INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE AR HIGH SPEED AUXILIARY RELAY FOR CLASS 1E APPLICATIONS

CAUTION: Before putting protective 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 can close properly. Operate the relay to check the settings and electrical connections.

APPLICATION

These relays have been specially designed and ✪ tested to establish their suitability for Class 1E applications. Materials have been selected and tested to insure that the relays will perform their intended function for their design life when operated in a normal environment as defined by ANSI standard C37.90-1978 when exposed to radiation levels up to 10^4 rads, and when subjected to seismic events producing a Shock Response ✪ Spectrum of 8g ZPA as defined in IEEE Standard C37.98-1978 for multifrequency broad-band standard response spectrum shape.

"Class 1E" is the safety classification of the electric equipment and systems in nuclear power generating stations that are essential to emergency shutdown of the reactor, containment isolation, cooling of the reactor, and heat removal from the containment and reactor, or otherwise are essential in preventing significiant release of radioactive material to the environment.

The AR relay is a four-pole auxiliary type relay, especially designed for ultra high speed circuit breaker tripping duty in protective relaying systems. The AR relay is well suited for bus arrangements where more than one breaker must be tripped. It can provide isolation as well as high speed tripping. The AR relay may also be applied to provide isolation of primary and back-up relaying, and provide high speed tripping for zone one faults.

However, when the AR relay is energized by the thyristor trip circuit of the SDG, SKD, SRU, SBFU, STU-91, or STU-92 relays, a 22 ohm resistor or its equivalent must be added in parallel with the AR coil. Without this resistor, it is possible that when dc voltage is suddenly applied to the relay, sufficient current will flow through the series R-C circuit paralleling the tripping thyristor to cause the 10-watt AR relay to pickup.

CONSTRUCTION AND OPERATION

AR UNIT

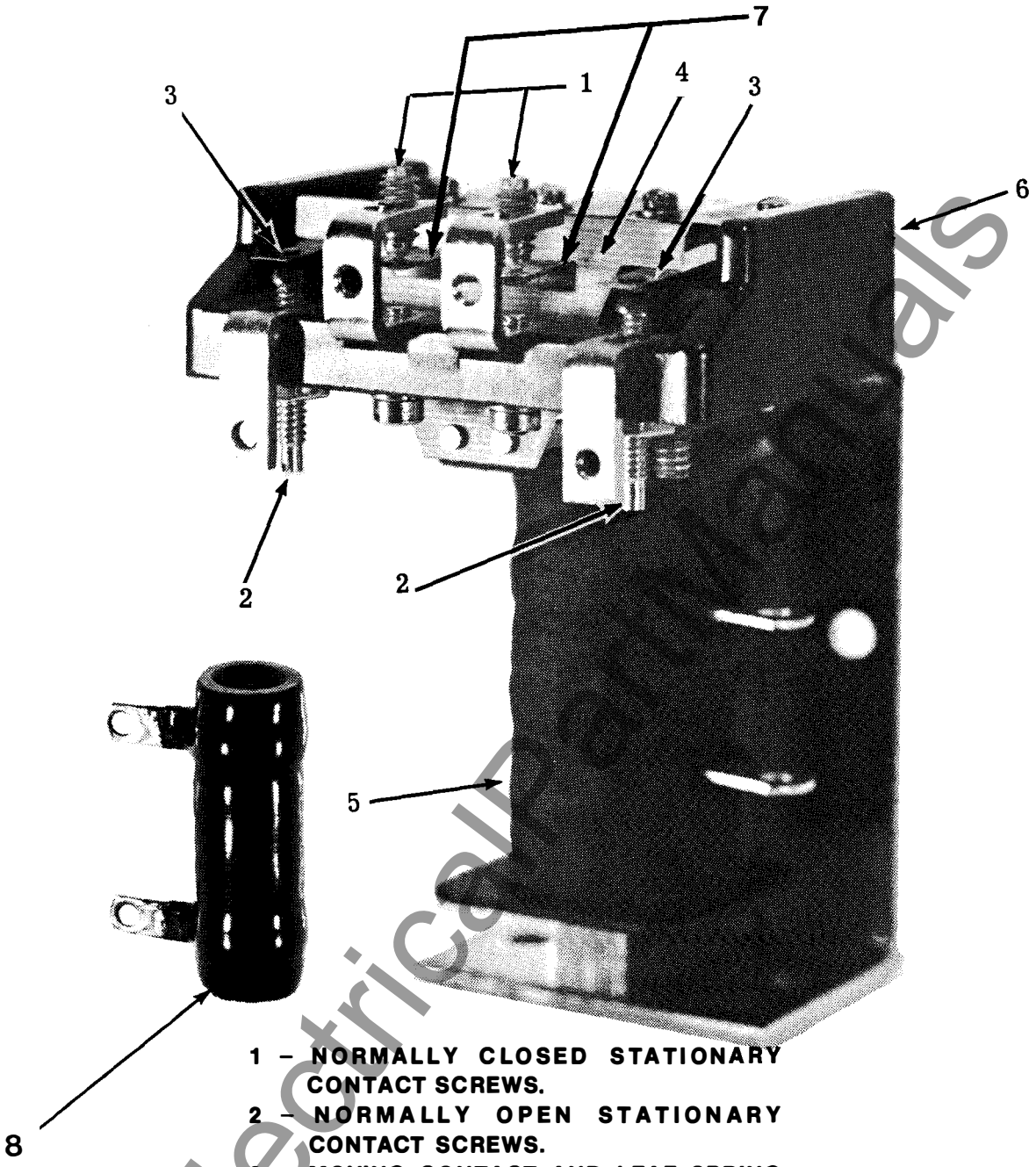
The relay consists of four stationary contact screws, four leaf spring moving contacts, a moving armature and card assembly, which operates the moving contacts; a U shaped laminated core, a coil, a frame, a molded insulation block and usually a series resistor. Refer to Fig. 1 and 2.

The armature and card assembly slip over a hinge pin which is inserted in the laminations. The moving and stationary contacts are mounted on the molded insulating block. The molded block and the coil and lamination assembly are mounted to the frame. All contacts are fine silver.

When the coil and resistor are energized, the armature is attracted to the laminations. The card moves with the armature thereby operating the moving contacts. The tension of the moving contacts is the resetting force.

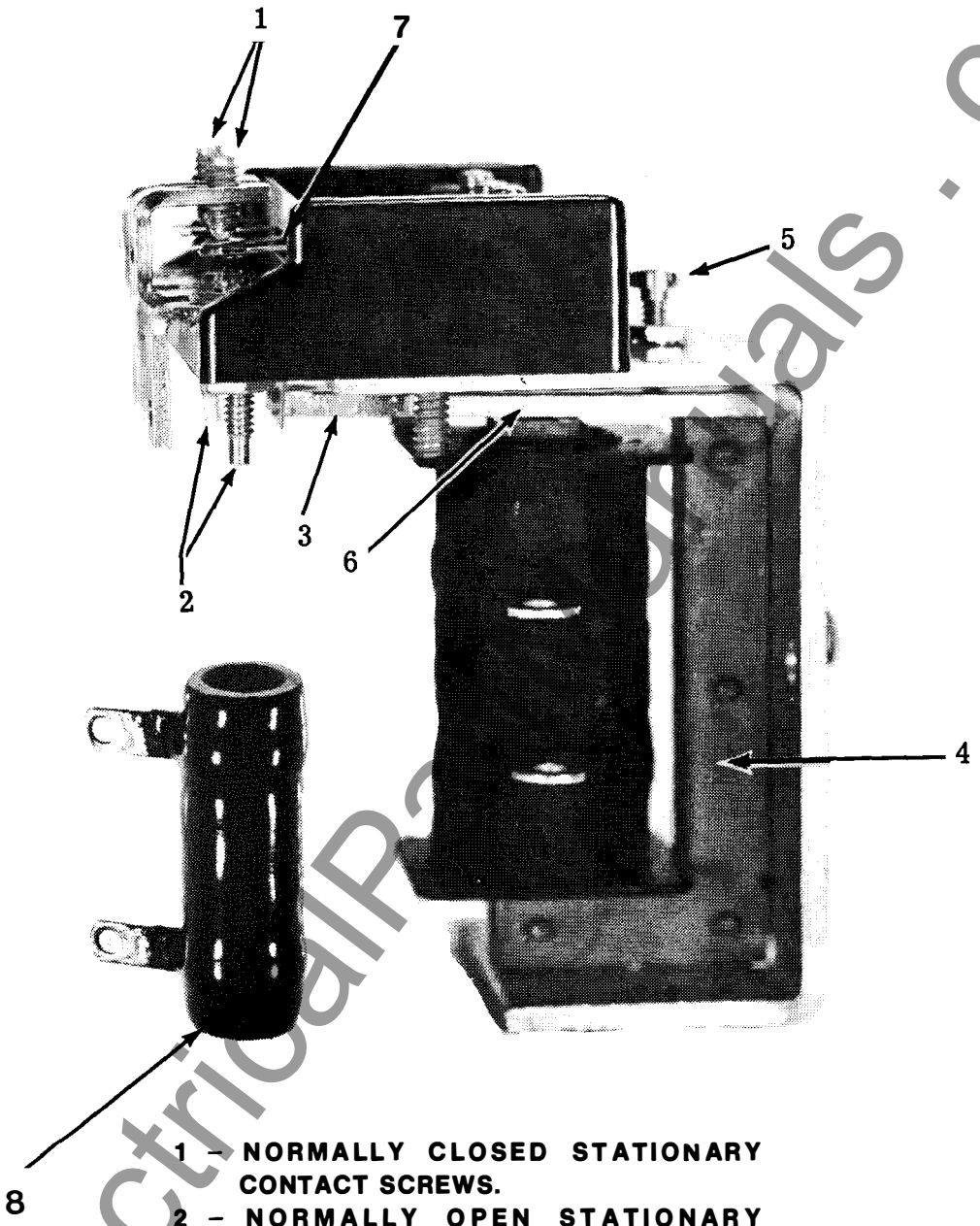
All possible contingencies which may arise during installation, operation, or maintenance, and all details and variations of this equipment do not purport to be covered by these instructions. If further information is desired by purchaser regarding his particular installation, operation or maintenance of his equipment, the local Westinghouse Electric Corporation representative should be contacted.

SUPERSEDES I.L. 41-759.4A, DATED MARCH 1979
✪ CHANGED SINCE PREVIOUS ISSUE. **EFFECTIVE JULY 1980**



1 – NORMALLY CLOSED STATIONARY CONTACT SCREWS.
2 – NORMALLY OPEN STATIONARY CONTACT SCREWS.
3 – MOVING CONTACT AND LEAF SPRING ASSEMBLY
4 – MOVING CARD ASSEMBLY (CARD)
5 – RELAY COIL
6 – MOLDED INSULATION BLOCK
7 – BEFORE CHECKING THE NORMALLY CLOSED CONTACT PRESSURE, THERE SHOULD BE A GAP BETWEEN THE MOVING CONTACT SPRING AND THE CARD.
8 – INTERNAL SERIES RESISTOR

Fig. 1. Type AR Unit



1 – NORMALLY CLOSED STATIONARY CONTACT SCREWS.
2 – NORMALLY OPEN STATIONARY CONTACT SCREWS.
3 – MOVING ARMATURE.
4 – U-SHAPED LAMINATED CORE.
5 – ARMATURE GAP ADJUSTMENT SET SCREW.
6 – ARMATURE GAP.
7 – BEFORE CHECKING THE NORMALLY CLOSED CONTACT PRESSURE, THERE SHOULD BE A GAP BETWEEN THE MOVING CONTACT SPRING AND THE CARD.
8 – INTERNAL SERIES RESISTOR.

Fig. 2. Type AR Unit

✪ TABLE I – OPERATING DATA

Coil Circuit Volts	Coil Circuit DC Ohms 25°C		Typical Time (Milliseconds)			Operating Volts	
			Pickup (Operate)		Dropout* (Reset)		
dc	Coil	Series Resistor	N.O. Contact Closes	N.C. Contact Opens	N.C. Contact Closes	Must Pickup	Must Dropout
24	4	50	<3	1.5	<4	19	2.4
48	14	200	<3	1.5	<4	38	4.8
125	100	1500	<3	1.5	<4	100	12.5
250	170	6000	<3	1.5	<4	200	25.0
62.5	1080	None	5	—	–	50	—

*Without Coil Suppression

TABLE II – CONTACT RATING OF THE NORMALLY OPEN CONTACTS

Contact Circuit Volts dc	Interrupting Rating (Amperes)				Carry Rating (Amperes)
	Resistive		Inductive†		Continuous
	Single	Double	Single	Double	
48	3.750	20.	1.750	20.	3
125	0.500	1.7	0.350	1.20	3
250	0.250	0.5	0.150	0.250	3

✪ †L/R = .005 for I>1 ampere
L/R = .040 for I<1 ampere

High speed operation is obtained by the inertia of the moving parts, a sensitive electromagnet, and the low L/R ratio of the operating circuit.

CHARACTERISTIC

The AR unit used in the ultra high speed, 2 millisecond operate time relay has a sensitivity of 0.5 watts. By the proper combination of the AR unit and a large series resistor, an optimum speed of 2 milliseconds is obtained for an energy input of 10 watts.

All relays are capable of being energized continuously. All relays will pickup when 80% of rated voltage is applied to the coil circuit, and will drop out if the voltage is reduced to 10% of rated voltage.

Tables I, II, and III give the following typical and/or test values.

Table I – Operating data – coil ohms-series resistor ohms

Table II – Contact ratings

Table III – Contact bounce

TABLE III
CONTACT BOUNCE

Contact Loading	Typical Effective Bounce Time In Milliseconds	
	Normally Open	Normally Closed
Dry Circuit	2-4	6-8
10 Watts (one AR relay)	1.0	—
Breaker Trip Coil	0.2	—

CONTACT RATING

Each relay contact is rated 3 amps continuous and will make and carry 30 amps long enough to trip a breaker.

Material transfer will be minimized and contact life extended, if positive polarity is connected to the moving contact.

SETTINGS

AR UNIT

No settings are required.

ICS UNIT

No settings are required.

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 the semi-flush type FT case. The mounting screws may be utilized for grounding the relay. External toothed washers are provided for use in the locations shown on the outline and drilling plan to facilitate making a good electrical connection between the relay case, its mounting screws and the relay panel. Ground Wires are affixed to the mounting screws as required for poorly grounded or insulating panels. Other electrical connections may be made directly to the terminals by means of screws for steel panel mounting.

For detail information on the FT case refer to I.L. 41-076 for semi-flush mounting.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not require readjustment after receipt by the customer. The routine test following is recommended for new equipment and prior to readjustment or recalibration. If the adjustments have been changed or the relay taken apart for repairs, the calibrations instructions should be followed.

ROUTINE TEST

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

1. Armature gap

   The armature gap should be approximately .009 inches measured at the narrowest part of the armature gap.

2. Visual inspection

   For relays having normally closed contacts, the contact spring should not be touching the card.

3. Contact gaps and forces

   All gram measurements should be made at the end of the moving contact spring per table IV.

✪ TABLE IV

Contact arrangement	With Relay De-energized			With relay energized	
	N.O. contact gap INCHES	N.C. contact force GRAMS	Force to move the N.O. contact spring away from the card	N.C. contact gap INCHES	N.O. contact force GRAMS
4 N.O.	.018 Min.	—	4 Grams ±1	—	15-40
3 N.O.-1N.C.	.018 Min.	15 min.	6 Grams ±1	.013 Min.	15-40
2 N.O.-2N.C.	.018 Min.	15 min.	*8-11 Grams	.013 Min.	15-40

*For this check to be made accurately, back out the N.C. stationary contact screw. This will disturb the factory calibration and therefore it is recommended this check not be made on a relay which passes all other checks.

4. Contact operate and reset timers

   Check values in Table I that have tolerances.

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 "Routine Test").

a. Adjust the set screw at the rear of the top of the frame to obtain a 0.009-inch gap at the rear end of the armature air gap.

b. Adjust each contact spring to obtain 4 grams pressure at the very end of the spring. This reading is taken when the pressure is sufficient to move the spring away from the edge of the slot of the card.

   On the two normally open, two normally closed contact relay, adjust each normally open contact spring of 8 grams to just move the contact spring away from the card. Adjust the normally closed contacts for 15 grams spring pressure, to just move the contact spring away from the card (See Fig. 1 and 2). Then adjust the normally closed stationary contact to just move the contact spring away from the card.

   On the three normally open, one normally closed contact relay, adjust each normally open contact spring for 6 grams to just move the contact spring away from the card. Adjust the normally closed contact for 15 grams spring pressure, to just move the contact spring away from the card (See Fig. 1 & 2). Then adjust the normally closed stationary contact to just move the contact spring away from the card.

c. Adjust each normally open stationary contact screw to obtain a contact gap of 0.020 to 0.022 inches. Energize the relay and the normally open contacts should have 15 to 30 grams contact follow. The normally closed contact, if any, should have a contact gap of .015 inches.

When calibrated as outlined above, the relay should meet the characteristics of Tables I and III.

MAINTENANCE

For worst case operating conditions; 30 amps resistive, contact make duty; the contact should be inspected each year or 50 operations and replaced every two years or 100 operations.

RENEWAL PARTS

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

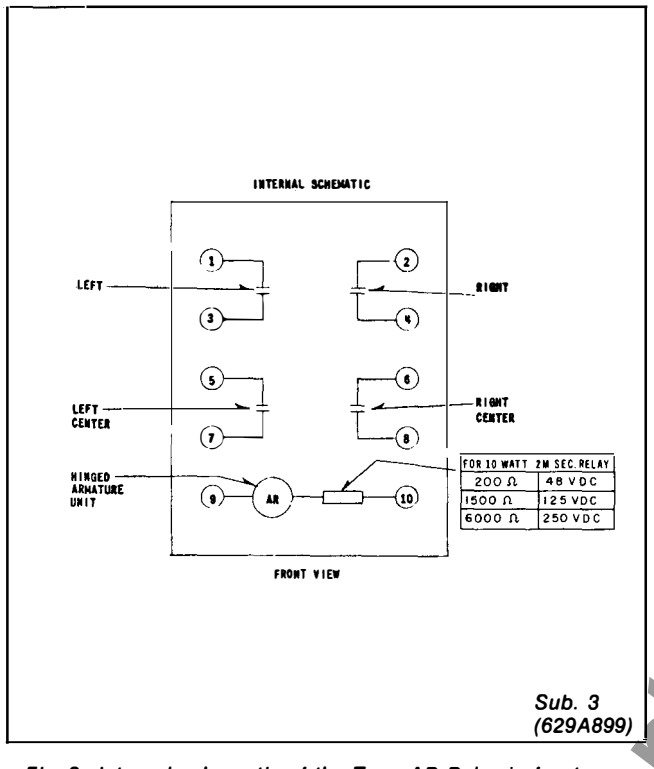


Fig. 3. Internal schematic of the Type AR Relay in front connected molded case with 4 make contacts.

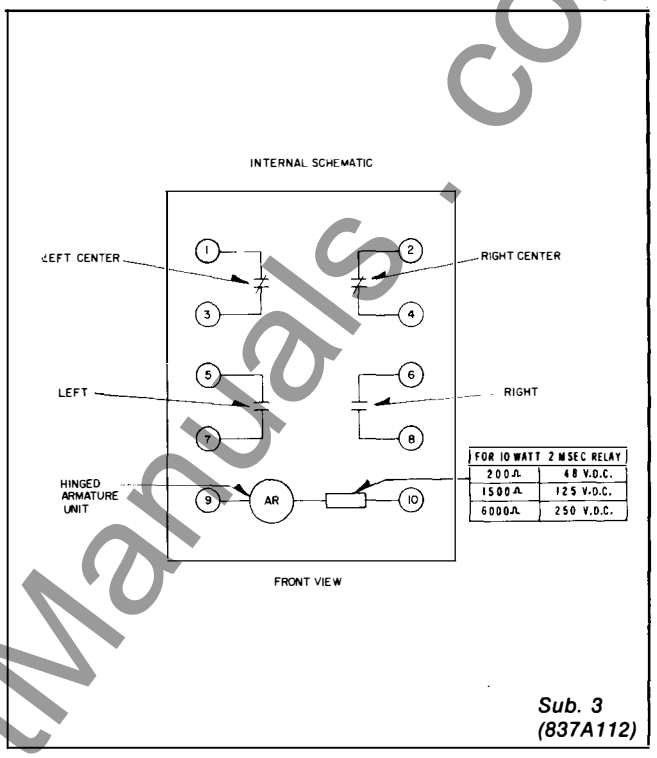


Fig. 4. Internal schematic of the Type AR Relay in front connected molded case with 2 make and 2 break contacts.

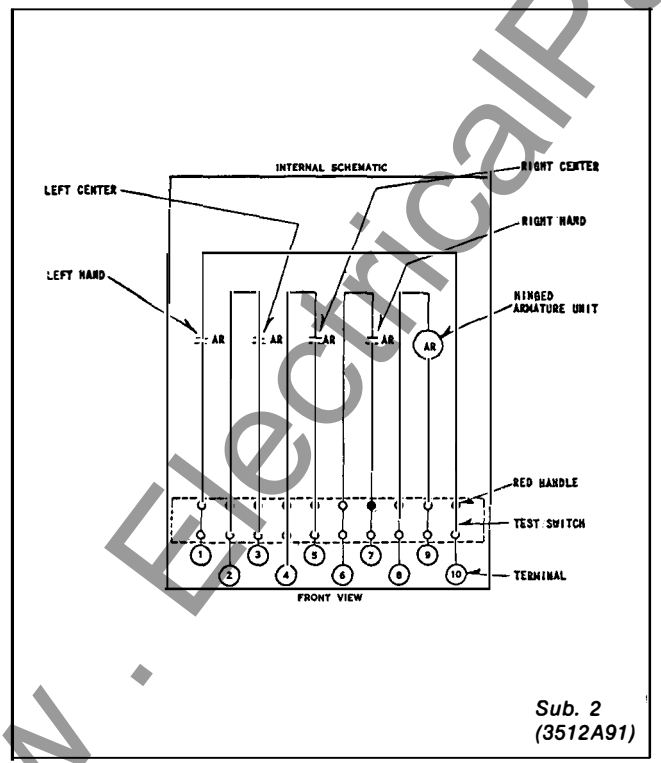


Fig. 5. Internal schematic of the Type AR Relay in semi-flush FT-11 case with 4 make contacts and without internal series resistor.

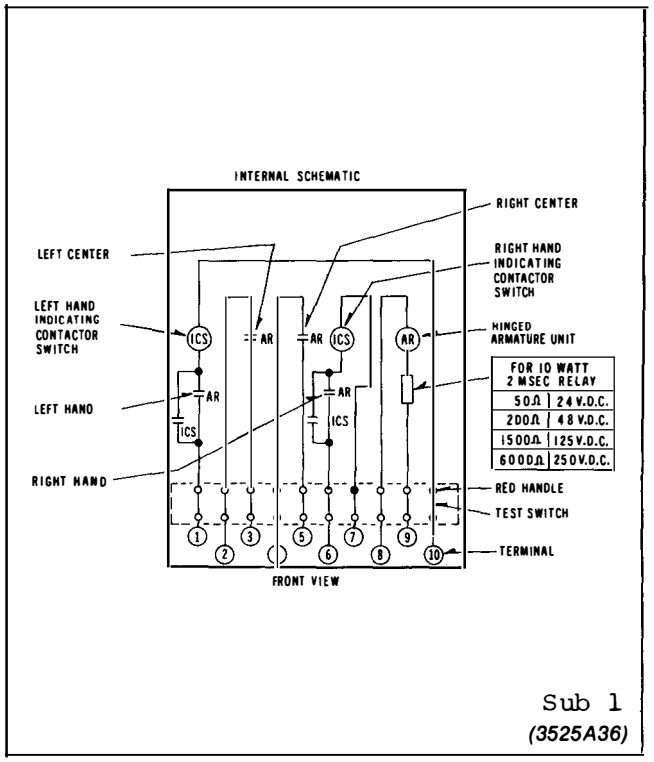


Fig. 6. AR Relay, FT-11, with 2 ICS units (4M)

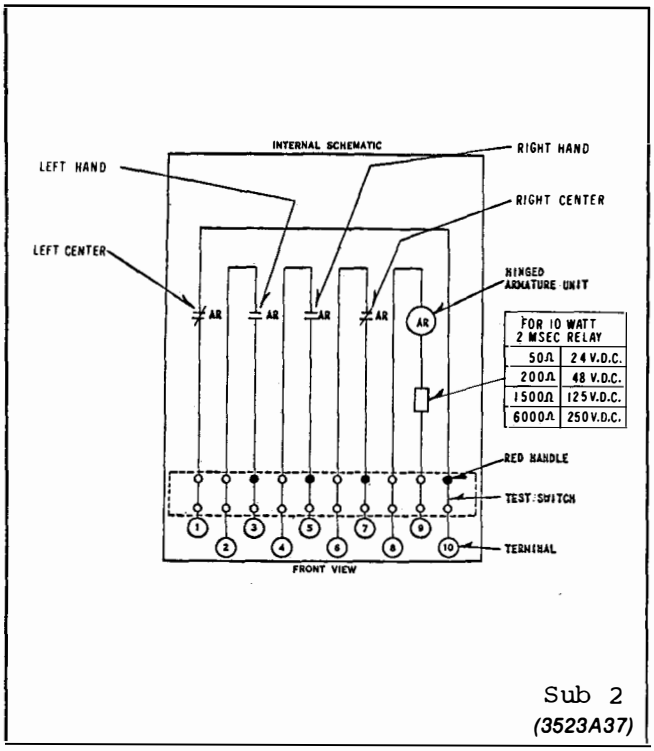


Fig. 7. AR Relay, FT-11 Case (2M-2B)

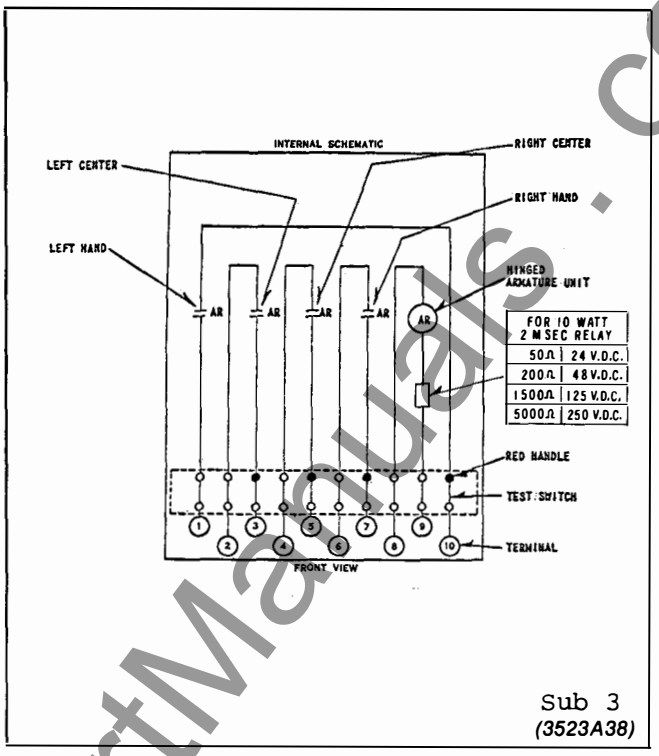


Fig. 8. AR Relay FT-11 (4M)

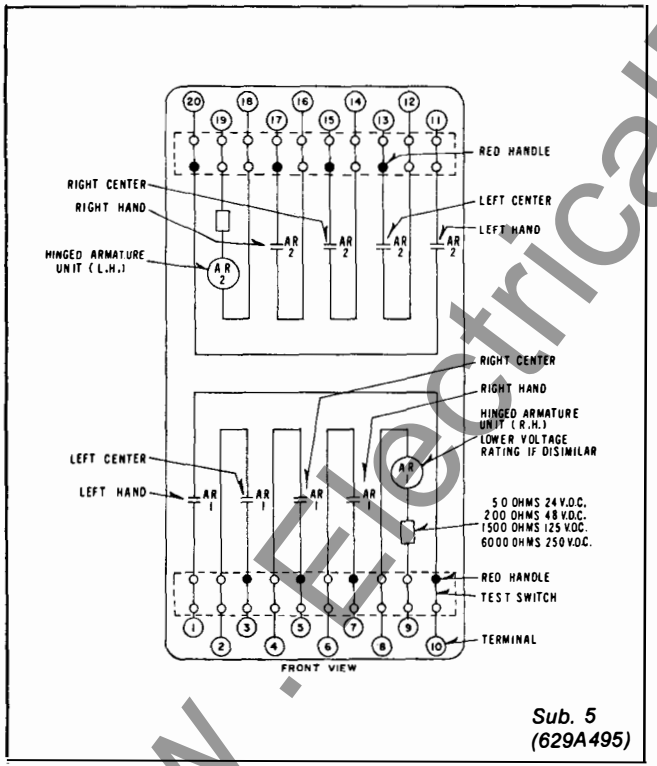


Fig. 9. Internal schematic of the Type AR Relay in semi-flush FT-22 case double unit, with 8 make contacts.

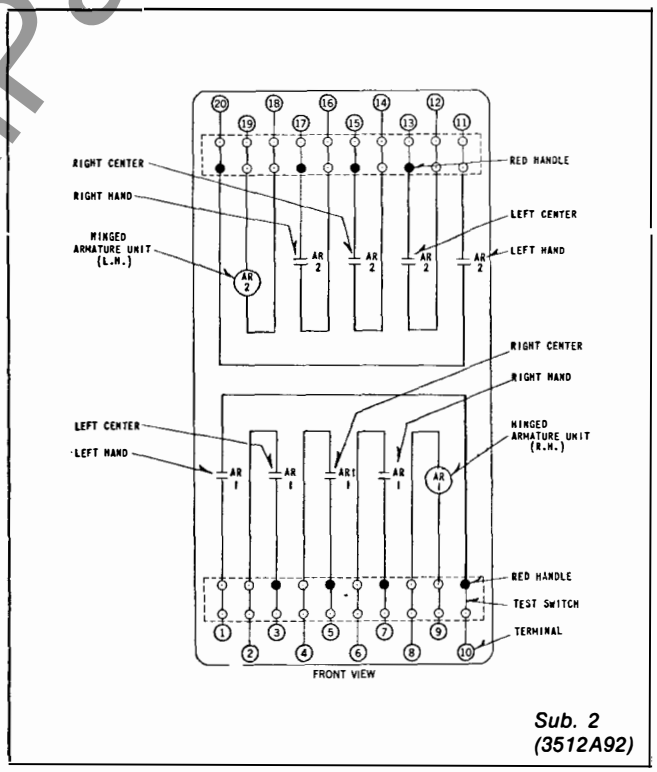


Fig. 10. Internal schematic of the type AR Relay in semi-flush FT-22 case double unit with 8 make contacts and without internal series resistor.

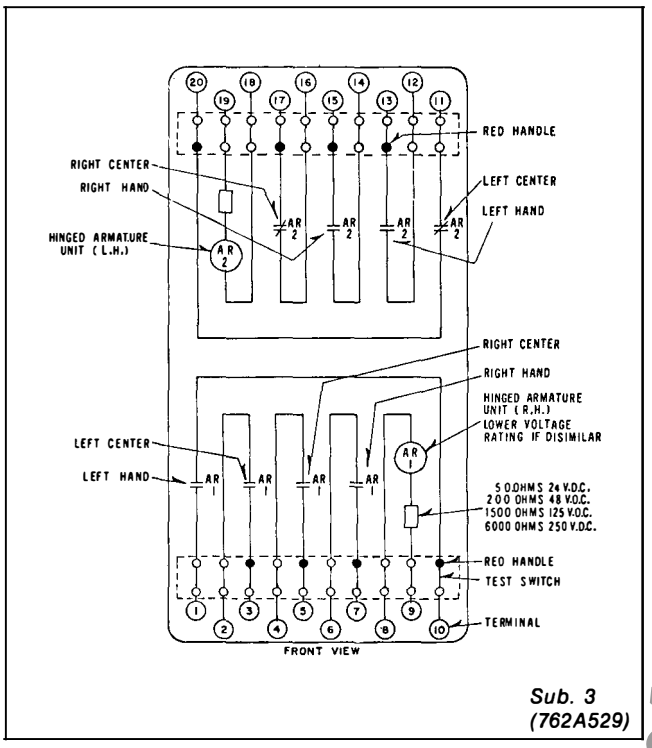


Fig. 11. Internal schematic of the type AR Relay in semi-flush FT-22 case, double unit, with 6 make and 2 break contacts.

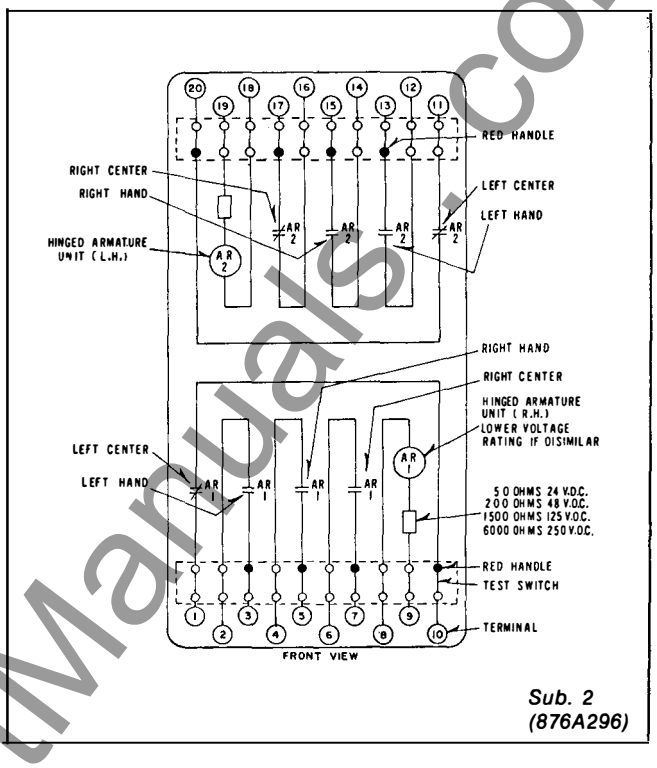


Fig. 12. Internal schematic of the type AR Relay in semi-flush FT-22 case, double unit, with 5 make and 3 break contacts.

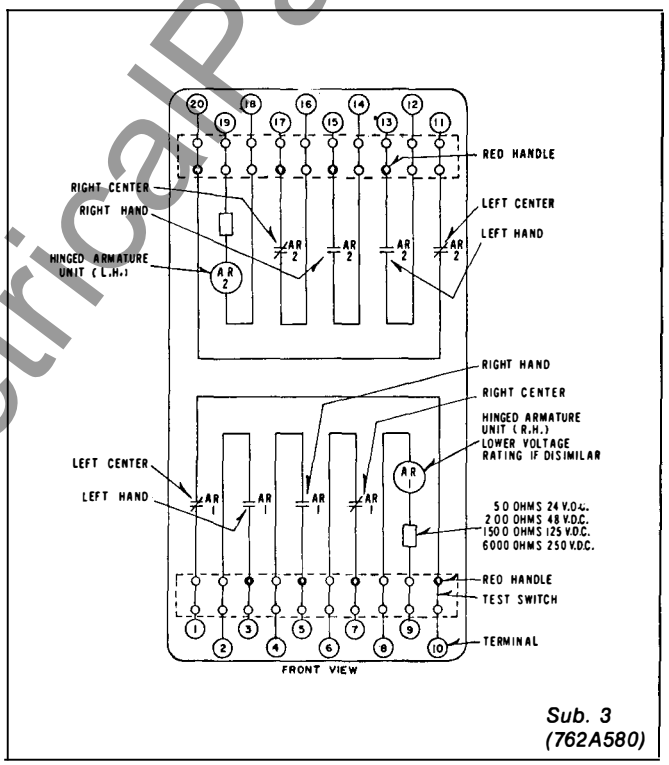


Fig. 13. Internal schematic of the type AR Relay in semi-flush FT-22 case, double unit, with 4 make and 4 break contacts.

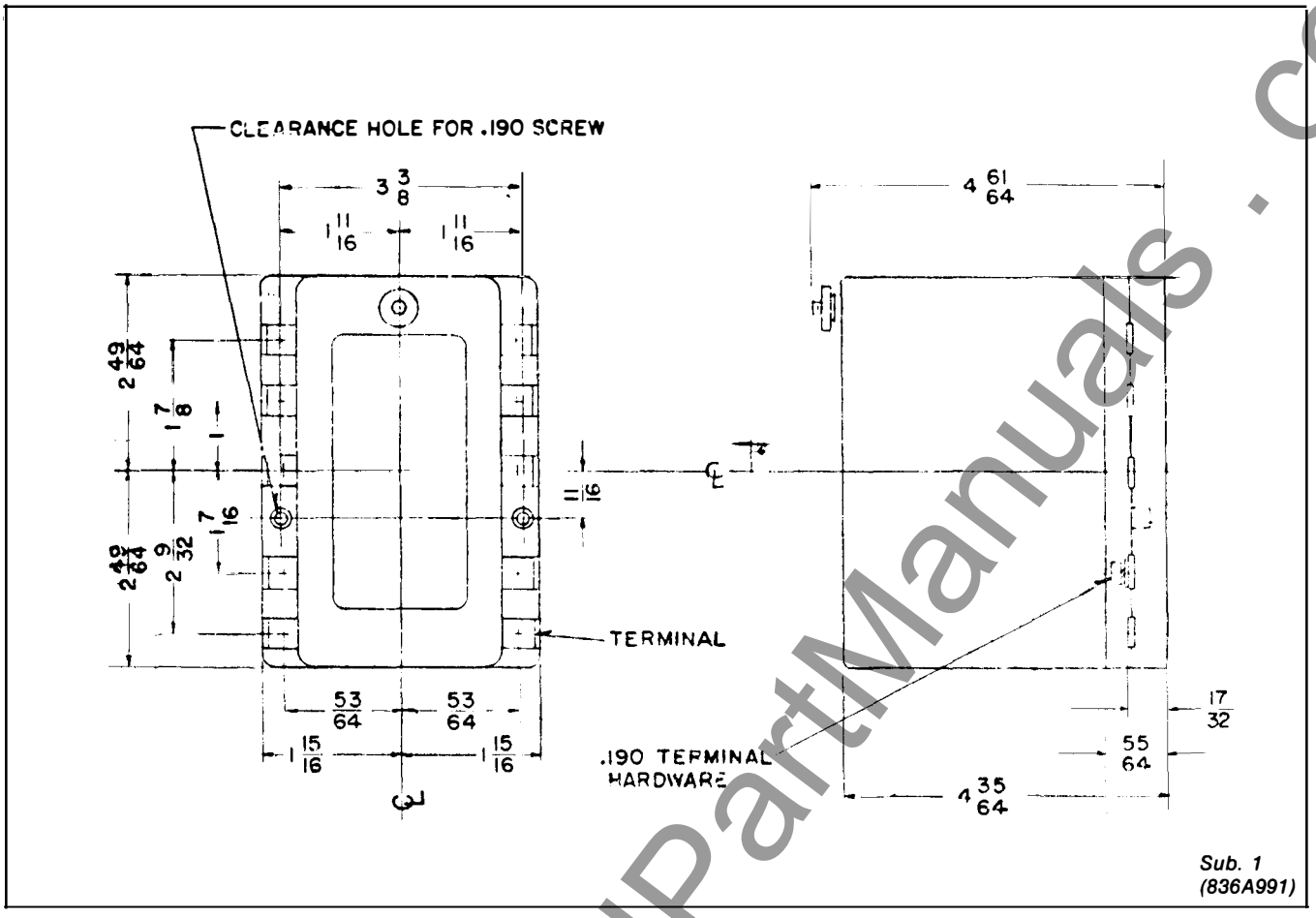


Fig. 14. Outline and drilling plan for type AR Relay in the front connected molded case

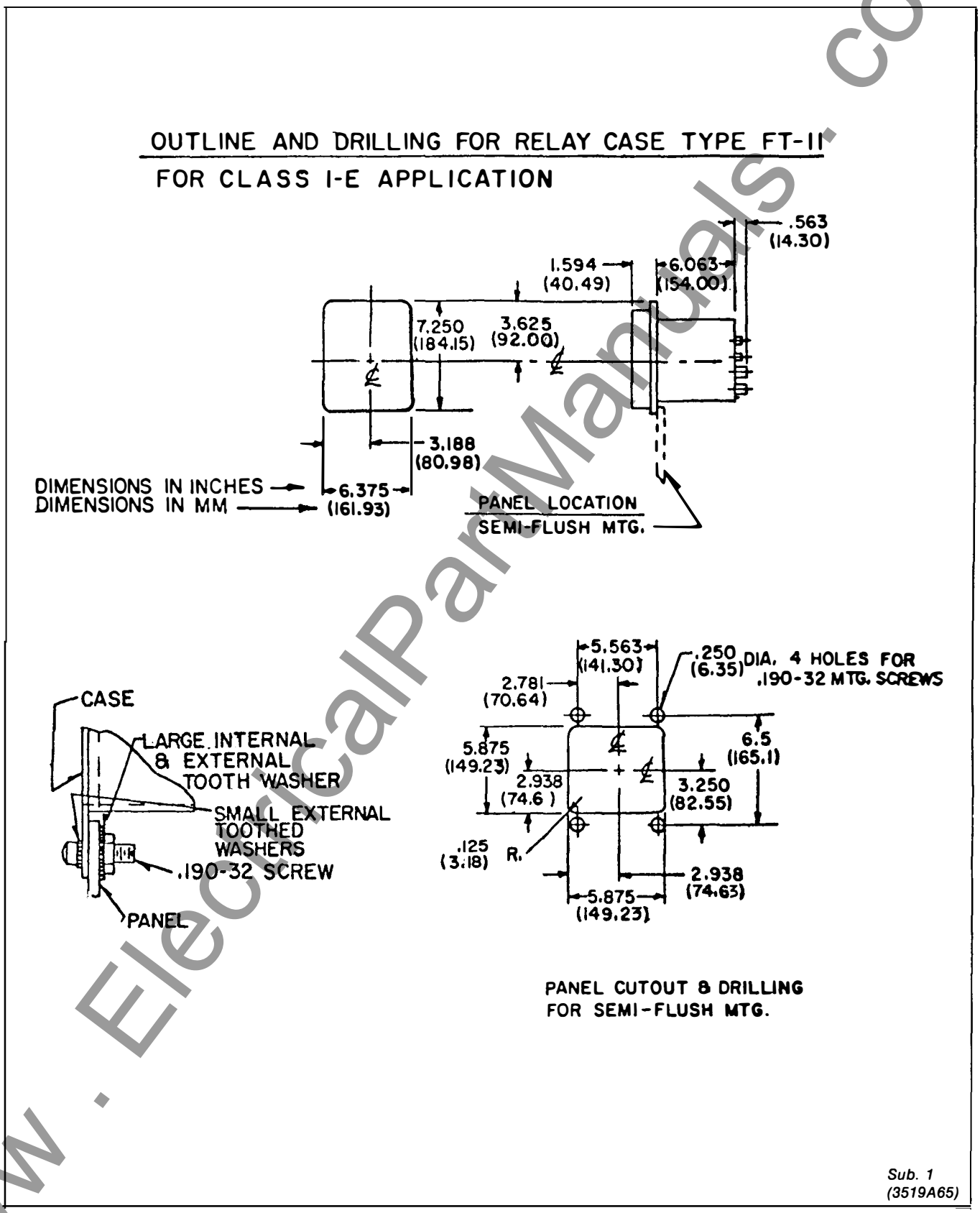


Fig. 15. Outline and drilling plan for Type AR Relay in semi-flush FT-11 case.

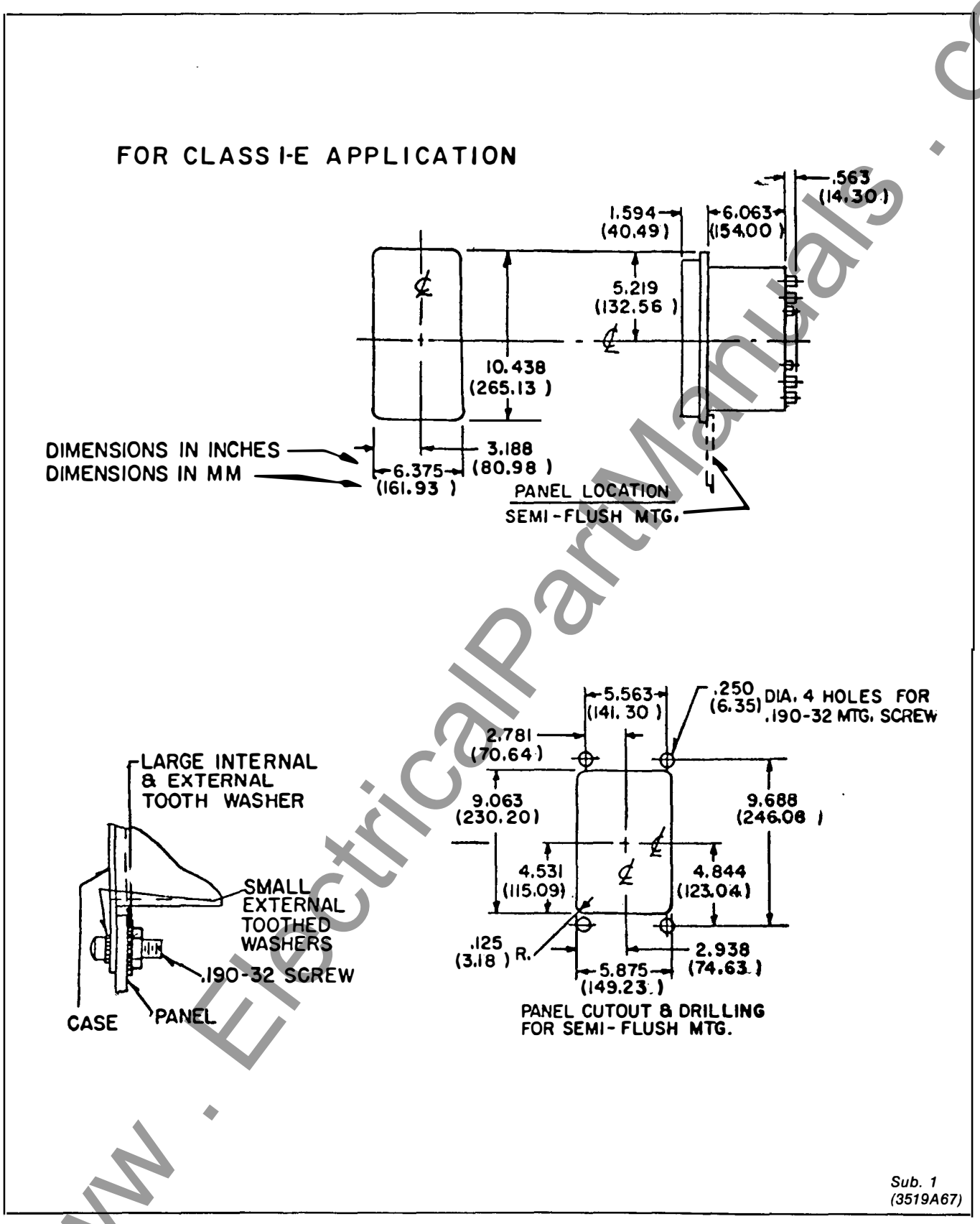


Fig. 16. Outline and drilling plan for Type AR Relay in semi-flush FT-22 case

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE AR HIGH SPEED AUXILIARY RELAY

CAUTION: Before putting protection 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 can close properly. Operate the relay to check the settings and electrical connections.

APPLICATION

The AR relay is a four-pole auxiliary type relay, especially designed for ultra high speed circuit breaker tripping duty in protective relaying systems. The AR relay is well suited for bus arrangements where more than one breaker must be tripped. It can provide isolation as well as high speed tripping. The AR relay may also be applied to provide isolation of primary and back-up relaying, and provide high speed tripping for zone one faults.

However, when the AR relay is energized by the thyristor trip circuit of the SDG, SKD, SRU, SBFU, STU-91, or STU-92 relays, a 22 ohm resistor or its equivalent must be added in parallel with the AR coil. Without this resistor, it is possible that when dc voltage is suddenly applied to the relay, sufficient current will flow through the series R-C circuit paralleling the tripping thyristor to cause the 10-watt AR relay to pickup.

An AR relay is available with a time delay dropout. It can be used in applications where a delayed dropout of 0.1 seconds is desired.

✪ The AR relay has a high seismic fragility level.

CONSTRUCTION AND OPERATION

AR UNIT

The relay consists of four stationary contact screws, four leaf spring moving contacts, a moving armature and card assembly, which operates the moving contacts; a U shaped laminated core, a coil, a frame, a molded insulation block and a series resistor. Refer to Fig. 1 and 2.

The armature and card assembly slip over a hinge pin which is inserted in the laminations. The moving and stationary contacts are mounted on the molded insulation block. The molded block and coil and lamination assembly are mounted to the frame. All contacts are fine silver.

When the coil and resistor are energized, the armature is attracted to the laminations. The card moves with the armature thereby operating the moving contacts. The tension of the moving contacts is the resetting force.

High speed operation is obtained by the low inertia of the moving parts, a sensitive electromagnet, and the proper L/R ratio of the operating circuit.

The AR unit used for a time delay dropout is similar to the one described above. The series resistor in the above is replaced by a resistor and capacitor combination shunting the AR coil.

OPERATION INDICATOR (O.I.)

The dc operation indicator is a small clapper type device. A magnetic armature is attracted to

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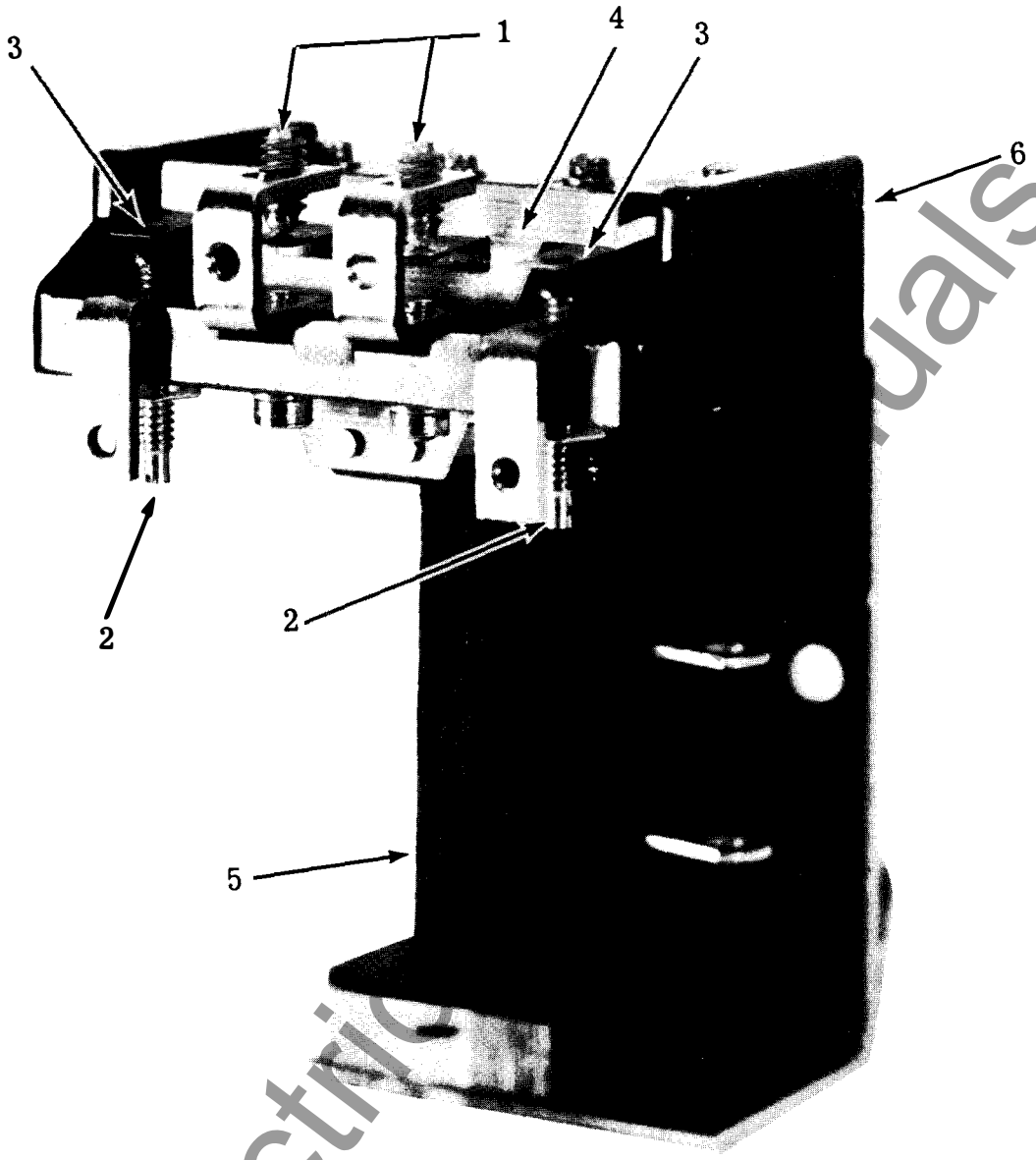
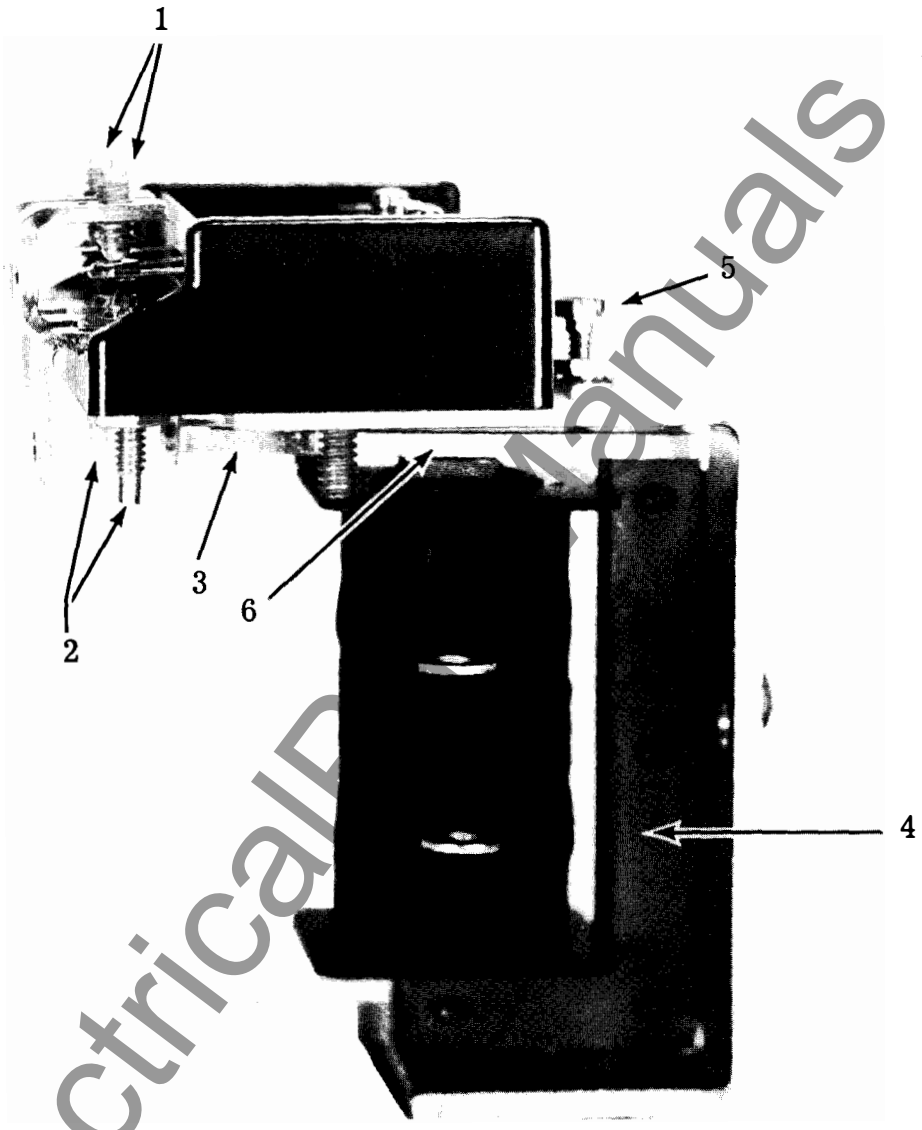
SUPERSEDES I.L. 41-759G, DATED OCTOBER 1976 AND ADDENDUM TO 41-759G DATED NOV., 1976

✪ DENOTES CHANGE FROM SUPERSEDED ISSUE. **EFFECTIVE SEPTEMBER 1978**



1 – NORMALLY CLOSED STATIONARY CONTACT SCREWS.
2 – NORMALLY OPEN STATIONARY CONTACT SCREWS.
3 – LEAF SPRING MOVING CONTACTS
4 – MOVING CARD ASSEMBLY
5 – RELAY COIL
6 – MOLDED INSULATION BLOCK

Fig. 1. Type AR Unit with two make and two break contacts (Front View).



1 – NORMALLY CLOSED STATIONARY CONTACT SCREWS.
2 – NORMALLY OPEN STATIONARY CONTACT SCREWS.
3 – MOVING ARMATURE.
4 – U-SHAPED LAMINATED CORE.
5 – ARMATURE GAP ADJUSTMENT SET SCREW.
6 – ARMATURE GAP

Fig. 2. Type AR Unit with two make and two break contacts (Side View).

TABLE I
OPERATE AND RESET TIMES

Rated Operating† Energy (WATTS)	Operate Time (Milliseconds)		Reset Time (Milli-seconds)
	NO contact Closes	NC contact Opens	NC contact Closes
10	2.0	1.5	4.0
2.25	3.5	2.5	3.5

†2.25W AR is a different style than the 10W AR.

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

CHARACTERISTICS

The AR unit without a series resistor has a sensitivity of 500 milliwatts. By the proper combination of the AR unit and a series resistor, an optimum speed of 2 milliseconds can be obtained for an energy input of 10 watts.

All relays are capable of being energized continuously. All high speed relays will pick up at 80% of rated voltage or less; and drop out at 10% of rated voltage or higher.

Typical operating times and effective contact bounce are outlined in the tables I and II.

TABLE II
CONTACT BOUNCE

Contact Loading	Effective Bounce Time In Milliseconds	
	Normally Open	Normally Closed
Dry Circuit	2	6 - 8
10 Watt (one AR relay)	1	- - -
Breaker Trip Coil	.2	- - -

The operate time of the relay with delayed dropout is about 6 milliseconds at rated voltage for a normally open contact. The relay will have a 0.1 second dropout time after being energized at least 0.015 seconds.

CONTACT RATING

Each relay contact is rated 3 amps continuous and 30 amps long enough to trip a breaker.

SETTINGS

AR UNIT

No settings are required.

OPERATION INDICATORS (OI)

The only setting required on the OI is 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.

INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from

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

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

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not require readjustment after receipt by the customer. If the adjustments have been changed or the relay taken apart for repairs, the instructions below should be followed.

ACCEPTANCE CHECK

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

1. Contact gaps

   a. Normally open contacts should have a gap ✪ of .018 to .023 inch.

   b. Normally closed contact gap should be .013 minimum.

2. Contact pressure

   a. On four normally open contact relays, the normally open contacts should have approximately 4 grams pressure on the card in the de-energized position, and 15 to 30 grams contact pressure in the energized position.

   b. On two normally open and two normally closed relays, the normally closed contacts should have approximately 8 grams contact pressure in the de-energized position. Each normally open contact spring should have approximately 8 grams pressure against the card.

3. Armature gap

   The armature gap should be approximately .009 inches measured at the narrowest part of the armature gap.

4. Contact operate time

   ✪ Per Table I

5. Operation Indicator (O.I.)

   Close the main relay contacts and pass sufficient dc current through the circuit to drop the O.I. This value of current should be not greater than the particular O.I. tap setting being used. The operation indicator target should drop freely.

6. AR relay with time delay dropout.

   Connect the relay as shown in Fig. 15. When the AR coil has been energized for 25-35 milliseconds its dropout time should be a minimum of 100 milliseconds. The R relay should be adjusted such that its contact break time is 25-35 milliseconds. Also the timer must be of the type which may be started and stopped by break contacts.

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").

TRIPPING RELAY (AR)

The Type AR tripping relay unit has been properly adjusted at the factory to insure correct operation, and under normal field conditions should not require readjustment. If, however, the

adjustments are disturbed in error, or it becomes necessary to replace some part, use the following adjustment procedure. This procedure should not be used until it is apparent that the relay is not in proper working order.

a. Adjust the set screw at the rear of the top of the frame to obtain a 0.009-inch gap at the rear end of the armature air gap.

b. Adjust each contact spring to obtain 4 grams pressure at the very end of the spring. This pressure should be sufficient to move the spring away from the edge of the slot of the card. On the two normally open two normally closed contact relay, adjust each normally open contact spring for 8 grams to just move the contact away from the card. Adjust the normally closed contact for 15 grams spring pressure, to just move contact spring away from the card. Then adjust the stationary contact to just move the contact spring away from the card.

c. Adjust each stationary contact screw to obtain a contact gap of 0.020 to 0.022 inches for the normally open contacts. Energize the relay and the normally open contacts should have 15 to 30 grams contact follow. The normally closed, if any, should have a contact gap of .015 inches.

When calibrated as outlined above, the relay should meet the characteristics of Table I and II.

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.

TABLE III - CONTACT RATING

Contact Circuit Volts DC	Interrupting Rating (Amps)				Carry Rating (Amps)
	Resistive		Inductive L/R = .005		Continuous
	Single	Double	Single	Double	
48	3.750	20.	1.750	20.	3
125	0.500	1.7	0.350	1.2	3
250	0.250	✪ .05	0.150	0.250	3

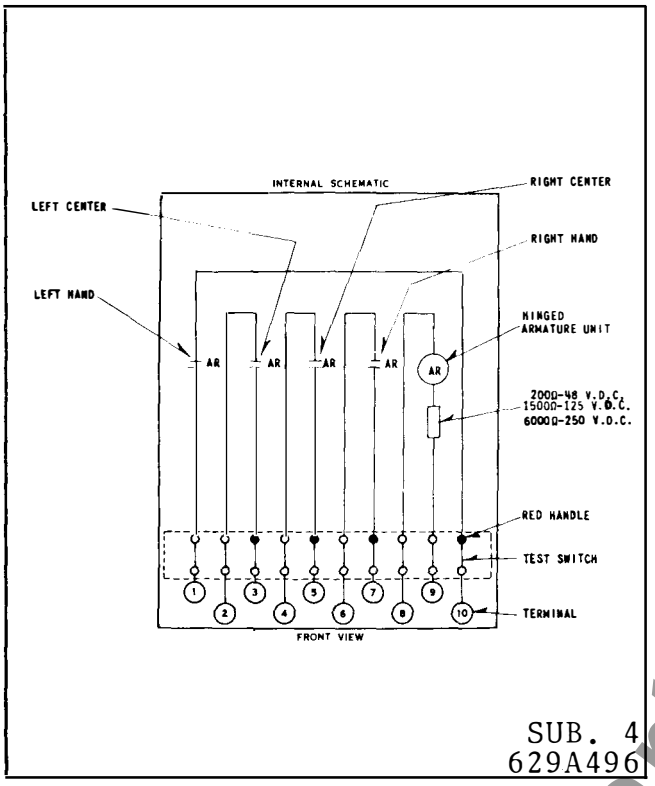


Fig. 3. Internal schematic of the Type AR Relay with 4 make contacts in FT-11 case.

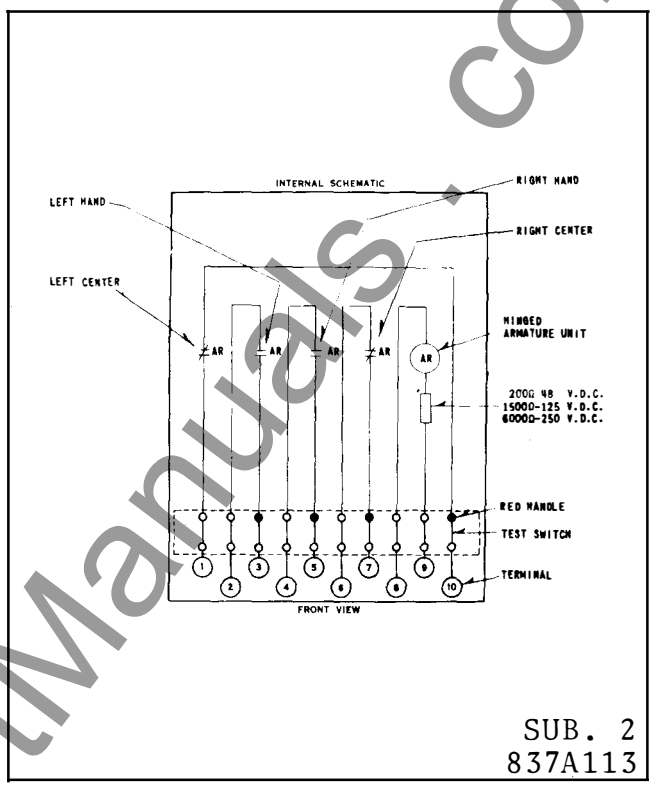


Fig. 4. Internal schematic of the Type AR Relay with 2 make - 2 break contacts in FT-11 case.

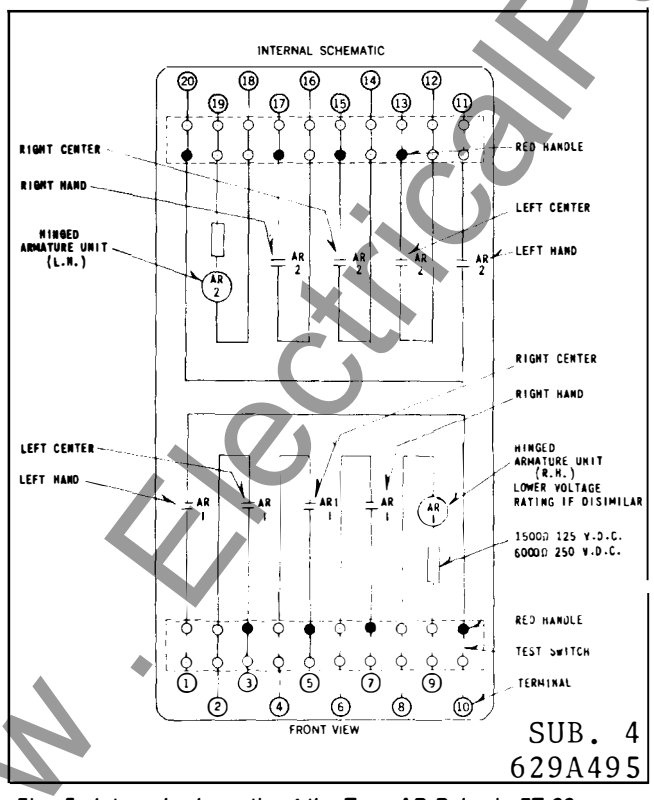


Fig. 5. Internal schematic of the Type AR Relay in FT-22 case, double unit, with 8 make contacts.

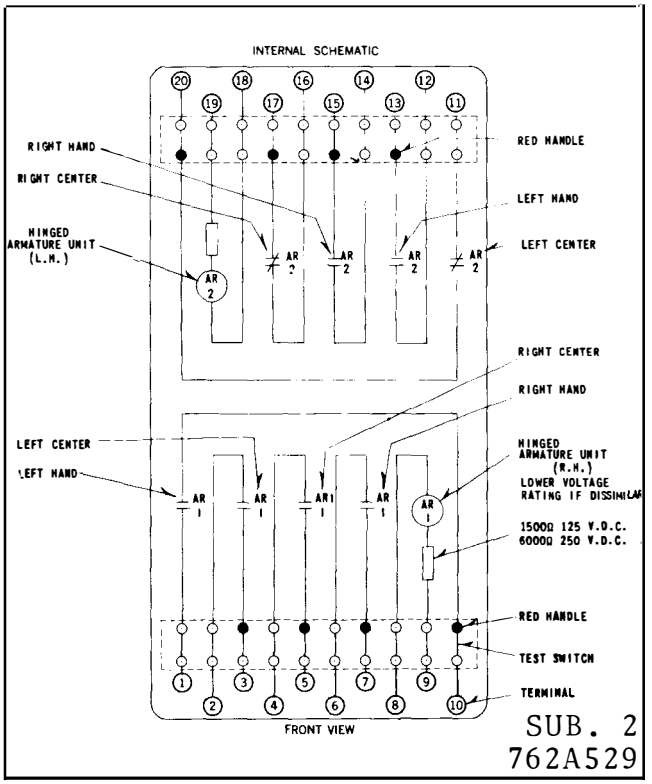


Fig. 6. Internal schematic of the Type AR Relay in FT-22 case, double unit, with 6 make and 2B contacts.

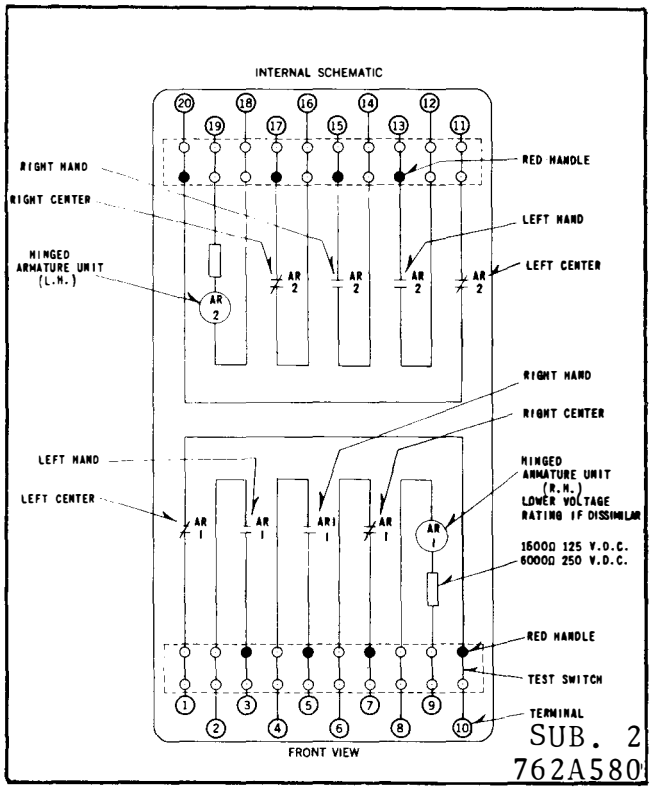


Fig. 7. Internal schematic of the Type AR Relay in FT-22 case, double unit, with 4 make and 4 break contacts.

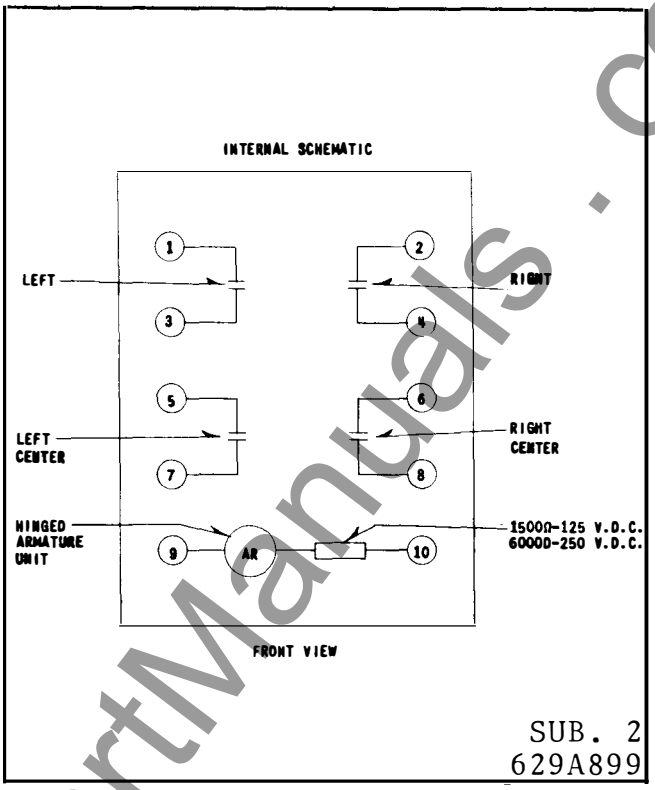


Fig. 8. Internal schematic of the Type AR Relay in front connected molded case with 4 make contacts.

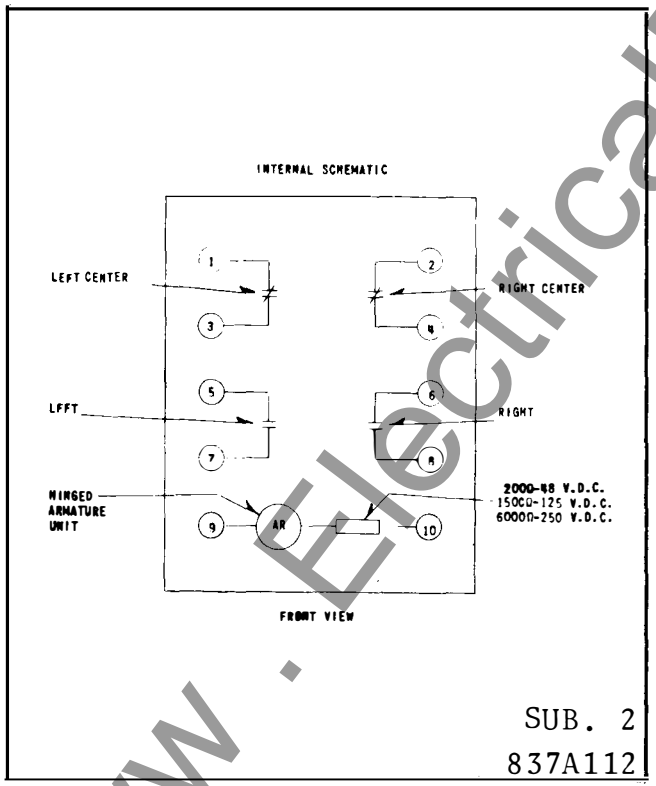


Fig. 9. Internal schematic of the Type AR Relay in front connected molded case with 2 make - 2 break contacts.

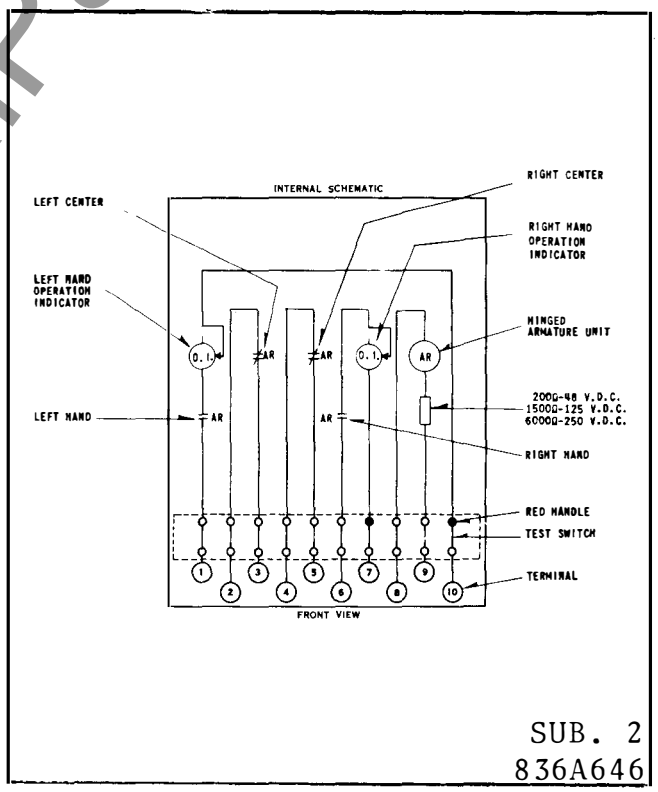


Fig. 10. Internal schematic of the Type AR Relay in the FT-11 case with 2 Operation Indicators.

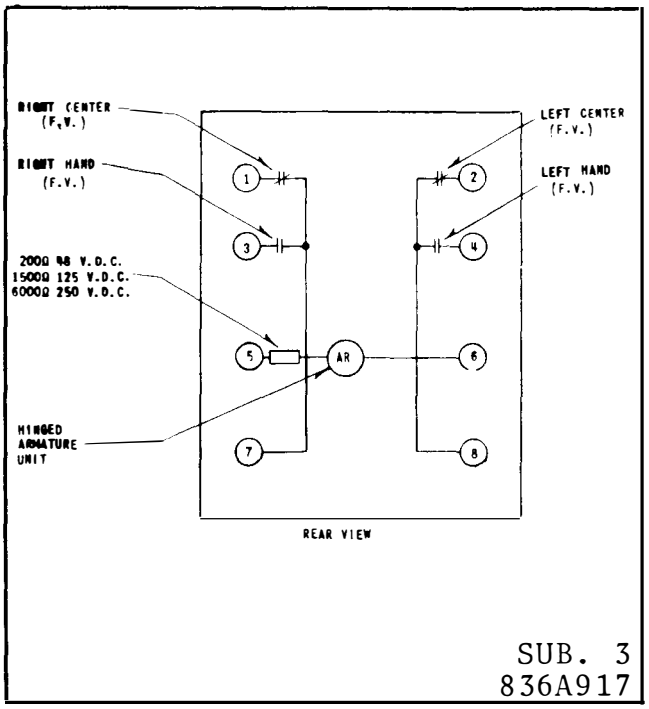


Fig. 11. Internal schematic of the AR Relay with 2 make and 2 break contacts in molded case.

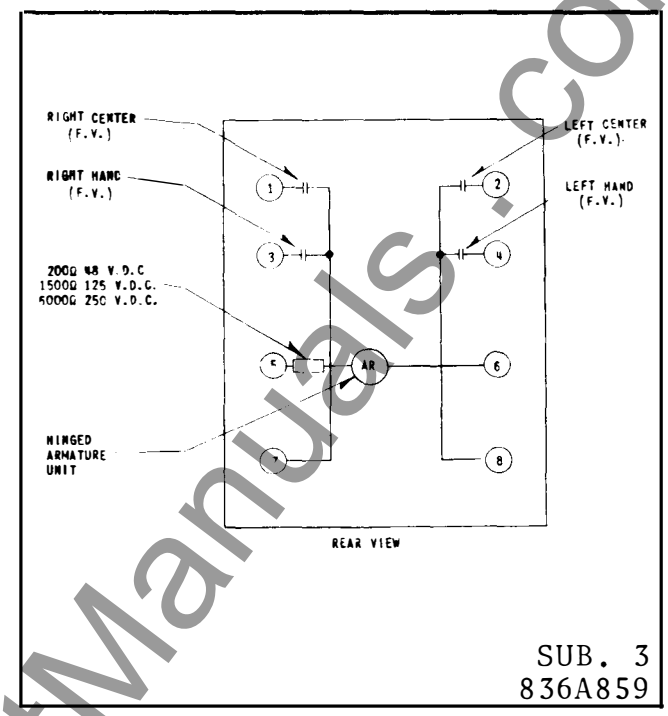


Fig. 12. Internal schematic of the AR with 4 make contacts in molded case.

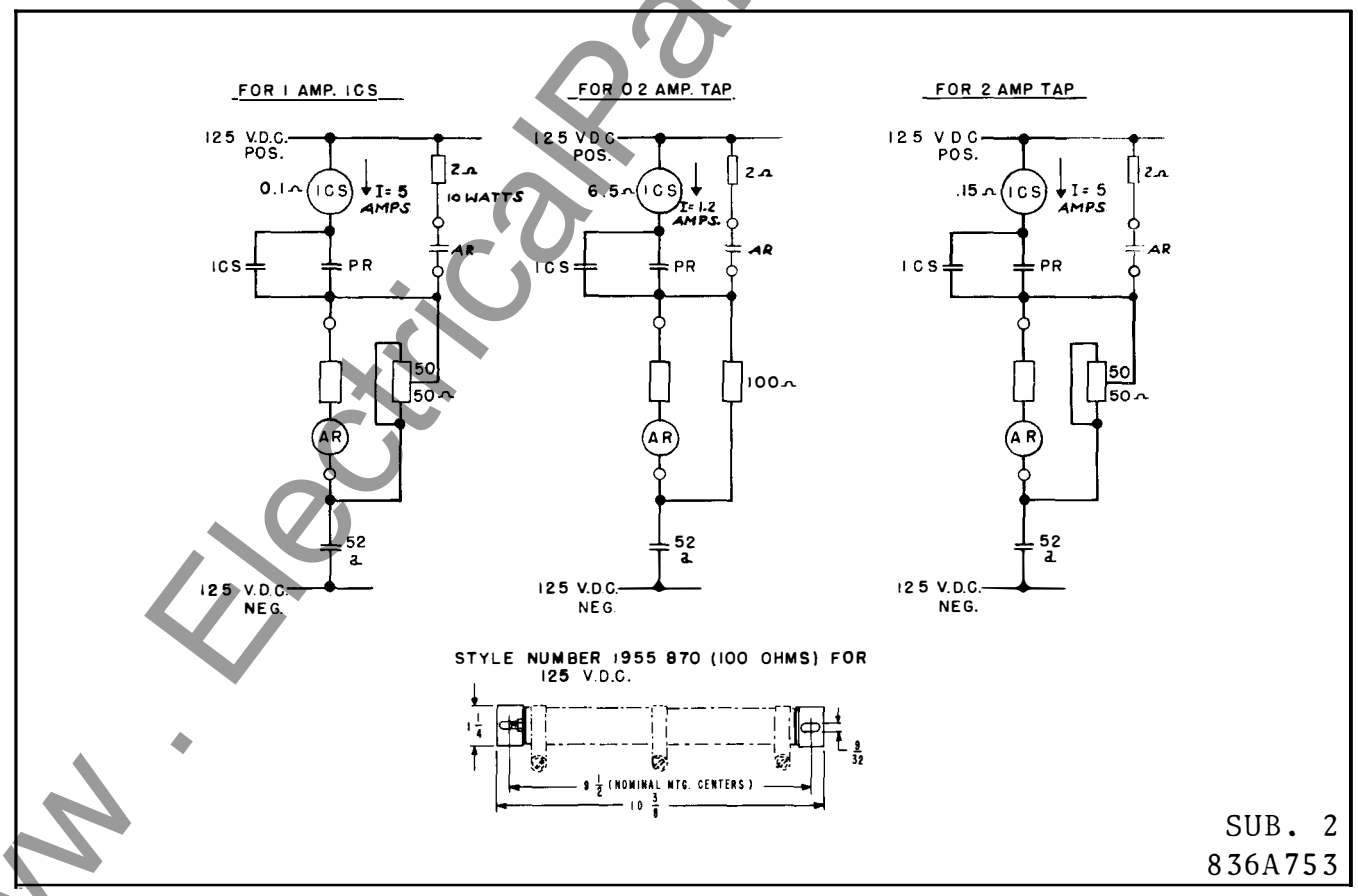


Fig. 13. External schematic for the Type AR Relay.

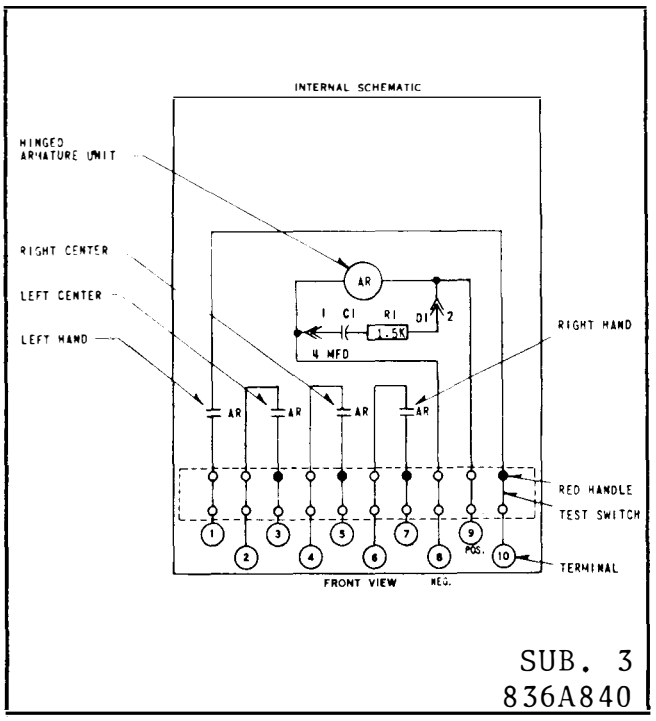


Fig. 14. Internal schematic of the Type AR Relay in the FT-11 case with time delay dropout.

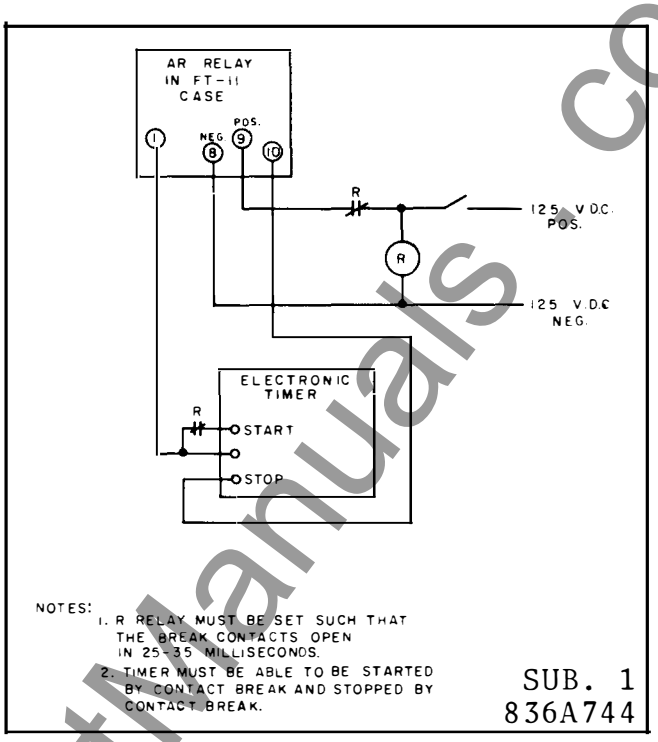


Fig. 15. Test connections for the Type AR Relay with time delay on dropout.

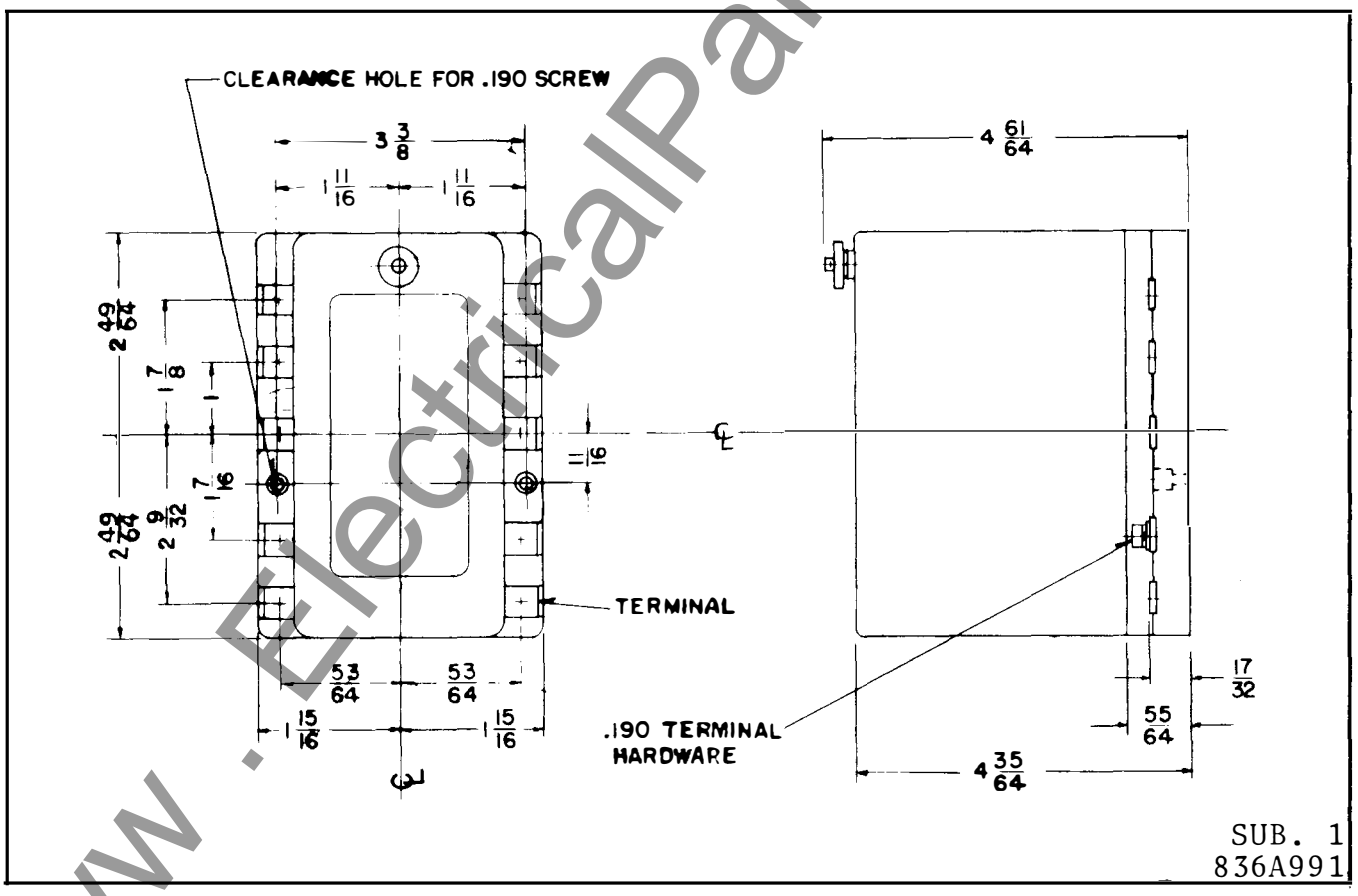


Fig. 16. Outline and drilling plan for the Type AR Relay in the front connected molded case.

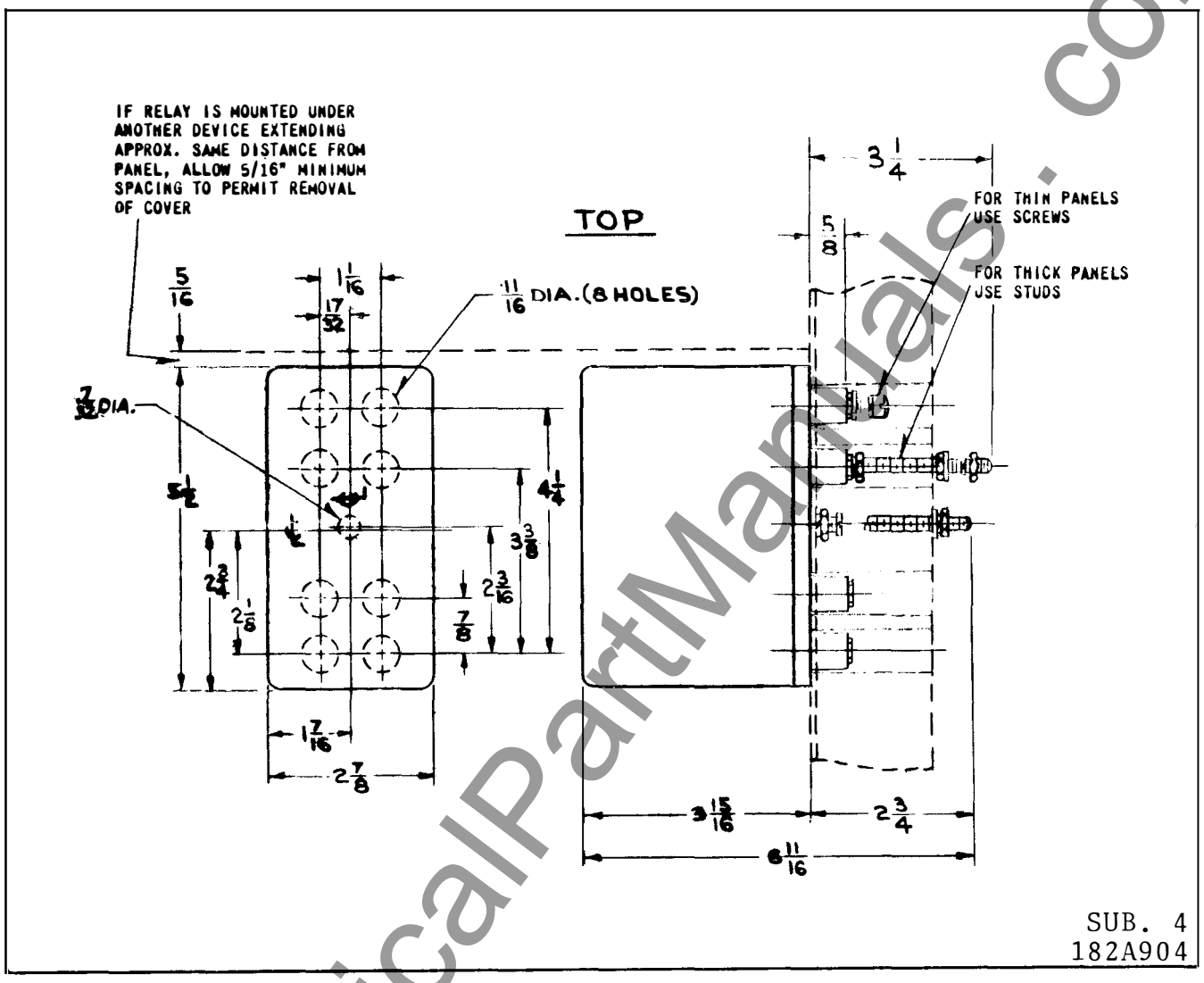


Fig. 17. Type AR Relay – Molded Base Rear Connected Outline & Drilling Plan.

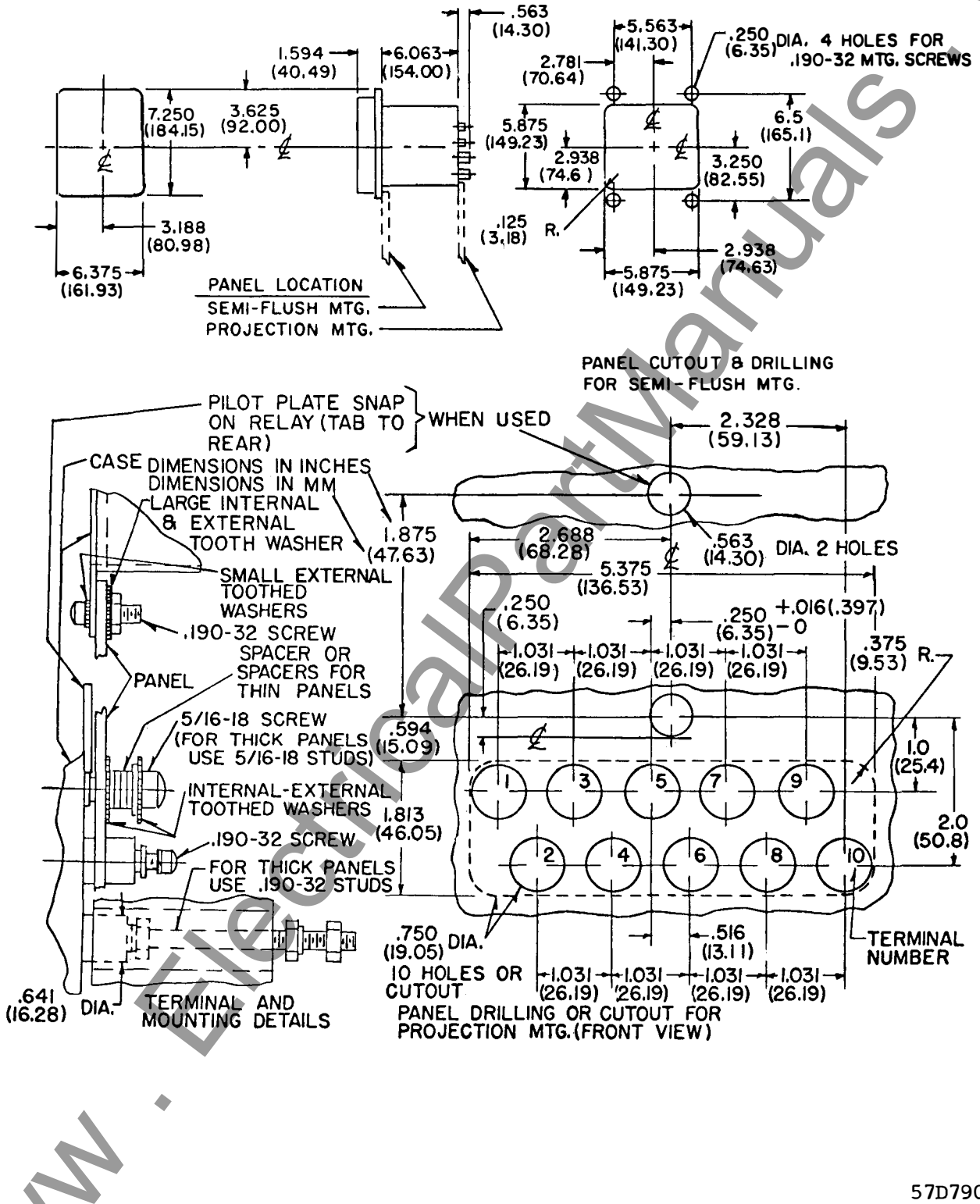


Fig. 18. Outline and drilling plan for the Type AR Relay in the FT-11 case.

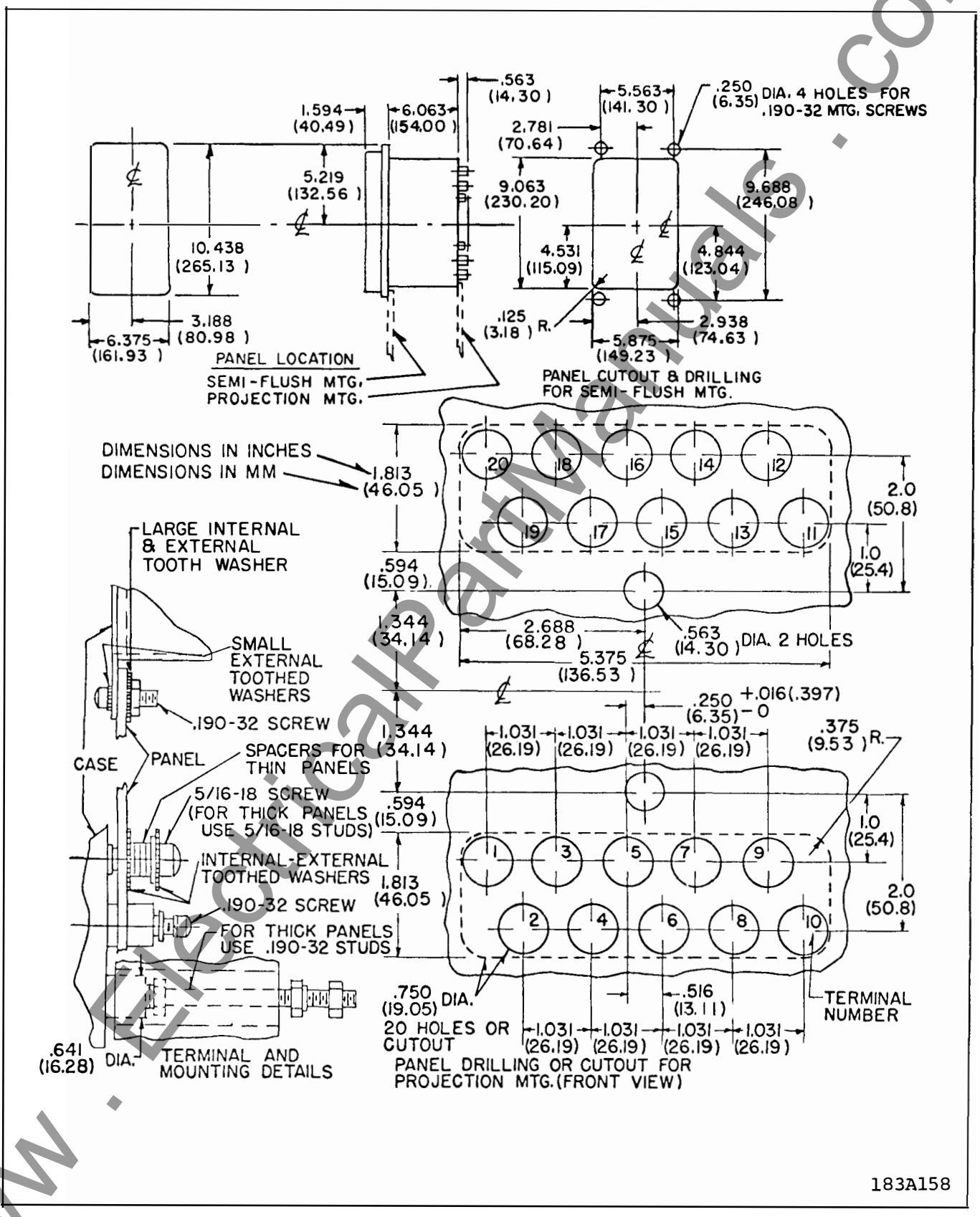


Fig. 19. Outline and drilling plan for the Type AR Relay in the FT-22 case.

WESTINGHOUSE ELECTRIC CORPORATION

RELAY-INSTRUMENT DIVISION **CORAL SPRINGS, FL.**

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE AR HIGH SPEED AUXILIARY RELAY

CAUTION: Before putting protection 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 can close properly. Operate the relay to check the settings and electrical connections.

APPLICATION

The AR relay is a four-pole auxiliary type relay, especially designed for ultra high speed circuit breaker tripping duty in protective relaying systems. The AR relay is well suited for bus arrangements where more than one breaker must be tripped. It can provide isolation as well as high speed tripping. The AR relay may also be applied to provide isolation of primary and back-up relaying, and provide high speed tripping for zone one faults.

An AR relay is available with a time delay dropout. It can be used in applications where a delayed dropout of 0.1 seconds is desired.

CONSTRUCTION AND OPERATION

AR Unit

The relay consists of four stationary contact screws, four leaf spring moving contacts, a moving armature and card assembly, which operates the moving contacts; a U shaped laminated core, a coil, a frame, a molded insulation block and a series resistor. Refer to Fig. 1 and 2.

The armature and card assembly slip over a hinge pin which is inserted in the laminations. The moving and stationary contacts are mounted on the molded insulation block. The molded block and coil and lamination assembly are mounted to the frame. All contacts are fine silver.

When the coil and resistor are energized, the armature is attracted to the laminations. The card moves with the armature thereby operating the moving contacts. The tension of the moving contacts is the resetting force.

High speed operation is obtained by the low inertia of the moving parts, a sensitive electromagnet, and the proper L/R ratio of the operating circuit.

The AR unit used for a time delay dropout is similar to the one described above. The series resistor in the above is replaced by a resistor and capacitor combination shunting the AR coil.

Operation Indicator (O.I.)

The d-c operation indicator is a small clapper type device. A magnetic armature is attracted to the magnetic core upon energization of the switch. 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 front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The AR unit without a series resistor has a sensitivity of 500 milliwatts. By the proper combination of the AR unit and a series resistor, an optimum speed of 2 milliseconds can be obtained for an energy input of 10 watts.

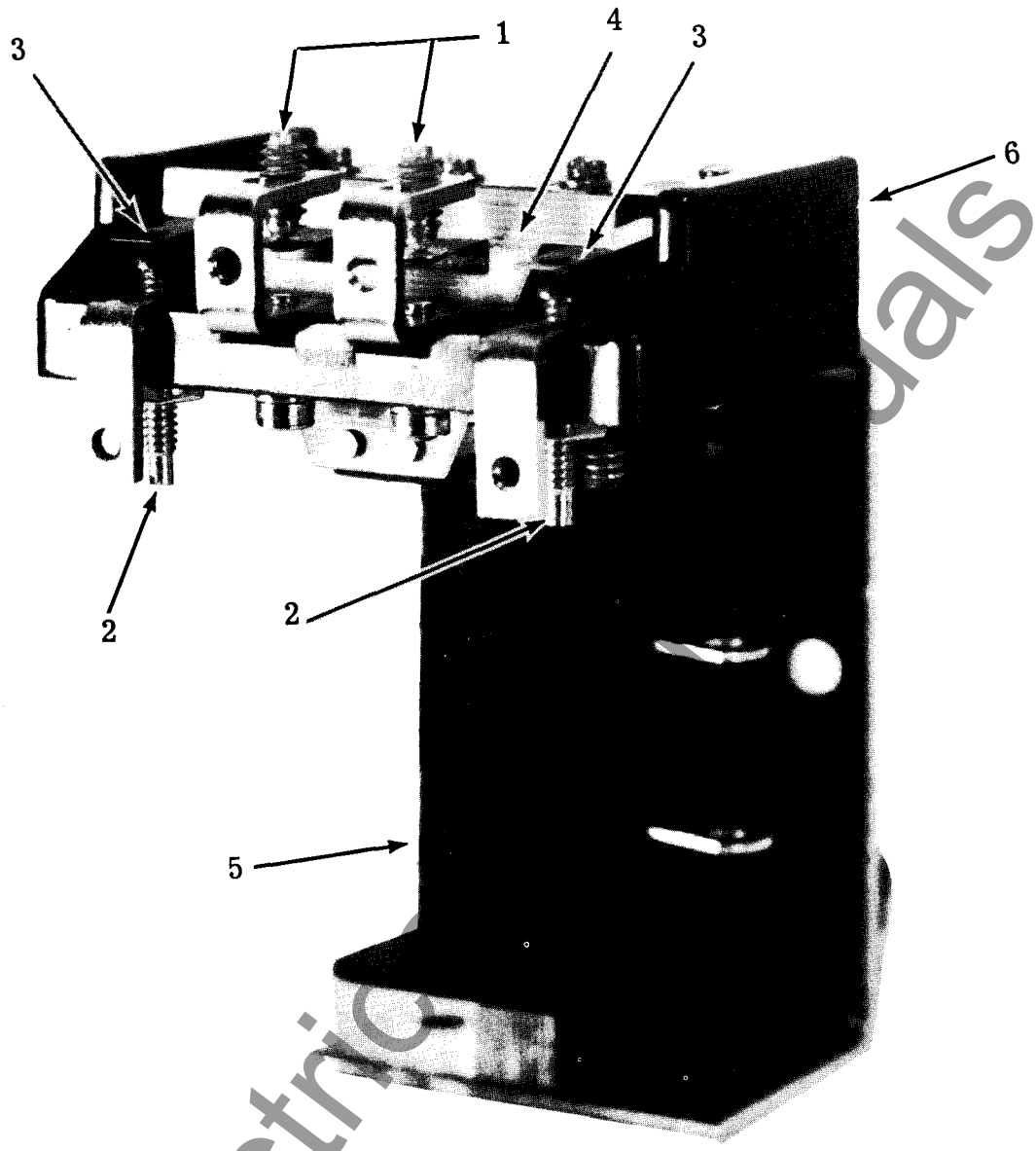
All relays are capable of being energized continuously. All high speed relays will pick up at 80% of rated voltage or less; and drop out at 10% of rated voltage or higher.

Typical operating times and effective contact bounce are outlined in the tables I and II.

The operate time of the relay with delayed dropout is about 6 milliseconds at rated voltage for a normally open contact. The relay will have a 0.1 second dropout time after being energized at least 0.015 seconds.

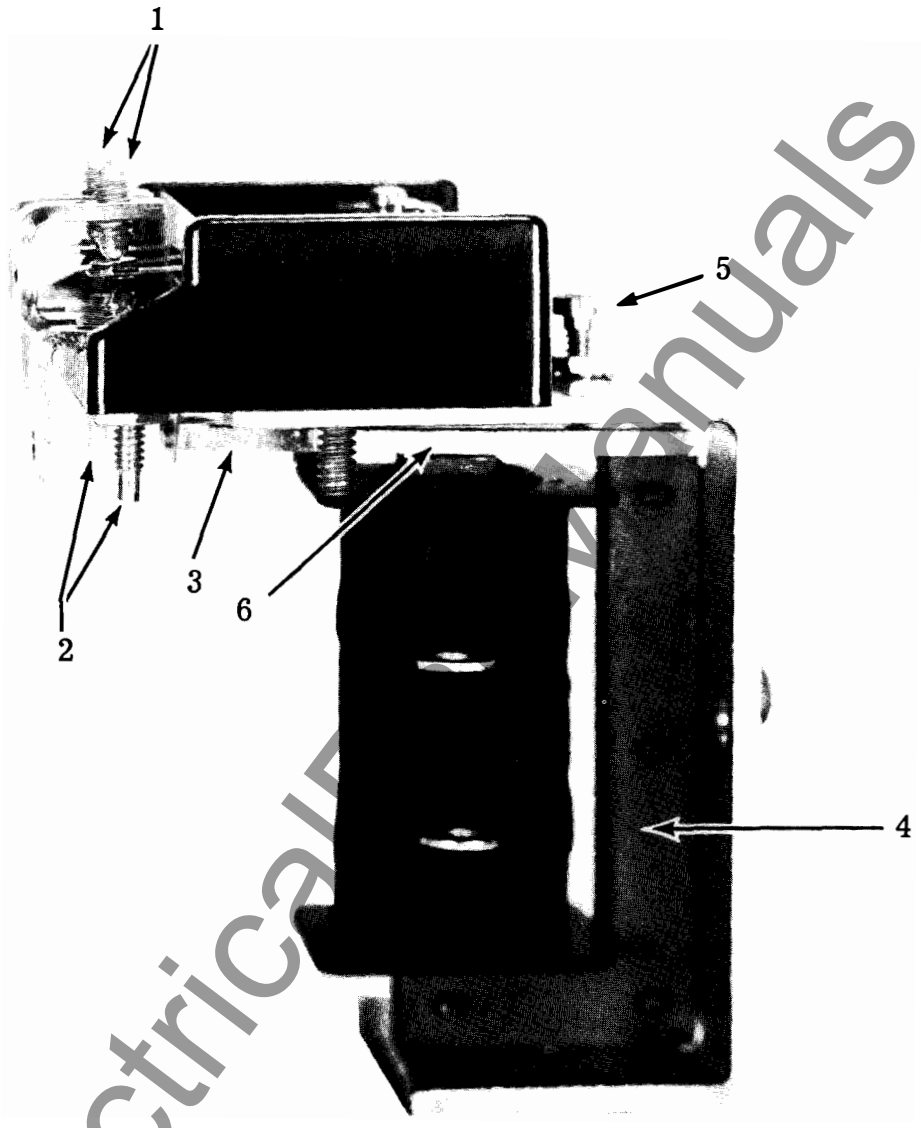
SUPERSEDES I.L. 41-759C
*Denotes change from superseded issue.

EFFECTIVE JANUARY 1969



1 – NORMALLY CLOSED STATIONARY CONTACT SCREWS.
2 – NORMALLY OPEN STATIONARY CONTACT SCREWS.
3 – LEAF SPRING MOVING CONTACTS
4 – MOVING CARD ASSEMBLY
5 – RELAY COIL
6 – MOLDED INSULATION BLOCK

Fig. 1 Type AR Unit with two make and two break contacts (Front View).



1 – NORMALLY CLOSED STATIONARY CONTACT SCREWS.
2 – NORMALLY OPEN STATIONARY CONTACT SCREWS.
3 – MOVING ARMATURE.
4 – U-SHAPED LAMINATED CORE.
5 – ARMATURE GAP ADJUSTMENT SET SCREW.
6 – ARMATURE GAP

Fig. 2 Type AR Unit with two make and two break contacts (Side View).

TABLE I
OPERATE AND RESET TIMES

Rated Operating † Energy (WATTS)	Operate Time (Milliseconds)		Reset Time (Milliseconds)
	NO contact Closes	NC contact Opens	NC contact Closes
10	2.0	1.5	4.0
2.25	3.5	2.5	3.5

† 2.25W AR is a different style than the 10W AR.

TABLE II
CONTACT BOUNCE

Contact Loading	Effective Bounce Time in Milliseconds	
	Normally Open	Normally Closed
Dry Circuit	2	6-8
10 Watt (one AR relay)	1	---
Breaker Trip Coil	.2	---

Contact Rating

Each relay contact is rated 3 amps continuous and 30 amps long enough to trip a breaker.

SETTINGS

AR Unit

No settings are required.

Operation Indicators (OI)

The only setting required on the OI is 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.

INSTALLATION

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

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

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not require readjustment after receipt by the customer. If the adjustments have been changed or the relay taken apart for repairs, the instructions below should be followed.

Acceptance Check

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

1. Contact gaps
   a. Normally open contacts should have a gap of .018 to .023 inch.
   b. Normally closed contact gap should be .013 minimum.
2. Contact pressure
   a. On four normally open contact relays, the normally open contacts should have approximately 4 grams pressure on the card in the de-energized position, and 15 to 30 grams contact pressure in the energized position.
   b. On two normally open and two normally closed relays, the normally closed contacts should have approximately 8 grams contact pressure in the de-energized position. Each normally open contact spring should have approximately 8 grams pressure against the card.

3. Armature gap

   The armature gap should be approximately .009 inches measured at the narrowest part of the armature gap.

4. Contact operate time

   Per Table 1

5. Operation Indicator (O.I.)

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

6. AR relay with time delay on dropout.

* Connect the relay as shown in Fig. 15. When the AR coil has been energized for 25-35 milliseconds its dropout time should be a minimum of 100 milliseconds. The R relay should be adjusted such that its contact break time is 25-35 milliseconds. Also the timer must be of the type which may be started and stopped by break contacts.

CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs of 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")

Tripping Relay (AR)

The type AR tripping relay unit has been properly adjusted at the factory to insure correct operation, and under normal field conditions should not require readjustment. If, however, the adjustments are disturbed in error, or it becomes necessary to replace some part, use the following adjustment procedure. This procedure should not be used until it is apparent that the relay is not in proper working order.

a. Adjust the set screw at the rear of the top of the frame to obtain a 0.009-inch gap at the rear end of the armature air gap.

b. Adjust each contact spring to obtain 4 grams pressure at the very end of the spring. This pressure should be sufficient to move the spring away from the edge of the slot of the card. On the two normally open two normally closed contact relay, adjust each spring for 8 grams to just move the contact away from the card.

c. Adjust each stationary contact screw to obtain a contact gap of 0.020 to 0.022 inches for the normally open contacts. Energize the relay and the normally open contacts should have 15 to 30 grams contact follow. The normally closed, if any, should have a contact gap of .015 inches.

When calibrated as outlined above, the relay should meet the characteristics of Table I and II.

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.

TABLE III

CONTACT INTERRUPTING CAPABILITY (AMPERES)

D.C. VOLTAGE	RESISTIVE LOAD	INDUCTIVE LOAD
	WILL INTERRUPT	WILL INTERRUPT
250	0.2	0.1
125	0.5	0.25
48	1.5	1.0

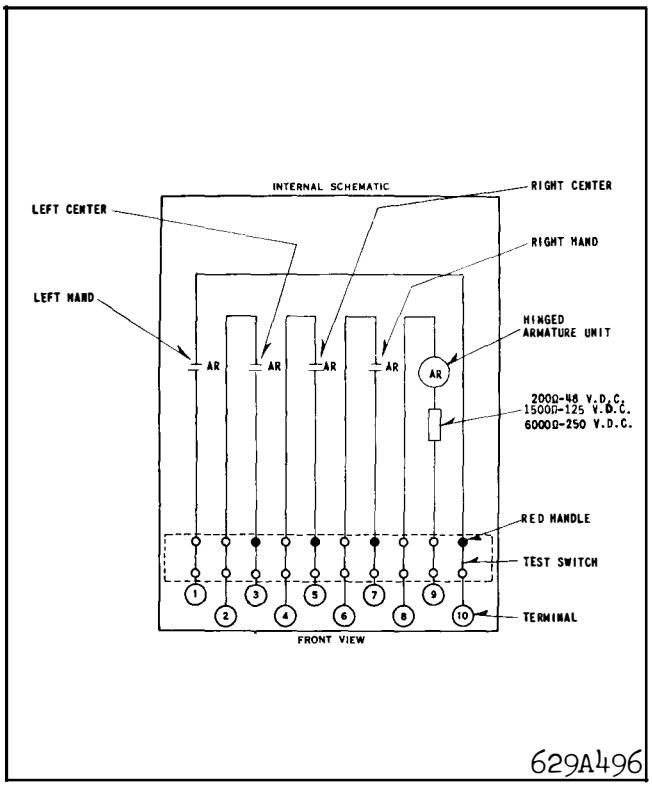


Fig. 3 Internal schematic of the Type AR Relay with 4 make contacts in FT-11 case.

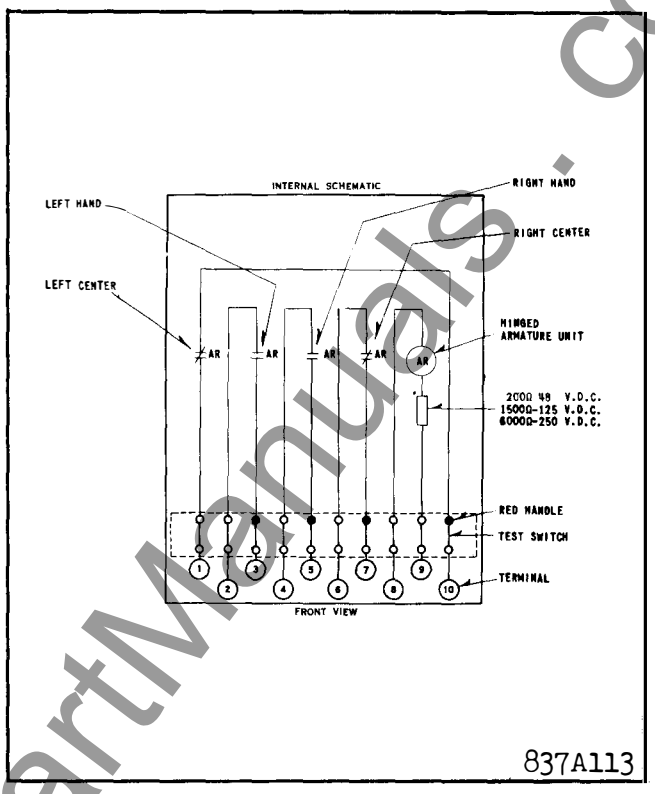


Fig. 4 Internal schematic of the Type AR Relay with 2 make - 2 break contacts in FT-11 case.

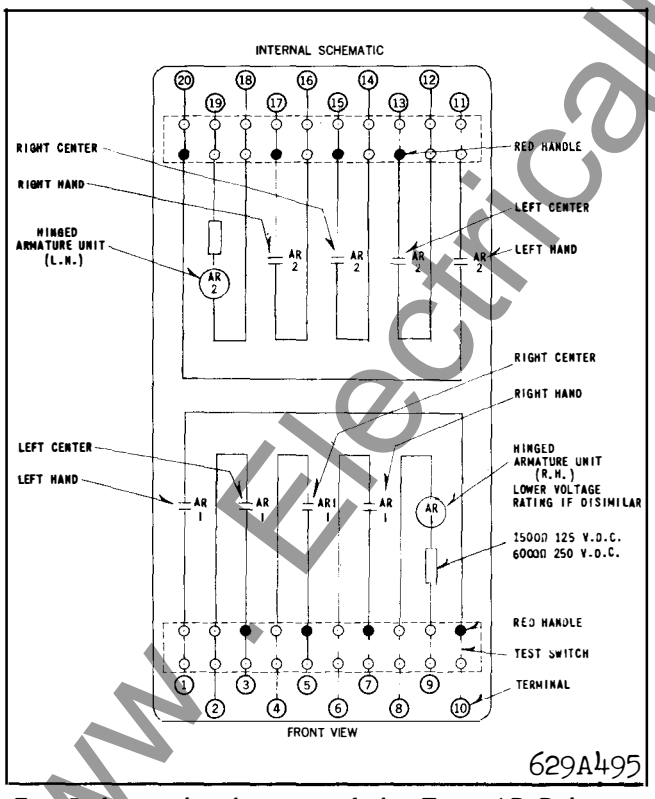


Fig. 5 Internal schematic of the Type AR Relay in FT-22 case, double unit, with 8 make contacts.

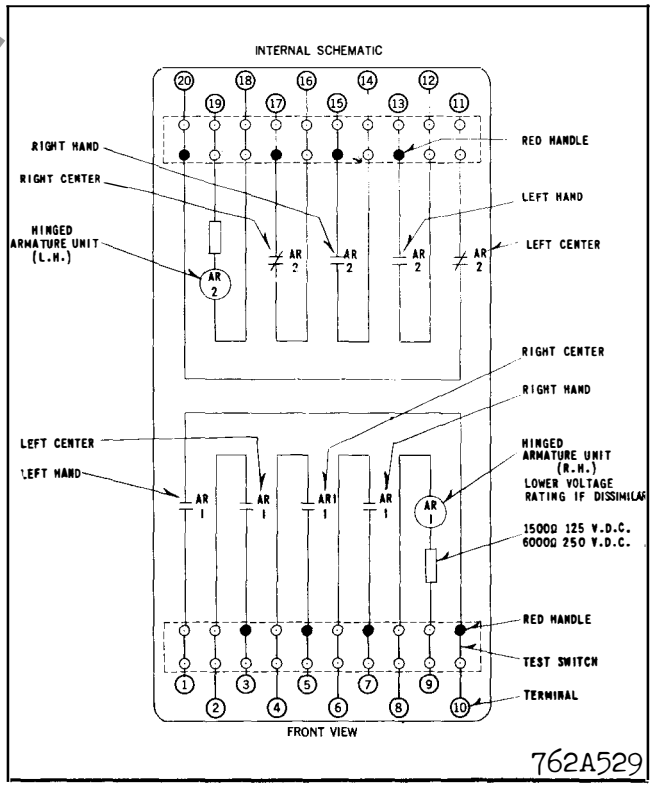


Fig. 6 Internal schematic of the Type AR Relay in FT-22 case, double unit, with 6 make and 2B contacts.

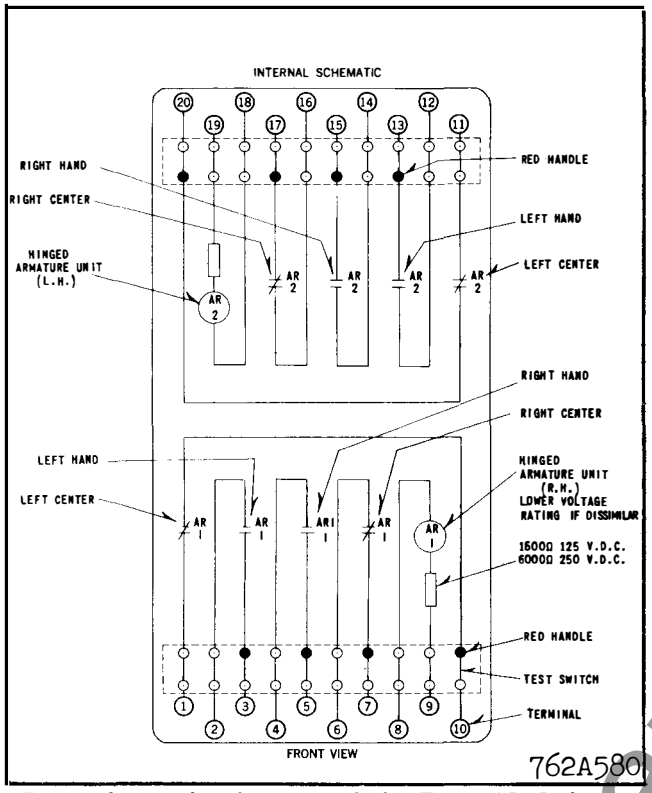


Fig. 7 Internal schematic of the Type AR Relay in FT-22 case, double unit, with 4 make and 4 break contacts.

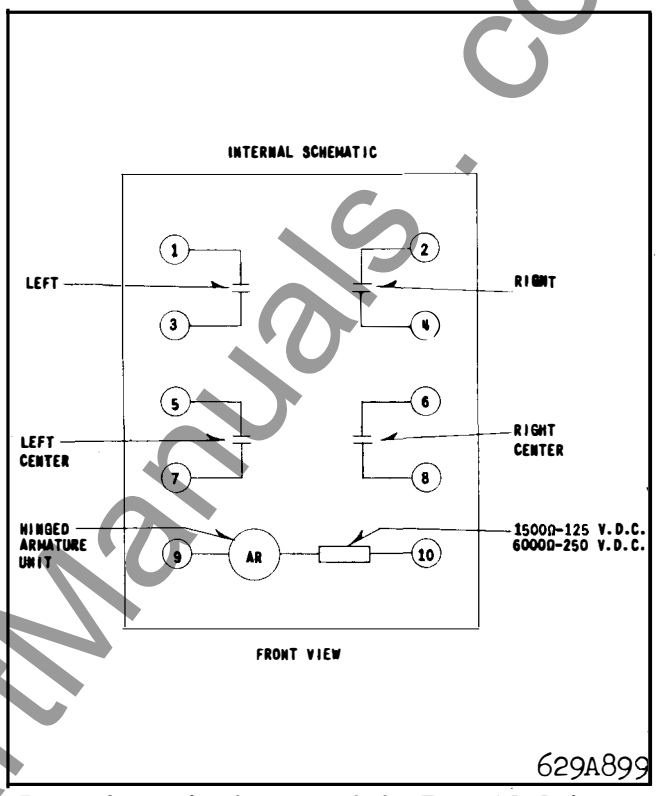


Fig. 8 Internal schematic of the Type AR Relay in front connected molded case with 4 make contacts.

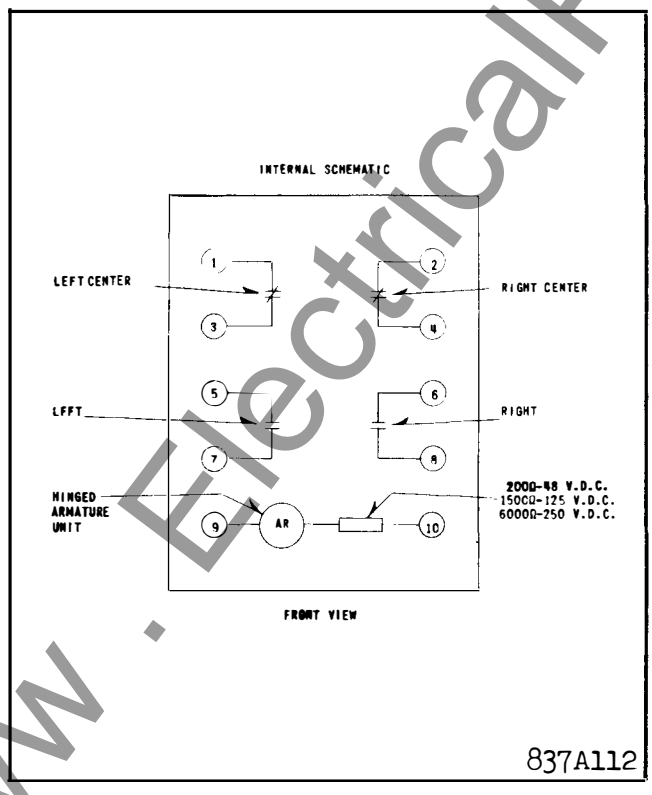


Fig. 9 Internal schematic of the Type AR Relay in front connected molded case with 2 make-2 break contacts.

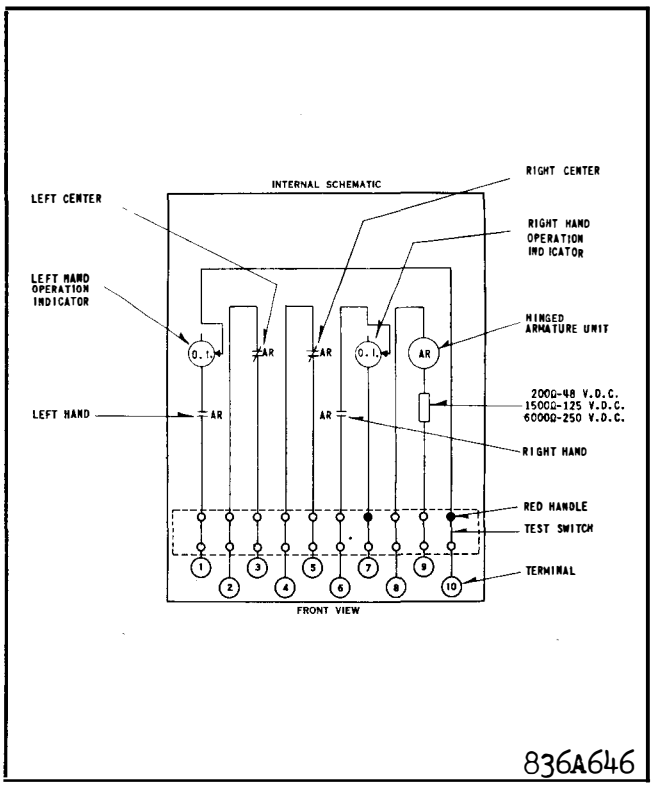
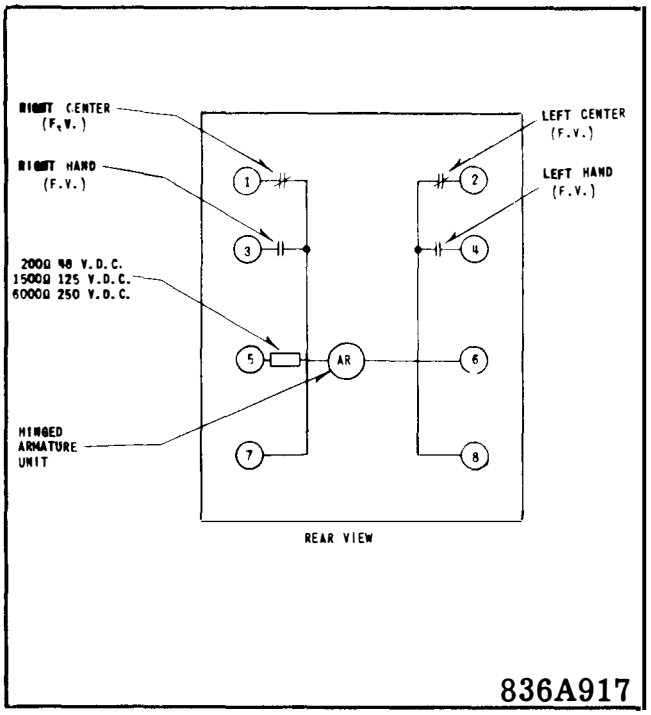


Fig. 10 Internal schematic of the Type AR Relay in the FT-11 case with 2 Operation Indicators.



* *Fig. 11 Internal schematic of the AR Relay with 2 make and 2 break contacts in molded case.*

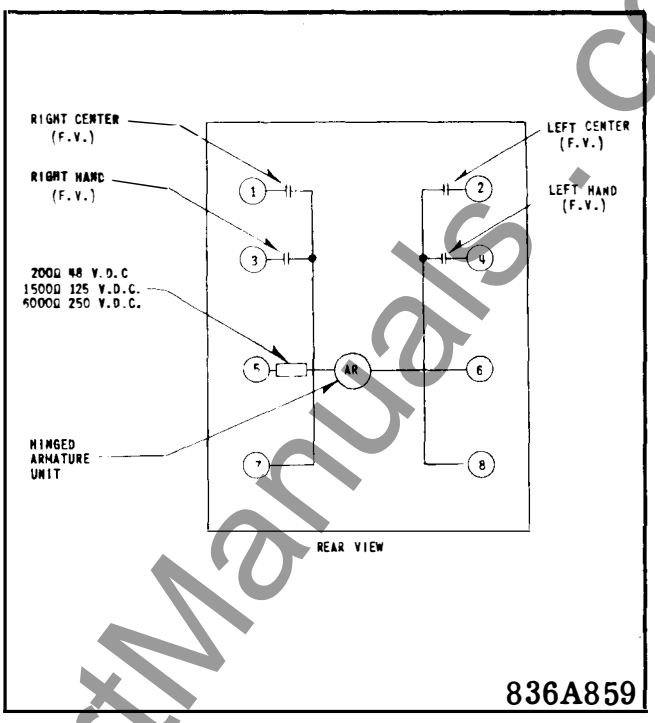


Fig. 12 Internal schematic of the AR with 4 make contacts in molded case.

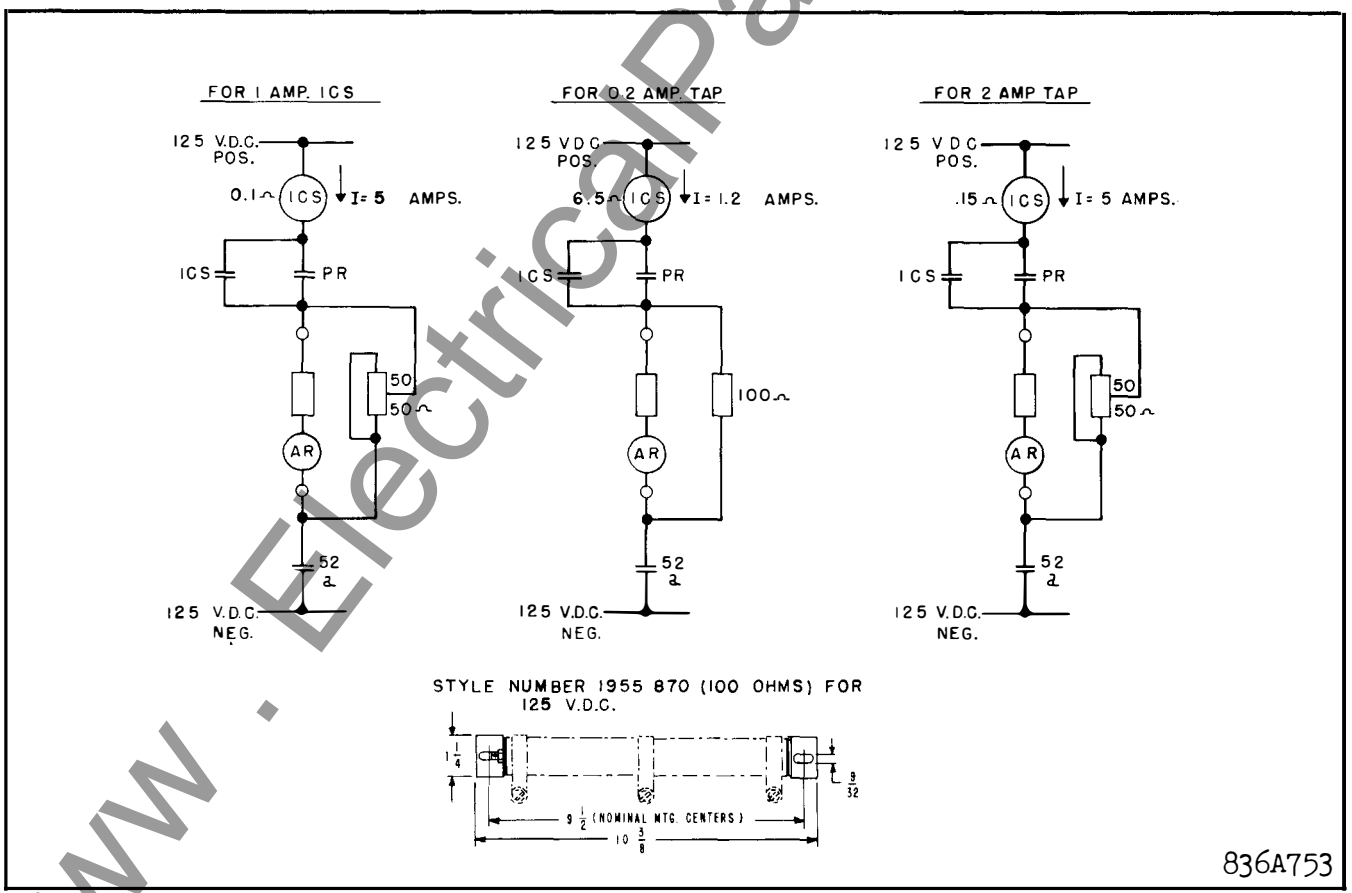


Fig. 13 External schematic for the Type AR Relay.

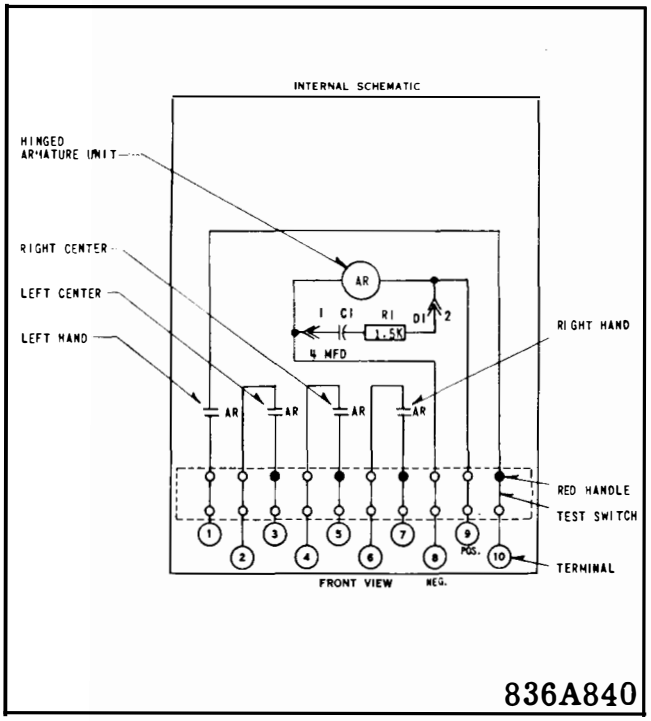


Fig. 14 Internal schematic of the Type AR Relay in the FT-11 case with time delay dropout.

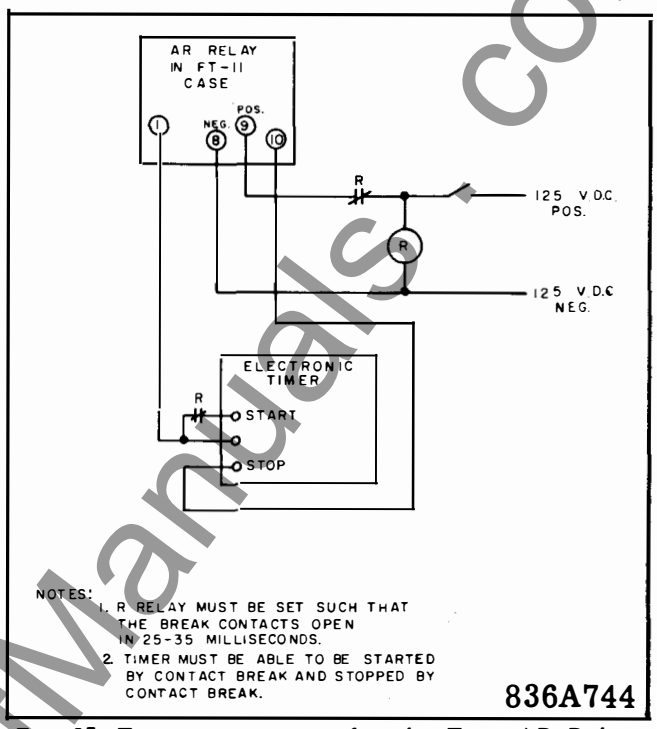


Fig. 15 Test connections for the Type AR Relay with time delay on dropout.

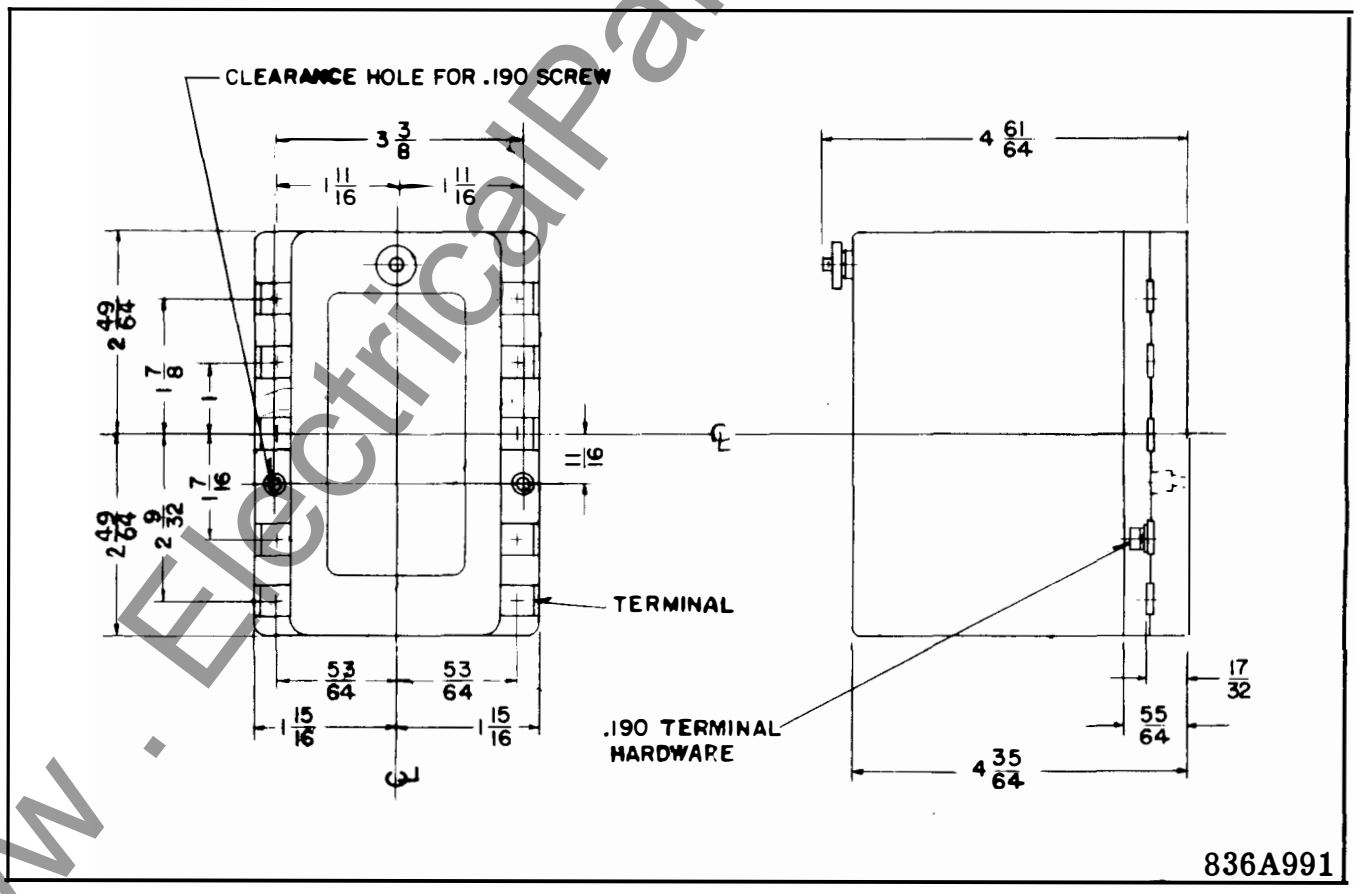


Fig. 16 Outline and drilling plan for the Type AR relay in the front connected molded case.

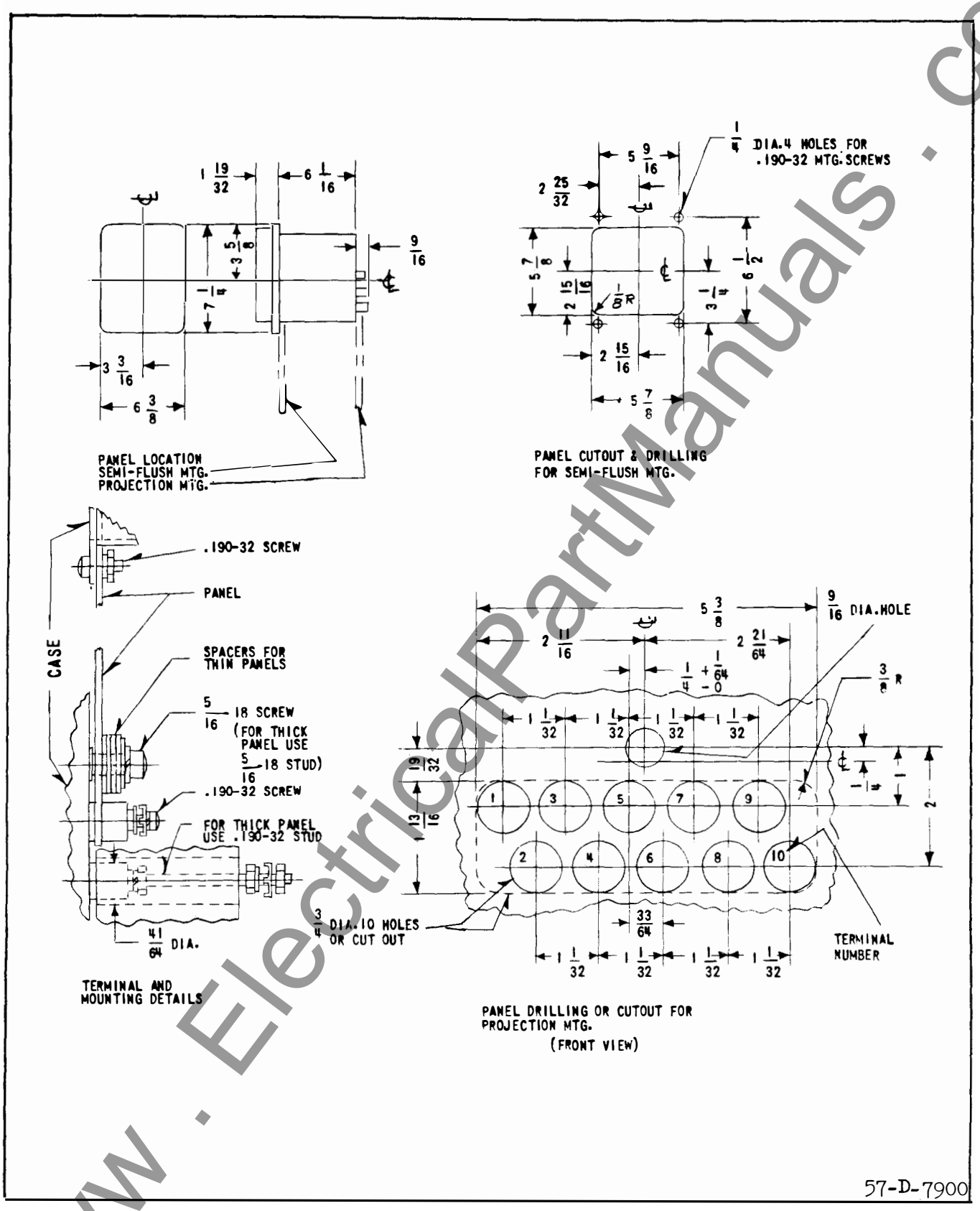


Fig. 17 Outline and drilling plan for the Type AR Relay in the FT-11 case.

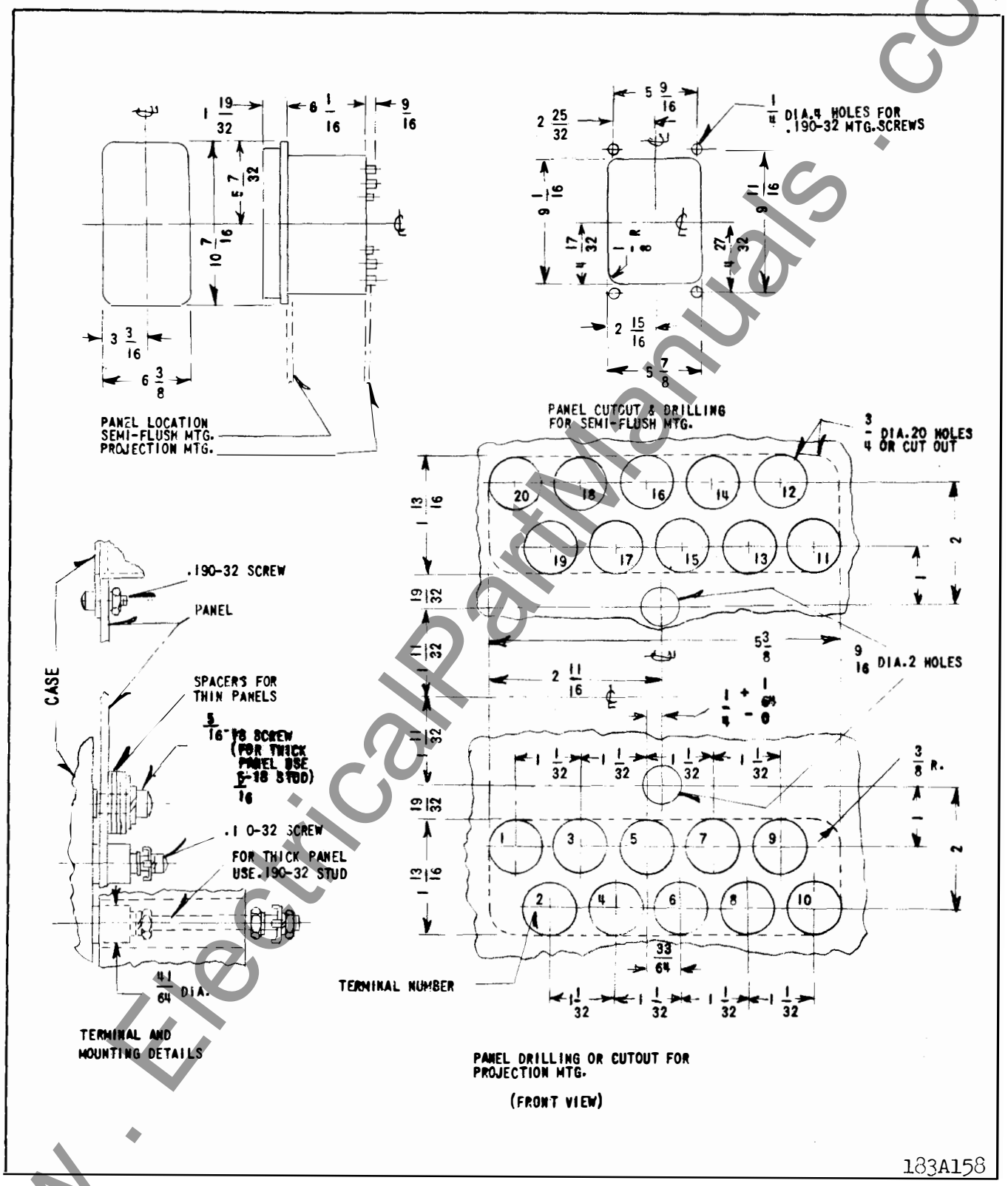


Fig. 18 Outline and drilling plan for the Type AR Relay in the FT-22 case.

WESTINGHOUSE ELECTRIC CORPORATION

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

Printed in U.S.A.

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE AR HIGH SPEED AUXILIARY RELAY

CAUTION: Before putting protection 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 can close properly. Operate the relay to check the settings and electrical connections.

APPLICATION

The AR relay is a four-pole auxiliary type relay, especially designed for ultra high speed circuit breaker tripping duty in protective relaying systems. The AR relay is well suited for bus arrangements where more than one breaker must be tripped. It can provide isolation as well as high speed tripping. The AR relay may also be applied to provide isolation of primary and back-up relaying, and provide high speed tripping for zone one faults.

An AR relay is available with a time delay dropout. It can be used in applications where a delayed dropout of 0.1 seconds is desired.

CONSTRUCTION AND OPERATION

AR Unit

The relay consists of four stationary contact screws, four leaf spring moving contacts, a moving armature and card assembly, which operates the moving contacts; a U shaped laminated core, a coil, a frame, a molded insulation block and a series resistor. Refer to Fig. 1 and 2.

The armature and card assembly slip over a hinge pin which is inserted in the laminations. The moving and stationary contacts are mounted on the molded insulation block. The molded block and coil and lamination assembly are mounted to the frame. All contacts are fine silver.

When the coil and resistor are energized, the armature is attracted to the laminations. The card moves with the armature thereby operating the moving contacts. The tension of the moving contacts is the resetting force.

High speed operation is obtained by the low inertia of the moving parts, a sensitive electromagnet, and the proper L/R ratio of the operating circuit.

The AR unit used for a time delay dropout is similar to the one described above. The series resistor in the above is replaced by a resistor and capacitor combination shunting the AR coil.

Operation Indicator (O.I.)

The d-c operation indicator is a small clapper type device. A magnetic armature is attracted to the magnetic core upon energization of the switch. 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 front spring, in addition to holding the target, provides restraint for the armature and thus controls the pickup value of the switch.

CHARACTERISTICS

The AR unit without a series resistor has a * sensitivity of 500 milliwatts. By the proper combination of the AR unit and a series resistor, an optimum speed of 2 milliseconds can be obtained for an energy input of 10 watts.

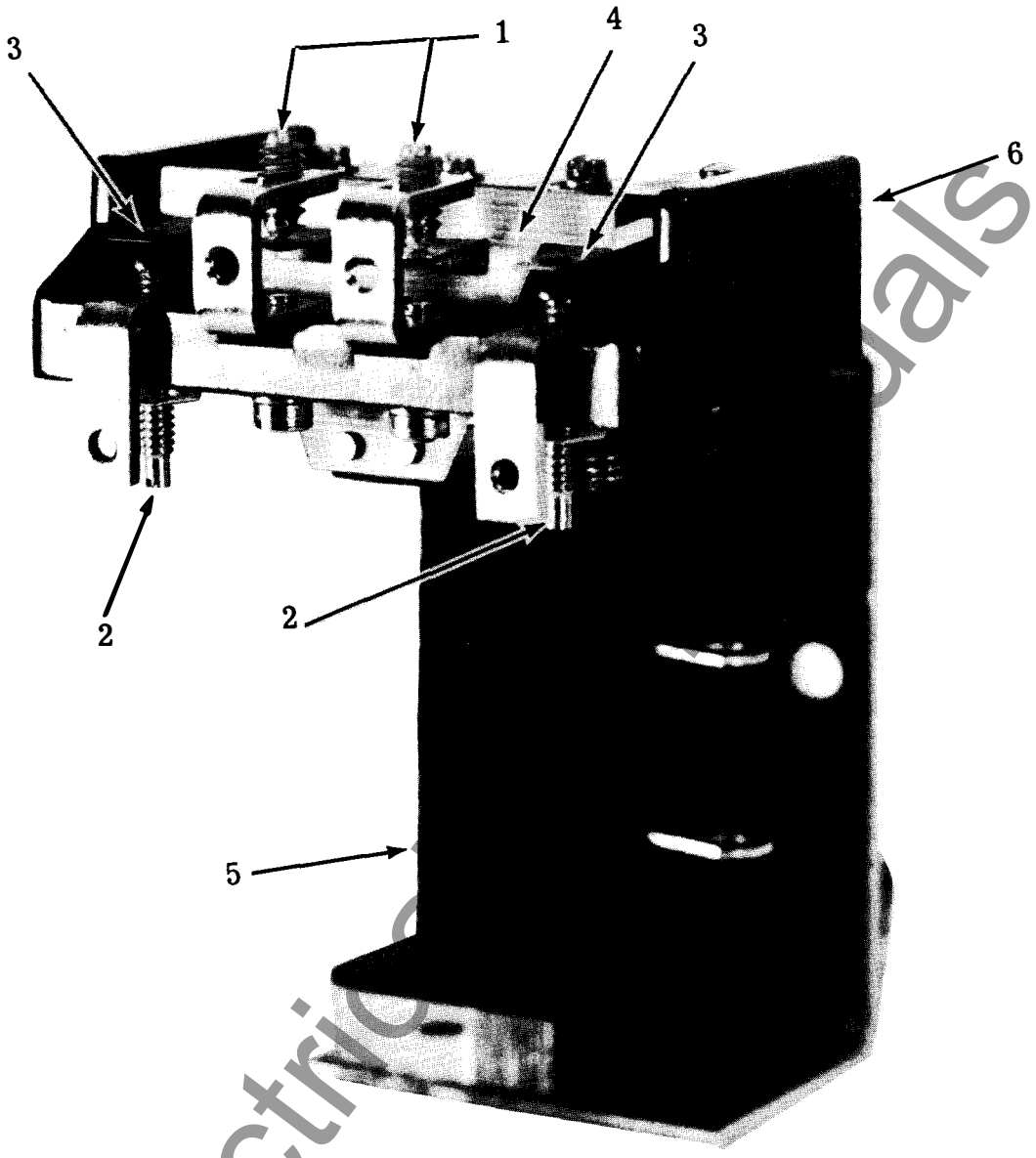
All relays are capable of being energized continuously. All high speed relays will pick up at 80% of rated voltage or less; and drop out at 10% of rated voltage or higher.

Typical operating times and effective contact bounce are outlined in the tables I and II.

The operate time of the relay with delayed dropout is about 6 milliseconds at rated voltage for a normally open contact. The relay will have a 0.1 second dropout time after being energized at least 0.015 seconds.

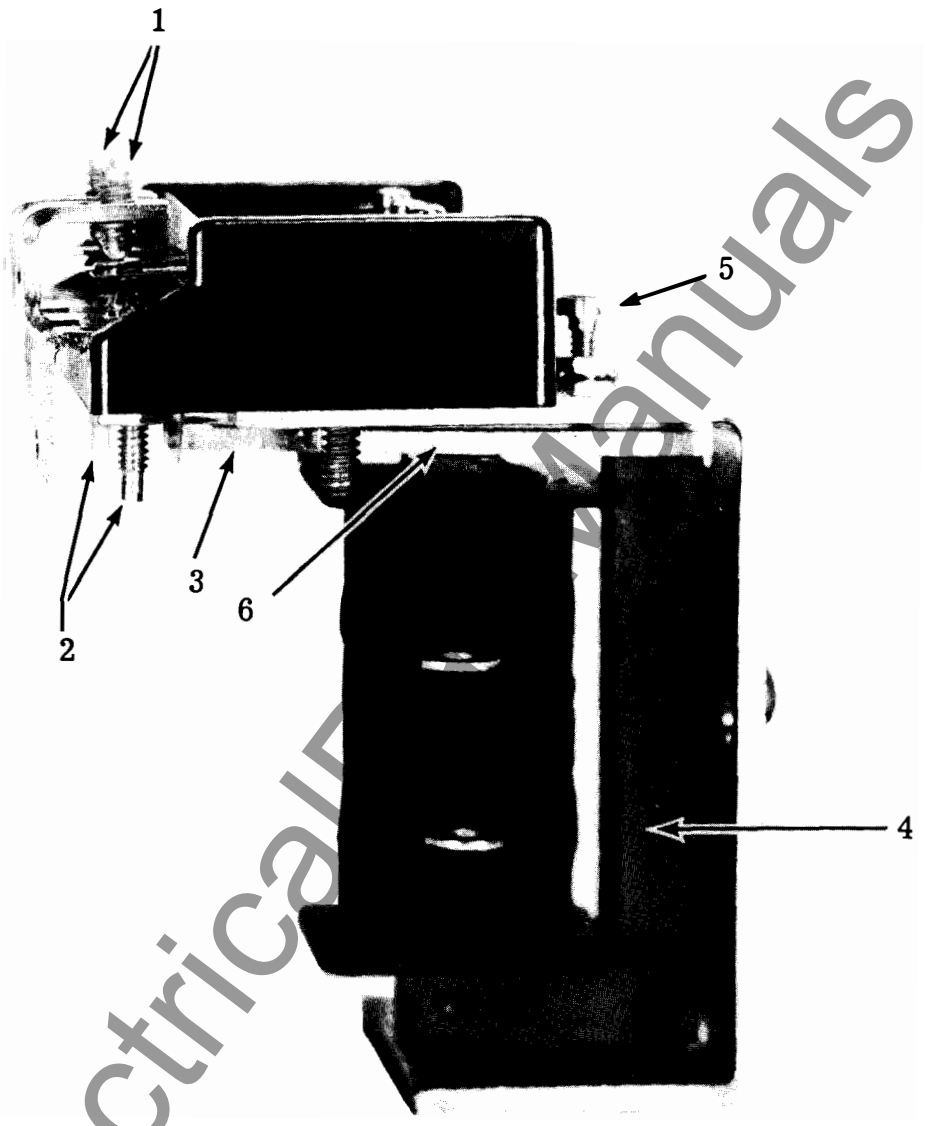
SUPERSEDES I.L. 41-759
*Denotes change from superseded issue

EFFECTIVE JANUARY 1966



1 – NORMALLY CLOSED STATIONARY CONTACT SCREWS.
2 – NORMALLY OPEN STATIONARY CONTACT SCREWS.
3 – LEAF SPRING MOVING CONTACTS
4 – MOVING CARD ASSEMBLY
5 – RELAY COIL
6 – MOLDED INSULATION BLOCK

** Fig. 1 Type AR Unit with two make and two break contacts (Front View).*



1 – NORMALLY CLOSED STATIONARY CONTACT SCREWS.
2 – NORMALLY OPEN STATIONARY CONTACT SCREWS.
3 – MOVING ARMATURE.
4 – U-SHAPED LAMINATED CORE.
5 – ARMATURE GAP ADJUSTMENT SET SCREW.
6 – ARMATURE GAP

** Fig. 2 Type AR Unit with two make and two break contacts (Side View).*

TABLE I
OPERATE AND RESET TIMES

Rated Operating Energy (WATTS)	Operate Time (Milliseconds)		Reset Time (Milliseconds)
	NO contact Closes	NC contact Opens	NC contact Closes
10	2.0	1.5	4.0
2.25	3.5	2.5	3.5

TABLE II
CONTACT BOUNCE

Contact Loading	Effective Bounce Time in Milliseconds	
	Normally Open	Normally Closed
Dry Circuit	2	6-8
10 Watt (one AR relay)	1	---
Breaker Trip Coil	.2	---

Contact Rating

Each relay contact is rated 3 amps continuous and 30 amps long enough to trip a breaker.

SETTINGS

AR Unit

No settings are required.

Operation Indicators (OI)

The only setting required on the OI is 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.

INSTALLATION

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

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

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not require readjustment after receipt by the customer. If the adjustments have been changed or the relay taken apart for repairs, the instructions below should be followed.

Acceptance Check

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

1. Contact gaps
   a. Normally open contacts should have a gap of .018 to .023 inch.
   b. Normally closed contact gap should be .013 minimum.
2. Contact pressure
   a. On four normally open contact relays, the normally open contacts should have approximately 4 grams pressure on the card in the de-energized position, and 15 to 30 grams contact pressure in the energized position.
   b. On two normally open and two normally closed relays, the normally closed contacts should have approximately 8 grams contact pressure in the de-energized position. Each normally open contact spring should have approximately 8 grams pressure against the card.

3. Armature gap

   The armature gap should be approximately .009 inches measured at the narrowest part of the armature gap.

4. Contact operate time

   Per Table 1

5. Operation Indicator (O.I.)

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

6. AR relay with time delay on dropout.

   Connect the relay as shown in Fig. 13. When the AR coil has been energized for 25-35 milliseconds its dropout time should be a minimum of 100 milliseconds. The R relay should be adjusted such that its contact break time is 25-35 milliseconds. Also the timer must be of the type which may be started and stopped by break contacts.

CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart for repairs of 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")

Tripping Relay (AR)

The type AR tripping relay unit has been properly adjusted at the factory to insure correct operation, and under normal field conditions should not require readjustment. If, however, the adjustments are disturbed in error, or it becomes necessary to replace some part, use the following adjustment procedure. This procedure should not be used until it is apparent that the relay is not in proper working order.

a. Adjust the set screw at the rear of the top of the * frame to obtain a 0.009-inch gap at the rear end of the armature air gap.

b. Adjust each contact spring to obtain 4 grams pressure at the very end of the spring. This pressure should be sufficient to move the spring away from the edge of the slot of the card. On the two normally open two normally closed contact relay, adjust each spring for 8 grams to just move the contact away from the card.

c. Adjust each stationary contact screw to obtain a contact of 0.020 to 0.022 inches for the normally open contacts. Energize the relay and the normally open contacts should have 15 to 30 grams contact follow. The normally closed, if any, should have a contact gap of .015 inches.

When calibrated as outlined above, the relay should meet the characteristics of Table I and II.

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.

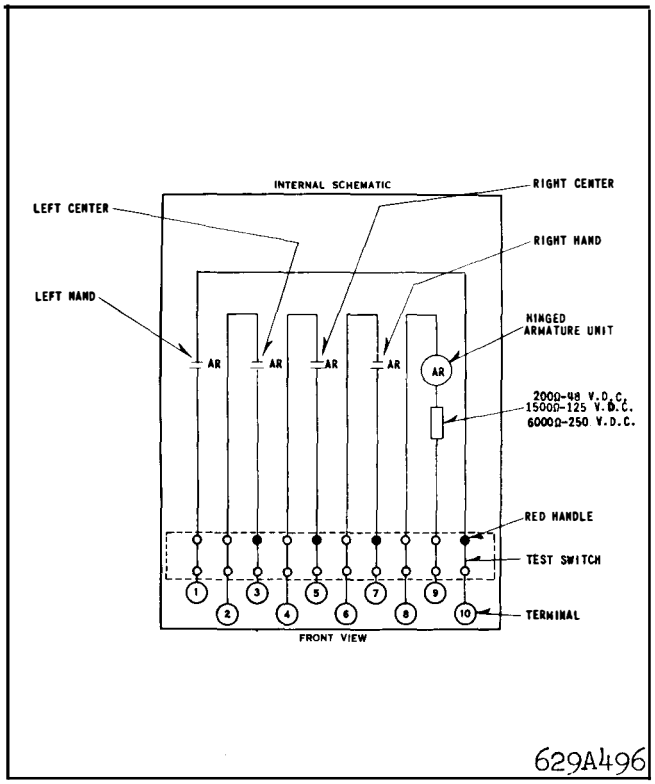
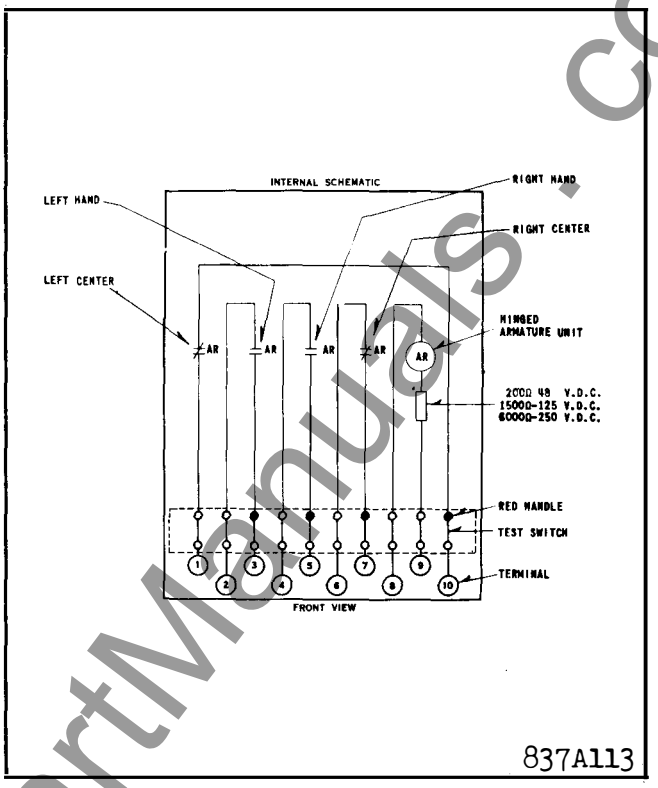


Fig. 3 Internal schematic of the Type AR Relay with 4 make contacts in FT-11 case.



** Fig. 4 Internal schematic of the Type AR Relay with 2 make - 2 break contacts in FT-11 case.*

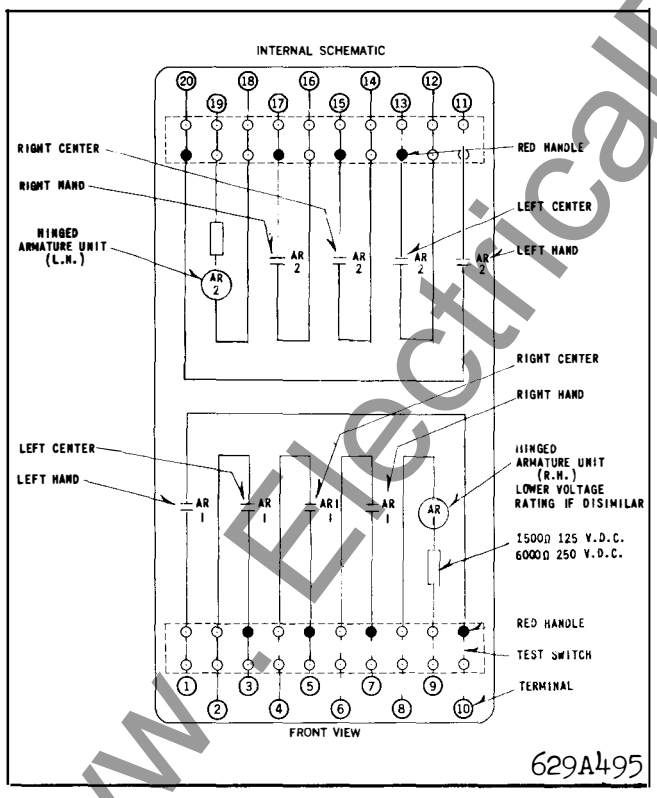


Fig. 5 Internal schematic of the Type AR Relay in FT-22 case, double unit, with 8 make contacts.

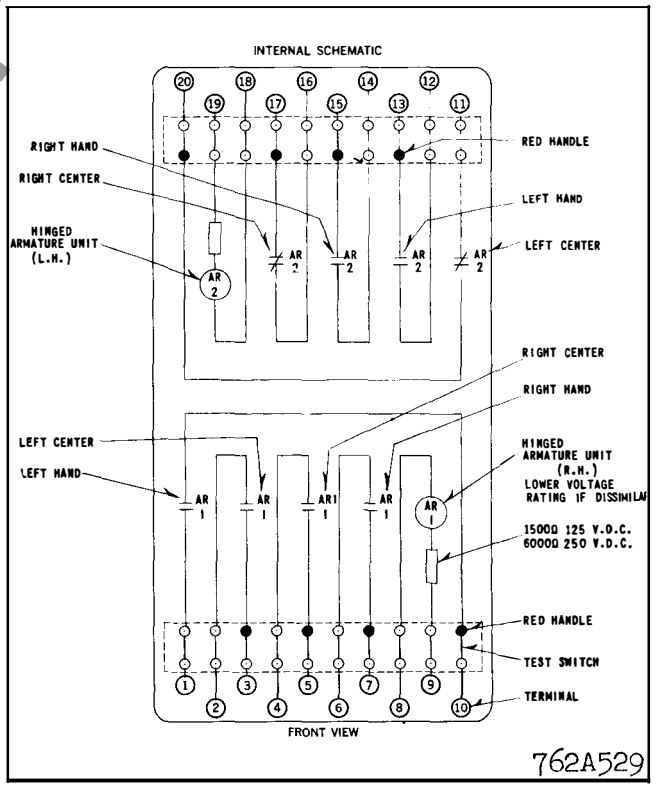


Fig. 6 Internal schematic of the Type AR Relay in FT-22 case, double unit, with 6 make and 2B contacts.

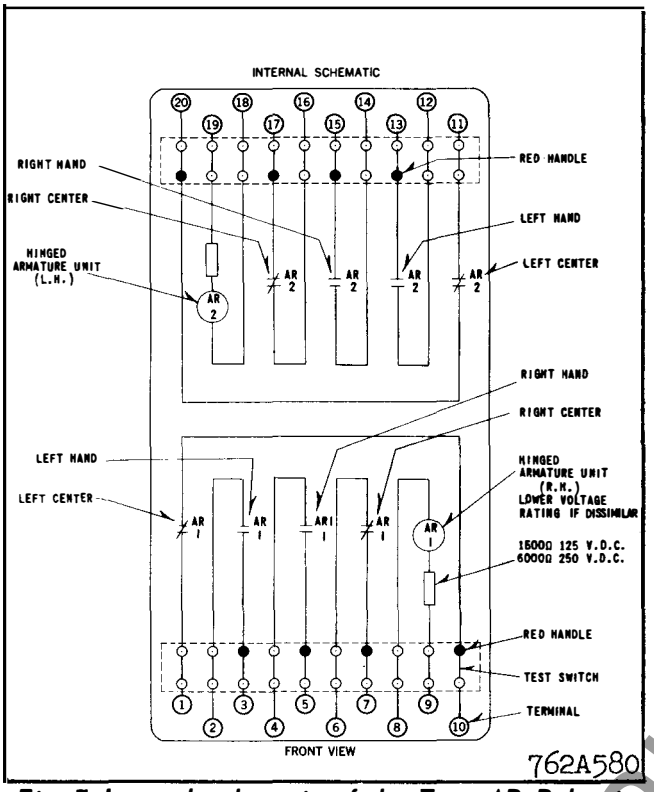


Fig. 7 Internal schematic of the Type AR Relay in FT-22 case, double unit, with 4 make and 4 break contacts.

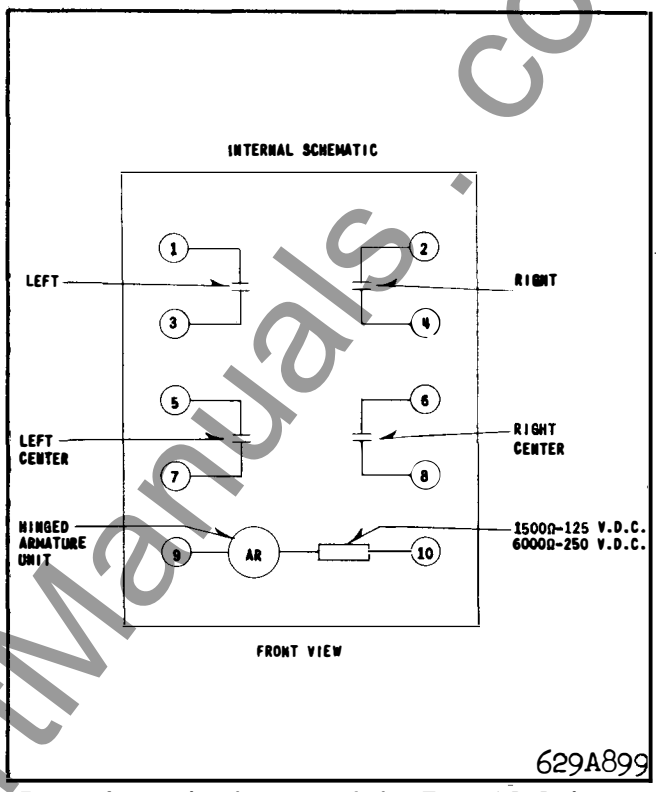
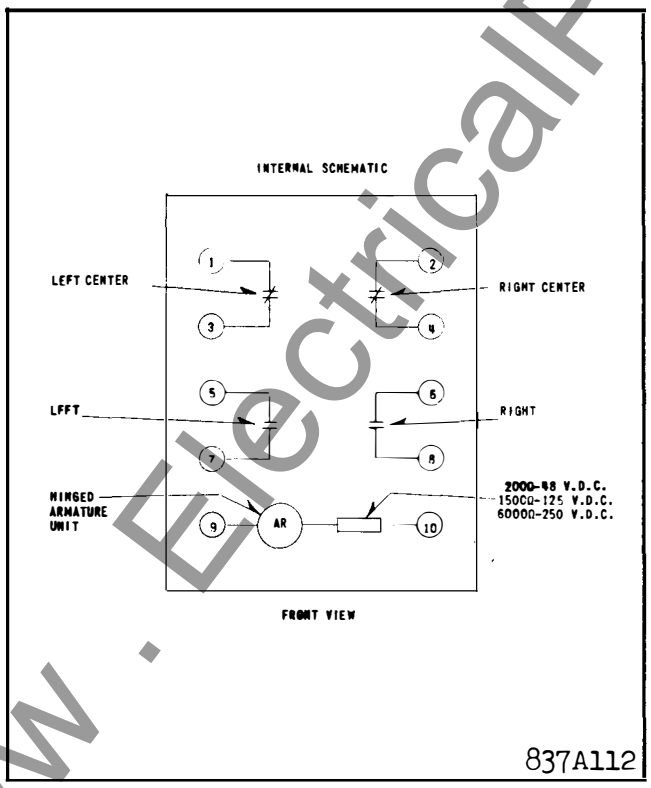


Fig. 8 Internal schematic of the Type AR Relay in front connected molded case with 4 make contacts.



* *Fig. 9 Internal schematic of the Type AR Relay in front connected molded case with 2 make-2 break contacts.*

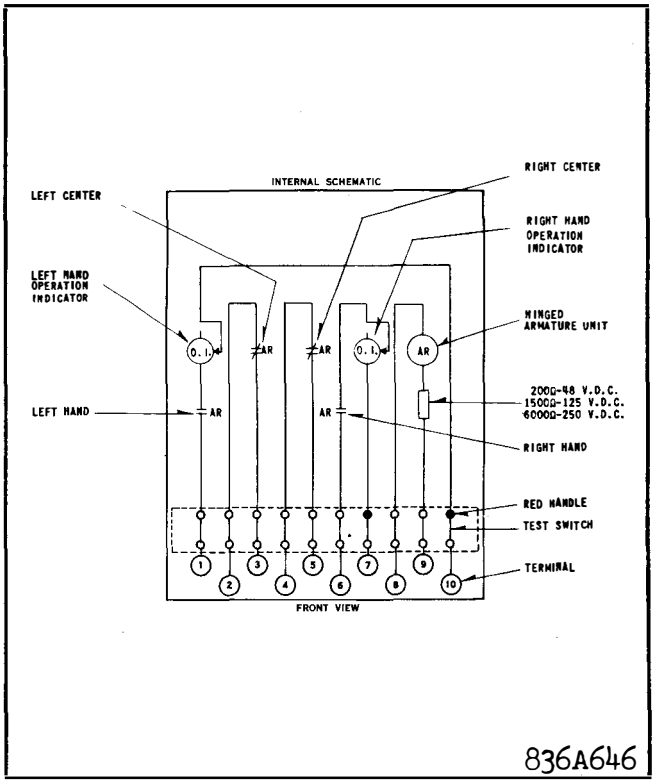


Fig. 10 Internal schematic of the Type AR Relay in the FT-11 case with 2 Operation Indicators.

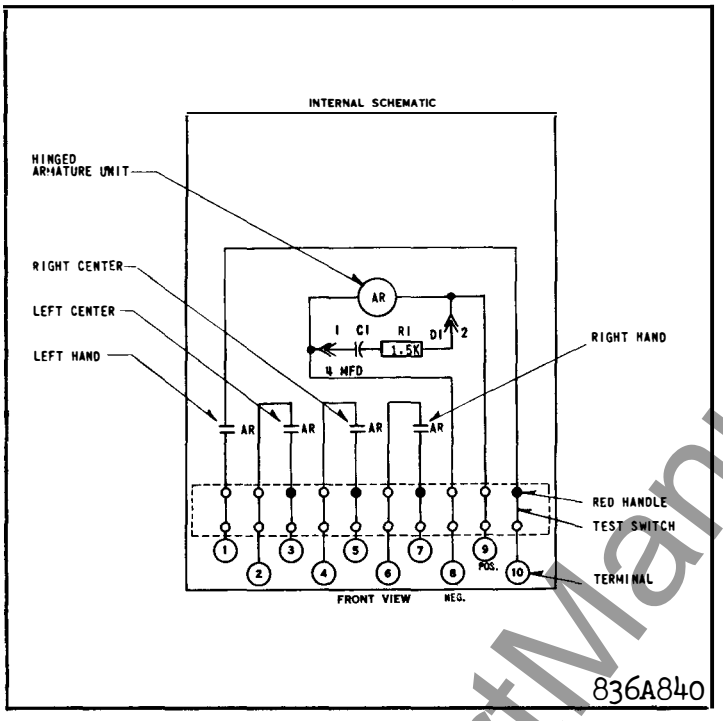
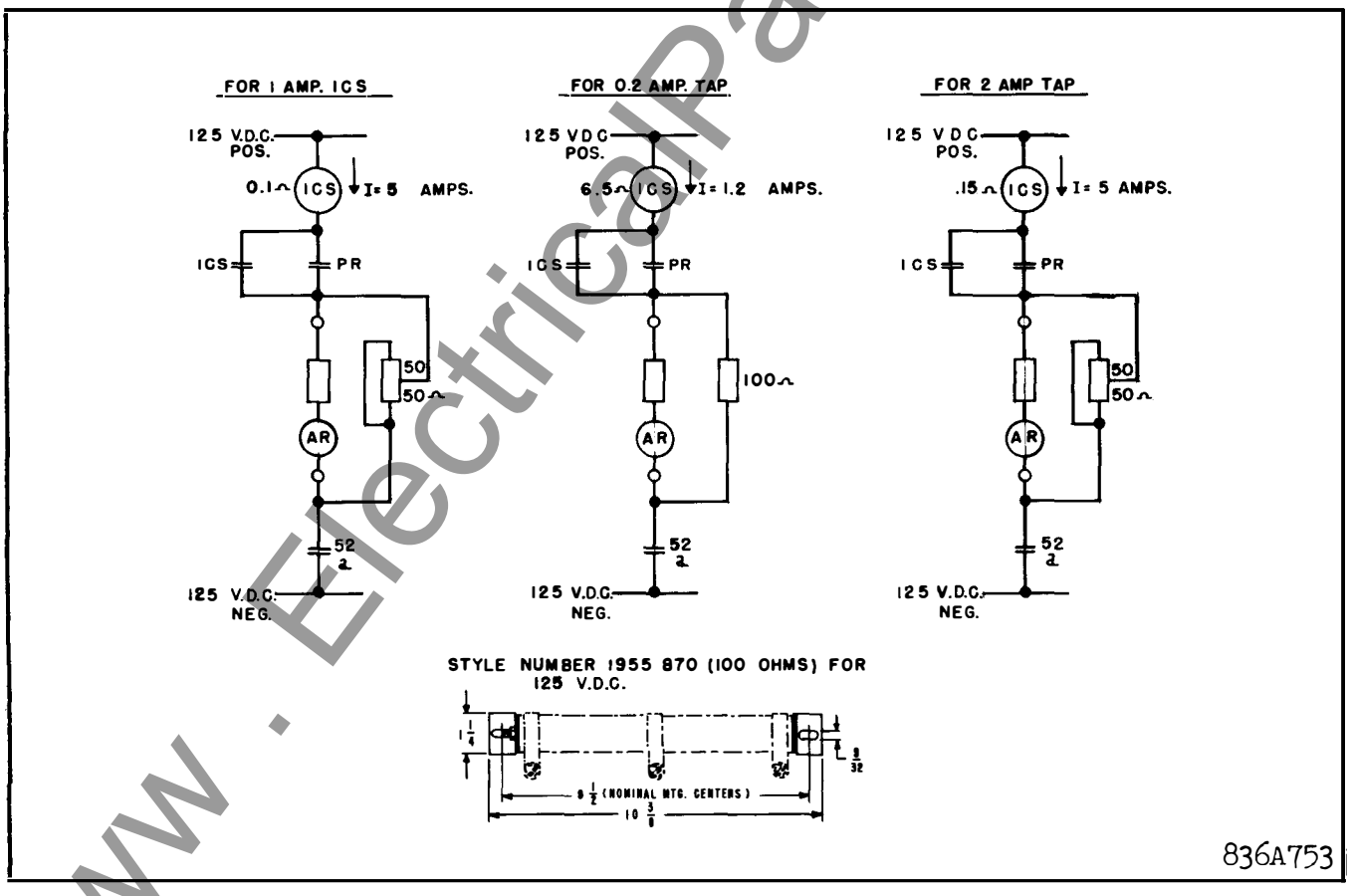


Fig. 11 Internal schematic of the Type AR Relay in the FT-11 case with time delay dropout.



* *Fig. 12 External schematic for the Type AR Relay.*

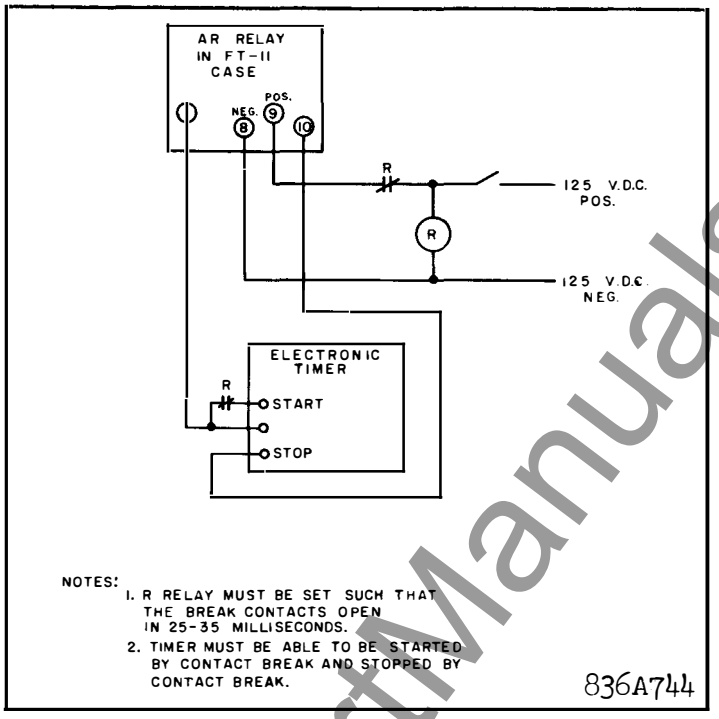
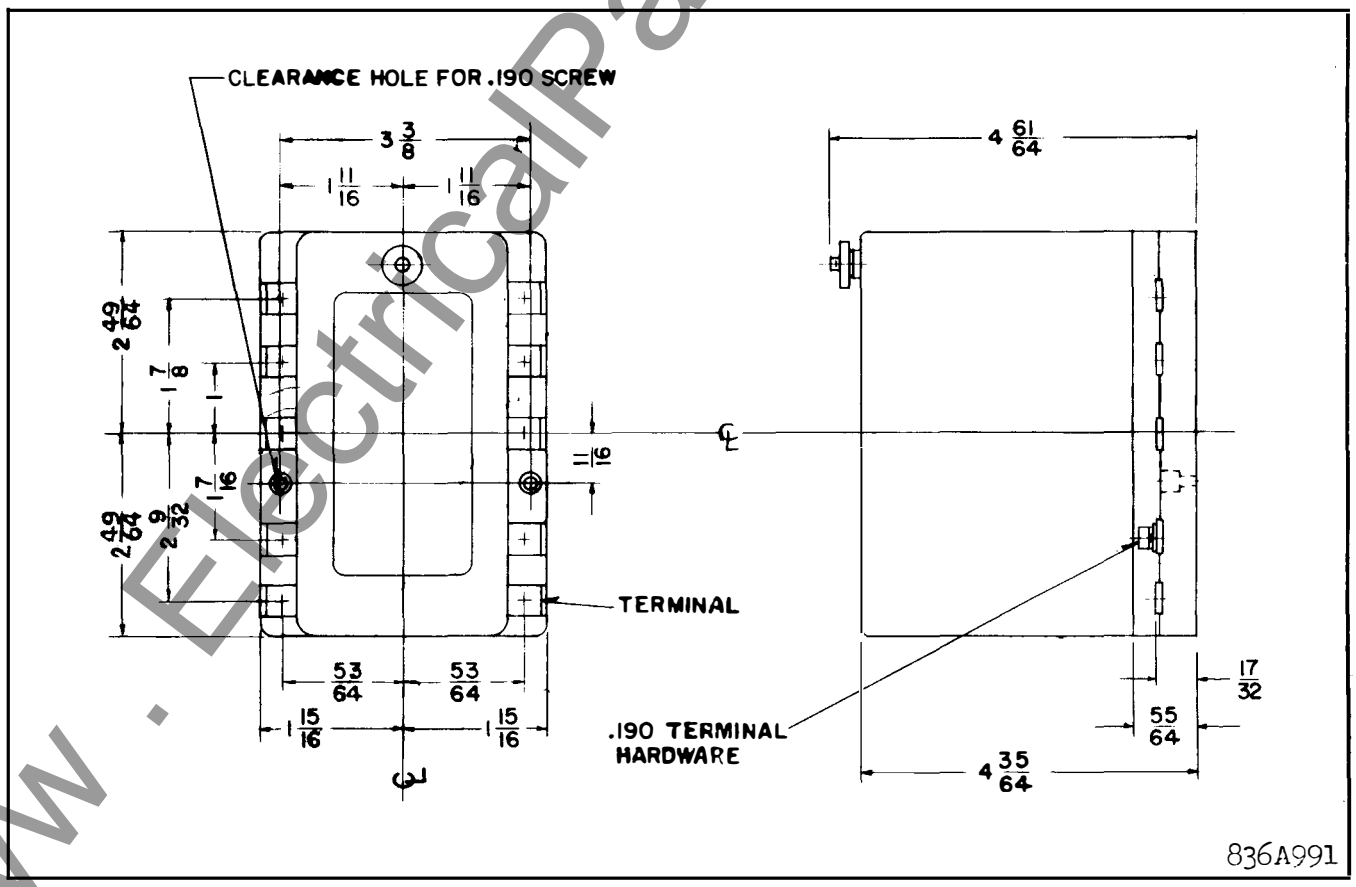


Fig. 13 Test connections for the Type AR Relay with time delay on dropout.



* *Fig. 14 Outline and drilling plan for the Type AR relay in the front connected molded case.*

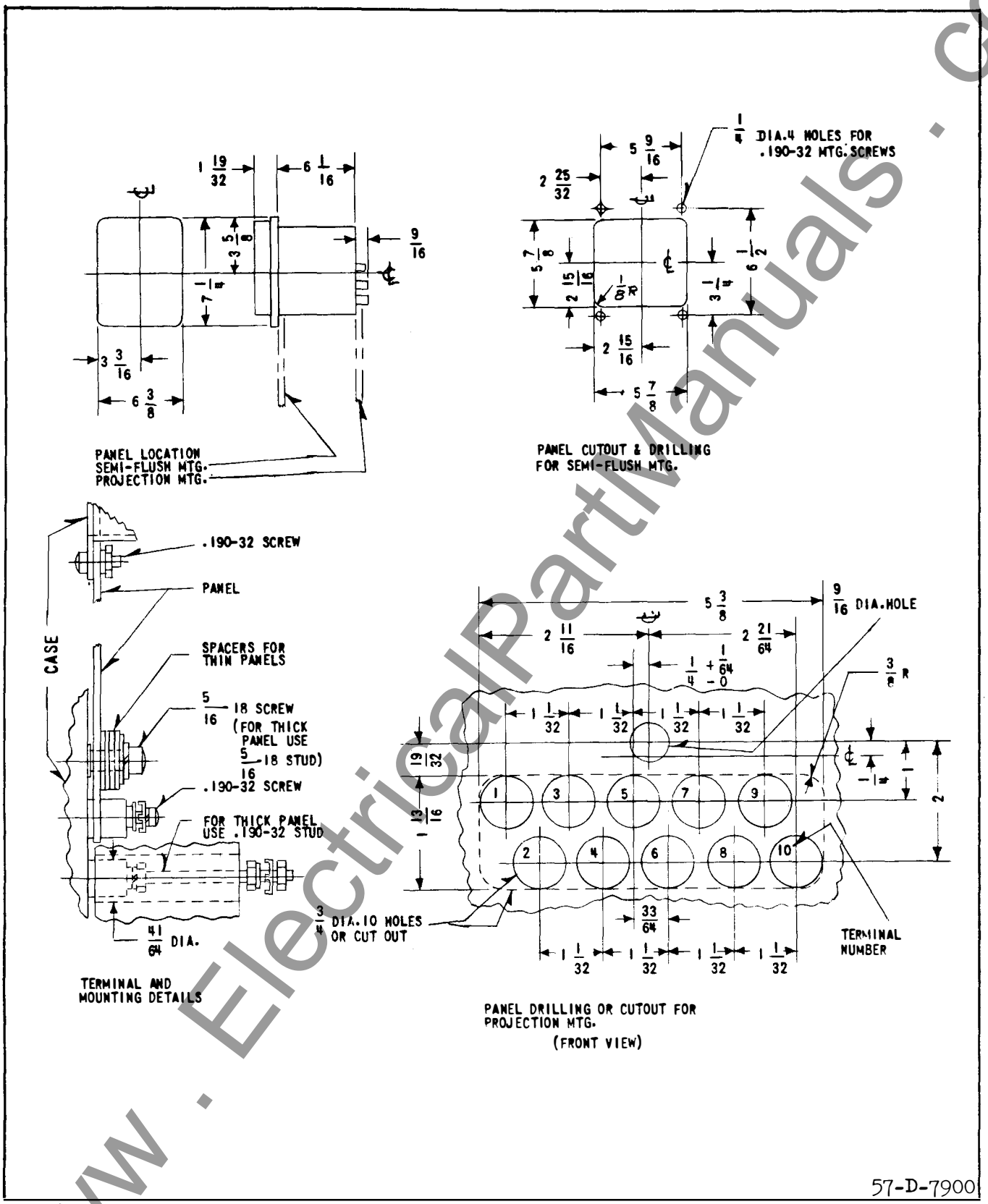


Fig. 15 Outline and drilling plan for the Type AR Relay in the FT-11 case.

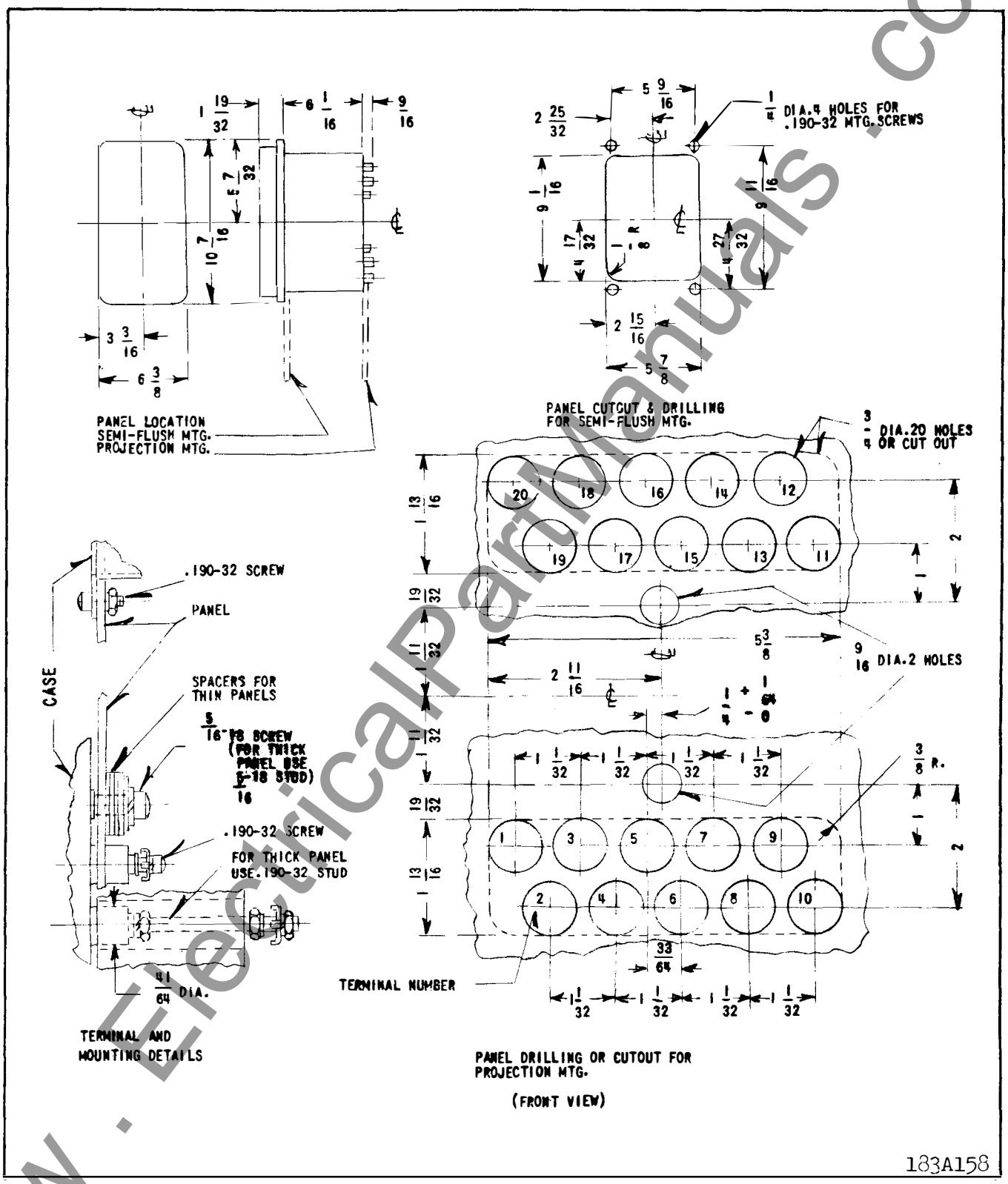


Fig. 16 Outline and drilling plan for the Type AR Relay in the FT-22 case.

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