Overview

4 Channel Power Meter, 0.1 Class, Multiple Communication Protocols

The N2-KW320 meter combines high performance with ease of integration to provide a power and energy monitoring solution with 400 metering parameters. The N2-KW320 series multifunction digital power meter is designed using modern MCU and DSP technology and its tamper-proof design is approved for revenue applications. It integrates three-phase energy measuring and displaying, energy accumulating, power quality analysis, malfunction alarming, data logging and network communication. The meter measures bidirectional, four quadrants kWh and kvarh. It provides maximum/minimum records for power usage and power demand parameters. All power and energy parameters can be viewed remotely via Accuview Utility Software to monitor various parameters. The meter comes standard to be mounted in a 4" Round or an IEC 92mm DIN Square form or has the flexibility to be mounted to 35mm DIN rail with the N2-AXM-DIN adapter (See Accessories Ordering).

In addition, the KW320 also has an optional upgrade that includes a NEMA 4X panel enclosure, pre-wired and labeled terminal for CT's, terminal blocks for voltage input, and industrial grade fuses. The KW320-P1-D-W-PC-A optional upgrade is an all-in-one Plug n' play Pre-Wired Panel Enclosure that provides a perfect solution for retrofit projects where metering space is not pre-designed in an electrical distribution panel. The meter supports user selectable RS-485 serial Modbus-RTU, BACnet™ MS/TP, multiple Ethernet communication protocols, and Wi-Fi connection allows seamless integration with data acquisition systems. This product provides demand measurement of Current, Active Power, Reactive Power and Apparent Power – see table 1 for all parameters monitored and metered. It also provides demand forecasting as well as the peak demand. The N2-KW320 series meter can record the time and event regarding important parameter events such as the run time of the meter and alarm functions. The N2-KW320 meter will accept both 333mV and Rogowski coil CT inputs (Input Field Selectable). Meters come standard with a four channel CT input to accurately measure neutral current. CTs are sold separately as shown on the Split-Core, Solid-Core and Rogowski Current Transformer product data sheets.

Applications: Tenant Billing, Data Centers, Sub-Metering Electrical Panel, Equipment Load Monitoring, Industrial Applications, Predicted Maintenance, Renewable Energy, Overhead Cost Reduction, "NET ZERO" Buildings, LEED Buildings, Green Buildings, and Refrigeration

The N2-KW320 Power Meters are covered by a Five (5) Year Limited Warranty

Part Numbers

N2-KW320-P1-D-W-XX-A	**N2-KW320-P1-D-W-PC-A**	**N2-KW320Q-P1-D-W-XX-A**
N2-KW320Q-P1-D-W-PC-A	**N2-USB-RS485**	**N2-AK-03**
N2-AXM-DIN		

Product Specifications

Service Type:	Single Phase, 3 Phase – Four Wire (WYE), Three Phase – Three Wire (Delta)
Power[1]:	100 - 415VAC, 50/60Hz, 100 - 300VDC on terminals L and N
Burden:	5W
Withstand:	3250VAC, 50/60Hz for 1 minute
Power Supply Wiring:	AWG22-16 (0.6-1.5mm2)
AC Fuse Protection:	External 1A/250VAC Fuse ***(Recommended)***
Rated Voltage:	100-400VAC Line to Neutral (L-N) or 100-690VAC Line to Line (L-L) RMS for three phase or 100-400VAC RMS for single phase
Number of CT Inputs:	4 (L1, L2, L3, and Neutral)
Revenue Grade Accuracy:	**Active Energy -** Class 0.1s (According to IEC 62053-22) and Class 0.1s (According to ANSI C12.20) **Reactive Energy -** Class 2 (According to IEC 62053-23) – See Table 2 for parameter accuracy, resolution, and range
Voltage Channels:	400 Volts AC (L-N), 690 VAC (L-L), 45Hz - 65Hz, 300Hz - 500Hz
Withstand Voltage:	1500VAC Continuous, 2500VAC, 50/60Hz for 1 Minute
Input Impedance:	2M ohm per Phase
Pickup Voltage:	10VAC
Current Channels:	4 Channels, 0.400 VAC max, 333 mV CTs or 0 to 6000 Amps with Rogowski Coils (Field Selectable)
Maximum Current Input:	120% of current sensor rating (mV CTs) to maintain accuracy. Up to 6000 Amps w/ Rogowski Coils
Harmonic Resolution:	63rd Harmonic (50Hz or 60Hz type) or 15th Harmonic (400Hz type)
Measurement Type:	Real-time, True RMS measurement of instantaneous Voltage, Current, Power, Frequency, Harmonics, Phase Angle, Demand, Unbalance Factor, Running Time, and Power Factor
Line Frequency:	50/60 Hz
Measurement Data Parameters:	See Table 1
Real Time Parameter Update Rate:	<20 ms
Accumulated Parameter Update Rate:	1 Sec
LCD Display:	Multiple Display Modes (Important Parameter's, All Parameter's, Settings Display Modes)
Communication Protocols:	**Serial RS-485:** Modbus RTU and BACnet MS/TP **Ethernet:** BACnet™ Over IP, IEC 61850, Modbus®-TCP, HTTP/HTTPs Webserver, SMTP Email, SNMP, HTTP/HTTPs Push, FTP Post, sFTP Server, WiFi
Maximum Distance:	1200 meters (3,937 Feet) with data range of 100K bits/second or less
Termination Resistor:	120 Ohm to 300 Ohm 1/4W Resistor *(Not Included); (Installed at end of RS-485 Comm Bus)*
Supported Baud Rates:	**BACnet MS/TP Protocol:** 9600, 19200, 38400, 76800 Baud Rate (38400 BACnet Default) **Modbus RTU Protocol:** 1200, 2400, 4800, 9600, 19200, 38400 Baud Rate (19200 Modbus Default)
Max Station:	127 MS/TP Masters (MAC Addresses is 0 to 127)
BACnet Device Instance Number:	1 *(Default); Field adjustable from 1 to 4194302*
Modbus Data Bits / Parity / Stop Bit	8 / None, Even, Odd / 2, 1

Datalogging Storage:	8 GB
Enclosure Material / Flammability Rating:	Polycarbonate / UL 94V-0
Operating Temperature Range:	-13 to 158oF (-25 to 70ºC)
Storage Temperature Range:	-40 to 185oF (-40 to 85oC)
Operating / Storage Humidity Range:	5 to 95%, non-condensing
Wiring Connections:	Screw Connections
Wire Size:	14-22 AWG (2.5 to 0.34 mm^2)
Mounting:	ANSI C39.1 (4" Round) or an IEC 92mm DIN (Square) form.
Utility Software:	AcuView Utility Software, Windows Based; *(USB-RS485 converter is required to connect to computer)*
Agency Approvals:	BTL Certified, CE, RoHS2, cULus Listed (File # E359521)
Standard Compliance:	**Measurement Standard:** IEC 62053-22; ANSI C12.20 **Environmental Standard:** IEC 60068-2 **Safety Standard:** IEC 61010-1, UL 61010-1, IEC 61557-12 **EMC Standard:** IEC 61000-4/-2-3-4-5-6-8-11, CISPR 22, IEC 61000-3-2, IEC 61000-6-2/4 **Outlines Standard:** DIN 43700, ANSI C39.1
Face Dimensions (L x W x H):	3.80" (96 mm) x 3.80" (96 mm) x 1.99" (50.7 mm)
Power Meter Weight:	0.77 lbs. (350g)
KW320 Panel Upgrade *(Optional)*	
NEMA Rating:	NEMA 4X
Enclosure Material:	Polycarbonate
Fuse:	600 VAC/1A
Wiring:	Two pluggable pre-cut holes to feed wiring, fused terminal blocks for voltage connections pre-installed, color-coded and labelled
Flammability Rating:	94-V0
Enclosure Dimensions (L x W x H):	7.88" (200 mm) x 11.81" (300 mm) x 7.34" (186.5 mm)
Enclosure Product Weight:	8 lbs. (3.63 kg)

NOTE A power supply can be an independent power supply and a fuse (typical 1A/250Vac) is suggested to be used when connecting the power supply to the meter.

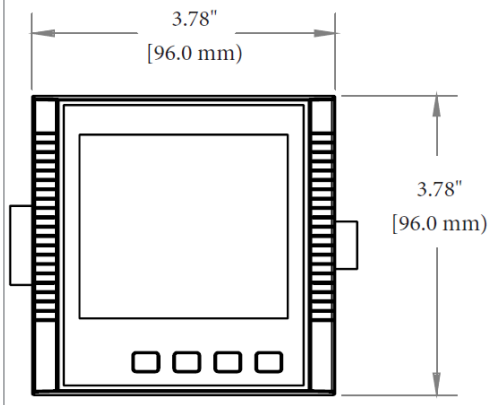
Table #1

CATEGORY		ITEM	Parameters
Metering	Real time metering	Phase Voltage	V1, V2, V3, Vlnavg
		Line Voltage	V12, V23, V31, Vllavg
		Current	I1, I2, I3, In, Iavg
		Power	P1, P2, P3, Psum
		Reactive Power	Q1, Q2, Q3, Qsum
		Apparent Power	S1, S2, S3, Ssum
		Power Factor	PF1, PF2, PF3, PF
		Frequency	F
		Load Features	Load Features
		Four Quadrant Powers	Four Quadrant Powers
	Energy & demand	Energy	Ep_imp, Ep_exp, Ep_total, Ep_net, Epa_imp, Epa_exp, Epb_imp, Epb_exp, Epc_imp, Epc_exp
		Reactive Energy	Eq_imp, Eq_exp, Eq_total, Eq_net, Eqa_imp, Eqa_exp, Eqb_imp, Eqb_exp, Eqc_imp, Eqc_exp
		Apparent Energy	Es, Esa, Esb, Esc
		Demand	Dmd_P, Dmd_Q, Dmd_S, Dmd_I1, Dmd_I2, Dmd_I3
Monitoring	Power quality	Voltage Unbalance Factor	U_unbl
		Current Unbalance Factor	I_unbl
		Voltage THD	THD_V1,THD_V2,THD_V3, THD_Vavg
		Current THD	THD_I1, THD_I2, THD_I, THD_Iavg
		Individual Harmonics	Harmonics 2nd to 63rd (50H or 60Hz) Harmonics 2nd to 15th (400Hz)
		Voltage Crest Factor	Crest Factor
		TIF	THFF
		Current K factor	K Factor
	Statistics	MAX with Time Stamp MIN with Time Stamp	Each phase of V & I; Total of P, Q, S, PF & F; Demand of I1, I2, I3, P, Q&S; Each phase THD of V & I; Unbalance factor of V & I
Others	Alarm	Over/Under Limit Alarm	V, I, P, Q, S, PF, V_THD & I_THD Each Phase and Total or Average; Unbalance Factor of V & I; Load Type; Analog Input of Each Channel; Demand of I1, I2, I3, P, Q&S; Reverse phase sequence; DI1~DI28
	Power quality event logging (KW320Q model only)	Sag/Dips, Swell	Voltage
	Onboard memory size	Memory	8GB on all 4 models
	Communication	RS485 Port, Half Duplex, Optical Isolated	Modbus®-RTU Protocol
	Time	Real Time Clock	Year, Month, Date, Hour, Minute, Second

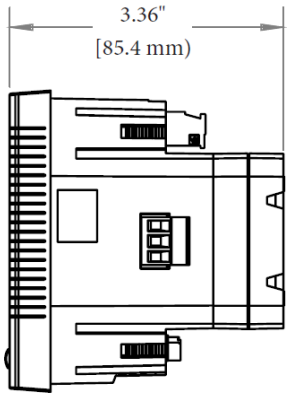
Table #2

METERING				
Parameters		**Accuracy**	**Resolution**	**Range**
Voltage		0.1%	0.1V	10V~1000kV
Current		0.1%	0.001A	5mA~50000A
Power		0.1%	1W	-9999MW~9999MW
Reactive Power		0.1%	1var	-9999Mvar~9999Mvar
Apparent Power		0.1%	1VA	0~9999MVA
Power Demand		0.1%	1W	-9999MW~9999MW
Reactive Power Demand		0.1%	1var	-9999Mvar~9999Mvar
Apparent Power Demand		0.1%	1VA	0~9999MVA
Power Factor		0.1%	0.001	-1.000~1.000
Frequency		0.001%	0.001Hz	45.00~65.00Hz (50 or 60Hz type) 300.00Hz~500.00Hz (400Hz type)
Energy	Primary	0.1%	0.1kWh	0-99999999.9kWh
	Secondary	0.1%	0.001kWh	0-999999.999kWh
Reactive Energy	Primary	0.1%	0.1kvarh	0-99999999.9kvarh
	Secondary	0.1%	0.001kvarh	0-999999.999kvarh
Apparent Energy	Primary	0.1%	0.1kVAh	0-99999999.9kVAh
	Secondary	0.1%	0.001kVAh	0-999999.999kVAh
Harmonics		1.0%	0.1%	
Phase Angle		2.0%	0.1°	0.0°~359.9°
Unbalance Factor		2.0%	0.1%	0.0%~100.0%
Running Time			0.01h	0~9999999.99h

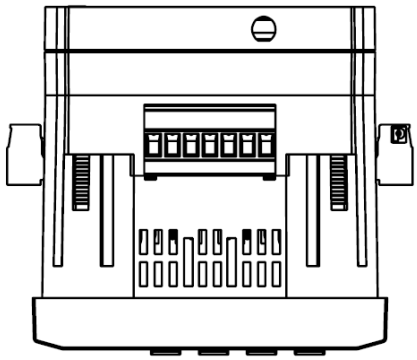
Product Drawings



FRONT VIEW

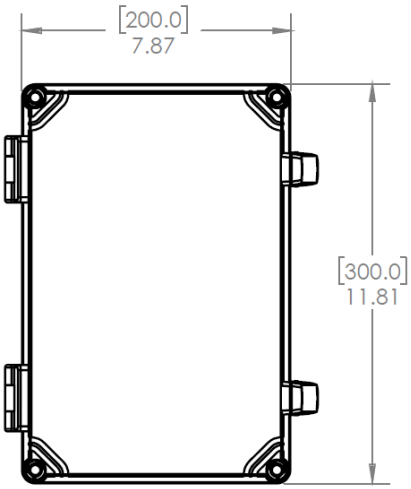


SIDE VIEW

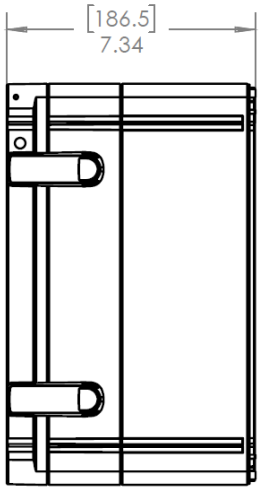


TOP VIEW

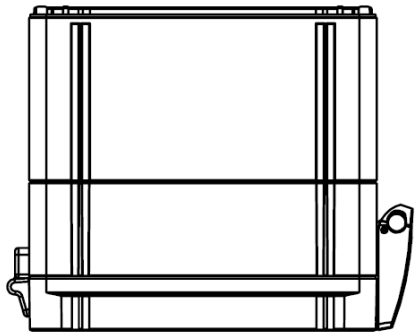
Power Meter Panel Upgrade



FRONT VIEW



SIDE VIEW



TOP VIEW

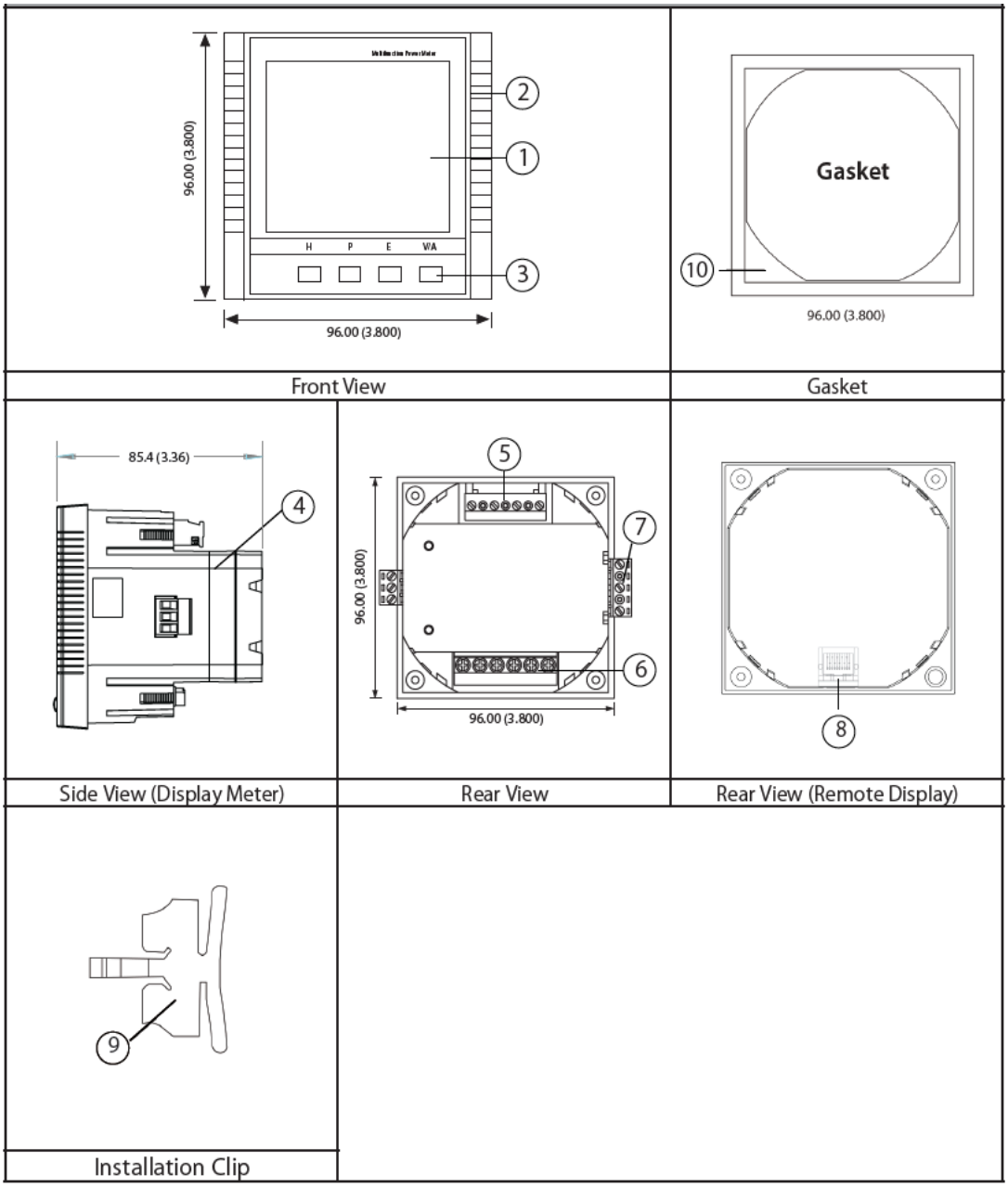
Standard Ordering

Part #	mV CT Input	Rogowski Coil Input	Meter Only	Panel Upgrade	Waveform Capture
N2-KW320-P1-D-W-XX-A	X	X	X		
N2-KW320-P1-D-W-PC-A	X	X		X	
N2-KW320Q-P1-D-W-XX-A	X	X	X		X
N2-KW320Q-P1-D-W-PC-A	X	X		X	X

Accessories Ordering

Part #	Description
N2-AXM-DIN	KW320 DIN Rail Adapter
N2-USB-RS485	RS485 to USB Converter
N2-AK-03	Three Fuse Pack; Inline Fuse Kit; 600V, 2A; Slow Blow

Mounting Instructions



Part Name	Description
1. LCD Display	Large bright white backlight LCD display
2. Front Casing	Visible portion (for display and control) after mounting onto a panel
3. Key	Four keys are used to select display and set
4. Enclosure	The KW320 series meter enclosure is made of high strength anti-combustible engineering plastic
5. Voltage Input Terminals	Used for voltage input
6. Current Input Terminals	Used for current input
7. Power Supply Terminals	Used for control power input
8. Communication Terminals	Communication output
9. Installation Clip	Used for fixing the meter to the panel
10. Gasket	Insert the gasket in between the meter and the cutout to cover up gaps from the round hole

Installation Methods

Environmental:

Before installation, please check the environment, temperature and humidity to ensure the KW320 series meter is being placed where optimum performance will occur.

Temperature:

Operation: -25 to 70°C (-13 to 158°F) Storage: -40 to 85°C (-40 to 185°F) Humidity:

5% to 95% non-condensing.

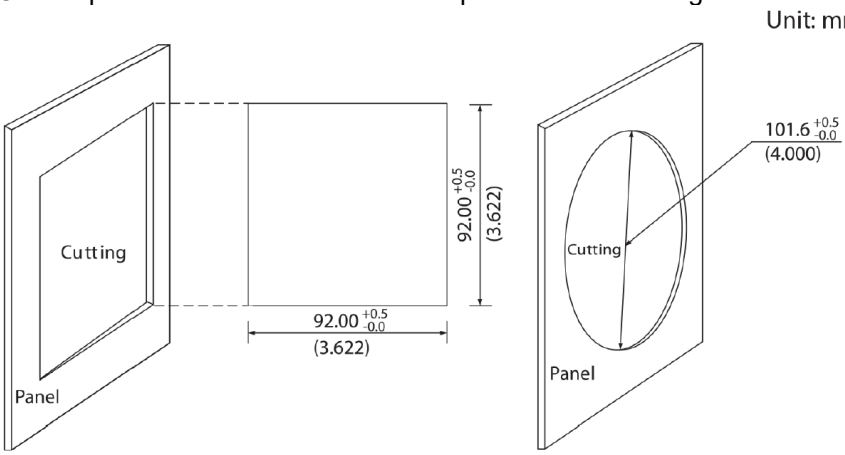
Location:

KW320 series meter should be installed in a dry and dust free environment. Avoid exposing the meter to excessive heat, radiation and high electrical noise sources.

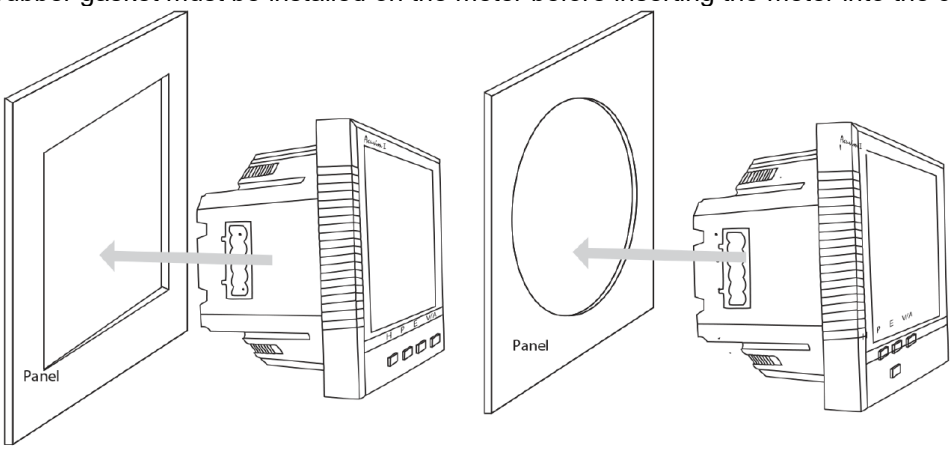
Installation Steps:

The KW320 series meter can be installed into a standard ANSI C39.1 (4" Round) or an IEC 92mm DIN (Square) form.

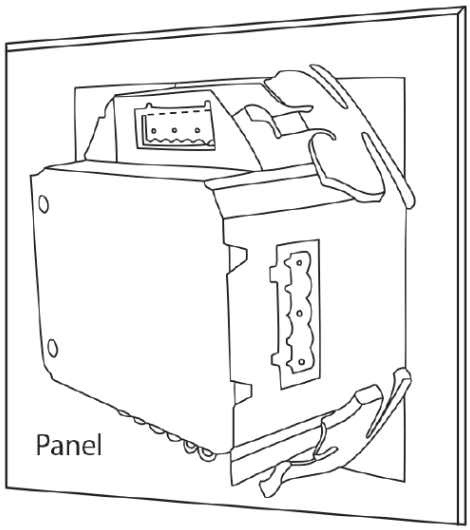
1. Cut a square hole or round hole on the panel of the switch gear. The cutting size is show in the figure below.



2. Remove the clips from the meter and insert the meter into the square hole from the front side. Please note: optional rubber gasket must be installed on the meter before inserting the meter into the cut out.



3. Install clips on the back side of the meter and secure tightly to ensure the meter is affixed to the panel.



NOTE The display meter and the remote display unit have the same installation method. The DIN rail meter is simply installed on a 35mm DIN rail.

Wiring Instructions

Warning	• Installation of the meter must be performed by qualified personnel only, who follow standard safety precautions through the installation procedures. Those personnel should have appropriate training and experience with high voltage devices. Appropriate safety gloves, safety glasses and protective clothing are recommended. • During normal operation, dangerous voltage may flow through many parts of the meter, including terminals, and any connected CTs (Current Transformers) and PTs (Potential Transformers) and their circuits. All primary and secondary circuits can, at times, produce lethal voltages and currents. AVOID contact with any current- carrying surfaces. • The meter and its I/O output channels are NOT designed as primary protection devices and shall NOT be used as primary circuit protection or in an energy limiting capacity. The meter and its I/O output channels can only be used as secondary protection. AVOID using the meter under situations where failure of the meter may cause injury or death. AVOID using the meter for any application where risk of fire may occur. • All meter terminals should be inaccessible after installation. • Do NOT perform Dielectric (HIPOT) test to any inputs, outputs or communication terminals. High voltage testing may damage electronic components of the meter. • Applying more than the maximum voltage the meter and/or its modules can withstand will permanently damage the meter and/or its modules. Please refer to the specifications for all devices before applying voltages.

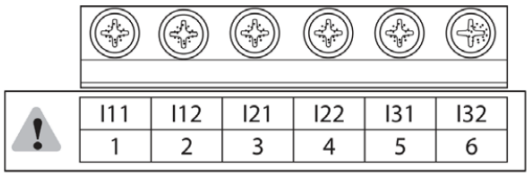
Warning	• When removing meter for service, use fuses for voltage leads and power supply to prevent hazardous voltage conditions or damage to CTs. • DISCONNECT DEVICE: The following part is considered the equipment disconnect device. • A SWITCH OR CIRCUIT-BREAKER SHALL BE INCLUDED IN THE INSTALLATION. THE SWITCH SHALL BE IN CLOSE PROXIMITY TO THE EQUIPMENT AND WITHIN EASY REACH OF THE OPERATOR. THE SWITCH SHALL BE MARKED AS THE DISCONNECTING DEVICE FOR THE EQUIPMENT. • IF THE EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.

Tip	• Recommend using a dry cloth to wipe the meter. • THERE IS NO REQUIRED PREVENTIVE MAINTENANCE OR INSPECTION NECESSARY FOR SAFETY. HOWEVER, ANY REPAIR OR MAINTENANCE SHOULD BE PERFORMED BY THE FACTORY.

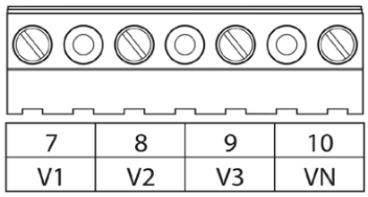
Terminal Strips

There are four terminal strips at the back of the KW320 series meter. The three-phase voltage and current are represented by using 1, 2 and 3 respectively. These numbers have the same meaning as A, B and C or R, S and T used in other literature.

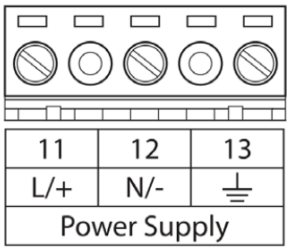
Current Input Terminal Strip



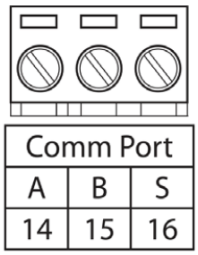
Voltage Input Terminal Strip



Power Supply Terminal Strip



Communication Terminal Strip



Safety Earth Connection Before setting up the meter's wiring, please make sure that the switch gear has an earth ground terminal. Connect both the meter's and the switch gear's ground terminal together. The following ground terminal symbol is used in this user's manual.

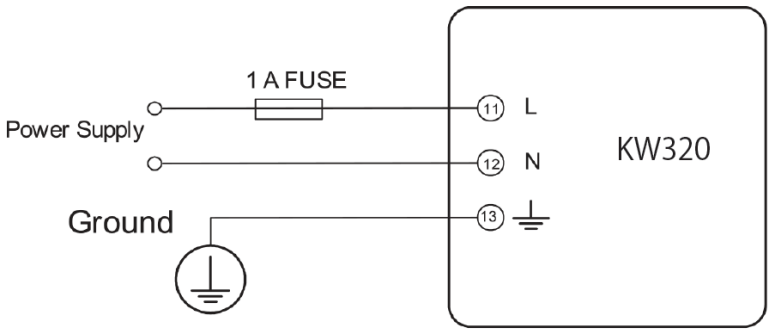
Power Requirements

Control Power:

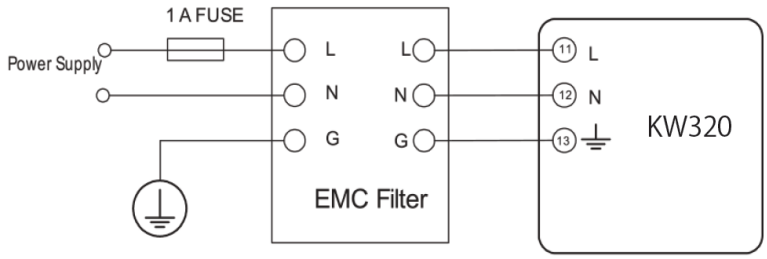
There are 2 options for the Control Power of the KW320 series meter:

Standard: 100~415 VAC (50/60Hz) or 100-300VDC

The meter's typical power consumption is very low and can be supplied by an independent source or by the measured load line. A regulator or an uninterrupted power supply (UPS) should be used under high power fluctuation conditions. Terminals for the control power supply are 11, 12 and 13 (L, N and Ground). A switch or circuit-breaker shall be in close proximity to the equipment, within easy reach of the operator and shall be marked as the disconnecting device for the equipment.



A fuse (typical 1A/250VAC) should be used in the auxiliary power supply loop. No. 13 terminal must be connected to the ground terminal of the switchgear. An isolated transformer or EMC filter should be used in the control power supply loop if there is a power quality problem in the power supply.



Choice of wire of power supply is AWG 22-16 or 0.6-1.5 mm2.

Voltage Input

Maximum input voltage for the KW320 series meter shall not exceed 400LN/690LL VAC rms for three phase or 400LN VAC rms for single phase. Potential Transformer (PT) must be used for high voltage systems. Typical secondary output for PT's shall be 100V or 120V. Please make sure to select an appropriate PT to maintain the measurement accuracy of the meter. When connecting using the star configuration wiring method, the PT's primary side rated voltage should be equal to or close to the line voltage of the system. A fuse (typical 1A/250VAC) should be used in the voltage input loop. The wire for voltage input is AWG16-12 pr 1.3-2.0 mm2.

NOTE In no circumstance should the secondary of the PT be shorted. The secondary of the PT should be grounded at one end. Please refer to the wiring diagram section for further details.

Current Input:

Current Transformers (CTs) are required in most applications. The KW320 series meter supports two CT input types: 333mV (SC) or Rogowski coil (RCT). Meter model selection is determined by which style of current transformer input being used. The CT should be selected to maintain revenue grade accuracy of the system. The distance between CT and the meter should be as short as possible as the length of the CT leads will have an effect on the accuracy.

The meter requires AWG22-14 as the wire size to the current input terminals.

Note: The secondary side of the CT should not be open circuit in any circumstance when the power is on. There should not be any fuse or switch in the CT loop.

When using mV and RCT CT's the secondary leads must not be grounded

VN Connection

VN is the reference point of the KW320 series meter voltage input. Low wire resistance helps improve the measurement accuracy. Different system wiring 20 modes require different VN connection methods. Please refer to the wiring diagram section for more details.

Three Phase Wiring Diagram

This meter can satisfy almost any kind of three phase wiring diagrams. Please read this section carefully before choosing the suitable wiring method for your power system.

Voltage and current input wiring mode can be set separately in the meter parameter setting process. The voltage wiring mode can be set as 3-phase 4-line Wye (3LN), 3-phase 3-line direct connection (3LL), 3-phase 3-line open delta (2LL), single phase 2-line (1LN) and single phase 3-line (1LL). The current input wiring mode can be set as 3CT, 2CT and 1CT.

Voltage Input Wiring

3-Phase 4-Line Wye Mode (3LN):

The 3-Phase 4-Line Wye mode is commonly used in low voltage electric distribution power systems. For voltage lower than 400LN/690LL VAC, power line can be connected directly to the meter's voltage input terminal as shown in Fig 2-9a. For high voltage systems (over 400LN/690LL VAC), PT's are required as shown in Fig 2-9b. The meter should be set to 3LN for both voltage levels.

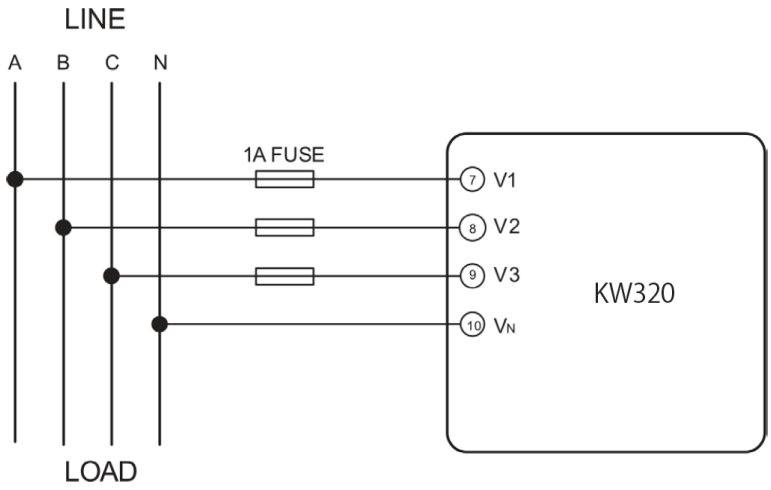


Figure 1: 3LN Direct Connection

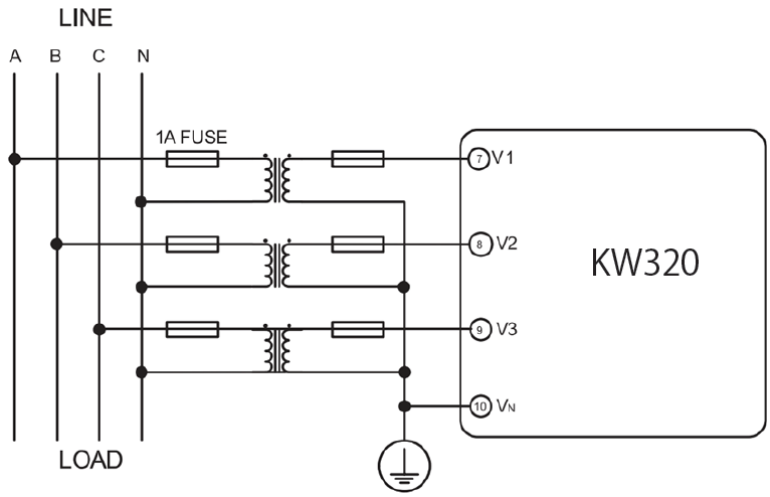


Figure 2: 9b3LN with 3PT

3-Phase 3-Line Direct Connection Mode (3LL):

In a 3-Phase 3-Line system, power line A, B and C are connected to V1, V2 and V3 directly. VN is floated. The voltage input mode of the meter should be set to 3LL.

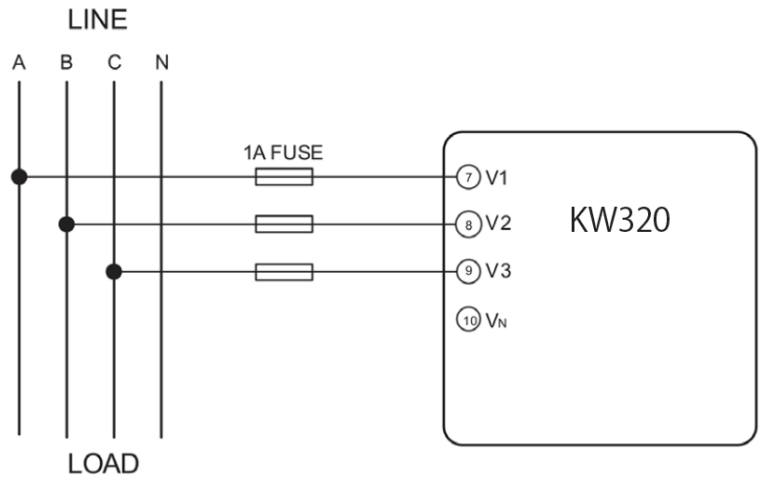


Figure 3: 3LL 3-Phase 3-Line Direct Connection

3-Phase 3-Line Open Delta Mode (2LL):

Open Delta Wiring Mode is often used in high voltage systems. V2 and VN are connected together in this mode. The voltage input mode of the meter should be set to 2LL for this voltage input wiring mode.

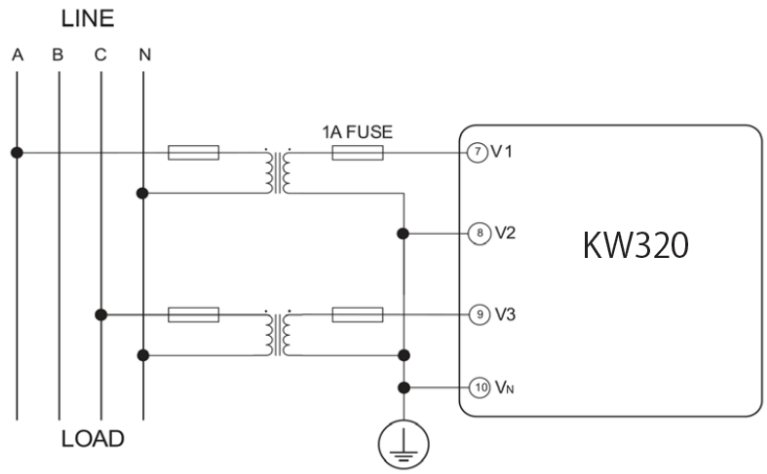


Figure 4: 2LL With 2PT's

Current Input Wiring

3CT:

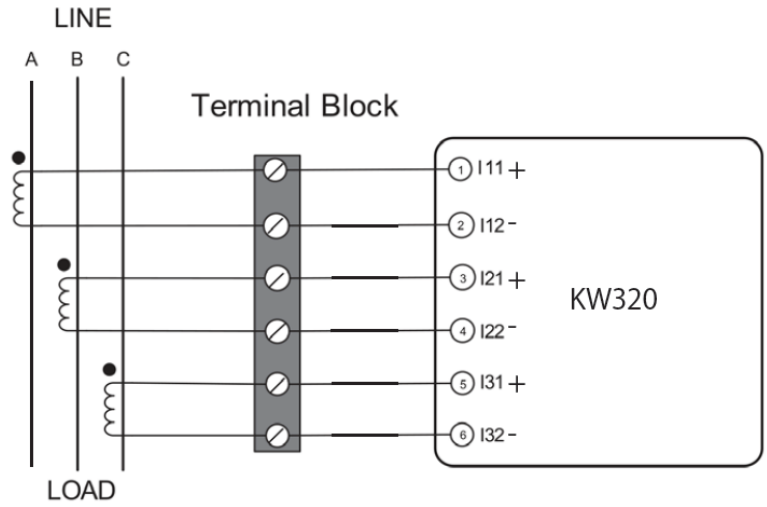


Figure 5: 3CT's

2CT:

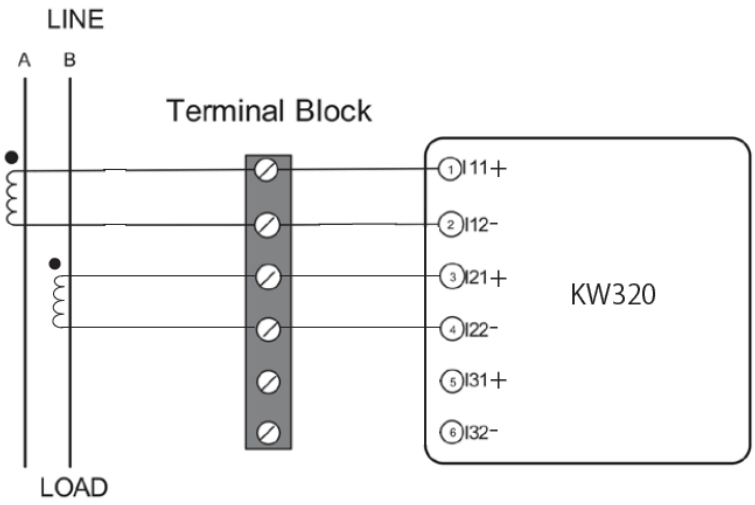


Figure 6: 2CT's

1CT:

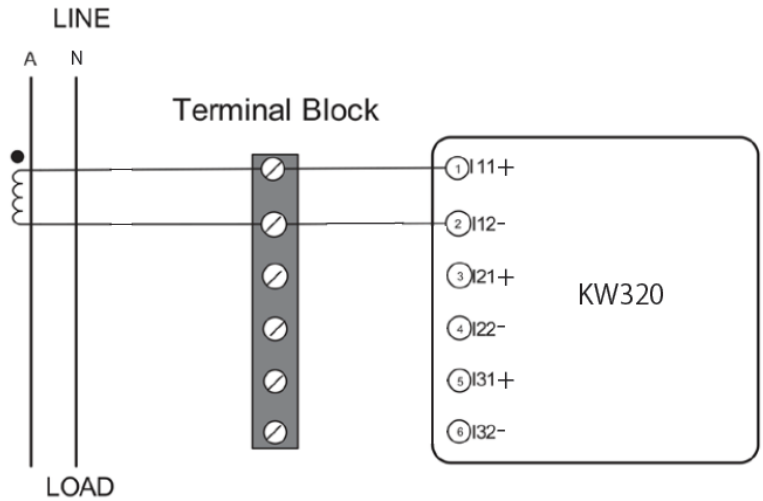


Figure 7: 1CT

Frequently Used Wiring Method

In this section, the most common voltage and current wiring combinations are shown in different diagrams. In order to display measurement readings correctly, please select the appropriate wiring diagram according to your setup and application.

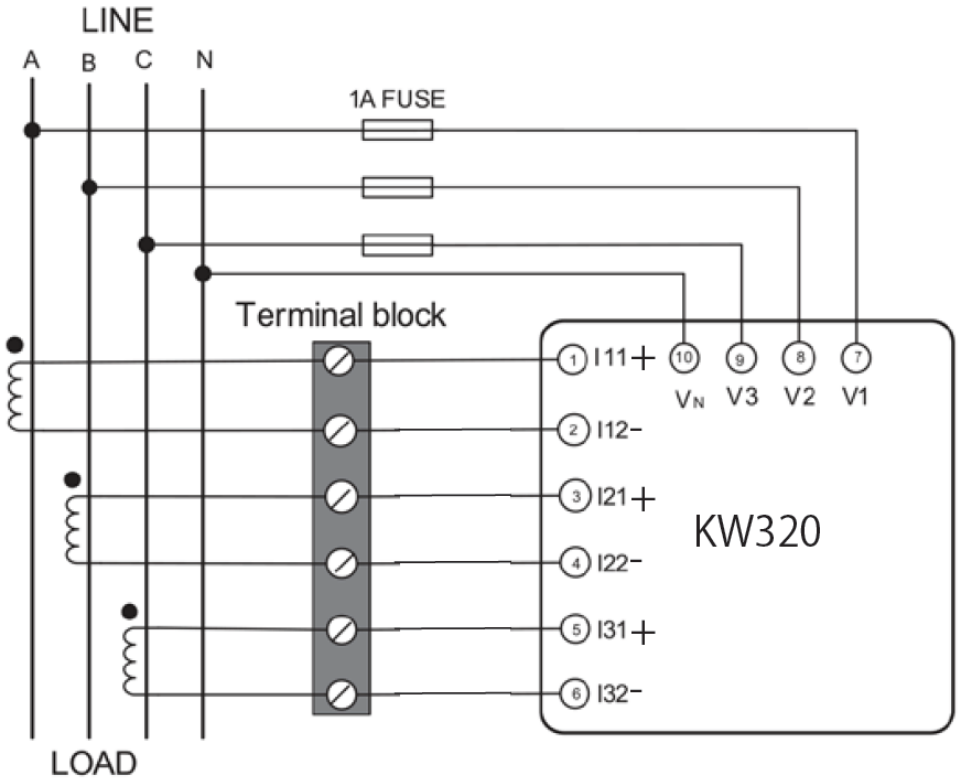


Figure 8: 3LN, 3CT

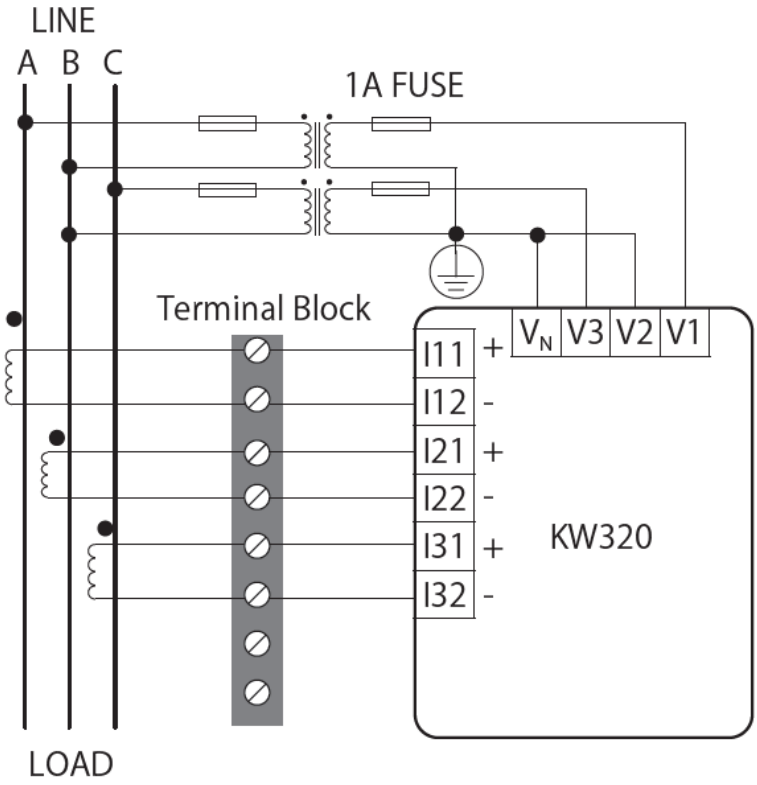


Figure 9: 2LL, 3CT

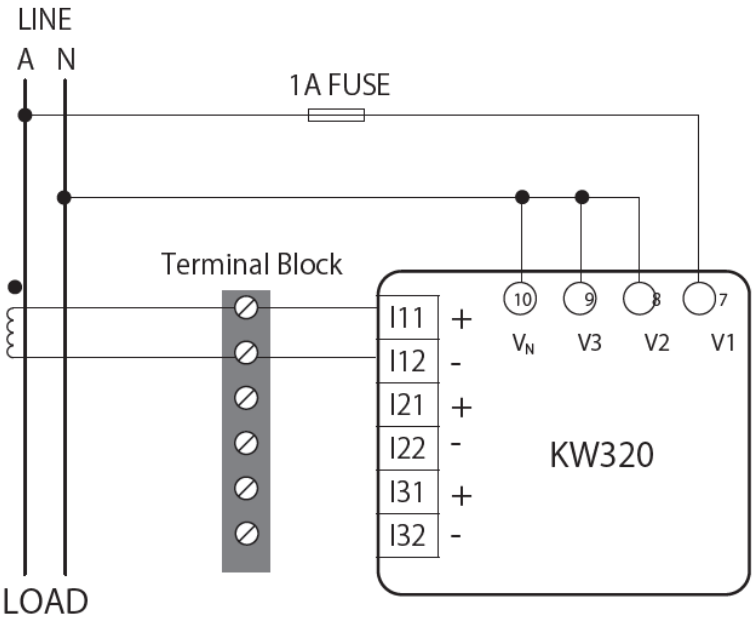


Figure 10: 1LN, 1CT

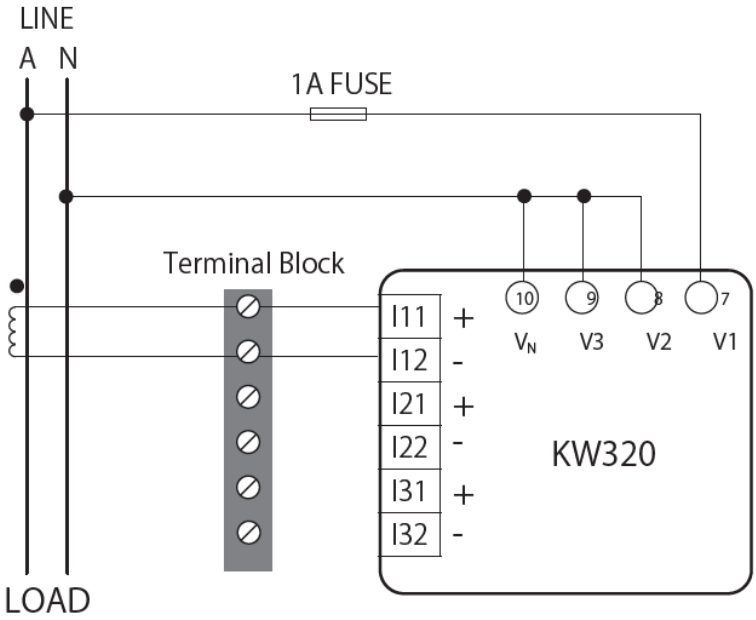


Figure 11: 1LL, 2CT

Communication

The KW320 meter supports user selectable RS-485 serial Modbus-RTU, BACnet™ MS/TP, dual Ethernet ports with multiple communication protocols, and Wi-Fi communication allows seamless integration with data acquisition systems.

KW320 series meter uses RS485 serial communication for both BACnet MS/TP and Modbus RTU protocols. The terminals of communication are A, B and S (14, 15, 16). A is differential signal +, B is differential signal - and S is connected to the shield of the twisted pair cables. Up to 32 devices can be connected on a RS485 bus. Use good quality shielded twisted pair cable, AWG22 (0.5mm2) or higher. The overall length of the RS485 cable connecting all devices should not exceed 1200m (40000 ft). The KW320 series meter is used as a slave device of masters such as a PC, PLC, Data Collector or RTU.

If the master does not have RS485 communication port, a converter (such as a RS232/RS485 or a USB/RS485 converter) will be required. Typical RS485 network topologies include line, circle and star (Wye). The shield of each segment of the RS485 cable must be connected to the ground at one end only.

Every A(+) should be connected to A(+), B(-) to B9(-) or it will influence the network or even damage the communication interface.

The connection topology should avoid "T" type which means there is a new branch and it does not begin from the beginning point.

Keep communication cables away from sources of electrical noise whenever possible.

When using a long communication cable to connect several devices, an anti-signal reflecting resistor (typical value 120Ω-300Ω/0.25W) is normally added to the end of the cable beside the last meter if the communication quality is distorted.

Use RS232/RS485 or USB/RS485 converter with optical isolated output and surge protection.

Refer to Chapter 6 of this manual for additional details on both Modbus RTU and BACnet MS/TP communication.

The KW320 meter also includes dual Ethernet ports that enables seamless integration utilizing BACnet IP, Modbus TCP, IPv6, and additional communication protocols. Refer to Chapter 5 of this manual regarding wiring and meter configuration as it relates Ethernet.

Appendix – Symbols Key

 **Warning**	Potential for death, serious injury, or permanent damage to a system.
 **Caution**	Potential for injury, damage to a system, or system failure.
 **Tip**	Useful information not related to injury or system damage.