



IB 7.2.1.7-5
Issue A

INSTRUCTIONS

Instantaneous Overcurrent Relays

CIRCUIT  SHIELD[®]

TYPE 50 INSTANTANEOUS

TYPE 50I INVERSE INSTANTANEOUS

Catalog Series 418

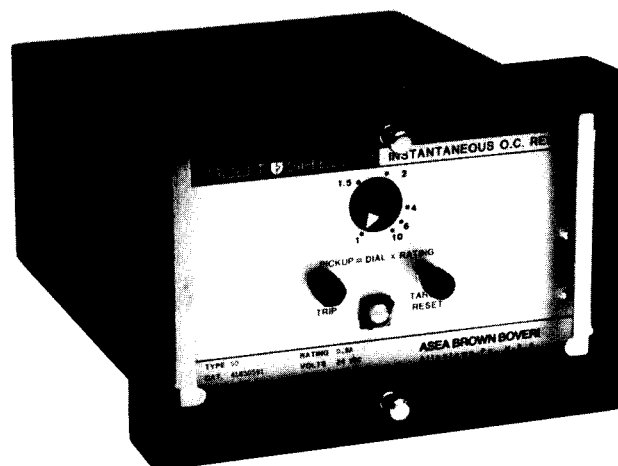


TABLE OF CONTENTS

Introduction.....	Page 2
Precautions.....	Page 2
Placing Relay into Service.....	Page 3
Application Data.....	Page 4
Testing.....	Page 9
Obsolete Units - Catalog Series 218.....	Page 11

INTRODUCTION

These instructions contain the information required to properly install, operate, and test the ABB Circuit-Shield™ Types 50 and 50I solid-state Instantaneous Overcurrent Relay, catalog series 418. Earlier versions, catalog series 218 are covered on page 11 of this instruction book.

These relays are housed in a case suitable for conventional semiflush panel mounting. All connections to the relay are made at the rear of the case and are clearly numbered. The 418 series relay provides totally drawout construction with integral test facilities. Current transformer shorting is accomplished by a direct-acting spring and blade assembly upon removal of the relay from its case. Sequenced disconnects prevent nuisance tripping during withdrawal or insertion of the relay.

The pickup setting dial is located on the front panel behind a clear plastic cover. A target indicator is also mounted on the front panel and is reset by means of a pushbutton which extends through the cover.

PRECAUTIONS

The following precautions should be observed when applying these relays:

1. Incorrect wiring may result in damage. Be sure wiring agrees with the connection diagram for the particular relay before the relay is energized.
2. Apply only the rated control voltage marked on the front panel of the relay. If rectified ac is used in place of a battery source for testing, proper filtering must be used to obtain relay operation.
3. Be sure the trip circuit is interrupted by an "a" contact to remove high currents from the solid-state output circuit upon operation of the circuit breaker or lockout relay. Solid-state output circuits have inherently high momentary ratings, but low continuous current ratings.
4. Trip coils or auxiliary relays connected to the output of the relay must draw at least 0.1 ampere to insure operation. Thyristor (SCR) outputs require a minimum current to seal-in and remain conducting.
5. Be sure to note the use of a link or connection to terminals 9-10, described under Connections, page 3 to insure proper operation of the relay.
6. High voltage insulation tests are not recommended. If a control wiring insulation test is required, withdraw the unit from its case before applying the test voltage.
7. When testing, be sure to interrupt test current immediately upon relay operation.
8. Follow test instructions to verify that the relay is in proper working order.

CAUTION: *since testing and troubleshooting entails working with energized equipment, caution should be taken to avoid personal shock. Only competent technicians familiar with good safety practices should service these devices.*

PLACING THE RELAY INTO SERVICE

1. RECEIVING, HANDLING, STORAGE

Upon receipt of the relay (when not included as part of a switchboard) examine for shipping damage. If damage or loss is evident file a claim at once and promptly notify ABB. Keep the unit clean and dry and use normal care in handling to avoid mechanical damage.

2. INSTALLATION

Mounting: the outline dimensions and panel drilling are given in Figure 1.

Connections:

Internal connections are shown in Figure 2 and typical external connections are shown in Figure 3.

For the relay function to be operable, terminals 9 and 10 must be shorted externally. A link is provided on the relay to accomplish this. The INST (50) function can be controlled by an external device by discarding the link and connecting the supervisory contact between terminals 9 and 10.

The control voltage rating for the relay is stamped on the front panel.

Control voltage must be connected in the proper polarity.

Trip coils or auxiliary relay loads must draw at least 0.1 ampere to insure that the relay's output SCR seals-in. Add resistance in parallel to low current coils to insure this holding current.

The trip circuit must be interrupted by an "a" switch to reset the output and to remove high currents from the output. SCR outputs have inherently high momentary trip ratings, but low continuous ratings.

Note that since the Types 50 and 50I are completely self-powered by the current being measured, they are suitable for use with capacitor trip devices.

The relay has a metal front panel which is connected through the printed circuit board and connector wiring to the rear terminal marked "G". This terminal should be wired to ground.

3. SETTINGS

Pickup Current:

A pickup setting dial provides for a continuous adjustment range of 1 to 10 times the relay's pickup rating. This rating is stamped on the lower left of the front panel. Three dials, one for each phase, are provided on 3-phase units.

For example, if the pickup dial is set at 6 times and the relay's rating is 2A, the instantaneous pickup is $6 \times 2A = 12$ amperes.

4. TARGET INDICATOR

A hand-reset target indicator is provided. The target is electronically actuated at the time that the relay's output SCR conducts to trip the circuit breaker. Control voltage must be present in order to reset the target.

APPLICATION DATA

The ABB Circuit-Shield™ Types 50 and 50I Instantaneous Overcurrent Relays are available in three-phase and single-phase models to provide fast phase and ground protection.

These relays are of totally solid-state design, providing high seismic capability and shock and vibration resistance. They employ SCR (thyristor) output, therefore they are suitable only for applications where a circuit-breaker or lockout relay are to be tripped, as they depend on the 52a or 86 auxiliary contact to reset the output. (Refer to IB 7.2.1.7-3 Types 50H, 50B for high-dropout units with contact output that are more suitable for fault detection, load alarm applications where a self-resetting output is required.)

The Types 50 and 50I are completely self-powered from the current being measured, therefore they are suitable for use with capacitor trip devices, as there is no standby drain from the control voltage source.

The Type 50 provides a conventional instantaneous timing characteristic, refer to curve 605807.

The Type 50I provides a instantaneous curve with an inverse shape. Refer to curve 605812. This characteristic is useful in allowing for inrush currents, or for downstream fuses to clear, thus reducing nuisance operations, but still maintaining a fast clearing time at high fault currents.

Both models provide excellent rejection of dc offset (low overreach).

The burden of these relays on the ct secondary is low, providing improved performance over electromechanical types.

CHARACTERISTICS OF COMMON UNITS

Type	Pickup Rating	Pickup Range	Catalog Numbers (see note 1)	
			Single-Phase	Three-Phase
50	0.8A	0.8-8A	418S05x1	418T05x1
	2.0A	2-20A	418S06x1	418T06x1
	8.0A	8-80A	418S07x1	418T07x1
50I	0.8A	0.8-8A	418S15x1	418T15x1
	2.0A	2-20A	418S16x1	418T16x1
	8.0A	8-80A	418S17x1	418T17x1

IMPORTANT NOTES:

- To complete the catalog number the "x" in the catalog numbers shown above must be replaced with the proper digit to specify the control voltage rating of the relay:

125 vdc.....4	350 vdc.....2
48 vdc.....3	250 vdc.....5
32 vdc.....8	175 vdc.....1
24 vdc.....9	

- The "pickup rating" is the rating stamped on the front panel of the relay. Refer to settings, page 3. See specifications for the continuous current capability.
- The 175 vdc control voltage rating is usually associated with the output of a 120 vac capacitor trip device, and the 350 vdc rating with the output of a 240 vac capacitor trip device. Some capacitor trip units include transformers. Determine dc output rating of capacitor trip unit before selecting relay catalog number.

Specifications:

Input Circuit: Suitable for 50/60 Hz.
See chart on page 4 for available pickup ranges.

One second rating: 235 amperes.

Continuous rating:
0.8A model - 2 amperes.
2.0A model - 5 amperes.
8.0A model - 15 amperes.

Burden: the input burden is a function of the dial setting and may be calculated from the following formula:

$$\text{Burden in VA} = 2.5 / (\text{dial setting})$$

For example, with a dial setting of 4 multiples the burden is $2.5/4 = 0.63$ VA.

Output Circuit: solid-state, (1) Thyristor (SCR).

Rated: 30 amperes tripping,
15 amperes, one second,
1 ampere continuous.

Note: minimum output load to insure seal-in of the SCR is 0.1 ampere. Once turned on the SCR will remain conducting until the dc current falls below the holding value, which can be as low as 5 milli-amperes. Use a 52/a auxiliary contact to break the external circuit.

Control Voltage: no standby drain, relay is self-powered.

Allowable range:	
Nominal Rating	Range of Operation
24 vdc	17 - 29 vdc
32	22 - 38
48	28 - 60
125	70 - 140
175	100 - 200
250	140 - 280
350	200 - 390

Operating Temperature Range: -30 to +70° C

Tolerances: at nominal 25° C ambient:
Pickup with respect to dial markings:
Setting = 1x +/-15%
Setting 2x-10x +/-10%

Repeatability: of pickup over temperature range -20° to +55° C: +/-5%.

Dielectric Strength: 1500 vac, 50/60 Hz., 60 seconds, all circuits to ground.

Seismic Capability: 6g ZPA, broadband multifrequency vibration per ANSI C37.98.

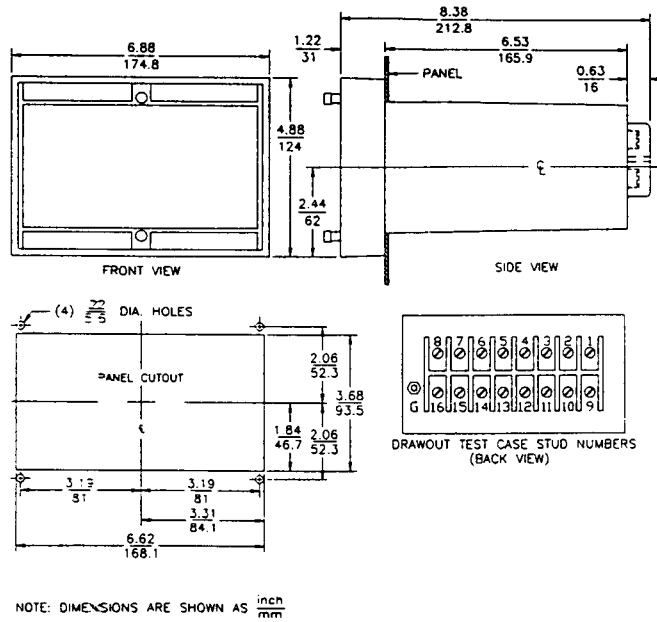
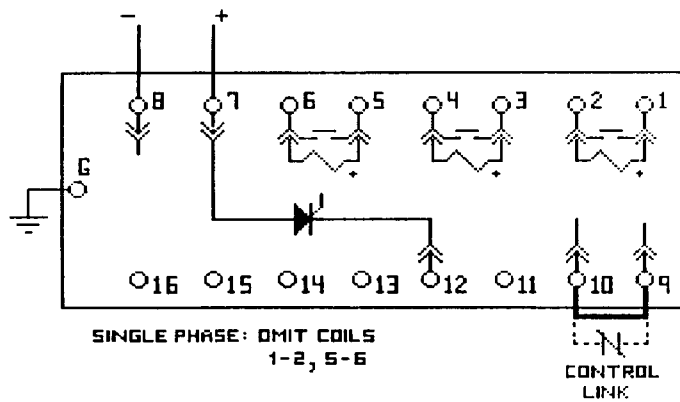


Figure 1: Relay Outline and Panel Drilling

16D418A Types 50, 50I
Catalog Series 418
Thyristor Output



- Notes:
1. Single-phase: omit coils 1-2, 5-6.
 2. Link or controlling contact required between 9-10 for proper operation.

Figure 2: Internal Connections

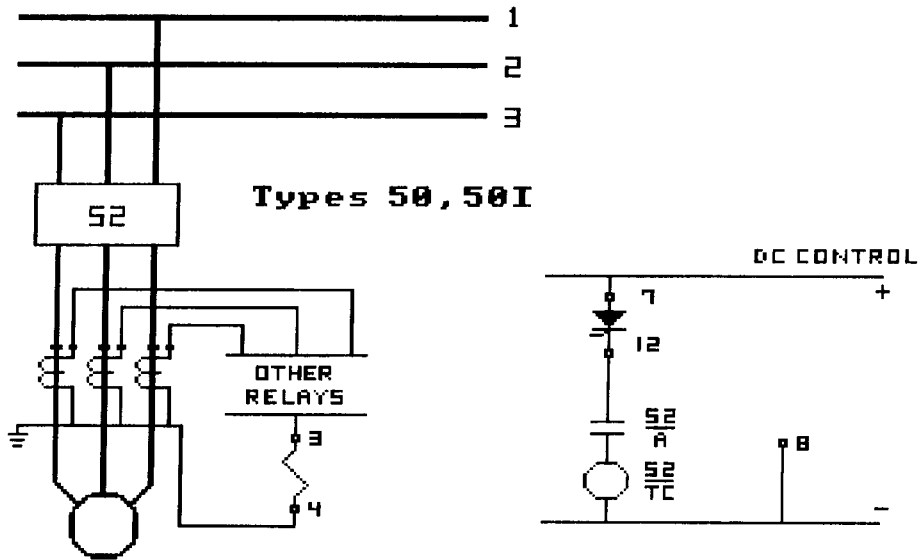


Figure 3a: Typical External Connections
Single-phase Type 50 or 50I used for Ground Fault Protection

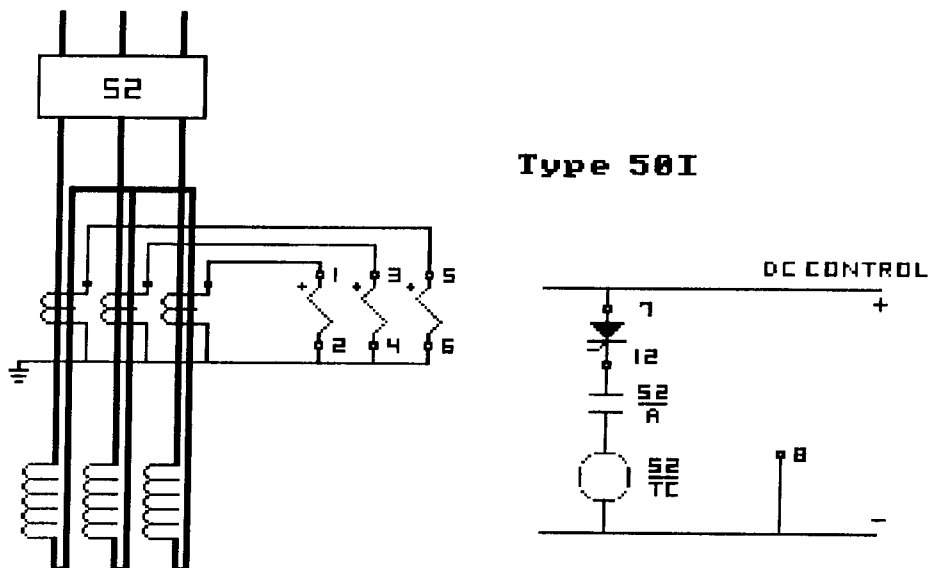
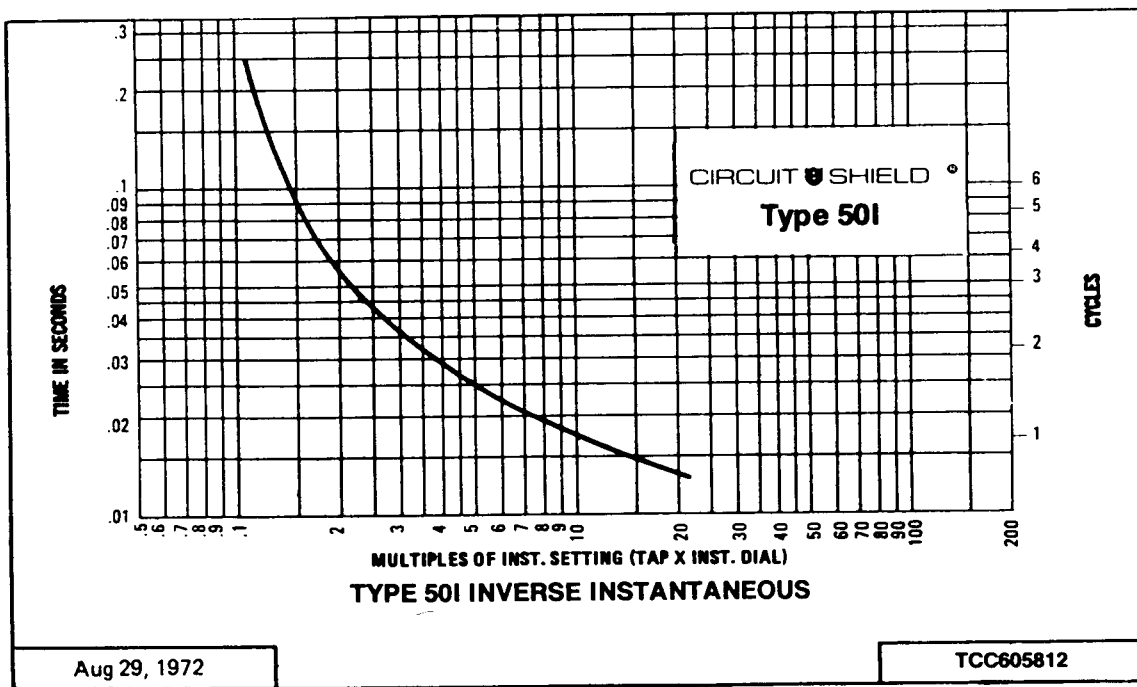
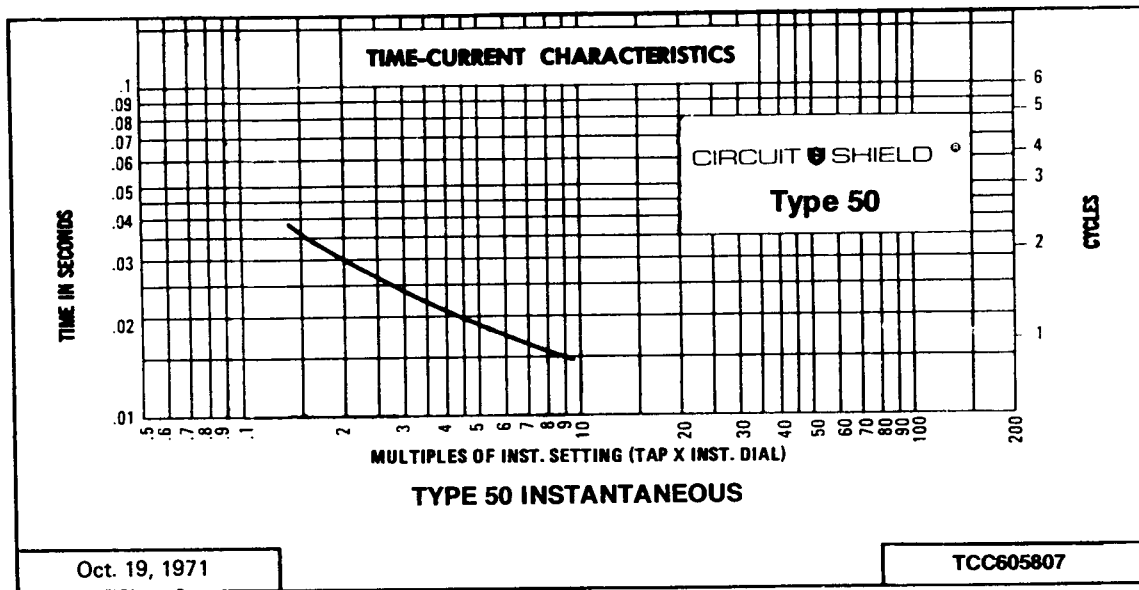


Figure 3b: Typical External Connections
Three-phase Type 50I used in a Self-Balancing Machine Differential Scheme



TESTING

1. MAINTENANCE AND RENEWAL PARTS

No routine maintenance is required on these relays. Follow test instructions to verify that the relay is in proper working order. We recommend that an inoperative relay be returned to the factory for repair; however, a schematic diagram will be provided on request for those who wish to troubleshoot the relay.

Caution: *since testing and troubleshooting entails working with energized equipment, caution should be taken to avoid personal shock. Only competent technicians familiar with good safety practices should service these devices.*

Renewal parts, such as the output SCR and the target-head assembly are available from the factory. Contact your ABB representative or the factory for quotations.

Drawout Assembly - 418 Series Units:

Metal handles provide leverage to withdraw the relay assembly from the case. The assembly is identified by the catalog number stamped on the front panel and a serial number stamped on the bottom of the circuit board.

Test connections are readily made to the drawout relay unit by means of standard banana plugs. Current connections are made to the vertical posts at the blade assemblies. Output and control voltage connections are made at the rear vertical circuit board. This rear board is marked for easy identification of the connection points.

Important: Since these relays include "torque-control" as a standard feature, a jumper must be connected between terminals 9 and 10 on the drawout unit before test currents are applied, in order to obtain operation.

Should separation of the upper and lower circuit boards be needed, remove (2) screws that attach the left and right handle assemblies to the upper printed circuit board. Some units may also require the removal of (2) screws on the underside of the unit that secure the lower board to the backplane. The lower board may then be withdrawn forward from the printed circuit connector. An 10 point extender board (cat. 200X0010) is available from the factory if access to the lower circuit board is required for troubleshooting.

Test Plug: A test plug assembly, catalog 400X0001, is available for use with the 418 series relays. This device plugs into the relay case on the switchboard and allows access to all external circuits wired to the case. See Instruction Book IB 7.7.1.7-8 for details on the use of this device.

2. HIGH POTENTIAL TESTS

High potential tests are not recommended. A hi-pot test was performed at the factory before shipping. If a control wiring insulation test is required, remove the drawout unit from the case before applying the test voltage.

3. BUILT-IN TEST FEATURE

A built-in trip test feature is provided as a convenient means of testing the operation of the relay and the associated trip circuit.

Tests should be made with the main circuit de-energized.

When the TRIP test button is depressed, a signal derived from the control voltage is applied to the relay's pickup circuitry, causing the relay to pick up and operate its output. The target should set when the relay trips the breaker. (The trip test will cause a trip even if the control link between terminals 9 and 10 is open.)

4. ACCEPTANCE TESTING

Test Connections:

A typical test circuit is shown in Figure 4. Apply the proper control voltage per the relay's nameplate rating. Be sure to connect jumper between terminals 9 and 10.

If rectified ac is to be used as the dc control voltage source, a filter capacitor of at least 250 microfarads should be used.

Generally, the Types 50 and 50I must be connected to trip an auxiliary relay or a lockout relay in order to properly load the output, and to provide a stop contact for the test set. The coil of the auxiliary relay must draw at least 0.1A to insure seal-in of the relay's output.

Actuate the built-in trip test button as a quick check of the test set-up and relay functionality. Note proper target operation and reset.

Single-phase relays: apply test current to terminals 3 and 4. For three-phase relays, check each input one-at-a-time.

Precautions:

Do not let high test currents persist. If a relay operation is not obtained as expected, turn off the current source immediately, and recheck all test connections.

Note continuous current limitations as shown in the specifications on page 5.

Allow some cool-down time before repeating a high current test.

Pickup Tests:

Adjust pickup dial to desired setting. If no setting has been specified, use 2x. Increase the test current rapidly until relay operation is obtained. Relay pickup should be within +/-10% of the dial setting (+/-15% for settings below 2x).

The pickup dial is continuous, therefore, a final adjustment may be made to obtain the operating point required for the application.

Timing Tests:

Since the Types 50 and 50I are instantaneous relays, point-on-wave switching effects, the added delay of the auxiliary relay in the test set-up, and other inherent limitations of the test equipment can make accurate measurements difficult. Therefore, timing tests are not recommended as part of routine acceptance testing for these units.

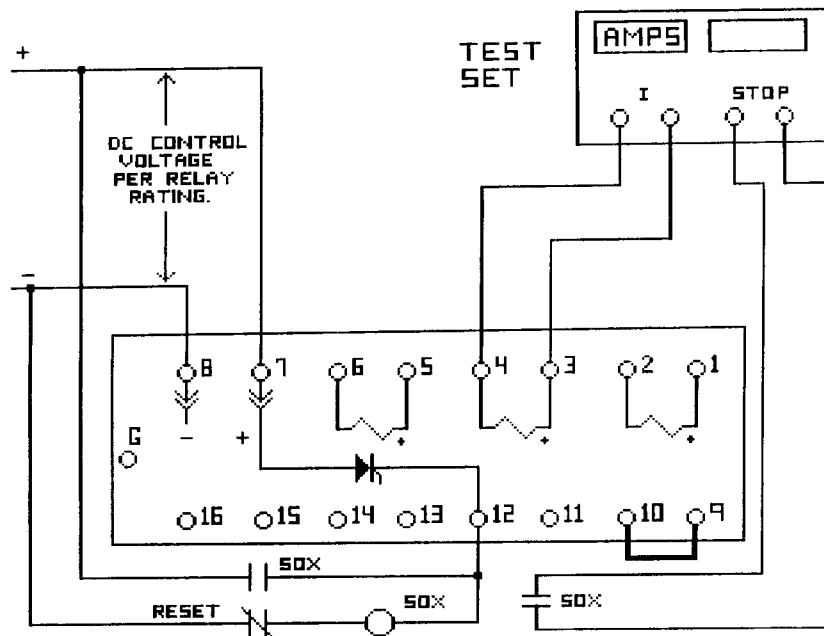


Figure 4: Typical Test Connections

OBSOLETE UNITS - Catalog Series 218:

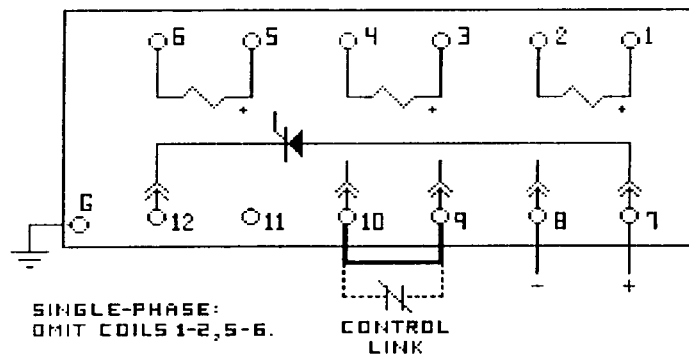
Relays of catalog series 218 are identical in function to the 418 series; however, they are of partial-drawout construction: the lower electronic circuit board assembly withdraws from the case, while the upper input transformer board assembly is fixed in the case. Removing the lower circuit board does not cause an open circuit in the ct circuits, and may be done with the relay in service.

Internal connections for the 218 series are shown in Figure 5 below. The terminal numbering is the same as for 418 units, however, the terminal arrangement on the back of the case is different.

Case mounting dimensions are the same for both units, so a 218 series unit may be replaced directly with a 418 series. The last 5 characters of the catalog number are identically translated from a 218 series to a 418 series unit. Refer to the listing on page 4.

Electrical specifications are identical for both series, and the same acceptance test criteria and testing method as described in this instruction book may be applied to 218 series units.

Figure 5: Internal Connections
Catalog Series 218
12D218A Types 50, 50I
Thyristor Output



- Notes:
1. For single-phase units, omit coils 1-2, 5-6.
 2. Link 9-10, or external controlling contact required to obtain relay operation.