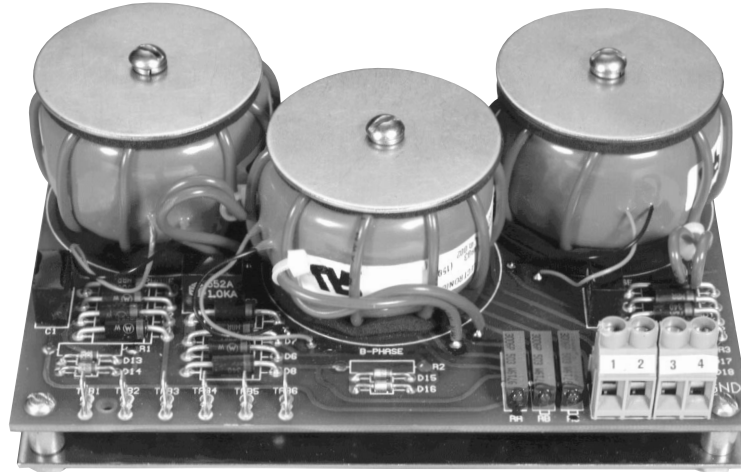


# Reclosers

## Form 4C Microprocessor-Based Recloser Control Analog Current Metering Accessory KME4-82-1, KME4-82-2 Installation and Operation Instructions

Service Information  
**S280-77-8**



**Figure 1.**  
Kyle® Form 4C Analog Current Metering Accessory KME4-82-1.

98047KM

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## SAFETY FOR LIFE



Cooper Power Systems products meet or exceed all applicable industry standards relating to product safety. 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 Cooper Power Systems 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 flash clothing, safety glasses, face shield, hard hat, rubber gloves, 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.

### 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 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 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 equipment can result in death, severe personal injury, and equipment damage.

G122.2

### 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.

## PRODUCT INFORMATION

### Introduction

The Analog Current Metering Accessory kits, KME4-82-1 (for use in single-size control cabinets) and KME4-82-2 (for use in double-size control cabinets), are available either as a factory-installed Form 4C accessory or as an aftermarket field retrofit kit.

Service Information S280-77-8 provides installation and operating instructions for the Kyle Form 4C Analog Current Metering Accessory. Before installing and/or operating this control, carefully read and understand the contents of this manual.

The information contained in this manual is organized into the following major categories: *Safety Information, Product Information, Specifications, Description of Operation, Installation, Verification of Operation, and Maintenance*. Refer to the table of contents for page numbers.

### Read This Manual First

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

### 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 Cooper Power Systems representative.

### Acceptance and Initial Inspection

Each Form 4C Analog Current Metering Accessory is completely assembled, tested, and inspected at the factory. It is carefully calibrated, adjusted, and in good condition when accepted by the carrier for shipment.

Upon receipt, inspect the carton for signs of damage. Unpack the control and inspect it thoroughly for damage incurred during shipment. If damage is discovered, file a claim with the carrier immediately.

### ANSI Standards

Kyle products are designed and tested in accordance with ANSI standards C37.60 and C37.85 and ANSI guideline C37.61.

### Quality Standards

The Quality System at the Cooper Power Systems Kyle Distribution Switchgear plant is certified to the ISO 9001 Standard.

### Description

The SCADA compatible Analog Current Metering Accessory (ACMA) replaces the need for externally mounted recloser bushing current transformers used to indicate line current. It features circuitry designed to monitor instantaneous load current and is suitable for use with 1000:1 or 500:1 current transformers.

The ACMA accessory has the ability to derive a signal representative of recloser current by interfacing with the existing control circuitry, thereby eliminating the need for bushing-mounted current-sensing transformers. The ACMA accessory is mounted inside the Form 4C cabinet and is connected in series between the current transformers and the Form 4C control. Its circuitry has negligible effect on the minimum pickup circuits of the controls. The key features of this derived signal are accuracy, isolation and minimal effect on minimum trip level. The accessory provides a dc output of 0-1 mA (current) for primary currents of 0–1000 A using 1000:1 current-sensing transformers. Other current-sensing transformer ratios are compatible, but the output will be scaled appropriately.

**Note:** The ACMA circuit is designed for Kyle reclosers with 1000:1 current transformers that supply fault sensing current. For reclosers with different current transformer ratings, contact your Cooper Power Systems representative for compatibility information.

# SPECIFICATIONS

Below are the key features of the Analog Current Metering Accessory:

- **Self-Powered**
- **Continuous Overload without Damage:** 1.5 A continuous, 20 A for 1 second, 40 A for 0.25 seconds
- **Calibration Level Point:** 300 mA ac
- **Output Scaling Resistor Range:** 0-10 kΩ
- **Power Factor Range:** All
- **Temperature Range:** -40°C to +50°C
- **Frequency Range:** 50/60 Hz
- **Effect on Maximum Trip - TCC's:** Less than 1%
- **Current Burden:** 0.2 VA
- **Analog outputs of 0-1 mA DC for SCADA applications**
- **Monitoring of phase A, B, and C line currents**
- **No extra CT's or cables for transducers required**
- **Factory calibrated to 5% from 150-1000 A with 1000:1 sensing CT's**
- **Field adjustable to provide maximum accuracy at selected range**

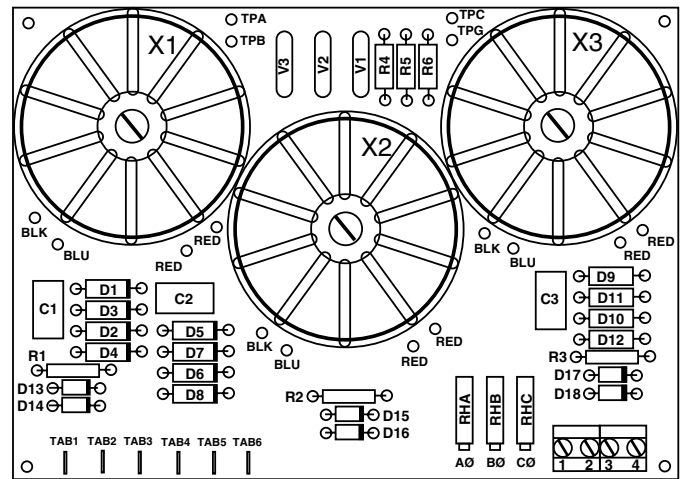


Figure 2. Analog Current Metering Accessory.

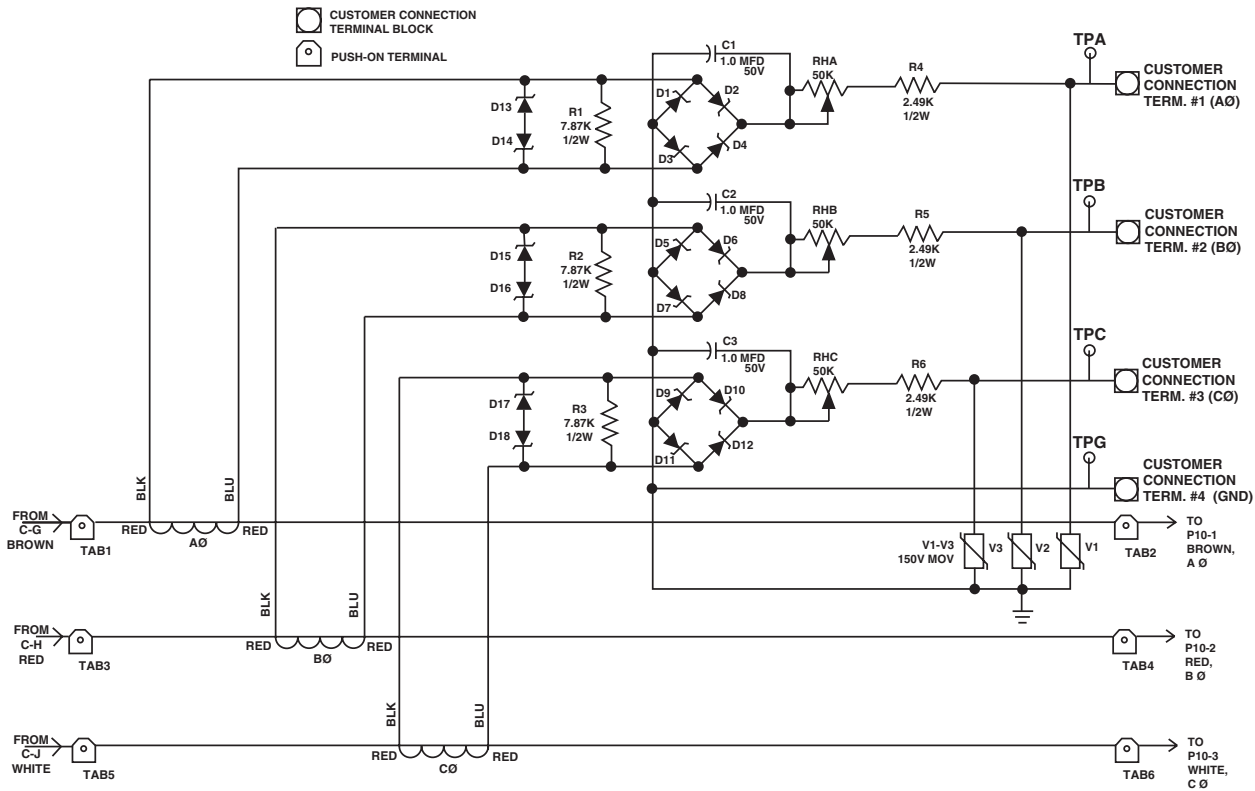


Figure 3. Schematic of Analog Current Metering Accessory KME4-82-1.

## DESCRIPTION OF OPERATION

The Analog Current Metering Accessory (ACMA) monitors instantaneous load current with 0-1 mA dc current output. It provides an indication of line current with an accuracy of  $\pm 5\%$  of the 1000 A full scale level for a balanced, three phase system.

The ACMA circuit consists of three isolated phase circuits (see Figure 3). Each phase circuit is the corresponding line current used by the Form 4C control for fault level detection and time-current curve (TCC) operation. The circuit places a small burden on the current-sensing transformers and has negligible effects on the Form 4C control. The input current is fed through another current transformer whose secondary is connected across a resistance to establish an ac voltage proportional to line current. This voltage is then full-wave rectified by a set of Schottky diodes specifically selected for their low voltage drop at low currents. The Schottky diodes and the circuit as a whole are protected by two back-to-back Zener diodes which limit the output of the accessory current transformer. The output of the Schottky bridge is filtered with a polycarbonate capacitor and an adjustable resistance is utilized to calibrate the circuit with a given setpoint input current. Each output is M.O.V. protected against surges on the output connection lines.

The factory calibration point is set at 300 mA ac input to provide 0.3 mA dc output. The calibration is performed with a 5 k $\Omega$  resistor across each of the outputs terminals, 1 to 4, 2 to 4, and 3 to 4, to obtain a 1.5 V dc output. The procedure is detailed in the VERIFICATION OF OPERATION section.

The accessory allows for fine tuning the setpoint current to obtain higher degrees of accuracy. Table 1 illustrates the setpoint established at 300 mA primary current and an adjustable value of 200 mA primary current. The values listed are dc milliamps.

**TABLE 1**  
**Comparison of 300 mA vs 200 mA Setpoint with 1000:1 Current Transformers for Accuracy**

Primary Current (mA)	300 mA Setpoint Value (DC mA)	% Error	200 mA Setpoint Value (DC mA)	% Error
1000	1.034	3.4	1.070	7.0
600	0.616	2.6	0.634	5.6
550	0.563	2.4	0.580	5.5
500	0.509	1.8	0.525	5.0
450	0.456	1.3	0.471	4.7
400	0.405	1.2	0.417	4.3
350	0.351	0.3	0.362	3.4
300	0.300	0.0	0.308	2.7
250	0.248	-0.8	0.255	2.0
200	0.195	-2.5	0.200	0.0
150	0.143	-4.7	0.146	-2.7
100	0.092	-8.0	0.094	-6.0
50	0.042	-16.0	0.042	-16.0

## INSTALLATION

### Factory Installation

Form 4C Controls can be furnished with an Analog Current Metering Accessory at the time of manufacture. Factory-installed units are completely assembled, tested, and inspected at the factory.

### Field Installation

**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

**CAUTION:** Control damage. De-energize both ac and dc power prior to removing or installing any internal connections or circuit boards in the control. Failure to comply can result in damage to the control. T241.1

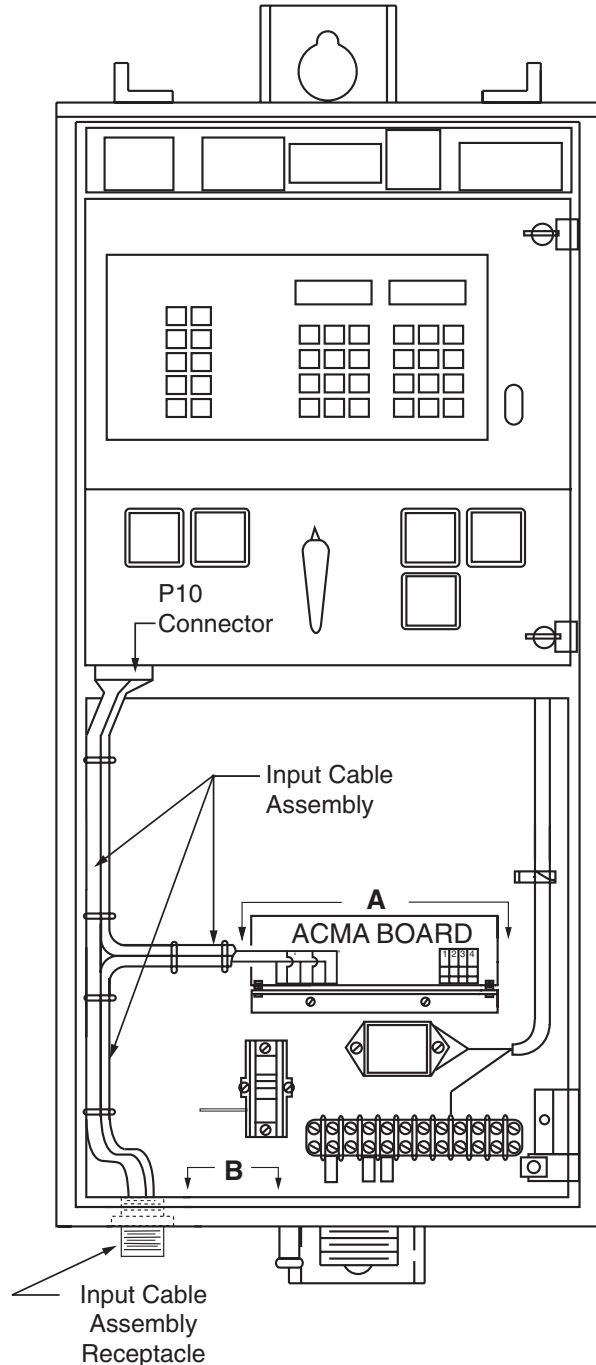
**NOTE:** The Analog Current Metering Accessory KME4-82-2, used with and installed below the LS loop-sectionalizing accessory, is installed directly above the Input Cable Receptacle. A longer cable is provided to accommodate installation.

1. If the unit is in service, by-pass and trip the recloser. (For by-pass instructions, refer to *Service Information S280-77-1 Kyle Form 4C Microprocessor-Based Recloser Installation and Operation Instructions*.) With the control tripped, it will be in the "Battery Off" position.
2. Disconnect the control cable.
3. Release and swing out the hinged control panel to gain access to the inside of the cabinet.

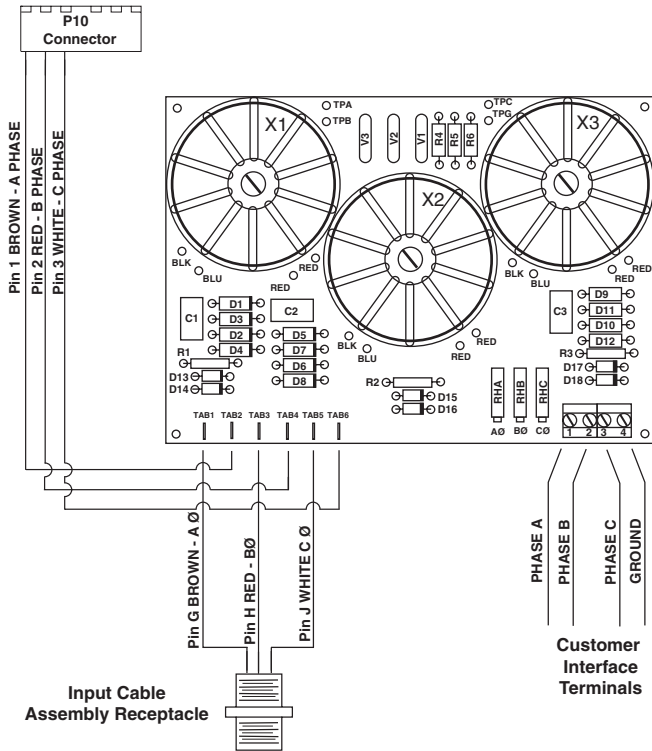
**CAUTION:** Equipment damage. Always wear a grounding wrist strap to control static electricity before handling circuit boards. Failure to use this strap may result in circuit board damage. T253.1

4. De-energize the 120 or 240 Vac low-voltage supplied to the control.
5. Disconnect the battery at the battery-lead plug and receptacle.
6. Disconnect input plug cable assembly from the control I/O board.
7. Disconnect opposite end of the input plug cable assembly receptacle from the base of the control cabinet. Discard input plug cable assembly.
8. Mount the accessory board, with the hardware provided, in the center of the lower panel (see Figure 4), leaving adequate space between accessories.
9. Connect new replacement ACMA input cable assembly to the base of the control cabinet and I/O board.

10. Connect brown lead from connector P10-1 to terminal TAB2 of ACMA board (see Figure 5 for steps 10 through 15).
11. Connect red lead from connector P10-2 to terminal TAB4 of ACMA board.
12. Connect white lead from connector P10-3 to terminal TAB6 of ACMA board.
13. Connect white lead from control cable input receptacle Pin G to terminal TAB1 of ACMA board.



**Figure 4.**  
**ACMA Board installed into double-size Form 4C Recloser Control Cabinet.**



**Figure 5.**  
**ACMA Connections.**

17. On the location guide found on the inside of the control cabinet floor, apply the accessory identification label in the approximate location of the accessory.
18. Route cables from customer SCADA or remote terminal unit through the knock out plugs located at the base of the control cabinet and connect leads to the green customer interface terminal strip located on the ACMA board. Interface terminals are marked 1, 2, 3, and 4 and respectively identify Phase A, Phase B, Phase C, and ground (see Figure 5).

**CAUTION:** Equipment damage. Do not drill connection holes into the top of the cabinet. Connection holes in the top of the cabinet will allow moisture to seep into the control and damage the components or cause control misoperation. Failure to comply will void the control's factory warranty.

T249.0

19. Return the recloser to service.
20. Energize the low-voltage power (120 or 240 Vac) if supplied to the control.

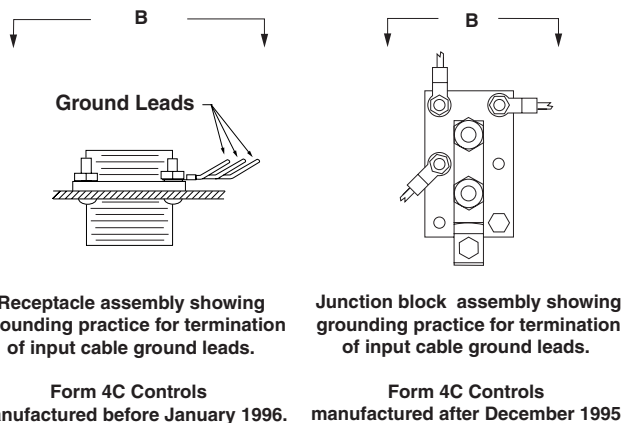
## VERIFICATION OF OPERATION

Use the following procedure to confirm the operation of the Analog Circuit Metering Accessory. If in service, bypass and trip the recloser. (For by-pass procedure, refer to *Service Information S280-77-1 Form 4C Microprocessor-Based Recloser Control Description, Installation, and Operation Instructions.*)

**Note:** The following test procedure is based on a 300 mA setpoint with 1000:1 BCT. Depending on customer application, other calibration setpoints can be adjusted using these same procedures.

Equipment required: MET TESTER, a dc Voltmeter (0 to 10 Vdc), and three 5 kΩ resistors (1%, 1/2 W).

1. Place a 5 kΩ resistor across customer connection terminals 1 and 4.
2. Place a 5 kΩ resistor across customer connection terminals 2 and 4.
3. Place a 5 kΩ resistor across customer connection terminals 3 and 4.
4. Connect the positive (+) cable of the dc voltmeter to test point TPA of the ACMA board.
5. Connect the negative (-) cable of the dc voltmeter to test point TPG of the ACMA board.
6. Set the MET tester to deliver a simulated load of 300 mA. See *Service information S280-76-1 MET Electronic Control Tester Operating Instructions.*
7. Apply and adjust the simulated load current from the MET tester to obtain 300 ±1 mA current in Phase A.
8. Adjust rheostat RHA on the accessory board to obtain 1.5±0.05 Vdc on the voltmeter.



**Figure 6.**  
**Termination of Input Plug Ground Leads.**

14. Connect red lead from control cable input receptacle Pin H to terminal TAB3 of ACMA board.
15. Connect black lead from control cable input receptacle Pin J to terminal TAB5 of ACMA board.
16. Connect 2 green and one black ground lead wires to terminals (see Figure 6) of the grounding junction block. On units manufactured prior to January of 1996, fasten ground lead wires (see Figure 6) to the mounting screws of the input plug cable assembly receptacle.



9. Return the MET tester settings to INITIAL CONDITIONS. See *Service information S280-76-1 MET Electronic Control Tester Operating Instructions*.
10. Connect the positive (+) cable of the dc voltmeter to test point TPB of the ACMA board.
11. Connect the negative (-) cable of the dc voltmeter to test point TPG of the ACMA board.
12. Set the MET tester to deliver a simulated load of 300 mA. See *Service Information S280-76-1 MET Electronic Control Tester Operating Instructions*.
13. Apply and adjust the simulated load current from the MET tester to obtain  $300 \pm 1$  mA current in Phase B.
14. Adjust rheostat RHB, on the accessory board, to obtain  $1.5 \pm 0.05$  Vdc on the voltmeter.
15. Return the MET tester settings to INITIAL CONDITIONS. See *Service information S280-76-1 MET Electronic Control Tester Operating Instructions*.
16. Connect the positive (+) cable of the dc voltmeter to test point TPC of the ACMA board.
17. Connect the negative (-) cable of the dc voltmeter to test point TPG of the ACMA board.
18. Set the MET tester to deliver a simulated load of 300 mA. See *Service Information S280-76-1 MET Electronic Control Tester Operating Instruction*.
19. Apply and adjust the simulated load current from the MET tester to obtain  $300 \pm 1$  mA current in Phase C.
20. Adjust rheostat RHC, on the accessory board, to obtain  $1.5 \pm 0.05$  Vdc on the voltmeter.
21. Return the MET tester to its INITIAL CONDITIONS after all three phases have been tested.
22. Remove the 5 k $\Omega$  resistors from the customer connection terminals on the ACMA accessory board.

## MAINTENANCE

### Replacement Parts

Replacement parts for Kyle products are available through the factory service department. Only factory-authorized replacement parts are to be used. To order replacement parts, refer to the applicable maintenance manual and the current replacement parts price list for catalog numbers and pricing. Contact your Cooper Power Systems sales representative for additional information and ordering procedures.

### Factory-Authorized Service Centers

Factory-authorized service centers are located throughout the continental United States to provide maintenance, repair, and testing services for Kyle reclosers and controls. For further information, contact your Cooper Power Systems sales representative.

### Factory Maintenance Classes

The factory service department offers recloser maintenance and control training classes. These classes, taught by experienced service technicians, are held at the factory's in-house training facility. These courses provide training and factory-recommended procedures for the routine maintenance, troubleshooting, repair, and testing of Kyle reclosers and controls. It is recommended that all personnel who service and maintain Kyle switchgear attend the appropriate classes. For additional information, contact your Cooper Power Systems sales representative.

