INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CRN-1 REVERSE POWER 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 CRN-1 relay is a single phase directionally controlled timing relay used to protect a-c generators from motoring. When such a condition occurs and persists for a predetermined time interval, the generator may be tripped or an alarm sounded. The CRN-1 may also be used to sense lagging power factor load flow in an abnormal direction as shown in fig. 6. The directional unit has 30° maximum torque characteristics and the timer unit is adjustable from approximately 2 to 40 seconds.

CONSTRUCTION AND OPERATION

The relay consists of a directional unit, a timing unit, and an indicating contactor switch unit.

Timer Unit (CV)

The timer unit operates on the induction-disc principle. A main coil located on the center leg of an "E" type laminated structure produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg (front view) to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap causes a contact closing torque.

Directional Unit (D)

The directional unit is a product induction cylinder type unit operating on the interaction between the polarizing circuit flux and the operating circuit flux.

Mechanically, the directional 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 series-connected polarizing coils mounted diametrically opposite one another; two series-connected operating coils mounted diametrically opposite one another; and 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 stops for the moving element contact arm are an integral part of the bridge.

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.

The timer unit cannot be energized unless the power flow is in the tripping direction because its

SUPERSEDES I.L. 41-251.2G
*Denotes change from superseded issue.

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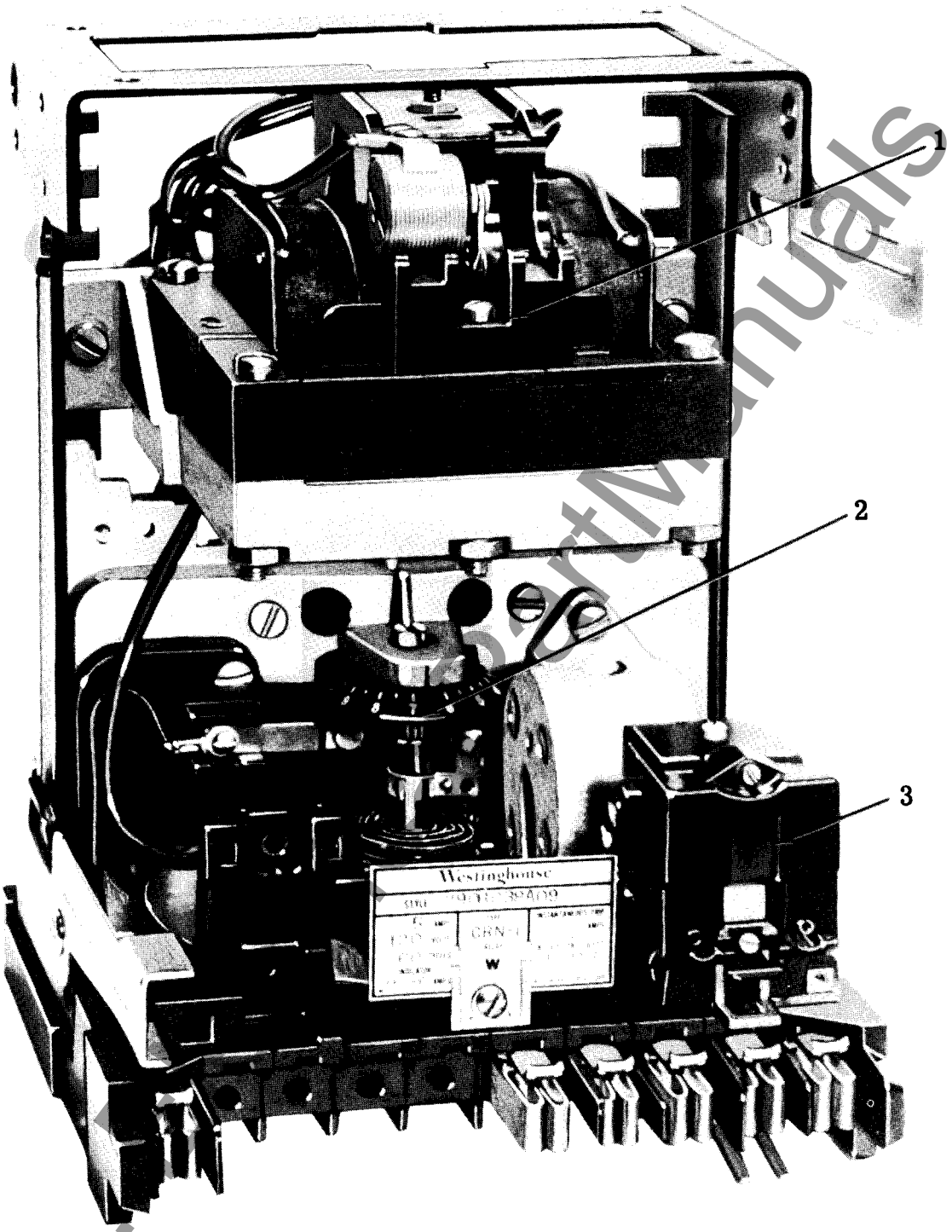


Fig. 1. Type CRN-1 Relay Without Case. 1-Directional Unit (D). 2-Timer Unit (T). 3-Indicating Contactor Switch (ICS).

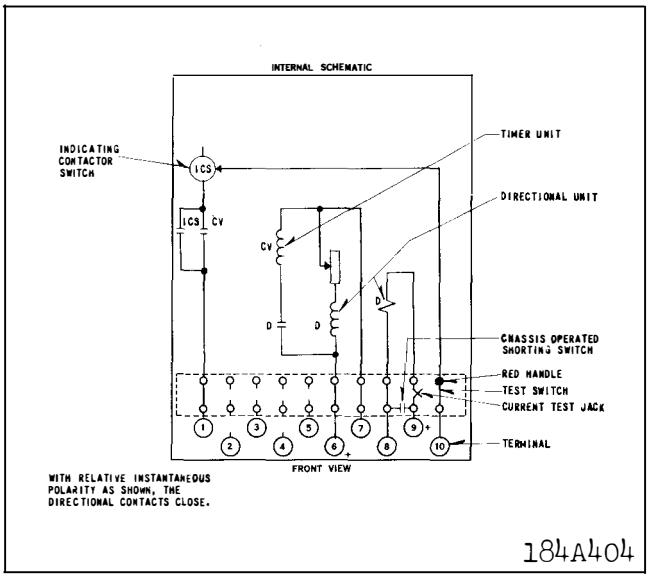


Fig. 2. Internal Schematic of the Single Trip Type CRN-1 Relay in the FT-21 Case.

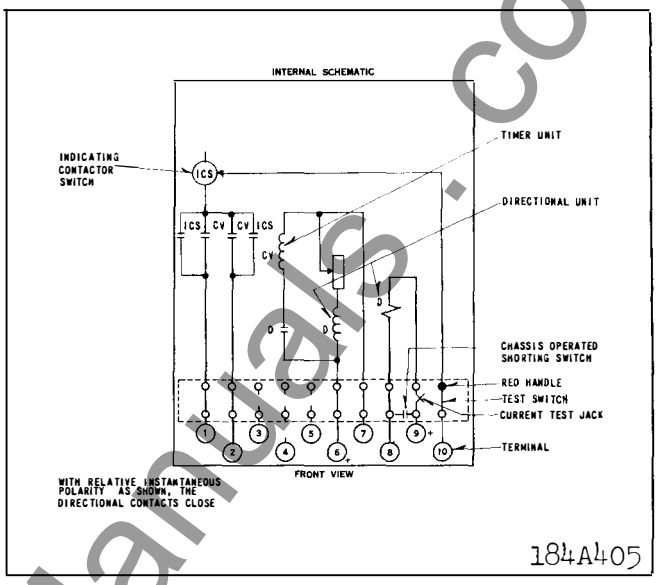


Fig. 3. Internal Schematic of the Double Trip Type CRN-1 Relay in the FT-21 Case.

potential coil is connected in series with the contacts of the directional unit. Hence, the relay is directionally controlled.

Indicating Contactor Switch Unit (ICS)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The type CRN-1 relay is available with either a 120 volt or 208 volt rating.

Timer Unit (CV)

The timer unit is rated at 120 or 208 volts, 60 cycles. The minimum trip value is 54% of rated voltage. The continuous overload capacity is 100% of rated voltage. Characteristic time curves are shown in Fig. 4 for various voltages and time lever settings.

Directional Unit (D)

The directional unit has its maximum torque when the current leads the voltage by 30°. The unit should be connected using the 30° connection. When using this connection the maximum torque of the relay occurs at 100% P.F. The pickup value is .02 amps at rated voltage and max. torque angle. The pickup may be increased to .05 amps or higher by increasing the spring tension.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating Contact Switch (ICS)

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

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 mount-

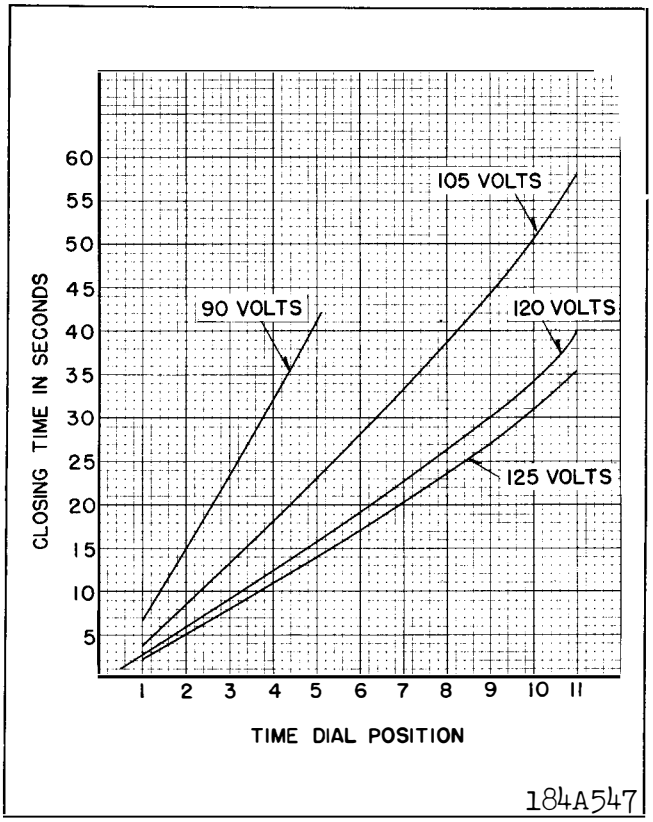


Fig. 4. Typical Time Curves of the Timer Unit of the 120 volt Type CRN-1 Relay. Proportional voltage apply for the 208 volt relay.

ing. Either a mounting stud or the mounting screws may by 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.

For detailed FT case information refer to I.L. 41-076.

For correct operation, the type CRN-1 relay should be connected so that maximum torque occurs for unity power factor on the system. Since the directional unit has a 30^{o} characteristic, this may be accomplished by using the connections shown in Fig. 5.

The voltage operated timer unit should be connected across the line. External schematic for this application as shown in Fig. 5.

SETTINGS

There is only one setting to be determined. This is the time delay of the voltage operated timer, and it is adjusted by the time dial position. Fig. 4 gives a curve of time delay vs time dial setting for various impressed voltages. Time is approximately proportional to time dial setting.

Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energized a 125 or 250 volt d-c type WL relay switch, or equivalent, use the 0.2 ampere tap.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be distrubed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. 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.

Acceptance Check

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

A. Timer Unit (CV)

The directional unit contacts must be in the closed position when checking the operation of the timer unit.

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lowerleft of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right

of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – Set the time dial to position 6. Alternately apply 54% of rated voltage plus 3% and minus 3%. The moving contact should leave the backstop at plus 3% and should return to the backstop at minus 3%.

3. Time Curve – Fig. 4 shows the time curve for the CRN-1 relay. With the time dial set to the indicated position, apply the voltages specified and measure the operating time of the relay. The operating times should equal those of Fig. 4 plus or minus 5 percent.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

C. Directional Unit (D)

1. Contact Gap – The gap between the stationary contact and moving contact with the relay in a de-energized position should be approximately .022".

2. Sensitivity – The respective directional units should trip with value of energization and phase angle relationships as indicated in Table 1. The pickup may be increased to .05 amps or higher by increasing the spring tension.

Routine Maintenance

All relays should be inspected periodically and the time of 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. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces an error in timing.

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").

A. Timer Unit (CV)

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – The adjustment of the spring tension in setting the minimum trip current value of the relay is most conveniently made with the damping magnet removed. Close directional contacts.

With the time dial set on "0", wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

Set the relay time dial to position 6.

Adjust the control spring tension so that the moving contact will leave the backstop at 65 volts +1.0% and will return to the backstop at 65 volts -1.0%.

TABLE 1

DIRECTIONAL UNIT SENSITIVITY

Relay Type	Rating Volts	Values for Min. Pick-Up†		Phase Angle Relationship
		Volts	Amperes	
CRN-1	120	Rated	.020	I leading V by 30° ††
	or 208	Rated	.023	I in-phase with V

† *The energization quantities are input quantities at the relay terminals.*

†† *Maximum torque angle.*

3. Time Curve Calibration – Install the permanent magnet.

Set the time dial to position #11. Apply rated voltage to terminals 6 and 7 with directional contacts closed. Adjust the permanent magnet keeper until the operating time is 40 seconds ±3%.

B. Indicating Contactor Switch – Unit (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The indicator target should drop freely.

C. Directional Unit (D)

1. The upper pin bearing should be screwed down until there is approximately .025" clearance between it and the top of shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

2. The contact gap adjustment for the directional unit is made as follows:

With the moving contact in the normally-opened position, i.e. against the right stop on bridge, screw in the stationary contact until both contacts just close as indicated by a neon lamp in the contact circuit. Then, screw the stationary contact away from the moving contact 3/4 of a turn. 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.

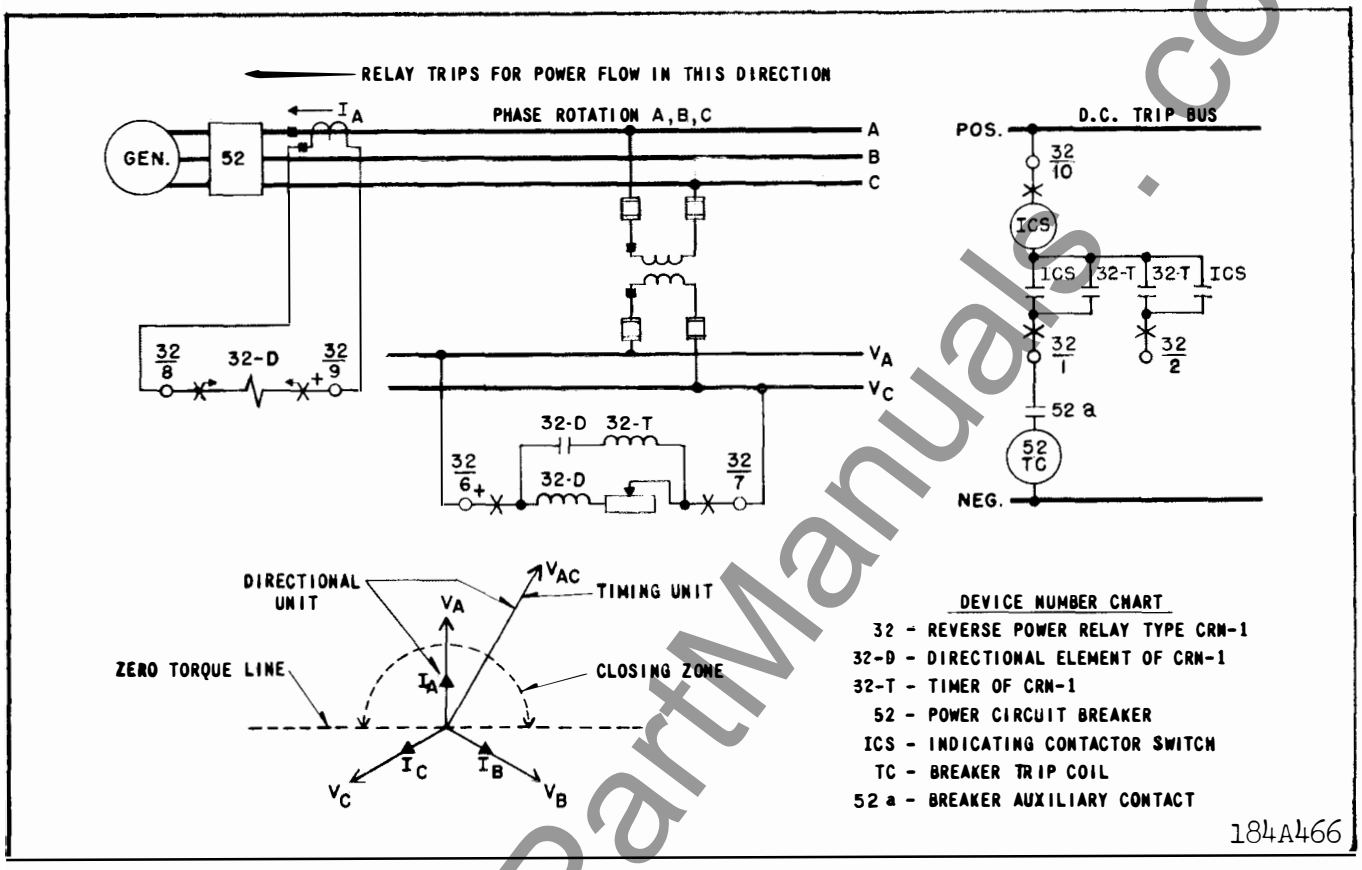
The set screw in the stationary contacts have been shop adjusted for optimum follow and this adjustment should not be disturbed.

The moving contact assembly has been factory adjusted for low contact bounce performance and should not be changed.

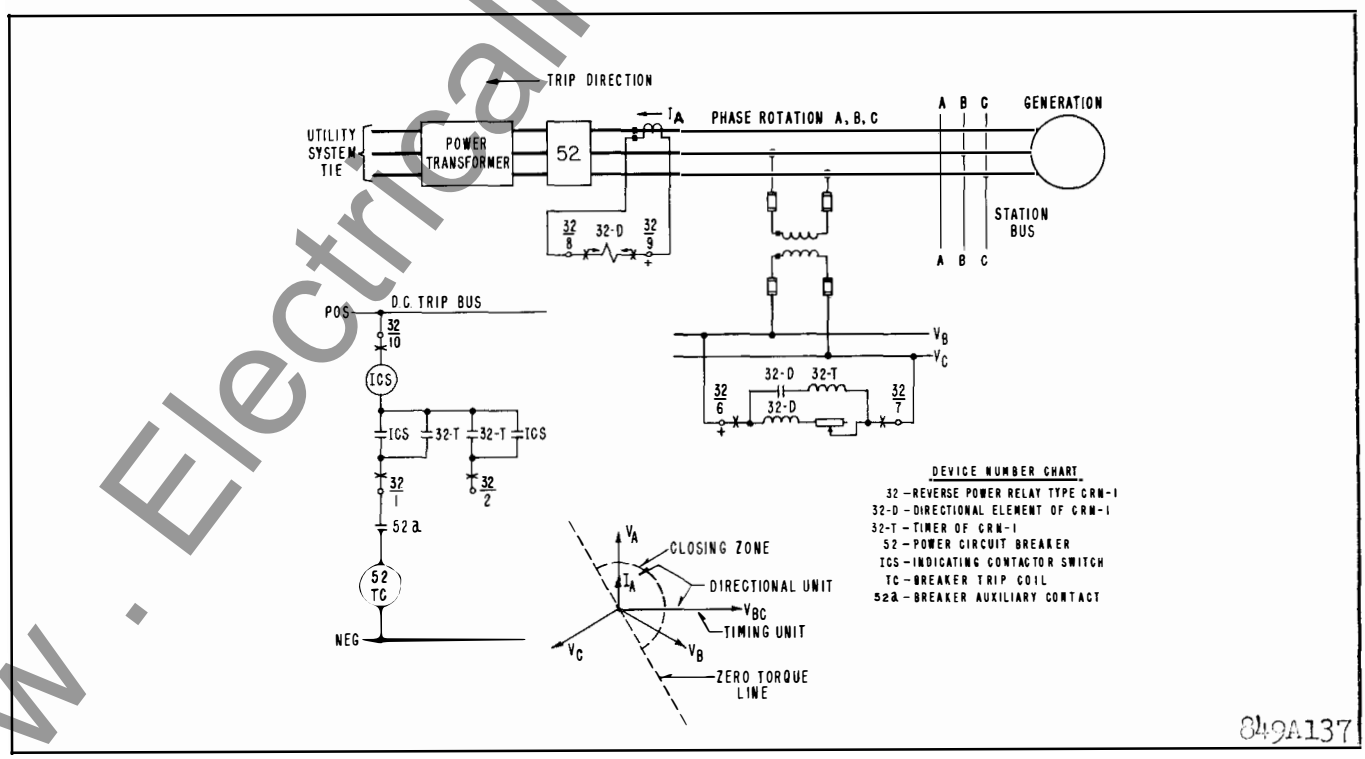
3. Maximum Torque Adjustment – Apply rated voltage to terminals 6 and 7, and 4 amperes to terminals 8 and 9, making sure the polarities are correct. With the voltage and current in phase, the contacts should close. Now adjust the angle between current and voltage to 120° (current leading the voltage). Adjust the resistor to just close the contacts. Contacts should open when the angle between current and voltage is 120° + 1° leading.

4. 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.

The spring is to be adjusted such that the contacts will close as indicated by a neon lamp in the contact circuit when energized with the required current and voltage as shown in Table 1. This table indicates that the spring can be adjusted when the phase angle relationship between the operating circuit and the polarizing circuit is at the maximum torque angle or when the circuit relationship has the operating and polarizing circuits in phase. It is recommended that a single phase (in phase relation-



** Fig. 5. External Schematic of the Type CRN-1 for Reverse Power Protection.*



** Fig. 6 External Schematic of the CRN-1 Relay to Prevent Reverse Magnetization When Utility Tie is Removed From the Local System.*

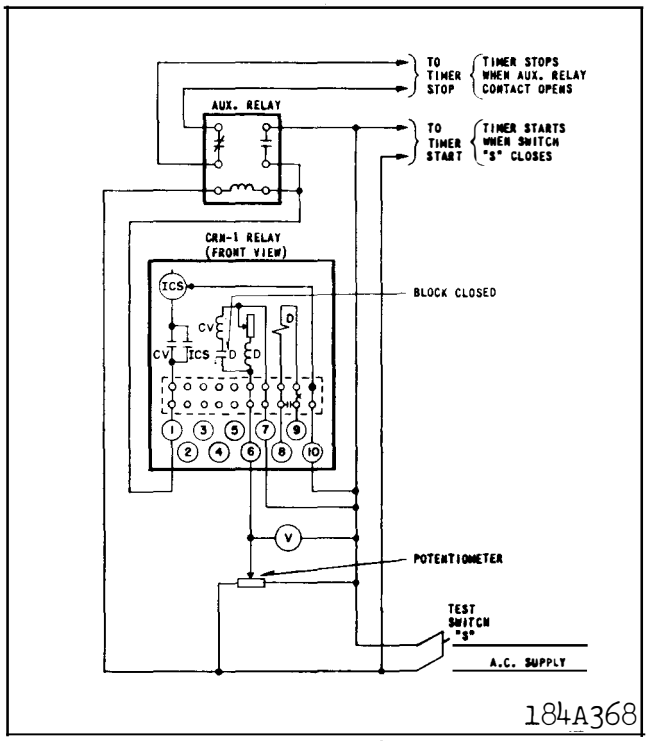


Fig. 7. Test Connections for the Timer Unit of the Type CRN-1 Relay in the Type FT-21 Case.

ship) set-up be used as a matter of ease and convenience.

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

The 60 cycle burden of the units of the type CRN-1 relay are as follows:

Coil	Burden at	Volt-Amperes	Power □ Factor
Timer	Rated voltage	6.5	73°
Directional Potential	Rated voltage	3.5	60°
Directional Current	5 Amps.	5.5	47°

□ Angle that current lags the voltage.

*

RATINGS

Circuit	Continuous
Voltage	132 Vac
Current	5 Amps.

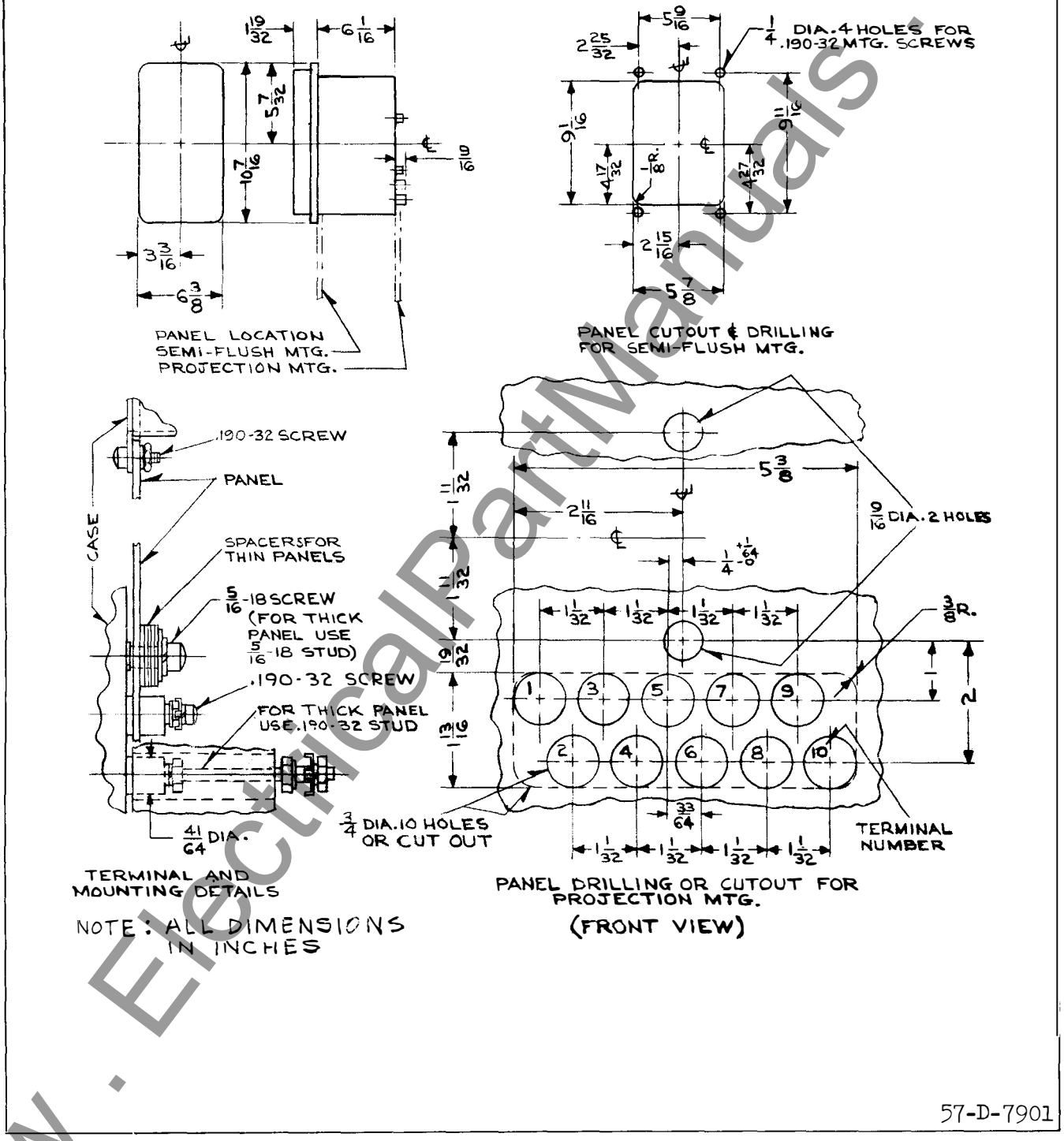


Fig. 8. Outline and Drilling Plan for the Type CRN-1 Relay in the Type FT-21 Case.

WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.

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APPLICATION

* The type CRN-1 relay is a single phase directionally controlled timing relay used to protect a-c generators from motoring. When such a condition occurs and persists for a predetermined time interval, the generator may be tripped or an alarm sounded. The directional unit has 30° maximum torque characteristics and the timer unit is adjustable from approximately 2 to 40 seconds.

CONSTRUCTION AND OPERATION

The relay consists of a directional unit, a timing unit, and an indicating contactor switch unit.

Timer Unit (CV)

The timer unit operates on the induction-disc principle. A main coil located on the center leg of an "E" type laminated structure produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg (front view) to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap causes a contact closing torque.

Directional Unit (D)

The directional unit is a product induction cylinder type unit operating on the interaction between the polarizing circuit flux and the operating circuit flux.

Mechanically, the directional 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 series-connected polarizing coils mounted diametrically opposite one another; two series-connected operating coils mounted diametrically opposite one another; and 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 stops for the moving element contact arm are an integral part of the bridge.

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.

The timer unit cannot be energized unless the power flow is in the tripping direction because its

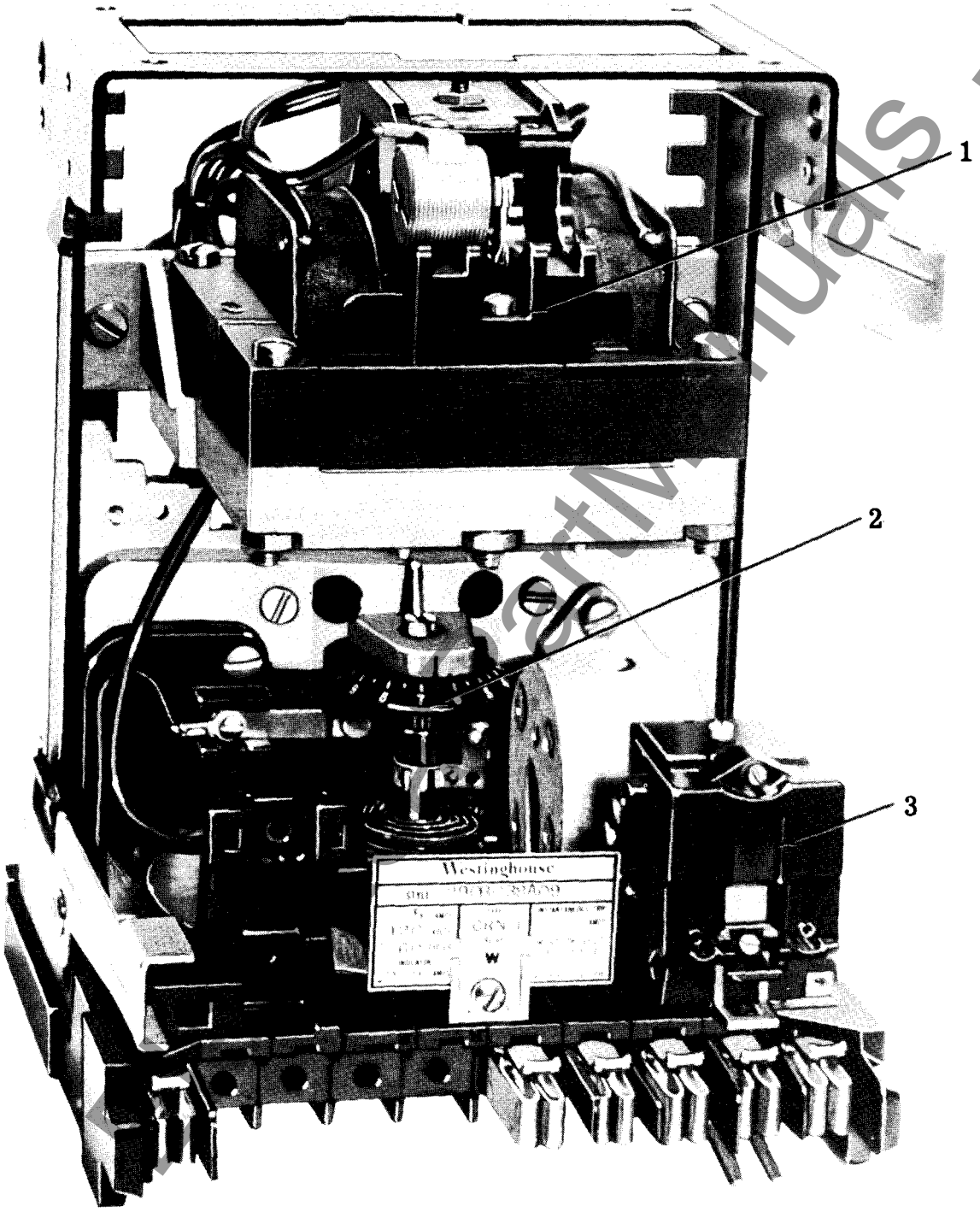


Fig. 1. Type CRN-1 Relay Without Case. 1-Directional Unit (D). 2-Timer Unit (T). 3-Indicating Contactor Switch (ICS).

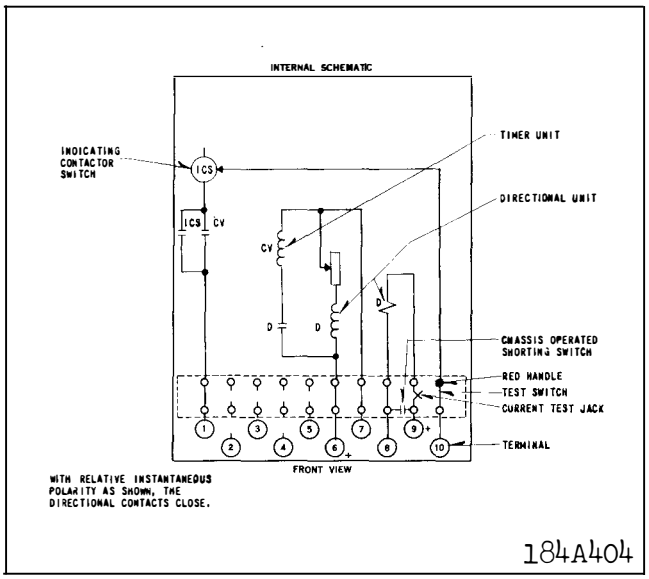


Fig. 2. Internal Schematic of the Single Trip Type CRN-1 Relay in the FT-21 Case.

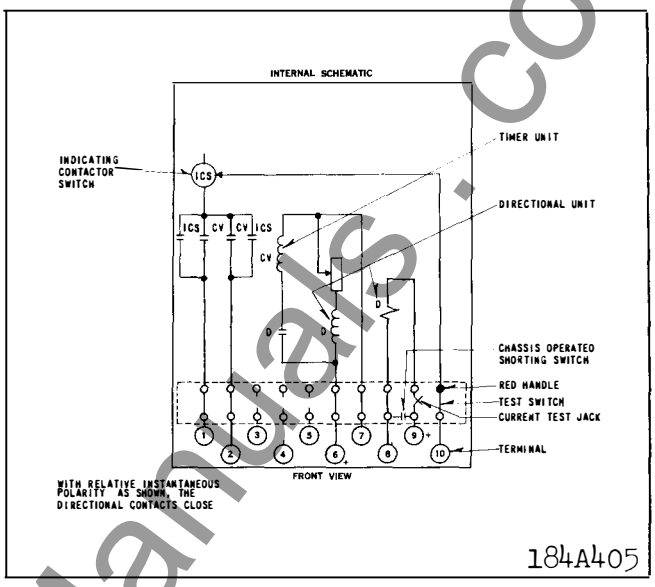


Fig. 3. Internal Schematic of the Double Trip Type CRN-1 Relay in the FT-21 Case.

potential coil is connected in series with the contacts of the directional unit. Hence, the relay is directionally controlled.

Indicating Contactor Switch Unit (ICS)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The type CRN-1 relay is available with either a 120 volt or 208 volt rating.

Timer Unit (CV)

The timer unit is rated at 120 or 208 volts, 60 cycles. The minimum trip value is 54% of rated voltage. The continuous overload capacity is 110% of rated voltage. Characteristic time curves are shown in Fig. 4 for various voltages and time lever settings.

Directional Unit (D)

The directional unit has its maximum torque when the current leads the voltage by 30^{o}. The unit should be connected using the 30^{o} connection. When using this connection the maximum torque of the relay occurs at 100% P.F.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating Contact Switch (ICS)

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

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 mount-

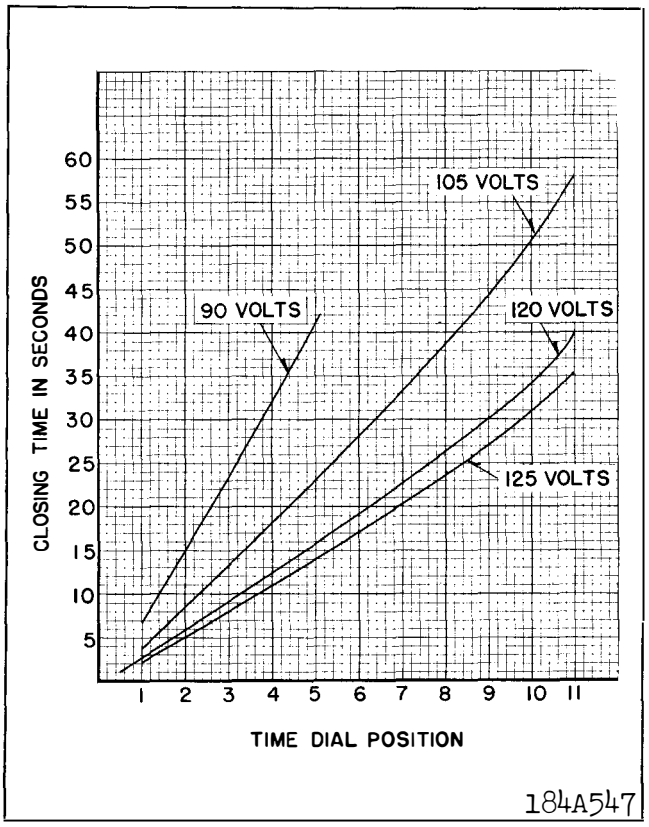


Fig. 4. Typical Time Curves of the Timer Unit of the 120 volt Type CRN-1 Relay. Proportional voltage apply for the 208 volt relay.

ing. Either a mounting stud or the mounting screws may by 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.

For detailed FT case information refer to I.L. 41-076.

For correct operation, the type CRN-1 relay should be connected so that maximum torque occurs for unity power factor on the system. Since the directional unit has a 30^{O} characteristic, this may be accomplished by using the connections shown in Fig. 5.

The voltage operated timer unit should be connected across the line. External schematic for this application as shown in Fig. 5.

SETTINGS

There is only one setting to be determined. This is the time delay of the voltage operated timer, and it is adjusted by the time dial position. Fig. 4 gives a curve of time delay vs time dial setting for various impressed voltages. Time is approximately proportional to time dial setting.

Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energized a 125 or 250 volt d-c type WL relay switch, or equivalent, use the 0.2 ampere tap.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be distrubed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. 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.

Acceptance Check

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

A. Timer Unit (CV)

The directional unit contacts must be in the closed position when checking the operation of the timer unit.

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right

of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – Set the time dial to position 6. Alternately apply 54% of rated voltage plus 3% and minus 3%. The moving contact should leave the backstop at plus 3% and should return to the backstop at minus 3%.

3. Time Curve – Fig. 4 shows the time curve for the CRN-1 relay. With the time dial set to the indicated position, apply the voltages specified and measure the operating time of the relay. The operating times should equal those of Fig. 4 plus or minus 5 percent.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

C. Directional Unit (D)

1. Contact Gap – The gap between the stationary contact and moving contact with the relay in a de-energized position should be approximately .020".

2. Sensitivity – The respective directional units should trip with value of energization and phase angle relationships as indicated in Table 1.

Routine Maintenance

All relays should be inspected periodically and the time of 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. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces an error in timing.

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").

A. Timer Unit (CV)

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – The adjustment of the spring tension in setting the minimum trip current value of the relay is most conveniently made with the damping magnet removed. Close directional contacts.

With the time dial set on "0", wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

Set the relay time dial to position 6.

Adjust the control spring tension so that the moving contact will leave the backstop at 65 volts +1.0% and will return to the backstop at 65 volts -1.0%.

TABLE 1

DIRECTIONAL UNIT SENSITIVITY

Relay Type	Rating Volts	Values for Min. Pick-Up†		Phase Angle Relationship
		Volts	Amperes	
CRN-1	120	Rated	.020	I leading V by 30° ††
	or 208	Rated	.023	I in-phase with V

† *The energization quantities are input quantities at the relay terminals.*

†† *Maximum torque angle.*

3. Time Curve Calibration – Install the permanent magnet.

Set the time dial to position #11. Apply rated voltage to terminals 6 and 7 with directional contacts closed. Adjust the permanent magnet keeper until the operating time is 40 seconds ±3%.

B. Indicating Contactor Switch – Unit (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The indicator target should drop freely.

C. Directional Unit (D)

1. The upper pin bearing should be screwed down until there is approximately .025" clearance between it and the top of shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

2. The contact gap adjustment for the directional unit is made as follows:

With the moving contact in the normally-opened position, i.e. against the right stop on bridge, screw in the stationary contact until both contacts just close as indicated by a neon lamp in the contact circuit. Then, screw the stationary contact away from the moving contact 3/4 of a turn. 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.

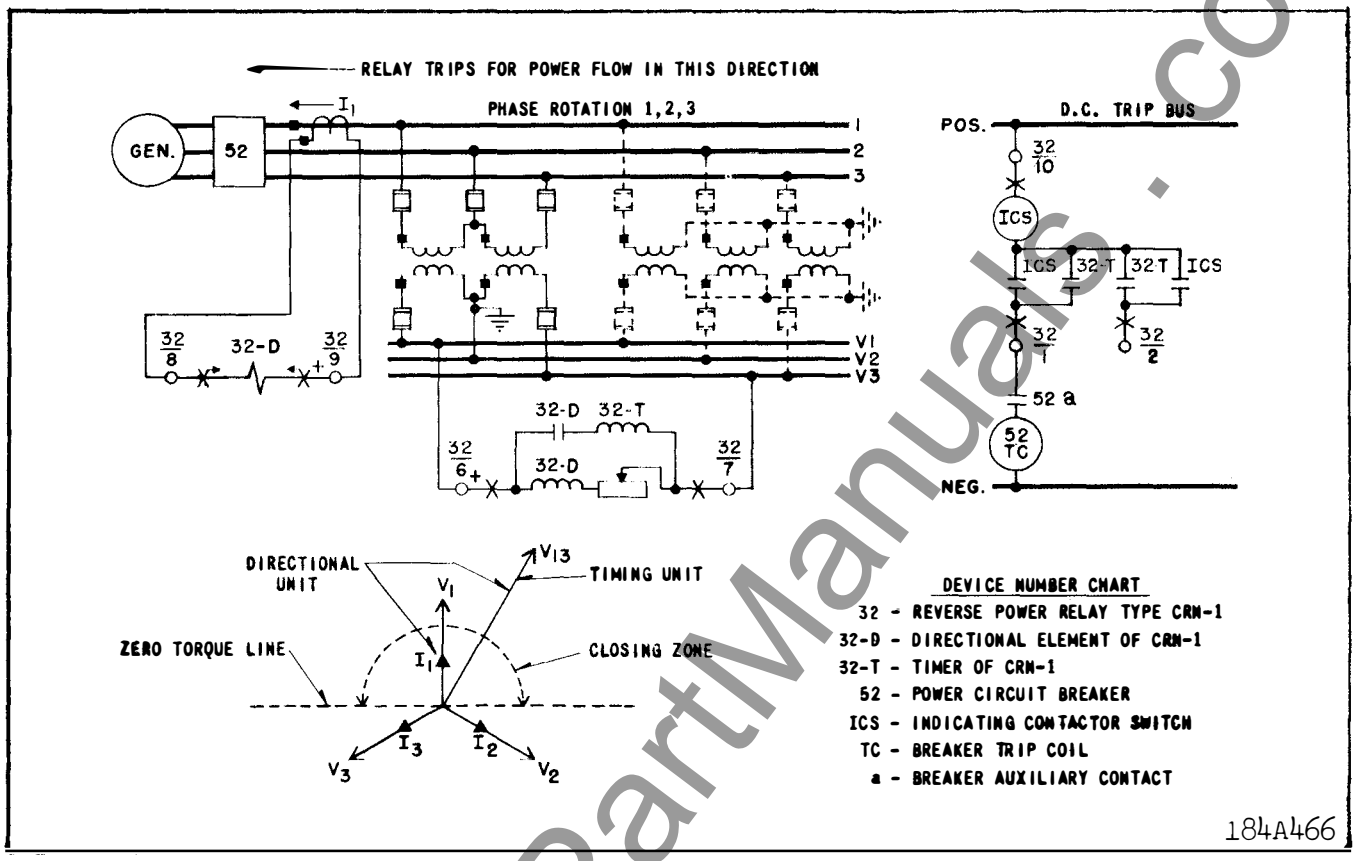
The set screw in the stationary contacts have been shop adjusted for optimum follow and this adjustment should not be disturbed.

The moving contact assembly has been factory adjusted for low contact bounce performance and should not be changed.

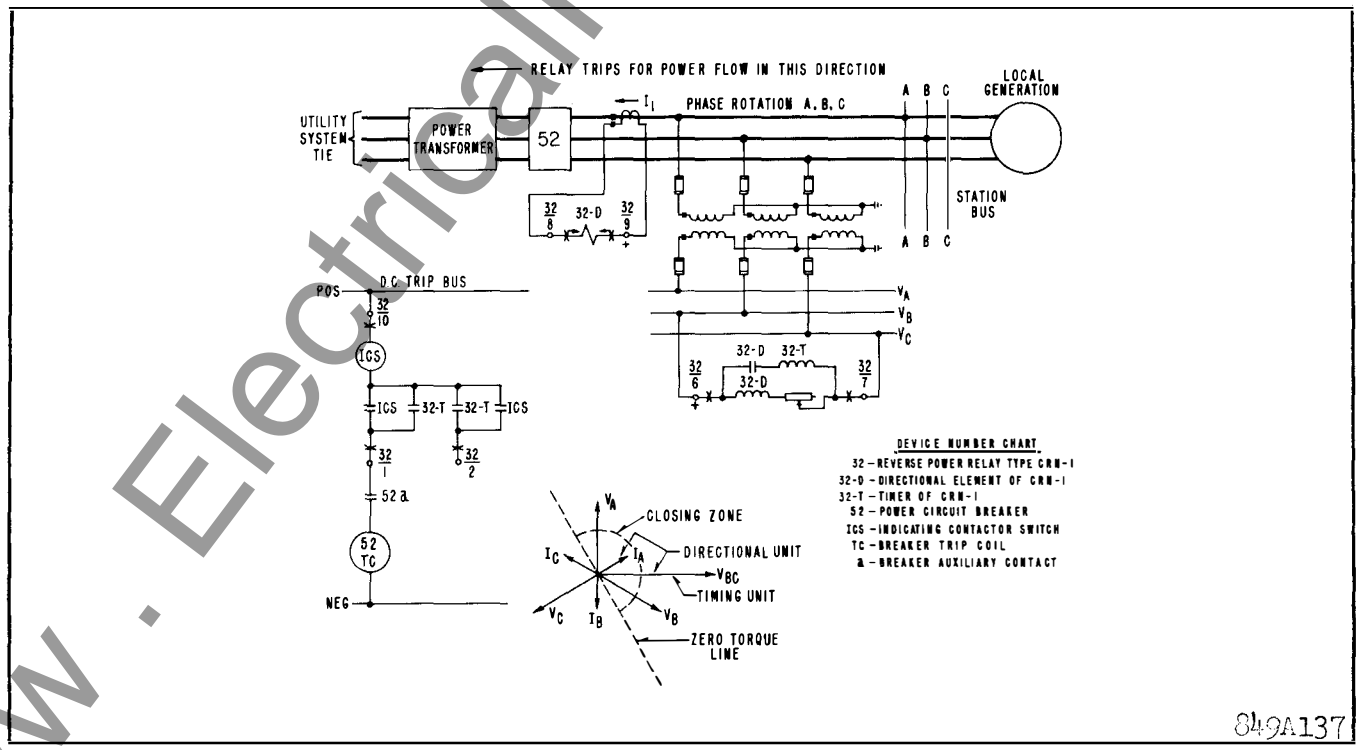
3. Maximum Torque Adjustment – Apply rated voltage to terminals 6 and 7, and 4 amperes to terminals 8 and 9, making sure the polarities are correct. With the voltage and current in phase, the contacts should close. Now adjust the angle between current and voltage to 120° (current leading the voltage). Adjust the resistor to just close the contacts. Contacts should open when the angle between current and voltage is 120° + 1° leading.

4. 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.

The spring is to be adjusted such that the contacts will close as indicated by a neon lamp in the contact circuit when energized with the required current and voltage as shown in Table 1. This table indicates that the spring can be adjusted when the phase angle relationship between the operating circuit and the polarizing circuit is at the maximum torque angle or when the circuit relationship has the operating and polarizing circuits in phase. It is recommended that a single phase (in phase relation-



** Fig. 5. External Schematic of the Type CRN-1 for Reverse Power Protection.*



** Fig. 6 External Schematic of the CRN-1 Relay to Prevent Reverse Magnetization When Utility Tie is Removed From the Local System.*

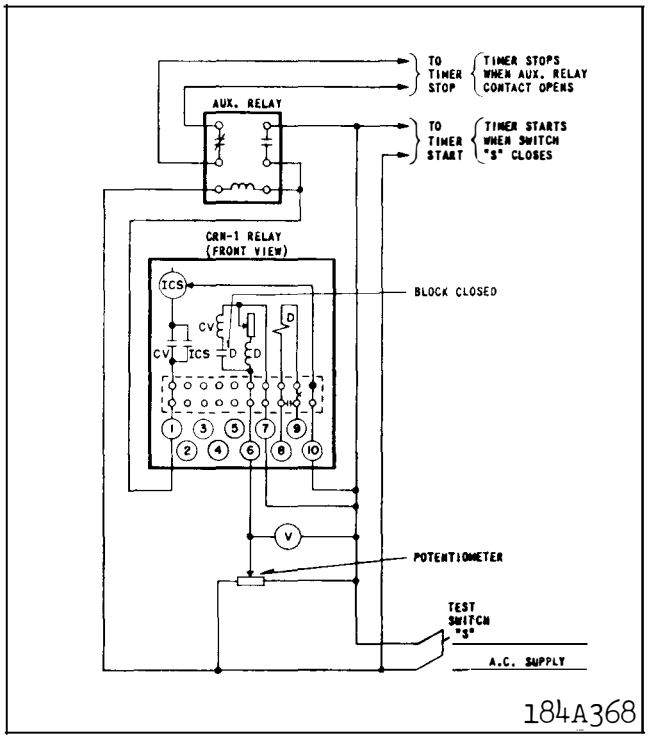


Fig. 7. Test Connections for the Timer Unit of the Type CRN-1 Relay in the Type FT-21 Case.

ship) set-up be used as a matter of ease and convenience.

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

The 60 cycle burden of the units of the type CRN-1 relay are as follows:

Coil	Burden at	Volt-Amperes	Power □ Factor
Timer	Rated voltage	6.5	73°
Directional Potential	Rated voltage	3.5	60°
Directional Current	5 Amps.	5.5	47°

□ Angle that current lags the voltage.

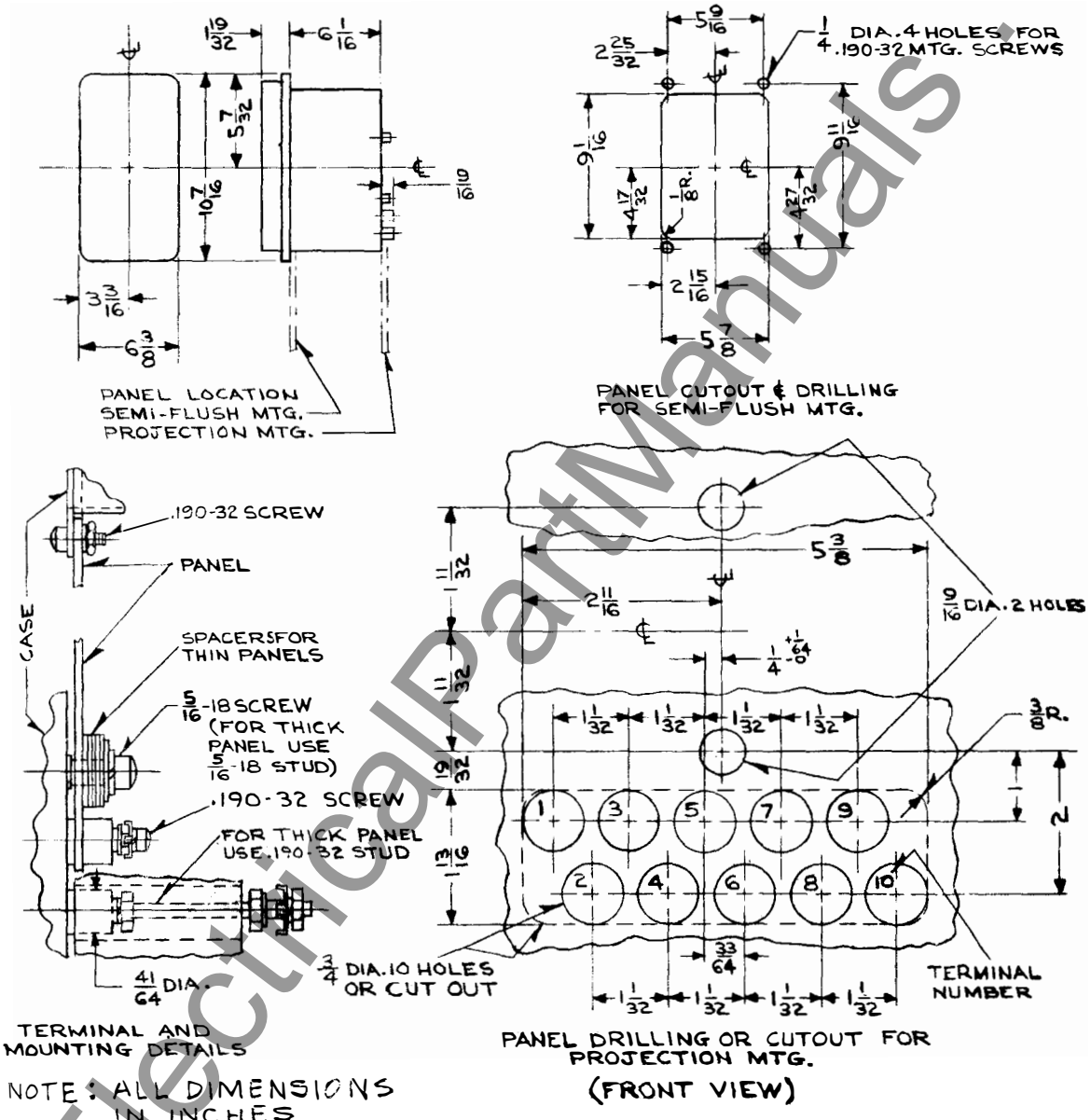
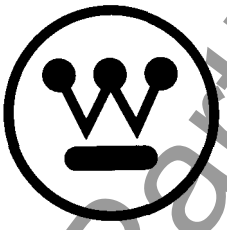


Fig. 8. Outline and Drilling Plan for the Type CRN-1 Relay in the Type FT-21 Case.



WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CRN-1 REVERSE POWER 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 CRN-1 relay is a single phase directionally controlled timing relay used to protect a-c generators from motoring. When such a condition occurs and persists for a predetermined time interval, the generator may be tripped or an alarm sounded. The directional unit has 30° maximum torque characteristics and the timer unit is adjustable from approximately 2 to 40 seconds.

CONSTRUCTION AND OPERATION

The relay consists of a directional unit, a timing unit, and an indicating contactor switch unit.

Timer Unit (CV)

The timer unit operates on the induction-disc principle. A main coil located on the center leg of an "E" type laminated structure produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg (front view) to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap causes a contact closing torque.

Directional Unit (D)

The directional unit is a product induction cylinder type unit operating on the interaction between the polarizing circuit flux and the operating circuit flux.

Mechanically, the directional 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 series-connected polarizing coils mounted diametrically opposite one another; two series-connected operating coils mounted diametrically opposite one another; and 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 stops for the moving element contact arm are an integral part of the bridge.

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.

The timer unit cannot be energized unless the power flow is in the tripping direction because its

SUPERSEDES I.L. 41-251.2D
*Denotes change from superseded issue.

EFFECTIVE OCTOBER 1967

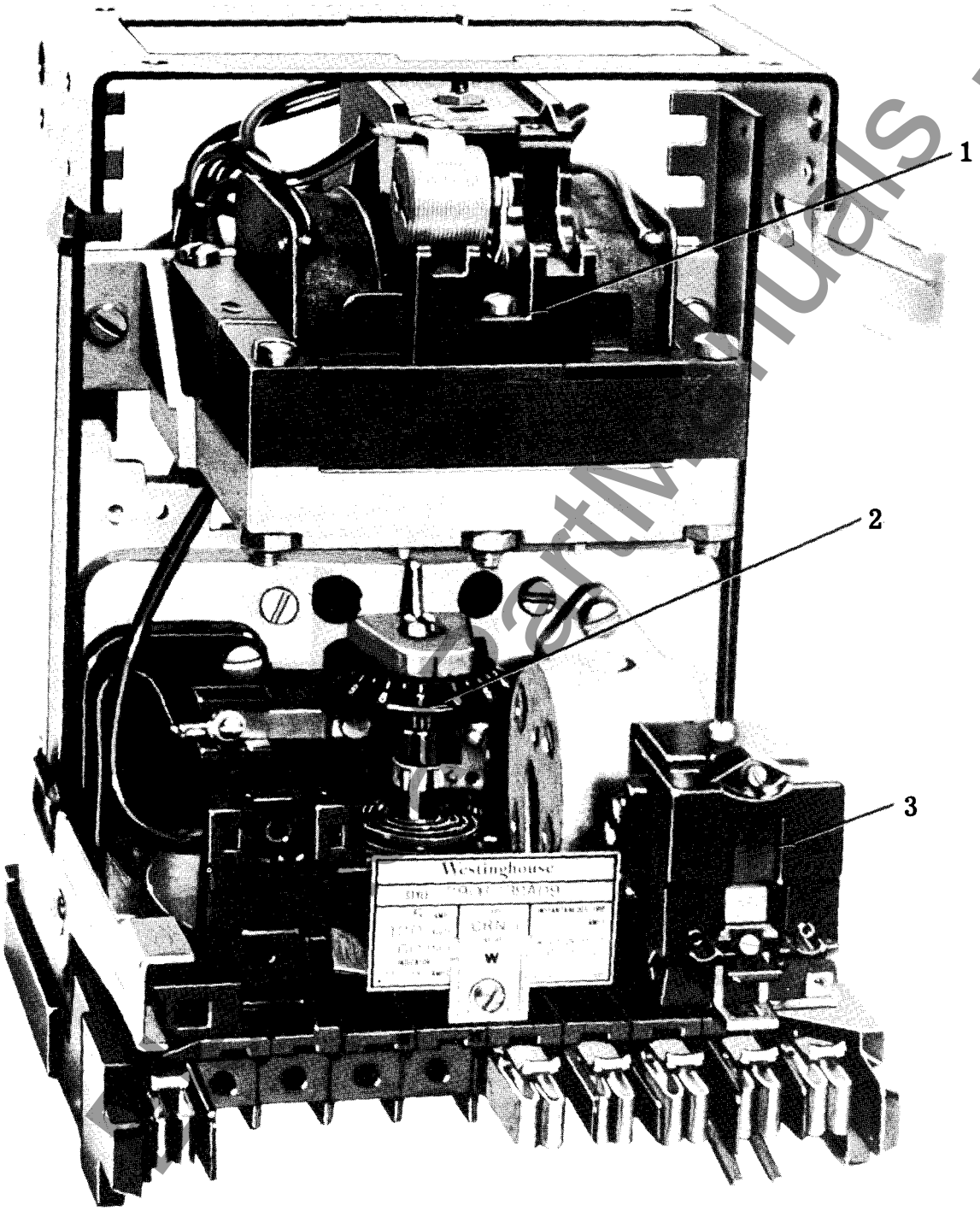


Fig. 1. Type CRN-1 Relay Without Case. 1-Directional Unit (D). 2-Timer Unit (T). 3-Indicating Contactor Switch (ICS).

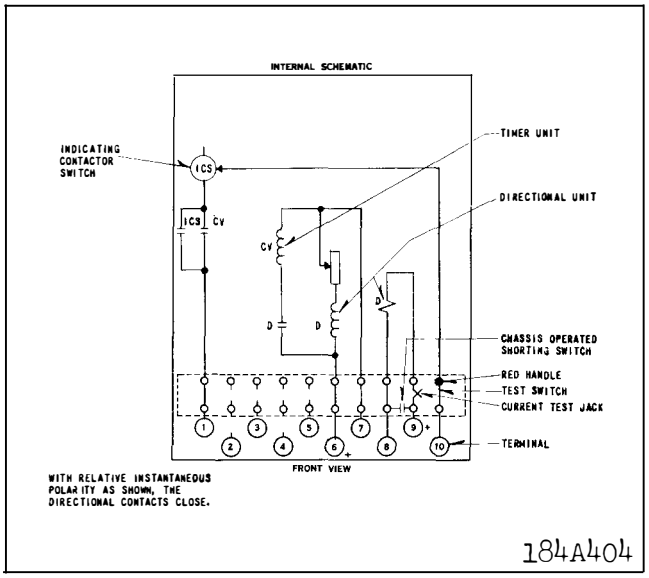


Fig. 2. Internal Schematic of the Single Trip Type CRN-1 Relay in the FT-21 Case.

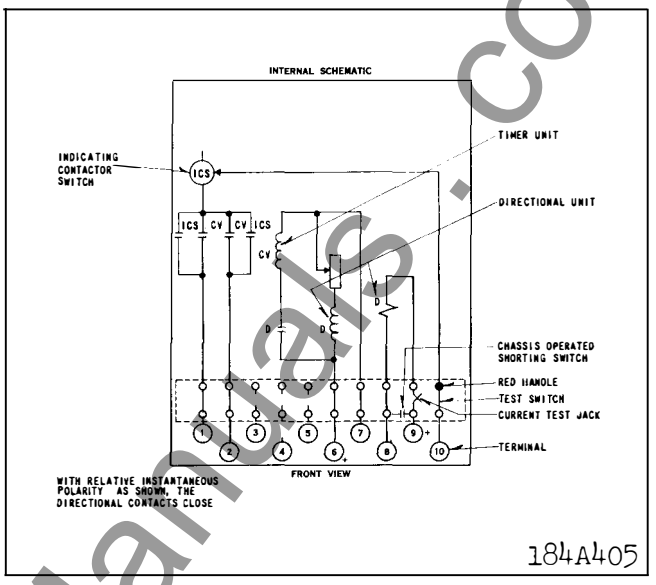


Fig. 3. Internal Schematic of the Double Trip Type CRN-1 Relay in the FT-21 Case.

potential coil is connected in series with the contacts of the directional unit. Hence, the relay is directionally controlled.

Indicating Contactor Switch Unit (ICS)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The type CRN-1 relay is available with either a 120 volt or 208 volt rating.

Timer Unit (CV)

The timer unit is rated at 120 or 208 volts, 60 cycles. The minimum trip value is 54% of rated voltage. The continuous overload capacity is 110% of rated voltage. Characteristic time curves are shown in Fig. 4 for various voltages and time lever settings.

Directional Unit (D)

The directional unit has its maximum torque when the current leads the voltage by 30°. The unit should be connected using the 30° connection. When using this connection the maximum torque of the relay occurs at 100% P.F.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating Contact Switch (ICS)

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

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 mount-

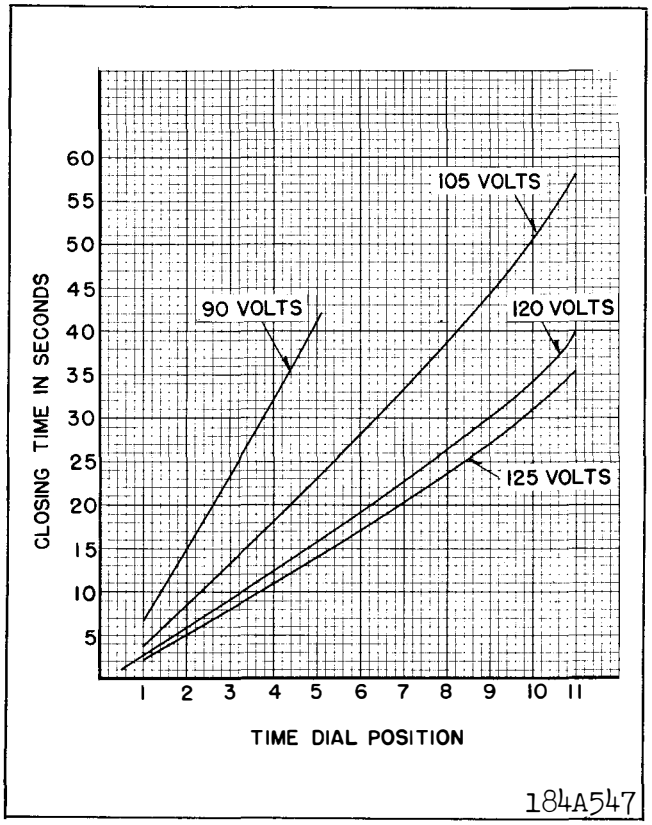


Fig. 4. Typical Time Curves of the Timer Unit of the 120 volt Type CRN-1 Relay. Proportional voltage apply for the 208 volt relay.

ing. Either a mounting stud or the mounting screws may by 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.

For detailed FT case information refer to I.L. 41-076.

For correct operation, the type CRN-1 relay should be connected so that maximum torque occurs for unity power factor on the system. Since the directional unit has a 30^{o} characteristic, this may be accomplished by using the connections shown in Fig. 5.

The voltage operated timer unit should be connected across the line. External schematic for this application as shown in Fig. 5.

SETTINGS

There is only one setting to be determined. This is the time delay of the voltage operated timer, and it is adjusted by the time dial position. Fig. 4 gives a curve of time delay vs time dial setting for various impressed voltages. Time is approximately proportional to time dial setting.

Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energized a 125 or 250 volt d-c type WL relay switch, or equivalent, use the 0.2 ampere tap.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be distrubed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. 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.

Acceptance Check

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

A. Timer Unit (CV)

The directional unit contacts must be in the closed position when checking the operation of the timer unit.

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right

of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – Set the time dial to position 6. Alternately apply 54% of rated voltage plus 3% and minus 3%. The moving contact should leave the backstop at plus 3% and should return to the backstop at minus 3%.

3. Time Curve – Fig. 4 shows the time curve for the CRN-1 relay. With the time dial set to the indicated position, apply the voltages specified and measure the operating time of the relay. The operating times should equal those of Fig. 4 plus or minus 5 percent.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

C. Directional Unit (D)

1. Contact Gap – The gap between the stationary contact and moving contact with the relay in a de-energized position should be approximately .020".

2. Sensitivity – The respective directional units should trip with value of energization and phase angle relationships as indicated in Table 1.

Routine Maintenance

All relays should be inspected periodically and the time of 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. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces an error in timing.

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").

A. Timer Unit (CV)

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – The adjustment of the spring tension in setting the minimum trip current value of the relay is most conveniently made with the damping magnet removed. Close directional contacts.

With the time dial set on "0", wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

Set the relay time dial to position 6.

Adjust the control spring tension so that the moving contact will leave the backstop at 65 volts +1.0% and will return to the backstop at 65 volts −1.0%.

TABLE 1

DIRECTIONAL UNIT SENSITIVITY

Relay Type	Rating Volts	Values for Min. Pick-Up†		Phase Angle Relationship
		Volts	Amperes	
CRN-1	120	Rated	.020	I leading V by 30° ††
	or 208	Rated	.023	I in-phase with V

† *The energization quantities are input quantities at the relay terminals.*

†† *Maximum torque angle.*

3. Time Curve Calibration — Install the permanent magnet.

Set the time dial to position #11. Apply rated voltage to terminals 6 and 7 with directional contacts closed. Adjust the permanent magnet keeper until the operating time is 40 seconds ±3%.

B. Indicating Contactor Switch — Unit (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The indicator target should drop freely.

C. Directional Unit (D)

1. The upper pin bearing should be screwed down until there is approximately .025" clearance between it and the top of shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

2. The contact gap adjustment for the directional unit is made as follows:

With the moving contact in the normally-opened position, i.e. against the right stop on bridge, screw in the stationary contact until both contacts just close as indicated by a neon lamp in the contact circuit. Then, screw the stationary contact away from the moving contact 3/4 of a turn. 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.

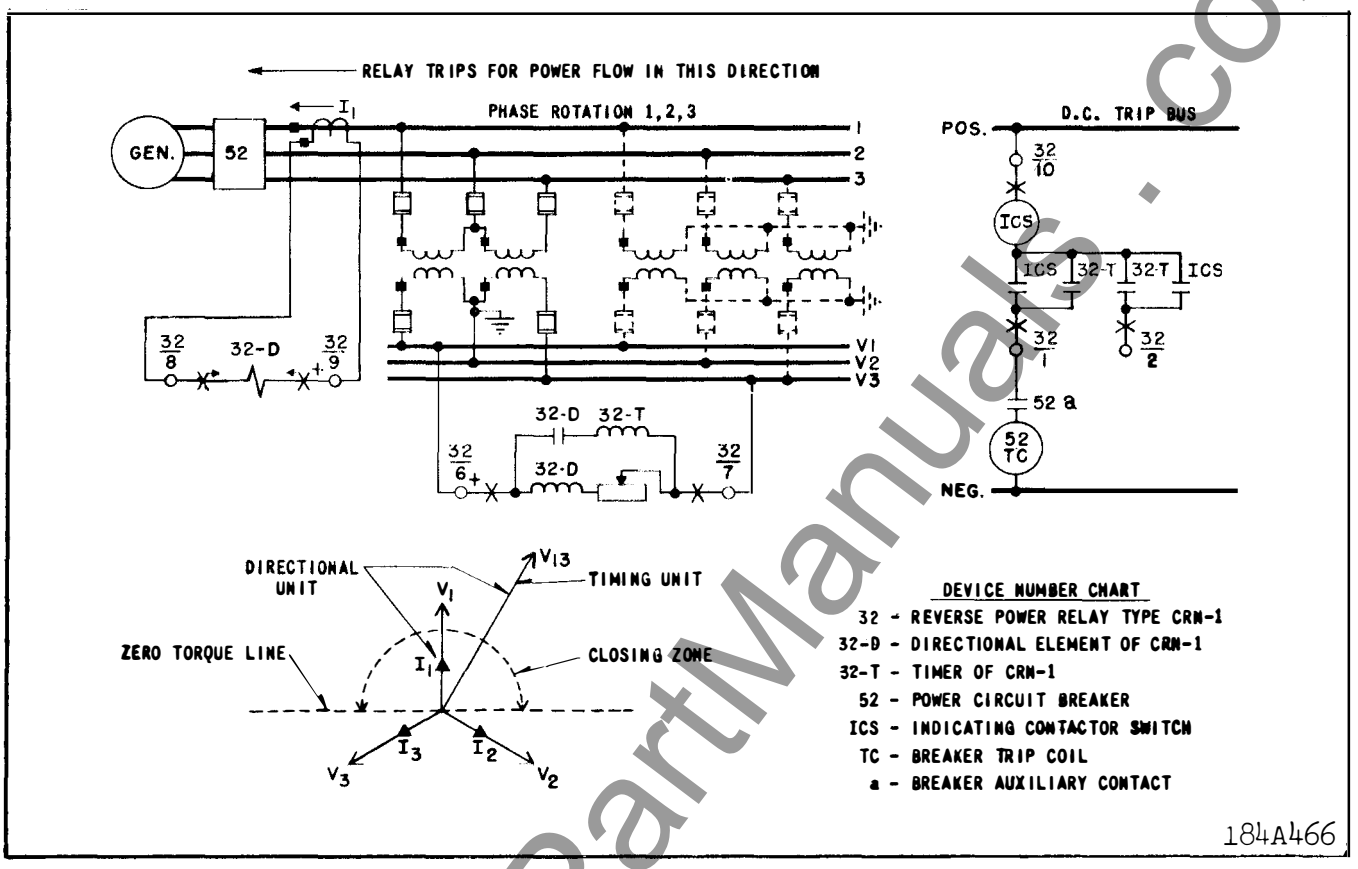
The set screw in the stationary contacts have been shop adjusted for optimum follow and this adjustment should not be disturbed.

The moving contact assembly has been factory adjusted for low contact bounce performance and should not be changed.

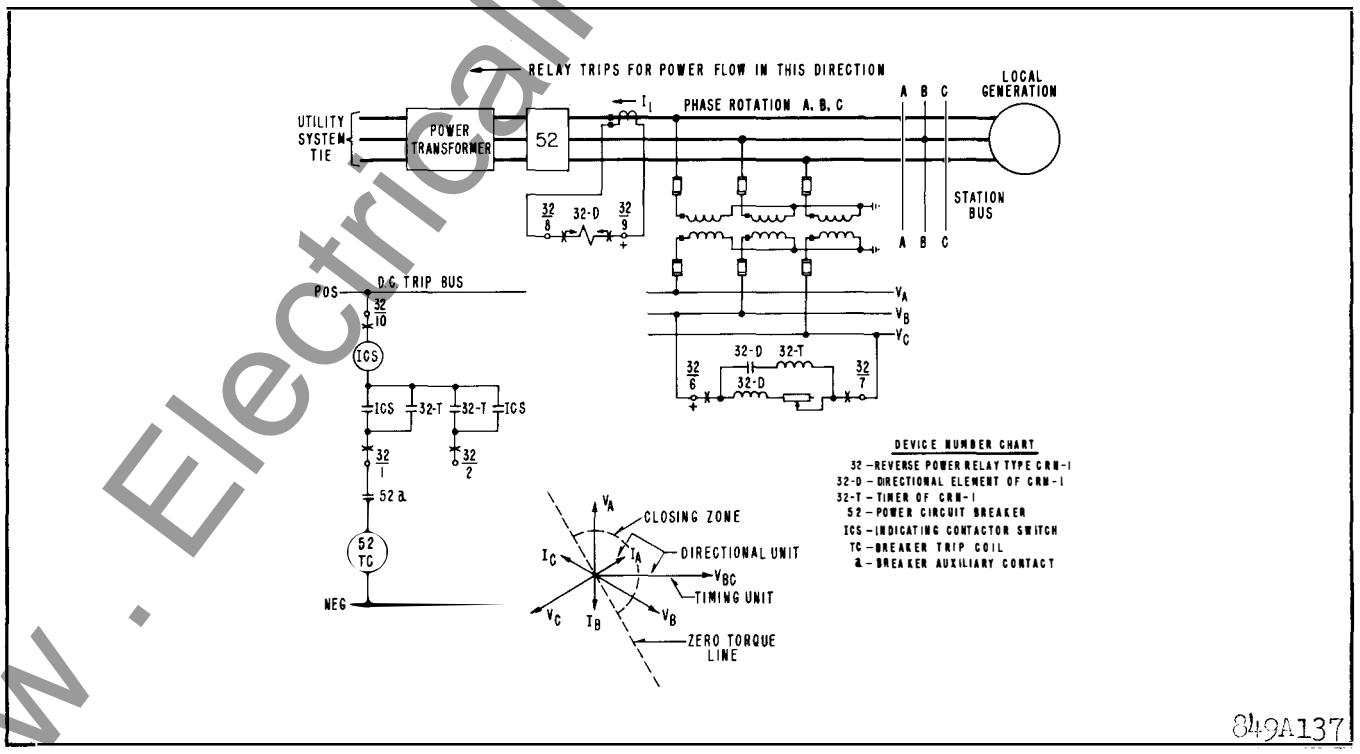
3. Maximum Torque Adjustment — Apply rated voltage to terminals 6 and 7, and 4 amperes to terminals 8 and 9, making sure the polarities are correct. With the voltage and current in phase, the contacts should close. Now adjust the angle between current and voltage to 120° (current leading the voltage). Adjust the resistor to just close the contacts. Contacts should open when the angle between current and voltage is 120° + 1° leading.

4. 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.

The spring is to be adjusted such that the contacts will close as indicated by a neon lamp in the contact circuit when energized with the required current and voltage as shown in Table 1. This table indicates that the spring can be adjusted when the phase angle relationship between the operating circuit and the polarizing circuit is at the maximum torque angle or when the circuit relationship has the operating and polarizing circuits in phase. It is recommended that a single phase (in phase relation-



* *Fig. 5. External Schematic of the Type CRN-1 for Reverse Power Protection.*



* *Fig. 6 External Schematic of the CRN-1 Relay to Prevent Reverse Magnetization When Utility Tie is Removed From the Local System.*

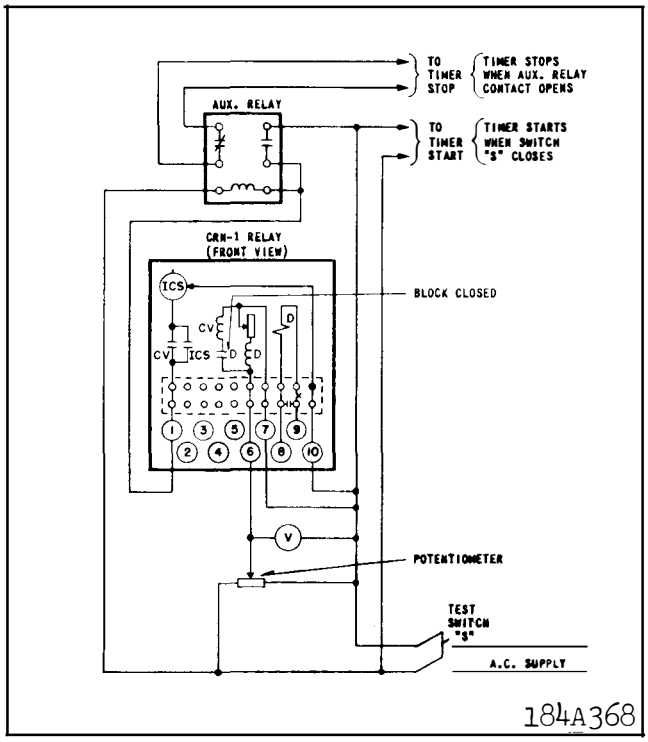


Fig. 7. Test Connections for the Timer Unit of the Type CRN-1 Relay in the Type FT-21 Case.

ship) set-up be used as a matter of ease and convenience.

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

The 60 cycle burden of the units of the type CRN-1 relay are as follows:

Coil	Burden at	Volt-Amperes	Power □ Factor
Timer	Rated voltage	6.5	73°
Directional Potential	Rated voltage	3.5	60°
Directional Current	5 Amps.	5.5	47°

□ Angle that current lags the voltage.

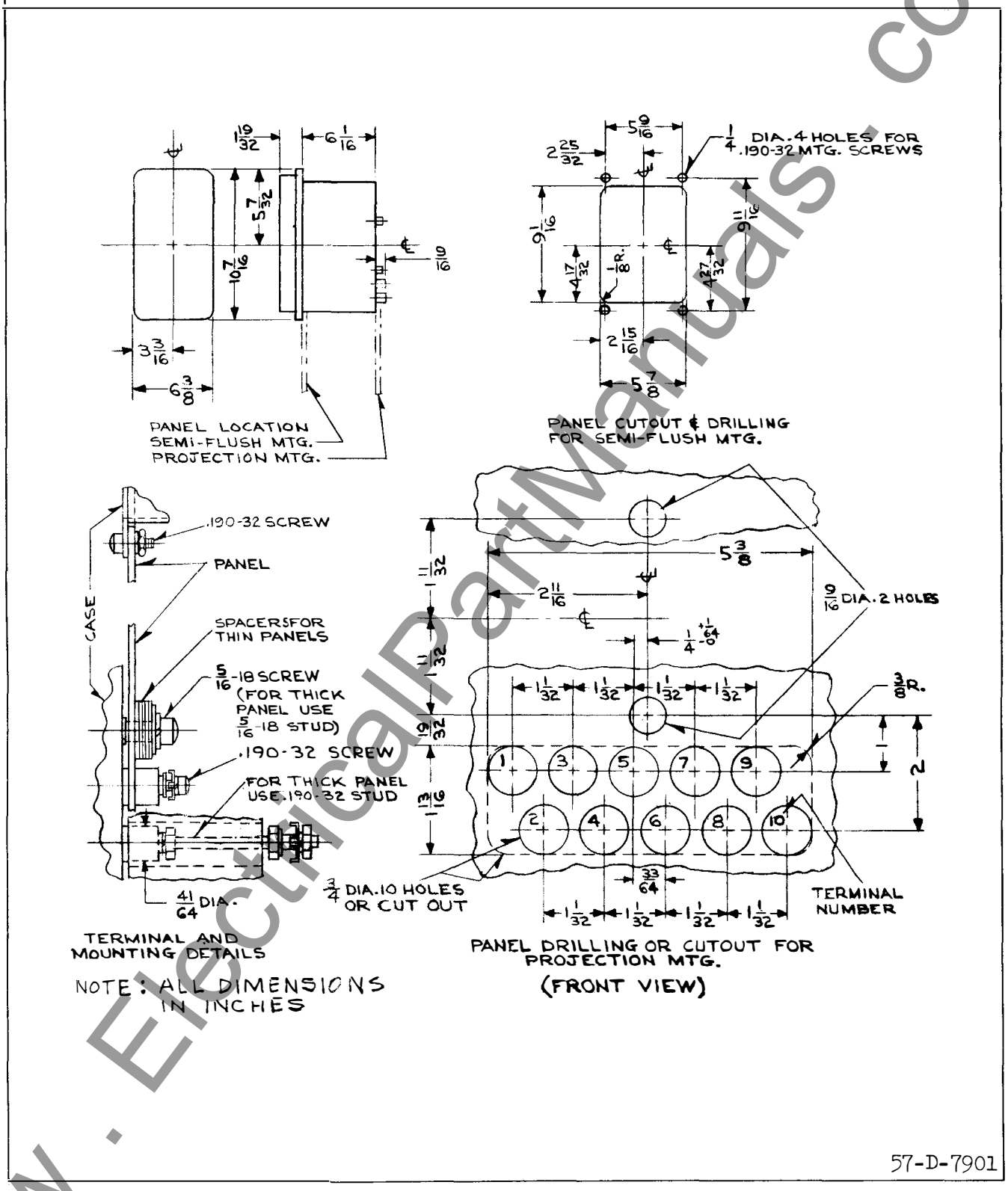
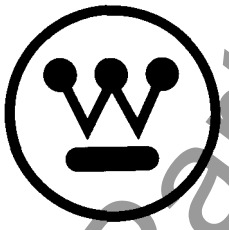


Fig. 8. Outline and Drilling Plan for the Type CRN-1 Relay in the Type FT-21 Case.



WESTINGHOUSE ELECTRIC CORPORATION
RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**
Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CRN-1 REVERSE POWER 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 CRN-1 relay is a three phase directionally controlled timing relay used to protect a-c generators from motoring. When such a condition occurs and persists for a predetermined time interval, the generator may be tripped or an alarm sounded. The directional unit has watt characteristics and the timer unit is adjustable from approximately 2 to 40 seconds.

CONSTRUCTION AND OPERATION

The relay consists of a directional unit, a timing unit, and an indicating contactor switch unit.

Timer Unit (CV)

The timer unit operates on the induction-disc principle. A main coil located on the center leg of an "E" type laminated structure produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg (front view) to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap causes a contact closing torque.

Directional Unit (D)

The directional unit is a product induction cylinder type unit operating on the interaction between the polarizing circuit flux and the operating circuit flux.

Mechanically, the directional 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 series-connected polarizing coils mounted diametrically opposite one another; two series-connected operating coils mounted diametrically opposite one another; two magnetic adjusting plugs; upper and lower adjusting plug clips, and 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 stops for the moving element contact arm are an integral part of the bridge.

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.

The timer unit cannot be energized unless the power flow is in the tripping direction because its

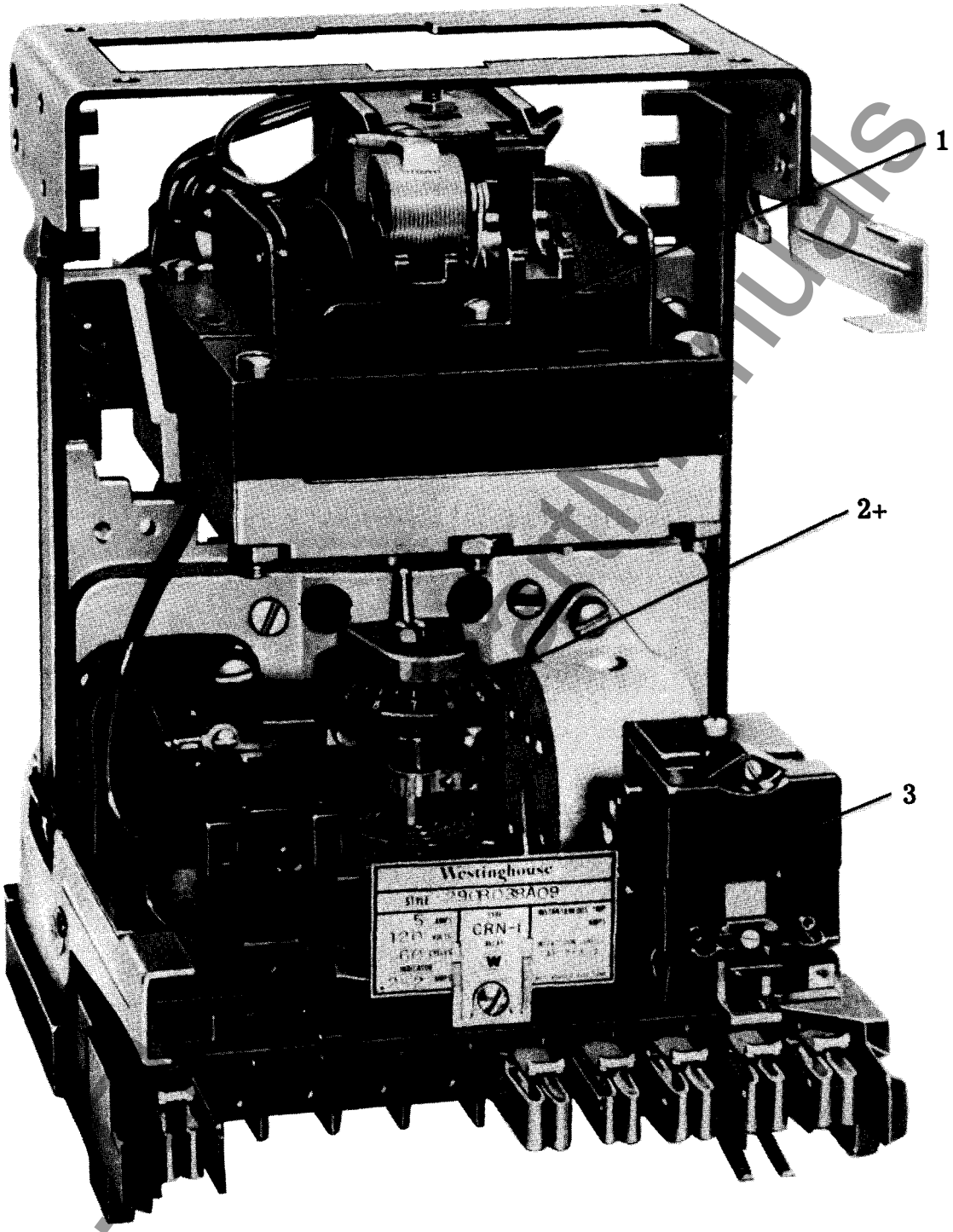


Fig. 1. Type CRN-1 Relay Without Case. 1-Directional Unit (D). 2-Timer Unit (T). 3-Indicating Contactor Switch (ICS).

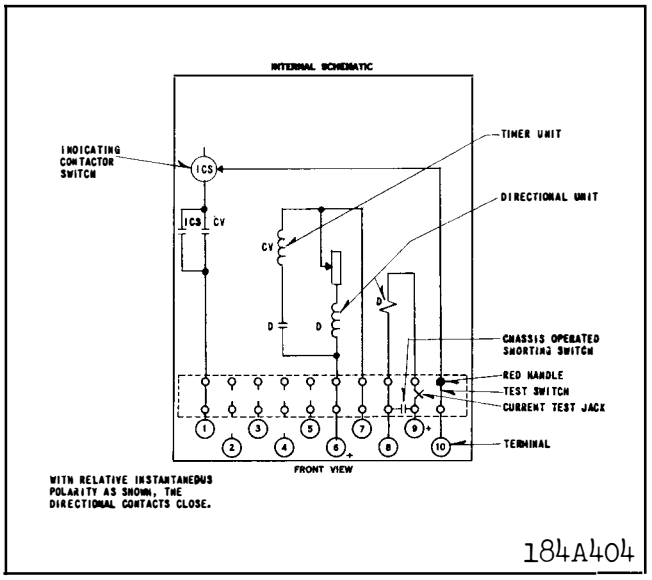


Fig. 2. Internal Schematic of the Single Trip Type CRN-1 Relay in the FT-21 Case.

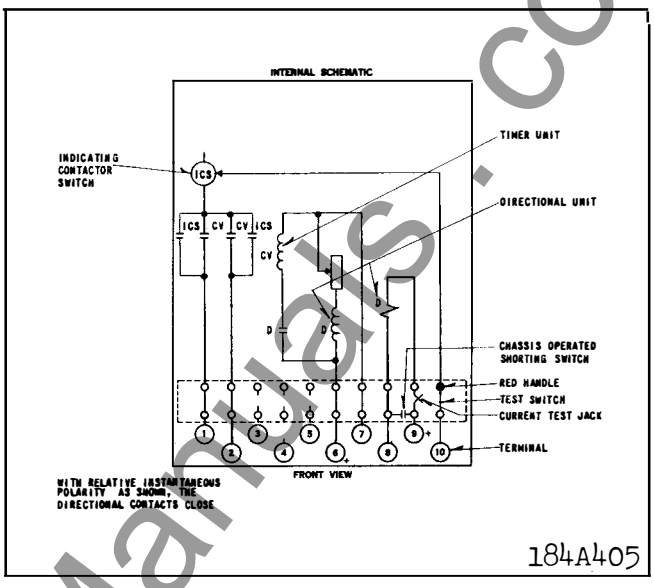


Fig. 3. Internal Schematic of the Double Trip Type CRN-1 Relay in the FT-21 Case.

potential coil is connected in series with the contacts of the directional unit. Hence, the relay is directionally controlled.

Indicating Contactor Switch Unit (ICS)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The type CRN-1 relay is available with either a 120 volt or 208 volt rating.

Timer Unit (CV)

The timer unit is rated at 120 or 208 volts, 60 cycles. The minimum trip value is 54% of rated voltage. The continuous overload capacity is 110% of rated voltage. Characteristic time curves are shown in Fig. 4 for various voltages and time lever settings.

Directional Unit (D)

The directional unit has its maximum torque when the current leads the voltage by 30^{o}. The unit should be connected using the 30^{o} connection. When using this connection the maximum torque of the relay occurs at 100% P.F.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating Contact Switch (ICS)

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

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 mount-

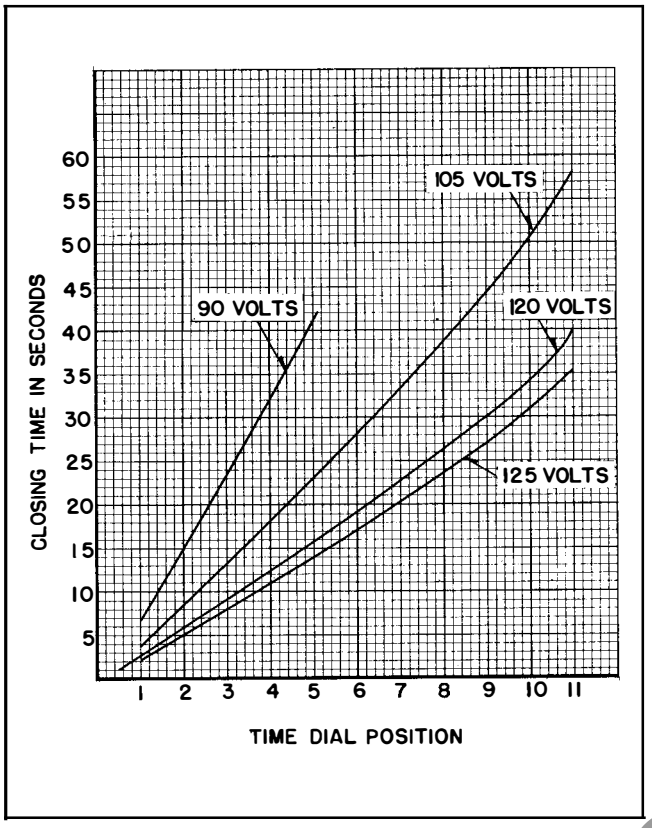


Fig. 4. Typical Time Curves of the Timer Unit of the 120 volt Type CRN-1 Relay. Proportional voltage apply for the 208 volt relay.

ing. Either a mounting stud or the mounting screws may by 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.

For detailed FT case information refer to I.L. 41-076.

For correct operation, the type CRN-1 relay should be connected so that maximum torque occurs for unity power factor on the system. Since the directional unit has a 30^{O} characteristic, this may be accomplished by using the connections shown in Fig. 5.

The voltage operated timer unit should be connected across the line. External schematic for this application as shown in Fig. 5.

SETTINGS

There is only one setting to be determined. This is the time delay of the voltage operated timer, and it is adjusted by the time dial position. Fig. 4 gives a curve of time delay vs time dial setting for various impressed voltages. Time is approximately proportional to time dial setting.

Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energized a 125 or 250 volt d-c type WL relay switch, or equivalent, use the 0.2 ampere tap.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be distrubed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. 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.

Acceptance Check

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

A. Timer Unit (CV)

The directional unit contacts must be in the closed position when checking the operation of the timer unit.

1. Contacts – By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is just resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial.

For double trip relays, the follow on the stationary contacts should be approximately .032".

2. Minimum Trip Current – Set the time dial to position 6. Alternately apply 54% of rated voltage plus 3% and minus 3%. The moving contact should leave the backstop at plus 3% and should return to the backstop at minus 3%.

3. Time Curve – Fig. 4 shows the time curve for the CRN-1 relay. With the time dial set to the indicated position, apply the voltages specified and measure the operating time of the relay. The operating times should equal those of Fig. 4 plus or minus 5 percent.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

C. Directional Unit (D)

1. Contact Gap – The gap between the stationary contact and moving contact with the relay in a de-energized position should be approximately .020".

2. Sensitivity – The respective directional units should trip with value of energization and phase angle relationships as indicated in Table 1.

Routine Maintenance

All relays should be inspected periodically and the time of 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. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces an error in timing.

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").

A. Timer Unit (CV)

1. Contacts – By turning the time dial move the moving contacts until they deflect the stationary contact to a position where the stationary contact is just resting against its backstop. The index mark located on the movement frame should coincide with the "0" mark on the time dial.

For double trip relays only, the follow on the stationary contacts is obtained through the use of the stationary contact adjusting screw. The upper stationary contact is adjusted first such that there is approximately .032" follow. The lower stationary contact is then adjusted such that both stationary contacts make contact simultaneously with their respective moving contact.

2. Minimum Trip Current – The adjustment of the spring tension in setting the minimum trip current value of the relay is most conveniently made with the damping magnet removed. Close directional contacts.

With the time dial set on "0", wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

Set the relay time dial to position 6.

Adjust the control spring tension so that the moving contact will leave the backstop at 65 volts +1.0% and will return to the backstop at 65 volts -1.0%.

3. Time Curve Calibration – Install the permanent magnet.

Set the time dial to position #11. Apply rated voltage to terminals 6 and 7 with directional contacts closed. Adjust the permanent magnet keeper until the operating time is 40 seconds ±3%.

B. Indicating Contactor Switch – Unit (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The indicator target should drop freely.

C. Directional Unit (D)

1. The upper pin bearing should be screwed down until there is approximately 1/64" clearance between

TABLE 1

DIRECTIONAL UNIT SENSITIVITY

Relay Type	Rating Volts	Values for Min. Pick-Up†		Phase Angle Relationship
		Volts	Amperes	
CRN-1	120	Rated	.020	I leading V by 30°††
	or 208	Rated	.023	I in-phase with V

† *The energization quantities are input quantities at the relay terminals.*

†† *Maximum torque angle.*

it and the top of shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

2. The contact gap adjustment for the directional unit is made as follows:

With the moving contact in the normally-opened position, i.e. against the right stop on bridge, screw in the stationary contact until both contacts just close as indicated by a neon lamp in the contact circuit. Then, screw the stationary contact away from the moving contact one-half turn. 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.

The set screw in the stationary contacts have been shop adjusted for optimum follow and this adjustment should not be disturbed.

The moving contact assembly has been factory adjusted for low contact bounce performance and should not be changed.

3. Maximum Torque Adjustment — Apply rated voltage to terminals 6 and 7, and 4 amperes to terminals 8 and 9, making sure the polarities are correct. With the voltage and current in phase, the contacts should close. Now adjust the angle between current and voltage to 120° (current leading the voltage). Adjust the resistor to just close the contacts. Contacts should open when the angle between current and voltage is 120° + 1° leading. The purpose of the resistor is to calibrate the relay for maximum torque at 120° leading without the use of an external phase shifting network.

4. 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.

The spring is to be adjusted such that the contacts will close as indicated by a neon lamp in the contact circuit when energized with the required current and voltage as shown in Table 1. This table indicates that the spring can be adjusted when the phase angle relationship between the operating circuit and the polarizing circuit is at the maximum torque angle or when the circuit relationship has the operating and polarizing circuits in phase. It is recommended that a single phase (in phase relationship) set-up be used as a matter of ease and convenience.

5. The magnetic plugs are used to reverse any unwanted spurious torques that may be present when the relay is energized on current alone.

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.

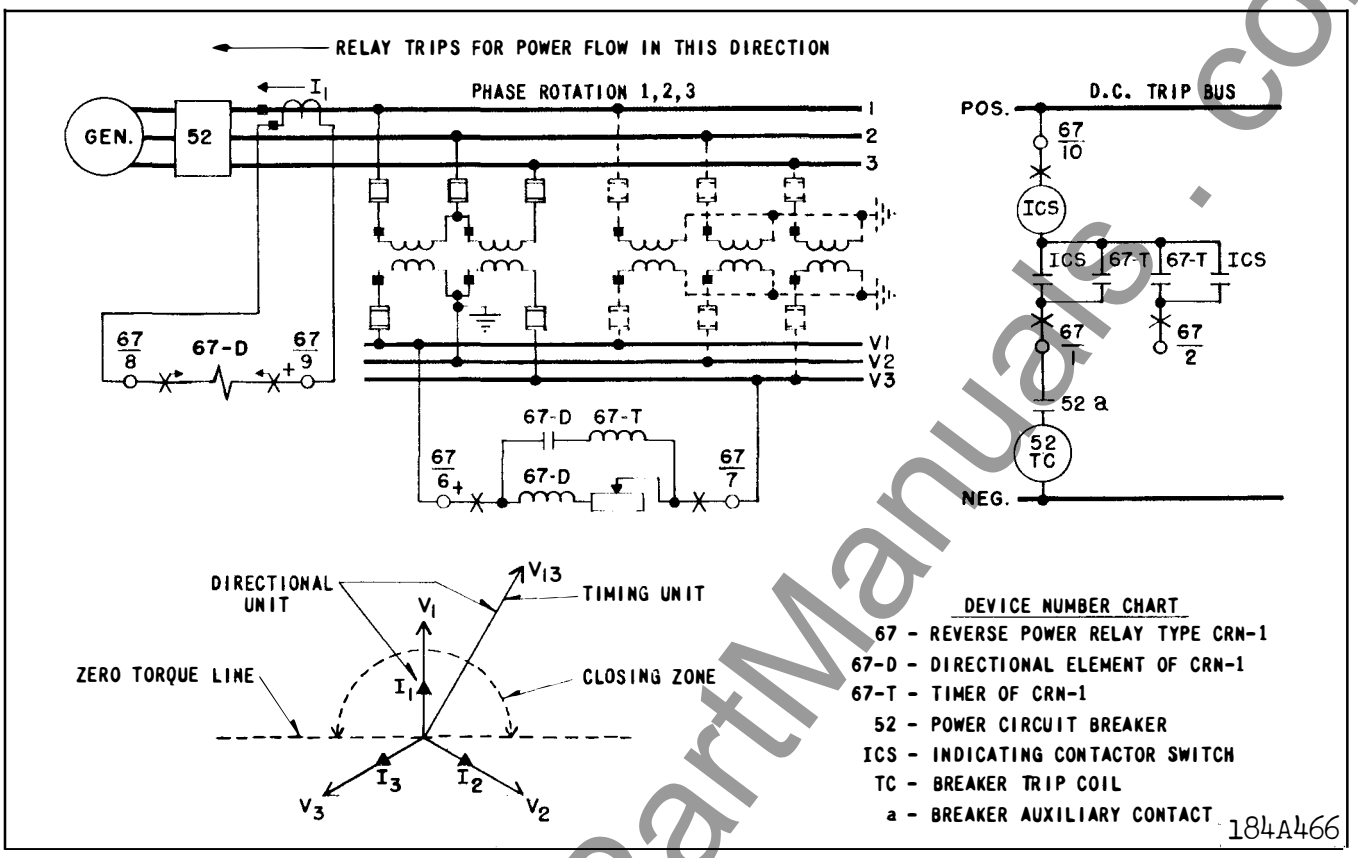


Fig. 5. External Schematic of the Type CRN-1 for Reverse Power Protection.

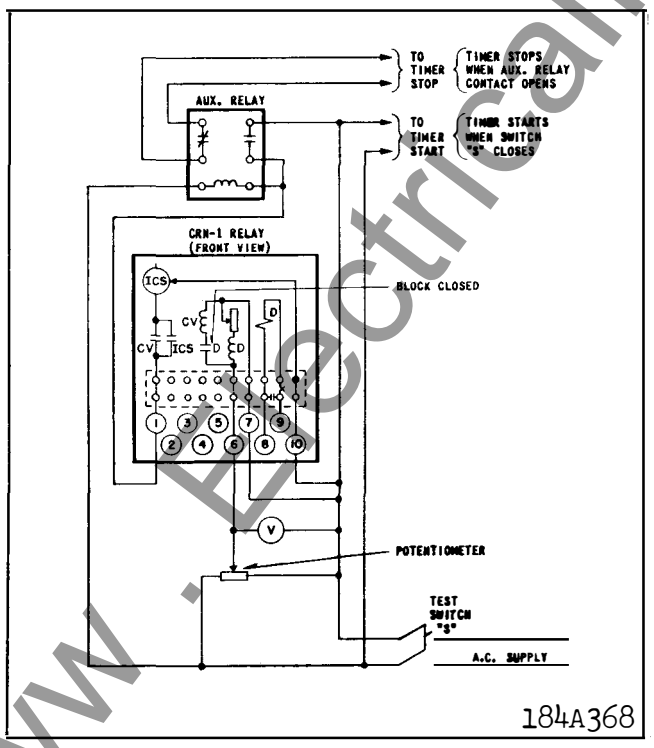


Fig. 6. Test Connections for the Timer Unit of the Type CRN-1 Relay in the Type FT-21 Case.

ENERGY REQUIREMENTS

The 60 cycle burden of the units of the type CRN-1 relay are as follows:

Coil	Burden at	Volt-Amperes	Power □ Factor
Timer	Rated voltage	6.5	73°
Directional Potential	Rated voltage	3.5	60°
Directional Current	5 Amps.	5.5	47°

□ Angle that current lags the voltage.

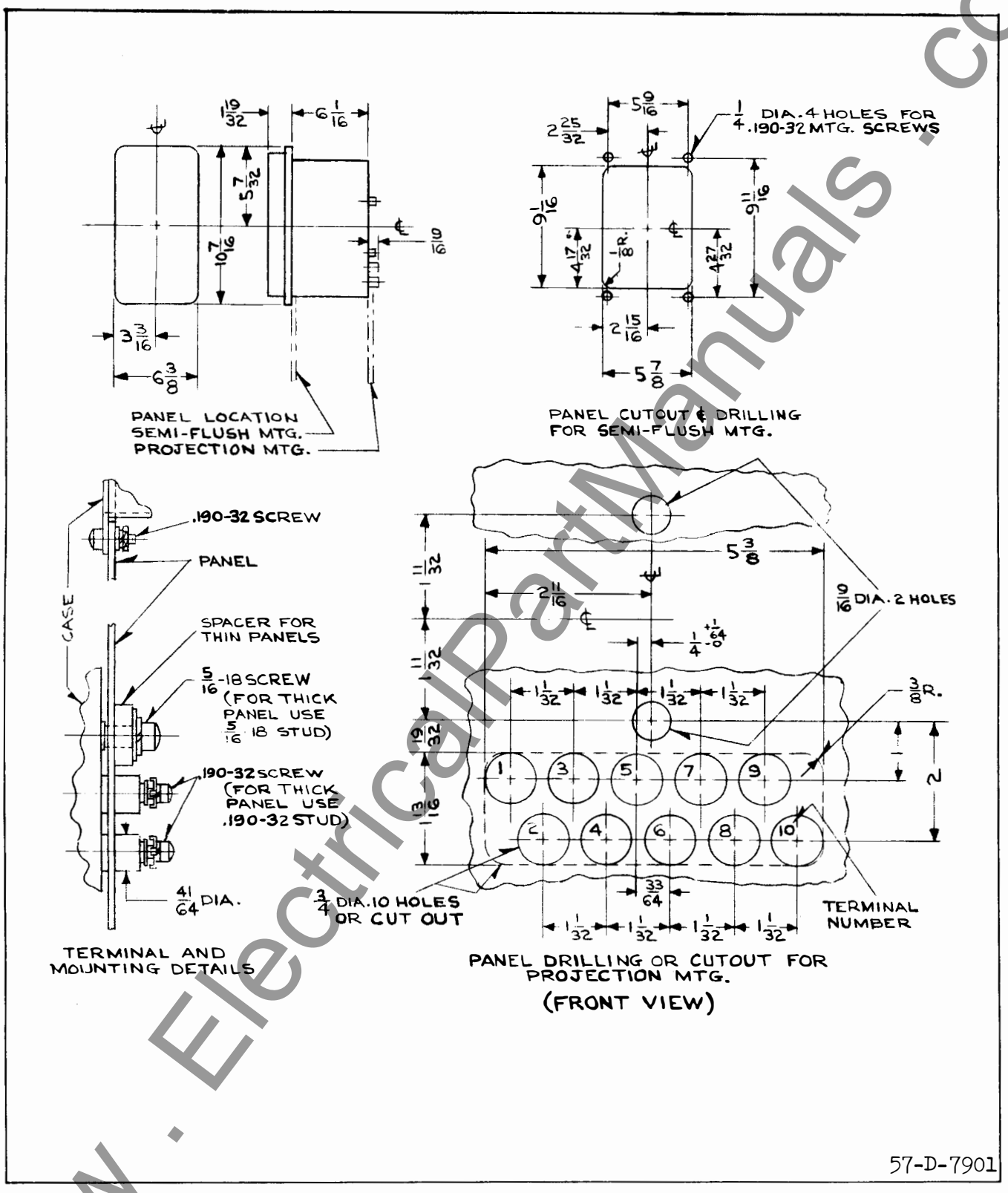


Fig. 7. Outline and Drilling Plan for the Type CRN-1 Relay in the Type FT-21 Case.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CRN-1 REVERSE POWER 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 CRN-1 relay is a three phase directionally controlled timing relay used to protect a-c generators from motoring. When such a condition occurs and persists for a predetermined time interval, the generator may be tripped or an alarm sounded. The directional unit has watt characteristics and the timer unit is adjustable from approximately 2 to 40 seconds.

CONSTRUCTION AND OPERATION

The relay consists of a directional unit, a timing unit, and an indicating contactor switch unit.

Timer Unit (CV)

The timer unit operates on the induction-disc principle. A main coil located on the center leg of an "E" type laminated structure produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg (front view) to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap causes a contact closing torque.

Directional Unit (D)

The directional unit is a product induction cylinder type unit operating on the interaction between the polarizing circuit flux and the operating circuit flux.

Mechanically, the directional 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 series-connected polarizing coils mounted diametrically opposite one another; two series-connected operating coils mounted diametrically opposite one another; two magnetic adjusting plugs; upper and lower adjusting plug clips, and 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 stops for the moving element contact arm are an integral part of the bridge.

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.

The timer unit cannot be energized unless the power flow is in the tripping direction because its

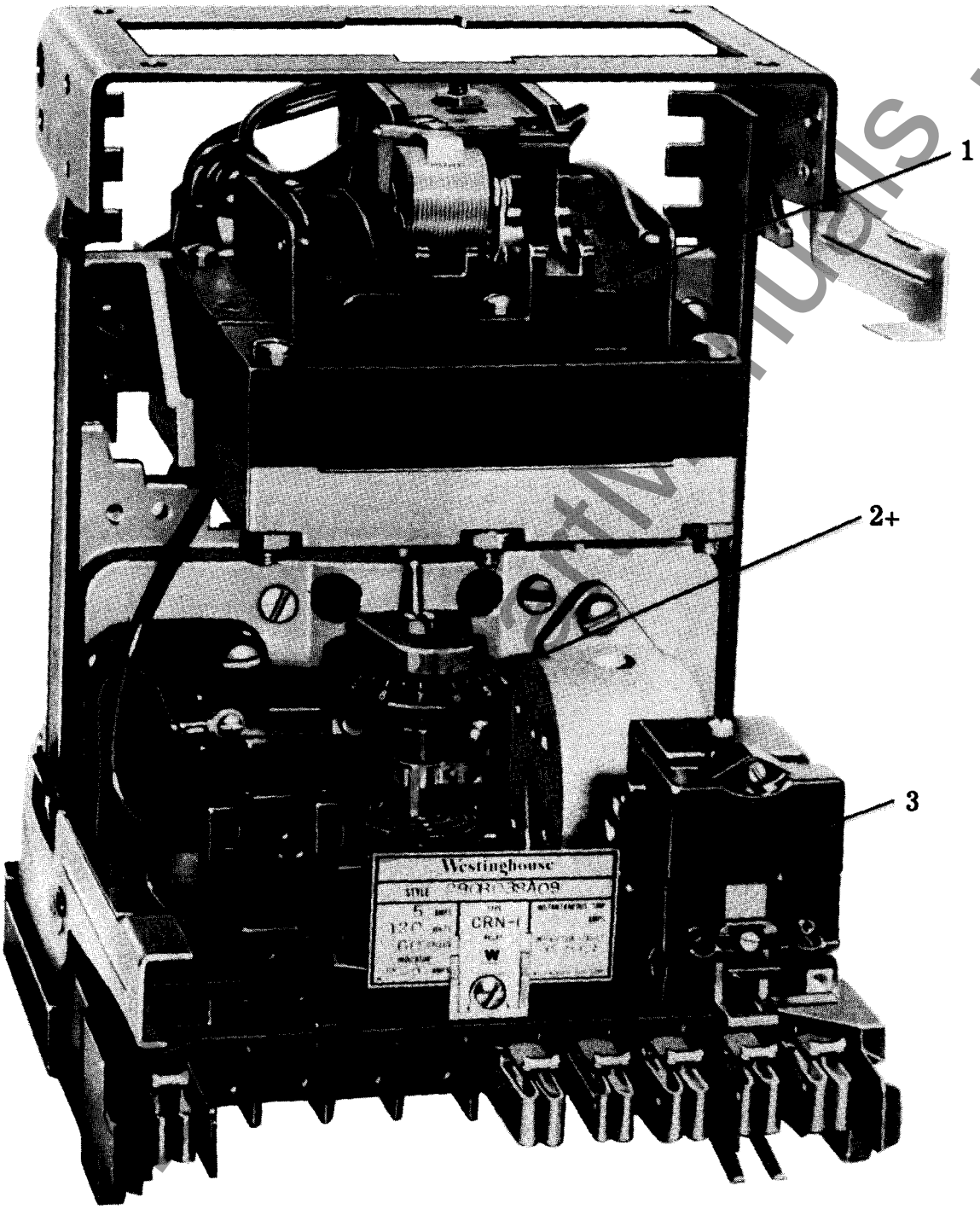


Fig. 1. Type CRN-1 Relay Without Case. 1 - Directional Unit (D). 2 - Timer Unit (T). 3 - Indicating Contactor Switch (ICS).

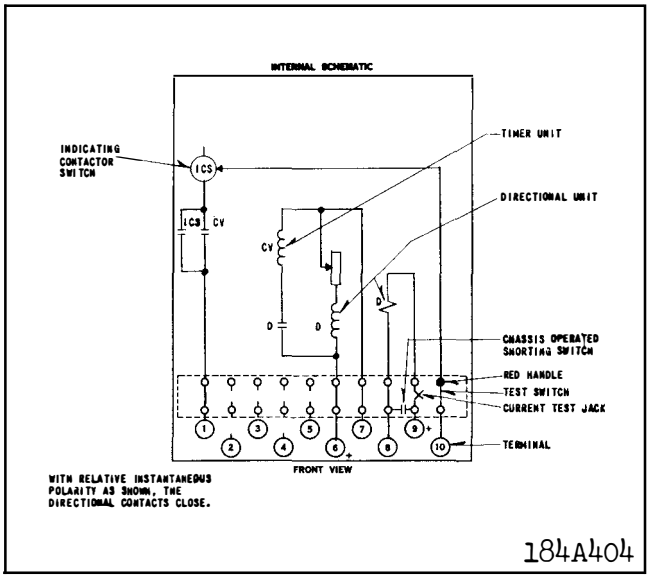


Fig. 2. Internal Schematic of the Single Trip Type CRN-1 Relay in the FT-21 Case.

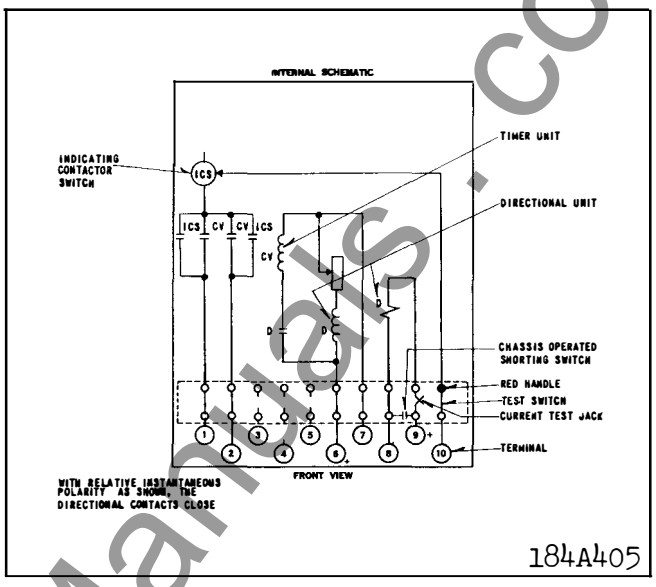


Fig. 3. Internal Schematic of the Double Trip Type CRN-1 Relay in the FT-21 Case.

potential coil is connected in series with the contacts of the directional unit. Hence, the relay is directionally controlled.

Indicating Contactor Switch Unit (ICS)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The type CRN-1 relay is available with either a 120 volt or 208 volt rating.

Timer Unit (CV)

The timer unit is rated at 120 or 208 volts, 60 cycles. The minimum trip value is 54% of rated voltage. The continuous overload capacity is 110% of rated voltage. Characteristic time curves are shown in Fig. 4 for various voltages and time lever settings.

Directional Unit (D)

The directional unit has its maximum torque when the current leads the voltage by 30^{O}. The unit should be connected using the 30^{O} connection. When using this connection the maximum torque of the relay occurs at 100% P.F.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating Contact Switch (ICS)

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

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 mount-

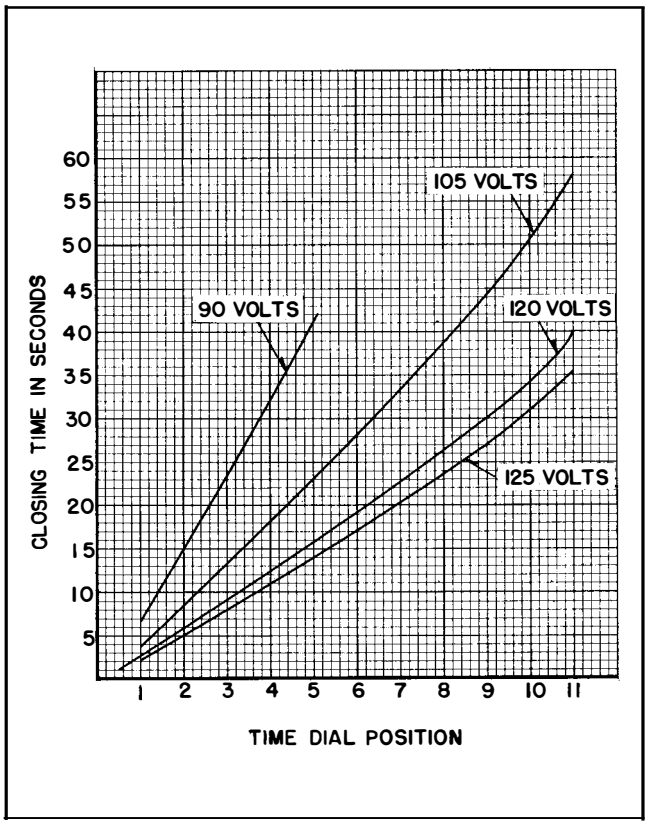


Fig. 4. Typical Time Curves of the Timer Unit of the 120 volt Type CRN-1 Relay. Proportional voltage apply for the 208 volt relay.

ing. Either a mounting stud or the mounting screws may by 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.

For detailed FT case information refer to I.L. 41-076.

For correct operation, the type CRN-1 relay should be connected so that maximum torque occurs for unity power factor on the system. Since the directional unit has a 30^{0} characteristic, this may be accomplished by using the connections shown in Fig. 5.

The voltage operated timer unit should be connected across the line. External schematic for this application as shown in Fig. 5.

SETTINGS

There is only one setting to be determined. This is the time delay of the voltage operated timer, and it is adjusted by the time dial position. Fig. 4 gives a curve of time delay vs time dial setting for various impressed voltages. Time is approximately proportional to time dial setting.

Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energized a 125 or 250 volt d-c type WL relay switch, or equivalent, use the 0.2 ampere tap.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be distrubed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. 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.

Acceptance Check

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

A. Timer Unit (CV)

The directional unit contacts must be in the closed position when checking the operation of the timer unit.

1. Contacts – By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is just resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial.

For double trip relays, the follow on the stationary contacts should be approximately .032".

2. Minimum Trip Current – Set the time dial to position 6. Alternately apply 54% of rated voltage plus 3% and minus 3%. The moving contact should leave the backstop at plus 3% and should return to the backstop at minus 3%.

3. Time Curve – Fig. 4 shows the time curve for the CRN-1 relay. With the time dial set to the indicated position, apply the voltages specified and measure the operating time of the relay. The operating times should equal those of Fig. 4 plus or minus 5 percent.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

C. Directional Unit (D)

1. Contact Gap – The gap between the stationary contact and moving contact with the relay in a de-energized position should be approximately .020".

2. Sensitivity – The respective directional units should trip with value of energization and phase angle relationships as indicated in Table 1.

Routine Maintenance

All relays should be inspected periodically and the time of 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. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces an error in timing.

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").

A. Timer Unit (CV)

1. Contacts – By turning the time dial move the moving contacts until they deflect the stationary contact to a position where the stationary contact is just resting against its backstop. The index mark located on the movement frame should coincide with the "0" mark on the time dial.

For double trip relays only, the follow on the stationary contacts is obtained through the use of the stationary contact adjusting screw. The upper stationary contact is adjusted first such that there is approximately .032" follow. The lower stationary contact is then adjusted such that both stationary contacts make contact simultaneously with their respective moving contact.

2. Minimum Trip Current – The adjustment of the spring tension in setting the minimum trip current value of the relay is most conveniently made with the damping magnet removed. Close directional contacts.

With the time dial set on "0", wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

Set the relay time dial to position 6.

Adjust the control spring tension so that the moving contact will leave the backstop at 65 volts +1.0% and will return to the backstop at 65 volts -1.0%.

3. Time Curve Calibration – Install the permanent magnet.

Set the time dial to position #11. Apply rated voltage to terminals 6 and 7 with directional contacts closed. Adjust the permanent magnet keeper until the operating time is 40 seconds ±3%.

B. Indicating Contactor Switch – Unit (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The indicator target should drop freely.

C. Directional Unit (D)

1. The upper pin bearing should be screwed down until there is approximately 1/64" clearance between

TABLE 1

DIRECTIONAL UNIT SENSITIVITY

Relay Type	Rating Volts	Values for Min. Pick-Upt		Phase Angle Relationship
		Volts	Amperes	
CRN-1	120	Rated	.020	I leading V by 30° ††
	or 208	Rated	.023	I in-phase with V

† *The energization quantities are input quantities at the relay terminals.*

†† *Maximum torque angle.*

it and the top of shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

2. The contact gap adjustment for the directional unit is made as follows:

With the moving contact in the normally-opened position, i.e. against the right stop on bridge, screw in the stationary contact until both contacts just close as indicated by a neon lamp in the contact circuit. Then, screw the stationary contact away from the moving contact one-half turn. 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.

The set screw in the stationary contacts have been shop adjusted for optimum follow and this adjustment should not be disturbed.

The moving contact assembly has been factory adjusted for low contact bounce performance and should not be changed.

3. Maximum Torque Adjustment – Apply rated voltage to terminals 6 and 7, and 4 amperes to terminals 8 and 9, making sure the polarities are correct. With the voltage and current in phase, the contacts should close. Now adjust the angle between current and voltage to 120° (current leading the voltage). Adjust the resistor to just close the contacts. Contacts should open when the angle between current and voltage is 120° + 1° leading. The purpose of the resistor is to calibrate the relay for maximum torque at 120° leading without the use of an external phase shifting network.

4. 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.

The spring is to be adjusted such that the contacts will close as indicated by a neon lamp in the contact circuit when energized with the required current and voltage as shown in Table 1. This table indicates that the spring can be adjusted when the phase angle relationship between the operating circuit and the polarizing circuit is at the maximum torque angle or when the circuit relationship has the operating and polarizing circuits in phase. It is recommended that a single phase (in phase relationship) set-up be used as a matter of ease and convenience.

5. The magnetic plugs are used to reverse any unwanted spurious torques that may be present when the relay is energized on current alone.

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.

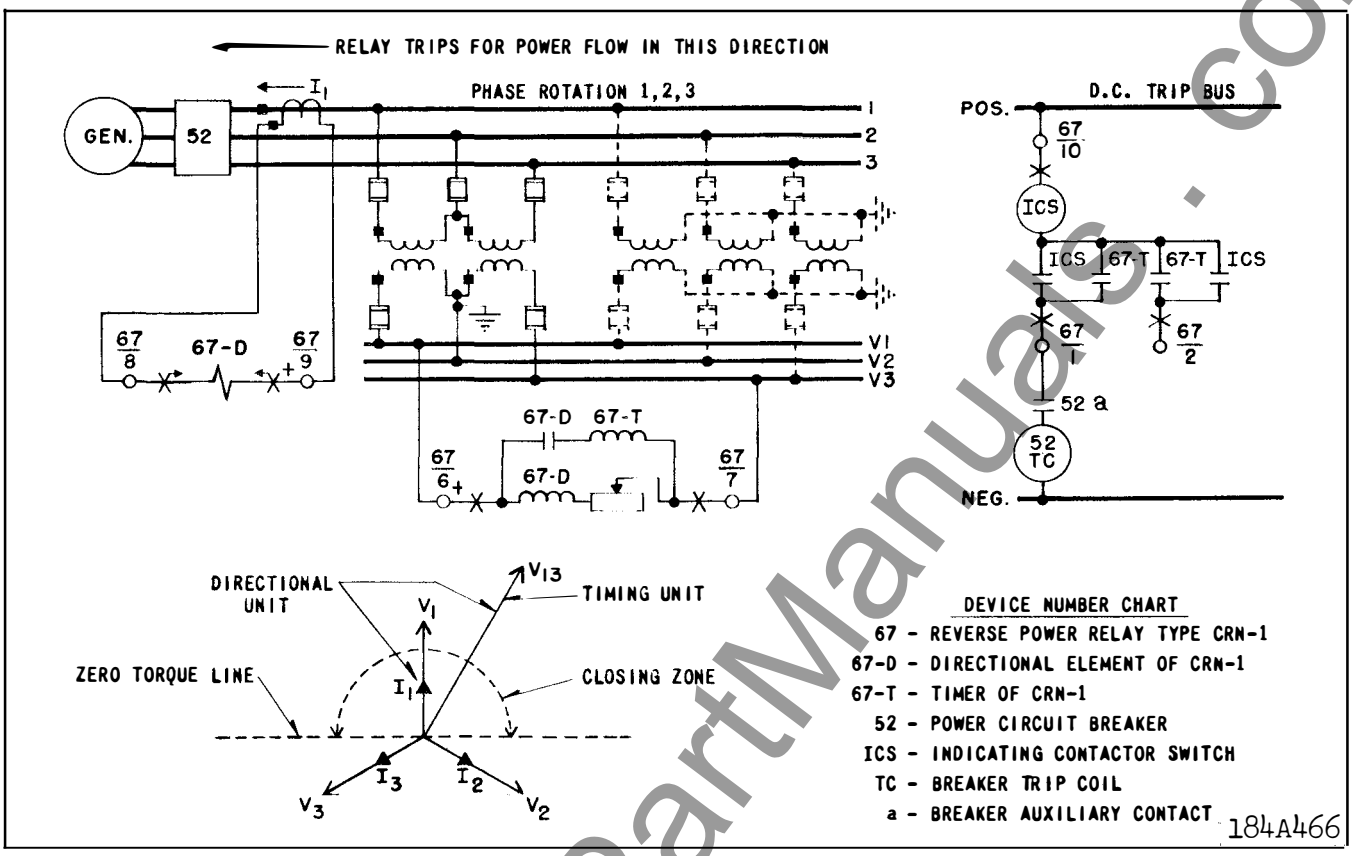


Fig. 5. External Schematic of the Type CRN-1 for Reverse Power Protection.

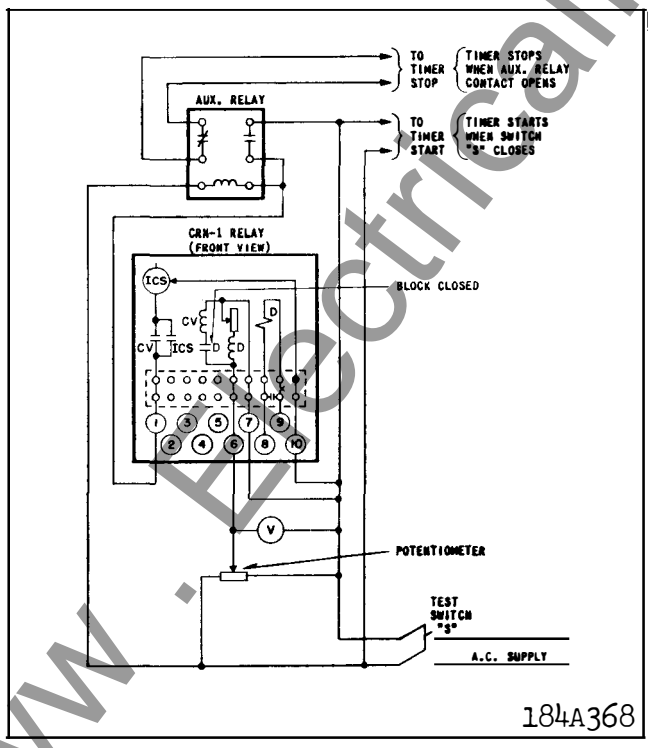


Fig. 6. Test Connections for the Timer Unit of the Type CRN-1 Relay in the Type FT-21 Case.

ENERGY REQUIREMENTS

The 60 cycle burden of the units of the type CRN-1 relay are as follows:

Coil	Burden at	Volt-Amperes	Power □ Factor
Timer	Rated voltage	6.5	73°
Directional Potential	Rated voltage	3.5	60°
Directional Current	5 Amps.	5.5	47°

□ Angle that current lags the voltage.

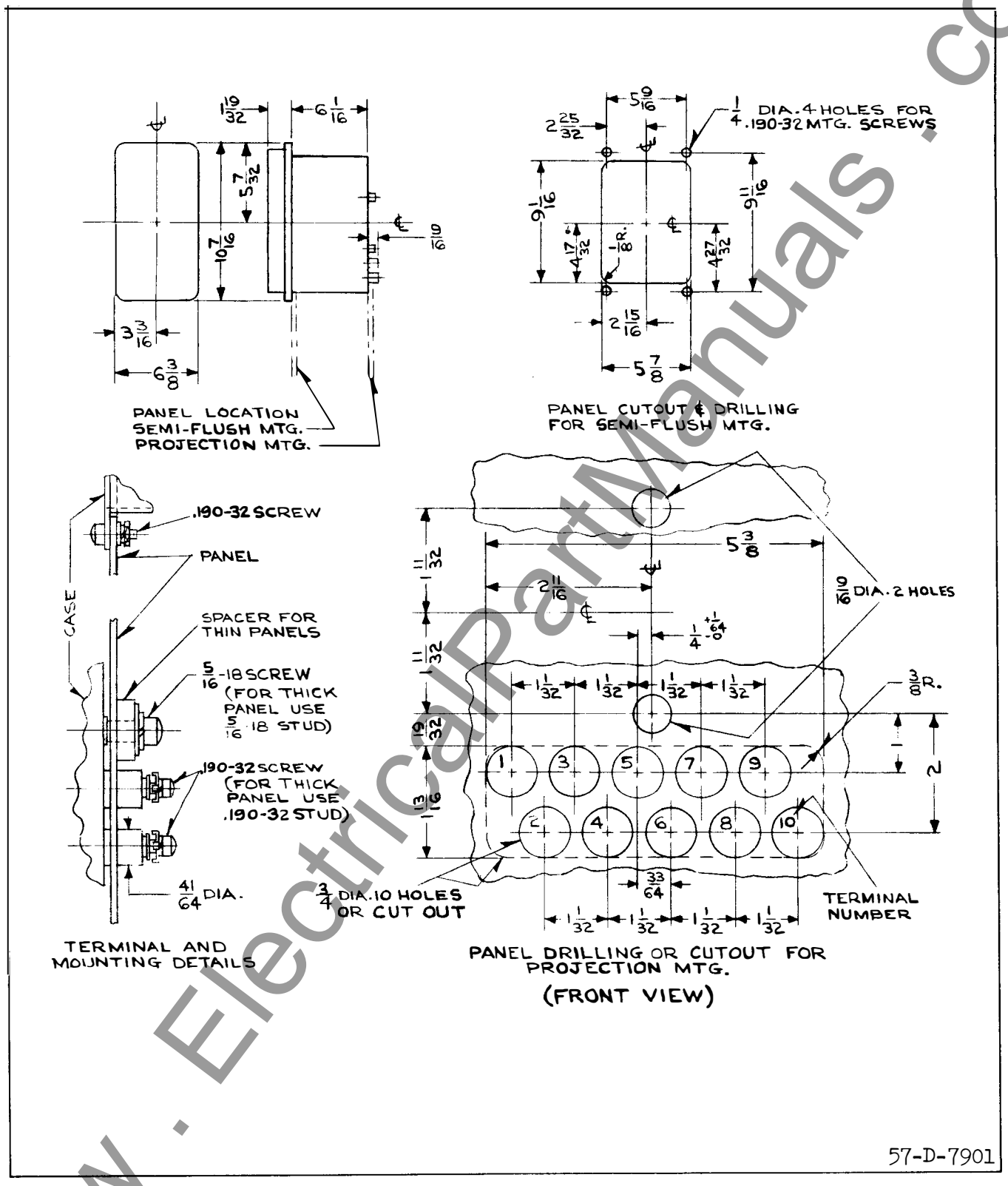


Fig. 7. Outline and Drilling Plan for the Type CRN-1 Relay in the Type FT-21 Case.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CRN-1 REVERSE POWER 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 CRN-1 relay is a three phase directionally controlled timing relay used to protect a-c generators from motoring. When such a condition occurs and persists for a predetermined time interval, the generator may be tripped or an alarm sounded. The directional unit has watt characteristics and the timer unit is adjustable from approximately 2 to 40 seconds.

CONSTRUCTION AND OPERATION

The relay consists of a directional unit, a timing unit, and an indicating contactor switch unit.

Timer Unit (CV)

The timer unit operates on the induction-disc principle. A main coil located on the center leg of an "E" type laminated structure produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg (front view) to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap causes a contact closing torque.

Directional Unit (D)

The directional unit is a product induction cylinder type unit operating on the interaction between the polarizing circuit flux and the operating circuit flux.

Mechanically, the directional 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 series-connected polarizing coils mounted diametrically opposite one another; two series-connected operating coils mounted diametrically opposite one another; two magnetic adjusting plugs; upper and lower adjusting plug clips, and 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 stops for the moving element contact arm are an integral part of the bridge.

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.

The timer unit cannot be energized unless the power flow is in the tripping direction because its

SUPERSEDES I.L. 41-251.2
*Denotes change from superseded issue.

EFFECTIVE DECEMBER 1960

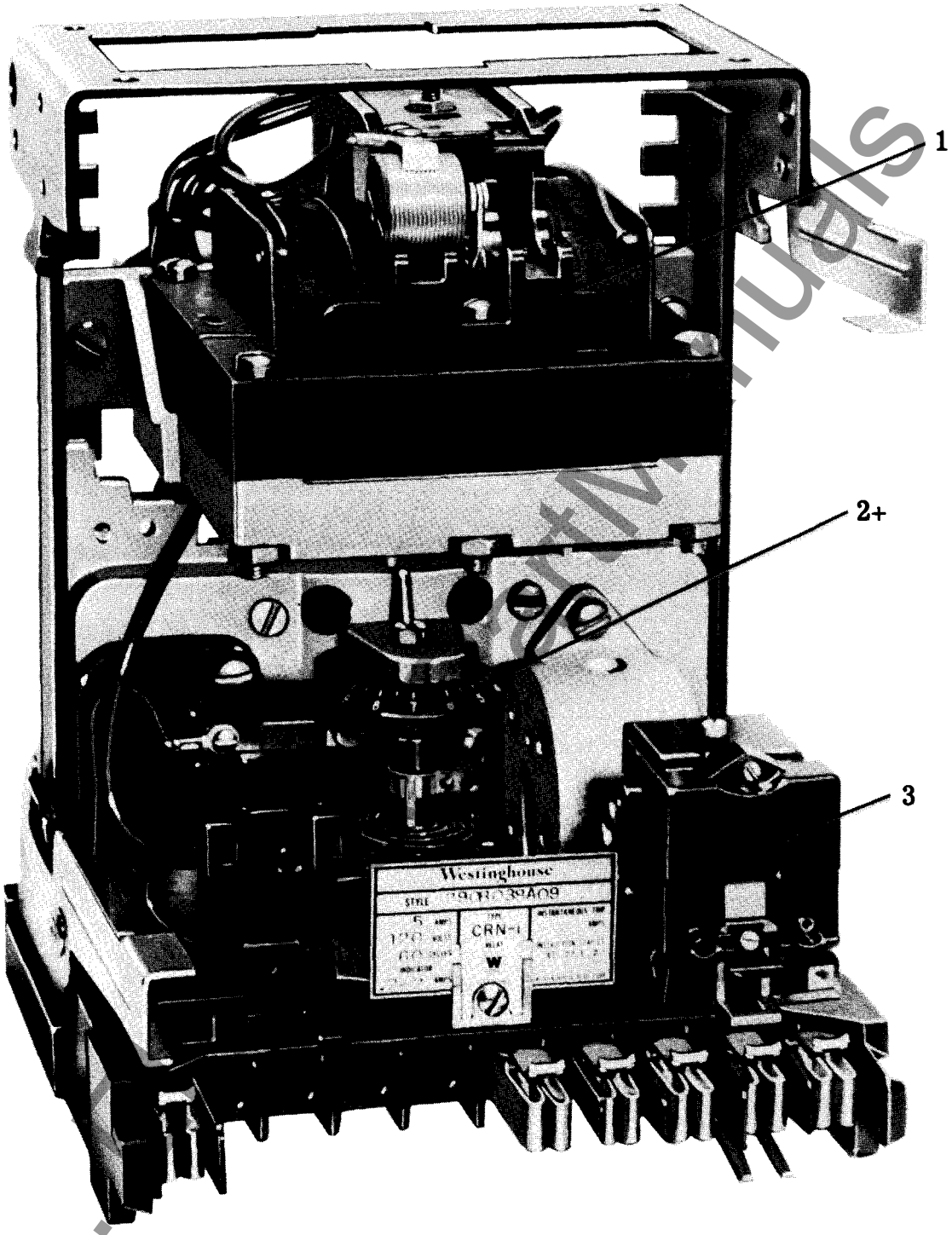


Fig. 1. Type CRN-1 Relay Without Case. 1-Directional Unit (D). 2-Timer Unit (T). 3-Indicating Contactor Switch (ICS).

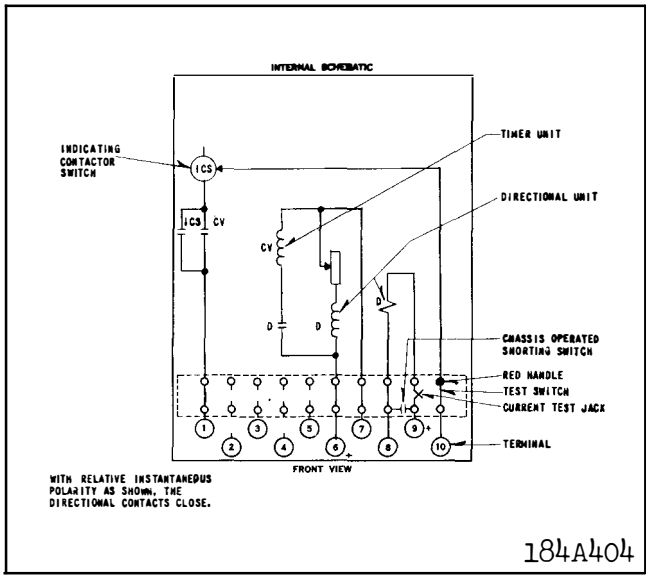


Fig. 2. Internal Schematic of the Single Trip Type CRN-1 Relay in the FT-21 Case.

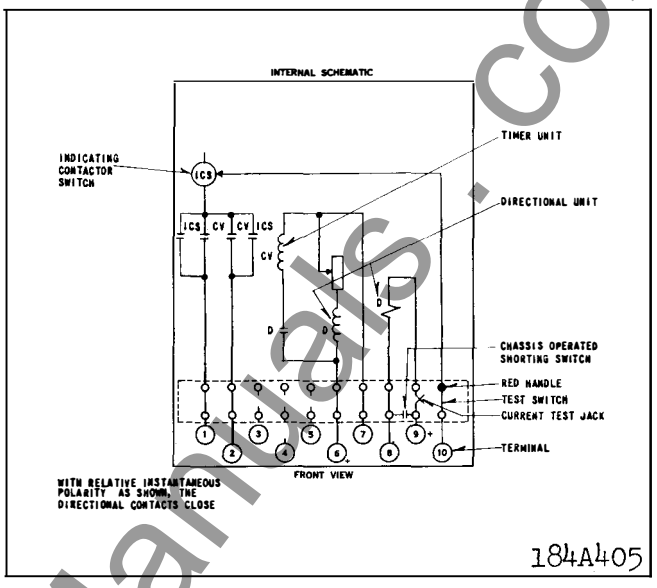


Fig. 3. Internal Schematic of the Double Trip Type CRN-1 Relay in the FT-21 Case.

potential coil is connected in series with the contacts of the directional unit. Hence, the relay is directionally controlled.

Indicating Contactor Switch Unit (ICS)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The type CRN-1 relay is available with either a 120 volt or 208 volt rating.

Timer Unit (CV)

The timer unit is rated at 120 or 208 volts, 60 cycles. The minimum trip value is 54% of rated voltage. The continuous overload capacity is 110% of rated voltage. Characteristic time curves are shown in Fig. 4 for various voltages and time lever settings.

Directional Unit (D)

The directional unit has its maximum torque when the current leads the voltage by 30^{O}. The unit should be connected using the 30^{O} connection. When using this connection the maximum torque of the relay occurs at 100% P.F.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating Contact Switch (ICS)

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

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 mount-

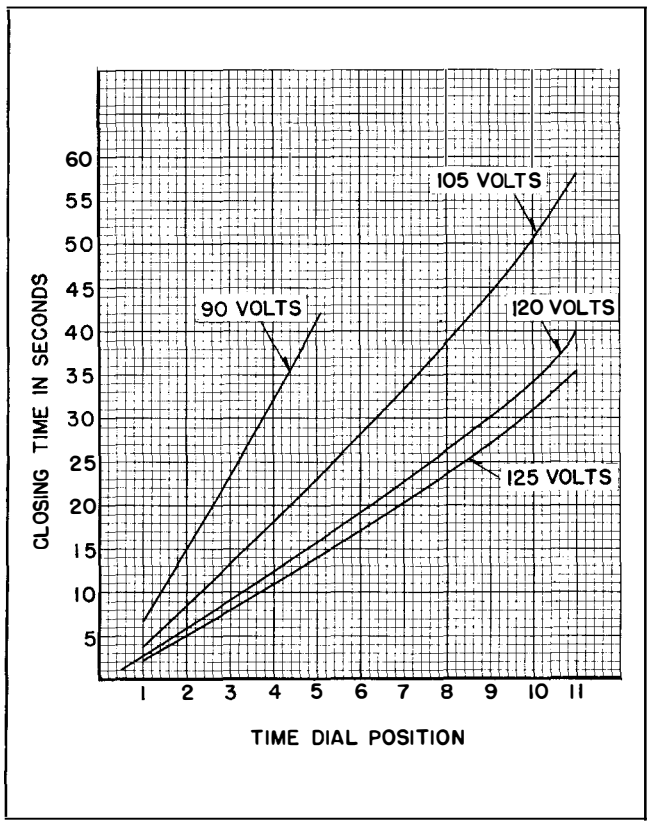


Fig. 4. Typical Time Curves of the Timer Unit of the 120 volt Type CRN-1 Relay. Proportional voltage apply for the 208 volt relay.

ing. Either a mounting stud or the mounting screws may by 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.

For detailed FT case information refer to I.L. 41-076.

For correct operation, the type CRN-1 relay should be connected so that maximum torque occurs for unity power factor on the system. Since the directional unit has a 30^{O} characteristic, this may be accomplished by using the connections shown in Fig. 5.

The voltage operated timer unit should be connected across the line. External schematic for this application as shown in Fig. 5.

SETTINGS

There is only one setting to be determined. This is the time delay of the voltage operated timer, and it is adjusted by the time dial position. Fig. 4 gives a curve of time delay vs time dial setting for various impressed voltages. Time is approximately proportional to time dial setting.

Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energized a 125 or 250 volt d-c type WL relay switch, or equivalent, use the 0.2 ampere tap.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be distrubed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. 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.

Acceptance Check

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

A. Timer Unit (CV)

The directional unit contacts must be in the closed position when checking the operation of the timer unit.

* 1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right

of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – Set the time dial to position 6. Alternately apply 54% of rated voltage plus 3% and minus 3%. The moving contact should leave the backstop at plus 3% and should return to the backstop at minus 3%.

3. Time Curve – Fig. 4 shows the time curve for the CRN-1 relay. With the time dial set to the indicated position, apply the voltages specified and measure the operating time of the relay. The operating times should equal those of Fig. 4 plus or minus 5 percent.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

C. Directional Unit (D)

1. Contact Gap – The gap between the stationary contact and moving contact with the relay in a de-energized position should be approximately .020".

2. Sensitivity – The respective directional units should trip with value of energization and phase angle relationships as indicated in Table 1.

Routine Maintenance

All relays should be inspected periodically and the time of 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. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces an error in timing.

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").

A. Timer Unit (CV)

* 1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – The adjustment of the spring tension in setting the minimum trip current value of the relay is most conveniently made with the damping magnet removed. Close directional contacts.

With the time dial set on "0", wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

Set the relay time dial to position 6.

Adjust the control spring tension so that the moving contact will leave the backstop at 65 volts +1.0% and will return to the backstop at 65 volts -1.0%.

TABLE 1

DIRECTIONAL UNIT SENSITIVITY

Relay Type	Rating Volts	Values for Min. Pick-Up†		Phase Angle Relationship
		Volts	Amperes	
CRN-1	120	Rated	.020	I leading V by 30° ††
	or 208	Rated	.023	I in-phase with V

† *The energization quantities are input quantities at the relay terminals.*

†† *Maximum torque angle.*

3. Time Curve Calibration – Install the permanent magnet.

Set the time dial to position #11. Apply rated voltage to terminals 6 and 7 with directional contacts closed. Adjust the permanent magnet keeper until the operating time is 40 seconds ±3%.

B. Indicating Contactor Switch – Unit (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The indicator target should drop freely.

C. Directional Unit (D)

* 1. The upper pin bearing should be screwed down until there is approximately .025" clearance between it and the top of shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

2. The contact gap adjustment for the directional unit is made as follows:

With the moving contact in the normally-opened position, i.e. against the right stop on bridge, screw in the stationary contact until both contacts just close as indicated by a neon lamp in the contact circuit. Then, screw the stationary contact away from the moving contact one-half turn. 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.

The set screw in the stationary contacts have been shop adjusted for optimum follow and this adjustment should not be disturbed.

The moving contact assembly has been factory adjusted for low contact bounce performance and should not be changed.

3. Maximum Torque Adjustment – Apply rated voltage to terminals 6 and 7, and 4 amperes to terminals 8 and 9, making sure the polarities are correct. With the voltage and current in phase, the contacts should close. Now adjust the angle between current and voltage to 120° (current leading the voltage). Adjust the resistor to just close the contacts. Contacts should open when the angle between current and voltage is 120° + 1° leading. The purpose of the resistor is to calibrate the relay for maximum torque at 120° leading without the use of an external phase shifting network.

4. 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.

The spring is to be adjusted such that the contacts will close as indicated by a neon lamp in the contact circuit when energized with the required current and voltage as shown in Table 1. This table indicates that the spring can be adjusted when the phase angle relationship between the operating circuit and the polarizing circuit is at the maximum torque angle or when the circuit relationship has the operating and polarizing circuits in phase. It is recommended that a single phase (in phase relation-

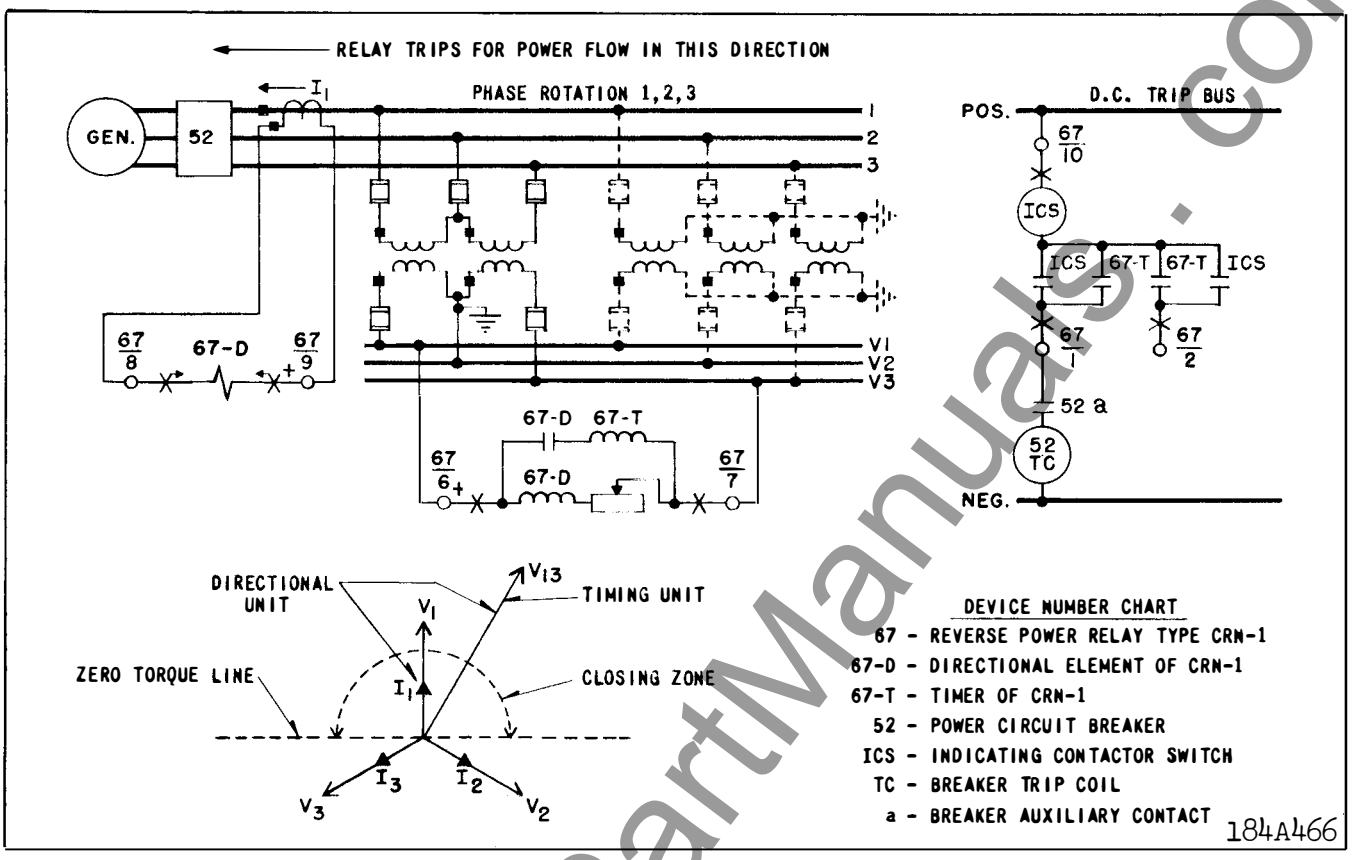


Fig. 5. External Schematic of the Type CRN-1 for Reverse Power Protection.

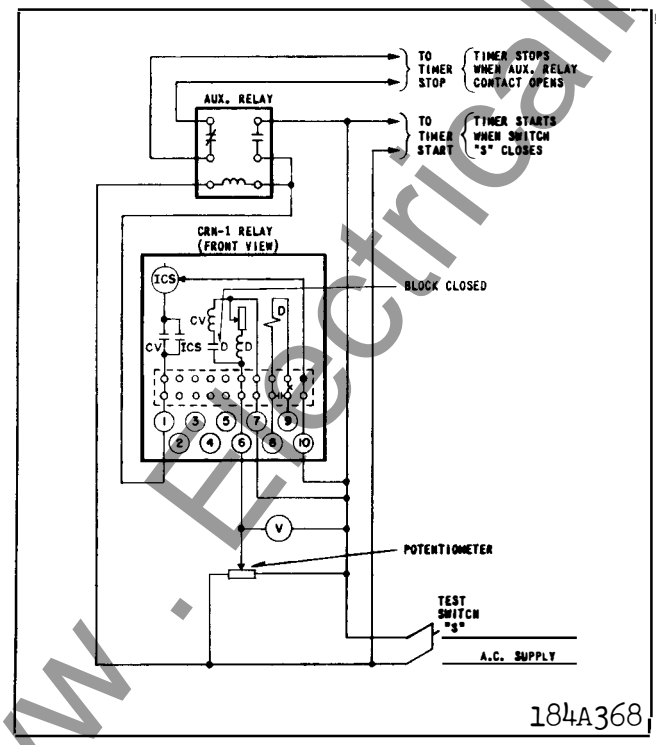


Fig. 6. Test Connections for the Timer Unit of the Type CRN-1 Relay in the Type FT-21 Case.

ship) set-up be used as a matter of ease and convenience.

5. The magnetic plugs are used to reverse any unwanted spurious torques that may be present when the relay is energized on current alone.

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

The 60 cycle burden of the units of the type CRN-1 relay are as follows:

Coil	Burden at	Volt-Amperes	Power □ Factor
Timer	Rated voltage	6.5	73°
Directional Potential	Rated voltage	3.5	60°
Directional Current	5 Amps.	5.5	47°

□ Angle that current lags the voltage.

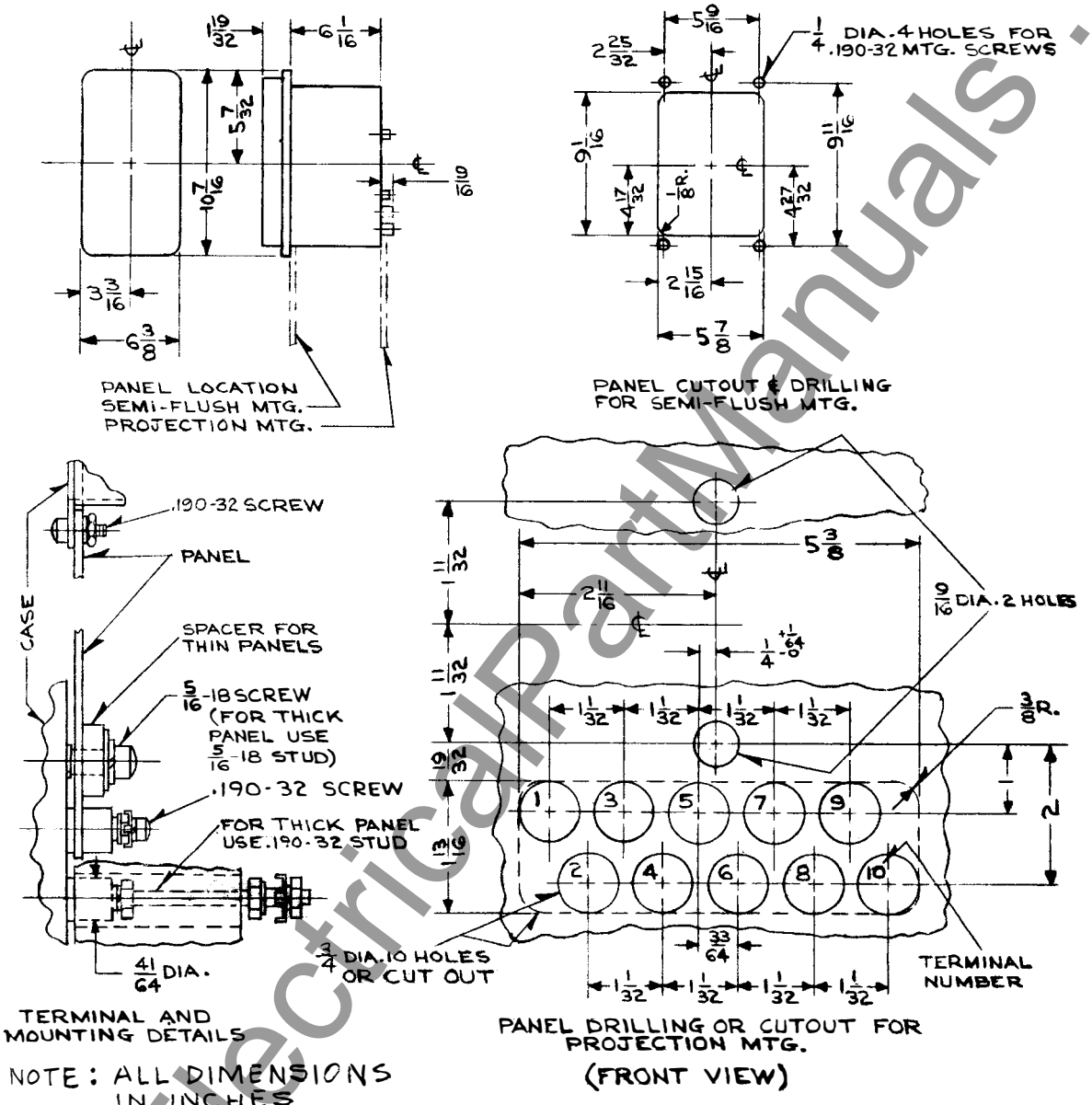


Fig. 7. Outline and Drilling Plan for the Type CRN-1 Relay in the Type FT-21 Case.

WESTINGHOUSE ELECTRIC CORPORATION
RELAY DEPARTMENT **NEWARK, N. J.**
Printed in U. S. A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CRN-1 REVERSE POWER 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 CRN-1 relay is a three phase directionally controlled timing relay used to protect a-c generators from motoring. When such a condition occurs and persists for a predetermined time interval, the generator may be tripped or an alarm sounded. The directional unit has watt characteristics and the timer unit is adjustable from approximately 2 to 40 seconds.

CONSTRUCTION AND OPERATION

The relay consists of a directional unit, a timing unit, and an indicating contactor switch unit.

Timer Unit (CV)

The timer unit operates on the induction-disc principle. A main coil located on the center leg of an "E" type laminated structure produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg (front view) to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap causes a contact closing torque.

Directional Unit (D)

The directional unit is a product induction cylinder type unit operating on the interaction between the polarizing circuit flux and the operating circuit flux.

Mechanically, the directional 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 series-connected polarizing coils mounted diametrically opposite one another; two series-connected operating coils mounted diametrically opposite one another; and 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 stops for the moving element contact arm are an integral part of the bridge.

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.

The timer unit cannot be energized unless the power flow is in the tripping direction because its

SUPERSEDES I.L. 41-251.2A
*Denotes change from superseded issue.

EFFECTIVE DECEMBER 1962

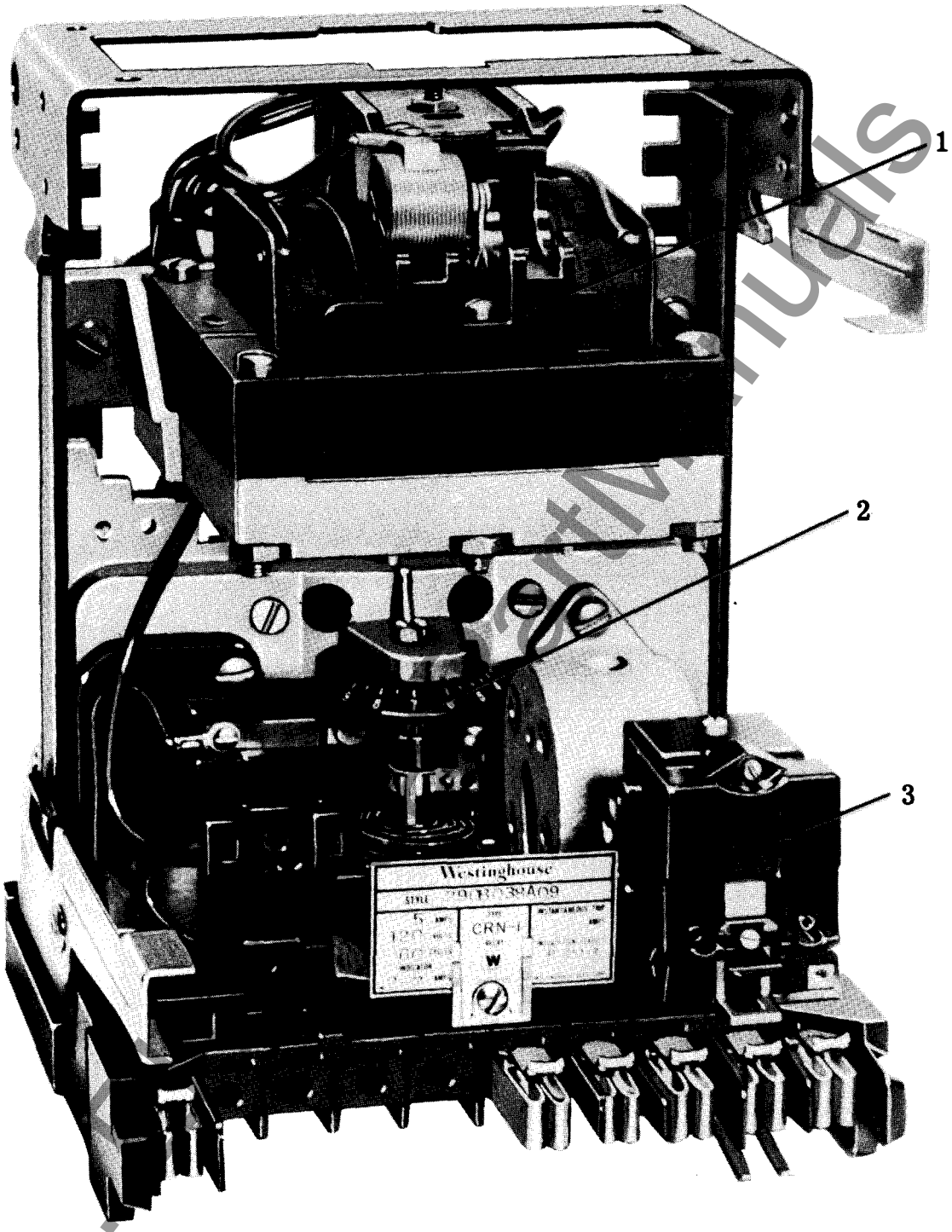


Fig. 1. Type CRN-1 Relay Without Case. 1 - Directional Unit (D). 2 - Timer Unit (T). 3 - Indicating Contactor Switch (ICS).

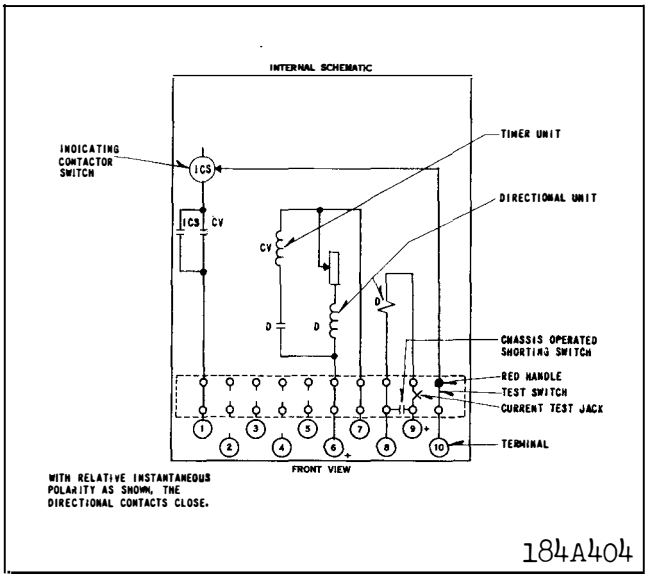


Fig. 2. Internal Schematic of the Single Trip Type CRN-1 Relay in the FT-21 Case.

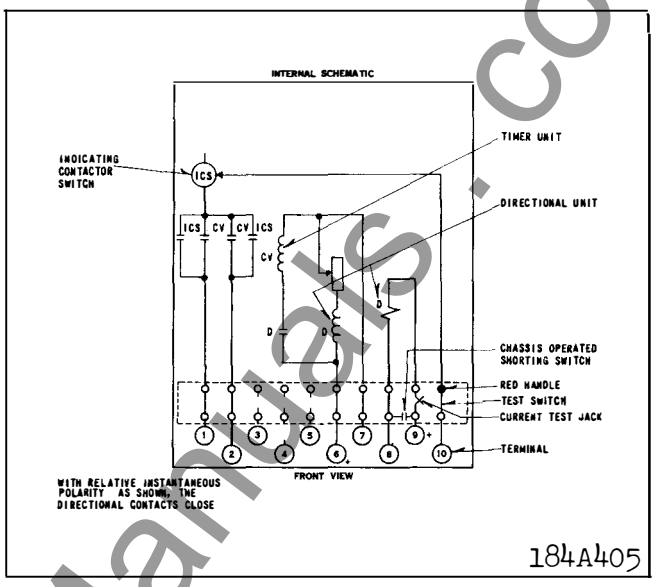


Fig. 3. Internal Schematic of the Double Trip Type CRN-1 Relay in the FT-21 Case.

potential coil is connected in series with the contacts of the directional unit. Hence, the relay is directionally controlled.

Indicating Contactor Switch Unit (ICS)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The type CRN-1 relay is available with either a 120 volt or 208 volt rating.

Timer Unit (CV)

The timer unit is rated at 120 or 208 volts, 60 cycles. The minimum trip value is 54% of rated voltage. The continuous overload capacity is 110% of rated voltage. Characteristic time curves are shown in Fig. 4 for various voltages and time lever settings.

Directional Unit (D)

The directional unit has its maximum torque when the current leads the voltage by 30^{O}. The unit should be connected using the 30^{O} connection. When using this connection the maximum torque of the relay occurs at 100% P.F.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating Contact Switch (ICS)

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

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 mount-

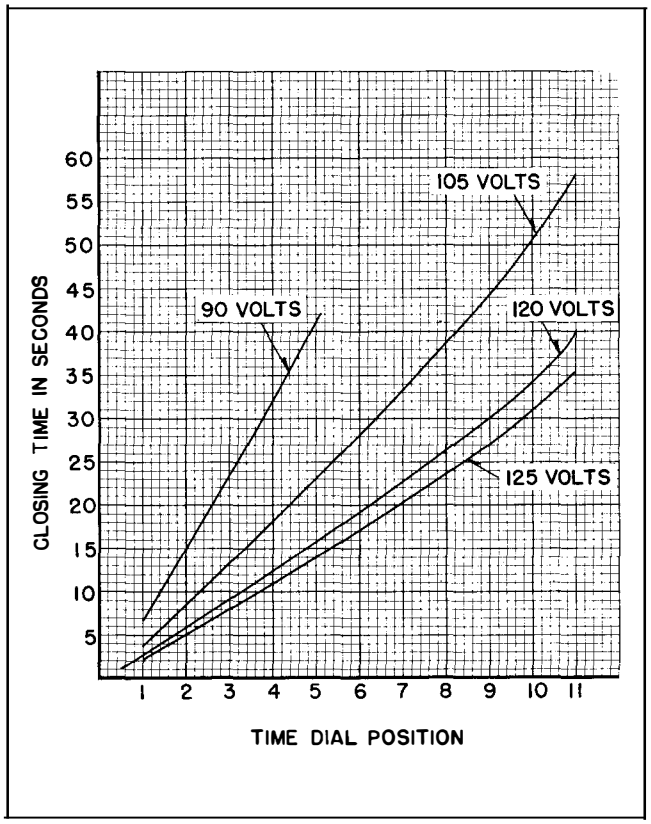


Fig. 4. Typical Time Curves of the Timer Unit of the 120 volt Type CRN-1 Relay. Proportional voltage apply for the 208 volt relay.

ing. Either a mounting stud or the mounting screws may by 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.

For detailed FT case information refer to I.L. 41-076.

For correct operation, the type CRN-1 relay should be connected so that maximum torque occurs for unity power factor on the system. Since the directional unit has a 30^{O} characteristic, this may be accomplished by using the connections shown in Fig. 5.

The voltage operated timer unit should be connected across the line. External schematic for this application as shown in Fig. 5.

SETTINGS

There is only one setting to be determined. This is the time delay of the voltage operated timer, and it is adjusted by the time dial position. Fig. 4 gives a curve of time delay vs time dial setting for various impressed voltages. Time is approximately proportional to time dial setting.

Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energized a 125 or 250 volt d-c type WL relay switch, or equivalent, use the 0.2 ampere tap.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be distrubed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. 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.

Acceptance Check

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

A. Timer Unit (CV)

The directional unit contacts must be in the closed position when checking the operation of the timer unit.

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right

of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – Set the time dial to position 6. Alternately apply 54% of rated voltage plus 3% and minus 3%. The moving contact should leave the backstop at plus 3% and should return to the backstop at minus 3%.

3. Time Curve – Fig. 4 shows the time curve for the CRN-1 relay. With the time dial set to the indicated position, apply the voltages specified and measure the operating time of the relay. The operating times should equal those of Fig. 4 plus or minus 5 percent.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

C. Directional Unit (D)

1. Contact Gap – The gap between the stationary contact and moving contact with the relay in a de-energized position should be approximately .020".

2. Sensitivity – The respective directional units should trip with value of energization and phase angle relationships as indicated in Table 1.

Routine Maintenance

All relays should be inspected periodically and the time of 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. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces an error in timing.

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").

A. Timer Unit (CV)

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – The adjustment of the spring tension in setting the minimum trip current value of the relay is most conveniently made with the damping magnet removed. Close directional contacts.

With the time dial set on "0", wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

Set the relay time dial to position 6.

Adjust the control spring tension so that the moving contact will leave the backstop at 65 volts +1.0% and will return to the backstop at 65 volts -1.0%.

TABLE 1

DIRECTIONAL UNIT SENSITIVITY

Relay Type	Rating Volts	Values for Min. Pick-Upt		Phase Angle Relationship
		Volts	Amperes	
CRN-1	120	Rated	.020	I leading V by 30° ††
	or 208	Rated	.023	I in-phase with V

† *The energization quantities are input quantities at the relay terminals.*

†† *Maximum torque angle.*

3. Time Curve Calibration – Install the permanent magnet.

Set the time dial to position #11. Apply rated voltage to terminals 6 and 7 with directional contacts closed. Adjust the permanent magnet keeper until the operating time is 40 seconds ±3%.

B. Indicating Contactor Switch – Unit (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The indicator target should drop freely.

C. Directional Unit (D)

1. The upper pin bearing should be screwed down until there is approximately .025" clearance between it and the top of shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

2. The contact gap adjustment for the directional unit is made as follows:

With the moving contact in the normally-opened position, i.e. against the right stop on bridge, screw in the stationary contact until both contacts just close as indicated by a neon lamp in the contact circuit. Then, screw the stationary contact away from * the moving contact 3/4 of a turn. 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.

The set screw in the stationary contacts have been shop adjusted for optimum follow and this adjustment should not be disturbed.

The moving contact assembly has been factory adjusted for low contact bounce performance and should not be changed.

3. Maximum Torque Adjustment – Apply rated voltage to terminals 6 and 7, and 4 amperes to terminals 8 and 9, making sure the polarities are correct. With the voltage and current in phase, the contacts should close. Now adjust the angle between current and voltage to 120° (current leading the voltage). Adjust the resistor to just close the contacts. Contacts should open when the angle between current and voltage is 120° + 1° leading.

4. 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.

The spring is to be adjusted such that the contacts will close as indicated by a neon lamp in the contact circuit when energized with the required current and voltage as shown in Table 1. This table indicates that the spring can be adjusted when the phase angle relationship between the operating circuit and the polarizing circuit is at the maximum torque angle or when the circuit relationship has the operating and polarizing circuits in phase. It is recommended that a single phase (in phase relation-

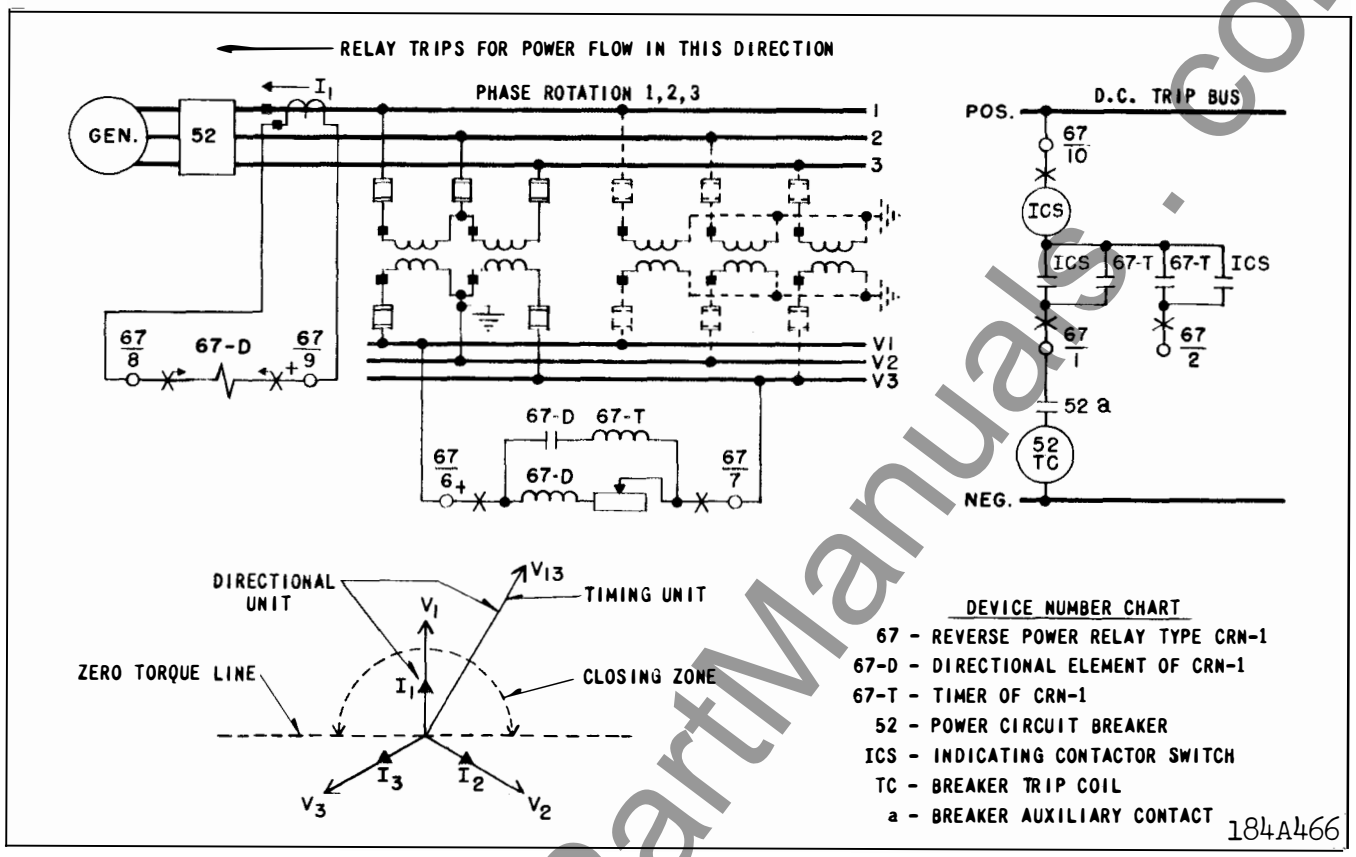


Fig. 5. External Schematic of the Type CRN-1 for Reverse Power Protection.

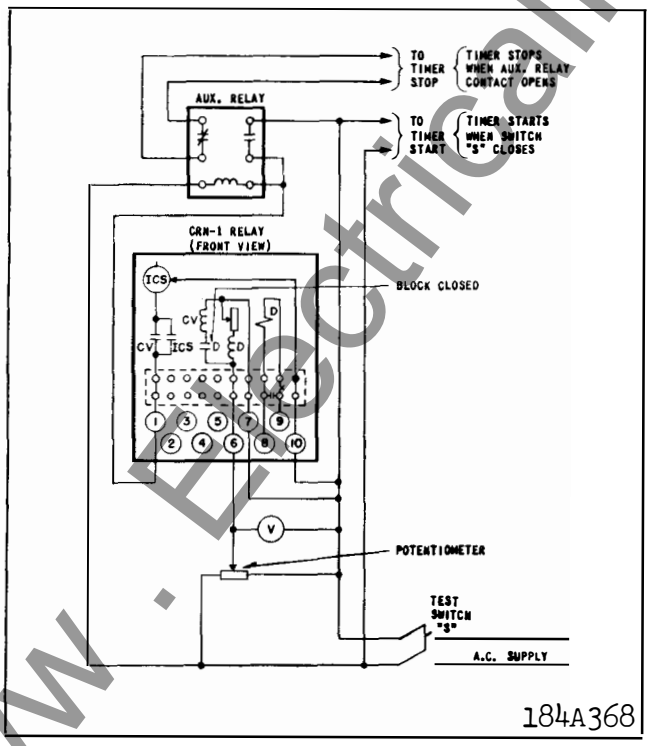


Fig. 6. Test Connections for the Timer Unit of the Type CRN-1 Relay in the Type FT-21 Case.

ship) set-up be used as a matter of ease and convenience.

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

The 60 cycle burden of the units of the type CRN-1 relay are as follows:

Coil	Burden at	Volt-Amperes	Power □ Factor
Timer	Rated voltage	6.5	73°
Directional Potential	Rated voltage	3.5	60°
Directional Current	5 Amps.	5.5	47°

□ Angle that current lags the voltage.

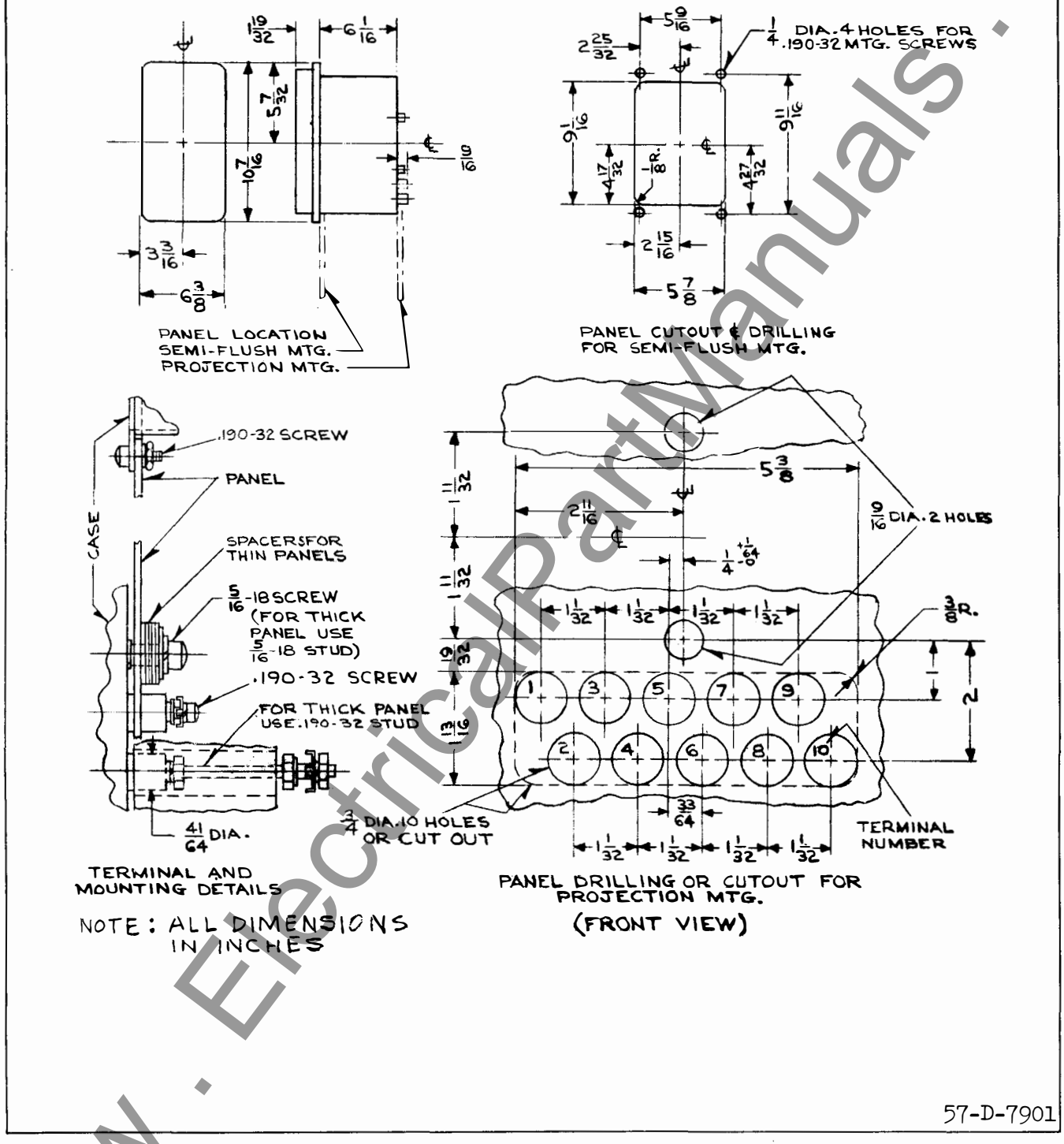


Fig. 7. Outline and Drilling Plan for the Type CRN-1 Relay in the Type FT-21 Case.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CRN-1 REVERSE POWER 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 CRN-1 relay is a single phase directionally controlled timing relay used to protect a-c generators from motoring. When such a condition occurs and persists for a predetermined time interval, the generator may be tripped or an alarm sounded. The directional unit has 30° maximum torque characteristics and the timer unit is adjustable from approximately 2 to 40 seconds.

CONSTRUCTION AND OPERATION

The relay consists of a directional unit, a timing unit, and an indicating contactor switch unit.

Timer Unit (CV)

The timer unit operates on the induction-disc principle. A main coil located on the center leg of an "E" type laminated structure produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg (front view) to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap causes a contact closing torque.

Directional Unit (D)

The directional unit is a product induction cylinder type unit operating on the interaction between the polarizing circuit flux and the operating circuit flux.

Mechanically, the directional 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 series-connected polarizing coils mounted diametrically opposite one another; two series-connected operating coils mounted diametrically opposite one another; and 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 stops for the moving element contact arm are an integral part of the bridge.

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.

The timer unit cannot be energized unless the power flow is in the tripping direction because its

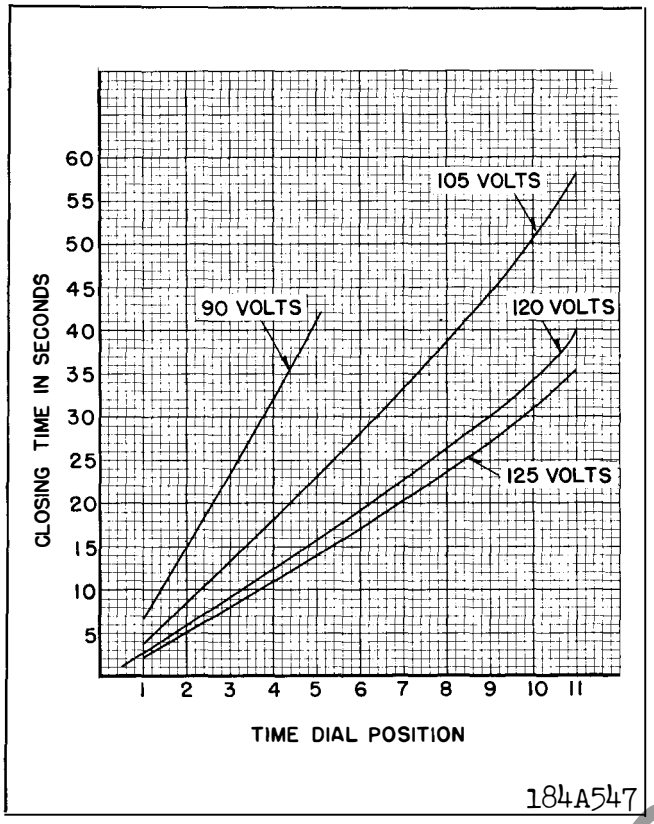


Fig. 4. Typical Time Curves of the Timer Unit of the 120 volt Type CRN-1 Relay. Proportional voltage apply for the 208 volt relay.

ing. Either a mounting stud or the mounting screws may by 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.

For detailed FT case information refer to I.L. 41-076.

For correct operation, the type CRN-1 relay should be connected so that maximum torque occurs for unity power factor on the system. Since the directional unit has a 30^{O} characteristic, this may be accomplished by using the connections shown in Fig. 5.

The voltage operated timer unit should be connected across the line. External schematic for this application as shown in Fig. 5.

SETTINGS

There is only one setting to be determined. This is the time delay of the voltage operated timer, and it is adjusted by the time dial position. Fig. 4 gives a curve of time delay vs time dial setting for various impressed voltages. Time is approximately proportional to time dial setting.

Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energized a 125 or 250 volt d-c type WL relay switch, or equivalent, use the 0.2 ampere tap.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be distrubed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. 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.

Acceptance Check

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

A. Timer Unit (CV)

The directional unit contacts must be in the closed position when checking the operation of the timer unit.

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right

of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – Set the time dial to position 6. Alternately apply 54% of rated voltage plus 3% and minus 3%. The moving contact should leave the backstop at plus 3% and should return to the backstop at minus 3%.

3. Time Curve – Fig. 4 shows the time curve for the CRN-1 relay. With the time dial set to the indicated position, apply the voltages specified and measure the operating time of the relay. The operating times should equal those of Fig. 4 plus or minus 5 percent.

B. Indicating Contactor Switch (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The indicator target should drop freely.

The contact gap should be approximately .047" between the bridging moving contact and the adjustable stationary contacts. The bridging moving contact should touch both stationary contacts simultaneously.

C. Directional Unit (D)

1. Contact Gap – The gap between the stationary contact and moving contact with the relay in a de-energized position should be approximately .020".

2. Sensitivity – The respective directional units should trip with value of energization and phase angle relationships as indicated in Table 1.

Routine Maintenance

All relays should be inspected periodically and the time of 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. Phantom loads should not be used in testing induction-type relays because of the resulting distorted current wave form which produces an error in timing.

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").

A. Timer Unit (CV)

1. Contact

a) By turning the time dial, move the moving contacts until they deflect the stationary contact to a position where the stationary contact is resting against its backstop. The index mark located on the movement frame should coincide with the "O" mark on the time dial. For double trip relays, the follow on the stationary contacts should be approximately 1/64".

b) For relays identified with a "T", located at lower left of stationary contact block, the index mark on the movement frame will coincide with the "O" mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the "O" mark by approximately .020". The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32".

2. Minimum Trip Current – The adjustment of the spring tension in setting the minimum trip current value of the relay is most conveniently made with the damping magnet removed. Close directional contacts.

With the time dial set on "0", wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

Set the relay time dial to position 6.

Adjust the control spring tension so that the moving contact will leave the backstop at 65 volts +1.0% and will return to the backstop at 65 volts -1.0%.

TABLE 1

DIRECTIONAL UNIT SENSITIVITY

Relay Type	Rating Volts	Values for Min. Pick-Up†		Phase Angle Relationship
		Volts	Amperes	
CRN-1	120	Rated	.020	I leading V by 30° ††
	or 208	Rated	.023	I in-phase with V

† *The energization quantities are input quantities at the relay terminals.*

†† *Maximum torque angle.*

3. Time Curve Calibration – Install the permanent magnet.

Set the time dial to position #11. Apply rated voltage to terminals 6 and 7 with directional contacts closed. Adjust the permanent magnet keeper until the operating time is 40 seconds ±3%.

B. Indicating Contactor Switch – Unit (ICS)

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should be not greater than the particular ICS tap setting being used. The indicator target should drop freely.

C. Directional Unit (D)

1. The upper pin bearing should be screwed down until there is approximately .025" clearance between it and the top of shaft bearing. The upper pin bearing should then be securely locked in position with the lock nut. The lower bearing position is fixed and cannot be adjusted.

2. The contact gap adjustment for the directional unit is made as follows:

With the moving contact in the normally-opened position, i.e. against the right stop on bridge, screw in the stationary contact until both contacts just close as indicated by a neon lamp in the contact circuit. Then, screw the stationary contact away from the moving contact 3/4 of a turn. 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.

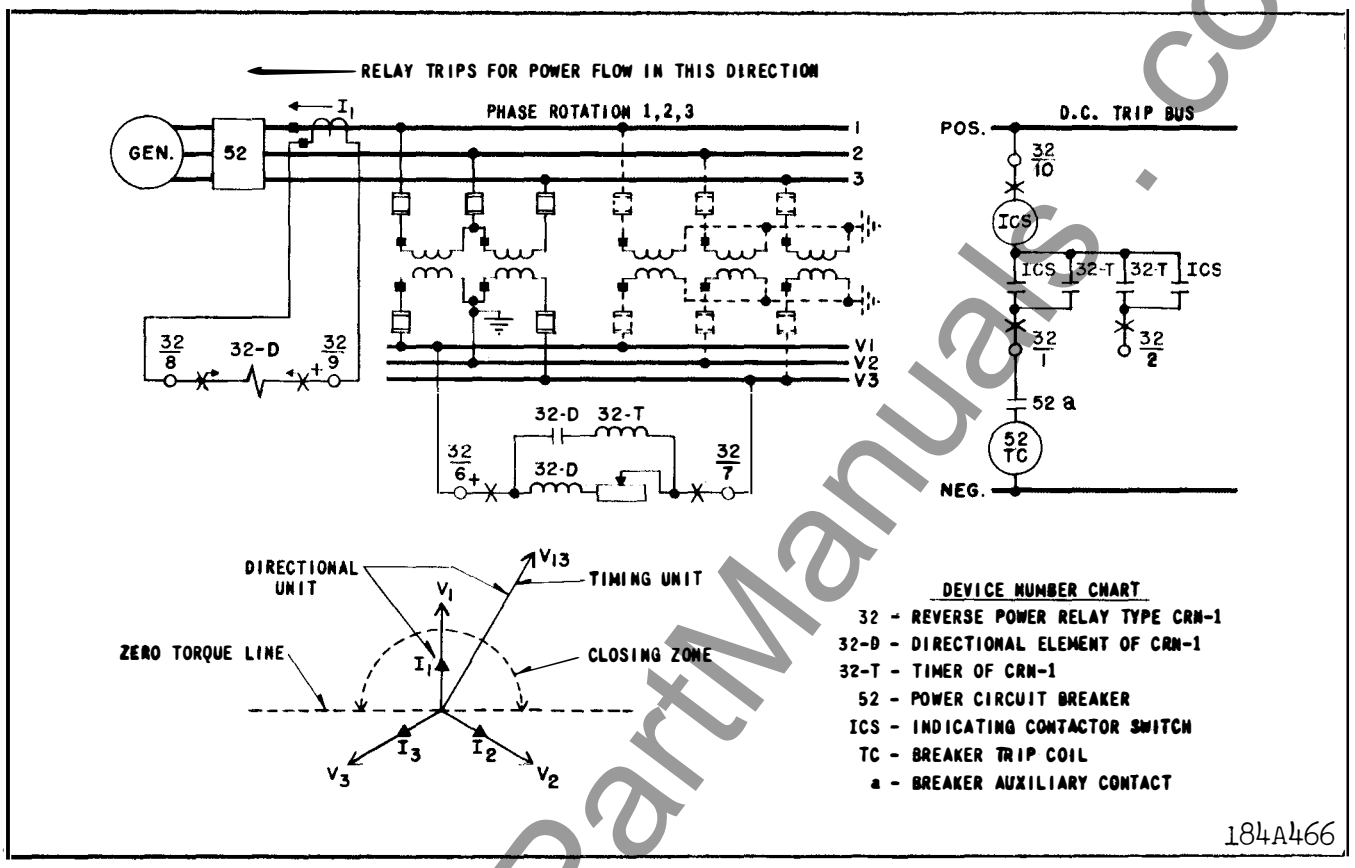
The set screw in the stationary contacts have been shop adjusted for optimum follow and this adjustment should not be disturbed.

The moving contact assembly has been factory adjusted for low contact bounce performance and should not be changed.

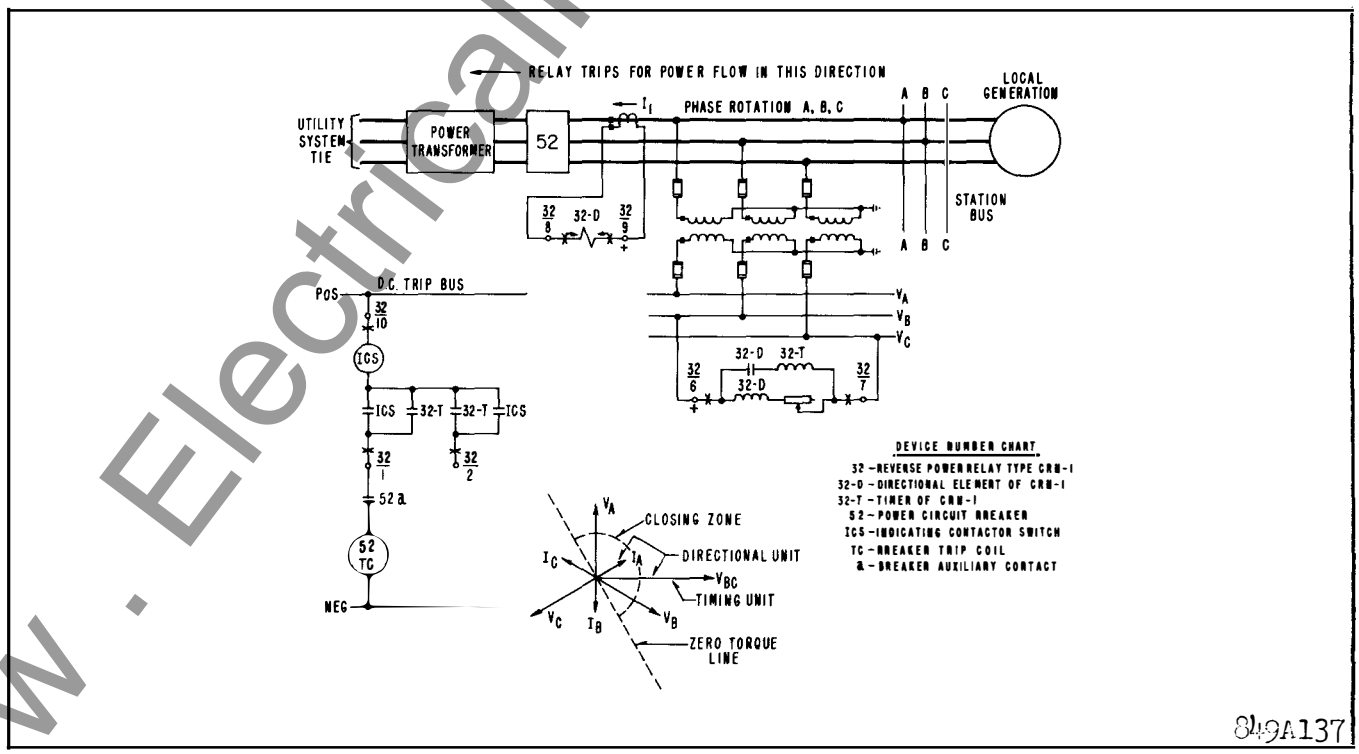
3. Maximum Torque Adjustment – Apply rated voltage to terminals 6 and 7, and 4 amperes to terminals 8 and 9, making sure the polarities are correct. With the voltage and current in phase, the contacts should close. Now adjust the angle between current and voltage to 120° (current leading the voltage). Adjust the resistor to just close the contacts. Contacts should open when the angle between current and voltage is 120° + 1° leading.

4. 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.

The spring is to be adjusted such that the contacts will close as indicated by a neon lamp in the contact circuit when energized with the required current and voltage as shown in Table 1. This table indicates that the spring can be adjusted when the phase angle relationship between the operating circuit and the polarizing circuit is at the maximum torque angle or when the circuit relationship has the operating and polarizing circuits in phase. It is recommended that a single phase (in phase relation-



** Fig. 5. External Schematic of the Type CRN-1 for Reverse Power Protection.*



** Fig. 6 External Schematic of the CRN-1 Relay to Prevent Reverse Magnetization When Utility Tie is Removed From the Local System.*

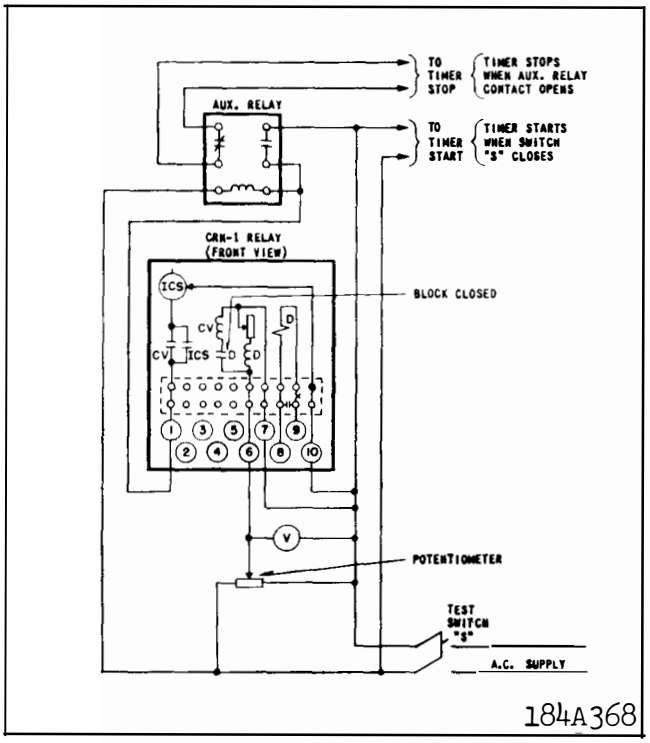


Fig. 7. Test Connections for the Timer Unit of the Type CRN-1 Relay in the Type FT-21 Case.

ship) set-up be used as a matter of ease and convenience.

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

The 60 cycle burden of the units of the type CRN-1 relay are as follows:

Coil	Burden at	Volt-Amperes	Power □ Factor
Timer	Rated voltage	6.5	73°
Directional Potential	Rated voltage	3.5	60°
Directional Current	5 Amps.	5.5	47°

□ Angle that current lags the voltage.

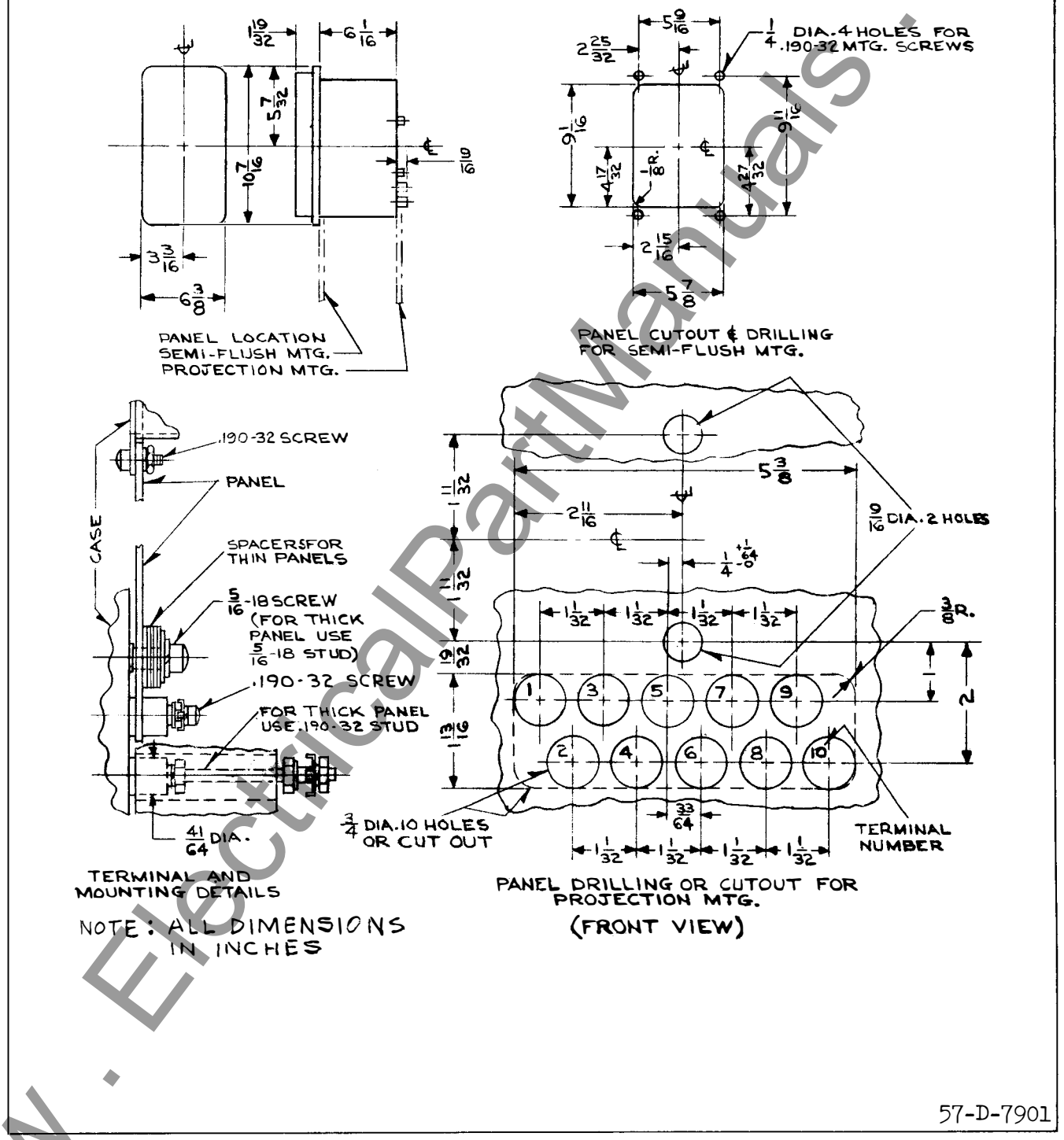


Fig. 8. Outline and Drilling Plan for the Type CRN-1 Relay in the Type FT-21 Case.

WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **NEWARK, N. J.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CRN-1 REVERSE POWER 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 CRN-1 relay is a single phase directionally controlled timing relay used to protect a-c. generators from motoring. When such a condition occurs and persists for a predetermined time interval, the generator may be tripped or an alarm sounded. The directional unit has watt characteristics and the timer unit is adjustable from approximately 2 to 25 seconds.

CONSTRUCTION AND OPERATION

The relay consists of two induction disc type units. The upper one is the timer unit and the lower one is a directional unit.

Timer Unit

This unit is a geared induction disc type unit. The induction disc is four inches in diameter, mounted on a vertical shaft. The shaft is supported on the lower end by a steel ball bearing riding between concave sapphire jewel surfaces, and at the upper end by a stainless steel pin.

The moving contact is a small silver hemisphere fastened on the end of an arm. The other end of this arm is clamped to an insulated shaft geared to the disc shaft. The electrical connection is made from the moving contact thru the arm and a spiral spring. One end of the spring is fastened to the arm, and the other to a slotted spring adjuster disc which in turn fastens to the moulded block mounted on the element frame.

The stationary contact assembly consists of a silver contact attached to the free end of a leaf spring. This spring is fastened to the moulded block. A small set screw provides adjustment of the contact follow. When double trip is required, another leaf spring contact is mounted on the moulded block and a double contact is mounted on the rigid moving arm. The set screws on the stationary contact assembly provide adjustment so that both circuits will be made simultaneously.

The disc is rotated by an electro-magnet in the rear and damped by a permanent magnet in front. The operating torque is obtained by the electromagnet construction shown in Fig. 1. The main pole coil of the unit is energized by line voltage. This coil acts as a primary of a transformer and induces a voltage in a secondary coil. Current from this secondary coil flows through the upper pole coils and thus produces torque on the disc by the reaction between fluxes of the upper and lower poles.

The timer unit cannot be energized unless the power flow is in the tripping direction because its potential coil is connected in series with the contacts of the directional unit. Hence, the relay is directionally controlled.

Directional Unit

This unit is similar to the timing unit except that the quantities used to rotate the disc and the contact assembly are different. The two upper poles of the electromagnet are energized by line current, and the lowerpole by polarizing voltage. The fluxes produced by these two electrical quantities cause rotation of the disc in a direction depending on the phase angle between the current and voltage. As power reverses, the current in the relay reverses while the polarizing voltage remains fixed, thus a directional torque is obtained.

The unit is non geared and the rotation of the disc in the contact opening direction is limited to a few degrees by a projecting stop on the disc which strikes the element frame.

The moving contact assembly consists of a rigid counterweighted arm fastened to an insulated section of the disc shaft. A leaf spring is fastened to the shaft end of the arm and a silver contact is attached to the free end of the leaf spring. When the moving contact strikes the stationary contact, the leaf spring

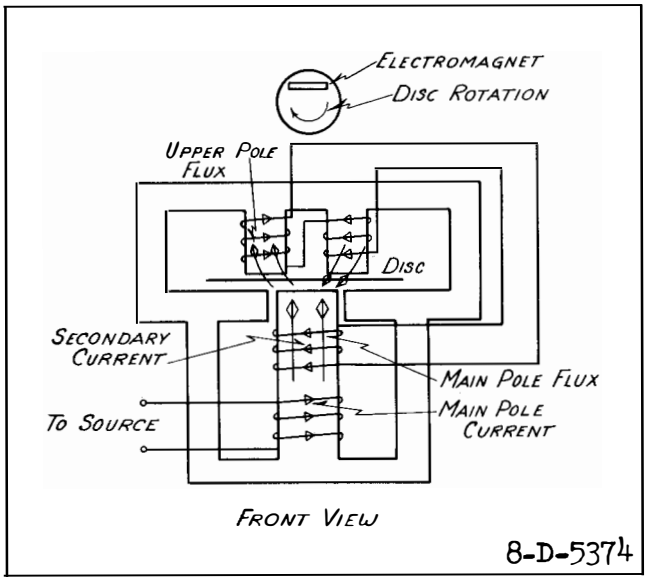


Fig. 1. Flux and Current Relations in the Induction Type Relay Unit.

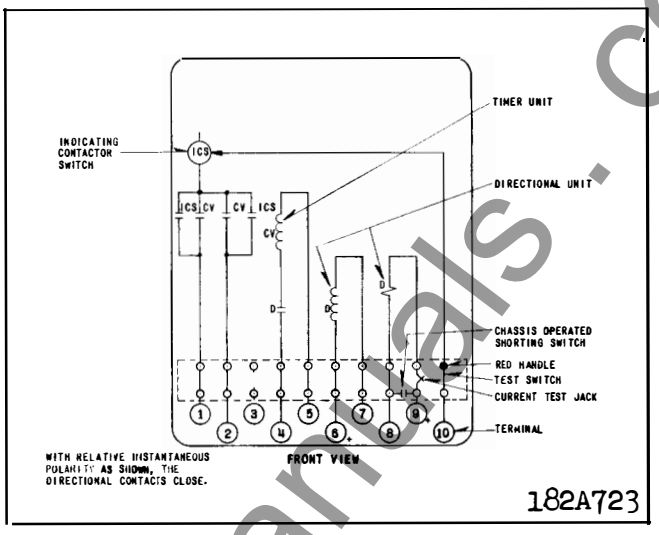


Fig. 2. Internal Schematic of the Double Trip Type CRN-1 Relay in the Type FT31 Case. For the Single Trip Relay the Circuits Associated with Terminal 2 are Omitted.

deflects to provide the required contact follow. The spiral spring assembly is made as described above for the timing unit.

The stationary contact is mounted on a right angle bracket fastened to the element frame on a Micarta insulating block. The contact screw projects thru the outer end of the bracket and provides adjustable contact separation.

Indicating Contactor Switch Unit (ICS)

The d-c indicating contactor switch is a small clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached, is attracted to the magnetic core upon energization of the switch. When the switch closes, the moving contacts bridge two stationary contacts, completing the trip circuit. Also during this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop. The target is reset from the outside of the case by a push rod located at the bottom of the cover.

The front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

Timer Unit

The timer unit is rated at 115 volts, 60 cycles. The minimum trip value is 65 volts or 57% of rated voltage. The continuous overload capacity is 127 volts or 110% of rated voltage. The characteristic time curves are shown in Fig. 3 for various voltages and time lever settings.

The directional unit has a watt characteristic with maximum torque when current and voltage are in phase. The potential coil is rated 70 volts, 60 cycles with an overload capacity of 77 volts or 110% of rated value. The current coil is rated 8 amperes, 60 cycles. This is also its continuous rating. The minimum pick-up current is 0.04 ampere in the current coil in phase with 65 volts across the potential coil.

Trip Circuit

The main contacts will safely close 30 amperes at 250 volts d-c and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The indicating contactor switch has two taps that provide a pickup setting of 0.2 or 2 amperes. To change taps requires connecting the lead located in front of the tap block to the desired setting by means of a screw connection.

Trip Circuit Constant

Indicating Contact Switch (ICS)

0.2 ampere tap	6.5 ohms d-c resistance
2.0 ampere tap	0.15 ohms d-c resistance

INSTALLATION

The relays should be mounted on switchboard

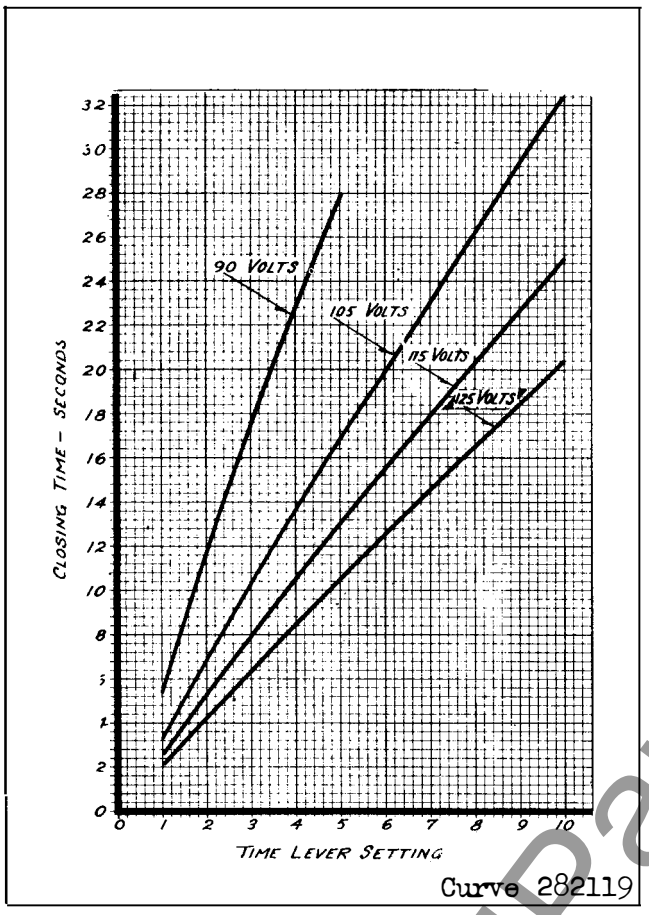


Fig. 3. Typical Time Curves of the Timer Unit of the Type CRN-1 Relay.

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.

For detailed FT case information refer to I.L. 41-076.

For correct operation, the type CRN-1 relay should be connected so that maximum torque occurs for unity power factor on the system. Since the directional unit has a watt characteristic, this may be accomplished by using line to neutral voltage for the directional unit potential coil and the corresponding line current in the series coil. If a neutral is not available, a dummy neutral may be obtained by using two reactors. The directional unit voltage coil then constitutes one leg of a wye connection, and the reactors the other two legs.

The voltage operated timer unit should be connected across the line. External schematics for these applications are shown in Figs. 4 and 5.

The time for the main contacts to break after operation can be decreased by eliminating the follow. This is done by screwing in the small set screw on the stationary contact assembly until the contact rivet rests solidly on the moulded support. When this is done, the position of the contact stop on the time lever should be shifted so that the moving and stationary contact barely touch when the time lever is set on zero.

SETTINGS

There is only one setting to be determined. This is the time delay of the voltage operated timer, and it is adjusted by the position of the time lever along the time lever scale. This scale has 10 divisions, and Fig. 3 gives a curve of time delay vs lever setting for various impressed voltages. Time is approximately proportional to lever setting.

Indicating Contactor Switch (ICS)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw. When the relay energizes a type WL relay switch, or equivalent, use the 0.2 ampere tap.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be distrubed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintenance periods, the instructions below should be followed.

All contacts should be cleaned periodically. 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.

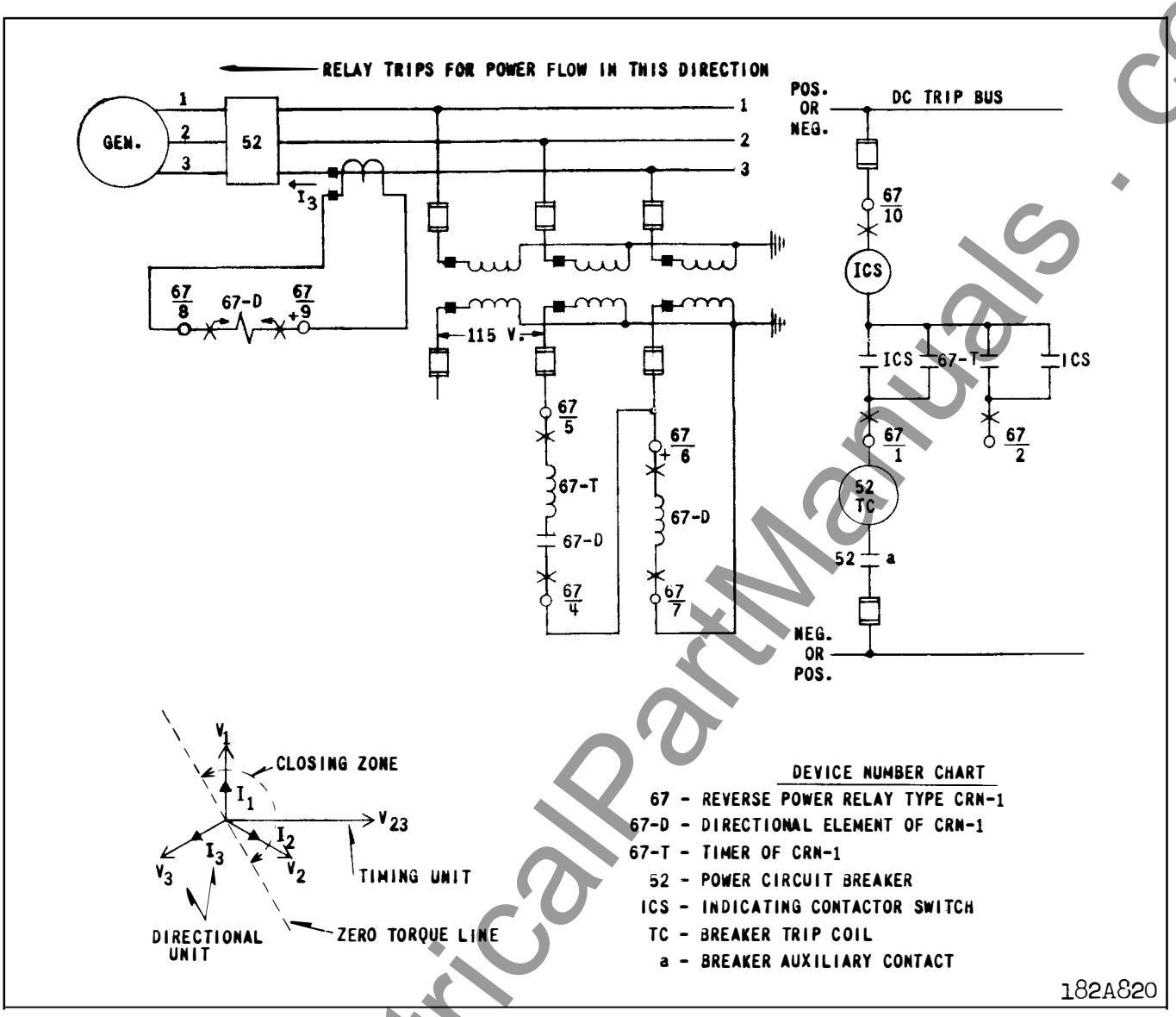


Fig. 4. External Schematic of the Type CRN-1 Relay For Reverse Power Protection Using Wye-Wye Potential Transformers.

Timer Unit

Adjust the back stop on the time lever so that the moving contact just touches the stationary contacts at the zero time lever setting. The small adment screw on the stationary contact should not be screwed in far enough to limit the follow of the stationary contact. For double-trip relays adjust these screws so that both circuits make at the same instant.

The convolutions of the spiral spring should not touch each other for all positions of the moving contacts. Adjust the tension of the spiral spring so that the contacts will operate at 65 volts. It may be necessary to shift the position of the damping magnets, as their position affects the time characterictics. This timing may be checked with a timer connected as per Fig. 6.

Directional Unit

The upper bearing screw should be screwed down until there is four to five thousandths inch clearance between it and the shaft and then securely locked in position with the lock nut. This adjustment can be made best by carefully screwing down the top bearing screw until the disc fails to turn freely and then backing up a fraction of a turn. Great care must be taken in making this adjustment to prevent damage to the bearings.

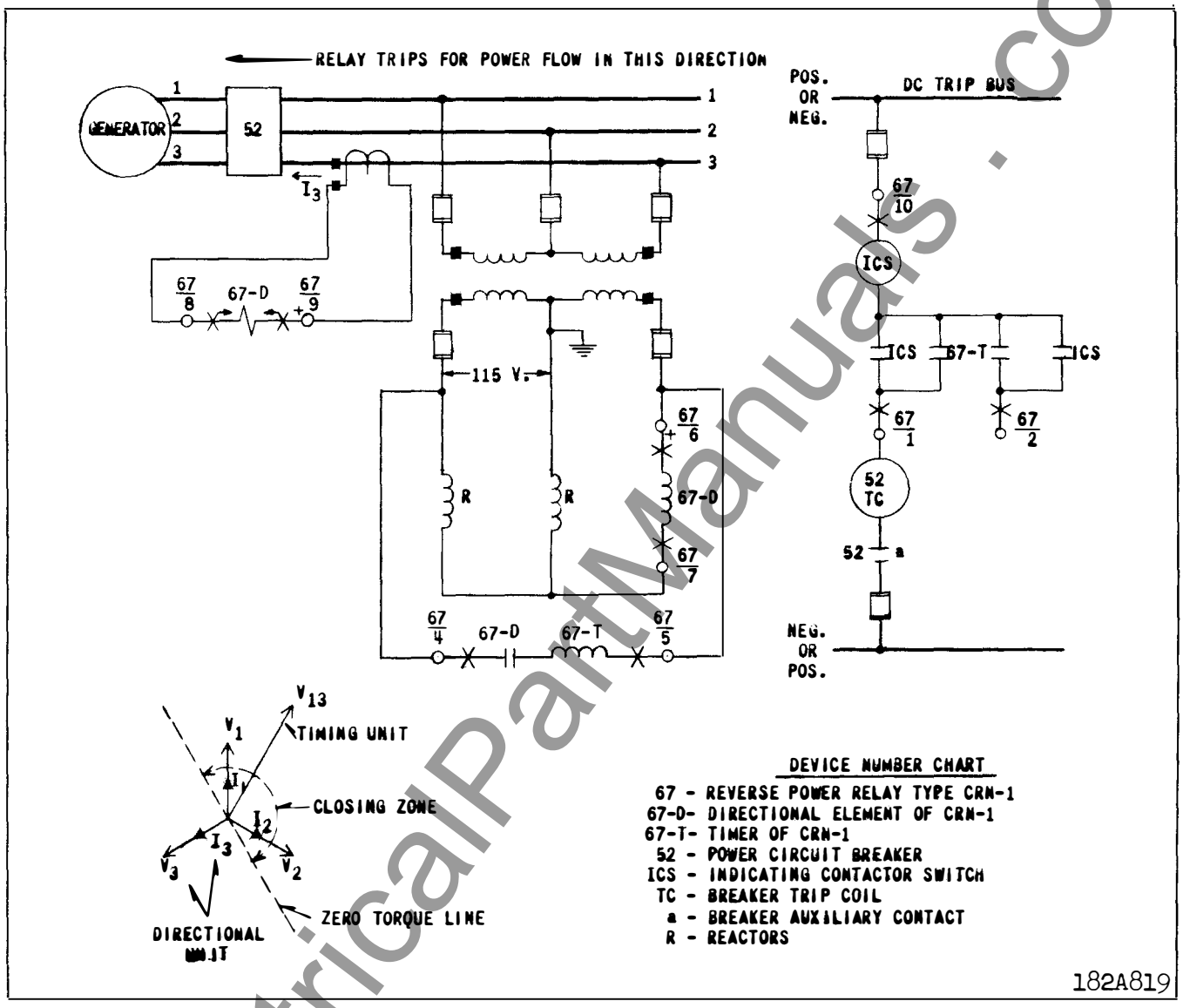


Fig. 5. External Schematic of the Type CRN-1 Relay For Reverse Power Protection Using Open Delta Potential Transformers and External Reactors.

The contact travel of the directional unit should be adjusted to 3/32". The spring tension should be adjusted so that the directional unit contacts close at 65 volts and 0.04 ampere at unity power factor.

External Reactors (When Furnished)

Connect the potential coil of the type CRN-1 directional unit in series with the two reactors. Apply 3 times rated voltage to the combination (220 volts for 70 volt relays). Using a high resistance voltmeter, check the voltage across each reactor and across the directional unit potential coil. All three voltages should be equal within ± 2 volts. Adjustments may be made by removing or reversing end laminations of the reactor iron.

Indicating Contactor Switch

Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contacts of the ICS. This value of current should not be greater than the particular ICS tap setting being used. The indicator target should drop freely.

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

The 60 cycle burden of the units of the type CRN-1 relay are as follows:

Coil	Burden at	Watts	Volt-Amperes	Power△ Factor
Timer	115 volts	4.72	8.13	54.5°
Directional Potential	70 volts	4.22	25.3	80.4°
Directional Current	5 Amps.	1.96	2.75	43.4°

△ Angle that current lags the voltage.

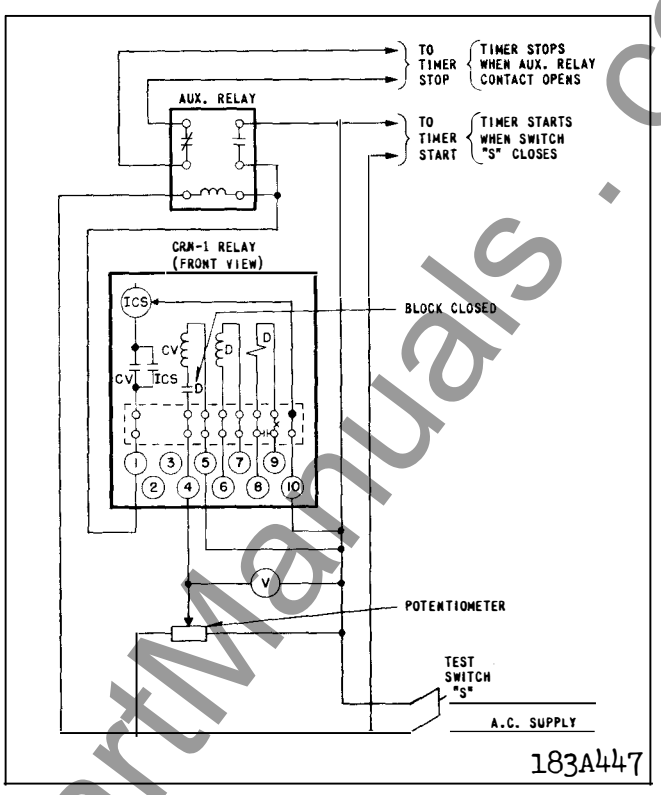


Fig. 6. Test Connections for the Timer Unit of the Type CRN-1 Relay in the Type FT31 Case.

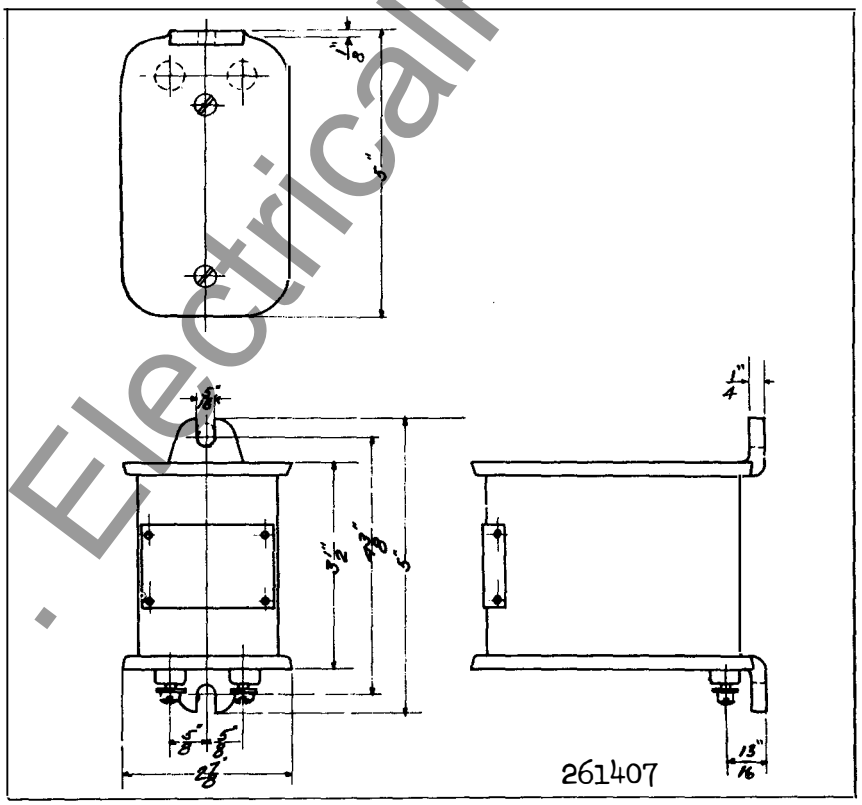


Fig. 7. Outline and Drilling Plan for the External Reactor.

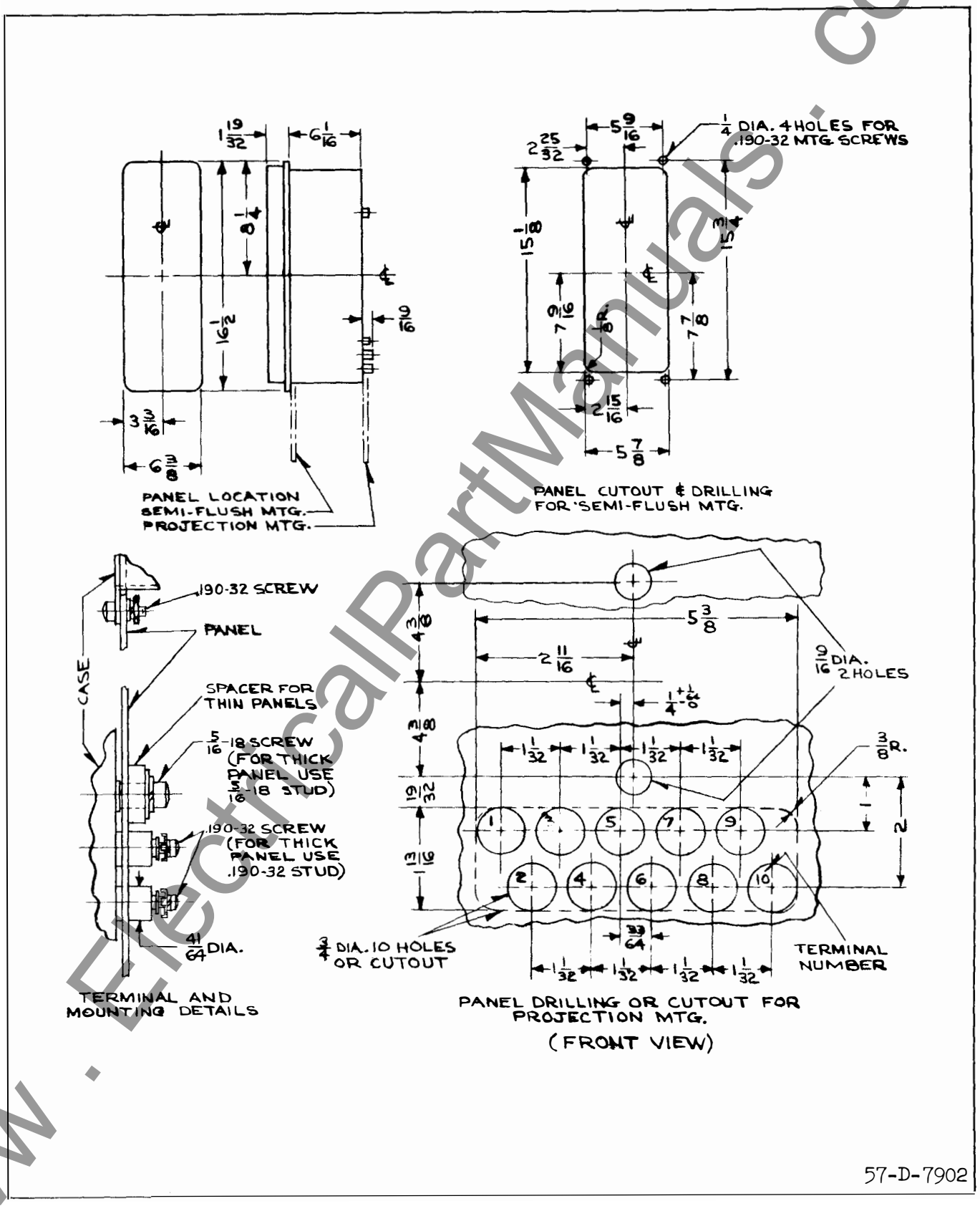


Fig. 8. Outline and Drilling Plan for the Type CRN-1 Relay in the Type FT31 Case.

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METER DIVISION

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