INSTRUCTIONS and TEST RECORD for GROUND FAULT SENSING EQUIPMENT

(Test Record on back)

GROUND FAULT RELAYS

WITHOUT INTERLOCK CIRCUIT:
CAT. NO. GFR-1

WITH INTERLOCK CIRCUIT:
CAT. NO. GFR-2

GROUND FAULT SENSORS

CAT. NO. GFS-___

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BULLETIN 108
REVISION 6

GENERAL

The Boltswitch Ground Fault Relay and Ground Fault Sensor combination is designed to detect downstream fault currents that occur phase-to-ground. When both the magnitude and duration of fault current exceed the set levels, the Ground Fault Relay will trip. The output signal may be used to trip a Boltswitch Shunt Trip switch, initiate tripping of another type of disconnecting means, or for indicating purposes. This ground fault sensing equipment is designed to help limit equipment damage caused by phase to ground faults. It is not intended, nor capable of directly providing personnel protection from a fault. Proper operation of this equipment is dependent on proper installation.

DESCRIPTION

A Boltswitch ground fault system consists of a Ground Fault Relay and a Ground Fault Sensor.

The ***Ground Fault Relay*** is available in two basic variations:

1. Normal range without zone interlock circuit
2. Normal range with zone interlock circuit

The ***Ground Fault Sensor*** is available in a variety of round and rectangular sizes. They feature a winding to detect fault currents and a test winding to inject a simulated fault for test purposes. A GFS sensor must be used with a GFR relay. The wires connecting X1 to terminal 1 and X2 to terminal 2 should be twisted and the sensor must be grounded.

FEATURES

Fault current setting

The fault current threshold is adjustable with a dial on the face of the relay. Catalog numbers GFR-1, and GFR-2 are adjustable from 100 to 1200 amperes. This is the minimum level that fault current must attain before the relay will respond.

Time delay setting

All units have a dial to adjust the time delay from Instantaneous to 1 second. The fault current must be sustained above the fault current setting and through the duration of the time delay setting before the relay will respond.

Power indicator light

An LED glows green when the relay is supplied with control power.

Ground Fault Indication

Upon sensing a ground fault condition, the LED light bar on the front of the GFR will indicate the level of the ground fault. If the GFR trips and power is still available, the GFR will continue to show the fault level that was present at the trip.

Trip indicator/manual reset

Upon sensing a fault of sufficient magnitude and duration, the relay will trip, a lever on the face of the unit will move to the “Tripped” position, and the contacts between terminals 3 & 5 will close. The relay will stay in this state until the fault is cleared **AND** the lever is manually moved to the “Normal” position.

Built-in test circuit

Test windings are built into every Boltswitch Ground Fault Sensor and a control circuit is built into every Ground Fault Relay. Pushing the test button on the relay injects a simulated fault into the sensor. If the components are properly installed and in proper operating condition, the system will detect the “fault” and the relay will trip. This test also checks that the sensor and relay are properly grounded.

Shunt Trip bypass

A bypass button on the face of the relay blocks the output signal from the relay while it is depressed. This allows testing of the system without interrupting service. Refer to "TESTING" for the proper procedure.

POWER

The Ground Fault Relay operates on 120 VAC, applied across terminals 3 and 4. Terminal 3 must be grounded. A 75 VA control transformer with good regulation is sufficient to operate this ground fault sensing equipment used in conjunction with a Boltswitch Shunt Trip switch. Applications using other than a Boltswitch Shunt Trip may require a larger control transformer.

OUTPUT CONTACTS

Output contacts between terminals 3 & 5 (Normal = Open)/(Tripped = Closed) rated for 10 amps inrush, 3 amps continuous.

RESET

To reset the Ground Fault Relay, move the lever on the front of the unit from the "Tripped" to the "Normal" position.

BASIC WIRING DIAGRAM

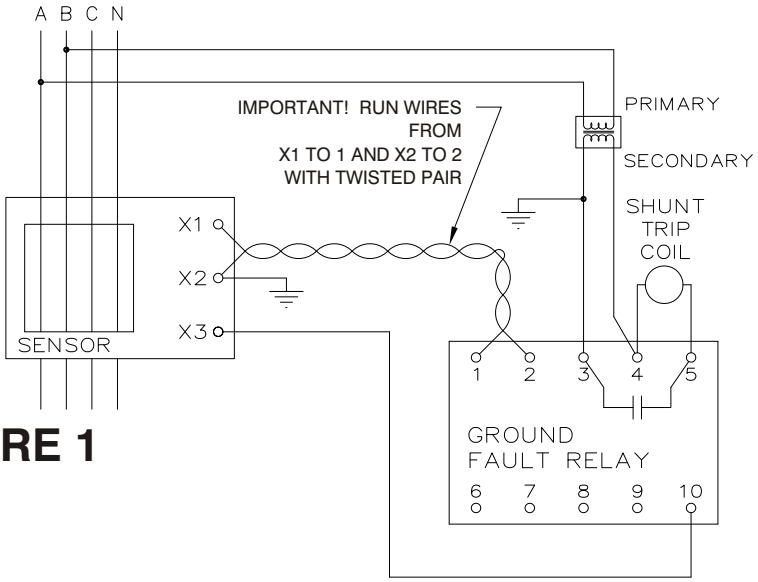


FIGURE 1

SELECTIVITY

On distribution systems using more than one ground fault detection device, two methods of selective coordination are available. One method relies solely on trip current level and time delay settings. The other method uses zone selective interlocking.

The first method uses Ground Fault Relays without interlock circuitry. The time delay and trip current levels must be carefully selected to assure that the device furthest downstream that senses the fault will be the first to trip, thus allowing maximum continuity of service.

The second method uses Ground Fault Relays with interlock circuitry to achieve zone selective interlocking. This method also requires careful adjustment of the time delay and current level settings This system allows the device closest to a fault to respond quickly, while telling devices upstream to delay tripping, thus providing the fastest response with minimal interruption of service.

Once the GFR (w/interlock) detects a Ground Fault Condition, the time delay begns and the GFR sends a signal to the unit(s) upstream to inhibit tripping. Once the GFR trips or loses power, the signal is lost and the upstream GFR continues on its own time delay (that started at the time the fault was detected). If the time delay had already expired, the GFR will verify the Ground Fault is still present and if so, trip.

INTERLOCK WIRING

Catalog number GFR-2 has built in zone selective interlock circuitry. The interlock wiring terminals are arranged as follows:

6. Common - This terminal should be wired together on all relays in the scheme.
7. Output - Provides an output signal to other relays when a fault is sensed.
8. Input, no trip - Accepts output signal from other relays to block tripping of the relay.

All interlock wiring should be #14 or larger twisted pairs of wire with a maximum of 250 feet from the first device to the last device. The wires should run separate from main conductors or other wiring. For a typical wiring diagram see Figure 2.

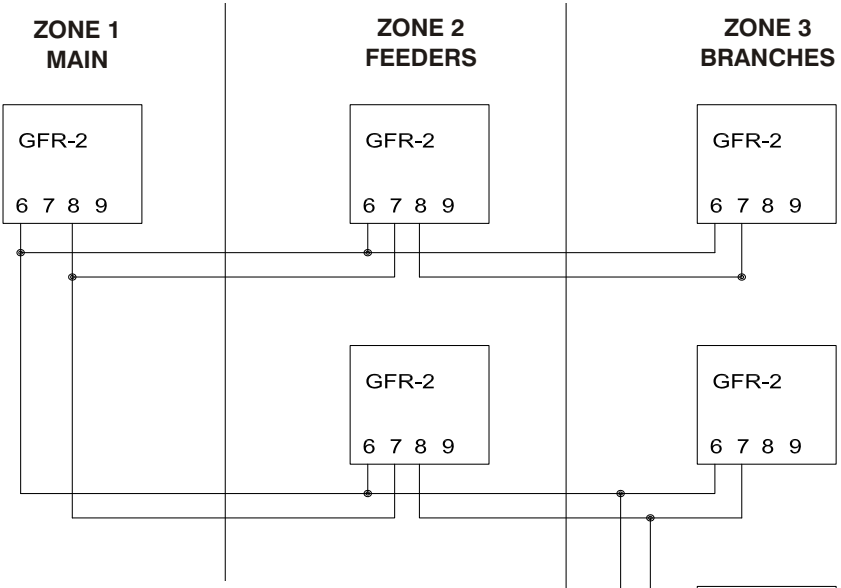
When using zone interlocking, all switches in the system must have control power derived identically. Boltswitch derives H1 on the transformer from “A” phase and H2 from “B” phase on switches with integral ground fault components. We suggest that all zone interlock systems be wired in this manner. Mixing the origin of control power can result in abnormal voltages in the interlock wiring and can damage the relays.

MOUNTING

The Ground Fault Relay should be securely mounted in a well protected location. For panel mounting, use a Panel Mounting Kit (refer to Figures 4 and 5). Mounting more than one relay side by side directly on the same metallic panel is not recommended.

The Ground Fault Sensor should be securely mounted to prevent excess twisting, bending, or sagging. The sensor should not be stressed.

TYPICAL WIRING DIAGRAM with ZONE SELECTIVE INTERLOCKING



TERMINAL KEY

6 COMMON
7 OUTPUT
8 INPUT, TIMED DELAY TRIP
9 INPUT, NO TRIP

FOR MORE COMPLETE DESCRIPTIONS, SEE TEXT

FIGURE 2

TESTING

Upon installation of this equipment it should be tested in accordance with the following instructions. These tests shall be conducted by qualified personnel only.

The proper location of the sensor shall be verified. This can be done visually with knowledge of which bus is involved.

The grounding points of the system shall be verified to determine that ground paths which would bypass the sensor do not exist. The following is a recommended procedure:

1. Disconnect the power source.
2. Disconnect any control transformers and any other devices sensitive to high voltages.
3. Remove the neutral disconnect link.
4. Using a “megger” type meter, measure the resistance to ground of each phase and neutral, if used. No reading of less than 100 ohms is acceptable. Readings of 1 Megohm or more are preferable. Note: High voltage testers and resistance bridges may be used.
5. Reconnect the neutral disconnect link.
6. Reconnect control transformers and other equipment.
7. Reconnect the power source.

Next, test the ground fault protection system to verify compliance with paragraph 230.95(C) of the National Electrical Code. A simulated or controlled fault current is to be generated and the reaction of the circuit interrupting device observed for correct response. To inject a simulated fault and test for proper grounding of the ground fault components, the following procedure is recommended:

1. Depress and hold the button marked “Push to test” on the front of the Ground Fault Relay. The relay should trip instantly or after the set time delay, dependent on the system. The interrupting device should trip immediately after the relay trips.
2. Release the button.
3. Reset the Ground Fault Relay (before re-closing the interrupting device).

Operation of the ground fault system should be tested periodically and the results recorded. The test record should be held by those in charge of the buildings electrical installation in order to be available to the authority having jurisdiction. A place for recording tests is provided on the back of this booklet.

The operation of the ground fault system can be tested without interrupting service using the following procedure:

1. Depress and hold the button marked “Shunt trip bypass” on the front of the relay.
2. Depress and hold the “Push to test” button. The relay should trip instantly or after the set time delay, dependent on the system.
3. Release the “Push to test” button.
4. Reset the Ground Fault relay.
5. Release the “Shunt trip bypass” button. Caution: Failure to first reset the relay will cause the interrupting device to trip upon release of this button.

PANEL MOUNTING

(Optional terminal arrangement)

CAT. NO. GFRK-1 **FOR RELAYS WITHOUT INTERLOCK CIRCUIT**

CAT. NO. GFRK-2 **FOR RELAYS WITH INTERLOCK CIRCUIT**

This kit makes the terminals accessible from the rear of the relay, allowing the relay to be mounted directly to a panel with the face extending through the panel. This can be used with or without the Trim Plate.

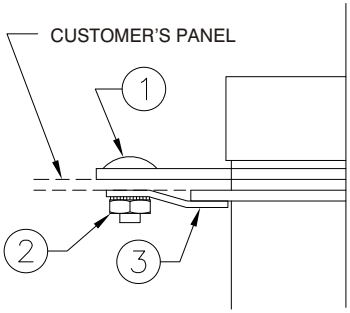


FIGURE 4

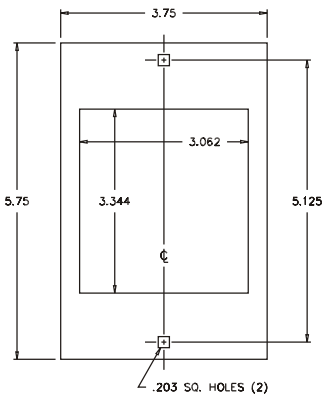
INSTRUCTIONS

1. Remove base mounting bracket. (slides off)
2. Remove existing #8-32 x 3/8" long terminal screws and replace with #8-32 x 1/2" long screws. The included round brass nuts will be used to attach the terminals from the back of the relay in step 4.
3. The relay is now ready to be mounted to the customer's panel. Using the same layout as the Trim Plate, the panel must have a 3.062 x 3.344 inch cut-out and two 5/16 diameter holes, 5.125 inches on center. If the Trim Plate is to be omitted, the two holes should be .203 inches square. After making the proper cut-out, install the unit from the rear and secure with Items 1, 2 & 3 (#10-24 carriage bolts, nuts & mounting clips).
4. The unit is now ready to be wired per the instructions in this book. Please note that when using this optional terminal arrangement, all wire connections to the relay must be made with UL Listed terminals suitable for use with #8 studs and appropriately sized for the wire used, such as:

AMP 51861-1, 31902, 322236, 55006-4, 328527
BURNDY TP-14-8, TP-14-10, TN14-8, TH14-10, YAE14N
T&B Sta-Kon 14RB-8, 14RBC-8, 14RB-8X, RB14-8X
or equivalent.

TRIM PLATE

(USE OPTIONAL)



MAT'L: #12 GA. GALVANIZED STEEL

FINISH: SATIN BLACK BAKED ENAMEL #1926

FIGURE 5

NEC 230.95(C) GROUND FAULT TEST RECORD

A RECORD OF ALL GROUND FAULT TESTS SHOULD BE RETAINED BY THOSE IN CHARGE OF THE BUILDING'S ELECTRICAL INSTALLATION IN ORDER TO BE AVAILABLE TO THE AUTHORITY HAVING JURISDICTION

SWITCH/CIRCUIT NUMBER:

TEST DATE	TESTED BY	RESULT