Installation
Instructions

GEI-86126 H

Ground Break™ System

For Ground Fault Protection

For additional information, see GET-2964

GENERAL ELECTRIC

SENSORS (Figure 1)

GE Type TGS or Type TGM sensors must be used with the Ground-Break system. All sensors are electrically identical. Select each sensor so that conductors will have the required electrical and magnetic spacings to the edge of the sensor window. See Table I for a listing of the available sensors. Type TGM sensors must be used with Type TGMR relays only.

TABLE I — GROUND-BREAK™ SENSORS

Cat. No.	Window Size	Type Core	Wt.
ROUND (Solid Core)			
TGM0002/TGS0002	2½ in. I.D.	Solid	3 lbs
TGM0005/TGS0005	5 in. I.D.	Solid	4 lbs
TGM0008/TGS0008	8 in. I.D.	Solid	7 lbs
RECTANGULAR (Split Core)			
TGS0408	4 x 8 in.	Split	17 lbs
TGS0418	4 x 18 in.	Split	18 lbs
TGS0424	4 x 24 in.	Split	21 lbs
TGS0429	4 x 29 in.	Split	23 lbs
TGS0432	4 x 32 in.	Split	25 lbs
TGS0808	8 x 8 in.	Split	25 lbs
TGS0808A	8 x 8 in.	Split	20 lbs
TGS0808S	8 x 8 in.	Solid	20 lbs
TGS0810	8 x 10 in.	Split	22 lbs
TGS0818	8 x 18 in.	Split	31 lbs
TGS0824	8 x 24 in.	Split	37 lbs
TGS0832	8 x 32 in.	Split	50 lbs
TGS0838	8 x 38 in.	Split	57 lbs
TGS1113	11 x 13 in.	Split	30 lbs

SENSOR OUTLINE DIMENSIONS (Inches)

Round Sensor Dimensions

Cat. No.	A	B	C	D	E	F	G
TGM0002/TGS0002	6.62	2.50	2.56	5.12	5.75	5.62	0.50
TGM0005/TGS0005	9.50	5.00	3.94	7.88	8.50	8.50	0.50
TGM0008/TGS0008	12.75	8.00	5.44	10.88	11.50	11.50	0.62

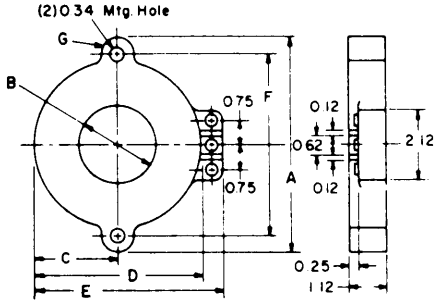


Figure 2

CLEARANCES

Maintain a minimum of 1 inch clearance between conductor bundles and inside surface of sensor window except as noted in Figure 2B and below:

TGM0002/TGS0002 0 inch

TGM0005/TGS0005 ½ inch

SENSOR OUTLINE DIMENSIONS (Inches)

Rectangular Sensor Dimensions *

Cat. No.	No. of Mfg. Holes	A	B	C	Fig. No.
TGS0418	6	23.25	18.00	2.12	2a
TGS0424	6	29.25	24.00	5.12	2a
TGS0432	10	37.25	32.00	0.62	2a
TGS0808	6	See Outline Drawing			2b
TGS0818	6	23.25	18.00	2.12	2c
TGS0824	6	29.25	24.00	5.12	2c
TGS0832	10	37.25	32.00	0.62	2c
TGS0838	10	43.25	38.00	3.62	2c
TGS0808A	6	See Outline Drawing			2b

* Additional sizes available. Consult factory.

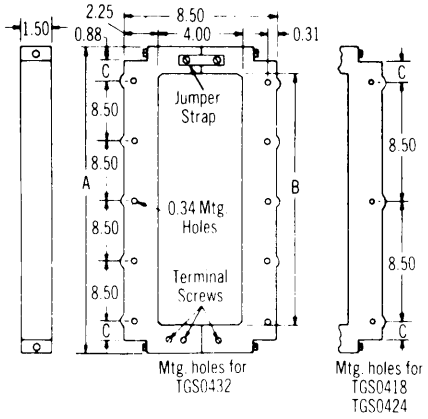


Figure 2A

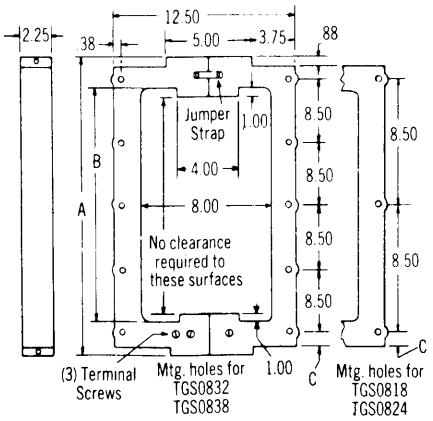
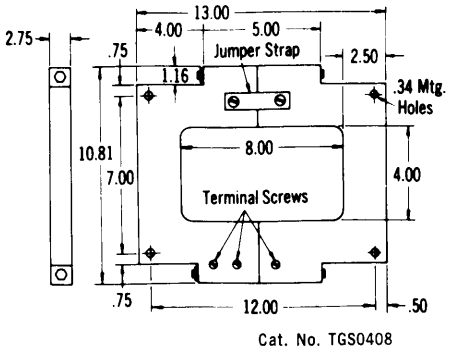
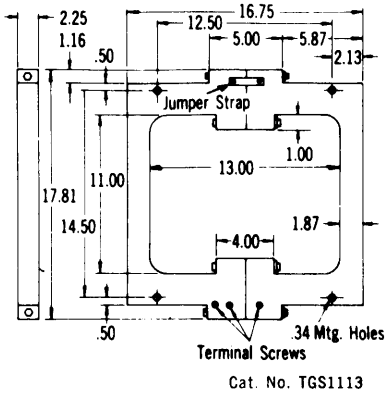


Figure 2B



Cat. No. TGS0408

Figure 2C



Cat. No. TGS1113

Figure 2D

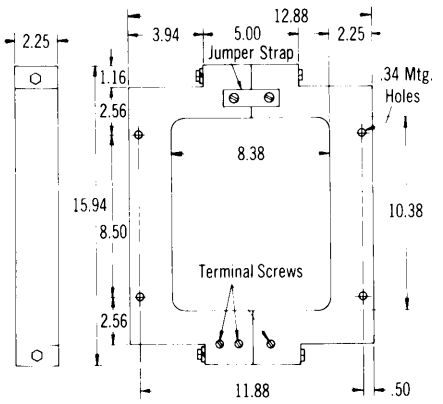


Figure 2E Cat. No. TGS0810

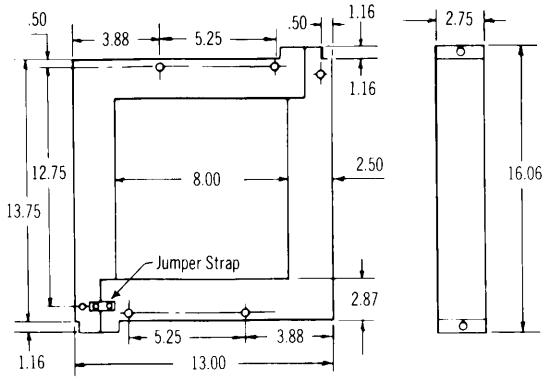


Figure 2F Cat. No. TGS0808

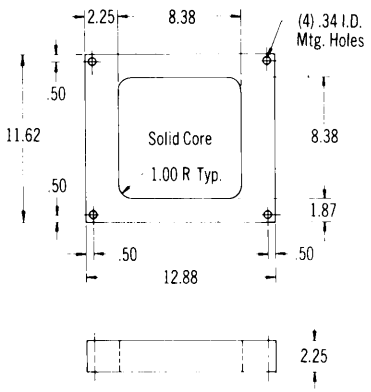


Figure 2G Cat. No. TGS0808S

SENSOR MOUNTING INSTRUCTIONS

1. Bolt the two halves of the split core sensors together, using the hardware provided, and torque bolts to 70 inch lbs.
2. Attach jumper strap with hardware provided to both halves of split core sensor. Torque strap mounting screws to 20 inch lbs.
3. Attach sensor to supporting brackets with a minimum of four bolts for the rectangular sensors and two bolts for the round sensors. Bolt torque should not exceed 45 inch lbs.

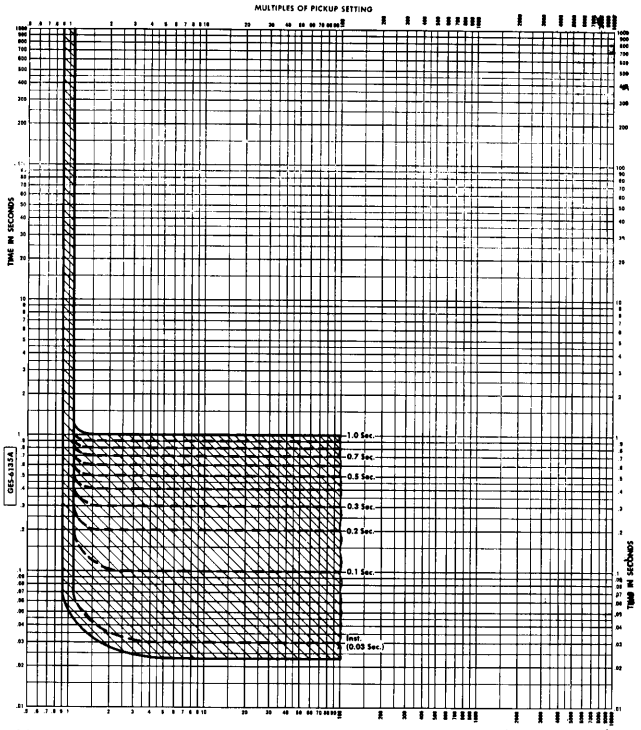
RELAYS (Figures 3, 4, 5 and 6)

General

Used in conjunction with a circuit protective device having a shunt trip, this relay, with its sensor, will detect ground currents and cause the circuit protecting devices to open (or activate a signalling device) when these currents reach preselected values of current and time. Optional Type Z zone selective interlocking provides instantaneous tripping in each protected zone, and time delay back-up protection between zones for a fully coordinated and selective system.

Three sizes of relays are available: Continuously adjustable range of 2-12 amperes, 5-60 amperes and 100-1200 amperes. All relays except Type TGMR5 have a continuously adjustable time delay range of Instantaneous (0.03) to 1.0 seconds. On Type TGMR5 relays time delay range is .03 to 5.0 sec. The time delay characteristic is flat, as shown in Fig. 4. Once settings have been selected, adjusting knobs can be clamped in position by means of the clamping bar on the face of the relay. (Fig. 5).

Time Current Curve GES-6135



10½" x 15" Translucent Paper available for systems coordination studies. Order from GE Distribution Unit, Hoerle Bldg., Plainville, CT 06062.

Figure 4

UL RECOGNIZED RATINGS

System Input Ratings

	Primary Amps *	Min. Withstand Time
2-12 Amp Relay	**100-1200 Amp Relay**	
35,000	200,000	.1 Seconds
12,000	60,000	1.0 Seconds
600	4,000 **	Continuous
	5-60 Amp Relay	
	60,000	1.0 Seconds
	4,000 **	Continuous

* Through fault current, phase-to-phase or phase-to-ground.

** Except as reduced by sensor continuous current ratings below.

Sensor Single Phase Thermal Ratings

Sensor	Continuous Current Rating
TGS0408 and TGS0808	4000 Amperes
TGS0005	2500 Amperes
TGS0002	1600 Amperes
All other sensors	3000 Amperes
TGM0002	600 Amperes
TGM0005	600 Amperes
TGM0008	600 Amperes

Relay Output Ratings

Max. Time	Max. Current	Max. Volts
0.25 Sec.	30 Amps	240VAC / 125VDC
Continuous	5 Amps	

Control Power

The Ground-Break system will function with a choice of control voltages for the relay and for the shunt trip coil. (See Table II.)

Monitor panels are available to match the selection of control voltage. However, a source of 120VAC, at least 200V.A. in size, is needed to test the system by connection to the test tap provided with each sensor.

Selectivity

Selectivity between upstream and downstream Ground-Break relays can be accomplished by either of two methods:

1. Time Delay Selectivity.
2. Zone Selective Interlocking.

1. Time Delay Selectivity

Time Delay Selectivity can be obtained by using Ground-Break relays without interlocking connections between relays. Using the preferred time delay steps shown in Figure 4, set each relay at least one step above the relays immediately downstream.

For any overcurrent protective devices which require more than .04 seconds of clearing time, the time delay steps should be increased by at least as much as the clearing time exceeds the .04 seconds.

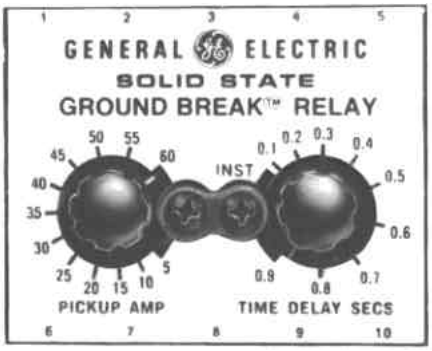


Figure 5

2. Zone Selective Interlocking

Zone Selectivity can be obtained with interlocking connections between Ground-Break relays, Type Z, (Cat. No. Suffix Z). See wiring diagram Figure 11. Time delay settings should be determined in the same way as for Time Delay Selectivity. However, each such relay will operate instantaneously if a ground-fault occurs in its zone of protection.

If interruption is not completed in normal time, for any reason, then an interlocked upstream relay, still sensing the ground-fault, will operate at the expiration of its selected time delay.

CAUTION

All relays in a zone selective system must operate from a single source of control voltage unless otherwise approved by the factory.

RELAYS — Ambient Range —35°C thru 80° TABLE II

Adjustable Trip Range Lo	Adjustable Trip Range Hi	Relay and Shunt Trip Voltage	Cat. No. without Zone Selectivity	Cat. No. with Type Z② Selectivity
2A.	12A.	120/240 VAC	TGMR1	. . . . .
2A.	12A.	125 VDC	TGMR1	. . . . .
2A.	12A.	48 VDC	TGMR1B	. . . . .
2A.	12A.	32 VDC	TGMR1C	. . . . .
2A.	12A.	24 VDC	TGMR1D	. . . . .
5A.	60A.	120/240VAC①	TGSR06	TGSR06Z
5A.	60A.	125VDC	TGSR06	TGSR06Z
5A.	60A.	48VDC	TGSR06B	TGSR06BZ
5A.	60A.	36VDC	TGSR06C	TGSR06CZ
5A.	60A.	24VDC	TGSR06D	TGSR06DZ
100A.	1200A.	120/240VAC①	TGSR12	TGSR12Z
100A.	1200A.	125VDC	TGSR12	TGSR12Z
100A.	1200A.	48VDC	TGSR12B	TGSR12BZ
100A.	1200A.	36VDC	TGSR12C	TGSR12CZ
100A.	1200A.	24VDC	TGSR12D	TGSR12DZ

① Shunt trip can operate at 120 or 240VAC, but relay operates from 120VAC in either case.

② A downstream relay, while sensing a ground fault above its pickup setting, will block an upstream Type Z relay only for the length of time-delay for which the Type Z relay is set.

RELAY OUTLINE DIMENSIONS (Inches)

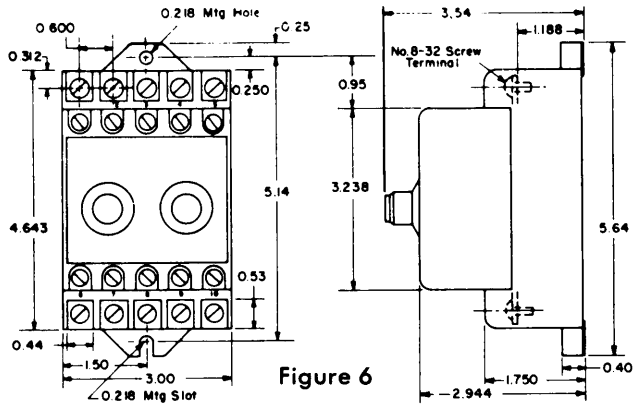


Figure 6

SYSTEM OPERATION

Recommended Relay Settings

Ground-Break relay settings of pick-up current and time-delay for main, feeder and branch circuits should be selected so as to provide optimum ground-fault protection and coordination with the conventional overcurrent devices in the distribution system. Since the ratings of the conventional devices will vary with application, no general statement can be made. However, the following recommendations are basic for satisfactory performance of most systems:

Pick-up Current

Relay pick-up current setting should be preferably 20% of circuit rating. Consideration should be given to higher settings for the purpose of having ground faults interrupted downstream by phase overcurrent devices so as to affect only the faulted circuit. Motor branch circuits may justify settings much lower.

Time Delay

The instantaneous (.03 seconds) setting generally should be used only for motor or branch circuits. Using the other preferred time delay steps shown in Figure 4, set each other relay at least one step above any relays immediately downstream.

For any overcurrent protective devices which require more than .04 seconds of clearing time, the time delay steps should be increased by at least as much as the clearing time exceeds .04 seconds.

MONITOR PANELS

A flush mounted monitor panel is a component part of the Ground-Break system. It provides the functions of monitoring and testing the Ground-Break system.

A pilot light is provided to indicate presence of control power. If the pilot light is "out", control power fuses and circuit should be checked.

There are two pushbuttons provided — red marked "Test" and yellow marked "Reset". The ground-fault lamp (red) lights or a mechanical indicator "pops out" to show that the Ground-Break relay has operated to trip a breaker/interrupter. The reset button must be pushed to reset the relay after the fault has been located before the breaker/interrupter can be reclosed, or the mechanical indicator can be manually reset.

The monitor panel has the ability to test the complete ground-break system with or without tripping the circuit protective device. Instructions for performing tests are printed on the face plate.

During the few seconds of each test operation, the monitor panel energizes the sensor test windings. This energy requirement dictates the use of a 120 VAC. test power source of at least 200 V.A. The test signal simulates a ground-fault of approximately 1600 amperes. (See Table III)

Figure 7

Monitor Panels (Cat. Nos.)	Application Voltages		Ground Fault Indicator
	Relay	Shunt Trip	
TGSMP	120VAC	120 to 240VAC	Lamp
TGSMPA	125VDC	125VDC	Lamp
TGSMPB	48VDC	48VDC	Lamp
TGSMPC	36VDC	36VDC	Lamp
TGSMPD	24VDC	24VDC	Lamp
TGSMA	120VAC	120 to 240VAC	Mechanical Indicator

MONITOR PANEL OUTLINE DIMENSIONS (Inches)

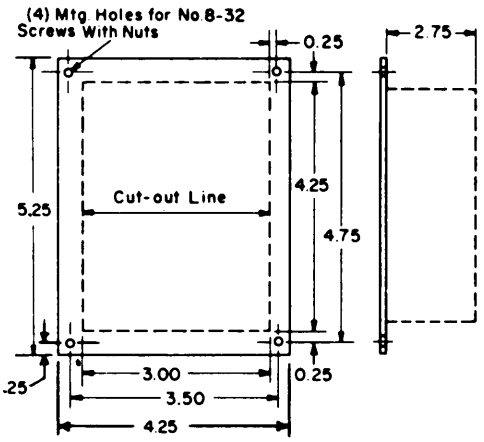


Figure 8

INSTALLATION

Mounting the Components

RELAY — See outline dimensions Figure 6. Should be surface mounted in such a position that the settings are accessible for adjustment by the operator without risk of electrical shock. Avoid mounting locations with excessive vibration or mechanical shock.

MONITOR PANEL — See outline dimensions Figure 8. — Designed to be flush mounted in such a position that the fault indication will be readily visible and pushbuttons can be operated conveniently.

SENSORS See outline dimensions page 1 and 2.

For Ground Strap Application

For the main circuit only, the Ground Strap Application is desirable if the neutral connection to ground of the service entrance is available. The sensor should be mounted to encircle only this neutral connection to ground.

For Zero Sequence Application

Sensors should be so mounted that all phase (and neutral when used) conductors pass through the sensor window. **Equipment ground conductor must not pass through the window.*** The service neutral must be grounded only on the line side of the sensor window. To minimize saturation effects, a 1-inch clearance should be maintained between phase/neutral conductors and the inside of the sensor window (except as noted on sensor outline drawings).

*Unless it also passes through window in opposite direction.

OPERATION OF SYSTEM

If a ground-fault occurs which exceeds the pick-up and time delay settings of the relay, it will energize the shunt trip or other load. The relay will remain ON (closed) to continue energizing any ground-fault signaling devices. The relay should not be reset until the cause of the ground-fault indication has been investigated and cleared. Only after the relay is reset, by operating the reset push-button, or by operating switch S1, Figures 9 and 10, will it be possible to reclose the breaker/interrupter.

TESTING THE SYSTEM

The reliability of the ground-break system is excellent. However, since testing is so convenient, it is recommended that a test be performed monthly, or after the breaker has experienced a fault of any kind.

Complete instructions or testing the ground-fault system are printed on the face of the monitor panel, Figure 7.

For wiring diagrams, see Figures 9, 10, 11, 12 and 13. Reduction of the simulated ground-fault signal below 1600 Amps (see Table III) is completely optional, but can substantially reduce the V.A. requirements of the test power source in some cases.

TABLE III

Wirewound Test Resistors

The simulated Ground-Fault Signal should be at least 20% higher than the pick-up setting of the Ground-Break Relay.

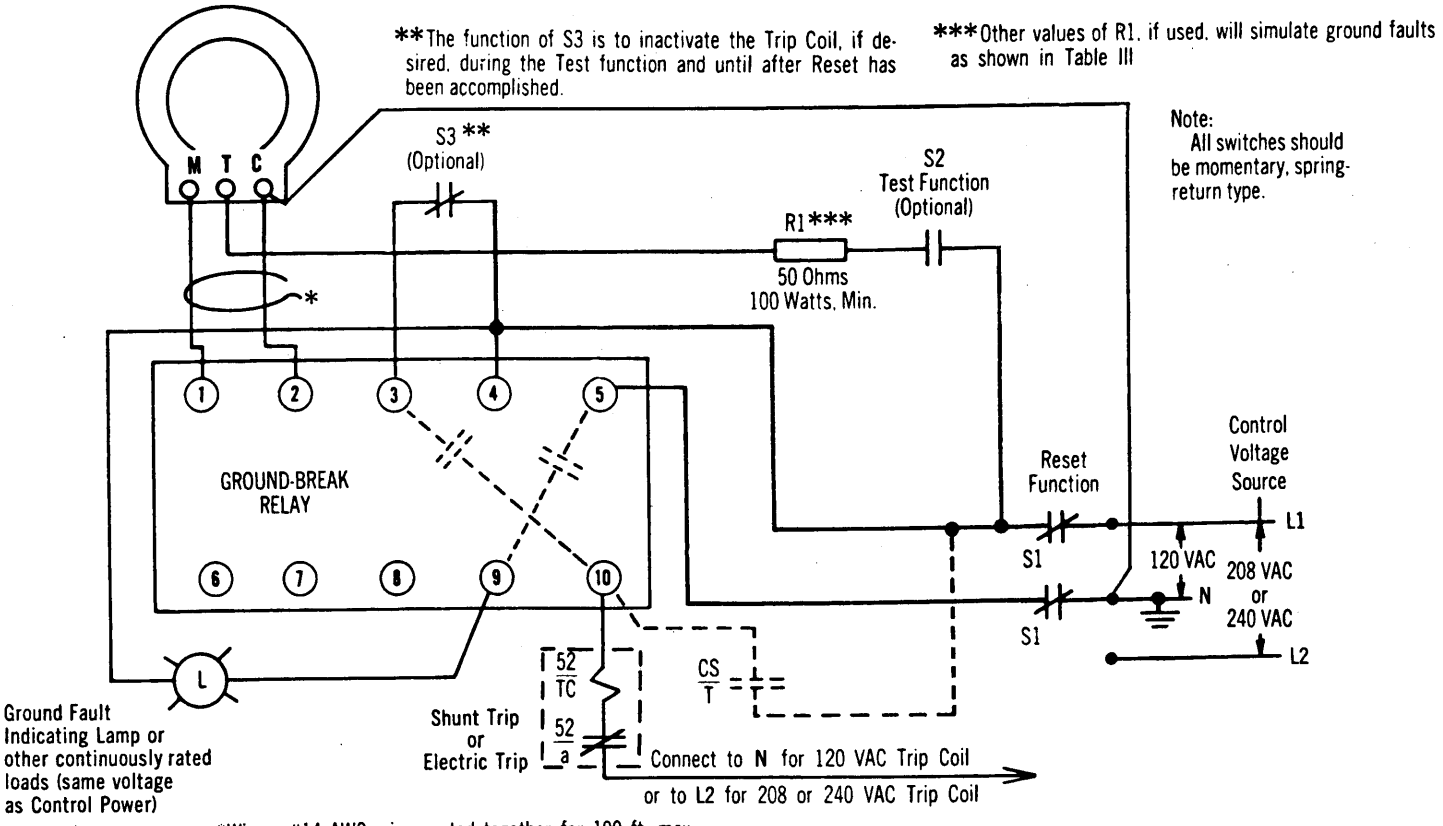
Simulated Ground Fault Current in Amperes		With Monitor Panel		Without Monitor Panel		
Type TGM Sensors	Type TGS Sensors	Add R1 Ohms	Min. Watts	Total R1 Ohms	Min. Watts	Min. V.A. of 120 VAC Test Power Source Volt/Amps
183	1600	None	None	50	100	200
137	1200	20	50	70	100	150
114	1000	30	50	80	100	150
91	800	50	50	100	50	100
69	600	90	25	140	50	75
46	400	150	25	200	25	50
23	200	350	25	400	25	25
11.4	100	750	20	800	20	25
6.9	60	1400	12	1400	12	25
4.6	40	2000	8	2000	8	25
2.3	20	4000	5	4000	5	25

CAUTION

Sensors should have a shorting jumper between terminals C and M whenever the sensor is disconnected from the ground-break relay circuit, to prevent a possible shock hazard to personnel if a ground-fault should occur.

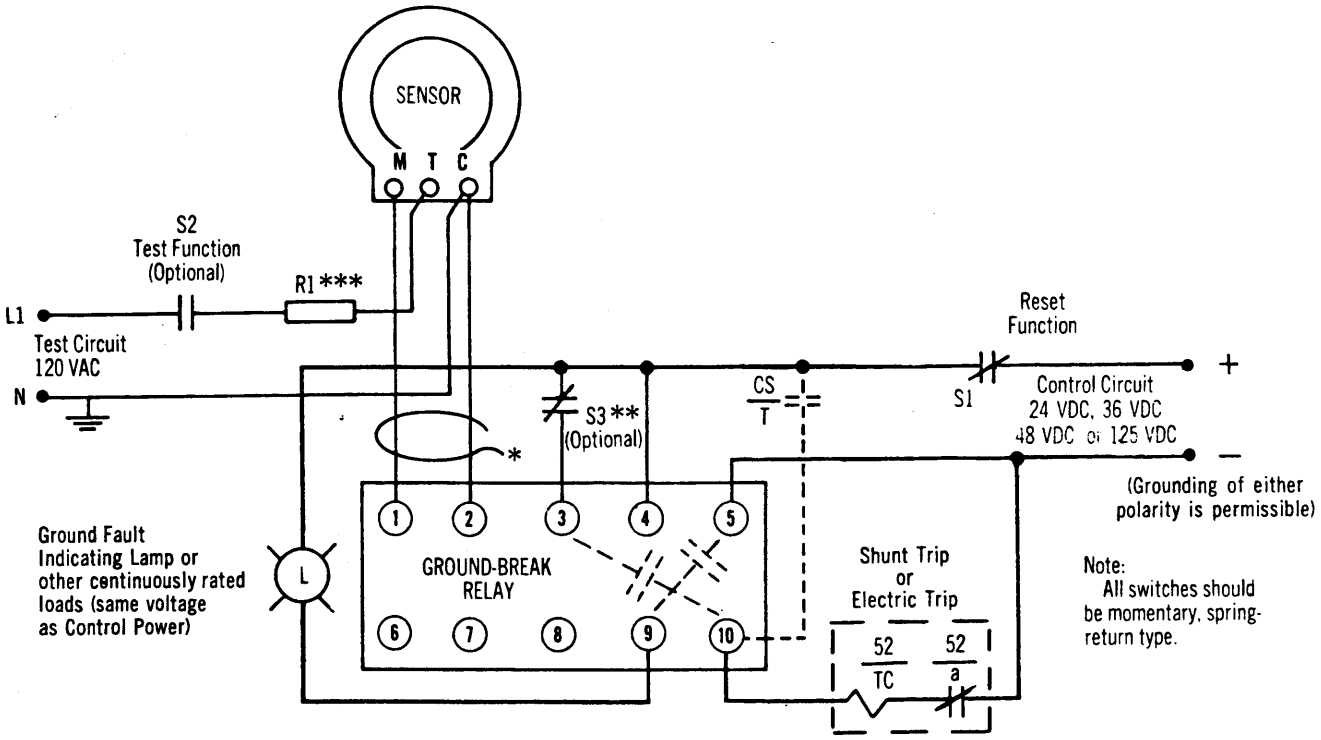
Control Wiring Insulation Tests

High voltage tests are not recommended for Ground-Break control wiring. However, if it is required, temporarily remove ground connections of control power and sensors, bond all Ground-Break relay terminals together, and apply test voltage between the bonded terminals and ground.



Wiring Diagram for Ground-Break without Monitor Panel using AC Control Voltage

Figure 9



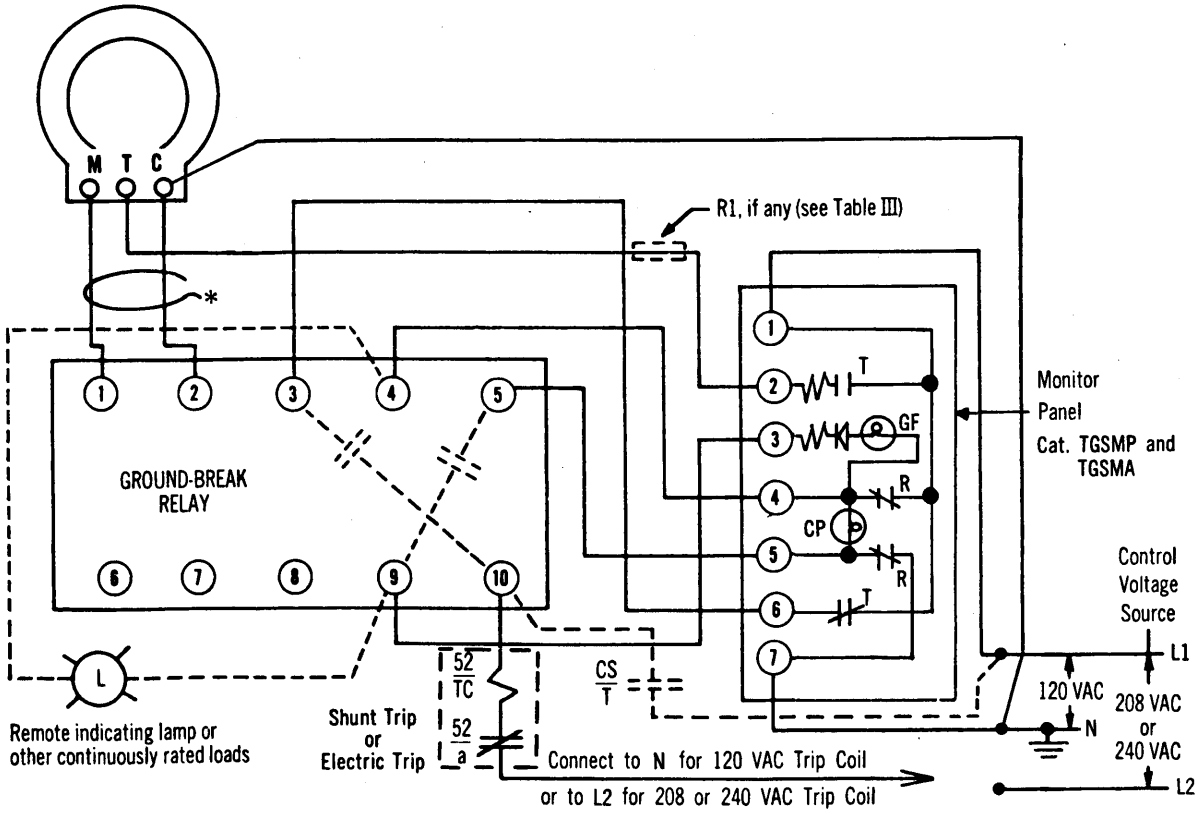
*Wires, #14 AWG min., routed together for 100 ft. max. run. Wires should not be harnessed with power conductors.

**The function of S3 is to inactivate the Trip Coil, if desired, during the Test function and until after Reset has been accomplished.

***Other values of R1, if used, will simulate ground faults as shown in Table III.

Wiring Diagram for Ground-Break without Monitor Panel using DC Control Voltage

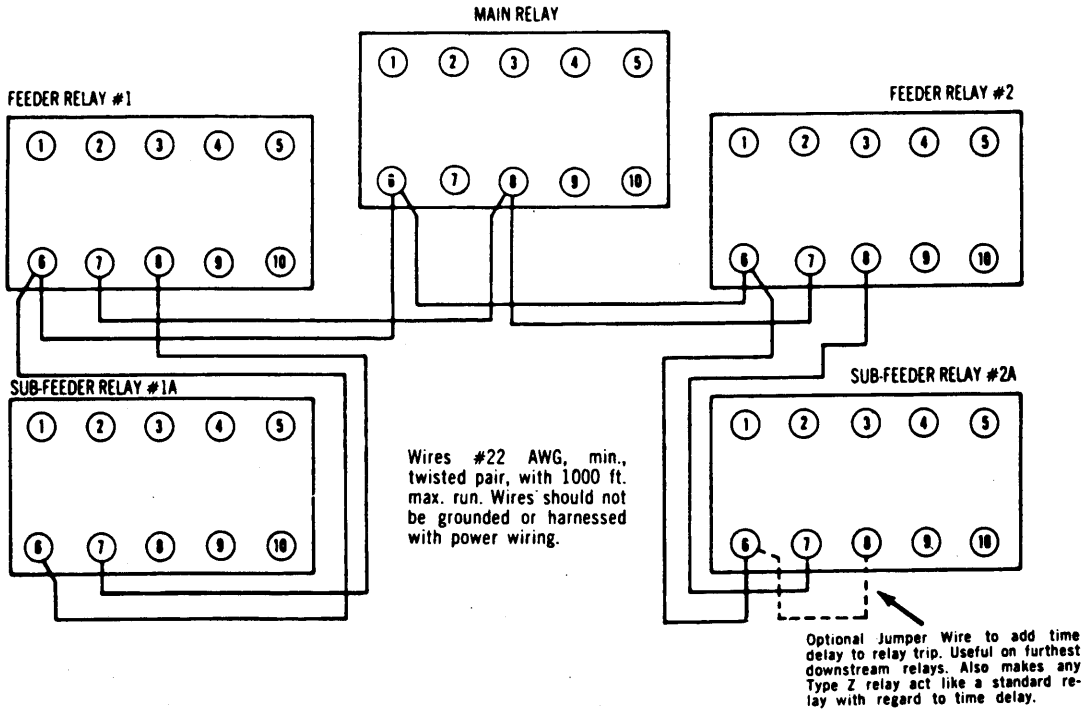
Figure 10



*Wires, #14 AWG min., routed together for 100 ft. max. run. Wires should not be harnessed with power conductors.

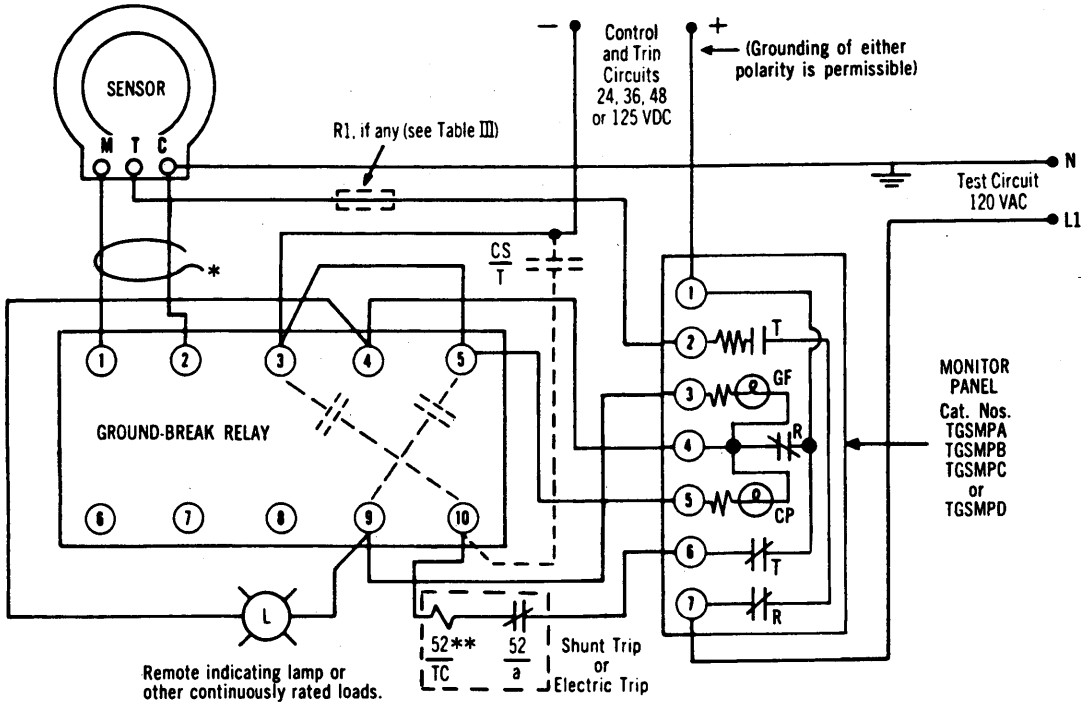
Wiring diagram for Ground-Break Relay and Monitor Panel using AC control voltage

Figure 11



Typical Zone Selective Interlocking Connections for a system having a main protective device and two feeders, with each feeder having a sub-feeder.

Figure 12



*Wires, #14 AWG min., routed together for 100 ft. max. run. Wires should not be harnessed with power conductors.

**Same voltage rating as DC control circuit

Wiring diagram for Ground-Break Relay and Monitor Panel using DC control voltage

Figure 13

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company. These instructions are intended for use by qualified personnel only.

For further information call or write your local General Electric Sales Office or . . .

Distribution Equipment Division
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Plainville, CT 06062

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