

LINE CONCENTRATOR-IDENTIFIER SYSTEM
APPLIED TO TELEPHONE SECRETARIAL ANSWERING SERVICE
CIRCUIT TESTS AND TROUBLE ANALYSIS

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4. APPARATUS	6	1.01 This section describes the circuit tests required to test the line concentrator-identifier and trouble analysis to assist if trouble conditions occur.	
5. PREPARATION	7	1.02 This section is reissued to change all information and tests to reflect the current issue of the CD and SD and add trouble analysis for maintaining the system. The title has been changed to include the additional contents. Due to extensive changes throughout the section, change arrows will not be used.	
6. METHOD	8	1.03 The concentrator-identifier system consists of two units interconnected with two, four, or six talking trunks and a maximum of four signaling pairs. The originating equipment (concentrator) is located in the central office and the terminating equipment (identifier) is located at the Telephone (Secretarial) Answering Service (TAS) location.	
7. TROUBLE ANALYSIS	31	1.04 This issue of the section is based on the following drawings:	
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determine the extent of the changes and the manner in which the section may be affected.

2. OUT OF SERVICE TESTS—EQUIPMENT MUST BE REMOVED FROM SERVICE

2.01 The following procedures are intended to isolate a trouble condition and provide a sequence to manually step the concentrator and visually observe its progress.

2.02 The tests are arranged to provide a method of testing the concentrator individually or as a complete system connected by cable facilities.

2.03 Detached contact drawings are provided to assist in isolating a trouble condition and provide an overall system concept for both the central office and plant personnel (Fig. 1 and 2).

2.04 This test is performed to make the concentrator operate as if the identifier were connected via cable pairs.

(a) The concentrators prior to issue 14AR of SD-95964-01 transmit signals on the P(R1) lead and receive signals from the identifier on the P(T1) lead. Place a ground on the P(R1) and P(T1) leads at the SUB(L) terminal strip to give the concentrator the same response as if the identifier were connected.

(b) Operate TB2 thru TB6 keys for the number of trunks available at that location.

(c) Originate a call and observe the S1 relay for trunk No. 1 operates during the ringing cycle.

(d) Place a ground on the tip of trunk No. 1, terminal 58 of trunk unit terminal strip 1.

(e) S Relay for trunk No. 1 operates and trips ringing.

(f) Remove ground from terminal 58 of trunk terminal strip 1.

(g) Release TB2 key and operate TB1 key.

(h) Originate a call and observe the S1 relay for trunk No. 2 operates during the ringing cycle.

(i) Place a ground on the tip of trunk No. 2 terminal 58 of trunk unit terminal strip 2.

(j) S Relay for trunk No. 2 operates and trips ringing.

(k) Remove ground from terminal 58 of trunk terminal strip No. 2.

(l) Perform the previous tests for all remaining trunks by releasing the appropriate TB-key and placing ground on terminal 58 of the respective trunk under test.

(m) Restore all TB keys to normal.

2.05 To perform tests on systems equipped with separate pulse and digit complete pairs, (issue 14AR of SD-95964-01) perform the following:

(a) Place straps across PR and PT leads, and DCR and DCT leads on SUB(L) terminal strip.

(b) Operate TB2 thru TB6 keys for the number of trunks available at that location.

(c) Originate a call and observe the S1 relay for trunk No. 1 operates during the ringing cycle.

(d) Place a ground on terminal 58 of trunk unit terminal strip No. 1.

(e) S Relay for trunk No. 1 operates and trips ringing.

(f) Remove ground from terminal 58 of trunk unit terminal strip No. 1.

(g) Release TB2 key and operate TB1 key.

(h) Perform the previous tests for all remaining trunks by releasing the appropriate TB-key and placing ground on terminal 58 of the respective trunk under test.

(i) Restore all TB keys to normal.

2.06 To test the timing tubes UT, TT, and CT, proceed as follows:

A. UT Tube

- (a) Operate CB key.
- (b) Block nonoperated the DC1 relay in the A controller.
- (c) Manually operate an RU relay.
- (d) Within approximately 3 seconds the alarm lamp lights.
- (e) Remove blocking tool from DC1 relay.
- (f) Operate alarm release key and the circuit restores to normal.

B. TT Tube

- (a) Remove UT tube.
- (b) Block nonoperated the DC1 relay in the A controller.
- (c) Manually operate an RU relay.
- (d) Corresponding units and tens lamps, CA lamp, and a trunk lamp light and remain lighted.
- (e) On systems prior to issue 14AR of SD-95964-01 remove ground on P(R1) lead on SUB(L) terminal strip.

Note: On systems installed with issue 14AR of SD-95964-01, remove strap on PR, PT leads on SUB(L) terminal strip.

- (f) Remove blocking tool from DC1 relay and within approximately 3 seconds the alarm lamp lights.
- (g) Operate alarm release key and the circuit restores to normal.
- (h) Replace UT tube.

C. CT Tube

- (a) On systems prior to issue 14AR of SD-95964-01, place ground on P(R1) lead on SUB(L) terminal strip.

Note: On systems installed with issue 14AR of SD-95964-01, place a strap on PR, PT leads on SUB(L) terminal strip.

- (b) Manually operate an RU relay and observe the momentary operation of the CT relay.
- (c) Restore CB key to normal.
- (d) Remove "straps" applied in Step (a).

2.07 Systems which are equipped with auxiliary pulsing paths require the following tests. See 2.08 for systems not equipped with auxiliary pulsing paths.

Note: Prior to SD-95964-01 issue 14AR, the *S* option must be installed to operate the SS relay. **See Step (f) for systems installed using SD-95964-01 issue 14AR or later.**

- (a) Momentarily operate an RU relay.
- (b) The alarm sounds, locks out that controller and lights the alarm lamp and appropriate controller and TI-, UI- lamps.
- (c) Visually observe the SS relay operates and remains operated.
- (d) Operate AR key.
- (e) All lamps extinguish and the SS relay releases.
- (f) Systems installed using SD-95964-01 issue 14AR require the YN option when auxiliary pulsing paths are provided.
- (g) Perform Steps *a* thru *e*.

2.08 Systems which are not equipped with auxiliary pulsing paths require the following tests.

Note: Prior to SD-95964-01 issue 14AR, the *T* option must be installed to insure the SS relay does *not* operate. **See Step (f) for systems installed using SD-95964-01 issue 14AR.**

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- (a) Momentarily operate an RU relay.
- (b) The alarm sounds, locks out that controller and lights the alarm lamp and appropriate controller and TI-, UI- lamps.
- (c) Visually observe the SS relay is not operated.
- (d) Operate the AR key.
- (e) All lamps extinguish.
- (f) Systems installed using SD-95964-01 issue 14AR require the YM option when auxiliary pulsing paths are *not* provided.
- (g) Perform steps (a) thru (e) in 2.07.

Note: The SS relay will operate regardless of which option (YN or YM) is provided on systems installed using SD-95964-01 issue 14AR. Option YM requires straps on the SUB(L) terminal strip to ensure the pulses are routed back to the primary pulsing pair when the SS relay is operated.

3. SYSTEM TESTS—EQUIPMENT REMAINS IN SERVICE

3.01 These tests can be performed before or after the equipment has been turned up for service.

A. Call Through and Pretripping: The following features are checked.

- (1) Identification of called subscriber auxiliary line equipment.
- (2) Start circuit seizure.
- (3) Alternate use of controllers in originating and terminating equipment.
- (4) Pulse generator in originating equipment and pulse receiver in terminating equipment.
- (5) Use of trunk allotter and trunk seizure.
- (6) Seizure of indicator and indicator timer.
- (7) Lighting of subscriber lamps at switchboard.
- (8) Ringing tripping relay in central office does not pretrip.

B. Trunk Make-Busy and Trunk Allotter Sequence: This test checks the ability of the trunk allotter to assign the remaining trunks in sequence when one or more trunks are made busy.

C. Alternate Allotter: The following features are checked.

- (1) The alternate trunk allotter is used when a trouble occurs in the regular trunk allotter.
- (2) The alternate trunk allotter is used when the AA key is operated.
- (3) The regular trunk allotter is released when the AR key is operated or when the alarm release telephone number is dialed.

D. Pulsing Path Transfer: The following features are checked.

- (1) The pulsing path is transferred to an alternate path when the circuit times out.
- (2) The pulses are transmitted over the alternate route.
- (3) The primary pulsing path is restored when the AR key is operated or when the alarm release telephone number is dialed.

E. Indicator Make-Busy: This test checks the ability of the indicator timer to assign the remaining indicator or indicators in sequence when one or more indicators are made busy.

F. Talking Path Seizure: The following features are checked.

- (1) The secretarial bureau attendant seizes a talking path during the period that the line lamp is illuminated.
- (2) The trunk is held under the control of the secretarial bureau attendant.
- (3) A talking path can be verified over each equipped trunk.

G. Alternate Use of Controllers: The following features are checked.

- (1) Alternate use of controllers in originating and terminating equipment.
 - (2) Make-busy of controllers when either CA or CB key is operated.
 - (3) Lamp indication of controller in use at originating equipment.
- H. Double Processing of a Call:** This test verifies the timed lockout interval of the timed lockout circuit is sufficient to prevent double processing of a call.
- I. Timed Lockout Circuit:**
- (a) This test checks the capabilities of the two timed lockout circuits associated with SD-95739-01 prior to issue 22. All later equipment has the five lockout circuits.
 - (b) This test checks the transfer capabilities of the five timed lockout circuits after issue 22 and all issues of SD-95964-01.
- J. Units Timing:** This test checks the units timing circuits.
- K. Tens Timing:** This test checks the tens timing circuits.
- L. Alarm Cutoff:** This test checks the alarm cutoff circuits.
- M. Hold Magnet Check Relay:** This test checks the hold magnet check relay for operations on either winding.
- N. Fuse Alarms:** The following features are checked.
- (1) The ability of the fuse alarm circuits in the originating and terminating equipment to function when a fuse has operated.
 - (2) Alarm functions in case of charging failure.
- O. Measurement of Line Current:** This test checks the circuits over which the pulses are transmitted.
- P. All-Trunks-Busy (Calls Waiting), Calls Display, and Traffic Registers:** The following features are checked.
- (1) All-trunks-busy (calls waiting) and traffic register circuit at the originating equipment.
 - (2) ATB (calls waiting) lamp and traffic register at the terminating equipment.
 - (3) Calls are pulsed through and displayed when all trunks are busy.
 - (4) Tone spurt, when provided, and inoperative talking path when all trunks are busy.
- Q. Battery Charging Rate:** This test checks the charging current of the battery charger at the terminating equipment.
- R. Controller Time-Out:** This test checks that a terminating equipment controller will time out in 4 to 6 seconds, if PC1 or PC2 relays are held operated due to controller relay failure.
- S. Trunk Capacity, Discharge:** This test checks the composite trunk capacity discharge circuit for both the 280- and 316-type relays.
- T. Units and Tens Digits and Select and Hold Magnet Operation:** This test checks that the appropriate units and tens digit relays and the appropriate select and hold magnets will be operated at the originating equipment in response to the operation of a particular RU-relay at the originating equipment.
- U. Originating Tens Digit Association and Lockout:** This test checks the operation of tens group RU- relays associated with corresponding T- relays. The preference feature of the T- relays is also checked.
- 3.02** Performance of the tests in this section requires simultaneous action and verification at the central office originating equipment, the telephone answering bureau terminating equipment cabinet, and the telephone answering bureau switchboard. Provisions for establishing a talking connection between the originating equipment and the terminating equipment have been provided.
- 3.03** Where a reference is made to an SD number in a step in Part 6, that particular phase of the test applies only to the equipment corresponding to the SD number. Where no reference is made to an SD number, that phase of the test applies to all equipment.

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3.04 Ringup circuits will function with three different ringing arrangements. The proper ringing current polarity should be determined before performing tests related to applying ringing current.

3.05 Performance of Tests C, D, F, M, P, and T will result in all service being interrupted. These tests should be performed only during periods of light traffic.

3.06 Performance of Test P will cause the all-trunks-busy register at the originating equipment and the calls-waiting register at the terminating equipment to score. Local instructions should be followed for recording and reporting these register operations.

3.07 The instruction "activate ringup circuit" in the ACTION column of Part 6 may be performed in accordance with Steps 5a, 6b, 7, 8, and 9 of Test A when the equipment is in service. If the equipment is not in service, the instruction "activate ringup circuit" may be performed by manually operating the RU- relay associated with the ringup circuit selected for test. It may be necessary to manually release the LO relay of the selected ringup circuit to operate the UI and TI lamps at the jack and lamp panel.

3.08 To test the alarm circuit (Test N) when 70-type fuses are mounted in a modular fuse block (such as the 22- or 23-type block), insert the tip of the 411B tool into the aperture provided

in the fuse block cover for the alarm to be tested, and touch the alarm bar.

3.09 Lettered Steps: A letter a, b, c, etc, added to a step number in Part 6 of this section, indicates an action which may or may not be required depending on local conditions. The condition under which a lettered step or a series of lettered steps should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.

4. APPARATUS

4.01 The apparatus required for each test is shown in Table A. The details of each item are covered in the paragraph indicated by the number in parentheses.

4.02 1013-type Handset (dial hand test set) equipped with a W2DB cord, 4 feet long, one 471A jack, and two KS-6780 connecting clips (2W37A cord) (used to establish test talk path at originating equipment).

4.03 1013B Handset (dial hand test set) or equivalent (used to establish test talk path at terminating equipment).

4.04 Testing cord, 893 cord, 6 feet long, with two 360A tools (1W13B cord), one KS-6278 connecting clip, one 411A (test pick) tool (for

TABLE A

APPARATUS	TESTS										
	A to E	F	G to M	N	O	P	Q	R	S	T	U
Handset (4.02)	1	1	1	1	-	1	-	1	-	1	1
Handset (4.03)	1	1	1	1	-	1	-	1	-	1	1
Testing cord (4.04)	1	-	1	2	-	-	-	2	-	1	1
Weston volt-ammeter (4.05)	-	-	-	-	1	-	1	-	-	-	-
Testing cord (4.06)	-	-	-	-	1	-	-	-	-	-	-
Volt-ohm-milliammeter (4.07)	-	-	-	-	-	-	-	-	1	-	-
Standard Time Corp S1 Timer (4.08)	-	-	-	-	-	-	-	1	-	-	-
Tool (4.09)	✓	-	✓	-	✓	-	-	✓	-	✓	✓

✓ As required.

applying battery, ringing current, or ground to test points), or one 419A (test connector) tool (for connecting to relay springs).

4.05 Weston model 280 volt-ammeter, or equivalent, equipped with test leads, having voltage scales of 60, 30, and 3 volts, and current scales of 15, 3, and 0.3 amperes.

4.06 Testing cord, W2BS cord, 5 feet long, equipped with one 310 plug and two No. 35 cord tips (2W33A cord), or equivalent, (for measuring battery charging current).

4.07 KS-14510, L1 volt-ohm-milliammeter (ohmmeter), or equivalent, equipped with KS-14510, L2 and KS-14510, L3 test leads, or equivalent.

4.08 Standard Time Corp S1 Timer, or equivalent, for timing controller time-out.

4.09 Two patching cords, one conductor, 12.5 inches long, equipped with two 30 Mueller Mini-Gator clips and two 32 Mueller insulators (W1AP cord).

4.10 310-type dummy plug.

4.11 Blocking and insulating tools, as required. Use tools and apply, as covered in Section 069-020-801.

5. PREPARATION

STEP	ACTION	VERIFICATION
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All Tests

1	At originating equipment— Restore all keys.	At originating equipment— All lamps extinguished.
2	At terminating equipment— Restore all keys.	At terminating equipment— All lamps extinguished.

Tests A through N, P, Q, T, U

3	At originating equipment— Determine which lines will be used in test and inform the switchboard attendant.	
4	Establish a talking connection between originating equipment in the central office and terminating equipment in the answering bureau.	

Tests B, C, D, E, G, H, J, K, L, M, N, U

5	Select for test a vacant ringup circuit, if available, and inform terminating equipment end which line was selected for test.	
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6. METHOD

STEP	ACTION	VERIFICATION
A. Call Through and Pretripping		
5a	If R resistor is 1470 ohms— At originating equipment SD-95739-01— At ringup circuit— Momentarily apply ground to terminal 2B of RU- relays in sequence.	At terminating equipment— At trunk unit— T- lamps associated with selected ringup circuit lighted for approximately 3.2 seconds. At switchboard— Line lamp associated with selected ringup circuit lighted for approximately 2 seconds.
6b	If R resistor is 20,500 ohms— At originating equipment SD-95739-01— At ringup circuit— Momentarily apply battery to terminal 2B of RU- relays in sequence.	Same as Step 5a.
7	At originating equipment SD-95964-01— At lockout circuit— Insulate in turn contacts of LO-0 through LO-9 relays listed in Table B associated with RU- relays selected for test.	
8	At originating equipment— At ringup circuit— Momentarily apply ringing current on even	At terminating equipment— At trunk unit— T- lamps associated with selected ringup circuit

TABLE B

LO- RELAY CONTACTS	LO- RELAYS*									
	LO-0	LO-1	LO-2	LO-3	LO-4	LO-5	LO-6	LO-7	LO-8	LO-9
	RU- RELAYS									
Lower 1-2	00	01	02	03	04	05	06	07	08	09
Lower 3-4	10	11	12	13	14	15	16	17	18	19
Lower 5-6	20	21	22	23	24	25	26	27	28	29
Lower 7-8	30	31	32	33	34	35	36	37	38	39
Lower 9-10	40	41	42	43	44	45	46	47	48	49
Upper 1-2	50	51	52	53	54	55	56	57	58	59
Upper 3-4	60	61	62	63	64	65	66	67	68	69
Upper 5-6	70	71	72	73	74	75	76	77	78	79
Upper 7-8	80	81	82	83	84	85	86	87	88	89
Upper 9-10	90	91	92	93	94	95	96	97	98	99

STEP	ACTION	VERIFICATION
	numbered insulated contact of LO- relay selected.	lighted for approximately 3.2 seconds. At switchboard— Line lamp associated with selected ringup circuit lighted for approximately 2 seconds.
9	At lockout circuit— Remove insulating tool from LO- relay.	
10	At main distributing frame— Connect test line to vacant subscriber line terminal. <i>Note:</i> If vacant subscriber line terminal is not available, obtain permission to use a working or assigned circuit.	
11	At main distributing frame— Originate a test call to test line.	Audible ringing tone heard. At originating equipment— S relay in central office does not operate. At terminating equipment— Switchboard lamp associated with ringup circuit lighted for approximately 2 seconds.
12	At main distributing frame— Disconnect test call.	At terminating equipment— Switchboard lamp associated with ringup circuit extinguished. At main distributing frame— Audible ringing tone silenced.
B. Trunk Make-Busy and Trunk Allotter Sequence		
6	At originating equipment— At jack and lamp panel— Operate TB1 key.	
7	Activate ringup circuit (3.07) to momentarily make busy all trunks in sequence.	At originating equipment— At jack and lamp panel— TK1 lamp does not light. Remaining TK- lamps lighted and extinguished in sequence. At terminating equipment— T1 lamp does not light. Remaining T- lamps lighted and extinguished in sequence.
8	At originating equipment— At jack and lamp panel— Restore TB1 key.	
9	At originating equipment— At jack and lamp panel— Operate TB2 key.	At originating equipment— At jack and lamp panel— TK2 lamp does not light.

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STEP	ACTION	VERIFICATION
		Remaining TK- lamps lighted and extinguished in sequence. At terminating equipment— T2 lamp does not light. Remaining T- lamps lighted and extinguished in sequence.
10	At originating equipment— At jack and lamp panel— Restore TB2 key.	
11	At originating equipment— Operate each next higher numbered TB- key and repeat Step 10 until all TB- keys have been operated and restored.	At originating equipment— At jack and lamp panel— TK- lamp associated with operated TB- key does not light. Remaining TK- lamps lighted and extinguished in sequence. At terminating equipment— T- lamp associated with operated TB_ key does not light. Remaining T- lamps lighted and extinguished in sequence.
12	At originating equipment— Restore all keys to normal and disconnect test call.	
C. Alternate Allotter		
6	At originating equipment— At jack and lamp panel— Operate AA key.	At jack and lamp panel— AA lamp lighted.
7	Activate ringup circuit (3.07).	At originating equipment— At jack and lamp panel— TK1 lamp lighted for each ringup circuit operation. At terminating equipment— T1 lamp lighted for each ringup circuit operation.
8	At originating equipment— At jack and lamp panel— Restore AA key.	At jack and lamp panel— AA lamp extinguished.
9	At originating equipment— At trunk allotter circuit— Manually release TA1 through TA6 relays if operated.	TA0 relay operated.
10	Block nonoperated TA0 relay.	

STEP	ACTION	VERIFICATION
11	Activate ringup circuit (3.07).	At jack and lamp panel— AA, AL lamps lighted. Audible alarm sounds. At terminating equipment— T1 lamp lighted for each ringup circuit operation.
12	At originating equipment— At jack and lamp panel— Momentarily operate AR key.	At jack and lamp panel— AA, AL lamps extinguished. Audible alarm silenced.
13	At trunk allotter circuit— Remove blocking tool from TA0 relay.	TA0 relay operates if no TA- relays are operated.
14	Activate ringup circuit (3.07).	At originating equipment— At jack and lamp panel— TK- lamps lighted in sequence. At terminating equipment— T- lamps lighted in sequence.
15	At originating equipment— Deactivate ringup circuit.	

D. Pulsing Path Transfer

6	At originating equipment— At controller connector circuit— Insulate 6T of SS relay.	
7	Activate ringup circuit (3.07).	At originating equipment— AL lamp lighted. Audible alarm sounds. At terminating equipment— TO lamp lighted. At switchboard— Line lamp associated with activated ringup circuit lighted for approximately 2 seconds.
8	At originating equipment— Deactivate ringup circuit. Momentarily operate AR key.	At originating equipment— AL lamp extinguished. Audible alarm silenced. At terminating equipment— TO lamp extinguished.
9	At originating equipment— At controller connector circuit— Remove insulating tool from 6T of SS relay.	

E. Indicator Make-Busy

6	At terminating equipment— Operate I1 key.	
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STEP	ACTION	VERIFICATION
7	At originating equipment— Activate ringup circuit (3.07) three times.	At terminating equipment— IT1 lamp does not light. IT2 lamp lighted and extinguished each time ringup circuit is activated.
8	At terminating equipment— Restore I1 key.	
9	At terminating equipment— Operate I2 key.	
10	At originating equipment— Activate ringup circuit (3.07) three times.	At terminating equipment— IT2 lamp does not light. IT1 lamp lighted and extinguished each time ringup circuit is activated.
11	At terminating equipment— Restore I2 key.	

F. Talking Path Seizure

5	At main distributing frame— Connect test line to vacant subscriber line terminal. <i>Note:</i> If vacant subscriber line terminal is not available, obtain permission to use a working or assigned circuit.	
6	At originating equipment— At jack and lamp panel— Leave TB1 key normal and operate remaining TB- keys.	
7	At main distributing frame— Originate a test call to test line.	Audible ringing tone heard. At originating equipment— TK1 lamp lighted and extinguished during each ringing interval. At terminating equipment— T1 lamp lighted and extinguished during each ringing interval. At switchboard— Line lamp associated with ringup circuit lighted for approximately 2 seconds.
8	At terminating equipment— At switchboard— Operate TALK key of idle cord circuit.	
9	At switchboard— At next interval while switchboard line lamp is steadily lighted—	At switchboard— Line lamp extinguished. Tone spurt heard, if provided.

STEP	ACTION	VERIFICATION
	Insert idle cord plug into jack associated with lighted lamp.	At main distributing frame— Audible ringing tone silenced. Talking circuit satisfactory between test set and switchboard.
10	At switchboard— Remove cord from jack.	
11	Restore TALK key.	
12	Repeat Steps 5 through 11 in turn until all TB- keys have been operated and restored.	
13	At main distributing frame— Disconnect test line from subscriber line terminal.	

G. Alternate Use of Controllers

6	At originating equipment— At jack and lamp panel— Operate CB or EA key.	
7	Activate ringup circuit (3.07) six times.	At originating equipment— At jack and lamp panel— CB lamp does not light. CA lamp lighted and extinguished for each ringup circuit operation. At terminating equipment— Controllers A and B operated alternately for each ringup circuit operation.
8	At originating equipment— At jack and lamp panel— Restore CB or EA key.	
9	At jack and lamp panel— Operate CA or EB key.	
10	At originating equipment— Activate ringup circuit (3.07) six times.	At originating equipment— At jack and lamp panel— CA lamp does not light. CB lamp lighted and extinguished for each ringup circuit operation. At terminating equipment— Controllers A and B operated alternately for each ringup circuit operation.
11	At originating equipment— At jack and lamp panel— Restore CA or EB key.	

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STEP	ACTION	VERIFICATION
12	At terminating equipment— Operate CB or EA key.	
13	At originating equipment— Activate ringup circuit (3.07) six times.	At originating equipment— CA, CB lamps lighted and extinguished alternately for each ringup circuit operation. At terminating equipment— Controller B does not operate. Controller A operated for each ringup circuit operation.
14	At terminating equipment— Restore CB or EA key.	
15	At terminating equipment— Operate CA or EB key.	
16	At originating equipment— Activate ringup circuit (3.07) six times.	At originating equipment— CA, CB lamps lighted and extinguished alternately for each ringup circuit operation. At terminating equipment— Controller A does not operate. Controller B operated for each ringup circuit operation.
17	At terminating equipment— Restore CA or EB key.	

H. Double Processing of a Call

Note: This test must be performed during a period in which the concentrator-identifier is not receiving or processing regular calls.

1	At originating equipment— Originate a call to the answering bureau and acquaint bureau attendant with test and line number(s) to be used for testing. Request bureau attendant not to answer test call(s).	
2	At originating equipment— At jack and lamp panel— Operate CB or EA key.	
3	At originating equipment— Originate a test call to a selected ringup circuit associated with lowest numbered units digit group arranged for code one ringing. (Observe requirements in Step 4.)	At jack and lamp panel— CA lamp lighted and extinguished each time ringing is heard in headset receiver. One TK- lamp lighted and extinguished each time ringing is heard in headset receiver. TK- lamps lighted and extinguished in sequence once for each ringing interval.

STEP	ACTION	VERIFICATION
		<i>Note:</i> If two TK- lamps are lighted during the same ringing interval, double processing of a call has occurred.
4	At originating equipment— After five ringing intervals— Disconnect test call.	
5	At jack and lamp panel— Restore CB or EA key.	
6	At jack and lamp panel— Operate CA or EB key.	
7	Repeat Steps 3 and 4.	Verifications same, except CB lamp lighted and extinguished instead of CA lamp.
8	At jack and lamp panel— Restore CA or EB key.	
9	Repeat Steps 2 through 8 using a ringup circuit associated with the next higher units digit arranged for code one ringing.	
10	Repeat Step 9 until all groups arranged for code one ringing have been tested.	

I. Timed Lockout Circuit

A. SD-95739-01 prior to issue 22.

Note: This checks the operation of the LO-A or LO-B keys to insure the transfer of its associated lockout relays to the next higher lettered group.

5	At originating equipment— At jack and lamp panel— Operate LO-A key.	
6	At originating equipment— Activate a ringup circuit (3.07) within the 0 through 4 units group.	At originating equipment— At timed lockout circuit— #2 MA, MB, MC relays operated and released.
7	Activate ringup circuit (3.07) within the 5 through 9 units group.	Same as Step 6.
8	At jack and lamp panel— Restore LO-A key.	
9	Operate LO-B key.	

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STEP	ACTION	VERIFICATION
10	Activate ringup circuit (3.07) within the 0 through 4 units group.	At originating equipment— At timed lockout circuit— #1 MA, MB, MC relays operated and released.
11	Activate ringup circuit (3.07) within the 5 through 9 units group.	Same as Step 10.
12	At jack and lamp panel— Restore LO-B key.	

B. SD-95739-01 after issue 22 and all issues of SD-95964-01.

Note: This test checks the operation of the LA thru the LE keys to insure the transfer of its associated lockout relays to the next higher lettered group.

5	At originating equipment— Momentarily operate a ringup relay with a units digit 0 or 5.	At originating equipment TMD LO relay unit— #1 MA, MB, MC relays operate and release.
6	At originating equipment— Momentarily operate a ringup relay with a units digit 1 or 6.	At originating equipment TMD LO relay unit— #2 MA, MB, MC relays operate and release.
7	At originating equipment— Momentarily operate a ringup relay with a units digit 2 or 7.	At originating equipment TMD LO relay unit— #3 MA, MB, MC relays operate and release.
8	At originating equipment— Momentarily operate a ringup relay with a units digit 3 or 8.	At originating equipment TMD LO relay unit— #4 MA, MB, MC relays operate and release.
9	At originating equipment— Momentarily operate a ringup relay with a units digit 4 or 9.	At originating equipment TMD LO relay unit— #5 MA, MB, MC relays operate and release.
10	At originating equipment jack and lamp panel— Operate LA key and momentarily operate a ringup relay with a units digit 0 or 5.	At originating equipment TMD LO relay unit— #2 MA, MB, MC relays operate and release.
11	At originating equipment jack and lamp panel— Restore LA key and operate LB key.	
12	Momentarily operate a ringup relay with a units digit 1 or 6.	At originating equipment TMD LO relay unit— #3 MA, MB, MC relays operate and release.
13	At originating equipment jack and lamp panel— Restore LB key and operate LC key.	

STEP	ACTION	VERIFICATION
14	Momentarily operate a ringup relay with a units digit 2 or 7.	At originating equipment TMD LO relay unit— #4 MA, MB, MC relays operate and release.
15	At originating equipment jack and lamp panel— Restore LC key and operate LD key.	
16	Momentarily operate a ringup relay with a units digit 3 or 8.	At originating equipment TMD LO relay unit— #5 MA, MB, MC relays operate and release.
17	At originating equipment jack and lamp panel— Restore LD key and operate LE key.	
18	Momentarily operate a ringup relay with a units digit 4 or 9.	At originating equipment TMD LO relay unit— #1 MA, MB, MC relays operate and release.
19	At originating equipment jack and lamp panel— Restore LE key.	

J. Units Timing

6	At terminating equipment— At controller A circuit— Operate CB key and insulate 3T of SM relay.	
7	At originating equipment— Activate ringup circuit (3.07).	At jack and lamp panel— AL, UI- lamps lighted. Audible alarm sounds. At terminating equipment— TO lamp lighted.
8	At terminating equipment— At controller A circuit— Restore CB key and remove insulating tool from 3T of SM relay.	
9	At originating equipment— At jack and lamp panel— Momentarily operate AR key.	AL, UI- lamps extinguished. Audible alarm silenced. At terminating equipment— TO lamp extinguished.
10a	If remote release alarm circuit is provided— Dial telephone number assigned for alarm release.	At originating equipment— At jack and lamp panel— AL, UI- lamps extinguished. Audible alarm silenced. At terminating equipment— TO lamp extinguished.
11	Repeat Steps 6 through 10a to test controller B.	

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STEP	ACTION	VERIFICATION
K. Tens Timing		
6	At originating equipment— At controller A circuit— Block operated DC1 relay.	
7	Activate ringup circuit (3.07) at least two times.	At jack and lamp panel— When CA lamp is lighted for controller A— AL, TI- lamps lighted. Audible alarm sounds. At terminating equipment— TO lamp lighted.
8	At originating equipment— At jack and lamp panel— Momentarily operate AR key.	AL, TI- lamps extinguished. Audible alarm silenced. At terminating equipment— TO lamp extinguished.
9a	If remote release alarm circuit is provided— Dial telephone number assigned for alarm release.	Same as Step 8.
10	At originating equipment— At controller A circuit— Remove blocking tool from DC1 relay.	
11	Repeat Steps 6 through 10 to test controller B circuit.	

L. Alarm Cutoff

6	At originating equipment— At controller A circuit— Block nonoperated DC3 relay.	
7	Operate CB key.	
8	Activate ringup circuit (3.07).	AL lamp lighted. Audible alarm sounds.
9a	If ACO key is locking-type— Operate ACO key.	ACO lamp lighted. AL lamp lighted. Audible alarm silenced.
10b	If ACO key is nonlocking-type— Momentarily operate ACO key.	ACO lamp lighted. AL lamp lighted. Audible alarm silenced.
11	Activate ringup circuit (3.07).	If ACO key is nonlocking-type— ACO lamp extinguished. AL lamp remains lighted. Audible alarm sounds.

STEP	ACTION	VERIFICATION
		If ACO key is locking-type— ACO, AL lamps remain lighted. Audible alarm does not sound.
12	Momentarily operate AR key.	If ACO key is nonlocking-type— AL lamp extinguished. Audible alarm silenced. If ACO key is locking-type— AL lamp extinguished. Audible alarm sounds.
13a	If ACO key is locking-type— Restore ACO key.	ACO lamp extinguished. Audible alarm silenced.
14c	If remote release alarm circuit is provided— Dial telephone number assigned for alarm release.	AL lamp extinguished. Audible alarm silenced.
15	Remove blocking tool from DC3 relay.	
16	Restore CB key.	
17	Repeat Steps 6 through 16 to test controller B.	
M. Hold Magnet Check Relay		
6	At originating equipment— At fuse panel— Remove CA or DA fuse.	
7	Activate ringup circuit (3.07).	At start timing and alarm circuit— H, HA relays continue to operate and release.
8	At fuse panel— Replace CA or DA fuse.	H, HA relays restore to normal. At jack and lamp panel AL lamp and appropriate lamp light at originating equipment.
9	At jack and lamp panel— Operate AR key.	AL lamp and appropriate lamps extinguished.
10	At fuse panel— Remove CB or DB fuse.	
11	Activate ringup circuit (3.07).	Same as Step 7.
11a	If circuit is not equipped with HS or HP resistors— At originating equipment SD-95739-01— At start circuit—	DA fuse does not operate.

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STEP	ACTION	VERIFICATION
	Momentarily connect ground to equipment side of DB fuse holder.	
12	At fuse panel— Replace CB or DB fuse.	
13	At jack and lamp panel— Operate AR key.	AL lamp and appropriate lamps extinguish.

N. Fuse Alarms

6	At originating equipment— At fuse panel— Connect battery to fuse alarm bus bar.	At jack and lamp panel— FA lamp lighted. Audible alarm sounds.
7	Disconnect battery from fuse alarm bus bar.	FA lamp extinguished. Audible alarm silenced.
8	At fuse panel— Connect battery to 411A test pick and insert into hole in fuse mounting.	At jack and lamp panel— 20A lamp lighted. Audible alarm sounds.
9	Remove 411A test pick from fuse mounting.	20A lamp extinguished. Audible alarm silenced.
10	At terminating equipment— At fuse panel— Connect battery to fuse alarm bus bar.	At terminating equipment— At equipment cabinet— FA lamp lighted. At switchboard— FA lamp lighted. Audible alarm sounds.
11	At terminating equipment— Disconnect battery from fuse alarm bus bar.	At equipment cabinet— FA lamp extinguished. At switchboard— FA lamp extinguished. Audible alarm silenced.
12	At terminating equipment— At fuse panel— Connect battery to fuse alarm bus bar.	At switchboard— FA lamp lighted. Audible alarm sounds.
13	At switchboard— Operate ACO or AS key.	Audible alarm silenced. FA lamp remains lighted.
14	At terminating equipment— Disconnect battery from fuse alarm bus bar.	At switchboard— FA lamp extinguished. Audible alarm sounds.
15	At switchboard— Restore ACO or AS key.	Audible alarm silenced.

STEP	ACTION	VERIFICATION
16a	If charge failure alarm is provided— At terminating equipment— Disconnect rectifier by removing ac power plug from power receptacle.	At terminating equipment— At equipment cabinet— FA lamp lighted. At switchboard— FA lamp lighted. Audible alarm sounds.
17a	Reconnect rectifier by plugging ac power plug into power receptacle.	At terminating equipment— At equipment cabinet— FA lamp extinguished. At switchboard— FA lamp extinguished. Audible alarm silenced.
O. Measurement of Line Current at Central Office Originating Equipment		
<i>Caution: This test will result in all service being interrupted. It should be performed only during periods of light traffic.</i>		
3	At terminating equipment— Block nonoperated PC1 relays in both controllers.	
4	Using the 120 milliamper scale on the KS-14510, L1 volt-ohm-milliammeter— Connect the KS-14510, L3 test leads to the (+) and (–) terminals of the milliammeter.	
5	Operate CB or EA key.	
6	Insert dummy plug into LC jack associated with controller A.	
7	Insulate 5 and 6T of SS relay.	
8	Block operated STA1 relay.	CA lamp lights.
9a	Using a W1AP cord— Ground 5B of SS relay (equipment installed using SD-95964-01 issue 14AR).	
10	Connect (+) lead of milliammeter to 5T and (–) lead to 6T of SS relay.	
<i>Caution: The sleeve of the LC jack and the K and KA resistors have +130V potential.</i>		
11	Patch the W1AP cord from terminal 1 to terminal 6 of the LC jack associated with controller A.	At milliammeter— Meter reads between 24 and 34 milliamperes.

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STEP	ACTION	VERIFICATION
		<i>Note:</i> If meter reading is incorrect, see Section 473-501-201 for line current adjustment.
12	Remove patching cord from terminal 1 and 6 of the LC jack associated with controller A.	
13	Remove plug from LC jack associated with controller A.	
14	Insert dummy plug into LC jack associated with controller B.	
15	Remove blocking tool from STA1 relay.	CA lamp extinguishes.
16	Block operated STB1 relay.	CB lamp lights.
17	Restore CB or EA key.	
18	Operate CA or EB key.	
19	Patch the W1AP cord from terminal 1 to terminal 6 of the LC jack associated with controller B.	At milliammeter— Meter reads between 24 and 34 milliamperes. <i>Note:</i> If meter reading is incorrect, see Section 473-501-201 for line current adjustment.
20	Remove patching cord from terminals 1 and 6 of the LC jack associated with the B controller.	
21	Remove ground from 5B of SS relay.	
22	Remove the milliammeter from 5T and 6T of SS relay.	
23	Remove plug from LC jack.	
24	Remove blocking tool from STB1 relay.	CB lamp extinguishes.
25	Restore CA or EB key.	
26	Remove insulating tool from 5 and 6T of SS relay.	
27	At terminating equipment— Remove blocking tools from PC1 relays in both controllers.	

STEP	ACTION	VERIFICATION	
P.	All-Trunks-Busy (Calls Waiting), Calls Display, and Traffic Registers		
		5 At main distributing frame— Connect test line to vacant subscriber line terminal.	
		<i>Note:</i> If vacant ringup circuit is not available, obtain permission to use a working or assigned ringup circuit.	
		6 At originating equipment— At jack and lamp panel— Leaving TB1 key normal, operate remaining TB- keys.	
		7 At main distributing frame— Originate a test call.	At terminating equipment— Switchboard lamp associated with selected ringup circuit lighted for approximately 2 seconds.
		8 At terminating equipment— At switchboard— Operate TALK key of idle cord circuit.	
		9 At terminating equipment— At switchboard— During next interval while switchboard line lamp is lighted— Insert cord plug of idle cord circuit into jack associated with lighted lamp.	At switchboard— Talking path completed between handset and switchboard. Spurt of tone not heard.
		10 Repeat Steps 5 thru 7 initiating a second test call.	ATB (calls waiting) lamp lighted (when provided). If composite signaling path has been removed (wiring circuit change)— ATB lamp does not light.
		11 At switchboard— Remove cord plug from switchboard jack.	
		12 At originating end— Disconnect test calls.	At originating equipment— ATB (calls waiting) register operated (when provided). At terminating equipment— At switchboard— ATB (calls waiting) lamp extinguished (when provided).
		13 At switchboard— Restore TALK key of idle cord circuit.	

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STEP	ACTION	VERIFICATION
14	Repeat Steps 6 through 12 with next higher numbered TB- key normal and all other TB- keys operated, until all TB- keys have been operated and restored.	
15	At originating equipment— At jack and lamp panel— Operate all TB- keys.	
16	At main distributing frame— Originate a test call.	At switchboard— Line lamp associated with test call lighted and extinguished during each ringing interval. ATB lamp lighted.
17	At switchboard— Operate TALK key of idle cord circuit.	
18	At switchboard— During next interval while switchboard line lamp is lighted— Insert cord plug of idle cord circuit into jack associated with lighted test call lamp.	At switchboard— Talking path not completed between handset and switchboard. Spurt of tone not heard. ATB lamp steadily lighted.
19	At switchboard— Remove cord plug from switchboard jack.	At switchboard— ATB lamp steadily lighted.
20	At switchboard— Restore TALK key of idle cord circuit.	
21	At originating equipment— At jack and lamp panel— Restore all TB- keys.	
22	At main distributing frame— Disconnect test calls.	

Q. Battery Charging Rate

3	At volt-ammeter— Set range switch to 3-ampere scale.	
4	At terminating equipment— At battery control and charge failure alarm circuit— Connect (–) terminal of volt-ammeter to middle terminal (load) of charge fuse holder.	
5	Connect (+) terminal of volt-ammeter to bottom bus terminal of charge fuse holder.	
6	At battery control and charge failure alarm circuit—	At terminating equipment— At battery control and charge failure alarm

STEP	ACTION	VERIFICATION
	Remove CHG fuse.	circuit— If a call is being served (CT relay operated and CC relay released)— Meter reads 0.600 ampere. If a call is not being served (CT relay released and CC relay operated)— Meter reads 0.350 ampere.
7	Repeat Step 6 to obtain meter reading for a call being served and for a call not being served.	
8	At terminating equipment— At battery control and charge failure alarm circuit— Replace CHG fuse.	
9	At battery control and charge failure alarm circuit— Disconnect volt-ammeter from charge fuse holder.	
R. Controller Time-Out		
3	At terminating equipment SD-95962-01— At controller A— Block nonoperated PC1 relay.	
4	At originating equipment— Activate ringup circuit (3.07) three times.	At terminating equipment— TO lamp lighted. Controller B operated for each ringup circuit operation. At originating equipment— At jack and lamp panel— AL lamp lighted. Audible alarm sounds.
5	At jack and lamp panel— Momentarily operate AR key.	AL lamp extinguished. Audible alarm silenced. At terminating equipment— TO lamp extinguished.
6	At terminating equipment— At controller A— Remove blocking tool from PC1 relay.	
7	At terminating equipment— At controller B— Block nonoperated PC1 relay.	

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STEP	ACTION	VERIFICATION
8	At originating equipment— Activate ringup circuit (3.07) three times.	At terminating equipment— TO lamp lighted. Controller A operated for each ringup circuit operation. At originating equipment— At jack and lamp panel— AL lamp lighted. Audible alarm sounds.
9	At jack and lamp panel— Momentarily operate AR key.	AL lamp extinguished. Audible alarm silenced. At terminating equipment— TO lamp extinguished.
10	At controller B— Remove blocking tool from PC1 relay.	

S. Trunk Capacity Discharge

Note: This test is to be performed when 280-type (P) relays are provided. (See Step 16 for 316-type relays.)

5	At originating equipment— At controller A circuit— Operate CA key.	At originating equipment— At jack and lamp panel— CA lamp lighted.
6	At ohmmeter— Set range switch to RX1 position.	
7	At originating equipment— At controller A circuit— Connect one test lead of ohmmeter to terminal 2 of P relay.	
8	Connect other test lead of ohmmeter to terminal 2T of W relay.	Meter reads infinite resistance.
9	Manually hold ST2 relay operated.	Meter reads 300 ohms. W relay operated.
10	Release ST2 relay.	Meter reads infinite resistance. W relay released.
11	Restore CA key.	
12	At controller B circuit— Operate CB key.	
13	Repeat Steps 6 through 10 for controller B.	
14	Disconnect meter leads.	

STEP	ACTION	VERIFICATION
15	Restore CB key. <i>Note:</i> This test is to be performed when 316-type (P) relays are provided.	
16	At originating equipment— At controller A circuit— Operate CA key and set range switch on meter to RX1 position.	
17	At originating equipment— At controller A circuit— Insert dummy plug in P jack of A controller.	
18	Connect one test lead of ohmmeter to terminal 7 of P relay and the other lead to 2T of W relay.	Meter reads infinite resistance.
19	Manually hold ST2 relay operated.	W relay operated and meter reads 300 ohms.
20	Release ST2 relay.	W relay released and meter reads infinite resistance.
21	Restore CA key. Remove dummy plug from P jack. Remove meter leads.	
22	At controller B circuit— Operate CB key. Insert dummy plug in P jack for controller B.	
23	Repeat steps 18 thru 20 for controller B.	
24	Disconnect meter leads. Remove dummy plug from P jack. Restore CB key.	

T. Units and Tens Digits and Select and Hold Magnet Operation

5	At originating equipment— At jack and lamp panel— Operate all TB- keys except TB- key associated with trunk unit selected for test.	
6a	If R resistor is 1470 ohms— At originating equipment SD-95739-01— At ringup circuit— Momentarily apply ground to terminal 2B of RU- relay selected for test as shown in Table D.	At terminating equipment— At switchboard— Switchboard lamp associated with operated RU- relay lighted for approximately 2 seconds as shown in Table D. At originating equipment—

TABLE C

MA, MB, MC RELAYS IN TMD LO CKT.	TRANSFER KEY	RINGUP RELAY	UNTS DIGITS
1	LA	RU-0	0 and 5
2	LB	RU-1	1 and 6
3	LC	RU-2	2 and 7
4	LD	RU-3	3 and 8
5	LE	RU-4	4 and 9

Note: Operation of L- key transfers to next higher numbered timed lockout circuit, except LE key which transfers to timed lockout circuit 1.

TABLE D

ACTION			VERIFICATION					
OPERATE RU -- RELAY*	SELECT MAGNET OPERATES SW1 THROUGH SW3**	SWITCH- BOARD LAMP LIGHTS*	TRUNK USED FOR TEST					
			1	2	3	4	5	6
			TRUNK CONNECT HOLD MAGNET	TRUNK CONNECT HOLD MAGNET	TRUNK CONNECT HOLD MAGNET	TRUNK CONNECT HOLD MAGNET	TRUNK CONNECT HOLD MAGNET	TRUNK CONNECT HOLD MAGNET
01	1	01	(SW1) A1	(SW1) A2	(SW1) A3	(SW1) A4	(SW3) A5	(SW3) A6
11	2	11	(SW1) A1	(SW1) A2	(SW1) A3	(SW1) A4	(SW3) A5	(SW3) A6
22	3	22	(SW1) A1	(SW1) A2	(SW1) A3	(SW1) A4	(SW3) A5	(SW3) A6
33	4	33	(SW1) B1	(SW1) B2	(SW1) B3	(SW1) B4	(SW3) B5	(SW3) B6
44	5	44	(SW1) B1	(SW1) B2	(SW1) B3	(SW1) B4	(SW3) B5	(SW3) B6
55	6	55	(SW2) C1	(SW2) C2	(SW2) C3	(SW2) C4	(SW3) C5	(SW3) C6
66	7	66	(SW2) C1	(SW2) C2	(SW2) C3	(SW2) C4	(SW3) C5	(SW3) C6
77	8	77	(SW2) C1	(SW2) C2	(SW2) C3	(SW2) C4	(SW3) C5	(SW3) C6
88	9	88	(SW2) D1	(SW2) D2	(SW2) D3	(SW2) D4	(SW3) D5	(SW3) D6
100	10	100	(SW2) D1	(SW2) D2	(SW2) D3	(SW2) D4	(SW3) D5	(SW3) D6

* May be 00-99.

** May be 0-9.

STEP	ACTION	VERIFICATION
		At jack and lamp panel— UI-, TI- lamps associated with operated RU- relay lighted for approximately 2 seconds.
7b	If R resistor is 20,500 ohms— At originating equipment SD-95739-01—	Same as Step 6a.

STEP	ACTION	VERIFICATION
	At ringup circuit— Momentarily apply battery to terminal 2B of RU- relay selected for test as shown in Table D.	
8	At originating equipment SD-95739-01 or SD-95964-01— At lockout circuit— Insulate contacts of LO- relay listed in Table B associated with RU- relay selected for test.	
9	At originating equipment— At ringup circuit— Momentarily apply ringing current on even numbered insulated contact of LO- relay selected.	At terminating equipment— At switchboard— Switchboard lamp associated with operated RU- relay lighted for approximately 2 seconds, as shown in Table D. At originating equipment— At jack and lamp panel— UI-, TI- lamps associated with operated RU- relay lighted for approximately 2 seconds.
10	At lockout circuit— Remove insulating tool from LO- relay.	
11	At terminating equipment— At switchboard— Operate TALK key of idle cord circuit.	
12	At switchboard— Insert cord plug into jack associated with lamp lighted in Steps 6a, 7b, or 8 and 9.	At terminating equipment— At trunk connector circuit— Observe that appropriate select and hold magnets associated with operated RU- relay are operated as shown in Table D.
13	At switchboard— Remove cord plug from jack.	
14	At switchboard— Restore TALK key.	
15	At originating equipment— At jack and lamp panel— Restore all TB- keys.	At originating equipment— At jack and lamp panel— TB- lamps extinguished.
16	Repeat Steps 5 through 15 until all RU- relays and trunks listed in Table D have been listed.	
U. Originating Tens Digit Association and Lockout		
6a	If R resistor is 1470 ohms— At originating equipment SD-95739-01— At ringup circuit—	At originating equipment— At jack and lamp panel— T10 lamp lighted.

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STEP	ACTION	VERIFICATION
	Momentarily apply ground to terminal 2B of an idle RU0- relay.	At terminating equipment— At switchboard— Switchboard lamp associated with operated RU0- relay lighted for approximately 2 seconds.
7b	If R resistor is 20,500 ohms— At originating equipment SD-95739-01— At ringup circuit— Momentarily apply battery to terminal 2B of an idle RU0- relay.	Same as Step 6a.
8	At originating equipment SD-95739-01 or SD-95964-01— At lockout circuit— Insulate contacts of LO- relay listed in Table B associated with RU relay selected for test.	
9	At originating equipment— At ringup circuit— Momentarily apply ringing current on even numbered insulated contact of LO- relay selected.	At originating equipment— At jack and lamp panel— TI- lamp lighted. UI- lamp lighted. At terminating equipment— At switchboard— Switchboard lamp associated with operated RU- relay lighted for approximately 2 seconds.
10	At lockout circuit— Remove insulating tool from LO- relay.	
11	At originating equipment— Operate an idle RU- relay for remaining tens group of RU-0 through RU-9 relays as described in Steps 6a, 7b, 8, 9, and 10.	At originating equipment— At jack and lamp panel— TI- lamp associated with operated tens group RU- relay lighted.
12	At originating equipment— Operate idle RU-0 and RU-1 relays simultaneously as described in Steps 6a, 7b, or 8 through 10.	At originating equipment— TI0, TI1 lamps lighted. Note: TI0 lamp will extinguish before TI1 lamp extinguishes. At terminating equipment— At switchboard— Switchboard lamp associated with RU-0 relay lighted before lamp associated with RU-1 relay lighted.
13	At originating equipment— At ringup circuit— Select other pairs of higher and lower tens group RU- relays, and test as described in Step 12.	At originating equipment— Lower numbered TI- lamp lighted before higher numbered TI- lamp lighted. At terminating equipment— Switchboard lamp associated with lower numbered RU- relay lighted before lamp associated with higher numbered RU- relay lighted.

7. TROUBLE ANALYSIS

7.01 The following procedures can be used as an aid to determine if the trouble is in the concentrator, the connecting cable facilities, or the identifier.

7.02 A sequential series of tests are contained in this section to manually walk the concentrator through a complete outpulsing sequence. The response from the identifier is required in some procedures, while other tests specifically request the cable pair be opened at the identifier.



Care should be taken not to lose a valid incoming call while performing these procedures.

7.03 *Pretripping of trunks 3 to 6:* This is a method to check trunks 3 to 6 when pretripping of trunks is the trouble indicated.

- (a) Select a trunk to be tested by operating all other trunk busy keys (TB1-6).
- (b) Have the T and R of that same trunk opened at the identifier.
- (c) Originate a call at the concentrator and observe the S relay for that trunk.
- (d) If the S relay operates, it indicates a defective cable pair on that trunk.
- (e) Replace the T and R of the trunk opened at the identifier.
- (f) Restore the operated trunk busy keys (TB1-6).



The following series of tests are performed to manually walk the concentrator through a complete outpulsing sequence. If controller A is being tested, operate the CB or EA key and perform the following actions and verifications on the controller A circuit. If controller B is being tested, operate the CA or EB key and perform

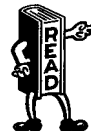
the following actions and verifications on the controller B circuit.

7.04 To test the selection of the proper units and tens digit relays for a line requesting service, perform the following:

- (a) Block TAA relay nonoperated.
- (b) Block ST1 relay nonoperated.
- (c) Manually operate RU-63 relay.
- (d) U3 relay operates and T6 relay operates.
- (e) LO3 relay operates.

7.05 Verification signals were received from the identifier:

- (a) Block ST2 relay nonoperated.
- (b) Unblock ST1 relay and observe ST1 and DSA/B operating and releasing.
- (c) Observe a trunk lamp lights to process this call.



From this point on, the tests must be performed before time out occurs or block the DL2 relays on both controllers nonoperated at the identifier.

7.06 Unit outpulsing by the concentrator.

- (a) Block DC3 relay nonoperated.
- (b) Observe the walking relays W, X, Y, and Z will operate during the outpulsing and release after outpulsing is completed.
- (c) Unblock ST2 relay and outpulsing begins to the identifier.
- (d) The PU and PU1 relays operated indicate outpulsing is completed.

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(e) Relay RU-63 is released. (If this call is the only one being processed by the concentrator, the unit relay U3 will release.)



The RU-63 relay must be released, (Step e) or the concentrator will double process this call by starting to outpulse on the next ring. Any RU-relay being tested that remains operated at this point in the test is possibly out of adjustment and should be readjusted.

(f) The PU and PU1 are operated and the W, X, Y, Z, and ST2 relays are released at this point.

7.07 Verification of units digits received at the identifier.

- (a) Block nonoperated the ST1 relay.
- (b) Observe the DC1 and DC3 relays operate after the action in Step (c) is performed.
- (c) Unblock the DC3 relay.

7.08 Identifier signals the concentrator it is ready to accept tens digits.

- (a) Block ST2 relay nonoperated.
- (b) Unblock the ST1 relay and observe the ST1 and DSA/B operating and releasing.
- (c) ST1 relay operating indicates the identifier is ready for tens digit.

7.09 Tens outpulsing from the concentrator.

- (a) Block the CT relay nonoperated.

Observe the following verifications after the action in Step (b) is performed.

- (b) Unblock ST2 relay.
- (c) W, X, Y, Z relays operate in sequence.
- (d) DC2 relay operates.
- (e) ST2 relay releases to indicate the outpulsing of tens is completed and releases the PU, PU1, W, X, Y, and Z relays.

(f) The released ST2 relay causes the DC relay at the identifier to release and score all tens digits sent. (At this point, the DC, DC3, DC1 relays release which ends the signaling between the concentrator and identifier.)

(g) The released PU1 relay releases relay TS which starts the 2.4 sec trunk timing.

(h) Observe Lockout Relays MA, MB, and MC relays release at this point.

(i) If answered at the identifier, the S relay for that trunk operates.

(j) If not answered, the selected trunk will disconnect in approximately 2.4 seconds after relay TS released.

(k) Select and hold magnets release.

(l) Unblock CT relay. The CT relay operates.

(m) All relays are normal providing no other calls are being processed by the concentrator.

7.10 Time out alarm tests. The timeout alarm operates when malfunction interrupts the units digit timing or tens digit timing.



The following tests are performed to test the proper functioning of the time out alarms.

A. Units digit timing

- (a) Block DC1 relay nonoperated.
- (b) Remove blocking tool from TAA relay.
- (c) Manually operate RU- relay.
- (d) 2.2 seconds, a Time Out alarm occurs.
- (e) Unblock DC1 relay.
- (f) Operate alarm release key to retire alarm.

B. Tens digit timing

- (a) Operate RU- relay.
- (b) When DC1 relay operates, hold it operated.

- (c) 2.2 seconds, a Time Out alarm occurs.
- (d) Release DC1 relay.
- (e) Operate alarm release key to retire TO alarm.
- (f) Restore controller busy keys at the concentrator.
- (g) Unblock the DL2 relays at the identifier.

7.11 The purpose of a lockout timer composed of relays MA, MB, and MC is to prevent an RU- relay from operating a second time on a single ring. The lockout relay LO- (Table E) is held operated for the call processing time plus the required release time of relays MA and MB. A potentiometer PBM 1 thru 5 is for adjustment of the MB relay release time as per Table E.



The lockout timer adjustment is to be performed only after the system is completely installed with cable facilities connected to the identifier. The signaling pair compensating resistors and pulsing speed adjustments must be made; then select the A controller by operating the CB key and adjust the LO-0 timer as per Table E. Release CB key and operate CA key and recheck timer LO-0 to insure it is within the requirements. Continue this procedure until all lockout timers LO-0 thru LO-4 have been adjusted.

7.12 Dirty contacts on the X and Z relays in the concentrator can cause distortion. See Fig. 4 to analyze a distorted pulse and determine which contact is responsible.

7.13 As an example, tens digit 6 should be outpulsed from the identifier. The tens digit 6 requires a +, -, + but a dirty contact on relay X would generate a +, blank, blank, and change the 6 to a 5.

7.14 Dirty contacts on relay Z would distort the digits to the extent the identifier would not score. Relay X could cause any digit to be changed and the identifier would be able to accept it and score.

7.15 The pulse register relays in Table F determine the two-digit code which is received from the concentrator. For example, a digit requires a combination of 3 positive and/or negative pulses or a first pulse and two opens for digit 0 and 5 to be accepted by the identifier as a valid code. The pulse register relays require a positive (XP), negative (YN), positive (ZP) signal be received to score the digit 6.

7.16 The call indicator auxiliary relays determine which lamp will be lit on the switchboard. Use Table F and Fig. 3, as a means to isolate a suspected trouble condition. The proper pulse register and auxiliary indicator relays operated would indicate a dirty or open contact exists on one of these relays.

TABLE E

TO TEST TIMER NO.	CONNECT S1 TIMER TO 14T AND 14B OF RELAY	MOMENTARILY OPERATE RELAY	OPERATED TIME OF
1	L00	RU-0	Lo
2	L01	RU-1	Relay
3	L02	RU-2	Should
4	L03	RU-3	Be
5	L04	RU-4	1.9 Sec To 2.3 Sec.

TABLE F

PULSE REGISTER RELAYS OPERATED	DIGIT	CALL INDICATOR AUXILIARY RELAYS OPERATED	HOLD MAGNET OPERATED
XN	0	None	A
XN, YN, ZP	1	B,C	A
XN, YN, ZN	2	C	A
XN, YP, ZN	3	A,B,C	B
XN, YP, ZP	4	A,C	B
XP	5	None	C
XP, YN, ZP	6	B,C	C
XP, YN, ZN	7	C	C
XP, YP, ZN	8	A,B,C	D
XP, YP, ZP	9	A,C	D

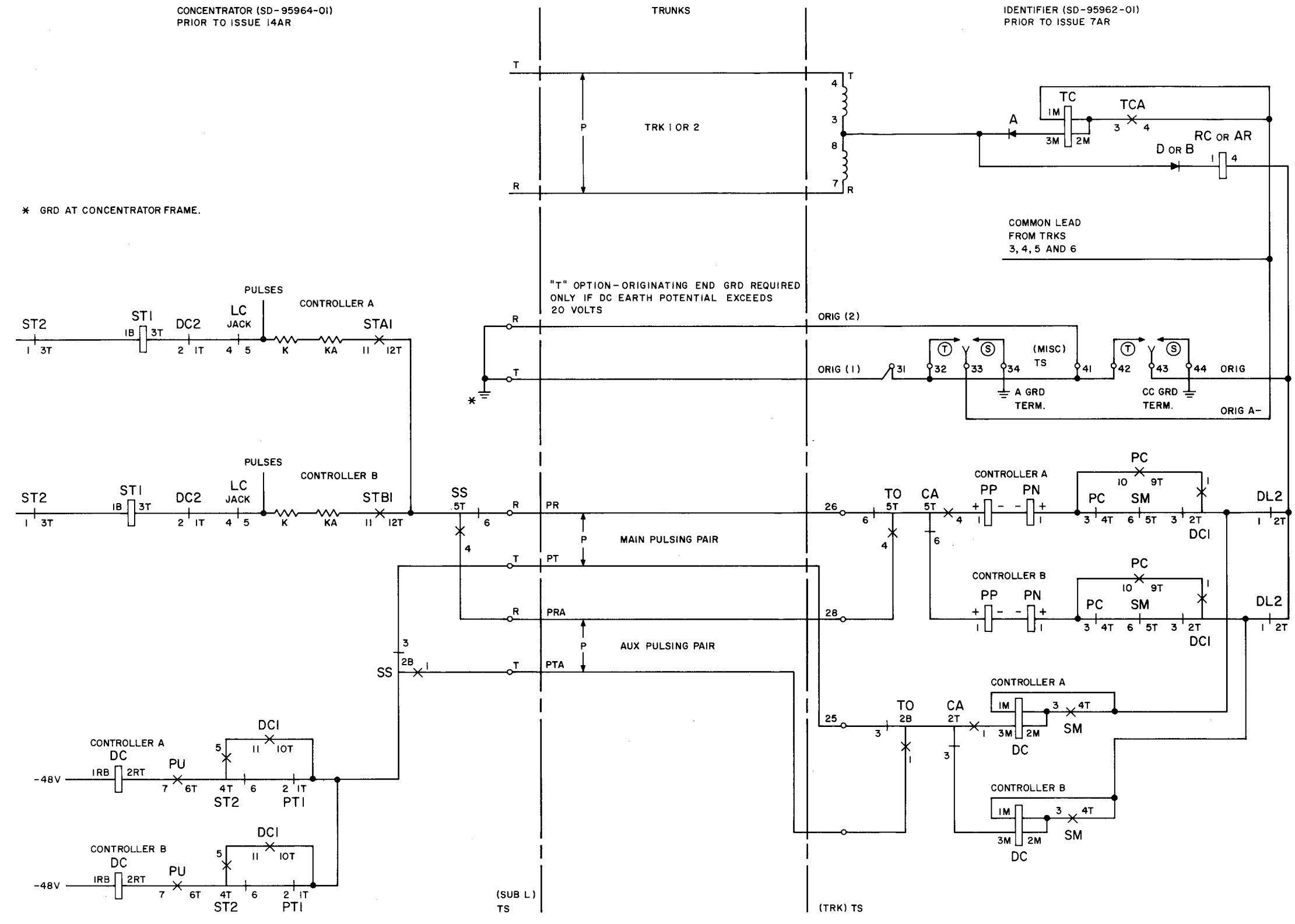


Fig. 1—Detached Contact Drawing of the Concentrator and Identifier

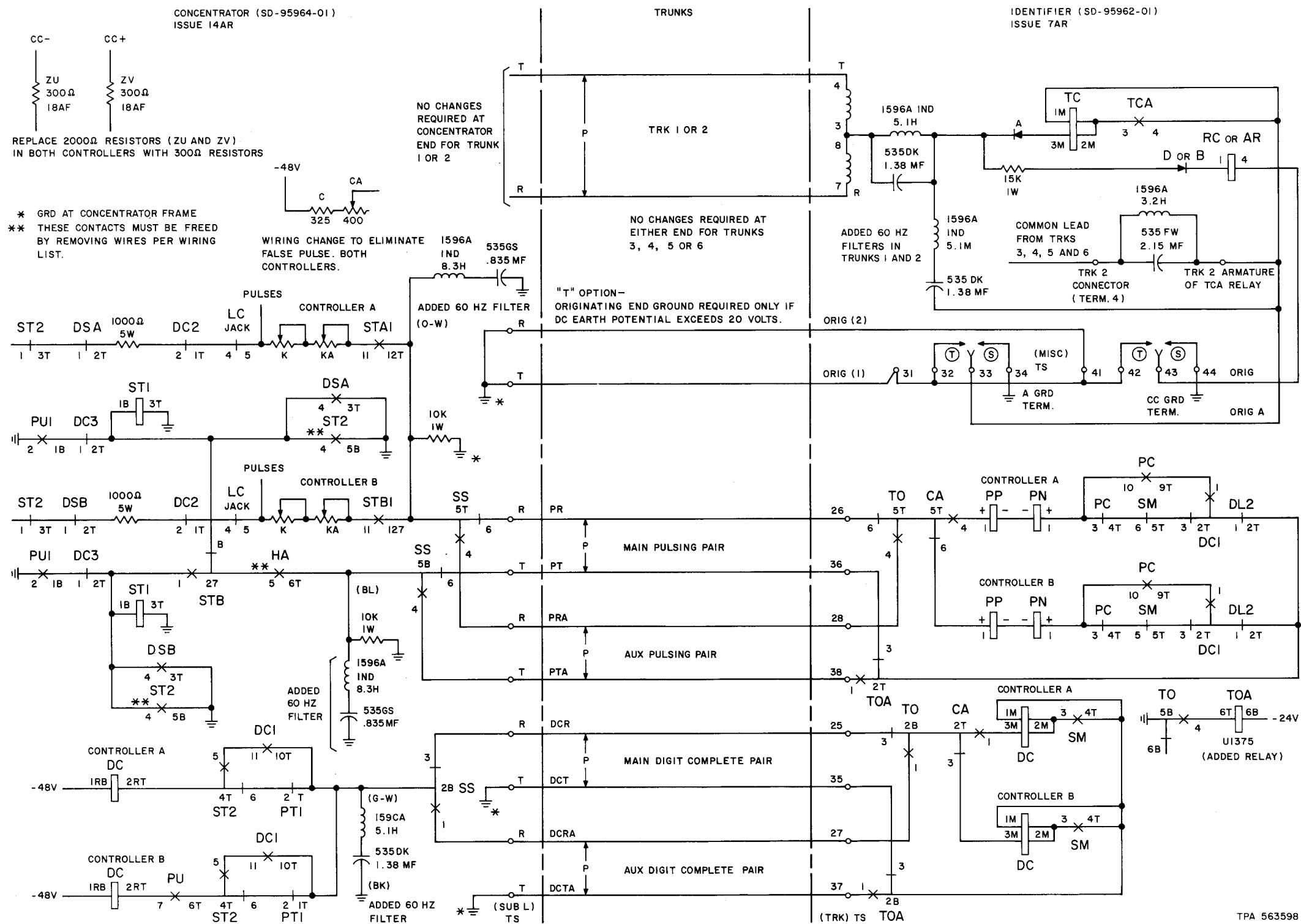


Fig. 2—Changes to Concentrator and Identifier to Improve Pulsing and Reduce Effects of AC Interference

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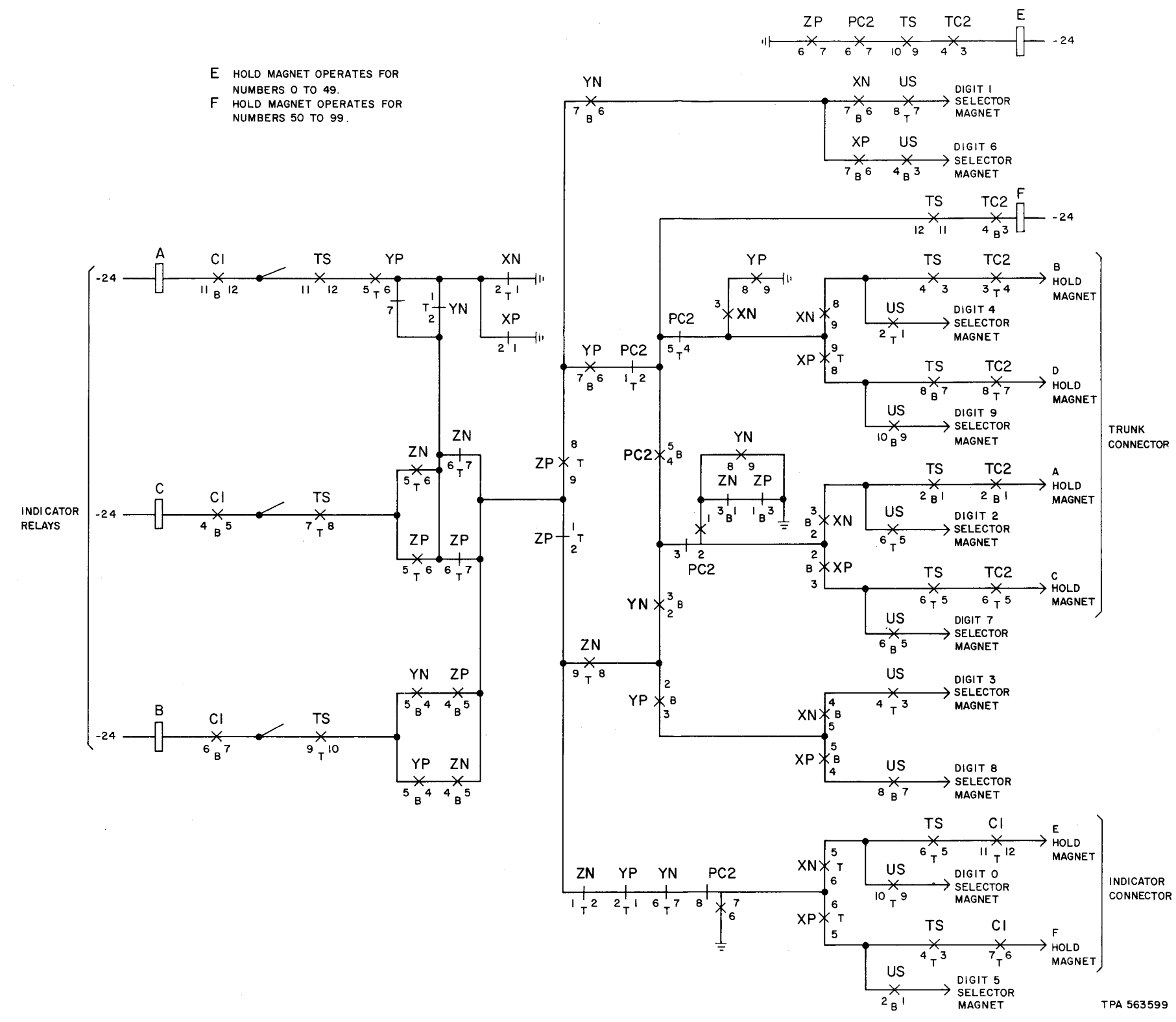


Fig. 3—Detached Contact Drawing of Identifier Showing Units and Tens Digit Registration Paths

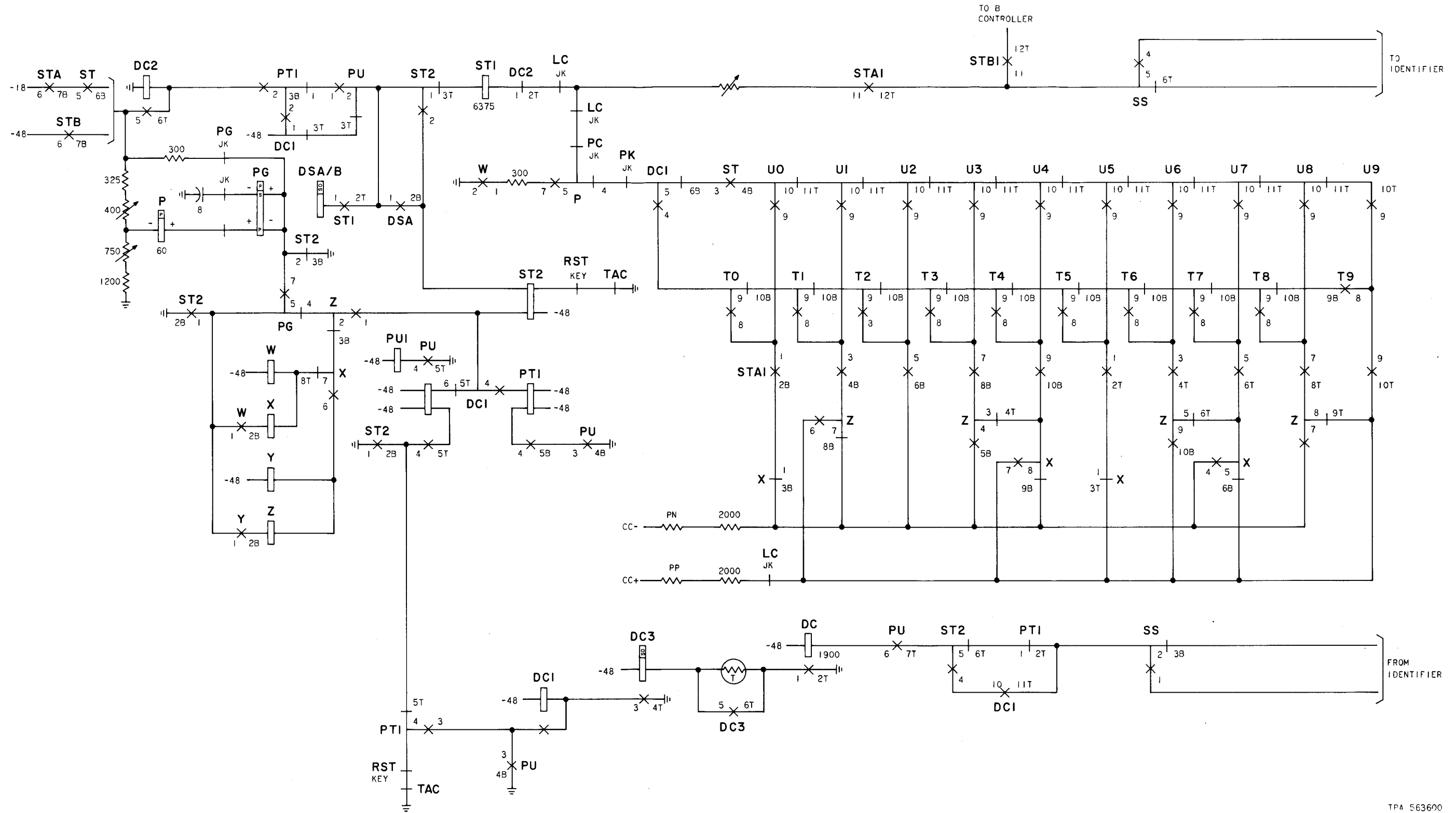


Fig. 4—Detached Contact Drawing of Concentrator Showing Units and Tens Digit Paths

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