

Fiber-optic/RS-232 communications module installation and operation 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.

CAUTION: 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.

G122.3

Product information

Introduction

Service Information MN225020EN provides the installation and operation instructions for Eaton's Cooper Power™ series CL-6 and CL-5 series regulator control fiber-optic/RS-232 communications module.

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. Read and understand the manuals detailing the installation and operation of the regulator and the regulator control used with the regulator. Refer to *MN225016EN CL-6 Series Control Installation, Operation, and Maintenance Instructions* for information on the CL-6 series voltage regulator control. Refer to *MN225008EN VR-32 Voltage Regulator with Quik-Drive Tap-Changer Installation, Operation, and Maintenance Instructions* for information on the voltage regulator with Eaton's Cooper Power series Quik-Drive™ tap-changer. Refer to *S225-10-10 McGraw-Edison VR-32 Voltage Regulator and CL-5 Series Control Installation, Operation and Maintenance Instructions and Parts Replacement Information* for information on the voltage regulator and CL-5 series control.

Additional information

These instructions cannot cover all details or variations in the equipment, procedures, or process described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, please contact your Eaton representative.

Acceptance and initial inspection

This kit is thoroughly inspected at the factory. It is in good condition when accepted by the carrier for shipment.

Upon receipt of the regulator kit, a thorough inspection should be made for damage, evidence of rough handling, or shortages. Should this initial inspection reveal evidence of rough handling, damage, or shortages, it should be noted on the bill of lading and a claim should immediately be made with the carrier. Also, notify your Eaton representative.

Handling and storage

Be careful during handling and storage of equipment to minimize the possibility of damage. If the regulator kit is not to be placed into immediate use, store the kit where the possibility of damage is minimized.

Quality Standards

ISO 9001 Certified Quality Management System

Description

The fiber-optic/RS-232 communications board allows digital SCADA communications from the CL-5/CL-6 series voltage regulator control to external remote communication devices.

Mounting instructions

Table 1. Kit Parts Identification

Item	Description	Qty
1	Communication module circuit board	1
2	Interface cable: CL-6/CL-5 to communication module	1
3	Nylon cable clip	1
4	Machine screw, 6-32 x 1/2, round head	2
5	Flat washer, #8, stainless steel	2
6	Cable ties, 1/16-5/8	8
7	Lock washer, #6, stainless steel	2
8	Stand-off stud, 1 1/4"	4
9	Stand-off stud 1/2"	6
10	Machine screw, 10-32 x 3/8", stainless steel	10
11	Lead assembly, #20, white/black	1
12	Lock washer, #10, stainless steel	12
13	Flat washer, #10, brass	4
14	Lead assembly, #20, white	1
15	Stainless steel mounting plates	2
16	Assembly Drawings	3

CL-6B control

Follow these instructions to install the fiber-optic/RS-232 communications module onto a CL-6B control.

1. De-energize the control panel according to the regulator manufacturers instructions.

CAUTION

Electrical Shock Hazard. Failure to de-energize the control panel will expose the equipment installer to 120 Vac resulting in an electrical shock.

VR-T247.0

On Eaton control boxes, open the **V₁** and **V₆** (if present) knife switches and close the **C** switch on the back panel. This will de-energize the control panel and also the back panel below the switches.

2. The communications board may be mounted at two possible locations on the rear of the CL-6B control panel. Each location is defined by four threaded mounting holes. Locate one set of four mounting holes on the rear of the CL-6B control panel. See Figure 1.

Note: These mounting holes are threaded to accept the stand-off studs.



Figure 1. Communications module mounting locations, rear of CL-6B control panel.

3. Screw four of the 1/2" threaded stand-off studs (Item 9) into the rear of the CL-6B control panel. See Figure 2.



Figure 2. Stand-off studs on control panel.



Figure 3. Module mounted on rear of CL-6B control panel.

4. Using the screws (Item 10), brass washers (Item 13), and lock washers (Item 12), mount the communications module (Item 1) to the stand-off studs. The brass washer is placed directly on the communications module; the lock washer is placed between the brass washer and the screw. See Figure 3.

Note: The ST (fiber-optic) connectors should point down.



Figure 4. Connecting interface cable to module.



Figure 5. Connecting interface cable to CL-6B control panel.

5. Connect the interface cable (Item 2) to the jack on the right side of the communications module marked "CL6". See Figure 4.
6. Loosen the module mounting screw next to the DB-9 port (lower right corner). Place the fork terminal of the grounding lead from the interface cable between the brass washer and the communication board and retighten the screw. See Figure 4.
7. Push the interface cable terminal connector into an open accessory jack on the hinge side of the control panel. Use the lower jack (Com2); if Com2 is in use, use the upper jack (Com3). See Figure 5.
8. Use the supplied cable clip (Item 3) to route the control cable through the clip and mount the clip to the control using the threaded hole adjacent to the accessory jacks. See Figure 5. Use Items 4, 5, and 7 to accomplish this.
9. Mount the control cable fork terminal lead (grounding lead) to the second threaded hole adjacent to the accessory jacks. See Figure 5. Use items 4, 5, and 7 to mount the fork terminal.
10. Confirm that both cable terminals and both fork leads are connected.
11. Route the cable along the back of the control panel and add cable ties (Item 6) where appropriate.



Figure 6. Connecting power to communications module.

12. Connect the white/black lead (Item 11) to the "L" terminal; connect the white lead (Item 14) to the "N" terminal. See Figure 6.
13. Connect the communications board to a stable approximately 120 Vac power source.
 - A. When installing the communications board in a Eaton control box the RCT terminal board should be used to supply power. See Figure 7.
 1. Connect the white/black lead (Item 11) to the 115 terminal.
 2. Connect the white wire (Item 14) to the COM terminal.
 - B. For communications boards installed in other than Eaton control boxes, any stable 120 Vac source can be used to supply power to the board.

CAUTION

The communications module must not be subjected to a voltage above 137 Vac or damage may result. A voltage supply below 80 Vac will result in loss of function. VR-T248.0

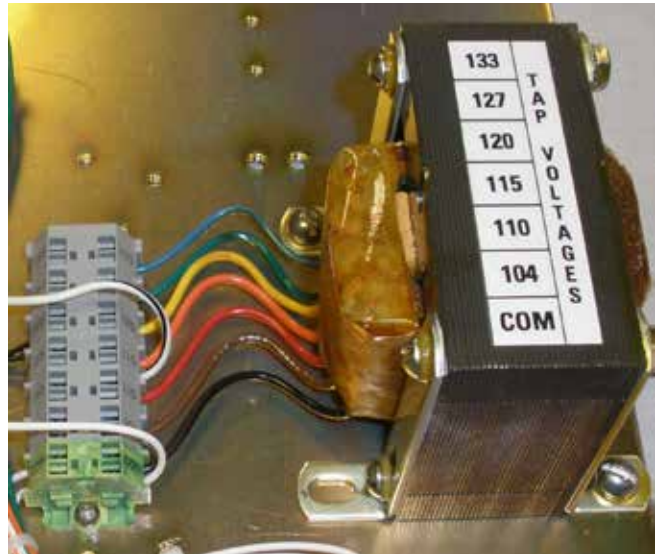


Figure 7. Connecting power leads to RCT terminal board.

14. Set the DIP switches, which are located at the center of the communication board. See Figure 8. Refer to the Operation section of this manual for more information.
 - A. Fiber communications:
 1. Set the lower DIP switch to FIBER OPTIC.
 2. Upper DIP switch:
 - a. For loop configuration, set the upper DIP switch to ECHO.
 - b. For point-to-point communication, set the upper DIP switch to NON-ECHO.
 - B. Serial communications:
 1. Set the lower DIP switch to RS-232.
 2. Set the upper DIP switch to NON-ECHO.

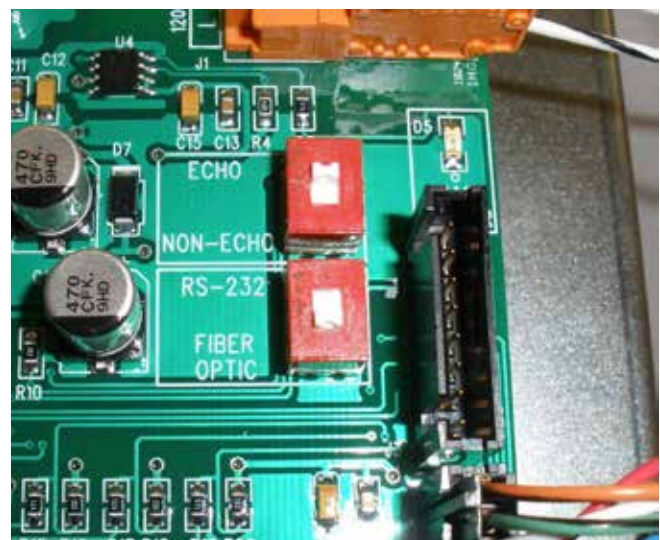


Figure 8. Setting DIP switches.

CL-6A and CL-5 series controls

Follow these instructions to install the fiber-optic/RS-232 communications module onto an Eaton or McGraw-Edison CL-6A control or a CL-5 series control. The preferred mounting location for these models is the control box back panel.

1. De-energize the control panel according to the regulator manufacturers instructions.

⚠ CAUTION

Electrical Shock Hazard. Failure to de-energize the control panel will expose the equipment installer to 120 Vac resulting in an electrical shock.

VR-T2470

On Eaton control boxes, open the **V₁** and **V₆** (if present) knife switches and close the **C** switch on the back panel. This will de-energize the control panel and also the back panel below the switches.

2. Locate the four mounting holes on the control back panel. See Figure 9.

Note: These mounting holes are threaded to accept the stand-off studs.

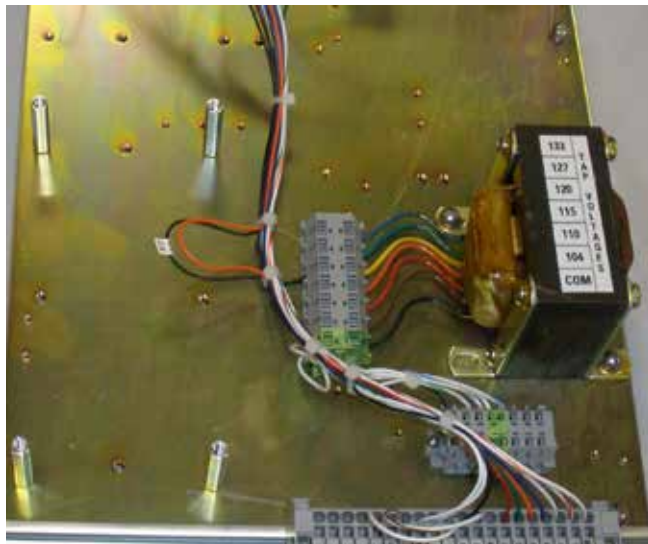


Figure 9. Module mounting location with stand-off studs mounted, control box back panel.

3. Determine which length stand-off studs are required to allow clearance off the terminal block at the lower edge of the rear panel. The kit includes 1/2" studs (Item 9) and 1 1/4" studs (item 8).
4. Screw the appropriate threaded stand-off studs into the mounting holes on the control box back panel. See Figure 9.



Figure 10. Module mounted on control box back panel.

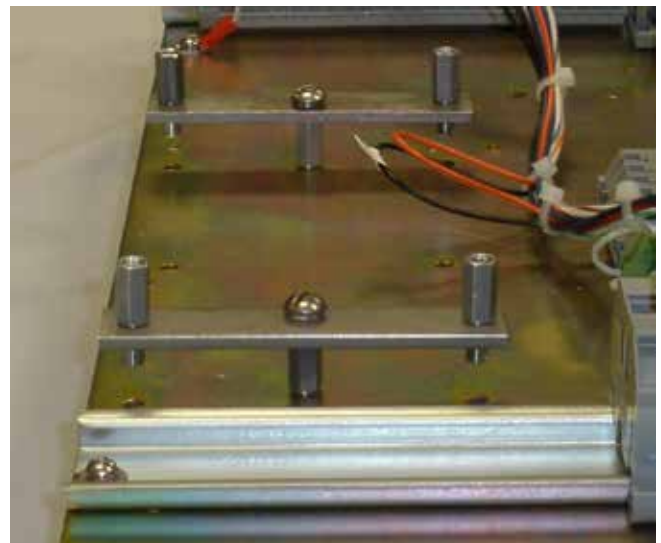


Figure 11. Alternate method of mounting communications module.

5. Using the screws (Item 10), brass washers (Item 13), and lock washers (Item 12), mount the communications module (Item 1) to the stand-off studs. The brass washer is placed directly on the communications module; the lock washer is placed between the brass washer and the screw. See Figure 10.

Note: The ST (fiber-optic) connectors should point down.



Figure 12. Communications module mounted using alternate method.

6. An alternate method of mounting the communications board onto the back panel is to use two (2) stainless steel mounting plates (Item 15), six (6) screws and lock washers (Items 10 and 12), four (4) brass washers (Item 13) and six (6) 1/2" stand-off studs, (Item 9). See Figures 11 and 12.
7. Connect the provided interface cable (Item 2) to the jack on the right side of the communications module. See Figure 13. Use the jack marked "CL5" for CL5 Series control panels and the one marked "CL6" for CL-6 Series control panels.



Figure 13. Connecting interface cable to module.



Figure 14. Connecting interface cable to CL-6A control panel.

8. Loosen the module mounting screw next to the DB-9 port (lower right corner). Place the fork terminal of the grounding lead from the interface cable between the brass washer and the communication board and retighten the screw. See Figure 13.
9. Connect the interface cable to the control panel:
 - A. For the CL-6A control panel: Push the interface cable terminal connector into an open accessory jack located on the hinged side of the control panel. Use the lower jack, (Com2); if Com 2 is in use, use the upper jack (Com 3). See Figure 14.
 - B. For the CL-5 control panel: Remove the metal shield from the back of the control by removing 4 nuts and wiring harness cable stay. Push the interface cable terminal connector into the accessory jack located at the top right of the printed circuit board. See Figure 15.
10. For the CL-6A, use the supplied cable clip (Item 3) to route the control cable through the clip and mount the clip to the control using the threaded hole adjacent to the accessory jacks. See Figure 14. Use items 4, 5, and 7 to accomplish this. Skip this step for the CL-5.
11. Connect the interface cable grounding lead to the control panel:
 - A. For the CL-6A, connect the lead to the threaded hole adjacent to the accessory jacks. See Figure 14. Use items 4, 5, and 7.
 - B. For the CL-5, connect the lead under the nut adjacent to the accessory jack. See Figure 16. Install the metal shield onto the back of the control panel, routing the interface cable through the slot in the side of the shield as it is installed. See Figure 16.



Figure 15. Connecting interface cable to CL-5 control panel.



Figure 16. Routing interface cable on CL-5 control panel.

12. Confirm that both cable terminals and both fork leads are connected.
13. Route the cable along the back of the control panel and add cable ties (Item 6) where appropriate.
14. Connect the white/black lead (Item 11) to the "L" terminal; connect the white lead (Item 14) to the "N" terminal. See Figure 17.

CAUTION

The communications module must not be subjected to a voltage above 137 Vac or damage may result. A voltage supply below 80 Vac will result in loss of function. VR-T248.0

15. Connect the communications board to a stable approximately 120 Vac power source.
 - A. When installing the communications board in a Eaton control box the RCT terminal board should be used to supply power. See Figure 17.
 1. Connect the white/black lead (Item 11) to the 115 terminal.
 2. Connect the white wire (Item 14) to the COM terminal.

- B. For communications boards installed in other than Eaton control boxes, any stable 120 Vac source can be used to supply power to the board.

16. Set the DIP switches, which are located at the center of the communication board. See Figure 17. Refer to the **Operation** section of this manual for more information.

- A. Fiber communications:
 1. Set the lower DIP switch to FIBER OPTIC.
 2. Upper DIP switch:
 - a. For loop configuration, set the upper DIP switch to ECHO.
 - b. For point-to-point communication, set the upper DIP switch to NON-ECHO.
- B. Serial communications:
 1. Set the lower DIP switch to RS-232.
 2. Set the upper DIP switch to NON-ECHO.

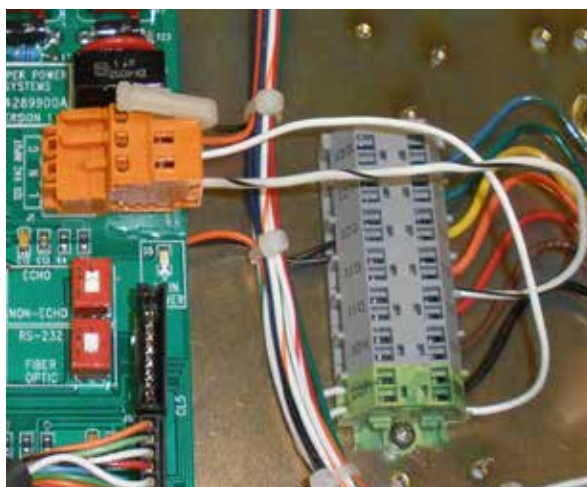


Figure 17. Connecting power to module.



Figure 18. Setting DIP switches.

Operation

The fiber-optic/RS-232 communications board allows digital SCADA communication from the CL-5/CL-6 series regulator control to external remote communication devices. Several Function Codes (FC) must be set properly when attempting to use the second communications port: for CL-5 series, FC 64—FC 68; for CL-6 series, FC 60—FC 67.

To properly set the FCs, refer to *Service Information MN225016EN CL-6 Series Control Installation, Operation, and Maintenance Instructions* for information on the CL-6 series voltage regulator control and refer to *Service Information S225-10-10* for information on the CL-5 series. Refer also to any manuals provided by the RTU/master station vendor.

Fiber-optic communication

When communicating using the standard ST terminal connectors and fiber-optic cables, the fiber-optic/RS-232 switch must be set in the FIBER OPTIC position.

CL-5 series controls:

FC 66, Communications Port Handshake Mode, must be set to "2", handshaking on. FC 67 determines the Number of Line Sync Characters. This must be set properly for the control to determine the dead-line sync time. The value for FC 67 is affected by communications parameters such as the system baud rate (under normal circumstances, values are in the 2 to 5 range). FC 68, Communications Port Transmit Enable Delay, can be used to increase the enable delay (warm-up time) before transmitting.

CL-6 series controls:

FC 65 (Com1/Com3) or FC 165 (Com2) must be set for the appropriate handshake mode. FC 62 (Com1/Com3) or FC 162 (Com2) Sync Time, defines the time the control must remain idle before recognizing the start of a message. The amount of sync time may need to be increased depending upon the number of controls in the ring/loop. FC 66 (Com1/Com3) or FC 166 (Com2) Communications Port Transmit Enable Delay, can be used to increase the enable delay (warm-up time) before transmitting.

Fiber-optic loop

For communication through the fiber-optic terminals with the regulator controls connected in a loop (ring) configuration, the ECHO/NO-ECHO DIP switch must be set in the ECHO position. In the ECHO mode, the regulator control will respond to the Master station by first echoing the command and then sending the response.

CL-5 series controls:

Set FC 66 to "2" to activate the handshaking mode and FC 68 to "50" for a 50 millisecond transmit enable delay time. FC 67 may need to be increased to improve communications efficiency.

CL-6 series controls:

Set FC 65 (Com1/Com3) or FC 165 (Com2) to the appropriate handshaking mode. Set FC 66 (Com1/Com3) or FC 166 (Com2) to "50" for a 50 millisecond transmit enable delay time. FC 62 (Com1/Com3) or FC 162 (Com2) may need to be increased to account for several controls in the loop.

Fiber-optic point-to-point

For communication through fiber-optic terminals in a point-to-point configuration, the ECHO/NO-ECHO DIP switch must be set in the NO-ECHO position. The regulator control will respond to the Master station by sending a response only.

CL-5 series controls:

Set FC 66 to "0" for no handshaking. Set FC 68 to "0" for no transmit enable delay.

CL-6 series controls:

Set FC 65 (Com1/Com3) or FC 165 (Com2) to "RTS without CTS." Set FC 66 (Com1/Com3) or FC 166 (Com2) to "0" for no transmit enable delay.

Fiber-optic cable

The interface board is designed for use with 62.5/125 multi-mode glass fiber-optic cable suitable for direct burial and/or outdoor use with the following specifications:

- Operating Temperature Range: -40 °C to +65 °C
- Strength Member: Kevlar

Note: The strength member should not be steel or any other conductive material as electrical isolation will be lost.

- Inner Jacket: PVC
- Outer Jacket: Polyethylene
- Optical Window (wavelength): 850 nanometers (nm)
- Core Size: 62.5 microns (mm)
- Attenuation at 850 nm: 3.5 dB/km
Cables with different attenuations are acceptable; however, maximum allowable cable length will be affected.

RS-232 communication

For applications that require a hard-wired digital signal, an RS-232 port is standard on the digital communication board. The RS-232 Interface Standard specifies a point-to-point interface. When operating in this mode, the FIBER OPTIC/RS-232 DIP switch must be set in the RS-232 position and the ECHO/NO-ECHO DIP switch must be set in the NO-ECHO position. For a typical configuration:

CL-5 series controls:

Set FC 66 to "0" for no handshaking. Set FC 68 to "0" for no transmit enable delay.

CL-6 series controls:

Set FC 66 (Com1/Com3) or FC 166 (Com2) to "RTS without CTS." Set FC 66 (Com1/Com3) or FC 166 (Com2) to "0" for no transmit enable delay.

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Printed in USA
Publication No. MN225020EN / May 2015
(Supersedes S225404 / November 2011)

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