

Type MET Electronic Recloser Control Tester Operating Instructions

Service Information
S280-76-1



Figure 1.
Type MET electronic recloser control tester.

010028KM

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SHIPMENT AND ACCEPTANCE

This test set is completely assembled, inspected, adjusted, and tested at the factory. It is in good condition when accepted by the carrier for shipment. Upon receipt, inspect the test set thoroughly for damage and loss of parts incurred during shipment. If damage or loss is discovered, file a claim immediately with the carrier.



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 high voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high and low voltage lines and

G101.0



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.

G102.1



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 may result in death, severe personal injury and equipment damage.

G122.2



WARNING: Power distribution equipment must be 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 this 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.

DESCRIPTION

The Kyle Type MET electronic recloser control tester (Figure 1) is designed specifically for testing Type ME Form 2, Form 3, Form 3A, Form 4A and Form 4C controls. The tester has the capability to check the following:

1. Battery voltage (load and no load).
2. Battery charge and discharge rates.
3. Minimum-trip current, phase and ground (low range to 5 amp ground).
4. Operating sequence.
5. Control response time (phase and ground trip).
6. Reclosing time.
7. Reset time.
8. Electrical operation of recloser.
9. Various accessory functions through simulation of the conditions under which they operate.

The self-contained unit is compactly packaged in a sturdy, weather-proof carrying case with a detachable front cover. Cables for connecting the recloser, electronic control, and control battery to the tester are supplied with the tester and stored in the carrying case along with spare fuses and bulbs for panel lights. No other external equipment or accessories are required when using the tester.

The tester can check operation of the electronic recloser control and also can check the electrical operation of the recloser (provided reclosing power is available at the recloser). However, the control cannot operate the recloser through the tester.

A recloser-simulator circuit is built into the tester to simulate recloser operation (indicated by red and green lights on the tester panel) and to simulate the response time of the recloser mechanism to trip and close signals. The recloser simulator provides a 2-1/2-cycles time delay to duplicate the interrupting time of a Type RE recloser in response to a trip signal from the control when recloser clearing time tests are being conducted. It also provides a time delay of approximately 30 cycles to duplicate the response time of a Type RE or WE recloser to a reclosing signal from the control when reclosing time tests are being conducted.

SPECIFICATIONS

Input

115 Vac, 50/60 Hz, single phase (fused for two amp) with 15-ft power cord and a three wire grounding plug.

240 Vac 50/60 Hz, single phase (fused for one amp) with 15-ft power cord with no plug attached, is available as an accessory.

Output

0—3000 mA continuously adjustable from front panel of tester.

Instrumentation

1. DC METER

Edgewise panel meter with two-in. horizontal scale; accuracy $\pm 5\%$ full scale; panel switched ranges: 0—4/40 mA, 0—40 V.

2. AC METER

Edgewise panel meter with two-in. horizontal scale; accuracy $\pm 5\%$ full scale; panel switched ranges: 0—30/100/1000/3000 mA.

NOTE: Jacks on the tester panel provide the means for connecting an external ammeter into the circuit. They may be used for calibrating the internal meter or it different scales or greater accuracy is desired.

3. TIMER

LCD readout digital clock timer, 000.000 to 999.999 seconds in 0.001-second increments; with manual and automatic reset; accuracy $\pm 0.001\%$ ± 1 digit.

Interconnecting Cables

1. 15-ft cable for connecting electronic control to tester.
2. 15-ft extension cable for connecting end of recloser cable to tester.
3. 15-ft cable for directly connecting control-panel battery terminals to tester.

NOTE: Connector terminations on all cables are polarized to assure proper interconnection. An internal buzzer will sound if a mismatch between grounds on the ME control and the MET tester exists.

AC Power Cord

15-ft three-wire power cord with groundable power plug

Carrying Case

Tester is packaged in a sturdy Formica covered carrying case with removable front cover; has provisions for storing power cord, interconnecting cables, and spare fuses and bulbs.

Dimension

9-1/2 in. high, 21 in. wide, 13-1/4 in. deep overall.

Weight (Approximately.)

Net 33 lb; shipping 37 lb.

DESCRIPTION AND USE OF OPERATING CONTROLS

Table 1 lists and describes the operating controls and instrumentation of the tester. All the devices are mounted on the

front panel and are keyed to Figure 2, a close-up view of the front panel. Reference designations are labeled on the front panel of the tester.

TABLE 1
Description and Use of Operating Controls, and Identification

Index No (Fig 2)	Reference Designation	Description	Purpose and Use
1	S-1	Power Switch	Energizes AC input to tester.
2		Power Fuse (2A-250 V Type AGC)	Protects power input circuits.
3	S-6	Test Selector Switch	Selects the dc Meter scale.
4	S-7	Battery Load Test Switch	Checks battery voltage under load.
5		Meter Fuse (2A-250 V Type AGC)	Protects dc Meter.
6		Dc Meter	Measures dc voltage or current.
7		Battery Test Terminals	Interface for battery test cable.
8		Recloser Cable Receptacle	Interface for recloser test cable.
9	S-8	Recloser Test Switch	Operates recloser electrically.
10		Recloser Simulator—Open Light	Indicates an open recloser during control testing.
11		Recloser Simulator—Closed Light	Indicates a closed recloser during control testing.
12		Timer	Measures time of test.
13	S-10	Timer Reset Button	Resets timer back to zero after timing operation.
14		Control Cable Receptacle	Interface for control test cable.
15		External Ammeter Jacks	Connects external ammeter to tester.
16	MA-1	Ac Ammeter	Measures ac test current.
17	S-4	Ammeter Range Switch	Selects ac Ammeter scale.
18	TR-1	Fault-Current Adjust	Determines test-current level.
19	S-2	Fault-Current Switch	Allows presetting fault currents and applies test current to control.
20	S-3	Time Selector Switch	Selects control function to be checked.
21	S-5	Phase Selector Switch	Selects the phase to be tested.
22	S-9	Low-Ground Trip—Normal Switch	Tests ground minimum-trip levels down to 5.8 amps.
23	S-11	Display Mode Switch	Continuous: Display shows time as it is accumulated. Update: Display shows time at end of each interval.
24	S-12	Auto Reset Switch	Off: Display will continually accumulate time until manually reset. On: Display will automatically reset at beginning of each interval.

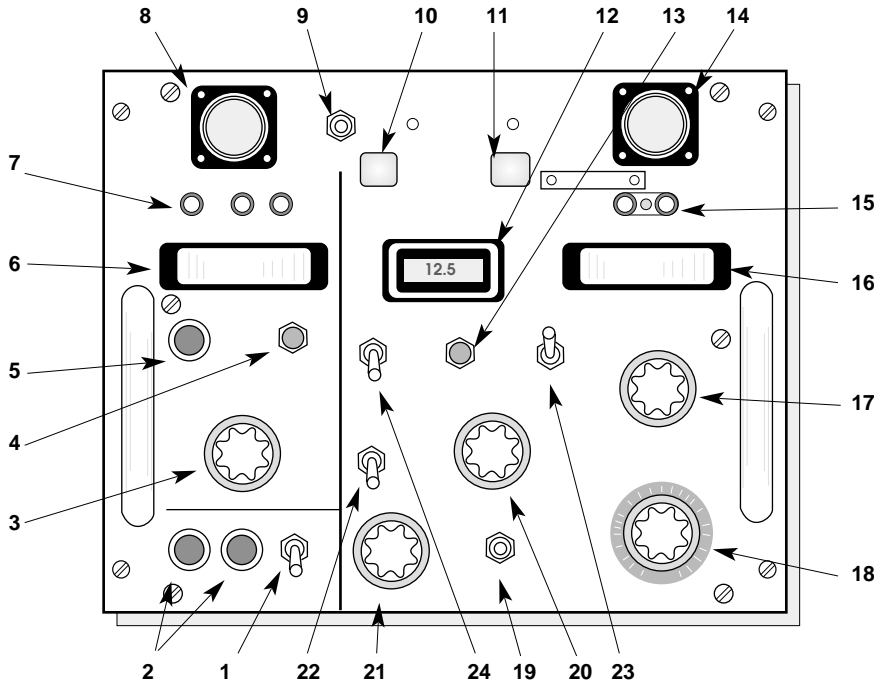


Figure 2.
Tester controls and instrumentation (See Table 1 for parts identification).

OPERATING PROCEDURES

The tester operating procedures have been grouped into:

1. Battery tests.
2. Control tests.
3. Recloser test.

Each group of tests is preceded by an INITIAL CONDITIONS paragraph which specifies required settings for both the control and tester. Make sure both are set to the INITIAL CONDITIONS before starting. Upon completion of testing, return the control settings to the desired operating conditions before returning the control to service.

CAUTION: To avoid electrical/ shock and possible equipment damage, the following grounding precautions must be observed.

Tester

The third-wire grounding pin of the plug on the input power cord must be grounded securely. Use a three-wire grounded-outlet receptacle which conforms to the latest electrical code. If a plug adapter is used, be sure to ground the pigtail lead securely.

Control

Make sure that the cabinet of the control is securely grounded to an earth ground.

If the control is equipped with an accessory which requires 120- or 240 Vac power, make sure that the grounded leg of the input power source is connected to the grounded input terminal in the control. (Older controls without ac surge protection may have neither terminal grounded. Controls with surge modules very likely have one line grounded.) Verify grounding of each terminal before applying ac power.

If a mismatch between grounds on the ME control and the MET tester exists when the ME control is energized with ac voltage, a buzzer within the MET Tester will sound. Correct the problem immediately before proceeding.

Testing In-Service Control

A recloser control can be taken out of service for testing and placed back into service without de-energizing the recloser and interrupting the system. However, during the time the control is out of service, system fault protection is lost.

CAUTION: In order to prevent possible mis-operation (unintentional operation) of the recloser the control must be removed from service prior to performing any maintenance, testing or programming changes.

TO REMOVE THE CONTROL FROM SERVICE

1. Place the Ground Trip switch to "BLOCK."
2. Disconnect the recloser interconnecting cable at the receptacle on the bottom of the control cabinet.

WARNING: If the recloser is energized while the control cable is disconnected the CT secondaries may generate dangerous voltages. Contact with high voltage can cause serious injury or death.

TO PLACE THE CONTROL BACK IN SERVICE

1. Make sure the Ground Trip switch is in BLOCK.
2. Check that the battery is connected and all control settings and plugs are correct, or programmed, as applicable.

3. All recloser controls other than Type Form 4A and Form 4B: operate the Manual Control switch to CLOSE to make sure the control is in the home position; verify by placing the test switch to LOCKOUT TEST; the Lockout Indicator lamp should not light.
4. Reconnect the recloser interconnecting cable to the receptacle on the bottom of the control cabinet.
5. Place the Ground Trip switch to NORMAL.

Battery Tests

Form 2 and Form 3 family controls only.

The left side of the tester contains the metering and associated switches for checking the battery and battery-charging circuits. The battery test cable provided with the tester is capable of checking battery voltage on all Form 3 and Form 3A controls equipped with either two- or three-battery test-terminal posts. For earlier Form 3 controls (with two-battery test-terminal posts), a special battery test cable—capable of checking both battery voltage and battery charge/discharge rates—is available as an accessory. With the addition of adapters to the special battery test cable, the battery voltage and charge/discharge rates of all Form 2 controls (no separable battery plug and receptacle) can also be checked. The adapters are included with the accessory test cable.

Instructions for using the special battery test cable and adapters are included in Appendix B, page 13.

INITIAL CONDITIONS

Control:

Battery connected and control in lockout (verify with the Lockout Test switch and/or Lockout Indicator, as applicable); battery charging circuit de-energized. Refer to the applicable control Installation Manual for specific information to de-energize the battery charging circuit.

Tester:

Test Selector switch (S6) in BATT. VOLTS—40V; Power switch (S1) OFF; power cord plugged into outlet (see CAUTION at beginning of OPERATING PROCEDURES section).

BATTERY VOLTAGE

1. Plug the battery test cable, furnished with the tester, into the BATT. TEST terminals on the tester and the battery terminals on the control.

NOTE: The spacing between the battery test-terminal posts on the tester is intentionally staggered to assure proper connection of the test cable plug. Make sure all three pins on the plug are properly seated in the three terminal posts.

The bar extension on the side of the plug at the other end of the battery test cable assures proper connection of the cable to the three-battery test-terminal posts on the electronic control. If the control is equipped with only two terminal posts, plug in the test cable with the two pins farthest from the bar extension engaged (Figure 3).

2. Read the open circuit voltage of the battery on the dc meter. A fully charged Form 2, Form 3 or Form 3A battery will normally read 26—28 volts.
3. Depress Battery Load Test switch (S7) for about two seconds (or just long enough to read the meter). For a fully charged Form 2, Form 3 or Form 3A battery, the voltage should not drop more than 3 volts from the open circuit voltage. (Typical drop will be 1.5 to 2 volts).

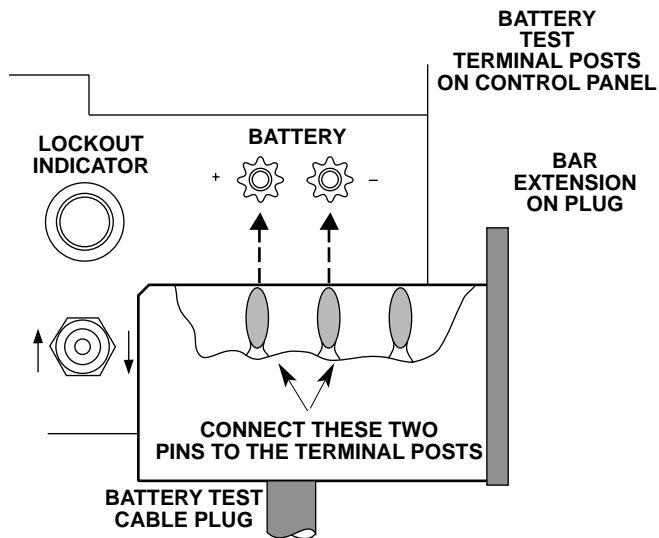


Figure 3.
Battery-test cable connections to control with only two battery-test terminal posts.

BATTERY DISCHARGE AND CHARGE RATES

The MET tester can be used to measure battery discharge and charge rates on Form 2, Form 3 and Form 3A controls only.

1. Connect the control to the tester with the proper test cable and energize the tester ON-OFF switch S1 to ON. Disconnect the jumper between the current ($\Leftarrow \Rightarrow$) terminals on controls equipped with three test terminals.
2. Move the manual control switch on the electronic control panel to CLOSE and release. The target above the switch will show red.
3. Turn Test Selector Switch S6 to DISCHARGE—(4 MA) and measure the battery drain. Normal quiescent battery drain measures 1.5 to 2.0 mA. Certain accessories can increase this nominal value above 4 mA. (See Table 2 in Appendix A).
NOTE: The 15-mA charging rate specified in Steps 4A, 4B, and 4C is a nominal value based on a 27-volt battery and rated input parameters (e.g., 120 or 240 Vac with potential chargers or 40-amp line current with recloser CT charger). Even under these standard conditions, a variation of ± 2 mA may be observed in the charging rate.

4.
 - A. If the electronic control is equipped with a 115-Vac battery charger, turn Test Selector Switch S6 to CHARGE—(40 MA) and energize the charger circuit. The charging rate should be approximately 15 mA minus the discharge rate measured in Step 3.
 - B. If power for the battery charger is supplied by a bushing-current transformer on the recloser (Type RE and WE reclosers) the following procedure may be used to check the charging rate.
NOTE: A minimum of 40 amps line current through Phase B of the recloser is required to power the battery charger. This may be obtained from normal line-current flow through an on-line recloser, or in the case of a recloser removed from service, by manually closing the recloser and applying a low-voltage, high-current ac power supply across Phase B.

- (1) Using the interconnecting cables supplied with the tester, connect both the control and recloser to the appropriate receptacles on the tester.
NOTE: The elbow plug of both test cables is connected to the tester.

- (2) With the recloser closed and a minimum of 40 amps flowing through Phase B, turn Test Selector Switch S6 to CHARGE—(40 MA). The meter should read approximately 15 mA minus the discharge rate measured in Step 3.

- C. If power for the battery charger is supplied from a 230-Vac source in the operator cabinet of the motor driven reclosers, proceed as follows:

- (1) Using the interconnecting cables supplied with the tester, connect both the control and the recloser to the appropriate receptacles on the tester.
- (2) Energize the operator cabinet of the recloser with 230-Vac power and turn Test Selector Switch S6 to CHARGE—(40 MA). The meter should read approximately 15 mA minus the discharge rate measured in Step 3.

5. Disconnect the test cable and reconnect the jumper link between the $\Leftarrow \Rightarrow$ terminals on the control panel.

Control Tests

The right side of the tester panel contains the instrumentation and associated test switches for checking the operation of the Type ME electronic control. The test current generated by the tester simulates the output of the recloser's current-sensing bushing transformers.

Minimum trip resistors, used in Form 2, Form 3 and Form 3A controls, with a yellow label are used with reclosers having 1000:1 bushing-current transformers. Thus, the test current in milliamps will be equivalent to the recloser current in amps in a direct 1:1 ratio. To simulate a 200-amp fault current, the tester output is adjusted to 200 mA.

Minimum trip resistors with blue labels are used in Form 2, Form 3 and Form 3A controls that are connected to reclosers having 2000:1 bushing-current transformers (Types ME, MLE, and MVE reclosers). In these cases the test current in amps will be equivalent to the recloser current in a 1:2 ratio. To simulate a 200-amp fault current, the tester output is adjusted to 100 mA.

Form 4A and Form 4B controls can be programmed to operate with 500:1, 1000:1 or 2000:1 ratio current transformers. Prior to testing Access Code 10 must be examined to determine the programmed ratio. The test current, in amps, is then equivalent to recloser current in either a 1:0.5, 1:1 or 1:2 ratio, respectively. To simulate a 200-amp fault current, at a 500:1 ratio, the tester output is adjusted to 400 mA. To simulate a 200-amp fault current, at a 1000:1 ratio, the tester output is adjusted to 200 mA. To simulate a 200-amp fault current, at a 2000:1 ratio, the tester output is adjusted to 100 mA.

INITIAL CONDITIONS

Control:

1. Battery connected and control in lockout (verify with the Lockout Test switch and/or Lockout Indicator, as applicable).
2. Non-reclosing switch in NORMAL RECLOSING position
3. Ground Trip switch in NORMAL position.
4. Control settings programmed for desired operating conditions.

Tester:

1. All switches and controls in their OFF or extreme counter-clockwise position, except Test Selector switch S6 in BATT. VOLTS—(40 V).
2. Power cord plugged into a 115-Vac grounded outlet. See CAUTION at beginning of OPERATING PROCEDURES section.
3. Cabinet of electronic control under test also grounded.
4. Control connected to tester with the elbow plug of the appropriate test cable at the tester.
NOTE: If it is desired to monitor battery voltage during the control tests, connect the battery to the tester with the appropriate test cable.

CONTROL OPERATION TEST (PHASE TRIP)

To check the programmed sequence of operation of the control for a phase fault, proceed as follows:

1. Check that the control and tester settings are as specified under INITIAL CONDITIONS.
2. Set the control Ground Trip switch to BLOCK to disable the ground-trip function while checking phase-trip operation.
3. Energize the tester by placing the ON/OFF Power switch S1 to ON. The green Recloser Simulator-Open lamp will light.
4. Set the Ammeter Range switch S4 to the milliamp range equivalent to the programmed phase minimum trip level.
5. While holding the Fault Current switch S2 in CALIBRATE, advance the Fault Current Adjust control TR1 to approximately 125—150% of the minimum trip rating. Release S2.
6. Set the Time Selector switch S3 to RECLOSER CLEARING, place Display Mode switch, S11, to UPDATE and the Auto Reset switch, S12, to ON. Reset the timer.
7. Move the Manual Control switch to CLOSE and release. The simulator will close in approximately 3/4 second; green OPEN light off, red CLOSE light on.
8. Set Fault-Current switch S2 to TEST and compare the number of fast and delayed operations to lockout with the programming of the electronic control.
9. Repeat Steps 7, and 8 with Phase Selector switch S5 set at B and at C.
10. Return the control and tester settings to INITIAL CONDITIONS before proceeding to the next test.

CONTROL OPERATION TEST (GROUND TRIP)

To check the programmed sequence of operation of the control for a ground fault, proceed as follows:

NOTE: To enable testing the ground-fault circuits of early Form 2 controls (below serial number 1615), a special test hookup is required. See Appendix C.

1. Check that the control and tester settings are as specified under INITIAL CONDITIONS.
2. Control settings:
 - A. Form 2, Form 3 and Form 3A controls: place a shorting jumper across the A phase-trip resistor to disable the phase trip function while checking the ground trip operation, and check that Phase Selector switch S5 is also set to A.
 - B. Form 4A and Form 4B controls: program the phase minimum trip level to, at minimum, 2 times (200%) the ground minimum trip level.
3. Energize the tester by placing the ON/OFF Power switch S1 to ON. The green Recloser Simulator-Open lamp will light.
4. Set the Ammeter Range switch S4 to the milliamp range equivalent to the programmed ground minimum-trip level.
5. While holding the Fault Current switch S2 in CALIBRATE, advance the Fault Current Adjust control TR1 to approximately 125—150% of the minimum-trip rating. Release S2.
6. Set the Time Selector switch S3 to RECLOSER CLEARING, place Display Mode switch, S11, to UPDATE and the Auto Reset switch, S12, to ON. Reset the timer.
7. Move the Manual Control switch to CLOSE and release. The simulator will close in approximately 3/4 second; green OPEN light off, red CLOSED light on.
8. Set the Fault Current switch S2 to TEST and compare the number of fast and delayed operations to lockout with the actual settings of the electronic control.
9. Return the control and tester settings to INITIAL CONDITIONS; Form 3 family controls, remove the shorting jumper from across the A-phase-trip resistor; Form 4 family controls, re-program the phase minimum trip level to its original level.

IMPORTANT: Form 2 and Form 3 family controls—when checking the minimum trip for either phase or ground on controls equipped with the sequence-coordination accessory, remove both fast TCC timing plugs to prevent the sequence relay from inadvertently advancing without tripping the recloser simulator.

MINIMUM-TRIP TEST (PHASE)

To check the phase minimum-trip-current setting of the control, proceed as follows:

1. Check that the control and tester settings are as specified under INITIAL CONDITIONS.
2. Form 3 family controls only: to prevent overshooting while raising the test current to the minimum-trip level, remove the timing plug from socket 1 to provide instantaneous trip.
3. Check to make sure that the control is programmed for at least one fast phase trip operation.
4. Set the control switches to GROUND TRIP BLOCK to disable the ground trip function and to NON-RECLOSING to provide one shot to lockout.
5. Energize the tester by setting the ON-OFF Power switch S1 to ON. The green Recloser Simulator-Open lamp will light.
6. Set the Ammeter Range switch S4 to the appropriate range for the expected minimum-trip current.
7. Move the Manual Control switch to CLOSE and release. The simulator will close in approximately 3/4 second; green OPEN light off, red CLOSED light on.
8. Apply fault current.
 - A. Form 2 and Form 3 family controls: Set Fault Current switch S2 to TEST and advance Fault-Current Adjust control TR1 from 0 while observing the ac Ammeter reading.

- B. Form 4 family controls: Set Fault Current switch S2 to TEST and advance Fault-Current Adjust control TR1 from 0 while observing the control's Current Above Minimum Trip indicator, note the current recorded by the Ac Ammeter at the point where the indicator displays.
- 9. Set Fault-Current switch S2 to OFF.
- 10. Repeat steps 7, 8, and 9 with Phase Selector Switch S5 set at B and at C to check the other two phase minimum trip levels.
- 11. Form 3 family controls only: Replace the timing plug in its socket and return the control and tester settings to INITIAL CONDITIONS.

MINIMUM-TRIP TEST (GROUND)

To check the ground minimum-trip current setting of the control, proceed as follows:

NOTE: To enable testing the ground-fault circuits of early Form 2 controls (below serial number 1615), a special test hookup is required. See Appendix C.

- 1. Check that the control and tester settings are as specified under INITIAL CONDITIONS.
 - 2. Control settings.
 - A. Form 2, Form 3 and Form 3A controls: place a shorting jumper across the A phase-trip resistor to disable the phase trip function while checking the ground trip operation, and check that Phase Selector switch S5 is also set to A.
 - B. Form 4A and Form 4B controls: program the phase minimum trip level to, at minimum, 2 times (200%) the ground minimum trip level.
 - 3. Form 3 family controls only: To prevent overshooting while raising the test current to the minimum-trip level, remove the timing plug from Socket 1 to provide instantaneous trip.
 - 4. Make sure the control is programmed for at least one fast ground trip operation.
 - 5. Set control switch to NON-RECLOSING to provide one-shot-to-lockout operation.
 - 6. Energize the tester by setting the ON/OFF Power switch S1 to ON. The green Recloser Simulator-Open lamp will light.
 - 7. Set the Ammeter Range switch S4 to the appropriate range for the expected minimum-trip current.
 - 8. Set the Low Ground Trip-Normal switch S9 to normal unless the control is programmed to trip at a below 10-amp; then place switch in Low Ground Trip position.
 - 9. Move the Manual Control switch to CLOSE and release. The simulator will close in approximately 3/4 second; green OPEN light off, red CLOSED light on.
 - 10. Apply fault current.
 - A. Form 2 and Form 3 family controls: Set Fault Current switch S2 to TEST and advance Fault-Current Adjust control TR1 from 0 while observing the ac Ammeter reading.
 - B. Form 4 family controls: Set Fault Current switch S2 to TEST and advance Fault-Current Adjust control TR1 from 0 while observing the control's Current Above Minimum Trip indicator, note the current recorded by the Ac Ammeter at the point where the indicator displays.
- NOTE: For Form 3 family controls equipped with the Low-Current Ground-Trip accessory, the 5.8-amp minimum-trip resistor should trip at an equivalent test current of 5.0 mA and the 10-amp resistor at an equivalent test current of 9.2 mA when the Low Ground Trip-Normal switch S9 is in the Low Ground Trip position.
- 11. Return the control and tester settings to INITIAL CONDITIONS; Form 3 family controls, remove the shorting jumper from across the A-phase-trip resistor; Form 4 family controls, re-program the phase minimum trip level to its original level.

TCC CHECK

Either the control-response time or the recloser-clearing time can be checked by setting the Time Selector switch to the appropriate position. In the RECLOSER CLEARING position, the trip time will include a delay of approximately 2-1/2 cycles, the time it takes a Type RE or RVE recloser to respond to the trip signal from the electronic control.

Figures 4 and 5, in Appendix A, show the control response and Types RE and RVE clearing TCC curves for some common Form 3A control phase-trip- and ground-trip-timing plugs.

To check the time-current characteristics, check that the control and tester settings are as specified under INITIAL CONDITIONS and proceed as follows:

- 1. Set the control switch to GROUND TRIP BLOCK to disable the ground trip function while checking the phase trip-timing plugs.
- 2. Set the Time Selector switch S3 to either CONTROL RESPONSE or RECLOSER CLEARING as appropriate. Place Display Mode switch, S11, to UPDATE and the Auto Reset switch, S12, to ON.
- 3. Energize the tester by setting the ON/OFF Power switch S1 to ON. The green Recloser Simulator-Open lamp will light.
- 4. Set the Ammeter Range switch S4 to the appropriate range for the current at the predetermined test point on the TCC curve.
- 5. While holding the Fault Current switch S2 in CALIBRATE, advance the Fault Current Adjust control TR1 until the ammeter indicates the desired value (minimum trip level, or greater).
- 6. Move the Manual Control switch to CLOSE and release. The simulator will close in approximately 3/4 second; green OPEN light off, red CLOSED light on.
- 7. Reset the timer.
- 8. Set the Fault Current switch S2 to TEST and record the response or clearing times of the phase-trip-timing curve.
- 9. Set the Fault Current switch S2 to OFF and repeat steps 6, 7, and 8 with Phase Selector switch S5 set at B and at C.
- 10. Return the Phase Selector switch S5 to A, control Ground Trip switch to NORMAL.
- 11. Control settings.
 - A. Form 2, Form 3 and Form 3A controls: place a shorting jumper across the A phase-trip resistor to disable the phase trip function while checking the ground trip operation, and check that Phase Selector switch S5 is also set to A.
 - B. Form 4A and Form 4B controls: program the phase minimum trip level to, at minimum, 2 times (200%) the ground minimum trip level.
- 12. Repeat steps 4 through 8 and record the response or clear-

ing times of the ground-trip-timing plugs.

13. Return the control and tester settings to INITIAL CONDITIONS; Form 3 family controls, remove the shorting jumper from across the A-phase-trip resistor; Form 4 family controls, re-program the phase minimum trip level to its original level.

RECLOSING TIME TEST

The recloser simulator has a built-in time delay of approximately 30 cycles before the reclosing signal from the electronic control is implemented. This simulates the mechanical operating time of the Types RE and WE reclosers.

To check the reclosing time, check that the control and tester settings are as specified under INITIAL CONDITIONS and proceed as follows:

1. Set the control switch to GROUND TRIP BLOCK to disable the ground trip function while checking the reclose timing.
2. Energize the tester by setting the ON/OFF Power switch S1 to ON. The green Recloser Simulator-Open lamp will light.
3. Set the Ammeter Range switch S4 to the appropriate range for the trip current to be used.
4. While holding the Fault Current switch S2 in CALIBRATE, advance the Fault Current Adjust control TR1 to approximately 125—150% of the minimum-trip value.
5. Move the Manual Control switch to CLOSE and release. The simulator will close in approximately 3/4 second; green OPEN light off, red CLOSED light on.
6. Set Time Selector switch S3 to CONTROL RECLOSE/RESET. Place Display Mode switch, S11, to UPDATE and the Auto Reset switch, S12, to ON; reset the timer.
7. Set the Fault Current switch S2 to TEST and record the reclosing intervals.
NOTE: If the recloser is set for more than one fast operation, the reclosing time may be difficult to read, especially if the control is programmed with fast reclosing times. For easier recording of the reclosing intervals, set the control for 0 or 1 fast operation.
8. Return the control and tester settings to the INITIAL CONDITIONS specified at the beginning of the CONTROL TESTS.

RESET TIME TEST

Reset time of standard Form 2 and Form 3 family controls with serial numbers below 26000 is measured from the first trip operation. However, if the control is equipped with the Reset-From-Successful-Reclose accessory, reset timing starts after any reclose where the current flowing (if any) is below minimum trip.

Reset time of a standard Form 3A control (serial number 26000 or higher) and Form 4 family controls is measured from successful reclosing, in the same manner as the accessory function described above.

Different test procedures are required for checking the reset time of electronic controls equipped with or without the Reset-From-Successful-Reclose feature.

Controls Which Time From First Trip:

To check the reset time of a control which times reset from the first trip; check that the control and tester settings are as specified under INITIAL CONDITIONS and proceed as follows:

1. Remove the first Reclosing Interval Delay plug from the control panel and program the control for all delayed operations.
2. Energize the tester by setting the ON/OFF Power switch S1 to ON. The green Recloser Simulator-Open lamp will light.

3. Set the Ammeter Range Switch S4 to the appropriate range for the trip current to be used.
4. While holding the Fault Current switch S2 in CALIBRATE, advance the Fault Current Adjust control TR1 to approximately 125—150% of the minimum-trip value.
5. Move the Manual Control switch to CLOSE and release. The simulator will close in approximately 3/4 second; green OPEN light off, red CLOSED light on.
6. Set the Time Selector switch S3 to CONTROL RECLOSE/RESET and reset the timer.
7. Place the Fault Current switch S2 to TEST.
8. When the control has tripped, place the Fault Current switch S2 to OFF. The clock will start timing and when the sequence relay steps around to the first operation, the clock will stop and record the timing of the Reset Delay plug.
NOTE: The control reset delay cannot be checked by placing the reset plug into the first Reclosing Interval socket. Proper control timing cannot be obtained under these conditions.
9. Replace the Reclosing Interval Delay plug in its socket and return the control and tester settings to the INITIAL CONDITIONS specified at the beginning of the CONTROL TESTS.

Controls Which Time From Successful Reclose:

Controls equipped with the Reset-From-Successful-Reclose feature; check that the control and tester settings are as specified under INITIAL CONDITIONS and proceed as follows:

1. Program the electronic control for one fast and three delayed operations. The first Reclosing Interval Delay time must be programmed to have a minimum setting of at least two seconds.
2. Set the control switch to GROUND TRIP BLOCK to disable the ground trip function while checking the reset time.
3. Energize the tester by setting the ON/OFF Power switch S1 to ON. The green Recloser Simulator-Open lamp will light.
4. Set the Time Selector switch S3 to CONTROL RESPONSE. Place Display Mode switch, S11, to UPDATE and the Auto Reset switch, S12, to ON; reset the timer.
5. Form 4 family controls only; turn the display on and enter CODE 38. Code 38 displays the sequence state of the control, "0" being home.
6. Set the Ammeter Range switch S4 to the appropriate range for the trip current to be used.
7. Move the Manual Control switch to CLOSE and release. The simulator will close in approximately 3/4 second; green OPEN light off, red CLOSED light on.
8. Reduce the Fault-Current Adjust Control TR1 to zero. Set the Fault Current switch S2 to TEST.
9. Advance the Fault-Current Adjust control TR1 until the control trips; immediately turn TR1 to zero before the control recloses the MET Tester. The clock will start running when the control recloses the MET tester.
10. As soon as the sequence relay resets to home (Form 3 family controls), or the display return to "0" (Form 4 family controls), place the Fault Current switch S2 to OFF and record the time. The time indicated is the reset time.
11. Return the control and tester settings to the INITIAL CONDITIONS specified at the beginning of the CONTROL TESTS, making sure the electronic control is reprogrammed to its operating settings.


Recloser Tests

The control cannot operate the recloser through the Type MET electronic recloser control tester. However, circuitry is provided to trip and close the recloser from the tester with the control battery (providing closing-coil or closing-motor energy is available at the recloser).

INITIAL CONDITIONS

Control

Battery connected and control in lockout (verify with Lockout Test switch and Lockout Indicator lamp).

 **CAUTION:** The recloser must be connected to an adequate ground whenever its closing solenoid or closing motor is to be energized.

Tester

All switches and controls in their OFF or extreme counterclockwise position, except Test Selector switch S6 in BATT. VOLTS—(40V).

NOTE: The tester need not be energized for this test. However, the power-line cord should be plugged into a three-wire grounded outlet to ground the front panel of the tester. See CAUTION at beginning of OPERATING PROCEDURES section.

Recloser

Closing power provided at the recloser (either line potential for solenoid closing or 240 Vac for motor closing).

TEST PROCEDURE

1. Plug the battery-test cable, furnished with the tester, into the BATT. TEST TERMINALS on the tester and the battery terminals on the control.
2. Connect the elbow plug of the recloser extension-test cable, furnished with the tester, to the Recloser receptacle on the tester and the other end to the recloser control cable.
3. The recloser can now be closed and tripped by operating the Recloser Test switch S8 either to CLOSE or OPEN. The battery voltage can be monitored on the Dc meter during these operations.

APPENDIX A- TABLES AND CHARTS

Page

Figure 4 Typical phase-trip TCC curves for Types RE and RVE reclosers 11

Figure 5 Typical ground-trip TCC curves for Types RE and RVE reclosers 11

Table 2 Quiescent Drain of Form 2 and Form 3 Family Control Accessories 12

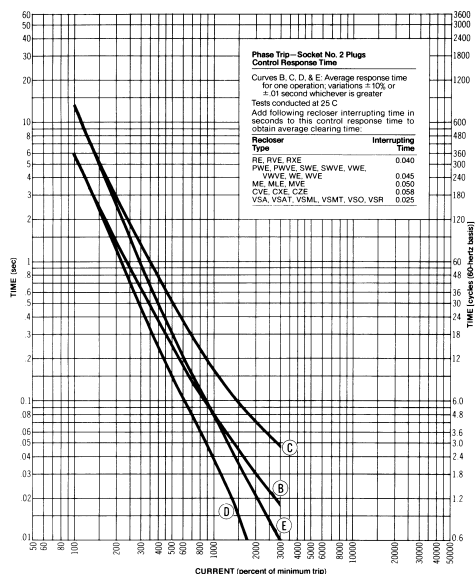


Figure 4.
Typical phase-trip TCC curves Type ME Electronic Control, Form 3A.

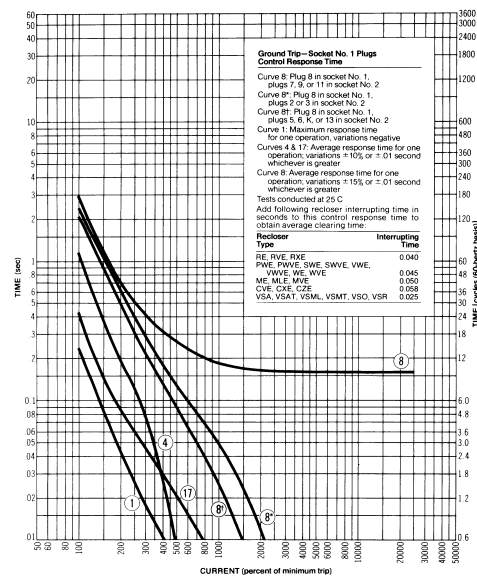


Figure 5.
Typical ground-trip TCC curves Type ME Electronic Control, Form 3A.

Type MET Electronic Recloser Control Tester

TABLE 2
Quiescent Drain of Control Accessories (Control In Home Position), Form 2 and Form 3 Family Controls

Accessory Cat. No.	Description	Drain (mA)	Remarks	Accessory Cat. No.	Description	Drain (mA)	Remarks
KA282ME	Battery Indicating Milliammeter	0		KA1021ME	High Phase and Ground Protection	0	
KA287ME	24-Vdc Surge Protector	0		KA1025ME	Targets—Phase Only	1.3	
KA293ME	Load Current Indicating Meter	0			Phase and Ground Targets	1.9	
KA304ME*	Reset After Reclose	2.3	For 3-sec. plug.	KA1030ME	Targets	—	Same as KA1025ME.
		0.8	For 10-sec. plug.	KA1036ME	Instantaneous Lockout—All Multipliers	0.3	If phase disabled.
KA305ME	Target—Phase and Ground	0				0	If accessory active.
KA316ME	Remote Closing	0				0	If ground disabled.
KA319ME	One Time Delay to Lockout on Ground	0		KA1037ME	Instantaneous Trip—All Multipliers	0	If phase disabled.
KA333ME	Blocking of Reclosing	0				0	If accessory active.
KA336ME	Target—Phase and Ground	0				0	If ground disabled.
KA339ME	Dc Supply Adapter						
	48-V, 3.5-A Style	6.4	48-Vdc source.				
	125-V, 3.5-A Style	5.5	125-Vdc source.				
			48-Vdc source.				
KA418ME	48-V, 15-A Style	9.6	If active in home.	KA1137ME	Targets, Auto/Manual Reset	—	See KA1025ME.
	Sequence Coordination	0	If blocked in home.				
		0.8					
KA472ME	Lockout Indicating Contact	0		KA1119ME	Capacitor Trip Backup	0	
KA498ME	Contact Position Indicator	0		KA1122ME	Capacitor Trip Backup	0	
KA522ME	Remote Minimum-Trip Doubler	0	Supervisory contacts open.	KA1163ME	Minimum Response Time	0	For any programmed sequence.
		5.7	Supervisory contacts closed.				
KA531ME	Fuse Elimination	0		KA2003ME	Remote Close with Cold-Load and Non-Reclose	0	
KA533ME	Dc Supply Adapter	—	See KA339ME.	KA2035ME2	Remote Non-Reclose and Remote Ground Trip Block, Maintained	.22	Supervisory contacts open.
KA542ME	Heater	0				.85	Supervisory contacts closed.
KA545ME	Load-Current Indicator	0				.06	Recloser Open
KA574ME	Battery Indicating Milliammeter	0		KA2039ME2	Recloser Status	.16	Recloser Closed
KA577ME	Instantaneous Phase Trip	0					
KA608ME	Battery Indicating Milliammeter	0		KA2047ME	Remote Battery Test and Voltage Monitor	.1	
KA609ME	Target—Phase and Ground	0		KA2070ME2	Remote Close with Cold Load Pickup and Recloser Status	.06	Recloser Open
KA639ME	Remote Lockout	0				.16	Recloser Closed
KA670ME	Ground Delay Pickup Multiplier	0	For fast operation.			0	Supervisory contacts open.
			For delayed operation.			29	Supervisory contacts closed.
		11					
KA674ME	Ground-Trip Target	0		KA2071ME	Remote Non-Reclose and Remote Ground Trip Block, Maintained	0	Supervisory contacts open.
KA698ME	Instantaneous Ground Trip	0				36	Supervisory contacts closed.
KA880ME	Dc Supply Adapter						
	48-V, 15-A Type	7.0	48-Vdc source.				
	125-V, 5-A Type	12	125-Vdc source.				
			125-Vdc source.				
	125-V, 15-A Type	12					
KA896ME	Ground Fault Target	1.4		KA2072ME	Remote Battery Test and Voltage Monitor, with Analog Output.	1	
KA1000ME	Manual Minimum-Trip Doubler	0		KA2189ME	Remote Fault Target Indicator	0	
KA1002ME	Remote Minimum-Trip Doubler	0	Supervisory contacts open.	KA2230ME	Supervisory Selector Switch	0	
		6	Supervisory contacts closed.				
KA1004ME	Remote Trip	0					

* Standard on Form 3A Controls

APPENDIX B

SPECIAL BATTERY-TESTING CABLE AND ADAPTER (CATALOG NO. KA11 14ME)

The special battery-test cable enables the MET tester to check battery voltage and charge/discharge rates of early Form 3 controls (below serial number 10649) which have only two battery-test-terminal posts on the front panel. With the addition of a set of adapters to the special battery-test cable, the battery voltage and charge/discharge rates of all Form 2 controls (which do not have a separable battery plug and receptacle) can also be checked. Color-coded leads and the combination of male and female plugs on the adapters and test cable assure proper polarities when connecting to the test set.

Form 3 Controls Below Serial Number 10649

1. Swing out the front panel of the ME control and disconnect the battery plug from its receptacle.
2. Connect the male CONTROL plug of the special test cable into the battery receptacle in the control.
3. Connect the battery plug into the other (female) plug of the test cable (Figure 6).
4. Connect the other end of the battery test cable to the BATT. TEST TERMINALS on the MET tester. Make sure all three pins of the test cable plug are engaged.
5. Perform the BATTERY TEST procedures as specified on Page 5 of this manual.

All Form 2 Controls

1. Attach both pig tailed-adapter assemblies to the special battery-test cable.
2. Swing out the front panel of the ME control and disconnect the red and black battery leads from the BATTERY (+) and (—) terminals along the bottom edge of the tie board on the back of the front panel.
3. Connect the leads of the adapter on the CONTROL plug to the BATTERY terminals on the tie board.
 - A. Male connector (red lead) to (+) terminal.
 - B. Female connector (black lead) to (—) terminal.
4. Connect the leads of the adapter on the BATTERY plug to the battery leads.
 - A. Female connector (red lead) to (+) terminal .
 - B. Male connector (black lead) to (—) terminal.
5. Slip the vinyl sleeves over the connections to insulate against accidental shorts.
6. Connect the other end of the special battery-test cable to the BATT. TEST TERMINALS on the MET tester. Make sure all three pins on the test cable plug are engaged.
7. Follow the BATTERY TEST procedures as specified on Page 5 of this manual.

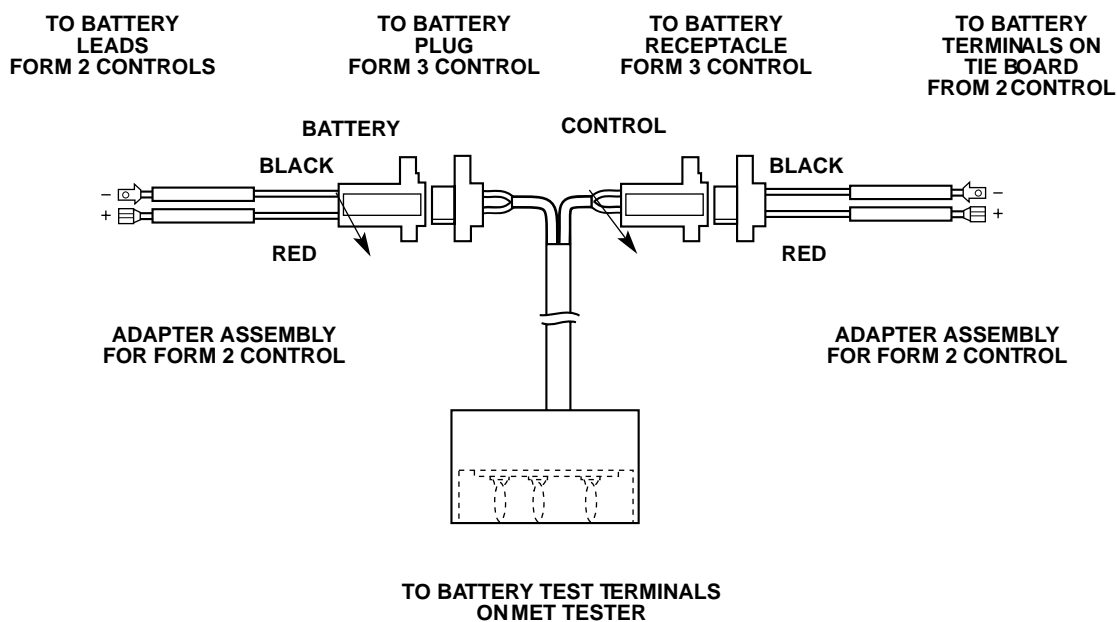


Figure 6.
Special battery-test cable and adapters.

APPENDIX C TESTING GROUND-TRIP OPERATION OF FORM 2 CONTROLS BELOW SERIAL NUMBER 1615

The following special hookup is required to test the ground-trip operation of Form 2 controls below serial number 1615 (Figure 7).

1. Open the shorting bar across the External Ammeter test jacks on the front panel of the MET tester.

2. Connect a jumper from the left hand jack to the cabinet on the front panel of the ME control.
3. Proceed to Step 1 in the Control Operation Test (Ground Trip) or the Minimum Trip Test (Ground) as applicable. The current measured by the Ac Ammeter on the MET tester will be the equivalent test current entering the ground section of the control.

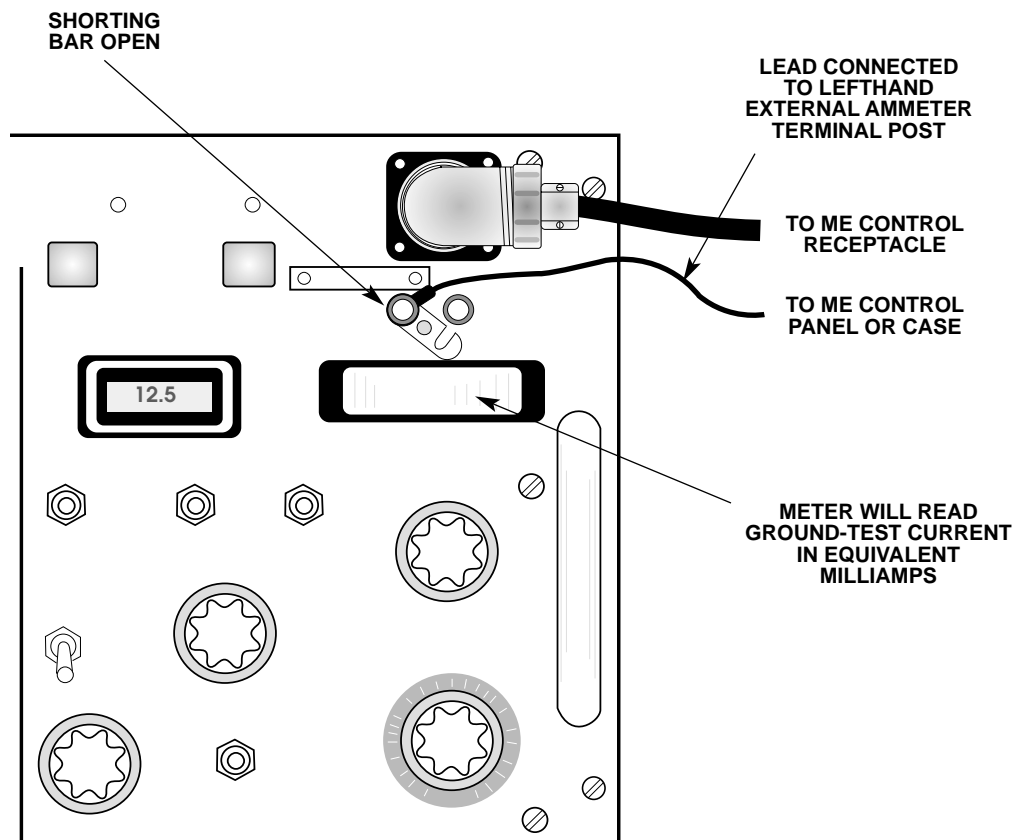


Figure 7.
Test hookup for Form 2 controls below Serial Number 1615.



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