TONE DETECTOR CIRCUIT SD-94800-01

TESTS AND ADJUSTMENTS

1. GENERAL

1.01 This section describes the methods of testing and adjusting the tone detector circuit SD-94800-01.

1.02 This section is reissued for the following reasons:

(1) Revision of Test C to provide information on new arrangement of circuit start control (Option ZM)

(2) Addition of Test I which provides a procedure for verifying the timing of the guard timer of CP12.

This reissue affects the Equipment Test List.

1.03 The tests covered are as follows:

1.04 When taking voltage indications, circuit ground must be used instead of frame ground to ensure accurate alignment of circuit.

1.05 When using KS-19353, L1 oscillator, the output level must be adjusted, using a 23A transmission measuring set as reference, before being used and after each change in frequency.

1.06 When the tone detector circuit is arranged for operation in ESS offices, the ON relay in Tests A through G is initially operated. Therefore, all references to blocking or removing blocking tools from ON the relay in all tests should be disregarded

when the circuit is arranged for operation in ESS offices.

1.07 Under no circumstances are tone detector circuit boards CP5 through CP8 ▶and CP12 per option ZP◀ to be mixed up with boards from another tone detector unit if more than one exists per location. The manufacturer aligns these boards to time correctly with the supply voltage, as regulated by a zener diode, in the unit that they are shipped in. Moving the boards to another unit will cause the tone detector to time differently, as all zener diodes are not exactly alike. Boards may experimentally be swapped to check for a bad one, but again, do not lose track of which unit they are associated with.

1.08 ▶Tests D and I◀ provide procedures for alignment of circuit packs when one or more of the following is believed to exist:

(a) If doubt exists that the boards in the unit are not those originally shipped with the unit

(b) If new boards have been installed and have not yet been aligned

(c) If a test failed in this section and it is believed to be due to a faulty or misaligned circuit board.

1.09 ***Lettered Steps:*** A letter a, b, c, etc, added to a step number in Part 3 of this section indicates an action which may or may not be required depending upon 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. When a condition does not apply, all steps designated by that letter should be omitted.

2. APPARATUS

2.01 KS-14510, L1 volt-ohm-milliammeter and one pair of L3 test leads equipped with KS-14530 connectors on one end and alligator clips on the other end.

2.02 KS-19353, L1 or L4 oscillator, or equivalent.

2.03 Electronic counter. ▶Any of the following units are acceptable:

Universal EPUT and Timer

Fairchild 8200

Beckman 7360 or 7370

Hewlett Packard 5223, 5233, 5325B, 5326, 5327, 5328, 5300 with 5302A, 5300 with 5304A, 5300 with 5308A, 5246 with 5247A, or an equivalent of any of the preceding.◀

2.04 Adapter, 159A, as required for extending circuit packs for potentiometer adjustment.

2.05 KS-3008 stopwatch, or equivalent.

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

2.07 Patching cord, W2W cord, 6 feet long, equipped with a 310 plug and two 360 tools and two 639A tools (2W17A cord, for connecting to fixed contacts of wire-spring relays).

2.08 Patching cord, 893 cord, 3 feet long, equipped with two 360A tools and two 419A test connectors (1W13A cord, for short-circuiting contacts of ST relay).

2.09 651A tools as required for holding 639A tools on wire-spring relays.

3. METHOD

STEP	ACTION	VERIFICATION
A. Broadband and Selective Channel Gain		
1	Using 893 cord, short-circuit contacts 5B and 5F of ST relay.	
2	Insulate make contacts 2 and 4 of ST relay.	

STEP	ACTION	VERIFICATION
3	Set oscillator FUNCTION switch to 600.	
4	Block ON and ST relays operated. See 1.06.	
5	Set oscillator to 600 Hz adjusted to -30 dBm.	
6	Connect oscillator to fixed contacts 2 and 4 of ST relay.	
7	Connect dc voltmeter between circuit ground (terminal 28 of terminal strip A) and TP1 (terminal 11 of terminal strip TP).	Voltmeter indicates -2.0 volts.
8a	If Step 7 verification is not obtained— Adjust P1 potentiometer until verification is obtained.	
9	Disconnect dc voltmeter from TP1.	
10	Remove blocking tool from ON relay.	
Circuits Arranged for 1100-Hz Tone Detection		
11	Set oscillator to 1100 Hz adjusted to -15.5 dB.	
12	Block ON, RG, and FI relays operated. See 1.06.	
13	Connect dc voltmeter between circuit ground (terminal 28 of terminal strip A) and TP1 (terminal 11 of terminal strip TP).	Voltmeter indicates -2.0 volts.
14b	If Step 13 verification is not obtained— Adjust P3 potentiometer until verification is obtained.	
15	Disconnect dc voltmeter from TP1.	
16	Remove blocking tool from FI relay.	
17	Connect dc voltmeter between circuit ground (terminal 28 of terminal strip A) and TP1 (terminal 11 of terminal strip TP).	Voltmeter indicates -2.0 volts.
18c	If Step 17 verification is not obtained— Adjust P4 potentiometer until verification is obtained.	
19	Disconnect dc voltmeter from TP1.	
20	Block FI relay operated.	

STEP	ACTION	VERIFICATION
21	Remove blocking tool from ON relay.	
22	Set oscillator to 1100 Hz adjusted to -15 dB.	
23	Operate ON relay.	Ground present on terminal 13 of terminal strip A.
24	Release ON relay.	Ground removed from terminal 13 of terminal strip A.
25	Set oscillator to 1100 Hz adjusted to -20 dB.	
26	Momentarily operate ON relay.	Ground not present on terminal 13 of terminal strip A.
27	Set oscillator to ◗950 Hz◖ adjusted to -0.5 dB.	
28	Momentarily operate ON relay.	Ground not present on terminal 13 of terminal strip A.
29	Set oscillator to ◗1250 Hz◖ adjusted to -0.5 dB.	
30	Momentarily operate ON relay.	Ground not present on terminal 13 of terminal strip A.
31	Remove blocking tool from RG and FI relays.	
Circuits Arranged for 2225-Hz Tone Detection		
32	Set oscillator to 2225 Hz at an output level of -25 dB.	
33	Block ON relay operated. See 1.06.	HTF relay operated.
34d	If Step 33 verification is not obtained— Adjust P2 potentiometer until HTF just operates.	
35e	If Step 33 verification is obtained— Adjust P2 potentiometer counterclockwise to release HTF relay, and then readjust P2 potentiometer until HTF relay just operates.	
36	Remove blocking tool from ON relay.	HTF relay released.
37	Set oscillator to 2050 Hz at an output level of -3 dB.	
38	Momentarily operate ON relay.	HTF relay not operated.
39	Set oscillator to 2420 Hz at an output level of -3 dB.	

STEP	ACTION	VERIFICATION
40	Momentarily operate ON relay.	HTF relay not operated.
Circuits Arranged for 1000-Hz Tone Detection		
41	Set oscillator to 1000 Hz at an output level of -18 dB.	
42	Block MWT relay operated, if provided.	
43	Block ON relay operated. See 1.06.	HTF relay operated.
44f	If Step 43 verification is not obtained and circuit is not arranged for 2225-Hz tone detection— Adjust P2 potentiometer until HTF relay just operates. ***Note:*** Do not change setting of P2 potentiometer if P2 was adjusted in Step 34d or 35e.	
45	Remove blocking tool from ON relay.	HTF relay released.
46	Set oscillator to 820 Hz at an output level of 0 dB.	
47	Momentarily operate ON relay.	HTF relay not operated.
48	Set oscillator to 1150 Hz at an output level of 0 dB.	
49	Momentarily operate ON relay.	HTF relay not operated.
50g	If MWT relay is provided— Remove blocking tool.	
51	Remove blocking tool from ST relay.	
52	Remove test connections.	
53	Remove insulators and short-circuiting cord from ST relay.	
B. DC Voltage Reference		
1	Insulate make contacts 2 and 4 of ST relay.	
2	Block ON and ST relays operated. See 1.06.	
3	Connect dc voltmeter between circuit ground (terminal 28 of terminal strip A) and test points as shown in Table A.	Voltmeter indicates voltages as shown in Table A.

STEP	ACTION	VERIFICATION

TABLE A

DIRECT VOLTAGES			
TP	TERM. T.S. "TP"	VOLTAGES	WHEN THIS CP PROVIDED
2	12	—1.7V Max	CP2
3	13	—0.3V Max	CP5
4	14	—0.3V Max	CP6
5	15	—15.5V Min	CP6
6	16	—0.3V Max	CP5
7	17	—0.3V Max	CP7
8	18	—0.3V Max	CP8
8	18	—15V Min	CP14
12	24	—0.3V Max	CP6 (OPTION ZM)

4	Using 893 cord, short-circuit contacts 5B and 5F of ST relay.	
5	Set oscillator to 600 Hz adjusted to -30 dBm.	
6	Connect oscillator to fixed contacts 2 and 4 of ST relay.	
7	Connect dc voltmeter between circuit ground (terminal 28 of terminal strip A) and TP2 (terminal 12 of terminal strip TP).	Voltmeter indicates -19 volts minimum.
8	Remove test connections.	
9	Remove blocking tools from ON and ST relays.	All relays in circuit normal.
10	Remove insulators and short-circuiting cord from ST relay.	

C. Gate Control Circuit Start Timing

1	Insulate make contacts 2 and 4 of ST relay.	
2	Block ON and ST relays operated. See 1.06.	
3	Using 893 cord, short-circuit contacts 5B and 5F of ST relay.	
4a	If AR1 relay is furnished in circuit— Block AR1 relay not operated.	

STEP	ACTION	VERIFICATION
5b	▶If CP6 is equipped with ZM option (MVG lamp not provided)— Connect dc voltmeter (40V scale) between circuit ground (terminal 28 of terminal strip A) and TP12 (terminal 24 of terminal strip TP).◀	
6	Set oscillator to 600 Hz adjusted to -30 dBm.	
7c	If W, Z, W1, and Z1 relays are furnished— Apply tone to fixed contacts 2 and 4 of ST relay for about 0.5 seconds.	W relay operated when tone applied. Z and W1 relays operated when tone removed. MVG lamp not lighted ▶(option ZL) or voltmeter indicates -0.5V max (option ZM).◀
8c	Apply tone to fixed contacts 2 and 4 of ST relay for about 0.5 seconds.	W relay released when tone applied. Z relay released when tone removed. Z1 relay operated when tone removed. MVG lamp not lighted ▶(option ZL) or voltmeter indicates -0.5V max (option ZM).◀
9c	Apply tone to T and R of tone detector circuit for about 0.5 seconds.	MVG lamp lighted on removal of tone.
10d	▶If provided with App. Fig. 19 (CP14 and CP15)— Connect negative lead of dc voltmeter to TP8 (terminal 18 of terminal strip TP).	Voltmeter indicates -0.5V max.◀
11e	If W, Z, W1, and Z1 relays are not furnished— Apply tone to fixed contacts 2 and 4 of ST relay for about 0.5 seconds.	MVG lamp lighted when tone removed.
12	Remove test connections.	
13	Remove blocking tool from AR1 relay.	
14	Remove blocking tools from ON and ST relays.	
15	Remove insulators and short-circuiting cord from ST relay.	All relays in circuit normal.

D. Monopulser and Multivibrator Timing

Note: If the following test fails at any point, the circuit pack under test at time of failure should be replaced with a new circuit pack and the test rechecked.

1	Insulate make contacts 2 and 4 of ST relay.	
2	Block ON and ST relays operated. See 1.06.	

STEP	ACTION	VERIFICATION
3	Using 893 cord, short-circuit contacts 5B and 5F of ST relay.	
4	Block ST1 relay nonoperated.	
5a	If MB and Z1 relays are furnished— Block MB relay nonoperated, and block Z1 relay operated.	
6	Set counter for time interval function with triggering for -Start and +Stop operation and trigger level for -6 to -10 volts.	
7	Set oscillator at 600 Hz adjusted to -30 dBm.	
8	Connect counter to TP3 (terminal 13 of terminal strip TP).	
9	Apply tone to fixed contacts 2 and 4 of ST relay for about 0.5 seconds.	Counter indicates a pulse of 20 ±1 milliseconds on removal of tone.
10b	If verification of Step 9 is not obtained— Remove blocking tools from ON and ST relays.	
11b	Remove CP5 and reinsert on 159A adapter.	
12b	Block ON and ST relays operated. See 1.06.	
13b	Adjust P8 potentiometer and repeat Step 9 until verification is obtained.	
14	Connect counter to TP6 (terminal 16 of terminal strip TP).	
15	Apply tone to fixed contacts 2 and 4 of ST relay for about 0.5 seconds.	Counter indicates a pulse of 15 ±1 milliseconds on removal of tone.
16c	If verification of Step 15 is not obtained— Remove blocking tools from ON and ST relays.	
17c	Remove CP5 and reinsert on 159A adapter.	
18c	Block ON and ST relays operated. See 1.06.	
19c	Adjust P9 potentiometer and repeat Step 15 until verification is obtained.	
20	Block ST1 relay operated.	
21	Connect counter to TP4 (terminal 14 of terminal strip TP).	Counter indicates no pulses.

STEP	ACTION	VERIFICATION
22	Apply tone to fixed contacts 2 and 4 of ST relay for about 0.5 seconds.	Counter indicates pulses of 360 ±1.5 milliseconds ▶for ZL option boards or 390 ±1.5 milliseconds for ZM option boards.◀
23d	If verification of Step 22 is not obtained— Remove blocking tools from ON and ST relays.	
24d	Remove CP6 and reinsert on 159A adapter.	
25d	Block ON and ST relays operated. See 1.06.	
26d	Adjust P10 potentiometer and repeat Step 22 until verification is obtained.	
27	Connect counter to TP5 (terminal 15 of terminal strip TP).	Counter indicates pulses of 180 ±1 millisecond ▶for ZL option boards or 185 ±1 millisecond for ZM option boards.◀
28e	If verification of Step 27 is not obtained— Remove blocking tools from ON and ST relays.	
29e	Remove CP6 and reinsert on 159A adapter.	
30e	Block ON and ST relays operated. See 1.06.	
31e	Apply tone to fixed contacts 2 and 4 of ST relay for about 0.5 seconds.	
32e	Adjust P11 potentiometer and repeat Step 27 until verification is obtained.	
33	Connect counter to TP7 (terminal 17 of terminal strip TP).	Counter indicates pulses of 180 ±5 milliseconds.
34f	If verification of Step 33 is not obtained— Remove blocking tools from ON and ST relays.	
35f	Remove CP7 and reinsert on 159A adapter.	
36f	Block ON and ST relays operated. See 1.06.	
37f	Apply tone to fixed contacts 2 and 4 of ST relay for about 0.5 seconds.	
38f	Adjust P12 potentiometer and repeat Step 33 until verification is obtained.	
39g	▶If provided with App. Fig. 19 (CP14 and CP15)— Omit Steps 40 through 45h.◀	

STEP	ACTION	VERIFICATION
40	Connect counter to TP8 (terminal 18 of terminal strip TP).	Counter indicates pulses of 590 ±35 milliseconds.
41h	If verification of Step 39 is not obtained— Remove blocking tools from ON and ST relays.	
42h	Remove CP8 and reinsert on 159A adapter.	
43h	Block ON and ST relays operated. See 1.06.	
44h	Apply tone to fixed contacts 2 and 4 of ST relay for about 0.5 seconds.	
45h	Adjust P13 potentiometer and repeat Step 40 until verification is obtained.	
46	Remove test connections.	
47	Remove blocking tool from ST1 relay.	
48	Remove blocking tools from MB and Z1 relays.	
49	Remove blocking tools from ON and ST relays.	All relays in circuit normal.
50	Remove insulators and short-circuiting cord from ST relay.	

E. Second and Third Ring Detection

1	Insulate make contacts 2 and 4 of ST relay.	
2	Block ON and ST relays operated. See 1.06.	
3	Using 893 cord, short-circuit contacts 5B and 5F of ST relay.	
4	Set oscillator to 600 Hz adjusted to -30 dBm.	
5	Apply tone to fixed contacts 2 and 4 of ST relay for about 1.0 second.	AR and AR1 relays operated when tone applied. (Approximately 750-millisecond delay.) AR1 relay released when tone removed.
6	Within 1 second— Apply tone to fixed contacts 2 and 4 of ST relay for about 1.0 second.	AR1 relay operated when tone applied. (Approximately 750-millisecond delay.) AR1 relay released when tone removed. RAR relay not operated.
7	After 3 seconds— Apply tone to fixed contacts 2 and 4 of ST relay for about 1.0 second.	AR1 and RAR relays operated when tone applied. (Approximately 750-millisecond delay.) AR1 relay released when tone removed. TRD relay not operated.

STEP	ACTION	VERIFICATION
8	After 3 seconds— Apply tone to fixed contacts 2 and 4 of ST relay for about 1.0 second.	AR1 and TRD relays operated when tone applied. (Approximately 750-millisecond delay.) AR1 relay released when tone removed.
9	Remove blocking tools from ON and ST relays.	All relays in circuit normal.
10	Remove test connections.	
11	Remove insulators and short-circuiting cord from ST relay.	

F. Pretrip Failure ▶(Option M)◀

1	Insulate make contacts 2 and 4 of ST relay.	
2	Block ON and ST relays operated. See 1.06.	
3	Using 893 cord, short-circuit contacts 5B and 5F of ST relay.	
4	Set oscillator to 600 Hz adjusted to -30 dBm.	
5	Apply tone to fixed contacts 2 and 4 of ST relay for about 1.0 second.	AR relay which prepares ground on PTF lead operated.
6	Manually operate RO relay.	Ground connection completed on PTF lead. RO lead now grounded. ***Note:*** A tone in excess of 800 milliseconds followed by 120-ipm interruptions is interpreted as pretrip failure.
7	Release ST relay.	RO relay normal.

G. Announcement Detection ▶(Option K)◀

1	Insulate make contacts 2 and 4 of ST relay.	
2	Block ON and ST relays operated. See 1.06.	
3	Using 893 cord, short-circuit contacts 5B and 5F of ST relay.	
4	Set oscillator to 600 Hz adjusted to -30 dBm.	
5a	If AR1 relay is provided— Block AR1 nonoperated.	
6	Apply tone three times to fixed contacts 2 and 4 of ST relay for about 1.0 second.	MVG lamp lighted ▶(option ZL).◀

STEP	ACTION	VERIFICATION
7	Key in pulses at a random rate or interval. ***Note:*** Each pulse should be over 200 milliseconds in length.	RO or BY relay may operate before ANN relay.
8	Continue keying for about 2 seconds.	ANN relay operated. ***Note:*** ANN relay must operate before the CT relay operates.
9	▶Remove blocking tools from ON and ST relays.	All relays in circuit normal.◀

H. Audible Ring Follower (Option ZJ)

1	Insulate make contacts 2 and 4 of ST relay.	
2	Block ON and ST relays operated. See 1.06.	
3	Using 893 cord, short circuit contacts 5B and 5F of ST relay.	
4	Set oscillator to 600 Hz adjusted to -30 dBm.	
5	Apply tone to fixed contacts 2 and 4 of ST relay for about 1.0 second.	AR and AR1 relays operated when tone applied. (Approximately 750-millisecond delay). AR1 relay released when tone removed.
6	Within 1 second— Apply tone to fixed contacts 2 and 4 of ST relay for about 1.0 second.	AR1 relay operated when tone applied. (Approximately 750-millisecond delay.) AR1 relay released when tone removed.
7	Remove blocking tools from ON and ST relays.	All relays in circuit normal.
8	Remove test connections.	
9	Remove insulators and short-circuiting cord from ST relay.	

I. ▶Guard Timer Timing (CP12 Option ZP)

1	Insulate make contacts 2 and 4 of ST relay.	
2	Block ON and ST relays operated. See 1.06.	
3	Using 893 cord, short-circuit contacts 5B and 5F of ST relay.	
4	Block any relay required to remove ground from STTM lead if grounded.	

STEP	ACTION	VERIFICATION
5	Arrange counter to read in seconds plus two digits below decimal.	
6	Set function switch of counter to time an interval from A to B or arrange an equivalent to this function.	
7	Arrange counter to begin timing on a negative slope and cease timing with a positive slope.	
8	Connect starting input probe to CP12 pin 17, and connect stopping input to RO lead on terminal strip A, terminal 42. ***Note:*** Should RO lead not have resistance battery on it from the connecting circuit, connect a test receiver tied to battery to the RO lead.	
9	Block RO relay operated.	CT relay operated in approximately 3 seconds. Counter indicates 2.75 ±.01 seconds.
10a	If counter reading is out of tolerance— Adjust P16 potentiometer on CP 12 (clockwise-increases time interval, counter-clockwise-decreases time interval).	
11	Strap pin 17 of CP12 to ground.	CT relay released.
12a	If counter reading is out of tolerance— Remove strap from pin 17 to repeat timing test.	
13	Release relays ST and ON.	
14	Remove blocking tool from CO relay.	
15	Remove insulator from contacts 2 and 4 of ST relay.	
16	Release any relay blocked in a connecting circuit.	
17	Disconnect frequency counter.◀	