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Supersedes I.L. 41-579.11, Dated May 2004

Type TD-5 Time Delay Relay

(for Class 1E application)

(|) Denotes Text Change Since Previous Issue
(*) Denotes Figure Change Since Previous Issue



Before putting relays into service, remove all blocking 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. Close the red handle switch last when placing the relay in service. Open the red handle first when removing relay from service.

CONTENTS

This instruction leaflet applies to Class 1E TD-5 Time Delay Relays which can be described as follows:

TD-5 Time Delay Relays with Smart Style Number
Ex: TD51ET1V1PNN

1.0 APPLICATION

This relay has been specially designed and tested to establish its suitability for Class 1E applications in accordance with the ABB Relay Division program for Class 1E Qualification Testing as detailed in the ABB publication STR-1.

“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 significant release of radioactive material to the environment.

The type TD-5 relay is used in timing applications where accuracy, repeatability and fast reset are required. Its principal use is in time delayed distance relaying and in breaker failure timing applications.

TD-5 is a dc relay capable of direct application to station batteries. It covers 0.05 to 30 seconds in 4 different ranges.

2.0 CONSTRUCTION AND OPERATION

The type TD-5 relay consists of a reference voltage circuit, a rheostat (T) and scale plate, a voltage biasing potentiometer or adjustable resistor (P), a printed circuit board containing static timing components; an output relay (TR), and an indicating contactor switch (ICS). An auxiliary relay (TX) is supplied on some TD-5 relays to override bounce of the initiating contact.

TR and TX are printed circuit board mounted miniature power relays.

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 ABB representative should be contacted.

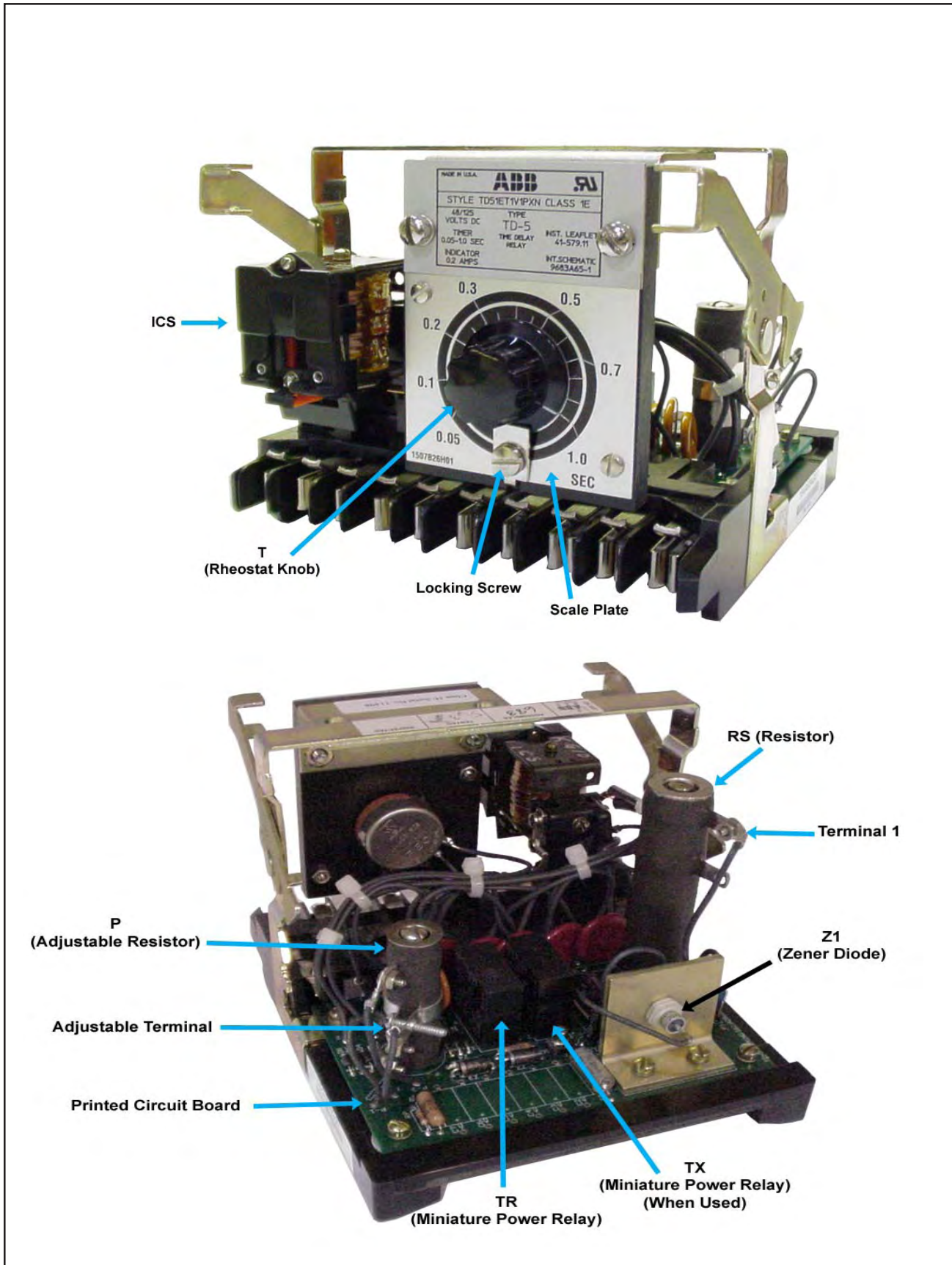


Figure 1. TD-5 Relay Front and Rear Views, Out of Case

TABLE OF REPLACEABLE PARTS					
COMPONENT DESIGNATION	TIME DELAY (SECONDS)	VOLTAGE RATING (VOLTS DC)	PARTNAME	DESCRIPTION	STYLE NUMBER
C1-C7	ALL	48/125 & 24/32	CAPACITOR	22UF 35V 10% TANTALUM	184A661H16
		250	CAPACITOR	22UF 50V 10% TANTALUM	184A661H17
C8, C10	ALL	ALL	CAPACITOR	0.01 UF 20% 3KV CERAMIC	3536A32H02
C9	ALL	ALL	CAPACITOR	0.1 UF 20% 500V CERAMIC	184A663H14
D1-D6	ALL	ALL	DIODE	1N5398	188A342H24
SCR	ALL	48/125 & 24/32	RECTIFIER	2N885 SILICON CONTROL RECTIFIER	185A517H02
		250	RECTIFIER	2N886 SILICON CONTROL RECTIFIER	185A517H03
P	ALL	48/125	RESISTOR	150 OHM 25W 5% ADJ	05D1327H74
	0.05-1 & 0.05-0.4	250	RESISTOR	1180 OHM 25W 5% ADJ	05D1328H27
	1.5-30 & 0.2-4	250	RESISTOR	750 OHM 25W 5% ADJ	05D1328H19
	ALL	24/32	RESISTOR	50 OHM 25W 5% ADJ	05D1327H55
RL	0.05-1 & 0.05-0.4	48/125 & 24/32	RESISTOR	1K 1/2W 1%	862A376H01
		250	RESISTOR	1K 3W 5%	184A636H08
		ALL	RESISTOR	5.6K 1/2W 1%	862A376H73
RP	0.05-1 & 0.05-0.4	ALL	RESISTOR	62K 1/4W 1%	3535A41H20
	1.5-30 & 0.2-4	ALL	RESISTOR	267K 1/4W 1%	3532A38H42
RS	ALL	48/125	RESISTOR	500 OHM 40W 5% (95 OHM TAP)	187A321H08
	0.05-1 & 0.05-0.4	250	RESISTOR	2240 OHM 40W 5% FIXED	1955651
	1.5-30 & 0.2-4	250	RESISTOR	1900 OHM 40W 5% FIXED	1955649
	ALL	24/32	RESISTOR	45 OHM 40W 5% (22.5 OHM TAP)	184A064H03
TR	ALL	ALL	RELAY	MINIATURE POWER RELAY (6V)	9676A51H01
VR1-VR4	ALL	ALL	VARIATOR	V320LA40B	3509A31H22
T	0.05-1	ALL	RHEOSTAT	40K 2W 10%	9676A50H02
	0.05-0.4	ALL	RHEOSTAT	20K 2W 10%	9676A50H01
	1.5-30 & 0.2-4	ALL	RHEOSTAT	100K 2W 10%	9676A50H03
Z1	ALL	48/125	ZENER	1N2986B 10W 24V	629A798H03
		250	ZENER	1N2999B 10W 56V	629A798H04
		24/32	ZENER	1N2977B 10W 13V	629A798H02
ADDITIONAL COMPONENTS WHEN TX RELAY IS USED					
TX	ALL	48/125 & 250	RELAY	MINIATURE POWER RELAY (48VDC)	9676A51H02
		24/32	RELAY	MINIATURE POWER RELAY (24VDC)	9676A51H03
VR5	ALL	ALL	VARIATOR	V320LA40B	3509A31H22
Z2	ALL	ALL	ZENER	1.5KE200	878A619H01
			ZENER	1N4529 AVALANCHE	837A875H03
Z3	ALL	ALL	ZENER	1.5KE200	878A619H01
			ZENER	1N4529 AVALANCHE	837A875H03
Z4	ALL	250	ZENER	1.5KE200	878A619H01
C11	ALL	48/125 & 250	CAPACITOR	4.7 UF 100V 20%	9645A13H20
		24/32	CAPACITOR	22 UF 50V 20%	9645A13H21
R1	ALL	48/125	RESISTOR	5K 5W 5%	763A129H01
		250	RESISTOR	7.5K 5W 5%	763A129H47
		24/32	RESISTOR	360 OHM 2W 5%	185A207H16
R2	ALL	48/125 & 24/32	RESISTOR	JUMPER	605920-010
R3	ALL	250	RESISTOR	7.5K 5W 5%	763A129H47
JP1	ALL	ALL	RESISTOR	1.5K, 1/2W 1%	848A819H65
		48/125 & 24/32	HEADER	3 POSITION SINGLE ROW	9640A47H01
JP1	ALL	250	HEADER	NOT REQUIRED	NONE
		48/125 & 24/32	JUMPER	BLUE CLIP	3532A54H01
JP1	ALL	250	JUMPER	NOT REQUIRED	NONE

2.1 REFERENCE VOLTAGE CIRCUITS

The reference voltage circuit provides a fixed supply voltage to the R-C time delay circuit and protects the static components from high voltages. It consists of a silicon power regulator and a series resistor.

The silicon power regulator (Z or Z1) is a 10 watt Zener diode mounted on an aluminum heat sink. The series resistor (RS) is a 3-1/2 inch 40 W resistor which is tapped for 24/32 VDC and 48/125 VDC relays, and fixed for 250 VDC relays.

2.2 RHEOSTAT (T) AND SCALE PLATE

The rheostat (T) provides a variable resistance for the R-C time delay circuit. The timing scale is non-linear, as explained in *Section 2.4, Printed Circuit Board*.

Please note, do not remove the knob from the rheostat shaft, since it is not easy to replace the knob in the calibrated position.

2.3 POTENTIOMETER (P)

The potentiometer (P) is a 2 inch wire-wound adjustable resistor. (See Figure 1 respectively). The adjustable terminal on the resistor should not be loosened at any time, unless the relay is being re-calibrated.

The potentiometer (P) provides a biasing voltage, which keeps the silicon-controlled rectifier (SCR) turned off until the capacitor voltage reaches the potentiometer brush voltage. The same functionality is achieved when (P) is an adjustable resistor. For simplicity, (P) will be referred to as a potentiometer throughout this IL. Reference to the potentiometer's brush is equivalent to the adjustable terminal on the adjustable resistor.

2.4 PRINTED CIRCUIT BOARD

The printed circuit board (Timer Module assembly) contains the following components:

(see Figure 2):

- Diode D1 to protect the static components in case the TD-5 relay is connected with reverse polarity.
- Limiting timing resistor RL.
- Timing capacitor(s) C1 to C7.
- Resistor RP parallel to C, which makes the calibrating scale non-linear.
- Silicon-controlled rectifier SCR.
- Diode D2 to reverse bias the SCR.
- Diode D3 to protect the static components from the inductive voltage kick associated with the coil of the TR relay.
- Series diodes D4, D5 & D6 to compensate for the forward voltage drop through the SCR and D2, and also compensate for zener (Z1) reference variations
- Filter capacitors C8, C9 & C10.
- Miniature power relays TR and TX, see *Sections 2.5 and 2.6* respectively.
- Varistors VR1 to VR5 across TR and TX relay contacts.
- Adjustable resistor P, see *Section 2.3*.
- Silicon power regulator Z1, and resistor RS, see *Section 2.1*.
- Resistors R1, R2 connected in series with TX coil, see *Section 2.6*
- Resistor R3, capacitor C11, and zener Z2 to protect the static components from the inductive voltage kick associated with the coil of the TX relay, see *Section 2.6*.
- Zener diodes Z3 and Z4.
- Jumper JP1 to select voltage rating.

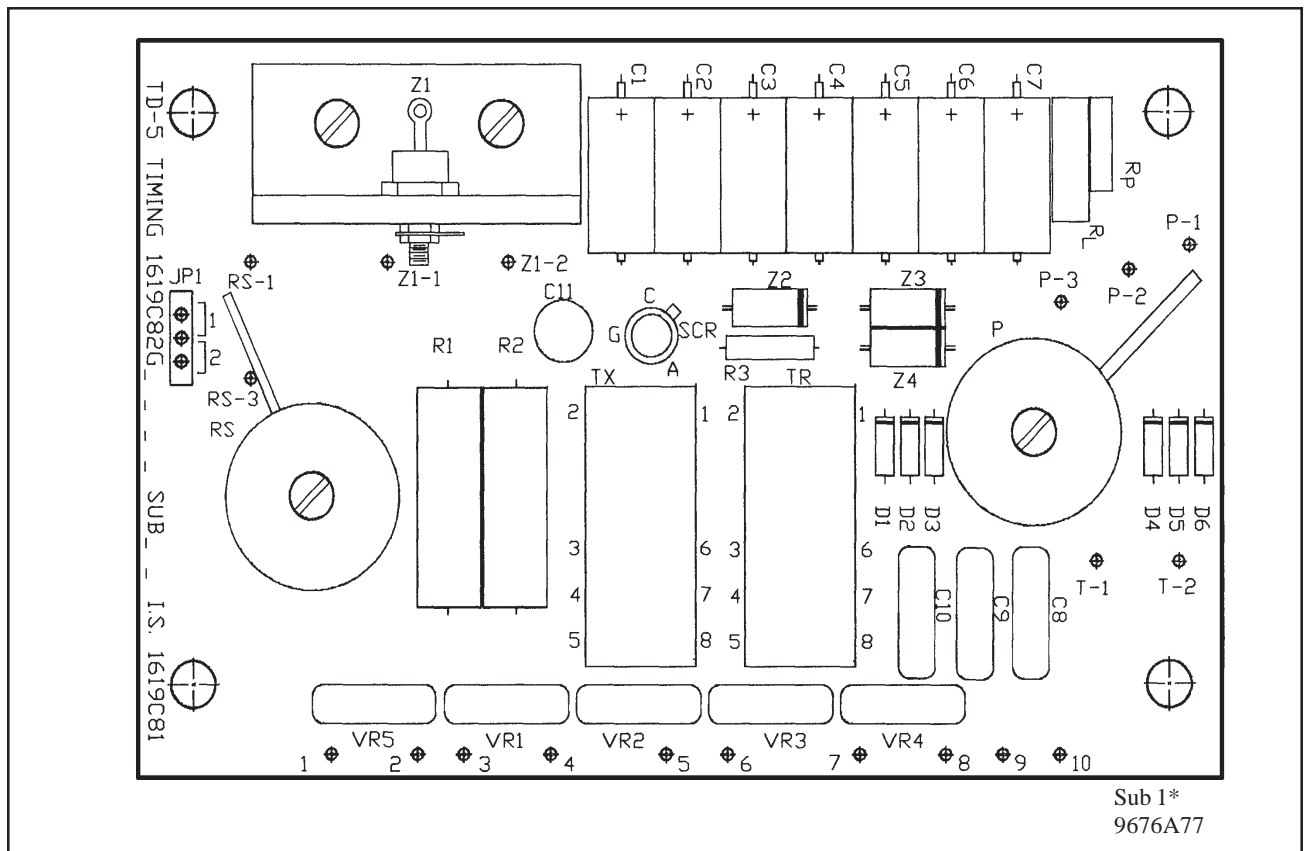


Figure 2. Printed Circuit Board, Component Location

2.5 TR RELAY

Construction:

P.C. board mounted miniature power relay.

Operation:

The TR relay is energized by the SCR at the conclusion of the time delay. Two sets of transfer contacts are provided to give a flexible trip circuit arrangement.

2.6 TX RELAY

Construction:

P.C. board mounted miniature power relay.

Operation:

When used (see Figure 6), the TX relay is energized by the application of dc voltage to the relay. Because of its slow dropout characteristic, a contact of the TX relay is connected externally around the contact of the initiating relay. This maintains voltage to the timing module of the relay if the contact of the initiating relay bounces. Discrete components (a resistor, diode, and capacitor) are connected across the coil of the TX relay to protect the static components from the inductive voltage kicks associated with the coil of the TX relay. Typical operate time for the TX relay is 7 ms. Dropout time is 15 ms.

A jumper JP1 on the printed circuit board is provided on 48/125 VDC and 24/32 VDC relays for setting the resistance that is in series with the coil of the TX relay.

This jumper is preset from the factory in Position 2 for 125 or 32 VDC operations. JP1 should be set to Position 1 in order to change setting from 125 to 48 or from 32 to 24 VDC.

JP1 is not required on 250 VDC relays.

RELAY RATING (VDC)	JP1 POSITION	RELAY OPERATION (VDC)
48/125	1	48
48/125	2	125
24/32	1	24
24/32	2	32

2.7 INDICATING CONTACTOR SWITCH (ICS)

The indicating contactor switch is a small dc operated clapper type device. A magnetic armature, to which leaf-spring mounted contacts are attached is attracted to the magnetic core upon energization 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, 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.

For Class 1E relays, ICS units are available with 0.2, 1.0 or 2.0 amp fixed rating operating current values. The relay nameplate identifies the value of the ICS in the relay.

2.8 OPERATION OF TD-5 RELAY

Operation of the TD-5 relay occurs when the silicon controlled rectified (SCR) switches from a non-conducting state to a conducting state. In the non-conducting state, the SCR acts as an opened switch to prevent energization of the TR relay, but in the conducting state it acts as a closed switch to connect the TR relay to the dc source. To switch the SCR from a non-conducting state to a conducting state requires that a maximum of 20 microamperes flow in the gate of the SCR. This current is produced by the difference in voltage across the capacitor (C) and brush of the potentiometer (P).

When dc voltage is first applied to the relay, voltage instantaneously appears across the potentiometer brush but is delayed in building up across the capacitor in accordance with the R-C time constant of the circuit. As long as the capacitor voltage is less than the potentiometer brush voltage, a reverse voltage appears across the diode D2 and the SCR to keep the silicon controlled rectifier (SCR) biased off.

When the capacitor voltage reaches the potentiometer brush voltage plus approximately one volt (forward voltage drops across SCR and D2), gate current will flow to the silicon controlled rectifier SCR. This current switches the SCR to a conducting state to allow the TR relay to pickup.

The SCR latches on when it switches and can be reset only by removing voltage from terminals 8 and 9 of the relay. If a trip coil supervisory indicator lamp is used when the timer is used and with a fault detector to trip a breaker, the breaker "a" contact must be connected between terminal 8 of the relay and negative.

The rate at which the capacitor charges is determined by the rheostat (T) setting. The charging rate is not a linear function of the rheostat setting, since RP gives a parallel resistive path. This has the effect of expanding the scale for short times and thereby permitting more accurate settings.

3.0 CHARACTERISTICS

The TD-5 relay is available in the following timing ranges:

0.05 - 0.4 seconds

0.05 - 1.0 seconds

0.2 - 4.0 seconds

1.5 - 30 seconds

The relay voltage rating can be 24/32 vdc, 48/125 vdc, or 250 vdc.

3.1 VOLTAGE RATING OVER THE TEMPERATURE RANGE

The relay can stand 110% of rated voltage continuously over a temperature range of -40° C to +70° C.

3.2 REVERSE POLARITY

Diode (D1) limits reverse voltage of the static components to less than one volt dc, so that no damage is done to the circuit by connecting the relay with reverse polarity. However, the relay will, of course, not operate under this condition, and series resistor (RS) may overheat if reverse voltage is applied for approximately 15 minutes or more.

3.3 RESET TIME

TR dropout time = 0.1 sec. or less. TR dropout time of TD-5 Relay with TX contact is an additional 15 msec.

3.3.1 Discharge of timing capacitor:

The discharge of C is essentially instantaneous, the RC time constant through P being less than 20 milliseconds, in most cases. However, the discharge path through P is limited by silicon voltage drops through SCR and D2, totaling approximately one volt. Therefore, C discharges rapidly through P down to about one volt and then more slowly through RP down to zero volts.

BATTERY DRAIN

24 VOLTS DC	32 VOLTS DC	48 VOLTS DC	125 VOLTS DC	250 VOLTS DC
0	0	0	0	0
500 mA	450 mA	240 mA	200 mA	#

= 100 mA for time delay ranges 0.05 - 0.4 and 0.05 - 1.0 seconds,
 115 mA for time delay ranges 0.2 - 4.0 and 1.5 - 30 seconds.

Note: For TD-5 with TX Relay, there is an extra operating drain of 15 mA at 48, 125 and 250 VDC.

3.4 ACCURACY

The accuracy of the time delay depends upon the repetition rate of consecutive timings, the supply voltage, and the ambient temperature. Self-heating has a negligible effect on the time accuracy.

3.4.1 Nominal Setting

The first time delay, as measured with the test circuit shown in Figure 4, taken at 25° C and rated voltage, will be within four milliseconds of its setting for settings of 0.2 seconds or less. For settings above 0.2 seconds, this accuracy will be ±2%.

3.4.2 Consecutive Timings

Incomplete capacitor discharge will cause changes in time delay. These changes are a function of discharge rate. Timing accuracy is shown per Tables 1 and 2.

TABLE 1

Timing accuracy for slow repetitions

RELAY RANGE TIME DELAY (SECONDS)	DELAY BETWEEN READINGS	ACCURACY AS PERCENT OF SETTING
0.05 - 0.4 0.05 - 1.0	AT LEAST 3 SECONDS	+2%
0.2 - 4.0	AT LEAST 5 SECONDS	+2%
1.5 - 30	AT LEAST 5 SECONDS	+2%

TABLE 2

Timing accuracy for fast repetitions

RELAY RANGE TIME DELAY (SECONDS)	DELAY BETWEEN READINGS	ACCURACY AS PERCENT OF SETTING
0.05 - 0.4 0.05 - 1.0	INSTANTANEOUS	+4%
0.2 - 4.0	INSTANTANEOUS	+4%
1.5 - 30	APPROX. 0.5 SEC.	+4%

3.4.3 Supply Voltage

Changes in supply voltage, between 80% and 110% of nominal, cause time delay variations of no more than ±3 milliseconds for settings of 0.3 seconds or less, and no more than ±1% for settings above 0.3 seconds.

3.4.4 Ambient Temperature

Changes in ambient temperature cause changes in time delay. This variation in time delay is a direct function of capacitance change with temperature. Typical variations of time delay with temperature are shown in Fig. 3.

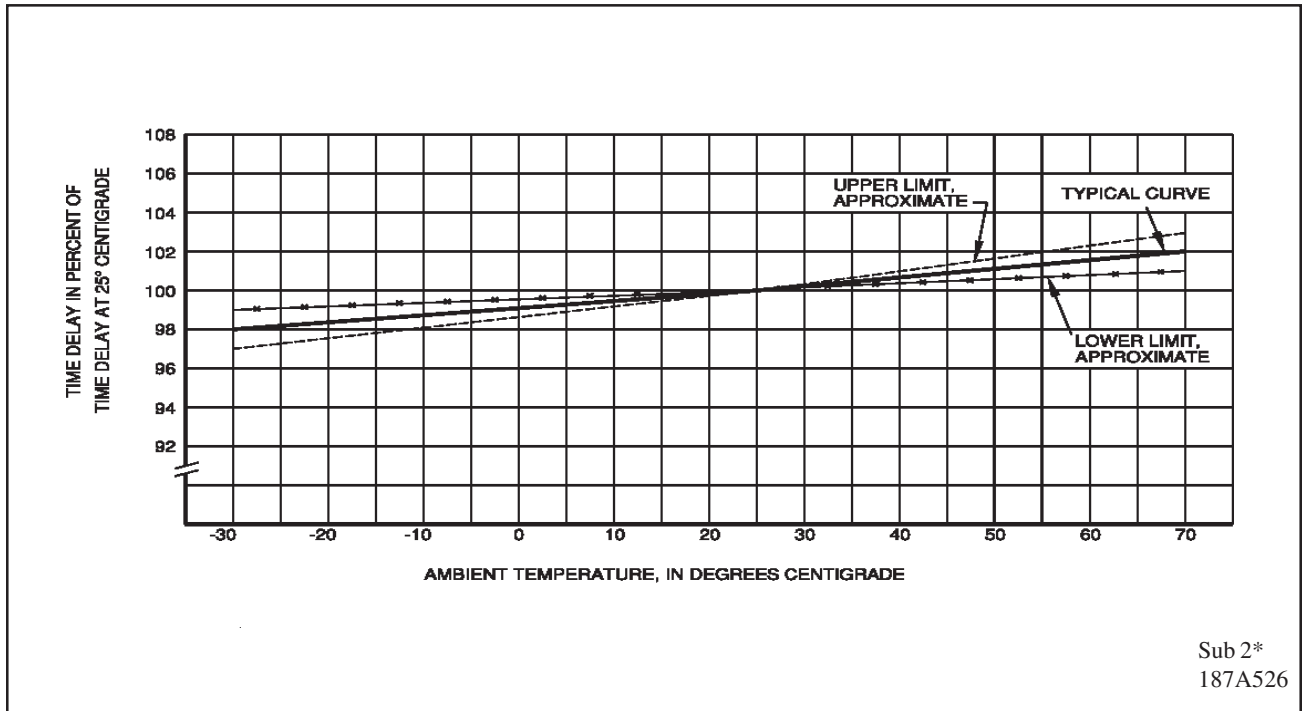


Figure 3. Timing Variations with Temperature Changes

3.5 INDICATING CONTACTOR SWITCH (ICS)

The seal-in contacts of the ICS will safely carry 30 amperes at 250 volts dc long enough to trip a circuit breaker.

TRIP CIRCUIT CONSTANTS INDICATING CONTACTOR SWITCH (TYPICAL VALUES)	
0.2 AMP RATING	8.5 OHMS DC RESISTANCE
1.0 AMP RATING	0.37 OHMS DC RESISTANCE
2.0 AMP RATING	0.10 OHMS DC RESISTANCE

3.6 CONTACT RATING (TR & TX)

Miniature power relay contacts: see table below.

MINIATURE POWER RELAY CONTACTS	@ 125 VDC	@ 250 VDC
TRIPPING DUTY	30A	30A
CONTINUOUS	5A	5A
BREAK	0.3A	0.1A

4.0 RELAY SETTINGS

4.1 TIME DELAY

Time delay is selected by adjusting rheostat T.

For Zone 2 distance applications, the timer setting should be sufficient to allow relays and breakers beyond the next bus to clear the fault. The time should be set to allow successful breaker failure clearing. This usually requires a setting of approximately 0.25 seconds. Zone 3 timing must coordinate with remote Zone 2 timing. A typical setting is 0.5 seconds. Breaker failure timing is set to assure normal fault clearing and fault detector reset plus 2 to 3 cycles margin. Settings of 0.1 to 0.2 second are typical.

4.2 VOLTAGE RATING (RESISTOR - RS)

The correct tap on resistor RS should be selected for the supply voltage being used, per the appropriate internal schematic (see Figures 5 to 6). Note that terminal 1 of the RS resistor has a red dot for ease of identification.

- 48/125 VDC relays are preset from the factory at 125 Volts.
- 24/32 VDC relays are preset from the factory at 32 volts.
- No adjustments are necessary for 250 VDC relays.

4.3 TX RELAY

When the TX relay is used, the correct resistance in series with the coil of the TX relay has to be selected for the supply voltage being used.

To use the relay with a supply voltage of 48 or 24 VDC, move jumper JP1 on Printed Circuit Board to Position 1. This will jumper resistor R1, see Figures 2 and 6.

4.4 INDICATING CONTACTOR SWITCH (ICS)

No setting is required on the ICS.

5.0 INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration, and heat. For semi-flush mounting, install the relay vertically by means of the four mounting holes on the case flange. The mounting screws may also be utilized for grounding the relay. External toothed washers are provided for use in the locations shown on the outline and drilling plan (Fig. 7) to facilitate making a good electrical connection between the relay case, the mounting screws, and the relay panel. Ground Wires should be affixed to the mounting screws as required for poorly grounded or insulated panels. The electrical connections are made directly to the relay terminals by means of screws (also provided).

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

6.0 ADJUSTMENTS AND MAINTENANCE

Note: The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after receipt by the customer. In particular, do not remove knob from rheostat shaft and do not loosen the potentiometer lock nut or adjustable resistor clamp. Upon receipt of the relay, no customer adjustment, other than those covered under relay settings should be required.

6.1 ACCEPTANCE CHECK

The following check is recommended to insure that the relay is in proper working order. Perform a timing check at minimum and maximum settings. A recommended test circuit is shown in Figure 4. When testing the TD-5 with a TX relay make the dotted connection as shown

in Figure 4. The neon lamp will light if the TX relay is operating properly.

6.1.2 Indicating Contactor Switch (ICS)

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 nameplate rating. The indicator target should drop freely.

Repeat above except pass 85% of ICS nameplate rating current. Contacts should not pickup and target should not drop.

6.2 ROUTINE MAINTENANCE

All relays should be inspected and checked periodically to assure proper operation. Generally a visual inspection should call attention to any noticeable changes.

All contacts should be cleaned periodically. 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. Also, a calibration check should be performed once a year to detect any electronic component failures which can occur on a random basis.

Potentiometers, tantalum capacitors, and plastic cased semi-conductors may have a common mode failure characteristic and routine replacement is recommended on the following schedule:

Tantalum Capacitors	C, C1 to C7	10 years
Potentiometer	P	5 years
Rheostat	T	5 years
Diodes	D1 to D6	10 years

Recalibration is necessary whenever any of these components are changed.

6.3 TROUBLE SHOOTING PROCEDURE

Use the following procedure to locate the source of trouble if the TD-5 is not operating correctly.

1. Inspect all wires and connections, paying particular attention to telephone relay and printed circuit board terminals.
2. Check the reference voltage circuit. This is done by measuring the dc voltage across the silicon power regulator, Z or Z1. Connect the dc voltmeter positive terminal to the bottom terminal of RS and the negative terminal to relay terminal 8. Apply rated voltage per the test circuit diagram, Figure 4. The Zener voltage should be between 11.0 and 14.0 volts for 24/32 VDC relays, between 21.5 and 25.5 volts for 48/125 VDC relays, and between 50 and 59 volts for 250 VDC relays.
3. Check the timing capacitor voltage and the P potentiometer brush voltage with an oscilloscope or a high resistance dc voltmeter.

Connect between adjustable terminal of P and relay terminal 8.

The brush voltage, which is constant until the TR relay trips, should be approximately one half the reference voltage. The capacitor should gradually change to the potentiometer brush voltage, plus approximately one volt for silicon junction forward voltage drops through SCR and D2.

4. If reference voltage, capacitor voltage, and potentiometer voltage all appear to be correct, the SCR may be the cause of trouble. The anode to cathode voltage, as measured, should be approximately one-half the reference voltage until the capacitor voltage reaches the P brush voltage, at which time the anode to cathode voltage should drop to approximately one volt.

Measure between anode of D3 and adjustable terminal of P.

7.0 CALIBRATION

Use the following procedure for calibrating the relay if the relay has been taken apart, or the adjustments have been disturbed. This procedure should not be used until it is apparent that the relay is not in proper working order. (See *Acceptance Check*, Section 6.1). Before calibrating, follow the *Trouble Shooting Procedure*, Section 6.3, to locate the source of trouble.

7.1 TR, TX RELAY ADJUSTMENT

No adjustments are necessary.

7.2 RHEOSTAT KNOB ADJUSTMENT (SAME SCALE)

If it is necessary to replace the rheostat (T) or the silicon power regulator (Z or Z1), in most cases the relay may be recalibrated with the same scale plate.

This is done by rotating the rheostat shaft, without knob, until a time delay equal to the minimum scale marking is obtained. Then, align the knob for this delay and tighten the knob set screw securely. Pause several seconds between readings for all delays above .05 seconds. See *section 3.4 Accuracy* for discussion of this.

7.3 SCALE PLATE CALIBRATION (NEW SCALE)

If it is necessary to replace the potentiometer P or the Printed Circuit Board, the relay should be recalibrated with a new scale plate. Use the following procedure:

1. With the knob off the shaft, set the rheostat (T) at maximum.
2. Adjust P so that the times are 5% to 10% longer than the maximum scale marking.
3. Set the rheostat T at minimum and check that times are less than or equal to the minimum scale marking. If not, adjust P slightly to reduce times. Tighten locknut or adjustable terminal on P.
4. Place the knob on the rheostat shaft in such a position that the times are symmetrical with respect to the scale plate marking. Tighten the knob setscrew and mark calibration lines on the scale plate. When striking calibration lines for delays above 0.5 seconds, pause at least 3 seconds between readings. See Section 3.4

7.4 INDICATING CONTRACTOR SWITCH (ICS)

Initially adjust ICS unit on the pedestal so that armature fingers do not touch the yoke in the rest position, (viewed from top of switch between cover and frame). This can be done by loosening the mounting screw in the molded pedestal and moving the ICS in the downward position.

Contact Wipe - Adjust the stationary contacts so that both stationary contacts make with the moving contacts simultaneously and wipe is 1/64" to 3/64" when the armature is against the core.

Target - Manually raise the moving contacts and check to see that the target drops at the same time as the contacts make or up to 1/16" ahead. The cover may be removed and the tab holding the target reformed slightly

if necessary. However, care should be exercised so that the target will not drop with a slight jar.

Pickup - The unit should pickup at 98% of rating and not pickup at 85% of rating. If necessary, the cover leaf springs may be adjusted.

To lower the pickup current use a tweezer or similar tool and squeeze each leaf spring approximately equally by applying the tweezer between the leaf spring and the front surface of the cover at the bottom of the lower window.

If the pickup is low, the front cover must be removed and the leaf spring bent outward equally.

8.0 RENEWAL PARTS

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

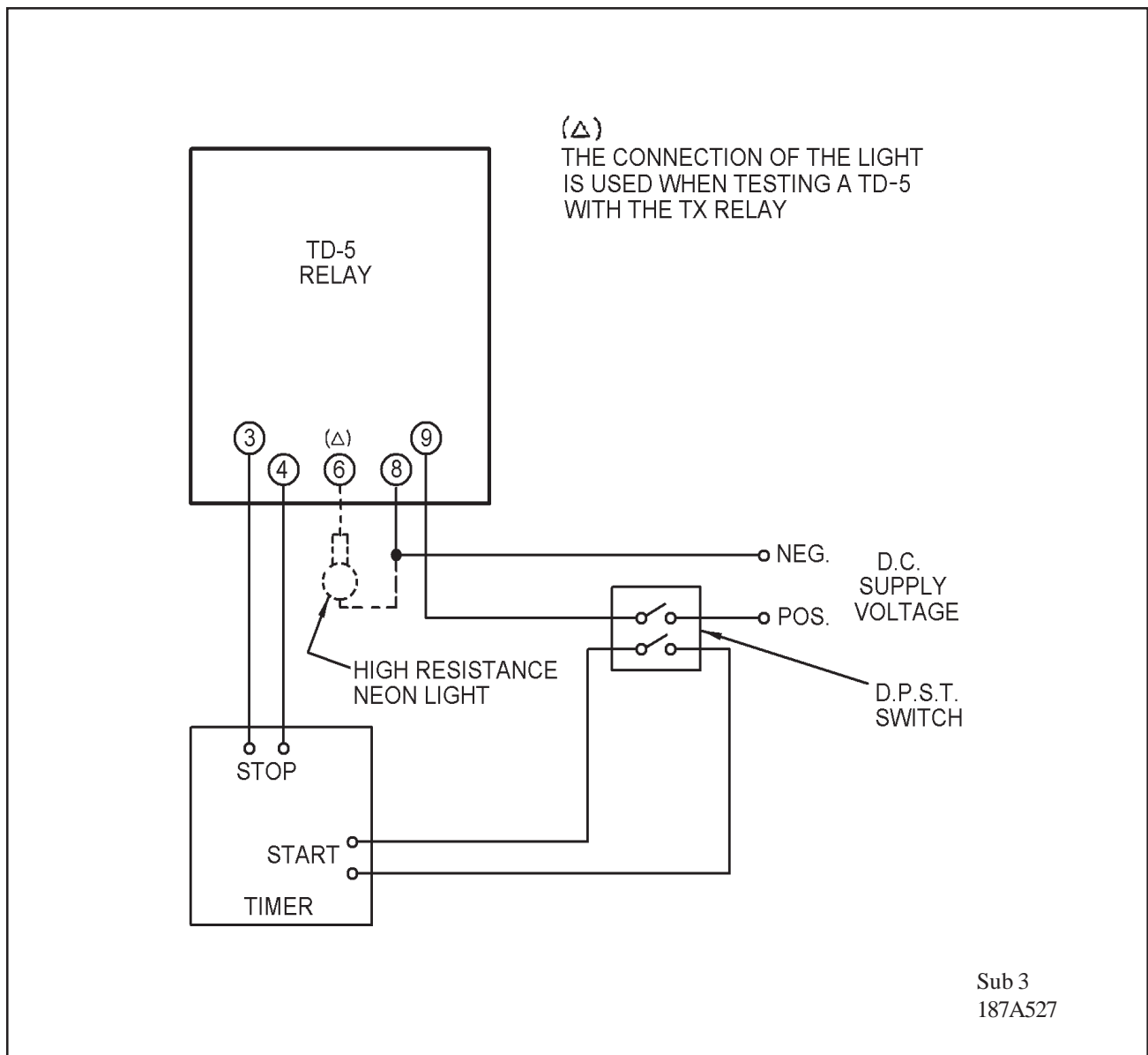


Figure 4. Test Circuit for Type TD-5 Relay

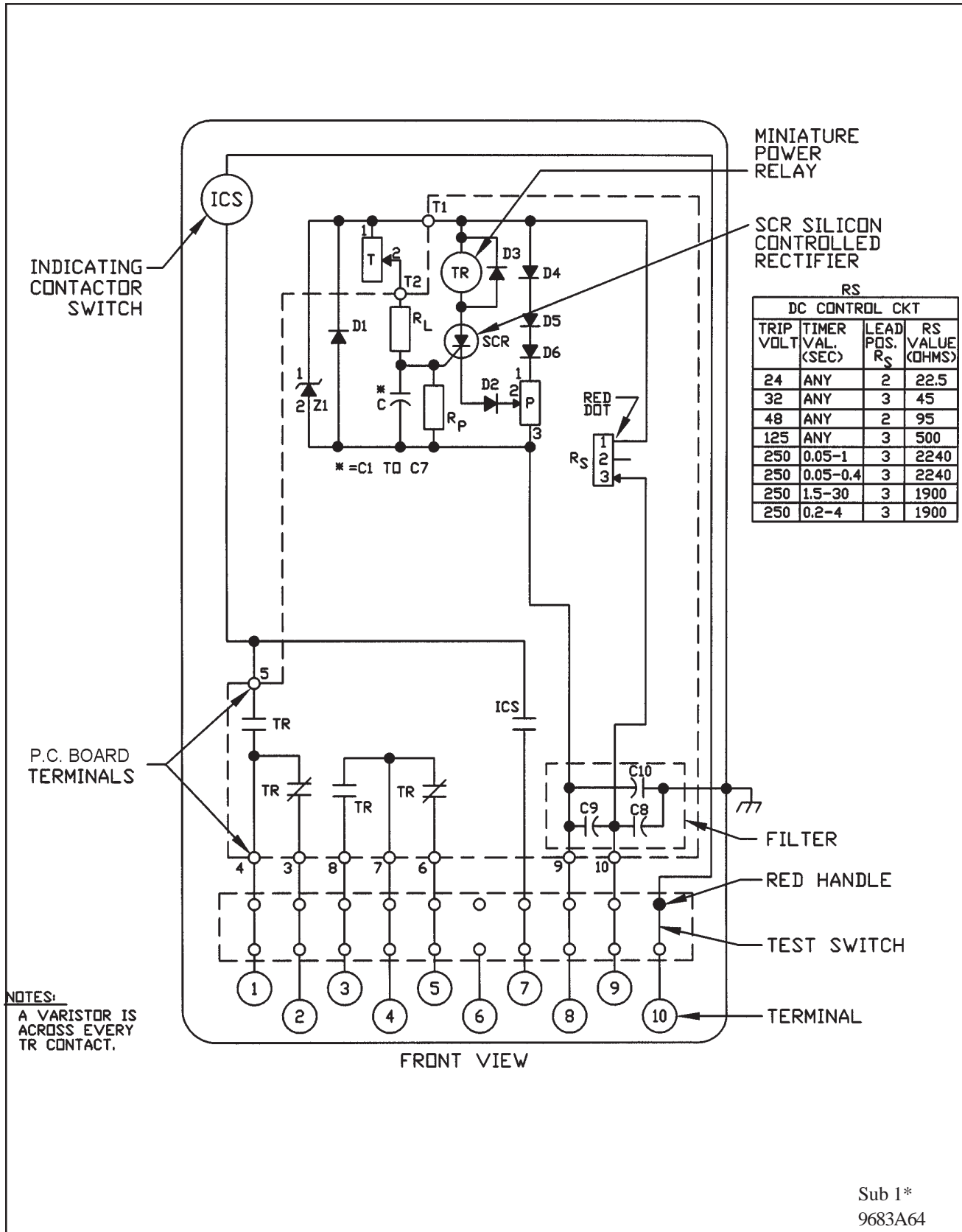


Figure 5. Internal Schematic of TD-5 Class 1E Relay in FT-11 Case

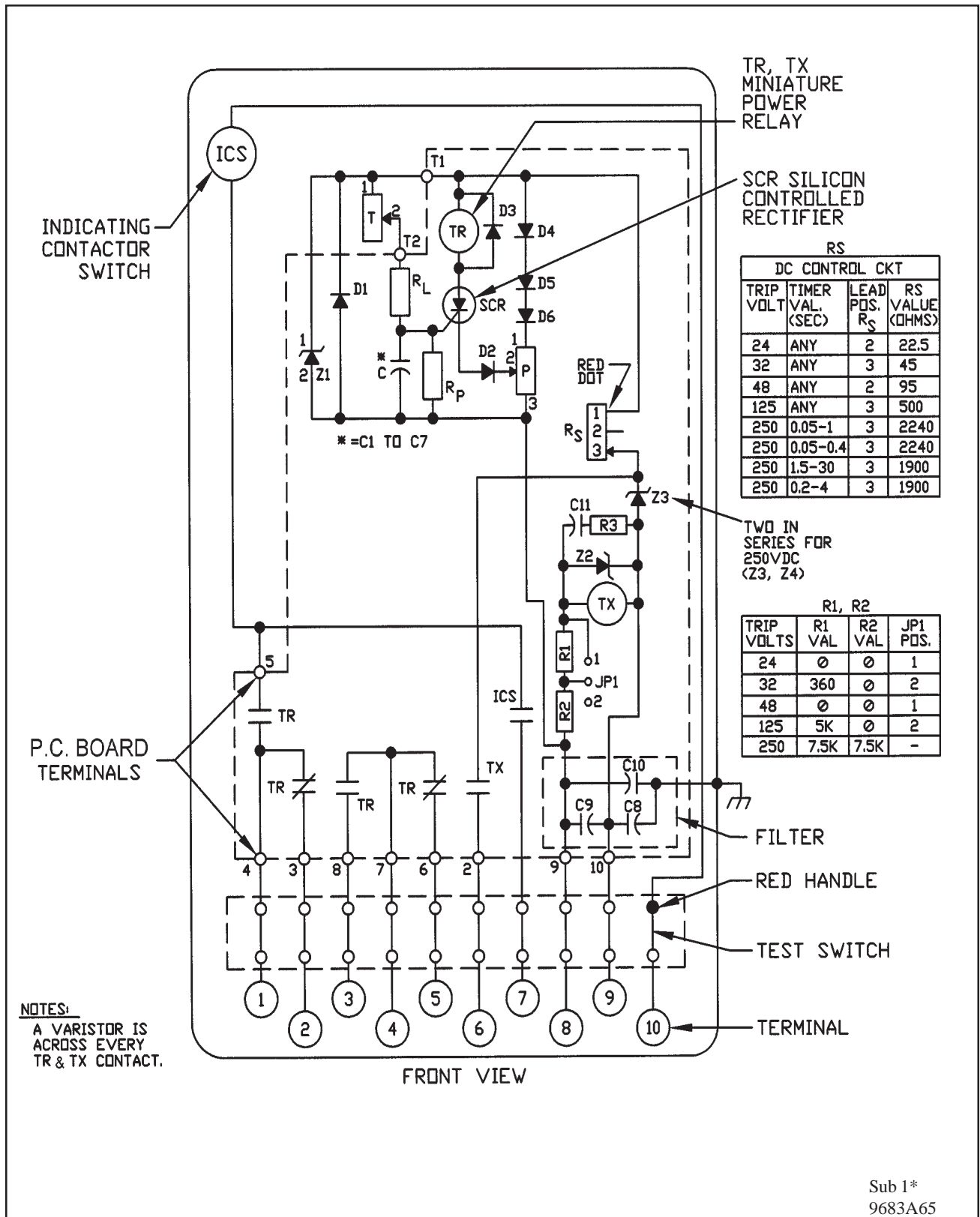


Figure 6. Internal Schematic of TD-5 Class 1E Relay in FT-11 Case, with TX Relay

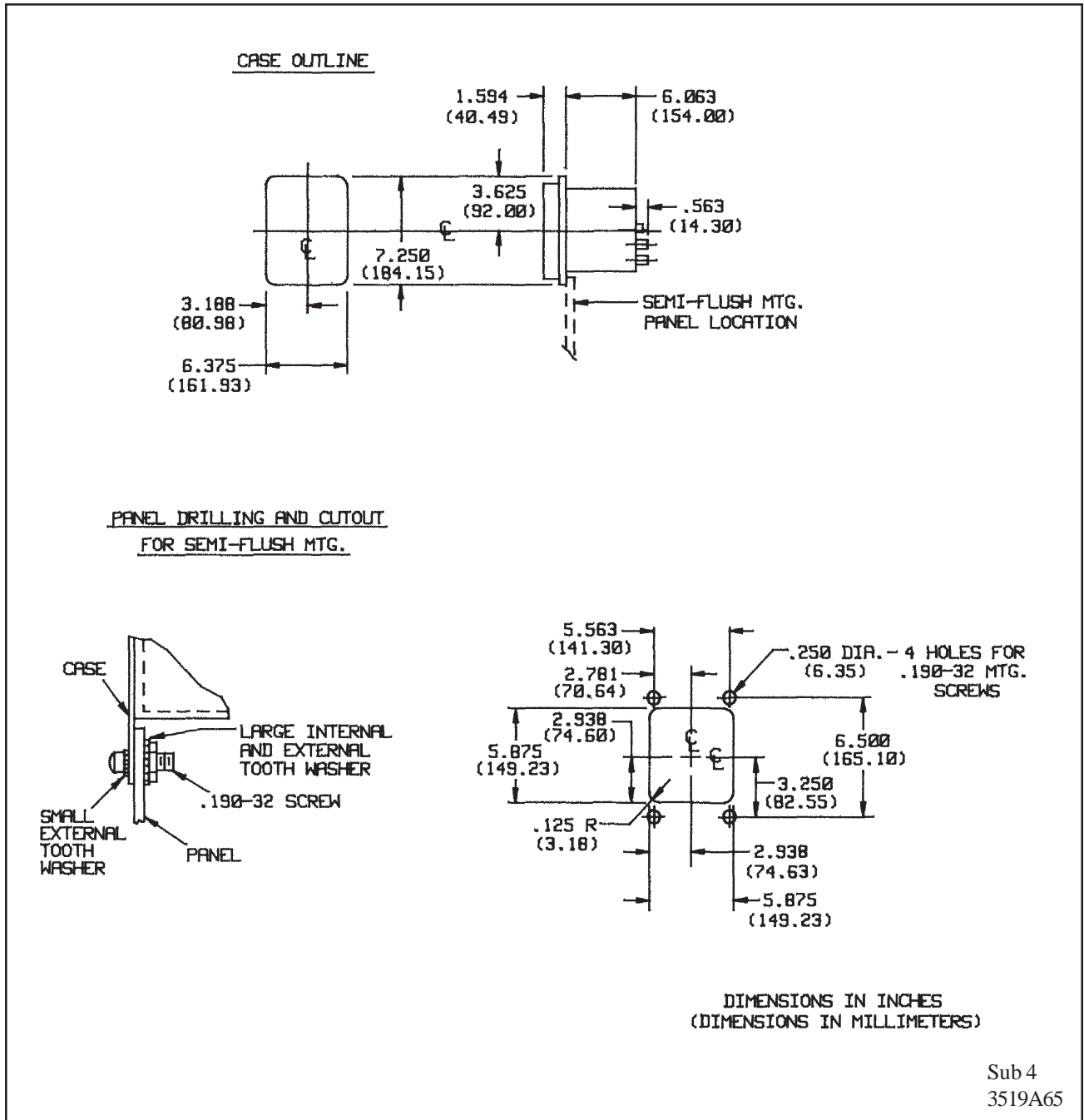


Figure 7. Outline and Drilling Plan for Type TD-5 Class 1E Relays in FT-II Case



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