INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE KA CARRIER AUXILIARY RELAY

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The type KA relay is an auxiliary relay used in the distance carrier relaying scheme to block or prevent instantaneous tripping for faults external to the line section to which it is applied, and to permit instantaneous simultaneous tripping for internal faults. The relay is arranged to respond to indications of fault power and direction provided by the phase and ground relays, thereby controlling the transmission of the carrier signals.

CONSTRUCTION AND OPERATION

The type KA relay consists of directional auxiliary units, receiver and alarm units, and a phase fault carrier operation indicator. In addition, the type KA relay contains a high speed overcurrent unit used to start carrier transmission for ground faults. The construction and operation of the relay units are described below. Complete details of the operation of this relay in the distance carrier relaying scheme is described in I.L. 41-911.

Overcurrent Unit

The overcurrent unit is a product induction cylinder type unit. The time phase relationship of the two air gap fluxes necessary for the development of torque is achieved by means of a capacitor connected in series with one pair of pole windings.

Mechanically, the overcurrent unit is composed of four basic components: a die-cast aluminum frame, an electromagnet, a moving element assembly, and a molded bridge.

The frame serves as the mounting structure for the magnetic core. The magnetic core which houses the lower pin bearing is secured to the frame by a locking nut. The bearing can be replaced, if necessary, without having to remove the magnetic core from the frame.

The electromagnet has two pairs of coils. The coils of each pair are mounted diametrically opposite one another. In addition, there are two locating pins. The locating pins are used to accurately position the lower pin bearing, which is mounted on the frame, with respect to the upper pin bearing, which is threaded into the bridge. The electromagnet is secured to the frame by four mounting screws.

The moving element assembly consists of a spiral spring, contact carrying member, and an aluminum cylinder assembled to a molded hub which holds the shaft. The shaft has removable top and bottom jewel bearings. The shaft rides between the bottom pin bearing and the upper pin bearing with the cylinder rotating in an air gap formed by the electromagnet and the magnetic core.

The bridge is secured to the electromagnet and frame by two mounting screws. In addition to holding the upper pin bearing, the bridge is used for mounting the adjustable stationary contact housing. The stationary contact housing is held in position by a spring type clamp. The spring adjuster is located on the underside of the bridge and is attached to the moving contact arm by a spiral spring. The spring adjuster is also held in place by a spring type clamp.

With the contacts closed, the electrical connection is made through the stationary contact housing clamp, to the moving contact, through the spiral spring out to the spring adjuster clamp.

When the current in the overcurrent unit exceeds the pick-up value the contacts open, allowing positive potential to be applied to the carrier transmitter.

A transformer and varistor assembly is used in conjunction with the overcurrent unit. The transformer is of the saturating type which limits the energy to the overcurrent unit and reduces the burden

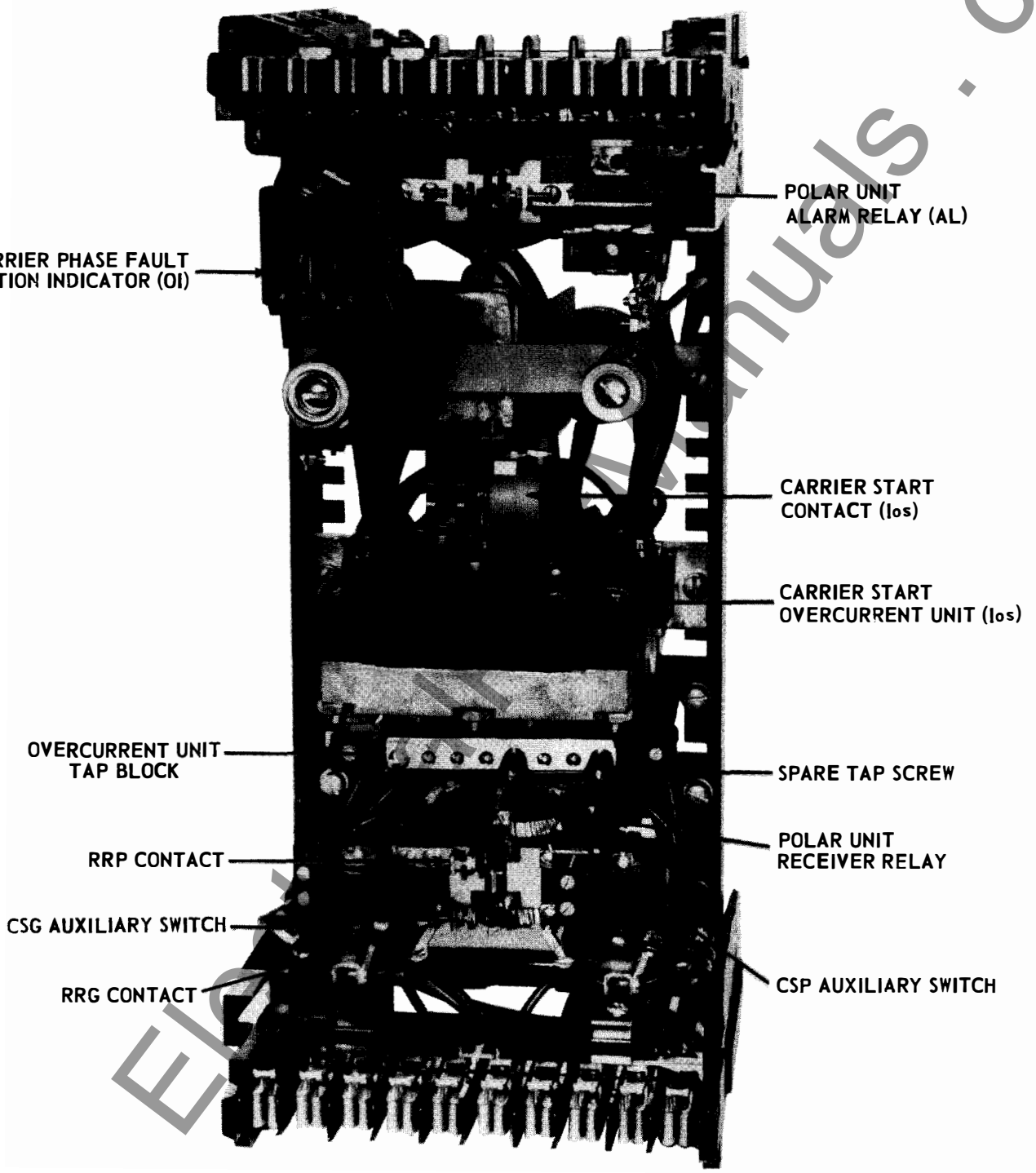

FIG. 1 TYPE KA RELAY WITHOUT CASE. (FRONT VIEW)

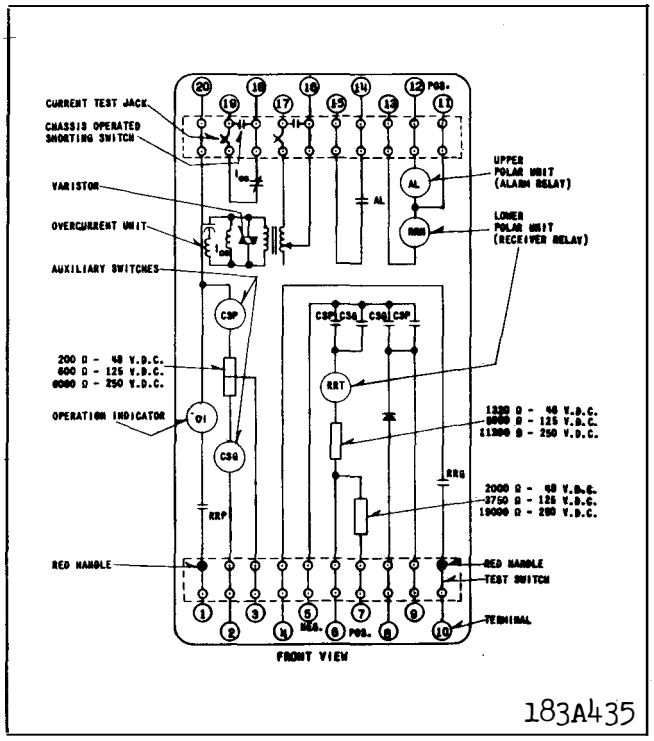

Fig. 2. Internal Schematic of the Type KA Relay in Type FT 32 Case.

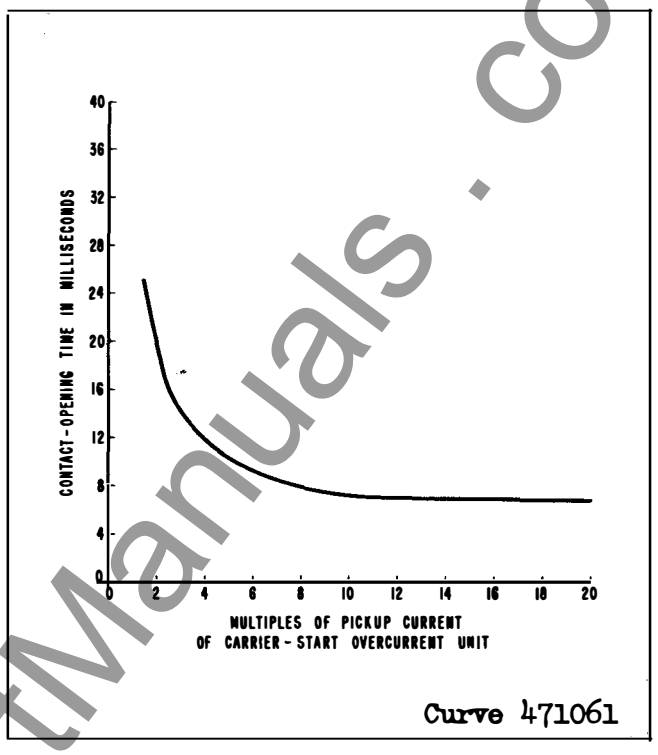

Fig. 3. Typical Time Characteristics of carrier start overcurrent unit of the type KA Relay.

on the operating CT.

The primary of the transformer is tapped and brought out to a tap connector block for ease in changing the pick-up current of the relay. The use of a tapped transformer provides approximately the same energy level at a given multiple of pick-up current for any tap setting, resulting in one time curve throughout the range of the relay.

Across the secondary is connected a non-linear resistor known as a varistor. The effect of the varistor is to reduce the voltage peaks applied to the overcurrent unit and phase shifting capacitor.

Directional Auxiliary Units

These are two solenoid-type contactor switches designated as CSP and CSG. The plunger of the contactor switch has a circular conducting disc mounted on its lower end and as the plunger travels upward, the disc bridges three silver stationary contacts. The CSP switch is energized by the operation of the second zone unit of the KD distance relay, and the CSG switch, by the operation of the directional and overcurrent units of the ground relay. The contacts of the two switches are connected in parallel as shown in the internal schematic. The operation of either of these switches connects the carrier control circuit to negative to stop carrier, and energizes the RRT operating coil of the receiver relay unit.

Receiver Unit

The polarized relay consists of an armature and contacts mounted on a leaf spring supported symmetrically within a magnet frame. The armature rides in the front air gap of the frame with the contacts projecting outside. The poles of a permanent magnet clamp directly to each side of the frame. Two adjustable shunts are located across the rear air gaps. These change the reluctance of the magnetic path as shown in Fig. 4 so as to force some of the flux thru the moving armature which is fastened to the frame midway between the two rear air gaps. Flux in the armature polarizes it and creates a magnetic bias, causing it to move towards either the left or right, depending upon the adjustment.

Two stationary contact screws are mounted to the left (front view) of the moving contact assembly and adjusted for normally open contacts. These contacts are designated, RRP and RRG, and are connected in the phase and ground trip circuits respectively. These contacts are operated by two concentric coils, RRT and RRH, which are placed around the armature

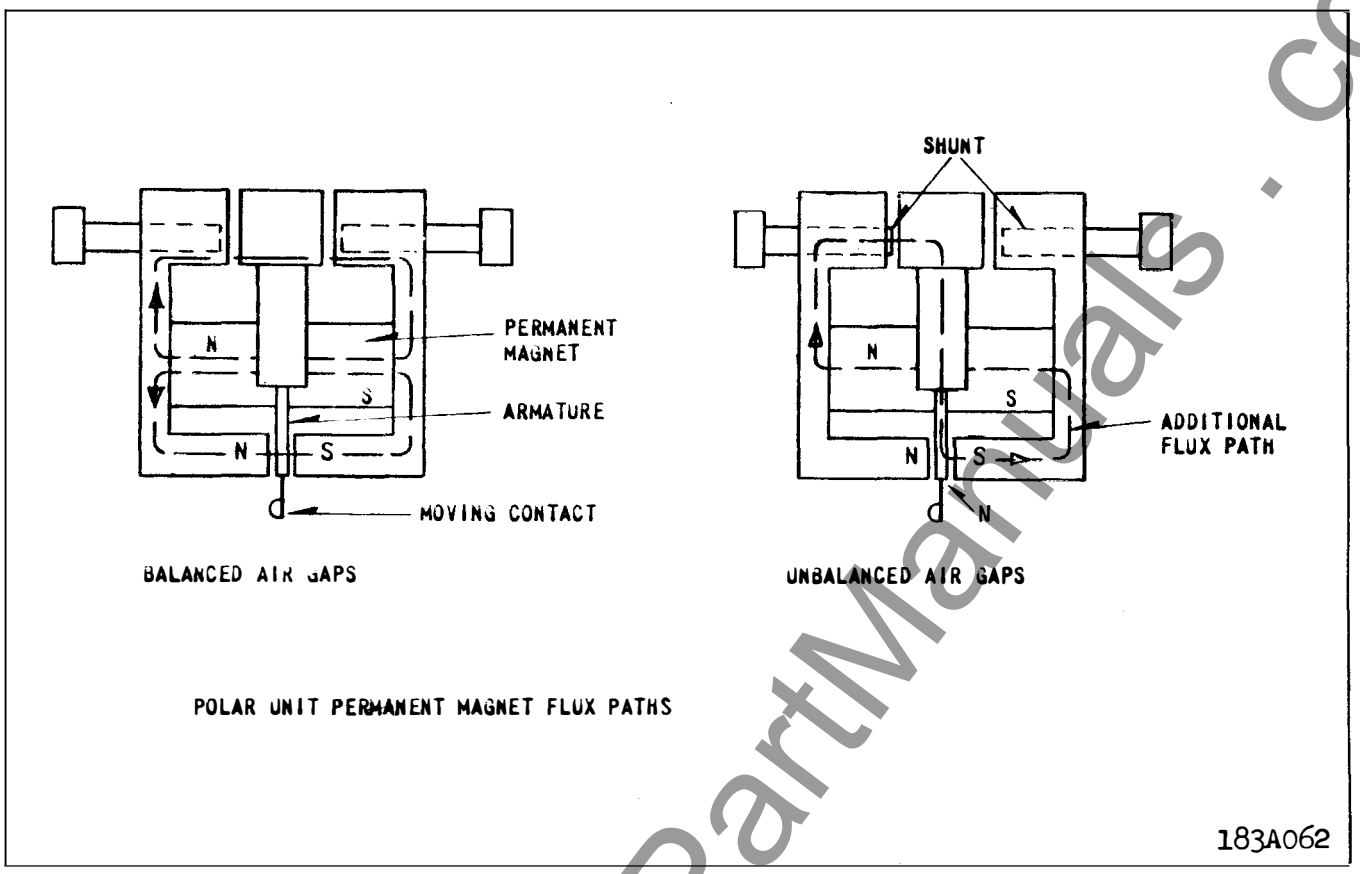

Fig. 4. Polar Unit Permanent Magnet Flux Paths.

and within the magnetic frame. RRT is the operating coil and receives its energy from the local battery when either CSP or CSG is closed. RRH is the holding coil and receives its energy from the carrier transmitted either from the local transmitter or the one at the other end of the line section. These two coils are connected to oppose each other with the operating coil, RRT operating to close the RRP and RRG contacts and trip; and the holding coil, RRH to hold the RRP and RRG contacts open and block tripping. The restraining torque of the RRH coil is sufficient to overcome the operating torque of the RRT coil. Consequently, RRP and RRG contacts cannot close as long as RRH is energized.

Alarm Unit

The alarm element is similar in construction to the receiver element except that it is energized by a single coil and operates a single set of contacts. The coil is energized by the received carrier to close the contacts and give an alarm. This element has a higher-pick-up than that of the receiver element in order to obtain a direct check on the sensitivity of the tubes in the carrier transmitter-receiver. The failure of the alarm relay to pick-up when carrier is started indicates insufficient output from the transmitter-receivers.

Operation Indicator

The operation indicator gives a visual indication of a carrier tripping operation for phase faults by the distance relay through the RRP contacts. For a ground fault carrier relaying operation, the indicating contactor switch (ICS) located in the ground relay will drop a target.

CHARACTERISTICS

The characteristics of the various elements of the relays are as follows:

	48V Avg. Ohms	125V Avg. Ohms	250V Avg. Ohms
CSP or CSG Coil	27	27	27
CSP & CSG Tapped Resistor	200	600	1250
Carrier Resistor	2000	3750	19000
RRT Operating Coil	1100	1100	1100
RRT Coil Resistor	1320	5000	11200
RRH Holding Coil	1700	1700	1700
AL Alarm Coil	500	500	500
Operation Indicator (1 amp.)	0.1	0.1	0.1

The pick-up and operating values of these units are given under "Adjustments and Maintenance".

The time characteristic of the overcurrent unit is shown in Fig. 3. The overcurrent unit is generally available in the following current ranges:

Range	Taps					
0.5 – 2 amps	0.5	0.75	1.0	1.25	1.5	2.0
1 – 4	1.0	1.5	2.0	2.5	3.0	4.0

The tap value is the minimum current required to just open the relay contacts. For pick-up settings in between taps, refer to the section under Adjustments.

SETTINGS

The only setting required is for the overcurrent unit which is made by inserting the tap screw in the tap to give the required pick-up.

Caution

Since the tap block connector screw carries operating current, be sure that the screw is turned tight. In order to avoid opening the current transformer circuits when changing taps under load, connect the spare tap screw in the desired tap position before removing the other tap screw from the original tap position.

The carrier-start overcurrent unit at each line terminal is set on a lower tap than the tripping element at the opposite end of the line. This arrangement insures proper blocking for remote external faults which may not pick up both overcurrent elements at each line terminal.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

The carrier relaying schematic (supplied with the carrier order) should be consulted for details of the external connections of these relays.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no customer adjustments, other than those covered under "SETTINGS", should be required.

ACCEPTANCE CHECK

The following check is recommended to insure that the relay is in proper working order:

Overcurrent Unit

With the tap screw in the desired tap hole, pass rated alternating current through the relay terminals. The contact should pick up within ±5% of tap value.

Directional Auxiliary Units (CSP and CSG).

Each contactor switch has a section of a tapped resistor in series with it, and will pick up positively when rated control voltage is applied across the coil and its section of the resistor.

These units should operate at 24 volts for the 48-volt relay, 60 volts for the 125-volt relay, and 120 volts for 250-volt relay. These units have an intermittent rating, and should not be energized for more than a few seconds.

Polar Unit (Receiver Relay)

Connect a jumper between the middle and left hand contact connection of the CSG or CSP switch. The CSG switch is located on the left-hand pedestal and CSP is located on the right-hand pedestal on the relay (front view). Apply rated voltage across the RRT coil and the RRT coil resistor, observing polarity as shown in the internal schematic. The armature should move to the left.

To the holding coil (RRH) relay terminals, apply direct current observing correct polarity. Increase the current until the armature moves to the right. The armature should move to the right at approximately 6 ma. Now reduce the current and the armature should move to the left at approximately 4 ma.

Alarm Unit (AL)

Connect direct current to the alarm unit relay terminals. Increase the current until the contacts pick up. The contacts should pick up at approximately 8 ma. Now reduce the current and the contacts should open at 4 to 6 ma.

Operation Indicator (OI)

With the polar unit contacts closed, apply direct current to the operation indicator relay terminals. The operation indicator should pick up and drop the indicator target between 1 ampere and 1.2 amperes d-c.

ROUTINE MAINTENANCE

All relays should be inspected periodically and the operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments have been disturbed. This procedure should not be used unless it is apparent that the relay is not in proper working order. (See "Acceptance Check").

Overcurrent Unit

The upper bearing screw should be screwed down until there is approximately 1/64" clearance between it and the top of the shaft bearing. Securely lock in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

With the moving contact in the normally closed position, i.e., against the right side of the bridge, screw in the stationary contact until both contacts just close. Then screw in the stationary contact approximately one-half turn farther to provide the correct amount of follow.

The clamp holding the stationary contact housing need not be loosened for the adjustment since the clamp utilizes a spring-type action in holding the stationary contact in position.

With the tap screw in the desired tap hole, pass rated a-c through the relay terminals.

The sensitivity adjustment is made by varying the tension of the spiral spring attached to the moving element assembly. The spring is adjusted by placing a screwdriver or similar tool into one of the notches located on the periphery of the spring adjuster and rotating it. The spring adjuster is located on the underside of the bridge and is held in place by a spring type clamp that does not have to be loosened prior to making the necessary adjustments.

Adjust the spring until the contacts just open. With this adjustment, the pick-up of the relay for any other tap setting should be within ±5% of tap value.

If settings in between taps are desired, place the tap screw in the next lower tap hole and adjust the spring until the contacts just open at the desired pick-up current.

Directional Auxiliary Units (CSP and CSG)

The two contactor switches, CSP and CSG, have adjustable plunger travel. Adjust the stationary core and the moving core of 1/64" when the switch is picked up. This can be done by turning the relay upside-down and screwing up the core screw of the switch until the contacts just separate. Then back off the core screw approximately one turn and lock in place. This prevents the moving core from striking and sticking to the stationary core because of residual magnetism. Adjust the contact clearance for approximately 1/32" by means of the two small nuts on either side of the Micarta disc.

Each contactor switch has a section of a tapped resistor in series with it, and will pick up positively when rated trip circuit voltage is applied across the coil and its section of the resistor.

The units should operate at 24 volts for the 48-volt relay, 60 volts for the 125-volt relay and 120 volts for 250-volt relay. These units have an intermittent rating, and should not be energized for more than a few seconds.

Polar Receiver Unit

Back off contact screws so that they do not make contact. Screw magnetic shunts into the all-out position (5 or 6 screw threads showing.) The armature should remain against whichever side it is pushed with this adjustment.

Adjust the stationary contacts for a contact gap of approximately .020". This perhaps can best be done by inserting a .010" steel thickness gage between the large rivet head on the moving armature and

the right hand pole face (a .010" travel of the rivet head is equal to .020" travel of the moving contacts). Using an indicating light in each contact circuit, adjust the upper and lower stationary contacts to touch the moving contact at the same time. With the feeler gauge removed the contact gap is .020" and the moving contacts close simultaneously.

Connect a jumper between the middle and left hand contact connection of the CSG or CSP switch. The CSG switch is located on the left-hand pedestal and CSP is located on the right hand pedestal of the relay (front view). Apply rated voltage across the RRT coil and the RRT coil resistor observing polarity as shown in the interval schematic diagram. The armature should move to the left.

To the holding coil, RRH, apply 10 to 20 milliamperes d.c. current observing correct polarity. The armature should now move to the right. De-energize both coils and see that the armature stays up against the right hand side.

Run both shunt screws all the way in, and then back out the left hand shunt screw approximately 6 turns. Back out the right hand shunt screw approximately 9 turns.

Re-energize the operating coil with rated voltage and the holding coil with 4 milliamperes d.c. Adjust the right hand contact shunt screw until the armature moves to the left. If the armature moves to the left, at a value of holding coil current greater than 4 milliamperes, the right hand shunt screw should be turned out to lower this value to the correct 4 milliampere point.

Increase the holding coil current to 6 milliamperes and adjust the left hand shunt screw until the armature resets, or moves to the right. If the armature resets at a value of current less than 6 milliamperes, the left hand shunt screw should be turned out. This will increase the reset value of the armature and provide for the correct 6 milliampere reset value.

Minor adjustments of both shunt screws must be made several times until the desired operating points are obtained, since the adjustments of one shunt screw affect the adjustment on the other shunt screw.

Polar Alarm Unit

The contacts should close with 8 milliamperes d-c ± 5% applied to the alarm coil. Adjust the contact screws to obtain an .050" contact gap such that the armature motion between the left and right hand contacts is in the central part of the air gap between the pole faces. Tighten the contact locking nuts. Approximate adjustments of the two magnetic shunt screws are as follows:

Turn both shunt screws all the way in. Then back out both shunt screws approximately seven turns. Apply 8 milliamperes d.c. to the coil observing correct polarity, and then screw in the left hand shunt screw until the armature moves to the right at a value of current less than 8 milliamperes, screw the left hand shunt out until the armature moves to the right at 8 milliamperes. Check the dropout point by reducing the d.c. current. The armature should move to the left between the limits of 4 and 6 milliamperes. If it fails to do so, adjust the right hand shunt screw until it does. It will then be necessary to recheck the pickup and dropout points again and make any minor adjustments to the shunt screws that may be necessary until correct calibration is obtained.

In general, screwing in the left hand shunt screw reduces the pickup current of the relay. Screwing in the right hand shunt screw increases the dropout current. This will in turn cause a change in the pickup current, making necessary several slight readjustments of both shunt screws to obtain the desired calibration. The armature as finally calibrated should pickup and dropout with a snappy action.

Operation Indicator

The operation indicator should pick up and drop the indicator target when the current is between 1 and 1.2 amperes d-c. To increase the pick-up current, remove the molded cover and bend the springs out or away from the cover. To decrease the pick-up current, bend the springs in toward the cover.

Make sure that the target drops freely when the unit operates.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

BURDEN DATA OPERATING CURRENT CIRCUIT - 60 CYCLES

Range Amps	Taps	Volt-Amperes Tap Value Current	Power Factor Angle ¢	Volt Amperes at 5 amperes	Power Factor Angle ¢
	.5	.37	39°	24	46°
	.75	.38	36	13	37
.5-2	1	.39	35	8.5	34
	1.25	.41	34	6.0	32
	1.5	.43	32	4.6	31
	2	.45	30	2.9	28
	1	.41	36°	9.0	36°
	1.5	.44	32	5.0	32
1-4	2	.47	30	3.0	29
	2.5	.50	28	2.1	27
	3	.53	26	1.5	26
	4	.59	24	.93	24

RATINGS OF OVERCURRENT UNIT

Range	Continuous Rating Amps	One Second Rating Amps
.5-2	5	100
1-4	5	140

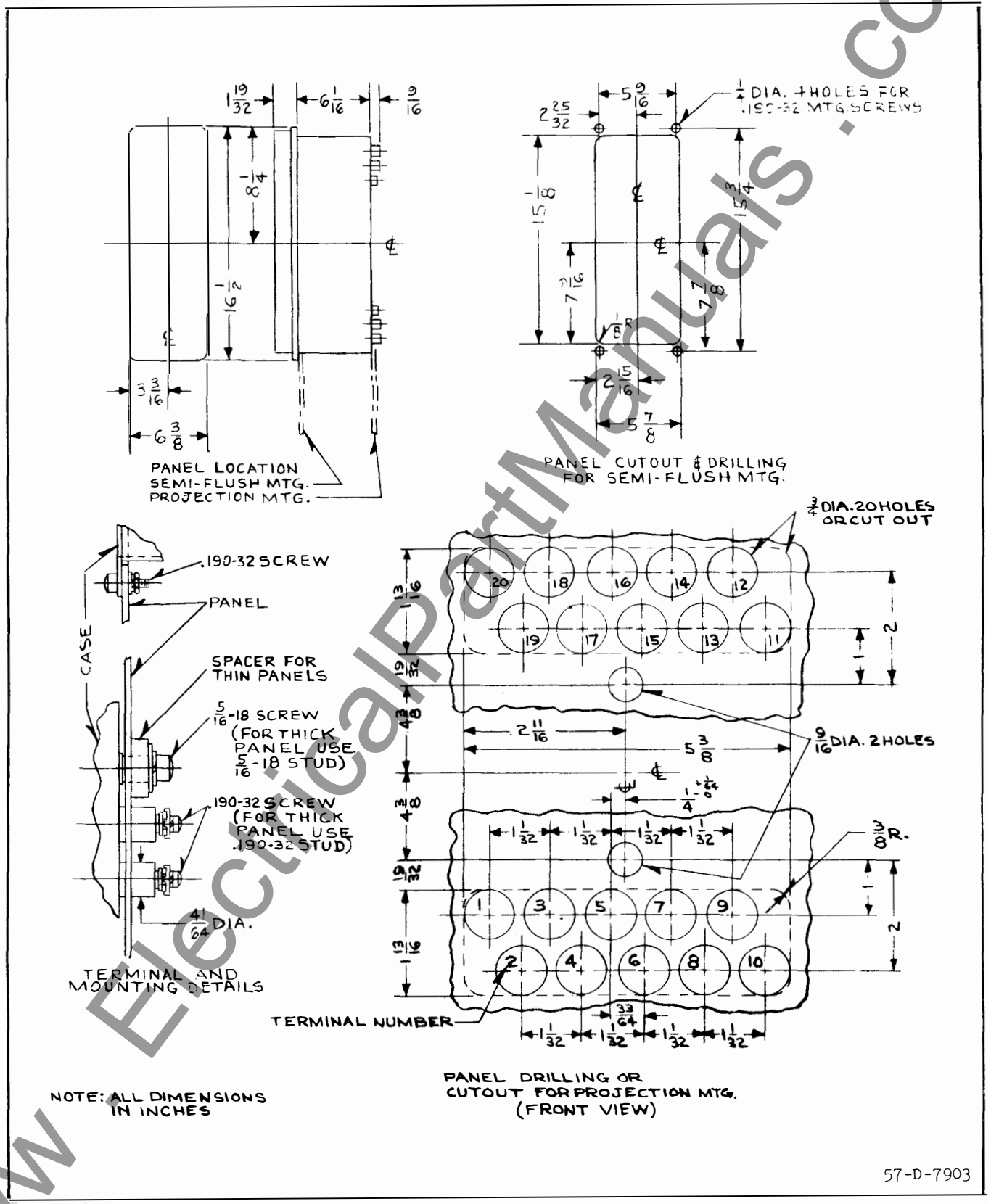

Fig. 5. Outline and Drilling Plan for the type KA Relay in the type FT 32 Case.

WESTINGHOUSE ELECTRIC CORPORATION

RELAY DEPARTMENT **NEWARK, N. J.**

Printed in U. S. A.

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CONSTRUCTION AND OPERATION

The type KA relay consists of directional auxiliary units, receiver and alarm units, and a phase fault carrier operation indicator. In addition, the type KA relay contains a high speed overcurrent unit used to start carrier transmission for ground faults. The construction and operation of the relay units are described below. Complete details of the operation of this relay in the distance carrier relaying scheme is described in I.L. 41-911.

Overcurrent Unit

The overcurrent unit is a product induction cylinder type unit. The time phase relationship of the two air gap fluxes necessary for the development of torque is achieved by means of a capacitor connected in series with one pair of pole windings.

Mechanically, the overcurrent unit is composed of four basic components: a die-cast aluminum frame, an electromagnet, a moving element assembly, and a molded bridge.

The frame serves as the mounting structure for the magnetic core. The magnetic core which houses the lower pin bearing is secured to the frame by a locking nut. The bearing can be replaced, if necessary, without having to remove the magnetic core from the frame.

The electromagnet has two pairs of coils. The coils of each pair are mounted diametrically opposite one another. In addition, there are two locating pins. The locating pins are used to accurately position the lower pin bearing, which is mounted on the frame, with respect to the upper pin bearing, which is threaded into the bridge. The electromagnet is secured to the frame by four mounting screws.

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The bridge is secured to the electromagnet and frame by two mounting screws. In addition to holding the upper pin bearing, the bridge is used for mounting the adjustable stationary contact housing. The stationary contact housing is held in position by a spring type clamp. The spring adjuster is located on the underside of the bridge and is attached to the moving contact arm by a spiral spring. The spring adjuster is also held in place by a spring type clamp.

With the contacts closed, the electrical connection is made through the stationary contact housing clamp, to the moving contact, through the spiral spring out to the spring adjuster clamp.

When the current in the overcurrent unit exceeds the pick-up value the contacts open, allowing positive potential to be applied to the carrier transmitter.

A transformer and varistor assembly is used in conjunction with the overcurrent unit. The transformer is of the saturating type which limits the energy to the overcurrent unit and reduces the burden

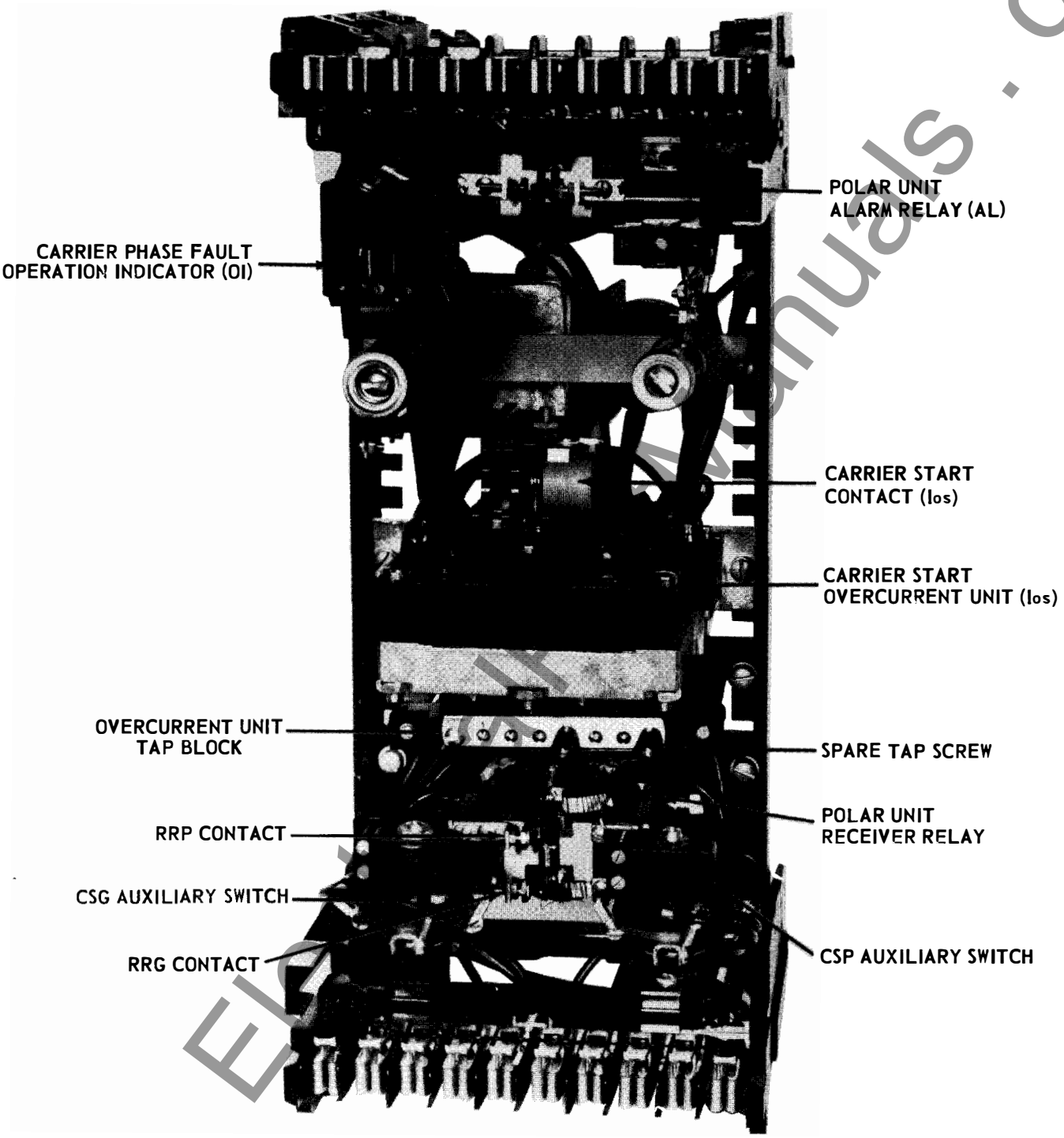
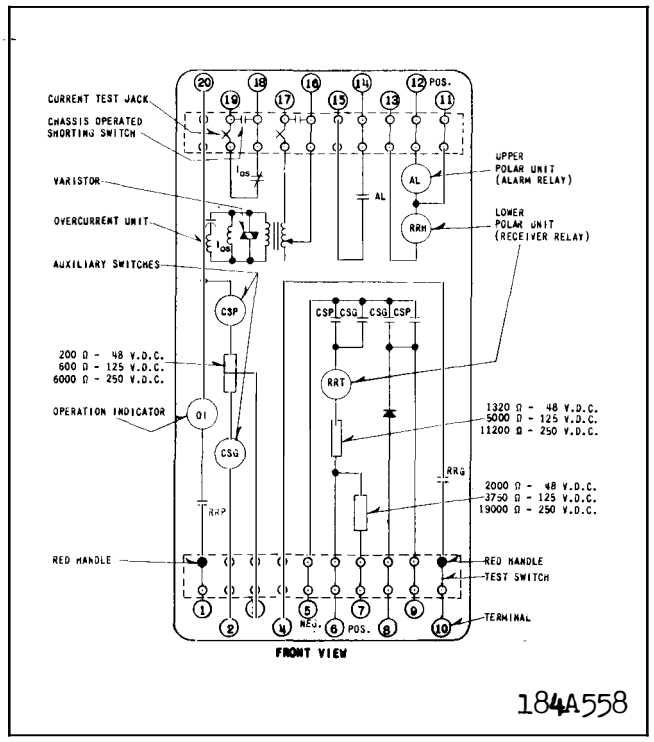


FIG. 1 TYPE KA RELAY WITHOUT CASE. (FRONT VIEW)



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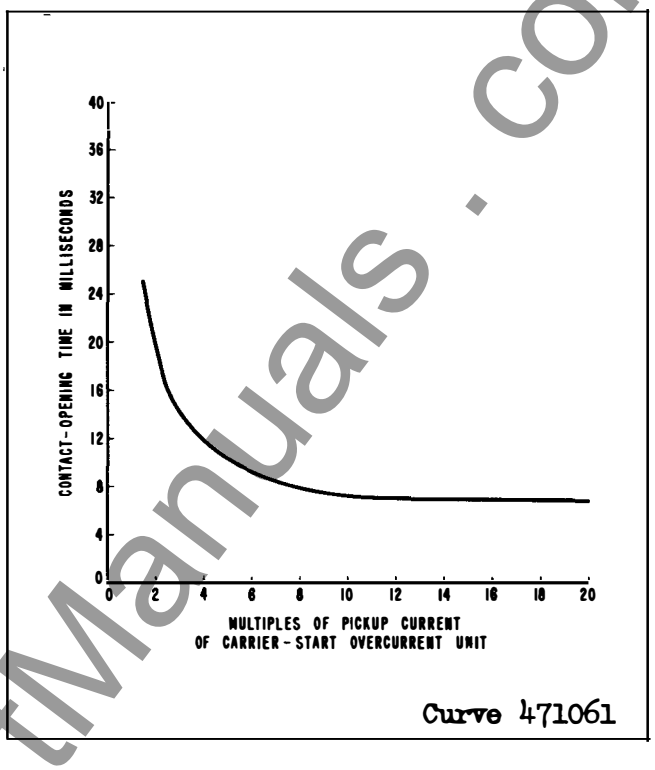

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Across the secondary is connected a non-linear resistor known as a varistor. The effect of the varistor is to reduce the voltage peaks applied to the overcurrent unit and phase shifting capacitor.

Directional Auxiliary Units

These are two solenoid-type contactor switches designated as CSP and CSG. The plunger of the contactor switch has a circular conducting disc mounted on its lower end and as the plunger travels upward, the disc bridges three silver stationary contacts. The CSP switch is energized by the operation of the second zone unit of the KD distance relay, and the CSG switch, by the operation of the directional and overcurrent units of the ground relay. The contacts of the two switches are connected in parallel as shown in the internal schematic. The operation of either of these switches connects the carrier control circuit to negative to stop carrier, and energizes the RRT operating coil of the receiver relay unit.

Receiver Unit

The polarized relay consists of an armature and contacts mounted on a leaf spring supported symmetrically within a magnet frame. The armature rides in the front air gap of the frame with the contacts projecting outside. The poles of a permanent magnet clamp directly to each side of the frame. Two adjustable shunts are located across the rear air gaps. These change the reluctance of the magnetic path as shown in Fig. 4 so as to force some of the flux thru the moving armature which is fastened to the frame midway between the two rear air gaps. Flux in the armature polarizes it and creates a magnetic bias, causing it to move towards either the left or right, depending upon the adjustment.

Two stationary contact screws are mounted to the left (front view) of the moving contact assembly and adjusted for normally open contacts. These contacts are designated, RRP and RRG, and are connected in the phase and ground trip circuits respectively. These contacts are operated by two concentric coils, RRT and RRH, which are placed around the armature

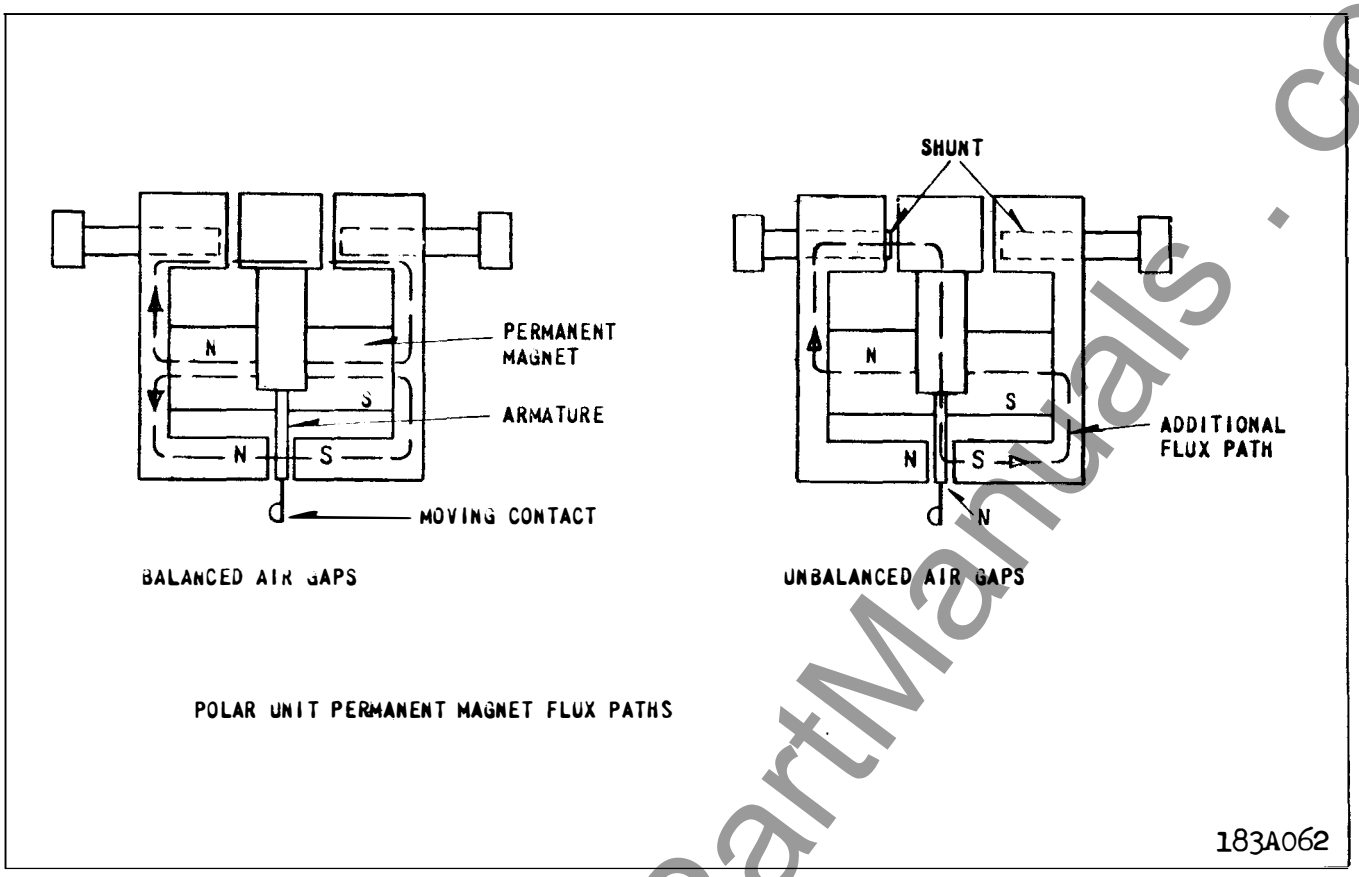

Fig. 4. Polar Unit Permanent Magnet Flux Paths.

and within the magnetic frame. RRT is the operating coil and receives its energy from the local battery when either CSP or CSG is closed. RRH is the holding coil and receives its energy from the carrier transmitted either from the local transmitter or the one at the other end of the line section. These two coils are connected to oppose each other with the operating coil, RRT operating to close the RRP and RRG contacts and trip; and the holding coil, RRH to hold the RRP and RRG contacts open and block tripping. The restraining torque of the RRH coil is sufficient to overcome the operating torque of the RRT coil. Consequently, RRP and RRG contacts cannot close as long as RRH is energized.

Alarm Unit

The alarm element is similar in construction to the receiver element except that it is energized by a single coil and operates a single set of contacts. The coil is energized by the received carrier to close the contacts and give an alarm. This element has a higher-pick-up than that of the receiver element in order to obtain a direct check on the sensitivity of the tubes in the carrier transmitter-receiver. The failure of the alarm relay to pick-up when carrier is started indicates insufficient output from the transmitter-receivers.

Operation Indicator

The operation indicator gives a visual indication of a carrier tripping operation for phase faults by the distance relay through the RRP contacts. For a ground fault carrier relaying operation, the indicating contactor switch (ICS) located in the ground relay will drop a target.

CHARACTERISTICS

The characteristics of the various elements of the relays are as follows:

	48V Avg. Ohms	125V Avg. Ohms	250V Avg. Ohms	
CSP or CSG Coil	27	27	435	*
CSP & CSG Tapped Resistor	200	600	6000	*
Carrier Resistor	2000	3750	19000	
RRT Operating Coil	1100	1100	1100	
RRT Coil Resistor	1320	5000	11200	
RRH Holding Coil	1700	1700	1700	
AL Alarm Coil	500	500	500	
Operation Indicator (1 amp.)	0.1	0.1	0.1	

The pick-up and operating values of these units are given under "Adjustments and Maintenance".

The time characteristic of the overcurrent unit is shown in Fig. 3. The overcurrent unit is generally available in the following current ranges:

Range	Taps					
0.5 – 2 amps	0.5	0.75	1.0	1.25	1.5	2.0
1 – 4	1.0	1.5	2.0	2.5	3.0	4.0

The tap value is the minimum current required to just open the relay contacts. For pick-up settings in between taps, refer to the section under Adjustments.

SETTINGS

The only setting required is for the overcurrent unit which is made by inserting the tap screw in the tap to give the required pick-up.

Caution

Since the tap block connector screw carries operating current, be sure that the screw is turned tight. In order to avoid opening the current transformer circuits when changing taps under load, connect the spare tap screw in the desired tap position before removing the other tap screw from the original tap position.

The carrier-start overcurrent unit at each line terminal is set on a lower tap than the tripping element at the opposite end of the line. This arrangement insures proper blocking for remote external faults which may not pick up both overcurrent elements at each line terminal.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. Mount the relay vertically by means of the four mounting holes on the flange for semi-flush mounting or by means of the rear mounting stud or studs for projection mounting. Either a mounting stud or the mounting screws may be utilized for grounding the relay. The electrical connections may be made directly to the terminals by means of screws for steel panel mounting or to the terminal studs furnished with the relay for thick panel mounting. The terminal studs may be easily removed or inserted by locking two nuts on the stud and then turning the proper nut with a wrench.

The carrier relaying schematic (supplied with the carrier order) should be consulted for details of the external connections of these relays.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay, no customer adjustments, other than those covered under "SETTINGS", should be required.

ACCEPTANCE CHECK

The following check is recommended to insure that the relay is in proper working order:

Overcurrent Unit

With the tap screw in the desired tap hole, pass rated alternating current through the relay terminals. The contact should pick up within ±5% of tap value.

Directional Auxiliary Units (CSP and CSG).

Each contactor switch has a section of a tapped resistor in series with it, and will pick up positively when rated control voltage is applied across the coil and its section of the resistor.

These units should operate at 24 volts for the 48-volt relay, 60 volts for the 125-volt relay, and 120 volts for 250-volt relay. These units have an intermittent rating, and should not be energized for more than a few seconds.

Polar Unit (Receiver Relay)

Connect a jumper between the middle and left hand contact connection of the CSG or CSP switch. The CSG switch is located on the left-hand pedestal and CSP is located on the right-hand pedestal on the relay (front view). Apply rated voltage across the RRT coil and the RRT coil resistor, observing polarity as shown in the internal schematic. The armature should move to the left.

To the holding coil (RRH) relay terminals, apply direct current observing correct polarity. Increase the current until the armature moves to the right. The armature should move to the right at approximately 6 ma. Now reduce the current and the armature should move to the left at approximately 4 ma.

Alarm Unit (AL)

Connect direct current to the alarm unit relay terminals. Increase the current until the contacts pick up. The contacts should pick up at approximately 8 ma. Now reduce the current and the contacts should open at 4 to 6 ma.

Operation Indicator (OI)

With the polar unit contacts closed, apply direct current to the operation indicator relay terminals. The operation indicator should pick up and drop the indicator target between 1 ampere and 1.2 amperes d-c.

ROUTINE MAINTENANCE

All relays should be inspected periodically and the operation should be checked at least once every year or at such other time intervals as may be dictated by experience to be suitable to the particular application.

All contacts should be periodically cleaned. A contact burnisher S#182A836H01 is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments have been disturbed. This procedure should not be used unless it is apparent that the relay is not in proper working order. (See "Acceptance Check").

Overcurrent Unit

The upper bearing screw should be screwed down until there is approximately 1/64" clearance between it and the top of the shaft bearing. Securely lock in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

With the moving contact in the normally closed position, i.e., against the right side of the bridge, screw in the stationary contact until both contacts just close. Then screw in the stationary contact approximately one-quarter turn farther to provide the correct amount of follow.

The clamp holding the stationary contact housing need not be loosened for the adjustment since the clamp utilizes a spring-type action in holding the stationary contact in position.

With the tap screw in the desired tap hole, pass rated a-c through the relay terminals.

The sensitivity adjustment is made by varying the tension of the spiral spring attached to the moving element assembly. The spring is adjusted by placing a screwdriver or similar tool into one of the notches located on the periphery of the spring adjuster and rotating it. The spring adjuster is located on the underside of the bridge and is held in place by a spring type clamp that does not have to be loosened prior to making the necessary adjustments.

Adjust the spring until the contacts just open. With this adjustment, the pick-up of the relay for any other tap setting should be within ±5% of tap value.

If settings in between taps are desired, place the tap screw in the next lower tap hole and adjust the spring until the contacts just open at the desired pick-up current.

Directional Auxiliary Units (CSP and CSG)

The two contactor switches, CSP and CSG, have adjustable plunger travel. Adjust the stationary core and the moving core of 1/64" when the switch is picked up. This can be done by turning the relay upside-down and screwing up the core screw of the switch until the contacts just separate. Then back off the core screw approximately one turn and lock in place. This prevents the moving core from striking and sticking to the stationary core because of residual magnetism. Adjust the contact clearance for approximately 1/32" by means of the two small nuts on either side of the Micarta disc.

Each contactor switch has a section of a tapped resistor in series with it, and will pick up positively when rated trip circuit voltage is applied across the coil and its section of the resistor.

The units should operate at 24 volts for the 48-volt relay, 60 v dts for the 125-volt relay and 120 volts for 250-volt relay. These units have an intermittent rating, and should not be energized for more than a few seconds.

Polar Receiver Unit

Back off contact screws so that they do not make contact. Screw magnetic shunts into the all-out position (5 or 6 screw threads showing.) The armature should remain against whichever side it is pushed with this adjustment.

Adjust the stationary contacts for a contact gap of approximately .020". This perhaps can best be done by inserting a .010" steel thickness gage between the large rivet head on the moving armature and

the right hand pole face (a .010" travel of the rivet head is equal to .020" travel of the moving contacts). Using an indicating light in each contact circuit, adjust the upper and lower stationary contacts to touch the moving contact at the same time. With the feeler gauge removed the contact gap is .020" and the moving contacts close simultaneously.

Connect a jumper between the middle and left hand contact connection of the CSG or CSP switch. The CSG switch is located on the left-hand pedestal and CSP is located on the right hand pedestal of the relay (front view). Apply rated voltage across the RRT coil and the RRT coil resistor observing polarity as shown in the interval schematic diagram. The armature should move to the left.

To the holding coil, RRH, apply 10 to 20 milliamperes d.c. current observing correct polarity. The armature should now move to the right. De-energize both coils and see that the armature stays up against the right hand side.

Run both shunt screws all the way in, and then back out the left hand shunt screw approximately 6 turns. Back out the right hand shunt screw approximately 9 turns.

Re-energize the operating coil with rated voltage and the holding coil with 4 milliamperes d.c. Adjust the right hand contact shunt screw until the armature moves to the left. If the armature moves to the left, at a value of holding coil current greater than 4 milliamperes, the right hand shunt screw should be turned out to lower this value to the correct 4 milliampere point.

Increase the holding coil current to 6 milliamperes and adjust the left hand shunt screw until the armature resets, or moves to the right. If the armature resets at a value of current less than 6 milliamperes, the left hand shunt screw should be turned out. This will increase the reset value of the armature and provide for the correct 6 milliampere reset value.

Minor adjustments of both shunt screws must be made several times until the desired operating points are obtained, since the adjustments of one shunt screw affect the adjustment on the other shunt screw.

Polar Alarm Unit

The contacts should close with 8 milliamperes d-c ± 5% applied to the alarm coil. Adjust the contact screws to obtain an .050" contact gap such that the armature motion between the left and right hand contacts is in the central part of the air gap between the pole faces. Tighten the contact locking nuts. Approximate adjustments of the two magnetic shunt screws are as follows:

Turn both shunt screws all the way in. Then back out both shunt screws approximately seven turns. Apply 8 milliamperes d.c. to the coil observing correct polarity, and then screw in the left hand shunt screw until the armature moves to the right at a value of current less than 8 milliamperes, screw the left hand shunt out until the armature moves to the right at 8 milliamperes. Check the dropout point by reducing the d.c. current. The armature should move to the left between the limits of 4 and 6 milliamperes. If it fails to do so, adjust the right hand shunt screw until it does. It will then be necessary to recheck the pickup and dropout points again and make any minor adjustments to the shunt screws that may be necessary until correct calibration is obtained.

In general, screwing in the left hand shunt screw reduces the pickup current of the relay. Screwing in the right hand shunt screw increases the dropout current. This will in turn cause a change in the pickup current, making necessary several slight readjustments of both shunt screws to obtain the desired calibration. The armature as finally calibrated should pickup and dropout with a snappy action.

Operation Indicator

The operation indicator should pick up and drop the indicator target when the current is between 1 and 1.2 amperes d-c. To increase the pick-up current, remove the molded cover and bend the springs out or away from the cover. To decrease the pick-up current, bend the springs in toward the cover.

Make sure that the target drops freely when the unit operates.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

BURDEN DATA OPERATING CURRENT CIRCUIT - 60 CYCLES

Range Amps	Taps	Volt-Amperes Tap Value Current	Power Factor Angle ¢	Volt Amperes at 5 amperes	Power Factor Angle ¢
	.5	.37	39°	24	46°
	.75	.38	36	13	37
.5-2	1	.39	35	8.5	34
	1.25	.41	34	6.0	32
	1.5	.43	32	4.6	31
	2	.45	30	2.9	28
	1	.41	36°	9.0	36°
	1.5	.44	32	5.0	32
1-4	2	.47	30	3.0	29
	2.5	.50	28	2.1	27
	3	.53	26	1.5	26
	4	.59	24	.93	24

RATINGS OF OVERCURRENT UNIT

Range	Continuous Rating Amps	One Second Rating Amps
.5-2	5	100
1-4	5	140

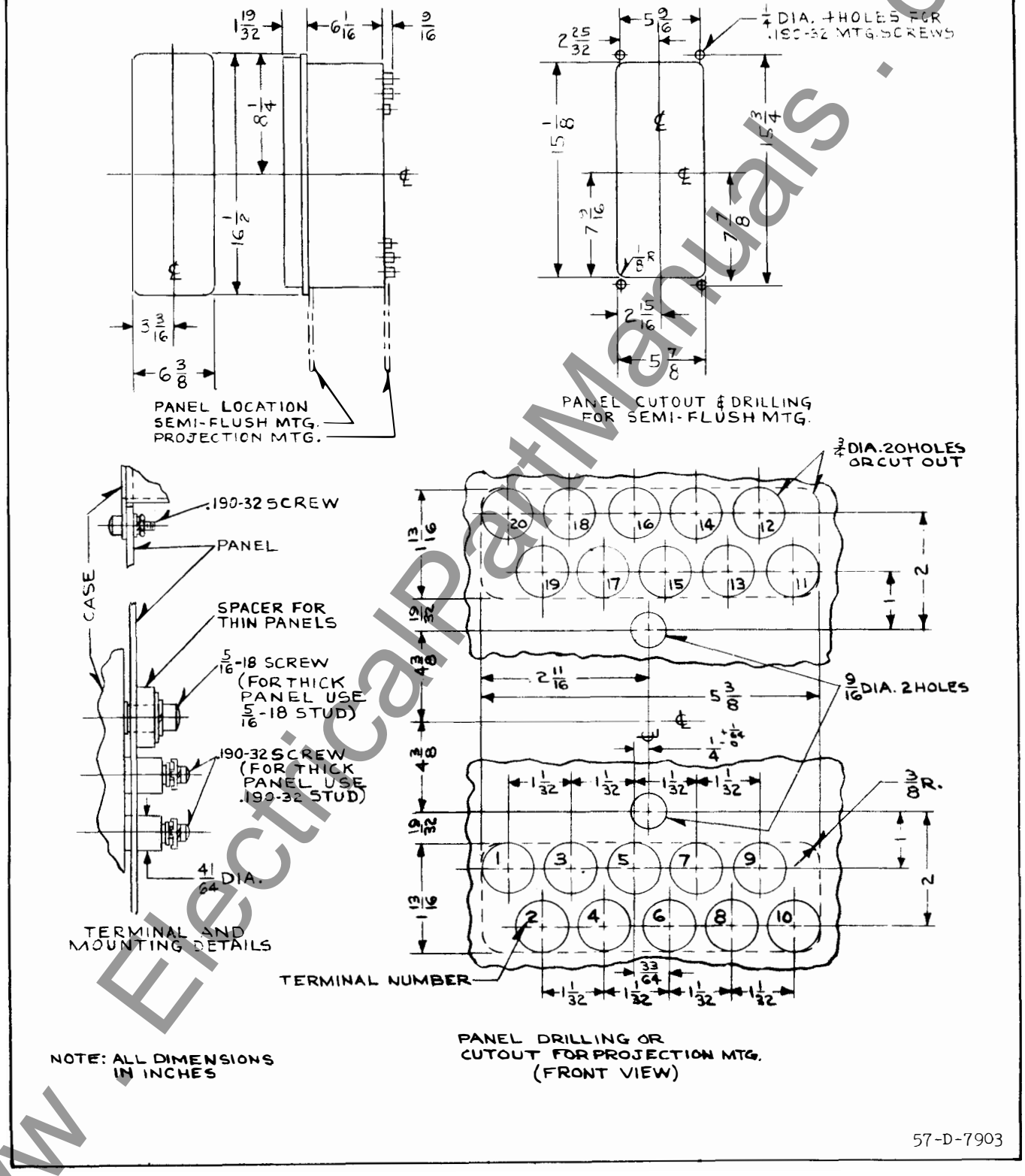

Fig. 5. Outline and Drilling Plan for the type KA Relay in the type FT 32 Case.

WESTINGHOUSE ELECTRIC CORPORATION

RELAY DEPARTMENT **NEWARK, N. J.**

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