

MS-3 Voltage Regulator Simulator; Operation and Connection Instructions



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Safety for life



Eaton meets or exceeds all applicable industry standards relating to product safety in its Cooper Power™ series products. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Eaton employees involved in product design, manufacture, marketing, and service.

We strongly urge that you always follow all locally-approved safety procedures and safety instructions when working around high-voltage lines and equipment, and support our “Safety For Life” mission.

Safety information

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians who are familiar with this equipment should install, operate, and service it.

A competent technician has these qualifications:

- Is thoroughly familiar with these instructions.
- Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.
- Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.
- Is trained in the care and use of protective equipment such as arc flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, hotstick, etc.

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Indicates a potentially hazardous situation which, if not avoided, may result in equipment damage only.

Safety instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

DANGER

Hazardous voltage. Contact with hazardous voltage will cause death or severe personal injury. Follow all locally-approved safety procedures when working around high- and low-voltage lines and equipment.

G103.3

WARNING

Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling, or maintenance can result in death, severe personal injury, and equipment damage.

G101.0

WARNING

This equipment is not intended to protect human life. Follow all locally-approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury, and equipment damage.

G102.1

WARNING

Power distribution and transmission equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install, or maintain power distribution and transmission equipment can result in death, severe personal injury, and equipment damage.

G122.2

Product information

Introduction

Document MN225079EN contains instructions for the operation and use of the Eaton Cooper Power series MS-3 voltage regulator simulator. The simulator is designed to be used with the CL-7 voltage regulator control for demonstration and troubleshooting purposes. The MS-3 can also be used with a control and QD3 (T-350) tap changer.

Read this manual first

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment.

Additional information

These instructions cannot cover all details or variations in the equipment, procedures, or processes described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact the Voltage Regulator Support Group at (866) 975-7347 or RES-VRSupport@Eaton.com.

Acceptance and initial inspection

Each MS-3 Voltage Regulator Simulator is in good condition when accepted by the carrier for shipment. Upon receipt, inspect the shipping container for signs of damage. Unpack the MS-3 Simulator and inspect it thoroughly for damage incurred during shipment. If damaged is discovered, file a claim with the carrier immediately.

Handling and storage

Be careful during handling and storage of the MS-3 Voltage Regulator Simulator to minimize the possibility of damage. If the assembly is to be stored for any length of time prior to use, provide a clean, dry storage area.

Quality standards

ISO 9001 Certified Quality Management System



Figure 1. Front View of MS-3 Simulator

Description of Feature

1. Simulator Power Switch
2. Simulator Power Fuse (6 A)
3. Simulator Power Light
4. Load Current Adjustment Dial
5. Motor Raise Indicator Light
6. Drag Hand Reset Indicator
7. Motor Lower Indicator Light
8. Output (Load) Voltage Adjustment Dial
9. VDIFF (Voltage Differential) Switch – Changes the source voltage type between a differential or source input.
10. Power Flow Switch – Changes the direction of power flow between forward, indeterminate, and reverse.
11. Neutral Light Switch – Simulates the tap-changer neutral switch.
12. General Purpose Input 1 (GPI 1) Switch – Activates GPI1 which is programmed as default on the CL-7 for Voltage Reduction and uses Terminal 5 in the control wire harness.

NOTICE

Operating GPI 1 switch when connecting the simulator to a CL-6 control will cause a 120 V short to ground, which may cause damage to equipment. See the section on connecting the simulator to a CL-6 control for more information.

13. GPI 2 Switch – Activates GPI2 which is programmed for Tap to Neutral as a default on the CL-7 and uses Terminal J in the control wire harness. This switch will not have any function when connected to a CL-6 control. See the section on connecting the simulator to a CL-6 control for more information.
14. GPI 3 Switch - Activates GPI3 which is programmed for Auto Tap Block as a default on the CL-7 and uses terminal BR in the control wire harness
15. Dual Connector Terminal Board
16. Tap-changer Connector – Makes the connections to the tap-changer simulation circuitry of the simulator.
17. Control Connector – Connection point for control wire harness.
18. Power Cord
19. Ground Wire Connector

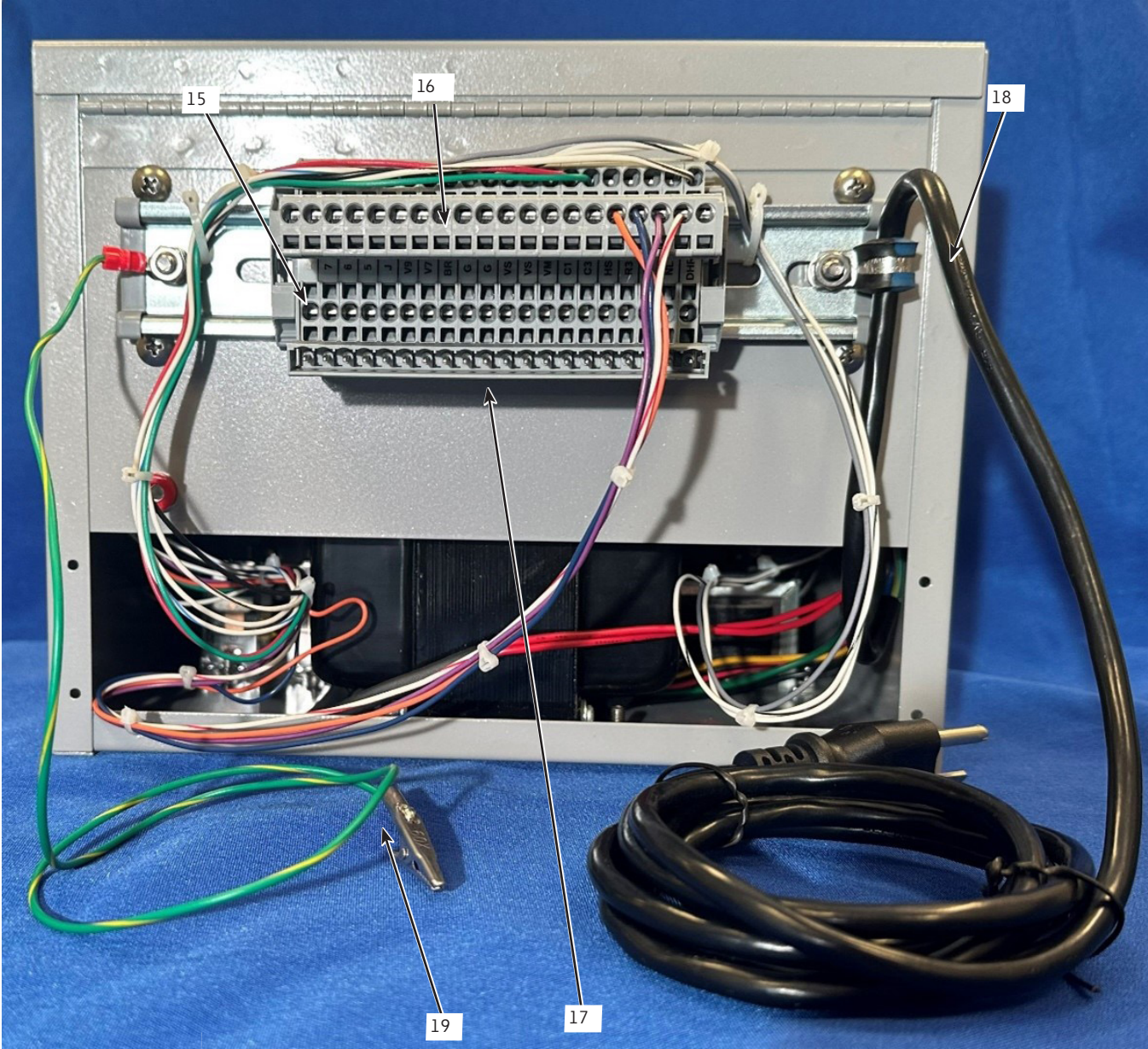


Figure 2. Front View of MS-3 Simulator

Connecting a control to the simulator

Follow these steps when connecting a CL-7 control to an MS-3 simulator.

1. Connect the ground wire connector. See Figure 3.

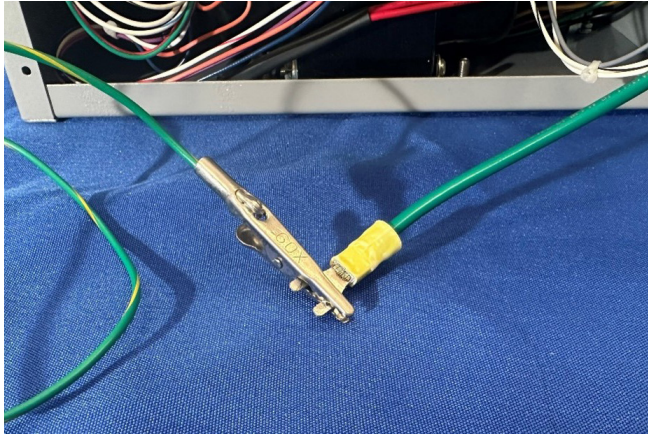


Figure 3. Ground Wire Connector Connected

2. Insert control wire harness connector into the terminal board receptacle. See Figure 4. The connector can be plugged into either the top or bottom receptacle. Make sure the labels on the connector match with the labels on the receptacle.

NOTICE

If the connector is not properly installed, control and simulator damage will result.

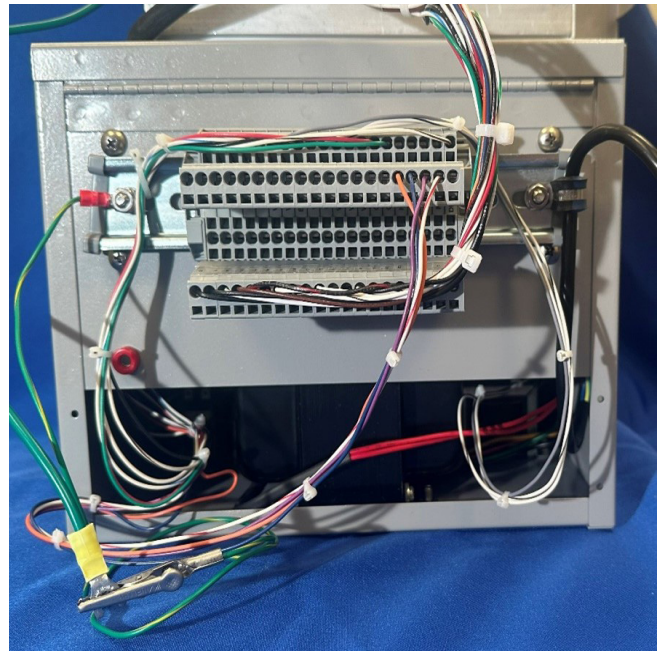


Figure 4. Inserting control wire harness connector into the simulator terminal board receptacle

3. If not already connected, insert the 20-position simulator tap-changer connector into a terminal board receptacle. This connection can be made to either the top or bottom connector. See Figure 5. Make sure the labels on the connector match with the labels on the receptacle.

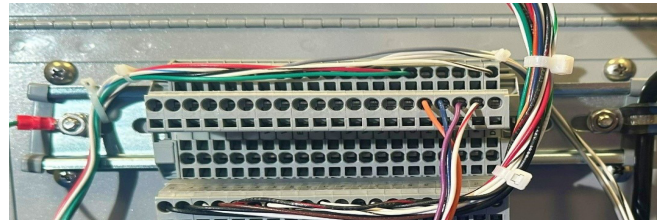


Figure 5. Inserting 20-position connector with 4-wires into the simulator terminal board receptacle

4. The control and MS-3 are ready to be used together as a unit.

Directions to connect a control and tap-changer to the simulator

Follow these steps when connecting a voltage regulator control and QD3 tap changer to an MS-3 simulator:

1. Follow steps 1 and 2 in the previous section to connect a control to the simulator.
2. Disconnect the 20-position connector shown in Figure 5 from the terminal board receptacle. It may hang down to the side of the terminal board when not in use.

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3. Insert the tap changer wiring harness connector into the open terminal Board receptacle. See Figure 6 and 7. When making this connection make sure that the labels on the connector match with the labels on the receptacle.
4. Use Figures 7 and 8 as a guide to install and connect the wiring harness from the simulator to the top terminal board of the QD3 tap-changer.

The circuits wired into the tap-changer connector are:

- White – Neutral/Ground (G)
- Orange – Holding switch (HS)
- Blue – Motor raise (R3)
- Black/Green – Motor Lower (L3)
- Black/Red – Neutral light (NL)

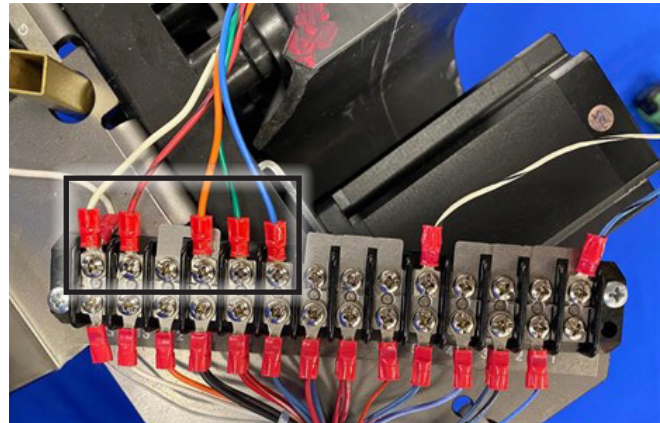


Figure 8. Connecting the tap-changer wires onto the terminal block on top the tap-change

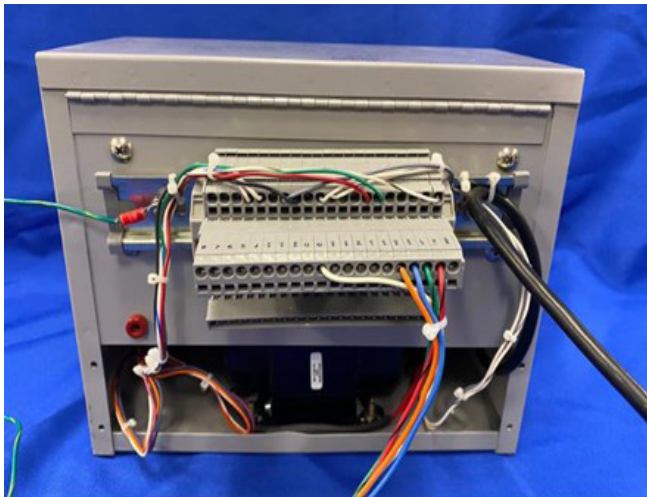


Figure 6. Connector wired to QD3 tap-changer

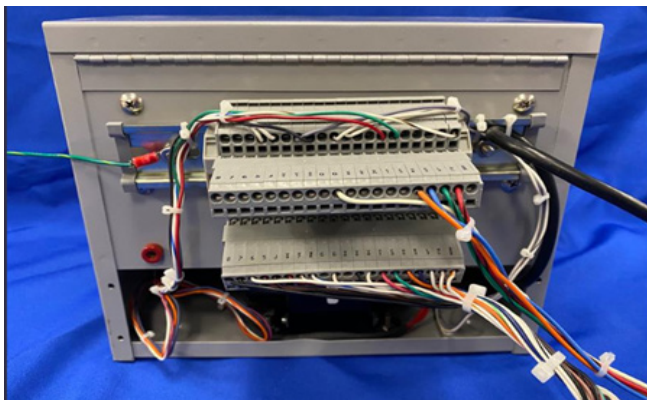
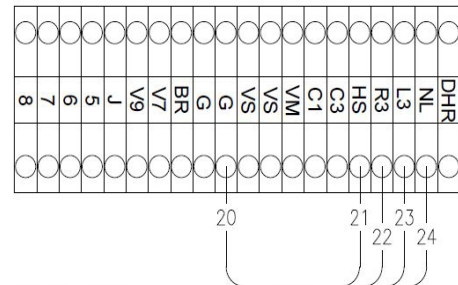


Figure 7. Inserting the tap-changer connector and control into the simulator terminal board receptacle



- WIRE COLOR CODES**
- 20 – WHITE
 - 21 – ORANGE
 - 22 – BLUE
 - 23 – GREEN/BLACK
 - 24 – RED/BLACK

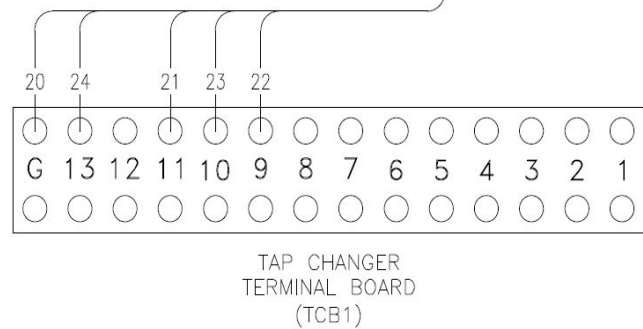


Figure 9. Connection drawing from the simulator to the top terminal block of the tap-changer

Connecting a CL-6 control to the MS-3 simulator

Most MS-3 functionality is compatible with the CL-6 control. The exceptions to this are GPI 1 and GPI 2. The CL-6 connection for GPI 3 is the same as that of the CL-7.

Instead of GPI 1 and GPI 2 connections in the wire harness of the CL-7, the CL-6 control has preprogrammed inputs on an orange Programmable Input/Output (PIO) connector on the side of the control.

For GPI 1, the default function is Voltage Reduction Point 1. For the CL-6, PIO terminal 10 is used for the same purpose. To enable the GPI 1 switch to operate this point on the CL-6 control, the white wire connected to the simulator at terminal 5 must be disconnected and then connected to terminal 10 on the PIO. See Figure 10. This can be done using a spliced wire.

NOTICE

Operating the GPI 1 switch with the CL-6 control connected to the MS-3 simulator without disconnecting the white wire connected to terminal 5 will cause a short to ground. This will operate the simulator fuse and could cause other damage.

For GPI 2, the default function is Tap to Neutral. For the CL-6, PIO terminal 3 is used for the same purpose. To enable the GPI 2 switch to operate this point on the CL-6 control, the white/blue wire connected to the simulator at terminal J must be disconnected and then connected to terminal 3 on the PIO. See Figure 10. This can be done using a spliced wire.

See the document MN225016EN, CL-6 series control installation, operation, and maintenance instructions, for more information on using the PIO on the CL-6 control.

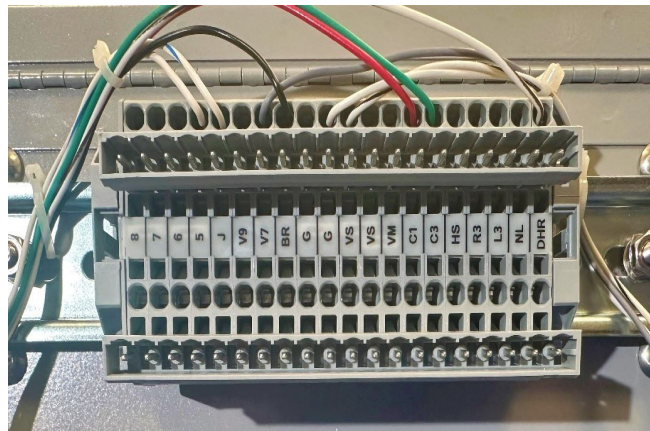


Figure 10. GPI 1 and GPI 2 wires connected from the simulator to the dual-connector terminal board

Control and MS-3 use and examples

The items in this section provide simulator use information and examples of how the simulator features affect the operation of the control. These examples can be used as a basis for developing testing and demonstration procedures for connected controls.

1. **Tap Changer Type Setting (FC 49):** When a QD3 tap changer is not connected to the control and the tap-changer simulator circuitry is used to simulate tap changer operations, the FC 49 setting of Cooper Spring Drive will give you the best operational results. When a QD3 tap changer is connected to the simulator, use the setting of Cooper QD3.
2. **Powering the Simulator and Control:** Toggle the simulator power switch to On; the simulator power indicator light will come on. Turn the output voltage adjustment dial up to 85 to produce an output of approximately 120 volts. Toggle the control panel power switch to Internal. The control will power up and can now be programmed and demonstrated.
3. **Load Current Adjustment:** With the power to the simulator turned on and a control panel connected, rotate the output voltage adjustment dial clockwise to increase the load voltage sensed by the control. Read the control load voltage secondary display at Function Code (FC 6) or by using the Metering-PLUS Load Voltage display (Key 2). The compensated voltage secondary may also be adjusted and viewed at FC 8 or by using the Metering-PLUS Comp Voltage display (Key 1).
4. **Load Voltage Adjustment:** With the power to the simulator turned on and a control panel connected, rotate the load current adjustment dial clockwise to increase the load current sensed by the control. Read the control load current display at FC 9 or by using the Metering-PLUS Load Current display (Key 3).
5. **Drag Hand Reset:** With the power to the simulator turned on and a control panel connected, press the drag hand reset button or switch on the control. Observe that the DHR light illuminates on the simulator.
6. **Raise and Lower:** With the power to the simulator turned on and a control panel connected, place the Control Function switch on the control to Local Manual, toggle the Raise/Lower switch on the control panel to Raise. Observe that the Raise light illuminates on the simulator. The same can be done in the lower direction by operating the lower switch on the control to illuminate the Lower light.
7. **VDIFF Switch:** With the power to the simulator turned on and a control panel connected, Enter FC 7 on the control. The control display will display the Source Voltage Secondary as calculated with the VDIFF Switch in the down position. The control is calculating the source voltage because the Load and Source voltage inputs are the same. Toggle the VDIFF Switch up to display a voltage without the calculation indication. This is because the source voltage input is now a differential voltage, and the control is displaying a source voltage that is measured.

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8. **Forward/Reverse Switch:** With the power to the simulator turned on and a control panel connected, press the Metering-PLUS Load Current button (Key 3). Put the Forward/Reverse Switch down for Forward; observe that the top line display shows Load Current (Value) Fwd. Place Forward/Reverse Switch up for Reverse; observe that the top line display shows Load Current (Value) Rev. Place Forward/Reverse Switch in the middle position; observe that the top line display Zero Load Current and neither Fwd nor Rev for direction.
9. **Neutral Light Switch:** With the power to the simulator turned on and a control panel connected, press the Neutral Switch down, the neutral light on the control panel will illuminate.

Note: When operating the neutral light switch, the control will sync its tap position to neutral. When the switch is release, the control will lose tap position tracking. To restore a valid tap position, enter a new tap position for demonstration purposes at FC 12.

10. **GPI 1 switch:** With the power to the simulator turned on and a control panel connected, make these settings changes:
 - Voltage Reduction (FC 70) to Remote Latch
 - Remote Set #1 (FC 73) to 1.0 %.

Press the GPI 1 button and observe the Voltage Reduction status LED illuminates. View FC 71 and observe the voltage reduction in effect is 1%.

11. **GPI 3 switch:** With the power to the simulator turned on and a control panel connected, move the Control Function switch to Auto/Remote. Press the GPI3 button. Observe the Auto Tap Block LED status LED illuminates.

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