

PowerMonic Circuit Connections (North America)

1. Introduction

This document outlines the guidelines and recommendations for connections to typical North American low voltage circuits. It is in addition to the *PowerMonic Installation & Users Manual*.

2. PowerMonic Voltage Cables & Accessory Items

The PowerMonic has four different types of main cables, these are:

1. **PC4-2:** Single phase, AC wall plug cable (Fig. 1) used to power up the PowerMonic to configure, download and monitor household single phase voltages
2. **VL3-2:** A three-wire voltage cable (Fig. 2) used on Delta voltage connections
3. **VL4-2:** A four-wire voltage cable (Fig. 3) used on Wye and Split circuit (single-bushing transformer-multi-grounded primary circuits) voltage connections.
4. **VL6-2:** A six-wire voltage cable (Fig. 4) that can be used on Delta, Wye and Split circuit (single-bushing transformer-multi-grounded primary circuits) voltage connections.



Figure 1 - PC4-2 Single phase



Figure 2 - VL3-2 Delta cable



Figure 3 - VL4-2 Wye cable



Figure 4 - VL6-2 Wye/Delta cable

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Figure 5 – 4mm banana plug, small alligator clamps



Figure 6 – Tinned ends (bare wire)



Figure 7 – Large clamps

The PowerMonic voltage cables are double insulated and UV stabilized and are suitable for indoor and outdoor installations. Each phase of the voltage cable is separately fused and there are various voltage cable attachments available to suit different types of installations, these include, 4mm banana plug, small alligator clamps, tinned (bare wire) ends, and large clamps.

3. PowerMonic Voltage Cables Color Coding

The table below shows the phasing color codes for the North American markets:

Voltage	North America
A-Phase	Black
B-Phase	Red
C-Phase	Blue
Neutral	White

4. PowerMonic Configuration Settings

The PowerMonic does *not* assume that it is connected to a balanced three phase system. It must be configured the same as the circuit connection that the PowerMonic measures.

PQ Logging Configuration - PowerView 4.1.4

Configuration Profile ID: **Not saved as predefined configuration**

General Settings | Log Profiling and Flicker | Event Capture Settings | Memory Management | Display Settings

Phase Notation

☒ A, B, C, N ☐ L1, L2, L3, N ☐ R, S, T, N

Nominal Line Frequency

☒ 50 Hz ☐ 60 Hz

Frequency Measurement Source

☒ Voltage A

Circuit Connection Type

☒ Star / Wye (3-phase, 4-wire)

☐ Delta (3-phase, 3-wire)

☐ Delta (3-phase, 2-wattmeter)

☐ Split Phase

☐ Single Phase

☐ Generic (independent measurement)

Nominal Voltage

Nominal Phase-Neutral Voltage (P-N) Volts

Nominal Phase-Phase Voltage (P-P) Volts

Memory Allocation Summary

Log Type	Log Capacity
Log Profiling	325 days 01h 54min
Flicker	0 days 00h 00min
Sag/Swell Event	0 events
RMS Event	0 events
Waveform Event	0 events

Reset Data Entry Read from File Save to File Apply Configuration To PowerMonic Close

23-02-2007 14:34:46 OFFLINE

Figure 8 - PowerView general configuration screen

When configuring the PowerMonic there are four configuration settings that correspond to the circuit connection on voltage (Fig. 8).

- Phase Notation = A,B,C,N or L1,L2, L3,N or R,S,T,N
- Nominal Line frequency = 50Hz Europe/Australasia, 60Hz North America
- Voltage Cable Connection = must be the same as the physical connection.
- Nominal Voltage = Phase-Phase voltage for Delta connection, Phase-Neutral voltage for Star/Wye connection.

Note: Before shipment, GridSense configures the nominal line frequency to 50Hz or 60Hz based on the application area. To change the default configuration, change the nominal line frequency then reset the PowerMonic by cycling the PowerMonic power off and on again. Alternatively, change the nominal line frequency then reset the PowerMonic using PowerView by selecting the Reset PowerMonic button in the Advanced Controls menu. It is **only** necessary to reset the PowerMonic if the nominal line frequency is changed.

5. Summary of PowerMonic Connections

The table below provides a summary of the various circuit connections that the PowerMonic can be installed on. The table highlights which voltage lead assembly can be used, the voltage connection type and nominal RMS Voltage settings to used in the PowerMonic configuration parameters. Detailed connection diagrams for each circuit can be found on the following pages.

Ref	Source Type	Load Type	Voltage Cable	Voltage Connection	Nominal Voltage
5.1	3 Phase, 4 Wire (Wye)	Star (Wye)	VL4, VL6	Star (Wye)	Phase-Neutral
5.2	3 Phase, 3 Wire, 3 Watt (Delta)	Delta	VL3, VL6	Delta	Phase-Phase
5.3	3 Phase, 3 Wire, 2 Watt (Delta)	Delta	VL3, VL6	Delta	Phase-Phase
5.4	Split Phase	2 Single Phase	VL4, VL6	Star (Wye)	Phase-Neutral
5.5	Single Phase	Single Phase	PC4, VL4, VL6	Star (Wye)	Phase-Neutral
5.6	Generic	3 Single Phase	VL6	Star (Wye)	Phase-Neutral
5.7	3 Phase, 3 Wire (Wye)	Delta	VL3, VL6	Delta	Phase-Phase
5.8	3 Phase, 3 Wire (Wye)	3 Single Phase	VL3, VL6	Delta	Phase-Phase
5.9	Delta Mid-Tap	2 Single Phase	VL4, VL6	Star (Wye)	Phase-Neutral

The circuit connections fall into two categories:

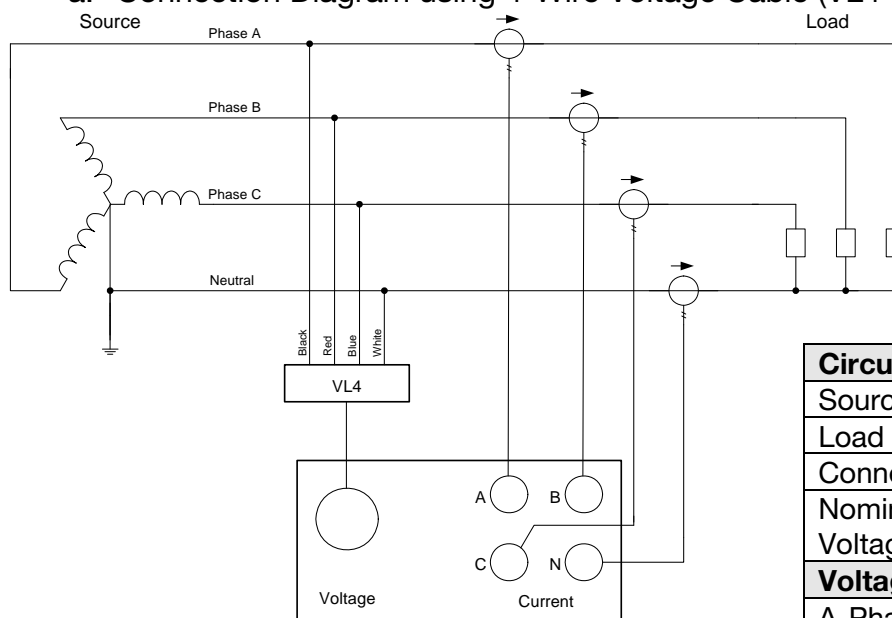
1. **Neutral line connection.** This includes connections 5.1, 5.4, 5.5, 5.6 and 5.9. The phase-neutral voltages and line currents are measured.
2. **Non-neutral line connection.** This includes connections 5.2, 5.3, 5.7 and 5.8. The phase-phase voltages and line currents are measured. The phase-phase voltages are converted to phase-neutral voltages and processed so that the centre of the phase-phase voltage triangle becomes the neutral point. This conversion is done point by point in the time domain so there is no assumption that the three phase system is balanced. For a balanced system, this is equivalent to applying a phase shift of 30 degrees and reducing the magnitudes by 3.

The phase-neutral voltages and line currents are processed to give:

- real power P
- reactive power Q
- apparent power S
- true power factor TPF
- displacement power factor DPF
- harmonic amplitudes and angles
- interharmonics
- other PQ measurements

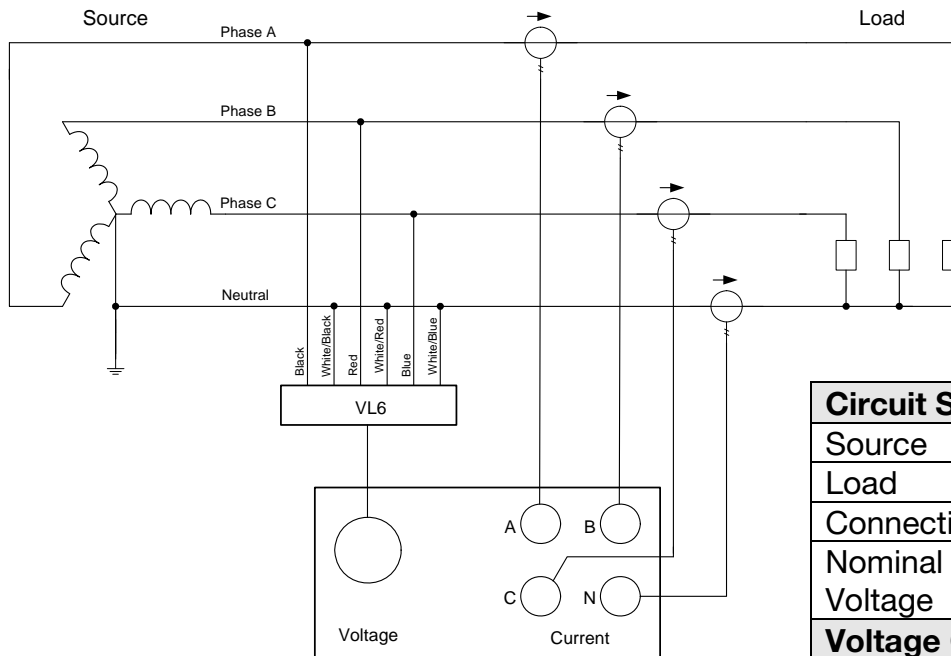
5.1 Three-Phase 4-Wire Wye Source with Wye Load (3P4W)

a. Connection Diagram using 4-Wire Voltage Cable (VL4-2)



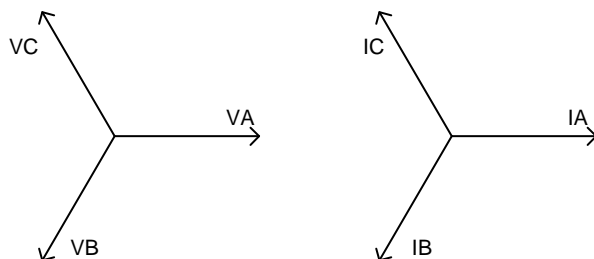
Circuit Summary Table	
Source	3-Phase Wye
Load	Wye
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue
Neutral	White

b. Connection Diagram using 6-Wire Voltage Cable (VL6-2)



Circuit Summary Table	
Source	3-Phase Wye
Load	Wye
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue
Neutral-A	White/Black
Neutral-B	White/Red
Neutral-C	White/Blue

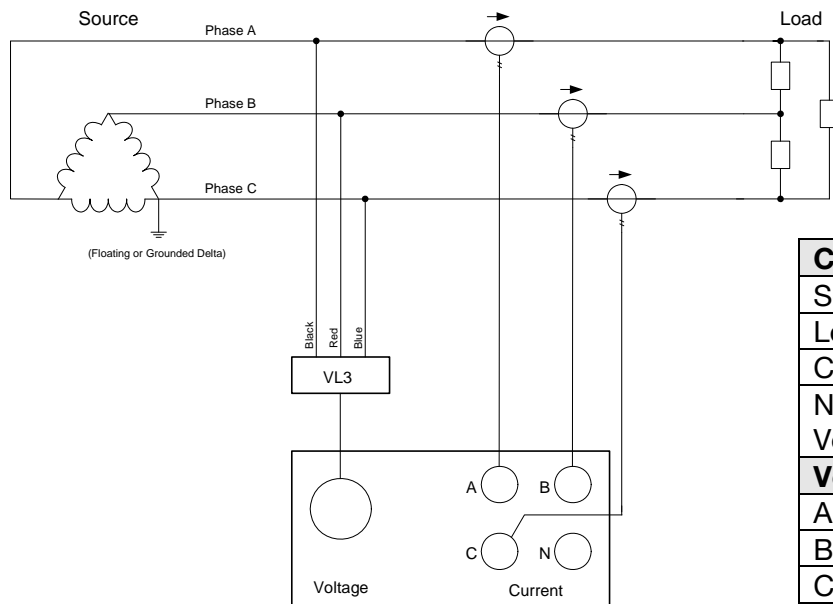
Phasor Diagram



Please note that this connection should be configured as Star/Wye (3-phase, 4-wire) in PowerView

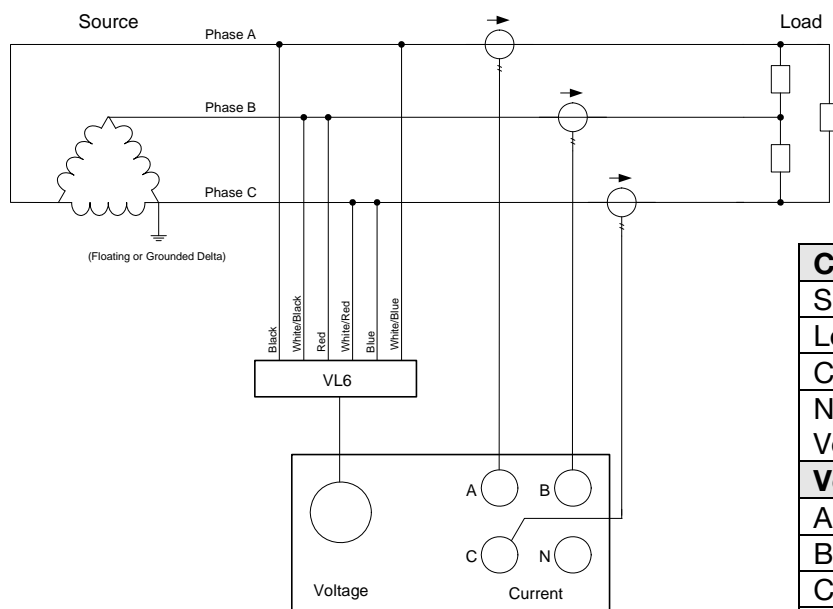
5.2 Three-Phase 3-Wire Delta Source with Delta Load (3P3W3M)

a. Connection Diagram using 3-Wire Voltage Cable (VL3-2)



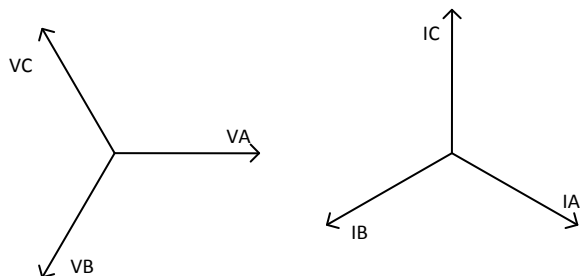
Circuit Summary Table	
Source	3-Phase Delta
Load	Delta
Connection	Delta
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue

b. Connection Diagram using 6-Wire Voltage Cable (VL6-2)



Circuit Summary Table	
Source	3-Phase Delta
Load	Delta
Connection	Delta
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue
Neutral-A	White/Black
Neutral-B	White/Red
Neutral-C	White/Blue

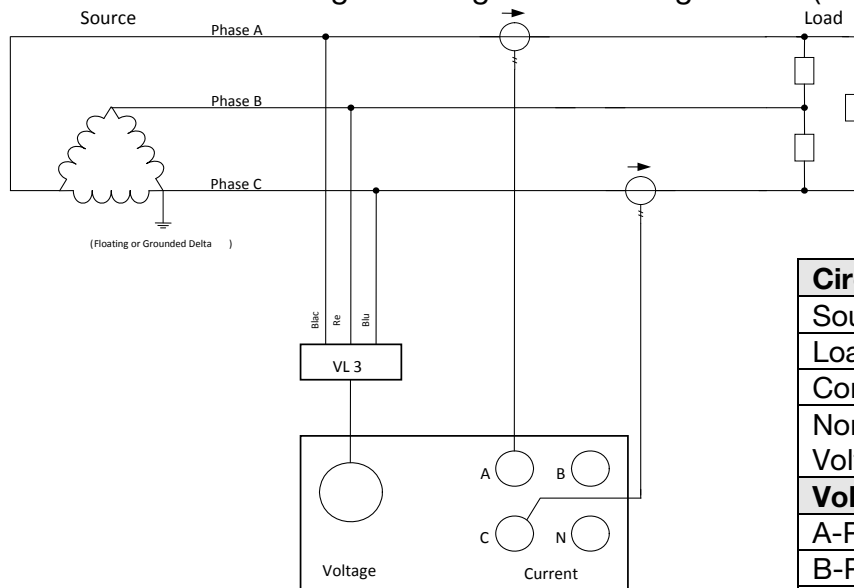
Phasor Diagram



Please note that this connection should be configured as Delta (3-phase, 3-wire) in PowerView

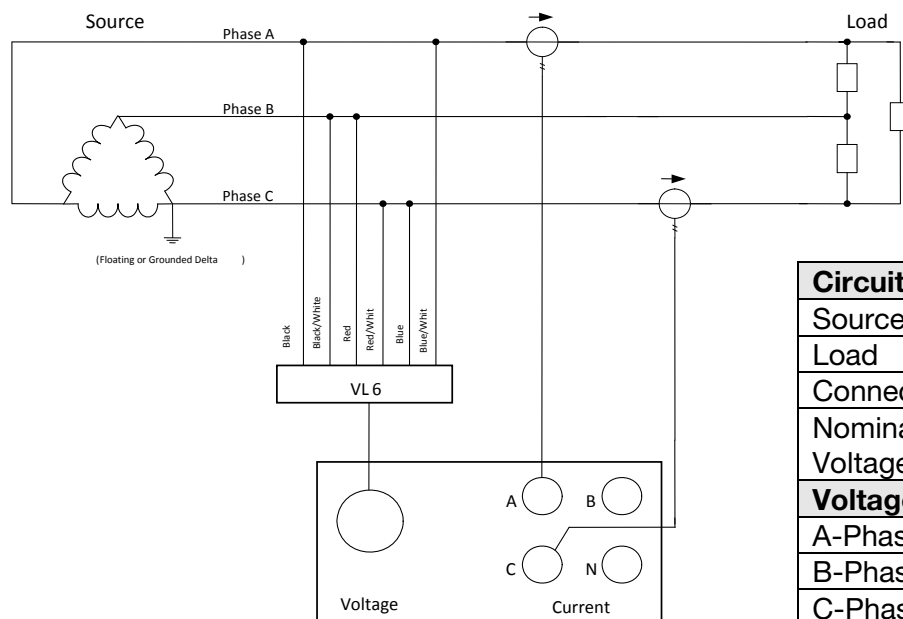
5.3 Three-Phase 2-Watt Delta Source with Delta Load – Standard (3P3W2W)

a. Connection Diagram using 3-Wire Voltage Cable (VL3-2)



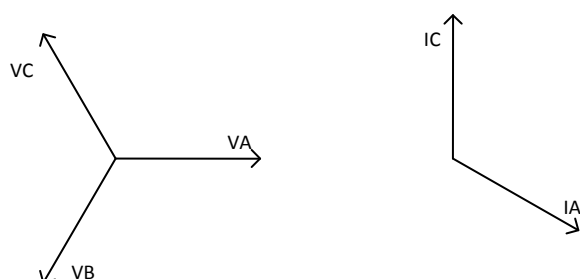
Circuit Summary Table	
Source	3-Phase Delta
Load	Delta
Connection	Delta
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue

b. Connection Diagram using 6-Wire Voltage Cable (VL6-2)



Circuit Summary Table	
Source	3-Phase Delta
Load	Delta
Connection	Delta
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue
Neutral-A	White/Black
Neutral-B	White/Red
Neutral-C	White/Blue

Phasor Diagram

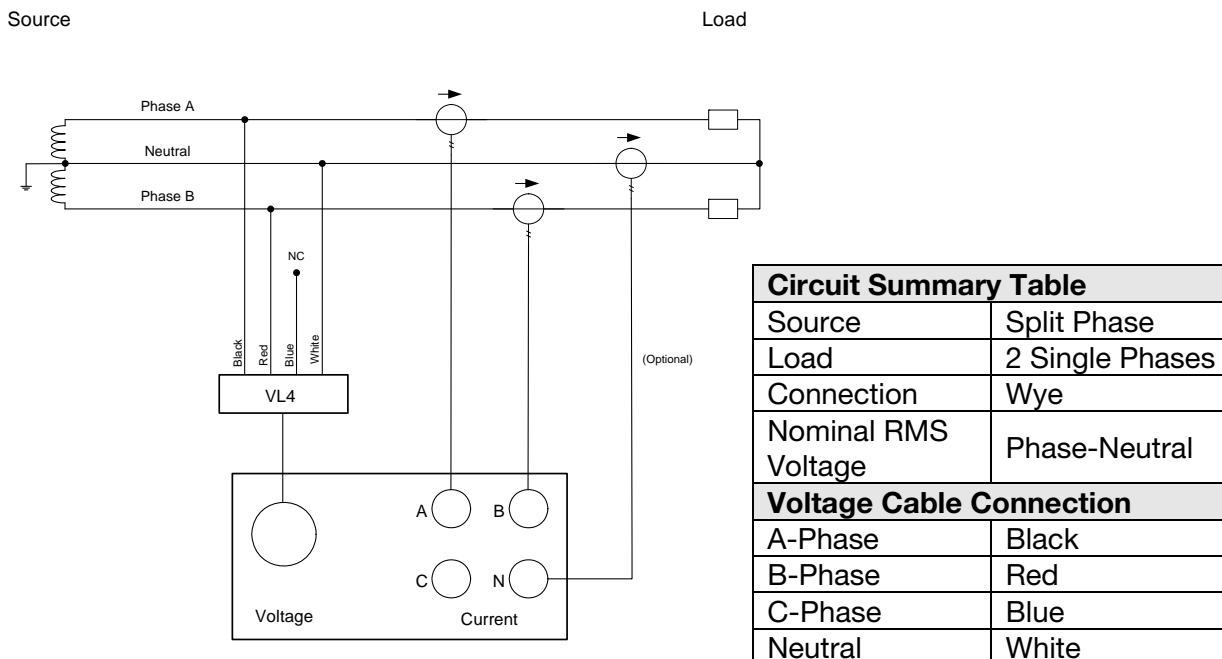


Please note that:

- The firmware version should be V1.72 or later.
- This connection should be configured as Delta (3-phase, 2-wattmeter) in PowerView.
- For a system with only 2 loads connect as above and configure the PowerMonic as Delta (3-phase, 2-wattmeter) in PowerView.

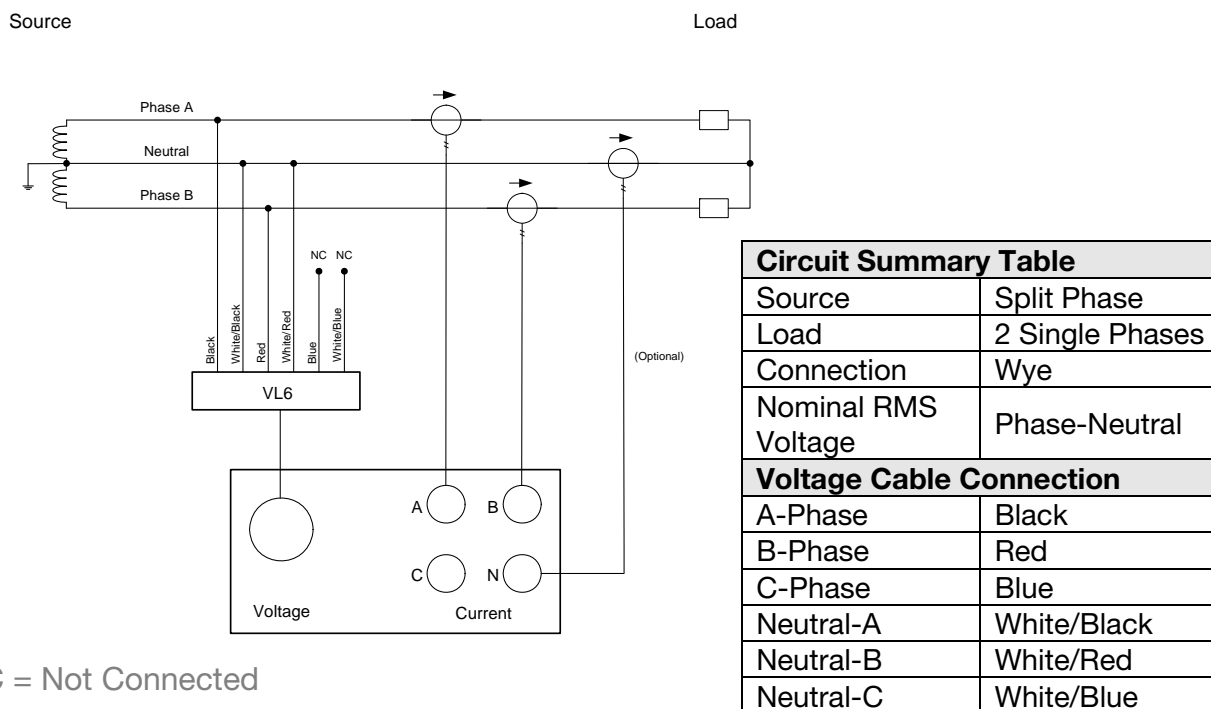
5.4 Split Phase with 2 Single Phase Loads (1P3W)

a. Connection Diagram using 4-Wire Voltage Cable (VL4-2)



NC = Not Connected

b. Connection Diagram using 6-Wire Voltage Cable (VL6-2)



NC = Not Connected

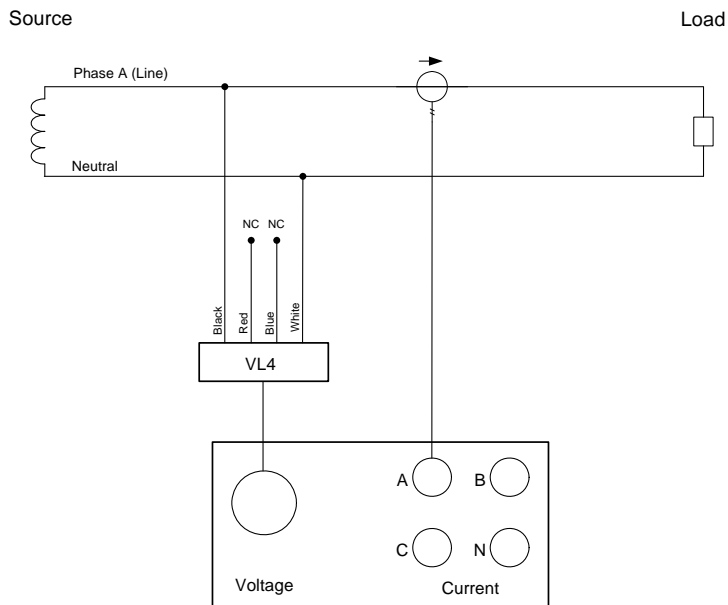
Phasor Diagram



Please note that this connection should be configured as Split Phase in PowerView

5.5 Single Phase (1P2W)

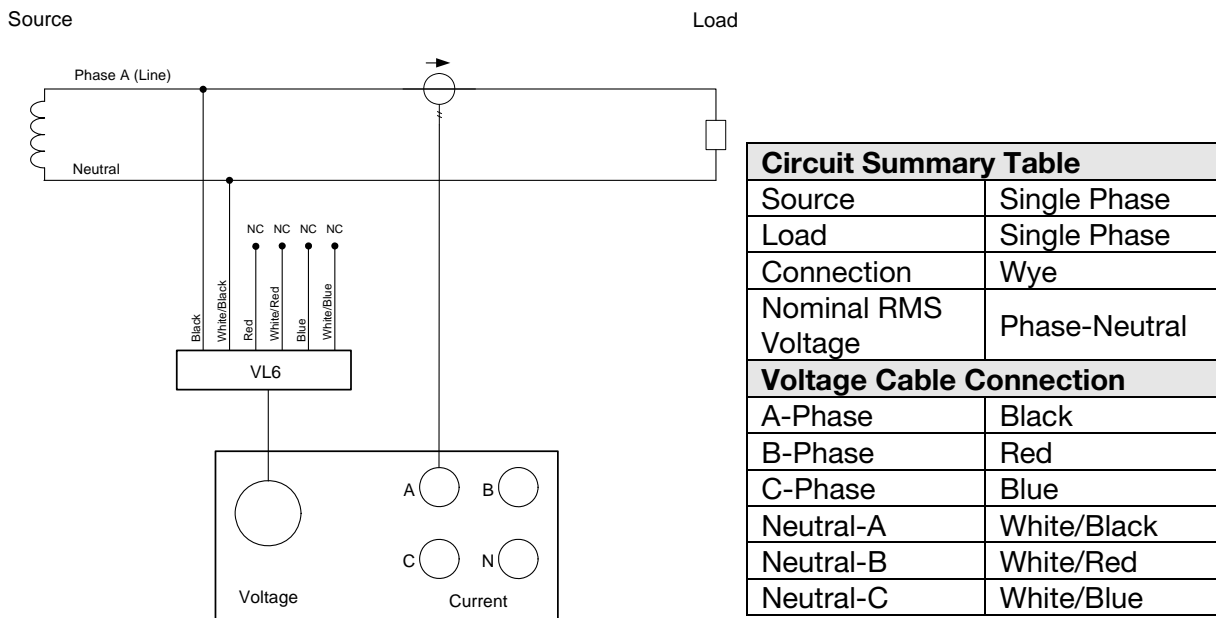
a. Connection Diagram using 4-Wire Voltage Cable (VL4-2)



Circuit Summary Table	
Source	Single Phase
Load	Single Phase
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue
Neutral	White

NC = Not Connected

b. Connection Diagram using optional 6-Wire Voltage Cable (VL6-2)



NC = Not Connected

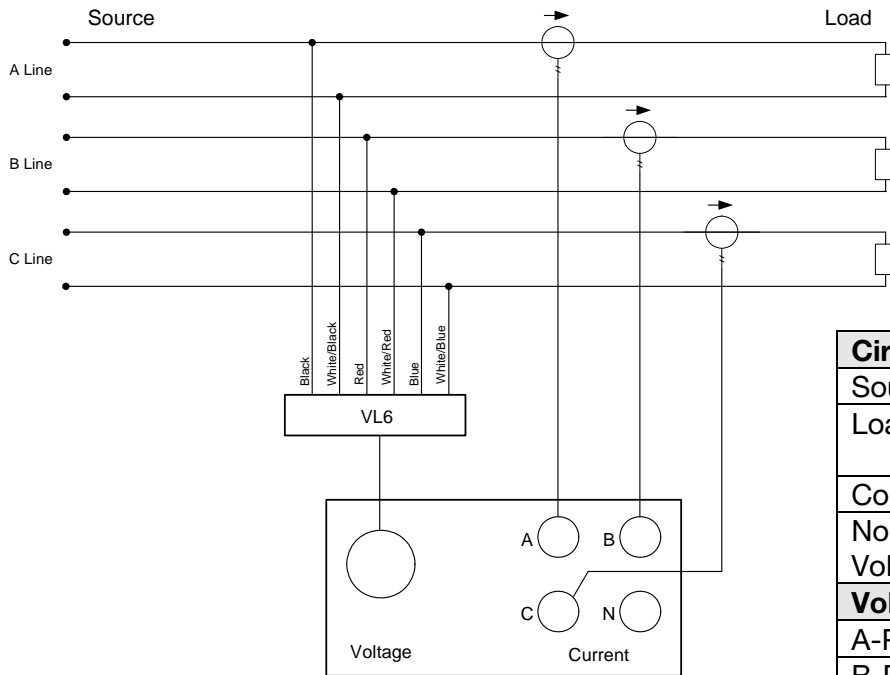
Phasor Diagram



Please note that this connection should be configured as Single Phase in PowerView

5.6 Generic, 3 independent circuits

Connection Diagram using 6-Wire Voltage Cable (VL6-2)



Circuit Summary Table	
Source	Generic
Load	3-Single Phases
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue
Neutral-A	White/Black
Neutral-B	White/Red
Neutral-C	White/Blue

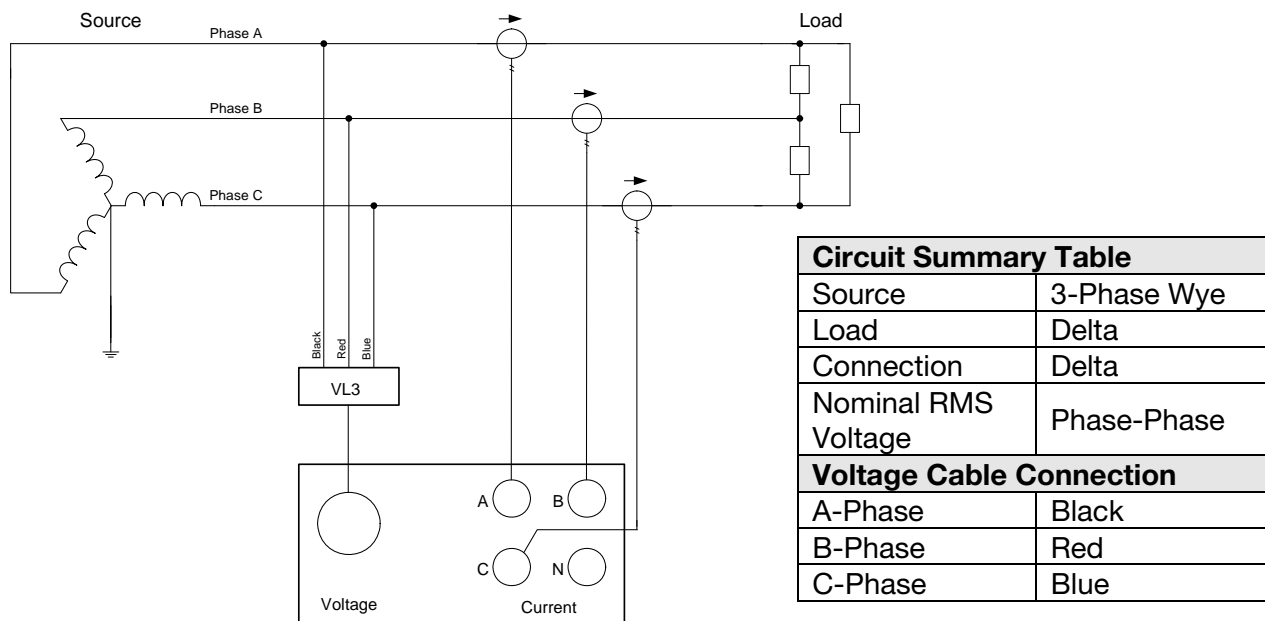
Phasor Diagram



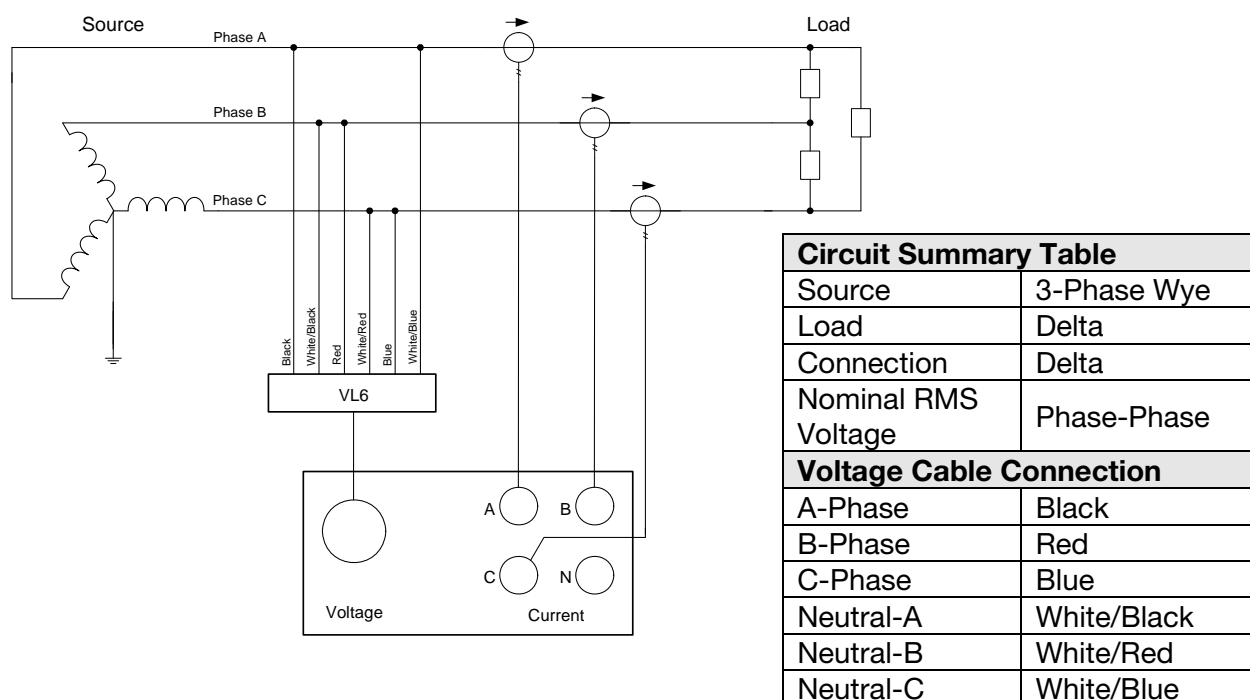
Please note that this connection should be configured as Generic (independent measurement) in PowerView

5.7 Three-Phase 4-Wire Wye Source with Delta Load

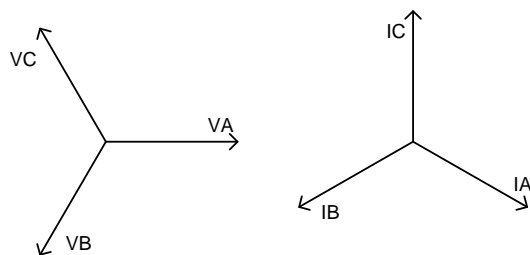
a. Connection Diagram using 3-Wire Voltage Cable (VL3-2)



b. Connection Diagram using 6-Wire Voltage Cable (VL6-2)



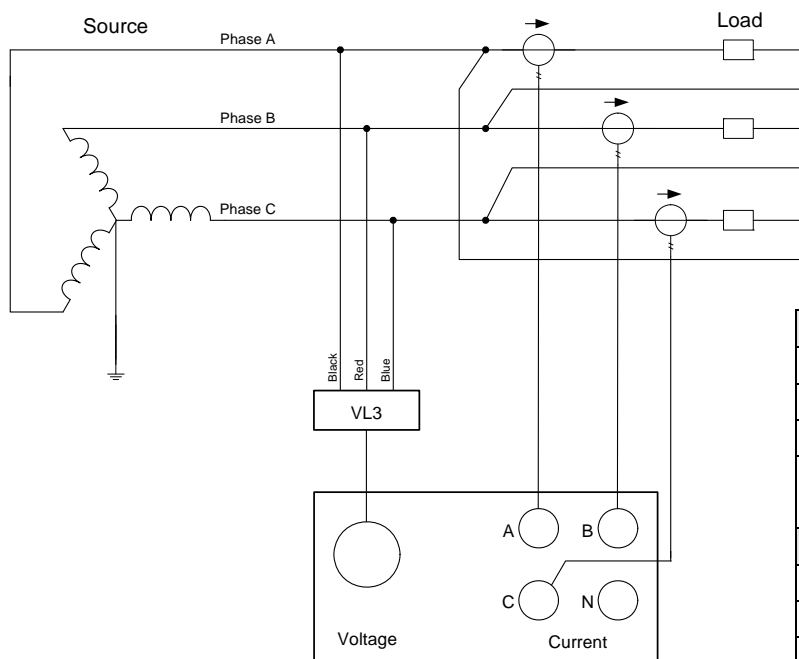
Phasor Diagram



Please note that this connection should be configured as Delta (3-phase, 3-wire) in PowerView

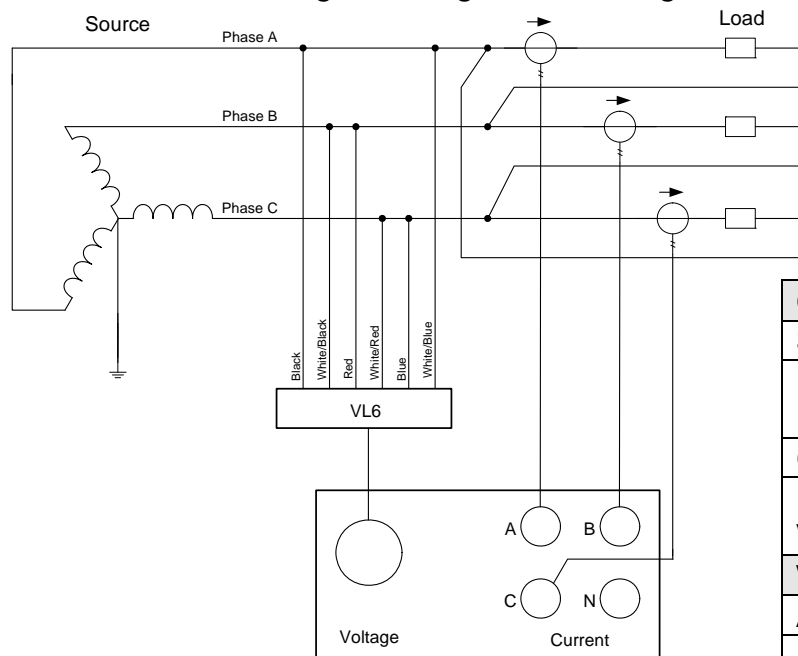
5.8 Three-Phase 4-Wire Wye Source with 3 Single Phase Loads

a. Connection Diagram using 3-Wire Voltage Cable (VL3-2)



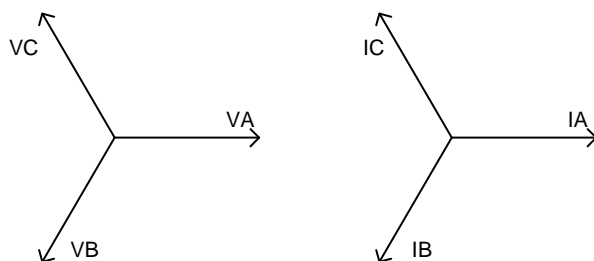
Circuit Summary Table	
Source	3-Phase Wye
Load	3 Single Phases
Connection	Star
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue

b. Connection Diagram using 6-Wire Voltage Cable (VL6-2)



Circuit Summary Table	
Source	3-Phase Wye
Load	3 Single Phases
Connection	Star
Nominal RMS Voltage	Phase-Phase
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue
Neutral-A	White/Black
Neutral-B	White/Red
Neutral-C	White/Blue

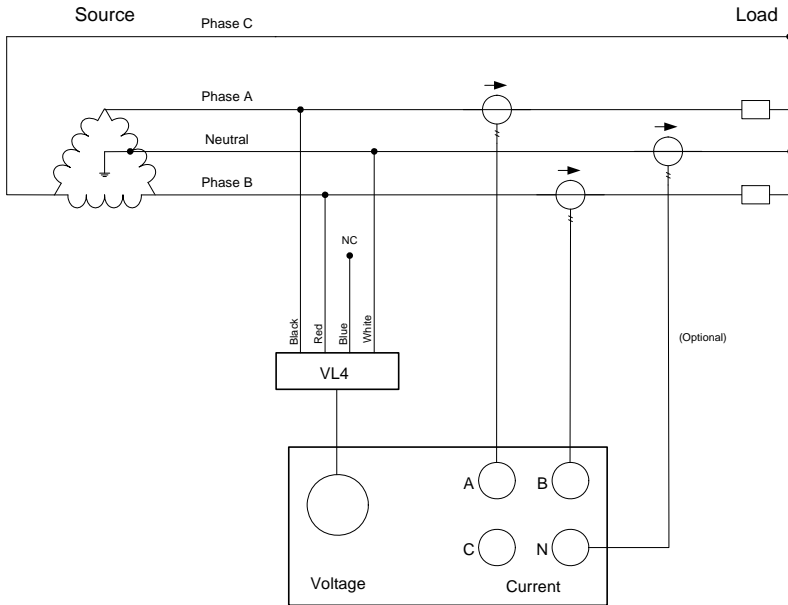
Phasor Diagram



Please note that: this connection should be configured as Generic (independent measurement) in PowerView

5.9 Delta Mid-Tap Source with 2 Single Phase Loads

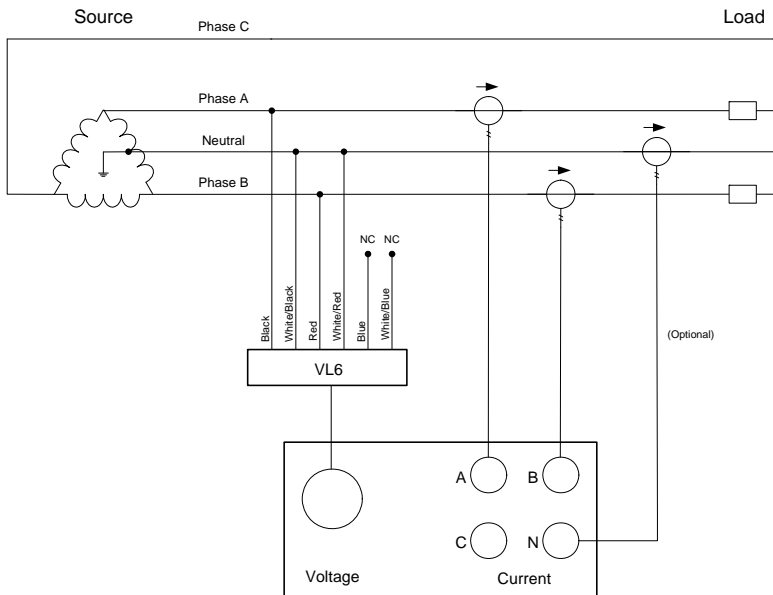
a. Connection Diagram using 4-Wire Voltage Cable (VL4-2)



Circuit Summary Table	
Source	Delta Mid Tap
Load	2-Single Phases
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue
Neutral	White

NC = Not Connected

b. Connection Diagram using 6-Wire Voltage Cable (VL6-2)



Circuit Summary Table	
Source	Delta Mid Tap
Load	2-Single Phases
Connection	Wye
Nominal RMS Voltage	Phase-Neutral
Voltage Cable Connection	
A-Phase	Black
B-Phase	Red
C-Phase	Blue
Neutral-A	White/Black
Neutral-B	White/Red
Neutral-C	White/Blue

NC = Not Connected

Phasor Diagram



Please note that this connection should be configured as Split Phase in PowerView