Instructions for source ground and zero sequence ground sensor

Instructions apply to:

UL489 : PD-NF
IEC : PD-NF, IZMX16

UL489 : PD-RF
IEC : PD-RF, IZMX40

WARNING

(1) ONLY QUALIFIED ELECTRICAL PERSONNEL SHOULD BE PERMITTED TO WORK ON THE EQUIPMENT.
(2) ALWAYS DE-ENERGIZE PRIMARY AND SECONDARY CIRCUITS IF A CIRCUIT BREAKER CANNOT BE REMOVED TO A SAFE WORK LOCATION.
(3) DRAWOUT CIRCUIT BREAKERS SHOULD BE LEVERED (RACKED) OUT TO THE DISCONNECT POSITION.
(4) ALL CIRCUIT BREAKERS SHOULD BE SWITCHED TO THE OFF POSITION AND MECHANISM SPRINGS DISCHARGED.

FAILURE TO FOLLOW THESE STEPS FOR ALL PROCEDURES DESCRIBED IN THIS INSTRUCTION LEAFLET COULD RESULT IN DEATH, BODILY INJURY, OR PROPERTY DAMAGE.

WARNING

THE INSTRUCTIONS CONTAINED IN THIS IL AND ON PRODUCT LABELS HAVE TO BE FOLLOWED. OBSERVE THE FIVE SAFETY RULES:
– DISCONNECTING
– ENSURE THAT DEVICES CANNOT BE ACCIDENTALLY RESTARTED
– VERIFY ISOLATION FROM THE SUPPLY
– EARTHING AND SHORT-CIRCUITING
– COVERING OR PROVIDING BARRIERS TO ADJACENT LIVE PARTS

DISCONNECT THE EQUIPMENT FROM THE SUPPLY. USE ONLY AUTHORIZED SPARE PARTS IN THE REPAIR OF THE EQUIPMENT. THE SPECIFIED MAINTENANCE INTERVALS AS WELL AS THE INSTRUCTIONS FOR REPAIR AND EXCHANGE MUST BE STRICTLY ADHERED TO PREVENT INJURY TO PERSONNEL AND DAMAGE TO THE SWITCHBOARD.
Section 1: General information

Ground Fault Trip used in air circuit breaker can detect ground faults via the source ground or zero sequence fault sensing methods. This I.L. applies to these two sensing methods only. Reference MN013003EN for more application information.

Figure 1. Ground current sensor.

Figure 2. Source ground sensing (NEMA).

Figure 3. Source ground sensing (IEC).

Figure 4. Zero sequence sensing (NEMA).

Figure 5. Zero sequence sensing (IEC).
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The PXR 20 and 25 for the air circuit breakers use three modes of sensing to detect ground fault currents: residual, source ground, and zero sequence (see Table 1). Air circuit breakers can accommodate all three types, including 4-pole circuit breakers. The breaker secondary contact inputs are used to configure the three schemes. In all three schemes, the proper current sensor required is displayed in Table 1.

### Table 1. Air circuit breaker/Digitrip ground fault sensing modes.

<table>
<thead>
<tr>
<th>Air circuit breaker frame</th>
<th>Ground (earth) sensing method</th>
<th>Required sensor (IZMX type coding)</th>
<th>Neutral input contacts</th>
<th>Ground sensor input contacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>NF</td>
<td>Residual</td>
<td>IZMX-CT16-N-1</td>
<td>11, 12</td>
<td></td>
</tr>
<tr>
<td>RF</td>
<td>Residual</td>
<td>IZMX-CT40-N-1</td>
<td>11, 12</td>
<td></td>
</tr>
<tr>
<td>NF or RF</td>
<td>Source ground</td>
<td>IZMX-CT-NGS-1</td>
<td>17, 18</td>
<td></td>
</tr>
<tr>
<td>NF</td>
<td>Zero sequence</td>
<td>IZMX-CT-NGS-1</td>
<td>17, 18</td>
<td></td>
</tr>
</tbody>
</table>

*This information applies to trip units with ground.*

### Source ground sensing

Depending upon the installation requirements, alternate ground fault sensing schemes may be dictated. The ground return method is usually applied when ground fault protection is desired only on the main circuit breaker in a simple radial system. This method is also applicable to double-ended systems where a mid-point grounding electrode is employed. For this mode of sensing, a single current sensor mounted on the equipment-bonding jumper directly measures the total ground current flowing in the grounding electrode conductor. The wiring is as displayed in Figures 2 and 3.

### Zero sequence sensing

Zero sequence sensing, also referred to as vectorial summation, is applicable to mains, feeders and special schemes involving zone protection. The wiring is as displayed in Figures 4 and 5.

### Table 2. Ground (earth) fault current settings - source ground/zero ground fault settings.

<table>
<thead>
<tr>
<th>Ground fault current settings (amperes)</th>
<th>0.20</th>
<th>0.40</th>
<th>0.60</th>
<th>0.80</th>
<th>1.0</th>
</tr>
</thead>
</table>

The current sensor 1ZMX-CTNGS-1 (400:1 ratio or 4000:1 equivalently) has been set up such that it will read out source ground current directly on PXR trip units. If other current sensor ratios are to be employed, contact Eaton.

### Performance testing for ground fault circuit breakers

#### Code requirements

In the United States of America and certain other countries it is required that any ground fault protection system be performance tested when first installed (National Electric Code under Article 230-95-C). The test shall be conducted in accordance with approved instructions provided with the equipment. A written record of this test shall be made available to the authority having inspection jurisdiction.

#### Standards requirements

In addition to the basic performance requirements stated above, UL Standard No. 1053 requires that certain minimum instructions accompany each ground fault protection system.

#### General test instructions

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

- The polarity of the sensor connection (if used) must agree with equipment assembler’s detailed instructions to avoid improper operation following apparently correct stimulated test operations.
- If there are questions, 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. High-voltage testers and resistance bridges may be used.
- Using a low voltage (0-24v) high current AC source, apply a test current of 125% of the ground fault pick-up setting through one phase of the circuit breaker as displayed in Figures 6 to 9. 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.

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**WARNING**

ELECTRICAL SHOCK OR BURN INJURY CAN OCCUR WHEN WORKING ON POWER SYSTEMS. ALWAYS TURN OFF POWER SUPPLYING CIRCUIT BREAKER BEFORE CONDUCTING TESTS. TEST OUT OF THE CELL, IF POSSIBLE.
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**Figure 6.** Source ground trip test (NEMA).

**Figure 7.** Source ground trip test (IEC).

**Figure 8.** Zero sequence ground trip test (NEMA).

**Figure 9.** Zero sequence ground trip test (IEC).

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**WARNING**

FIELD TESTING SHOULD BE USED FOR FUNCTIONAL TESTING, NOT FOR FIELD CALIBRATION. IF TEMPORARY CONNECTIONS WERE MADE FOR THE PURPOSE OF CONDUCTING TESTS, RESTORE PROPER OPERATING CONDITIONS BEFORE RETURNING THE BREAKER TO SERVICE.
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