ABB Inc.
BU Substation Automation and Protection
Coral Springs, FL 33065

Instruction Leaflet

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TYPE COM Overcurrent Relay

Class 1E Applications

CONTENTS

This instruction leaflet applies to the following types of relays:

COM-2	**Short Time Relay**
COM-5	**Long Time Relay**
COM-6	**Definite Minimum Time Relay**
COM-7	**Moderately Inverse Time Relay**
COM-8	**Inverse Time Relay**
COM-9	**Very Inverse Time Relay**
COM-11	**Extremely Inverse Time 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. Operate the relay to check the settings and electrical connections.

1.0 APPLICATION

These relays have been specially designed and tested to establish their suitability for Class 1E applications in accordance with the ABB Relay Division program for Class 1E Qualification Testing as detailed in bulletin STR-1.

COM relays may be applied wherever two instantaneous overcurrent units are required in addition to the time overcurrent unit. For example figure 19, page 27 shows how the COM-5 (long time) relay is used for motor protection, with the CO-5 unit alarming just above motor full load and tripping at higher overloads, through the low set SSC-T unit; the high set instantaneous unit is set above locked rotor current to provide high speed tripping of heavy faults. Figure 20 (page 28) shows how another variation of COM-5 provides improved fault protection for a motor by delaying SSC-T tripping by 5 to 6 cycles to override the asymmetrical current following fast transfer.

2.0 CONSTRUCTION AND OPERATION

The type COM relays, figure 1 & 2 (page 2), consist of a time-overcurrent unit (CO), two indicating contactor switches (ICS), a indicating instantaneous trip unit (IIT) and a high drop out instantaneous unit (SSC-T) or (IITH, obsolete). The principal component parts of the relay are shown in figures 3 to 5 COM-5 Class 1E Relay (Rear View) on page 2.

2.1 ELECTROMAGNET

The electromagnets for the types COM-5, COM-6, COM-7, COM-8 and COM-9 relays have a main tapped coil located on the center leg of an “E” type laminated structure that produces a flux which divides and returns through the outer legs. A shading coil causes the flux through the left leg to lag the main pole flux. The out-of-phase fluxes thus produced in the air gap cause a contact closing torque.

The electromagnets for the types COM-2 and COM-11 relays have a main coil consisting of a tapped primary winding and a secondary winding. Two identical coils on the outer legs of the lamination structure are connected to the main coil secondary in a manner so that the combination of all the fluxes produced by the electromagnet result in out-of-phase fluxes in the air gap. The out-of-phase air gap fluxes produced cause a contact closing torque.

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 Inc. representative should be contacted.

Printed in U.S.A.

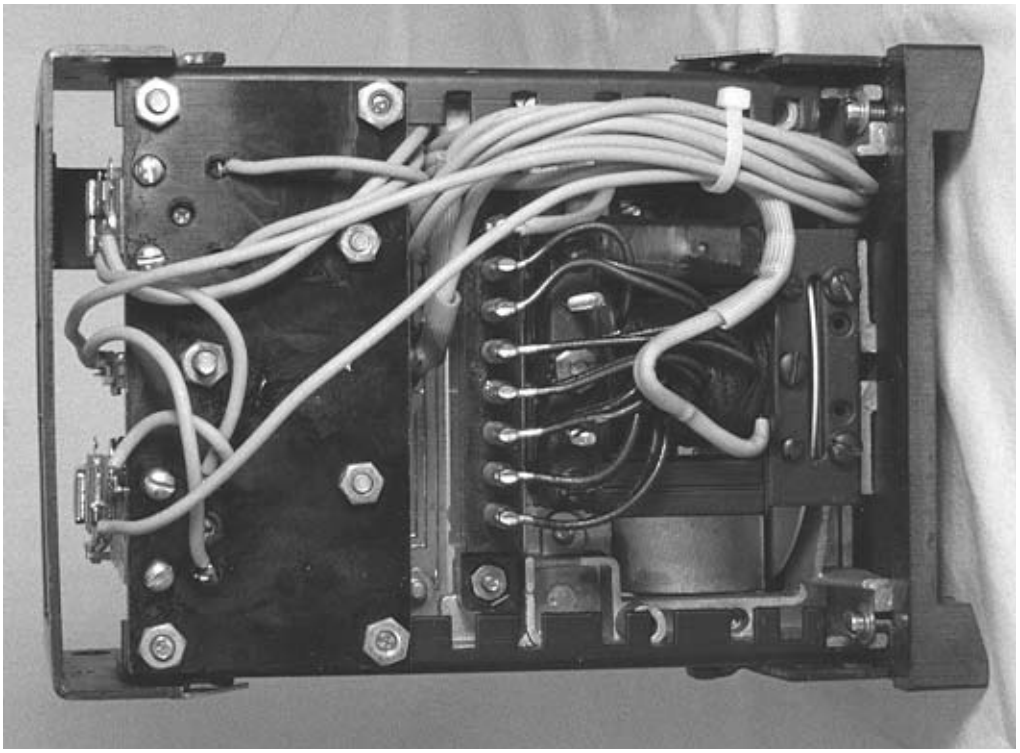

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Figure 2: COM-5 Class 1E Relay (Rear View)

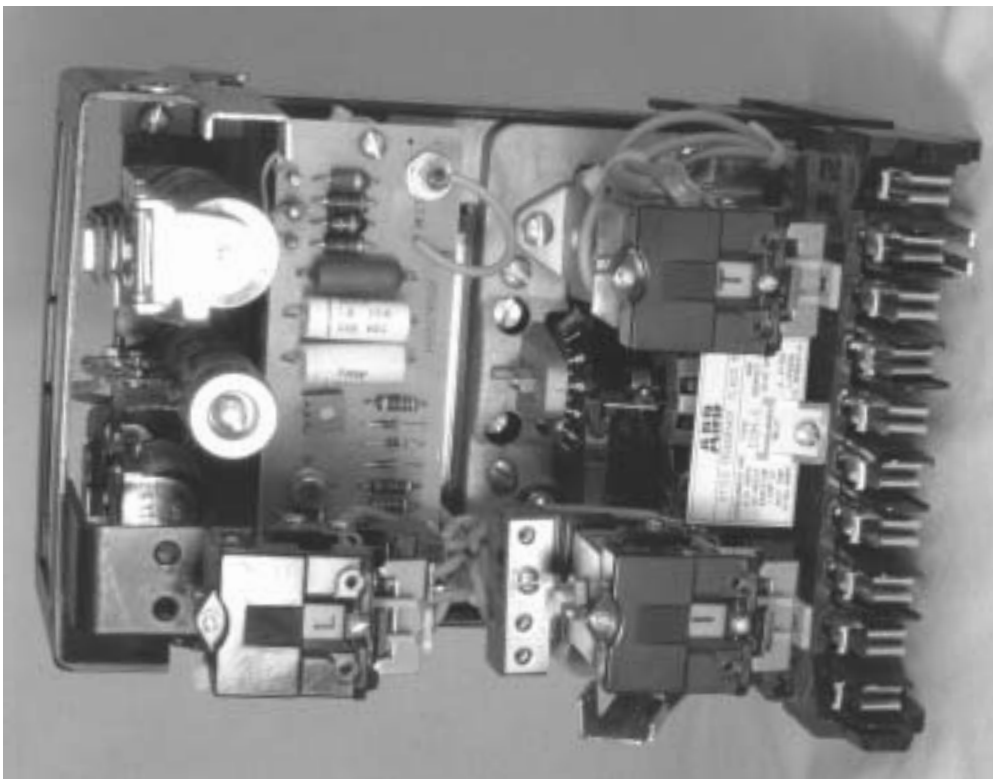

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Figure 1: COM-5 Class 1E Relay (Front View)

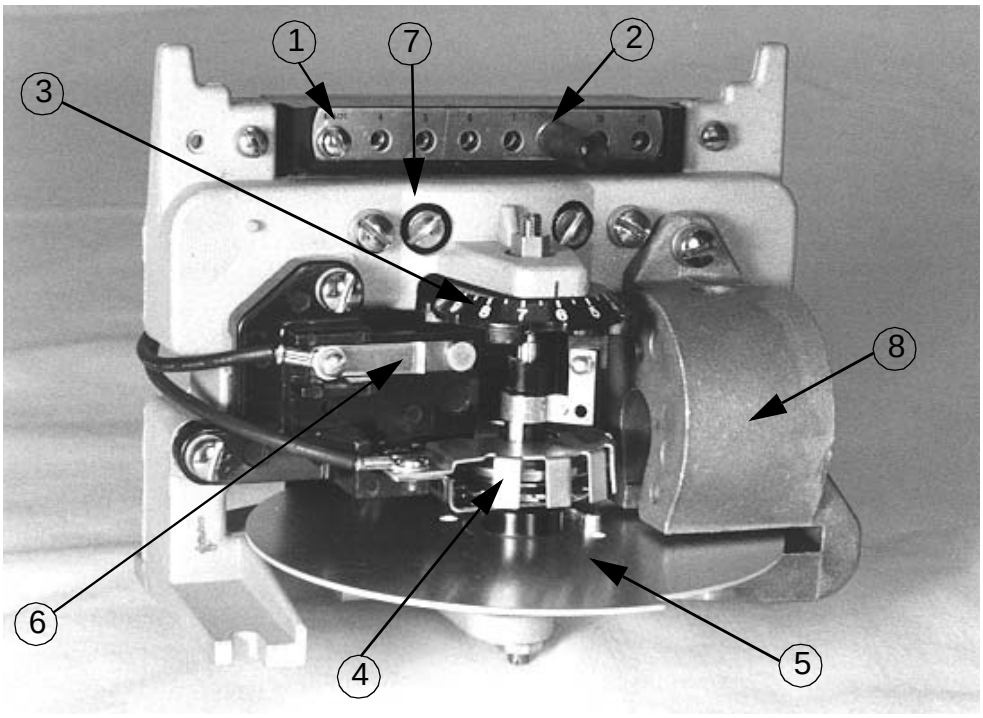

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Figure 3 :Time Overcurrent Unit (Front View)

1. *Tap Block*
2. *Tap Screw*
3. *Time Dial*
4. *Control Spring Assembly & Moving Contact*
5. *Disc*
6. *Stationary Contact Assembly*
7. *Magnetic Plugs*
8. *Permanent Magnet*

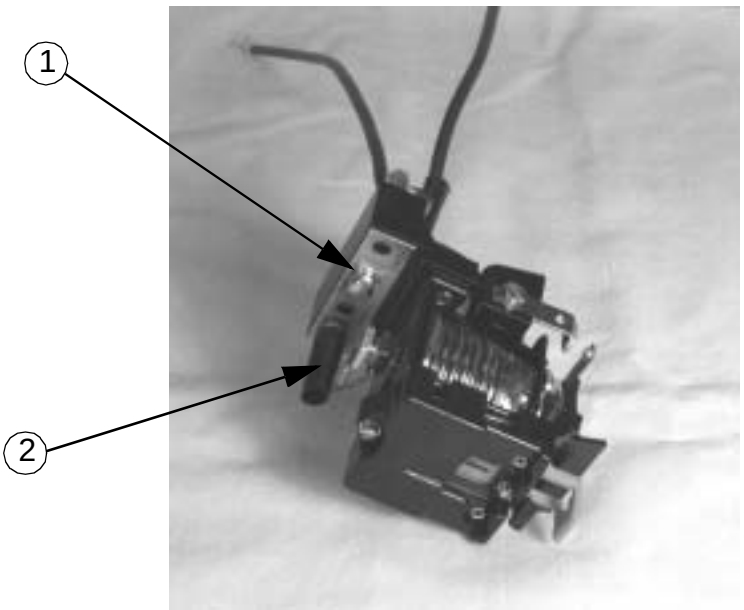

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Figure 4 :Indicating Instantaneous Trip Unit (IIT)

1. *Tap Block*
2. *Tap Screw*

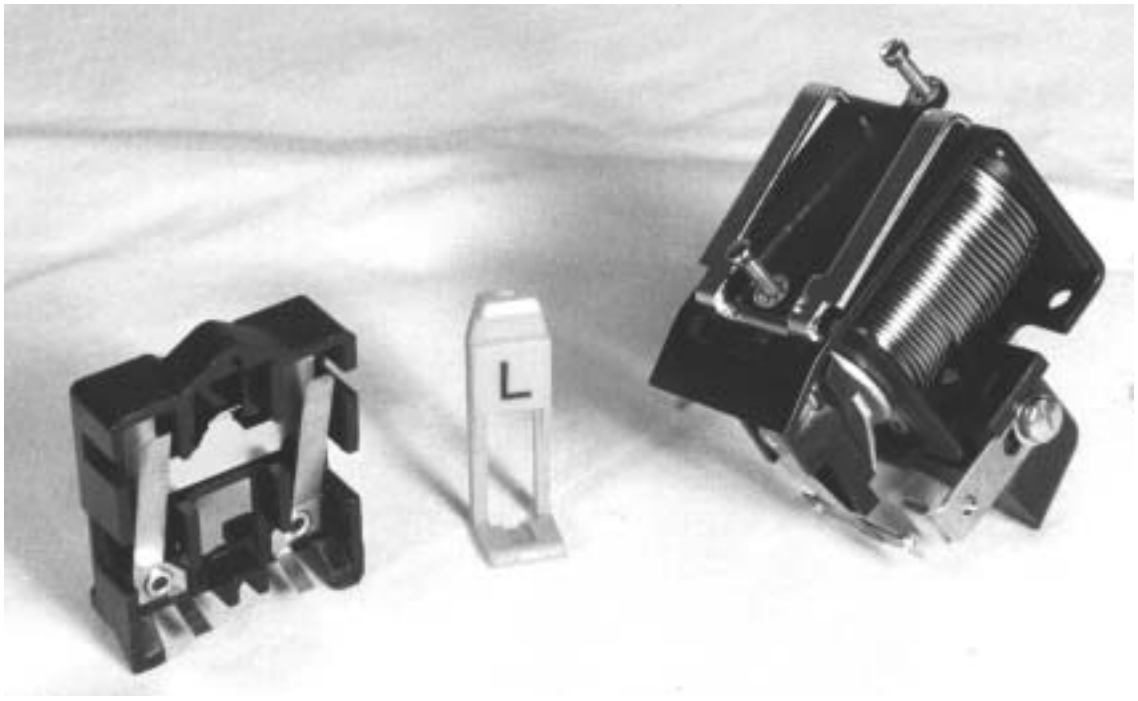


Figure 5: Indicating Contactor Switch (ICS).

2.2 INDICATING CONTACTOR SWITCH UNIT (ICS)

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 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 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 INSTANTANEOUS TRIP UNIT (IIT)

The instantaneous trip unit is a small ac operated clapper type device with tapped coil. 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 the operation, two fingers on the armature deflect a spring located on the front of the switch which allows the operation indicator target to drop.

A core screw accessible from the top of the switch provides the adjustable pickup for each tap range. The minimum and maximum pick-up points are indicated on the scale which is located to the rear of the core screw. The setting range for the IIT unit is 6-144 amperes.

2.4 SSC-T

The SSC-T unit consists of a small input transformer, printed circuit module, and output relay. The printed circuit module (refer to figure 22, page 29), contains rectifying and filtering components for level sensing and for a power supply to operate the sensing circuit and the telephone type output relay. (See location drawing figure 21, page 29.)

For overcurrent detection, transistor Q2 is normally not conducting and the telephone relay is deenergized. Transistor Q1 is used as an emitter follower. When ac current is applied to the primary of the transformer, a voltage is produced on the secondary side that is proportional to the input. Rheostat (R2) is for the pick-up setting. When voltage from rectifiers Z1, Z2, and capacitor C2 exceeds the breakdown voltage of Zener diode Z5, the Zener diode conducts to turn on transistor Q2 and operate the telephone relay (SSC-T Relay) per schematic of figure 17, page 25.

2.5 AUXILIARY TIME-DELAY UNIT (T)

This slugged telephone type unit, in conjunction with a tapped resistor, provides a 5-6 cycle delay on pickup. The resistor in the front of the relay is tapped for use with 24, 48, 125 or 250 volt dc supply, as shown in the internal schematics of figures 15 & 16, page 23 and page 24.

3.0 CHARACTERISTICS

3.1 TIME-OVERCURRENT UNIT (CO)

The relays are generally available with CO units in the following current ranges:

Range	Taps
0.5 – 2.5	0.5 0.6 0.8 1.0 1.5 2.0 2.5
2 – 6	2 2.5 3 3.5 4 5 6
4 – 12	4 5 6 7 8 10 12

The time vs. current characteristics are shown in figures 6 to 12 (beginning on page 14). These characteristics give the contact closing time for the various time dial settings when the indicated multiples of tap value current are applied to the relay.

3.2 IIT UNIT

Time of operation of the IIT unit at twice pickup is 35 milliseconds or less.

3.3 OVERCURRENT RELAY SSC-T

Range:	0.5 - 2 Amps 2.0 - 8 Amps 4.0 - 16 Amps 10 - 40 Amps
Continuous Rating:	Highest Current of range setting or 10 Amps whichever is lower
1 Second Rating:	20 Times the continuous rating
Temperature Error:	2% between -20°C and +65°C
Dropout Ratio:	90% to 98%
Response Time:	Pickup Time = (10-13) ms Dropout Time = (10-26) ms For 2 to 15 times pickup setting value, see curve 619507 (figure 23, page 30)
Transient Overreach:	5% of setting
Frequency Response:	Curve No. 619505 (figure 24)

3.4 TRIP CIRCUIT

The main contacts will safely close 30 amperes at 250 volts dc and the seal-in contacts of the indicating contactor switch will safely carry this current long enough to trip a circuit breaker.

The IIT and SSC-T contacts will safely close 30 amperes at 250 volts dc, and will carry this current long enough to trip a breaker.

Three different operate level ratings for the ICS are available.

Trip Circuit Constants
Indicating Contactor Switch Coil

Ampere Pickup	Ohms dc Resistance
0.2	8.5
1.0	0.37
2.0	0.10

4.0 SETTINGS

CAUTION

<u>In order to avoid opening current transformer circuits when changing taps under load, the relay must first be removed from the case</u>. Chassis operating shorting switches on the case will short the secondary of the current transformer. The taps should then be changed with the relay outside of the case and then reinserted into the case. Since the tap block connector screw carries operating current, be sure that the screw is turned tight.

4.1 CO UNIT

The overcurrent unit settings can be defined either by tap setting and time dial position or by tap setting and a specific time of operation at some current multiple of the tap setting (e.g. 4 tap setting, 2 time dial position or 4 tap setting, 0.6 seconds at 6 times tap value current for the COM-7. See figure 9 page 17).

To provide selective circuit breaker operation, a minimum coordinating time of 0.3 seconds plus circuit breaker time is recommended between the relay being set and the relays with which coordination is to be effected.

The tap screw on the tap block above the time dial, figure 3, page 2, makes connections to various turns on the operating coil. By placing this screw in the various terminal plate holes, the relay will respond to multiples of tap value currents in accordance with the various typical time-current curves.

4.2 INSTANTANEOUS RECLOSING

The factory adjustment of the CO unit contact provides a contact follow. Where instantaneous circuit breaker reclosing will be initiated upon the closure of the CO contact, this contact follow must be eliminated by loosening the stationary contact mounting screw, removing the contact plate and then replacing the plate with the bent end resting against the contact spring. With this change and the contact mounting screw tightened, the stationary contact will rest solidly against its backstop.

4.3 INDICATING CONTACTOR SWITCH (ICS)

No setting is required on the ICS unit.

4.4 INDICATING INSTANTANEOUS TRIP (IIT)

CAUTION

Since the tap block connector screw on the IIT unit carries operating current, be sure that the screw is turned tight. To avoid opening the current circuits under load, do not change tap position without first opening all the case mounted test switches starting with the RED handle switch first. Close the RED handle switch last, after all tap changes have been completed, to put the relay back into service

The proper tap must be selected (figure 4, page 3) and the core screw must be adjusted to the value of pick-up current desired.

The nameplate data will furnish the actual current range that may be obtained from the IIT unit. It is recommended that the IIT be set on the higher tap where there is a choice of tap settings. For example, for a 20 ampere setting use the 20 to 50 tap rather than the 6 to 20 tap.

4.5 SSC-T UNIT

The pickup setting is a screw driver adjustment made by adjusting rheostat R2 for the desired level of current. Refer to figure 22, page 29, for the location of R2 on the printed circuit module. A clockwise rotation increases the trip level while a counterclockwise rotation decreases the tripping level.

4.6 TAPPED RESISTOR (WHEN USED)

The relay is shipped with the resistor tapped for 125 volt dc service. See Figure 15 or 16, page 23 and page 24 for the proper positions for other dc ratings. When viewed from the front of the relay the red dot on terminal 1 of the resistor is next to the sub-base.

5.0 INSTALLATION

These relays have been specially designed and tested to establish their suitability for Class 1E applications in accordance with the ABB Power T&D Company program for Class 1E Qualification Testing as detailed in bulletin STR-1.

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 the semi-flush type FT case. The mounting screws may be utilized for grounding the relay. External toothed washers are provided for use in the locations shown on the outline and drilling plan to facilitate making a good electrical connection between the relay case, its mounting screws and the relay panel. Ground wires should be affixed to the mounting screws as required for poorly grounded or insulated panels. Other electrical connections may be made directly to the terminals by means of screws for steel panel mounting.

For detail information on the FT case see figure 25. Refer to I.L. 41-076 for additional information.

6.0 ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory. Upon receipt of the relay no customer adjustments, other than those covered under “SETTINGS” should be required.

6.1 ACCEPTANCE CHECK

The following check is recommended to insure that the relay is in proper working order:

1. Contacts – For relays identified with a “T”, located at lower left of stationary contact block,

ENERGY REQUIREMENTS

IIT Unit (60 Hz)

Range of IIT	Tap Setting	Ohms at Minimum Pickup	Min. Pickup	Volt Amps @ 5 amps	Continuous Current	1 Sec. Rating
6-144 Amps	6-20 Amps 20-50 Amps 50-144 Amps	0.18 ∠37° .026 ∠27° .009 ∠13°	6 20 50	4.5 .65 .225	6 Amp 13 Amp 20 Amp	100 Amp 230 Amp 370 Amp

SSC-T Unit (60 Hz)

Range (Amps)	Pickup Current Setting			
	Lowest Setting		Highest Setting	
	VA	P.F. Angle Ø	VA	P.F. Angle Ø
0.5 - 2.0	0.5	8.5°	4.0	12.5°
2.0 - 8.0	0.5	8.5°	5.0	12.5°
4.0 - 16.0	0.5	8.5°	5.0	15.5°
10.0 - 40.0	0.8	10.0°	8.0	10.7°

CO Unit of Type COM-2 Relay

AMPERE RANGE	TAP	CONTINUOUS RATING (AMPERES)	ONE SECOND RATING[a] (AMPERES)	POWER FACTOR ANGLE[b]	VOLT AMPERES[c]			
					AT TAP VALUE CURRENT	AT 3 TIMES TAP VALUE CURRENT	AT 10 TIMES TAP VALUE CURRENT	AT 20 TIMES TAP VALUE CURRENT
0.5/2.5	0.5	0.91	28	58	4.8	39.6	256	790
	0.6	0.96	28	57	4.9	39.8	270	851
	0.8	1.18	28	53	5.0	42.7	308	1024
	1.0	1.37	28	50	5.3	45.4	348	1220
	1.5	1.95	28	40	6.2	54.4	435	1740
	2.0	2.24	28	36	7.2	65.4	580	2280
	2.5	2.50	28	29	7.9	73.6	700	2850
2/6	2.0	3.1	110	59	5.04	38.7	262	800
	2.5	4.0	110	55	5.13	39.8	280	920
	30.	4.4	110	51	5.37	42.8	312	1008
	3.5	4.8	110	47	5.53	42.8	329	1120
	4.0	5.2	110	45	5.72	46.0	360	1216
	5.0	5.6	110	41	5.90	50.3	420	1500
	6.0	6.0	110	37	6.54	54.9	474	1800
4/12	4.0	7.3	230	65	4.92	39.1	268	848
	5.0	8.0	230	50	5.20	42.0	305	1020
	6.0	8.8	230	47	5.34	44.1	330	1128
	7.0	9.6	230	46	5.35	45.8	364	1260
	8.0	10.4	230	43	5.86	49.9	400	1408
	10.0	11.2	230	37	6.6	55.5	470	1720
	12.0	12.0	230	34	7.00	62.3	528	2064

a Thermal capacities for short times other than one second may be calculated on the basis of time being inversely proportional to the square of the current.

b Degrees current lags voltage at tap value current.

c Voltages taken with high impedance type voltmeter.

CO UNIT OF TYPE COM-5 AND TYPE COM-6

AMPERE RANGE	TAP	CONTINUOUS RATING (AMPERES)	ONE SECOND RATING[a] (AMPERES)	POWER FACTOR ANGLE[b]	VOLT AMPERES[c] AT TAP VALUE CURRENT	AT 3 TIMES TAP VALUE CURRENT	AT 10 TIMES TAP VALUE CURRENT	AT 20 TIMES TAP VALUE CURRENT
	0.5	2	56	69	3.92	20.6	103	270
	0.6	2.2	56	68	3.96	20.7	106	288
	0.8	2.5	56	67	3.96	21	114	325
0.5/2.5	1.0	2.8	56	66	4.07	21.4	122	360
	1.5	3.4	56	62	4.19	23.2	147	462
	2.0	4.0	56	60	4.30	24.9	168	548
	2.5	4.4	56	58	4.37	26.2	180	630
	2.0	8	230	67	3.88	21	110	308
	2.5	8.8	230	66	3.87	21.6	118	342
	30.	9.7	230	64	3.93	22.1	126	381
2/6	3.5	10.4	230	63	4.09	23.1	136	417
	4.0	11.2	230	62	4.08	23.5	144	448
	5.0	12.5	230	59	4.20	24.8	162	540
	6.0	13.7	230	57	4.38	26.5	183	624
	4.0	16	460	65	4.00	22.4	126	376
	5.0	18.8	460	63	4.15	23.7	143	450
	6.0	19.3	460	61	4.32	25.3	162	531
4/12	7.0	20.8	460	59	4.27	26.4	183	611
	8.0	22.5	460	56	4.40	27.8	204	699
	10.0	25	460	53	4.60	30.1	247	880
	12.0	28	460	47	4.92	35.6	288	1056

CO UNIT OF TYPE COM-7

AMPERE RANGE	TAP	CONTINUOUS RATING (AMPERES)	ONE SECOND RATING[a] (AMPERES)	POWER FACTOR ANGLE[b]	VOLT AMPERES[c] AT TAP VALUE CURRENT	AT 3 TIMES TAP VALUE CURRENT	AT 10 TIMES TAP VALUE CURRENT	AT 20 TIMES TAP VALUE CURRENT
	0.5	2	56	68	3.88	20.7	103	278
	0.6	2.2	56	67	3.93	20.9	107	288
	0.8	2.5	56	66	3.93	21.1	114	320
0.5/2.5	1.0	2.8	56	64	4.00	21.6	122	356
	1.5	3.4	56	61	4.08	22.9	148	459
	2.0	4.0	56	58	4.24	24.8	174	552
	2.5	4.4	56	56	4.38	25.9	185	640
	2.0	8	230	66	4.06	21.3	111	306
	2.5	8.8	230	63	4.07	21.8	120	342
	30.	9.7	230	63	4.14	22.5	129	366
2/6	3.5	10.4	230	62	4.34	23.4	141	413
	4.0	11.2	230	61	4.34	23.8	149	448
	5.0	12.5	230	59	4.40	25.2	163	530
	6.0	13.7	230	58	4.62	27	183	624
	4.0	16	460	64	4.24	22.8	129	392
	5.0	18.8	460	61	4.30	24.2	149	460
	6.0	19.3	460	60	4.62	25.9	168	540
4/12	7.0	20.8	460	58	4.69	27.3	187	626
	8.0	22.5	460	55	4.80	29.8	211	688
	10.0	25	460	51	5.20	33	260	860
	12.0	28	460	46	5.40	37.5	308	1032

a Thermal capacities for short times other than one second may be calculated on the basis of time being inversely proportional to the square of the current.

b Degrees current lags voltage at tap value current.

c Voltages taken with high impedance type voltmeters.

CO UNIT OF TYPE COM-8 AND TYPE COM-9

AMPERE RANGE	TAP	CONTINUOUS RATING (AMPERES)	ONE SECOND RATING[a] (AMPERES)	POWER FACTOR ANGLE[b]	VOLT AMPERES[c]			
					AT TAP VALUE CURRENT	AT 3 TIMES TAP VALUE CURRENT	AT 10 TIMES TAP VALUE CURRENT	AT 20 TIMES TAP VALUE CURRENT
0.5/2.5	0.5	2	56	72	2.38	21	132	350
	0.6	2.2	56	71	2.38	21	134	365
	0.8	2.5	56	69	2.40	21.1	142	400
	1.0	2.8	56	67	2.42	21.2	150	440
	1.5	3.4	56	62	2.51	22	170	530
	2.0	4.0	56	57	2.65	23.5	200	675
	2.5	4.4	56	53	2.74	24.8	228	800
2/6	2.0	8	230	70	2.38	21	136	360
	2.5	8.8	230	66	2.40	21.1	142	395
	30.	9.7	230	64	2.42	21.5	149	430
	3.5	10.4	230	62	2.48	22	157	470
	4.0	11.2	230	60	2.53	22.7	164	500
	5.0	12.5	230	58	2.64	24	180	580
	6.0	13.7	230	56	2.75	25.2	198	660
4/12	4.0	16	460	68	2.38	21.3	146	420
	5.0	18.8	460	63	2.46	21.8	158	480
	6.0	19.3	460	60	2.54	22.6	172	550
	7.0	20.8	460	57	2.62	23.6	190	620
	8.0	22.5	460	54	2.73	24.8	207	700
	10.0	25	460	48	3.00	27.8	248	850
	12.0	28	460	45	3.46	31.4	292	1020

CO UNIT OF TYPE COM-11 RELAY

AMPERE RANGE	TAP	CONTINUOUS RATING (AMPERES)	ONE SECOND RATING[a] (AMPERES)	POWER FACTOR ANGLE[b]	VOLT AMPERES[c]			
					AT TAP VALUE CURRENT	AT 3 TIMES TAP VALUE CURRENT	AT 10 TIMES TAP VALUE CURRENT	AT 20 TIMES TAP VALUE CURRENT
0.5/2.5	0.5	2	56	36	0.72	6.54	71.8	250
	0.6	2.2	56	34	0.75	6.80	75.0	267
	0.8	2.5	56	30	0.81	7.46	84.0	298
	1.0	2.8	56	27	0.89	8.30	93.1	330
	1.5	3.4	56	22	1.13	10.04	115.5	411
	2.0	4.0	56	17	1.30	11.95	136.3	502
	2.5	4.4	56	16	1.48	13.95	160.0	610
2/6	2.0	8	230	32	0.73	6.30	74.0	264
	2.5	8.8	230	30	0.78	7.00	78.5	285
	30.	9.7	230	27	0.83	7.74	84.0	309
	3.5	10.4	230	24	0.88	8.20	89.0	340
	4.0	11.2	230	23	0.96	9.12	102.0	372
	5.0	12.5	230	20	1.07	9.80	109.0	430
	6.0	13.7	230	20	1.23	11.34	129.0	504
4/12	4.0	16	460	29	0.79	7.08	78.4	296
	5.0	18.8	460	25	0.89	8.00	90.0	340
	6.0	19.3	460	22	1.02	9.18	101.4	378
	7.0	20.8	460	20	1.10	10.00	110.0	454
	8.0	22.5	460	18	1.23	11.1	124.8	480
	10.0	25	460	17	1.32	14.9	131.6	600
	12.0	28	460	16	1.8	16.3	180.0	720

a Thermal capacities for short times other than one second may be calculated on the basis of time being inversely proportional to the square of the current.

b Degrees current lags voltage at tap value current.

c Voltages taken with high impedance type voltmeter.

the index mark on the movement frame will coincide with the “0” mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the “0” mark by approximately.020”. The placement of the various time dial positions in line with the index mark will give operating times as shown on the respective time-current curves. For double trip relays, the follow on the stationary contacts should be approximately 1/32”.

2. Minimum Trip Current – Set the time dial to position 6. Using lowest tap setting, alternately apply tap value current plus 3% and tap value current minus 3%. The moving contact should leave the backstop at tap value plus 3% and should return to the backstop at tap value current minus 3%.

3. Time Curve – Table 1 shows the time curve calibration points for the various types of relays. With the time dial set to the indicated position and on the lowest tap setting, apply the current specified by Table 1, (e.g. for the COM-2, 3 and 20 times tap value current) and measure the operating time of the relay. The operating times should equal those of Table 1 plus or minus 5%. For type COM-11 relay only, the 1.30 times tap value operating time from the number 6 time dial position is 54.9 ± 5% seconds. It is important that the 1.30 times tap value current be maintained accurately. The maintaining of this current accurately is necessary because of the steepness of the slope of the time-current characteristic (figure 12, page 20). A 1% variation in the 1.30 times tap value current (including measuring instrument deviation) will change the nominal operating time by approximately 4%.

4. Indicating Instantaneous Trip Unit (IIT) – The core screw which is adjustable from the top of the trip unit and the tap located on the top of the IIT determine the pickup value. The trip unit has a nominal ratio of adjustment of 1 to 24.

   The indication should occur within 1/16” before, or at the same time, the contacts make.

   The moving contact should provide 1/64” to 3/64” wipe of the stationary contact. This should provide a minimum of 3 grms contact pressure with the armature held against the core.

   Apply sufficient current to operate the IIT. The operation indicator target should drop freely.

5. 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 nameplate ratings. The operation indicator target should drop freely.

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

6. SSC-T – Check to see that the SSC-T circuit can be adjusted to trip for values of current within its rated range. Apply the low current level of the rated current range to see that the SSC-T output relay will operate. Reduce the current to a level where the relay drops out. The drop-out current should be between 90% and 99% of the trip

.

PERMANENT MAGNET ADJUSTMENT				ELECTROMAGNET PLUGS	
RELAY TYPE	TIME DIAL POSITION	CURRENT (MULTIPLES OF TAP VALUE)	OPERATING TIME SECONDS	CURRENT (MULTIPLES OF TAP VALUE)	OPERATING TIME SECONDS
COM-2	6	3	0.57	20	0.22
COM-5	6	2	37.80	10	14.30
COM-6	6	2	2.46	20	1.19
COM-7	6	2	4.27	20	1.11
COM-8	6	2	13.35	20	1.11
COM-9	6	2	8.87	20	0.65
COM-11	6	2	11.27	20	0.24[a]

a For 50 cycle CO-11 relay 20 times operating time limits are 0.24 + 10%, - 5%.

value. Apply the high current value of the range and rotate the R2 adjustment clockwise until the output relay just resets, then counterclockwise so that it just picks up. Reduce the current and check to see that the dropout level is between 90% and 99% of the trip value. NOTE: Values of test current greater than 10 amperes should be left only momentarily to avoid overheating.

7. Auxiliary Time-Delay Unit (T) – For relays wired per figure 15 or 16, (page 23 and page 24) apply 100 volts dc to terminals 5 and 7. Manually close the contacts of the telephone relay in the top left-hand corner of the relay (front view). The T unit should operate.

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. A minimum suggested check on the relay system is to close the contacts manually to assure that the breaker trips and the target drops. Then release the contacts and observe that the reset is smooth and positive.

If an additional time check is desired, pass secondary current through the relay and check the time of operation. It is preferable to make this at several times pick-up current at an expected operating point for that particular application.

Phantom loads should not be used in testing induction-type relays because of the resulting distorted current waveform which produces an error in timing.

All contacts should be periodically cleaned. A contact burnisher style number 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.

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” on p a g e6. and 11)

NOTE: A spring shield covers the reset spring of the CO Relay. To remove the spring shield, requires that the damping magnet be removed first. The screw connection holding the lead to the moving contact should be removed next. The second screw holding the lead to the moving contact assembly should then be loosened but not removed.

CAUTION: This screw terminates into a nut held captive beneath the molded block. If screw is removed, difficulty will be experienced in the re-assembly of the moving contact assembly.) Slide the spring shield outward and remove from relay. Tighten the screw holding the moving contact assembly to the molded block.

7.1 CO UNIT

1. Contact – The index mark on the movement frame will coincide with the “0” mark on the time dial when the stationary contact has moved through approximately one-half of its normal deflection. Therefore, with the stationary contact resting against the backstop, the index mark is offset to the right of the “0” mark by approximately .020”.

2. Minimum Trip Current – The adjustment of the spring tension in setting the minimum trip current value of the relay is most conveniently made with the damping magnet removed.

   With the time dial set on “0”, wind up the spiral spring by means of the spring adjuster until approximately 6-3/4 convolutions show.

   The spiral spring can be adjusted with the spring shield in place as follows. One slot of the spring adjuster will be available for a screwdriver in one window of the front barrier of the spring shield. By adjusting this slot until a barrier of the spring shield prevents further adjustment, a second slot of the spring adjustment will appear in the window on the other side of the spring shield barrier. Adjusting the second slot in a similar manner will reveal a third slot in the opposite window of the spring shield.

   Set the relay on the lowest tap setting, the time dial to position 6.

   Adjust the control spring tension so that the moving contact will leave the backstop at tap value current +1.0% and will return to the backstop at tap value current - 1.0%.

3. Time Curve Calibration – Install the permanent magnet.

   Apply the indicated current per Table 1 for per-

manent magnet adjustment (e.g. COM-8, 2 times tap value) and measure the operating time. Adjust the permanent magnet keeper until the operating time corresponds to the value of Table 1.

For Type COM-11 Relay only, the 1.3 times tap value operating time from the number 6 time dial position is 54.9 ±5% seconds. It is important that the 1.30 times tap value current be maintained accurately. The maintaining of this current accurately is necessary because of the steepness of the slope of the time-current characteristic (figure 12, page 20). A 1% variation in the 1.30 times tap value current (including measuring instrument deviation) will change the nominal operating time by approximately 4%. If the operating time at 1.3 times tap value is not within these limits, a minor adjustment of the control spring will give the correct operating time without any undue effect on the minimum pick-up of the relay. This check is to be made after the 2 times tap value adjustment has been completed.

Apply the indicated current per Table 1 for the electromagnet plug adjustment (e.g. COM-8, 20 times tap value) and measure the operating time. Adjust the proper plug until the operating time corresponds to the value in Table 1. (Withdrawing the left-hand plug, front view, increases the operating time and withdrawing the right-hand plug, front view, decreases the time.) In adjusting the plugs, one plug should be screwed in completely and the other plug run in or out until the proper operating time has been obtained.

Recheck the permanent magnet adjustment. If the operating time for this calibration point has changed, readjust the permanent magnet and then recheck the electromagnet plug adjustment.

4. Indicating Contactor Switch (ICS) – Use the following procedure for calibrating the relay if the relay has been taken apart for repairs or the adjustments have been disturbed. This procedure should not be used unless it is apparent that the relay is not in proper working order. (See “Acceptance Check” on page 6. and 11.)

   Initially adjust unit on the pedestal so that armature fingers do not touch the yoke in the reset position. This can be done by loosening the mounting screw in the molded pedestal and moving the ICS in the downward position.

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

      For double trip type units, adjust the third contact so that it makes with its stationary contacts at the same time as the two main contacts or up to 1/64” ahead.

   b) Target: Manually raise the moving contacts and check to see that the target drops at the same time 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 due to a slight jar.

   c) Pickup: 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 springs bent outward equally.

5. Indicating Instantaneous Trip Unit (IIT) –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” on page 6. and 11).

   Initially adjust unit on the pedestal so that the armature fingers do not touch the yoke in the reset position. This can be done by loosening the mounting screw in the molded pedestal and moving the IIT in the downward direction.

   a) Contact Wipe: Adjust the stationary contacts so that both stationary contacts make with the moving contacts simultaneously and wipe 1/64” to 3/64” when the armature is held against the core. This can be accomplished by inserting a .0125 thickness gauge between the armature and core and adjusting the stationary contacts until they just touch the moving contacts.

For double trip types adjust the third contact until it makes with its stationary contact at the same time as the two main contacts or up to 1/64" ahead.

b) Target: Manually raise the moving contacts and check to see that the target drops at the same time the contacts make or up to 1/16" ahead. If necessary, the cover may be removed and the tab holding the target reformed slightly. However, care should be exercised so that the target will not drop due to a slight jar.

c) Pickup: Place tap screw in the 6 to 20 tap and turn the core screw all the way in. Contacts should pickup between 5.1 and 5.7 amperes. If pickup is above this range it may be reduced by using a tweezer or similar tool and squeezing 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 below this range it may be increased by removing the front cover and bending the leaf springs outward equally. An approximate adjustment would be where the end of the leaf spring is in line with the edge of the molded cover.

The desired pickup is obtained by setting the tap screw in the proper range and adjusting the core screw.

6. High Drop-out Instantaneous Unit (SSC-T) – Check to see that the SSC-T circuit can be adjusted to trip for values of current within its rated range. Apply the low current level of the rated current range to see that the SSC-T output relay will operate. Reduce the current to a level where the relay drops out. The drop-out current should be between 90% and 99% of the trip value. Apply the high current value of the range and rotate the R2 adjustment clockwise until the output relay just resets, then counterclockwise so that it just picks up. Reduce the current and check to see that the dropout level is between 90% and 99% of the trip value. NOTE: Values of test current greater than 10 amperes should be left on only momentarily to avoid overheating.

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.

9.0 OBSOLETE UNIT INFORMATION

9.1 IITH

Any information needed as to the characteristics, settings, adjustments, maintenance, calibration, or energy requirements may be found in L-Spec L-914526.

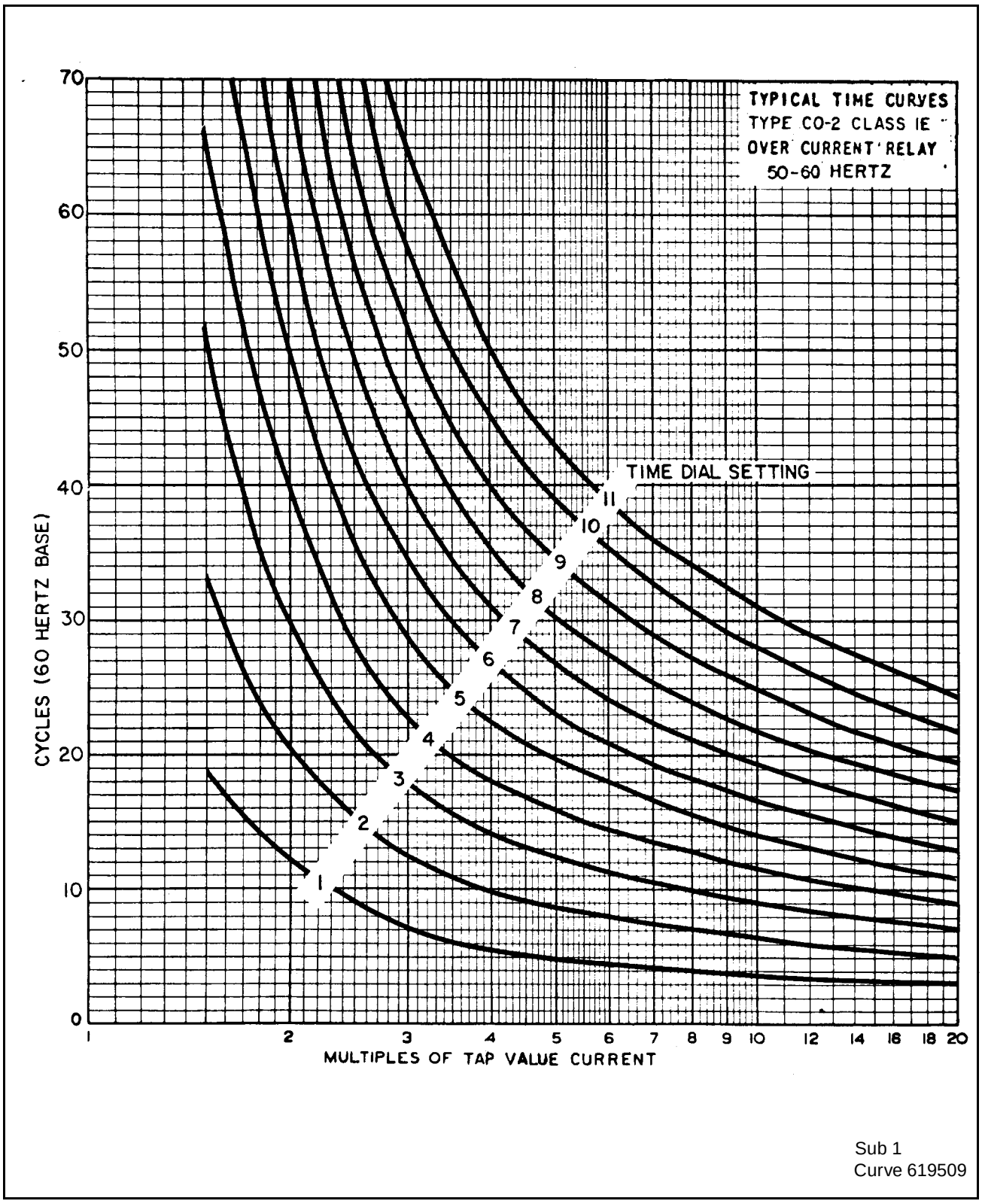
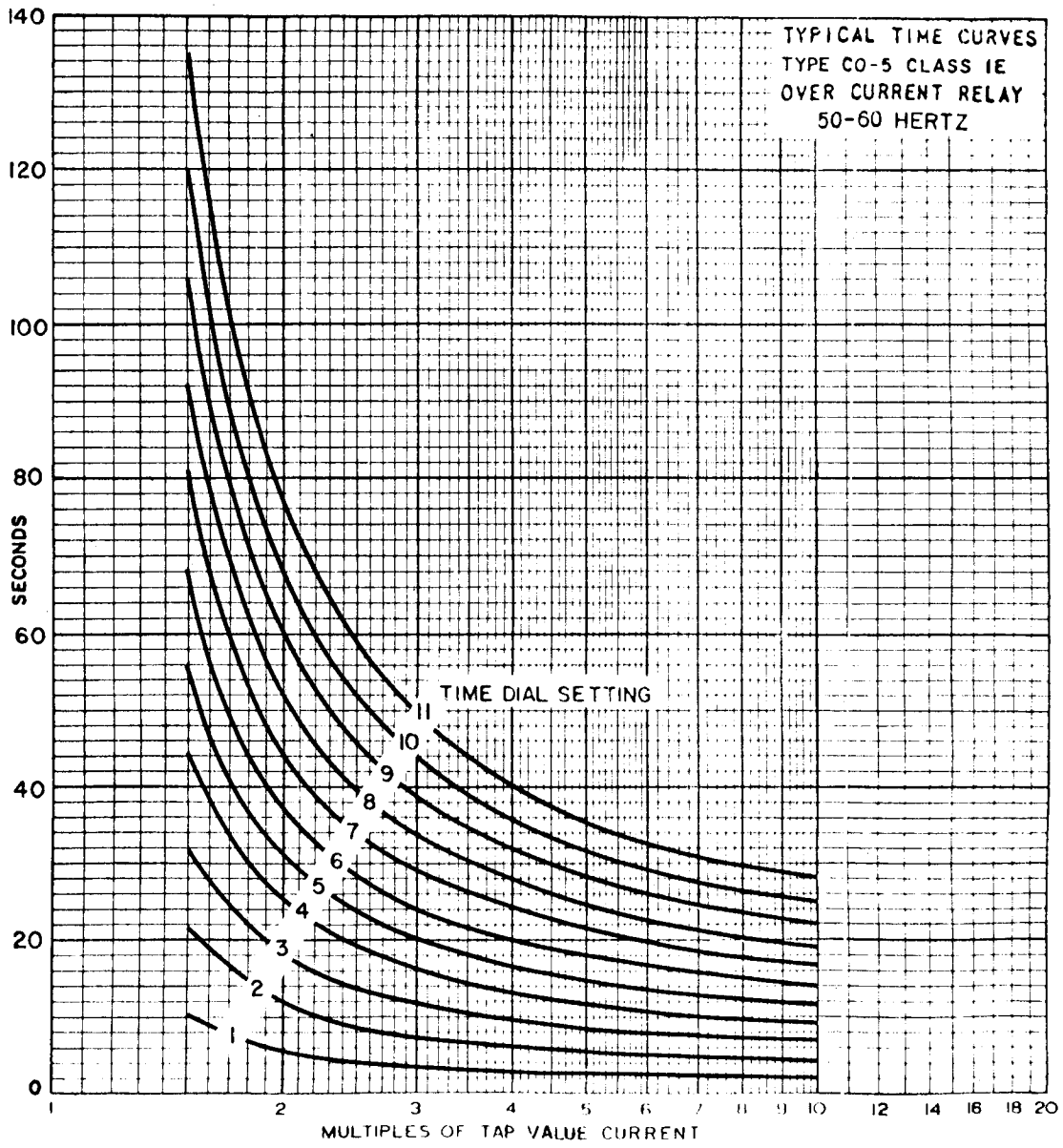


Figure 6 :Typical time curves of the type COM-2 relay.



Sub 1
Curve 619510

Figure 7 :Typical time curves of the type COM-5 relay.

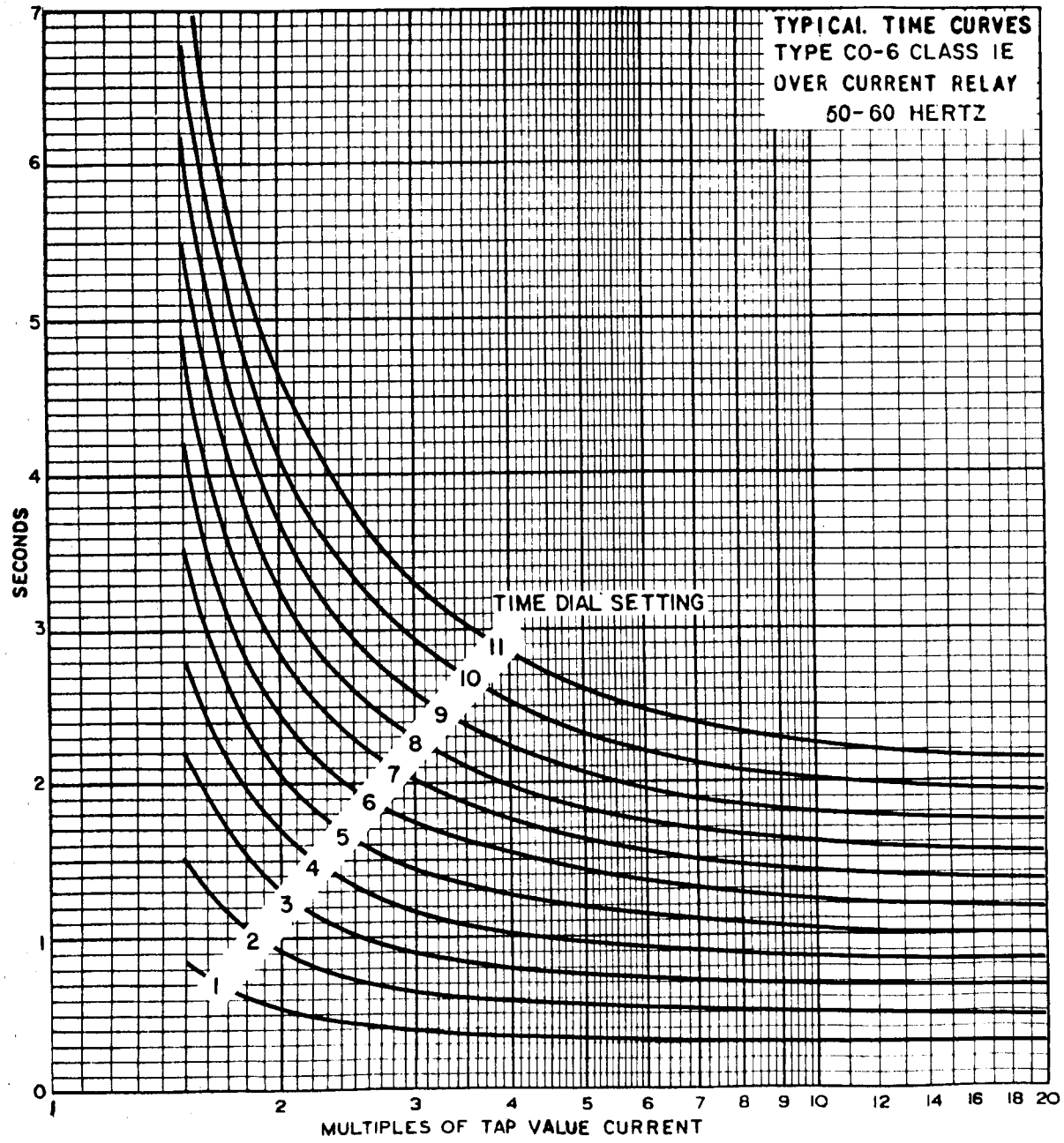


Figure 8: Typical time curves of the type COM-6 relay.

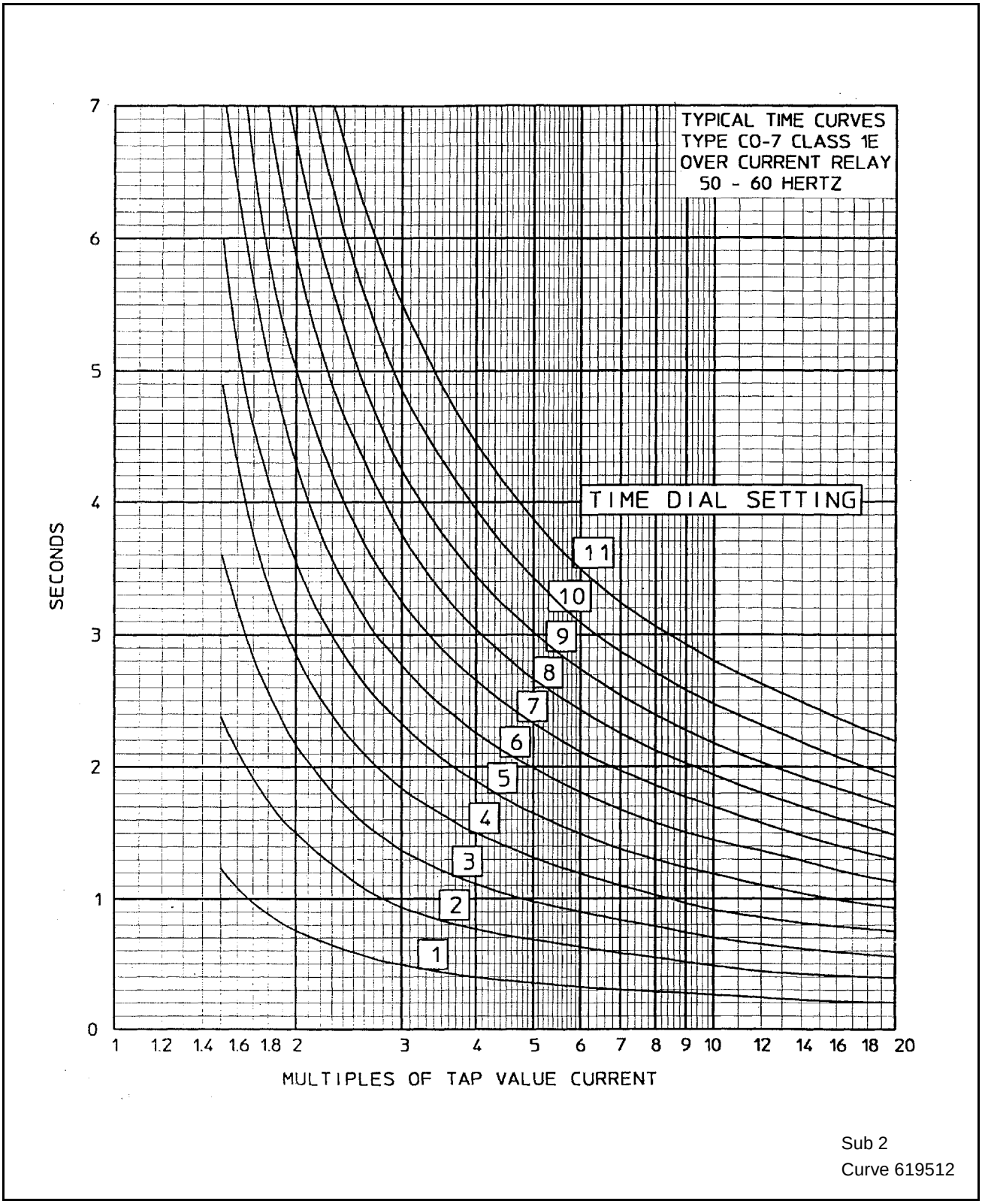
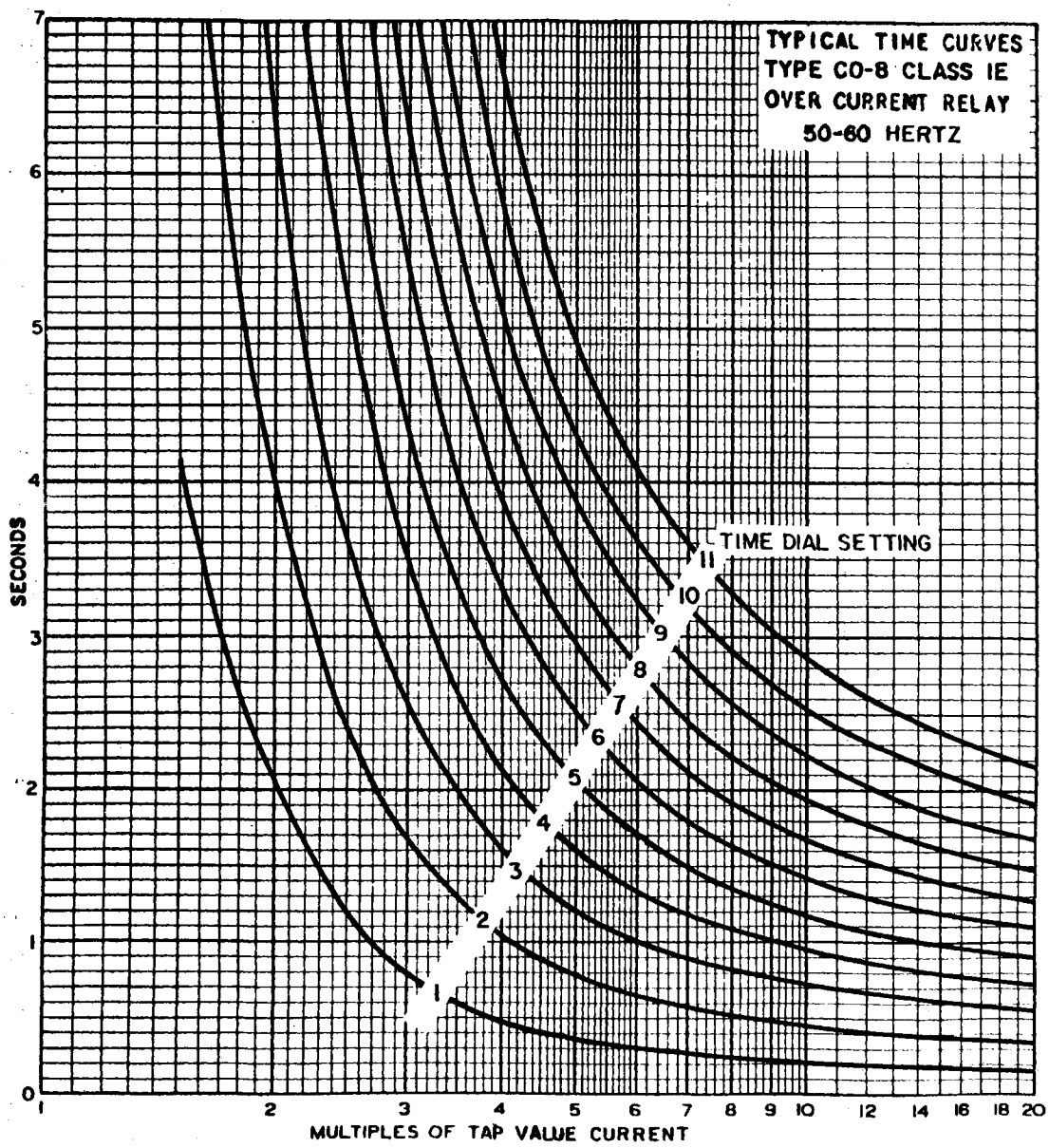
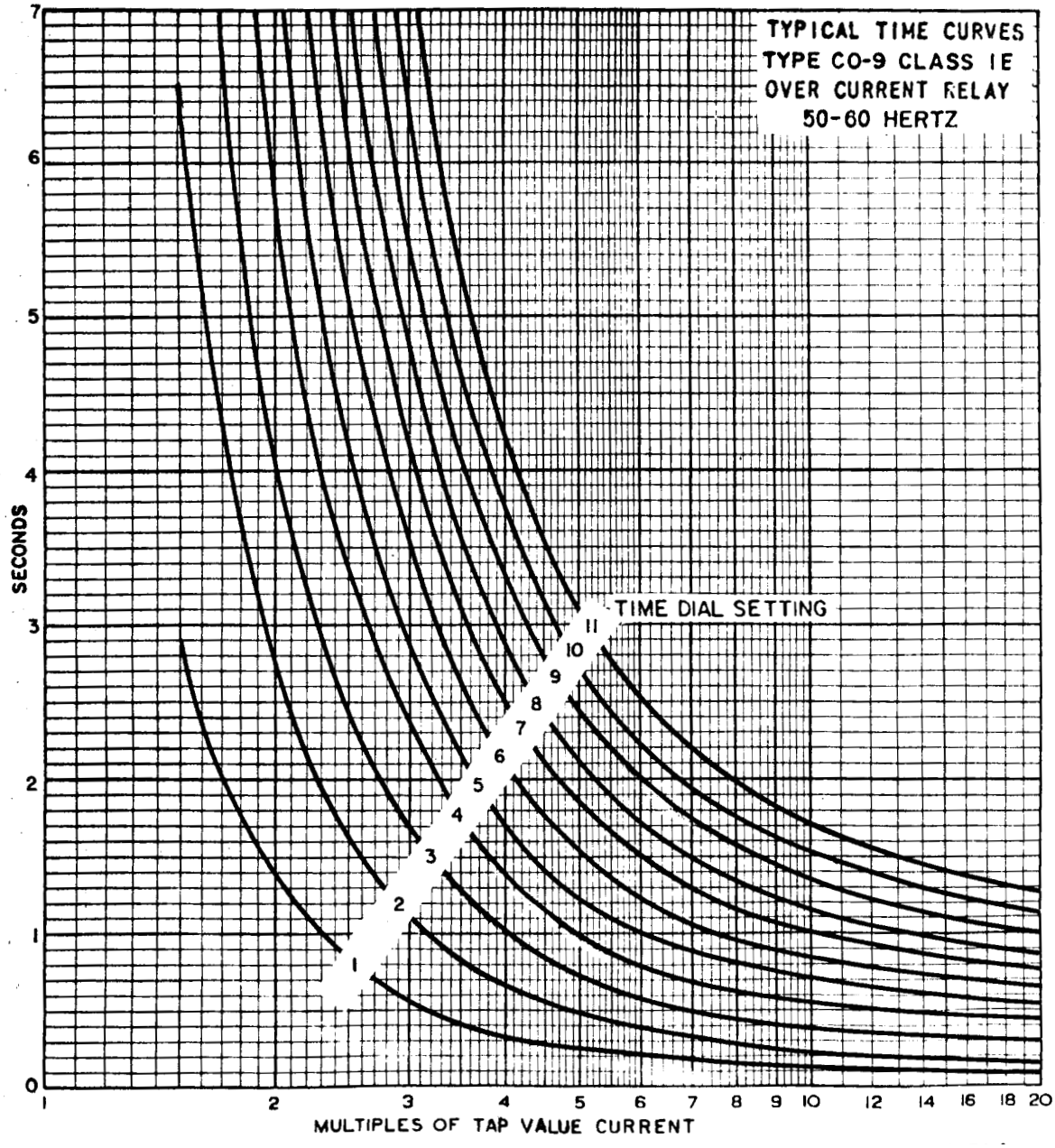


Figure 9 :Typical time curves of the type COM-7 relay.



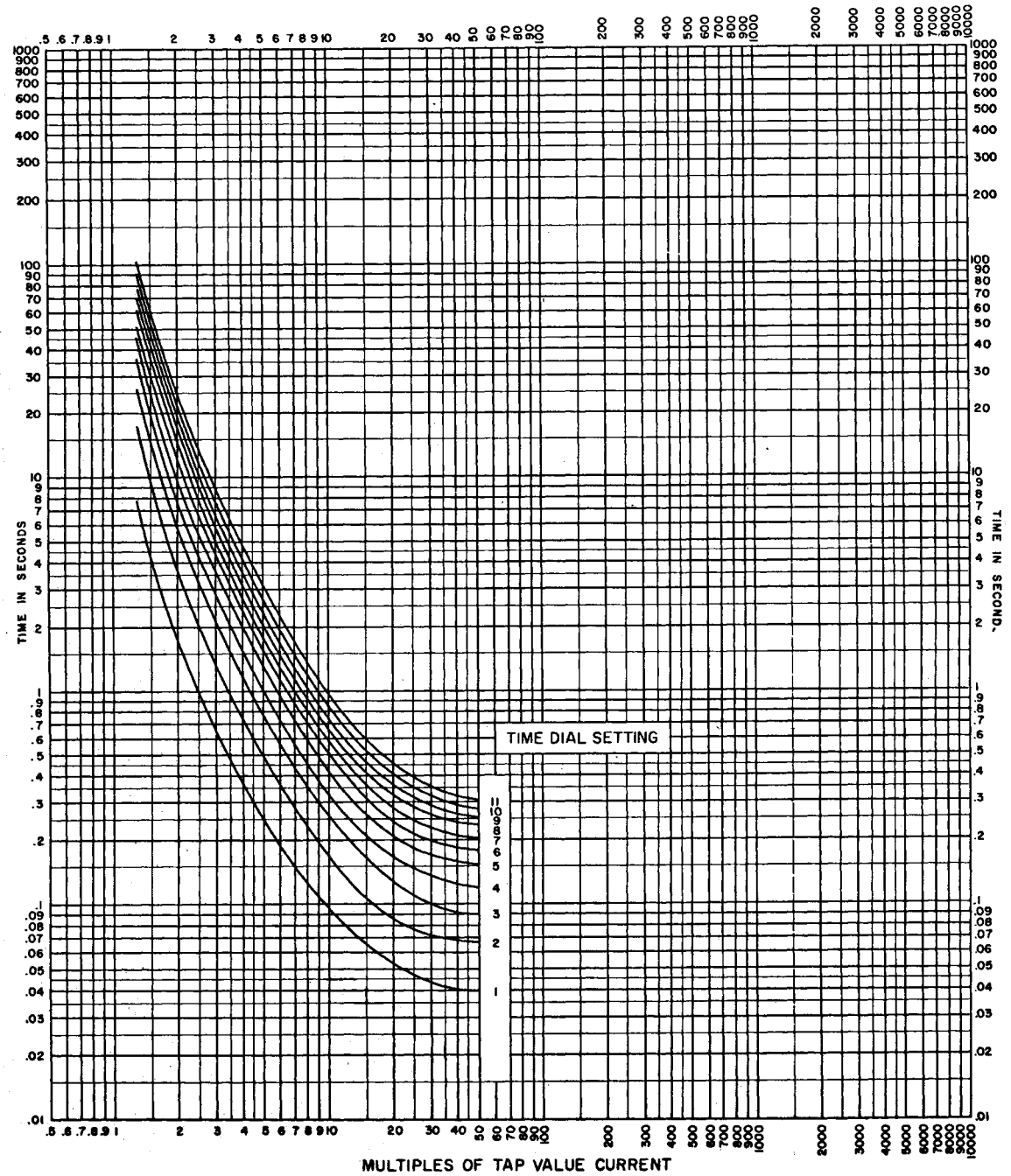
Sub 1
Curve 619513

Figure 1 0 :Typical time curves of the type COM-8 relay.



Sub 1
Curve 619514

Figure 1 1 :Typical time curves of the type COM-9 relay.



Sub 1
Curve 619515

Figure 1 2 :Typical time curves of the type COM-11 relay.

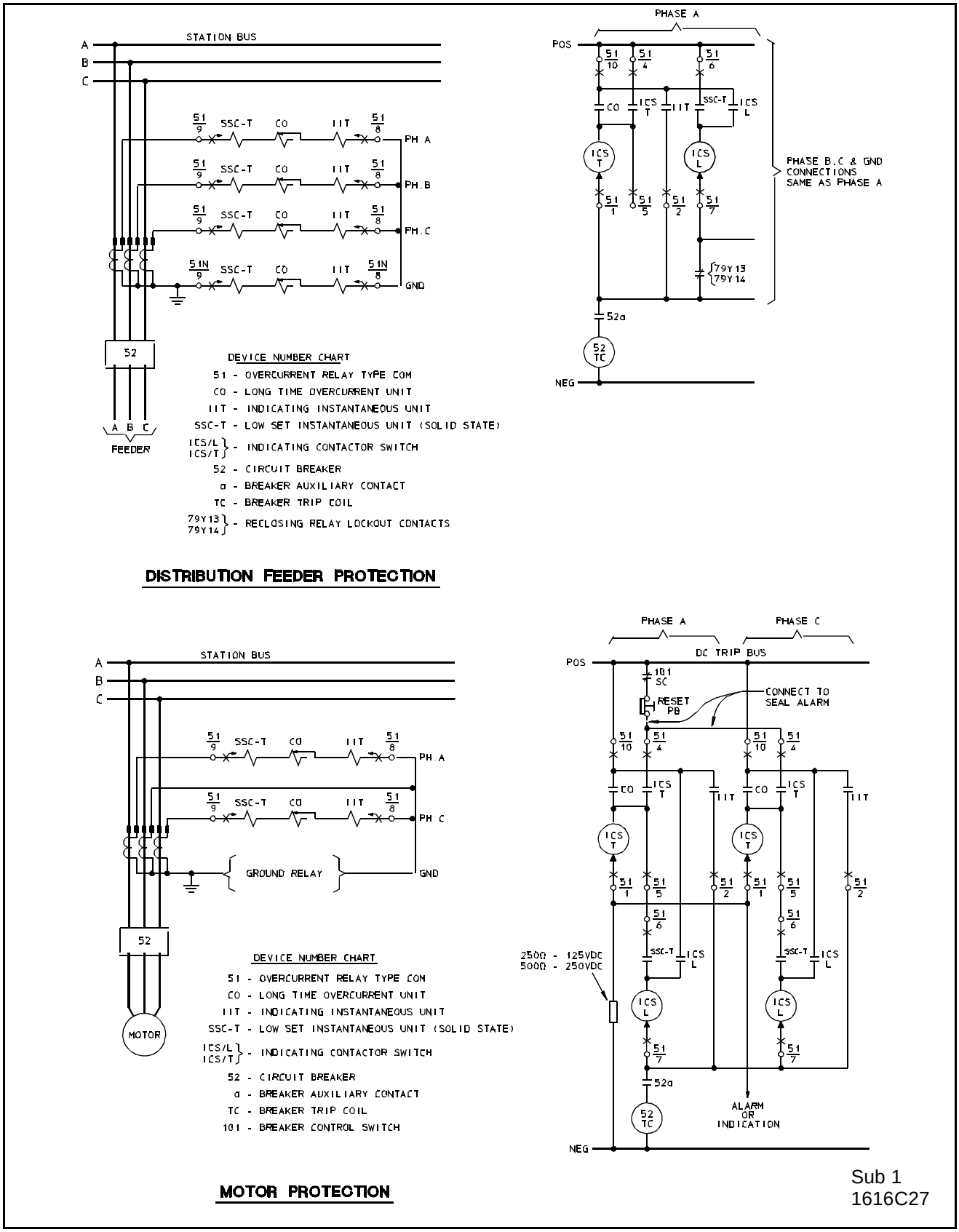


Figure 13: External schematic of COM relays without auxiliary time-delay unit and SSC-T unit.

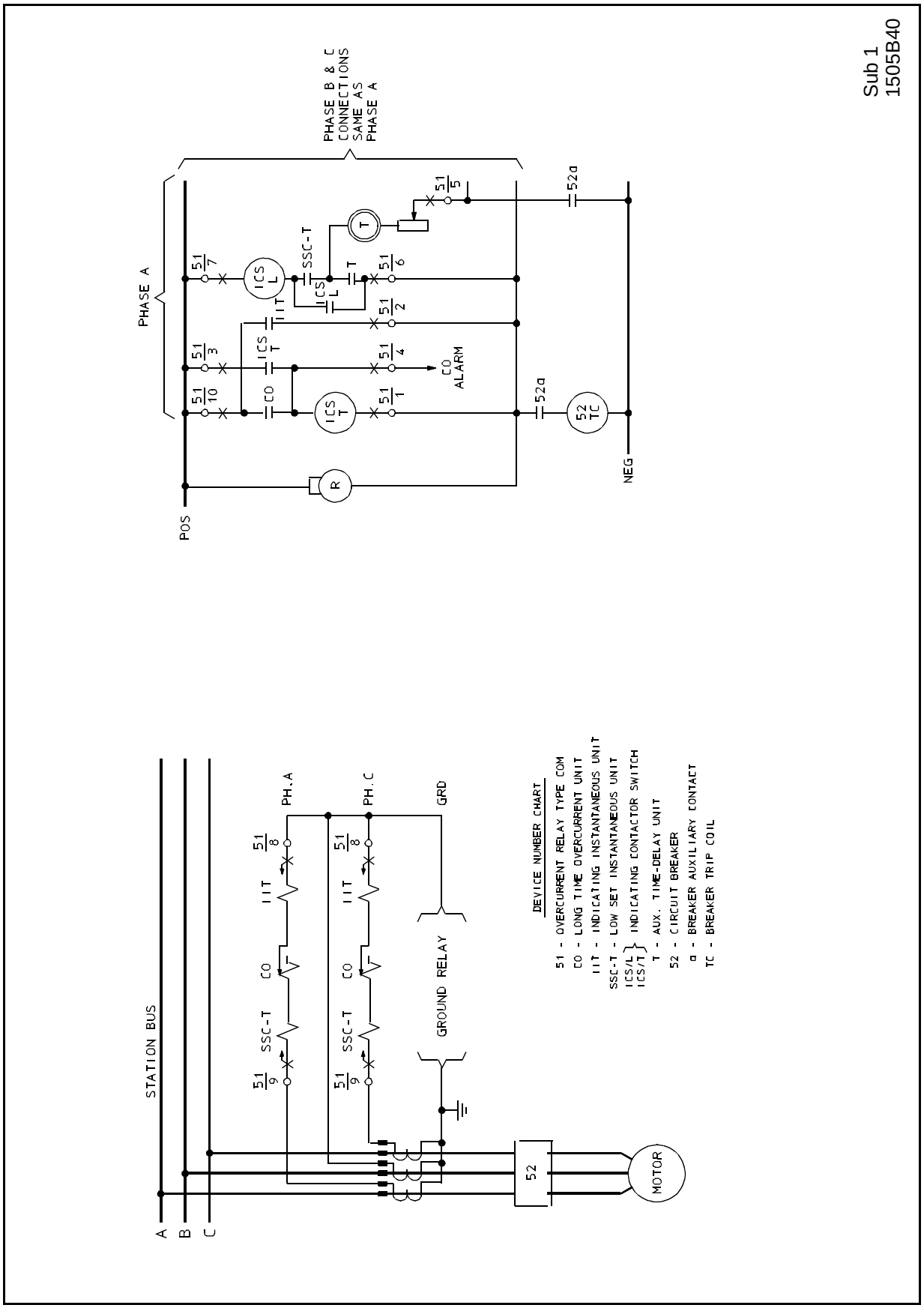


Figure 14: External schematic of COM relays with auxiliary time-delay unit and SSC-T unit.

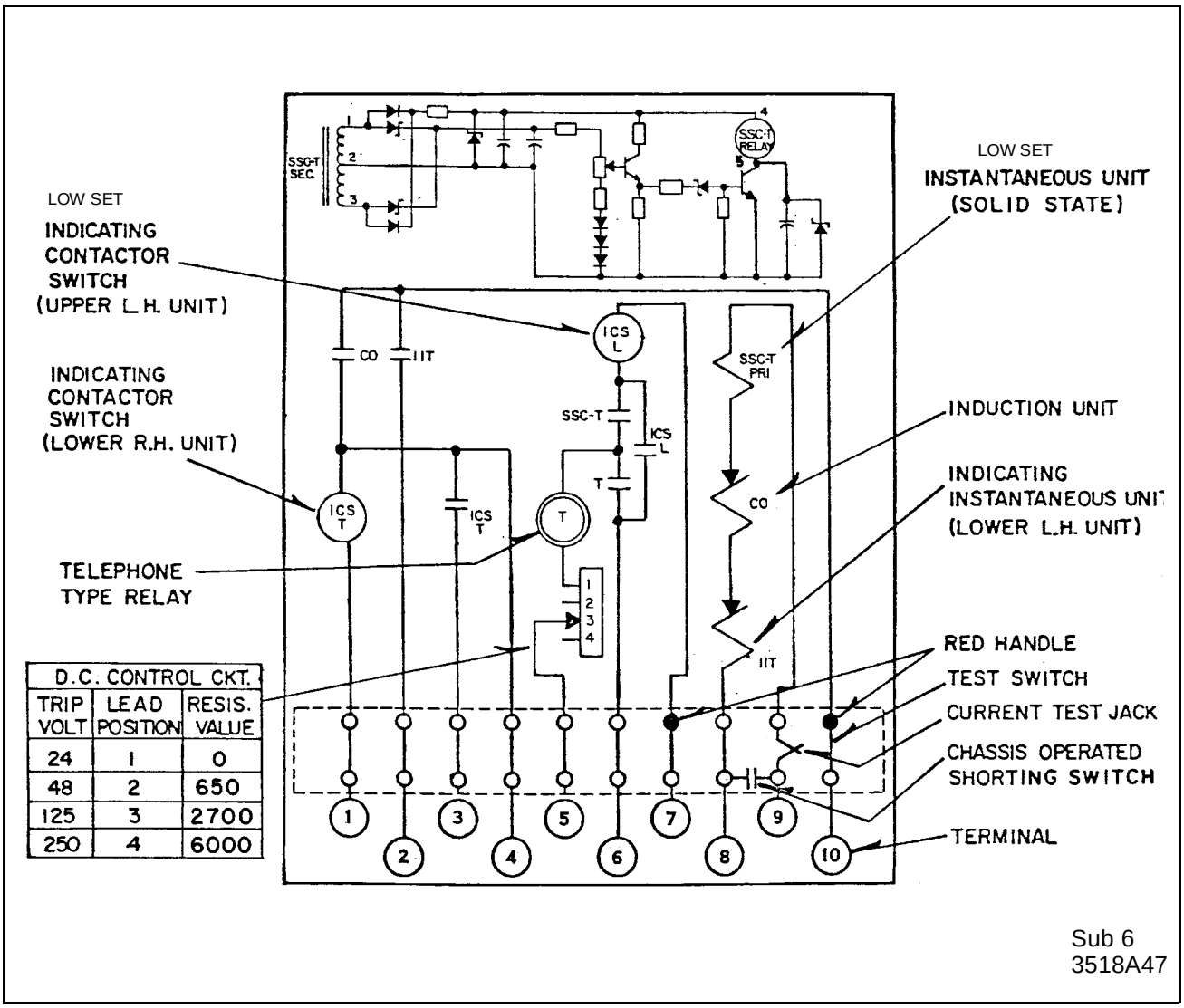
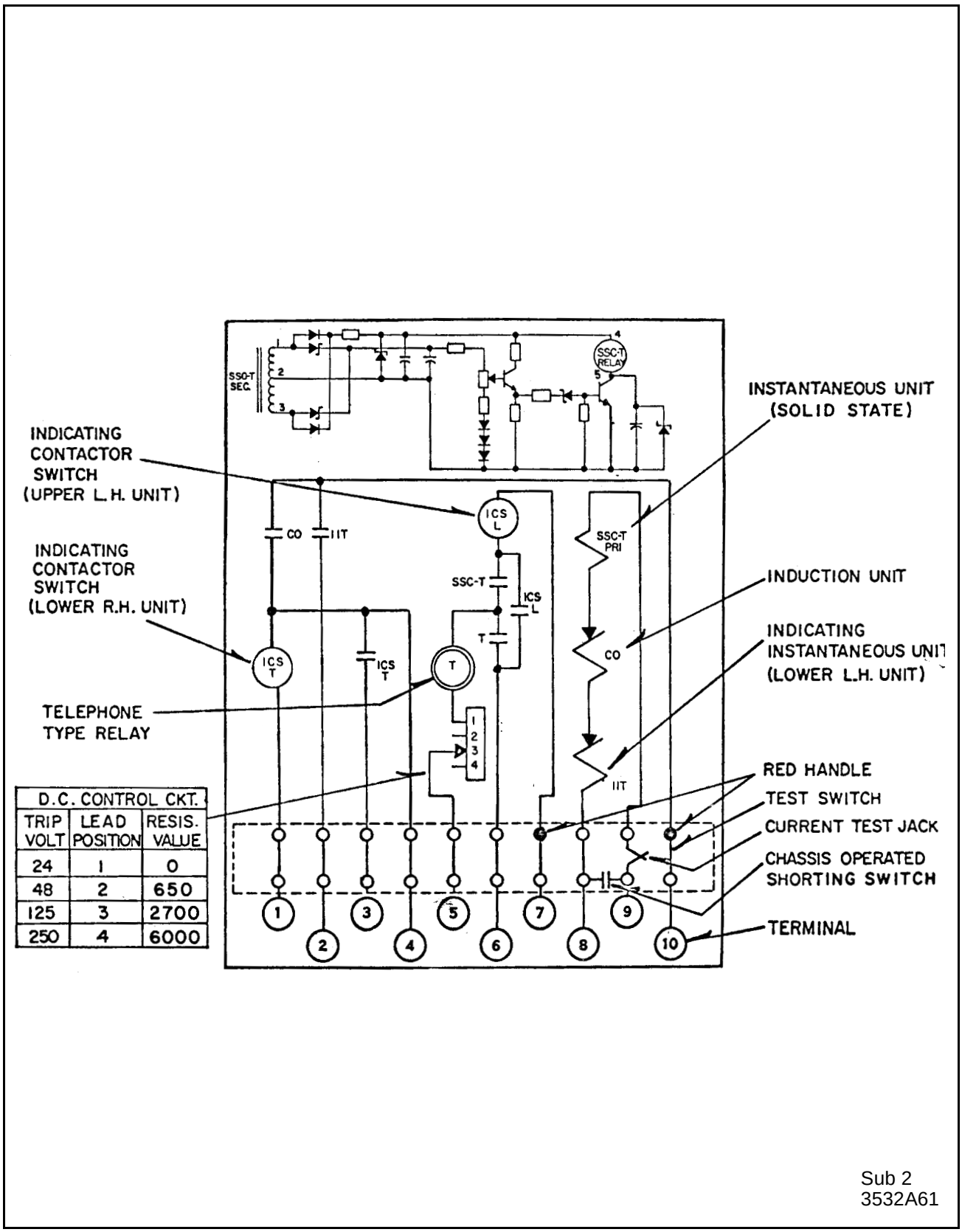


Figure 15: Internal schematic of type COM-5 relay with auxiliary time-delay unit and SSC-T unit inFT-21 case.



D.C. CONTROL CKT.		
TRIP VOLT	LEAD POSITION	RESIS. VALUE
24	1	0
48	2	650
125	3	2700
250	4	6000

Figure 16 :Internal schematic of type COM-9 with auxiliary time delay unit and SSC-T unit in FT-21 case.

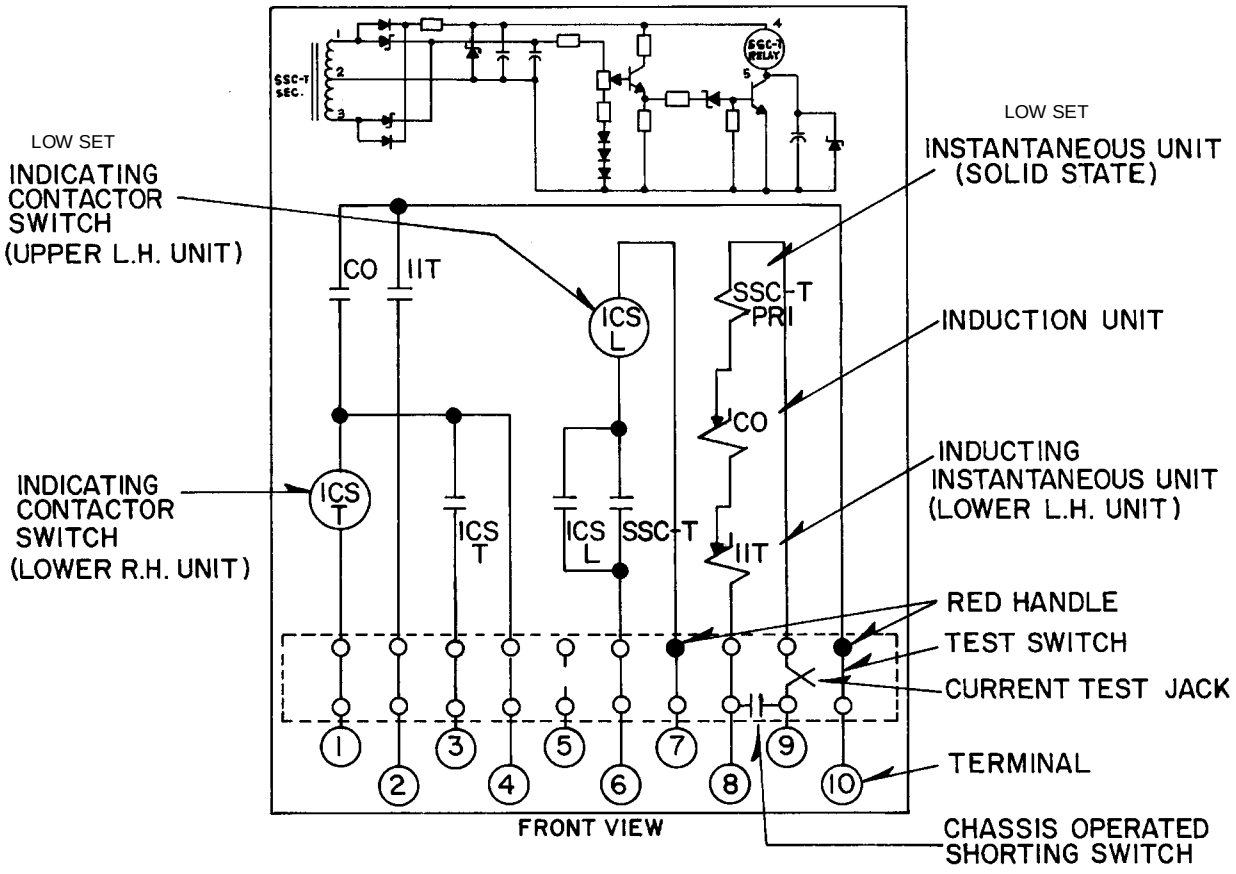


Figure 1 7 :Internal schematic of type COM-5 relay with SSC-T unit and without auxiliary time-delay unit inFT-21 case.

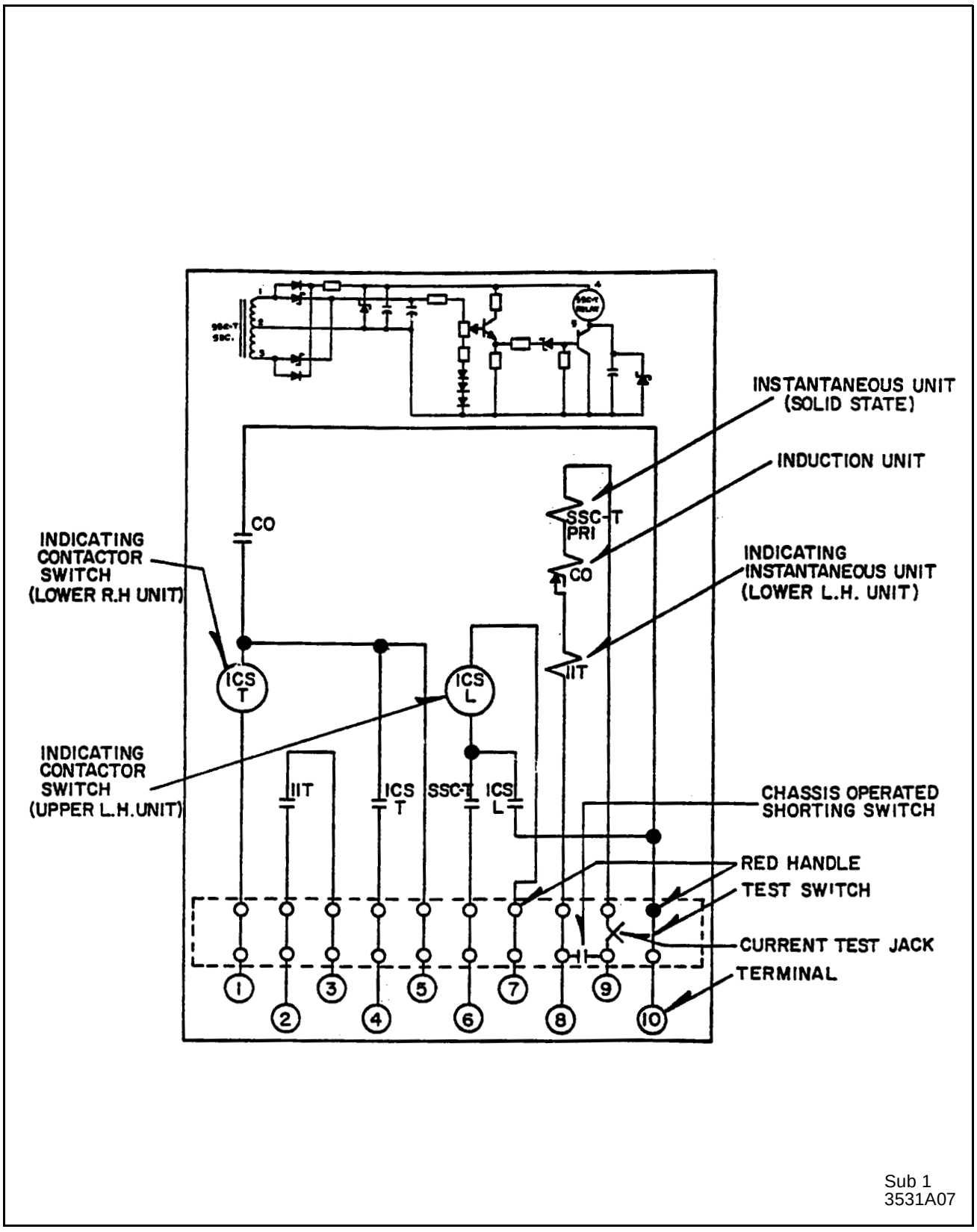


Figure 1 8 : Internal schematic of type COM-5 with SSC-T unit and IIT Contacts out to separate terminals inType FT-21 case.

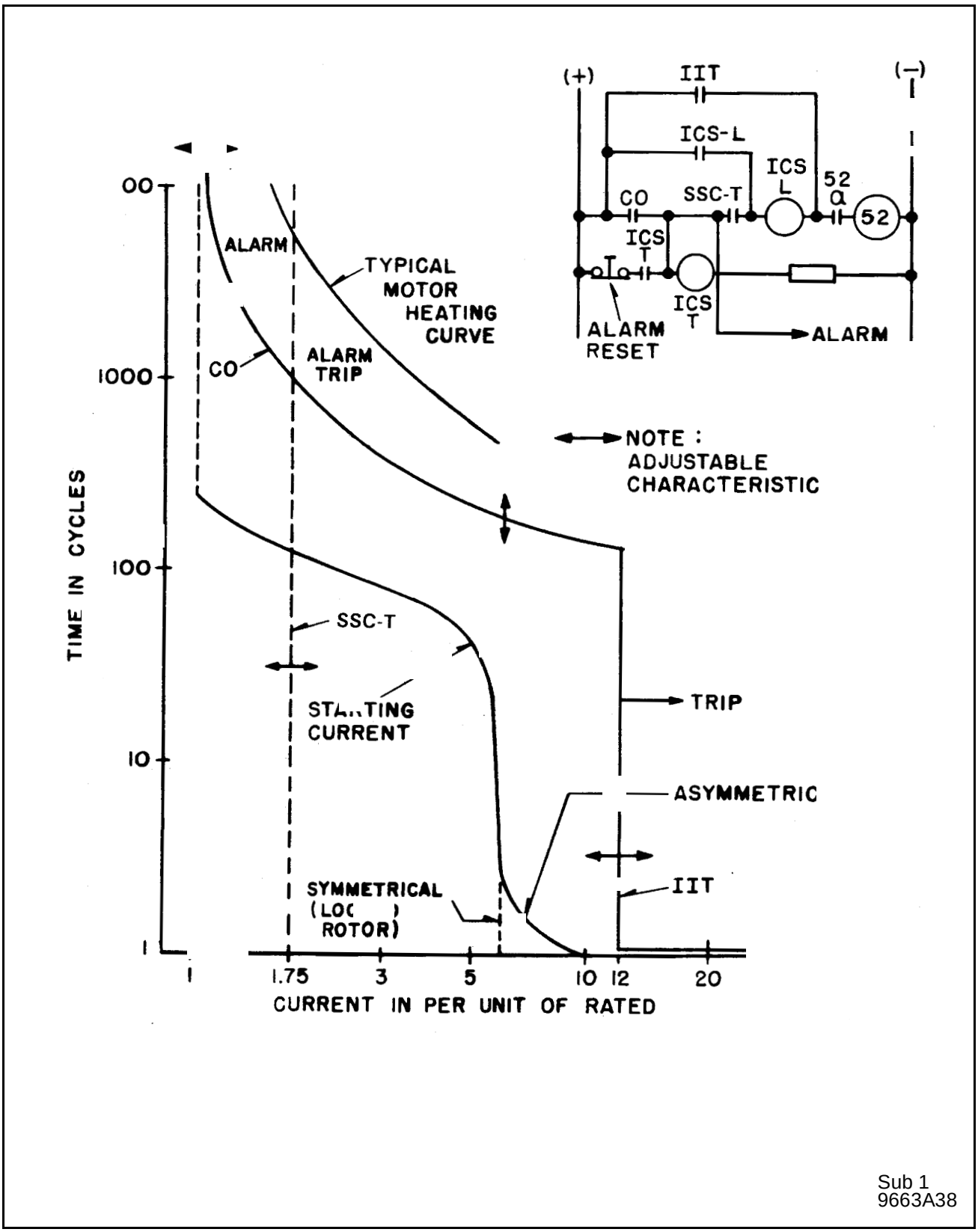


Figure 1 9 :Setting example of motor protection without auxiliary time-delay unit.

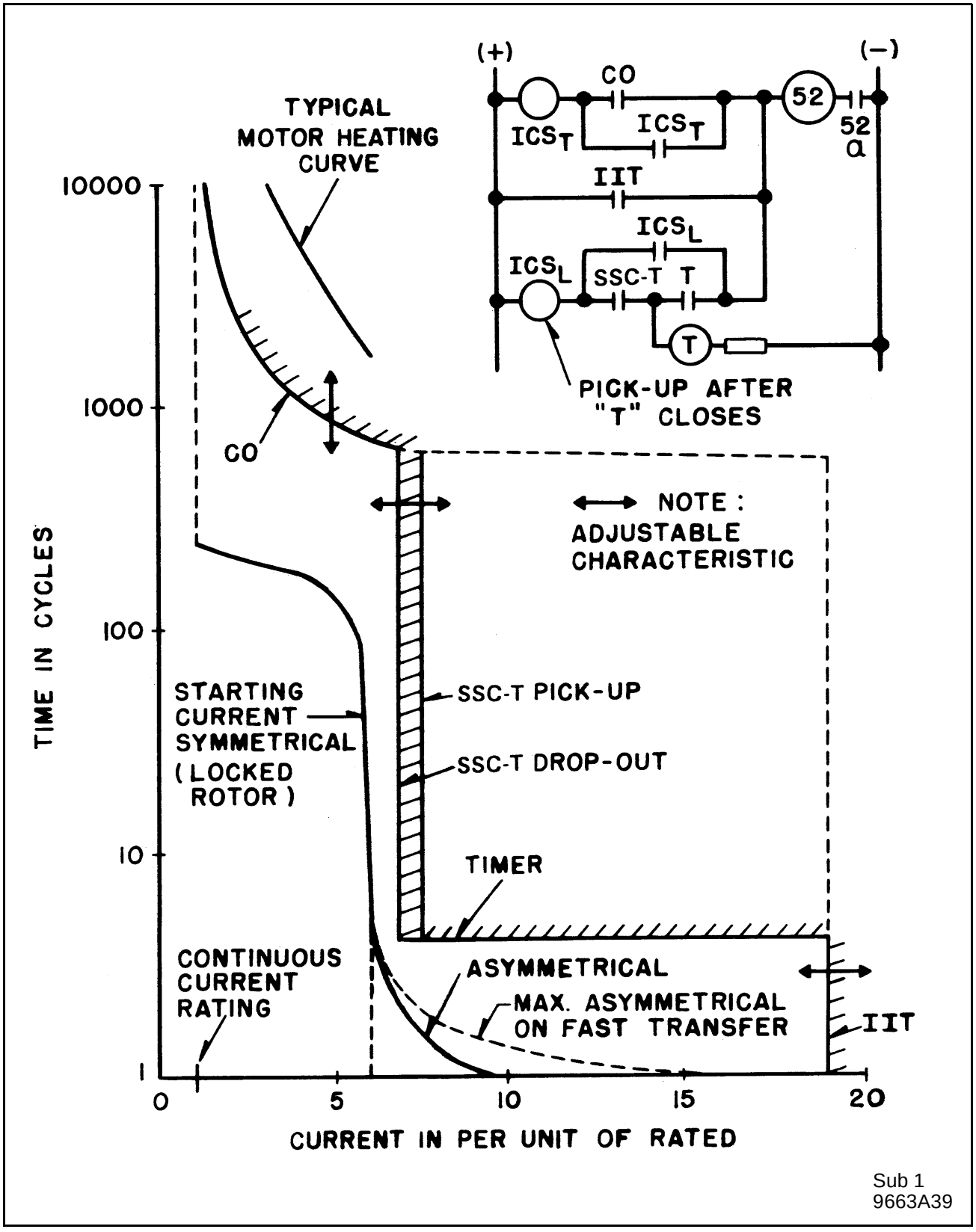


Figure 2 0 :Setting example for motor protection with auxiliary time-delay unit.

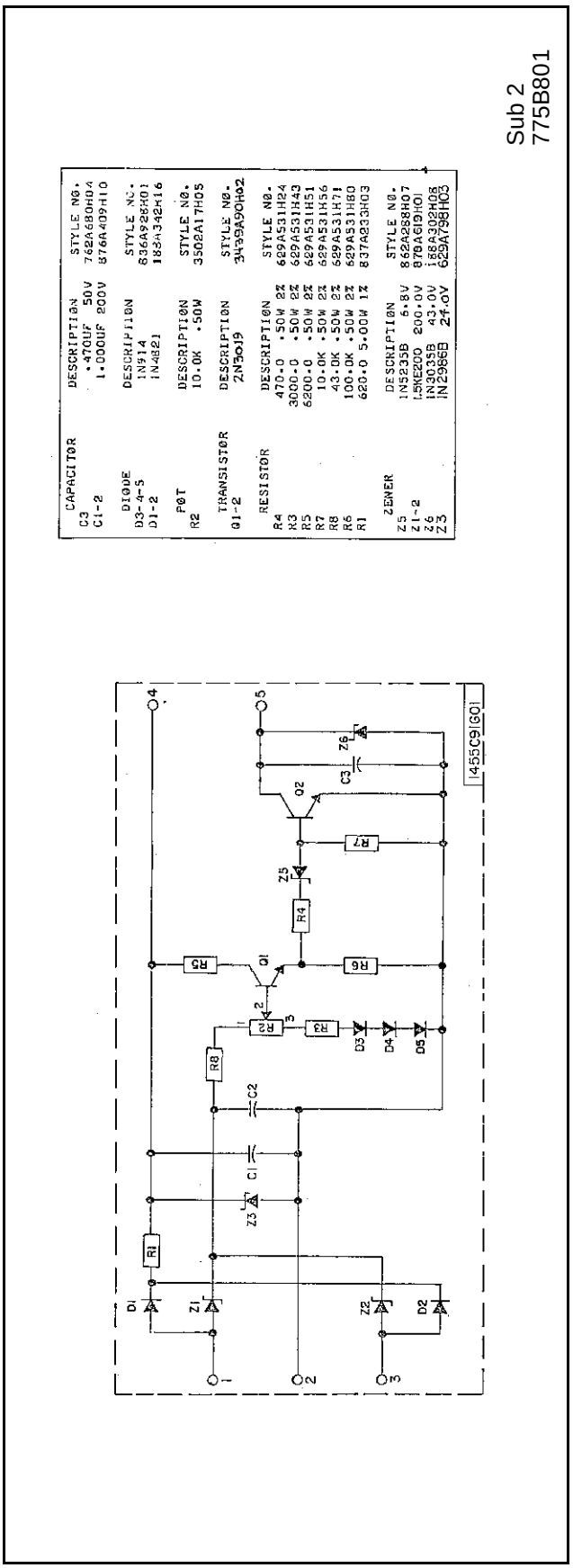


Figure 21: SSC-T module internal schematic for COM-5 Class 1E.

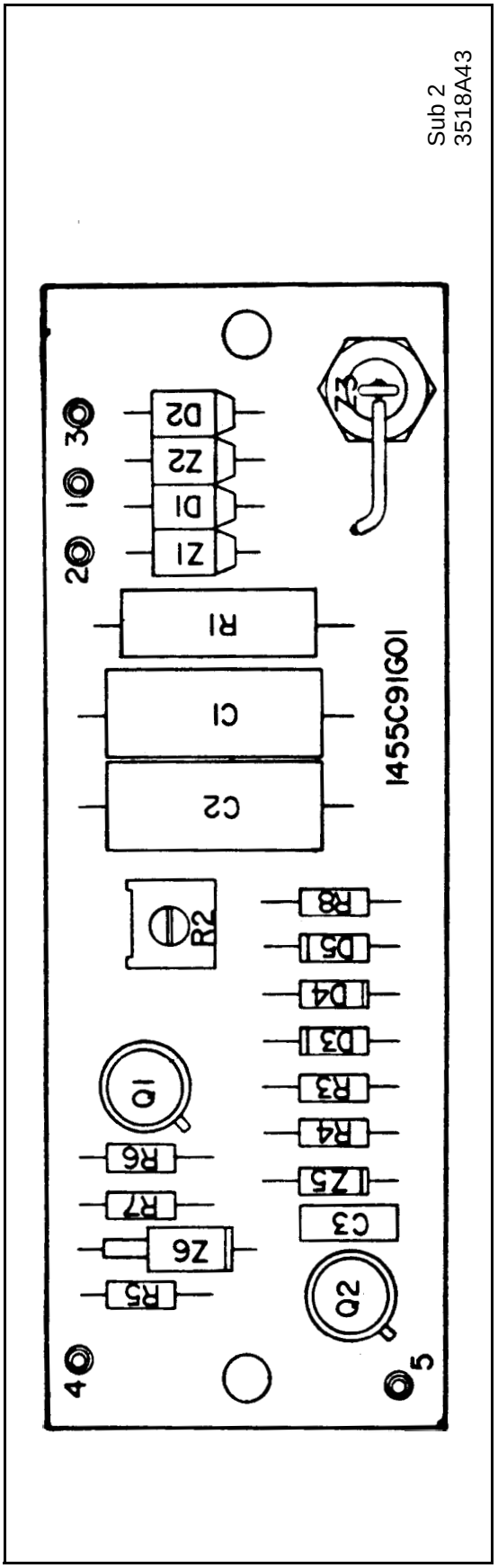


Figure 22: SSC-T module.

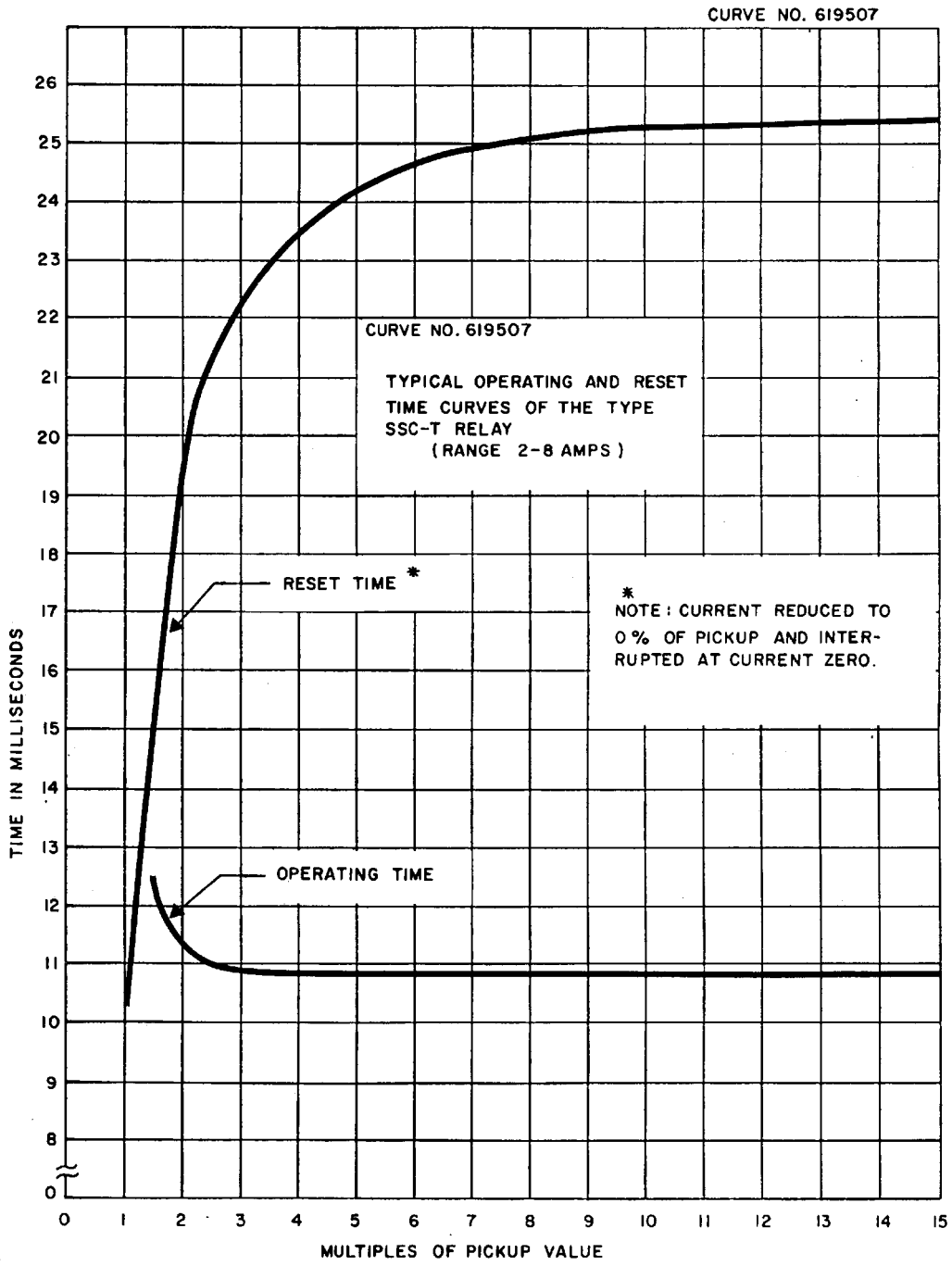


Figure 23: Time Curve for SSC-T Unit.

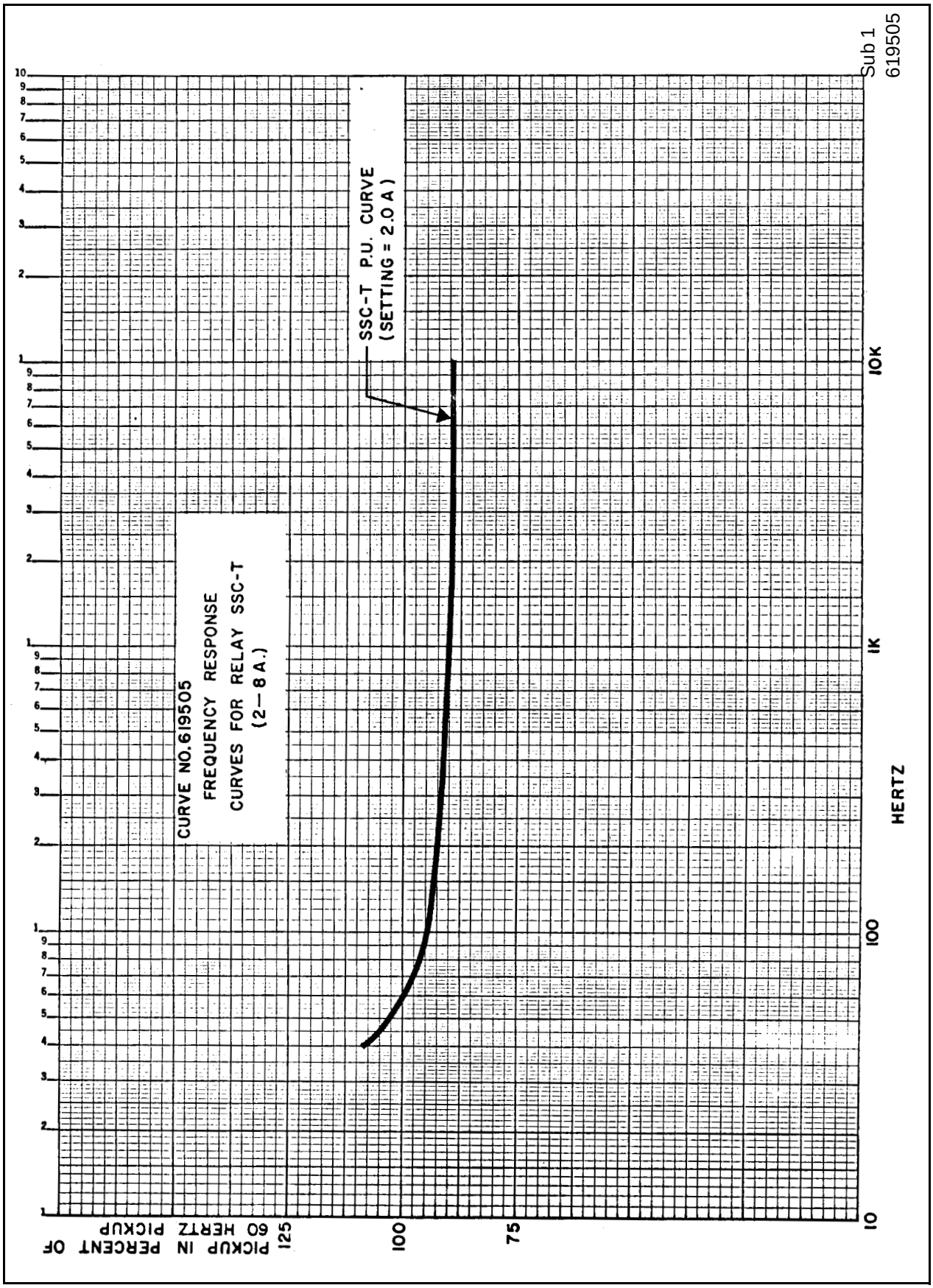


Figure 24: Frequency response for SSC-T unit.

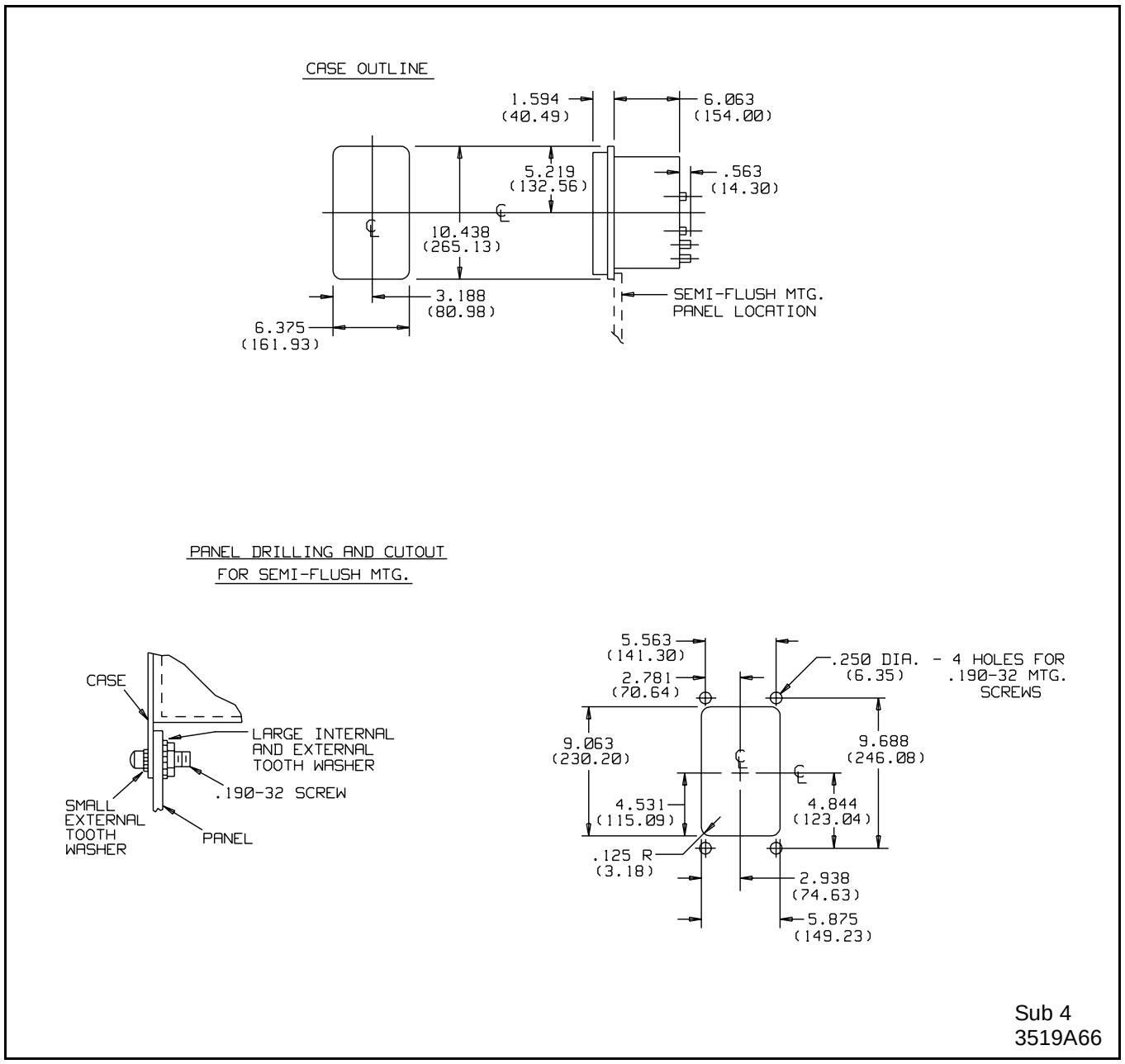


Figure 25: Outline and Drilling plan for theType COM relay in the FT21 Case for Class 1E.

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