



Effective: December 1990  
Supersedes I.L. 41-759.3A Dated December 1977  
\* Denotes Change Since Previous Issue

## Type AR High Speed Auxiliary Relay High Threshold Design

### 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 setting and electrical connections.

#### 1. APPLICATION

The high threshold AR relay is a sensitive high speed auxiliary relay with 4 N.O. contacts designed to be secure against misoperation due to inadvertent grounding of a station battery or the trip lead. With the battery balanced with respect to ground, the maximum momentary voltage that can be applied to an auxiliary relay for either of these grounds is half battery voltage. The operating level of the high threshold AR exceeds these levels.

#### 2. CONSTRUCTION AND OPERATION

##### 2.1 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 Figures 1 and 2. A zener

diode is connected around the coil to eliminate the generation of induced voltages upon interruption of the coil circuit.

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, coil and lamination assembly are mounted to the frame. All contacts are fine silver.

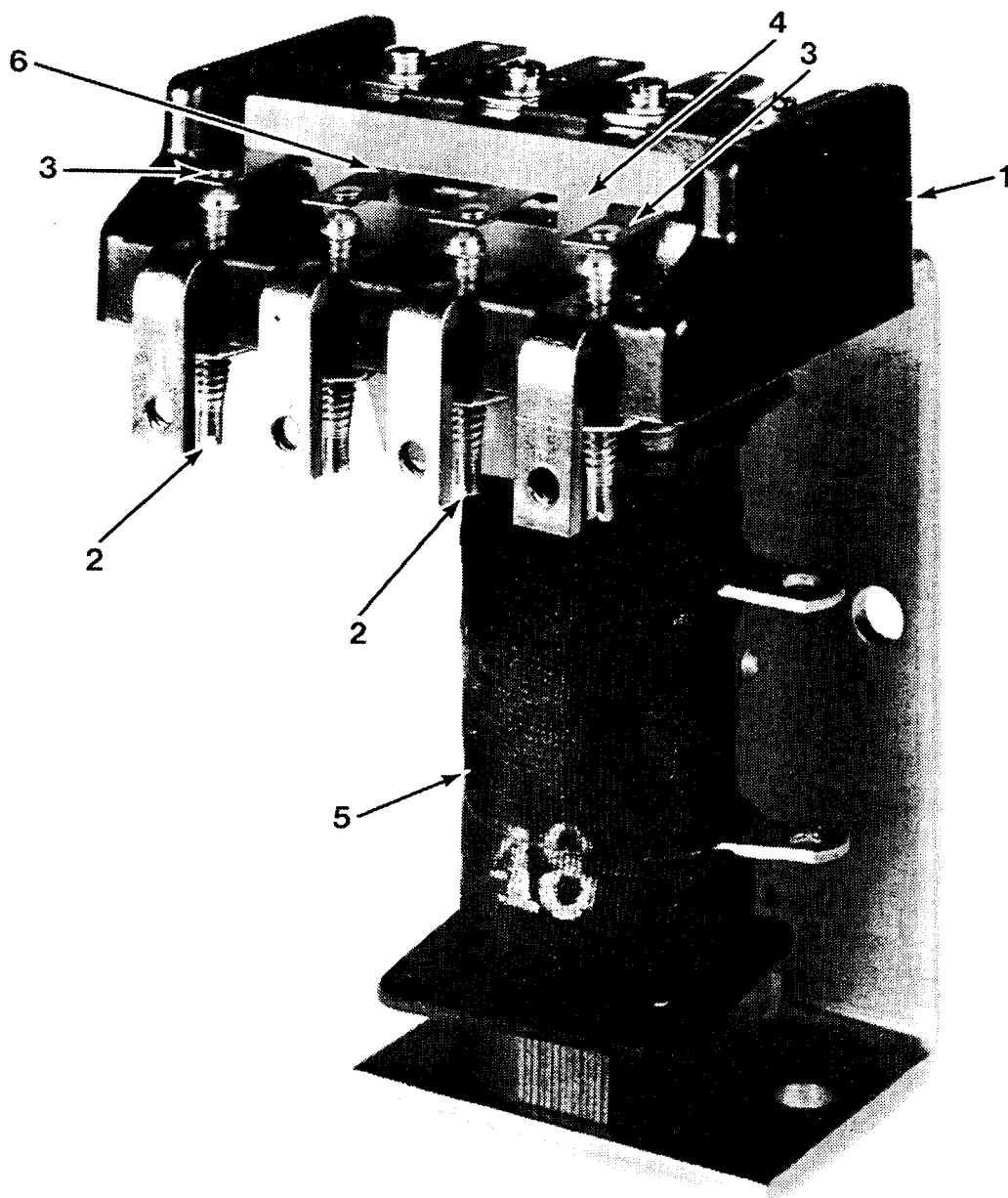
When the coil and resistor are energized, the armature is attracted to the laminations. The card moves with the armature thereby operating the moving contacts. The tension of the moving contacts is the resetting force.

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.

##### 2.2 Operating Indicator (O.I.) (When Supplied)

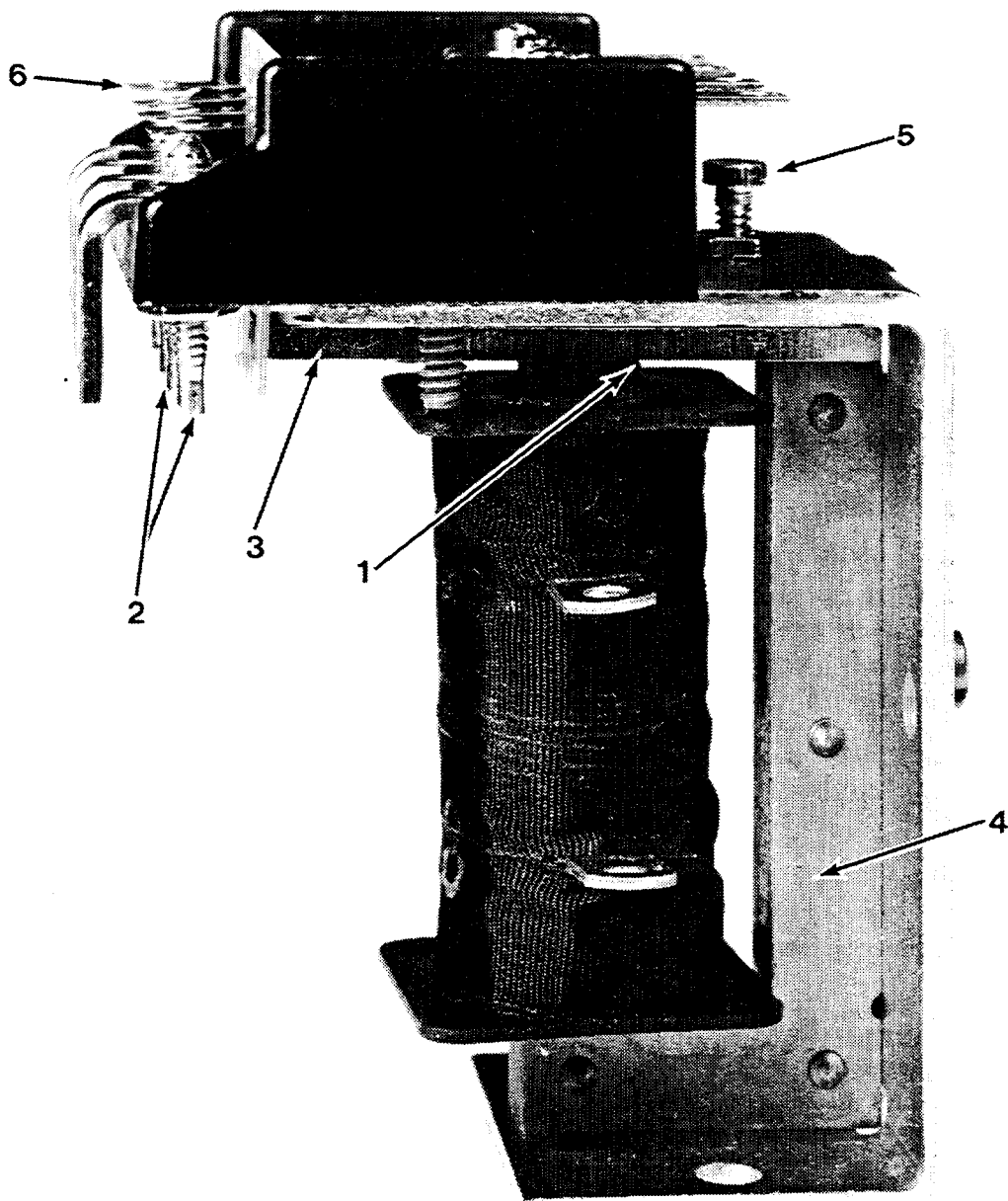
The dc operation indicator is a small clapper type device. A magnetic armature is attracted to the magnetic core upon energization of the switch. During this operation two fingers on the armature deflect a spring located on the front of the switch, which allows the operation indicator target to drop.

*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 this particular installation, operation or maintenance of this equipment, the local Asea Brown Boveri representative should be contacted.*



1. Molded Insulation Block
2. Normally Open Stationary Contact Screws
3. Leaf Spring Moving Contacts
4. Moving Card Assembly
5. Relay Coil
6. Gap at this point when checking Reset Pressure

Figure 1. Type AR Unit with Four Make Contacts (Front View).



1. Armature Gap - Measure at Rear End of Gap
2. Normally Open Stationary Contact Screws
3. Moving Armature
4. U-Shaped Laminated Core
5. Armature Gap Adjustment Set Screw
6. Measure contact Pressure at this Point

Figure 2. Type AR Unit with Four Make Contacts (Side View).

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

2.3 Indicating Contactor Switch (ICS)  
(When Supplied)

The dc 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 energizing 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, allowing 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.

3. CHARACTERISTICS

The relay operates in 4 milliseconds for an energy input of 10 watts. The reset time is typically 16 milliseconds.

The relay is adjusted to have a pickup value less than 80% of rating, but not less than 50% of the typical battery equalizing charge voltage. See Table I.

TABLE I  
MINIMUM PICKUP VALUES

28 volts for 48 volt rating
70 volts for 125 volt rating
140 volts for 250 volt rating

The relay will drop out at 10% of rated voltage or higher. The relay is only available in a 4 make contact configuration. Typical effective contact bounce is outlined in Table II, Contact Bounce.

TABLE II  
CONTACT BOUNCE

Contact Loading	Effective Bounce Time in Milliseconds Normally Open
Dry Circuit	2.
10 Watt (One AR Relay)	1.
Breaker Trip Coil	.2

3.1 Contact Rating

Each relay contact is rated 3 amps continuous and 30 amps long enough to trip a breaker. For interrupting rating see Table IV, Contact Interrupting Capability.

3.2 Indicating Contactor Switch Unit (ICS)  
(When Supplied)

The indicating contactor switch (ICS) 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.

0.2 amperes tap - 6.5 ohms dc resistance

2.0 amperes tap - 0.15 ohms dc resistance

4. SETTINGS

4.1 AR Unit

No settings are required.

4.2 Operation Indicators (OI)  
(When Supplied)

The only setting required on the OI is the selection of the 0.2 or 2.0 amperes 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.

4.3 Indicating Contactor Switch (ICS)  
(When Supplied)

No setting is required on the ICS unit except the selection of the 0.2 or 2.0 ampere tap setting. This selection is made by connecting the lead located in front of the tap block to the desired setting by means of the connecting screw.

5. 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 connection 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.

## 6. 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.

### 6.1 Acceptance Check

The following check is recommended to ensure that the relay is in proper working order. The relay should pickup at 80% of rating and should not pick up below values in Table I, Minimum Pickup Values.

#### a. Contact Gaps

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

#### b. Contact Pressure

On relays with four normally open contacts, contacts should have approximately 5 grams pressure on the card in the de-energized position, and 15 to 30 grams contact pressure in the energize position. Pressure readings are taken at the end of the contact spring.

#### c. Armature Gap

The armature gap should be approximately .010 inches measured at the narrowest part of the armature gap.

#### d. Contact Operate Time

4 milliseconds at rated voltage.

#### e. Operation Indicator (OI) — When Supplied

Close the main relay contacts and pass sufficient dc current through the circuit to drop the target of the OI. This value of current should be not greater than the particular OI

tap setting being used. The operation indicator target should drop freely.

#### f. Indicating Contractor Switch (ICS) — When Supplied

Close the main relay contacts and pass sufficient dc 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 indicator target should drop freely.

- \* For proper contact adjustment, insert a .030" feeler gauge between the core pin and the armature. Hold the armature closed against the core pin and gauge and adjust the stationary contacts such that they just make with the moving contact. Both stationary contacts should make at approximately the same time. The contact follow will be approximately 1/64" to 3/64".

## 7. 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 Section 6.1, Acceptance Check.)

### 7.1 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 0.010-inch gap at the rear end of the armature air gap.
- b. Adjust each contact spring to obtain 5 grams reset 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.

- c. Adjust each 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.
- d. Apply rated voltage to the relay in line with the terminal polarity designation. Then calibrate by adjusting the spring tension until the relay picks up in the line with Table III, Pickup Values.

**TABLE III  
PICKUP VALUES**

31 volts for 48 volt rating  
80 volts for 125 volt rating  
160 volts for 250 volt rating

## 8. 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 IV - CONTACT RATING**

Contact Circuit Volts dc	Interrupting Rating (Amps)				Carry Rating (Amps)
	Resistive		Inductive <sup>†</sup>		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	0.5	0.150	0.250	3

<sup>†</sup> L/R = .005 for I ≤ 1 amp  
L/R = .040 for I > 1 amp

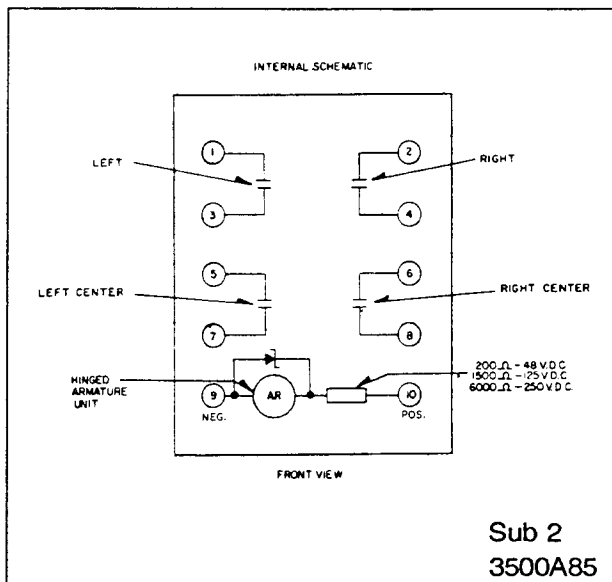


Figure 3. Internal Schematic of the Type AR Relay, High Threshold, with Four Make Contacts in Front Connected Molded Case.

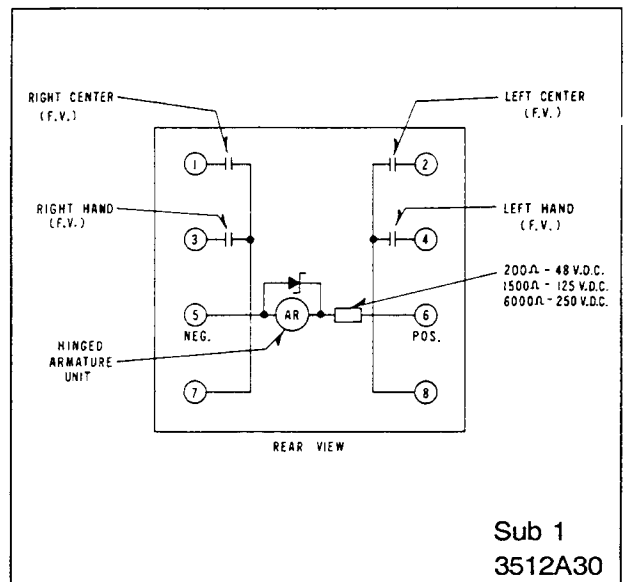


Figure 4. Internal Schematic of the Type AR Relay, High Threshold, with Four Make Contacts in Rear Connected Molded Case.

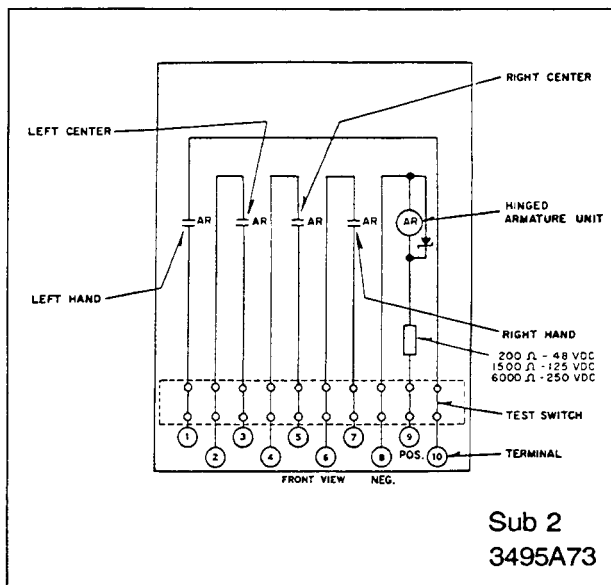


Figure 5. Internal Schematic of the Type AR Relay, High Threshold, with Four Make Contacts in FT-11 Case.

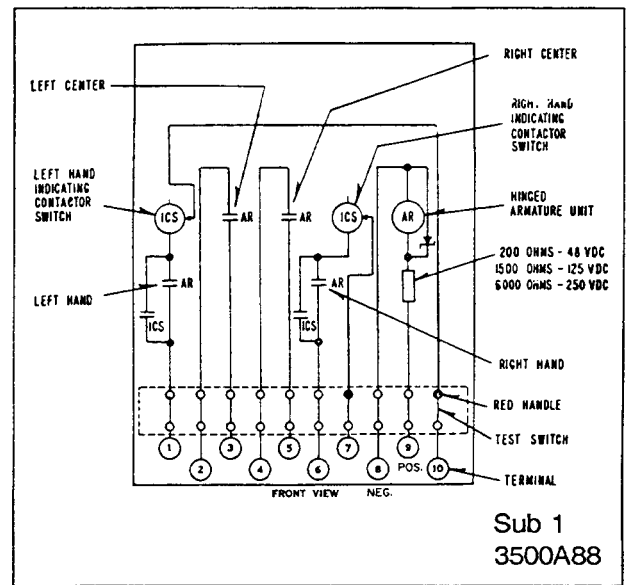


Figure 6. Internal Schematic of the Type AR Relay, High Threshold, with Four Make Contacts and Two ICS Units in FT-11 Case.

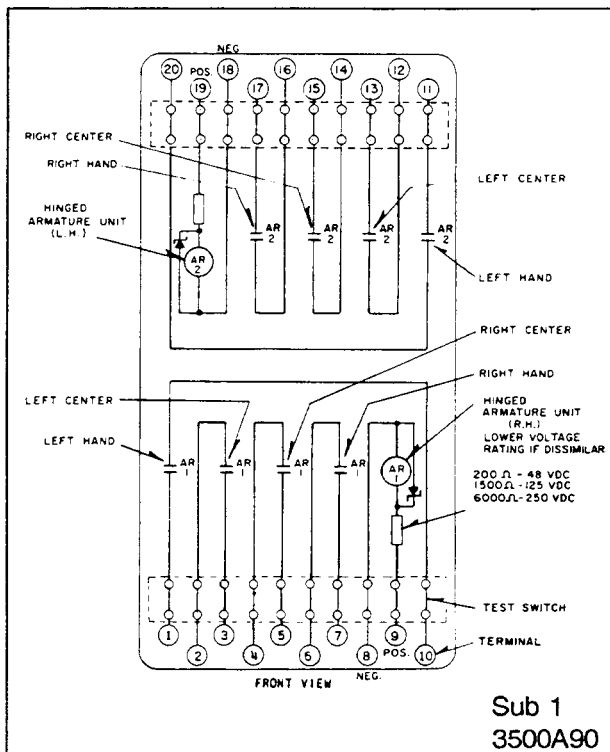


Figure 7. Internal Schematic of the Type AR Relay, High Threshold, Double Unit with Eight Make Contacts in FT-22 Case.

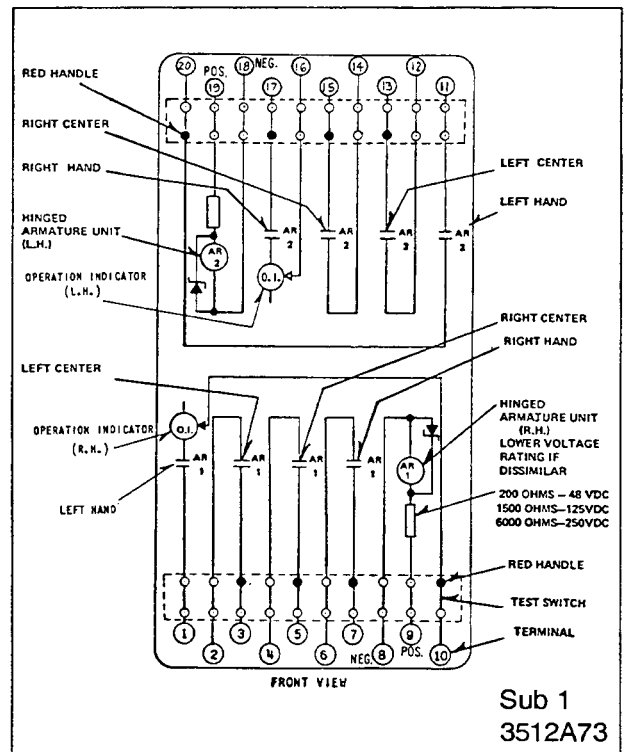


Figure 8. Internal Schematic of the Type AR Relay, High Threshold, Double Unit with Make Contacts and Two OI Units in FT-22 Case.

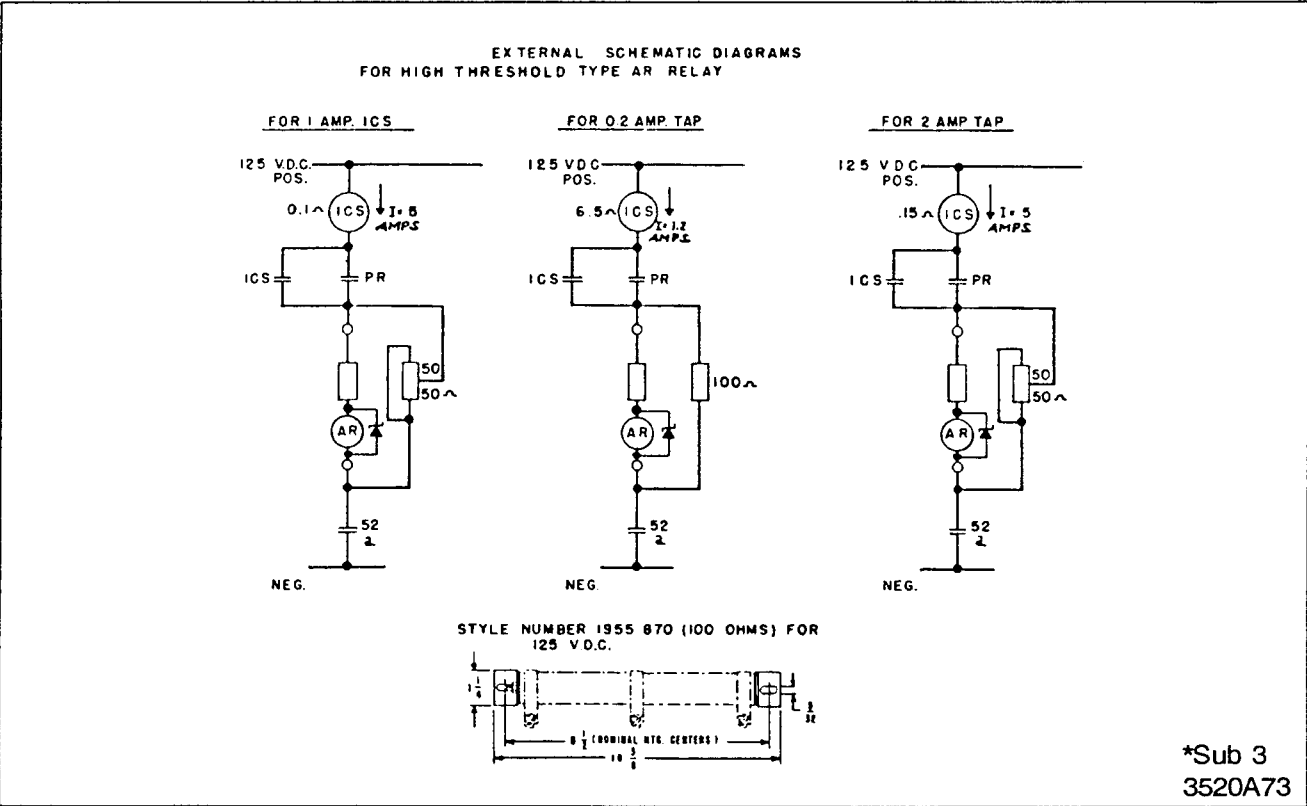


Figure 9. External Schematic for the Type AR Relay.

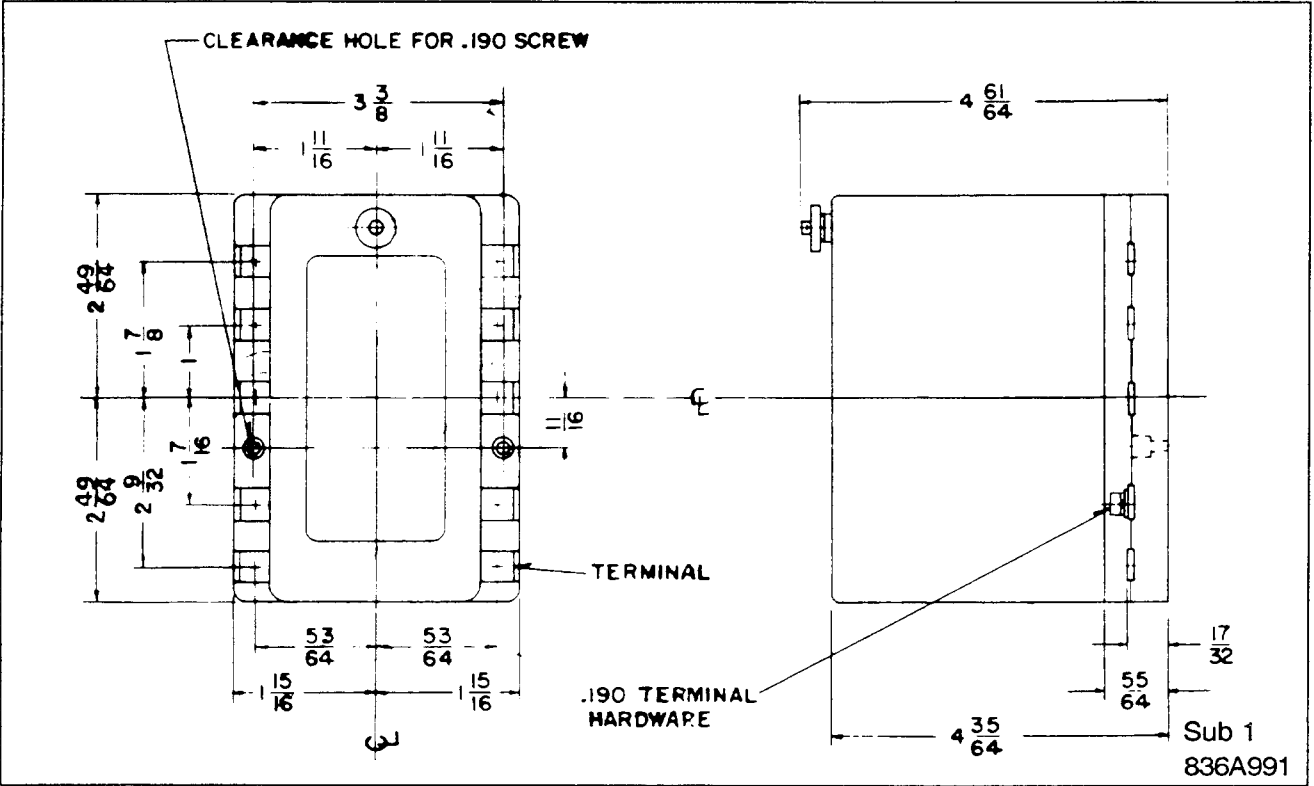


Figure 10. Outline and Drilling Plan for the Type AR Relay in the Front Connected Molded Case.



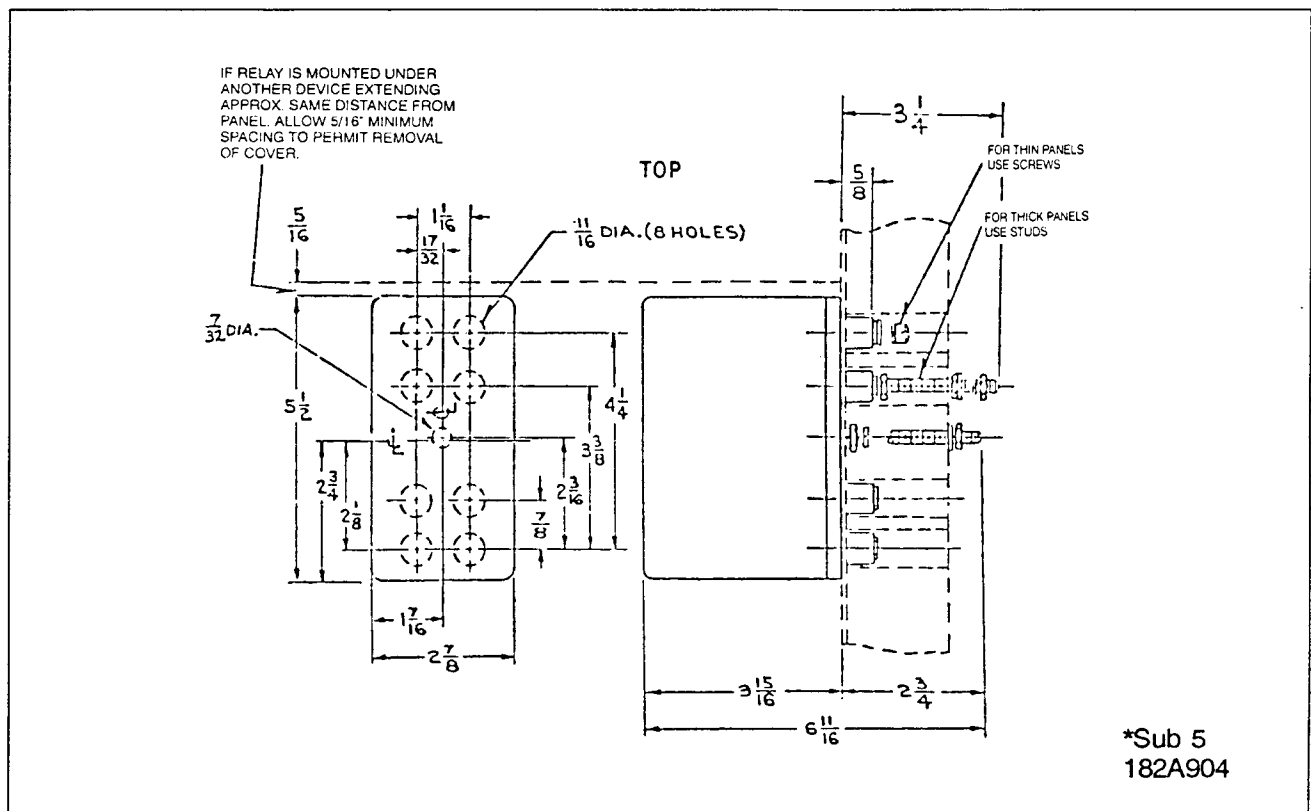


Figure 11. Outline and Drilling Plan for the Type AR Relay in the Rear Connected Molded Case.

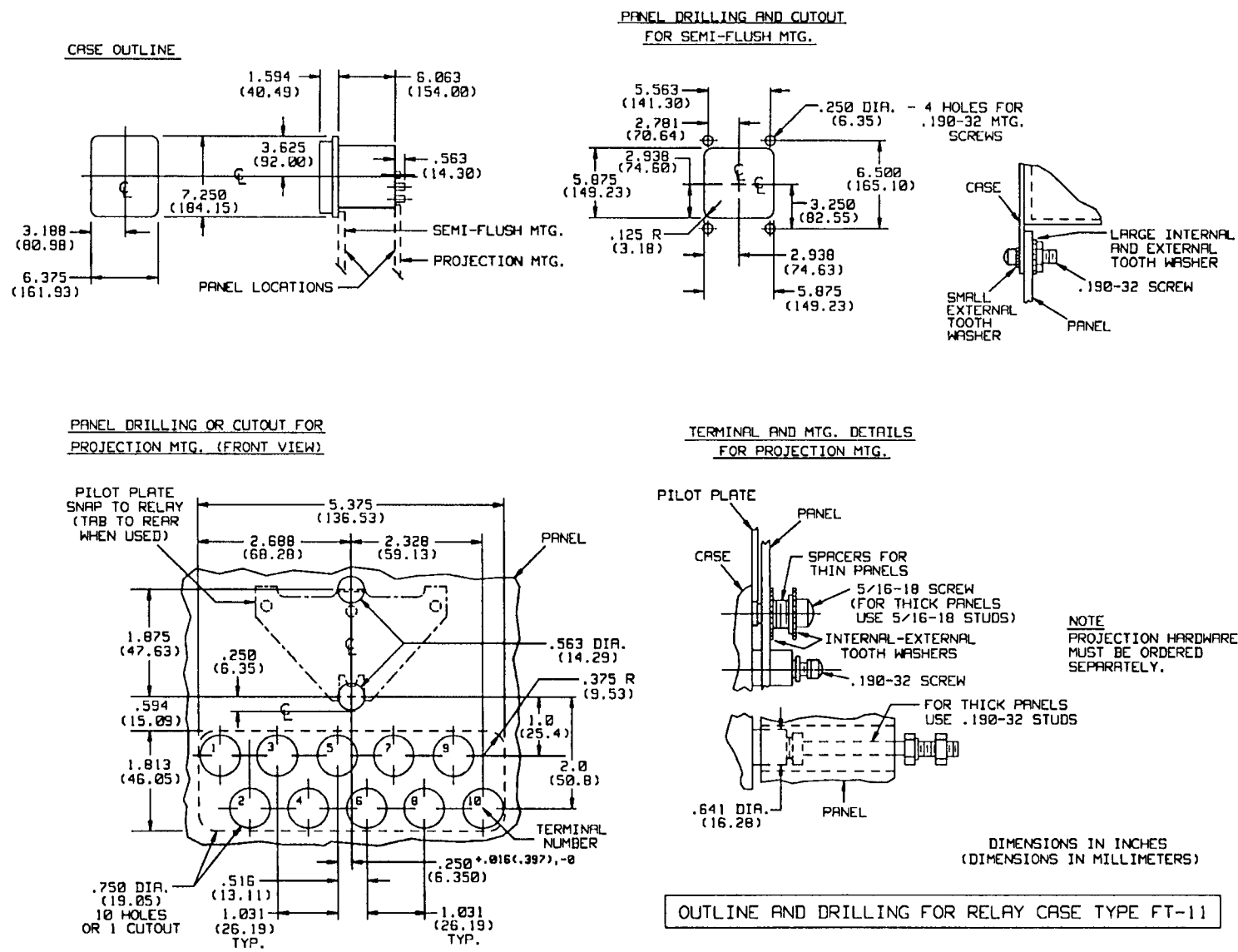


Figure 12. Outline and Drilling Plan for the Double Unit AR Relay in FT-11 Case.

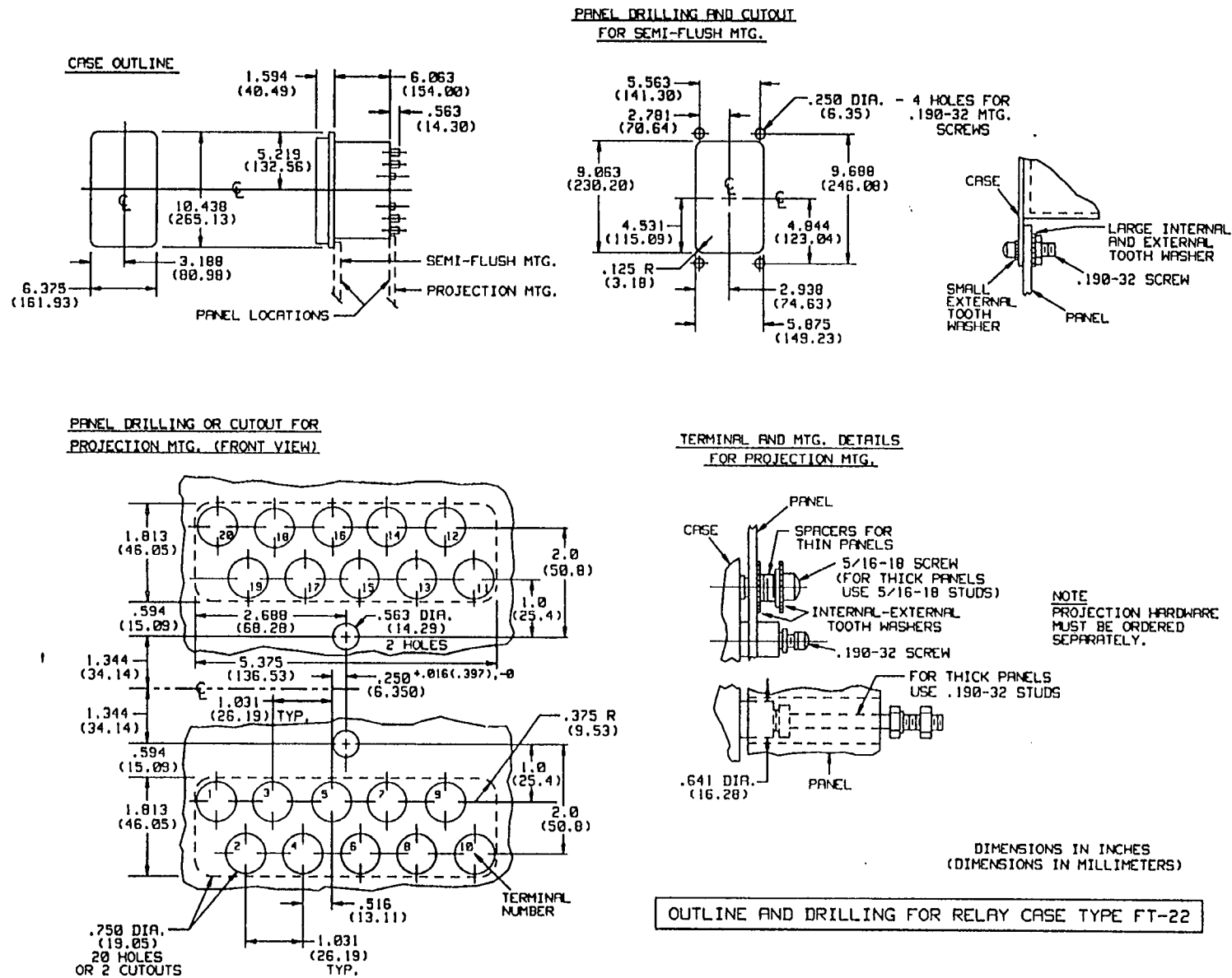


Figure 13. Outline and Drilling Plan for the Type AR Relay in FT 22 Case.

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