



**kV2c[®] Gen 5 Electronic Meter
User Manual**

132271-TUM
Revision 4
www.Aclara.com

Proprietary Notice

This document contains information that is private to Aclara Technologies LLC, an Ohio limited liability company, and/or that is private to Aclara Meters LLC, a Delaware limited liability company (individually or collectively “Aclara”). This information may not be published, reproduced, or otherwise disseminated without the express written authorization of Aclara.

Any software or firmware described in this document is furnished under a license and may be used or copied only in accordance with the terms of such license.

Disclaimer

The information in this document is subject to change without notice and should not be construed as a commitment by Aclara. Aclara assumes no responsibility for any errors that may appear in this document.

No responsibility is assumed for the use or reliability of software on equipment that is not supplied by Aclara.

Fitzall, kV2c, MeterMate, and Site Genie are trademarks of Aclara Meters LLC. All third-party trademarks are the property of their respective owners. Aclara may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not provide any license whatsoever to any of these patents.

Aclara
Confidential and Proprietary
Copyright 2019. All Rights Reserved.

FCC COMPLIANCE



This product generates and uses radio frequency energy. It has been tested and verified that it complies with the limits for the Code of Federal Regulations (CFR) 47, Part 15 - Radio Frequency Devices, Subparts A - General and B -Unintentional Radiators issued by the Federal Communications Commission for Class B digital devices. If, however, the product causes radio or television interference, notify:

Manager - Technology
Aclara Technologies
130 Main Street
Somersworth, NH 03878-3194

Class A equipment is intended for use in an industrial environment. The equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with these instructions, may cause interference to other devices in the vicinity. If this equipment does cause interference with other devices, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving device.
- Increase the separation between the equipment.
- Connect the equipment into an outlet on a circuit different from the impacted device(s).
- Consult the manufacturer or field service technician for help.

Class B equipment is intended for use in a residential environment. The equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interferences to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from the receiver.
- Consult the dealer or an experienced ration/TV technician for help.

NOTE All meters mentioned in this manual meet requirements for FCC Class B devices.

This Class B digital apparatus complies with Canadian ICES-003.

NOTE All meters mentioned in this manual meet requirements for ICES-003 Class B devices.

WARNINGS AND CAUTIONS



Electrical equipment contains hazardous voltages and may cause death, serious personal injury, or equipment damage.

Always de-energize and ground the equipment before maintenance. Maintenance should be performed only by qualified personnel. The use of unauthorized parts in the repair of the equipment or tampering by unqualified personnel will result in dangerous conditions which will cause severe personal injury or equipment damage. Follow all safety instructions contained herein.

IMPORTANT

The information contained herein is general and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Aclara reserves the right to make changes in the specifications shown herein or to make improvements at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawing or supplementary material or both, the latter shall take precedence.

The equipment in this manual must be operated only from the power source specified.

The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.

All electronic components within the meter are susceptible to damage from electrostatic discharge. To prevent damage when handling this product, use approved static control procedures.

Hazardous voltages can cause shock, burns, or death. To prevent exposure to hazardous voltages, disconnect and lock out all power sources before servicing and removing components.

If the meter is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.

Unauthorized changes or modifications made to the unit could void the warranty.

QUALIFIED PERSON

For the purpose of this manual, a qualified person is one who is familiar with the installation, configuration, or operation of the equipment and the hazards involved. In addition, the person is:

- trained and authorized to de-energize, clear, ground, and tag circuits and equipment in accordance with established safety procedures;
- trained in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc. in accordance with established safety practices; and
- trained in rendering first aid.

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 procedures.

Table of Contents

Chapter 1: Introduction	1
Support	1
Technical Support	1
Returning Product	1
Chapter 2: Product Description	3
Operating Range and Ratings	4
Physical Variants	5
Fitzall® Operation.	6
Timebase	6
Hardware Options	6
AMI Interface	6
Battery Port	6
Communications Option Boards	6
Input / Output Option Boards	7
Output Pulse	7
Remote Disconnect Relay Control Board	7
Metering Modes	7
Demand	8
Demand Load Profile	8
Time-of-Use (TOU).	9
TOU Load Profile.	9
Site Genie® System	9
Power Guard System	9
On-Site Features	11
Theory of Operation	11
Sensing Devices	11
Data Acquisition	12
Microcomputer	12
Nonvolatile Memory	12
Power Supply	12
TOU Battery	12
Option Boards	13
Chapter 3: Operating Information	15
Labels	15
Upper Nameplate	15
Lower Nameplate	16
Input/Output	17
Display.	18
Normal	19
Alternate	20
Site Genie®.	21
Service Display	22
Display Scroll	22
Phasor	24
Diagnostics	25
Diagnostic Output	30
Test	31

Reset Switch	31
Frozen	31
Display Switch	32
Chapter 4: Testing and Maintenance	33
Test Mode	33
Initiating	33
Energy Calculations	34
Field Accuracy	34
Maximum Demand Reading	34
Disk Analog Testing	35
Shop Test	36
Battery Replacement	37
Battery Port	37
Non-Battery Port	38
Service, Repair, and Storage	38
Troubleshooting	38
Errors	38
Er 000 002 - Battery Failure and Power Outage	39
Er 000 020 - Hardware Failure	40
Er 000 200 - Non-Volatile Memory Data Error	40
Er 001 000 - Firmware Code Error	40
Er 100 000 - Voltage Reference Error.	40
Er 200 000 - DSP Error.	40
Cautions	41
CA 000 001 - Low Battery	41
CA 000 010 - Unprogrammed	41
CA 000 040 - Loss of Program.	42
CA 000 400 - Low Potential	42
CA 004 000 - Demand Overload	42
CA 040 000 - Leading kvarh	42
CA 400 000 - Received kWh.	43
Incorrect Password	43
Time Change	43
High Temperature	43
Conditions without Codes	44
Chapter 5: Upgrading	45
Softswitches	45
B: Quadrant Measurement	46
E: Event Log	46
H: Huge Load Profile	47
I: Instrument Transformer Correction	48
K: kVA, kvar, and PF Measurement.	48
L: Transformer Loss Compensation	48
M: Expanded Measurement	49
Q: Power Quality Measurement	49
R: Basic Recording	50
T: Time-of-Use	50

V: Fast Voltage Event Monitor/Log	50
W: Waveform Capture	51
X: Expanded Recording	51
Z: Totalization	52
Meter Modes	52
Meter Disassembly	53
Meter Cover Removal	54
kV2c® Gen 5 Module Removal	54
Option Board Removal	54
Communication Board Installation	55
I/O Board Installation	56
I/O Cable Installation	57
S-Base.	57
Installation of I/O Cable to Bezel.	57
Meter Assembly	59
Chapter 6: Site Analysis Guides	61
Form 1S (2W-1 ϕ)	62
Form 2S (3W-1 ϕ)	63
Form 3S (2W-1 ϕ)	64
Form 3S (3W-1 ϕ)	65
Form 4S (3W-1 ϕ)	66
Form 9S (4W-4 Δ)	67
Form 9S (4W-Y)	68
Form 12S (3W-1 ϕ)	69
Form 12S (3W-N)	70
Form 12S (3W- Δ)	71
Form 16S (4W- Δ)	72
Form 16S (4W-Y)	73
Form 36S (4W-Y)	74
Form 45S (3W-1 ϕ)	75
Form 45S (3W- Δ)	76
Form 45S (4W- Δ)	77
Form 45S (4W-Y)	78
Form 45S (5W-2 ϕ)	79
Form 56S (3W-1 ϕ)	80
Form 56S (3W- Δ)	81
Form 56S (4W- Δ)	82
Form 56S (4W-Y)	83
Form 56S (5W-2 ϕ)	84
Chapter 7: Diagrams	85
Index	87

CHAPTER**1**

INTRODUCTION

The purpose of this document is to provide qualified metering personnel with product description; operating, maintenance, and upgrading instructions; site analysis guides; and diagrams for the kV2c Gen 5 meter family. 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 procedures.

Support

If you have a question, an issue, or would like to speak with Aclara Support personnel, please contact Aclara using one of the following methods.

Technical Support

Email support@aclara.com or call 1-800-892-9008 to speak with an Aclara representative.

Returning Product

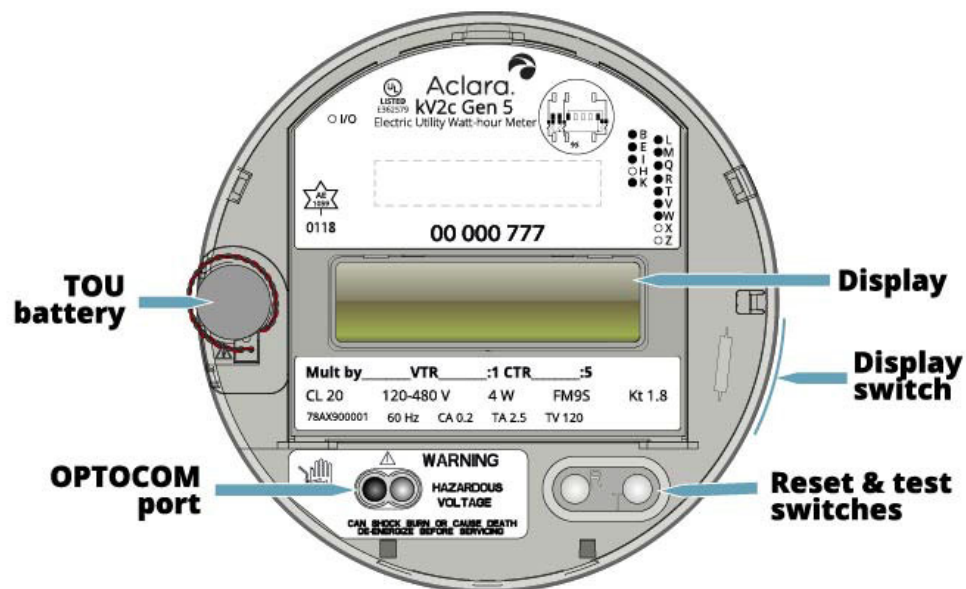
To return product, email rma@aclara.com or call 1-800-892-9008.

CHAPTER

2

PRODUCT DESCRIPTION

The kV2c Gen 5 meter base assembly provides provision for all common S base configurations. The meter is housed in a one-piece, clear cover that provides access to the OPTOCOM™ optical communications port and the demand reset switch. The demand reset and test switches are located on the lower right side of the meter face. The cover must be removed to operate the test switch.



The time-of-use (TOU) battery is located on the left side of the meter face. An optional battery port can be ordered in the cover to enable changing the battery without removing the meter cover.

The display indicates energy consumption and other data using alphanumeric characters and icons. Please refer to *Display* on page 18 for more details.

The display switch is used to change display modes. It is located on the right side of the meter face slightly below the midpoint and is activated by a magnet. Please refer to *Display Switch* on page 32 for more information.


The OPTOCOM port is located at the lower left side of the meter face, and allows a computer to communicate with the meter using standard tables (ANSI C12.19) and the ANSI standard protocol for two-way meter communication (ANSI C12.18). The OPTOCOM port can communicate at speeds from 9600 to 57,600 baud.

Operating Range and Ratings

The operating attributes along with their values are listed in the following table:

Attribute	Value
Operating Voltage	
kV2c Gen 5	120 V to 480 V ($\pm 20\%$)
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
Relative Humidity	95% non-condensing
Frequency	50 or 60 Hz
Power Consumption for both Single and Three Phase Forms <i>(Not including power consumption from I/O option boards or AMI communication modules)</i>	
On Phase A at 120 V	0.8 W typical
On Phase A at 480 V	1.7 W typical
On Phase B or C at 120 V	< 0.1 W typical
On Phase B or C at 480 V	< 0.4 W typical
Accuracy	
S-base	$\pm 0.2\%$ Class 0.2 per ANSI C12.20
Current	Class 20, Class 200, Class 320
Enclosure	One-piece polycarbonate cover
Remote Disconnect Relay Option Board with Relay Base <i>(with this option, the following specs supersede those listed above)</i>	
Available Meter Forms	16S with 3-phase relay
Operating Voltage	120 V to 240 VAC ($\pm 20\%$)
Relay Type	3 phase (A, B, and C) latching relay
Relay Current Rating	100 amp maximum current
Electrical Endurance	5,000 cycles
Contact Material	AgSnO ₂

Attribute	Value
Load-side Monitoring Accuracy ¹	8.5%
Power Consumption ² (not including AMI option boards)	
On Phase A at 240 V	1.2 W typical
On Phase B and C at 240 V	0.5 W typical
Load-side Voltage Threshold ³	User programmable; 0 VAC min, 50 VAC max

-  1 Load-side monitoring is not isolated.
- 2 Relay is powered by the meter's internal 20 volt supply.
- 3 RMS voltage above which the meter will indicate that load-side voltage is present.

Physical Variants

The available ANSI Standard S Base Forms are outlined below:

Form	Wires	Circuit	Elements	Self-Contained/ Transformer Rated	Class
1	2	1 Φ	1	Self-Contained	200, 320
2	3	1 Φ	1	Self-Contained	200, 320
3S	2	1 Φ	1	Transformer Rated	20
3CS	2	1 Φ	1	Transformer Rated	20
4S	3	1 Φ	1	Transformer Rated	20
9S	4	3 Φ Y or Δ	3	Transformer Rated	20
9S	4	3 Φ	3	Self-Contained	200, 320
12S	3	Network or 3 Φ Δ	2	Self-Contained	200, 320
16S	4	3 Φ Y or Δ	3	Self-Contained	200, 320
36S ^{1,3}	4	3 Φ Y	3	Transformer Rated	20
45S ^{2,3}	3,4,5	1 Φ , 2 Φ , Network, 3 Φ Y or Δ	2	Transformer Rated	20
56S ⁴	3,4,5	1 Φ , 2 Φ , Network, 3 Φ Y or Δ	2	Transformer Rated	20

- 1 Form 36S replaces 6S
- 2 Form 45S replaces Form 5S and may also be used in 4-wire circuits
- 3 These forms are the traditional 2 and 2½ element solutions for metering 4-wire circuits in the United States. 2 and 2½ element meters in 4-wire circuits do not produce a Blondel solution, and may lead to systematic errors when voltage imbalance occurs.
- 4 Form 56S replaces Form 26S

Fitzall® Operation

The Fitzall feature allows users to meter a wide variety of electric service with only 2 basic meter types. A basic form 9S meter is used for transformer-rated applications, and form 16S 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. For more information on the Fitzall feature, refer to the Fitzall User Guide.

Timebase

The standard meter keeps time from the line frequency.

Hardware Options

Each feature described in this section is a hardware option that can be added to the meter.

AMI Interface

The meter has a interface that can be used with various AMR modules. Power and data signals allow an AMR device to operate and retrieve metering data through this interface. The interface scheme must be configured to match the installed AMR device requirement. See *Meter Disassembly* on page 53 for more information and a list of supported AMR modules. Use of unlisted AMR/AMI modules shall result in voided warranty as Aclara can no longer guarantee the safety and integrity of the product.

Battery Port

The kV2c Gen 5 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. The battery provided by Aclara with the kV2c Gen 5 meter should not need to be changed throughout the life of the meter.

Communications Option Boards

Communication with kV2c Gen 5 meters is restricted to AMI vendor options.

Input / Output Option Boards

Two types of I/O option boards are available for the kV2c Gen 5 meter. The Simple I/O board (type S I/O) 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) 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 that 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.

Output Pulse

When this document refers to Form A pulse initiator outputs, it is technically referring to two-wire, bi-stable outputs. Every contact change of state represents the programmed value of Wh/varh/Qh/VAh.

A traditional Form A output represents a normally open, momentary closure type of output where one cycle (where the contact state changes from open to closed and back to open again) represents the desired output value.

Most modern solid state metering products, including the kV2c Gen 5 meter, have adopted the revised definition of Form A outputs where each change of contact 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 (A or C).

Remote Disconnect Relay Control Board

The Aclara relay control board allows the meter to control kV2c bases with integrated relays. When utilized with an AMI system, the meter can remotely disconnect and reconnect power.

SAFETY NOTICE The kV2c Gen 5 meter, when integrated with the Aclara kV2c remote disconnect relay, is designed to connect and disconnect electrical service under the remote control of the electric utility. The meter and its associated switching relay are not intended to provide protection to the consumer premises against voltage transients, current faults, or equipment failure.

Metering Modes

The kV2c Gen 5 meter is capable of four different metering modes: demand, demand load profile, time-of-use (TOU), and time-of-use/load profile. Aside from

the softswitches required to enable load profile and TOU metering, changing metering modes does not require the installation of any additional hardware.

Demand

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

- Energy measurement (5 quantities)
- Demand (5 quantities: block, or rolling demand, maximum, cumulative, and continuously cumulative displays) - Alternatively, 5 thermal demand measures are available.
- Coincident values at the time of maximum demand (2 quantities per demand)
- Fundamental only and fundamental plus harmonics measurements (available simultaneously)
- Bi-directional energy measurements
- 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 impacting billing quantities or load profile data
- I/O 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

Demand Load Profile

Demand load profile provides the same features as the demand operating mode, but adds features based on the time and date. The meter may be configured to record demand intervals or self-reads into the meter memory.

Demand load profile operating mode requires either an H, R, or X softswitch and configuration via MeterMate software.

Time-of-Use (TOU)

TOU operation allows the user to specify different rates for different times of the each day of the week, seasons, and holidays. TOU requires a T softswitch. It also requires configuration of the TOU schedule via MeterMate software.

TOU Load Profile

The TOU load profile operating mode is the same as demand load profile operation, with the exception that it separates recorded measurements based on the time of day of the energy consumption. TOU load profile requires a T and either an H, R, or and X softswitch. Multiple schedules may be configured for different days of the week, seasons, and holidays

Site Genie® System

The Site Genie Monitoring System displays circuit information used by the kV2c Gen 5 meter to determine service type. Diagnostic information and 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 Site Genie display scrolls through 26 display screens (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

Power Guard System

The Power Guard system provides measurements for 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 and some definitions may require softswitches to access these measures.

- Line frequency
- Phase sequence-ABC or CBA
- Phase voltages: fundamental or fundamental plus harmonics-RMS
- Phase voltage phase angles (display or table reading only)
- Phase currents: fundamental or fundamental plus harmonics-RMS
- Phase current phase angles (display or table reading only)
- Neutral current
- Power-Active, per phase (fundamental or fundamental plus harmonics)
- Power-Reactive, per phase (fundamental 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 load profile)
- Cumulative power outage time (TOU and demand load profile)
- Site Genie diagnostics
- Distortion diagnostic with counter (user defined)
- High neutral current diagnostic with counter
- Over voltage / under voltage diagnostic with counter
- Distortion kVA per phase
- Distortion Power Factor (DPF)-Total and per phase
- Total Harmonic Distortion (THD) per voltage phase or current phase
- Total demand distortion per phase

The following 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
- Time-of-Use (TOU) rate alert
- Real-time pricing alert

On-Site Features

The kV2c Gen 5 meter provides several tools for field personnel to use when at the site of a meter installation:

- Nameplate and label information
- Alphanumeric display with key annunciators
- Ability to change the display mode between Normal, Alternate, Site Genie, and Test
- Site Genie mode with information on the installation voltages, currents, phase angles, and several installation diagnostic functions
- Allows software changes and feature additions to be completed in the field
- Provides a disk analog representation on the display, as well as a test mode for field calibration testing without impacting billing data
- Ability to perform a self-test of meter operation

Theory of Operation

This section contains the general circuit configuration of the kV2c Gen 5 meter. The theory of operation of the kV2c Gen 5 meter is described in the following sections.

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 ATSENSE301 analog-to-digital converter chip.

Data Acquisition

The Microchip ATSENSE301 chip contains seven independent, fully integrated analog-to-digital converters, four for current inputs and three for voltage inputs. The converters are continuous time, delta-sigma analog to digital converters digitizing each signal 1.024 million times per second. Each input signal has a dedicated converter; multiplexing is not used. The converter over sampling rate of 64 provides 4,000 complete sets of decimated samples per second. For a full three element meter, six sets of samples are processed, providing more than 66 decimated sample sets per line cycle.

Microcomputer

The microcomputer is a Microchip SAM4C ARM Cortex M4 dual-core 32-bit single chip microcomputer. It receives voltage and current samples from the ATSENSE301 chip. One of the two cores in the microcomputer performs all digital signal processing functions, including sample processing and digital filtering, accumulations, products, and calculation of basic metrology quantities. The other core in the microcomputer performs calculations of advanced quantities, 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 optical and AMI ports for reading and programming.

Nonvolatile Memory

The kV2c Gen 5 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 firmware images and memory intensive data requirements such as load profile recording and event logs. Meter data quantities are updated at each power fail event. Stored data is constantly checked to detect errors.

Power Supply

The kV2c Gen 5 meter is powered from the A phase voltage line. It has a solid-state switching power supply. Please see *Operating Range and Ratings* on page 4 for details.

See *Shop Test* on page 36 for electric service voltage limitations.

TOU Battery

A standard 3.6 V, half-size AA, lithium battery maintains the meter clock when the meter is programmed as a TOU meter or demand meter with load profile recorder. All billing and programming information is stored in non-volatile memory, the

battery is used for maintaining date and time information during a power outage. Under normal conditions, the battery should provide more than 10 years of service during outage conditions (time on battery backup), and more than 15 years of service during storage conditions, or when properly installed in an energized meter.

NOTE The kV2c Gen 5 meter provides a battery-free option in which a battery is not required.

Option Boards

The basic meter provides connections, signals, and power for other snap-in option boards. One is a communications board. The second is a pulse Input/Output interface board. It is available as either a Simple I/O or Multiple I/O version. Another option board is the remote disconnect relay controller. This is used with the kV2c 3-phase relay base. When used with a communications board, the relay controller can remotely control the service connection. Note that the relay controller board does not allow for the simultaneous installation of a pulse Input/Output interface board.

CHAPTER**3****OPERATING INFORMATION**

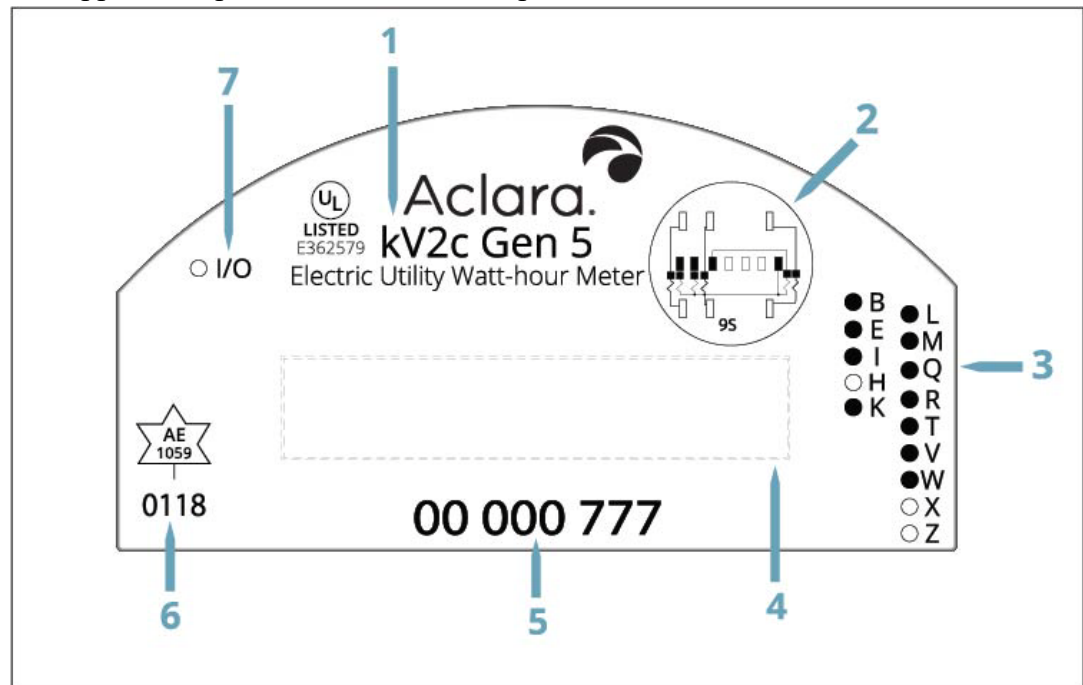
This chapter provides basic operational information.

Labels

The following sections provide information about the location and how to interpret each label. The meter nameplate is composed of two parts, and is found on the front of the meter.

Upper Nameplate

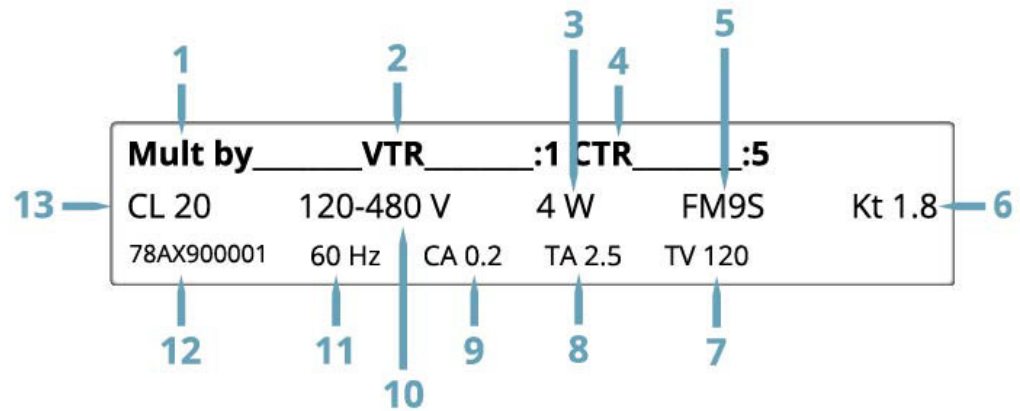
The upper nameplate is located at the top of the meter face.



- | | |
|--------------------------|--|
| 1. Meter name | 5. Meter serial number |
| 2. ANSI C12.10 diagram | 6. Month and year of manufacture (MM/YY) |
| 3. Softswitch selections | 7. Option boards installed |
| 4. Utility area | |

Lower Nameplate

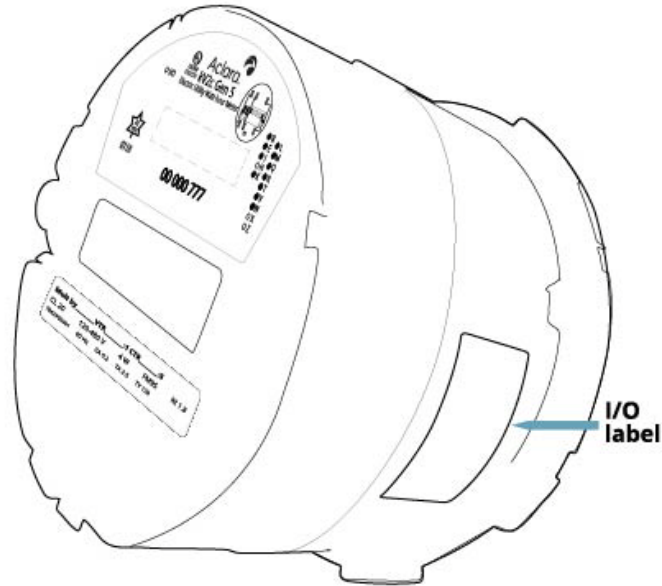
The lower nameplate is located directly below the display on the meter face.



- 1 Multiplication constant
- 2 Voltage transformer ratio
- 3 Number of wires for metered service
- 4 Current transformer ratio
- 5 ANSI C12.10 form number
- 6 Watt-hour test constant
- 7 Test voltage
- 8 Test amperes
- 9 ANSI C12.20 accuracy class
- 10 Nominal voltage operating range
- 11 Nominal frequency
- 12 Catalog number
- 13 Current class

Input/Output

If present, the I/O label will be found on the side of the shroud. There are two possible Input/Output (I/O) labels. The exact label will depend whether the meter has a simple I/O board or a Multiple I/O board installed.

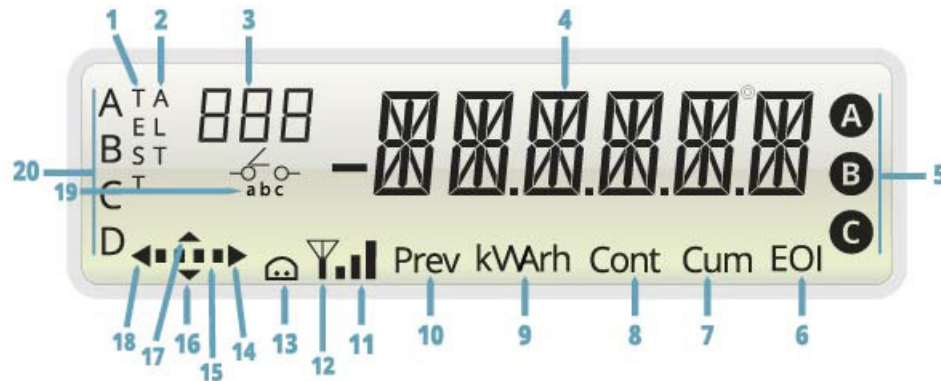


I/O Cable		
Signal Name	Wire Color	Measure
Y1_OUT	Yellow	
Z1_OUT	Black	
Y2_OUT	Grey	
Z2_OUT	Blue	
K1/K2_OUT	Red	
Z3_OUT	Orange	
K3/K8_OUT	Brown	
RTP+	Violet	
RTP-	Green	

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	

Display

The display has a variety of indicators and is capable of five different modes: Normal, Alternate, Site Genie, Test, and Frozen. The following sections provide information about the display indicators and modes



- 1 Test mode indicator
- 2 Alternate display mode indicator
- 3 Three-character user defined display label. (**CA** indicates a Caution message and **Er** indicates an Error message)
- 4 Six-character display that includes four possible decimal positions, negative indicator, and a degree symbol
- 5 The A, B, or C indicators show phase voltage is present. A blinking indicator signifies low voltage. An unlit indicator signifies voltage is not present for that service and meter form.
- 6 End of Interval (EOI) indicator
- 7 Cumulative demand measurement indicator
- 8 Continuous cumulative demand measurement indicator
- 9 Units of measure for the display quantity (energy = kWh, Apparent Power = kVA)
- 10 Previous season or billing period data indicator
- 11 Signal strength indicator (not currently used)
- 12 AML device communicating with meter indicator
- 13 Optical communication indicator
- 14 Energy delivered indicator

- Disk revolution simulator. The four segments in the middle of the energy flow indicators indicate the magnitude and are used to simulate revolutions of an analog disk. The meter lights a maximum of three segments at a time.
- 15 Each state change represents the meter test constant (Kt) which is equal to the number of watt-hours or var-hours assigned to each calibration pulse. One complete revolution represents ten state changes.
- If Wh are delivered or varh is lagging, the block indicators appear from left to right. If Wh are received or varh is leading, the block indicators appear from right to left.
- 16 Leading varh
- 17 Lagging varh
- 18 Energy received indicator
- 19 Service disconnect switch state indicator (used only with kV2c relay control board with integrated base relay)
- 20 Time-of-use (TOU) rate indicator (no letters indicate non-TOU rate)

Normal

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.
- Optical communication is initiated.
- Test Display mode is invoked.
- A Frozen error, caution, or diagnostic message is triggered.

Normal display mode 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.

NOTE While the meter is communicating over the OPTOCOM port, the data indicators are off and the LCD displays BUSY. While the meter is communicating with an AMI module, the AMI device communication indicator will be on.

Normal Display Example (kWh)



- | | | | |
|---|---------------------------------------|---|-----------------------------|
| 1 | 01 display label | 6 | Energy is being delivered |
| 2 | Six-digit energy display (kWh) | 7 | 60% of K_t watt-hours |
| 3 | Voltage on all phases | 8 | Quadergy (kvarh) is lagging |
| 4 | End of Interval indicator | 9 | TOU rate B is in effect |
| 5 | Displayed energy is in kilowatt-hours | | |

Alternate

The Alternate display mode provides additional information not shown during Normal display mode. The display items shown in Alternate mode are selected during MeterMate program development. The meter will automatically return to the Normal display mode after the last Alternate display item.

Alternate Display



- | | | | |
|---|------------------------------|----|--|
| 1 | Alternate display mode | 6 | Display is previous billing period or season |
| 2 | 108 display label | 7 | 70% of K_t watt-hours |
| 3 | Six-digit energy display | 8 | Quadergy (kvarh) is leading |
| 4 | Voltage on phase A and C | 9 | Energy is being received |
| 5 | Displayed energy is in kvarh | 10 | TOU rate A is in effect |

Site Genie®

The Site Genie Monitor checks the installation, monitors the service after installation, and displays information to alert and diagnose problems. The Site Genie Display mode shows service type, phasor information, and the status of the diagnostic counters.

At power up, the kV2c Gen 5 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. While the meter is determining the service type, the display will show INPROG. Use the Site Genie display scroll to ensure the meter has correctly determined the service type. If the meter cannot determine the service type, diagnostic checks are disabled.

NOTE The meter form must be capable of metering the service type to consider 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.

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.

As an alternative to automatic service determination, the meter may be programmed for a specific service type. In this case, the meter will use the programmed service type as the basis for operations. For more details regarding automatic service determination, refer to the *kV2c Gen 5 Electronic Meter Features and Applications Guide (132272-TUM)*.

The Site Genie supported service types are shown in the following table.

Form	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	3 element, 4 wire	3 phase, 4 wire (Wye)	Yes	Yes
		3 phase, 4 wire (Delta)	No	Yes
12S	2 element, 3 wire	3 phase, 3 wire (Delta)	Yes	Yes
		1 phase, 3 wire	Yes	Yes
		network	No	Yes
16S	3 element, 4 wire	3 phase, 4 wire (Wye)	Yes	Yes
		3 phase, 4 wire (Delta)	No	Yes
36S	2½ element, 4 wire	3 phase, 4 wire (Wye)	Yes	No

Form	Construction	Service	Symmetrical Service	Blondel Solution
45S	2 element, 3 wire	3 phase, 3 wire (Delta)	Yes	Yes
		3 phase, 4 wire (Wye)	No	No
		3 phase, 4 wire (Delta)	No	No
		1 phase, 3 wire (Delta)	Yes	Yes
		2 phase, 5 wire	Yes	No

Service Display

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.

Display	Indication
_2-1PH	2 Wire, single phase
_3-1PH	3 Wire, single phase
_5-21PH	5 Wire, two phase
_3-D	3 Wire delta
_4-D	4 Wire delta
_4-Y	4 Wire wye
_3-N	3 Wire network
INPROG	Detection in progress
SER_ER	Service Error

A service error display indicates 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.

Display Scroll

The Site Genie display scroll is started by holding a magnet to near the display switch for more than six seconds. The Site Genie display scroll shows 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

following table shows the label that appears on the display and the order in which the items appear.

Order	Label	Display Item
1	SER	Service
2	PhA	Voltage angle (phase A)
3		Voltage magnitude (phase A)
4		Current angle (phase A)
5		Current magnitude (phase A)
6	PhB	Voltage angle (phase B)
7		Voltage magnitude (phase B)
8		Current angle (phase B)
9		Current magnitude (phase B)
10	PhC	Voltage angle (phase C)
11		Voltage magnitude (phase C)
12		Current angle (phase C)
13		Current magnitude (phase C)
14	PF_	Power factor
15	dPF	Distortion Power Factor
16	d1	Diagnostic counter 1
17	d2	Diagnostic counter 2
18	d3	Diagnostic counter 3
19	d4	Diagnostic counter 4
20	d5	Diagnostic counter 5
21	d5A	Diagnostic counter 5 (phase A)
22	d5B	Diagnostic counter 5 (phase B)
23	d5C	Diagnostic counter 5 (phase C)
24	d6A	Diagnostic counter 6 (phase A)
25	d6B	Diagnostic counter 6 (phase B)
26	d6C	Diagnostic counter 6 (phase C)
27	d7A	Diagnostic counter 7 (phase A)
28	d7B	Diagnostic counter 7 (phase B)
29	d7C	Diagnostic counter 7 (phase C)
30	d8	Diagnostic counter 8

Phasor

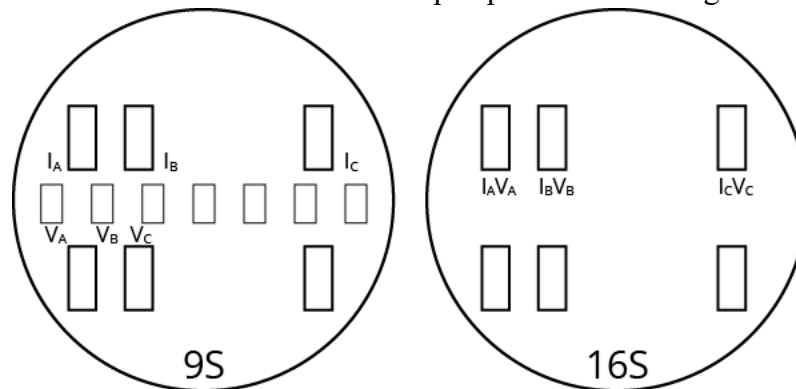
The phase information displayed by the Site Genie Monitor is referenced to the internal voltage and current sensors of the meter, filtered to the fundamental frequency component. The meter defines each phase in terms of meter elements.

Notation

The 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. The phase designations for meter elements are:

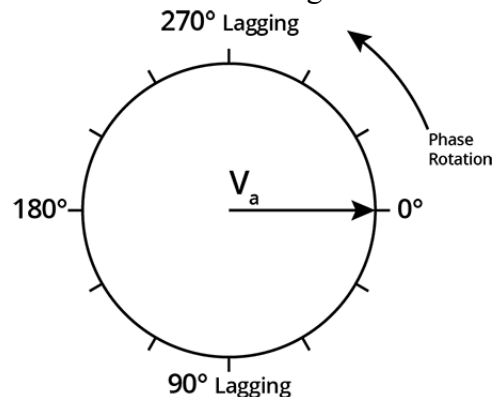
Display Label	Phase	Meter Element
PhA	A	Left element
PhB	B	Center element
PhC	C	Right element

Elements are described from the perspective of looking at the face of the meter.



Angle and Rotation

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 counter-clockwise; therefore, positive angles measure the amount of lag from the Phase A voltage.

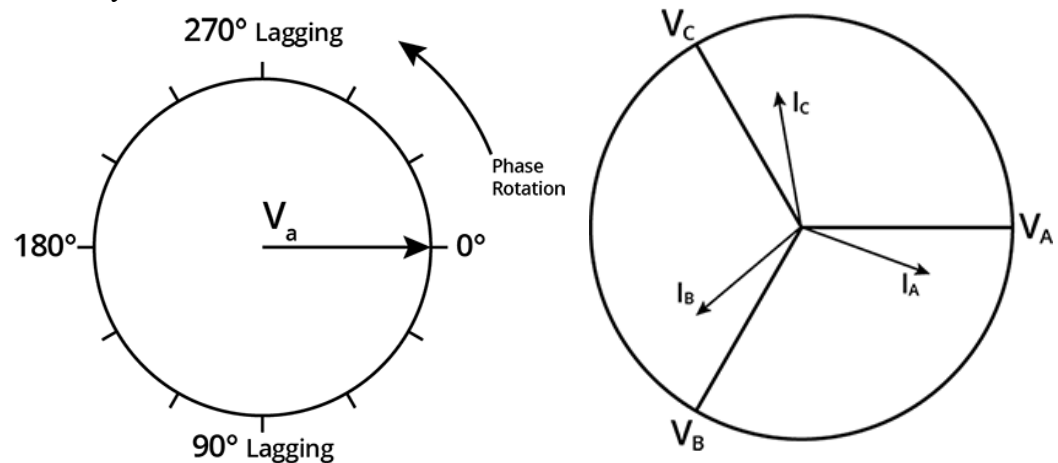


NOTE The Site Genie Monitor uses the Phase A voltage as a reference point; therefore, the Phase A voltage angle is always 0.0 degrees.

Voltage and Current

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 a phasor diagram.

Phase sequence is determined by rotating the phasors counter-clockwise and observing the order they would rotate through zero. In images below, if the phasors are stationary, A is at zero. Rotating V_B and V_C counter-clockwise, phase B next moves through zero followed by C. This indicates ABC phase sequence. For CBA rotation, A is at zero, but when the phasors are rotated counter-clockwise A is followed by C, and C is followed by B. In the following image, all phase currents are lagging, and the phase angles for voltage and current are as expected for a Wye installation.



Diagnostics

Site Genie diagnostics continually monitor the meter installation. They track and report unexpected operating conditions (unless disabled by the meter's program). A diagnostic check that fails a preconfigured number of consecutive tests (≤ 3), the diagnostic display is added to the Normal display scroll and the counter in the Site Genie scroll is incremented.

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.

Over and under voltage diagnostic conditions are checked every second. The remaining diagnostics are checked every 5 seconds. The condition must remain out-of-limits for a preconfigured period of time (15 seconds to 30 minutes in 5-second increments) before a diagnostic condition is set in the meter. Once a diagnostic is set, the meter displays the diagnostic and increments the diagnostic counter. The diagnostic is cleared when 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 will roll over to 0 after 255. Diagnostic counters may be reset using the Master Reset command in the MeterMate software.

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.

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 120 V, 277 V, or 347 V Wye, or 120 V, 240 V, or 480 V Delta or Single Phase. The reference voltage may be overridden by programming a specific reference voltage.

Diagnostic Test 1 - Polarity, Cross-phase, and Energy Flow

Display	Diagnostic Test
Test Description	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
Tolerance	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)
Possible Causes	Cross-phasing of a voltage or current circuit, incorrect polarity of voltage or current circuit, reverse energy flow, wiring error
Exception	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test display mode.

Diagnostic Test 2 - Voltage Imbalance

Display	Diagnostic Test
Test Description	Verifies the magnitude of each phase voltage is within tolerance of the average of the voltage magnitudes, taking into account the meter form and service
Frequency	Every 5 seconds using the data from the previous second
Tolerance	Voltage magnitude must be within the preconfigured limit. 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).

Display	Diagnostic Test
Set	Fails all tests during the programmed time period (15 seconds to 30 minutes in 5-second increments)
Possible Causes	Loss of a phase voltage, incorrect voltage transformer ratio, blown fuse - voltage transformer, incorrect phase voltage, wiring error
Exception	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test display mode.

The high and low voltage diagnostics (D6 A,B,C and D7 A,B,C) monitor range of the service voltages. D2 monitors voltage imbalance.

D2 indicates whether any phase is out of limit relative to the average of the voltage magnitudes. If any phase is more than T% (T = tolerance) away from the average, then a Diagnostic 2 alert occurs.

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

Display	Diagnostic Test
Test Description	Detect shorted current circuits or unbalanced loading. Checks the magnitude of the phase currents for any fall below the minimum threshold (at least one other phase must be above the threshold)
Frequency	Every 5 seconds using the data from the previous second
Tolerance	The range of settings for Diagnostic 3 is 0.1 A to class amps (e.g., 20, 200, 320) in increments of 0.1 A.
Set	Fails all tests during the programmed time period (15 seconds to 30 minutes in 5-second increments)
Possible Causes	Shorted current transformer, wiring error, tampering or current diversion, shorting bar or by-pass closed in socket
Exception	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test display mode.

Diagnostic Test 4 - Current Phase Angle

Display	Diagnostic Test
Test Description	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). Tighter tolerances are applied 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

Display	Diagnostic Test
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)
Possible Causes	Poor power factor, imbalanced load
Exception	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.

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

Display	Diagnostic Test
Test Description	The meter measure Distortion Power Factor, Total Harmonic Voltage Distortion (per element), Total Harmonic Current Distortion (per element), Total Demand Distortion (per element), or DC Detection. DC presence is sensed by measurement of the second harmonic content in the measured current waveform. D5 is set when the total current level and the ratio of second harmonic current to total current exceeds preconfigured tolerance.
Frequency	Every 5 seconds using the data from the previous second
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)
Possible Causes	DC current, non-linear load created distortion, SCR and TRIAC motor controls, switching power supplies, reciprocating pumps
Exception	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.

Distortion Power Factor is very good at identifying distortion sources and avoids penalizing others because distortion power is usually a result of nonlinear 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.

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

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. In the equation, U = Apparent Power, P = Active Power, Q = Reactive Power, and D = Distortion Power.

$$U^2 = P^2 + Q^2 + D^2$$

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 range (5% to 80%). This is because current distortion is usually much larger than voltage distortion and overwhelms the effects of voltage distortion.

Diagnostic Test 6 - A, B, and C Under Voltage Test

Display	Diagnostic Test
Test Description	Checks that the magnitude of each voltage phase 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 (120 V, 240 V, 277 V, 347 V or 480 V) unless a reference voltage is programmed into the meter.
Frequency	Every 1 second
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)
Possible Causes	High load, voltage regulation, high system impedance, blown fuse, wrong VT ratio
Exception	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test Mode.

Diagnostic Test 7 - A, B, and C Over Voltage Test

Display	Diagnostic Test
Test Description	Checks that the magnitude of each voltage phase 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 (120 V, 240 V, 277 V, 347 V or 480 V) unless a reference voltage is programmed into the meter.
Frequency	Every 1 second
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)

Display	Diagnostic Test
Possible Causes	Capacitor banks, voltage regulation, blown fuse, wrong VT ratio
Exception	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test Mode.

Diagnostic Test 8 - High Neutral Current

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

Display	Diagnostic Test
Test Description	Checks that the magnitude of the imputed neutral current is below the programmed tolerance.
Frequency	Every 5 seconds using the data from the previous second
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)
Possible Causes	Third harmonic distortion adding in neutral, switching power supplies in PCs, copiers, fax machines, large single phase loading.
Exception	The diagnostic is not performed when service detection is in progress, a service error is present, or the meter is in Test mode. This is disabled for Form 45 and 56 meters used in a 4-wire wye or 4-wire delta service.

Triplen currents add in the neutral. Triplens are the harmonics that are 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.

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.

Diagnostic events can also be recorded using the optional Event Recorder, enabled with the E softswitch, to determine the date/time when diagnostics occur. The meter must be operating in a demand/load profile or TOU mode for date/time information to be captured.

Test

The Test display mode is used to display data for testing the meter. Normal accumulation of billing data is suspended in the test mode. The items shown in Test display mode are selected during MeterMate program development.

NOTE The cover must be removed to press the Test Switch and enter Test Mode.

Hold the Test (T) switch for 1 second to enter Test display mode. Once in Test display mode, actuating the display switch (see *Display Switch* on page 32) will advance the display to the next display item. The display will return to Normal display mode after a preconfigured timeout period. To exit Test mode and return to Normal display mode manually, press the Test switch for 1 second.

The Test display mode is configurable via MeterMate software. The default values are shown below.

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

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

- Test mode maximum demand
- 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

Reset Switch

Holding the Reset (R) switch will zero all accumulators and activate all display indicators. When the Reset switch is released, the display will return to Test mode. The Reset switch does not affect billing data.

Frozen

The Frozen display mode stops the Normal display to draw attention to an Error, Caution, or Diagnostic in the meter. The Errors, Cautions, and Diagnostics that will freeze the display are selected during MeterMate program development. Actuating the display switch (see *Display Switch* on page 32) with the display in Frozen display mode will initiate a single Normal display scroll before it returns to

the Frozen display. The condition that initiated the Frozen display mode must be cleared in order to return to Normal display mode.

Display Switch

Holding a magnet near the meter just below the 3:00 position for varying lengths of time allows the user to change display modes.

Less than Three Seconds

Holding a magnet next to the display switch for less than three seconds will restart the Normal display scroll or initiate a single Normal display scroll if an error, caution, or diagnostic is frozen on the display.

Three to Six Seconds

Holding a magnet next to the display switch for three to six seconds will force the display to switch to the Alternate display mode for a single scroll and then return to the Normal display mode.

More than Six Seconds

Holding a magnet next to the display switch to a magnet for longer than six seconds will initiate a single scroll in Site Genie mode before returning the display to Normal display mode.

CHAPTER**4**

TESTING AND MAINTENANCE

This chapter provides information to aid qualified personnel when testing or troubleshooting a meter.

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 cover and pushing the test switch (marked with a T).

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, watt-hour, var-hour, 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.

Initiating

To enter the test mode, use the test switch on the face of the meter or MeterMate software 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.
- Load profile recording is suspended, and load profile interval status bits reflect test mode was in effect during affected interval(s).

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

Energy Calculations

If the metering constants are not programmed, default values are used. These default values are:

Constant	Default
Demand decimal position	Same as non-test
Demand interval length	15 minutes
Demand subinterval length	5 minutes
Energy display format	xxx.xxx
Demand subintervals	3
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. Items can be added or deleted using MeterMate software.

Field Accuracy

The test mode allows the meter to be accuracy tested in the field without disturbing any billing data. Testing the meter in the field can be accomplished three ways in the test mode by using the following:

- Maximum demand reading in the display
- Disk analog display
- Instantaneous demand feature of the kV2c Gen 5

Maximum Demand Reading

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. Confirm 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.

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 meter's magnitude indicator consists of four segments used to simulate the rotation of the disk on an electromechanical meter. Each state change represents Kt. One complete revolution represents 10 state changes, which represents Kh watt-hours or var-hours. The meter illuminates the segments.

If the Wh direction is delivered or the varh direction is lagging (as described in *Display* on page 18), the state changes occur in increasing order. If the Wh direction is received (or the varh direction is leading), the state changes occur in decreasing order.

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. Ensure 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 Kh watt-hours of accumulation. (The Kh value is printed on the meter nameplate.)
5. When the disk analog transitions from one segment 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 one segment on to all segments off the desired number of times.

8. Calculate the accumulated watt-hours as shown in the equation below. Compare the results of the calculation to the reading on the Standard.

Accumulated Watt-hours Calculation

Accumulated Energy = (Kh) × (the number of disk analog cycles)

For example, if Kh equals 10, and 10 complete cycles were counted, then the following is equation is true: 10 Kh × 10 complete scrolls = 100 Wh.

Shop Test

Shop testing allows personnel to verify the accuracy of the meter.

WARNING Do not apply polyphase test voltages using Wye test conditions at voltages higher than 382 volts line-to-neutral (347 + 10%).

Meter forms 9S, 36S, or 16S, rated 120-480 V may be applied in 600/347 V Wye services.

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.

Equipment

The meter loading equipment must be capable of maintaining accuracy while 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.

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.

Test Constant

The meter test constant (Kt) is the number of watt-hours per calibration pulse. This value is printed on the meter label.

Watt-hour Test

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 120 V is typically used.)
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.
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 Gen 5 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.)

Var-hour Test

kV2c Gen 5 meters are digital sampling meters. All quantities are derived mathematically from the same set of voltage and current sampled data used to compute watt-hours. Therefore, it is only necessary to check watt-hour calibration to ensure that all revenue quantities are accurate. However, some utilities are required by their Public Utilities Commissions to verify the accuracy of var-hour data as well as watt-hour data.

1. Use MeterMate software to put the meter calibration LED into var-hour pulse output mode.
2. Set up the meter for testing as described in *Watt-hour Test* on page 36. The test pulse value is now Kt var-hours per pulse.
3. Begin testing according to your standard var-hour 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 120 V and 0.5 PF.

Battery Replacement

The battery provided by Aclara is a Lithium Thionyl Chloride 3.6 volt battery. The battery in a kV2c Gen 5 meter is designed to last for the life of the meter. If the battery is replaced, the replacement must be equivalent to the factory-installed battery. Replacing the battery in a de-energized meter will cause the meter to lose date/time information and force the meter into an Er 000002 state.

Battery Port

Follow this procedure to replace a battery in a meter with a battery port.

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 bezel.
6. Slide new battery into battery compartment.
7. Close battery port hatch and replace seal.
8. Energize the meter.
9. Reset the meter's date, time, and accumulated outage duration (time on battery backup) value using MeterMate software.

Non-Battery Port

Follow this procedure to replace a battery in a meter without a battery port.

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 meter's date, time, and accumulated outage duration (time on battery backup) value using the MeterMate software.

Service, Repair, and Storage

kV2c Gen 5 meter is factory calibrated and requires no service by the user. Likewise, the repair of on-board components is not recommended. Return the whole meter to Aclara as described in *Returning Product* on page 1.

Troubleshooting

The meter displays error codes and caution codes. Error codes begin ER and caution codes begin with CA. These are described in more detail in the following sections.

Errors

The meter continuously checks its hardware components-ROM, EEPROM, flash, battery, analog-to-digital converter, and 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. If subsequent tests indicate that the hardware component is operating properly, the meter will clear the error automatically.

With the exception of ER 000 002 (Battery Failure and Power Loss), errors are serious events and usually indicate a condition has occurred which may have compromised the meter data. Er 000 002 indicates the meter lost time during a power outage because of a weak, missing, disconnected, or defective battery. The meter will display an Er 000 002 even if it is operating in battery-free mode. The error will be cleared when the meter date and time are successfully set. If the meter is not intended to operate in battery-free mode, replace the battery and reprogram the meter to eliminate the problem.

For all other errors, it is recommended that the utility remove the meter from service and contact your sales representative.

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

Er 000 002 - Battery Failure and Power Outage

The Battery Failure and Power Outage error indicates the battery failed to maintain power during an outage or that no battery was installed to maintain power during an outage.

A meter programmed for TOU operation will revert to its programmed default TOU rate and load control state while it does not have a valid date and time.

If the meter is programmed for load profile operation, it will perform one of the following operations on its load profile data when it powers up without date and time:

- Suspend load profile recording-In this case, load profile 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 load profile 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.
- Recover load profile recording-The meter will continue to record load profile data in temporary intervals. (These temporary load profile intervals are not readable.) When the meter's date and time is set, it will reconstruct the load profile intervals for the time during which it did not have date and time. No other operation is required to restore the meter's operation. Refer to the *kV2c*

Gen 5 Electronic Meter Features and Applications Guide (132272-TUM) for details on this operating mode.

- Resume load profile recording-The meter will account for the period during which it did not have date and time by recording additional power outage intervals in the load profile data once its date and time are set. No other operation is required to restore the meter's operation. Refer to the *kV2c Gen 5 Electronic Meter Features and Applications Guide (132272-TUM)* for details on this operating mode.

Er 000 020 - Hardware Failure

The Hardware Failure error indicates the meter detected an internal hardware failure. Date, Time, recording, TOU schedule and TOU calendar are all stopped. Programs will be retained, however it is possible that billing data may get corrupted during hardware failures. It is recommended the meter be taken out of service and returned to Aclara.

Er 000 200 - Non-Volatile Memory 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 Memory Data error. If subsequent tests pass, the error is cleared. It is recommended a meter with a Non-Volatile Data error be removed from service and returned to Aclara.

Er 001 000 - Firmware Code Error

The Firmware Code error indicates a failure in the active firmware image that resides in the flash memory internal to the meter's microcontroller. When the meter is not communicating, it continually tests the integrity of the firmware. If the meter detects an error in the firmware, the meter sets Firmware Code error. If subsequent tests pass, the error is cleared. It is recommended a meter with a Firmware Code error be removed from service and returned to Aclara.

Er 100 000 - 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. It is recommended a meter with a Voltage Reference error be taken out of service and returned to Aclara.

Er 200 000 - DSP Error

The DSP error indicates a problem with the digital signal processing of the voltage and current samples. Date, Time, recording, TOU schedule, TOU calendar, and Billing data are all stopped. 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. It is recommended a meter with a DSP error be taken out of service and returned to Aclara.

Cautions

The meter also checks other conditions that 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.

With the exception of the bad password, time change, and high temperature cautions, which are not displayable, cautions can be configured to be displayed and optionally freeze the display. The caution must be enabled to be displayed.

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.

NOTE When multiple cautions occur they are combined. For example, CA 040 400 indicates leading quadergy and low potential.

CA 000 001 - 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)
- Once per day
- Activate the display switch (not in Test mode)
- MeterMate software

This caution should be disabled if the meter is being used in battery-free mode. Refer to the *kV2c Gen 5 Electronic Meter Features and Applications Guide (132272-TUM)* for details on this operating mode.

CA 000 010 - Unprogrammed

The Unprogrammed caution indicates the meter is not programmed and is functioning in a default demand mode. The meter is shipped unprogrammed unless ordered factory programmed. The MeterMate software unprogram command will

put the meter into the default demand mode and set the Unprogrammed caution. Programming the meter clears the Unprogrammed caution.

CA 000 040 - Loss of Program

The Loss of Program caution indicates 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.

To set the meter date and time, which is required to restart load profile operation in a meter operating in battery-free mode, you need to start a programming session. If this operation is interrupted (by a power outage, for example), the meter will flag this caution (if it is programmed to do so). This caution does not indicate the meter has lost its program, only that the operation was interrupted. The meter does not require a reprogramming in this case, only the caution flag needs to be cleared.

For meters integrated with communication modules that will be performing operations such as setting date/time or changing meter programs, it is recommended this caution be disabled.

CA 000 400 - Low Potential

The Low Potential caution indicates 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.

CA 004 000 - Demand Overload

The Demand Overload caution indicates 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 at the end of every demand interval or subinterval. The meter sets the Demand Overload caution when the user-selected demand exceeds its threshold. The meter does not automatically clear the Demand Overload caution. The Demand Overload caution is cleared by a demand reset.

CA 040 000 - Leading kvarh

The Leading kvarh caution indicates 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 and its magnitude exceeds the programmed threshold for 3 consecutive tests. The meter does not automatically clear this caution. It is cleared by a demand reset.

CA 400 000 - Received kWh

The Received kWh caution indicates 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 and its magnitude exceeds the programmed threshold for 3 consecutive tests. The meter does not automatically clear the Received kWh caution. The Received kWh caution is cleared by a demand reset.

Incorrect Password

This caution is not displayable. The bad password caution flag and history flag are set when the meter receives more than the programmed number of invalid passwords without receiving a valid password.

Time Change

This caution is not displayable. The time change caution flag and history flag are set when the meter's time is changed.

High Temperature

The threshold for the caution is programmable from 0 to 100 degrees Celsius in increments of 1 degree Celsius. The default value is 95 degrees Celsius. The high temperature caution is always enabled.

The High Temperature Caution Flag is set when the temperature reading by the meter reaches or exceeds the programmed threshold for 60 seconds. The Caution Flag clears when the temperature drops below the programmed threshold for 60 seconds.

The meter will perform the high temperature check at least once every five seconds.

When a high temperature caution condition is detected, a High Temperature Caution Flag is set. When the condition clears, the High Temperature Caution Flag clears. The meter will also clear the High Temperature Caution Flag at power up.

A High Temperature Caution Flag is indicative of environmental changes detrimental to the reliability and accuracy of meter functions. While this caution flag does not appear on the display, you may poll the meter using reading software to check the latest high temperature cautions or the current environment temperature.

NOTE These values are not definitive enough to determine a meter is functioning properly and should not be used in place of regular inspection.

Conditions without Codes

The following table provides information for troubleshooting conditions that do not set errors or cautions in the meter.

Condition	Probable Cause	Remedy
High/low demand registration	Socket wiring error	Correct socket wiring
	Meter internal wiring is defective.	Check that voltage and current connectors are seated properly. Check the leads for damage.
	Defective sensor	Replace meter
Meter creeps	Defective measurement circuit	Replace meter
Meter overheats	Meter socket or socket wiring incorrect	Replace with heavier socket or wiring
	Meter is overloaded	Use transformer rated installation
	Poor socket connection	Replace socket terminal
Meter runs slow	Incorrect socket wiring	Rewire socket
	Defecting internal meter wiring	Check leads for damage and that connections are seated properly
	Defective sensor	Replace meter
No display	Circuit de-energized	Check voltages
	Test link(s) open	Close all test links
	Internal wiring defective	Check leads for damage and that connections are seated properly
Option board malfunction	Board installed incorrectly	Install board correctly
	Defective output cables	Check for damaged cables or leads
	Defective option board	Replace option board
	Wrong program values	Reprogram meter

CHAPTER**5****UPGRADING**

This chapter covers the internal optional features available for kV2c Gen 5 meter, along the AMI modules that are available for the kV2c Gen 5.

Softswitches

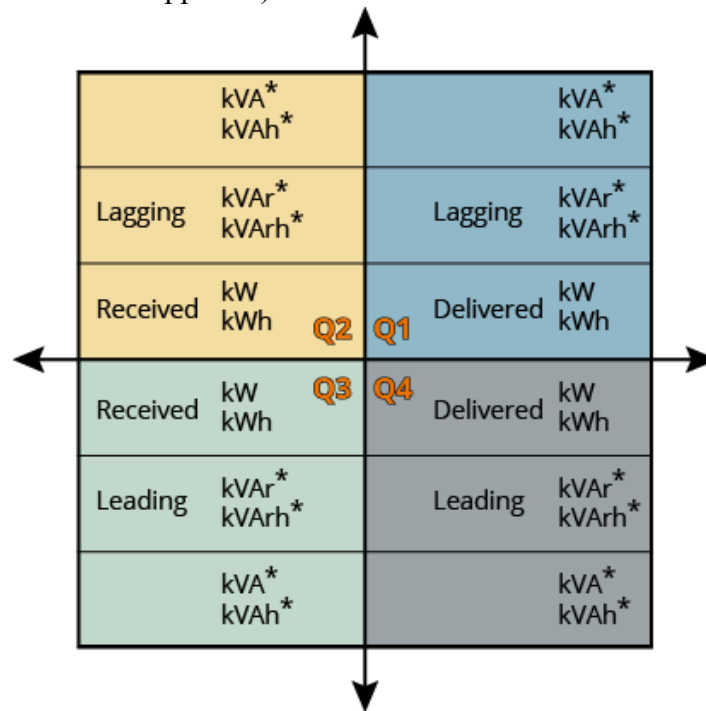
The basic kV2c Gen 5 meter provides a powerful platform for advanced metering. Features may be added to the basic meter through softswitches, which enable built-in capabilities. Softswitches may be ordered at the time the meter is purchased or added in the field. Softswitches may be removed from one meter and installed in another meter.

The following table lists the softswitches available in the kV2c Gen 5:

Softswitch	Description
B	By Quadrant measurements
E	Event Log
H	Increases recording memory to 384 kB (firmware 4.11.8 or later)
I	Instrument Transformer Correction
K	kVA - Power Factor, kvar, and kVA measures
L	Transformer Loss Compensation
M	Expanded Measures-per element measurements
Q	Power Quality Measures
R	Basic Recording (8-channel)
T	Time-of-Use
V	Fast Voltage Event Monitor and Log (sag and swell, 1 to 65 k cycles)
W	Waveform Capture (for harmonic analysis) (70 sample sets-6 measures per set-V and I per phase)
X	Expanded Recording (20-channel)
Z	Totalization

B: Quadrant Measurement

The Quadrant Measurement softswitch allows the enabled measurements to be tracked for each quadrant. These measurements include kWh and kW demand, kvarh* and kvar* demand, and kVAh* and kVA* demand (phasor, apparent, and arithmetic apparent).



*These measurements require the K softswitch.

E: Event Log

The Event Log softswitch allows the meter to track the most recent 500 events. Use the MeterMate software to select which event types should be logged and how many occurrences should be tracked-up to 500 occurrences max. Date and time stamps are included on logged events for demand/load profile or TOU meters. Logged events include:

- Diagnostics 1-8: When set and when cleared (d5 by phase and total; d6 and d7 by phase)
- Cautions: Under voltage, Demand overload, leading kvarh, reverse energy flow-when set and 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

H: Huge Load Profile

The H softswitch increases recording memory from 192 kB to 384 kB for the 20 recording channels. Below is a chart displaying the capacity, in number of days, of a kV2c Gen 5 meter with the H softswitch enabled to record interval data.

Num Chan	Interval Length (minutes)					
	1	5	10	15	30	60
1	87	434	868	1,302	2,604	5,208
2	44	220	439	659	1,318	2,636
3	33	165	330	495	990	1,980
4	24	120	241	361	722	1,444
5	20	102	203	305	610	1,220
6	16	82	165	248	496	992
7	14	73	147	221	442	884
8	12	63	126	189	378	756
9	11	57	115	173	346	692
10	10	51	102	153	306	612
11	9	47	94	142	284	568
12	8	42	85	128	256	512
13	8	40	80	120	240	480
14	7	36	73	110	220	440
15	7	34	69	104	208	416
16	6	32	64	97	194	388
17	6	30	61	92	184	368
18	5	28	57	86	172	344
19	5	27	55	83	166	332
20	5	26	52	78	156	312

I: Instrument Transformer Correction

The Instrument Transformer Correction softswitch allows users to create and optionally use an alternate set of calibration constants. Use MeterMate software to input the CT and VT ratio and phase angle correction factors for the instrument transformers used at that installation. MeterMate software 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. MeterMate software 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.

K: kVA, kvar, and PF Measurement

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 Gen 5 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.

L: Transformer Loss Compensation

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 MeterMate software to input the no-load and load loss data for the power transformers and conductors used at that installation. MeterMate software translates the data into compensation factors to be optionally used by the meter. The original factory calibration constants are unaffected. MeterMate software 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.

M: Expanded Measurement

The Expanded Measurements softswitch allows the accumulation or Recording of these per element values:

- kWh and kW demand
- kvarh and kvar demand
- Apparent kVAh and kVA demand

Measured values with this softswitch include by element and by quadrant. The B softswitch is required to sum all elements by quadrant. The K softswitch is required to sum reactive or apparent measurements.

NOTE These values are always available for real-time displays but cannot be accumulated or recorded without the M softswitch.

Q: Power Quality Measurement

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

- Distortion kVA(h) (total and per element)
- Distortion PF (total and per element)
- Total demand distortion
- Total demand distortion = Total harmonic current/max. current per phase
- Total Harmonic Distortion (THD): I_{THD} and 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 softswitch.

R: Basic Recording

The Basic Recording softswitch enables up to eight channels of load profile recording in 128 KB of on-board memory. The number of active channels and days of load profile data are configurable using the MeterMate software. Below is a chart displaying the capacity, in number of days, of a kV2c Gen 5 meter with the R softswitch enabled to record interval data.

Num Chan	Interval Length (minutes)					
	1	5	10	15	30	60
1	29	144	289	434	868	1,736
2	14	73	147	221	442	884
3	11	55	110	165	330	660
4	8	40	80	120	240	480
5	6	34	67	101	202	404
6	5	27	55	82	164	328
7	4	24	48	73	146	292
8	4	21	42	63	126	252

T: Time-of-Use

The Time-of-Use softswitch enables TOU operation. The meter supports the following:

- Up to 4 TOU periods and 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
- Holiday, season change, daylight saving time, self read, and demand reset
- Perpetual calendar handles most dates
- Up to 5 billing and 5 demand measures per TOU period-Each demand measure capable of 2 coincident values
- Future activation of TOU schedule and calendar possible
- Enables load control output switch capabilities
- Enables Self Read actions on specified dates-with or without a demand reset

V: Fast Voltage Event Monitor/Log

The Fast Voltage Event Monitor and 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. @ 60 Hz)
- 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 the following:

- 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/load profile or TOU mode

W: Waveform Capture

The Waveform Capture softswitch enables the capture of sample data from the kV2c Gen 5. The meter captures 6 sets of 85 samples each (3 voltages, 3 currents). There are approximately 66 samples per cycle, per phase, at 60 Hz. A MeterMate command triggers the data capture. MeterMate can then generate a harmonic analysis report for each voltage and current input. A Power Analysis report is also generated.

X: Expanded Recording

The Expanded Recording softswitch enables up to 20 channels of load profile recording in 192 kB of memory. Number of active channels and days of load profile data are configurable with the MeterMate software. The number of days of storage depends on number of active channels and load profile interval length. Below is a chart displaying the capacity, in number of days, of a kV2c Gen 5 meter with the X softswitch enabled to record interval data.

Num Chan	Interval Length (minutes)					
	1	5	10	15	30	60
1	43	217	434	651	1,302	2,604
2	22	109	219	329	658	1,316
3	16	82	164	247	494	988
4	12	60	120	180	360	720
5	10	51	101	152	304	608
6	8	41	82	124	248	496
7	7	36	73	110	220	440
8	6	31	63	94	188	376
9	5	28	57	86	172	344
10	5	25	50	76	152	304

Num Chan	Interval Length (minutes)					
	1	5	10	15	30	60
11	4	23	47	71	142	284
12	4	21	42	64	128	256
13	4	20	40	60	120	240
14	3	18	36	55	110	220
15	3	17	34	52	104	208
16	3	16	32	48	96	192
17	3	15	30	46	92	184
18	2	14	28	43	86	172
19	2	13	27	41	82	164
20	2	13	26	39	78	156

Z: Totalization

The Totalization softswitch enables combining data from up to 5 meters-4 external meter inputs plus the internal kV2c Gen 5 metered data. External inputs require the use of the Multiple I/O option board. Up to 8 data combinations are allowed 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 softswitch installed.

Meter Modes

The kV2c Gen 5 is capable of measuring demand, demand/load profile, TOU, and TOU/load profile. The recording and TOU options require softswitches to extend the functionality of the basic demand meter.

The following items are required to enable demand/load profile, TOU, or TOU/load profile operation:

- Computer with MeterMate Software
- Softswitch holder with T and H, R, or X switches
- SMARTCOUPLER device
- Time keeping battery (A battery may not be required for meters programmed for battery-free operation.)

To validate a meter upgrade, use the MeterMate software to view the capabilities of the meter. To enable the TOU function:

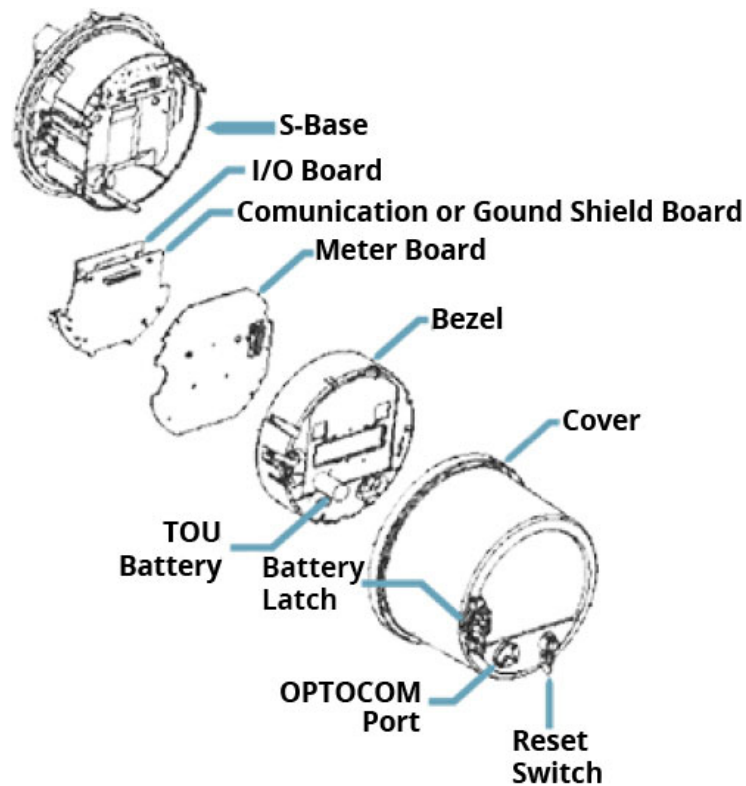
1. Plug the Softswitch holder into the parallel port of the computer.
2. Install and connect the battery. (See *Battery Replacement* on page 37.)

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 Gen 5 meter.
5. Enable TOU (T), and either Basic Recording (R) or Extended Recording (X) using the Meter Mate software.
6. Mark the TOU box on the nameplate.

NOTE 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 should not be connected until the meter has been programmed for TOU operation.

Meter Disassembly

Use the following procedures to disassemble the meter.



Meter Cover Removal

1. If present, remove the seal from the right side of the meter.
2. Turn the cover counterclockwise approximately 30 degrees.
3. Lift the cover straight up.

kV2c[®] Gen 5 Module Removal

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.

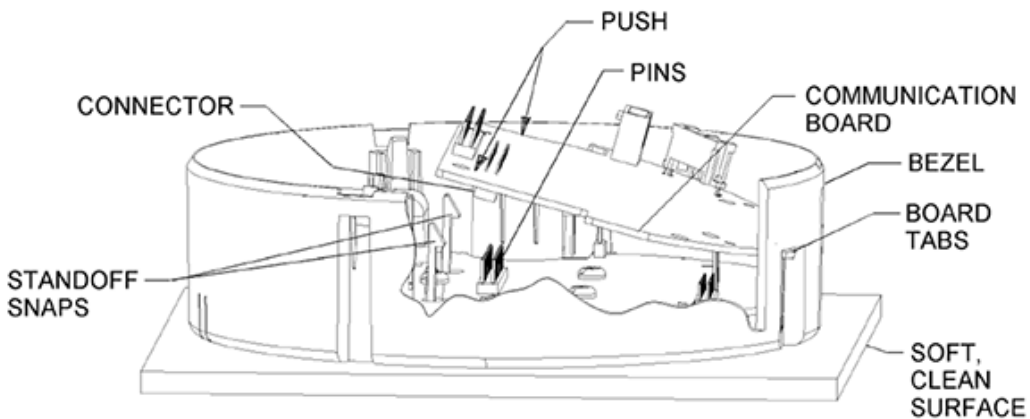
1. Insert the small screwdriver under one of the snap retainers. Twist the screwdriver and pry up on the snap retainer until it releases. Repeat the procedure with the remaining snaps.
2. Gently remove the meter bezel. Take care not to put significant strain on the wires.
3. If any option boards are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

Option Board Removal

If you are adding a communication board and an I/O board is already installed, or if you are replacing an I/O board, follow these steps to remove the I/O board:

1. Disconnect the battery if present.
2. Disconnect the bezel from the meter and orient the meter bezel so that the TOU battery cavity is located on the left-hand side.
3. Place the meter bezel on a flat, clean, cloth-covered surface with meter face down.
4. 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. Remove the communication or ground shield board by holding it with the thumb and index finger. Continue tilting the board until the tabs on the meter board and the tabs on the board are disengaged. Then lift the board out of the meter bezel.

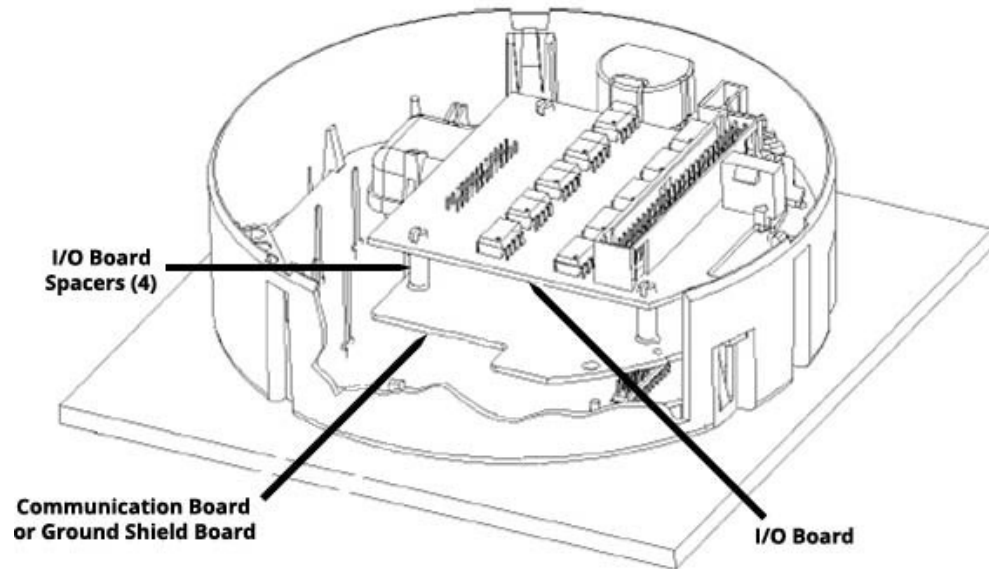
Communication Board Installation



1. Disassemble the meter using the instructions in *Meter Disassembly* on page 53.
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 communication board near the connector. Push gently until the standoffs snap firmly on the edge of the option communication board.
7. Reassemble the meter. See *Meter Assembly* on page 59.

I/O Board Installation

Below are the instructions for installing an I/O board into a meter.

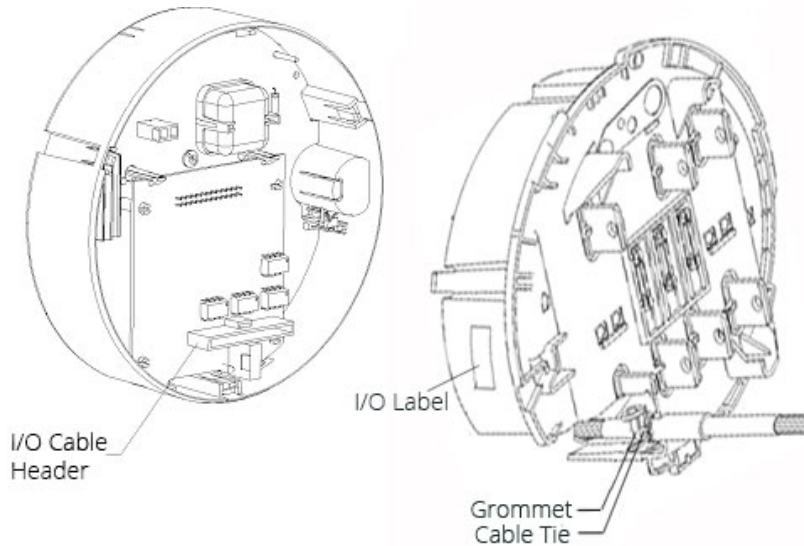


1. Disassemble the meter using the instructions in *Meter Disassembly* on page 53.
2. Place the bezel face down on a soft, clean surface to protect the nameplate and the liquid crystal display.
3. If a communication board is not installed, a ground shield board must be used in its place. A ground shield board is provided as part of every I/O kit.
4. Check the pins on the meter board. Align any pin that is out of alignment.
5. With the 30-pin connector on the underside of the ground shield board, insert the tabs on the board into the slots on the bezel.
6. Gently move the ground shield board until the connector engages the meter board pins.
7. Push straight down on the ground shield board near the connector. Push gently until the bezel snaps firmly on the edge of the ground shield board.
8. Insert the four spacers into the four holes.
9. Place the I/O board on top of the communication or ground shield board and align 30-pin connector to 30-pin header.
10. Gently press connector and header together until the four posts are aligned with the four holes in the I/O board.
11. Press boards together until all four posts have snapped securely in place. Once snapped in place, boards should not disengage easily.
12. Refer to *I/O Cable Installation* on page 57 for instructions on installing the I/O cable to the meter 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.

S-Base



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. (Refer to *Input/Output* on page 17)
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. Reassemble the meter. See *Meter Assembly* on page 59.

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 the meter uses KYZ output through the base, plug the 3-position connector into the mating header on the I/O board.

3. Reassemble the meter. See *Meter Assembly* on page 59.

S I/O Cable			M I/O Cable		
Signal	Wire Color	Pin #	Signal	Wire Color	Pin #
Y1_OUT	Yellow	4	Y1_OUT	Yellow	8
Z1_OUT	Black	6	Z1_OUT	Black	12
Y2_OUT	Gray	10	Y2_OUT	Gray	20
Z2_OUT	Blue	12	Z2_OUT	Blue	24
K1/K2_OUT	Red	8	K1/K2_OUT	Red	16
Z3_OUT	Orange	14	Z3_OUT	Orange	28
K3_OUT	Brown	16	K3_OUT	Brown	32
RTP+	Violet	2	RTP+	Violet	4
RTP-	Green	1	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/Gray	21
			Z2_IN	White/Black/Brown	25
			Y3_IN	White/Black/Red	29
			K3_IN	White/Black/Orange	33
			Z3_IN	White/Black/Yellow	41
			Y4_IN	White/Black/Green	45
			K4_IN	White/Black/Blue	49
			Z4_IN	White/Black/Violet	

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.

Meter Assembly

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 6-position connector and connects to a 6-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.

WARNING I/O cable should be routed separately from high voltage, exposed circuits. Take care to avoid pinching the cable or damaging the cable's insulation.

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.

CHAPTER**6****SITE ANALYSIS GUIDES**

These site analyses include rudimentary connection diagrams for identification of metering installation. These diagrams are not metering installation guides. The page number for each site analysis is listed in the table below. Blondel solutions are in **bold**.

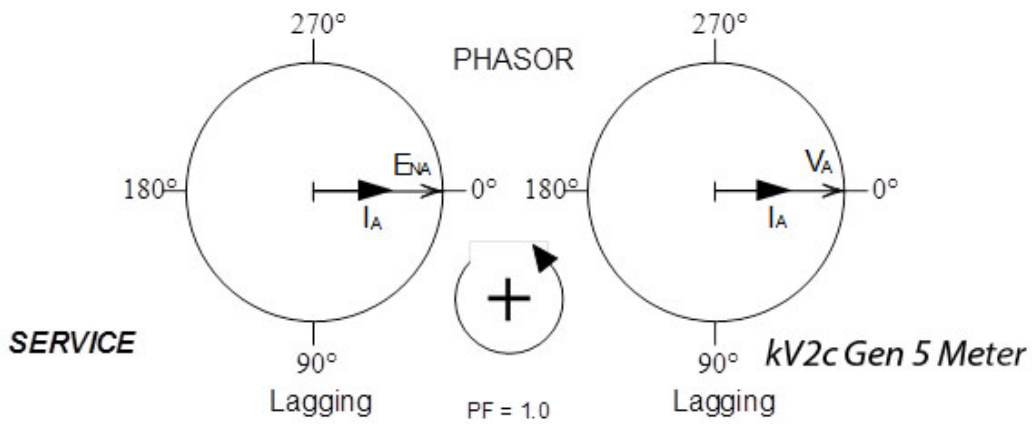
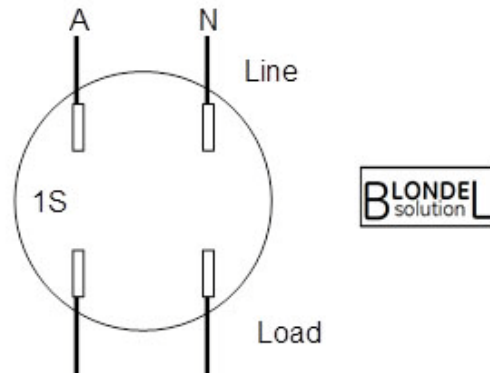
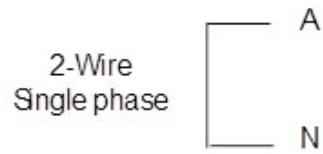
Form	2W-1 ϕ	3W-1 ϕ	3W-N	3W- Δ	4W- Δ	4W-Y	5W-2 ϕ
1S	62						
2S		63					
3S	64	65					
4S		66					
9S					67	68	
12S		69	70	71			
16S					72	73	
36S						74	
45S		75		76	77	77,78	
56S		80		81	82, 83	83, 84	84

- 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.

Form 1S (2W-1φ)

kV2c Gen 5 Site Analysis

Form 1S (Self-Contained)



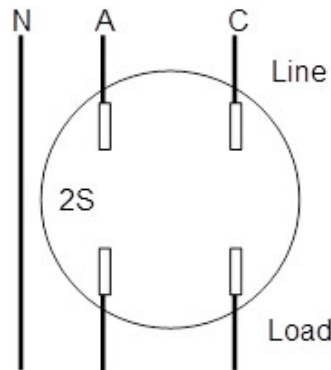
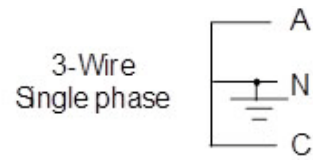
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

2-wire, 1-phase, 1-element

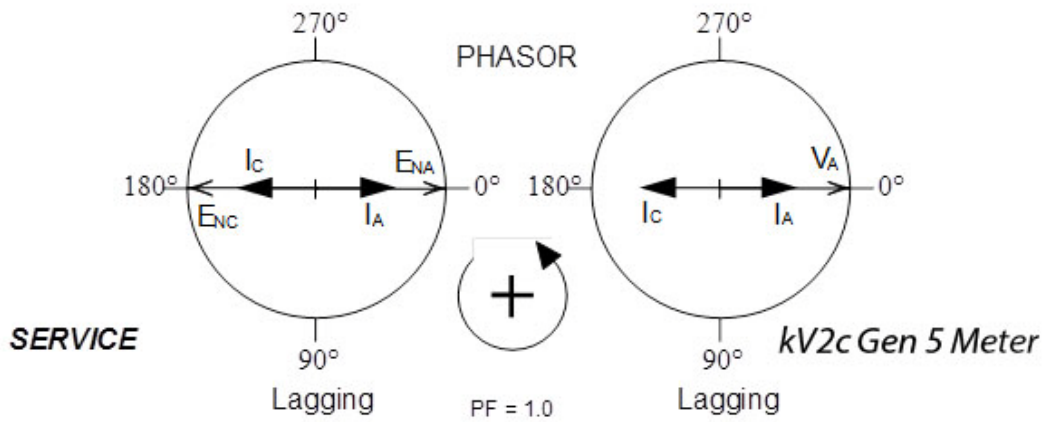
Form 2S (3W-1 ϕ)

kV2c Gen 5 Site Analysis

Form 2S (Self-Contained)



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

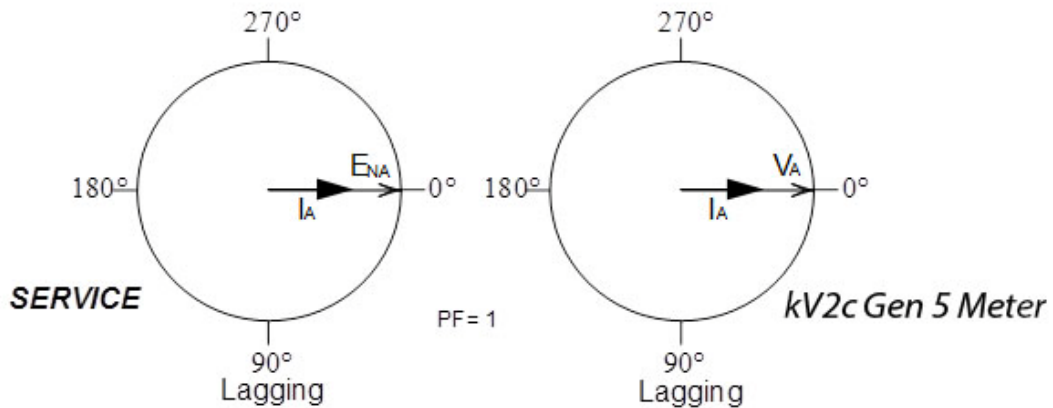
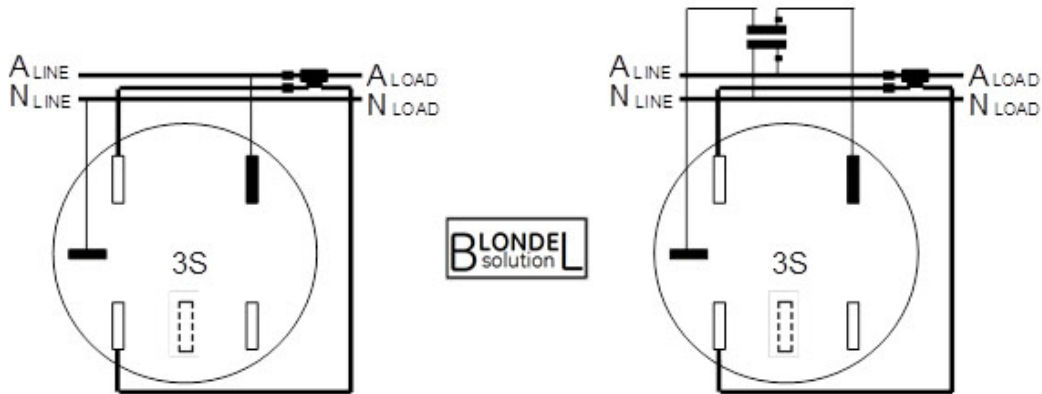
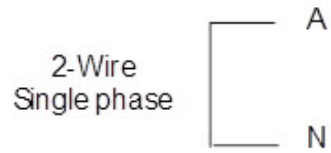


Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

3-wire, 1-phase, 1-element

Form 3S (2W-1 ϕ)

kV2c Gen 5 Site Analysis
Form 3S (Transformer Rated)



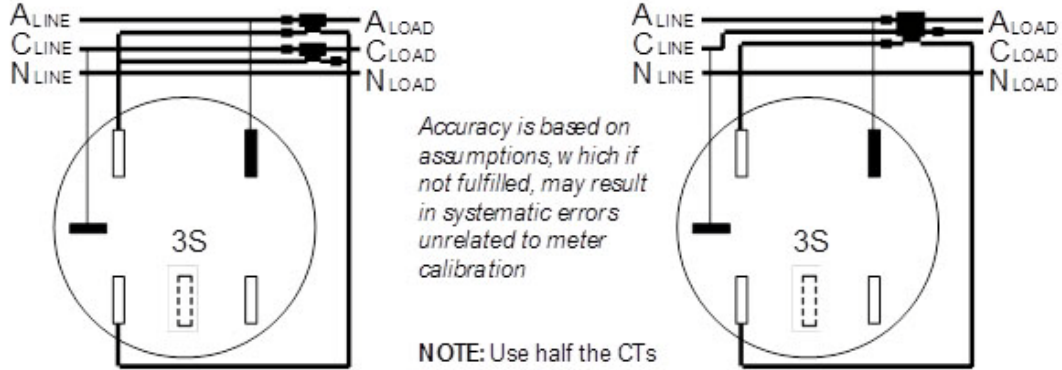
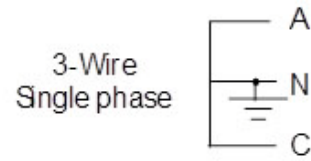
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

2-wire, 1-phase, 1-element

Form 3S (3W-1 ϕ)

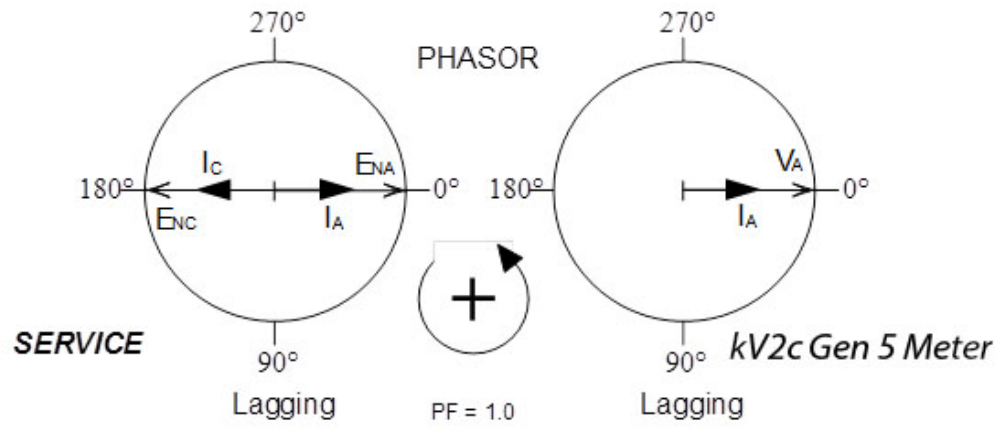
kV2c Gen 5 Site Analysis

Form 3S (Transformer Rated)



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

NOTE: Use half the CTs ratio as transformer factor in determining meter multiplier, except for 3-wire CTs

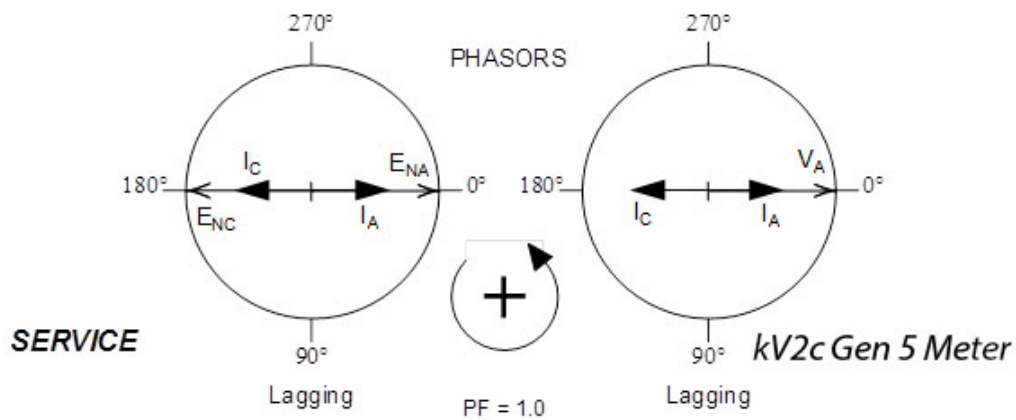
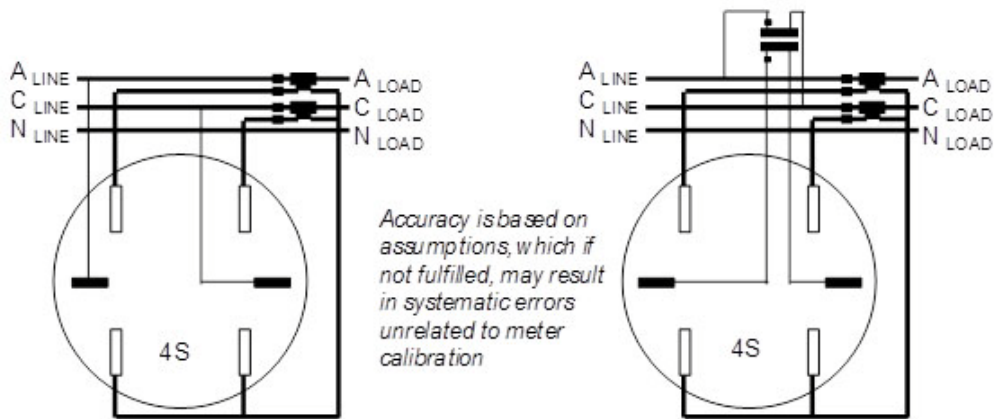
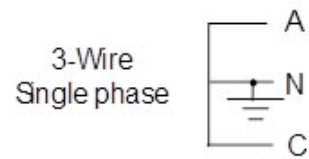


Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards.

3-wire, 1-phase, 1-element

Form 4S (3W-1φ)

kV2c Gen 5 Site Analysis Form 4S (Transformer Rated)



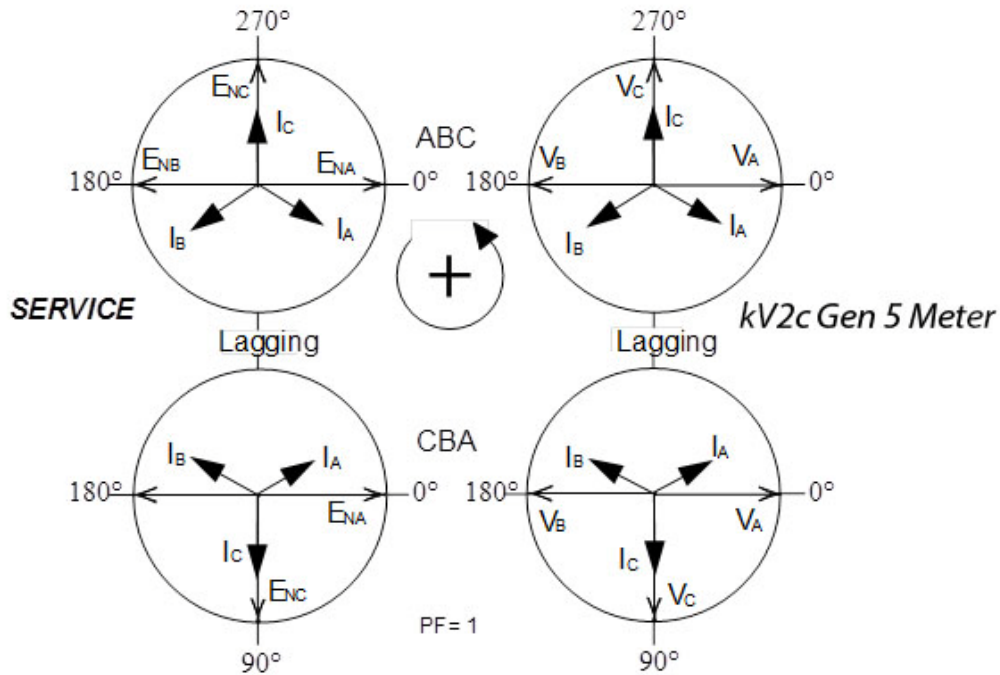
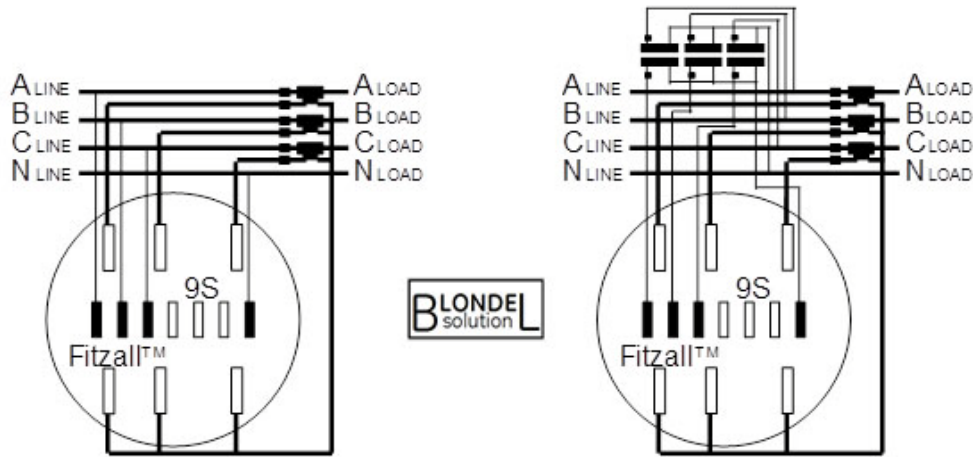
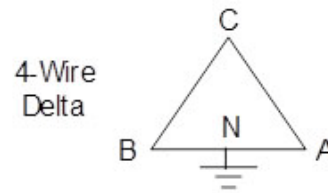
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

3-wire, 1-phase, 1-element

Form 9S (4W-4Δ)

kV2c Gen 5 Site Analysis

Form 9S (Transformer Rated)



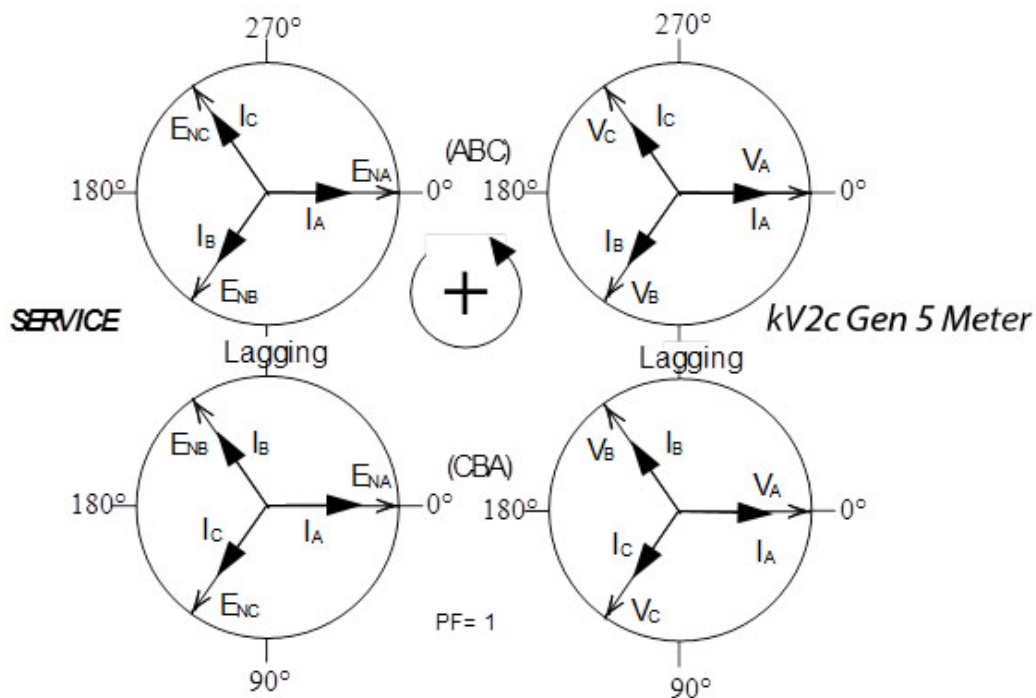
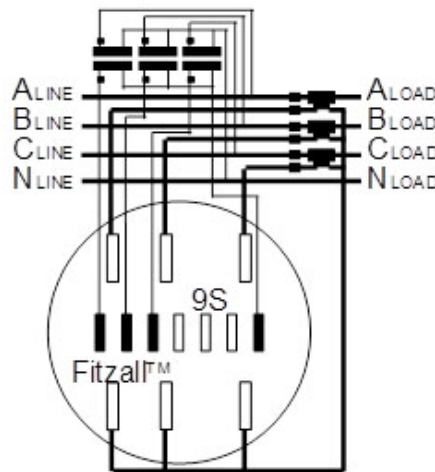
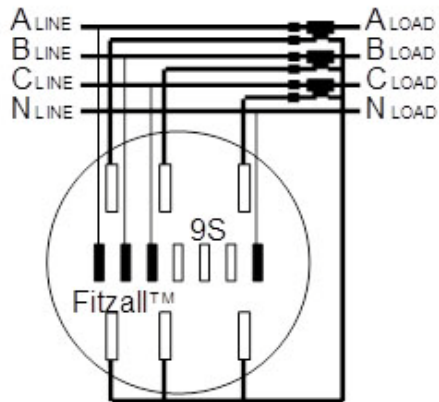
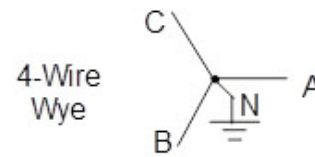
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

4-wire, 3-Element

Form 9S (4W-Y)

kV2c Gen 5 Site Analysis

Form 9S (Transformer Rated)



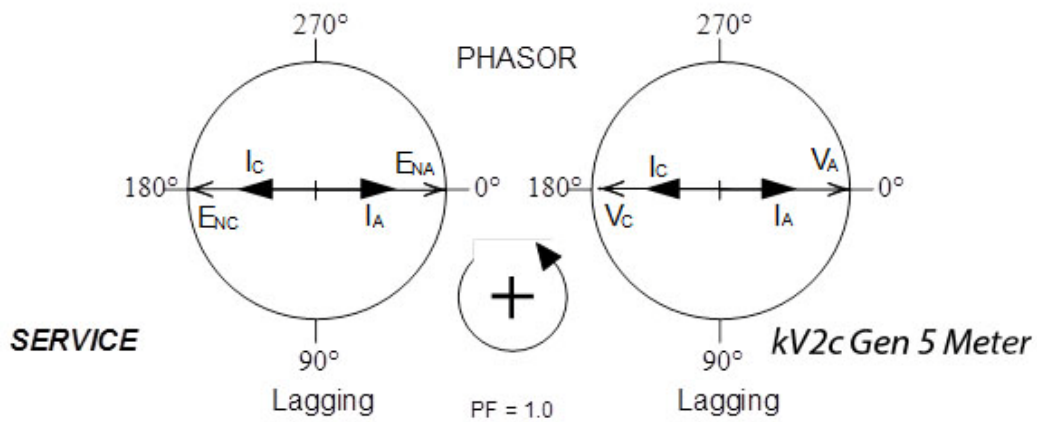
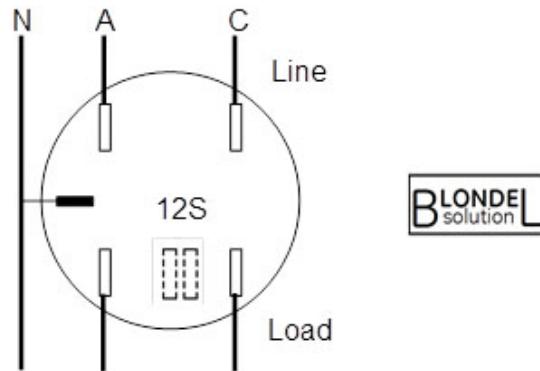
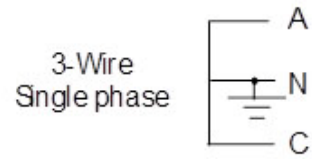
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards.

4-wire, 3-Element

Form 12S (3W-1 ϕ)

kV2c Gen 5 Site Analysis

Form 12S (Self-Contained)



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

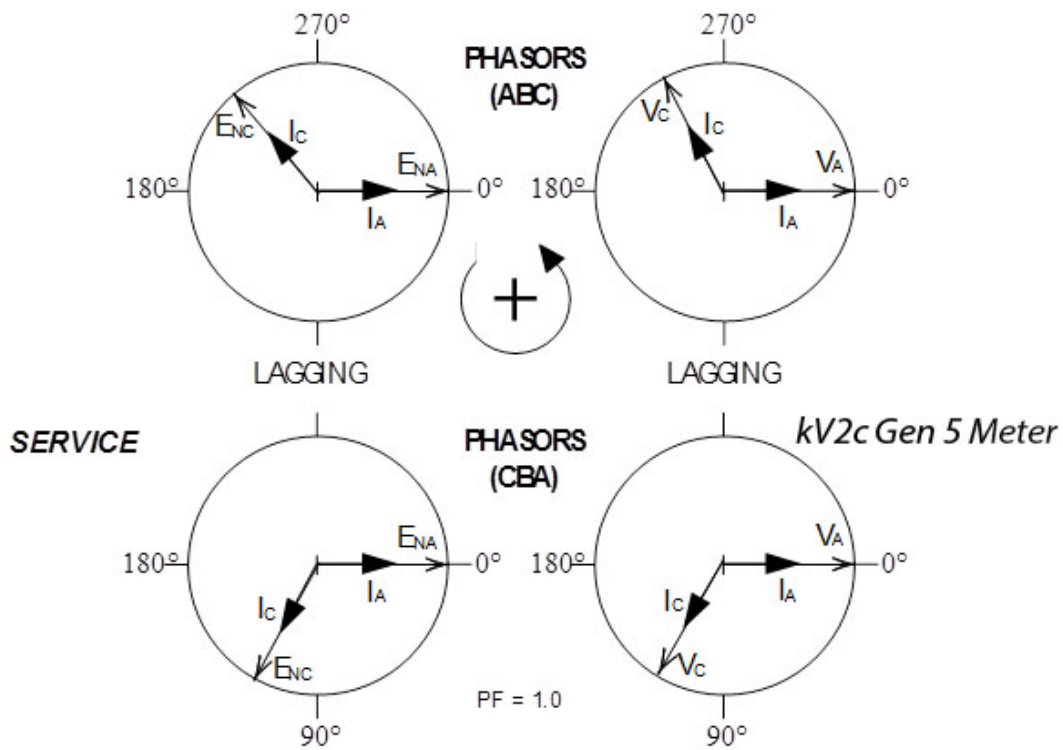
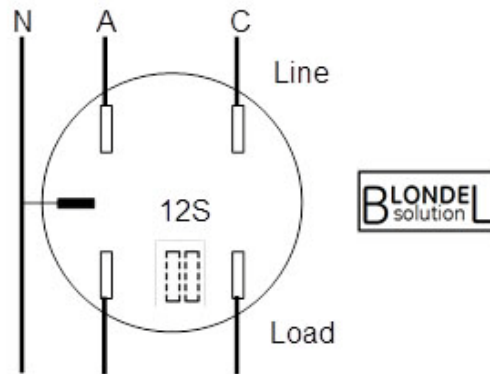
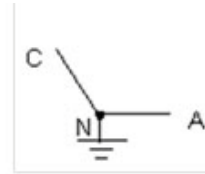
3-wire, 1-phase, 2-element

Form 12S (3W-N)

kV2c Gen 5 Site Analysis

Form 12S (Self-Contained)

3-Wire Network



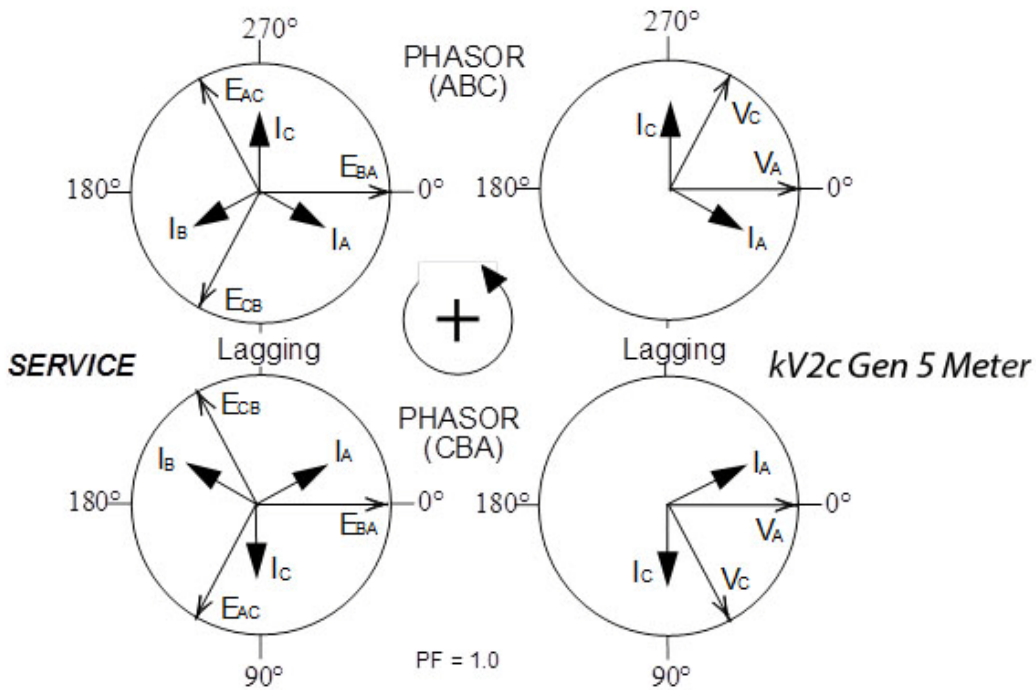
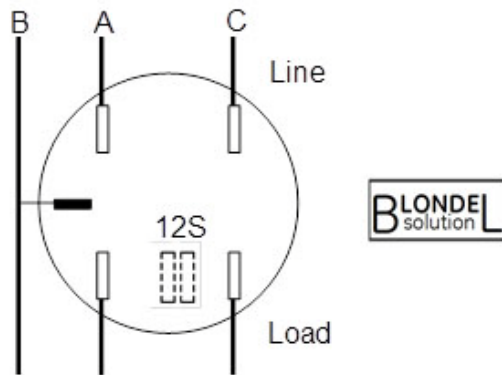
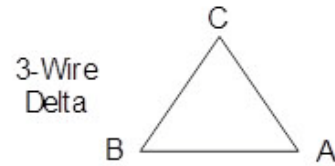
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards.

3-wire, Network, 2-element

Form 12S (3W-Δ)

kV2c Gen 5 Site Analysis

Form 12S (Self-Contained)



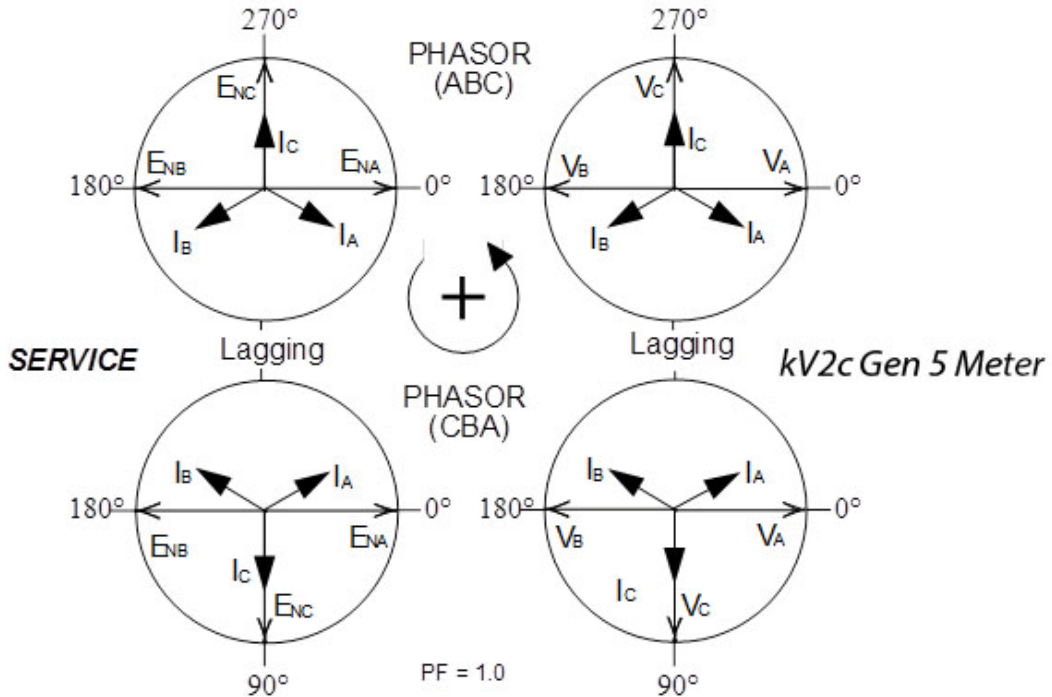
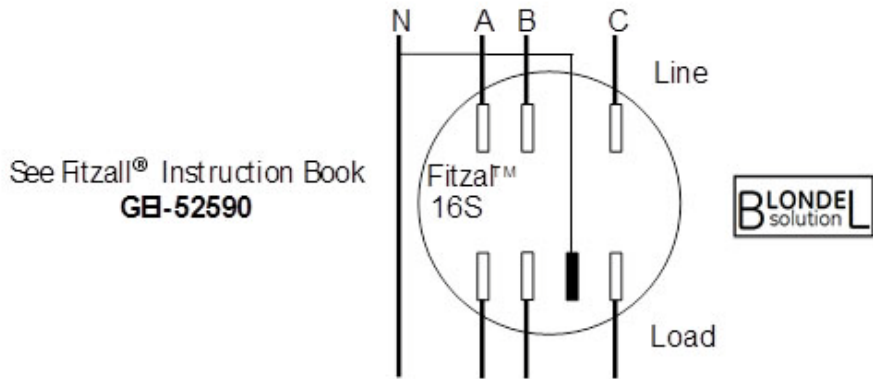
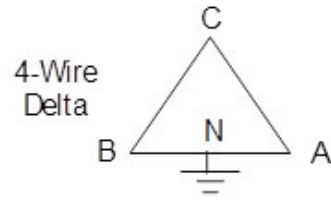
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards.

3-wire, 3-phase, 2-element

Form 16S (4W-Δ)

kV2c Gen 5 Site Analysis

Form 16S (Self-Contained)



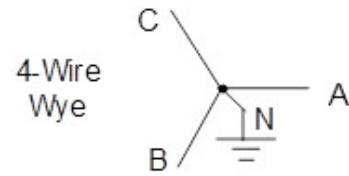
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards.

4-wire, 3-Element

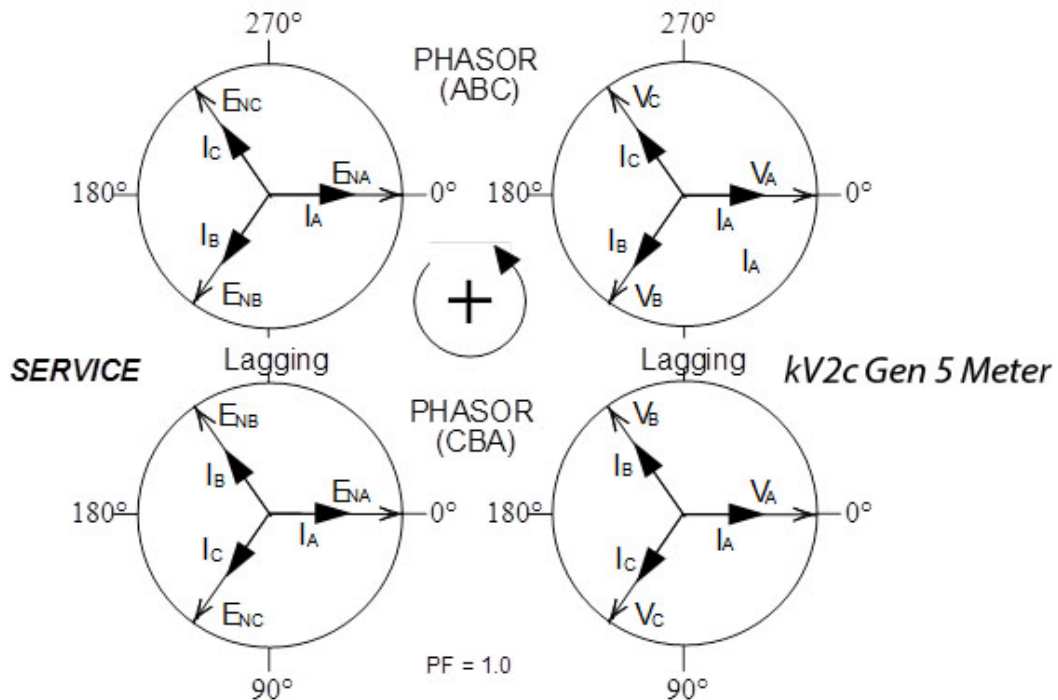
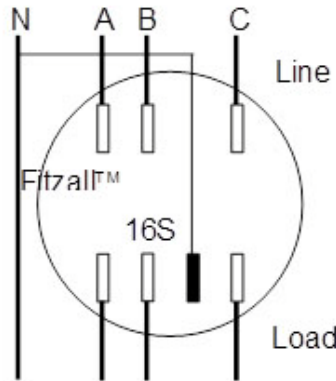
Form 16S (4W-Y)

kV2c Gen 5 Site Analysis

Form 16S (Self-Contained)



See Fitzall® Instruction Book
GB-52590



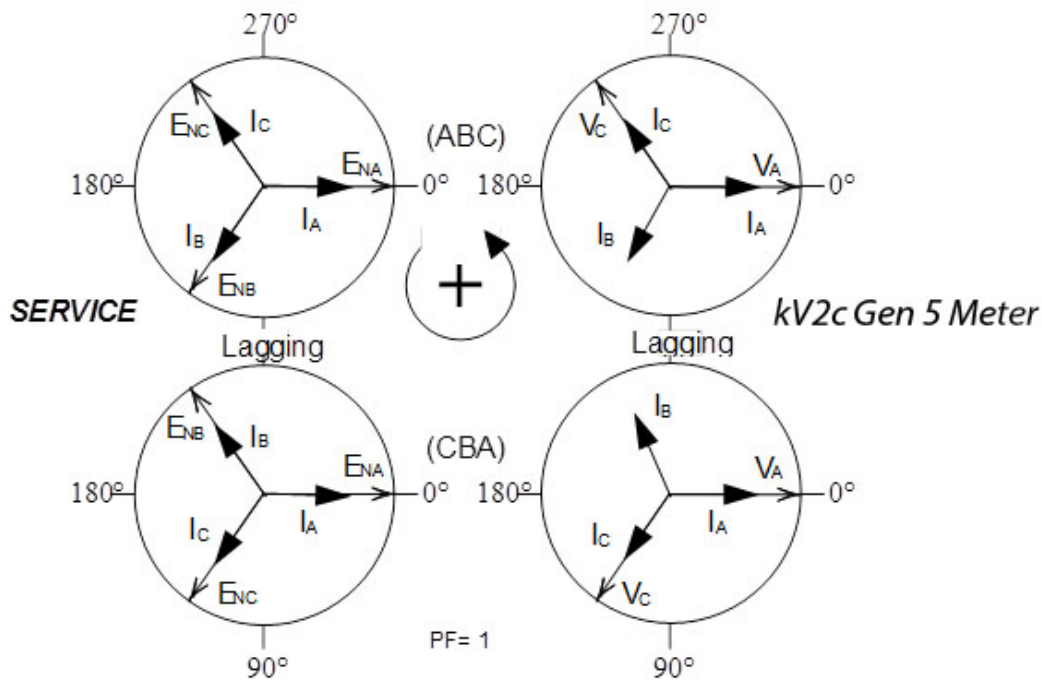
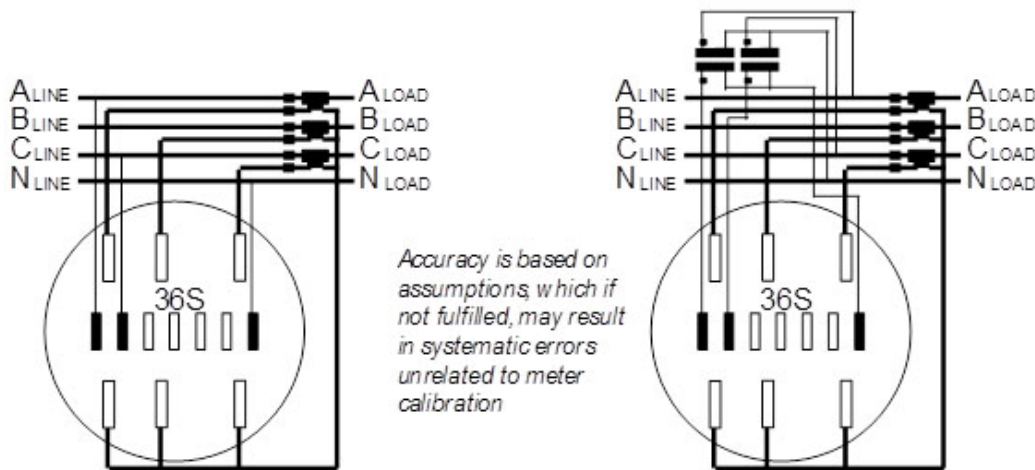
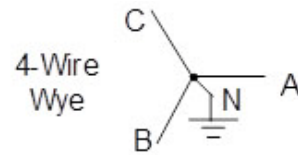
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards.

4-wire, 3-Element

Form 36S (4W-Y)

kV2c Gen 5 Site Analysis

Form 36S (Transformer Rated)



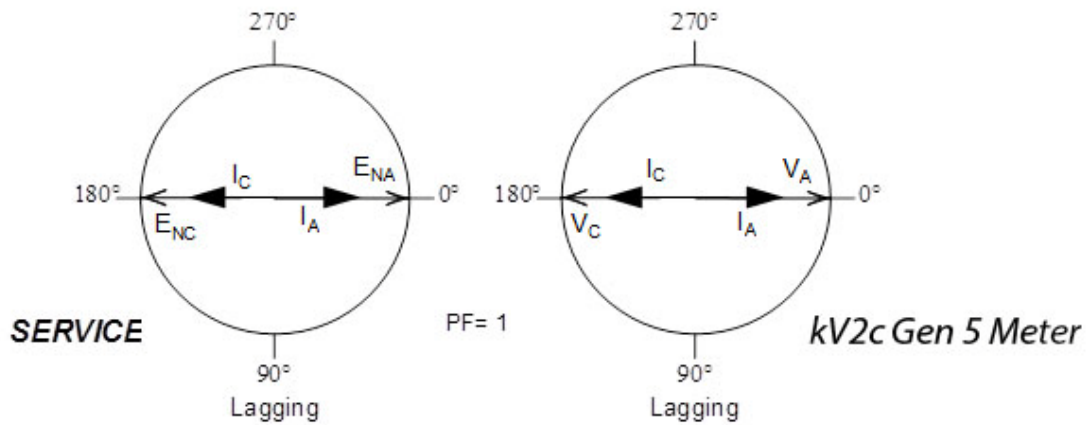
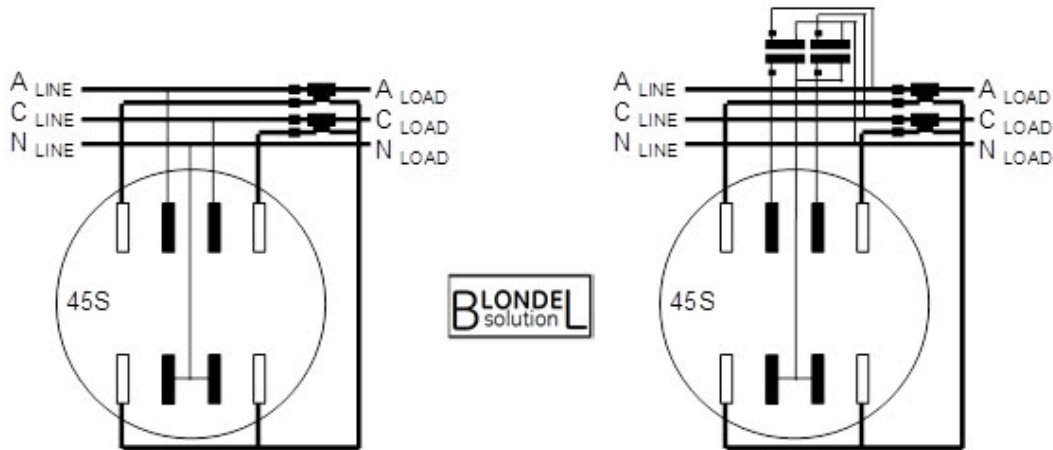
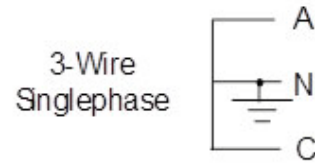
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards.

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

Form 45S (3W-1 ϕ)

kV2c Gen 5 Site Analysis

Form 45S (Transformer Rated)



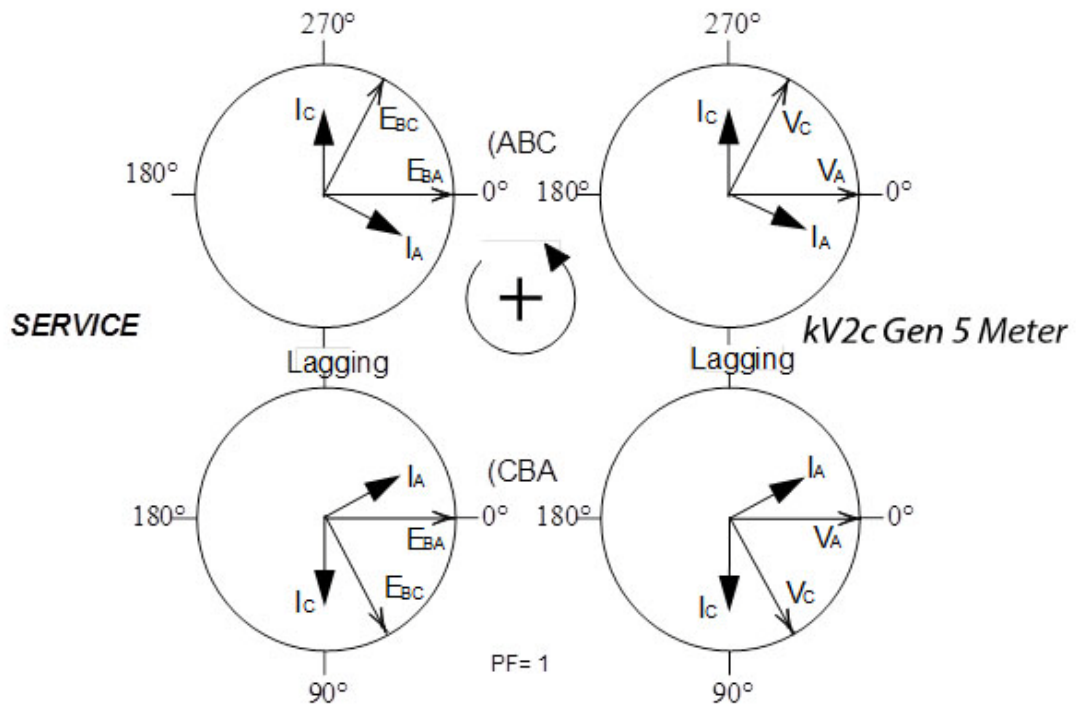
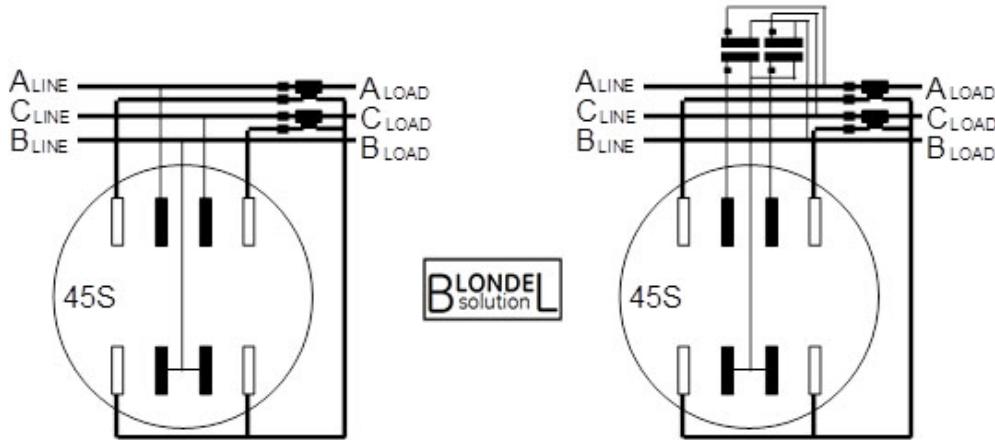
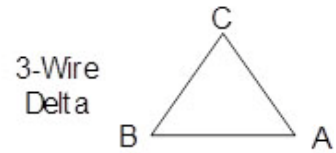
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

3-wire, 1-phase, 2-element

Form 45S (3W-Δ)

kV2c Gen 5 Site Analysis

Form 45S (Transformer Rated)



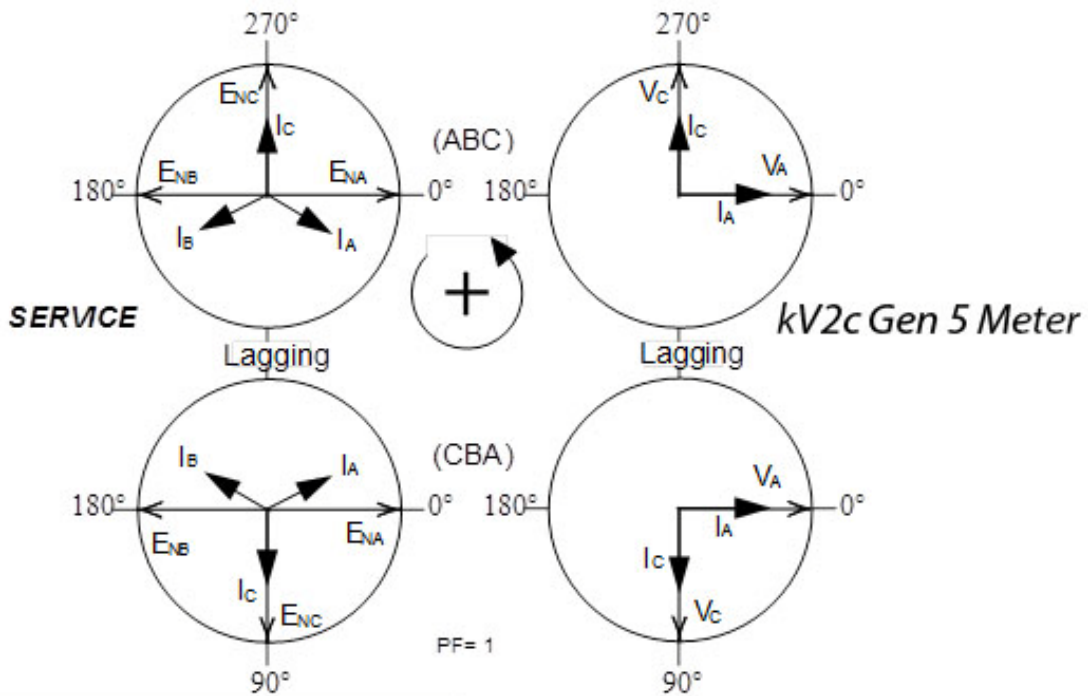
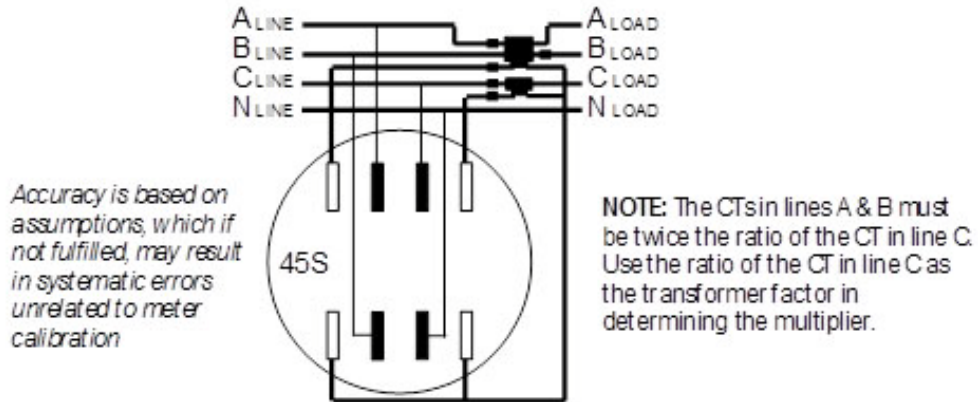
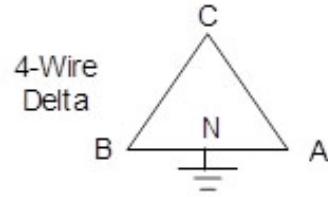
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

3-wire, 3-phase, 2-element

Form 45S (4W-Δ)

kV2c Gen 5 Site Analysis

Form 45S (Transformer Rated)



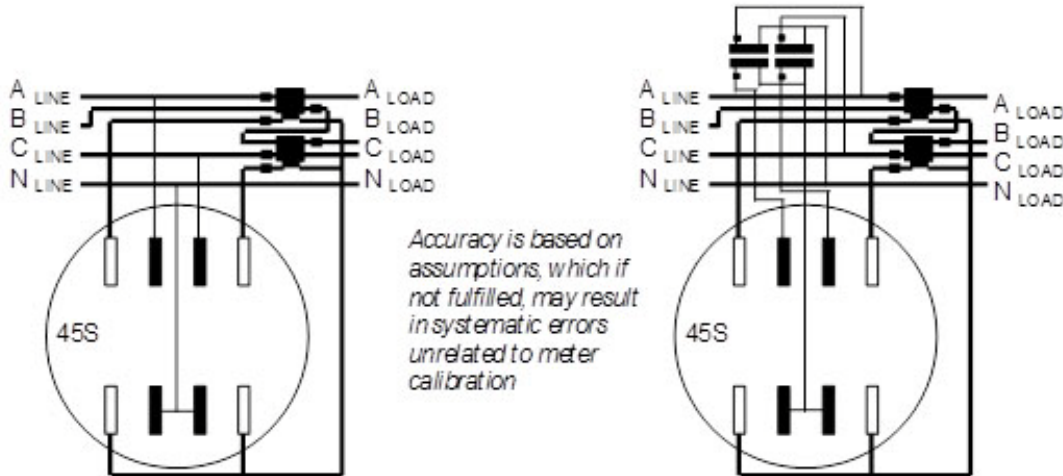
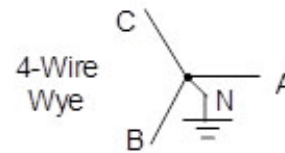
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

4-wire, delta, 2-element

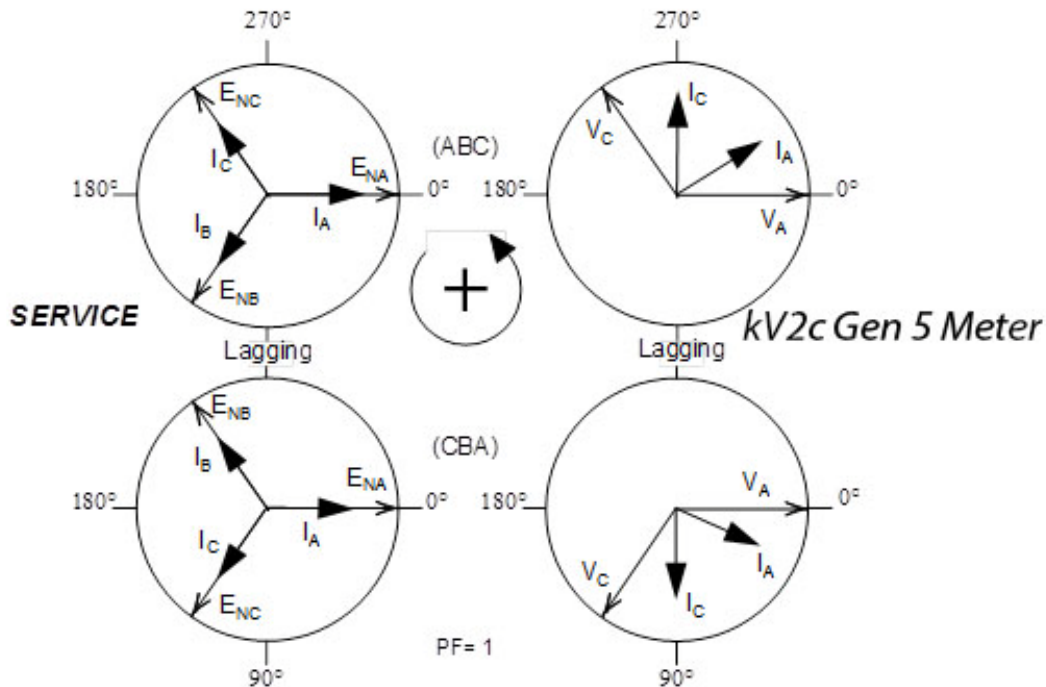
Form 45S (4W-Y)

kV2c Gen 5 Site Analysis

Form 45S (Transformer Rated)



NOTE: For 3-wire CTs Rated x&x:5, use 2x:5 when determining the Transformer Factor



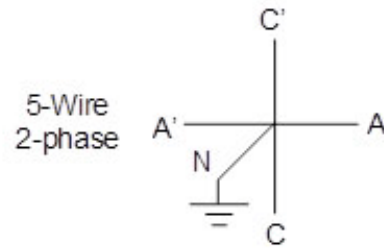
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

4-wire, wye, 2-element

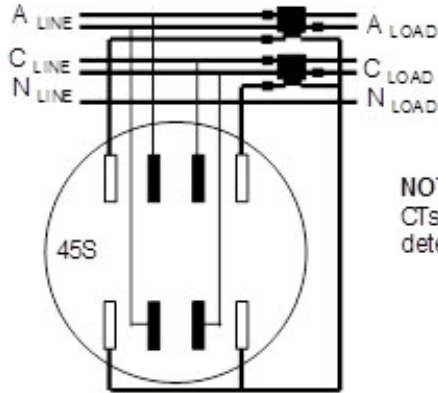
Form 45S (5W-2 ϕ)

kV2c Gen 5 Site Analysis

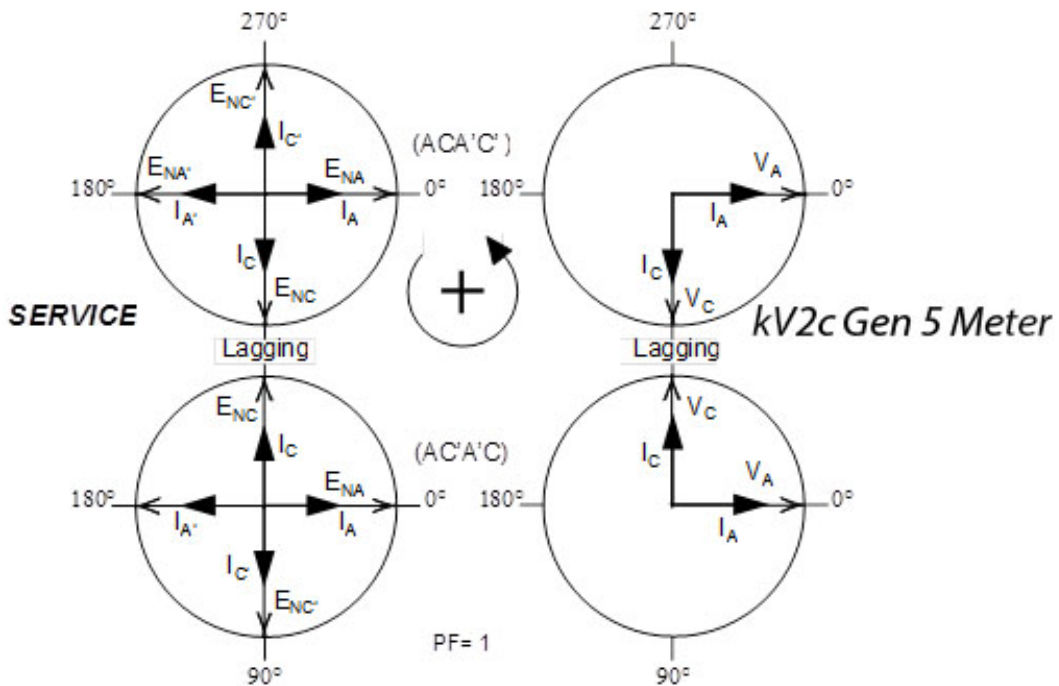
Form 45S (Transformer Rated)



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 the multiplier.



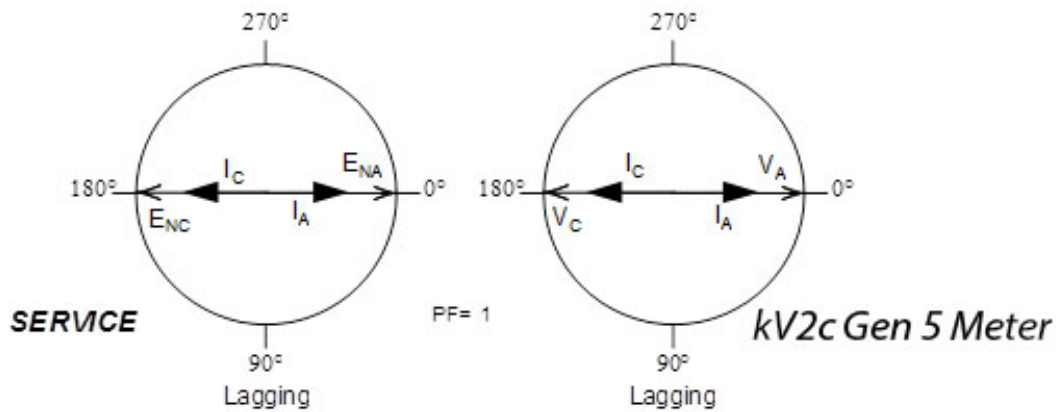
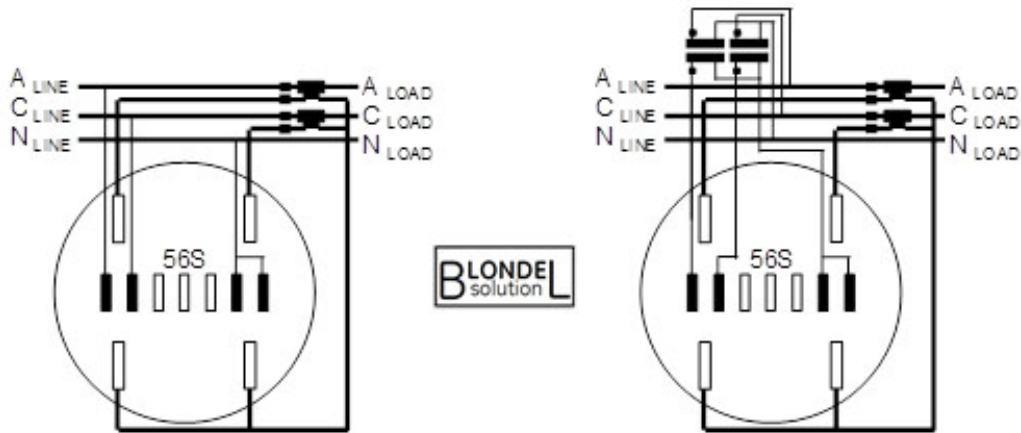
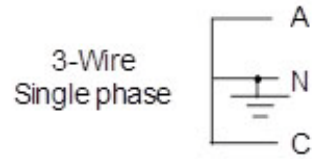
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

5-wire, 2-phase, 2-element

Form 56S (3W-1 ϕ)

kV2c Gen 5 Site Analysis

Form 56S (Transformer Rated)



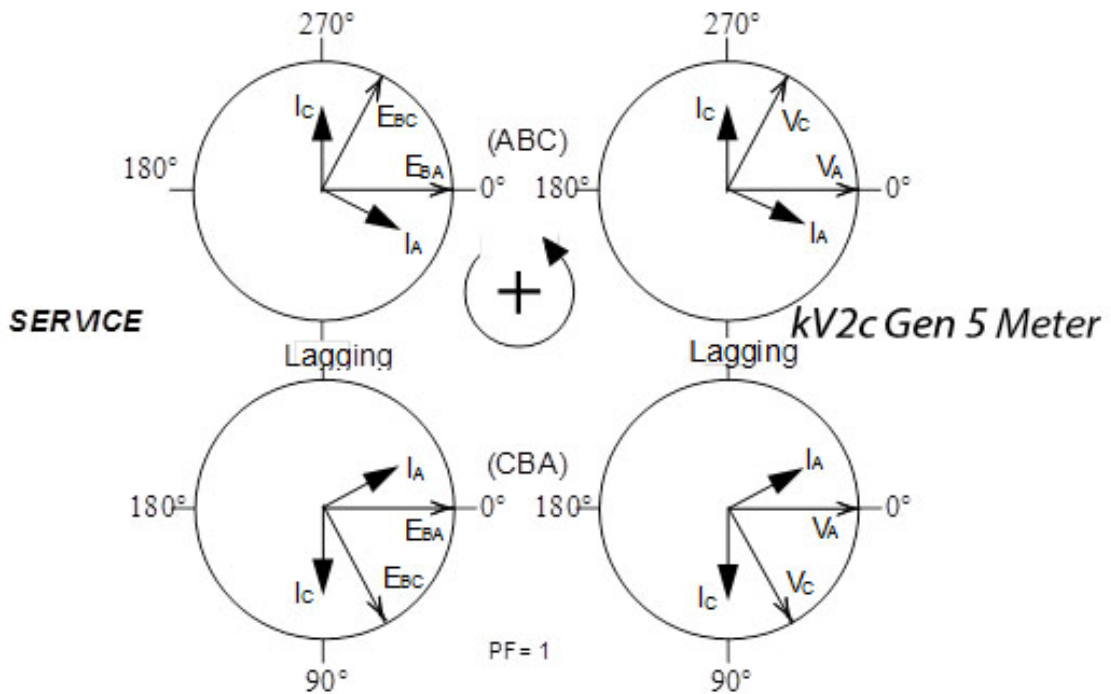
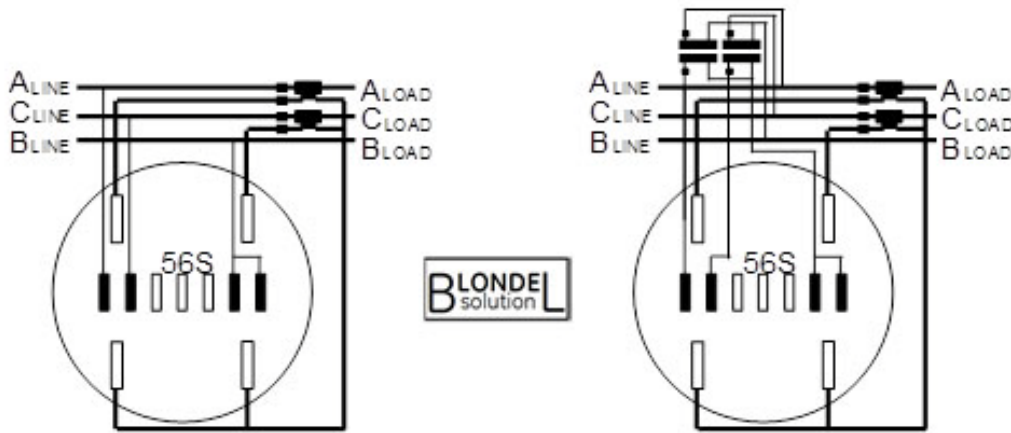
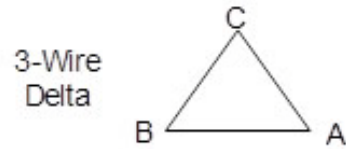
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

3-wire, 1-phase, 2-element

Form 56S (3W-Δ)

kV2c Gen 5 Site Analysis

Form 56S (Transformer Rated)



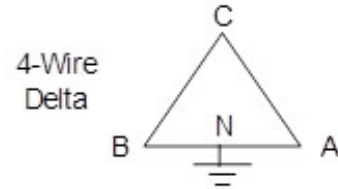
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

3-wire, 3-phase, 2-element

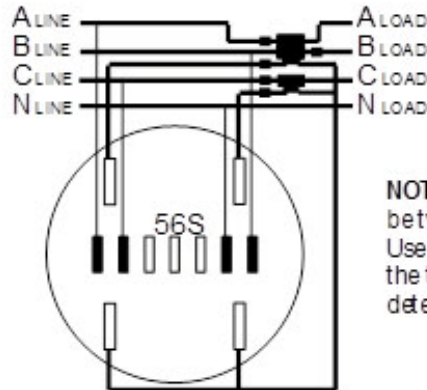
Form 56S (4W-Δ)

kV2c Gen 5 Site Analysis

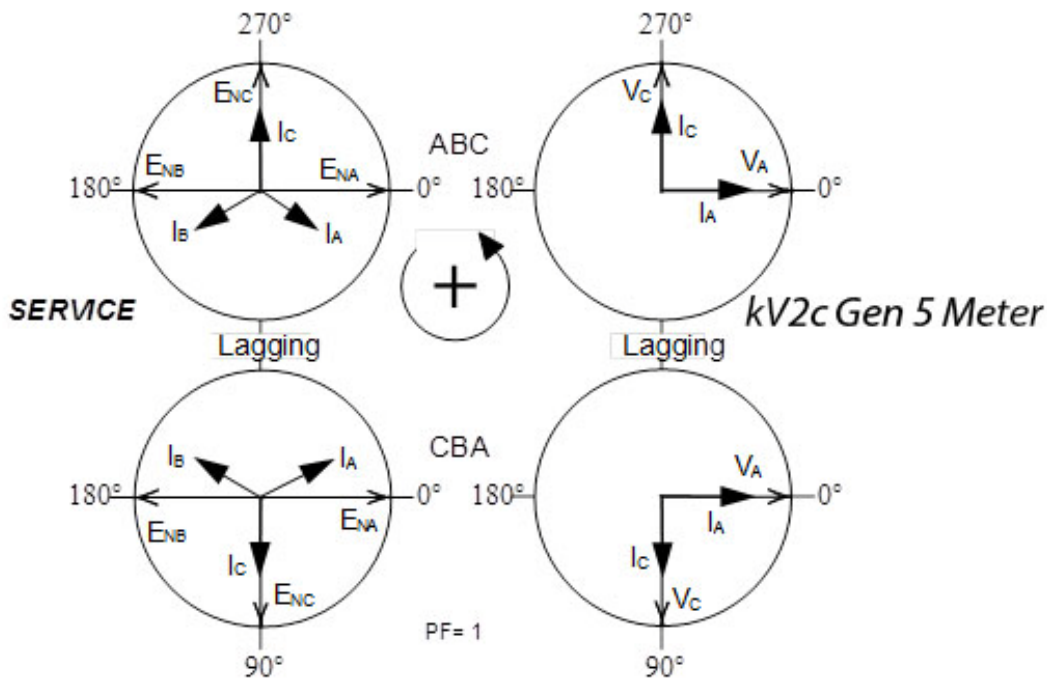
Form 56S (Transformer Rated)



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



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



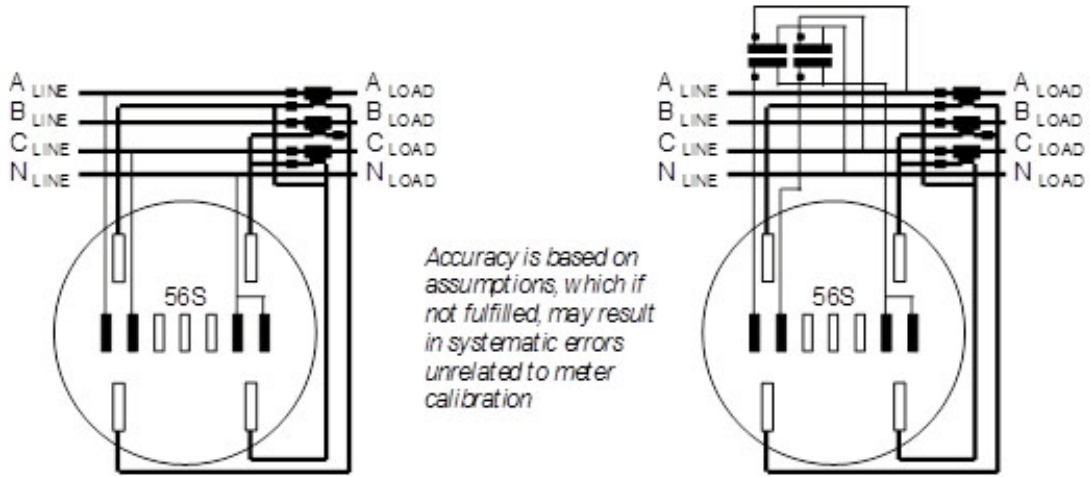
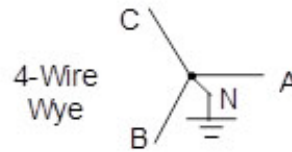
Actual installation procedures, materials, equipment, and connections must conform to applicable codes and standards.

4-wire, delta, 2-element

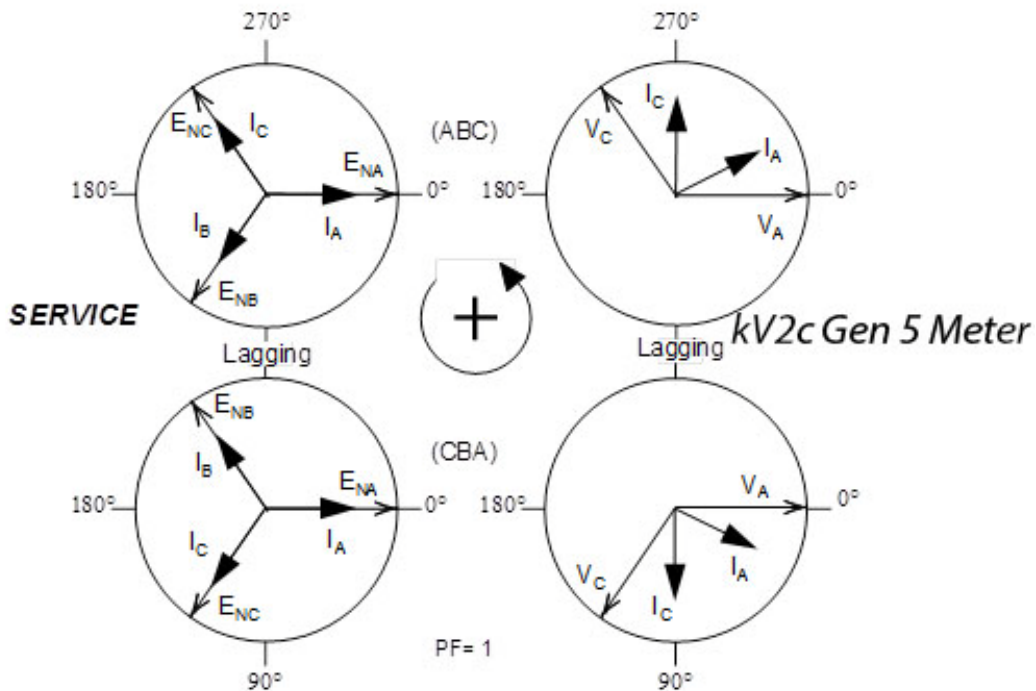
Form 56S (4W-Y)

kV2c Gen 5 Site Analysis

Form 56S (Transformer Rated)



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



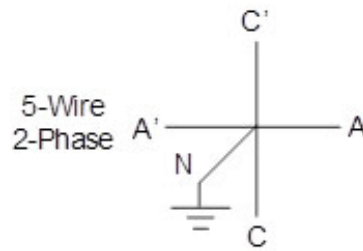
Actual installation procedures, materials, equipment and connections must conform to applicable codes and standards.

4-wire, wye, 2-element

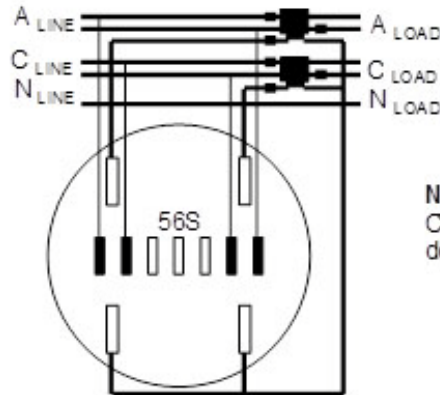
Form 56S (5W-2φ)

kV2c Gen 5 Site Analysis

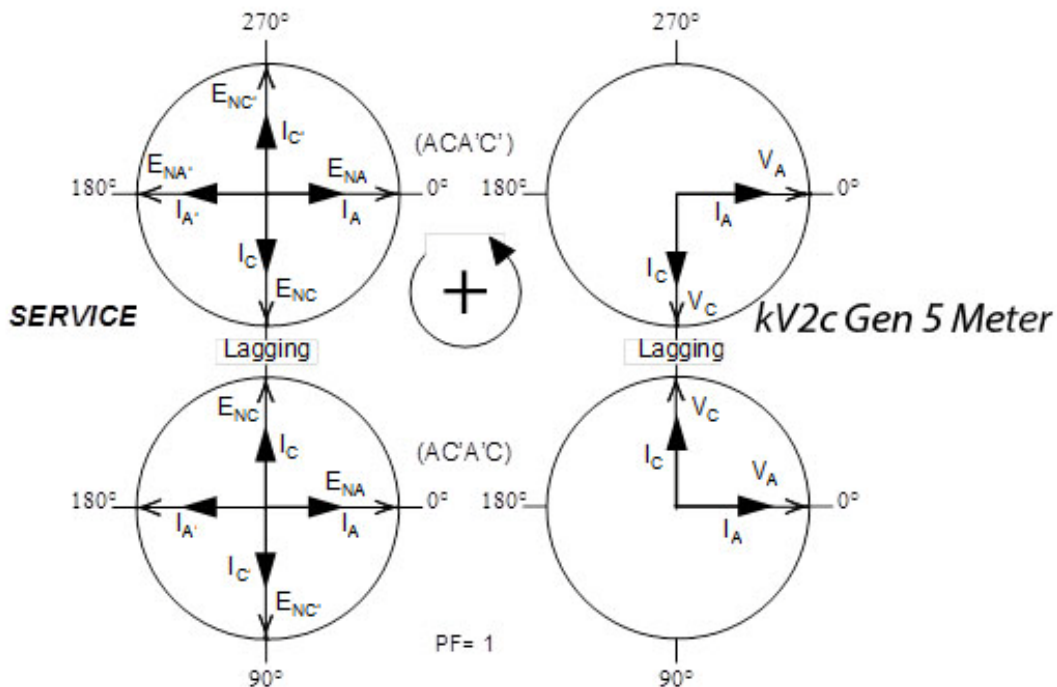
Form 56S (Transformer Rated)



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 the multiplier.



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

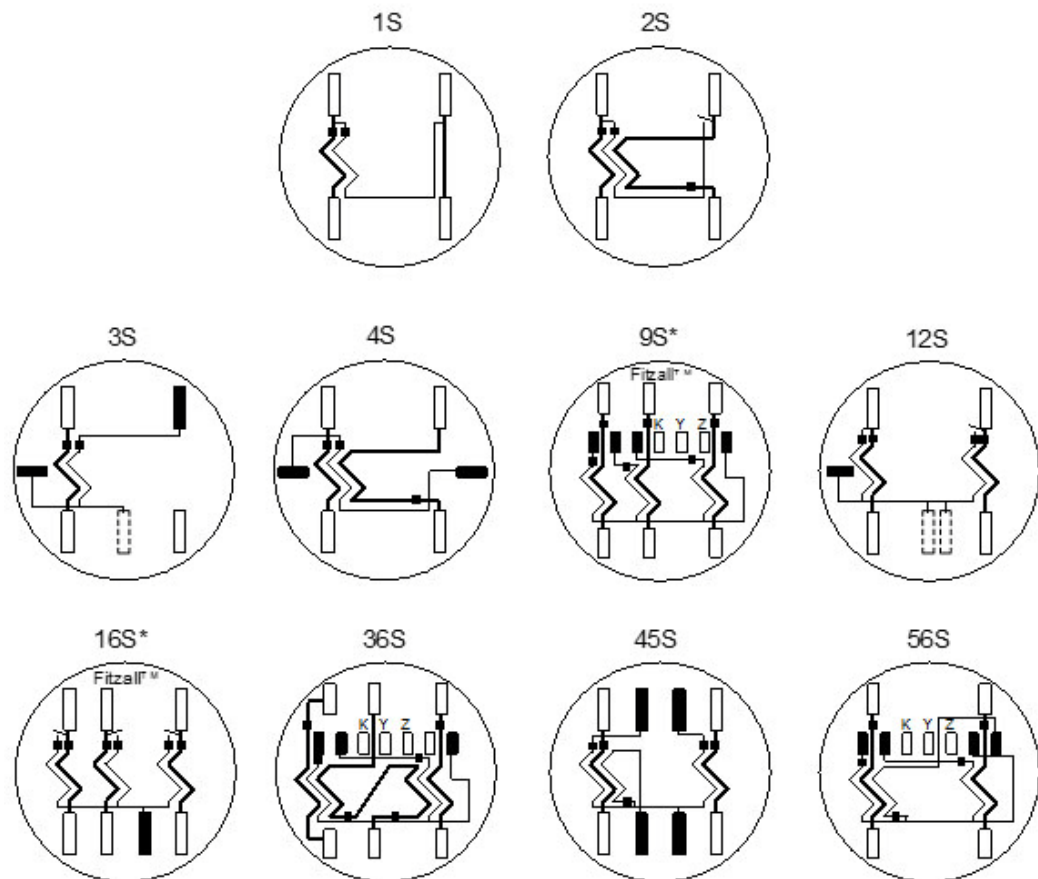
5-wire, 2-phase, 2-element

CHAPTER

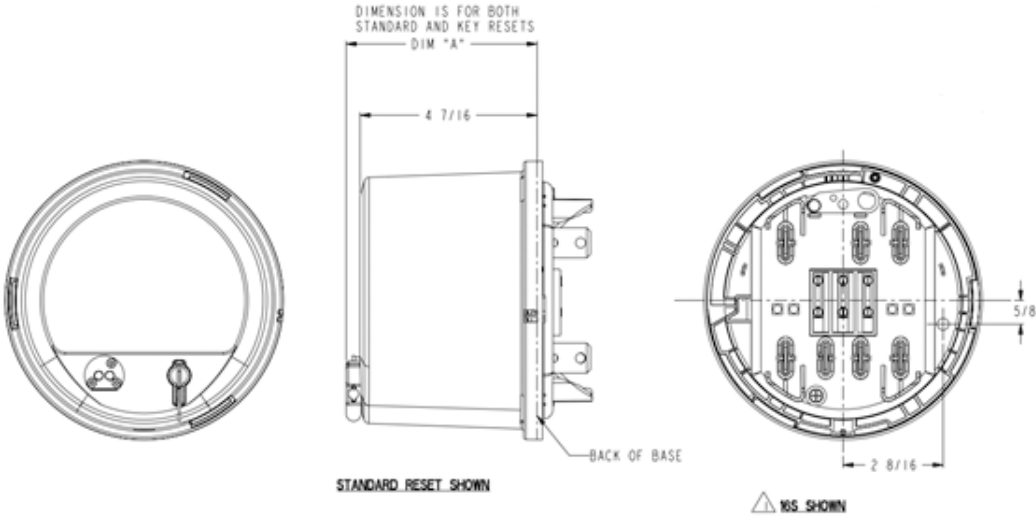
7

DIAGRAMS

ANSI Meter Diagrams.

ANSI C12.10 Internal Connections

Meter Outline Drawings



OPTIONS	LEXAN
	DIM "A" (APPROX)
STANDARD RESET	4 13/16
KEYLOCK	5 1/16

Index

A

AMI/AMR 4, 5, 6, 7, 12, 18, 19, 45

B

battery 3, 6, 8, 12, 37, 38, 39, 41, 42, 52, 53, 54
board

- communications option 6, 13, 54, 55, 56
- input/output option 4, 7, 8, 13, 30, 52, 54, 56, 57, 58, 59
- multiple input/output 17
- option 5, 13, 15, 44, 54
- remote disconnect relay control option 4, 7, 13, 19
- simple input/output 17
- test 37

D

demand 7, 8, 12, 33, 34, 41, 42, 46, 48, 49, 50, 52, 53

- continuous cumulative 18
- continuously cumulative 8
- cumulative 8, 18
- distortion 10, 28, 49
- high 10
- instantaneous 34, 42
- load profile 7, 8, 10, 30, 46, 51, 52
- maximum 8, 31, 33, 34
- measurements 8
- overload 11, 42, 46
- reset 3, 19, 42, 43, 47, 50
- rolling 8, 31, 35
- thermal 8

display 3, 9, 10, 11, 12, 18, 19, 22, 23, 24, 26, 27, 28, 29, 30, 31, 33, 34, 35, 38

- Alternate 8, 11, 18, 20, 32

- Frozen 18, 19, 31–32

- Normal 11, 18, 19–20, 25, 31, 32

- Site Genie 9, 11, 18, 21, 22, 24, 25, 32

- Test 11, 18, 19, 26, 27, 31, 34

display switch 3, 19, 22, 31, 32, 34, 41

L

load profile 8, 12, 39, 40, 42, 50, 51

- huge 47

- recording 12, 33, 39, 40, 50, 51

O

output 7, 8, 10, 30, 50, 57, 59

output cable 44, 57, 58

R

real-time display 49

real-time pricing 7, 8, 46

- alert 11

RMA 1

S

support 1

T

Timebase 6

time-of-use 3, 6, 7, 9, 10, 11, 12, 19, 20, 30, 39, 40, 45, 46, 50, 51, 52, 53, 54

- load profile 7, 9, 52

