Instruction Manual
CMF™
COMMON MODE FILTER

INSTRUCTIONS SHOULD BE FULLY READ AND UNDERSTOOD BEFORE INSTALLING THE COMMON MODE FILTER.

WARNINGS! SHOCK HAZARDS:

- Prior to installation of the Common Mode Filter (CMF™), remove system power and be certain that all safe work practices are followed to avoid electrical shock.
- Use appropriate safety precautions and PPE for arc flash protection.
- Improper use can cause death, injury and/or equipment damage. Follow all warnings and cautions. Verify that all information in this instruction manual has been read and understood before attempting to install or operate this equipment.
- Improper wiring could cause death, injury and/or equipment damage. Only licensed/qualified electricians who are trained in the installation and service of electrical devices are to install and service this equipment.

WARNING

HAZARDOUS & POTENTIALLY DEADLY ENERGY LEVELS PRESENT


Risk of Explosion


Risk of Electrical Shock


Risk of Electrical Fire

1.0 INTRODUCTION

This installation manual contains the information necessary to install the Magney Grande Common Mode Filter (CMF™) for Electrical Submersible Pump (ESP) electrical protection on the Variable Frequency Drives/Variable Speed Drives/Adjustable Speed Drives (VFDs/VSDs/ASDs) on the Medium Voltage (MV) lugs of the Step Up Transformer (SUT).

These instructions do not cover all details, variations or combinations or the equipment, its storage, delivery, installation, checkout, safe operation or maintenance. If more information is required regarding a particular application or installation that is not covered in this manual, please contact Magney Grande at +1 (970) 884-0508.

1.1 SAFETY PRECAUTIONS

A licensed/qualified electrician must complete instructions as detailed in this manual and in accordance with the U.S. National Electrical Code, state and local codes or other applicable country codes. All electrical codes supersede these instructions.

WARNING: THE CMF™ CONTAINS MEDIUM VOLTAGE CAPACITORS. WAIT 5 MINUTES AFTER POWER IS TURNED OFF TO ALLOW FOR PROPER DISCHARGE OF THE CAPACITORS.

1.2 APPLICATION GUIDELINES

- CMFB-VGR2-2T: (2/Phase) 80 Ω Resistors, 2E Fuses, Temperature Switches
    - FPWM: 500 KVA and Less
- CMFB-VGC-T-3: (2/Phase) 80 Ω Resistors, 3E Fuses, Temperature Switches
    - FPWM: 501 - 750 KVA
    - FPWM operating PMM
- CMFB-VGC-T-5: (2/Phase) 80 Ω Resistors, 5E Fuses, Temperature Switches – Model Phasing Out
    - 6 Step ASD (Baker ESP Mode)
- CMFB-VGMM-T-5 (4/Phase) 160 Ω Resistors, 5E Fuses, Temperature Switches
    - 6 Step ASD (Baker ESP Mode)
    - SLB: 501 - 750 KVA
    - All Else above 750KVA (for applications of 1000KVA or greater, consult Magney Grande)

These are intended as guidelines, but lower KVA models of CMF may be functional in applications with drives which are producing a lower magnitude of high-frequency, differential mode noise. While they may be functional, the application of CMF outside these guidelines may adversely affect the warranty.

2.0 INSTALLATION

The CMF™ requires an additional relay on VFDs that can operate in ESP mode (call Magney Grande at +1 (970) 884-0508 if your application has a FPWM filter and reset button).

CAUTION: Damage to the CMF™ may result if it is connected to an electrical system of a higher voltage (< 4800V L-L/L-G).

2.1 TOOLS & REQUIREMENTS

- PPE as required by Code and/or company
- Standard tools for use by licensed/qualified electricians who will conduct installation of CMF™
- Drill or Hole Saw
- Boom truck or forklift is recommended for lifting and placement of CMF™
- Non-conductive ¾”conduit (20 feet (6 meters) recommended)
- Ground wire (should be minimum of #4AWG)
- LV Copper #18AWG (see page 13, Image 27)

2.2 MOUNTING

Mount or locate the CMF™ stand next to the MV lugs on the SUT. This location provides the shortest and straightest possible wiring (lead length) from the CMF™ to the electrical system connections. It is recommended that CMF™ leads be 10 feet or shorter. Longer leads are approved, but the maximum length should be not more than 15 feet/5 meters.

Excessive lead length and/or sharp bends will degrade CMF™ performance.

Once a location has been determined, set the CMF™ so that the door is easily accessible and the back of the CMF™ allows for the mounting of other MV accessories (choke package and The Splitter).

2.3 CONDUIT INSTALLATION

Follow the guidelines below when installing conduit between the CMF™ and SUT:

- Avoid using 90° elbows and keep the conduit run as short and straight as possible.
- Use ¾” weatherproof (corrosion resistant), non-metallic flex conduit (not supplied) and fittings to maintain the rating of the NEMA 3R/4 (IP66) enclosure.
- Avoid sharp bends in wiring.

- Keep wire lengths as short (10 feet/3 meters or less is best, but not more than 15 feet/5 meters) and straight as possible.

2.4 WIRE & FUSE INSTALLATION

The CMF™ is supplied with High Voltage rated stranded wires that are connected to the terminals of the CMF™.

Once the CMF™ is set and the electrical connections are made, the six resistors must be installed (included inside of the CMF™ enclosure and wrapped in bubble wrap).

NOTE: The resistors are EXTREMELY FRAGILE, and care must be taken when inserting them into resistor clips.

2.5 WIRING

WARNING: SHOCK HAZARD

When working inside the electrical panel, remove system power and follow safe work procedures to avoid an electrical shock hazard.

When wiring the CMF™ to the electrical system, follow these guidelines:

- Follow all national, state and local electrical codes.
- Connect the CMF™ to the MV lugs on the SUT.
- Cut the wires from the CMF™ to the electrical system as necessary to keep them as short and straight as possible (not more than 15 feet/5 meters).
- **DO NOT BIND THE WIRES TOGETHER.** To maximize the performance of the CMF™ and to ensure corona is mitigated, **DO NOT** bind the wires together.
- The ground wire (not supplied) of the CMF™ should be a minimum of #4AWG and must be connected to the wellsite pole or chemical ground rod (The ROD).
- The CMF leads should **NEVER** be braided.

WIRE CMF™ TO ELECTRICAL SYTEM AS FOLLOWS:

Contact Magney Grande as necessary for any support in the following steps.

1. The CMF™ is to be wired to the 3 hot lugs of the MV Transformer.
2. Identify the phase wires of the CMF™. These are the three rolled up wires that are in the enclosure and connected to the fuses at the top.
3. Route wires from the CMF™ through the non-metallic conduit into the electrical panel.
4. Connect the CMF™ ground wire at the lug that is provided outside of the enclosure. Take this wire directly to the pole of the electrical system or The ROD ground point.
5. Connect the CMF™ Phase A (black) wire to the A phase on the MV lugs.
6. Repeat Step 5 to connect the CMF™ Phase B and C (black) wires to the appropriate MV lugs.
7. Install the LV control wires in appropriate flexible conduit and terminate at a discreet input of the VFD. The discreet input should be programmed as either a shutdown or a warning on opening of the circuit with a recommended 2-minute delay. It is normal for this circuit to change state at startup, shutdown and the opening of a fuse in the CMF™.
8. Install the six resistors into the resistor clips. ***Once resistors have been installed, check for tightness and adjust clips as necessary for a secure connection.***
9. Reapply power to the electrical system.

After system power has been applied, the CMF™ automatically begins to protect downstream electrical devices from damaging high frequency content on the common mode (Line-to-Ground). The CMF™ also adds Line-to-Line filtering through the wye connection of the CMF™.

The CMF™ is repairable and in the event the fuses open, contact Magney Grande or local representative to purchase spare parts.

Fuses opening indicates SWF failure in FPWM drives or the misapplication of CMF™ model.

WARNING: THE CMF™ CONTAINS MEDIUM VOLTAGE CAPACITORS. WAIT 5 MINUTES AFTER POWER IS TURNED OFF TO ALLOW FOR PROPER DISCHARGE OF THE CAPACITORS.

3.0 GENERAL INSTALLATION IMAGES

Image 1: CMF™ set next to the Step Up Transformer (SUT).

Image 2: Drilling holes in SUT for CMF™ leads and conduit. Hole diameters: Left = 1 1/8", Right = 7/8".

Image 3: Drilling holes in CMF™ for leads and conduit (these holes may be pre-punched upon receiving CMF™). Hole diameters: Left = 1 1/8", Right = 7/8".

Image 4: Completed hole in lower panel of CMF™ enclosure. Hole diameters: Left = 1 1/8", Right = 7/8".

Image 5: CMF™ power leads. Leads should be ≤ 10 feet/3 meters for best results, but no more than 15 feet/5 meters in length.

Image 6: CMF™ fuses and resistor clips (resistors have not yet been installed).

Image 7: Power leads being pulled through conduit hole in CMF™.

Image 8: CMF™ power leads installed in non-metallic flex conduit.

Image 9: CMF™ conduit run to MV enclosure of SUT.

Image 10: Preparing lead to install on MV lugs of SUT.

Image 11: Crimping lug eye to install on the MV lug bolt.

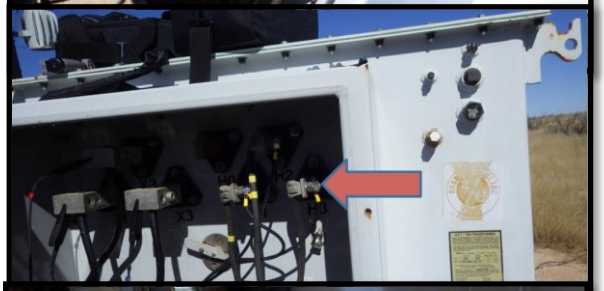

Image 12:CMF™ leads on MV lugs in SUT.

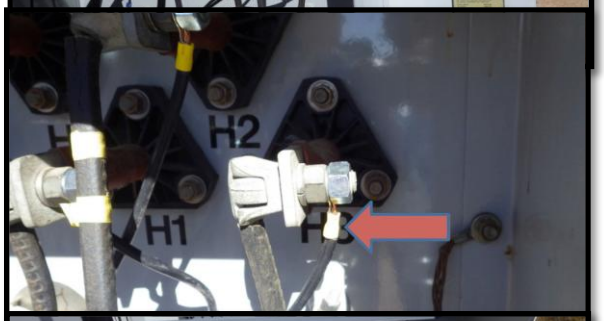

Image 13: CMF™ leads installed in SUT.

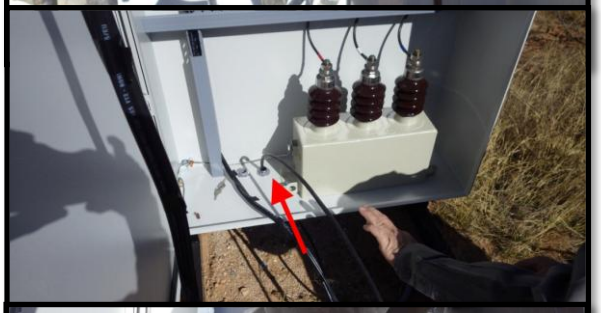

Image 14: CMF™ LV wire in conduit hole.

Image 15: CMF™ LV conduit

Image 16: CMF™ LV conduit to VFD

Image 17: LV control wire into the VFD

Image 18: Attaching LV control leads to terminal block of the CMF™

Image 19: LV leads run in cable tray inside CMF™

Image 20: Replacing cable tray cover

Image 21: Terminal block termination (see page 13, image 27 for further instructions).

Image 22: Ground wire finalized

Image 23: CMF™ lead wire connected to The ROD chemical ground point

Image 24: CMF™ with resistors installed (Newer version CMF™ units have resistors installed in the left clips, while the fuses will be installed in the right clips). Once resistors have been installed, check for tightness and adjust clips as necessary for a secure connection.

Image 25: CMF™ closed and in operation

3.1 CMFB-VGMM-T-5 SPECIFIC NOTES

The CMFB-VGMM-T-5 is the largest model MGD common mode filter and has specific notes for its application. This model uses the 5E fuses exclusively. The resistors are larger and more numerous. There are optionally utilized vents. Installation is largely the same for all models of CMF. Following are CMFB-VGMM-T-5 specific notes.

Figure 26: CMFB-VGMM-T-5

Figure 27: Fitting Resistors (4/phase)

Figure 28: Properly Fitted Resistors

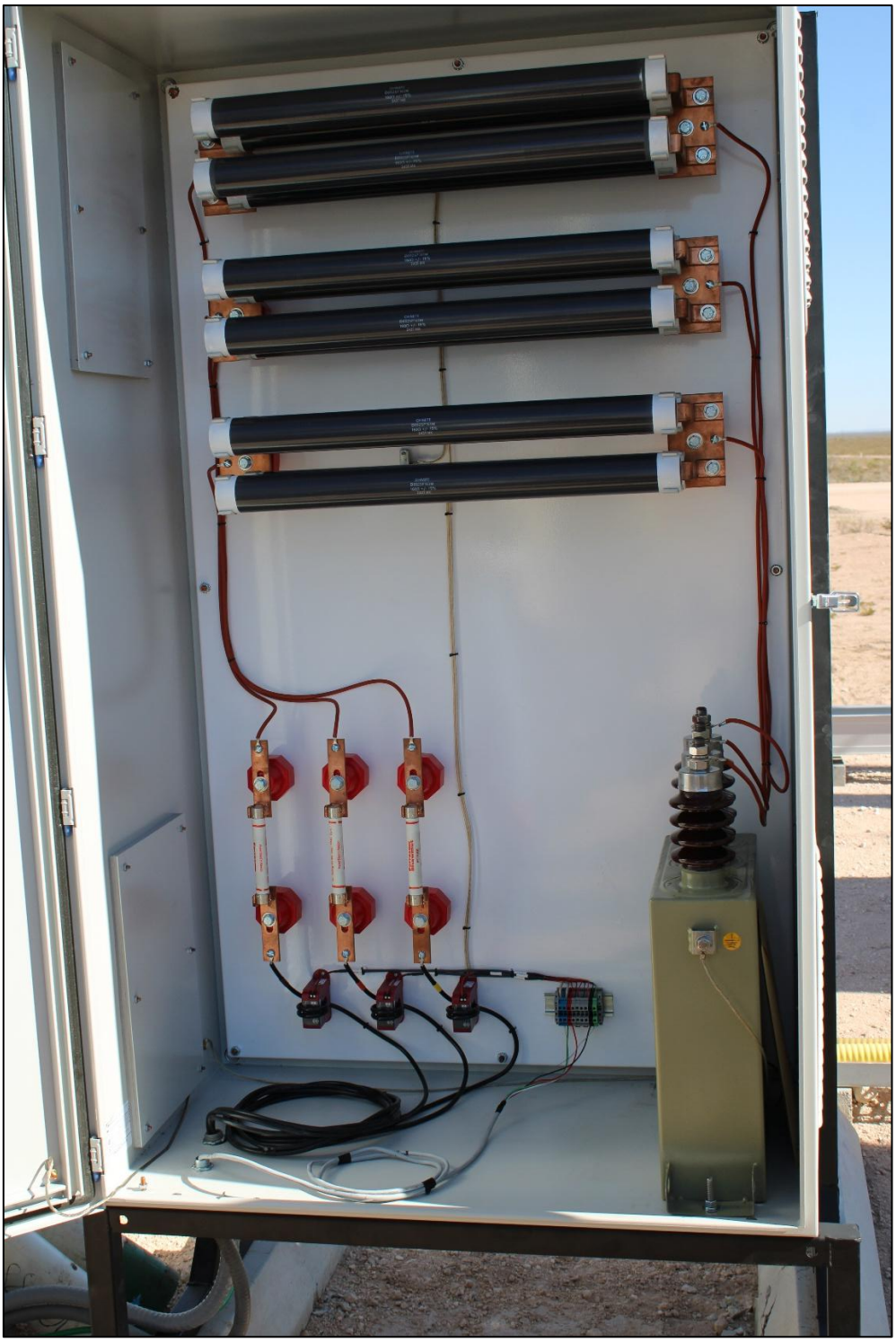

Figure 29: CMFB-VGMM-T-5 Internal (Note Arrangement and Component Locations)

The four vents, in the CMFB-VGMM-T-5, are optional and rarely required. Reusable, stainless-steel filters are pre-fitted under the removable vent covers. These may be cleaned externally with the use of a portable vacuum, as needed. **If the covers for the optional vents are removed, the ¼" plug at the bottom of the enclosure must be removed or a hole must be drilled of at least ¼" to allow for drainage.**

The use of the optional vents remains at the discretion of the end-user. Their use may be desired in high-temperature applications where venting is judged to not be of concern.

3.2 CMF TERMINAL BLOCK

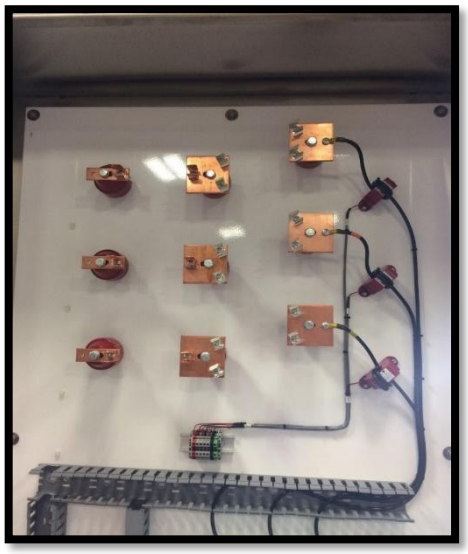

Image 30: Terminal block as mounted in CMF™ Cabinet

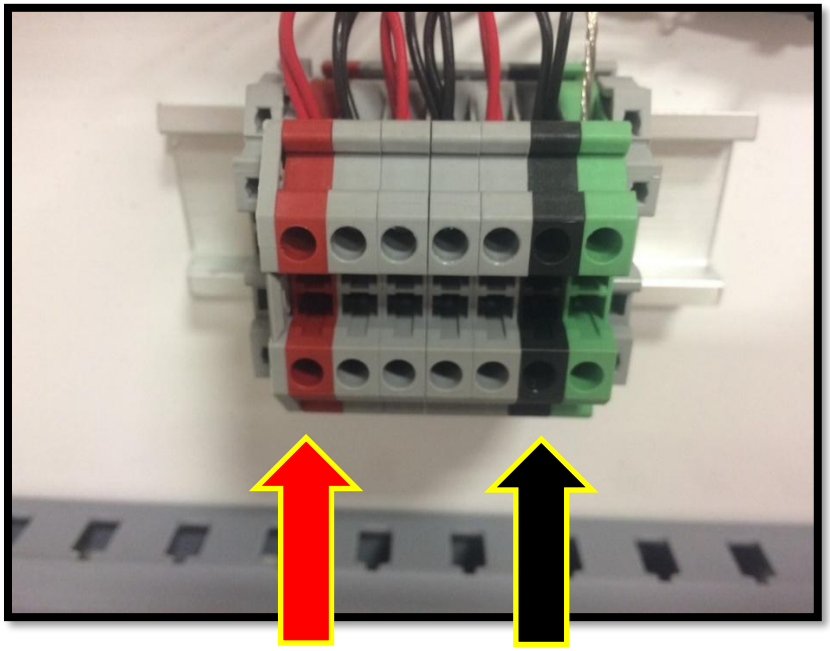

*Image 31: LV Copper #18AWG twisted pair to be installed on the RED and BLACK terminals of the terminal block and run to VFD controller I/O point with a maximum wire length of **98.4 feet (30 meters)**. The green terminal is grounded shield.*

The current switches are provided as Normally Open. An opening of any current switch indicates a loss of current at one or more phases and will open the Red-Black circuit. It is normal for this circuit to open during VSD shutdown, therefore it is recommended that a time delay is implemented.

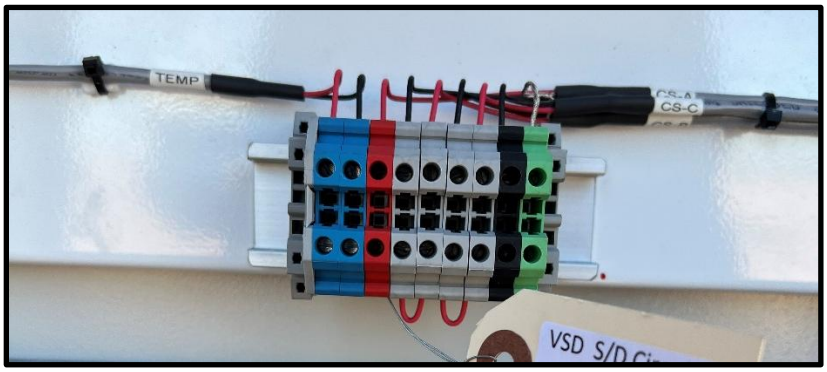

Image 32: For CMF™ equipped with temperature switches, the blue terminal blocks are a circuit that opens on indication of excessive temperatures. This can be used as a separate input to the VFD controller I/O point.

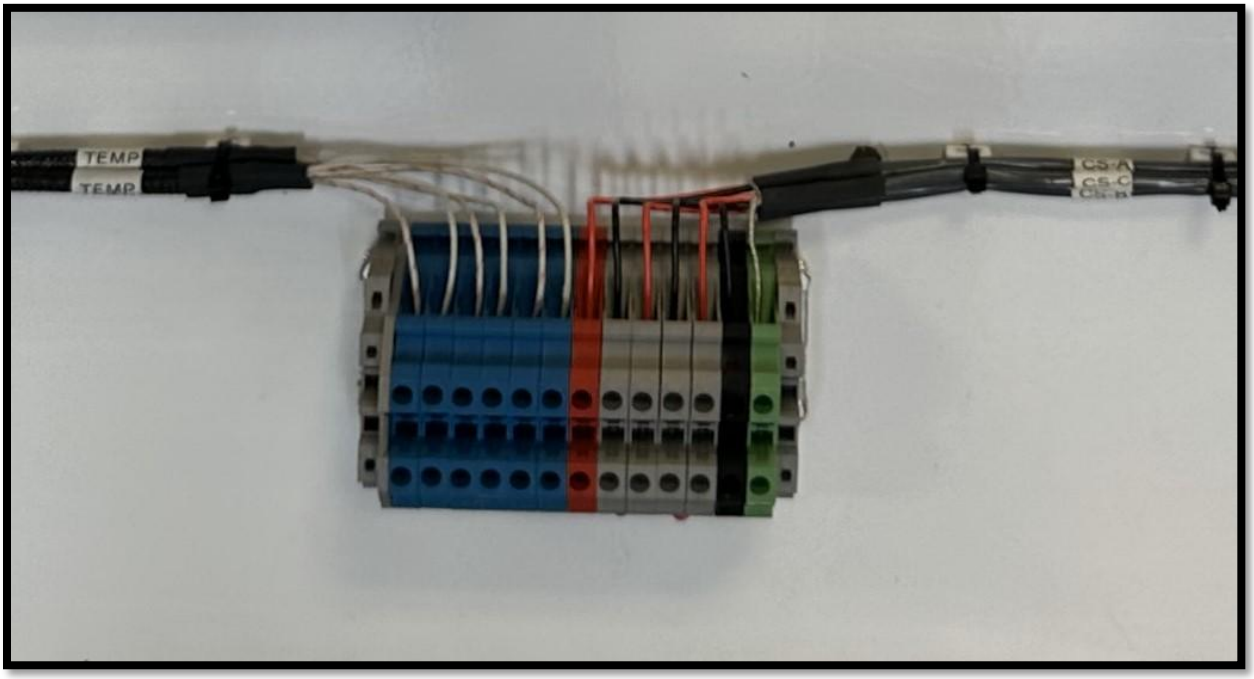

Image 33: For CMF™ equipped with analog temperature feedback (ATF), the blue terminal blocks are in non-polarity sensitive pairs utilizing PT1000 RTDs. These should be connected as per section 3.2 Analog Temperature Feedback. ***(Option Phasing Out)***

3.3 ANALOG TEMPERATURE FEEDBACK

The following section applies if the CMF™ is fitted with the Analog Temperature Feedback option. **This option is phasing out.**

PT1000 RTDs are fitted to the backpanel behind each of the resistor banks. These RTDs are read by the Analog Temperature Feedback Module which ships with its own mounting hardware and can be mounted to the lower front of the CMF™ or a nearby location with no more than 20' (6m) of lead length.

The RTD is part of a voltage divider circuit (PT1000 and 10KΩ resistor) that creates a very low voltage DC signal input that is then converted into a 4-20mA signal that is displayed locally by robust analog panel meters. Optional outputs are provided for connecting the 4-20mA output to an existing SCADA system.

The purpose of the Analog Temperature Feedback option is to allow for tracking of changes in the current through the CMF™ over time which may be an indicator of the changing health of the variable speed drive. The output should be periodically recorded and charted. As a baseline, 12mA correlates to 350F (176C) which has been observed to indicate that a problem with the variable speed drive has occurred, but rapid changes in a short period of time may be more indicative of a problem. In this event, we recommend evaluating the health of the sine wave filter components installed in the variable speed drive.

Overrange output (panel meters pinned over scale) indicates an open circuit at the corresponding RTD wire run. In this event, please verify the RTD wire run connections. They are in pairs that are not polarity sensitive.

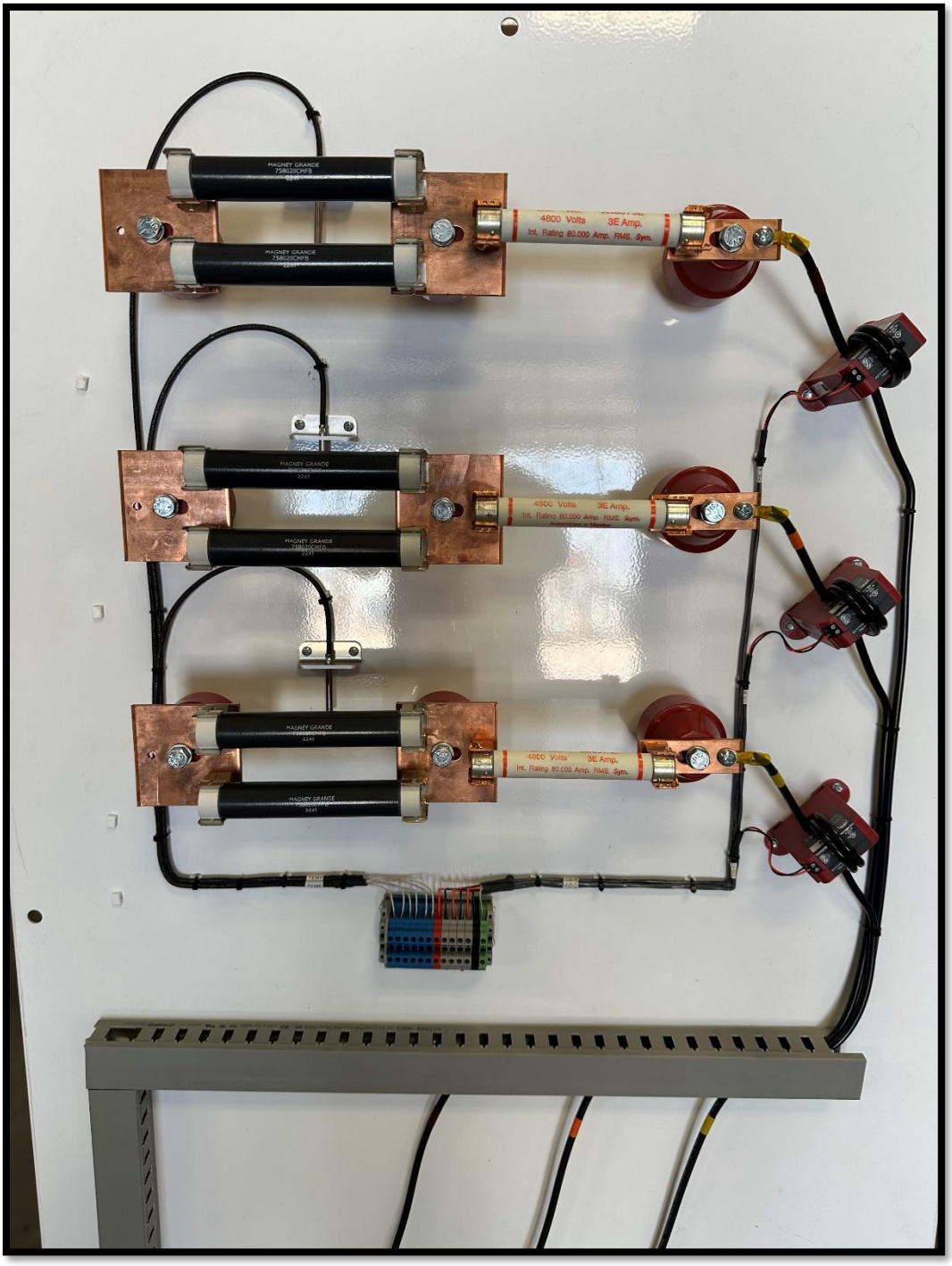

Image 34: CMF™ fitted with RTDs for Analog Temperature Feedback option.

Image 35: Analog Temperature Feedback Module (external).

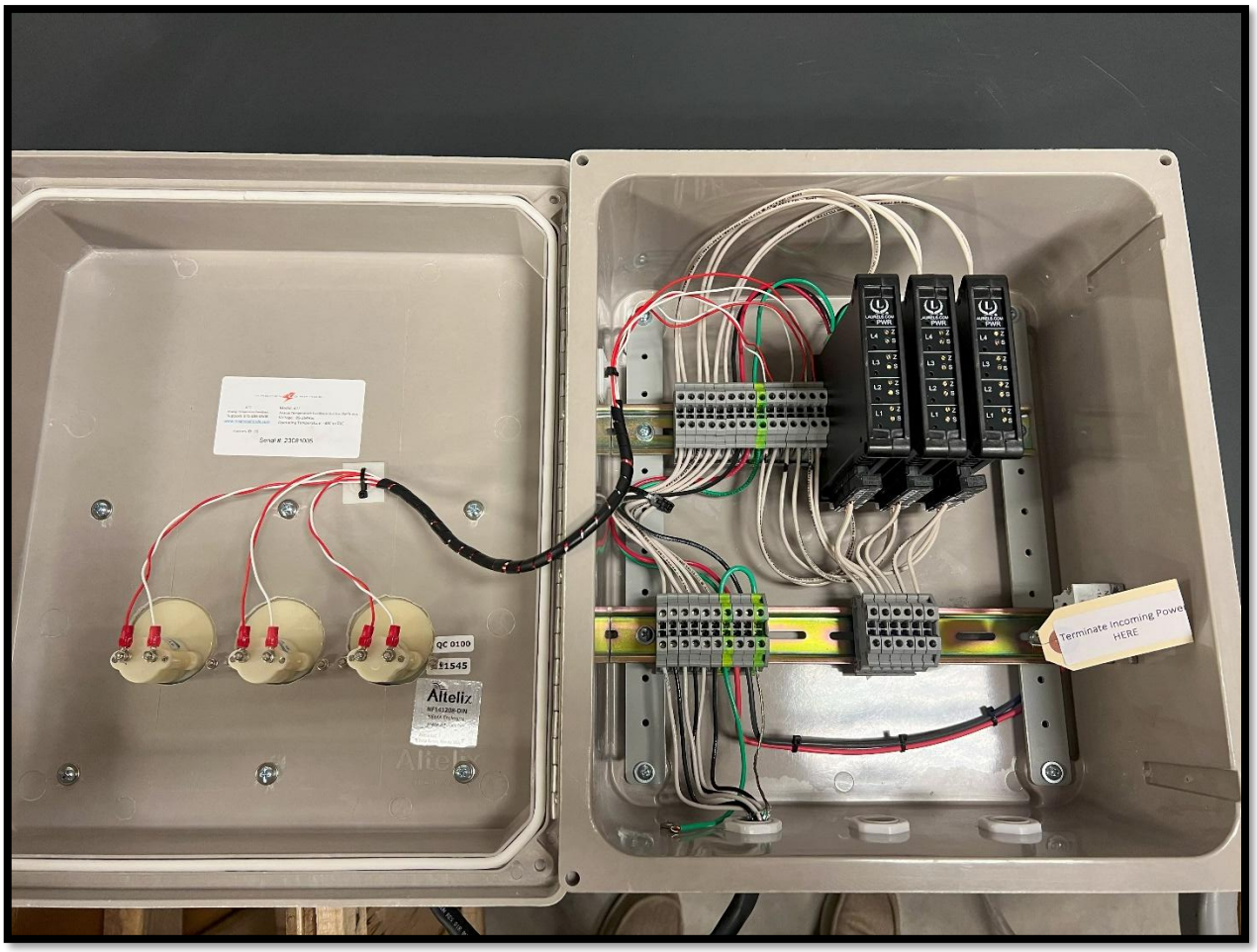

Image 36: Analog Temperature Feedback Module (internal).

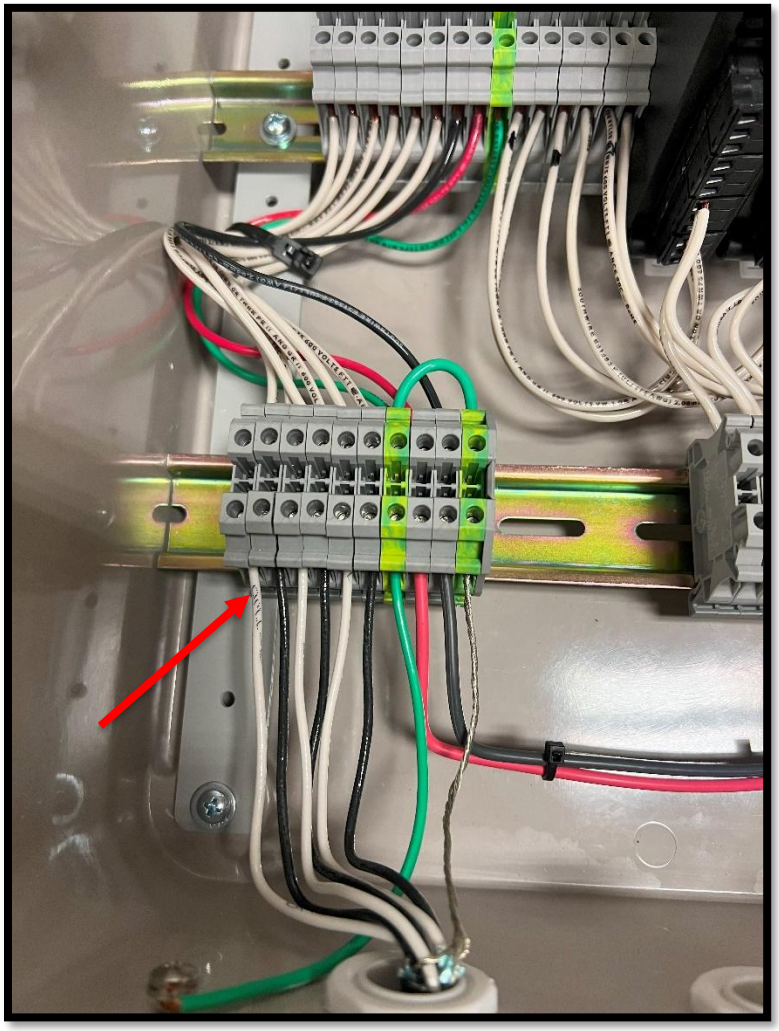

Image 37: Prewired RTD Inputs (non-polarity sensitive).

Image 38: 3-pair RTD Inputs to be connected to blue terminal blocks in CMF™ (non-polarity sensitive, refer to image 29).

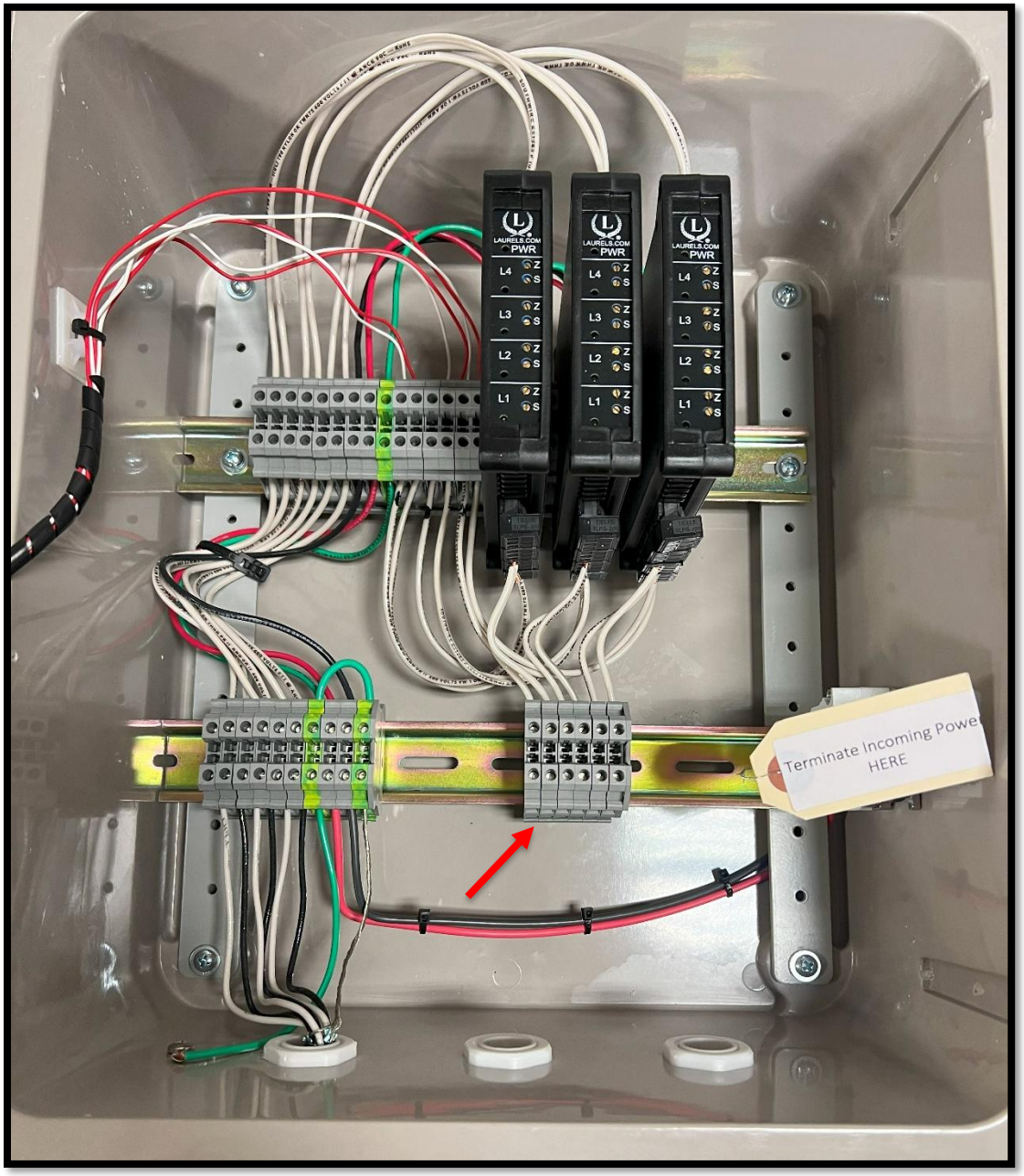

Image 39: Analog Outputs (Optional, 4-20mA, polarity sensitive with ground to right of each pair)

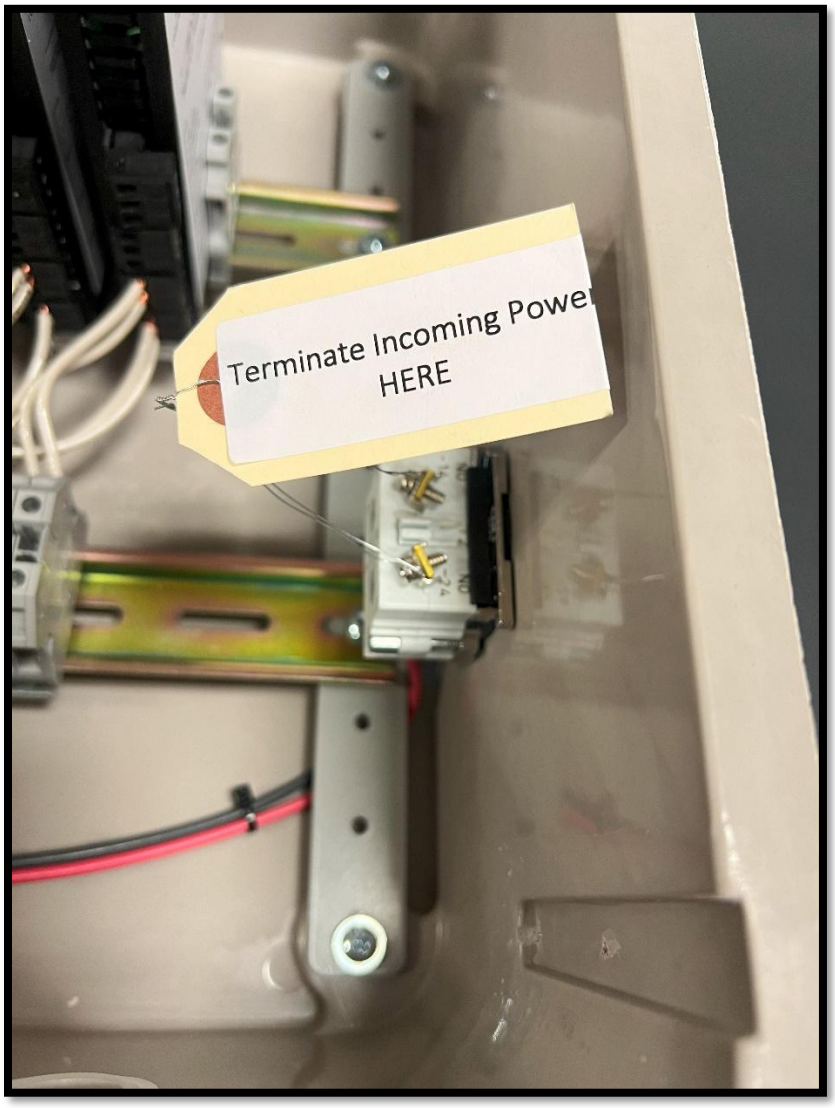

Image 40: Incoming Power Terminations (85 to 264Vac).

Image 41: Power Isolation Switch.