

2600-CYCLE E1C SINGLE-FREQUENCY SIGNALING CIRCUITS OUT-OF-SERVICE TESTS USING TESTING CIRCUITS SD-95874-01 AND SD-56335-01

1. GENERAL

1.01 This section describes methods of making out-of-service tests of 2600-cycle single-frequency signaling circuits per SD-98086-01, using testing circuits per SD-95874-01 and SD-56335-01. It also describes methods of making potentiometer adjustments to correct for changes in the characteristics of some circuit elements. The E1C signaling units are factory tested and ready for service except for the REC potentiometer adjustment. The tests and adjustments described in this section, with the above exception, need be made only if trouble is indicated after making over-all test calls or "in service" tests per Section 179-314-501 or by some other means. This section should be used for adjusting the REC potentiometer but should not be used for performance requirements. On new units, failure to meet test limits of this section does not necessarily indicate that the unit is not suitable for service. If the requirements of this section cannot be met after readjustment of potentiometers or relays, the units should be returned to a repair center because of special techniques involved in testing and clearing trouble on some of the components.

Caution: *Adjustments specified in this section should not be attempted during periods of power supply irregularities. Observe that springs of wire-spring relays are not crossed and that the covers and cards do not interfere with their proper operation.*

1.02 The tests covered are:

- A. Pulsing of Transmitter A Relay:** This test checks the ability of the A relay to properly follow dial pulses.
- B. Hold of B Relay:** This test checks that the B relay releases in the desired time limits.

C. Transmitted Tone Level: This test checks the level of the transmitted single-frequency tone.

D. Bias of Q64 Transistor: This test checks the base bias and emitter current of this transistor for no signal input.

E. Test of 4-wire Terminating Circuit, Gain of Receiver Voice Amplifier, Blocking of Amplifier, and Insertion of Band Elimination Network: The following features are checked. (1) Transmission loss from 2 wire to 4-wire transmit. (2) Transmission loss from 4-wire receive to 2 wire and adjustment of REC potentiometer. (3) Trans-hybrid loss from 4-wire receive to 4-wire transmit. (4) Blocking of the voice amplifier by the received signal frequency and insertion of band elimination network. (5) Final adjustment of REC potentiometer.

F. Operate Sensitivity of Receiver Signaling Amplifier: This test checks the receiver sensitivity and tells how to adjust the SS potentiometer to get the required operation.

G. Timing of Receiver R Relay: This test checks the operate and release time of the R relay.

H. Receiver Guard Action: This test checks how effective the receiver guard circuit is in preventing operation by voice signals.

1.03 The transmission measuring set is referred to in this section as TMS.

1.04 The No. 2B signaling test set is referred to in this section as No. 2B test set.

1.05 The J68602CS test panel (SD-56335-01) is referred to in this section as CS panel. KEYERS Switch 1 and RECEIVER Switch 2 on this panel are referred to as SW 1 and SW 2,

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respectively. Jacks and keys associated with this circuit are located on the jack strip just below the unit.

1.06 The J98613N test panel (SD-95874-01, FS1) is referred to in this section as N panel. Jacks and keys associated with this circuit are located on the jack strip just above the CS panel.

1.07 The J98613P test panel (SD-95874-01, FS2) is referred to in this section as P panel. The jacks and keys associated with this circuit are located on the jack strip just below the CS panel.

1.08 The J98613BA auxiliary test unit (SD-95874-01, FS3) is referred to in this section as BA panel. Jacks and keys associated with this circuit are mounted on the mounting plate with associated inductor and other apparatus. It is most likely located below the jack strip of the P panel.

1.09 Make per cent break adjustments of the No. 2B test set slowly, above 70 per cent to prevent pulsing out incorrect values. Incorrect values will be obtained if the rate of vibration of the PER CENT BREAK meter pointer is half that of the PULSES PER SECOND meter pointer. To restore correct per cent break values, turn the ADJ % BK control counterclockwise until both pointers are vibrating at the same rate, then turn the control more slowly clockwise until the desired per cent break value is obtained. It may also be necessary to change the coarse ADJ % BK switch from S, M, or L setting to obtain the desired range of the PER CENT BREAK meter.

1.10 It is anticipated that the tests will be made in the order specified in this section.

1.11 Lettered Steps: A letter a, b, c, etc, added to a step number in Part 3 or 4 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.

2. APPARATUS

2.01 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.

TABLE A

APPARATUS	TESTS							
	A	B	C	D	E	F	G	H
Test Circuit (2.02)	1	1	1	1	1	1	1	1
No. 2B Test Set (2.03)	1	1	1	1	—	—	1	1
TMS (2.04)	—	—	1	—	1	1	—	1
Cord (2.05)	—	—	1	—	1	1	—	1
Cord (2.06)	—	—	—	1	—	—	—	—
Cord (2.07)	—	—	—	—	1	—	—	—
Cord (2.08)	—	—	—	—	1	—	—	—
Cord (2.09)	1	—	—	—	—	—	—	—
No. 258D (dummy) Plug	1	1	—	—	—	—	1	1
Screwdriver R-8210	—	—	—	—	1	1	—	—
Tool (2.10)	1	1	1	1	1	1	1	1
Tool (2.11)	—	—	—	—	√	—	—	—

√ As required.

2.02 Testing circuit includes J68602CS (SD-56335-01), J98613N, J98613P, and J98613BA (SD-95874-01) and includes folding test fixture J98613AC.

2.03 No. 2B test set, J64730B (SD-56134-02) includes power cords and patch cords for E and M leads (No. 2P1D, 2P3B cords).

2.04 No. 13A TMS, or equivalent with the same dynamic characteristic (No. 6A is not satisfactory).

2.05 Testing cord, W2BP cord, 6 feet long, with two No. 35 cord tips equipped with a No. 241A plug (No. 2W15B cord).

2.06 Patching cord, P3E cord, 6 feet long, equipped with two No. 310 plugs (No. 3P7A cord).

2.07 Patching cord, P2AA cord, 6 feet long, equipped with two No. 241A plugs (No. 2P13B cord).

- 2.08 Patching cord, P3N cord, 6 feet long, equipped with one No. 241A plug and one No. 310 plug (No. 3P17B cord).
- 2.09 Testing cord, 2 feet long, equipped with 8-pin (male) Jones plug, KS-8585, L10, and No. 347 plug (P1P cord).

- 2.10 Disengaging tool P-43C851, for removing unit from working position.
- 2.11 Blocking and insulating tools as required. Use tools and apply as covered in Section 069-020-801.

3. PREPARATION

STEP	ACTION	VERIFICATION
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Calibration of TMS for Tests C, E, F, and H

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|---|---|--|
| 1 | Calibrate TMS in accordance with appropriate practice (see Section 103-213-100 for No. 13A TMS, allow warmup time). | |
| 2 | Connect No. 2W15B cord to TMS set. | |

All Tests

- | | | |
|---|--|--|
| 3 | Obtain release of signaling circuit in usual manner as required. | |
| 4 | Remove signaling unit from its service position connector using disengaging tool. | |
| 5 | Plug unit to be tested into folding test fixture. | |
| 6 | Plug folding test fixture cord into A2 connector on N panel. | |
| 7 | Using No. 2P3B cord, patch from E jack of No. 2B test set to 2B E jack on P panel.
<i>Note:</i> The individual tests specify to which jack the M lead should be connected. If it is not mentioned, do not connect it. | |
| 8 | On P panel —
Turn 2-wire key to 2-WIRE, E1C key to E1C. | |

Tests A, B, G and H

Note: If the No. 2B test set has been recently calibrated and the individual performing the tests has reason to believe that it is in good adjustment, Steps 9 through 13 and 17 can be eliminated. Steps 14, 15 and 16 should be repeated at 30-minute intervals.

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|----|---|--|
| 9 | On No. 2B test set —
Set SCALE SEL switch to PPS. | |
| 10 | Set all No. 2B test set lever keys to normal. | |
| 11 | Plug power cords of No. 2B test set into A, B jacks on P panel. | |

After 1 minute, PULSES PER SECOND meter reads other than 0.

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STEP	ACTION	VERIFICATION
12	On No. 2B test set — Operate CONT PLS key to DIAL PLS.	PER CENT BREAK meter reads 0 on <i>black</i> scale. See Step 13a.
13a	If requirement in Step 12 is not met — Adjust pointer adjustment screw of PER CENT BREAK meter to obtain 0 reading.	
14	On No. 2B test set — Insert No. 258D plug into P jack.	PER CENT BREAK meter reads 100 on <i>black</i> scale. See Step 15b.
	<i>Note:</i> Repeat Steps 14, 15b, and 16, if test extends beyond 30 minutes.	
15b	If requirement in Step 14 is not met — Unlock CAL % BK control, adjust to obtain reading of 100, relock control taking care not to change 100 reading.	
16	Remove No. 258D plug.	
17	Restore CONT PLS key to normal.	

4. METHOD

STEP	ACTION	VERIFICATION
	A. Pulsing of Transmitter A Relay	
18	On No. 2B test set — Set SCALE SEL switch to PPS.	
19	On No. 2B test set — Restore all keys to normal.	
20	Connect P1P test cord from S socket of signaling unit to M1 jack on P panel.	
21	Using No. 2P1D cord, connect M jack of No. 2B test set to LP-M jack on P panel.	
22	On CS panel — Set SW 1, SW 2 to position 1.	
23	On No. 2B test set — Adjust ADJ PPS control to obtain 10 pps reading on PULSES PER SECOND meter (0 to 20 scale).	
24	On No. 2B test set — Operate PLS, MEAS % BK keys to LINE, and TWD LINE key to OFF HK.	
25	On P panel — Turn MIN LP key to MIN LP.	A relay pulses.
26	On P panel — Turn CAL key to CAL.	

STEP	ACTION	VERIFICATION
27	On No. 2B test set — Adjust ADJ % BK control to obtain reading of 45 on <i>black</i> scale of PER CENT BREAK meter. Set coarse ADJ % BK switch to M.	
28	Restore CAL key to normal.	PER CENT BREAK meter reads 39 ± 5 on <i>black</i> scale. See Step 29c.
29c	If requirement in Step 28 or 37d is not met — It may be caused by improper mechanical, electrical adjustments of A relay on unit under test. Check relay per Circuit Requirement Table.	
30d	If any adjustments were made on A relay — Restore MIN LP key to normal.	
31d	Repeat Steps 24 through 28.	
32	Restore MIN LP key to normal.	A relay releases.
33	On P panel — Turn MAX LP key to MAX LP.	A relay pulses.
34	On P panel — Turn CAL key to CAL.	
35	On No. 2B test set — Adjust ADJ % BK control to obtain reading of 70 on <i>black</i> scale of PER CENT BREAK meter.	
36	Restore CAL key to normal.	PER CENT BREAK meter reads 75 ± 5 on <i>black</i> scale. See Step 37d.
37e	If requirement in Step 36 is not met — See Step 29c.	
38d	If any adjustments were made on A relay — Restore MAX LP key to normal.	
39d	Repeat Steps 24 through 28, 32 through 36.	
40	Restore MAX LP key to normal.	A relay releases.
41	Remove test cord between S socket, M1 jack.	
42f	If no other tests are to be made — Remove all cords, restore all keys to normal, return signaling unit to service or spare position.	

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STEP	ACTION	VERIFICATION
B. Hold of B Relay		
18	On No. 2B test set — Set SCALE SEL switch to PPS.	
19	On No. 2B test set — Restore all keys to normal.	
20	Using No. 2P1D cord, connect M jack of No. 2B test set to LP-M jack on P panel.	
21	On CS panel — Set SW 1, SW 2 to position 1.	
22	On No. 2B test set — Adjust ADJ PPS control to obtain 2-1/2 or minimum PPS on PULSES PER SEC- OND meter.	
23	On No. 2B test set — Operate TWD LINE key to OFF HK and PLS, MEAS % BK keys to LINE.	
24	On P panel — Turn CAL key to CAL.	
25	On P panel — Turn MAX LP key to MAX LP.	
26	On No. 2B test set — Adjust ADJ % BK control to obtain read- ing of 70 (or maximum reading if 70 can- not be obtained) on <i>black</i> scale of PER CENT BREAK meter. Set coarse ADJ % BK control to L.	
27	Restore CAL key to normal.	A relay pulses while B relay operates, remains operated. Observe that green S lamp remains lit. See Step 28c.
28c	If requirement in Step 27 is not met — See Test A if A relay does not pulse. If B relay pulses, the mechanical, electrical requirements should be checked per Circuit Requirement Table.	
29d	If any adjustments were made on B relay — Repeat Steps 23 to 27, inclusive.	
30	On No. 2B test set — Restore PLS, MEAS % BK keys to normal, TWD LINE key to ON HK.	A relay releases immediately. B relay should release in less than a second, which extinguishes S lamp. See Step 31d.
31e	If requirements in Step 30 are not met — See Steps 28c, 29c.	

STEP	ACTION	VERIFICATION
32d	If any adjustments were made on B relay — Repeat Steps 23 to 30.	
33	On No. 2B test set — Reduce ADJ % BK control to minimum.	
34	Restore MAX LP key to normal.	
35f	If no other tests are to be made — Remove all cords, restore all keys to normal, return signaling unit to service or spare position.	

C. Transmitted Tone Level

9	Set dial switch of TMS to 35.	
10	Connect TMS to TMS jack on P panel.	
11	Using No. 2P1D cord, connect M jack of No. 2B test set to LP-M jack on P panel.	
12	On CS panel — Set SW 1 to position 3, SW 2 to position 1.	
13	On P panel — Turn MIN LP key to MIN LP.	
14	On No. 2B test set — Operate TWD-L key to ON HK.	Reading of TMS -35.5 ± 1.5 db.
15	Set dial switch of TMS to 20.	
16	Operate B relay manually.	Reading of TMS -23.5 ± 1.5 db.
17	Release B relay.	
18	On No. 2B test set — Operate TWD-L key to OFF HK.	A, B relays operate, reading of TMS indicates less power than -45 dbm.
19	Disconnect TMS from TMS jack.	
20	On No. 2B test set — Restore all keys to normal.	
21	Remove cord from LP-M jack.	A, B relays release.
22	Restore MIN LP key to normal.	
23	On CS panel — Set SW 1 to position 4.	
24a	If no other tests are to be made — Remove all cords, restore all keys to normal, return signaling unit to service or spare position.	

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STEP	ACTION	VERIFICATION
D. Bias of Q64 Transistor		
9	On CS panel — Set SW 1 to position 5, SW 2 to position 1.	
10	Using No. 3P7A cord, patch SENS jack on P panel to VM jack of No. 2B test set.	
11	On No. 2B test set — Set SCALE SEL switch to 20V.	VOLTS meter reads between 0.5 and 1.7 volts.
12	Remove patch between SENS, VM jacks.	
13a	If no other tests are to be made — Remove all cords, restore all keys to normal, return signaling unit to its service or spare position.	
E. Test of 4-wire Terminating Circuit, Gain of Receiver Voice Amplifier, Blocking of Amplifier, and Insertion of Band Elimination Network		
9	Set dial switch of TMS to 0.	
10	Connect TMS to 0-1000~ jack on N panel.	TMS reads 0 db. See Step 11a.
11a	If requirement of Step 10 is not met — Verify calibration of TMS.	
12	Disconnect TMS from 0-1000~ jack, connect to LINE TRANS jack on P panel.	
13	Patch TMS jack on P panel to 2-WIRE A jack on BA panel.	
14	On CS panel — Set SW 1 to position 5, SW 2 to position 3.	
15	Set dial switch of TMS to 15.	
16	Patch TMS-A on BA panel to 0-1000~ jack on N panel.	
17	On BA panel — Turn E1C-A key to E1C-A.	A, B relays operate. TMS reads -15.5 ± 0.5 db.
18	Restore E1C-A key to normal.	A, B relays release.
19	Remove patch between 0-1000~ jack, TMS-A jack.	
20	Disconnect TMS from LINE TRANS jack.	
21	On BA panel — Connect TMS to TMS-A jack.	
22	On CS panel — Set ATT to 25.6.	
23	On CS panel — Set SW 1 to position 6, SW 2 to position 4.	
24	Set dial switch of TMS to 0.	

STEP	ACTION	VERIFICATION
25	Patch SF TONE TEST jack on P panel to 0-1000~ jack on N panel.	TMS reads 0 db. See Step 26b.
26b	If requirement in Step 25 is not met — Adjust ATT to obtain 0 ± 0.1 db, then adjust V3 test amplifier for exactly 0 db.	
27	On CS panel — Set SW 2 to position 3.	
28	On BA panel — Turn E1C-A key to E1C-A. <i>Note:</i> Minor readjustment of the REC potentiometer of less than 1 db may be necessary to meet over-all trunk net loss requirements.	A, B relays operate, TMS reads specified value for signaling unit shown on trunk circuit layout record plus 0.2 db (additional 0.2 db is due to measuring a 900 Ω circuit using a 600 Ω TMS). Example: Specified value shown for signaling unit is 8.8 db, $8.8 \text{ db} + 0.2 \text{ db} = 9 \text{ db}$.
29	Set dial switch of TMS to +0.	
30	Adjust REC potentiometer of signaling unit under test to full clockwise position.	TMS reads +1.5 dbm or greater power.
31	Disconnect TMS from TMS-A jack, connect to LINE TRANS jack on P panel.	
32	Set dial switch of TMS to 10.	
33	On BA panel — Insert No. 258D plug into TMS-A jack.	TMS reads between -10 and -20 db.
34	Remove No. 258D plug.	TMS reads -40 dbm or less power.
35	Disconnect TMS from LINE TRANS jack, connect to TMS-A jack on BA panel.	
36	Remove patch cord between 0-1000~ jack and SF TONE TEST jacks.	
37	On CS panel — Set SW 1 to position 6, SW 2 to position 4.	A, B relays release.
38	Set dial switch of TMS to 0.	
39	On CS panel — Set ATT to 10.	TMS reads ± 0.2 db. See Step 40c.
40c	If requirement of Step 39 is not met — Adjust gain potentiometer of V3 test amplifier to obtain this reading.	
41	Block nonoperated R relay.	
42	On CS panel — Set SW 2 to position 3.	A, B relays operate, TMS reads -36 dbm or less power.
43	Remove blocking tool, allow R relay to operate.	

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STEP	ACTION	VERIFICATION
44	Restore E1C-A key to normal.	A, B relays release. TMS reads -34 dbm or less power.
45	Set dial switch of TMS to 0.	
46	On CS panel — Set SW 1 to position 6, SW 2 to position 4.	
47	On CS panel — Set ATT to 25.6.	
48	Patch SF TONE TEST jack on P panel to 0-1000~ jack on N panel.	TMS reads 0 db. See Step 49d.
49d	If requirement of Step 48 is not met — Adjust ATT to obtain 0 ± 0.1 db, then adjust V3 test amplifier for 0 db.	
50	On BA panel — Turn E1C-A key to E1C-A.	
51	On CS panel — Set SW 2 to position 3.	TMS reads +1.5 dbm or greater power.
52	Adjust REC potentiometer of signaling unit under test to specific 4-wire to 2-wire loss. <i>Note:</i> Minor readjustment of the REC potentiometer of less than 1 db may be necessary to meet overall trunk net loss requirements.	TMS reads specified value for signaling unit shown on trunk layout record plus 0.2 db (additional 0.2 db is due to measuring a 900 Ω circuit using a 600 Ω TMS). Example: Specified value shown for signaling unit is 8.8 db, 8.8 db + 0.2 db = 9 db.
53	Remove patch between 0-1000~ jack, SF TONE TEST jacks.	
54	Restore E1C-A key to normal.	
55	Remove patch between TMS, 2-WIRE A jacks.	
56	Disconnect TMS from TMS-A jack.	
57e	If no other tests are to be made — Remove all cords, restore all keys to normal, return signaling unit to service or spare position.	

F. Operate Sensitivity of Receiver Signaling Amplifier

9	On CS panel — Set SW 1 to position 6, SW 2 to position 4.	
10	Connect TMS to TMS jack on P panel.	
11	On CS panel — Set ATT to 10.	TMS reads 0 ± 0.2 db. See Step 12a.

STEP	ACTION	VERIFICATION
12a	If reading in Step 11 is not met — Adjust gain control of V3 amplifier in CS panel for 0 db.	
13	Disconnect TMS from TMS jack.	
14	Set ATT to 36.	
15	Change SW 2 to position 3.	R relay should not operate. See Step 16b.
16b	If R relay operates — Set SW 2 to position 4.	
17b	Adjust SS potentiometer of signaling unit slightly counterclockwise.	
18b	Set SW 2 to position 3.	R relay should not operate.
19c	If R relay operates again — Repeat Steps 16b, 17b until requirement is met.	
20	Change SW 2 to position 4.	R relay remains released.
21	Set ATT to 32.	
22	Change SW 2 to position 3.	R relay should just operate. See Step 22c.
23d	If R relay does not operate — Increase SS potentiometer slightly until it just operates.	
24d	Repeat Steps 14 to 21, inclusive, until the requirements are obtained, beginning with SW 2 in position 4.	
25e	If no other tests are to be made — Remove all cords, restore all keys to normal, return signaling unit to service or spare position.	

G. Timing of Receiver R Relay

18	On No. 2B test set — Restore all keys to normal.
19	On No. 2B test set — Set SCALE SEL switch to PPS.
20	On No. 2B test set — Adjust ADJ PPS control to obtain reading of 10 pps on PULSES PER SECOND meter (0 to 20 scale).
21	On No. 2B test set — Adjust ADJ % BK control for reading of 55 on <i>black</i> scale of PER CENT BREAK meter. Set coarse ADJ % BK control to M.

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STEP	ACTION	VERIFICATION
22	Using No. 2P1D cord, connect M jack of No. 2B test set to 2B M jack on P panel.	
23	On CS panel — Set SW 1 to position 7, SW 2 to position 3.	
24	On No. 2B test set — Set PLS, MEAS % BK keys of signaling test set to LINE, TWD LINE key to OFF HK.	
25	On CS panel — Adjust M potentiometer to obtain reading of 55 on <i>black</i> scale of PER CENT BREAK meter.	
26	On CS panel — Set ATT to 23.	
27	On No. 2B test set — Adjust ADJ PPS control to obtain reading of 3 PPS.	
28	On No. 2B test set — Adjust ADJ % BK control to obtain reading of 55 on <i>black</i> scale of PER CENT BREAK meter. Set coarse ADJ % BK control to L.	
29	On CS panel — Set SW 1 to position 8.	R relay should pulse, PER CENT BREAK reading should be between 44 and 66 on <i>red</i> scale.
30	On No. 2B test set — Restore all keys to normal.	
31	On No. 2B test set — Reduce ADJ % BK control to obtain reading of 22 on <i>black</i> scale.	
32c	If no other tests are to be made — Remove all cords, restore all keys to normal, return signaling unit to service or spare position.	

H. Receiver Guard Action

18	Connect TMS to TMS jack on P panel.	
19	Set dial switch of TMS to 15.	
20	On CS panel — Set SW 1 to position 5, SW 2 to position 6, TL key to +7.	TMS reads 19 ±0.5 db.
21	Disconnect TMS from TMS jack.	

STEP	ACTION	VERIFICATION
22	On CS panel — Set ATT to 32.	
23	On CS panel — Set SW 2 to position 5.	R relay remains released.
24	On No. 2B test set — Operate MEAS % BK key to LINE.	PER CENT BREAK meter reads 0 on <i>red</i> scale.
25	On CS panel — Move SW 1 to position 6.	R relay remains released.
26	On CS panel — Change ATT to 19.	R relay operates, PER CENT BREAK meter reads 100 on <i>red</i> scale.
27	On No. 2B test set — Restore MEAS % BK key to normal.	
28c	If no other tests are to be made — Remove all cords, restore all keys to normal, return signaling unit to service or spare position.	