

DATA SIGNAL DISTORTING SET 911J

DESCRIPTION AND OPERATION

1. GENERAL

1.01 This section provides physical and functional descriptive information to aid in the installation, operation, and maintenance of the Data Signal Distorting Set 911J.

1.02 The Data Signal Distorting Set 911J provides a means for precise distortion control of serial data test signals. The types of distortion available from the 911J are marking bias (MB), spacing bias (SB), switched bias (SWB), switched end distortion (SWE), switched combination distortion

(SWC), and switched narrow distortion (SWN). The types of distortion are shown pictorially in Fig. 1. The amount of distortion available from the 911J is variable, in 1 percent increments, from 0 to 49 percent for all codes and speeds except the single STOP pulse code which is variable from 0 to 44 percent and SWN which is fixed at 10 percent and 15 percent.

1.03 The 911J introduces distortion by displacing the signal elements mark-to-space (MS) transition or the space-to-mark (SM) transition.

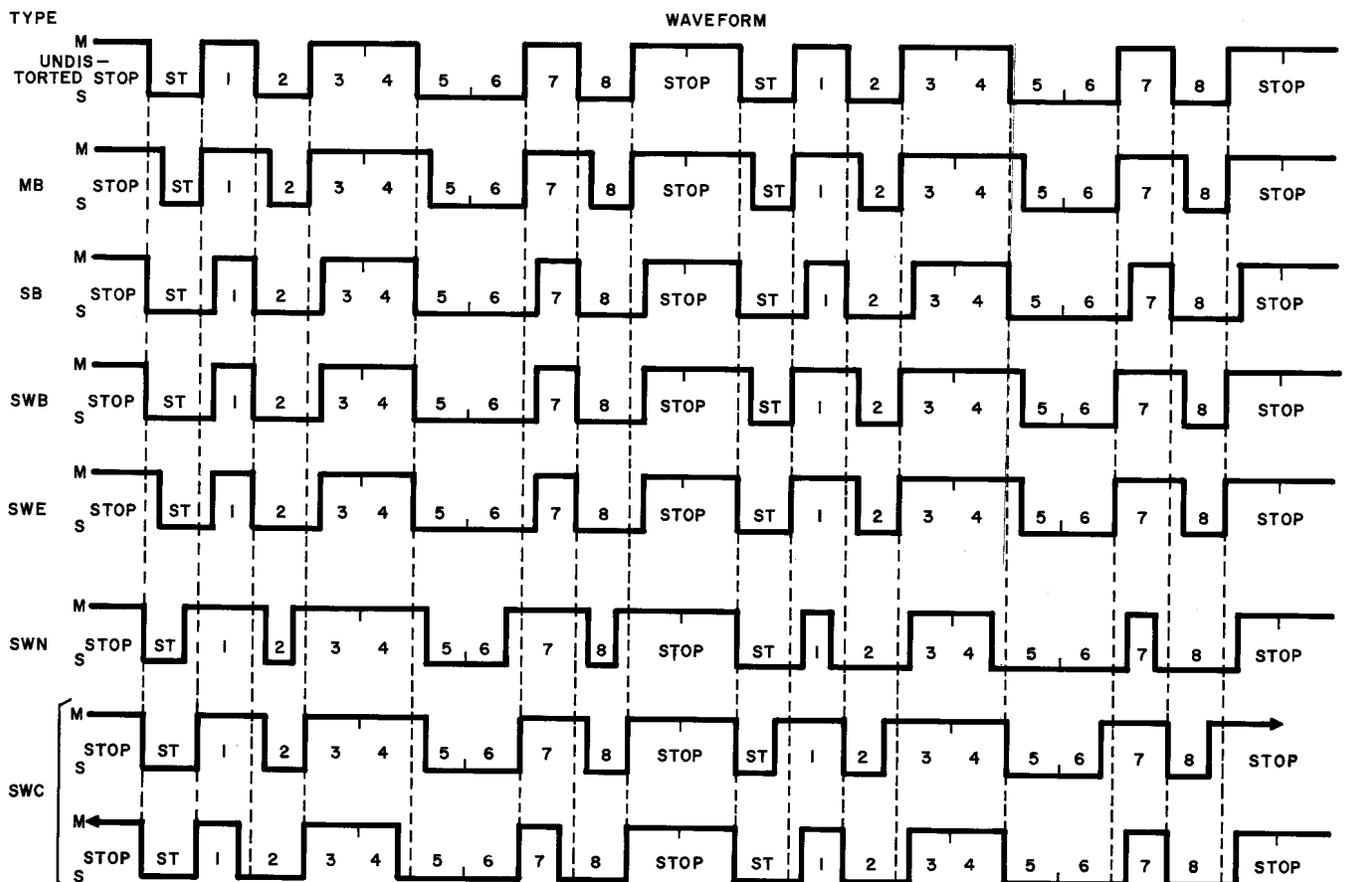


Fig. 1—Data Signal Distorting Set, Types of Distortion

1.04 The Data Signal Distorting Set 911J is developed for application to single or multiple installations of Telegraph Serviceboards No. 2 and 9B and the Data Observing Test Center (DOTC) developed by Long Lines. The 911J is primarily of solid state circuitry mounted on printed wiring boards. The printed wiring boards are enclosed in an electronic unit that is approximately 23 inches by 7 inches high by 8 inches deep. The electronic unit may be associated with a maximum of five control and display panels located in the serviceboard positions. The control panel used in the No. 2 Serviceboard is 7-3/4 inches square and the control panel used in No. 9B and DOTC serviceboards is 3-3/4 inches high by 12-1/2 inches wide.

2. IDENTIFICATION

2.01 A complete Data Signal Distorting Set 911J consists of an electronic unit, a control panel, and a rectifier power supply (Fig. 2). An exclusion unit (911K), optional for the installation, allows for use of a single electronic unit by a maximum of five control positions. The length of cabling between the electronic unit, the control panel(s), and output jacks should be limited to a maximum of 200 feet.

2.02 The Data Signal Distorting Set 911J can be used for any existing teletypewriter code and speed up to 200 bits per second. Selection of

the code to be generated is obtained by positioning the CODE switch (S7) on the control panel. The code may be one of the following: 5, 6, 7, 8, 9, 10, 11, 12, or 13 information elements with a STOP pulse of one or more element lengths. Selection of the speed is controlled by the BAUDS switch (S4) on the control panel. The BAUDS switch operates one of 22 relays within the electronic unit to select the desired speed. Position 23 of the BAUDS switch is reserved to allow speed switching to be made by the class of service lead to the diode matrix, when developed.

2.03 Circuit conditioning to match input signals is controlled by the INPUT switch (S6) located on the control panel. The electronic unit will accept any of the following inputs.

- (1) **HD position**—In this position, the input of the electronic unit is connected to the built-in half-duplex hub potentiometer driven by the 110C1 or 110E1 multiple sender. A marking signal causes no current drain from the hub potentiometer. The voltage at the input will be +60 volts. A spacing signal causes a current of 30 ma to flow from the hub potentiometer and the input will change to -30 volts.
- (2) **20R position**—In this position the electronic unit will recognize a mark at the input as

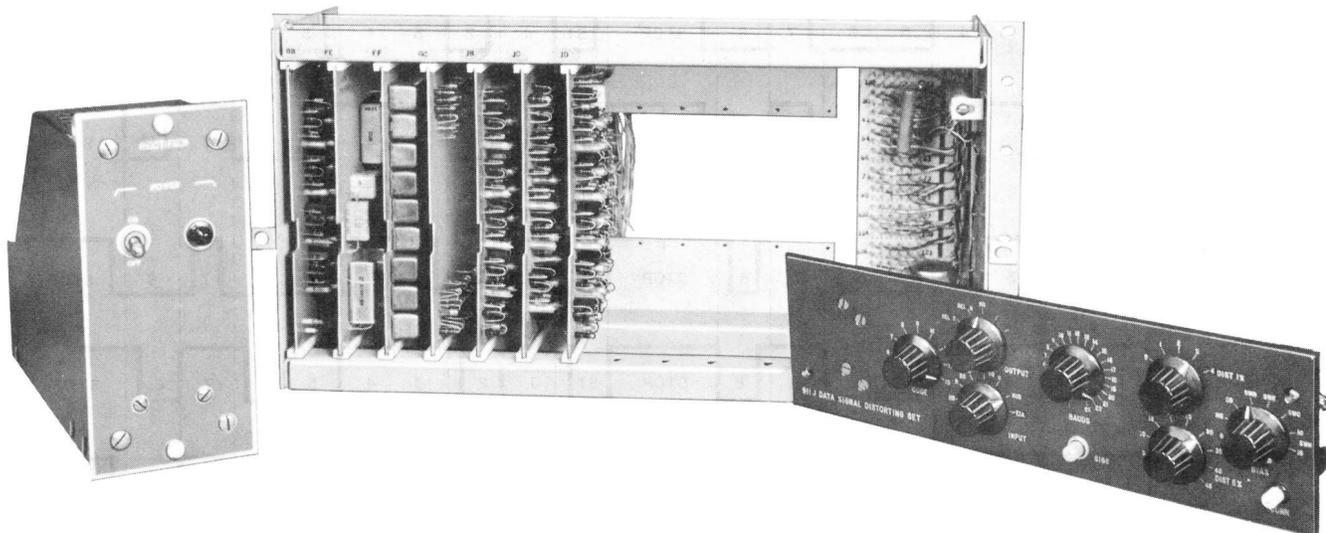


Fig. 2—Data Signal Distorting Set 911J

0.0 ma current and a space as a positive 20 ma current.

(3) **20N position**—This position is the same as 20R position except that mark and space condition is reversed.

(4) **60R position**—In this position the electronic unit will recognize a mark at the input as 0.0 ma current and a space as a positive 60 ma current.

(5) **60N position**—This position is the same as 60R position except that mark and space condition is reversed.

(6) **HUB position**—In this position the electronic unit will accept hub signals, +60v for mark and -30v for space.

(7) **EIA position**—In this position the electronic unit recognizes a negative 12 volts for a mark and a positive 12 volts for a space.

2.04 The type of distortion to be introduced is controlled by the BIAS switch (S1) while the amount of distortion is controlled by the DIST 1 percent switch (S2) and the DIST 5 percent switch (S3).

(a) When the BIAS switch is in the "0" position there will be no distortion introduced at the output of the distortion set and the set will regenerate and repeat incoming signals.

(b) The incoming signals are sampled at the first quarter point of each element to determine whether the element being sampled is a mark or a space and a new element of proper length for the code and speed is generated by the input circuitry.

(c) This allows the unit to accept incoming signals containing distortion up to 20 percent and to produce undistorted signals with a corresponding 25 percent element displacement between the input and output signals.

(d) The 25 percent element displacement is not distortion, but is merely a time delay between the input and output signal.

(e) This element displacement should not be confused with the shift in mark-to-space or

space-to-mark transitions that are made when distortion is introduced to the signal.

(f) In the MB, SB, SWB, SWE, and SWC positions the type of distortion generated corresponds to the examples shown in Fig. 1.

(g) The amount of distortion is controlled by positioning the DIST 1 percent and DIST 5 percent to the desired distortion level.

(h) In the SWN 10 and SWN 15 positions the amount of distortion is controlled entirely by the BIAS switch. The 10 and 15 represent the percent of shift of the leading and trailing edges of the distorted elements. The standard element is shortened 20 percent for the SWN 10 position and the standard element is shortened 30 percent for the SWN 15 position.

2.05 A SIGS lamp is provided on the control panel that will be lighted when mark signals are present at the output of the electronic unit.

2.06 A CONN switch is provided on the control panel that is used to obtain access to the electronic unit in multiple installations where an exclusion circuit 911K is provided. When a test position has obtained access, the exclusion circuit is arranged to prevent any of the remaining test positions from obtaining simultaneous access.

(a) A BSY lamp is associated with each CONN switch on every control panel. When any test position has obtained access to the electronic unit, the BSY lamp on the other associated test positions will light. If during the BSY period another test position desires access, and closes the CONN switch, the BSY lamp at the using position will then flash at a 60 IPM rate.

3. OPERATION

3.01 The Data Signal Distorting Set 911J (Fig. 3) has been designed for use with a maximum of five control panel positions. Codes and speeds may be switched manually or by the class of service lead to the diode matrix when developed.

(a) A clock frequency 100 times the bit rate of the INPUT signal is used for timing and distortion control. These frequencies may be generated internally (17 frequencies maximum), or connected from an external clock source (22

frequencies maximum). Internal and external clock sources cannot be used in combination.

(b) Because of the variety of options available for the 911J, a detailed knowledge of individual installation configuration is necessary for optimum utilization of the set.

3.02 The INPUT and OUTPUT jack appearances for the 911J will normally be located in the jack field of the serviceboard adjacent to the 911J control panel; however, they may be located at any point up to 200 feet from the control panel when required. For a single serving position installation, the INPUT and OUTPUT jacks are connected through the control panel INPUT and OUTPUT switches directly to the 911J electronic unit. In a multiple position installation, the INPUT and OUTPUT circuits are connected to the electronic unit through the exclusion circuit (911K) which prohibits use of the electronic unit by more than one serving position at any time. Option V provides a strap to bypass the function of the CONN switch so that a bid for access to the electronic unit will be made at any time a cord is connected to the OUTPUT. Option V is particularly useful when the OUTPUT jack appearances are remote from the control panel.

3.03 BAUDS SWITCH: The Data Signal Distorting Set 911J requires selection of a clock frequency to satisfy each specific test condition. This frequency selection is controlled by the BAUDS switch located on the control panel. Functions of the BAUDS switch are outlined in Table A. When option Z is provided, crystals are installed for operation at the five commonly used baud rates and only the first five positions of the BAUDS switch will be active.

(a) For hub drive operation (INPUT switch in HD position) the input to the set is keyed from the 110C1 or 110E1 multiple sender. The multiple sender provides a separate output lead for each different speed or code. The first five positions of the 911J BAUDS switch will select the appropriate multiple sender output lead and connect it to the 911J input. At the same time, the BAUDS switch will also connect the correct clock frequency to the clock input.

3.04 The Data Signal Distorting Set 911J will accept a variety of input signals, regenerate input signals that contain 20 percent or less distortion,

and introduce a precisely controlled distortion to the signals at the output jacks. Table B outlines the functions of the INPUT, OUTPUT, CODE, BIAS, and DISTORTION switches.

3.05 INPUT SWITCH: The INPUT switch has seven functional positions to condition the 911J for recognition of the several types of input signals.



The proper input jack must be selected for the type of signal being introduced to the 911J or damage to the 911J might result.

(a) The HD position of the INPUT switch is used to generate a distorted signal when no input hub or line signal is available. In this position the input is received from the 110C1 or 110E1 multiple sender. Positions one through six of the BAUDS switch will control the bauds rate of the input as shown in Table A.

(b) The 20R, 20N, 60R, and 60N positions of the INPUT switch condition the 911J to receive 20 or 60 ma neutral signals. The input cord should be connected to the 20 or 60 MA IN jack. The INPUT switch reverses the input circuit connections depending upon whether a current or no current is to represent a marking condition as indicated in Table B.

3.06 OUTPUT SWITCH: The REL "R" and REL "N" positions of the OUTPUT switch provide relay contact closures at the REL OUT jack. The position to use is determined by whether a closed contact represents a mark or a space as shown in Table B.

(a) The HD position of the OUTPUT switch provides half-duplex No. 2 hub pot drive signals (+60v mark -30v space) at the HD OUT jack.

3.07 CODE SWITCH: The CODE switch of the Data Signal Distorting Set 911J has nine positions that condition the set to accept and introduce distortion to signals with 5 to 13 information elements. Each input character may contain a single start element and a stop element of one or two element lengths. The 911J will accept any signal from a 5/7 code to a 13/16 code by placing the CODE switch in the position

TABLE A

BAUDS SWITCH FUNCTIONS — 911J

SWITCH POSITION	EXTERNAL CLOCK CIRCUIT SELECTED	RELAY OPERATED		INTERNAL CRYSTAL SELECTED	OPERATING FREQUENCY RANGE KILOHERTZ	OPTION Z BAUDS RATE
1	EC1	C L O C K B O A R D CP7	K1	CR1	4.0 to 5.5	45.5 (60 speed 3 row)
2	EC2		K2	CR3	5.6 to 7.6	56.9 (75 speed 3 row)
3	EC3		K3	CR6	5.6 to 7.6	74.2 (100 speed 3 row)
4	EC4		K4	CR12	7.7 to 20.0	110.0 (100 speed 4 row)
5	EC5		K5	CR15	7.7 to 20.0	150.0 (150 speed 4 row)
6	EC6	C L O C K S E L E C T O R R E L A Y B O A R D CP6	K1	CR2	4.0 to 5.5	_____
7	EC7		K2	CR4	5.6 to 7.6	_____
8	EC8		K3	CR5	5.6 to 7.6	_____
9	EC9		K4	CR7	5.6 to 7.6	_____
10	EC14		K5	CR16	7.7 to 20.0	_____
11	EC17		K6	CR17	7.7 to 20.0	_____
12	EC12		K7	CR10	5.6 to 7.6	_____
13	EC13		K8	CR11	7.7 to 20.0	_____
14	EC16		K9	CR8	5.6 to 7.6	_____
15	EC15		K10	CR14	7.7 to 20.0	_____
16	EC10		K11	CR13	7.7 to 20.0	_____
17	EC11		K12	CR9	5.6 to 7.6	_____
18	EC18		K13	—	_____	_____
19	EC19		K14	—	_____	_____
20	EC20		K15	—	_____	_____
21	EC21		K16	—	_____	_____
22	EC22		K17	—	_____	_____
23	Conditions Set For Switching By Class Of Service Lead to Diode Matrix					

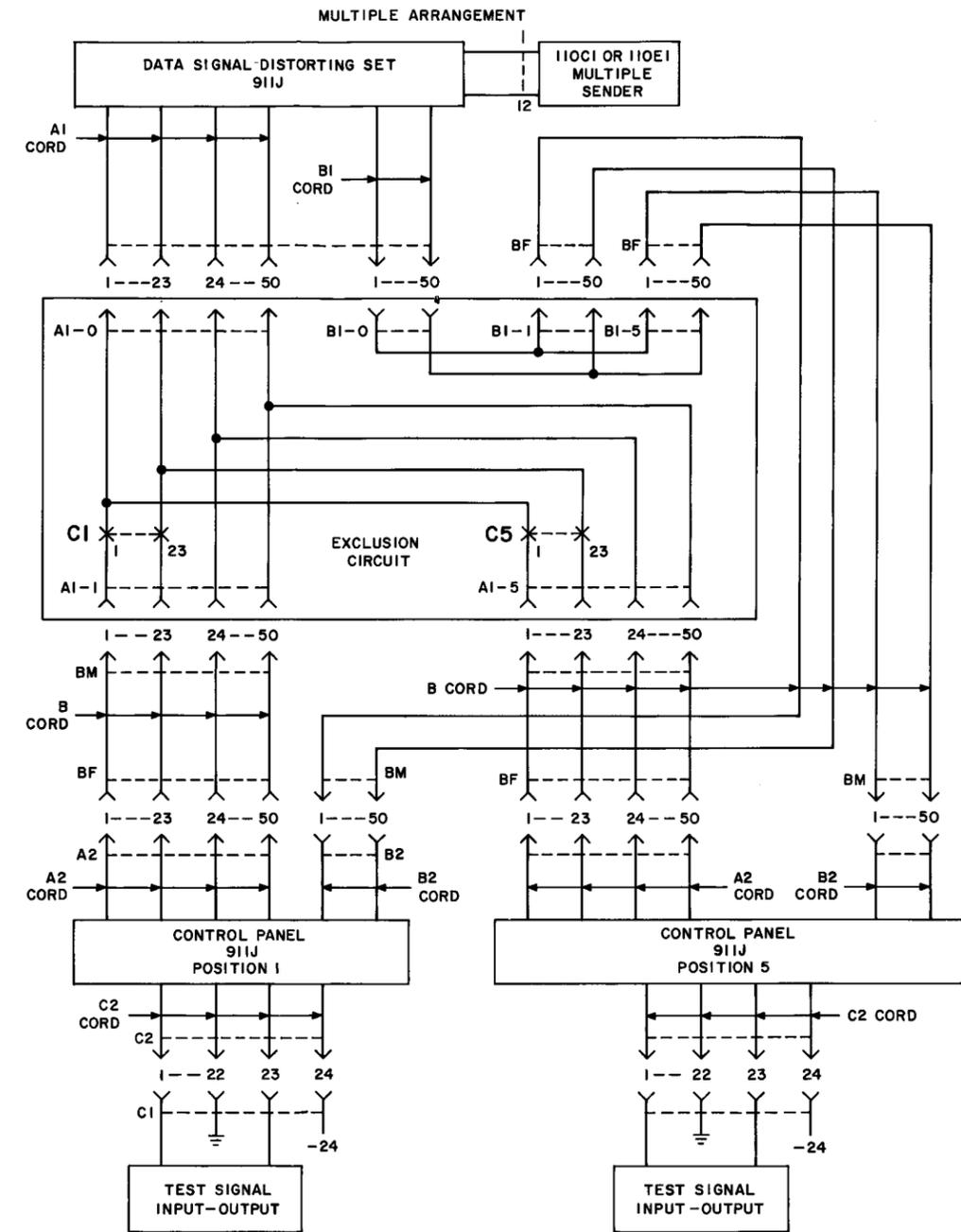
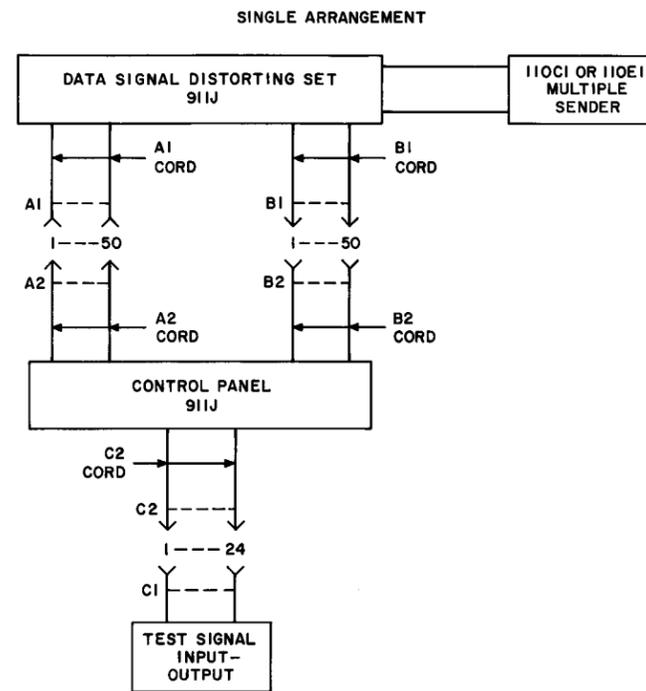


Fig. 3—Data Signal Distorting Set 911J, Arrangement For Single and Multiple Installation

TABLE B

DATA SIGNAL DISTORTING SET 911-J — SWITCH FUNCTIONS

SWITCH	POSITION DESIGNATION	MEANING	FUNCTION
INPUT	HD	Hub Drive	Input Is Taken From 110C Or 110E Multiple Sender Through Positions 1-5 Of Bauds Switch
	20R	20ma Neutral Signals	Set Conditioned To Recognize 0.0ma As A Mark And 20ma As A Space
	20N		Set Conditioned To Recognize 20ma As A Mark And 0.0ma As A Space
	60R	60ma Neutral Signals	Set Conditioned To Recognize 0.0ma As A Mark And 60ma As A Space
	60N		Set Conditioned To Recognize 60ma As A Mark And 0.0ma As A Space
	HUB	Hub Signals	Set Conditioned To Recognize +60 Volts As A Mark And -30 Volts For Space
	EIA	Electronic Industries Association	Set Conditioned To Recognize -3 To -20 Volts As A Mark And +3 To +20 Volts As A Space
OUTPUT	REL R	Relay Contact Output	Set Provides Relay Contact Output — Open Circuit For Mark — Closed Circuit For Space
	REL N		Set Provides Relay Contact Output — Closed Circuit For Mark — Open Circuit For Space
	HD	Half Duplex Hub Drive	Set Provides Half Duplex Hub Drive — +60 Volts For Mark — -30 Volts For Space
CODE	5	5 Information Elements	Conditions Character Counter To Divide Bit Rate Frequency By 7
	6	6 Information Elements	" " " " " " " " " 8
	7	7 Information Elements	" " " " " " " " " 9
	8	8 Information Elements	" " " " " " " " " 10
	9	9 Information Elements	" " " " " " " " " 11
	10	10 Information Elements	" " " " " " " " " 12
	11	11 Information Elements	" " " " " " " " " 13
	12	12 Information Elements	" " " " " " " " " 14
	13	13 Information Elements	" " " " " " " " " 15
Each Character Contains A "Start" Pulse And A 1 Or 2 Element Stop Pulse.			
BIAS	O	No Distortion Generated	Conditions Set To Regenerate Input Signals And Repeat Them Without Distortion
	MB	Marking Bias	Conditions Set To Introduce Marking Bias (MB) Distortion To Input Signals
	SB	Spacing Bias	Conditions Set To Introduce Spacing Bias (SB) Distortion To Input Signals
	SWB	Switched Bias	Conditions Set To Introduce MB Then SB Distortion To Alternate Characters
	SWE	Switched End	Conditions Set To Introduce Marking End (ME) Then Spacing End (SE) Distortion To Alternate Characters
	SWC	Switched Combination	Conditions Set To Introduce ME, MB, SE, Or SB Distortion To Successive Characters
	SWN 10	Switched Narrow 10%	Conditions Set To Introduce Combinations Of 10% MB And 10% ME Or 10% SB And 10% SE On Alternate Characters
SWN 15	Switched Narrow 15%	Conditions Set To Introduce Combinations Of 15% MB and 15% ME Or 15% SB And 15% SE On Alternate Characters	
DIST 1%	0 to 4	Percent Of Element Displacement Or Distortion	Conditions Set To Introduce Distortion To Each Element Of The Input Equal To The Sum Of The Dist 1% And Dist 5% Switch Settings
DIST 5%	0 to 45		Note: The Dist 1% and Dist 5% Switches Have No Control Of Distortion Introduced When Bias Switch Is In The SWN 10% Or SWN 15% Positions

corresponding to the number of information elements of the input signal as shown in Table B.

3.08 The BIAS switch conditions the 911J to introduce distortion to the elements of the input signal as shown in Fig. 1. In all instances the waveforms of Fig. 1 show the displacement of the mark-to-space or space-to-mark transitions in relation to the undistorted input signal. In all instances where the mark-to-space transition of the start element is displaced, the waveform of the entire character must be displaced a corresponding amount to see the distortion as presented to a receiving device.

(a) When the BIAS switch is in the "0" position, no distortion is introduced but all incoming signals are sampled at 25 percent of the element time to determine whether the signal is marking or spacing. At this 25 percent point, an element (mark or space) of the proper duration for the code of the input signal is generated. The 911J will therefore reproduce undistorted signals from input signals with up to 20 percent distortion.

(b) When the BIAS switch is in the MB position, the 911J is conditioned to delay all mark-to-space transitions by the percentage of element time determined by the setting of the DIST 1 percent and DIST 5 percent switches. Because the mark-to-space transition of the start pulse is delayed, the receiving device will shift its operation cycle with respect to the entire character waveform and, as a result, the receiver will see all space-to-mark transitions occurring early, which is marking bias distortion.

(c) In the SB position, the BIAS switch conditions the 911J to delay all space-to-mark transitions by the percentage of element time determined by the setting of the DIST 1 percent and DIST 5 percent switches. The receiving device will then see a signal with spacing bias distortion.

(d) In the SWB (switched bias) position, the BIAS switch will condition the 911J to introduce spacing bias (SB) distortion to one character and switch during the period of the stop element to introduce marking bias (MB) distortion to the following character. The receiving device will then see both marking and spacing bias distortion on alternate characters.

(e) In the SWE (switched end) position the BIAS switch will condition the 911J to introduce marking end (ME) distortion and spacing end (SE) distortion on alternate characters of the output signal. The change from ME to SE distortion is made during the start pulse. The result is such that alternate start pulses are displaced with reference to the input signal, but all start pulses will be the proper width for the code being used.

(f) In the SWC (switched combination) position, the BIAS switch conditions the 911J to alternately produce ME, MB, SE, and SB, i.e., it is a combination of the SWB and SWE distortion just described. The SWC distortion is composed of the four basic types of distortion generated in a repetitive cycle of four characters. The switching from one type of distortion to the next is accomplished during the start pulse of every second character. If the first character has been switched to produce marking end distortion, the next character, which is not preceded by any switching, will have marking bias. The third character will be switched during the START pulse to give spacing end distortion, and the fourth character of the cycle, not preceded by switching,

(g) In the SWN (Switched narrow) position, the BIAS switch conditions the 911J to introduce a combined marking bias and marking end distortion on one character and spacing bias and spacing end distortion on the next. Switched narrow distortion has the effect of shortening the spacing bits of the first character and the marking bits of the second character on a two count sequence. The amount of distortion introduced in the SWN 10 percent and SWN 15 percent is controlled by the BIAS switch only, i.e., not varied by the DIST 1 percent or DIST 5 percent switches. The percentage of distortion indicated by the SWN switch position is the percentage that the marking or spacing bits are shortened on each end; therefore, the total shortening introduced is 20 percent in the SWN 10 percent position and 30 percent in the SWN 15 percent position.

3.09 More detailed information pertaining to the Data Signal Distorting Set 911J may be found in SD-70954-01.