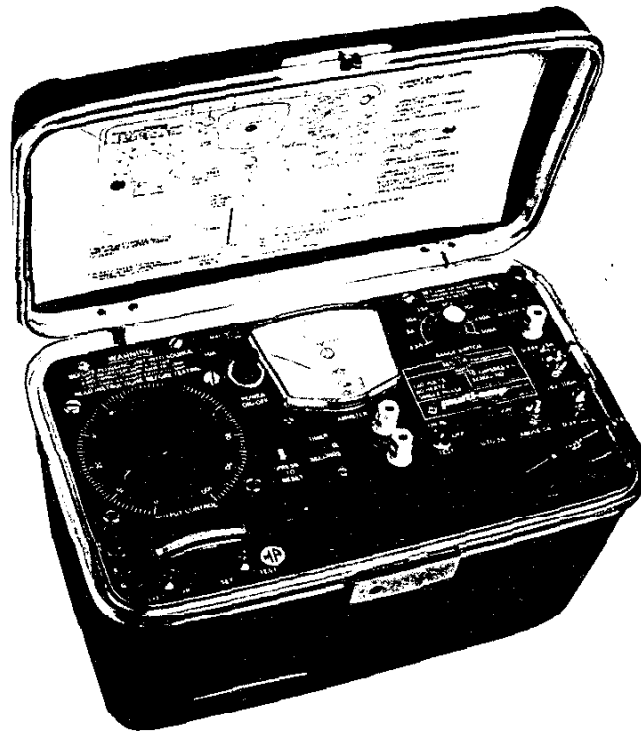




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Instruction Manual MS-1A
ITA-1

INSTRUCTION MANUAL
MULTI-AMP® MODEL MS-1A
for testing Motor Overload Relays and Molded Case Circuit Breakers
AND OPTIONAL ACCESSORY MODEL ITA-1
for testing Insulation Resistance



It is recommended that this instruction manual be read thoroughly before proceeding with testing. A thorough understanding of the MULTI-AMP Model MS-1A test unit will permit its use in many applications too numerous to list.

NOTICE
A MINIMUM OF \$100.00 WILL BE CHARGED FOR ANY ACCESSORY NOT RETURNED WITH INSTRUMENT

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GENERAL DESCRIPTION

The MULTI-AMP Model MS-1A test unit has a patented circuit consisting of a continuously variable autotransformer which supplies a MULTI-AMP output transformer, thus providing stepless

control of the output current. Integral metering, timing and control circuitry are included. The unit is housed in a convenient suitcase-type enclosure for easy portability.

COMMON TEST APPLICATIONS

Model MS-1A will test time-current characteristics of motor overload relays and molded case circuit breakers rated up to 100 amperes by simulating overloads up to 300% of their rating.

Auxiliary applications include testing of in-line motor cut-outs, fuse links, meters and ratioing current transformers.

SPECIFICATIONS

- Rating:** 0.6 kVA
- Input:** 120 volts, 60 hertz*, single phase
- Output:** Continuously adjustable in four ranges to meet a variety of test circuit impedances:
- 0 - 140 volts at 4.5 amperes
 - 0 - 24 volts at 25 amperes
 - 0 - 6 volts at 100 amperes
 - 0 - 3 volts at 200 amperes
- Ammeter:** A large, easily read instrument with 3½-inch scale:
Scales: 5/10/25
Ranges (switch selected): 0-2.5/5/10/25/50/100/250/500 amperes.
- Timer:** A synchronous motor-driven digital mechanism accurate to $\pm 0.5^*$ second. Measures elapsed time of the test from 0.1 second to 9999.9** seconds. Push-button reset.
- Housing:** Molded plastic, high strength suitcase type enclosure with easy-to-carry handle. Storage space is provided for test leads.
- Dimensions:** Height: 9 inches. Width: 14½ inches. Depth: 9 inches.
- Weight:** Net: 35 pounds. Shipping: 42 pounds.
- Test Leads:** Two No. 22 timer leads each 5 feet long. These leads are used to connect the binding posts on the MS-1A labeled CONTACTS to the contacts of the device under test which will open when the device trips.
Two No. 4 high current leads, each 5 feet long. These cables are used to connect the output terminals of the MS-1A to the current element of the device under test.

**50 hertz units are equipped to operate from 120 volts, 50 hertz, single phase. For other input voltages use a suitable 1.0 kVA step-down transformer.*

***S/N 3070 and up. Earlier units are accurate to ± 1 second and measure from 1 second to 999 seconds.*

OVERLOAD CAPACITY

Model MS-1A is rated at 0.6 kVA output and is equipped with four output terminals, each capable of supplying its rated current. The current rating of these output terminals may be exceeded for short durations provided the voltage rating is sufficient to "push" the desired current through the device under test and the connecting test leads. The overload capacity, represented by multiples of rated current, versus Time ON and Time OFF are given below:

% RATED CURRENT	MAXIMUM TIME ON	MINIMUM TIME OFF
100 (1x)	30 minutes	30 minutes
150 (1.5x)	6 minutes	13 minutes
200 (2x)	3 minutes	8 minutes
250 (2.5x)	1 minute	6 minutes
300 (3x)	30 seconds	4 minutes
400 (4x)	7 seconds	2 minutes

Model MS-1A also can be used continuously for any reasonable length of time at 70.7% of the current rating of the output terminal.

Example:

Consider the 0-3 volt terminal rated 200 amperes:

- (a) 200 amperes may be drawn at any voltage from 0-3 volts for 30 minutes provided the test set is subsequently de-energized for 30 minutes.

- (b) 141.4 amperes (70.7% of 200 amperes) may be continuously drawn at any voltage from 0-3 volts for any reasonable length of time.

- (c) The following overload currents may be drawn at any voltage from 0 to maximum volts for the Time ON indicated, followed by the indicated Time OFF. The maximum output voltage available when the current rating of the output terminal is exceeded (overloaded) will be less than the rated value due to the regulation of the transformer in the test set. For example, when drawing 300 amperes from the 200-ampere terminal, the maximum voltage available is approximately 2.4 volts.

Overload Current from 200-Ampere Terminal		
Terminal	Time ON	Time OFF
300 amperes	6 min.	13 min.
400 amperes	3 min.	8 min.

It should be noted that because of the impedance of the device under test and the connecting test leads, the maximum practical test current available from the 0-3 volt terminal rated 200 amperes is approximately 300 amperes. Higher currents are usually available from the 0-6 volt terminal rated 100 amperes; HOWEVER, these higher currents are available only for very short durations as illustrated in the overload capacity table above. For example, it is possible to get 400 amperes from this terminal for 7 seconds, followed by 2 minutes off.

SELECTION OF OUTPUT TERMINAL

Four output terminals at various voltage and current ratings are provided to adapt the MS-1A to a wide variety of test circuit impedances.

The MULTI-AMP Model MS-1A test unit can be operated most efficiently by using the terminal with the HIGHEST CURRENT-LOWEST VOLTAGE rating suitable for the test. In this way, finer adjustment can be obtained by making full use of the variable autotransformer range. Even the smallest currents can be obtained from the high-current terminals. The low current-HIGH VOLTAGE terminals should be used ONLY when

testing high impedance devices where the low voltage terminal(s) will not "push" the desired test current through the device. The operator should start with the low voltage terminal and move to a higher voltage terminal only when necessary.

IT SHOULD BE NOTED THAT THERE IS NO RELATIONSHIP BETWEEN THE AMMETER RANGES AND THE RATING OF THE OUTPUT TERMINAL. All ammeter ranges can be used in conjunction with any of the output terminals.

SELECTION OF COMMON TERMINAL

When using test currents of 5 amperes or less, the common terminal labeled 0 TO 5A should be utilized. When using test currents in excess of

5 amperes, utilize the common terminal labeled ABOVE 5A.

TESTING MOTOR OVERLOAD RELAYS

Always refer to the manufacturer's literature applicable to the particular overload relay before testing. The test operator should be familiar with the operating characteristics of the relay, the tolerances applicable to the operating characteristics and the means of adjusting the relay, if any.

The test usually performed on these devices is to verify the time delay characteristics of the relay when subjected to an overload. One test point is usually suggested to establish whether the relay is operating correctly and within the band of the time-current curve for the relay. The suggested test current is three times (3x) the normal current rating of thermal overload relays or three times (3x) the pick-up current (setting) of magnetic overload relays.

It is, of course, easiest to make the connections and perform the tests on the relays if they are removed from the starter. However, it is not necessary to remove the relay as long as the test leads can be connected and the circuit de-energized. It should be further noted that any leads already connected to the relay need not be removed when conducting the tests. The high current leads from the test set to the relay under test should be kept as short as possible and should be twisted to minimize the losses caused by inductive reactance.

Run the test and note the time required for the overload relay to trip. If the tripping time exceeds the desired value, or if the relay does not trip at all, the relay may not be protecting the motor properly. If the relay operates too quickly, it may result in unnecessary nuisance trips. It should be remembered that these devices operate over a wide band and precise results should not be sought. A tolerance of $\pm 15\%$ is usually acceptable.

If a thermal overload relay is not operating properly, tripping too soon or too late, remove the heater element. Note its type, rating, etc., and compare with manufacturer's data for operating characteristics of the motor. If correct for the application, substitute a new heater of the same rating and retest. If improper heater elements are being used, either under or oversized, replace with the proper size heater and retest.

If a magnetic overload relay is not operating properly, refer to the relay manufacturer's literature for instructions on making adjustments to the time delay. If the relay is operating improperly, it may also be desirable to verify the pick-up point (minimum operating point) of the relay. To perform this test, it is necessary to disengage the time delay feature of the overload relay. Refer to the manufacturer's literature for detailed instructions.

TEST PROCEDURE FOR TIME DELAY OF MOTOR OVERLOAD RELAYS

1. Set-up MS-1A with:
 - a. POWER ON/OFF button in OFF position (red light out)
 - b. OUTPUT CONTROL knob at minimum, "O" position
 - c. ON-OFF-TEST switch in center OFF position
2. Connect one end of a high-current lead to one side of thermal element or current coil in overload relay. Connect other end of this lead to appropriate COMMON terminal of test set.
 - If test current is in excess of 5 amperes, use common terminal labeled ABOVE 5A.
 - If test current is 5 amperes or less, use common terminal labeled 0 TO 5A.
3. Connect one end of second high-current lead to other side of thermal element or current coil in overload relay. Connect other end of this lead to output terminal labeled 0-3V, 200A (See SELECTION OF OUTPUT TERMINAL, page 2).
4. Use RANGE SWITCH to select ammeter range so that test current will be read in upper 1/3 of meter scale.
5. Connect test set to suitable 120-volt, single-phase power supply.
6. Press POWER ON/OFF button (red light should glow).
7. Rotate OUTPUT CONTROL knob clockwise and momentarily press and hold ON-OFF-TEST switch in TEST position to observe current reading on ammeter. Release ON-OFF-TEST switch.

— CONTINUED —

8. Continue to rotate OUTPUT CONTROL knob clockwise while jogging (repeatedly moving to TEST position and releasing) ON-OFF-TEST switch until desired test current is reached. Suggested test current is three times (3x) the rating of thermal relays or three times (3x) the pick-up current of magnetic relays.

If desired test current is not reached with OUTPUT CONTROL knob at maximum clockwise rotation, return knob to zero and transfer output lead from terminal labeled 0-3V, 200A to terminal labeled 0-6V, 100A. Proceed with current adjustment as in Steps 7 and 8.

If the relay utilizes a high impedance thermal element or operating coil and the desired test current cannot be reached, transfer output lead to the terminal labeled 0-24V, 25A, and repeat Steps 7 and 8. If test current is still not reached, transfer output lead to terminal labeled 0-140V, 4.5A, and repeat Steps 7 and 8. (See SELECTION OF OUTPUT TERMINAL, page 2).

9. Connect a pair of light leads (timer leads) from Normally Closed Contacts of overload relay to binding posts of test set labeled CONTACTS.
10. Set TIMER to zero by pressing timer reset button.
NOTE: Before starting test, allow time for thermal element to cool; or in the case of magnetic overload relays, for the piston to reset. Incorrect tripping time may otherwise result.
11. Start test by pressing ON-OFF-TEST switch to TEST and release.
12. When overload relay trips, TIMER stops and output is de-energized. TIMER indicates total elapsed time of the test in seconds.
NOTE: Test current may decrease (fall off) during the test because the resistance or impedance of the test circuit increases. Rotate OUTPUT CONTROL knob clockwise to keep test current at desired value.
13. Turn test set OFF by pushing POWER ON/OFF button.
14. Record test results on Test Record Card.

IMPORTANT NOTE

In order to obtain accurate tripping times with some types of magnetic overload relays, particularly those using high viscosity dashpot oil, it may be necessary to "preheat" the relay by running rated current through the relay for a few minutes.

TESTING MOLDED CASE CIRCUIT BREAKERS

Always refer to the manufacturer's literature applicable to the particular circuit breaker before testing. The test operator should be familiar with the operating characteristics of the circuit breaker, the tolerances applicable to the operating characteristics and the means for adjusting the circuit breaker, if any.

The test usually performed on these devices is to verify the time delay characteristics of the circuit breaker when subjected to an overload. Each pole of the circuit breaker should be tested independently. One test point is usually suggested to establish whether the circuit breaker is operating correctly and within the band of the time-current curve for the circuit breaker. The suggested test current is three times (3x) the normal current rating of the circuit breaker.

It is, of course, easiest to make connections and perform the test on circuit breakers if they are removed from the circuit. However, it is not necessary to remove the circuit breaker, as long as the test leads can be connected and the line side of the breaker de-energized. It should be further noted that any leads already connected to

the circuit breaker need not be removed when conducting the test. The high current leads from the test set to the circuit breaker under test should be kept as short as possible and should be twisted to minimize the losses caused by inductive reactance.

Run the test and note the time required for the circuit breaker to trip. If the tripping time exceeds the desired value or if the circuit breaker does not trip at all, the circuit breaker may not be protecting the circuit properly. If the circuit breaker operates too quickly, it may result in unnecessary nuisance trips. It should be remembered that molded case circuit breakers operate within a wide time band. Therefore, precise results should not be sought and, if the circuit breaker trips within the time band, it is considered satisfactory. A tolerance of $\pm 15\%$ is usually acceptable. Look for the circuit breaker that has unusually short time delay or takes an abnormally long time to trip or does not trip at all. In the latter case, electrically operating and thereby exercising the breaker may correct the condition.

TEST PROCEDURE FOR THERMAL ELEMENT OF MOLDED CASE CIRCUIT BREAKERS

1. Set-up MS-1A with:
 - a. POWER ON/OFF button in OFF position (red light out)
 - b. OUTPUT CONTROL knob at minimum, "O" position
 - c. ON-OFF-TEST switch in center OFF position
2. Connect one end of a high-current lead to one pole of circuit breaker. Connect other end of this lead to appropriate COMMON terminal of test set.
 - If test current is in excess of 5 amperes, use common terminal labeled ABOVE 5A.
 - If test current is 5 amperes or less, use common terminal labeled 0 TO 5A.
3. Connect one end of second high-current lead to other side of same pole of circuit breaker. Connect other end of this lead to output terminal labeled 0-3V, 200A (See SELECTION OF OUTPUT TERMINAL, page 2).
4. Use RANGE SWITCH to select ammeter range so that test current will be read in upper 1/3 of meter scale.
5. Connect test set to suitable 120-volt, single-phase power supply.
6. Press POWER ON/OFF button (red light should glow).
7. Rotate OUTPUT CONTROL knob clockwise and momentarily press and hold ON-OFF-TEST switch in TEST position to observe current reading on ammeter. Release ON-OFF-TEST switch.

— CONTINUED —

8. Continue to rotate OUTPUT CONTROL knob clockwise while jogging (repeatedly moving to TEST position and releasing) ON-OFF-TEST switch until desired test current is reached. Suggested test current is three times (3x) the rating of the circuit breaker.

If desired test current is not reached with OUTPUT CONTROL knob at maximum clockwise rotation, return knob to zero and transfer output lead from terminal labeled 0-3V, 200A to terminal labeled 0-6V, 100A. Proceed with current adjustment as in Steps 7 and 8. (See SELECTION OF OUTPUT TERMINAL, page 2).

9. Connect together (short) the binding posts of test set labeled CONTACTS with one light lead.
10. Set TIMER to zero by pressing timer reset button.
NOTE: Before starting test, allow time for the thermal element to cool, otherwise incorrect tripping time may result.
11. Start test by pressing ON-OFF-TEST switch to TEST and release.
12. When circuit breaker trips, TIMER stops and output is de-energized. TIMER indicates the total elapsed time of the test in seconds.
NOTE: Test current may decrease (fall off) during the test because the resistance of the test circuit increases. Rotate OUTPUT CONTROL knob clockwise to keep test current at desired value.
13. Turn test set OFF by pushing POWER ON/OFF button.
14. Record test results on Test Record Card.