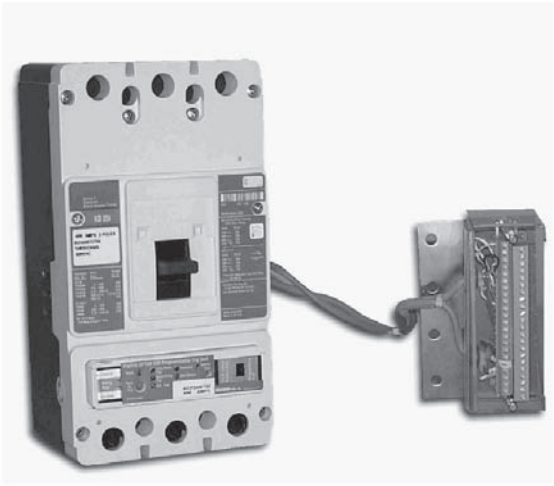
Instruction Leaflet IL29C092E

Effective November 2013
Supersedes IL29C092D 08/11

# Installation Instructions for KD, HKD, KDC, CKD, CHKD, Circuit Breakers with Digitrip OPTIM Trip Unit and Powernet and/or Zone Interlock



Contents



Powering Business Worldwide

## 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.**

**EATON 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.

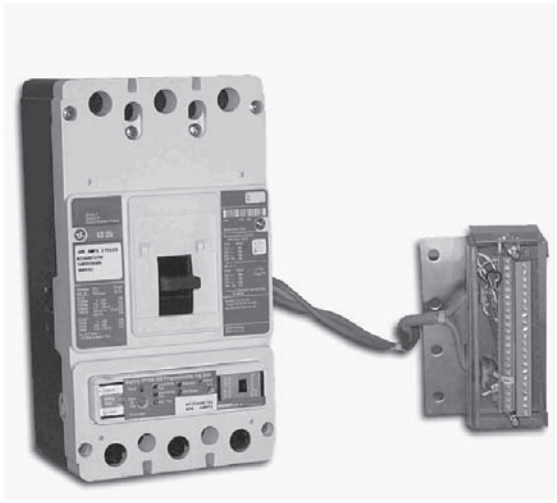


*Figure 1-1 K-Frame OPTIM Series C Circuit Breaker Frame (OPTIM 550 Shown)*

The recommendations and information contained herein are based on Eaton 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 Eaton for further information or instructions.

### 1-0 INTRODUCTION

#### *General Information*

The K-Frame OPTIM Series C circuit breaker types KD, HKD, and KDC are 600 VAC maximum rated devices with Digitrip OPTIM trip units rated 125A, 250A, or 400A maximum continuous current (Figure 1-1). They are for AC applications only. They are listed in accordance with Underwriters Laboratories, Inc. Standard UL 489 and satisfy the (P1) requirements of International Electrotechnical Commision Recommendations No. IEC 157-1. The OPTIM 750 and 1050 K-Frame 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 Eaton for the following information and user manuals:

| | |
|---|---|
| K-Frame and Accessories Selection Data | 29-120K |
| Instructions and Overview of OPTIM Trip Units | 29C890 |
| Instructionson the Operation of Digitrip OPTIMIZER Hand Held Programmer | 29C892 |
| Instructionson 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 K-Frame Circuit Breakers*

CKD and CHKD circuit breakers are suitable for continuous operation at 100 percent of the frame rating if used with 90°C insulated wire and AL9CU terminals in an enclosure which measures at least 24" high x 15" wide x 6" deep. Ventilation is not required in an enclosure having these minimum dimensions.

### 2-0 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 existinq equipment ratings and system requirements 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. Remove installed cover screws and cover.

**NOTICE**

The circuit breaker must be in the tripped or OFF position to remove the cover.

2-3. If not already installed, install the rating plug and, if required, accessories in the circuit breaker frame.

**NOTICE**

If required, internal accessory installation in any type of circuit breaker should be done before the circuit breaker is mounted and connected. Refer to individual accessory instruction leaflets.

2-4. Replace cover and install pan-head screws followed by thread-forming screws.

**CAUTION**

WHEN REMOVED AND REINSTALLED. THREAD FORMING SCREWS WILL TRY TO REFORM THE THREADS IN THE BASE. CARE SHOULD BE TAKEN EVERY TIME A THREAD-FORIVIING SCREW IS USEDTO ENSURE THE SCREW STARTS IN THE ORIGINAL THREADS. DAMAGED THREADS CAN RESULT IN IWIPROPER CIRCUIT BREAKER COVER RETENTION.

2-5. If not already installed, mount wire connecting terminals as shown in Figure 2-1 Secure the terminals to the circuit breaker using a 7/32 inch socket wrench. Torque to 6 to 8 lb.-ft. (8 to 11 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. If Warning Label is supplied with terminals, place Warning Label on upper portion of circuit breaker cover.

**WARNING**

THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE DEATH OR SEVERE PERSONAL INJURY. BEFORE MOUNTING THE CIRCUIT BREAKER IN AN ELECTRICAL SYSTEIVI, MAKE SURE THERE IS NO VOLTAGE PRESENT WHERE WORK IS TO BE PERFORMED.

**NOTICE**

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 electrical operator), the instruction leaflet describing the accessory also describes the special mounting arrangements.

2-6. To mount circuit breaker, perform the following steps:

a. For individual surface mounting, drill mounting panel using the drilling plan shown in Figure 2-2. For panelboard mounting, only load end support mounting holes are required. For deadfront cover applications, cut out cover to correct escutcheon dimensions, see Figure 2-3. Make sure accessory wiring is accessible when the circuit breaker is mounted.

b. Position circuit breaker on mounting surface.

**NOTICE**

Labels with accessory connection schematic diagrams are provided on the side of the circuit breaker. A note should be made of the diagrams if the labels cannot be seen when the circuit breaker is mounted.

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

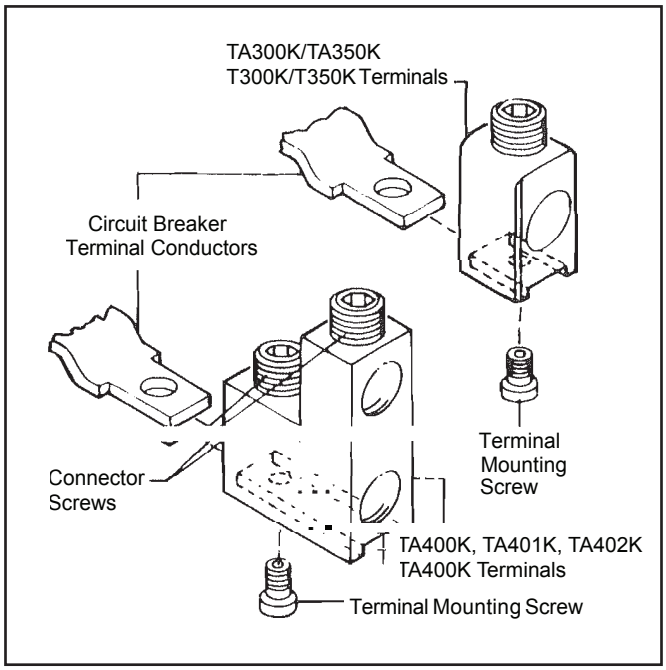



*Figure 2-1 Terminal Installation*

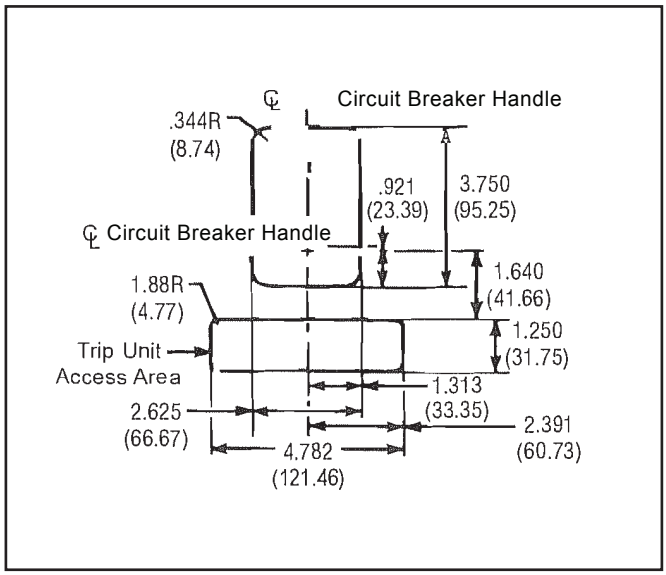



*Figure 2-3 Circuit Breaker Escutcheon Cutout Dimensions for 3- and 4-Pole Circuit Breakers*

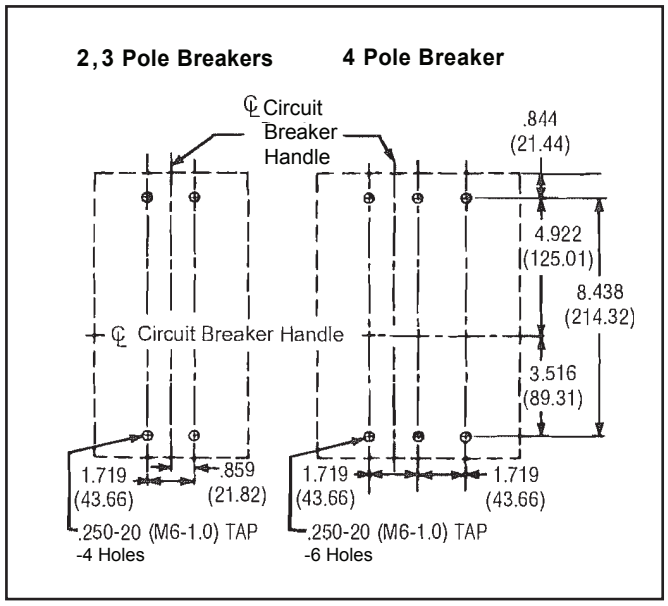



*Figure 2-2 Circuit Breaker Mounting Bolt Drilling Plans*

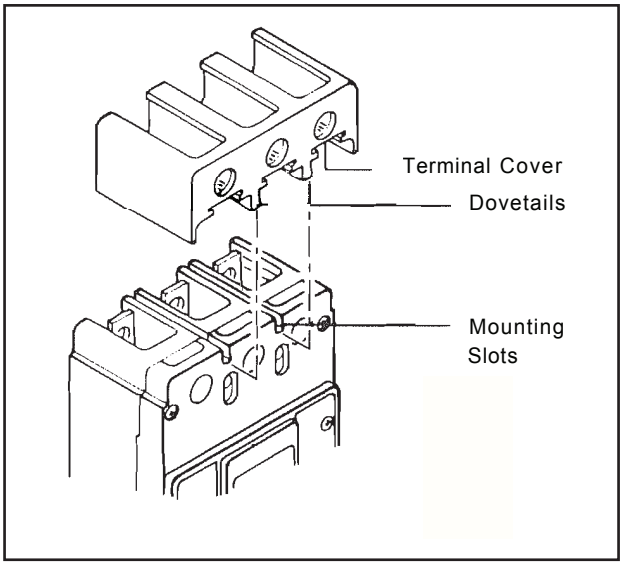
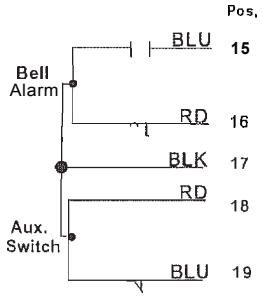



*Figure 2-4 Terminal Cover Installation*

| Pos. | Terminal | Wire Color | Description | | 550 ICK | Zone Interlock | Zone w/Powernet |
|---|---|---|---|---|---|---|---|
| 1 | GF AL | White/Brown | GF Alarm | | | X | X |
| 2 | Zone OUT | White/Black | Short Delay/Ground Output | Zone | | X | X |
| 3 | Zone IN | White/Red | Short Delay/Ground Input | Zone Select ④ Interlock | | X | X |
| 4 | COM | (imp) | Common | | | X | X |
| 5 | NEG | Black* | 24 V Neg* | Control ① Power | X | | |
| 6 | +24 Vdc | Orange* | 24 Vdc* Power Supply* | | X | | X |
| 7 | NS | White | Neutral Sensor Non-Polarity | | X | X | X |
| 8 | NS* | Gray | Neutral Sensor Polarity ② | | X | X | X |
| 9 | ØC | Blue | ØC | PT Module Inputs | | | |
| 10 | ØB | Yellow | ØB | | | | |
| 11 | ØA | Red | ØA | | | | |
| 12 | INCOM | Violet | INCOM | PowerNet | X | | X |
| 13 | INCOM | Violet | INCOM | | X | | X |
| 14 | Shield | N/A | Shield | | | | |
| 15 | Bell N.O. | Blue | Bell Alarm N.O. | | | | |
| 16 | Bell N.C. | Red | Bell Alarm N.C. | | | | |
| 17 | Com | Black | Bell/Aux Common | | | | |
| 18 | Aux N.O. | Red | Aux Switch N.O. | | | | |
| 19 | Aux N.C. | Blue | Aux Switch N.C. | | | | |
| 20 | Spare | | | | | | |
| 21 | Spare | | | | | | |
| 22 | Spare | | | | | | |




The combination Bell Alarm / Auxiliary Switch is only available on the OPTIM 1050 units.

**NOTICE**

1. It is crucial to connect the +24 VDC power supply to the correct terminal. Improper connection can destroy the electronic protection functions of the circuit breaker. The trip unit imposes a load of 45 ma.
2. The OPTIM 550 Ground Fault Trip and Ground Fault Alarm units have "NS and NS*" wires. The Non-Ground Fault Optim 550 units have no wires.
3. Customer wiring connections are made on the removable male plug of the terminal block.
4. If the customer requires the interlock feature in their system then the removal of the jumper between positions 2 & 3 is required. Breaker is shipped as self interlocked from the factory.

*Figure 2-5 OPTIM Wiring Terminations*

*Table 2-1 Terminal Types*

| Terminal Cat. No. | Terminal Material Body | Screw Head Type | AWG Wire Range | Metric Wire Range | Wire Type | Torque Value lb-in (N.m.) |
|---|---|---|---|---|---|---|
| TA300K | Aluminum | Socket | 3-350(1) | 35-185 | Cu/Al | 275 (31) |
| TA350K | Aluminum | Socket | 250-500(1) | 120-240 | Cu/Al | 375 (42) |
| TA400K | Aluminum | Socket | 3/0-250(2) | 95-120(2) | Cu/Al | 275 (31) |
| TA401K | Aluminum | Socket | 250(2) | 120(2) | Cu/Al | 275 & 375 |
| | | | or | or | | (31 &42) |
| | | | 500(1) | 240(1) | Cu/Al | 375 (42) |
| TA402K | Aluminum | Socket | 500-750(1) | 240-300 | Cu/Al | 550 (62) |
| T300K | Copper | Socket | 3-350(1) | 35-185 | Cu Only | 275 (31) |
| T350K | Copper | Socket | 250-500(1) | 120-240 | Cu Only | 375 (42) |
| T400K | Copper | Socket | 3/0-250(2) | 95-120(2) | Cu Only | 275 (31) |

**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.

2-7. Connect line and load conductors and accessory leads.

**NOTICE**

**When a dual conductor terminal (Catalog No. TA402K, TA401K, TA400K or T400K is installed on the circuit breaker and a single conductor is used, the conductor should be installed in the terminal opening nearest to the circuit breaker terminal mounting conductor.**

2-8. Install the supplied neutral current sensor in the neutral pole of a four-wire system, see Figure 2-6.

2-9. 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.

2-10. If required, install line terminal cover on circuit breaker cover with mounting slots provided.

*Table 2-2 Rating Plugs*

| Trip Unit Rating | Available Rating Plugs |
|---|---|
| 125A | 63A, 70A, 90A, 100A, 110A, 125A |
| 250A | 125A, 150A, 160A, 175A, 200A, 225A, 250A |
| 400A | 200A, 225A, 250A, 300A, 350A, 400A |

2-11. When step-type terminals (TA400K, TA401K, TA402K or T400K) are used, terminal shields (supplied with terminals) must be installed on the circuit breaker (Figure 2-4). 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 CREEPAGE SPACINGS AT TERMINATIONS.

2-12. Connect the control wires and power wires to their appropriate locations on the male plug of the terminal block, see Figure 2-5. Control power is necessary if IMPACC communication is required.

2-13. Install an appropriate rating plug, see Table 2-2.

2-14. 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, or when INCOM is available, use the circuit

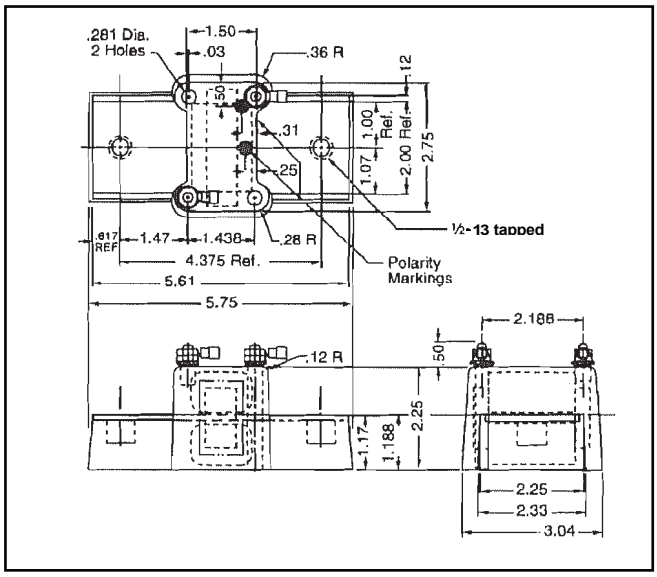



*Figure 2-6 Neutral Sensor Dimensions*

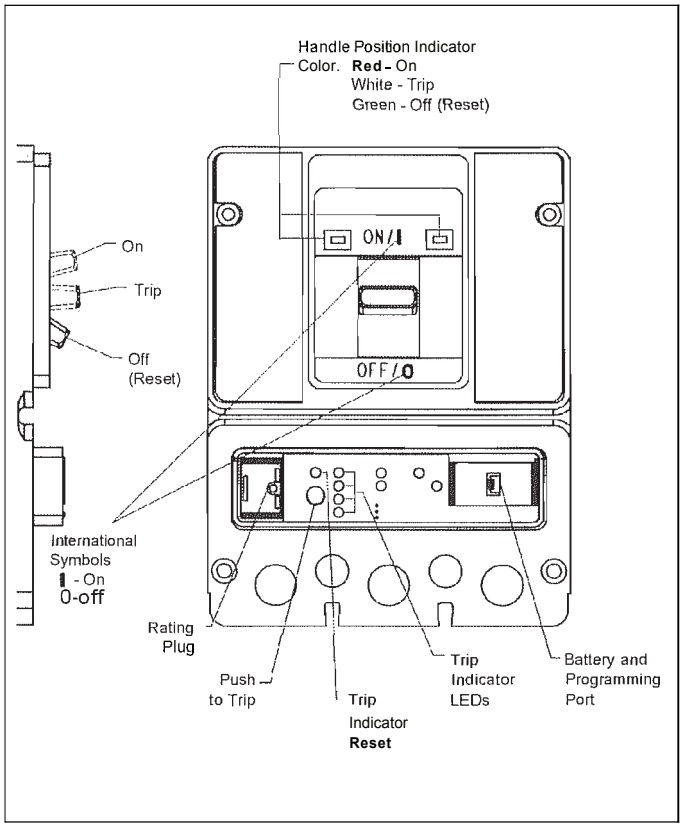



*Figure 3-1 Circuit Breaker*

breaker interface module. If IMPACC Series III software is part of the system, this too can be used to set the trip unit settings. Refer to the user manuals for details.

## 3-0 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 Figure 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.

**NOTICE**

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.

## 4-0 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.

**CAUTION**

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

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 breakers with Digitrip OPTIM trip units can be field tested periodically using the hand held OPTIMIZER (see user 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 Figure 4-1 are shipped with each Digitrip OPTIM trip unit.

### *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 EQLIIPMENT. ALWAYS TURN OFF POWER SUPPLYING BREAKER BEFORE CONDUCTING TESTS.**

**NOTICE**

**Since Digitrip OPTIM 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 Ground Fault Trip Unit pick-up setting through one phase of the circuit breaker, as shown in Figure 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 Figure 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 Figure 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 GROUND FAULT TRIP UNIT.

ANY TEMPORARY CONNECTION MADE FOR THE PURPOSE OF CONDUCTING TESTS SHOULD BE RESTORED TO PROPER OPERATING CONDITION 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 Records 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 |
|---|---|---|---|
| | | | |

*Figure 4-1 Typical Performance Test Record Form*

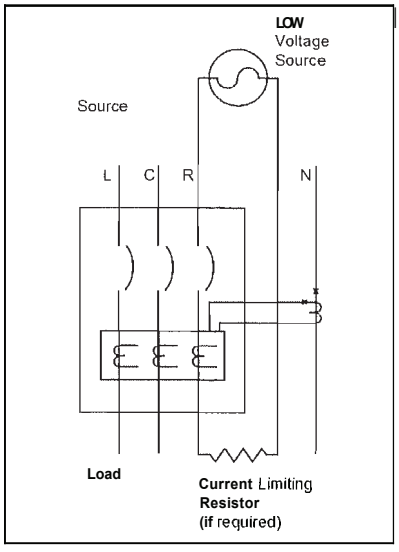



*Figure 4-2 Connections for Ground Fault Trip Test*

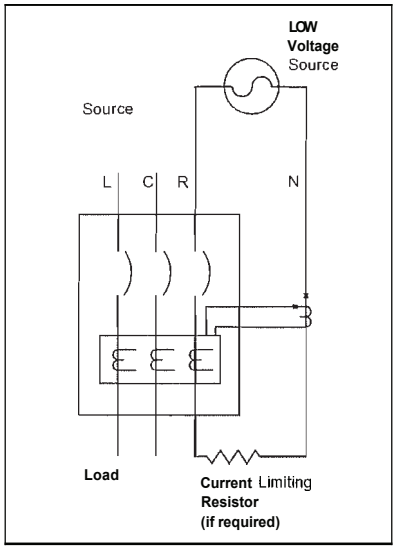



*Figure 4-3 Connections for Ground Fault No-Trip Test, with a Four-Wire System*

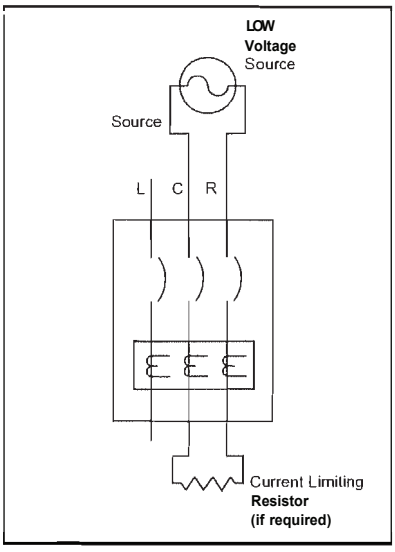



*Figure 4-4 Connections for Ground Fault No-Trip Test, with a Three-Wire System*

Notes:

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Effective November 2013

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The instructions for installation, testing, maintenance, or repair herein are provided for the use of the product in general commercial applications and may not be appropriate for use in nuclear applications. Additional instructions may be available upon specific request to replace, amend, or supplement these instructions to qualify them for use with the product in safety-related applications in a nuclear facility.

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