CROSSBAR SYSTEMS
NO. 1
ORIGINATING AND AUXILIARY SENDER TEST
TRANSVERTER TEST

CIRCUIT UNIT SECTION -0101
KEYSHEET

CHANGES

A. Changes in Units

Unit -0141 Auxiliary Sender MF Pulse Check Control Circuit

1. PURPOSE OF KEYSHEET

1.01 The purpose of the keysheet (sheet -0101 of the schematic) is to show the various units of the test circuit and to indicate in general the manner in which they are interconnected when used for the test of subscriber and keypulsing senders, or auxiliary senders used in connection with subscriber senders for subscriber direct distance dialing.

2. PURPOSE OF CIRCUIT

2.01 This circuit provides means for automatic routine testing of subscriber senders, auxiliary senders associated with subscriber senders, and keypulsing senders of the crossbar system. Registration in the senders is made directly from the test circuit and the proper functioning of the senders is checked by the test circuit. When a test has been completed satisfactorily, the next circuit continues to function automatically until a trouble is encountered, or all senders have been tested. Repeat tests can be made in two ways: first, repeat tests can be made continuously on a particular sender; or second, two tests can be made on each sender consecutively. The test circuit is automatically advanced until all senders under test have been tested twice. The test circuit is connected to the senders by means of crossbar switches; one crossbar switch is necessary for each group of 100 or less senders. Each switch can connect to 10 sender subgroups, each one having a maximum of 10 subscriber or 5 keypulsing senders. Each subgroup has a separate horizontal row of the crossbar switch. Connection to the circuit common to a subgroup of senders is obtained by means of a multicontact relay and a U-type relay. Each multicontact relay and U- relay is associated with a horizontal row of the crossbar switch to which row are connected the senders of the subgroup. A particular circuit test can be made. An automatic pass-busy feature is provided. The sender being tested can be located by means of lamps which indicate the position of the sender on the test circuit crossbar switch. There are two alarms, major and minor. The major alarm is used when the test is stuck on a time-out while testing common equipment for ten senders, the minor alarm when the test is stuck while testing individual senders.

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* This CD covers drawing issues through 98A. For Reasons for Reissue, see Appendix 1A.

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3. SUMMARY OF MAJOR TEST FEATURES

Type	Class Key	Section	Paragraph	Remarks
FS	1-SUB	-0102	5-9	Start
		-0131	5-14	Seizure
		-0111	5-17	Dial Cont
		-0105	5-9	Dial Code
		-0111	8	Code Check
		-0133	5-9,12	Code Check
		-0111	10-12	Off. Sel
		-0108	5-7	Off. Sel
		-0111	14-17	Dial No.
FS	1-SUB	-0105	10-14	Dial No.
		-0113	5-8,18	TG Test
		-0113	9-16	Inc & Fin. Sel
		-0108	8-9	Inc & Fin. Sel
		-0113	17	Inc & Adv
		-0111	20	Release
		-0102	10	Advance Test
FS	1-KP	-0102	5-9	Start
		-0131	5-11	Seizure
		-0105	8-13,21	Key Control
		-0133	5-9,12	Code Check, if any
		-0108	5-7	Office Sel
		-0125	7-10	OS Control
		-0113	5-8,25	Trunk Test
		-0113	24	Syn Test
		-0108	8,9	Inc & Fin. Sel

Type	Class Key	Section	Paragraph	Remarks
		-0113	9,16,26	Inc & Fin. Sel
FS	1-	-0113	17,27	Inc Adv
	KP	-0125	11	TC Test
		-0102	10	Advance
FS	2-		Same as	FS-1 Sub
	SUB	-0113	20	+ Register Control
		-0108	16	Time Intvl
FS	3-		Same as	Class 1 +
LR	SUB	-0113	21	LRFS
FS	3-	-0125	15	KPLR
LR	KP	-0113	28	KPLR
PCI-	4-	-0102	5-9	Start
TDM	SUB	-0131	5-11	Seizure
		-0115	5-10	Dial Cont
		-0105	5-19	Dial Pulse
		-0133	5-9,12	Code Check
		-0115	11	Code Check
		-0108	5-7	Office Sel
		-0115	18,19	Office Sel
		-0115	18-20	Sta Delay
		-0117	6-9	Trunk Test Asgn
		-0117	10,12 14-16	PCI Pulse Check
PCI-	4-	-0117	10,12	PCI Pulse
TDM	KP		14-16	Check
PCI-	5-	Same as Class 4 except		
DIR	KP	-0117	12	Omit
		-0117	11	Add
PCI-	5-	Same as Class 4 except		
DIR	SUB	-0117	12	Omit
		-0117	11	Add
PCI-	6-	-0102	5-9	Start
TDM	SUB	-0131	5-11	Seizure
		-0115	5,7,12	Dial Cont
		-0105	5-18	Dial Pulse
		-0133	5-9	Code Check
		-0115	17,21,23	Trunk Test
		-0117	10,12-16	PCI Check
DIR	KP	-0117	12	Omit
		-0117	11	Add
PCI-	6-	-0102	5-9	Start
TDM	SUB	-0131	5-11	Seizure
		-0115	5,7,12	Dial Control
		-0105	5-18	Dial Pulsing
		-0133	5-9	Code Check
		-0115	17,21 23	Trunk Test
		-0117	10,12-16	PCI Check
PCI	6-	-0102	5-9	Start
TDM	KP	-0131	5-11	Seizure
		-0105	5-13, 20,21	Key Control
		-0123	5-9,11	Pulsing
		-0133	5-9,12	Code Check
		-0108	5-7	Office Sel
		-0125	7-10, 12,16	OS Cont
		-0115	17,21-23	Trunk Test
		-0117	10,12, 14-16	PCI Check
LR-	7-	No distant off. sel, etc, TW normal		
PCI	SUB	Same as Class 4 through trk test		
		-0117	17	Release
		-0115	24,23	Release
LR	7-	No distant off. sel, etc, TW normal		
PCI	KP	Same as Class 4 through trk test		
		-0117	17	Release
		-0115	24,23	Release
		-0123	10	Release
LR-	8-	Same as Class 7 except TW operated		
PCI	SUB			
LR-	8-	Same as Class 7 except TW operated		
PCI	KP			
SPL SERV OPR	9- SUB	-0102	5-9	Start
		-0131	5-11	Seizure
		-0121	5-7,9	Dial Control
		-0105	5-19	Dialing
		-0108	5-7	Office Sel, if used
SPL SERV OPR	9- SUB	-0133	5-9,12	Code Check
		-0121	8	Code Check
		-0121	10	Completion
3-DIG OPR DIR	10- SUB	Same as Class 9 Code Check -0121 through 12 Completion		
3-DIG OPR DIR	10- KP	-0102	5-9	Start
		-0131	5-11	Seizure
		-0129	5-6	Control
		-0105	8,13,21	Pulsing
		-0133	5-9,12	Code Check
		-0108	5-7	Off. Sel
		-0129	7-11	OS Cont
		-0129	12-14	Trunk Test

Type	Class Key	Section	Paragraph	Remarks
3-DIG	11-	Through distant off. sel, TW operated		
OPR	KP	Same as Class 10 except		
		-0129	12	Omit
		-0129	13	Add
PS	12-	-0102	5-9	Start
	SUB	-0131	5-11	Seizure
		-0121	14	Control
		-0133	11	Code Check
TO	12-	-0102	5-9	Start
	KP	-0131	5-11	Seizure
		-0123	5-8,14	Pulsing
		-0127	5,16	Completion
OFF.	13-	-0102	5-9	Start
OFL	SUB	-0131	5-11	Seizure
		-0105	5-18	Dial Pulsing
		-0119	5-11	Control (always reqd)
		-0133	5-9	Code Check
		-0108	5-7	Office Sel
		-0127	17,2	Completion
OE	16-	INC or TDM DIST TRK		
	KP	-0102	5-9	Start
		-0131	5-11	Seizure
		-0105	8-13,21	Key Control
		-0123	5-9	Pulsing
		-0125	10,17	OS Cont
OE	18-	Unassigned Code		
	KP	-0102	5-9	Start
		-0131	5-11	Seizure
		-0105	8-13,21	Key Control
		-0123	5-9	Pulsing
		-0127	10,18	Control
		-0133	5-9	Code Check
AMA	SUB*	-0135	5-6	Seizure and Test
PB	SUB*	-0143	6	Seizure
TCH) TN)	SUB*	-0143	10	Normal Test Call
			11	PB Receiver Test

A. Miscellaneous Tests

Test	Section	Par.
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	-0117	7,8
Coin	-0111	18
	-0115	20
DC Lead KP	-0131	17
DC Lead KP	-0133	16
False Operate GTT	-0111	21
FT & FR Ground	-0117	9
FT & FR Ground Cancel	-0105	22
Incoming Trunk Reversal	-0141	19
Intersender Timing	-0105	26
Intersender Timing	-0121	18
KP Stuck Sender	-0108	12
L Relay	-0105	25
OF Speed	-0119	12.03
Official Reroute Sub	-0113	22
Official Reroute KP	-0113	29
PBX Surge	-0105	24
Preference Lead	-0131	12
Reversed Trunks	-0121	16
S and LR Leads	-0111	9
	-0115	12
Sender Lamps	-0121	17
SC- Contact Crosses	-0131	13
SGT Operate	-0113	30
Slow Revertive Pulses	-0108	10
Stations Delay	-0115	18,19
Synchronizing Sub	-0113	6-18
Synchronizing KP	-0113	24-27
TG & MTG Relay	-0113	7,8, 25
Trouble Release	-0133	16
Trunk Closure KP	-0125	11.02
Trunk Closure FS	-0119	11
TR Ground	-0121	10
Two-Party Check	-0133	17
TS & RS Release	-0123	5.02
Tip and Ring Polarity - Test of Restricted PBX Call Diversion	-0102	29

B. Attached Figures (See ES-558991)

Fig.	Section	Par.	Remarks
1	-0102	5	Time Alarm and Blocking
2	-0102	6	Selection of 1st XBR Switch
3,5	-0102	7	Operation of Select Magnet
4,5	-0102	8	Operation of Hold Magnet
6	-0102	9	Seizure of Sender Group Test Ckt
7	-0102	10	Completion of Test and Advance to Next Sender
8	-0102	11	Advance to Next Sub-group of Senders
9	-0102	17	Repeat Tests
10	-0102	18	Repeat 2 Tests
11	-0102	19	Automatic Pass Busy Feature
12	-0102	26	Dial Tone Test
13	-0102	29	Tip and Ring Polarity Test

*Same as other classes of subscriber sender test.

Fig.	Section	Par.	Remarks
14	-0105	5	Seizure by Control Circuits
15	-0105	6	Dialing Preliminary Pulse
16	-0105	7	Dialing Prefix 1-1 (Sub Sdrs)
17	-0105	8	Pulsing Prefix 1-1 (KP Sdrs)
18	-0105	14	Typical Sender Dialing Loop
19	-0108	5	Office Brush Selection
20	-0108	5	Operation of L Relay
21	-0108	5	Operation of L Relay
22	-0108	9	Incoming Advance and Overflow Tests
23	-0108	14	Test for Opening of Fundamental in Sender
24	-0111	5	Seizure
25	-0111	6	Dialing Preliminary Pulse
26	-0111	7	Dialing A,B, and C Code Digits
27	-0111	8	Code Check
28	-0111	14	Synchronizing for Thousands Digit (Panel Class)
29	-0111	15,16	Synchronizing for Hundreds, Tens, and Units Digits (Panel Class)
30	-0111	17	Synchronizing for Crossbar Class
31	-0111	20	Release
32	-0113	5	Seizure
33	-0113	6	Synchronizing Test for Thousands Digit (Panel Call)
34	-0113	7	TG Relay Test
35	-0113	9	Incoming Brush Selection
36	-0113	10	Synchronizing for Hundreds Digit
37	-0113	17	Incoming Advance
38	-0113	18	Synchronizing for Crossbar Calls
39	-0113	21	Late Release Full Selector Test
40	-0115	5	Seizure
41	-0115	6	Dialing A Code Digit
42	-0115	7	Dialing B and C Code Digits
43	-0115	8	Dialing 1st Numerical Digit
44	-0115	11	Code Check
45	-0115	17	Synchronizing Sender for Trunk Test
46	-0115	18	Test of No Stations Delay by Sender
47	-0115	19	Test of Station Delay Feature of Sender
48	-0115	23	Release
49	-0115	-	Sequence Chart of PCI Control Ckt
50	-0117	5	Seizure
51	-0117	6	Synchronizing Test for Trunk Closure
52	-0117	7,8	Check of Slow and Fast Assignments
53	-0117	9	Checking the Grounding of the "FT" and "FR" Before Sending PCI Pulses
54	-0117	10	Checking of PCI Pulses
55	-0117	13	Two-Stage Tandem PCI Calls
56	-0117	14	Check of Final Heavy Positive Pulse
57	-0117	16	Check of Digits Registered on Register Relays
58	-0119	5	Seizure
59	-0119	6	Dialing of the Code and Number
60	-0119	7	Code Check
61	-0119	11	Office Overflow Test
62	-0119	12	Incoming Overflow Test
63	-0119	11,12	Sequence Chart
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66	-0121	5,6, 7,8	Sequence Chart for Seizure and Dialing
67	-0121	10	Check of Sender Awaiting Dialing of All Digits Before Grounding the TR Lead
68	-0121	13	Panel or Tandem Crossbar Office Selection
69	-0121	14	Permanent Signal Test - MR
70	-0123	5	Seizure
71	-0123	6	Registration
72	-0123	7	Full Selector Call
73	-0123	7.05	Check of Key Release
74	-0123	8	Late Release - Full Selector - Incomplete Numerical Registration
75	-0125	5,6	Seizure - Awaiting Pulsing and Check of Code
76	-0125	7,8, 10	Office Brush, Office Group, and Skip Office Selections
77	-0125	11.01	Full Selector Tests, Seizure of Incoming And Final Selections Control Circuit
78	-0125	11.02	Trunk Closure Test

Fig.	Section	Par.	Remarks
79	-0125	12	Call Indicator Calls - Seizure of PCI Register Circuit
80	-0125	13	Check Operation of TR and DC and Release of S Relays
81	-0127	5	Seizure
82	-0127	6	Check of the Key Release
83	-0127	7,8, 10	Office Brush, Office Group, and Skip Office Selections
84	-0127	12	Office Overflow Test
85	-0127	13	Test of Trunk Closure
86	-0127	15	Incoming Overflow
87	-0129	5	Seizure
88	-0129	6	Seizure of KP Circuit
89	-0129	7,8, 9	Office Brush, Office Group, and Skip Office Selections
90	-0129	12	Trunk Test, No Distant Office Selector
91	-0129	-	Sequence Chart
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93	-0131	7	Busy Test
94	-0131	8	Busy Test of Sender Group
95	-0131	10	Seizure of Sender
96	-0131	11	Check of Release Signal
97	-0131	12	Check of Advance of Preference Lead to Next Sender - Premature Closure
98	-0131	13	Check for Crosses on SC- Relay Contacts
99	-0131	16	Group Make Busy
100	-0133	5	Seizure
101	-0133	7	Registration
102	-0133	10	Checking the A Digit
103	-0133	11	Checking the Other Digits
104	-0133	12	Release
105	-0135	5	Seizure
106	-0135	6	Seizure and Test
107	-0137	5	Seizure
108	-0137	6	Preparation for Dialing and Pulsing
109	-0139	5,6	Seizure and Preparation for Dialing
110	-0139	8	Dialing the ACA or A Digit
111	-0139	9	Dialing the ACB and ACC, or B and C Digits
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113	-0139	12	Dialing the Other Digits
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115	-0139	-	Sequence Chart - 7-Digit Call
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117	-0141	7	Trunk Test
118	-0141	8	Checking the KP Signal
119	-0141	9	Checking the 1st Numerical Digit
120	-0141	10	Checking the Other Numerical Digits
121	-0141	11,12	Checking the Start Pulse
122	-0141	13	Release
123	-0141	15	Time Alarm and Blocking Sequence Chart
124	-0141	-	Sequence Chart
125	-0141	14	Sequence Chart - Skip Features
126	-0141	-	7-Digit Call - Sequence Chart - Stations Digit
127	-0139	-	Wipe-Out and Disconnect Before and After Dialing Is Completed
128	-0139	-	Time-Out and Disconnect Before and After Dialing Is Completed
129	-0141	-	Wipe-Out and Disconnect Before MF Pulsing Is Completed
130	-0143	6,10	Digit Control
131	-0143	7	High- and Low-Frequency Oscillators
132	-0143	7	Special Frequency Oscillator
133	-0143	10	Digit Advance
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136	-0143	11	Timing for Slow Pulsing Tests
137	-0143	11	Single and Special Frequency Tests
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140	-0143	10	Sequence Chart - 10-Digit DDD Call
141	-0143	10	Sequence Chart PCI Call
142	-0143	11	Sequence Chart Single Frequency Test
143	-0143	11	Sequence Chart Special Frequency Test
144	-0143	11	Sequence Chart - Slow Pulse Test
145	-0143	12	Sequence Chart - Pulsing Step by Step
146	-0105	7	Outpulsing Prefix Digits 0 or 1
147	-0105	7	Starting Pulse Generators
148	-0105	7	Prefix Digit 0 & 1 Control Circuit

Fig.	Section	Par.	Remarks
149	-0133	8	Check Circuit for Prefix Digit Leads
150	-0133	9	Zero Operator Timing Circuit Digit Leads
151	-0141	11	Check of Start Pulse on Prefix Digit 0 Coin Calls
152	-0111	6	Sequence Chart - Prefix Digits 0 & 1 Full Selector Call
153	-0121	11	Sequence Chart - Zero Operator Call - Dial Digit Zero
154	-0121	11	Sequence Chart - Zero Operator Call Dial 0-0
155	-0121	11	Sequence Chart - Zero Operator Call Dial 1-0
156	-0139	7	Sequence Chart - Prefix Digits 0 & 1 DDD Call
157	-0141	20	Sequence Chart - ODN Test Call
158	-0141	22	Sequence Chart - 0 Operator ODN Test Call
159	-0141	20	Release and Reset for ODN
160	-0141	20	Reset of Section For ODN
161	-0141	20	Digit Check For ODN
162	-0141	20	Prefix Digit Lead Check with ODN
163	-0141	20	Trunk Test with ODN
164	-0141	22	0 Operator ODN Call
165	-0111	22	Dialing and Checking - Full Selector Interchangeable Code
166	-0115	25	Dialing and Checking - PCI Interchangeable Code
167	-0133	21	Preparation - Interchangeable Code
168	-0133	21	First and Second Seizure Check Interchangeable Code
169	-0135	6	INF an 5L Lead Check
170	-0139	27	Information Code 411
171	-0111	22.03	Sequence Chart - Full Selector Call, Skip Office, Interchangeable Code
172	-0111	22.04	Sequence Chart - Full Selector Call with Office Selection Interchangeable Code
173	-0115	25	Sequence Chart - PCI Call Interchangeable Code
174	-0139	29	MF Call, Interchangeable Code
175	-0139	30.02	Circuit for TOUCH-TONE to dial pulse converter speed test
176	-0139	30.04	Circuit for prefix "0" or "1" and TOUCH-TONE to dial pulse converter speed test
177	-0139	30	Sequence chart, "TOUCH-TONE" to dial pulse converter circuit speed test
178	-0102	33.02	Bypassing the SD-25012-01 sender when testing double prefix 0-1, 1-0 feature of sender SD-27810-01
179	-0165	13	Coin Service Improvements

C. Typical Selection Showing Interchange of Controls - FS Synchronizing for Crossbar Call

Section -0105 - Code Key & Dial Pulsing

Section -0108 - Route Keys & Revertive Pulsing

Section -0111 - Full Selector Dial Pulse Control Pos 13

Section -0113 - Incoming & Final Selections Control Pos N

XB-SY Key Operated

3.01 When the DP switch of Section -0111 arrives in position 13, relay SB operates locally. Relay SB, operated, advances the DP switch to position 14 and operates relays IP and G of Section -0113. The XB-SY key of Section -0113 has operated relay SY2 of -0111 which now operates relay SY1. Relay SY1 grounds lead SY to Section -0105. The TH lead is also closed, and the thousands digit is dialed (10., Section -0105). Relay SY of -0105 operates and grounds lead AV to -0111, operating relay AV, which operates relay AV1 and energizes the DP stepper. After Section -0105 completes dialing the thousands digit, relay R operates opening the AV of Section -0111. The release of relay AV, advances the DP switch to position 15 and releases relays SY and AV1.

3.02 As the test circuit must dial thousands and hundreds digits before trunk test on this type of call, the SY2 relay of -0111 started dialing without synchronizing.

3.03 To check for false trunk guard closure, Section -0113 must be ready before hundreds digit is dialed.

3.04 The operation of relay IP Section -0113 (as described before) advances the SP switch to position 1 (Section -0113). This operates relay SY locally. Ground from the AV1 relay normal, -0111, over the SY lead operates relay SY1 and the relay SY2 of -0113. This closes leads FR3, FT, and SY1 to Section -0111. Leads SY1 and SY2 are connected together by the operated XB-SY key. Ground on lead SY1 from Section -0113 operates relay SY of -0111, closing lead SY to Section -0105. When the DP switch advances to position 15, lead H is closed to Section -0105. Leads H and SY, grounded, start the dialing of the hundreds digits. The SY relay, -0105, closes the AV lead to Section -0111, operating relays AV and AV1, and energizes the DP stepper. After dialing hundreds digit, relay R operates, releasing relay AV of Section -0111 which advances the DP switch to position 16. This opens leads SY1 and SY2 of Section -0113 releasing relays SY and SY1. Section -0113 now times for slow trunk guard test. Relays N1 to N4 and S count for about 2 seconds. If relays TC, TC1, and TTG operate before relay N4 and S, the call will advance, otherwise relay S will block the circuit. Relay TTG advances switch SP to position 2 where relays SY, SY1, and SY2 release, and lead IB is closed to Section -0108.

3.05 To check the thousands digit, relays RVP, RVP1, CHK, and FND operate from the ST relay -0102. Relay IB of -0108 operates from Section -0113 and closes the fundamental. Relays L, L1, and BT operate. When relay BT operates, relay L1 releases. During trunk test, 5. to 8., Section -0113, the selections are checked. After the counting relays operate, relays BO and BO1 operate. Then, relays L, BT, BO, BO1, and the counting relays release. This closes lead AV1 and advances the SP switch to position 3 for the next selection.

4. MANUFACTURING TESTING REQUIREMENTS

4.01 The test circuit shall be capable of performing all the functions listed in this circuit description, and shall meet the requirements listed in the Circuit Requirements Tables and Circuit Notes.

4.02 All operation and timing tests shall be made with the test voltages within the following limits:

	Minimum	Maximum
Signaling Battery	48.5	50.0

Note: This reissue also covers information authorized by the following appendix to Issue 25D of this CD.

APPX 1A DWG ISS 98A

CIRCUIT UNIT SECTION -0102
CONNECTOR CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit controls the connection of the senders to the other circuit units of the sender test set.

1.02 The class of test to be made on the sender is controlled by the position of the class keys.

1.03 Connection to the senders is made by means of crossbar switches. The selection of each crossbar switch is controlled by a set of relays designated G-.

1.04 The connecting switches are automatically advanced to all senders in rotation, or may be manually advanced to a particular sender.

1.05 One crossbar switch is necessary for each group of 100 or less senders. Each switch can connect to 10 sender subgroups, each one having maximum 10 subscriber or maximum 5 keypulsing senders. Each subgroup has a separate horizontal row on the crossbar switch, and has one relay of each of the four following groups of relays 0-9, SM0-SM9, A0-A9, and B0-B9 if required.

1.06 Connection of the circuit common to a subgroup of senders is obtained by means of a multicontact relay SM0-SM9 and U-type relays A0-A9 and B0-B9 per subgroup. Each multicontact relay and U- relay is associated with a horizontal row on the crossbar switch. This row is connected to eight leads of each of the senders of the subgroups.

1.07 The connector circuit may control the advance from a busy sender after a predetermined period.

1.08 The connection to the individual test control circuits is made over a number of leads. The closure of these leads to any one of the circuits is controlled over a lead through the class keys.

1.09 This circuit is arranged so that an audible test of the dial tone may be made on all subscriber senders in succession.

1.10 This circuit is arranged so that an audible test may be made of the disconnect tone furnished by subscriber senders arranged for timed release.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 Preparation for Test - The operation of the ST start key causes this circuit to seize a sender after which connection is made to the individual control circuit as determined by the setting of the class keys. Means are provided to prevent interference with any sender while the connections are being established.

3.02 Passing Busy Senders - A pass-busy feature is provided under control of the APB key. The pass-busy feature functions after 29 seconds minimum, 69 seconds maximum.

3.03 Alarm and Blocking - An alarm is given after a period of minimum 60 seconds, maximum 90 seconds from the start of the test. When the alarm is given, the test circuit blocks by opening the leads which furnish progress ground for the circuit units.

3.04 Registration - Registers are provided to record the number of circuits tested satisfactorily, the number of repeated single tests (not recorded on the circuits tested meter), and the number of busy senders which are passed without testing.

3.05 Passing Spare Terminals and End of Cycle - This circuit is arranged to pass by spare terminals on the crossbar switches and to give an alarm indication when all senders have been tested.

3.06 Blocking Time Alarm Feature - The operation of the TA time alarm key prevents the functioning of the time alarm circuit and prevents the connector circuit, -0103, from advancing to the next sender.

3.07 A receiver is furnished connected across the T and R leads which permit an audible test of the dial tone and disconnect tone supplied by subscriber senders.

3.08 When the office is equipped with SD-25012-01 and SD-27810-01 senders, a feature is added to recognize when a SD-27810-01 sender is being tested. This feature will allow testing the pulsing requirements, grounding the FT and FR on

balanced PCI pulsing, partial dial, double prefix, and bypassing tests not required by SD-27810-01 or by bypassing tests not required by SD-25012-01 senders.

3.09 A feature is added to provide for testing of the toll diversion feature on auxiliary sender calls (class 17 key operated).

3.10 A feature is provided to remove the automatic distribution of sender usage feature on subgroups partially converted for TOUCH-TONE, when making the automatic progressive testing of subscriber senders.

KEYS

3.11 Start Key ST - The operation of this key controls the advance of the connector circuit from normal and when restored causes the test set to complete the test in progress but not to start a new test. The crossbar switch does not restore when the ST key is restored.

3.12 Group Keys G- - The operation of a G- key causes the selection of the associated crossbar switch for connecting to senders.

3.13 Particular Circuit Keys PCR and PCS - These keys are used to advance the crossbar switch to a particular terminal.

3.14 Control Advance Key CA - The operation and release of this key causes a test to be started on the next sender if the repeat key is normal, or causes a new test to be started on the sender upon which the test circuit is resting if the repeat key is operated. It should not be operated while a transverter is connected.

3.15 Repeat Key REP - This key causes the test circuit to test the same sender repeatedly. It is also used to extend the control advance feature to the remote control jack at the sender frames.

3.16 Repeat 2 Key REP 2 - This key causes two tests to be made on each sender.

3.17 Time Alarm Key TA - When this key is operated, the time alarm circuit is restored to normal. The key must be restored to normal before the test circuit will advance to the next sender. If this key is left operated while the test frame is unattended, the alarms cannot operate, and, if a trouble is then detected by the test frame, either one sender or a subgroup of senders may be held out of service.

3.18 End of Group Keys EG0 to EG4 - T Option - These keys are used to stop the test before advancing to a succeeding group, wherein it is necessary to reset the route keys due to the use of different selection for the same dialed code.

3.19 Pass Group Keys PG0 to PG4 - S Option - These keys are used to pass a group of senders which require a different test circuit preparation than the senders preceding and following them in the test cycle.

3.20 Free Call Key FC - This key causes the individual test circuits to test a coin sender for a free call or a noncoin call.

3.21 Automatic Pass-Busy Key APB - This key causes the test circuit to pass a busy sender after a period of 29 seconds minimum, 59 seconds maximum.

3.22 Return to Normal Key RN - This key is used to restore the connector mechanism to normal.

3.23 Alarm cutoff key AC0 is used to silence the minor alarm without interfering with aisle pilot and floor alarm frame lamp indications.

3.24 Class Keys - There are 19 class keys mounted on the test frame. Sixteen of these keys (1 to 10), (12 to 16), and (18) are used in testing subscriber senders. One key, (17), is used in testing subscriber senders associated with auxiliary senders, and fifteen keys (1, 3 to 8, 10 to 16, and 18) are used in testing key pulsing senders. A designation strip adjacent to the keys will show which key is to be operated for a particular test. The R1 and R2 keys are for the purpose of ensuring that a test will not be made with a class key operated in both strips of keys. That is, when making tests using class keys 1 to 9 the R2 key must be operated, and when making tests using class keys 11 to 18 the R1 key must be operated before a test will start.

JACKS

3.25 Remote control jacks RC are installed in suitable locations on the sender frames, and by the use of a make-busy plug the remote control advance feature is operated. The use of a 32A test set will permit the same function as the make-busy plug when that key, which furnished ground on the ring, is depressed. When the key which furnishes ground on the tip is depressed, the step-by-step dialing and selection features of the test set are operated.

3.26 The TDV jack located at the sender test frame is used with a 322A plug to operate the feature for testing senders equipped for the diversion of restricted PBX traffic on extra charge calls. The use of the TDV jack is restricted to revertive calls and should not be used for test calls involving the auxiliary sender.

3.27 The TT-RD jack is provided to manually test the automatic distribution of sender usage feature on subgroups partially converted for TOUCH-TONE. When TT-RD jack is operated, the sender-busy (SB-) relays in the subscriber sender link circuits are locked.

LAMPS

3.28 Time Alarm Lamp TA - This lamp lights at the expiration of the time alarm period.

3.29 End of Group Lamp EG - T Option - This lamp is furnished when different sender groups require different routing for the same dial code. When the test set has finished testing a group of senders, this lamp will light if the EG- key, corresponding to the group of senders, is operated. The test set will wait until the EG- key is restored to normal.

3.30 Group Locating Lamps G- - Each crossbar switch is associated with a lamp which identifies the group of senders to which the crossbar switch is connected.

3.31 Sender Locating Lamps - Tens 0 to 9 and Units 0 to 9 - These lamps indicate which crosspoint of the crossbar switch is operated.

3.32 End of Cycle Lamp EC - This lamp lights when the last sender connected to this test circuit has been tested. Since a test cycle is usually started at the first sender, lamp EC, in general, indicates all senders tested.

3.33 Sender Tip and Ring Reversal Lamp TDR - This lamp lights at dialing completion in full selector or PCI class calls if the sender tip and ring potentials are reversed.

4. CONNECTING CIRCUITS AND SECTIONS

4.01 Typical connecting circuits are:

(a) Crossbar Subscriber Sender - SD-25012-01 or SD-25772-01.

(b) Crossbar Key Pulsing "A" Swbd Sdr - SD-25015-01.

(c) Orig Mkr Conn - SD-25035-01 or SD-25635-01.

(d) Floor Alarm Frame, Fuse, and Time Alarm Circuit - SD-25046-01 or SD-25460-01.

(e) Misc Ckt Subscriber Sender Fr - SD-25052-01.

(f) Interrupter Frame Circuit - SD-25062-01 or SD-25638-01.

(g) Misc Circuits for Sender Test Frame - SD-25174-01.

(h) Misc Ckt for Misc Frame - SD-25281-01.

(i) Misc Ckt for Relay Rack Bays - SD-25440-01.

(j) Sub Link and Controller - SD-25554-01 and SD-25604-01.

(k) Maintenance Recorder - SD-25601-01.

(l) Misc Ckt Transverter Trouble Indicator Fr - SD-25609-01.

(m) Misc Ckt Calling Line Register Fr - SD-25614-01.

(n) Misc Ckt Translator Fr - SD-25790-01.

(o) Transverter Connector - SD-25804-01 and SD-25607-01.

(p) Misc Ckt Transverter Fr - SD-25874-01.

(q) Misc Ckt Recorder & Recorder Connector Frame AMA - SD-25884-01.

(r) Misc Ckt for Aux Transverter Link Fr - SD-26212-01.

(s) Misc Ckt Aux Sender Frame - SD-96491-01.

(t) Misc Ckt Aux Sender Link Frame - SD-96492-01.

(u) Code Compressor Connector Ckt - SD-96526-01.

(v) Misc Ckt Recycle Frames - SD-96534-01.

(w) Miscellaneous circuits for other test frames.

(x) PBX Automatic Identified Outward Dialing Fuse Alarm and Miscellaneous Circuit - SD-1C006-01.

4.02 This circuit unit has connecting leads to all circuit units of the test frame.

DESCRIPTION OF OPERATION

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5. TIME ALARM AND BLOCKING

5.01 When one of the class keys and the ST key have been operated, the ST relay operates supplying ground to the time alarm circuit which consists of the TA interrupter and relays W, Z, W1, PS, PS1, and BK. This ground, supplied to the time alarm circuit, operates the W relay when the TA interrupter closes. When the TA interrupter opens the Z relay operates. When the TA interrupter closes again, the W relay is shunted down. With the W relay released and the Z relay operated, the W1 relay operates. The next opening of the TA interrupter permits the Z relay to release. When the interrupter closes for the third time, the W relay operates. When the interrupter opens, the Z relay operates, operating the BK relay. The BK relay operated, grounds lead LA to the floor alarm frame fuse and time alarm circuit to operate the minor alarm, etc, lights the TA lamp on this test frame and other test frames, and removes ground from the G lead to the control circuits which prevents further advance of those circuits. While the time alarm circuit is functioning, tests of the sender are being made and if the tests are completed satisfactorily before the BK relay operates, the ground supply to the time alarm circuit is opened by the operation of the CA1 relay. This restores the time alarm circuit to normal and prevents the operation of the time alarm bell and the display of the time alarm lamp signals. The time alarm period is ordinarily 60 to 90 seconds. This interval is extended by 29 seconds on "permanent signal," "time-out," and "sender lamp" tests, by the operation of the PS relay from one of the control circuits. The operation of the PS relay modified the time alarm circuit so that the operating path of the BK relay is transferred to the front contact of the PS1 relay. The timing circuit operates as described above until the operation of the W1 relay. The next operation of the Z relay, with the W relay operated, operates the PS1 relay. The subsequent release of the W relay, under control of the TA interrupter, operates relay BK.

6. SELECTION OF THE FIRST CROSSBAR SWITCH

6.01 The operation of the ST key also operates the G- relay of Fig. 1A if this figure is used. This relay locks under control of the RN key, lights a lamp corresponding to the crossbar switch to be selected, and connects certain leads to the first crossbar switch so that its magnets may be operated. If the GO relay is not required, most of the leads are direct.

7. OPERATION OF SELECT MAGNET

7.01 The operation of the ST relay as described above also connects a ground through the back contacts of the AV, CA1, and CA relays to the WH and ZH relays, causing the operation of the WH relay. The operation of the WH relay connects ground through the back contacts of relays AH and ZH to lead EHO. This lead is extended by the operated G1 relay to the first Fig. 2. Since all hold magnets of this figure are normal, this ground is extended to the armature of the No. 9 relay and through its back contact to lead AVS to Fig. 1. This causes the operation of relay AS which locks under control of the WH relay, operates the AS1 relay, operates the CO relays of all Figs. 2, and connects ground to the WS and ZS relays. This causes the operation of the WS relay. The WS relay operated, connects ground to the ESO lead which is extended to the first Fig. 2 and through the normally closed contacts of the odd-numbered relays of the first Fig. 2 to the select magnet SO. This magnet operates and extends its ground through its front contact to lead ESL operating relay AH. Relay AH operated, locks under control of the WH relay, removes the operating and locking circuits of the AS relay, and supplies a ground to the ESL lead for locking the operated select magnet. The release of the AS relay permits the ZS relay to operate and opens the circuit to the AS1 relay. The ZS relay operated, opens the circuit to the ESO lead which operated the select magnet, and connects ground to the ESL lead for locking the select magnet.

8. OPERATING OF HOLD MAGNET

8.01 The AS1 relay releases as described in the previous paragraph removing ground from the CO lead which permits all CO relays to restore to normal. This causes the operation of a O-9 relay in Fig. 2 associated with the operated select magnet. The O-9 relay also closes the operating path of a particular MS- relay for AMA tests. The AS1 relay released also grounds the OHM lead which operates magnets HO and HOA. The operation of these two hold magnets closes two crosspoints on the crossbar switch. The crosspoints correspond to the two hold magnets and the operated select magnet. The operated hold magnets also operate the U- relay. These two crosspoints close eight leads from the sender to be tested to the test circuit. The operation of magnets HO and HOA extends ground to lead EHL which operates relay AV. Relay AV operated:

(a) Locks through a back contact of the CA relay to ground from the operated U- relay.

(b) Connects ground to the C lead of the sender group test circuit.

(c) Connects ground to the EHL lead to lock the operated even hold magnet.

(d) Opens the circuit to the WH and ZH relays permitting the ZH relay to operate.

8.02 The ZH relay operated, connects ground to the EHL lead to lock the operated hold magnet, opens the operating circuit of the AV relay, and opens the operating circuit of the hold magnet.

9. SEIZURE OF SENDER GROUP TEST CIRCUIT

9.01 The operation of relay AV, grounds the C lead to the sender group test circuit which then starts its portion of the test. When the sender group test circuit -0131 is ready for testing, it connects battery to the EV lead, operating either the EV or OD relay, depending upon the position of the WH and ZH relays. If an even-numbered hold magnet is operated, the WH and ZH relays will be operated, causing the operation of relay EV. If an odd-numbered hold magnet is operated, the ZH and WH relays will be normal causing the operation of relay OD. Either the EV or OD relay operated, connects the eight leads from the sender to be tested into the control circuits to be used for this particular test, and also removes ground from the BT lead to start the busy test circuit of the sender group test circuit. If the sender group test circuit has found that the sender to be tested is busy, it connects ground to the PB lead, operating the PB relay. The PB relay operated, locks and closes the circuit for causing the test frame to pass busy senders. Later in its portion of the test, the sender group test circuit grounds lead OL, operating relay OL to close the dialing tip and ring. At the completion of its test, the sender group test circuit operates relay C. Relay C operated:

(a) Locks to a make-contact of the ST relay.

(b) Opens the C lead to the sender group test circuit, causing that circuit to return to normal.

(c) Transfers the sleeve lead to the S relay (which remains normal because of the ground supplied by the sender).

(d) Supplies ground to the control circuits to indicate that the sleeve is grounded by the sender.

(e) Connects ground through the operated class key to the C lead of the control circuit to be used in this test, causing that control circuit to prepare itself for testing.

9.02 When equipped for AMA the MS- relay connects the line register keys Fig. 19 of Section -0135 to the sender when the GE relay of Section -0131 operates. The B- relay connects two leads to the TV connector and the SDT- lead controls functions of the transverter and connector. The A lead cancels AMA tests with KP senders, and the C lead signals the end of sender group tests.

10. COMPLETION OF TEST AND ADVANCE TO NEXT SENDER

10.01 At the end of a test the sender removes ground from the sleeve lead, and the test circuit S relay operates in series with the sender ON2 relay after the sender AV4 relay operates. The S relay operated opens the ground supply to the control circuit to indicate that the sender has opened the sleeve. When the control circuits have completed the test of a sender, ground is connected to the ADV lead, operating the CT register. The CT register operated, connects ground to the CA relay. The CA relay operated, operates relay CA1 which removes the locking ground for the relays of this circuit. The CA relay operated also releases relay AV. When the C relay releases, it opens the sleeve lead permitting the sender to restore, and opens the ground supply to the C lead of the control circuit used for this test, which causes that circuit to restore to normal. It also opens the control lead to the marker test relays. The restoration of the control circuit opens lead ADV which releases the CT register and the CA and CA1 relays. The CA relay released, connects ground to the WH and ZH relays, causing the release of the WH relay. The WH relay released, connects ground to lead OHO which is connected through the back contacts of the even-numbered hold magnets and front contact of the operated HO hold magnet, causing the operation of hold magnets H1 and H1A. The operation of these hold magnets causes the crosspoints corresponding to the operated select magnet to close, connecting the eight leads of the second sender to be tested into this test circuit. In addition, the operation of these hold magnets connect ground to lead OHL which operates relay AV through a front contact of relay ZH, and operates the U- relay. Relay AV performs the functions described in 8.; however, relay AV causes the release of relay ZH instead of the operation of relay ZH. The release of relay ZH connects ground to the OHL lead to lock the operated hold magnet and removes ground from the EHL lead to release the previously operated hold magnet. The test of the second sender proceeds in the same manner as the test of the first sender. The ADV lead is grounded as its completion again causing the operation of the CA and CA1 relays. These relays operated, cause the release of all relays of this circuit including the C relay and AV relays, and restore the control circuit to normal which permits the release of the CA and CA1 relays. With all relays normal, the circuit to the WH and ZH relays is again closed, causing the operation of the WH relay which supplies ground to the EHO lead as described above. Ground on the EHO lead operates the H2 and H2A hold magnets through the operated contacts of the H1 hold magnet. The advance from one hold magnet to the next is accomplished in the manner described above until all the senders connected to the first horizontal row of the crossbar switch have been tested.

11. ADVANCE TO NEXT SUBGROUP OF SENDERS

11.01 When the last sender connected to the first horizontal row of the crossbar switch has been tested, lead ADV is grounded in the usual manner and eventually causes the operation of the WH relay. The operation of the WH relay with the H9 hold magnet operated, operates the RLN relay, lighting the GO lamp. The RLN relay operated, locks under control of the back contact of the ZH relay and opens the OHL lead which permits the release of the H9 hold magnet. With the H9 hold magnet released, the ground supply from the front contact of the WH relay over the EHO lead is extended through the back contacts of all the odd-numbered hold magnets, through the back contact of the No. 9 relay, to the AVS lead which operates the AS relay. The AS relay operated, operates the AS1 relay and all CO relays, locks under control of the WH relay and connects ground to the WS and ZS relays which are operated at this time. This causes the release of the WS relay which grounds lead OSO, operating select magnet S1 through the front

contact of relay O. Relay O has remained locked up through the locking contact of select magnet SO over lead ESL to a front contact of relay ZS. With select magnet S1 operated, ground is connected to lead OSL operating relay AH through a front contact of the ZS relay. Relay AH operated performs the functions described above, releasing relays AS and AS1. Relay AS released, permits the release of relay ZS. Relay ZS released, connects ground to the OSL lead to lock the operated select magnet and removes ground from the ESL lead to release the previously operated select magnet and corresponding relay. The release of the ASI relay releases the CO relay as previously described and grounds the OHM lead which operates hold magnets HO and HOA. The CO relay is held operated by the slow-release AS1 relay until the previously operated O-9 relay of Fig. 2 has released. These hold magnets operated, cause the crosspoints corresponding to the select magnets S1 to close. The select magnets are operated in numerical order until select magnet S9 is operated.

12. ADVANCE TO NEXT CROSSBAR SWITCH OR END OF CYCLE

12.01 At the completion of the test of sender No. 99, the ADV lead is grounded as usual and the WH relay operates. This connects ground to lead EHO which operates relay RLN and releases hold magnet 9 in the usual manner. With hold magnet 9 released, ground is connected through the front contact of relay 9 to lead AV. This ground operates the G- relay corresponding to the next crossbar switch, or if there is no subsequent crossbar switch, operates the EC relay. The operation of the next G- relay causes the release of the operated G- relay and connects the controlling leads to the next crossbar switch. The circuit operation for the subsequent crossbar switches is the same as the first switch. If the EC relay operates it lights the EC lamp, opens the locking circuit of relay ST, and prevents relays of the group test circuit from operating. Releasing the ST and momentarily operating the RN key will restore the test circuit.

13. CLASS OF SENDER INDICATION

13.01 The numerical relays associated with the select magnets have four contacts connected to terminal punchings. These terminal punchings are cross-connected to the EP or CN relays or any other class of sender relays which may be provided in the future to indicate which class of sender is being tested. The circuit is arranged so that four different classifications may be provided in the future. Relays connected to battery may be connected to the C or E punchings and relays connected to ground may be connected to the D or F punchings. Ground and battery punchings are provided in Fig. 1 to substitute for class of sender indication relays which are not required for particular jobs. The class of sender indication relays which are at present provided are the CN relay and the KP relay. The operation of the CN relay connects ground to the CN lead to the control circuits to cause those circuits to make tests on coin senders. The operation of the KP relay:

(a) Transfers control lead ground from subscriber control circuits to keypulsing control circuits.

(b) Closes FT and FR leads to the sender group test circuit for testing the class of trunk relays in the sender.

(c) Closes the KP lead to the sender group test circuit to cause that circuit to make the test required for keypulsing senders.

(d) Opens the winding of the OL relay to prevent the operation of this relay from interfering with keypulsing sender tests.

14. CONNECTION TO SUBGROUP OF SENDERS

14.01 The operation of the numerical relays corresponding to the select magnets, operates a corresponding multicontact relay and a U-type relay which close leads common to the same ten senders. These ten senders must be wired to the same horizontal row on the crossbar switch.

15. LOCATING LAMPS

15.01 The operation of one of the G- relays operates a corresponding lamp, which indicates the crossbar switch and therefore the group of 100 senders being used for test purposes. When only one group is used, the GO lamp is lighted at the end of the group test. The operation of one of the O-9 relays connects ground to one of the ten lamps to indicate on which horizontal row the sender under test is located. The operation of the hold magnet operates a

corresponding relay in Fig. 1 designated U0 and U9 which lights one of the unit lamps indicating in which vertical row the sender under test is located. With AMA the lamp leads provide identifying signals to the maintenance recorder.

16. SELECTION OF ONE OF TEN COMMON LEADS

16.01 As described above, the operation of a multicontact relay connects certain common leads to the test circuit. Some of these leads are in groups of ten, one lead for each of the ten senders in a subgroup. The operation of relays U0 and U9 connects SDT, SEL, SPF, and SPF1 leads to the proper leads of the groups of ten leads.

17. REPEAT TESTS

17.01 In order to make repeat tests on a particular sender, the REP key is operated. With this key operated, the ground on the ADV lead at the end of a test operates the RST repeat single test register instead of the CT circuits tested meter. The RST register operates and grounds the RP interrupter. Closure of contact B operates relay T1, which locks under control of the RST register; and grounds lead MGB to cause the group of senders to be made busy. One second later after any link attempting to pick a sender in the group has done so, the F contact closes, operating relay T2. Relay T2 operates the CA1 relay directly and does not operate the CA relay. The operation of the CA1 relay releases the C relay and restores the control circuits to normal. This removes ground from the ADV lead and causes the release of the RST register and the T1, T2, and CA1 relays. With the CA1 relay released, a new test is started upon the same sender. Relay T2 is slow-release to permit the C relay and other relays on the back contact to release before the CA1 is allowed to release. With the C relay released the sleeve is opened which permits the sender to restore to normal.

18. REPEAT 2 TEST

18.01 In order to test the same sender twice before advancing to the next sender, the REP2 key is operated. When the ADV lead is grounded at the conclusion of a test, the RP relay is operated, grounding the RP interrupter which operates the T1 and T2 relays. The T1 and T2 relays operate the CA1 relay and perform their usual functions. The operated CA1 relay restores the test circuit by removing ground from the ADV lead and operates the RP1 relay in series with the RP relay. This releases the CA1 relay and causes a new test to be started on the same sender. The RP relay furnished ground to lead LS to lock the S relay and block the test if the sender does not restore promptly. At the conclusion of the second test, the ADV lead is grounded again, locking the RP1 relay and operating the CT register. The CT register operated, causes the operation of the CA which operates the CA1 relay. With option VJ, the operation of relay CA will release the AV relay. With option VK, the operation of relay CA1 will release the AV relay. Relay AV released, opens the locking circuit of the RP and RP1 relays, causing the release of the RP relay but not the RP1. When the ground is removed from the ADV lead, the RP1 relay and the CT register release, causing the release of the CA and CA1 relays and the advance to a new sender.

18.02 If a sender is found busy, with the APB and REP-2 keys operated, the test circuit will advance to the next sender as described in 19. On the second test, however, if the sender is still busy, the test circuit will not automatically advance to the next sender. There is no advance to the next sender because the lead for operating the PB register is through a back contact on the RP relay which will be operated. The test circuit will therefore time out and block.

19. AUTOMATIC PASS-BUSY FEATURE

19.01 If the sender selected for test is busy and the APB key is operated, the test circuit will wait 29 to 59 seconds for the sender to become idle and will then advance to a new sender. This action is controlled by the time alarm circuit which operates relay W1 after an interval of 29 to 59 seconds. The operation of relay W1 connects ground to operate the PB relay. The PB relay locks to the CA1 relay, closes a holding path to the AV relay, and with the APB key operated, the PB register is operated only while the busy test is being made. The PB register operated, connects ground to the CA relay which advances the test circuit to the next sender in the usual manner. If the APB key is normal and the sender is found busy, the time alarm circuit will eventually operate the BK relay which will light the TA lamp and sound the time alarm bell. The PB relay may be operated by a circuit from the sender group test circuit if that circuit encounters a sender group which is busy for 5 to 12 seconds.

20. OPERATION OF REGISTERS

20.01 A register is provided to count the number of tests successfully completed. This register is designated CT and operates at the conclusion of each successful test if the repeat key is normal. If the repeat key is operated for a number of tests, the RST register operates at the conclusion of each successful test. When the repeat key is restored during the last test on that sender, the CT register operates at the conclusion of the test. The CT register therefore counts the number of circuits tested successfully, and the RST counts the number of successful tests made which are not counted on the CT register. The PB register counts the number of senders passed by automatically. It can not be operated with the REP key operated or with the REP2 key operated when making the second test.

21. CONTROL ADVANCE FEATURE

21.01 When it is desired to advance the test circuit from a busy sender, the CA key is operated. With the C relay of this circuit and the S1D relay of the sender group test circuit both normal, the operated CA key operates relays CA and CA1 which perform their usual functions. These relays will be held operated and the next sender will not be selected until the CA key is released. If the REP key is operated and the sender is found busy, the CA key operated, operates the CA1 in place of the CA. This causes the test circuit to release but not to advance to the next sender.

21.02 When it is desired to advance the test circuit for any reason other than sender busy condition, the CA key is operated, which operates the CA2 and CA3 relays. The CA2 and CA3 relays operated:

(a) Lock under control of the CA1 relay.

(b) Open lead R to simulate a release in the subscriber sender.

(c) Open lead DC.

(d) Ground lead LR to simulate release in the KP sender.

(e) Connect battery and ground to the FT and FR leads to simulate a selector to tell-tale.

21.03 In most cases the sender will restore to normal at this point or when the release of CA2 or interrupter SD of Sheet -0115 opens the fundamental. The CA2 relay also opens the circuit to the RP interrupter and grounds the CA interrupter. This causes the T1 and T2 relays to operate, as described above, in not less than 2 seconds. This interval allows the sender sufficient time to respond to the signals described above. The T2 relay operates either the CA or CA1 depending upon whether the REP key is normal or operated. These relays perform their usual functions except that they remain operated while the CA key is operated and the relays locked to the back contact of the CA1 remain locked to the CA2. In addition, the operation of T1, with REP key operated, causes the sender group to be made busy. If a repeat 2 test is being made, the CA2 unlocks the RP and RP1 relays so that both tests will be made on the next sender to be tested.

22. REMOTE CONTROL FEATURE

22.01 Jacks are provided at the sender frames and auxiliary sender link frames to enable the test employee to control this test frame from a remote point. Insertion of a make-busy plug into a remote control jack causes the same operation as the operation of the CA key. The remote control jacks at the sender frames are ineffective, however, unless the repeat key is operated. Instead of using a make-busy plug, a 32A test set may also be inserted into the remote control jacks and the operation of the red key of this test set will short-circuit the ring and sleeve to perform the same function as a make-busy plug. In addition, a 32A test circuit is provided with a white key which short-circuits the sleeve and tip. This causes a ground to be connected to the RC lead or the code keys and dial pulse circuit which will cause the circuit to control the step-by-step dialing, keypulsing, and selection features.

23. PARTICULAR CIRCUIT FEATURES

23.01 The test may be started on any sender by using the particular circuit feature of this test frame. The crossbar switch to be used is first selected by the operation of its corresponding G- key which operates and locks the corresponding G- relay. A particular crosspoint on this

crossbar switch may be selected by means of the PCS and PCR keys. The PCR key causes the crossbar switch to advance automatically as long as the PCR key is held operated. When a point near the desired crosspoint is reached and indicated by the tens and units lamps, the PCR key is restored. The operation and release of the PCS key will cause the crossbar switch to advance one step at a time. The circuit operation to perform these functions is described below. If the test circuit is not connected to any sender, the operation of the PCR key will operate the PC relay which locks through a back contact on the ST relay. The PC relay also connects ground through the back contacts of the AV and CA relays to the WH and ZH relays, causing the first sender to be selected and the AV relay operated in the usual manner. With the AV relay operated, ground is connected to the CA relay which operates and causes the release of the AV relay. The AV relay released, releases the CA and CA1 relays which causes the crossbar switch to advance to the next sender. When the OHO lead is grounded to operate the first hold magnet, the PCR relay also operates and short-circuits the contacts of the PCR key, so that release of the key will not interfere with subsequent operations. When next the WH relay operates, the RLN relay operates, releasing the odd hold magnet and the PCR relay and causing the advance to the next level in the usual manner. The PCR relay is slow-release so that it will not close the EHO lead until the hold magnet has released. The operation continues as long as the PCR key is held operated. When a crosspoint near the desired crosspoint is reached, the PCR key is restored. The position of the crossbar switch will be indicated by the tens and units lamps. The operation of the PCS key at this time operates relay SPT through a contact of the AV relay. The SPT relay operated, locks under control of the PCS key and operates relay CA and CA1. When the PCS key is restored, the SPT, CA, and CA1 relays release and cause the test circuit to advance to the next sender. This operation is repeated until the desired sender has been selected. If the PCS key is operated while no sender is connected to the test circuit, the AV relay will be normal and it will, therefore, provide no path for the operation of the SPT relay. In this case, however, a path is provided through a back contact of the PC relay to operate the SPT, CA, and CA1 relays. With the CA1 relay operated, ground from the PCS key operates the PC relay which locks through a back contact of the ST relay and connects a ground to the back contact of the CA relay which is operated at this time. The release of the PCS key releases the SPT, CA, and CA1 relays which causes the first sender to be selected. Subsequent operation of the PCS key will advance the crossbar switch one step at a time. When the ST key and ST relay are subsequently operated to start testing, the AV relay is already operated, which prevents stepping to the next sender until the sender to which the test circuit is connected has been tested.

24. TIME ALARM KEY

24.01 If at any time the time alarm bell operates, it may be silenced and the time alarm circuit restored to normal by the operation of the TA key. The TA key operated, removes ground from a time alarm interrupter and its associated relays, restoring these relays to normal, and opens the circuit to the CA relay so that the test circuit cannot be advanced to another sender while the TA key is operated. The operation of the TA key will not, however, interfere with repeat tests.

25. SPARE TERMINALS

25.01 When a crosspoint not connected to a sender is operated, the SPT relay operates in series with the S relay of the sender group test circuit, -0131. This causes relays CA and CA1 to operate and release the AV and either the EV or OD, opening the circuit to the SPT relay. The SPT, CA, and CA1 relays release, and the next crosspoint is operated in the usual manner.

26. DIAL TONE TEST

26.01 For this test the dial tone test class key is depressed. When the C relay operates, a circuit is provided to hold the DT and OL relays, which maintain a closure on the tip and ring to operate the sender L relay and connect the tip and ring to the receiver.

26.02 The attendant listens to dial tone in the receiver and if it is satisfactory, operates and releases the CA key which causes the circuit to pass to the next sender. By the operation and release of the CA key, the audible dial tone test may be made on all senders in succession.

27. PASSING GROUP OF SENDERS - S OPTION

27.01 Relay PSD operates whenever an 0-9 relay and a PG- key, corresponding to a particular group of senders, are operated. This causes the SPT relay to operate through a make-contact of OD or EV to the same circuit which operates the SPT relay for passing spare terminals. The operation of relay SPT causes the test circuit to advance from terminal to terminal until all senders of that type have been passed.

28. END OF GROUP - T OPTION

28.01 With an EG- key operated, the circuit for operating the select magnet of the first level of a type of senders is opened. The EG lamp is lit when the test circuit arrives at this level on the crossbar switch. After the test circuit has been prepared for testing this type of sender, the EG key is released and the test proceeds.

29. TIP AND RING POLARITY TEST AT DIALING COMPLETION - PBX CALL DIVERSION FEATURE

29.01 Figure Q provides a test of the subscriber senders ability to reverse the dialing tip and ring potentials at dialing completion which is a function of senders arranged for the diversion of restricted PBX traffic on extra charge calls. The test is made for full selector and PCI class calls only. The TDV jack shall not be plugged if the class 17 key is operated and option RA is provided; it may be plugged with the class 17 key operated when RB option is provided.

PROGRESS OF A TEST CALL WHEN THE CODE KEYED REQUIRES A REVERSAL OF THE TIP AND RING POTENTIALS AT DIALING COMPLETION FOR PCI AND FULL SELECTOR CLASS CALLS

29.02 The operation of the ST key, when the TDV jack is plugged, operates relay TDB, which locks, through normal contacts 3 and 4T of the CA3 relay, to the ST key ground. The TDB relay operated, applies resistance battery and ground to the secondary winding of polar relay TDV. Relay TDV is electrically biased to its back contact. Relay TDB operated, also closes the primary winding of relay TDC to contact 1B of the AV relay, Fig. R, sheet -0115 or 1T of the AV relay, Fig. S, sheet -0115, and closes the secondary winding of the TDC relay to the DP switch, arc 4, position 20, sheet -0111; therefore, the TDC relay has two separate operate paths. One closed by the operation of the AV relay of Fig. R or S, which occurs for PCI class calls at dialing completion, and the other closed by the DP switch, arc 4, Fig. 7 which advances to position 20 at dialing completion during a full selector class of call.

29.03 The TDR punching will be grounded for all senders under test which are equipped with the features for the diversion of restricted PBX calls on an extra charge basis. With a 322A plug inserted into the TDV jack, a ground at the TDR punching is closed to operate the TDR relay. The TDR relay operated will open the operate paths of the TR relays of Fig. 9, sheet -0115 and Fig. 7, sheet -0111 and transfer control of these paths to make-contacts of the TDK relay.

29.04 The circuit of Fig. Q remains in the condition described above until dialing is completed for either PCI or full selector class calls. The progress of dialing in a PCI call is described in Section -0115, and the progress of dialing in a full selector call is described in Section -0111. Dialing completion in either case causes the TDC relay to operate. The TDC relay operated, lights the RLS lamp and removes a short across the primary winding of the polarized relay TDV and places this winding in series with the dialing ring lead. The polarity of this winding is such that the direction of current flow determined by the dialing tip and ring potentials causes no change in the condition of the polar relay if the normal tip and ring potentials exist; however, if these potentials are reversed, the polar relay operates to its front contact overcoming the electrical bias of its secondary winding. The TDV relay operated to its front contact, closes a ground from operated make-contacts on the TDB relay to operate the TDK relay. The TDK relay operated, locks, lights the TDR lamp indicating detection of a reversal of the tip and ring potentials, and closes the operate path of the TR relays of Fig. 9, sheet -0115 and Fig. 7, sheet -0111, which were opened by the operated TDR relay. If the reversal did not occur, the TDK could not operate and the TR relays operate paths would remain opened. The test circuit would block with the RLS lamp lit but not the TDR lamp. Assuming that the reversal did occur, the test circuit advances in the normal manner releasing the sender. The primary winding of the TDV relay is shorted out of the ring lead by the release of the TDC relay as the test circuit restores. The TDV is again biased to its

back contact and relay TDK releases. The TDB relay and TDR relay remain operated for repeat tests or tests on the next selected sender.

30. DIRECT DISTANCE DIALING

30.01 The class 17 key (previously a spare) is now used to permit the test of subscriber senders associated with auxiliary senders for direct distance dialing (DDD). Since DDD requires the use of a 3-digit area code prefixing the directory number, new circuits are needed to aid in dial pulsing and checking the added digits. These new circuits are:

(a) Auxiliary Sender Area Code Circuit, Section -0137.

(b) Auxiliary Sender Dial Pulse and Code Check Control Circuit, Section -0139.

(c) Auxiliary Sender MF Pulse Check Control Circuit, Section -0141.

30.02 When the C relay (9.01) operates, with the class 17 and R1 keys pressed, the SAS relay, Section -0137, operates. The operation of relay SAS, operates the C relays of -0139 and -0141. These relays move their respective selector switches (SAS and MFK) off-normal, and prepare the circuits for the control of dial pulses and the check of MF pulsing. A detailed description is given in Sections -0137, -0139, and -0141.

Note: The functions of the auxiliary sender and the code compressor circuits are incorporated within the SD-27810-01 sender. When routing this sender any reference to the auxiliary sender or code compressor circuit should be taken to mean that the function is taking place in the sender.

31. SIX-DIGIT TRANSLATION (SENDER RECYCLE) TEST CALL

31.01 Subscriber senders may be tested for recycle calls by dialing in ten digits in the same manner as DDD test calls are made. Information is received in the test circuit as on a 7-digit revertive, PCI or MF call depending on the routing used.

31.02 One additional control jack is provided (RCY jack) in the DDD jack strip. A plug in this jack indicates that a recycle test call will be effected. All other normal key settings are required including any class key (1 through 18) indicating the type of call to be used for treatment of a particular code. The PP key is operated to eliminate the use of the preliminary pulse.

31.03 When the ST key is operated (as described in 5., 6., and 7.) relay ST is operated, and in turn, grounds lead RC to the AS area code circuit. This ground passes through the plugged RCY jack make-contact and returns over lead RCY to operate relay RC. Relay RC operated:

(a) Removes the control ground from class keys 1 to 16 and 18 so that the associated control circuits cannot be seized at this time even if one of these class keys is operated.

(b) Does not affect the control ground of the class 17 key since the auxiliary sender dial pulse and code check control circuit is to be seized in any case, to dial the first three digits.

(c) Closes ground over lead RCY to the AS dial pulse and code check control circuit to operate relay RCY.

(d) Closes a path to the code test circuit, -0133, to prepare that section to advance after the office code is checked in the marker.

(A detailed description of the functions performed by relay RCY is given in Section -0139.)

Note: The functions of the auxiliary sender and the code compressor circuits are incorporated within the SD-27810-01 sender. When routing this sender any reference to the auxiliary sender or code compressor circuit should be taken to mean that the function is taking place in the sender.

32. BYPASSING THE SD-27810-01 SENDER

32.01 The PNS key is operated for all tests not required for the SD-27810-01 sender. When the test frame connects ground to the SDT lead this ground is also extended to the sender identifying unit through a 2000- resistor to operate the NS relay. With the PNS key operated a path is closed to operate the PSD relay. The circuit will advance as described in 27.

33. TESTING OF DOUBLE PREFIX 0-1, 1-0 FEATURE PER SENDER SD-27810-01. OPERATE CLASS KEY 9.

33.01 When the PDG0 and A1 keys (prefix 0-1) or PDG1 and A0 keys (prefix 1-0) Section -0105 are operated, and with the NSA relay operated and the PNS key normal (new sender attached), a path is provided to operate the PD relay. The circuit will function as described in Section -0133, 22.

BYPASSING THE SENDER PER SD-25012-01
WHEN TESTING DOUBLE PREFIX 0-1, 1-0
FEATURE OF SENDER PER SD-27810-01.
OPERATE CLASS KEY 9

33.02 When the test frame connects ground to the STD lead this ground is also extended to the POS relay through a front contact of relay OCL (Section -0133). The POS relay is a slow-operate to allow time for the operation of the NS, NSA relays to allow the test frame to distinguish new and old senders. With the PNS key and NSA relay normal, (old sender attached) an operate path is closed to operate relay PSD. The circuit will function and advance as described in 27.

CIRCUIT UNIT SECTION -0105
CODE KEYS AND DIAL PULSING CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to perform the functions of dialing into the subscriber sender, of controlling the tip and ring while testing a subscriber sender, and of controlling the code and number used for pulsing into the keypulsing A sender. This circuit is also used to dial and check dial-pulsed digits, and to check MF-pulsed digits, on direct distance dialed (DDD) test calls.

1.02 The code and number to be used in pulsing into the sender are set up on the keys designated A, B, C, TH, H, T, U, and STA; also 1-1 when senders are arranged to record 1-1 before the regular office code. A PDG0-PDG1 key is provided when the senders are arranged to register a prefix digit 0 or 1.

1.03 The progress of the dialing is controlled by the individual control circuits over leads A, B, C, etc.

1.04 Keys are furnished to permit simulating maximum and minimum line, pulse speed, and percentage break conditions.

1.05 A key is furnished to provide controls for starting intersender timing for each group of 100 subscriber senders to be tested.

1.06 A key is provided to apply severe loop conditions needed in testing subscriber sender polar L relays.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 Dial Progress Control - The code and number are dialed by connecting ground successively to leads A, B, C, etc, from the individual control circuits.

3.02 Variation in Dial Pulses and Line Conditions - By means of keys shown on Sheet -0106, the line conditions, the pulsing speed, and percentage break of the dial pulses are controlled.

3.03 Step-by-Step Dial Control - By means of the keys DDS and AV the dialing can be controlled so that the AV key must be operated once for each digit that is dialed. This enables the attendant to follow closely the progress of the subscriber sender.

3.04 Step-by-Step Keypulsing - By means of keys DSS and AV, the keypulsing can be controlled so that the AV key must be operated once for each pulse. This enables the test frame attendant to follow closely the progress of the keypulsing sender.

3.05 Test Tone - A distinctive tone is placed continuously during the test on the T and R leads for the purpose of identification by the sender monitor. This tone is omitted in offices arranged for timed release or automatic priming of stuck senders.

KEYS

3.06 Code and Number Keys A, B, C, etc - These are interlocking pushbutton-type keys and are used to control the code and number to be dialed into the subscriber sender or pulsed into the keypulsing sender. They also control the code check or PCI register check, incoming and final selections, and the test for ground on FT and FR before PCI pulsing.

(a) The NST key, when operated, connects lead EP to lead EP1 to indicate to Section -0139 that no stations digit will be dialed.

3.07 The PP key is furnished in order to omit the dialing of the preliminary pulse when this pulse is not desired for subscriber senders.

(a) The PP key when furnished must be operated for testing DDD calls.

3.08 The DSS and AV keys are furnished in connection with the step-by-step control of the dialing and keypulsing.

3.09 Seven lever-type keys are provided to control the speed, percent break, and line conditions for testing the dial pulse and register circuit as follows:

(a) The 1-1 key, when furnished, causes the digits 1-1 to be dialed into the sender before the office code.

(b) The DISC TONE key is furnished when both sender monitor and timed release senders are tested by one testing circuit.

(c) The BA key (Mfr Disc.) is furnished in connection with 3/2 digit subscriber or keypulsing sender in order to permit the sending of the B code digit.

(d) The IST0 and IST1 keys, when furnished, provide controls for starting intersender timing features in subscriber senders.

(e) The ZLL key, when furnished, provides special line conditions to detect poorly adjusted polar L relays.

(f) The PDG0-PDG1 key, which furnished, causes a prefix digit 0 or 1 to be dialed into the sender before the office or area code.

LAMPS

3.10 Dial progress lamps A, B, C, etc, indicate the position of the dial progress switches or the keypulsing switch in the associated control circuits.

3.11 The CN lamp indicates failure of the coin test feature.

3.12 Lamps IST0 and IST1 indicate that intersender timing is being applied to either sender group 0 or sender group 1.

3.13 The PP lamp indicates that a preliminary dial pulse is being pulsed into the sender.

3.14 Lamp IT indicates there is a trunk closure during intersender timing tests.

4. CONNECTING SECTIONS AND CIRCUITS

4.01 The connecting sections are:

(a) Connector Circuit -0102

(b) Route Keys and Revertive Pulsing Circuit -0108

(c) Full Selector Dial Pulse Control Circuit -0111

(d) Incoming and Final Selections Control Circuit -0113

(e) PCI Dial Pulse Control Circuit -0115

(f) PCI Register Circuit -0117

(g) Overflow Control Circuit for Subscriber Senders -0119

(h) Operator Class Control Circuit for Subscriber Senders -0121

(i) Keypulsing Circuit -0123

(j) Code Test Circuit -0133

(k) AMA Check Circuit -0135

(l) Auxiliary Sender Area Code Circuit -0137

(m) Auxiliary Sender Dial Pulse and Code Check Control Circuit -0139

(n) Auxiliary Sender MF Pulse Check Control Circuit -0141

(o) TOUCH-TONE Signaling Circuit -0143

4.02 A typical connecting circuit is:

(a) Traffic Register Circuit - SD-25942-01

DESCRIPTION OF OPERATION

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5. SEIZURE BY CONTROL CIRCUITS

5.01 When the start relay of the connector operates, relay ST operates, furnishing off-normal battery and ground to the dialing interrupter relays and operating relays BD1, INT, INT1, PLS, and CTG. The tip and ring leads are closed to the sender by the control circuits. This circuit is then ready to dial the digits in accordance with the grounding of leads A, B, C, etc, which is under the control of the associated control circuits.

5.02 On DDD calls, when relay ST operates, with relay CTG operated, it provides a ground over lead PLS to Section -0139. The code keys circuit is then ready to dial the area code ACA, ACB, and ACC digits.

6. DIALING PRELIMINARY PULSE

6.01 With the PP key normal the P lead is grounded by the full selector dial pulse control circuit which operates relay PP. The operation of relay PP lights the PP lamp and closes ground through the DSS key to operate the SY relay. The SY relay operated, grounds the AV lead to energize the magnet of the control circuit progress switch, and, as described in a later paragraph, causes the interrupter to transmit pulses corresponding in number to the counting relay to which the CTG front contact is connected. With the PP relay operated this connection is made to counting relay No. 1 causing one pulse to be sent. When the pulsing has been completed, relay R opens the AV lead permitting the control circuit progress switch to advance, releasing the PP relay.

6.02 The PP key when furnished must be operated when making DDD tests. If the PP key is in its normal position when these tests are made, and the first digit is pulsed into the sender, this digit will be recognized as a false preliminary pulse, since the P3 relay is not operated at this time. As a result, the AV lead will not be grounded to advance the control circuit -0139.

7. PREFIX DIGITS OR PRELIMINARY PULSE

7.01 General - The associated subscriber senders may be arranged to register prefix digits 0, 1, or 1-1 or to absorb a preliminary pulse. The associated keypulsing senders may be arranged to register a prefix digit 1-1. When the subscriber senders are arranged for prefix digit 0 or 1, the prefix digit 1-1 and the preliminary pulse features must be omitted. The PDG0 or PDG1 key operated will register a prefix digit 0 or 1 in the subscriber sender before the office or area code. When the 1-1 key is operated and the PP key is normal, three ones will be dialed into the subscriber sender before the regular office code. When the 1-1 and PP keys are both operated, two ones will be transmitted to the subscriber sender. When the 1-1 and PP keys are both normal, only one digit 1, that is, a preliminary pulse will be dialed into the sender as outlined in the previous paragraph. With the 1-1 key normal and the PP key operated, the first dialing to take place is the first digit of the regular office code.

7.02 Preliminary Pulse with Prefix Digit 1-1 - To dial a preliminary pulse followed by the prefix 1-1, the 1-1 key is operated and the PP key is normal. When the associated control circuit grounds the A lead, the PP relay operates under control of a break-contact of the P3 relay. This causes a preliminary pulse to be dialed into the sender as outlined in the preceding paragraph. However, the connection of ground to the AV lead instead of operating the switch of the associated control circuit operates the P1 relay. When the pulse has been sent and ground is removed from the AV lead by the dial interrupter relays, the P1' relay operates in series with the P1 relay and these relays lock. The dial pulse interrupter relays will continue to advance for transmitting the next digit 1 as explained later under Operation of Dial Pulse Interrupter. The associated control circuit maintains ground on the A lead and the next digit 1 is then transmitted, as outlined above, with an interval of approximately 0.2 second between digits. At the conclusion of the second digit 1, ground is again removed from the AV lead and the P2' relay operates in series with the P2 relay and these relays lock. After another interval of approximately 0.2 second, the dial pulse interrupter relays again cause the third digit 1 to be transmitted and ground is again removed from the AV lead, allowing the P3' relay to operate in series with the P3 relay. These relays lock and the P3'

relay opens the operating circuit for the PP relay which releases, extinguishing the PP lamp. The P3' relay also operates the A relay, and the dial pulse interrupter relays proceed to transmit the pulses for the A digit according to the setting of the A digit code key as is outlined later.

7.03 Prefix Digit 1-1 - To dial two digits 1 before the regular office code, the 1-1 and PP keys are both operated. When the connector circuit grounds the TFO lead, the P1 and P1' relays operate in series without waiting for ground on the AV lead from the dial pulse interrupter relays and therefore when the associated control circuit grounds the A lead, the PP relay is operated for transmitting the first digit 1 as outlined above. Since the P1 and P1' relays are operated, however, at the conclusion of the first digit 1 the P2' relay operates instead of the P1' as outlined above. The dial pulse interrupter relays continue and the second digit 1 is transmitted, after which the P3' relay operates in series with the P3 relay. The PP relay then releases after the second digit 1 has been transmitted, and the ground that was operating the PP relay is extended through the contacts of the A digit code key to operate the proper relay for transmitting the pulses for the A digit.

7.04 Preliminary Pulse - To transmit only one digit 1 to the sender, the 1-1 and PP keys are both left in their normal positions. In this case, ground on the TFO lead from the connector circuit operates the P1 and P1' relays in series and then the P2 and P2' relays are operated. When the associated control circuit grounds the A lead, the PP relay operates under control of a break-contact of the P3' relay, and the dial pulse interrupter relays proceed to transmit a digit 1 to the sender. At the conclusion of the first digit 1 the P3' relay operates in series with the P3 relay as outlined above. The PP relay then releases and only one digit 1 is transmitted to the sender as a preliminary pulse.

7.05 Person-to-Person Prefix Digit 0 - To cause the sender to outpulse a person-to-person prefix digit 0 the PDG0 key is operated which in turn operates relay PDG0. When the connector circuit grounds lead TFO, relays P1 and P1' operate in series and then relays P2 and P2' operate. When the associated control circuit grounds lead A, relay DG0 operates under control of the break-contacts of relay P3A', and the dial pulse interrupter or the TOUCH-TONE signal generator proceeds to transmit a digit 0 into the sender. At the conclusion of the prefix digit 0, relay P3' operates in series with relay P3 as outlined above. Relay P3' operated, operates relay P3A' which in turn releases relay DG0.

7.06 Station Paid Toll Prefix Digit 1 - When the prefix digit 1 feature is furnished, the preliminary pulse and prefix digit 1-1 features must be omitted.

7.07 To cause the sender to outpulse a station-to-station prefix digit 1 the PDG1 key is operated. When the connector circuit grounds lead TFO, relays P1 and P1' operate in series and then relays P2 and P2' operate. When the associated control circuit grounds lead A, relay PP operates under control of a break-contact of relay P3' and the dial pulse interrupter circuit or the TOUCH-TONE signal generator circuit proceeds to transmit a prefix digit 1 into the sender. At the conclusion of the prefix digit 1, relay P3' operates in series with relay P3 and releases relay PP.

7.08 No Prefix Digits and No Preliminary Pulse - To cause the test circuit to register the area or office code in the sender without a prefix digit or preliminary pulse, the PDG0, PDG1, 1-1 keys are left normal and the PP key if furnished is operated.

7.09 It should be noted that when the 1-1 key and associated P relays are furnished any one of the four combinations of events can be transmitted to the sender as outlined above with any one of the associated control circuits used for subscriber senders. When the 1-1 key and the P relays are not furnished, a preliminary pulse can be transmitted only when using the full selector dial pulse control circuit, Section -0111.

7.10 The prefix digits and preliminary pulse can be transmitted on a step-by-step basis if the DSS key or PSS key is operated.

8. PULSING PREFIX 1-1 - KEYPULSING SENDERS

8.01 The keypulsing senders are not arranged to absorb a preliminary pulse and therefore even when they are arranged for the registration of the prefix 1-1, only

two "ones" can be transmitted before the office code. There are, therefore, only two combinations of events to be considered for keypulsing senders, that is, to send the prefix 1-1 before the office code or to omit this prefix and proceed immediately to transmit the regular office code.

8.02 The PP key should always be normal in testing keypulsing senders for 1-1 calls. The 1-1 key is operated if the prefix 1-1 is to be transmitted, otherwise this key should also be normal when testing keypulsing senders.

8.03 If the 1-1 key is normal, the circuit functions just as described for the keypulsing circuit -0123. If the 1-1 key is operated when the keypulsing circuit grounds the A lead, the first pulse from the keypulsing interrupter relays over the SA lead operates the P1 relay, and when the pulse ends, the P1' relay operates in series with the P1 and these relays lock. The P1' relay closes the A lead which has ground connected to it to the winding of the 1 relay in the keypulsing circuit. The next pulse from the keypulsing interrupter relays causes the digit 1 to be transmitted to the keypulsing sender and during this pulse the P2 relay is operated from ground over the SA lead. When the pulse ends, the P2' relay operates in series with the P2 relay and they lock. The keypulsing interrupter relays continue to pulse, the 1 relay remains operated, and the second digit 1 is transmitted to the keypulsing sender. During the transmission of the second digit 1 the P3 relay operates from ground on the SA lead, and when the pulse ends, the P3' relay operates in series with the P3 relay and they lock. The P3' relay releases the 1 relay in the keypulsing circuit, and the ground that was operating this relay is transferred through the contacts of the A-digit code key to operate the desired relay in the keypulsing circuit for the regular A digit. The P3' relay also connects the SA lead to the SA1 lead from the keypulsing circuit. The SA1 lead is the operating path for the KP selector in the keypulsing circuit and during the transmission of the pulse for the A digit, the SA lead is again grounded for advancing the keypulsing circuit in a normal manner.

8.04 With the 1-1 key normal, the SA and SA1 leads are connected together and the test circuit will proceed to key the regular office code without transmitting the prefix 1-1.

8.05 The prefix 1-1 digits can be transmitted on a step-by-step basis by means of the DSS and AV keys.

9. DIALING AREA CODE DIGITS ON DDD OR RECYCLE TESTS (ACA, ACB, ACC)

9.01 The code keys circuit performs its normal functions, as described in 14., when the control circuit of Section -0139 is seized. The ACA relay, of Section -0139, operates when its progress switch advances to position 1. Relay ACA operated, grounds lead SY1 to operate the SY relay (Sheet -0106), and closes the last link in the ground circuit of the counting relays through the PLS lead. The ACA digit is then pulsed to the sender. At the end of dial pulsing of the ACA digit, the AV lead ground to control, Section -0139, is removed. This advances the selector switch of Section -0139 to position 2 in preparation for dialing the ACB digit. Digits ACB and ACC are dial pulsed to the sender in a similar manner.

9.02 The ACA, ACB, and ACC lamps of Section -0139 light in succession as the selector switch is advanced. The dialing of the A, B, and C digits, etc, follows the procedure as outlined below and in Section -0139.

10. DIALING OF THE A CODE DIGIT

10.01 When the progress switch of the associated control circuit is advanced by the opening of the AV lead, the A lead is grounded which operates relay A. The operation of relay A lights the A lamp and performs the same functions in controlling the dialing interrupter as was performed by the PP relay except that the number of pulses dialed is controlled by the A code key which has been depressed.

11. DIALING OF THE OTHER DIGITS

11.01 The dialing of the other digits and the progress of the associated control circuit is accomplished in the same manner as the preliminary pulse and the A code digit. Leads B, C, etc, are grounded in succession by the control circuit. When the TH relay operates for dialing the thousands digit, the dialing does not immediately take place but waits for grounding of leads SY by the associated control circuit. This is also true in the case of the H, T, U, and STA digits. This is necessary in order for the control circuits to test for synchronizing of the functions of the sender.

12. TONE TO SENDER MONITOR OR DISCONNECT TONE

12.01 The operation of the SY and SY1 relays during the dialing of a digit short-circuits the test tone coil TT. When the SY1 relay is normal, a tone is placed on the tip and ring in order to inform the sender monitor that the sender is connected to the test set. This tone is omitted when this circuit is used in an office arranged for timed release or automatic priming of stuck senders, and the repeating coil is used in conjunction with a receiver for listening for disconnect tone. The SY1 relay is slow-release to prevent inserting the repeating coil into the line at the same time or shortly after the PBX surge test is made.

12.02 When both timed release and sender monitor senders are to be tested, the DISC. TONE key is operated to listen for disconnect tone when making a manual test of timing with timed release senders. If the timed release senders are in one or more separate subgroups, they are connected to separate test selector subgroups for testing the operation of an end-of-group key. If these senders are scattered, they may be selected by a particular circuit test.

13. THREE-DIGIT SENDERS (3/2) ARRANGED TO OMIT THE SECOND CODE DIGIT (BA KEY PROVIDED) (MFR DISC.)

13.01 The BA key normal causes the control circuit to pass by the position for dialing the second code digit. The second code digit 0 key should be operated. A zero is checked in the B position on a PCI call. With the BA key operated, a B code digit is dialed and checked as for 3-digit sender operation; with the BA key normal, the B digit is not transmitted to the keypulsing senders, and with the BA key operated, this digit is sent.

14. TWO-DIGIT SENDER (BA KEY OMITTED) (MFR DISC.)

14.01 The position for dialing or keypulsing the C code digit in the control circuits is passed by. See Note 104.

15. DIAL STEP-BY-STEP AND KEYPULSING STEP-BY-STEP

15.01 The DSS and AV keys are furnished in order to permit the transmission of each digit individually. The operation of the DSS locking key stops the dialing or keypulsing after each digit, from which point dialing or keypulsing is advanced by the momentary operation of the AV nonlocking key. The operation of the AV key operates the RC relay which operates the DA relay, and the release of the AV key and RC relay permits the operation of the DA1 relay. The DA1 relay operated, connects ground to the SY relay to cause a digit to be dialed in the usual manner, and also connects ground to the AV lead to energize the magnet of the dial control progress switch. The closure of the SY relay contact short-circuits and releases the DA relay but holds the DA1 relay operated. When the R relay contact opens at the end of the digit, the DA1 relay releases and the dial control progress switch advances. The functions of the AV key are also performed by the operation and release of the RC relay under control of the remote control jack at the sender frame. In the case of keypulsing senders, operation of the DSS key closes the SS lead to prepare the keypulsing circuit for step-by-step operation. Each operation of the AV key or closure of ground on the tip of the RC jack closes the AV lead to cause the keypulsing circuit progress switch to advance. In each position corresponding to a digit, a pulse is sent.

16. OPERATION OF DIAL PULSE INTERRUPTER

16.01 The operation of the ST relay, as described above, supplies off-normal battery and ground to the relays of the dial pulse interrupter, operating relays BD1, INT, INT1, PLS, and CTG, and energizes the biasing windings of relays BD1 and R. When the SY relay operates to cause a digit to be dialed, the tone coil is short-circuited, the AV lead is grounded to energize the control circuit progress switch, and ground is removed from the operate winding of the BD1 relay. The BD1 relay is slow-release due to the fact that the current for charging the BD capacitor flows through

the operate winding, holding the relay operated until the capacitor becomes partially charged. This slow-release feature measures the interval between digits which are sent in rapid succession for testing the sender register advance feature. The release of relay BD1 removes ground from terminal 3 of the secondary winding of the INT relay. This ground was shunting ground through a capacitor and resistor that are connected to terminal 9 of the secondary winding of the INT relay. Removing this shunt ground permits current to start flowing through the secondary winding charging the series capacitor. This current is sufficient to cause the INT relay to release even though its primary winding is energized in the operate direction; however, the relay will reoperate when the capacitor is charged. The length of time the INT relay remains released depends upon the values of resistance and capacitance in series with the secondary winding and the resistor in series with its primary winding. The magnitude of the capacitance and resistance are controlled by the speed and percent break keys.

16.02 The INT relay released, discharges the capacitor in series with the secondary winding of the INT1 relay and when the INT reoperates, the capacitor, in series with the secondary winding of the INT1 relay, starts to charge. The charging current is in the direction to cause the INT1 relay to release. This relay will reoperate, however, when the capacitor is charged. The interval during which INT1 is released controls the open period of the dial interrupter. With the INT1, PLS, and CTG relays released, the capacitor in series with the secondary winding of the INT relay is discharged. The discharge current is in the direction to hold the relay operated. When the INT1 relay reoperates, the PLS and CTG relays reoperate, the short circuit is removed from the INT secondary winding and its associated capacitor. This causes the INT relay to release while the current is charging the associated capacitor. The interval during which the INT is released controls the length of the closed period of the dial interrupter. With the INT relay released, the capacitor associated with the INT1 is discharged. Reoperation of the INT closes the circuit through the capacitor and winding of the INT1 causing it to release. The INT and INT1 relays continue to operate and release as described above as long as the front contact of the BD1 relay is open. The rate of pulsing is dependent upon the key operated. The PLS and CTG relays pulse at the same rate as the INT1, releasing with the INT1 front contact open and operating with the INT1 front contact closed. Each opening of the PLS front contact opens the dial tip and ring, transmitting a pulse to the sender. The ratio of the open-to-closed period of these pulses is controlled by the ratio of the released period of the INT1 to the released period of INT.

16.03 The front contact of the CTG relay is connected through a front contact of the A, B, or C, etc, relay (whichever one is operated) and through the operated contact of a key in the corresponding row to the armature of the prime relay corresponding to the key depressed in that row. If the PP relay is operated, this connection is made directly to relay 1'. When the A, B, or C, etc, operates, the counter corresponding to the key depressed will be operated. The release of CTG on the first pulse permits the prime relay to operate. The reoperation of the CTG relay operates the next lower numbered counter. When the CTG releases for the last pulse (which may also be the first pulse if 1 pulse is to be dialed for that digit), the 1' and BD relays operate. With the BD operated, ground is supplied to the operate winding of the BD1 relay, which operates without delay, connecting ground to terminal 3 of the secondary winding of the INT which prevents the capacitor associated with this winding from starting to charge when the INT1 again operates. When the INT1, PLS, and CTG relays operate at the end of the pulse, they stay operated until the BD1 relay again releases.

16.04 The operation of the CTG relay at the end of the last pulse operates relays R2 and BD2. The BD2 relay opens the operating circuit of the BD1 relay, causing it to release. The BD2 relay also operates relay S. The operation of the S relay is delayed for approximately 0.050 second until the S capacitor has charged. When PBX surge test is being made, the S relay connects an inductor into the line to produce a surge equivalent to that produced at PBX switchboards. This tests the ability of the sender L relay to hold operated. The R2 relay connects the discharge capacitor R to the secondary winding of relay to operate while the capacitor is charging. The R relay is operated for approximately 0.1 second. The operation of relay R opens the AV lead, permitting the control circuit progress switch to advance, holds the R2 and BD2 relays, and operates the R1 relay. The R1 relay operated, releases the counting relays. While the R relay is operated, the control circuit progress switch advances and releases the A, B, C, etc, relay that

is operated. If the next progress relay does not immediately operate, or if it operates and the SY lead to its armature is held open in the control circuit, the SY relay releases before the R relay has closed its back contact. With the SY relay released, the release of the R and R1 grounds the operate winding of the BD1 relay, preventing its release. The next digit is not dialed until the progress relay and the SY relay have operated.

16.05 In case the next digit is not to be delayed, the next progress relay operates while the previous relay is releasing and the SY relay is either maintained in the operated position or reoperates quickly after its release. In any event the SY is operated at the time the R1 releases, thereby preventing ground through these contacts from being connected to the BD1 relay. The BD1, therefore, starts releasing when the BD2 operates at the end of the last pulse of a digit. The interval thus provided imposes a time test upon the register advance relays of the sender. To be most effective this test should be made with the maximum speed, minimum percent break key operated. This key provides the most suitable line conditions for this test. When the BD1 front contact opens again, the next digit is dialed as explained above.

17. ADJUSTING INTERRUPTER RELAYS FOR REQUIRED MAKE AND BREAK INTERVALS

17.01 Facilities are provided by means of the 36- and 63-type resistors for controlling the length of time the interrupter relays are operated and released, that is, the percentage of make and break periods of the relay contacts that are outlined in the Circuit Requirements Table. A list of the resistors and the dial speed and relays which they control is shown.

17.02 The circuit should be wired on the initial installation so that the nominal resistance values shown in Table A are used. If it is necessary to change the resistance values to obtain the required speed or percent break, the strapping on the resistors may be changed. The values of resistors provided are such that the resistance can be increased or decreased in the units shown in the table from the minimum value shown to the maximum which should be sufficient to obtain the required speed and percent break. Increasing the resistance associated with the INT relay, increases the length of the make period of the pulse, while increasing the resistance associated with the INT1 relay increases the open period of the pulse.

18. TEST OF SELECT BAR

18.01 The test of the ability of the select bar and its associated mechanism to release and become stabilized between digits should be made by first dialing a digit which will cause the operation of the select bar in question, and follow this with the lowest digit (lowest number of pulses) which will actuate a select bar other than the one under test. This second digit is 1 in all cases except when the 0-1 select bar is under test, in which case the second digit is 2. In this test the 26 PPS MIN BR key should be operated.

TABLE A

CIRCUIT REQUIREMENTS

Desig	Resistance Min	Nom	Max.	Units	Key	Relay	Pulse
A	3700	4600	6200	100	7 PPS MIN BR	INT	Make
C	1700	2000	2450	50	7 PPS MIN BR	INT1	Break
D	1400	1800	2950	50	7 PPS MAX. BR	INT	Make
E	3600	4400	5150	50	7 PPS MAX. BR	INT1	Break
F	1000	2400	2550	50	15 PPS MIN BR	INT	Make
G	900	1200	2450	50	15 PPS MIN BR	INT1	Break
H	700	1200	2250	50	15 PPS MAX. BR	INT	Make
J	1600	2100	3150	50	15 PPS MAX. BR	INT1	Break
K	1000	1800	3050	50	26 PPS MIN BR	INT	Make
L	280	360	590	10	26 PPS MIN BR	INT1	Break
M	500	700	1300	50	26 PPS MAX. BR	INT	Make
N	400	600	900	10	26 PPS MAX. BR	INT1	Break

19. OPENING OF T AND R LEADS BY CONTROL CIRCUITS

19.01 The RL relay is operated by the associated control circuit when it is desired to abandon the call or open the tip and ring leads.

20. COIN GROUND

20.01 The C resistor, 1000 ohms, is grounded over lead CN1 by the associated control circuit when it is desired to simulate the coin magnet ground at the subscriber station. The CN lead is used by the control circuits when it is desired to make special tests of the coin test relays in the senders.

20.02 When a test is to be made of the sender coin relays, the CNT lead is grounded by the associated control circuit when that circuit has advanced to the position for making the coin test. There are four control circuits that make coin test as follows:

(a) Full Selector Dial Pulse Control Circuit -0111.

(b) PCI Dial Pulse Control Circuit -0115.

(c) Overflow Control Circuit -0119.

(d) Operator Class Control Circuit -0121.

However, only Section -0111 makes a special test of the sender coin relay. The other three control circuits connect ground through the 1000-ohm C resistor to the T and R leads to satisfy the sender coin relays.

20.03 To permit the use of any of the several dialing loop conditions with any of the above control circuits, it is necessary that the dialing loop resistance be shorted out as soon as dialing has been completed. Otherwise the sender coin relays will not function with the maximum dialing loop resistance. The CT relay performs this function and operates over the CNT lead from the associated unit.

20.04 The CT1 relay operates from the CT relay. This relay operating, places approximately 1000 ohms in the loop and thereby tests the sender CLR relay to ensure that this relay will hold over this loop resistance.

20.05 The function of the CT 274D inductor is to prevent the false operation of the sender SGT relay, when making a non-operate test of this relay, due to the faster buildup of current in the operate winding than in the nonoperate winding.

21. DIALING NUMBERS OVER TEN THOUSAND

21.01 The OT lead to the PCI dial pulse control circuit is grounded by the STA No. 1 key when it is required to dial a number over 10,000.

TABLE B

RELAY OPERATION TESTS

Condition	Key Desig	Loop	Leak	Ringing Br Cap.
SD-25012-01				
A	7 PPS Min Br	1710	3,500	None
B	7 PPS Max. Br	1710	3,500	None
SD-27810-01				
A	7 PPS Min Br	2140	5,008	None
B	7 PPS Max. Br	2140	5,008	None
SD-25012-01				
C	15 PPS Min Br		10,000	2 - 274F Inductors each ISW 2.7 μF
D	15 PPS Max. Br		10,000	2 - J-12 Relays each ISW 3.24 μF
SD-27810-01				
C	15 PPS Min Br		10,000	2 - 274F Inductors each ISW 2.16 μF
D	15 PPS Max. Br	300	3.24 μF	2 - 274F Inductors each ISW 2.7 μF
E	26 PPS Min Br		15,000	None
F	26 PPS Max. Br	1500	None	None
G	PBX Surge	Special	None	None
H	ZLL		None	None

Condition "A" using the 7 PPS MIN BR key tests the ability of the sender RA relay to hold over the pulses and the correctness of the biasing winding strength and the adjustment of the L relay.

Condition "B" using the 7 PPS MAX. BR key tests the ability of the sender SR relay to hold over dial pulses, and the correctness of the biasing winding strength and the adjustment of the L relay.

Condition "C" using the 15 PPS MIN BR key tests the ability of the sender L relay to release and close its back contact long enough to operate and lock the sender L3 relay or to operate the sender L4 relay and release the sender L3 relay.

Condition "D" using the 15 PPS MAX. BR key tests the sender L relay for an open secondary winding.

Condition "E" using the 26 PPS MIN BR key tests the ability of the sender L relay to release, the L1 relay to release, and the RA relay to operate fast enough on the first dial pulse of a train to ensure that locking ground is established early enough for the L3 relay.

Condition "F" using the 26 PPS MAX. BR key tests the ability of the sender L relay to operate fast enough to make its front contact before the dial closure has ended and to keep its back contact open long enough for the L5 relay to either operate or release. This combination also tests the ability of the sender RA relay to release in the minimum time between digits when making register control tests, the ability of the senders 3-relay "W" and "Z" combination L3, L4, and L5 to complete a cycle of its operations in the time allowed at this speed, and the ability of the sender P1 to P6 relays to operate on the minimum closure received from the contacts on the L5 relay.

Condition "G" tests the ability of the sender to ignore a false pulse on a PBX surge condition.

Condition "H" tests the ability of the sender polar L relay to pulse properly under severe loop conditions.

22. CANCELLATION OF TEST FOR GROUND ON THE FT AND FR LEADS BEFORE PCI PULSING

22.01 The PCI register circuit is arranged to test for a ground on both the FT and FR leads before PCI pulsing except when the first pulse is positive. The PCI register circuit receives information from the setting of the keys in this circuit as to whether the first pulse is to be positive or not. On tandem PCI calls the first digit of the office code determines the character of the first pulse and a circuit through the contacts of keys No. 1, 3, 6, and 8 of row A is provided for furnishing this information. These contacts ground lead A1 to the PCI register circuit. On nontandem PCI calls the station or ten-thousand digit determines the character of the first pulse, and a circuit is provided through a contact of the R key and a contact on key 1 for this purpose. These contacts ground lead ST1 to the PCI register circuit.

23. CONTROL OF PULSING INTO KEYPULSING "A" SENDER

23.01 Connections are provided through each of the code, numerical, and station keys to the keypulsing circuit for controlling the character of the pulses transmitted to the keypulsing "A" sender.

24. PBX SURGE TEST

24.01 To simulate high-speed PBX dialing the PBX SURGE key may be used. This gives 26-PPS maximum break dialing with a shunted inductance included in the loop. With the PBX SURGE key operated, a high surge is produced 50 milliseconds after the last dial closure. If the subscriber sender surge filter is open, the L relay will release falsely causing an overregistration failure. However, the high surge will not falsely release the sender L relay if the R-C network is present and if the L relay is within requirements.

24.02 With Fig. W, an improved test is added which simulates one of the worst PBX dial surge conditions that is produced from a PBX operator, from a maximum loop standpoint. The new test will also detect certain sender L relay maladjustments with the surge filter normal.

25. POLAR L RELAY MALADJUSTMENT TESTS (ZLL KEY OPERATED) FIG. W

25.01 Tests for maladjustment of subscriber sender polar L relays can be made by operating the ZLL key, and either the 7 PPS MAX. BR or 26 PPS MIN BR keys. When a full selector code and class key 2 are used, tests similar to those described in Section -0113, 20., are performed. These tests are now made under zero loop - no leak conditions and will cause maximum L relay chatter. If the sender L relay is out of adjustment, registration failures may occur with a short loop - no leak condition.

25.02 When the 7 PPS MAX. BR key is used with the ZLL key, the break period of the pulse cycle is generally long enough to permit the L relay back contact chatter to cause an overcount in registration. When the 26 PPS MAX. BR key is used with the ZLL key, the break period of the pulse cycle is minimum, and the very short sender L relay back contact make is composed entirely of contact chatter, causing a pulse insufficient to operate the sender L3 relay. If the L3 relay does not operate, it will cause undercount registration. Sender polar L relay maladjustment tests can be made to determine if the relay armature is hitting the pole piece, or if the relay has a wide magnetic gap. Both maladjustments result in registration failures.

26. INTERSENDER TIMING TESTS

Note: When intersender timing tests are made, the other senders in the same subgroup are also in the 3- to 6-second timing at trunk test. Any service call timed out at trunk test will be routed to an announcement trunk.

26.01 These tests check that intersender timing features in the subscriber senders function properly on full selector and PCI calls, and that the sustaining period of the control in the traffic register circuit for intersender timing is properly applied. With the test frame off-normal, if key IST0 or IST1 is operated, a trigger ground is applied to the intersender timing control located on the traffic register circuit to operate the OSB

relay. Relay IST of Fig. 28 will operate and prepare the test circuit for intersender timing tests as described in Section -0121, 18.

26.02 Figure 28 provides a key (IST0 or IST1) and a lamp (IST0 or IST1) for each group of subscriber senders as arranged at the subscriber sender link frame. Lamp IT is also provided to indicate, when it is lighted, the time from trunk closure to sender advance of the subscriber sender. Relay IST1, which is a sensitive relay, detects the trunk closure and lights lamp IT. The off-normal ground from the connector circuit supplies a trigger ground to each key, and also a ground for each key to operate the IST control relay. If either key is inadvertantly left operated, ground through a normal contact on a relay in the traffic register circuit over leads IL0 or IL1 will cause the corresponding group lamp (IST0 or IST1) to light. The lighted lamp indicates that the IST0 or IST1 key is operated and intersender timing will be in effect if the test frame goes off-normal.

26.03 Circuit operation and stopwatch timing tests for intersender timing are described in Section -0121, 18.

27. INFORMATION CODE 411

27.01 The PDG1 key and the A4, B1, and C1 code keys of this section and the class 17 key of Section -0102 are operated for this test. Ground from the class 17 key is extended through the operated PDG1 and A4, B1, C1 keys to operate the INF relay of Section -0139. A detailed description of this feature is given in Section -0139, 27.

28. INTERCHANGEABLE CODE

28.01 This circuit is effected by the interchangeable code feature only during full selector calls with office selections. In order to place the DP switch of Section -0111 in position to check the office selections after the units digit has been dialed, it is necessary to recycle the switch. To prevent redialing the directory number during the second cycle of the DP switch, the operation of the SMS relay of Section -0133 opens the operating path of the SY relay of this circuit.

CIRCUIT UNIT SECTION -0108
ROUTE KEYS AND REVERTIVE PULSING CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit is arranged to control the checking of fundamental selections of the sender in conjunction with the other sections of the originating sender test circuit.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To close the fundamental circuit on signal from the associated control circuits.

3.02 To send revertive pulses to the sender over the fundamental circuit and to check the number of pulses sent.

3.03 To signal the test circuit to progress if the number of pulses sent to the sender corresponds to the number as determined by the setting of the route keys.

3.04 To cause the control circuit to pass by office selections on calls which do not require the use of these selections.

3.05 To test the sender by means of slow revertive pulses under the control of a key.

3.06 To provide compensating resistance for the fundamental loop so that the total compensating resistance (sender plus test circuit) may be varied from 900 to 1600 ohms.

3.07 To permit the checking of each selection individually under the control of keys or by the use of a jack at the sender frame.

3.08 To provide for testing senders for transmitting over or under five incoming group selection pulses. This is controlled by the 1G5 key.

3.09 To provide for testing that the sender waits for the distant circuit to open the fundamental when reversed battery is received after incoming brush selection.

3.10 To provide for checking that the sender allows sufficient opening between selections.

KEYS

3.11 Route Keys OB, OG, SB, and SG - These keys are pushbutton interlocking-type keys. The desired route is set up by depressing keys corresponding keys corresponding to the desired selections.

3.12 Keys SO and SSO Skip Office - These keys, when operated, cause the control circuit to pass by the positions for checking office selection: SO for first office and SSO for second office selections.

3.13 Compensating Resistance Keys for Office and Beyond-Office Compensation OFF-CR, OFF-SCR, and B-OFF-CR - These keys connect resistance, as indicated by their designations, to the fundamental ring. Their use is in conjunction with the compensating resistance which is connected to the fundamental ring by the sender.

3.14 Step-by-Step Checking SS - When the SS key is operated, the check is stopped at the end of each selection. The momentary operation of the nonlocking AV key (code keys and dial pulsing circuit) in conjunction with the SA and SA1 relays advances the circuit for the check of the next selection if the sender has closed the fundamental and operated the L relay. The SA and SA1 relays may also be controlled from the sender frame by means of the remote control jack and a 32A test set.

3.15 Slow Pulse Key SP - This key when operated causes the circuit to test the fundamental with revertive pulses of approximately one-third normal frequency.

3.16 Pulse Lamp Key PL-LP - When operated, this key and its associated relay display a lamp for each operated counting relay.

3.17 Incoming Group Over Five IG5 - When this key is operated, the sender is checked for transmitting five additional incoming group selection pulses.

3.18 Long Incoming Overflow Key L1OF - When this key is operated, a check is made that the sender holds the fundamental closed and waits for the distant circuit to open reversed battery received after incoming brush selection.

3.19 The STP key, when normal, provides a 90-ohm shunt for checking the STP relay. When operated, it provides a 110-ohm shunt for checking a readjusted STP relay. The 110-ohm shunt test should be used to check the performance of STP relays immediately after they have been readjusted either mechanically or electrically.

LAMPS

3.20 Selection Progress Lamps - These lamps indicate the position of the progress switch in the associated control circuit.

3.21 Pulse Lamps - These lamps light under control of the PL-LP key. They indicate the number of revertive pulses which actually were sent to the sender.

3.22 OF Overflow, RLS Release, KR Key Release, TG Trunk Guard, and TC Trunk Closure - These lamps are used as progress lamps and are lighted from the control circuits.

3.23 Lamp FC - This lamp indicates delayed opening of the fundamental.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit -0102

(b) Code Keys and Dial Pulsing Circuit -0105

(c) Full Selector Dial Pulse Control Circuit -0111

(d) Incoming and Final Selections Control Circuit -0113

(e) PCI Dial Pulse Control Circuit -0115

(f) PCI Register Circuit -0117

(g) Overflow Control Circuit for Subscriber Senders -0119

(h) Operator Class Control Circuit for Subscriber Senders -0121

(i) Office Selection Control Circuit for Keypulsing Senders -0125

(j) Overflow Control Circuit for Keypulsing Senders -0127

(k) Operator Class Control for Keypulsing Senders -0129

(ℓ) Code Test Circuit -0133

DESCRIPTION OF OPERATION

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5. OFFICE BRUSH SELECTION

5.01 This circuit operates to check the number of pulses required to satisfy the sender for the various selections. The first selection checked is office brush. When the control circuit is ready for the check of office brush selection, OB lead is grounded which operates relay OB. Relay OB operates relay L1 which closes the FT lead to the sender. When the sender closes the fundamental circuit, relay L operates and operates relay BT. The fundamental ring circuit is closed through a front contact of the OB relay and through compensating resistances to ground at a front contact of the OB relay. With relay BT operated, the L1 relay releases, but the L relay remains locked to the fundamental circuit. Relay BT locks to a front contact on relay OB. The operation of relay BT closes battery on the windings of the counting relays. The operation of relay OB closes a checking path for first office brush selection through the depressed office brush key to the corresponding counting relay winding. The operation of the connector ST relay, -0103, connects ground over the STG lead and operates the RVP, RVP1, CHK, and FND relays. The operation of relay BT operates and releases the interrupted relays RVP and RVP1. The RVP1 relay, in turn, operates and releases the CHK and FND relays. The FND relay controls the ground that shunts the sender STP relay while the CHK controls the counting relays of this circuit.

5.02 The following is a detailed description of how the interrupter relays operate and release. When the ST relay (-0103) first operates, ground is connected to the STG lead which will operate the RVP, RVP1, and in turn the CHK and FND relays. When the BT relay operates, ground is removed

from the No. 3 winding of the RVP relay which allows the RV capacitor to start charging in series with the secondary winding of the RVP relay. This will cause this relay to release momentarily until the capacitor is charged or until the current in the secondary winding does not produce enough energy to prevent the relay from operating on its primary winding. While the RVP relay is released, the RVP capacitor is discharged through the relays back contact. When the RVP relay again operates, the RVP capacitor is charged in series with the secondary winding of the RVP1 relay. This current is in the direction to cause the RVP1 relay to release. This relay will reoperate, however, just as soon as the current that is charging the capacitor is reduced to a point where the energy produced by the secondary winding is not as great as that produced by the primary winding. When the RVP1 releases, the CHK and FND relays also release and the reoperation of the RVP1 again operates these relays. The RVP1 released, also discharges the RV capacitor and then when the RVP1 relay reoperates, the RV capacitor again starts to charge in series with the secondary winding of the RVP relay. The RVP relay again releases and the cycle of events just outlined is repeated. The CHK and FND relays continue to send pulses until the BO relay in this circuit is operated or until the fundamental is opened in the sender releasing the L relay. Either condition removes the ground to the contacts of the FND and CHK relays so that even though these relays should continue to pulse, the pulses would not be effective. The operating and releasing times of relays RVP, RVP1 are controlled by capacitor RVP and RV and associated resistors. With the SP key normal, these values are such that the FND and CHK contacts deliver pulses of approximately 0.012 second closed, 0.015 second open. With relays L, OB, and BT operated, the first closure of relay CHK operates relay P, and the opening of this interrupter allows relays P1 and P2 to operate. Relay P1 connects the contacts of relays FND to the FT lead through 37 ohms, YX option, or 110 ohms, YZ option (STP key normal or operated, respectively). This tests the ability of the stepping relay to release (110 ohms readjust -90 ohms test). The operation of relay P2 connects the contacts of relay CHK to the counting relays through the make-contact on relay OB and the depressed OB key. While the FND relay is sending pulses to the sender, the CHK relay is counting these pulses on the counting relays. When the sender is satisfied, it opens the fundamental circuit and, at the break of the ground pulse from the FND relay, the L relay releases. If the number of pulses required to satisfy the sender corresponds to the OB key which is depressed, the BO and O' relays will have operated at the break of the last pulse from the CHK relay. When the L relay releases, ground is removed from both the CHK and the FND relays which prevents further pulsing. The RVP relay also stops in the operated position. With relay BO operated, relay BO1 operates. With relay BO1 operated and relay L released, ground is connected over lead AV to the control circuit as a signal that the selection has been properly checked. The control circuit advances releasing relay OB, and in turn the BT relay. With relay BT released, the counting relays release. When relay BO1 releases, lead AV1 is grounded which advances the control circuit for the next selection.

5.03 If the number of pulses required to satisfy the sender is fewer than that registered on the OB keys, the BO and O' relays will not be operated. When the L relay releases, ground is removed from the pulsing relays thus stopping further pulsing. If the number of pulses sent to the sender is not sufficient to satisfy the sender, and the BO and O' relays have operated, relay L will remain operated over the fundamental circuit. In either of the above cases, lead AV will not be grounded and the circuit will block. Operation of the pulse lamp key PL-LP indicates the number of pulses which were sent to the sender. The depressed OB key indicates the selection which should have been made. A progress lamp corresponding to the selection being checked also lights.

5.04 Facilities are provided by means of the 36-type resistors A and B for controlling the length break and make periods of the high speed revertive pulse interrupter relays. These requirements are outlined in the BSP.

5.05 The A resistor is associated with the RVP1 relay. This relay controls the length of break period.

5.06 The B resistor is associated with the RVP relay. This relay controls the length of make period.

5.07 The chart below shows how the resistance can be varied. The circuit should be wired initially so that the nominal resistance value is used. In order to obtain the required speed and percent break, the strapping on the resistors may be changed. An increase in resistance lengthens the make or break period, depending on which resistance is changed.

RESISTANCE

Desig	Min	Nom	Max.	Units	Relays	Pulse
A	500	620	810	10	RVP1	Break
B	700	1000	1450	50	RVP	Make

6. OFFICE GROUP SELECTIONS

6.01 Selection OG is made in the same manner as OB selection except that OG key controls the number of pulses to be sent.

7. SKIP OFFICE

7.01 If office selections are not required, the SO and SSO keys are operated and the operation of relays OG, OB, SB, and SG causes the control circuit to pass by the positions for these selections. As second office selections are not required, the SSO key operated, causes the control circuit to pass by second office selection only. With H wiring, second office selection will always be skipped.

8. INCOMING AND FINAL SELECTIONS

8.01 These selections all are made and checked in the same manner as office selections. The proper steering relay, IB, IG and IG1, FB, etc, is operated by the control circuit when that circuit is ready for the particular selection. Contacts on the TH, H, T, and U keys of the code keys and dial pulsing circuit are used for this check. For IG selection, the OTH relay is operated if an odd thousands key is operated, and the UH relay is operated if a hundreds key above 4 is operated. These relays control the number of pulses for IG selection.

9. INCOMING ADVANCE AND OVERFLOW TESTS

9.01 On incoming advance for a full selector call, on reverse battery for a full selector late release call, and on reverse battery for incoming overflow and full selector office overflow tests, the associated circuit grounds lead L1, operating relay L2. Relay L2 operated:

(a) Closes in part the circuit through the L relay to the fundamental for reverse battery.

(b) Connects the L relay contact to lead AV2 to signal the associated circuit when the fundamental closes and opens.

9.02 A test can be made to see that the sender waits for the distant circuit to open the fundamental when reversed battery is received after incoming brush selection. With the L IOF key operated, Y option, operation of relay L, as described above, operates relay L4. The L4 relay locks under control of relay L2, opens the operating circuit of relay L, leaving relay L locked to the FT lead, and connects ground through the front contact of relay L to lead AV4. The L4 relay is slow-operate to ensure that the L relay locks before its operating circuit is opened. Ground on the AV4 lead is used to control a timing circuit on Sheet -0119. If the sender falsely opens the fundamental circuit, the L relay will release, stopping the timing circuit and blocking the test. If the L relay remains operated, the timing circuit causes the test to progress. See Section -0119. The G lead is used to complete the fundamental circuit on this kind of test.

10. SLOW REVERTIVE PULSES

10.01 If a cross occurs between the normally closed contacts of a prime counting relay, a stepping relay protection capacitor breaks down, or a high resistance occurs in the stepping relay contact lead, more than the expected pair of counting relays in the sender may be operated from a single revertive pulse if sufficient time is allowed. As the normal fundamental test from the revertive pulse relays is at a high speed, the test circuit will not always detect such a trouble when using this high speed. The SP key, when operated, changes the values of resistance and capacitance associated with the pulse relays causing them to generate pulses of a considerably longer interval. Also the SP relay operates from a back contact of the O relay. When the O relay operates at the beginning of the last pulse to be sent for a selection, the SP relay releases, connects a resistance in parallel with the winding of RVP, and thereby shortens the last pulse. This is necessary because, if the last pulse is very long, the sender may be satisfied for one selection, and close the fundamental for the next selection before the pulse ended. This reclosure of the fundamental would hold the L relay and cause the test frame to block even though no trouble existed in the sender.

11. STEP-BY-STEP SELECTIONS

11.01 When the step-by-step key SS is operated, the L1 relay is prevented from operating until the AV key (code keys and dial pulsing circuit) is operated and

released. The operation and release of the nonlocking AV key operates relays SA and SA1, which permit the L1 relay to operate. The functions of the AV key may be performed at the sender frame by the use of the white button of the 32A test set which momentarily grounds the RC lead.

12. TEST OF KP STUCK SENDER FEATURE

12.01 To test the stuck sender feature of the keypulsing sender, operate class key 1 and SS key, and operate the cancel priming key of the senders to be tested. When the ST key is operated, the sender is seized and tested in the usual manner up to the point at which the first selection is to be made. The test circuit then stops due to the operated SS key. If any office selections are involved, the AV key shall be operated a sufficient number of times to complete office selections. This permits the test circuit to pulse the numerical digits. At the completion of the last digit, the sender starts its stuck sender timing interval. This interval is 30 to 50 seconds usually, but it is increased to 60 to 80 seconds if the code used is one whose route is through a distant office selector, ADCI, or a tandem office. At the completion of the stuck sender timing interval, the sender prepares an operating circuit for its CT relay but the operated CTR key prevents the CT relay from operating at this time. Ten seconds later the sender lamp at the make-busy frame will light. The sender is then released by restoring the CTR key, and the test circuit advanced to the next sender by operating and releasing its CA key. When the long time-out interval is used, the test circuit time alarm may operate before the test has been completed. This may be prevented by operating the TA key during the test of each sender.

13. COMPENSATING RESISTANCE FOR SPECIAL TESTS

13.01 During the tests of the TG and MTG relays in the sender by the control circuits, the resistance of the fundamental circuit must be kept within certain limits. The arrangement of the compensating resistance and the provision of leads FR2 and FR3, which are grounded as required, accomplish this purpose.

14. TEST FOR OPENING OF FUNDAMENTAL IN SENDER

14.01 The class key 1 in the connector unit, Sheet -0103, will be operated on full selector tests. A test is made that the sender does not delay too long at the end of each selection. A lengthy delay would open the fundamental circuit and cause overstep of the terminating sender or panel selector. The TRO relay operates from class key 1. This transfers the FR lead to the winding of the L3 relay. This winding is shunted by a back contact on the BO counting relay. The L relay operates and a selection takes place in a normal manner until the BO relay is operated. On the last shunt pulse, which holds the L relay, prevents the L3 from operating, and shunts the sender STP relay, the STP relay should release and allow the sender BO and FO relays to operate. The operation of BO and FO relays should open the fundamental. When the shunt pulse ends, the L relay should release and the L3 relay will not operate. If, however, the fundamental is not promptly opened in the sender as just described, when the shunt pulse is terminated the L3 relay will operate in series with the L relay over the fundamental. The L3 locks under control of the TRO relay, lights the FC lamp, and opens the ground that should have closed the AV lead to the control circuit. This causes the test circuit to block.

14.02 A failure of the sender STP or counting relay, or wrong dial registration, etc, may cause the test circuit to transmit less shunt pulses to the sender than the sender requires. The fundamental would then fail to open at the end of a selection and relay L3 would operate and light the FC lamp as described above. The pulse lamp will give an indication of this type of trouble (the lighting of the FC lamp is incidental). The TFO and L3 relays are primarily intended to test the sender BO relay for falsely shorted contacts. Experience has shown that occasionally the back and front contacts of this relay become shorted. Under this condition, the fundamental is opened when the back contact opens but is closed again when the front contacts close. The momentary open of the fundamental may not be long enough to permit the L relay in a panel selector or terminating sender to release. The test circuit

L relay may release, however, and the test circuit might not detect the false short on the front and back contacts of the B relay. For this reason the senders should have the front contact and armature of the BO relay strapped so when there is a false short between the back and front contact the operation of the BO relay will not open the fundamental even for an instant, and the test circuit can make a satisfactory test.

15. INCOMING GROUP "OVER FIVE" SELECTION

15.01 To provide for completing calls over common trunks to two crossbar terminating units, the originating senders may be arranged to send over or under five incoming group selection pulses. That is, for one of the office units reached over the common trunk group, the sender receives information from the marker to transmit the regular number of incoming group selection pulses while for the other unit the marker will signal the sender to add five pulses to the regular number of pulses. The terminating sender will accordingly direct the call to the desired office.

15.02 To test the senders for this, the IG5 key with associated wiring is provided. With the IG5 key normal, the sender will be checked for transmitting the regular number of incoming group selection pulses as has been outlined. With the IG5 key operated, the sender will be checked that five pulses are added to incoming group selection. The IG5 key intercepts the four paths to the counting relays and connects them so that five additional pulses must be received before the O and BO relays are operated to terminate the selection.

16. TEST OF TIME INTERVAL BETWEEN SELECTIONS - W OPTION

16.01 This test is made on selections not using the sender F01 relay. For testing subscriber senders, operate register control class key 2 of -0103, operate either of the 26 PPS keys of -0106, and use numerical code 9999 so that the selections will not have to wait for dialing. For testing keypulsing senders, operate full selector class key 1 of -0103. The slow revertive pulse key SP should be operated. As described above under Slow Revertive Pulses, the last pulse is shortened in order to end the pulse before the sender recloses the fundamental. With W option, this last pulse will be approximately 0.065 second. This is short enough so that a sender which provides the proper opening between selections will not reclose the fundamental before the pulse is ended; but the pulse is long enough so that a sender which provides too short an interval will reclose the fundamental circuit before the pulse is ended. This will hold the test circuit L relay and block the test.

CIRCUIT UNIT SECTION -0111
FULL SELECTOR DIAL PULSE CONTROL CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to control the dialing of the code and number only when testing a full selector call in conjunction with the other sections of the sender test circuit. The PCI dial pulse control circuit, -0115, controls dialing of the code and number when testing a PCI class of call. The auxiliary sender dial pulse and code check control circuit, -0139, controls dialing of the code and number when testing MF calls.

1.02 This circuit also performs tests on the coin relays in the sender to determine that these relays function properly.

1.03 This circuit is arranged so that, in conjunction with the incoming and final selections control circuit, a test of the register control relays in the sender can be made.

1.04 In conjunction with the route keys and revertive pulsing circuit, the sender is tested for office selections.

1.05 This circuit is arranged to check the ability of the sender to control the district over the S, LR, and TR leads.

1.06 This circuit is arranged for making late release full selector class tests.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To dial a preliminary pulse.

3.02 To control the dialing of the code and numerical digits in conjunction with the code keys and dial pulsing circuit.

3.03 To test the sender for synchronizing the dialing of the digits with the fundamental circuit closure. This test is made in conjunction with the incoming and final selections control circuit.

3.04 To test the GT and SGT relays of the sender on the operate and nonoperate currents.

3.05 To maintain a continuous test on the S and LR leads for opens.

3.06 To control the checking of office selections by the route keys and revertive pulsing circuit.

3.07 To block when the test set alarm operates. The blocking of this circuit also blocks the associated test circuits.

3.08 To make wipe-out tests.

3.09 To check that the TR lead is closed at the end of the test, and not before.

3.10 To enable the test frame to dial all digits into the sender before the fundamental is closed when testing full selector codes which are interchangeable area and office codes.

KEYS

3.11 Key SGT-OPR - When this key is operated, the SGT relay in the sender is tested for operate.

3.12 Key SGT-NO - When this key is operated, the SGT relay in the sender is tested for nonoperate.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit	-0102
(b) Code Keys and Dial Pulsing Circuit	-0105
(c) Route Keys and Revertive Pulsing Circuit	-0108
(d) Incoming and Final Selections Control Circuit	-0113
(e) Operator Class Control Circuit for Subscriber Senders	-0121
(f) Code Test Circuit	-0133
(g) AMA Check Circuit	-0135
(h) TOUCH-TONE Signaling Circuit	-0143

DESCRIPTION OF OPERATION

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5. SEIZURE

5.01 When this circuit is seized by the connector C relay operation, the C and G leads are grounded. Ground on the C lead operates the C relay through the normal terminal position 22 of the DP switch. The C relay operated locks directly to the C lead, provides locking circuits for various relays, closes the tip and ring leads, operates the C1 relay, and advances the DP switch to position 1. The C1 relay operated closes the fundamental tip and ring, the CN, S, LR, and G leads. Ground on the G lead operates the G relay, which closes the circuits for advancing the DP switch from its various test positions. The ground on the G lead is indirectly controlled from the time alarm circuit of the test circuit. If the time alarm in the connector circuit operates, the G lead is opened and relay S operates. The opening of the G lead causes the G relay to release and block further operation of the DP switch.

6. DIALING OF THE PRELIMINARY PULSE OR PREFIX DIGITS

6.01 Preliminary Pulse - With the DP switch in position 1, the PP lead to the Code Keys and Dial Pulsing Circuit -0105, is grounded. This causes a single pulse to be dialed by Section -0105. While this preliminary pulse is being dialed, ground is supplied over the AV lead, operating the AV relay. The AV relay operated energizes the DP magnet. At the completion of the dialing of the preliminary pulse, ground is removed from the AV lead, releasing the AV relay, and advancing the DP switch to position 2.

6.02 Prefix Digit 1-1 - When the associated subscriber senders are arranged to record a prefix 1-1 before the office code, the 1-1 key in the dial pulse control circuit is furnished. When this key is operated and the DP switch is advanced to position 2, grounding the A lead, the dial pulse relays proceed to transmit the prefix 1-1 to the sender before transmitting the regular A digit as is outlined in Section -0105.

6.03 Prefix Digit 0 or 1 - When it is desired to outpulse a prefix digit 0 or 1 before the office code, the PDG0 or PDG1 key in the dial pulse control circuit is operated. The DP switch is advanced to position 2 grounding lead A. The dial pulse interrupter circuit or the TOUCH-TONE signal generator circuit then proceeds to transmit a prefix digit 0 (PDG0 key operated) or a prefix digit 1 (PDG1 key operated) to the sender before transmitting the A digit of the office code as outlined in Section -0105.

7. DIALING OF THE A, B, AND C CODE DIGITS

7.01 With the switch in position 2, lead A is grounded, causing the code keys and dial pulsing circuit to dial the A digit in accordance with the setting of the A keys. While this digit is being dialed, the AV relay and the DP switch magnet are energized, as previously described, and at the completion of the digit, the AV relay is released, allowing the switch to step into position 3. In positions 3 and 4 the B and C digits are dialed in the same manner and the switch is advanced to position 5.

8. CODE CHECK

8.01 With the switch in position 3, 4, and 5, a ground is supplied to the C lead of the code test circuit, -0133. In addition, a ground is supplied from a contact of the G relay to the G lead of the code test circuit. This causes the code test circuit to check the information which the sender transmits to the marker. While this check is in progress, the code test circuit grounds the CF lead, operating the LK relay, which locks to the LR lead. Subsequently, the code test circuit opens the CF lead, leaving the LK relay locked. At the completion of the functions of the code test circuit, the AV lead is grounded, operating the CD relay which locks under control of the C relay, opens the operating circuits of the S and LK relays, and advances the switch to position 6.

9. CHECK OF S AND LR LEAD CONTROLS

9.01 The S and LR leads are grounded by the sender, operating the S relay and providing a locking circuit for the LK relay. Both of these leads should remain grounded until the end of the test. If the S or LR lead is opened falsely, or relay LK fails to operate from DC lead closure, the S or LK relay will release and open the operating circuit of the TR or TR1 relay which will cause the DP switch to block in position 20. With Y option the TR1 and TR relays operate slowly to check that the sender provides adequate time to operate a district relay on a service call.

10. OFFICE BRUSH SELECTION

10.01 In position 6 of the DP switch, lead OB to the route keys and revertive pulsing circuit -0108 is grounded. This causes the office brush selection to be checked. If the check is satisfactory, lead AV from the route keys and revertive pulsing circuit is grounded, advancing the DP switch to position 7. After certain relays in the route keys and revertive pulsing circuit have restored to normal, lead AV1 is grounded, advancing the DP switch to position 8.

11. OTHER OFFICE SELECTIONS

11.01 In position 8, office group selections are checked in the manner described for office brush selection. Positions 9 to 12 are always passed by as no second office selections are used.

12. SKIP OFFICE

12.01 Two keys are provided in the route keys and revertive pulsing circuit to cause the DP switch to pass by the first office positions 6 to 9, or the second office positions 10 to 12, or both.

13. SELECTIONS BEYOND OFFICE

13.01 In position 13 the SB relay operates. The SB relay operated, transfers the fundamental tip and ring to the incoming and final selections control circuit, supplies ground on the C and G leads to that circuit, locks under control of the C relay, and advances the DP switch to position 14.

14. SYNCHRONIZING FOR THOUSANDS DIGIT (PANEL CLASS)

14.01 With the DP switch in position 14, and TH to the code keys and dial pulsing circuit is grounded. The thousands digit, however is not dialed until ground is placed on the SY lead to the code keys and dial pulsing circuit by the operation of the SY relay. The SY relay operates over the SY1 lead from the incoming and final selections control circuit and closes the SY lead to the code keys and dial pulsing circuit. This ground on the SY1 lead indicates that the incoming and final selections control circuit is ready for trunk test. During the dialing of the thousands digit the AV relay is operated on the AV lead from -0106, operating the AV1 relay which locks under control of the SY relay. With the AV relay operated, the DP switch magnet is energized in the usual way and ground is supplied over the SY lead to the incoming and final selections control circuit. If the fundamental circuit is closed during the dialing of the thousands digit, the incoming and final selections control circuit will recognize this condition as a trouble and block. However, if the fundamental is not closed falsely, at the completion of the dialing of the thousands digit the AV relay releases, causing the switch to advance to position 15, and subsequently releases the SY and AV1 relays. The removal of ground from the SY lead by the release of the AV relay signals the incoming and final selections control circuit that TG test can be made. Reconnecting ground to the SY lead by means of a back contact of the AV1 relay prepares that circuit for synchronizing for the hundreds digit.

15. SYNCHRONIZING FOR HUNDREDS DIGIT (PANEL CLASS)

15.01 With the switch in position 15, the H lead to the code keys and dial pulsing circuit is grounded. When the incoming and final selections control circuit has completed incoming brush selection check, it will ground the SY1 lead, operating the SY1 relay which, in turn, grounds the SY lead to the code keys and dial pulsing circuit. During the dialing of the hundreds digit, the incoming and final selections control circuit tests for the false closure of the fundamental tip and ring. While the hundreds digit is being dialed, the AV, AV1, and SY relays are operated, and at the completion of the dialing of the hundreds digit, these relays release and the DP switch steps to position 16. The release of the AV relay, opening the SY lead, signals the incoming and final selections control circuit that incoming group and final brush selections should be made.

16. SYNCHRONIZING THE DIALING OF TENS AND UNITS DIGITS (PANEL CLASS)

16.01 This is accomplished in the manner similar to that described for the thousands and hundreds digits. The DP switch advances to position 18 at the end

of units dialing. If no coin tests are to be made, the switch is advanced to position 20 by means of a circuit through the back contact of the CN relay.

17. SYNCHRONIZING FOR CROSSBAR CLASS

17.01 If the office code used for test purposes is one which corresponds to a crossbar office, the synchronization between dialing and selections is somewhat different than for calls terminating in a panel office. For crossbar codes, trunk guard test is delayed until the hundreds digit has been dialed. In order to check this, the SY2 relay is operated by means of the XB-SY key, shown on the incoming and final selections control circuit, which causes the SY2 lead to be grounded. The SY2 relay operated causes the SY1 relay to operate in positions 13 and 14 of the DP switch, grounding the SY lead thereby permitting the dialing of the thousands digit without waiting for a signal that the incoming and final selections control circuit is ready for trunk guard test. The hundreds digit is delayed until the incoming and final selections control circuit is ready for the TG test and operates the SY relay. At the completion of the hundreds digit, the incoming and final selections control circuit is signaled by opening the SY lead, and the DP switch is advanced to position 16. The incoming and final selections control circuit checks incoming brush, incoming group, and final brush selections, and the synchronizing for tens and units is accomplished as described for the panel class call.

18. TESTS ON COIN TEST FEATURE OF SENDER

18.01 Synchronizing of Units Selection of Coin Senders - When coin senders are being tested, lead CN is grounded by the connector circuit, operating relay CN. When the DP switch arrives in position 17, relay CN1 operates and locks. The units digit is dialed when the incoming and final selections control circuit grounds lead SY1, and the DP switch advances to position 18. The test for false trunk closure is maintained because ground is maintained on the SY lead through a make-contact on CN1 and break-contacts on the CN6 relay and SGT-NO key.

18.02 Nonoperate and Operate Current Flow Tests of the GT in the Sender - The TPO or TPNO key should be normal, and class key 1 and a full selector code should be used. With the DP switch in position 18, the CN2 relay operates, locks, and connects ground to the CNT lead, and closes ground through the CT relay. When 116- to 120-volt coin battery is used, this ground is extended through 4504 ohms in this unit over the CN lead to code keys and dial pulse circuit -0105 and through 70 ohms in that unit to the T and R leads to the sender. In -0105 there are 620 ohms in the T and also in the R lead. When 100- to 120-volt coin battery is used, there are 4500 ohms in series with the CT relay in this unit. Regardless of the coin battery voltage, the resistance arrangement in unit -0105 stays the same. This applies also to other tests of the sender coin relays. The sender advances and places 110-volt battery on the dialing tip and ring, which operates relay CT. The CT relay will not operate on 48-volt battery through the sender L relay on the ring and 155-ohm ground on the tip. The resistance in the circuit is sufficient to prevent the operation of the GT relay in the sender. The operation of the CT relay operates relay CN3 which locks and grounds the CN lead through 3570 ohms. This places a nonoperate current flow test on the GT relay in the sender. If the CT and CN3 relays fail to operate, the CN lamp will light. The operation of the CN3 relay closes ground to the CT interrupter contact. The pulses from the interrupter operate and release the W, Z relay combination, which advances the DP switch to position 19. When the Z relay releases at the end of 1.5 seconds minimum, 2 seconds maximum, with the DP switch in position 19, the CN6 relay operates. If the sender GT relay operates falsely, the sender will advance and close the fundamental which will cause the incoming and final selections control circuit to ground lead BK thus operating relay CN4. This prevents the operation of relay CN6 and lights the CN lamp. The operation of the CN6 relay connects ground through 2064 ohms (116- to 120-volt coin battery) or 1925 ohms (100- to 120-volt coin battery) to the CN lead as an operate current flow test on the sender GT relay. The CN6 relay removes ground from the SY lead, which causes the incoming and final selections control circuit to start timing for an immediate closure of the fundamental circuit. If this closure does not occur within a short interval, the incoming and final selections control circuit grounds lead BK, which operates relay CN4. Relay CN4 operated, opens the CN lead from the tip and lights the CN lamp.

18.03 Nonoperate Test on SGT Relay in the Sender - TPO or TPNO Key Normal - The SGT-NO key, class key 1, and a full selector code should be used. With the SGT-NO key operated, a nonoperate test is made on the SGT relay in the sender. When the CN2 and CN3 relays operated, 294 ohms (116- to 120-volt coin battery) or 290 ohms (100- to 120-volt coin battery), ground is placed on the CN lead. The sender should advance and close the fundamental for final units within a short interval. If, however, the SGT relay operates falsely, the sender will not advance and relay CN4 will be operated by the incoming and final selections control circuit.

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18.04 Operate Test on SGT Relay in the Sender - AR Key and TPO and TPNO Keys Should Be Normal - Class key 1 and a full selector code should be used. With the SGT-OPR key operated, an operate test is made on the SGT relay in the sender. The test will proceed as described above for an operate test of the GT relay except that the operation of the CN3 relay connects ground through 194 ohms (116- to 120-volt coin battery) or 180 ohms (100- to 120-volt coin battery) to lead CN. The SGT relay in the sender should operate and block the sender. If the SGT relay fails to operate, the sender will advance and close the fundamental which will cause the incoming and final selections control circuit to ground lead BK, operating relay CN4. The operation of relay CN4 will prevent the operation of the CN6 relay and will block the test with the CN lamp lit. If the SGT relay in the sender operates, this circuit will wait until the interrupter has counted out the delay period, and then the operation of the CN6 relay will operate the RB relay. With Fig. K the operation of relay RB:

(a) Grounds the N lead to the code keys and dial pulsing circuit causing the dialing tip and ring to be opened and registering a release in the sender.

(b) Supplies reverse battery to the fundamental tip and ring which operates the sender OF relay simulating a tell-tale after a wipe-out and permitting the sender to restore without the aid of the monitor.

With Fig. L, the RB relay operated:

(a) Grounds lead N to the code keys and dial pulsing circuit causing the dialing tip and ring to be opened and registering a release in the sender.

(b) Grounds lead FU PB to the incoming and final selections control circuit causing that circuit to send a momentary reverse battery to the sender simulating a tell-tale after wipe-out and causing release of the sender. The sender connects battery to the LR lead operating the WO relay and this circuit restores to normal.

19. TESTING THE REGISTER CONTROL CIRCUIT OF THE SENDER

19.01 A full selector code that uses the TG relay in the sender must be used for this test.

19.02 The register control class key in the connector circuit is depressed for this test. The 26 PPS MAX. BR key in the code keys and dial pulsing circuit should be operated and the 5, 6, 7, 8, 9, or zero numerical keys should be depressed. The operation of the 26 PPS MAX. BR key connects a 1000- or 1500-ohm artificial line into the dialing circuit and causes the interrupter to generate high percentage break pulses. The dialing of the A, B, C code digits proceeds as described above. When the incoming and final selections control circuit is seized, ground is placed immediately on lead SY1. This ground is maintained continuously on lead SY1 by the incoming and final selections control circuit regardless of the removal of ground from lead SY by this circuit. This causes the TH, H, T, and U digits to be dialed in rapid succession by the dialing interrupter in the code keys and dial pulsing circuit. The speed of dialing and the time between the dialing of successive digits is such as to test the register control relays in the sender for proper operation. Synchronizing tests are canceled during this test and the incoming and final selections control circuit proceeds with selections as soon as the sender closes the fundamental circuit.

20. RELEASE

20.01 The DP switch advances to position 20 at the completion of coin test, or at the completion of units dialing if coin test is omitted. In position 20 this circuit waits for the sender to ground the TR lead as an indication that the call has been completed. With ground on the TR lead, the TR1 and TR relays operate and lock under control of the C relay. When the incoming and final selections control circuit has completed its part of the test, it grounds the S lead, and the operation of the TR relay extends this ground to terminal 20 of ARC 3 of the DP switch causing the switch to advance to position 21. This path for advancing from position 20 goes through a back contact of relay S to check that the sender has opened the S lead. In position 21, the ADV lead to the connector circuit is grounded, causing that circuit to open the C and G leads, releasing the C and G relays, and restoring the DP switch and all relays to normal. If the TR relay operates falsely during the early part of the test, it opens the fundamental circuit which will block the test circuit. The TR1 and TR relays are slow operating with Y option to guarantee time for operating the district

TR relay before the S and LR leads are opened which might falsely release the OT or TP relay.

21. TEST FOR FALSE OPERATION OF GTT RELAY IN TIMED RELEASE SENDERS ARRANGED FOR COIN TEST

21.01 Under certain trouble conditions, for example, a cross between 4 and 5 top of the CT relay of coin-timed senders, the GTT relay of these senders may be operated falsely at the time the sender CT and CT1 relays are releasing to supply disconnect tone to the calling customer. This would give a false indication that a coin had been deposited and might permit the call to be established without a coin.

21.02 In order to detect this type of trouble the following procedure should be used. Set the test circuit as described for register control test, and in addition, operate the FC key. The circuit operation is the same as for the register control test except that the sender coin test should detect that there is no coin ground present. This should prevent units selection. When the sender times out, disconnect tone will be heard in the test circuit receiver. If the sender GTT relay operates falsely, units selection will be made and the test circuit will automatically advance to the next sender. If the GTT relay does not operate falsely, the CA key should be operated and released to advance the test circuit to the next sender.

22. INTERCHANGEABLE CODE

22.01 General - The interchangeable code feature requires that all digits be received by the sender before the sender can obtain a routing from the marker and close the fundamental for trunk test or office selections. Therefore, no synchronizing tests are made on these types of codes.

(a) When a skip office test call is made, all circuit functions take place during one cycle of the DP selector switch.

(b) When test calls with office selections are made, two cycles of the switch are necessary. Dialing is completed in position 17 of the first cycle of the switch. The switch is then recycled so that office selections may be checked in position 6.

22.02 Preparation - The ICD key of Section -0133 is operated for this test. Ground on the G lead from this circuit is extended through the ICD key of Section -0133 to operate the 7DS relay. The 7DS relay and its auxiliary, the 7DSA relay, prepares the code test circuit to check the sender to marker CC lead information, indicating a 7-digit call, and to check that the sender times 3 to 4 seconds before making the second marker seizure.

(a) In addition, the IOS key of Section -0133 is operated for test calls with office selections. The IOS key operated enables the circuit to recycle the DP switch (see 22.01) without interfering with the functions of the various connecting circuits.

22.03 Skip Office Calls - The progress of the call is the same as a regular full selector skip office test call up to the check of the incoming selections in position 14 of the DP switch. When the incoming and final selections control circuit, Section -0113, is seized, the RC1 relay of that circuit operates. The RC1 relay operated maintains a steady ground on the SY1 lead to operate and hold the SY relay. With the SY relay operated, the TH, H, T, and units digits are dialed into the sender, positions 14 through 17 of the DP switch, without waiting for the checks of the incoming and final selections. After the units digit is dialed the DP switch advances to position 18. In position 18 the SMS relay of Section -0133 operates to start the test of the second marker seizure, as described in Section -0133, 21.03. The operation of the SMS relay releases the ICD relay to advance the DP switch to position 20. After the second marker seizure is completed the sender closes the fundamental and makes trunk test. The test frame advances as described in 20.

22.04 Calls With Office Selections - As described in 21.02, the DP switch makes two cycles and the ICD and IOS keys are operated for this test.

(a) The progress of the call is the same as a regular full selector call with office selections up to position 6 of the DP switch. In position 6 through 12 the office brush and group selections should be checked; however, the sender is waiting for more digits in order to make the second marker seizure and obtain a routing. The operated ICD relay of Section -0133 provides a path from the OB, OG, SB, and SG relays of Section -0113 to the AV lead of this circuit to advance the DP switch to position 13. In position 13 the operated IOS relay of Section -0133 opens the operate path of the SB relay, preventing the seizure of the incoming and final selections control

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circuit at this time, and advances the switch to position 14. When the CD relay operated at the end of the code test, position 5 of the DP switch, a path was provided through the 7DS and IOS relays of Section -0133 to operate the SY relay of this section. With the SY relay operated, the TH, H, T, and U digits are dialed in positions 14 through 17 of the switch and the switch advances to position 18. In position 18 the SMS relay of Section -0133 operates to prepare for the check of the second marker seizure.

(b) The SMS relay and its auxiliary the SMSA relay, perform the following functions in this circuit:

(1) Release the ICD relay which advances the DP switch to position 20.

(2) Opens the C relay ground to the DP4 selector. This prevents premature ground on the RLS lead to Section -0109 and the ADV and ND leads to Section -0105.

(3) Opens the operate path of the SY relay of Section -0105 to prevent redialing the TH, H, T, and U digits during the second cycle of the DP switch.

(4) Opens the C lead to the code test circuit to prevent a second code test attempt.

(5) Advances the DP switch to position 5. The IOS relay operated advanced the switch from position 20 to position 1 to start the second cycle.

(c) The second marker seizure occurs 3 to 4 seconds after the units digit is dialed. Ground on the DC lead from the sender operates the IDA relay of Section -0133. The IDA relay operated releases the IOS relay and advances the DP switch to position 6. With the ICD relay released, the circuit is now ready to check office selections. The sender closes the fundamental. Office selections are checked in positions 6 through 12 of the switch. In position 13, the SB relay operates to seize the incoming and final selections control circuit and advances the switch to position 14. The IDA relay operated and the ICD relay released advances the switch to position 20. The IDA relay also restores the C relay ground to the DP4 selector. In position 20 the circuit waits for the incoming and final selections control circuit to complete its functions and then releases as described in 20.

CIRCUIT UNIT SECTION -0113
INCOMING AND FINAL SELECTIONS CONTROL CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to test the sender for incoming and final selections in conjunction with the other sections of the automatic sender test set.

1.02 This circuit is under the control of the full selector dial pulse control circuit, or the keypulsing control circuit.

1.03 Operate and nonoperate tests are made on the TG and MTG sender relays.

1.04 In conjunction with the full selector dial pulse control circuit or the keypulsing circuit synchronizing tests of the sender are made.

1.05 When the late release full selector class key in the connector circuit is depressed, this circuit simulates the functions of an incoming selector circuit on a call abandoned after the thousands digit has been dialed.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To test the sender TG and MTG relays on their operate and nonoperate current flow values.

3.02 To test that the sender waits for the dialing or pulsing of the proper digit before closing the fundamental circuit.

3.03 To test the sender in conjunction with the route keys and revertive pulsing circuit for incoming and final selections.

3.04 To test the subscriber sender for incoming advance.

3.05 To test that the sender does not introduce a stations delay interval falsely.

3.06 To test that the customer is released promptly on an abandoned call.

3.07 To return to normal when released by the full selector dial pulse control circuit.

3.08 To permit all digits to be dialed into the sender before making incoming and final selections when testing an interchangeable code.

KEYS

3.09 Key MTG - When this key is operated, the circuit tests the MTG relay in the sender for nonoperate and for operate. When the key is normal, the TG relay is tested.

3.10 Key XB SY - This key must be normal for "panel" tests and operated for all "crossbar" tests.

3.11 Key ORR - Special - When this key is operated, the sender is tested for properly rerouting calls for code "OFF-9300."

LAMPS

3.12 Lamp MTG-OPR - This lamp lights during the operate test of the MTG relay in the sender.

3.13 Lamp MTG-NO - This lamp lights when the sender MTG relay fails to meet its nonoperate test.

3.14 Lamp IA - This lamp lights during the incoming advance test.

3.15 Lamp S - This lamp lights if the sender closes the fundamental too soon or too late.

3.16 Lamp ORR - Special - This lamp lights during official reroute test.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit	-0102
(b) Code Keys and Dial Pulsing Circuit	-0105
(c) Route Keys and Revertive Pulsing Circuit	-0108
(d) Full Selector Dial Pulse Control Circuit	-0111

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(e) Overflow Control Circuit for Subscriber Senders -0119

(f) Keypulsing Circuit -0123

(g) Office Selection Control Circuit for Keypulsing Sender -0125

(h) Code Test Circuit -0133

(i) AMA Check Circuit -0135

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TESTING SUBSCRIBER SENDERS

5. SEIZURE

5.01 This circuit is controlled by the Full Selector Dial Pulse Control Circuit -0111 over leads C and G. When lead C is grounded (13, 14 of -0111), relay IP operates. When lead G is grounded, relay G operates. The operation of these relays advances the selections progress switch SP to position 1.

6. SYNCHRONIZING TEST FOR THOUSANDS DIGIT (PANEL CALL)

6.01 (See 3 C, Section -0101 for crossbar detail). In position 1 of the SP switch the SY relay operates which closes the SY lead from the Full Selector Dial Pulse Control Circuit -0111 to the winding of relay SY1. Ground on the SY lead from the full selector dial pulse control circuit operates relay SY1 which in turn operates relay SY2. Relay SY1 locks to the SY lead. Relay SY2 locks to ground on the front contact of the SY relay. Relay SY2 operated, closes the fundamental tip through the winding of TTG relay - MTG key normal - 15,000 ohms resistance and the winding of the TC relay to battery. The operation of the SY relay grounds lead FR3 to the route keys and revertive pulsing circuit which connects compensating resistance to the FR1 lead over the FR lead to the full selector dial pulse control circuit and through that circuit to the sender. The operation of relay SY2 closes ground on lead SY1 to the full selector dial pulse control circuit causing that circuit to proceed with the dialing of the thousands digit (14. -0111). During the dialing of the thousands digit*, if the sender falsely closes the fundamental circuit, relay TC operates followed by relay TC1 which locks and operates relay S. After the thousands digit is dialed, the full selector dial pulse control circuit removes ground from the SY lead releasing relay SY1. If the sender has falsely closed the fundamental and the S relay is operated, the further advance of this circuit is prevented, and the S lamp lights. The release of the SY1 relay opens SY1 lead which prevents the dialing of any further digits at this time.

*If the number of pulses in the digit and the pulsing speed are such that the length of the digit is very short, the sender may not have time to falsely close the fundamental even though a trouble exists in the sender. To make this test for false closure most effective, therefore, a high number and slow pulsing speed should be used. This also applies to synchronizing for other digits covered in subsequent paragraphs.

7. TG RELAY TEST AND TEST FOR UNDUE DELAY IN TRUNK CLOSURE

7.01 During synchronizing tests if the sender does not close the fundamental falsely, relay S will not be operated. The release of relay SY1 permits the operation of the counting relays N, N1, N2, N3, and N4 from the interrupter SY. The sender should close the fundamental and operate relays TC and TC1 before relay N4 operates. If TC1 relay is not operated by the time relay N4 operates, relay S is operated which lights the S lamp and blocks the further progress of this circuit. The TTG relay is marginal and does not operate when the sender first closes the fundamental. The current flow in the fundamental circuit is an operate test on the TG relay in the sender. By grounding lead FR3 instead of lead FR2 to the route keys and revertive pulsing circuit, the sum of the compensating resistances in the sender and test circuit is made 900 ohms for TG test, even though this sum is 1600 ohms for selections. The TG relay in the sender should operate and advance the sender which reduces the resistance of the fundamental circuit so that relay TTG in this circuit will operate. If the relay TG has not operated by the time the third pulse is received from the interrupter, relay N4 will have operated and the path for advancing the SP switch will be open. If the sender TG relay operates and the resistance of the fundamental circuit is reduced before the operation of relay N4, the TTG relay operates which advances the SP switch to position 2. The advance of the SP switch to position 2 releases relay SY and the other relays associated with the TG test. On the above tests the current flow is too small to operate the sender STP relay.

8. MTG RELAY TEST

8.01 An office code which causes the sender to use its MTG relay must be dialed. Register control test, as described later, cannot be made at the same time as this test. With the MTG key operated, the sender MTG relay is first tested for nonoperate and then for operate on its test current values. If relay S has not operated during the synchronizing test, the release of relay SY1 closes the interrupter path to the N, N1, N2, N3, and N4 counting relays as before. Relays TC and TC1 should operate before relay N4 operates thus indicating that the sender has closed the fundamental promptly. The current flow in the fundamental circuit is a nonoperate test on the MTG relay in the sender. If the sender MTG relay falsely operates before relay N4 is operated by the interrupter, the resistance of the fundamental circuit is reduced which allows relay MTG1 to operate. Relay MTG1 operates relay BK. Relay BK locks and opens the path for advancing the SP switch from position 1. When relay N4 operates from the interrupter, the MTG1 relay is shunted by 7635 ohms which increases the current flow in the fundamental circuit to an operate test on the MTG relay. The operation of the sender MTG relay reduces the resistance on the fundamental circuit permitting the test circuit MTG1 relay to operate. The operation of the MTG1 relay advances the SP switch from position 1. The SY relay and other relays associated with the synchronizing and MTG relay test are released. On the above tests the current flow is too small to operate the sender STP relay.

9. INCOMING BRUSH SELECTION

9.01 Assume that the full selector class key in the connector circuit is operated and that the XB SY key of this circuit is normal for panel tests. The release of relay SY, when the SP switch advances from position 1, opens the SY lead which prevents further dialing at this time. With the SP switch in position 2, lead IB to the route keys and revertive pulsing circuit is grounded which causes that circuit to close the fundamental circuit to the sender. When the sender closes the fundamental circuit to route keys and revertive pulsing circuit, it checks the sender for incoming brush selection. If no trouble is found, the route keys and revertive pulsing circuit grounds lead AV which advances the SP switch to position 3.

10. SYNCHRONIZING FOR HUNDREDS DIGIT

10.01 In position 3 of the SP switch, the SY3 relay operates which closes the SY lead from the full selector dial pulse control circuit to the winding of the SY1 relay which operates. Relay SY1 operates relay SY2 which closes ground on the SY1 lead to the full selector dial control circuit, causing that circuit to dial the hundreds digit. The operation of the SY2 relay closes the FT lead to battery through the TC relay. If during the dialing of the hundreds digit, the sender falsely closes the fundamental circuit, the operation of the TC and TC1 relays operates relay S which locks and opens the path for advancing the SP switch from position 3. If the sender does not close the fundamental falsely, the completion of the dialing of the hundreds digit by the full selector dial control circuit removes ground from the SY lead releasing relay SY1 which connects the interrupter to the N- relays. If the fundamental is not closed by the time relay N4 operates, relay S is operated which blocks the test.

If the sender closes the fundamental promptly, the operation of the TC1 relay advances the SP switch to position 4. The resistance in the fundamental for this test is sufficient to prevent the operation of the STP relay in the sender.

11. INCOMING GROUP SELECTION

11.01 The check of incoming group selection is made in position 5 of the SP switch in the same manner as incoming brush selection, and the SP switch advances to position 6. Position 6 is a passby to permit the relays in the route keys and revertive pulsing circuit to release. When these relays release, lead AV1 is grounded advancing the SP switch to position 7.

12. FINAL BRUSH SELECTION

12.01 The check of final brush selection is made in position 7 and the SP switch advances to position 8.

13. SYNCHRONIZING FOR TENS DIGIT

13.01 The synchronizing test for the tens digit is accomplished in position 8 in the same manner as the synchronizing for the hundreds digit, and the SP switch advances to position 9.

14. FINAL TENS SELECTION

14.01 The check for final tens selection is made in position 9, and the SP switch advances to position 10.

15. SYNCHRONIZING FOR FINAL UNITS SELECTION AND CHECK FOR FALSE STATION DELAY

15.01 In position 10, the test for synchronizing of units digit is accomplished in the same manner as for the hundreds and tens digits and the SP switch advances to position 11. The timing for fundamental closure ensures that the sender does not introduce the station delay interval falsely. Synchronizing for final units is canceled with 4-line AMA calls, and all synchronizing is canceled with trouble release tests.

16. FINAL UNITS SELECTION

16.01 The check of final units selection is made in position 11, and the SP switch advances to position 12 in the same manner as for previous selections. The switch advances from position 12 by ground on lead AV1.

17. INCOMING ADVANCE

17.01 In position 13, relay IA1 operates operating relay IA which locks. The operation of relay IA reverses the FT and FR leads and grounds lead L1 to the route keys and revertive pulsing circuit. This causes battery through L to be returned on the fundamental ring, and ground on the fundamental tip to the sender. When the sender closes the fundamental circuit, the route keys and revertive pulsing circuit functions to ground lead AV2 which operates relay IA2 and advances the SP switch to position 14 and releases the IA1 relay. The SP switch is advanced to position 15 through back contacts of the IA1 and IA3 relays. If the L relay -0108 releases prematurely, opening AV2 and allowing the IA3 to operate before IA1 releases, the switch blocks in position 14. In position 15, relay F1 operates. The operation of relay F1, opens the fundamental circuit permitting the sender to advance, and connects ground over the S lead to the full selector dial pulse control circuit.

18. SYNCHRONIZING ON CROSSBAR CALLS

18.01 (See 3 C, Section -0101). If the office code dialed corresponds to a crossbar office, the fundamental should not be closed for TG test until after the hundreds digit has been dialed. Then incoming selections and final brush selection are made. The synchronizing for tens and units is the same as for a panel call. The XB-SY key is operated for all calls to crossbar. The XB-SY key operated, grounds lead SY2 to the full selector dial pulse control circuit to signal that circuit that the office code is of the crossbar class and provides an operating circuit for the RC KP relay in positions 1 to 7. The thousands digit is dialed without waiting for this circuit to ground the SY1 lead, but hundreds digit is held up until the SY, SY1, and SY2 relays operate and ground the SY1 lead in position 1 of the SP switch. A test is made to see that the fundamental circuit is not closed until after the hundreds digit has been dialed, as indicated by the release of the SY1 relay. The details of this operation are described above. Incoming brush, incoming group, and final brush selections are checked as usual, the SP switch advancing through the intermediate positions 3 and 6, due to ground on the AV1 lead with the RC relay operated. In position 8, the SY3 relay operates and tens and units are checked as described above.

19. RELEASE

19.01 The advance of the Full Selector Dial Pulse Control Circuit, Section -0111, due to ground on the S lead causes that circuit to open leads C and G which permits this circuit to return to normal. This circuit cannot be reseized until the switch has returned to normal.

20. REGISTER CONTROL TEST - CLASS KEY 2

20.01 The 26 PPS MAX. BR key should be operated and the XB-SY key normal for this test. With class key 2 operated, relay RC1 operates after relay IP operates. The test proceeds as described above up to the time of the operation of the SY2 relay. When relay SY2 operates, relay RC operates and locks. Relay RC operated, cancels synchronizing tests for the H, T, and U digits and advances the SP switch over these synchronizing positions. The operation of relay RC causes the full selector dial pulse control circuit to dial all the numerical digits in rapid succession as a test of the register control functions of the sender.

21. LATE RELEASE FULL SELECTOR TEST, KEY 3 OPERATED, XB-XY AND AR KEYS NORMAL (AMA AND 2L KEYS OPERATED FOR AMA TESTS)

21.01 If the late release full selector class key is depressed, the WO relay operates from a ground supplied over the WO lead from the class key. The SP switch is advanced to position 1, and the synchronizing test and dialing of the thousands digit are made as described above. The test on the TG or MTG relays in the sender is made as described above with the following addition. The WO3 relay operates and locks when relays WO and SY2 have operated, relay SY1 has released, and the SY interrupter closes its F contact. When the interrupter closes its B contact, the N relay operates, and when the B contact opens, the N1 relay operates. There is a delay then from the dialing of the TH digit until the N1 relay operates, and this delay is to allow the sender time to lock in the TH digit. When the N1 relay operates, ground is connected over the N lead to the code keys and dial pulsing circuit, which causes that circuit to open the dialing tip and ring to the sender. The sender should register a release condition within a short interval, which causes the full selector dial pulse circuit to ground lead LR to this circuit. The grounding of lead LR operates relay WO2 through break-contacts on relay N3. If the LR lead is not grounded, and relay WO2 not operated by the time that relay N3 operates, the circuit will block, thus indicating a failure of the sender to record the wipe-out within approximately 0.6 to 1.7 seconds from the time the call is abandoned. With relay WO2 operated the SP switch advances to position 2 after TG or MTG test is finished. The release condition in the sender should cause the sender to send the incoming selector to tell-tale. This condition is tested by this circuit in conjunction with the Route Keys and Revertive Pulsing Circuit, Section -0108. In position 2 this circuit waits for ground on the AV3 lead from the route keys and revertive pulsing circuit. The route keys and revertive pulsing circuit attempt to check the sender for incoming brush selection. The sender, however, should not be satisfied by these pulses sent by the route keys and revertive pulsing circuit, and therefore should not open the fundamental. If the sender does not open the fundamental circuit, the route keys and revertive pulsing circuit grounds lead AV3 which operates relay WO1 in this circuit. The WO1 relay locks, opens the fundamental circuit, and advances the SP switch from position 2 to position 12. When testing AMA senders, the 2L and AMA keys are operated. These keys provide a path through their make-contacts to advance the SP selector from position 10 to position 12. The switch advances from position 12 by ground on lead AV1. In positions 13 and 14 incoming advance test is made as before. The operation of relay F1 in position 15 opens the fundamental circuit and closes ground on the S lead which advances the full selector dial pulse control circuit. The release of this circuit occurs as described above.

21.02 When testing AMA senders that terminate calls in a panel office, the time for the operation of the N- relays is extended by the use of option VP. Option VP extends the senders time to record the wipe-out to 1.7 to 2.7 seconds before the test circuit will block.

21.03 The WO2 relay can now operate after the N3 relay operates, through a path traced through the back contact of the N6 relay. If the LR lead is not grounded, and relay WO2 not operated by the time that relay N6 operates, the circuit will block. This indicates a failure of the sender to wipe out within approximately 1.7 to 2.7 seconds from the time the call is abandoned.

22. OFFICIAL REROUTE TEST, SUB, OR KP SPL

22.01 The senders may be arranged to reroute calls for code "OFF-9300" and in this case M apparatus and wiring will be furnished. To provide this reroute arrangement, the senders have a circuit from the back contact of the OF relay through a contact on the SG5 relay and through the hundreds digit 3 register to the contact of the STP relay. This test ensures that this circuit is properly closed when it should be closed, or is open when it should be open.

22.02 Class key 1 and ORR key operated - code OFF-9300. This test should be made during light load periods because it causes the sender to call for a marker three times.

22.03 This circuit is seized with selector SP in position 2.2. With the ORR key operated and the XB-SY key normal, the ORR relay operates under control of the IP relay. The test advances normally to trunk test. Since the path for operating the counting relays in the sender is made ineffective, the test circuit proceeds to send ten pulses for incoming brush (the operation of the ORR relay has closed the path for operating the 9 counting relay in Section -0108). On the tenth pulse, the B01 relay in -0108 is operated and grounds the AV3 lead to this section operating the ORR2 relay. This relay first closes a path for holding the L relay -0108 and then operates the ORR1 relay. The operation of the ORR1 relay restores the code test circuit to normal to ensure that no false grounds will be connected to the receiving leads when a KP sender reseizes a marker as described below. The ORR2 relay then releases removing the ground that was holding the L relay and with the ORR1 relay operated reverse battery is sent to the sender. The ORR2 relay is slow-release to ensure holding the L relay as the ORR1 relay operated reversing the fundamental. This operates the sender OF relay, which should cause the fundamental circuit in the sender to open and the L relay of the test circuit to release. The release of the B01 relay grounds the AV1 lead to this section which advances the SP switch to position 1. In this position the ORR relay releases again closing reverse battery to the sender. The sender then calls for a second marker. The ORR relay releasing with the ORR1 operated connects ground to the LU lead to the code test circuit. This is for the purpose of operating the CKG relay in that section and prevents the marker breaking the extra load of the test circuit relays on code check. After the second trial release from the marker, the sender again receives reverse battery from the test circuit. The sender proceeds to make connection to a marker for a third trial and again receives reverse battery from the test circuit. After the third trial release, the sender will advance and open the S lead. The S relay of the connector circuit will operate and connect ground to the ADV lead. The connector then proceeds to release the sender.

22.04 If the path in the sender that causes the STP relay to be ineffective is not closed as it should be on this class of test, the sender will open the fundamental circuit after five incoming brush selection pulses have been received. The B01 relay -0108 will not have been operated. This path for connecting the ORR2 relay will not be closed and the test circuit will block. The PL-LP key when operated will light the 9-5 pulse lamps under this condition. The ORR lamp will also be lighted.

22.05 If the sender fails to open the fundamental on receipt of reverse battery, the L relay will not release and the test will block with the ORR lamp lighted.

22.06 If the path in the sender that makes the STP relay contact ineffective is falsely closed, this condition will be detected on a regular test because it will cause the fundamental to remain closed after the required number of pulses have been sent. The senders should be tested, therefore, with codes other than OFF but with the numericals 9300. The senders should also be tested with the codes OFF-9100 and keypulsing senders also tested with code OFF-9200.

22.07 To test the sender for properly setting up a connection to the reroute group of trunks, the code OFF-9300 should be used with the test circuit AR key operated. On this class of test, the marker, on first seizure by the sender under test, will be given a trouble release signal as is outlined under Alternate Route Test, Section -0133. The sender, after receiving the trouble release signal, will make connection to a second marker and the route relay corresponding to the reroute group of trunks responding to the reroute group of trunks will be operated. The sender SG5 relay will not be operated, however, from this route relay, and the test should proceed in a normal manner.

TESTING KEYPULSING "A" SWITCHBOARD SENDERS

23. SEIZURE

23.01 For tests on keypulsing senders, this circuit is seized by operating relays IP and G over leads C and G from the office selection control circuit for keypulsing senders. Lead KP is also grounded by the office selection control circuit operating relay KP which remains operated during the

tests. The operation of the IP and G relays advances the SP switch to position 1.

24. SYNCHRONIZING TEST FOR PULSING OF NUMERICAL DIGITS

24.01 The operation of the circuit for this test is similar to that for subscriber senders except that the SY and SY1 leads are connected to the keypulsing circuits. The keypulsing circuit grounds lead SY which operates relay SY1 in turn operating relay SY2. Relay SY2 operates relay RC from ground at the operated KP relay. The SY lead is grounded causing the keypulsing circuit to pulse the thousands, hundreds, tens, and units digits. The KP circuit then opens the lead SY which permits this circuit to proceed with the TG tests providing the sender has not closed the fundamental falsely up to this time. After the keypulsing circuit has pulsed the start signal, the sender closes the fundamental for TG test.

25. TG AND MTG RELAY TESTS AND TEST FOR UNDUE DELAY IN TRUNK CLOSURE

25.01 These tests are performed in the same manner as described above for subscriber senders.

26. INCOMING BRUSH, INCOMING GROUP, FINAL BRUSH, FINAL TENS, AND FINAL UNITS SELECTIONS

26.01 The test of these selections is performed in the same manner as described above for subscriber senders. The synchronizing positions for hundreds, tens, and units digits are passed by since the RC relay is operated.

26.02 When incoming brush selection has been completed, the AV1 lead from the route keys and revertive pulse circuit is grounded. With the RC relay operated, the SP switch is advanced to position 4. The switch stays in this position until the KR lead is grounded by the keypulsing circuit as a signal that the Key Release Test has been made. If this test should fail, the KR lamp -0109 stays lit.

27. INCOMING ADVANCE

27.01 The test of incoming advance is performed in the same manner as described above for a call on a subscriber sender. When relay F1 operates, lead AV is grounded to the office selections control circuit which causes that circuit to proceed with the further testing of the call.

28. LATE RELEASE FULL SELECTOR TEST

28.01 The WO relay operates from the class key. The SP switch advances to position 1 where the SY relay operates. The closing of leads SY and SY1 to the keypulsing circuit causes that circuit to pulse the thousands digit. After pulsing the thousands digit, the keypulsing circuit opens lead SY which permits the test to proceed. The sender should close the fundamental for trunk test immediately. If this closure does not take place by the time relay N4 operates, relay S operates blocking the advance of this circuit. The operation of the N relay grounds the WO lead to the office selection control circuit which causes a release condition in the sender. The operation of the N relay also supplies ground to the advancing circuit, -0125, on this class of test, to delay advancing from position 1 until the wipe-out signal has been passed. The sender should function to send the incoming selector to tell-tale. This condition is tested in the same manner as described for subscriber senders. Incoming advance test is performed in positions 13 and 14, and the switch advances to position 15. The grounding of the AV lead in position 15 causes the advance of the office selection control circuit as above.

29. OFFICIAL REROUTE TESTS

29.01 The tests of keypulsing senders for properly functioning on reroute are as outlined for subscriber senders under 22.

30. SGT OPERATE TEST

30.01 This test is similar to a full selector test except that in the final units position the full selector dial pulse control circuit operates the sender SGT relay. When the full selector unit is satisfied that the SGT has operated, lead FUPB is grounded causing the incoming and final selections unit to pass by final units position 11. In 13 and 14 a momentary reverse battery is sent to the sender in the usual way simulating tell-tale. This circuit then releases in the normal way.

31. INTERCHANGEABLE CODE

31.01 This feature requires that all digits be dialed into the sender before the sender can make a second marker seizure and advance to close the fundamental for trunk test or office selections.

31.02 When this circuit is seized, the RC1 relay operates through the bottom 1 and 2 contacts of the IP relay to ground on

the RC lead from the code test circuit, Section -0133. The RC1 relay maintains a steady ground on the SY1 lead to the Full Selector Dial Pulse Control Circuit, Section -0111. The SY relay of Section -0111 operates and holds, causing all digits to be dialed without waiting for synchronizing checks by this circuit.

CIRCUIT UNIT SECTION -0115
PCI DIAL PULSE CONTROL CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to function in connection with the other sections of the automatic test circuit.

1.02 This circuit controls the dialing of the code and number during the test of a PCI class of call on subscriber senders.

1.03 The full selector dial pulse control circuit controls the dialing of the code and number during the test of a full selector class of call.

1.04 The auxiliary sender dial pulse and code check control circuit controls the dialing of the code and number during the test of an MF class of call.

1.05 This circuit is arranged to test the sender for the station delay feature and for waiting for the dialing of all digits and deposit of a coin before trunk test.

1.06 In conjunction with the route keys and revertive pulsing circuit, the sender is tested for office selections.

1.07 This circuit is arranged to check the ability of the sender to control the district over the S, LR, and TR leads.

1.08 This circuit is arranged for making late release PCI class tests.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To control the dialing of the code and number of a PCI call in conjunction with the code keys and dial pulsing circuit.

3.02 To test the sender for delaying trunk test until all digits are dialed.

3.03 To test that the sender waits at least 2 seconds for the dialing of a fifth numerical digit when this is required.

3.04 To test that the sender waits maximum of 6 seconds for the dialing of a fifth numerical digit.

3.05 To test that the sender advances immediately for trunk closure when station delay is not required.

3.06 To test that the sender makes coin test in case a coin sender is being tested, and waits at least 1.5 seconds for the coin to be deposited.

3.07 To maintain the continuous test of the S and LR leads for false opens.

3.08 To control the checking of office selections by the route keys and revertive pulsing circuit.

3.09 To block in case of operation of the test set alarm. The blocking of this circuit also blocks the associated test circuits.

3.10 To make wipe-out tests.

3.11 To check that the TR lead is closed at the end of the test and not before the end of the test.

3.12 To test PCI office codes which are interchangeable area and office codes.

KEYS

3.13 Station Delay Key (SD-OFR) - The SD key is operated when testing a call which requires that the sender wait for the possible dialing of a fifth numerical digit.

3.14 Coin Key (CN-BTI) - The coin key is operated to test the ability of the coin sender to delay the TG test until a coin is deposited.

LAMPS

3.15 SD Lamp - If the sender fails on station delay test, this lamp lights.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit -0102

(b) Code Keys or Switches and Dial Pulsing Circuit -0105

(c) Route Keys and Revertive Pulsing Circuit -0108

(d) PCI Register Circuit -0117

(e) Code Test Circuit -0133

DESCRIPTION OF OPERATION

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5. SEIZURE

5.01 When this circuit is seized by the connector circuit, the C and G leads are grounded. The C lead, being grounded, operates the G relay through the normal position of the SP switch. The C relay operated, locks directly to the C lead, closes leads S, LR, T, R, FT, and FR, and operates the G and DP relays. The DP relay operated, locks and advances the DP switch to position 1.

6. DIALING THE A CODE DIGIT

6.01 When the associated subscriber senders are arranged to record a prefix digit before the office code, a PDGO, PDG1, or 1-1 key in the code keys and dial pulse control circuit is furnished. When one of these keys is operated and the DP switch is advanced to position 1, grounding the A lead, the dial pulse relays proceed to transmit the prefix 0 (PDGO key operated), 1 (PDG1 key operated), or 1-1 (1-1 key operated) to the sender before transmitting the regular A digit as is outlined in Section -0105, code keys and dial pulsing circuit.

6.02 With the DP switch is position 1, ground is supplied over the A lead to the code keys and dial pulsing circuit. This causes the A digit to be dialed in accordance with the setting of the A row of keys in that circuit. While this digit is being dialed, the AV lead is grounded, energizing the DP switch magnet. At the completion of the dialing of the A digit the AV lead is opened and the DP switch advances to position 2.

7. DIALING OF THE B AND C CODE DIGITS

7.01 In position 2, the B lead is grounded, the B digit is dialed, and the DP switch advances to position 3. In position 3, the C digit is dialed in a like manner, and the switch is advanced to position 4. Since the TO relay is normal, the DP switch advances immediately from position 4 to position 5.

7.02 On 2-stage PCI class calls, the TS-PCI key in -0117 will be operated. The DP switch remains in position 4 waiting for the PCI register circuit to check that the sender transmits the PCI pulses for the office code without waiting for the numerical digits to be dialed as is outlined in Section -0117. When the prefix 1-1 and the office code digits have been dialed, the code check and office selections, if there are any, take place as is outlined later. When the office code PCI pulses are received by the PCI register circuit, -0117, that circuit grounds the ADV lead advancing the DP switch to position 5. The circuit then continues as on a regular basis.

8. DIALING THE FIRST NUMERICAL DIGIT

8.01 If the number to be dialed is less than 10,000, the OT relay will be normal, connecting terminal 5 of arc 4 to the TH lead, causing the thousands digit to be dialed. If the number to be dialed is over 10,000, the number 5 terminal will be connected through a front contact of the OT relay to the STA lead causing the digit registered on the stations row of keys to be dialed. This digit will always be 1. The dialing of this first numerical digit causes the DP switch to advance to position 6.

9. DIALING THE SECOND NUMERICAL DIGIT

9.01 In position 6, either the hundreds or thousands digit is dialed depending upon the position of the OT relay, and the switch is advanced to position 7.

10. DIALING THE OTHER NUMERICAL DIGITS

10.01 In position 7, either the tens or hundreds digit is dialed in the usual manner and the switch is advanced to position 8. In position 8, the circuit for causing the next numerical digit to be dialed is held open by a front contact of the SY relay. This relay is operated as described below when the PCI register circuit is ready for TG testing.

11. CODE CHECK

11.01 As soon as a third digit has been dialed, the sender under test connects itself to a marker in order to make translation. The information which the sender transmits to the marker is checked by means of the code test circuit. This code test circuit is seized when the C relay of this circuit operates in position 22 of the SP switch. In this position the C and G leads to the code test circuit are grounded, causing that circuit to check the information transmitted by the sender to the decoder. While this check is in progress, the code test circuit grounds the CF lead which operates the LK relay. At the completion of the code test, the code test circuit grounds the AV lead which operates the CD relay. The CD relay operated locks under control of the C relay, advances the SP switch to position 1, and opens the operating circuit of the LK and S relays.

12. CHECK OF THE S AND LR LEAD CONTROLS

12.01 The S and LR leads are grounded by the sender, operating the S relay and providing a locking circuit for the LK relay. Both of these leads should remain grounded until the end of the test. If either lead is opened falsely, the corresponding relay will release and open the operating circuit of the TR relay which will cause the SP switch to block in position 13.

13. OFFICE BRUSH SELECTION

13.01 In position 1 of the SP switch, lead OB to the route keys and revertive pulsing circuit is grounded. This causes the office brush selection to be checked. If the check is satisfactory, lead AV from the route keys and revertive pulsing circuit is grounded, advancing the SP switch to position 2. After certain relays in the route keys and revertive pulsing circuit have restored to normal, lead AV1 is grounded, advancing the SP switch to position 3.

14. OFFICE GROUP SELECTION

14.01 In position 3 and 4, office group selection is checked in the manner described for office brush selection.

15. SKIP OFFICE

15.01 Two keys, SO and SSO, are provided in the route keys and revertive pulsing circuit to cause the SP switch to pass by the office positions, 1 to 4, or the second office positions, 5 to 7, or both by grounds on leads AV and AV1.

16. SELECTIONS BEYOND OFFICE

16.01 Positions 8, 9, 10, and 11 are always passed by, due to a ground on the AV1 lead from the route keys and revertive pulsing circuit. In position 12, the SB relay operates. The SB relay operated, locks under control of the C relay, transfers the fundamental tip and ring to the PCI register circuit, and supplies a ground over the C and G leads to the PCI register circuit.

17. SYNCHRONIZING THE SENDER FOR TRUNK TEST

17.01 When the PCI register circuit is ready for trunk guard test, it

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connects ground to the SY lead, operating the SY relay. The SY relay operated, connects ground from a terminal of the DP switch in position 8, to the lead corresponding to the next numerical digit to be dialed. With the OT relay normal, this will be the units digit; with the OT relay operated, the tens digit. At this time the TG lead from the PCI register circuit is connected to the BK relay winding. If the trunk guard circuit of the sender is closed prematurely, it will cause the PCI register to ground the TG lead, thus operating the BK relay which locks and blocks the test circuit.

18. TEST OF NO STATIONS DELAY BY THE SENDER - SD KEY NORMAL, ZERO STATION KEY OPERATED

18.01 With the SD key normal, the call is one for which the sender should not wait for the dialing of a fifth numerical digit, and the sender should close the fundamental circuit within a short interval after the units digit has been dialed. When the code keys and dial pulsing circuit finishes the dialing of the units digit, the DP switch steps to position 9. This operates relay T and grounds the CNT lead to the code keys and dial pulse circuit operating the CT relay in that circuit. The T relay locks under control of relay T1 and transfers the TG lead from the winding of the BK relay to the winding of the AV relay. The stepping magnet DP is connected to the SD interrupter contact whose pulse cycle is 0.5 second (0.3 second make, 0.2 second break). The interrupter steps the DP switch to position 14 which requires 2 seconds minimum, 2.5 seconds maximum. During the time the DP switch is being advanced from position 9 to position 14, the sender should advance causing the PCI register circuit to close ground on the TG lead. This operates relay AV which grounds lead TG1 to the PCI register circuit, causing that circuit to proceed with the test. If the sender does not advance and close the fundamental by the time that the T1 relay is operated, the circuit to the SD lamp will be closed, relay T will be released, and the TG lead connected again to the winding of the BK relay. The closure of the fundamental by the sender will then operate BK which will block further progress of the test. If this test is being made on a coin sender, ground is supplied from the connector circuit over the CN lead, through the CN key normal, and a 1000-ohm resistor to the CN lead which connects to the dialing tip in the code keys and dial pulsing circuit. This causes the coin test relays in the sender to function and advance the sender for trunk closure. The grounding of the TG1 lead causes the PCI register circuit to remove the test for false trunk closure and proceed with the test.

19. TEST OF STATIONS DELAY FEATURE OF THE SENDER - SD KEY OPERATED

19.01 With the SD key operated, this circuit tests that the sender waits the proper interval for the dialing of a fifth numerical digit. The test is made under two conditions:

(a) When no fifth digit is dialed.

(b) When the fifth digit is dialed.

19.02 Test of Stations Delay When No Fifth Digit Is Dialed - SD Key Operated - Zero Stations Key Operated - When the call is one on which the sender should wait for a fifth numerical digit but the digit is not dialed, ground is placed on lead NFD by the zero stations key in the code keys and dial pulsing circuit. This operates relay NFD and prevents the operation of relay SD. When lead SY is grounded, operating the SY relay, and the units digit is dialed, the DP switch is advanced by the interrupter contact to position 14 as before. During this time, 2 seconds minimum, 2.5 seconds maximum, if the sender falsely closes the fundamental circuit, relay BK will operate over the TG lead thus blocking progress of the test. In position 14, relay T operates, which transfers the TG lead to the AV relay. Relay T locks to relay T1. The interrupter continues to step the DP switch and after 5.5 seconds minimum, 6 seconds maximum from the time the dialing of the last digit was completed, the switch reaches position 21. Relay T1 operates in position 21, releasing relay T. The sender should advance and close the fundamental, operating relay AV before the switch reaches position 21. If the AV relay is not operated by the time relay T releases, the TG lead is transferred back to the winding of the BK relay.

19.03 Test of Stations Delay When a Fifth Digit Is Dialed - SD Key Operated - Party Letter or Station Key 1 Operated - In this case the SD relay is operated, but the NFD relay does not operate. The fifth digit is dialed and a test is made that the sender advances immediately for trunk test. After the dialing of the units or tens digit, the DP switch is stepped to

position 9 where the stations or units digit is dialed. The stations digit is dialed in case the number is less than 10,000. The units digit is dialed in case the number is over 10,000. During this time the TG lead is connected to the winding of the BK relay. Should the sender advance falsely and close the fundamental, the operation of the BK relay blocks progress of the test.

19.04 At the finish of the dialing of the stations or units digit, the DP switch is advanced to position 10 grounding CNT lead to the code keys and dial pulse circuit operating the CT relay in that circuit. The T relay operates in that circuit. The T relay operates in position 10, transferring the TG lead to the AV relay. The sender should close the fundamental before the DP switch reaches position 14. The time allowed for the sender to close the fundamental is 1.5 seconds minimum, 2 seconds maximum. In position 14, relay T1 operates, releasing relay T and reclosing the TG lead to the BK relay. If the above tests are made on a coin sender, the dialing tip is grounded through 1000 ohms as described above.

20. TEST OF COIN FEATURE - CN KEY OPERATED - SD KEY NORMAL - ZERO STATION KEY OPERATED

20.01 In order to test the ability of a coin sender to delay TG test until a coin has been deposited, the CN key is operated. The office code dialed should be one which does not require the sender to await a stations or fifth numerical digit. If no such code is available, use a code requiring a station digit and depress a stations key and the SD key. This will change the timing for false trunk closure, as is described later in this paragraph, from 1.5 to 2 seconds to 1 to 1.5 seconds. The operation of the CN key transfers the lamp lead from the SD lamp to the coin lamp in the code keys and dial pulsing circuit, and also closes a circuit for operating the CN relay when the connector circuit closes the CN lead. When the code keys and dial pulsing circuit finishes dialing the units digit, the DP switch steps to position 9 and the CNT lead to the code keys and dial pulsing circuit is grounded operating the CT relay in that circuit. However, the interrupter cannot advance the switch from position 9 until the coin battery closes, operating the CT relay in this circuit. With the CT relay operated, the switch steps to position 13 under control of the interrupter, where the T relay operates and locks. The interval from the operation of the CT to the operation of the T relay is 1.5 seconds minimum, 2 seconds maximum. If the sender closes the fundamental during this time, the PCI register circuit grounds the TG lead, operating the BK relay which blocks the test. Also during this time (1.5 to 2 seconds) the CT1 relay in the code keys and dial pulse circuit has been operated, placing 1200 ohms in the T and R leads to the sender, and the sender CLR relay must hold over this loop resistance or the sender will be prematurely released causing the test circuit to block. The operation of the T relay short-circuits the B and C resistors and the CT relay winding, thus permitting the operation of the coin relays in the sender. The sender should then close the fundamental causing the TG lead to be grounded and operating the AV relay. If the sender does not close the fundamental by the time the DP switch has reached position 21 (additional 4 seconds), the T1 relay will operate, light the coin lamp, and release the T relay, thereby preventing subsequent operation of the AV relay.

21. THREE-DIGIT TANDEM OPERATOR CALL - CN KEY NORMAL - ZERO TH, H, T, U, AND STATION KEYS OPERATED

21.01 When a test of the 3-digit tandem operator call is to be made, the TO relay operates over the TO lead from the connector circuit. The DP switch advances to position 4 after dialing the 3-digit tandem operator code. In position 4, the AV relay operates which grounds the TG1 lead and advances the PCI register circuit. If this test is being made on a coin sender, the operation of the TO relay connects 1000-ohm ground to the dialing tip to satisfy the coin test. The CNT lead is also grounded operating the CT relay in the code keys and dial pulse circuit.

22. FAST ASSIGNMENT AND SLOW ASSIGNMENT

22.01 The PCI register circuit is arranged to test the sender for either slow or fast assignment under control of a key. A thorough check for station delay and coin condition cannot be made at the same time as fast assignment. The CN key should be normal and the code and numerical digits should be such that the sender does not wait for additional digits. If the code requires a stations digit, one should be dialed so that the sender will quickly

close its TG circuit and not wait for stations delay timing. When the fast assignment test is to be made, the TG lead is opened by the PCI register circuit and lead FAS is grounded. When relay T1 operates, ground on the FAS lead operates relay AV. This circuit counts time before operating relay T1 in order to ensure that the sender has time to advance and close the fundamental before the fast assignment test is made.

23. RELEASE

23.01 When the PCI register circuit completes its part of the test satisfactorily, it grounds the S lead, advancing the SP switch to position 13. In position 13, ground on the TR lead from the sender operates the TR relay which locks. The sender opens the S lead, releasing relay S which advances the switch to position 14. If, at any time during the progress of the test, the TR relay is operated falsely by the sender, the fundamental tip lead will be opened and the test will be blocked. In position 14, the ADV lead to the connector circuit is grounded, causing that circuit to release all test units and start a new test. The C and G leads are opened by the connector circuit, causing the C, DP, and all other relays of this circuit to restore. The C and DP relays being normal cause their associated switches to restore to normal.

24. LATE RELEASE TESTS

24.01 When a release test is being made, the PCI register circuit causes the dialing tip and ring to be opened after trunk closure has been received from the sender. Upon receiving this signal, the sender disconnects ground from the LR lead and substitutes battery through a resistance, thereby operating the WO relay. The WO relay operated grounds the LR lead to the PCI register circuit to inform that circuit that the wipe-out signal has been received from the sender. These operations take place with the SP switch in position 12. When the PCI register circuit has completed its parts of the wipe-out test, it grounds the S lead which advances the SP switch to position 13. Ground on the AV lead advances the SP switch to position 14 where this circuit operates in the manner described above.

25. INTERCHANGEABLE CODE

25.01 A PCI interchangeable office code is used for this test, and the ICD key of Section -0133 and the zero stations key of Section -0105 are operated. The sender will make two marker seizures. On the first seizure the marker cannot determine the type of code (area or office - 10 digit or 7 digit) and instructs the sender to time for an eighth digit. The second seizure is made 3 to 4 seconds after the units digit is received. The sender indicates to the marker a 7-digit call, receives a routing and closes the fundamental. All digits must be registered in the sender before it can make the second marker seizure; therefore, synchronizing the sender for trunk guard test, 17., is omitted.

25.02 The first marker seizure and the code check take place as soon as the third digit has been dialed, as described in 11. Operations in the code test circuit for the first marker seizure are described in Section -0133, 21.02. With the ICD relay of Section -0133 operated, the units digit is dialed as soon as the DP switch reaches position 8. At the conclusion of the units digit the AV lead from Section -0105 is open and the switch advances to position 9. In position 9 the SMS relay of Section -0133 operates to prepare for the check of the second marker seizure and the SD interrupter is connected to the stepping magnet of the DP switch. The interrupter steps the switch to position 10. In position 10 the T relay operates and locks. The interrupter continues to step the DP switch and in 2 to 2.5 seconds advances the switch to position 14. In position 14 the T relay would normally release and if trunk guard test had not been made by this time the BK relay would operate to block the circuit when the trunk guard test is made. However, on this test the T relay is provided with an alternate lock path through the operated SMSA relay of Section -0133, preventing the operation of the BK relay when trunk test is made. When the sender seizes the second marker, 3 to 4 seconds after the units digit is dialed, it receives a routing and closes the fundamental for trunk test or office selections.

CIRCUIT UNIT SECTION -0117
PCI REGISTER CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to operate in conjunction with the other circuits of the automatic sender test set.

1.02 This circuit is arranged to register and check the PCI pulses from the sender.

1.03 This circuit is also arranged, under control of the class keys in the connector circuit, to test the sender for wipe-out conditions.

1.04 Both tandem and direct calls can be tested depending upon the setting of class keys in the connector circuit.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To advance from normal and close the fundamental circuit to the sender when seized by the PCI dial pulse control circuit.

3.02 To signal the PCI dial pulse control circuit to proceed with the dialing of the fourth numerical (units or tens) digit.

3.03 To signal the PCI dial pulse control circuit in case the sender closes the fundamental falsely.

3.04 To test the sender for slow or fast assignment depending upon the position of the FAS key.

3.05 To test that the sender connects ground, when required, to the FT and FR leads at the beginning of PCI pulsing.

3.06 To register the PCI pulses received from the sender and to check that the pulses are correct.

3.07 To test the PCI impulser in the sender for slow operation.

3.08 To test the sender for setting up the proper wipe-out condition.

3.09 To block further progress of the test in case the test set time alarm operates.

3.10 To provide connection to the pulsing loop for observation of the PCI pulse patterns of the subscriber sender being tested.

3.11 To control the start of the auxiliary recorder used for observing PCI pulses.

3.12 This circuit is arranged to test the following classes of calls under the control of the class keys in the connector circuit:

(a) PCI Tandem.

(b) PCI Direct.

(c) PCI 3-Digit Operator.

(d) PCI Wipe-Out.

KEYS

3.13 Key FAS - This key when operated changes the test from slow assignment to fast assignment.

3.14 Key CAP-PCI - This key when operated causes a test to be made for the absence of ground on the FT and FT leads between pulses.

3.15 Key TS-PCI - This key when operated causes a test to be made that subscriber senders will send PCI pulses satisfactorily in two stages.

LAMPS

3.16 Check Lamps PCI - These lamps light during the check of the number registered by the PCI impulses. They indicate the actual number received from the sender and are compared with the code keys which indicate the number which should have been received.

3.17 Lamp IMP - This lamp indicates that the PCI pulses have not been completely received during the time allowed by the test circuit.

3.18 Progress Lamps PCI and MF - These lamps indicate which digit is being checked by this circuit. The A, B, and C lamps also indicate which digit the code test circuit is checking. When making DDD tests, these lamps light in succession under control of the auxiliary sender MF pulse check control circuit, to indicate the progress of MF pulsing.

JACKS

3.19 The PCI jack provides access to the pulsing loop for observing pulse patterns generated by the subscriber sender. The PCI jack bridged across a 10-ohm resistor in the pulsing loop may be used to connect the tip and ring to the amplifier of a pen recorder for display of the pulsing patterns. Automatic control of an auxiliary control circuit for the recorder is provided by connection to the test circuit assignment relay over the sleeve of the PCI jack.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit -0102

(b) Code Keys and Dial Pulsing Circuit -0105

(c) Route Keys and Revertive Pulsing Circuit -0108

(d) PCI Dial Pulse Control Circuit -0115

(e) Keypulsing Control Circuit -0123

(f) Office Selection Control Circuit for Keypulsing Senders -0125

(g) Code Test Circuit -0133

(h) AMA Check Circuit -0135

DESCRIPTION OF OPERATION

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5. SEIZURE

5.01 This circuit is controlled over leads C and G from the PCI dial pulse control circuit or the office selection control circuit. The grounding of these leads operates relays CIP and G which advance the call indicator progress CIP switch to position 1.

6. SYNCHRONIZING TEST FOR TRUNK CLOSURE

6.01 The seizure of this circuit closes lead FT to the sender through test resistors, and closes the TG relay to battery. The operation of relay CIP closes ground on lead FR2 to the route keys and revertive pulsing circuit, through the beyond-office compensating resistance, back on lead FR1 over the FR lead to the sender. With the CIP switch in position 1, the SY lead to the PCI dial pulse control circuit or keypulsing circuit is grounded which causes that circuit to proceed with the dialing or keypulsing. When the sender closes the fundamental circuit for trunk test, relay TG operates, in turn operating relay TG1. The front contact of relay TG1 is closed through a back contact on relay TG2 over the TG lead to the PCI dial pulse control circuit. If the sender closes the fundamental falsely, the grounding of the TG lead to the PCI dial pulse control circuit causes that circuit to block further progress of the test. If the sender does not close the fundamental falsely, the PCI dial pulse control circuit will ground lead TG1 operating relay TG2 in this circuit.

7. CHECK OF SLOW ASSIGNMENT

7.01 The FAS key and relay are normal for this test. When the sender closes the fundamental, with relay TG2 operated, the operation of relays TG and TG1 advances the CIP switch from position 1. For this test, the fundamental circuit is closed through sufficient resistance to give a trunk test current of 0.0015 ampere. With the CIP switch in position 2, the IP interrupter contact F is connected through arc 5 of the CIP switch to the stepping magnet. The interrupter steps the switch to position 4. In position 4, the SA relay operates. The SA relay operated, locks under control of the CIP relay, and opens a short circuit on the secondary winding of the SA1 relay. The SA1 relay operates due to the charging of the SA capacitor. When the capacitor becomes charged, the secondary current decreases sufficiently so that the primary winding causes the relay to release. During the time the SA1 relay is operated, which is approximately 0.015 second, ground is removed from the fundamental ring. This open period tests the ability of the TG relays in the sender to hold up. With the CIP switch in position 5, interrupter contacts B and F are connected to the AS, AS1 relay combination. The next closure of the F contact of this interrupter operates the AS relay which connects the BE resistor to the FT lead to soak the sender TG relay for release test. When the F contact of the interrupter opens, the AS1 relay operates and transfers the fundamental tip and fundamental ring leads to the PCI receiving relays. The next F contact closure and open of the interrupter advances the CIP switch to position 6. If the TG relays in the sender failed to hold during the 0.015-second open period, the check of the first digit received from the sender will block this circuit.

8. FAST ASSIGNMENT TEST

8.01 If a fast assignment test is to be made, the FAS key is operated which operates the FAS relay. The sender, under these circumstances, should not close the fundamental until after relay TG2 is operated by the PCI dial pulse control circuit. With relays FAS and TG2 operated, the CIP switch is advanced to position 2. The IP interrupter steps the CIP switch from position 2 to position 5 as before. During this interval the fundamental circuit is open since the FAS relay is operated. When the interrupter operates relay AS in position 5, the fundamental circuit is closed through the TG relay and test resistances to give an operate current flow test of approximately 0.0011 ampere to the TG relay in the sender. The closure of the F contact is approximately 0.2 second. During this time the operate current flow is on the fundamental circuit. When the AS1 relay operates, the fundamental circuit is transferred to the PCI receiving relays. If the TG relays in the sender have functioned properly, the sender will proceed with sending of the PCI impulses. If the sender TG relay has failed to operate, the circuit will be blocked in position 13.

9. CHECKING THE GROUNDING OF THE FT AND FR LEADS BY THE SENDER BEFORE SENDING PCI PULSES

9.01 On numbers where the first pulse is in an open segment, the sender impulser connects ground to both the FT and FR leads to discharge the trunk. The GT and GR relays are connected from 48-volt battery to the FT and FR leads, respectively, when relay AS1 operates. The GT relay operated, operates relay GT1, which locks under control of relay GR. Relay GR locks under control of relay CIP. With the GT1 and GR relays operated, a circuit is closed for operating the OG relay, but it is short-circuited by the contact of the GT relay. When the ground is removed from the FT lead, the GT relay releases and operates the OG relay, which transfers the FT and FR leads to the pulse checking circuit. If the first pulse sent by the sender is a light positive pulse, the sender does not ground the fundamental tip. The test for ground is canceled under those conditions by operating the OG relay. On tandem calls the A1 lead from the A code digit is connected through the back contact of the DR1 relay to operate the OG relay if key 1, 3, 6, or 8 is depressed in the A row. On non-tandem calls lead STA1 of the stations digit is connected through the front contact of the DR1 relay to operate relay OG if key 1 or R of the stations row is depressed.

9.02 When testing sender circuit SD-27810-01 which is arranged for balanced PCI pulsing, the 3200-ohm ground on the FT lead

from the sender operates the GTA relay which locks. The GTA relay in operating locks to solid ground allowing the GT relay to operate in series. The GT relay in operating closes a path to operate the GT1 relay. The GTA locking ground is sent over the FT lead to the sender through the operated CIR or GR relay in the sender to the FR lead of the test frame operating the GR relay, if it did not operate from the 3200-ohm ground on the FR lead. (With compensating resistance in the test frame or sender there may not be sufficient current flow from the 3200-ohm ground to operate the GR relay) with the GR and GT1 relay operated a path is closed to operate the OG relay and the circuit functions as described.

10. CHECKING OF PCI PULSES

10.01 When relay OG operates, the FT and FR leads are transferred to the PCI checking circuit. This circuit consists of the MG, SN+, and SN- relays. The pulses received and checked by these relays are as follows.

10.02 A pulse may be light (battery through 6500 ohms) or heavy (battery through 125 ohms), and positive (ground on FR lead and battery on FT lead) or negative (ground on FT lead and battery on FR lead). A space or blank is an open-circuit condition on the FT lead for the length of time equivalent to a pulse.

10.03 Three different codes of pulse combinations are used as indicated in the table below:

Regular	Thousands	Stations
0 - n - n 1 p n - n 2 - N - n 3 p N - n 4 - n p n	0 - n - n 1 - n - N 2 p n - n 3 p n - N 4 - N - n	0 - n - n 1 p n - n
5 - n - N 6 p n - N 7 - N - N 8 p N - N 9 - n p N	5 - N - N 6 p N - n 7 p N - N 8 - n p n 9 - n p N	5 (J) - n p n 6 (M) - n - N 7 (R) p N - n 9 (W) - N - n

10.04 Each digit consists of four pulses or spaces. The second and fourth pulses of each digit are negative, and operate the SN- relay. The operation of the SN- relay maintains the test circuit in synchronism or in step with the pulse transmitting circuit of the sender circuit so that the received pulses will be switched to the register relays of the digit corresponding to that which the sender circuit is transmitting. The first closure of the SN- contact during the second pulse of the digit operates the W relay. When the SN- releases during the third pulse of the digit, the Z operates and the W holds. When the SN- operates during the fourth pulse of the digit, the Z relay holds but the W is short-circuited and releases. When the SN- releases during the first pulse of the succeeding digit, the Z relay releases. This operation of the W and Z relays is repeated during each of the digits. Contact 1T 2T of the Z relay closes and opens once per digit and is used to control the "steering" relays, A, AA, B, BA, C, CA, etc. The relays A, B, C, ST, etc, are operated by the closure of the Z contact during the third pulse of the digit with which they are associated, and the AA, BA, CA, STA, etc, are operated when the Z contact opens during the first pulse of the succeeding digit. The operation of the steering relays transfers operating leads from the associated register relays to the relays of the succeeding digit.

10.05 The first pulse of a digit may be light positive or blank. If it is positive, the SN+ relay operates and, the W relay being unoperated, operates the No. 1 relay of the digit being registered (TH2 of thousands digit).

10.06 The second pulse of a digit is negative. If it is heavy, the MG relay operates and, the Z relay being unoperated, operates the No. 2 relay of the digit being registered (TH4 of the thousands digit).

10.07 The third pulse of a digit may be light positive or blank. If it is positive, the SN+ relay operates, and the W relay being operated, operates the No. 4 relay of the digit being registered (TH8 of the thousands digit).

10.08 The fourth pulse of a digit is negative. If heavy, the MG relay operates, and, the Z relay being operated, operates the No. 5 relay of the digit being registered (TH1 of the thousands digit).

10.09 As mentioned above, the pulses from the contacts of the SN+ and MG relays are "steered" to the proper digit by means of the contacts of relays A, AA, B, BA, etc. The relays which are operated by the contacts of the SN+ and MG relays, lock to the ground leads supplied by the GN relay which operates from a contact of the AS relay. When steering relays UA and UA1 operate at the end of the last pulse of the last digit, the FT and FR leads are reversed by the reversed AN- and MG relays. The last pulse is registered by the F and F1 relays, thus checking the strength, polarity, and continuity of this pulse.

11. PCI DIRECT CALL

11.01 On direct calls, the operation of the direct class key operates relays DR and DR1. The operation of relays DR and DR1 causes the checking circuit to skip the A, B, and C register relays. The first digit received is registered on the stations register relays, the second digit is registered on the thousands register relays, the third on the hundreds, the fourth on the tens, and the fifth on the units register relays.

12. TANDEM CALL

12.01 If the call is to a tandem office, the depression of the tandem PCI class key does not operate relays DR and DR1 so that the first digit received is registered on the A digit register relays. The second digit is registered on the B and the third on the C register relays. The remaining digits are registered on the stations, thousands, hundreds, tens, and units register relays, as on nontandem calls.

13. TWO-STAGE TANDEM PCI CALLS - TS-PCI KEY OPERATED (MFR DISC.)

13.01 The subscriber senders can be arranged to send PCI pulses in two stages on calls through sender tandem. On this class of call, the sender will proceed with trunk test and the transmission of the PCI pulses for the office code as soon as the subscriber has completed dialing the office code. Ordinarily the sender waits until dialing is complete before transmitting any PCI pulses. On this class of call the office code PCI pulses will be transmitted before the subscriber has completed dialing and therefore the sender sends these PCI pulses in two stages. The TS-PCI key and associated wiring will be furnished when the subscriber senders are arranged for this class, and this key will be operated to test that the sender will function properly under this condition.

13.02 When the associated PCI dial pulse control circuit -0115 has caused the transmission of the prefix 1-1 (if this is required) and the office code into the sender, it waits for this circuit to check the office code PCI pulses before the numerical digits are dialed. Ground on the TO lead operates the TG2 relay. The sender, after making connection to a marker, should make trunk test operating the TG relay. The TG1 relay is in turn operated, as on a regular call. This advances the CIP switch to position 2 and assignment takes place as has been outlined for a regular call. The subscriber sender will then proceed to transmit the office code PCI pulses, and the C relay is operated. This prepares a path for advancing the CIP switch out of positions 6 and 7 under control of the IP interrupter. The CIP switch will stay in positions 6 and 7 for approximately 0.5 to 1 second. During this time, if the sender should wrongly proceed with the transmission of PCI pulses for the numerical digits, the ST relay will be operated and the BK relay in -0115 will be operated, blocking the call. The sender should wait for the numerical digits to be dialed after transmitting the office code PCI pulses. The CIP switch in position 7 then grounds the ADV lead to -0115 energizing the DP switch in that circuit. When the CIP switch leaves position 7, the DP switch advances and with the CIP switch in position 8, ground on the SY lead to -0115 causes that circuit to proceed with the dialing of the numerical digits. When dialing is complete, the sender transmits the PCI pulses for the numerical digits. The TH relay is operated and closes the path for advancing the CIP switch out of position 8 through 12 under control of the IP interrupter, and the circuit will continue to function as is outlined in subsequent paragraphs.

14. CHECKING OF FINAL HEAVY POSITIVE PULSE

14.01 If the wiring is arranged for the reception of a final heavy positive pulse, the operation of the UA and UA1 relays, after the units pulse has been received, reverses the connection of the polarized and marginal relays to the fundamental circuit. If the apparatus and wiring

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is furnished for receiving a final heavy positive pulse, the F and F1 relays will not operate until this pulse is received. As soon as the pulse is received, the SN- and MG relays operate, in turn operating the F relay. At the end of the pulse, relay F1 operates opening the fundamental tip and ring leads. The fact that the pulse is heavy is recorded by the MG relay and the fact that the pulse is positive is recorded by the SN- relay. If the wiring is not arranged for the reception of a final positive pulse, the F relay will operate as soon as the U relay operates. The operation of the UA relay will open the operating path of the F relay, permitting the F1 relay to operate and lock in series with the F relay. The operation of relay F1 also grounds lead AV which causes the Office Selections Control Circuit for Keypulsing Sender -0125 to check the trunk closure.

15. CHECKING FOR SLOW PCI IMPULSER

15.01 When the AS1 relay operates, the CIP switch advances from position 5 to position 6. In position 6, the F interrupter contact is again connected through the No. 5 arc to the stepping magnet. While the switch is stepped from position 6 to position 13 by means of this interrupter, the sender is transmitting PCI pulses to this circuit. If the sender completes the sending of these pulses and the F relay is operated before the switch reaches position 10 for nontandem, or 13 for tandem calls, the IT relay operates through a front contact on the F relay. The IT relay operated, advances the CIP switch to position 13. If the sender has not completed the sending of the PCI pulses by the time that the IP switch reaches position 10 for nontandem, or 12 for tandem calls, the ground for operating relay IT through the front contacts of the F relay is removed. The CIP switch cannot pass by position 13, and the circuit will remain stuck in this condition.

16. CHECKING DIGITS REGISTERED ON REGISTER RELAYS

16.01 With the CIP switch in position 13 and the DR and DR1 relays normal, ground through terminal 13, arc 4 of the CIP switch to the A register relays will advance the CIP switch to position 14 providing the setting of the A register relays agrees with the button depressed on the A code keys in the code keys and dial pulsing circuit. If this setting does not agree, the switch will remain stuck in position 13. The PCI check lamp indicates the setting of the register relays, and the A progress lamp will light from terminal 13 of arc 5. The button depressed on the A row of the code keys and dial pulsing circuit indicates the setting which the register relays should have taken. If the check of the A digit is correct, the CIP switch is advanced to position 14 where the check of B digit takes place in a similar manner and the switch advanced to position 15. The check of the remaining digits is accomplished in the same way and the CIP switch is advanced finally to position 21. Ground on the S lead causes the PCI dial pulse control circuit or the office selection control circuit to remove ground from the C and G leads to this circuit. This releases the CIP and G relays which release all relays that may be operated in this circuit and restores the CIP switch to normal. This circuit cannot be reseized until the CIP switch reaches normal. In 2-digit offices, there is no B digit, and the check of this digit is omitted by passing by position 14 by means of the A wiring at the DR relay. On nontandem calls, the DR relay operated, causes the A, B, and C check positions of the CIP switch to be passed by.

17. TESTING A RELEASED CALL (THIS TEST SHOULD BE MADE WITH THE FAS KEY NORMAL)

17.01 For codes that cause the sender TW relay to be operated, if the PCI wipe-out class key is operated, relay WO operates. The operation of relay WO operates relay DR and DR1. This test must, therefore, be made using a nontandem call. The test will proceed as described for a regular call until the operation of the TG, TG1, and TG2 relays, at which time the N lead to the code keys and dial pulsing circuit or the WO lead to the office selection control circuit is grounded. This causes the code keys and dial pulsing circuit to open the dialing tip and ring or the office selection control circuit to ground the LR lead. The sender registers a wipe-out condition and on subscribers sender tests should cause the PCI dial pulse control circuit to ground lead LR advancing the CIP switch to position 2. On KP sender tests the office selection control circuit grounds the LR lead. The sender, however, should not immediately release, but should await assignment. The CIP switch is stepped from position 2 to position 5 by the IP interrupter which allows the sender sufficient time to advance in case it does not wait for assignment. When the CIP switch steps into position 5, relays AS and AS1 operate from the interrupter thus assigning the call. The operation of relay AS1 advances the CIP switch

to position 5. This circuit checks for slow PCI pulsing as before and advances to position 12. The operation of relay F operates relays W01 and IT in parallel. The operation of relay W01 causes this circuit to check for the reception of a zero for each digit. If the sender has functioned properly and zeros have been registered on the register relays, the CIP switch will advance to position 21 through the front contact of the W01 relay. In position 21 the S lead is grounded. Ground on the S lead advances the PCI dial pulse control circuit, releasing this circuit as described above.

17.02 For codes that do not cause the sender TW relay to be operated, the sender does not wait for assignment on wipe-out. The W02 relay is operated from the class key and in turn operates the WO relay. The operation is as described above up to where the CIP switch reaches position 5. With the W02 relay operated, instead of operating the AS relay, the CIP switch is advanced and release takes place.

18. CAPACITY PCI KEY CAP-PCI

18.01 This key when operated, connects 1.5-microfarad capacitor across the center of the compensating resistors. The purpose of this condition is to check the effect of capacity upon the PCI pulses and to detect the absence of the ground closures between pulses in the sender impulser. The value of the capacity and resistance network is designed for maximum efficiency when the compensating resistance is 1300 ohms.

19. TEST OF KEYPULSING SENDERS

19.01 The operation with keypulsing senders is the same as for subscriber senders except that the KP relay will be operated. This closes the WO lead from the office selections control circuit -0125 for making release call indicator calls as described in that unit. The KP relay also removes direct ground from the IP interrupter and connects this interrupter to the KR lead to the keypulsing circuit -0123. This circuit then waits for that unit to complete key release test after which the KR lead will be grounded. The CIP switch will be advanced out of position 2 under control of the interrupter as has been described. Should the key release test fail, the switch will remain in position 2, and the KR lamp 0109 will remain lit.

CIRCUIT UNIT SECTION -0119
OVERFLOW CONTROL CIRCUIT FOR SUBSCRIBER SENDERS

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to test subscriber senders for overflow conditions in conjunction with the other circuits of the automatic sender test set.

1.02 The sender is tested for overflow after office selections and for overflow during incoming selections.

1.03 During the office overflow test, a check is made that the sender advances from trunk test position and reduces the resistance of the fundamental circuit.

1.04 During incoming overflow test, the overflow relay in the sender is given a speed of operation test.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To control the dialing of the code and number.

3.02 To control the check of office and incoming selections as required.

3.03 To return reverse battery as an overflow signal to the sender after office selections, or during incoming selection depending upon whether the IO relay is normal or operated.

3.04 To test the sender OF relay for speed of operation.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit -0103

(b) Code Keys and Dial Pulsing Circuit -0105

(c) Route Keys and Revertive Pulsing Circuit -0108

(d) Incoming and Final Selections Control -0113

(e) Overflow Control for KP Senders -0127

(f) Code Test Circuit -0133

DESCRIPTION OF OPERATION

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5. SEIZURE

5.01 Since the marker is used several times on overflow tests, care should be exercised to see that these tests are made at such a time that these marker usages will not interfere with service. When this circuit is seized by the connector circuit, the C and G leads are grounded. Ground on the C lead operates the C relay through the normal position of the DP switch. The C relay operated, locks directly to the C lead, closes leads T, R, FT, CN, etc, operates relay G, and advances the DP switch to position 1.

6. DIALING OF THE CODE AND NUMBER

6.01 With the DP switch in position 1, ground is connected over the A lead to the code keys and dial pulsing circuit which causes that circuit to dial the first code digit as set up on the A keys. The code keys and dial pulsing circuit returns ground on the AV lead. This ground is removed after the first code digit is dialed, and causes the advance of the DP switch to position 2. In position 2, ground on the B lead causes the dialing of the B digit in the same manner as the first code digit. The DP switch is advanced to position 3 by ground on the AV lead as before. In a similar manner, the C digit and the numerical digits are dialed and the switch advances to position 8 where the CNT lead to the code keys and dial pulsing circuit will be grounded, operating the CT relay in that circuit. The numerical digits are required for all classes, including operator.

7. CODE CHECK

7.01 In positions 3 to 8, the C and G leads to the code test circuit are

grounded, which causes that circuit to check the information transmitted by the sender to the marker. If this test is satisfactory, the code test circuit grounds the AV lead which advances the DP switch position 9.

8. OFFICE BRUSH SELECTION

8.01 Since overflow tests are made when the sender is asking for alternate route as outlined under Overflow Test of Section -0133, the skip office keys should not be operated if the alternate route is through an office selector. The compensating resistance should be set at 900 ohms for all selections preceding overflow tests. If office selections are to be made, the OB lead is grounded in position 9. This causes the route keys and revertive pulsing circuit to check office brush selection. If the proper selection is made, ground is placed on the AV lead advancing the DP switch to position 10. When the relays in the route keys and revertive pulsing circuit are released, the AV1 lead is grounded which advances the DP switch to position 11.

9. OTHER OFFICE SELECTIONS

9.01 Office group selection is made in position 11 in the same manner as office brush selection, and the DP switch is advanced to position 12 and then to position 13 by ground on the AV1 lead. Second office brush and second office group are passed by.

10. SKIP OFFICE

10.01 If office selections are not required, the operation of the SO key in the route keys and revertive pulsing circuit causes the DP switch to pass by the positions for first office selections. In a similar manner, the second office selection positions are skipped by operating the SSO key.

11. OFFICE OVERFLOW TEST - CLASS KEY 13

11.01 This test should be made even though the senders do not handle calls through office selectors because certain tests such as reversed trunk test are made only in this class. Use codes which are routed full selector, PCI, or operator class on second trial, since the overflow test is made on second trial. The code used need not be one which uses office selections. The sum of the beyond office-compensating resistance in the sender and test circuit shall be 900 ohms for this test. After office selections are checked or passed by, the DP switch is passed by positions 16 to 18, inclusive. With the DP switch in position 19, the RV relay operates reversing the fundamental tip and fundamental ring and causing the route keys and revertive pulsing circuit to close the fundamental to the L relay. On full selector calls, the L relay is used and it will not operate until the sender advances and reduces the resistance of the fundamental circuit which includes 14,500 ohms. The TG relay, but not the OF relay in the sender, operates through this high-resistance and causes the sender to advance and remove this resistance. This allows the sender OF relay and the L relay in the route keys and revertive pulsing circuit to operate. On operator class calls, the sender does not include the 14,500-ohm resistor so that the L relay operates immediately on trunk closure. The L relay contact grounds lead AV2 energizing the DP switch in position 19. After a short time, the sender opens the fundamental which releases the L relay and advances the DP switch to position 20. In position 20, the TC relay operates which connects the TC2 relay to the fundamental. The circuit in the sender, which provides trunk closure on overflow calls, operates the TC2 relay, opening the circuit which holds the TC3 unoperated. The TC3 relay is slow in operating due to the fact that the TC capacitor must be charged before the current in the S winding is reduced sufficiently to allow the relay to operate. The operating time of the TC3 relay is approximately 0.235 second, and the trunk closure must be sufficiently long to operate this relay or the switch will block in position 20. With the TC3 relay operated, the DP switch advances to position 21. In position 21, the OF lead to the code test circuit is grounded to cause that circuit to check that the sender reseizes a marker and requests a connection to an overflow trunk. The code test circuit completes this test and the C lead is opened, releasing the C relay and restoring the switch and all operated relays to normal. Release of the TC and TC2 causes the TC3 to restore to normal.

12. INCOMING OVERFLOW TEST - CLASS KEY 14

12.01 Operation of IO Relay - Use any code which is routed full selector on its alternate route or second trial. Set office selection and compensating resistance in accordance with this route. Use any four numerical digits which do not use incoming group selection zero. The sum of the office and beyond-office compensating resistances in the sender and test circuit shall be 900 ohms for this test. When this circuit is seized and relay C operates, the IO

relay is operated over lead IO which is grounded by class key 14. The advance of this circuit for incoming overflow test is the same as office overflow test up to position 16.

12.02 Incoming Selections - In position 16 of the DP switch, the FR relay operates and locks under control of the C relay. The operation of the FR relay advances the DP switch to position 17. Incoming brush selection check is made in position 17 in the same manner as office selections are made, and the DP advanced to position 18.

12.03 Speed Test of OF and STP Relays in the Sender - With the DP switch in position 18, relay TC operates, transferring the FT lead to the TC1 relay through resistor C, and the FR lead to ground. When the sender closes the fundamental for group selection, the current is insufficient to advance the sender, but relay TC1 operates, advancing the DP switch to position 19. The advance of the switch releases the TC relay. This check is made in order to ensure that the sender has advanced and closed the fundamental for incoming group selection before reversed battery is returned for the incoming overflow test. With the DP switch in position 19, the RV relay operates. The operation of the RV relay connects ground to the L1 lead to the route keys and revertive pulse circuit, which causes that circuit to connect battery through the winding of L relay to the FR lead to the sender. The FT lead from the sender is connected over the FR1 to the beyond-office compensating resistance and back over the FR2 lead through contacts of the FR relay to FR2 lead to -0113, through MTG key and back over the G lead to ground on front contact RV1 relay. The RV relay lights the OF lamp and connects ground over the RV lead. This ground returns over the RV1 lead and operates the RV1 relay. The RV1 relay removes direct ground from the secondary winding of the RV2 relay which was holding this relay in its nonoperated position even though it is energized in the operate direction on its primary winding. The RV2 relay will not operate immediately, however, on the removal of ground to its secondary winding since current continues to flow through this winding as the associated RV capacitor is charged. This current is reduced as the capacitor becomes charged, and eventually the energy produced by current in the secondary winding is not as great as that produced by the primary winding . The RV2 relay will then operate. There is a delay from the time that the operation of the RV1 relay closes the fundamental circuit for reverse battery, until the RV2 relay operates opening the fundamental. With the MTG key normal, this time is approximately 0.075 second. The resistance in the fundamental is such that the sender OF relay is tested for operating in a minimum time to ensure satisfactory operation when functioning with long range incoming selector circuits. These circuits give a long reverse battery closure on incoming to overflow. With the MTG key operated, the time of operation of the RV2 relay is changed to cause the fundamental to be closed for approximately 0.040 second, and the loop resistance is such that the sender OF relay is tested to ensure satisfactory operation when functioning with short range incoming selectors. These selections give a short closure of reverse battery on incoming to overflow. Senders that function with both of these types of incoming selectors should, therefore, be tested with the MTG key operated as well as normal, using the codes requiring sender MTG or TG relay as necessary. The RV2 operating also advances the DP switch to position 20 which is a passby position on this class of test. In position 21, the code test circuit takes control as described above.

12.04 Long Incoming Overflow - This paragraph describes the test of a sender waiting for the distant circuit to open the fundamental when reversed battery is received after incoming brush selection, Z option, LIOF key of -0108 operated. This test is similar to the incoming overflow test described above, up to the point of operating the RV1 relay. Instead of operating relay RV1, ground is supplied over lead G from the route keys and revertive pulsing circuit to complete the closure of the fundamental circuit. The front contact of the L relay supplies ground over lead

AV4 to the armature of the IOF interrupter. Closure of contact B operates relay I01 which locks under control of relay L. The next closure of contact F advances the DP switch to position 20. Position 20 is passed by, and in position 21, lead OF to the code test circuit is grounded. The code test circuit completes the test as previously described. If the sender opens the fundamental, the L relay will release, releasing relay I01 and blocking the DP switch in position 19. This test checks that the L relay holds operated for 1 to 2.3 seconds.

CIRCUIT UNIT SECTION -0121
OPERATOR CLASS CONTROL CIRCUIT FOR SUBSCRIBER SENDERS

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to test the following operator class calls in conjunction with the other circuits of the automatic sender test circuit.

(a) Calls to special service operator (zero operator), zero operator key 9 operated.

(b) Full selector calls to 3-digit operator, 3-digit operator key 10 operated.

(c) Calls using a code which is restricted (restricted code) or which has not been assigned (vacant code), class key 18.

(d) Permanent signal calls, permanent signal class key 12 operated.

(e) Calls that test for the proper operation of the sender under "stuck sender," "partial dial," "no coin," and "false coin ground" conditions.

(f) Calls through panel 3-wire office selectors or tandem XBR, Fig. 12B.

1.02 This circuit controls the dialing of the code and numerical digits in conjunction with the code keys and dial pulsing circuit.

1.03 Arrangements are made to facilitate a check of the sender lamp.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To control dialing into the sender for the particular class of operator call as determined by the setting of the class keys in the connector circuit.

3.02 To simulate the conditions of trunk test corresponding to the kind of operator trunk seized.

3.03 To permit tests for the proper functioning of the sender lamps and proper release of the sender when primed by the sender monitor.

3.04 To control dialing into the subscriber sender for intersender timing tests.

KEYS

3.05 The SL key is operated for making sender lamp checks.

3.06 The RVT key should be operated when using a code which ordinarily routes the call to a trunk with battery on the tip and ground on the ring. This key is also operated for incoming trunk reversal tests on auxiliary senders.

3.07 The TRK IDT key, when operated for an AMA permanent signal test call, permits a permanent signal trunk identification type of record to be perforated on the maintenance recorder tapes. Also with this key operated for a regular non-AMA sender test call, a check is made to ensure that the ACC lead is not falsely grounded. With this key normal an AMA permanent signal test call is completed on an NT, no trunk, basis.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit -0102

(b) Code Keys and Dial Pulsing Circuit -0105

(c) Route Keys and Revertive Pulsing Circuit -0108

(d) Full Selector Dial Pulsing Circuit -0111

(e) Sender Group Test Circuit -0131

(f) Code Test Circuit -0133

(g) AMA Check Circuit -0135

(h) Auxiliary Sender MF Pulse Check Control Circuit -0141

DESCRIPTION OF OPERATION

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RESTRICTED SERVICE CODE

5. SEIZURE

5.01 If a test is to be made using a restricted class code or an unassigned code where the sender requires numerical digits to be dialed, the PS, ZO, and TD relays remain normal. The closure of ground on the C lead by the connector circuit operates relay C through the normal position of arc 1 of the dial progress switch DP. Relay C locks to lead C, closes the T and R leads from the sender to the code keys and dial pulsing circuit, closes the fundamental tip and ring to battery and ground, operates relay G, and advances the DP switch to position 1.

6. DIALING THE A DIGIT

6.01 The advance of the DP switch to position 1 grounds lead A to the code keys and dial pulsing circuit which causes that circuit to dial the first code digit. As the code keys and dial pulsing circuit is dialing this digit, ground is placed on the AV lead which operates the DP stepping magnet. On the completion of the dialing of this digit, ground is removed from the AV lead which allows the DP switch to advance to position 2.

7. DIALING THE B, C DIGITS

7.01 In position 2 of the DP switch, ground is connected over the B lead to the code keys and dial pulsing circuit, causing that circuit to dial the second code digit in a manner similar to the dialing of the first code digit. The dial progress switch DP is advanced to position 3 at the completion of this digit by ground over the AV lead as before. The C digit is dialed in the same manner, the progress switch being advanced to position 4 at the completion of the C digit.

8. CODE CHECK

8.01 In positions 1, 2, 3, and 4, ground is supplied to the C and G leads to the code test circuit. This causes the code test circuit to check the information transmitted by the sender into the marker after the office code has been registered. If this check is satisfactory, the code test circuit grounds the AV lead which advances the DP switch to position 5. With Fig. 12B and the SO and SSO keys operated the DP switch is advanced to position 9.

9. DIALING TH, H, T, AND U DIGITS

9.01 The thousands, tens, hundreds, and units are dialed in positions 5, 6, 7, and 8 (Fig. 12A), or 9 to 12 (Fig. 12B) as described for the A, B, and C digits. The DP switch advances to position 9 or 13, which is passed by.

10. CHECK OF THE SENDER FOR AWAITING THE DIALING OF ALL DIGITS BEFORE GROUNDING THE TR LEAD

10.01 On this type of call, the sender should wait until all digits have been dialed before closing the trunk and grounding the TR lead. If the sender falsely closes the TR lead before the completion of the dialing of the units digit, the TR relay will operate, closing a circuit through the back contact of the RLS relay to the BLK lead which operates the block relay of the connector. After the units digit has been

dialed, the dial progress switch is advanced to position 9 (Fig. 12A) or position 13 (Fig. 12B) over the AV lead from the code keys and dial pulsing circuit, and the RLS relay operates. Position 9 or 13 is passed by with the SL key normal. The RLS relay operated, locks, lights the RLS lamp, and prepares a path for moving the switch to position 11 or 15 when the TR relay operates. The CN lead to the code keys and dial pulse circuit is also grounded operating the CT relay in that circuit. In position 11 or 15, the ADV lead to the connector is grounded, causing the connector to start a new test.

11. ZERO OPERATOR TEST CALL

11.01 Single Digit 0 Registered in the Subscriber Sender. Operate Keys A0, B0, C0, and Class Key 9 - The testing of a call to a special service operator is similar to that for the restricted service call except that only one digit (zero) is dialed. When the zero operator class key in the connector circuit is operated, ground is placed on the Z0 lead to this circuit which operates relay Z0. The operation of relay Z0 prevents dialing the B and C digits and advances the switch to position 4 where the code check is made. Also, in position 4, the RLS relay operates, advancing the switch to position 10 (Fig. 12A) or 14 (Fig. 12B). In positions 10 and 11 or 14 and 15, the circuit operates as described above.

(a) When a single digit 0 is registered in a subscriber sender arranged for prefix digit 0, the sender will delay 3 to 5 seconds before calling in the marker. The A0 key of Section -0105 operated will operate relay OTC of Section -0133 to check the 3- to 5-second delay in the subscriber sender.

11.02 Digits 0-0 Registered in the Subscriber Sender. Operate Keys PDG0, A0, B0, C0, and Class Key 9 - The operation of relay C in Section -0102 operates relays P1, P1', P2, and P2', and the operation of relay C of this section advances the DP selector to position 1. The DP selector in position 1 operates relay DG0 of Section -0105 which in turn causes the dial pulse interrupter circuit or TOUCH-TONE signal generator circuit to outpulse the first digit 0 into the sender. At the end of the first digit 0 relay P3A' of Section -0105 operates, releasing relay DG0 and operating relay A of Section -0105. Relay A operated causes the test circuit to outpulse a second digit 0 into the sender and advances the DP selector to position 2. The circuit then advances the DP selector to position 15 as described above.

11.03 Digits 1-0 Registered in the Subscriber Sender. Operate Keys PDG1, A0, B0, C0, and Class Key 9 - The operation of relay C in Section -0102 operates relays P1, P1', P2, and P2', and the operation of relay C of this section advances the DP selector to position 1. The DP selector in position 1 operates relay PP of Section -0105 which in turn causes the dial pulse interrupter circuit or the TOUCH-TONE signal generator circuit to outpulse a digit 1 into the sender. At the end of this digit, relay P3' of Section -0105 operates, releasing relay PP and operating relay A of Section -0105. Relay A operated causes the test circuit to outpulse a digit 0 into the sender and advances the DP selector to position 2. The circuit then advances the DP selector to position 15 as described above.

12. 11X SERVICE CODES - OPERATE 1-1 KEY AND CLASS KEY 9

12.01 The operation of relay C in Section -0102 operates relays P1 and P1' of Section -0105, and the operation of relay C in this section advances selector DP to position 1. The DP selector in position 1 operates relay PP of Section -0105 which in turn causes the dial pulse interrupter circuit or the TOUCH-TONE signal generator circuit to outpulse a digit 1. At the end of the digit the DP interrupter circuit or TOUCH-TONE signal generator circuit grounds lead AV to operate relays P2 and P2' in series. The DP interrupter circuit or TOUCH-TONE signal generator outpulses a second digit 1 and then operates relays P3 and P3' of Section -0105. Relay P3' operated releases relay PP and operates relay A of Section -0105. Relay A operated causes the test circuit to outpulse the digit registered on the A- digit control key of Section -0105 and advances the DP selector to position 2. Relay Z0 operated through the make-contacts of class key 9

operated advances the DP selector to position 4 to prevent any other digits from being outpulsed. Selector DP then advances to position 15 as described above.

13. PANEL OR TANDEM CROSSBAR OFFICE SELECTION, FIG. 12B, CLASS KEY 10 OPERATED

13.01 Figure 12B is used when the subscriber senders are required to route a 3-digit operator call through a 3-wire panel office selector or tandem crossbar.

13.02 The C relay is operated in position 22, operating relay G and advancing the DP selector to position 1. After dialing the first three digits, the code is checked in position 4 (as per 8). Relay RLS operates in position 4 through a make-contact on relay TD and locks to a make-contact on the C relay. In position 5, the OB lead is closed, and office test and office brush selections are checked. If these selections are satisfactory, the AV lead is closed by the route keys and revertive pulsing circuit, Section -0108, and the switch advances to position 6. Lead AV1, closed by the normal revertive circuit, advances DP to position 7. These operations are repeated for office group selection in positions 7 and 8. In position 8, relay SB operates and locks to the C relay, and transfers the FT and FR leads from the office selections to trunk test. Relay RLS operated, advances the DP switch to position 13. The circuit is advanced to position 14 through the normal SL key. Relay TR (operated after trunk test) advances the DP switch to position 15 where the ADV lead is closed to the connector. When the SB relay is not provided, the fundamental is closed through loops, and the SO key in Section -0108 must be operated.

14. PERMANENT SIGNAL TEST - MR - CLASS KEY 12 OPERATED - AR KEY NORMAL. ZERO, B, AND C CODE KEYS OPERATED

14.01 When class key 12 is operated, ground over the PS lead operates the PS relay. The operation of relay PS prevents dialing the A, B, and C digits, connects ground to the TM lead to the connector to extend the time alarm, and grounds the PS lead to the code test circuit to cause that circuit to check the permanent signal combination on the A digit. It also provides a path for operating relay RLS in position 4, and connects interrupter PS to the DP magnet. The DP switch advances to position 4 under control of the interrupter in 6 to 9 seconds. If the sender grounds the TR lead during this interval, the BLK lead to the connector will be grounded causing the test circuit to block. If the sender circuit does not prematurely ground lead TR, RLS relay operates in position 4 and the test is completed in the usual manner. The permanent signal time-out interval may be checked with a stop watch by observing the time during which the CD lamp (shown on the Code Test Circuit -0133) is lit. This time interval should be 20 to 40 seconds. To stop the test between senders in order to read and reset the stopwatch, the TA key should be operated after a test has started and released after the test has been completed. This will cause the next sender to be selected and tested. After the test on this next sender has started, the TA key should be again operated. See description of connector circuit. (When disconnect tone is used, it may be aurally tested.) The time interval for the SD-27810-01 sender is 18.5 to 22 seconds.

15. PERMANENT SIGNAL CHECK - AMA - CLASS KEY 12, CODE KEYS ZERO, B, AND C OPERATED, AMA AND MR KEYS OPERATED. AR KEY NORMAL

15.01 The test continues per 13 and when relay PS is operated, ground is removed from the MR lead to the transverter, forcing the transverter to recognize the PS code and summon the maintenance recorder. It also connects the NT relay to the sender LR lead. When the sender DRL relay operates, test relay NT operates. The operation of relay NT grounds the TR lead, operating the sender TR1 relay. Relay TR1 operated, releases relay DST, which releases relay DRL. When ground is removed from the TR lead, sender relay TR2 operates, operating relay DST. Relay DST operated, grounds the NT lead to the transverter connector but does not recall the marker.

15.02 The sender closes for trunk guard test through polarized relay BB which does not operate and connects to the transverter and recorder. After the recorder completes its recording, it signals the transverter to release the sender, operating the test circuit TR relay. If the no trunk NT lead is open, the maintenance recorder fails and records a trouble.

15.03 With the trunk identity TRK-IDT key operated, the TR1 and TR2 sender relays are not operated. When the maintenance recorder is connected, the 115- to 120-volt position trunk identifying battery over the FT lead operates polarized relay BB which operates relay MSN (modify sender number). This grounds a special lead to the maintenance recorder, operating its MSN relay. The maintenance recorder then substitutes the sender number in the usual place for the permanent signal trunk number and modifies the sender number by adding 5 to the hundreds digit. If the FT lead is open, the recorder does not operate the MSN relay and blocks with a trouble record.

16. TESTING OF CALLS TO TRUNKS THAT NORMALLY RETURN REVERSE BATTERY TO SENDER - RVT KEY OPERATED, CLASS KEY 18 - SO KEY OPERATED

16.01 Certain trunks reached directly off the crossbar office switch have battery connected to the ring and ground to the tip of the trunk. This is in the proper direction to operate the sender OF relay when the sender makes trunk test on setting up calls to this type of trunk. It is necessary, therefore, on this class of call, to short-circuit the operating winding of the OF relay in the sender. This is accomplished by means of cross-connections in the marker which operates the sender TW relay. The RVT key is provided to make a test of the sender to ensure that on this class of call, the OF relay is properly short-circuited. The RVT key reverses battery and ground on the fundamental and if during trunk test, the sender OF relay operates because its operating winding is not shorted out (if the TW relay failed to operate, or its make-contact failed to close the path around the winding of the sender of relay), then the sender will make another trial with the marker. With Y wiring, since the code check circuit -0133 has not been released, many of the register relays in that circuit will be locked operated. When the marker attempts to make another trial, these locking grounds will back up to the marker and cause it to fail to check out properly. The marker will then time out and send a trouble release to the sender. The sender will call a marker for a third attempt and again the marker will fail because of grounds on many of the register leads. The trouble indicator circuit will be called in on these two trouble release trials but the record should be disregarded. The final result of this action by the sender and marker is that the test circuit will block and time out with the RLS lamp lighted. This is assuming, of course, that the OF relay operated on the reversed trunk condition when it should not have operated. With Z wiring and apparatus, the second seizure of a marker operates relay OF1 of the code test circuit, which locks and opens the RVT-RVT1 leads, blocking the DP switch in position 10, Fig. 12A, or 14, Fig. 12B. Any trouble indicator record resulting from this should be disgregarded. Otherwise the circuit functions as on a regular call.

17. SENDER LAMP CHECK

17.01 Partial Dial - The 3-digit operator class key 10, the SO key, and the SL key should be operated for this test and a code for a full selector or PCI call set up. The CTR keys of all automatic release senders should be pushed in. Three digits are dialed, the code is checked, and the switch is advanced to position 9 of Fig. 12A, or 13 of Fig. 12B for a 3-digit operator call. Position 9 or 13 is not passed by because the SL key is operated. For the monitor-type sender the partial dial signal lights at the monitor position, and, hearing the warning tone from the test circuit, the monitor primes the sender. For the timed release sender, a disconnect tone is first transmitted and then the sender is automatically primed. With automatic priming, the sender is primed without delay. In any case, the sender connects resistance battery to the LR lead. The PR relay operates, which advances the DP switch to position 10 or 14 and opens the ring lead. The sender also removes ground from the S lead. Monitor-type senders or automatic primed senders will do this within a fraction of a second after relay PR operates. Timed release senders required further timing by the sender, this time being approximately 110 seconds for codes corresponding to PCI calls or calls through a distant office selector, and approximately 70 seconds for all other codes. The removal of ground from the S lead allows the S relay -0102 to operate which advances the switch to position 11 or 15, where the ADV lead to -0102 is grounded and release takes place as usual.

On a partial dial call to sender SD-27810-01, the test frame dials the A and B digits and with RB option the dialing of the C digit is bypassed. The sender times 18.5 to 22 seconds, grounds the A2 and A4 leads and calls in the marker. The sender times an additional 10 seconds and places a low-resistance battery on the LR lead. The circuit functions as above.

(a) The partial dial interval may be checked with a stopwatch. This may be done by observing the interval from the time the A dial progress lamp lights until the RLS lamp is extinguished. For monitor-type or automatic primed senders, this interval will be 30 to 50 seconds. For timed release senders the total interval is 150 to 170 seconds for PCI and distant office calls, and 110 to 130 seconds for other calls. This is composed of a 20- to 40-second interval from the time the A digit is dialed until the disconnect tone is applied to the tip and ring, a 20-second interval of disconnect tone, and the remainder stuck sender time-out. The disconnect tone may be heard by listening in the receiver furnished at the test frame. Since it is desirable to check the disconnect tone when testing the timed release senders for time-out, these tests should always te under the supervision of a test employee. Since these tests require an interval longer than the test circuit time alarm interval, it may be necessary to silence the alarm by operating the TA key during the test of each sender. If it is desired to stop the test between senders in order to read and reset the stopwatch, the TA key should be manipulated as described under permanent signal test.

17.02 Stuck Sender - The restricted code class key 18 and the SL key should be operated and a full selector or PCI code should be set up on the code keys. The numerical keys should be operated also. The CTR key of all automatic release senders should be pushed in. A full set of digits is dialed, which causes the sender timing circuit to start timing for completion of the call (stuck sender time-out). With the SL key operated the fundamental is open, which:

(a) Causes the stuck sender signal to light at the monitor position in the case of monitor-type senders.

(b) Causes the timed release sender to transmit disconnect tone.

(c) Causes priming without delay in senders with automatic priming.

In any case, the sender is primed, which connects resistance battery to the LR lead operating relay PR, and the circuit performs the functions described under partial dial test. The stuck sender interval may be checked with a stopwatch by observing the interval during which the RLS lamp is lit. (The use of a low units digit will increase the accuracy of this test.) For monitor-type senders, this interval is 60 to 80 seconds for PCI calls through a distant office selector, and 30 to 50 seconds for other codes. For timed release senders, after 20 to 40 or 60 to 80 seconds, a disconnect tone is transmitted for 20 seconds, and 10 seconds later, the test circuit PR relay operates. When checking the long stuck sender interval, the test frame time alarm may operate. To prevent this, the TA key should be operated during each test. The TA key may also be used to stop the test circuit between tests as described under permanent signal tests. The time interval for the SD-27810-01 sender is 54.5 to 64.5 seconds for PCI calls or calls through a distant office selector, and 36.5 to 43.5 seconds for other calls.

17.03 No Ground Coin Test - This test shall be made on postpayment coin senders only. The restricted code class key 18, the FS, and SL keys should be operated, and a full selector code used. The circuit blocks in position 9 Fig. 12A, or 13 Fig. 12B. In the case of the monitor-type sender, the monitor coin lamp lights, and upon hearing the test circuit warning tone, the monitor primes the sender and the test circuit restores as usual. In the case of timed release senders, a disconnect tone is sent. If key CTR, located at the sender make-busy frame, is operated to the "in" position, relay AV1 is operated and the sender is automatically released. The time interval for coin time-out may be

checked by measuring the interval during which the RLS lamp is lighted. (The use of a low units digit will increase the accuracy of this test.) The time interval for monitor-type senders is 2 to 3 seconds, and for timed release senders is 20 to 40 seconds, plus 20 seconds of disconnect tone, and 10 additional seconds before relay PR operates. To stop the test circuit between senders, the TA key may be manipulated as described under 15, Permanent Signal Test.

17.04 Solid Ground Coin Test - This test shall be made on postpayment coin senders only. The restricted code class key 18, the SGT-OPR, and SL keys should be operated and a full selector code used. The circuit blocks in position 9 Fig. 12A or 13 Fig. 12B and subsequent operation is as described for no ground coin test. The coin time-out interval may be measured as above, but on timed-release senders, the tone cannot be heard due to the ground on the tip. Therefore, the check for disconnect tone should be made when making the no coin ground test.

18. INTERSENDER TIMING TESTS - FIG. 12B

18.01 Class key 18 and keys IST- and SL should be operated for these tests, and codes for full selector or PCI calls set up. In position 22 of the DP selector switch, relay C is operated, operating relay G and advancing the DP selector to position 1. The code is dialed in positions 1, 2, and 3, and is checked in position 4 (as described in 6, 7, and 8). The selector switch advances to position 5 if the code check from the marker is satisfactory. In position 5, with the SO key operated, ground is put on the AV lead from the route keys and revertive pulsing circuit to advance the stepper to position 6, and on the AV1 lead to advance the stepper to position 7. The switch is advanced in this manner to position 9. As the selector switch passes position 8, relay SB is operated. Ground on lead IST1 from Fig. 28, Section -0105, is transferred to the FR lead to prepare the circuit for trunk test.

18.02 When using a full selector panel class code, trunk test is made after the TH digit is dialed in position 9. Relay IST1 of Section -0105, Fig. 28, operates when the fundamental is closed and lights lamp IT. Intersender timing begins during trunk test when the sender TG2 relay is operated in parallel with sender relay IT. Relay IT operated, locks and provides ground to an interrupter that starts the sender, intersender timing relays to count the interval of 3 to 6 seconds. After the TH digit is dialed and trunk test is made, the selector switch advances to positions 10, 11, and 12 to dial the H, T, and U digits.

18.03 When using a full selector crossbar class code, trunk test is made after the H digit is dialed in position 10. Intersender timing starts after trunk test in the same manner described for a panel class call. The T and U digits are dialed in positions 11 and 12.

18.04 When using a PCI class code, trunk test is made after the U digit has been dialed in position 12, and intersender timing starts after trunk test in the same manner described for a panel class call.

18.05 The selector switch will advance to position 13 after the U digit is dialed, and relay RLS will operate and lock. Relay RLS operated, lights the RLS lamp and opens the C lead to code test circuit, Section -0133, to release the lockup relays of that circuit. In position 13, ground on lead ISG from Fig. 28, Section -0105, causes the DP selector to step to position 14.

18.06 During any of the aforementioned classes of calls, after trunk test is made and the 3- to 6-second intersender timing has elapsed, the sender will operate and release its overflow relays and make second trial, recalling the marker for an overflow routing. When dialing is completed and there has been no assignment within the intersender timing interval, the sender STL relay operates, the fundamental open relays release (except for relay FO3), trunk guard is made again, and relay AV1 operates. (On a service call, the customer should have been routed to a pronouncement trunk before trunk guard.)

18.07 In position 14, the circuit waits for the sender to put battery on the S lead to the S relay in the connector circuit, Section -0102. When the S relay operates, it grounds lead ADV1 and causes the DP selector to move to position 15. In position 15, the DP selector grounds lead AV1 to the connector circuit to cause the test frame to release.

18.08 Stopwatch Timing Tests - Reference is made to Section -0105, 26 connection with these tests.

18.09 The restricted code class key No. 18, and keys SL, IST0 or IST1, and S0 should be operated. A full selector or PCI code should be set up on the code keys, and the numerical keys should be operated. (The use of low numerical digits will increase the accuracy of these tests.) The A, B, and C digits are dialed, and the code is checked by the marker. If the code being tested is of a panel class, trunk test will be made after the TH digit is dialed. Intersender timing is in effect during trunk test when the sender TG2 and IT relays operate in parallel. The intersender timing interval may be checked with a stopwatch by observing the interval of time the IT lamp is lit. The time measured should be a 3- to 6-second interval, instead of the regular 20- to 40-second sender timing. For the SD-27810-01 sender the time measured should be 4 to 4.75 seconds instead of the regular 18.5- to 22-second timing.

(a) If the code being tested is of a crossbar class, trunk test will be made after H digit is dialed. Intersender timing will be in effect after trunk test when the sender TG2 and IT relays operate in parallel. The intersender timing interval may be checked with a stopwatch by observing the interval of time the IT lamp is lit. The time measured should be a 3- to 6-second interval instead of the regular 20- to 40-second sender timing. For the SD-27810-10 sender the time measured should be 4 to 4.75 seconds instead of the regular 18.5- to 22-second timing.

(b) If the code being tested is of a PCI class, trunk test is made when all the digits have been dialed into the sender. Intersender timing is in effect when sender TG2 and IT relays operate in parallel. The intersender timing interval may be checked with a stopwatch by observing the interval during which the IT lamp is lit. The time measured should be a 3- to 6-second interval instead of the regular 60- to 80-second CI timing after the U digit has been dialed. For the SD-27810-01 sender the time measured should be 4- to 4.75-second interval, instead of the regular 54.5- to 64.5-second CI timing after the U digit has been dialed.

18.10 Intersender sustaining time may be checked with a stopwatch by observing the interval during which the IST-lamp is lit after the test frame disconnects. With the IST-key operated first, and a full selector panel or crossbar code set up on the code keys (as described in 18.09), the ST key of the connector circuit is operated momentarily. The ST key provides the necessary trigger ground to the intersender timing control in the traffic register circuit. The stopwatch is started when the CT register operates (or when RST operates if the REP key is operated), and the time measured is 6 to 12 seconds until the IST- lamp is extinguished.

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CIRCUIT UNIT SECTION -0123
KEYPULSING CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to perform the functions of the keypulsing "A" switchboard key set when testing keypulsing "A" switchboard senders with the automatic sender test circuit.

1.02 This circuit in conjunction with the incoming and final selections control circuit or the PCI register control circuit performs synchronizing tests on the sender.

1.03 Current flow tests are applied to the KRA and KC relays.

1.04 Speed tests are applied to the keypulsing relays and to the key register relays in the keypulsing sender.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To control the pulsing of the code and numerical digits in conjunction with the code keys and dial pulsing circuit and to do this on a step-by-step basis when desired.

3.02 To test the sender for premature fundamental circuit closure. This test is made in conjunction with the incoming and final selections control circuit.

3.03 To apply current flow tests to the KRA and KC relays.

3.04 To apply speed tests to the keypulsing relays and to the key register relays in the sender.

3.05 To check the key release function of the sender.

3.06 To test release of TS and RS relays.

KEYS

3.07 The SKP key causes the KP- relays to generate slow pulses to detect certain troubles in the sender steering relays.

3.08 The TRT and RRT keys provide release tests for the TS and RS relays.

JACKS

3.09 The RTR jack provides for reversing the tip and ring leads from this unit into the sender.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit -0102

(b) Code Keys and Dial Pulsing Circuit -0105

(c) Incoming and Final Selections Control Circuit -0113

(d) PCI Register Circuit -0117

(e) Office Selections Control Circuit for Keypulsing Sender -0125

(f) Overflow Control Circuit for Keypulsing Senders -0127

(g) Operator Class Control Circuit for Keypulsing Senders -0129

(h) Sender Group Test Circuit -0131

(i) Code Test Circuit -0133

DESCRIPTION OF OPERATION

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5. SEIZURE

5.01 This circuit is controlled over lead C from the operator class control circuit, the overflow control circuit, and the office selections control circuit for keypulsing senders. When lead C is grounded by one of these circuits, relay C operates, locks directly to lead C, and advances the progress switch to position 2. If at any time lead C is opened, relay C releases, restoring the KP switch to normal. This circuit cannot be reseized until the KP switch reaches normal.

5.02 Keypulsing - With the C relay operated, ground is supplied through the back contacts of the KR, KS relays, the F resistor, the KP- windings, and the P winding of the KP1 relay. This same ground is connected through the KA relay to the KP1 armature. This causes the operation of the KP1 relay. When the KP1 front contact closes, the KP1 relay releases slowly and the opening of the front contact starts the KP1 operating again. The operation of this relay is delayed since capacitor KP must be charged by a current flowing through the KP1 secondary winding before the relay can operate. This capacitor charging current in the secondary winding is in the direction to prevent the relay operation. The relay will not operate until the charging current has been sufficiently reduced so that the primary ampere turns are greater than the secondary. The release of the KP1 relay is delayed in a similar manner due to the KP capacitor discharging through the secondary winding. The characteristics of the KP1 relay and associated capacitor and resistors are such that the relay contact furnishes pulses of approximately 0.047 second closed and 0.045 second open with the SKP key normal, and approximately 0.250 second closed, 0.250 second open with the SKP key operated.

5.03 Operate, NO, and Release Tests - The slower pulses are used to detect certain troubles in the sender steering relays, and with V option, to provide an operate current flow test for the TM and RM relays of the sender. The KP2, KP3, and KP4 relays repeat the pulses supplied by the KP1 contact for the purpose described below. The 230/243 ground for the L+ pulse constitutes a nonoperate test for the TM and RM relays and steering circuit, and is most effective during slow pulsing. The digits selected should alternate an H+ and L+ pulse on the same lead. Operation of the TRT or RRT key provides a release test for the TS or RS relay with fast pulses on FS or PCI calls. This test is effective only after an H- pulse such as 3 for the TS relay or 9 for the RS relay. This test is not effective after the units pulse, or after the tens pulse if no start pulse is used.

5.04 Tip and Ring Reversal - By inserting a plug in the RTR jack, the RTR relay may be operated to reverse the tip and ring leads into the sender. The reversal of the tip and ring leads is recognized by a KP sender as a class signal, and is used in connection with the stored-ring feature described in Section -0125. Any other tests may be made, however, with the RTR relay operated, to simulate this condition on any type of call originated on trunks which may be wired with tip and ring reversed between the trunk and the sender link.

(a) The ringing relay R in series with the R capacitor is bridged across the T and R leads to provide a release condition for the sender TP and RP relays, and to meet service conditions imposed by some types of controlled-ringing trunks.

6. REGISTRATION

6.01 With the C relay operated and the KP switch in position 2, this circuit awaits the closure of the T lead by the sender. Through resistor DB, 24-volt battery over the R lead to the sender causes the sender to connect 24-volt battery to the T lead. This operates relay CTA which locks and opens its winding from the T lead. The CTA operated, operates the CTB relay which removes the 24-volt battery from the R lead and closes the T and R

TABLE A

ALL DIGITS

Key	0	1	2	3	4	5J	6M	7R	8	9W	ST
Lead T		H+	L-	H-		L+	H+	L-	H-	L+	H+
Lead R	L+	L+		L+	L-	H+	H+	H+	H+	H-	L-

H+ = Low resistance (112 or 124 ohms) ground
H- = Low resistance (100 ohms) 48-volt battery
L+ = High resistance (230 or 245 ohms) ground
L- = High resistance (665 ohms) 48-volt battery

leads to the KP2 and KP3 relay contacts. The KP4 relay contact is closed through arc 3 of the KP switch to the KP magnet. When the KP4 contact closes, the KP magnet is energized and when the KP4 contact opens, the KP switch steps to position 3. In position 3 the A lead to the code keys and dial pulsing circuit is grounded.

6.02 This operates one of the relays 0 to 9 depending on the setting of the A code keys. With one of relays 0 to 9 operated, the KP2 and KP3 contacts close battery or ground to the tip and ring leads causing the corresponding digit to be registered in the sender. The resistances applied during registration are intended to make operate tests of the sender TP, TS, RP, RS, TM-, and RM relays, and nonoperate tests of the TM- relays. In a series of tests, the numbers used should be such that all of these relays are tested. The KP relay interrupter is designed to generate pulses of 0.045 second open, 0.047 second closed, the KP2, KP3, and KP4 contacts opening and closing at the same time. During the time the contacts are closed, KP4 contact energizes the KP magnet. When KP4 contact opens, the KP switch steps to position 4. With the KP switch in position 4, the relay which has operated for the A digit is released, and the grounding of the B lead in position 4 causes one of the 0 to 9 relays to operate in accordance with the setting of the B code keys. The pulsing of the B digit occurs in the same manner as for the A digit. In a similar manner, the pulsing of the C digit is performed. The closing of the T and R leads for the different digits is in accordance with the code shown in Table A.

7. FULL SELECTOR CALL - CLASS KEY 1 OPERATED

7.01 Pulsing of Code Prefix 1-1 - If the associated keypulsing senders are arranged to record the prefix 1-1 before the regular office code, G wiring is furnished. When it is desired to transmit the prefix 1-1 to the sender, the 1-1 key in the code keys and dial pulse circuit, Section -0105, will be operated. Under this condition, when the KP switch has advanced to position 3, ground is closed to the A lead, and the contact of the KP4 relay is connected to the SA lead. Ground on the A lead operates the 1 relay which transmits a digit 1 to the sender as the keypulsing interrupter relays pulse. The KP switch stays in position 3 until the prefix 1-1 and the A digit have been transmitted to the sender. While the A digit pulse is being sent, ground from the contacts of the KP4 relay over the SA lead returns over the SA1 lead and operates the KP switch magnet. When the A digit pulse ends, the KP4 relay releases and the KP switch advances to position 4 where the B digit is transmitted.

(a) With G option and the 1-1 key normal, the A digit is pulsed at once. The KP4 relay continues to pulse, advancing the KP switch to position 15 subject to control from the SY, WO, NN, and TMO relays.

7.02 Pulsing of the Code and Number - For this call the A, B, and C digits are pulsed as described above. The KP switch is stepped to position 7 by means of the KP4 contact and awaits the operation of

relay SY. The office selection control circuit proceeds to make the test of office selections and then seizes the incoming and final selections control circuit. This circuit grounds lead SY to the incoming and final selections control circuit which causes that circuit to return ground on lead SY1 when that circuit is ready for TG test. This ground on lead SY1 operates relay SY of this circuit. With relay SY operated, the stepping of the KP switch is synchronized with the KP4 contact, and the switch steps to position 8. Position 8 is passed by means of the KP4 contact without pulsing any digit into the sender because key 1 of the station row in the code keys and dial pulsing circuit will be normal for this class of test. In positions 9, 10, 11, and 12 and TH, H, T, and U digits are pulsed, respectively, and the KP switch is stepped to position 13. Since stations key 0 is operated, the KP4 contact will advance the KP switch to position 14 without sending a pulse in 13.

7.03 Test for Premature Fundamental Closure - With A wiring (see Note 103), during the interval of pulsing the TH, H, and T digits, a test is maintained by the incoming and final selections control circuit for a false closure of the fundamental circuit. Without A wiring this test is continued during the pulsing of the U and STA digits. When the KP switch steps to position 12 or 14, relay AV operates which removes ground from the SY lead. The removal of ground from the SY lead causes the incoming and final selections control circuit to cancel the test for false fundamental closure.

7.04 Pulsing the Start Signal - In position 14, relay ST operates and connects the start signal to the tip and ring leads when the KP2 and KP3 contacts close. The KP switch advances to position 15 where it awaits the release of relay C. If the start signal is not required, the pulse leads are open at the position of the ST relay but the KP4 relay continues pulsing to advance the KP switch.

7.05 Check of Key Release - Following the reception of the start signal by the sender, or the last digit in an area where the start signal is not sent, the sender connects 48-volt battery to the T and R leads which operates the polarized relays D and D1. If both of these relays operate, indicating a satisfactory closure in the sender, the KR relay operates and locks. This places the nonoperate condition for the sender KRA relay on the T lead and at the same time opens the circuit for holding the slow-release KR1 relay. The KR1 relay releases. The D1 relay may release when ground is placed on the T lead, but it will reoperate when the KR1 relay releases and removes the nonoperate ground. Following the release of the KR1 relay and the reoperation of the D1 relay, the D2 relay operates and locks, applying the operate current for the KRA relay to the T lead. With R option, the D2 relay cannot operate until after KP position 14, to prevent false operation during the release test of the GS and RS relays. When the KRA relay in the sender operates, it removes the battery from the R lead, releasing the D relay and operating the D3 relay. The operation of the D3 relay grounds the KR lead as a signal that the key release test has been satisfactorily made. If the KRA relay should falsely operate on its nonoperate current, it would operate the sender KR1 relay which would release the sender KR relay, removing 48-volt battery from the R lead. This would release the test circuit D relay before the test circuit KR1 released, thus preventing the D2 relay from operating. This would cause the circuit to block because the KR lead would not be grounded.

7.06 Code Check - When the CTB relay operates as described in a previous paragraph, its contacts connect ground to the G lead of the code test circuit and connect the C lead of the code test circuit to lead DEC of the sender group circuit. If the class of call is such that a marker should be used, the DEC will be grounded by the sender test circuit which will cause the code test circuit to check the information transmitted by the sender to the marker. If this check is satisfactory, the code test circuit will ground the AV lead. If a marker is not to be used, the sender group test circuit grounds lead CD. With either lead CD or AV grounded, a ground is supplied to the AV lead of the office selections control circuit. If, as a result of a failure to satisfactorily check the code, the AV lead is not grounded, the office selections control circuit will block.

7.07 Call Direct to Incoming Selector - If the full selector call being tested is one which requires a direct trunk to an incoming circuit, no code is pulsed. In

this case the sender group test circuit grounds leads NC operating relay NC. This causes the KP switch to pass by positions 3, 4, and 5 without operating any of relays 0 to 9, so that no pulses are sent to the sender for these three positions. After key release, the sender grounds the DC lead momentarily, operating relay DC and advancing the KP switch from 15 to 16. If the closure comes too soon, the DC relay will be released by the time position 15 is reached, and the KP switch will block in 15. In position 16 the DCS lead is grounded to advance the office selections control circuit.

8. LATE RELEASE - FULL SELECTOR - INCOMPLETE NUMERICAL REGISTRATION - CLASS KEY 3 OPERATED

8.01 The connector circuit grounds the WO lead to this circuit which causes the operation of the WO relay after the C relay has operated. The A, B, and C digits are pulsed if required, as described above, and the KP switch is stepped to position 7, awaiting the seizure of the incoming and final selections control circuit by the office selections control circuit. The incoming and final selections control circuit operates relay SY causing this circuit to advance to position 8.

8.02 Position 8 is passed by and the thousands digit is pulsed in position 9. The KP switch stops in position 10 because the WO relay has opened the path for advancing from this position. The WO relay also opens a path for pulsing the H digit. In position 10, the AV relay operates removing ground from the SY lead to the incoming and final selections control circuit. This causes that circuit and the office selections control circuit to supply a releasing signal to the sender and to check the sender for proper response to this release signal. The sender does not in this case send a key release signal and, therefore, the KR lead is grounded by the contacts of the WO relay.

9. CALL INDICATOR CALLS - CLASS KEY 5 OPERATED

9.01 The pulsing of the code and number for call indicator calls is accomplished in the same manner as described above for full selector calls except that a digit may be pulsed in position 8 if key 1 of the stations row is depressed in the code keys and dial pulsing circuit. A stations digit is pulsed in position 13 if one of the stations letter keys is operated. If the 0 stations key is operated, position 8 and 13 are passed by. The office selections control circuit is connected to the PCI register circuit after office selections have been completed. The PCI register circuit grounds lead SY which operates relay SY causing this circuit to proceed as described above for full selector calls. The operation of relay AV grounds lead TG1 to the PCI register circuit causing that circuit to advance for assignment.

10. RELEASED CALL INDICATOR CALLS - CLASS KEY 7 OR 8 OPERATED

10.01 This circuit is controlled for this test by the office selections control circuit. All digits are pulsed for this call and this circuit operates otherwise in the same manner as described above for a completed call indicator call.

11. TANDEM OPERATOR CALL PCI - KEY 6 OPERATED

11.01 This circuit is seized by the office selections control circuit. In this case the NN lead from the connector circuit is grounded, which operates relay NN. The operation of relay NN prevents the pulsing of the numerical digits and causes the sending of the start signal in position 6. The KP switch stops in position 7. The NN relay, with the KP switch in position 7, causes the PCI register circuit to advance. The key release function of the sender is tested as described above. In areas having no offices of over 10,000 lines and no party letters, the ST and NN relays are omitted, and A wiring is used. In this case the SY relay operates permitting the numerical digits to be pulsed.

12. THREE-DIGIT OPERATOR CLASS - CLASS KEY 10 OPERATED

12.01 This circuit is seized by the operator class control circuit, Section -0129. Key 10, Section -0102, grounds lead NN preventing the pulsing of any numericals. After pulsing the code and start signals the KP switch advances to position 7 and awaits the key release check which grounds the KR lead to Section -0129 where the test is completed.

13. OVERFLOW TESTS - CLASS KEY 13 OR 14 OPERATED

13.01 This circuit is seized by the overflow control circuit. The operation of this circuit for these tests is the same as described above for full selector or PCI calls except that the SY lead is grounded by the overflow control circuit which causes this circuit to pulse all digits. The overflow control circuit does not advance for selections until the KR lead is grounded by this circuit.

14. TIME-OUT - TWO DIGITS REGISTERED - CLASS KEY 12 OPERATED

14.01 This circuit is seized by the overflow control circuit. The connector circuit grounds the TMO lead causing the operation of the TMO relay. The operation of the TMO relay stops the KP switch in position 5, but no digit is pulsed in this position as the C lead to the code keys and dial pulsing circuit is opened. With the KP switch in position 5, two digits will have been registered in the sender except on 2-digit codes where only one digit will have been registered. In position 5 of the KP switch the TM lead to the connector circuit is grounded causing the time alarm interval to be extended 30 seconds.

15. OPERATOR ERRORS

15.01 Trunk to Incoming Selector - Class Key 16 Operated - This circuit is seized by the office selections control circuit, Section -0125. In this case the 2-INC key of the sender group test circuit is operated. This grounds leads NC and SY causing the operation of relays NC and SY. A stations letter key should be depressed in the code keys and dial pulsing circuit. No code is pulsed, but four numerical digits and a stations digit are pulsed. The sender is arranged so that when a fifth digit is pulsed on this class of call, a reorder signal is sent to the trunk. This reorder signal is checked by the office selections control circuit. The key release function of the circuit is tested in the usual manner.

15.02 Trunk to Tandem District - Class Key 16 - This circuit is seized by the office selections control circuit which grounds leads NC and SY operating the NC and SY relays. Four digits and the start signal are pulsed. The 3-TAN key in the sender group test circuit is depressed, which indicates to the sender a call to full selector for tandem district. The sender recognizes an error when the start signal is received after four digits have been pulsed, and sets up the reorder condition which is checked by the office selections control circuit.

15.03 Trunk to an Office Selector - Class Key 18 - This circuit is seized by the overflow control circuit. The 1-TW key in the sender group test circuit is operated, indicating to the sender a call through the distant office selector. The code setup on the code keys is one which requires a district junctor. The code and number are pulsed in the usual manner, and the check for reorder is made by the overflow control circuit.

15.04 Trunk to District Junctor - Office Code Keyed - Class Key 15 - This circuit is seized by the overflow control circuit. The 0-DIS key of the sender group test circuit is operated, indicating to the sender that it is associated with a trunk to district junctor. The code setup on the code keys is one corresponding to a trunk-to-distant-office selector. The code and number are pulsed in the usual manner, and the check for reorder is made by the overflow control circuit.

15.05 Trunk to District Junctor - Four Numerical and Start Digits Keyed - Class Key 16 - The 0-DIS key of the sender group test circuit is operated, indicating a trunk-to-district junctor. This circuit is seized by the office selectors control circuit which operates relays NC and SY. Four digits and a start signal are pulsed, the first three being an operators code, which would normally be routed through a district junctor. When a fourth digit and a start digit are registered on an operator class call, the sender recognizes an error and sets up a reorder condition which is checked by the office selections control circuit.

16. SENDING PULSES STEP BY STEP

16.01 In order to aid in locating troubles, the digits may be transmitted to the keypulsing sender one at a time under control of a key. To do this the DSS key in the code keys and dial pulsing circuit is operated which grounds the SS lead and operates the KS relay. This opens the circuits of the KP2, KP3, and KP4 relay

contacts, prevents the KP relays from pulsing, and closes the path from the KA relay to the code keys and dial pulsing circuit. Each operation of a key in the connecting circuit operates the KA relay winding which closes the circuits ordinarily closed by the interrupter relays. In this way a pulse is transmitted and the KP switch is advanced for each key operation. The key must also be operated to advance through positions 6 and 7 which are usually passed by means of the KP4 contact. Arc 4 grounds leads to lamps which indicate which digit the circuit is ready to pulse.

17. VACANT CODE TEST - CLASS KEY 18

17.01 This circuit is seized by the overflow control and pulses into the sender in the usual manner. The code is checked in the usual manner, and the overflow control circuit checks the reorder signal.

CIRCUIT UNIT SECTION -0125
OFFICE SELECTION CONTROL CIRCUIT FOR KEYPULSING SENDERS

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to perform the functions of the office selectors in the sender test circuit when used for testing keypulsing A switchboard senders.

1.02 This circuit is controlled from the connector circuit of the test set and in turn controls the keypulsing circuit, the incoming and final selections control circuit, the PCI register circuit, and the route keys and revertive pulsing circuit.

1.03 In conjunction with the route keys and revertive pulsing circuit, the sender is tested for office selections.

1.04 Functions of a district selector such as S, LR, and TR lead control are performed by this circuit.

1.05 This circuit is also arranged to check the sender on full selector calls released after the thousands digit is keyed, on released call indicator calls either distant office or local office, on tandem operator calls, and on certain operators errors as described below.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To test the LR relay in the sender on operate current flow.

3.02 To control the checking of the office selections by the route keys and revertive pulsing circuit.

3.03 To skip office selections as required by the routing of the call.

3.04 To seize the incoming and final selections control circuit on full selector calls.

3.05 To seize the PCI register circuit on call indicator calls.

3.06 To test the sender for timed trunk closure after selections beyond office have been completed.

3.07 On late release full selector calls, to ground the LR lead and check that the proper release conditions have been set up.

3.08 To ground the LR lead at the proper time on released call indicator calls, and to check that the proper release conditions have been set up in the sender.

3.09 To check that the sender sets up the proper reorder conditions on certain types of operator errors.

3.10 To block in case of the operation of the test set time alarm. The blocking of this circuit also blocks the associated circuits.

3.11 The SRG jack provides for testing the stored-ring feature in KP senders.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit	-0102
(b) Route Keys and Revertive Pulsing Circuit	-0109
(c) Incoming and Final Selections Control Circuit	-0113
(d) PCI Register Circuit	-0117
(e) Keypulsing Circuit	-0123
(f) Sender Group Test Circuit	-0131

DESCRIPTION OF OPERATION

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5. SEIZURE

5.01 When this circuit is seized by the connector circuit, lead C is grounded which operates relay C through the normal contact of arc 1 of the selection progress switch SP. Relay C locks directly to lead C. The G relay also operates from the connector circuit after relay C has operated.

6. AWAITING PULSING AND CHECK OF THE CODE - SP SWITCH IN POSITION 22

6.01 This circuit waits for the keypulsing circuit to complete the pulsing and check of the code after which the AV lead is grounded advancing the SP switch to position 1.

7. OFFICE BRUSH SELECTION

7.01 With the SP switch in position 1, the OB lead to the route keys and revertive pulsing circuit is grounded. The route keys and revertive pulsing circuit checks office brush selection. If this selection is found to be correct, ground is placed on lead AV which advances the SP switch to position 2. When the counting relays in the connecting circuit have released, ground on the AV1 lead advances the switch to position 3.

8. OFFICE GROUP SELECTION

8.01 Office group selection is made in positions 3 and 4 in a similar manner to office brush selection, and the SP switch advances to position 5.

9. SECOND OFFICE SELECTIONS

9.01 Second office selections are always omitted.

10. SKIP OFFICE SELECTIONS

10.01 Two keys are provided in the route keys and revertive pulsing circuit to cause the SP switch to pass by the first office positions 1 to 4, or the second office positions 5 to 7, or both.

11. FULL SELECTOR TESTS - CLASS KEY 1 OPERATED

11.01 Seizure of the Incoming and Final Selections Control Circuit - In position 8 of the SP switch, relay SB operates. For full selector calls, the connector circuit grounds lead FS. When relay SB operates, relay FS operates connecting this circuit to the incoming and final selections control circuit. The operation of relay FS closes ground on leads C and G to the incoming and final selections control circuit. These leads control the seizure, blocking, and restoration of that circuit. The operation of relay FS also closes ground on the KP lead to the incoming and final selections control circuit which causes that circuit to function for testing keypulsing senders.

11.02 Trunk Closure Test - After the incoming and final selections control circuit has completed incoming and final selections and has sent the reversed battery pulse, it grounds lead AV to this circuit which operates relay TC2. The operation of relay TC2 advances the SP switch to position 9 and transfers the fundamental tip to the winding of the TC1 relay and the fundamental ring to the winding of the TC relay. The sender should now close the trunk through 390 to 500 ohms, and relays TC and TC1 should both operate. The sender should maintain this closure on the fundamental for a minimum period of approximately 0.24 second. This interval is checked by means of the TC4 relay. The TC4 relay has current in both windings, the primary winding tending to operate the relay and the secondary to prevent its operation. Under this condition the relay does not operate. When the TC1 relay operates, disconnecting ground from the secondary winding, current continues to flow in this winding due to the fact that capacitor TC

begins to charge in series with the secondary winding. As the capacitor charges, the current decreases and when the secondary current becomes low enough, the relay operates on its primary winding. The time required is determined by the capacity of the TC capacitor and the resistance of the primary and the secondary circuits. The operation of the TC4 relay operates the TC3 which locks. However, if the sender operates the TR relay before the TC3 relay operates, the TC3 relay will be prevented from operating and the test circuit will block. If there is a cross to ground on the fundamental, the TC relay will fail to operate and a cross to battery will prevent operation of the TC1 relay. If either of these relays fails to operate, the TC3 relay cannot operate. If, however, this function of the sender is performed properly, the operation of the TC3 relay will advance the SP switch to position 10. The SP switch is then advanced to position 11 by means of the back contact of relay PC. If the keypulsing circuit has checked the DC lead, lead DCS advances the SP switch to position 12, otherwise the switch blocks, lighting the DC lamp.

11.03 Stored-Ring Tests:

(a) To test the stored-ring feature of KP senders, a plug is inserted in the SRG jack, and a full selector call direct to an incoming selector is set up, as described in Section -0123. The plug in the SRG jack operates the TCR relay in Fig. F, -0125.

(b) Incoming and final selections and incoming advance are completed as described in Section -0113. When the SP switch in incoming and final selections control circuit, Sheet -0113, reaches position 12, the RS1 relay in Fig. F, Sheet -0125, is operated. This places resistance battery on the ring lead to the sender, which imposes a nonoperate test on the SRR relay in the sender and checks that the SRR circuit is present by operating the RS2 relay in Fig. F. This closes resistance battery to the tip lead for an operate test of the SRT relay in the sender. The SRT will be unable to operate if SRR operated on its nonoperate test. The SRT operates SRA in the sender, which prepares the sender for outward ringing as soon as incoming advance is completed.

(c) Operation of RS2 connects ground to the armature of the IOF interrupter in the overflow control circuit for subscriber senders, Sheet -0119. This ground operates the IO1 relay when the interrupter closes its back contact. When the interrupter F contact closes, it operates relay RBS which increases the resistance in the battery path to the tip lead to impose a release test on the sender SRT relay. Unless relay SRT releases, it prevents the sender from operating its AV relay following the completion of incoming advance, and the test will block. If SRT did not operate, the sender AV relay will be operated and the sender released without giving an outward ringing signal.

(d) With the SRT relay in the sender released, the sender, having completed incoming advance, will close continuous 20-cycle ringing current to the fundamental tip and ring leads for about 0.3 second. At the same time, the incoming and final selections control circuit, on completing incoming advance, operates relay TC2. With relay TCR operated, the operation of relay TC2 connects the fundamental tip and ring to the TCR varistor. The ringing current applied to the varistor operates the SRG relay which operates TC3 from ground through a front contact of RRS and a normal contact of the TR relay. If the sender SRT relay had not delayed the sender advance by its continued operation, the sender would have rung and operated TR before RRS operated, thus preventing the operation of TC3 and blocking the test.

(e) The sender then grounds the TR lead, causing the TR relay to operate. The release of the sender ON relay then causes the S relay in the connector circuit, Sheet -0102, to operate, which releases the S relay in this control circuit, -0125. With S released and TR operated, the SP switch advances to position 13, where ground is placed on the ADV lead to the connector circuit as a release signal.

11.04 Test for Simplex Ringing:

(a) If the KP senders are arranged for both 20-cycle and simplex outward ringing signals, the tip and ring leads from the trunk-to-sender link are reversed

in those trunks which require simplex ringing. This reversal causes the sender KCT relay to operate instead of the KCR relay, which is a class indication by which simplex ringing instead of 20-cycle ringing is sent out on stored-ring calls.

(b) This reversal of the tip and ring leads is simulated in the test circuit by placing a plug in the RTR jack which operates the RTR relay in keypulsing circuit, -0123. On stored-ring calls, the operation of the TCR relay from the SRG jack will also operate SXR relay through a front contact of RTR.

(c) The SXR relay transfers relay SRG from its position across the TCR varistor where it was used to detect 20-cycle ringing, and connects SRG to FT lead to the sender. Relay SRG will be operated in this case by 130-volt battery from the sender. The operation of the circuit is otherwise the same as for 20-cycle ringing described above.

11.05 Repeater Termination and Pad Control - Simplex Battery Tests:

(a) The sender bridges a repeater termination consisting of a capacitor and resistor across the tip and ring leads at all times except during the registration of key pulses; it also places a pad control simplex battery across the tip and ring while in the await-ringing signal condition, following digit registration.

(b) A short-circuited repeater-termination capacitor, or short-circuited pad-control resistor, or failure of the contacts involved in these features will be detected by the test-frame on stored-ring tests. However, a complete transmission test of these features is not made by the test circuit so that manual tests should be made as required. The requirements as to frequency of such tests may be based on operator reports of trouble which might be attributed to these features, such as singing of repeaters during connection to the sender.

12. CALL INDICATOR CALLS - CLASS KEY 5 OPERATED

12.01 Seizure of PCI Register Circuit - On call indicator calls the connector circuit, Sheet -0102 grounds lead PCI. When the SB relay operates in position 8 of the SP switch, relay PC operates connecting this circuit to the PCI register circuit. The PCI register circuit is controlled over leads C and G. The grounding of lead KP to the PCI register circuit causes that circuit to function for testing keypulsing senders. The PC relay also operates relay G in the PCI register circuit to enable interruptions to be closed to the CIP switch. This is done in a manner similar to the operation of relay G by the PCI dial pulse control circuit.

12.02 Check of Trunk Closure on Call Indicator Calls - When the PCI register circuit has finished checking the PCI registration, it grounds lead AV operating relay TC2 which advances the SP switch to position 9 and transfers the fundamental tip and fundamental ring to relays TC1 and TC, respectively. With the TC, TC1, and PC relays operated, the TC3 operates, locks, and advances the SP switch to position 10. No check of the duration of trunk closure is made on PCI tests.

12.03 Check of Registration by PCI Register Circuit - If the PCI register circuit finds that the registration is correct, it grounds lead S which advances this circuit from position 10. The test of DC lead is the same as described in 11.02.

13. CHECK OPERATION OF TR AND DC AND RELEASE OF S RELAYS

13.01 After furnishing trunk closure, the sender operates relay TR and releases relay S. With the TR relay operated and S released, the SP switch advances to position 13.

14. RELEASE

14.01 With the SP switch in position 13, ground is placed on the ADV lead to the connector circuit causing that circuit to open lead C to this circuit, which releases relay C. The release of relay C restores the SP switch to normal, opens the C lead to the keypulsing circuit permitting that circuit to restore to normal. It also opens the C lead to the incoming and final selections control circuit or the PCI register circuit, permitting those circuits to restore. This circuit cannot be reseized by the connector circuit until the SP switch has reached normal.

15. LATE RELEASE - FULL SELECTOR CALL - CLASS KEY 3 OPERATED

15.01 For this test, class key 3 grounds lead FS. The operation of this circuit is as described above up to the time the incoming and final selections control circuit has been seized. The incoming and final selections control circuit causes the keypulsing circuit to pulse the thousands digit. After the thousands digit has been pulsed, the incoming and final selections control circuit grounds lead WO, operating relay WO. The operation of relay WO advances the SP switch to position 9 and places 1170-ohm ground on the LR lead which causes the sender to register a release condition. The incoming and final selections control circuit tests that the sender has set up a tell-tale condition after which lead AV is grounded as before. This circuit completes the test as described above for full selector calls. Position 11 is passed by from a WO relay contact.

16. RELEASED CALL INDICATOR CALLS - CLASS KEY 7 OR 8 OPERATED

16.01 For this test, the operation is as described above up to the time the PCI register circuit is seized. The PCI register circuit, after causing the keypulsing circuit to pulse the numerical digits, grounds lead WO to this circuit operating relay WO. The operation of relay WO advances the SP switch to position 9 and places 1170-ohm ground on the LR lead which causes the sender to register a release condition. The PCI register circuit grounds lead AV and S which causes this circuit to proceed as described above for regular PCI calls. The remaining tests are made in the manner previously described, position 11 being passed by from a contact of WO.

17. OPERATOR ERRORS

Note: For operator error tests, the sender CTR keys should be pulled outward to prevent release due to timeout.

17.01 Trunk to Incoming - Class Key 16, Five Numerical Digits, and a Start Digit Keyed - For this test the class key grounds lead OE. Ground on lead OE operates relay OE. Relay OE operated, grounds the NC lead to the keypulsing circuit causing that circuit to pass by the positions for pulsing the code, grounds lead SY to cause the numerical digits to be keyed, short-circuits the contacts of the DC relay of Section -0123 (because on OE tests the sender may ground the DC lead before the end of pulsing), and provides a passby circuit for positions 8, 9, and 10. The SO and SSO keys in the route keys and revertive pulsing circuit are operated for this test causing this circuit to pass by office selections. The 2-INC key in the sender group test circuit must be operated for this test indicating to the sender that a trunk to an incoming selector is to be used. Positions 8, 9, and 10 are passed by. The keypulsing circuit transmits the numerical digits including a fifth digit set up on the stations code keys. The sender on receiving a fifth numerical digit recognizes an error and sets up a reorder condition. As a result of the operator error, the sender releases the S relay, but does not operate relay TR. Under this condition, the SP switch advances to position 13. In position 13 the test circuit grounds the ADV lead to the connector.

17.02 Trunk to Full Selector Tandem District - Class Key 16, Four Numerical Digits, and a Start Digit Keyed - For this test lead OE is grounded by the connector circuit. The SO, SSO, and 3-TAN keys must be operated. The operation of the OE relay grounds leads NC and SY to the keypulsing circuit causing that circuit to pass by the positions for pulsing the code and to pulse the numerical digits and a start digit. The SO and SSO keys operated cause this circuit to pass by office selections. The sender recognizes an error and sets up a reorder condition. Positions 8, 9, and 10 are passed by. The check of trunk closure and release of S relay are made and the SP switch advances to position 13 where the ADV lead to the connector is grounded.

17.03 Trunk to District Junctor - Four Numerical Digits and a Start Digit Keyed - First Three Digits are Operator Code - Class Key 16 - For this test the SO and SSO keys and the O-DIS key of the sender group test circuit are operated. Lead OE is grounded, operating relay OE which grounds lead SY and NC to cause the keypulsing circuit to pulse four numerical digits and the start digit.

The first three digits should be those of an operator code, which would normally be routed through a district junctor. Registration of the fourth digit causes the sender to recognize an error and return a reorder signal. The circuit operates from this point, as described in 17.01. In order to permit the code test circuit to check the code, operate the A, B, and C keys in the code keys and dial pulsing circuit corresponding to the TH, H, and T keys, respectively.

CIRCUIT UNIT SECTION -0127
OVERFLOW CONTROL CIRCUIT FOR KEYPULSING SENDERS

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to test keypulsing A switchboard senders for overflow conditions in conjunction with other circuits of the originating sender test.

1.02 The sender is tested for overflow after office selection and for overflow during incoming group selection.

1.03 During office overflow test, a check is made that the sender advances from trunk test position and reduces the resistance of the fundamental circuit.

1.04 During incoming overflow test, the overflow relay in the sender is given a speed test.

1.05 This circuit is arranged to test the sender for operator error under the condition in which the operator keys a code which does not require an office selector when the indication is that a trunk to an office selector is required. Key FR in the sender group test circuit is operated.

1.06 This circuit is arranged to test for proper time-out operation after two digits have been keyed.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To control the keypulsing circuit when making office overflow, incoming overflow, time-out, and certain operator error tests.

3.02 To control the route keys and revertive pulsing circuit for office, second office, and incoming selection as required.

3.03 To return reverse battery as an overflow signal to the sender after office selections or during incoming group selections, depending upon whether the IO relay is normal or operated.

3.04 To test the sender OF relay for speed of operation.

3.05 To test the sender for proper operation when it times out after two digits have been keyed.

3.06 To test the sender for proper operation when the operator in error selects a direct trunk to a distant office selector and keys a code which requires a district junctor.

3.07 To check for a reorder signal from the sender on overflow time-out, or operator error features.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit	-0102
(b) Route Key and Revertive Pulsing Circuits	-0108
(c) Overflow Control Circuit	-0119
(d) Keypulsing Circuit	-0123
(e) Code Test Circuit	-0133

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Note: The CTR key for each keypulsing sender should be operated during overflow tests to prevent release due to time-out.

5. SEIZURE

5.01 This circuit is seized by ground over the C lead from the connector circuit. This ground is extended through the normal position of the SP switch and operates relay C which locks to the C lead. When the connector circuit grounds the G lead, the G relay operates. The operation of the C and G relays advances the SP switch to position 1, and supplies ground to the C lead of the keypulsing circuit to start its operation.

6. CHECK OF KEY RELEASE

6.01 In position 1 of the SP switch, ground is connected to the KR lead to the route keys and revertive pulsing circuit lighting the KR lamp in that circuit. The C relay, when it operated, grounded the C lead, and the G relay grounded the SY lead to the keypulsing circuit. The keypulsing circuit proceeds to pulse the code and number and check the key release signal from the sender. If the key release function of the sender is properly performed, the keypulsing circuit grounds lead KR which advances the SP switch to position 2. As the SP switch leaves position 1, the KR lamp in the route keys and revertive pulsing circuit is extinguished.

7. OFFICE BRUSH SELECTION

7.01 For office selections the fundamental is closed from the connector circuit to the route keys and revertive pulsing circuit over the FT and FR leads. The TC, RV, and FR relays are normal.

7.02 As soon as the code is pulsed by the keypulsing circuit, the sender closes the fundamental for office brush selection. After the key release is checked and the SP switch advanced to position 2, lead OB to the route keys and revertive pulsing circuit is grounded. If the proper selection is made, the AV lead is grounded which advances the SP switch to position 3. When the counting relays in the route keys and revertive pulsing circuit release, lead AV1 is grounded advancing the SP switch to position 4.

8. OFFICE GROUP SELECTION

8.01 Office group selection is made in positions 4 and 5 in the same manner as office brush selection, except that the OG lead is grounded instead of the OB lead, and the SP switch advances to position 6.

9. SECOND OFFICE SELECTIONS

9.01 Second office selections are not made.

10. SKIP OFFICE SELECTION

10.01 If the call is one that does not require office selections, ground on the OB and OG leads causes ground to be placed on the AV and AV1 leads thus passing the office selections to position 8.

11. SKIP SECOND OFFICE SELECTION POSITIONS

11.01 As second office selections are not required, ground on the SB and SG leads causes the AV and AV1 leads to be grounded thus passing the office selections to position 13.

12. OFFICE OVERFLOW TEST

12.01 Office overflow test should always be made because certain tests such as reversed trunk are required even though no office selectors are used. Use codes as outlined for subscriber senders. The sum of the test circuit and sender beyond office compensating resistance shall be 900 ohms for the test. For this test class key 13 is operated in the connector circuit. This causes the code test circuit to send a trouble release signal to the sender so that subsequent operation of the sender overflow relay will cause a reorder. In position 18, relay RV operates. Relay RV operated, connects ground to the FT lead to the sender and connects the FR lead over the FT lead to the L relay in the route keys and revertive pulsing circuit. On full selector calls, the L relay will not operate until the sender advances. The TO relay, but not the OF relay in the sender, operates through 14,500 ohms in the fundamental circuit and causes the sender to advance and remove the 14,500 ohms from the fundamental circuit. This allows the sender OF relay and the L relay in the route keys and revertive pulsing circuit to operate. The operation of the L relay grounds lead AV2 which energizes the SP magnet in position 18. On calls other than full selector,

the sender does not include the 14,500-ohm resistance, and the L relay operates immediately and energizes the DP switch in position 18. The L relay contact grounds lead AV2 and energizes the DP switch in position 18. After a short interval, the sender opens the fundamental which releases the L relay and advances the SP switch to position 19. As the switch leaves position 18, the RV relay releases. While the RV relay is operated, ground over the OFL lead to the route keys and revertive pulsing circuit lights the OF lamp in that circuit. When the RV relay is released, the OF lamp is extinguished.

13. TEST OF TRUNK CLOSURE

13.01 After a short interval, the sender should advance and close 390- or 500-ohm resistance across the fundamental circuit as a trunk closure. In position 19, RV relay normal, the TC relay operates, closes ground on the FR lead and closes the FT lead through resistor B and relay TC1 to battery. When the sender closes the 500-ohm trunk closure resistance across the fundamental, the TC1 relay should operate advancing the SP switch to position 20. This releases the TC and TC1 relays. The S relay has been operated through a make-contact on the C relay at the start of the test. On calls that are completed correctly after trunk closure the sender connects ground to the TR lead as an indication that it has completed all its operations. However, on overflow calls, time-out awaiting completion of keying, stuck senders, operator errors, or when the decoder has no trunk available, this ground is not connected to the TR lead and consequently the TR relay cannot operate. At completion of trunk closure, the sender operates the S relay in the connector circuit, -0103, which removes ground from the S lead to this circuit. With both TR and S leads open, the trunk or district receives a reorder indication. When ground is removed from the S lead, the S relay releases. With the S and TR relays both normal, the SP switch is advanced to position 21.

14. RELEASE

14.01 In position 21, ground at arc 4 of the SP switch is closed to the ADV lead to the connector circuit causing that circuit to open its C lead which releases the C relay. The release of the C relay restores this circuit to normal by advancing the SP switch to position 22 and also permits the keypulsing circuit to return to normal. This circuit cannot be reseized until the SP switch is in position 22.

15. INCOMING OVERFLOW

15.01 Operation of IO Relay - Use codes as outlined for subscriber senders. Use any four numerical digits which do not use incoming group selection zero. When the incoming overflow test is to be made, the IO lead is grounded by the connector circuit. With the incoming overflow class key 14 operated, the IO relay operates.

15.02 Operation of the Circuit for Office and Second Office Selections - The operation of this circuit is the same as previously described. For skip office and skip second office selections, the SO and SSO keys in the route keys and revertive pulsing circuit are operated.

15.03 Incoming Selections - In positions 13 of the SP switch, the FR relay operates and locks. The operation of the FR relay advances the SP switch to position 14 from ground on the AV1 lead. In position 14, the IB lead is grounded. If incoming brush selection is completed satisfactorily, ground is placed on the AV lead which advances the SP switch to position 15. When the counting relays in the route keys and revertive pulsing circuit release, ground is placed on the AV1 lead which advances the SP switch to position 17.

15.04 Check Fundamental Closed - In position 17, a check is made that the sender is closed for incoming group selection. The TC relay operates from ground at arc 4 of the SP switch and connects the FT lead to battery through the B resistor and TC1 relay in series. The FR lead is grounded. When the sender closes its fundamental, the current is insufficient to advance the sender, but relay TC1 operates which advances the SP switch to position 18. This check is made to ensure that the sender had advanced and closed its fundamental for incoming group selection before reversed battery is returned for the incoming overflow test.

15.05 Speed of Operation Test of OF Relay - In position 18 of the SP switch, the RV relay operates which operates RV1 relay

of -0119. The RV relay operated, grounds the OFL lead to the route keys and revertive pulsing circuit and lights the OF lamp in that circuit. The operation of the RV relay causes the route keys and revertive pulsing circuit to close the sender FR lead to the L relay in that circuit, the L2 relay having been operated over the L1 lead as previously described. The sender FT lead is connected to the FR1 lead to the beyond-office compensation resistance in the route keys and revertive pulsing circuit and thence back over the FR2 lead through a resistance in the incoming and final selections control circuit, through the back contact of relay RV2 to ground at the contacts of RV1 relay (Sheet -0119). With the MTG key of the incoming and final selections control circuit normal, a "2-position" incoming call is simulated. The time interval is approximately 0.075 second, and the current in the fundamental is relatively low. With the MTG key operated, a "1-position" incoming call is simulated. The time interval is approximately 0.040 second, and the current is higher than for the above case. The total test circuit and sender office and beyond-office compensating resistance should be 900 ohms for this test. The operation of the RV1 relay, -0119, operates the RV2 relay of that circuit. The RV2 relay is slow in operating due to the fact that the current for charging the RV capacitor flows through the secondary winding of the RV2 relay preventing its operation until the capacitor is charged. Thus the RV2 relay opens the fundamental ring a short time after the RV1 relay closes it. The OF relay in the sender should operate on this pulse. If the OF relay fails to operate, the sender will fail to advance for trunk closure in position 19. The operation of the RV2 relay advances the SP switch to position 19. If the OF relay operates, trunk closure, advance of sender, and release of this circuit take place as previously described for office overflow.

15.06 Long Incoming Overflow - This test is similar to the long incoming overflow test described in Section -0119. Operate the incoming overflow class key of Sheet -0103 and the LIOF key of Sheet -0108. Instead of operating relays RV1 and RV2 of Sheet -0119, the IOF interrupter and IO1 relays operated as described in Section -0119. If the sender does not wait for the test circuit to open the fundamental, the test circuit will block in position 18. If the sender does wait, the IOF interrupter grounds lead F advancing the SP switch to position 19. From this point the test proceeds as described for office overflow test.

16. TIME-OUT TEST - CLASS KEY 12

16.01 The sender CTR key should be pushed in to permit the sender to release after time-out. When an incomplete number is keyed, the sender after an interval, times out and sends a reorder signal to the operator. This function of the sender is tested by this circuit in conjunction with the keypulsing circuit. After the seizure of this circuit by the connector circuit, followed by the seizure of the keypulsing circuit by this circuit, one or two digits will be pulsed into the sender by the keypulsing circuit. The connector circuit grounds lead OE to this circuit, operating the OE relay. This circuit waits in position 1 for the sender to time out. When the sender times out, it sends a key release signal to the keypulsing circuit. The keypulsing circuit then grounds lead KR advancing this circuit to position 2. For this test the SO, SSO keys in the route keys and revertive pulsing circuit are operated which causes the circuit to advance to position 18 as described in 10. and 11. Positions 18 and 19 are passed by since the OE relay is operated. The release of the S relay, the TR relay being normal, advances the SP switch to position 21 as described in 13. The release of the circuit now takes place as described in 14. The time-out interval may be measured by observing the time during which the KR lamp is lit. This time interval should be 20 to 40 seconds. If it is desired to stop the test between senders in order to read and reset the stopwatch, the TA key should be operated after a test has been completed and the watch reset. This will cause the next sender to be selected and tested.

17. OPERATOR ERRORS

17.01 Direct Trunk to Distant Office Selector - Class Key 18 - For this test the 1-TW key in the sender group test circuit must be operated which indicates to the sender that a code requiring a direct trunk to distant office selector is to be keyed.

The CTR key of the sender should be pulled out to prevent release on time-out. The code set up on the code keys should, however, be a code which requires a district junctor. The SO and SSO keys in the route keys and revertive pulsing circuit should be operated. The connector circuit grounds lead OE to this circuit operating relay OE. After the code is pulsed into the sender by the keypulsing circuit, the sender recognizes an error and proceeds to set up the reorder signal. The keypulsing circuit advances the SP switch to position 2 by grounding the KR lead. The remaining operations are the same as described in 16.

17.02 Trunk to District Junctor - Class Key 15 - Office Code Keyed - For this test the O-DIS key of the CS keys of the sender group test circuit must be operated, which indicates to the sender that a code corresponding to a trunk to district junctor is to be keyed. The CTR key of the sender should be pulled out to prevent release on time-out. The code set-up on the code keys should be one which corresponds to a trunk-to-distant-office selector. The SO and SSO keys of the route keys and revertive pulsing circuit should be operated. The operated class key 15 of the connector circuit operates a relay in the code test circuit which:

(a) Opens the DC lead to the decoder marker preventing the operation of the sender D relay.

(b) Operates the OE relay of this circuit.

After the code is pulsed by the keypulsing circuit, the sender recognizes an error and sets up a reorder signal. The keypulsing circuit advances the SP switch to position 2 by grounding the KR lead. The remaining operations are the same as described in 16.

18. UNASSIGNED CODE TEST - CLASS KEY 18

18.01 For this test, the O-DIS key of the CS row of the group test circuit is operated indicating that a trunk-to-district junctor is to be served. The CTR key of each sender to be tested should be pulled out to prevent the sender from releasing due to time-out. The code set on the code keys should be a blank code. The numerical keys should also be operated. The SO and SSO keys in the route keys and revertive pulsing circuit should be operated. The connector grounds lead OE operating relay OE. The code and number are pulsed into the sender in the usual way. After checking key release, the keypulsing circuit advances the SP switch to position 2. Positions 2 to 11 are passed by. Relay OE operated, causes the switch to pass by position 12. Positions 13 to 19 are passed by. The decoder recognizes the blank code and operates the sender RO relay. When keypulsing has been completed, the sender CT relay operates, opening the S lead without grounding lead TR. This releases the S relay which advances the SP switch to position 21 grounding the ADV lead to the connector.

CIRCUIT UNIT SECTION -0129
OPERATOR CLASS CONTROL CIRCUIT FOR KEYPULSING SENDERS

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to test the following classes of calls in conjunction with the other sections of the originating sender test circuit:

(a) Three-Digit Operator - Distant Office Selector in Circuit. (Not Used.)

(b) Three-Digit Operator - No Distant Office Selector in Circuit.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To control the testing of the routing of the call in accordance with the route keys which are depressed in the route keys and revertive pulsing circuit.

3.02 To simulate the conditions of trunk test corresponding to the kind of operator trunk seized.

3.03 On 3-digit operator calls through a distant office selector to test for a minimum trunk test closure by the sender of approximately 0.070 second and for a minimum reverse battery closure of approximately 0.070 second.

LAMPS

3.04 The TGT lamp lights when making trunk guard closure test on this class of call.

3.05 The RBT lamp lights when making a reverse battery closure test on this class of call.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit -0102

(b) Route Keys and Revertive Pulsing -0108

(c) Keypulsing Circuit -0123

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5. SEIZURE

5.01 This circuit is controlled by the connector circuit over lead C. Ground from the connector circuit over lead C operates relay C which locks to lead C. When C relay operates, ground over lead G operates the G relay. Relays C and G operated, advance the SP switch to position 1.

6. SEIZURE OF THE KEYPULSING CIRCUIT

6.01 When relay C operates, lead C to the keypulsing circuit is grounded causing that circuit to proceed with pulsing the code into the sender.

6.02 Pulsing of the Code by the Keypulsing Circuit - The keypulsing circuit pulses three digits into the sender after which a check of the key release function of the sender is made. If this is found to be correct, the keypulsing circuit grounds lead KR, advancing the SP switch to position 2. In position 2 the D01 relay operates, locks, and advances the SP switch to position 3.

7. OFFICE BRUSH SELECTION

7.01 After the code is pulsed, the sender closes the fundamental for office brush selection. With the SP switch in

position 3, lead OB to the route keys and revertive pulsing circuit is grounded causing that circuit to check office brush selection. If this selection is correct, lead AV is grounded advancing the SP switch to position 4. When the counting relays release, lead AV1 is grounded advancing the switch to position 5.

8. OFFICE GROUP SELECTION

8.01 Office group selection is checked in positions 5 and 6 in the same manner as office brush selection except that the OG lead is grounded instead of the OB and the switch advanced to position 7.

9. SKIP OFFICE SELECTIONS

9.01 If no office selections are required, leads AV and AV1 are grounded by the route keys and revertive pulsing circuit when the OB and OG leads are grounded, thus advancing the SP switch to position 7.

10. SKIP SECOND OFFICE SELECTIONS

10.01 As no second office selections are required, the grounding of leads SB and SG causes the route keys and revertive pulsing circuit to ground leads AV and AV1, and they advance the SP switch immediately to position 14.

11. CHECK OPERATION OF RELAY DO1

11.01 In position 2 of the SP switch, relay DO1 operates and locks to the back contact of relay TC1. A check is made in position 14 to ensure that this relay is locked operated, and the switch advances to position 15.

12. TRUNK TEST - NO DISTANT OFFICE SELECTOR

12.01 The DO relay is normal for this test. In position 15, relay SB operates connecting fundamental tip through the primary winding of the TC relay to battery and connecting the fundamental ring over the FR1 lead to the route keys and revertive pulsing circuit. The FR1 lead in the route keys and revertive pulsing circuit is connected through compensating resistance to lead FR2 to ground on a make-contact of relay C. The sum of the beyond-office compensating resistance in the test circuit and the sender shall be 900 ohms for this test. When the sender closes the fundamental for trunk test, relay TC operates and operates relay W. Relay TC1 operates approximately 0.035 second after relay TC which releases relay DO1. The release of relay DO1 advances the SP switch to position 16, the W relay advancing the switch to 17.

13. CHECK OF REVERSE BATTERY

13.01 Following the short open period, the sender closes reverse battery on the fundamental. During the open interval after Z relay operated and relay DO1 released, relay RB operates reversing the connection of the FT and FR leads to the TC relay winding. When the sender closes the fundamental for reverse battery, relay TC operates immediately which shunts down relay W. Approximately 0.035 of a second after relay TC operates, relay TC1 operates which operates relay RB1 through a front contact on relay RB. Relay RB1 operated, locks and advances the SP switch to position 17. If the closure of reverse battery was not long enough to permit relay TC1 to operate and operate relay RB1, the circuit will block in position 16. When the reverse battery is opened by the sender, relay TC releases, releasing relay Z, and in turn relay RB.

14. TRUNK CLOSURE

14.01 In position 17 of the SP switch, a check is made of trunk closure by the sender which should be maintained for a short interval. Trunk closure reoperates relay TC in turn operating relay W which advances the SP switch to position 18. A short interval after the sender closes the trunk, it grounds the TR lead. The length of the trunk closure before the grounding of the TR lead should be sufficient to advance the SP switch to position 18. The TR lead grounded, operates the TR relay which advances the SP switch to position 19.

15. RELEASE

15.01 In position 19, lead ADV to the connector circuit is grounded causing that circuit to open lead C which releases relay C. The release of this relay permits the keypulsing circuit to restore to normal and restores the SP switch in this circuit to normal. This circuit cannot be reseized until the SP switch reaches normal.

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CIRCUIT UNIT SECTION -0131
SENDER GROUP TEST CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 In conjunction with other units of the sender test circuit, this circuit is designed to test the group relays common to ten subscriber senders or five keypulsing senders. Tests are made of the ability of these relays to operate properly. Continuity and cross tests are made of the contacts and associated wiring.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To make a busy test of the sender to be tested.

3.02 To make a busy test of the group circuit common to ten subscriber senders or five keypulsing senders.

3.03 To transmit class of service and frame indication to the sender.

3.04 To check the relay contacts and associated wiring for opens and crosses.

3.05 To operate the major alarm if the test is not completed in a short interval.

3.06 Under control of the MGB key, to make the group circuit busy to all links, giving preference to the test circuit for this group.

KEYS

3.07 The LT key is operated in light load periods to test for a premature advance of the sender preference lead and to make effective certain tests which cannot be made during heavy load periods.

3.08 The MGB key is operated to make busy the group circuit to which the test circuit is connected, thereby giving preference to the test circuit for this group of senders.

3.09 The TCT key is operated to make a test for false operation of KP sender AL and AC relays due to a cross, such as 3T-4T CO.

3.10 For the CS keys, 10-button strip-type class of service keys serve to ground the SCO to CS7 leads to the sender for the purpose of operating the sender class of service relays.

(a) When subscriber senders are being tested, the operation of the CSO key grounds the CSO lead causing the operation of the CSO relay in the sender. The sender CS1 relay operates from ground on the CS1 lead when the CS1 key is operated and so on for the other numbered keys and leads.

(b) On senders arranged to serve a maximum of 12 classes of subscribers, the lever-type CS6-CS7 and CS8-CS9 keys must be furnished. These senders require the closure of ground to two classes of service leads, to one of the leads CSO to CS5 and one of the CS6, CS7, CS8, or CS9 leads. Accordingly, one of the keys of the strip-type keys should be operated and a lever-type CS6-CS9 key operated depending upon what class is desired. The numbers of the keys and leads correspond to the designations of the relays in the senders.

(c) The operation of sender class of service relays grounds certain leads or combinations of the D1, D2, D4, D8, and SGR leads to the marker. Depending upon which lead or leads should be grounded, the correspondingly numbered keys in -0133 should be operated in order to check that the sender sends the required information to the marker.

(d) When testing keypulsing senders, one of the keys on the strip-type class of service keys should be operated depending upon the particular type of trunk it is desired to test the sender with.

(1) The O-DIST for a call from a district.

(2) The 1-TW for a call to a direct trunk to a distant office selector.

(3) The 2-INC, 4-INC, or 5-INC for a call to a direct trunk to either panel or crossbar incoming selector.

(4) 3-TAN for a call over a direct trunk to tandem.

On the latter four classes the marker is not called in. The 4-INC and 5-INC keys are used only where the KP senders are equipped with a marginal relay in the FT lead for determining which of two terminating units is to be called and adding five pulses to incoming group selection for the proper unit.

3.11 The 10-button strip-type F and FA keys are operated to pass the required district frame indications to the sender.

3.12 The ASB key is operated during tests of all auxiliary senders busy to prevent false release of the LO- relays in the miscellaneous circuit for sender test circuit.

LAMPS

3.13 Lamp BY lights during busy test.

3.14 Lamp GB lights during group-busy test.

3.15 Lamp SEL lights while waiting for the S- relay, associated with the sender under test, to operate.

3.16 The CH lamp lights while waiting for the ground chain on the S- relays to open.

3.17 The CH1 lamp lights while waiting for the battery chain on the S- relays to open.

3.18 The GH lamp lights while waiting for the GH lead to be grounded.

3.19 The RL lamp lights while waiting for the sender to close the RL lead.

3.20 The SPF lamp indicates that the sender chain circuit has failed to advance the preference lead to the next lower sender in the chain when the sender becomes busy, or that the chain circuit has failed to disconnect the S- relay from its associated preference lead when the sender becomes busy.

3.21 The X lamp indicates that a cross has been detected at the contacts of the SC- relays of the sender under test, or that the chain circuit advances the preference lead prematurely.

3.22 The MGB lamp lights when a sender group is being held out of service, waiting for a particular sender to become idle.

3.23 The DC lamp lights during DC lead test.

4. CONNECTING CIRCUITS AND SECTIONS

4.01 The connecting circuit is:

(a) Traffic Register Circuit - SD-25317-01.

4.02 The connecting sections are:

(a) Connector Circuit	-0102
(b) Code Keys and Dial Pulsing Circuit	-0105
(c) Operator Class Control Circuit	-0121
(d) Keypulsing Circuit	-0123
(e) Office Selection Control Circuit	-0125
(f) Code Test Circuit	-0133
(g) AMA Check	-0135

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DESCRIPTION OF OPERATION

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5. PRELIMINARY OPERATION

5.01 Prior to the seizure of this circuit, a ground is supplied by the operated ST key of the connector circuit to the BT lead through the back contact of the CIl relay, operating the BT2 relay which in turn operates the Sl relay. The back contact of the CIl relay is used to make sure that this and other relays are normal before permitting this circuit to be used. These relays are operated before this circuit is seized so that they may have sufficient soak in order to ensure proper releasing time. The BT2 relay operated also connnects the S lead to the BTl relay for busy test purposes as described in subsequent paragraphs.

6. SEIZURE

6.01 When this circuit is seized by the connector circuit, ground is supplied over the C lead through a contact of the operated Sl relay to operate the C relay. The C relay operated, locks directly to the C lead, connects battery to the EV lead as a signal to the connector that this circuit is ready to proceed with its test, supplies grounds for locking various relays of this circuit, and energizes the XC, S1D3, and S1D2 relays for use in subsequent tests.

7. BUSY TEST

7.01 The connector circuit closes the S lead and opens the BT lead at approximately the same time. Also, the CH relay operates from ground at the SM- relay through a contact chain in the link circuit when the sender group is idle. The CH relay operated, opens the remaining circuit for holding the BT2 relay and closes the sleeve to the BT relay. This causes the release of the BT2 relay and subsequently the release of the Sl relay. However, while the BT2 relay is still operated, the BTl relay is connected to the S lead and this connection is extended by the connector circuit to the S lead of the sender to be tested. If the sender to be tested is "made busy," battery through a resistance will be connected to its S lead, and this circuit will operate the BTl relay which will hold the BT2 relay and operate the BT4. Relay BT4 operated, holds BT2 and operates BT3. Relay BT3 operated, locks under control of CH, opens the winding of the BTl relay, and releases the BT4. The BT4 is slow-release and keeps the winding of BTl and the sleeve lead open momentarily. Thus, if the battery which operates BTl was not the "make-busy" battery in the sender but was some relay or hold magnet winding, this false operating circuit will remove itself before a second test is made by the BTl relay. After the BT4 has released, the BTl is again connected to the sleeve, and if battery is still on the sleeve, it reoperates, holding the BT2 and blocking the test. This circuit remains blocked in this condition until the "make-busy" condition is removed from the sender, or until the test circuit is advanced to another sender where the test is restarted. If the sender is not "made busy," the release of the BT2 relay connects the S lead to the S relay, and at the same time, starts the Sl relay releasing. If the sender to be tested is busy in service, the S lead will be grounded, operating the S relay. The Sl relay is slow enough in releasing to ensure that the S relay will operate if the S lead is grounded. If the S relay operates, the circuit remains blocked until the sender becomes idle or until the test circuit is advanced to a new sender. While the S or Sl relay is operated, the BY lamp is lit. If the sender to be tested is idle, or if it becomes idle, a circuit through the back contacts of the Sl and BG relays is closed to the SID relay winding. If the sender is seized by a service call during the busy test, the CH relay releases, restoring the busy test circuit to normal. When the sender group again becomes available, the busy test restarts as described above. On spare terminals the CH relay may not operate. The CH relay connects the S relay to the sleeve to permit the connector to pass spare terminals. If the CH does operate, the S relay is eventually connected to the sleeve for this purpose. While the busy test is being made, the TC lead is grounded which makes the automatic pass-busy feature effective in the connector circuit.

7.02 If the next sender to be tested is either plugged busy or busy in service and the APB key is not operated, the BT1 or S relay will be operated in turn holding the S1 relay. The long time-out circuit in the connector, -0102, will eventually cause an alarm to be sounded. When the sender is made available, either due to the removal of the make-busy plug or released from a service connection, the BT1 or S relay will release and the test circuit will continue to advance in a normal manner, and the SID and SID1 relays will operate. The SID1 relay, in addition to performing the functions as described later, opens the locking circuit for the BK relay and the timing relays in -0102, the alarm is silenced, and the test proceeds without having to operate the CA key.

8. BUSY TEST OF SENDER GROUP CIRCUIT

8.01 When option SN is not provided a busy subgroup will cause battery to be connected to the GB lead operating the GB relay. When SN option is provided, all busy rotary senders of a subgroup or all busy TOUCH-TONE senders of a subgroup will cause battery to be connected to the GBO or TGBO leads, respectively. These leads are under control of the TTA relay which causes the GBO lead to operate the GB relay through the normal contacts of the TTA relay and the TGBO lead to operate the GB relay through make-contacts of the TTA relay. The TTA relay operates when a TOUCH-TONE sender is to be tested. The operation of the GB relay causes the release of the SID relay and starts the timing circuit consisting of the T and T1 relays as described in a later paragraph, the T1 relay operates after 5 to 12 seconds, grounding lead PB. This signals the connector circuit to pass by this sender if the APB key is operated. If the APB key is normal, this circuit blocks with the GB lamp lit. If the sender subgroup is or becomes idle, the GB relay is released, releasing relays T and T1, and operating relays SID, SID1, and MGB. With these relays operated, battery is connected to the GB leads to make the subgroup of senders appear busy to all link circuits, the GB lamp is lighted, and circuits are closed for operating the RES, RES1, RES2, RES3, and RES4 relays. When option UX is provided, battery is also connected to relays REG, REG1, REG2, REG3, and REG4. Relays SID3 and SID2 are released. These relays are slow-release to allow any link which has started to seize this group of senders to complete its action and exclude the test circuit and also to allow any sender which is restoring to normal to completely restore before seizing the sender. If the sender group is idle, the RES relays will operate. If the sender group is idle, more than one sender is available, and option UX provided, the REG relays will operate. With all of the REG and RES relays operated and the SID2 relay released, the GE relay operates. The GE relay operated, locks under control of the SID relay, extinguishes the GB lamp, lights the SEL lamp, and operates relay CI and CI1. With AMA, the GE relay also operates the MS- relay of Section -0102 closing the line register GO and LO leads. The LT key is operated during light load periods to make effective the check of the regular GT testing lead.

9. CLASS OF SERVICE INDICATION AND FRAME INDICATION

9.01 With the CI relay operated, ground is connected to the CS, F, and FA keys. One button in each of these three rows of keys and one of the CS6 to CS9 keys is operated as required, causing two frame indications and one or two class of service leads to be grounded. In addition, signals are also transmitted over the FT and FR leads to register the class of trunk in the KP senders. The class keys also furnish information to the keypulsing control circuit as follows:

(a) Lead ETS grounded if a marker is to be used.

(b) Lead CD grounded if no marker is to be used.

(c) Lead NC grounded if no code is to be dialed.

Where T option is provided, either the 2-INC, 4-INC, or 5-INC key may be used to simulate a call direct to a crossbar incoming trunk. The only difference between the three keys is the resistance of the ground circuit connected to the FT lead.

9.02 With 2-INC key operated, an operate test is applied to the marginal FTA relay of the KP sender. With the 4-INC key

operated, a nonoperate test is applied to the FTA relay. With the 5-INC key operated, an operate test is applied to the sensitive FTB relay of the KP sender. The FTB relay should operate when one of the three keys is operated. The FTA relay should operate only when the 2-INC key is operated. When the FTA relay is operated, the incoming group selection will be less than five pulses, and with the FTA relay normal five pulses will be added to the incoming group selection. The IG5 key of Sheet -0108 should, therefore, be operated when the 4-INC or 5-INC key is operated and should be normal when the 2-INC key is operated.

10. SEIZURE OF SENDER

10.01 The CI1 relay operated, connects the CH1 lead (of the sender selector figure of the link) to the CH1 relay of this circuit. The CH1 relay operates through a chain of contacts to battery. The CH relay has already operated as described above. If either or both of these relays fail to operate, the test circuit will block. The CH and CH1 relays lock under control of the SEL relay, and supply ground to the SPF lead. The connector circuit extends the SPF lead to the preference lead corresponding to the sender to be tested, and since the sender to be tested is idle, the corresponding S- relay will be operated. The S- relay operated, causes ground to be removed from leads GT and RT releasing the REG and RES relays and preparing the operating circuit of the SEL relay. The winding of the SEL relay is connected through the connector to the S- lead of the link corresponding to the sender under test, and if the proper S- relay operates, it causes the test circuit SEL to operate over the S- lead. The SEL relay locks under control of the GE relay, extinguishes the SEL lamp, lights the CH lamp, and unlocks the CH and CH1 relays. The link S- relay should open both the battery and ground chains, releasing the CH and CH1 relays. If the ground chain fails to open, the CH relay will remain operated, blocking the test frame with the CH lamp lit. If the battery chain fails to open, the CH1 relay will remain operated, blocking the test frame with the CH1 lamp lit. With the CH and CH1 relays released, the GH lamp lights, the operating circuit of the link S- relay is opened, and the SPF relay is connected to the SPF lead, through the connector, to the winding of the S- relay corresponding to the sender under test. The SPF relay operates through the locking circuit of the S- relay and closes in part the operating circuit of the GH relay. The GH lead is grounded by the operated S- relay, causing the GH relay to operate. If the GH relay does not operate, the test frame will block with the GH lamp lit. The GH relay operated:

(a) Locks to the SPF1 lead.

(b) Opens the CH and CH1 leads.

(c) Extinguishes the GH lamp.

(d) Lights the RL lamp.

(e) Grounds the ON lead to the subscriber sender through 830-ohm ground, or solid ground with the TP key operated, to start the 2-party timing circuit.

(f) Operates the OL relay in the connector circuit, which closes the tip and ring.

(g) Grounds the S lead to the sender to check the continuity of the path between the S and SL leads of the sender. The S lead ground returns to the test circuit over the SL lead.

10.02 Ground from the normal sender SR1 relay, over the BS, through the operated SB- relay, over sender lead AS, through the operated sender SC1 relay, over lead GS, operates relay GS which locks. While the GS relay is being operated, the tip and ring leads will be closed, 2-party test will be completed, and the SR1 relay will be operated. Relay GS operated, closes the last link in the circuit to operate the SL relay. The operation of the SL relay connects ground through a resistor to lead GS to operate the ON2 relay in the subscriber sender or the ON relay in the KP sender. The SL also connects ground to the S lead. This is to lock the SL independently of the SPF5 relay. The SPF5 relay may release, following the operation of the link SB- (as is described later), before the sender ON2 relay has operated. This is particularly true when the ON2 relay does not operate until after 2-party test has been made.

11. CHECK OF RELEASE SIGNAL

11.01 When the ON2 relay of the sender has operated, ground is connected to lead RL operating relay RL. In service, this is

used as a release signal. The RL relay operated, extinguishes the RL lamp, lights the SPF lamp, and closes a link in the circuit for operating relay SPF2. If the release feature fails to operate properly, the test circuit blocks with the RL lamp lit. If the release lead is grounded prematurely, the operating circuit of the GH relay will be opened, blocking the test.

12. CHECK OF ADVANCE OF PREFERENCE LEAD TO NEXT SENDER - PREMATURE CLOSURE

12.01 With the GH relay operated, circuits are closed, as described above, for operating the subscriber sender ON1 or the keypulsing sender ON1 relay. This causes the operation of the SB- relay of the link. The SB- relay operated, should disconnect the SPF lead from the locking circuit of the S- relay, thereby releasing the test circuit SPF relay, and should connect the SPF lead to the preference lead of the next sender. The release of the SPF relay releases SPF4, which releases SPF5 and operates SPF2. The SPF2 relay operated, grounds the SPF lead and opens the CG lead, releasing the link S- and sender SC- relays. Ground on the SPF lead is returned through the operated contacts of the SB- relay to the preference lead of the next sender, which is connected to lead SPF1. This operates relay SPF3 and SPF1. If the SPF3 relay operates before the SPF5 releases, indicating that the preference lead has been connected to the next preference lead prematurely, the XA relay will operate, block the test circuit, and light the X lamp. The SPF4 relay is slow-release to allow this test to be made. With the LT key normal during heavy load, this test for premature operation of SPF3 is canceled. The operation of the SPF1 relay extinguishes the SPF lamp and operates relay XB.

13. CHECK FOR CROSSES ON SC- RELAY CONTACTS

13.01 This paragraph describes the method used for checking the contacts of the SC1 and SC2 (SC3 and SC4 if used) relays of the sender and their associated leads for crosses. With the SC relay normal, all of the class of service, frame indication, CS, SL, and ON leads should be open. Also, for AMA, the CH-, CT-, CU-, SW-, and VF- leads should be open. Under this condition, a relay connected to a potential of approximately 24 volts is connected to all of these leads for the purpose of detecting crosses to either battery or ground. The operation of this feature is as follows: The operation of the XB relay as described above, connects ground to the windings of the X1, X2, X3, X4, and X5 relays which operate and ground the armature of the X relay. For AMA senders the X6, X7, X8, and X9 relays of Section -0135 are also operated at this time. The outer end of the winding of the X relay is connected to a potential of approximately 24 volts, obtained by means of a potentiometer, and the inner end is connected through make-contacts on the X1 to X5 relays to all the leads to be tested for crosses. If any of these leads is connected to either 48-volt battery or ground, the X relay will operate, operating the XA relay. The XA relay operated, locks under control of the C relay, prevents closing the advance lead, and grounds the circuit to the X lamp causing this lamp to light. If no crosses are detected, the XC relay releases, closing a circuit to the AV lead of the connector circuit and causing that circuit to proceed with the test. The XC relay is slow-release so as to permit the X and XA relays to operate. The XB relay is slow-operate to permit the sender SC- relays to release before applying the cross test.

14. RELEASE

14.01 The connector circuit, having received a signal over the AV lead, releases this circuit by removing ground from the C lead. The removal of ground from the C lead releases the C relay which causes all other relays of this circuit to restore to normal. Release of the MGB relay releases the link GB relay. This circuit cannot be reseized until the BT2 and S1 relays have been operated and the CI1 has released to close the operating circuit of the C relay.

15. SHORT TIME ALARM

15.01 When the SID1 relay operates to seize the group circuit as described above, it closes a circuit from the interrupter to the T relay. The T relay is slow-operate to ensure that the SID1 will lock before its operating circuit is opened. When the B contact of the interrupter closes, the T relay operates and locks under control of the C relay. The T relay operated, supplements the ground applied by the SID relay for locking various relays and closes

a path from the F contact of the interrupter to the T1 relay. When the F contact of the interrupter closes, the T1 relay operates. The T1 operated, locks under control of the SIDl and G relays. The T1 relay operated also grounds the MA lead to the connector circuit to function the major alarm, and also lights the TA lamp with Fig. B. The purpose of this timing circuit and the operation of the major alarm is to ensure that a subgroup of senders will not be held out of service if the test circuit blocks while testing the group circuit. The interval is approximately 5 to 12 seconds. This timing circuit also operates when the MGBl or GB relays operate. The T1 opens the AV lead to the connector and thereby prevents the advance of the test circuit if the condition that causes the time-out was of a temporary nature. It also releases the MS- relay.

16. GROUP MAKE BUSY

16.01 In order that the test frame attendant may make a particular subgroup of senders busy from the test frame, the MGB key and MGB and MGBl relays are provided. The operation of the MGB key operates the MGBl relay which locks under control of the SID relay and operates relay MGB. Relay MGB operated, connects battery to the group-busy leads of the group to which the test circuit is connected. This enables the test employee to seize a sender which is busy in service or which has been made busy and give preference to the test circuit over link circuits when this particular sender becomes idle. When the SID relay operates, the MGBl releases, but the MGB is held operated. Since the operation of the MGB key causes a group of senders to be held out of service, care should be taken to see that the sender to be tested is made available quickly. The MGBl relay will cause the major alarm to operate if the sender is not made available quickly. The MGBl relay will cause the major alarm to operate if the sender is not made available within 5 to 12 seconds. To silence this alarm, operate the TA key.

16.02 When a repeat test is to be made, the MGBl relay operates over the MGB lead to the connector circuit and performs the above functions thereby ensuring that the sender under test will not be seized by a service call.

16.03 The MGBl relay is made slow-release for two reasons:

(a) To hold the MGB from the time that the SID opens the MGBl locking circuit until the time that the SID establishes the MGB holding circuit.

(b) On CA calls with the SID operated, to hold the MGB relay from the time that the CA key is released until the time that the C and SID relays have released.

17. DC LEAD TEST (KP SENDERS ONLY)

17.01 When simulating distant office or PCI tandem calls, the operation of the C relay operates DCT. This connects the DC lead to the DC relay. After trunk class has been registered in the sender, the DC lead is momentarily grounded, operating DC. When DC operates, DCl operates and locks. If no ground is supplied over the DC lead, or if the DC lead is permanently grounded, this circuit blocks with the DC lamp lit. The DC lead is checked on incoming class calls by the keypulsing circuit.

18. TEST FOR PREMATURE OPERATION OF KP SENDER AL AND AC RELAYS

18.01 When W option is provided, a test can be made for premature operation of relays AL and AC of the KP sender. To make this test, operate the TCT key and either the 2-INC or 3-TAN key. When the 2-INC key is operated, use a full selector call, class key 1; and when 3-TAN key is operated, use a tandem PCI call, class key 4. Tests should be made using both classes.

18.02 With the TCT key operated, resistors AA and C are short-circuited to provide an increase in the current to the ON and FTB relays of the KP sender to approximate more closely the service conditions. The operation of the TCT key also opens the shunt on the contacts of relay SL. This causes the circuit to the FT and FR leads to be closed at the same time that the KP sender ON relay is operated over lead GS. This is similar to service operation and will permit detection of trouble conditions, such as a short on 3T-4T CO, which causes premature operation of AL and AC relays of the KP sender. If the AL

and AC relays are operated falsely, they operate sender relay DS1 and subsequent operation of relay FT will release AL and AC preventing registration of key pulses.

18.03 Under some conditions the AL and AC relays may not operate falsely even though the cross exists. This will permit the THL and THC relays to operate when FT operates. Under these conditions keypulse registration will not be interfered with, either on a service or test call. However, due to the cross on the CO contact, a marker may be seized momentarily on a non-marker-type call, causing the trouble indicator to display an XT lamp.

CIRCUIT UNIT SECTION -0133
CODE TEST CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to be used in conjunction with other units of the automatic sender test circuit.

1.02 This circuit records and checks the information which the sender under test transmits to the marker.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS

3.01 To connect to the receiving leads of the marker selected by the sender under test.

3.02 To record the information transmitted to the marker on these leads.

3.03 To check this information against the setting of test circuit keys.

3.04 To ground the dialing tip to simulate a tip party message rate subscriber calling.

3.05 To make trouble release tests.

3.06 To make overflow tests in conjunction with other units.

3.07 To cause the sender to request the alternate route.

3.08 To test subscriber senders arranged for person-to-person prefix digit 0, station paid prefix digit 1, and 11X service codes.

3.09 To test subscriber senders arranged for interchangeable codes in offices provided with information code 411.

3.10 To test subscribers senders arranged for interchangeable codes in offices not provided with information code 411.

KEYS

3.11 The TPO key is operated when it is desired to simulate a tip party calling. It causes the test operate current to be supplied to the sender TP relay.

3.12 The TP-NO key is operated to apply a nonoperate test to the sender TP relay.

3.13 The AGS-1 key is operated when it is desired to cause the marker to advance from ground supply 1 to ground supply 2.

3.14 The AR key is operated when it is desired to test the alternate route feature of the sender.

3.15 Keys 1, 2, 4, and 8 are operated in combination for checking the class of service registration in the sender as transmitted to the marker.

3.16 The SGR key is operated when testing subscriber classes 14 to 25 in the same marker group.

(a) The ICD key is operated when testing an interchangeable code.

(b) The IOS key is operated when testing a full selector interchangeable office code with office selections.

LAMPS

3.17 Lamp CD lights to indicate that this circuit is checking the code.

3.18 Lamp DEC lights to indicate that this circuit is waiting release of the marker.

3.19 Lamps LA and EA light to indicate which code group is being used in the marker: the LA lamp indicating the regular local numbering area code group, and the EA lamp indicating the extended numbering area code group.

3.20 Lamps D, F, FA, PTY, and AR are progress lamps which indicate which part of the registration is being checked. Lamps A, B, and C of the PCI register circuit are also used to indicate which part of the registration is being checked.

3.21 Lamp SGR is lighted when the SGR key is operated.

4. CONNECTING CIRCUITS AND SECTIONS

4.01 The connecting circuit is:

(a) Originating Marker - SD-25016-01.

4.02 The connecting sections are:

(a) Connector Circuit -0102

(b) Code Keys and Dial Pulsing Circuit -0105

(c) Route Keys and Revertive Pulsing Circuit -0108

(d) Full Selector Dial Pulse Control Circuit -0111

(e) Incoming and Final Selector Control Circuit -0113

(f) PCI Dial Pulse Control Circuit -0115

(g) PCI Register Circuit -0117

(h) Overflow Control Circuit for Subscriber Senders -0119

(i) Operator Control Circuit for Subscriber Senders -0121

(j) Keypulsing Control Circuit -0123

(k) Sender Group Test Circuit -0131

(ℓ) AMA Check -0135

(m) Auxiliary Sender Dial Pulse and Code Check Control Circuit -0139

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5. SEIZURE

5.01 While dialing or keypulsing is in progress, for any type of call except one using the auxiliary sender, the unit which controls dialing or keypulsing connects ground to the C and G leads of this circuit. Ground on the C lead operates the C relay through the normal terminals of the CP switch. The C relay operated, locks to the C lead and operates the G relay. The C relay operated also closes a path for advancing the CP switch to position 1, operates relay CKG, connects relay CF to the DC lead, and closes circuits to the CD and DEC lamps.

6. CONNECTION TO MARKER

6.01 Each marker has a pair of sender test multicontact relays for connection to the test circuit. When the office code has been registered in the sender under test, the sender causes the connector to select a marker. The ground on the SDT lead is extended through a contact on the connector multicontact relay corresponding to the marker seized by the sender under test. Sender test multicontact relays connect all the receiving leads of that marker to register relays in this circuit and inform the marker that it is to make translation for a sender test call and must not set up district and office switches.

7. REGISTRATION

7.01 The operated sender code digit register relays ground certain of the receiving leads and the remaining receiving leads are grounded through break-contacts

on the register relays by means of ground supplied over CK1, CK2, CK3 leads from the test circuit and the marker in multiple. All register relays of both the marker and the test circuit operate. When all register relays have operated, ground supplied from the marker connector over the CKG lead to this test circuit causes the operation of the CK1, CK2, and CK3 relays of this circuit. These relays operated cause the operation of the CK4 relay. The CK4 relay operated:

(a) Advances the CP switch to position 3 with the AR key normal.

(b) Releases CKG which removes ground from the CK1, CK2, and CK3 leads.

At the same time, a similar action is taking place in the marker, and it removes ground from the CK1, CK2, and CK3 leads. With these grounds removed, only those leads which have been grounded by the sender under test remain grounded and only those register relays corresponding to these leads remain operated. When one or more of the register relays in each of the three chains of relays have released, the corresponding CK1, CK2, or CK3 relay releases. When these three relays have released, a circuit is supplied for operating the LUA, LUB, and LUC relays. These relays operated, provide a locking ground for each of the register relays which has remained operated and, therefore, locks in a record of the information which has been transmitted by the sender to the marker. These relays operated, also operate the LU1 relay which locks and holds the LUA, LUB, and LUC relays operated. The LU1 relay operated, extinguishes the DEC lamp and advances the CP switch to position 4. When the translation has been recorded in the sender, the marker grounds the DC lead to the sender which extends this ground to the sender test circuit operating the CF relay. The CF relay operated, locks under control of the LUA and CK4 relays. The CK4 locking circuit is required for alternate route tests because the AR relay may not operate quickly enough. The sender then causes the marker connector to restore to normal. This releases the pair of multicontact relays which connected the marker to this test circuit. Ground is then removed from the CKG lead releasing the CK4 relay. Relay CK1 is slow-release to allow all register relays held by CK leads to release before LUA, LUB, and LUC are allowed to operate, and to allow CK1 and CK3 of the marker to release.

8. CHECKING THE PREFIX DIGIT LEADS BETWEEN SENDER AND MARKER

8.01 When the associated subscriber senders are arranged for prefix digit 0, 1, or 11X codes, the sender will ground two-out-of-five CC- leads to the marker as follows:

Digits Dialed Subscriber Senders	CC- Leads Grounded
ABC +4 X 0/1 X -ABC +4 0 0-0 1-0	CC4, CC7
0 - ABC +4 0 - X 0/1 X - ABC +4 0-1	CC0, CC7
1 - ABC +4 1 - X 0/1 X - ABC +4	CC1, CC7
11X	CC2, CC4
Keypulsing Senders	
ABC +4	CC2, CC7

8.02 The CC- relays in the test circuit operate corresponding to the CC- leads grounded by the sender. With the CP switch in position 4, the test circuit checks the operated CC- relays against the prefix code keys operated in Section -0105. A check is also made that two and only two CC- relays are operated. A failure to check will prevent the CP switch from advancing out of position 4. The operation of class key 9 of Section -0102 operates relay OCL to provide a check path for 0-0 and 1-0 zero operator calls. The operation of relay KP of Section -0102 operates relay KP1 to provide a check path for keypulsing sender test calls.

8.03 When the subscriber senders are arranged for sender recycle and prefix 0, 1, or 11X codes, Fig. 35 is furnished.

The sender grounds lead LA to the marker on nonrecycled test calls or lead EA on recycled test calls. The test circuit makes a one-up check of the operated EA/LA relays. In addition, on calls prefixed by a 1 the sender grounds the PD1 lead causing the operation of the PD1 relay. This relay is checked against the PDG1 relay. A failure to check will prevent the CP switch from advancing out of position 4.

8.04 Checking Prefix Digit 1-1 Leads - The prefix digit 1-1 feature must be omitted when the associated senders are arranged for prefix digit 0, 1, or 11X codes.

(a) When the associated senders are arranged to record the prefix 1-1, the associated markers will be arranged for a second group of 800 code points or for the use of a single route relay to reach all offices in an adjacent numbering area through a tandem office, and the LA and EA relays will be furnished. The LA relay will be operated from the sender over its associated lead when the code does not include the prefix 1-1, and the EA relay will be operated by the sender when the prefix 1-1 is transmitted to the marker before the office code.

(b) When these relays and G wiring are furnished, the path for advancing the CP switch out of position 4 (outlined in the above paragraphs) is also extended through the contacts of the 1-1 key on the code keys and dial pulse circuit, -0105. If this key is normal, then the 1-1 prefix is not transmitted to the marker, and the LA relay should operate from the sender. The path for advancing the CP switch out of position 4 is through a normally closed contact of the 1-1 key, a break-contact on the EA relay, and a make-contact on the LA relay. If the 1-1 key is operated for transmitting the prefix 1-1 to the marker, then the EA relay should be operated by the sender. The path for advancing the CP switch out of position 4 is through make-contacts on the 1-1 key, the EA relay, and a break-contact on the LA relay.

9. CHECKING SUBSCRIBER SENDER DELAY ON ZERO OPERATOR CALLS. CODE KEY A0 OPERATED. PREFIX DIGIT KEYS PDG0, PDG1 NORMAL

9.01 When the first digit dialed into a subscriber sender arranged for prefix digit 0 is zero, the sender will start a 3- to 4.3-second timing circuit to determine whether any additional digits will be received. If no other digits are received by the end of this timing period, it will call in the marker on a zero operator call.

9.02 Relay OTC, Fig. 34, will operate on a zero operator call when only one digit zero is dialed into the sender. Relay OTC operated:

(a) Lights the zero operator timing lamps ZOT.

(b) Starts the zero operator timing check.

(c) Removes the short across capacitor ZOT.

(d) Closes a path to charge capacitor ZOT.

9.03 At the end of the timing period (2.5 seconds) capacitor ZOT will have been charged to a point where the voltage across the starter anode and cathode of tube ZOT will cause the tube to fire and operate relay ZOT. With relay OTC and ZOT operated, a path is closed to check the A digit as described below. If the sender calls in the marker before relay ZOT is operated, an attempt to check the A digit will operate relay BK and cause the test circuit to block.

10. CHECKING THE A DIGIT

10.01 In position 4 of the CP switch, the registration of the A digit on the A1, A2, A4, and A5 relays is checked against the setting of the A digit key of the code keys and dial pulsing circuit. Arc 4 of the CP switch connects ground to circle lead A which in turn is connected to circle lead A at the A4 relay. Depending upon the setting of these four relays, this ground is extended to one of the numbered circle leads (0 to 9). These circle leads are connected to contacts on keys 0 to 9 of the A row of keys of the code keys and dial pulsing circuit. If the numbered lead grounded by the A group of relays corresponds to the button on the A row of keys which is depressed, this ground will be extended from the code keys and dial pulsing circuit, returning over lead A, through arc 2 of the CP switch to position 5.

10.02 If the setting of the A register relays is such that a numbered lead is grounded which does not correspond to the operated button of the A row of keys, no circuit will be provided for advancing the CP switch from position 4. Likewise, if

the combination of operated A register relays is such that no numbered circle is grounded, the CP switch cannot advance from position 4.

11. CHECKING THE OTHER DIGITS

11.01 The B and C digits are checked in positions 5 and 6 in a manner similar to the A digit. The B and C relays are connected to numbered circle leads in the same manner as the A digit except for circle lead zero. On the A digit, circle lead zero requires relays A1, A4, and A5 to be operated, whereas on the B and C digits all relays must be normal to ground lead zero. The D digit is checked in position 7 in a manner similar to the A digit except that the setting of the relays is matched against the settings of keys 1, 2, 4, 8, and SGR of this circuit. These keys are operated in combinations of none, 1, 2, or more keys. The F digit, which is the units digit of the frame indication, is checked in position 8 in a manner similar to the B and C digits, the setting of the F relays being matched against the F key of the sender group test circuit. The FA digit, which is the tens portion of the frame indication, is checked in position 9. In this position, the setting of the tens relays is checked against the position of the tens row of frame indication keys in the sender group test circuit. In positions 10 and 11, the positions of the TP and AR1 relays are checked against the positions of the TP and AR keys of this circuit. While each digit is being checked, a progress lamp corresponding to that digit is lit. The A, B, and C lamps are located in the PCI register circuit, and the D, F, FA, PTY, and AR lamps are shown on this drawing. Match lamps shown on the PCI register drawing are also lit by the contacts of the register relays of the digit being checked. These match lamps are connected to the numbered circuit leads and indicate the number which had been registered in the test circuit and in the associated decoder.

12. RELEASE

12.01 When the CP switch arrives in position 12, a circuit is provided for operating the AV relay. The AV relay operated, grounds the AV lead to the unit which controls dialing and releases the CF relay when its operating path is opened by the marker DC lead. This associated unit thereupon opens the G and C leads to this circuit releasing the G and C relays. The C released, causes the CP switch and all operated relays to restore to normal. This circuit cannot be seized again until the CP switch has restored to normal providing an operating path for the C relay.

13. PERMANENT SIGNAL TEST - AR KEY NORMAL

13.01 When a permanent signal test is being made, the PS relay of this circuit is operated by means of a ground over the PS lead from the operators control circuit for subscriber senders. The PS relay operated, transfers the path for advancing the CP switch from position 4 to a contact in the A register relays. This contact will be grounded by these relays if these relays are operated in the combination corresponding to permanent signal. This combination is relays 1 and 4 operated. The PS relay also short-circuits the contact of the CK2 relay so that the circuit will not be blocked by failure of the B and C relays to be energized on this class of call. The lead designated ZO is provided by the connector circuit so that the CK2 contact may also be short-circuited when the class key, corresponding to special service operator class, is depressed.

14. ALTERNATE ROUTE TESTS

14.01 Subscriber Senders - The AR key is operated for this test and this test should not be made when making special tests on the coin relays. In this test, the operation is similar to that described for a regular test except that the CP switch does not pass by position 1. Instead, the AR relay is operated in position 1 over the LR lead from ground at the DRL relay in the sender. This provides a second locking circuit for CF, and energizes the CP magnet in position 1. The CK4 relay locks CF and the sender DC relay until the AR relay operates. In position 1, ground is supplied through a front contact of the AR relay and a back contact of the CK4 or AR2 relay to the TR lead which registers a trouble release signal in the

sender. The CK4 or AR2 contact is required in this lead to prevent the ground on the TR lead from being extended into the TRL lead of the marker, thereby falsely operating a cross-detecting relay. Relay AR2 is made slow-release to ensure that the cross-detecting relay will not operate even though the marker connector opens the TRL lead a considerable time after the CKG lead is opened. The AR relay locks up to the break-contact of the CP magnet to insure the operation of the CP magnet in case the LR lead is opened. When the DRL relay of the sender releases, the CP switch steps to position 2. When the CP selector steps to position 2, the TR lead is opened. This causes the sender to seize a marker again and ask for the alternate route corresponding to the code dialed. The check of the information on the receiving leads is made in the usual way. The routing for the alternate, instead of the regular route, is checked by the units relays which check selections or PCI registration.

14.02 Keypulsing Senders - This test should be made only on a district junctor class of call. The AR key is operated for this test, and leads K and K1 are connected together by the connector circuit providing an operating circuit for the KAR relay to the front contact of the CK4 or AR2 relay. In this test, the CP switch will not pass by position 1. When the CK4 relay operates in position 1, relay KAR operates. When the sender releases the marker and thereby the CK4 relay, ground is supplied through the back contact of CK4 or AR2 and the front contact of KAR to the TR lead as a trouble release signal to the keypulsing sender. The KAR is slow-release to give the sender relays sufficient time to operate before opening the TR lead. While the KAR is operated, the test circuit CF and the sender DC relays are held operated, thereby connecting the TR lead to the trouble release relays in the sender. Also the KAR relay energizes the CP magnet, and the release of KAR causes the CP switch to advance to position 2. The trouble release signal causes the sender to seize a marker again and ask for the alternate route corresponding to the code dialed. The check of the information on the receiving leads is made in the usual way. The routing for the alternate, instead of the regular route, is checked by the units which check selections or PCI registration.

14.03 Test of Ground Supply 2, Fig. N - With the AGS1 key in Fig. N operated, the marker is advanced to route the call through ground supply 2 and thus permits a test of the sender for this routing.

15. OVERFLOW TEST

Note: Since this test causes the marker to time out, the test should be made during periods of light load.

15.01 When the overflow class of test is being made, the OF2 relay operates from a class key contact. This causes a trouble release to be registered in the sender so that the subsequent operation of the sender OF relay will not cause the sender to ask the marker for the alternate route, but will cause the subscriber sender to ask for an overflow trunk or the keypulsing sender to set up a reorder. This trouble release is brought about as follows: Operation of the CK4 relay in position 2 energizes the CP magnet, and ground is supplied through the operated contact of the OF2 relay to the locking contact of the AR1 relay. This blocks the marker which times out and causes a trouble release to be registered in the sender. This releases the marker and the CK4 relay and advances the CP switch to position 3. A second trial is requested with the AR lead grounded. This time, however, ground is not supplied to the AR lead by the test circuit, and the marker does not block. This circuit checks the information transmitted from the sender to the marker as described for alternate route tests, operates its AV relay, and restores to normal as usual. For keypulsing senders, this circuit performs no further function, but for subscriber senders, after the overflow condition has been set up in the sender under test, the overflow control circuit for subscriber senders operates the OF relay of this circuit. The OF relay operated, lights the overflow lamp shown on the route keys and revertive pulsing circuit, lights the DEC lamp shown on this circuit, and supplies ground to the G4 lead because the switch will not advance to ground this lead at this time. The sender now transmits the same office code, class of service indication, and frame indication which is transmitted in the earlier part of the test, but in addition, it grounds the overflow lead. With the overflow lead

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grounded, the OF1 relay operates and locks, and, after LU1 operates and CK4 releases, relay OF1 connects ground to the ADV lead to the connector circuit. Ground on the ADV lead causes all test units to restore to normal, and the connector circuit starts another test.

16. TROUBLE RELEASE TEST (SUBSCRIBER SENDERS ONLY)

16.01 With Y wiring, the full selector dial pulse control circuit controls this test, and with Z wiring, the operator class control circuit for subscriber senders is used. This test should be made during light load periods only because it causes three markers to time out. In making this test, the marker is caused to send three trouble release signals to the sender. The test circuit checks that the sender will ask for translation three times. Checks of the alternate route signal on second trial and overflow signal on third trial are made on other classes of test. When making this class of test, the TRL lead is grounded by the operated class key 16 of the connector circuit, causing the operation of the TRL relay of this circuit. This relay, when operated, opens the circuit to the AV relay and provides a path for passing by positions 1 to 11 of the CP switch, and opens the operating circuit of the CK4 relay. When this circuit is seized, it connects to the marker in the usual manner, but the CP switch is immediately advanced to position 12. In position 12, the F1 relay operates with the other receiving relays in the usual manner and energizes the CP magnet. Due to the fact that the CK4 relay cannot operate, the marker will time out and send a trouble release signal to the sender. The sender, upon receiving the trouble release signal, releases the marker to which it was connected and seizes a different marker. The F1 relay releases when the first marker is released, stepping the CP switch to position 13. In the usual way, the multicontact relays corresponding to the second marker are operated, and the F1 relay is again energized causing the CP magnet to energize again. The second marker also times out and transmits a trouble release signal to the sender. The sender thereupon disconnects the second marker and seizes a third marker. At the same time that the sender released the second marker, it also opened the F1 lead releasing the F1 relay and advancing the CP switch to position 14. When the sender seizes the third marker, the multicontact relays connect this marker to the test circuit, and a trouble release is caused. In position 14 with the OF1 and F1 relays operated, the CP magnet is energized. The trouble release signal causes the marker connector to release, releasing all test circuit register relays including the OF1 and F1. The OF1 released, advances the switch to 15. With Y wiring, the TRL interrupter causes the switch to advance through 15 and 16 to 17. If the sender asks for a fourth trial, the OF1 relay operates, preventing the switch from advancing to 17 and grounding the BLK lead to the connector unit. If the fourth trial is not asked for, the switch in 17 grounds lead N to -0105 operating its RL relay. This causes the sender to release and the S relay -0102 operates, grounding the ADV1 lead which is extended through the contacts of the TRL to the ADV lead causing a new test to be started. With Z wiring, the CP switch passes by positions 15 and 16. In 17, the AV lead to the operator class control circuit is grounded causing the circuit to dial the numerical digits. Upon completion of dialing, the sender should restore, restoring the test circuit in the usual manner. The Z wiring at 2B-3B OF1 is used in connection with the reversed trunk test as described in Section -0121. (For keypulsing senders, the trouble release feature is adequately tested on overflow tests which use a marker.)

17. TEST OF 2-PARTY CHECK FEATURE - CLASS KEY 1 - (MR ONLY)

17.01 For 2-party test, the subscriber sender is arranged to test for the ground at the subscriber station which indicates that the tip party is calling. The test is made before dialing starts and is repeated at the conclusion of dialing. If on each of the two tests the same line condition is not found (grounded tip or nongrounded tip), the sender blocks and does not complete the call. In order to check that the sender will block, if it finds a tip grounded before dialing and not grounded after dialing, or vice versa, two tests are made on full selector class with class key 1 operated. On the first test, the TPO key is operated before dialing

and released after code check as indicated by the CD lamp going out. On the second test, the TPO key is left normal at the beginning of the test and operated after the CD lamp goes out but before units have been dialed. In either case, the sender should block and the test circuit should block with the RLS lamp lit. When the test employee is satisfied that the sender has blocked, the test employee should operate and release the CA key to advance to the next sender. To make sure that the TPO key is in the right position for the beginning of the next test, it may be placed in this position before operating the CA key.

18. LEAD DC TEST

18.01 Certain parts of the DC lead of the keypulsing senders are not checked on regular tests. The alternate route test should be made to check this lead completely.

19. FALSELY OPERATED SDT RELAY IN MARKER

19.01 To prevent senders from receiving a release signal due to a falsely operated SDT relay in the marker, ground is supplied to lead CK1 when this circuit is normal.

20. TEST OF ALTERNATE ROUTE IN GROUND SUPPLY 2, FIG. N

20.01 When alternate route trunks are associated with route relays in ground supply 2, Fig. N tests the sender for its ability to complete a call using the ground supply 2 route relay information. When a test is made with the advance ground supply 1, AGS1 key operated, the marker route advances out of ground supply 1 into ground supply 2 and tests the sender against the information received from the ground supply 2 route relay.

21. INTERCHANGEABLE CODE

21.01 General - The sender makes two marker seizures on this type of call. On the first seizure the marker determines that the code is an interchangeable area and office code. It instructs the sender to time for an eighth digit and then releases without progressing beyond the decoder stage. After the sender receives the units digit, it starts a 3- to 4-second timing period. If the sender receives an eighth digit before the end of the timing period, it seizes a marker immediately and, via CC lead information, indicates a 10-digit call. If the sender does not receive an eighth digit, it seizes a marker at the end of the timing period and indicates a 7-digit call.

(a) The test frame checks that two marker seizures are made, that the CC lead information is correct, that the sender times for an eighth digit on 7-digit calls, and that the DC lead is not grounded on the first marker seizure but is grounded on the second.

21.02 First Marker Seizure - The ICD key is operated for this test. Ground from the C relay Section -0102 is extended through the ICK key and the bottom 1 and 3 contacts of the SMS relay to operate the ICD relay.

(a) On 7-digit calls the ICD relay closes a path to operate the 7DS relay. The operate path of the 7DS relay is from ground on the G lead from the full selector dial pulse contact circuit or the PCI dial pulse control circuit, or through the 7DE relay on 7-digit MF calls. The 7DS relay operates the 7DSA relay.

(b) The first marker seizure operations for PCI or full selector calls are the same as the regular test calls described in this section with the exception of the DC lead ground check. The DC lead is not grounded to operate the CF relay because the marker does not advance beyond the decoder stage. However, the 7DSA relay operated provides a path from ground on the C relay to operate the CF relay in position 3 of the CP3 selector.

(c) The first marker seizure for MF calls is described in Section -0139, 29.

21.03 Second Marker Seizure - 7-Digit Calls - After the units digit is dialed, the SMS relay operates and locks to prepare for the second marker seizure. The various operate paths for the SMS relay are from the control circuits and through the ICD' relay as follows:

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(a) Ground on terminal 18 of the DP2 selector, Section -0111, for full selector calls.

(b) Ground on terminal 9 of the DP4 selector, Section -0115, and through the top 1 and 2 contacts of the operated 7DSA relay for PCI calls.

(c) Ground on terminal 12 of the ASDC 6 selector of Section -0139 and the top 1 and 2 contacts of the operated 7DS relay for 7-digit MF calls.

The SMS relay operated:

(a) Operates the SMSA relay.

(b) Releases the ICD relay.

(c) Opens the operate path of the SY relay at the Code Keys and Dial Pulsing Circuit, Section -0105, and the C lead to the code test circuit in the Full Selector Dial Pulse Control Circuit, Section -0111.

(d) Closes a path to block the test frame if the fundamental is closed before the second marker seizure is completed.

The SMSA relay operated:

(a) Closes through the check path for the second seizure CC lead information.

(b) Closes a path through the operated 7DSA relay to operate the OTC relay of the zero operator timing circuit. This circuit is used to check the timing for an eighth digit by the sender.

(c) Provides an operate path for the IDA relay.

The ICD relay released:

(a) Grounds the DC lead to the marker and restores the normal DC lead check path.

(b) Closes a path through the operated SMSA relay and the unoperated IDA relay to operate the MC relay in preparation for the second marker seizure check.

21.04 The OTC relay closes the DC lead through transfer contacts of the unoperated ZOT relay in the zero operator timing circuit to the BK relay. If the sender times correctly, the ZOT relay will have operated to transfer the DC lead from the winding of the BK relay back to its normal path before the second marker seizure is made.

21.05 When the sender seizes the marker it grounds the CC leads that indicate the second seizure of a 7-digit call. Corresponding CC relays in the test frame operate and lock as follows:

(a) CC1-2 - Second seizure, 7 digits, no prefix.

(b) CC2-7 - Second seizure, 7 digits, prefix 0.

21.06 The DC ground to the marker is extended through the marker connector and the sender and back to the test frame on the DC lead. The test frame extends this ground through a check path of the CC- relays to operate the DA relay. The operation of the SMS relay had operated the DAS1 relay which provided a shunt around the DAS relay and locked through a DAS2 normal contact. The DA relay operated provides ground through a DAS1 make-contact to operate the DAS2 relay. The operation of the DAS2 relay removes the lock path of the DAS1 relay and starts the slow-release DAS1 relay to release. This slow-release holds the DC lead grounded to the sender for a minimum time of 185 ms to insure operation of the selection relay in the SD-27810-01 sender. The release of the DAS1 relay releases the DAS2 relay and removes the shunt from the DAS relay. The DAS relay now operates if the DC ground was removed from the marker. The DAS relay operates the DBS and IDA relays and the IDA relay locks operated. The MC relay releases and in turn releases the DA, DAS, and DBS relays.

21.07 The operation of the IDA relay indicates to the control circuits that the second marker seizure has been checked and that the sender will now close the fundamental and proceed with trunk test or office selections.

21.08 Second Marker Seizure - 10-Digit Call - Timing for an eighth digit is canceled on 10-digit MF calls. When the sender receives the hundreds digit it stops timing and immediately makes the second marker seizure.

21.09 Circuit operations are the same as for 7-digit MF calls except for the following:

(a) The 7DS and 7DSA relays do not operate.

(b) The OTC relay does not operate to check the eighth digit timing.

(c) The SMS relay operates in position 10 of the ASDC 6 selector of Section -0139.

(d) The CC- relays for the second seizure of a 10-digit call operate and are checked.

The CC- relays operate as follows:

(a) CCO-2 - Second seizure, 10-digits, no prefix.

(b) CCO-4 - Second seizure, 10-digits, prefix 0.

21.10 Second Seizure - Information Code 411 - The operations for the first marker seizure for this test are the same as the regular interchangeable code tests described previously.

(a) On the second marker seizure, the point at which the sender goes for a marker and the extra digit timing requirements are changed. The sender makes the second marker seizure on 1+NPA+411 calls after registering the tens digit and completing an extra digit timing period. The information given to the marker is the same as described in 21.08 and 21.09. On 2+ABC+411X calls, where A, B, C is a local interchangeable office code, the sender makes the second marker seizure immediately upon receiving the units digit. Eighth digit timing (or extra digit timing) is not initiated in this case.

(b) Details of this test are covered in Section -0139, 29.

22. CHECK OF A2 AND A4 LEADS ON PARTIAL DIAL CALL FROM SENDER SD-27810-01

22.01 On a partial dial call to sender SD-27810-01 the dialing of the C digit is bypassed by the operation of the PD relay in Fig. 45. The A and B digits are pulsed into the sender and the sender times an interval of 18.5 to 22 seconds and grounds the A2 and A4 leads to the marker. The circuit functions as described in 7 except the A2 and A4 check relays are operated by the marker. The operation of the A2 and A4 relays causes the CP switch to advance to position 5. Position 5 and 6 are bypassed with the PD relay of Fig. 45 operated. The circuit will function as described in Section -0121.

23. CHECK OF A2 AND A4 LEADS ON DOUBLE PREFIX 0-1, 1-0 CALLS FROM SENDER SD-27810-01 (IMPROPER DIALING, CALLS ROUTED TO OVERFLOW OR ANNOUNCEMENT.) OPERATE CLASS KEY 9

23.01 On a double prefix 0-1 or 1-0 dialed calls to sender SD-27810-01 will operate to relay 2PD in the sender. Relay 2PD operates relay ROR and starts a trouble reroute sequence which grounds the A2 and A4 leads to the marker. The circuit functions as described in 7. except the A2 and A4 check relays are operated by the marker. The operation of the A2 and A4 relays causes the CP switch to advance to position 5. Position 5 and 6 are bypassed with the PD PD relay of Fig. 45 operated. The circuit will function as described in Section -0121 when the sender places a low-resistance battery on the LR lead.

CIRCUIT UNIT SECTION -0135
AUTOMATIC MESSAGE ACCOUNTING CHECK CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This section checks all AMA features of the sender, transverter connector, and transverter which are not checked on a service call.

1.02 This circuit is used with all subscriber class keys. The 2L key must be normal with classes 13, 14, 16, and 18 and MR or RR keys operated. Use a detail billed code for these tests.

2. WORKING LIMITS

2.01 None - local office testing only.

3. FUNCTIONS

3.01 To advance from normal upon signal from the originating marker that the called code requires a charge, with AMA tests.

3.02 To test for battery on the DC lead.

3.03 To test the continuity of the ICK lead to ground in the AMA transverter.

3.04 To test the ICK lead for shorts or grounds.

3.05 To test the efficiency of the test relay used per 3.04.

3.06 To check the removal of battery from the DC lead.

3.07 To check the connection of ground to the DC lead.

3.08 To check the continuity of the OT, 2L, and TP leads when the associated testing circuit keys are operated with the AMA key only.

3.09 To simulate the calling line equipment number code and line-observing signals.

3.10 To select a particular transverter.

3.11 To check for false seizure of the transverter connector, seizure on a noncharge call, or failure to seize it on a charge call.

3.12 To coordinate the completion of the AMA test with the district advance test in Section -0111 or -0115.

3.13 To operate the blocking relay in the connector section if the ICK lead is shorted or if other test failures are detected.

3.14 To stop recording after any line.

3.15 To test the translator tubes for operate.

3.16 To cause the translator to signal for overflow.

3.17 To force a trouble entry on a particular line on LAMA test calls.

3.18 To block the sender test circuit in the event that the transverter originates or attempts to originate a trouble indication during a LAMA test call.

3.19 To check the continuity of the 5L lead when the associated key is operated.

3.20 To check the continuity of the INF lead when testing the information code 411 feature.

KEYS

3.21 The AMA key is operated for all AMA tests.

3.22 Key RR operated, signals the transverter to connect the regular recorder, and the test is always blocked with a TI record. If the CA key is operated before the transverter has released, the sender may be left off-normal and unguarded.

3.23 Key MR operated, signals the AMA transverter to call in the maintenance recorder and cancels other checks.

3.24 The operated LO key grounds that lead to provide an operate test for the sender relays and provide a check path (either normal or operated) through the associated relay which is operated from ground on that lead in the AMA transverter.

3.25 The 2L and OT keys check their respective leads. The 2L key should not be operated in classes 13, 14, 16, and 18.

3.26 The TVO-7 keys are required to select a particular transverter. Only the TV9 key is depressed unless a particular transverter is needed. Particular transverters must be made busy before testing.

3.27 The VF-, SW-, CU-, CT-, and CH keys operate the calling line register relays to simulate the calling line equipment number.

3.28 The TV-TRL key causes the transverter to give a trouble release after two trials and sends the sender to overflow.

3.29 The TE1, TE2, TE3, TE4, and TE5 keys block the recording and test with trouble indicator lamp displays.

3.30 The T-OP key provides an operate test for the translator tubes with no reaction (unless a tube fails, in which case a display on the trouble indicator is provided).

3.31 The BTI key operated, causes the sender test frame to block if the transverter originates or attempts to originate a trouble indication during LAMA test calls.

3.32 The T-OV key causes an overflow signal to be returned to the sender and is checked as an overflow test.

3.33 The 5L key checks the 5L lead.

3.34 The BT key is operated when a test call is to be made using an AIOD translator connector that is made busy. This causes the transverter to ignore the busy condition and signal the connector to complete a connection to an AIOD translator.

3.35 The AT key is operated when it is desired to simulate the failure to complete a connection to the AIOD translator.

3.36 The L key is operated to inform the AIOD equipment to make a long loop test. Normally a short loop test is made which does not verify the internal cross-connections and translating features of the buffer register.

3.37 The OF key is used to indicate an office indice to the AIOD equipment.

3.38 Key RS-AIOD provides for release of PBX-AIOD-A2 alarms.

3.39 Reset key releases the shutdown printer PBX-AIOD-A1.

3.40 The TCL lamp indicates a trunk closure failure on the test of the sender feature for transverter trouble release.

3.41 The AMA lamp indicates an AMA test is in progress if the AMA key is operated. With the AMA key normal and the TRK IDT key operated, a false ground on the ACC lead from the marker is indicated.

3.42 The BDL lamp indicates that the transverter has tried to originate a test call trouble indication and that a previous trouble other than the test call trouble was originated. The test call has blocked with display lost.

3.43 The BTI lamp indicates that the transverter has originated a trouble display at the transverter trouble indicator caused by a test failure.

3.44 The 5L and INF lamp indicate the progress of the test.

3.45 The LLT lamp is used to indicate a long loop test is being made.

3.46 Lamp MJ-AIOD indicates major alarm over leads MJB and MJG PBX-AIOD-A1 or A2 Systems.

3.47 Lamp MN-AIOD indicates minor alarm over leads MNB and MNG PBX-AIOD-A1 or A2 Systems.

3.48 The DLNO 1, 2, 4, and 7 lamps are lighted over leads DLNO, 1, 2, 4, and 7, respectively, under control of SD-1C235-01, PBX-AIOD-A2 System.

3.49 Lamp TSD indicates timed shutdown over leads TS and TSG PBX-AIOD-A1 System.

3.50 Lamp PSD indicates printer shutdown over leads PS and PSG PBX-AIOD-A1 System.

3.51 Trap lamp indicates trap over lead TP and TPG PBX-AIOD-A1 System.

4. CONNECTING CIRCUITS AND SECTIONS

4.01 Connecting circuits are:

(a) Originating Marker - SD-25016-01.

(b) Transverter - SD-25802-01.

(c) Transverter Connector - SD-25804-01.

(d) Maintenance Recorder - SD-25601-01.

(e) Translator - SD-25754-01.

(f) Translator Circuit for PBX Automatic Identified Outward Dialing - SD-99319-01.

4.02 Connecting sections of this circuit are:

(a) Connector	-0102
(b) Code Keys and Dial Pulse Control	-0105
(c) Full Selector Dial Pulsing Control	-0111
(d) Incoming and Final Selector Control	-0113
(e) PCI Register Circuit	-0117
(f) Operator Class Control	-0121
(g) Sender Group Test	-0131
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5. SEIZURE

5.01 If the MF or RR key is operated, the AMA transverter seizes the maintenance or regular recorder, and this section does not function except to operate the B and TR relays.

5.02 The CH-, CT-, CU-, SW-, and VF- leads are checked for crosses and grounds (see Section -0131) for all tests on AMA senders.

6. SEIZURE AND TEST

6.01 With the AMA key operated, for all codes for which a charge is made, also the MR and RR keys normal, the ICK - DC leads are tested for continuity and false grounds. The LO, 2L, OT, and TP leads are also tested.

(a) When the marker grounds the ACC lead, the AC selector advances to position 1, the C and G relays are operated, the AMA lamp lights, and the AC selector advances to position 3, lighting the DC lamp. When the transverter connects a battery through 226 ohms to the DS lead, relay B operates and connects battery through TNO and CON to the ICK lead as a test for continuity and false ground. The CON operates when the circuit is closed, operating D which locks and shunts CON to aid the ground test. The AC selector is advanced to position 8, and the TNO relay will not operate unless there is a false ground on the ICK lead which causes TNO to operate and block the test.

(b) In position 8 of the AC selector, the D relay is shunted and released, leaving battery through 9,000 ohms connected through the TNO and CON relays to the ICK lead as a release test for the ICK relay. The B relay releases when battery is removed from the DC lead, advancing AC to position 9. When the ICK relay releases, ground is connected to the DC lead advancing AC to position 10. Relay A operates, connecting battery through 2,000 ohms to the TNO and CON relays as a check operate test for the TNO relay, which operates advancing AC to position 11. Position 11 is passed by from ground on AC arc 1.

(c) In positions 12 to 15, the LO, OT, TP, and 2L leads are checked in accordance with the associated keys. The selector advances through position

16 to 19 and through 21 by local ground. In position 20, the TR lead is checked for premature closure, and the RL lead is grounded to release the transverter. When the sender grounds the TR lead from AV1 operated, per Section -0111, 20., the AC selector returns to normal.

(d) If the sender is released after the first marker connection but before the transverter connector is seized, the AC selector will advance to position 3, then restore when the C relay is released.

(e) If the AC selector is blocked before position 16 is reached, the TR relay cannot operate to advance the control section.

(f) If the code calls for detail billing, the sender 2L (2-line) relay should be normal, and if battery is connected to the DC lead before dialing is finished, the test circuit will block from ground through U (Section -0105) operated. This is preferably a light traffic, FS test, to avoid delay in seizing the transverter. The B relay should not operate until after the units digit is dialed. With 2L operated, the B delay should operate after TH is dialed but before U is dialed. The units digit cannot be dialed until the 2L check is completed or, if the TH is operated when B operates, the circuit is blocked.

6.02 With the AMA and MR or RR keys operated, the transverter seizes the maintenance or regular recorder, and the B relay is operated. The transverter ICK relay is given an operate test and is released when the DC lead is opened. The test is blocked after the fourth line when the RR key is operated.

6.03 If the originating marker grounds the ACC lead with the AMA key normal and the TRK-ICT (Section -0121) key operated, the G relay operates and locks, operating the blocking relay and lighting the AMA lamp. If the transverter is seized with the AMA key normal, the B and G relays are operated, blocking the test with the AMA lamp lit. The A relay is operated during KP tests to open the DC lead.

6.04 The sender locating lamp leads are extended to the maintenance recorder through the SN1-2 relays. The SN1-2 relays are operated from the maintenance recorder.

6.05 The TSB relay is operated from the TV connector between first and second trials to permit reselection of the same transverter. The TSB relay operated, lights the TSB lamp and withholds transverter start battery for second trial until the transverter is normal. Two testing circuits cannot use the TV keys while testing in the same sender subgroup.

6.06 Ground on the RR lead is detected by maintenance recorder tests.

6.07 Synchronizing for final units is waived on 4-line (detail-billed) FS calls. A 2L test may block if transverter delay is excessive.

6.08 The CA key should not be operated while the transverter is connected as the sender should not abandon the transverter, and the sender may be left off-normal with SR1 operated.

6.09 In position 13 of the AC switch, the 5L lead is checked in accordance with the 5L relay and the associated key.

6.10 In position 16 of the AC switch, the INF lead is checked in accordance with the INFK relay and the INF relay of Section -0139.

7. ACCOUNTING TROUBLE RELEASE TEST OVERFLOW WITH INDEX 9

(To Test Sender, Marker, and Transverter.)

7.01 This test should be made to a particular transverter with that transverter and the TBL indicator made busy.

7.02 The AMA, TV-TRL, and the 1, 4, or 5 class keys are used with a code that causes the marker to operate the sender relays for index 9. The TV-TRL key opens the RL regular release lead to the transverter causing it to block and give a trouble release. This key also closes in part a path to the ATR relay, -0135, and the advance path to Sheet -0103.

7.03 The FS or CI call proceeds as usual until the sender operates its AV2 relay for trunk closure. When the test circuit operates the F1 relay of Section -0133 or -0117 after incoming advance or CI pulsing, the operation of relay ATR connects both windings of the TCL relay

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to the fundamental tip and ring. Relay TCL operates from trunk closure and operates the C relay of -0133. The sender recalls the marker for overflow selection as soon as a trouble release is received from the transverter. The code test circuit functions as usual except that relay OF1 is operated and AR1 is bypassed. The sender makes trunk test from battery through the TCL relay and then operates relay TR. Ground from BLK1 through TV-TRL and the LU1 and OF1 relays, Section -0133, grounds the ADV lead to the connector. The connector advances, releases all sections, and releases the sender and marker.

7.04 If the sender falsely closes the TR lead on the first test, the TR relay will operate with the TR lamp lighted. If no trunk closure is checked, the TCL lamp remains lighted.

7.05 If the MA lead is falsely grounded, TSB will not release and lead TRB is open.

8. TEST OF TROUBLE ENTRY USING THE MAINTENANCE RECORDER AND THE TRANSVERTER TROUBLE INDICATOR - LAMA CALLS - TE KEYS OPERATED, BTI KEY OPERATED

8.01 Tests of proper entry on a particular line can be made with the test circuit as per 6.02 with any TE key operated. Reference is made to CD-25802-01, 21.23.

8.02 During trouble entry tests, if the transverter originates a trouble indication with the test circuit BTI key operated, lead DL from the transverter circuit is grounded operating relay DL. Relay DL locks to lead BLK1 of the connector circuit and grounds lead BLK to cause the test circuit to block. The BTI lamp is lighted indicating the transverter has originated a test call trouble display at the transverter trouble indicator.

8.03 In the event that a trouble display has been originated from a service call, during the time that a test trouble entry call is being made, leads DL and TIB are grounded from the transverter operating relays DL and TIB. These relays lock to lead BLK1 and ground lead BLK causing the test circuit to block. Lamp BDL is lighted indicating that a previous display was originated in the transverter trouble indicator and that the test call trouble entry display was lost.

9. PBX-AIOD-A1 AND A2 ALARM LAMPS AND KEYS

9.01 Figure AL provides major and minor alarm lamp indications and an RS-AIOD key which provides an alarm release. This figure is required for both PBX-AIOD-A1 and A2 Systems.

9.03 Figures AN and AM provide lamp and key control to facilitate maintenance requirement per PBX-AIOD-A1 and A2 System, respectively.

CIRCUIT UNIT SECTION -0137
AUXILIARY SENDER AREA CODE CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to permit dialing of the three digits of the toll numbering area code (XOX or X1X) preceding the directory number when testing subscriber senders associated with auxiliary senders.

1.02 This circuit causes the proper preset of the selector switch in Section -0139 when only seven digits are to be dialed to subscriber senders associated with auxiliary senders.

1.03 This circuit provides for the proper preset of the selector switch in Section -0141 when only four, five, or seven digits are to be MF-pulsed forward by the auxiliary sender.

1.04 Any reference to 7-digit calls includes those using eight digits (tandem calls on MF basis).

2. WORKING LIMITS

2.01 None - used for local circuit operation.

3. FUNCTIONS

3.01 To provide for dialing 10-digit test calls into the subscriber sender and the auxiliary sender using an XOX or X1X code (in connection with Sections -0105 and -0139).

3.02 To provide for dialing 7-digit test calls to the subscriber sender, which will be MF-pulsed forward by the auxiliary sender (in connection with Sections -0105 and -0139).

3.03 To provide for checking four, five, seven, or ten digits, MF-pulsed from the auxiliary sender (in connection with Sections -0105 and -0141).

3.04 To provide controls for checking the wipe-out and time-out features in auxiliary senders during dialing and MF-pulsing of XOX or X1X codes (in connection with Sections -0139 and -0141).

3.05 To provide for dialing a zero operator call when testing ODN features (in connection with Sections -0139 and -0141).

3.06 To provide for dialing an ACBO-9 digit in offices provided with interchangeable area and office codes.

JACKS

Area Code Jacks (ACA 2-9, ACBO, 1, and ACCO-9)

3.07 These jacks are used to set up the toll numbering area code used in Direct Distance Dialing (XOX or X1X). They also provide a path to operate the area code relays A (2-out-of-5), BO, 1, and C (2-out-of-5).

Auxiliary Sender Class Control Jacks 7DG PL and (VL Option) 7DG-DL, 5DG PL, 4DG PL

3.08 The 7DG DL jack is plugged when 7-digit MF-type calls are to be tested. On these tests, seven digits are dialed into the subscriber sender, and seven digits are pulsed forward by the auxiliary sender.

3.09 The 7DG PL jack is plugged when a 10-digit call is dialed into the subscriber sender and only seven digits are pulsed forward from the auxiliary sender.

3.10 The 4DG PL jack is plugged when a 7-digit MF-type call is to be dialed into the subscriber sender and only four digits are to be pulsed forward by the auxiliary sender. On this type of call, the 7DG DL jack must also be plugged.

3.11 The 5DG PL jack is plugged when a 7-digit MF call is to be dialed into the subscriber sender, and only five digits are to be pulsed forward by the auxiliary sender. On this type of call, the 7DG DL jack must also be plugged.

Wipe-Out Test Control Jacks WO, WO1, and WO2 (VZ Option), and Time-Out Test Control Jacks TO and TO1 (VZ Option)

3.12 The WO jack is plugged when "wipe-out before dialing is completed" tests are made on auxiliary senders. Nine digits are dialed, eight into the subscriber sender and one into the auxiliary sender. The auxiliary sender recognizes the wipe-out (or abandoned call) and disconnect.

3.13 The W01 jack is plugged when "wipe-out after dialing is completed but before sender attached wink" tests are made on auxiliary senders. Ten digits are dialed, eight into the subscriber sender and two into the auxiliary sender. The auxiliary sender recognizes the wipe-out before it MF-pulses forward the digits, and it disconnects.

3.14 The W02 jack is plugged when "wipe-out before MF pulsing is completed" tests are made on auxiliary senders. The auxiliary sender starts to MF-pulse forward the registered digits, recognizes the wipe-out, and disconnects before it completes MF-pulsing all the digits.

3.15 The TO jack is plugged when "time-out before dialing is completed" tests are made on auxiliary senders. Nine digits are dialed, dialing stops, and the auxiliary sender times out and releases.

3.16 The T01 jack is plugged when "time-out after dialing is completed but before sender attached wink" tests are made on auxiliary senders. Ten digits are dialed, the auxiliary sender is prevented from making trunk test, and it times out.

3.17 The RCY jack is plugged when recycle test calls (6-digit translation) are made. Three area code digits are dialed and the subscriber sender is recycled to accept the next seven digits on a revertive or PCI basis.

Area Code Jacks (ACB0-9)

3.18 These jacks are used to set up the toll numbering area code used in direct distance dialing in offices provided with the interchangeable code feature. They also provide a path to operate the B (2-out-of-5) area code relays.

LAMPS

Auxiliary Sender Class Control Lamps (10DG, 7DG (VL Option), and 7DP)

3.19 With only the 10DG lamp lighted, ten digits will be dialed into the subscriber and auxiliary senders, and ten digits will be MF-pulsed forward by the auxiliary sender.

3.20 With only the 7DG lamp lighted, seven digits will be dialed into the subscriber sender, and four, five, or seven digits will be MF-pulsed forward by the auxiliary sender.

3.21 If ten digits are to be dialed into the subscriber sender and auxiliary sender, but only seven digits are to be MF-pulsed forward by the auxiliary sender, the 10DG and 7DP lamps will be lighted.

3.22 The lamps light when Section -0139 steps off-normal and grounds lead L.

4. CONNECTING SECTIONS AND SHEETS

4.01 The connecting sections and sheets are:

(a) Connector Circuit - Section -0102, Sheet -0103.

(b) Code Keys and Dial Pulsing Circuit - Section -0105.

(c) Code Test Circuit - Section -0133, Sheets -0133 and -0134.

(d) Auxiliary Sender Dial Pulse and Code Check Control Circuit - Section -0139, Sheets -0139 and -0140.

(e) Auxiliary Sender MF Pulse Check Control Circuit - Section -0141, Sheets -0141 and -0142.

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5. SEIZURE

5.01 When a subscriber sender is seized for test, leads C and C1 are grounded from Section -0102 if class key 17 has been operated. The connector circuit, -0102, and the sender group test circuit, -0131, perform their usual functions.

5.02 The ground on lead C operates relay SAS unless the recycle feature is provided, RCY jack is plugged, and the A (2-out-of-5), B0, or B1, and C (2-out-of-5) relays operate through the plugged jacks in the ACA, ACB, and ACC jack strips. This prepares paths for the subsequent dialing of the toll numbering area code digits to the subscriber sender and for checking the MF-pulsing of these digits from the auxiliary sender.

5.03 On 10-digit test calls, if only seven digits are to be MF-pulsed forward by the auxiliary sender, the 7DG PL jack is plugged, and relay 7P will operate when relay SAS and the digit relays operate.

5.04 On 7-digit MF test calls (VL option), the 7DG DL jack is plugged, and relay 7D will operate (and 7DE if provided) when relay SAS operates. In addition (under VL option), either the 5DG PL or 4DG PL jack may also be plugged to cause the test circuit to check only five or four digits on MF pulsing (Skip 2 and Skip 3 features).

6. PREPARATION FOR DIALING AND PULSING

Note: The function of the auxiliary sender is incorporated in the SD-27810-01 sender. Any reference to the auxiliary sender in this CD should be taken to mean the operation is taking place in the sender.

6.01 The operation of relay SAS -

(a) Grounds lead C to operate the C relay of Section -0139. This C relay presets the ASDC selector switch in accordance with the number of digits to be dialed.

(b) Closes the last link in the circuit for operating the C relay of Section -0141. This C relay presets the MFK selector switch in accordance with the number of digits to be MF-pulse checked.

6.02 If the 7DG PL jack is plugged, relay 7P will operate. Relay 7P operated:

(a) Connects leads PB-1 and PB-2 (to Section -0141) together. This causes the MFK switch to preset to position 7 where the MF-pulsed A digit from the auxiliary sender is the first digit checked.

(b) Lights lamp 7P in parallel with lamp 10DG.

6.03 7-Digit MF Test Calls (VL Option) -

(a) If the 7DG DL jack is plugged, relay 7D will operate. Relay 7D operated:

(1) Transfers the lamp-lighting lead from lamp 10DG to lamp 7DG.

(2) Connects leads PB-1 and PB-2 together to Section -0139. This causes the ASDC selector switch to preset to position 4 where digit A, instead of ACA, will be the first digit dialed.

(3) Connects leads PB-1 and PB-2 together to Section -0141. This causes the MFK selector switch to preset to position 7 where digit A, instead of ACA, is checked as the first digit MF-pulsed from the auxiliary sender.

(b) On a 7-digit MF call where the first three digits are to be skipped, the 7DG DL and 4DG PL jacks are plugged. This connects leads PB-4 and PB-2 together to Section -0141, presetting the MFK selector switch in Section -0141 to position 10. In position 10, the MF-pulsed TH digit from the auxiliary sender is the first digit checked by the test circuit.

(c) On a 7-digit MF call where the first two digits are to be skipped, the 7DG DP and 5DG PL jacks are plugged. This connects leads PB-3 and PB-1 together to Section -0141, presetting the MFK selector switch to position 9. In position 9, the MF-pulsed C digit from the auxiliary sender is the first digit checked by the test circuit.

6.04 The operation of the 0 relay in Section -0141, on an ODN test call results in the operation of the A4 and A7 relays causing a zero to be dialed into the sender. Detailed descriptions of ODN test features are given in 20., 21., and 22. of Section -0141.

7. RELEASE

7.01 No further relay position changes will occur in this circuit. When leads C and C1 are opened, upon completion of the test call or manual restore, relay SAS will release, releasing all operated relays in this circuit.

8. WIPE-OUT TESTS - 10-DIGIT CALLS

(See Note under 6.)

8.01 To cause auxiliary senders to wipe out and disconnect before dialing into the subscriber sender is completed, the WO jack is plugged. This causes the WO relay of Section -0139 to operate when the selector switch of that section reaches a position in which the dialing is to be stopped. Ground on lead WO from the selector switch, through the plugged WO jack and back on lead W1 to Fig. 26, operates the WO relay.

8.02 To cause auxiliary senders to wipe out and disconnect, after dialing into the subscriber sender has been completed but before the sender attached wink, the WO1 jack is plugged. This causes the WT relay of

Section -0139 to operate. When the selector switch of that section reaches position 15, after dialing is completed, relay WO will operate through the operated WT relay. Relay WO will start the wipe-out in the auxiliary sender.

8.03 To cause auxiliary senders to wipe out and disconnect after pulsing from an auxiliary sender has begun, the WO2 jack is plugged. This causes a relay in Section -0141 to operate and start a timing cycle preparatory to wiping out the test call and disconnecting the auxiliary sender.

8.04 Further detailed descriptions of wipe-out test features are given in 14. and 15. in Section -0139, and 17. in Section -0141.

9. TIME-OUT TESTS - 10-DIGIT CALLS

(See Note under 6.)

9.01 To cause auxiliary senders to time out and disconnect before dialing into the subscriber sender has been completed, the TO jack is plugged. This causes the TO relay in Section -0139 to operate when a selector switch in that section reaches a position in which the dialing will be stopped. Ground on lead WO from the selector switch, through the plugged TO jack and back over lead TO to Fig. 26, operates the TO relay. The auxiliary sender will time out when no more digits are dialed, and then it will disconnect.

9.02 To cause auxiliary senders to time out and disconnect after dialing into the subscriber sender has been completed, the TO1 jack is plugged. This causes the TO relay in Section -0139 to operate when a selector switch in that section reaches a position in which dialing into the subscriber sender is completed but before trunk test is made by the auxiliary sender. Ground on lead TO1 from the selector switch through the plugged TO1 jack and back over lead TO to Fig. 26 operates the TO relay The auxiliary sender will time out awaiting trunk closure, and then it will disconnect.

9.03 Further detailed descriptions of time-out test features are given in 16. and 17. in Section -0139, and 18. in Section -0141.

10. INTERCHANGEABLE CODE

10.01 When testing toll numbering area codes which are interchangeable area and office codes, the ACBO-9 jacks of Fig. 41A are plugged. The B (2-out-of-5) relays of Fig. 41 operate in the same way and with the same function as the A and C relays described in 5.02.

10.02 When testing 7-digit MF codes the ACA, ACB, and ACC jacks are not plugged. The operation of the 7DE relay, 5.04 will close a path to operate the 7DS relay of Section -0133. The 7DS relay operated prepares the test frame for checking the first and second marker seizures for a 7-digit MF call as described in Section -0139, 29.

CIRCUIT UNIT SECTION -0139
AUXILIARY SENDER DIAL PULSE AND CODE CHECK CONTROL CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit unit is provided to control the dialing into the No. 1 crossbar subscriber sender and the auxiliary sender for DDD calls. It also causes elimination of the unusual code check, to speed up testing. A code check is not needed when all digits can be pulsed forward and checked against the digits dialed.

1.02 This circuit unit is provided to control wipe-out tests (abandoned calls) and time-out tests (no outgoing trunks available) on auxiliary senders.

1.03 This circuit unit is provided to control dialing into the No. 1 crossbar subscriber sender for recycle class calls (6-digit translation).

1.04 This circuit unit is called into use by class key 17 only.

1.05 This circuit unit is provided to control dialing into the No. 1 crossbar subscriber sender and the auxiliary sender for testing the routing of 7-digit revertive calls to a 7-digit MF trunk when an alternate route is desired.

1.06 This circuit unit is used to control dialing on zero operator ODN test calls in conjunction with Sections -0137 and -0141.

2. WORKING LIMITS

2.01 None - used for local circuit operation.

3. FUNCTIONS

The functions of this circuit are:

3.01 To advance from normal upon signal from Section -0137.

3.02 To preset for the actual number of digits (ten or seven) to be dialed into the sender.

3.03 To signal Section -0105 (code keys and dial pulsing circuit) when to start the dialing of each digit.

3.04 To extend the local pulses from Section -0105 through the proper circuits so that each digit contains the proper number of dial pulses. The digits written up on the jacks of Section -0137 and/or the keys in Section -0105 are checked through the operated digit relays in those two units.

3.05 To close the dialing T and R leads to Section -0105.

3.06 To prepare to advance the ASDC selector switch when Section -0105 opens lead AV as a signal that the dialing of a digit has been completed.

3.07 To prevent operation of the next digit relay until the switch contacts are normal following an advance.

3.08 To await the completion of the marker functions after the first three digits have been dialed to the subscriber sender.

3.09 To advance the ASDC switch and resume dialing after lead DC is grounded (through the sender) as a signal that the marker has been disconnected.

3.10 To pass by the second marker check position on the ASDC switch when a 10-digit number is dialed into the subscriber and auxiliary senders.

3.11 To end dialing immediately when the tenth (or seventh) digit has been dialed for numbers below 10,000 with no party designation.

3.12 To time a nominal 2.5 seconds, after the units digit has been dialed, before signaling to start the dialing of the fifth numerical digit when a number above 10,000 or party letter is used for 7-digit calls.

3.13 To assist in blocking the test circuit if the auxiliary sender attempts trunk test before the last required digit has been dialed into auxiliary or subscriber senders.

3.14 To give lamp signals showing the toll numbering area code digit that is awaiting dialing or is being dialed into the subscriber sender.

3.15 To restore to normal upon successful completion of a test call or upon reset of the test circuit by momentary operation of the CA key in Section -0102 after a test failure.

3.16 To provide facilities to cause auxiliary senders to wipe out or time out when testing 10-digit DDD calls.

3.17 To test subscriber senders in areas using 7-digit MF as a first alternate route for initial revertive routes.

3.18 To simulate overflow at revertive trunk test, to check that the subscirber sender reconnects to a marker, and then to check that the call is completed on an MF basis.

3.19 To control dialing on zero operator ODN test calls.

3.20 To provide facilities for testing the information code 411 feature in offices arranged for DDD.

3.21 To provide facilities for testing the interchangeable code feature.

3.22 To provide facilities for speed testing the TOUCH-TONE to dial pulse converter circuit on 10- or 11-digit DDD TOUCH-TONE calls.

LAMPS

3.23 Dialed digit area code lamps (ACA, ACB, and ACC) light in turn as each code digit is awaiting dialing or is being dialed into the subscriber sender.

3.24 The MT lamp is used to indicate marker translation in process when speed test of the TOUCH-TONE to dial pulse converter circuit is in effect.

KEYS

3.25 The CT key is operated when performing speed test of the TOUCH-TONE to dial pulse converter feature.

3.26 The CID key is provided to enable the test frame to continue dialing after the 411 is dialed on information code 1+NPA+411 calls, and when the interchangeable code feature is not provided. This tests the ability of the auxiliary sender to ignore any additional digits and to continue to outpulse the start pulse after the C digit.

3.27 The CID key is also used when both the information code 411 interchangeable code features are provided to cancel the extra digit timing check when testing 1+ABC+411x calls involving MF interchangeable area and office codes.

4. CONNECTING CIRCUITS, SECTIONS, AND SHEETS

4.01 The connecting circuit is:

(a) Miscellaneous Circuit for Originating Sender Test Frame - SD-25174-01.

4.02 The connecting sections are:

(a) Connector Circuit, Section -0102, Sheets -0102, -0103.

(b) Code Keys and Dial Pulsing Circuit, Section -0105, Sheet -0105.

(c) Code Test Circuit, Section -0133, Sheets -0133 and -0134.

(d) Auxiliary Sender Area Code Circuit, Section -0137, Sheets -0137 and -0138.

(e) Auxiliary Sender MF Pulse Check Control Circuit, Section -0141, Sheets -0141 and -0142.

(f) Route Keys and Revertive Pulsing Circuit, Section -0108, Sheet -0109.

(g) Operator Class Control Circuit, Section -0121.

DESCRIPTION OF OPERATION

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5. SEIZURE

5.01 When a subscriber sender has been seized for test purposes. lead C is grounded from Section -0137, If the ASDC switch is normal, relay C operates through the brush and normal terminal 22 of arc 3. Relay C locks directly to lead C. Relay C operated:

(a) Closes the T and R leads from Section -0102 to Section -0106.

(b) Provides off-normal ground to the brush of arc 5 of the ASDC selector switch, the locking contact of relay MKM and lead L to Section -0137 and to Fig. 26 and Y and Misc Ckt for Sdr Test Ckt.

(c) Through a make before make-contact, first shunts relay PS keeping it normal until the switch is preset, then grounds the operate path for relay PS.

(d) Removes restore ground from the restore strapping of arc 1, ASDC.

(e) Connects ground to terminal 22 of arc 2, ASDC, to cause the switch to step from normal.

(f) Closes the operate path for relay G.

5.02 Relay G operated, closes a link in the circuit for operating the digit relays and a link in lead AV to the code keys and dial pulsing circuit, Section -0105.

6. PREPARATION FOR DIALING

(PP key operated - see 6.02, Section -0105.)

6.01 If a 10-digit call is to be dialed, selector switch ASDC presets to position 1. In this case, the shunt circuit of relay PS is opened as the switch advances to position 1, and relay PS operates. If a 7-digit call (VL option) is to be dialed, leads PB-1 and PB-2 are connected together by the previous operation of relay 7D, Section -0137, and selector switch ASDC is stepped to position 5. The path for keeping relay PS shunted down on a 7-digit call is traced from ground on relay C through the brush and terminal 22, arc 2, ASDC, through a break-contact on relay PS, to the side of resistor PS that is connected to the relay winding. With VL option, the supplementary path for shunting relay PS, when the switch is advanced to terminal 5, is from ground on relay C through the brush and strapped terminals 1 to 4 or arc 2, ASDC, over lead PB-1 to Section -0137, through a make-contact on relay 7D, back over lead PB-2 to resistor PS over the path previously traced. The same ground that keeps relay PS shunted down is closed through a second break-contact on relay PS to the break-contact of the ASDC switch stepper springs. This causes the switch to advance until it opens the shunt ground by advancing to a terminal having no connection to resistor PS.

6.02 When the shunt circuit for relay PS is opened, relay PS operates. Relay PS operated:

(a) Opens its own shunt circuit.

(b) Transfers the break-contact of step per ASDC to resistor DLK and through the winding of relay DLK to ground. The resistance of this path is too high to energize the stepper.

(c) Closes a link in the circuit for operating relay MC.

(d) Closes a link in the circuit for operating the digit relays.

6.03 Relay DLK is now in series with the stepper winding. Relay DLK operates but the stepper is marginal and does not operate. Relay DLK operated, opens the locking circuit of relays AV and AV1.

7. DIALING THE PREFIX DIGIT 0 OR 1

7.01 When it is desired to dial a prefix digit 0 or 1 before the area or office code, the PDG0 or PDG1 key in the dial pulse control circuit is operated. With the ASDC selector preset in position 1 for

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10-digit calls or position 5 for 7-digit calls as described in PREPARATION FOR DIALING the dial pulse interrupter circuit or the TOUCH-TONE signal generator circuit will proceed to outpulse a prefix digit 0 (PDG0 key operated) or a prefix digit 1 (PDG1 key operated) into the sender as outlined in Section -0105.

8. DIALING THE ACA OR A DIGIT

8.01 With relays PS and G operated, the circuit is closed for operating the first digit relay. This path is traced from ground through a break-contact on relay AV1, through a make-contact on relay PS, through a make-contact on relay G, through a break-contact on relay EP, through the brush and terminals of arc 4, ASDC, to the winding of relay ACA of this circuit, or relay A of Section -0105 (for a 7-digit call VL option).

8.02 If the switch was preset to terminal 1, the first digit relay operated is relay ACA in this section. If the switch was preset to position 5, the first digit relay operated is relay A in Section -0105. Relay ACA operated:

(a) Closes lead PLS from Section -0105 to Section -0137. (This is the local pulsing lead used to count the pulses in any digit. The A, 2-out-of-5, relays in Section -0137 will direct the pulses to the correct counting lead in Section -0105.)

(b) Connects ground to lead SY1 as a signal to Section -0105 to start dialing the digit.

Relay A (if operated) performs similar functions as relay ACA, and in addition, lights the A progress lamp. The progress lamps for the area code digits are lighted from ground through the brush and terminals of arc 6, ASDC.

8.03 The ground on lead SY1 from the area code relays (ACA, ACB, ACC) to Section -0105 is extended to lead SY to operate the SY relay. The code keys and dial pulsing circuit reacts by grounding lead AV as dialing starts. Ground on lead AV is extended through Section -0105 to this circuit to operate relay AV. This path is traced from lead AV through a make-contact on relay G, through a break-contact on relay AV1, to battery through the winding of relay AV. Relay AV operated:

(a) Closes a link in the locking path for relays AV and AV-1.

(b) Energizes the stepper winding of the ASDC switch.

9. DIALING THE ACB AND ACC OR B AND C DIGITS

9.01 Relays AV and AV-1 constitute a counting pair. Regardless of the position of relay DLK, the AV-1 relay cannot operate until lead AV is opened. The path for energizing stepper magnet ASDC is traced from ground through a break-contact on relay AV-1, through a make-contact on relay PS, through a make-contact on relay AV to the stepper winding. This same ground shunts down relay DLK. Relay DLK released, closes the locking circuit for relays AV and AV-1 in series.

9.02 When the last pulse of the digit has been counted by Section -0105, lead AV is opened permitting relay AV-1 to operate in series with relay AV. Relay AV-1 operated, opens lead AV and removes ground from the operating circuits of the ACA relay (A relay for 7-digit call VL option) and the ASDC stepper. When the operate circuit of the stepper is opened, the stepper releases advancing the switch and closing its back contact. Relay DLK reoperates when the back contact of the stepper is closed. The operation of relay DLK releases relays AV and AV-1 causing the dialing of the second digit as written up on the ACB jacks in Section -0137 or on the B keystrip of Section -0105. (Relay ACB will operate for a 10-digit call, and relay B of Section -0105 will operate for a 7-digit call.)

9.03 The dialing of the third digit (ACC for 10-digit and C for 7-digit), is similar to the above description.

10. MARKER TRANSLATION

10.01 The subscriber sender will call in a marker after the sender has received the first three digits (toll numbering area code for 10-digit call, office code for 7-digit call) from the test circuit. The marker then checks and translates the code and returns the proper class information to the sender.

10.02 While the marker is performing the functions mentioned above, the ASDC switch in this circuit is advanced to position 4 (10-digit call) or position 8 (7-digit call VL option). In either of these

positions, the circuit for operating the digit relays is open at the terminals of arc 4, ASDC. In position 4, the C lead through the brush and terminal of arc 3, ASDC, through a make-contact on relay P8, operates relay MC. In position 8, the C lead ground through the brush and terminal of arc 3, ASDC, through a break-contact on relay MKM, operates relay MC. Relay MC operated:

(a) Through a break-contact, separates leads CK1 and CKG to Section -0133 to ensure that lead CK1 is grounded from the marker circuit only during the integrity test.

(b) Closes lead DC to the windings of relays DA and DAS (Fig. T or Fig. U).

(c) Closes a link in the circuit for energizing the ASDC stepper. This circuit is traced from ground, through a make-contact on relay MC, through the make-contact of a transfer on relay DA, through the break-contact of a transfer on relay AV to the stepper winding.

10.03 When the marker has translated and checked the area code, it extends the ground on lead DC from the code test circuit, Section -0133, through the marker connector to the subscriber sender under test, to operate the sender relay DC. Relay DC returns this ground on lead DC through the connector circuit to operate relay DA. Relay DA operated:

(a) Operates the MKM relay.

(b) Connects the DAS relay to the DC lead to hold the subscriber sender DC relay. The DAS relay does not operate until the marker releases, removing the shunt ground.

10.04 The DAS relay in operating:

(a) Closes the last link for energizing selector ASDC.

(b) Operates the DBS relay.

The DBS relay in operating grounds lead AV1 to operate relays AV and AV1 to advance the ASDC selector to position 5 and releases the MC relay which in turn releases relays DA and DAS and the subscriber sender DC relay.

10.05 Relay MKM operated:

(a) Locks to off-normal ground.

(b) Opens the path that would operate relay MC in position 8, on a 10-digit call.

(c) Closes the circuit that would cause a passby on a 10-digit call.

Relay MKM does not operate on a 7-digit call.

11. CHECKING THE PREFIX DIGIT INFORMATION (CC- LEADS) SENDER TO MARKER (OPTION TV)

11.01 When the associated subscriber senders are arranged for prefix digit 0 or 1, the sender will operate two-out-of-five CC- relays in Section -0133 when the marker is seized. The DC lead from the subscriber sender is wired through a check path consisting of the CC- relay contacts and PDG0 or PDG1 key contacts to the winding of relay DA. This path checks the CC- relays operated against the prefix digit keys operated as described in Section -0133. A failure to check will prevent the ground on the sender DC lead from operating relay DA.

12. DIALING THE OTHER DIGITS

Note: The function of the auxiliary sender and the code compressor circuit are incorporated in the SD-27810-01 sender. Any reference to these circuits in this CD should be taken to mean the operation is taking place in the sender.

12.01 On a 10-digit call, since three digits have been previously dialed, the test circuit must dial seven more digits. On a 7-digit call (VL option), since the three digits had been previously dialed, the test circuit has to dial four more digits (five with stations). These conditions are explained below.

Ten-Digit Call (NST Key Operated)

12.02 The A, B, and C digits are dialed as explained in 10. of the code keys and dial pulsing circuit - Section -0105 under control of Section -0139. The ASDC stepper switch advances to position 8. Since the MKM relay has been locked operated, the ASDC switch will pass by position 8. This passby circuit is traced from off-normal ground through the brush and terminal of arc 5, ASDC, through a make-contact on relay MKM, through the strapped terminals and brush of arc 1, ASDC, to the break-contact of the ASDC stepper to the ASDC stepper winding. The ASDC switch will now advance to position 9, and the thousands digit will be dialed in a similar manner to that described above for the A, B, and C digits.

12.03 After the thousands digit has been dialed, the switch will advance to position 10, and at the same time, the subscriber sender will connect to an idle auxiliary sender through the auxiliary sender link. When the ASDC switch is in position 10, the hundreds digit is dialed. At this time, a test for false trunk closure

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is made by grounding lead TTG at positions 10, 11, and 12 of arc 3, ASDC, to Section -0141 TC relay transfer break-contact that is connected to the FR lead. If battery is falsely applied to the FT lead at the subscriber sender, the fundamental loop will be closed causing the test circuit to block. After hundreds digit is dialed, the ASDC switch advances to position 11. The auxiliary sender is now ready to receive and register the last two digits.

12.04 The tens and units digits are dialed into the auxiliary sender, tens and units digits being dialed in positions 11 and 12 of the ASDC switch respectively. After the units digit has been dialed, the ASDC switch advances to position 13.

12.05 The advance of the ASDC switch to position 13 operates relay EP. The circuit for operating relay EP is from ground through a make-contact on relay C, through the brush and terminal of arc 5, ASDC, over lead EP1 to Section -0105, through a make-contact of the NST key, back over lead EP to the winding of relay EP. Relay EP operated:

(a) Grounds lead TDK to Section -0141 to indicate that the last required digit has been dialed and lights lamp EP of Section -0141.

(b) Opens the link from lead FT to lead BLK to permit trunk test by the auxiliary sender without blocking the test circuit.

(c) Opens the digit relay operate lead.

(d) Opens a link in the interrupter circuit.

(e) Grounds lead TTG to check for false MF trunk closure.

Seven-Digit Call - VL Option

12.06 The thousands, hundreds, tens, and units digits are dialed as explained in 10. of the code keys and dial pulsing circuit, Section -0105, under control of Section -0139. The ASDC stepper switch advances after each digit is dialed until it reaches position 13. After the units digit has been dialed, the subscriber sender will connect to an idle auxiliary sender through the auxiliary sender link.

12.07 If no stations digit is required, the circuit functions the same as described in 10. for a 10-digit call.

12.08 If a stations digit is required, the dialing is delayed nominally 2.5 seconds to check that the auxiliary sender does not make trunk test immediately after the units digit has been dialed. The path for advancing the ASDC switch from position 13 to position 18 is traced from ground to a make-contact on relay C, through the brush and strapped terminals (13 to 17) on arc 3, ASDC, through the 0.5-second cycle interrupter, through a break-contact on relay EP, to the stepper winding. In position 18, the interrupter circuit is open at the bank of arc 3, ASDC, and the digit relay operating circuit is closed at the bank of arc 4, ASDC. The stations digit will now be dialed. When the stations digit has been dialed, the switch is advanced to position 19, and relay EP operates through the brush and terminal of arc 5, ASDC. However, the stations digit will be dialed into the subscriber sender which will operate a relay in the auxiliary sender to indicate that the stations digit has been dialed.

13. RELEASE

13.01 With relay EP operated, under the conditions described above, this circuit is awaiting restore to normal. After the dialed digits have been MF-pulsed forward by the auxiliary sender, and checked by Section -0141, the C lead is opened. This releases relay C, which releases all other operated relays in this section, and advances the ASDC stepper switch to its normal position 22. The circuit for advancing the switch is from ground through a break-contact of relay C, through the strapped terminals of arc 1, ASDC (except position 22), through the arc 1 brush, through the break-contact of the ASDC stepper to the winding of the stepper.

13.02 The circuit may also be restored to normal by manual reset. With the ASDC switch in position 22, the circuit awaits the next test call.

14. SELECTING A PARTICULAR AUXILIARY SENDER

(The PNS key should be operated for this test.)

Note: This test should be made with the test circuit attended and should preferably be made during intervals of light traffic.

14.01 A feature is provided for selecting a particular auxiliary sender when testing DDD calls. (Reference is made to SD- and CD-25174-01, Miscellaneous Circuit for Originating and Auxiliary Sender Test Frame.) With any one of ten PAS- keys operated, and the test circuit off normal (see 5.01 (b)) the MB- lead of the desired auxiliary sender is grounded. This ground is extended to the auxiliary sender link circuit, making the selected auxiliary sender busy. When the ASDC switch, arc 5, is advanced to position 10 (dialing hundreds digit), the AL lead is grounded, operating relays L01, L02, and L03 in the miscellaneous

circuit. The operation of relays L01 and L02 causes ground to be placed on the MB- leads of all other auxiliary senders making those busy that have not been busy in service. Ground is removed from the MB- lead of the selected auxiliary sender making it the only auxiliary sender available for test. At the time the ASDC switch is in position 10 (dialing hundreds digit) the subscriber sender prepares to seize the selected auxiliary sender since all other auxiliary senders are made busy.

14.02 When the sender test circuit dials the units digit (position 12 ASDC switch) into the subscriber sender, the subscriber sender seizes the selected auxiliary sender. The selected auxiliary sender grounds its MB- lead to operate relay LOR on its secondary winding. Relay LOR operated, releases relays L01, L02, and L03 thus removing ground from all auxiliary sender MB- leads and making these auxiliary senders available for service or test. In the event that the auxiliary sender selected on the PAS- key is not seized, and ground is not returned on the MB- lead, the ASDC switch, arc 5, in position 12 (dial units digit) will ground lead AR to the miscellaneous circuit causing the LOR relay of that circuit to operate on its primary winding. The LOR relay operated, performs the same functions as described above.

14.03 The particular auxiliary sender circuit operates in a similar manner on 7-digit MF calls. On this type of call lead AL to the miscellaneous circuit is grounded in position 11 (dial tens digit) of the ASDC selector switch. Relays L01, L02, and L03 operate as described in paragraphs 12.1 and 12.2. Relay 7DE of Section -0137 will operate as described in that section, causing a transfer of leads AL and AR for 7-digit MF calls. In the event that the selected auxiliary sender is not selected and ground is not returned in the MB- lead of the selected auxiliary sender, the ASDC switch, arc 5, in positions 13 and 14 will provide the necessary ground on lead AR to operate the LOR relay in the miscellaneous circuit to release relays L01, L02, and L03.

15. MISCELLANEOUS FEATURES

15.01 Other features, such as repeat test, repeat 2 test, automatic pass busy, etc, are the same as described in Section -0102, 17. to 23.

15.02 If the BLK lead from Section -0139 is grounded at any time during the test, the BK relay of Section -0102 will operate, causing the circuit to block. The time alarm feature will then function as described in 5., Section -0102, provided the TA key of that section is normal.

16. WIPE-OUT AND DISCONNECT

(Before Dialing Is Completed) Fig. U and 26 and Option VZ Using 10-Digit DDD Call

Note: The function of the auxiliary and the code compressor circuits are incorporated in the SD-27810-01 sender. Any reference to these circuits in this CD should be taken to mean the operation is taking place in the sender.

16.01 Auxiliary senders may be tested for wipe-out (abandoned call) features, before dialing into the subscriber sender is completed. With the WO jack of Section -0137 plugged, the WO relay will operate when the digits dialed into the subscriber sender (as per 5. through 10.) reach the point where the U digit is about to be dialed. In position 12, the ASDC switch grounds lead WO to operate relay WO. Relay WO operated:

(a) Locks to its own make-contact over lead L to ground on relay C.

(b) Through a break-contact, removes the ground that causes the circuit to advance over the U lead to Section -0105.

(c) Opens the T dialing lead from the code keys and dial pulsing circuit, Section -0105, to prevent further dialing and to register a disconnect in the subscriber sender.

(d) Closes the last link in the circuit to operate relay WO of Section -0141 over lead WO, for that section.

16.02 Relay WO, of Section -0141, operated:

(a) Locks to its own make-contact.

(b) Closes a link in the circuit for grounding lead ADV of Section -0141.

(c) Opens lead FT, of Section -0141, to relay TC of that section, to prevent the subscriber sender from making trunk test.

If trunk test is made, lead FT will be grounded, grounding lead BLK through the EP relay normal and the C relay operated, causing the test circuit to block.

16.03 When the T lead is opened, the sender LR and STL relays operate. The sender registers a late release and closes the trunk test bridge to the auxiliary sender. The auxiliary sender recognizes the wipe-out condition, and it disconnects from the circuit. The subscriber sender will then remove ground from the S lead, substituting battery and operate the S relay in the connector circuit, Section -0102. Relay S operated, grounds lead ADV1 to Section -0141 operating relay AV of that section. Relay AV closes the last link to ground lead AV1 to the connector circuit to operate the CT register. The CT register restores the test circuit as described in 10., Section -0102.

17. WIPE-OUT AND DISCONNECT

(After Dialing Is Completed, But Before Remote Sender Attached Wink) Fig. U and 26, and Option VZ Using a 10-Digit DDD Class Call

(See Note under 16.)

17.01 Auxiliary senders may be tested for wipe-out (abandoned call) features after dialing into the subscriber sender is completed, and when the 9th and 10th digits are registered in the auxiliary sender. With the W01 jack of Section -0137 plugged, relay WT will operate when the ASDC selector reaches position 6 during the dialing of the digits. Relay WT operated:

(a) Locks to its own make-contacts.

(b) Opens lead EP1 from Section -0105 to ASDC selector arc 5 to prevent relay EP from operating after dialing is completed.

(c) Transfers the FT1 lead from Section -0141 to a resistance battery to prevent the sender attached wink from taking place.

(d) Closes a link in the path to operate relay WO.

17.02 When all the digits have been dialed (as per 5. through 10.), the TSTA interrupter will step the ASDC selector to position 15 to operate relay WO. Relay WO operated:

(a) Locks to its own make-contact over lead L to ground on relay C.

(b) Opens lead T to Section -0105, to open the dialing loop that holds the sender L relay operated.

(c) Closes the last link in the circuit to operate relay WO of Section -0141, over lead WO to that section.

17.03 Relay WO of Section -0141 operated:

(a) Locks to its own make-contact.

(b) Opens lead FT to Section -0139 to prevent the circuit from blocking in the event that trunk test is made from the auxiliary sender.

(c) Closes a link in the circuit for grounding lead ADV to the connector circuit.

17.04 When lead T is opened by the operation of relay WO, the L relay in the subscriber sender goes to its back contact. The ninth and tenth digits, having been dialed into the auxiliary sender, cause it to make trunk test back to the subscriber sender, then trunk test forward to the simulated remote incoming trunk in Section -0141 over leads FT and FR. Meanwhile, the subscriber sender grounds lead LR to operate relay LR in the auxiliary sender. The auxiliary sender recognizes the wipe-out and it releases. The subscriber sender then releases in a manner similar to that described in 14.02.

17.05 The interrupter steps the selector to position 19 operating relay EP, and the circuit returns to normal as described in 14.02.

18. WIPE-OUT DISCONNECT

(Before MF Pulsing Is Completed) 10-Digit DDD Call

(See Note under 16.)

18.01 Auxiliary senders may be tested for wipe-out (abandoned call) features after the start of MF pulsing to a remote sender. When the W02 jack of Section -0137 is plugged, relays in Section -0141 operate to cause the auxiliary sender to wipe out and disconnect. See Section -0141, 17. for detailed description of circuit operation.

19. TIME-OUT AND DISCONNECT

(Before Dialing Is Completed) Fig. U and 26 and Option VZ, Using 10-Digit DDD Call

(See Note under 16.)

19.01 If this test is made with the auxiliary sender CTR key out to check the ability of the auxiliary sender to stick, the PNS key should be operated.

19.02 Auxiliary senders may be tested for time-out features, before dialing into the subscriber sender is completed. With the TO jack of Section -0137 plugged, relay TO will operate when the digits

dialed into the subscriber sender (as per 5. through 10.) reach the point where the U digit is about to be dialed. In position 12, the ASDC selector switch grounds lead WO to operate relay TO. Relay TO operated:

(a) Locks to its own make-contact over lead L to ground on the C relay.

(b) Closes lead DC from the code test circuit, Section -0133, to the primary winding of relay DA over lead DC1.

(c) Through a transfer contact, closes a link in the FT1 lead to operate relay TC1 of Section -0141.

(d) Through a break-contact, removes ground that causes the circuit to advance to position 13 over lead U from Section -0105.

(e) Through a break-contact, separates leads CK1 and CKG from Section -0133, to ensure that lead CK1 is grounded from the marker only during an integrity check.

(f) Closes a link in the locking circuit to the secondary winding of relay DA.

19.03 Since the operation of relay TO causes the stepper switch to stop its advancement, in position 12, dialing into the subscriber sender ceases. The auxiliary sender under test will time for 6 to 12 seconds, then it will ground the DC lead to the subscriber sender. The subscriber sender will then make trunk test toward the auxiliary sender, which will send an overflow signal back to the subscriber sender. Second trial is not made in the subscriber sender, and it calls in a marker and requests routing to an overflow trunk. The marker will give class information back to the subscriber sender, and then it will release. When the marker releases, the subscriber sender grounds lead DC which operates relay DA through the make-contacts of relay TO. Relay DA operated:

(a) Locks to its own make-contact and its secondary winding through contacts on relay TO and ground on the selector switch in position 12.

(b) Closes a link in the circuit for operating relay TC1 of Section -0141.

19.04 When the marker has released, the subscriber sender will make trunk test toward the test circuit over the fundamental leads. Lead FT to Section -0141 is grounded during trunk closure, operating relay TC1 of that section over lead FT1, through a break-contact on relay WT, through a transfer make-contact on relay TO, through a make-contact on relay DA, to the TC1 winding over lead TC1. Relay TC1 operated, locks to its own make-contact, and closes a link in the circuit for grounding lead ADV to the connector circuit, Section -0102.

19.05 After making trunk test, the subscriber sender disconnects in a manner similar to that described in 14.02.

20. TIME-OUT AND DISCONNECT

(After Dialing Is Completed) Fig. U and 26 and Option VZ, Using 10-Digit DDD Call

(See Note under 16.)

20.01 If the test is made with the auxiliary sender CTR key out to check the ability of the auxiliary sender to stick, the PNS key should be operated.

20.02 Auxiliary senders may be tested for time-out features after dialing into the subscriber sender and auxiliary sender has been completed. With the TO1 jack of Section -0137 plugged, relay TO will operate when the ASDC selector switch advances to position 13 grounding lead TO1. Relay TO operated, performs the same functions as described in 17.01.

20.03 In position 13, relay EP operates and performs the same functions as described in 10. The subscriber sender, having received all the digits, operates relay STL; the fundamental circuit, having been opened when relay TO operated, causes the auxiliary sender to time from 6 to 12 seconds, then sends an overflow signal to the subscriber sender and disconnects. The subscriber sender calls in a marker and requests routing to an overflow trunk. The marker returns class information and then releases. The test circuit proceeds to release as described in 17.02 and 17.03.

21. ALTERNATE ROUTE ADVANCE TO MF

(Fig. X and Y)

21.01 Subscriber senders may be tested for alternate route advance to MF in areas where 7-digit MF calls are used as a first alternate route for initial revertive routes. Using a 7-digit revertive to MF code, the test circuit keys and jacks are

operated as described in Section -0137, 5.04, 6.02, and 6.03 and Section -0139, 5., 6., and 10.02 with the addition of the operation of the AR key. The digits are dialed into the subsecriber sender (as described in Section -0139, 5. to 10.02). When the hundreds digit is about to be dialed, the ASDC selector switch in position 10 grounds lead RA. The AR key operated, opens the lead that causes the test frame to block if the fundamental is prematurely grounded, and connects the ground on the RA lead to the RA1 lead. The RA1 lead grounded, operates relay RA through a continuity transfer. Relay RA operated:

(a) Locks to its own make-contact through the RA resistor over lead 4 to ground on the C relay.

(b) Grounds lead RA2 to Section -0141, Fig. 7, to operate relay RVT.

(c) Puts battery on lead FTR to Section -0141 and opens the FT lead of that section to prevent the operation of relay TC.

(d) Over lead 3, closes a link in the path that operates relay RA1.

(e) Using leads 5 and 6 opens the TN lead to the code keys and dial pulsing circuit, Section -0105, to prevent the dialing of the tens digit.

(f) Grounds lead 7 to operate the MC relay.

21.02 Relay RVT (Section -0141, Fig. 27) operated:

(a) Reverses lead FT that comes from the connector circuit (Section -0102), over leads FT1 and FR2, through the normal transfer contact on relay TC, over lead TTG to Section -0139, to a ground at the ASDC switch which is in position 10.

(b) Reverses lead FR that comes from the connector circuit, over leads FR1 and FT1, to Fig. 26, Section -0139, through the normal transfer contact on relay WT, through the normal transfer contact on relay TO, back to Section -0141 on leads FTA, to battery at relay RA.

21.03 Relay MC operated:

(a) Opens lead CK1 to the code test circuit, Section -0131, to prevent the marker from making second trial.

(b) Closes lead DC to the winding of relay DA.

(c) Puts ground on lead AG.

21.04 When hundreds digit is dialed, the ASDC switch advances to position 11, and the subscriber sender attempts trunk test and finds a reversal on the fundamental (ground on FT and battery on FR). The sender recalls a marker to obtain new class information, and the marker returns information that causes the sender to reset for a 7-digit DDD class of call. When the marker has disconnected, the sender grounds the DC lead, operating relay DA. Relay DA operated closes the ground on lead AG to lead AV to energize the ASDC stepper. When ground on lead DC is removed, relay DA releases.

21.05 In position 11, dialing of the tens digit is delayed by the opening of the TN lead at the RA relay, and relay RA1 operates. Relay RA1 operated:

(a) Locks to its own make-contact.

(b) Puts an additional holding ground on lead RA2 to hold the RVT relay operated thus preventing a premature wink signal from relay TC (Section -0141).

(c) Opens the FTR1 lead to Section -0141.

(d) Transfers the ground on lead AG through relay DA (before its release) over leads AV and 1 to the RA resistor, to shunt down relay RA which is released. Relay RA released:

(1) Closes the TN lead to the code keys and dial pulsing circuit to start the dialing of the tens digit.

(2) Opens the locking path to release relay RA1.

21.06 Relay RA1 released:

(a) Removes the holding ground from lead RA2 to release relay RVT, thus restoring the polarity of the fundamental to normal.

(b) Closes a path to connect leads FTR and FTR1 to Section -0141 thus closing the FT lead to relay TC.

(c) Removes the shunt path from relay RA.

(d) Over leads 1 and 2, closes the path on lead AV to advance the ASDC switch after the tens digit is dialed.

21.07 The tens and units digits are dialed as described in paragraph 10.02.

22. SIX-DIGIT TRANSLATION (SENDER RECYCLE) TEST CALL

(The PNS key should be operated for this test.)

22.01 Subscriber senders can be tested for recycle class calls, using keys and jacks to effect the test call, in a similar manner to that of a 10-digit DDD class call. With area code jacks plugged for the first three area code digits, the RCY jack plugged for recycle class, and the PP key operated, a recycle call is started as described in 31., Section -0102. Relay RCY operated:

(a) Through a transfer contact, grounds the C2 lead to the area code circuit, Section -0137 to provide a ground to the area code jacks. Relay SAS of Section -0137 is not operated on a revertive or PCI recycle test call.

(b) Provides a ground on lead C, to operate relay C, causing the auxiliary sender dial pulse and control circuit to go off-normal, and to start dialing the area code.

(c) Opens lead CKG to the code test circuit, Section -0133, to ensure that lead CK1 is grounded from the marker circuit only, during an integrity test.

(d) Opens the operate path for relay MC, thus preventing relays DA and DAS from operating after the marker check.

(e) Opens the operate path for relay MKM through a transfer contact, and closes a link for operating the ASDC stepper through arc 1, in the event that relay SAS (Section -0137) is operated on an auxiliary sender call.

(f) Opens a ground supply through the SM-relays of Section -0102, on lead TSTG to the code compressor connector circuit. During recycle overflow tests, this ground will operate a major alarm if the RCY relay has released but the code compressor connector has not been released from the test circuit control.

(g) Closes a link in the circuit for operating relay OFR, during recycle overflow tests.

(h) Provides ground to lock relay OFR on its secondary winding.

(i) Closes a link in the circuit to operate relay OFR of Section -0102, on recycle overflow test calls.

22.02 The area code digits are dialed into the subscriber sender as described in 6., 7., and 8. Registration of a 0 or 1 in the ACB digit closes a start lead in the sender, to the sender recycle circuit. When the third or ACC digit is dialed, a ground signal is extended to the connector start relay in the sender recycle circuit. Registration of this signal opens the marker start lead, starts the sender and code compressor preference to operate their respective connectors, and connects the subscriber sender recycle circuit with a code compressor. The code compressor circuit compresses the area code to a 2-out-of-5 signal which is registered as a single digit in the sender recycle circuit. This digit will subsequently be used by the marker to determine the routing of the call.

22.03 Upon registration of the compressed code, the sender register is recycled by releasing its A, B, and C registrations. The remaining seven digits, which are to be dialed subsequent to the area code, will be registered as on a 7-digit revertive or PCI call.

22.04 After the dialing of the three area code digits, the ASDC selector switch is stepped to position 4 as described in 9.02. If the test call is to be handled as an auxiliary sender call, the operation will continue as described in 9.02, but if a class other than class 17 is used, relay SAS of Section -0137 does not operate. This relay provides a path through a back contact to operate relay RCC. Relay RCC operated:

(a) Through a back contact opens lead AV from the code keys and dial pulsing

circuit. The AS dial pulse and code check control circuit cannot advance since the circuit to operate the ASDC stepper is opened. The ASDC selector switch will remain in position 4 until the test call is completed.

(b) Closes leads RCC1 to RCC2, and RCC3 to RCC4, to restore the control grounds to class keys 1 to 16 and 18.

22.05 After the control grounds have been restored to the class keys, the test call will proceed according to the class of call selected. The remaining seven digits are dialed into the subscriber sender as described in the sections pertaining to the selected class of call.

22.06 At the completion of dialing, the connector circuit and the control circuit being used prepare to release, as described in Section -0102, 10. When the ST relay of Section -0102 releases, relay RC of that section releases. This in turn releases relay RCY which removes the C ground from the AS Dial Pulse and Code Check Control Circuit. The ASDC selector switch restores to normal, releasing relay RCC.

23. SIX-DIGIT TRANSLATION (SENDER RECYCLE) OVERFLOW OR AUXILIARY SENDER REQUEST TEST CALL

(The PNS key should be operated for this test.)

Note: These tests should be made during hours of light traffic.

23.01 Preparation for testing the ability of the subscriber senders for recycle overflow calls to recognize recycle class of calls that may be routed to overflow trunks, to an operator direct, to 10-digit MF, or 10-digit skip 3 trunks by the marker are made in a similar manner to recycle calls described in 20. The area code jacks are plugged for a recycle class code, the RCY jack is plugged, the PP key operated, and in addition, the CCB key is operated. To facilitate the overflow test, the same code that is plugged on the area code jacks should be punched on the A, B, and C keys of the code keys and dial pulsing circuit.

23.02 The test call proceeds in a similar manner to the recycle call described in 22. When the ASDC selector switch reaches position 3, dial ACB digit, ground from relay C, through ASDC selector switch, arc 5, through the operated OFR key, through the operated RCY relay, over lead OFR to Section -0102, operates relay CCB of that section. Relay CCB locks through its own make-contact and through a break-contact on relay B, Section -0105, code keys and dial pulsing circuit. Relay CCB operated, grounds lead TST to all the SM- relays. The one SM- relay that is operated extends this ground over lead TST to the code compressor connector circuit associated with this subgroup of subscriber senders, operating the TST relay. Relay TST operated disables the code compressor connector so that no code compressors are available.

23.03 When the test circuit has completed the dialing of the third digit, the subscriber sender finds that it cannot be connected to a code compressor. The dialing of the office code A digit, continues as described in 22., but the subscriber sender has not recycled.

(At this point it must be mentioned that the markers may be cross-connected in such a manner as to route a "No Code Compressor Available" class call to overflow, to a 10-digit MF trunk, or to an intercept operator.)

23.04 The ASDC switch is advanced to position 4 as described in 10.02 and 22.02, and relay RCC is operated as previously described. If the marker is cross-connected to route to overflow, upon receipt of the fourth digit (A of the office code) the sender recycle circuit will close a control lead to bring in the marker. The marker will route the call to an overflow trunk and return a signal on the OF lead to the test circuit, code test circuit, to operate relay OF1 of that circuit. Relay OF1 operated, closes the path to operate relay OFR of Section -0139. This path is traced from ground on the C relay make-contact Section -0133, over lead RCY2 to the OFR key (Fig. 24A) in Section -0139, through the operated OFR key, over lead RCY1 to the OF1 relay make-contact, Section -0133, back over lead RCY to make-contact on relay RCY, Section -0139, and to the primary winding of relay OFR. Relay OFR operated:

(a) Locks to its secondary winding through its own make-contact and through a make-contact on relay RCY, to ground.

(b) Grounds lead EP to operate relay EP. Relay EP operated, prevents the test circuit from blocking during trunk test.

(c) Operates relay OFR1.

23.05 Relay OFR1 operated:

(a) Grounds lead OF to Section -0108 to light the OF lamp.

(b) Opens the synchronizing path to stop the dialing of the B office code digit. A break-contact opens leads OB and OB1 to the B relay of Section -0105.

(c) Through make-contacts, applies 2000-ohm battery and a ground to leads TT and TT1. These leads are connected to the FT and FR leads and provide the loop closure for trunk test to operate the sender TG relay.

(d) Closes ground to lead ADV to Section -0141 to advance the test circuit to normal.

23.06 When the B relay of Section -0105 operates, dialing of the B office code digit is stopped when the OB and OB1 leads are opened. The ground through the break-contact over lead OFL is removed, releasing relay CCB which is slow-release to allow the code compressor or connector to remain busy sufficiently long enough for a marker to be called in prior to the dialing of the C office code digit. When relay OFR is released, ground is removed from the TST lead to the code compressor connector circuit releasing that circuit for service.

23.07 The subscriber sender, having received the overflow routing from the marker, makes trunk test and prepares to disconnect. Battery is put on the S lead to the S relay of the connector circuit, which operates. This relay in turn operates relay AV of Section -0141 which closes the ground path from the operated OFR1 relay over lead ADV back to the connector circuit to restore the test circuit to normal. Section -0139 releases and restores all relays to normal as described in 20.

24. AUXILIARY SENDER 10-DIGIT MF ROUTING

(No Code Compressors Available)

The PNS key should be operated for this test.

24.01 Test calls can be made to check that recycle class calls are routed to 10-digit MF trunks if no code compressors are available. In this instance the marker circuit must be arranged for 10-digit MF routing on recycle class calls. The area code and office code are set up exactly the same as for a DDD class of call (class 17), but with the CCB key operated. The RCY jack is not plugged. When the AS dial pulse and code check control circuit (Section -0139) goes off-normal, ground lead C through class key 17 and over lead TMG to the code compressor connector circuit prepares the sender recycle circuit to call in a marker since no code compressors are available. Relay SAS of Section -0137 closes leads CB0 and CB1 to operate relay CCB of Section -0102 as described in 21.01. The test will proceed as described in 5. to 13. of Section -0139.

24.02 Recycle test calls routed to a direct operator, if no code compressors are available, can be made in a manner similar to that described in 23.02.

25. TEST OF SENDER RECYCLE CIRCUIT THERMISTOR

(The PNS key should be operated for this test.)

25.01 A check of the sender recycle circuit thermistor can be made by setting the test circuit for an operator class call (class key 10 operated) with the CCB key operated. When selector DP advances to position 2, ground over arc 4 is extended through diode CB over lead CB2 to Section -0139, through key CCB to operate relay CCB of Section -0102. This relay performs the functions described in 23.02 in Section -0139.

25.02 When relay TD operates, it extends ground over lead TMG to the connector circuit to prepare the sender recycle circuit to call in a marker when a code compressor is not available. When the C digit of an operator code is dialed, the thermistor will time and then operate relay ASR in the sender recycle circuit which in turn will call in a marker to translate the code. Relay CCB of Section -0102 is locked over lead CBL through a make-contact on relay G thus holding relay TST of the code compressor circuit operated until the call is completed. If the thermistor in the sender recycle circuit is open, the test circuit will block.

26. ZERO OPERATOR ODN TEST

26.01 A test of the outpulsing of the directory number feature on a zero operator test call is made using class key 17 with plugs in the ODN and 0 jacks. In addition, keys corresponding to a calling number and its equipment location must be operated.

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26.02 The operation of the 0 relay in Section -0141 operates the A4 and A7 relays of Section -0137 causing a zero to be dialed into the subscriber sender.

26.03 After dialing the zero, the ASDC selector advances to position 2 and operates the EP relay of this section stopping further dialing. The MC relay is operated by the EP relay in preparation for checking the DC lead as illustrated in Fig. 162 and explained in 10. MARKER TRANSLATION.

26.04 The selection of a particular auxiliary sender for a zero operator ODN test call should be made with the test circuit attended and should preferably be made during periods of light traffic. The PNS key should be operated for this test.

26.05 On this type of call with any one of the ten PAS- keys operated, off-normal ground is extended over the MB lead to the desired auxiliary sender to make it test busy.

26.06 After timing 2.5 seconds the sender calls in the marker and transfers to it the CC4 and CC7 information. The parallel operation of the CC4 and CC7 relays in this section grounds the AL lead operating the LO1, LO2, and LO3 relays in the miscellaneous circuit. The operation of these relays makes busy all other auxiliary senders not busy in service and makes available the selected auxiliary sender for test. The selected auxiliary sender returns ground on its MB lead operating the LOR relay and restoring all but the selected auxiliary senders to service.

27. INFORMATION CODE 411

27.01 The information code feature tests the ability of the sender to ground the INF lead to the auxiliary sender, and the ability of the auxiliary sender to outpulse the start pulse immediately after the C digit.

27.02 Ground on the class 17 key of Section -0103, through the operated PDG1 key and A4, B1, and C1 code keys of Section -0105 is extended to this circuit to operate the INF relay. The INF relay operated:

(a) Transfers the ground at terminal 9 of the ASDC2 selector from the SY lead to the winding of the EP relay.

(b) Transfers the operate path of the ST relay of Section -0141 from terminal 14 to terminal 10 of the MFK5 selector. The start pulse is checked immediately after the C digit.

27.03 The CID key operated checks the ability of the auxiliary sender to disregard extra digits on 1+NPA+411 and 1+411 calls. The CID key opens the operate path provided by the operated INF relay, for the EP relay, and restores the SY ground to Section -0105. The TH, H, T, and U digits are dialed into the sender. If the auxiliary sender does not receive the information mark from the sender (ground on DC lead) and therefore outpulses these digits the test frame blocks, as described in Section -0141, 23. This test is made only in offices not provided with interchangeable codes.

28. INTERCHANGEABLE CODE

28.01 Circuit operations for this test are covered in Section -0133, 21., with the exception of the DC lead check for the first marker seizure on MF calls.

28.02 In position 4 (10-digit calls) or position 8 (7-digit calls) of the ASDC switch the MC relay operates to prepare for the check of the first marker seizure.

28.03 During the marker translation test of regular test calls, as described in 10., the code test circuit of the test frame provides a ground on the DC lead to the marker. When the marker is seized and advances to the decoder stage, it extends the DC ground to the sender to operate the sender DC relay. The operated DC relay returns the ground to the test frame where it is used to check the operate CC- relays and to operate the DA relay. When testing interchangeable codes, the operated ICD relay of Section -0133 opens the path of the DC lead to the marker and connects the DC ground directly to the DC lead check path. The DC relay in the sender does not operate, but the CC- relays operated in the test frame for the first marker seizure are checked and the IDA relay operates. The IDA relay operates the DA and DAS relays in series. The DAS operates the DBS relays and provides a path to energize the ASDC step magnet. The slow-operate DBS relay operates the AV relay which releases the ASDC step magnet to

advance the switch. The MC relay releases and the IDA, DA, DAS, DBS, and AV relays release. The remaining digits are now dialed into the sender.

28.04 The circuit operations for the second marker seizure are described in Section -0133, 10.

29. INTERCHANGEABLE CODES AND INFORMATION CODE 411

29.01 General - When the associated subscriber senders are arranged for both information code 411 and interchangeable codes the sender must distinguish between 1+NPA+411 calls where the NPA code is an interchangeable area code, and 1+ABC+411x calls where the ABC code is an interchangeable office code. After the first marker seizure is completed for an interchangeable code, the sender sets up a scan of the TH, H, and T vertical files of its register switch. If 411 is received in these positions it starts a 3 to 4 seconds timing period for a units digit. If the units digit is received before the completion of the timing period the sender immediately makes the second marker seizure and indicates a 7-digit call. If the units digit is not received before the completion of the timing period the sender makes the second marker seizure and indicates a 10-digit call.

> Note: Even though only six digits with or without a prefix 1 are dialed, the code involved is an area code and the call is handled as a 10-digit call.

29.02 1+NPA+411 Calls - For this test the interchangeable NPA code is set up on the ACA, ACB, and ACC code jacks and the A4, B1, and C1 code keys are operated. The ICD key of Section -0133 is operated. The INF relay operates as described in 27. of this section. The INF relay operated closes a path through the ICD key to operate the 7DSA relay independent of the 7DS relay which does not operate on this test. The operations to check the first marker seizure are the same as described in 28. The operations for the second marker seizure are the same as described in Section -0133, 21.08, except for the following:

(a) The SMS relay operates through the 1 and 2 bottom contacts of the INF relay to ground on terminal 8 of the ASDC 5 selector.

(b) With the 7DSA and SMS relays operated, the OTC relay operates to start a timing check for units digit timing by the sender.

(c) With the 7DSA and OTC relays operated, the DC lead from the sender is monitored for a premature ground - indicating a premature second marker seizure.

29.03 1+ABC+411x Calls - For this test the interchangeable office code is set up on the A, B, C, code keys and the 411x is set up on the TH, H, T, and U code keys of Section -0105. The ICD key of Section -0133 and the CID key of Section -0139 are operated. The INF relay does not operate for this test and the call is handled as a regular 7-digit interchangeable code test described in Section -0133, 28. However, the operated CID keys opens the operating path of the OTC relay, canceling the eighth digit timing check.

30. SPEED TEST OF "TOUCH-TONE" TO DIAL PULSE CONVERTER CIRCUIT ON 10- OR 11-DIGIT DDD CALLS (FIG. AK)

30.01 General - With the development of automatic card dialers, a new method of operation of the TOUCH-TONE to dial pulse circuit was required. This operation permitted the converter to accept TOUCH-TONE signals dialed at a nominal rate of 10 digits per second with a maximum of 11 digits per second.

(a) Figure AK is added to this circuit to accommodate the new required digit rate. Circuit operation of this section is identical to a 10-digit call with or without prefix 0 or 1 with one exception. That is, after dialing the prefix and/or area code, marker translation will run concurrent to the dialing of the remaining digits rather than pausing for completion of marker translation. This arrangement provides uninterrupted TOUCH-TONE outpulsing at a rate equal to that of the TOUCH-TONE card dialer.

30.02 Dialing of Digits - With the CT key operated and the selector switch ASDC preset to terminal 1, the first digit relay operates (Relay DGO, PP, or ACA). Digit relay operates:

(a) Relay SPV which locks through its own contact and the C relay operated.

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(b) Relay SPV1 which locks through its own contact through the back contact of the U relay.

30.03 The operation of the SPV and SPV1 relay sets the terminal sequence of the selector switch ASDC in a manner to accommodate continuous dialing.

30.04 Marker Translation - When the ASDC selector in this circuit is advanced to position 4, a circuit path through an operated SPV1 relay operates:

(a) Digit relay A.

(b) Relay CD which locks through its own contact, the back contact of the CDA, and the front contact of the CT key.

30.05 The CD relay operated:

(a) Opens the DAS relay advance path of selector switch ASDC.

(b) Operates the MC relay.

(c) Provides an operate path to the CDA relay.

(d) Operates the MT lamp to indicate marker translation.

(e) Provides an operate path to the MKM relay.

30.06 With the operation of the MC relay, circuit functions are identical as described in 10.02, up to and including the operation of the DAS relay.

30.07 The DAS relay operates the DBS relay but does not close the link for energizing selector ASDC. Relay DBS operates relay CDA which releases the MC relay which, in turn, releases relays DA and DAS and the subscriber-sender DC relay. The release of the DAS releases the DBS and CDA in order.

30.08 The above circuit operation removes marker translation from control of selector ASDC, and allows this translation to run concurrent to the dialing of the remaining digits which is controlled by the ASDC selector.

30.09 Prefix 0 or 1 - With the ASDC selector preset in position 1, prefix 0 or 1 is dialed as stated in 7. However, at the completion of the prefix dialed, the operate path of the ACA relay is bypassed by a circuit path through the front contacts of the CT key P3 and PG1 relay to the winding of the ACA relay. This arrangement insures the operation of the digit ACA relay within the interdigital time period without affecting prefix digit 0 or 1 operation.

30.10 Release - In addition to the release requirements set in 13., the C relay will not release until marker translation is completed. This condition is indicated by the release of the CD relay which extinguishes the MT lamp.

CIRCUIT UNIT SECTION -0141
AUXILIARY SENDER MF PULSE CHECK CONTROL CIRCUIT

CHANGES

B. Changes in Apparatus

B.1 The A2, B2, C2 2000-ohm 146A resistors are replaced by 4020-ohm 146A resistors. The A3, B3, C3 4020-ohm 146A resistors are replaced by 2000-ohm 146A resistors.

D. Description of Changes

D.1 Option QW and QX to provide battery connection options for tube type or solid-state type MF receivers.

D.2 The 185A networks are added to improve timing circuit operation and add contact protection.

1. PURPOSE OF CIRCUIT

1.01 This circuit unit is provided to work with other units in the originating sender test circuit, to allow for checking the auxiliary sender MF pulsing.

1.02 This circuit, in conjunction with an MF receiver, checks that the digits pulsed forward by the auxiliary sender are the same as the digits dialed into the subscriber and auxiliary senders.

1.03 This circuit, in conjunction with an MF receiver, checks that the calling number outpulsed by the auxiliary sender, after outpulsing the called number, corresponds to the number set in the code and numerical keys.

2. WORKING LIMITS

2.01 None - used for local circuit operation.

3. FUNCTIONS

3.01 To advance from normal upon signal from Section -0137.

3.02 To preset for the actual number of digits to be checked for the test call.

3.03 To give lamp signals, showing which MF- pulsed signal (KP numerical digit or ST) is awaiting pulsing, is being pulsed, or has failed to check.

3.04 To precheck its digit timing circuit.

3.05 To check that all pulses subsequent to the KP "gate opener" signal are not of excessive length.

3.06 To translate the 2-out-of-5 code received from the MF receiver to a decimal code. This code is checked through the relays of Section -0137 or the keys of Section -0105.

3.07 To steer the pulse check lead to the proper relay group in Section -0137 or keystrip in Section -0105.

3.08 To control the operation of the MF receiver.

3.09 To check the restore of the translator relays between digits.

3.10 To attenuate the MF pulsing signals 15 dB in order to detect any decrease in the auxiliary sender MF generator sending level.

3.11 To simulate a CAMA trunk for test purposes.

3.12 To give a lamp signal if the precheck of the timing circuit fails.

3.13 To give a lamp display (on a 2-out-of-5 basis) of the digit actually received when a test fails.

3.14 To cause the test circuit to block if:

(a) The wrong digit is received.

(b) No digit is received within a specified time interval (nominally 50 milliseconds) after lead Q is closed by the MF receiver.

(c) Only one number lead is grounded.

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(d) More than two number leads are grounded.

(e) The digit is received but the pulse is more than its nominal length.

3.15 To provide for trunk test by the auxiliary sender.

(a) To provide facilities for abandoning or timing out 10-digit DDD test calls, in conjunction with Section -0139.

(b) To provide facilities to test auxiliary senders for incoming trunk reversal features by reversing the fundamental leads before trunk test.

3.16 To provide (after trunk test) for signals simulating a trunk awaiting a sender in a remote toll or tandem office, followed by the signal that the remote sender is attached.

3.17 To signal the connector circuit to restore the test circuit after the ST signal has been checked.

3.18 To restore to normal, when lead C is opened, either after the completion of a successful test call or after the test circuit is reset by the operation of the CA key in Section -0102, following a test failure.

3.19 To provide facilities for checking the directory number outpulsed by the auxiliary sender.

(a) To provide facilities, in conjunction with Sections -0137 and -0139, to control dialing on a zero operator ODN test call.

3.20 To provide facilities for testing the information code 411 feature.

3.21 To provide facilities for testing the emergency code 0-0 feature.

LAMPS

3.22 Keypulsing lamp KP lights from completion of dialing until the KP signal is received.

3.23 Area code MF pulse digit lamps (ACA, ACB, and ACC) will light while awaiting and checking the pulses of the numbering area code digits. (Digits subsequent to the ACC digit cause the A, B, C, TH, H, T, U, and STA of Section -0117 to light.)

3.24 Start signal lamp ST lights from the completion of checking the last digit (either U or STA) until the start pulse has been checked.

3.25 Pulse time failure lamp PTF will light to indicate a failure of the TO relay to operate on its short timing interval while the KP signal is being registered in the MF receiver.

3.26 Pulse lamps (P0, P1, P2, P4, P7, P10) light after a test failure, and they indicate which of the number leads from the MF receiver are actually grounded for the digit that failed.

3.27 End-of-dial-pulsing lamp EP lights when dial pulsing ends (after U or STA digit is dialed) and when relay EP of Section -0139 has operated.

3.28 The ODN lamp lights to indicate that the test circuit has reset and is prepared to check the ODN pulses.

JACKS

3.29 The TO jack is provided for current flow tests of the TO relay.

3.30 The W01 jack is provided for current flow tests of the W01 relay.

3.31 The ID 0-5 jacks are provided to permit the checking of the identification digit outpulsed by the sender on an ODN call.

3.32 The ODN jack is provided to prepare the test circuit for an ODN-type test call.

3.33 The 0 jack is provided to permit the testing of 0 operator ODN calls.

4. CONNECTING CIRCUITS, SECTIONS, AND SHEETS

4.01 The connecting circuit is:

(a) Signaling Receiving Circuit Multifrequency Pulsing - SD-95536-01.

4.02 The connecting sections are:

(a) Connector Circuit - Section -0102, Sheet -0103.

(b) Code Keys and Dial Pulsing Circuit - Section -0105, Sheet -0105.

(c) PCI Register Circuit - Section -0117, Sheet -0117.

(d) Operators Class Control Circuit - Section -0121, Sheet -0121.

(e) Code Test Circuit - Section -0133, Sheets -0133 and -0134.

(f) Auxiliary Sender Area Code Circuit - Section -0137, Sheet -0137.

(g) Auxiliary Sender Dial Pulse and Code Check Control Circuit - Section -0139.

DESCRIPTION OF OPERATION

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5. SEIZURE

5.01 When lead C is grounded from Section -0137, relay C operates and locks directly to the C lead. The path for operating relay C is traced from the C lead, through the brush and terminal 22, arc 1, MFK, to the winding of relay C. Relay C operated:

(a) Removes the restore ground from the strapped terminals of arc 1, MFK.

(b) Grounds terminal 22 of arc 1, MFK, to cause the selector to step from normal.

(c) Through a make-before-make contact, grounds first the shunt circuit of relay PMR, and then grounds the operate circuit of the same relay.

(d) Operates relay BAT.

(e) Grounds the off-normal ground leads for this circuit.

(f) Closes a link in lead TDK.

(g) Closes the last link in the operate circuit for relay G.

5.02 Relay G operated, closes links in leads FT and FR.

6. PREPARATION FOR MF PULSE CHECKING

Note: That function of the auxiliary sender is incorporated in the SD-27810-01 sender. Any reference to the auxiliary sender in this CD should be taken to mean the operation is taking place in the sender.

6.01 While the MFK selector presets, the PMR relay is kept normal by its shunt path. This shunt path is traced from ground, through a make-contact on relay C, through the brush and strapped terminals 22, 1, 2, and 3 of arc 2, MFK, through a break-contact on relay PMR, to resistor BA. This shunt path ground is extended through a second break-contact on relay PMR, through the break-contact of the MFK stepper, causing the selector to advance to position 4 for a 10-digit call when ten digits are to be checked. If seven digits are to be checked on a 10-digit call, the 7P relay will be operated in Section -0137, causing the circuit to preset the MFK selector to position 7. The 7P relay operated, connects leads PB1 and PB2 together.

6.02 Option VL is provided for testing 7-digit MF calls. In this case, relay 7D in Section -0137 operates and connects lead PB1 to lead PB2 causing the MFK selector switch to advance to position 7. If only five digits are to be checked, the 5DG PL jack of Section -0137 will be plugged. This closes lead PB1 to lead PB3 which continues the strapping of arc 2, MFK, to terminal 8, and causes the MFK selector switch to preset to position 9. When only four digits are to be checked, the 4DG PL jack of Section -0137 is plugged. This closes lead PB2 to lead PB4 causing the MFK selector switch to advance to position 10 through the strapped terminals on arc 5, MFK.

6.03 When the shunt circuit of relay PMR is opened, at the terminal of arc 2, MFK, relay PMR operates. Relay PMR operated:

(a) Opens its own shunt circuit.

(b) Opens the circuit toward the MFK stepper contacts.

(c) Closes a link in the circuit to the stepper winding.

(d) Closes a link in the operate circuit of relay MKG.

6.04 Relay BAT operated (5.01 (d)):

(a) Closes two battery supplies to the MF receiver circuit.

(b) Supplies battery through resistor AA to the winding of relay LBD, and directly to the windings of relay TO. Relay LBD is shunted down at this time by off-normal ground through a break-contact on relay UL. Relay TO is held on its back contact by a circuit through its secondary winding, through a series of break-contacts on relays N-10, N-7, N-4, N-2, N-1, and N-0, through a break-contact on relay Q to off-normal ground.

7. TRUNK TEST

(See Note under 6.)

7.01 The circuit stands awaiting the completion of dialing and trunk test by the auxiliary sender. The auxiliary sender should wait for the dialing of the last digit. If it makes trunk test before dialing is completed, ground on the FT lead will cause the circuit to block.

When testing a SD-27810-01 sender on TOUCH-TONE calls the test circuit is prevented from blocking on early trunk test during the units digit. The SD-27810-01 sender will make trunk test immediately after recognizing the TT units digit which can occur before the test frame finishes outpulsing that digit. To prevent blocking the test frame the operate path of the BK relay will be opened when the NSA, TTA, and the U relays operate.

7.02 When the auxiliary sender attempts trunk test, it closes a high-resistance bridge to leads FT and FR. If it finds the "trunk" normal, ie, battery on the FT lead and ground on the FR lead, the auxiliary sender reduces the resistance of the test bridge (to 400 ohms) to operate relay TC.

7.03 The SD-27810-01 does not place a high-resistance bridge across the FT and FR lead during trunk test. A low-resistance bridge is placed across the tip and ring to operate the TC relay. Relay TC operated:

(a) Locks to off-normal ground and removes its winding from connection to the FT lead.

(b) Removes ground from the FR lead.

(c) Closes links in leads FT and FR toward the CF relay which gives the awaiting sender signal to the auxiliary sender (2000-ohm battery on the FR lead and 2000-ohm ground on the FT lead). This is the start of the simulated "sender wink" feature which would ordinarily in service be supplied by the remote incoming sender.

(d) Closes a link in the operate circuit of relay PKL. Relay EP having operated at the end of dialing (Section -0139), grounds lead TDK which lights lamp EP to signify that dialing has ended, and operates relay PKL.

7.04 Relay PKL operated:

(a) Operates relay PK under control of relay PKH.

(b) Closes a link in the L lead to the MF receiver circuit.

(c) Lights lamp KP, under control of relay UL, to show that the test circuit is awaiting pulsing of the KP "gate opener" signal.

(b) Closes lead UL from the MF receiver to the operate circuit for relay UL.

(c) Extinguishes lamp PTF.

9. CHECKING THE FIRST NUMERICAL DIGIT

(See Note under 6.)

9.01 When the KP signal has been registered, the Q lead ground is removed by the MF receiver, and lead UL is grounded, operating relay UL. When ground is removed from lead Q, relay Q releases. Relay Q released:

(a) Opens the holding ground from relay PKH.

(b) Reconnects the inhibitor ground to capacitor TO, moving relay TO to its back contact.

9.02 Relay UL is a 2500-ohm relay in series with resistor AK. This provides sufficient delay to ensure the release of relay Q before the inhibitor ground for relay LBD is opened. Relay UL operated:

(a) Locks to off-normal ground.

(b) Closes the last link in the operate path for the MFK stepper.

(c) Extinguishes lamp KP.

(d) Lights lamp ACA in this section or A for 10-digit calls in Section -0117, or with option VL lights lamp A, C, or TH for 7-digit calls in Section -0117 under control of relay ST and the brush and terminals of arc 6, MFK.

When relay UL closes the operate circuit for the MFK stepper, relay MKG operates and stays operated until the MFK stepper break-contact opens. The break-contact opens when the stepper is fully energized. Relay MKG operated, opens the L lead through its break-contact. When relay MKG releases, the MF receiver and this control circuit are awaiting the pulsing of the first numerical digit (ACA or A for 10-digit calls or with option VL, A, C, or TH for 7-digit calls). The checking relays PK, KG, and PKH are operated, the MFK stepper is energized, and relays Q and MKG are released.

9.03 When the auxiliary sender connects the signal frequencies for the first numerical digit to leads FT and FR, the MF receiver immediately grounds lead Q. This operates relay Q and approximately 15 milliseconds later, grounds two of five number leads, 0, 1, 2, 4, and 7, to indicate the digit registered. Relay Q operated, locks relay PKH and permits relay TO to start a timing cycle.

9.04 If two, and only two, of the number relays are operated, ground is connected to one of the decimal check leads. These decimal check leads appear in circles on the number relay contacts (on the SD drawings) and are multipled to the contacts of the area code digit relays in Section -0137 and the code keys in Section -0105. The position of the MFK selector switch (4 or 7 for 10-digit calls, or with option VL, 7, 9, or 10 for 7-digit calls) determines whether digit ACA, A, C, or TH is checked first. If the correct digit is received by the MF receiver, lead P1, P4, P6, or P7 will be grounded, shunting down relay PK. Relay PK releases relay KG.

9.05 Relay KG released:

(a) Opens lead L to the MF receiver so that the channels in the receiver are held only by the signal pulse, and not locked.

(b) Opens the operate circuit to relay PKH and the MFK stepper. (These are then held by relay Q.)

(c) Removes ground from resistor AF which changes relay TO from its short to its long timing cycle.

(d) Opens its own locking circuit. The long timing cycle of relay TO is longer than a normal numerical signal pulse (65 milliseconds maximum), but shorter than a KP signal, so that if the number digit signal is of correct length, relay Q and the number digit relays will release before relay TO can leave its back contact. With relay Q, and all number relays released, relay TO is held on its back contact. The release of relay Q also releases the MFK stepper and opens the locking circuit of relay PKH. The short timing cycle of relay TO is 44 milliseconds. The long timing cycle is 110 milliseconds.

(d) Operates relay CF.

7.05 Relay CF operated:

(a) Removes the "awaiting sender" signal as described in 7.02 (c), encloses leads FT and FR through a 15-dB pad to the input transformer of the MF receiver. Leads T1 and R1 which connect to the primary windings of the transformer in the MF receiver, loop back to the T and R leads, and supply a "sender attached" signal back to the auxiliary sender. (This signal consists of ground on the ring and 226-ohm battery on the tip.) This is the end of the "sender wink" signal.

(b) Closes a link in the circuit for lighting lamp PTF (which may light briefly).

7.06 Relay PK operated (7.03 (a)).

(a) Locks to off-normal ground, through its own make-contact, through its own winding, resistor AE, diode PK, and resistor BD, to battery.

(b) Operates relay KG. Relay KG operated:

(1) Locks under control of relay PK.

(2) Closes ground to resistor AF to bias relay TO for its short timing interval.

(3) Closes a link in the operate path toward the MFK stepper.

(4) Operates relay PKH.

7.07 Relay PKH operated:

(a) Closes a link in the operate circuit for relay TOK.

(b) Opens the operate ground from the winding of relay PK.

(c) Transfers the winding of relay KG from its operate circuit to a resistance battery. (This circuit slows down the later release of relay KG.)

(d) Closes a link in the circuit over which it holds to ground through a relay Q make-contact when relay Q operates.

8. CHECKING THE KP SIGNAL

(See Note under 6.)

8.01 The MF receiver and the MF pulse check control circuit are now awaiting the pulsing of the KP signal. When the auxiliary sender connects the KP signal to leads FT and FR, the MF receiver immediately grounds lead Q operating relay Q. The Q lead ground is also closed through a make-contact on relay KG, through break-contacts on relays MKG and STK and a make-contact on relay PKL, to lead L to lock operated the channel relays in the MF receiver. Relay Q operated.

(a) Locks relay PKH through its own make-contact.

(b) Removes the ground to capacitor TO through resistor AL. (This circuit is traced through series break-contacts on translator relays N-0, N-1, N-2, N-4, and N-7 to afford a "down check" on these relays between numerical digits.)

8.02 The KP signal pulse is several times the TO relay short timing interval. Relay TO is therefore allowed to operate. Relay LBD does not operate when relay TO leaves its back contact because of the supplementary inhibitor ground through a break-contact on relay UL. When relay TO reaches its front contact, relay TOK operates. Relay TOK operated:

(a) Locks to off-normal ground.

(b) Closes lead UL from the MF receiver to the operate circuit for relay UL.

(c) Extinguishes lamp PTF.

8.03 Transistorized 2-out-of-5 Multi-frequency Receiver - SD-99493-01 - Option QH - When the transistorized receiver is provided with this unit, checking of the KP signal is not required since the KP signal check now takes place within the receiver. The transistor receiver after its KP signal check grounds lead Q operating relay Q. Relay Q operated immediately operates relay TOK through diode CKP, thereby preempting the KP signal check as described in 8.01 and 8.02. Relay TOK operated:

(a) Locks to off-normal ground.

10. CHECKING THE OTHER NUMERICAL DIGITS

10.01 When the MFK stepper is released, the MFK switch advances, advancing the p-lead (check) to the next digit, and advancing the digit lamp lead to extinguish lamp ACA or A for 10-digit calls (or with option VL, A, C, or TH for 7-digit calls), and to light lamp ACB or B (or B, TH, or H on 7-digit calls).

10.02 The release of relay PKH operates relay PK which then operates relay KG. Relay PKH reoperates following the operation of relay KG. The circuit now stands awaiting the check of the second numerical digit. The check of this digit and subsequent numerical digits is described above in 9. The MFK selector switch advances one step after each digit is checked.

10.03 If a stations digit is required when checking 7-digit calls, it is checked in position 14 in the same manner as the other numerical digits are checked.

10.04 In position 14, relay NT operates. Keys W, R, J, and M (Section -0105) ordinarily provide check paths for station pulsing of digits in the stations PCI code. For the MF class of call, all pulsing received for checking is in a single 1-out-of-10 code. It is therefore necessary to switch the connections through the stations keys by means of the operated NT relay. This relay provides the proper check paths for stations digits and translates as follows:

Digit	PCI Pulse	Translated To
W	9	2
R	7	3
J	5	4
M	6	5

11. CHECKING THE START PULSE AFTER STATIONS DIGIT IS CHECKED

(See Note under 6.)

11.01 After the stations digit has been checked, the MFK selector switch advances to position 15 extinguishing the STA lamp. In position 15, the C lead ground operates relay ST to prepare for the check of the start pulse. Relay ST operated lights lamp ST under control of relay STK, opens the shunt lead to resistor BD, and closes the ST check lead to the winding of relay STK.

11.02 When the auxiliary sender connects the ST signal to leads FT and FR, the MF receiver operates relays N7 and N10 for all calls other than prefix 0 calls or relays N1 and N10 for prefix 0 calls. On prefix 0 calls, relay CN of Section -0102 operates relay CN of Section -0141 which in turn switches the check path from N7, N10 to N1, N10 relays. If the start pulse check is satisfactory, the ground at relay N1 will operate relay STK.

11.03 Relay STK operated:

(a) Locks to off-normal ground.

(b) Extinguishes lamp ST.

(c) Opens a link in lead L.

(d) Closes a ground to the inhibitor lead of relay TO.

(e) Closes a link in the circuit from lead M of the MF receiver toward a make-contact on relay AV.

12. CHECKING THE START PULSE WHEN NO STATIONS DIGIT IS CHECKED

12.01 After the units digit has been checked, the MFK selector switch advances to position 14. Relay ST now operates through a path traced from off-normal ground through the brush and terminal 14 of arc 5, MFK, over lead STR to Section -0105, through the operated NST key, back over lead ST to the winding of relay ST. Relay ST operated performs its functions as described in 11.01. The transmission of the start signal and the operation of relay STK are described in 11.02.

13. RELEASE

(See Note under 6.)

13.01 When the auxiliary sender has sent the start pulse, it grounds the AV1 lead to the subscriber sender. This causes the subscriber sender to attempt to cut through and disconnect. The subscriber sender removes ground from the S lead, to Section -0102 and places battery on that lead. This operates relay S of Section -0102 which grounds lead ADV-1 to Section -0141, operating relay AV. Relay AV operated, connects the M lead ground to lead ADV operating register CT in the connector circuit. The CT register performs the functions described in 10. of Section -0102.

13.02 When lead C is opened (by the restore of the test circuit at the completion of a successful test or following operation of the CA key of Section -0102), relay C of -0141 releases. Relay C released:

(a) Removes all off-normal grounds from this circuit unit, releasing all locked relays or relays operated by off-normal grounds.

(b) Opens circuit for moving the MFK selector from normal (position 22).

(c) Closes ground to the restore strapping on arc 1, MFK, to cause the switch to restore to normal.

With the MFK switch in position 22, the circuit awaits the next test call.

14. "SKIP" FEATURES

(See Note under 6.)

14.01 Ten-Digit Call -

(a) On certain 10-digit calls, the toll numbering area code may be skipped when the digits are being MF pulsed forward by the auxiliary sender. When testing this type of call, the 7DG PL jack is plugged, causing the MFK selector switch to preset to position 7, at the time this circuit is seized. The test circuit is now ready to check the A digit as the first digit MF- pulsed forward by the auxiliary sender.

(b) When the test circuit has dialed the area code digits into the subscriber sender, the subscriber sender sends these digits and other information to the marker. When the marker has decoded these digits (area code), it transmits certain information to the subscriber sender. This information will cause the SK3 relay in the subscriber sender to operate. Relay SK3 operated, will put a direct ground on a lead to the auxiliary sender. This will cause the auxiliary sender to skip the first three digits when MF-pulsing forward. The auxiliary sender will then MF-pulse forward the A digit as the first digit to be checked. The A digit and subsequent digits are checked in the same manner as described in 9.

14.02 Seven-Digit Call (VL Option) -

(a) When No. 1 Crossbar offices are provided with features for dialing certain local area 7-digit calls, and pulsing these calls forward on an MF basis, option VL is provided to test these calls. This option also provides "skip digit" pulse-checking features when it is desired to dial seven digits and MF-pulse forward only five digits ("Skip 2") or four digits ("Skip 3").

(b) With a normal 7-digit MF test call, the 7DG DL jack is plugged. In order to skip two digits, when checking MF pulsing, the 7DG DL and the 5DG DL jacks are plugged, causing the MFK selector switch to preset to position 9 at the time this circuit is seized. The test circuit is now ready to check the C digit as the first digit MF-pulsed forward by the auxiliary sender.

(c) After the test circuit has dialed the first three digits (A, B, and C) into the subscriber sender, the subscriber sender sends these digits and other information to the marker. When the marker has decoded these digits (office code), it transmits certain information to the subscriber sender. This information will cause the 7DG and SK2 relays in the subscriber sender to operate. The operation of these relays will send resistance ground to the auxiliary sender, causing the auxiliary sender to skip the first two digits when it is MF-pulsing the digits forward. The auxiliary sender will then MF-pulse forward the C digit as the first digit to be checked by Section -0141. The C digit and subsequent digits are checked in the same manner as described in 9.

(d) When it is desired to skip three digits on a 7-digit MF test call, the 7DG DL and the 4DG PL jacks are plugged. This causes the MFK selector switch to preset to position 10 at the time this circuit is seized. The test circuit is now ready to check the TH digit as the first digit MF-pulsed forward by the auxiliary sender. Subsequent operation of the subscriber sender and the marker are the same as described in 14.01 except that the office code is checked by the marker and the auxiliary sender will MF-pulse forward only four digits.

15. TIME ALARM AND BLOCKING

15.01 If this circuit unit starts to check a numerical digit or the start pulse, as indicated by the grounding of lead Q, and the digit is not checked within the

short timing interval of relay TO (44 milliseconds), relay TO will leave its back contact. This permits relay LBD to operate. Relay LBD operated:

(a) Holds the MFK stepper energized to prevent a false advance of the digit signal.

(b) Supplies a supplementary ground to lead L to lock in the MF receiver channels.

(c) Releases relay G immediately, to prevent the reception of further signal pulses over leads FT and FR.

(d) Grounds lead BLK to Section -0102 to block the test circuit. The BLK relay in Section -0102 will operate, and the time alarm feature will function as described in 5., Section -0102, provided the TA key of that section is normal.

(e) Operates relay LMP.

15.02 The operation of relay LMP connects lamps P0, P1, P2, P4, P7, and P10 to the number of leads of the MF receiver to indicate which, if any, channels are operated.

15.03 The short timing cycle of relay TO will cause a block of the test circuit under the following conditions:

(a) No channels operated in the MF receiver.

(b) One channel only operated in the MF receiver.

(c) Wrong digit received.

15.04 If more than two channels are operated in the MF receiver, it will immediately ground lead K. Ground on lead K will operate relay LBD and block the test circuit as described above.

15.05 If a digit is checked as correct, the release of relay KG changes the bias on relay TO so that it will leave its back contact after more than a normal signal pulse interval but less than a KP signal pulse interval. If the pulse is of the correct length, relay Q will release in time to hold relay TO on its back contact. If the pulse is too long, relay TO will operate and the test circuit will block as described above.

15.06 Should the test frame block at any time previous to trunk test, the release of relay G by Section -0102 will prevent any checks by this circuit.

16. WIPE-OUT AND DISCONNECT BEFORE AND AFTER DIALING IS COMPLETED (FIG. 27 AND OPTION VZ)

16.01 Relay WO of Fig. 27 operates when lead WO is grounded through relay WO of Section -0139. Relay WO operated opens the fundamental circuit to prevent trunk test, before or after dialing is completed, and grounds lead ADV to prepare the test circuit for disconnect.

16.02 Wipe-out tests (abandoned calls) before dialing is completed, and after dialing is completed but before remote sender attached wink, are described in Section -0139, 14. and 15.

17. WIPE-OUT AND DISCONNECT BEFORE MF PULSING IS COMPLETED (FIG. 27 AND OPTION VZ) USING A 10-DIGIT DDD CLASS OF CALL

(See Note under 6.)

17.01 Auxiliary senders may be caused to wipe out (abandon a call) during the time that they are MF-pulsing forward 10-digit DDD calls. With the WO2 jack of Section -0137 plugged, relay WOL will operate when the MFK selector switch reaches position 7. The selector switch advances to position 7, as described in 8., 9., and 10., and grounds lead AP to Fig. 23B, Section -0137. Ground is traced through the WO2 jack and back over lead AP1 to operate relay WOL. Relay WOL operated:

(a) Locks to its own make-contact to a ground on lead ON.

(b) Removes a shunt ground from the WO1 relay timing circuit. Relay WO1 starts its timing cycle which is 639 to 697 milliseconds.

(c) Grounds lead AP2 to Section -0139 to operate relay WO of that Section.

17.02 Relay WO of Section -0139 operated:

(a) Locks to its own make-contact.

(b) Closes the last link in the circuit for operating relay WO1 on its primary winding.

(c) Opens lead T to the subscriber sender, simulating the opening of the subscriber loop.

17.03 When lead T is opened by relay WO of Section -0139, relay L in the subscriber sender returns to its back contact releasing relays SR and SR1, and operating relay LR. When the wipe-out has been registered, the subscriber sender will PCI-pulse a series of zeros to the auxiliary sender. Relay LR in the auxiliary sender will operate, and MF-pulsing to the test circuit will cease.

17.04 Relay WO1, Fig. 27, has now timed to a point where it will operate after relay SR in the subscriber sender has released. The operate path is traced from off-normal ground through a make-contact of the transfer on relay WOL, over lead AP3 to the WO relay of Section -0139, through a make-contact on relay WO, and back over lead AP4, through the WOT potentiometer and AP resistor to the primary winding of relay WO1. Relay WO1 operated, operates relay WO2. For the SD-27810-01 sender when the T lead is opened the sender L relay returns to its back contact releasing relays SR and SR1, and operating relay LR and LR1. When the LR1 relay operates MF outpulsing will stop. Relay WO2 operated:

(a) Locks to its own make-contact to off-normal ground on relay C.

(b) Transfers the digit check lead from resistance battery to lead BLK to block the test circuit if the auxiliary sender MF-pulses any further digits.

(c) Grounds the timing circuit of relay TO (Fig. 25) to prevent this circuit from blocking the test circuit during the wipe-out test.

(d) Closes a link in the circuit for grounding lead ADV to the connector circuit, Section -0102.

17.05 When the auxiliary sender disconnects from the subscriber sender, the subscriber sender removes ground from its S lead, substituting battery, thus operating relay S of the connector circuit, Section -0102. Relay S operated, grounds lead ADV1 to Section -0141, operating relay AV. Relay AV operated, closes the last link in the circuit for grounding lead AV1 to Section -0102 to operate the CT register. The operation of the CT register restores the test circuit to normal as described in Section -0102, 10.

18. TIME-OUT AND DISCONNECT BEFORE AND AFTER DIALING IS COMPLETED (FIG. 27 AND OPTION VZ)

18.01 Relay TC1, Fig. 27, performs functions described in Section -0139, 17. and 18., when auxiliary senders are to be tested for time-out features

19. INCOMING TRUNK REVERSAL TESTS (FIG. 27 AND OPTION VZ) USING 10-DIGIT DDD CLASS OF CALL

19.01 The SD-27810-01 sender will recognize the reversal on the tip and ring as part of the wink signal and will time to a stuck sender, the sender LR relay will operate and the circuit will release. The stuck sender register will operate on this test.

19.02 Auxiliary senders may be tested for incoming trunk reversal features (remote incoming trunk off-normal). With the RVT key of Section -0121 operated, relay RVT will operate when relay PMR operates after the MF pulse check and control circuit goes off-normal. The digits are dialed into the subscriber sender and auxiliary sender as described in Section -0139. At the end of dialing, the auxiliary sender attempts trunk test toward the simulated CAMA trunk (relay TC) and finds that the fundamental leads are reversed by the operation of relay RVT. Relay RVT operated:

(a) Reverses lead FT over leads FT1 and FR2 to ground on relay TC.

(b) Reverses lead FR over leads FR1 and FT1 to battery through Section -0139 to the TC relay winding.

(c) Opens lead CK1 to code test circuit, Section -0133, to prevent the marker from making second trial.

(d) Grounds lead ADV as a preparation to release the test circuit.

19.03 Relay OF in the auxiliary sender will operate when the trunk polarity is reversed and the subscriber sender will attempt CI trunk test, operating relay OF1. Relay OF1 reverses the polarity connected to the fundamental leads of the subscriber sender and the subscriber sender OF relay operates. The subscriber sender gets an overflow routing from the marker, and then it releases.

19.04 Relay RVT supplies ground to lead ADV to release the test circuit as described in 17.05.

20. TEST OF OUTPULSING OF THE DIRECTORY NUMBER IN LAMA OFFICES

20.01 A test of the outpulsing of the directory number (ODN) feature is made with class key 17 operated and plugs in the ODN and ID0 or ID3 jacks.

20.02 A working area code with ODN is chosen, and corresponding ACA, ACB, and ACC jacks are plugged. The office code used must correspond to the office code of the calling subscriber as determined by the translator.

20.03 The thousands, hundreds, tens, and units of the called number set on the TH, H, T, and U keys must correspond with the directory number obtained by translation of the line location, also set into keys of the test frame.

20.04 The test call proceeds as described in Sections 5 to 12 to the operation of the STK relay.

20.05 At the end of the ST pulse the MF receiver becomes normal and extends ground over the M lead, through operated contacts of the STK and ODN relays to operate the RS relay.

20.06 The operation of the RS relay releases the ST, STK, UL, TOK, and BAT relays to prepare this section for checking the KP of the directory number signal. Release of the UL relay opens the MFK magnet path causing its release and the advance of the selector to position 15. Release of the BAT relay causes the KP1 and KP2 relays in the signal-receiving circuit to release and remove one of the grounds holding the RS relay operated. The operation of the T relay in position 15 removes the second locking ground allowing the RS relay to release and re-establish the locking grounds for the ST, STK, and TOK relays and reoperate the BAT relay.

20.07 The operation of the T relay reverses the FT and FR leads as a signal to the auxiliary sender to outpulse the directory number starting with a KP signal. The ODN lamp is now lighted to indicate that the directory number is being checked.

20.08 The KP signal is received and checked as described in 8. Operation of the UL relay, which extinguishes the KP lamp, indicates a good check of the KP signal. The ACC lamp is lighted to indicate that the identification digit is to be checked next.

20.09 The identification digit 0 is outpulsed on nonservice-observed calls while a 3 is outpulsed on service-observed calls, simulated by the operation of the test frame LO key. The received signal is checked against the operated ID-relay or plugged jack as illustrated in Fig. 161. Detailed circuit operation is furnished in 9. A successful check of the identification digit advances the MFK selector to position 16 for a check of the A digit of the office code. The MFK selector is advanced one step after the successful check of each digit until it reaches position 1 where the ST relay is operated in preparation for checking the ST signal as described in detail in 11. followed by release described in 13.

21. ODN MULTIPARTY AND IDENTIFICATION FAILURE TESTS - LAMA OFFICES

21.01 This test uses class key 17 and plugs in the ODN and one of the ID1, 2, 4, or 5 jacks. The test proceeds as described in 20. to the successful test of the identification digit. The advance for the MFK selector to position 16 operates the ST and STK relays in preparation for release described in 13.

	Identification Digits	
	No S.O.	S.O.
Multiparty	1	4
Ident. Failure	2	5

22. ZERO OPERATOR ODN TEST CALL - LAMA OFFICES

22.01 This test is made using class key 17 with the ODN, 0, and proper ID- jacks plugged.

22.02 The operation of the 0 and 0A relays cause the MFK selector to advance to position 6 in preparation for checking the

KP, ID-, and directory number to be outpulsed. The T relay is also operated at this time to reverse the FT and FR leads in preparation for sending a reverse signal to the auxiliary sender.

22.03 This section now sits waiting for trunk test by the auxiliary sender.

22.04 The operated 0 relay causes Sections -0137 and -0139 to dial a zero into the subscriber sender and prepare for a DC lead check as described in those sections.

22.05 Sender delay on zero operator calls is checked as described in Section -0133 with the operated 0 relay taking the place of the A0 code key.

22.06 After timing, the subscriber sender calls a marker, receives routing instructions, and seizes an auxiliary sender. The auxiliary sender makes trunk test and lowers the resistance across the FT and FR leads operating the TC relay in this section. The operation of the TC relay causes a reverse to be returned to the auxiliary sender as a signal to outpulse the directory number.

22.07 The auxiliary sender outpulses the KP and ID- signals which are received and checked as described in 8. and 9. The MFK selector advances to position 7 after a successful KP and ID check and either operates the ST and STK relays, if one of the ID-1, 2, 4, or 5 jacks had been plugged and the corresponding digit has been received, or prepares to check the A digit of the calling office against the information set up on the A code key as described in 9. The remaining signals are checked as described in 10., 11., and 13.

23. INFORMATION CODE 411

23.01 When testing the information code feature the operated PDG1 key and the A4, 131, and C1 code keys of Section -0105 close the path to operate the INF relay of Section -0139. The operation of the INF relay transfers the operating path of the ST relay from terminal 14 to terminal 10 of the MFK 5 selector. When the sender recognizes the information code call it grounds the DC lead to the auxiliary sender. The auxiliary sender recognizes the DC ground as an information mark and outpulses the start pulse immediately after the C digit, deleting the TH, H, T, and U digits. After the C digit is checked by this circuit, the MKF switch advances to position 10 and the ST relay operates. The ST relay operated:

(a) Lights the ST lamp.

(b) Opens the shunt path of the PK relay.

(c) Prepares a path through operated contacts of the N7 and N10 relays to operate the STK relay.

23.02 The auxiliary sender sends the start pulse after the C digit and the STK relay operates to advance the test frame as described in 11.02.

23.03 If the auxiliary sender does not send the start pulse after the C digit, indicating that the auxiliary sender did not receive the information mark, the open shunt path of the PK relay prevents the TH digit check and the test frame blocks.

24. EMERGENCY CODE 0-0 ODN TEST CALL - LAMA OFFICES

24.01 This test is made in the same manner as the zero operator ODN test call, 22., with the addition of the operation of the PDGO key.

24.02 The PDGO relay operated causes the following:

(a) The regular zero operator test call is prefixed by a zero.

(b) The operating path of the OTC relay is opened preventing zero operator timing. The sender, having received 0-0, does not time 2.5 seconds but calls in the marker immediately.

(c) A path is closed by option SU to operate the CN relay to enable this circuit to check the special start pulse sent by the auxiliary sender on emergency code 0-0 calls.

24.03 The special start pulse is the same as that normally sent on a prefix digit zero call. The CN relay operated enables the test frame to check this start pulse. The T relay, operated on ODN calls, normally opens the path of the CN relay, however, option SU bypasses the 11 break-contact of the T relay with the 6 make of the 0 relay enabling the CN relay to operate.

CIRCUIT UNIT SECTION -0143
"TOUCH-TONE" SIGNALING CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit is arranged to test TOUCH-TONE calling receiver circuits, TOUCH-TONE calling to dial pulse converter circuits, and subscriber senders modified for TOUCH-TONE signaling.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS

3.01 To perform various tests on subscriber senders arranged to function with TOUCH-TONE signaling.

3.02 To generate TOUCH-TONE signals similar to those produced by TOUCH-TONE customer sets.

3.03 To control connection of this circuit to the sender being tested by means of a key.

3.04 To outpulse each TOUCH-TONE signal at the rate of 11.1 pps.

3.05 To permit single frequency or special frequency tests to be performed on the TOUCH-TONE receiver and the converter circuit associated with the sender being tested.

3.06 To permit long and short pulsing speed tests to be performed under control of keys.

3.07 To control the signaling of the code and the numerical digits in conjunction with the code keys circuit and the MF pulse generator circuit.

3.08 To permit step-by-step signaling of each digit under control of a key.

3.09 To inactivate the dial pulse generator circuit of Section -0105 when this circuit is seized.

KEYS

3.10 The T-T TOUCH-TONE key closes various leads to this circuit to activate the TOUCH-TONE signaling features of this circuit.

3.11 The LGP long pulse key operated changes the percent make-break period of the pulse generator lengthening the transmission period and shortening the interdigital period of the TOUCH-TONE signal.

3.12 The SLP slow pulse key operated controls operation of the pulse generator and allows the signal to be transmitted for a 1-second period. This condition simulates extremely slow digit keying by the customer.

3.13 The LLV low-level key operated causes low-level signals to be transmitted simulating high-loss line signals.

3.14 The HLV high-level key operated causes high-level signals to be transmitted simulating strong signal conditions.

3.15 The HFA, LFA, ADJ, and ADJ1 keys provide for adjusting the output level and frequency of the high, low, and special frequency oscillators.

3.16 The PPS pulsing step-by-step key operated permits step-by-step signaling of each digit with each operation of the AV key of Section -0105.

3.17 The FCA and FCB frequency control switches select the particular frequencies required for the single- and special-frequency tests. In addition, the FCB controls the maximum and minimum frequency outpulsing of the digit frequencies.

LAMPS

3.18 A T-T lamp is provided to indicate when this circuit is set to originate a TOUCH-TONE test call.

4. CONNECTING SECTIONS

4.01 The connecting sections are:

(a) Connector Circuit	-0102
(b) Code Keys and Dial Pulsing Circuit	-0105
(c) Full Selector Dial Pulse Control Circuit	-0111

DESCRIPTION OF OPERATION

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5. GENERAL

5.01 Any test call other than a KP test made in conjunction with the TOUCH-TONE key T-T operated will cause this test circuit to outpulse the test code set up on the code keys of Section -0105, as TOUCH-TONE MF digit frequencies instead of as dial pulse signals. These digit frequencies will be outpulsed through the sender under test to the associated TOUCH-TONE calling receiver circuit. The receiver circuit will identify each digit as it is received and transmit the digit information to the TOUCH-TONE calling signal to dial pulse converter circuit in the form of a ground on two leads out of seven. The converter circuit will convert the information from the receiver circuit into dial pulses and outpulse all digits into the subscriber sender under test. The subscriber sender will count the dial pulses and register each digit on the crossbar switch. On a 10-digit call the subscriber sender will call in an auxiliary sender and register the ninth and tenth digits in the auxiliary sender.

5.02 The subscriber sender will then call in a marker and transmit the office code and other information to the marker. The code test circuit Section -0133 will check the information between the sender and marker against the number registered on the code keys of Section -0105. This checks the ability of the receiver circuit to identify the digit frequencies, the ability of the converter circuit to convert the output of the receiver circuit into corresponding dial pulses, and the ability of the sender to register the digits correctly.

5.03 The single- and special-frequency tests check the ability of the receiver circuit to ignore talk-off frequencies. In these tests, the test circuit will precede the legitimate digit frequencies of the number registered on the code keys Section -0105, with a single pulse consisting of a single frequency or three frequencies. In this test the receiver circuit will ignore all frequencies other than the legitimate digit frequencies.

6. SEIZURE

6.01 Seizure of this circuit is manually controlled by operation of the T-T key. When the TOUCH-TONE features of a subscriber sender are to be tested, contacts of the T-T key operated complete ground circuits to operate the TT and TTA relays. Contacts of the TT relay close a number of connections to place this circuits digit control relays PD0 to PD9 under control of the code keys of Section -0105. The TT relay also provides a ground circuit to permit operation of the TOUCH-TONE signal generator circuit. Contacts of the TTA relay complete circuits:

(a) To inactivate the dial pulse generator circuit of Section -0105.

(b) To connect this circuit to the T and R leads of Section -0105.

(c) To provide a ground circuit to permit simultaneous operation of the three TOUCH-TONE signal oscillators of Fig. 31. This circuit is then ready to signal the digits in accordance with the grounding of leads A, B, C, etc, of Section -0105, and the settings of the PDG0, PDG1, PP, or 1-1 keys. On DDD calls, when relay DC1 operates, ground is extended over lead PLS to Section -0139. The code keys circuit is then ready to signal the area code ACA, ACB, and ACC digits.

7. "TOUCH-TONE" SIGNAL OSCILLATORS

7.01 The frequencies required for TOUCH-TONE calling tests are generated by the three bridge-stabilized oscillators in Fig. 31. Power for operating the oscillators is obtained from the 48-volt supply. The oscillators are prepared to function when relays TT and TTA are operated at the start of subscriber sender TOUCH-TONE tests.

7.02 The transistor in each oscillator operates as an emitter follower amplifier in which any change in base voltage results in a corresponding change in emitter voltage. The current in the base is in phase with the current in the emitter. Base-to-emitter bias is maintained across the varistor which is connected to ground when the TT relays operate. The amplification obtained from the transistor is sufficient to drive a tuned circuit and therefore it can act as an osillator. The oscillations are maintained by returning a sufficient portion of the output as an input to the base. This feedback is obtained from the transformer winding in series with the emitter which is inductively coupled to the transformer winding in series with the base. The third winding on the transformer together with a fixed capacitor forms the tuned circuit. Taps are furnished on this winding which are connected to a fixed capacitor by the frequency selection relays H-, L-, or TF of Fig. 32. Four taps are provided thereby permitting the oscillator to generate any one of four frequencies. The transformers employ ferrite cup cores with slug tuning for control of the transformer inductance to provide means for precise frequency adjustment at any particular tap. The taps are located at points of exact turns ratios, thereby permitting all the required frequencies to be adjusted within range by a single adjustment. To prevent overloading of the transistor, the peak amplitude of the oscillations is limited by the varistor in shunt with one section of the tuned winding of the transformer. The potentiometer in each oscillator controls the signal current flowing in the oscillator output transformer, thereby providing means whereby the output level of each oscillator can be adjusted.

7.03 The output of each oscillator appears in the primary winding of its associated A1, B1, or C1 output transformers. The secondary windings of these transformers are multipled under control of the LF, HF, and SPF relays to permit the oscillator outputs to be superimposed on each other. When not included in the multiple, the transformer secondary is replaced by its associated A4, B4, or C4 resistor to maintain a constant line impedance.

7.04 Each oscillator is adjusted to fall within specified frequency limits as outlined in Note 105. Capacitors (A04) and/or (B04) are added across the entire transformer winding in order to reduce the effects of distributed winding capacitance. Increasing the value of the (A04) or (B04) causes the frequency limits of the oscillator to move closer together. Nominal frequency adjustments with (A04) and/or (B04) capacitors in place should be made by slug tuning the appropriate transformer.

7.05 The high-frequency oscillator consists of the TA transistor, LA transformer and associated apparatus and is used to generate any one of four high frequencies. Under control of the MXF and MNF relays the oscillator can also generate frequencies which are 1.4 to 1.6 percent above or below the nominal frequencies. The nominal high frequencies are generated by forming the tuned circuit with the A01 and the A02 tuning capacitors. With the MNF relay operated, frequencies 1.4 to 1.6 percent below nominal are generated by forming the tuned circuit with the A01, A02, and the A03 tuning capacitors. With the MXF relay operated, frequencies 1.4 to 1.6 percent above nominal are generated by forming the tuned circuit with the A01 tuning capacitor.

7.06 The low-frequency oscillator consists of the TB transistor, LB transformer, and associated apparatus and is used to generate any one of four low frequencies. Under control of the MXF and MNF relays the oscillator can also generate frequencies which are 1.4 to 1.6 percent above or below the nominal frequencies. The frequencies generated are determined by forming tuned circuits with the BO- capacitors in the same manner as the AO- capacitors described above for the high-frequency oscillator. The special-frequency oscillator consists of the TC transistor, LC transformer, and associated apparatus and is used to generate a 2000-cycle frequency. With the SPF relay operated, this frequency, designated "special frequency," is generated by forming the tuned circuit at tap 3 of LC with capacitor C01.

7.07 Figure A0 - During the interdigital period, the AO-, BO-, and CO- capacitors of the TOUCH-TONE oscillators are

charged to -48 volts through contacts of the PG1 relay. This prevents signal distortion due to capacitor buildup time.

7.08 Figure AP - During the interdigital period, the AO-, BO-, and CO- capacitors of the TOUCH-TONE oscillators are charged to -48 volts through the break-contacts of the OSB relay and make-contacts of the OSA relay. The operation of the OSA relay provides an operate path to ground for the OSB relay. The operation of the OSB relay opens the operate path of the OSA relay and it releases. The OSB remains operated through its locking path under release control of the PG1 relay. Break-contacts of relay AU1 are used to control the operate time of OSB on calls which use AU1.

8. "TOUCH-TONE" OSCILLATOR NOMINAL FREQUENCIES

8.01 The high- and low-frequency oscillator circuits can generate a different nominal frequency at each tap of transformers LA and LB as follows:

TABLE A

Transformer Tap	Transformer LA Freq Hz	Transformer LB Freq Hz
HG1	1209	--
HG2	1336	--
HG3	1477	--
HG4	1633	--
LG0	-	697
LG3	-	770
LG6	-	852
LG9	-	941

8.02 These frequencies are combined in pairs, each pair consisting of one high and one low frequency to form ten combinations corresponding to the digits 0 to 9. The 1633-Hz frequency is not used as a signal frequency for any numerical digit but is used for special tests in this circuit. The frequency combinations are shown in Table B.

TABLE B

Lead Desig	Freq	Digit 0	1	2	3	4	5	6	7	8	9
L0	697		X	X	X						
L3	770					X	X	X			
L6	852								X	X	X
L9	941	X									
H1	1209		X			X			X		
H2	1336	X		X			X			X	
H3	1477				X			X			X

8.03 The circuit consisting of transistor TD and associated apparatus in Fig. 31 provides a relatively constant signal voltage level over the range of TOUCH-TONE frequencies to the input of the receiver under test. This circuit functions as an emitter-follower with a gain of approximately unity, and compensates for the variation of input impedances of circuits associated with the TOUCH-TONE receiver.

9. "TOUCH-TONE" SIGNAL GENERATOR

9.01 The time of application of the frequencies to the line and consequently the speed of pulsing is under control of the pulse generator.

9.02 The pulse generator Fig. 30 consists of the PG and PG1 relays and the associated capacitor and resistors. Relay PG is a mercury contact relay with two windings. This relay is polarized so that it can be controlled by current direction, and it is not biased, so that with no current flowing the armature takes no definite position; that is, it may close with the front contacts or it may close with the back contacts. The current reversals are under control of the auxiliary relay PG1, which in turn is under control of PG, thus completing the self-interrupter circuit. Operation of this circuit depends upon relay SP which must be operated to complete the operate path for PG1. Operation of SP is controlled by Section -0105 on 7-digit calls and by Section -0139 on 10-digit calls.

9.03 Prior to operation of SP, when PB operates, it connects ground through a normal contact of SP to one side of the PG capacitor which is in series with the primary winding and to the PGO resistor thus grounding out the battery and connecting ground to the -6 terminal of the secondary winding. At this time the 7 terminal, + for the secondary winding and - for the primary winding, is connected to resistance battery. The current in the secondary winding is in a direction to release PG, but the current in the primary winding charging the PG capacitor is in a direction to operate PG. Initially the primary ampere turns are more powerful and the relay operates, but as the capacitors become charged, the primary winding ampere turns decrease, and finally the secondary winding ampere turns become controlling and cause PG to release. The circuit remains in this condition until SP is operated. Relay SP in operating disconnects the ground from the PG capacitor and from the PGO resistor allowing the PGO resistor battery to become effective and connects ground to the 7 terminal through PG1 normal contacts. This causes the current in the secondary winding to flow in a direction to cause operation of the relay, and sets up a circuit for discharging and charging in the opposite direction the PG capacitor through the primary winding. At first the primary winding ampere turns are controlling and PG remains unoperated. Then as the capacitor becomes charged, the primary ampere turns decrease, and the secondary winding again takes control causing PG to operate. The PG in operating with SP operated, operates PG1 to again reverse the circuits through both windings, causing PG to release after a timed interval. This cycle is repeated as long as PG1 remains under control of PG. When it is desired to stop the interrupter, an auxiliary circuit releases relay SP, thus preventing operation of PG1 and stopping the interrupter.

9.04 The time PG remains on its back and front contacts is controlled by the values of the capacitor and resistors. On this circuit two sets of constants are provided to give two combinations under control of the LGP key. Facilities are provided for adjusting and controlling the output by removing or adding resistance to the circuit network.

9.05 When the PG1 relay is normal, it closes the tip and ring conductors from the sender to windings 4 to 7 of repeat coil, PBL, Fig. 31, and permits the digit frequencies present in windings 2 to 5 of repeat coil PBL to be transmitted to the sender. When relay PG1 operates, the tip and ring path to repeat coil PBL is opened to remove the frequencies transmitted to the sender, and to provide interdigital timing.

10. SEVEN- OR TEN-DIGIT TEST CALL

10.01 The operation of the T-T key operates relays TT and TTA. Relays TT and TTA operated:

(a) Connect 48-volt supply to activate the TOUCH-TONE signal oscillators.

(b) Transfer lead SY in Section -0105 from relay SY to relay SP. Relay SP operated, starts the TOUCH-TONE signal generator of Fig. 30.

(c) Transfer the digit control leads 0 to 9 from the counting relays of Section -0105 to the windings of relays PD0 to PD9.

10.02 The PD- relays operated will operate one L- and one H- relay and cause the oscillator to transmit the digit frequencies indicated in Table C below:

TABLE C

Digit	PD- Relay Operated	L- and H- Relays Operated		Frequencies Transmitted Cycles	
0	PD0	L9	H2	941	1336
1	PD1	L0	H1	697	1209
2	PD2	L0	H2	697	1336
3	PD3	L0	H3	697	1477
4	PD4	L3	H1	770	1209
5	PD5	L3	H2	770	1336
6	PD6	L3	H3	770	1477
7	PD7	L6	H1	852	1209
8	PD8	L6	H2	852	1336
9	PD9	L6	H3	852	1477

10.03 Prefix Digit 0, 1, 1-1, or Preliminary Pulse - To outpulse a prefix digit 0 or 1 before the area of office code, the

11.02 Special-Frequency Test - This test checks the ability of the TOUCH-TONE receiver circuit to ignore signals comprised of three frequencies, two of which are a valid combination of TOUCH-TONE frequencies, at a normal (-7 dBm) level and the third a frequency above the range of TOUCH-TONE frequencies at a higher (-6 dBm) level. For this test, a 2000-cycle signal is used as the third frequency.

11.03 When this test is made, a long 3-frequency pulse is sent in the same manner as described for the single-frequency test. The test is under control of the FCB switch, and the frequencies transmitted are under control of the FCA switch of Fig. 32. The switch settings and frequencies tested are shown in Table D.

11.04 When the FCB switch is placed in the 3FS position, ground is extended through terminals of the switch to operate the SPF relay. Contacts of SPF close a path to place the output of the special frequency oscillator in multiple with the outputs of the low- and high-frequency oscillators. When the test starts and the MP relay operates, ground is extended through terminals of the FCB switch and contacts of MP to operate the TF relay. Ground is also extended through terminals of the FCA switch and contacts of SPF to operate one of the H1-4 relays and one of the LO, L3, L6, or L9 relays. Consequently, the three oscillators of Fig. 31 generate a valid combination of TOUCH-TONE frequencies and a 2000-cycle signal simultaneously.

11.05 Slow Pulse Test - This test is provided to test the response of the receiver to long pulsing intervals followed by equally long interdigital periods. This condition simulates slow digit keying by the customer. Each digit is transmitted for approximately 0.5 second, and each interdigital period is 0.5 second.

11.06 This test is performed with the SLP key operated, which places the pulsing relay PG1 under control of slow-release relays SP1 and SP2. These relays are connected to form a self-interrupter circuit, with the release time of SP2 controlling the length of pulse transmission and the release time of SP1 controlling the length of the interdigital period. The SLP key operated prepares a ground connection for operation of the SP1 relay.

11.07 The SLP key operated also operates the SLP relay. This eliminates trunk closure tests on all RP or PCI slow pulse TOUCH-TONE tests.

12. PULSING STEP BY STEP

12.01 With the PSS key operated the pulsing of each digit is placed under control of the AV key of Section -0105. The test call will progress up to the point where the pulse generator relay PG1 operates for the first time. Relay PG1 will lock under control of the PSS key operated and relay RC1 operated. The subsequent operation of the AV key will operate relays RC and RC1 and release relay PG1 to outpulse the first digit. This first digit MF pulse will persist until the AV key is released. Each subsequent digit will be outpulsed and persist as long as the AV key is held in the operated position.

13. ADJUSTMENT OF "TOUCH-TONE" OSCILLATORS

13.01 The ADJ, ADJ1, HFA, and LFA keys and the VL jack are provided for the purpose of adjusting the output frequencies and levels of the TOUCH-TONE oscillators.

13.02 Frequency Adjustment - For this adjustment an EPUT meter is plugged into the VL jack to measure the output frequency of each oscillator. Each oscillator is adjusted to oscillate at four nominal frequencies and at frequencies which are 1.4 to 1.6 percent above or below the nominal values as shown in Note 105. The oscillator transformers are equipped with slug tuning for the nominal frequency adjustment, and fixed capacitors are provided for the 1.4 to 1.6 percent above and below nominal frequency adjustments. The adjusting procedure is outlined in Circuit Note 105.

13.03 Level Adjustment - For this adjustment a vacuum tube voltmeter is plugged into the VL jack to measure the voltage output of each oscillator. The PA, PB, and PC potentiometers are provided to adjust the oscillator output levels as covered in Circuit Note 106.

14. ADJUSTMENT OF "TOUCH-TONE" SIGNAL GENERATOR

14.01 Two combinations of speed and percent breaks are provided for the TOUCH-TONE signal generator as covered in the Circuit Requirements Table. Four adjustments

PDG0 or PDG1 key is operated. To outpulse the prefix digits 1-1 or a preliminary pulse before the office code, the 1-1 or PP key is operated. The 1-1 or PP key must not be operated on 10-digit calls. When the associated control circuit grounds lead A of Section -0105, relay PD0 will operate for a prefix digit 0, or relay PD1 will operate for a prefix digit 1. The PD- relay operated will operate one L- and one H- relay and cause the oscillator to transmit the frequencies for digit 0 or 1 as shown on Table C. At the end of the prefix digit, the pulse generator relay PG1 will operate for interdigital timing and operate relay P3' and P3A' of Section -0105. Relays P3' and P3A' will transfer the A lead of the associated control circuit to the ACA or A relay to prepare for outpulsing the first digit of the area of office code.

10.04 Outpulsing the First Digit of the Area or Office Code - When the pulse generator PG1 relay releases, it closes the tip and ring conductors from the sender to the oscillator repeat coil L and transmits the frequencies corresponding to the first digit of the area or office code.

10.05 The release of relay PG1 also grounds the digit steering advance lead AV to operate the selector in the associated control circuit. The subsequent reoperation of relay PG1 terminates the frequencies for the first digit of the area or office code and also removes ground from the digit steering advance lead AV. Removal of ground from lead AV releases the digit steering selector in the associated control unit, and the selector steps to its next position releasing the operated ACA or A relay and operating the ACB or B relay in preparation for outpulsing the next digit.

10.06 Outpulsing the Remaining Digits - The successive release and operate cycles of relay PG1 cause the oscillator to outpulse the successive digits into the sender in a manner similar to that described for the ACA or A digit.

11. TEST OF "TOUCH-TONE" CALLING RECEIVER CIRCUIT

11.01 Single-Frequency Test - This test checks the ability of the receiver circuit to guard against talk-off. In this test a long pulse consisting of a single-frequency is outpulsed before the area or office code and the numerical digits. The receiver circuit will ignore the single-frequency pulse and identify only the area code (for 10-digit calls), the office code, and the numerical digits. The switch settings and the frequencies tested are shown in Table D.

TABLE D

Test	Switch Position FCA	Switch Position FCB	Relay Operated	Freq Tested
Single Freq (High)	1	SFH	SF HF H1	1209
	2	SFH	SF HF H2	1336
	3	SFH	SF HF H3	1477
	4*	SFH	SF HF H4	1633
Single Freq (Low)	1	SFL	SF LF L0	697
	2	SFL	SF LF L3	770
	3	SFL	SF LF L6	852
	4	SFL	SF LF L9	941
Special Freq	1	3FS	SPF TF L0 H1	697 1209 2000
	2	3FS	SPF TF L3 H2	770 1336 2000
	3	3FS	SPF TF L6 H3	852 1477 2000
	4	3FS	SPF TF L9 H2	941 1336 2000

* Tests involving the transmission of 1633 cycles shall be omitted when the TOUCH-TONE receiver circuit is not arranged to recognize this frequency.

are provided; two for the two pulsing speeds and two for the corresponding percent breaks. The PG2-PG6 and the PG11-PG15 resistors control the two pulsing speeds. The PG7-PG9 and PG16-PG18 resistors control the two percent break adjustments. A speed and an associated percent break adjustment slightly affect each other; therefore, an adjustment of one function requires a check of the other. A summary of the pulse times is tabled below:

Control Key	PG1 Closed Back Contacts	PG1 Open Front Contacts
	ms	ms
LGP Key Normal	40	50
LGP Key Operated	50	40

CIRCUIT UNIT - SECTION -0156
SENDER SELECT CIRCUIT FOR TESTING COMBINATION "TOUCH-TONE" AND ROTARY DIAL AND/OR NONCOIN SERVICE IMPROVEMENTS AND COIN SERVICE IMPROVEMENTS SUBGROUPS

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to automatically select senders arranged for TOUCH-TONE signaling when testing TOUCH-TONE features in offices which are partially equipped with senders modified for TOUCH-TONE calling.

1.02 This circuit provides facilities for checking the sender preference of all subgroups of senders in offices partially equipped with senders modified for TOUCH-TONE calling.

2. WORKING LIMITS

2.01 None.

3. FUNCTIONS OF THIS CIRCUIT UNIT

3.01 To determine which senders of each subgroup are not arranged for TOUCH-TONE calling and to make these senders appear busy to the test frame when testing TOUCH-TONE features.

3.02 To provide a method of testing the sender preference of all subgroups in offices with sender groups containing senders modified for TOUCH-TONE calling and senders arranged for rotary dial calling.

4. CONNECTING CIRCUITS

4.01 The connecting circuits are:

(a) Connector Circuit - Section -0102

(b) TOUCH-TONE Signaling Circuit - Section -0143

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DESCRIPTION OF OPERATION

5. GENERAL

5.01 Every office partially equipped with senders modified for TOUCH-TONE calling and/or coin service improvements will be equipped with one Fig. 38 per sender group, including any sender groups that may not be equipped with senders modified for TOUCH-TONE calling and/or coin service improvements. Cross-connections on the T-T terminal strip provide a path to operate one pattern (P-) relay as determined by the sender preference of the subgroup under test. Additional cross-connections associated with the contacts of the pattern relay operated permit the test frame to check the advance of the sender preference and, if the T-T key of Section -0143 or CON key of Section -0165 is operated, to indicate to the test frame those senders of the subgroup that are not arranged for TOUCH-TONE calling and/or coin service improvements when testing TOUCH-TONE and/or coin service improvements features.

6. PATTERN RELAY OPERATION

6.01 Each Fig. 38 is equipped with one T-T terminal strip and from three to six P- relays. All sender subgroups with the same sender preference arrangement, regardless of the sender group in which they appear, are assigned to one P- relay of a Fig. 38. The T-T terminal strip of each Fig. 38 is equipped with terminals associated with the windings of the P- relays of that particular Fig. 38 and terminals associated with the windings of the P- relays of all other Fig. 38's furnished. The T-T terminal strip is also equipped with terminals associated with the contacts of the P- relays of that particular Fig. 38. The T-T terminal strips are cross-connected as per circuit Note 401 of SD-25221-01, sheet -0156.

The operating ground of the select magnet in Section -0102 that is associated with the subgroup under test is advanced through an SG(0-9) diode and a cross-connection on the T-T terminal strip to operate the assigned P- relay.

7. SENDER PREFERENCE CHECK

7.01 In order for the test frame to check the advance of the preference lead to the next sender, every subgroup, including any in which no senders modified for TOUCH-TONE and/or coin service improvements appear, must be assigned to a P- relay.

7.02 When the test frame checks the advance of the sender preference, as described in Section -0131 12., a ground is placed on the SPF lead by the release of the SPF2 relay. With option SN and Fig. 38 provided, this ground is advanced by the SP- lead associated with the next sender to the T-T terminal strip cross-connection, through the operated contact of the assigned P- relay and back on the SPF- lead associated with the sender under test. The SPF3 and SPF1 relays of Section -0131 operate, and normal test frame functions continue.

8. SENDER SELECTION

8.01 When tests of senders modified for TOUCH-TONE calling and/or coin service improvements are to be made, the operation of the hold magnet associated with the appearance on the connector switch of Section -0102 of the sender under test, places a ground on a U(0-9) lead to Fig. 38A. This ground is advanced through a U(0-9) diode and through a make-contact of the operated P- relay to the T-T terminal strip. All senders not modified for TOUCH-TONE calling and/or coin service improvements will have the U- terminal on the T-T terminal strip associated with their appearance on the verticals of the connector switch cross-connected to the PSD terminal. A ground on the PSD terminal is advanced through make-contacts of the TTA relay of Section -0143 to operate the PSD relay of Section -0102, as described in 27. of that section, and the test frame advances to the next sender. Senders arranged for TOUCH-TONE calling and/or coin service improvements will not have a PSD cross-connection associated with its appearance on the T-T terminal strip enabling the test frame to seize the sender for test.

CIRCUIT UNIT SECTION -0165
COIN SERVICE IMPROVEMENTS
DIAL-TONE-FIRST TEST CIRCUIT

1. PURPOSE OF CIRCUIT

1.01 This circuit is designed to be used in conjunction with other units to test the ability of an originating sender arranged for "Coin Service Improvements" to recognize and process coin failure.

1.02 This circuit is designed to test the functions of the originating sender GT relay.

2. WORKING LIMITS

2.01 None - used for local circuit operation.

3. FUNCTIONS OF THIS CIRCUIT

3.01 Determine if an originating sender recognizes a coin failure with the absence of coin ground on a coin class call.

3.02 Provide a means to allow the originating sender to complete its release of distant end prior to second marker seizure when required.

3.03 To check if the originating sender initiated a second marker seizure and determine if that information transmitted to the marker would route the call to a coin failure announcement trunk.

3.04 Provide a means for straightforward or office selection completion.

3.05 Provide the following tests of the originating sender GT relay.

(a) Release.

(b) Operate.

(c) False operation (noncoin class call).

KEYS

3.06 Key GTO - The operation of this key places a stringent operate resistance in the operate path of the sender GT relay.

3.07 Key GTN - The operation of this key places a release resistance in the operate path of the sender GT relay.

3.08 Key DGT - The operation of this key places the GTK relay on the tip lead to detect a false exposure of the sender GT relay on noncoin class calls.

3.09 Key CON - The operation of this key starts:

(a) Coin failure routing test.

(b) Sender GT relay operate and release tests.

3.10 Key FTC - The operation of this key detects false trunk closure on direct PCI call when testing coin failure announcement routing.

3.11 Key CR - The operation of this key provides a 1000- coin ground to the tip lead to assure coin test for all noncoin service improvements coin class calls.

3.12 Key TWD - The operation of this key provides necessary circuit control when testing coin failure routing on PCI calls with office selections with sender relay TW normal.

3.13 Key TWU - The operation of this key provides necessary circuit control when testing coin failure routing on PCI calls with office selections with sender relay TW operated (2-wire office).

3.14 Key SBA - The operation of this key allows coin failure announcement routing office selection completion.

LAMPS

3.15 Lamp COK - This lamp indicates correct second marker seizure coin failure translation.

3.16 Lamp GTK - This lamp indicates a sender relay GT operate or release failure.

3.17 Lamp DGT - This lamp indicates that a false exposure of sender relay GT has taken place on noncoin class calls.

3.18 Lamps OBA, OGA - These lamps indicate the progress of office selections when coin failure announcement routings require office selections.

SWITCHES

3.19 Switches OBA, OGA - Provide a means for selecting office selection on coin failure announcement routing.

3.20 Switch CRA - Provides a means for selecting compensating resistance for coin failure announcement routing requiring office selections.

4. CONNECTING CIRCUITS

4.01 The connecting sections are:

(a) Connector Circuit - Section -0102

(b) Route Keys and Revertive Pulsing Circuit - Section -0108

(c) Full Selector Dial Pulse Control Circuit - Section -0111

(d) Incoming and Final Selection Control Circuit - Section -0113

(e) PCI Dial Pulse Control Circuit - Section -0115

(f) PCI Register Circuit - Section -0117

(g) Operator Class Control for Subscriber Sender - Section -0121

(h) Sender Group Test Circuit - Section -0131

(i) Code Test Circuit - Section -0133

(j) AS Dial Pulse Check Control Circuit - Section -0139

(k) AS MF Pulse Check Control Circuit - Section -0141

(ℓ) Sender Select Circuit for Testing Combination TOUCH-TONE and Rotary Dial Subgroups - Section -0156

DESCRIPTION OF OPERATION

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5. SEIZURE (COIN FAILURE TEST)

5.01 With the CON key operated and the GTO, GTN, and DGT keys normal, select and set a coin class call. After test start when a connection has been established to the sender under test, the operation of relay C (Section -0102) operates the CON relay through the operated CON key. The CON relay prepares the operate path for relay CNF.

6. FIRST MARKER SEIZURE

6.01 With first marker seizure, the code test circuit checks the information transmitted from the sender to the marker. At the completion of this check, the operation of relay AV (Section -0133) or DAS (Section -0139) operates relay CNF. Operated CNF relay:

(a) Locks under control of relay CON.

(b) Releases relays LUA, B, C (Section -0133), if operated.

(c) Provides lock path for relay C (Section -0133), if operated.

(d) Prepares an operate path for relays CNFA and COK.

The test circuit awaits sender coin test functions.

7. SENDER COIN TEST FUNCTIONS

SENDER FUNCTION

7.01 In the sender after completion of dialing (registration complete) and after first marker translation, the sender performs a coin test by placing the GT relay on the tip lead. With the absence of coin ground on the tip lead, the GT relay will remain normal. This condition dictates a coin test failure and the sender calls for a second marker seizure to reroute the call to coin failure announcement. The method in which the sender proceeds with second marker seizure is dependent on the type of outpulsing which was required by the original call (first marker translation).

REVERTIVE PULSE CALLS (COIN FAILURE)

7.02 On revertive pulse calls the test circuit simulates the distant end. The sender proceeds with final units selections but functions to send the distant office to telltale. When the test circuit relay FU (Section -0108) operates, the FUA also operates. The sender counts revertive pulses beyond the number of the unit digit registered (because of telltale function) causing the operation of relay L3 (Section -0108) as a false closure indication. With the FUA relay operated the L3 will not lock but operates relay FUB. Relay FUB operated opens the FR lead and the test circuit proceeds to the incoming advance position and releases relay FUA. The sender now receives the reversed battery and ground normally sent as an incoming advance signal, and treats the reversal as "telltale" and operates its OF relay for reroute (second marker seizure).

PCI CALLS (COIN FAILURE)

A. Direct PCI

7.03 On a direct PCI call the test circuit is not required to simulate the distant end since the sender in a coin test failure condition will immediately start second marker trial. The PCI dial pulse control circuit (Section -0115) advances past the registration positions and awaits completion of second marker trial.

False Trunk Closure FTC Key Operated (Direct PCI Only)

7.04 The FTC key operated provides a means of monitoring the fundamental tip for a false trunk closure prior to completion of second marker seizure. If a false trunk closure takes place, the FTC key provides a path to operate relay TG (Section -0117) which in turn operates relay TG1 (Section -0117). Relay TG1 locks through the FTC key. The TG1 relay operated with a TG2 relay normal (Section -0117) provides a path to operate relay BK (Section -0115). Relay BK operated blocks the test.

B. PCI Call With Office Selections and Sender Relay TW Normal. TWD Key Operated

7.05 A PCI call with office selection with a coin test failure requires that the test circuit simulate the distant end. The sender proceeds to make office selections and upon second trunk test operates its TG2 relay and starts second marker trial. The TWD key operated provides the second trunk test loop to enable the sender relay TG2 to operate.

C. PCI Call With Office Selections and the Sender TW Relay Operated (2-Wire Office) TWU Key Operated

7.06 On this call the test circuit simulates the distant end since the sender must complete office selections and PCI registrations (outpulsing of zeros to return distant end to normal) prior to second marker trial. The TWU key operated assures the operation of relay SB (Section -0115) and also places the control of relay U (Section -0115) to relay SY (Section -0115). Relay SB must be operated to assure PCI registration.

MULTIFREQUENCY OUTPULSING OPTION QD

7.07 A multifrequency call with a coin test failure condition, will cause the sender to initiate a second marker trial immediately. With the CON key operated the AS pulse check circuit (Section -0141) is disabled and relay MFCA is operated. Relay MFCA operated provides for returning the AS dial pulse and code check control circuit to normal, close a portion of the trunk test loop and provides a path to release the test circuit after coin failure announcement trunk test.

STRAIGHTFORWARD

7.08 A straightforward call with a coin failure will cause the sender to initiate a second marker trial immediately.

8. SECOND MARKER SEIZURE

8.01 The operation of code test circuit (Section -0133) relay CK3 during second marker seizure for coin failure announcement routing, operates relay CNFA. Relay CNFA locks and opens the fundamental ring lead to block the call if the proper reroute translation is not received. When relay CK3 releases the LUA-C relays (Section -0133) reoperate to provide a lock for the register relays (Section -0133). Relay COK then operates if register relays A2, A4, A5 are operated and relay OF1 is normal, indicating that the sender has transmitted proper coin failure announcement routing. The operated COK relay prepares:

(a) Paths to provide straightforward trunk test or later trunk test for office selection completion when marker functions are complete.

(b) Lights the COK lamp indicating proper marker check.

9. COIN FAILURE ANNOUNCEMENT ROUTINGS REQUIRING OFFICE SELECTIONS

9.01 To enable office selection completion, the SBA is operated, and the office brush, office group, and compensating resistance setting are made on switches OBA, OGA, and CRA, respectively.

9.02 The SBA key operated prepares a path to operate relays SBA-D and also prepares a trunk test path. The operation of these relays are under control of a particular control circuit. The operated SBA-D relays provide:

(a) Necessary AV, AV1 advance ground when making selection checks.

(b) Transfer control from the OB, OG, CR keys to the OBA, OGA, CRA switches.

(c) Provide the STP path to Section -0108.

(d) Complete a trunk test loop for trunk test.

For selection test, lead OB to the route switches and revertive pulsing circuit (Section -0108) is grounded. This causes the office brush selection to be checked. If the check is satisfactory, lead AV from the route switch and revertive pulsing circuit is grounded, advancing the control circuit to its next position. After the office brush registrations return to normal, lead AV1 is grounded advancing the control circuit to the office group position. Office group selections are checked in the same manner as described for office brush selections. The progress of office selections can be monitored by the OBA, OGA lamps.

10. RELEASE (COIN FAILURE TEST)

10.01 After straightforward or office selection completion has been completed, the release of the test circuit is reverted to the particular control circuit which initiated the test.

11. SENDER GT RELAY RELEASE TEST

11.01 Operate keys CON and GTN and select a coin class revertive pulse call. After marker release and sender registration complete, the DP selector (Section -0111) advances to Position 18. In Position 18, relay GTA operates and places ground to the ring lead and relay GTK to the tip lead to detect the sender relay GT. When the sender relay SCT operates, it places relay GT on the tip. This allows relays GT and GTK to operate in series which in turn operates relay GTB. Relay GTB places a release resistance of 10,000 ohms in the operate path of relay GT which should cause it to release. This release of relay GT indicates a coin failure and the call should route to coin failure announcement (see 7.02). The operation of relay GTB provides an advance path for the DP selector (Section -0111) which advances the selector to position 20 to await release. If the sender relay GT does not release, the sender will attempt to complete the call normally. However, the test frame will not permit incoming advance (since relay L3 (Section -0108) and FUB are normal) and the test will block in Position 11, SP selector (Section -0113) and Position 20, DP selector (Section -0111). Lamp GT will light indicating a sender relay GT release failure.

12. SENDER GT RELAY OPERATE TEST

12.01 Operate key CON and GTO and select a coin class revertive pulse call. After marker release and sender registration complete, the test circuit advances as indicated in 11., to the operation of relay GTB. The sender GT relay open circuit releases. Relay GTA releases and places a stringent operate resistance path to reoperate the GT relay. If the GT relay operates, the call will complete normally. If the GT relay does not operate, the sender will attempt to route the call to coin failure announcement. However, the test circuit will not permit incoming advance and will block in Position 12, SP-SEL (Section -0113) and Position 20, DP-SEL (Section -0111) and will light lamp GTK indicating a sender relay GT operate test failure.

13. DETECT FALSE EXPOSURE OF SENDER GT RELAY

13.01 Key DGT operated, and a noncoin class straightforward, "911" or operator call (Section -0121). After sender registration complete and first marker completion, a path via the operated DGT key operates relay GTA which places the GTK

relay on the tip lead. If the sender GT relay is not exposed to the tip lead, the call completes normally. However, if the GT relay is falsely exposed to the tip lead, the GTK relay operates and provides a blocking ground to Section -0102 which blocks the circuit and also lights the DGT lamp indicating the false exposure of sender relay GT.

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14. NONCOIN SERVICE IMPROVEMENTS COIN CLASS TEST CALLS (COIN REQUIRED)

14.01 Key CR operated. The CR key provides a 1000-Ω coin ground to the tip lead to assure coin test for all noncoin service improvements coin class test calls.