Instructions for Retrofit Kit AK-2A-50

Retrofit Kit Styles 8186A52G24 8186A52G25

I.L. 33-851-2A

NOTICES FOR COMMERCIAL GRADE COMPONENTS

The descriptions and specifications for the products described herein are provided for general commercial use and are not applicable for use in a nuclear power plant. Additional certification may be available upon specific request to qualify these products for use in safety-related applications in a nuclear facility.

GENERAL INFORMATION

The retrofit kit which you have received contains all the necessary parts to convert your AK breaker from a device using an electro-mechanical tripping system to one which will have solid state tripping. To understand the transition, one should be acquainted with the basic components and their functions.

The circuit breaker is tripped on fault conditions by combined operation of three components:

(a) Sensors – Quantity of Three
(b) RK – Solid-state Trip Unit – Quantity of One
(c) Actuator – Quantity of One

Schematically this can be shown in Figs. 1 and 2. This makes a very flexible system covering a wide range of tripping characteristics, due to the adjustable RK unit and the range of sensors available. All necessary tripping energy is derived from the load current flowing through the sensors, no separate power source is required. The tripping characteristics for a specific breaker rating, as established by the sensor rating, are determined by the continuously variable settings of the RK static trip unit. This unit supplies a pulse of tripping current to the actuator which trips the breaker.

SENSORS

The sensors produce an output proportional to the load current, so the breaker continuous current rating within the frame size can be changed simply by changing the tap setting or the sensors. Proper polarities must be maintained.

It is the sensor rating (or tap) that determines the actual current for one (1) per unit current on the RK.

All sensors are mounted on the upper studs on the back of the breaker base.

ACTUATOR

When the actuator receives a tripping current from the RK, it releases a mechanical force to trip the breaker. The actuator is made up of a permanent magnet and a spring (see Fig. 2). When the breaker is open, the cross bar pushes the reset lever. The reset lever moves the plunger out, and the plunger then compresses the spring and pulls the keeper until it contacts the pole pieces of the magnet. Although the magnet cannot pull and reset the keeper against the force of the spring acting on the plunger, it can hold the spring force when the keeper is in contact with the magnet. A tripping current from the RK unit counteracts the effects of the permanent magnet allowing the spring to separate the keeper from the magnet and move the plunger to actuate the trip lever.

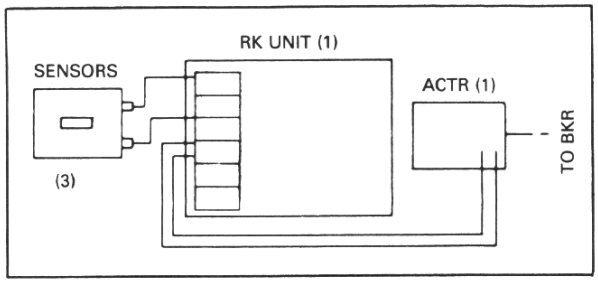

Fig. 1. *Schematic of Solid State Tripping*

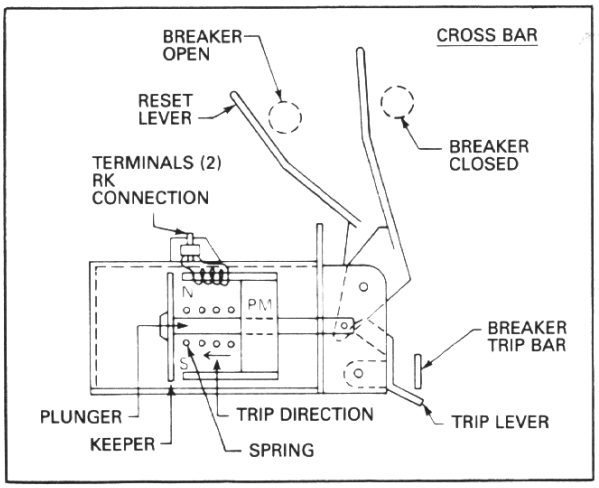

Fig. 2. *Actuator Diagram*

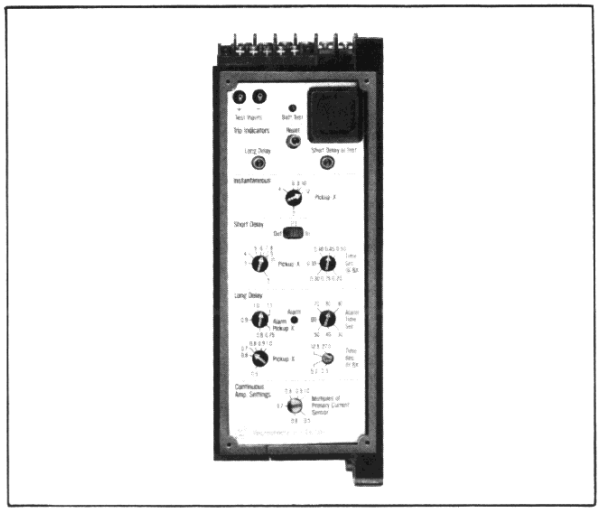

Fig. 3. *RK Unit*

WARNING

High voltages are present in a circuit breaker and associated accessories. Before working on a circuit breaker or accessories installed in an electrical system, make sure the circuit breaker is OPEN and there is no voltage present where work is to be performed. The voltages in energized equipment can cause serious injury or death.

Before closing a circuit breaker, make sure that no work is being carried out by personnel on equipment serviced by the circuit breaker. The voltages from energized circuit breakers can cause serious injury or death.

RK UNIT

The Westinghouse RK unit is a solid state device that provides adjustable overcurrent tripping for the retrofitting of AK breakers.

Only one unit is required per breaker; it receives all its energy from a set of sensors – one mounted on each pole of the breaker. It develops an output for its associated trip actuator when preselected conditions of current magnitude and duration are exceeded.

The RK is supplied in two (2) models of a combination of three (3) independent continuously adjustable overcurrent tripping functions: Long delay (L), Short delay (S), and Instantaneous. The combination of RK unit are:

LS Long Delay and Short Delay
LSI Long Delay, Short Delay and Instantaneous

Adjustments:

There are a maximum of eight (8) adjustable controls on the RK with LSI and seven (7) on the LS, all adjustable with a screwdriver after removal of the protective cover.

(1) Continuous Current Setting (Cont. Adj.) 0.5x to 1.0x External Sensor Rating.
(2) Long Delay Current Pickup (Cont. Adj.) 0.5x to 1.0x Cont. Current Rating.
(3) Long Delay Time (Discreet Adj.) 2.5, 5.0 12.5 and 27.0 Sec. @ 6x
(4) High Current Alarm Pickup (Relay Contact) (Closure of Form C Contacts Min. of 40% Sensor Rated Current Required)
(5) High Current Alarm Time 30-90 Sec. Delay
(6) Short Delay Current Pickup (Cont. Adj.) 2x to 10x
(7) Short Delay Time (Cont. Adj.) 0.18 Sec. to 0.5 Sec. @ 6x
(8) Instantaneous Current Pickup (Cont. Adj.) 2x to 12x

In addition to the standard LSI and LS settings the RK unit has several other added features.

(A) High Load Alarm Contact, which closes after a selected delay time of 30-90 sec. when the High Current Alarm pickup current reaches a predetermined value and resets when the current recedes below the setpoint. Adjustable from 0.75 to 1.1 of the long delay pickup, it provides an early warning on a possible trip out.

(B) I_2t Switch provides options in I_2t slope in fixed short time delay or short-time delay of 0.085 sec. @ 6x.

(C) LED Indicators – for overload and short circuit fault trip indication, lithium battery powered.

(D) Reset Button – for LED indicator and battery check.

MAKING CURRENT RELEASE (DISCRIMINATOR)

All RK trip units which do not have an instantaneous trip function, (LS version) are provided with a "making current release" which is referred to as a "Discriminator". This is a circuit in the trip unit which determines at the time of a fault whether or not there has been any current flow in the primary circuit previous to the fault. If there has been no measurable current flow previous to the fault, indicating that the circuit breaker is just being closed (or possibly that a switching device ahead of the breaker has just been closed) and if the primary current flow exceeds approximately twelve times the sensor rating, the trip unit will function instantaneously. If the "Discriminator" circuit determines that there has been a measurable current flow prior to the fault, the instantaneous operation will not occur and the normal short time delay element will take over to delay tripping. The purpose of this unique tripping concept is that selectivity and continuity of service in un-faulted sections of the system can be maintained if there is any need, but if there is no previously operating load on the circuit, the instantaneous function takes over to limit extensive damage which might occur due to a delayed tripping operation.

SERVICING OF THE RK

The RK unit is the intelligence of the overcurrent protection provided by the breaker. It is made up of many solid state components: the only moving parts are for setpoint adjustments. All internal components, including the printed circuit board are coated to give effective environmental protection.

Each RK unit includes two (2) test pin terminals for field checking of operation and calibration. A specially designed portable test device with a plug to match the receptacle on the front of the unit is available and recommended for verifying the functional operation of the RK unit. The tester can be plugged into any 120V, 60 HZ outlet and can provide enough current to check any pickup and time calibration.

If there is any reason to suspect that the RK unit is not operating correctly, it should not be tampered with: tampering can result in loss of vital overcurrent protection. If the unit is questionable it should be substituted with a new unit and returned to the factory for service. **NOTE: RK UNITS ARE NOT FIELD REPAIRABLE.**

REQUIREMENTS

Before proceeding with the conversion the following should be noted.

1. Items on hand:

   Ratchet (⅜") socket set with ¼", ⅜", ½" sockets, straight edge, scriber, center punch, file, screwdriver, hammer.
   Electric drill, ¼", ⅜", ½" twist drill and 1 tap for .190-32 screws.
   28 Vdc source.
   Test apparatus, RK unit Tester S#1232C08G01.

2. Check items received against bill of material as listed for each type of breaker and for proper style numbered kit.

3. Operate the actuator a few times. Alternately pull back on the reset lever (see Fig. 2) and then trip by applying 28 Vdc (be sure to use correct polarity) to the terminals.

NOTE: Arm must be manually reset after each operation.

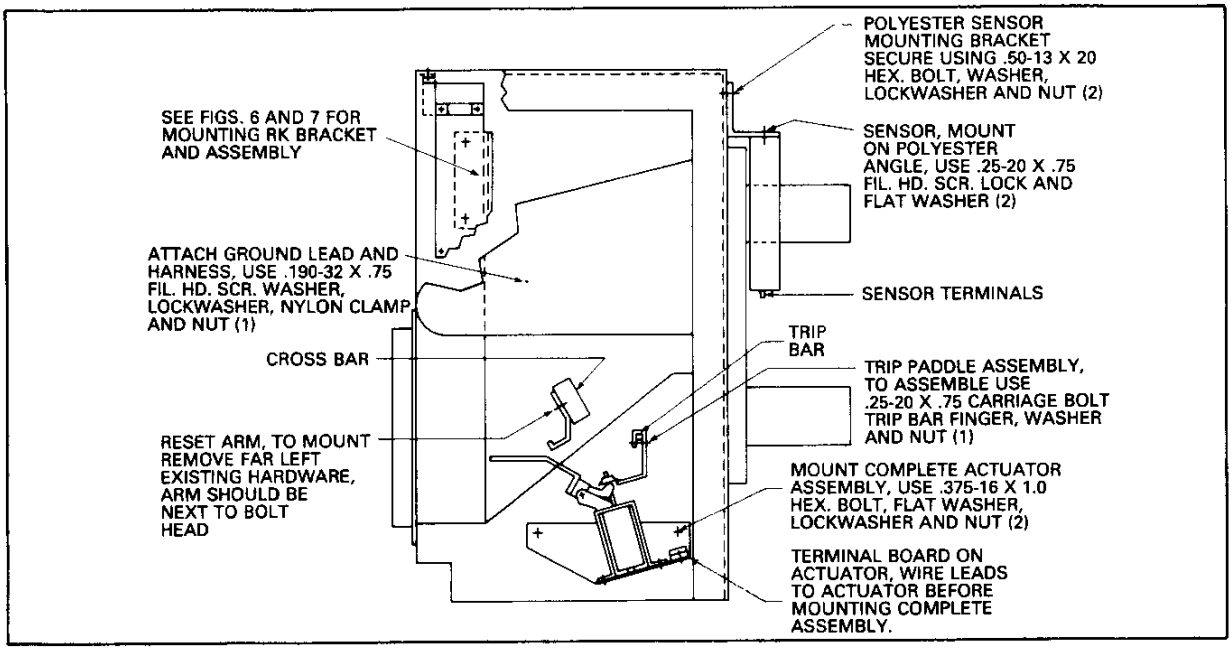

Fig. 9 *Left Inside View of Breaker Looking Through from Right Side*

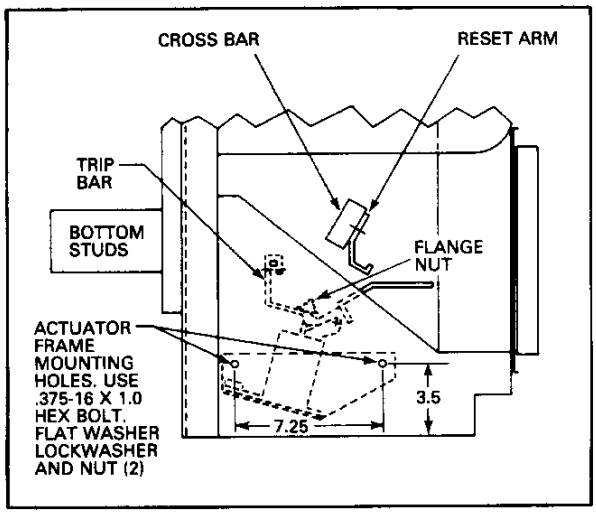

Fig. 10 *Left Side View*

3. Locate the two (2) .50 holes on the left side of the breaker frame. See Fig. 10. Attach the actuator base to the left side using .375-16 x 1.0 hex bolt, lockwasher, flat washer and nut. The two (2) actuator leads should be located between the left inside frame and the actuator housing.

4. Move the trip paddle assembly so that the paddle is located under the left side of the flange nut (viewing from the front) and secure the trip assembly to the bar. See Fig. 10.

5. Viewing the breaker from the front, remove the .375-16 x 1.5 hex bolt located on the far left side of the cross bar. Place the reset arm between the bolt head and lockwasher (Fig. 10), tighten the bolt being positive that the locking clip is in its previous position.

6. If you did not complete steps 8, 9 and 10 in the sensor and harness placement, do so at this time.

7. Use a 28 Vdc source close breaker, check tripping and resetting functions of actuator, repeat numerous times for verification. It may be necessary to bend reset arm for positive resetting of actuator, Fig. 10.

TEST

NOTE: The amptector test sets identified by style 140D481G02 or 140D481G03 should not be used to check calibration of the RK trip units. These test units are not regulated well enough to provide an undistorted wave form to the trip unit. All timing values will not be consistent with the time-current curve.

Using the RK test kit S#1232C08G01:

1. Check operation of the RK unit/actuator system sufficient number of times to insure proper operation.

2. Set the RK dials to the required settings and verify that the RK is in calibration.

3. Record the settings on the side of the RK unit for permanent record.

WARNING

Circuit breakers applied in systems with available fault currents in excess of their interrupting/withstand capabilities can cause severe personal injury or death. To avoid misapplication, the interrupting/withstand rating of the breaker together with the maximum possible settings of the trip unit used, must equal or exceed the maximum fault current available in the applied system.

4. Review the procedure for each type of breaker involved and the sensor tap connections for the various current ratings.

5. Review the illustrations to acquaint yourself with the items and location, especially the right and left side view of the breaker, Figs. 4, 6, 7, 9 and 10.

6. Arc chutes need not be removed and breaker should be worked on in the upright position.

RETROFIT KIT

All retrofit kits are style numbered and contain the parts necessary to fulfill your requirements, therefore check to see that you have received the styles as ordered. Remove items from box and check against bill of material for appropriate parts.

AK-2A-50 RETROFIT KIT BILL OF MATERIAL

Quantity per Breaker	Description	Style Number
1	RK Unit LS	1375D25G03
or 1	RK Unit LSI	1375D25G04
1	Actuator	693C365G01
3	Sensors Multi-Current (400-1600 Amperes)	8257A67H01
1	Sensor Mounting Angle	697B511H01
1	RK Mounting Bracket	6502C12H01
1	"L" Reinforcing Brace	8187A11H02
3	Copper Spacers	697B513H01
3	Copper Connectors	697B513H02
1	Wiring Harness	6502C13G02
*1	Hardware Kit	8186A53G06

*Note: Kits contain more hardware than required due to multi-purpose use, check right and left side views for number and size of hardware. Figs. 4, 6, 7, 9 and 10.

PROCEDURE

After you have read the requirements and you are familiar with all details, proceed in the following manner:

1. Remove the three (3) electro-mechanical trip units.

2. Place the 2⅛" x 2⅛" x 1³⁄₁₆" copper spacer in a position to line up with the two (2) .375 holes on the stationary bottom copper terminal. Place the 3½" x 4" x ½" copper connector over the copper spacer and over the upper stationary terminal, line up the holes of the copper connector with those of the spacer and upper terminal. Secure the connector to (See Fig. 4) the upper terminal using .375 x 16 x 1.0 hex bolt, lockwasher, and flat washer. Now secure the connector to the spacer and lower terminal using .375 x 16 x 2.12 hex bolt, lockwasher and flat washer.

MOUNTING THE RK UNIT

1. Viewing the breaker from the right side locate the main spring slotted slide hole which is 1" x 3" and located on the side of the front middle frame. Using the inner edge of the hole as a guide, scribe a line 5.94 inches from the top of the frame (See Fig. 5) to locate a centerline.

2. From this centerline locate a point 2.0 inches above and 2.0 inches below, drill two .438 holes. Fig. 5

3. Viewing the breaker from the top, locate a starting point at the junction of the top of the front frame and the middle side frame. From this point measure 3.38 inches along the front frame and .25 inches in to locate the first hole (See Fig. 6), measure another .50 inches over and .25 inches in to locate the second hole. Drill two (2) .25 holes.

4. Line up the RK unit with the four (4) holes on the bracket, the RK unit should be in a vertical position, secure the RK to the top inner and two lower holes using .190-32 x 1.0 fil. head screws, flat washer, lockwasher and nut. Fig. 7.

5. Secure the complete assembly to the right side of the front frame (See Fig. 7) using .375-16 x 1.0 hex bolt, washer, lockwasher and nut.

6. Invert and place a .190-32 x 1.0 fil. hd. scr. into the outer top hole of the RK bracket and unit, place a nut on the screw and secure. Place the "L" bracket on the screw and secure with washer, lockwasher and nut. Securing the "L" bracket at this time can be made after Step 7. See Figs. 6 and 7.

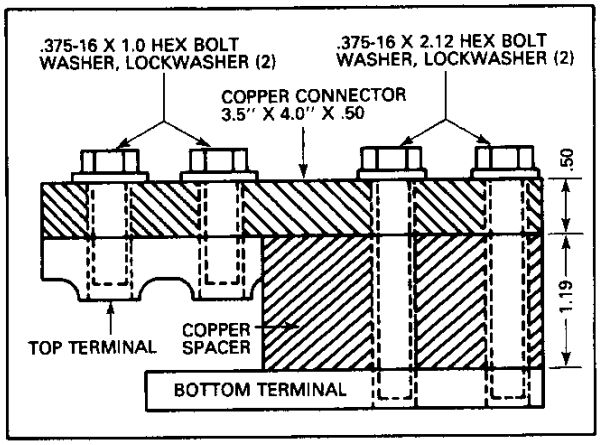

Fig. 4 *Side View of Terminals with Spacer and Connector After Removal of Electro-mechanical Trip Units*

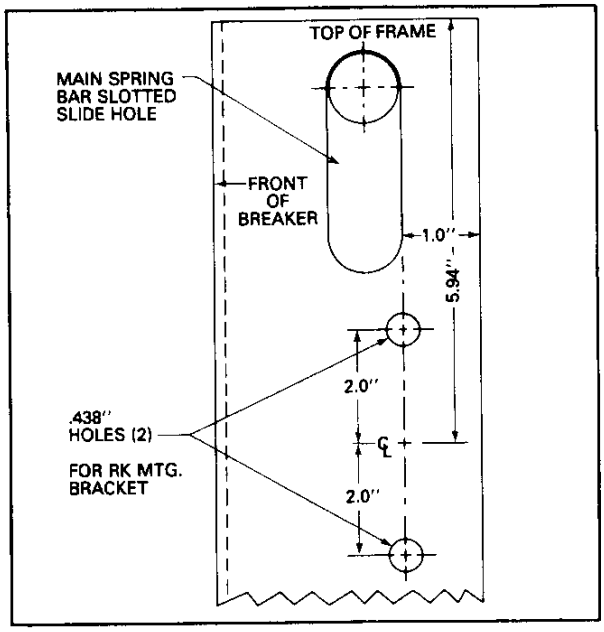

Fig. 5 *Middle Front, Right Side View*

7. Secure the top of the "L" brace to the top front frame using two (2) .25-20 x .75 fil. head screws, washer, lockwasher and nut. See Figs. 6 and 7.

HARNESS AND SENSORS

1. Acquaint yourself with the wiring scheme, Fig. 8.
2. Check each lug on the harness to ensure that they are properly secured to the wires.
3. Connect the wires to the RK unit per wiring diagram.
4. Facing the front of the breaker remove the bolt on the right side holding the retainer bar which holds the arc quencher. Place the nylon connector of the harness on the bolt and reinstall. **CAUTION: DO NOT OVER TIGHTEN BOLT.**
5. Directly downward about five (5) inches from the retainer bar and to the right you will locate a 3/16" hole on the side frame. Attach both the ground lead and the harness at this point using .190-32 x .75 fil. head screw, nylon clamp, washer and nut. This now grounds the sensor start point. Fig. 9.
6. Place a grommet in the .50 hole located in the lower end of the right hand side of the rear frame.

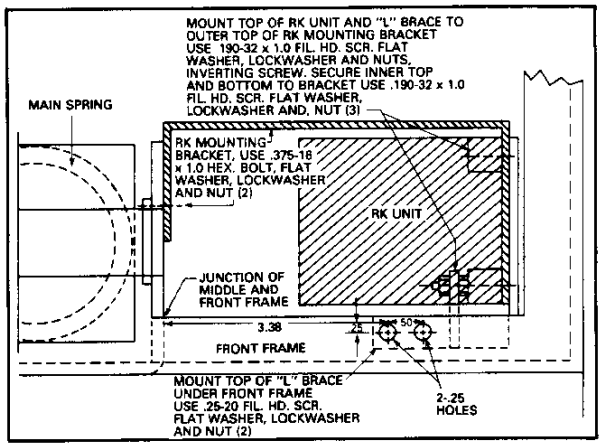

Fig. 6 *Right Front Top View*

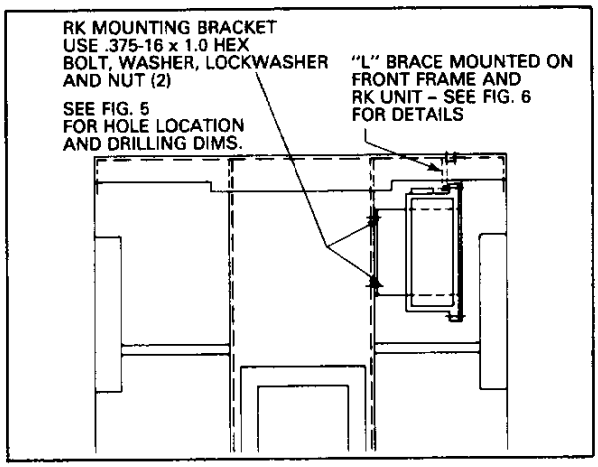

Fig. 7 *Front View of Breaker*

7. Thread the sensor end of the harness through the grommet. **If you have difficulty with getting harness through .50 hole, remove enough harness cover to make the connections to sensors.**
8. Remove the finger clusters from the top studs, attach the sensor polyester mounting angle to the back of the breaker utilizing the existing holes on the rear frame using .50-13 x 2.0 bolt, washer, lockwasher and nut.
9. Mount the sensors on the polyester angle. See Fig. 9. Use .25-20 x .75 fil. head screw, lock and flat washers and nut.
10. Connect the harness wiring to the sensors, and reinstall the finger clusters.

    NOTE: It may be desirable to complete steps 8, 9 and 10 after the actuator is mounted and operating properly.

11. The two leads going to the actuator are brought down under the motor housing and over to the hole which secures the motor leads (if breaker is electrically operated) using a nylon tie attach the harness to the motor leads. If breaker is manually operated attach the two leads to the hole which is normally used for the motor leads. Use .190-32 x .75 fil. head screw, nylon clamp; flat washer, lockwasher and nut.
12. Bring the leads directly under the bottom front of the breaker, with a nylon tie attach the leads to the welded clete. Continue with the actuator end of harness under the left side of the breaker to a position half way between the left side frame and the middle frame. At this point you will find a 3/16" hole on the bottom brace, attach the leads using .190-32 x .75 fil. head screw, nylon wire clamp, washers and nut.
13. DO NOT attach the actuator leads until after verification tests are completed. See **Placement of the Actuator,** paragraph 7.

PLACEMENT OF THE ACTUATOR

1. Viewing the breaker from the left side, position and assemble trip paddle on breaker trip bar using .25-20 x .75 carriage bolt, trip bar finger, washer and nut. DO NOT tighten this assembly. See Figs. 9 and 10.
2. Attach the two leads to the terminal board on the actuator, the leads should be to the left of the actuator housing.

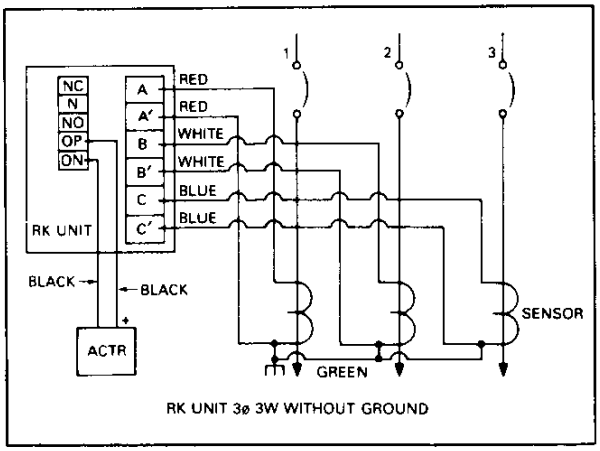

Fig. 8