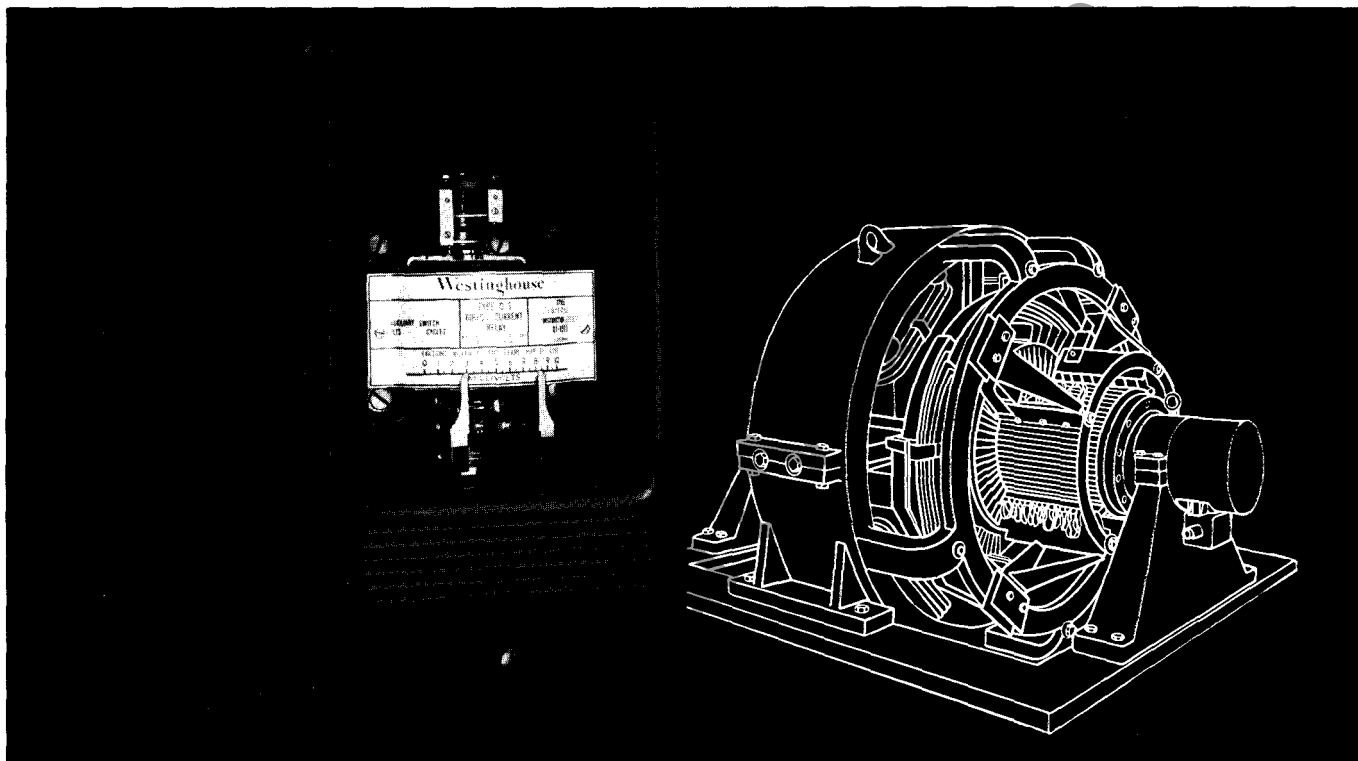


Westinghouse



Type D-3 Direct Current Relays

Overcurrent, Undercurrent, or
Reverse Current Protection



Application

The D-3 relay is a highly sensitive D'Arsonval type contact-making dc millivoltmeter designed for a wide variety of applications, including:

- overload and internal fault protection for dc machinery
- loss-of-field voltage protection for dc motors
- anti-motoring protection for motor-generator sets and rotary converters
- reverse current protection for electroplating control

In addition, the standard relay can be modified for a wide variety of ratings and special applications.

Typical Modifications

Calibration in dc amperes for use with a particular shunt rating.

Supplied with external or internal series resistors for use as a contact-making dc voltmeter (typical scales: 0-150, 0-250, 75-150 volts).

Self-contained contactor switches added for additional contact capacity.

"Anti-pump" trip circuit added for load regulation.

In applications of this type where the relay is used to regulate a load rather than to initiate circuit interruption on overload, a dc contactor switch (CS) with a voltage coil is mounted within the relay case (see Figure 7). When contact D-3(R) closes, CS closes trip circuit and seals-in around D-3(R) until D-3(L) closes to prevent excessive operation or "pumping" of D-3(R) on small load fluctuations. If the contact rating of CS is insufficient, use the standard D-3 relay and an additional SG relay (see Figure 4).

Self-contained rectifier unit incorporated for sensitive ac applications.

Five milliamperes 60 cycle ac through terminals 6 and 7 (see Figure 8) will give full scale deflection. By incorporating a suitable internal resistor, the relay scale can be calibrated in volts.

Device Number: 76

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Construction and Operation

1 Moving Coil

Rotates in air gap between magnetic core and frame casting.

2 Scale

Calibrated in millivolts, milliamperes, volts, or amperes.

3 Current Carrying Restraining Springs

4 Moving Contact

Attached to bottom shaft of moving element.

5 Stationary Contacts

Independently adjustable. Minimum contact gap is 1/32-inch either side of the moving contact.

A Moldarta bracket mounted on the rear of the magnetic core carries bearings for the moving coil, and provides connection points for spiral springs through which electrical connection is made to the moving coil and the moving contact.

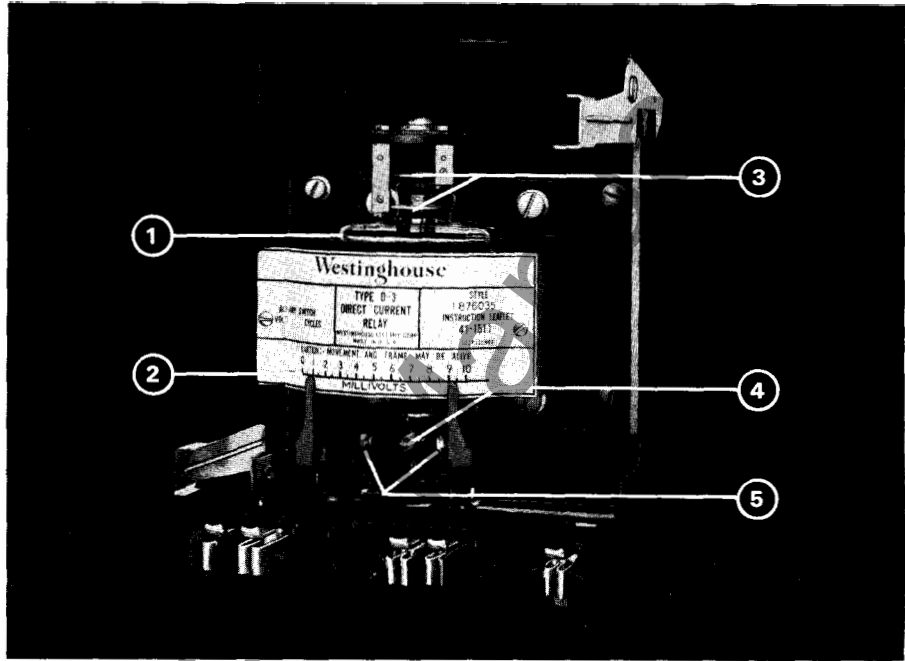
Two springs are connected to the moving coil at the top of the element. The outer ends of these springs are fastened to posts mounted on a circular insulating plate which, in turn, is mounted on the Moldarta bracket. The plate is rotated to adjust the zero position of the moving element.

The moving contact is mounted on the outer end of a counter-balanced arm fastened to the bottom of the moving coil shaft. Current is introduced into this contact by a third spiral spring. On either side of the moving contact, the stationary contacts are fastened to the frame. Each stationary contact is adjustable in a small arc, and an upright guide arm indicates its position relative to a calibrated scale on the lower part of the nameplate.

Relays for special applications are provided with a pointer which is fastened to the contact arm and moves in front of the calibrated scale.

Special Restraining Springs

The D-3 relay can be supplied with restraining springs adjusted for "left zero", "center zero", or "suppressed zero" as starting position for the moving contact. Operation is as follows:



Left Zero

When the relay is de-energized, the moving contact makes with the left stationary contact. When the relay is energized, with proper polarity, the moving contact moves up scale.

Center Zero

When the relay is de-energized, the moving contact rests at mid-point of scale, and when the relay is energized it moves to the

right or left, depending on the polarity applied to the relay.

Suppressed Zero

When the relay is de-energized, the moving contact is held firmly against the left stationary contact, but does not move up scale when the relay is energized until a pre-determined current sufficient to overcome "biased" torque of the restraining springs flows through the coil winding.

Characteristics

Sensitivity^①

Shunt	Percent Sensitivity (10 Mv Relay)	
	1 Mv Setting	5 Mv Setting
50 mv	2%	10%
100 mv	1%	5%

^① Ratio of relay millivolt setting divided by rated voltage of shunt.

Operating Time

Relay has slight time delay with inverse characteristic. This is affected by whether or not it is connected across a shunt. The relay will operate and reset faster when it can be wired directly in the circuit.

Percent Full Load Applied	Operating Time, Seconds (Approx.)		
	Half-Scale Travel ^②	Full-Scale Travel	
	With Shunt	With Shunt	Without Shunt
125	1.1	4.0	1.25
150	0.9	2.2	0.9
200	0.65	1.45	0.6
500	0.25	0.5	0.3
1000	0.15	0.25	0.15
Reset to 10% of Setting, Relay De-energized	3.0	5.0	2.0

^② Full scale travel for "center zero" relay.

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Coil Circuit Data

Relay Voltages In Millivolts, Dc	Average Resistance In Ohms At 25°C Between Terminals 6 and 7
0-10	0.3
5-0-5	0.3
40-80	1.2
100-0-100	6.0
0-200	6.0

34 ma through the coil circuit will give full scale deflection.

On the rectifier type D-3 (Figure 8), 6 ma ac input will produce full scale deflection.

Maximum Continuous Coil Rating

Maximum continuous operation is approximately 1500% of full scale in order to avoid mechanical damage to the moving element due to excessive operating torque.

Contact Ratings

Contacts will close a circuit carrying 1 ampere dc, but should not be used to open appreciable current. For larger tripping currents, a "high contact capacity" relay (see Figure 6) is recommended, or the standard relay can be used with an auxiliary SG relay (see Figure 3). In all cases, an auxiliary contact (52a) on the circuit breaker must be provided to open the trip circuit when the breaker opens.

Contacts	Dc Control Voltage	Amperes Contacts Will: (Non-Inductive Load)		
		Open	Close	Carry Continuously
D-3 Relay	125V	0.04Ⓣ	1.0	...
	250V	0.02Ⓣ	1.0	...
Contactor Switch (When Supplied)	125V	3.5	30	5.0
	250V	1.0	30	5.0

Ⓣ Infrequent operation.

Lead Resistance

Relays are calibrated without leads, so lead resistance must be kept to a minimum in the lower millivolt ranges. Example: With the 0-10 mv relay, leads 8 feet long of No. 10 B-S copper wire will reduce relay indication 5%. But with the 0-100 mv relay using same leads, error is only 0.5%.

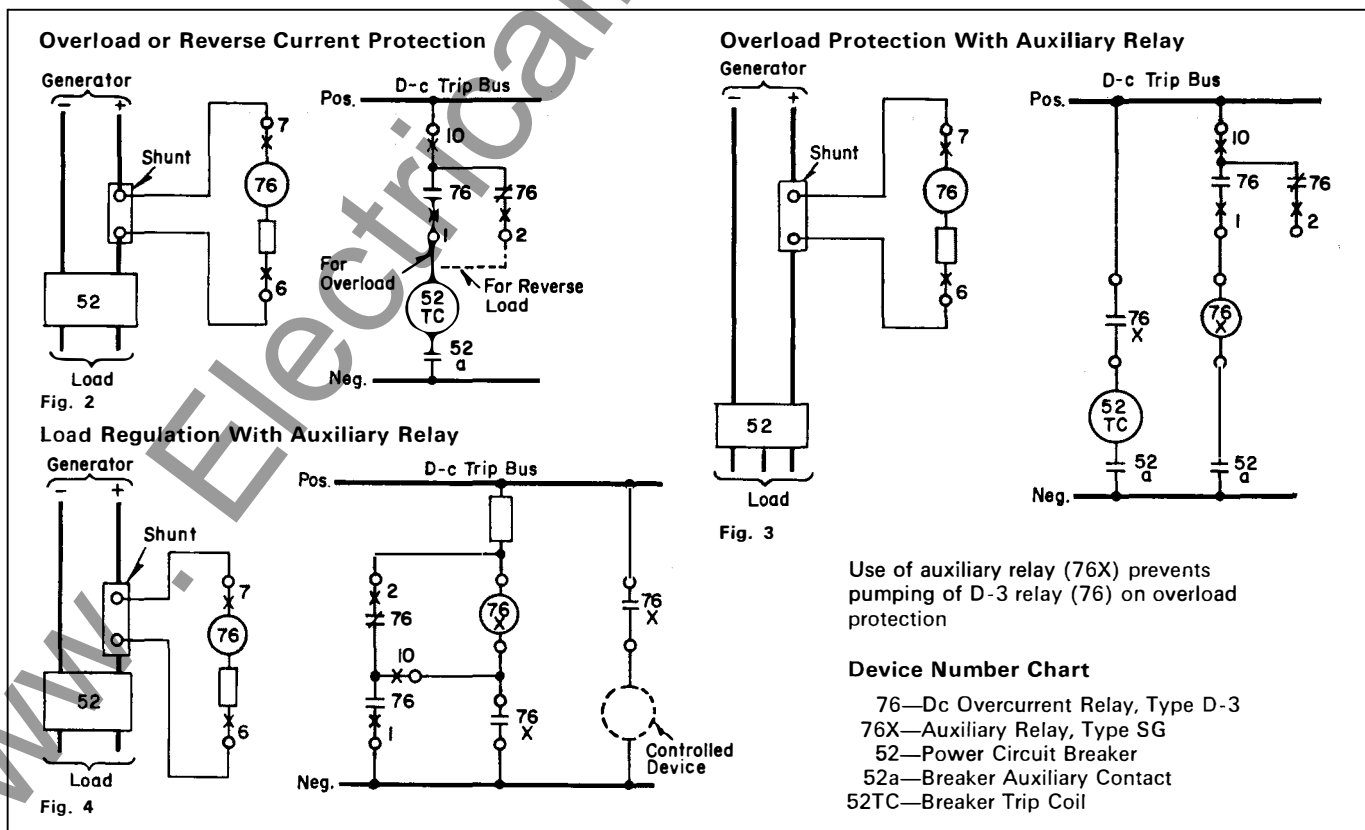
Bus Bar Connection

An equivalent length of bus bar may be used in place of ammeter shunts. Example: Based on 1000 amperes per square inch at 20°C, 6 feet of copper bus will give 50 mv drop.

Minimum Relay Setting

The minimum setting which the D-3 relay can accommodate is 5% of full scale for the characteristics listed.

Circuit Diagrams



Type D-3 Direct Current Relays

Overcurrent, Undercurrent, or
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Internal Wiring Diagrams (Front View), FT-21 Case Standard Relay

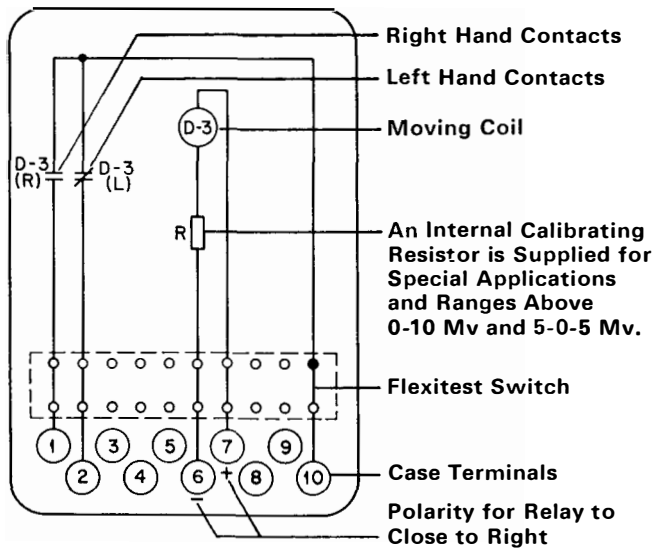


Fig. 5

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High Capacity Contact Relay

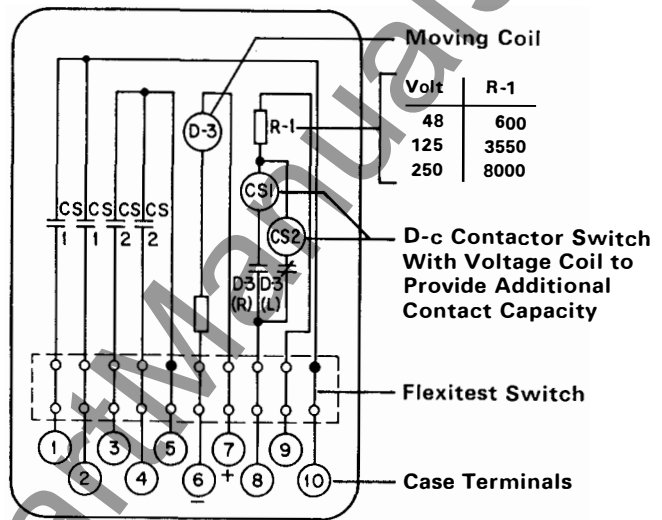


Fig. 6

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Load Regulating Relay

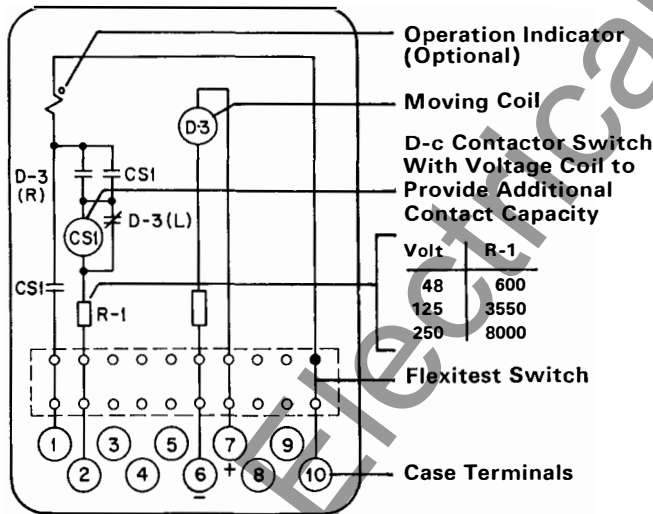


Fig. 7

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Rectifier Modified Relay

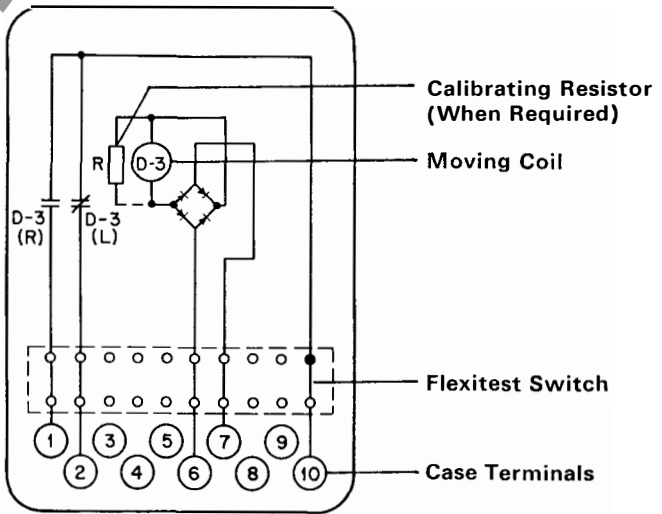


Fig. 8

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Shipping Weights and Carton Dimensions

Case Type	Weight, Lbs: Approx.		Domestic Shipping Carton Dimensions: Inches
	Net	Shipping	
FT-21	15	19	9 x 12 x 12

Further Information

Prices: PL 41-020
Dimensions: DB 41-075
Instructions: IL 41-151.1
Renewal Parts: RPD 41-260A1
Shunts: DB 43-800
SG Relay: DB 41-750A