INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CF-1 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 CF-1 relay is an induction disc type frequency relay. It is used for the protection or control of equipment on systems where the frequency of the system changes. A typical application is in the protection of local generators in industrial plants from severe overload when the power company tie is lost.

CONSTRUCTION AND OPERATION

The type CF-1 relay contains an electromagnet, and an indicating contactor switch unit. A condenser and resistor associated with the relay circuits are mounted in an external box.

Frequency Unit

The operating unit consists of an electromagnet operating on a conducting disc. The electromagnet has potential windings on both the upper and lower poles. The lower pole circuit has capacitance in series, the upper pole has not. The underfrequency relay is so designed that at normal frequency (60) cycles the upper pole current leads the lower pole current and the two out of phase fluxes thus produced act to give contact opening torque on the disc. When the frequency drops, the phase angle of the lower pole circuit becomes more leading, until at the frequency setting of the relay the lower pole current begins to lead the upper pole current, and the relay torque is reversed to the tripping direction. The lower the frequency the greater the phase angle displacement and hence the faster the relay trips. An adjustable resistor in the upper pole circuit is provided to set the frequency at which the relay trips.

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 CF-1 relay is available in two forms --either as an underfrequency relay or an overfrequency relay. Where operation on both underfrequency and overfrequency is desired, two relays are required, one of each form. Major changes are required to convert from one form to other. The relay contacts are single or double pole single throw, or single pole double throw.

The underfrequency relay can be set to close contacts for any desired frequency between 50 and 60 cycles by setting the knob of the frequency adjusting rheostat to the desired frequency marked on the calibrated dial. Since the relay at minimum trip operates like a direc-

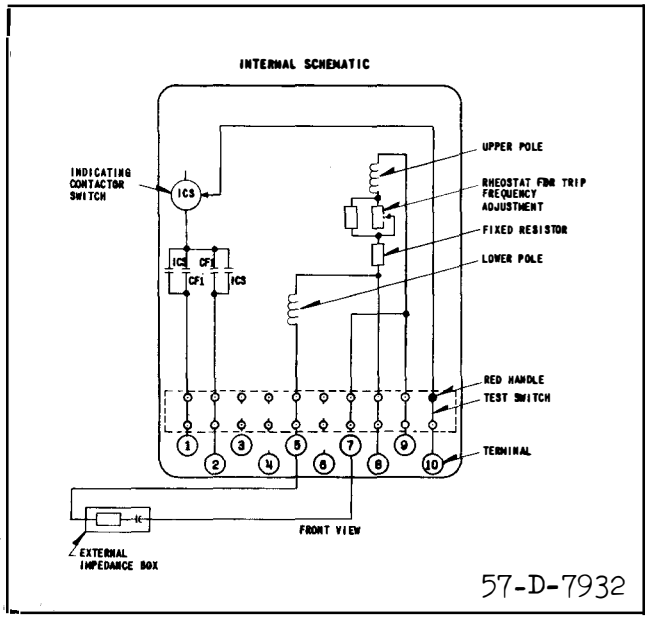

Fig. 1—Internal schematic of the double pole, single throw type CF-1 Relay in the Type FT21 Case. For the single pole, single throw relay the circuits associated with terminal 2 are omitted.

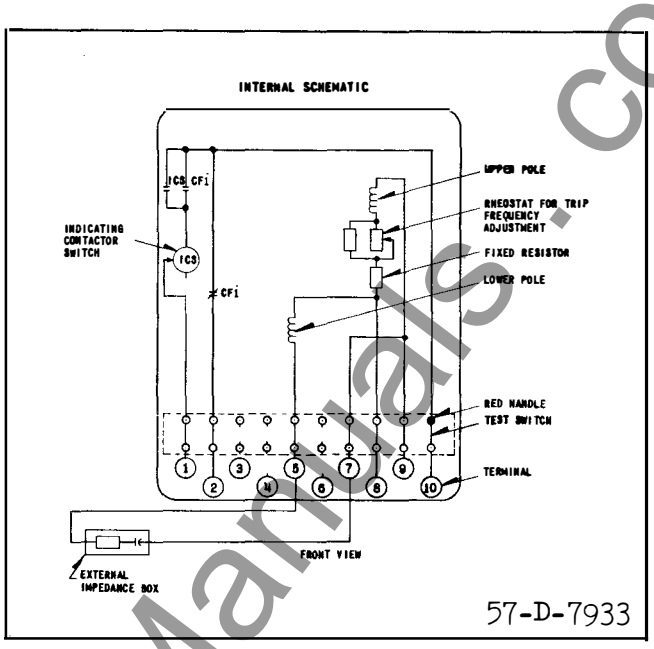

Fig. 2—Internal schematic of the single pole, double throw Type CF-1 Relay in the type FT21 Case.

tional element near zero torque, the relay is very sensitive to phase angle change resulting from a frequency change. Thus minimum trip is little affected by voltage variation. Typical voltage vs. minimum trip frequency curves are shown in Fig. 3. The circuits are also designed to minimize temperature error. Typical minimum trip frequency vs. temperature curves are shown in Fig. 4.

The relay has an inverse time characteristic. Desired time settings may be made by means of the time lever which is continuously adjustable from the #1/2 to #10 lever positions. Typical time curves for the different lever settings are shown in Figs. 5, 6 and 7.

The frequency relay contact closing and opening points are essentially the same. The relay will reset to the maximum time lever setting when the frequency changes .1 to .2 cycles from the setting. For example, suppose the 60 cycle under-frequency relay is set to close its contacts at 59 cycles from the #10 lever setting. The contact will start to move at 59.1 to 59.2 cycles but will not close until the frequency drops to 59 cycles or below. As the frequency rises just above 59 cycles, the contacts open, but will not completely reset to the #10 lever setting until the frequency rises to 59.1 or 59.2 cycles. With the time lever set at less than its maximum position, the .1 to .2 cycle differential is correspondingly less.

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 Contactor 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

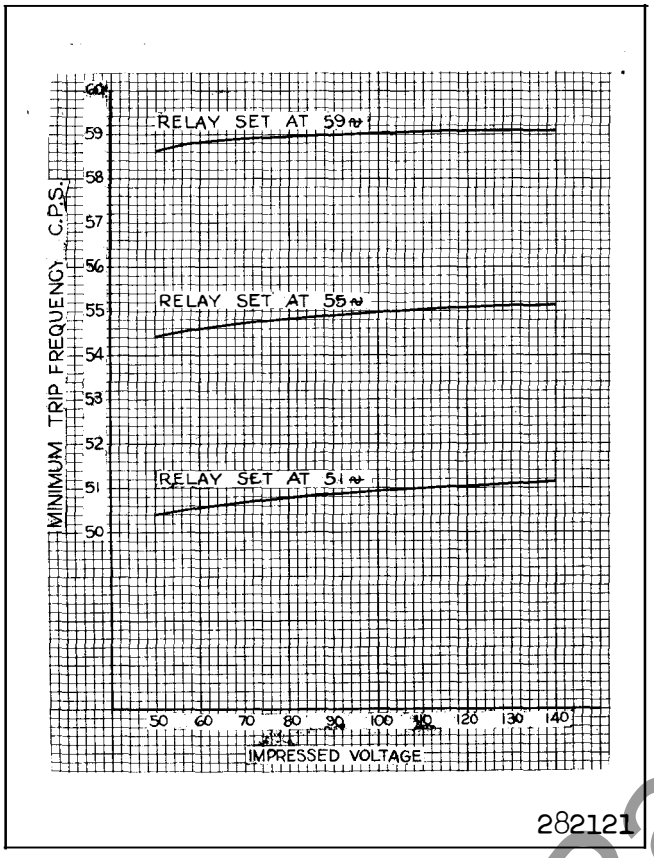

Fig. 3—Typical Voltage-Minimum Trip Frequency Curves of the Type CF-1 Underfrequency Relay.

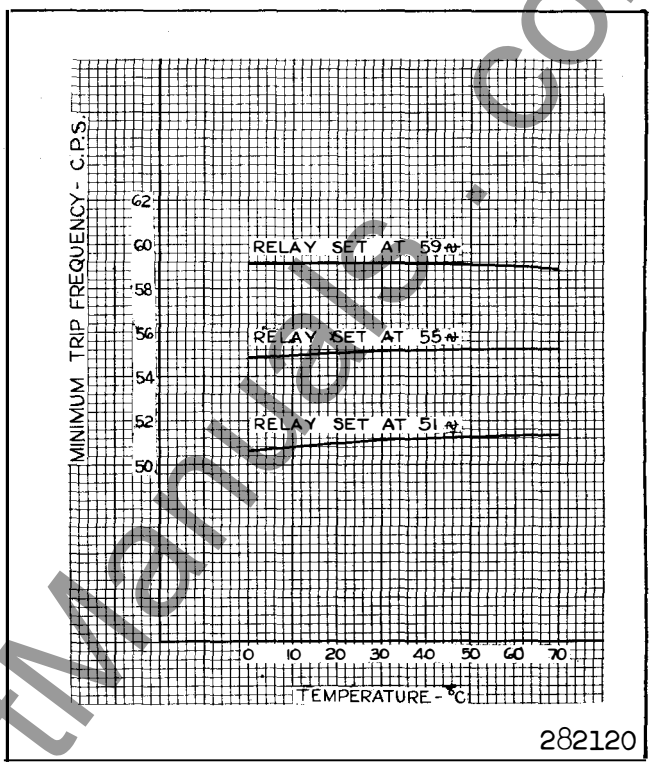

Fig. 4—Typical Temperature-Minimum Trip Frequency Curves of the Type CF-1 Underfrequency Relay.

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.

The operating windings of the relay should be connected across a suitable potential transformer with the external impedance box connected as shown in Figs. 1 and 2. Each relay must be used with its designated auxiliary unit. Relays and auxiliary units may not be interchanged.

SETTINGS

The relay is set for minimum trip by means of the frequency adjusting rheostat. The time lever position determines relay timing. The curves are drawn for variation of frequency in cycles below the frequency adjusting rheostat setting.

To adjust the CF-1 relay contacts to be quick opening, screw in the small set screw on the stationary contact assembly until the contact rivet rests solidly on the Micarta support. When this is done, the position of the contact stop on the time lever should be shifted so that the moving and stationary contacts barely touch when the time lever is set on zero. The contact opening time with no follow will be 3 to 6 cycles.

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

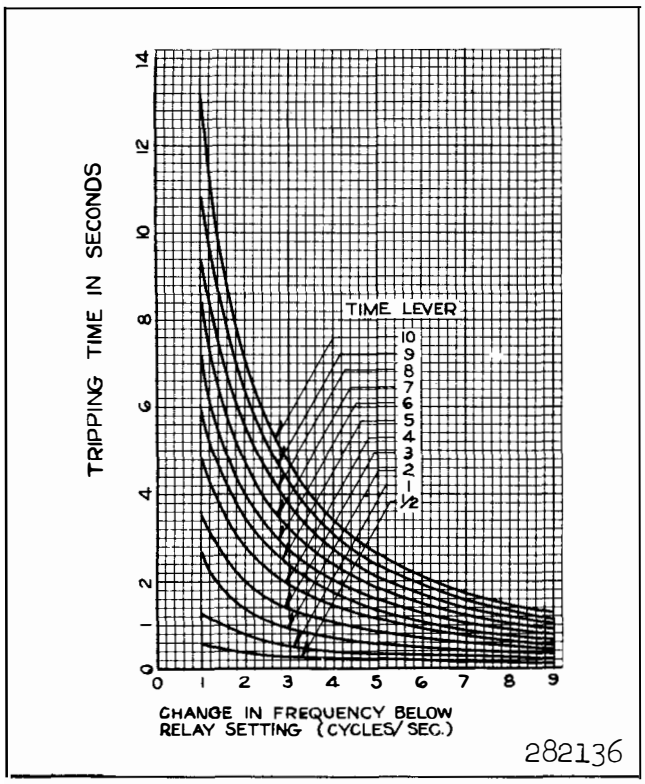

Fig. 5—Typical 57-60 Cycle Time Curves of the Type CF-1 Underfrequency Relay.

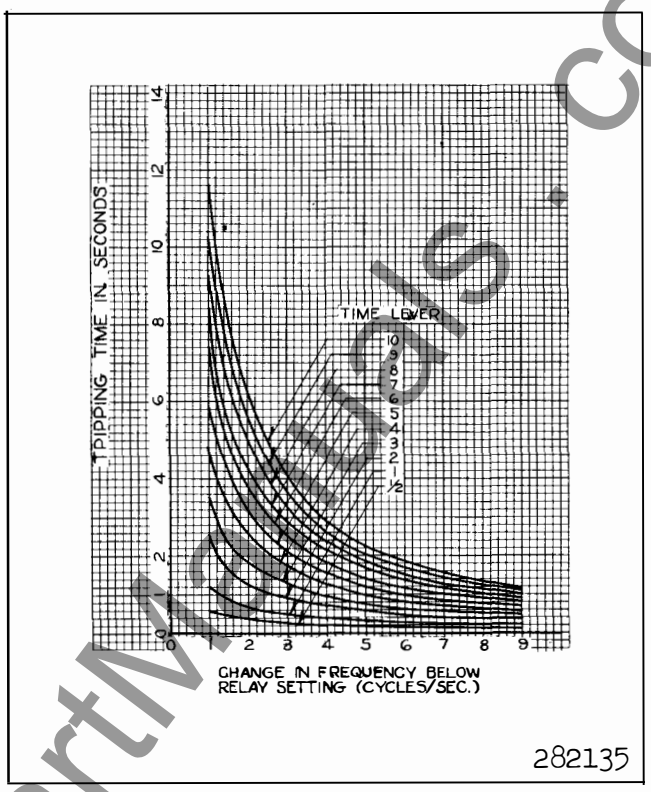

Fig. 6—Typical 53-57 Cycle Time Curves of the Type CF-1 Underfrequency Relay.

* the lead located in front of the tap block to the desired setting by means of the connecting screw.

ADJUSTMENTS AND MAINTENANCE

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

Acceptance Check

The following check is recommended to insure that the underfrequency relay is in proper working order. Relays and auxiliary units of matching serial numbers should be connected together.

A. Frequency Unit

1. Minimum Trip — Connect the relay and auxiliary unit to a variable frequency source and apply 120 volts, 60 cycles to the relay for at least 1 hour. Set the frequency adjusting rheostat at 60 cycle and apply 60 cycles to the relay. The contacts should just close. Repeat for all major scale divisions on the frequency adjusting rhetostat.

2. Time Curve — Set the time lever at 10 setting, and the frequency adjusting rheostat at 58 cycles. Apply 120 volts 60 cycles to the relay for at least 1 hour to allow the coils to reach their finally temperature. De-energize the relay and suddenly apply 54 cycles. The relay contacts should close in 3.4 ± 10% seconds.

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 operation target should drop freely.

The contact gap should be approximately .047 inch between the bridging moving contact and the adjustable stationary contacts.

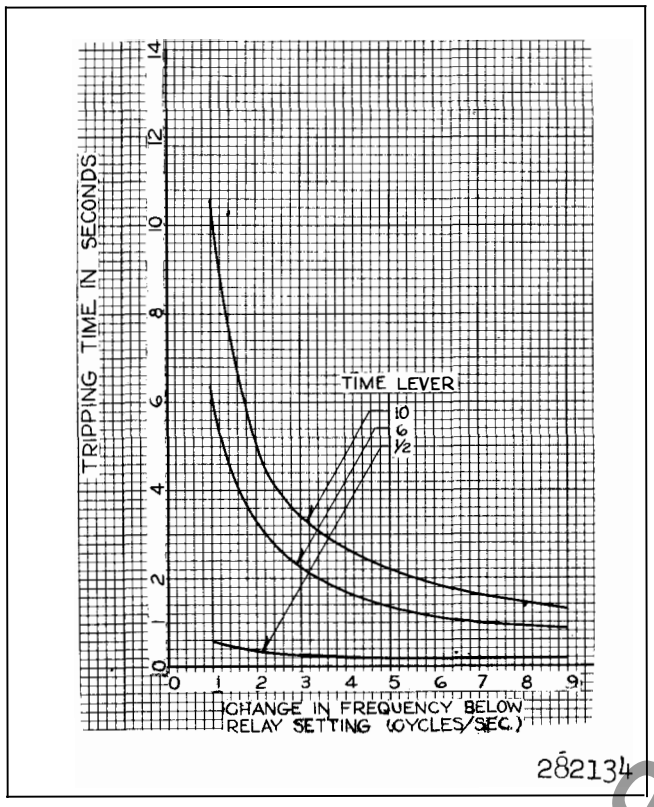

Fig. 7—Typical 50-53 Cycle Time Curves of the Type CF-1 Underfrequency Relay.

The bridging moving contact should touch both stationary contacts simultaneously.

Routine Maintenance

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 disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order. (See "Acceptance Check")

A. Spring tension — Adjust the spring tension such that the moving contact just resets to the #10 time lever position when the relay is de-energized. Then give the adjuster an additional 1/4 to 1/2 turn initial tension.

B. Frequency Adjusting Rheostat — Allow the relay to warm up for at least 1 hour at 120 volts, 60 cycles before making any adjustments. Set the frequency adjusting rheostat in the maximum counter-clockwise position and apply frequency marked on dial to the relay. Adjust the resistors in the auxiliary unit until the relay contacts just close.

Set the frequency adjusting rheostat in the extreme clockwise position and apply frequency marked on the dial to the relay. Adjust the resistor in the lower left hand corner of the relay until the contacts just close. Intermediate frequency points may then be checked by applying these frequencies to the relay and observing if the contacts just close. The trip frequencies of the relay may not agree with the markings on the frequency adjusting rheostat if components in the relay has been changed. If such is the case the scale plate should be remarked to agree with the tripping frequencies of the relay.

C. Time Curves — Energize the relay with 120 volts 60 cycles for at least an hour before making any checks. De-energize the relay and then apply the desired frequency at 120 volts. The timing may be determined by means of a cycle counter. The damping magnet may be shifted to make the relay timing agree with the curves.

D. Indicating Contactor Switch (ICS) — Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contact 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

Typical burden characteristics of the relay coils at 120 volts, 60 cycles are as follows:

Frequency Adjusting Rheostat set for	VA	Watts	Lagging Vars
59 Cycles	17.2	12.8	11.4
55 Cycles	15.7	12.5	9.7
51 Cycles	13.4	11.2	7.4

* These relays will continuously stand 110% of rated voltage.

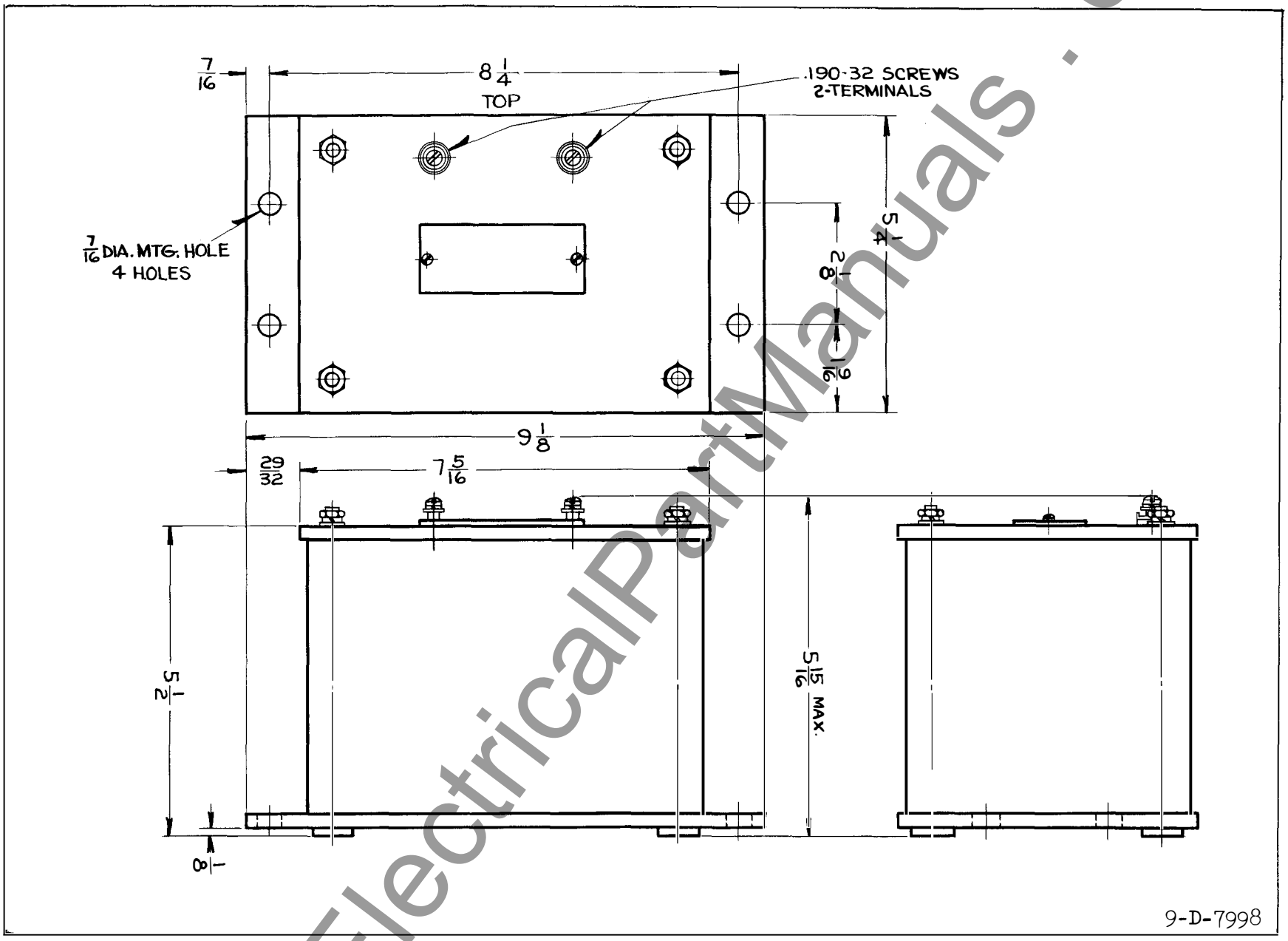

Fig. 8—Outline and Drilling Plan for the External Impedance Box.

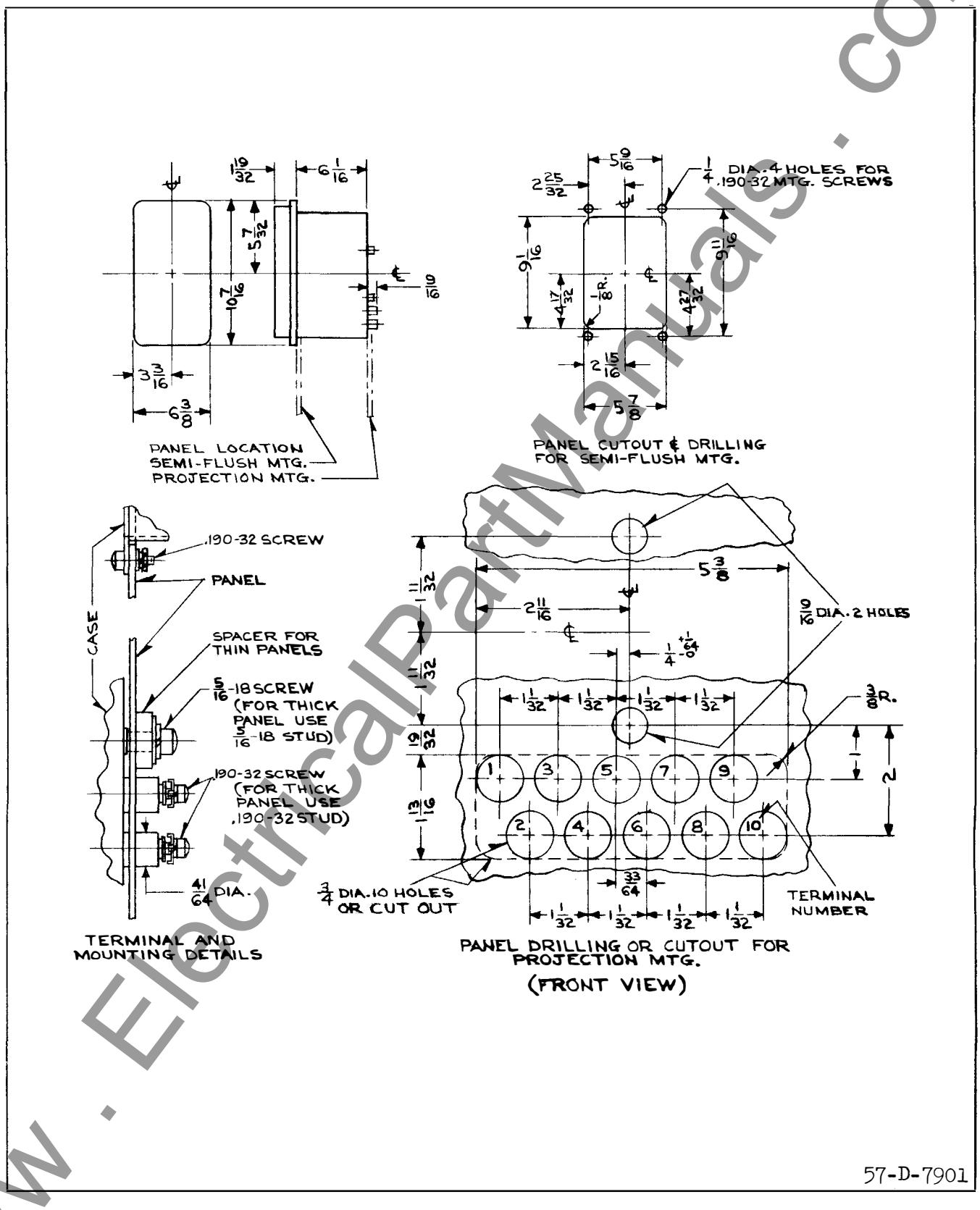

Fig. 9—Outline and Drilling Plan for the Type CF-1 Relay in the Type FT21 Case.

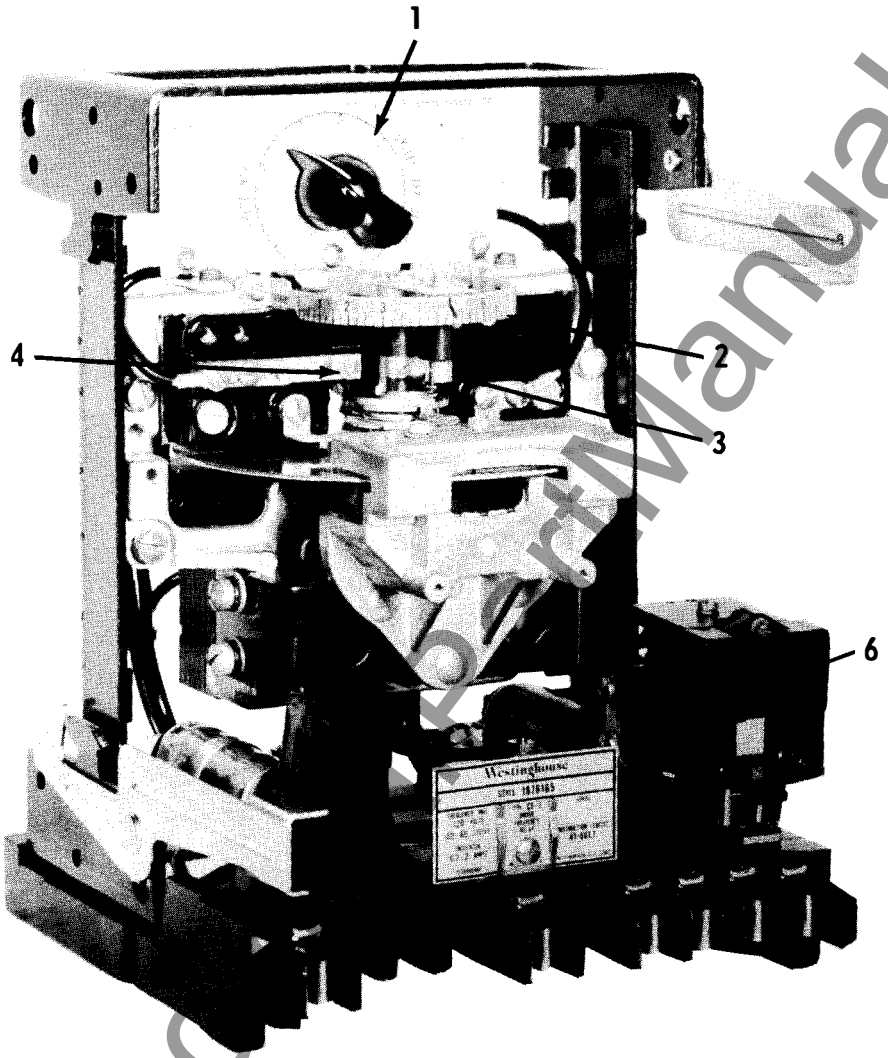

Fig. 10 — Type CF-1 Relay Without Case, 1-Frequency Setting Rheostat. 2-Time Setting Dial, 3-Moving Contact, 4-Stationary Contact, 6-Indicating Contactor Switch (ICS).

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

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CF-1 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 CF-1 relay is an induction disc type frequency relay. It is used for the protection or control of equipment on systems where the frequency of the system changes. A typical application is in the protection of local generators in industrial plants from severe overload when the power company tie is lost.

CONSTRUCTION AND OPERATION

The type CF-1 relay contains an electromagnet, and an indicating contactor switch unit. A condenser and resistor associated with the relay circuits are mounted in an external box.

Frequency Unit

The operating unit consists of an electromagnet operating on a conducting disc. The electromagnet has potential windings on both the upper and lower poles. The lower pole circuit has capacitance in series, the upper pole has not. The underfrequency relay is so designed that at normal frequency (60) cycles the upper pole current leads the lower pole current and the two out of phase fluxes thus produced act to give contact opening torque on the disc. When the frequency drops, the phase angle of the lower pole circuit becomes more leading, until at the frequency setting of the relay the lower pole current begins to lead the upper pole current, and the relay torque is reversed to the tripping direction. The lower the frequency the greater the phase angle displacement and hence the faster the relay trips. An adjustable resistor in the upper pole circuit is provided to set the frequency at which the relay trips.

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 CF-1 relay is available in two forms --either as an underfrequency relay or an overfrequency relay. Where operation on both underfrequency and overfrequency is desired, two relays are required, one of each form. Major changes are required to convert from one form to other. The relay contacts are single or double pole single throw, or single pole double throw.

The underfrequency relay can be set to close contacts for any desired frequency between 50 and 60 cycles by setting the knob of the frequency adjusting rheostat to the desired frequency marked on the calibrated dial. Since the relay at minimum trip operates like a direc-

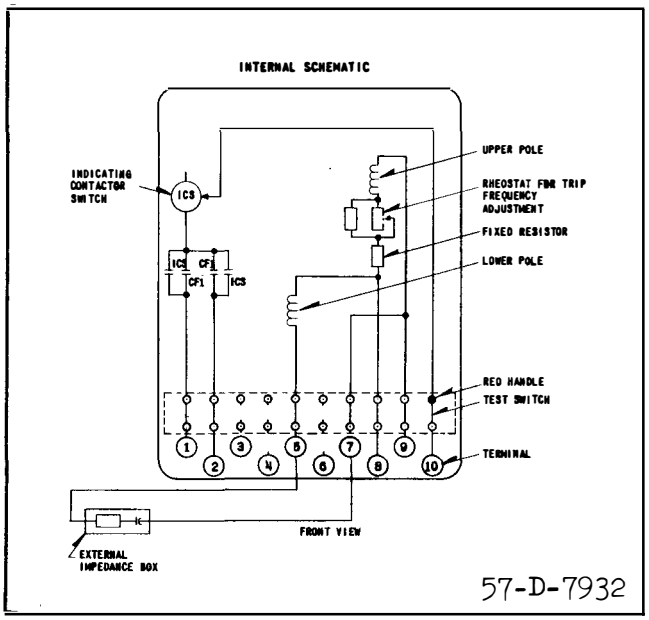

Fig. 1—Internal schematic of the double pole, single throw type CF-1 Relay in the Type FT21 Case. For the single pole, single throw relay the circuits associated with terminal 2 are omitted.

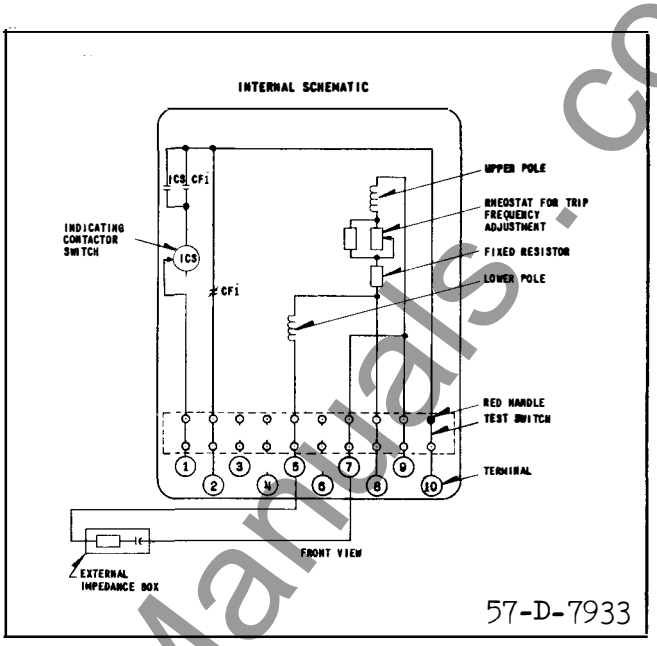

Fig. 2—Internal schematic of the single pole, double throw Type CF-1 Relay in the type FT21 Case.

tional element near zero torque, the relay is very sensitive to phase angle change resulting from a frequency change. Thus minimum trip is little affected by voltage variation. Typical voltage vs. minimum trip frequency curves are shown in Fig. 3. The circuits are also designed to minimize temperature error. Typical minimum trip frequency vs. temperature curves are shown in Fig. 4.

The relay has an inverse time characteristic. Desired time settings may be made by means of the time lever which is continuously adjustable from the #1/2 to #10 lever positions. Typical time curves for the different lever settings are shown in Figs. 5, 6 and 7.

The frequency relay contact closing and opening points are essentially the same. The relay will reset to the maximum time lever setting when the frequency changes .1 to .2 cycles from the setting. For example, suppose the 60 cycle under-frequency relay is set to close its contacts at 59 cycles from the #10 lever setting. The contact will start to move at 59.1 to 59.2 cycles but will not close until the frequency drops to 59 cycles or below. As the frequency rises just above 59 cycles, the contacts open, but will not completely reset to the #10 lever setting until the frequency rises to 59.1 or 59.2 cycles. With the time lever set at less than its maximum position, the .1 to .2 cycle differential is correspondingly less.

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 Contactor 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

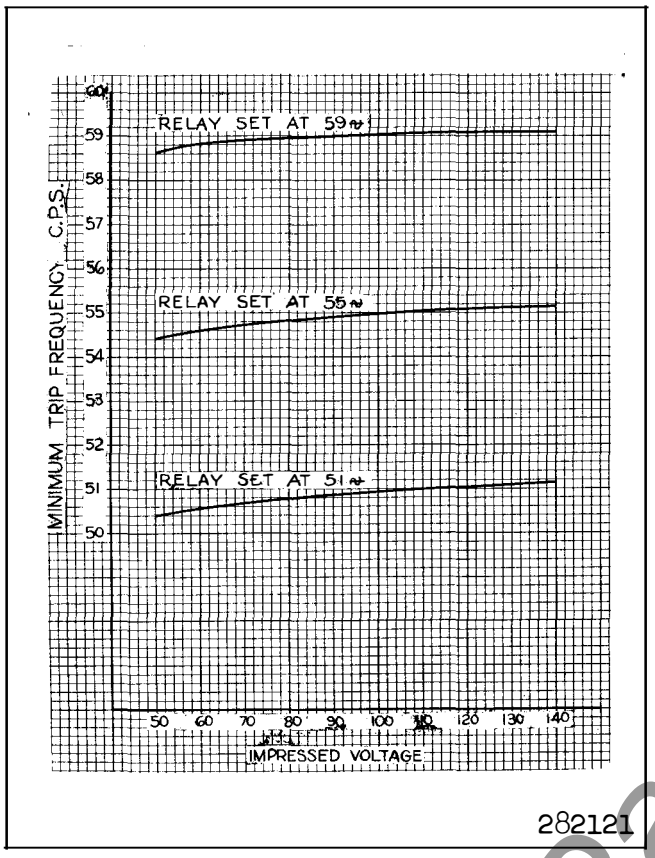

Fig. 3—Typical Voltage-Minimum Trip Frequency Curves of the Type CF-1 Underfrequency Relay.

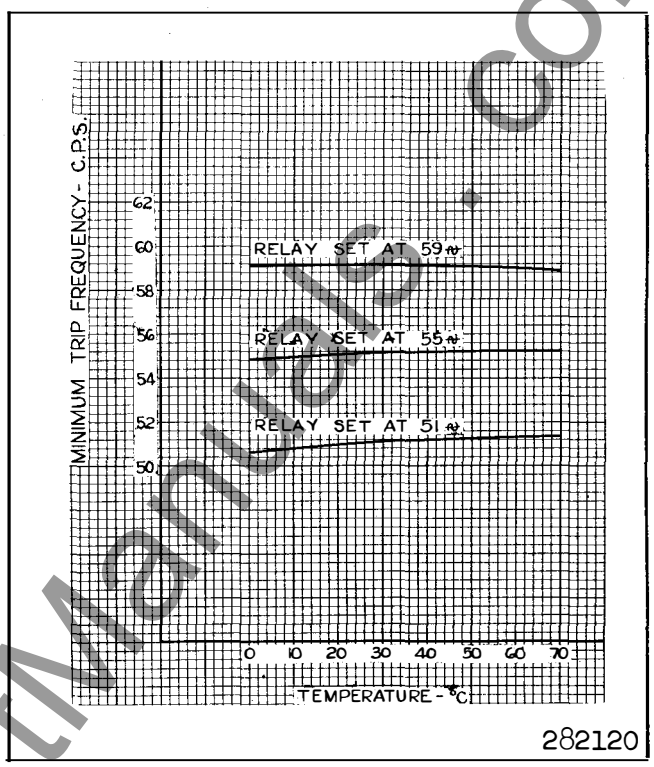

Fig. 4—Typical Temperature-Minimum Trip Frequency Curves of the Type CF-1 Underfrequency Relay.

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.

The operating windings of the relay should be connected across a suitable potential transformer with the external impedance box connected as shown in Figs. 1 and 2. Each relay must be used with its designated auxiliary unit. Relays and auxiliary units may not be interchanged.

SETTINGS

The relay is set for minimum trip by means of the frequency adjusting rheostat. The time lever position determines relay timing. The curves are drawn for variation of frequency in cycles below the frequency adjusting rheostat setting.

To adjust the CF-1 relay contacts to be quick opening, screw in the small set screw on the stationary contact assembly until the contact rivet rests solidly on the Micarta support. When this is done, the position of the contact stop on the time lever should be shifted so that the moving and stationary contacts barely touch when the time lever is set on zero. The contact opening time with no follow will be 3 to 6 cycles.

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

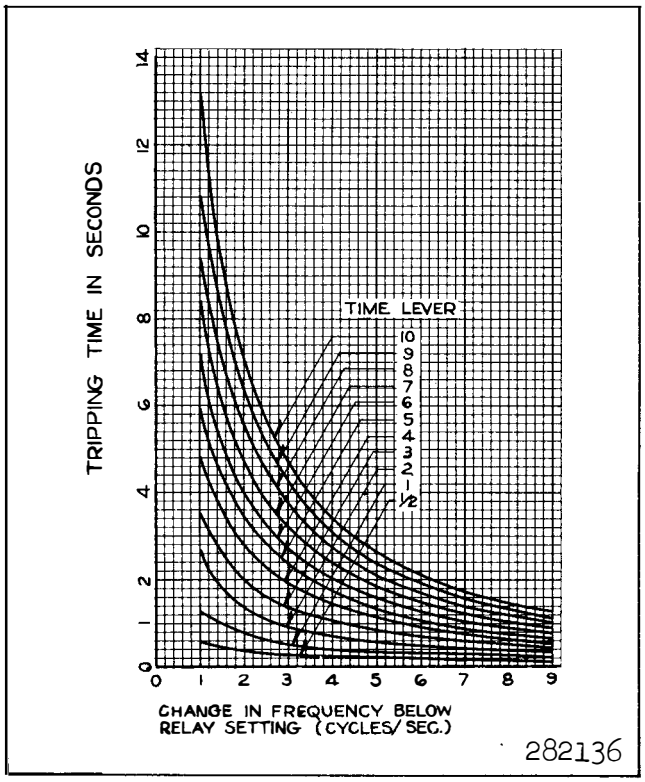

Fig. 5—Typical 57-60 Cycle Time Curves of the Type CF-1 Underfrequency Relay.

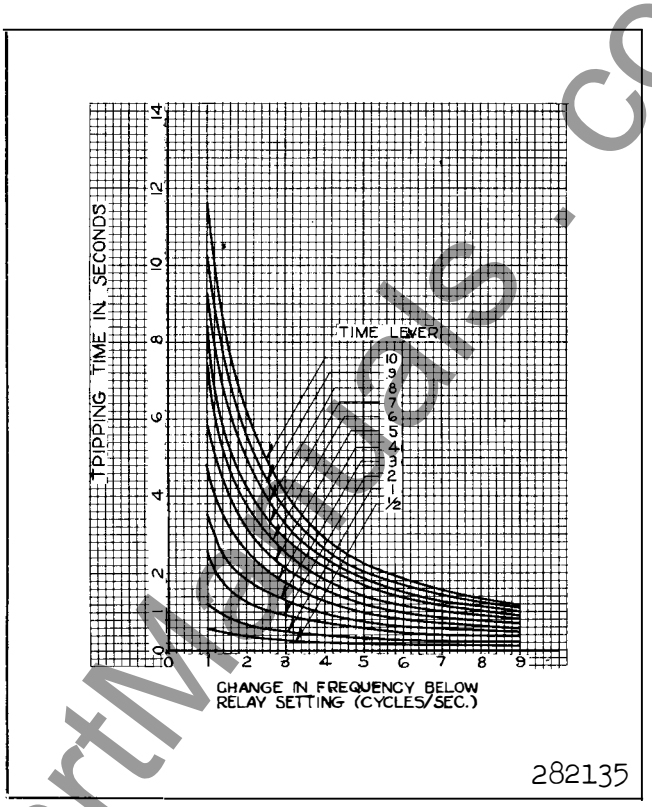

Fig. 6—Typical 53-57 Cycle Time Curves of the Type CF-1 Underfrequency Relay.

* the lead located in front of the tap block to the desired setting by means of the connecting screw.

ADJUSTMENTS AND MAINTENANCE

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

Acceptance Check

The following check is recommended to insure that the underfrequency relay is in proper working order. Relays and auxiliary units of matching serial numbers should be connected together.

A. Frequency Unit

1. Minimum Trip — Connect the relay and auxiliary unit to a variable frequency source and apply 120 volts, 60 cycles to the relay for at least 1 hour. Set the frequency adjusting rheostat at 60 cycle and apply 60 cycles to the relay. The contacts should just close. Repeat for all major scale divisions on the frequency adjusting rhetostat.

2. Time Curve — Set the time lever at 10 setting, and the frequency adjusting rheostat at 58 cycles. Apply 120 volts 60 cycles to the relay for at least 1 hour to allow the coils to reach their finally temperature. De-energize the relay and suddenly apply 54 cycles. The relay contacts should close in 3.4 ± 10% seconds.

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 operation target should drop freely.

The contact gap should be approximately .047 inch between the bridging moving contact and the adjustable stationary contacts.

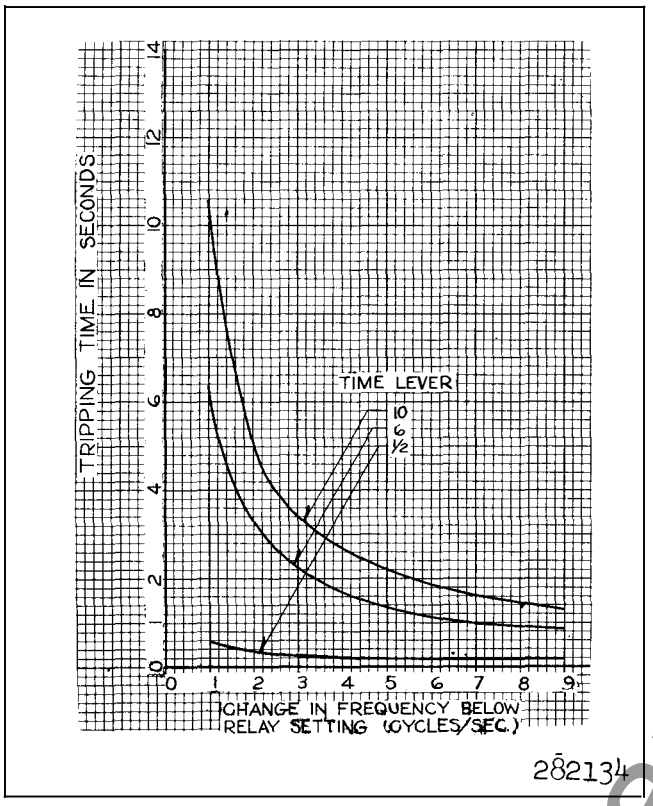

Fig. 7—Typical 50-53 Cycle Time Curves of the Type CF-1 Underfrequency Relay.

The bridging moving contact should touch both stationary contacts simultaneously.

Routine Maintenance

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 disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order. (See "Acceptance Check")

A. Spring tension — Adjust the spring tension such that the moving contact just resets to the #10 time lever position when the relay is de-energized. Then give the adjuster an additional 1/4 to 1/2 turn initial tension.

B. Frequency Adjusting Rheostat — Allow the relay to warm up for at least 1 hour at 120 volts, 60 cycles before making any adjustments. Set the frequency adjusting rheostat in the maximum counter-clockwise position and apply frequency marked on dial to the relay. Adjust the resistors in the auxiliary unit until the relay contacts just close.

Set the frequency adjusting rheostat in the extreme clockwise position and apply frequency marked on the dial to the relay. Adjust the resistor in the lower left hand corner of the relay until the contacts just close. Intermediate frequency points may then be checked by applying these frequencies to the relay and observing if the contacts just close. The trip frequencies of the relay may not agree with the markings on the frequency adjusting rheostat if components in the relay has been changed. If such is the case the scale plate should be remarked to agree with the tripping frequencies of the relay.

C. Time Curves — Energize the relay with 120 volts 60 cycles for at least an hour before making any checks. De-energize the relay and then apply the desired frequency at 120 volts. The timing may be determined by means of a cycle counter. The damping magnet may be shifted to make the relay timing agree with the curves.

D. Indicating Contactor Switch (ICS) — Close the main relay contacts and pass sufficient d-c current through the trip circuit to close the contact 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

Typical burden characteristics of the relay coils at 120 volts, 60 cycles are as follows:

Frequency Adjusting Rheostat set for	VA	Watts	Lagging Vars
59 Cycles	17.2	12.8	11.4
55 Cycles	15.7	12.5	9.7
51 Cycles	13.4	11.2	7.4

* These relays will continuously stand 110% of rated voltage.

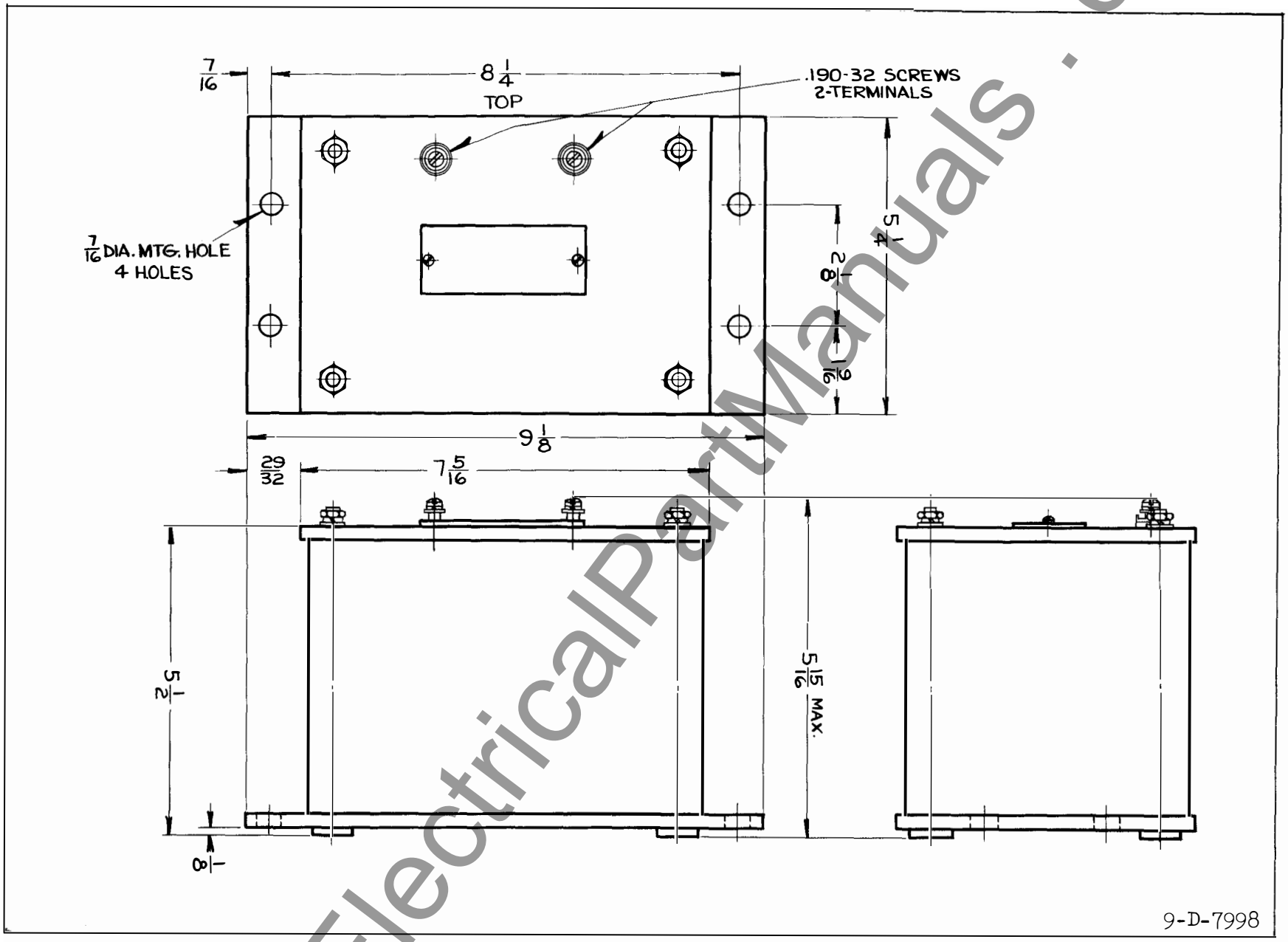

Fig. 8–Outline and Drilling Plan for the External Impedance Box.

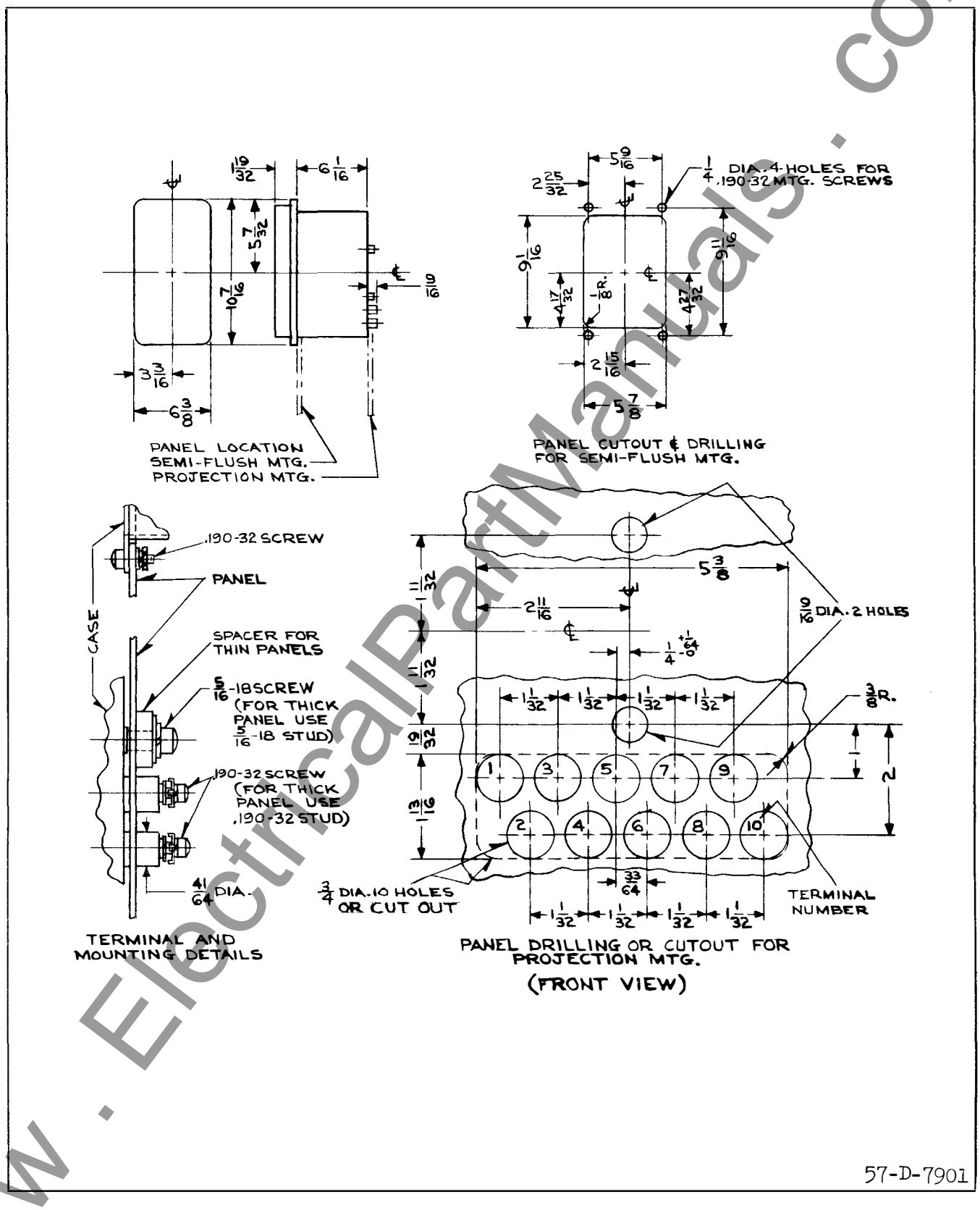

Fig. 9—Outline and Drilling Plan for the Type CF-1 Relay in the Type FT21 Case.

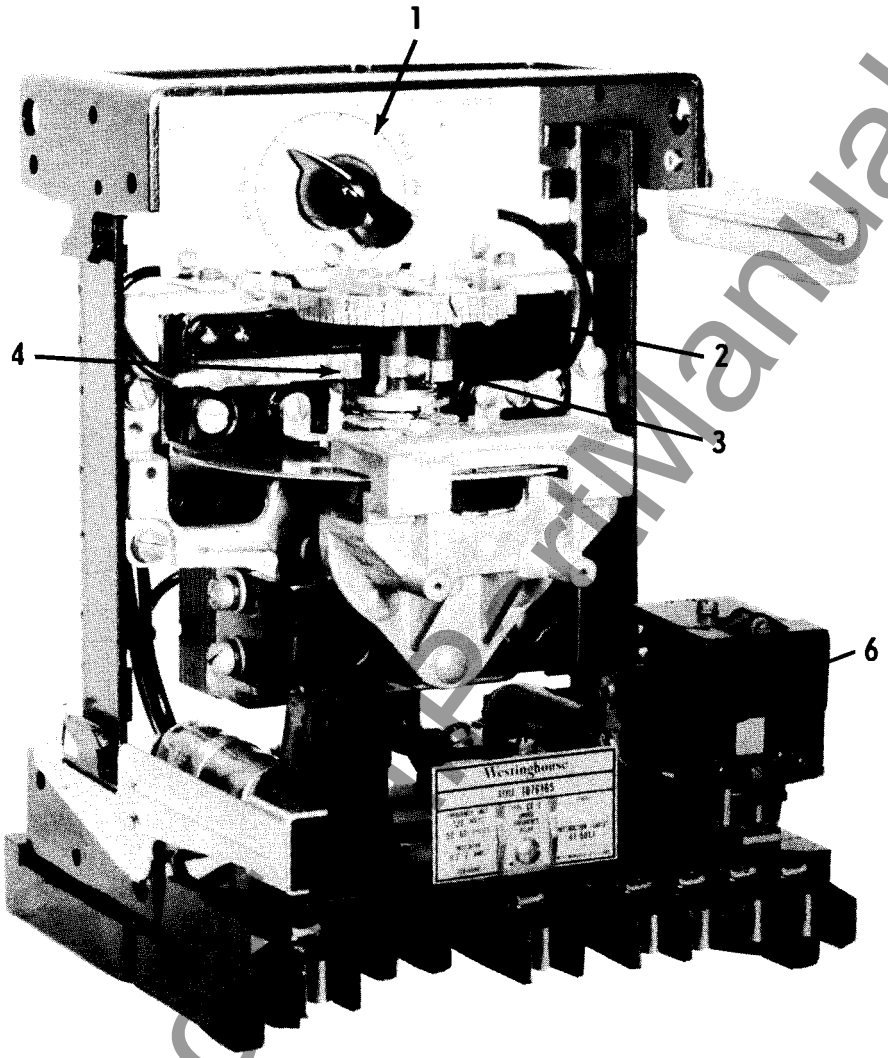

Fig. 10 — Type CF-1 Relay Without Case, 1-Frequency Setting Rheostat. 2-Time Setting Dial, 3-Moving Contact, 4-Stationary Contact, 6-Indicating Contactor Switch (ICS).

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

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CF-1 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 CF-1 relay is an induction disc type frequency relay. It is used for the protection or control of equipment on systems where the frequency of the system changes. A typical application is in the protection of local generators in industrial plants from severe overload when the power company tie is lost.

CONSTRUCTION AND OPERATION

The type CF-1 relay contains an electromagnet, and an indicating contactor switch unit. A condenser and resistor associated with the relay circuits are mounted in an external box.

Frequency Unit

The operating unit consists of an electromagnet operating on a conducting disc. The electromagnet has potential windings on both the upper and lower poles. The lower pole circuit has capacitance in series, the upper pole has not. The underfrequency relay is so designed that at normal frequency (60) cycles the upper pole current leads the lower pole current and the two out of phase fluxes thus produced act to give contact opening torque on the disc. When the frequency drops, the phase angle of the lower pole circuit becomes more leading, until at the frequency setting of the relay the lower pole current begins to lead the upper pole current, and the relay torque is reversed to the tripping direction. The lower the frequency the greater the phase angle displacement and hence the faster the relay trips. An adjustable resistor in the upper pole circuit is provided to set the frequency at which the relay trips.

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 CF-1 relay is available in two forms --either as an underfrequency relay or an overfrequency relay. Where operation on both underfrequency and overfrequency is desired, two relays are required, one of each form. Major changes are required to convert from one form to other. The relay contacts are single or double pole single throw, or single pole double throw.

The underfrequency relay can be set to close contacts for any desired frequency between 50 and 60 cycles by setting the knob of the frequency adjusting rheostat to the desired frequency marked on the calibrated dial. Since the relay at minimum trip operates like a direc-

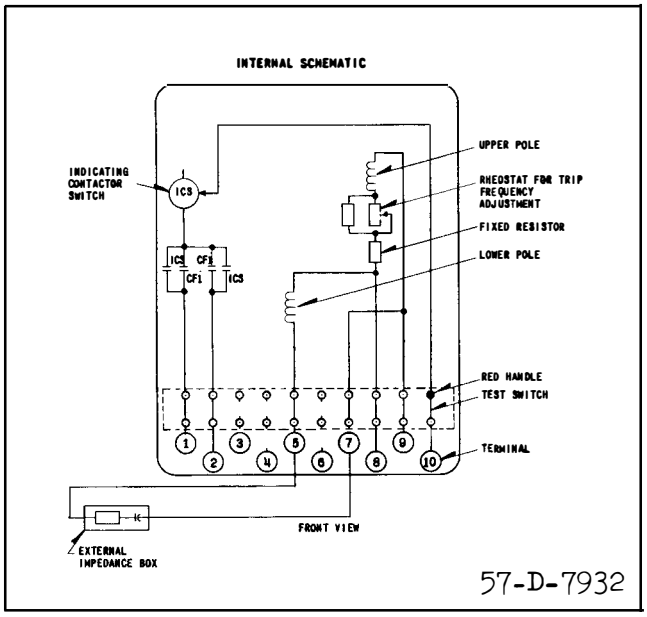

Fig. 1—Internal schematic of the double pole, single throw type CF-1 Relay in the Type FT21 Case. For the single pole, single throw relay the circuits associated with terminal 2 are omitted.

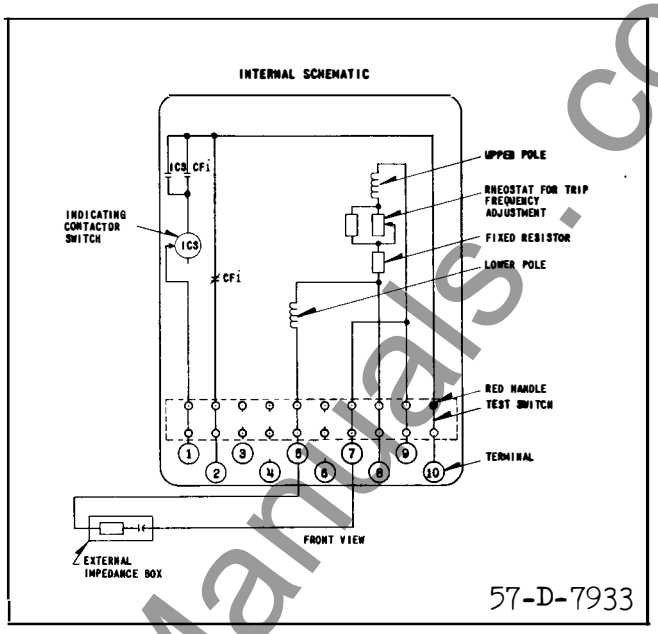

Fig. 2—Internal schematic of the single pole, double throw Type CF-1 Relay in the type FT21 Case.

tional element near zero torque, the relay is very sensitive to phase angle change resulting from a frequency change. Thus minimum trip is little affected by voltage variation. Typical voltage vs. minimum trip frequency curves are shown in Fig. 3. The circuits are also designed to minimize temperature error. Typical minimum trip frequency vs. temperature curves are shown in Fig. 4.

The relay has an inverse time characteristic. Desired time settings may be made by means of the time lever which is continuously adjustable from the #1/2 to #10 lever positions. Typical time curves for the different lever settings are shown in Figs. 5, 6 and 7.

The frequency relay contact closing and opening points are essentially the same. The relay will reset to the maximum time lever setting when the frequency changes .1 to .2 cycles from the setting. For example, suppose the 60 cycle under-frequency relay is set to close its contacts at 59 cycles from the #10 lever setting. The contact will start to move at 59.1 to 59.2 cycles but will not close until the frequency drops to 59 cycles or below. As the frequency rises just above 59 cycles, the contacts open, but will not completely reset to the #10 lever setting until the frequency rises to 59.1 or 59.2 cycles. With the time lever set at less than its maximum position, the .1 to .2 cycle differential is correspondingly less.

The continuous rating of the relay is 132 volts, 50 to 60 cycles.

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 Contactor 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

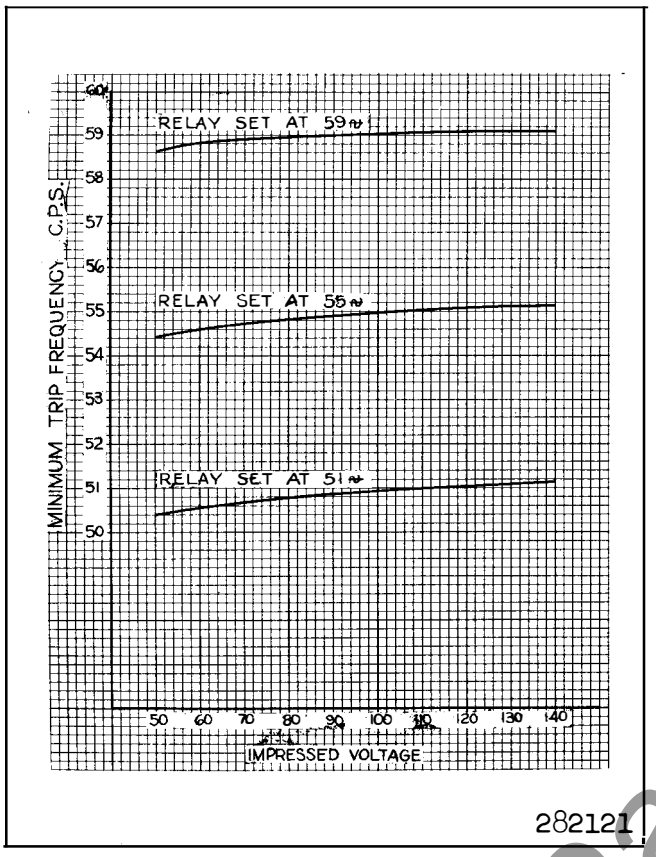

Fig. 3—Typical Voltage-Minimum Trip Frequency Curves of the Type CF-1 Underfrequency Relay.

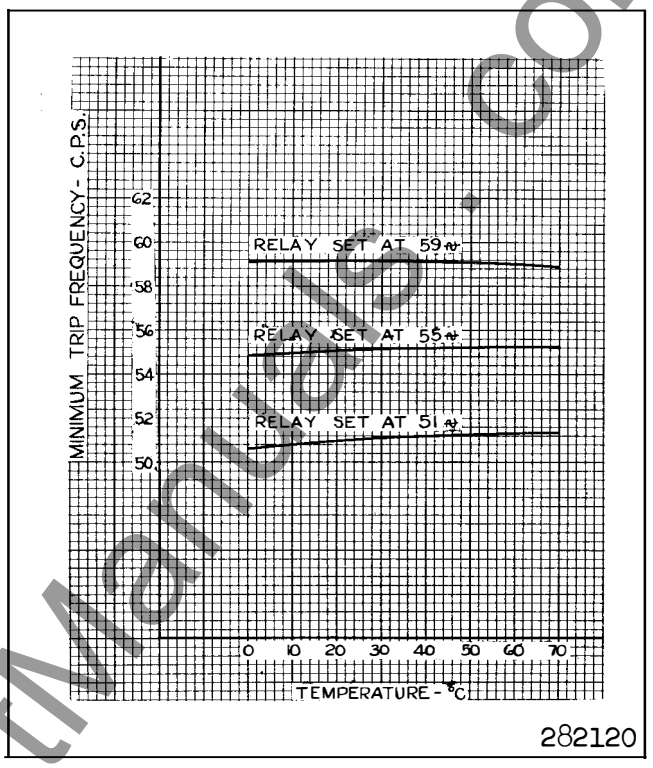

Fig. 4—Typical Temperature-Minimum Trip Frequency Curves of the Type CF-1 Underfrequency Relay.

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.

The operating windings of the relay should be connected across a suitable potential transformer with the external impedance box connected as shown in Figs. 1 and 2. Each relay must be used with its designated auxiliary unit. Relays and auxiliary units may not be interchanged.

SETTINGS

The relay is set for minimum trip by means of the frequency adjusting rheostat. The time lever position determines relay timing. The curves are drawn for variation of frequency in cycles below the frequency adjusting rheostat setting.

To adjust the CF-1 relay contacts to be quick opening, screw in the small set screw on the stationary contact assembly until the contact rivet rests solidly on the Micarta support. When this is done, the position of the contact stop on the time lever should be shifted so that the moving and stationary contacts barely touch when the time lever is set on zero. The contact opening time with no follow will be 3 to 6 cycles.

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

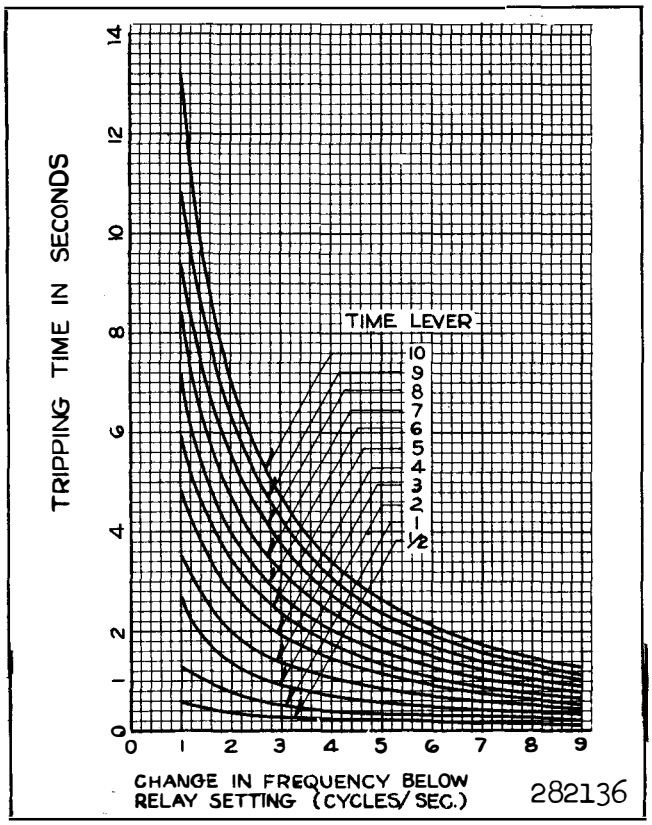

Fig. 5—Typical 57-60 Cycle Time Curves of the Type CF-1 Underfrequency Relay.

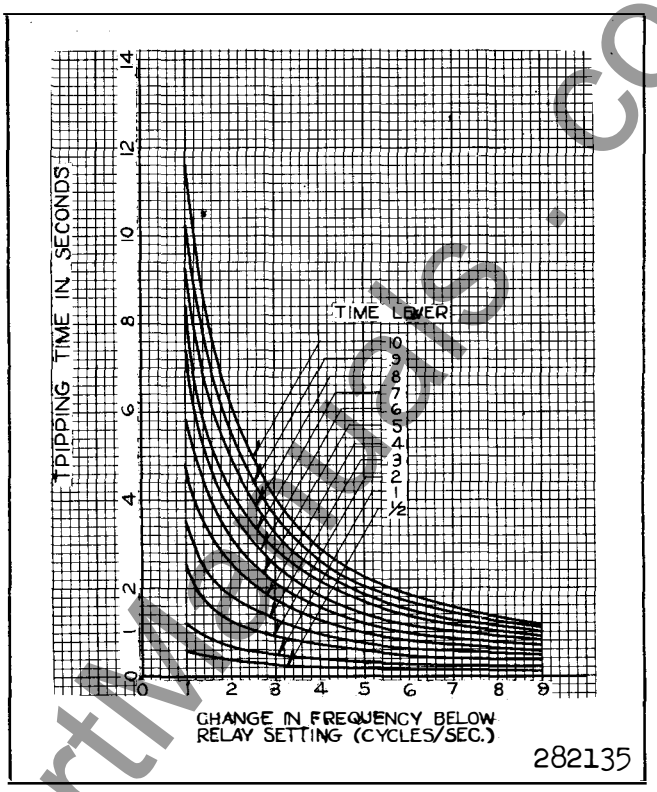

Fig. 6—Typical 53-57 Cycle Time Curves of the Type CF-1 Underfrequency Relay.

the lead located in front of the tap block to the desired setting by means of the connecting screw.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed 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.

Frequency Unit

Shift the position of the contact stop on the time lever, and adjust the contacts so that they barely touch when the time lever is set on zero.

The relay spring tension is adjusted to just reset the moving contact to the #10 lever position when the operating windings are de-energized, and the adjuster is then wound up an additional 1/4 to 1/2 turn.

To check the minimum trip calibration of any point on the frequency scale, the relay should be energized at 120 volts and 60 cycles for at least 1/2 hour. The frequency may then be changed to the desired value, and the relay checked for minimum trip.

To check the time curves, the relay, after being energized at 60 cycles and 120 volts for at least 1/2 hour to reach equilibrium coil temperature, should be de-energized and then the desired frequency applied at 120 volts. Timing may be determined by means of a cycle counter, and the damping magnet shifted to make the relay timing agree with the curves.

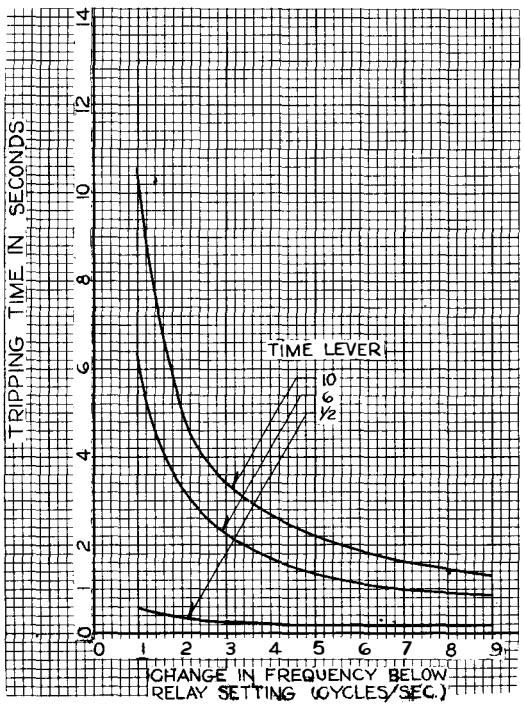

Fig. 7—Typical 50-53 Cycle Time Curves of the Type CF-1 Underfrequency Relay.

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.

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

Typical burden characteristics of the relay coils at 120 volts, 60 cycles are as follows:

Frequency Adjusting Rheostat set for	VA	Watts	Lagging Vars
59 Cycles	17.2	12.8	11.4
55 Cycles	15.7	12.5	9.7
51 Cycles	13.4	11.2	7.4

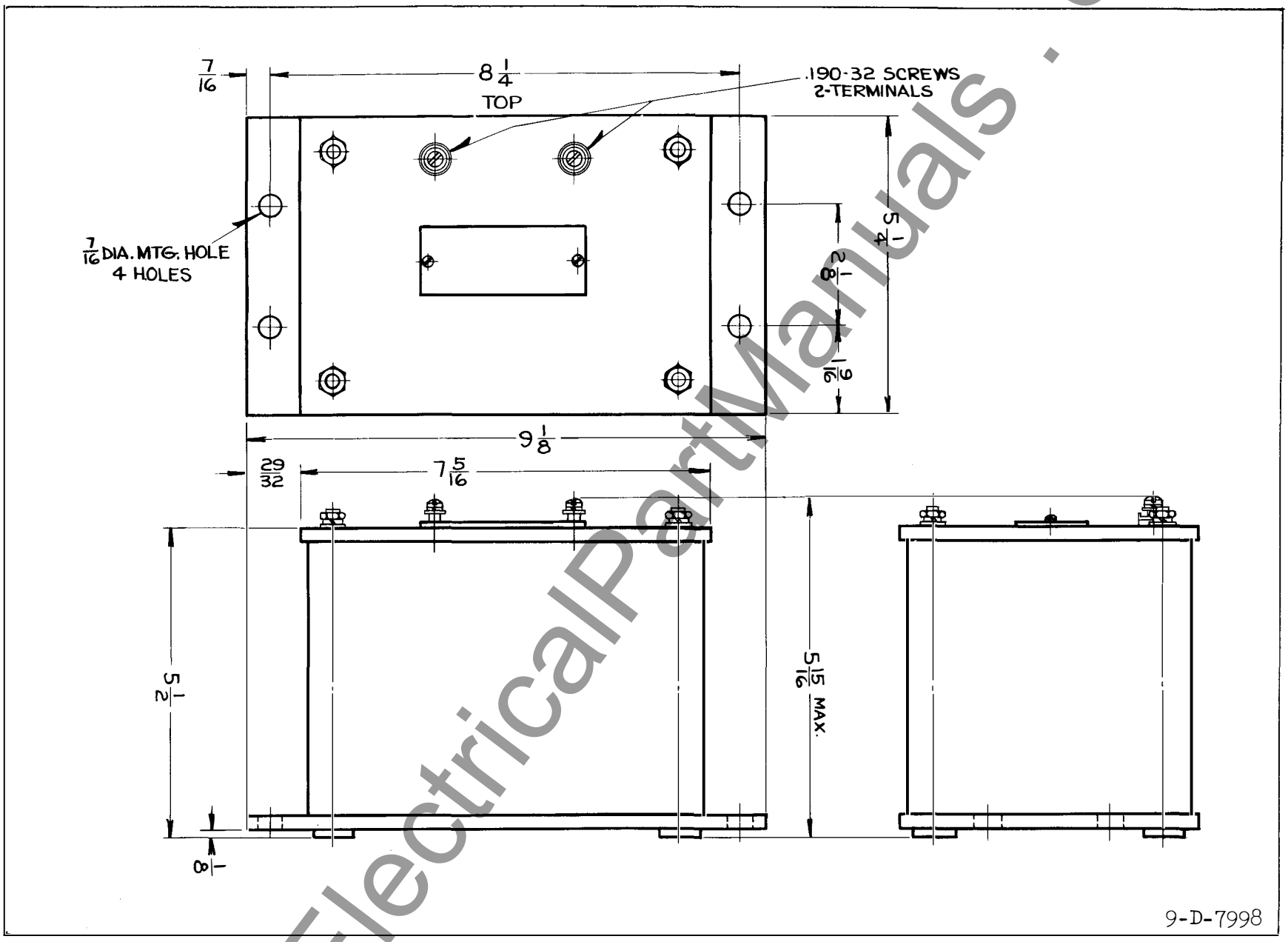

Fig. 8—Outline and Drilling Plan for the External Impedance Box.

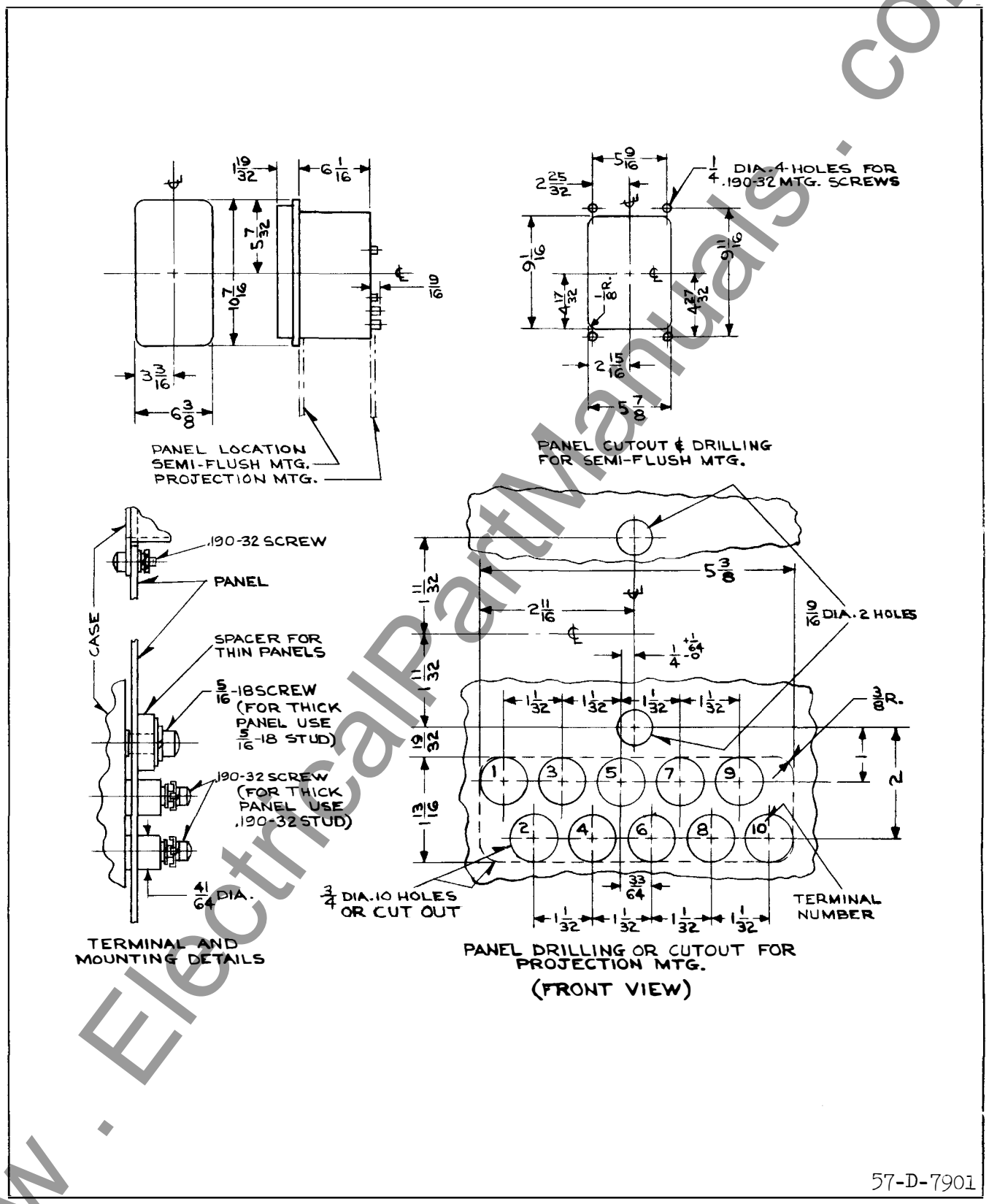

Fig. 9—Outline and Drilling Plan for the Type CF-1 Relay in the Type FT21 Case.

WESTINGHOUSE ELECTRIC CORPORATION

METER DIVISION **NEWARK, N.J.**

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