Type AR
Auxiliary Relay
High Speed

2.0 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, page 5.

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.

2.2 OPERATION INDICATOR (OI) (When used)

The dc indicating contactor switch is a small operated 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 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.

3.0 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.

Typical operating times and effective contact bounce are outlined in the Tables 1 and 2.

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 5% of rated voltage or higher.

Relays with delayed dropout are available with a minimum dropout time of 0.1 second and also available with a minimum dropout time of 0.2 seconds.

3.1 CONTACT RATING (Table 3)

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

**Table 1:**

<table>
<thead>
<tr>
<th>Energy (Watts)</th>
<th>Operate Time (Milliseconds)</th>
<th>Reset Time (Milliseconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Contact Closes</td>
<td>NC Contact Opens</td>
</tr>
<tr>
<td>10</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>2.25</td>
<td>3.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

^2.25 W AR is a different style than the 10W AR

**Table 2:**

<table>
<thead>
<tr>
<th>Contact Loading</th>
<th>Normally Open</th>
<th>Normally Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Circuit</td>
<td>2</td>
<td>6 - 8</td>
</tr>
<tr>
<td>10 Watt (One AR Relay)</td>
<td>1</td>
<td>- -</td>
</tr>
<tr>
<td>Breaker Trip Coil</td>
<td>.2</td>
<td>- -</td>
</tr>
</tbody>
</table>

**Table 3:**

<table>
<thead>
<tr>
<th>Contact Circuit Volts dc</th>
<th>Interrupting Rating (Amps)</th>
<th>Carry Rating (Amps)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Resistive</td>
<td>Inductive L/R = .005</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>Double</td>
</tr>
<tr>
<td>48</td>
<td>3.750</td>
<td>20.0</td>
</tr>
<tr>
<td>125</td>
<td>0.500</td>
<td>1.7</td>
</tr>
<tr>
<td>250</td>
<td>0.250</td>
<td>0.5</td>
</tr>
</tbody>
</table>
4.0 SETTINGS

4.1 AR UNIT
No settings are required.

4.2 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 con-
necting screw.

5.0 INSTALLATION
The relays should be mounted on switchboard pan-
els 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 a semi-flush mounting or by means
of the rear mountings 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 mount-
ing 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.

6.0 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 cus-
tomer. If the adjustments have been changed or the
relay taken apart for repairs, the calibration instruc-
tions below should be followed.

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

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

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

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

b. On relays with two normally open and two
   normally closed contacts, the normally
   closed contacts should have approxi-
mately 15 grams contact pressure in the
de-energized position.

Each normally open contact spring should have approximately 8 grams pressure
against the card.

NOTE: For this check to be made accurately, it is necessary to
back out the NC stationary contact screw. This will disturb the fac-
tory calibration and therefore it is recommended this check not be
made on a relay which passes all other checks.

Armature Gap
The armature gap should be approximately .009
inches measured at the narrowest part of the arma-
ture gap.

Contact Operate Time
Per Table 1.

Operation Indicator (OI)
Close the main relay contacts and pass sufficient dc
current through the circuit to drop 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.

6.2 SPECIAL AR RELAY WITH TIME DELAY
DROPOUT
Connect the relay as shown in Figure 16 page 12.
When the AR coil has been energized for 25-35 milli-
seconds its dropout time should be a minimum of
100 milliseconds. The AR relay should be adjusted
such that its contact break time is 25-35 milliseconds.
Also the timer should be of the type which may be
started and stopped by break contacts.

6.3 AR RELAYS WITH TIME DELAY DROPOUT
Connect the relay as shown in Figure 17 page 13.
When the AR coil has been energized approximately
3 cycles, (40 millisecond or longer) the dropout time
should be a minimum of 100 milliseconds or the dropout time should be a minimum of 200 milliseconds depending upon the relay style.

7.0 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”, page 3)

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 0.009-inch gap at the rear end of the armature air gap.

b. On the four normally open contact relay 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. For this check to be made accurately, it is necessary to back out the NC 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.

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 pressure. 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 Tables 1 and 2.

8.0 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.
Figure 1. Type AR Unit with 2 Make – 2 Break Contacts (Front View).

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 isolation block

Figure 2. Type AR Unit with 2 Make – 2 Break Contacts (Side 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
Figure 3. Internal Schematic of the Type AR Relay with 4 Make Contacts in FT-11 Case.

Figure 4. Internal Schematic of the Type AR Relay with 2 Make – 2 Break Contacts in FT-11 Case.
Figure 5. Internal Schematic of the Type AR Relay in FT-22 Case, Double Unit, with 8 Make Contacts.

Figure 6. Internal Schematic of the Type AR Relay in FT-22 Case, Double Unit, with 6 Make – 2 Break Contacts.
Figure 7. Internal Schematic of the Type AR Relay in Ft-22 Case, Double Unit, with 4 Make – 4 Break Contacts.

Figure 8. Internal Schematic of the Type AR Relay in Front Connected Molded Case with 4 Make Contacts.
Figure 9. Internal Schematic of the Type AR Relay in Front Connected Molded Case with 2 Make – 2 Break Contacts.

Figure 10. Internal Schematic of the Type AR Relay in the Ft-11 Case with 2 Operation Indicators.
Figure 11. Internal Schematic of the Type AR Relay with 2 Make – 2 Break Contacts in Molded Case.

Figure 12. Internal Schematic of the Type AR Relay with 4 Make Contacts in Molded Case.
Figure 13. Internal Schematic of the Type AR Relay in the FT-11 Case with Time Delay Dropout.

Figure 14. Internal Schematic of the Type AR Auxiliary Tripping Relay with Time Delay on Dropout in FT-11 Case, 125 Vdc.
NOTES:

1. A relay must be set such that the break contacts open in 25-35 milliseconds.

2. Timer must be able to be started by contact break and stopped by contact break.

Figure 15. Internal Schematic of the Type AR Relay in Type FT-22 Case with Time Delay on Release, 6 make – 2 Break Contacts.

Figure 16. Test Connections for the Special Type AR Relay with Time Delay on Dropout.
Figure 17. Test Connections for the Special Type AR Relay with Time Delay on Dropout.
Figure 18. External Schematic of the Type AR Relay
Figure 19. Outline and Drilling Plan for the Type AR Relay in the Front Connected Molded Case.
IF RELAY IS MOUNTED UNDER ANOTHER DEVICE EXTENDING APPROX. SAME DISTANCE FROM PANEL, ALLOW 5/16" MINIMUM SPACING TO PERMIT REMOVAL OF COVER

Sub 5
182A904

Figure 2.0 Type AR Relay – Molded Base, Rear Connected Outline and Drilling Plan
Figure 21. Outline and Drilling Plan for the Type AR Relay in the Ft-11 Case.
Figure 22. Outline and Drilling Plan for the Type AR Relay in the FT-22 Case.
NOTES