



Installation Instructions for LD, HLD, LDC, CLD, CHLD, CLDC Circuit Breakers with Digitrip OPTIM Trip Unit



WARNING

CONTACT WITH ENERGIZED EQUIPMENT CAN RESULT IN DEATH, SEVERE PERSONAL INJURY, OR SUBSTANTIAL PROPERTY DAMAGE. DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE ON EQUIPMENT WHILE IT IS ENERGIZED. ALWAYS VERIFY THAT NO VOLTAGE IS PRESENT BEFORE PROCEEDING WITH THE TASK, AND ALWAYS FOLLOW GENERALLY ACCEPTED SAFETY PROCEDURES.

CUTLER-HAMMER IS NOT LIABLE FOR THE MISAPPLICATION OR MISINSTALLATION OF ITS PRODUCTS.

The user is cautioned to observe all recommendations, warnings, and cautions relating to the safety of personnel and equipment as well as all general and local health and safety laws, codes, and procedures.

The recommendations and information contained herein are based on Cutler-Hammer experience and judgement, but should not be considered to be all-inclusive or covering every application or circumstance which may arise. If any questions arise, contact Cutler-Hammer for further information or instructions.

1. INTRODUCTION

General Information

The L-frame OPTIM Series C circuit breaker (Fig. 1-1) types LD, HLD, and LDC are 600 Vac maximum rated devices with Digitrip OPTIM RMS trip units rated 125A, 250A, 400A or 600A maximum continuous current. They are for AC applications only, factory sealed, and can be reverse fed. They are listed in accordance with Underwriters Laboratories, Inc. Standard UL 489 and satisfy the requirements of International Electrotechnical Commission Recommendations No. IEC 947-2. All L-frame OPTIM circuit breakers are equipped with an extra auxiliary switch and alarm (signal)/lockout switch for customer usage. Other internal accessories are available but must be factory installed. Contact Cutler-Hammer for the following information and user's manuals:

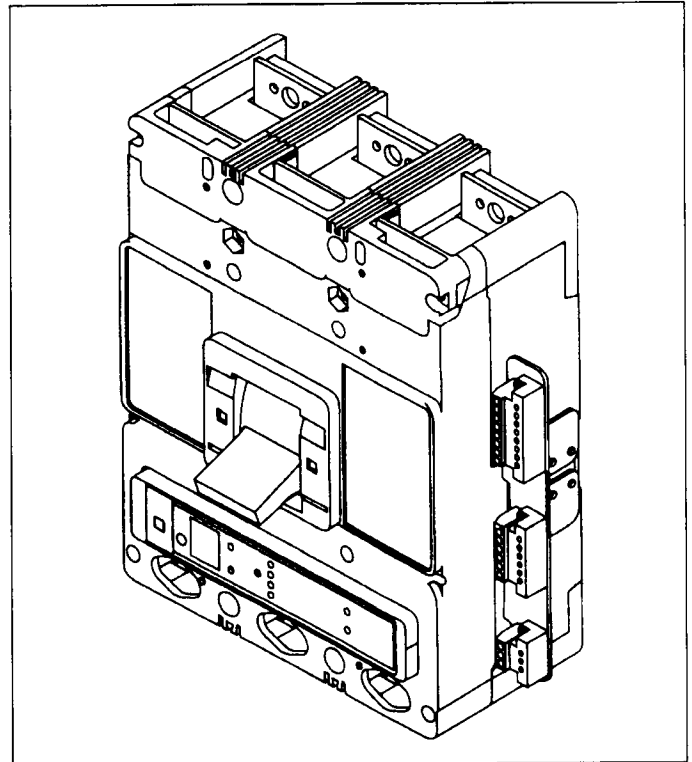


Fig. 1-1. L-frame OPTIM Series C Circuit Breaker Frame

L-Frame and Accessories Selection Data	29-120L
Instructions and Overview of OPTIM Trip Units	29C890
Instructions on the Operation of Digitrip OPTIMIZER Hand Held Programmer	29C892
Instructions on the Operation of Digitrip Breaker Interface Module	29C893
Instructions on the Operation of Digitrip OPTIM Trip Units	29C891
Digitrip OPTIM Wire Diagrams	29C894

100 Percent Rated L-frame Circuit Breakers

CLD, CHLD, and CLDC circuit breakers are suitable for 100 percent of the frame rating. The 125A, 250A, and 400A circuit breakers do not require ventilation. The 600A circuit breaker must be used with 90°C insulated wire and AL9CU terminals in an enclosure which measures at least 24" high x 15" wide x 6" deep. The minimum required ventilation is 8 sq. in. top front and 8 sq. in. bottom front.

2. INSTALLATION

The installation procedure consists of inspecting the circuit breaker and, as applicable, installing the rating plug and terminals; mounting the circuit breaker; connecting the line and load conductors; torquing terminals; and attaching terminal shields. Circuit breaker frames rating plugs, accessories, mounting hardware, and unmounted terminals may be supplied in separate packages. To install the circuit breaker, perform the following steps.

- 2-1. Compare nameplate data with existing equipment ratings and system requirements to make sure that the circuit breaker is suitable for the intended installation. Prior to mounting, confirm that the circuit breaker has not been damaged during transit or initial handling.
- 2-2. If not already installed, mount wire connecting terminals as shown in Fig. 2-1. Secure the terminals to the circuit breaker using two pan head slotted screws and lockwashers. Torque to 6 to 8 lb.-ft. (8.14 to 10.85 N.m). With the circuit breaker mounted and before the conductors are installed and conductor clamping screws inserted, the terminal mounting screws may be checked for correct torque.



WARNING

THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE DEATH OR SEVERE PERSONAL INJURY. BEFORE MOUNTING THE CIRCUIT BREAKER IN AN ELECTRICAL SYSTEM, MAKE SURE THERE IS NO VOLTAGE PRESENT WHERE WORK IS TO BE PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT.

Note: Depending on the equipment configuration, the circuit breaker can be mounted using different styles of hardware. The following steps describe how to mount the circuit breaker using standard hardware. When special hardware is needed (for example, with the motor operator), the instruction leaflet describing the accessory also describes the special mounting arrangements.

- 2-3. To mount the circuit breaker, perform the following steps:
 - a. For individual surface mounting, drill mounting panel using the drilling plan shown in Fig. 2-2.

For panelboard mounting, only load end support mounting holes are required. For dead-front cover applications, cut out cover to correct escutcheon dimensions, see Fig. 2-3. Make sure accessory wiring is accessible when the circuit breaker is mounted.

- b. Position circuit breaker on mounting surface.
- c. Install circuit breaker mounting screws and washers. Tighten screws firmly, but do not exceed 28 lb.-in. (3 N.m).



CAUTION

WHEN ALUMINUM CONDUCTORS ARE USED, THE APPLICATION OF A SUITABLE JOINT COMPOUND IS RECOMMENDED TO REDUCE THE POSSIBILITY OF TERMINAL OVERHEATING. OVERHEATING CAN CAUSE NUISANCE TRIPPING AND DAMAGE TO THE CIRCUIT BREAKER.

- 2-4. Connect line and load conductors and accessory leads.
- 2-5. Install the supplied neutral current sensor in the neutral pole of a four-wire system, see Fig. 2-6.
- 2-6. After the circuit breaker is installed, check all mounting hardware and terminal connecting hardware for correct torque loading. Torque values for line/load terminals are given in Table 2-1 and on the circuit breaker nameplate.
- 2-7. Install line terminal cover on circuit breaker cover with mounting screws provided. Torque to 20-22 lb.-in. (2.26-2.49 N.m).
- 2-8. When step-type terminals (Cat. No. TA603LD or TA401LD) are used, terminal shields (supplied with terminals) must be installed on the circuit breaker (Fig. 2-4) and secured using retainer and screws included with the terminal shield kit. Warning label supplied with the kit must be attached to the circuit breaker cover.



WARNING

HAZARDOUS VOLTAGE CONDITIONS CAN CAUSE DEATH OR SEVERE PERSONAL INJURY. MAINTAIN ORIGINAL ELECTRICAL CLEARANCE AND CREEP-AGE SPACINGS AT TERMINATIONS.

- 2-9. Connect the power and control wires to the terminal blocks on the side of the breaker, see Fig. 2-5.
- 2-10. Install an appropriate rating plug, see Table 2-2.
- 2-11. Plug in the hand held Digitrip OPTIMIZER into the programming port and set the INCOM address. Then set the various trip unit current settings using the OPTIMIZER, the Breaker Interface Module, or through a computer with Series III software. Refer to the user's manuals for details.

3. MANUAL OPERATION

Manual operation of the circuit breaker is controlled by the circuit breaker handle and the PUSH-TO-TRIP button in the trip unit. The circuit breaker handle has three positions, two of which are shown on the cover with raised lettering to indicate ON and OFF. On the handle, ON, OFF, and trip are also shown by a color-coded strip for each circuit breaker handle position: red for ON, white for tripped, and green for OFF (see Fig. 3-1).

Circuit Breaker Reset

After a trip operation, the circuit breaker is reset by moving the circuit breaker handle to the Reset (extreme OFF) position. It is **not** necessary to press the reset button before resetting the breaker. The reset button affects only the cause of trip indicator LED's. It does not affect the operation of the circuit breaker itself.

Note: No circuit breaker should be reclosed until the cause of trip is known and the situation rectified.

PUSH-TO-TRIP Button

The PUSH-TO-TRIP button operates the circuit breaker tripping function and may be used to periodically exercise the operating mechanism. The button is designed to be operated by a small screwdriver.

4. INSPECTION AND FIELD TESTING

Series C molded case circuit breakers are designed to provide years of almost maintenance-free operation. The following procedure describes how to do a limited amount of field inspection and testing of a circuit breaker.

Inspection

Circuit breakers in service should be inspected periodically. The inspection should include the following checks 4-1 through 4-7.



WARNING

THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE SEVERE PERSONAL INJURY OR DEATH. BEFORE INSPECTING THE CIRCUIT BREAKER IN AN ELECTRICAL SYSTEM, MAKE SURE THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THAT THERE IS NO VOLTAGE PRESENT WHERE WORK IS TO BE PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT.



CAUTION

SOME COMMERCIAL CLEANING AGENTS WILL DAMAGE THE NAMEPLATES OR MOLDED PARTS. MAKE SURE THAT CLEANING AGENTS OR SOLVENTS USED TO CLEAN THE CIRCUIT BREAKER ARE SUITABLE FOR THE JOB.

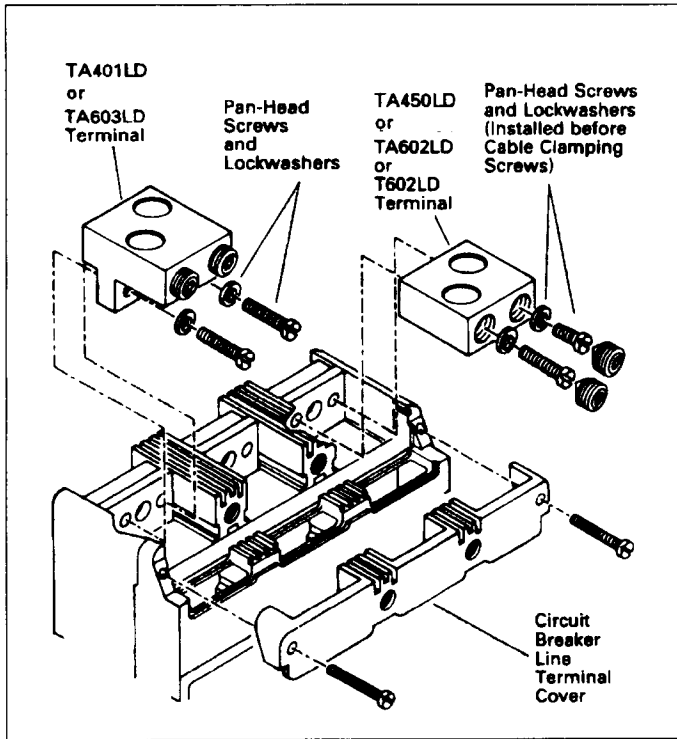


Fig. 2-1. Terminal Installation

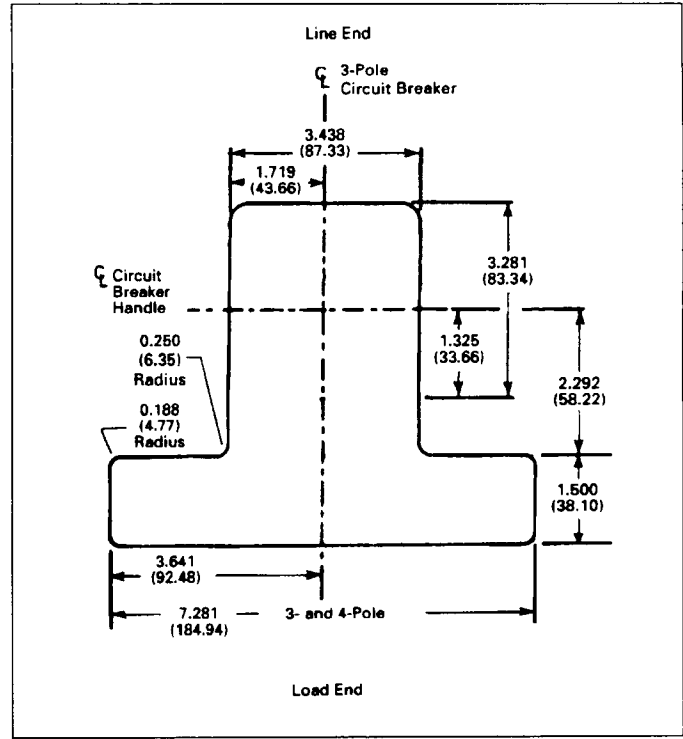


Fig. 2-3. Circuit Breaker Escutcheon Cutout Dimensions for 3- and 4-Pole Circuit Breakers

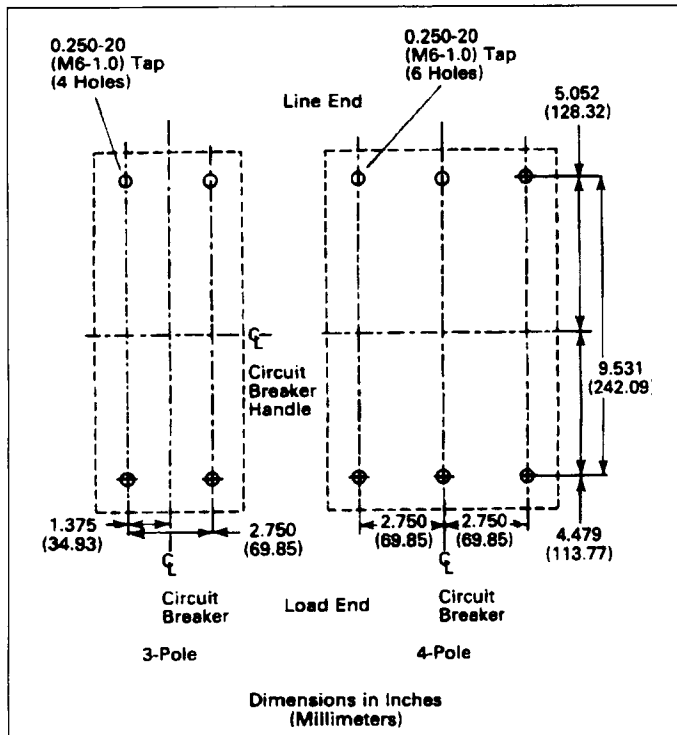


Fig. 2-2 3- and 4-Pole Circuit Breaker Mounting Bolt Drilling Plans

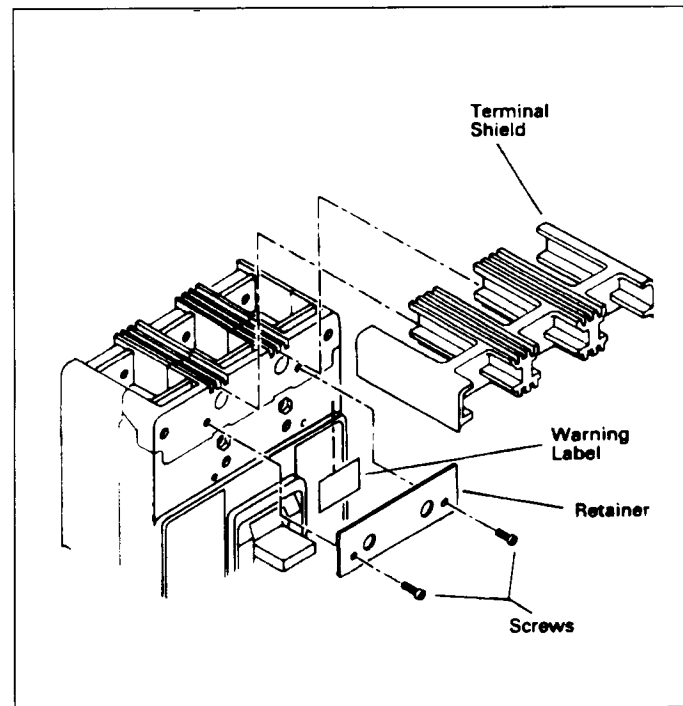
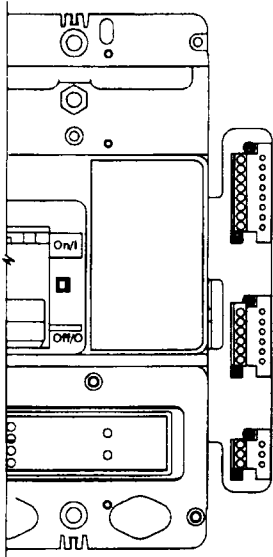


Fig. 2-4. Installation of Terminal Shields and Warning Label

Power and Control Wiring of the L-frame Breakers with Digitrip OPTIM Units



Power and Control Wiring of the L-frame Digitrip OPTIM Breaker

Terminal	Wire Color	Description
GF AL	White/Brown	GF Alarm
SOUT	White/Black	Short Delay Output
SIN	White/Red	Short Delay Input
COM.	Black	Common
GOUT	Green	Ground Output
GIN	Brown	Ground Input
NS	White	Neutral Sensor Non-polarity
NS •	Gray	Neutral Sensor Polarity
Shield	N/A	Shield
Ø C	Blue	Ø C
Ø B	Yellow	Ø B
Ø A	Red	Ø A
Neg.	Black *	Neg.* (Common)*
+30 Vdc	Orange*	+30 Vdc* Power Supply*
INCOM	Violet	INCOM
INCOM	Violet	INCOM
Shield	N/A	Shield

The mating male terminal blocks can be purchased through Cutler-Hammer. Their part numbers are:

Terminal	Part No.
3 position	4213B80H03
6 position	4213B80H06
8 position	4213B80H08

WARNING

*It is crucial to connect the +30 Vdc power supply to the correct terminal. Improper connection can destroy the electronic protection functions of the circuit breaker.

Fig. 2-5.

Table 2-1. Terminal Types^{①②③④}

Terminal Catalog Number	Terminal Material Body	Screw Head Type	AWG Wire Range	Metric Wire Range (MM ²)	Wire Type	Torque Value Lb. -in. (N.m)
TA602LD	Aluminum	Socket	3/0-350 ^②	120-150	Cu/Al	275 (31.1)
TA603LD ^⑤	Aluminum	Socket	400-500 ^②	185-240	Cu/Al	275 (31.1)
T602LD	Copper	Socket	250-350 ^②	120-150	Cu	275 (31.1)
TA401LD ^⑤	Aluminum	Socket	4/0-600 ^②	120-300	Cu//Al	400 (45.2)
TA450LD	Aluminum	Socket	4-4/0 ^②	25-95	Cu/Al	275 (31.1)

- ① The maximum width non-standard wire connector (tang-type) or bus bar connector that can be used without reducing electrical clearance and creepage distances between phases is 1.690 inches.
- ② No hardware or connector should be installed in a manner to reduce the electrical clearance between the underneath side of the phase termination (line or load) and ground without the addition of supplementary insulation.
- ③ The metric conductor sizes indicated are the minimum /maximum sizes that can be inserted in the terminal. Larger size conductors may be required to satisfy ampacity requirements for local installation rules.
- ④ All terminals can accommodate two cables, except TA401LD.
- ⑤ Sold in 2-, 3-, and 4-pole kits only.

Table 2-2

Trip Unit Rating	Available Rating Plugs
125A	70A, 90A, 100A, 110A, 125A
250A	125A, 150A, 175A, 200A, 225A, 250A
400A	200A, 225A, 250A, 300A, 350A, 400A
600A	300A, 350A, 400A, 500A, 600A

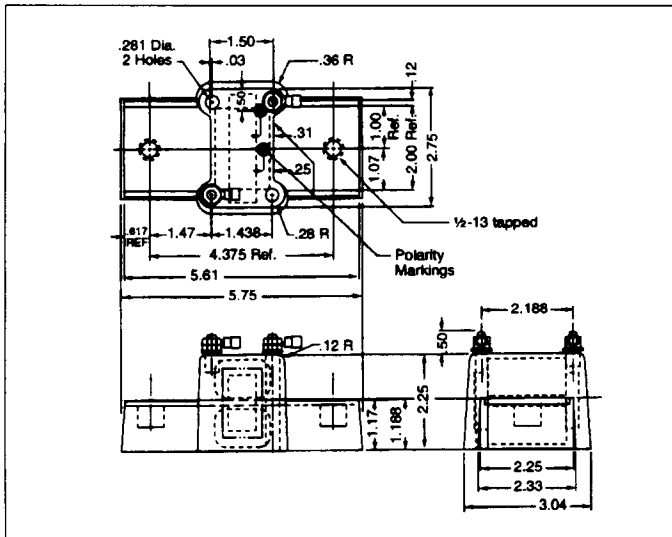


Fig. 2-6. Neutral Sensor Dimensions

- 4-1. Remove dust, dirt, soot, grease, or moisture from the surface of the circuit breaker using a lint-free dry cloth, brush, or vacuum cleaner. Do not blow debris into circuit breaker. If contamination is found, look for the source and eliminate the problem.
- 4-2. Switch circuit breaker to ON and OFF several times to be sure that the mechanism linkages operate freely and do not bind. If mechanical linkages do not operate freely, replace circuit breaker.
- 4-3. With the circuit breaker in the ON position, press the PUSH-TO-TRIP button to mechanically trip the circuit breaker. Trip, reset, and switch circuit breaker ON several times. If mechanism does not reset each time the circuit breaker is tripped, replace the circuit breaker.
- 4-4. Check base, cover, operating handle, and handle barrier for cracks, chipping, and discoloration. Circuit breakers should be replaced if cracks or severe discoloration is found.

- 4-5. Check wire connecting terminals and other type bus bar connectors for looseness or signs of overheating. Overheating will show as discoloration, melting, or blistering of conductor insulation, or as pitting or melting of conductor surfaces due to arcing. If there is no evidence of overheating or looseness, do not disturb or tighten the connections. If there is evidence of overheating, terminations should be cleaned or replaced. Before re-energizing the circuit breaker, all terminations and cable should be refurbished to the originally installed condition.

- 4-6. Check circuit breaker mounting hardware, and tighten if necessary.

- 4-7. Exposure to certain types of chemicals can cause deterioration of electrical connections. Check area where circuit breaker is installed for any safety hazards, including personal safety and fire hazards and take required precautionary actions.

Field Testing

Any field testing should be done in accordance with applicable NEMA Standard. The operation of circuit breaker switch Digitrip OPTIM RMS trip units can be field tested periodically using the hand held OPTIMIZER. (See user's manuals.)

PERFORMANCE TESTING FOR GROUND FAULT TRIP UNITS

Code Requirements

The National Electrical Code under Article 230-95-C requires that any ground-fault protection system be performance tested when first installed. The test shall be conducted in accordance with approved instructions provided with the equipment. A written record of this test shall be made and shall be available to the authority having inspection jurisdiction.

Standards Requirements

As a follow-up to the basic performance requirements stipulated by the N.E.C. as stated above, UL Standard No. 1053 requires that certain minimum instructions must accompany each ground fault protection system. These following statements plus a copy of the test record form illustrated in Fig. 4-1 are shipped with each Digitrip OPTIM RMS trip unit.

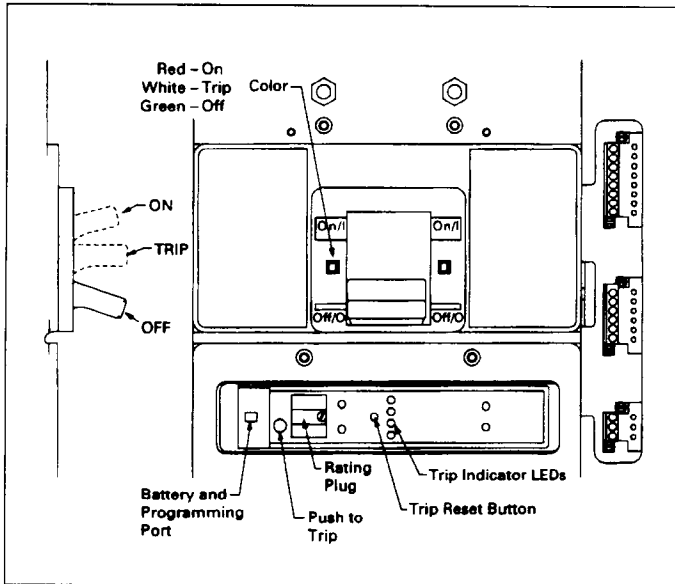


Fig. 3-1. Circuit Breaker

General Test Instructions

The interconnected system shall be evaluated in accordance with the equipment assembler's detailed instructions by qualified personnel.

The polarity of the neutral sensor connections (if used) must agree with equipment assembler's detailed instructions to avoid improper operations following apparently correct simulated test operations. Where a question exists, consult the specifying engineer and/or equipment assembler.

The grounding points of the system shall be verified to determine that ground paths do not exist that would bypass the sensors. The use of high-voltage testers and resistance bridges may be used.



WARNING

THERE IS A HAZARD OF ELECTRICAL SHOCK OR BURN WHENEVER WORKING IN OR AROUND ELECTRICAL EQUIPMENT. ALWAYS TURN OFF POWER SUPPLYING BREAKER BEFORE CONDUCTING TESTS.

Note: Since the Digitrip OPTIM RMS trip units derive their operating power from the phase currents, and not from the neutral current, passing current through

the neutral sensor only will not properly test the ground fault feature.

Using a low-voltage (0-24 volt), high current, ac source, apply a test current of 125% of the Digitrip OPTIM RMS Ground Fault Trip Unit pick-up setting through one phase of the circuit breaker, as shown in Fig. 4-2. This should cause the breaker to trip in less than 1 second, and if an alarm indicator is supplied, it should operate. Reset the breaker and the alarm indicator. Repeat the test on the other two phases.

If the system is a 4-wire system with a neutral current sensor, apply the same current as described above through one phase of the breaker, returning through the neutral sensor, as shown in Fig. 4-3. The breaker should not trip, and the alarm indicator, if supplied, should not operate. Repeat the test on the other two phases.

If the system is a 3-wire system with no neutral current sensor, apply the same current as described above through any two phases of the breaker, with the connections exactly as shown in Fig. 4-4. The breaker should not trip, and the alarm indicator, if supplied, should not operate. Repeat the test using the other two combinations of breaker phases.



CAUTION

FIELD TESTING SHOULD BE USED FOR FUNCTIONAL TESTING AND NOT FIELD CALIBRATION OF THE DIGITRIP OPTIM RMS GROUND FAULT TRIP UNIT.

ANY TEMPORARY CONNECTION MADE FOR THE PURPOSE OF CONDUCTING TESTS SHOULD BE RESTORED TO PROPER OPERATING CONDITIONS BEFORE RETURNING THE BREAKER TO SERVICE.

The results of the test are to be recorded on the test form provided with the equipment.

GROUND FAULT TEST RECORD FORM

Ground Fault Test Record should be Retained by Those in Charge of the Building's Electrical Installation in order to be available to the Authority having Jurisdiction.

Test Date	Circuit Breaker Number	Results	Tested By:

Fig. 4-1. Typical Performance Test Record Form

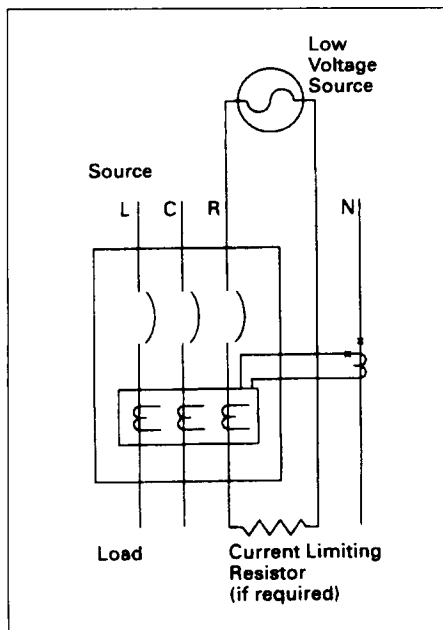


Fig. 4-2. Connections for Ground Fault Trip Test

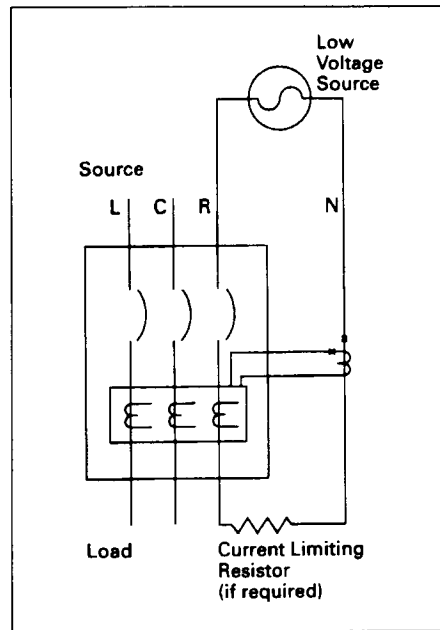


Fig. 4-3. Connections for Ground Fault No-Trip Test, with a Four-Wire System

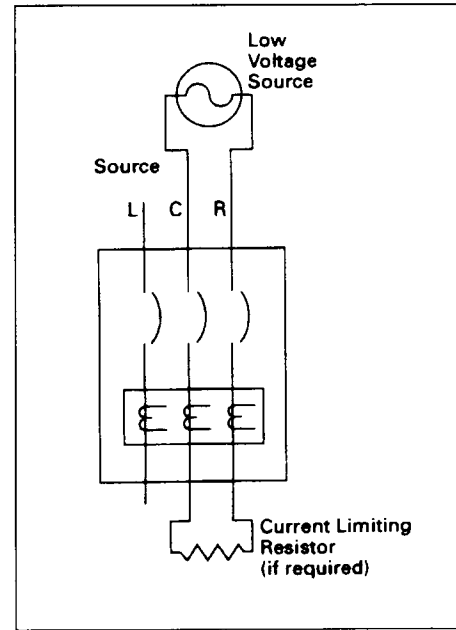


Fig. 4-4. Connections for Ground Fault No-Trip Test, with a Three-Wire System

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