INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE DT-3 TEMPERATURE AND MICRON 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 setting and electrical connections.

APPLICATION

The principal application of the type DT-3 relay is for protection against excessive temperature in electrical machines through response to changes in resistance of an exploring coil installed in the protected apparatus. The relay may be used for protecting transformers and either a-c or d-c generators and motors from damage resulting from abnormally high temperatures. The point at which the relay contacts close is adjustable along a scale calibrated in degrees Centigrade. The operation of the relay contacts may be used to open the circuit breaker, sound an alarm, start blowers, or take care of the high temperature in any desired manner. The DT-3 relay may be supplied for a-c or d-c operation. A modified form of the DT-3 relay is used as part of a vacuum measuring device and has a scale calibrated in microns.

The type DT-3 relay has a permanent magnet field, and consequently it is free from the variations in operating point that would result from fluctuations in the voltage source if an electromagnet field were used.

CONSTRUCTION AND OPERATION

The type DT-3 relay is a d'Arsonval type d-c contact making milliammeter. The magnetic circuit is shown schematically in Fig. 2. A cylindrical core, consisting of an Alnico permanent magnet, two iron pole pieces and two brass spacer blocks, is mounted concentrically in the bore of a malleable iron frame casting. The moving coil rotates in the air gap between the core and the frame casting. A Moldarta bracket mounted on the rear of the core carries bearings for the frame on which the moving coil is wound, and also provides connection points for the spiral springs through which electrical connection is made to the moving contact and the moving coil. The two springs which are connected to the moving coil are located at the top of the element. The outer ends of these springs are fastened to posts mounted in a circular insulating plate. This plate is mounted on the Moldarta bracket by means of the upper bearing screw and a spring washer, so that it is held in position securely, but yet can be rotated to permit adjustment of the zero position of the moving element.

The moving contact is mounted to the outer end of a counterbalanced arm fastened to the bottom of the moving coil shaft. Current is introduced into this contact by the third spiral spring. On either side, a stationary contact arm is fastened to the frame. Each of these stationary contacts is adjustable in a small arc and an upright guide arm indicated its position relative to a calibrated scale on the lower part of the nameplate. Relays for certain special applications are provided with a pointer, which is fastened to the contact arm and moves in front of the calibrated scale.

A screw containing a sapphire thrust bearing and a ring guide bearing is mounted in the lower bearing support of the moving element. The inverted position of this bearing screw prevents dirt particles from falling into it. A guide bearing only is provided at the top of the moving element, but the bearing pin is the lower of the two bearing members here also.

The type DT-3 temperature relay is supplied with a self-contained bridge. As shown in Figs. 6 and 7, the connections take the form of a Wheatstone bridge composed of three fixed resistors and the search or

SUPERSEDES I.L. 41-552.1F
*Denotes change from superseded issue.

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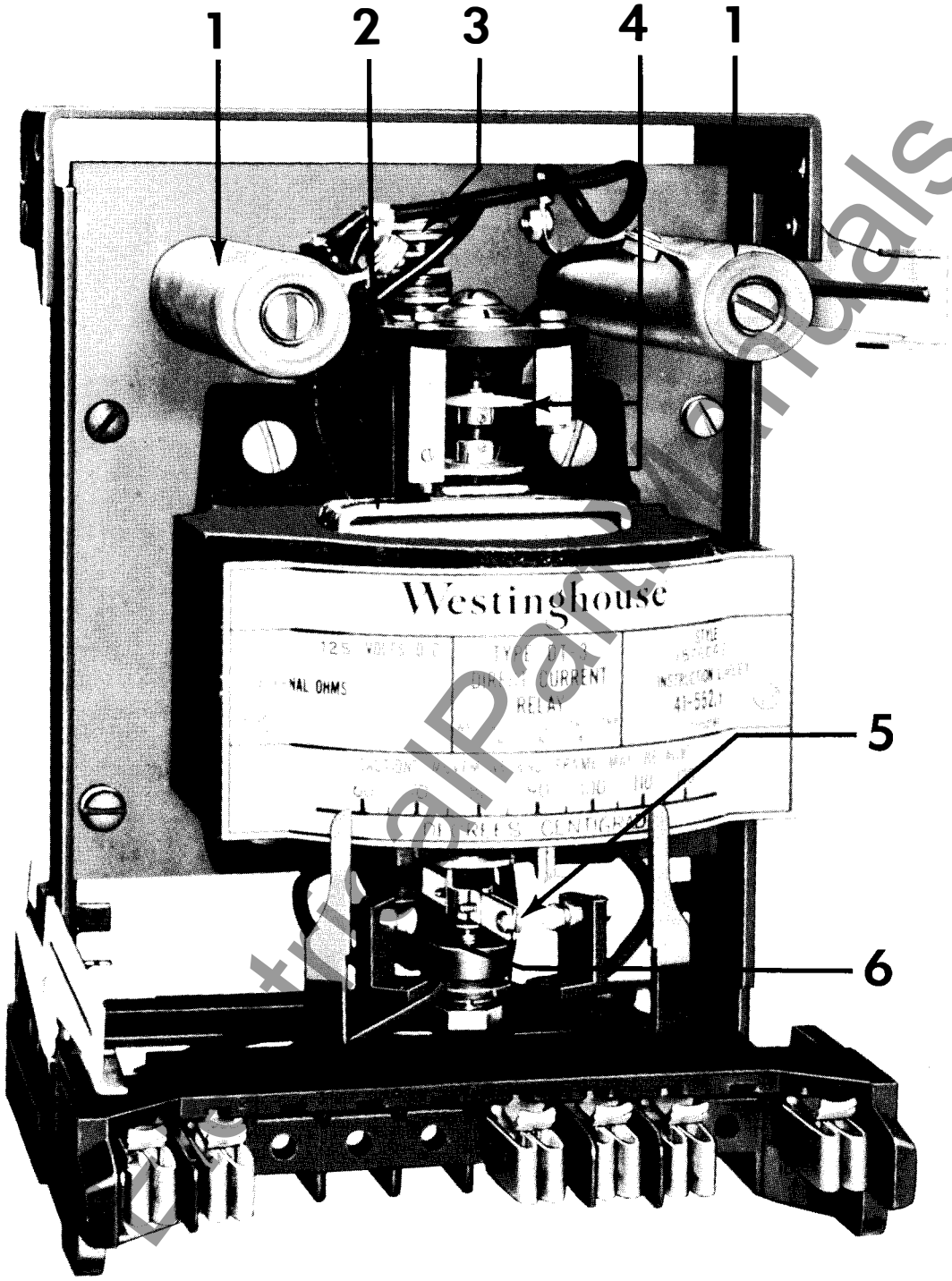


Fig. 1. D.C. Type DT-3 Temperature Relay without Case. 1-Internal Series Resistor. 2-Moving Coil. 3-Bridge Resistor. 4-Current carrying Counter Wound Restraining Springs. 5-Moving Contact. 6-Stationary Contacts.

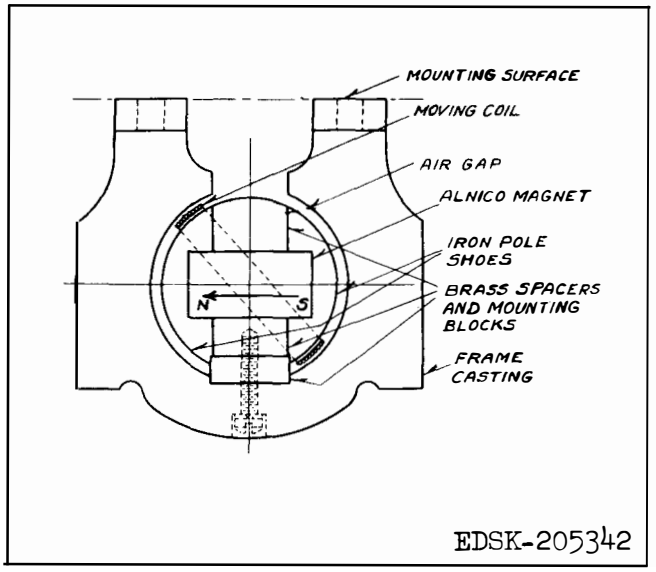


Fig. 2. Schematic Drawing of Magnetic Circuit of Type DT-3 Relay (Top View). Moving Coil Bearing Supports, Springs and Contacts Omitted.

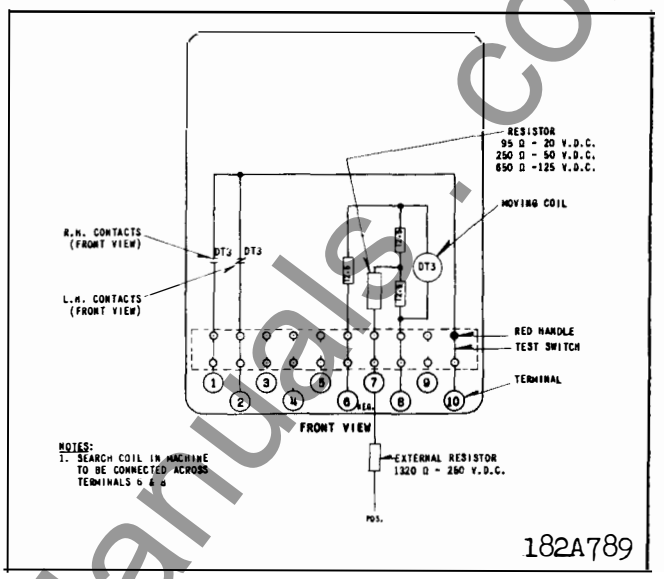


Fig. 3. Internal Schematic of the D.C. Type DT-3 Temperature Relay in the Type FT21 Case.

exploring coil, with the moving coil of the relay connected across the center of the bridge.

The a-c type DT-3 temperature relay consists of a transformer, rectifier, zener diode, three fixed resistors, two adjustable resistors, contactor switch, and a d'Arsonval type d-c contact making milliammeter. A zener diode connected across the temperature indicating bridge serves as a voltage regulator for the bridge. For changes of ± 10 percent in the supply voltage, only a small change occurs in voltage across the bridge.

TRIP CIRCUIT

contacts	d-c control voltage	amperes contacts will: (non-inductive load) open	close	carry continuously
* DT-3 relay	125 v	0.04♦	1.0	....
	250 v	0.02♦	1.0	....
contactor switch (when supplied)	125 v	3.5	30	5.0
	250 v	1.0	30	5.0

♦ infrequent operation

The high-temperature contact is immediately bypassed by a contact of the auxiliary relay when the latter picks up, and when the auxiliary relay is dropped out by the low temperature contact of the DT-3 relay the circuit is interrupted by the same contact of the auxiliary relay.

The d.c. contactor switch in the relay is a small solenoid type switch. A cylindrical plunger with a silver disc mounted on its lower end moves in the core of the solenoid. As the plunger travels upward, the disc bridges three silver stationary contacts. The coil is in series with the high temperature contact of the relay. The low temperature contacts of the relay shunt the contactor switch coil. When the temperature of the protected apparatus, reaches the setting of the relay, the coil of the contactor switch is energized and closes the switch contacts. One contact of the switch seals-in around the high temperature contact of the DT-3 relay. Another contact of the switch sounds an alarm or trips a breaker. When the temperature of the protected apparatus decreases to the low temperature setting of the relay, the contacts of the relay shorts the coil of the contactor switch to cause the switch to dropout.

CHARACTERISTICS AND SETTINGS

Type DT-3 Relay for Temperature Measurement

The d-c type DT-3 relay is available in the temperature ranges listed below. It has a moving coil resistance of approximately 15 ohms at 25 °C. The a-c type has a scale calibrated from 50 to 190 degrees Centigrade.

Temperature range
60 - 120 °C
60 - 140
100 - 160
50 - 190

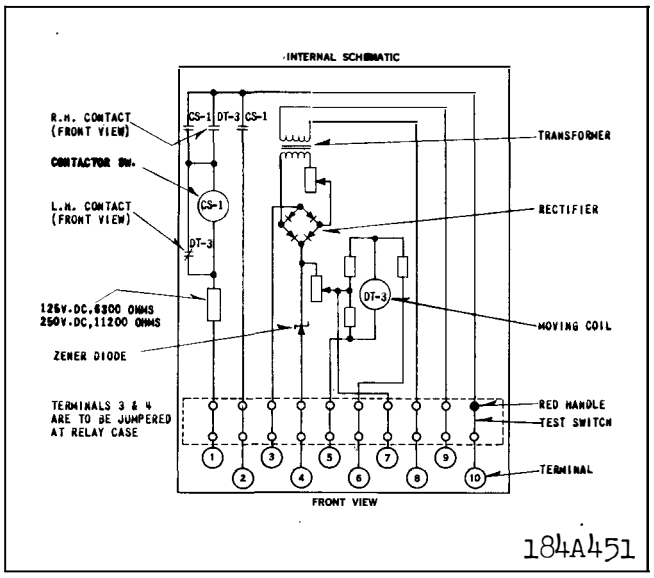


Fig. 4. Internal Schematic of the A.C. Type DT-3 Temperature Relay in the Type FT21 Case.

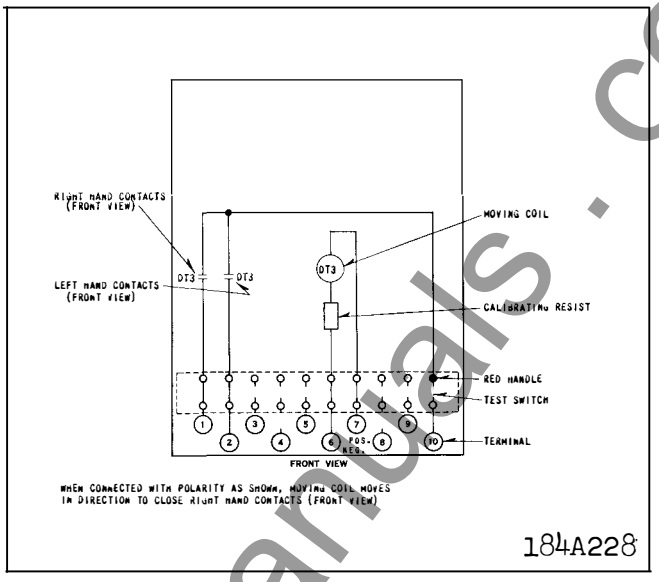


Fig. 5. Internal Schematic of the Type DT-3 Pirani Gage (Vacuum Measuring) Relay in the Type FT21 Case.

The right-hand (front-view) stationary contact can be set so that a circuit is closed at and above any search coil temperature within the calibrated range of the relay. Similarly, the left-hand stationary contact can be set so that a second circuit is closed at and below any temperature less than the setting of the right-hand contact.

The standard d-c relay is designed for operation with a 10 ohm copper exploring coil, and is calibrated for a range of settings from 60°C. to 120°C. The moving element is arranged so that the contacts stand at the 90°C. position when there is no current in the moving coil. The resistors forming the three fixed legs of the bridge are adjusted to a value of 12.50 ohms, which is the resistance at 90°C. of a copper search coil which measures 10 ohms at 25°C. When the bridge circuit is energized, the current in the moving coil, and the resulting torque, will be in one direction or the other, depending upon whether the search coil temperature is above or below 90°C., and the contacts will move to the position where the electrical torque is balanced by the restraining torque of the control springs.

On the standard a-c type DT-3 relay the mechanical balance point is at approximately 115°C.

The 60 cycle burden of the a-c type DT-3 relay at rated voltage is 5.9 volt-amperes, and will continuously stand 110% of rated voltage.

Type DT-3 Relay with Micron Scale

A special form of the type DT-3 relay used as part of a vacuum-measuring device is calibrated in microns. It has a moving coil with a resistance of approximately 90 ohms, and sufficient resistance is connected in series with the moving coil internally to increase the resistance measured across the relay terminals to 100 ohms. This relay has a pointer which indicates the moving contact position on the calibrated scale. The standard relay has a scale calibrated from 0 to 30 microns.

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 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.

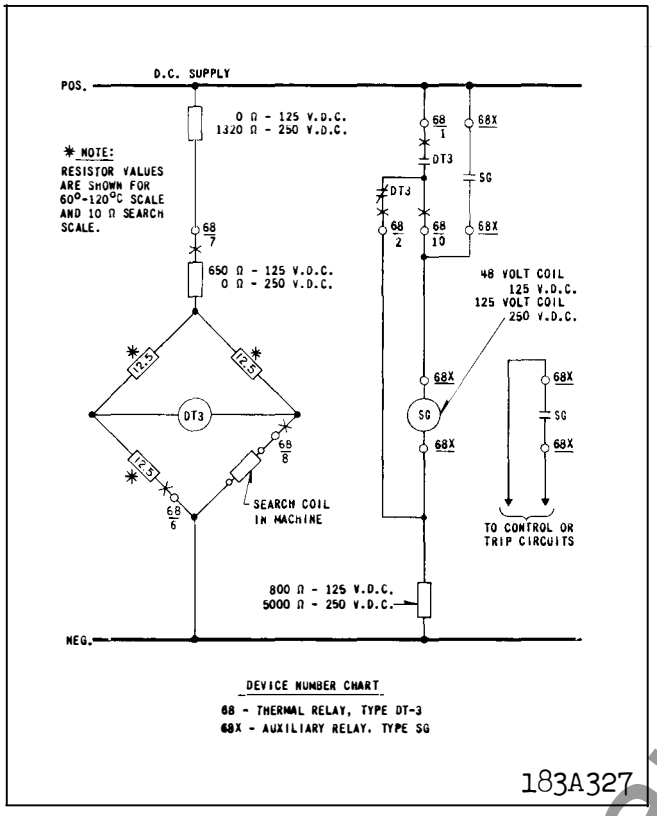


Fig. 6. External Schematic Diagram for Thermal Protection of Electrical Equipment using the D.C. Type DT-3 Temperature Relay in the Type FT21 Case.

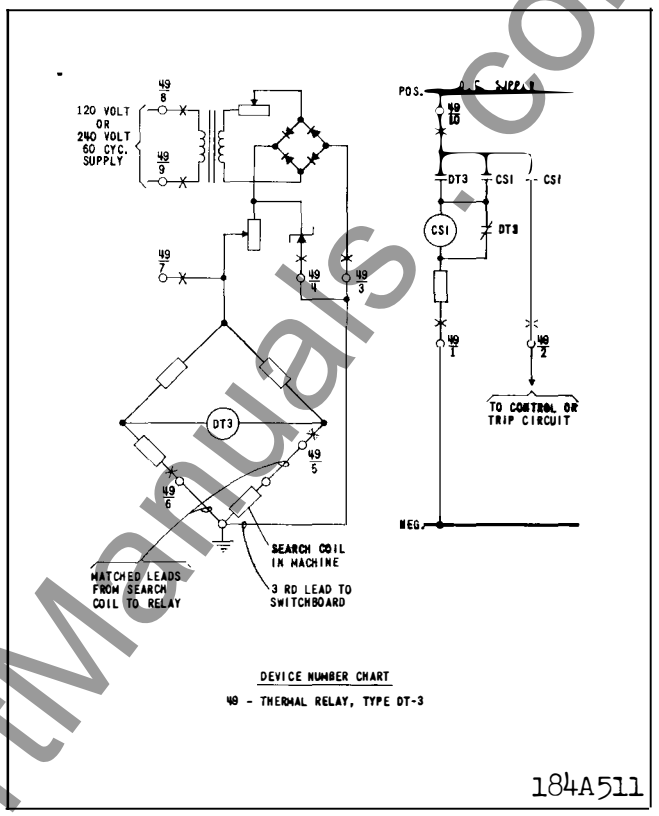


Fig. 7. External Schematic Diagram for Thermal Protection of Electrical Equipment Using the A.C. Type DT-3 Temperature Relay in the Type FT21 Case.

The ambient temperature at the type DT-3 relay has no appreciable effect on its operation. The ambient temperature will affect the resistance of the leads to the search coil. By connecting one side of the supply directly to the search coil and then to the relay terminal, the search coil lead resistance is added to both sides of the bridge and thus the variation of lead resistance is thus substantially balanced out. It might be more convenient in some cases to connect the bridge directly to the source, instead of running one supply lead to a search coil terminal at the machine. This can be done if the search coil leads are short or have a total resistance less than about 0.25 ohms. Such a lead resistance would cause the d-c relay contacts to close when the search coil was 6.5°C. below the relay temperature setting, but this error can be compensated largely by adjusting the relay setting accordingly.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of the 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 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.

If the moving element should be removed, the bearing end-play should be checked when replacing it. This should be from .020 inch to .025 inch, and can be measured by inserting a feeler gauge between the upper bearing screw and the shoulder on the moving element shaft.

In case it should be desirable to check the calibration of the type DT-3 relay, this can be conven-

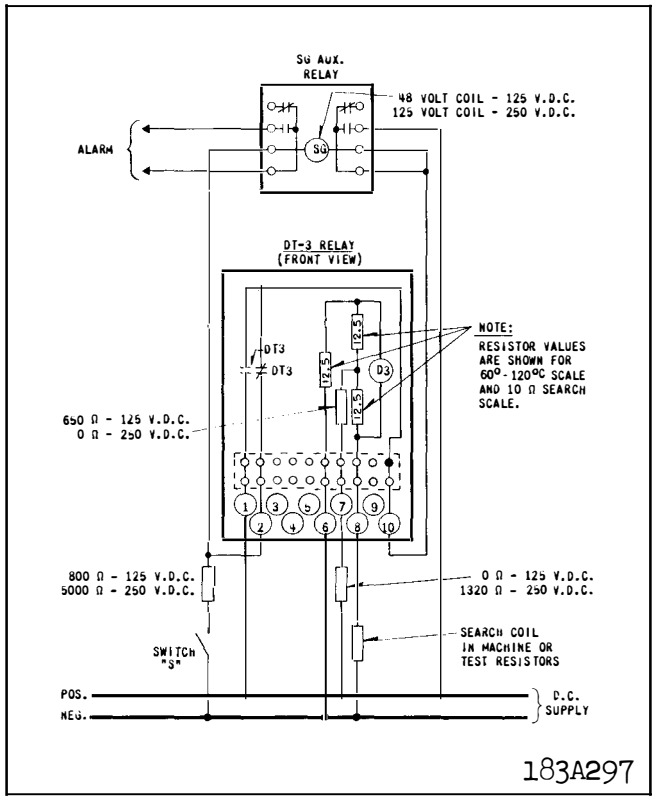


Fig. 8. Diagram of Test Connections for the D.C. Type DT-3 Temperature Relay in the Type FT21 Case.

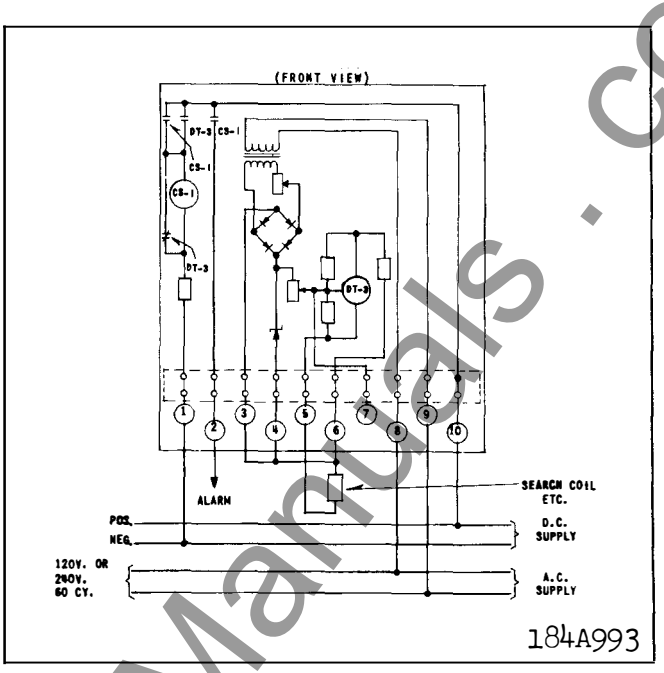


Fig. 9. Diagram of Test Connections for the A.C. Type DT-3 Temperature Relay in the Type FT21 Case.

iently done by substituting a variable resistor for the search coil. Any scale point can be checked by setting the resistor for the corresponding resistance, as indicated in the tables below, and seeing that the moving contacts travel to the indicated scale position. The relay should be energized at normal voltage for the test, and all other connections should be made as shown in Fig. 8 for d-c relays, and Fig. 9 for a-c relays.

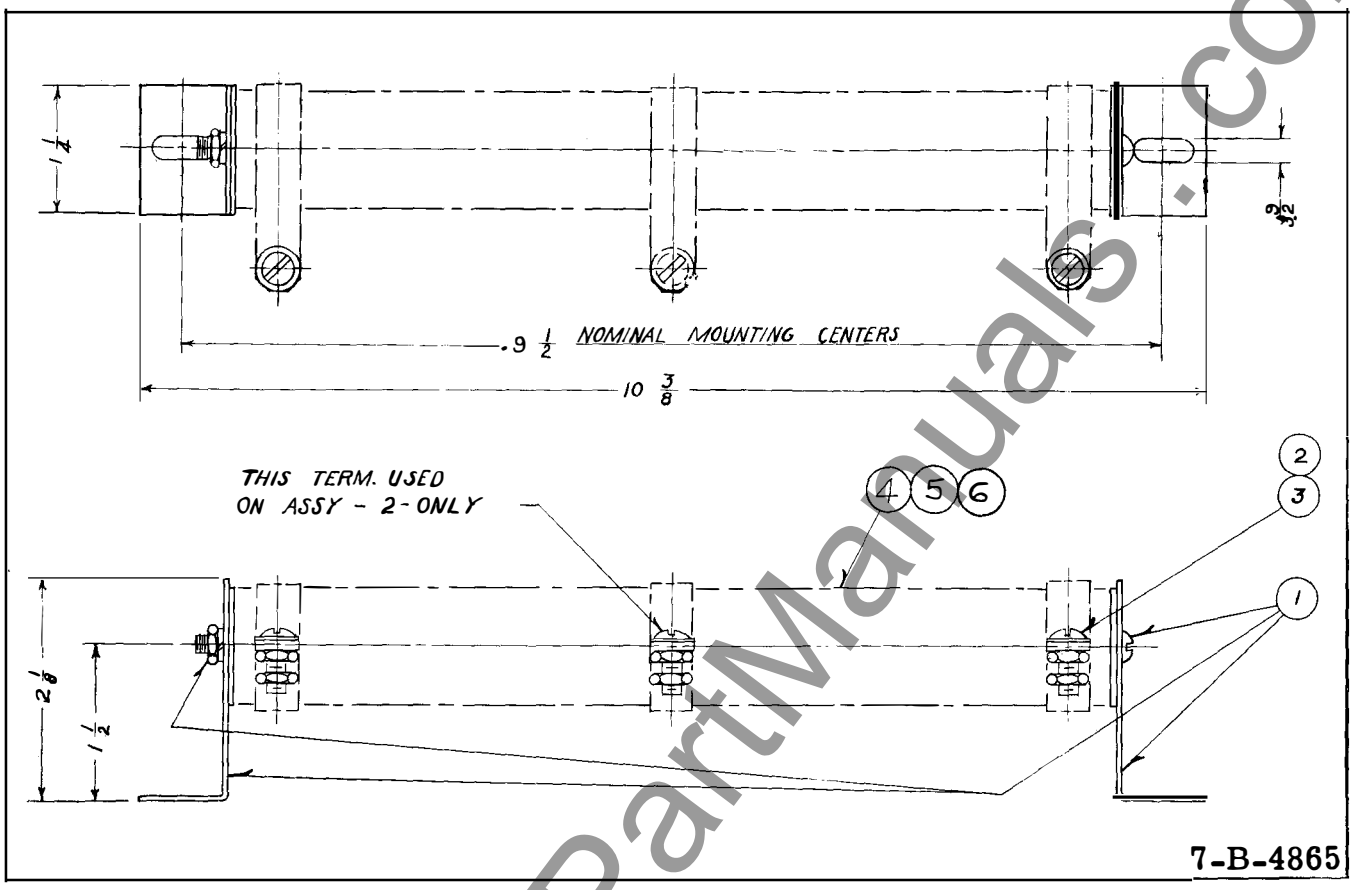
D-C Type DT-3 Relays

Temperature Degrees Centigrade	Resistance Ohms
60°	11.35
70°	11.73
80°	12.12
90°	12.50
100°	12.89
110°	13.28
120°	13.66

A-C Type DT-3 Relays

Temperature Degrees Centrigrade	Resistance Ohms
50°	10.96
70°	11.73
90°	12.50
110°	13.28
130°	14.05
150°	14.81
170°	15.59
190°	16.36

The core and moving coil assembly should not be removed from the frame casting of the DT-3 relay unless a keeper having the same radius on the core is placed on the core in such manner as to bridge the iron pole pieces as the core is withdrawn from the bore of the casting. It is necessary also to insert spacers in the air gap so that the core will remain approximately centered when the mounting screws are removed, to prevent damaging the coil winding when sliding the assembly out of the casting. The factory assembly is made before the magnet has been magnetized, and the complete assembly is placed between the poles of a magnetizer which produces a field sufficiently strong to saturate both the magnet

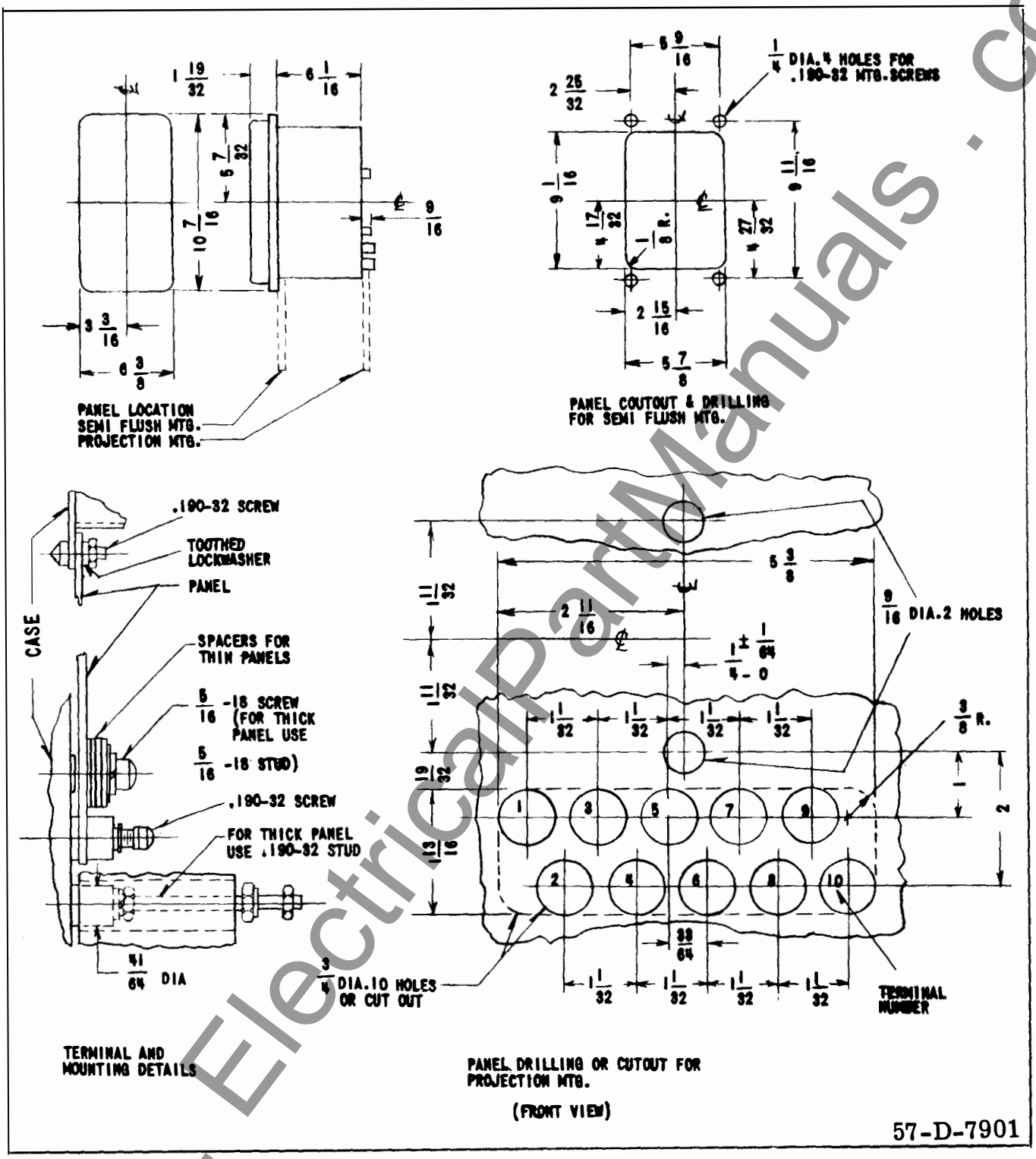


* *Fig. 10. Outline and Drilling Plan for External Resistor used with 250 V.D.C. Type DT-3 Temperature Relay.*

and the frame casting. This avoids the necessity of using magnet keepers and simplifies the assembly.

REPAIRS AND 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. 11. Outline and Drilling Plan for the Type DT-3 Relay in the Type FT21 Case.*

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