

110E1 MULTIPLE SENDER CIRCUIT DESCRIPTION AND OPERATION

	CONTENTS	PAGE	
1. GENERAL		1	5-element and 8-element distorted and undistorted test signals for use in testing teletypewriter stations, data circuits, and associated equipment.
2. DESCRIPTION		1	1.02 This section is reissued to add information concerning the hub signal output unit (J70162C-1), neutral signal output unit (J70162D-1), and the 911B2 Data Test Set. The use of the hub- and neutral-signal output units will increase the number of serviceboard appearances of distorted and/or undistorted test signals from a maximum of 10 appearances of each type to 100 appearances of each type. Due to extensive revision, arrows ordinarily used to indicate changes have been omitted.
	A. Driver Unit (J70162A-1)	2	
	B. 911B-Type Test Sentence Generator	2	
	C. Driver Circuit	4	
	D. Output Unit (J70162B-1)	6	
	E. Neutral- and Hub-Signal Output Units (J70162D-1 and J70162C-1)	6	1.03 The 110E1 Multiple Sender Circuit provides type 2 hub and neutral test signals at all codes and speeds presently used in the telegraph plant.
3. INSTALLATION		8	
4. OPERATION		10	
5. THEORY OF OPERATION		13	1.04 The addition of the hub- and neutral-signal output units presents two basic configurations for the 110E1 Multiple Sender Circuit that may be installed in a telegraph central office. The initial configuration consists of a driver unit (J70162A-1) and from one to a maximum of ten hub- and neutral-signal output units (J70162B-1). The later configuration consists of a driver unit (J70162A-1) and from one to a maximum of ten distorted and undistorted drive circuits. Each of the distorted and undistorted drive circuits will drive from one to a maximum of ten hub- and/or neutral-signal outputs units (J70162C-1 and/or J70162D-1).
	A. 911B Test Sentence Generator	13	
	B. Driver Circuit (J70162A-1)	13	
	C. Output Circuit (J70162B-1)	13	
	D. Distorted and Undistorted Drive Circuit	14	
	E. Hub-Signal Output Circuit	14	
	F. Neutral-Signal Output Circuit	14	
	G. Test Signal Supply Circuit Jack Appearances	14	2. DESCRIPTION
6. REFERENCES		14	2.01 The initial 110E1 Multiple Sender Circuit (J70162A and B) consists of the driver unit, one to ten output units, and test signal supply circuit jack appearances. At least one output unit shall be supplied with the driver unit. A front view of the driver unit with one output unit is shown in Fig. 1.
1. GENERAL			
1.01	This section describes the 110E1 Multiple Sender (J70162) which is used to provide		

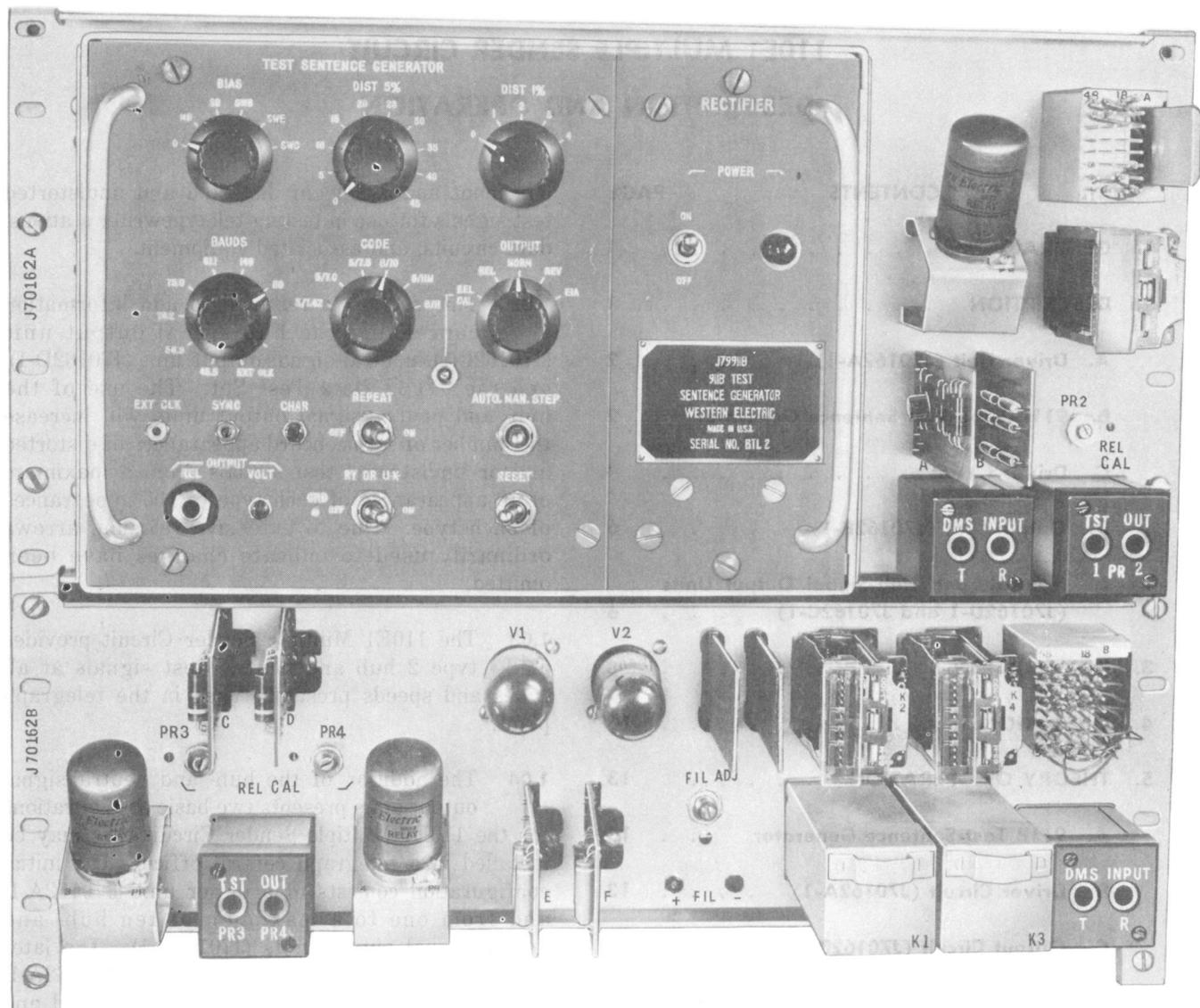


Fig. 1—Driver Unit (J70162A-1) and Output Unit (J70162B-1), Relay Rack Arrangement

2.02 The later 110E1 Multiple Sender Circuit (J70162A, C, and/or D) consists of the driver unit, one to twenty output units, and test signal supply circuit jack unit appearances. At least one output unit shall be supplied with the driver unit. Front views of one neutral output unit for ten circuits and one hub output unit for ten circuits are shown in Fig. 2 and 3, respectively.

A. Driver Unit (J70162A-1)

2.03 The driver unit for either configuration consists of a 911B-type test sentence generator

(TSG), a relay driver circuit pack (ED-71301-30 G1), a grid bias voltage divider circuit pack (ED-71302-30 G1), and associated components for driving the output units.

B. 911B-Type Test Sentence Generator

2.04 There are two types of 911B TSGs used with the 110E1 Multiple Sender Circuit. The initial configuration uses a 911B1 TSG (J79911B-1), while the later configuration may be equipped with either a 911B1 TSG or a 911B2 TSG (J79911B-2). The basic difference between the two 911B-type

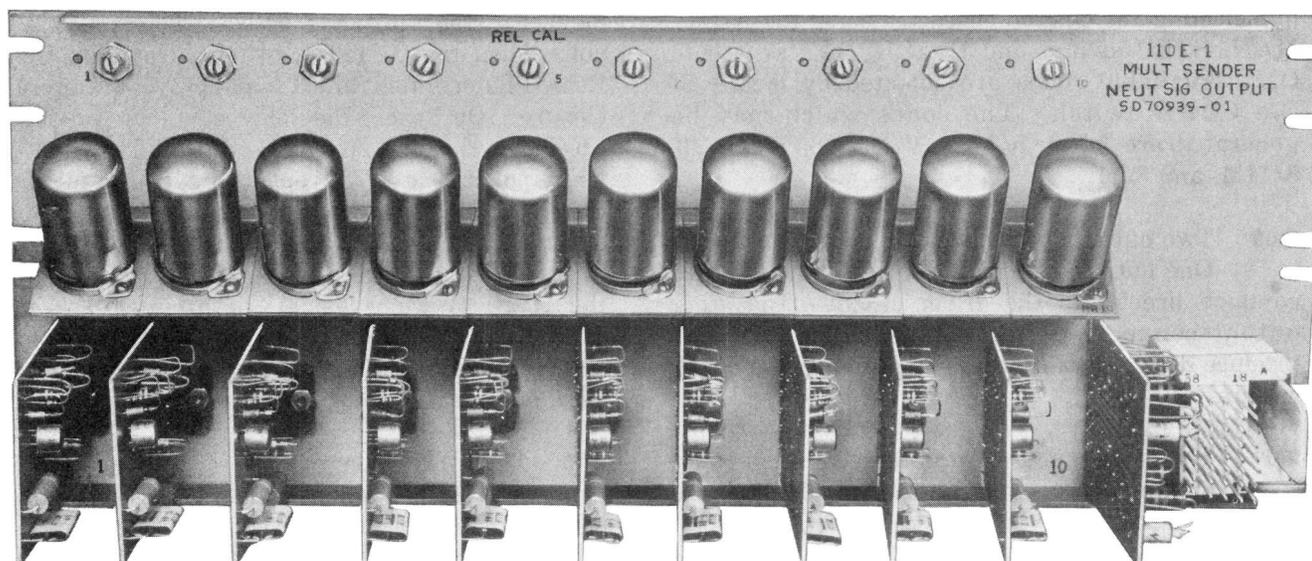


Fig. 2—Neutral Signal Output Unit (J70162D-1)

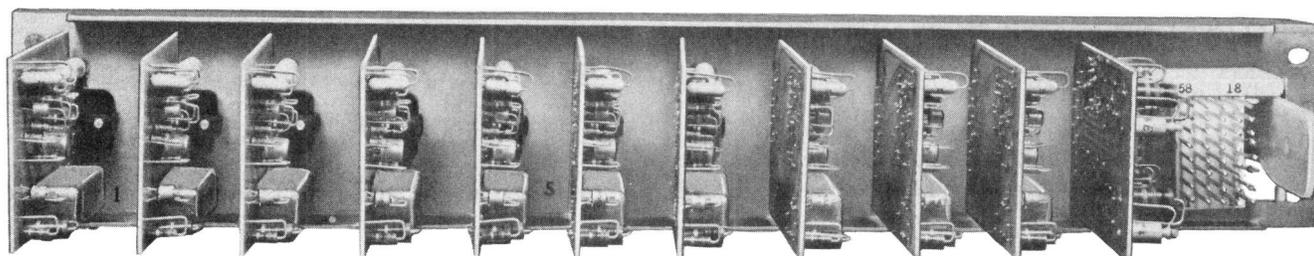


Fig. 3—Hub Signal Output Unit (J70162C-1)

TSGs is the designations on the BAUDS control switch.

2.05 The BAUDS control switch of the 911B2 TSG, designated with the sequential numbers, enables the selection of those baud rates required for each particular central office and/or location.

2.06 The 911B-type TSG includes three main electronic circuits; the word generator, the distortion generator, and the output circuit. The 911B-type TSG is described in the section entitled 911A, B, and C Data Test Sets—Description, Operation, and Maintenance (103-813-100).

2.07 The word generator produces the standard FOX test sentences as follows: THE QUICK BROWN FOX JUMPED OVER A LAZY DOG'S BACK 1234567890 TESTING for 8-element code, or THE QUICK BROWN FOX JUMPED OVER A LAZY DOGS BACK 1234567890 TESTING A1A for 5-element code. Each sentence is preceded by four functions, which are LETTERS (RUB OUT for 8-element code), CARRIAGE RETURN, CARRIAGE RETURN, and LINE FEED. The word generator may be arranged to produce repeated RY (5-element code) or U* (8-element code) by operating the RY OR U* and REPEAT switches to ON. The output may be manually stepped, one character at a time, and any desired character of the test sentence may be transmitted repeatedly.

SECTION 103-806-104

by selecting the desired character using the AUTO. MAN. STEP switch and the REPEAT switch to ON. Available codes are selected by means of the CODE switch. The codes which may be generated are 5/7.0, 5/7.42, 5/7.5, 6/8, 7/9, 8/10, 8/11M, and 8/11.

2.08 Two outputs of the word generator are used.

One output is undistorted test signals which connect directly to the driver circuit. The other output connects to the distortion generator to produce distorted test signals and then to the driver circuit.

2.09 The distortion generator is used to introduce a known type and amount of distortion in the test signals received from the word generator.

2.10 Test signals from the 911B TSG may have the following types of distortion:

- (a) Marking bias (MB)
- (b) Spacing bias (SB)
- (c) Switched bias (SWB)
- (d) Switched end distortion (SWE)
- (e) Switched combination distortion (SWC). The type of distortion is selected by the BIAS switch. The amount of distortion can be set in 1-percent steps from 0-percent to 49-percent distortion. The amount of distortion is selected by the DIST 1% and DIST 5% switches.

2.11 Distorted test signals from the distortion generator are transmitted to the output circuit. The output circuit includes the polar relay PR1.

2.12 The OUTPUT switch arranges the output circuit to provide several types of distorted test signals. Signals measured at the VOLT OUT test point are as follows:

- (a) +9 volts for mark and ground for space when the OUTPUT switch is on NORM
- (b) +9 volts for space and ground for mark when the OUTPUT switch is on REV
- (c) -12 volts for mark and +12 volts for space when the OUTPUT switch is on EIA.

Signals at the tip of the REL OUT jack are +12 volts when the OUTPUT switch is on REL CAL. Relay PR1 operates for mark and provides a tip-ring closure. On space, the relay contacts provide a tip-sleeve closure. With the OUTPUT switch on REL, polar relay PR1 repeats neutral signals to the REL OUT jack and to leads C, M, and S (common, mark, and space). The OUTPUT switch must be set to REL position for operation with the 110E1 Multiple Sender. **Connection to the REL OUT jack should not be made while the 911B TSG is associated with the 110E1 Multiple Sender Circuit.**

2.13 Undistorted test signals appear on the CH lead as +8 volts for mark and ground for space. Distorted and undistorted test signals are carried by the C, M, S, and CH leads to the driver circuit.

2.14 Rectifier circuit J87272A or J87272B in the 911B TSG furnishes +26 volts, +12 volts, and -12 volts for the 911B TSG. The rectifier furnishes +12 volts and -12 volts to the driver circuit and to the output units. The rectifier requires 1/3 ampere of 50- to 60-Hz ac power at 105 to 129 volts.

Note: The J87272B rectifier is the same as a J87272A except that the J87272B also provides at 200V 0.040A dc tap. This tap is used to drive the 911F distortion measuring set (DMS) display tubes, and has no application for the 911B TSG.

C. Driver Circuit

2.15 The driver circuit (Fig. 4) provides the means for controlling the 911B-type TSG and provides the signals for driving either up to 10 output units (J70162B-1) or up to 10 hub-signal output units (J70162C-1) and/or 10 neutral-signal output units (J70162D-1). The driver circuit consists of a relay driver (CP1), grid bias voltage divider (CP2), relay PR2, start relay ST, PR2 REL CAL potentiometer, and test jacks PR1 TST OUT and PR2 TST OUT.

2.16 A KS-19088-L1 connector cable (15 pins) plugs into the rear of the 911B-type TSG, and the other end of the connector cable is wired to various terminals in the driver circuit.

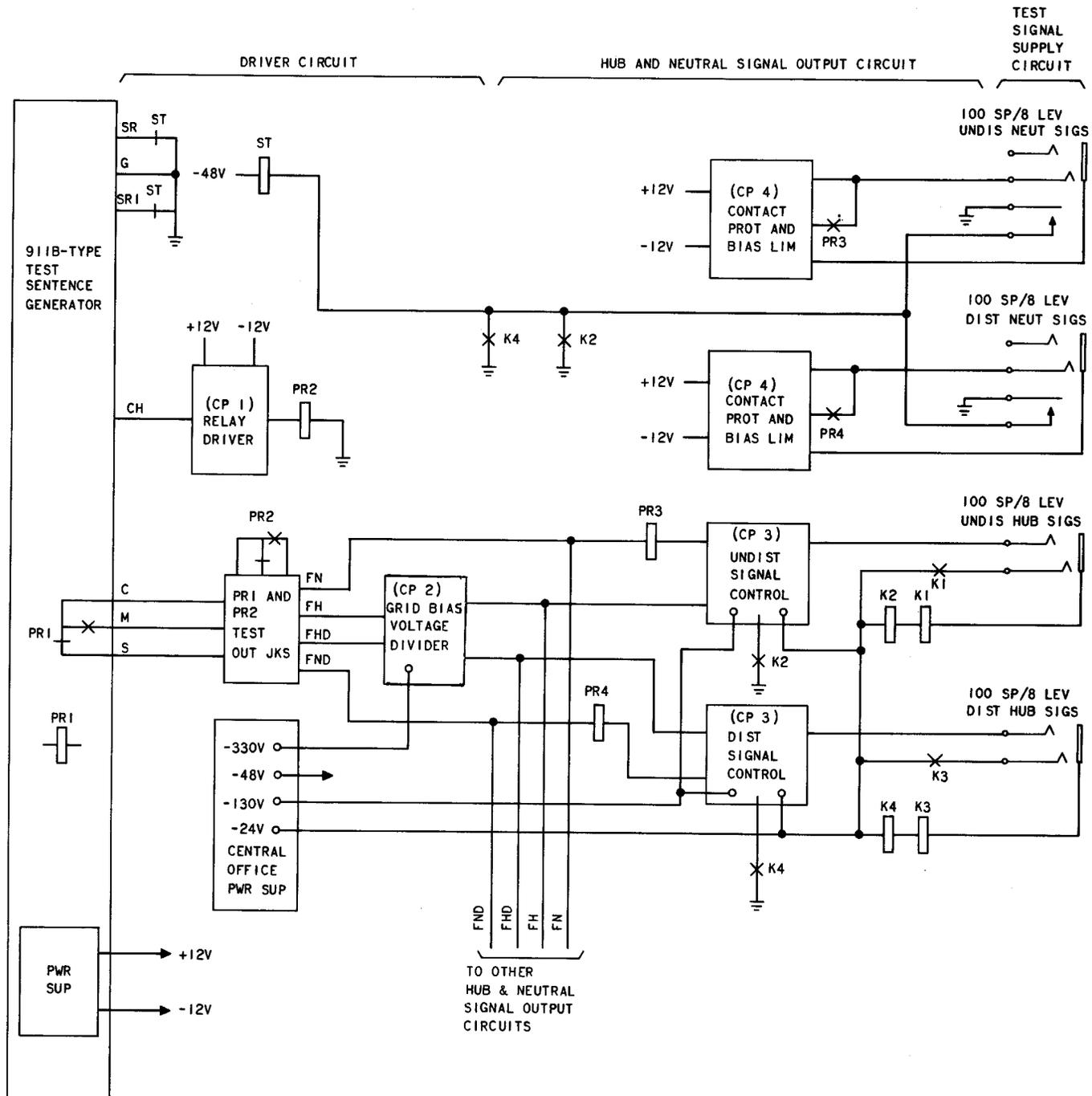


Fig. 4—110E1 Multiple Sender Circuit, Initial Configuration—Block Diagram

SECTION 103-806-104

2.17 The driver circuit requires -48 volts and -330 volts which are obtained from the central office -48 and -330 volt supplies. The +12 volts and -12 volts for the relay driver circuit pack are obtained from the J87272A or J87272B rectifier associated with 911B-type TSG.

D. Output Unit (J70162B-1)

2.18 Each output unit receives distorted and undistorted test signals from the driver unit and transmits distorted and undistorted hub and neutral signals to the corresponding test signal supply circuit jack appearances at the telegraph serviceboards.

2.19 Each output unit includes two signal control circuit packs (CP 3); two contact protection and bias limiting circuit packs (CP 4); polar relays PR3 and PR4; electron tubes V1 and V2; control relays K1, K2, K3, and K4; and four test signal supply jack circuits.

2.20 Relay PR3 repeats signals to the UNDIS NEUTRAL SIGS test jack at the telegraph serviceboards. Relay PR4 repeats signals to the DIST NEUTRAL SIGS jack. Tube V1 provides signals to the UNDIS HUB SIGS jack, and tube V2 provides signals to the DIST HUB SIGS jack.

2.21 Control relays K1 and K2 operate when a patch is made to the UNDIS HUB SIGS jack, and relays K3 and K4 operate when a patch is made to the DIST HUB SIGS jack. Control relays K1 and K3 complete the hub output circuits. Relays K2 and K4 control relay ST. When a patch is made to any test jack, relay ST operates and starts the 911B TSG. Relay ST also completes the circuit of the operating windings of relays PR3 and PR4 of all output units. When all patches are removed, relay ST releases, causing the 911B TSG to stop and reset. Thus, the test sentence starts at the beginning each time the multisender circuit is used.

2.22 Output unit jacks PR3 TST OUT and PR4 TST OUT are used when measuring and adjusting the bias of relays PR3 and PR4. These jacks are used to patch the relay outputs to DMS INPUT T jacks of the output units. The DMS INPUT T jacks are connected by lead M1 to the 911D or 911F distortion measuring set (DMS) at the telegraph serviceboard.

2.23 Output units require -24 and -130 volts which are obtained from taps on the office supplies, and +12 and -12 volts which are obtained from the rectifier in the 911B TSG.

E. Neutral- and Hub-Signal Output Units (J70162D-1 and J70162C-1)

2.24 Each neutral- and hub-signal output unit (Fig. 5) contains 10 output circuits which are driven by a distorted and undistorted drive circuit (CP 5). One CP 5 will provide both a distorted and an undistorted test signal output.

Distorted and Undistorted Drive Circuit

2.25 Each distorted and undistorted drive circuit (CP 5) receives distorted and undistorted test signals from the driver unit (J70162A-1) and repeats the test signals (at a reduced impedance) to the hub output circuit (CP 6) and/or the neutral output circuit (CP 7). Each CP 5 contains two driver circuits and is capable of driving up to ten hub- or neutral-output circuits with distorted or undistorted test signals.

2.26 Each hub- and neutral-signal output unit provides the connector for mounting CP 5. However, since one CP 5 will drive up to 20 circuits, only half of the output units will be equipped with CP 5.

Hub Output Circuit

2.27 Each of the hub output circuits (CP 6) provides an individual test signal output at jack appearances of the serviceboard. The input test signals from CP 5 may be either the distorted or undistorted signals. The hub output circuit, in addition to providing test signals at the serviceboard, may be used to drive a 911J Data Signal Distorting Set (DSDS). When the 911J DSDS is connected to a hub output circuit, the input to the hub output circuit must be connected to the undistorted output of CP 5. A ground or -48 volt potential applied to the sleeve of the test signal supply jack at the serviceboard will operate the SL relay on CP 6; and the SL relay, in turn, starts the 911B-type TSG.

Neutral Output Circuit

2.28 Each of the neutral output circuits (CP 7) provides an individual test signal output at

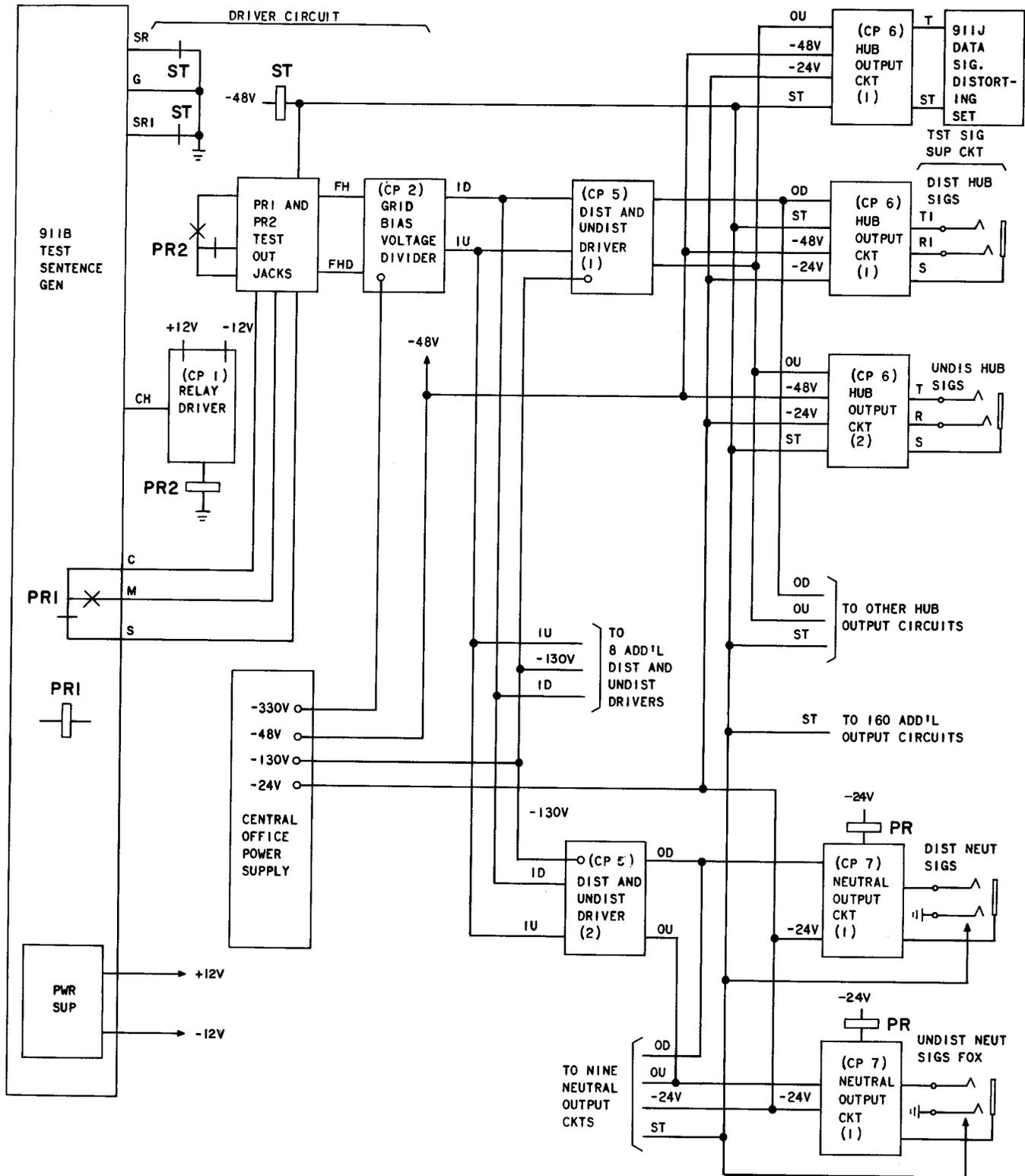


Fig. 5—110E1 Multiple Sender Circuit, Later Configuration—Block Diagram

SECTION 103-806-104

jack appearances of the serviceboard. The input test signals from CP 5 may be either distorted or undistorted signals. The output of CP 7 drives its PR relay. An incoming mark signal from CP 5 releases the PR relay which, in turn, closes the circuit between the ring and sleeve of the test signal supply jack circuit at the serviceboard. A space signal from CP 5 operates the PR relay which will open the ring-sleeve circuit to the serviceboard. An off-normal contact in the test signal supply jack at the serviceboard provides the start ground to operate the ST relay (driver unit) when a cord is inserted into the jack.

3. INSTALLATION

3.01 General: Multiple sender equipment should be mounted in bays located near the telegraph serviceboards. The control panel of the 911-type DMS is located in the telegraph serviceboard positions.

3.02 Translator Matrix Card: Before changing a translator matrix card, the rectifier should be turned off and the power cord plug and P1 connector should be removed. The 911B-type TSG should then be removed from its mounting. The translator matrix card should be carefully removed. The desired matrix card should be carefully inserted, making sure it is seated in its connector. The unit should be remounted in the framework, the cords reconnected, and the power turned on.

3.03 Relay Bias: A potentiometer is provided in the bias circuit of each polar relay to compensate for relay-introduced bias. Setting the bias of relay PR1 is the only adjustment required on the 911B-type TSG. A similar bias adjustment is required for relay PR2 of the driver circuit and for relays PR3 and PR4 in each of the initial configuration output units or the PR relays associated with the later neutral signal output units. The bias should be adjusted for minimum distortion as measured in the same type of loop that it will be used for (eg, ± 130 volt .0625 ampere, +130 volt .020 ampere etc.). Polar relay bias adjustments should be checked when relays are replaced and occasionally during operation by measuring distortion with the 911D DMS. Tubes in the 911D or 911F DMS display the amount of distortion in the signals. For adjusting relay bias, the controls on the 911B-type TSG and 911-type DMS should be set as indicated in Table A.

3.04 The following steps should be performed to adjust the bias of relay PR1 in the 911 TSG.

- (1) Patch PR1 TST OUT jack of driver circuit to DMS INPUT T jack, using a 3-conductor cord equipped at each end with 310 plugs (P3E cord, or equivalent).
- (2) Adjust REL CAL potentiometer on 911B TSG control panel for minimum bias reading on the 911-type DMS.
- (3) Remove patch cord.

3.05 The following steps should be performed to adjust the bias of relay PR2 in the driver circuit.

- (1) Patch PR2 TST OUT jack to DMS INPUT T jack.
- (2) Adjust PR2 REL CAL potentiometer on driver unit for minimum bias reading on 911-type DMS.
- (3) Remove patch cord.

3.06 The following steps should be performed to adjust the bias of relays PR3 and PR4 in each of the initial configuration output units.

- (1) Patch PR3 TST OUT jack on output unit to DMS INPUT T jack.
- (2) Adjust PR3 REL CAL potentiometer for minimum bias reading on 911-type DMS.
- (3) Patch PR4 TST OUT jack to DMS INPUT T jack.
- (4) Adjust PR4 REL CAL potentiometer for minimum bias reading on 911-type DMS.
- (5) Repeat Steps 1 through 4 for relays PR3 and PR4 in each output unit.
- (6) Remove patch cord.

3.07 The following steps should be performed to adjust the bias of the PR relays in each of the later configuration neutral-signal output units.

TABLE A
CONTROL SETTINGS FOR RELAY BIAS ADJUSTMENT

UNIT	SWITCH	SETTING
911B TSG	AUTO MAN STEP BAUDS BIAS CODE DIST 1% DIST 5% OUTPUT REPEAT RY OR U*	AUTO 74.2 or 110 0 5/7.0 or 8/11 0 0 REL OFF OFF
911-type DMS	BAUDS CODE DISCR % FILTER PARITY PIP-PK	(To agree with 911B TSG) (To agree with 911B TSG) 0 OUT OFF PIP

Note: The switch for input-type selection is not provided on the 911D DMS. The EIA input setting is permanently wired within the card unit.

- (1) At the serviceboard test signal supply jack appearance, connect the 911-type DMS to the jack associated with the neutral output circuit to be adjusted.
 - (2) Adjust PR REL CAL potentiometer for minimum bias reading on 911-type DMS.
 - (3) Repeat Steps 1 and 2 for PR relays associated with each neutral output circuit.
 - (4) Remove the connection to the neutral output circuit.
 - (5) Repeat Steps 1 through 4 for the PR relays in each neutral output circuit to be adjusted.
- 3.08** The following steps should be performed to check the distorted test output.
- (1) Patch PR1 TST OUT jack of driver circuit to DMS INPUT T jack.
 - (2) Operate DIST 1% switch to 3 and DIST 5% switch to 20 on the 911B TSG.
 - (3) Operate BIAS switch to MB, SB, SWB, SWE, and SWC in turn on the 911B TSG.
 - (4) The 911-type DMS should indicate the amount and type of distortion within ± 1 percent in each case.
 - (5) Return BIAS, DIST 1%, and DIST 5% switches to positions as required by local office requirements.
 - (6) Remove patch cord.
- 3.09 Driver Circuit:** The grid bias voltage divider circuit connects to a tap on the office -330 volt bias supply circuit. The driver circuit also requires -48 volts from the office supply and +12 and -12 volts from the rectifier in the 911B TSG. Leads FH, FHD, FN, FND, ST and ON connect to output unit number one. These leads parallel from output unit one to two, two to three, etc.
- 3.10 Output Unit:** Test points FIL + and F - on the output units are used when measuring filament voltage. Filament voltage is obtained from the -24 volt office supply and is adjusted to 20

volts by means of the FIL ADJ potentiometers on the output units.

Note: The later configuration output units do not require any filament adjustment.

4. OPERATION

4.01 For normal telegraph serviceboard testing, the 110E1 Multiple Sender Circuit is arranged to produce the standard FOX test sentence. For special tests, the repeated RY (U*) sequence, a specific repeated single character, or manual stepping of the test output may be desirable.

4.02 All serviceboard test signal supply circuit jack appearances can start, stop, and reset the 911B TSG. When all jacks are free from patches, the 911B TSG maintains a steady mark to all outputs. Patching to any output jack will start the 911B TSG, and test signals will appear at all output jacks. When all patch cords are removed, the 911B TSG will stop sending the test sentence, reset, and provide a steady mark output.

4.03 Two types of translator matrix cards are provided—CP 5D for the 5-element code and CP 5C for 8-element code signals. The translator matrix card must be changed when switching from the 5-element to the 8-element code positions of the CODE switch.

4.04 The code, speed, amount, and type of distortion of the test signals are selected by controls on the 911B TSG. Distortion control settings do not affect the undistorted test signal output on the CH lead. The OUTPUT switch must be set to REL to provide distorted test signals on the C, M, and S leads. The CODE and BAUD switches determine the code and speed of the test signals at all jack appearances at the serviceboards. Table B provides the position designations, meanings, and functions of the 911B TSG control switches.

4.05 Repeated Character: When a repeated character from the word generator is desired, the connection between the character counter and the 7-stage counter is opened by operating the REPEAT switch to ON. The 7-stage counter will

now remain fixed, and the same character will be read out on a repeated basis either automatically or manually, depending on the position of the AUTO. MAN. STEP switch.

4.06 Manual Stepping: To manually control the time at which a character is generated, the MAN. flip-flop is set by momentarily operating the AUTO. MAN. STEP switch to STEP. The MAN. flip-flop then enables the character counter, which counts the bits for one character. At the end of the character, the 7-stage counter advances one, the character counter resets itself, and the MAN. flip-flop is cleared. The MAN. flip-flop clears the character counter and the element counter. To generate the next character, the AUTO. MAN. STEP switch again is operated momentarily to STEP.

4.07 Special Sequence: Translator matrix J79911BF-2 (8-element code) is wired to generate the character U (1010101) when the 7-stage counter registers count 127, and to generate the character * (0101010) when the 7-stage counter registers count 128. Translator matrix J79911BG-2 (5-element code) is wired to generate the characters R and Y on counts 127 and 128. The state of the 7-stage counter is (0111111) when registering count 127, and (1111111) when registering count 128. When the RY OR U* switch is ON, stages 2 through 7 of the 7-stage counter are held set while the first flip-flop remains free. The 7-stage counter will step from count 127 to 128 to 127, etc. The word generator output is a repeated sequence of U*s or RYs.

4.08 Parity Check: Translator matrix J79911BF-2 is wired to generate an even parity check bit as the eighth bit of the 8-element code. The eighth bit (for even parity) will produce an even number of mark bits for each character (eg, if the character has an odd number of mark bits in bits one through seven, the eighth bit will be mark to make an even number of mark bits). The parity check bit is generated when the CODE switch is in the 8/10 and 8/11 positions. When the parity check bit is not generated, the matrix output is a mark for the eighth bit.

TABLE B
911B TSG CONTROLS

SWITCH	POSITION	MEANING	FUNCTION
AUTO.MAN.STEP	AUTO†	Automatic	Automatic transmission of test sequence
	MAN	Manual	Stops transmission, marking outputs.
	STEP	Step	Provides manual stepping of test sequence to provide one character at a time.
BAUDS‡	45.5	45.5 bauds	60 word-per-minute 3-row KB, 5/7.42 code
	56.9	56.9 bauds	75 word-per-minute 3-row KB, 5/7.42 code
	74.2	74.2 bauds	100 word-per-minute 3-row KB, 5/7.42 code
	75.0	75.0 bauds	100 word-per-minute 7 element — Government speed, 5/7.0 code
	61.1	61.1 bauds	Government speed, synchronous
	148	148.5 bauds	200 word-per-minute 3-row KB, 5/7.42 code
	110	110 bauds	100 word-per-minute 4-row KB, used with 8/11M or 8/11 code
	150	150 bauds	150 word-per-minute 4-row KB, used with 8/10 code
			Reserved for future use
	EXT CLK	External clock	Used when crystal is not provided for baud rate desired
BIAS	0	Zero bias	Undistorted signals
	MB	Marking bias	Distortion — Marking bias per amount of DIST 1% & DIST 5% switch settings
	SB	Spacing bias	Distortion — Spacing bias per amount of DIST 1% & DIST 5% switch settings
	SWB	Switched bias	Distortion — Alternate MB & SB per amount of DIST 1% & DIST 5% switch settings
	SWE	Switched end distortion	Distortion — Alternate ME & SE per amount of DIST 1% & DIST 5% switch settings
	SWC	Switched combination	Distortion — Alternate MB, SB, ME, & SE per amount of DIST 1% & DIST 5% switch settings

TABLE B (Cont)

SWITCH	POSITION	MEANING	FUNCTION
CODE	5/7.42	5-element code 1.42 stop pulse	3-row teletypewriter stations — 5-element matrix card installed
	5/7.0	5-element code 1.0 stop pulse	Government stations — Simulate 6/6 synchronous by sending this code. 5- element matrix card installed
	5/7.5	5-element code	European teletypewriter stations — 5- element matrix card installed
	6/8	6-element code 1.0 stop pulse	Reserved for future — 5-element matrix card installed
	7/9	7-element code 1.0 stop pulse	Reserved for future — 8-element matrix card installed
	8/10	8-element code 1.0 stop pulse	4-row teletypewriter stations — (37), 8-element matrix card installed
	8/11M	8-element code 2.0 stop pulse	100 word-per-minute 4-row KB, 8th ele- ment always mark, 8-element matrix card installed
	8/11	8-element code 2.0 stop pulse	100 word-per-minute 4-row KB, 8th ele- ment even parity, 8-element matrix card installed
DIST 1%	0 - 4	0 to 4 percent	Adjust percent of distortion in 1% steps from 0% to 4%
DIST 5%	0 - 45	0 to 45 percent	Adjust percent of distortion in 5% steps from 0% to 45%
REPEAT	OFF† ON	Repeat character	Repeated transmission of a selected character
RESET	—	Reset	Reset test sentence to beginning of sen- tence
RY OR U*	OFF† ON	Send RY or U*	Generate repeated RY for 5-element code or U* for 8-element code
OUTPUT	REL CAL	Relay calibrate	For calibration of PR1 relay
	REL†	Relay	Dry contact signals to REL OUT jack and to leads C, M, and S
	NORM	Normal	Voltage signals (+9 volts mark, grd space)
	REV	Reverse	Voltage signals (grd mark, +9 volts space)
	EIA	Electronics Industries Association	Voltage signals (-12 volts mark, +12 volts space)

† Switch settings of 911B TSG when used with 110E1 multiple sender for normal operation. OUTPUT switch must be set to REL for all cases.

‡ The 911B-2 numerical switch settings may or may not be equipped with the same baud rates as shown in the position column. Local requirements will determine the baud rate for each numerical position. Refer to the P-46U504 BAUD SETTINGS information plate for specific baud rate at each setting.

4.09 Reversals: The 911B TSG may be used as a square-wave generator when 8-level translator matrix J79911BF-2 is used. The controls should be set as follows:

SWITCH	SETTING
BAUD	Desired speed
BIAS	0
CODE	8/10
DIST 1%	0
DIST 5%	0
REPEAT	ON
RY OR U*	ON
RESET	Operate momentarily.

5. THEORY OF OPERATION

A. 911B Test Sentence Generator

5.01 The 911B TSG (Fig. 4 and 5) provides the source of the test signals for the 110E1 Multiple Sender. The 911B TSG circuits are arranged to provide two test signal outputs and a remote test start, stop, and reset of the test signals. In addition, the J87272-type rectifier provides +12 volts and -12 volts to the driver circuit.

5.02 The two test signal outputs of the 911B TSG are distorted and undistorted test signals.

5.03 The distorted test signals are generated by the PR1 relay of the 911B TSG. The amount and type of distortion is selected by the BIAS, DIST 1%, and DIST 5% controls on the front of the 911B TSG.

5.04 The undistorted test signals are furnished to the driver circuit via the CH lead. The test signals on the CH lead are not under control of the distortion controls of the 911B TSG.

5.05 Detailed operation of the 911B TSG is covered in the section entitled 911A,B, and C Data Test Sets—Description, Operation, and Maintenance (103-813-100).

B. Driver Circuit (J70162A-1)

5.06 The driver circuit receives distorted test signals from the 911B TSG over leads C, M, and S, and undistorted signals are received over lead CH. Leads SR, SR1, and G are for start, stop, and reset controls of the 911B TSG. Ground is applied to leads SR and SR1 when relay ST releases. Lead G provides the ground circuit between the driver circuit unit and the 911B TSG.

5.07 Undistorted signals on lead CH are applied to the relay driver (CP1). The relay driver in turn controls relay PR2, which is released for mark and operated for space. Contacts of relay PR2 provide undistorted hub and neutral outputs. The undistorted neutral output appears on lead FN as ground for mark and open for space.

5.08 The grid bias voltage divider (CP 2) of the driver circuit requires -330 volts from a bias supply circuit. The undistorted hub output appears on lead FH as a high negative voltage for mark and as a lower negative voltage for space.

5.09 The distorted neutral signals appear on lead FND as ground for mark and open for space. Distorted hub signals appear on lead FHD as a high negative voltage for mark and as a lower negative voltage for space.

C. Output Circuit (J70162B-1)

5.10 Undistorted signals received from the driver circuit on lead FN operate relay PR3 (Fig. 4). Relay PR3 contacts repeat undistorted neutral signals to the UNDIS NEUTRAL SIGS test jack at the telegraph serviceboard. Similarly, distorted signals from the driver on lead FND operate relay PR4. Relay PR4 contacts repeat distorted neutral signals to the DIST NEUTRAL SIGS test jack.

5.11 Undistorted signals on lead FH appear as high negative voltage for mark and cause electron tube V1 to cut off. When V1 is cut off and the UNDIS HUB SIGS test jack is connected to a hub potentiometer, +60 volts appears at the UNDIS HUB SIGS test jack on lead T to represent a mark. The lower negative voltage on lead FH, for space, makes the grid of V1 positive with respect to its cathode. Electron tube plate current is 30 mA and the voltage at the test jack lead T becomes -30 volts, which represents a space.

SECTION 103-806-104

Distorted signals received on lead FHD as similar negative voltages control electron tube V2. The output at the DIST HUB SIGS test jack lead T2 also is +60 volts for mark and -30 volts for space when connected to a hub potentiometer.

D. Distorted and Undistorted Drive Circuit (Fig. 5)

5.12 The distorted and undistorted drive circuit (CP 5) receives distorted and undistorted test signals from the grid bias voltage divider (CP 3). The distorted signal is approximately -182 volts for a mark and -150 volts for a space, while the undistorted signal is approximately -150 volts for a mark and -100 volts for a space. The incoming voltage signals are converted by CP 5 to ground for a mark and -22 volts for a space. Either distorted or undistorted signals are used to drive the hub- or neutral-signal output supply circuits.

E. Hub-Signal Output Circuit

5.13 The incoming distorted or undistorted mark signal (ground) from CP 5 conditions the output of the hub-signal output circuit (CP 6) to be cut off. When connected to a hub potentiometer, the +60 volt hub potential (mark) will not be affected. A space signal (-22 volts) causes CP 6 to conduct to the hub potentiometer and the 30-mA current flow lowers the hub potential to the -30 volt space signal.

5.14 When a cord is inserted into the hub signal test signal supply jack at the serviceboard, the ground or -48 volt potential on the sleeve of the cord will operate the SL relay on CP 6 which will start the driver unit.

5.15 In addition to providing hub-type test signals to the serviceboard, the hub signal output circuit may also be used to furnish undistorted test signals for the 911J DSDS (J79911J).

F. Neutral-Signal Output Circuit

5.16 The incoming distorted or undistorted mark signal (ground) from CP 5 conditions the PR relay associated with the neutral-signal output circuit to its released position. The released PR

relay closes the path between the ring and sleeve of the neutral-signal test signal supply jack at the serviceboard. A space signal (-22 volts) causes the PR relay to operate, which opens the path between the ring and sleeve, and in turn opens the loop.

5.17 When a cord is inserted in the neutral-signal test signal supply jack appearance at the serviceboard, an off-normal contact in the jack provides the ground to operate the ST relay in the driver unit to start the driver unit.

G. Test Signal Supply Circuit Jack Appearances

5.18 Distorted and undistorted hub test signals appear at the tips of the corresponding FH and FHD jacks at the serviceboard for the initial configuration and at the DIST and UNDIS HUB SIGS jacks for the later configuration. Serviceboard circuits which connect to hub output test jacks must include a half-duplex hub potentiometer. The output circuit draws 30 mA from the hub potentiometer circuit for a space, and output circuit is cut off for a mark. The half-duplex hub voltage is +60 volts for a mark and -30 volts for a space.

5.19 Distorted and undistorted neutral test signals appear between the ring and sleeve of the corresponding FN and FND jacks at the serviceboard for the initial configuration, and at the DIST NEUT SIGS and UNDIS NEUT SIGS FOX jacks for the later configuration. The type and amount of distortion is preset at the bay containing the 110E1 Multiple Sender.

6. REFERENCES

6.01 The following sections pertain to the 110E1 Multiple Sender.

911A, B, and C Data Test Sets—

103-813-100 Description, Operation, and Maintenance

No. 2 Telegraph Serviceboard—

666-101-100 Description and Operating Principles

666-101-500 Method of Operation

No. 9B Telegraph Serviceboard—

666-102-100 Hub Operation

6.02 The following schematic drawings (SDs) and circuit descriptions (CDs) pertain to the equipment required for a 110E1 Multiple Sender installation.

SD- & CD-70592-01 Telegraph Serviceboards No. 2 and 9B, Test Signal Supply Circuit

SD- & CD-70627-01 -330 Volt Bias Supply Circuit

SD- & CD-70937-01 911B Test Sentence Generator

SD- & CD-70939-01 No. 110E1 Multiple Sender Circuit

SD- & CD-70940-01 911D Distortion Measuring Set

SD- & CD-70952-01 911F Distortion Measuring Set

SD- & CD-81867-01 Rectifier for 911B TSG.