



SCOPE

This test procedure covers the testing of the Basler BE1-46N negative sequence current relay. Refer to IM 9170000990 Rev. L (12/12) for testing support information and component level identification. See pg. 4-10 through 4-12 for wiring schematics and Section 5 for manufacturer test procedures.

SAFETY

In the field, withdraw the lower test paddle first to open the trip circuit. Removing the upper paddle first may cause an inadvertent trip.

Be sure DC power is applied safely to terminals 3-4. Use caution during testing.

Per IM pg. 1-3, do not apply more than 10 amps continuous or 250 amps for 1 second to the relay.

INTRODUCTION

The type BE1-46N relay provides protection for generators and motors from unbalanced loading or power system faults. It monitors I_2 current and responds based on settings that correspond to machine characteristics.

TOOLS, EQUIPMENT, AND MATERIALS

- One, two, or three variable ac current, variable phase-angle sources
- Variable dc voltage/current source
- Contact continuity check method

INSPECTION

1. Remove the cover from the relay, taking care to not shake or jar other relays around it.
2. Withdraw the lower relay test paddle to disable the trip circuit and then withdraw the upper paddle.
3. Unlatch and remove the relay from the case.
4. Visually check the relay for any obvious problems.
5. Clean the relay thoroughly.

If you are testing a relay with in-service settings, adjust this test procedure to verify that the relay responds correctly to the in-service settings.

This procedure uses a single phase current source for testing. To verify all three phases, repeat the operational test procedure for each of the three phases, IA (terminals 9 and 8), IB (terminals 14 and 13) and IC (terminals 16 and 15).

For single phase testing the negative sequence derivation formula becomes quite easy. For three phase testing, $I_2 = \frac{1}{3} (IA + a^2 IB + a IC)$. For single phase testing, $IB=IC=0$, so the formula becomes simply $I_2 = \frac{1}{3} (IA)$ or $I_2 = (\text{single phase current}) / 3$.

Additional testing to verify trip and alarm circuit pickup, dropout and timing may be implemented by changing the PICKUP, ALARM, K SET, and MAX TIME thumbwheel settings on the front panel.

TEST PROCEDURE

1. Find the style number on the relay and check the style number identification chart in *Figure 1* to determine the appropriate voltage setting for the power supply.
2. Connect the power supply voltage source to Terminals 3 and 4, turn on, and verify that the power LED comes on.

I₂ PICKUP AND ALARM RANGE TESTING

1. Set the Tap Adjust to position "A" and adjust the CAL to completely CCW.
NOTE: The Tap Adjust span is 3 – 5 amps for a 5 amp relay. This will adjust the tap to the low end of the range (3 amps).
2. Set the Pickup and Alarm thumbwheels to 33 (33%).
NOTE: The formula for I₂ pickup is (thumbwheel pickup setting in percent) * (tap adjust setting). This will adjust the I₂ pickup setting to 0.33 * 3 = 0.99 amps.
3. Connect the variable ac current source to terminals 9 and 8 (A-phase input).
4. Slowly increase the current until the Pickup and Alarm indication LEDs just light.
NOTE: The I₂ current pickup (IA / 3) should be 0.99 amps +/- 5% for a range of 0.94 to 1.04 amps.
5. Slowly decrease the current until the Pickup and Alarm indication LEDs extinguish.
NOTE: The I₂ current dropout (IA / 3) should be no less than 98% of the I₂ current pickup.
6. Set the Tap Adjust to position "J" and adjust the CAL to completely CW.
NOTE: The Tap Adjust span is 3 – 5 amps for a 5 amp relay. This will adjust the tap to the high end of the range (5 amps) and the I₂ pickup setting to 0.33 * 5 = 1.65 amps.
7. Slowly increase the current until the Pickup and Alarm indication LEDs just light.
NOTE: The I₂ current pickup (IA / 3) should be 1.65 amps +/- 5% for a range of 1.57 to 1.73 amps.

8. Slowly decrease the current until the Pickup and Alarm indication LEDs extinguish.
NOTE: The I_2 current dropout ($I_A / 3$) should be no less than 98% of the I_2 current pickup.

I_2 ALARM AND TRIP DELAY TESTING

NOTE: Power cycling the relay between timing tests will eliminate the need to wait for reset timing.

1. Set the Tap Adjust to position “A” and adjust the CAL to completely CCW.
NOTE: The Tap Adjust span is 3 – 5 amps for a 5 amp relay. This will adjust the tap to the low end of the range (3 amps).
2. Set the K SET thumbwheel to 10.
NOTE: See *Figure 3* for Characteristic Curves.
3. Set the MAX TIME thumbwheel to 10.
NOTE: The MAX TIME setting is in multiple of 10 seconds. In this case the time delay setting is (MAX TIME thumbwheel setting) * 10 = 10 * 10 = 100 seconds.
4. Adjust the variable ac current source to apply a level of 50% I_2 .
NOTE: 50% of the TAP ADJUST setting would generate 50% I_2 . In this case the TAP ADJUST setting is 3 amps so 50% $I_2 = 0.50 * 3 = 1.5$ amps. I_A would then be equal to $3 * I_2 = 3 * 1.5 = 4.5$ amps.
5. Monitor the alarm output at terminals 11 and 12.
6. Initiate the current, starting the pickup timer. Record the pickup time.
NOTE: Both the PICKUP and the ALARM LEDs should light during the test. The alarm pickup time is not adjustable and is factory set at 3 seconds +/- 5% for a range of 2.86 to 3.15 seconds.
7. Monitor the trip output at terminals 1 and 10. (if the relay style includes an auxiliary trip output, also test this function at terminals 2 and 5)
8. Initiate the current, starting the pickup timer. Record the pickup time.
NOTE: Both the PICKUP and the ALARM LEDs should light during the test. The trip pickup time should be 40 seconds +/- 5% for a range of 38.1 to 42.0 seconds. See *Figure 3*, Characteristic Curves, for times using alternate I_2 percentages or K SET settings.
9. Set the MAX TIME thumbwheel to 01.
NOTE: The MAX TIME setting is in multiple of 10 seconds. In this case the time delay setting is (MAX TIME thumbwheel setting) * 1 = 10 * 1 = 10 seconds.
10. Initiate the current, starting the pickup timer. Record the pickup time.
NOTE: Both the PICKUP and the ALARM LEDs should light during the test. The trip pickup time is reduced due to the MAX TIME setting and should be 10 seconds +/- 5% for a range of 9.5 to 10.5 seconds.

FIGURE 1 Style Legend

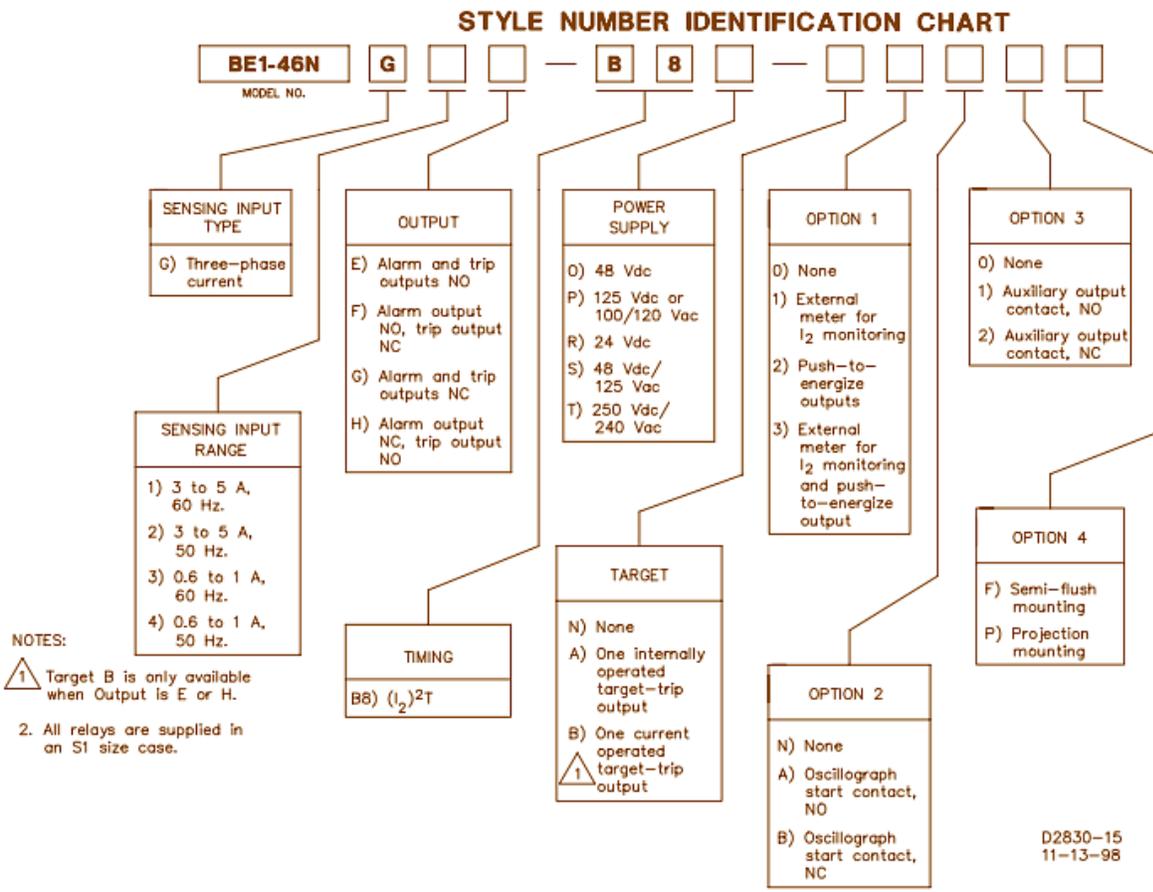


FIGURE 2 BE1-46N Internal Connections

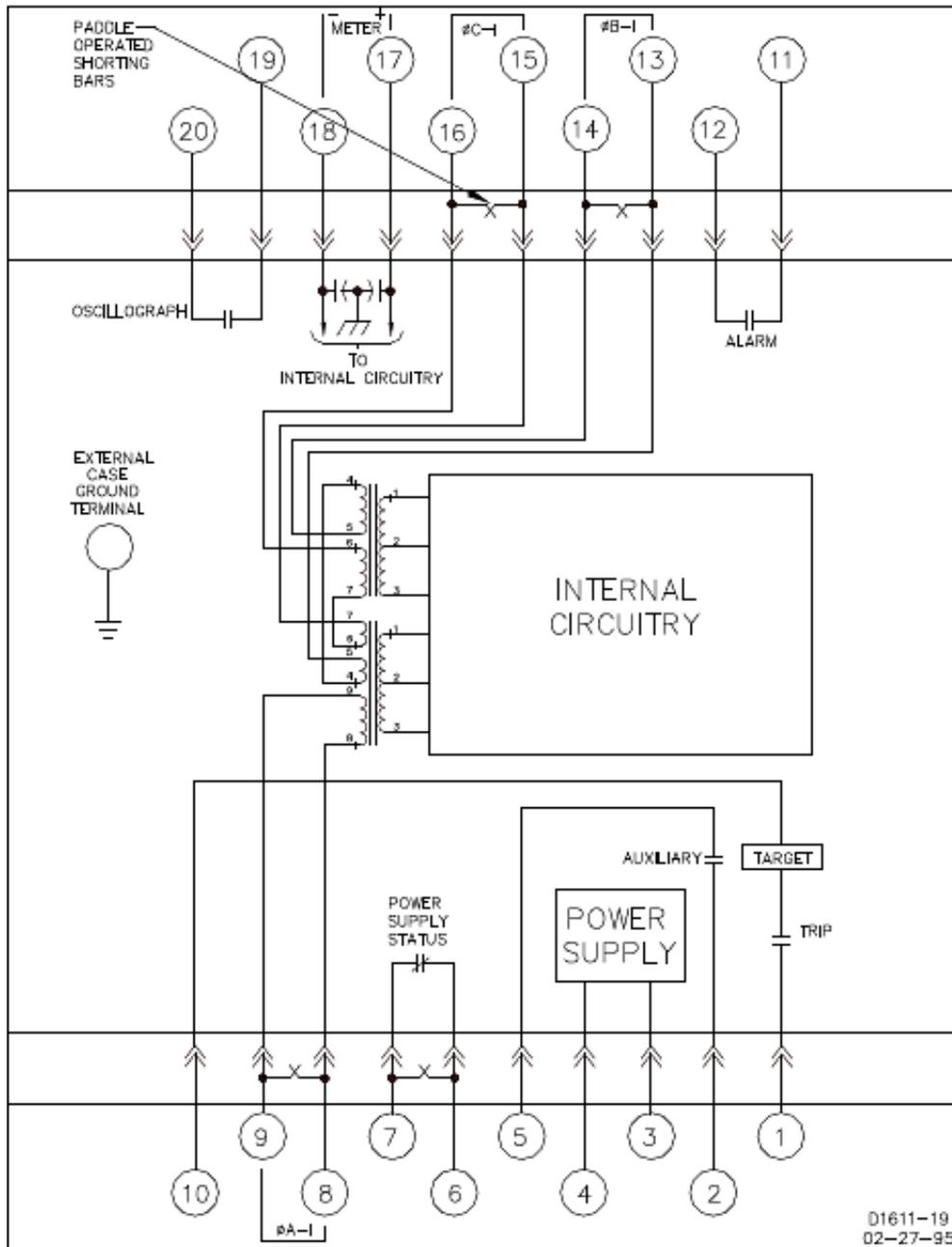


FIGURE 3 *Characteristic Curves*

