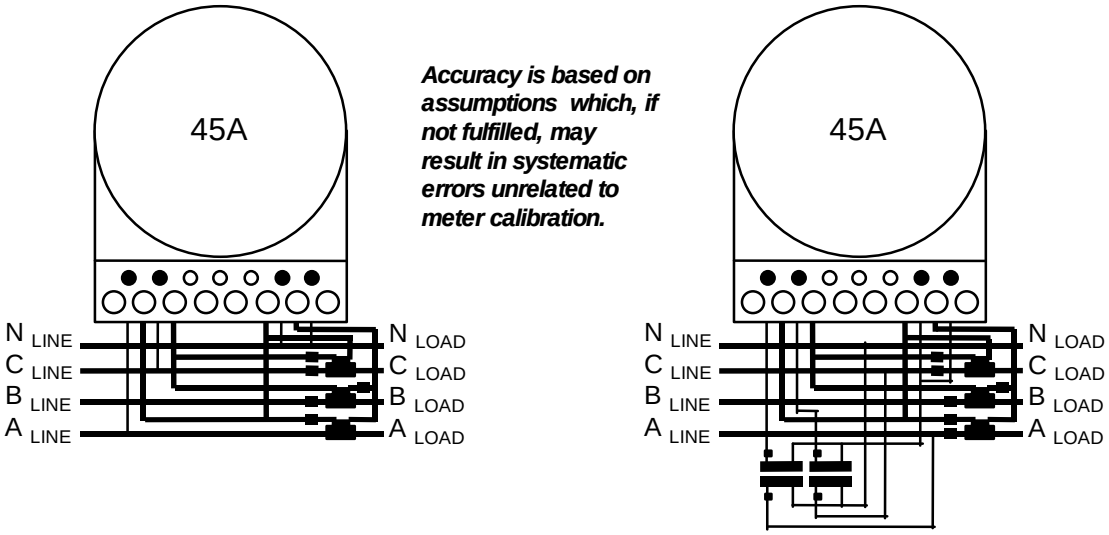
MO 45-3

KV2c Site Analysis

Form 45A ***(Transformer Rated)***

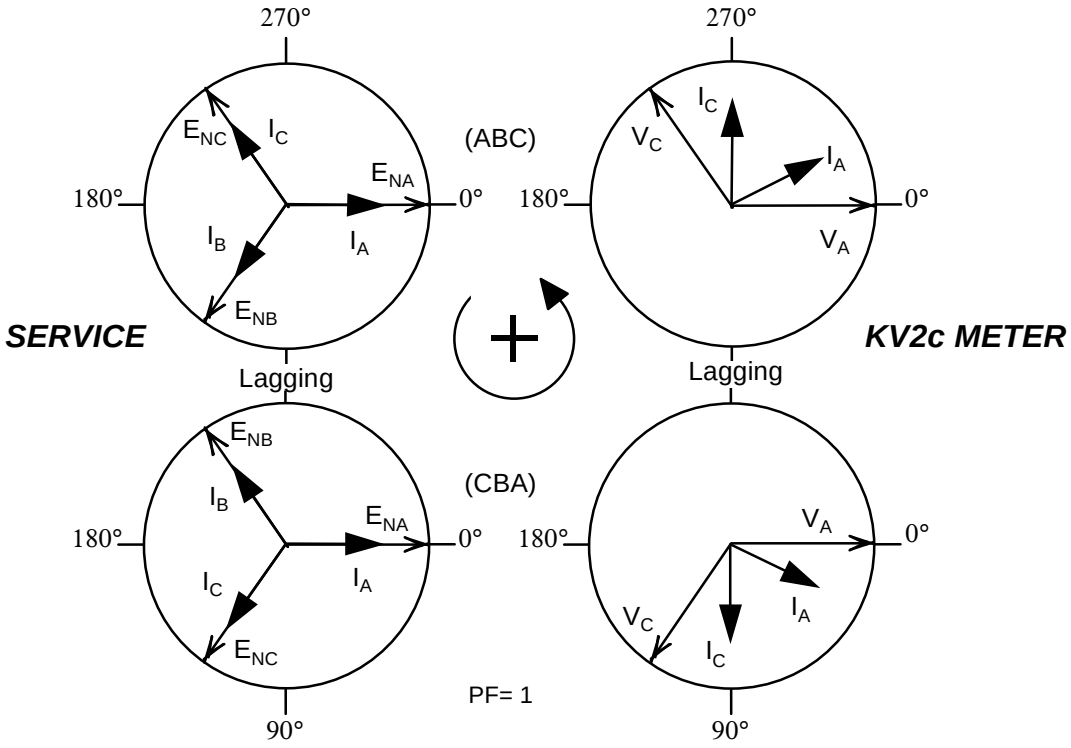


4-Wire, Wye



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.

NOTE: For 3-wire CTs rated x&x:5, use 2x:5 when determining the TF.



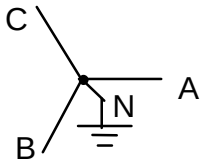
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

4-wire, wye, 2-element

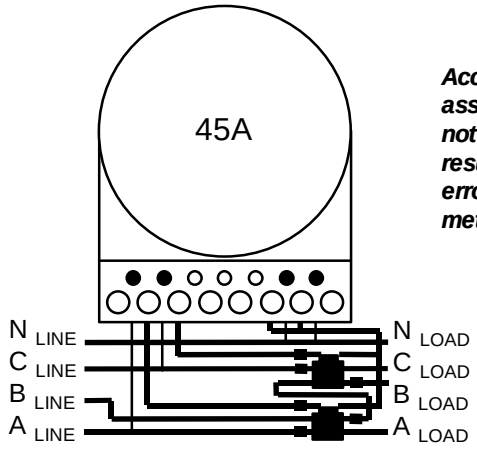
MO 45-3

KV2c Site Analysis

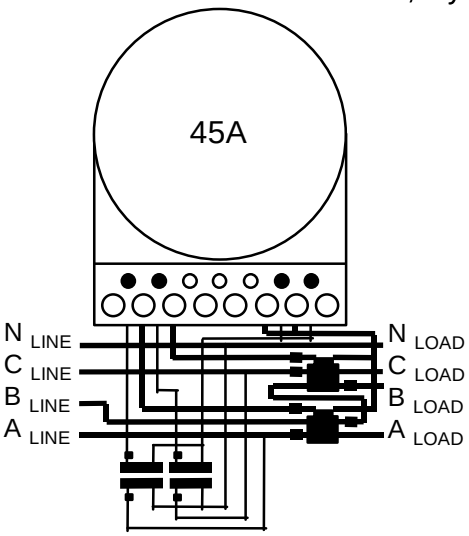
Form 45A ***(Transformer Rated)***



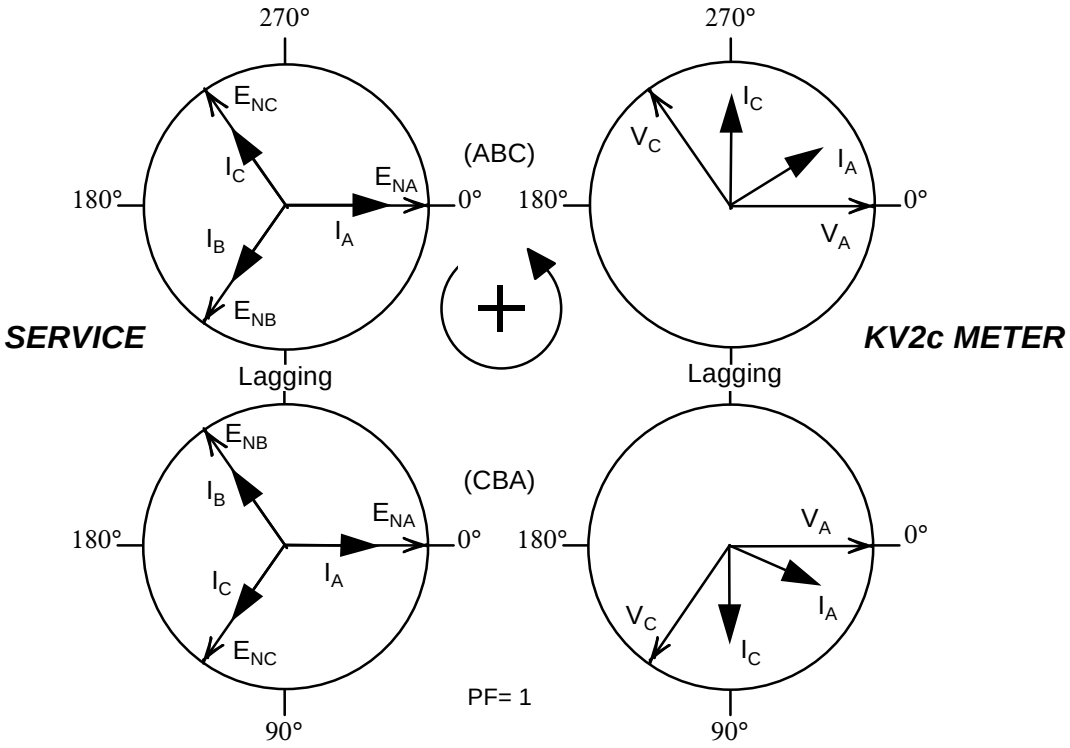
4-Wire, Wye



Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.



NOTE: For 3-wire CTs rated x&x:5, use 2x:5 when determining the TF.



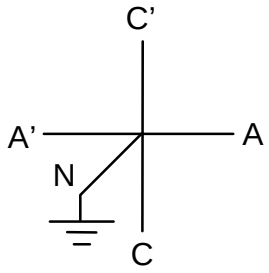
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

4-wire, wye, 2-element

MO 45-3

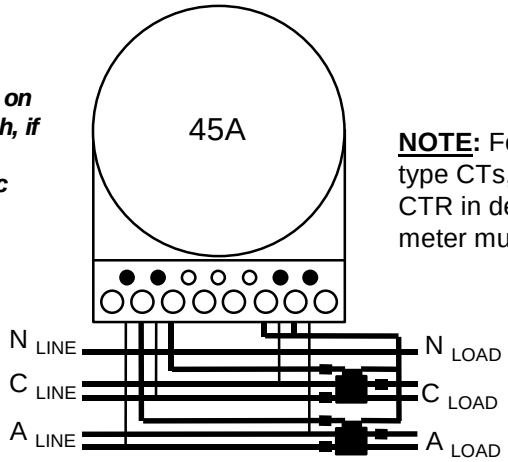
KV2c Site Analysis

Form 45A ***(Transformer Rated)***

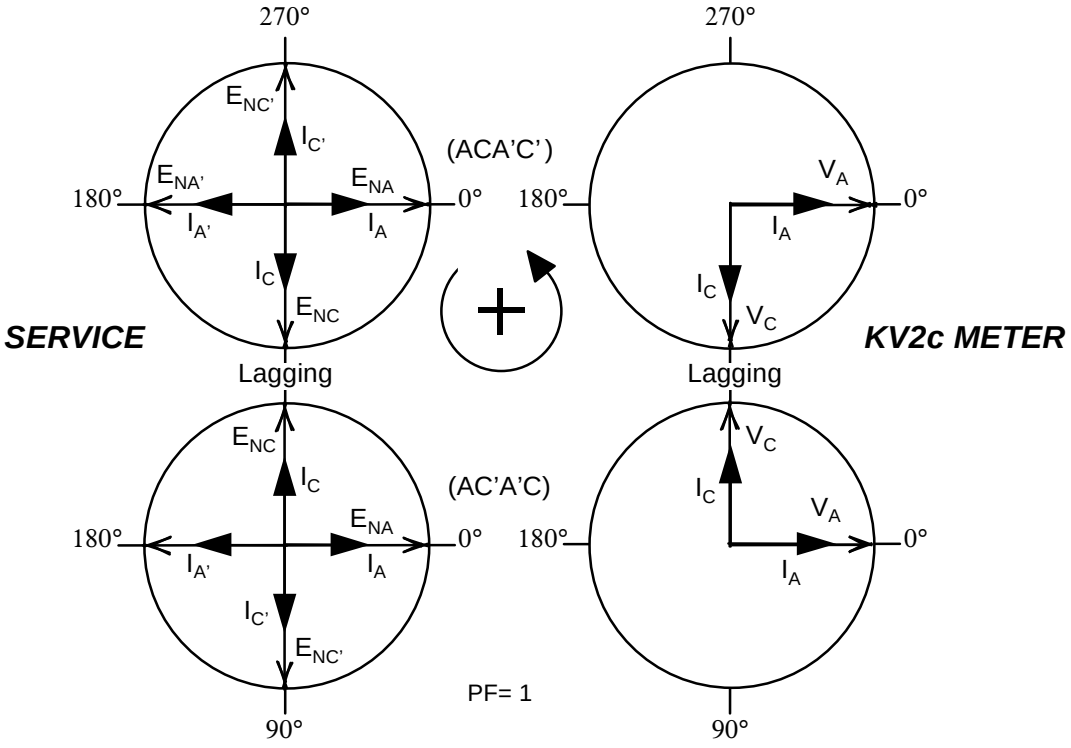


5-Wire, 2-Phase

Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.



NOTE: For window type CTs, use half the CTR in determining meter multiplier.



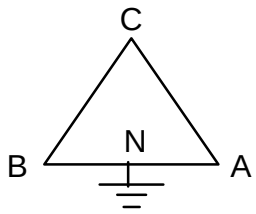
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

5-wire, 2-phase, 2-element

MO 45-3

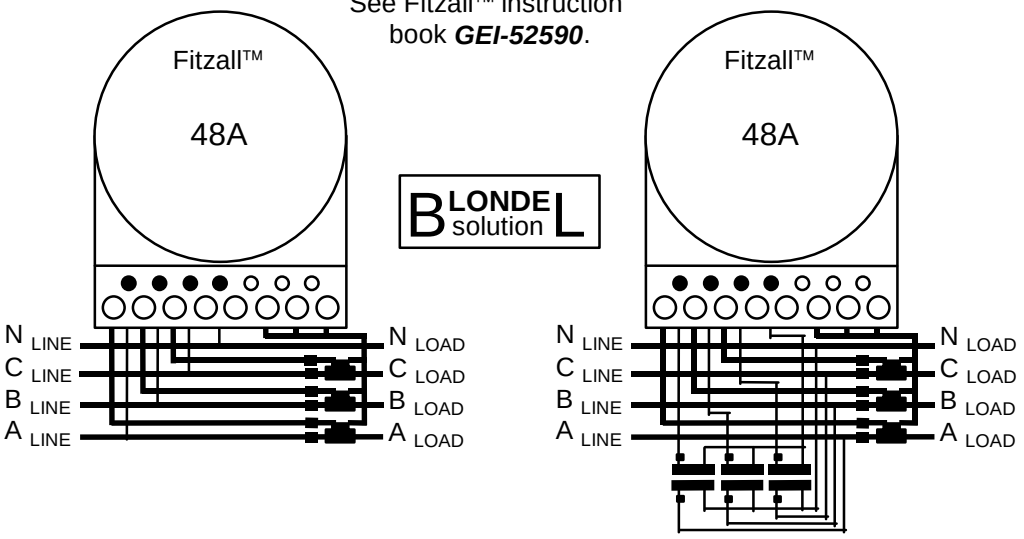
KV2c Site Analysis

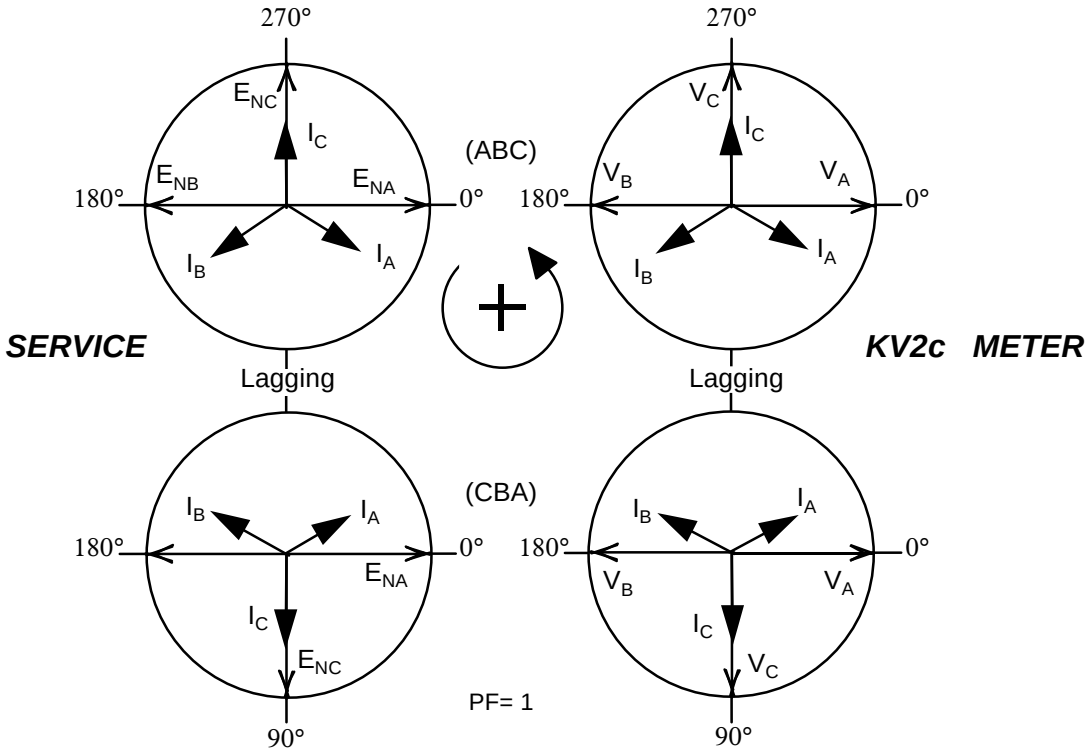
Form 48A ***(Transformer Rated)***



4-Wire, Delta

See Fitzall™ instruction book ***GEI-52590***.





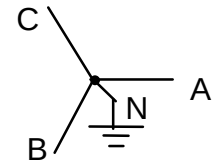
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards

4-wire, 3-Element

MO 9-6

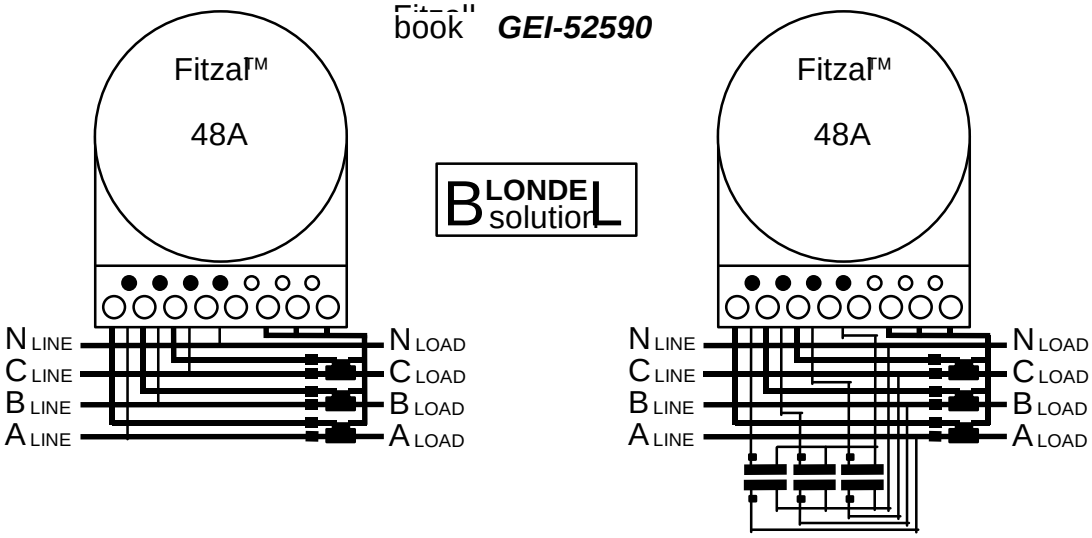
KV2c Site Analysis

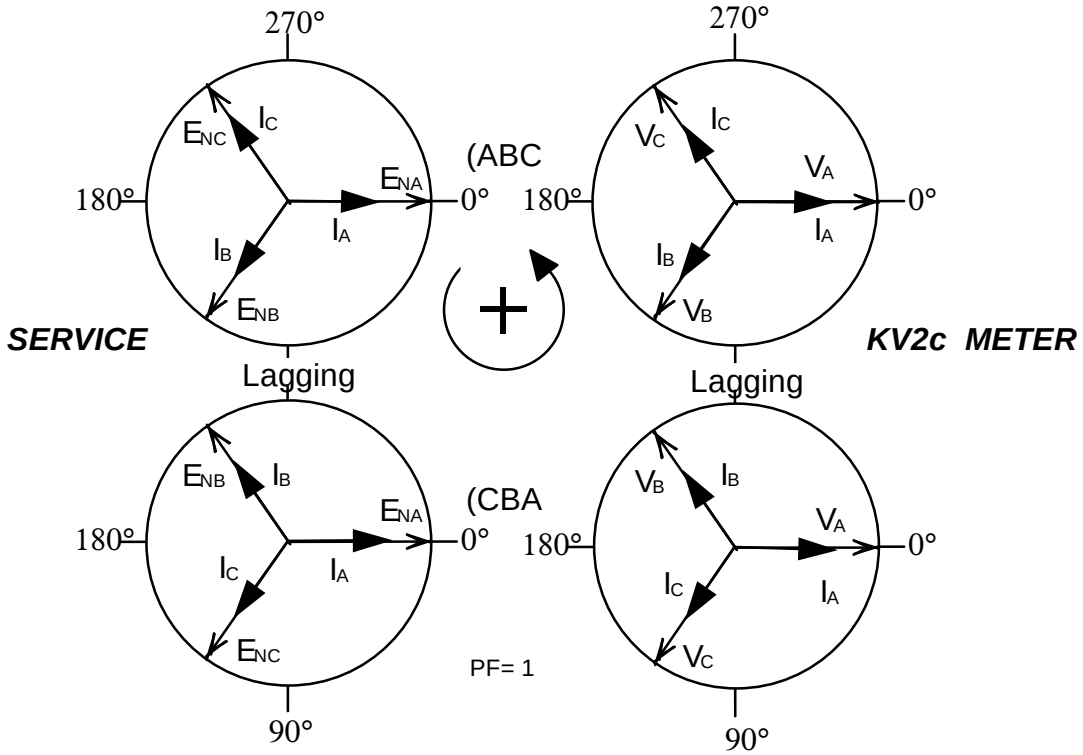
Form 48A ***(Transformer Rated)***



4-Wire, Wye

See ™ instruction book ***GEI-52590***





Actual installation procedures, equipment, and connections must to applicable codes and standards

4-wire, 3-Element

MO 9-6

Figure 5-1 Site Genie Worksheet

GE Meter

kV2c Site Genie™ Worksheet

Data File Name: _____._____
Complete Path: _____

Meter #: _____
Site: _____
_____
_____
Service: _____
Service Display: _____

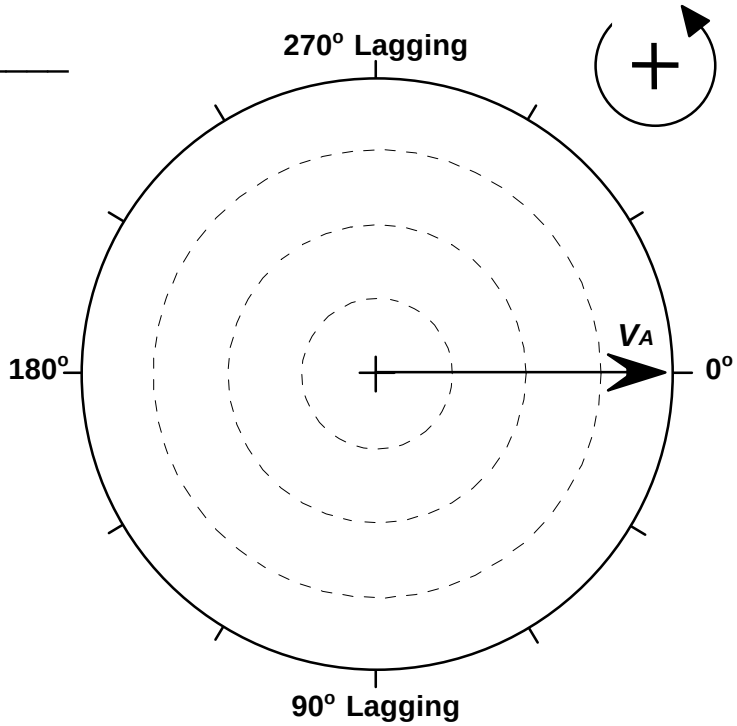
FUNDAMENTAL PHASORS

	A	B	C	
Voltage Angle	*0.0*			º Lagging
Voltage				Volts
Current Angle				º Lagging
Current				Amperes

Power Factor : _____
Distortion Power Factor: _____

Diagnostic Counts

D1	
D2	
D3	
D4	
D5T	
D5A	
D5B	
D5C	
D6	
D7	
D8	



Meter Display Status

Fill-in Lit Arrows

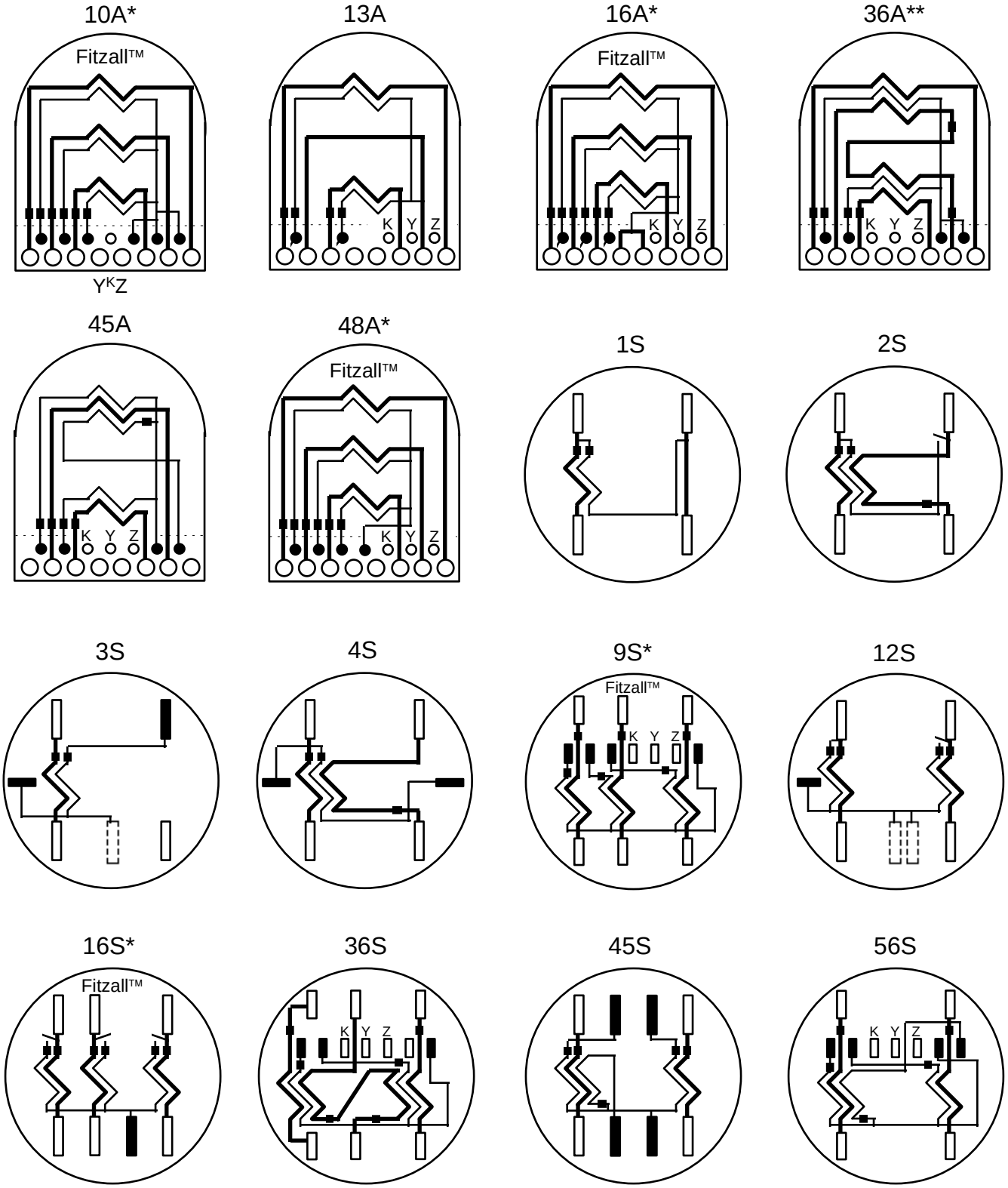
A Blinking
B Off - Blinking
C Off - Blinking

Ca _____
_____
Er _____

6. Diagrams

Figure 0-1 ANSI Meter Diagrams

ANSI C12.10 Internal Connections

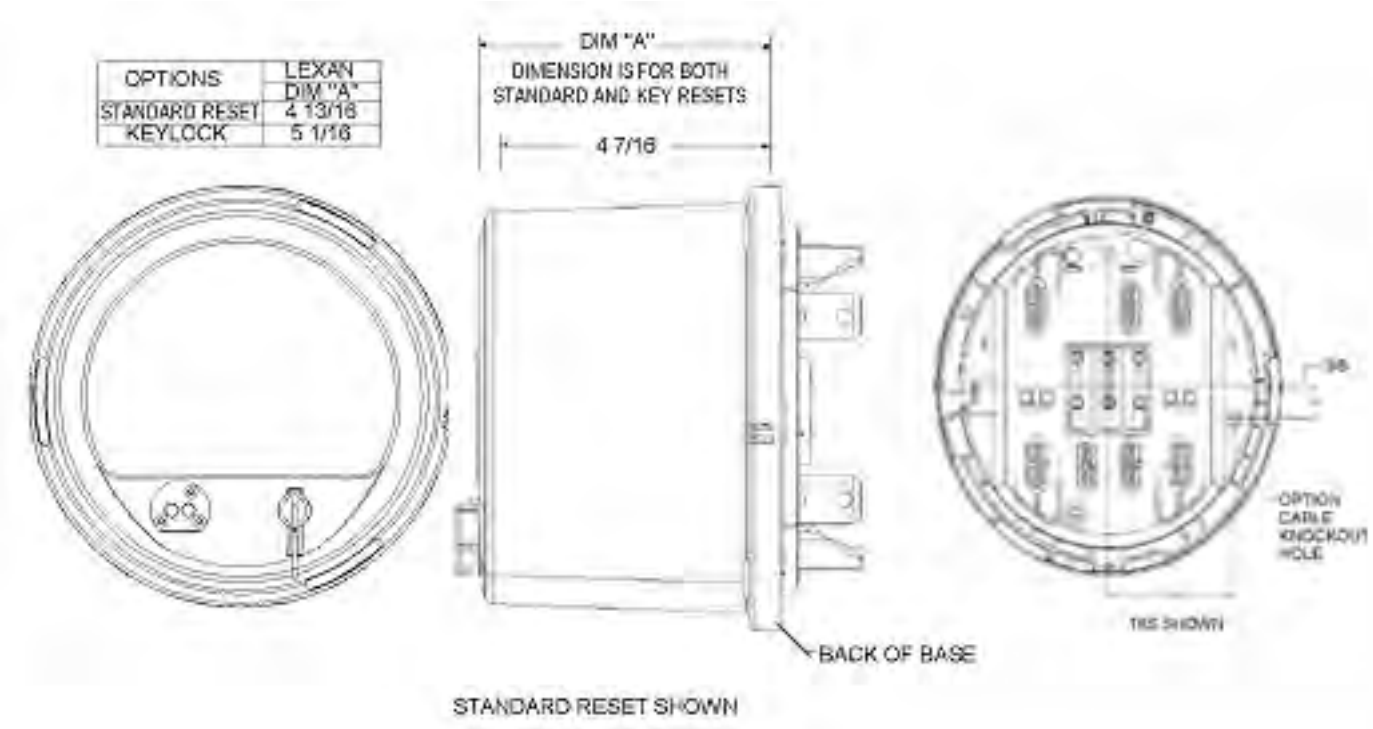


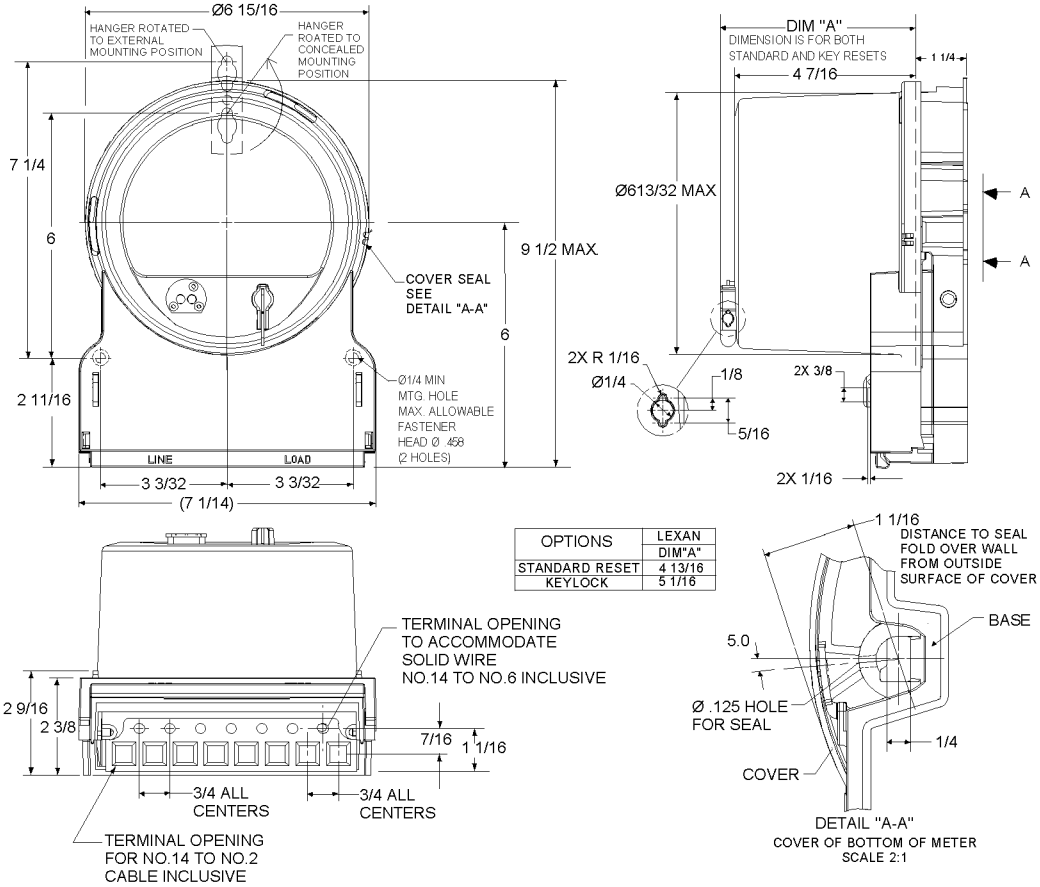
* See Fitzall™ instruction book ***GEI-52590***.

** Terminal for terminal, the 36A and 46A are identical.

7.

Figure 7-1 Outline Drawings





8. Index