IB 7.1.1.7-11
Issue C

INSTRUCTIONS

Ground Fault Protection Systems

Type GKC	Ground Relay without Sensor Test Feature
Type GKT	Ground Relay with Sensor Test Feature
	For Use With Type GS Ground Sensors

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INTRODUCTION

These instructions contain the information required to properly install, operate, and test ABB Ground-Shield ground fault relays, types GKC and GKT, drawout case.

The relays have both adjustable pickup current and time delay settings and are designed for use as a system with a type GS Ground Sensor, to provide time-current coordinated ground fault protection. The GKC includes provisions for testing the relay and operation of the disconnect device. The GKT additionally provides a sensor test. The GKT may be used only with those type GS sensors that include a test winding (terminal "T").

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 ABB.

PRECAUTIONS

The following precautions should be taken when applying these relays:

1. Incorrect wiring may result in damage to the relay. Be sure wiring agrees with the connection diagram for the particular relay before the relay is energized.

2. Do not apply high voltage tests to solid-state relays. If a control wiring insulation test is required, bond all terminals together and disconnect ground wire before applying test voltage.

3. Follow test instructions to verify that unit is in proper working order. If a relay is found to be defective, we suggest that it be returned to the factory for repair. Immediate replacement can be made available from the factory; identify by catalog number. We suggest that a complete spare unit be ordered as a replacement, and the inoperative unit be repaired and retained as a spare. CAUTION: Since troubleshooting entails working with energized equipment, caution should be taken to avoid personal shock. Only competent technicians familiar with good safety practices should service these devices.

4. Do not hold the TEST SWITCH in the test position for more than 2 seconds.

PLACING THE RELAY INTO SERVICE

1. RECEIVING, HANDLING, STORAGE

Upon receipt of the relay (when not included as part of a switchboard), examine for shipping damage. If damage or loss is evident, file a claim at once and promptly notify the nearest ABB Sales Office. Use normal care in handling to avoid mechanical damage. The relay has no vital moving parts and if kept reasonably clean and dry, has no practical limit to its operating life.

2. INSTALLATION

Mounting

The outline dimensions and mounting information are given in Figure 1. The relay should be mounted in a location where the settings are accessible and can be adjusted without danger to the operator.

Terminal and basic circuit identification will be found in Figure 2 for type GKC relays and Figure 3 for type GKT relays.

The sensor should be mounted so as to enclose all phase conductors and the neutral conductor if supplied (but not the ground conductor). For application other than dual source, the connection between neutral and ground must be made ahead of the sensor. In some service applications the sensor can be installed around the main bonding jumper (neutral to ground bus connection). If a separate grounding electrode conductor is connected to the neutral in this case, it too should be routed through the sensor window. On four wire systems with dual sources, special consideration must be given to the location of the sensors. Check the factory on the use of the no-trip input to the relay for these applications.

Cable conductors should be bundled tightly and centered in the sensor window. Rectangular sensors should be applied with 1 inch or more clearance from the sensor to the nearest current carrying bus. The sensor should not be mounted in a manner that would put stress on the mounting bushings.

For information on installation of split sensors, refer to page 13.

When mounting a ground sensor over shielded cable or metal sheathed cable, certain precautions must be taken so that proper relay operation is assured: On shielded cable, the shielding tape must be connected to ground at a point on the cable side (opposite switchgear bus side) of the current sensor. If the ground wire is connected to the shield on the switchgear bus side of the sensor window, the ground wire must be brought back through the sensor window before being connected to the ground bus.

When a ground sensor is applied over sheathed cable which is terminated at a pothead, the pothead mounting must be insulated from ground (600 volt insulation level) and the ground wire from the pothead body brought back through the sensor window before being connected to the ground bus.

Connections

Typical external connection diagrams of Type GKC relays are shown in Figures 4 and 5 for AC and DC control voltages respectively. Figures 6 and 7 give similar connections for Type GKT relays that include the sensor testing feature and require an AC source of test power.

Special care must be taken to connect control power of proper voltage, frequency, and polarity. The trip and control power source should have sufficient capacity to accommodate trip coil inrush current and to avoid excessive voltage collapse during operation. See Application Data section for control and test power requirements, and additional notes on connections.

The relays will accept a "No-Trip" contact input at terminals 7 and 16. This control input is used to prevent relay operation in certain double-ended substation applications. Operation is blocked when contact is closed.

Wires from the sensor to the relay should be at least #14 gauge wire and no more than 100 feet in length. Larger wire should be used for greater distances. All sensor leads should be routed together. All control circuit equipment and wiring should be so located or protected as to minimize the possibility of control circuit damage from a power circuit arcing fault or other accident. Conductors carrying low energy signals should be twisted pairs and isolated from power circuits to reduce noise pickup.

Although copper wire is preferred for protective circuits, the relay and sensor terminals are suitable to accommodate copper or aluminum conductors.

The relays have metal front panels which are connected through printed circuit board runs and connector wiring to a terminal at the rear of the relay case. The terminal is marked "G" and is located as shown in Figure 3. In all applications this terminal should be wired to ground.

Initial Check

After wiring is completed and checked, apply control power, note if the power light is lit, and reset the operation indicator. If the indicator cannot be reset, recheck connections, voltage and polarity. Do not attempt any other tests until wiring errors are corrected.

3. SETTINGS

Primary Trip Amperes

This switch selected current pickup setting is calibrated in primary side ground fault current amperes.

Time Curve - Seconds

This switch selected setting determines the time required, once the ground current is above pickup, for the relay to close its output circuit to trip the breaker. The range of adjustment is Instantaneous (2 cycles) to 1.0 seconds (60 cycles). The time-current characteristic is definite time - see page 8.

Operation Plug

A movable plug is provided on the relay printed circuit board to select SELF RESET or LATCH (Seal-In) operation. The latch operation requires manual reset by the RESET PB or temporary removal of the relay control power.

4. CONTROLS AND INDICATORS

The following controls and indicators are provided:

CONTROL POWER LIGHT - Indicates presence of control or trip power.

NO-TRIP SWITCH - Holding the spring-return toggle in the up position temporarily disconnects the trip coil.

TEST SWITCH - Tests relay with or without tripping of circuit breakers.

GROUND FAULT TARGET - Orange target indicates relay operation under ground fault or test conditions. Indication is retained even if control power is lost after operation.

RESET PUSHBUTTON - Resets target to black (and resets the output relays if seal-in or latching operation was selected).

APPLICATION DATA

ABB Ground Fault Relay Systems provide fast sensitive protection against ground faults on grounded electrical distribution systems. The system consists of a special design current transformer, which is called a ground sensor, and a solid state relay. The ground sensor which encircles all phase conductors and the neutral conductor, if present, provides an output to the ground relay when a ground fault occurs in the circuit. In some applications, the ground sensor can be put around the neutral connection to ground to operate the main protective device. Most common use of a ground fault relay is to operate shunt trip devices on circuit breakers or to open coil circuits of contactors. However, the relay outputs can also be used for alarm, indication and interlocking purposes.

The Type GKC and GKT Relays are drawout construction for ease of maintenance. Standard features include: 1) A CONTROL POWER LAMP to indicate the presence of control power to the relay system. 2) A ground fault OPERATION INDICATOR which maintains indication even on loss of control power. 3) A TEST SWITCH for performing an operational test on the relay system. 4) A NO-TRIP switch to prevent the disconnect from tripping when the operational test is performed, if continuity of service must be maintained. 5) A RESET pushbutton to reset the target from orange to black.

TYPE GKC RELAY

This relay includes a built-in test feature that allows testing of the relay and disconnect device operation. Any of the type GS Ground Sensors may be used in this system. If the sensor includes the "T" terminal it must be jumpered to the S1 terminal.

TYPE GKT RELAY

The type GKT relay is provided with test circuits and current limiting resistors to inject a test current into the sensor test winding (3 - 5 amperes maximum). Thus the test power transformer should be sized accordingly to supply the test current at 120VAC for 1 - 2 seconds. A minimum rating of 250VA is recommended. Note that the control power and test power circuits are isolated, hence could be connected to different sources. However, the relay terminal 10 should be connected to the ungrounded end of the 120VAC test source and terminal 1 (or terminal S2 of the sensor) should be wired to the grounded end of the source.

Type GKT relays are designed for use with type GS sensors that have provisions for testing (terminal T). The test circuit requires that the T-S1 jumper supplied on the sensor be removed.

CONTROL SOURCE CONNECTIONS

The primary of a control transformer, if provided and supplied from the power circuit, must be connected line to line.

When control power is taken from the power circuit ahead of the main disconnecting means or from a separate source, the control circuit conductors should have overcurrent protection. Control circuit overcurrent protective devices should have an interrupting rating adequate for the short-circuit current available. Conductors ahead of the control circuit overcurrent protection should be kept as short as possible.

DISCONNECT DEVICE

Type GKC and GKT relays are normally used to open disconnecting means, such as shunt-trip circuit breakers or bolted pressure contact switches. The input requirements for the shunt trip must be compatible with the output ratings of the ground fault sensing relay. A Class 1 ground fault protection device (UL1053) is one which does not incorporate means to prevent opening of the disconnect means at high levels of fault current and is intended for use with (1) circuit breakers, (2) fused circuit breakers, (3) fused switches having an interrupting rating not less than 12 times their ampere rating, or (4) fused switches having integral means to prevent disconnecting at levels of fault current exceeding the contact interrupting rating of the switch.

RATINGS

Major ratings appear on the front panel or labels on the unit.

Input Signal: current from a secondary winding of a type GS sensor.

Input Withstand: (sensor primary current) 200 kA RMS for 0.033 sec., 65 kA RMS for 0.5 sec., 3,000A RMS continuous (20-240A and 100-1200A units), 300A RMS continuous (2-24A and 5-60A units).

Primary Trip Amperes: The following ranges are offered:

2- 24 Amperes	(Switch selected: 2,4,8,12,16,20,24A)
5- 60 Amperes	(Switch selected: 5,10,20,30,40,50,60A)
20- 240 Amperes	(Switch selected: 20,40,80,120,160,200,240A)
100-1200 Amperes	(Switch selected: 100,200,400,600,800,1000,1200A)

Time Delay: Definite time as shown on Page 8. Switch selected: INST (0.033), 0.1, 0.2, 0.3, 0.4, 0.6, 1.0 seconds.

Control Voltage: The relays require an external control power source to operate shunt trip coils, auxiliary relays, or other utilization devices. See relay nameplates for nominal control voltage. Maximum voltage is nominal plus 10%.

Minimum Operating Control Voltage:
55% of nominal for AC relays
80% of nominal for DC relays

Control Source Drain: Approximately 5-7mA stand-by, 30-40mA operate.

Sensor Test Source (Type GKT Only): 120VAC (+10, -20%)

Sensor Test Drain: The test current provided must be related to the pickup current range of the relay used in the application. Resistors in the relay are sized to provide sufficient current to operate the relay for all pickup settings. The range of current drain to be expected for each model is given here. The control transformer must provide this current. The actual value of current drawn will depend on the particular sensor being used in the system and the line voltage. Test current drain exists only during operation of the Sensor Test (should be 1-2 seconds in duration).

Relay Range	Sensor Test Drain
100-1200A	3 - 5A
20- 240A	0.7 - 1A
5- 60A	0.2 - 0.4A
2- 24A	0.1 - 0.2A

Output Contacts: One Form C (SPDT) and one Form A (NO), isolated from other circuits, rated at 125VDC:

40A for 0.033 sec. (trip duty)
30A for 0.25 sec.
8A continuous
1A break (resistive)
0.3A break (inductive)

TOLERANCES

Pickup Current Settings:

RELAY PICK-UP RANGE	USED WITH ROUND SENSORS	USED WITH RECTANGULAR SENSORS
2-24A	±10% of 1A whichever is greater	+20% or 2A whichever is greater -10% or 1A whichever is greater
20-240A	±10%	±10%
100-1200A	±10%	±10%

Time Delay: ±10 percent or ±0.016 seconds whichever is greater.

GROUND SENSORS

The relays are intended for protection of solidly or resistance grounded power systems and are used in conjunction with type GS magnetic sensors which encircle the ground-return or the power conductors (3-4 conductors of 3-phase loads; 2 conductors of single phase loads). Sensors detect zero-sequence or ground fault currents. The current sensor consists of a wound core of small cross section with a uniformly distributed secondary winding. Solid core units have the entire assembly cast in epoxy. Split core units are separable for easy installation over existing cables or bus.

Application to circuits is independent of power circuit current ratings. Select from the tables of typical sensors below by the physical opening necessary to accommodate the power circuit conductors. Any of the listed sensors are suitable for use with the type GKC relay. Series 302L-,302G-302T- sensors include the test winding and are therefore suitable for use with the GKT relay.

The sensors are 600V class insulation. The sensors can be used in high voltage power systems providing proper clearances between HV conductors and the surface of the sensor are maintained, or if insulated HV cables are utilized.

Although copper wire is preferred for protective circuits, the sensor terminals are intended to accommodate copper or aluminum conductors.

TYPE GS GROUND SENSORS

SOLID CORE		SPLIT CORE	
SIZE & SHAPE	CATALOG NUMBERS	SIZE & SHAPE	CATALOG NUMBERS
2" Round	302B0200UL	8" Round	302D0800UL
3" Round	302B0300UL		
5" Round	302B0500UL 302G0500UL	7" x 7" Rectangular	302T0707UL
8" Round	302B0800UL 302G0800UL	7" x 17" Rectangular	302T0717UL
		7" x 24" Rectangular	302T0724UL
7" x 21" Rectangular	302L0721UL	7" x 27" Rectangular	302T0727UL
7" x 25" Rectangular	302L0725UL	7" x 30" Rectangular	302T0730UL
7" x 27" Rectangular	302L0727UL	7" x 37" Rectangular	302T0737UL
7" x 31" Rectangular	302L0731UL	10" x 10" Rectangular	302T1010UL
7" x 37" Rectangular	302L0737UL	10" x 17" Rectangular	302T1017UL
		10" x 24" Rectangular	302T1024UL
10" x 13" Rectangular	302B1013UL	10" x 30" Rectangular	302T1030UL
10" x 17" Rectangular	302B1017UL		
10" x 24" Rectangular	302B1025UL		

SUMMARY OF COMMON UNITS

Relay Type	Pickup Range	Sensor Test Drain	Relay Catalog Number
GKC	2 - 24A	--	202R26x8
	5 - 60A	--	202R21x8
	20 - 240A	--	202R27x8
	100 -1200A	--	202R23x8
GKT	2 - 24A	0.1 - 0.2A	202L26x8
	5 - 60A	0.2 - 0.4A	202L21x8
	20 - 240A	0.7 - 1A	202L27x8
	100 -1200A	3 - 5A	202L23x8

IMPORTANT: The "x" in the above catalog numbers MUST be replaced with the proper digit indicating the main control voltage value to completely specify the unit. These are:

"1" for 120 Vac/ 125 Vdc "3" for 48 Vdc

"0" for 24/ 32 Vdc "7" for 175 Vdc

For the Type GKT, the sensor test voltage source is always 120VAC. Test current drain shown exists only during operation of the Sensor Test (should be 1 - 2 seconds in duration).

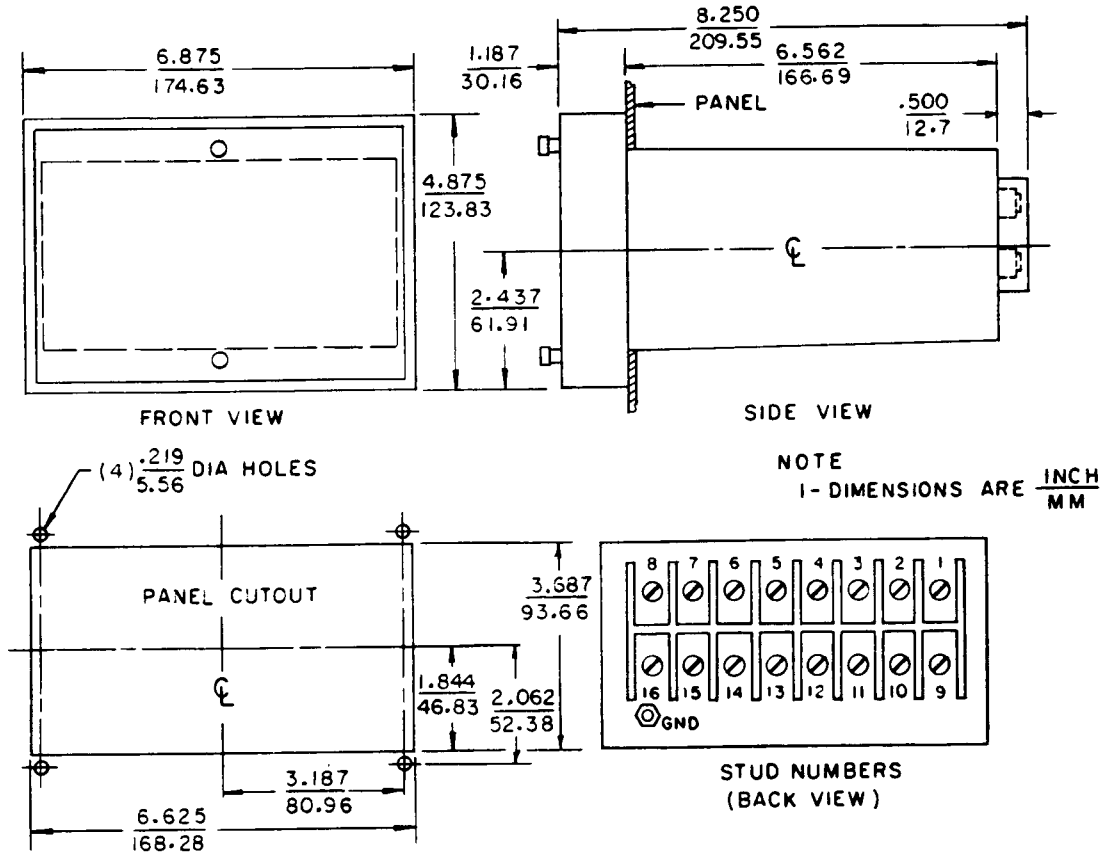


Figure 1: Relay Outline and Panel Drilling

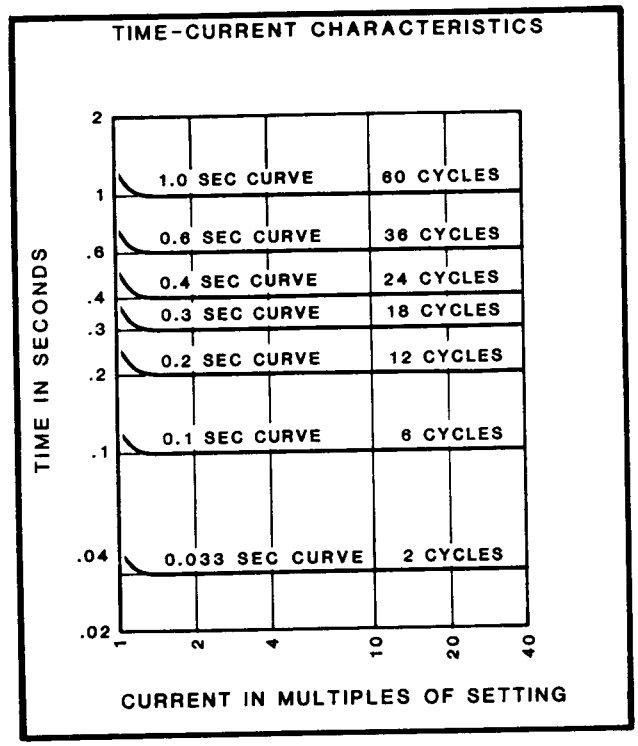


FIGURE 2. TYPE GKC RELAY. INTERNAL CONNECTION DIAGRAM

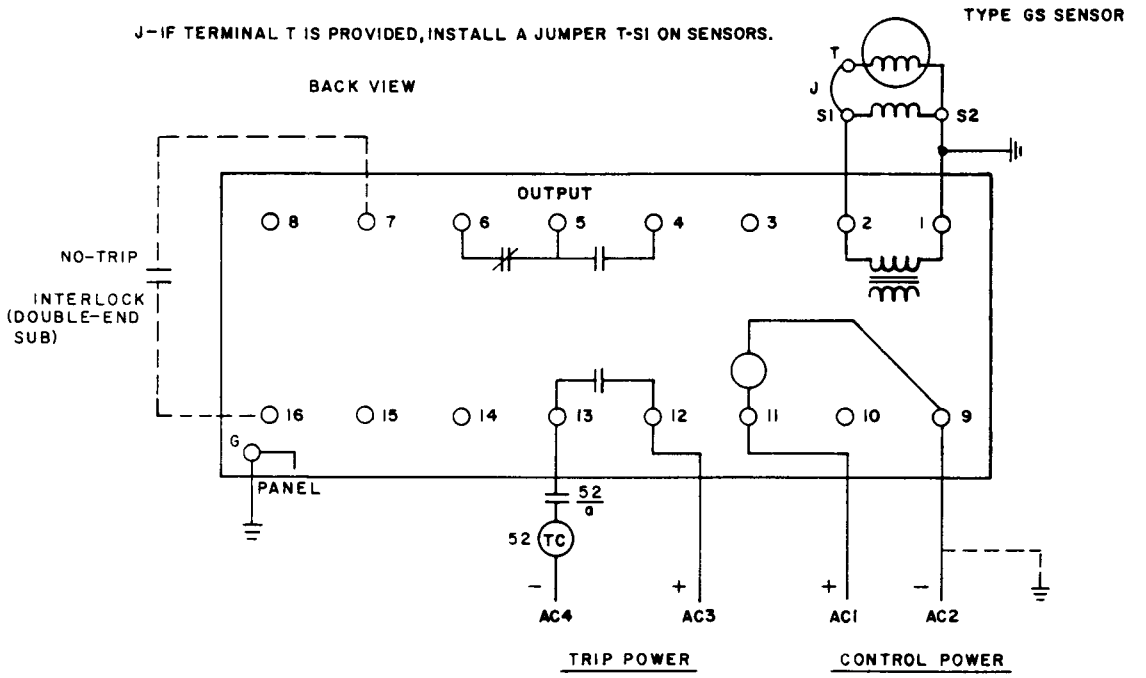
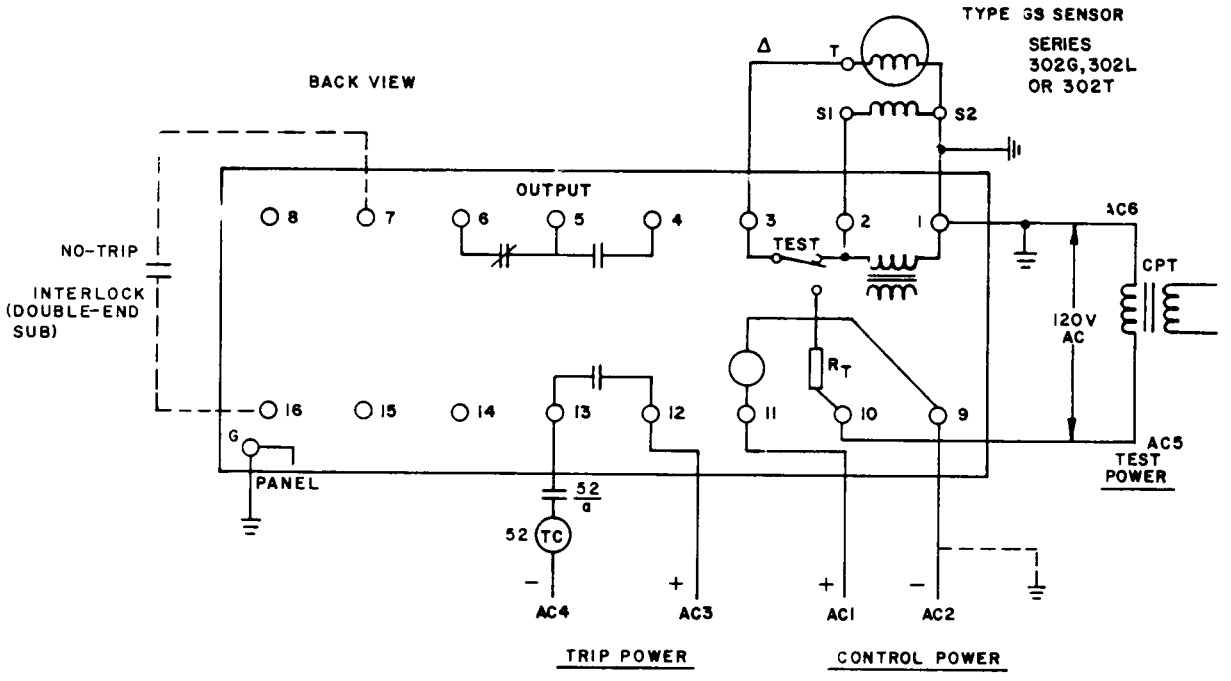
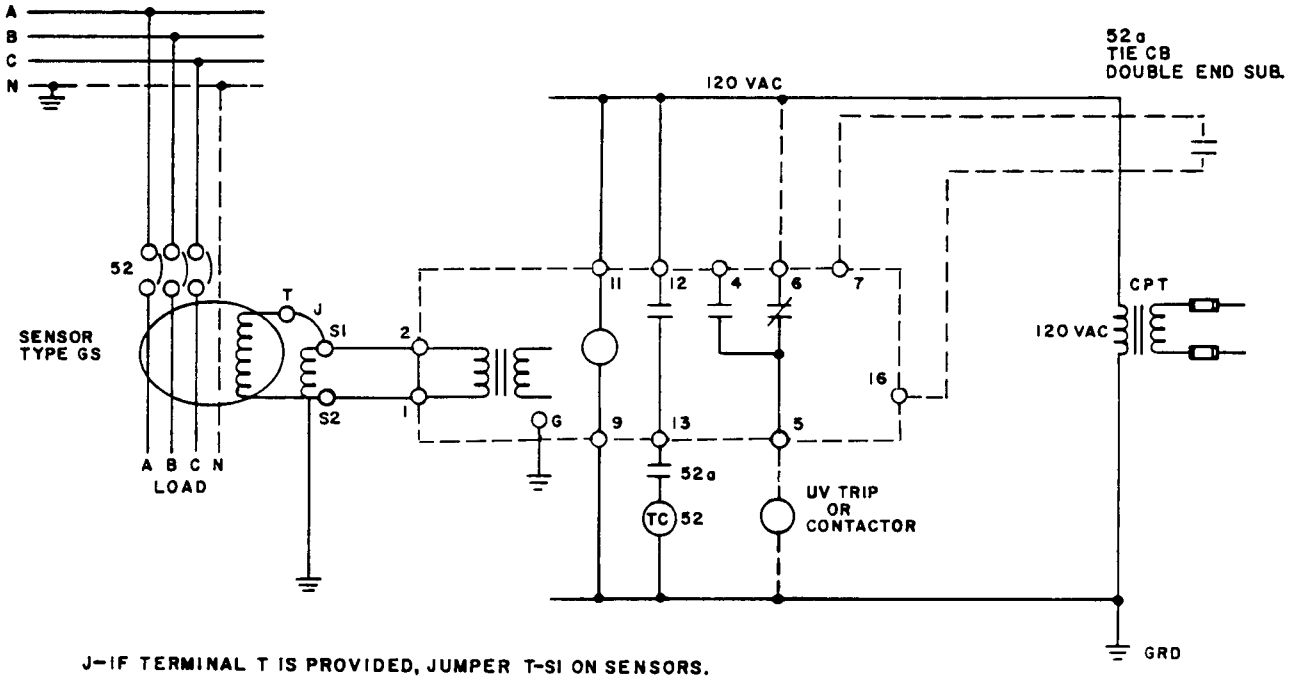


FIGURE 3. TYPE GKT RELAY. INTERNAL CONNECTION DIAGRAM



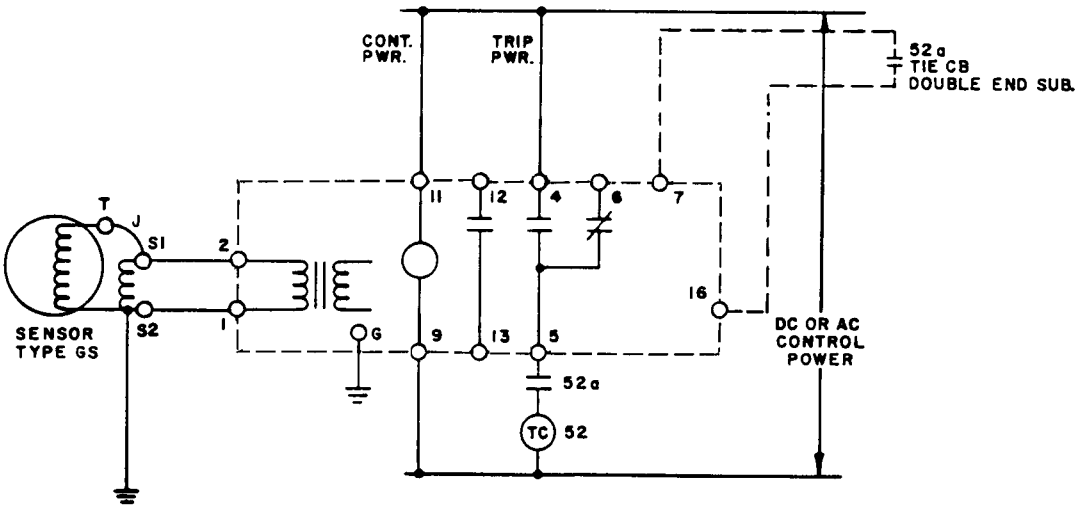
Δ REMOVE T-S1 LINK FROM SENSORS

FIGURE 4. TYPICAL EXTERNAL CONNECTIONS.
TYPE GKC RELAY. 120V AC CONTROL PWR.



J-IF TERMINAL T IS PROVIDED, JUMPER T-SI ON SENSORS.

FIGURE 5. TYPICAL EXTERNAL CONNECTIONS.
TYPE GKC RELAY. DC CONTROL PWR.



J-IF TERMINAL T IS PROVIDED, JUMPER T-SI ON SENSORS.

FIGURE 6. TYPICAL EXTERNAL CONNECTIONS.
TYPE GKT RELAY. 120VAC TEST AND
CONTROL POWER.

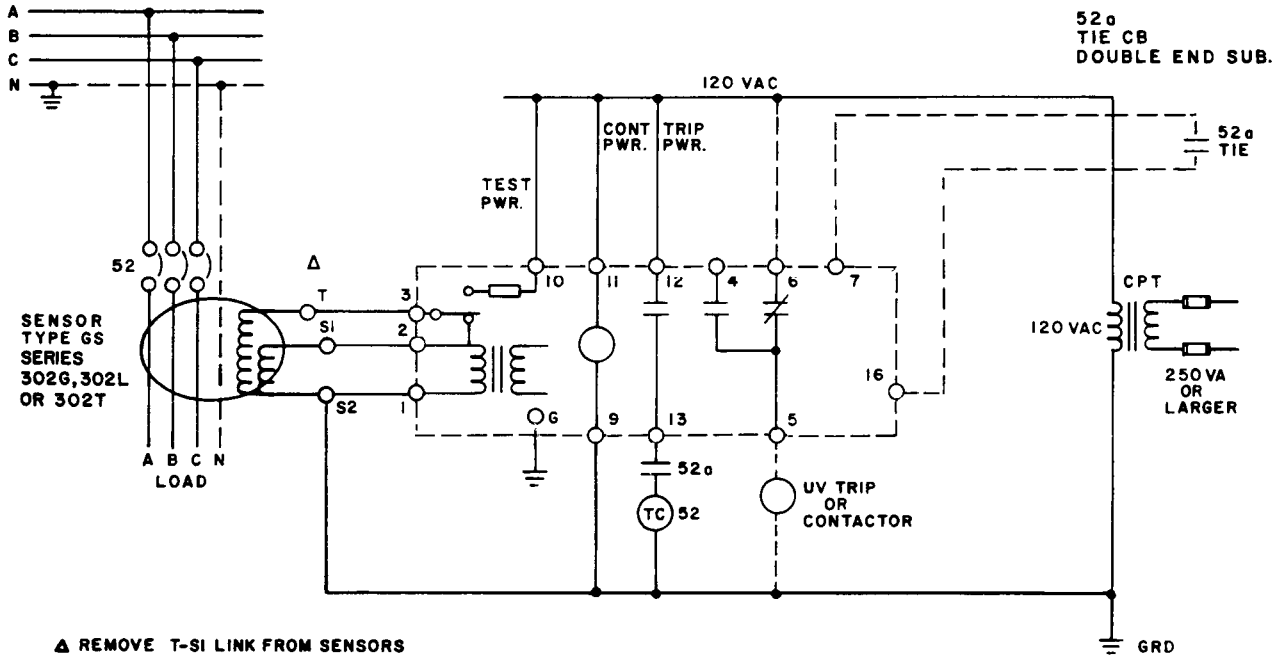
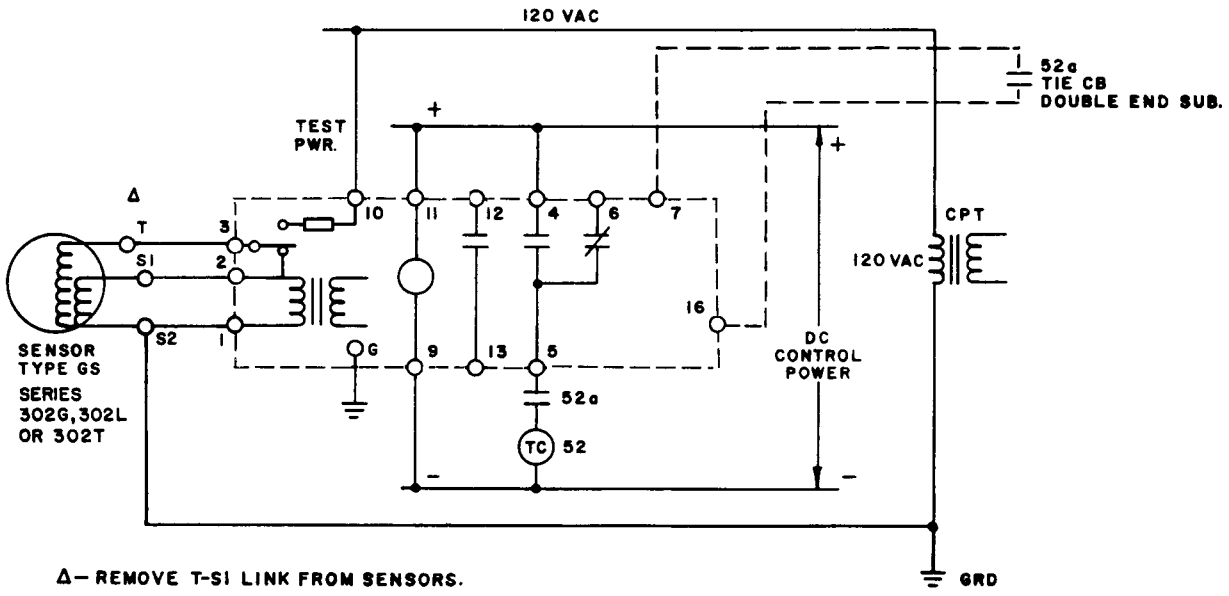


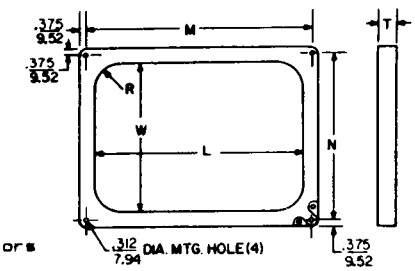
FIGURE 7. TYPICAL EXTERNAL CONNECTIONS.
TYPE GKT RELAY. 120VAC TEST PWR.
DC CONTROL PWR.



SENSOR DIMENSIONS

Catalog Number	Units	L	W	R	M	N	T	Approx Weight
302B1013UL	in.	13	10	1.75	14.75	11.75	1.5	10.5 lb
	mm.	330	254	44.5	374.7	298.5	38.1	4.8 kg
302B1017UL	in.	17	10	1.75	18.75	11.75	1.5	14 lb
	mm.	432	254	44.5	476.3	298.5	38.1	6.4 kg
302B1024UL	in.	24	10	1.75	25.75	11.75	1.63	20.5 lb
	mm.	610	254	44.5	654.1	298.5	41.3	9.3 kg

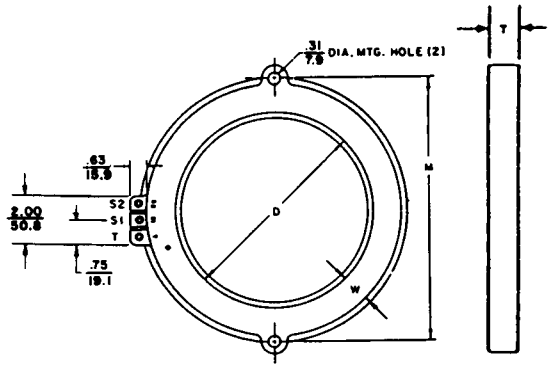
NOTE: apply with 1 inch (25 mm) minimum clearance from sensor to conductors



DIMENSIONS ARE $\frac{INCH}{MM}$

Catalog Number	Units	D	M	W	T	Approx Weight
302B0200UL	in.	2.125	5.063	1.125	1.875	3 lb
	mm.	54.0	128.6	28.58	47.63	1.4 kg
302B0300UL	in.	3.125	6.00	1.125	1.875	3.5 lb
	mm.	79.5	152.4	28.58	47.63	1.6 kg
302G0500UL	in.	5.00	7.50	1.00	1.25	3.5 lb
	mm.	127	190.5	25.4	31.75	1.6 kg
302G0800UL	in.	8.00	10.75	1.125	1.25	6 lb
	mm.	203	273.1	28.58	31.75	2.7 kg

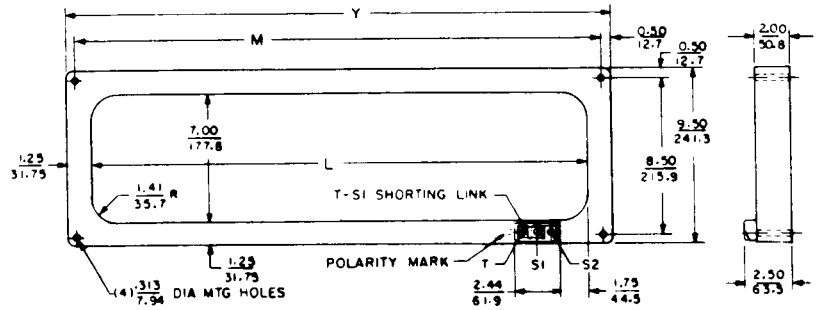
NOTE: Apply with minimum 1 inch (25mm) clearance from sensor to conductors.



Notes:

1. 302B0200UL and 302B0300UL have 2 terminals, S1 and S2.
2. 302G0500UL and 302G0800UL have 3 terminals, S1, S2, and T. When applying with the Type GKC relay, connect jumper from T to S1; connect relay to S1-S2.
3. When using the 5 inch or 8 inch sensors, apply with 1 inch (25mm) clearance from sensor to conductors. Tie cables together and center in window for best performance.
4. 302G0500UL replaces earlier models 302A0500UL and 302B0500UL.
5. 302G0800UL replaces earlier models 302A0800UL and 302B0800UL.

CAUTION: Sensors are 600V class devices. Follow air and surface clearance requirements of electrical equipment designs.



DIMENSIONS ARE $\frac{INCH}{MM}$

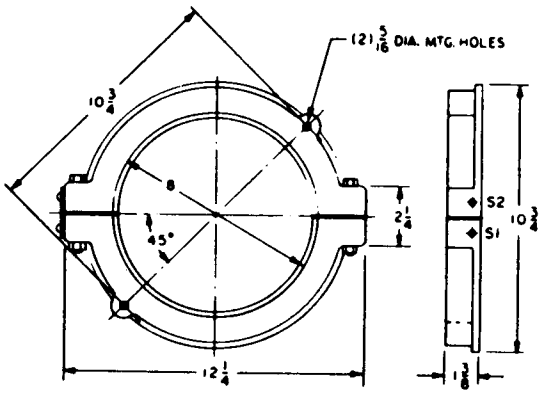
Catalog Number	Units	L	W	M	Y	Approx Weight
302L0721UL	in.	21	7	22.5	23.5	16 lb
	mm.	533	17.8	571.5	596.9	7.3 kg
302L0725UL	in.	25	7	26.5	27.5	18 lb
	mm.	635	17.8	673.1	698.5	8.2 kg
302L0727UL	in.	27	7	28.5	29.5	20 lb
	mm.	686	17.8	723.9	749.3	8.9 kg
302L0731UL	in.	31	7	32.5	33.5	22 lb
	mm.	787	17.8	825.5	850.9	10 kg
302L0737UL	in.	37	7	38.5	39.5	25 lb
	mm.	940	17.8	977.9	1003	11 kg

NOTE: 1. Apply with minimum 1 inch (25 mm) clearance from sensor to conductors.

2. Shorting link required between terminals T and S1.

3. Ground Fault Relay connects to terminals S1 and S2.

INSTALLATION OF SPLIT SENSORS



8" Round Type GS Split Sensor **Cat. No. 302D0800UL**

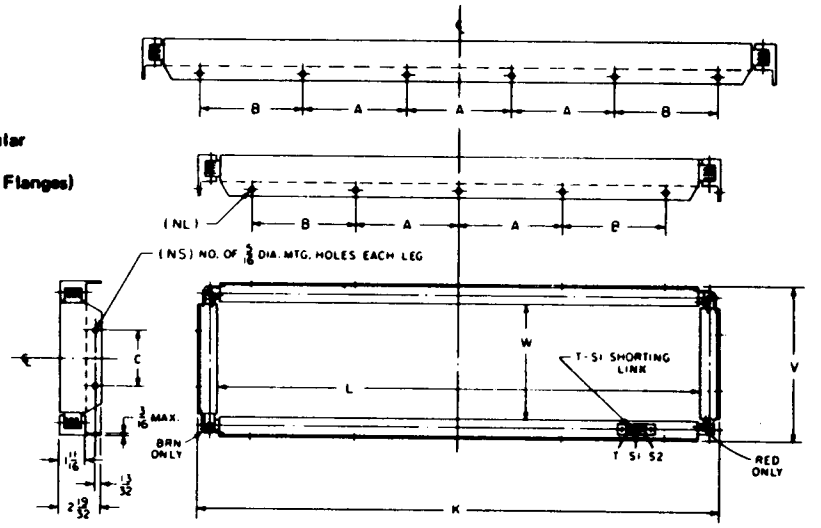
1. Handle the disassembled halves with care to prevent dust or metallic particles from settling on the iron gaps. Gap surfaces should be perfectly CLEAN prior to reassembly.

2. When mounting, make sure there is no mechanical stress imposed on either gap by LOOSELY bolting the sensor to the supports using locking type nuts which lock on the bolt threads.

3. Apply with minimum 1" clearance from sensor to conductors.

All dimensions on this page are in inches.

Type GS Rectangular Sensors (Outside Flanges)



Catalog Number	Size	W	L	V	K	NL	A	B	NS	C
302T0717UL	7 x 17	7-1/8	17-1/8	9-5/8	19-5/8	(3)	6.5	6.5	(2)	4.5
302T0724UL	7 x 24	7-1/8	24-1/8	9-5/8	26-5/8	(4)	6.5	6.5	(2)	4.5
302T0727UL	7 x 27	7-1/8	27-1/8	9-5/8	29-5/8	(4)	6.5	6.5	(2)	4.5
302T0730UL	7 x 30	7-1/8	30-1/8	9-5/8	32-5/8	(5)	6.5	6.5	(2)	4.5
302T0737UL	7 x 37	7-1/8	37-1/8	9-5/8	39-5/8	(6)	6.5	6.5	(2)	4.5
302T1010UL	10 x 10	10-1/8	10-1/8	12-5/8	12-5/8	(2)	6.5	6.5	(2)	6.5
302T1017UL	10 x 17	10-1/8	17-1/8	12-5/8	19-5/8	(3)	6.5	6.5	(2)	6.5
302T1024UL	10 x 24	10-1/8	24-1/8	12-5/8	26-5/8	(4)	6.5	6.5	(2)	6.5
302T1030UL	10 x 30	10-1/8	30-1/8	12-5/8	32-5/8	(5)	6.5	6.5	(2)	6.5

NOTE:

1. Caution: Sensors are 600V class devices. Follow air and surface clearance requirements of electrical equipment designs.
2. Apply with minimum 1 inch clearance from sensor to conductors.
3. Ground Fault relay connects to terminals S1 and S2.
4. Shorting link required T and S1 (except for Type GKT).
5. Any sensor leg is removable. The sensor is shipped with the mounting flanges toward the outside. The sensor can be reassembled with flanges inside.
6. When assembling use care to avoid damage to laminations.
7. Recommended tightening torque for corner bolts is 40 in-lbs. Do not overtighten. We recommend that stack ends be covered or sprayed with rust inhibiting coating such as silicone grease.
8. Reconnect all corner lead connectors. Observe color code.

OPERATION

The CONTROL POWER light should normally be lit, indicating the availability of control power. If it is off, control power fuses or wiring should be checked. If the control power transformer is on the load side of the circuit protective device, the light will no be on until the disconnect is closed. Should the light be burned out it is easily replaced.

Upon a ground fault or a test operation, the GROUND-FAULT indicator will change state to orange, and the output relay will pick up (and seal-in if such operation was selected). The FAULT target is a memory type and will retain its indication even if the control power transformer is on the load side of the disconnect, thus resulting in loss of control power upon operation. The RESET pushbutton resets the target (and the output contacts if seal-in operation was selected).

Reclosing on a fault may increase wiring damage, therefore, it is recommended that a ground fault condition be located and corrected before the disconnect is reclosed.

The types GKC and GKT Relays allow testing with or without tripping the circuit disconnect device. For the type GKT, actuation of the TEST switch disconnects one of several sensor windings from a parallel arrangement and connects it to a 120VAC source through resistors which set the test current level. The test sequence, which is also printed on the front panel of the relay, is:

FOR "TRIP TEST"

1. Operate TEST switch UP for 1-2 seconds maximum, RELEASE.
2. Press target RESET button.

FOR "NO-TRIP TEST"

1. Operate NO-TRIP switch UP and HOLD.
2. Operate TEST switch UP for 1-2 seconds maximum, RELEASE.
3. Press RESET button.
4. Release NO-TRIP switch.

CAUTION: Do not hold the TEST switch on for more the 2 seconds. If the relay or monitor operation is improper, recheck wiring, voltages, and interconnected devices before resuming tests.

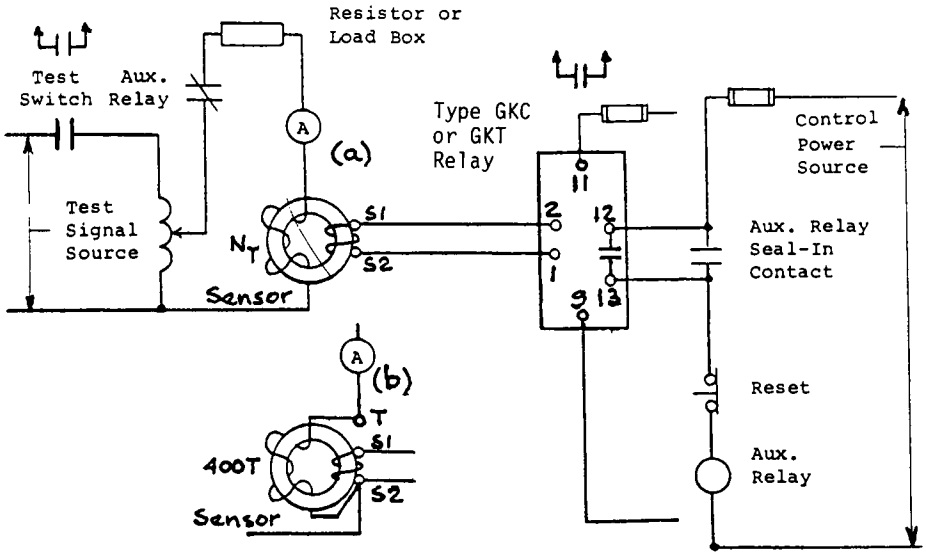
NOTE: Control power must be present to reset the target.

DOUBLE ENDED APPLICATIONS

To verify the operation of the relay's "No-Trip" interlock used on the main breakers in double-ended applications, the following procedure may be used: close the interlocking device or the tie circuit breaker, or temporarily short circuit relay terminals 7 and 16. Perform the TRIP TEST. The relay should NOT trip.

If terminals 7 and 16 were shorted to run the test, BE SURE to remove the short at the end of the tests.

Figure 8: Calibration Test Circuit



TESTING

MAINTENANCE AND RENEWAL PARTS

No routine maintenance is required on these relay systems. Periodic testing is recommended to verify that the relay is in proper working order. We recommend that an inoperative relay be returned to the factory for repair; however, a schematic diagram may be obtained through your local sales engineer should you wish to attempt repairs.

Replacement target head assemblies for the relay may be ordered should the target become damaged. Also available for the drawout style relay are circuit card extenders. These relays use 18 point extenders, catalog 200X0018 or 200X9018. A multiturn test cable, which simplifies primary current testing is available. Catalog number 202W1219 provides 19 turns per loop.

CAUTION: Since testing and troubleshooting entails working with energized equipment, caution should be taken to avoid personal shock. Only competent technicians familiar with good safety practices should service these devices.

HIGH POTENTIAL TESTS

Do not apply high potential tests to solid state relay circuits. If a control wiring insulation test is required, withdraw the circuit board so that the connections in the rear of the case are broken before applying test voltage.

ACCEPTANCE TESTS

Relay Mounted in Switchgear

See Field Test Instructions, IB 7.1.1.7-9 for test of completed installations required by the National Electrical Code. (or short form version 7.1.1.7-9.2)

A. OPERATIONAL TESTS (Built-in Test Feature)

Refer to "OPERATION" section, Page 14. Tests can be performed with the circuit breaker in the open position, providing control and test power is available.

B. PRIMARY-CURRENT TESTING

Tests should be made on a de-energized main circuit. Be sure to take all necessary safety precautions.

1. Set the relay at minimum pickup.

2. Use a multi-turn test cable or loop a test coil of sufficient number of turns and current carrying capacity through the sensor window.

3. Apply control power to the circuit breaker trip circuit and relay.

4. Apply a test signal (signal level = amperes X turns) equal to 1.25 to 2.5 times the pickup setting. The relay should trip the breaker immediately. Since the relay should operate in less than 1 second, the test current should not be applied for more than a few seconds. As an example, assume a 19 turn test cable, a relay setting of 100 amperes: the test current equivalent to a test signal of 125 amperes is 125 amp/19 turns = 6.6 amperes.

5. If the breaker did not trip, interrupt the test current, then check the continuity of the trip circuit, including the trip coil. This can be done by momentarily shorting terminals 12 and 13 on the unit to see if the breaker will trip.

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BENCH TESTING

We suggest that fuses be used in the power leads to protect devices at least until test connections and conditions are verified.

A. OPERATIONAL TESTS

Type GKC Relay:

Connect control power per Figures 4 or 5, as applicable. Operate controls as described in the "OPERATION" section, Page 14, or on the front plate of the relay.

Type GKT Relay:

Use a spare sensor and connect control and test power per Figures 6 or 7, as applicable. Operate controls as described in "OPERATION" section, Page 14.

B. CALIBRATION TESTS

1. Use a spare sensor and make connections as shown in Figure 8(a). Loop a sensor test cable or winding of sufficient number of turns and current carrying capacity through the sensor window as shown and energize from any convenient AC source or commercial test set. If a fixed resistor and variable transformer are used, select fixed resistor value to use not less than 40 volts from the variable transformer or test set during tests.

2. For current pickup tests, increase test current slowly and gradually until the relay operates.

3. For operational or timing tests, apply test current by means of a switch for not more than 2 seconds. Test ampere turns (winding turns X test current) should be at least 1.25-2 times the relay pickup setting (e.g. 100A setting, 20 turns, test current ((100A x 1.5)/20T = 7.5 amperes). Contacts of the test switch and relay output can be used to start and stop a timer. If a contact of an auxiliary relay is used, its operating time should be subtracted from readings.

Alternatively and if provided, appropriate test current may be applied to the built-in sensor test winding as shown in Figure 8(b) (remove T-S1 link). As an example: 1200A setting, 1.5 multiplier, 400 turns, test current (1200A x 1.5)/400T = 4.5 amperes.

Note that accuracy of field testing and suitability of test setups may have limitations due to current waveform distortions, low readout accuracy, touchy current adjustments, magnetizing current effects, etc. Avoid excessive overloads of relay inputs and outputs.