

## REVERTIVE PULSE INTERRUPTER

### TERMINATING SENDERS

### TESTS

### NO. 1 CROSSBAR OFFICES

#### 1. GENERAL

**1.01** This section outlines the procedure for testing the revertive pulse interrupter of the No. 1 crossbar full selector terminating sender (SD-25013-01) under maximum and minimum loop conditions.

**1.02** This section is reissued for the following reasons:

- (a) To add Table A
- (b) To add Method C for using 4A Signaling test set.

This reissue affects the Equipment Test List.

**1.03** The "pulse speed" and the "percent break" requirements are specified on the circuit requirement table for the sender.

**1.04 Method A:** This method applies where the 35-type test set (Section 100-101-101), percent break meter and impulse counter are available.

**1.05 Method B:** This method applies where the pulse checking test set J94723A (SD-96362-01) (Section 100-234-101) is available. With the lever type key in the PCB (percent break) position, the pulsing circuit is connected to the meter in series with a suitable network to read "percent break." With the lever type key in the PPS (pulses-per-second) position, the pulsing circuit is connected to an auxiliary relay which charges a precision condenser resistance network and then discharges the network through the meter, as each pulse is received, resulting in a direct reading of pulse speed in pulses-per-second.

**1.06 Method C:** This test applies where the 4A Signaling test set equipped with E&M interface unit J94743A (SD-1C244-01) (Section 100-267-101) is available. The percent break

measurement is made by averaging the break interval for nine pulses of a ten pulse train. The display appears on the NIXIE tubes after every nine pulses. The display is in percent to the nearest 0.5 percent. The pulses-per-second measurement is made over a time span of nine pulses and is recorded to the nearest 0.1 PPS.

**1.07 Lettered Steps:** The letters a, b, c, etc, are added to a step number to indicate that the steps cover an action which may or may not be required, depending on local conditions. The conditions under which a lettered step or series of steps should be made are given in the ACTION column, and all steps governed by the same condition are designated by the same letter. Where a condition does not apply, the associated steps should be omitted.

#### 2. APPARATUS

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

**2.02** 35-type test set and associated cords. (Section 100-101-101)

**2.03** KS-7361 percent break meter (Section 100-261-101).

**2.04** KS-7608 Impulse counter or No. F-789 Cenco impulse counter.

**2.05** KS-3008 stopwatch or equivalent.

**2.06** Patching cord, P2P cord, 10 feet long, equipped with one 309 plug and one 310 plug (2P10A cord).

→TABLE A←

APPARATUS	METHOD		
	A	B	C
322A Make-busy plug	1	1	1
35-Type test set (2.02)	1	1	1
KS-7361 percent break meter (2.03)	1		
KS-7608 Impulse counter or No. F-789 Cenco impulse counter (2.04)	1		
KS-3008 stopwatch or equivalent (2.05)	1		
Patching cord (2.06)	1		
Patching cord (2.07)	2		
Testing cord (2.08)	2		
Tools (2.09)	√	√	√
Pulse checking test set (2.10)		1	
Patching cord (2.11)		1	
Testing cord (2.12)		1	2
Testing cord (2.13)		1	1
Testing cord (2.14)		1	
4A Signaling test set (2.15)			1

√ As required

**3. PREPARATION**

STEP	ACTION	VERIFICATION
1	◆At terminating trouble indicator frame— Insert make-busy plug into MB jack for sender under test.◆	
2	At sender under test— Check GR relay.	Relay meets contact make requirements shown in Section 040-518-701.
3	Using the 35-type test set, check the STP and L relays.	Relays meet electrical requirements shown on circuit requirement tables.
4a	If sender is equipped with S <sub>-</sub> type L relay— With the 35-type test set connected to the L relay, close circuit through the test set and adjust current to 240 ma.	

**2.07** Patching cord, P3F cord, 6 feet long, equipped with one 309 plug and one 310 plug (3P12E cord).

**2.08** Testing cord, W2W cord, 6 feet long, equipped with one 310 plug, one 360B tool and one 360C tool (2W17A cord) and two 364 tools.

**2.09** ◆Blocking and insulating tools as required. Use tools and apply as covered in Section 069-020-801.◆

**2.10** Pulse checking test set J94723A (SD-96362-01) ◆(Section 100-234-101)◆

**2.11** Patching cord, P3K cord, 6 feet long, equipped with two 310 plugs (3P15A cord).

**2.12** Testing cord, W2W cord, 6 feet long, equipped with one 310 plug, one 360B tool and one 360C tool (2W17A cord).

**2.13** Testing cord, W3M cord, 6 feet long, equipped with one 310 plug, one 360A tool, one 360B tool and one 360C tool (3W4A cord) and three 141 cord tips.

**2.14** ◆Testing cord, 893 cord, 3 feet long, equipped with two 360A tools (1W13A cord) and one 364 tool.

**2.15** 4A Signaling test set J94743A (SD-1C244-01), including E&M interface unit J94743AD (Section 100-267-101)◆

STEP	ACTION	VERIFICATION
5a	Manually operate relay L1.	Current drops to approximately 210 ma.

**Note:** This is a check that the shunt normally present through contact 1 and 2T of relay L1 is removed after the relay has operated.

#### 4. METHOD

STEP	ACTION	VERIFICATION
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##### Method A: Using 35-Type Test Set, Percent Break Meter, and Impulse Counter

- |    |   |  |
|----|---|--|
| 6  | At 35-type test set—<br>Restore switches and keys of test set to normal and move resistance sliders to extreme right.   |  |
|    | <b>Caution:</b> To avoid possible grounding of —48 volt battery, connect P2P cord to 35-type test set first.  |  |
| 7  | Using P2P cord, connect TEST BATT and GRD jack of 35-type test set to sender frame battery and ground supply A jack, with the 309 plug connected to the test set.                       |  |
| 8  | Using W2W cord, connect 3R jack of 35-type test set to percent break meter with the white (tip) conductor to positive (+) terminal and black (ring) conductor to negative (–) terminal. |  |
|    | <b>Note:</b> To insure proper accuracy of percent break meter it should be approximately level and should not be located closer than 12 inches to magnetic material.                    |  |
| 9  | Using W2W cord, connect 4W jack of 35-type test set to impulse counter with the white (tip) conductor to the left terminal of the counter and black (ring) conductor to right terminal. |  |
| 10 | Using P3F cord, connect TEST T&R jack of 35- test set to sender frame MX jack with the 309 plug connected to the test set.  |  |
| 11 | Using P3F cord, connect TEST S jack of 35-type test set to T jack of sender, with 309 plug connected to the test set.   |  |

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STEP	ACTION	VERIFICATION
12a	◆If sender is equipped with S-type L relay—◆ Block operated L1 and L2 relays.	
13b	◆If sender is not equipped with S- type L relay— Block operated L1 relay.◆	
14	Block operated GR relay.	
15	◆At 35-type test set—◆ Close key 3 and adjust resistance sliders so that the current, through the percent break meter is 12 milliamperes.	Needle of percent break meter deflects to left and coincides with the 0 line on the meter scale.
<i>Caution: Exercise extreme care to see that the current is not allowed to exceed this value while adjusting the resistance sliders.</i>		
16	Open key 3.	
17	At impulse counter— Operate key.	
18	◆At 35-type test set—◆ Close key 4 and adjust resistance sliders so that the current through the impulse counter is as follows:	
	<u>IMPULSE COUNTER</u>	<u>CURRENT IN MILLIAMPERES</u>
	KS-7608 Cenco No. F-789 with serial numbers from 1 to 400	150 500
	Cenco No. F-789 with serial numbers from 401 and above	150
19	Open key 4.	
20	◆At sender under test—◆ Remove blocking tool from GR relay.	
21	◆If the interrupter does not start when the blocking tool is removed from the GR relay— Remove blocking tools placed in Step 12a or 13b and replace the blocking tools in sequence.	Pulse interrupter starts.◆

STEP	ACTION	VERIFICATION
22	At 35-type test set— Close key 3.	Needle on percent break meter deflects to right and stabilizes.
23	At percent break meter— Record reading on percent break meter.	
24	At 35-type test set— Open key 3.	
25	Close key 4. With KS-3008 stopwatch or equivalent start timing simultaneously with starting of impulse counter.	Impulse counter counts number of pulse cycles.
26	At end of 1 minute— Open key 4.	Impulse counter stops counting pulse cycles.
27	At impulse counter— Record the number of pulses-per-second by dividing the reading on the impulse counter by 60.	
28a	If sender is equipped with S-type L relay— Using MAX LOOP tabular form associated with STP and GR relays on the circuit requirement tables of the SD— Find the line corresponding to the pulse speed in pulses-per-second recorded in Step 27 and note the extent of allowable percent break.	The measured percent break noted in Step 23 falls within allowable limits.  <i>Note:</i> If the requirements are not met, it indicates that the relays in the interrupter circuit require adjustment.
29b	If sender is not equipped with S-type L relay— Using MAX LOOP chart associated with STP and GR relays on the circuit requirement tables of the SD— Find the lines corresponding to the percent break recorded in Step 23 and pulses-per-second recorded in Step 27.	Intersection of percent break and pulses-per-second fall within the block bounded by the solid lines.  <i>Note:</i> If the requirements are not met, it indicates that the relays in the interrupter circuit requires adjustment.
30	Repeat Steps 22 through 27 using the MN jack instead of the MX jack.	
31a	If sender is equipped with S-type L relay— Using MIN LOOP tabular form associated with STP and GR relays on the circuit requirement tables of the SD— Find the line corresponding to the pulse speed in pulses-per-second recorded in Step 27 and note the extent of allowable percent break.	The measured percent break noted in Step 23 falls within allowable limits.  <i>Note:</i> If the requirements are not met, it indicates that the relays in the interrupter circuit requires adjustment.
32b	If sender is not equipped with S-type L relay—	Intersection of percent break and pulses-per-second fall within the block bounded by the solid

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STEP	ACTION	VERIFICATION
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Using MIN LOOP chart associated with STP and GR relays on the circuit requirement tables of the SD—  
Find the lines corresponding to the percent break recorded in Step 23 and pulses-per-second in Step 27.

lines.

**Note:** If the requirements are not met, it indicates that the relays in the interrupter circuit require adjustment.

33a If sender is equipped with S- type L relay—  
Remove blocking tools from L1 and L2 relays.

34b If sender is not equipped with S- type L relay—  
Remove blocking tool from L1 relay.

**Caution:** To avoid possible grounding of — 48 volt battery, remove P2P cord from the sender frame A jack first.

35 Remove all connections.

36 At terminating trouble indicator frame—  
Remove make-busy plug from MB jack of sender under test.

**Method B: Using Pulse Checking Test Set**

6 At pulse checking test set—  
Set scale turn button key to 40.

7 Position the PPS-PCB lever key to normal (center position). With no patch cords connected, adjust the screw on top of the meter so that the pointer is on the 100 percent break scale division.

8 Turn the CAL 0-500 potentiometer in a counterclockwise direction to the limit of its travel (zero position) in order to prevent the needle from moving off scale when battery and ground are connected to the test set.

**Caution:** To avoid possible grounding of — 48 volt battery, connect P3K cord to the Pulse Checking Test set first.

9 Using P3K cord, connect BATT G jack of test set to sender frame battery and ground supply A jack, as shown in Fig. 1.

**Note:** To insure proper accuracy of the pulse checking test set, it should be set in a level position.

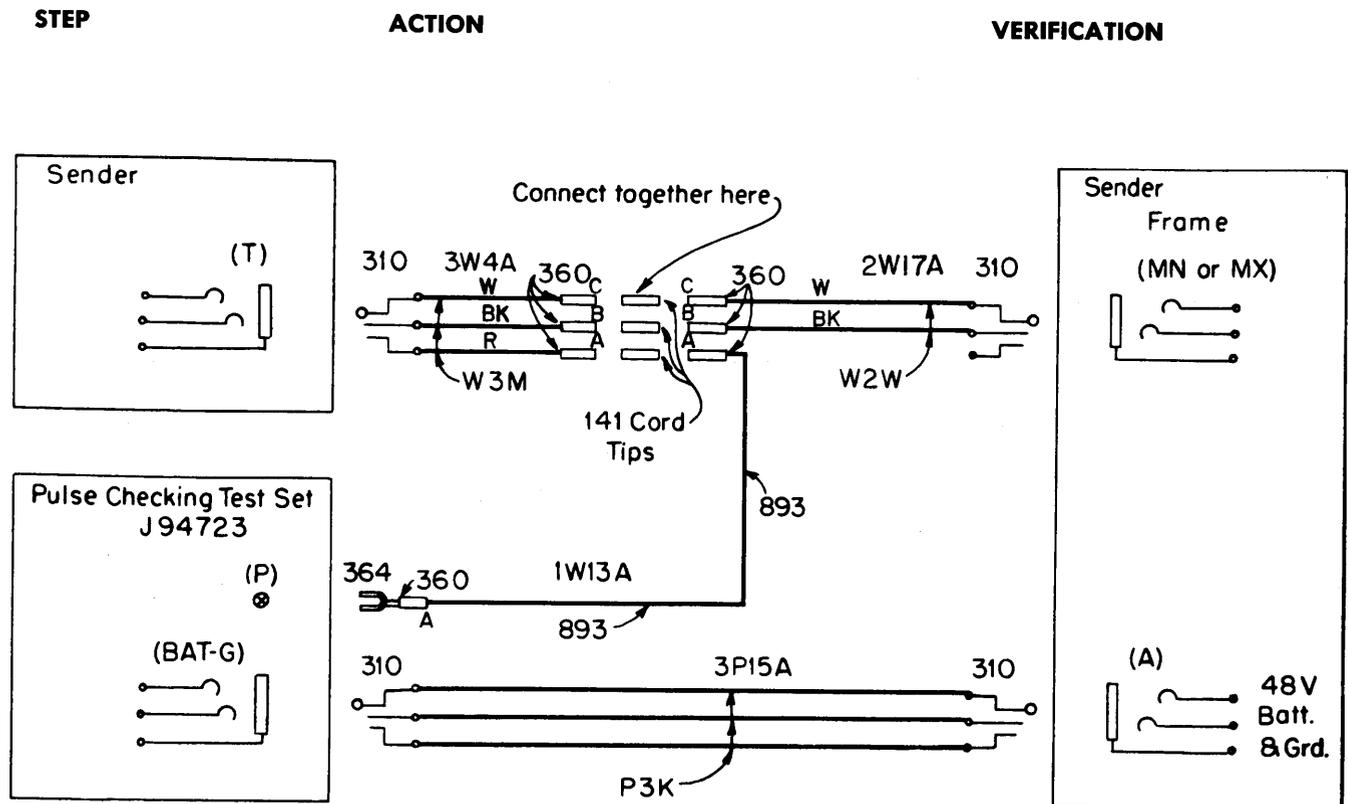


Fig. 1—Pulse Checking Test Set Connections

- 10 Adjust the CAL 0-500 potentiometer in a clockwise direction as required to bring pointer to 0 percent break.

**Note:** With this test set, it is not necessary to block the interrupter (GR relay) and adjust the current flow as indicated in the circuit requirement table; this adjustment having been made with the CAL potentiometer.

- 11 At sender under test—  
Using W3M cord equipped with 141 cord tips, connect to sender T jack as shown in Fig. 1.
- 12 At sender frame—  
Using W2W cord, connect to MX jack as shown in Fig. 1.
- 13 Connect tip to tip and ring to ring of the two cords used in Steps 11 and 12.
- 14 At pulse checking test set—  
Using 893 cord equipped with 364 tool, connect

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STEP	ACTION	VERIFICATION
	to P binding post of test set and sleeve of cord used in Step 10 as shown in Fig. 1.	
15a	◆If sender is equipped with S- type L relay—◆ Block operated L1 and L2 relays.	◆Pulse interrupter starts.◆
16b	◆If sender is not equipped with S- type L relay— Block operated L1 relay.	Pulse interrupter starts.◆
17	At pulse checking test set— Operate PCB key.	Meter needle stabilizes.
18	Estimate midpoint of range of oscillations of meter needle and record reading.	
19	Restore PCB key to normal.	
20	Operate PPS key.	Meter needle stabilizes.
21	Record reading of pulse speed on 40-0 scale.	
22c	If the indicated pulse speed is less than 20 pulses-per-second— Rotate scale key to position 20.	
23c	Record reading of pulse speed on 20-0 scale.	
24	Restore PPS key.	
25a	◆If sender is equipped with S- type L relay—◆ Using MAX LOOP tabular form associated with STP and GR relays on the circuit requirement tables of the SD— Find the line corresponding to the pulse speed in pulses-per-second recorded in Step 21 or 23c and note the extent of allowable percent break.	The measured percent noted in Step 18 falls within the allowable limits.  <i>Note:</i> If the requirements are not met, it indicates that the relays in the interrupter circuit require adjustment.
26b	◆If sender is not equipped with S- type L relay—◆ Using MAX LOOP chart associated with STP and GR relays on the circuit requirement tables of the SD— Find the lines corresponding to the percent break recorded in Step 18 and pulses-per-second recorded in Step 21 or 23c.	Intersection of percent break and pulses-per-second fall within block bounded by the solid lines.  <i>Note:</i> If the requirements are not met, it indicates that the relays in the interrupter circuit require adjustment.
27	Repeat Steps 17 through 24 using the MN jack instead of the MX jack.	

STEP	ACTION	VERIFICATION
28a	<p>◆If sender is equipped with S- type L relay— Using MIN LOOP tabular form associated with STP and GR relays on the circuit requirement tables of the SD— Find the lines corresponding to the pulse speed in pulses-per-second recorded in Step 21 or 23c and note the extent of allowable percent break.</p>	<p>The measured percent break noted in Step 18 falls within allowable limits.</p> <p><b>Note:</b> If the requirement are not met, it indicates that the relays in the interrupter circuit require adjustment.</p>
29b	<p>If sender is not equipped with S- type L relay— Using MIN LOOP chart associated with STP and GR relays on the circuit requirement tables of the SD— Find the lines corresponding to the percent break recorded in Step 18 and pulses-per-second recorded in Step 21 or 23c.</p>	<p>Intersection of percent break and pulses-per-second fall within the block bounded by the solid lines.</p> <p><b>Note:</b> If the requirements are not met, it indicates that the relays in the interrupter circuit require adjustment.</p>
30a	<p>If sender is equipped with S- type L relay—◆ Remove blocking tool from L1 and L2 relays.</p>	
31b	<p>◆If sender is not equipped with S- type L relay— Remove blocking tool from L1 relay.</p>	
	<p><b>Caution:</b> To avoid possible grounding of —48 volt battery, remove P3K cord from the sender frame A jack first.</p>	
32	<p>Remove all connections.</p>	
33	<p>At terminating trouble indicator frame— Remove make-busy plug from MB jack of sender under test.◆</p>	

◆Method C: Using 4A Signaling Test Set

- 6 Connect 4A test set to 110 Vac.
- 7 Equip 4A test set with E&M interface unit.
- 8 Operate POWER switch to ON.
- 9 At sender under test—  
Using W3M cord equipped with 141 cord tips, connect to sender T jack as shown in Fig. 2.
- 10 At sender frame—  
Using W2W cord, connect to MX jack as shown in Fig. 2.

STEP ACTION VERIFICATION

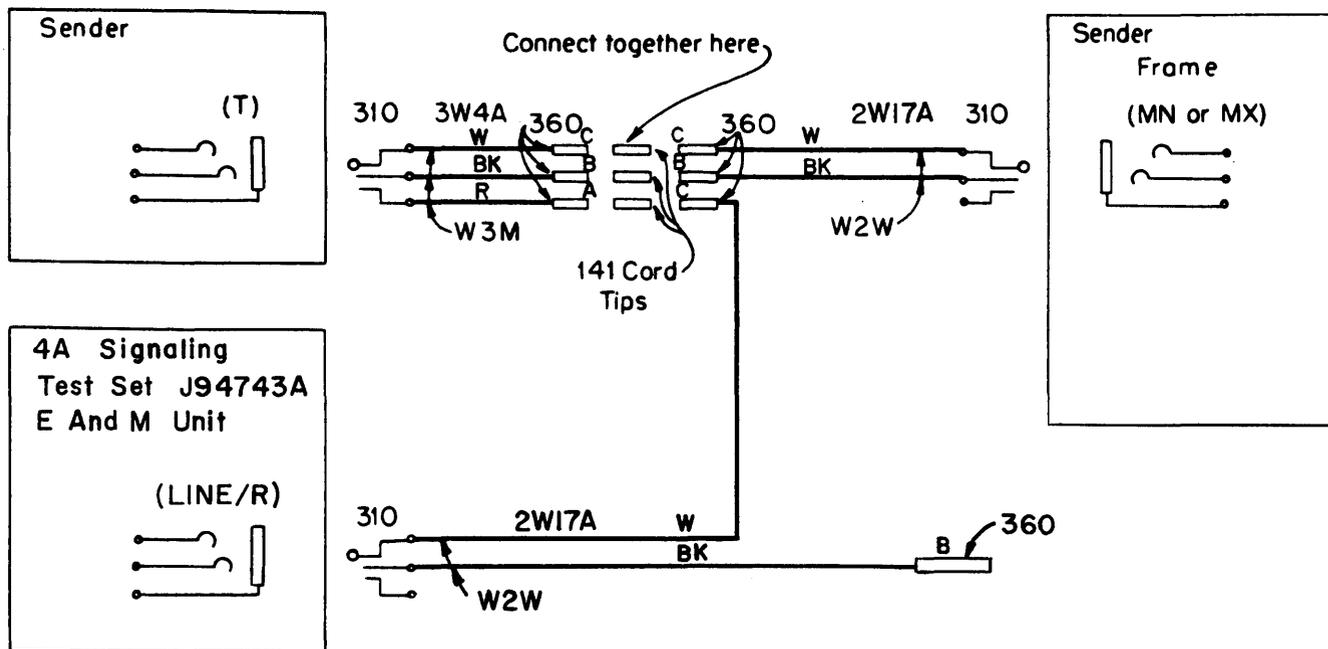


Fig. 2—4A Signaling Test Set Connections

- 11 Connect tip to tip and ring to ring of the two cords used in Steps 9 and 10.
  - 12 At 4A test set—  
Using W2W cord, connect 310 plug to LINE/R jack of 4A test set as shown in Fig. 2.
  - 13 Connect the white tip conductor of the W2W cord used in Step 12 to the red sleeve conductor of the W3M cord used in Step 9 as shown in Fig. 2.
- Note:** Refer to the figure in Section 100-267-101 covering E&M Unit Pulsing and Measuring the line (with Drop supervision)
- 14 Set MS RANGE switch to 999.
  - 15 Set SELECTOR switch to NORM.
  - 16 Set FUNCTION switch to SPEED.
  - 17 Set RECEIVE switch to E&M.

STEP	ACTION	VERIFICATION
18	At E&M interface unit— Set E&M/CX—SR switch to E&M/CX.	
19	Operate PULSE/MEAS key to LINE.	
20	Operate TWD DROP key to ON HK.	
21	Operate TWD LINE key to OFF HK.	
22a	If sender is equipped with S- type L relay— At sender under test— Block operated L1 and L2 relays.	Pulse interrupter starts.
23b	If sender is not equipped with S- type L relay— Block operated L1 relay.	Pulse interrupter starts.
24	At 4A test set— Operate START-STOP key.	4A display indicates pulses-per-second of sender GR relay.
	<i>Note:</i> The OPERATE-CLEAR key and the START-STOP key are released when the lamp behind the key is extinguished and operated when the lamp is lighted.	
25	Record pulses-per-second indication shown on display.	
26	Release START-STOP key.	
27	Set FUNCTION switch to % BK.	
28	Operate START-STOP key.	4A display indicates percent break of sender GR relay.
29	Record percent break indication shown on display.	
30a	If sender is equipped with S- type L relay— Using MAX LOOP tabular form associated with STP and GR relays on the circuit requirement tables of the SD— Find the lines corresponding to the pulse speed in pulses-per-second recorded in Step 25 and note the extent of allowable percent break.	The measured percent break noted in Step 29 falls within allowable limits.  <i>Note:</i> If the requirements are not met, it indicates that the relays in the interrupter circuit require adjustment.
31b	If sender is not equipped with S- type L relay— Using MAX LOOP chart associated with STP and GR relays on the circuit requirement tables of the SD—	Intersection of percent break and pulses-per-second fall within the block bounded by the solid lines.  <i>Note:</i> If the requirements are not met, it

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STEP	ACTION	VERIFICATION
	Find the lines corresponding to the percent break recorded in Step 29 and pulses-per-second recorded in Step 25.	indicates that the relays in the interrupter circuit require adjustment.
32	Release START-STOP key.	
33	Repeat Steps 24 through 29 using the MN jack instead of the MX jack.	
34a	If sender is equipped with S- type L relay— Using MIN LOOP tabular form associated with STP and GR relays on the circuit requirement tables of the SD— Find the line corresponding to the pulse speed in pulses-per-second recorded in Step 25 and note the extent of allowable percent break.	The measured percent break noted in Step 29 falls within allowable limits.  <i>Note:</i> If the requirements are not met, it indicates that the relays in the interrupter circuit require adjustment.
35b	If sender is not equipped with S- type relay— Using MIN LOOP chart associated with STP and GR relays on the circuit requirement tables of the SD— Find the lines corresponding to the percent break recorded in Step 29 pulses-per-second in Step 25.	Intersection of percent break and pulses-per-second fall within the block bounded by the solid lines.  <i>Note:</i> If the requirements are not met, it indicates that the relays in the interrupter circuit require adjustment.
36	At 4A test set— Release START-STOP key.	
37a	If sender is equipped with S- type L relay— Remove blocking tool from L1 and L2 relays.	
38b	If sender is not equipped with S- type L relay— Remove blocking tool from L1 relay.	
39	Remove test connections from sender T jack, sender frame MN jack and 4A test set, E&M unit LINE/R jack.	
40	At 4A test set— Restore all keys to normal and remove connections.	
41	At terminating trouble indicator frame— Remove make-busy plug from MB jack of sender under test.⚡	