

**DC KEY PULSING SENDERS
ARRANGED TO TRANSMIT DIAL PULSES
OPERATION TESTS
USING MANUAL TEST CIRCUIT SD-90635-01
NO. 1 AND NO. 3 TYPE TOLL SWITCHBOARDS AND NO. 15C SWITCHBOARD
STEP-BY-STEP SYSTEMS**

1. GENERAL

1.01 This section describes a method of testing DC key pulsing sender circuits by means of manual test circuit SD-90635-01. This section is intended primarily for use in step-by-step areas for senders associated with a No. 1, 1B, 3, 3B, 3C, or 3CL toll switchboard or a No. 15C switchboard.

1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.

1.03 The tests covered are:

- (A) Sender Operation Test
- (B) Test of Stored Ring
- (C) Leak Test of TS and RS Relays
- (D) Closure of Pulsing Leads Test
- (E) All Paths Busy Test
- (F) Test of Stop-Go Feature
- (G) Non-Operate Test of R and NR Relays
- (H) Preliminary Disconnect Test
- (I) Reorder Test
- (J) Sender Time-Out Test
- (K) Pad Control Test
- (L) Pulsing Speed Test
- (M) Per Cent Break Test

1.04 Tests (B), (C), (D), (F), and (I) need only be made when the features checked by these tests are provided in the sender and the keys are furnished in the test circuit. Test (K) need only be made when the senders are associated with a No. 3 type toll switchboard.

1.05 Before proceeding with the tests, determine which features are used in each class, such as digit delay, stop-go, number of digits to be keyed, pulsing speed, the ringing conditions, and whether or not the class is fixed or variable. The following chart may be made up locally to serve as a guide as to which ringing keys to operate in each class for both inward and outward toll position test calls. This will facilitate the operation of the various combinations of keys which represent the different kinds of test calls which are to be made with each class. Check marks can be used to indicate whether or not the P, CR, SX, SB, ST and F-RB keys should be operated on the particular test call.

	No. of digits						
CLASS	P	CR	SX	SB	for class	ST	F-RB
CL	___						
CL	___						
CL	___						
CL	___						

1.06 The senders are tested individually with the manual sender test circuit. This test circuit is connected to the individual sender by means of a T (test) jack at the test circuit jack and lamp panel.

1.07 Keys are furnished at the test circuit jack and lamp panel to make a check of the various features provided in the sender. An OK lamp is provided as a signal (either lighted or extinguished) to indicate a satisfactory completion of an individual test function.

1.08 Checking lamps 1 to 0 are provided on the test circuit jack and lamp panel to check that the number of pulses received from the sender agrees with the number keyed. For example, if the No. 3 key of the test circuit keyset is depressed for a digit, the No. 3 checking lamp should remain lighted after pulsing this digit.

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1.09 Delayed Pulsing: The sender may be arranged to delay outpulsing in various ways. This delay may be either individually by digits, two consecutive digits, or two separate digits. In such a case, it is necessary to key into the sender the succeeding digit before the sender pulses out the delayed digit. If the next digit is not delayed, two digits will be pulsed out in rapid succession. Where this occurs there is insufficient time to release the pulse checking lamp for the delayed digit with the RLS (release) key before the pulses of the next digit appear on the checking lamps. The number of the checking lamp which remains lighted will indicate the sum of the two digits. When the sum of these numbers exceeds ten, the count will return to lamp 1 and repeat, that is, if the sum of the numbers used is 14, lamp 4 will remain lighted.

1.10 Fixed or Variable Classes: The sender may be arranged for either fixed or variable classes or for both. When testing fixed classes the ST (start) key is not used. In a variable class it is necessary to depress the ST key after the final digit, unless the sender is arranged not to require a start key operation when the number of digits keyed is the maximum for which the sender is equipped.

1.11 Test Numbers: The number which gives the most comprehensive test of the sender register relays is 1254. In order to test certain other leads in the sender not tested with 1254, the following numbers should be used; 2915, 2090, 0538, 8671, and 9807. For senders requiring more than four digits, the last registered digit may be repeated for each additional digit required.

2. APPARATUS

2.01 The apparatus required for each test is shown in the following list. The details for each item are covered in the indicated paragraphs.

APPARATUS	TEST			
	(A) to	(J)	(K)	(L) (M)
No. 258C (dummy) Plug	1	1	1	1
35-type Test Set	-	1	-	1
KS-3008 Stop Watch	-	-	1	-
KS-7361 Per Cent Break Meter	-	-	-	1
No. 298A or No. 310 Plug (2.02)	-	-	2	1
No. 365 Tool	-	2	-	-
Patching Cord (2.03)	-	1	-	1
Patching Cord (2.04)	-	1	-	-
Patching Cord (2.05)	-	-	-	1
Patching Cord (2.06)	-	-	-	1

2.02 No. 298A Plug or a No. 310 (or 110) Plug with tip and ring short-circuited.

2.03 P3E Cord, six feet long, equipped with two No. 310 (or 110) Plugs (3P7A)

2.04 W2W Cord, six feet long, equipped at one end with a No. 310 (or 110) Plug and at the other end with No. 360B and No. 360C Tools (2W17A), and a No. 365 Tool attached to each 360-type Tool.

2.05 P2P Cord, ten feet long, equipped at one end with a No. 309 (or 109) Plug and at the other end with a No. 310 (or 110) Plug (2P10A).

2.06 W2BC Cord, five and a half feet long, equipped with a No. 310 (or 110) Plug (2W27A).

3. PREPARATION

3.01 At the test circuit jack and lamp panel insert a No. 258C plug into the T jack associated with the sender to be tested.

3.02 Operate the H (hold) key. If the sender is idle, or when it becomes idle, the OK lamp should light. This is a check of the H lead circuit. The H key should be left operated until all the tests of a sender are completed.

3.03 On the test circuit operate the following keys, when they are provided, as specified in 4. METHOD.

Key	Purpose
H	<u>Hold:</u> To hold the sender connected to the test circuit and make it test busy to hunting links.
CL-	<u>Class:</u> To simulate the different classes for which the sender may be arranged.
P	<u>Position:</u> When operated, represents an inward toll position call where the sender is expected to ring. When left normal, represents an outward toll or DSA position call where the sender is expected to cut through without ringing.
CR	<u>Cancel Ring:</u> To be used in conjunction with the P key when making an inward toll position call in a variable class where the sender cancels the ringing in certain digits.

<u>Key</u>	<u>Purpose</u>	<u>Key</u>	<u>Purpose</u>
PT	<u>Pulsing Test:</u> To check pulsing speed and per cent break.	OR-NO	<u>Operator Ring Non-Operate:</u> To make a non-operate test of the SR or AC relay in the sender.
SB	<u>Switchboard:</u> To be operated when simulating a call from a No. 1 toll switchboard. When left normal represents a call from No. 3 type toll or DSA switchboards.	TRT	<u>Tip Release Test:</u> To test the release of the TS relay with a leak resistance on the KT lead.
F-OF	<u>Open Fundamental:</u> To open the fundamental tip and ring.	RRT	<u>Ring Release Test:</u> To test the release of the RS relay with a leak resistance on the KR lead.
F-RB	<u>Reverse Battery:</u> To reverse the potential on the FR and FT leads to the sender to represent a "line seizure" signal.	RLS	<u>Release:</u> To extinguish the checking lamp after each digit is keyed and checked.
PD-O	<u>Preliminary Disconnect - Operate:</u> To test the operate adjustment of the PD relay in the sender.	<u>4. METHOD</u>	
PD-NO	<u>Preliminary Disconnect - Non-Operate:</u> To test the non-operate adjustment of the PD relay in the sender.	<u>(A) Sender Operation Test</u>	
TO-A	<u>Time-Out-A:</u> To test the TA relay time-out feature in the sender.	4.01 This test checks that the sender performs its functions in handling the different classes of calls for which it may be arranged. It also checks the SC lead, class registration, the operation of the proper registration relays, that the number of pulses pulsed out by the sender agrees with the digits keyed in, and that the sender performs its proper ringing and cut-through functions.	
TO-B	<u>Time-Out-B:</u> To test the TB relay time-out feature in the sender.	4.02 Operate a CL key. Operate keys P, SX, and CR when necessary to set up the proper ringing condition for the test being made. Operate the SB key when simulating a test call from a No. 1 toll switchboard.	
SX	<u>Simplex:</u> To be operated when testing a simplexed DC ringing class when the sender is expected either to ring or cut through without ringing.	4.03 Operate the SC key. Note that the OK lamp is momentarily extinguished.	
SC	<u>Sender Control:</u> To impose an operate test of the SC, OF or OF1, and KR or KT (or KR1, KT1, KR3, KT3) relays in the sender depending on the CL key operated.	4.04 Operate the K key. By means of the numerical digit keys of the keyset register one of the test numbers. Check that the digits keyed in are received on the proper checking lamps and in the proper sequence. The RLS key may be operated between digits if desired. Operate the ST key after the last digit if required. The OK lamp will be extinguished after the last digit is registered or the ST key is operated until the ringing test or the immediate cut-through test is made as covered in 4.05.	
K	<u>Keyset:</u> To connect the test circuit keyset to the sender.	4.05 In a class where the sender is expected to apply 20-cycle AC ringing start signal, operate the F-RB key to simulate "line seizure" signal. The OK lamp should relight if the ringing and cut through test is satisfactory. In all other types of tests including ringing not required, simplexed DC ring-	
SD	<u>Sender Delay:</u> To give a reverse battery signal to delay the outpulsing in a stop-go class.		
FT	<u>Fundamental Test:</u> To open the pulsing leads to the sender for checking delayed outpulsing until class registration is completed.		
OR-O	<u>Operator Ring Operate:</u> To simulate a ring from the operator to the sender on an outward toll position call which changes the sender from a non-ringing to a ring condition.		

ing, and canceled ringing, the OK lamp should relight immediately after the ringing and cut through test is made.

Note: Operate the F-RB key within one second after the outpulsing of the last digit in the case of senders arranged to operate with repeated dialing toll trains, in order to obtain a reliable check of the ringing and cut through features of the sender. The F-RB key may be operated during the pulsing of the last digit which will perform a reliable check of the ringing, but the last digit will not be properly registered on the checking lamp.

4.06 Restore all keys to normal except the H key.

4.07 Repeat this test, using all test numbers, covering all types of calls and all classes for which the sender is arranged. It is not necessary to use each test number with each class. In variable classes requiring canceling the ringing in certain digits and ringing in other digits, test all digits with the proper ringing keys operated. Tests (B), (C), and (D) may be combined with these repeat tests.

4.08 Test of Timed Cut-Through Feature When Sender is Arranged to Operate with Repeated Dialing Toll Trains: On one of the test calls covered by 4.07, where the sender is expected to ring, operate the P and CR keys and proceed as in 4.02 to 4.04, inclusive. The OK lamp should relight in approximately two seconds after the last digit is pulsed out.

4.09 If no other tests are to be made on the sender, restore all keys to normal and remove the plug from the T jack. If other tests are to be made, restore all but the H key and leave a 258C plug in the T jack. The OK lamp should remain lighted indicating that the sender is being held connected to the test circuit.

(B) Test of Stored Ring

4.10 This test checks that the sender will change from a non-ring condition to a ring condition on a call from an outward toll position if the operator rings on the circuit immediately after completion of keying. The SR relay performs this function in the case of a DC signal to the sender (No. 3 type toll switchboard). The AC relay performs this function in the case of a 20-cycle AC ringing signal to the sender (No. 1 toll switchboard).

4.11 Operate Test of SR Relay: Operate a class key representing an outward toll position call. Operate the OR-O key. Operate the SX key if required for the class.

4.12 Operate the SC and K keys. By means of the numerical digit keys of the keyset register one of the test numbers and check the ringing as in 4.05. Restore all keys to normal except the H key.

4.13 Non-Operate Test of SR Relay: Repeat 4.11 and 4.12 with the OR key in the NO position. The OK lamp should relight after pulsing is finished. Restore all keys to normal except the H key when proceeding with 4.14, otherwise release the circuits as in 4.09.

4.14 AC Relay Test: Repeat 4.11 to 4.13 with the SB key operated to test the sender AC relay. Release the circuits as in 4.09.

(C) Leak Test of TS and RS Relays

4.15 This test applies a leak resistance to the KT and KR leads to check the release of the TS and RS relays in the sender.

4.16 To test the TS relay, make a test call as covered in Test (A). Operate the TRT key just before digit keying and release it before keying the last digit. Use test number 0538. Restore all keys to normal except the H key.

4.17 To test the RS relay, repeat 4.16 using the RRT key and test number 2090.

4.18 Release the circuits as in 4.09.

(D) Closure of Pulsing Leads Test

4.19 This test checks senders arranged to accept digit registration before the fundamental FT and FR leads are closed through to the sender. It checks that when these leads are closed the sender will then properly transmit the digits.

4.20 Operate the F-OF key. Make a test call as covered in Test (A). Key in several digits and note that no pulses are received from the sender. Restore the F-OF key and note that the sender then pulses out the digits properly.

4.21 Release the circuits as in 4.09.

E) All Paths Busy Test

4.22 This test checks that the sender will cut through immediately upon receiving a reversal on the FT and FR leads representing an all paths busy signal. This test is only to be made on classes not equipped for stop-go.

4.23 Operate a class key for a class not equipped for stop-go. Make a test call as covered in Test (A). Key in several digits and note that the pulses are received properly. Operate the F-RB key and note that the OK lamp is momentarily extinguished. Release the F-RB key and key in an additional digit. Note that no more pulses are received, indicating that the sender has cut through.

4.24 Release the circuits as in 4.09.

(F) Test of Stop-Go Feature

4.25 This test checks the stop-go feature of the sender. A battery and ground reversal over the FT and FR leads is given the sender as an indication to stop pulsing. When pulsing is to be resumed, the battery and ground is again reversed as a signal to resume outpulsing of the remainder of the digits. Any further battery reversals during pulsing indicates an "all paths busy" condition.

4.26 Operate a class key arranged for stop-go. Make a test call as covered in Test (A), and after a digit is pulsed out, following which a stop signal is expected, operate the SD key. Key another digit and note that the sender does not pulse out the digit. Release the SD key and the sender should then pulse out the digit.

4.27 To check the release of the TT relay to permit an "all paths busy flash" after a stop-go signal, operate the SD key again. Key another digit and note that no pulsing takes place. Release the SD key and note that pulsing still does not take place.

4.28 Release the circuits as in 4.09 and repeat this test on all stop-go classes.

(G) Non-Operate Test of R and NR Relays

4.29 This test checks the non-operate adjustment of the R and NR relays in the sender.

4.30 To test the R relay, operate a class key for the maximum number of digits for which the sender is equipped. Operate the P or P and SX keys for the ringing required, and the CR key if required for the maximum digit. Operate the SB key if the sender is arranged to work with a No. 1 toll switchboard.

4.31 Operate the F-OF, PD-NO, SC and K keys. Key a maximum digit number and operate the ST key if required. The OK lamp should remain lighted after keying.

4.32 Release the F-OF and PD-NO keys. The sender will then pulse out the digits and the test should be completed as in 4.05. Restore all keys to normal except the H key.

4.33 To test the NR relay, repeat 4.30 to 4.32 with the P, and CR keys normal. Operate the SX key if required for the class. When the pulsing is completed, the OK lamp should relight.

4.34 Release the circuits as in 4.09.

(H) Preliminary Disconnect Test

4.35 This test applies a non-operate, operate, and release test to the PD relay in the sender.

4.36 Non-Operate: Operate the F-OF and SC keys. Note that the OK lamp is momentarily extinguished. Operate the PD-NO key. Observe that the OK lamp remains lighted.

4.37 Operate: Operate the PD key to the O position. Observe that the OK lamp is extinguished but relights immediately.

4.38 Release: Restore the PD key to normal. Observe that the OK lamp is extinguished but relights immediately.

4.39 Release the circuits as in 4.09.

(I) Reorder Test

4.40 This test checks that if the operator falsely depresses the ST key in a digit position where it is not intended, the sender will return a reorder signal. This test should be made on both a fixed and a variable class if both are provided. This test should not be made if the sender is arranged for fixed classes only.

4.41 Operate any class key, the SC, K, CR, and PD-NO keys. Operate the TO-B key. The OK lamp will be extinguished.

4.42 Fixed Class: Depress the ST key momentarily, and note that the OK lamp lights.

4.43 Variable Class: Key one or more digits and then depress the ST key following a digit where it is not intended to be depressed. The OK lamp should light. On successive test

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cycles, depress the ST key after a different number of digits to check all digits arranged to recognize a misplaced ST key.

4.44 Release the circuits as in 4.09.

(J) Sender Time-Out Test

4.45 This test checks the time-out alarm relays in the sender and the audible and visual alarms associated with the sender.

4.46 Operate the SC key, then operate the TO key, first to position A, then to position B and release it. The OK lamp will be extinguished but should immediately relight. The MB lamp associated with the sender will also light. Release the circuits as in 4.09.

4.47 Test of Visual and Audible Alarms: Once during the cycle of testing all of the senders, following 4.46, block the ON relay operated in the sender under test. Then remove the plug from the T jack. Wait the time-out period and observe that the associated visual and audible alarms are operated.

4.48 Reinsert the plug into the T jack and remove the blocking tool from the ON relay. Observe that the alarms are retired. Release the circuits as in 4.09.

(K) Pad Control Test

4.49 This test provides a means for testing the PC (pad control) resistances in the sender. It also provides a resistance balance test of the SR and SRA relays when these relays are provided in the sender.

4.50 Operate a CL key for the maximum number of digits for which the sender is equipped. Operate the SC, K, and then the F-OFF keys. When simulating a call from a No. 1 toll switchboard, operate the SB key and insulate the 6T contact of relay KR3. If the sender is not equipped with the SR and SRA relays proceed as in 4.52 to 4.54, inclusive, and 4.58.

4.51 If the sender is equipped with the SR and SRA relays, block the CT relay in the sender non-operated, and insulate the 5B contact of the ON relay and the 3B contact of the CT relay. Proceed as in 4.52 to 4.58.

4.52 Key in a maximum digit number and operate the ST key if required. No pulsing will be received by the test circuit and the OK lamp should be extinguished.

4.53 With the 35-type test set keys normal and the resistance slides at the right-hand side, connect a P3E cord to the T & R

jack of the test set and to the TT jack of the sender test circuit. With the black conductor of the W2W cord connected to 24-volt battery and the white conductor connected to ground, insert the No. 310 plug into the TEST BATT & GRD jack of the test set.

Note: If a 24-volt test battery jack is available, battery and ground can be supplied by patching to the TEST BATT & GRD jack.

4.54 Operate the BATT & GRD C.O. key of the test set and close switch G. Then move the No. 1 resistance slides to the extreme left, so that the resistance in series with the meter will be at a minimum. Operate the short-circuiting switch of telegraph key No. 1 and read the meter. The reading should be between 2.15 and 2.39 milliamperes. Operate the REV key and note that the meter reads between the same limits.

4.55 SR and SRA Relay Balance Test: Move the No. 1 slides to the right-hand side and restore all keys of the 35-type set to normal.

4.56 Remove the insulators from 5B of the ON relay and 3B of the CT relay, leaving the CT relay blocked non-operated.

4.57 Move the No. 1 slides to the extreme left and close the short-circuiting switch of telegraph key No. 1. The reading of the meter should be between 22.8 and 27.4 milliamperes. Operate the REV key. The meter should read between the same limits.

4.58 If the CT relay was blocked non-operated in 4.51 remove the blocking tool. Remove the insulation from 6T contact of the KR3 relay if previously insulated. Disconnect the test set and release the circuits as in 4.09.

(L) Pulsing Speed Test

4.59 This test provides a means of checking low speed pulsing of the sender and high speed pulsing when provided.

4.60 Operate the PT key. Operate a class key for low speed pulsing and the SC key.

4.61 Insert a No. 298A plug into the MB jack associated with the sender being tested. The OK lamp will be extinguished and the numerical checking lamps will flash continuously as the sender pulses.

4.62 With the stop watch, count the number of times the O lamp flashes in a minute. The number of flashes of the O lamp should be between 57 to 66 flashes per minute.

4.63 To check for high speed pulsing, proceed as in 4.60 to 4.62, inclusive, except that a class key for high speed pulsing should be operated and a 298A plug should replace the 258C plug in the T jack of the sender being tested. The number of flashes of the O lamp should be between 96 to 126 flashes per minute.

4.64 If the per cent break test is to be made, proceed with 4.68 to 4.73. Otherwise, remove the plugs from the MB and T jacks and release the test circuit as covered in 4.09.

(M) Per Cent Break Test

4.65 This test provides a means for checking the per cent break of the low speed pulses and of the high speed pulses when provided.

4.66 Operate the PT key. Then operate a class key for low speed pulsing and the SC key.

4.67 Insert a No. 298A plug into the MB jack associated with the sender being tested. The OK lamp will be extinguished, and the numerical checking lamps will flash continuously as the sender pulses.

4.68 With the 35-type test set keys normal and the resistance slides at the right-hand side, connect the T & R jack of the test set to the PT jack of the sender test circuit with a P3E cord.

4.69 Insert the No. 309 plug of the P2P cord into the TEST BATT & GRD jack of the test set and the No. 310 plug into the BAT supply jack of the sender test circuit.

4.70 With the W2BC cord connect the per cent break meter to the 4W jack of the test set. Check that the per cent break meter reads 100 on the scale. (This is the no current position.) If necessary, bring the reading to 100 by means of the zero adjusting screw on the meter. Operate the CR key of the sender test circuit and close the No. 4 key of the test set. Move the No. 4 resistance slides to the left until the per cent break meter reads zero. (The test set meter will read approximately .012 ampere.)

Note: To ensure proper accuracy of the per cent break meter, it should be located approximately level and should not be closer than 12 inches to magnetic material, such as steel or iron framework or metal test sets.

4.71 Restore the CR key and observe that the per cent break meter reads between 59.5 and 67.5 per cent break.

4.72 To check for high speed pulsing, proceed as in 4.66 to 4.71, except that a class key for high speed pulsing should be operated. The per cent break meter should read between 62 and 70 per cent break.

4.73 Disconnect the per cent break meter and the 35-type test set. Release the circuits as in 4.09.

5. REPORTS

5.01 The required record of these tests should be entered on the proper form.