V1K Basic Debugging Measurements Guide

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Version 1.1

Introduction

Purpose: To help identify the condition of a V1K dv/dt filter and its components that is installed on the output of a variable frequency drive in the field. While full condition of the V1K may only be known by performing factory test, this document aids in the following:

- Periodic inspection and maintenance
- Debugging potential issues found in a V1K Filter or VFD & motor power system

The sections below outline several basic measurement procedures which will aid TCI Tech Support in diagnosing a potential problem with V1k filter components.

General Safety

- Only qualified electricians should carry out maintenance work on the filter
- Turn off power to the VFD and ensure the motor is stopped
- Wait five minutes after shut down to open the filter enclosure or work on the filter
- This ensures all voltages have discharged to safe levels

Typical Configurations of V1K dv/dt output Filters

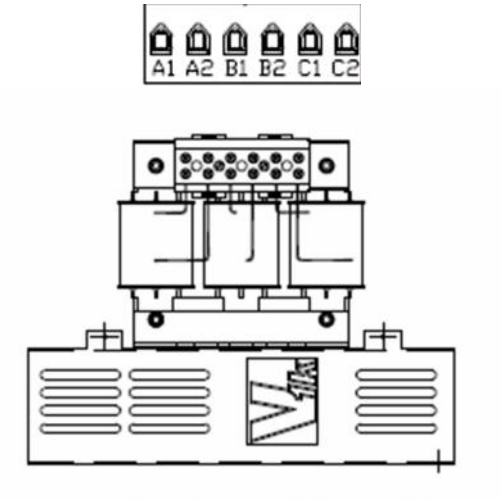

Figure 1- V1K with terminal block

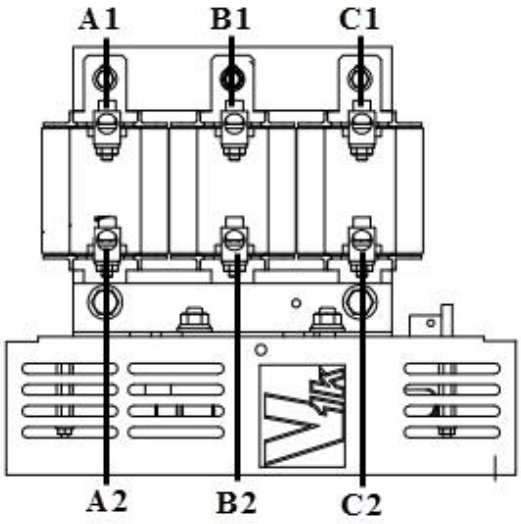

Figure 2- V1K with single barrel lugs

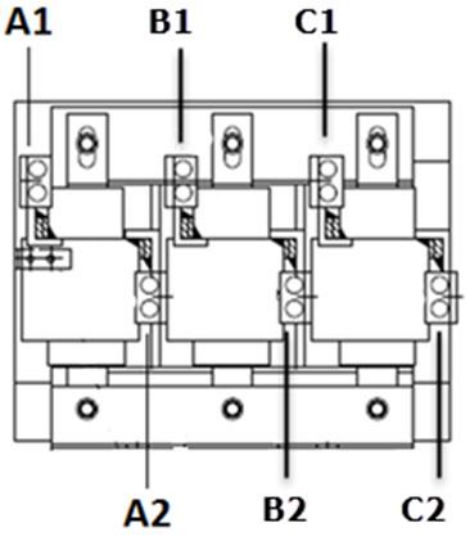

Figure 3- V1K with double barrel lugs

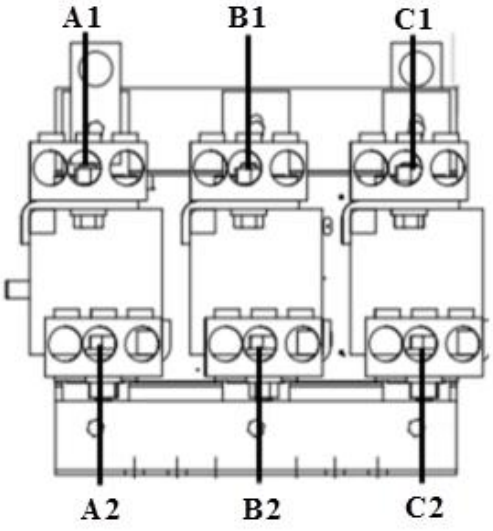

Figure 4- V1K with triple barrel lugs

Typical Schematic and RC board configurations of V1K dv/dt output Filters

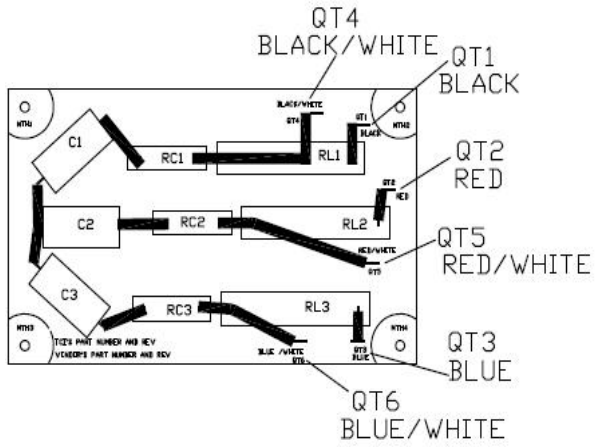

Figure 5- V1K RC board

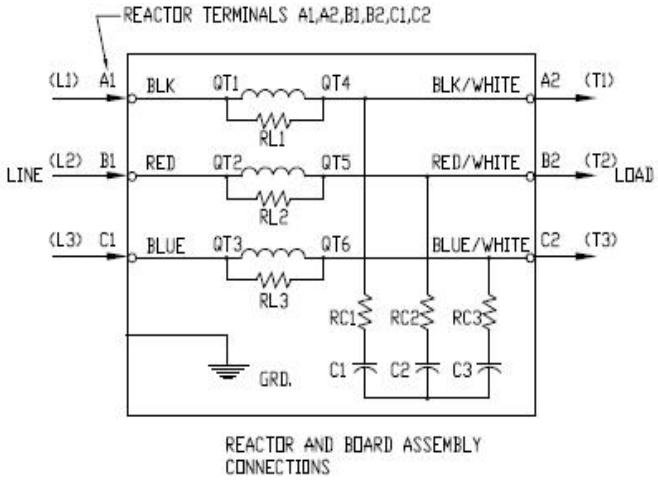

Figure 6-V1K schematis

1. Basic Load Information

A table to collect all the VFD and load information.

V1K Filter Part Number:
Power System Voltage and Frequency:
VFD Manufacturer:
VFD Part Number/Serial Number:
VFD HP:
VFD Switching Frequency (kHz):
Motor HP:
Lead Length to the Motor (feet):
Cable size:
Single Drive /Multiple Motor Application: ☐ Yes ☐ No
Number of parallel motor runs:
Load Description/Typical Loading Conditions:
Description of the issue with the V1K or VFD and motor power system, including odd sounds/smells:
Is there visible heat damage or blackening of the coils and or board components?: ☐ Yes ☐ No

Table 1- Basic VFD and Load Information

2. Reactor Inspection and Measurements

A problematic or faulty reactor may have a dramatic effect on the V1K filter performance. A visual inspection and continuity test can indicate the presence of a problematic coil/reactor.

2-A Visual inspection of the reactor coils and RC circuit board

Inspecting the Reactor:

1. Ensure all power to the filter/VFD is off.
2. Check each coil in its entirety for any darkened spots. A typical look of a coil can be seen below.
3. Take a photograph of the product label as shown below (Figure 7), to send tech-support@transcoil.com to for review.
4. Take a photograph of the entire reactor to indicate the state of the coils (Figure 8), to send to tech-support@transcoil.com for review.
5. Take a photograph of the job number on the reactor mounting foot (Figure 9), to send to tech-support@transcoil.com for review.

Further Clarification: Figure 7, 8, & 9 show the photograph examples of what is required for inspection of the reactor integrity.

Figure 7-Example picture of filter product label

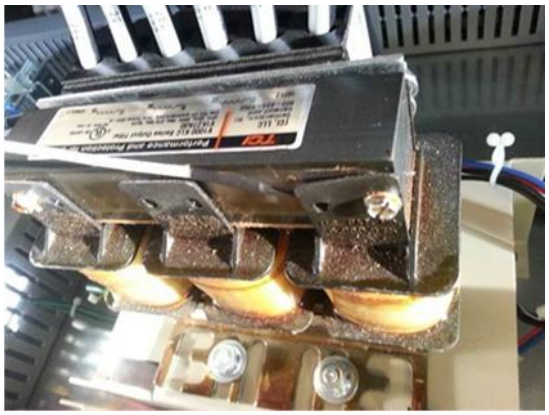

Figure 8-Example picture of coil state

Figure 9-Example picture of job number label

2-B Measuring the Winding Ohms per phase

Each winding or coil is a continuous piece of copper and should have a low impedance. Checking winding impedance helps determine the integrity of the reactor.

Measure the ohms (Ω) of the reactor phases

Figure 10-Setting a DMM to measure ohms

1. Ensure all power to the filter/VFD is off.
2. Turn your Multimeter to read ohms (Ω) and measure the value between A1 & A2 of the reactor terminals. Depiction of terminal markings is found on page 2 of this document.
3. Record the ohm value in Table 2.
4. Repeat steps 2 and 3 to the measure the ohms between B1 & B2, and C1 & C2.

Further Clarification: Figure 11 shows the placement of the meter probes using a typical V1K schematic. Measurements should be taken at point A, B, and C. The Ohm's in all three phases should be balanced. If in any phases are not balanced this could point to there being a short in one of the phases.

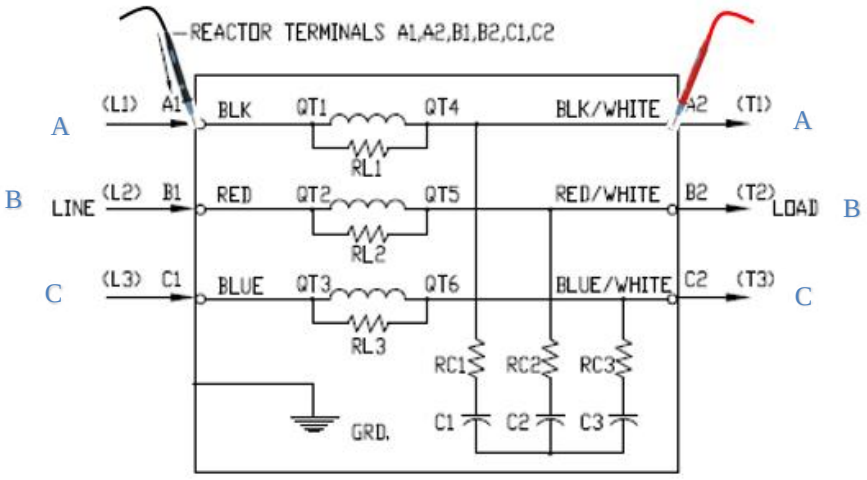

Figure 11-Placement of probes for measurements (Phase A, measuring points A)

Filter Part Number:			Measuring point
No Load, Ohm Reading	Phase A Ohms	Ω	A
	Phase B Ohms	Ω	B
	Phase C Ohms	Ω	C

Table 2- Record Ohms phase-phase at no load

2-C Insulation Resistance testing of the reactor (if available)

Perform a DC insulation resistance test to check the insulation condition of the reactor from each phase to ground. Use a DC insulation test instrument that applies DC voltage to measure the insulation resistance in ohms (Ω). For example, Megger MIT4xx or Fluke 15xx series equivalent insulation resistance tester.

1. Ensure all power to the filter/VFD is off.
2. Remove all leads to the RC circuit board from the reactor (refer to Figure 5 for image of RC circuit board). ***WARNING*: if RC board is not disconnected from the reactor it may be damaged during test.**
3. Remove all other cables to the reactor (both the VFD and motor leads). This must only be a reactor test. ***WARNING*: if the VFD and Motor is not disconnected from the reactor it may be damaged during test.**
4. Ensure the case of the reactor is grounded.
5. Wire the tester as shown on schematic in Figure 13. One clip goes to ground, the other is connected to the phase A1 terminal.
6. Set your meter to 500V.
7. Apply 500V for no more than 10 seconds and record the resistance value (ohms) in Table 3.
8. Repeat step 7 for Phase B to ground, and Phase C to ground.
9. Turn off and disconnect the tester.
10. Keep the cables removed from the reactor and RC circuit board if other tests in this document have yet to be performed.
    a. Otherwise if the tests are complete: Return the power wiring that was removed in steps 2 and 3 to the V1K.

Further Clarification: Figure 13 shows the placement of the meter probes using reactor schematic. The insulation resistance to ground in each of three phases should be balanced and greater that 100 MΩ. If any phases are not balanced, or the insulation resistance is low, this could point to insulation decay. If the resistance is less than 100 MΩ the reactor should be serviced or considered to be replaced, depending on historical readings and age. If the reading is significantly less than 100MΩ, it should be replaced immediately (<25 MΩ).

Figure 12-Megger insulation resistance meter

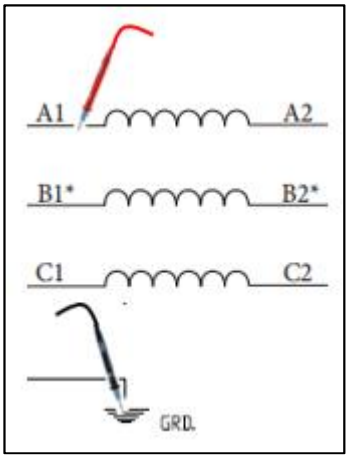

Figure 13-Placement of probes for measurements (Phase A)

Meter Model Used:	
Resistance of Coil A to ground	MΩ
Resistance of Coil B to ground	MΩ
Resistance of Coil C to ground	MΩ

Table 3-Insulation Resistance Test Results

3. RC circuit board component measurements.

Measuring the RC circuit board component values may help to show a stressful environmental factor or a faulty component.

Measure the ohms (Ω) of RL1, RL2, RL3, RC1, RC2, & RC3

Figure 14- Setting DMM to measure Ohms

1. Completely turn off the VFD load (to place meter probes).
2. Completely switch off supply voltage to the filter.
3. Wait five minutes after switching off the supply voltage to connect the current meter.
4. With the RC board still removed, turn your Multimeter to read ohms (Ω) and measure the value across the 6 RC circuit board resistors, RL1, RL2, RL3, RC1, RC2, & RC3 (seen in Figure 16 below).
5. Record the ohm value in Table 4.
6. Turn your Multimeter to read capacitance and measure the value across C1, C2, & C3 (seen in Figure 16 below).
7. Record the capacitance value in Table 4.

Measure the Capacitance (µF) of C1, C2, & C3

Figure 15-Setting DMM to measure Capacitance

Further Clarification: Below shows a zoomed in drawing of the V1K PRC circuit board. The measurements can be taken using a Multimeter and directly placing the probes on each leg of the component solder connection to the board.

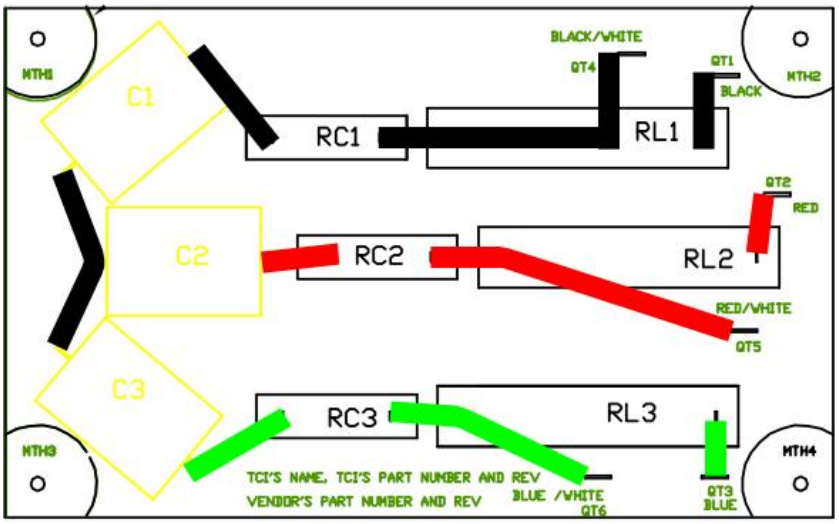

Figure 16- Typical V1K RC circuit board

RC circuit board part number:	
Resistance of RL1	Ω
Resistance of RL2	Ω
Resistance of RL3	Ω
Resistance of RC1	Ω
Resistance of RC2	Ω
Resistance of RC3	Ω
Capacitance of C1	µF
Capacitance or C2	µF
Capacitance of C3	µF

Table 4-RC circuit board component measurements